

4825898 INTEGRATED POWER

82D 00273 D

T-43-25

# INTEGRATED POWER SEMICONDUCTORS, LTD.

## 1.25 Amp Quad Darlington Arrays

### Description

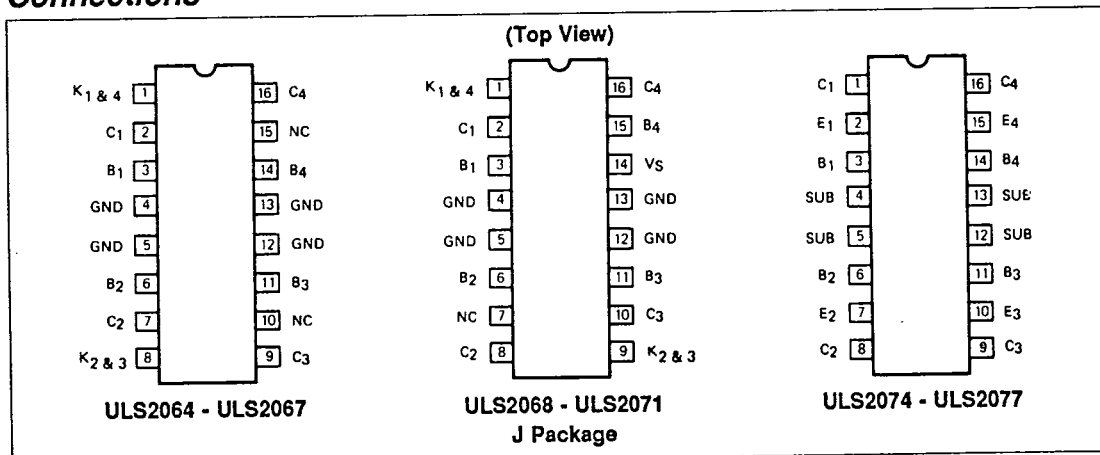
Intended for military, aerospace and related applications, the ULS2064 through ULS2077 are high voltage, high current monolithic bipolar integrated circuits especially designed for interfacing low-level control logic and peripheral loads such as relays, solenoids, DC and stepping motors, multiplexed LED and incandescent displays and heaters. The devices are specified with a minimum output breakdown of 50 volts, and  $V_{CE(SUS)}$  minimum of 35V measured at 100mA, or a minimum output breakdown of 80V,  $V_{CE(SUS)}$  minimum of 50V, and an output current specification of 1.25A. The logic inputs are designed to be compatible with TTL, DTL, LSTTL, CMOS, NMOS and PMOS logic families. The ULS2064-71 include internal clamp diodes for driving inductive loads. All twelve quad darlington arrays are supplied in 16-pin hermetic DIP packages which meet the processing and environmental requirements of MIL-STD-883 methods 5004 and 5005, and the dimensional requirements of MIL-M-38510.

### Features

- Four power drivers per package
- 1.5 amp collector currents
- 80 and 50 volt  $BV_{CEX}$  ratings
- Internal clamp diodes for inductive loads
- Hermetically sealed package to MIL M-38510
- High-reliability screening to MIL STD-883, class B
- Compatibility with all popular logic families
- Low internal parasitics

Section 4 - Power Drivers  
ULS2064 through ULS2077

### Connections



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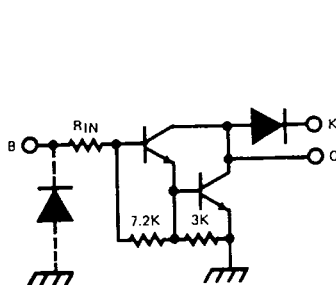
### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ )

|                         |                     |                                         |                     |
|-------------------------|---------------------|-----------------------------------------|---------------------|
| Input Voltage (Note 2)  | See Selection Guide | Output Sustaining Voltage               | See Selection Guide |
| Input Current (Note 3)  | 25mA                | Power Dissipation, $P_D$                | 2.2W                |
| Supply Voltage          |                     | Operating Junction Temperature, $T_J$   | +150°C              |
| ULS2068, ULS2069        | 10V                 | Oper. Ambient Temp. Range, $T_A$        | -55°C to +125°C     |
| ULS2070, ULS2071        | 20V                 | Storage Temp. Range, $T_S$              | -65°C to +150°C     |
| Output Voltage          | See Selection Guide | Thermal Resistance: junction to ambient |                     |
| Output Current (Note 1) | 1.5A                | L Package                               | 90°C/W              |
|                         |                     | J Package                               | 75°C/W              |

