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# HD66730/HD66731

(Dot-Matrix Liquid Crystal Display Controller/Driver Supporting  
Japanese Kanji, Korean Font Display)

# HITACHI

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## Description

The HD66730/1 is a dot-matrix liquid crystal display controller (LCD) and driver LSI that displays Japanese characters consisting of kanji, hiragana and katakana according to the Japanese Industrial Standard (JIS) Level-1 Kanji Set. The HD66730/1 incorporates the following five functions on a single chip: (i) display control function for the dot matrix LCD, (ii) a display RAM to store character codes, (iii) ROM fonts to support kanji, (iv) liquid crystal driver, and (v) a booster to drive the LCD. A two 6-character (HD66730) or four 10-character (HD66731) kanji display can easily be achieved by receiving character codes (2 bytes/character) from the MPU.

The font ROM includes 2,965 kanji from the JIS Level-1 Kanji Set, 524 JIS non-kanji characters, and 128 half-size alphanumeric characters and symbols. Full-size fonts such as Japanese kanji and half-size of fonts such as alphanumeric characters can be displayed together.

In addition, display control equivalent to full bit mapping can be performed through horizontal and vertical dot-by-dot smooth scroll functions for each display line. To help make systems more compact, a three-line clock synchronous serial transfer method is adopted in addition to an 8-bit bus for interfacing with a microcomputer.

## Features

- Dot-matrix liquid crystal display controller/driver supporting the display of kanji according to JIS Level-1 Kanji Set
- Large character generator ROM: 510 kbits
  - Kanji according to JIS Level-1 Kanji Set (11 × 12 dots): 2,965-character font
  - JIS non-kanji (11 × 12 dots): 524-character font
  - Half-size alphanumeric characters and symbols (5 × 12 dots): 128-character font
- Display of 11 × 12 dots for full-size fonts consisting of kanji and kana, 5 × 12 dots for half-size fonts of alphanumeric characters and symbols in the same display
- 2-line 6-character full-size font display with a single chip (HD66730)
- 4-line 10-character full-size font display with a single chip (HD66731)
- Expansion driver interface: maximum 2-line 20-character (or 4-line 10-character) display (HD66730)
- Dot matrix font and 71 marks and icons (96 at HD66731)

## HD66730/HD66731

- Various display control functions: horizontal smooth scroll (in dot units), vertical smooth scroll, white black inversion/blinking/white black inversion blinking character display, cursor display, display on/off
- Display data RAM:  $40 \times 2$  bytes (stores codes to support 40 characters in a full-size font)
- Character generator RAM:  $8 \times 26$  bytes (displays 8 characters of a  $12 \times 13$  dot user font)
- 16-byte 96-segment RAM
- Three-line clock synchronous serial bus, 8-bit bus interface
- Built-in double/triple liquid-crystal voltage booster circuit and built-in oscillator (operating frequency can be adjusted through external resistors)
- Operating power supply voltage: 2.4V to 5.5V; liquid crystal display voltage: 3.0V to 13.0V
- HD66730: QFP 1420-128 (0.5 mm pitch), bare-chip
- HD66731: TCP-171 (straight), TCP-206 (bent), chip with bump

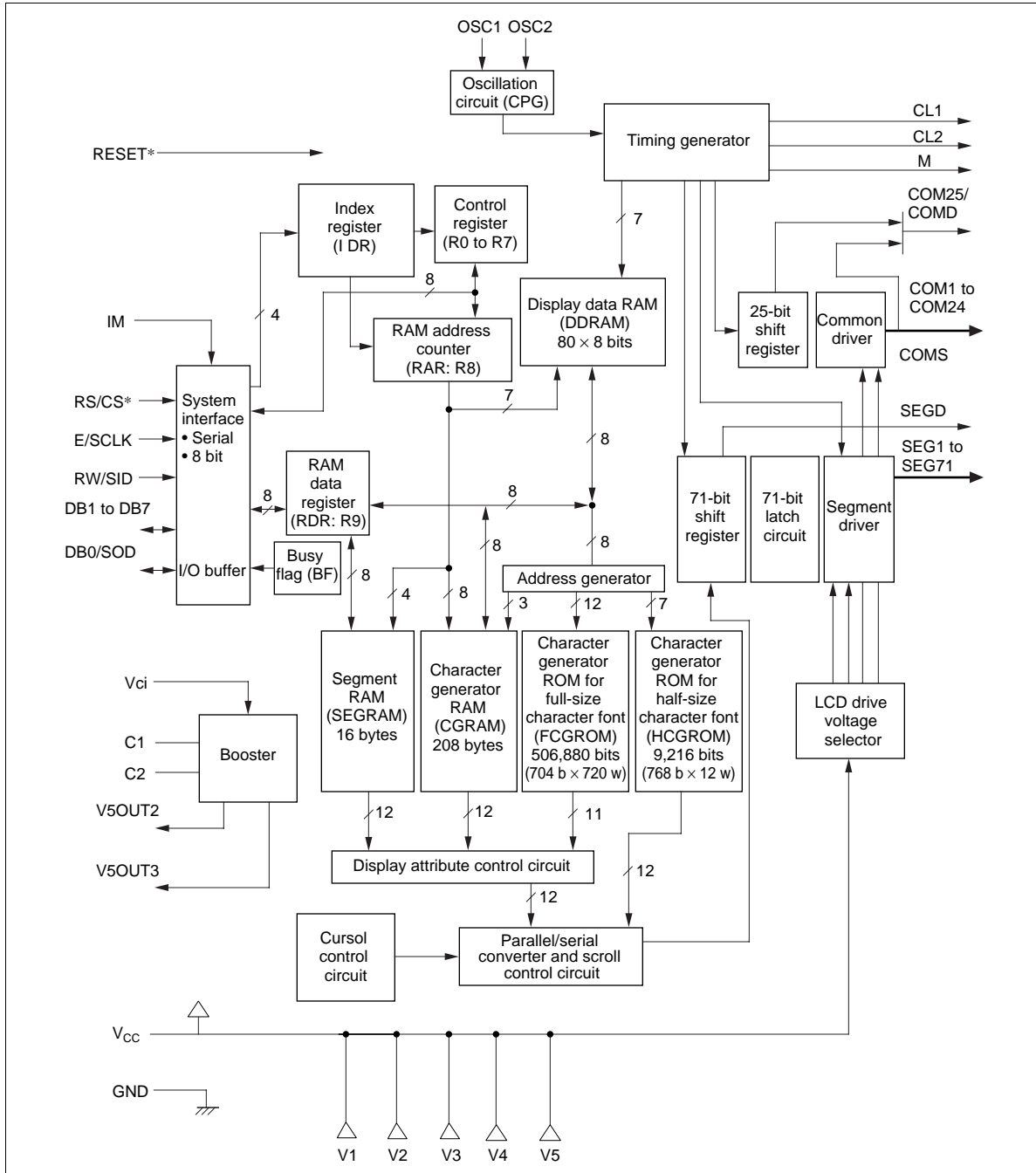
**List 1 Programmable Duty Cycles**

| Duty Drive Setting | Number of Display Characters in Full-Size Font |                     | Number of Segments/Marks |         |
|--------------------|--|---------------------|--------------------------|---------|
|                    | HD66730  | HD66731             | HD66730                  | HD66731 |
| 1/14               | One 6-character                                | One 10-character    | 71pcs                    | 96pcs   |
| 1/27               | Two 6-character                                | Two 10-character    | 71pcs                    | 96pcs   |
| 1/40               | —  | Three 10-characters | —                        | 96pcs   |
| 1/53               | —  | Four 10-characters  | —                        | 96pcs   |

## Ordering Information

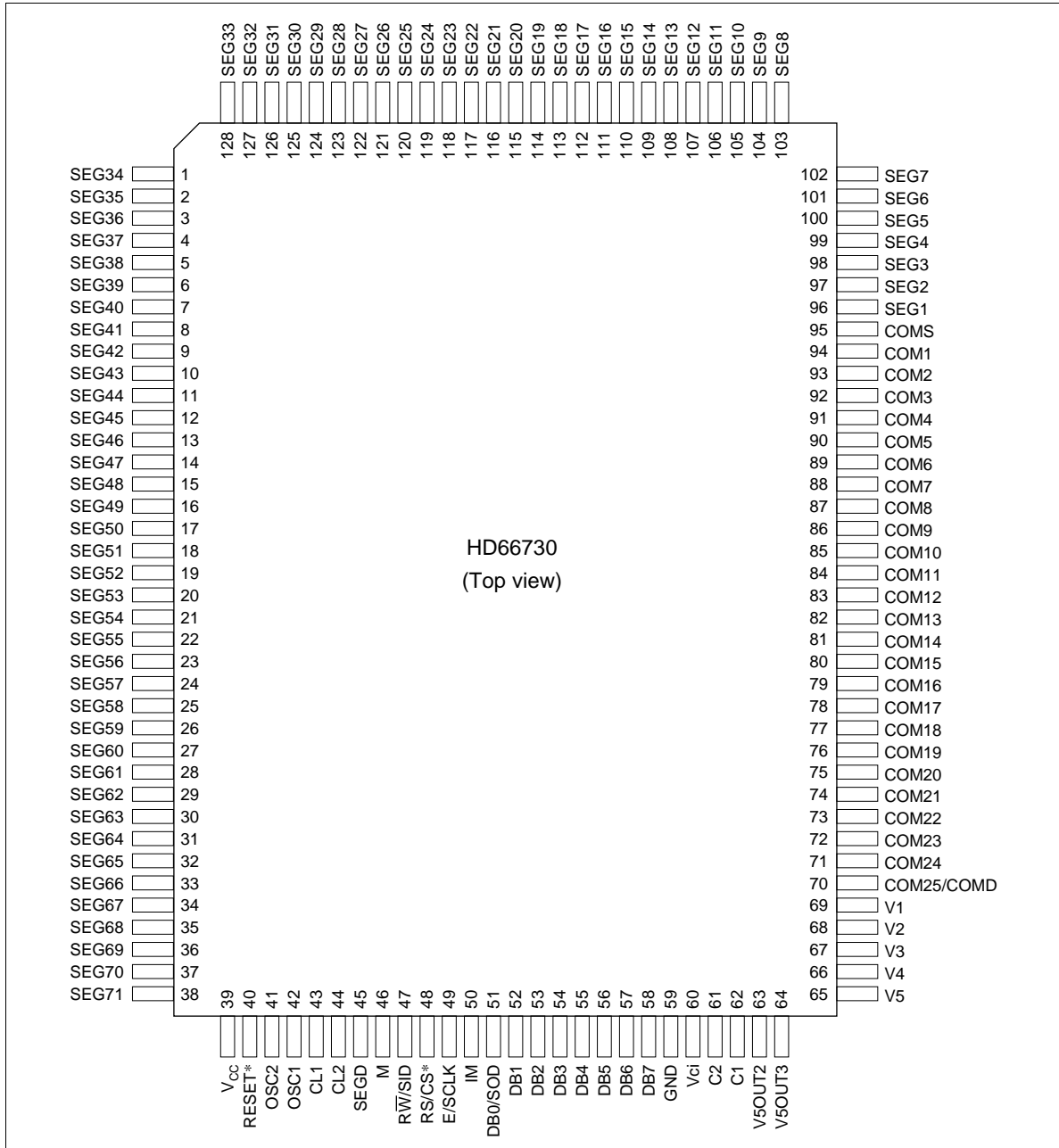
| Type No.       | Package        | Number of Display character | CGROM                   |
|----------------|----------------|-----------------------------|-------------------------|
| HD66730A00FS   | FP-128         | Two 6-characters            | JIS Level-1 Kanji (A00) |
| HCD66730A00    | Bare chip      | Two 6-characters            |                         |
| HD66731A00TA0L | Straight TCP   | Three 8-characters          |                         |
| HD66731A00TB0L | Bending TCP    | Four 10-characters          |                         |
| HCD66731A00BP  | Au-bumped chip | Four 10-characters          |                         |
| HD66730A01FS   | FP-128         | Two 6-characters            | Korean font (A01)       |
| HCD66730A01    | Bare chip      | Two 6-characters            |                         |
| HD66731A01TA0L | Straight TCP   | Three 8-characters          |                         |
| HD66731A01TB0L | Bending TCP    | Four 10-characters          |                         |
| HCD66731A01BP  | Au-bumped chip | Four 10-characters          |                         |

Block Diagram (HD66730)

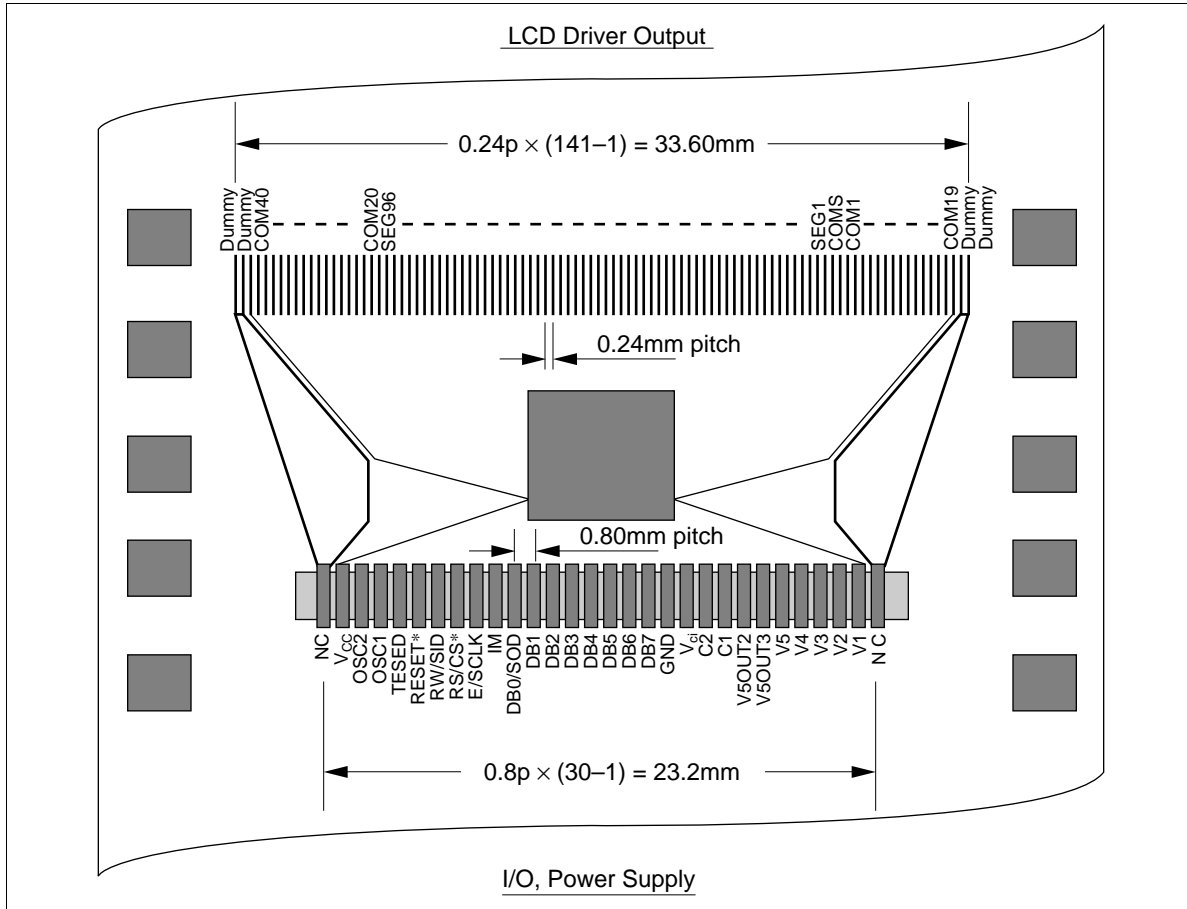


# HD66730/HD66731

## Pin Arrangement (HD66730)

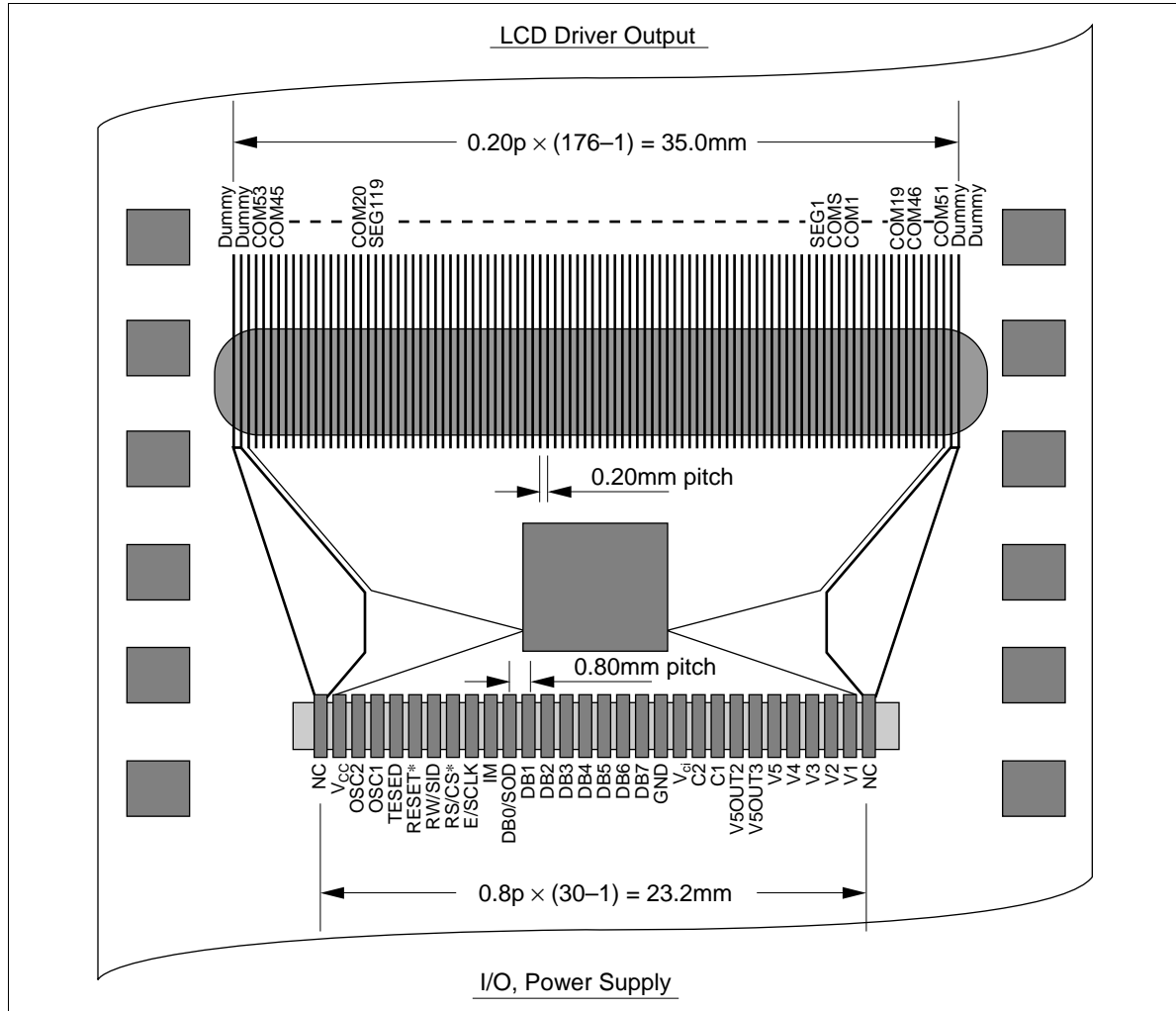


**TCP Dimensions (HD66731TA0: Three 8-characters)**

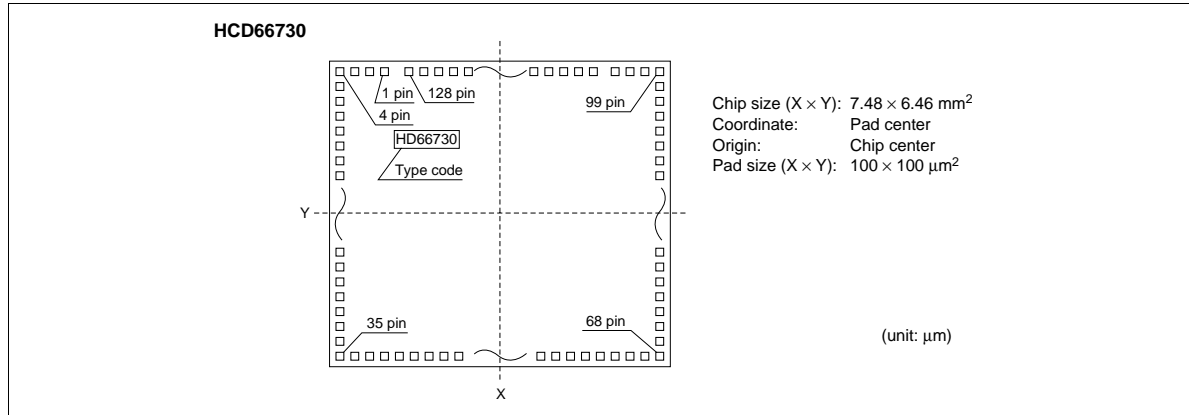


## HD66730/HD66731

### TCP Dimensions (HD66731TB0: Four 10-characters)



# The Location of Bonding Pads (HD66730)



| Pin No. | Function | Coordinate |       | Pin No. | Function        | Coordinate |       | Pin No. | Function | Coordinate |       |
|---------|----------|------------|-------|---------|-----------------|------------|-------|---------|----------|------------|-------|
|         |          | X          | Y     |         |                 | X          | Y     |         |          | X          | Y     |
| 1       | SEG34    | -2602      | 3012  | 31      | SEG64           | -3522      | -2183 | 61      | C2       | 1896       | -2959 |
| 2       | SEG35    | -2984      | 3012  | 32      | SEG65           | -3522      | -2364 | 62      | C1       | 2057       | -2959 |
| 3       | SEG36    | -3263      | 3012  | 33      | SEG66           | -3522      | -2544 | 63      | V5OUT2   | 2219       | -2959 |
| 4       | SEG37    | -3522      | 3012  | 34      | SEG67           | -3522      | -2774 | 64      | V5OUT3   | 2478       | -2959 |
| 5       | SEG38    | -3522      | 2782  | 35      | SEG68           | -3522      | -2984 | 65      | V5       | 2782       | -2984 |
| 6       | SEG39    | -3522      | 2582  | 36      | SEG69           | -3160      | -2984 | 66      | V4       | 3016       | -2984 |
| 7       | SEG40    | -3522      | 2341  | 37      | SEG70           | -2860      | -2984 | 67      | V3       | 3253       | -2984 |
| 8       | SEG41    | -3522      | 2161  | 38      | SEG71           | -2660      | -2984 | 68      | V2       | 3522       | -2984 |
| 9       | SEG42    | -3522      | 1981  | 39      | V <sub>CC</sub> | -2435      | -2984 | 69      | V1       | 3522       | -2806 |
| 10      | SEG43    | -3522      | 1801  | 40      | RESET*          | -2233      | -2984 | 70      | COM25/D  | 3522       | -2626 |
| 11      | SEG44    | -3522      | 1621  | 41      | OSC2            | -2063      | -2984 | 71      | COM24    | 3522       | -2445 |
| 12      | SEG45    | -3522      | 1440  | 42      | OSC1            | -1859      | -2984 | 72      | COM23    | 3522       | -2265 |
| 13      | SEG46    | -3522      | 1260  | 43      | CL1             | -1689      | -2984 | 73      | COM22    | 3522       | -2085 |
| 14      | SEG47    | -3522      | 1030  | 44      | CL2             | -1519      | -2984 | 74      | COM21    | 3522       | -1855 |
| 15      | SEG48    | -3522      | 800   | 45      | SEGD            | -1349      | -2984 | 75      | COM20    | 3522       | -1625 |
| 16      | SEG49    | -3522      | 620   | 46      | M               | -1179      | -2984 | 76      | COM19    | 3522       | -1444 |
| 17      | SEG50    | -3522      | 439   | 47      | RW/SID          | -975       | -2984 | 77      | COM18    | 3522       | -1264 |
| 18      | SEG51    | -3522      | 259   | 48      | RS/CS*          | -771       | -2984 | 78      | COM17    | 3522       | -1084 |
| 19      | SEG52    | -3522      | 79    | 49      | E/SCLK          | -567       | -2984 | 79      | COM16    | 3522       | -854  |
| 20      | SEG53    | -3522      | -101  | 50      | IM              | -363       | -2984 | 80      | COM15    | 3522       | -624  |
| 21      | SEG54    | -3522      | -281  | 51      | DB0/SOD         | -146       | -2984 | 81      | COM14    | 3522       | -443  |
| 22      | SEG55    | -3522      | -462  | 52      | DB1             | 71         | -2984 | 82      | COM13    | 3522       | -263  |
| 23      | SEG56    | -3522      | -642  | 53      | DB2             | 287        | -2984 | 83      | COM12    | 3522       | -83   |
| 24      | SEG57    | -3522      | -822  | 54      | DB3             | 504        | -2984 | 84      | COM11    | 3522       | 97    |
| 25      | SEG58    | -3522      | -1002 | 55      | DB4             | 721        | -2984 | 85      | COM10    | 3522       | 277   |
| 26      | SEG59    | -3522      | -1182 | 56      | DB5             | 938        | -2984 | 86      | COM9     | 3522       | 458   |
| 27      | SEG60    | -3522      | -1363 | 57      | DB6             | 1154       | -2984 | 87      | COM8     | 3522       | 638   |
| 28      | SEG61    | -3522      | -1543 | 58      | DB7             | 1371       | -2984 | 88      | COM7     | 3522       | 818   |
| 29      | SEG62    | -3522      | -1723 | 59      | GND             | 1533       | -2984 | 89      | COM6     | 3522       | 998   |
| 30      | SEG63    | -3522      | -1939 | 60      | V <sub>ci</sub> | 1730       | -2959 | 90      | COM5     | 3522       | 1178  |

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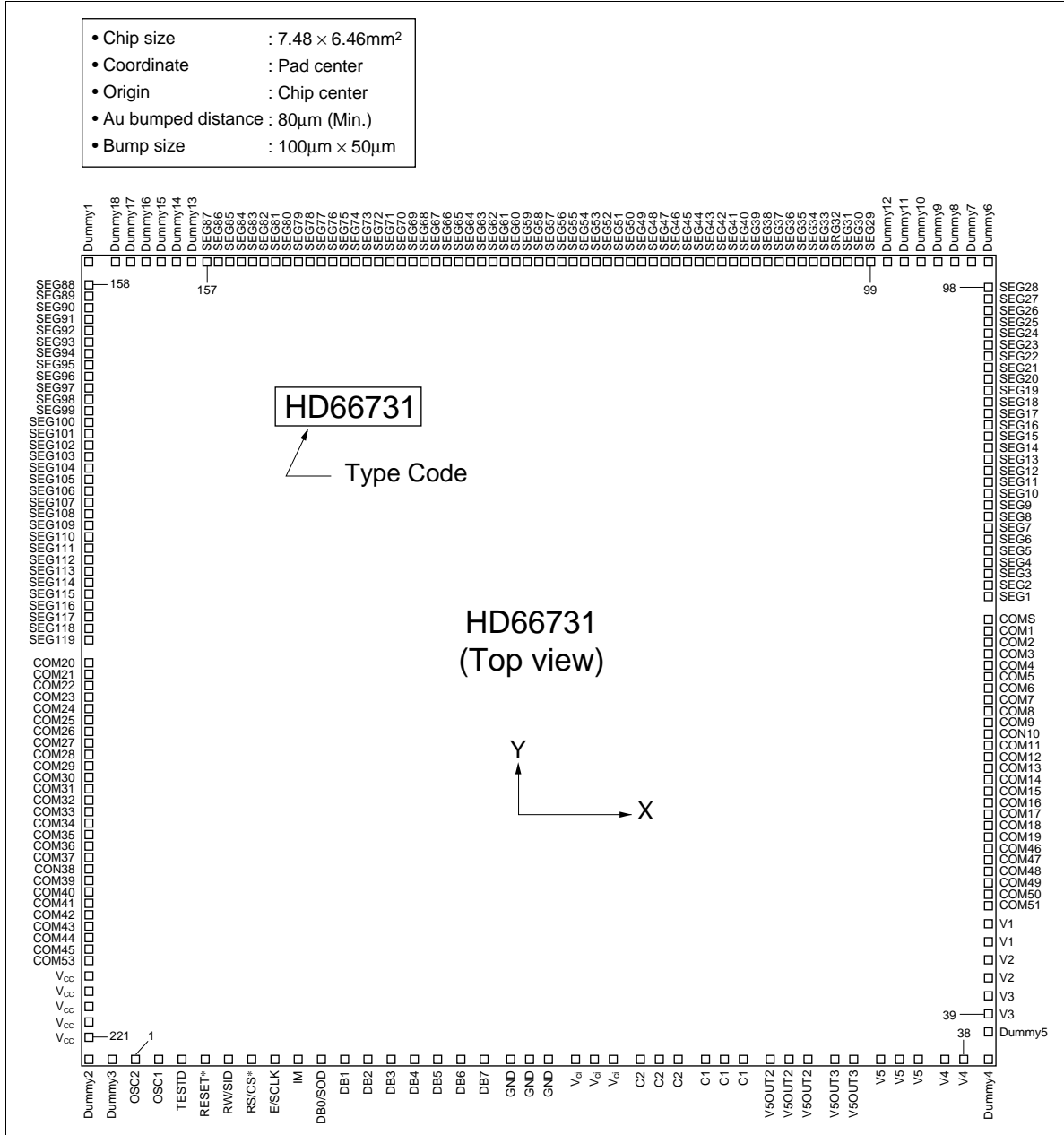
**HD66730/HD66731**

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| Pin<br>No. | Function | Coordinate |      | Pin<br>No. | Function | Coordinate |      | Pin<br>No. | Function | Coordinate |      |
|------------|----------|------------|------|------------|----------|------------|------|------------|----------|------------|------|
|            |          | X          | Y    |            |          | X          | Y    |            |          | X          | Y    |
| 91         | COM4     | 3522       | 1409 | 104        | SEG9     | 2152       | 3012 | 117        | SEG22    | -191       | 3012 |
| 92         | COM3     | 3522       | 1639 | 105        | SEG10    | 1972       | 3012 | 118        | SEG23    | -371       | 3012 |
| 93         | COM2     | 3522       | 1819 | 106        | SEG11    | 1791       | 3012 | 119        | SEG24    | -551       | 3012 |
| 94         | COM1     | 3522       | 1999 | 107        | SEG12    | 1611       | 3012 | 120        | SEG25    | -731       | 3012 |
| 95         | COMS     | 3522       | 2179 | 108        | SEG13    | 1431       | 3012 | 121        | SEG26    | -912       | 3012 |
| 96         | SEG1     | 3522       | 2410 | 109        | SEG14    | 1251       | 3012 | 122        | SEG27    | -1092      | 3012 |
| 97         | SEG2     | 3522       | 2590 | 110        | SEG15    | 1071       | 3012 | 123        | SEG28    | -1272      | 3012 |
| 98         | SEG3     | 3522       | 2819 | 111        | SEG16    | 890        | 3012 | 124        | SEG29    | -1452      | 3012 |
| 99         | SEG4     | 3522       | 3012 | 112        | SEG17    | 710        | 3012 | 125        | SEG30    | -1632      | 3012 |
| 100        | SEG5     | 3222       | 3012 | 113        | SEG18    | 530        | 3012 | 126        | SEG31    | -1813      | 3012 |
| 101        | SEG6     | 2942       | 3012 | 114        | SEG19    | 350        | 3012 | 127        | SEG32    | -1993      | 3012 |
| 102        | SEG7     | 2662       | 3012 | 115        | SEG20    | 170        | 3012 | 128        | SEG33    | -2173      | 3012 |
| 103        | SEG8     | 2332       | 3012 | 116        | SEG21    | -11        | 3012 |            |          |            |      |



# The Location of Bonding Pads (HD66731)



## HD66730/HD66731

| Pin No. | Function | Coordinate |       | Pin No. | Function | Coordinate |       | Pin No. | Function | Coordinate |      |
|---------|----------|------------|-------|---------|----------|------------|-------|---------|----------|------------|------|
|         |          | X          | Y     |         |          | X          | Y     |         |          | X          | Y    |
| —       | Dummy3   | −3202      | −2984 | 45      | COM51    | 3474       | −1621 | 92      | SEG22    | 3474       | 2255 |
| 1       | OSC2     | −2926      | −2984 | 46      | COM50    | 3474       | −1541 | 93      | SEG23    | 3474       | 2335 |
| 2       | OSC1     | −2722      | −2984 | 47      | COM49    | 3474       | −1460 | 94      | SEG24    | 3474       | 2416 |
| 3       | TESTD    | −2543      | −2984 | 48      | COM48    | 3474       | −1379 | 95      | SEG25    | 3474       | 2497 |
| 4       | RESET*   | −2339      | −2984 | 49      | COM47    | 3474       | −1298 | 96      | SEG26    | 3474       | 2578 |
| 5       | RW/SID   | −2135      | −2984 | 50      | COM46    | 3474       | −1218 | 97      | SEG27    | 3474       | 2658 |
| 6       | RS/CS    | −1931      | −2984 | 51      | COM19    | 3474       | −1137 | 98      | SEG28    | 3474       | 2739 |
| 7       | E/SCLK   | −1727      | −2984 | 52      | COM18    | 3474       | −1056 | —       | dummy6   | 3474       | 3027 |
| 8       | IM       | −1523      | −2984 | 53      | COM17    | 3474       | −975  | —       | dummy7   | 3202       | 3027 |
| 9       | DB0/SOD  | −1306      | −2984 | 54      | COM16    | 3474       | −895  | —       | dummy8   | 3066       | 3027 |
| 10      | DB1      | −1090      | −2984 | 55      | COM15    | 3474       | −814  | —       | dummy9   | 2930       | 3027 |
| 11      | DB2      | −873       | −2984 | 56      | COM14    | 3474       | −733  | —       | dummy10  | 2794       | 3027 |
| 12      | DB3      | −656       | −2984 | 57      | COM13    | 3474       | −652  | —       | dummy11  | 2658       | 3027 |
| 13      | DB4      | −439       | −2984 | 58      | COM12    | 3474       | −572  | —       | dummy12  | 2522       | 3027 |
| 14      | DB5      | −223       | −2984 | 59      | COM11    | 3474       | −491  | 99      | SEG29    | 2343       | 2963 |
| 15      | DB6      | −6         | −2984 | 60      | COM10    | 3474       | −410  | 100     | SEG30    | 2262       | 2963 |
| 16      | DB7      | 211        | −2984 | 61      | COM9     | 3474       | −329  | 101     | SEG31    | 2182       | 2963 |
| 17      | GND      | 373        | −2971 | 62      | COM8     | 3474       | −249  | 102     | SEG32    | 2101       | 2963 |
| 18      | GND      | 509        | −2971 | 63      | COM7     | 3474       | −168  | 103     | SEG33    | 2020       | 2963 |
| 19      | GND      | 645        | −2971 | 64      | COM6     | 3474       | −87   | 104     | SEG34    | 1939       | 2963 |
| 20      | Vci      | 781        | −2971 | 65      | COM5     | 3474       | −6    | 105     | SEG35    | 1859       | 2963 |
| 21      | Vci      | 917        | −2971 | 66      | COM4     | 3474       | 74    | 106     | SEG36    | 1778       | 2963 |
| 22      | Vci      | 1053       | −2971 | 67      | COM3     | 3474       | 155   | 107     | SEG37    | 1697       | 2963 |
| 23      | C2       | 1189       | −2971 | 68      | COM2     | 3474       | 236   | 108     | SEG38    | 1616       | 2963 |
| 24      | C2       | 1325       | −2971 | 69      | COM1     | 3474       | 317   | 109     | SEG39    | 1536       | 2963 |
| 25      | C2       | 1461       | −2971 | 70      | COMS     | 3474       | 397   | 110     | SEG40    | 1455       | 2963 |
| 26      | C1       | 1597       | −2971 | 71      | SEG1     | 3474       | 559   | 111     | SEG41    | 1374       | 2963 |
| 27      | C1       | 1733       | −2971 | 72      | SEG2     | 3474       | 640   | 112     | SEG42    | 1293       | 2963 |
| 28      | C1       | 1869       | −2971 | 73      | SEG3     | 3474       | 720   | 113     | SEG43    | 1213       | 2963 |
| 29      | V5OUT2   | 2005       | −2971 | 74      | SEG4     | 3474       | 801   | 114     | SEG44    | 1132       | 2963 |
| 30      | V5OUT2   | 2141       | −2971 | 75      | SEG5     | 3474       | 882   | 115     | SEG45    | 1051       | 2963 |
| 31      | V5OUT2   | 2277       | −2971 | 76      | SEG6     | 3474       | 963   | 116     | SEG46    | 970        | 2963 |
| 32      | V5OUT3   | 2413       | −2971 | 77      | SEG7     | 3474       | 1043  | 117     | SEG47    | 890        | 2963 |
| 33      | V5OUT3   | 2549       | −2971 | 78      | SEG8     | 3474       | 1124  | 118     | SEG48    | 809        | 2963 |
| 34      | V5       | 2685       | −2971 | 79      | SEG9     | 3474       | 1205  | 119     | SEG49    | 728        | 2963 |
| 35      | V5       | 2821       | −2971 | 80      | SEG10    | 3474       | 1286  | 120     | SEG50    | 647        | 2963 |
| 36      | V5       | 2957       | −2971 | 81      | SEG11    | 3474       | 1366  | 121     | SEG51    | 567        | 2963 |
| 37      | V4       | 3093       | −2971 | 82      | SEG12    | 3474       | 1447  | 122     | SEG52    | 468        | 2963 |
| 38      | V4       | 3229       | −2971 | 83      | SEG13    | 3474       | 1528  | 123     | SEG53    | 405        | 2963 |
| —       | dummy4   | 3474       | −2971 | 84      | SEG14    | 3474       | 1609  | 124     | SEG54    | 324        | 2963 |
| —       | dummy5   | 3474       | −2699 | 85      | SEG15    | 3474       | 1689  | 125     | SEG55    | 244        | 2963 |
| 39      | V3       | 3474       | −2563 | 86      | SEG16    | 3474       | 1770  | 126     | SEG56    | 163        | 2963 |
| 40      | V3       | 3474       | −2427 | 87      | SEG17    | 3474       | 1851  | 127     | SEG57    | 82         | 2963 |
| 41      | V2       | 3474       | −2291 | 88      | SEG18    | 3474       | 1932  | 128     | SEG58    | 1          | 2963 |
| 42      | V2       | 3474       | −2155 | 89      | SEG19    | 3474       | 2012  | 129     | SEG59    | −79        | 2963 |
| 43      | V1       | 3474       | −2019 | 90      | SEG20    | 3474       | 2093  | 130     | SEG60    | −160       | 2963 |
| 44      | V1       | 3474       | −1883 | 91      | SEG21    | 3474       | 2174  | 131     | SEG61    | −241       | 2963 |

## HD66730/HD66731

| Pin No. | Function | Coordinate |      | Pin No. | Function | Coordinate |      | Pin No. | Function        | Coordinate |       |
|---------|----------|------------|------|---------|----------|------------|------|---------|-----------------|------------|-------|
|         |          | X          | Y    |         |          | X          | Y    |         |                 | X          | Y     |
| 132     | SEG62    | -322       | 2963 | 158     | SEG88    | -3474      | 2728 | 191     | COM21           | -3474      | -17   |
| 133     | SEG63    | -402       | 2963 | 159     | SEG89    | -3474      | 2647 | 192     | COM22           | -3474      | -98   |
| 134     | SEG64    | -483       | 2963 | 160     | SEG90    | -3474      | 2567 | 193     | COM23           | -3474      | -179  |
| 135     | SEG65    | -564       | 2963 | 161     | SEG91    | -3474      | 2486 | 194     | COM24           | -3474      | -260  |
| 136     | SEG66    | -645       | 2963 | 162     | SEG92    | -3474      | 2405 | 195     | COM25           | -3474      | -340  |
| 137     | SEG67    | -725       | 2963 | 163     | SEG93    | -3474      | 2324 | 196     | COM26           | -3474      | -421  |
| 138     | SEG68    | -806       | 2963 | 164     | SEG94    | -3474      | 2244 | 197     | COM27           | -3474      | -502  |
| 139     | SEG69    | -887       | 2963 | 165     | SEG95    | -3474      | 2163 | 198     | COM28           | -3474      | -583  |
| 140     | SEG70    | -968       | 2963 | 166     | SEG96    | -3474      | 2082 | 199     | COM29           | -3474      | -663  |
| 141     | SEG71    | -1048      | 2963 | 167     | SEG97    | -3474      | 2001 | 200     | COM30           | -3474      | -744  |
| 142     | SEG72    | -1129      | 2963 | 168     | SEG98    | -3474      | 1921 | 201     | COM31           | -3474      | -825  |
| 143     | SEG73    | -1210      | 2963 | 169     | SEG99    | -3474      | 1840 | 202     | COM32           | -3474      | -906  |
| 144     | SEG74    | -1291      | 2963 | 170     | SEG100   | -3474      | 1759 | 203     | COM33           | -3474      | -986  |
| 145     | SEG75    | -1371      | 2963 | 171     | SEG101   | -3474      | 1678 | 204     | COM34           | -3474      | -1067 |
| 146     | SEG76    | -1452      | 2963 | 172     | SEG102   | -3474      | 1598 | 205     | COM35           | -3474      | -1148 |
| 147     | SEG77    | -1533      | 2963 | 173     | SEG103   | -3474      | 1517 | 206     | COM36           | -3474      | -1229 |
| 148     | SEG78    | -1614      | 2963 | 174     | SEG104   | -3474      | 1436 | 207     | COM37           | -3474      | -1309 |
| 149     | SEG79    | -1694      | 2963 | 175     | SEG105   | -3474      | 1355 | 208     | COM38           | -3474      | -1390 |
| 150     | SEG80    | -1775      | 2963 | 176     | SEG106   | -3474      | 1275 | 209     | COM39           | -3474      | -1471 |
| 151     | SEG81    | -1856      | 2963 | 177     | SEG107   | -3474      | 1194 | 210     | COM40           | -3474      | -1552 |
| 152     | SEG82    | -1937      | 2963 | 178     | SEG108   | -3474      | 1113 | 211     | COM41           | -3474      | -1632 |
| 153     | SEG83    | -2017      | 2963 | 179     | SEG109   | -3474      | 1032 | 212     | COM42           | -3474      | -1713 |
| 154     | SEG84    | -2098      | 2963 | 180     | SEG110   | -3474      | 952  | 213     | COM43           | -3474      | -1794 |
| 155     | SEG85    | -2179      | 2963 | 181     | SEG111   | -3474      | 871  | 214     | COM44           | -3474      | -1875 |
| 156     | SEG86    | -2260      | 2963 | 182     | SEG112   | -3474      | 79   | 215     | COM45           | -3474      | -1955 |
| 157     | SEG87    | -2340      | 2963 | 183     | SEG113   | -3474      | 709  | 216     | COM53           | -3474      | -2036 |
| —       | dummy13  | -2522      | 3027 | 184     | SEG114   | -3474      | 629  | 217     | V <sub>CC</sub> | -3474      | -2169 |
| —       | dummy14  | -2658      | 3027 | 185     | SEG115   | -3474      | 548  | 218     | V <sub>CC</sub> | -3474      | -2305 |
| —       | dummy15  | -2794      | 3027 | 186     | SEG116   | -3474      | 467  | 219     | V <sub>CC</sub> | -3474      | -2441 |
| —       | dummy16  | -2930      | 3027 | 187     | SEG117   | -3474      | 386  | 220     | V <sub>CC</sub> | -3474      | -2577 |
| —       | dummy17  | -3066      | 3027 | 188     | SEG118   | -3474      | 306  | 221     | V <sub>CC</sub> | -3474      | -2713 |
| —       | dummy18  | -3202      | 3027 | 189     | SEG119   | -3474      | 225  | —       | dymmy2          | -3474      | -2984 |
| —       | dummy1   | -3474      | 3027 | 190     | COM20    | -3474      | 63   |         |                 |            |       |

## HD66730/HD66731

### Pin Function (HD66730)

**Table 1 Pin Functional Description**

| Signal        | Number of Pins | I/O    | Device Interfaced with | Function  |
|---------------|----------------|--------|------------------------|---|
| RESET*        | 1              | I      | —                      | Acts as a reset input pin. The LSI is initialized during low level. Refer to Reset Function. Must be reset after power-on.  |
| IM            | 1              | I      | —                      | Selects interface mode with the MPU;<br>Low: Serial mode<br>High: 8-bit bus mode  |
| RS/CS*        | 1              | I      | MPU                    | Selects registers during bus mode:<br>Low: Index register (write);<br>Status register (read)<br>High: Control register (write);<br>RAM data (read/write)<br>Acts as chip-select during serial mode:<br>Low: Select (access enable)<br>High: Not selected (access disable) |
| RW/SID        | 1              | I      | MPU                    | Selects read/write during bus mode;<br>Low: Write<br>High: Read<br>Inputs serial data during serial mode.   |
| E/SCLK        | 1              | I      | MPU                    | Starts data read/write during bus mode;<br>Inputs (Receives) serial clock during serial mode.   |
| DB1 to DB7    | 7              | I/O    | MPU                    | Seven high-order bidirectional tristate data bus pins. Used for data transfer between the MPU and the HD66730. DB7 can be used as a busy flag. Open these pins during serial mode since these signals are not used.   |
| DB0/ SOD      | 1              | I/O /O | MPU                    | The lowest bidirectional data bit (DB0) during bus mode. Outputs (transmits) serial data during serial mode. Open this pin if reading (transmission) is not performed.  |
| SEG1 to SEG71 | 71             | O      | LCD                    | Display data output signals for the segment extension driver.   |
| COMS          | 1              | O      | LCD                    | Acts as a common output signal for segment display. Used to display icon and marks beside the character display.  |
| COM1 to COM24 | 24             | O      | LCD                    | Acts as common output signals for character display. COM15 to COM24 become non-selective waveforms when the duty ratio is 1/14.   |
| COM25/ COMD   | 1              | O      | LCD/ extension driver  | Acts as common output signal (COM25) for character display when EXT2 bit is 0. Acts as a common extension pulse signal (COMD) when EXT2 bit is 1. The pin is grounded after RESET input is cleared. When this signal is used as COMD, GND ≥ V5 must be maintained.        |

**Table 1 Pin Functional Description (cont. HD66730)**

| Signal        | Number of Pins | I/O | Device Interfaced with         | Function   |
|---------------|----------------|-----|--------------------------------|--|
| CL1           | 1              | O   | Extension driver               | Outputs the latch pulse of segment extension driver. Can also be used as a shift clock of common extension driver. Enters tristate when both EXT1 and EXT2 are 0.                                  |
| CL2           | 1              | O   | Extension driver               | Outputs shift clock of segment extension driver. Can also be used as a common extension driver latch clock. Enters tristate when both EXT1 and EXT2 are 0.   |
| SEGD          | 1              | O   | Extension driver               | Outputs data of extension driver. Data after the 72nd dot is output. Enters tristate when EXT1 bit is 0.   |
| M             | 1              | O   | Extension driver               | Acts as an alternating current signal of extension driver. Enters tristate when both EXT1 and EXT2 bits are 0.   |
| V1 to V5      | 5              | —   | Power supply                   | Power supply for LCD drive<br>$V_{CC} - V5 = 15V$ (max)  |
| $V_{CC}/GND$  | 2              | —   | Power supply                   | $V_{CC}$ : +2.4V to +5.5V, GND: 0V   |
| OSC1/<br>OSC2 | 2              | —   | Oscillation resistor/<br>clock | When crystal oscillation is performed, an external resistor must be connected. When the pin input is an external clock, it must be input to OSC1.  |
| Vci           | 1              | I   | —                              | Inputs voltage to the booster to generate the liquid crystal display drive voltage.<br>Vci is reference voltage and power supply for the booster.<br>$V_{ci}: 1.0V \text{ to } 5.0V \leq V_{CC}$ . |
| V5OUT2        | 1              | O   | V5 pin/<br>booster capacitor   | Voltage input to the Vci pin is boosted twice and output. When the voltage is boosted three times, a capacitor with the same capacitance as that of C1–C2 should be connected here.                |
| V5OUT3        | 1              | O   | V5 pin                         | Voltage input to the Vci pin is boosted three times and output.  |
| C1/C2         | 2              | —   | Booster capacitor              | External capacitor should be connected here when using the booster.  |

## HD66730/HD66731

### Pin Function (HD66731)

**Table 2 Pin Functional Description**

| Signal         | Number of Pins | I/O     | Device Interfaced with | Function  |
|----------------|----------------|---------|------------------------|---|
| RESET*         | 1              | I       | —                      | Acts as a reset input pin. The LSI is initialized during low level. Refer to Reset Function. Must be reset after power-on.  |
| IM             | 1              | I       | —                      | Selects interface mode with the MPU;<br>Low: Serial mode<br>High: 8-bit bus mode  |
| RS/CS*         | 1              | I       | MPU                    | Selects registers during bus mode:<br>Low: Index register (write);<br>Status register (read)<br>High: Control register (write);<br>RAM data (read/write)<br>Acts as chip-select during serial mode:<br>Low: Select (access enable)<br>High: Not selected (access disable) |
| RW/SID         | 1              | I       | MPU                    | Selects read/write during bus mode;<br>Low: Write<br>High: Read<br>Inputs serial data during serial mode.   |
| E/SCLK         | 1              | I       | MPU                    | Starts data read/write during bus mode;<br>Inputs (Receives) serial clock during serial mode.   |
| DB1 to DB7     | 7              | I/O     | MPU                    | Seven high-order bidirectional tristate data bus pins. Used for data transfer between the MPU and the HD66731. DB7 can be used as a busy flag. Open these pins during serial mode since these signals are not used.   |
| DB0/ SOD       | 1              | I/O / O | MPU                    | The lowest bidirectional data bit (DB0) during bus mode. Outputs (transmits) serial data during serial mode. Open this pin if reading (transmission) is not performed.  |
| SEG1 to SEG119 | 119            | O       | LCD                    | Display data output signals for the segment extension driver.   |
| COMS           | 1              | O       | LCD                    | Acts as a common output signal for segment display. Used to display icon and marks beside the character display.  |
| COM1 to COM51  | 51             | O       | LCD                    | Acts as common output signals for character display. COM14 acts as same as COMS when 1/14 duty. COM27 acts as same as COMS when 1/27 duty. COM40 acts as same as COMS when 1/40 duty. Unused common pins output non-selective waveforms.                                  |
| COM53          | 1              | O       | LCD                    | Acts as common output signal for segment display when 1/53 duty. The waveform is same as coms. This COM53 outputs non-selective waveform when another duty.   |

**Table 2 Pin Functional Description (cont. HD66731)**

| Signal               | Number of Pins | I/O | Device Interfaced with         | Function   |
|----------------------|----------------|-----|--------------------------------|--|
| V1 to V5             | 5              | —   | Power supply                   | Power supply for LCD drive<br>$V_{CC} - V5 = 15V$ (max)  |
| $V_{CC}$ /GND        | 2              | —   | Power supply                   | $V_{CC}$ : +2.4V to +5.5V, GND: 0V   |
| OSC1/<br>OSC2        | 2              | —   | Oscillation resistor/<br>clock | When crystal oscillation is performed, an external resistor must be connected. When the pin input is an external clock, it must be input to OSC1.  |
| Vci                  | 1              | I   | —                              | Inputs voltage to the booster to generate the liquid crystal display drive voltage.<br>Vci is reference voltage and power supply for the booster.<br>$V_{ci}: 1.0V \text{ to } 5.0V \leq V_{CC}$ . |
| V5OUT2               | 1              | O   | V5 pin/<br>booster capacitor   | Voltage input to the Vci pin is boosted twice and output. When the voltage is boosted three times, a capacitor with the same capacitance as that of C1–C2 should be connected here.                |
| V5OUT3               | 1              | O   | V5 pin                         | Voltage input to the Vci pin is boosted three times and output.  |
| C1/C2                | 2              | —   | Booster capacitor              | External capacitor should be connected here when using the booster.  |
| TESTD                | 1              | O   | —                              | Test pin. Must be left disconnected.   |
| Dummy1 to<br>Dummy18 | 18             | —   | —                              | Dummy pads. These pads are electrically floating level.  |

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## HD66730/HD66731

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### Function Description

#### System Interface

The HD66730/1 has two system interfaces: a synchronized serial one and an 8-bit bus. Both are selected by the IM pin.

