



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

Symbol	Parameter		Rating	Unit
V <sub>DSS</sub>	Drain-Source Voltage		20	V
V <sub>GSS</sub>	Gate-Source Voltage		±12	
I <sub>D</sub> *	Continuous Drain Current	V <sub>GS</sub> =4.5V	3	A
I <sub>DM</sub> *	Pulsed Drain Current		10	
I <sub>S</sub> *	Diode Continuous Forward Current		1	A
T <sub>J</sub>	Maximum Junction Temperature		150	°C
T <sub>STG</sub>	Storage Temperature Range		-55 to 150	
P <sub>D</sub> *	Maximum Power Dissipation	T <sub>A</sub> =25°C	0.83	W
		T <sub>A</sub> =100°C	0.3	
R <sub>θJA</sub> *	Thermal Resistance-Junction to Ambient		150	°C/W

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

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>STATIC CHARACTERISTICS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	20	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=16V, V_{GS}=0V$	-	-	1	$\mu A$
		$T_J=85^\circ\text{C}$	-	-	30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	0.5	0.7	1	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 10V, V_{DS}=0V$	-	-	$\pm 10$	$\mu A$
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=4.5V, I_{DS}=3A$	-	50	65	m $\Omega$
		$V_{GS}=2.5V, I_{DS}=2A$	-	65	90	
		$V_{GS}=1.8V, I_{DS}=0.5A$	-	120	200	
$V_{SD}^a$	Diode Forward Voltage	$I_{SD}=1A, V_{GS}=0V$	-	0.7	1.3	V
<b>GATE CHARGE CHARACTERISTICS<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=10V, V_{GS}=4.5V, I_{DS}=3A$	-	4.4	6	nC
$Q_{gs}$	Gate-Source Charge		-	0.5	-	
$Q_{gd}$	Gate-Drain Charge		-	1.6	-	

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

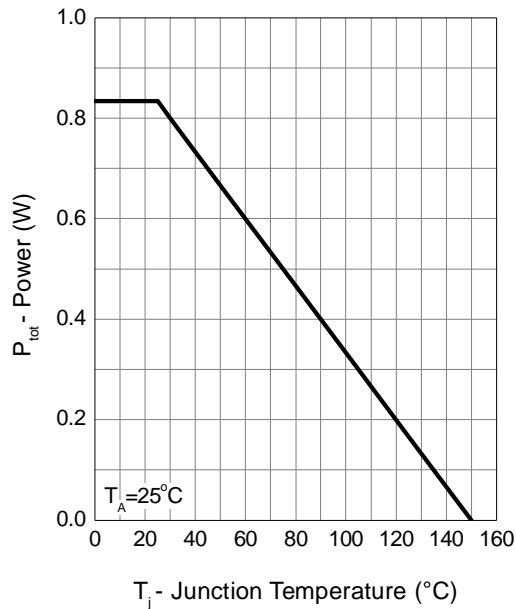
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>DYNAMIC CHARACTERISTICS<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	-	5	-	$\Omega$
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=10V,$ Frequency=1.0MHz	-	320	-	pF
$C_{oss}$	Output Capacitance		-	70	-	
$C_{rss}$	Reverse Transfer Capacitance		-	50	-	
$t_{d(ON)}$	Turn-On Delay Time	$V_{DD}=10V, R_L=10\Omega,$ $I_{DS}=1A, V_{GEN}=4.5V,$ $R_G=6\Omega$	-	4	8	ns
$t_r$	Turn-On Rise Time		-	14	26	
$t_{d(OFF)}$	Turn-Off Delay Time		-	21	39	
$t_f$	Turn-Off Fall Time		-	5	10	
$t_{rr}$	Reverse Recovery Time	$I_{SD}=3A, dI_{SD}/dt=100A/\mu s$	-	15	-	ns
$Q_{rr}$	Reverse Recovery Charge		-	6	-	nC

Note a : Pulse test ; pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ .

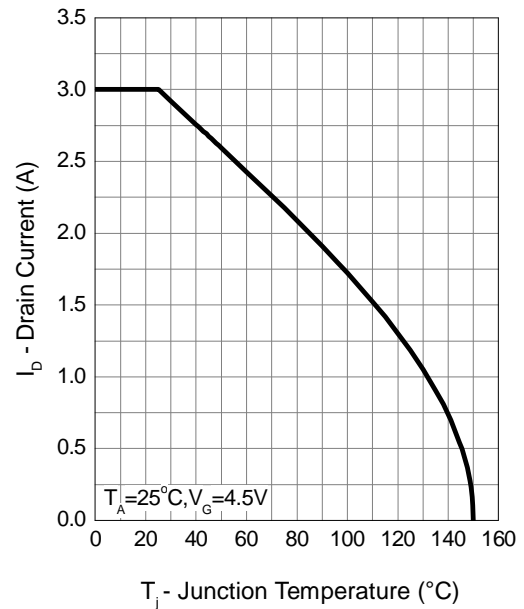
Note b : Guaranteed by design, not subject to production testing.

## Typical Operating Characteristics

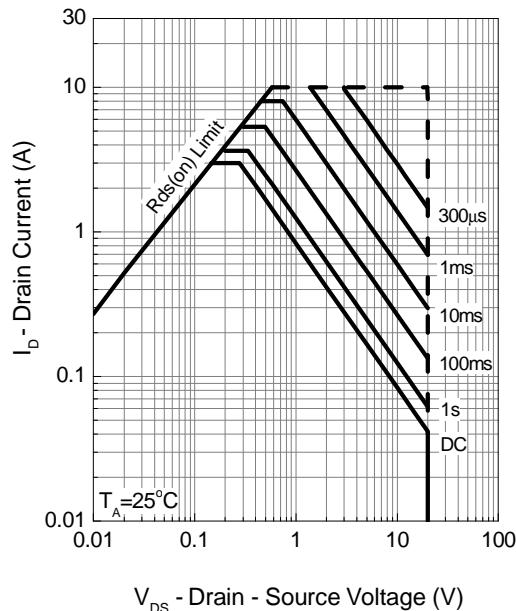
**Power Dissipation**



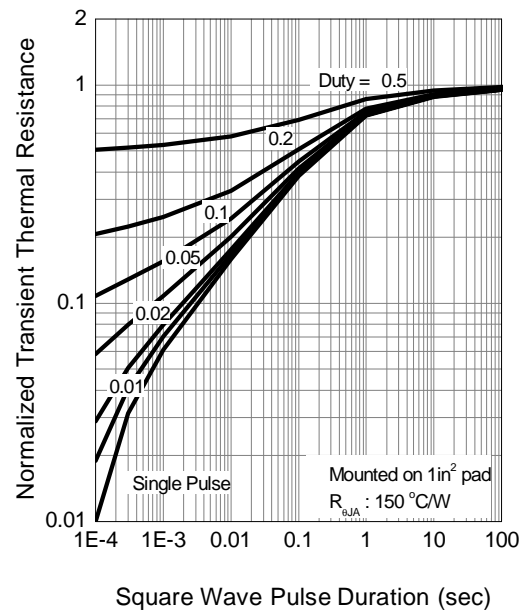
**Drain Current**



**Safe Operation Area**

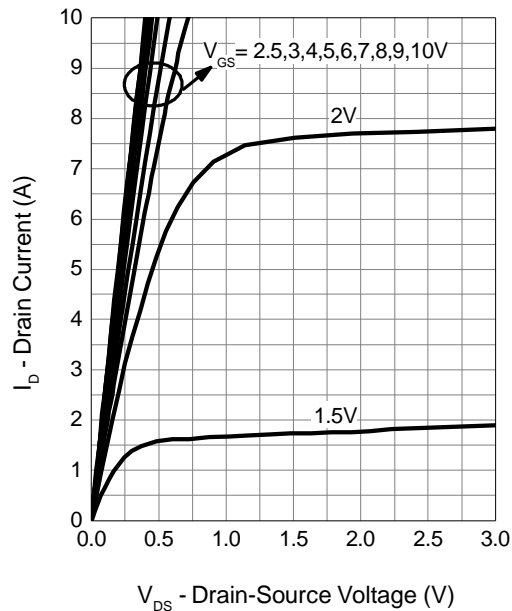


