

# LP2997

## DDR-II Termination Regulator

### General Description

The LP2997 linear regulator is designed to meet the JEDEC SSTL-18 specifications for termination of DDR-II memory. The device contains a high-speed operational amplifier to provide excellent response to load transients. The output stage prevents shoot through while delivering 500mA continuous current and transient peaks up to 900mA in the application as required for DDR-II SDRAM termination. The LP2997 also incorporates a  $V_{SENSE}$  pin to provide superior load regulation and a  $V_{REF}$  output as a reference for the chipset and DIMMs.

An additional feature found on the LP2997 is an active low shutdown ( $\overline{SD}$ ) pin that provides Suspend To RAM (STR) functionality. When  $\overline{SD}$  is pulled low the  $V_{TT}$  output will tri-state providing a high impedance output, but,  $V_{REF}$  will remain active. A power savings advantage can be obtained in this mode through lower quiescent current.

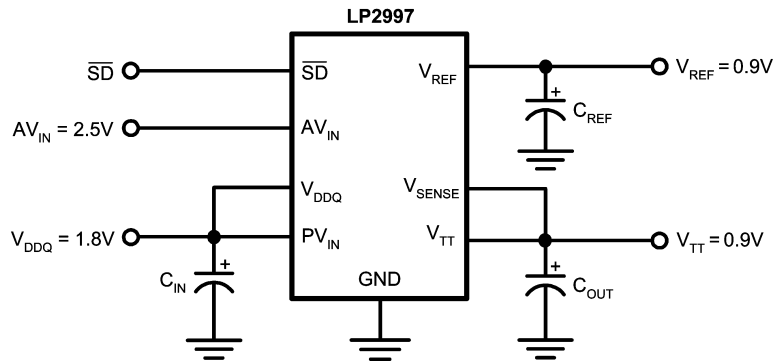
### Features

- Source and sink current
- Low output voltage offset
- No external resistors required
- Linear topology
- Suspend to Ram (STR) functionality
- Low external component count
- Thermal Shutdown
- Available in SO-8, PSOP-8 packages

### Applications

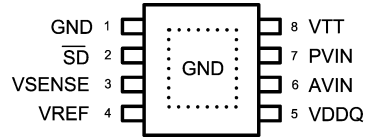
- DDR-II Termination Voltage
- SSTL-18 Termination

### Typical Application Circuit



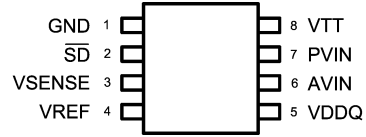
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## Connection Diagrams



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PSOP-8 Layout



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SO-8 Layout

## Pin Descriptions

SO-8 Pin or PSOP-8 Pin	Name	Function
1	GND	Ground
2	$\overline{SD}$	Shutdown
3	VSENSE	Feedback pin for regulating $V_{TT}$ .
4	VREF	Buffered internal reference voltage of $V_{DDQ}/2$
5	VDDQ	Input for internal reference equal to $V_{DDQ}/2$
6	AVIN	Analog input pin
7	PVIN	Power input pin
8	VTT	Output voltage for connection to termination resistors
	EP	Exposed pad thermal connection Connect to soft Ground

## Ordering Information

Order Number	Package Type	NSC Package Drawing	Supplied As
LP2997M	SO-8	M08A	95 Units per Rail
LP2997MX	SO-8	M08A	2500 Units Tape and Reel
LP2997MR	PSOP-8	MRA08A	95 Units Tape and Reel
LP2997MRX	PSOP-8	MRA08A	2500 Units Tape and Reel

**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

PVIN, AVIN, VDDQ to GND	
No pin should exceed AVIN	-0.3V to +6V
Storage Temp. Range	-65°C to +150°C
Junction Temperature	150°C
Lead Temperature (Soldering, 10 sec)	260°C

SO-8 Thermal Resistance ( $\theta_{JA}$ )	151°C/W
PSOP-8 Thermal Resistance ( $\theta_{JA}$ )	43°C/W
Minimum ESD Rating (Note 2)	1kV

