

# NCP51145

## 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 ±1.8 A peak currents while regulating an output voltage to within ±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 ±1.8 A, DDR-III to ±1.5 A
- Supports LPDDR-III and DDR-IV to ±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
- V<sub>TT</sub> Remote Sense Available in the DFN8 2x2mm Package
- These Devices are Pb-Free and are RoHS Compliant

### Typical Applications

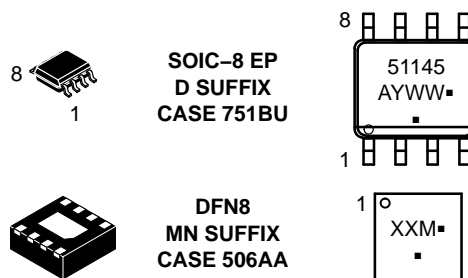
- DDR-II / DR-III / DDR-IV SDRAM Termination Voltage
- Motherboard, Notebook, and VGA Card Memory Termination
- Set Top Box, Digital TV, Printers
- Low Power DDR-3LP



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

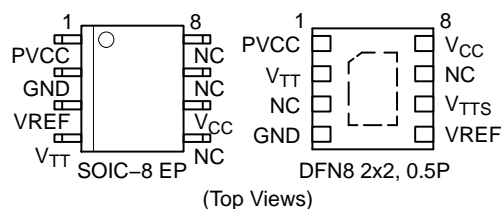
### MARKING DIAGRAMS



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



### ORDERING INFORMATION

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

# NCP51145

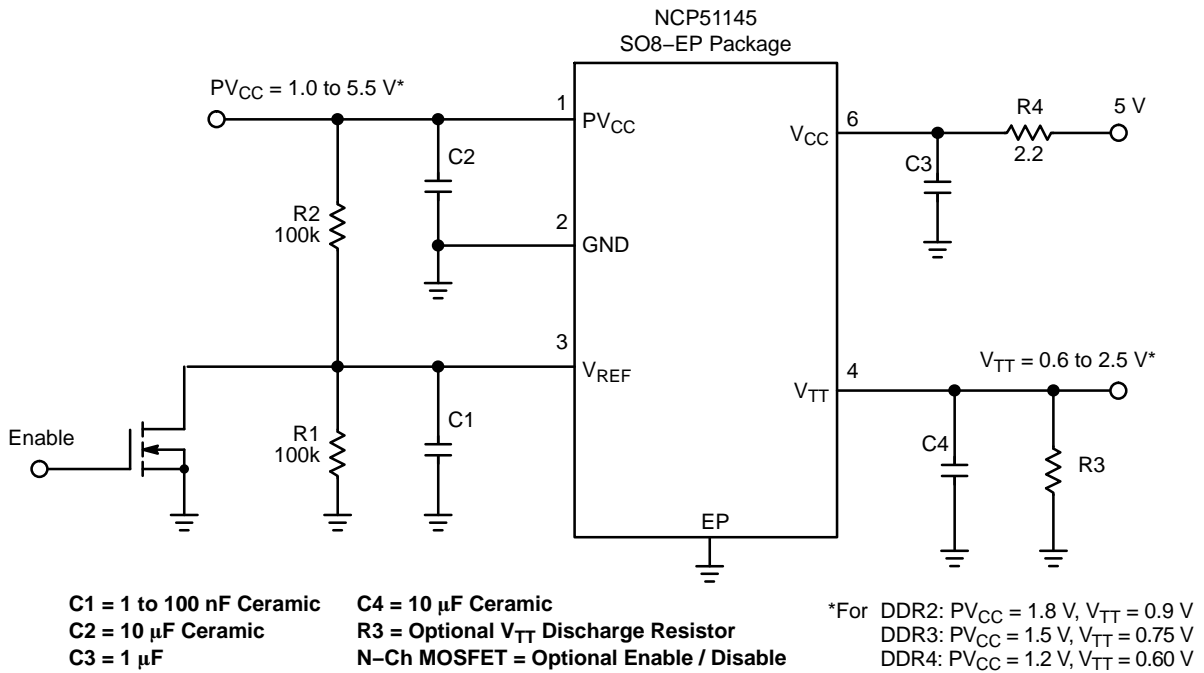


Figure 1. Application Diagram

## PIN FUNCTION DESCRIPTION

Pin No. SO8-EP	Pin No. DFN8	Pin Name	Description
1	1	PV <sub>CC</sub>	Input voltage which supplies current to the output pin. $C_{IN} \cong \frac{1}{2} \cdot C_{OUT}$
2	4	GND	Common Ground
3	5	V <sub>REF</sub>	Buffered reference voltage input equal to $\frac{1}{2}$ of V <sub>DDQ</sub> and active low shutdown pin. An external resistor divider dividing down the PV <sub>CC</sub> voltage creates the regulated output voltage. Pulling the pin to ground (0.15 V maximum) turns the device off.
4	2	V <sub>TT</sub>	Regulator output voltage capable of sourcing and sinking current while regulating the output rail. C <sub>OUT</sub> = 10 μF Ceramic, or greater
5, 7, 8	3, 7	NC	True No Connect
6	8	V <sub>CC</sub>	The V <sub>CC</sub> pin is a 5 V input pin that provides internal bias to the controller. PV <sub>CC</sub> should always be kept lower or equal to V <sub>CC</sub> .
-	6	V <sub>TTS</sub>	V <sub>TT</sub> Sense
EP	EP	EPAD	Pad for thermal connection. The exposed pad must be connected to the ground plane using multiple vias for maximum power dissipation performance.

# NCP51145

## 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 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) Thermal Resistance, Junction-to-Air (Note 5) Thermal Reference, Junction-to-Lead2 (Note 5)	$R_{\theta JA}$ $R_{\psi JL}$	82 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.