**Thermal Transient Impedance**

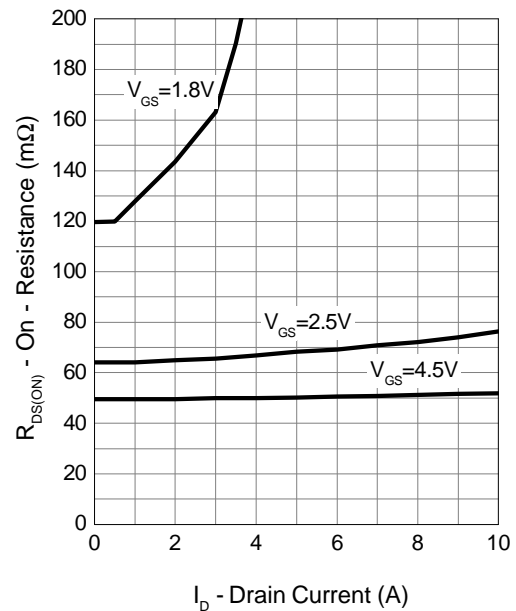


## Typical Operating Characteristics (Cont.)

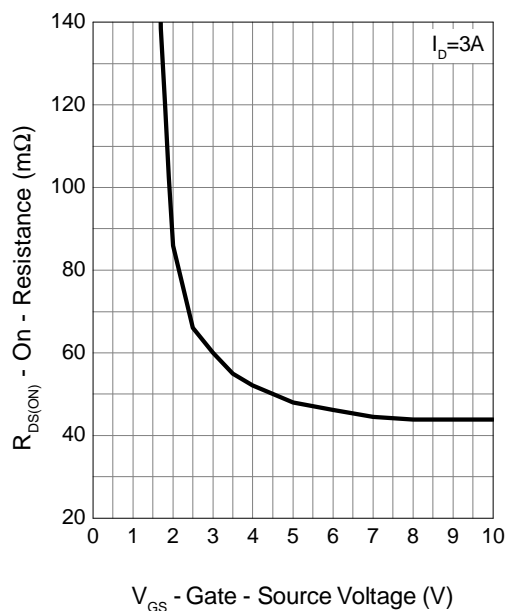
**Output Characteristics**



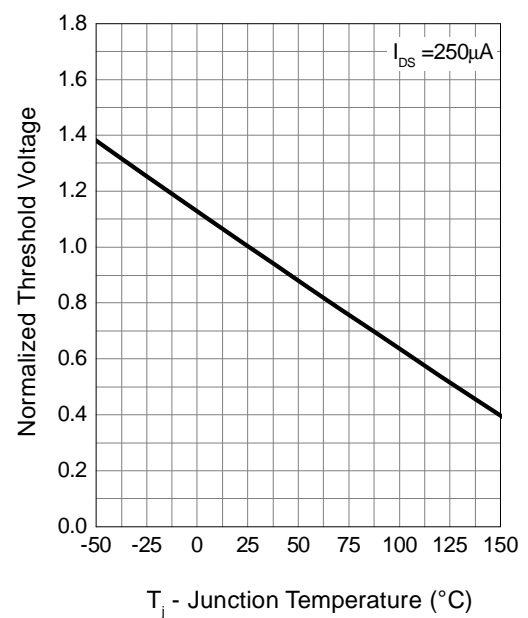
**Drain-Source On Resistance**



**Gate-Source On Resistance**

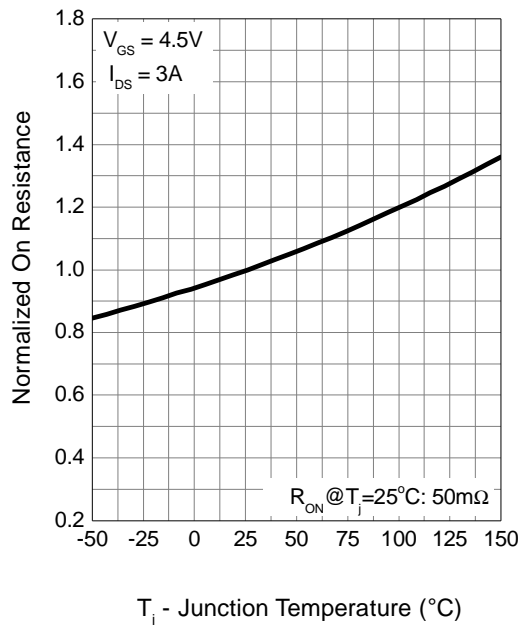


**Gate Threshold Voltage**

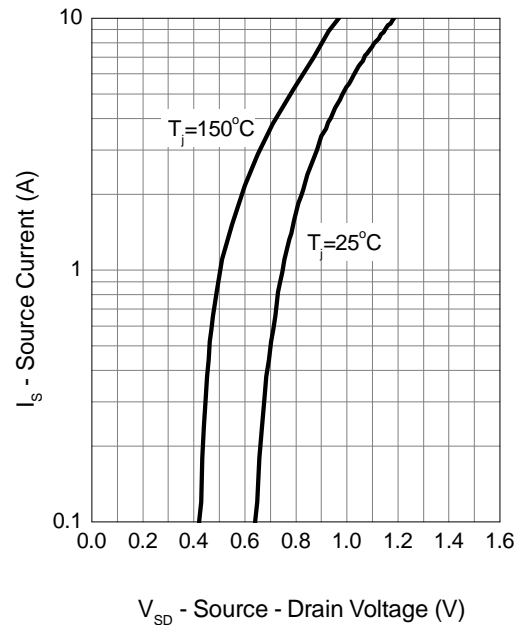


