

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	± 12		
I_D^*	Continuous Drain Current	-3	A	
I_{DM}^*	300 μs Pulsed Drain Current			-12
I_S^*	Diode Continuous Forward Current	-1.3	A	
T_J	Maximum Junction Temperature	150	$^\circ\text{C}$	
T_{STG}	Storage Temperature Range	-55 to 150		
P_D^*	Maximum Power Dissipation	$T_A=25^\circ\text{C}$	0.83	W
		$T_A=100^\circ\text{C}$	0.3	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	75	$^\circ\text{C}/\text{W}$	
$R_{\theta JA}^*$	Thermal Resistance-Junction to Ambient	150	$^\circ\text{C}/\text{W}$	

Note : *Surface Mounted on 1in² pad area, t \leq 10sec.

Electrical Characteristics ($T_A = 25^\circ\text{C}$ Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	APM2301CA			Unit
			Min.	Typ.	Max.	
Static Characteristics						
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	μA
			-	-	-30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=-250\mu\text{A}$	-0.5	-0.75	-1	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 12\text{V}, V_{DS}=0\text{V}$	-	-	± 10	μA
$R_{DS(ON)}^a$	Drain-Source On-State Resistance	$V_{GS}=-4.5\text{V}, I_{DS}=-3\text{A}$	-	56	70	m Ω
		$V_{GS}=-2.5\text{V}, I_{DS}=-2\text{A}$	-	85	115	
		$V_{GS}=-1.8\text{V}, I_{DS}=-1\text{A}$	-	135	250	
V_{SD}^a	Diode Forward Voltage	$I_{SD}=-1.3\text{A}, V_{GS}=0\text{V}$	-	-0.75	-1.3	V
Gate Charge Characteristics ^b						
Q_g	Total Gate Charge	$V_{DS}=-10\text{V}, V_{GS}=-4.5\text{V},$ $I_{DS}=-3\text{A}$	-	7	10	nC
Q_{gs}	Gate-Source Charge		-	1.9	-	
Q_{gd}	Gate-Drain Charge		-	1.9	-	

Electrical Characteristics (Cont.) (T_A = 25°C Unless Otherwise Noted)

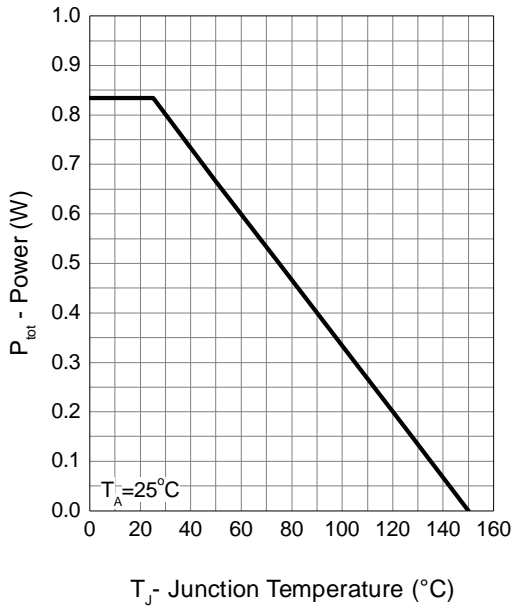
Symbol	Parameter	Test Conditions	APM2301CA			Unit
			Min.	Typ.	Max.	
Dynamic Characteristics^b						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-10V, Frequency=1.0MHz	-	580	-	pF
C _{oss}	Output Capacitance		-	100	-	
C _{rss}	Reverse Transfer Capacitance		-	75	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-10V, R _L =10Ω, I _{DS} =1A, V _{GEN} =-4.5V, R _G =6Ω	-	4	7	ns
t _r	Turn-on Rise Time		-	13	23	
t _{d(OFF)}	Turn-off Delay Time		-	35	63	
t _f	Turn-off Fall Time		-	20	36	
t _{rr}	Reverse Recovery Time	I _{SD} =-3A, di _{SD} /dt =100A/μs	-	20	-	ns
Q _{rr}	Reverse Recovery Charge		-	7	-	nC

Note a : Pulse test ; pulse width≤300μs, duty cycle≤2%.