# NCP51145

## 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

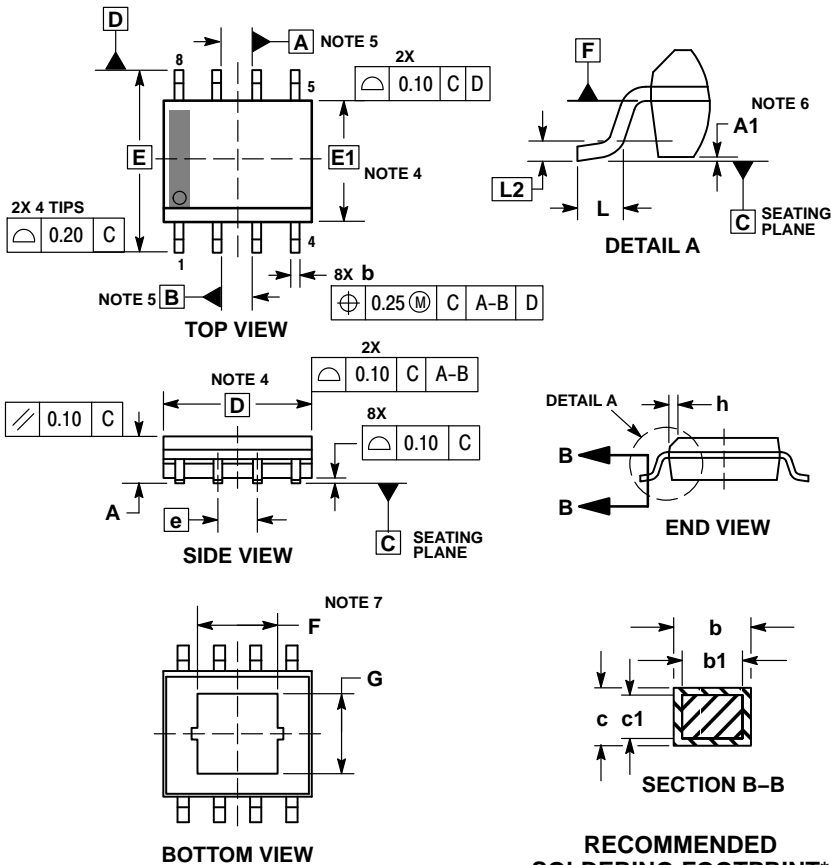
Thermal Shutdown Temperature	$V_{CC} = 5\text{ V}$	$T_{SD}$	-	125	-	$^\circ\text{C}$
Thermal Shutdown Hysteresis	$V_{CC} = 5\text{ V}$	$T_{SH}$	-	35	-	$^\circ\text{C}$

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

### SOIC8-NB EP CASE 751BU ISSUE E

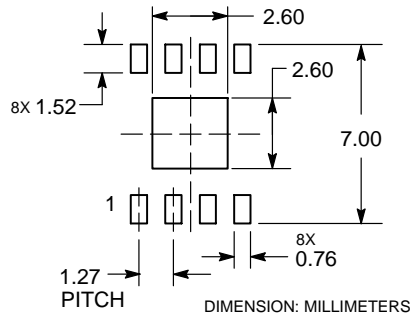


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.10mm IN EXCESS OF MAXIMUM MATERIAL CONDITION.
4. DIMENSION D DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE. DIMENSION E DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25mm PER SIDE. DIMENSIONS D AND E ARE DETERMINED AT DATUM F.
5. DIMENSIONS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
7. TAB CONTOUR MAY VARY MINIMALLY TO INCLUDE TOOLING FEATURES.

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\*

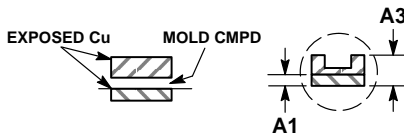
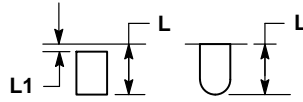
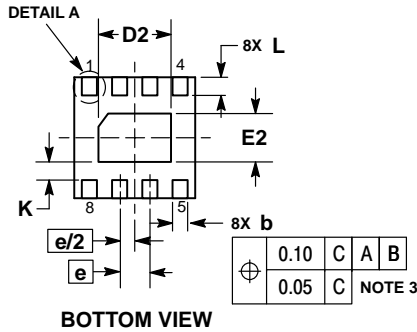
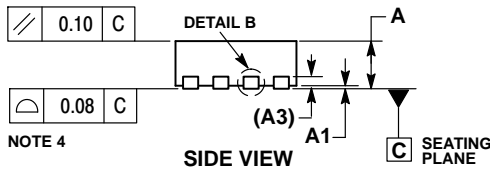
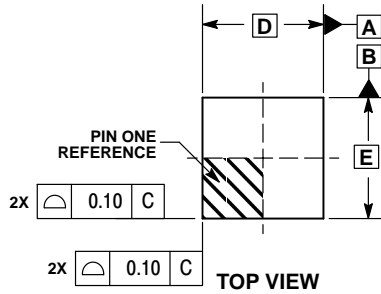


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NCP51145

## PACKAGE DIMENSIONS

DFN8 2x2, 0.5P  
CASE 506AA  
ISSUE F

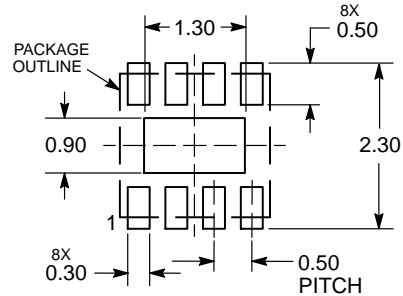


**NOTES:**

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.

MILLIMETERS		
DIM	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.

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative