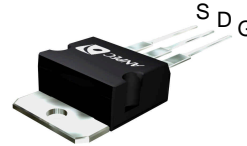


N-Channel Enhancement Mode MOSFET

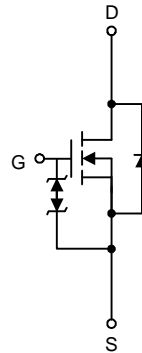
Features

- 60V/25A,
 $R_{DS(ON)} = 50m\Omega$ (typ.) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 65m\Omega$ (typ.) @ $V_{GS} = 4.5V$
- Super High Dense Cell Design
- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)

Pin Configuration



Top View of TO-220




N-Channel MOSFET

Applications

- Power Management in DC/DC Converter, DC/AC Inverter Systems.

Ordering and Marking Information

<p>APM6001N □□-□□□</p> <div style="margin-left: 20px;"> <p>└─ Assembly Material</p> <p>└─ Handling Code</p> <p>└─ Temperature Range</p> <p>└─ Package Code</p> </div>	<p>Package Code F : TO-220</p> <p>Operating Junction Temperature Range C : -55 to 150 °C</p> <p>Handling Code TU : Tube</p> <p>Assembly Material L : Lead Free Device G : Halogen and Lead Free Device</p>
<p>APM6001N F :  APM6001N XXXXX </p>	<p>XXXXX - Date Code</p>

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. 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 defines “Green” to mean lead-free (RoHS compliant) and halogen free (Br or Cl does not exceed 900ppm by weight in homogeneous material and total of Br and Cl does not exceed 1500ppm by weight).

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

Symbol	Parameter	Rating	Unit	
COMMON RATINGS ($T_A=25^\circ\text{C}$ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage	60	V	
V_{GSS}	Gate-Source Voltage	± 20		
T_J	Maximum Junction Temperature	150	$^\circ\text{C}$	
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ\text{C}$	
I_S	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ 2.5	A	
MOUNTED ON LARGE HEAT SINK				
I_{DP}	300 μs Pulse Drain Current Tested	$T_C=25^\circ\text{C}$	100	A
		$T_C=100^\circ\text{C}$	64	
I_D	Continuous Drain Current	$T_C=25^\circ\text{C}$	25	A
		$T_C=100^\circ\text{C}$	16	
P_D	Maximum Power Dissipation	$T_C=25^\circ\text{C}$	62.5	W
		$T_C=100^\circ\text{C}$	25	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	2	$^\circ\text{C/W}$	
MOUNTED ON PCB OF MINIMUM FOOTPRINT				
I_{DP}	300 μs Pulse Drain Current Tested	$T_A=25^\circ\text{C}$	20	A
		$T_A=100^\circ\text{C}$	12	
I_D	Continuous Drain Current	$T_A=25^\circ\text{C}$	6	A
		$T_A=100^\circ\text{C}$	3	
P_D	Maximum Power Dissipation	$T_A=25^\circ\text{C}$	2	W
		$T_A=100^\circ\text{C}$	0.8	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	62.5	$^\circ\text{C/W}$	

