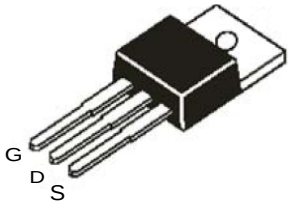
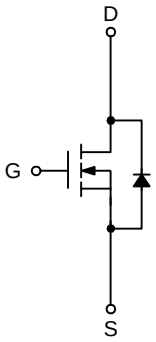
N-Channel Enhancement Mode MOSFET

Features

- 100V/160A
  $R_{DS(ON)}$ = 4.5 mΩ (typ.) @ V_{GS}=10V
- 100% avalanche tested
- Reliable and Rugged
- Lead Free and Green Devices Available
  (RoHS Compliant)

Pin Description





N-Channel MOSFET

Applications

- Switching application
- Power Management for Inverter Systems.

Ordering and Marking Information

P HY3610 YYXXXJWW G	Package Code P : TO220-3L Date Code YYXXX WW Assembly Material G : Lead Free Device

Note: HOOYI lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. HOOYI 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. HOOYI 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).

Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
Common Ratings (T_A=25°C Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage		100	V
V_{GSS}	Gate-Source Voltage		±25	
T_J	Maximum Junction Temperature		175	°C
T_{STG}	Storage Temperature Range		-55 to 175	°C
I_S	Diode Continuous Forward Current	T_C=25°C	160	A
Mounted on Large Heat Sink				
I_{DM}	Pulsed Drain Current *	T_C=25°C	620**	A
I_D	Continuous Drain Current	T_C=25°C	160	A
		T_C=100°C	118	
P_D	Maximum Power Dissipation	T_C=25°C	380	W
		T_C=100°C	190	
$R_{\theta JC}$	Thermal Resistance-Junction to Case		0.39	°C/W
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient		62.5	
Avalanche Ratings				
E_{AS}	Avalanche Energy, Single Pulsed	L=0.5mH	1050***	mJ

Note：* Repetitive rating ; pulse width limiited by junction temperature
** Drain current is limited by junction temperature
*** VD=80V

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

Symbol	Parameter	Test Conditions	HY3610P			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V, I_{DS}=250μA	100	110	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=100V, V_{GS}=0V	-	-	1	μA
		T_J=85°C	-	-	10	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_{DS}=250μA	2.0	3.0	4.0	V
I_{GSS}	Gate Leakage Current	V_{GS}=±25V, V_{DS}=0V	-	-	±100	nA
$R_{DS(ON)}$*	Drain-Source On-state Resistance	V_{GS}=10V, I_{DS}=80A	-	4.5	5.5	mΩ
Diode Characteristics						
V_{SD}*	Diode Forward Voltage	I_{SD}=80A, V_{GS}=0V	-	0.8	1	V
t_{rr}	Reverse Recovery Time	I_{SD}=80A, dI_{SD}/dt=100A/μs	-	65	-	ns
Q_{rr}	Reverse Recovery Charge		-	103	-	nC

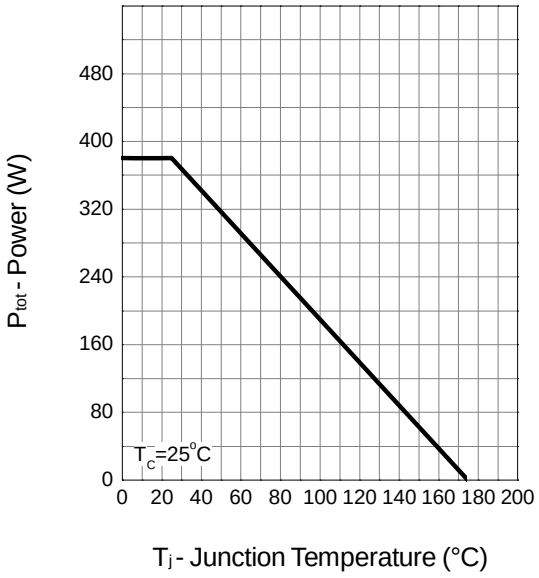
Electrical Characteristics (Cont.) (T_A = 25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HY3610P			Unit
			Min.	Typ.	Max.	
Dynamic Characteristics						
R_G	Gate Resistance	V_{GS}=0V,V_{DS}=0V,F=1MHz	-	1.3	-	Ω
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, Frequency=1.0MHz	-	16200	-	pF
C_{oss}	Output Capacitance		-	996	-	
C_{rss}	Reverse Transfer Capacitance		-	295	-	
$t_{d(ON)}$	Turn-on Delay Time	V_{DD}=50V, R_G= 6 Ω, I_{DS} =80A, V_{GS}=10V,	-	25	-	ns
T_r	Turn-on Rise Time		-	40	-	
$t_{d(OFF)}$	Turn-off Delay Time		-	85	-	
T_f	Turn-off Fall Time		-	45	-	
Gate Charge Characteristics						
Q_g	Total Gate Charge	V_{DS}=80V, V_{GS}=10V, I_{DS}=80A	-	201	-	nC
Q_{gs}	Gate-Source Charge		-	49	-	
Q_{gd}	Gate-Drain Charge		-	57	-	

