

NCP51199, NCV51199

DDR 2-Amp Source / Sink V_{TT} Termination Regulator

The NCP/NCV51199 is a linear regulator designed to supply a regulated V_{TT} termination voltage for DDR-2 and DDR-3 memory applications. The regulator is capable of actively sourcing and sinking ± 2 A peak currents for DDR-2, and DDR-3 up to ± 1.5 A while regulating the V_{TT} output voltage to within ± 10 mV. The output termination voltage is regulated to track $V_{DDQ} / 2$ by two external voltage divider resistors connected to the PV_{CC} , GND, and V_{REF} pins.

The NCP/NCV51199 incorporates a high-speed differential amplifier to provide ultra-fast response to line and load transients. Other features include source/sink current limiting, soft-start and on-chip thermal shutdown protection.

Features

- Supports DDR-2 V_{TT} Termination to ± 2 A, DDR-3 to ± 1.5 A (peak)
- Stable with 10 μ F Ceramic Capacitance on V_{TT} Output
- Integrated Power MOSFETs
- High Accuracy V_{TT} Output at Full-Load
- Fast Transient Response
- Built-in Soft-Start
- Shutdown for Standby or Suspend Mode
- Integrated Thermal and Current-Limit Protection
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

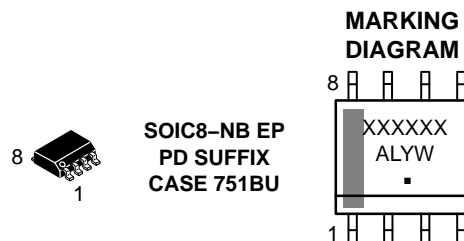
Typical Applications

- SDRAM Termination Voltage for DDR-2 / DDR-3
- Motherboard, Notebook, and VGA Card Memory Termination
- Set Top Box, Digital TV, Printers



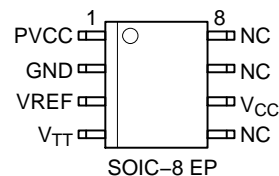
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XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
▪ = Pb-Free Package

PIN CONNECTION



ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

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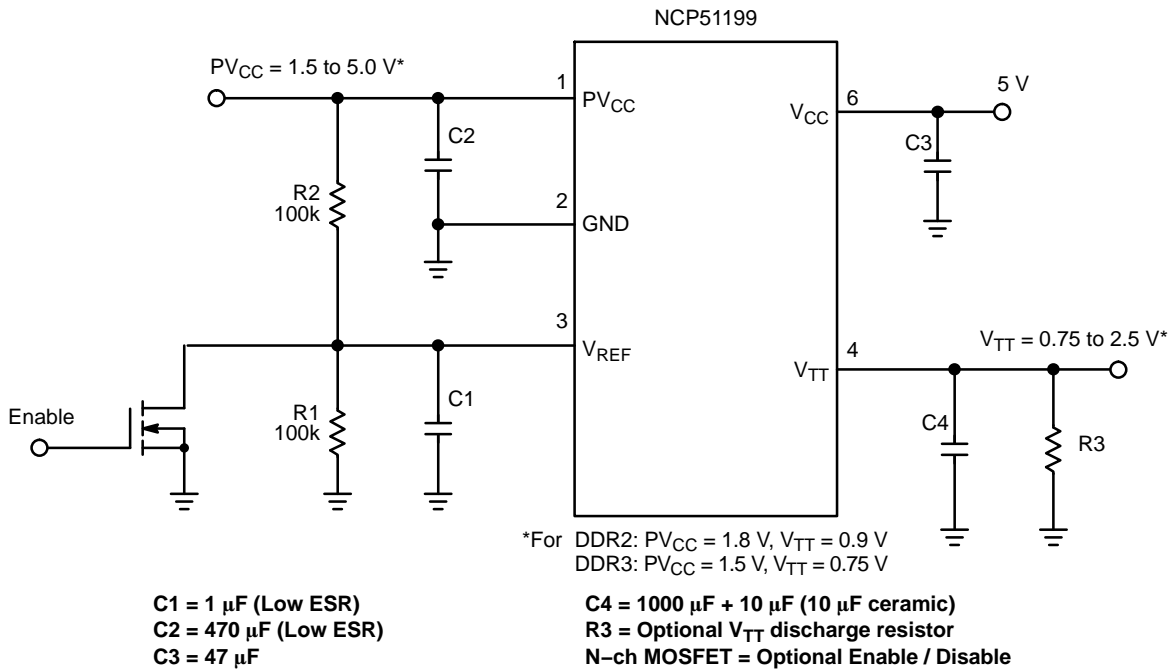