The HD66730/1 has five types of 8-bit registers: an index register (IDR), status register (STR), various control registers, RAM address register (RAR), and RAM data register (RDR).

The index register (IDR) selects control registers, the RAM address register (RAR) or the RAM data register (RDR) for performing data transfer.

The status register (STR) indicates the internal state of the system. Various control registers store display control data here.

The RAM address register (RAR) stores the address data of display data RAM (DDRAM), character generator RAM (CGRAM), and segment RAM (SEGRAM).

The RAM data register (RDR) temporarily stores data to be written into DDRAM, CGRAM, or SEGRAM. Data written into the RDR from the MPU is automatically written into DDRAM, CGRAM, or SEGRAM by internal operations. The RDR is also used for data storage when reading data from DDRAM, CGRAM, or SEGRAM. Here, when address information is written into the RAR, data is read and then stored into the RDR from DDRAM, CGRAM, or SEGRAM by internal operations.

Data transfer between the MPU is then completed when the MPU reads the RDR. After this read, data in DDRAM, CGRAM, or SEGRAM stored at the next address is sent to the RDR at the next data read from the MPU.

These registers can be selected by the register select signal (RS) and the read/write signal (R/W) in the 8-bit bus interface, and by the RS bit and R/W bit of start-byte data in the synchronized serial interface.

#### Busy Flag

When the busy flag is 1, the HD66730/1 is in internal operation mode, and only the status register (STR) can be accessed. The busy flag (BF) is output from bit 7 (DB7). Access of other registers can be performed only after confirming that the busy flag is 0.

#### RAM Address Counter (RAR)

The RAM address counter (RAR) provides addresses for accessing DDRAM, CGRAM, or SEGRAM. When an initial address value is written into the RAM counter (RAR), the RAR is automatically incremented or decremented by 1. Note that a control register specifies which RAM (DDRAM, CGRAM, SEGRAM) to select.



**Table 3     Register Selection**

| <b>RS</b> | <b>R/W</b> | <b>Operation</b>  |
|-----------|------------|---|
| 0         | 0          | IDR write   |
| 0         | 1          | STR read  |
| 1         | 0          | Control register write, RAM address register (RAR) write, and RAM data register (RDR) write |
| 1         | 1          | RAM data register (RDR) read  |

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## HD66730/HD66731

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### Display Data RAM (DDRAM)

Display data RAM (DDRAM) stores character codes and display attribute codes for displaying data.

A full-size font is displayed using two bytes, and a half-size font is displayed using one byte. Since the RAM capacity is 80 bytes, 40 full-size characters or 80 half-size characters can be stored.

DDRAM displays only that data stored within the range corresponding to the number of display columns. Data stored outside the range is ignored. Refer to Combined Display of Full-Size and Half-Size characters for details on character codes stored in DDRAM. The relationship between DDRAM addresses and LCD display position depends on the number of display lines (1 line/2 lines/4 lines).

Execution of the display-clear instruction writes H'A0 corresponding to the half-size character for “space” throughout DDRAM.

**Note:** The HD66730/1 performs display by reading character codes from the DDRAM according to the number of display columns set by the control register. In particular, reading from the DDRAM begins at the position corresponding to the rightmost character as set by the maximum number of display columns. This means that one byte of a two-byte full-size character code should not be set in a position exceeding the maximum number of display columns. For example, do not write a full-size code (2 bytes) in the 12th and 13th byte when the display is set for six characters.

- 1-line display (NL1/0 = 00)

80 bytes of consecutive addresses from H'00 to H'4F are allocated for DDRAM addresses. When there are fewer than 40 display characters (at full size), only the number of display characters specified by NC1/0 are displayed starting from H'00 in the DDRAM. For example, 12 bytes of addresses from H'00 to H'0B are used when a 6-character display (NC1/0 = 00) is performed using one HD66730; addresses from H'0C on are ignored. In this case, do not write a full-size code into bytes H'0B and H'0C because a half-size character may be displayed. See Figure 1 for a 1-line display.

- 2-line display (NL1/0 = 01)

The first line in the DDRAM address is displayed for the 40 bytes of addresses from H'00 to H'27, and the second line is displayed for the 40 bytes of addresses from H'40 to H'67. When there are fewer than 20 display characters (at full size), only the number of display characters specified by NC1/0 will be displayed starting from the leftmost address of the DDRAM. For example, 24 bytes of addresses from H'00 to H'0B and H'40 to H'4B are used when a 6-character display (NC1/0 = 00) is performed using one HD66730. Addresses from H'0C and H'4C on are ignored. See Figure 2 for a 2-line display.

- 4-line display (NL1/0 = 11)

The first line in the DDRAM address is displayed from H'00 to H'13, the second line from H'20 to H'33, the third line from H'40 to H'53, and the fourth line from H'60 to H'73. For a 6-character display (NC1/0 = 00) (at full-size), only 12 bytes from the leftmost address of DDRAM are displayed. See Figure 3 for a 4-line display.

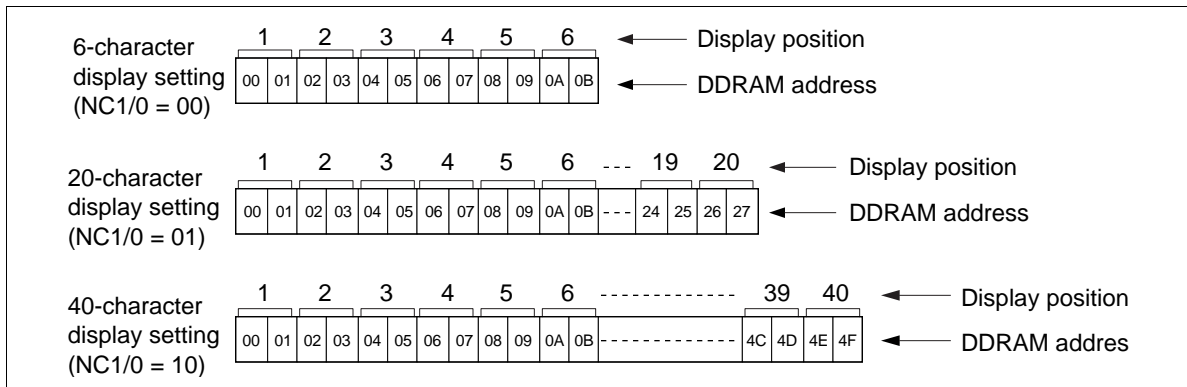


Figure 1 1-Line Display (NL1/0 = 00)

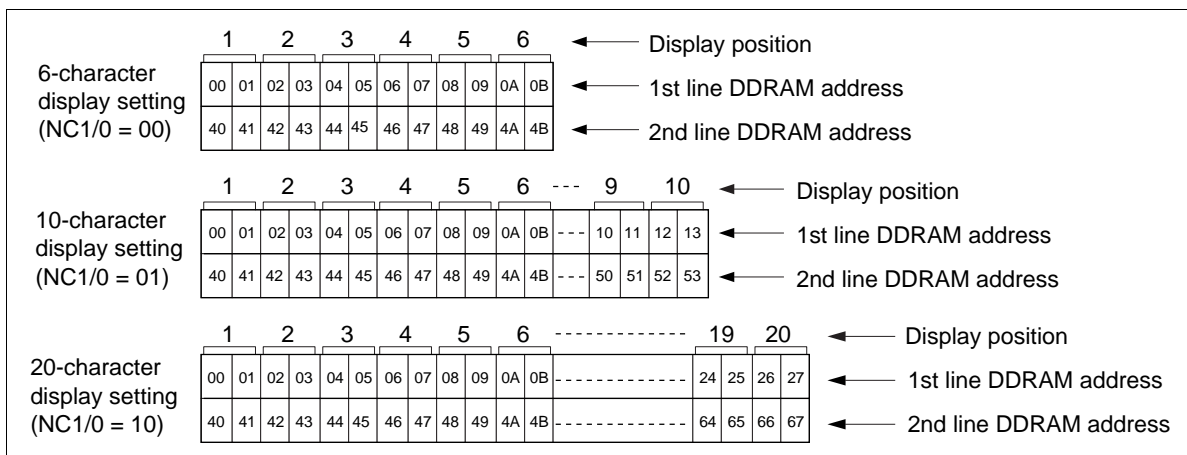


Figure 2 2-Line Display (NL1/0 = 01)

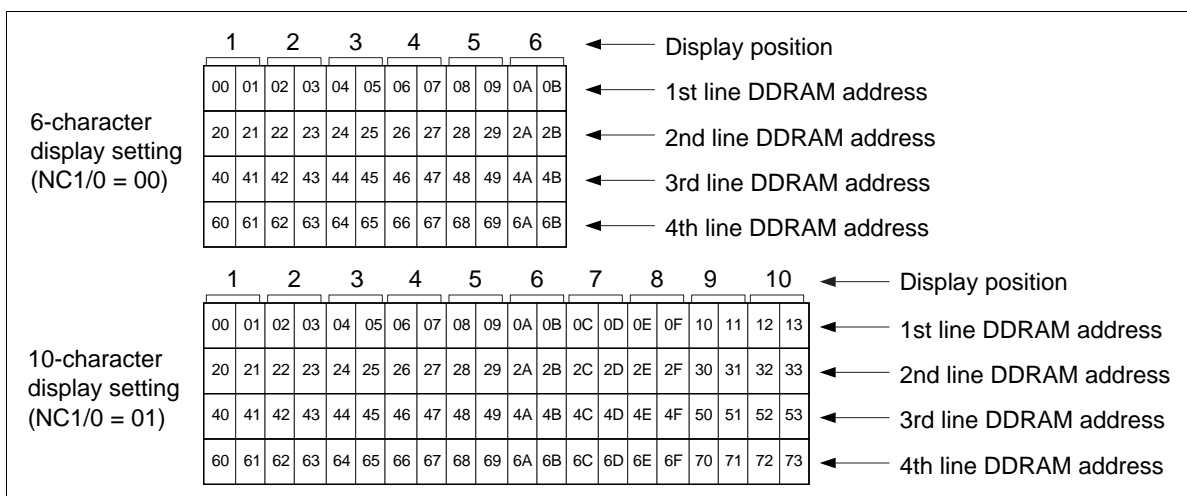


Figure 3 4-Line Display (NL1/0 = 11)

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## HD66730/HD66731

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### Character Generator ROM for a Full-Size Font (FCGROM)

The character generator ROM for a full-size font (FCGROM) generates 3,840  $11 \times 12$  dot full-size character patterns from a 12-bit character code. This includes 2,965 kanji according to the JIS Level-1 Kanji Set and 524 JIS non-kanji. Table 4 shows the relationship between character codes set in DDRAM and full-size font patterns. Refer to Combined Display of Full-Size and Half-Size Characters for the relationship between JIS codes and the character codes to be set in the DDRAM.

### Character Generator ROM for a Half-Size Font (HCGROM)

The character generator ROM for a half-size font (HCGROM) generates 128  $6 \times 12$  dot character patterns from 7-bit character codes. A half-size font (alphanumeric characters and symbols) can be displayed together with a full-size font. Refer to Combined Display of Full-Size and Half-Size Characters for details.

### Character Generator RAM (CGRAM)

The character generator RAM (CGRAM) allows the user to display arbitrary full-size font patterns. It can display 8  $12 \times 13$  dot fonts.

This RAM can also display double-size characters and figures by combining multiple CGRAM fonts. Specify character codes from H'000 to H'007 in a full size of character code when displaying font patterns stored in the CGRAM.

### Segment RAM (SEGRAM)

The segment RAM (SEGRAM) is used to control icons and marks in segment units by the user program. Bits in SEGRAM corresponding to segments to be displayed are directly set by the MPU, regardless of the contents of DDRAM and CGRAM. The SEGRAM is read and displayed when the COMS output pin is selected.

Up to 71 icons can be displayed using a single HD66730. Up to 96 icons can be displayed by expanding the drivers on the segment side. SEGRAM data is stored in eight bits. The lower six bits control the display of each segment, and the upper two bits control segment blinking.

HD66731 can display 96 icons without the expanding driver.

### **Timing Generator**

The timing generator generates timing signals for the operation of internal circuits such as DDRAM, FCGROM, HCGROM, CGRAM, and SEGRAM. RAM read timing for display and internal operation timing for MPU access are generated separately to avoid interference. This prevents undesirable interferences, such as flickering, in areas other than the display area when writing data to DDRAM, for example.

The timing generator of HD66730 generates interface control signals CL1, CL2, M, and COMD-output of extension drivers for a extension configuration.

### **Display Attribute Controller**

The display attribute controller displays white/black inverse, blinking, and white/black inverse blinking for a full size font in FCGROM according to the attribute code set in the DDRAM. Refer to Display Attribute Designation for details.

Fonts in CGRAM and bit patterns in SEGRAM control display attributes using the upper two bits (bits 7 and 6) in each display-pattern data.

### **Cursor Control Circuit**

The cursor control circuit is used to produce a cursor on a displayed character corresponding to the DDRAM address set in the RAM address counter (RAR). Cursors can be chosen from three types: 12th raster-row cursor that is displayed only on the 12th raster-row of each font; blink cursor that periodically displays the whole font in black and white and black inverted cursor that periodically displays the font in white and black (see Figure 9). Note that when the RAM address counter (RAR) is selecting CGRAM or SEGRAM, a cursor would be generated at that address, however, it does not have any meaning.

Note: One display line consists of 13 raster-rows.

### **Smooth Scroll Control Circuit**

The smooth scroll control circuit is used to perform a smooth-scroll in units of dots.

When the number of characters to be displayed is greater than that possible at one time in the liquid crystal module, this horizontal smooth scroll can be used to display characters in an easy-to-read manner for each line. Refer to Horizontal Smooth Scroll for details for each line.

**Liquid Crystal Display Driver Circuit**

The liquid crystal display driver circuit of HD66730 consists of 26 common signal drivers and 71 segment signal drivers. HD66731 has 54 common signal drivers and 119 segment signal drivers. When the liquid crystal driver duty ratio is set by a program, the necessary common signal drivers output drive waveforms and the remaining common drivers output non-selected waveforms. In addition, drivers can be expanded on the common and segment sides through register settings.

Display pattern data is sent serially through a shift register and latched when all needed data has arrived. The latched data then enables the LCD driver to generate drive waveform outputs. This serial data is sent from the display pattern that corresponds to the last address of the DDRAM and is latched when the character pattern of the display data corresponding to the first address enters the internal shift register.

**Booster**

The booster outputs a voltage that is two or three times higher than the reference voltage input from pin Vci. Since the LCD voltage can be generated from the LSI operation power supply, this circuit can operate with a single power supply. Refer to Power Supply for Liquid Crystal Display Drive for details.

**Oscillator**

The HD66730/1 performs R-C oscillation by adding a single external oscillation resistor. The oscillation frequency corresponding to display size and frame frequency can be adjusted by changing the oscillation resistor. Refer to Oscillator for details.

Table 4 Relationship between Full-Size Character Code and Kanji

| Upper / Lower | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 2           | 𣎵 | 𣎵 | 𣎵 | 娃 | 阿 | 哀 | 愛 | 挨 | 始 | 逢 | 葵 | 茜 | 穉 | 惡 | 握 | 渥 |
| 0 3           | 旭 | 葦 | 芦 | 鯨 | 梓 | 庄 | 幹 | 扱 | 宛 | 姐 | 虻 | 飴 | 絢 | 綾 | 鮎 | 或 |
| 0 4           | 粟 | 裕 | 安 | 庵 | 按 | 暗 | 案 | 闇 | 杏 | 為 | 以 | 伊 | 位 | 依 | 偉 | 圉 |
| 0 5           | 夷 | 委 | 威 | 尉 | 惟 | 意 | 慰 | 易 | 椅 | 為 | 畏 | 異 | 移 | 維 | 緯 | 胃 |
| 0 6           | 葵 | 衣 | 謂 | 遑 | 遣 | 医 | 井 | 亥 | 域 | 育 | 郁 | 磯 | 一 | 忒 | 溢 | 逸 |
| 0 7           | 稻 | 茨 | 芋 | 錫 | 允 | 印 | 咽 | 員 | 囚 | 姻 | 引 | 飲 | 淫 | 胤 | 蔭 | 𣎵 |
| 0 A           | 昂 | 院 | 陰 | 隱 | 韻 | 吋 | 右 | 宇 | 烏 | 羽 | 迂 | 雨 | 卯 | 鵠 | 窺 | 丑 |
| 0 B           | 確 | 白 | 渦 | 嘘 | 唄 | 薔 | 蔚 | 鱧 | 姥 | 麗 | 浦 | 瓜 | 閨 | 噂 | 云 | 運 |
| 0 C           | 雲 | 荏 | 餌 | 叡 | 營 | 嬰 | 影 | 映 | 曳 | 榮 | 永 | 泳 | 洩 | 瑛 | 盈 | 穎 |
| 0 D           | 穎 | 英 | 衛 | 詠 | 銳 | 液 | 疫 | 益 | 馱 | 悅 | 謁 | 越 | 閱 | 榎 | 厭 | 円 |
| 0 E           | 園 | 堰 | 奄 | 宴 | 延 | 怨 | 掩 | 援 | 沿 | 演 | 炎 | 焰 | 煙 | 燕 | 猿 | 縁 |
| 0 F           | 艶 | 苑 | 菌 | 遠 | 鉛 | 鴛 | 塩 | 於 | 汚 | 甥 | 凹 | 央 | 奧 | 往 | 応 | 𣎵 |
| 1 2           | 葇 | 押 | 旺 | 橫 | 欧 | 毆 | 王 | 翁 | 襖 | 鶯 | 鷗 | 黄 | 岡 | 沖 | 荻 | 億 |
| 1 3           | 屋 | 憶 | 臆 | 桶 | 牡 | 乙 | 俺 | 卸 | 恩 | 温 | 穩 | 音 | 下 | 化 | 仮 | 何 |
| 1 4           | 伽 | 伽 | 佳 | 加 | 可 | 嘉 | 夏 | 嫁 | 家 | 寡 | 科 | 暇 | 果 | 架 | 歌 | 河 |
| 1 5           | 火 | 珂 | 禍 | 禾 | 稼 | 箇 | 花 | 苛 | 茄 | 荷 | 華 | 菓 | 蝦 | 課 | 嘩 | 貨 |
| 1 6           | 迦 | 過 | 霞 | 蚊 | 俄 | 峨 | 我 | 牙 | 画 | 臥 | 芽 | 蛾 | 賀 | 雅 | 餓 | 駕 |
| 1 7           | 介 | 会 | 解 | 回 | 塊 | 壞 | 廻 | 快 | 怪 | 悔 | 恢 | 懷 | 戒 | 拐 | 改 | 𣎵 |
| 1 A           | 洌 | 魁 | 晦 | 械 | 海 | 灰 | 界 | 皆 | 絵 | 芥 | 蟹 | 開 | 階 | 貝 | 凱 | 効 |
| 1 B           | 刈 | 咳 | 害 | 崖 | 慨 | 概 | 涯 | 蓋 | 街 | 該 | 鎧 | 骸 | 骸 | 隄 | 蛙 | 𣎵 |
| 1 C           | 垣 | 柿 | 蛎 | 鈎 | 劃 | 嚇 | 各 | 廊 | 披 | 格 | 核 | 核 | 確 | 確 | 確 | 穫 |
| 1 D           | 覺 | 角 | 赫 | 較 | 郭 | 閣 | 隔 | 革 | 学 | 岳 | 樂 | 額 | 額 | 掛 | 笠 | 橙 |
| 1 E           | 糧 | 棍 | 鯀 | 渴 | 割 | 喝 | 恰 | 括 | 活 | 渴 | 滑 | 葛 | 褐 | 轄 | 且 | 鯨 |
| 1 F           | 叶 | 栳 | 樺 | 鞆 | 株 | 兜 | 竈 | 蒲 | 釜 | 鎌 | 噴 | 鴨 | 栢 | 茅 | 萱 | 𣎵 |
| 2 2           | 澤 | 粥 | 刈 | 苴 | 瓦 | 乾 | 侃 | 冠 | 寒 | 刊 | 勘 | 勸 | 卷 | 喚 | 堪 | 姦 |
| 2 3           | 完 | 官 | 寬 | 干 | 幹 | 患 | 感 | 慣 | 憾 | 換 | 敢 | 柑 | 垣 | 棺 | 款 | 歛 |
| 2 4           | 汗 | 漢 | 澗 | 灌 | 環 | 甘 | 監 | 看 | 竿 | 管 | 簡 | 緩 | 缶 | 翰 | 肝 | 艦 |
| 2 5           | 莞 | 觀 | 諫 | 貫 | 還 | 鑑 | 間 | 閑 | 閑 | 陷 | 韓 | 館 | 館 | 丸 | 含 | 岸 |
| 2 6           | 嚴 | 玩 | 癌 | 眼 | 岩 | 駢 | 贗 | 雁 | 頑 | 頑 | 願 | 企 | 伎 | 危 | 喜 | 器 |
| 2 7           | 基 | 奇 | 嬉 | 寄 | 岐 | 希 | 幾 | 忌 | 揮 | 机 | 旗 | 既 | 期 | 棋 | 棄 | 𣎵 |
| 2 A           | 萌 | 機 | 婦 | 穀 | 氣 | 汽 | 畿 | 祈 | 季 | 稀 | 紀 | 微 | 規 | 記 | 貴 | 起 |
| 2 B           | 軌 | 輝 | 飢 | 騎 | 鬼 | 龜 | 偽 | 儀 | 妓 | 宜 | 戲 | 技 | 擬 | 欺 | 犧 | 疑 |
| 2 C           | 祇 | 義 | 蟻 | 誼 | 議 | 拘 | 菊 | 鞠 | 吉 | 吃 | 喫 | 桔 | 橘 | 詰 | 砧 | 杵 |
| 2 D           | 柰 | 却 | 客 | 脚 | 虐 | 逆 | 丘 | 久 | 仇 | 休 | 及 | 吸 | 宮 | 弓 | 急 | 救 |
| 2 E           | 朽 | 求 | 汲 | 泣 | 灸 | 球 | 究 | 笈 | 級 | 級 | 糾 | 給 | 旧 | 牛 | 去 | 居 |
| 2 F           | 巨 | 拒 | 挾 | 拳 | 渠 | 虛 | 許 | 鋸 | 漁 | 禦 | 禦 | 魚 | 亨 | 享 | 京 | 𣎵 |
| 3 2           | 萊 | 供 | 俠 | 僑 | 兇 | 競 | 共 | 凶 | 協 | 匡 | 脚 | 叫 | 喬 | 境 | 峽 | 強 |
| 3 3           | 彊 | 怯 | 恐 | 恭 | 扶 | 教 | 橋 | 況 | 狂 | 狹 | 矯 | 胸 | 脅 | 興 | 喬 | 鄉 |
| 3 4           | 鏡 | 響 | 響 | 驚 | 仰 | 凝 | 堯 | 曉 | 業 | 局 | 曲 | 極 | 玉 | 桐 | 杆 | 僅 |
| 3 5           | 勤 | 均 | 巾 | 錦 | 斤 | 欣 | 欽 | 琴 | 禁 | 禽 | 筋 | 緊 | 芹 | 菌 | 衿 | 襟 |
| 3 6           | 謹 | 近 | 金 | 吟 | 銀 | 九 | 俱 | 句 | 區 | 狗 | 玖 | 矩 | 苦 | 軀 | 驅 | 駢 |
| 3 7           | 駒 | 具 | 愚 | 虞 | 喰 | 空 | 偶 | 寓 | 遇 | 隅 | 串 | 櫛 | 釧 | 屑 | 屈 | 𣎵 |
| 3 A           | 莉 | 掘 | 窟 | 沓 | 靴 | 響 | 窪 | 熊 | 隈 | 糸 | 栗 | 繰 | 桑 | 歛 | 勲 | 君 |
| 3 B           | 薰 | 訓 | 群 | 軍 | 郡 | 卦 | 袈 | 邗 | 係 | 傾 | 刑 | 兄 | 啓 | 圭 | 珪 | 型 |
| 3 C           | 契 | 形 | 徑 | 惠 | 慶 | 慧 | 憩 | 揭 | 携 | 敬 | 景 | 桂 | 溪 | 蛙 | 稽 | 系 |
| 3 D           | 經 | 繼 | 繫 | 界 | 莖 | 荊 | 螢 | 計 | 詣 | 警 | 輕 | 頸 | 鷄 | 芸 | 迎 | 鯨 |
| 3 E           | 劇 | 戟 | 擊 | 激 | 隙 | 衍 | 傑 | 欠 | 決 | 潔 | 穴 | 結 | 血 | 訣 | 月 | 件 |
| 3 F           | 俟 | 倦 | 健 | 兼 | 券 | 劍 | 喧 | 圉 | 堅 | 嫌 | 建 | 憲 | 懸 | 拳 | 捲 | 𣎵 |

Table 4 Relationship between Full-Size Character Code and Kanji (cont)

| Upper / Lower | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 2           | 計 | 檢 | 權 | 牽 | 犬 | 獻 | 研 | 硯 | 絹 | 鼎 | 肩 | 見 | 謙 | 賢 | 軒 | 遣 |
| 4 3           | 鍵 | 險 | 顛 | 駢 | 鯨 | 元 | 原 | 嚴 | 幻 | 弦 | 減 | 源 | 玄 | 現 | 絃 | 舷 |
| 4 4           | 言 | 諺 | 限 | 乎 | 個 | 古 | 呼 | 固 | 姑 | 孤 | 己 | 庫 | 弧 | 戶 | 故 | 枯 |
| 4 5           | 湖 | 狐 | 糊 | 袴 | 股 | 胡 | 菰 | 虎 | 誇 | 跨 | 鉗 | 雇 | 顧 | 鼓 | 五 | 互 |
| 4 6           | 伍 | 午 | 吳 | 吾 | 娛 | 後 | 御 | 悟 | 梧 | 橋 | 瑚 | 碁 | 語 | 誤 | 護 | 嗣 |
| 4 7           | 乞 | 鯉 | 交 | 佼 | 侯 | 候 | 侯 | 光 | 公 | 功 | 効 | 勾 | 厚 | 口 | 向 | 嚮 |
| 4 A           | 鵠 | 后 | 喉 | 坑 | 垢 | 好 | 孔 | 孝 | 宏 | 工 | 巧 | 巷 | 幸 | 広 | 庚 | 康 |
| 4 B           | 弘 | 恒 | 慌 | 抗 | 拘 | 控 | 攻 | 昂 | 晃 | 更 | 杭 | 校 | 梗 | 構 | 江 | 洪 |
| 4 C           | 浩 | 港 | 溝 | 甲 | 皇 | 硬 | 稿 | 糠 | 紅 | 絃 | 絞 | 綱 | 耕 | 考 | 肯 | 肱 |
| 4 D           | 腔 | 膏 | 航 | 荒 | 行 | 衡 | 講 | 貢 | 購 | 郊 | 酵 | 鉉 | 硃 | 銅 | 閣 | 降 |
| 4 E           | 項 | 香 | 高 | 鴻 | 剛 | 劫 | 号 | 合 | 壕 | 拷 | 濠 | 豪 | 轟 | 趙 | 克 | 刻 |
| 4 F           | 告 | 国 | 穀 | 酷 | 鵠 | 黑 | 獄 | 漉 | 腰 | 甌 | 忽 | 惚 | 骨 | 狛 | 込 | 𩺰 |
| 5 2           | 餃 | 此 | 頃 | 今 | 困 | 坤 | 壘 | 婚 | 恨 | 懇 | 昏 | 昆 | 根 | 梱 | 混 | 痕 |
| 5 3           | 紺 | 艮 | 魂 | 些 | 佐 | 叉 | 唆 | 嗟 | 左 | 差 | 查 | 沙 | 瑳 | 砂 | 詐 | 鎖 |
| 5 4           | 裘 | 坐 | 座 | 挫 | 債 | 催 | 再 | 哉 | 塞 | 妻 | 宰 | 彩 | 才 | 採 | 裁 | 在 |
| 5 5           | 歲 | 濟 | 災 | 采 | 犀 | 碎 | 碧 | 祭 | 齋 | 細 | 菜 | 裁 | 載 | 際 | 劑 | 在 |
| 5 6           | 材 | 罪 | 財 | 牙 | 坂 | 阪 | 堺 | 柵 | 肴 | 咲 | 崎 | 埼 | 碕 | 鷺 | 作 | 削 |
| 5 7           | 詐 | 搾 | 昨 | 朔 | 柵 | 窄 | 策 | 索 | 錯 | 桜 | 鮭 | 笹 | 匙 | 冊 | 刷 | 𩺰 |
| 5 A           | 𩺰 | 察 | 撈 | 撮 | 擦 | 札 | 殺 | 薩 | 雜 | 阜 | 鯖 | 捌 | 鎗 | 蛟 | 皿 | 晒 |
| 5 B           | 三 | 傘 | 參 | 山 | 慘 | 撒 | 散 | 棧 | 燦 | 珊 | 產 | 算 | 纂 | 蚤 | 讚 | 贊 |
| 5 C           | 酸 | 餐 | 斬 | 暫 | 殘 | 仕 | 仔 | 伺 | 使 | 刺 | 司 | 史 | 嗣 | 四 | 士 | 始 |
| 5 D           | 姉 | 姿 | 子 | 屍 | 市 | 師 | 志 | 思 | 指 | 支 | 孜 | 斯 | 施 | 旨 | 枝 | 止 |
| 5 E           | 死 | 氏 | 獅 | 祉 | 私 | 糸 | 紙 | 紫 | 脂 | 至 | 視 | 詞 | 詩 | 時 | 誌 | 誌 |
| 5 F           | 諮 | 資 | 賜 | 雌 | 飼 | 齒 | 事 | 似 | 侍 | 兒 | 字 | 寺 | 慈 | 持 | 時 | 𩺰 |
| 6 2           | 𩺰 | 次 | 滋 | 治 | 爾 | 聖 | 痔 | 磁 | 示 | 而 | 耳 | 自 | 薛 | 辭 | 汐 | 鹿 |
| 6 3           | 式 | 識 | 鳴 | 竺 | 軸 | 穴 | 零 | 七 | 叱 | 執 | 失 | 娛 | 室 | 悉 | 濕 | 漆 |
| 6 4           | 疾 | 質 | 寔 | 蔀 | 篠 | 怨 | 柴 | 芝 | 屢 | 藥 | 失 | 縞 | 舍 | 射 | 捨 | 赦 |
| 6 5           | 斜 | 煮 | 社 | 紗 | 者 | 謝 | 車 | 遮 | 蛇 | 邪 | 借 | 勺 | 尺 | 杓 | 灼 | 爵 |
| 6 6           | 酌 | 積 | 錫 | 若 | 寂 | 弱 | 惹 | 主 | 取 | 守 | 手 | 朱 | 殊 | 狩 | 珠 | 種 |
| 6 7           | 腫 | 趣 | 酒 | 首 | 儒 | 受 | 呪 | 寿 | 授 | 樹 | 綬 | 需 | 囚 | 収 | 周 | 𩺰 |
| 6 A           | 𩺰 | 宗 | 就 | 州 | 修 | 愁 | 拾 | 洲 | 秀 | 秋 | 終 | 繡 | 習 | 臭 | 舟 | 蒐 |
| 6 B           | 衆 | 龔 | 豐 | 蹴 | 輯 | 週 | 酉 | 酬 | 集 | 醜 | 什 | 住 | 充 | 十 | 從 | 戎 |
| 6 C           | 柔 | 汁 | 洪 | 獸 | 縱 | 重 | 銃 | 叔 | 夙 | 宿 | 淑 | 祝 | 縮 | 肅 | 塾 | 熟 |
| 6 D           | 出 | 術 | 述 | 俊 | 峻 | 春 | 瞬 | 竣 | 舜 | 駿 | 准 | 循 | 旬 | 楯 | 殉 | 淳 |
| 6 E           | 準 | 潤 | 盾 | 純 | 巡 | 遵 | 醇 | 順 | 処 | 初 | 所 | 暑 | 曙 | 渚 | 庶 | 緒 |
| 6 F           | 署 | 書 | 薯 | 諸 | 諸 | 助 | 叙 | 女 | 序 | 徐 | 恕 | 鋤 | 除 | 傷 | 償 | 𩺰 |
| 7 2           | 𩺰 | 勝 | 匠 | 升 | 召 | 哨 | 商 | 唱 | 嘗 | 獎 | 妾 | 娼 | 宵 | 將 | 小 | 少 |
| 7 3           | 尚 | 庄 | 床 | 廠 | 彰 | 承 | 抄 | 招 | 掌 | 捷 | 昇 | 昌 | 昭 | 晶 | 松 | 梢 |
| 7 4           | 樟 | 樵 | 沼 | 消 | 涉 | 湘 | 燒 | 焦 | 照 | 症 | 省 | 硝 | 礁 | 祥 | 称 | 章 |
| 7 5           | 笑 | 粧 | 紹 | 肖 | 莒 | 蔣 | 蕉 | 衝 | 裳 | 訟 | 証 | 詔 | 詳 | 象 | 賞 | 醬 |
| 7 6           | 鉦 | 鍾 | 鐘 | 障 | 鞘 | 上 | 丈 | 丞 | 乘 | 冗 | 刺 | 城 | 鎗 | 壤 | 嬢 | 常 |
| 7 7           | 情 | 擾 | 条 | 杖 | 淨 | 狀 | 疊 | 穰 | 蒸 | 讓 | 釀 | 錠 | 囑 | 埴 | 飾 | 𩺰 |
| 7 A           | 𩺰 | 拭 | 植 | 殖 | 燭 | 織 | 職 | 色 | 舐 | 食 | 蝕 | 辱 | 尻 | 伸 | 信 | 侵 |
| 7 B           | 唇 | 娠 | 寢 | 審 | 心 | 慎 | 振 | 新 | 晉 | 森 | 榛 | 浸 | 深 | 申 | 疹 | 真 |
| 7 C           | 神 | 秦 | 紳 | 臣 | 芯 | 薪 | 親 | 診 | 身 | 辛 | 進 | 針 | 震 | 人 | 仁 | 刃 |
| 7 D           | 塵 | 壬 | 尋 | 甚 | 尽 | 腎 | 訊 | 迅 | 陣 | 韌 | 筍 | 諏 | 須 | 酢 | 冏 | 厨 |
| 7 E           | 逗 | 吹 | 垂 | 帥 | 推 | 水 | 炊 | 睡 | 粹 | 翠 | 衰 | 遂 | 醉 | 錐 | 鍾 | 隨 |
| 7 F           | 瑞 | 髓 | 崇 | 嵩 | 數 | 樞 | 趨 | 雛 | 据 | 杉 | 梔 | 菅 | 頗 | 雀 | 裾 | 𩺰 |



Table 4 Relationship between Full-Size Character Code and Kanji (cont)

| Upper / Lower | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 2           | 澄 | 摺 | 寸 | 世 | 瀬 | 畝 | 是 | 凄 | 制 | 勢 | 姓 | 征 | 性 | 成 | 政 |   |
| 8 3           | 整 | 星 | 晴 | 棲 | 栖 | 正 | 清 | 性 | 生 | 盛 | 精 | 聖 | 声 | 製 | 西 | 誠 |
| 8 4           | 誓 | 請 | 逝 | 醒 | 青 | 靜 | 齊 | 稅 | 脆 | 隻 | 席 | 惜 | 戚 | 斥 | 昔 | 析 |
| 8 5           | 石 | 積 | 籍 | 績 | 脊 | 責 | 赤 | 跡 | 蹟 | 碩 | 切 | 拙 | 接 | 撰 | 折 | 設 |
| 8 6           | 窃 | 節 | 說 | 雪 | 絶 | 舌 | 蟬 | 仙 | 先 | 千 | 占 | 宣 | 專 | 尖 | 川 | 戰 |
| 8 7           | 扇 | 撰 | 栓 | 梅 | 泉 | 淺 | 洗 | 潜 | 煎 | 煽 | 旋 | 穿 | 箭 | 線 | 閃 | 鮮 |
| 8 A           | 緋 | 緋 | 羨 | 腺 | 舛 | 船 | 薦 | 詮 | 賤 | 踐 | 選 | 遷 | 錢 | 銑 | 閃 | 鮮 |
| 8 B           | 前 | 善 | 漸 | 然 | 全 | 禪 | 繕 | 膳 | 纏 | 贈 | 塑 | 阻 | 措 | 錫 | 曾 | 楚 |
| 8 C           | 狙 | 疏 | 疎 | 礎 | 祖 | 粗 | 素 | 組 | 蘇 | 訴 | 阻 | 遇 | 鼠 | 僧 | 創 |   |
| 8 D           | 双 | 叢 | 倉 | 衰 | 壯 | 奏 | 爽 | 宋 | 層 | 匠 | 惣 | 想 | 搜 | 掃 | 搔 |   |
| 8 E           | 操 | 早 | 曹 | 巢 | 槍 | 槽 | 漕 | 燥 | 争 | 瘦 | 相 | 窓 | 糟 | 綜 | 聰 |   |
| 8 F           | 草 | 莊 | 葬 | 蒼 | 藻 | 裝 | 走 | 送 | 遭 | 鎗 | 霜 | 騷 | 像 | 憎 | 慥 |   |
| 9 2           | 臍 | 臍 | 藏 | 贈 | 造 | 促 | 側 | 則 | 即 | 息 | 捉 | 束 | 測 | 足 | 速 | 俗 |
| 9 3           | 属 | 賊 | 族 | 統 | 卒 | 袖 | 其 | 揃 | 存 | 孫 | 尊 | 損 | 村 | 遜 | 他 | 多 |
| 9 4           | 太 | 汰 | 訖 | 唾 | 墮 | 妥 | 情 | 打 | 柁 | 舵 | 椅 | 陀 | 駄 | 驛 | 体 | 堆 |
| 9 5           | 対 | 耐 | 岱 | 帶 | 待 | 怠 | 態 | 戴 | 替 | 泰 | 滯 | 胎 | 腿 | 苔 | 袋 | 貸 |
| 9 6           | 退 | 逮 | 隊 | 黛 | 鯛 | 代 | 台 | 大 | 第 | 醍 | 題 | 鷹 | 滝 | 龍 | 卓 | 啄 |
| 9 7           | 宅 | 托 | 挾 | 拓 | 沢 | 濯 | 琢 | 託 | 鐸 | 濁 | 諾 | 茸 | 鳳 | 蛸 | 只 |   |
| 9 A           | 叩 | 但 | 達 | 辰 | 奪 | 脫 | 異 | 堅 | 辿 | 棚 | 谷 | 狸 | 鯉 | 樽 | 誰 |   |
| 9 B           | 丹 | 單 | 嘆 | 坦 | 担 | 探 | 旦 | 歎 | 淡 | 湛 | 炭 | 短 | 端 | 綻 | 耽 |   |
| 9 C           | 胆 | 蛋 | 誕 | 鍛 | 团 | 壇 | 彈 | 斷 | 暖 | 檀 | 段 | 男 | 談 | 值 | 知 | 地 |
| 9 D           | 弛 | 恥 | 智 | 池 | 痴 | 稚 | 置 | 致 | 蚰 | 遲 | 馳 | 築 | 畜 | 竹 | 筑 | 蓄 |
| 9 E           | 逐 | 秩 | 室 | 嫡 | 着 | 仲 | 著 | 宙 | 忠 | 抽 | 昼 | 柱 | 注 | 虫 | 衷 |   |
| 9 F           | 註 | 耐 | 鑄 | 駐 | 櫓 | 猪 | 苧 | 著 | 貯 | 丁 | 兆 | 凋 | 喋 | 寵 |   |   |
| A 2           | 帖 | 帳 | 庁 | 弔 | 張 | 彫 | 微 | 懲 | 挑 | 暢 | 朝 | 潮 | 牒 | 町 | 眺 |   |
| A 3           | 聽 | 脹 | 腸 | 蝶 | 調 | 譟 | 超 | 跳 | 銚 | 長 | 頂 | 鳥 | 勅 | 抄 | 直 | 朕 |
| A 4           | 沈 | 珍 | 賃 | 鎮 | 陳 | 津 | 墜 | 椎 | 槌 | 追 | 鎚 | 痛 | 通 | 塚 | 拇 | 摺 |
| A 5           | 槻 | 佃 | 漬 | 柘 | 辻 | 薦 | 綴 | 鏑 | 椿 | 潰 | 坪 | 壺 | 嬌 | 紬 | 爪 | 吊 |
| A 6           | 釣 | 鶴 | 亭 | 低 | 停 | 偵 | 剃 | 貞 | 呈 | 堤 | 定 | 帝 | 底 | 庭 | 廷 | 弟 |
| A 7           | 佛 | 抵 | 挺 | 提 | 梯 | 汀 | 碇 | 禎 | 程 | 締 | 艇 | 訂 | 諦 | 蹄 | 通 |   |
| AA            | 邸 | 鄭 | 釘 | 鼎 | 泥 | 摘 | 擢 | 敵 | 滴 | 的 | 笛 | 適 | 鎬 | 溺 | 哲 |   |
| AB            | 徹 | 撤 | 轍 | 迭 | 鉄 | 典 | 填 | 天 | 展 | 店 | 添 | 纏 | 甜 | 貼 | 軫 | 顛 |
| AC            | 点 | 伝 | 殿 | 澁 | 田 | 電 | 兎 | 吐 | 堵 | 塗 | 妬 | 屠 | 徒 | 斗 | 杜 | 渡 |
| AD            | 登 | 菟 | 賭 | 途 | 都 | 鍍 | 砥 | 砺 | 努 | 度 | 土 | 奴 | 怒 | 倒 | 党 | 冬 |
| AE            | 凍 | 刀 | 唐 | 塔 | 塘 | 套 | 宕 | 烏 | 嶋 | 悼 | 投 | 搭 | 東 | 桃 | 袴 | 棟 |
| AF            | 盜 | 淘 | 湯 | 涛 | 灯 | 燈 | 当 | 痘 | 棒 | 等 | 答 | 筒 | 糖 | 統 | 到 |   |
| B 2           | 董 | 蕩 | 藤 | 討 | 騰 | 豆 | 踏 | 逃 | 透 | 鎧 | 陶 | 頭 | 騰 | 闕 | 働 |   |
| B 3           | 動 | 同 | 堂 | 導 | 憧 | 撞 | 洞 | 瞳 | 童 | 胴 | 苟 | 道 | 銅 | 峠 | 錫 | 匿 |
| B 4           | 得 | 德 | 沆 | 特 | 督 | 禿 | 篤 | 毒 | 独 | 読 | 析 | 橡 | 凸 | 突 | 楸 | 屈 |
| B 5           | 鳶 | 苦 | 寅 | 酉 | 靜 | 順 | 屯 | 惇 | 敦 | 沌 | 豚 | 遁 | 頓 | 吞 | 曇 | 鈍 |
| B 6           | 奈 | 那 | 内 | 乍 | 凧 | 雍 | 謎 | 灘 | 捺 | 鍋 | 楮 | 馴 | 縄 | 暖 | 南 | 楠 |
| B 7           | 軟 | 難 | 汝 | 二 | 尼 | 弍 | 迹 | 勾 | 販 | 肉 | 虹 | 廿 | 日 | 乳 | 入 |   |
| BA            | 如 | 尿 | 韭 | 任 | 妊 | 忍 | 認 | 濡 | 欄 | 祢 | 寧 | 葱 | 猫 | 熟 | 年 |   |
| BB            | 念 | 捻 | 撚 | 粘 | 乃 | 迺 | 之 | 埜 | 囊 | 惱 | 濃 | 納 | 能 | 腦 | 膿 |   |
| BC            | 農 | 覗 | 蚤 | 巴 | 把 | 播 | 覇 | 杷 | 波 | 派 | 琶 | 破 | 婆 | 芭 | 馬 |   |
| BD            | 俳 | 癡 | 排 | 敗 | 杯 | 盃 | 牌 | 背 | 肺 | 輩 | 配 | 倍 | 培 | 媒 | 梅 |   |
| BE            | 煤 | 煤 | 狽 | 買 | 壳 | 賠 | 陪 | 這 | 蠅 | 秤 | 矧 | 荻 | 伯 | 剥 | 博 | 拍 |
| BF            | 柏 | 泊 | 白 | 箔 | 柏 | 舶 | 薄 | 迫 | 曝 | 爆 | 縛 | 莫 | 駁 | 麥 |   |   |

