

## Dual-Channel, 3.3V/500mA and 1.8V/300mA Linear Regulator

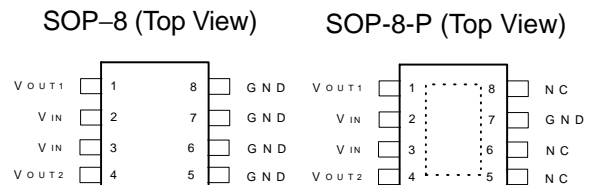
### Features

- Fixed Output Voltage :  
 $V_{OUT1}=3.3V/500mA$   
 $V_{OUT2}=1.8V/300mA$
- Low Dropout Voltage (defined as the minimum input/output voltage difference):  
 Output 1 Dropout Voltage : 0.6V (at 500mA)  
 Output 2 Dropout Voltage : 0.9V (at 300mA)
- Stable with 4.7uF Output Capacitor(at  $V_{OUT1}$ )  
 Stable with 2.2uF Output Capacitor(at  $V_{OUT2}$ )
- Built in Thermal Protection
- Built in Current Limit Protection
- Fast transient Response
- Short Setting Time
- SOP-8 and SOP-8-P Package Available

### General Description

The APL5523 is a dual low dropout regulator with output1 with 3.3V/0.5A and output2 with 1.8V/0.3A output capability. In order to obtain lower dropout voltage and faster transient response, which is critical for low voltage applications, the APL5223 has been optimized. The dropout voltages are guaranteed at 0.6V at 0.5A for output1 and 0.9V at 0.3A for output 2. 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 APL5523 regulator comes in a SOP-8 and SOP-8-P package.

### Pin Configuration



= Thermal Pad  
 (connected to GND plane for better heat dissipation)

### Applications

- Desktop Computer
- Networking Systems
- Optical Data Storage Systems

### Ordering and Marking Information

<p>APL5523    <span style="border: 1px solid black; padding: 2px;">□□-□□□</span></p> <p style="margin-left: 20px;"> <span style="border: 1px solid black; padding: 2px;">□□□</span> → Lead Free Code  <span style="border: 1px solid black; padding: 2px;">□□</span> → Handling Code  <span style="border: 1px solid black; padding: 2px;">□</span> → Temp. Range  <span style="border: 1px solid black; padding: 2px;">□</span> → Package Code         </p>	<p>Package Code            K : SOP-8      KA : SOP-8-P</p> <p>Operating Junction Temp. Range            C : 0 to 150°C</p> <p>Handling Code            TU : Tube      TR : Tape &amp; Reel</p> <p>Lead Free Code            L : Lead Free Device      Blank : Original Device</p>
<p>APL5523 K/KA :    <span style="border: 1px solid black; padding: 2px;">APL5523 XXXXX</span></p>	<p style="text-align: center;">XXXXX - Date Code</p>

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.

## Pin Description

PIN		I/O	Description
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.
3	V <sub>IN</sub>	I	Supply Voltage.
4	V <sub>OUT2</sub>	O	V <sub>OUT2</sub> output Voltage 1.8V. sources up to 300 mA.
5	GND		Ground also functions as a heatsink. Solder to the ground plane to maximize thermal dissipation
6	GND		
7	GND		
8	GND		

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V <sub>IN</sub> , V <sub>OUT</sub>	Input Voltage or Out Voltage	6	V
R <sub>TH,JA</sub>	Thermal Resistance – Junction to Ambient SOP-8 SOP-8-P	150 75	°C/W
R <sub>TH,JC</sub>	Thermal Resistance – Junction to Case SOP-8 SOP-8-P	30 5	°C/W
PD	Power Dissipation	Internally Limited	W
T <sub>J</sub>	Operating Junction Temperature Control Section Power Transistor	0 to 125 0 to 150	°C
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
TL	Lead Temperature (Soldering, 10 second)	260	°C

## Electrical Characteristics

Unless otherwise noted these specifications apply over full temperature, C<sub>IN</sub>=1μF, C<sub>OUT1</sub>=4.7μF, C<sub>OUT2</sub>=2.2μF, T<sub>J</sub>=0 to 125°C. Typical values refer to T<sub>J</sub>=25°C.