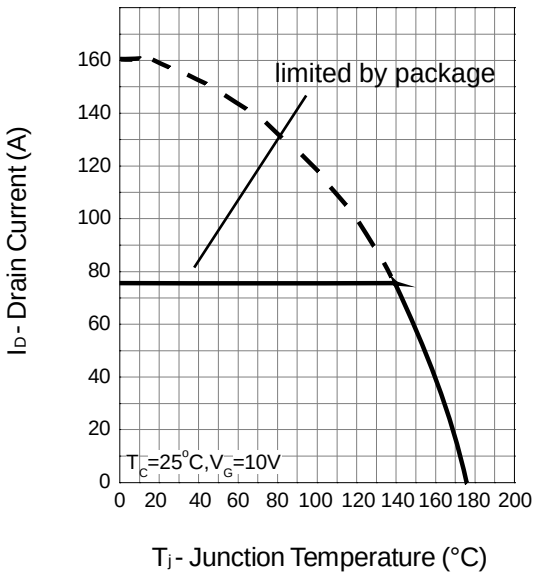
Note * : Pulse test ; pulse width ≤300μs, duty cycle≤2%.

Typical Operating Characteristics

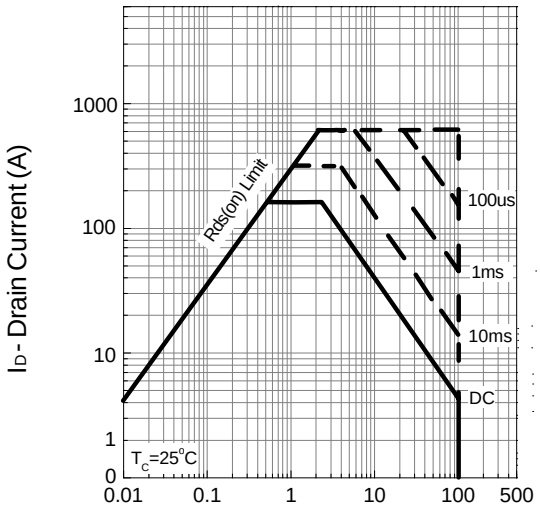
Power Dissipation



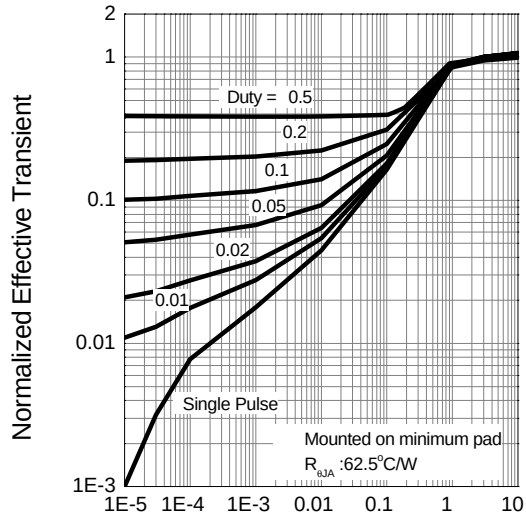
Drain Current



Safe Operation Area

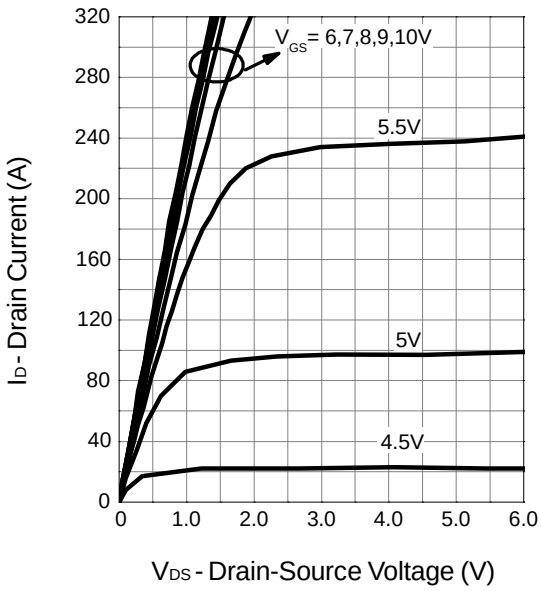


Thermal Transient Impedance

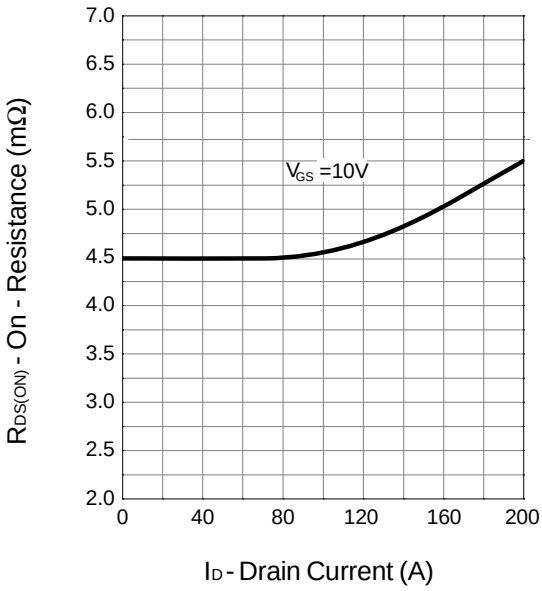


Typical Operating Characteristics (Cont.)

