

NLAS3157, NLAS3257

Low Voltage SPDT Mux / Demux Analog Switch

The NLAS3157 Mux / Demux Analog Switch is an advanced high-speed single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching. The control input, S, is independent of supply voltage line switch in an ultra-small footprint.

Features

- High Speed: $t_{PD} = 0.25$ ns (Max) @ $V_{CC} = 4.5$ V
- R_{ON} : 8.5Ω Typ @ $V_{CC} = 4.2$ V
- C_{ON} : 7.5 pF Typ @ $V_{CC} = 3.3$ V
- V_{CC} Range: 1.65 V to 4.5 V
- Ultra-Small 1×1 mm Package
- This Device is Pb-Free, Halogen Free/BFR Free and RoHS Compliant

Typical Applications

- Mobile Phones, PDAs, Camera

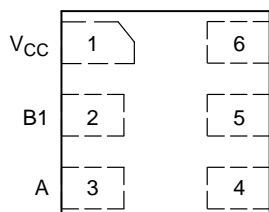


Figure 1. ULLGA6 (NLAS3157)
(Top View)

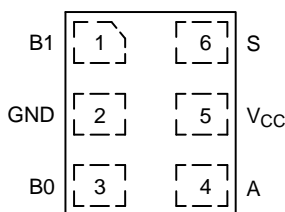


Figure 2. XLLGA6 (NLAS3257)
(Top View)

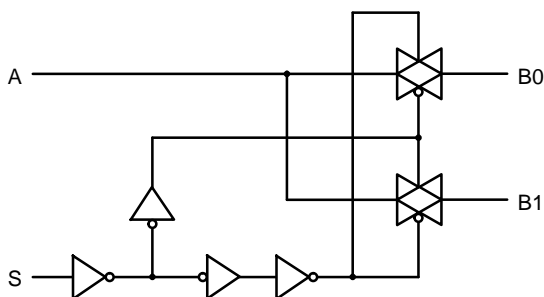


Figure 3. Logic Diagram



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MARKING DIAGRAMS



ULLGA6
1.0 x 1.0
CASE 613AD



Y = Specific Device Code
M = Date Code



XLLGA6
1.0 x 1.0
CASE 713AD



L = Specific Device Code
M = Date Code

FUNCTION TABLE

| Input S | Function |
|---------|----------|
| L | A = B0 |
| H | A = B1 |

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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Table 1. MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|----------------------|--|-------------------------------|------|
| V _{CC} | DC Supply Voltage | -0.5 to +5.5 | V |
| V _{IN} | Control Input Voltage (S Pin) | -0.5 to +5.5 | V |
| V _{IS} | Switch Input / Output Voltage (A, BO, B1 Pins) | -0.5 to V _{CC} + 0.5 | V |
| I _{IK} | Control DC Input Diode Current (S Pin) V_{IN} < GND | -50 | mA |
| I _{OK} | Switch I/O Port DC Diode Current (A, BO, B1 Pins) V_{I/O} < GND or V_{I/O} > V_{CC} | ±50 | mA |
| I _O | On-State Switch Current | ±128 | mA |
| | Continuous Current Through V _{CC} or GND | ±150 | mA |
| I _{CC} | DC Supply Current per Supply Pin | ±150 | mA |
| I _{GND} | DC Ground Current per Ground Pin | ±150 | mA |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C |
| T _L | Lead Temperature, 1 mm from Case for 10 Seconds | 260 | °C |
| T _J | Junction Temperature Under Bias | 150 | °C |
| θ _{JA} | Thermal Resistance (Note 1) | 407 | °C/W |
| P _D | Power Dissipation in Still Air at 85°C (Note 1) | 1.5 | mW |
| MSL | Moisture Sensitivity | Level 1 | |
| F _R | Flammability Rating Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in | |
| V _{ESD} | ESD Withstand Voltage Human Body Mode (Note 2) Machine Mode (Note 3) Charged Device Mode (Note 4) | >8000 >300 >2000 | V |
| I _{LATCHUP} | Latchup Performance Above V _{CC} and Below GND at 85°C (Note 5) | ±100 | mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow.
2. Tested to EIA/ JESD22-A114-A
3. Tested to EIA/ JESD22-A115-A
4. Tested to JESD22-C101-A
5. Tested to EIA / JESD78