Symbol	Parameter	Test Conditions	APL5523			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
OTS	Over Temperature Shutdown			150		°C
	Over Temperature Shutdown Hysteresis	Hysteresis		20		°C
TC	Output Voltage Temperature Coefficient			100		ppm/°C
I <sub>Q</sub>	Quiescent Current	I <sub>OUT1</sub> =500mA, I <sub>OUT2</sub> =300mA		900	1000	μA
		I <sub>OUT1</sub> =0mA, I <sub>OUT2</sub> =0mA		100	200	

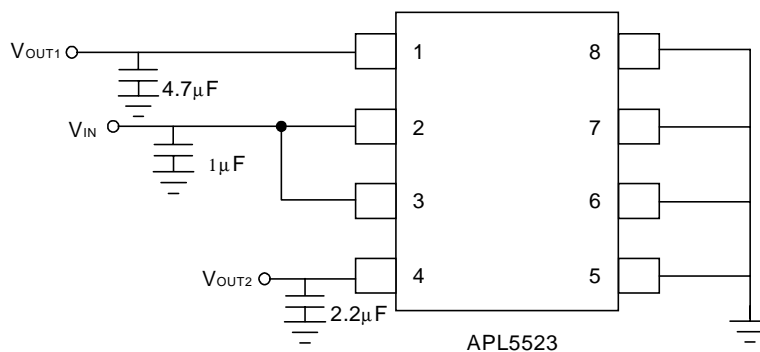
## Electrical Characteristics (Cont.)

Unless otherwise noted these specifications apply over full temperature,  $C_{IN}=1\mu F$ ,  $C_{OUT1}=4.7\mu F$ ,  $C_{OUT2}=2.2\mu F$ ,  $T_J=0$  to  $125^\circ C$ . Typical values refer to  $T_J=25^\circ C$ .

