

## 3A/2A Bus Termination Regulator

### Description

The FP6137A/B linear regulator is designed to provide the transient peaks up to 3A/2A sourcing or sinking capability for DDR SDRAM bus termination application. The output voltage can track half of input power by two external voltage divider resistors.

The FP6137A/B provides current limit in both sourcing/sinking mode and thermal shutdown function which protects the excessive heating due to high current and high junction temperature.

The FP6137A are available in SOP-8 (exposed pad), TO-252-5 and TO-263-5 packages. The FP6137B are available in the SOP-8 (fused), SOP-8 (exposed pad) and TO-252-5 packages.

### Features

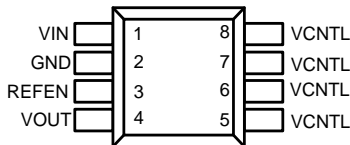
- 3A/2A Source or Sink Current
- Power MOSFET Integrated
- Low Output Voltage Offset
- Current Limit Protection
- Thermal Shutdown Protection
- Adjusted Output by External Resistors
- Shutdown for Standby or Suspend Mode
- SOP-8, TO-252-5 and TO-263-5 Packages
- RoHS Compliant

### Applications

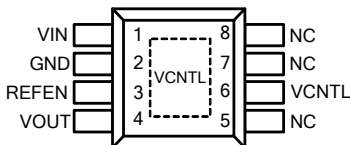
- DDR-I and DDR-II Bus Termination Voltage
- SSTL-2 and SSTL-3 Termination
- Active Termination Buses

### Pin Assignments

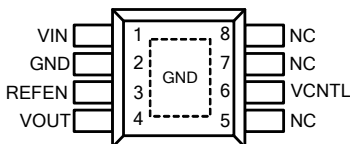
#### SO Package (SOP-8<Fused>) (FP6137B)



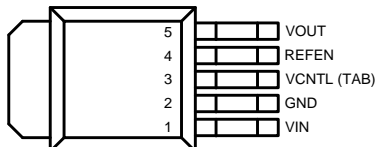
#### SP Package (SOP-8 Exposed Pad) (FP6137B)



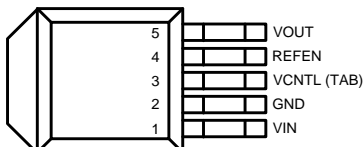
#### SP Package (SOP-8 Exposed Pad) (FP6137A)



#### T5 Package (TO-252-5) (FP6137A/B)



#### T6 Package (TO-263-5) (FP6137A)



### Ordering Information

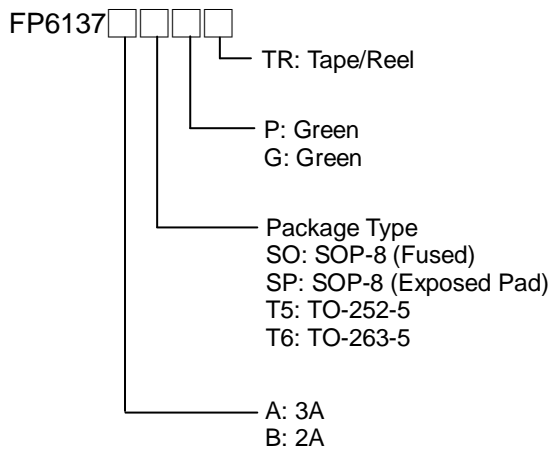


Figure 1. Pin Assignment of FP6137 (Top View)