Table 2. RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|-----------------|--|------|-----------------|------|
| V _{CC} | Positive DC Supply Voltage | 1.65 | 4.5 | V |
| V _I | Control Input Voltage (S Pin) | 0 | 4.5 | V |
| V _{IS} | Switch Input / Output Voltage (A, BO, B1 Pins) | 0 | V _{CC} | V |
| T _A | Operating Free-Air Temperature | -40 | +85 | °C |
| Δt / ΔV | Input Transition Rise or Fall Rate Control Input Switch I/O | 0 | 5 | ns/V |
| | | 0 | DC | |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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Table 3. DC ELECTRICAL CHARACTERISTICS (Typical: T = 25°C, V_{CC} = 3.3 V)

| Symbol | Parameter | Test Conditions | V _{CC} (V) | -40°C to +85°C | | | Unit |
|--|--------------------------------|--|---------------------------|------------------------------|-----|---------------------------|------|
| | | | | Min | Typ | Max | |
| V _{IH} | Control Input, HIGH Voltage | | 1.65 2.7 3.3 4.2 | 0.75 1.25 1.52 1.94 | | | V |
| V _{IL} | Control Input, LOW Voltage | | 1.65 2.7 3.3 4.2 | | | 0.25 0.4 0.4 0.5 | V |
| I _{IN} | Control Input, Leakage Current | 0 ≤ V _{IS} ≤ V _{CC} | 1.65 – 4.5 | | | ±1.0 | μA |
| I _{CC} | Quiescent Supply Current | V _{IS} = V _{CC} or GND; I _D = 0 A | 1.65 – 4.5 | | | 1.0 | μA |
| I _{NC (OFF)} I _{NO (OFF)} | NC or NO Leakage Current | V _{IS} = 1.65 V to 4.5 V | 4.5 | | ±10 | ±100 | nA |
| I _{COM (ON)} | COM ON Leakage Current | V _{IS} = 1.65 V to 4.5 V | 4.5 | | ±10 | ±100 | nA |

ON RESISTANCE (Typical: T = 25°C)

| | | | | | | | |
|-------------------|------------------------|--|---------------------------|--|----------------------------|------------------------------|---|
| R _{ON} | Peak On-Resistance | I _{ON} = 8 mA V _{IS} = 0 V to V _{CC} | 1.65 2.7 3.3 4.2 | | 15.4 10.8 9.5 8.5 | 23.2 12.4 11.0 9.9 | Ω |
| R _{FLAT} | On-Resistance Flatness | I _{ON} = 8 mA V _{IS} = 0 V to V _{CC} | 1.65 2.7 3.3 4.2 | | 5.5 2.9 2.7 2.8 | 10.2 3.3 3.3 3.3 | Ω |
| ΔR _{ON} | Delta On-Resistance | I _{ON} = 8 mA V _{IS} = 0 V to V _{CC} | 1.65 2.7 3.3 4.2 | | 0.3 0.3 0.3 0.3 | 0.35 0.35 0.35 0.35 | Ω |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Table 4. AC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | V _{CC} (V) | -40°C to +85°C | | | Unit |
|--------|-----------|-----------------|---------------------|----------------|-----|-----|------|
| | | | | Min | Typ | Max | |

TIMING/FREQUENCY (Typical: T = 25°C, V_{CC} = 3.3 V, R_L = 50 Ω, C_L = 35 pF, f = 1 MHz)

| | | | | | | | |
|------------------|---------------------------------------|-----------------------|------------|-----|------|------|-----|
| t _{PD} | Propagation Delay, A to Bn or Bn to A | (See Figures 4 and 5) | 1.65 – 4.5 | | | 0.25 | ns |
| t _{ON} | Turn-ON Time | (See Figures 7 and 8) | 1.65 – 4.5 | 3.1 | 13.0 | 30.0 | ns |
| t _{OFF} | Turn-OFF Time | (See Figures 7 and 8) | 1.65 – 4.5 | 3.4 | 12.0 | 25.0 | ns |
| T _{BBM} | Break-Before-Make Time | (See Figure 6) | 1.65 – 4.5 | 2.0 | | | ns |
| BW | -3 dB Bandwidth | C _L = 5 pF | 1.65 – 4.5 | | 1000 | | MHz |