# HD66730/HD66731

Table 4 Relationship between Full-Size Character Code and Kanji (cont)

| Upper / Lower | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C 2           | 𠄎 | 函 | 箱 | 裕 | 箸 | 肇 | 筭 | 櫨 | 幡 | 肌 | 畑 | 畠 | 八 | 鉢 | 澆 | 発 |
| C 3           | 醜 | 髮 | 伐 | 罰 | 拔 | 筏 | 閥 | 鳩 | 嘶 | 塙 | 蛤 | 隼 | 伴 | 判 | 半 | 反 |
| C 4           | 叛 | 帆 | 搬 | 斑 | 板 | 汜 | 汎 | 版 | 犯 | 斑 | 畔 | 繁 | 般 | 藩 | 販 | 範 |
| C 5           | 忝 | 煩 | 頒 | 飯 | 挽 | 晩 | 番 | 盤 | 磐 | 蕃 | 蛭 | 匪 | 卑 | 否 | 妃 | 庇 |
| C 6           | 彼 | 悲 | 扉 | 批 | 披 | 斐 | 比 | 泌 | 疲 | 皮 | 碑 | 秘 | 緋 | 罷 | 肥 | 被 |
| C 7           | 誹 | 費 | 避 | 非 | 飛 | 樋 | 簸 | 備 | 尾 | 微 | 枇 | 毘 | 毳 | 眉 | 美 | 𠄎 |
| CA            | 𠄎 | 鼻 | 柎 | 稗 | 匹 | 疋 | 髭 | 彦 | 膝 | 菱 | 肘 | 彌 | 必 | 畢 | 筆 | 逼 |
| CB            | 桧 | 姫 | 媛 | 紐 | 百 | 謬 | 俵 | 彪 | 標 | 氷 | 漂 | 瓢 | 票 | 表 | 評 | 豹 |
| CC            | 廟 | 描 | 病 | 秒 | 苗 | 錨 | 鉦 | 蒜 | 蛭 | 鱈 | 品 | 彬 | 斌 | 浜 | 瀕 | 貧 |
| CD            | 賓 | 頻 | 敏 | 瓶 | 不 | 付 | 埠 | 婦 | 富 | 富 | 布 | 赴 | 阜 | 怖 | 扶 | 敷 |
| CE            | 斧 | 普 | 浮 | 父 | 符 | 腐 | 膚 | 芙 | 譜 | 負 | 賦 | 赴 | 阜 | 附 | 侮 | 撫 |
| CF            | 武 | 舞 | 葡 | 蕪 | 部 | 封 | 楓 | 風 | 葺 | 落 | 伏 | 副 | 復 | 幅 | 服 | 𠄎 |
| D 2           | 𠄎 | 福 | 腹 | 複 | 覆 | 淵 | 弗 | 弘 | 沸 | 仏 | 物 | 鮒 | 分 | 吻 | 噴 | 墳 |
| D 3           | 憤 | 扮 | 焚 | 奮 | 粉 | 糞 | 紛 | 雰 | 文 | 聞 | 丙 | 併 | 兵 | 塀 | 幣 | 平 |
| D 4           | 弊 | 柄 | 並 | 蔽 | 閉 | 陞 | 米 | 頁 | 僻 | 壁 | 癖 | 碧 | 別 | 瞥 | 蔑 | 篋 |
| D 5           | 偏 | 變 | 片 | 篇 | 編 | 辺 | 返 | 遍 | 便 | 勉 | 婉 | 弁 | 鞭 | 保 | 鋪 | 鋪 |
| D 6           | 圃 | 捕 | 步 | 甫 | 補 | 輔 | 穗 | 募 | 墓 | 慕 | 戊 | 暮 | 母 | 簿 | 菩 | 倣 |
| D 7           | 俸 | 包 | 呆 | 報 | 奉 | 宝 | 峰 | 峯 | 崩 | 庖 | 抱 | 捧 | 放 | 方 | 朋 | 𠄎 |
| DA            | 𠄎 | 法 | 泡 | 烹 | 砲 | 繆 | 胞 | 芳 | 萌 | 蓬 | 蜂 | 褒 | 訪 | 豐 | 邦 | 鋒 |
| DB            | 飽 | 鳳 | 鵬 | 乏 | 亡 | 傍 | 剖 | 坊 | 妨 | 帽 | 忘 | 忙 | 房 | 暴 | 望 | 某 |
| DC            | 棒 | 冒 | 紡 | 肪 | 膨 | 謀 | 貌 | 貿 | 鉦 | 防 | 吠 | 頰 | 北 | 僕 | 卜 | 墨 |
| DD            | 撲 | 朴 | 牧 | 睦 | 穆 | 釦 | 勃 | 沒 | 殆 | 堀 | 幌 | 奔 | 本 | 翻 | 凡 | 盆 |
| DE            | 摩 | 磨 | 魔 | 麻 | 埋 | 妹 | 昧 | 枚 | 每 | 哩 | 棋 | 幕 | 膜 | 枕 | 鮪 | 桎 |
| DF            | 鱒 | 榊 | 亦 | 俣 | 又 | 抹 | 末 | 沫 | 迄 | 俚 | 蔭 | 曆 | 萬 | 慢 | 滿 | 𠄎 |
| E 2           | 𠄎 | 漫 | 蔓 | 味 | 未 | 魅 | 巳 | 箕 | 岬 | 密 | 蜜 | 湊 | 糞 | 稔 | 脈 | 妙 |
| E 3           | 耗 | 民 | 眠 | 務 | 夢 | 無 | 牟 | 矛 | 霧 | 鷄 | 嬌 | 娘 | 冥 | 名 | 命 | 模 |
| E 4           | 明 | 盟 | 迷 | 銘 | 鳴 | 姪 | 牝 | 滅 | 免 | 綿 | 緬 | 面 | 麵 | 奎 | 勿 | 餅 |
| E 5           | 茂 | 妄 | 孟 | 毛 | 猛 | 盲 | 網 | 耗 | 蒙 | 儲 | 木 | 默 | 目 | 矚 | 勿 | 彌 |
| E 6           | 尤 | 戾 | 初 | 貫 | 問 | 悶 | 紋 | 門 | 匆 | 也 | 冶 | 夜 | 爺 | 耶 | 野 | 弥 |
| E 7           | 矢 | 厄 | 役 | 約 | 葉 | 訖 | 躍 | 靖 | 柳 | 菽 | 鍾 | 愉 | 愈 | 油 | 癒 | 𠄎 |
| EA            | 𠄎 | 論 | 輪 | 唯 | 佑 | 優 | 勇 | 友 | 宥 | 幽 | 悠 | 憂 | 揖 | 有 | 柚 | 湧 |
| EB            | 涌 | 猶 | 猷 | 由 | 祐 | 裕 | 誘 | 遊 | 邑 | 郵 | 雄 | 融 | 夕 | 予 | 余 | 与 |
| EC            | 譽 | 輿 | 預 | 傭 | 幼 | 妖 | 容 | 庸 | 揚 | 搖 | 擁 | 曜 | 楊 | 樣 | 洋 | 溶 |
| ED            | 熔 | 用 | 窯 | 羊 | 耀 | 葉 | 蓉 | 要 | 謠 | 踊 | 遙 | 陽 | 養 | 慾 | 抑 | 欲 |
| EE            | 沃 | 浴 | 翌 | 翼 | 淀 | 羅 | 螺 | 裸 | 來 | 萊 | 賴 | 雷 | 洛 | 絡 | 落 | 酪 |
| EF            | 乱 | 卵 | 嵐 | 欄 | 濫 | 藍 | 蘭 | 覽 | 利 | 吏 | 履 | 李 | 梨 | 理 | 璃 | 𠄎 |
| F 2           | 𠄎 | 痢 | 裏 | 裡 | 里 | 離 | 陸 | 律 | 率 | 立 | 律 | 掠 | 略 | 劉 | 流 | 溜 |
| F 3           | 琉 | 留 | 疏 | 粒 | 隆 | 竜 | 龍 | 侶 | 慮 | 旅 | 虜 | 了 | 亮 | 僚 | 兩 | 凌 |
| F 4           | 寮 | 料 | 梁 | 涼 | 胤 | 療 | 瞭 | 稜 | 糧 | 良 | 諒 | 遼 | 量 | 陵 | 領 | 力 |
| F 5           | 綠 | 倫 | 厘 | 林 | 淋 | 憐 | 琳 | 臨 | 輪 | 隣 | 鱗 | 麟 | 璫 | 罌 | 淚 | 累 |
| F 6           | 類 | 令 | 伶 | 列 | 冷 | 勵 | 嶺 | 伶 | 玲 | 礼 | 苓 | 鈴 | 隸 | 零 | 靈 | 麗 |
| F 7           | 齡 | 曆 | 歷 | 列 | 劣 | 烈 | 嶺 | 廉 | 戀 | 憐 | 漣 | 煉 | 鍊 | 練 | 聯 | 𠄎 |
| FA            | 𠄎 | 蓮 | 連 | 鍊 | 呂 | 魯 | 櫓 | 路 | 路 | 露 | 勞 | 婁 | 廊 | 弄 | 朗 | 朗 |
| FB            | 樓 | 榔 | 浪 | 漏 | 牢 | 狼 | 籠 | 老 | 輦 | 蠟 | 郎 | 六 | 麓 | 碌 | 肋 | 録 |
| FC            | 論 | 倭 | 和 | 話 | 歪 | 賄 | 脇 | 惑 | 粹 | 鶯 | 互 | 亘 | 鯉 | 詔 | 藁 | 蔵 |
| FD            | 腕 | 灣 | 碗 | 腕 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 |
| FE            | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 |
| FF            | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 | 𠄎 |

Table 5 Relationship between Full-Size Character Code and Non-Kanji

| Upper / Lower | 0  | 1 | 2 | 3 | 4 | 5 | 6 | 7  | 8  | 9  | A  | B  | C  | D  | E  | F  |
|---------------|----|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| 4 8           |    |   | 、 | 。 | ， | ・ | ・ | ：  | ：  | ？  | ！  | °  | °  | ′  | ′  | ″  |
| 4 9           | ˆ  | — | — | 、 | 、 | 、 | 、 | 、  | 全  | 々  | 々  | 〇  | —  | —  | —  | /  |
| 8 8           | ／  | ／ | ／ | ／ | ／ | ／ | ／ | ／  | ／  | ／  | ／  | ／  | ／  | ／  | ／  | ／  |
| 8 9           | ／  | ／ | ／ | ／ | ／ | ／ | ／ | ／  | ／  | ／  | ／  | ／  | ／  | ／  | ／  | ／  |
| C 8           | ÷  | = | ≠ | < | > | ≤ | ≥ | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  |
| C 9           | \$ | ¢ | £ | % | # | & | * | @  | §  | ☆  | ★  | ○  | ●  | ◎  | ◇  | ◇  |
| 5 0           | Ⓢ  | ◆ | □ | ■ | △ | ▲ | ▼ | ※  | 〒  | →  | ←  | ↑  | ↓  | ↔  | ↔  | ↔  |
| 5 1           | ↗  | ↖ | ↗ | ↖ | ↗ | ↖ | ↗ | ↖  | ↗  | ↖  | ↗  | ↖  | ↗  | ↖  | ↗  | ↖  |
| 9 0           | U  | ∩ | ∩ | ∩ | ∩ | ∩ | ∩ | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  |
| 9 1           | ∩  | ∩ | ∩ | ∩ | ∩ | ∩ | ∩ | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  | ∩  |
| D 0           | ▽  | ≡ | ≡ | < | > | √ | ∞ | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  | ∞  |
| D 1           | ♪  | ♪ | ♪ | ♪ | ♪ | ♪ | ♪ | ♪  | ♪  | ♪  | ♪  | ♪  | ♪  | ♪  | ♪  | ♪  |
| 5 8           | ①  | ① | ① | ① | ① | ① | ① | ①  | ①  | ①  | ①  | ①  | ①  | ①  | ①  | ①  |
| 5 9           | 0  | 1 | 2 | 3 | 4 | 5 | 6 | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
| 9 8           | A  | B | C | D | E | F | G | H  | I  | J  | K  | L  | M  | N  | O  |    |
| 9 9           | P  | Q | R | S | T | U | V | W  | X  | Y  | Z  | Ⓢ  | Ⓢ  | Ⓢ  | Ⓢ  | Ⓢ  |
| D 8           | a  | b | c | d | e | f | g | h  | i  | j  | k  | l  | m  | n  | o  |    |
| D 9           | p  | q | r | s | t | u | v | w  | x  | y  | z  | Ⓢ  | Ⓢ  | Ⓢ  | Ⓢ  | Ⓢ  |
| 6 0           | あ  | あ | い | い | う | う | え | え  | お  | お  | か  | が  | き  | ぎ  | く  |    |
| 6 1           | ぐ  | け | げ | こ | ご | さ | ざ | し  | じ  | す  | ず  | せ  | ぜ  | そ  | ぞ  | た  |
| A 0           | だ  | ち | ぢ | っ | つ | づ | て | で  | と  | ど  | な  | に  | ぬ  | ね  | の  | は  |
| A 1           | ば  | ぱ | び | び | ふ | ぶ | ぶ | へ  | べ  | べ  | は  | ほ  | ほ  | ま  | み  |    |
| E 0           | む  | め | も | や | ゆ | ゆ | よ | へ  | べ  | べ  | り  | る  | れ  | ろ  | わ  |    |
| E 1           | ゐ  | ゑ | を | ん | ゐ | ゑ | を | ん  | ゐ  | ゑ  | を  | ん  | ゐ  | ゑ  | を  | ん  |
| 6 8           | ア  | ア | イ | イ | ウ | ウ | エ | エ  | オ  | オ  | カ  | ガ  | キ  | ギ  | ク  |    |
| 6 9           | ケ  | ケ | コ | ゴ | サ | ザ | シ | ジ  | ス  | ズ  | セ  | ゼ  | ソ  | ゾ  | タ  |    |
| A 8           | ダ  | チ | ヂ | ッ | ツ | ヅ | テ | デ  | ト  | ド  | ナ  | ニ  | ヌ  | ノ  | ハ  |    |
| A 9           | バ  | パ | ヒ | ビ | フ | ブ | ブ | ヘ  | ベ  | ベ  | ホ  | ボ  | ボ  | マ  | ミ  |    |
| E 8           | ム  | メ | モ | ヤ | ユ | ユ | ヨ | ヨ  | ラ  | リ  | ル  | レ  | ロ  | ワ  | ワ  |    |
| E 9           | キ  | エ | ヲ | ン | ヅ | カ | ケ | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| 7 0           | ア  | B | Γ | Δ | E | Z | H | Θ  | I  | K  | Λ  | M  | N  | Ξ  | O  |    |
| 7 1           | Π  | P | Σ | T | T | Φ | X | Ψ  | Ω  | Δ  | Δ  | Δ  | Δ  | Δ  | Δ  | Δ  |
| B 0           | α  | β | γ | δ | ε | ζ | η | θ  | ι  | κ  | λ  | μ  | ν  | ξ  | ο  |    |
| B 1           | π  | ρ | σ | τ | υ | φ | χ | ψ  | ω  | Δ  | Δ  | Δ  | Δ  | Δ  | Δ  | Δ  |
| F 0           | Α  | Α | Α | Β | Γ | Δ | Ε | Ε  | Ε  | Ε  | Ε  | Ε  | Ε  | Ε  | Ε  | Ε  |
| F 1           | Ι  | Υ | Ι | Ι | Ι | Ι | Ι | Ι  | Ι  | Ι  | Ι  | Ι  | Ι  | Ι  | Ι  | Ι  |
| 7 8           | Α  | Β | Β | Γ | Δ | Ε | Ε | Ζ  | Ζ  | Η  | Θ  | Κ  | Λ  | Μ  | Ν  |    |
| 7 9           | Ο  | Π | Ρ | Σ | Τ | Υ | Φ | Χ  | Ψ  | Ω  | Α  | Β  | Γ  | Δ  | Ε  |    |
| B 8           | Ю  | Я | У | Ф | У | Ф | У | Ф  | У  | Ф  | У  | Ф  | У  | Ф  | У  |    |
| B 9           | а  | б | в | г | д | е | ё | ж  | з  | и  | й  | к  | л  | м  | н  |    |
| F 8           | о  | п | р | с | т | у | ф | х  | ц  | ч  | ш  | щ  | ъ  | ы  | ь  | э  |
| F 9           | ю  | я | ю | я | ю | я | ю | я  | ю  | я  | ю  | я  | ю  | я  | ю  | я  |
| 4 0           | —  | — | — | — | — | — | — | —  | —  | —  | —  | —  | —  | —  | —  | —  |
| 4 1           | —  | — | — | — | — | — | — | —  | —  | —  | —  | —  | —  | —  | —  | —  |
| 8 0           | +  | + | + | + | + | + | + | +  | +  | +  | +  | +  | +  | +  | +  | +  |
| 8 1           | —  | — | — | — | — | — | — | —  | —  | —  | —  | —  | —  | —  | —  | —  |
| C 0           | —  | — | — | — | — | — | — | —  | —  | —  | —  | —  | —  | —  | —  | —  |
| C 1           | —  | — | — | — | — | — | — | —  | —  | —  | —  | —  | —  | —  | —  | —  |

## HD66730/HD66731

**Table 6** Relationship between Half-Size Character Code and Character Pattern  
(ROM Code: A00)

| Upper<br>(4 bits)<br>Lower<br>(3 bits) | 0000 | 0001 | 0010 | 0011 | 0100    | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|--|------|------|------|------|---------|------|------|------|------|------|------|------|------|------|------|------|
| xxxx 000                               |      |      |      |      | (Space) |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 001                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 010                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 011                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 100                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 101                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 110                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |
| xxxx 111                               |      |      |      |      |         |      |      |      |      |      |      |      |      |      |      |      |

◆ **THE FIRST LUGGERS**

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

[illegible]

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|                                      |  |  |  |  |  |  |  |
|--------------------------------------|--|--|--|--|--|--|--|
| Full Font - 5,604, 730 - 000 ... 0FF |  |  |  |  |  |  |  |
| (000)                                |  |  |  |  |  |  |  |
| (001)                                |  |  |  |  |  |  |  |
| (002)                                |  |  |  |  |  |  |  |
| (003)                                |  |  |  |  |  |  |  |
| (004)                                |  |  |  |  |  |  |  |
| (005)                                |  |  |  |  |  |  |  |
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| (007)                                |  |  |  |  |  |  |  |
| (008)                                |  |  |  |  |  |  |  |
| (009)                                |  |  |  |  |  |  |  |
| (00A)                                |  |  |  |  |  |  |  |
| (00B)                                |  |  |  |  |  |  |  |
| (00C)                                |  |  |  |  |  |  |  |
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| (00F)                                |  |  |  |  |  |  |  |
| (010)                                |  |  |  |  |  |  |  |
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| (019)                                |  |  |  |  |  |  |  |
| (01A)                                |  |  |  |  |  |  |  |
| (01B)                                |  |  |  |  |  |  |  |
| (01C)                                |  |  |  |  |  |  |  |
| (01D)                                |  |  |  |  |  |  |  |
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| (01F)                                |  |  |  |  |  |  |  |
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| (02A)                                |  |  |  |  |  |  |  |
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| (030)                                |  |  |  |  |  |  |  |
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| (038)                                |  |  |  |  |  |  |  |
| (039)                                |  |  |  |  |  |  |  |
| (03A)                                |  |  |  |  |  |  |  |
| (03B)                                |  |  |  |  |  |  |  |
| (03C)                                |  |  |  |  |  |  |  |
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| (040)                                |  |  |  |  |  |  |  |
| (041)                                |  |  |  |  |  |  |  |
| (042)                                |  |  |  |  |  |  |  |
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| (046)                                |  |  |  |  |  |  |  |
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| (048)                                |  |  |  |  |  |  |  |
| (049)                                |  |  |  |  |  |  |  |
| (04A)                                |  |  |  |  |  |  |  |
| (04B)                                |  |  |  |  |  |  |  |
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| (059)                                |  |  |  |  |  |  |  |
| (05A)                                |  |  |  |  |  |  |  |
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| (068)                                |  |  |  |  |  |  |  |
| (069)                                |  |  |  |  |  |  |  |
| (06A)                                |  |  |  |  |  |  |  |
| (06B)                                |  |  |  |  |  |  |  |
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| (079)                                |  |  |  |  |  |  |  |
| (07A)                                |  |  |  |  |  |  |  |
| (07B)                                |  |  |  |  |  |  |  |
| (07C)                                |  |  |  |  |  |  |  |
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| (085)                                |  |  |  |  |  |  |  |
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| (089)                                |  |  |  |  |  |  |  |
| (08A)                                |  |  |  |  |  |  |  |
| (08B)                                |  |  |  |  |  |  |  |
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| (099)                                |  |  |  |  |  |  |  |
| (09A)                                |  |  |  |  |  |  |  |
| (09B)                                |  |  |  |  |  |  |  |
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| (09F)                                |  |  |  |  |  |  |  |
| (0A0)                                |  |  |  |  |  |  |  |
| (0A1)                                |  |  |  |  |  |  |  |
| (0A2)                                |  |  |  |  |  |  |  |
| (0A3)                                |  |  |  |  |  |  |  |
| (0A4)                                |  |  |  |  |  |  |  |
| (0A5)                                |  |  |  |  |  |  |  |
| (0A6)                                |  |  |  |  |  |  |  |
| (0A7)                                |  |  |  |  |  |  |  |
| (0A8)                                |  |  |  |  |  |  |  |
| (0A9)                                |  |  |  |  |  |  |  |
| (0AA)                                |  |  |  |  |  |  |  |
| (0AB)                                |  |  |  |  |  |  |  |
| (0AC)                                |  |  |  |  |  |  |  |
| (0AD)                                |  |  |  |  |  |  |  |
| (0AE)                                |  |  |  |  |  |  |  |
| (0AF)                                |  |  |  |  |  |  |  |
| (0B0)                                |  |  |  |  |  |  |  |
| (0B1)                                |  |  |  |  |  |  |  |
| (0B2)                                |  |  |  |  |  |  |  |
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| (0B5)                                |  |  |  |  |  |  |  |
| (0B6)                                |  |  |  |  |  |  |  |
| (0B7)                                |  |  |  |  |  |  |  |
| (0B8)                                |  |  |  |  |  |  |  |
| (0B9)                                |  |  |  |  |  |  |  |
| (0BA)                                |  |  |  |  |  |  |  |
| (0BB)                                |  |  |  |  |  |  |  |
| (0BC)                                |  |  |  |  |  |  |  |
| (0BD)                                |  |  |  |  |  |  |  |
| (0BE)                                |  |  |  |  |  |  |  |
| (0BF)                                |  |  |  |  |  |  |  |
| (0C0)                                |  |  |  |  |  |  |  |
| (0C1)                                |  |  |  |  |  |  |  |
| (0C2)                                |  |  |  |  |  |  |  |
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| (0C7)                                |  |  |  |  |  |  |  |
| (0C8)                                |  |  |  |  |  |  |  |
| (0C9)                                |  |  |  |  |  |  |  |
| (0CA)                                |  |  |  |  |  |  |  |
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| (0CE)                                |  |  |  |  |  |  |  |
| (0CF)                                |  |  |  |  |  |  |  |
| (0D0)                                |  |  |  |  |  |  |  |
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| (0D9)                                |  |  |  |  |  |  |  |
| (0DA)                                |  |  |  |  |  |  |  |
| (0DB)                                |  |  |  |  |  |  |  |
| (0DC)                                |  |  |  |  |  |  |  |
| (0DD)                                |  |  |  |  |  |  |  |
| (0DE)                                |  |  |  |  |  |  |  |
| (0DF)                                |  |  |  |  |  |  |  |
| (0E0)                                |  |  |  |  |  |  |  |
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| (0E7)                                |  |  |  |  |  |  |  |
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| (0E9)                                |  |  |  |  |  |  |  |
| (0EA)                                |  |  |  |  |  |  |  |
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| (0EC)                                |  |  |  |  |  |  |  |
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| (0EE)                                |  |  |  |  |  |  |  |
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| (0F0)                                |  |  |  |  |  |  |  |
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| (0F3)                                |  |  |  |  |  |  |  |
| (0F4)                                |  |  |  |  |  |  |  |
| (0F5)                                |  |  |  |  |  |  |  |
| (0F6)                                |  |  |  |  |  |  |  |
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| (0F9)                                |  |  |  |  |  |  |  |
| (0FA)                                |  |  |  |  |  |  |  |
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| (0FE)                                |  |  |  |  |  |  |  |
| (0FF)                                |  |  |  |  |  |  |  |

# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 | 0008 | 0009 | 000A | 000B | 000C | 000D | 000E | 000F |
| 0010 | 0011 | 0012 | 0013 | 0014 | 0015 | 0016 | 0017 | 0018 | 0019 | 001A | 001B | 001C | 001D | 001E | 001F |
| 0020 | 0021 | 0022 | 0023 | 0024 | 0025 | 0026 | 0027 | 0028 | 0029 | 002A | 002B | 002C | 002D | 002E | 002F |
| 0030 | 0031 | 0032 | 0033 | 0034 | 0035 | 0036 | 0037 | 0038 | 0039 | 003A | 003B | 003C | 003D | 003E | 003F |
| 0040 | 0041 | 0042 | 0043 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 | 004A | 004B | 004C | 004D | 004E | 004F |
| 0050 | 0051 | 0052 | 0053 | 0054 | 0055 | 0056 | 0057 | 0058 | 0059 | 005A | 005B | 005C | 005D | 005E | 005F |
| 0060 | 0061 | 0062 | 0063 | 0064 | 0065 | 0066 | 0067 | 0068 | 0069 | 006A | 006B | 006C | 006D | 006E | 006F |
| 0070 | 0071 | 0072 | 0073 | 0074 | 0075 | 0076 | 0077 | 0078 | 0079 | 007A | 007B | 007C | 007D | 007E | 007F |
| 0080 | 0081 | 0082 | 0083 | 0084 | 0085 | 0086 | 0087 | 0088 | 0089 | 008A | 008B | 008C | 008D | 008E | 008F |
| 0090 | 0091 | 0092 | 0093 | 0094 | 0095 | 0096 | 0097 | 0098 | 0099 | 009A | 009B | 009C | 009D | 009E | 009F |
| 00A0 | 00A1 | 00A2 | 00A3 | 00A4 | 00A5 | 00A6 | 00A7 | 00A8 | 00A9 | 00AA | 00AB | 00AC | 00AD | 00AE | 00AF |
| 00B0 | 00B1 | 00B2 | 00B3 | 00B4 | 00B5 | 00B6 | 00B7 | 00B8 | 00B9 | 00BA | 00BB | 00BC | 00BD | 00BE | 00BF |
| 00C0 | 00C1 | 00C2 | 00C3 | 00C4 | 00C5 | 00C6 | 00C7 | 00C8 | 00C9 | 00CA | 00CB | 00CC | 00CD | 00CE | 00CF |
| 00D0 | 00D1 | 00D2 | 00D3 | 00D4 | 00D5 | 00D6 | 00D7 | 00D8 | 00D9 | 00DA | 00DB | 00DC | 00DD | 00DE | 00DF |
| 00E0 | 00E1 | 00E2 | 00E3 | 00E4 | 00E5 | 00E6 | 00E7 | 00E8 | 00E9 | 00EA | 00EB | 00EC | 00ED | 00EE | 00EF |
| 00F0 | 00F1 | 00F2 | 00F3 | 00F4 | 00F5 | 00F6 | 00F7 | 00F8 | 00F9 | 00FA | 00FB | 00FC | 00FD | 00FE | 00FF |

HITACHI



[illegible]

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |   |   |   |   |
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| 276 | 275 | 274 | 273 | 272 | 271 | 270 | 269 | 268 | 267 | 266 | 265 | 264 | 263 | 262 | 261 | 260 | 259 | 258 | 257 | 256 | 255 | 254 | 253 | 252 | 251 | 250 | 249 | 248 | 247 | 246 | 245 | 244 | 243 | 242 | 241 | 240 | 239 | 238 | 237 | 236 | 235 | 234 | 233 | 232 | 231 | 230 | 229 | 228 | 227 | 226 | 225 | 224 | 223 | 222 | 221 | 220 | 219 | 218 | 217 | 216 | 215 | 214 | 213 | 212 | 211 | 210 | 209 | 208 | 207 | 206 | 205 | 204 | 203 | 202 | 201 | 200 | 199 | 198 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 190 | 189 | 188 | 187 | 186 | 185 | 184 | 183 | 182 | 181 | 180 | 179 | 178 | 177 | 176 | 175 | 174 | 173 | 172 | 171 | 170 | 169 | 168 | 167 | 166 | 165 | 164 | 163 | 162 | 161 | 160 | 159 | 158 | 157 | 156 | 155 | 154 | 153 | 152 | 151 | 150 | 149 | 148 | 147 | 146 | 145 | 144 | 143 | 142 | 141 | 140 | 139 | 138 | 137 | 136 | 135 | 134 | 133 | 132 | 131 | 130 | 129 | 128 | 127 | 126 | 125 | 124 | 123 | 122 | 121 | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 | 112 | 111 | 110 | 109 | 108 | 107 | 106 | 105 | 104 | 103 | 102 | 101 | 100 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 | 91 | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 | 75 | 74 | 73 | 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 | 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
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**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|                    |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     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|       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
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| Full-Font Code Map | (280) | (281) | (282) | (283) | (284) | (285) | (286) | (287) | (288) | (289) | (290) | (291) | (292) | (293) | (294) | (295) | (296) | (297) | (298) | (299) | (300) | (301) | (302) | (303) | (304) | (305) | (306) | (307) | (308) | (309) | (310) | (311) | (312) | (313) | (314) | (315) | (316) | (317) | (318) | (319) | (320) | (321) | (322) | (323) | (324) | (325) | (326) | (327) | (328) | (329) | (330) | (331) | (332) | (333) | (334) | (335) | (336) | (337) | (338) | (339) | (340) | (341) | (342) | (343) | (344) | (345) | (346) | (347) | (348) | (349) | (350) | (351) | (352) | (353) | (354) | (355) | (356) | (357) | (358) | (359) | (360) | (361) | (362) | (363) | (364) | (365) | (366) | (367) | (368) | (369) | (370) | (371) | (372) | (373) | (374) | (375) | (376) | (377) | (378) | (379) | (380) | (381) | (382) | (383) | (384) | (385) | (386) | (387) | (388) | (389) | (390) | (391) | (392) | (393) | (394) | (395) | (396) | (397) | (398) | (399) | (400) | (401) | (402) | (403) | (404) | (405) | (406) | (407) | (408) | (409) | (410) | (411) | (412) | (413) | (414) | (415) | (416) | (417) | (418) | (419) | (420) | (421) | (422) | (423) | (424) | (425) | (426) | (427) | (428) | (429) | (430) | (431) | (432) | (433) | (434) | (435) | (436) | (437) | (438) | (439) | (440) | (441) | (442) | (443) | (444) | (445) | (446) | (447) | (448) | (449) | (450) | (451) | (452) | (453) | (454) | (455) | (456) | (457) | (458) | (459) | (460) | (461) | (462) | (463) | (464) | (465) | (466) | (467) | (468) | (469) | (470) | (471) | (472) | (473) | (474) | (475) | (476) | (477) | (478) | (479) | (480) | (481) | (482) | (483) | (484) | (485) | (486) | (487) | (488) | (489) | (490) | (491) | (492) | (493) | (494) | (495) | (496) | (497) | (498) | (499) | (500) | (501) | (502) | (503) | (504) | (505) | (506) | (507) | (508) | (509) | (510) | (511) | (512) | (513) | (514) | (515) | (516) | (517) | (518) | (519) | (520) | (521) | (522) | (523) | (524) | (525) | (526) | (527) | (528) | (529) | (530) | (531) | (532) | (533) | (534) | (535) | (536) | (537) | (538) | (539) | (540) | (541) | (542) | (543) | (544) | (545) | (546) | (547) | (548) | (549) | (550) | (551) | (552) | (553) | (554) | (555) | (556) | (557) | (558) | (559) | (560) | (561) | (562) | (563) | (564) | (565) | (566) | (567) | (568) | (569) | (570) | (571) | (572) | (573) | (574) | (575) | (576) | (577) | (578) | (579) | (580) | (581) | (582) | (583) | (584) | (585) | (586) | (587) | (588) | (589) | (590) | (591) | (592) | (593) | (594) | (595) | (596) | (597) | (598) | (599) | (600) | (601) | (602) | (603) | (604) | (605) | (606) | (607) | (608) | (609) | (610) | (611) | (612) | (613) | (614) | (615) | (616) | (617) | (618) | (619) | (620) | (621) | (622) | (623) | (624) | (625) | (626) | (627) | (628) | (629) | (630) | (631) | (632) | (633) | (634) | (635) | (636) | (637) | (638) | (639) | (640) | (641) | (642) | (643) | (644) | (645) | (646) | (647) | (648) | (649) | (650) | (651) | (652) | (653) | (654) | (655) | (656) | (657) | (658) | (659) | (660) | (661) | (662) | (663) | (664) | (665) | (666) | (667) | (668) | (669) | (670) | (671) | (672) | (673) | (674) | (675) | (676) | (677) | (678) | (679) | (680) | (681) | (682) | (683) | (684) | (685) | (686) | (687) | (688) | (689) | (690) | (691) | (692) | (693) | (694) | (695) | (696) | (697) | (698) | (699) | (700) | (701) | (702) | (703) | (704) | (705) | (706) | (707) | (708) | (709) | (710) | (711) | (712) | (713) | (714) | (715) | (716) | (717) | (718) | (719) | (720) | (721) | (722) | (723) | (724) | (725) | (726) | (727) | (728) | (729) | (730) | (731) | (732) | (733) | (734) | (735) | (736) | (737) | (738) | (739) | (740) | (741) | (742) | (743) | (744) | (745) | (746) | (747) | (748) | (749) | (750) | (751) | (752) | (753) | (754) | (755) | (756) | (757) | (758) | (759) | (760) | (761) | (762) | (763) | (764) | (765) | (766) | (767) | (768) | (769) | (770) | (771) | (772) | (773) | (774) | (775) | (776) | (777) | (778) | (779) | (780) | (781) | (782) | (783) | (784) | (785) | (786) | (787) | (788) | (789) | (790) | (791) | (792) | (793) | (794) | (795) | (796) | (797) | (798) | (799) | (800) | (801) | (802) | (803) | (804) | (805) | (806) | (807) | (808) | (809) | (810) | (811) | (812) | (813) | (814) | (815) | (816) | (817) | (818) | (819) | (820) | (821) | (822) | (823) | (824) | (825) | (826) | (827) | (828) | (829) | (830) | (831) | (832) | (833) | (834) | (835) | (836) | (837) | (838) | (839) | (840) | (841) | (842) | (843) | (844) | (845) | (846) | (847) | (848) | (849) | (850) | (851) | (852) | (853) | (854) | (855) | (856) | (857) | (858) | (859) | (860) | (861) | (862) | (863) | (864) | (865) | (866) | (867) | (868) | (869) | (870) | (871) | (872) | (873) | (874) | (875) | (876) | (877) | (878) | (879) | (880) | (881) | (882) | (883) | (884) | (885) | (886) | (887) | (888) | (889) | (890) | (891) | (892) | (893) | (894) | (895) | (896) | (897) | (898) | (899) | (900) | (901) | (902) | (903) | (904) | (905) | (906) | (907) | (908) | (909) | (910) | (911) | (912) | (913) | (914) | (915) | (916) | (917) | (918) | (919) | (920) | (921) | (922) | (923) | (924) | (925) | (926) | (927) | (928) | (929) | (930) | (931) | (932) | (933) | (934) | (935) | (936) | (937) | (938) | (939) | (940) | (941) | (942) | (943) | (944) | (945) | (946) | (947) | (948) | (949) | (950) | (951) | (952) | (953) | (954) | (955) | (956) | (957) | (958) | (959) | (960) | (961) | (962) | (963) | (964) | (965) | (966) | (967) | (968) | (969) | (970) | (971) | (972) | (973) | (974) | (975) | (976) | (977) | (978) | (979) | (980) | (981) | (982) | (983) | (984) | (985) | (986) | (987) | (988) | (989) | (990) | (991) | (992) | (993) | (994) | (995) | (996) | (997) | (998) | (999) |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--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**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

[illegible]

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

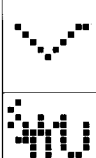
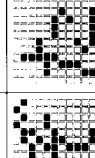

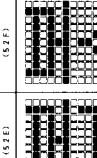
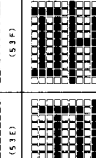
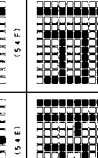
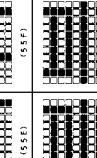
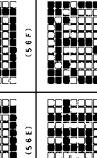

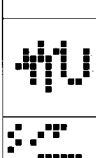
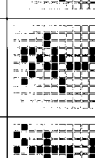

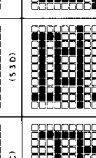
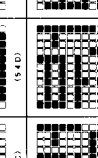
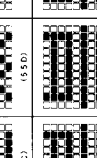
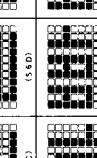


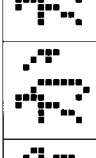
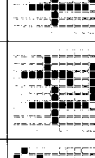
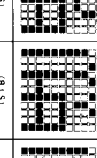
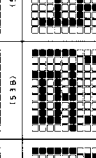
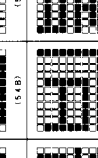
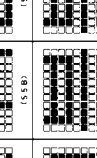
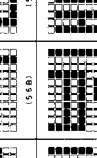


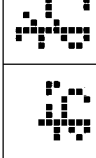
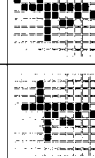

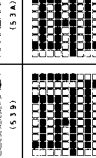





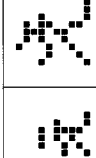
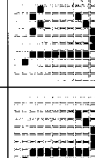
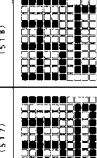
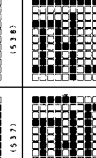


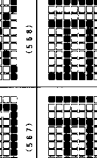


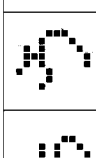
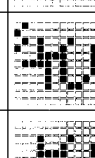
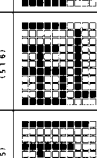
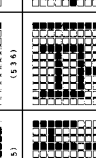
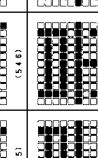
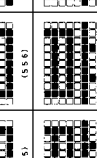
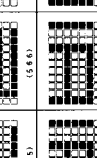


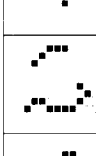
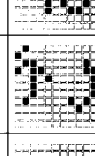

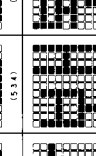
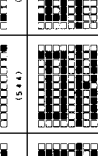
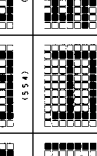
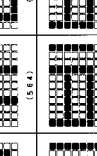


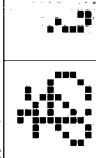
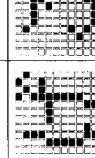


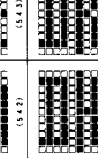

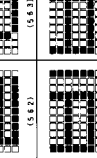


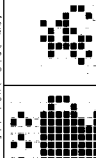
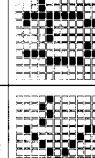

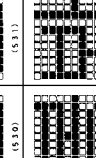
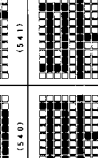

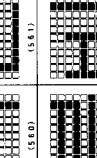










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| 3816      | 3817      | 3818      | 3819      | 3820      | 3821      | 3822      | 3823      |
| 3824      | 3825      | 3826      | 3827      | 3828      | 3829      | 3830      | 3831      |
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| 3848      | 3849      | 3850      | 3851      | 3852      | 3853      | 3854      | 3855      |
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| 3864      | 3865      | 3866      | 3867      | 3868      | 3869      | 3870      | 3871      |
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| 3880      | 3881      | 3882      | 3883      | 3884      | 3885      | 3886      | 3887      |
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| 3904      | 3905      | 3906      | 3907      | 3908      | 3909      | 3910      | 3911      |
| 3912      | 3913      | 3914      | 3915      | 3916      | 3917      | 3918      | 3919      |
| 3920      | 3921      | 3922      | 3923      | 3924      | 3925      | 3926      | 3927      |
| 3928      | 3929      | 3930      | 3931      | 3932      | 3933      | 3934      | 3935      |
| 3936      | 3937      | 3938      | 3939      | 3940      | 3941      | 3942      | 3943      |
| 3944      | 3945      | 3946      | 3947      | 3948      | 3949      | 3950      | 3951      |
| 3952      | 3953      | 3954      | 3955      | 3956      | 3957      | 3958      | 3959      |
| 3960      | 3961      | 3962      | 3963      | 3964      | 3965      | 3966      | 3967      |
| 3968      | 3969      | 3970      | 3971      | 3972      | 3973      | 3974      | 3975      |
| 3976      | 3977      | 3978      | 3979      | 3980      | 3981      | 3982      | 3983      |
| 3984      | 3985      | 3986      | 3987      | 3988      | 3989      | 3990      | 3991      |
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HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|    |    |    |    |    |    |    |    |
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| +  | +  | +  | +  | +  | +  | +  | +  |
| △  | △  | △  | △  | △  | △  | △  | △  |
| ○  | ○  | ○  | ○  | ○  | ○  | ○  | ○  |
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| +  | +  | +  | +  | +  | +  | +  | +  |
| +  | +  | +  | +  | +  | +  | +  | +  |
|    |    |    |    |    |    |    |    |
| 3  | 3  | 3  | 3  | 3  | 3  | 3  | 3  |
|    |    |    |    |    |    |    |    |
| 4  | 4  | 4  | 4  | 4  | 4  | 4  | 4  |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 8  | 8  | 8  | 8  | 8  | 8  | 8  | 8  |
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



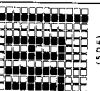







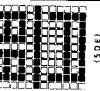







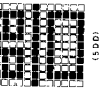























































































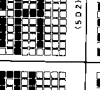


















**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|   |   |   |   |  |   |   |   |   |
|---|---|---|---|--|---|---|---|---|
|    |  (50.0%)   |  (51.0%)   |  (52.0%)   |  (53.0%)    |  (54.0%)    |  (55.0%)   |  (56.0%)   |  (57.0%)   |
|    |  (51.1%)   |  (52.1%)   |  (53.1%)   |  (54.1%)   |  (55.1%)   |  (56.1%)   |  (57.1%)   |  (58.0%)   |
|    |  (51.2%)   |  (52.2%)   |  (53.2%)   |  (54.2%)   |  (55.2%)   |  (56.2%)   |  (57.2%)   |  (58.1%)  |
|   |  (51.3%)  |  (52.3%)  |  (53.3%)  |  (54.3%)  |  (55.3%)  |  (56.3%)  |  (57.3%)  |  (58.2%) |
|  |  (51.4%) |  (52.4%) |  (53.4%) |  (54.4%) |  (55.4%) |  (56.4%) |  (57.4%) |  (58.3%) |
|  |  (51.5%) |  (52.5%) |  (53.5%) |  (54.5%) |  (55.5%) |  (56.5%) |  (57.5%) |  (58.4%) |
|  |  (51.6%) |  (52.6%) |  (53.6%) |  (54.6%) |  (55.6%) |  (56.6%) |  (57.6%) |  (58.5%) |
|  |  (51.7%) |  (52.7%) |  (53.7%) |  (54.7%) |  (55.7%) |  (56.7%) |  (57.7%) |  (58.6%) |
|  |  (51.8%) |  (52.8%) |  (53.8%) |  (54.8%) |  (55.8%) |  (56.8%) |  (57.8%) |  (58.7%) |
|  |  (51.9%) |  (52.9%) |  (53.9%) |  (54.9%) |  (55.9%) |  (56.9%) |  (57.9%) |  (58.8%) |
|  |  (52.0%) |  (53.0%) |  (54.0%) |  (55.0%) |  (56.0%) |  (57.0%) |  (58.0%) |   |
|  |  (52.1%) |   |   |  |   |   |   |   |

**HITACHI**



HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|   |   |   |   |   |  |   |   |
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**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

[illegible]

[illegible]

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

Full-Foot Calfs Meo 92. 92.

Full-Font Code Map 180 ~ 188


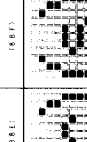








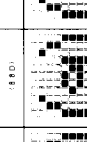
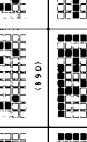
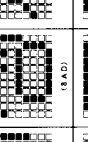


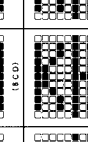
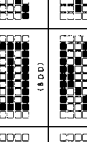
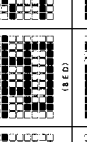

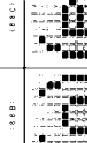


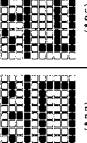

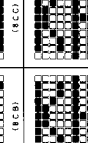



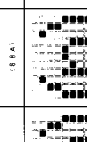

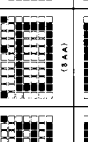

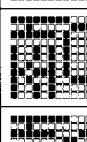
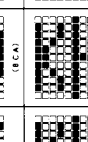
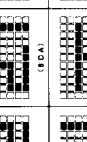


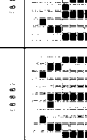


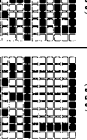

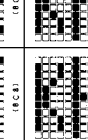
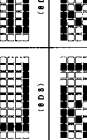


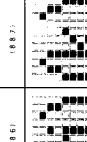





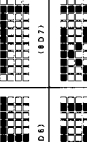
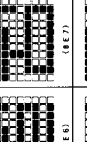

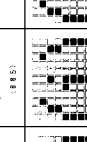

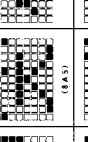

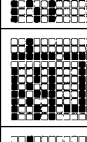
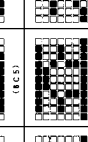
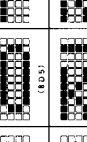
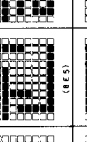
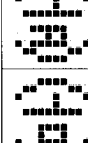
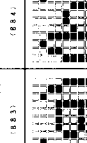

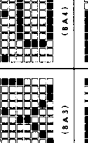

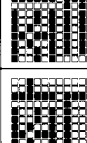




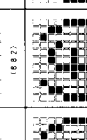
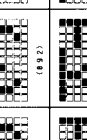
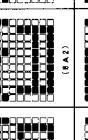

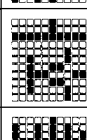
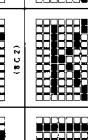
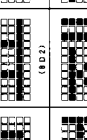
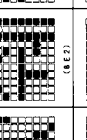
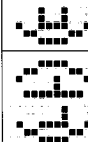
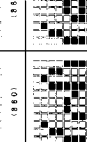

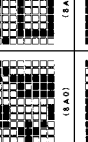



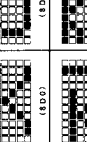

# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|
| 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 |
| 0008 | 0009 | 0010 | 0011 | 0012 | 0013 | 0014 | 0015 |
| 0016 | 0017 | 0018 | 0019 | 0020 | 0021 | 0022 | 0023 |
| 0024 | 0025 | 0026 | 0027 | 0028 | 0029 | 0030 | 0031 |
| 0032 | 0033 | 0034 | 0035 | 0036 | 0037 | 0038 | 0039 |
| 0040 | 0041 | 0042 | 0043 | 0044 | 0045 | 0046 | 0047 |
| 0048 | 0049 | 0050 | 0051 | 0052 | 0053 | 0054 | 0055 |
| 0056 | 0057 | 0058 | 0059 | 0060 | 0061 | 0062 | 0063 |
| 0064 | 0065 | 0066 | 0067 | 0068 | 0069 | 0070 | 0071 |
| 0072 | 0073 | 0074 | 0075 | 0076 | 0077 | 0078 | 0079 |
| 0080 | 0081 | 0082 | 0083 | 0084 | 0085 | 0086 | 0087 |
| 0088 | 0089 | 0090 | 0091 | 0092 | 0093 | 0094 | 0095 |
| 0096 | 0097 | 0098 | 0099 | 0100 | 0101 | 0102 | 0103 |
| 0104 | 0105 | 0106 | 0107 | 0108 | 0109 | 0110 | 0111 |
| 0112 | 0113 | 0114 | 0115 | 0116 | 0117 | 0118 | 0119 |
| 0120 | 0121 | 0122 | 0123 | 0124 | 0125 | 0126 | 0127 |
| 0128 | 0129 | 0130 | 0131 | 0132 | 0133 | 0134 | 0135 |
| 0136 | 0137 | 0138 | 0139 | 0140 | 0141 | 0142 | 0143 |
| 0144 | 0145 | 0146 | 0147 | 0148 | 0149 | 0150 | 0151 |
| 0152 | 0153 | 0154 | 0155 | 0156 | 0157 | 0158 | 0159 |
| 0160 | 0161 | 0162 | 0163 | 0164 | 0165 | 0166 | 0167 |
| 0168 | 0169 | 0170 | 0171 | 0172 | 0173 | 0174 | 0175 |
| 0176 | 0177 | 0178 | 0179 | 0180 | 0181 | 0182 | 0183 |
| 0184 | 0185 | 0186 | 0187 | 0188 | 0189 | 0190 | 0191 |
| 0192 | 0193 | 0194 | 0195 | 0196 | 0197 | 0198 | 0199 |
| 0200 | 0201 | 0202 | 0203 | 0204 | 0205 | 0206 | 0207 |
| 0208 | 0209 | 0210 | 0211 | 0212 | 0213 | 0214 | 0215 |
| 0216 | 0217 | 0218 | 0219 | 0220 | 0221 | 0222 | 0223 |
| 0224 | 0225 | 0226 | 0227 | 0228 | 0229 | 0230 | 0231 |
| 0232 | 0233 | 0234 | 0235 | 0236 | 0237 | 0238 | 0239 |
| 0240 | 0241 | 0242 | 0243 | 0244 | 0245 | 0246 | 0247 |
| 0248 | 0249 | 0250 | 0251 | 0252 | 0253 | 0254 | 0255 |
| 0256 | 0257 | 0258 | 0259 | 0260 | 0261 | 0262 | 0263 |
| 0264 | 0265 | 0266 | 0267 | 0268 | 0269 | 0270 | 0271 |
| 0272 | 0273 | 0274 | 0275 | 0276 | 0277 | 0278 | 0279 |
| 0280 | 0281 | 0282 | 0283 | 0284 | 0285 | 0286 | 0287 |
| 0288 | 0289 | 0290 | 0291 | 0292 | 0293 | 0294 | 0295 |
| 0296 | 0297 | 0298 | 0299 | 0300 | 0301 | 0302 | 0303 |
| 0304 | 0305 | 0306 | 0307 | 0308 | 0309 | 0310 | 0311 |
| 0312 | 0313 | 0314 | 0315 | 0316 | 0317 | 0318 | 0319 |
| 0320 | 0321 | 0322 | 0323 | 0324 | 0325 | 0326 | 0327 |
| 0328 | 0329 | 0330 | 0331 | 0332 | 0333 | 0334 | 0335 |
| 0336 | 0337 | 0338 | 0339 | 0340 | 0341 | 0342 | 0343 |
| 0344 | 0345 | 0346 | 0347 | 0348 | 0349 | 0350 | 0351 |
| 0352 | 0353 | 0354 | 0355 | 0356 | 0357 | 0358 | 0359 |
| 0360 | 0361 | 0362 | 0363 | 0364 | 0365 | 0366 | 0367 |
| 0368 | 0369 | 0370 | 0371 | 0372 | 0373 | 0374 | 0375 |
| 0376 | 0377 | 0378 | 0379 | 0380 | 0381 | 0382 | 0383 |
| 0384 | 0385 | 0386 | 0387 | 0388 | 0389 | 0390 | 0391 |
| 0392 | 0393 | 0394 | 0395 | 0396 | 0397 | 0398 | 0399 |
| 0400 | 0401 | 0402 | 0403 | 0404 | 0405 | 0406 | 0407 |
| 0408 | 0409 | 0410 | 0411 | 0412 | 0413 | 0414 | 0415 |
| 0416 | 0417 | 0418 | 0419 | 0420 | 0421 | 0422 | 0423 |
| 0424 | 0425 | 0426 | 0427 | 0428 | 0429 | 0430 | 0431 |
| 0432 | 0433 | 0434 | 0435 | 0436 | 0437 | 0438 | 0439 |
| 0440 | 0441 | 0442 | 0443 | 0444 | 0445 | 0446 | 0447 |
| 0448 | 0449 | 0450 | 0451 | 0452 | 0453 | 0454 | 0455 |
| 0456 | 0457 | 0458 | 0459 | 0460 | 0461 | 0462 | 0463 |
| 0464 | 0465 | 0466 | 0467 | 0468 | 0469 | 0470 | 0471 |
| 0472 | 0473 | 0474 | 0475 | 0476 | 0477 | 0478 | 0479 |
| 0480 | 0481 | 0482 | 0483 | 0484 | 0485 | 0486 | 0487 |
| 0488 | 0489 | 0490 | 0491 | 0492 | 0493 | 0494 | 0495 |
| 0496 | 0497 | 0498 | 0499 | 0500 | 0501 | 0502 | 0503 |
| 0504 | 0505 | 0506 | 0507 | 0508 | 0509 | 0510 | 0511 |
| 0512 | 0513 | 0514 | 0515 | 0516 | 0517 | 0518 | 0519 |
| 0520 | 0521 | 0522 | 0523 | 0524 | 0525 | 0526 | 0527 |
| 0528 | 0529 | 0530 | 0531 | 0532 | 0533 | 0534 | 0535 |
| 0536 | 0537 | 0538 | 0539 | 0540 | 0541 | 0542 | 0543 |
| 0544 | 0545 | 0546 | 0547 | 0548 | 0549 | 0550 | 0551 |
| 0552 | 0553 | 0554 | 0555 | 0556 | 0557 | 0558 | 0559 |
| 0560 | 0561 | 0562 | 0563 | 0564 | 0565 | 0566 | 0567 |
| 0568 | 0569 | 0570 | 0571 | 0572 | 0573 | 0574 | 0575 |
| 0576 | 0577 | 0578 | 0579 | 0580 | 0581 | 0582 | 0583 |
| 0584 | 0585 | 0586 | 0587 | 0588 | 0589 | 0590 | 0591 |
| 0592 | 0593 | 0594 | 0595 | 0596 | 0597 | 0598 | 0599 |
| 0600 | 0601 | 0602 | 0603 | 0604 | 0605 | 0606 | 0607 |
| 0608 | 0609 | 0610 | 0611 | 0612 | 0613 | 0614 | 0615 |
| 0616 | 0617 | 0618 | 0619 | 0620 | 0621 | 0622 | 0623 |
| 0624 | 0625 | 0626 | 0627 | 0628 | 0629 | 0630 | 0631 |
| 0632 | 0633 | 0634 | 0635 | 0636 | 0637 | 0638 | 0639 |
| 0640 | 0641 | 0642 | 0643 | 0644 | 0645 | 0646 | 0647 |
| 0648 | 0649 | 0650 | 0651 | 0652 | 0653 | 0654 | 0655 |
| 0656 | 0657 | 0658 | 0659 | 0660 | 0661 | 0662 | 0663 |
| 0664 | 0665 | 0666 | 0667 | 0668 | 0669 | 0670 | 0671 |
| 0672 | 0673 | 0674 | 0675 | 0676 | 0677 | 0678 | 0679 |
| 0680 | 0681 | 0682 | 0683 | 0684 | 0685 | 0686 | 0687 |
| 0688 | 0689 | 0690 | 0691 | 0692 | 0693 | 0694 | 0695 |
| 0696 | 0697 | 0698 | 0699 | 0700 | 0701 | 0702 | 0703 |
| 0704 | 0705 | 0706 | 0707 | 0708 | 0709 | 0710 | 0711 |
| 0712 | 0713 | 0714 | 0715 | 0716 | 0717 | 0718 | 0719 |
| 0720 | 0721 | 0722 | 0723 | 0724 | 0725 | 0726 | 0727 |
| 0728 | 0729 | 0730 | 0731 | 0732 | 0733 | 0734 | 0735 |
| 0736 | 0737 | 0738 | 0739 | 0740 | 0741 | 0742 | 0743 |
| 0744 | 0745 | 0746 | 0747 | 0748 | 0749 | 0750 | 0751 |
| 0752 | 0753 | 0754 | 0755 | 0756 | 0757 | 0758 | 0759 |
| 0760 | 0761 | 0762 | 0763 | 0764 | 0765 | 0766 | 0767 |
| 0768 | 0769 | 0770 | 0771 | 0772 | 0773 | 0774 | 0775 |
| 0776 | 0777 | 0778 | 0779 | 0780 | 0781 | 0782 | 0783 |
| 0784 | 0785 | 0786 | 0787 | 0788 | 0789 | 0790 | 0791 |
| 0792 | 0793 | 0794 | 0795 | 0796 | 0797 | 0798 | 0799 |
| 0800 | 0801 | 0802 | 0803 | 0804 | 0805 | 0806 | 0807 |
| 0808 | 0809 | 0810 | 0811 | 0812 | 0813 | 0814 | 0815 |
| 0816 | 0817 | 0818 | 0819 | 0820 | 0821 | 0822 | 0823 |
| 0824 | 0825 | 0826 | 0827 | 0828 | 0829 | 0830 | 0831 |
| 0832 | 0833 | 0834 | 0835 | 0836 | 0837 | 0838 | 0839 |
| 0840 | 0841 | 0842 | 0843 | 0844 | 0845 | 0846 | 0847 |
| 0848 | 0849 | 0850 | 0851 | 0852 | 0853 | 0854 | 0855 |
| 0856 | 0857 | 0858 | 0859 | 0860 | 0861 | 0862 | 0863 |
| 0864 | 0865 | 0866 | 0867 | 0868 | 0869 | 0870 | 0871 |
| 0872 | 0873 | 0874 | 0875 | 0876 | 0877 | 0878 | 0879 |
| 0880 | 0881 | 0882 | 0883 | 0884 | 0885 | 0886 | 0887 |
| 0888 | 0889 | 0890 | 0891 | 0892 | 0893 | 0894 | 0895 |
| 0896 | 0897 | 0898 | 0899 | 0900 | 0901 | 0902 | 0903 |
| 0904 | 0905 | 0906 | 0907 | 0908 | 0909 | 0910 | 0911 |
| 0912 | 0913 | 0914 | 0915 | 0916 | 0917 | 0918 | 0919 |
| 0920 | 0921 | 0922 | 0923 | 0924 | 0925 | 0926 | 0927 |
| 0928 | 0929 | 0930 | 0931 | 0932 | 0933 | 0934 | 0935 |
| 0936 | 0937 | 0938 | 0939 | 0940 | 0941 | 0942 | 0943 |
| 0944 | 0945 | 0946 | 0947 | 0948 | 0949 | 0950 | 0951 |
| 0952 | 0953 | 0954 | 0955 | 0956 | 0957 | 0958 | 0959 |
| 0960 | 0961 | 0962 | 0963 | 0964 | 0965 | 0966 | 0967 |
| 0968 | 0969 | 0970 | 0971 | 0972 | 0973 | 0974 | 0975 |
| 0976 | 0977 | 0978 | 0979 | 0980 | 0981 | 0982 | 0983 |
| 0984 | 0985 | 0986 | 0987 | 0988 | 0989 | 0990 | 0991 |
| 0992 | 0993 | 0994 | 0995 | 0996 | 0997 | 0998 | 0999 |