## Typical Application Circuit

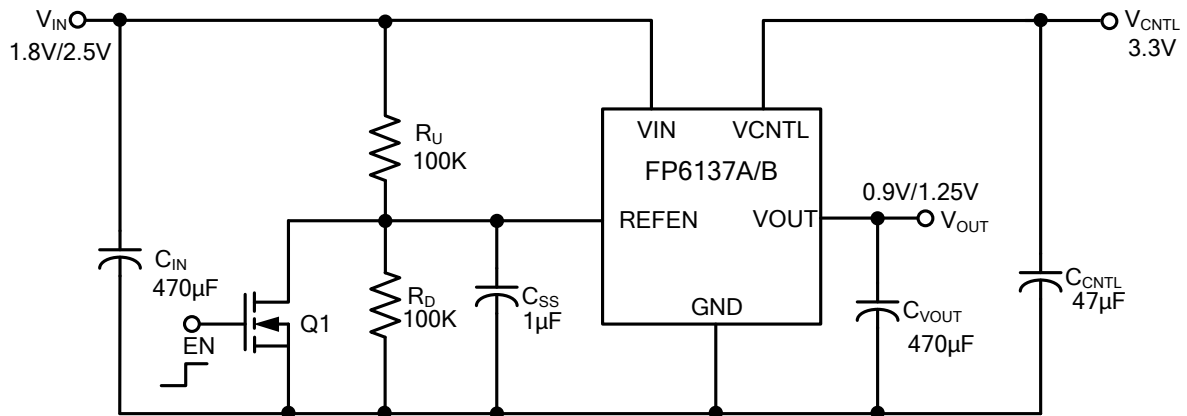


Figure 2. Typical Application Circuit of FP6137

## Functional Pin Description

Pin Name	Pin Function
<b>VIN</b>	Power Input Pin. VIN is the input power supply used to create the external reference voltage for regulating VOUT. VIN sources current to VOUT by upper NMOS.
<b>GND</b>	Common Ground Pin. The VOUT sinks current to GND by lower NMOS.
<b>VCNTL</b>	Power Input Pin. The VCNTL power supplies the internal control circuitry and gate drive voltage.
<b>REFEN</b>	Chip Enable, and Input Reference Voltage Pin. The reference voltage is half of the VIN power by two external voltage divide resistors.
<b>VOUT</b>	Regulator Output Pin. VOUT voltage tracks the REFEN voltage and is capable of sourcing or sinking current up to peak 3A.

## Block Diagram

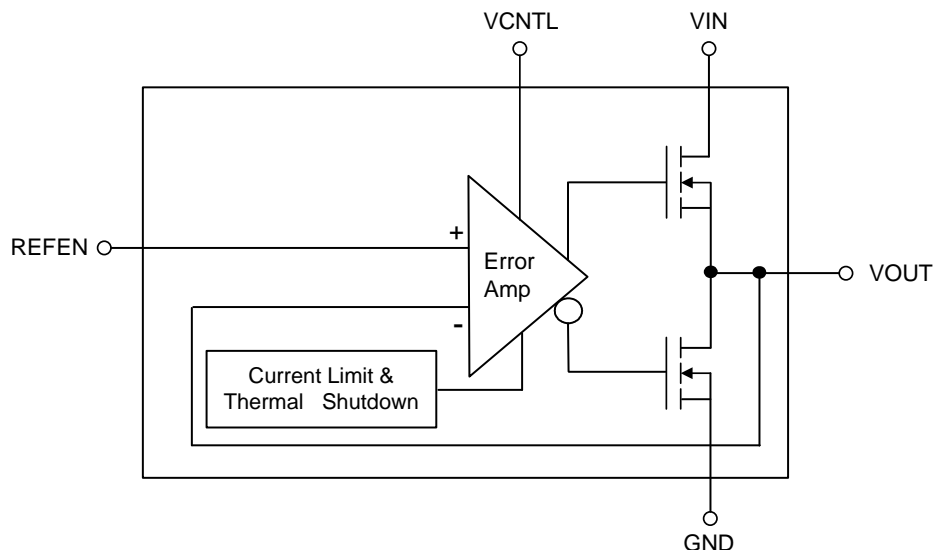


Figure 3. Block Diagram of FP6137

## Absolute Maximum Ratings

- VIN to GND ----- 6V
- VCNTL to GND ----- 6V
- Power Dissipation @25°C, (P<sub>D</sub>)
  - SOP-8 (Fused) ----- 0.63W
  - SOP-8 (Exposed Pad) ----- 1.25W
  - TO-252-5 ----- 1.33W
  - TO-263-5 ----- 1.67W
- Package Thermal Resistance, (θ<sub>JA</sub>)
  - SOP-8 (Fused) ----- 160°C/W
  - SOP-8 (Exposed Pad) ----- 80°C/W
  - TO-252-5 ----- 75°C/W
  - TO-263-5 ----- 60°C/W
- Junction Temperature ----- 150°C
- Storage Temperature Range ----- -65°C to 150°C
- Lead Temperature (Soldering, 10sec.) ----- 260°C
- ESD Susceptibility
  - HBM(Human Body Mode) ----- 2KV
  - MM(Machine Mode) ----- 200V

Note 1 : Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.

