

## Dual-Channel, 3.3V/500mA and 2.5V/500mA Linear Regulator

### Features

- **Fixed Output Voltage :**  
 $V_{OUT1}=3.3V/500mA$  (within Maximum Power Dissipation)  
 $V_{OUT2}=2.5V/500mA$  (within Maximum Power Dissipation)
- **Low Dropout Voltage (Defined as the Minimum Input/Output Voltage Difference):**  
**Output 1 Dropout Voltage : 550mV (at 500mA)**  
**Output 2 Dropout Voltage : 630mV (at 500mA)**
- **Stable with 4.7mF Output Capacitor(at  $V_{OUT1}$ )**  
**Stable with 4.7mF Output Capacitor(at  $V_{OUT2}$ )**
- **No Protection Diodes Needed**
- **Built-In Thermal Protection**
- **Built-In Current-Limit Protection**
- **Fast transient Response**
- **Short Setting Time**
- **SOP-8 and SOP-8P Packages Available**
- **Lead Free and Green Devices Available (RoHS Compliant)**

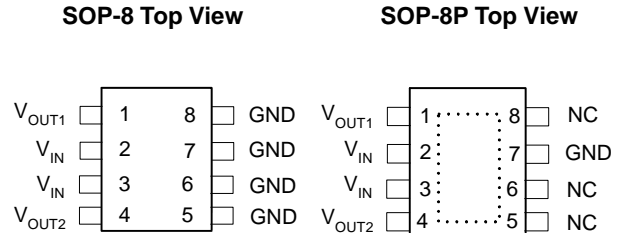
### Applications


- **Desktop Computer**
- **Networking Systems**
- **Optical Data Storage Systems**

### General Description

The APL5522 is a dual low dropout regulator with output 1 with 3.3V/0.5A and output2 with 2.5V/0.5A output capability. In order to obtain lower dropout voltage and faster transient response, which is critical for low voltage applications, the APL5522 has been optimized.  $V_{OUT1}$  typical dropout voltage is 550mV at 500mA loading and  $V_{OUT2}$  typical dropout voltage is 630mV at 500mA loading. 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 temperatures. The APL5522 regulator comes in a SOP-8 and SOP-8P packages.

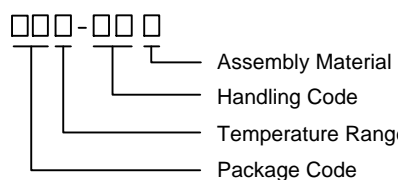
### Pin Configuration



 = Thermal Pad

(The thermal pad of SOP-8P has to be connected to the GND plane to get better heat dissipation than SOP-8.)

## Ordering and Marking Information

APL5522 □□□-□□□  <ul style="list-style-type: none"> <li>□□□ □ Assembly Material</li> <li>□□□ □ Handling Code</li> <li>□□□ □ Temperature Range</li> <li>□□□ □ Package Code</li> </ul>	Package Code K : SOP-8                      KA : SOP-8P Operating Ambient Temperature Range C : 0 to 70 °C Handling Code TR : Tape & Reel Assembly Material G : Halogen and Lead Free Device
APL5522 K /KA: <span style="border: 1px solid black; padding: 2px;">APL5522 XXXXX ●</span>	XXXXX - Date Code

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-020C 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).

## Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
V <sub>IN</sub> , V <sub>OUT</sub>	Input Voltage or Out Voltage	6	V
P <sub>D</sub>	Power Dissipation	Internally Limited	W
T <sub>J</sub>	Operating Junction Temperature	0 to 150	°C
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.

## Thermal Characteristics

Symbol	Parameter	Typical Value	Unit	
R <sub>TH,JA</sub>	Thermal Resistance – Junction to Ambient	SOP-8	120	°C/W
		SOP-8P	65	
R <sub>TH,JC</sub>	Thermal Resistance – Junction to Case	SOP-8	30	°C/W
		SOP-8P	5	

## Electrical Characteristics

Unless otherwise noted these specifications apply over full temperature, C<sub>IN</sub>=1μF, C<sub>OUT1</sub>=C<sub>OUT2</sub>=4.7μF, T<sub>J</sub>=0 to 150°C. Typical values refer to T<sub>J</sub>=25°C.

