

# NCP51145

## Product Preview

### DDR 1.8 Amp Source / Sink V<sub>TT</sub> Termination Regulator

The NCP51145 is a linear regulator designed to supply a regulated V<sub>TT</sub> termination voltage for DDR-II, DDR-III, LPDDR-III and DDR-IV memory applications. The regulator is capable of actively sourcing and sinking  $\pm 1.8$  A peak currents while regulating an output voltage to within  $\pm 20$  mV. The output termination voltage is regulated to track V<sub>DDQ</sub> / 2 by two external voltage divider resistors connected to the PV<sub>CC</sub>, GND, and V<sub>REF</sub> pins.

The NCP51145 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

- For DDR V<sub>TT</sub> Applications, Source/Sink Currents:
- Supports DDR-II to  $\pm 1.8$  A, DDR-III to  $\pm 1.5$  A
- Supports LPDDR-III and DDR-IV to  $\pm 1.2$  A
- Stable Using Ceramic-Only (Very Low ESR) Capacitors
- Integrated Power MOSFETs
- High Accuracy V<sub>TT</sub> Output at Full-Load
- Fast Transient Response
- Built-in Soft-Start
- Shutdown for Standby or Suspend Mode
- Integrated Thermal and Current-Limit Protection
- NCP51145MWTAG – Wettable Flank Option for Enhanced Optical Inspection
- These Devices are Pb-Free and are RoHS Compliant

#### Typical Applications

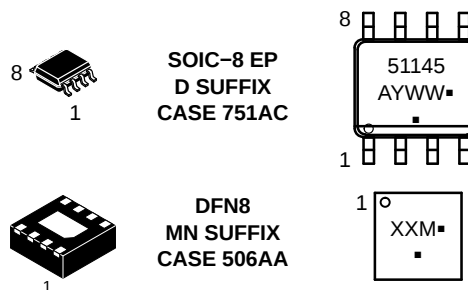
- DDR-II / DR-III / DDR-IV SDRAM Termination Voltage
- Motherboard, Notebook, and VGA Card Memory Termination
- Set Top Box, Digital TV, Printers
- Low Power DDR-3LP



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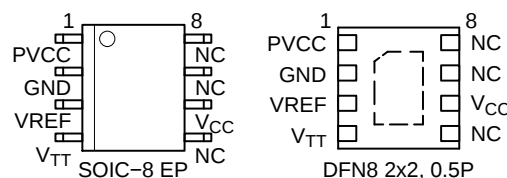
#### MARKING DIAGRAMS



51145 = Specific Device Code  
XX = Specific Device Code  
M = Date Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### PIN CONNECTIONS



(Top Views)

#### ORDERING INFORMATION

| Device        | Package             | Shipping <sup>†</sup> |
|---------------|---------------------|-----------------------|
| NCP51145PDR2G | SOIC-8<br>(Pb-Free) | 2500 / Tape &<br>Reel |
| NCP51145MNTAG | DFN-8<br>(Pb-Free)  | 3000 / Tape &<br>Reel |
| NCP51145MWTAG | DFN-8<br>(Pb-Free)  | 3000 / Tape &<br>Reel |

<sup>†</sup>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.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

