

**Q**

# High Speed CMOS Bus Interface 8-, 9-, and 10-Bit Latches

QS54/74FCT841T  
QS54/74FCT843T  
QS54/74FCT845T\*

QS54/74FCT2841T  
QS54/74FCT2843T\*  
QS54/74FCT2845T\*

## FEATURES/BENEFITS

- Pin and function compatible to the Am29841 /29843/29845 74FCT 841/843/845 and 74FCT841T/843T/845T
- CMOS power levels: <7.5 mW static
- Available in DIP, SOIC, QSOP, ZIP
- Undershoot Clamp diodes on all inputs
- TTL-compatible input and output levels
- Ground bounce controlled outputs
- Reduced output swing of 0-3.5V
- Military product compliant to MIL-STD-883

### FCT-T 841T, 843T, 845T

- JEDEC-FCT spec compatible
- Fastest CMOS Logic family Available
- A, B, and C speed grades with 5.5 ns t<sub>PD</sub> for C
- I<sub>OL</sub> = 48 mA Com, 32 mA Mil

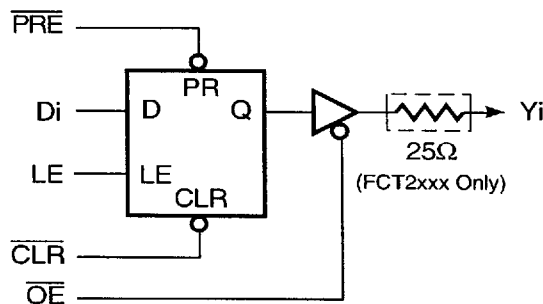
### FCT-T 2841T, 2843T, 2845T

- Built-in 25Ω series resistor outputs reduce reflection and other system noise
- A, B, and C speed grades with 5.5 ns t<sub>PD</sub> for C
- I<sub>OL</sub> = 12 mA Com

## DESCRIPTION

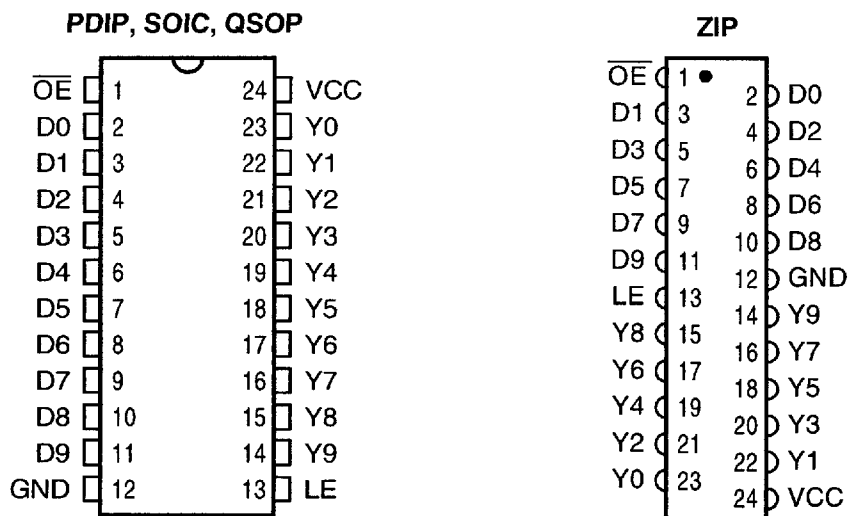
The QSFCT841T, 843T, and 845T are 10, 9, and 8-bit high-speed CMOS TTL-compatible buffered latches with three-state outputs that are ideal for driving high capacitance loads such as memory and address buses. The devices come in A, B, and C speed grades with 5.5 ns (Max.) t<sub>PLH</sub>/t<sub>PLH</sub> for the C grade. The 2841/3/5 devices are 25Ω resistor output versions useful for driving transmission lines and reducing system noise. The 284x eliminate the need for external series resistor in high speed systems and can replace the 84x series to reduce noise in an existing design. All inputs have clamp diodes for undershoot noise suppression. All output have ground bounce suppression see QSI Application Note AN-001), and outputs will not load an active bus when V<sub>CC</sub> is removed from the device.