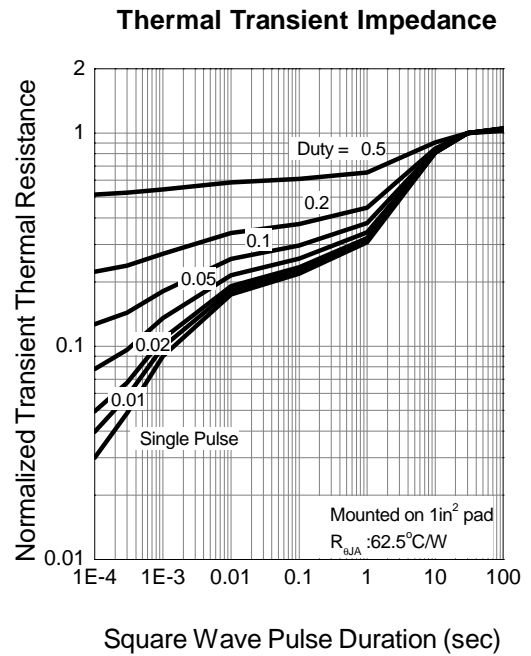
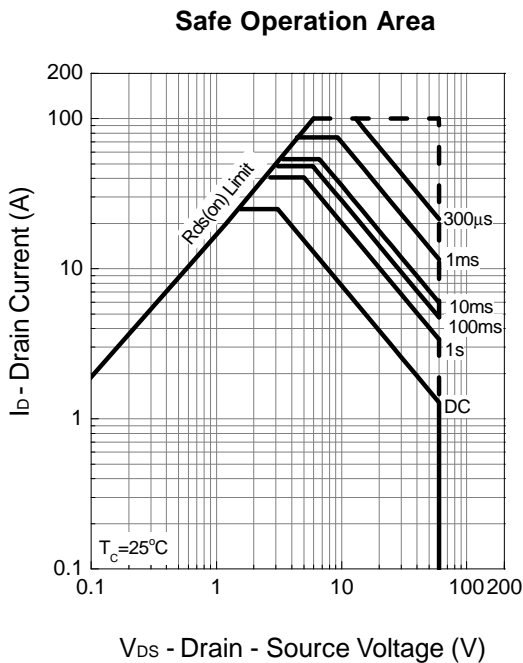
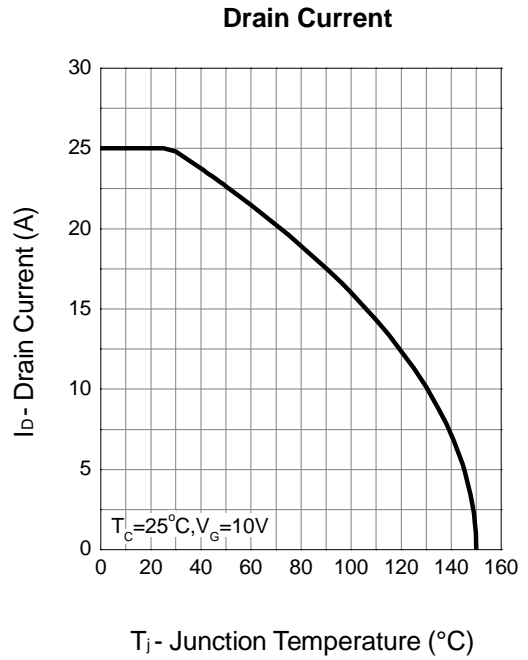
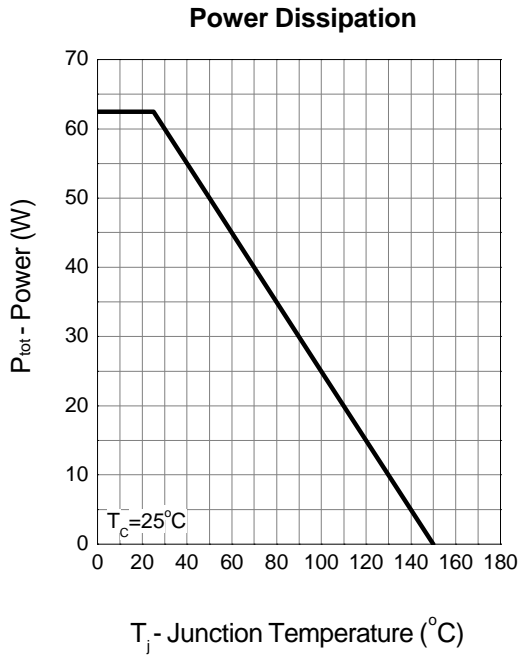
Electrical Characteristics ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	APM6001NF			Unit
			Min.	Typ.	Max.	
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=48V, V_{GS}=0V$	-	-	1	μA
		$T_J=85^\circ C$	-	-	30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1	-	3	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 16V, V_{DS}=0V$	-	-	± 10	μA
$R_{DS(on)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=6A$	-	50	65	m Ω
		$V_{GS}=4.5V, I_{DS}=3A$	-	65	90	
DIODE CHARACTERISTICS						
V_{SD}^a	Diode Forward Voltage	$I_{SD}=2.5A, V_{GS}=0V$	-	0.8	1.1	V
t_{rr}	Reverse Recovery Time	$I_{DS}=6A, di_{SD}/dt=100A/\mu s$	-	25	-	ns
Q_{rr}	Reverse Recovery Charge		-	22	-	nC
DYNAMIC CHARACTERISTICS^b						
R_G	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1MHz$	-	4.5	-	Ω
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=30V, \text{Frequency}=1.0MHz$	-	550	-	pF
C_{oss}	Output Capacitance		-	50	-	
C_{rss}	Reverse Transfer Capacitance		-	30	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=30V, R_L=30\Omega, I_{DS}=1A, V_{GEN}=10V, R_G=6\Omega$	-	7	14	ns
T_r	Turn-on Rise Time		-	6	12	
$t_{d(OFF)}$	Turn-off Delay Time		-	27	50	
T_f	Turn-off Fall Time		-	9	17	
GATE CHARGE CHARACTERISTICS^b						
Q_g	Total Gate Charge	$V_{DS}=30V, V_{GS}=10V, I_{DS}=6A$	-	12.4	17.4	nC
Q_{gs}	Gate-Source Charge		-	1.7	-	
Q_{gd}	Gate-Drain Charge		-	3.1	-	

