

## Dual Input Low Dropout Regulator

### Features

- **450mV Typ. Dropout at 3A in Dual Power Voltage Mode**
- **Remote Sense Pin Available**
- **2% Accuracy Over-Temperature Range**
- **Built-in Over-Temperature Protection**
- **Built-in Current-Limit**
- **5-Pin TO-252 and TO-263 Packages**
- **Lead Free and Green Devices Available (RoHS Compliant)**

### Applications

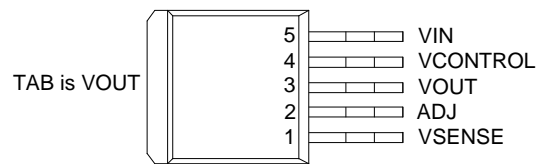
- **Microprocessor Supplies**
- **Chip Set Supplies**
- **VGA Card Power**
- **LCD Monitor Power**

### General Description

The APL1582 of high performance positive voltage regulators are designed for using in applications requiring very low dropout voltage at 3Amps. The superior dropout characteristics result in reduced heat dissipation compared to regular LDOs. The APL1582 also provides excellent regulation over line, load, and temperature variations.

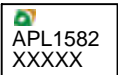
Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperature. The APL1582 is available in both the through-hole and surface mount versions of the industry standard 5-pin TO-252 and TO-263 power packages.

### Pin Configuration



Top View of TO-252-5 / TO-263-5

### Ordering and Marking Information

<p>APL1582 □□□ - □□□</p> <ul style="list-style-type: none"> <li>□□□ - Assembly Material</li> <li>□□□ - Handling Code</li> <li>□□□ - Temperature Range</li> <li>□□□ - Package Code</li> </ul>	<p>Package Code                  G5: TO-263-5    U5 : TO-252-5                  Operating Ambient Temperature Range                  C : 0 to 70 °C                  Handling Code                  TR : Tape &amp; Reel                  Assembly Material                  G : Halogen and Lead Free Device</p>
<p>APL1582 G5/U5 : </p>	<p>XXXXX - Date Code</p>

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. ANPEC defines "Green" to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

**Absolute Maximum Ratings** (Note 1)

Symbol	Parameter	Rating	Unit
V <sub>IN</sub>	Input Voltage	7	V
V <sub>CONTROL</sub>	Control Voltage	13.2	V
θ <sub>JA</sub>	Thermal Resistance - Junction to Ambient <sup>(Note 2)</sup>	62.5	°C/W
P <sub>D</sub>	Power Dissipation	Internally Limited	W
T <sub>J</sub>	Operating Junction Temperature	Control Section	0 to 125
		Power Transistor	0 to 150
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>L</sub>	Maximum Lead Soldering Temperature, 10 Seconds	260	°C

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2: θ<sub>JA</sub> is measured with the component mounted on a high effective thermal conductivity test board in free air.

**Electrical Characteristics**

Unless otherwise noted these specifications apply over , C<sub>IN</sub>=1µF , C<sub>OUT</sub>=10µF , T<sub>J</sub>=0 to 125°C. Typical values refer to T<sub>J</sub>=25°C.

V<sub>OUT</sub>=V<sub>SENSE</sub>\*

Symbol	Parameter	Test Conditions	APL1582			Unit
			Min.	Typ.	Max.	
V <sub>REF</sub>	Reference Voltage	V <sub>CONTROL</sub> =2.75 to 12V, V <sub>IN</sub> =2.05V to 5.5V, I <sub>O</sub> =10mA to 3A, V <sub>ADJ</sub> =0V	1.225	1.250	1.275	V
REG <sub>LINE</sub>	Line Regulation	V <sub>CONTROL</sub> =2.75V to 12V, V <sub>IN</sub> =1.75V to 5.5V, I <sub>O</sub> =10mA, V <sub>ADJ</sub> =0V	-	-	3	mV
REG <sub>LOAD</sub>	Load Regulation <sup>(Note 3)</sup>	V <sub>CONTROL</sub> =2.75V, V <sub>IN</sub> =2.1V, I <sub>O</sub> =10mA to 3A, V <sub>ADJ</sub> =0V	-	-	5	mV
V <sub>CONTROL</sub> -V <sub>OUT</sub>	Dropout Voltage <sup>(Note 4)</sup>	V <sub>IN</sub> =2.05V, I <sub>O</sub> =3A, V <sub>ADJ</sub> =0V	-	1.10	1.25	V
V <sub>IN</sub> -V <sub>OUT</sub>	Dropout Voltage <sup>(Note 4)</sup>	V <sub>CONTROL</sub> =2.75V, I <sub>O</sub> =3A, V <sub>ADJ</sub> =0V	-	0.45	-	V
I <sub>LIMIT</sub>	Current-Limit	V <sub>CONTROL</sub> =2.75V, V <sub>IN</sub> =2.05V	3.2	-	-	A
I <sub>LMIN</sub>	Minimum Load Current <sup>(Note 5)</sup>	V <sub>CONTROL</sub> =5V, V <sub>IN</sub> =3.3V, V <sub>ADJ</sub> =0V	-	5	10	mA
REG <sub>THERMAL</sub>	Thermal Regulation	30mS Pulse	-	0.01	-	%/W
PSRR	Power Supply Ripple Rejection	T <sub>J</sub> =25°C, V <sub>RIPPLE</sub> =1V <sub>PP</sub> at 120Hz, V <sub>CONTROL</sub> =5, V <sub>IN</sub> =5V, I <sub>O</sub> =3A , V <sub>ADJ</sub> =0V	60	70	-	dB
I <sub>CONTROL</sub>	Control Pin Current	V <sub>CONTROL</sub> =2.75V, V <sub>IN</sub> =2.05V, I <sub>O</sub> =3A, V <sub>ADJ</sub> =0V	-	33	120	mA
I <sub>ADJ</sub>	Adjust Pin Current	V <sub>CONTROL</sub> =2.75V, V <sub>IN</sub> =2.05V, V <sub>ADJ</sub> =0V	-	50	120	µA