## FUNCTIONAL BLOCK DIAGRAM

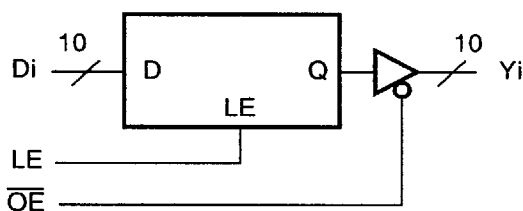


\*Note: QS54/74FCT845T, 2843T, 2845T are not recommended for use in new designs

## FCT841 PIN CONFIGURATIONS (All Pins Top View)



## FCT841 LOGIC SYMBOL



## PIN DESCRIPTION

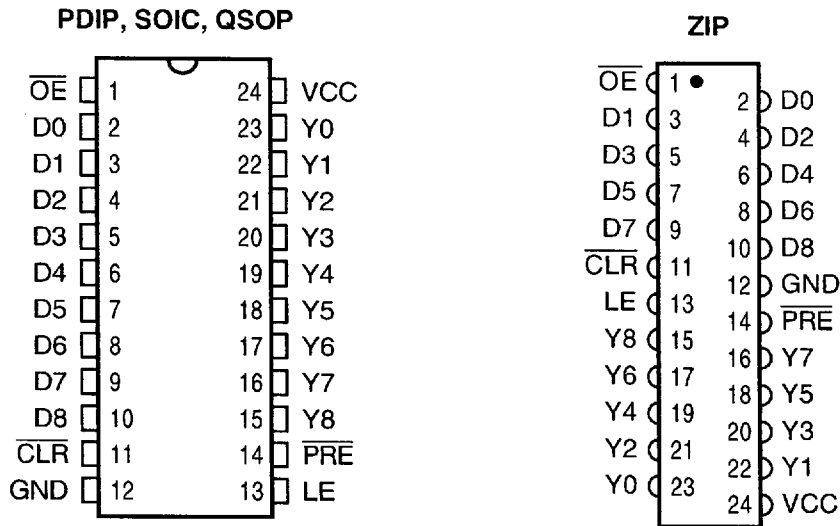
| Name            | I/O | Description                |
|-----------------|-----|----------------------------|
| Di              | I   | Data Inputs                |
| Yi              | O   | Data Outputs - Three State |
| LE              | I   | Latch Enable               |
| $\overline{OE}$ | I   | Output Enable              |

## FUNCTION TABLES

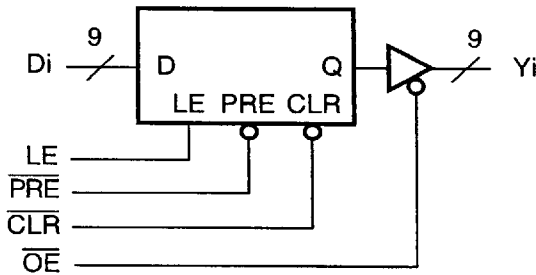
### QSFCT841, 2841

| Inputs          |    |    | Internal<br>Qi | Outputs<br>Yi | Function       |
|-----------------|----|----|----------------|---------------|----------------|
| $\overline{OE}$ | LE | Di |                |               |                |
| H               | X  | X  | X              | Z             | Hi-Z           |
| L               | X  | X  | H              | H             | Output Enabled |
| L               | X  | X  | L              | L             | Output Enabled |
| X               | H  | H  | H              | X             | Transparent    |
| X               | H  | L  | L              | X             | Transparent    |
| X               | L  | X  | NC             | X             | Latched        |

# FCT843 PIN CONFIGURATIONS (All Pins Top View)



## FCT843 LOGIC SYMBOL



## PIN DESCRIPTION

| Name             | I/O | Description                |
|------------------|-----|----------------------------|
| Di               | I   | Data Inputs                |
| Yi               | O   | Data Outputs - Three State |
| $\overline{OE}$  | I   | Output Enable              |
| LE               | I   | Latch Enable               |
| $\overline{PRE}$ | I   | Preset                     |
| CLR              | I   | Asynchronous Reset         |

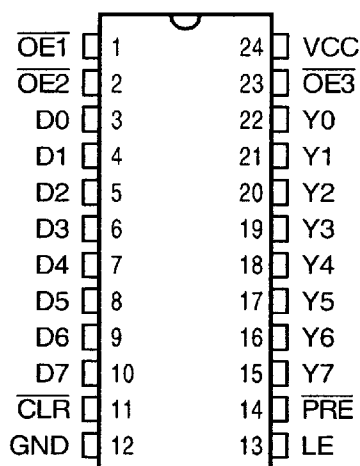
## FUNCTION TABLE

QSFCT843, 2843, 845, 2845

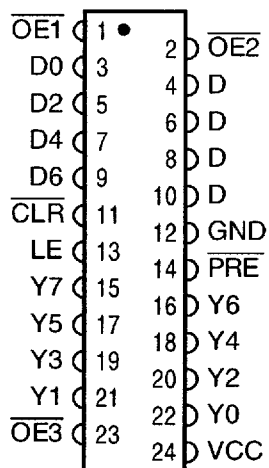
| Inputs           |                  |                 |    |    | Internal | Outputs | Function       |
|------------------|------------------|-----------------|----|----|----------|---------|----------------|
| $\overline{CLR}$ | $\overline{PRE}$ | $\overline{OE}$ | LE | Di | Qi       | Yi      |                |
| H                | H                | H               | X  | X  | X        | Z       | Hi-Z           |
| X                | X                | L               | X  | X  | H        | H       | Output Enabled |
| X                | X                | L               | X  | X  | L        | L       | Output Enabled |
| H                | H                | L               | H  | H  | H        | H       | Transparent    |
| H                | H                | L               | H  | L  | L        | L       | Transparent    |
| H                | H                | L               | L  | X  | NC       | NC      | Latched        |
| H                | L                | L               | X  | X  | H        | H       | Preset         |
| L                | H                | L               | L  | X  | L        | L       | Clear          |
| L                | L                | L               | L  | X  | H        | H       | Preset         |