Figure 1. Application Diagram

PIN FUNCTION DESCRIPTION

| Pin No. | Pin Name | Description |
|---------|-------------|---|
| 1 | PV_{CC} | Input voltage which supplies current to the output pin. $C_{IN} = 470 \mu\text{F}$ with low ESR. |
| 2 | GND | Common Ground |
| 3 | V_{REF} | Buffered reference voltage input equal to $\frac{1}{2}$ of V_{DDQ} and active low shutdown pin. An external resistor divider dividing down the PV_{CC} voltage creates the regulated output voltage. Pulling the pin to ground (0.15 V maximum) turns the device off. |
| 4 | V_{TT} | Regulator output voltage capable of sourcing and sinking current while regulating the output rail. $C_{OUT} = 1000 \mu\text{F} + 10 \mu\text{F}$ ceramic with low ESR. |
| 5 | NC | True No Connect |
| 6 | V_{CC} | The V_{CC} pin is a 5 V input pin that provides internal bias to the controller. PV_{CC} should always be kept lower or equal to V_{CC} . |
| 7 | NC | True No Connect |
| 8 | NC | True No Connect |
| EP | Thermal Pad | Pad for thermal connection. The exposed pad must be connected to the ground plane using multiple vias for maximum power dissipation performance. |

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ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|-------------------|------------|------|
| Input Supply Voltage Range ($V_{CC} \geq PV_{CC}$) (Note 1) | PV_{CC}, V_{CC} | -0.3 to 6 | V |
| Output Voltage Range | V_{TT} | -0.3 to 6 | V |
| Reference Input Range | V_{REF} | -0.3 to 6 | V |
| Maximum Junction Temperature | $T_{J(max)}$ | 125 | °C |
| Storage Temperature Range | TSTG | -65 to 150 | °C |
| ESD Capability, Human Body Model (Note 2) | ESDHBM | 2 | kV |
| ESD Capability, Machine Model (Note 2) | ESDMM | 150 | V |
| Lead Temperature Soldering Reflow (SMD Styles Only), Pb-Free Versions (Note 3) | T_{SLD} | 260 | °C |

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. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. This device series incorporates ESD protection and is tested by the following methods:
ESD Human Body Model tested per AEC-Q100-002 (EIA/JESD22-A114)
ESD Machine Model tested per AEC-Q100-003 (EIA/JESD22-A115)
Latchup Current Maximum Rating: ≤ 150 mA per JEDEC standard: JESD78
3. For information, please refer to our Soldering and Mounting Techniques Reference Manual, SOLDERRM/D

THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|----------------------------------|----------|------|
| Thermal Characteristics, SO8-EP (Note 4) Thermal Resistance, Junction-to-Air (Note 5) Power Rating at 25°C Ambient = 1.19 W, derate 12 mW/°C Thermal Reference, Junction-to-Lead2 (Note 5) | $R_{\theta JA}$ $R_{\psi JL}$ | 84 20 | °C/W |

4. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
5. Values based on copper area of 645 mm² (or 1 in²) of 1 oz copper thickness and FR4 PCB substrate.