Symbol	Parameter	Test Conditions	APL5522			Unit
			Min.	Typ.	Max.	
V <sub>IN</sub>	Input Voltage		2.7	-	6	V
I <sub>SHORT</sub>	Short Current	V <sub>OUT</sub> =0V	-	50	-	mA
PSRR	Ripple Rejection	F≤1kHz, 1Vpp at V <sub>IN</sub> = V <sub>OUT</sub> +1.0V C <sub>OUT</sub> =10nf	45	55	-	dB

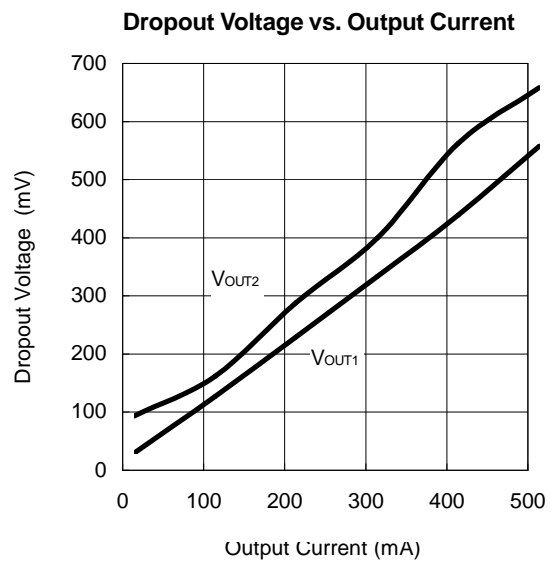
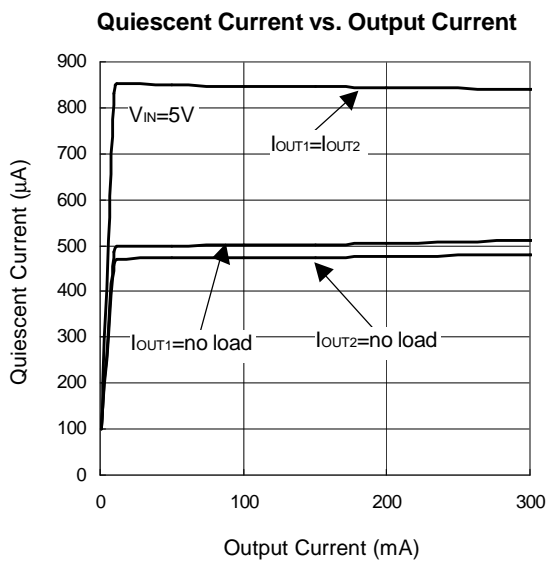
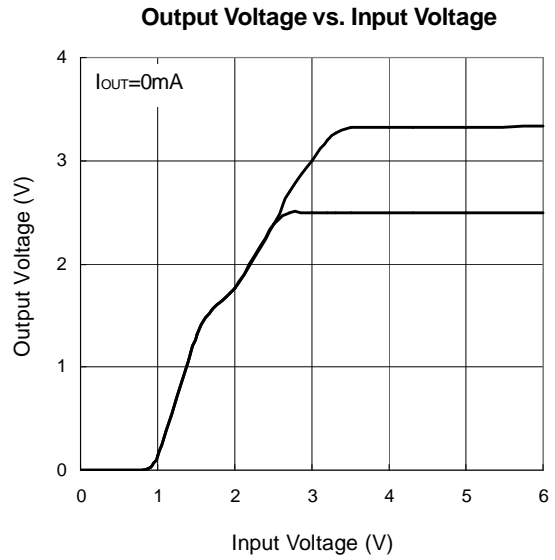
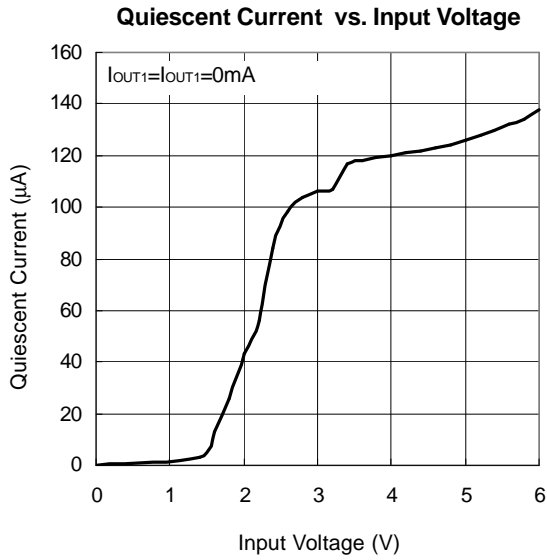
## Electrical Characteristics (Cont.)