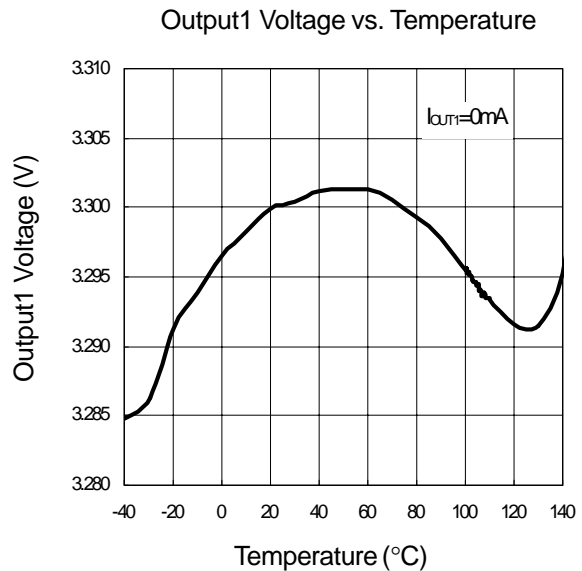
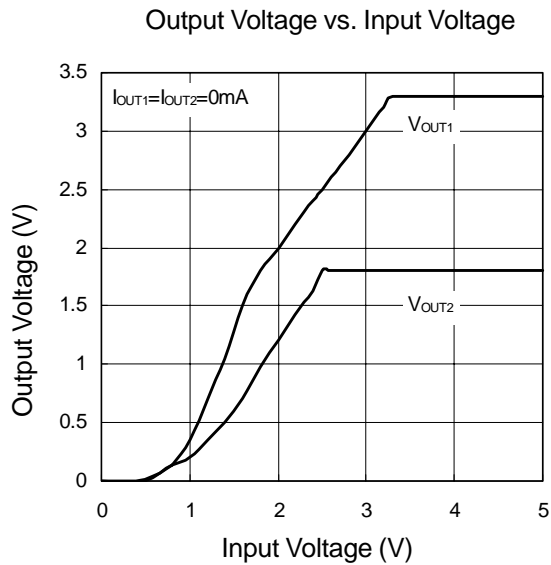
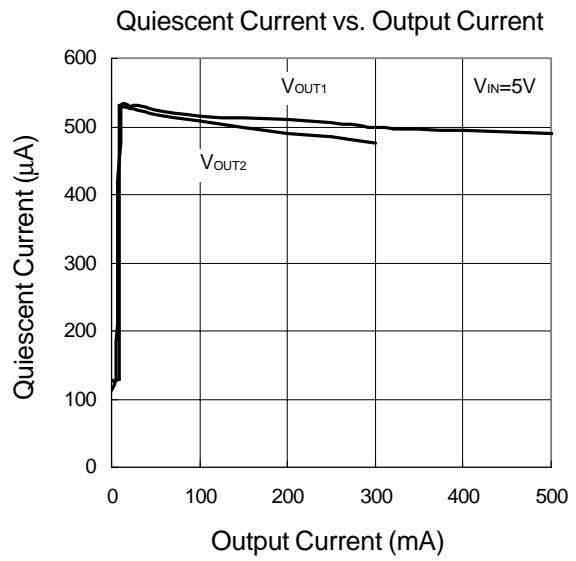
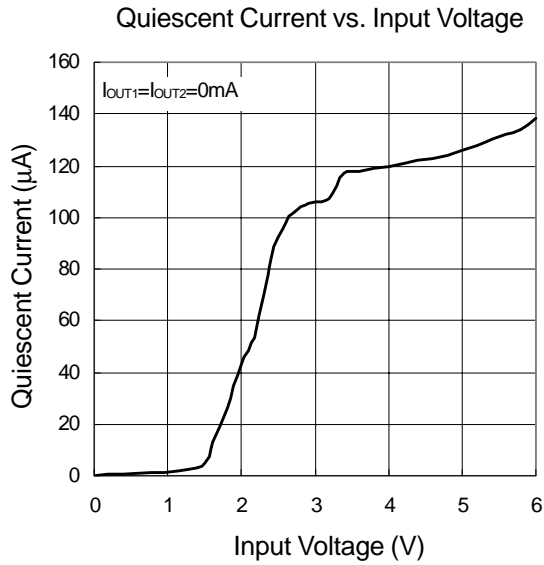
Symbol	Parameter	Test Conditions	APL5523			Unit
			Min.	Typ.	Max.	
Output1 (500mA)						
$V_{OUT}$	Output Voltage	$V_{IN}=5V$	$V_{OUT}-2\%$	3.3	$V_{OUT}+2\%$	V
$I_{LIMIT}$	Circuit Current Limit	$V_{IN}=V_{OUT}+1V$		900		mA
$I_{OUT}$	Load Current	$V_{IN}=V_{OUT}+1V$	500			mA
$REG_{LINE}$	Line Regulation	$V_{OUT}+1V < V_{CC} < 6.0V$ , $I_{OUT}=1mA$		5	10	mV
$REG_{LOAD}$	Load Regulation	$V_{IN}=V_{OUT}+1V$ , $0mA < I_{OUT} < I_{MAX}$		40	60	mV
PSRR	Ripple Rejection	$F \leq 1kHz$ , $1V_{pp}$ at $I_{OUT}=50mA$	40	48		dB
$V_{DROP}$	Dropout Voltage <sup>(Note1)</sup>	$I_{OUT}=500mA$		0.6	0.7	V
$C_{OUT}$	Output Capacitor			4.7		$\mu F$
	ESR		0.01	0.1	1	Ohm
Output2(300mA)						
$V_{OUT}$	Output Voltage	$V_{IN}=5V$	$V_{OUT}-2\%$	1.8	$V_{OUT}+2\%$	V
$I_{LIMIT}$	Circuit Current Limit	$V_{IN}=V_{OUT}+1V$		900		mA
$I_{OUT}$	Load Current	$V_{IN}=V_{OUT}+1V$	300			mA
$REG_{LINE}$	Line Regulation	$V_{OUT}+1V < V_{CC} < 6.0V$ , $I_{OUT}=1mA$		4	10	mV
$REG_{LOAD}$	Load Regulation	$V_{IN}=V_{OUT}+1V$ , $0mA < I_{OUT} < I_{MAX}$		20	40	mV
PSRR	Ripple Rejection	$F \leq 1kHz$ , $1V_{pp}$ at $I_{OUT}=50mA$	45	55		dB
$V_{DROP}$	Dropout Voltage <sup>(Note1)</sup>	$I_{OUT}=300mA$		0.9	1	V
$C_{OUT}$	Output Capacitor			2.2		$\mu F$
	ESR		0.01	0.1	1	Ohm

