

## N-Channel Enhancement Mode MOSFET

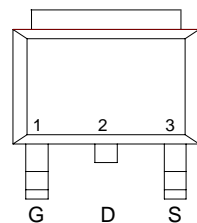
### Features

- 25V/60A ,  $R_{DS(ON)}=8m\Omega(\text{typ.}) @ V_{GS}=10V$   
 $R_{DS(ON)}=11m\Omega(\text{typ.}) @ V_{GS}=4.5V$
- Super High Dense Advanced Cell Design for Extremely Low  $R_{DS(ON)}$
- Reliable and Rugged
- TO-252 Package

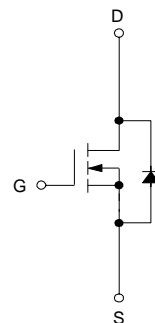
### Applications

- Power Management in Desktop Computer or DC/DC Converters.

### Pin Description




Top View of TO-252



N-Channel MOSFET

### Ordering and Marking Information

<p>APM2509N    □□-□□□</p> <div style="margin-left: 40px;"> <p>└─ Lead Free Code</p> <p>└─ Handling Code</p> <p>└─ Temp. Range</p> <p>└─ Package Code</p> </div>	<p>Package Code U : TO-252</p> <p>Operating Junction Temp. Range C : -55 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>APM2509N U :</p> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 20px;">  </div>	<p>XXXXX - Date Code</p>

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

Symbol	Parameter	Rating	Unit
$V_{DSS}$	Drain-Source Voltage	25	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	
$I_D^*$	Maximum Drain Current – Continuous	60	A
$I_{DM}$	Maximum Drain Current – Pulsed	110	

\* Surface Mounted on FR4 Board,  $t \leq 10$  sec.  
 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 (Cont.) (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Rating	Unit	
P <sub>D</sub>	Maximum Power Dissipation	T <sub>C</sub> =25°C	50	W
		T <sub>C</sub> =100°C	20	
T <sub>J</sub> , T <sub>STG</sub>	Maximum Operating and Storage Junction Temperature	-55 to 150	°C	
R <sub>θJA</sub> <sup>*</sup>	Thermal Resistance – Junction to Ambient	50	°C/W	
R <sub>θJC</sub>	Thermal Resistance – Junction to Case	2.5	°C/W	

## Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	APM2509N			Unit
			Min.	Typ.	Max.	
<b>Static</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	25			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V			1	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1	1.5	2	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V			±100	nA
R <sub>DS(ON)</sub> <sup>a</sup>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =35A		8	9	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =20A		11	15	
V <sub>SD</sub> <sup>a</sup>	Diode Forward Voltage	I <sub>S</sub> =35A, V <sub>GS</sub> =0V		0.85	1.3	V
<b>Dynamic<sup>b</sup></b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, I <sub>DS</sub> =30A V <sub>GS</sub> =4.5V,		20.2	28	nC
Q <sub>gs</sub>	Gate-Source Charge			4.8		
Q <sub>gd</sub>	Gate-Drain Charge			8.4		
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =15V, I <sub>DS</sub> =1A, V <sub>GEN</sub> =10V, R <sub>G</sub> = 6Ω		10	15	ns
T <sub>r</sub>	Turn-on Rise Time			7	13	
t <sub>d(OFF)</sub>	Turn-off Delay Time			35	50	
T <sub>f</sub>	Turn-off Fall Time			10	20	
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V		1785		pF
C <sub>oss</sub>	Output Capacitance	V <sub>DS</sub> =15V		605		
C <sub>rss</sub>	Reverse Transfer Capacitance	Frequency =1.0MHz		490		