OPERATING RANGES (Note 6)

| Rating | Symbol | Min | Max | Unit |
|----------------------|-----------|------|------|------|
| Input Voltage | PV_{CC} | 1.5 | 5.5 | V |
| Bias Supply Voltage | V_{CC} | 4.75 | 5.25 | V |
| Ambient Temperature | T_A | -40 | 85 | °C |
| Junction Temperature | T_J | -40 | 125 | °C |

6. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

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ELECTRICAL CHARACTERISTICS

$PV_{CC} = 1.8\text{ V} / 1.5\text{ V}$; $V_{CC} = 5\text{ V}$; $V_{REF} = 0.9\text{ V} / 0.75\text{ V}$; $C_{OUT} = 10\text{ }\mu\text{F}$ (Ceramic); $T_A = +25^\circ\text{C}$, unless otherwise noted.

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|-----------|-----------------|--------|-----|-----|-----|------|
|-----------|-----------------|--------|-----|-----|-----|------|

REGULATOR OUTPUT

| | | | | | | |
|-----------------------|--|--------------|-----|---|-----|----|
| Output Offset Voltage | $I_{out} = 0\text{ A}$ | V_{OS} | -20 | - | +20 | mV |
| Load Regulation | $V_{REF} = 900\text{ mV}$, $I_{out} = \pm 1.8\text{ A}$, $PV_{CC} = 1.8\text{ V}$ $V_{REF} = 750\text{ mV}$, $I_{out} = \pm 1.4\text{ A}$, $PV_{CC} = 1.5\text{ V}$ | Reg_{load} | -10 | - | +10 | mV |

INPUT AND STANDBY CURRENTS

| | | | | | | |
|---------------------|---|------------|---|-----|-----|---------------|
| Bias Supply Current | $I_{out} = 0\text{ A}$ | I_{BIAS} | - | 0.8 | 2.5 | mA |
| Standby Current | $V_{REF} < 0.2\text{ V}$ (Shutdown), $R_{LOAD} = 180\Omega$ | I_{STB} | - | 1 | 90 | μA |

CURRENT LIMIT PROTECTION

| | | | | | | |
|---------------|--|-----------|-----|---|-----|---|
| Current Limit | $PV_{CC} = 1.8\text{ V}$, $V_{REF} = 0.9\text{ V}$ | I_{LIM} | 2.0 | - | 3.5 | A |
| | $PV_{CC} = 1.5\text{ V}$, $V_{REF} = 0.75\text{ V}$ | | 1.5 | - | 3.5 | |

SHUTDOWN THRESHOLDS

| | | | | | | |
|----------------------------|----------|----------|-----|---|------|---|
| Shutdown Threshold Voltage | Enable | V_{IH} | 0.6 | - | - | V |
| | Shutdown | V_{IL} | - | - | 0.15 | |

THERMAL SHUTDOWN

| | | | | | | |
|------------------------------|-----------------------|----------|-----|-----|-----|------------------|
| Thermal Shutdown Temperature | $V_{CC} = 5\text{ V}$ | T_{SD} | 160 | 168 | 176 | $^\circ\text{C}$ |
| Thermal Shutdown Hysteresis | $V_{CC} = 5\text{ V}$ | T_{SH} | 35 | 35 | 40 | $^\circ\text{C}$ |