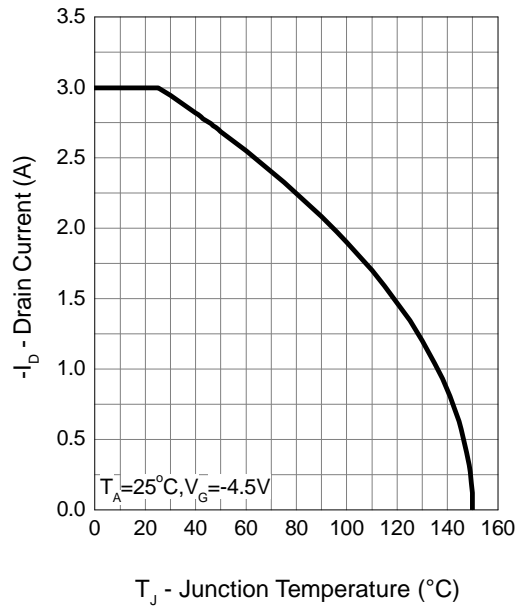
Note b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

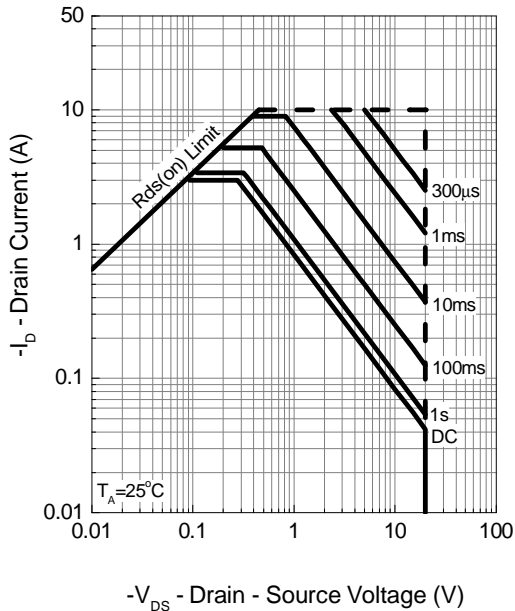
Power Dissipation



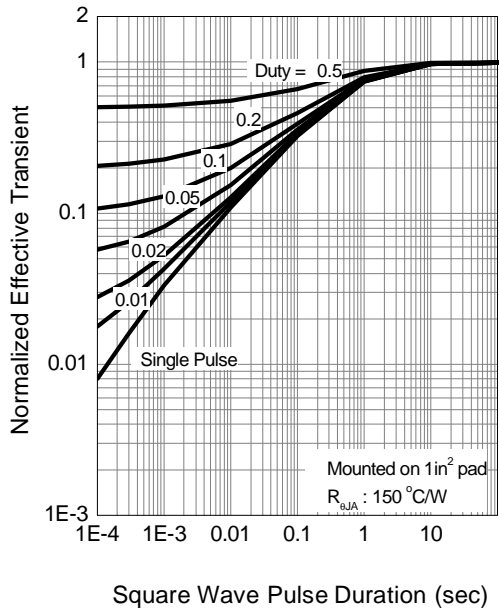
Drain Current



Safe Operation Area

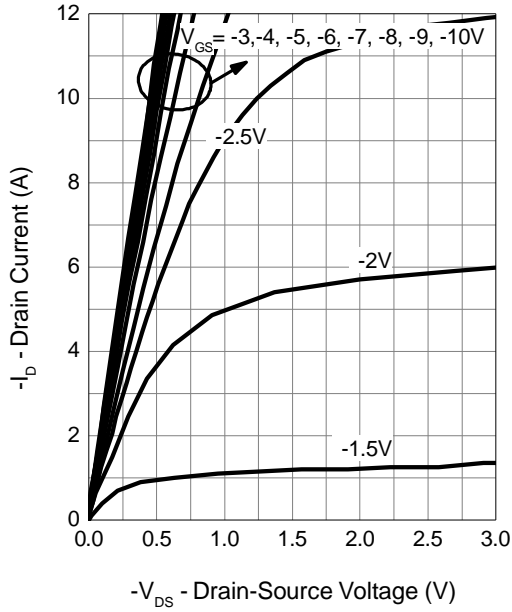


Thermal Transient Impedance

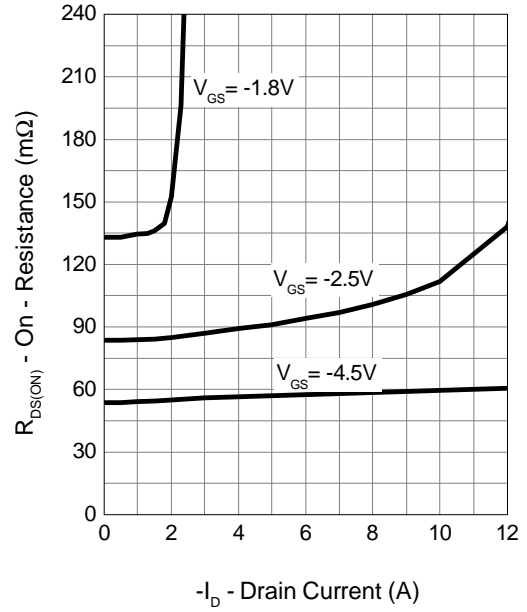


Typical Operating Characteristics (Cont.)

