

P-Channel Enhancement Mode MOSFET

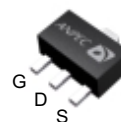
Features

- 20V/-3A,
 $R_{DS(ON)} = 75m\Omega (typ.) @ V_{GS} = -4.5V$
 $R_{DS(ON)} = 100m\Omega (typ.) @ V_{GS} = -2.5V$
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)

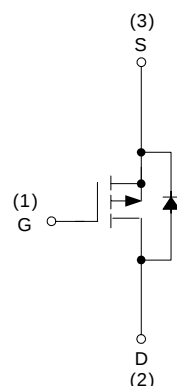
Applications

- Switching Regulators
- Switching Converters

Pin Description



Top View of SOT-89



P-Channel MOSFET

Ordering and Marking Information

APM2095P □□-□□□ └─ Lead Free Code └─ Handling Code └─ Temp. Range └─ Package Code	Package Code D : SOT-89 Operating Junction Temp. Range C : -55 to 150°C Handling Code TU : Tube TR : Tape & Reel Lead Free Code L : Lead Free Device Blank : Original Device
APM2095P D: APM2095 XXXXX	XXXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte in plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

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

Symbol	Parameter		Rating	Unit
V _{DSS}	Drain-Source Voltage		-20	V
V _{GSS}	Gate-Source Voltage		±10	
I _D *	Continuous Drain Current	V _{GS} =-4.5V	-3	A
I _{DM} *	300μs Pulsed Drain Current		-12	
I _S *	Diode Continuous Forward Current		-1	A
T _J	Maximum Junction Temperature		150	°C
T _{STG}	Storage Temperature Range		-55 to 150	
P _D *	Power Dissipation for Single Operation	T _A =25°C	1.47	W
		T _A =100°C	0.58	
R _{θJA} *	Thermal Resistance-Junction to Ambient		85	°C/W

Note:

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

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

Symbol	Parameter	Test Condition	APM2095PD			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =-250μA	-20			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-12V, V _{GS} =0V			-1	μA
		T _J =85°C			-30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =-250μA	-0.5	-0.7	-1	V
I _{GSS}	Gate Leakage Current	V _{GS} =±10V, V _{DS} =0V			±100	nA
R _{DS(ON)} ^a	Drain-Source On-state Resistance	V _{GS} =-4.5V, I _{DS} =-3A		75	100	mΩ
		V _{GS} =-2.5V, I _{DS} =-1.5A		100	130	
V _{SD} ^a	Diode Forward Voltage	I _{SD} =-0.5A , V _{GS} =0V		-0.7	-1.3	V
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} =-10V, V _{GS} =-4.5V, I _{DS} =-3A		11.5	15	nC
Q _{gs}	Gate-Source Charge			1.7		
Q _{gd}	Gate-Drain Charge			1.8		

Electrical Characteristics (Cont.) (T_A = 25°C unless otherwise noted)