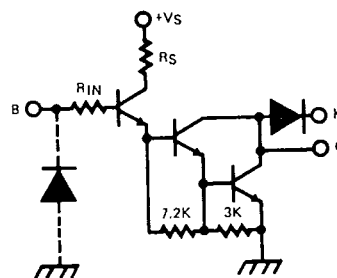
Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

- Note 1. Allowable combinations of output current, number of outputs conducting, and duty cycle are shown on following pages.  
 Note 2. Input voltage is referenced to the substrate (no connection to other pins) for type ULS2074/75/76/77; reference is ground for all other types.  
 Note 3. Input current may be limited by maximum allowable input voltages.

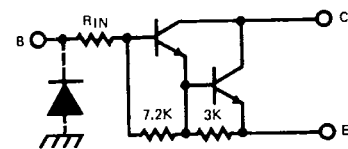
### Schematic Diagram (Single Darlington Shown)



ULS2064/2065:  $R_{IN} = 350\Omega$   
 ULS2066/2067:  $R_{IN} = 3K\Omega$



ULS2068/2069:  
 $R_{IN} = 2.5K\Omega$ ,  $R_S = 900\Omega$   
 ULS2070/2071:  
 $R_{IN} = 11.6K\Omega$ ,  $R_S = 3.4K\Omega$



ULS2074/2075:  $R_{IN} = 350\Omega$   
 ULS2076/2077:  $R_{IN} = 3K\Omega$

Section 4 - Power Drivers  
 ULS2064 through ULS2077

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**Electrical Characteristics**