ISOLATION (Typical: T = 25°C, V_{CC} = 3.3 V, R_L = 50 Ω, C_L = 5 pF)

| | | | | | | | |
|-------------------|--------------------------------|----------------------------|------------|--|-----|--|----|
| O _{IRR} | OFF-Isolation | f = 240 MHz (See Figure 9) | 1.65 – 4.5 | | -21 | | dB |
| X _{TALK} | Non-Adjacent Channel Crosstalk | f = 240 MHz | 1.65 – 4.5 | | -21 | | dB |

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Table 4. AC ELECTRICAL CHARACTERISTICS

CAPACITANCE (Typical: T = 25°C)

| | | | | | |
|-----------|-------------------------------|---|-----|--|----|
| C_{IN} | Control Pin Input Capacitance | $V_{CC} = 0\text{ V}$, $f = 1\text{ MHz}$ | 1.5 | | pF |
| | | $V_{CC} = 0\text{ V}$, $f = 10\text{ MHz}$ | 1.0 | | |
| C_{ON} | ON Capacitance | $V_{CC} = 3.3\text{ V}$; $OE = 0\text{ V}$, $S = 0\text{ V}$ or 3.3 V , $f = 1\text{ MHz}$ | 7.5 | | |
| | | $V_{CC} = 3.3\text{ V}$; $OE = 0\text{ V}$, $S = 0\text{ V}$ or 3.3 V , $f = 10\text{ MHz}$ | 6.5 | | |
| C_{OFF} | OFF Capacitance | $V_{CC} = V_{IS} = 3.3\text{ V}$; $OE = 0\text{ V}$, $S = 3.3\text{ V}$ or 0 V , $f = 1\text{ MHz}$ | 3.8 | | |
| | | $V_{CC} = V_{IS} = 3.3\text{ V}$; $OE = 0\text{ V}$, $S = 3.3\text{ V}$ or 0 V , $f = 10\text{ MHz}$ | 2.0 | | |

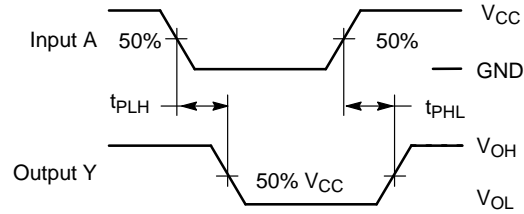
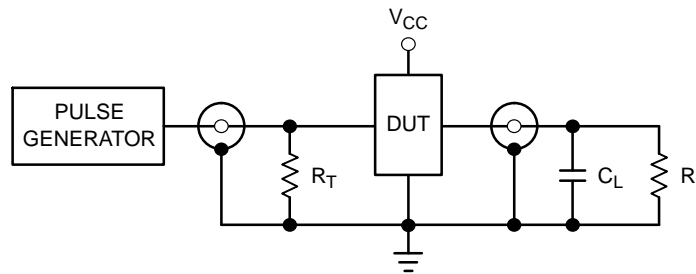


Figure 4. Propagation Delay Waveforms



$R_T = Z_{OUT}$ of pulse generator (typically $50\ \Omega$)

Figure 5. Propagation Delay Test Circuit

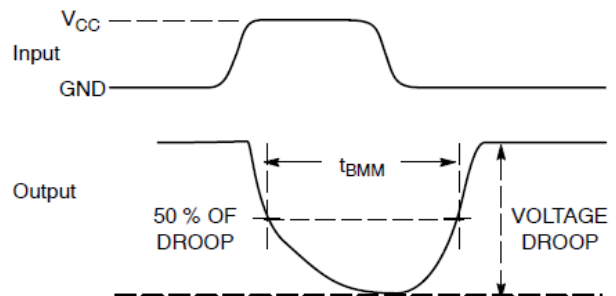
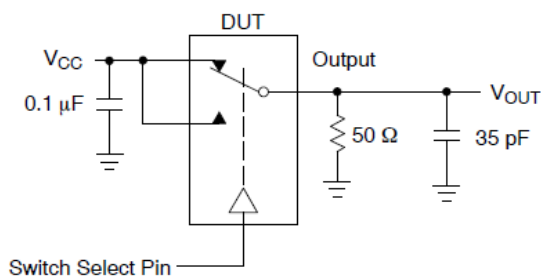


Figure 6. t_{BMM} (Time Break-Before-Make)