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

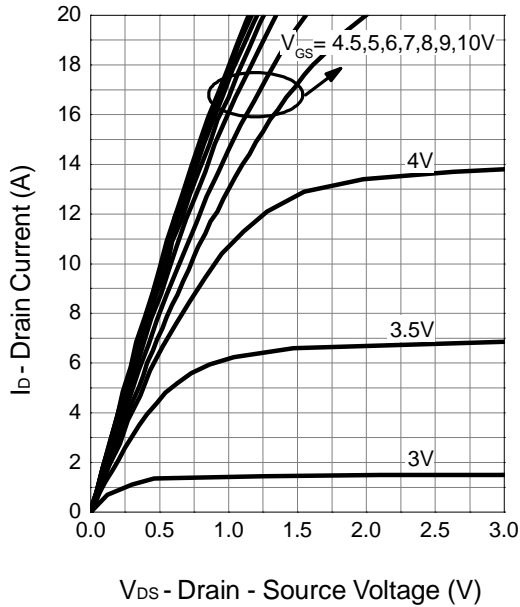
b : Guaranteed by design, not subject to production testing.

Typical Operating Characteristics

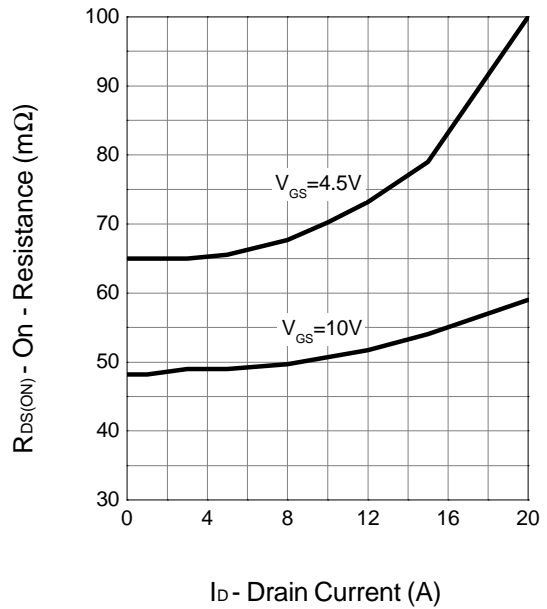


Typical Operating Characteristics (Cont.)