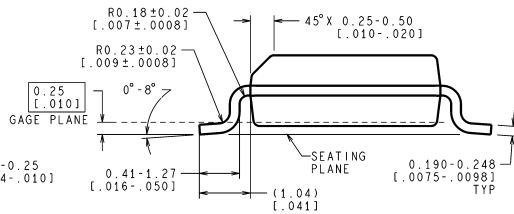
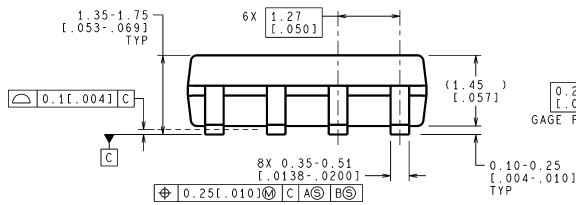
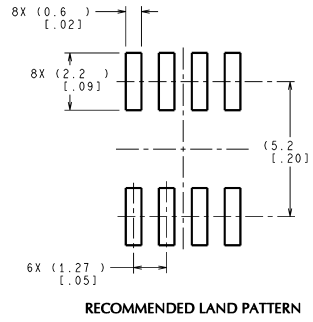
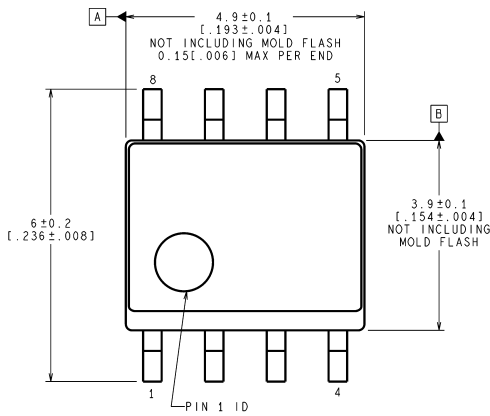
**Operating Range**

Junction Temp. Range (Note 3)	0°C to +125°C
AVIN to GND	2.2V to 5.5V

**Electrical Characteristics** Specifications with standard typeface are for  $T_J = 25^\circ\text{C}$  and limits in **boldface type** apply over the full **Operating Temperature Range** ( $T_J = 0^\circ\text{C}$  to  $+125^\circ\text{C}$ ) (Note 4). Unless otherwise specified, AVIN = 2.5V, PVIN = 1.8V, VDDQ = 1.8V.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{REF}$	$V_{REF}$ Voltage	PVIN = VDDQ = 1.7V PVIN = VDDQ = 1.8V PVIN = VDDQ = 1.9V	<b>0.837</b> <b>0.887</b> <b>0.936</b>	0.860 0.910 0.959	<b>0.887</b> <b>0.937</b> <b>0.986</b>	V
$Z_{VREF}$	$V_{REF}$ Output Impedance	$I_{REF} = -30$ to $+30 \mu\text{A}$		2.5		k $\Omega$
$V_{TT}$	$V_{TT}$ Output Voltage	$I_{OUT} = 0\text{A}$ PVIN = VDDQ = 1.7V PVIN = VDDQ = 1.8V PVIN = VDDQ = 1.9V $I_{OUT} = \pm 0.5\text{A}$ (Note 7) PVIN = VDDQ = 1.7V PVIN = VDDQ = 1.8V PVIN = VDDQ = 1.9V	<b>0.822</b> <b>0.874</b> <b>0.923</b> <b>0.828</b> <b>0.878</b> <b>0.928</b>	0.856 0.908 0.957 0.856 0.908 0.957	<b>0.887</b> <b>0.939</b> <b>0.988</b> <b>0.890</b> <b>0.940</b> <b>0.990</b>	V
$V_{osTT}/V_{TT}$	$V_{TT}$ Output Voltage Offset ( $V_{REF} - V_{TT}$ )	$I_{OUT} = 0\text{A}$ $I_{OUT} = -0.5\text{A}$ $I_{OUT} = +0.5\text{A}$	<b>-25</b> <b>-25</b> <b>-25</b>	0 0 0	<b>25</b> <b>25</b> <b>25</b>	mV
$I_Q$	Quiescent Current (Note 5)	$I_{OUT} = 0\text{A}$ (Note 5)		320	<b>500</b>	$\mu\text{A}$
$Z_{VDDQ}$	VDDQ Input Impedance			100		k $\Omega$
$I_{SD}$	Quiescent Current in Shutdown (Note 5)	SD = 0V		115	<b>150</b>	$\mu\text{A}$
$I_{Q\_SD}$	Shutdown Leakage Current	SD = 0V		2	<b>5</b>	$\mu\text{A}$
$V_{IH}$	Minimum Shutdown High Level		<b>1.9</b>			V
$V_{IL}$	Maximum Shutdown Low Level				<b>0.8</b>	V
$I_{SENSE}$	$V_{SENSE}$ Input Current			13		nA
$T_{SD}$	Thermal Shutdown	(Note 6)		165		Celsius
$T_{SD\_HYS}$	Thermal Shutdown Hysteresis			10		Celsius