## FCT845 PIN CONFIGURATIONS (All Pins Top View)

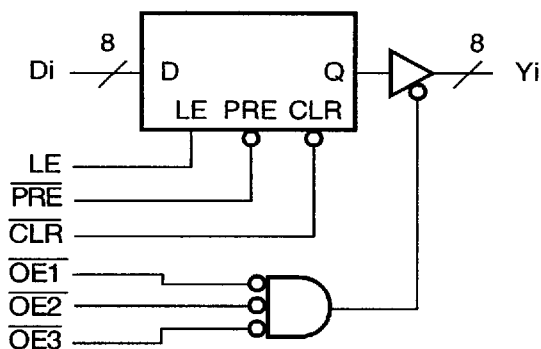
PDIP, SOIC, QSOP



ZIP



## FCT845 LOGIC SYMBOL



## PIN DESCRIPTION

| Name              | I/O | Description                |
|-------------------|-----|----------------------------|
| Di                | I   | Data Inputs                |
| Yi                | O   | Data Outputs - Three State |
| $\overline{OE_i}$ | I   | Output Enable              |
| LE                | I   | Latch Enable               |
| $\overline{PRE}$  | I   | Preset                     |
| $\overline{CLR}$  | I   | Asynchronous Reset         |

## ABSOLUTE MAXIMUM RATINGS

|                                                         |                |
|---------------------------------------------------------|----------------|
| Supply Voltage to Ground .....                          | -0.5V to +7.0V |
| DC Output Voltage $V_{OUT}$ .....                       | -0.5V to +7.0V |
| DC Input Voltage $V_{IN}$ .....                         | -0.5V to +7.0V |
| AC Input Voltage (for a pulse width $\leq 20$ ns) ..... | -3.0V          |
| DC Input Diode Current with $V_{IN} < 0$ .....          | -20 mA         |
| DC Output Diode Current with $V_{OUT} < 0$ .....        | -50 mA         |
| DC Output Current Max. Sink Current/Pin .....           | 120 mA         |
| Maximum Power Dissipation .....                         | 0.5 watts      |
| $T_{STG}$ Storage Temperature .....                     | -65° to +150°C |

**Note:** Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to QSI devices that result in functional or reliability type failures.

## CAPACITANCE

$T_A = 25^\circ\text{C}$ ,  $f = 1$  MHz,  $V_{IN} = 0\text{V}$ ,  $V_{OUT} = 0\text{V}$

| Pins             | SOIC | QSOP | PDIP | ZIP | Unit |
|------------------|------|------|------|-----|------|
| 1-11, 13, 14, 23 | 4    | 4    | 5    | 7   | pF   |
| 15-22            | 6    | 6    | 7    | 9   | pF   |

**Note:** Capacitance is characterized but not tested.

## POWER SUPPLY CHARACTERISTICS

| Symbol          | Parameter                           | Test Conditions <sup>(1)</sup>                                                                                                             | Min | Max  | Unit   |
|-----------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----|------|--------|
| $I_{CC}$        | Quiescent Power Supply Current      | $V_{CC} = \text{Max.}$ , $\text{freq} = 0$<br>$0\text{V} \leq V_{IN} \leq 0.2\text{V}$ or $V_{CC}-0.2\text{V} \leq V_{IN} \leq V_{CC}$     | —   | 1.5  | mA     |
| $\Delta I_{CC}$ | Supply Current per Input @ TTL HIGH | $V_{CC} = \text{Max.}$ , $V_{IN} = 3.4\text{V}$ , $\text{freq} = 0$ <sup>(2)</sup>                                                         | —   | 2.0  | mA     |
| $Q_{CCD}$       | Supply Current per Input per MHz    | $V_{CC} = \text{Max.}$ , Outputs open and enabled<br>One bit toggling @ 50% duty cycle<br>Other inputs at GND or $V_{CC}$ <sup>(3,4)</sup> | —   | 0.25 | mA/MHz |

### Notes:

- For conditions shown as Min. or Max., use the appropriate values specified under DC specifications.
- Per TTL driven input ( $V_{IN} = 3.4\text{V}$ ).
- For flip-flops,  $Q_{CCD}$  is measured by switching one of the data input pins so that the output changes every clock cycle. This is a measurement of device power consumption only and does not include power to drive load capacitance or tester capacitance. This parameter is guaranteed by design but not tested.
- $I_C$  can be computed using the above parameters as explained in the Technical Overview section.

# DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Commercial  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