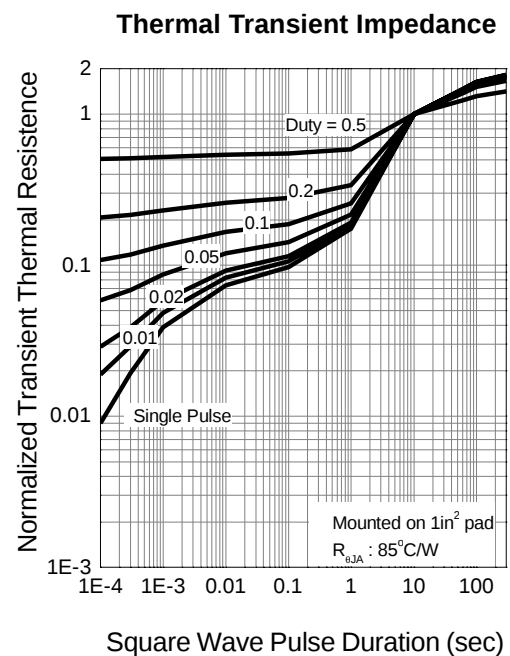
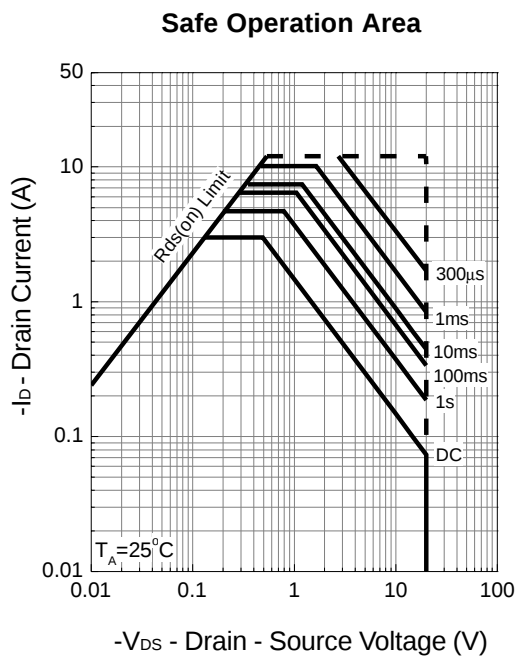
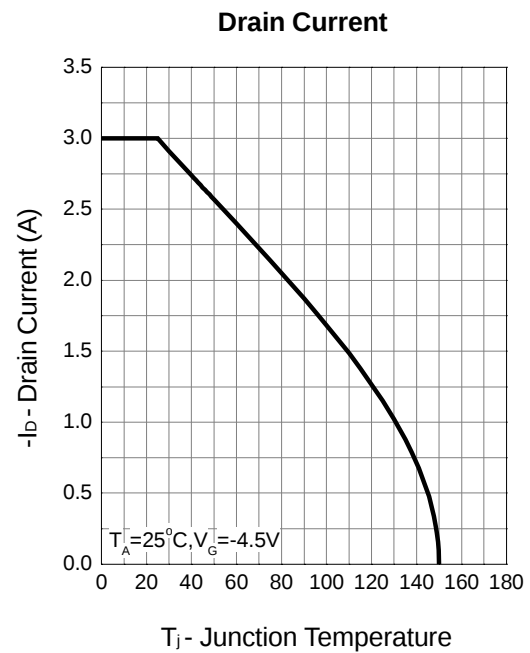
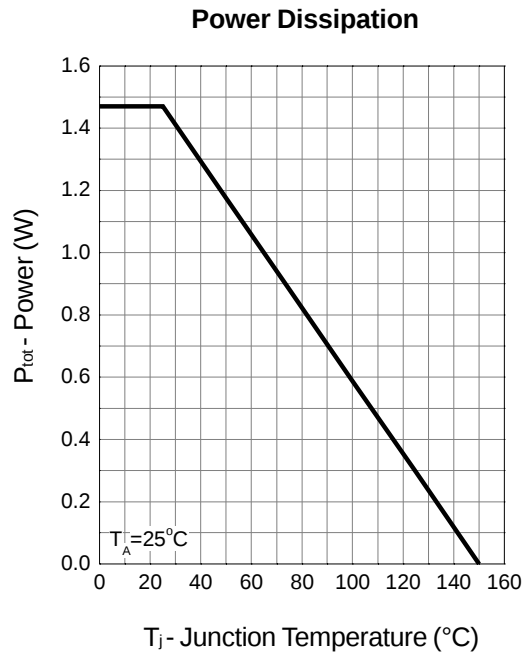
Symbol	Parameter	Test Condition	APM2095PD			Unit
			Min.	Typ.	Max.	
Dynamic Characteristics ^b						
R _G	Gate Resistance	V _{GS} =0V,V _{DS} =0V,F=1MHz		12.5		Ω
C _{iSS}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V, Frequency=1.0MHz		1160		pF
C _{oSS}	Output Capacitance			250		
C _{rSS}	Reverse Transfer Capacitance			85		
t _{d(ON)}	Turn-on Delay Time	V _{DD} =-10V, R _L =10Ω, I _{DS} =-1A, V _{GEN} =-4.5V, R _G =6Ω		12	21	ns
T _r	Turn-on Rise Time			25	42	
t _{d(OFF)}	Turn-off Delay Time			52	85	
T _f	Turn-off Fall Time			18	32	