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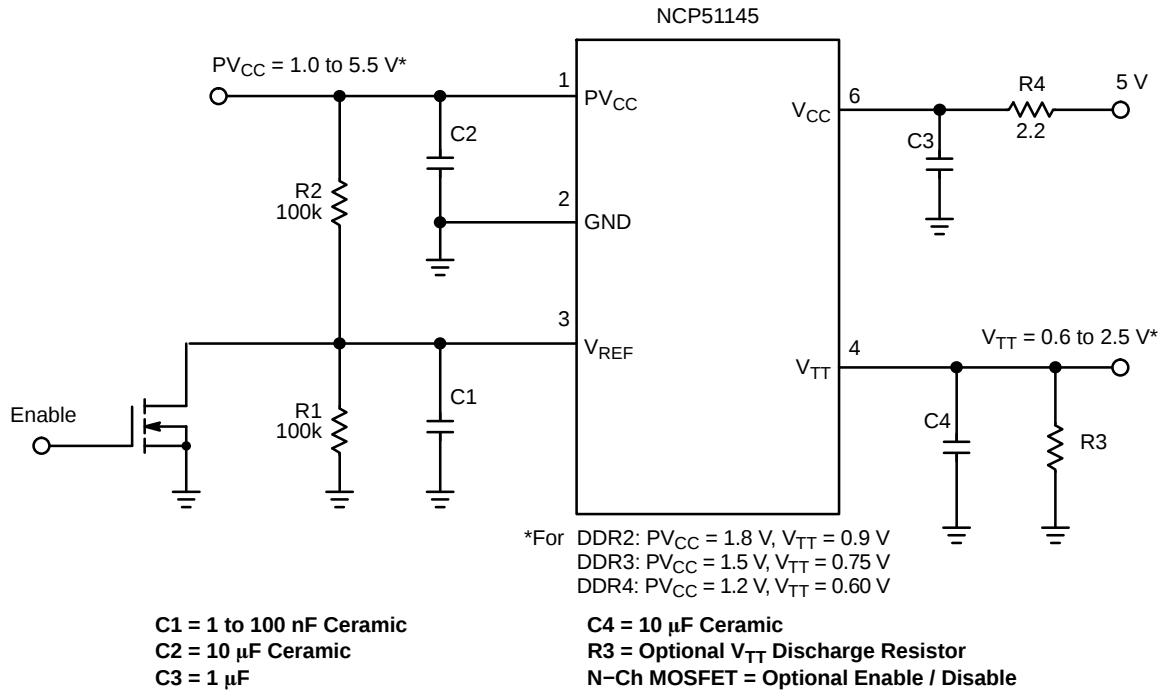


Figure 1. Application Diagram

## PIN FUNCTION DESCRIPTION

| Pin No.<br>SO8-EP | Pin Name    | Description                                                                                                                                                                                                                                                               |
|-------------------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                 | $PV_{CC}$   | Input voltage which supplies current to the output pin. $C_{IN} = 470 \mu F$ 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. $C_{OUT} = 10 \mu F$ Ceramic                                                                                                                                           |
| 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                                                      | $T_{J(max)}$      | 150        | °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             | 200        | V    |
| Lead Temperature Soldering<br>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:  $\leq 150$  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)<br>Thermal Resistance, Junction-to-Air (Note 5)<br>Thermal Reference, Junction-to-Lead2 (Note 5) | $R_{\theta JA}$<br>$R_{\psi JL}$ | 82<br>TBD | °C/W |

4. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
5. Values based on copper area of 645 mm<sup>2</sup> (or 1 in<sup>2</sup>) of 1 oz copper thickness and FR4 PCB substrate.

## OPERATING RANGES (Note 6)

| Rating              | Symbol    | Min  | Max  | Unit |
|---------------------|-----------|------|------|------|
| Input Voltage       | $PV_{CC}$ | 1.0  | 5.5  | V    |
| Bias Supply Voltage | $V_{CC}$  | 4.75 | 5.25 | V    |
| Ambient Temperature | $T_A$     | -40  | 85   | °C   |

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.

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

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## ELECTRICAL CHARACTERISTICS

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

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

### REGULATOR OUTPUT

|                       |                                                                                       |              |     |   |     |    |
|-----------------------|---------------------------------------------------------------------------------------|--------------|-----|---|-----|----|
| Output Offset Voltage | $I_{out} = 0\text{ A}$                                                                | $V_{OS}$     | -16 | - | +16 | mV |
| Load Regulation       | $I_{out} = \pm 1.8\text{ A}$ , $PV_{CC} = 1.8\text{ V}$ , $V_{REF} = 0.9\text{ V}$    | $Reg_{load}$ | -4  | - | +4  | mV |
|                       | $I_{out} = \pm 1.5\text{ A}$ , $PV_{CC} = 1.5\text{ V}$ , $V_{REF} = 0.75\text{ V}$   |              |     |   |     |    |
|                       | $I_{out} = \pm 1.2\text{ A}$ , $PV_{CC} = 1.35\text{ V}$ , $V_{REF} = 0.675\text{ V}$ |              |     |   |     |    |
|                       | $I_{out} = \pm 1.2\text{ A}$ , $PV_{CC} = 1.2\text{ V}$ , $V_{REF} = 0.6\text{ V}$    |              |     |   |     |    |