TYPICAL CHARACTERISTICS

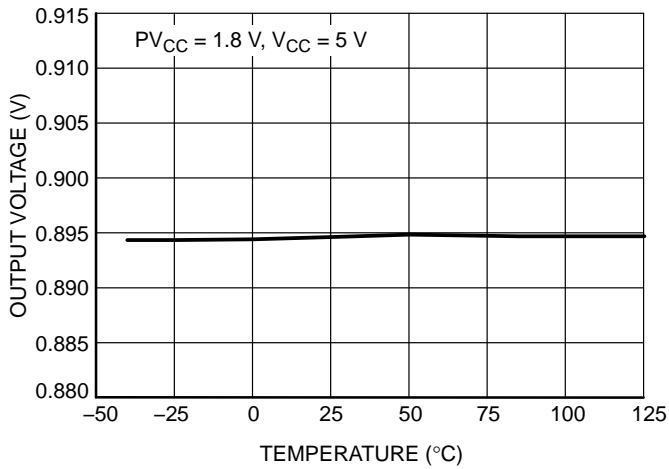


Figure 2. Output Voltage vs. Temperature

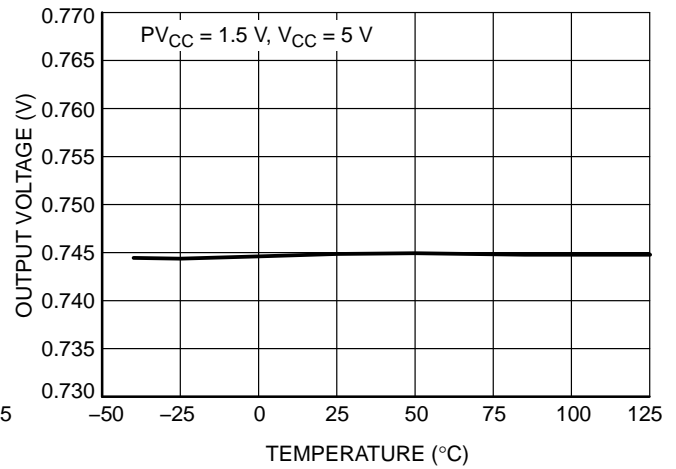


Figure 3. Output Voltage vs. Temperature

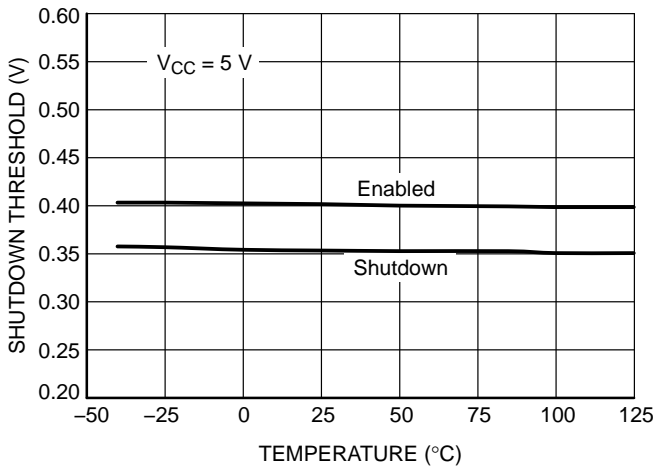


Figure 4. Shutdown Threshold vs. Temperature

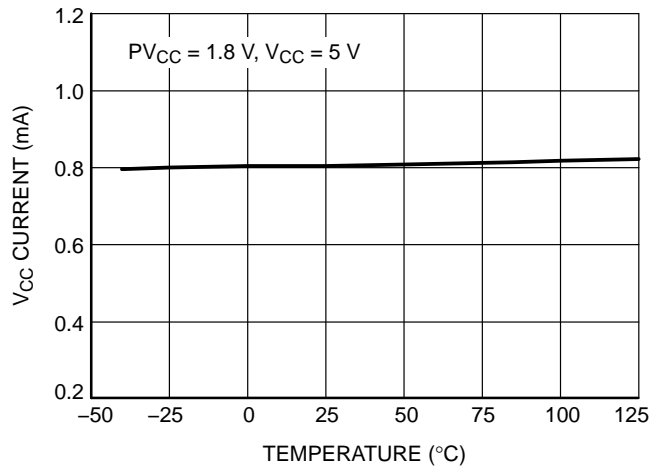


Figure 5. VCC Current vs. Temperature

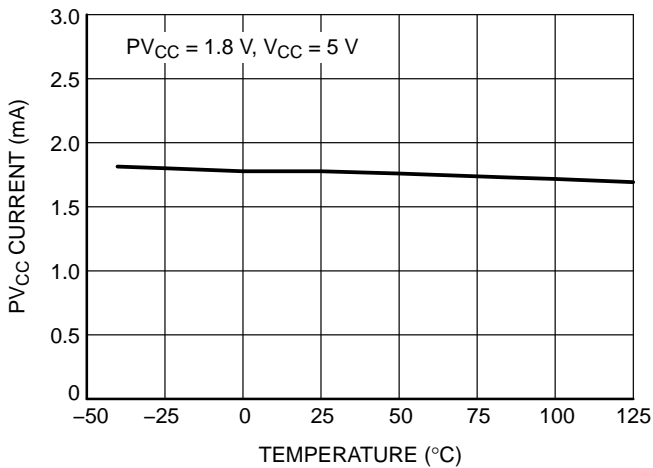


Figure 6. PVCC Current vs. Temperature

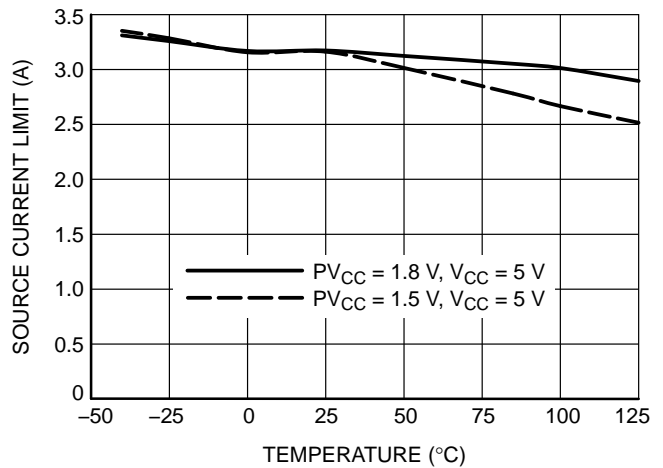


Figure 7. Source Current Limits vs. Temperature

