



**Absolute Maximum Ratings** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Rating	Unit	
$V_{DSS}$	Drain-Source Voltage	20	V	
$V_{GSS}$	Gate-Source Voltage	$\pm 16$		
$I_D^*$	Continuous Drain Current	5	A	
$I_{DM}^*$	Pulsed Drain Current			20
$I_S^*$	Diode Continuous Forward Current	3	A	
$T_J$	Maximum Junction Temperature	150	$^\circ\text{C}$	
$T_{STG}$	Storage Temperature Range	-55 to 150		
$P_D^*$	Power Dissipation for Single Operation	$T_A=25^\circ\text{C}$	1.47	W
		$T_A=100^\circ\text{C}$	0.58	
$R_{\theta JA}^*$	Thermal Resistance-Junction to Ambient	85	$^\circ\text{C/W}$	

Note:

\*Surface Mounted on  $1\text{in}^2$  pad area,  $t \leq 10\text{sec}$ .

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Condition	APM2054NV			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\mu\text{A}$	20			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=16\text{V}, V_{GS}=0\text{V}$ $T_J=85^\circ\text{C}$			1	$\mu\text{A}$
					30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu\text{A}$	0.6	0.9	1.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 16\text{V}, V_{DS}=0\text{V}$			$\pm 100$	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10\text{V}, I_{DS}=5\text{A}$		35	40	m $\Omega$
		$V_{GS}=4.5\text{V}, I_{DS}=3.5\text{A}$		45	54	
		$V_{GS}=2.5\text{V}, I_{DS}=2.5\text{A}$		110	130	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=3\text{A}, V_{GS}=0\text{V}$		0.85	1.3	V
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=10\text{V}, V_{GS}=4.5\text{V},$ $I_{DS}=6\text{A}$		11	13	nC
$Q_{gs}$	Gate-Source Charge			3.8		
$Q_{gd}$	Gate-Drain Charge			5.2		

## Electrical Characteristics (Cont.) ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

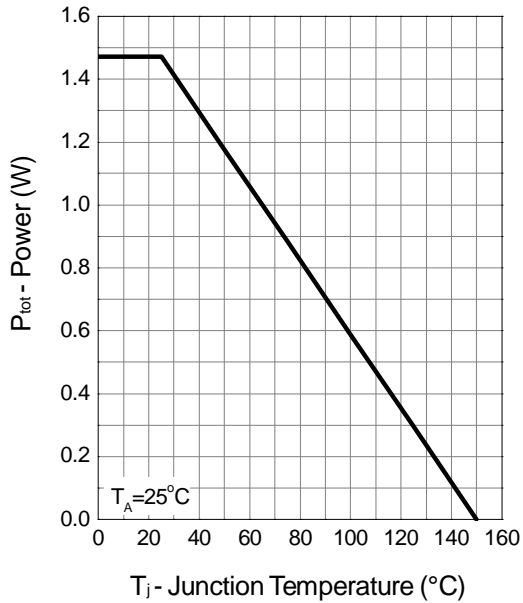
Symbol	Parameter	Test Condition	APM2054NV			Unit
			Min.	Typ.	Max.	
<b>Dynamic Characteristics<sup>b</sup></b>						
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=10V, R_L=10\Omega,$ $I_{DS}=1A, V_{GEN}=4.5V,$ $R_G=6\Omega$		7	10	ns
$T_r$	Turn-on Rise Time			15	25	
$t_{d(OFF)}$	Turn-off Delay Time			19	26	
$T_f$	Turn-off Fall Time			6	7	
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$		2.5		$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=20V,$ Frequency=1.0MHz		450		pF
$C_{oss}$	Output Capacitance			100		
$C_{rss}$	Reverse Transfer Capacitance			60		

Notes:

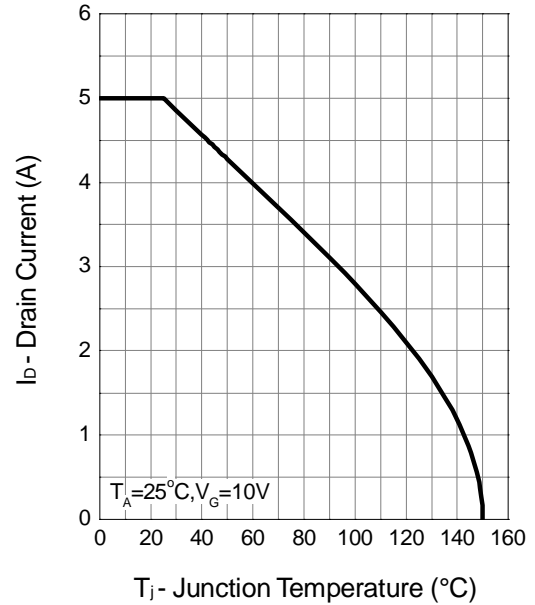
- a : Pulse test ; pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- b : Guaranteed by design, not subject to production testing.