### INPUT AND STANDBY CURRENTS

|                     |                                                             |            |   |   |     |               |
|---------------------|-------------------------------------------------------------|------------|---|---|-----|---------------|
| Bias Supply Current | $I_{out} = 0\text{ A}$                                      | $I_{BIAS}$ | - | 1 | 2.5 | mA            |
| Standby Current     | $V_{REF} < 0.2\text{ V}$ (Shutdown), $R_{LOAD} = 180\Omega$ | $I_{STB}$  | - | 2 | 90  | $\mu\text{A}$ |

### CURRENT LIMIT PROTECTION

|               |                                                      |           |     |   |     |   |
|---------------|------------------------------------------------------|-----------|-----|---|-----|---|
| Current Limit | $PV_{CC} = 1.8\text{ V}$ , $V_{REF} = 0.9\text{ V}$  | $I_{LIM}$ | 2   | - | 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   | $V_{IH}$ | 0.45 | - | -    | V |
|                            | Shutdown | $V_{IL}$ | -    | - | 0.15 |   |

### THERMAL SHUTDOWN

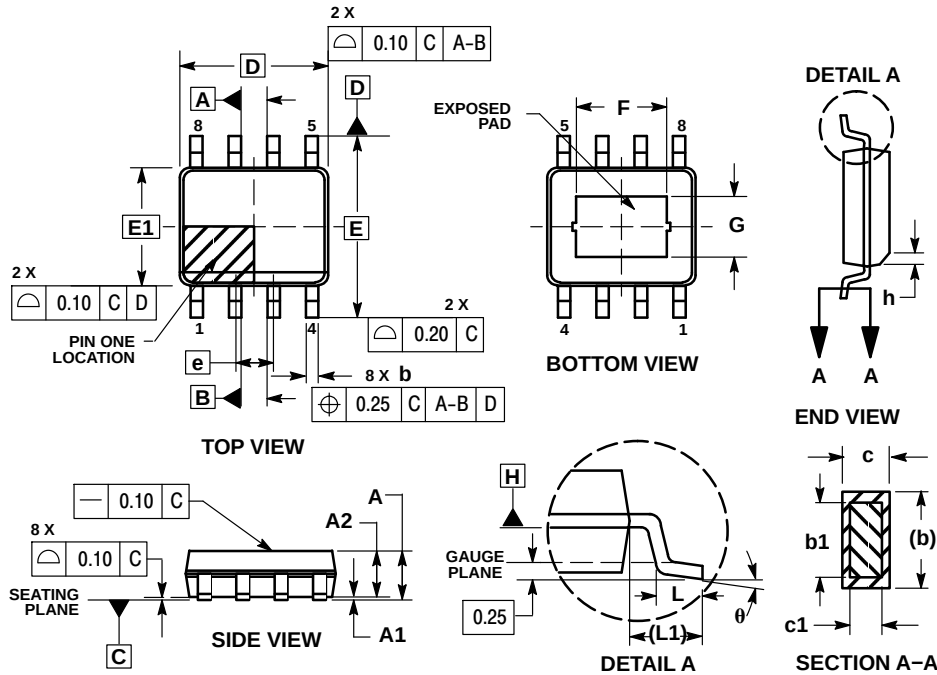
|                              |                       |          |   |     |   |                  |
|------------------------------|-----------------------|----------|---|-----|---|------------------|
| Thermal Shutdown Temperature | $V_{CC} = 5\text{ V}$ | $T_{SD}$ | - | 125 | - | $^\circ\text{C}$ |
| Thermal Shutdown Hysteresis  | $V_{CC} = 5\text{ V}$ | $T_{SH}$ | - | 35  | - | $^\circ\text{C}$ |

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.