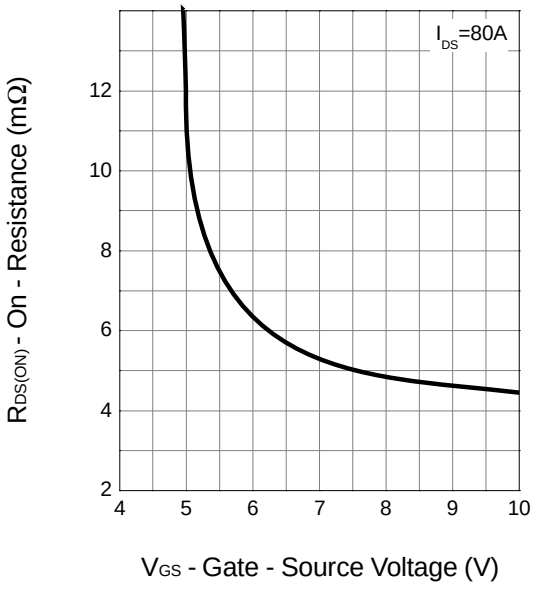
Output Characteristics



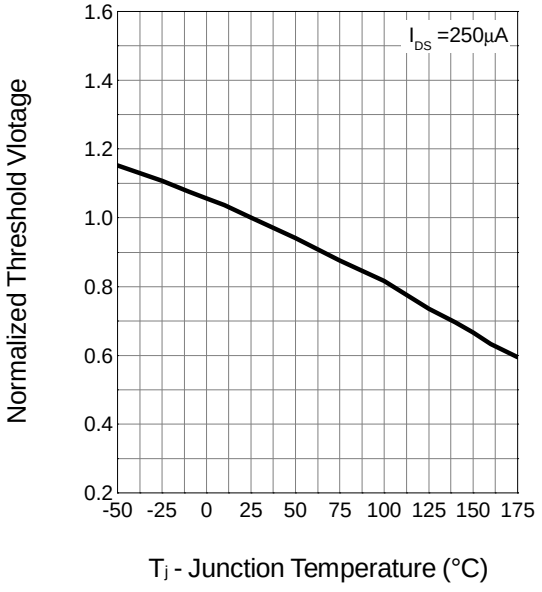
Drain-Source On Resistance



Drain-Source On Resistance

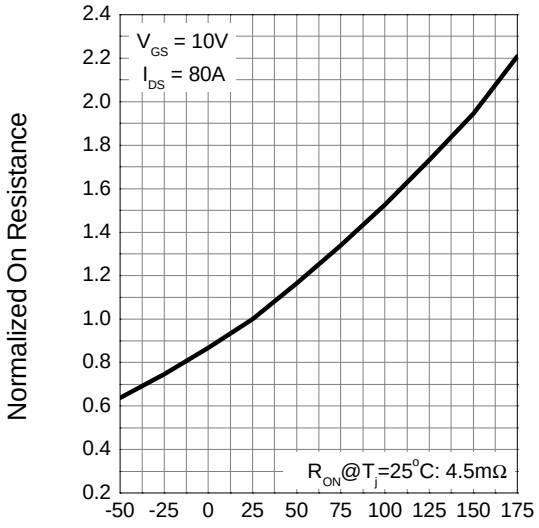


Gate Threshold Voltage

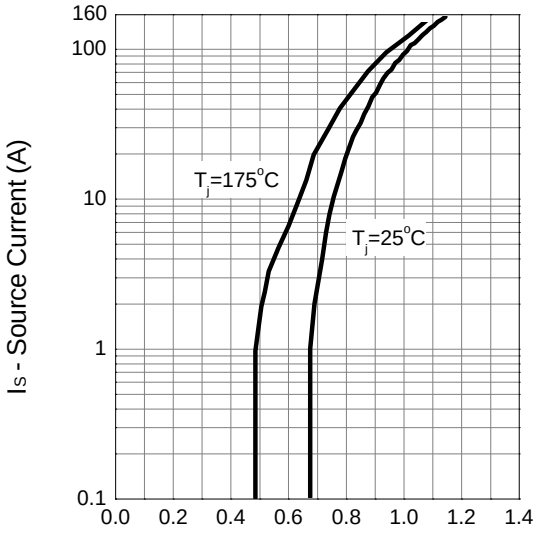