## Typical Characteristics

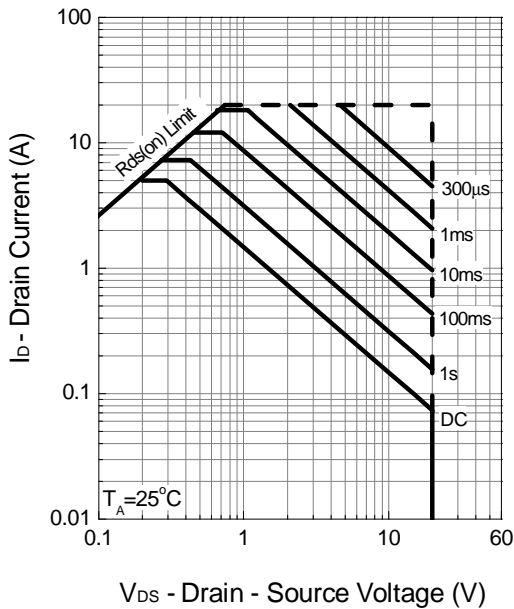
Power Dissipation



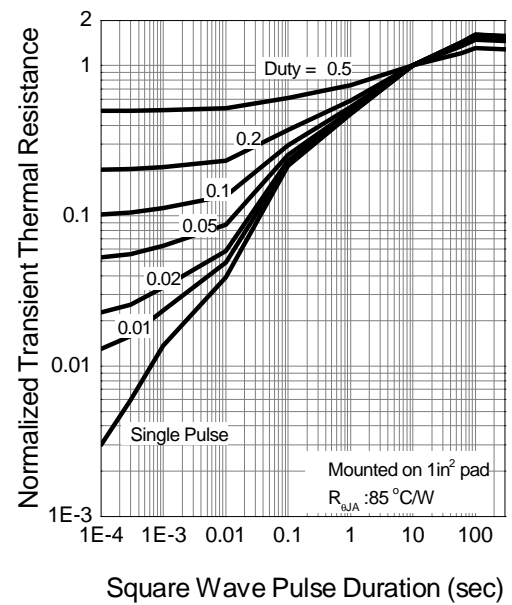
Drain Current



Safe Operation Area

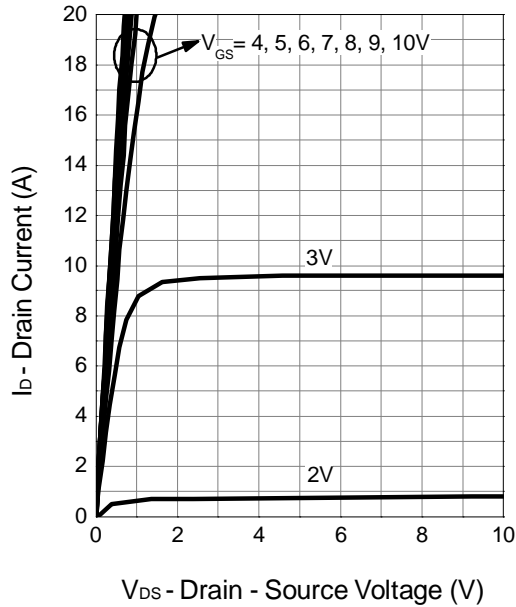


Thermal Transient Impedance

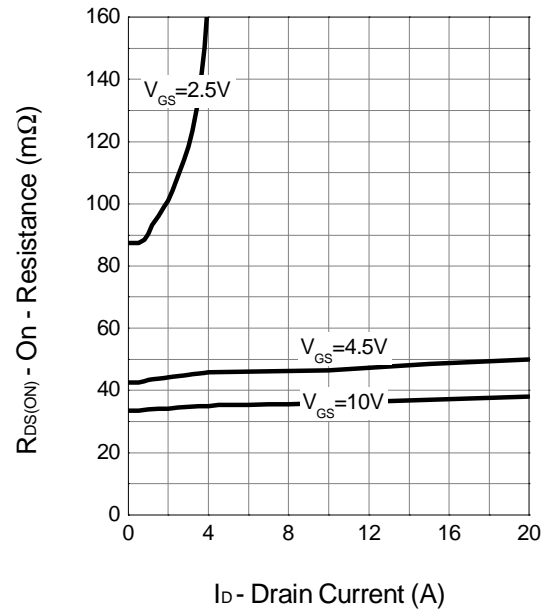