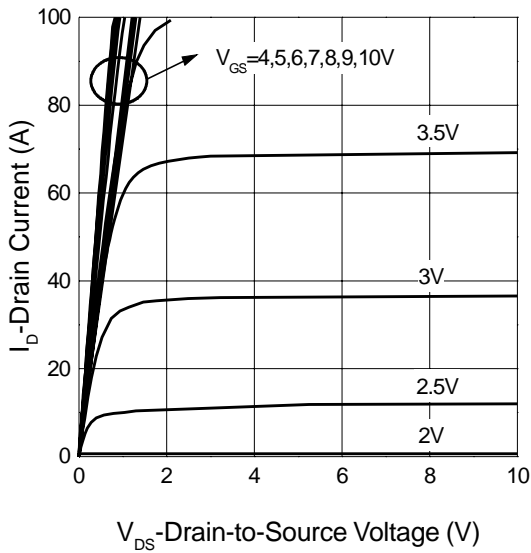
### Notes

<sup>a</sup> : Pulse test ; pulse width ≤300μs, duty cycle ≤ 2%

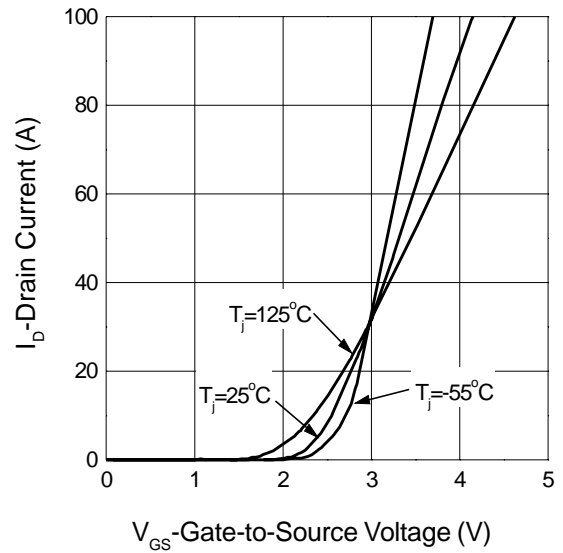
<sup>b</sup> : Guaranteed by design, not subject to production testing