| Symbol                   | Parameter                                  | Test Conditions                                                                            | Min        | Typ <sup>(1)</sup> | Max          | Unit          |
|--------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------|------------|--------------------|--------------|---------------|
| $V_{IH}$                 | Input HIGH Voltage                         | Logic HIGH for All Inputs                                                                  | 2.0        | —                  | —            | V             |
| $V_{IL}$                 | Input LOW Voltage                          | Logic LOW for All Inputs                                                                   | —          | —                  | 0.8          | V             |
| $\Delta V_T$             | Input Hysteresis                           | $V_{TLH} - V_{THL}$ for All Inputs                                                         | —          | 0.2                | —            | V             |
| $ I_{IH} $<br>$ I_{IL} $ | Input Current<br>Input HIGH or LOW         | $V_{CC} = \text{Max.}, 0 \leq V_{IN} < V_{CC}$                                             | —          | —                  | 5            | $\mu\text{A}$ |
| $ I_{OZ} $               | Off-State Output Current (Hi-Z)            | $V_{CC} = \text{Max.}, 0 \leq V_{IN} \leq V_{CC}$                                          | —          | —                  | 5            | $\mu\text{A}$ |
| $I_{OS}$                 | Short Circuit Current (FCTXXX)             | $V_{CC} = \text{Max.}, V_{OUT} = \text{GND}^{(2,3)}$                                       | -60        | —                  | —            | mA            |
| $I_{OR}$                 | Current Drive (FCT2XXX - $25\Omega$ )      | $V_{CC} = \text{Min.}, V_{OUT} = 2.0\text{V}^{(3)}$                                        | 50         | —                  | —            | mA            |
| $V_{IC}$                 | Input Clamp Voltage                        | $V_{CC} = \text{Min.}, I_{IN} = -18\text{ mA}, T_A = 25^\circ\text{C}^{(3)}$               | —          | -0.7               | -1.2         | V             |
| $V_{OH}$                 | Output HIGH Voltage                        | $V_{CC} = \text{Min.}$<br>$I_{OH} = -12\text{ mA (MIL)}$<br>$I_{OH} = -15\text{ mA (COM)}$ | 2.4<br>2.4 | —<br>—             | —<br>—       | V             |
| $V_{OL}$                 | Output LOW Voltage (FCTXXX)                | $V_{CC} = \text{Min.}$<br>$I_{OL} = 32\text{ mA (MIL)}$<br>$I_{OL} = 48\text{ mA (COM)}$   | —<br>—     | —<br>—             | 0.50<br>0.50 | V             |
| $V_{OL}$                 | Output LOW Voltage (FCT2XXX - $25\Omega$ ) | $V_{CC} = \text{Min.}$<br>$I_{OL} = 12\text{ mA (MIL)}$<br>$I_{OL} = 12\text{ mA (COM)}$   | —<br>—     | —<br>—             | 0.50<br>0.50 | V             |
| $R_{OUT}$                | Output Resistance (FCT2XXX - $25\Omega$ )  | $V_{CC} = \text{Min.}$<br>$I_{OL} = 12\text{ mA (MIL)}$<br>$I_{OL} = 12\text{ mA (COM)}$   | —<br>20    | 25<br>28           | —<br>40      | $\Omega$      |

## Notes:

1. Typical values indicate  $V_{CC} = 5.0\text{V}$  and  $T_A = 25^\circ\text{C}$ .
2. Not more than one output should be shorted and the duration is  $\leq 1$  second.
3. These parameters are guaranteed by design but not tested.

**SWITCHING CHARACTERISTICS OVER OPERATING RANGE**

Commercial  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

$C_{LOAD} = 50\text{ pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

| Symbol           | Description                             |     | 841A<br>843A<br>845A<br>2841A<br>2843A<br>2845A |     | 841B<br>843B<br>845B<br>2841B<br>2843B<br>2845B |      | 841C<br>843C<br>845C<br>2841C<br>2843C<br>2845C |      | Unit |
|------------------|-----------------------------------------|-----|-------------------------------------------------|-----|-------------------------------------------------|------|-------------------------------------------------|------|------|
|                  |                                         |     | Min                                             | Max | Min                                             | Max  | Min                                             | Max  |      |
| t <sub>PHL</sub> | Data to Y Delay                         | COM |                                                 | 9.0 |                                                 | 6.5  |                                                 | 5.5  | ns   |
| t <sub>PLH</sub> | $\overline{OE} = \text{LOW}$ , 841/3/5  | MIL |                                                 | 10  |                                                 | 7.5  |                                                 | 6.3  |      |
| t <sub>PHL</sub> | Data to Y Delay <sup>(2,3)</sup>        | COM |                                                 | 13  |                                                 | 13   |                                                 | 13   | ns   |
| t <sub>PLH</sub> | $\overline{OE} = \text{LOW}$ , 841/3/5  | MIL |                                                 | 15  |                                                 | 15   |                                                 | 15   |      |
| t <sub>PHL</sub> | Data to Y Delay                         | COM |                                                 | 9.5 |                                                 | 6.5  |                                                 | 5.5  | ns   |
| t <sub>PLH</sub> | $\overline{OE} = \text{LOW}$ , 2841/3/5 | MIL |                                                 | 11  |                                                 | 7.5  |                                                 | 6.3  |      |
| t <sub>PHL</sub> | Data to Y Delay <sup>(2,3)</sup>        | COM |                                                 | 20  |                                                 | 13   |                                                 | 13   | ns   |
| t <sub>PLH</sub> | $\overline{OE} = \text{LOW}$ , 2841/3/5 | MIL |                                                 | 20  |                                                 | 15   |                                                 | 15   |      |
| t <sub>s</sub>   | Data to LE Setup                        | COM | 2.5                                             |     | 2.5                                             |      | 2.5                                             |      | ns   |
|                  |                                         | MIL | 2.5                                             |     | 2.5                                             |      | 2.5                                             |      |      |
| t <sub>h</sub>   | Data to LE Hold Time                    | COM | 2.5                                             |     | 2.5                                             |      | 2.5                                             |      | ns   |
|                  |                                         | MIL | 3.0                                             |     | 2.5                                             |      | 2.5                                             |      |      |
| t <sub>LEY</sub> | LE to Y Delay                           | COM |                                                 | 12  |                                                 | 8.0  |                                                 | 6.4  | ns   |
|                  | $\overline{OE} = \text{LOW}$ , 841/3/5  | MIL |                                                 | 13  |                                                 | 10.5 |                                                 | 6.8  |      |
| t <sub>LEY</sub> | LE to Y Delay <sup>(2,3)</sup>          | COM |                                                 | 16  |                                                 | 15.5 |                                                 | 15   | ns   |
|                  | $\overline{OE} = \text{LOW}$ , 841/3/5  | MIL |                                                 | 20  |                                                 | 18   |                                                 | 16   |      |
| t <sub>LEY</sub> | LE to Y Delay                           | COM |                                                 | 12  |                                                 | 8    |                                                 | 8    | ns   |
|                  | $\overline{OE} = \text{LOW}$ , 2841/3/5 | MIL |                                                 | 13  |                                                 | 10.5 |                                                 | 10.5 |      |
| t <sub>LEY</sub> | LE to Y Delay <sup>(2,3)</sup>          | COM |                                                 | 16  |                                                 | 15.5 |                                                 | 15   | ns   |
|                  | $\overline{OE} = \text{LOW}$ , 2841/3/5 | MIL |                                                 | 20  |                                                 | 18   |                                                 | 16   |      |