## Typical Operating Characteristics (Cont.)

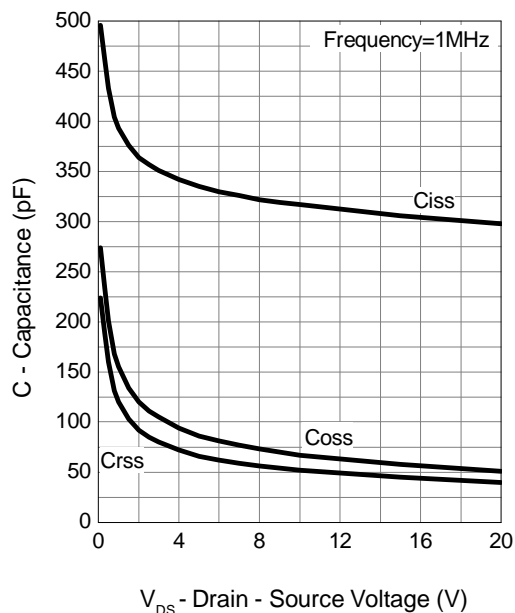
**Drain-Source On Resistance**



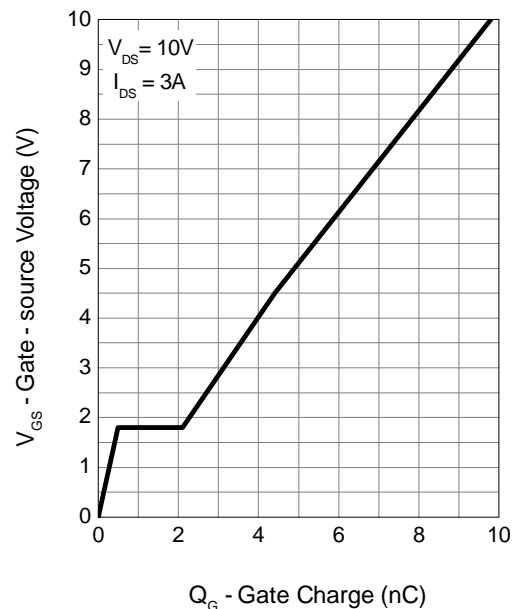
**Source-Drain Diode Forward**



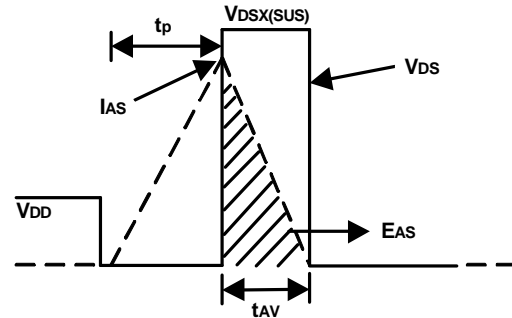
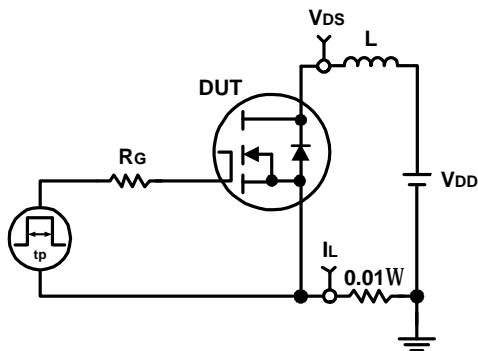
**Capacitance**



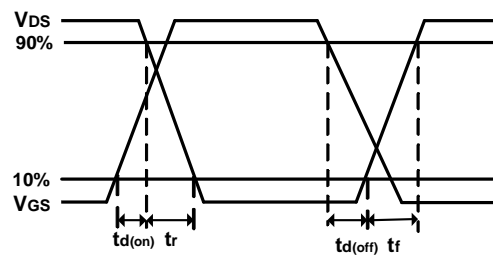