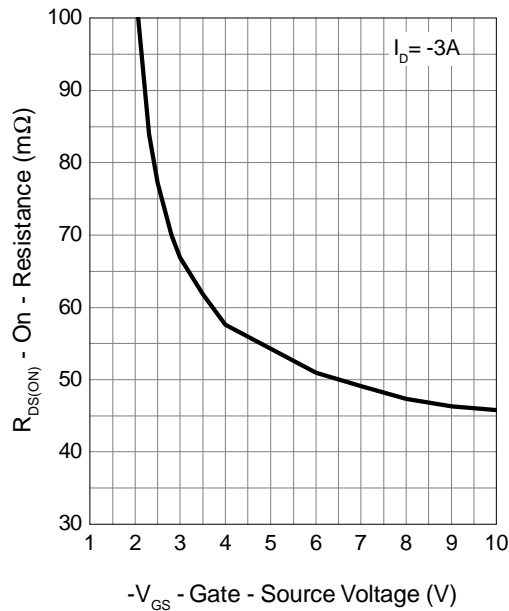
Output Characteristics



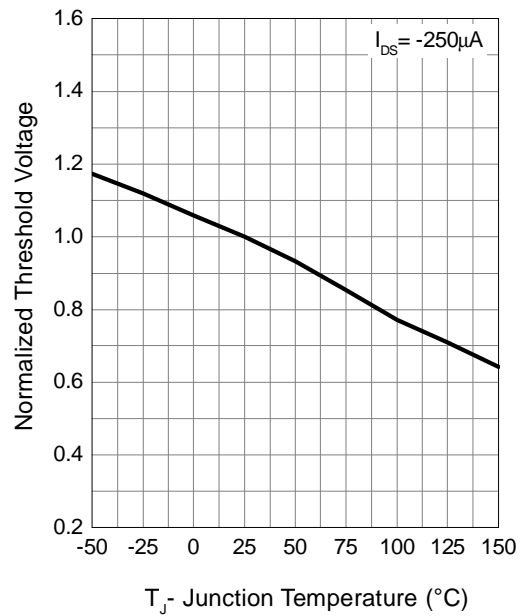
Drain-Source On Resistance



Gate-Source On Resistance

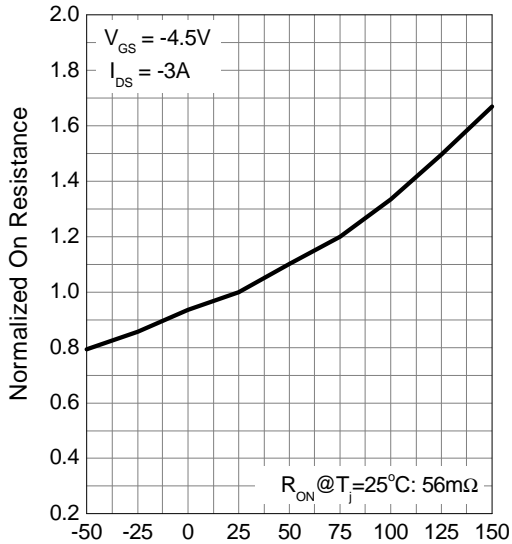


Gate Threshold Voltage



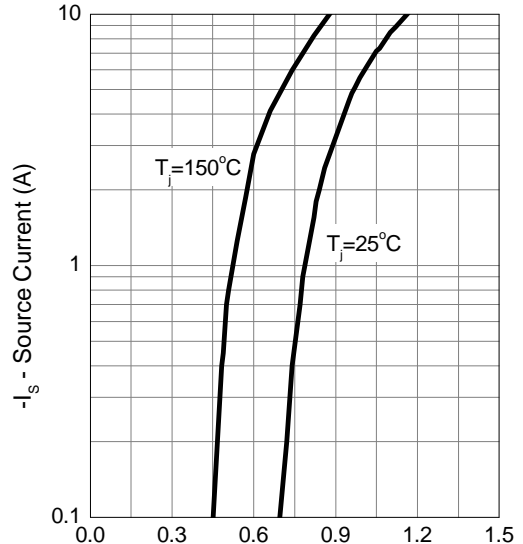