## Recommended Operating Conditions

- Input Voltage (V<sub>IN</sub>) ----- +1.8V or +2.5V
- Input Voltage (V<sub>CNTL</sub>) ----- +3.3V to +5.5V
- Operating Temperature Range (T<sub>OPR</sub>) ----- -40°C to +85°C

## Electrical Characteristics

( $V_{CNTL}=3.3V$ ,  $V_{IN}=2.5V$ ,  $V_{REFEN}=0.5 \cdot V_{IN}$ ,  $C_{OUT}=10\mu F$ ,  $T_A=25^\circ C$ , unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
<b>INPUT</b>						
Operation Voltage Range (DDRI and DDII)	$V_{IN}$		1.6	2.5/1.8		V
	$V_{CNTL}$			3.3	5.5	
$V_{CNTL}$ Quiescent Current	$I_{CNTL}$	No Load		1.5	3.0	mA
Shutdown Current	$I_{SD}$	$V_{REFEN} < 0.2V$		5	30	$\mu A$
<b>OUTPUT VOLTAGE</b>						
Output Offset Voltage	$V_{OS}$	No Load , ( $V_{REFEN}-V_{OUT}$ )	-20	0	20	mV
Load Regulation (DDRI and DDII) (Note2)	$ \Delta V_{LOAD} $	$I_{OUT} = 0$ to 2A			20	mV
		$I_{OUT} = 0$ to -2A			20	
<b>PROTECTION</b>						
Current Limit	$I_{LIM}$	FP6137A	3.0	3.5		A
		FP6137B	2.0	2.5		A
Thermal Shutdown Temperature (Note3)	$T_{SD}$			170		$^\circ C$
	$\Delta T_{SD}$	Hysteresis		35		$^\circ C$
<b>SHUTDOWN CONTROL</b>						
Enable High Level	$V_{REF-H}$		0.6			V
Shutdown Low Level	$V_{REF-L}$				0.2	V

Note 2 : Load regulation is measured at a constant junction temperature by using a 20ms low duty cycle current pulse.

Note 3 : Guarantee by design.