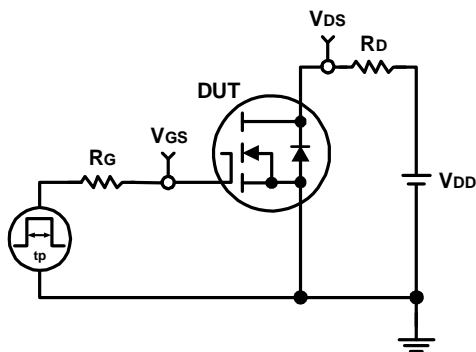
**Gate Charge**



## Avalanche Test Circuit and Waveforms



## Switching Time Test Circuit and Waveforms



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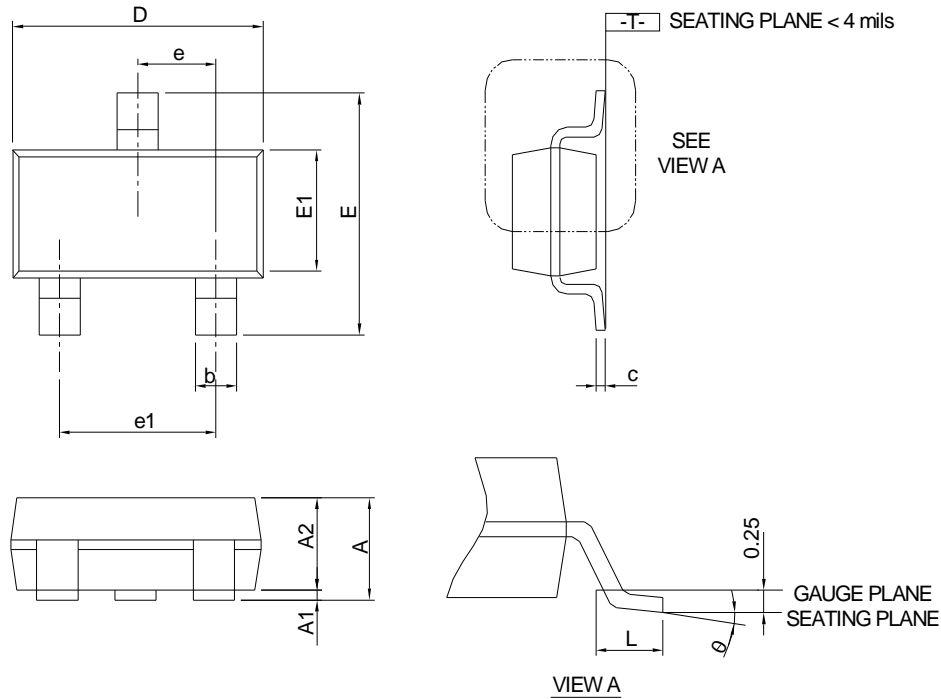
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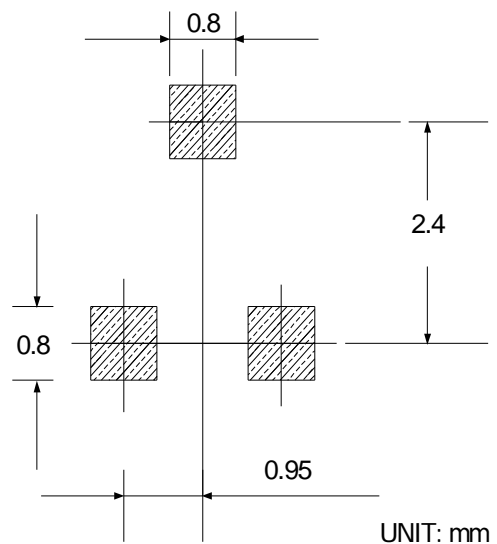
## Package Information