## Typical Characteristics

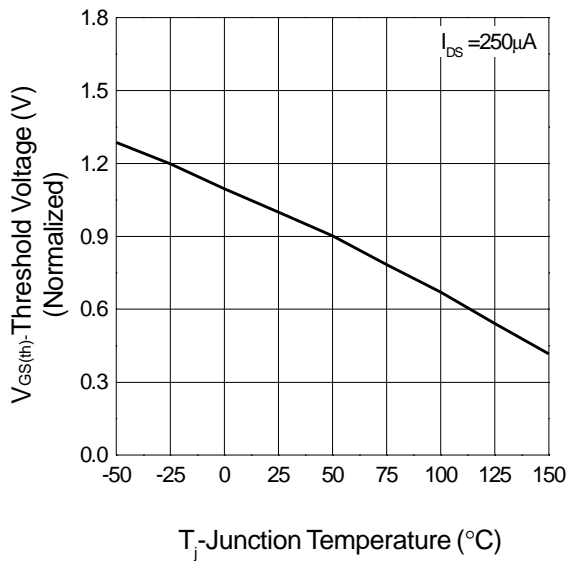
Output Characteristics



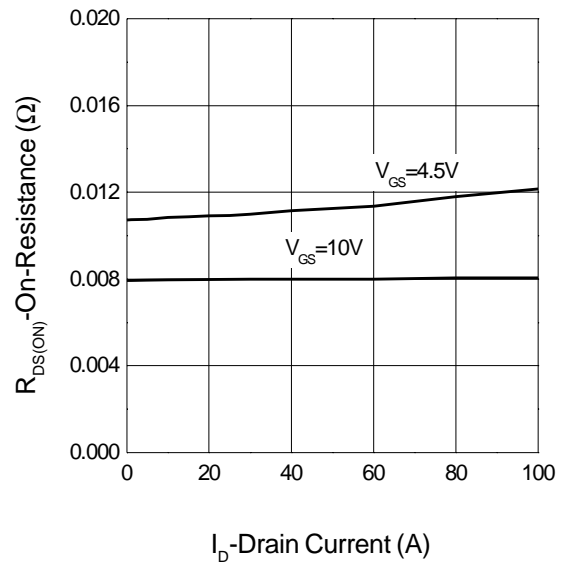
Transfer Characteristics



Threshold Voltage vs. Junction Temperature

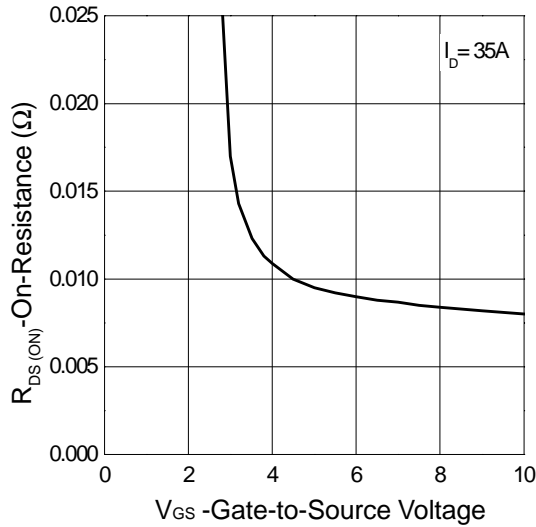


On-Resistance vs. Drain Current

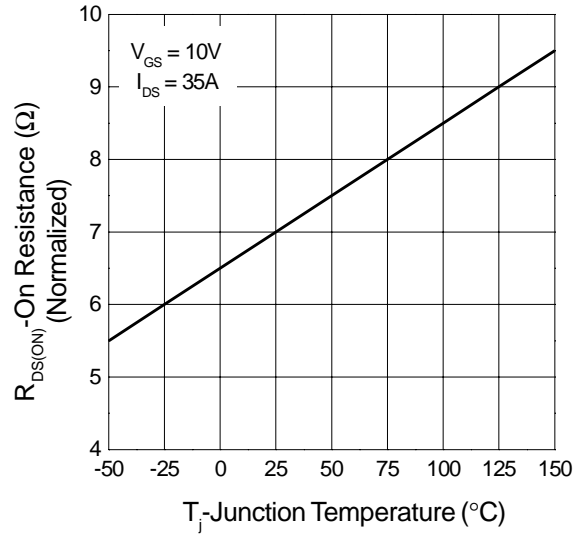


Typical Characteristics (Cont.)

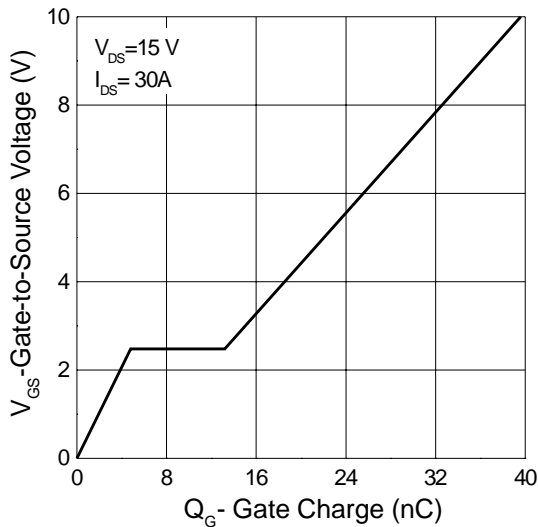
On-Resistance vs. Gate-to-Source Voltage