**Typical Performance Curves**

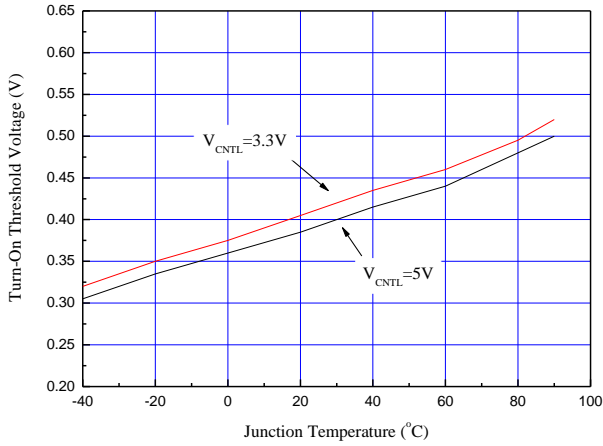


Figure 4. Turn-On Threshold Voltage vs. Junction Temperature

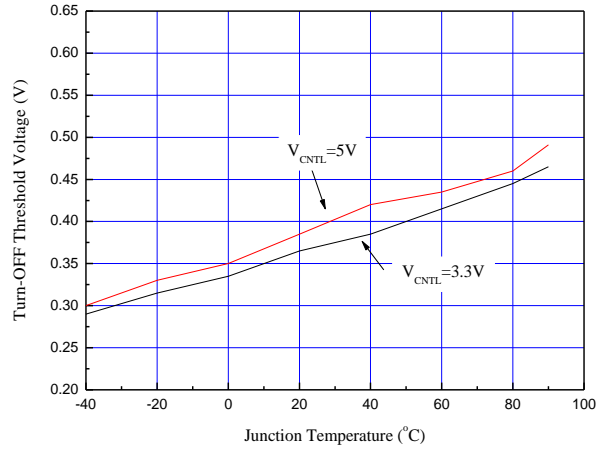


Figure 5. Turn-Off Threshold Voltage vs. Junction Temperature

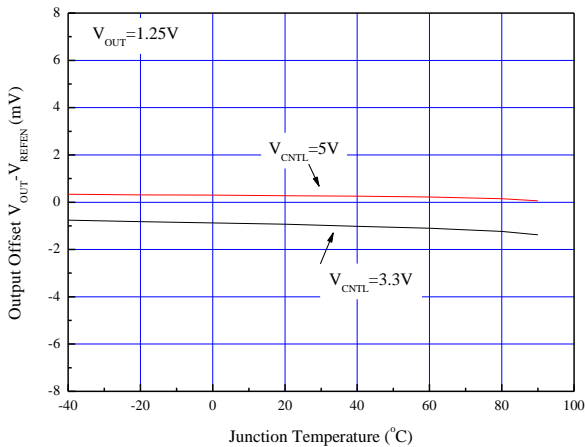


Figure 6. Output offset ( $V_{OUT}-V_{REFEN}$ ) vs. Junction Temperature

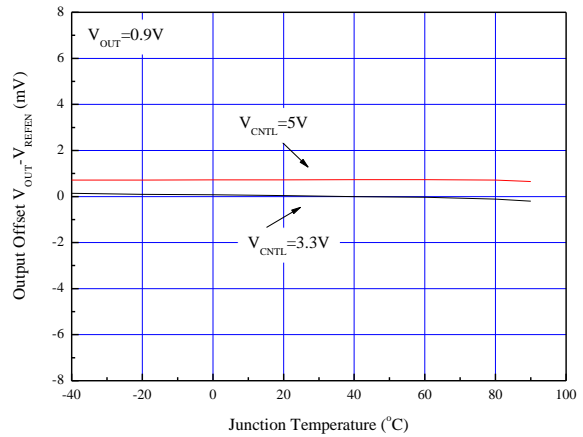


Figure 7. Output offset ( $V_{OUT}-V_{REFEN}$ ) vs. Junction Temperature

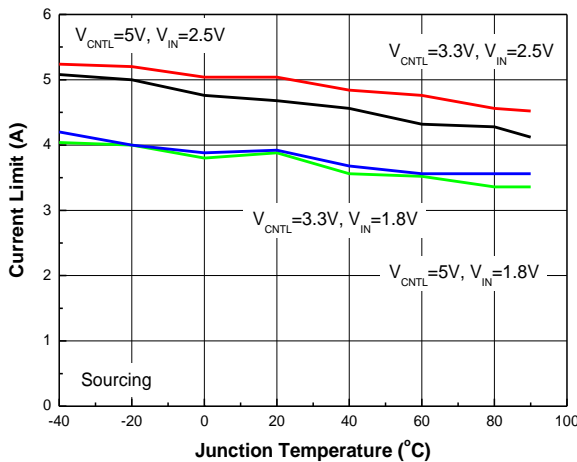


Figure 8. Current Limit vs. Junction Temperature

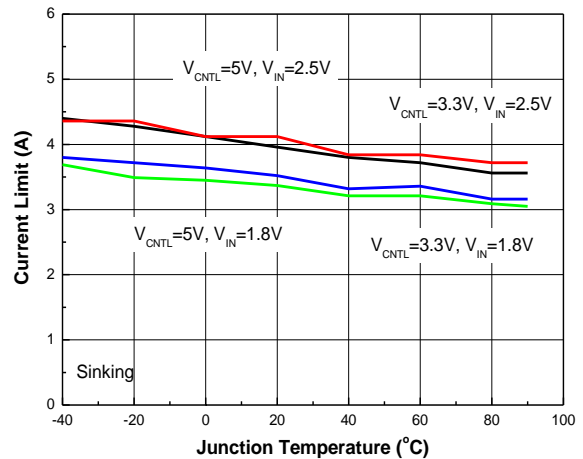