**Notes:**

1. See Test Circuit and Waveforms.
2. This parameter is guaranteed by design but not tested.
3.  $C_{LOAD} = 300\text{ pF}$ .

# SWITCHING CHARACTERISTICS OVER OPERATING RANGE

Commercial  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 5\%$

Military  $T_A = -55^\circ\text{C}$  to  $125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V} \pm 10\%$

$C_{LOAD} = 50\text{ pF}$ ,  $R_{LOAD} = 500\Omega$  unless otherwise noted.

| Symbol         | Description <sup>(1)</sup>                                                          |            | 841A<br>843A<br>845A<br>2841A<br>2843A<br>2845A |            | 841B<br>843B<br>845B<br>2841B<br>2843B<br>2845B |          | 841C<br>843C<br>845C<br>2841C<br>2843C<br>2845C |            | Unit |
|----------------|-------------------------------------------------------------------------------------|------------|-------------------------------------------------|------------|-------------------------------------------------|----------|-------------------------------------------------|------------|------|
|                |                                                                                     |            | Min                                             | Max        | Min                                             | Max      | Min                                             | Max        |      |
| tsLEC          | $\overline{\text{CLR}}$ to LE Setup                                                 | COM<br>MIL | 3<br>3                                          |            | 2.5<br>2.5                                      |          | 2.5<br>2.5                                      |            | ns   |
| tCLR<br>tPRE   | $\overline{\text{CLR}}$ , $\overline{\text{PRE}}$ to Y Delay, 843/5                 | COM<br>MIL |                                                 | 12<br>14   |                                                 | 8<br>10  |                                                 | 7<br>9     | ns   |
| tCLR<br>tPRE   | $\overline{\text{CLR}}$ , $\overline{\text{PRE}}$ to Y Delay,<br>2843/5             | COM<br>MIL |                                                 | 12<br>14   |                                                 | 8<br>10  |                                                 | 7<br>9     | ns   |
| tCLRR<br>tPRER | $\overline{\text{CLR}}$ , $\overline{\text{PRE}}$ <sup>(2)</sup><br>Recovery Time   | COM<br>MIL |                                                 | 14<br>17   |                                                 | 8<br>10  |                                                 | 8<br>9     | ns   |
| tLEH           | LE Pulse Width HIGH <sup>(2)</sup>                                                  | COM<br>MIL | 6<br>6                                          |            | 4<br>4                                          |          | 4<br>4                                          |            | ns   |
| tPREL          | $\overline{\text{PRE}}$ , $\overline{\text{CLR}}$ <sup>(2)</sup><br>Pulse Width LOW | COM<br>MIL | 8<br>9                                          |            | 4<br>4                                          |          | 4<br>4                                          |            | ns   |
| tpZH<br>tpZL   | Output Enable Time<br>$\overline{\text{OE}}$ to $Y_i$ , 841                         | COM<br>MIL |                                                 | 11.5<br>13 |                                                 | 8<br>8.5 |                                                 | 6.5<br>8.5 | ns   |
| tpZH<br>tpZL   | Output Enable Time <sup>(2,3)</sup><br>$\overline{\text{OE}}$ to $Y_i$ , 841        | COM<br>MIL |                                                 | 23<br>25   |                                                 | 14<br>15 |                                                 | 12<br>13   | ns   |
| tpZH<br>tpZL   | Output Enable Time<br>$\overline{\text{OE}}$ to $Y_i$ , 2841                        | COM<br>MIL |                                                 | 11.5<br>13 |                                                 | 8<br>8.5 |                                                 | 6.5<br>8.5 | ns   |
| tpZH<br>tpZL   | Output Enable Time <sup>(2,3)</sup><br>$\overline{\text{OE}}$ to $Y_i$ , 2841       | COM<br>MIL |                                                 | 23<br>25   |                                                 | 14<br>15 |                                                 | 12<br>13   | ns   |
| tpHZ<br>tplZ   | Output Disable Time <sup>(2,4)</sup><br>$\overline{\text{OE}}$ to $Y_i$             | COM<br>MIL |                                                 | 7<br>9     |                                                 | 6<br>6.5 |                                                 | 5.7<br>6   | ns   |
| tpHZ<br>tplZ   | Output Disable Time <sup>(2)</sup><br>$\overline{\text{OE}}$ to $Y_i$               | COM<br>MIL |                                                 | 8<br>10    |                                                 | 7<br>7.5 |                                                 | 6<br>6.3   | ns   |