Notes:

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

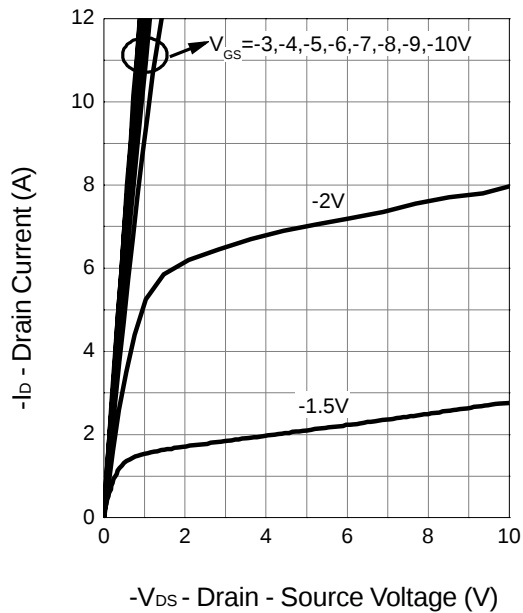
b : Guaranteed by design, not subject to production testing.

Typical Characteristics

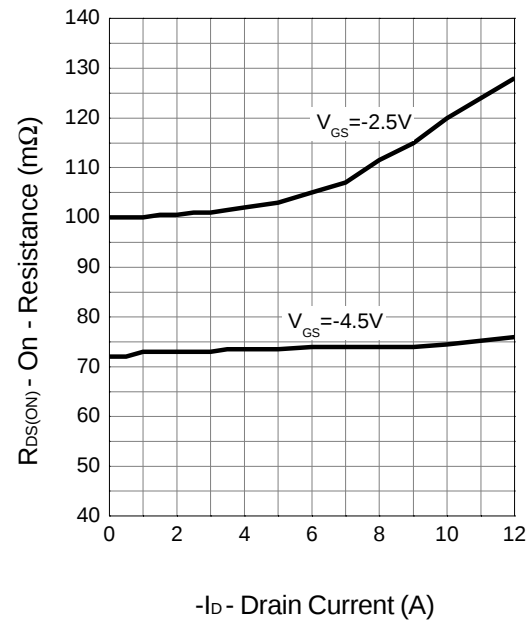


Typical Characteristics (Cont.)