Figure 9. Current Limit vs. Junction Temperature

**Typical Performance Curves (Continued)**

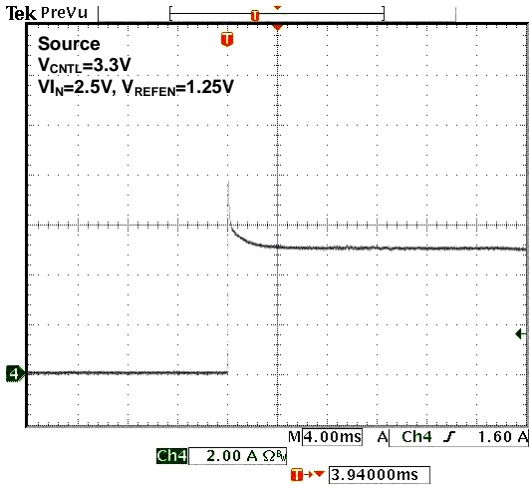


Figure10. Output Short-Circuit Protection

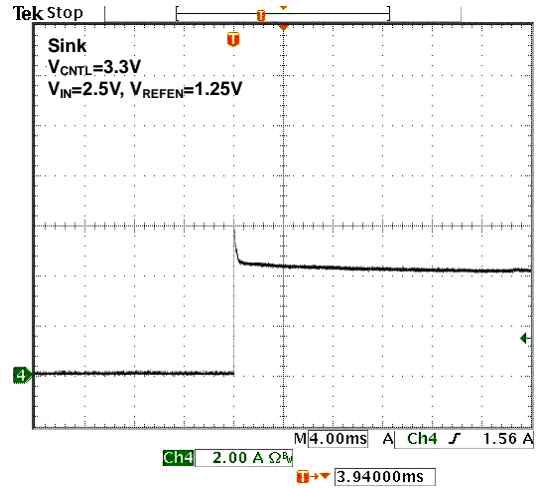


Figure11. Output Short-Circuit Protection

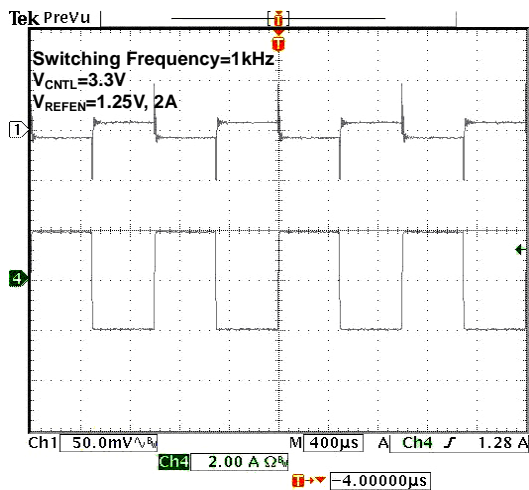


Figure12. 1.25V<sub>OUT</sub> @ 2A Transient Response

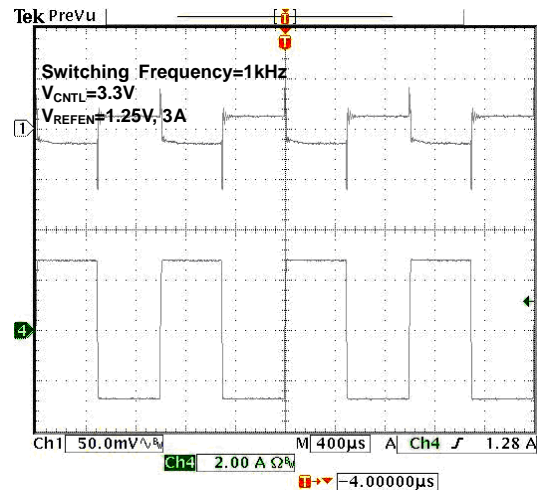


Figure13. 1.25V<sub>OUT</sub> @ 3A Transient Response

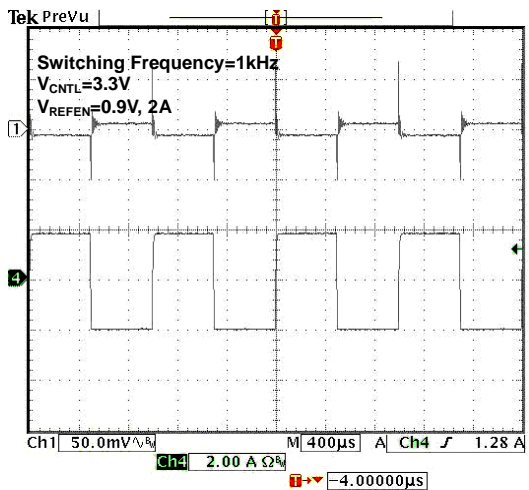


Figure 14. 0.9V<sub>OUT</sub> @ 2A Transient Response

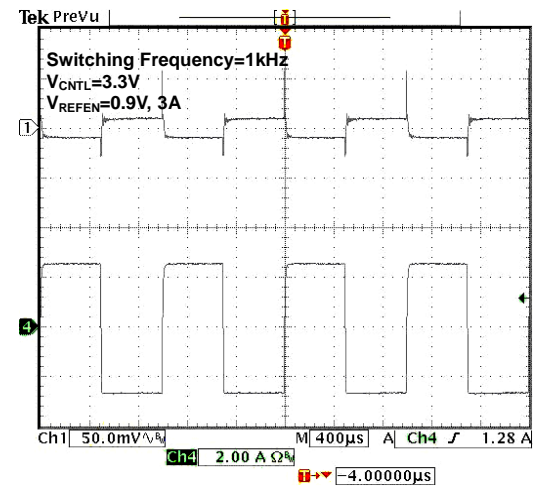
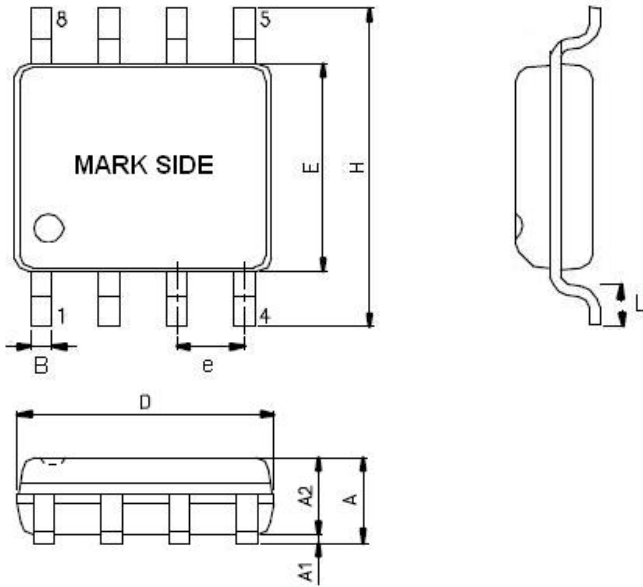


Figure 15. 0.9V<sub>OUT</sub> @ 3A Transient Response

**Outline Information**

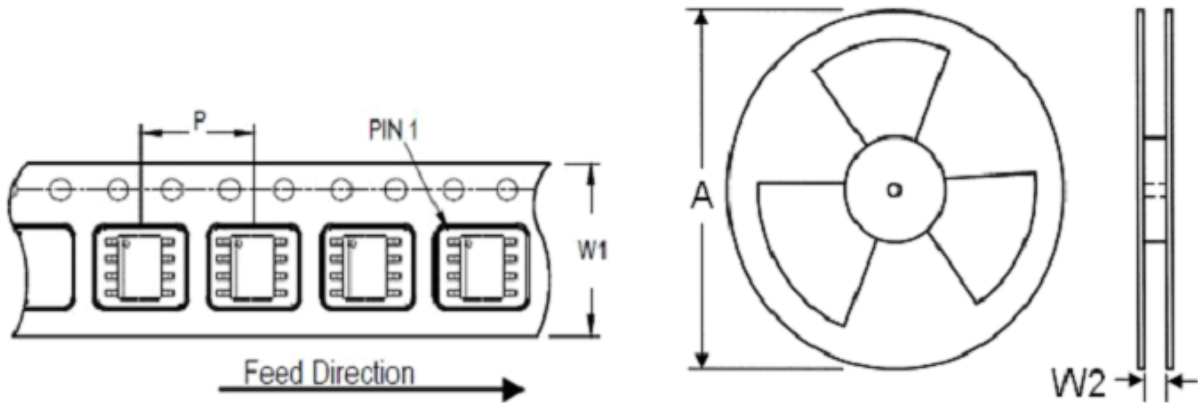
SOP-8 (Fused) Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
A2	1.25	1.50
B	0.31	0.51
D	4.80	5.00
E	3.80	4.00
e	1.20	1.34
H	5.80	6.20
L	0.40	1.27

Note : Followed From JEDEC MO-012-E

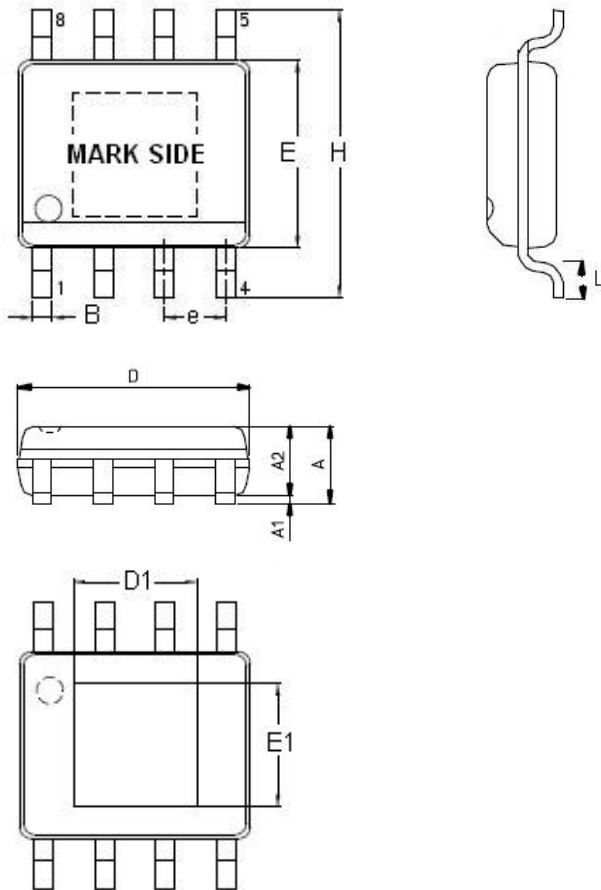
**Carrier Dimensions**



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
12	8	13	330	12.4	400~1000	2,500

**Outline Information (Continued)**

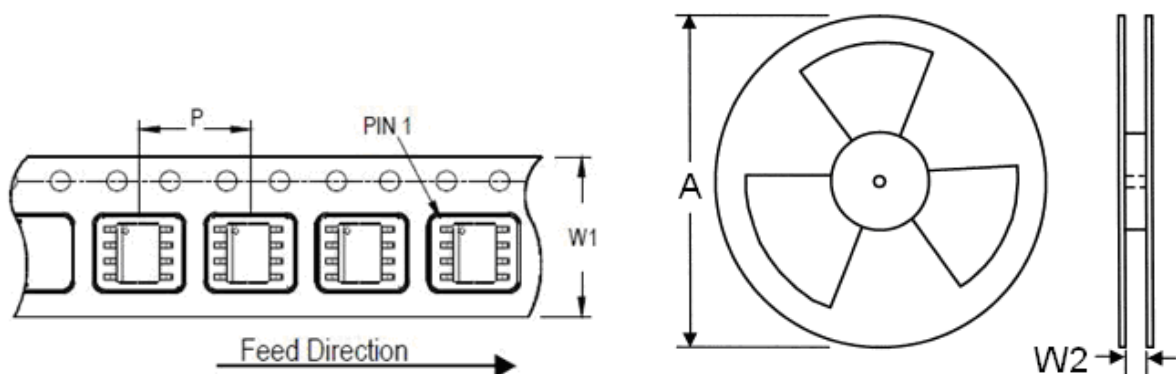
**SOP-8 (Exposed Pad) Package (Unit: mm)**



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.25	1.70
A1	0.00	0.15
A2	1.25	1.55
B	0.31	0.51
D	4.80	5.00
D1	3.04	3.50
E	3.80	4.00
E1	2.15	2.41
e	1.20	1.34
H	5.80	6.20
L	0.40	1.27

Note : Followed From JEDEC MO-012-E.

**Carrier Dimensions**

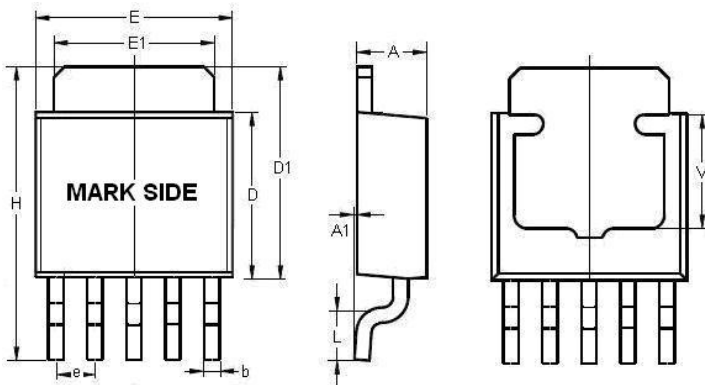


Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
12	8	13	330	12.4	400~1000	2,500



**Outline Information (Continued)**

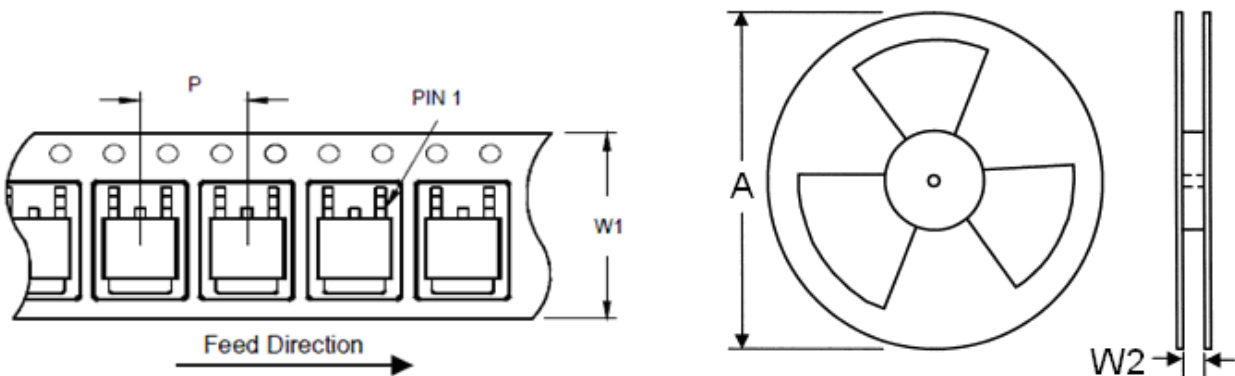
TO-252-5 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	2.22	2.40
A1	0.01	0.13
b	0.55	0.65
D	6.00	6.20
D1	7.10	7.30
E	6.40	6.60
E1	5.30	5.45
e	1.22	1.32
L	1.42	1.65
H	9.50	10.20
V	3.60	4.00

Note : Followed From JEDEC TO-252-E.