## Notes:

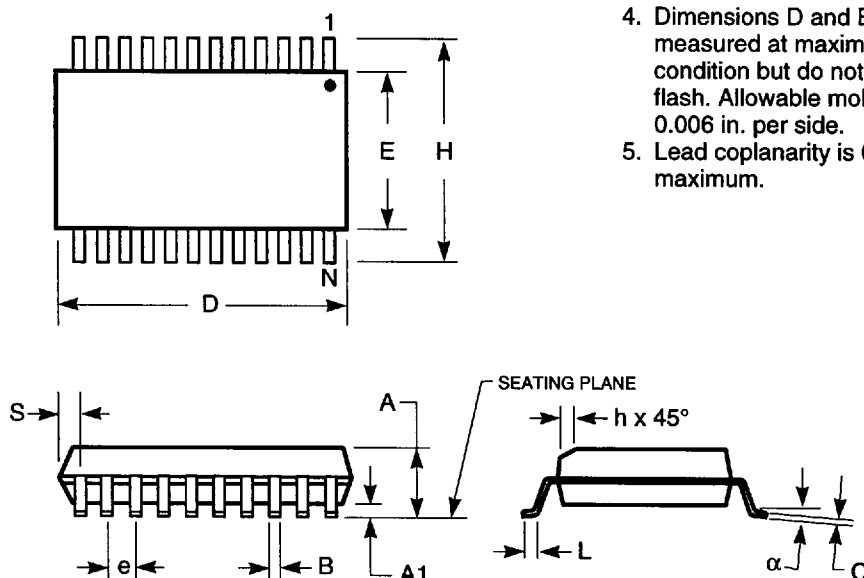
1. See Test Circuit and Waveforms.
2. This parameter is guaranteed by design but not tested.
3.  $C_{LOAD} = 300\text{ pF}$ .
4.  $C_{LOAD} = 5\text{ pF}$ .

# PACKAGING INFORMATION

## 150-MIL QSOP - Package Code Q

Quarter-Size Outline Package

Plastic Small Outline Gull-Wing



### Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.

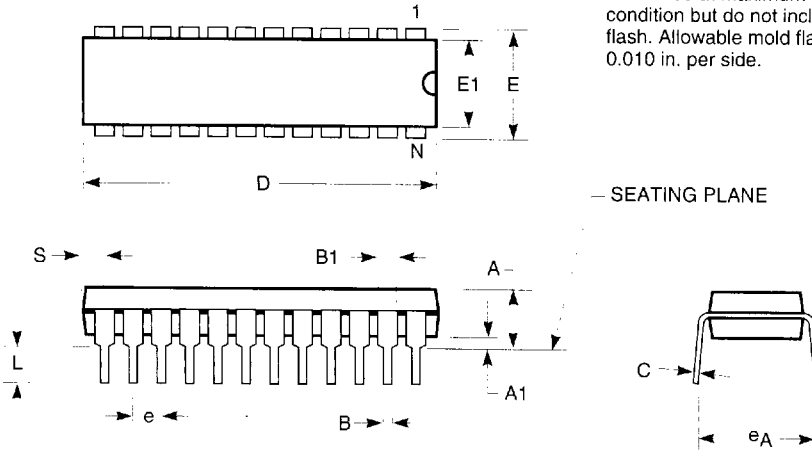
| JEDEC#   | MO-137AB  |       |       | MO-137AD  |       |       | MO-137AE  |       |       | MO-137AF  |       |       |
|----------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| DWG#     | PSS-16A   |       |       | PSS-20A   |       |       | PSS-24A   |       |       | PSS-28A   |       |       |
| Symbol   | Min       | Nom   | Max   | Min       | Nom   | Max   | Min       | Nom   | Max   | Min       | Nom   | Max   |
| A        | 0.060     | 0.064 | 0.068 | 0.060     | 0.064 | 0.068 | 0.060     | 0.064 | 0.068 | 0.060     | 0.064 | 0.068 |
| A1       | 0.004     | 0.006 | 0.008 | 0.004     | 0.006 | 0.008 | 0.004     | 0.006 | 0.008 | 0.004     | 0.006 | 0.008 |
| B        | 0.009     | 0.010 | 0.012 | 0.009     | 0.010 | 0.012 | 0.009     | 0.010 | 0.012 | 0.009     | 0.010 | 0.012 |
| C        | 0.007     | 0.008 | 0.010 | 0.007     | 0.008 | 0.010 | 0.007     | 0.008 | 0.010 | 0.007     | 0.008 | 0.010 |
| D        | 0.189     | 0.193 | 0.197 | 0.337     | 0.341 | 0.344 | 0.337     | 0.341 | 0.344 | 0.386     | 0.390 | 0.394 |
| E        | 0.150     | 0.154 | 0.157 | 0.150     | 0.154 | 0.157 | 0.150     | 0.154 | 0.157 | 0.150     | 0.154 | 0.157 |
| e        | 0.025 BSC |       |       | 0.025 BSC |       |       | 0.025 BSC |       |       | 0.025 BSC |       |       |
| H        | 0.230     | 0.236 | 0.244 | 0.230     | 0.236 | 0.244 | 0.230     | 0.236 | 0.244 | 0.230     | 0.236 | 0.244 |
| h        | 0.010     | 0.013 | 0.016 | 0.010     | 0.013 | 0.016 | 0.010     | 0.013 | 0.016 | 0.010     | 0.013 | 0.016 |
| L        | 0.016     | 0.025 | 0.035 | 0.016     | 0.025 | 0.035 | 0.016     | 0.025 | 0.035 | 0.016     | 0.025 | 0.035 |
| N        | 16        |       |       | 20        |       |       | 24        |       |       | 28        |       |       |
| $\alpha$ | 0°        | 5°    | 8°    | 0°        | 5°    | 8°    | 0°        | 5°    | 8°    | 0°        | 5°    | 8°    |
| S        | 0.006     | 0.009 | 0.010 | 0.056     | 0.058 | 0.060 | 0.031     | 0.033 | 0.035 | 0.031     | 0.033 | 0.035 |