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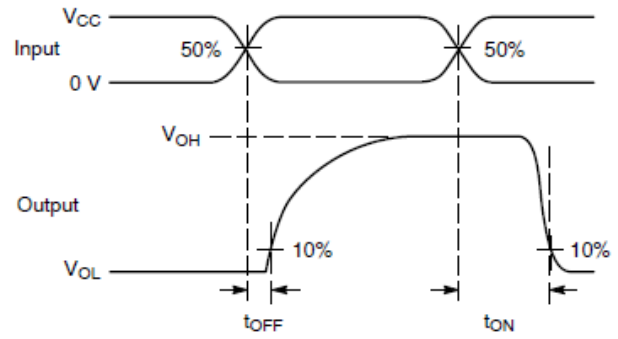
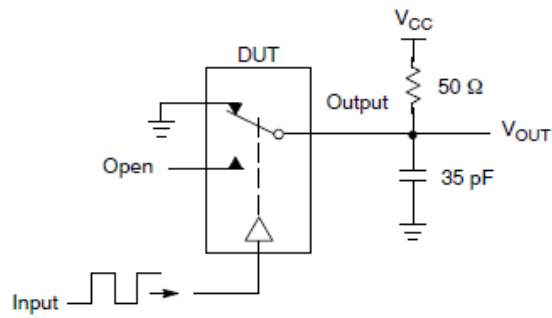


Figure 7. t_{ON} / t_{OFF}

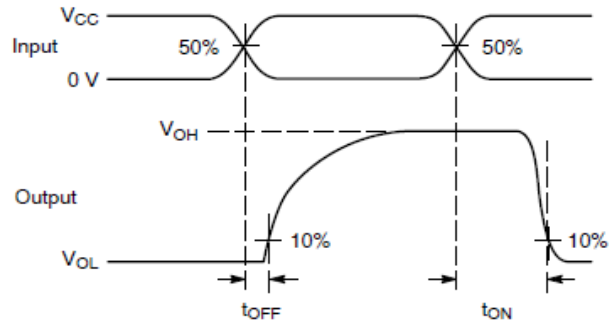
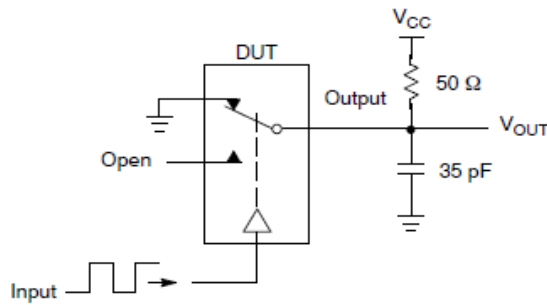
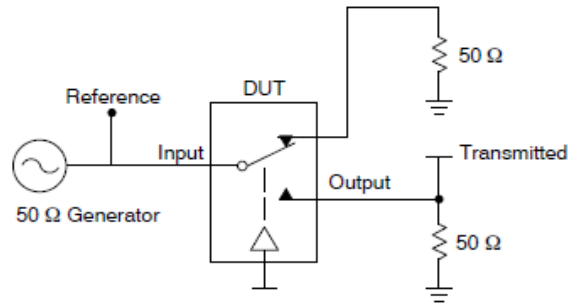


Figure 8. t_{ON} / t_{OFF}



Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch. V_{ISO} , Bandwidth and V_{ONL} are independent of the input signal direction.

$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left(\frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left(\frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

Bandwidth (BW) = the frequency 3 dB below V_{ONL}

V_{CT} = Use V_{ISO} setup and test to all other switch analog input/outputs terminated with 50 Ω

Figure 9. Off Channel Isolation / On Channel Loss (BW)/Crosstalk (On Channel to Off Channel) / V_{ONL}