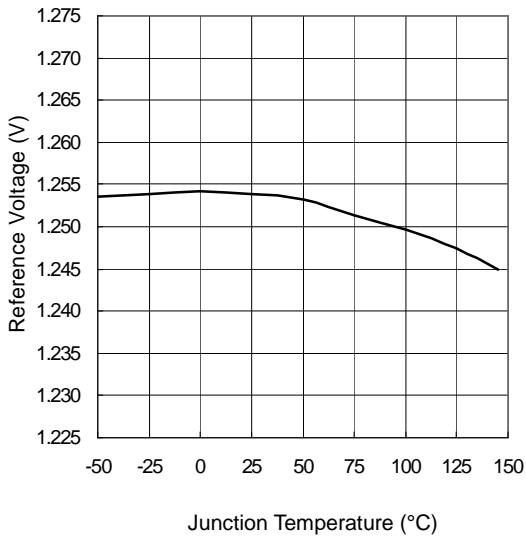
Note 3: Low duty cycle pulse test with Kelvin connections are required to maintain data accuracy .

Note 4: Drop-out voltage is defined as the minimum difference between V<sub>IN</sub> and V<sub>OUT</sub> required to maintain 1% V<sub>OUT</sub> regulation .

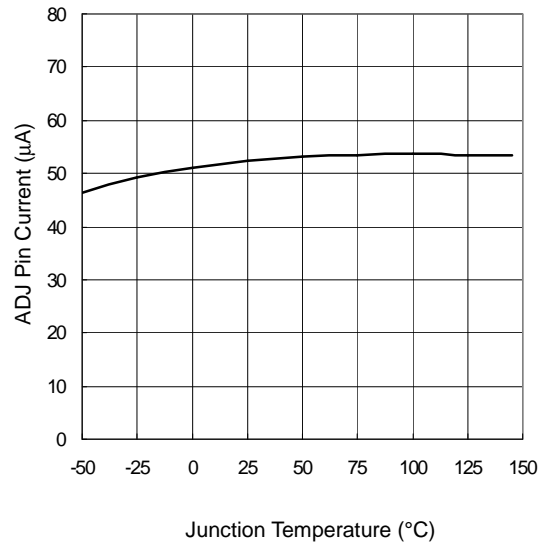
Note 5: Minimum load current is defined as the minimum current required at the output to maintain V<sub>OUT</sub> regulation.

### Typical Operating Characteristics

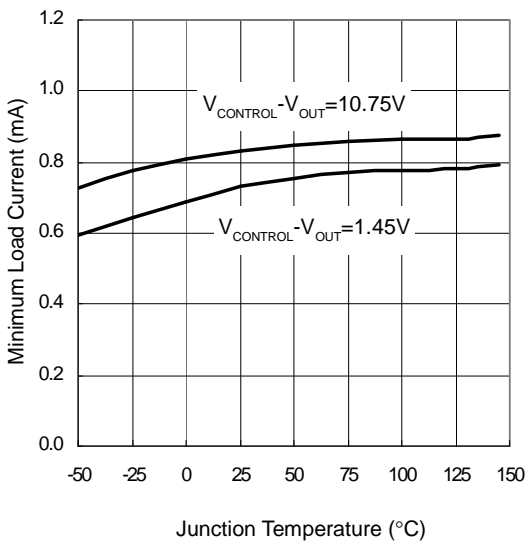
Reference Voltage vs. Junction Temperature



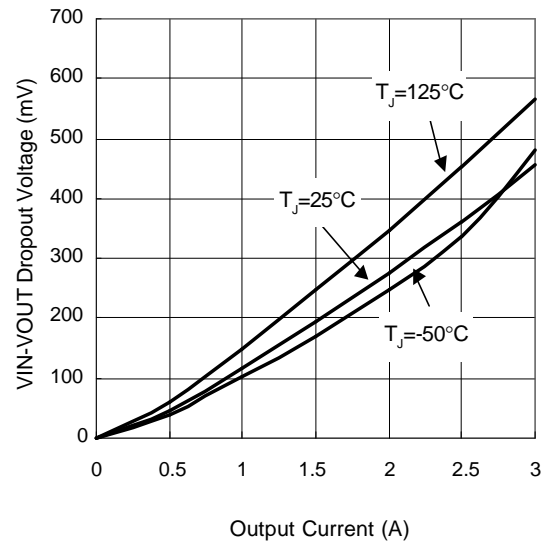
ADJ Pin Current vs. Junction Temperature



Minimum Load Current vs. Junction Temperature

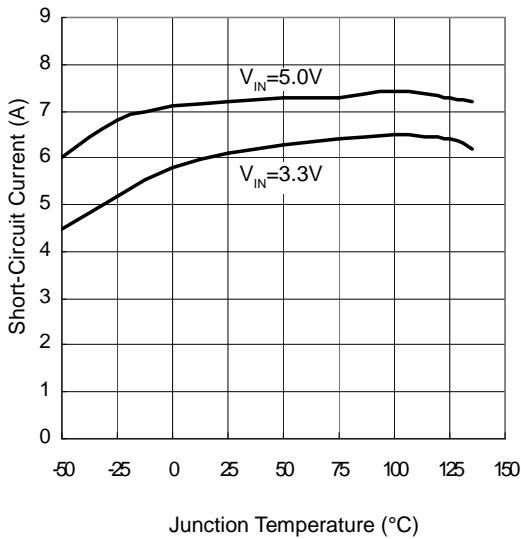


VIN-VOUT Dropout Voltage vs. Output Current

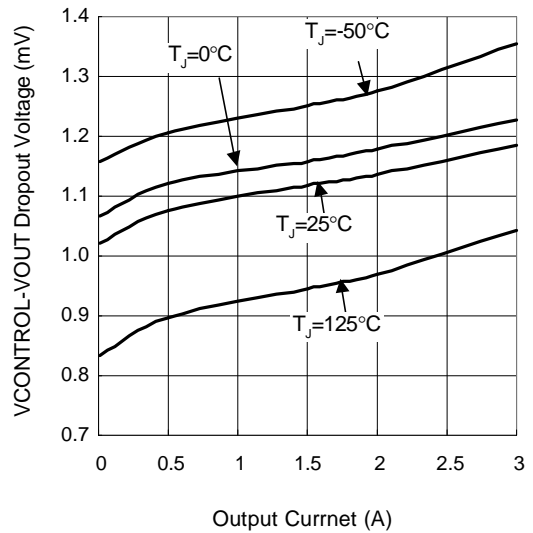


Typical Operating Characteristics (Cont.)

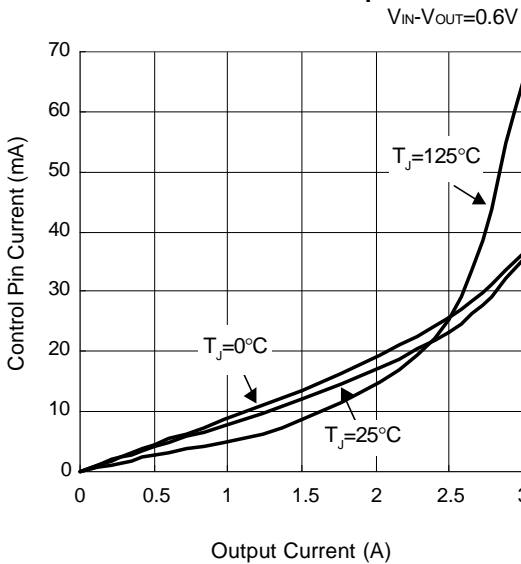
Short-Circuit Current vs. Junction Temperature



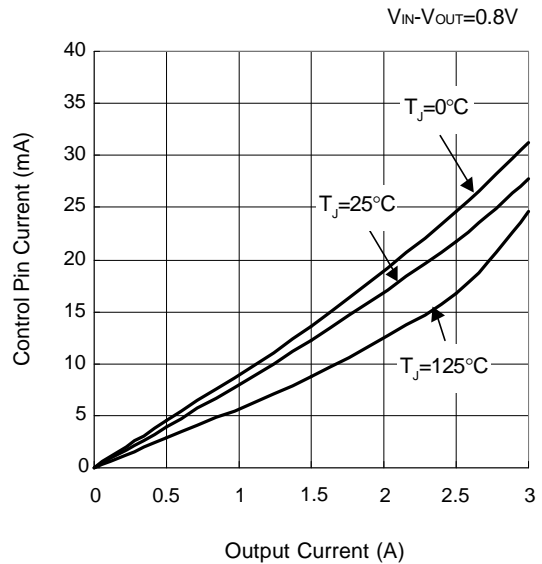
VCONTROL-VOUT Dropout Voltage vs. Output Current



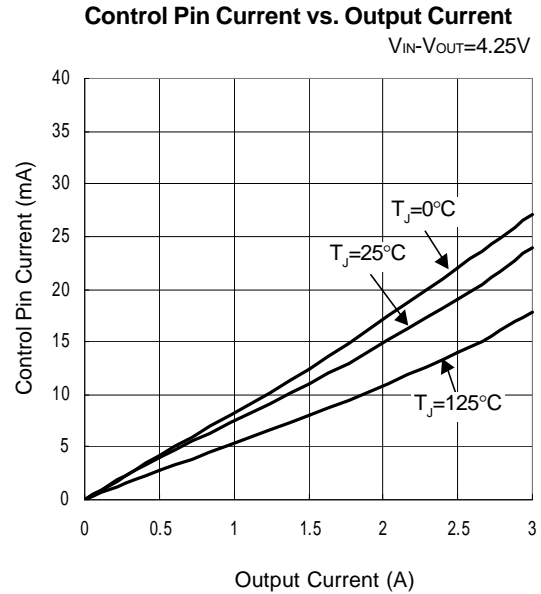
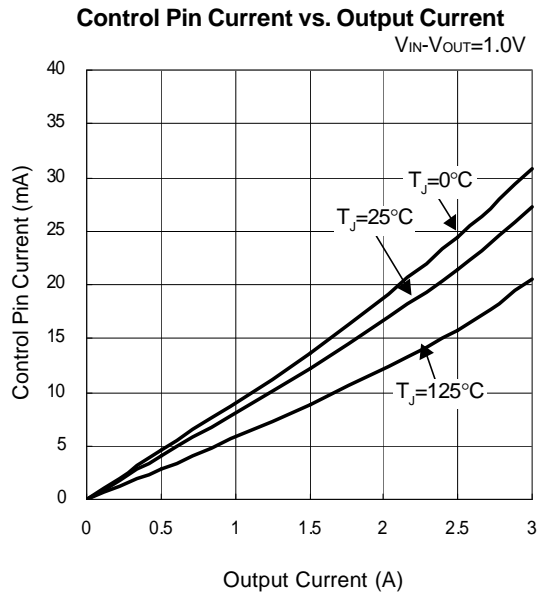
Control Pin Current vs. Output Current



Control Pin Current vs. Output Current



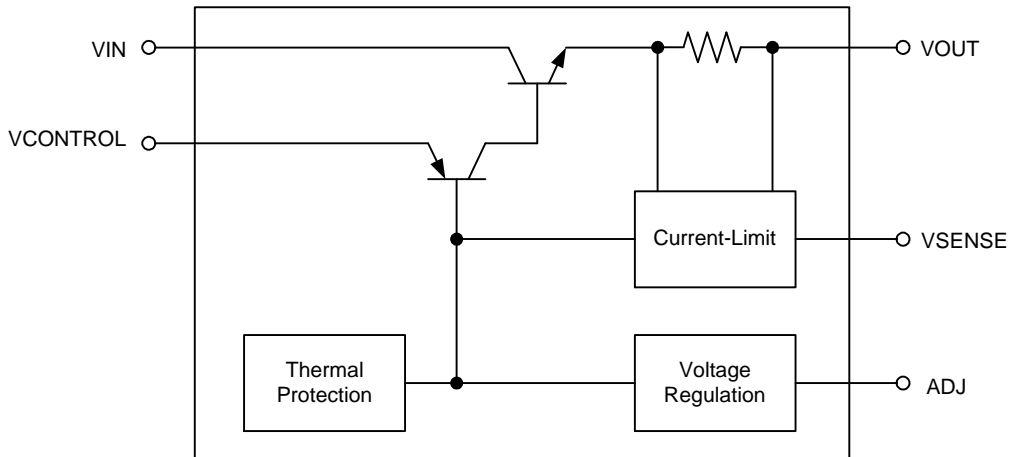
Typical Operating Characteristics (Cont.)



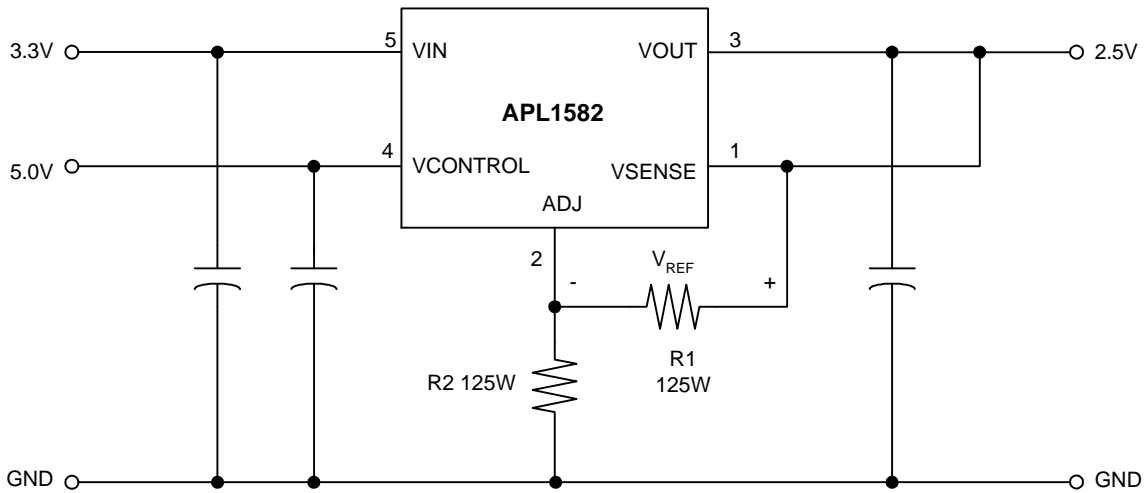
Pin Description

PIN		I/O	FUNCTION
NO.	NAME		
1	VSENSE	I	Positive side of the reference voltage, which allows remote sensing to obtain excellent load regulation.
2	ADJ	O	Negative side of the reference voltage, which allows to use resistor divider to set an expect output voltage. A small bypass capacitor can be connected from this pin to the ground to improve PSRR performance.
3	VOUT	O	Output pin of the regulator, which connects to the TAB. A minimum of 10μF capacitor must be connected from this pin to ground to ensure the stability.
4	VCONTROL	I	Supply pin of the control circuitry, which must be always higher than VOUT for the device to regulate. (See Electrical Characteristics)
5	VIN	I	Power input pin of the regulator, which must be always higher than VOUT for the device to regulate. (See Electrical Characteristics)

Block Diagram



Typical Application Circuit

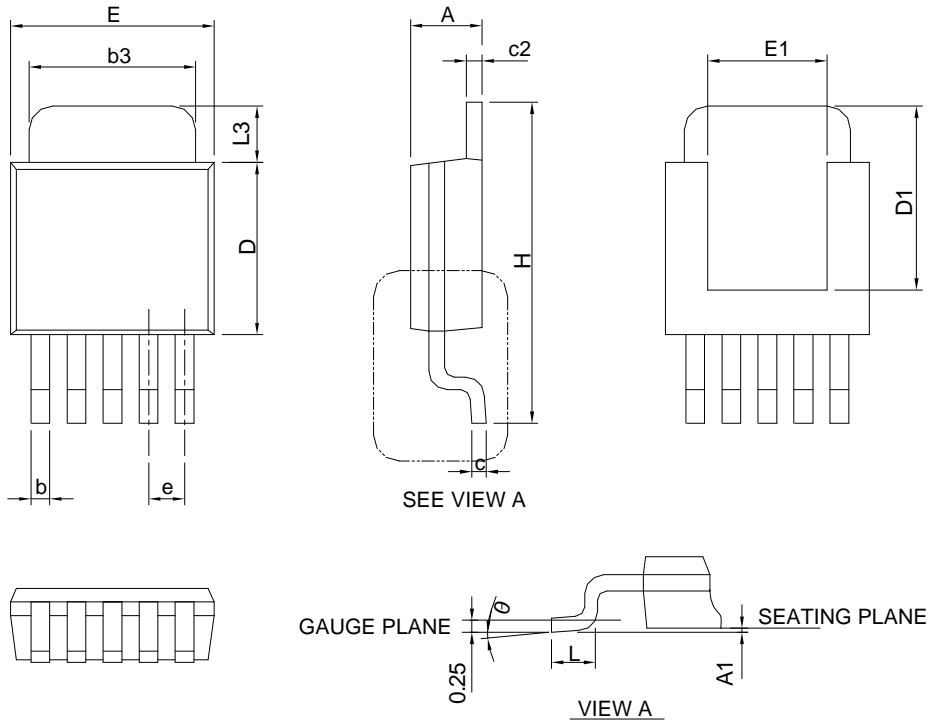


\*  $V_{OUT} = V_{REF} ( 1 + R2 / R1 ) + I_{ADJ} * xR2$

\* R1 is typically in range of 100Ω to 125Ω to satisfy the minimum load current requirement.

Package Information

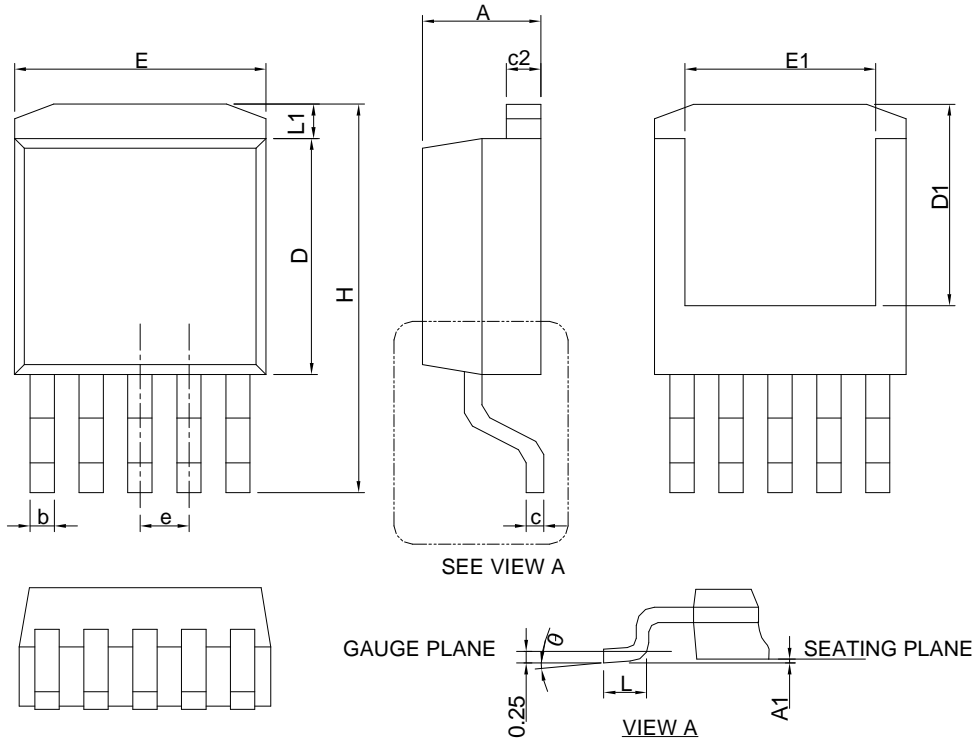
TO-252-5



SYMBOL	TO-252-5			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.32	5.46	0.170	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	1.27 BSC		0.050 BSC	
H	9.40	10.41	0.370	0.410
L	1.40	1.78	0.055	0.070
L3	0.89	2.03	0.035	0.080
$\theta$	0°	8°	0°	8°