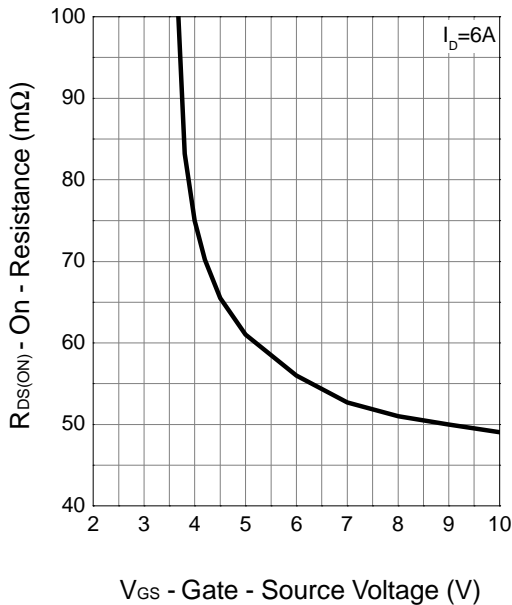
Output Characteristics



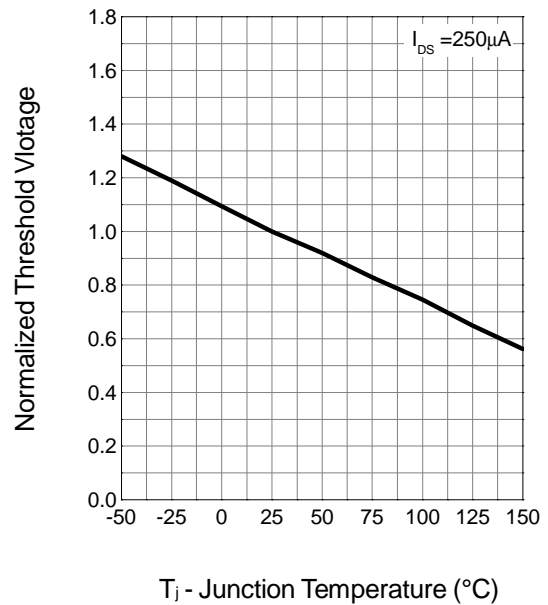
Drain-Source On Resistance



Drain-Source On Resistance

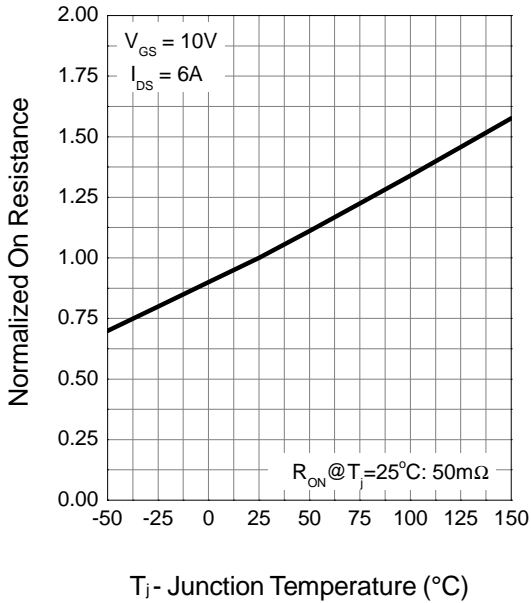


Gate Threshold Voltage

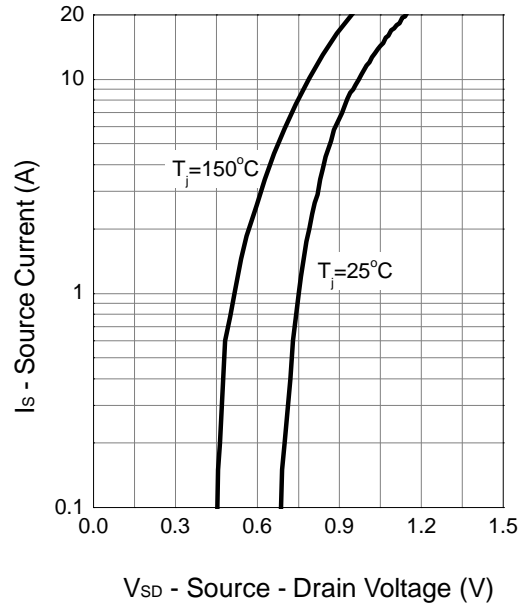


Typical Operating Characteristics (Cont.)