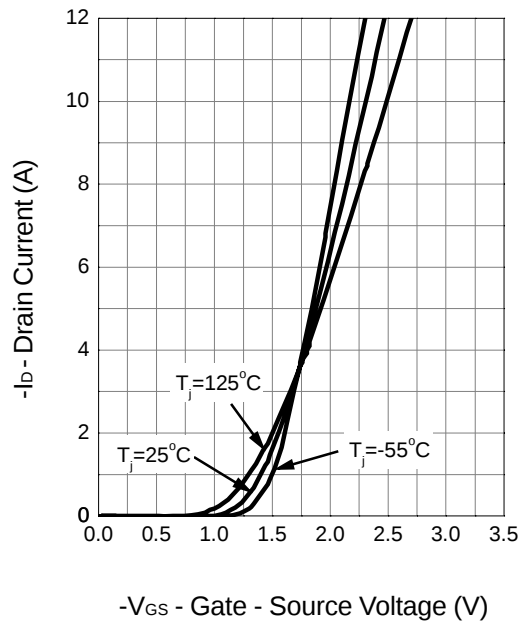
Output Characteristics



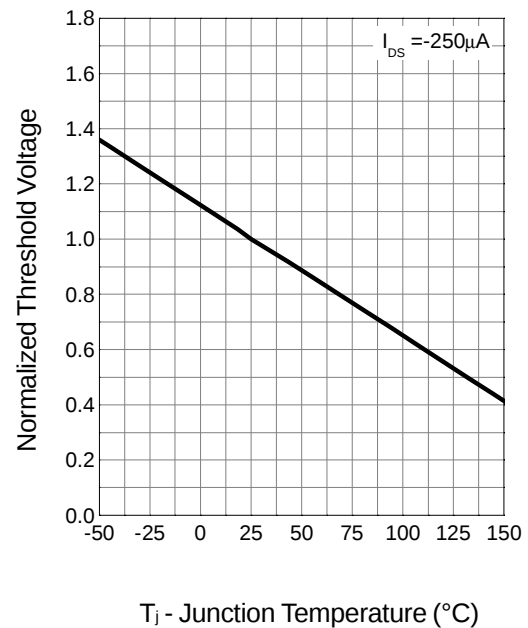
Drain-Source On Resistance



Transfer Characteristics

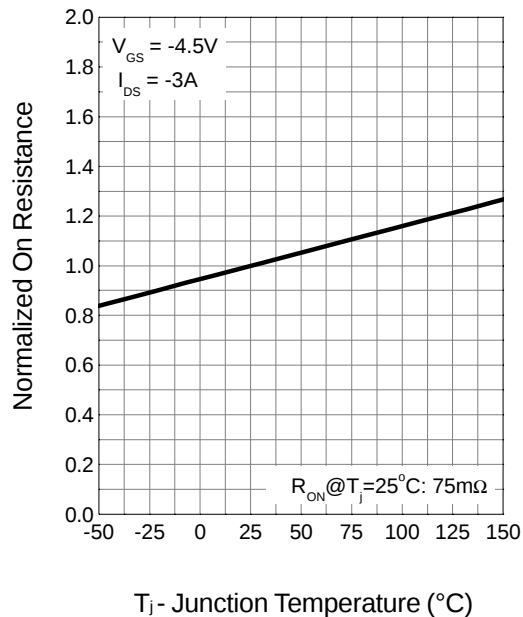


Gate Threshold Voltage

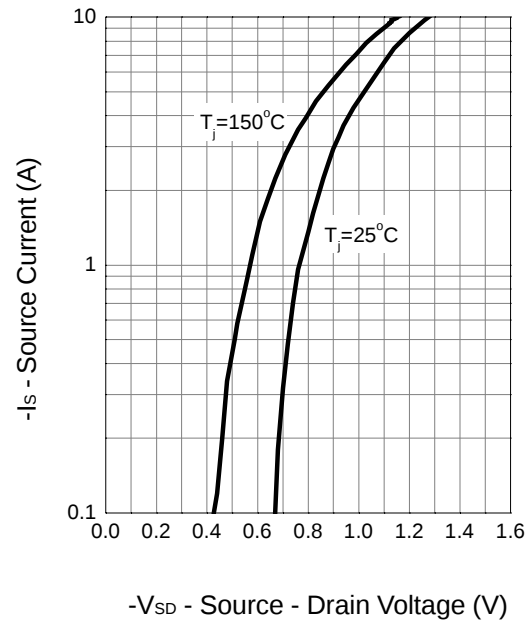


Typical Characteristics (Cont.)