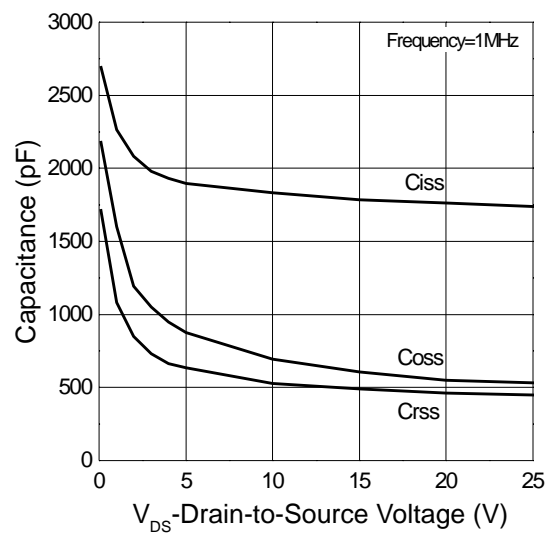
On-Resistance vs. Junction Temperature



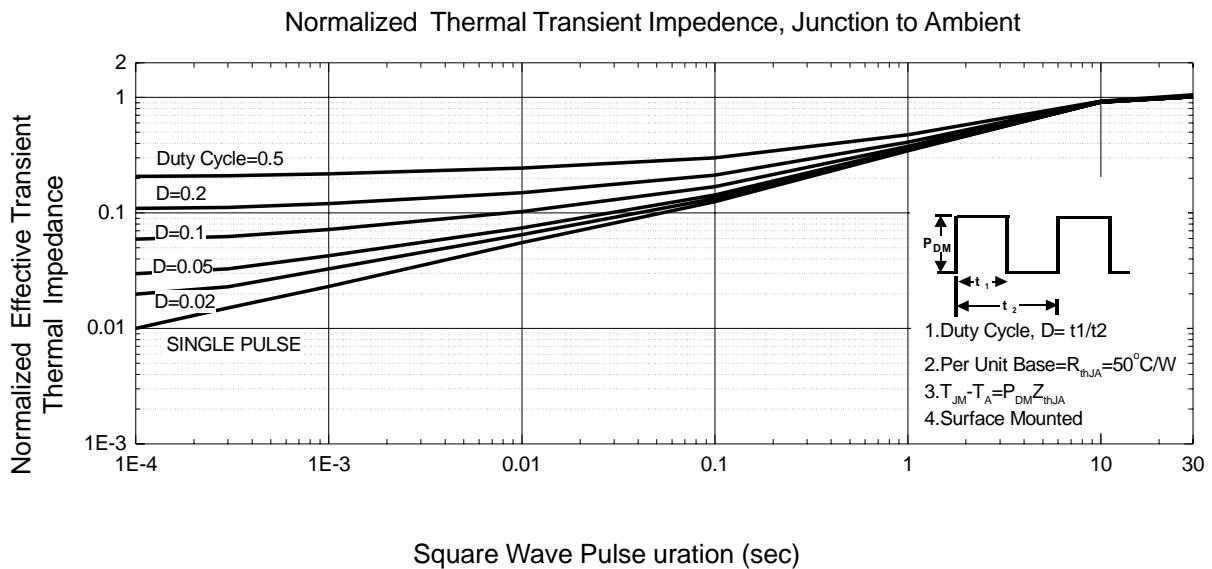
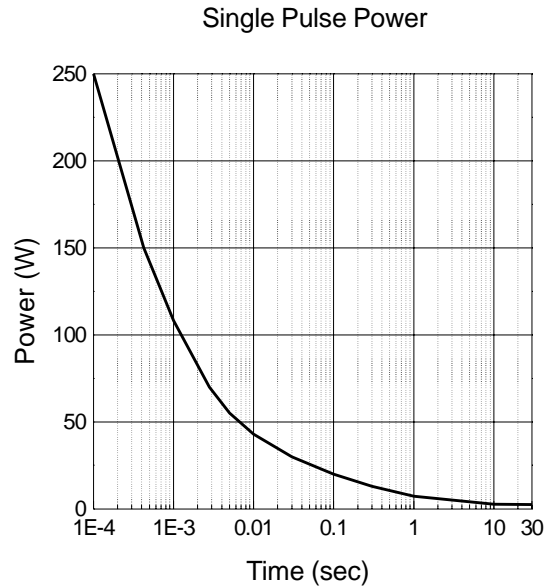
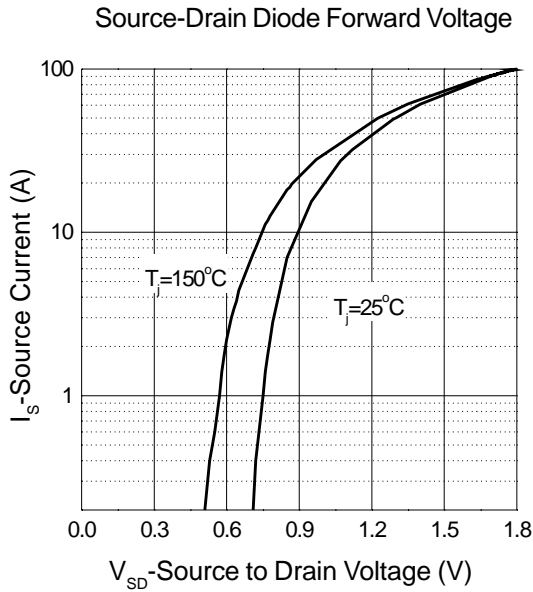
Gate Charge