Package Information

TO-263-5

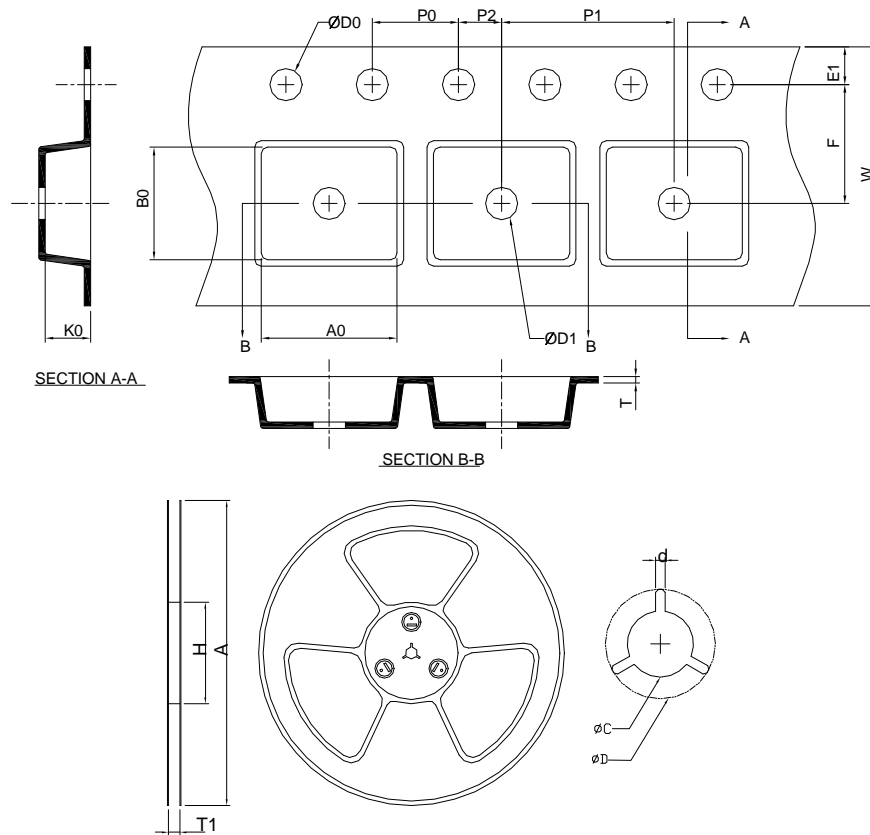


SYMBOL	TO-263-5			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
c	0.38	0.74	0.015	0.029
c2	1.14	1.65	0.045	0.065
D	8.38	9.65	0.330	0.380
D1	6.00	9.00	0.236	0.354
E	9.65	11.43	0.380	0.450
E1	6.22	9.00	0.245	0.354
e	1.70 BSC		0.067 BSC	
H	14.61	15.88	0.575	0.625
L	1.78	2.79	0.070	0.110
L1		1.68		0.066
$\theta$	0°	8°	0°	8°

Note : Follow JEDEC TO-263 BB.



### Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
TO-252-5	330.0 ±0.00	50 MIN.	16.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	16.0 ±0.30	1.75 ±0.10	7.50 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	8.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.80 ±0.20	10.40 ±0.20	2.50 ±0.20
Application	A	H	T1	C	d	D	W	E1	F
TO-263-5	330.0 ±0.00	50 MIN.	24.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	24.0 ±0.30	1.75 ±0.10	11.5 ±0.10
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	16.0 ±0.10	2.0 ±0.10	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	10.8 ±0.20	16.1 ±0.20	5.2 ±0.20

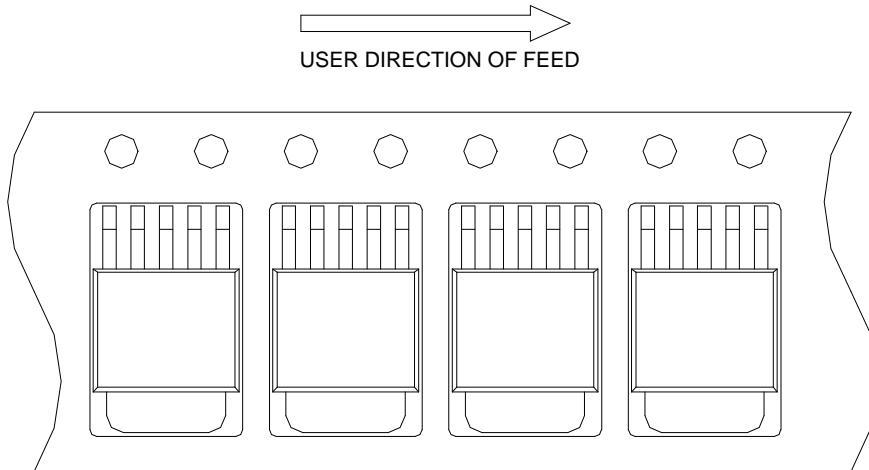
(mm)

### Devices Per Unit

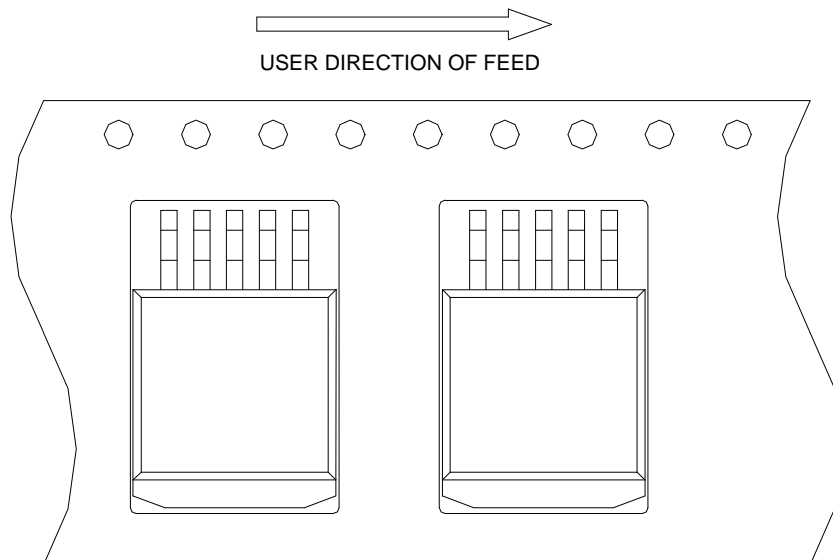
Package Type	Unit	Quantity
TO-252-5	Tape & Reel	2500
TO-263-5	Tape & Reel	800