HITACHI

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|   |   |   |   |   |   |   |  |   |
|---|---|---|---|---|---|---|--|---|
|    |    |    |    |    |    |    |    |    |
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|  |  |  |  |  |  |  |  |  |

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

[illegible]


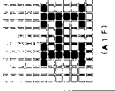





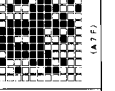


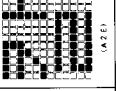





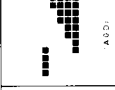
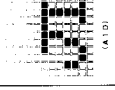
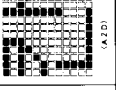


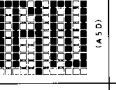
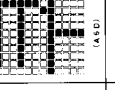


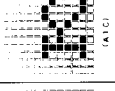
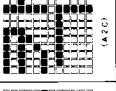





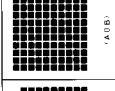
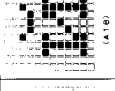



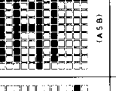
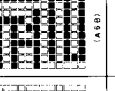
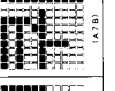
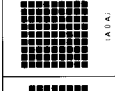
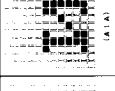



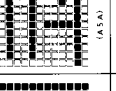
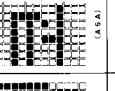

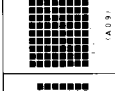
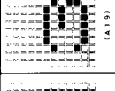




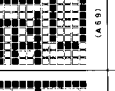

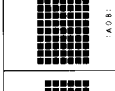
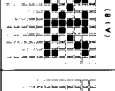
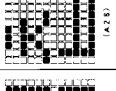


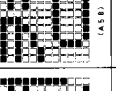
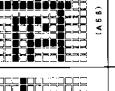

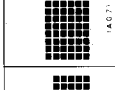
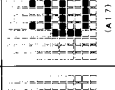


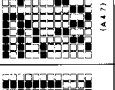

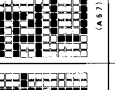
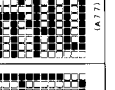
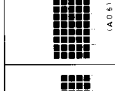
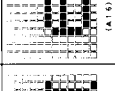
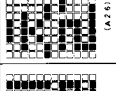




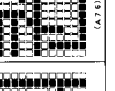
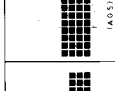
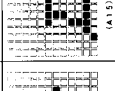


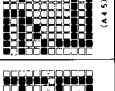
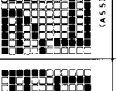

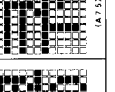
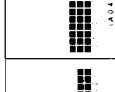
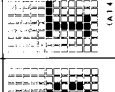
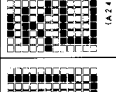
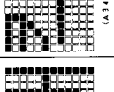


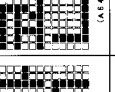
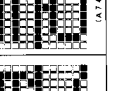

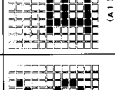
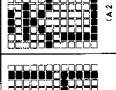
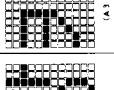

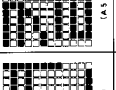


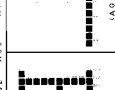
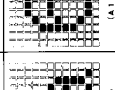




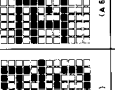

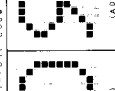
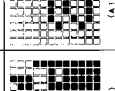
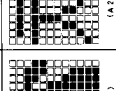





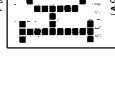









**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

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# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

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# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

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131 Full-Font Code Map A80 -- Aff

**HD66730/HD66731**

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

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**HD66730/731 A01 Korean font set (KS C 5601–1992 subset)**

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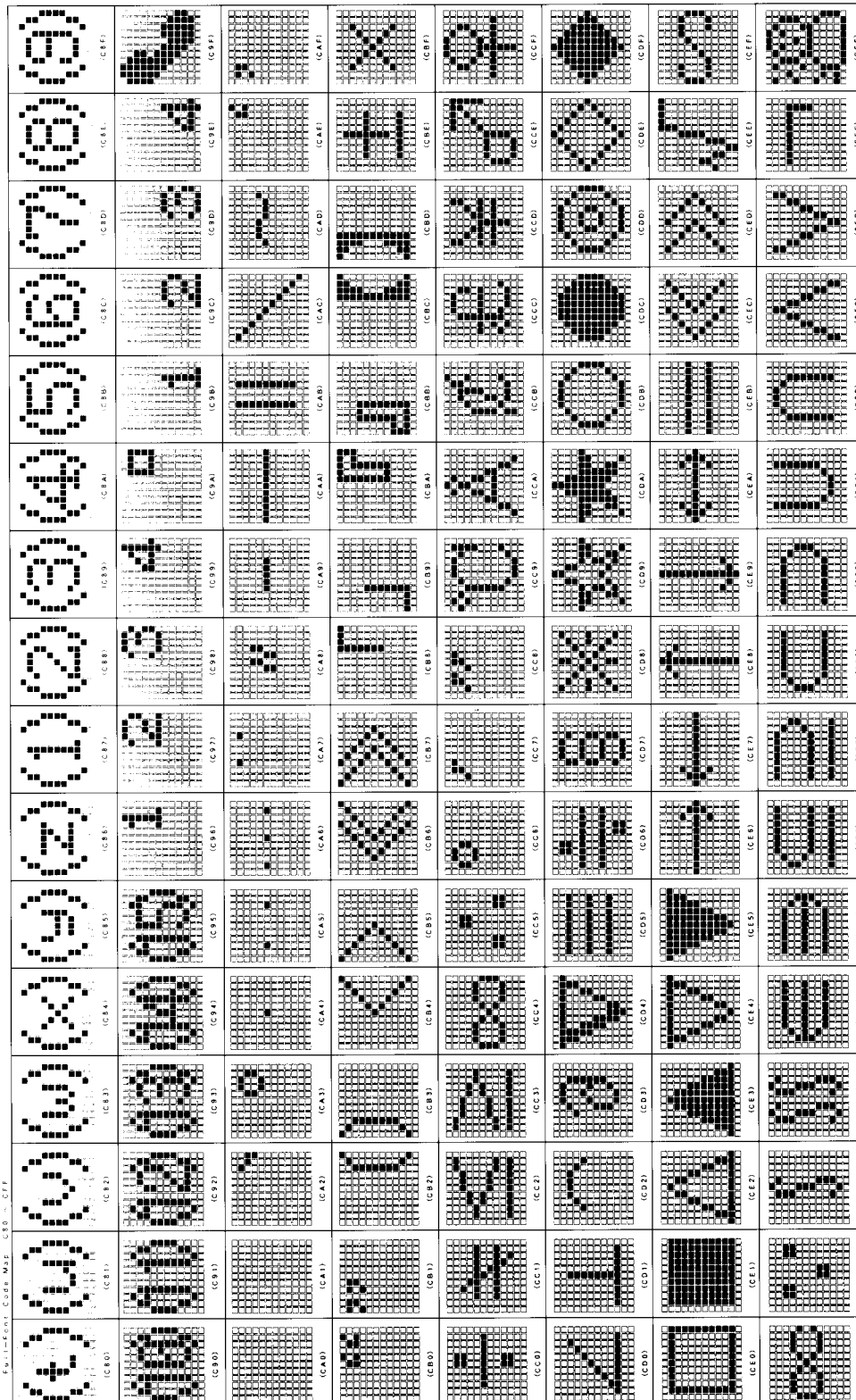
# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

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| 㔆 | 㔇 | 㔈 | 㔉 | 㔊 | 㔋 | 㔌 | 㔍 |
| 㔎 | 㔏 | 㔐 | 㔑 | 㔒 | 㔓 | 㔔 | 㔕 |
| 㔖 | 㔗 | 㔘 | 㔙 | 㔚 | 㔛 | 㔜 | 㔝 |
| 㔞 | 㔟 | 㔠 | 㔡 | 㔢 | 㔣 | 㔤 | 㔥 |
| 㔦 | 㔧 | 㔨 | 㔩 | 㔪 | 㔫 | 㔬 | 㔭 |
| 㔮 | 㔯 | 㔰 | 㔱 | 㔲 | 㔳 | 㔴 | 㔵 |
| 㔶 | 㔷 | 㔸 | 㔹 | 㔺 | 㔻 | 㔼 | 㔽 |
| 㔾 | 㔿 | 㕀 | 㕁 | 㕂 | 㕃 | 㕄 | 㕅 |
| 㕆 | 㕇 | 㕈 | 㕉 | 㕊 | 㕋 | 㕌 | 㕍 |
| 㕎 | 㕏 | 㕐 | 㕑 | 㕒 | 㕓 | 㕔 | 㕕 |
| 㕖 | 㕗 | 㕘 | 㕙 | 㕚 | 㕛 | 㕜 | 㕝 |
| 㕞 | 㕟 | 㕠 | 㕡 | 㕢 | 㕣 | 㕤 | 㕥 |
| 㕦 | 㕧 | 㕨 | 㕩 | 㕪 | 㕫 | 㕬 | 㕭 |
| 㕮 | 㕯 | 㕰 | 㕱 | 㕲 | 㕳 | 㕴 | 㕵 |
| 㕶 | 㕷 | 㕸 | 㕹 | 㕺 | 㕻 | 㕼 | 㕽 |
| 㕾 | 㕿 | 㖀 | 㖁 | 㖂 | 㖃 | 㖄 | 㖅 |
| 㖆 | 㖇 | 㖈 | 㖉 | 㖊 | 㖋 | 㖌 | 㖍 |
| 㖎 | 㖏 | 㖐 | 㖑 | 㖒 | 㖓 | 㖔 | 㖕 |
| 㖖 | 㖗 | 㖘 | 㖙 | 㖚 | 㖛 | 㖜 | 㖝 |
| 㖞 | 㖟 | 㖠 | 㖡 | 㖢 | 㖣 | 㖤 | 㖥 |
| 㖦 | 㖧 | 㖨 | 㖩 | 㖪 | 㖫 | 㖬 | 㖭 |
| 㖮 | 㖯 | 㖰 | 㖱 | 㖲 | 㖳 | 㖴 | 㖵 |
| 㖶 | 㖷 | 㖸 | 㖹 | 㖺 | 㖻 | 㖼 | 㖽 |
| 㖾 | 㖿 | 㗀 | 㗁 | 㗂 | 㗃 | 㗄 | 㗅 |
| 㗆 | 㗇 | 㗈 | 㗉 | 㗊 | 㗋 | 㗌 | 㗍 |
| 㗎 | 㗏 | 㗐 | 㗑 | 㗒 | 㗓 | 㗔 | 㗕 |
| 㗖 | 㗗 | 㗘 | 㗙 | 㗚 | 㗛 | 㗜 | 㗝 |
| 㗞 | 㗟 | 㗠 | 㗡 | 㗢 | 㗣 | 㗤 | 㗥 |
| 㗦 | 㗧 | 㗨 | 㗩 | 㗪 | 㗫 | 㗬 | 㗭 |
| 㗮 | 㗯 | 㗰 | 㗱 | 㗲 | 㗳 | 㗴 | 㗵 |
| 㗶 | 㗷 | 㗸 | 㗹 | 㗺 | 㗻 | 㗼 | 㗽 |
| 㗾 | 㗿 | 㘀 | 㘁 | 㘂 | 㘃 | 㘄 | 㘅 |
| 㘆 | 㘇 | 㘈 | 㘉 | 㘊 | 㘋 | 㘌 | 㘍 |
| 㘎 | 㘏 | 㘐 | 㘑 | 㘒 | 㘓 | 㘔 | 㘕 |
| 㘖 | 㘗 | 㘘 | 㘙 | 㘚 | 㘛 | 㘜 | 㘝 |
| 㘞 | 㘟 | 㘠 | 㘡 | 㘢 | 㘣 | 㘤 | 㘥 |
| 㘦 | 㘧 | 㘨 | 㘩 | 㘪 | 㘫 | 㘬 | 㘭 |
| 㘮 | 㘯 | 㘰 | 㘱 | 㘲 | 㘳 | 㘴 | 㘵 |
| 㘶 | 㘷 | 㘸 | 㘹 | 㘺 | 㘻 | 㘼 | 㘽 |
| 㘾 | 㘿 | 㘿 | 㘿 | 㘿 | 㘿 | 㘿 | 㘿 |

HITACHI

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)





# HD66730/HD66731

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|
| 009F | 009F | 009F | 009F | 009F | 009F | 009F | 009F |
| 009E | 009E | 009E | 009E | 009E | 009E | 009E | 009E |
| 009D | 009D | 009D | 009D | 009D | 009D | 009D | 009D |
| 009C | 009C | 009C | 009C | 009C | 009C | 009C | 009C |
| 009B | 009B | 009B | 009B | 009B | 009B | 009B | 009B |
| 009A | 009A | 009A | 009A | 009A | 009A | 009A | 009A |
| 0099 | 0099 | 0099 | 0099 | 0099 | 0099 | 0099 | 0099 |
| 0098 | 0098 | 0098 | 0098 | 0098 | 0098 | 0098 | 0098 |
| 0097 | 0097 | 0097 | 0097 | 0097 | 0097 | 0097 | 0097 |
| 0096 | 0096 | 0096 | 0096 | 0096 | 0096 | 0096 | 0096 |
| 0095 | 0095 | 0095 | 0095 | 0095 | 0095 | 0095 | 0095 |
| 0094 | 0094 | 0094 | 0094 | 0094 | 0094 | 0094 | 0094 |
| 0093 | 0093 | 0093 | 0093 | 0093 | 0093 | 0093 | 0093 |
| 0092 | 0092 | 0092 | 0092 | 0092 | 0092 | 0092 | 0092 |
| 0091 | 0091 | 0091 | 0091 | 0091 | 0091 | 0091 | 0091 |
| 0090 | 0090 | 0090 | 0090 | 0090 | 0090 | 0090 | 0090 |
| 008F | 008F | 008F | 008F | 008F | 008F | 008F | 008F |
| 008E | 008E | 008E | 008E | 008E | 008E | 008E | 008E |
| 008D | 008D | 008D | 008D | 008D | 008D | 008D | 008D |
| 008C | 008C | 008C | 008C | 008C | 008C | 008C | 008C |
| 008B | 008B | 008B | 008B | 008B | 008B | 008B | 008B |
| 008A | 008A | 008A | 008A | 008A | 008A | 008A | 008A |
| 0089 | 0089 | 0089 | 0089 | 0089 | 0089 | 0089 | 0089 |
| 0088 | 0088 | 0088 | 0088 | 0088 | 0088 | 0088 | 0088 |
| 0087 | 0087 | 0087 | 0087 | 0087 | 0087 | 0087 | 0087 |
| 0086 | 0086 | 0086 | 0086 | 0086 | 0086 | 0086 | 0086 |
| 0085 | 0085 | 0085 | 0085 | 0085 | 0085 | 0085 | 0085 |
| 0084 | 0084 | 0084 | 0084 | 0084 | 0084 | 0084 | 0084 |
| 0083 | 0083 | 0083 | 0083 | 0083 | 0083 | 0083 | 0083 |
| 0082 | 0082 | 0082 | 0082 | 0082 | 0082 | 0082 | 0082 |
| 0081 | 0081 | 0081 | 0081 | 0081 | 0081 | 0081 | 0081 |
| 0080 | 0080 | 0080 | 0080 | 0080 | 0080 | 0080 | 0080 |
| 007F | 007F | 007F | 007F | 007F | 007F | 007F | 007F |
| 007E | 007E | 007E | 007E | 007E | 007E | 007E | 007E |
| 007D | 007D | 007D | 007D | 007D | 007D | 007D | 007D |
| 007C | 007C | 007C | 007C | 007C | 007C | 007C | 007C |
| 007B | 007B | 007B | 007B | 007B | 007B | 007B | 007B |
| 007A | 007A | 007A | 007A | 007A | 007A | 007A | 007A |
| 0079 | 0079 | 0079 | 0079 | 0079 | 0079 | 0079 | 0079 |
| 0078 | 0078 | 0078 | 0078 | 0078 | 0078 | 0078 | 0078 |
| 0077 | 0077 | 0077 | 0077 | 0077 | 0077 | 0077 | 0077 |
| 0076 | 0076 | 0076 | 0076 | 0076 | 0076 | 0076 | 0076 |
| 0075 | 0075 | 0075 | 0075 | 0075 | 0075 | 0075 | 0075 |
| 0074 | 0074 | 0074 | 0074 | 0074 | 0074 | 0074 | 0074 |
| 0073 | 0073 | 0073 | 0073 | 0073 | 0073 | 0073 | 0073 |
| 0072 | 0072 | 0072 | 0072 | 0072 | 0072 | 0072 | 0072 |
| 0071 | 0071 | 0071 | 0071 | 0071 | 0071 | 0071 | 0071 |
| 0070 | 0070 | 0070 | 0070 | 0070 | 0070 | 0070 | 0070 |

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HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

|      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|
| 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 | 0007 |
| 0008 | 0009 | 000A | 000B | 000C | 000D | 000E | 000F |
| 0010 | 0011 | 0012 | 0013 | 0014 | 0015 | 0016 | 0017 |
| 0018 | 0019 | 001A | 001B | 001C | 001D | 001E | 001F |
| 0020 | 0021 | 0022 | 0023 | 0024 | 0025 | 0026 | 0027 |
| 0028 | 0029 | 002A | 002B | 002C | 002D | 002E | 002F |
| 0030 | 0031 | 0032 | 0033 | 0034 | 0035 | 0036 | 0037 |
| 0038 | 0039 | 003A | 003B | 003C | 003D | 003E | 003F |
| 0040 | 0041 | 0042 | 0043 | 0044 | 0045 | 0046 | 0047 |
| 0048 | 0049 | 004A | 004B | 004C | 004D | 004E | 004F |
| 0050 | 0051 | 0052 | 0053 | 0054 | 0055 | 0056 | 0057 |
| 0058 | 0059 | 005A | 005B | 005C | 005D | 005E | 005F |
| 0060 | 0061 | 0062 | 0063 | 0064 | 0065 | 0066 | 0067 |
| 0068 | 0069 | 006A | 006B | 006C | 006D | 006E | 006F |
| 0070 | 0071 | 0072 | 0073 | 0074 | 0075 | 0076 | 0077 |
| 0078 | 0079 | 007A | 007B | 007C | 007D | 007E | 007F |
| 0080 | 0081 | 0082 | 0083 | 0084 | 0085 | 0086 | 0087 |
| 0088 | 0089 | 008A | 008B | 008C | 008D | 008E | 008F |
| 0090 | 0091 | 0092 | 0093 | 0094 | 0095 | 0096 | 0097 |
| 0098 | 0099 | 009A | 009B | 009C | 009D | 009E | 009F |
| 00A0 | 00A1 | 00A2 | 00A3 | 00A4 | 00A5 | 00A6 | 00A7 |
| 00A8 | 00A9 | 00AA | 00AB | 00AC | 00AD | 00AE | 00AF |
| 00B0 | 00B1 | 00B2 | 00B3 | 00B4 | 00B5 | 00B6 | 00B7 |
| 00B8 | 00B9 | 00BA | 00BB | 00BC | 00BD | 00BE | 00BF |
| 00C0 | 00C1 | 00C2 | 00C3 | 00C4 | 00C5 | 00C6 | 00C7 |
| 00C8 | 00C9 | 00CA | 00CB | 00CC | 00CD | 00CE | 00CF |
| 00D0 | 00D1 | 00D2 | 00D3 | 00D4 | 00D5 | 00D6 | 00D7 |
| 00D8 | 00D9 | 00DA | 00DB | 00DC | 00DD | 00DE | 00DF |
| 00E0 | 00E1 | 00E2 | 00E3 | 00E4 | 00E5 | 00E6 | 00E7 |
| 00E8 | 00E9 | 00EA | 00EB | 00EC | 00ED | 00EE | 00EF |
| 00F0 | 00F1 | 00F2 | 00F3 | 00F4 | 00F5 | 00F6 | 00F7 |
| 00F8 | 00F9 | 00FA | 00FB | 00FC | 00FD | 00FE | 00FF |

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| A | A | A | A | A | A | A | A |
| B | B | B | B | B | B | B | B |
| C | C | C | C | C | C | C | C |
| D | D | D | D | D | D | D | D |
| E | E | E | E | E | E | E | E |
| F | F | F | F | F | F | F | F |
| G | G | G | G | G | G | G | G |
| H | H | H | H | H | H | H | H |
| I | I | I | I | I | I | I | I |
| J | J | J | J | J | J | J | J |
| K | K | K | K | K | K | K | K |
| L | L | L | L | L | L | L | L |
| M | M | M | M | M | M | M | M |
| N | N | N | N | N | N | N | N |
| O | O | O | O | O | O | O | O |
| P | P | P | P | P | P | P | P |
| Q | Q | Q | Q | Q | Q | Q | Q |
| R | R | R | R | R | R | R | R |
| S | S | S | S | S | S | S | S |
| T | T | T | T | T | T | T | T |
| U | U | U | U | U | U | U | U |
| V | V | V | V | V | V | V | V |
| W | W | W | W | W | W | W | W |
| X | X | X | X | X | X | X | X |
| Y | Y | Y | Y | Y | Y | Y | Y |
| Z | Z | Z | Z | Z | Z | Z | Z |
| [ | [ | [ | [ | [ | [ | [ | [ |
| \ | \ | \ | \ | \ | \ | \ | \ |
| ] | ] | ] | ] | ] | ] | ] | ] |
| ^ | ^ | ^ | ^ | ^ | ^ | ^ | ^ |
| _ | _ | _ | _ | _ | _ | _ | _ |
| ` | ` | ` | ` | ` | ` | ` | ` |
| { | { | { | { | { | { | { | { |
|   |   |   |   |   |   |   |   |
| } | } | } | } | } | } | } | } |
| ~ | ~ | ~ | ~ | ~ | ~ | ~ | ~ |
|   |   |   |   |   |   |   |   |

HD66730/731 A01 Korean font set (KS C 5601-1992 subset)

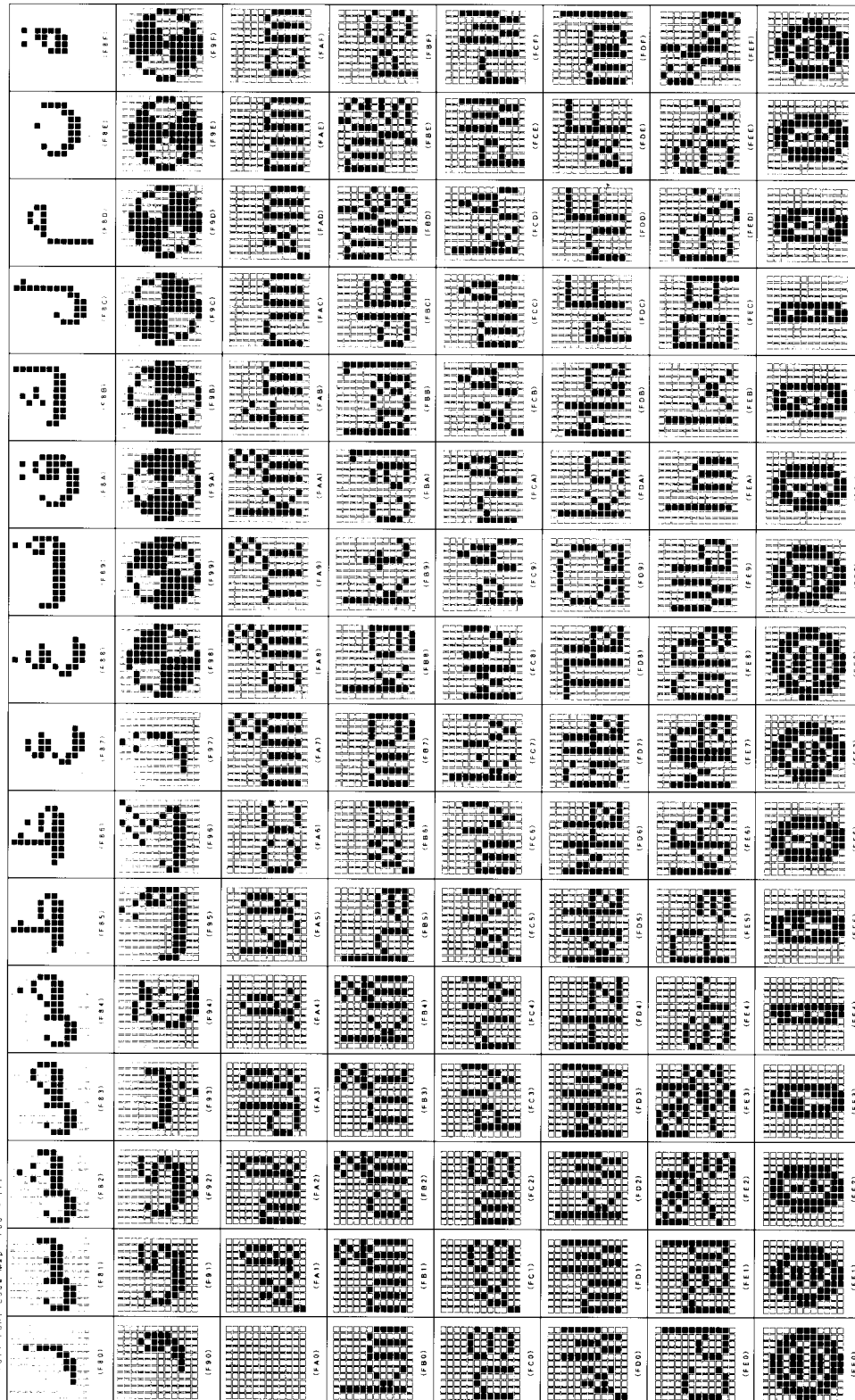
|          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 田 (E8F6) | 畚 (E8F7) | 𪎭 (E8F8) | 𪎮 (E8F9) | 𪎯 (E8FA) | 𪎰 (E8FB) | 𪎱 (E8FC) | 𪎲 (E8FD) |
| 米 (E8FE) | 𪎳 (E8FF) | 𪎴 (E900) | 𪎵 (E901) | 𪎶 (E902) | 𪎷 (E903) | 𪎸 (E904) | 𪎹 (E905) |
| 𪎺 (E906) | 𪎻 (E907) | 𪎼 (E908) | 𪎽 (E909) | 𪎾 (E90A) | 𪎿 (E90B) | 𪏀 (E90C) | 𪏁 (E90D) |
| 𪏂 (E90E) | 𪏃 (E90F) | 𪏄 (E910) | 𪏅 (E911) | 𪏆 (E912) | 𪏇 (E913) | 𪏈 (E914) | 𪏉 (E915) |
| 𪏊 (E916) | 𪏋 (E917) | 𪏌 (E918) | 𪏍 (E919) | 𪏎 (E91A) | 𪏏 (E91B) | 𪏐 (E91C) | 𪏑 (E91D) |
| 𪏒 (E91E) | 𪏓 (E91F) | 𪏔 (E920) | 𪏕 (E921) | 𪏖 (E922) | 𪏗 (E923) | 𪏘 (E924) | 𪏙 (E925) |
| 𪏚 (E926) | 𪏛 (E927) | 𪏜 (E928) | 𪏝 (E929) | 𪏞 (E92A) | 𪏟 (E92B) | 𪏠 (E92C) | 𪏡 (E92D) |
| 𪏢 (E92E) | 𪏣 (E92F) | 𪏤 (E930) | 𪏥 (E931) | 𪏦 (E932) | 𪏧 (E933) | 𪏨 (E934) | 𪏩 (E935) |
| 𪏪 (E936) | 𪏫 (E937) | 𪏬 (E938) | 𪏭 (E939) | 𪏮 (E93A) | 𪏯 (E93B) | 𪏰 (E93C) | 𪏱 (E93D) |
| 𪏲 (E93E) | 𪏳 (E93F) | 𪏴 (E940) | 𪏵 (E941) | 𪏶 (E942) | 𪏷 (E943) | 𪏸 (E944) | 𪏹 (E945) |
| 𪏺 (E946) | 𪏻 (E947) | 𪏼 (E948) | 𪏽 (E949) | 𪏾 (E94A) | 𪏿 (E94B) | 𪐀 (E94C) | 𪐁 (E94D) |
| 𪐂 (E94E) | 𪐃 (E94F) | 𪐄 (E950) | 𪐅 (E951) | 𪐆 (E952) | 𪐇 (E953) | 𪐈 (E954) | 𪐉 (E955) |
| 𪐊 (E956) | 𪐋 (E957) | 𪐌 (E958) | 𪐍 (E959) | 𪐎 (E95A) | 𪐏 (E95B) | 𪐐 (E95C) | 𪐑 (E95D) |
| 𪐒 (E95E) | 𪐓 (E95F) | 𪐔 (E960) | 𪐕 (E961) | 𪐖 (E962) | 𪐗 (E963) | 𪐘 (E964) | 𪐙 (E965) |
| 𪐚 (E966) | 𪐛 (E967) | 𪐜 (E968) | 𪐝 (E969) | 𪐞 (E96A) | 𪐟 (E96B) | 𪐠 (E96C) | 𪐡 (E96D) |
| 𪐢 (E96E) | 𪐣 (E96F) | 𪐤 (E970) | 𪐥 (E971) | 𪐦 (E972) | 𪐧 (E973) | 𪐨 (E974) | 𪐩 (E975) |
| 𪐪 (E976) | 𪐫 (E977) | 𪐬 (E978) | 𪐭 (E979) | 𪐮 (E97A) | 𪐯 (E97B) | 𪐰 (E97C) | 𪐱 (E97D) |
| 𪐲 (E97E) | 𪐳 (E97F) | 𪐴 (E980) | 𪐵 (E981) | 𪐶 (E982) | 𪐷 (E983) | 𪐸 (E984) | 𪐹 (E985) |

**HD66730/731 A01 Korean font set (KS C 5601-1992 subset)**

|    |    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|----|
| 十  | 𠂇  | 𠂈  | 𠂉  | 𠂊  | 𠂋  | 𠂌  | 𠂍  | 𠂎  |
| 𠂏  | 𠂐  | 𠂑  | 𠂒  | 𠂓  | 𠂔  | 𠂕  | 𠂖  | 𠂗  |
| 𠂘  | 𠂙  | 𠂚  | 𠂛  | 𠂜  | 𠂝  | 𠂞  | 𠂟  | 𠂠  |
| 𠂡  | 𠂢  | 𠂣  | 𠂤  | 𠂥  | 𠂦  | 𠂧  | 𠂨  | 𠂩  |
| 𠂪  | 𠂫  | 𠂬  | 𠂭  | 𠂮  | 𠂯  | 𠂰  | 𠂱  | 𠂲  |
| 𠂳  | 𠂴  | 𠂵  | 𠂶  | 𠂷  | 𠂸  | 𠂹  | 𠂺  | 𠂻  |
| 𠂼  | 𠂽  | 𠂾  | 𠂿  | 𠃀  | 𠃁  | 𠃂  | 𠃃  | 𠃄  |
| 𠃅  | 𠃆  | 𠃇  | 𠃈  | 𠃉  | 𠃊  | 𠃋  | 𠃌  | 𠃍  |
| 𠃎  | 𠃏  | 𠃐  | 𠃑  | 𠃒  | 𠃓  | 𠃔  | 𠃕  | 𠃖  |
| 𠃗  | 𠃘  | 𠃙  | 𠃚  | 𠃛  | 𠃜  | 𠃝  | 𠃞  | 𠃟  |
| 𠃠  | 𠃡  | 𠃢  | 𠃣  | 𠃤  | 𠃥  | 𠃦  | 𠃧  | 𠃨  |
| 𠃩  | 𠃪  | 𠃫  | 𠃬  | 𠃭  | 𠃮  | 𠃯  | 𠃰  | 𠃱  |
| 𠃲  | 𠃳  | 𠃴  | 𠃵  | 𠃶  | 𠃷  | 𠃸  | 𠃹  | 𠃺  |
| 𠃻  | 𠃼  | 𠃽  | 𠃾  | 𠃿  | 𠄀  | 𠄁  | 𠄂  | 𠄃  |
| 𠄄  | 𠄅  | 𠄆  | 𠄇  | 𠄈  | 𠄉  | 𠄊  | 𠄋  | 𠄌  |
| 𠄍  | 𠄎  | 𠄏  | 𠄐  | 𠄑  | 𠄒  | 𠄓  | 𠄔  | 𠄕  |
| 𠄖  | 𠄗  | 𠄘  | 𠄙  | 𠄚  | 𠄛  | 𠄜  | 𠄝  | 𠄞  |
| 𠄟  | 𠄠  | 𠄡  | 𠄢  | 𠄣  | 𠄤  | 𠄥  | 𠄦  | 𠄧  |
| 𠄨  | 𠄩  | 𠄪  | 𠄫  | 𠄬  | 𠄭  | 𠄮  | 𠄯  | 𠄰  |
| 𠄱  | 𠄲  | 𠄳  | 𠄴  | 𠄵  | 𠄶  | 𠄷  | 𠄸  | 𠄹  |
| 𠄺  | 𠄻  | 𠄼  | 𠄽  | 𠄾  | 𠄿  | 𠅀  | 𠅁  | 𠅂  |
| 𠅃  | 𠅄  | 𠅅  | 𠅆  | 𠅇  | 𠅈  | 𠅉  | 𠅊  | 𠅋  |
| 𠅌  | 𠅍  | 𠅎  | 𠅏  | 𠅐  | 𠅑  | 𠅒  | 𠅓  | 𠅔  |
| 𠅕  | 𠅖  | 𠅗  | 𠅘  | 𠅙  | 𠅚  | 𠅛  | 𠅜  | 𠅝  |
| 𠅞  | 𠅟  | 𠅠  | 𠅡  | 𠅢  | 𠅣  | 𠅤  | 𠅥  | 𠅦  |
| 𠅧  | 𠅨  | 𠅩  | 𠅪  | 𠅫  | 𠅬  | 𠅭  | 𠅮  | 𠅯  |
| 𠅰  | 𠅱  | 𠅲  | 𠅳  | 𠅴  | 𠅵  | 𠅶  | 𠅷  | 𠅸  |
| 𠅹  | 𠅺  | 𠅻  | 𠅼  | 𠅽  | 𠅾  | 𠅿  | 𠆀  | 𠆁  |
| 𠆂  | 𠆃  | 𠆄  | 𠆅  | 𠆆  | 𠆇  | 𠆈  | 𠆉  | 𠆊  |
| 𠆋  | 𠆌  | 𠆍  | 𠆎  | 𠆏  | 𠆐  | 𠆑  | 𠆒  | 𠆓  |
| 𠆔  | 𠆕  | 𠆖  | 𠆗  | 𠆘  | 𠆙  | 𠆚  | 𠆛  | 𠆜  |
| 𠆝  | 𠆞  | 𠆟  | 𠆠  | 𠆡  | 𠆢  | 𠆣  | 𠆤  | 𠆥  |
| 𠆦  | 𠆧  | 𠆨  | 𠆩  | 𠆪  | 𠆫  | 𠆬  | 𠆭  | 𠆮  |
| 𠆯  | 𠆰  | 𠆱  | 𠆲  | 𠆳  | 𠆴  | 𠆵  | 𠆶  | 𠆷  |
| 𠆸  | 𠆹  | 𠆺  | 𠆻  | 𠆼  | 𠆽  | 𠆾  | 𠆿  | 𠇀  |
| 𠇁  | 𠇂  | 𠇃  | 𠇄  | 𠇅  | 𠇆  | 𠇇  | 𠇈  | 𠇉  |
| 𠇊  | 𠇋  | 𠇌  | 𠇍  | 𠇎  | 𠇏  | 𠇐  | 𠇑  | 𠇒  |
| 𠇓  | 𠇔  | 𠇕  | 𠇖  | 𠇗  | 𠇘  | 𠇙  | 𠇚  | 𠇛  |
| 𠇜  | 𠇝  | 𠇞  | 𠇟  | 𠇠  | 𠇡  | 𠇢  | 𠇣  | 𠇤  |
| 𠇥  | 𠇦  | 𠇧  | 𠇨  | 𠇩  | 𠇪  | 𠇫  | 𠇬  | 𠇭  |
| 𠇮  | 𠇯  | 𠇰  | 𠇱  | 𠇲  | 𠇳  | 𠇴  | 𠇵  | 𠇶  |
| 𠇷  | 𠇸  | 𠇹  | 𠇺  | 𠇻  | 𠇼  | 𠇽  | 𠇾  | 𠇿  |
| 𠈀  | 𠈁  | 𠈂  | 𠈃  | 𠈄  | 𠈅  | 𠈆  | 𠈇  | 𠈈  |
| 𠈉  | 𠈊  | 𠈋  | 𠈌  | 𠈍  | 𠈎  | 𠈏  | 𠈐  | 𠈑  |
| 𠈒  | 𠈓  | 𠈔  | 𠈕  | 𠈖  | 𠈗  | 𠈘  | 𠈙  | 𠈚  |
| 𠈛  | 𠈜  | 𠈝  | 𠈞  | 𠈟  | 𠈠  | 𠈡  | 𠈢  | 𠈣  |
| 𠈤  | 𠈥  | 𠈦  | 𠈧  | 𠈨  | 𠈩  | 𠈪  | 𠈫  | 𠈬  |
| 𠈭  | 𠈮  | 𠈯  | 𠈰  | 𠈱  | 𠈲  | 𠈳  | 𠈴  | 𠈵  |
| 𠈶  | 𠈷  | 𠈸  | 𠈹  | 𠈺  | 𠈻  | 𠈼  | 𠈽  | 𠈾  |
| 𠈿  | 𠉀  | 𠉁  | 𠉂  | 𠉃  | 𠉄  | 𠉅  | 𠉆  | 𠉇  |
| 𠉈  | 𠉉  | 𠉊  | 𠉋  | 𠉌  | 𠉍  | 𠉎  | 𠉏  | 𠉐  |
| 𠉑  | 𠉒  | 𠉓  | 𠉔  | 𠉕  | 𠉖  | 𠉗  | 𠉘  | 𠉙  |
| 𠉚  | 𠉛  | 𠉜  | 𠉝  | 𠉞  | 𠉟  | 𠉠  | 𠉡  | 𠉢  |
| 𠉣  | 𠉤  | 𠉥  | 𠉦  | 𠉧  | 𠉨  | 𠉩  | 𠉪  | 𠉫  |
| 𠉬  | 𠉭  | 𠉮  | 𠉯  | 𠉰  | 𠉱  | 𠉲  | 𠉳  | 𠉴  |
| 𠉵  | 𠉶  | 𠉷  | 𠉸  | 𠉹  | 𠉺  | 𠉻  | 𠉼  | 𠉽  |
| 𠉾  | 𠉿  | 𠊀  | 𠊁  | 𠊂  | 𠊃  | 𠊄  | 𠊅  | 𠊆  |
| 𠊇  | 𠊈  | 𠊉  | 𠊊  | 𠊋  | 𠊌  | 𠊍  | 𠊎  | 𠊏  |
| 𠊐  | 𠊑  | 𠊒  | 𠊓  | 𠊔  | 𠊕  | 𠊖  | 𠊗  | 𠊘  |
| 𠊙  | 𠊚  | 𠊛  | 𠊜  | 𠊝  | 𠊞  | 𠊟  | 𠊠  | 𠊡  |
| 𠊢  | 𠊣  | 𠊤  | 𠊥  | 𠊦  | 𠊧  | 𠊨  | 𠊩  | 𠊪  |
| 𠊫  | 𠊬  | 𠊭  | 𠊮  | 𠊯  | 𠊰  | 𠊱  | 𠊲  | 𠊳  |
| 𠊴  | 𠊵  | 𠊶  | 𠊷  | 𠊸  | 𠊹  | 𠊺  | 𠊻  | 𠊼  |
| 𠊽  | 𠊾  | 𠊿  | 𠋀  | 𠋁  | 𠋂  | 𠋃  | 𠋄  | 𠋅  |
| 𠋆  | 𠋇  | 𠋈  | 𠋉  | 𠋊  | 𠋋  | 𠋌  | 𠋍  | 𠋎  |
| 𠋏  | 𠋐  | 𠋑  | 𠋒  | 𠋓  | 𠋔  | 𠋕  | 𠋖  | 𠋗  |
| 𠋘  | 𠋙  | 𠋚  | 𠋛  | 𠋜  | 𠋝  | 𠋞  | 𠋟  | 𠋠  |
| 𠋡  | 𠋢  | 𠋣  | 𠋤  | 𠋥  | 𠋦  | 𠋧  | 𠋨  | 𠋩  |
| 𠋪  | 𠋫  | 𠋬  | 𠋭  | 𠋮  | 𠋯  | 𠋰  | 𠋱  | 𠋲  |
| 𠋳  | 𠋴  | 𠋵  | 𠋶  | 𠋷  | 𠋸  | 𠋹  | 𠋺  | 𠋻  |
| 𠋼  | 𠋽  | 𠋾  | 𠋿  | 𠌀  | 𠌁  | 𠌂  | 𠌃  | 𠌄  |
| 𠌅  | 𠌆  | 𠌇  | 𠌈  | 𠌉  | 𠌊  | 𠌋  | 𠌌  | 𠌍  |
| 𠌎  | 𠌏  | 𠌐  | 𠌑  | 𠌒  | 𠌓  | 𠌔  | 𠌕  | 𠌖  |
| 𠌗  | 𠌘  | 𠌙  | 𠌚  | 𠌛  | 𠌜  | 𠌝  | 𠌞  | 𠌟  |
| 𠌠  | 𠌡  | 𠌢  | 𠌣  | 𠌤  | 𠌥  | 𠌦  | 𠌧  | 𠌨  |
| 𠌩  | 𠌪  | 𠌫  | 𠌬  | 𠌭  | 𠌮  | 𠌯  | 𠌰  | 𠌱  |
| 𠌲  | 𠌳  | 𠌴  | 𠌵  | 𠌶  | 𠌷  | 𠌸  | 𠌹  | 𠌺  |
| 𠌻  | 𠌼  | 𠌽  | 𠌾  | 𠌿  | 𠍀  | 𠍁  | 𠍂  | 𠍃  |
| 𠍄  | 𠍅  | 𠍆  | 𠍇  | 𠍈  | 𠍉  | 𠍊  | 𠍋  | 𠍌  |
| 𠍍  | 𠍎  | 𠍇  | 𠍈  | 𠍉  | 𠍊  | 𠍋  | 𠍌  | 𠍍  |
| 𠍎  | 𠍏  | 𠍐  | 𠍑  | 𠍒  | 𠍓  | 𠍔  | 𠍕  | 𠍖  |
| 𠍗  | 𠍘  | 𠍙  | 𠍚  | 𠍛  | 𠍜  | 𠍝  | 𠍞  | 𠍟  |
| 𠍠  | 𠍡  | 𠍢  | 𠍣  | 𠍤  | 𠍥  | 𠍦  | 𠍧  | 𠍨  |
| 𠍩  | 𠍪  | 𠍫  | 𠍬  | 𠍭  | 𠍮  | 𠍯  | 𠍰  | 𠍱  |
| 𠍲  | 𠍳  | 𠍴  | 𠍵  | 𠍶  | 𠍷  | 𠍸  | 𠍹  | 𠍺  |
| 𠍻  | 𠍼  | 𠍽  | 𠍾  | 𠍿  | 𠎀  | 𠎁  | 𠎂  | 𠎃  |
| 𠎄  | 𠎅  | 𠎆  | 𠎇  | 𠎈  | 𠎉  | 𠎊  | 𠎋  | 𠎌  |
| 𠎍  | 𠎎  | 𠎏  | 𠎐  | 𠎑  | 𠎒  | 𠎓  | 𠎔  | 𠎕  |
| 𠎖  | 𠎗  | 𠎘  | 𠎙  | 𠎚  | 𠎛  | 𠎜  | 𠎝  | 𠎞  |
| 𠎟  | 𠎠  | 𠎡  | 𠎢  | 𠎣  | 𠎤  | 𠎥  | 𠎦  | 𠎧  |
| 𠎨  | 𠎩  | 𠎪  | 𠎫  | 𠎬  | 𠎭  | 𠎮  | 𠎯  | 𠎰  |
| 𠎱  | 𠎲  | 𠎳  | 𠎴  | 𠎵  | 𠎶  | 𠎷  | 𠎸  | 𠎹  |
| 𠎺  | 𠎻  | 𠎼  | 𠎽  | 𠎾  | 𠎿  | 𠏀  | 𠏁  | 𠏂  |
| 𠏃  | 𠏄  | 𠏅  | 𠏆  | 𠏇  | 𠏈  | 𠏉  | 𠏊  | 𠏋  |
| 𠏌  | 𠏍  | 𠏎  | 𠏏  | 𠏐  | 𠏑  | 𠏒  | 𠏓  | 𠏔  |
| 𠏕  | 𠏖  | 𠏗  | 𠏘  | 𠏙  | 𠏚  | 𠏛  | 𠏜  | 𠏝  |
| 𠏞  | 𠏟  | 𠏠  | 𠏡  | 𠏢  | 𠏣  | 𠏤  | 𠏥  | 𠏦  |
| 𠏧  | 𠏨  | 𠏩  | 𠏪  | 𠏫  | 𠏬  | 𠏭  | 𠏮  | 𠏯  |
| 𠏰  | 𠏱  | 𠏲  | 𠏳  | 𠏴  | 𠏵  | 𠏶  | 𠏷  | 𠏸  |
| 𠏹  | 𠏺  | 𠏻  | 𠏼  | 𠏽  | 𠏾  | 𠏿  | �0 | �1 |
| �2 | �3 | �4 | �5 | �6 | �7 | �8 | �9 | 𠐊  |
| 𠐋  | 𠐌  | 𠐍  | 𠐎  | 𠐏  | 𠐐  | 𠐑  | 𠐒  | 𠐓  |
| 𠐔  | 𠐕  | 𠐖  | 𠐗  | 𠐘  | 𠐙  | 𠐚  | 𠐛  | 𠐜  |
| 𠐝  | 𠐞  | 𠐟  | 𠐠  | 𠐡  | 𠐢  | 𠐣  | 𠐤  | 𠐥  |
| 𠐦  | 𠐧  | 𠐨  | 𠐩  | 𠐪  | 𠐫  | 𠐬  | 𠐭  | 𠐮  |
| 𠐯  | 𠐰  | 𠐱  | 𠐲  | 𠐳  | 𠐴  | 𠐵  | 𠐶  | 𠐷  |
| 𠐸  | 𠐹  | 𠐺  | 𠐻  | 𠐼  | 𠐽  | 𠐾  | 𠐿  | �0 |
| �1 | �2 | �3 | �4 | �5 | �6 | �7 | �8 | �9 |
| 𠑊  | 𠑋  | 𠑌  | 𠑍  | 𠑎  | 𠑏  | 𠑐  | 𠑑  | 𠑒  |
| 𠑓  | 𠑔  | 𠑕  | 𠑖  | 𠑗  | 𠑘  | 𠑙  | 𠑚  | 𠑛  |
| 𠑜  | 𠑝  | 𠑞  | 𠑟  | 𠑠  | 𠑡  | 𠑢  | 𠑣  | 𠑤  |
| 𠑥  | 𠑦  | 𠑧  | 𠑨  | 𠑩  | 𠑪  | 𠑫  | 𠑬  | 𠑭  |
| 𠑮  | 𠑯  | 𠑰  | 𠑱  | 𠑲  | 𠑳  | 𠑴  | 𠑵  | 𠑶  |
| 𠑷  | 𠑸  | 𠑹  | 𠑺  | 𠑻  | 𠑼  | 𠑽  | 𠑾  | 𠑿  |
| 𠒀  | 𠒁  | 𠒂  | 𠒃  | 𠒄  | 𠒅  | 𠒆  | 𠒇  | 𠒈  |
| 𠒉  | 𠒊  | 𠒋  | 𠒌  | 𠒍  | 𠒎  | 𠒏  | 𠒐  | 𠒑  |
| 𠒒  | 𠒓  | 𠒔  | 𠒕  | 𠒖  | 𠒗  | 𠒘  | 𠒙  | 𠒚  |
| 𠒛  | 𠒜  | 𠒝  | 𠒞  | 𠒟  | 𠒠  | 𠒡  | 𠒢  | 𠒣  |
| 𠒤  | 𠒥  | 𠒦  | 𠒧  | 𠒨  | 𠒩  | 𠒪  | 𠒫  | 𠒬  |
| 𠒭  | 𠒮  | 𠒯  | 𠒰  | 𠒱  | 𠒲  | 𠒳  | 𠒴  | 𠒵  |
| 𠒶  | 𠒷  | 𠒸  | 𠒹  | 𠒺  | 𠒻  | 𠒼  | 𠒽  | 𠒾  |
| 𠒿  | 𠓀  | 𠓁  | 𠓂  | 𠓃  | 𠓄  | 𠓅  | 𠓆  | 𠓇  |
| 𠓈  | 𠓉  | 𠓊  | 𠓋  | 𠓌  | 𠓍  | 𠓎  | 𠓏  | 𠓐  |
| 𠓑  | 𠓒  | 𠓓  | 𠓔  | 𠓕  | 𠓖  | 𠓗  | 𠓘  | 𠓙  |
| 𠓚  | 𠓛  | 𠓜  | 𠓝  | 𠓞  | 𠓟  | 𠓠  | 𠓡  | 𠓢  |
| 𠓣  | 𠓤  | 𠓥  | 𠓦  | 𠓧  | 𠓨  | 𠓩  | 𠓪  | 𠓫  |
| 𠓬  | 𠓭  | 𠓮  | 𠓯  | 𠓰  | 𠓱  | 𠓲  | 𠓳  | 𠓴  |
| 𠓵  | 𠓶  | 𠓷  | 𠓸  | 𠓹  | 𠓺  | 𠓻  | 𠓼  | 𠓽  |
| 𠓾  | 𠓿  | 𠔀  | 𠔁  | 𠔂  | 𠔃  | 𠔄  | 𠔅  | 𠔆  |
| 𠔇  | 𠔈  | 𠔉  | 𠔊  | 𠔋  | 𠔌  | 𠔍  | 𠔎  | 𠔏  |
| 𠔐  | 𠔑  | 𠔒  | 𠔓  | 𠔔  | 𠔕  | 𠔖  | 𠔗  | 𠔘  |
| 𠔙  | 𠔚  | 𠔛  | 𠔜  | 𠔝  | 𠔞  | 𠔟  | 𠔠  | 𠔡  |
| 𠔢  | 𠔣  | 𠔤  | 𠔥  | 𠔦  | 𠔧  | 𠔨  | 𠔩  | 𠔪  |
| 𠔫  | 𠔬  | 𠔭  | 𠔮  | 𠔯  | 𠔰  | 𠔱  | 𠔲  | 𠔳  |
| 𠔴  | 𠔵  | 𠔶  | 𠔷  | 𠔸  | 𠔹  | 𠔺  | 𠔻  | 𠔼  |
| 𠔽  | 𠔾  | 𠔿  | 𠕀  | 𠕁  | 𠕂  | 𠕃  | 𠕄  | 𠕅  |
| 𠕆  | 𠕇  | 𠕈  | 𠕉  | 𠕊  | 𠕋  | 𠕌  | 𠕍  | 𠕎  |
| 𠕏  | 𠕐  | 𠕑  | 𠕒  | 𠕓  | 𠕔  | 𠕕  | 𠕖  | 𠕗  |
| 𠕘  | 𠕙  | 𠕚  | 𠕛  | 𠕜  | 𠕝  | 𠕞  | 𠕟  | 𠕠  |
| 𠕡  | 𠕢  | 𠕣  | 𠕤  | 𠕥  | 𠕦  | 𠕧  | 𠕨  | 𠕩  |
| 𠕪  | 𠕫  | 𠕬  | 𠕭  | 𠕮  | 𠕯  | 𠕰  | 𠕱  | 𠕲  |
| 𠕳  | 𠕴  | 𠕵  | 𠕶  | 𠕷  | 𠕸  | 𠕹  | 𠕺  | 𠕻  |
| 𠕼  | 𠕽  | 𠕾  | 𠕿  | �0 | �1 | �2 | �3 | �4 |
| �5 | �6 | �7 | �8 | �9 | 𠖊  | 𠖋  | 𠖌  | 𠖍  |
| 𠖎  | 𠖏  | 𠖐  | 𠖑  | 𠖒  | 𠖓  | 𠖔  | 𠖕  | 𠖖  |
| 𠖗  | 𠖘  | 𠖙  | 𠖚  | 𠖛  | 𠖜  | 𠖝  |    |    |