Note1 : Dropout voltage definition :  $V_{IN}-V_{OUT}$  when  $V_{OUT}$  is 2% below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT}+1V$

## Application Circuit

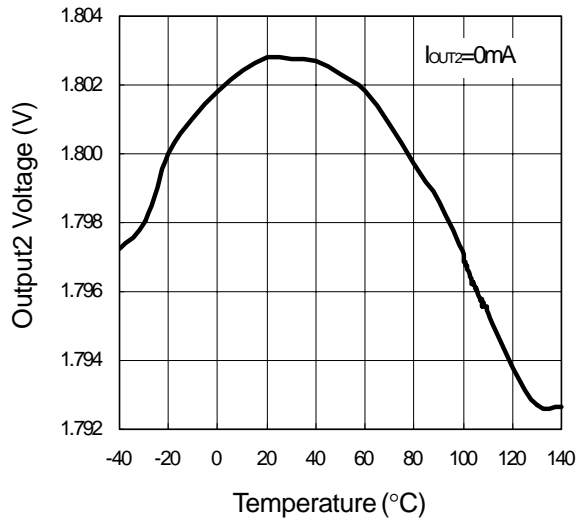


## Typical Characteristics

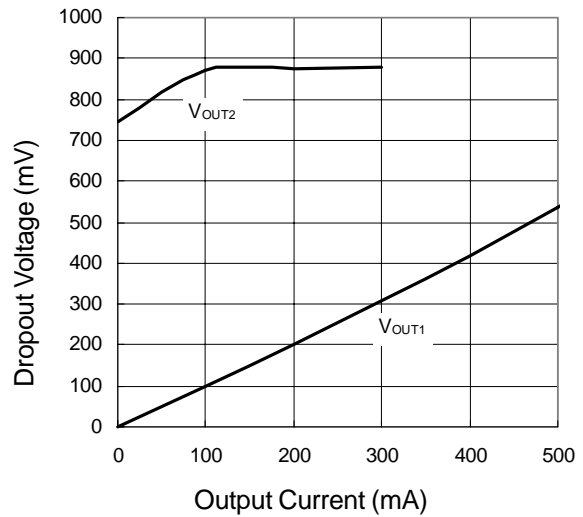


## Typical Characteristics

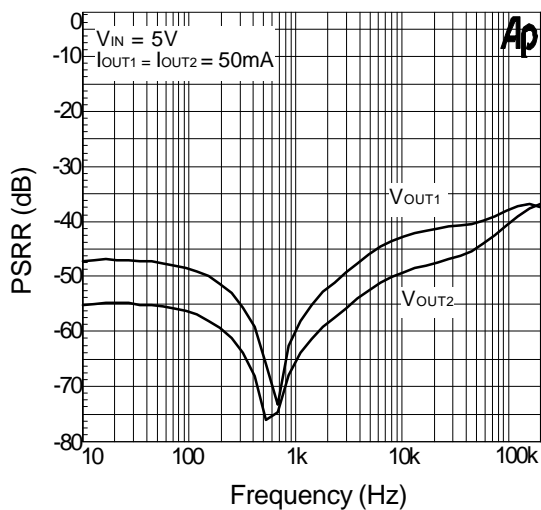
Output2 Voltage vs. Temperature