## Typical Characteristics (Cont.)

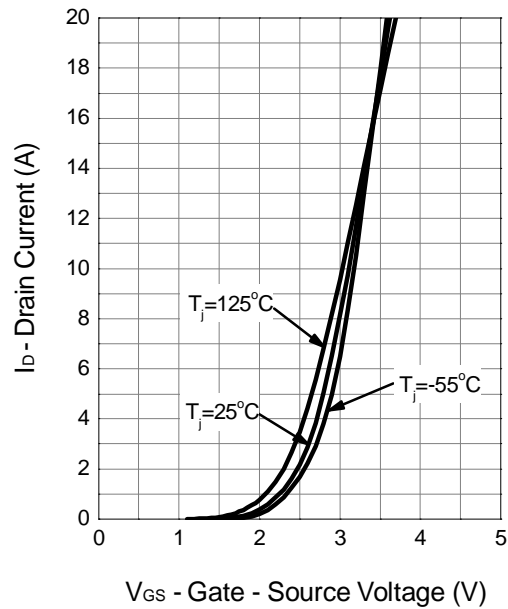
Output Characteristics



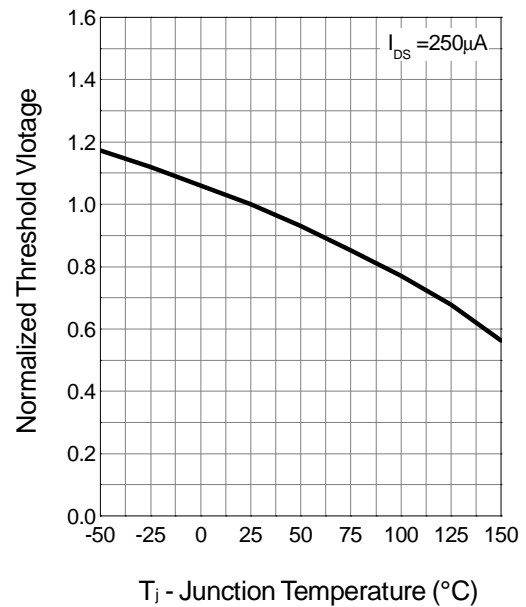
Drain-Source On Resistance



Transfer Characteristics

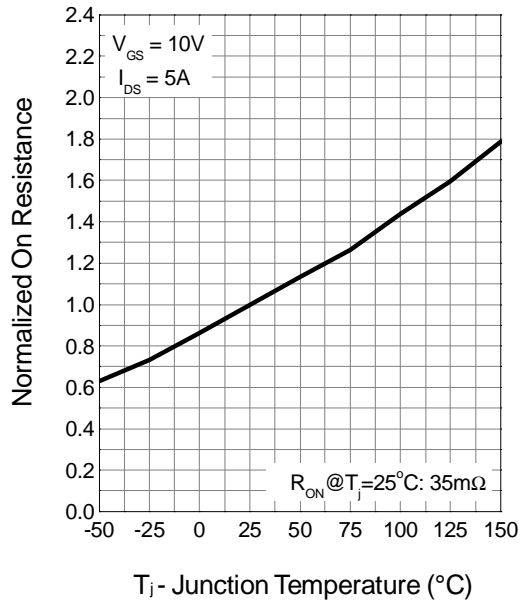


Gate Threshold Voltage

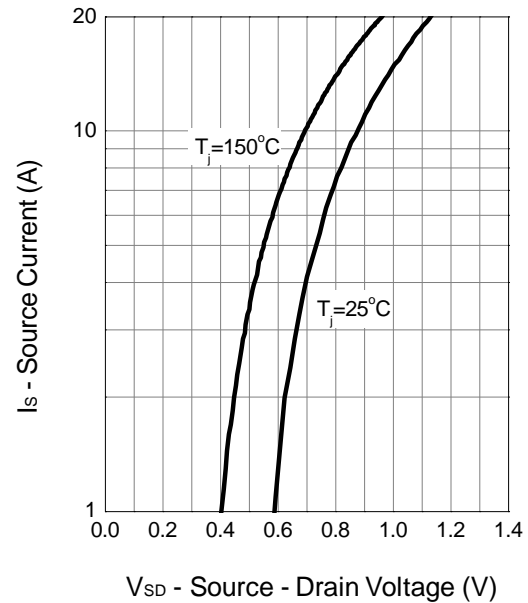


Typical Characteristics (Cont.)