Unless otherwise noted these specifications apply over full temperature,  $C_{IN}=1\mu F$ ,  $C_{OUT1}=C_{OUT2}=4.7\mu F$ ,  $T_J=0$  to  $150^\circ C$ . Typical values refer to  $T_J=25^\circ C$ .

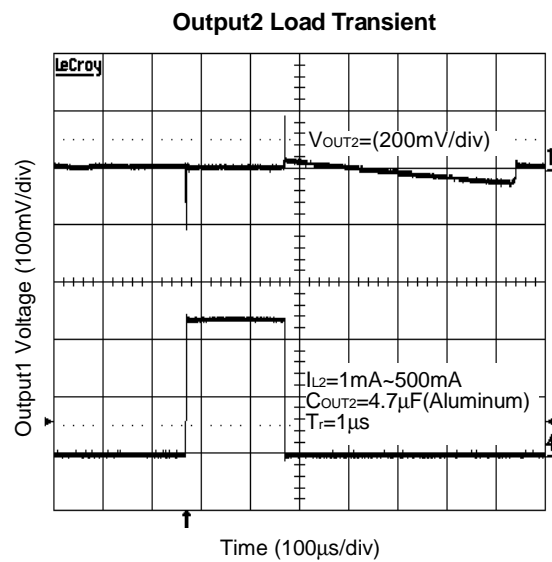
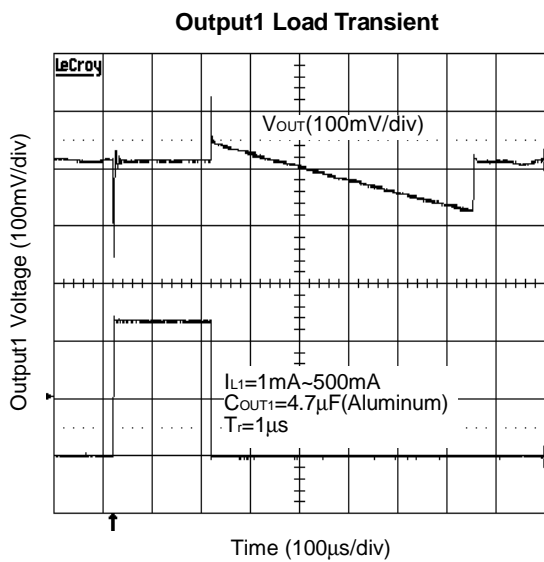
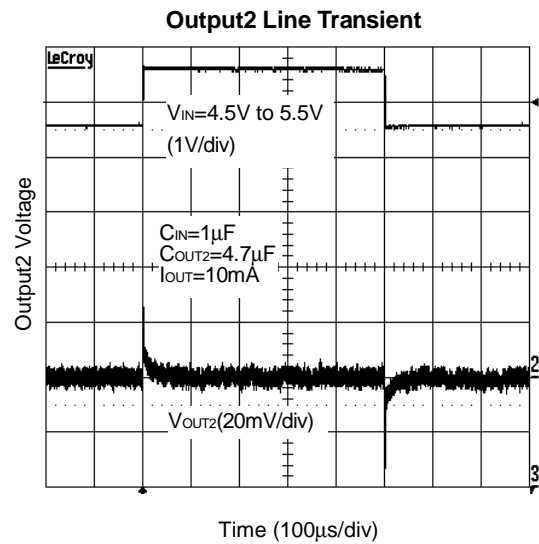
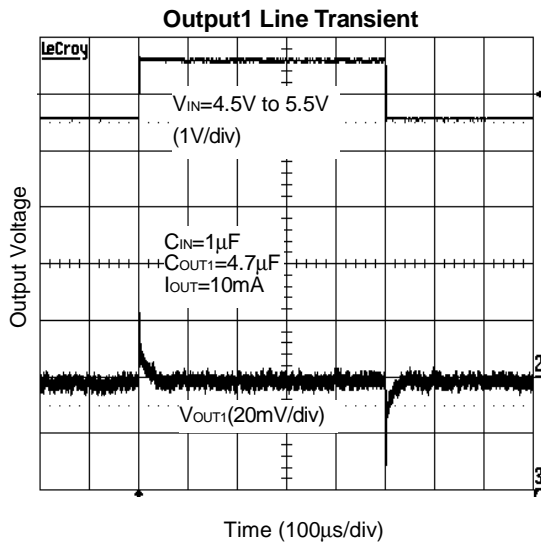
Symbol	Parameter	Test Conditions	APL5522			Unit
			Min.	Typ.	Max.	
$I_Q$	Quiescent Current	$I_{OUT1}=300mA, I_{OUT2}=300mA$	-	900	1000	$\mu A$
		$I_{OUT1}=0mA, I_{OUT2}=0mA$	-	100	200	
<b>OUTPUT1 (500mA)</b>						
$V_{OUT}$	Output Voltage	$V_{OUT}+1.0V < V_{CC} < 6.0V, 0mA < I_{OUT} < I_{MAX}$	$V_{OUT} -2\%$	3.3	$V_{OUT} +2\%$	V
$I_{LIMIT}$	Circuit Current Limit	$V_{IN}=V_{OUT}+1V$	-	800	-	mA
$I_{OUT}$	Load Current	$V_{IN}=V_{OUT}+1V$	500	-	-	mA
$REG_{LINE}$	Line Regulation	$V_{OUT}+1V < V_{CC} < 6.0V, I_{OUT}=1mA$	-	4	10	mV