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TYPICAL CHARACTERISTICS

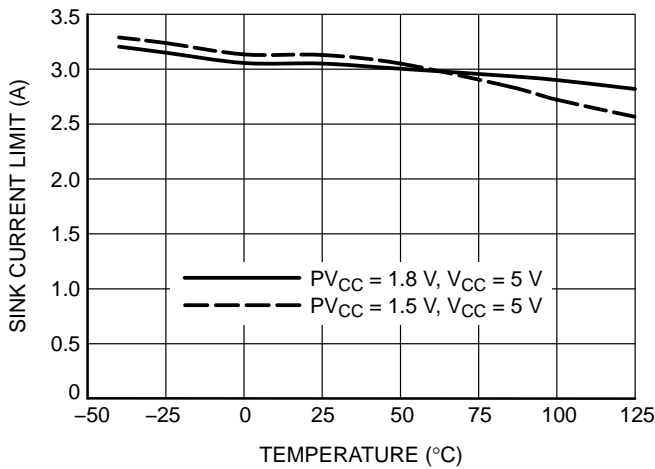


Figure 8. Sink Current Limits vs. Temperature

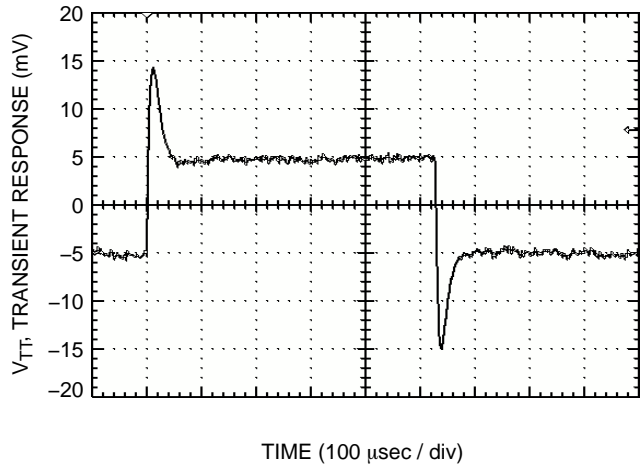


Figure 9. 1.25 V, ±1.6 A Transient Response

Table 1. ORDERING INFORMATION

| Device | Marking | Package | Shipping † |
|----------------|---------|---------------------|--------------------|
| NCP51199PDR2G | 51199 | SOIC-8 (Pb-Free) | 2500 / Tape & Reel |
| NCV51199PDR2G* | V51199 | | |