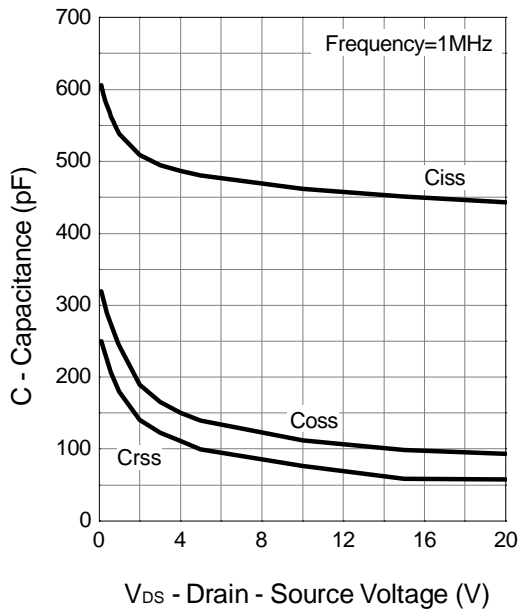
Drain-Source On Resistance



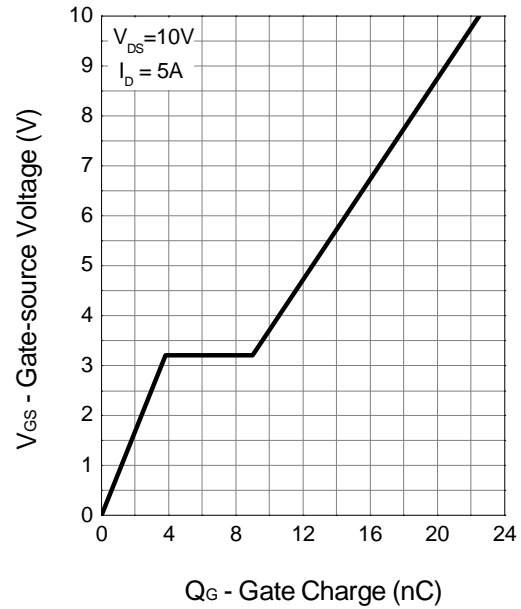
Source-Drain Diode Forward



Capacitance

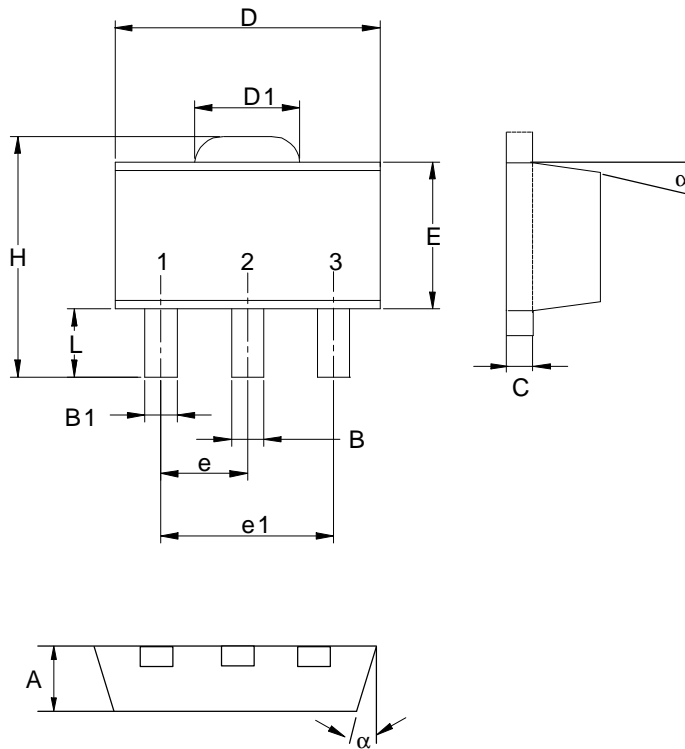


Gate Charge



## Packaging Information

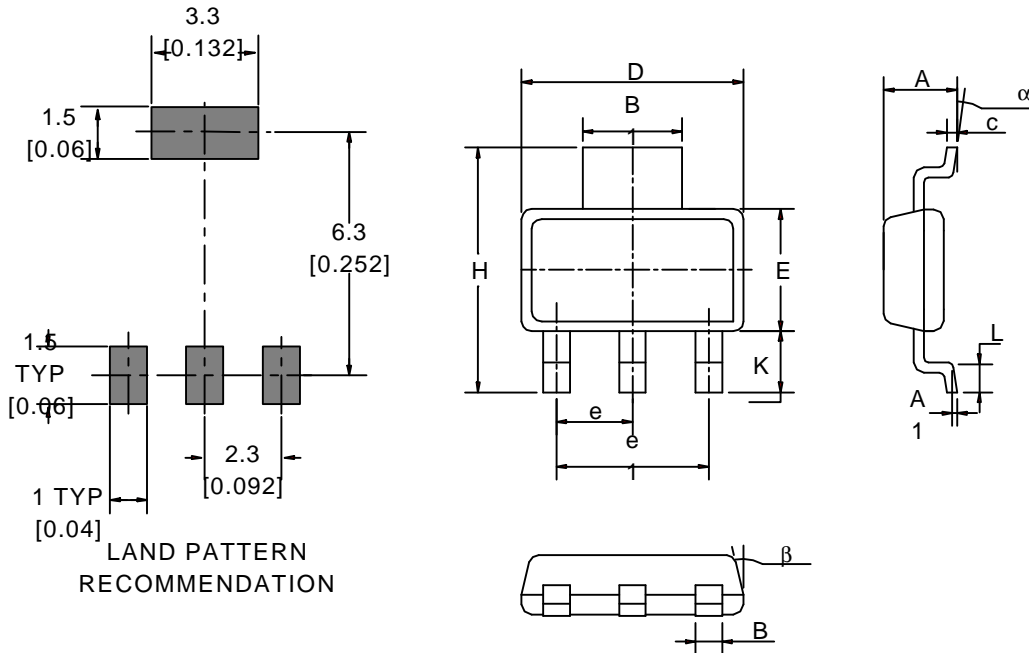
SOT-89 (Reference EIAJ ED-7500A Registration SC-62)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031	0.047
$\alpha$		10°		10°