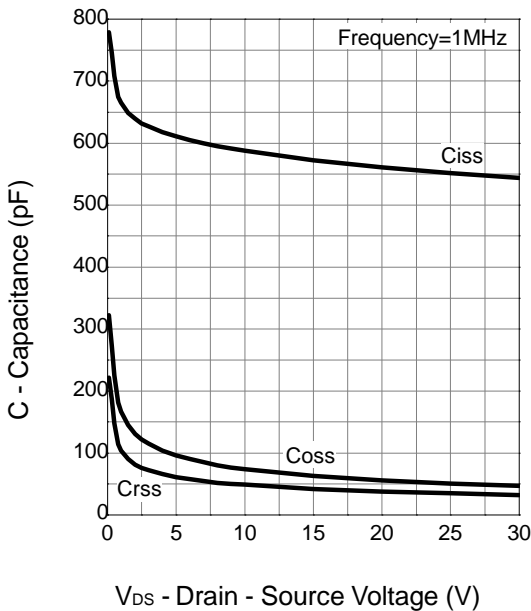
Drain-Source On Resistance



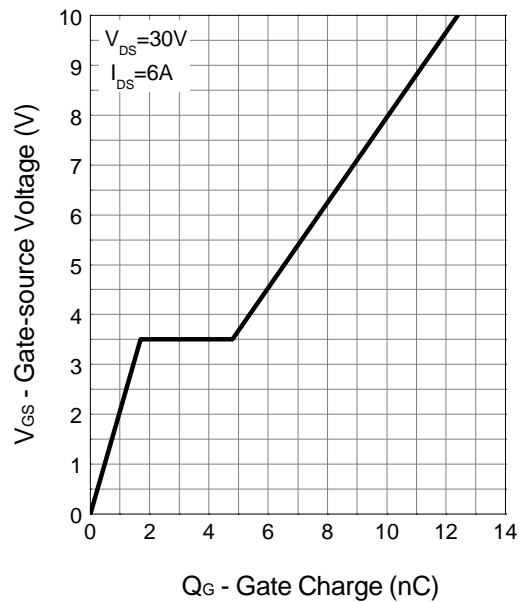
Source-Drain Diode Forward



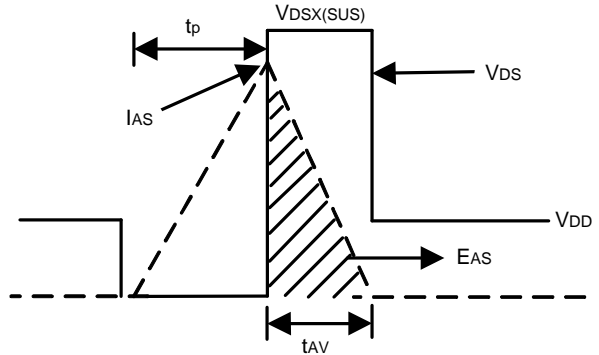
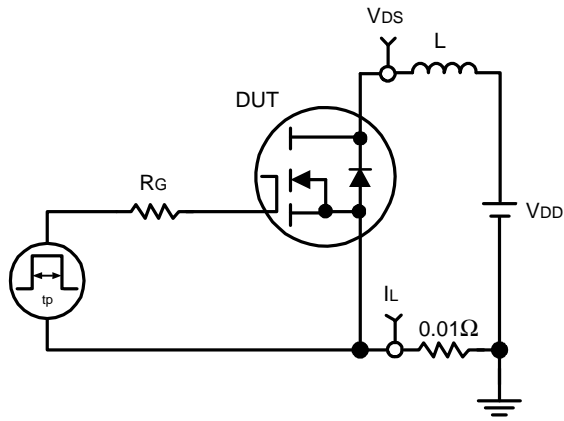
Capacitance