| Parameter                                              | Conditions                    | Devices | Temp   | ULS2064/2067 |      | Units   |
|--------------------------------------------------------|-------------------------------|---------|--------|--------------|------|---------|
|                                                        |                               |         |        | Min          | Max  |         |
| Output Leakage Current, $I_{CEX}$                      | $V_{CE} = 50V$                | 2064/66 | •      |              | 500  | $\mu A$ |
|                                                        | $V_{CE} = 80V$                | 2065/67 | •      |              | 500  | $\mu A$ |
| Output Sustaining Voltage, $V_{CE}$ (SUS)              | $I_C = 100mA, V_{IN} = 0.4V$  | 2064/66 | •      | 35           |      | V       |
|                                                        | $I_C = 100mA, V_{IN} = 0.4V$  | 2065/67 | •      | 50           |      | V       |
| Collector-Emitter Saturation Voltage<br>$V_{CE}$ (SAT) | $I_C = 500mA, I_B = 1.1mA$    | All     | -55°C  |              | 1.35 | V       |
|                                                        | $I_C = 750mA, I_B = 1.7mA$    |         |        |              | 1.55 | V       |
|                                                        | $I_C = 1.0A, I_B = 2.25mA$    |         |        |              | 1.75 | V       |
|                                                        | $I_C = 1.25A, I_B = 3.75mA$   |         |        |              | 1.95 | V       |
|                                                        | $I_C = 500mA, I_B = 625\mu A$ |         |        |              | 1.20 | V       |
|                                                        | $I_C = 750mA, I_B = 935\mu A$ |         |        |              | 1.35 | V       |
|                                                        | $I_C = 1.0A, I_B = 1.25mA$    |         |        |              | 1.55 | V       |
|                                                        | $I_C = 1.25A, I_B = 2.0mA$    |         |        |              | 1.75 | V       |
|                                                        | $I_C = 500mA, I_B = 625\mu A$ |         | +125°C |              | 1.35 | V       |
|                                                        | $I_C = 750mA, I_B = 935\mu A$ |         |        |              | 1.55 | V       |
|                                                        | $I_C = 1.0A, I_B = 1.25mA$    |         |        |              | 1.75 | V       |
|                                                        | $I_C = 1.25A, I_B = 2.0mA$    |         |        |              | 1.95 | V       |
| Input Current, $I_{IN}$ (ON)                           | $V_{IN} = 2.4V$               | 2064/65 | •      |              | 4.3  | mA      |
|                                                        | $V_{IN} = 3.75V$              |         | •      |              | 9.6  | mA      |
|                                                        | $V_{IN} = 5.0V$               | 2066/67 | •      |              | 1.8  | mA      |
|                                                        | $V_{IN} = 12V$                |         | •      |              | 5.2  | mA      |
| Input Voltage, $V_{IN}$ (ON)                           | $V_{CE} = 2.0V, I_C = 1.0A$   | 2064/65 | -55°C  |              | 3.1  | V       |
|                                                        | $V_{CE} = 2.0V, I_C = 1.0A$   |         |        |              | 2.0  | V       |
|                                                        | $V_{CE} = 2.0V, I_C = 1.0A$   | 2066/67 | -55°C  |              | 11.5 | V       |
|                                                        | $V_{CE} = 2.0V, I_C = 1.0A$   |         |        |              | 6.5  | V       |
| Turn-on Delay, $t_{PLH}$                               | $0.5E_{IN}$ to $0.5E_{OUT}$   | All     | •      |              | 1.0  | $\mu S$ |
| Turn-off Delay, $t_{PHL}$                              | $0.5E_{IN}$ to $0.5E_{OUT}$   |         | •      |              | 1.5  | $\mu S$ |
| Clamp Diode Leakage Current, $I_R$                     | $V_R = 50V$                   | 2064/66 | •      |              | 100  | $\mu A$ |
|                                                        | $V_R = 80V$                   | 2065/67 | •      |              | 100  | $\mu A$ |
| Clamp Diode Forward Voltage, $V_F$                     | $I_F = 1.25A$                 | All     | •      |              | 2.1  | V       |

The • denotes the specifications which apply over the full operating temperature range, all others apply at  $T_A = 25^\circ C$  unless otherwise specified.

Section 4 - Power Drivers  
ULS2064 through ULS2077

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**Electrical Characteristics (Cont.)**