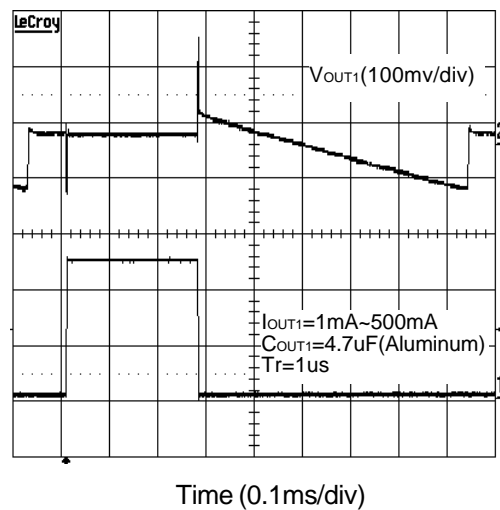
Dropout Voltage vs. Output Current



PSRR vs. Frequency

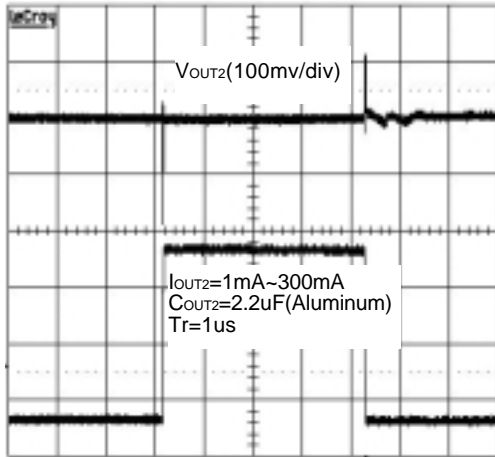


Load-Transient Response



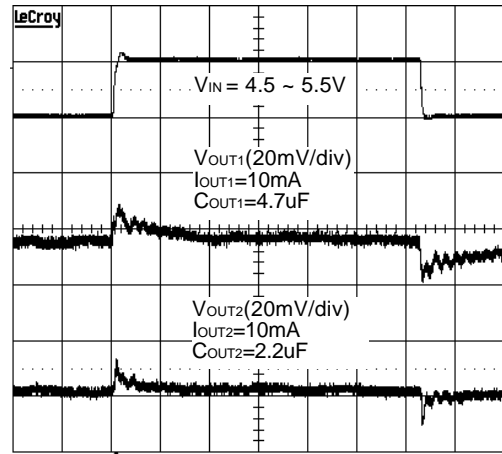
## Typical Characteristics

Load-Transient Response



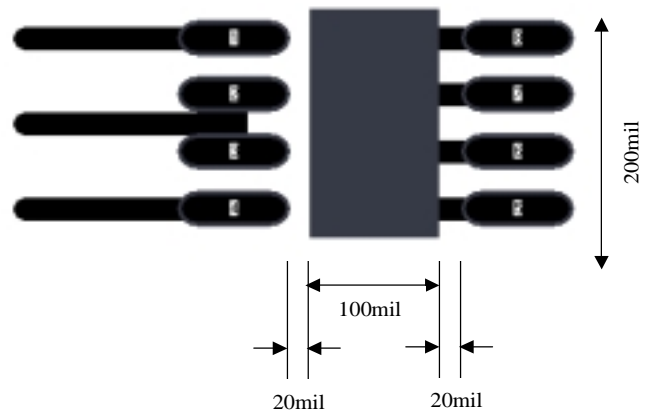
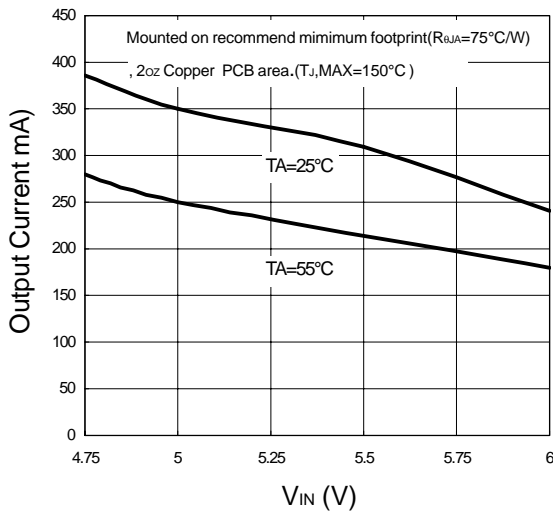
Time (0.1ms/div)