# NCP51145

## PACKAGE DIMENSIONS

### SOIC-8 EP CASE 751AC ISSUE B

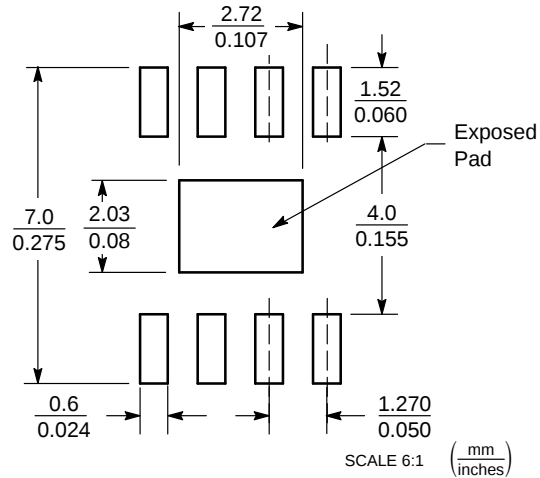


#### NOTES:

1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS IN MILLIMETERS (ANGLES IN DEGREES).
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION.
4. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 1.35        | 1.75 |
| A1  | 0.00        | 0.10 |
| A2  | 1.35        | 1.65 |
| 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    |      |
| L   | 0.40        | 1.27 |
| L1  | 1.04 REF    |      |
| F   | 2.24        | 3.20 |
| G   | 1.55        | 2.51 |
| h   | 0.25        | 0.50 |
| θ   | 0°          | 8°   |

### SOLDERING FOOTPRINT\*

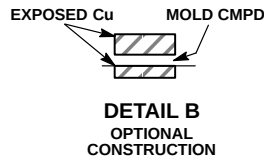
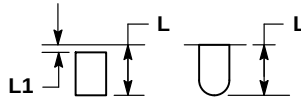
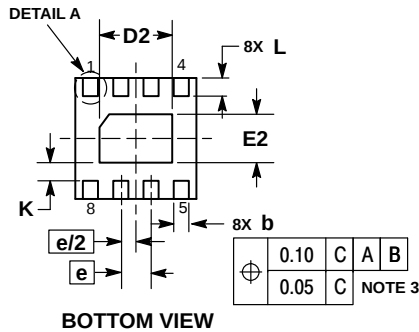
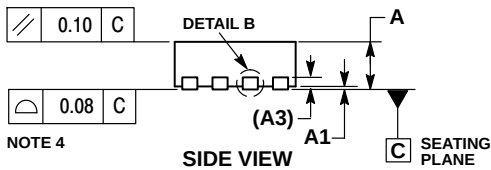
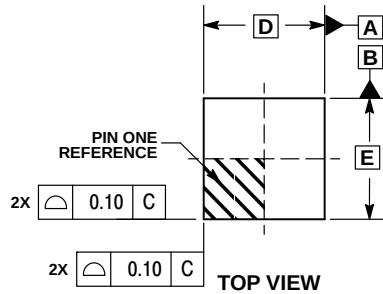


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NCP51145

## PACKAGE DIMENSIONS

DFN8 2x2, 0.5P  
CASE 506AA  
ISSUE E

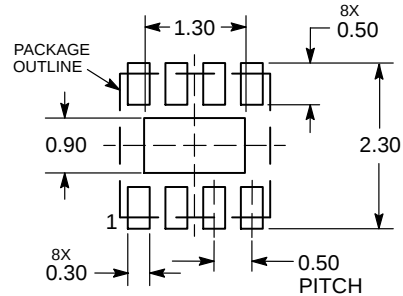


### NOTES:

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 0.20 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.80        | 1.00 |
| A1  | 0.00        | 0.05 |
| A3  | 0.20        | REF  |
| b   | 0.20        | 0.30 |
| D   | 2.00        | BSC  |
| D2  | 1.10        | 1.30 |
| E   | 2.00        | BSC  |
| E2  | 0.70        | 0.90 |
| e   | 0.50        | BSC  |
| K   | 0.30        | REF  |
| L   | 0.25        | 0.35 |
| L1  | ---         | 0.10 |

### RECOMMENDED SOLDERING FOOTPRINT\*



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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