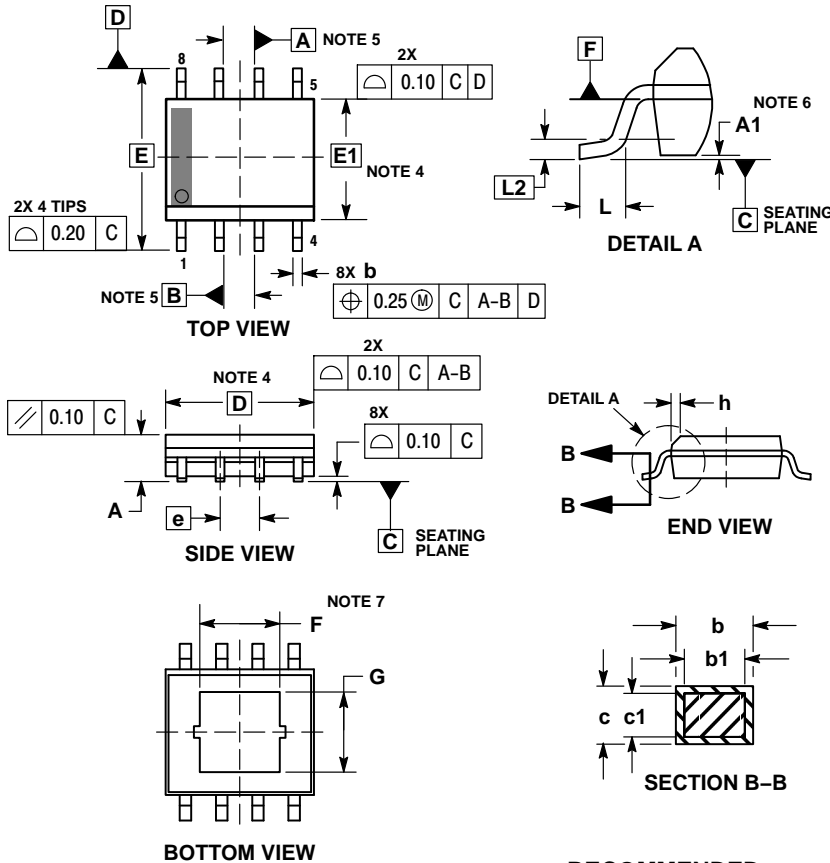
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

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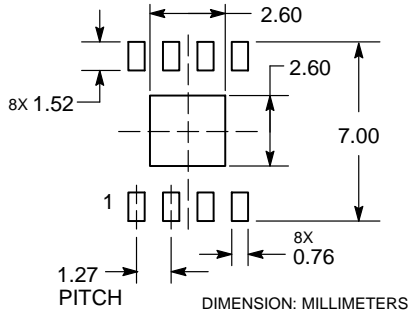
PACKAGE DIMENSIONS

SOIC8-NB EP CASE 751BU ISSUE E




| DIM | MILLIMETERS | |
|-----|-------------|------|
| | MIN | MAX |
| A | 1.35 | 1.75 |
| A1 | 0.00 | 0.10 |
| b | 0.31 | 0.51 |
| b1 | 0.28 | 0.48 |
| c | 0.17 | 0.25 |
| c1 | 0.17 | 0.23 |
| D | 4.90 BSC | |
| E | 6.00 BSC | |
| E1 | 3.90 BSC | |
| e | 1.27 BSC | |
| F | 1.55 | 2.39 |
| G | 1.55 | 2.39 |
| h | 0.25 | 0.50 |
| L | 0.40 | 1.27 |
| L2 | 0.25 BSC | |

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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