Line-Transient Response



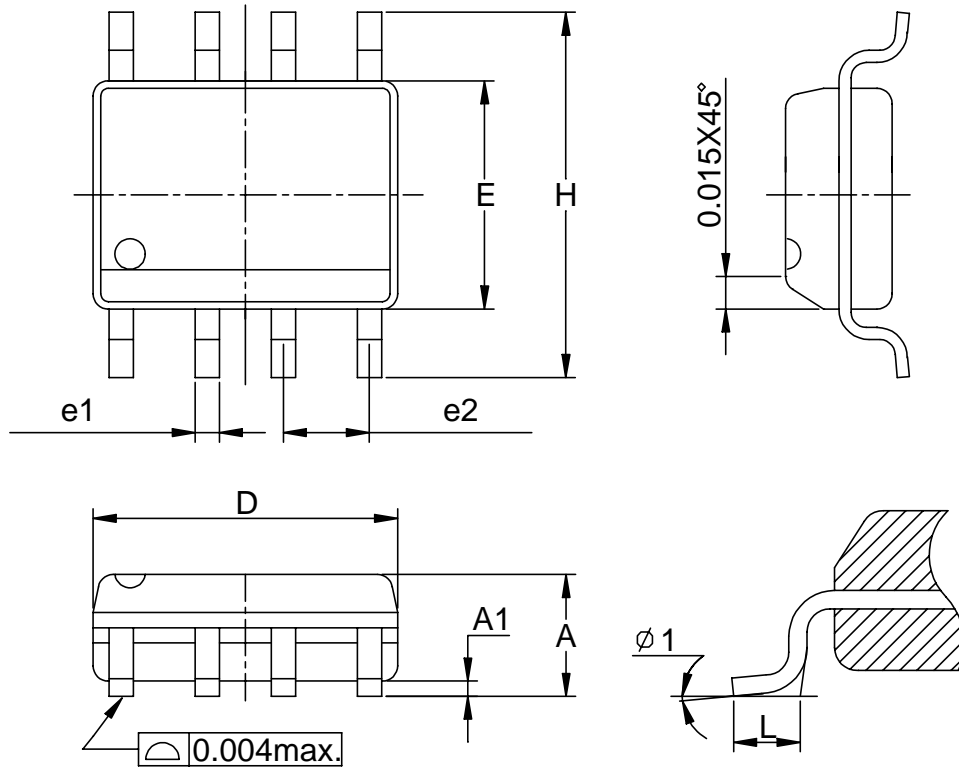
Time (20μs/div)

Output Current vs.  $V_{IN}$



## Packaging Information

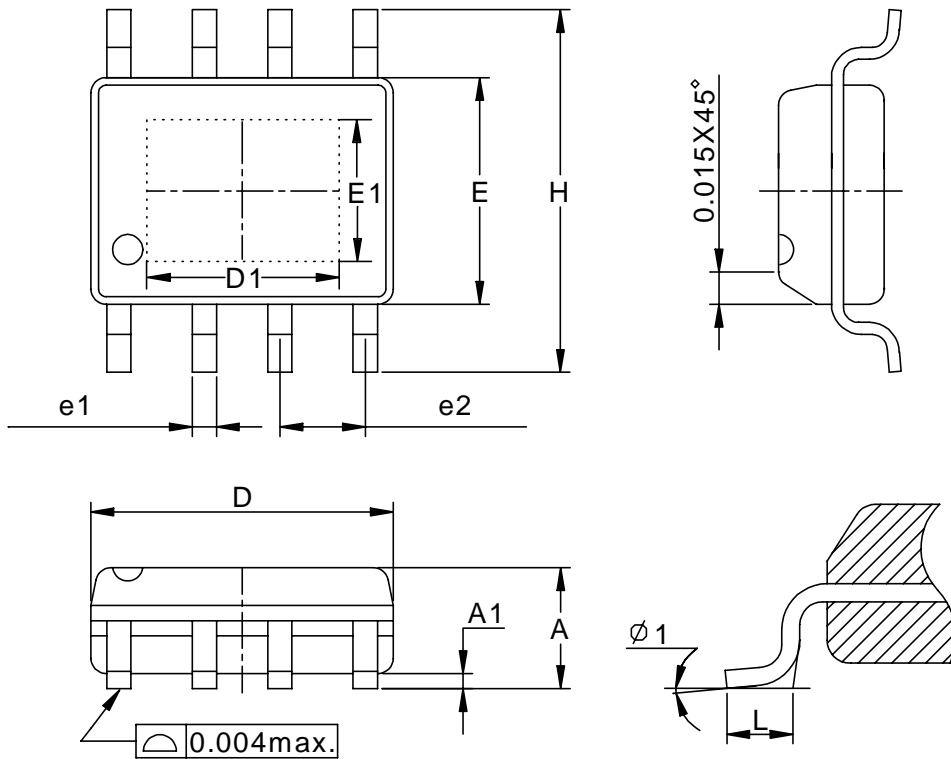
SOP-8 pin ( Reference JEDEC Registration MS-012)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
E	3.80	4.00	0.150	0.157
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	8°		8°	