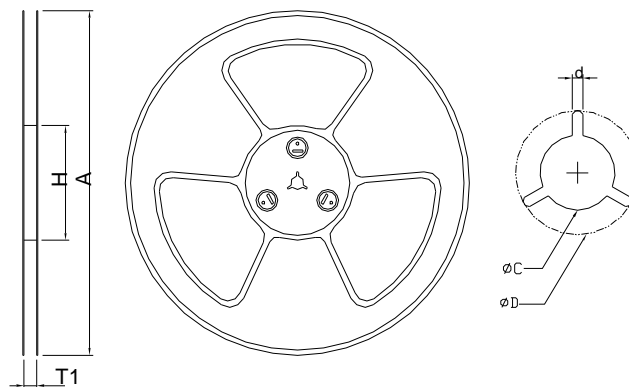
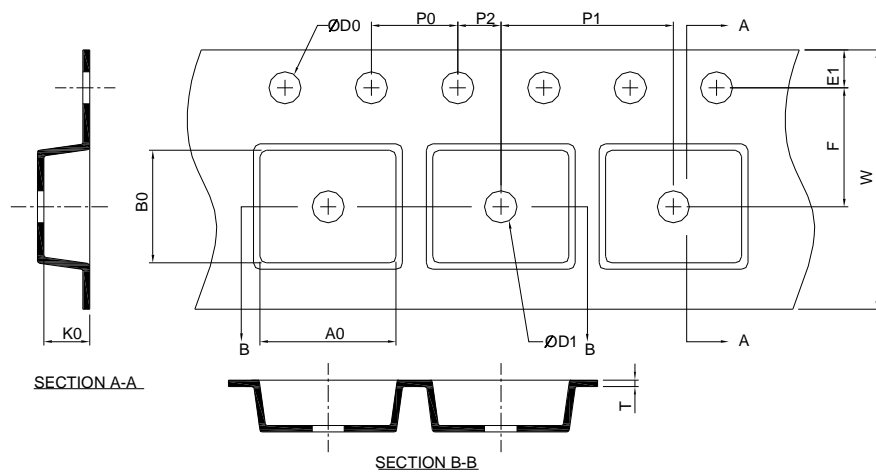
DIMENSIONS	SOT-23			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.20	-	0.047
A1	0.00	0.08	0.000	0.003
A2	0.70	1.12	0.035	0.044
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

Note : Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.