$REG_{LOAD}$	Load Regulation	$V_{IN}=V_{OUT}+1V, 0mA < I_{OUT} < I_{MAX}$	-	26	40	mV %
	Load Transient	$V_{IN}=V_{OUT}+1V, I_{OUT}=1mA-500mA$ in $1\mu s$	-	150	250	mV
$V_{DROP}$	Dropout Voltage <sup>(Note2)</sup>	$I_{OUT}=500mA$	-	0.6	0.7	V
$C_{OUT}$	Output Capacitor		-	4.7	-	$\mu F$
	ESR		0.01	0.1	1	Ohm
<b>OUTPUT2 (500mA)</b>						
$V_{OUT}$	Output Voltage	$V_{OUT}+1.0V < V_{CC} < 6.0V, 0mA < I_{OUT} < I_{MAX}$	$V_{OUT} -2\%$	2.5	$V_{OUT} +2\%$	V
$I_{LIMIT}$	Circuit Current Limit	$V_{IN}=V_{OUT}+1V$	-	800	-	mA
$I_{OUT}$	Load Current	$V_{IN}=V_{OUT}+1V$	500	-	-	mA
$REG_{LINE}$	Line Regulation	$V_{OUT}+1V < V_{CC} < 6.0V, I_{OUT}=1mA$	-	4	10	mV
$REG_{LOAD}$	Load Regulation	$V_{IN}=V_{OUT}+1V, 0mA < I_{OUT} < I_{MAX}$	-	26	40	mV %
	Load Transient	$V_{IN}=V_{OUT}+1V, I_{OUT}=1mA-500mA$ in $1\mu s$	-	150	250	mV
$V_{DROP}$	Dropout Voltage <sup>(Note2)</sup>	$I_{OUT}=500mA$	-	0.6	0.7	V
$C_{OUT}$	Output Capacitor		-	4.7	-	$\mu F$
	ESR		0.01	0.1	1	Ohm