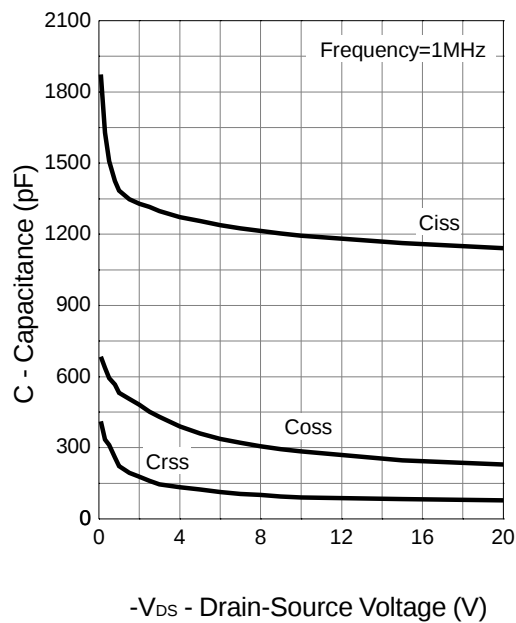
Drain-Source On Resistance



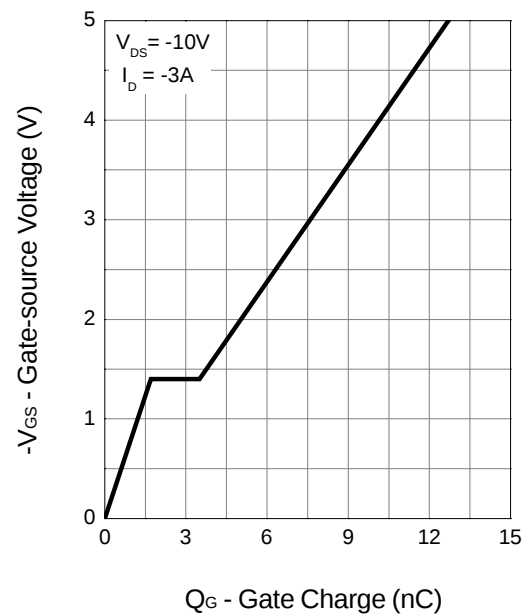
Source-Drain Diode Forward



Capacitance

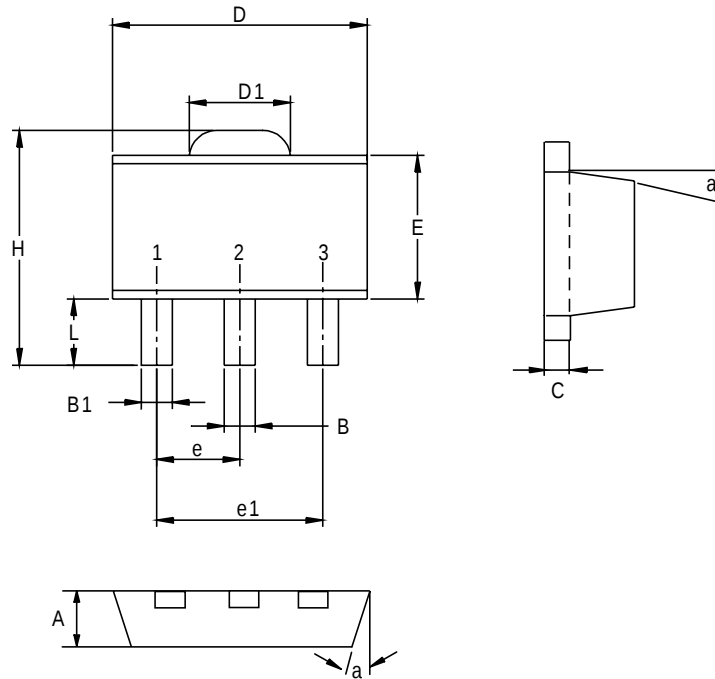


Gate Charge



Package Information

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

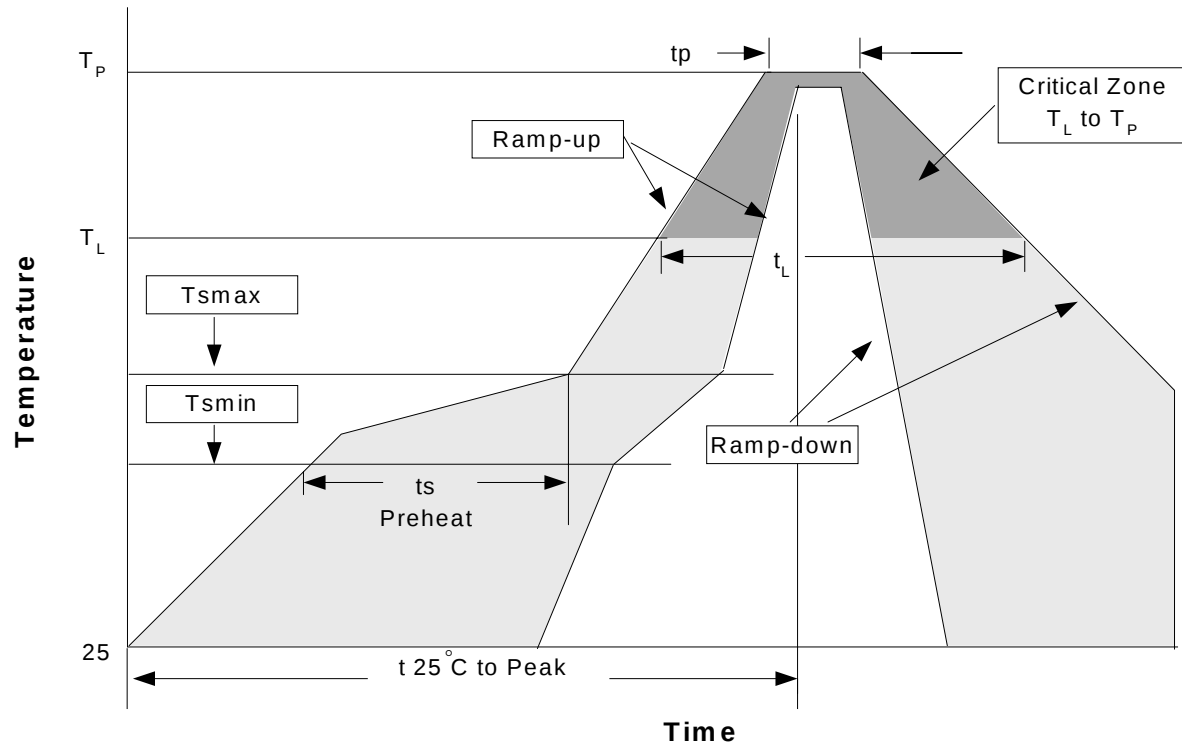


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031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

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}) - Temperature Max (T_{smax}) - Time (min to max) (t_s)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 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 ³ <350	Volume mm ³ ≥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