Capacitance

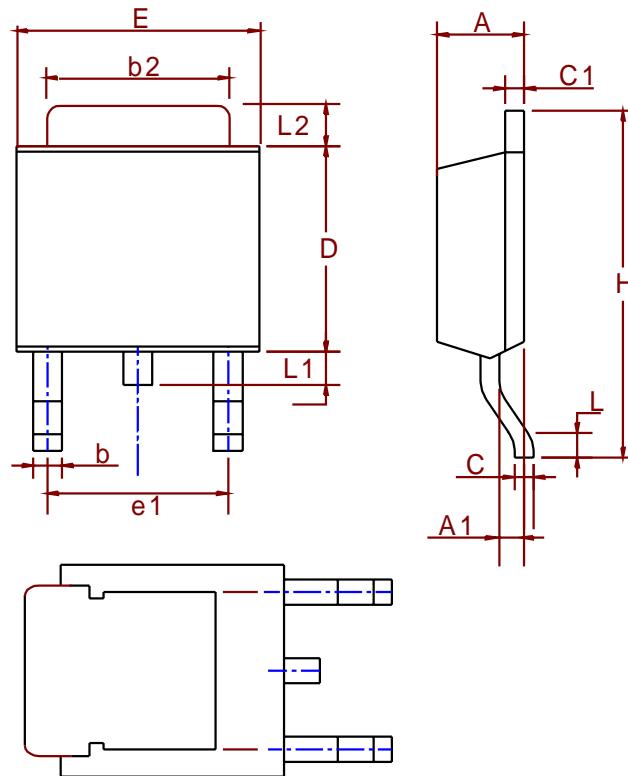


Typical Characteristics (Cont.)



## Package Informaion

TO-252( Reference JEDEC Registration TO-252)