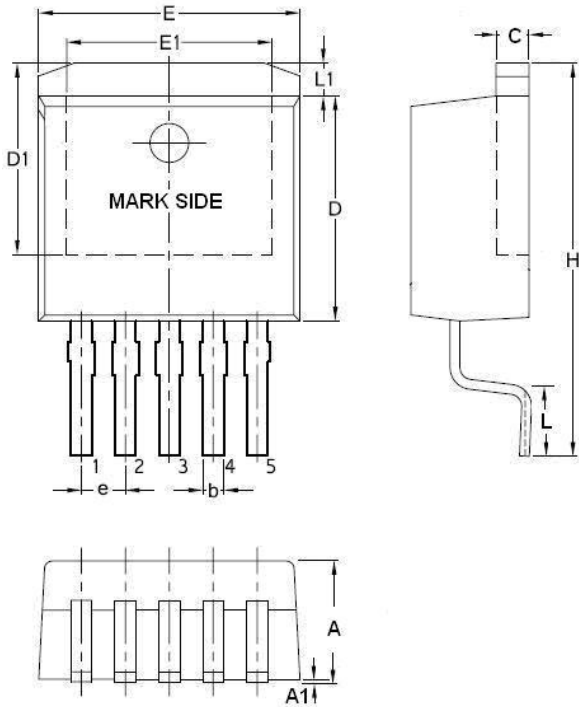
**Carrier Dimensions**



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
16	8	13	330	16.4	300~1000	3,000

**Outline Information (Continued)**

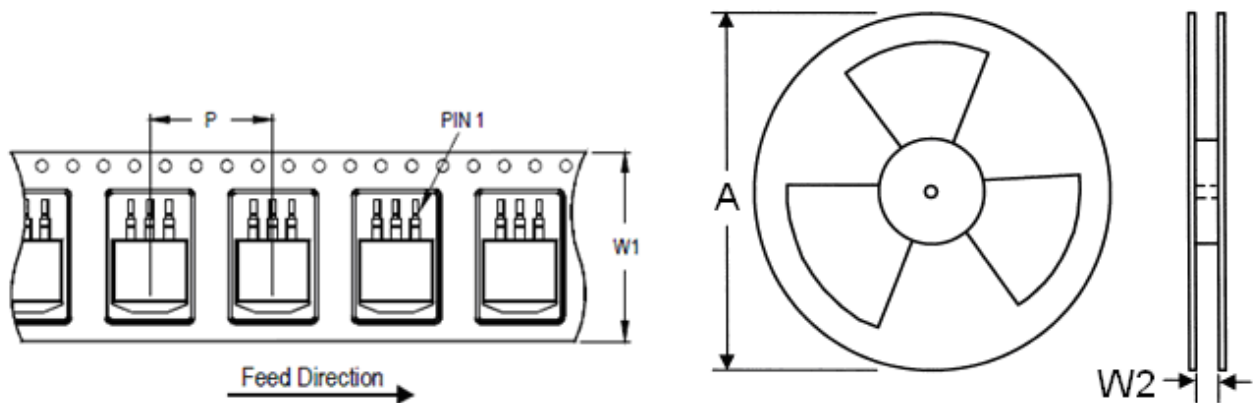
TO-263-5 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	4.064	4.826
A1	0.005	0.254
b	0.508	0.991
C	1.143	1.651
D	8.382	9.652
D1	6.858	7.858
E	9.652	10.668
E1	6.223	7.225
L	1.778	2.800
L1	1.146	1.676
e	1.600	1.800
H	14.605	15.875

Note : Followed From JEDEC TO-263-E

**Carrier Dimensions**



Tape Size (W1) mm	Pocket Pitch (P) mm	Reel Size (A)		Reel Width (W2) mm	Empty Cavity Length mm	Units per Reel
		in	mm			
24	16	13	330	24.4	300~1000	800

**Life Support Policy**

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