Note 2 : Dropout voltage definition :  $V_{IN}-V_{OUT}$  when  $V_{OUT}$  is 2% below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT}+1V$

Typical Operating Characteristics

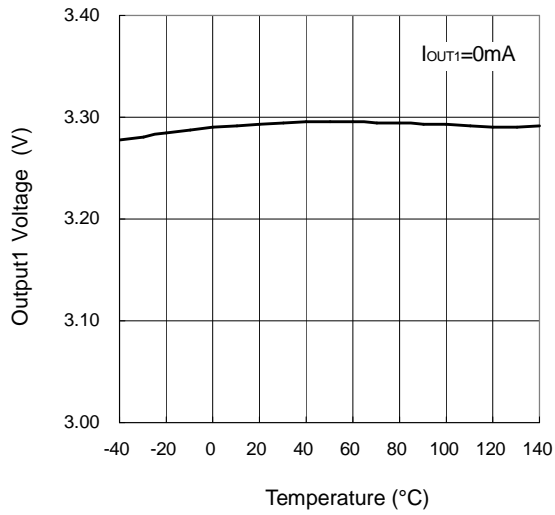


Typical Operating Characteristics (Cont.)

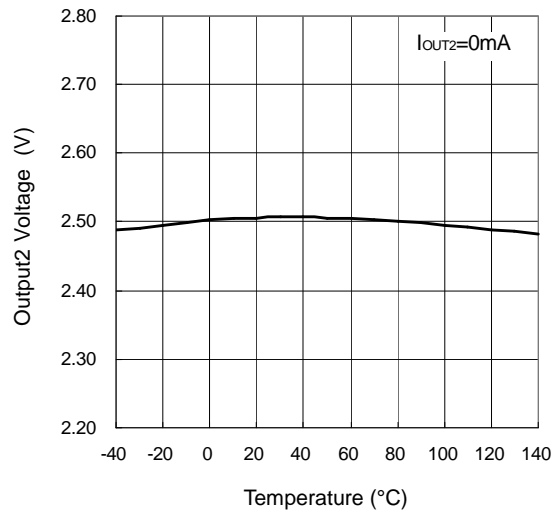


Typical Operating Characteristics (Cont.)

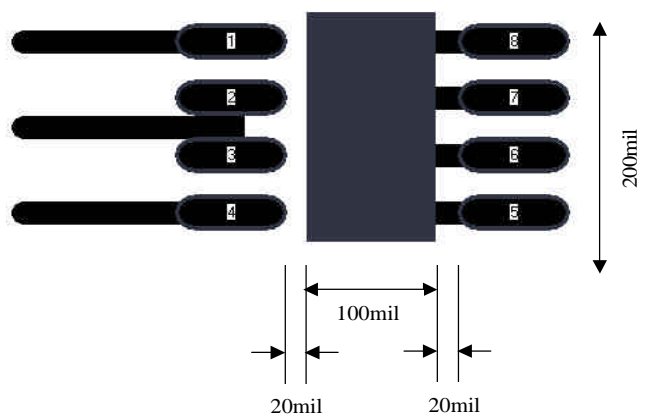
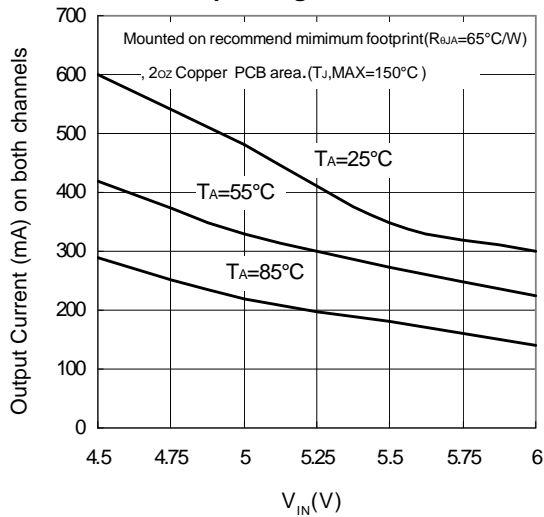
Output1 Voltage vs. Temperature