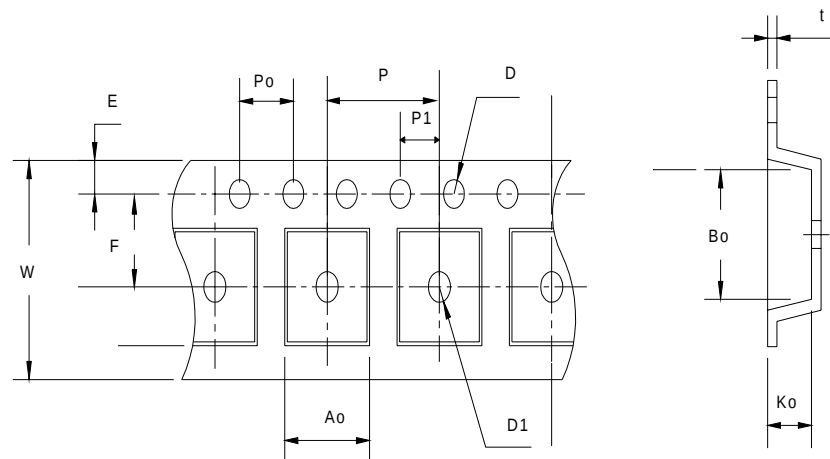
Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

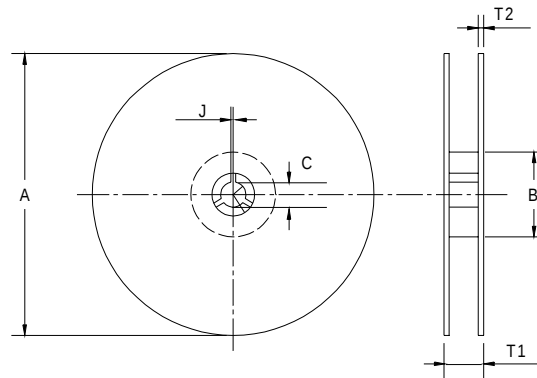
*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

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
SOT-89	178 ± 1	70 ± 2	13.5 ± 0.15	3 ± 0.15	14 ± 2	1.3 ± 0.3	12 + 0.3 12 - 0.1	8 ± 0.1	1.75 ± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.05	1.5 ± 0.1	1.5 ± 0.1	4.0 ± 0.1	2.0 ± 0.1	4.8 ± 0.1	4.5 ± 0.1	1.80 ± 0.1	0.3 ± 0.013

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOT-89	12	9.3	1000

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