## PACKAGING INFORMATION

### 300-MIL PDIP - Package Code P Plastic Dual In-line Package

#### Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E1 are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010 in. per side.



| JEDEC#         | MS-001AC |       | MS001AA |       | MS-001AE |       | N/A   |       | MS-001AF |       | MO-095AH |       |
|----------------|----------|-------|---------|-------|----------|-------|-------|-------|----------|-------|----------|-------|
| DWG#           | PD14A    |       | PD16A   |       | PD20A    |       | PT22B |       | PT24A    |       | PT28A    |       |
| Symbol         | Min      | Max   | Min     | Max   | Min      | Max   | Min   | Max   | Min      | Max   | Min      | Max   |
| A              | 0.130    | 0.170 | 0.130   | 0.170 | 0.130    | 0.170 | 0.130 | 0.170 | 0.130    | 0.170 | 0.130    | 0.180 |
| A1             | 0.015    | 0.040 | 0.015   | 0.040 | 0.015    | 0.040 | 0.015 | 0.040 | 0.015    | 0.040 | 0.015    | 0.040 |
| B              | 0.016    | 0.020 | 0.016   | 0.020 | 0.016    | 0.020 | 0.016 | 0.020 | 0.016    | 0.020 | 0.016    | 0.020 |
| B1             | 0.045    | 0.070 | 0.045   | 0.070 | 0.045    | 0.070 | 0.045 | 0.070 | 0.045    | 0.070 | 0.045    | 0.060 |
| C              | 0.009    | 0.012 | 0.009   | 0.012 | 0.009    | 0.012 | 0.009 | 0.012 | 0.009    | 0.012 | 0.009    | 0.012 |
| D              | 0.745    | 0.765 | 0.745   | 0.765 | 1.020    | 1.040 | 1.020 | 1.040 | 1.150    | 1.260 | 1.345    | 1.385 |
| E              | 0.300    | 0.325 | 0.300   | 0.325 | 0.300    | 0.325 | 0.300 | 0.325 | 0.300    | 0.325 | 0.300    | 0.325 |
| E1             | 0.240    | 0.270 | 0.240   | 0.270 | 0.240    | 0.270 | 0.240 | 0.270 | 0.250    | 0.280 | 0.275    | 0.295 |
| e              | 0.090    | 0.110 | 0.090   | 0.110 | 0.090    | 0.110 | 0.090 | 0.110 | 0.090    | 0.110 | 0.090    | 0.110 |
| e <sub>A</sub> | 0.310    | 0.380 | 0.310   | 0.380 | 0.310    | 0.380 | 0.310 | 0.380 | 0.310    | 0.380 | 0.310    | 0.380 |
| L              | 0.120    | 0.140 | 0.120   | 0.140 | 0.120    | 0.140 | 0.120 | 0.140 | 0.120    | 0.140 | 0.120    | 0.140 |
| S              | 0.070    | 0.080 | 0.020   | 0.035 | 0.060    | 0.070 | 0.010 | 0.020 | 0.025    | 0.080 | 0.020    | 0.040 |
| N              | 14       |       | 16      |       | 20       |       | 22    |       | 24       |       | 28       |       |

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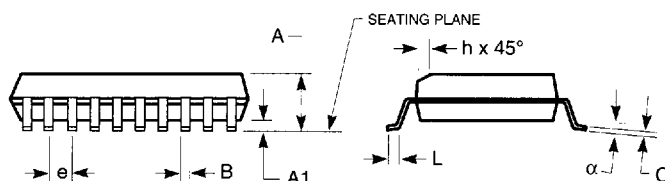
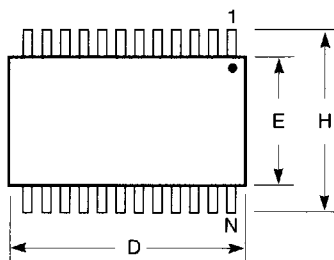
## PACKAGING INFORMATION

### 300-MIL SOIC - Package Code SO

Plastic Small Outline Gull-Wing

#### Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.006 in. per side.
5. Lead coplanarity is 0.004 in. maximum.