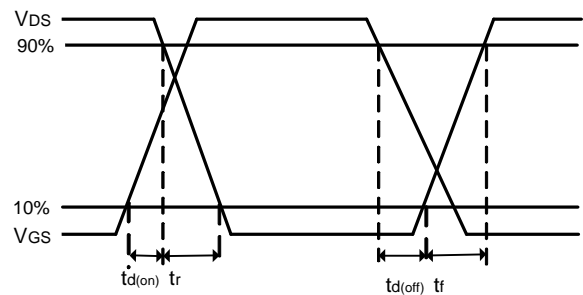
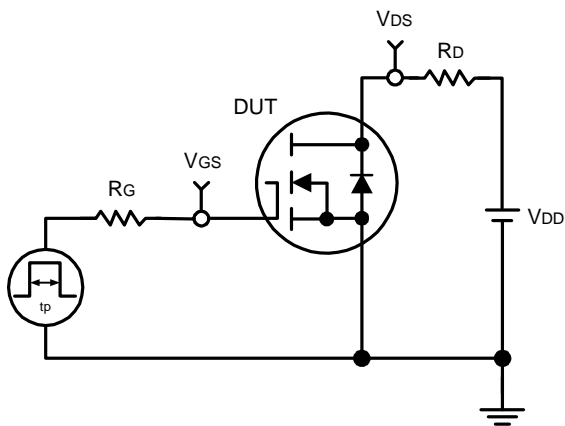
Gate Charge