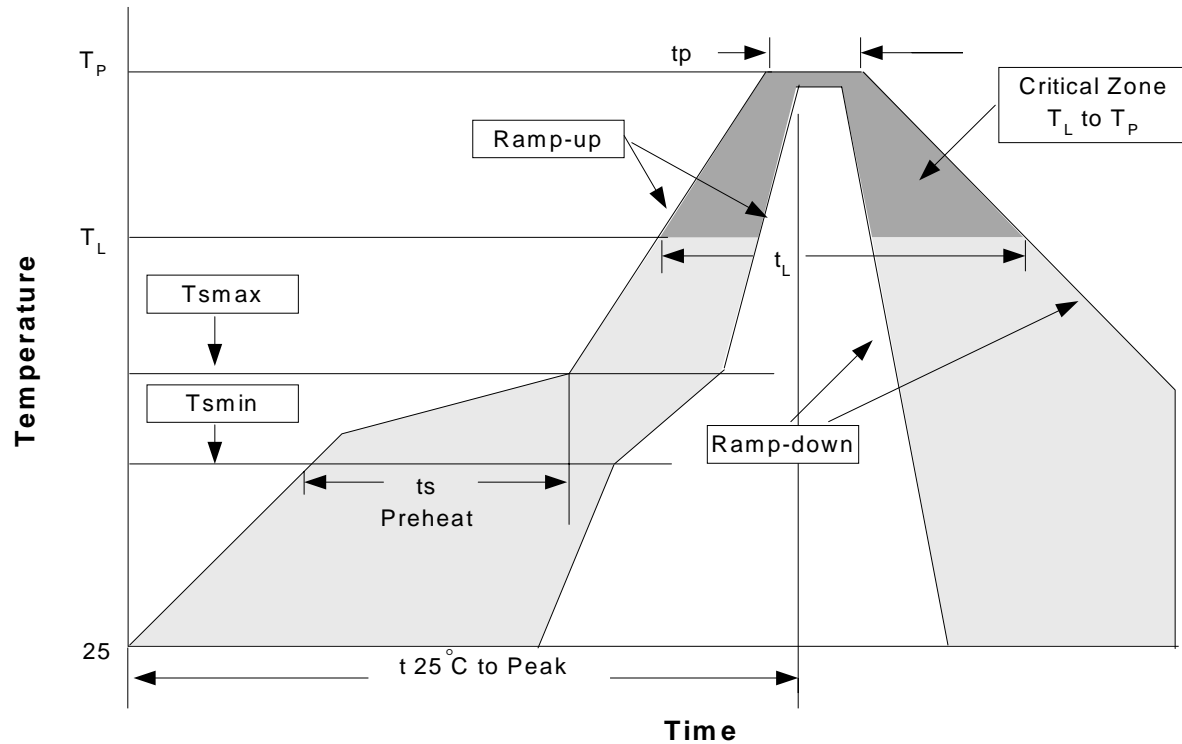


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.18	2.39	0.086	0.094
A1	0.89	1.27	0.035	0.050
b	0.508	0.89	0.020	0.035
b2	5.207	5.461	0.205	0.215
C	0.46	0.58	0.018	0.023
C1	0.46	0.58	0.018	0.023
D	5.334	6.22	0.210	0.245
E	6.35	6.73	0.250	0.265
e1	3.96	5.18	0.156	0.204
H	9.398	10.41	0.370	0.410
L	0.51		0.020	
L1	0.64	1.02	0.025	0.040
L2	0.89	2.032	0.035	0.080

**Physical Specifications**

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RS186-91, ANSI/J-STD-002 Category 3.

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



**Classification Reflow Profiles**

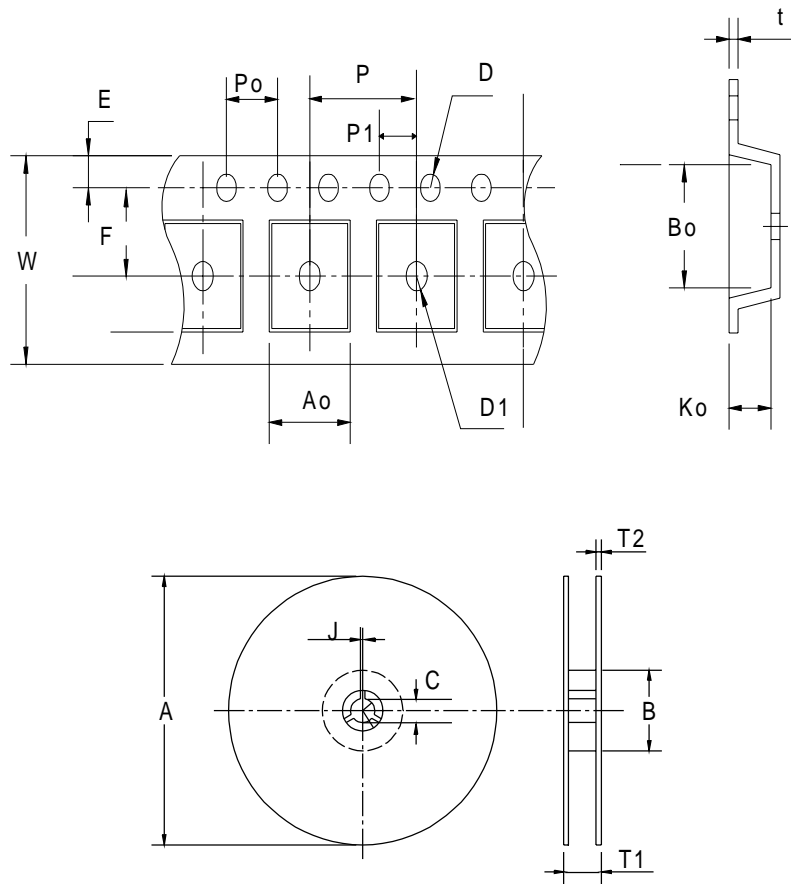
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate ( $T_L$ to $T_P$ )	3°C/second max.		3°C/second max.	
Preheat				
- Temperature Min ( $T_{smin}$ )	100°C		150°C	
- Temperature Mix ( $T_{smax}$ )	150°C		200°C	
- Time (min to max)( $t_s$ )	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

## Carrier Tape & Reel Dimension



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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