Typical Operating Characteristics (Cont.)

Drain-Source On Resistance



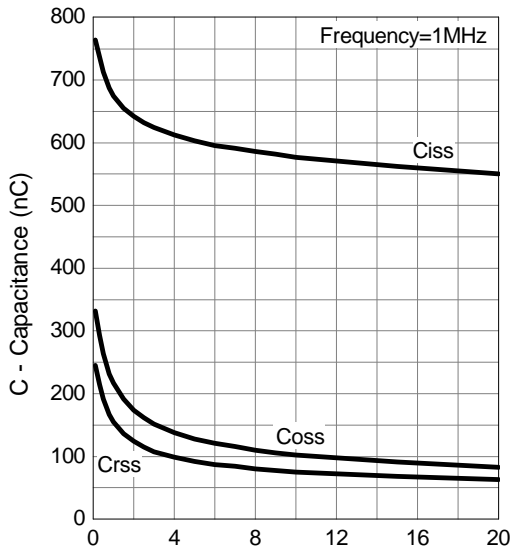
T_j - Junction Temperature (°C)

Source-Drain Diode Forward



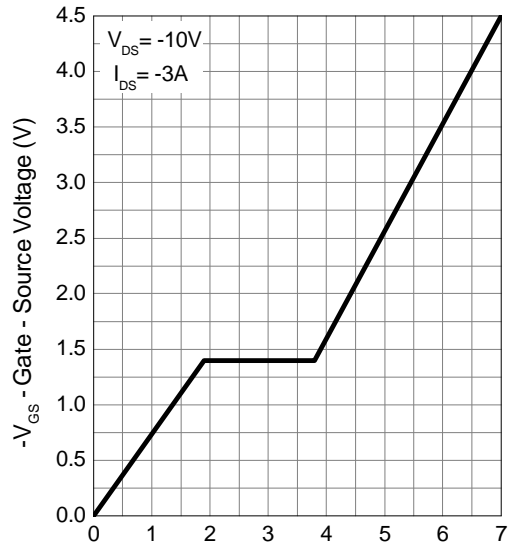
$-V_{SD}$ - Source - Drain Voltage (V)