Output2 Voltage vs. Temperature



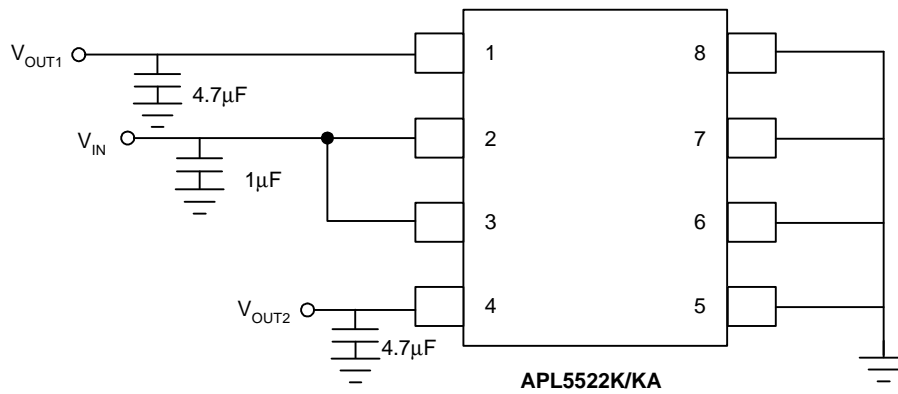
Safe Operating Area of SOP-8P



## Pin Description

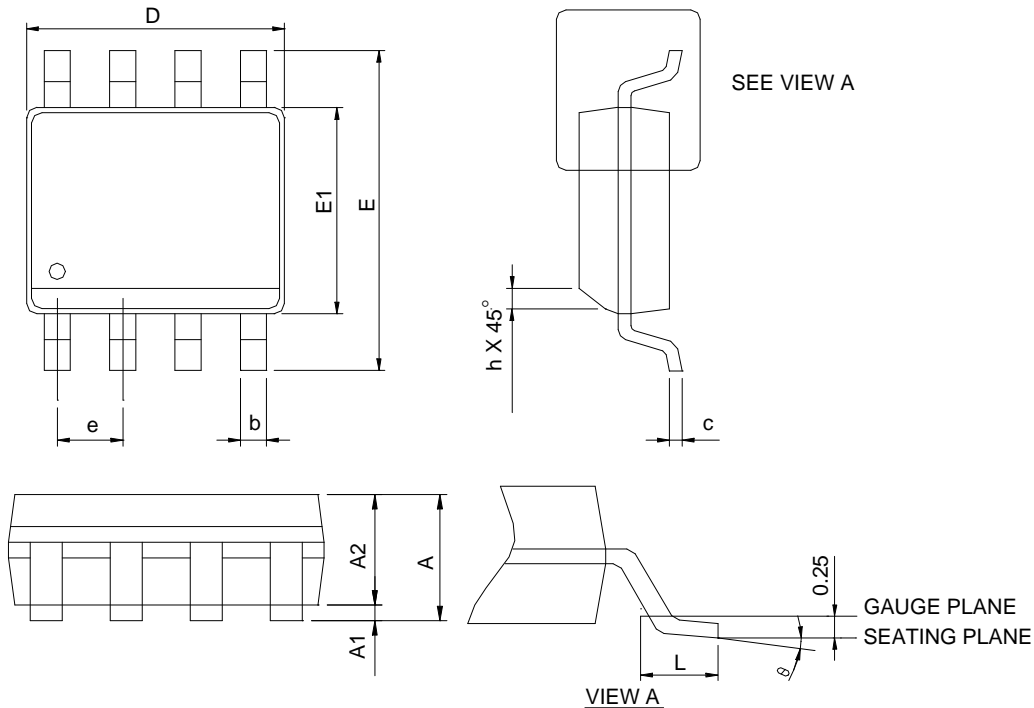
PIN		I/O	FUNCTION
NO.	NAME		
1	V <sub>OUT1</sub>	O	V <sub>OUT1</sub> output Voltage 3.3V. sources up to 500 mA.
2	V <sub>IN</sub>	I	Supply Voltage. Voltage can range from 4V to 6V
3	V <sub>IN</sub>	I	Supply Voltage. Voltage can range from 4V to 6V
4	V <sub>OUT2</sub>	O	V <sub>OUT2</sub> output Voltage 2.5V. sources up to 500 mA.
5	GND		Ground also functions as a heatsink. Solder to the ground plane to maximize thermal dissipation
6	GND		
7	GND		
8	GND		

## Typical Application Circuit



Package Information

SOP-8



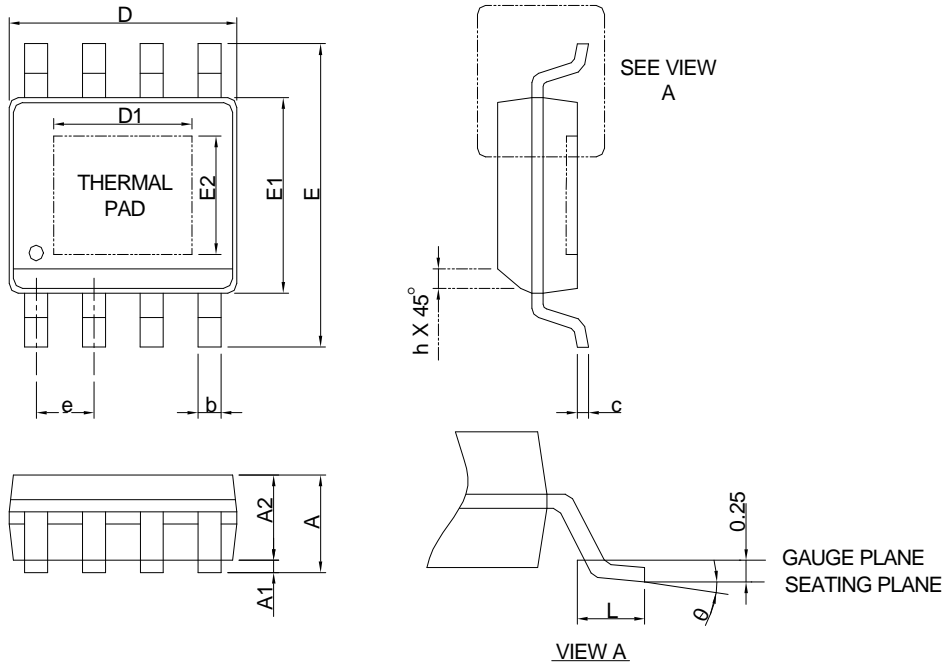
SYMBOL	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

- Note: 1. Follow JEDEC MS-012 AA.  
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.  
 3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.