### RECOMMENDED LAND PATTERN



## Carrier Tape & Reel Dimensions

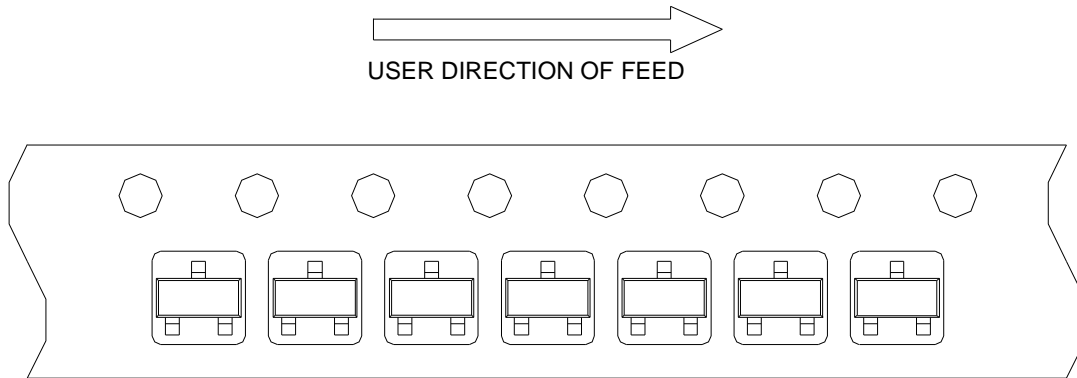


Application	A	H	T1	C	d	D	W	E1	F
SOT-23	178.0±2.00	50 MIN.	8.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	8.0±0.30	1.75±0.10	3.5±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0±0.10	4.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.0 MIN.	0.6+0.00 -0.40	3.20±0.20	3.10±0.20	1.50±0.20

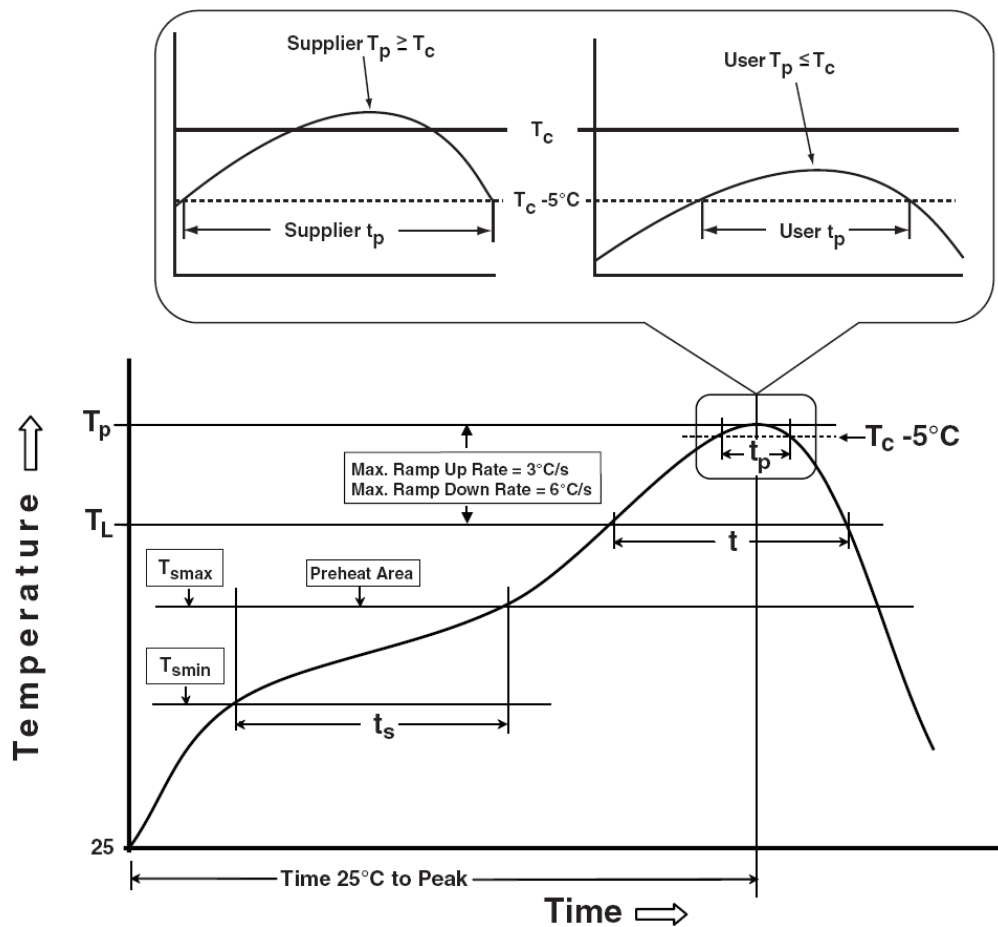
(mm)

## Taping Direction Information

SOT-23



## 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.		

Table 1. SnPb Eutectic Process – Classification Temperatures ( $T_c$ )

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 ( $T_c$ )

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
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ $T_{jmax}$
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ $T_{jmax}$
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

## Customer Service

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