ORDERING INFORMATION

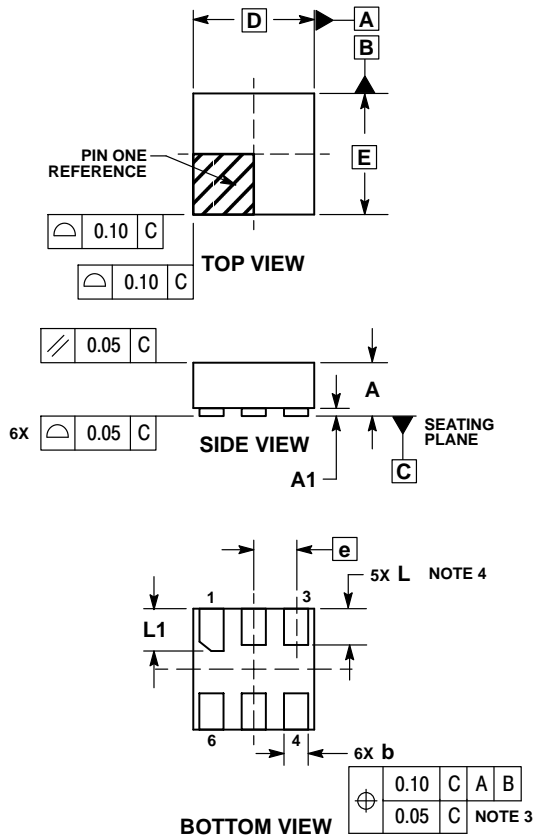
| Device | Package | Shipping† |
|-----------------|-------------------------------------|--------------------|
| NLAS3157MX3TCG | ULLGA6 – 1.0 x 1.0, 0.35P (Pb-Free) | 3000 / Tape & Reel |
| NLAS3257CMX2TCG | XLLGA6 – 1.0 x 1.0, 0.35P (Pb-Free) | 3000 / Tape & Reel |
| NLAS3257CMX3TCG | | |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

ULLGA6 1.0x1.0, 0.35P
CASE 613AD
ISSUE A

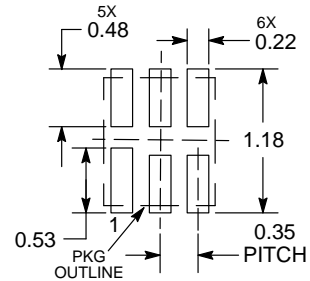


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| MILLIMETERS | | |
|-------------|----------|------|
| DIM | MIN | MAX |
| A | — | 0.40 |
| A1 | 0.00 | 0.05 |
| b | 0.12 | 0.22 |
| D | 1.00 BSC | |
| E | 1.00 BSC | |
| e | 0.35 BSC | |
| L | 0.25 | 0.35 |
| L1 | 0.30 | 0.40 |

**MOUNTING FOOTPRINT
SOLDERMASK DEFINED***



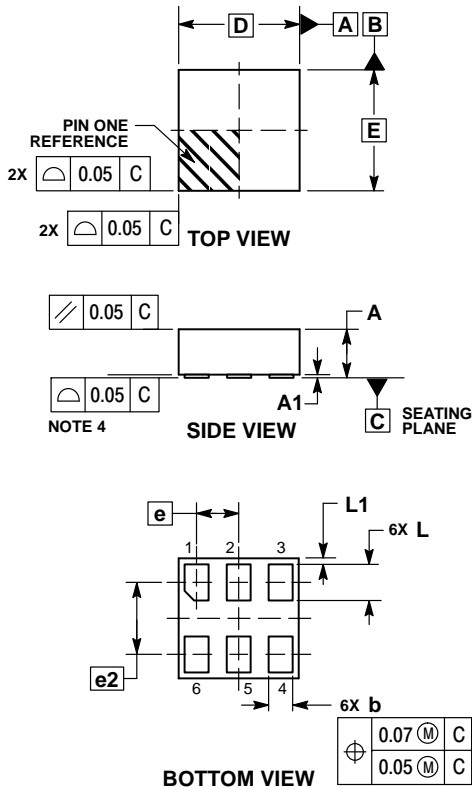
DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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PACKAGE DIMENSIONS

XLLGA6 1.0x1.0, 0.35P CASE 713AD ISSUE O

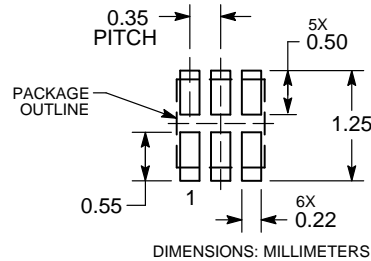


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO THE PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.25 MM FROM THE TERMINAL TIPS.
4. COPLANARITY APPLIES TO ALL OF THE TERMINALS.

| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | --- | 0.40 |
| A1 | 0.00 | 0.05 |
| b | 0.17 | 0.23 |
| D | 1.00 BSC | |
| E | 1.00 BSC | |
| e | 0.35 BSC | |
| e2 | 0.60 BSC | |
| L | 0.27 | 0.33 |
| L1 | 0.05 REF | |

RECOMMENDED SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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