Package Information

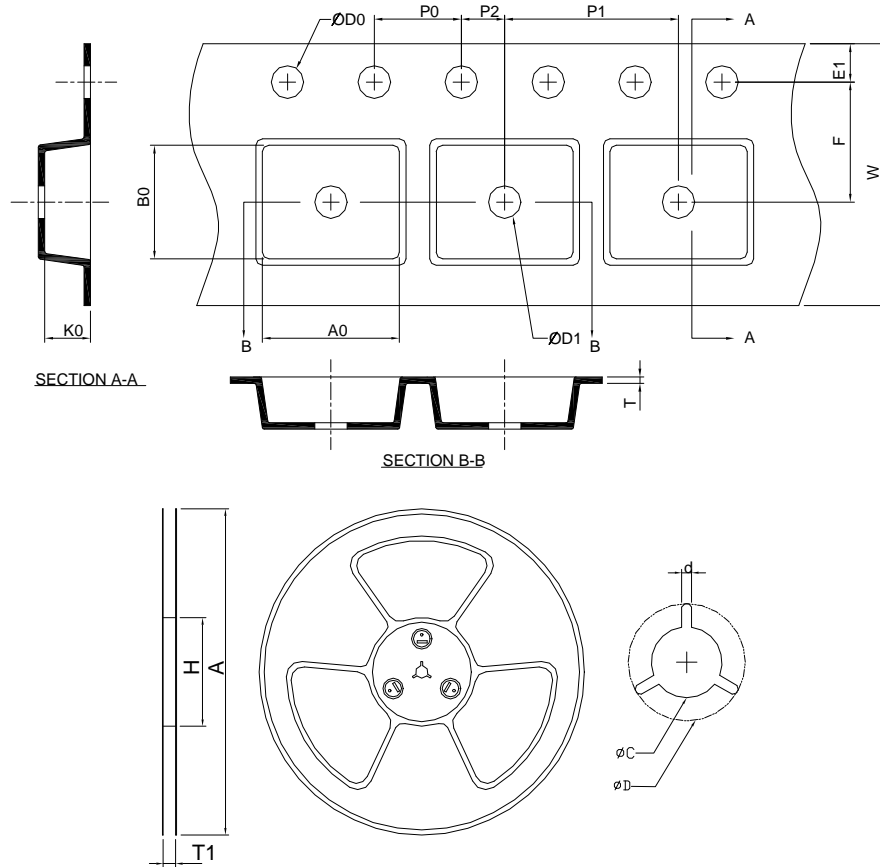
SOP-8P



SYMBOL	SOP-8P			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.60		0.063
A1	0.00	0.15	0.000	0.006
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
D1	2.25	3.50	0.098	0.138
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
E2	2.00	3.00	0.079	0.118
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

- Note : 1. Follow JEDEC MS-012 BA.  
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .  
 3. Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash and protrusions shall not exceed 10 mil per side.

### Carrier Tape & Reel Dimensions



Application	A	H	T1	C	d	D	W	E1	F
SOP-8(P)	330.0 ±0.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0 ±0.30	1.75 ±0.10	5.5 ±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	6.40 ±0.20	5.20 ±0.20	2.10 ±0.20

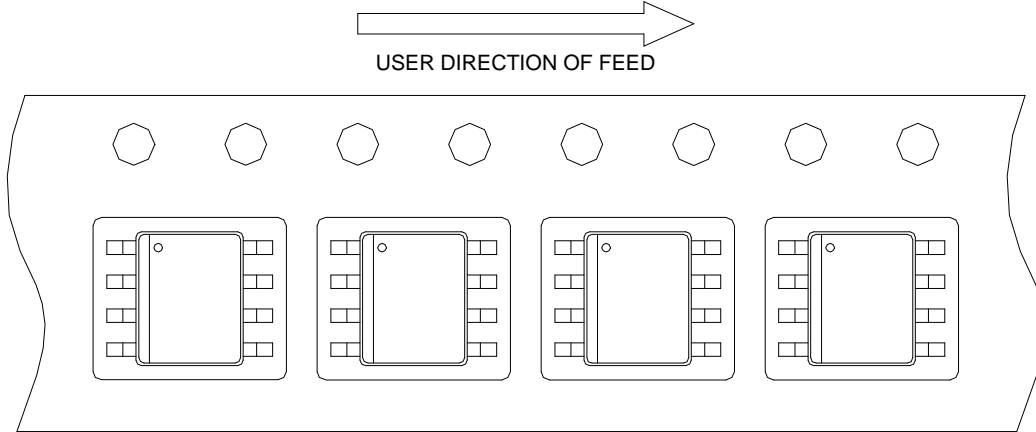
(mm)