## Packaging Information

SOT-223 (Reference JEDEC Registration SOT-223)



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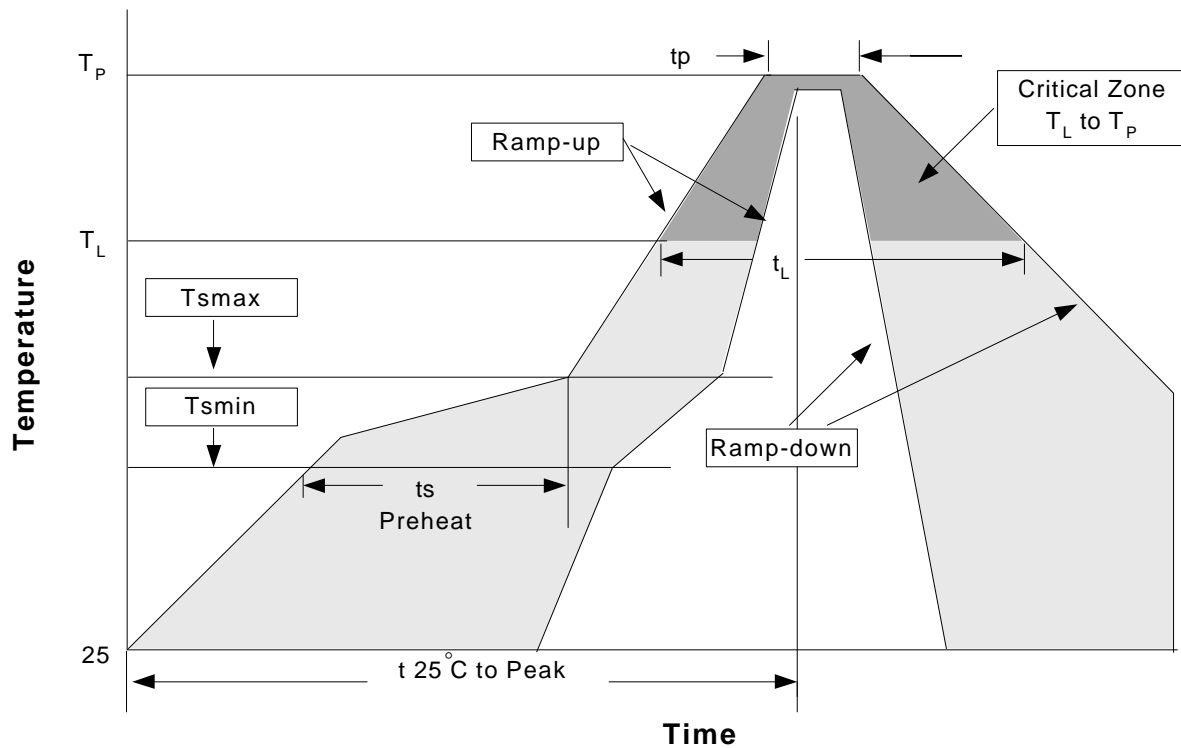
Dim	Millimeters		Inches	
	Min.	Max.		Min.
A	1.50	1.80	A	1.50
A1	0.02	0.08	A1	0.02
B	0.60	0.80	B	0.60
B1	2.90	3.10	B1	2.90
c	0.28	0.32	c	0.28
D	6.30	6.70	D	6.30
e	2.3 BSC		0.09 BSC	
e1	4.6 BSC		0.18 BSC	
H	6.70	7.30	H	6.70
L	0.91	1.10	L	0.91
K	1.50	2.00	K	1.50
$\alpha$	0°	10°	$\alpha$	0°
$\beta$	13°		13°	