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HD66730/731 A01 Korean font set (KS C 5601-1992 subset)



## Relationship between Character Codes (DDRAM), CGRAM Addresses, and Display Characters

Full size character codes H'000 to H'007 can be used to access 8 character patterns in the CGRAM. Since each character pattern can be displayed up to  $12 \times 13$  dots, CGRAM patterns can be displayed immediately next to each other (to the right, left, top, or bottom) without any character spaces between them. Table 6 shows the correspondence between CGRAM addresses and full-size character codes for access of the CGRAM by the MPU.

**Table 7 Relationship between Character Codes (DDRAM), CGRAM Addresses, and Display Characters**

| Character Code |       |    |    |    |    |    |    | CGRAM Data    |    |    |    |    |    |    |    |        |    |    |    |    |    |    |    |        |    |    |    |    |                       |  |  |
|----------------|-------|----|----|----|----|----|----|---------------|----|----|----|----|----|----|----|--------|----|----|----|----|----|----|----|--------|----|----|----|----|-----------------------|--|--|
|                |       |    |    |    |    |    |    | CGRAM Address |    |    |    |    |    |    |    | A0 = 0 |    |    |    |    |    |    |    | A0 = 1 |    |    |    |    |                       |  |  |
| C11            | ----- | C3 | C7 | C6 | C5 | A7 | A6 | A5            | A4 | A3 | A2 | A1 | D7 | D6 | D5 | D4     | D3 | D2 | D1 | D0 | D7 | D6 | D5 | D4     | D3 | D2 | D1 | D0 |                       |  |  |
| 0              | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0             | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | Character pattern (1) |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 1  | 1  | 1  | 1  | A  | A  | 1  | 1      | 1  | 1  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 1  | 1  | 1  | 1  | A  | A  | 1  | 1      | 1  | 1  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  | Character pattern (2) |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | A  | A  | 1  | 0      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 1  | 1  | 1  | 1  | A  | A  | 1  | 1      | 1  | 1  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  | Character pattern (8) |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  | A  | A  | 0  | 1      | 0  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 1  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 1  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 1  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 1  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 1  | 0      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 0  | 1  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 1      | 0  | 0  | 0  | 1  | A  | A  | 0  | 0      | 0  | 1  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 1  | 0  | 0  | 1  | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 1  | 0  | 0  | 1  | A  | A  | 0  | 0      | 1  | 0  | 0  | 0  |                       |  |  |
|                |       |    |    |    |    |    |    |               |    |    |    |    | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  | A  | A  | 0  | 0      | 0  | 0  | 0  | 0  |                       |  |  |

- Notes:
1. CGRAM is selected when the upper 9 bits (C3 to C11) of the full size character codes are 0. In this case, the lower 3 bits (C0 to C2) of the character code correspond to bits 5 to 7 (A5 to A7) (3 bits: 8 types) in the CGRAM address.
  2. CGRAM address bits 1 to 4 (A1 to A4) designate the character pattern line position. The 12th line is the cursor position and its display is formed by a logical OR with the cursor.
  3. CGRAM address 0 (A0) corresponds to the left-half and right-half of a full-size character pattern.
  4. The character data is stored with the rightmost character element in bit 0 (LSB), as shown in the table above. Pattern produced by bits 0 to 5 is displayed and 13 raster-rows are displayed together. Thus, an arbitrary character pattern consisting of  $12 \times 13$  dots can be displayed.
  5. A set bit in the CGRAM data corresponds to display selection, and 0 to non-selection.
  6. The upper two bits (AA) of CGRAM data indicate the display attribute for the lower 6-bit pattern. In this case, display attributes specified for the DDRAM during full-size character display is disabled. When these upper two bits are 00, the CGRAM pattern is simply displayed as set; when 01, the pattern reverses (black/white), when 10, the pattern blinks; and when 11, the pattern reverses and blinks.



### Relationship between SEGRAM Addresses and Display Patterns

SEGRAM data is displayed when the select level of the COMS pin is output. Since SEGRAM data does not depend on character code data in DDRAM, and does not undergo horizontal smooth scroll, it can be used to display icon and marks. The following shows the relationship between SEGRAM addresses and segment output pins.

**Table 8 Relationship between SEGRAM Addresses and Display Patterns**

| SEGRAM Address |    |    |    | SEGRAM Data |    |       |       |       |       |       |       |
|----------------|----|----|----|-------------|----|-------|-------|-------|-------|-------|-------|
| A3             | A2 | A1 | A0 | D7          | D6 | D5    | D4    | D3    | D2    | D1    | D0    |
| 0              | 0  | 0  | 0  | B1          | B0 | SEG1  | SEG2  | SEG3  | SEG4  | SEG5  | SEG6  |
| 0              | 0  | 0  | 1  | B1          | B0 | SEG7  | SEG8  | SEG9  | SEG10 | SEG11 | SEG12 |
| 0              | 0  | 1  | 0  | B1          | B0 | SEG13 | SEG14 | SEG15 | SEG16 | SEG17 | SEG18 |
| 0              | 0  | 1  | 1  | B1          | B0 | SEG19 | SEG20 | SEG21 | SEG22 | SEG23 | SEG24 |
| 0              | 1  | 0  | 0  | B1          | B0 | SEG25 | SEG26 | SEG27 | SEG28 | SEG29 | SEG30 |
| 0              | 1  | 0  | 1  | B1          | B0 | SEG31 | SEG32 | SEG33 | SEG34 | SEG35 | SEG36 |
| 0              | 1  | 1  | 0  | B1          | B0 | SEG37 | SEG38 | SEG39 | SEG40 | SEG41 | SEG42 |
| 0              | 1  | 1  | 1  | B1          | B0 | SEG43 | SEG44 | SEG45 | SEG46 | SEG47 | SEG48 |
| 1              | 0  | 0  | 0  | B1          | B0 | SEG49 | SEG50 | SEG51 | SEG52 | SEG53 | SEG54 |
| 1              | 0  | 0  | 1  | B1          | B0 | SEG55 | SEG56 | SEG57 | SEG58 | SEG59 | SEG60 |
| 1              | 0  | 1  | 0  | B1          | B0 | SEG61 | SEG62 | SEG63 | SEG64 | SEG65 | SEG66 |
| 1              | 0  | 1  | 1  | B1          | B0 | SEG67 | SEG68 | SEG69 | SEG70 | SEG71 | SEG72 |
| 1              | 1  | 0  | 0  | B1          | B0 | SEG73 | SEG74 | SEG75 | SEG76 | SEG77 | SEG78 |
| 1              | 1  | 0  | 1  | B1          | B0 | SEG79 | SEG80 | SEG81 | SEG82 | SEG83 | SEG84 |
| 1              | 1  | 1  | 0  | B1          | B0 | SEG85 | SEG86 | SEG87 | SEG88 | SEG89 | SEG90 |
| 1              | 1  | 1  | 1  | B1          | B0 | SEG91 | SEG92 | SEG93 | SEG94 | SEG95 | SEG96 |

Blinking control

Pattern on/off

- Notes:
1. SEG1 to SEG71 are pin numbers of the segment output driver of the HD66730. Pin SEG1 is positioned on the left edge of the display. Segments from SEG72 on are displayed by extension drivers. After SEG 96, display is performed from SEG1 again.
  2. The lower six bits (D0 to D5) indicate display on/off for of each segment. A bit setting of 1 selects display while 0 selects no display.
  3. Pattern blinking of the lower six bits is controlled by the upper two bits (D6 and D7) of SEGRAM data. When the upper two bits (B0 and B1) are 10, segments whose corresponding bits in the lower 6 bits are set to 1 will blink on the display. When the upper two bits (B0 and B1) are 01, only the bit-5 pattern can blink. Do not attempt to set the upper two bits (B0 and B1) to 11 (setting is prohibited).

## **Register Functions**

### **Outline**

Data can be written from the MPU to the internal control registers and internal RAM of the HD66730/1 via an 8-bit bus interface or a serial interface. There are five types of internal control registers, as follows (details are described later):

- Index register: Selects and designates which control register the MPU is to access
- Status register: Indicates the internal state
- Control registers: Designates display control
- RAM address register: Sets an address for accessing the various RAMs
- RAM data register: Receives and transmits data to and from the various RAMs

Table 17 shows the instruction list and the number of execution cycles of each instruction after performing register setting. Instructions that perform data transfer with the RAM data register tend to be used the most. However, auto-incrementation by 1 (or auto decrementation by 1) of internal HD66730/1 RAM addresses after each data write can lighten the program load on the MPU. Note that when an instruction is being executed (internal operations are being performed), only the busy flag in the status register can be read.

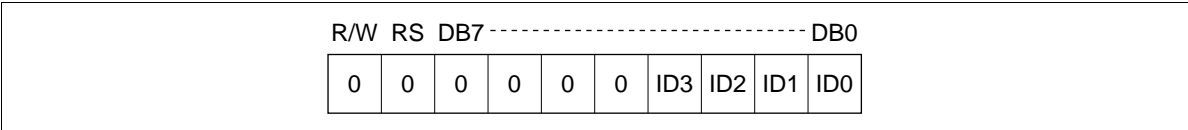
Since the busy flag is 1 during execution, the MPU should check this value before accessing a register. When accessing a register without checking the busy flag, an interval longer than the instruction execution time is needed before the next access. Refer to Table 17 Instruction Registers, for instruction execution times.

When rewriting DDRAM, character display will momentarily breakdown if the data (character codes) that is being rewritten is also being read by the system for display. For this reason, check the display read line position (NF) and the display read raster-row position (LF) in the status register (SR), and rewrite a DDRAM line that is not being read and displayed.

**Functional Description**

**Index Register (IR)**

The index register (Figure 4) designates control registers (R0 to R7), RAM address register (RAR: R8), and RAM data register (RDR: R9). The register number must be set between addresses 0000 to 1001 in binary digits. Note that if address 1111 is set, the test register will be selected. Addresses 1010 to 1110 are ignored.



**Figure 4 Index Register**

### Status Register (ST)

The status register (Figure 5) includes the busy flag (BF), display line bits (NF1/0), and display raster-row bits (LF0 to LF3). If BF is 1, an instruction is being executed, and another instruction will not be accepted during this time. Any attempt to write data to a register at this time is ignored.

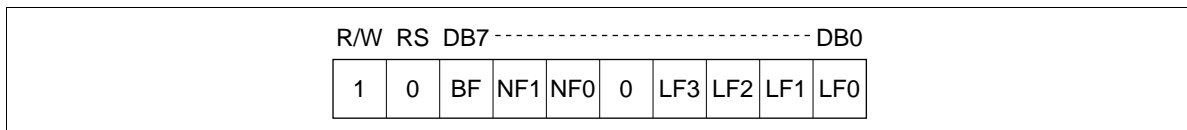
Rasters-rows are driven one at a time according to specific timing to perform liquid crystal display. Bits NF1 and NF0 indicate display lines, and bits LF3 to LF0 indicate the raster-row in a line. If character display degenerates when rewriting DDRAM, rewrite only those display lines that are not currently being read out by the system for display. During segment display, the next state of the last raster-row in the character display is read out.

**Table 9 Display State According to NF1 and NF0**

| NF1 | NF0 | Display State              |
|-----|-----|----------------------------|
| 0   | 0   | Displaying the first line  |
| 0   | 1   | Displaying the second line |
| 1   | 0   | Displaying the third line  |
| 1   | 1   | Displaying the fourth line |

**Table 10 Display State According to LF3 to LF0**

| LF3 | LF2 | LF1 | LF0 | Display State                    |
|-----|-----|-----|-----|----------------------------------|
| 0   | 0   | 0   | 0   | Displaying the first raster-row  |
| 0   | 0   | 0   | 1   | Displaying the second raster-row |
| 0   | 0   | 1   | 0   | Displaying the third raster-row  |
| 0   | 0   | 1   | 1   | Displaying the fourth raster-row |
| •   |     |     |     | •                                |
| •   |     |     |     | •                                |
| •   |     |     |     | •                                |
| 1   | 1   | 0   | 0   | Displaying the 13th raster-row   |



**Figure 5 Status Register**

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### Entry Mode Register (R0)

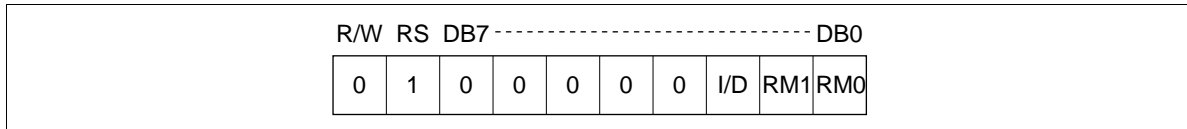
The entry mode register (Figure 6) includes bits I/D, RM1, and RM0.

**I/D:** Increments ( $I/D = 1$ ) or decrements ( $I/D = 0$ ) the DDRAM address by 1 when a character code is written into or read out from the DDRAM. When the DDRAM address is incremented by 1, the cursor or blinking will also shift to the right. This applies to both CGRAM and SEGRAM.

**RM1/0:** Selects DDRAM, CGRAM, or SEGRAM for access (Table 10).

**Table 11** RAM Selection by RM1 and RM0

| RM1 | RM0 | Selected RAM                    |
|-----|-----|---------------------------------|
| 0   | 0/1 | Display data RAM (DDRAM)        |
| 1   | 0   | Character generator RAM (CGRAM) |
| 1   | 1   | Segment RAM (SEGRAM)            |



**Figure 6** Entry Mode Register

**Function Set Register (R1)**

The function set register (Figure 7) includes bits BST, EXT2, EXT1, DT1, DT0, and DCL.

**BST:** When BST is 1, the booster starts to operate. When the LCD voltage is external, set BST to 0 to stop operation of the internal booster. In addition, the consumption current can be suppressed by stopping the booster when entering standby mode without display.

**EXT2/1:** Extends the common driver and segment driver of HD66730. Set EXT2 to 1 to extend the driver to the common side if the duty ratio is 1/40 or 1/53. Extend the driver to the segment side by setting EXT1 to 1 when displaying 7 or more digits (of full size) in the horizontal direction. DDRAM capacity is 80 bytes. When the HD66731, these EXT2/1 bits must be set to 1.

**DT1/0:** Selects the duty ratio of the LCD (Table 11). Although this bit can be set separately from the display line designation (NL1/0), the duty ratio must be selected so that it will be smaller than the number of display lines.

**DCL:** When DCL is 1, the display is cleared by writing the code for half-size space (H'A0) into all DDRAM addresses. Then H'00 is written into the RAM address counter (RAR) and the DDRAM is selected. The character code for character code H'A0 must be a blank pattern when rewriting HCGROM used for half-size characters.

**Cursor Control Register (R2)**

The cursor control register includes bits CHM, C, CM1, and CM0.

**CHM:** When CHM is set to 1, DDRAM is selected, the RAM address counter (RAR) is set to 0, and the cursor home instruction is executed. The contents of DDRAM do not change. The cursor or blinking moves to the left edge of the display (the left edge of the first line if two lines are displayed).

**C:** When C = 1, cursor display is turned on. The cursor is displayed at the position corresponding to the count value of the RAM address counter (RAR). To set data in the RAR, set the index register (IDR) to 1000 to select it, and modify the data in the RAR. Note that the RAM address counter (RAR) automatically increments (decrements) when the RAM is accessed, and the cursor will move accordingly.

**CM1/0:** Selects cursor display mode (Table 12 and Figure 9). The blinking frequency (cycle) of the blink cursor and the white/black inverted cursor has 64 frames.

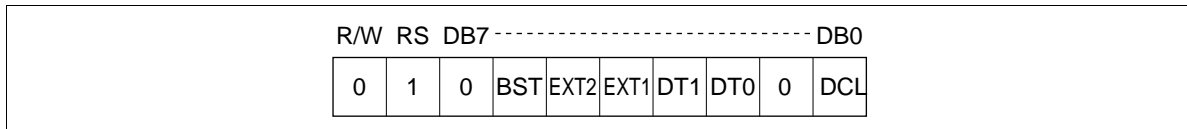
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**Table 12 Duty Drive Ratio**

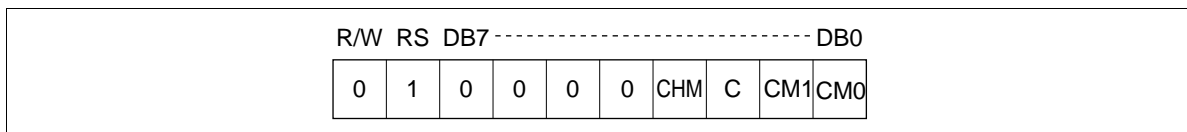
| DT1 | DT0 | Duty Drive Ratio |
|-----|-----|------------------|
| 0   | 0   | 1/14 duty drive  |
| 0   | 1   | 1/27 duty drive  |
| 1   | 0   | 1/40 duty drive  |
| 1   | 1   | 1/53 duty drive  |

**Table 13 Cursor Mode Selection**

| CM1 | CM0 | Selected Cursor Mode        |
|-----|-----|-----------------------------|
| 0   | 0   | 12th raster-row cursor      |
| 0   | 1   | Blink cursor                |
| 1   | 0/1 | White/black inverted cursor |



**Figure 7 Function Set Register**



**Figure 8 Cursor Control Register**

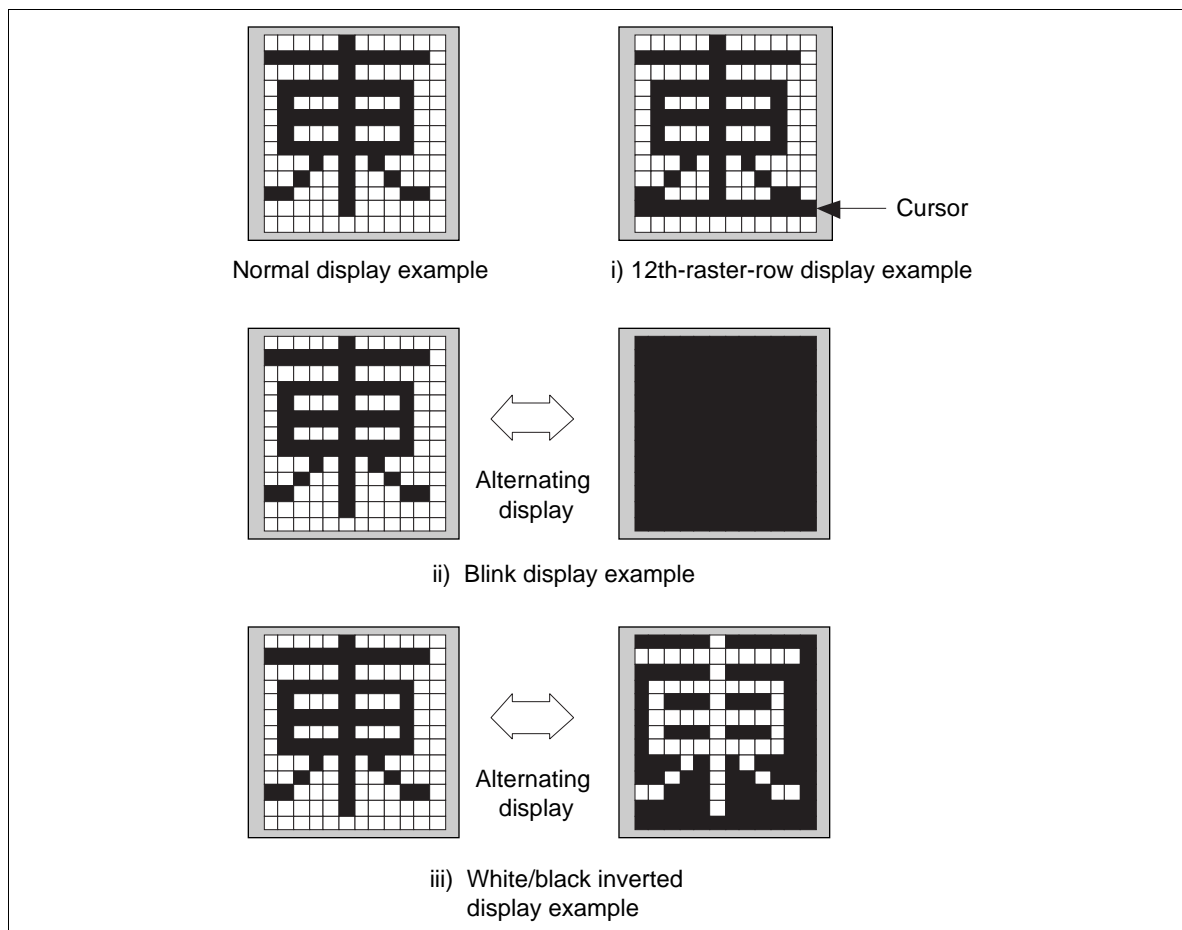


Figure 9 Cursor Display Examples



## HD66730/HD66731

### Display Control Register 1 (R3)

The display control register 1 (Figure 10) includes bits ST, DC, and DS.

**ST:** When ST is 1, the display control register 1 enters the standby mode. The internal operation clock is divided into 32. Data cannot be displayed on the LCD panel, however, the consumption current can be suppressed during the standby mode. Note that the register setting value and the data inside the RAM are maintained.

**DC:** When DC is 1, the character display is turned on.

**DS:** When DS is 1, the segment display is turned on. Bit DS can selectively display marks.

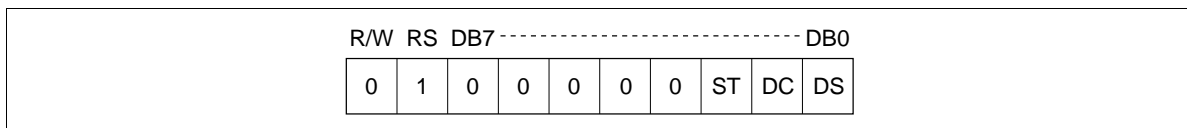
### Display Control Register 2 (R4)

**NC1/0:** Selects the display character in the horizontal direction. When performing a horizontal smooth scroll, set the number of display characters larger than the actual number of liquid crystal drive characters. When the frame frequency (cycle) is stable, the operation frequency is proportional to the display characters. Operation frequency must be suppressed by setting the number of display character as small as possible because the consumption current is proportional to the operation frequency. Refer to Oscillator for details.

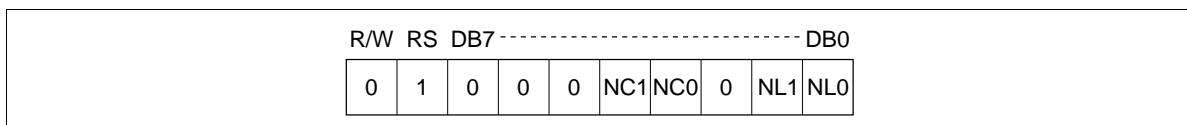
**NL1/0:** Sets the number of display lines. Set the number of display lines larger than the duty drive ratio (DT1/0). Do not set 10 to these bits. Table 13 indicates the settings of the display lines.

**Table 14 Display Control Register 2 Setting**

| Display Lines<br>NL1/0 | Display Characters: NC1/0 |                      |                      |
|------------------------|---------------------------|----------------------|----------------------|
|                        | 00                        | 01                   | 10                   |
| 00                     | 1-line 6 characters       | 1-line 20 characters | 1-line 40 characters |
| 01                     | 2-line 6 characters       | 2-line 10 characters | 2-line 20 characters |
| 10                     | Setting is inhibited.     |                      |                      |
| 11                     | 4-line 6 characters       | 4-line 10 characters | 4-line 10 characters |



**Figure 10 Display Control Register 1**



**Figure 11 Display Control Register 2**

### Scroll Control Register 1 (R5)

The scroll control register 1 (Figure 12) includes bits SN1, SN0, SL3, SL2, SL1, and SL0.

**SN1/0:** Selects the starting line to be displayed. When SN1/0 shows 00, display begins from the first line. When SN1/0 shows 01, 10, 11, display begins from the second, third, or fourth line, respectively. Use these bits within the display line setting (NL1/0). SN can be used to display a smooth scroll and DDRAM memory bank switching.

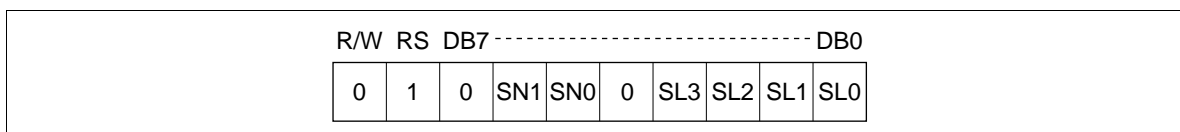
**SL0 to SL3:** Selects the scroll starting raster-row of the line set by the start display line (SL1/0). When these bits show 0000, a display line starting from the head raster-row (first raster-row) is displayed and can be set to 1100 (13th raster-row) showing the last raster-row. A vertical smooth scroll can be performed by sequentially incrementing the first raster-row. Refer to Vertical Smooth Scroll for details. Note that bits SL0 to SL3 that are set to a value above 1100 will not operate correctly.

### Scroll Control Register 2 (R6)

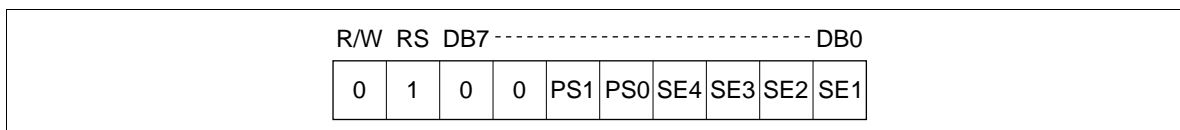
The scroll control register 2 (Figure 13) includes bits PS1, PS0, SE4, SE3, SE2, and SE1.

**PS1/0:** Selects the partial smooth scroll mode. When PS1/0 bits are 00, all characters scroll horizontally across the display. When bits PS1/0 are 01, only the leftmost character is fixed and the remaining characters perform horizontal smooth scroll display. When bits PS1/0 are 10, the two leftmost bits, and when 11, the three leftmost characters are fixed and the remaining characters perform horizontal smooth scroll. Refer to Partial Smooth Scroll for details.

**SE1 to SE4:** These bits enable a dot scroll in display lines designated by scroll control register 3 (R7). When bit SE is 1, the first line is scrolled according to scroll control register 3 (R7). When SE2 is 1, the second line scrolls independently, when SE3 is 1, the third line scrolls independently, when SE4 is 1, the fourth line scrolls independently. Scrolling multiple lines at the same time is also possible.



**Figure 12 Scroll Control Register 1**



**Figure 13 Scroll Control Register 2**

### Scroll Control Register 3 (R7)

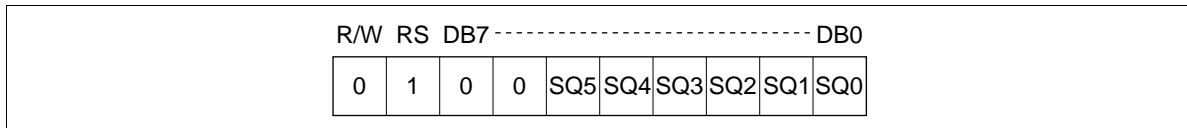
The scroll control register 3 (Figure 14) includes bits SQ5, SQ4, SQ3, SQ2, SQ1, and SQ0.

**SQ0 to SQ5:** These bits designate the number of dots to be horizontally scrolled to the left on the panel. Horizontal smooth scroll can be performed for any number of dots between 1 and 48 inclusive by using the non-display DDRAM area. When these bits are 000000, scrolling is not performed. When these bits are 110000, 48 dots are scrolled to the left. If these bits are set to a value above 110000, 48 dots are still scrolled. Refer to Horizontal Smooth Scroll for details.

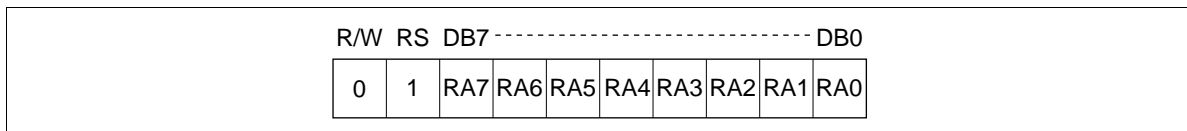
### RAM Address Register (R8)

The RAM address register (Figure15) initially contains the RAM address at which incrementation (decrementation) starts. RAM selection bits (RM1/0) in the entry mode register (R0) select which RAM to access (DDRAM/CGRAM/SEGRAM). When DDRAM (RM1/0 = 00) is selected, address allocation differs according to the number of display lines, but in all cases the most significant bit (RA7) is ignored. During a 1-line display (NL1/0 = 00), addresses H'00 to H'4F are allocated to that line. During a 2-line display, addresses H'00 to H'27 are allocated to the first line, and addresses H'40 to H'67 are allocated to the second line. During a 4-line display, addresses H'00 to H'13 are allocated to the first line, H'20 to H'33 to the second, H'40 to H'53 to the third, and H'60 to H'73 to the fourth. See Table 14.

When CGRAM (RM1/0 = 10) is selected, addresses H'00 to H'19 are allocated to the first character and addresses H'20 to H'39 are allocated to the second character, and so on (Table 15). The setting of addresses between characters (example: H'1A to H'1F) is ignored here. When SEGRAM is selected (RM1/0 = 11), addresses H'0 to H'F are allocated to the RAM and the upper four bits (R4 to R7) are ignored (Table 16).



**Figure 14 Scroll Control Register 3**



**Figure 15 RAM Address Register**

**Table 15 DDRAM Address Allocation**

| Displayed Lines | 1-Line Display<br>(NL1/0 = 00) | 2-Line Display<br>(NL1/0 = 01) | 4-Line Display<br>(NL1/0 = 00) |
|-----------------|--------------------------------|--------------------------------|--------------------------------|
| First line      | H'00 to H'4F                   | H'00 to H'27                   | H'00 to H'13                   |
| Second line     | —                              | H'40 to H'67                   | H'20 to H'33                   |
| Third line      | —                              | —                              | H'40 to H'53                   |
| Fourth line     | —                              | —                              | H'60 to H'73                   |

**Table 16 CGRAM Address Allocation**

| Displayed Character | CGRAM Address |
|---------------------|---------------|
| First character     | H'00 to H'19  |
| Second character    | H'20 to H'39  |
| Third character     | H'40 to H'59  |
| Fourth character    | H'60 to H'79  |
| Fifth character     | H'80 to H'99  |
| Sixth character     | H'A0 to H'B9  |
| Seventh character   | H'C0 to H'D9  |
| Eighth character    | H'E0 to H'F9  |

**Table 17 SEGRAM Address Allocation**

| Displayed Segment | SEGRAM Address |
|-------------------|----------------|
| SEG1 to SEG6      | H'0            |
| SEG7 to SEG12     | H'1            |
| SEG13 to SEG18    | H'2            |
| SEG19 to SEG24    | H'3            |
| SEG25 to SEG30    | H'4            |
| SEG31 to SEG36    | H'5            |
| SEG37 to SEG42    | H'6            |
| SEG43 to SEG48    | H'7            |
| SEG49 to SEG54    | H'8            |
| SEG55 to SEG60    | H'9            |
| SEG61 to SEG66    | H'A            |
| SEG67 to SEG72    | H'B            |
| SEG73 to SEG78    | H'C            |
| SEG79 to SEG84    | H'D            |
| SEG85 to SEG90    | H'E            |
| SEG91 to SEG96    | H'F            |

Note: SEG72 to SEG96 are driven by extension drivers.

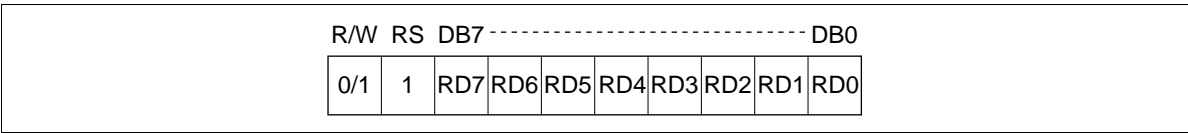
**RAM Data Register (R9)**

This register (Figure 16) stores 8-bit data that is written to or read from the DDRAM, CGRAM, or SEGRAM at the address indicated by the RAM address counter (RAC). The RAM selection bit (RM1/0) selects the RAM (DDRAM, CGRAM, SEGRAM). After the said RAM is accessed, RAM address is automatically incremented (decremented) by 1 according to the I/D bit.

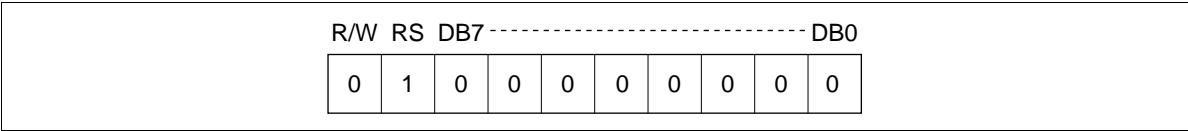
Note that RAM selection bits (RM1/0) and RAM address register (R8) must be set before reading. If not, the first data read is invalid. If read instructions continue to be executed, however, data will be read correctly from the second read.

**Test Register (RF)**

This is a test register (Figure 17) and must be set to H'00 at all times. This register is automatically cleared (H'00) by reset input; however, it must be cleared by software after power-on if the reset pin is not used.



**Figure 16 RAM Data Register**



**Figure 17 Test Register**

**Table 18 Instruction Registers**

| Reg. No. | Index (Hex) | Register                 | Code |    |     |     |      |      |     |     |     |     |   | Description               | Execution Clock Cycle |
|----------|-------------|--------------------------|------|----|-----|-----|------|------|-----|-----|-----|-----|---|---------------------------|-----------------------|
|          |             |                          | R/W  | RS | DB7 | DB6 | DB5  | DB4  | DB3 | DB2 | DB1 | DB0 |   |                           |                       |
| IR       | —           | Index (IDR)              | 0    | 0  | —   | —   | —    | —    | ID3 | ID2 | ID1 | ID0 | Designates the register number of the instruction register to access. ID = 0000: R0 to 1001: R9   | 12                        |                       |
| SR       | —           | Status (STR)             | 1    | 0  | BF  | NF1 | NF0  | —    | LF3 | LF2 | LF1 | LF0 | Indicates the busy flag (BF), display read line position (NF1/0), display read raster-row position(NL0 to NL3).   | 0                         |                       |
| R0       | 0           | Entry mode (EMR)         | 0    | 1  | 0   | 0   | 0    | 0    | 0   | I/D | RM1 | RM0 | Designates RAM address in incrementation or decrementation (I/D) and RAM selection (RM1/0).   | 12                        |                       |
| R1       | 1           | Function set (FSR)       | 0    | 1  | 0   | BST | EXT2 | EXT1 | DT1 | DT0 | 0   | DCL | Clears display (DCL) and initializes the DDRAM address. Selects duty drive ratio(DT1/0), enables extension driver (EXT2/1) and sets the booster operation on. | DCL = 1: 492<br>Other: 12 |                       |
| R2       | 2           | Cursor control (CCR)     | 0    | 1  | 0   | 0   | 0    | 0    | CHM | C   | CM1 | CM0 | Designates cursor-on (C) and cursor display mode(CM1/0). Executes cursor home (CHM) instruction.  | 12                        |                       |
| R3       | 3           | Display control 1 (DCR1) | 0    | 1  | 0   | 0   | 0    | 0    | 0   | ST  | DC  | DS  | Designates standby mode (ST), character display on (DC), and segment display on (DS).   | 12                        |                       |
| R4       | 4           | Display control 2 (DCR2) | 0    | 1  | 0   | 0   | NC1  | NC0  | 0   | 0   | NL1 | NL0 | Sets the number of display characters(NC1/0) and display lines(NL1/0).  | 12                        |                       |
| R5       | 5           | Scroll control 1 (SCR1)  | 0    | 1  | 0   | SN1 | SN0  | 0    | SL3 | SL2 | SL1 | SL0 | Sets the display start line (SN1/0) and start raster-row (ST0 to ST3).  | 12                        |                       |
| R6       | 6           | Scroll control 2 (SCR2)  | 0    | 1  | 0   | 0   | PS1  | PS0  | SE4 | SE3 | SE2 | SE1 | Designates partial scroll columns (PS1/0) and scroll display line enable(SE1 to SE4).   | 12                        |                       |
| R7       | 7           | Scroll control 3 (SCR3)  | 0    | 1  | 0   | 0   | SQ5  | SQ4  | SQ3 | SQ2 | SQ1 | SQ0 | Sets the number of dots to be scrolled (SQR0 to SQR5).  | 12                        |                       |

## HD66730/HD66731

**Table 18 Instruction Registers (cont)**

| Reg. No. | Index (Hex) | Register          | Code |    |     |     |     |     |     |     |     |     |  | Description | Execution Clock Cycle |
|----------|-------------|-------------------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|--|-------------|-----------------------|
|          |             |                   | R/W  | RS | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 |  |             |                       |
| R8       | 8           | RAM address (RAR) | 0    | 1  | RA7 | RA6 | RA5 | RA4 | RA3 | RA2 | RA1 | RA0 | Resets the address address counter for DDRAM/CGRAM/SEGRAM. RAM is selected by RM1/0. | 12          |                       |
| R9       | 9           | RAM data (RDR)    | 0/1  | 1  | RD7 | RD6 | RD5 | RD4 | RD3 | RD2 | RD1 | RD0 | Writes or reads data to and from DDRAM/CGRAM/SEGRAM. RAM is selected by RM1/0.       | 12          |                       |
| RF       | F           | Test (TSR)        | 0    | 1  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | This is a test register. Set 00 in this register.                                    | 12          |                       |

Note: The execution time depends on the input or oscillation frequency.

- BF = 1: Internal processing being performed
- NF1/0: Position of display read line
- LF0 to LF3: Position of display read raster-row
- ID= 1: Address increment
- = 0: Address decrement
- RM1/0: RAM selection (00/01: DDRAM, 10: GGRAM, 11: SEGRAM)
- BST = 1: Booster on
- EXT2 = 1: Common driver extension enable
- EXT1 = 1: Segment driver extension enable
- DT1/0: Duty ratio (00: 1/14, 01: 1/27, 10: 1/40, 11: 1/53)
- DCL = 1: Executes display-clear instruction
- CHM = 1: Executes cursor-home instruction
- C = 1: Cursor on
- CM1/0: Designates cursor mode (00: 12th raster-row, 01: blinking, 10: white/black inverse)
- ST = 1: Standby mode
- DC = 1: Character display on
- DS = 1: Segment display on
- NC1/0: Sets the number of display characters (6 to 40 characters)
- NL1/0: Sets the number of display lines (00: 1 line, 01: 2 lines, 11: 4 lines)
- SN1/0: Designates the line to start displaying (00: first line, 01: second line, 10: third line, 11: fourth line)
- SL0 to SL3: Designates scroll starting raster-row(0000: first raster-row, 1100: 13th raster-row)
- PS1/0: Designates partial scroll (00: all columns scroll, 01: the leftmost column fixed, 10: the two leftmost columns fixed, 11: the three leftmost columns fixed)
- SE1 to SE4: Designates which line to scroll (SE = 1: enables the first line to be scrolled, etc.)
- SQ0 to SQ5: Number of dots to scroll (0 to 48 dots)
- RA0 to RA7: RAM address
- RD0 to RD7: RAM data

## **Reset Function**

The HD66730/1 is reset by setting the RESET pin to low level. During reset, the system performs next-control-register setting and executes instructions. The busy flag (BF) therefore indicates a busy state (BF = 1) at this time, which means that only the index register and status register can be accessed.

Display clear (DDRAM reset) is performed automatically by reset input. Since more than 1,000 clocks of execution cycles are needed to initialize the DDRAM, the reset period must be set to more than this number. Note that if the reset input conditions specified in Electrical Characteristics are not satisfied, the HD66730/1 will not operate correctly, and reset should be performed by software.

## **Initialization of Instruction Register Function**

### **1. Index Register: IR**

The index register cannot be initialized by reset. After reset release, the index register must be set to access a control register.

### **2. Status register: SR**

BF = 1: Busy state

### **3. Entry mode register: R0**

I/D = 1: +1 (incrementation)

RM1/0 = 00: DDRAM selection

### **4. Function set register: R1**

BST = 0: Booster off

EXT2/1 = 11: Driver extension enable

DT1/0 = 11: 1/53 duty drive

DCL = 1: Display-clear execution

Note: At least 1,000 clock cycles of execution time is needed to clear the DDRAM.



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## HD66730/HD66731

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5. Cursor control register: R2
  - CHM = 1: Cursor home execution
  - C = 0: Cursor display off
  - CM1/0 = 00: 12th raster-row cursor display mode
6. Display control register 1: R3
  - ST = 0: Standby mode clear
  - DC = 0: Character display off
  - DS = 0: Segment display off
7. Display control register 2: R4
  - NC1/0 = 00: 6-column display mode
  - NL1/0 = 00: 1-line display mode
8. Scroll control register 1: R5
  - SN1/0 = 00: Starts displaying from the first line.
  - SL3 to SL0 = 0000: Starts displaying from the first raster-row.
9. Scroll control register 2: R6
  - PS1/0 = 00: Partial scroll release
  - SE4 to SE1 = 0000: Disables dot scrolling for all lines.
10. Scroll control register 3: R7
  - SQ5 to SQ0 = 000000: Number of dots to be scrolled = 0
11. RAM address register: R8
  - RAM address register is automatically incremented during reset when display-clear is executed. Note that after reset is released, this register must be reset by software before accessing RAM.

**Initial Setting of Pin Functions****1. Bus/serial interface**

The input level of pin IM selects the 8-bit bus or serial interface. For an 8-bit bus interface, data is written into the index register or read from the status register according to the level of pin R/W. Note that pin RS must be held low during this time. For serial interface, data is written into the index register according to bit R/W. Note that bit RS must be 0 during this time. During reset, only the index register and status register can be set and RAM cannot be accessed.

**2. LCD driver output**

Since segment drivers (pins SEG1 to SEG71/119) are in a display-off state during reset, they output non-selective levels (V2/V3 level) during reset. At this time, a 4-line 6-character display alternates its current. Common drivers (pins COM1 to COM24/53 and COMS) output non-selective levels (V1/V4 level) during reset, and alternate its current for a 4-line 6-character display.

**Note:** Pins COM25/COMD of HD66730 are grounded (0V) during reset. When pin COM25 is used without expanding drivers to the common side, display may be performed using the liquid crystal drive voltage. In this case, adjust the liquid crystal voltage during reset.

**3. Extension driver interface output (HD66730)**

Since bits EXT2/1 are 11 during reset, extension is performed to both segment side and common side. Pin CL2 outputs the oscillation (operation) frequency clock. Pins CL1 and M output signals in a cycle corresponding to a 4-line 6-character display size. In addition, pins SEGD and COM25/COMD output low (ground level) since the display is turned off.

**4. Booster output**

The operation of the internal booster stops because bit BST becomes 0 during reset.