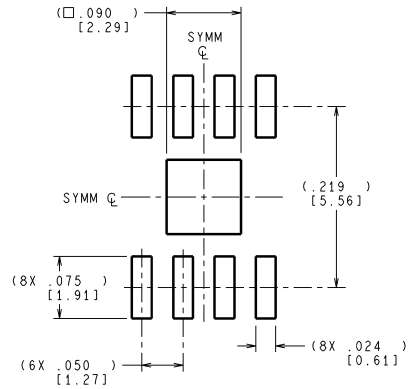
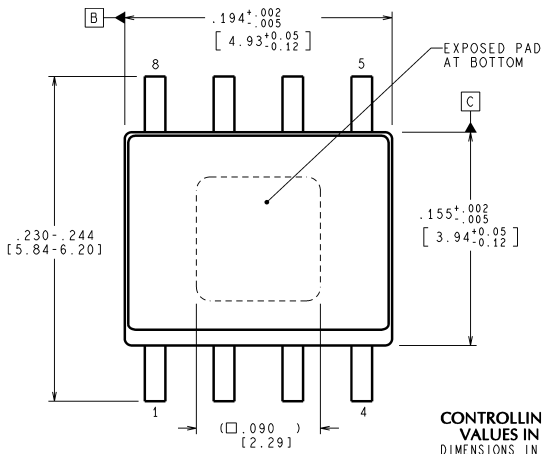
**Physical Dimensions** inches (millimeters) unless otherwise noted



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VALUES IN [ ] ARE INCHES  
DIMENSIONS IN ( ) FOR REFERENCE ONLY

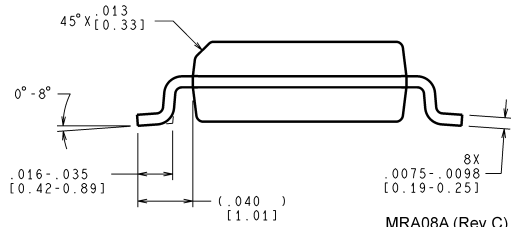
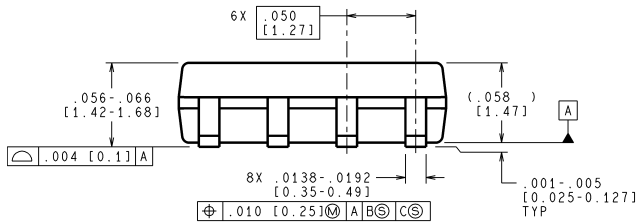
M08A (Rev K)

**8-Lead Small Outline Package (M8)**  
**NS Package Number M08A**



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RECOMMENDED LAND PATTERN



MRA08A (Rev C)

**8-Lead PSOP Package (PSOP-8)**  
**NS Package Number MRA08A**