VS = 5V for ULS2068/67, VS = 12V for ULS2070/71

| Parameter                                           | Conditions                   | Devices | Temp  | 2068-2071 |      | Units   |
|-----------------------------------------------------|------------------------------|---------|-------|-----------|------|---------|
|                                                     |                              |         |       | Min       | Max  |         |
| Output Leakage Current, $I_{CEX}$                   | $V_{CE} = 50V$               | 2068/70 | •     |           | 500  | $\mu A$ |
|                                                     | $V_{CE} = 80V$               | 2069/71 | •     |           | 500  | $\mu A$ |
| Output Sustaining Voltage, $V_{CE(SUS)}$            | $I_C = 100mA, V_{IN} = 0.4V$ | 2068/70 | •     | 35        |      | V       |
|                                                     | $I_C = 100mA, V_{IN} = 0.4V$ | 2069/71 | •     | 50        |      | V       |
| Collector Emitter Saturation Voltage; $V_{CE(SAT)}$ | $I_C = 500mA, V_{IN} = 3.2V$ | 2068/69 | -55°C |           | 1.35 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 3.2V$ |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 3.2V$  |         |       |           | 1.75 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 3.2V$ |         |       |           | 1.95 | V       |
|                                                     | $I_C = 500mA, V_{IN} = 2.9V$ |         |       |           | 1.20 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 2.9V$ |         |       |           | 1.35 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 2.9V$  |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 2.9V$ |         |       |           | 1.75 | V       |
|                                                     | $I_C = 500mA, V_{IN} = 2.8V$ |         |       |           | 1.35 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 2.8V$ |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 2.8V$  |         |       |           | 1.75 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 2.8V$ |         |       |           | 1.95 | V       |
|                                                     | $I_C = 500mA, V_{IN} = 5.5V$ | 2070/71 | -55°C |           | 1.35 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 5.5V$ |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 5.5V$  |         |       |           | 1.75 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 5.5V$ |         |       |           | 1.95 | V       |
|                                                     | $I_C = 500mA, V_{IN} = 5.1V$ |         |       |           | 1.20 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 5.1V$ |         |       |           | 1.35 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 5.1V$  |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 5.1V$ |         |       |           | 1.75 | V       |
|                                                     | $I_C = 500mA, V_{IN} = 5.0V$ |         |       |           | 1.35 | V       |
|                                                     | $I_C = 750mA, V_{IN} = 5.0V$ |         |       |           | 1.55 | V       |
|                                                     | $I_C = 1.0A, V_{IN} = 5.0V$  |         |       |           | 1.75 | V       |
|                                                     | $I_C = 1.25A, V_{IN} = 5.0V$ |         |       |           | 1.95 | V       |
| Input Current, $I_{IN(ON)}$                         | $V_{IN} = 3.2V$              | 2068/69 | -55°C |           | 600  | $\mu A$ |
|                                                     | $V_{IN} = 2.75V$             |         |       |           | 550  | $\mu A$ |
|                                                     | $V_{IN} = 2.75V$             |         |       |           | 850  | $\mu A$ |
|                                                     | $V_{IN} = 3.75V$             | 2070/71 | •     |           | 1000 | $\mu A$ |
|                                                     | $V_{IN} = 5.0V$              |         |       |           | 400  | $\mu A$ |
|                                                     | $V_{IN} = 12V$               |         |       |           | 1250 | $\mu A$ |
| Input Voltage, $V_{IN(ON)}$                         | $V_{CE} = 2.0V, I_C = 1.0A$  | 2068/69 | -55°C |           | 3.2  | V       |
|                                                     | $V_{CE} = 2.0V, I_C = 1.0A$  | 2070/71 | -55°C |           | 2.75 | V       |
|                                                     | $V_{CE} = 2.0V, I_C = 1.0A$  |         |       |           | 5.0  | V       |
|                                                     | $V_{CE} = 2.0V, I_C = 1.0A$  |         |       |           | 5.0  | V       |
| Supply Current, $I_S$                               | $I_C = 500mA, V_{IN} = 3.2$  | 2068/69 | •     |           | 6.0  | mA      |
|                                                     | $I_C = 500mA, V_{IN} = 5.0$  | 2070/71 | •     |           | 4.5  | mA      |
| Turn-on Delay, $t_{ON}$                             | $0.5E_{IN}$ to $0.5E_{OUT}$  | All     | •     |           | 1.0  | $\mu s$ |
| Turn-off Delay, $t_{OFF}$                           | $0.5E_{IN}$ to $0.5E_{OUT}$  | All     | •     |           | 1.5  | $\mu s$ |
| Clamp Diode Leakage Current, $I_P$                  | $V_R = 50V$                  | 2068/70 | •     |           | 100  | $\mu A$ |
|                                                     | $V_R = 80V$                  | 2069/71 | •     |           | 100  | $\mu A$ |
| Clamp Diode Forward Voltage, $V_F$                  | $I_F = 1.25A$                | All     | •     |           | 2.1  | V       |

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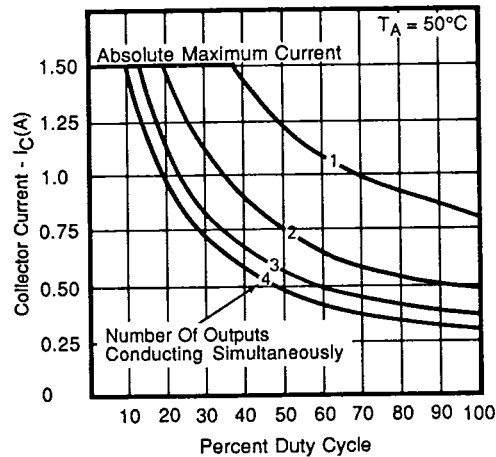
# Electrical Characteristics (Cont.)

| Parameters                                  | Conditions                    | Devices | Temp   | ULS2074/2077 |      | Units   |
|---------------------------------------------|-------------------------------|---------|--------|--------------|------|---------|
|                                             |                               |         |        | Min          | Max  |         |
| Output Leakage Current, $I_{CEX}$           | $V_{CE} = 50V$                | 2074/76 | •      |              | 500  | $\mu A$ |
|                                             | $V_{CE} = 80V$                | 2075/77 | •      |              | 500  | $\mu A$ |
| Output Sustaining Voltage, $V_{CE} (SUS)$   | $I_C = 100mA, V_{IN} = 0.4V$  | 2074/76 | •      | 35           |      | V       |
|                                             | $I_C = 100mA, V_{IN} = 0.4V$  | 2075/77 | •      | 50           |      | V       |
| Collector Emitter Saturation, $V_{CE(SAT)}$ | $I_C = 500mA, I_B = 1.1mA$    | All     | -55°C  |              | 1.35 | V       |
|                                             | $I_C = 750mA, I_B = 1.7mA$    |         |        |              | 1.55 | V       |
|                                             | $I_C = 1.0A, I_B = 2.25mA$    |         |        |              | 1.75 | V       |
|                                             | $I_C = 1.25A, I_B = 3.75mA$   |         |        |              | 1.95 | V       |
|                                             | $I_C = 500mA, I_B = 625\mu A$ |         | +125°C |              | 1.20 | V       |
|                                             | $I_C = 750mA, I_B = 935\mu A$ |         |        |              | 1.35 | V       |
|                                             | $I_C = 1.0A, I_B = 1.25mA$    |         |        |              | 1.55 | V       |
|                                             | $I_C = 1.25A, I_B = 2.0mA$    |         |        |              | 1.75 | V       |
|                                             | $I_C = 500mA, I_B = 625\mu A$ |         |        |              | 1.35 | V       |
|                                             | $I_C = 750mA, I_B = 935\mu A$ |         |        |              | 1.55 | V       |
|                                             | $I_C = 1.0A, I_B = 1.25mA$    |         |        |              | 1.75 | V       |
|                                             | $I_C = 1.25A, I_B = 2.0mA$    |         |        |              | 1.95 | V       |
|                                             |                               |         |        |              |      |         |
|                                             |                               |         |        |              |      |         |
|                                             |                               |         |        |              |      |         |
|                                             |                               |         |        |              |      |         |
| Input Current, $I_{IN} (ON)$                | $V_{IN} = 2.4V$               | 2074/75 | •      |              | 4.3  | mA      |
|                                             | $V_{IN} = 3.75V$              |         | •      |              | 9.6  | mA      |
|                                             | $V_{IN} = 5.0V$               | 2076/77 | •      |              | 1.8  | mA      |
|                                             | $V_{IN} = 12V$                |         | •      |              | 5.2  | mA      |
| Input Voltage, $V_{IN} (ON)$                | $V_{CE} = 2.0V, I_C = 1.0A$   | 2074/75 | -55°C  |              | 3.1  | V       |
|                                             | $V_{CE} = 2.0V, I_C = 1.0A$   |         |        |              | 2.0  | V       |
|                                             | $V_{CE} = 2.0V, I_C = 1.0A$   | 2076/77 | -55°C  |              | 11.5 | V       |
|                                             | $V_{CE} = 2.0V, I_C = 1.0A$   |         |        |              | 6.5  | V       |
| Turn-on Delay, $t_{ON}$                     | $0.5E_{IN}$ to $0.5E_{OUT}$   | All     | •      |              | 1.0  | $\mu s$ |
| Turn-off Delay, $t_{OFF}$                   | $0.5E_{IN}$ to $0.5E_{OUT}$   | All     | •      |              | 1.5  | $\mu s$ |

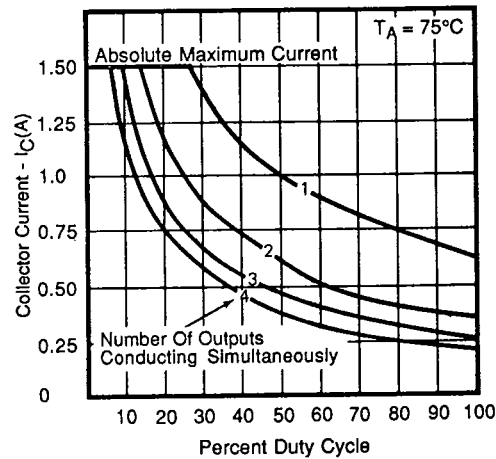
The • denotes the specifications which apply over the full operating temperature range, all others apply at  $T_A = 25^\circ C$  unless otherwise specified.

## Performance Characteristics

Peak Collector Current vs Duty Cycle



Peak Collector Current vs Duty Cycle

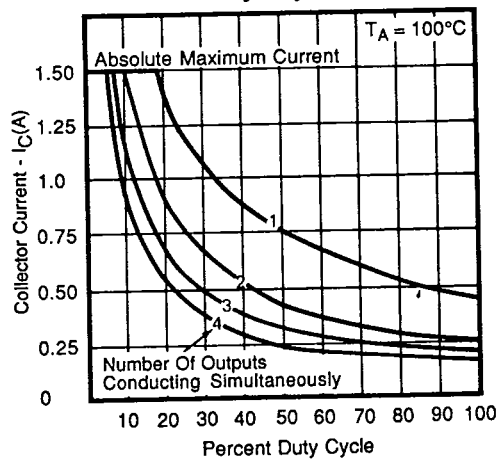
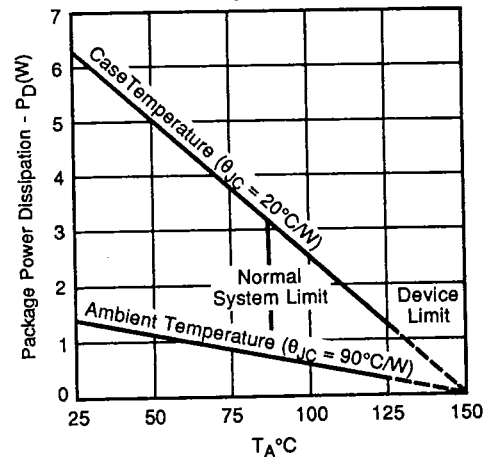


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**Performance Characteristics, continued****Peak Collector Current vs Duty Cycle****Power Dissipation vs Temperature****Order Information**

| Input Conditions                        | $V_{IN}$<br>MAX | $V_{CE} = 50V$<br>$I_C = 1.5A$ | $V_{CE} = 80$<br>$I_C = 1.5A$ |
|-----------------------------------------|-----------------|--------------------------------|-------------------------------|
| TTL, DTL, Schottky TTL 5V CMOS and NMOS | 15V             | ULS2064J                       | ULS2065J                      |
| 6 to 15V CMOS and PMOS                  | 30V             | ULS2066J                       | ULS2067J                      |
| TTL, DTL, Schottky TTL 5V CMOS and NMOS | 15V             | ULS2068J                       | ULS2069J                      |
| 6 to 15V CMOS and PMOS                  | 30V             | ULS2070J                       | ULS2071J                      |
| General Purpose                         | 30V             | ULS2074J                       | —                             |
| General Purpose                         | 60V             | —                              | ULS2075J                      |
| 6 to 15V CMOS and PMOS                  | 30V             | ULS2076J                       | —                             |
| 6 to 15V CMOS and PMOS                  | 60V             | —                              | ULS2077J                      |

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