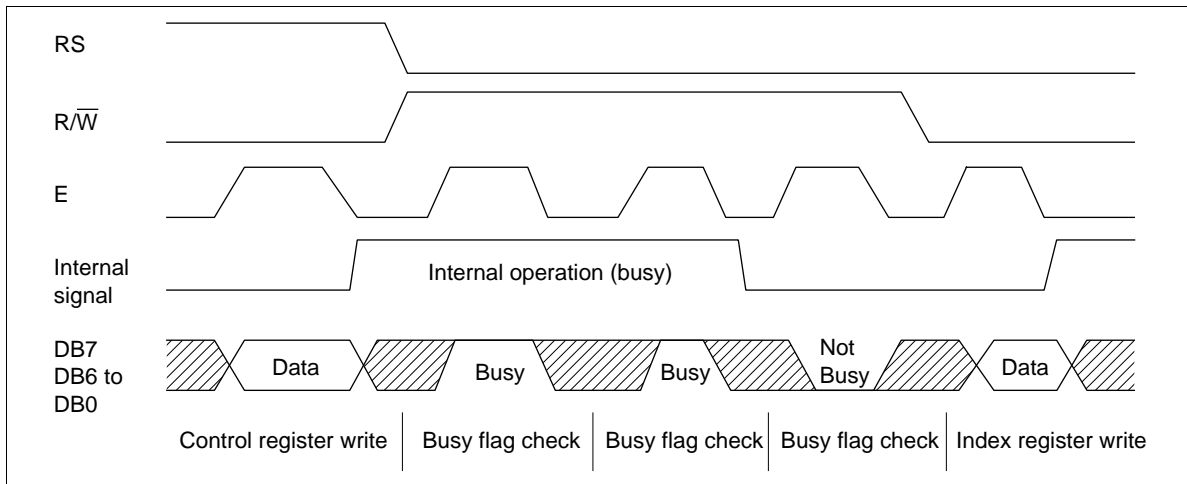
**Note:** The potential of pins V5OUT2 and V5OUT3 increases by about +0.7 V with respect to GND level when the booster stops. When using external polarized capacitors, make sure that no reverse bias occurs.

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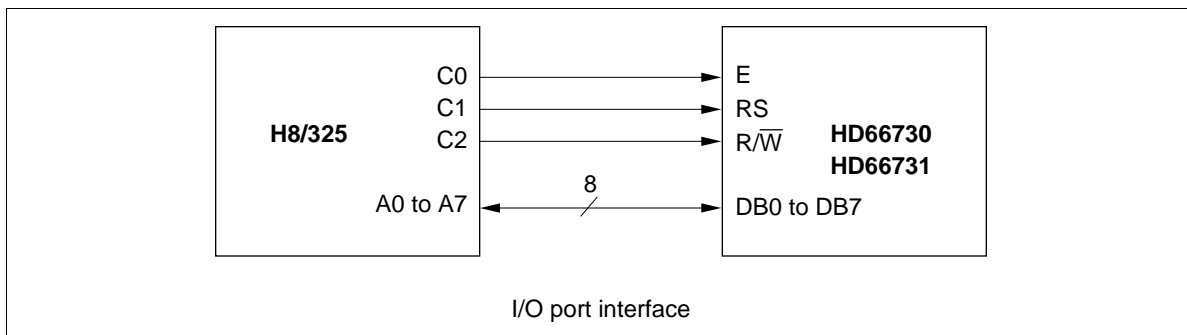
### Interfacing to the MPU

The HD66730/1 enters 8-bit bus interface mode when the IM pin is set high. The HD66730/1 can interface with the MPU via an I/O port. Use the serial interface when there are restraints in the bus wiring width.

Instruction is executed when data is written into the control register. In this case, only the status register can be read (busy check, etc.). In this case, check the busy flag when accessing (polling), or insert an interval considering the execution time and perform the next access when the internal process has completely finished. The instruction execution time depends on the HD66730/1 operation frequency. When using the internal oscillation circuit of the HD66730/1, the instruction time will change as the oscillation frequency does. Figure 18 shows an example of an 8-bit data transfer timing sequence. Figure 19 shows an example of interface between HD66730/1 and 8-bit microcomputers.



**Figure 18 Example of an 8-bit Data Transfer Timing Sequence**



**Figure 19 Example of Interfacing with 8-Bit Microcomputers**

## **Transferring Serial Data**

The HD66730/1 enters serial interface mode when the IM pin is set low. A three-line clock-synchronous transfer method is used. The HD66730/1 receives serial input data (SID) and transmits serial output data (SOD) by synchronizing with a transfer clock (SCLK) sent from the master side.

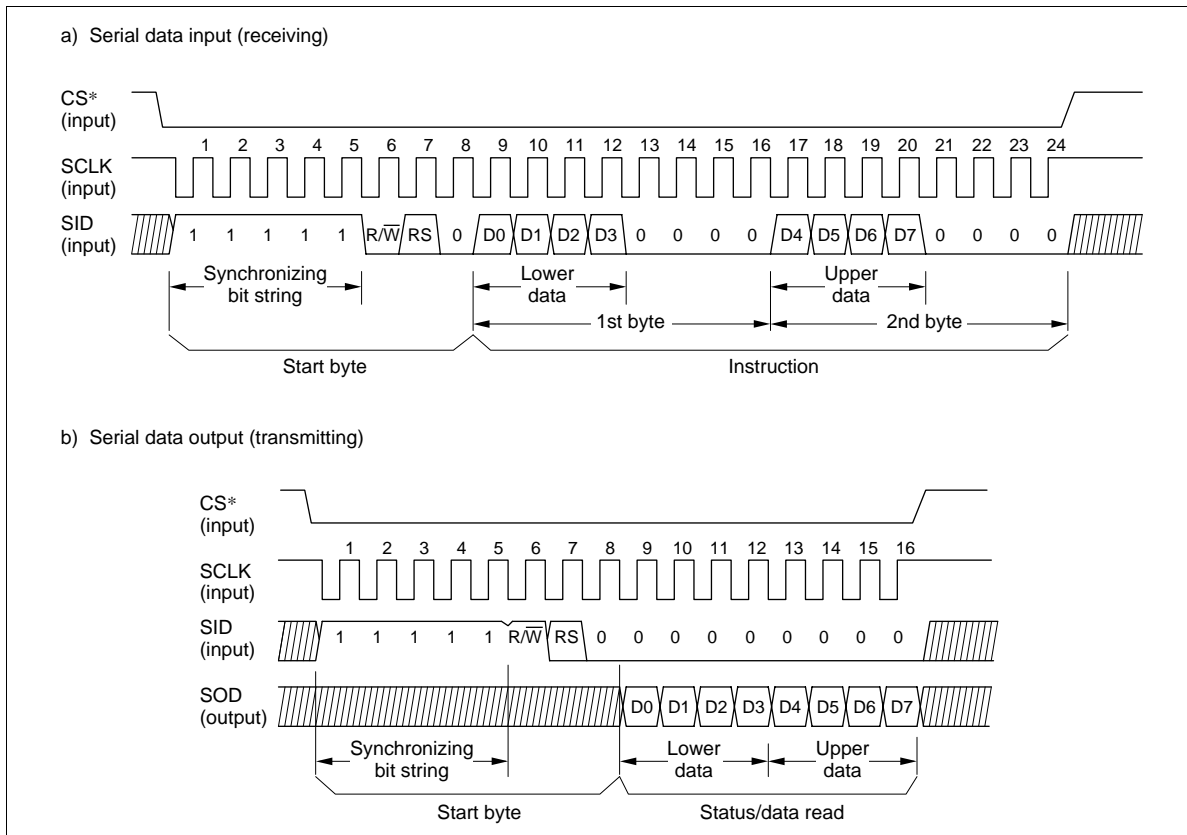
When the HD66730/1 interfaces with several chips, chip select pin (CS\*) must be used. The transfer clock (SCLK) input is activated by making chip select (CS\*) low. In addition, the transfer counter of the HD66730/1 can be reset and serial transfer synchronized by making chip select (CS\*) high. Here, since the data which was being sent at reset is cleared, restart the transfer from the first bit of this data. In a minimum system where a single HD66730/1 interfaces to a single MPU, an interface can be constructed from the transfer clock (SCLK) and serial input data (SID). In this case, chip select (CS\*) should be fixed to low.

The transfer clock (SCLK) is independent of operational clock (CLK) of the HD66730/1. However, when several instructions are continuously transferred, the instruction execution time determined by the operational clock (CLK) (see Continuous Transfer) must be considered since the HD66730/1 does not have an internal transmit/receive buffer.

Figure 20 shows the basic procedure for transferring serial data. To begin with, transfer the start byte. By receiving five consecutive bits of 1 (synchronizing bit string) at the beginning of the start byte, the transfer counter of the HD66730/1 is reset and serial transfer is synchronized. The 2 bits following the synchronizing bit string (5 bits) specify transfer direction ( $R/\overline{W}$  bit) and register select (RS bit). Be sure to transfer 0 in the 8th bit.

After receiving the start byte, instructions are received and the data/busy flag is transmitted. When the transfer direction and register select remain the same, data can be continuously transmitted or received.

The transfer protocol is described in detail in the following.



**Figure 20 Basic Procedure for Transferring Serial Data**

- Receiving (write)

After receiving the start synchronizing bit string, the R/W bit (= 0), and the RS bit in the start byte, an 8-bit instruction is received in 2 bytes: the lower 4 bits of the instruction are placed in the LSB of the first byte, and the higher 4 bits of the instruction are placed in the LSB of the second byte. Be sure to transfer 0 in the following 4 bits of each byte. When instructions are received with R/W bit and RS bit unchanged, continuous transfer is possible (see Continuous Transfer in the following).

- Transmitting (read)

After receiving the synchronizing bit string, the R/W bit (= 0), and the RS bit in the start byte, 8-bit read data is transmitted from pin SOD in the same way as receiving. When read data is transmitted with R/W bit and RS bit unchanged, continuous transfer is possible (see Continuous Transfer in the following).

The status register (SR) is read when the RS bit is 0. RAM data is read out when the RS bit is set to 1 after designating RAM data register (R9) with the index register (IR). Bits RM1/0 of entry mode register (R0) select the RAM. When reading RAM data, an interval longer than the RAM reading time must be taken after the start byte has been accepted and before the first data has been read out. During transmission (data output), the  $\overline{\text{SID}}$  input is continuously monitored for a start synchronizing bit string (1111). Once this has been detected, the  $\overline{\text{R/W}}$  and RS bits are received. Accordingly, 0 must always be input to  $\overline{\text{SID}}$  when transmitting data continuously.

- Continuous Transfer

When instructions are received with the R/W bit and RS bit unchanged, continuous receive is possible without inserting a start byte between instructions.

After receiving the last bit (the 8th bit in the 2nd byte) of an instruction, the system begins to execute it. To execute the next instruction, the instruction execution time of the HD66730/1 must be considered. If the last bit (the 8th bit in the 2nd byte) of the next instruction is received during execution of the previous instruction, the instruction will be ignored.

In addition, if the next unit of data is read before read execution of previous data is completed for RAM data, normal data is not sent. To transfer data normally, the busy flag must be checked. However, if the amount of wiring used for transmission needs to be reduced, or if the burden of polling on the CPU needs to be lightened, transfer can be performed without reading the busy flag. In this case, insert a transfer wait between instructions so that the current instruction has time to complete execution. Figure 21 shows the procedure for continuous data transfer.

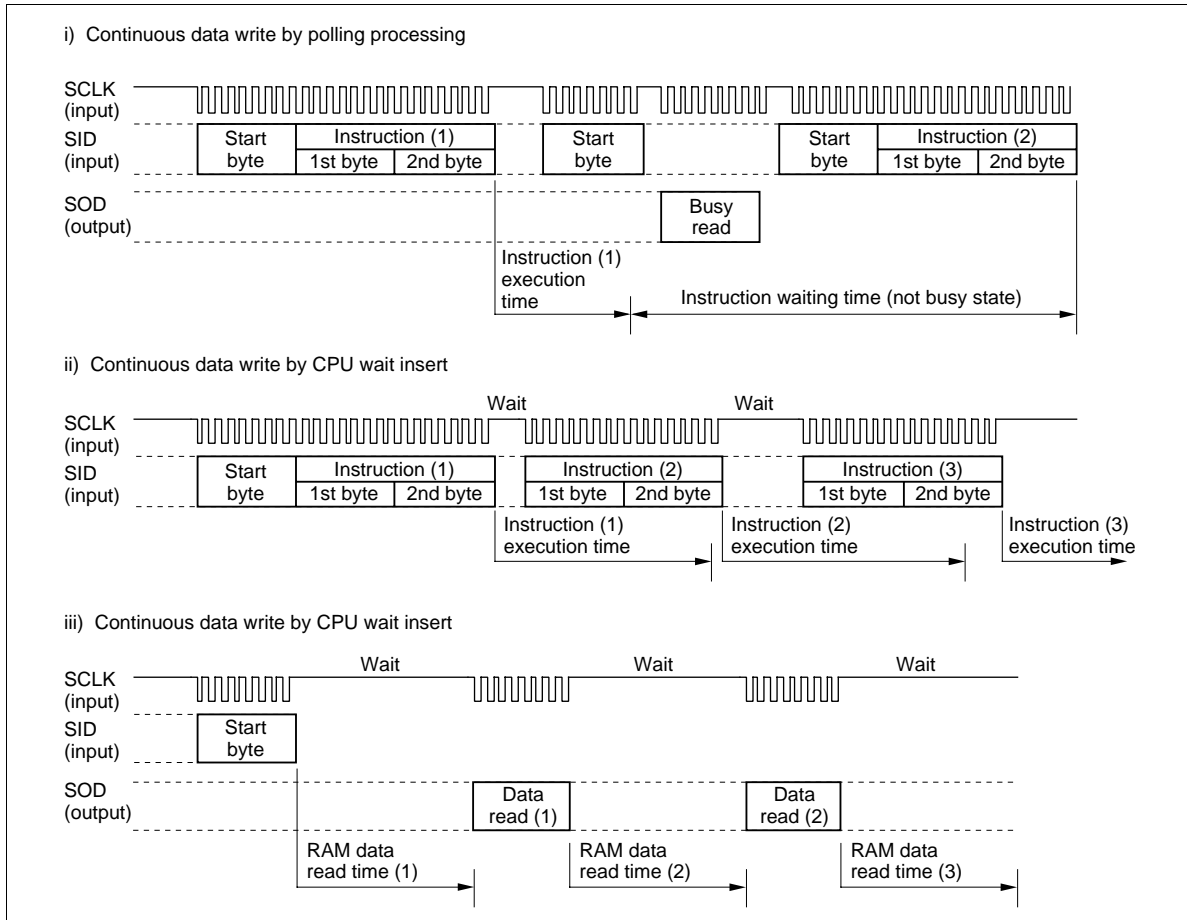


Figure 21 Procedure for Continuous Data Transfer

## Combined Display of Full-Size and Half-Size Characters

The HD66730/1 performs display from the left edge of the display combining 12-dot full-size (character size:  $11 \times 12$  dots) and 6-dot half-size characters (character size:  $6 \times 12$  dots). There will be a one-dot space between these fonts.

The most significant bit in the data (8 bits) in DDRAM is allocated to the designation bit indicating a full-size or half-size character. When this MSB is 0, the full-size character is selected, and when 1, the half-size character is selected.

When the full-size character is selected, 2 bytes of DDRAM are linked and used as a 16-bit code (Figure 22). In this case, the lower byte is written into the smaller DDRAM address. 12 bits of this 16-bit code are used as character codes. Up to 4096 character codes can be specified. In addition, two of the remaining four bits can be allocated to a display-attribute code and can designate white/black inverted display for individual characters (refer to Display Attribute Designation). Table 18 shows the relationship between the 16-bit designated JIS code and the HD66730/1 12-bit character code. 8-bit data designating half-size characters are used as an 8-bit code (Figure 23). Specifically, 7 bits of the 8-bit half-size characters become the character codes, so that a total of 128 characters can be displayed (alphanumeric characters and symbols can be displayed as half-size characters).

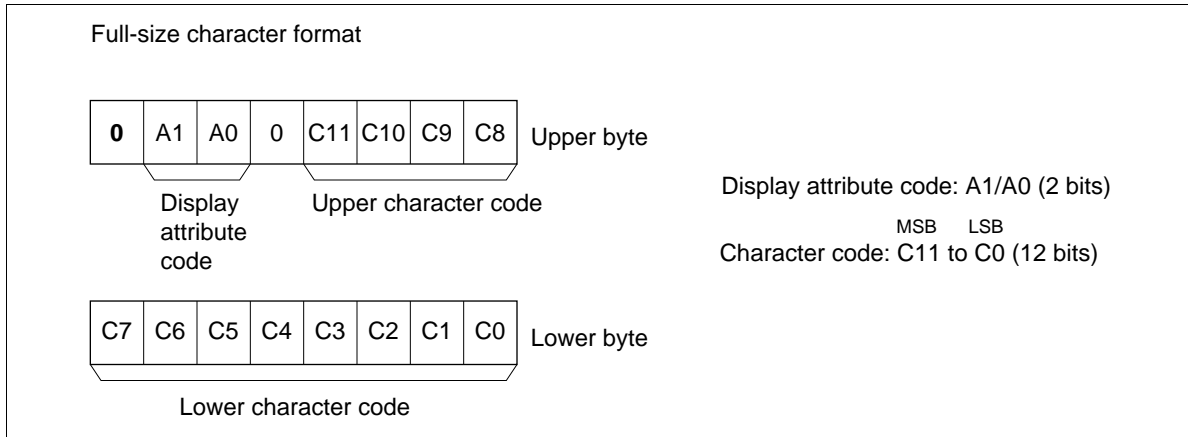
User fonts can be displayed using the CGRAM. Special symbols not included in the internal CGROM or the JIS Level-2 Kanji Set can be displayed as needed. Since the display font size of the CGRAM is  $12 \times 13$  dots, CGRAM fonts can be displayed to the right, left, top or bottom, in order to be used to display double-size characters or graphics. Note that the display-attribute code (A1/A0) designation that is to be written into the DDRAM is ignored when the CGRAM is used. In this case, bits 6 and 7 in the CGRAM are used for display-attribute-code designation. Refer to CGRAM for details.

**Table 19 Relationship between JIS Codes and HD66730 Character Codes**

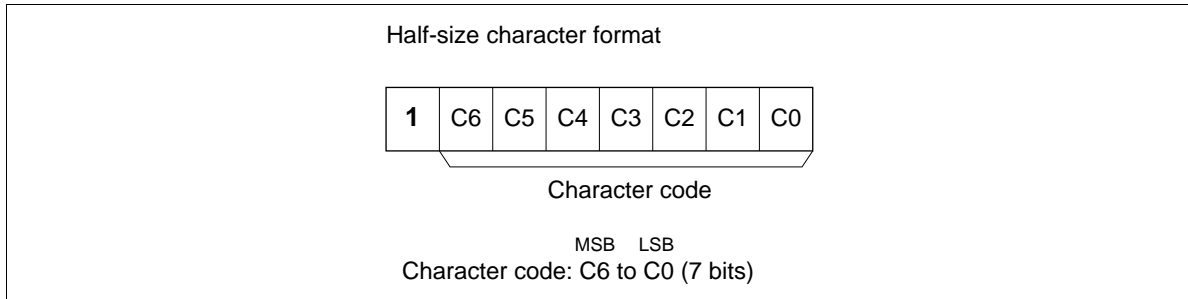
- JIS first byte code: b1 to b7 (7 bits)
- JIS second byte code: a1 to a7 (7 bits)
- CGRAM address for user fonts: u0 to u2 (3 bits)

| Character Code Arrangement of HD66730 |    |    |    |            |     |    |    |            |    |    |    |    |    |    |    |
|---------------------------------------|----|----|----|------------|-----|----|----|------------|----|----|----|----|----|----|----|
| JIS                                   | b7 | b6 | b5 | C11        | C10 | C9 | C8 | C7         | C6 | C5 | C4 | C3 | C2 | C1 | C0 |
| Non-kanji                             | 0  | 1  | 0  | a7         | a6  | b3 | b2 | b1         | 0  | 0  | a5 | a4 | a3 | a2 | a1 |
| Level 1 kanji                         | 0  | 1  | 1  | b7         | b4  | b3 | b2 | b1         | a7 | a6 | a5 | a4 | a3 | a2 | a1 |
| Level 1 kanji                         | 1  | 0  | 0  | b7         | b4  | b3 | b2 | b1         | a7 | a6 | a5 | a4 | a3 | a2 | a1 |
| User font                             | —  | —  | —  | 0          | 0   | 0  | 0  | 0          | 0  | 0  | 0  | 0  | u2 | u1 | u0 |
|                                       |    |    |    | Upper byte |     |    |    | Lower byte |    |    |    |    |    |    |    |





**Figure 22 Full-Size Character Codes**



**Figure 23 Half-Size Character Codes**

An example of displaying full-size and half-size characters together is described here.

Full-size character display conforms to JIS (16 bits). Perform code conversion (16 bits → 12 bits) according to the relationship between the 16-bit JIS code and the HD66730/1 12-bit character code and write two-byte character data to the DDRAM (write the lower byte to the smaller DDRAM address). The example is shown in Table 19. When displaying a half-size character, refer to Table 5 the HD66730/1 Half-size Font List and write one-byte character data into the DDRAM. The example is shown in Table 20.

Figure 24 shows how to set data to the DDRAM when performing a 2-line display and Figure 25 shows the resulting liquid crystal display.

**Table 20 Example of Full-Size Font Conversion**

| Displayed Character | JIS Code<br>(First/Second Byte) | Character Code<br>(C11 to C0) |
|---------------------|---------------------------------|-------------------------------|
| 東                   | 45/6C (Hex)                     | AEC (Hex)                     |
| 京                   | 35/7E (Hex)                     | 2FE (Hex)                     |
| 都                   | 45/54 (Hex)                     | AD4 (Hex)                     |
| 小                   | 3E/2E (Hex)                     | 72E (Hex)                     |
| 平                   | 4A/3F (Hex)                     | D3F (Hex)                     |
| 市                   | 3B/54 (Hex)                     | 5D4 (Hex)                     |
| 本                   | 4B/5C (Hex)                     | DDC (Hex)                     |
| 町                   | 44/2E (Hex)                     | A2C (Hex)                     |
| の                   | 24/4E (Hex)                     | A0E (Hex)                     |

**Table 21 Example of Half-Size Font Code**

| Display Character | Character Code (C0 to C11) |
|-------------------|----------------------------|
| 1                 | 31 (Hex)                   |
| 2                 | 32 (Hex)                   |
| 0                 | 30 (Hex)                   |
| ,                 | 2C (Hex)                   |
| M                 | 4D (Hex)                   |
| C                 | 43 (Hex)                   |

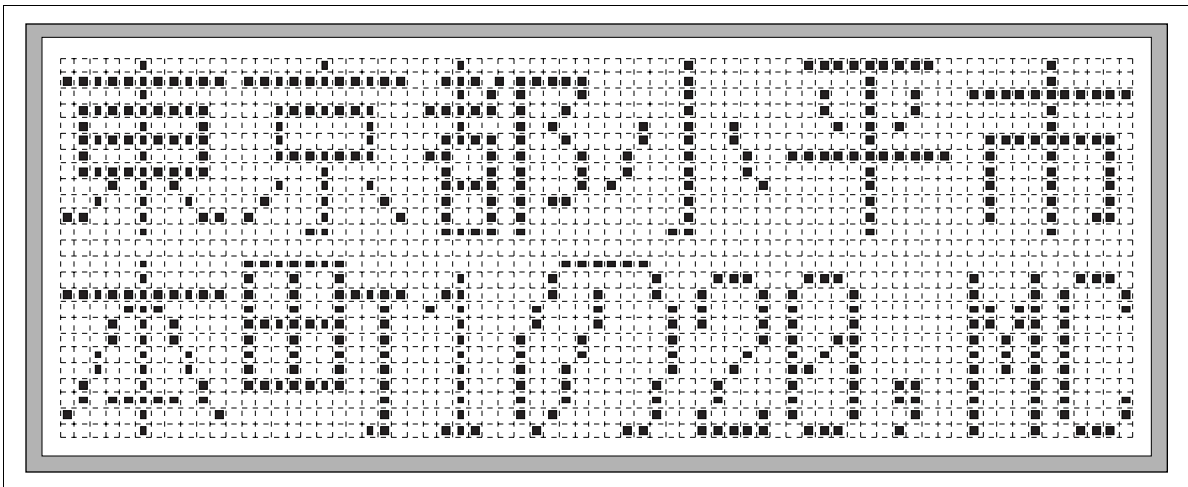
0: Full-size designation  
1: Half-size designation

| Address       | 00 (Hex)     | 01 (Hex)     | 02 (Hex)     | 03 (Hex)     | 04 (Hex)     | 05 (Hex)     | 06 (Hex)     | 07 (Hex)     | 08 (Hex)     | 09 (Hex)     | 0A (Hex)     | 0B (Hex)     |
|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 1st-line data | 1110<br>1100 | 0000<br>1010 | 1111<br>1110 | 0000<br>0010 | 1101<br>0100 | 0000<br>1010 | 0010<br>1110 | 0000<br>0111 | 0011<br>1111 | 0000<br>1101 | 1101<br>0100 | 0000<br>0101 |
|               | 東京都市小平市      |              |              |              |              |              |              |              |              |              |              |              |

| Address       | 40 (Hex)     | 41 (Hex)     | 42 (Hex)     | 43 (Hex)     | 44 (Hex)     | 45 (Hex)     | 46 (Hex)     | 47 (Hex)     | 48 (Hex)     | 49 (Hex)     | 4A (Hex)     | 4B (Hex)     |
|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| 2nd-line data | 1101<br>1100 | 0000<br>1101 | 0010<br>1110 | 0000<br>1010 | 1011<br>0001 | 0000<br>1110 | 0000<br>1010 | 1011<br>0010 | 1011<br>0000 | 1010<br>1100 | 1100<br>1101 | 1100<br>0011 |
|               | 本町1の20, M C  |              |              |              |              |              |              |              |              |              |              |              |

**Figure 24 Example of DDRAM Character Code (2-Line Display Mode)**



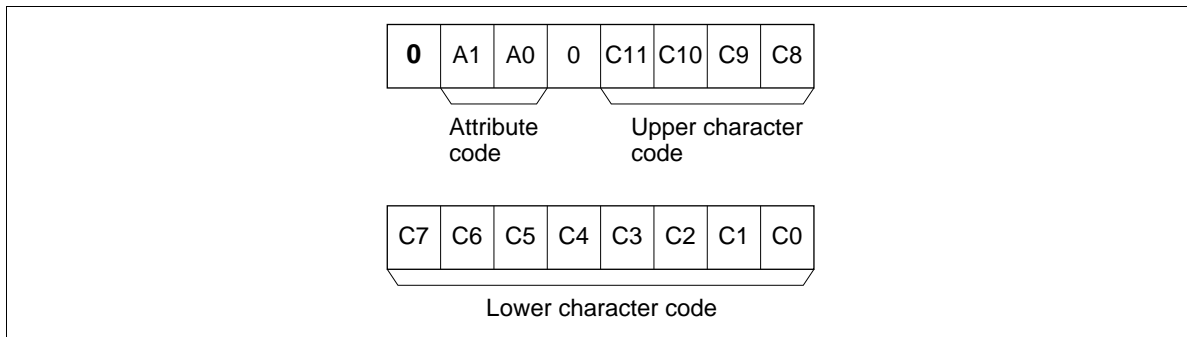
**Figure 25 Example of Liquid Crystal Display**

## Display Attribute Designation

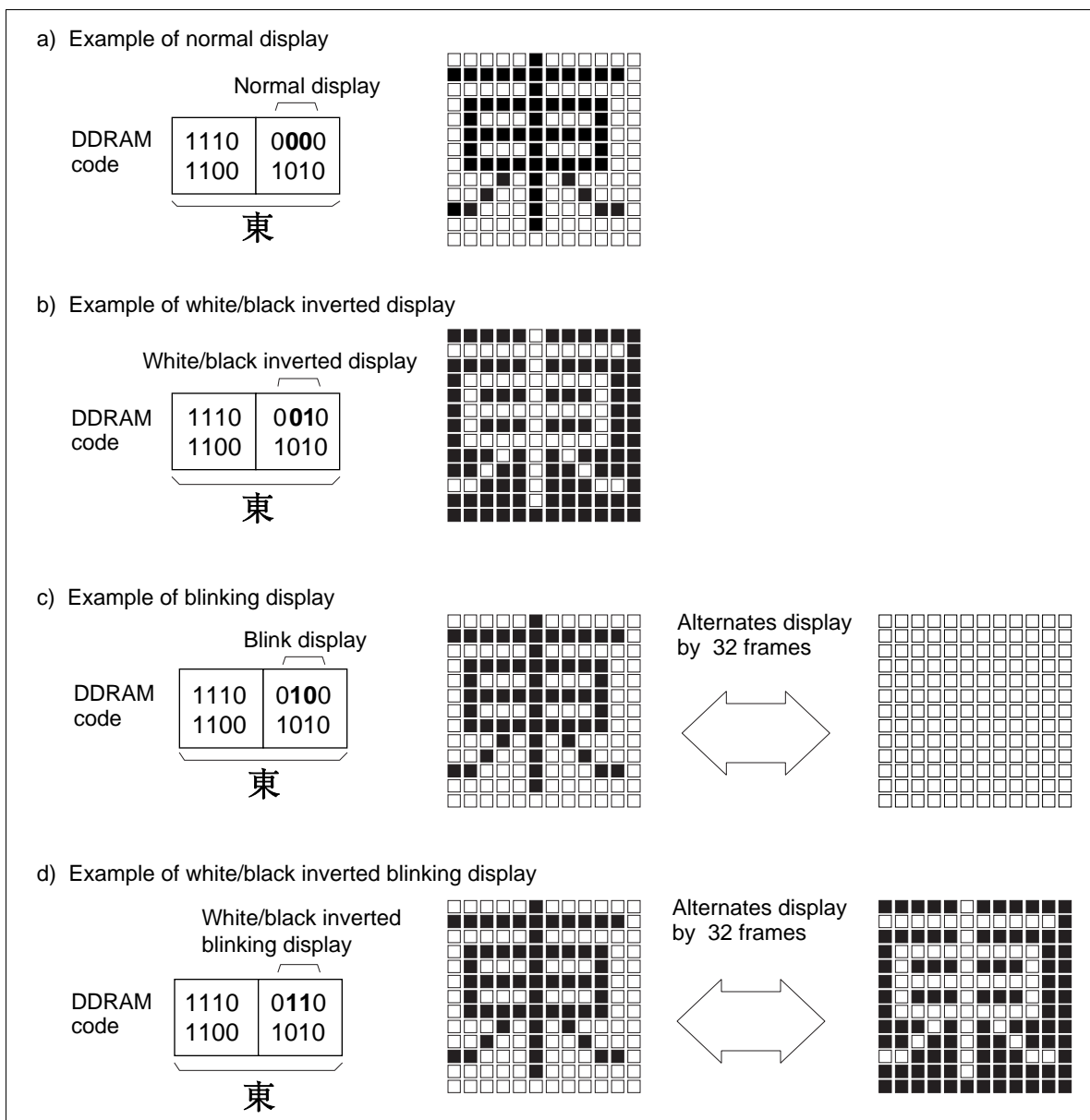
The HD66730/1 allocates 12 bits of the full-size 16-bit code character to an abbreviated character code and 2 bits to a display-attribute code (Figure 26). White/black inverted display, blinking display, and white/black inverted blinking display can be designated for each full-size character (Table 21). Display attribute control is performed for a  $12 \times 13$  dot matrix unit that includes a  $11 \times 12$  dot full-size character and a column of dots to the right and a row of dots to the bottom (Figure 27). The blinking cycle for blinking display and white/black inverted blinking display is 64 frames. Blinking display is performed by changing the display pattern every 32 frames. Since the 8-bit code designated for half-size characters cannot accommodate a display attribute, they will always be displayed normally.

**Table 22     Display Attribute Designation**

| <b>A1</b> | <b>A0</b> | <b>Display State</b>                  |
|-----------|-----------|---------------------------------------|
| 0         | 0         | Normal display                        |
| 0         | 1         | White/black inverted display          |
| 1         | 0         | Blinking display                      |
| 1         | 1         | White/black inverted blinking display |



**Figure 26   Full-Size Code Format**



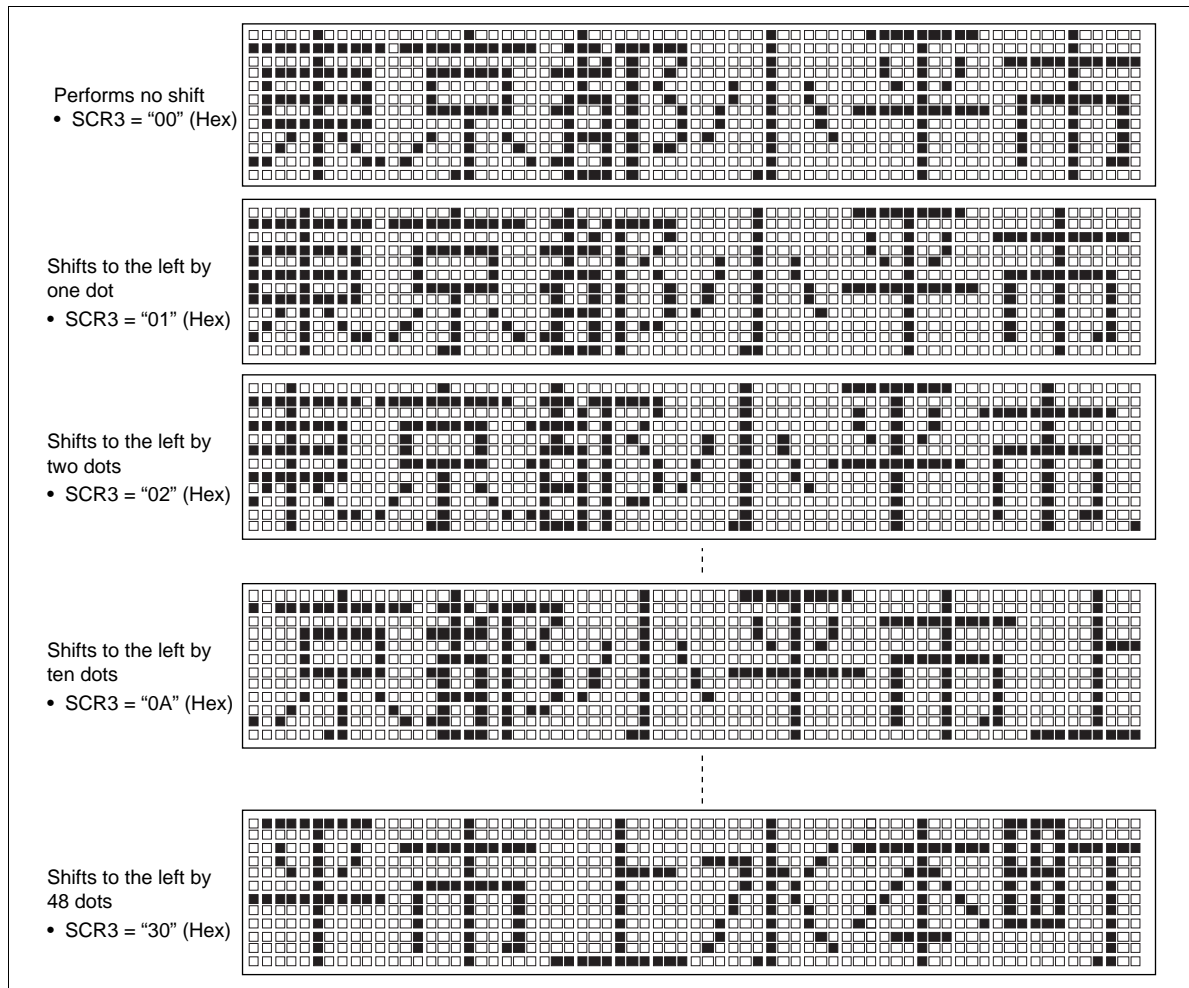
**Figure 27 Setting Codes in the DDRAM and Display Examples**

## **Horizontal Smooth Scroll**

Data shown on the display can be scrolled horizontally to the left for a specified number of dots (Figure 28). The number of dots are set in scroll control register 3 (SCR3: R7), and the display lines to be scrolled are designated by the display line enable bits (SE1/SE2/SE3/SE4) in scroll control register 2 (SCR2: R6). Because the number of dots that can be set for scrolling here is 48, scrolling for more than this number can be achieved by shifting to the left by four characters of character code data in DDRAM for the scroll display line in question, rewriting the characters, and then scrolling again. When rewriting DDRAM while displaying characters, however, character output will momentarily breakdown, and the display may flicker. In this case, first check which display lines are currently being displayed by referring to NF1/0 (line 1 to the line 4) and display raster-rows LF0 to LF3 (raster-row 1 to raster-row 13) in the status register, and then rewrite a DDRAM line that is not being displayed. Keep in mind that scroll display line enable bits (SE1 to SE4) can be used to designate those display lines for which horizontal smooth scroll is desired.

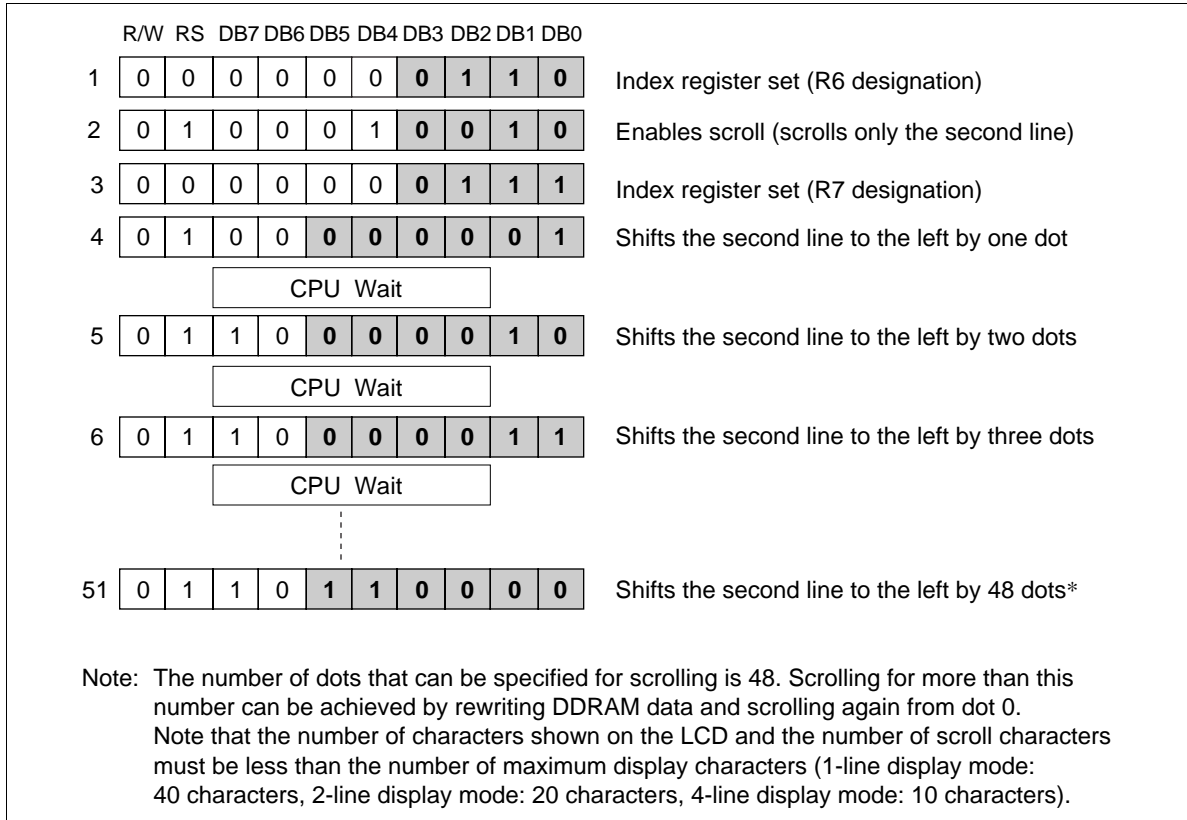
In partial scroll, one to three leftmost characters on the display as specified by the partial scroll bits (PS1/0) of the scroll control register 2 (SCR: R6) are fixed and the remaining characters undergo a smooth scroll to perform partial smooth scroll.

When performing horizontal smooth scroll, the number of characters to be displayed (NC1/0: R4) must be at least 4 characters more than the number of characters actually displayed on the liquid crystal display. For example, set 10 or more display characters (NC1/0) for a single-chip 6-character display.



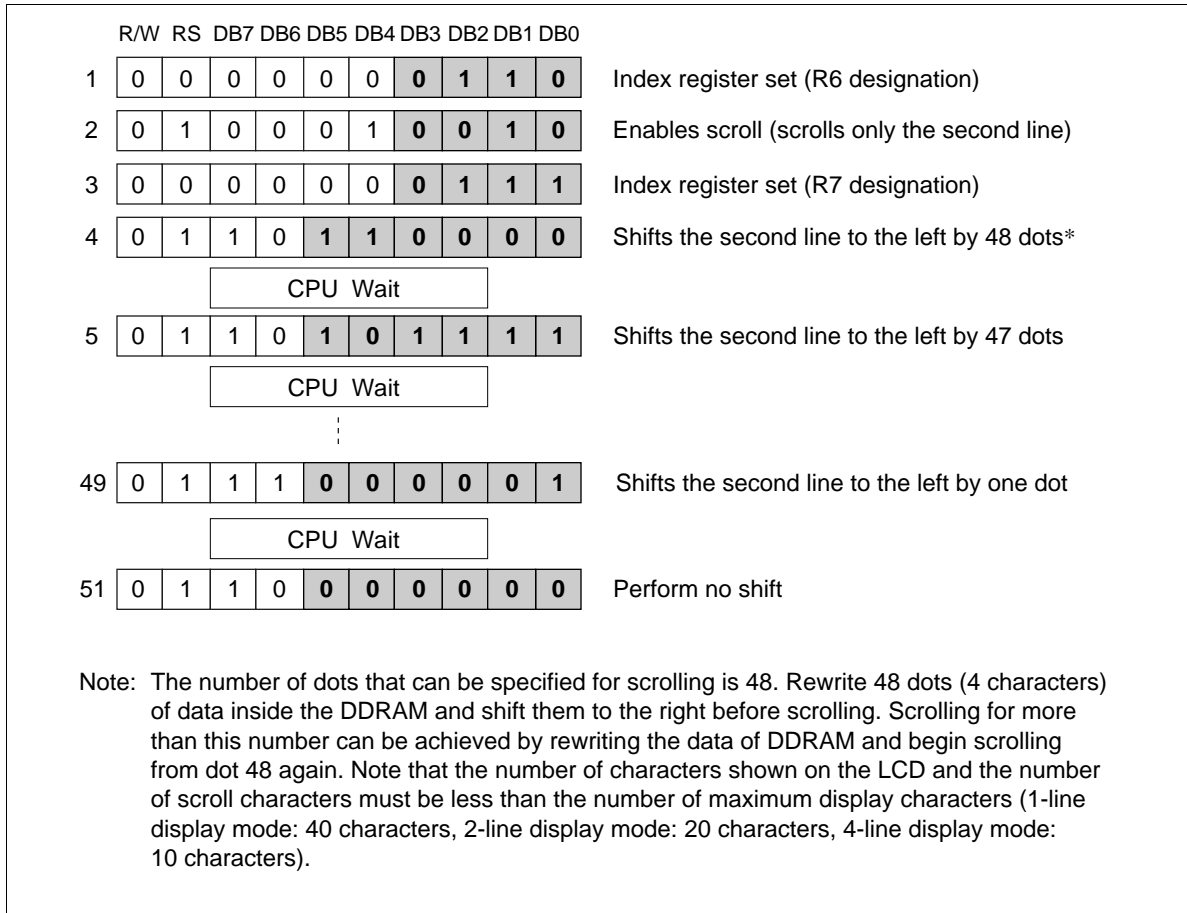
**Figure 28 Example of Horizontal Smooth Scroll Display**

## Examples of Register Setting



**Figure 29 Example of Executing Smooth Scroll to the Left**





**Figure 30 Example of Executing Smooth Scroll to the Right**

## Partial Smooth Scroll

Partial smooth scroll displays one to three leftmost characters as fixed while the remaining ones undergo a horizontal smooth scroll in the left and right direction. Specifically, the number of leftmost characters to be fixed is specified by the partial scroll bits (PS1/0) in the scroll control register 2 (SCR2: R6). For example, when bits PS1/0 are 10, the two leftmost characters are fixed; when 11, the three leftmost characters are fixed.

Although half-size characters can be displayed in a fixed display area, they must be displayed in even-numbered groups of two, four or six characters. Figure 31 shows an example of smooth scroll performed in a display when bits PS1/0 are set to 10. The two leftmost characters (住所) are displayed as fixed, and the remaining four characters undergo a smooth scroll.

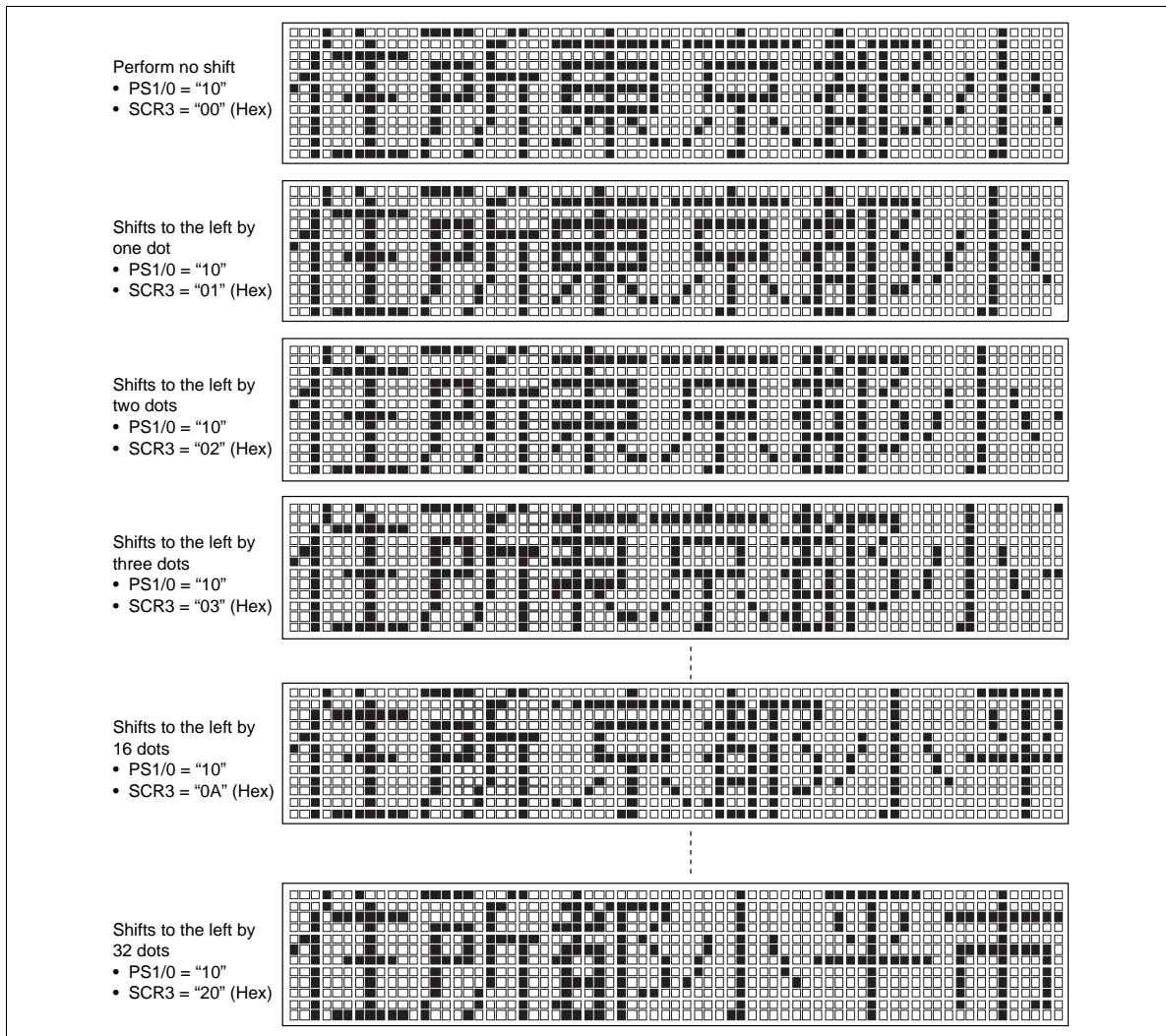


Figure 31 Example of Partial Smooth Scroll Display

## **Vertical Smooth Scroll**

Vertical smooth scroll up and down can be performed by setting the number of display lines (NL1/0: R4) to a value greater than the actual number of liquid crystal display lines, which can be set by the duty drive ratio (DT1/0: R1) to 1/14 (1-line display), 1/27 (2-line display), 1/40 (3-line display), or 1/53 (4-line display). The display line setting (NL1/0: R4), which controls the display, can select 1-line display mode, 2-line display mode, or 4-line display mode.

For example, to perform normal vertical smooth scroll for a 3-line liquid crystal display with a duty ratio of 1/40, set the number of display lines (NL1/0: R4) to 4 lines. Note that if vertical smooth scroll is performed when the number of actual liquid display lines is the same as the number of set display lines, the display line that has scrolled out of the display will appear again from the bottom (or the top) (this function is called lap-around). In a 4-line crystal liquid display, only the lap-around function can be performed. Vertical smooth scroll is controlled by incrementing or decrementing the display line (SN1/0), which indicates which line to start from, and the display raster-row (SL0 to SL3). For example, when performing smooth scroll up, the display raster-row (SL0 to SL3) is incremented from 0000 to 1100 in order to scroll 12 raster-rows. Moreover, by incrementing the display line (SN1/0) and then incrementing the display raster-row from 0000 to 1100 again, a total of 25 raster-rows can be scrolled. Since the DDRAM is only 80 bytes, its data must be rewritten when performing continuous scroll exceeding this capacity.