Capacitance



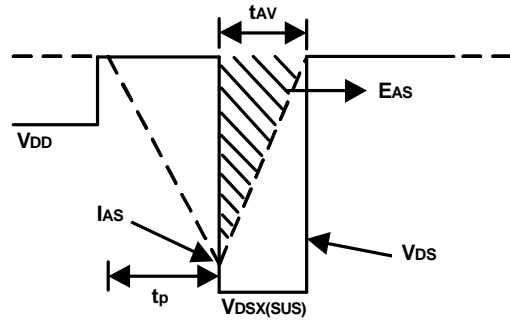
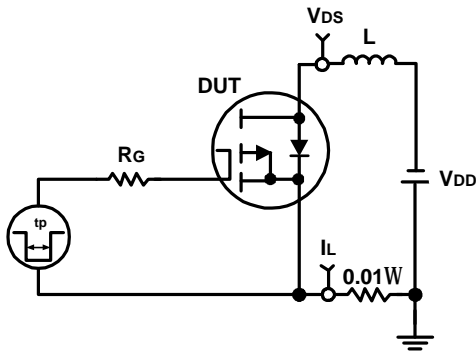
$-V_{DS}$ - Drain - Source Voltage (V)

Gate Charge

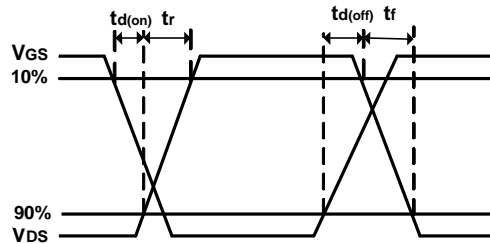
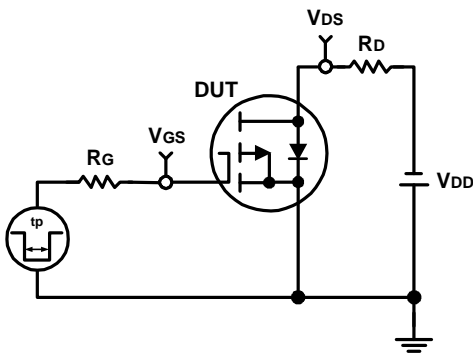


Q_g - Gate Charge (nC)

Avalanche Test Circuit and Waveforms



Switching Time Test Circuit and Waveforms



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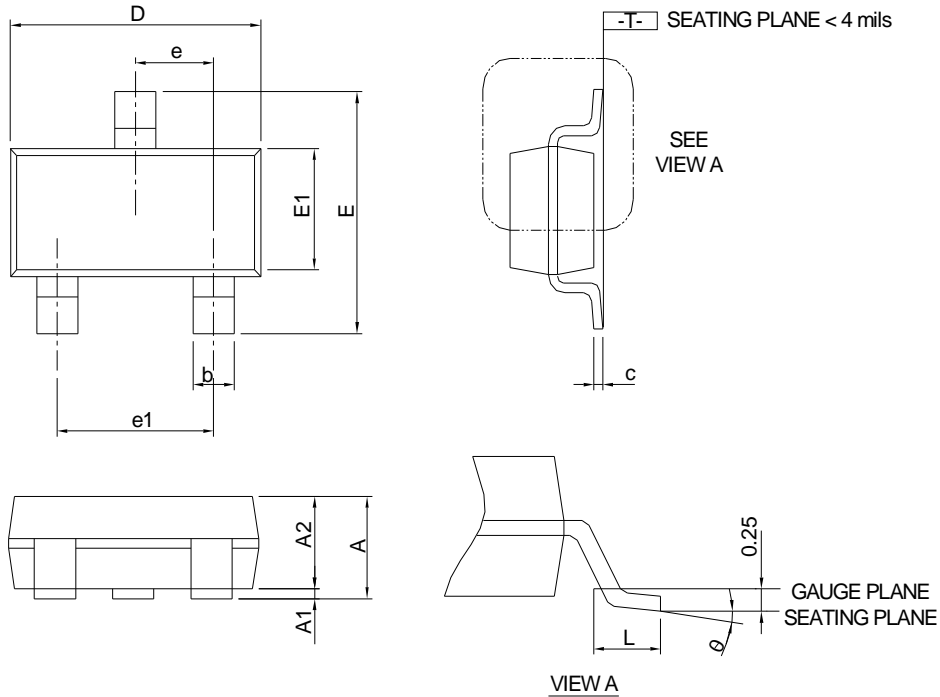
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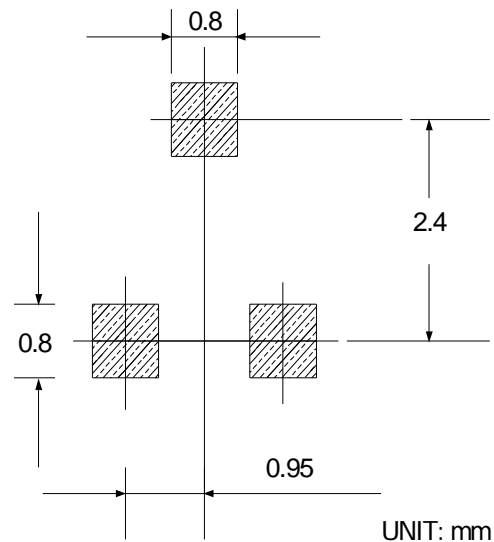
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Package Information