## Packaging Information

SOP-8-P pin ( Reference JEDEC Registration MS-012)



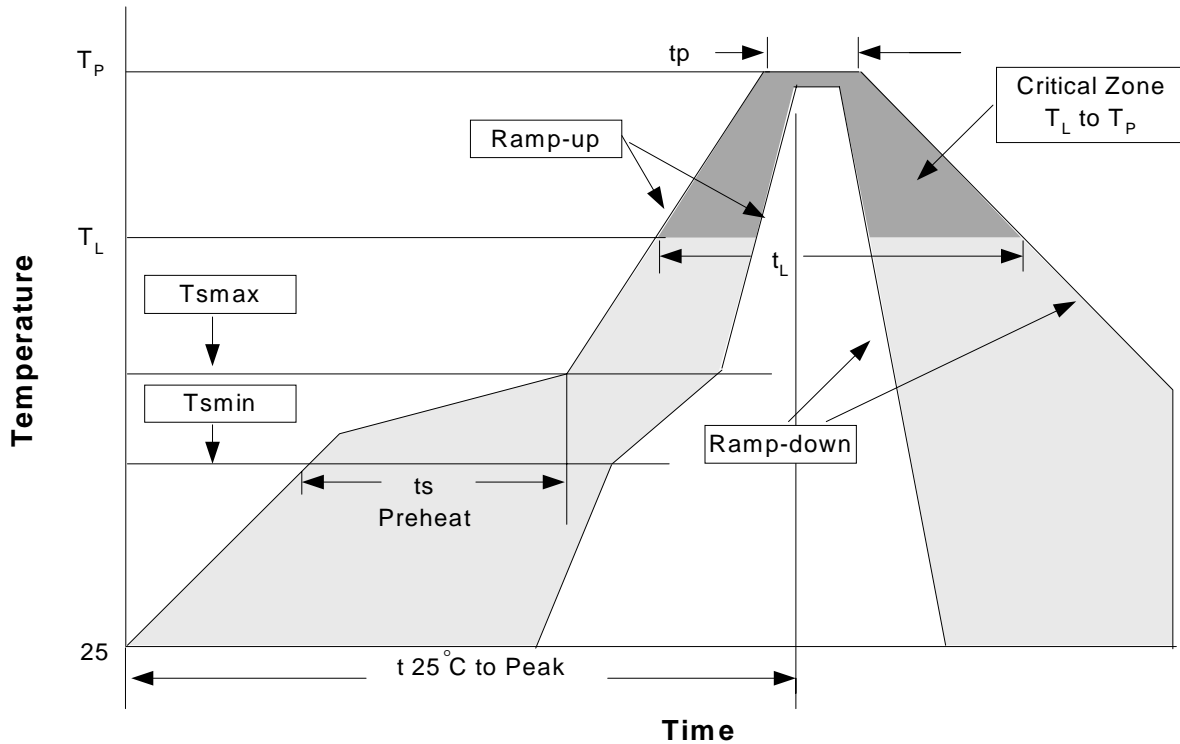
Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
D	4.80	5.00	0.189	0.197
D1	3.00REF		0.118REF	
E	3.80	4.00	0.150	0.157
E1	2.60REF		0.102REF	
H	5.80	6.20	0.228	0.244
L	0.40	1.27	0.016	0.050
e1	0.33	0.51	0.013	0.020
e2	1.27BSC		0.50BSC	
φ 1	8°		8°	



## Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

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



### Classification Reflow Profiles

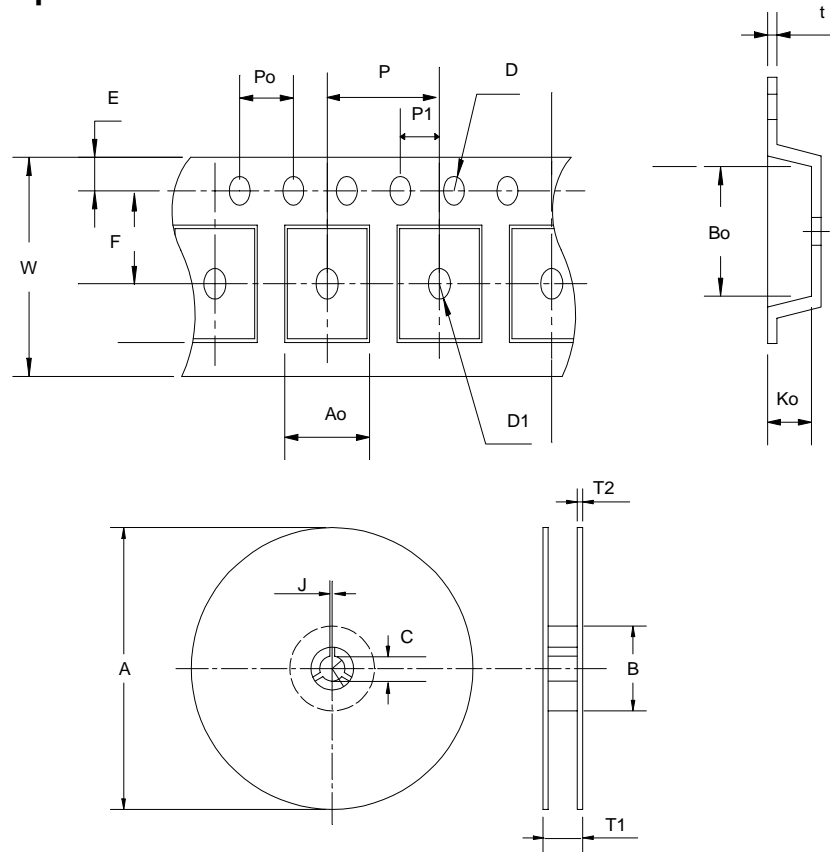
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max.		3°C/second max.	
Preheat				
- Temperature Min ( $T_{smin}$ )	100°C		150°C	
- Temperature Mix ( $T_{smax}$ )	150°C		200°C	
- Time (min to max)( $t_s$ )	60-120 seconds		60-180 seconds	
$T_{smax}$ to $T_L$			3°C/second max	
- Ramp-up Rate				
$T_{smax}$ to $T_L$				
- Temperature( $T_L$ )	183°C		217°C	
- Time ( $t_L$ )	60-150 seconds		60-150 seconds	
Peak Temperature( $T_p$ )	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature( $t_p$ )	10-30 seconds	10-30 seconds	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.	

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

### 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 , I <sub>tr</sub> > 100mA

### Carrier Tape



Application	A	B	C	J	T1	T2	W	P	E
SOP-8/P	330±1	62 ± 1.5	12.75 + 0.15	2 + 0.5	12.4 +0.2	2± 0.2	12 + 0.3 - 0.1	8± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.1	1.55±0.1	1.55+ 0.25	4.0 ± 0.1	2.0 ± 0.1	6.4 ± 0.1	5.2± 0.1	2.1± 0.1	0.3±0.013

(mm)

## Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOP- 8/P	12	9.3	2500

## Customer Service

### **Anpec Electronics Corp.**

Head Office :

5F, No. 2 Li-Hsin Road, SBIP,

Hsin-Chu, Taiwan, R.O.C.

Tel : 886-3-5642000

Fax : 886-3-5642050

Taipei Branch :

7F, No. 137, Lane 235, Pac Chiao Rd.,

Hsin Tien City, Taipei Hsien, Taiwan, R. O. C.

Tel : 886-2-89191368

Fax : 886-2-89191369