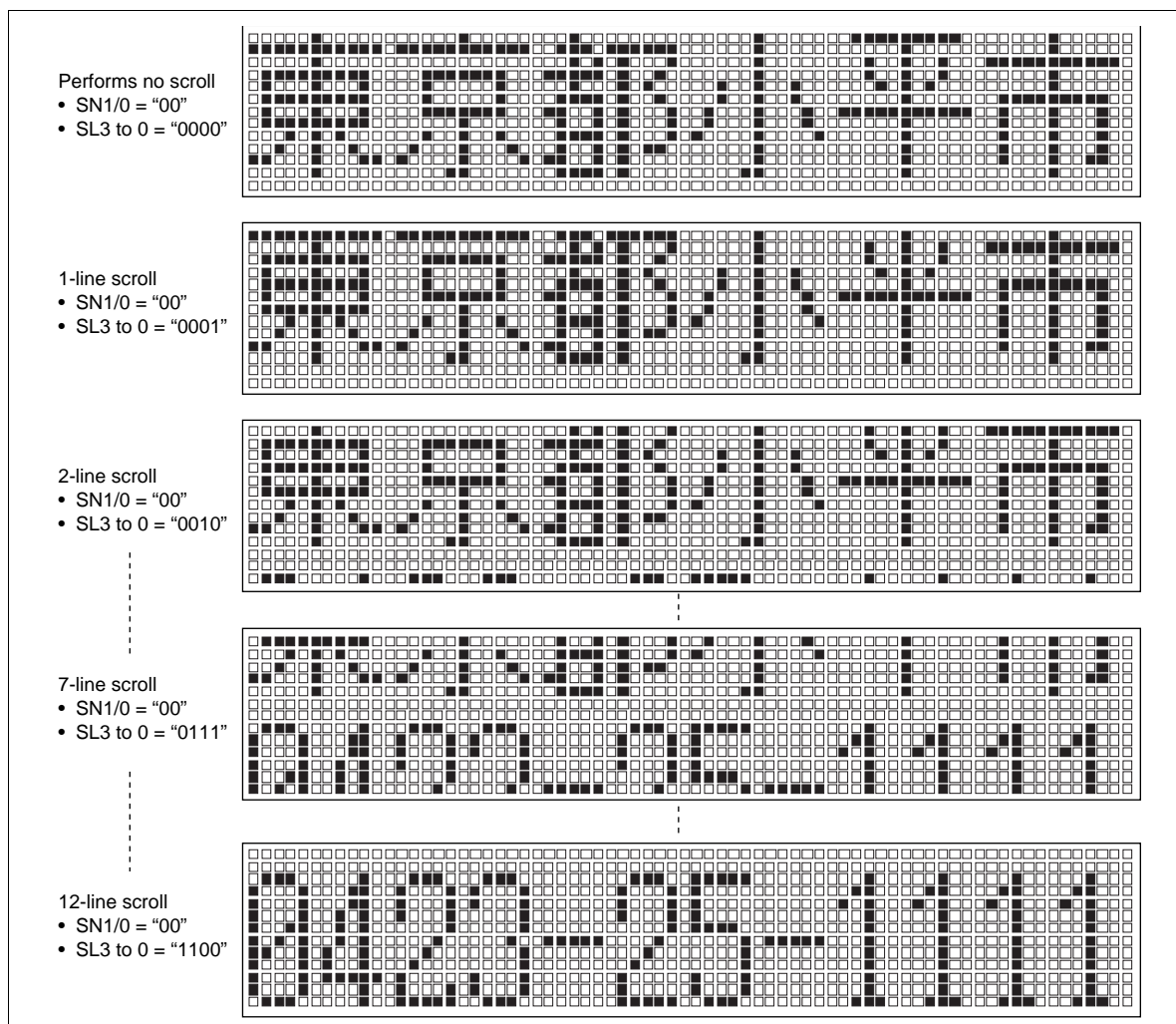
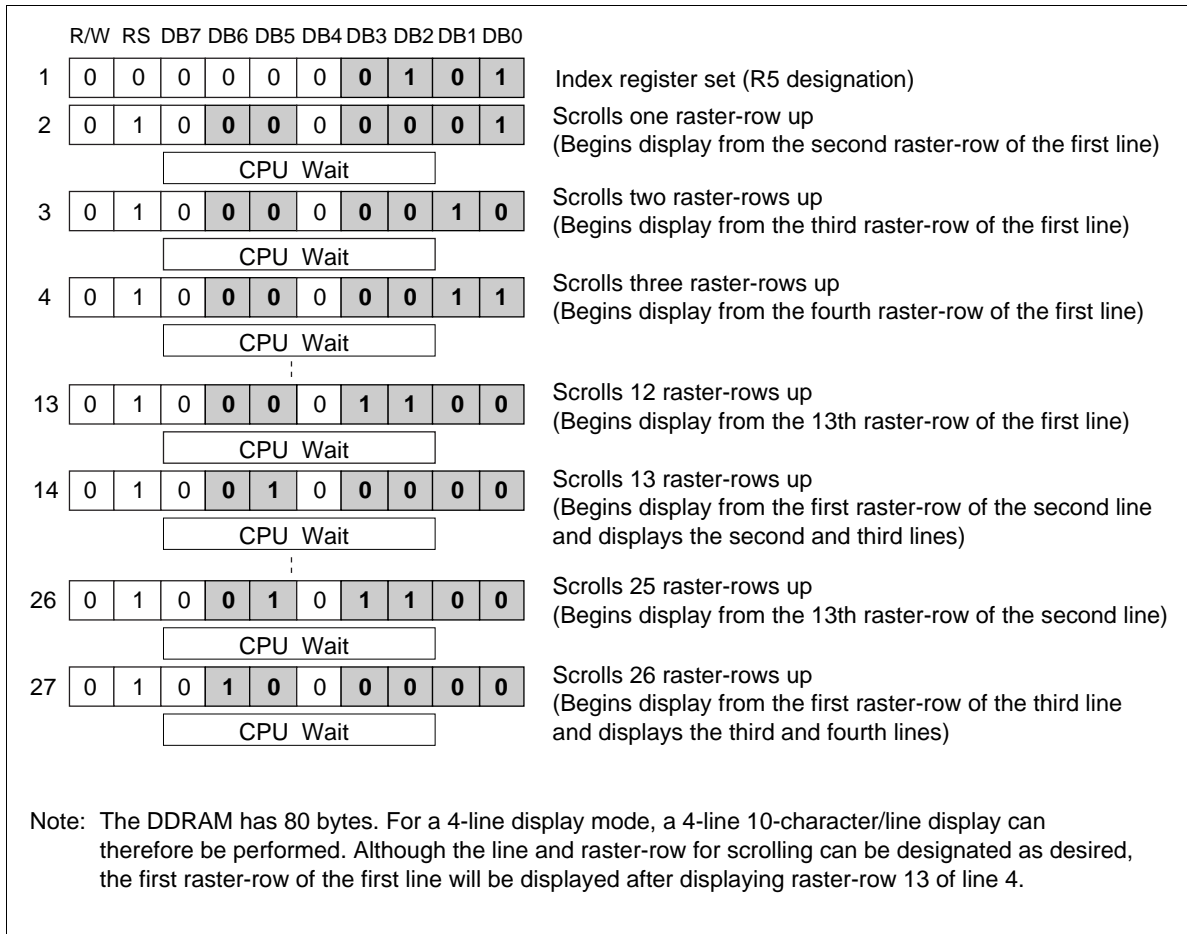


Figure 32 Example of Vertical Smooth Scroll Display

## Examples of Register Setting (2-Line Liquid Crystal Drive: DT1/0 = 01, 4-Line Display Mode: NL1/0 = 11)



**Figure 33 Example of Performing Smooth Scroll Up**

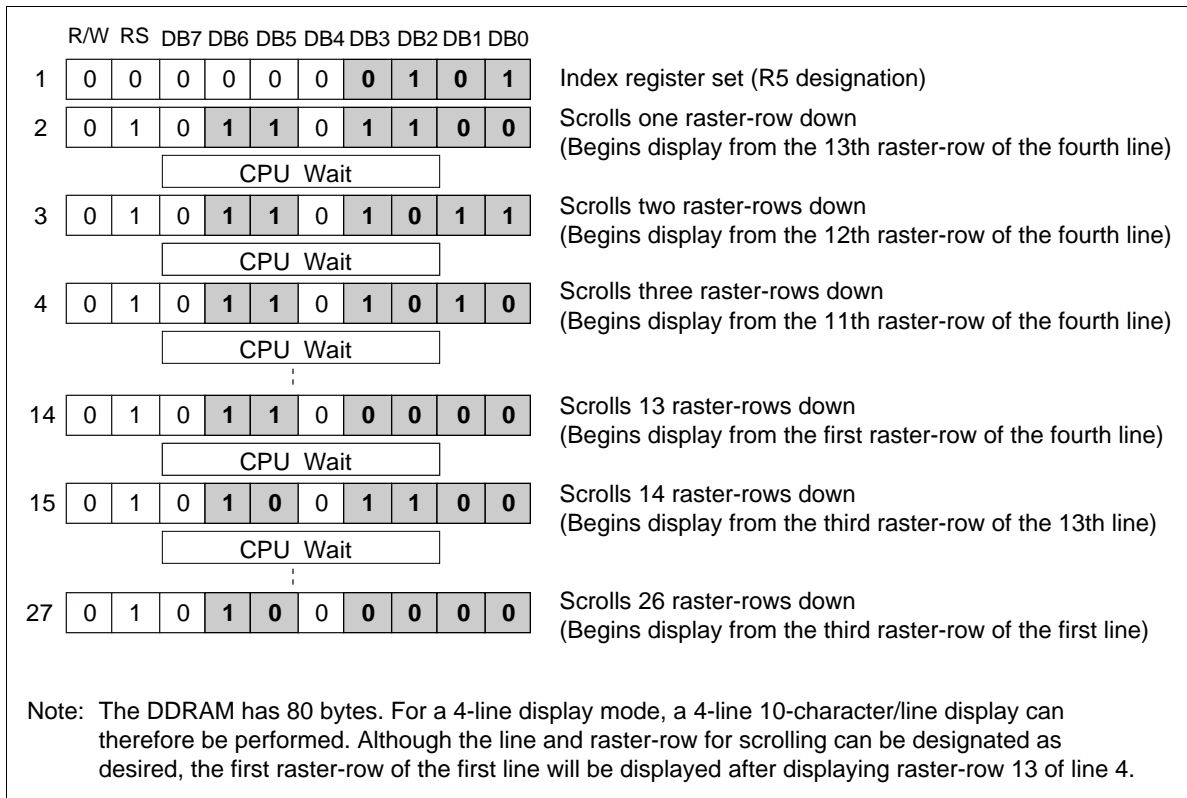


Figure 34 Example of Performing Smooth Scroll Down

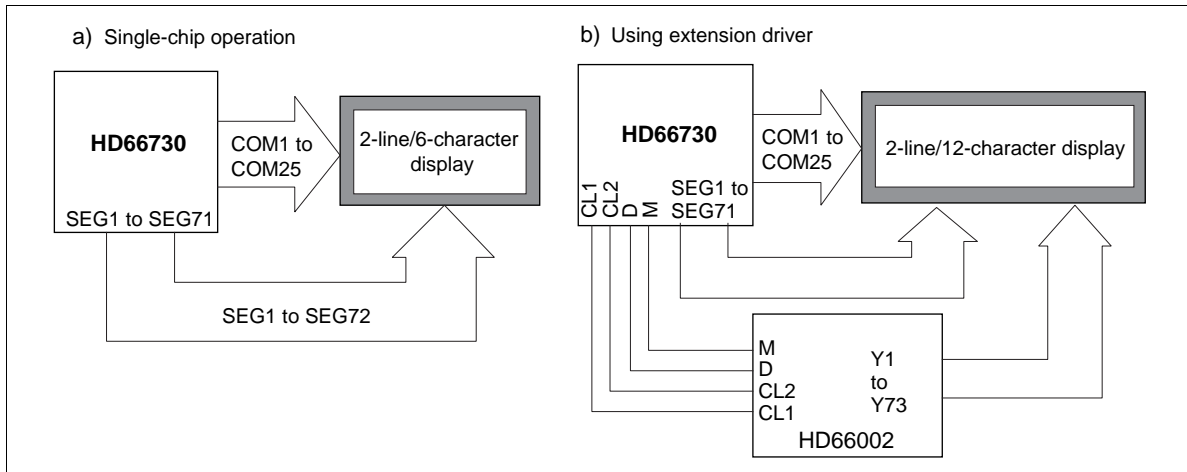
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## HD66730/HD66731

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### Extension Driver LSI Interface (HD66730)

The HD66730 can interface with extension drivers using extension driver interface signals CL1, CL2, D, and M output from the HD66730, increasing the number of display characters (Figure 35). Although the liquid crystal driver voltage that drives the booster of the HD66730 can also be used as the driver power supply of extension drivers, the output voltage drop of the booster increases as the load of the booster increases.



**Figure 35 HD66730 and Extension Driver LSI Connection**

## Interfacing with the Liquid Crystal Panel

By connecting the HD66730 to extension drivers, the display can be expanded up to a 1-line/40-character, 2-line/20-character, or a 4-line/10-character display configuration. Bits DT1/0 set the duty drive ratio and bits NC1/0 set the number of characters per line. In addition, bits NL1/0 sets the number of display lines during display read control. Table 22 shows the relationship between the number of characters actually displayed on the liquid crystal panel and the corresponding number of extension drivers needed.

**Table 23 Relationship between the Number of Liquid Crystal Display Characters and Extension Drivers**

| Display Lines | Number of Display Characters per Line |               |                  |                  |                  |                  | Duty Drive |
|---------------|---------------------------------------|---------------|------------------|------------------|------------------|------------------|------------|
|               | 6 Characters                          | 10 Characters | 12 Characters    | 16 Characters    | 20 Characters    | 40 Characters    |            |
| 1 line        | (0/0)                                 | (2/0)         | (2/0)            | (3/0)            | (5/0)            | (11/0)           | 1/14       |
| 2 lines       | (0/0)                                 | (2/0)         | (2/0)            | (3/0)            | (5/0)            | Display disabled | 1/27       |
| 3 lines       | (0/1)                                 | (2/1)         | Display disabled | Display disabled | Display disabled | Display disabled | 1/40       |
| 4 lines       | (0/1)                                 | (2/1)         | Display disabled | Display disabled | Display disabled | Display disabled | 1/53       |

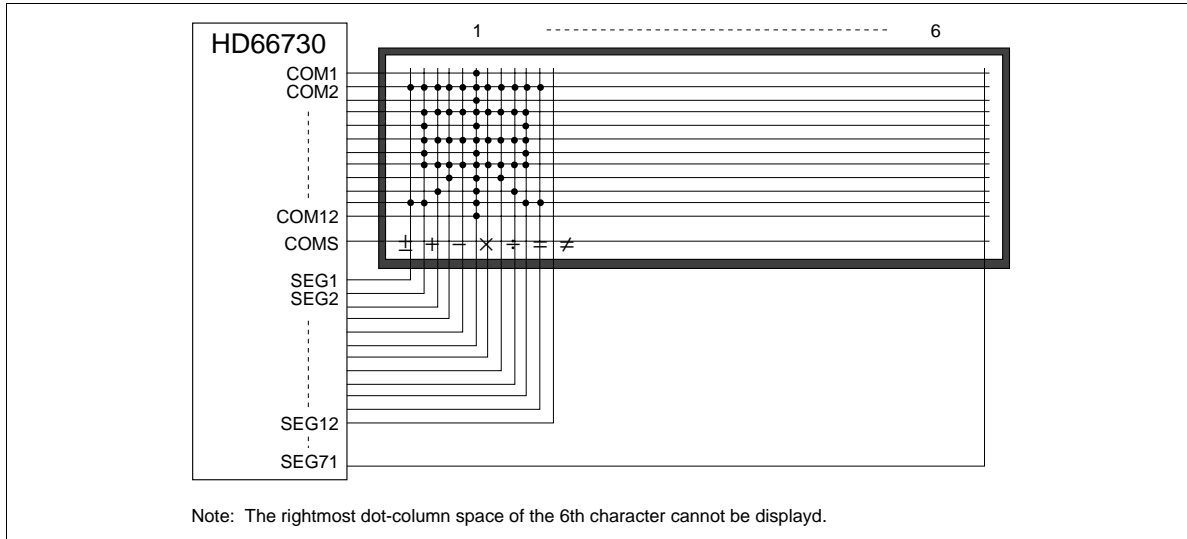
- Notes:
1. Numbers in parentheses = (number of extension segment drivers/number of common drivers)
  2. This is an example when using the 40 output extension drivers, and when  $N_h$  represents display characters and  $N_d$  extension driver outputs, the number of extension drivers needed can generally be calculated as follows:  

$$[\text{Number of extension drivers}] = (12 * N_h - 71 - 1)/N_d \uparrow$$
  3. The right-edge segment (space between characters) is not displayed in 6-character or 16-character display.
  4. Horizontal smooth scroll cannot be performed during an 1-line/40-character, 2-line/20-character, 3-line/10-character, or 4-line/10-character display.

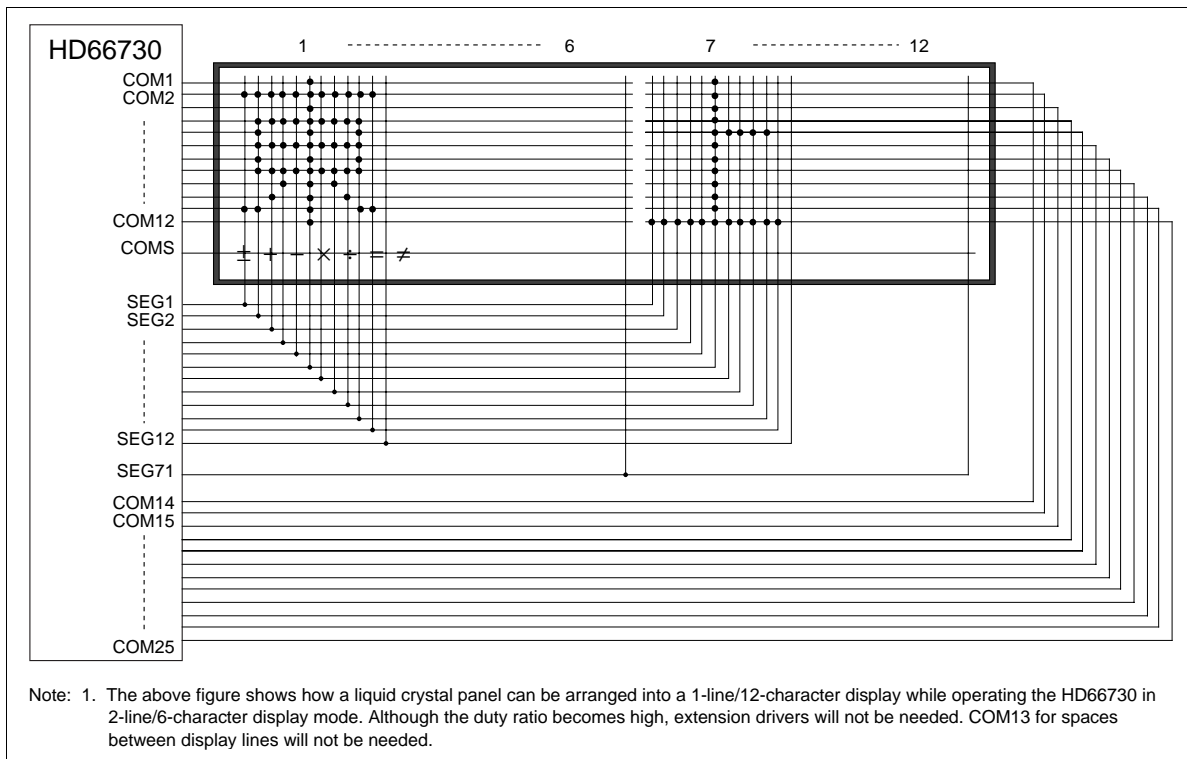


## HD66730/HD66731

### Example of Interfacing with a 1-Line Display Panel



**Figure 36 Example of 1-Line/6-Character + 71-Segment Display (Using 1/14 Duty)**



**Figure 37 Example of 1-Line/12-Character + 71-Segment Display (Using 1/27 Duty)**

Example of Interfacing with a 2-Line Display Panel

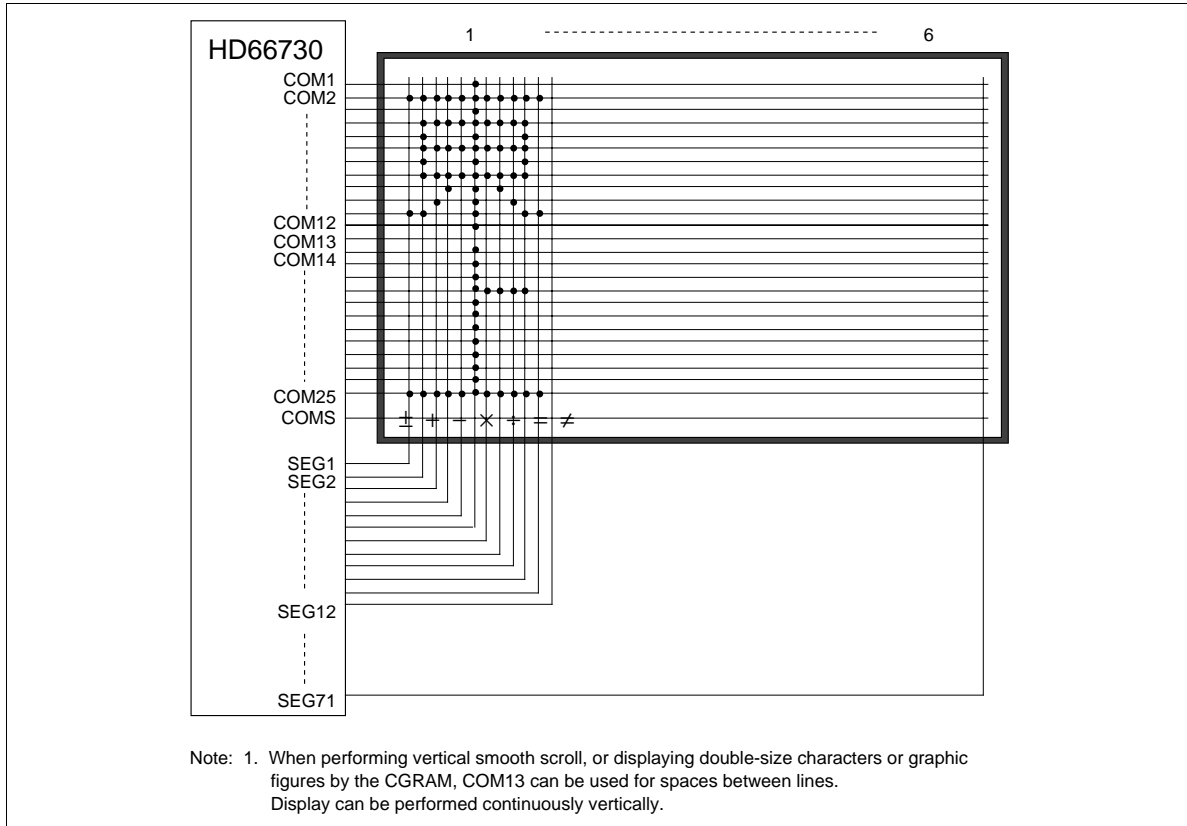
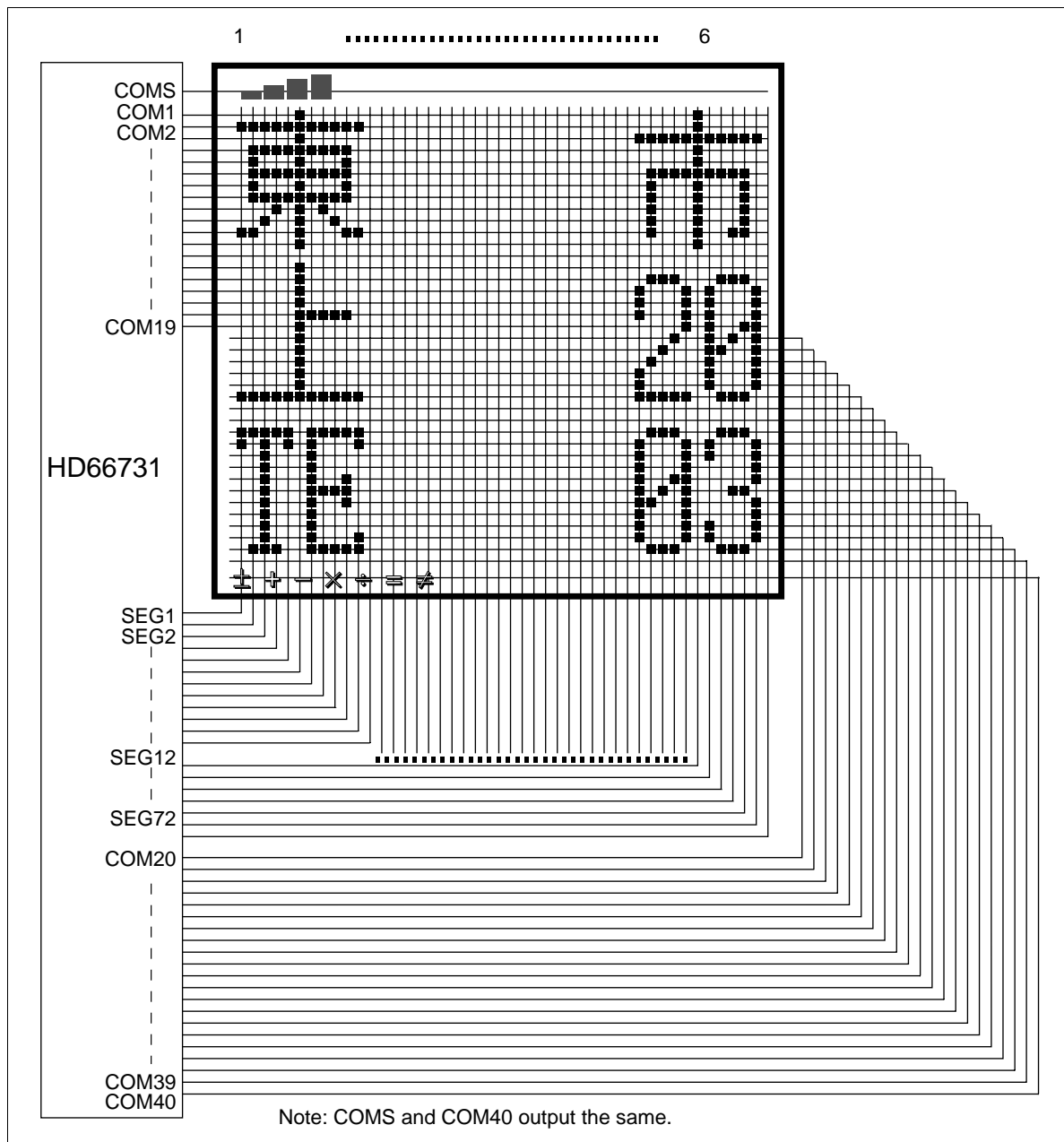


Figure 38 Example of 2-Line/6-Character + 71-Segment Display (Using 1/27 Duty)



**Figure 39 Example of 3-Line/6-Character + 72-Segment Display (Using 1/40 Duty)**

# Interfacing between HD66730 and HD66002

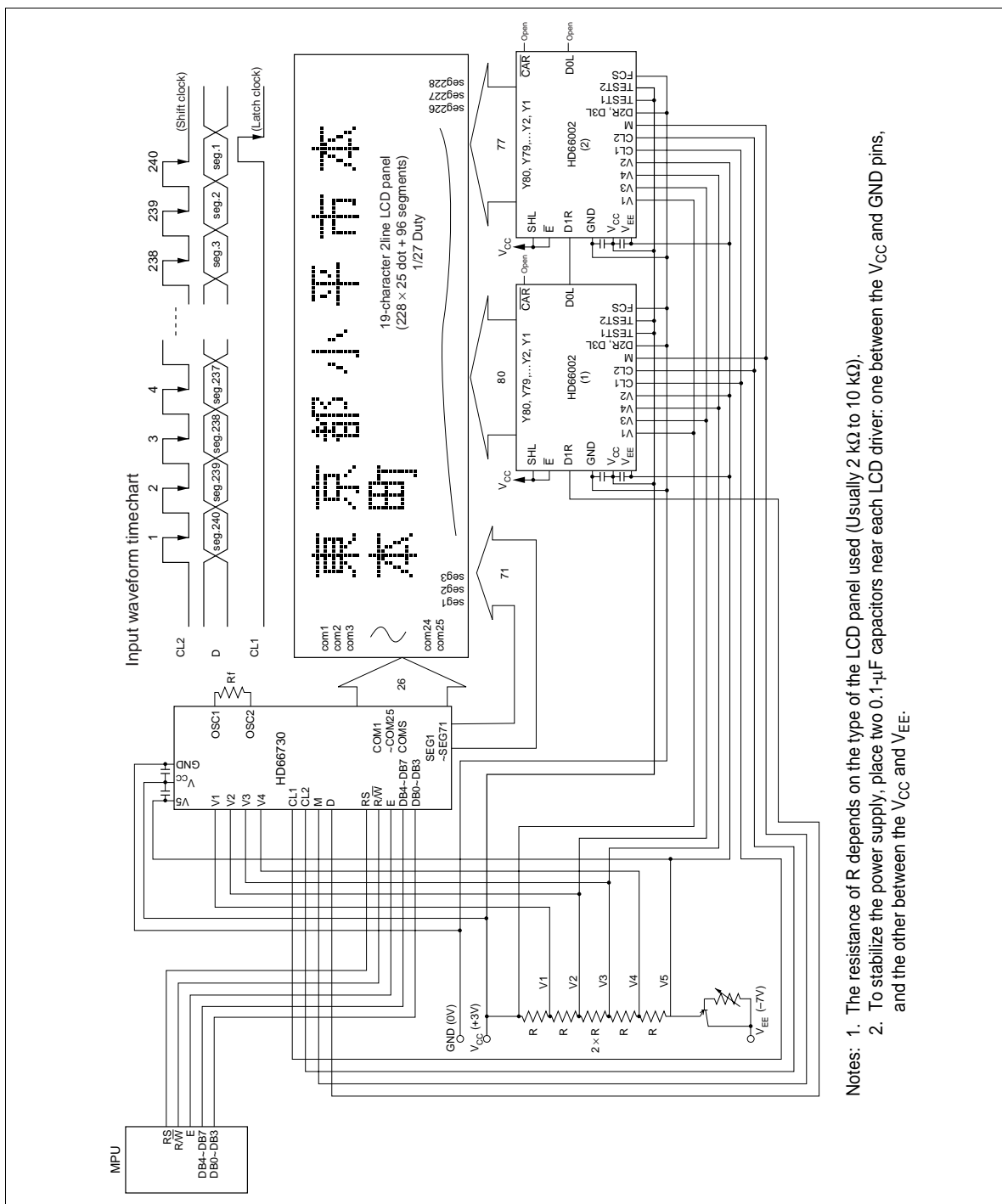
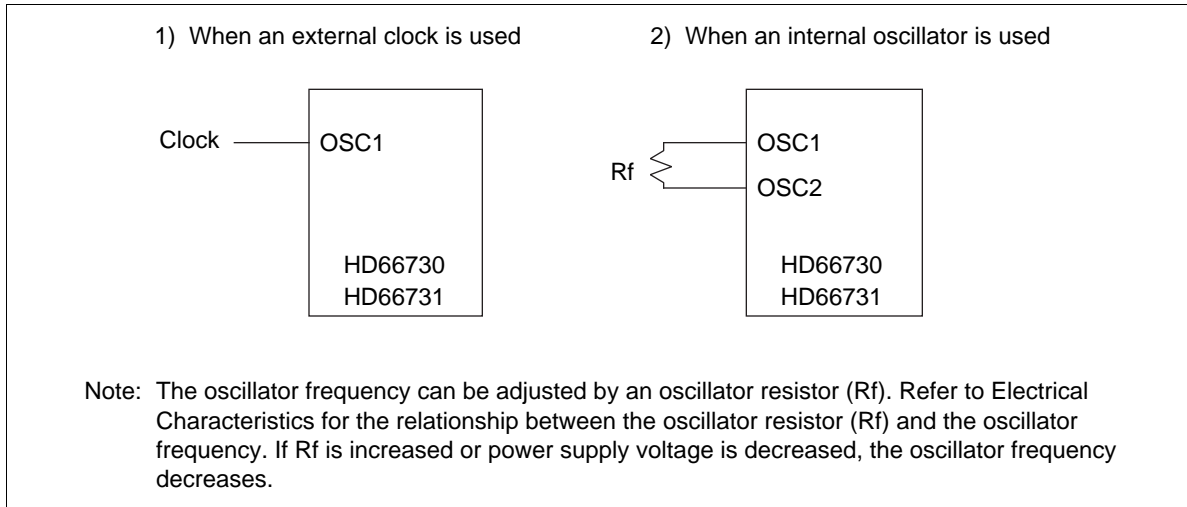


Figure 40 Example of Display Extension Circuit

## Oscillator

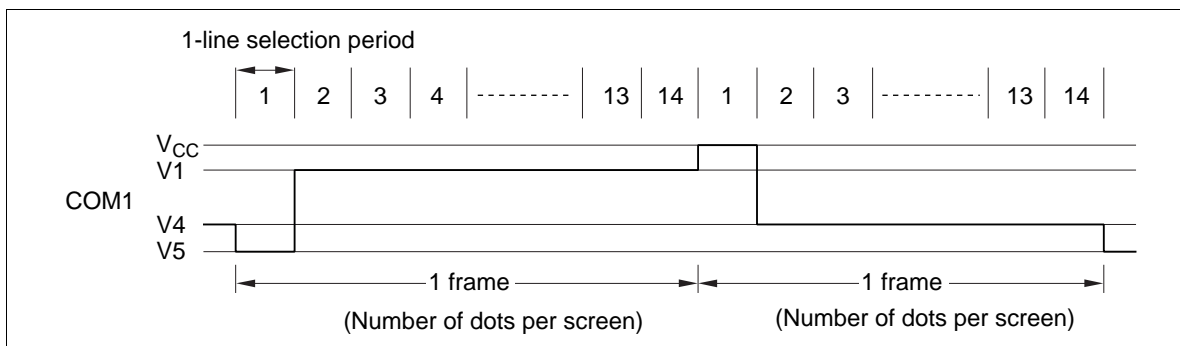
Figure 41 shows the optimal value of the oscillation frequency or the external clock frequency depends on the duty drive ratio setting (DT1/0), number of display lines (NL1/0), and the number of display characters (NC1/0) in the HD66730/1. The oscillation frequency or the external clock frequency must be adjusted according to the frame frequency of the liquid crystal drive.



**Figure 41 Oscillator Connections**

**Relationship between the Oscillation Frequency and the Liquid Crystal Display Frame Frequency**

Figures 42 to 45 and Tables 24 to 27 show the oscillation frequency and the external clock frequency for various register settings when the frame frequency is 80 Hz.



**Figure 42 Frame Frequency (1/14 Duty Cycle)**

## HD66730/HD66731

**Table 24 1/14 Duty Drive**

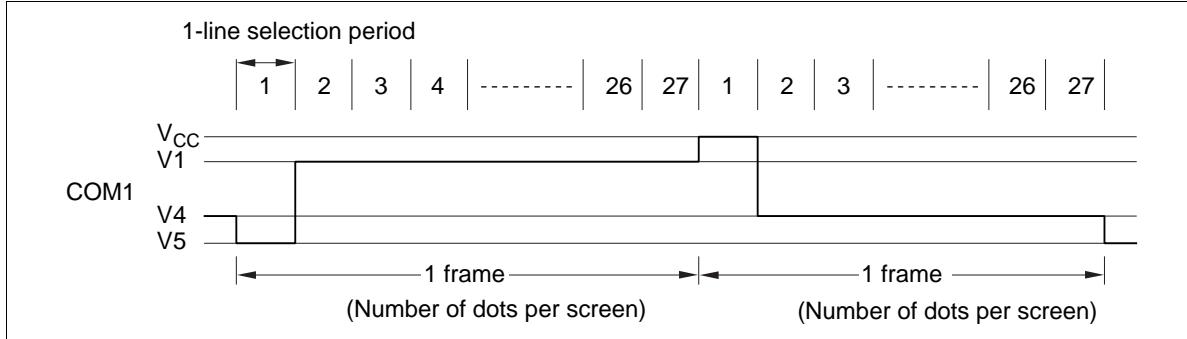
| <b>Number of Display Lines:<br/>(NL1/0 Set Value):</b> | <b>1-Line Display<br/>(00)</b> |               |               |
|--|--------------------------------|---------------|---------------|
| Number of display characters                           | 6 characters                   | 20 characters | 40 characters |
| (NC1/0 set value)                                      | (00)                           | (01)          | (11)          |
| 1-line selection period (dot)                          | 72 dots                        | 240 dots      | 480 dots      |
| Number of dots per screen (dot)                        | 1008 dots                      | 3360 dots     | 6720 dots     |
| Oscillation frequency (kHz)*                           | 70                             | 235           | 475           |

| <b>Number of Display Lines:<br/>(NL1/0 Set Value):</b> | <b>2-line Display<br/>(01)</b> |               |               |
|--|--------------------------------|---------------|---------------|
| Number of display characters                           | 6 characters                   | 20 characters | 40 characters |
| (NC1/0 set value)                                      | (00)                           | (01)          | (11)          |
| 1-line selection period (dot)                          | 72 dots                        | 120 dots      | 240 dots      |
| Number of dots per screen (dot)                        | 1008 dots                      | 1680 dots     | 3360 dots     |
| Oscillation frequency (kHz)*                           | 70                             | 120           | 235           |

| <b>Number of Display Lines:<br/>(NL1/0 Set Value):</b> | <b>4-Line Display<br/>(11)</b> |               |
|--|--------------------------------|---------------|
| Number of display characters                           | 6 characters                   | 10 characters |
| (NC1/0 set value)                                      | (00)                           | (01)          |
| 1-line selection period (dot)                          | 72 dots                        | 120 dots      |
| Number of dots per screen (dot)                        | 1008 dots                      | 1680 dots     |
| Oscillation frequency (kHz)*                           | 70                             | 120           |

Note: \* The frequencies in Table 23 are examples when the frame frequency is set to 70 Hz. Adjust the oscillation frequency so that a optimum frame frequency can be obtained.

**1/27 Duty Cycle (DT1/0 = 01: 2-Line Drive)**



**Figure 43 Frame Frequency (1/27 Duty Cycle)**

**Table 25 1/27 Duty Drive**

| Number of Display Lines:<br>(NL1/0 Set Value): | 2-Line Display<br>(01) |               |               |
|--|------------------------|---------------|---------------|
| Number of display characters                   | 6 characters           | 10 characters | 20 characters |
| (NC1/0 set value)                              | (00)                   | (01)          | (11)          |
| 1-line selection period (dot)                  | 72 dots                | 120 dots      | 240 dots      |
| Number of dots per screen (dot)                | 1944 dots              | 3240 dots     | 6480 dots     |
| Oscillation frequency (kHz)*                   | 135                    | 225           | 475           |

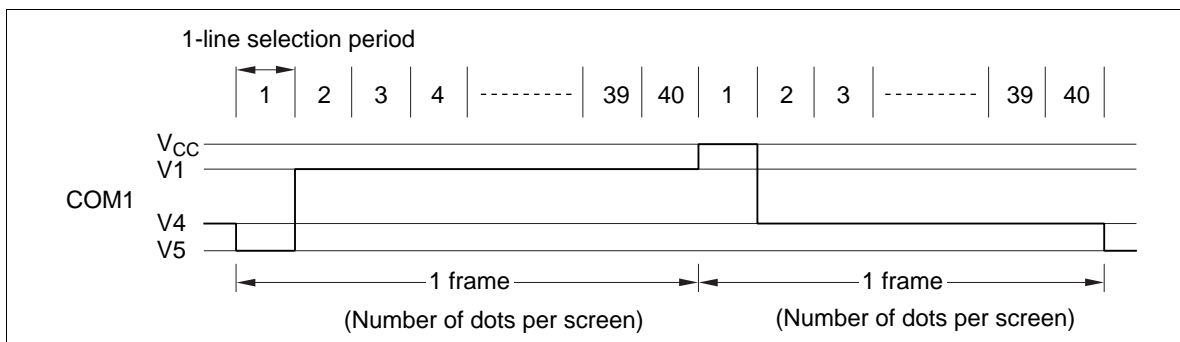
| Number of Display Lines:<br>(NL1/0 Set Value): | 4-Line Display<br>(11) |               |
|--|------------------------|---------------|
| Number of display characters                   | 6 characters           | 10 characters |
| (NC1/0 set value)                              | (00)                   | (01)          |
| 1-line selection period (dot)                  | 72 dots                | 120 dots      |
| Number of dots per screen (dot)                | 1944 dots              | 3240 dots     |
| Oscillation frequency (kHz)*                   | 135                    | 225           |

Note: \* The frequencies in Table 24 are examples when the frame frequency is set to 70 Hz. Adjust the oscillation frequency so that an optimum frame frequency can be obtained.



## HD66730/HD66731

### 1/40 Duty Cycle (DT1/0 = 10: 3-Line Drive)



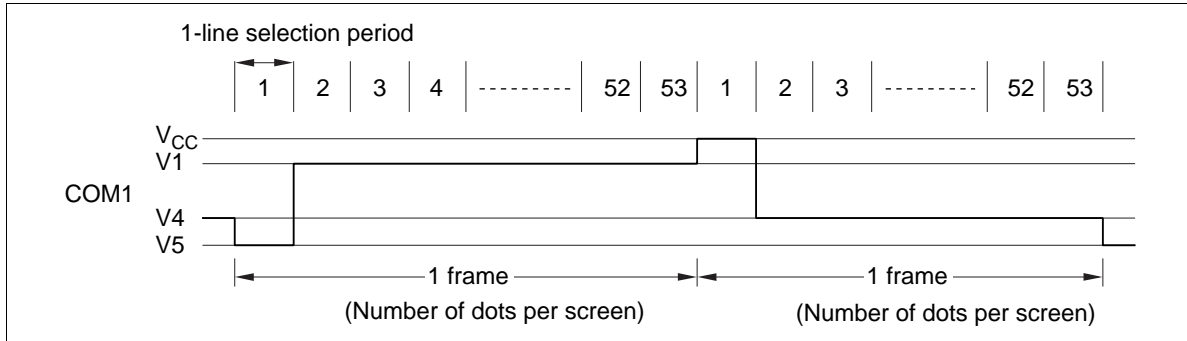
**Figure 44 Frame Frequency (1/40 Duty Cycle)**

**Table 26 1/40 Duty Drive**

| Number of Display Lines:<br>(NL1/0 set value): | 4-Line Display<br>(11) |               |
|--|------------------------|---------------|
| Number of display characters                   | 6 characters           | 10 characters |
| (NC1/0 set value)                              | (00)                   | (01)          |
| 1-line selection period (dot)                  | 72 dots                | 120 dots      |
| Number of dots per screen (dot)                | 2880 dots              | 4800 dots     |
| Oscillation frequency (kHz)*                   | 200                    | 335           |

Note: \* The frequencies in Table 25 are examples when the frame frequency is set to 70 Hz. Adjust the oscillation frequency so that an optimum frame frequency can be obtained.

**1/53 Duty Cycle (DT1/0 = 11: 4-Line Drive)**



**Figure 45 Frame Frequency (1/53 Duty Cycle)**

**Table 27 1/53 Duty Drive**

| Number of Display Lines:<br>(NL1/0 Setting Value): | 4-line Display (11) |               |
|--|---------------------|---------------|
|  | (00)                | (01)          |
| Number of display characters                       | 6 characters        | 10 characters |
| (NC1/0 setting value)                              | (00)                | (01)          |
| 1-line selection period (dot)                      | 72 dots             | 120 dots      |
| Number of dots per screen (dot)                    | 3816 dots           | 6360 dots     |
| Oscillation frequency (kHz)*                       | 265                 | 445           |

Note: \* The frequencies in Table 26 are examples when the frame frequency is to 80 Hz. Adjust the oscillation frequency so that an optimum frame frequency can be obtained.

### Power Supply for Liquid Crystal Display Drive

The HD66730/1 incorporates a booster for raising the LCD voltage two or three times that of the reference voltage input below  $V_{CC}$  (Figure 48). A two or three times boosted voltage can be obtained by externally attaching two or three 1- $\mu$ F capacitors.

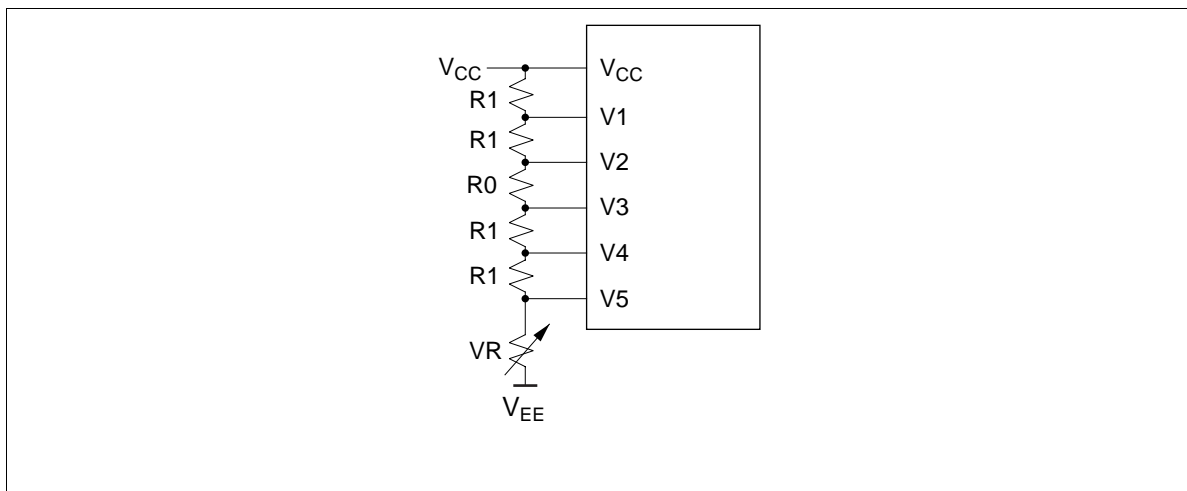
If the LCD panel is large and needs a large amount of drive current, the values of bleeder resistors that generate the V1 to V5 potential are made smaller. However, the load current in the booster and the voltage drop increases in this case.

We recommend setting the resistance value of each bleeder larger than 4.7 k $\Omega$  and to hold down the DC load current to 0.4 mA if using a booster circuit. An external power supply should supply LCD voltage if the DC load current exceeds 0.7 mA (Figure 49). Refer to Electrical Characteristics showing the relationship between the load current and booster voltage output. Table 27 shows the duty factor and bleeder resistor value for power supply for liquid crystal display drive.

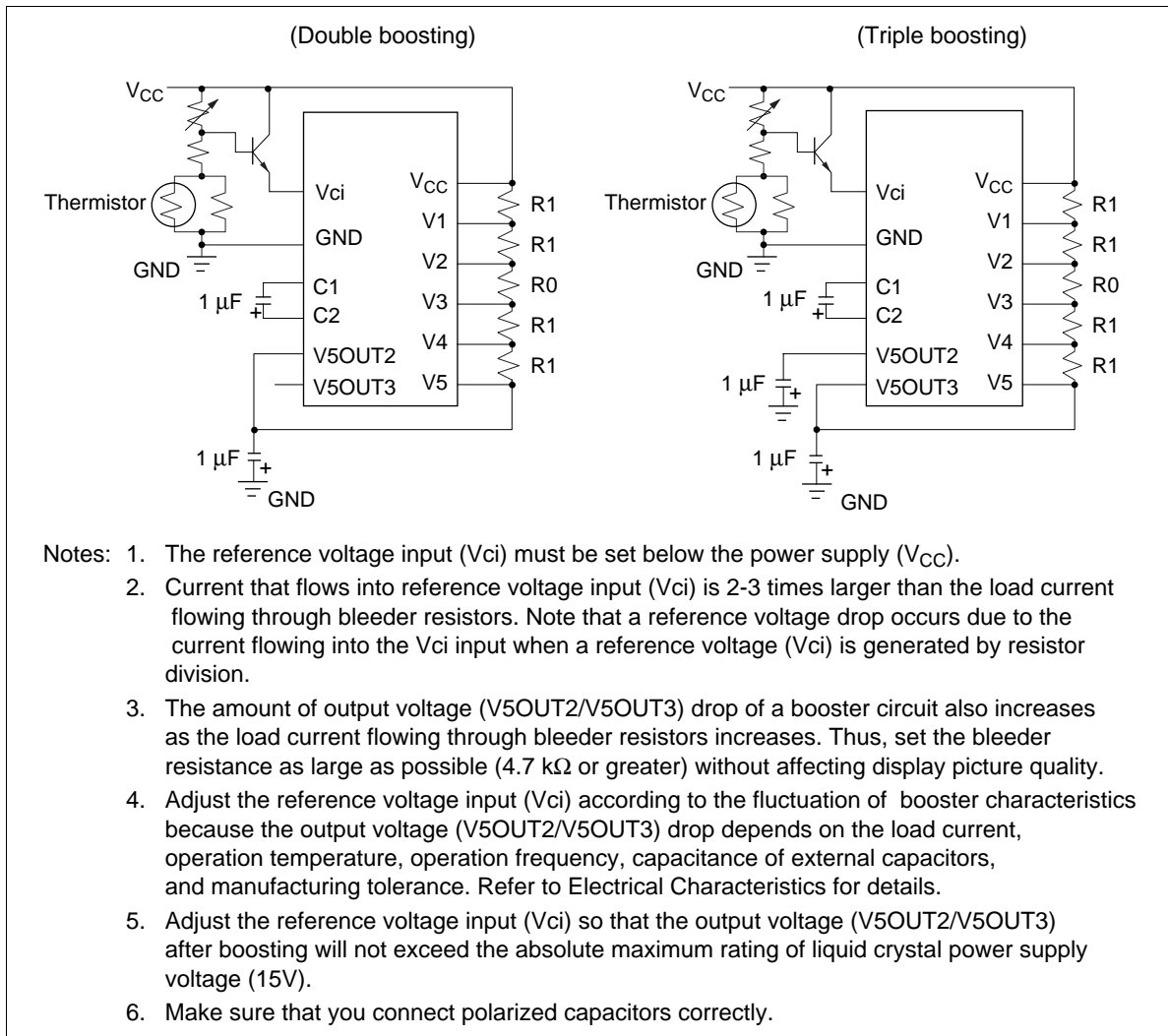
**Table 28     Duty Factor and Bleeder Resistor Value for Power Supply for Liquid Crystal Display Drive**

| Item                              |    | Data  |       |       |       |
|-----------------------------------|----|-------|-------|-------|-------|
| Drive lines (DT1/0 setting value) |    | 1     | 2     | 3     | 4     |
| Duty factor                       |    | 1/14  | 1/27  | 1/40  | 1/53  |
| Bias                              |    | 1/4.7 | 1/6.2 | 1/7.3 | 1/8.3 |
| Bleeder resistance value          | R1 | R     | R     | R     | R     |
|                                   | R0 | R*0.7 | R*2.2 | R*3.3 | R*4.3 |

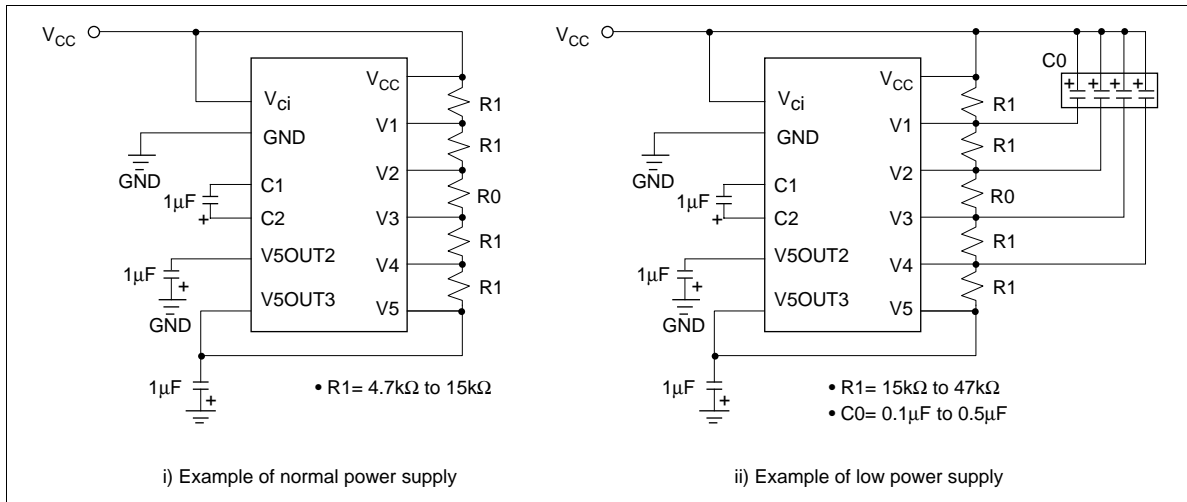
Note: \* R changes depending on the size of a liquid crystal panel. Normally, R must be 4.7 k $\Omega$  to 20 k $\Omega$ . Adjust R to the optimum value with the consumption current and display picture quality.