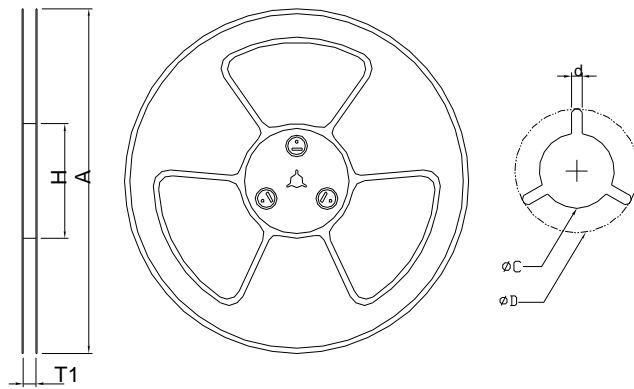
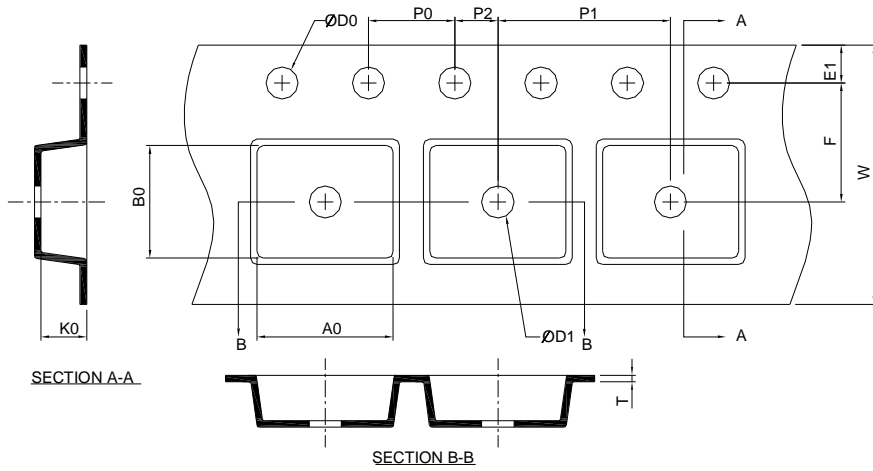
SYMBOL	SOT-23			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.20	-	0.047
A1	0.00	0.08	0.000	0.003
A2	0.70	1.12	0.035	0.044
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30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

RECOMMENDED LAND PATTERN



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.