### Devices Per Unit

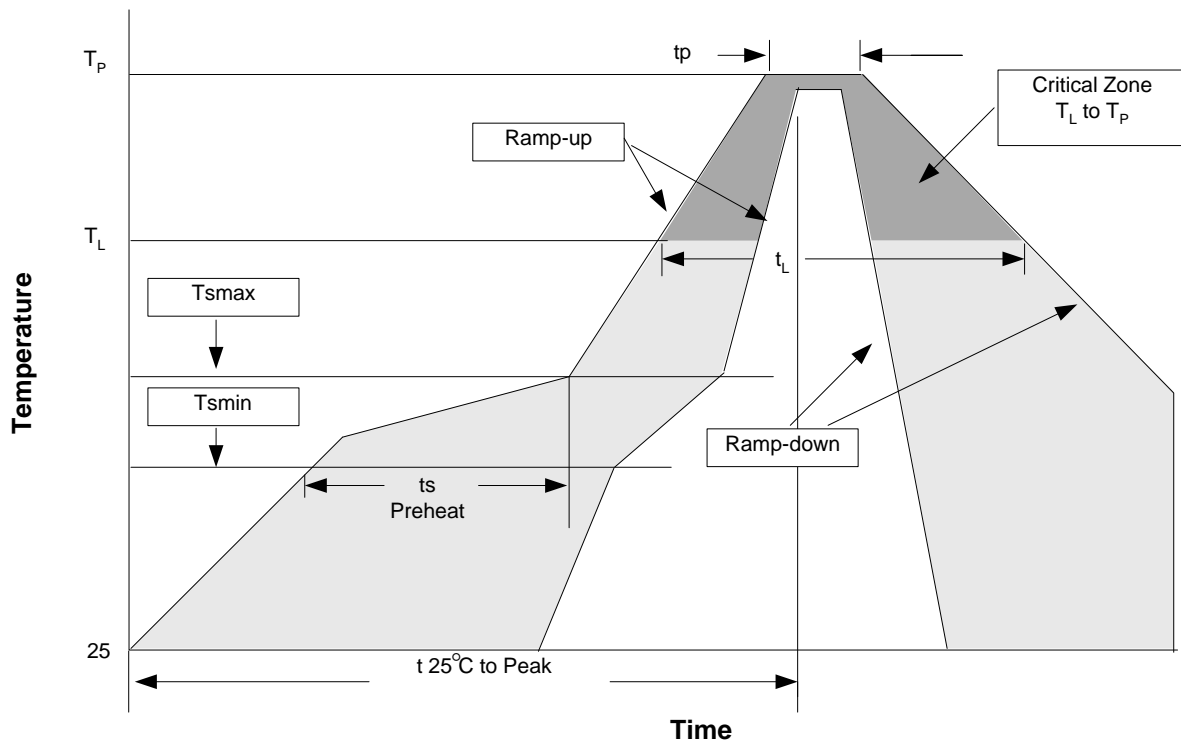
Package Type	Unit	Quantity
SOP-8(P)	Tape & Reel	2500

### Taping Direction Information

SOP-8(P)



### Reflow Condition (IR/Convection or VPR Reflow)



### Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 sec
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @125°C
PCT	JESD-22-B,A102	168 Hrs, 100%RH, 121°C
TST	MIL-STD-883D-1011.9	-65°C~150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms, 1 <sub>tr</sub> > 100mA

**Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T <sub>L</sub> to T <sub>P</sub> )	3°C/second max.	3°C/second max.
Preheat - Temperature Min (T <sub>smin</sub> ) - Temperature Max (T <sub>smax</sub> ) - Time (min to max) (t <sub>s</sub> )	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T <sub>L</sub> ) - Time (t <sub>L</sub> )	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature (T <sub>p</sub> )	See table 1	See table 2
Time within 5°C of actual Peak Temperature (t <sub>p</sub> )	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.	6°C/second max.
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.

Notes: All temperatures refer to topside of the package. Measured on the body surface.

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> ≥350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

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 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

\* Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

**Customer Service**

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