## 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
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 Max ( $T_{smax}$ )	150°C	200°C
- Time (min to max) ( $t_s$ )	60-120 seconds	60-180 seconds
Time maintained above:		
- Temperature ( $T_L$ )	183°C	217°C
- Time ( $t_L$ )	60-150 seconds	60-150 seconds
Peak/Classification Temperature ( $T_p$ )	See table 1	See table 2
Time within 5°C of actual Peak Temperature ( $t_p$ )	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.

## Classification Reflow Profiles(Cont.)

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

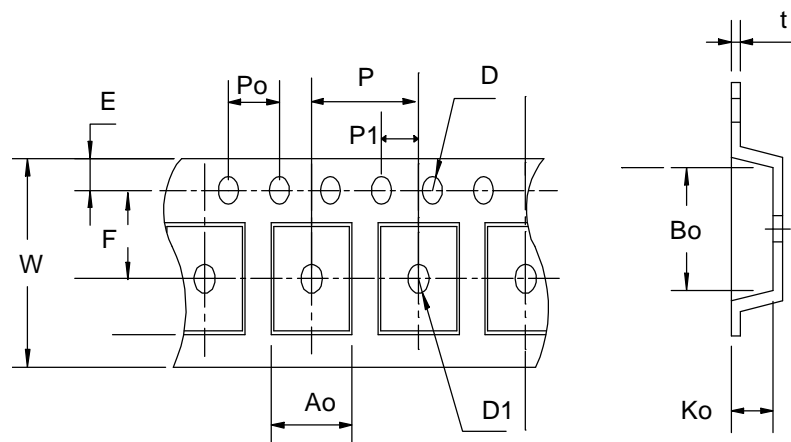
Package Thickness	Volume mm <sup>3</sup> <350	Volume mm <sup>3</sup> 350-2000	Volume mm <sup>3</sup> >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

\*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.

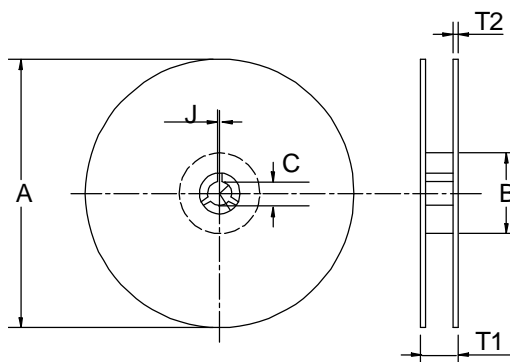
## Reliability Test Program

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

## Carrier Tape & Reel Dimensions



### Carrier Tape & Reel Dimensions (Cont.)



Application	A	B	C	J	T1	T2	W	P	E
TO-252	330 ±3	100 ±2	13 ±0.5	2 ±0.5	16.4 +0.3 -0.2	2.5 ±0.5	16+ 0.3 -0.1	8 ±0.1	1.75 ±0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	7.5 ±0.1	1.5 +0.1	1.5 ±0.25	4.0 ±0.1	2.0 ±0.1	6.8 ±0.1	10.4 ±0.1	2.5 ±0.1	0.3 ±0.05

(mm)

### Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO-252	16	13.3	2500

### Customer Service

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