Avalanche Test Circuit and Waveforms

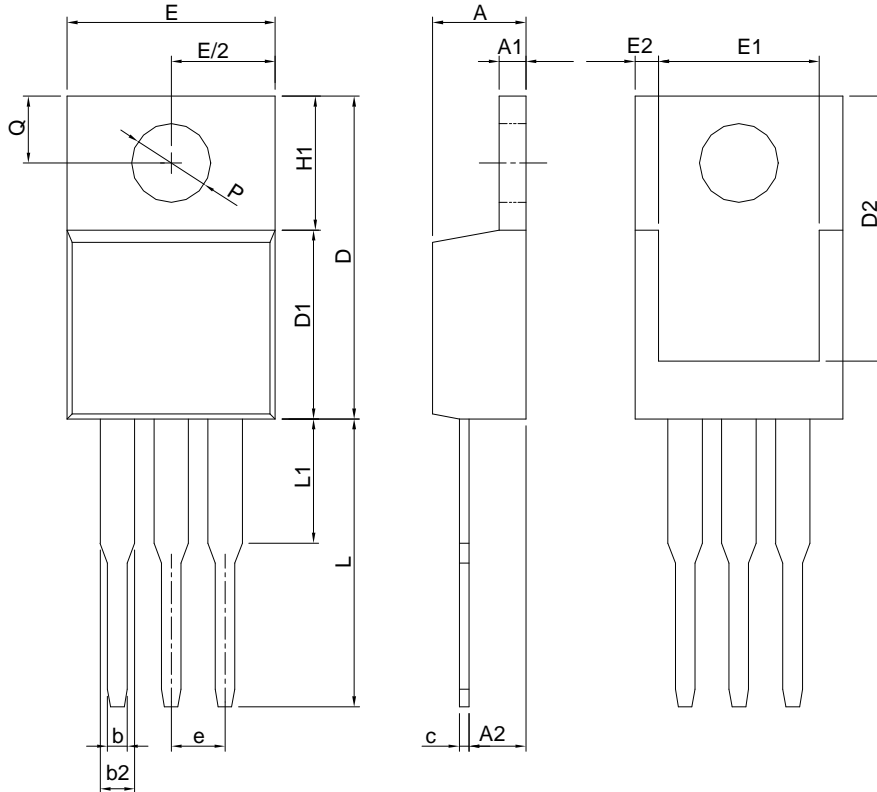


Switching Time Test Circuit and Waveforms



Package Information

TO-220



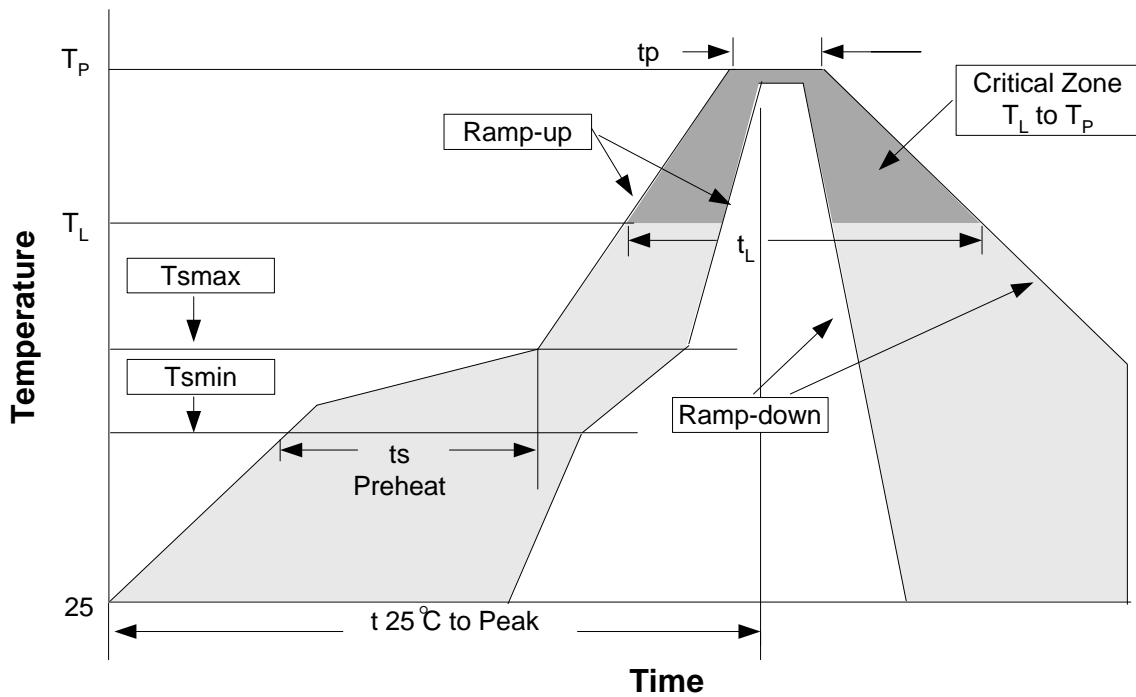
SYMBOL	TO-220			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	3.56	4.83	0.140	0.190
A1	0.51	1.40	0.020	0.055
A2	2.03	2.92	0.080	0.115
b	0.38	1.02	0.015	0.040
b2	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.22	16.51	0.560	0.650
D1	8.38	9.02	0.330	0.355
D2	12.19	12.88	0.480	0.507
E	9.65	10.67	0.380	0.420
E1	6.86	8.89	0.270	0.350
E2		0.76		0.030
e	2.54 BSC		0.100 BSC	
H1	5.84	6.86	0.230	0.270
L	12.70	14.73	0.500	0.580
L1		6.35		0.250
P	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

Note: Follow JEDEC TO-220 AB.

Devices Per Unit

Package Type	Unit	Quantity
TO-220	Tube	50

Reflow Condition (IR/Convection or VPR Reflow)



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

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) (ts)	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 (tp)	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.

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.

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