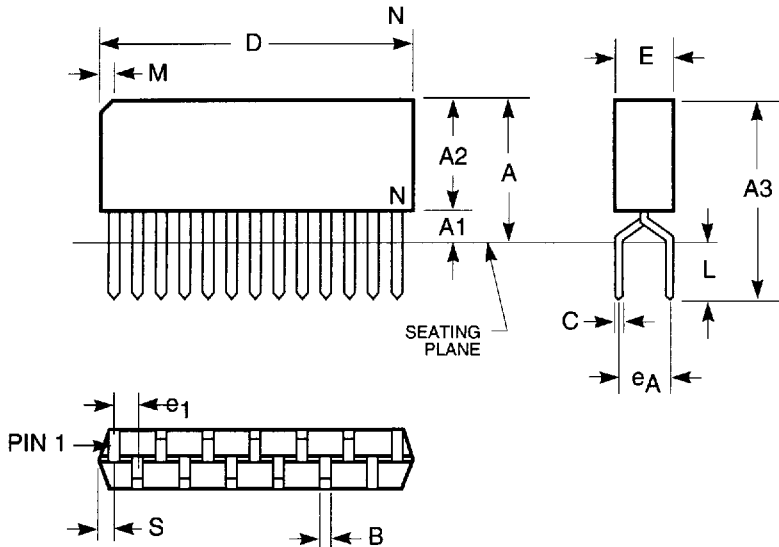
| JEDEC#   | MS-013AA |       | MS-013AC |       | MS-013AD |       | MS-013AE |       |
|----------|----------|-------|----------|-------|----------|-------|----------|-------|
| DWG#     | PS16A    |       | PS20A    |       | PS24A    |       | PS28A    |       |
| Symbol   | Min      | Max   | Min      | Max   | Min      | Max   | Min      | Max   |
| A        | 0.096    | 0.104 | 0.096    | 0.104 | 0.096    | 0.104 | 0.096    | 0.104 |
| A1       | 0.005    | 0.011 | 0.005    | 0.011 | 0.005    | 0.011 | 0.005    | 0.011 |
| B        | 0.014    | 0.019 | 0.014    | 0.019 | 0.014    | 0.019 | 0.014    | 0.019 |
| C        | 0.009    | 0.012 | 0.009    | 0.012 | 0.009    | 0.012 | 0.009    | 0.012 |
| D        | 0.402    | 0.412 | 0.500    | 0.510 | 0.602    | 0.612 | 0.701    | 0.711 |
| E        | 0.292    | 0.299 | 0.292    | 0.299 | 0.292    | 0.299 | 0.292    | 0.299 |
| e        | 0.044    | 0.056 | 0.044    | 0.056 | 0.044    | 0.056 | 0.044    | 0.056 |
| H        | 0.396    | 0.416 | 0.396    | 0.416 | 0.396    | 0.416 | 0.396    | 0.416 |
| h        | 0.010    | 0.016 | 0.010    | 0.016 | 0.010    | 0.016 | 0.010    | 0.016 |
| L        | 0.020    | 0.040 | 0.020    | 0.040 | 0.020    | 0.040 | 0.020    | 0.040 |
| N        | 16       |       | 20       |       | 24       |       | 28       |       |
| $\alpha$ | 0°       | 8°    | 0°       | 8°    | 0°       | 8°    | 0°       | 8°    |

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# PACKAGING INFORMATION

## 300-MIL ZIP - Package Code Z

Zig-zag In-line Packages



| JEDEC# | MO-072AB  |       | MO-072AC  |       | MO-072AD  |       |
|--------|-----------|-------|-----------|-------|-----------|-------|
| DWG#   | PZ20A     |       | PZ24A     |       | PZ28A     |       |
| Symbol | Min       | Max   | Min       | Max   | Min       | Max   |
| A      | 0.350     | 0.400 | 0.350     | 0.400 | 0.350     | 0.400 |
| A1     | 0.030     | 0.070 | 0.030     | 0.070 | 0.032     | 0.055 |
| A2     | 0.280     | 0.340 | 0.320     | 0.350 | 0.335     | 0.345 |
| A3     | 0.450     | 0.550 | 0.450     | 0.550 | 0.460     | 0.550 |
| B      | 0.015     | 0.024 | 0.015     | 0.024 | 0.015     | 0.024 |
| C      | 0.008     | 0.012 | 0.008     | 0.012 | 0.008     | 0.012 |
| D      | 1.008     | 1.030 | 1.200     | 1.250 | 1.409     | 1.424 |
| E      | 0.100     | 0.120 | 0.100     | 0.120 | 0.110     | 0.120 |
| e1     | 0.050 BSC |       | 0.050 BSC |       | 0.050 BSC |       |
| eA     | 0.100 BSC |       | 0.100 BSC |       | 0.100 BSC |       |
| L      | 0.100     | 0.150 | 0.100     | 0.150 | 0.110     | 0.150 |
| M      | 0.035     | 0.085 | 0.035     | 0.085 | 0.035     | 0.085 |
| N      | 20        |       | 24        |       | 28        |       |
| S      | 0.018     | 0.032 | 0.018     | 0.032 | 0.025     | 0.038 |

### Notes:

1. Refer to applicable symbol list.
2. All dimensions are in inches.
3. N is the number of lead positions.
4. Dimensions D and E are to be measured at maximum material condition but do not include mold flash. Allowable mold flash is 0.010 in. per side.

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