Carrier Tape & Reel Dimensions

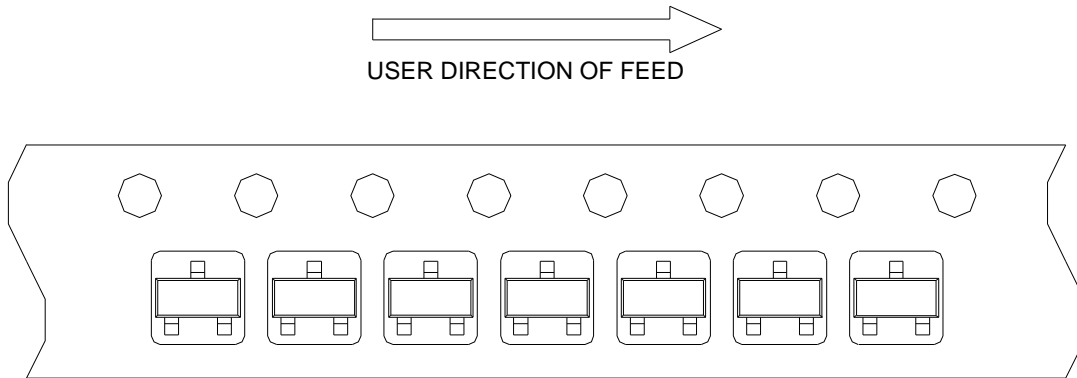


Application	A	H	T1	C	d	D	W	E1	F
SOT-23	178.0±2.00	50 MIN.	8.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	8.0±0.30	1.75±0.10	3.5±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0±0.10	4.0±0.10	2.0±0.05	1.5+0.10 -0.00	1.0 MIN.	0.6+0.00 -0.40	3.20±0.20	3.10±0.20	1.50±0.20

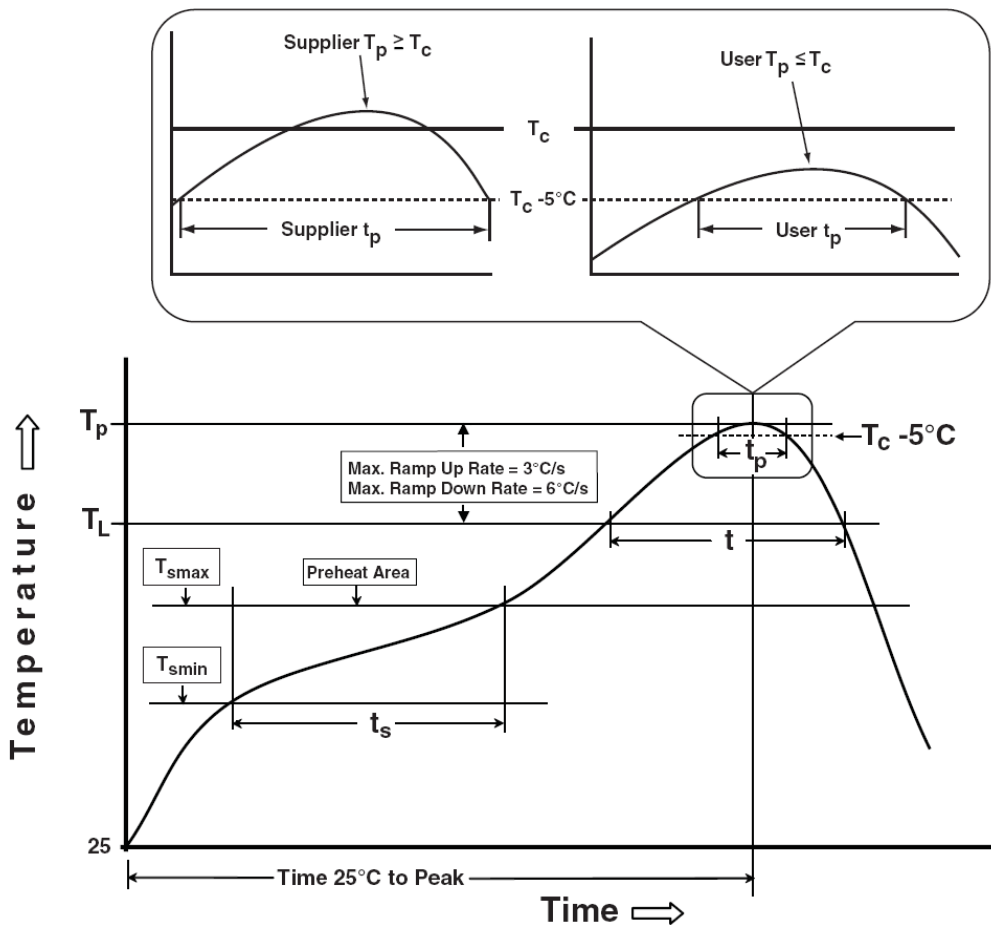
(mm)

Taping Direction Information

SOT-23



Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak		
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 ³ <350	Volume mm ³ ≥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 ³ <350	Volume mm ³ 350-2000	Volume mm ³ >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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