### Taping Direction Information

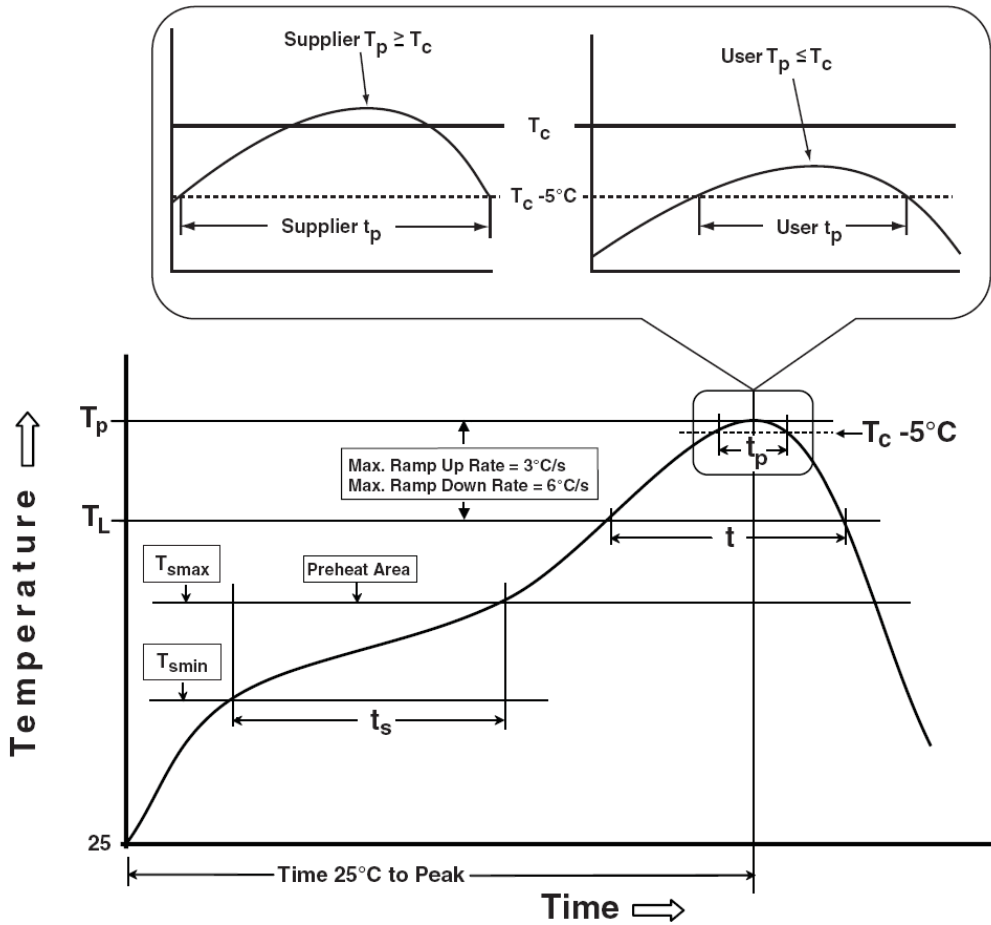
TO-252-5



TO-263-5



**Classification Profile**



**Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
Temperature min ( $T_{smin}$ )	100 °C	150 °C
Temperature max ( $T_{smax}$ )	150 °C	200 °C
Time ( $T_{smin}$ to $T_{smax}$ ) ( $t_s$ )	60-120 seconds	60-120 seconds
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C/second max.	3°C/second max.
Liquidous temperature ( $T_L$ )	183 °C	217 °C
Time at liquidous ( $t_L$ )	60-150 seconds	60-150 seconds
Peak package body Temperature ( $T_p$ )*	See Classification Temp in table 1	See Classification Temp in table 2
Time ( $t_p$ )** within 5°C of the specified classification temperature ( $T_c$ )	20** seconds	30** seconds
Average ramp-down rate ( $T_p$ to $T_{smax}$ )	6 °C/second max.	6 °C/second max.
Time 25°C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.		
** Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.		

## Classification Reflow Profiles (Cont.)

Table 1. SnPb Eutectic Process – Classification Temperatures (Tc)

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (Tc)

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

## Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245°C
HOLT	JESD-22, A108	1000 Hrs, Bias @ T <sub>j</sub> =125°C
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C
HBM	MIL-STD-883-3015.7	VHBM 2KV
MM	JESD-22, A115	VMM 200V
Latch-Up	JESD 78	10ms, 1 <sub>tr</sub> 100mA

## Customer Service

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