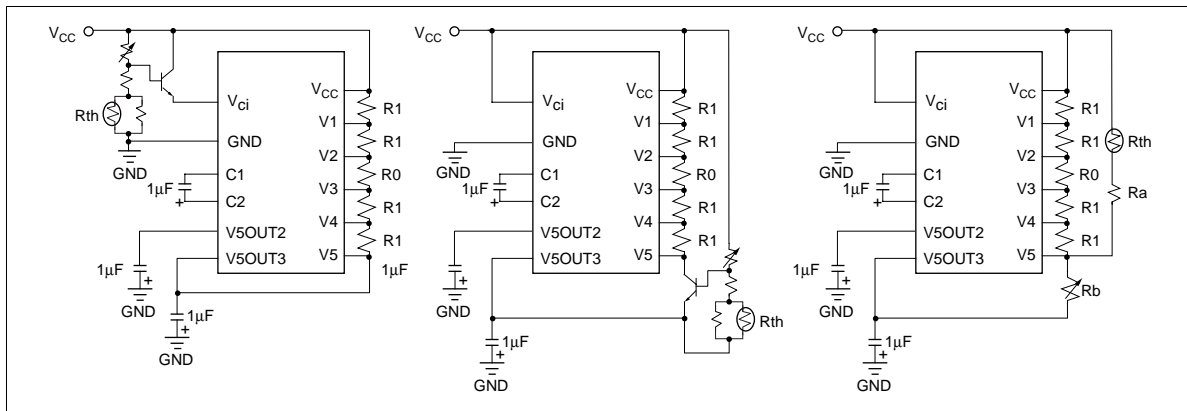
**Figure 46   Example of Power Supply for Liquid Crystal Display Drive  
(with External Power Supply)**



**Figure 47 Example of Power Supply for Liquid Crystal Display Drive (with Internal Booster)**



**Figure 48 Example of Power Supply for Low Power Consumption**



**Figure 49 Example of Temperature Compensation Circuit**

**Absolute Maximum Ratings (HD66730)\***

| Item                     | Symbol       | Value                  | Unit | Notes |
|--------------------------|--------------|------------------------|------|-------|
| Power supply voltage (1) | $V_{CC}$     | -0.3 to +7.0           | V    | 1     |
| Power supply voltage (2) | $V_{CC}-V_5$ | -0.3 to +17.0          | V    | 1, 2  |
| Input voltage            | $V_t$        | -0.3 to $V_{CC} + 0.3$ | V    | 1     |
| Operating temperature    | $T_{opr}$    | -30 to +75             | °C   |       |
| Storage temperature      | $T_{stg}$    | -55 to +125            | °C   | 4     |

Note: \* If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristic limits is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

**Absolute Maximum Ratings (HD66731)\***

| Item                     | Symbol       | Value                  | Unit | Notes |
|--------------------------|--------------|------------------------|------|-------|
| Power supply voltage (1) | $V_{CC}$     | -0.3 to +7.0           | V    | 1     |
| Power supply voltage (2) | $V_{CC}-V_5$ | -0.3 to +17.0          | V    | 1, 2  |
| Input voltage            | $V_t$        | -0.3 to $V_{CC} + 0.3$ | V    | 1     |
| Operating temperature    | $T_{opr}$    | -40 to +85             | °C   |       |
| Storage temperature      | $T_{stg}$    | -55 to +110            | °C   | 4     |

Note: \* If the LSI is used above these absolute maximum ratings, it may become permanently damaged. Using the LSI within the following electrical characteristic limits is strongly recommended for normal operation. If these electrical characteristic conditions are also exceeded, the LSI will malfunction and cause poor reliability.

## HD66730/HD66731

### DC Characteristics ( $V_{CC} = 2.4 \text{ V to } 5.5 \text{ V}$ , $T_a = -30 \text{ to } +75^\circ\text{C}^{*3}$ )

| Item                                      | Symbol    | Min          | Typ | Max         | Unit          | Test Condition  | Notes  |
|---|-----------|--------------|-----|-------------|---------------|---|--------|
| Input high voltage (1)<br>(except OSC1)   | VIH1      | $0.7V_{CC}$  | —   | $V_{CC}$    | V             |   | 5, 6   |
| Input low voltage (1)<br>(except OSC1)    | VIL1      | -0.3         | —   | $0.2V_{CC}$ | V             | $V_{CC} = 2.4 \text{ to } 3.0\text{V}$  | 5, 6   |
|   |           | -0.3         | —   | 0.6         | V             | $V_{CC} = 3.0 \text{ to } 4.5\text{V}$  |        |
| Input high voltage (2)<br>(OSC1)          | VIH2      | $0.7V_{CC}$  | —   | $V_{CC}$    | V             |   | 15     |
| Input low voltage (2)<br>(OSC1)           | VIL2      | —            | —   | $0.2V_{CC}$ | V             |   | 15     |
| Output high voltage (1)<br>(D0–D7)        | VOH1      | $0.75V_{CC}$ | —   | —           | V             | $-I_{OH} = 0.1 \text{ mA}$  | 7      |
| Output low voltage (1)<br>(D0–D7)         | VOL1      | —            | —   | $0.2V_{CC}$ | V             | $I_{OL} = 0.1 \text{ mA}$   | 7      |
| Output high voltage (2)<br>(except D0–D7) | VOH2      | $0.8V_{CC}$  | —   | —           | V             | $-I_{OH} = 0.04 \text{ mA}$   | 8      |
| Output low voltage (2)<br>(except D0–D7)  | VOL2      | —            | —   | $0.2V_{CC}$ | V             | $I_{OL} = 0.04 \text{ mA}$  | 8      |
| Driver ON resistance<br>(COM)             | $R_{COM}$ | —            | 2   | 20          | $k\Omega$     | $\pm I_d = 0.05 \text{ mA}$ ,<br>VLCD = 4V  | 13     |
| Driver ON resistance<br>(SEG)             | $R_{SEG}$ | —            | 2   | 30          | $k\Omega$     | $\pm I_d = 0.05 \text{ mA}$ ,<br>VLCD = 4V  | 13     |
| I/O leakage current                       | $I_{LI}$  | -1           | —   | 1           | $\mu\text{A}$ | $V_{IN} = 0 \text{ to } V_{CC}$   | 9      |
| Pull-up MOS current<br>(RESET* pin)       | $-I_p$    | 5            | 50  | 120         | $\mu\text{A}$ | $V_{CC} = 3\text{V}$<br>$V_{IN} = 0\text{V}$  |        |
| Power supply current                      | $I_{CC1}$ | —            | 150 | 300         | $\mu\text{A}$ | $R_f$ oscillation,<br>external clock<br>$V_{CC} = 3\text{V}$ ,<br>$f_{OSC} = 215 \text{ kHz}$ | 10, 14 |
|   | $I_{CC2}$ | —            | 25  | —           | $\mu\text{A}$ | Sleep mode<br>$V_{CC} = 3\text{V}$<br>$f_{OSC} = 215 \text{ kHz}$                             |        |
| LCD voltage                               | VLCD      | 3.0          | —   | 15.0        | V             | $V_{CC}-V_5$  | 16     |

**Booster Characteristics**

| Item                           | Symbol          | Min | Typ | Max | Unit | Test Condition   | Notes* |
|--------------------------------|-----------------|-----|-----|-----|------|--|--------|
| Output voltage<br>(V5OUT2 pin) | VUP2            | 8.2 | 8.9 | —   | V    | $V_{CC} = V_{Ci} = 4.5V$ ,<br>$I_o = 0.25\text{ mA}$ ,<br>$C = 1\text{ }\mu\text{F}$ ,<br>$f_{OSC} = 215\text{ kHz}$ ,<br>$T_a = 25^\circ\text{C}$ | 18     |
| Output voltage<br>(V5OUT3 pin) | VUP3            | 7.2 | 7.8 | —   | V    | $V_{CC} = V_{Ci} = 2.7V$ ,<br>$I_o = 0.25\text{ mA}$ ,<br>$C = 1\text{ }\mu\text{F}$ ,<br>$f_{OSC} = 215\text{ kHz}$ ,<br>$T_a = 25^\circ\text{C}$ | 18     |
| Input voltage                  | V <sub>Ci</sub> | 1.0 | —   | 5.0 | V    | $V_{Ci} \leq V_{CC}$   | 18, 19 |

**AC Characteristics ( $V_{CC} = 2.4V$  to  $5.5V$ ,  $T_a = -30$  to  $+75^\circ\text{C}^{*3}$ )**
**Clock Characteristics ( $V_{CC} = 2.7\text{ V}$  to  $5.5\text{ V}$ ,  $T_a = -30$  to  $+75^\circ\text{C}^{*3}$ )**

| Item                       |                                       | Symbol    | Min | Typ | Max | Unit          | Test Condition                                | Notes* |
|----------------------------|---------------------------------------|-----------|-----|-----|-----|---------------|---|--------|
| External clock operation   | External clock frequency              | $f_{cp}$  | 80  | 215 | 350 | kHz           | $V_{CC} = 2.4$ to $2.7V$                      | 11     |
|                            |                                       |           | 80  | 215 | 550 | kHz           | $V_{CC} = 2.7$ to $5.5V$                      |        |
|                            | External clock duty                   | Duty      | 45  | 50  | 55  | %             |   |        |
|                            | External clock rise time              | $t_{rqp}$ | —   | —   | 0.2 | $\mu\text{s}$ |   |        |
|                            | External clock fall time              | $t_{fqp}$ | —   | —   | 0.2 | $\mu\text{s}$ |   |        |
| R <sub>f</sub> oscillation | Clock oscillation frequency (HD66730) | $f_{OSC}$ | 110 | 150 | 200 | kHz           | $R_f = 150\text{ k}\Omega$ ,<br>$V_{CC} = 3V$ | 12     |
|                            | Clock oscillation frequency (HD66731) | $f_{OSC}$ | 150 | 215 | 275 | kHz           | $R_f = 91\text{ k}\Omega$ ,<br>$V_{CC} = 3V$  | 12     |



## HD66730/HD66731

### System Interface Timing Characteristics (1) ( $V_{CC} = 2.4V$ to $4.5V$ , $T_a = -30$ to $+75^{\circ}C^{*3}$ )

#### Bus Write Operation

| Item                               | Symbol           | Min | Typ | Max | Unit | Test Condition           |
|------------------------------------|------------------|-----|-----|-----|------|--------------------------|
| Enable cycle time                  | $t_{CYCE}$       | 500 | —   | —   | ns   | Figure 50                |
| Enable pulse width (high level)    | $PW_{EH}$        | 250 | —   | —   |      | $V_{CC} = 2.4$ to $3.0V$ |
|                                    |                  | 150 | —   | —   |      | $V_{CC} = 3.0$ to $4.5V$ |
| Enable rise/fall time              | $t_{Er}, t_{Ef}$ | —   | —   | 20  |      | Figure 50                |
| Address set-up time (RS, R/W to E) | $t_{AS}$         | 80  | —   | —   |      |                          |
| Address hold time                  | $t_{AH}$         | 20  | —   | —   |      |                          |
| Data set-up time                   | $t_{DSW}$        | 140 | —   | —   |      |                          |
| Data hold time                     | $t_H$            | 30  | —   | —   |      |                          |

#### Bus Read Operation

| Item                               | Symbol           | Min  | Typ | Max | Unit | Test Condition |
|------------------------------------|------------------|------|-----|-----|------|----------------|
| Enable cycle time                  | $t_{CYCE}$       | 1000 | —   | —   | ns   | Figure 51      |
| Enable pulse width (high level)    | $PW_{EH}$        | 450  | —   | —   |      |                |
| Enable rise/fall time              | $t_{Er}, t_{Ef}$ | —    | —   | 25  |      |                |
| Address set-up time (RS, R/W to E) | $t_{AS}$         | 60   | —   | —   |      |                |
| Address hold time                  | $t_{AH}$         | 20   | —   | —   |      |                |
| Data delay time                    | $t_{DDR}$        | —    | —   | 360 |      |                |
| Data hold time                     | $t_{DHR}$        | 5    | —   | —   |      |                |

#### Serial Interface Operation

| Item                            | Symbol             | Min | Typ | Max | Unit    | Test Condition |
|---------------------------------|--------------------|-----|-----|-----|---------|----------------|
| Serial clock cycle time         | $t_{SCYC}$         | 1   | —   | 20  | $\mu s$ | Figure 52      |
| Serial clock (high level width) | $t_{SCH}$          | 400 | —   | —   | ns      |                |
| Serial clock (low level width)  | $t_{SCL}$          | 400 | —   | —   |         |                |
| Serial clock rise/fall time     | $t_{scr}, t_{scf}$ | —   | —   | 50  |         |                |
| Chip select set-up time         | $t_{CSU}$          | 60  | —   | —   |         |                |
| Chip select hold time           | $t_{CH}$           | 200 | —   | —   |         |                |
| Serial input data set-up time   | $t_{SISU}$         | 200 | —   | —   |         |                |
| Serial input data hold time     | $t_{SIH}$          | 200 | —   | —   |         |                |
| Serial output data delay time   | $t_{SOD}$          | —   | —   | 360 |         |                |
| Serial output data hold time    | $t_{SOH}$          | 5   | —   | —   |         |                |

**System Interface Timing Characteristics (2) ( $V_{CC} = 4.5V$  to  $5.5V$ ,  
 $T_a = -30$  to  $+75^{\circ}C^{*3}$ )**
**Bus Write Operation**

| Item                               | Symbol           | Min | Typ | Max | Unit | Test Condition |
|------------------------------------|------------------|-----|-----|-----|------|----------------|
| Enable cycle time                  | $t_{CYCE}$       | 500 | —   | —   | ns   | Figure 50      |
| Enable pulse width (high level)    | $PW_{EH}$        | 150 | —   | —   |      |                |
| Enable rise/fall time              | $t_{Er}, t_{Ef}$ | —   | —   | 20  |      |                |
| Address set-up time (RS, R/W to E) | $t_{AS}$         | 40  | —   | —   |      |                |
| Address hold time                  | $t_{AH}$         | 30  | —   | —   |      |                |
| Data set-up time                   | $t_{DSW}$        | 80  | —   | —   |      |                |
| Data hold time                     | $t_H$            | 30  | —   | —   |      |                |

**Bus Read Operation**

| Item                               | Symbol           | Min | Typ | Max | Unit | Test Condition |
|------------------------------------|------------------|-----|-----|-----|------|----------------|
| Enable cycle time                  | $t_{CYCE}$       | 500 | —   | —   | ns   | Figure 51      |
| Enable pulse width (high level)    | $PW_{EH}$        | 230 | —   | —   |      |                |
| Enable rise/fall time              | $t_{Er}, t_{Ef}$ | —   | —   | 20  |      |                |
| Address set-up time (RS, R/W to E) | $t_{AS}$         | 40  | —   | —   |      |                |
| Address hold time                  | $t_{AH}$         | 30  | —   | —   |      |                |
| Data delay time                    | $t_{DDR}$        | —   | —   | 160 |      |                |
| Data hold time                     | $t_{DHR}$        | 5   | —   | —   |      |                |

**Serial Interface Sequence**

| Item                            | Symbol             | Min | Typ | Max | Unit    | Test Condition |
|---------------------------------|--------------------|-----|-----|-----|---------|----------------|
| Serial clock cycle time         | $t_{SCYC}$         | 0.5 | —   | 20  | $\mu s$ | Figure 52      |
| Serial clock (high level width) | $t_{SCH}$          | 200 | —   | —   | ns      |                |
| Serial clock (low level width)  | $t_{SCL}$          | 200 | —   | —   |         |                |
| Serial clock rise/fall time     | $t_{scr}, t_{scf}$ | —   | —   | 50  |         |                |
| Chip select set-up time         | $t_{CSU}$          | 60  | —   | —   |         |                |
| Chip select hold time           | $t_{CH}$           | 100 | —   | —   |         |                |
| Serial input data set-up time   | $t_{SISU}$         | 100 | —   | —   |         |                |
| Serial input data hold time     | $t_{SIH}$          | 100 | —   | —   |         |                |
| Serial output data delay time   | $t_{SOD}$          | —   | —   | 160 |         |                |
| Serial output data hold time    | $t_{SOH}$          | 5   | —   | —   |         |                |

## HD66730/HD66731

### HD66730 Segment Extension Signal Timing Characteristics ( $V_{CC} = 2.4V$ to $5.5V$ , $T_a = -30$ to $+75^{\circ}C^{*3}$ )

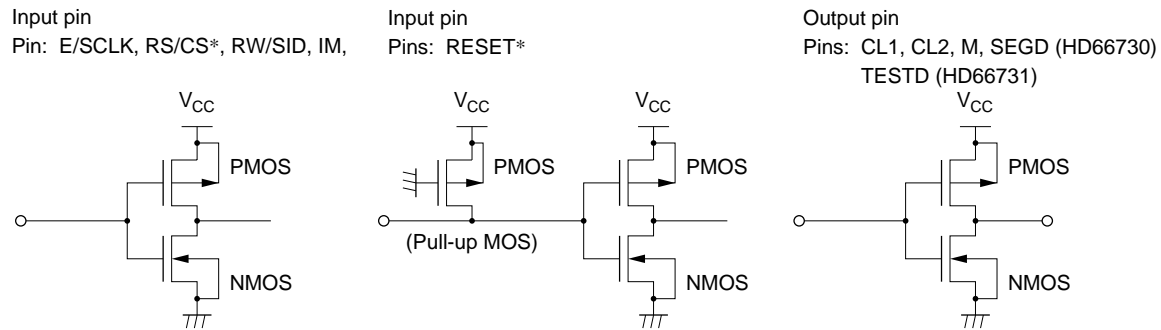
| Item                 |                  | Symbol    | Min   | Typ | Max  | Unit | Test Condition |
|----------------------|------------------|-----------|-------|-----|------|------|----------------|
| Clock pulse width    | High level       | $t_{CWH}$ | 800   | —   | —    | ns   | Figure 53      |
|                      | Low level        | $t_{CWL}$ | 800   | —   | —    |      |                |
| Clock set-up time    |                  | $t_{CSU}$ | 500   | —   | —    |      |                |
| Data set-up time     |                  | $t_{SU}$  | 300   | —   | —    |      |                |
| Data hold time       |                  | $t_{DH}$  | 300   | —   | —    |      |                |
| M delay time         |                  | $t_{DM}$  | −1000 | —   | 1000 |      |                |
| COMD set-up time     |                  | $t_{DSU}$ | 300   |     |      |      |                |
| Clock rise/fall time | COMD             | $t_{cl1}$ | —     | —   | 700  |      |                |
|                      | Pins except COMD | $t_{cl2}$ | —     | —   | 200  |      |                |

### Reset Timing Characteristics ( $V_{CC} = 2.4V$ to $5.5V$ , $T_a = -30$ to $+75^{\circ}C^{*3}$ )

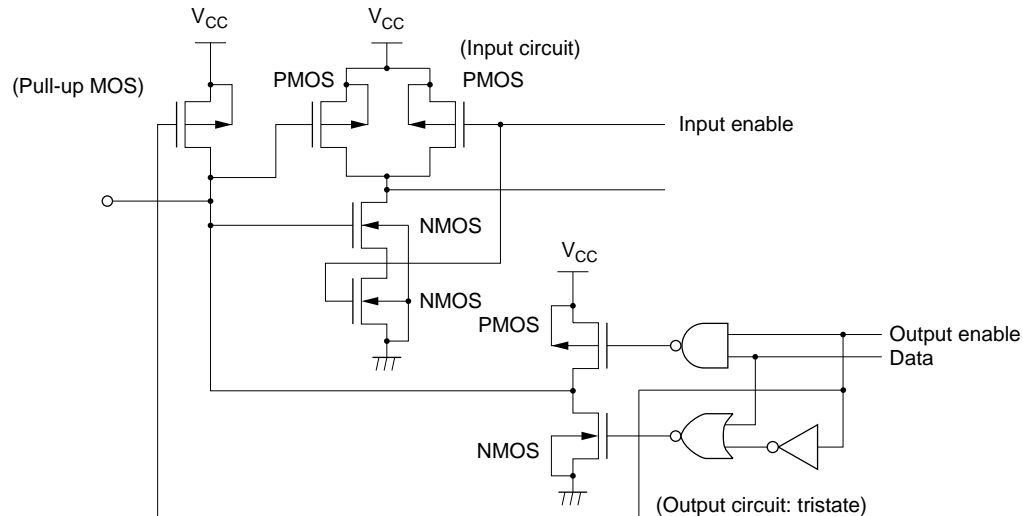
| Item                  |  | Symbol    | Min | Typ | Max | Unit | Test Condition |
|-----------------------|--|-----------|-----|-----|-----|------|----------------|
| Reset low-level width |  | $t_{RES}$ | 10  | —   | —   | ms   | Figure 54      |

## Electrical Characteristics Notes

1. All voltage values are referred to GND = 0V. If the LSI is used above the absolute maximum ratings, it may become permanently damaged. Using the LSI within the electrical characteristic is strongly recommended to ensure normal operation. If these electrical characteristic are exceeded, the LSI may malfunction or exhibit poor reliability.
2.  $V_{CC} \geq V_5$  must be maintained. When the COM25/COMD pin is used as a extension driver interface signal (COMD), GND  $\geq V_5$  must be maintained.
3. For die products, specified at 75°C.
4. For die products, specified by the die shipment specification.
5. The following four circuits are I/O pin configurations except for liquid crystal display output.



I/O Pin  
Pins: DB0/SOD to DB7

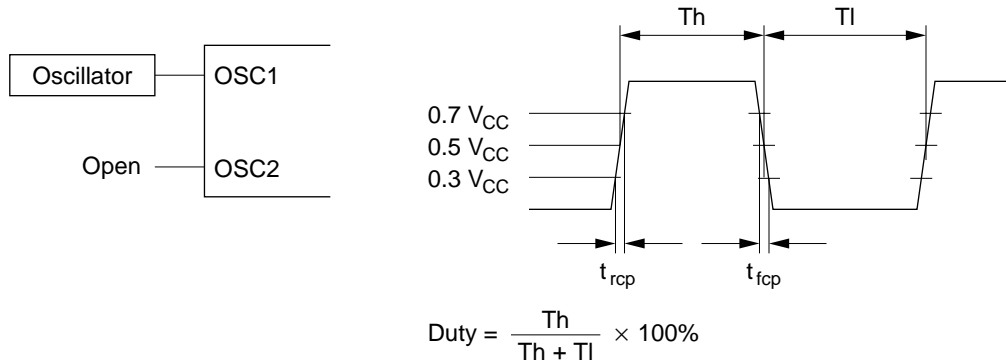


6. Applies to input pins and I/O pins, excluding the OSC1 pin.
7. Applies to I/O pins.
8. Applies to output pins of HD66730.
9. Current flowing through pull-up MOSs, excluding output drive MOSs.

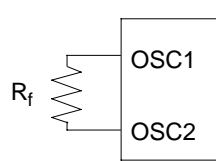
## HD66730/HD66731

10. Input/output current is excluded. When input is at an intermediate level with CMOS, the excessive current flows through the input circuit to the power supply. To avoid this from happening, the input level must be fixed high or low.

11. Applies only to external clock operation.



12. Applies only to the internal oscillator operation using oscillation resistor  $R_f$ .

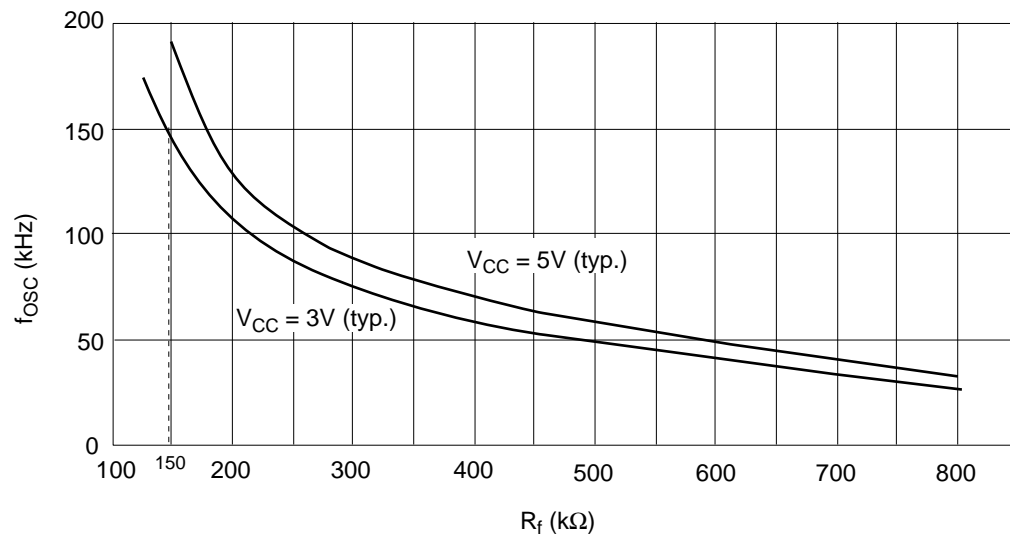


Recommended register value

$R_f$ :  $150\text{k}\Omega \pm 2\%$  (When  $V_{CC} = 3\text{V}$  to  $4\text{V}$ )

$R_f$ :  $180\text{k}\Omega \pm 2\%$  (When  $V_{CC} = 4\text{V}$  to  $5\text{V}$ )

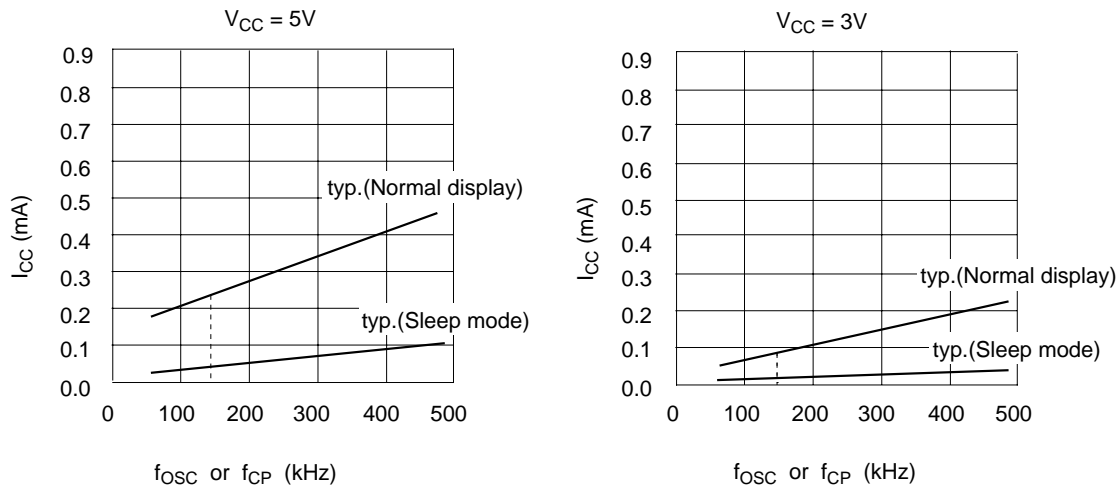
Since oscillation frequency varies depending on OSC1 and OSC2 terminal capacitance, wiring length to these pins should be minimized.



13. RCOM is the resistance between the power supply pins ( $V_{CC}$ , V1, V4, V5) and each common signal pin (COM0 to COM25/COM53).

RSEG is the resistance between the power supply pins ( $V_{CC}$ , V2, V3, V5) and each segment signal pin (SEG1 to SEG71/SEG119).

14. The following graphs show the relationship between operation frequency and current consumption (referential data).

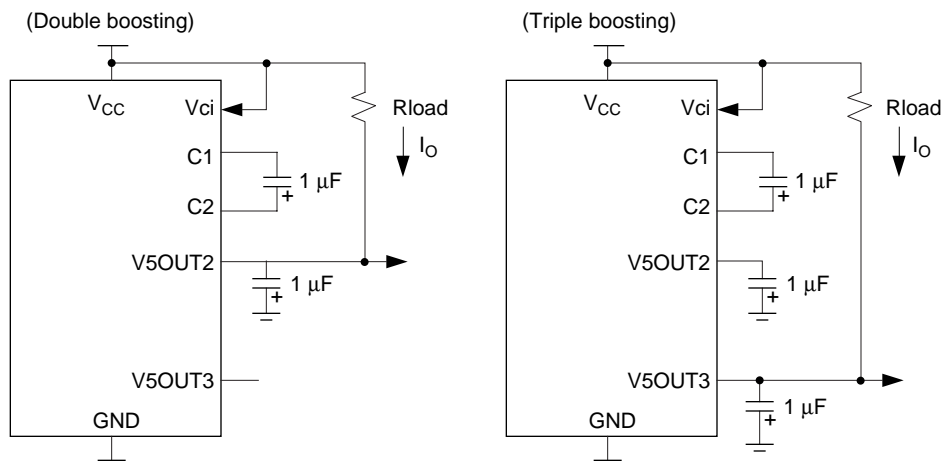


15. Applies to the OSC1 pin.

16. Each COM and SEG output voltage is within  $\pm 0.15V$  of the LCD voltage ( $V_{CC}$ , V1, V2, V3, V4, V5) when there is no load.

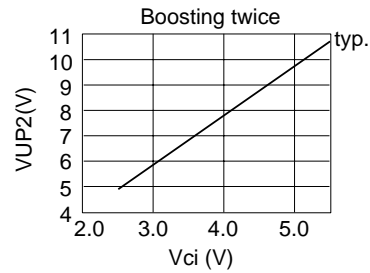
17. The TEST pin must be fixed to ground, and the IM pin must also be connected to  $V_{CC}$  or ground.

18. Booster characteristics test circuits are shown below.

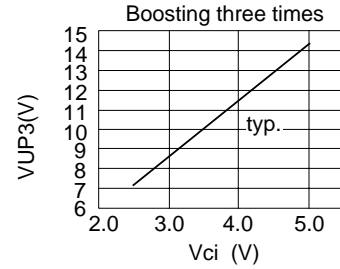


$$VUP2 = V_{CC} - V5OUT2 \quad VUP3 = V_{CC} - V5OUT3$$

(i) VUP2, VUP3 vs Vci

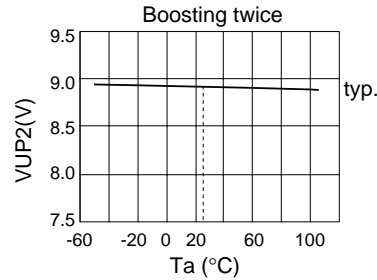


Test condition :  $V_{ci} = V_{CC}$ ,  $f_{cp} = 140\text{kHz}$ ,  
 $T_a = 25^\circ\text{C}$

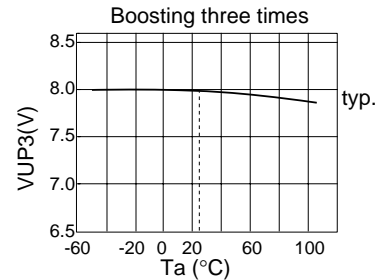


Test condition :  $V_{ci} = V_{CC}$ ,  $f_{cp} = 140\text{kHz}$ ,  
 $T_a = 25^\circ\text{C}$

(ii) VUP2, VUP3 vs  $T_a$

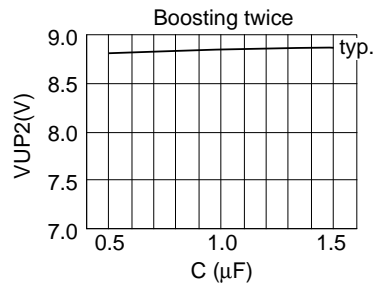


Test condition :  $V_{ci} = V_{CC} = 4.5\text{V}$ ,  $R_f = 180\text{k}\Omega$ ,  
 $I_O = 0.1\text{mA}$

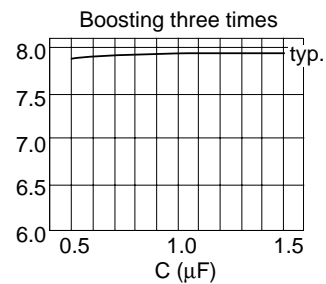


Test condition :  $V_{ci} = V_{CC} = 2.7\text{V}$ ,  $R_f = 150\text{k}\Omega$ ,  
 $I_O = 0.1\text{mA}$

(iii) VUP2, VUP3 vs Capacitance

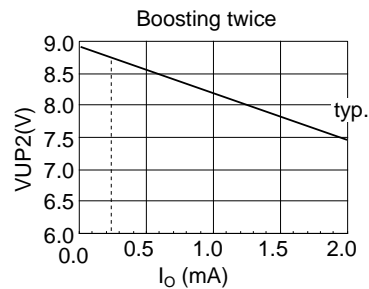


Test condition :  $V_{ci} = V_{CC} = 4.5\text{V}$ ,  $R_f = 180\text{k}\Omega$ ,  
 $I_O = 0.1\text{mA}$

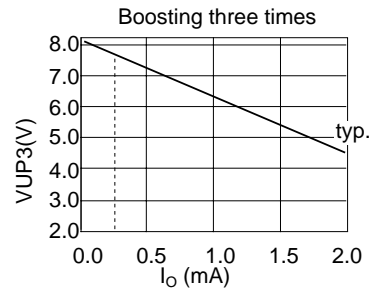


Test condition :  $V_{ci} = V_{CC} = 2.7\text{V}$ ,  $R_f = 150\text{k}\Omega$ ,  
 $I_O = 0.1\text{mA}$

(iv) VUP2, VUP3 vs  $I_O$



Test condition :  $V_{ci} = V_{CC} = 4.5\text{V}$ ,  $R_f = 180\text{k}\Omega$ ,  
 $T_a = 25^\circ\text{C}$

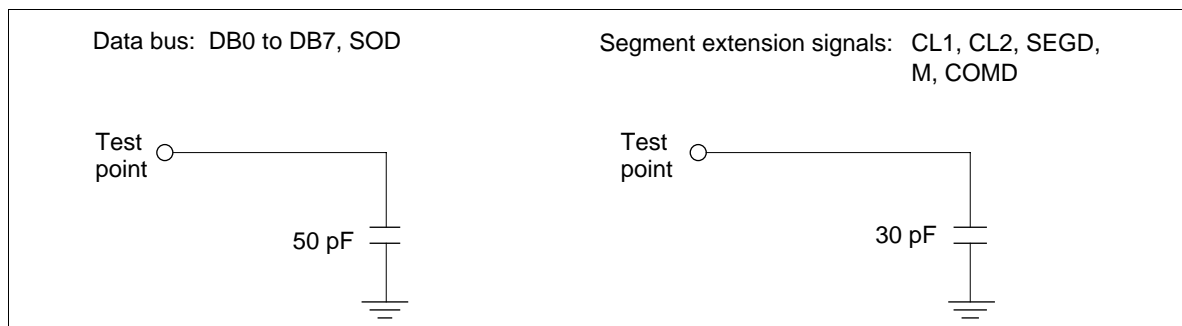


Test condition :  $V_{ci} = V_{CC} = 2.7\text{V}$ ,  $R_f = 150\text{k}\Omega$ ,  
 $T_a = 25^\circ\text{C}$

19.  $V_{ci} \leq V_{CC}$  must be maintained.

## Load Circuits

### AC Characteristics Test Load Circuits





## Timing Characteristics

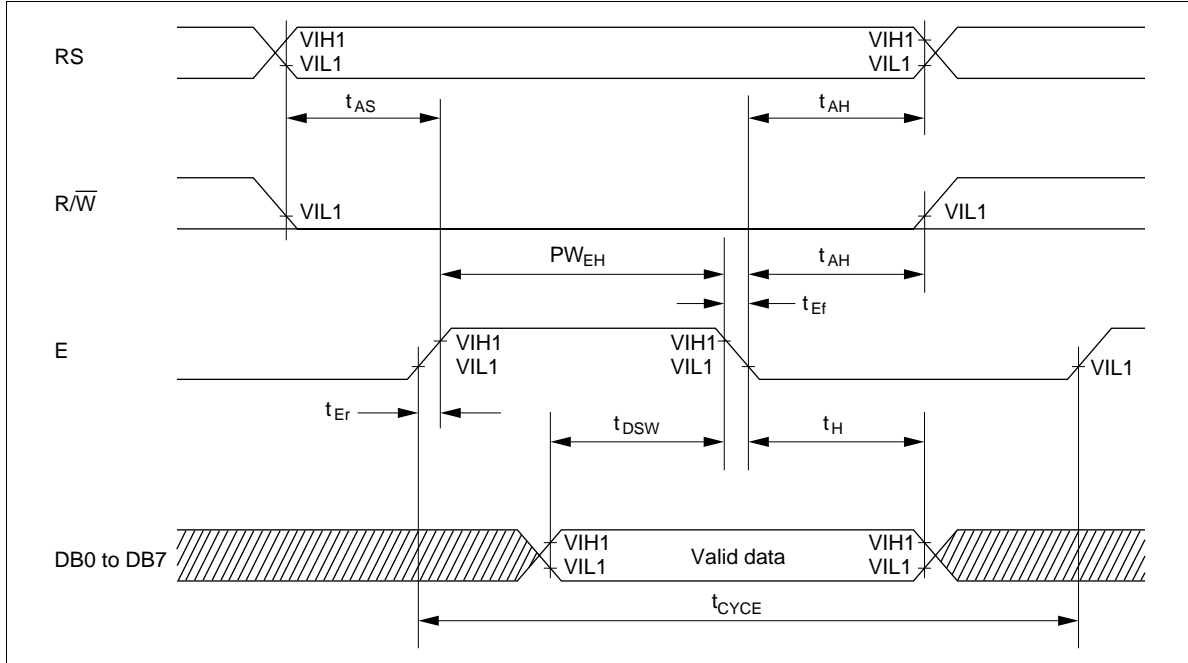


Figure 50 Bus Write Operation

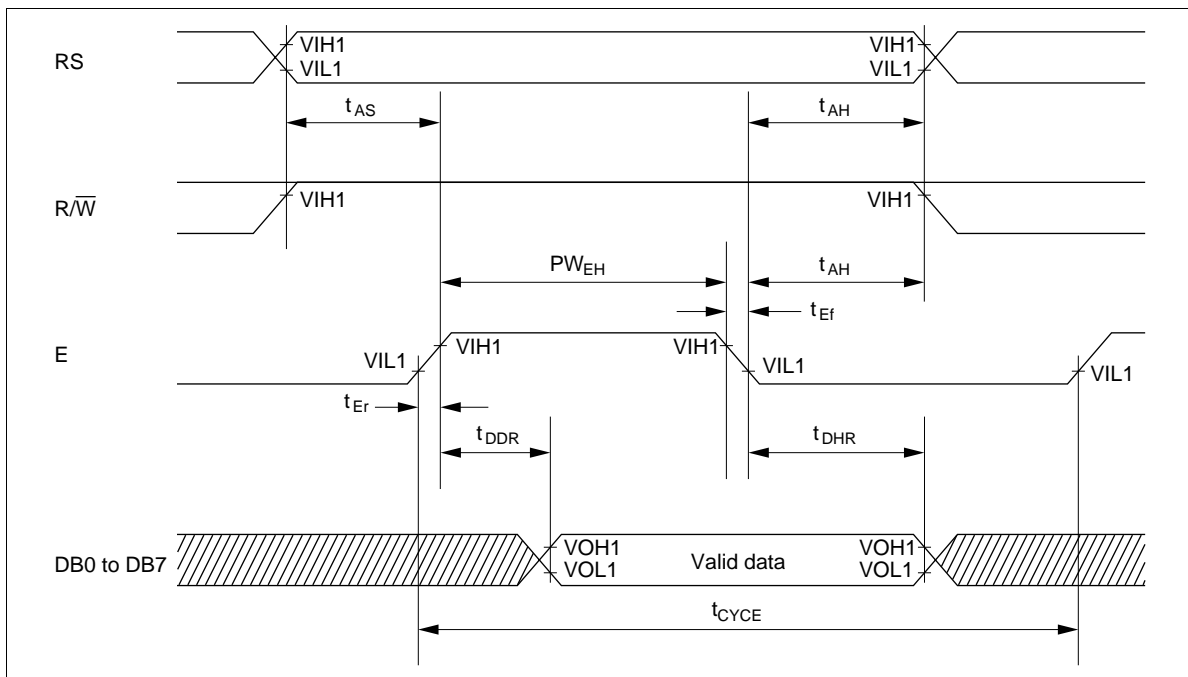


Figure 51 Bus Read Operation

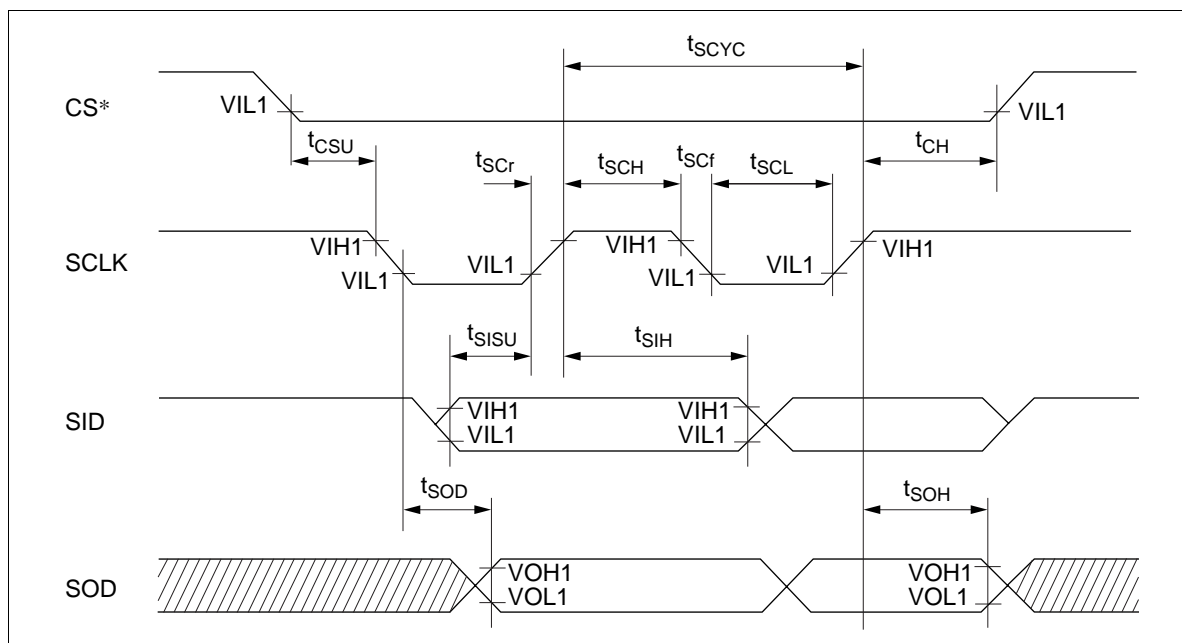


Figure 52 Serial Interface Timing

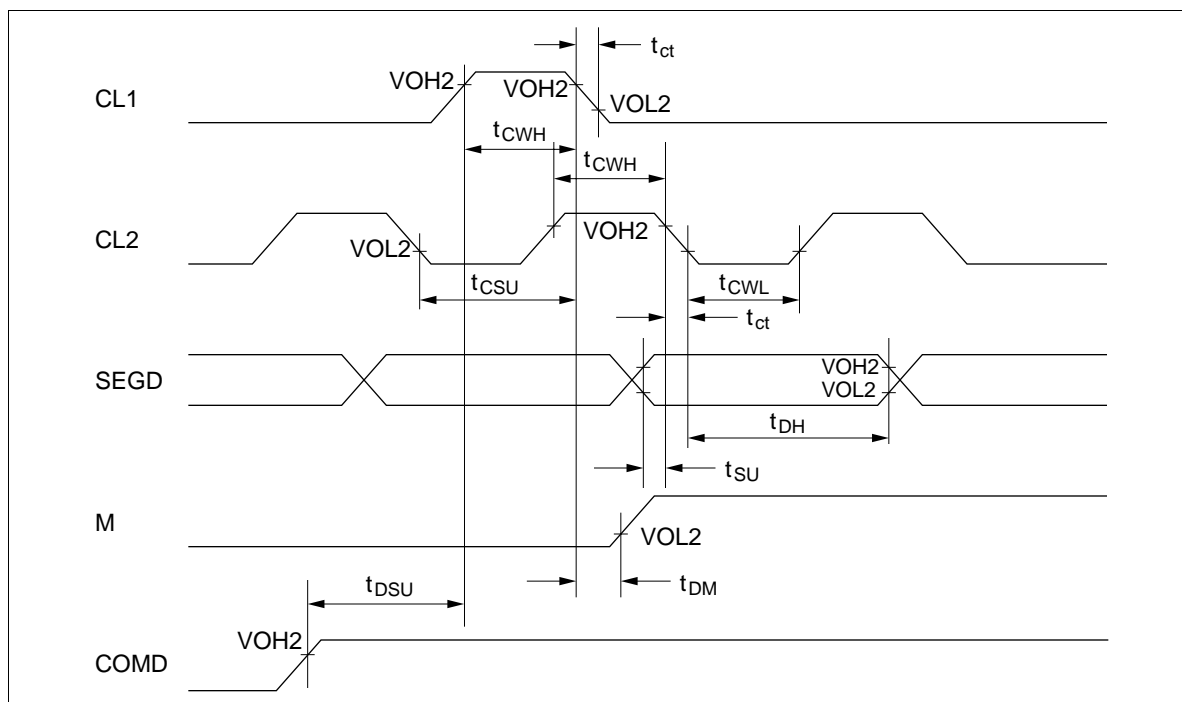
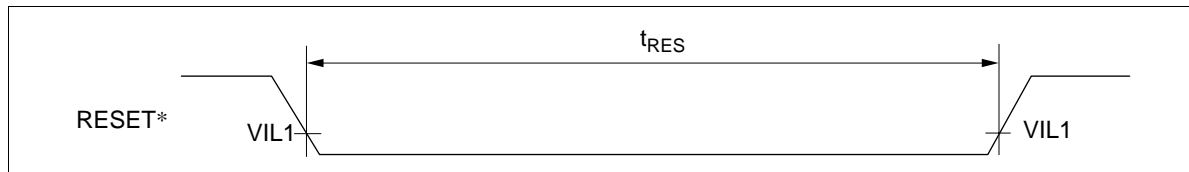
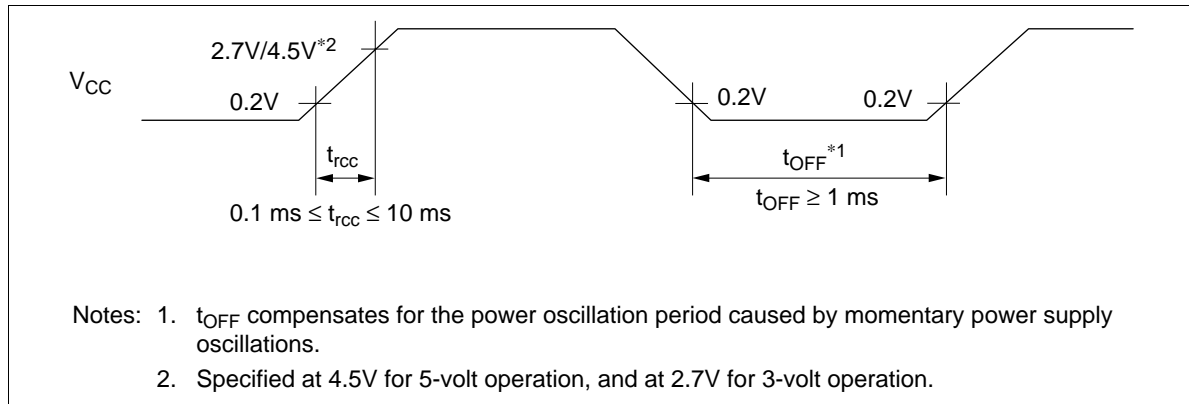


Figure 53 Interface Timing with Extension Driver



**Figure 54 Reset Timing**



**Figure 55 Power Supply Sequence**