Typical Operating Characteristics (Cont.)

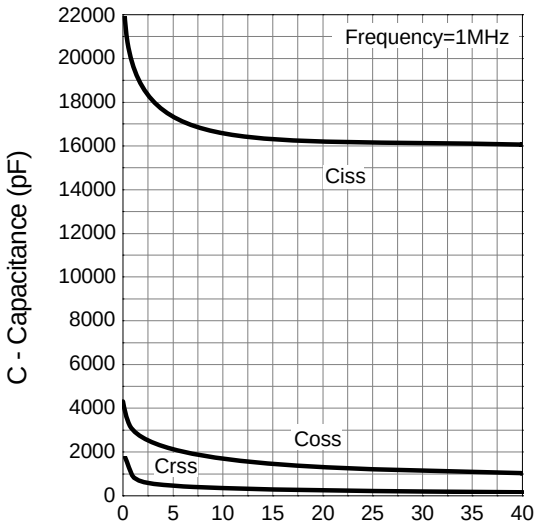
Drain-Source On Resistance



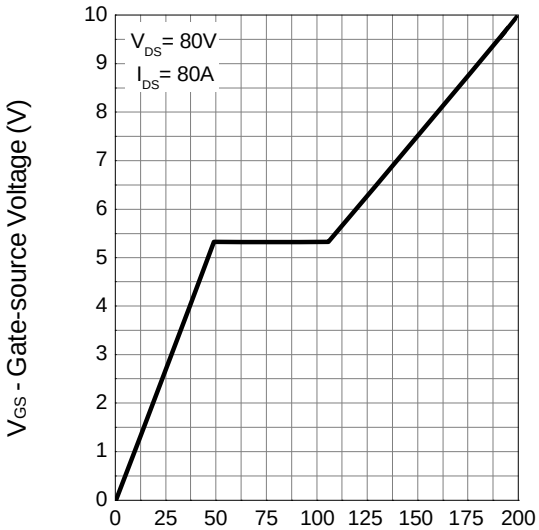
Source-Drain Diode Forward



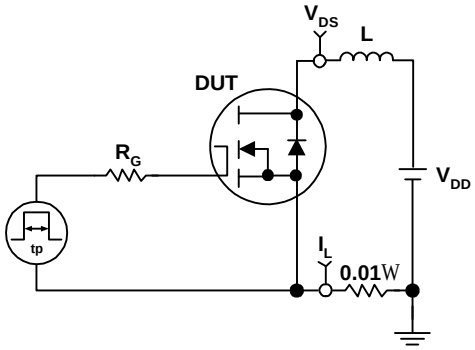
Capacitance

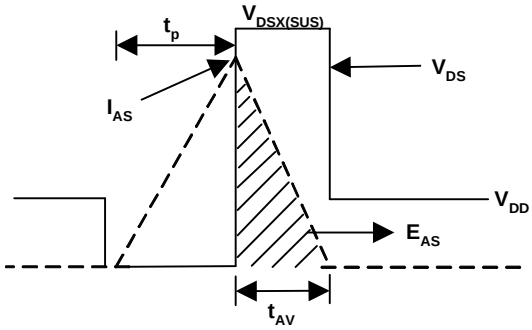


Gate Charge

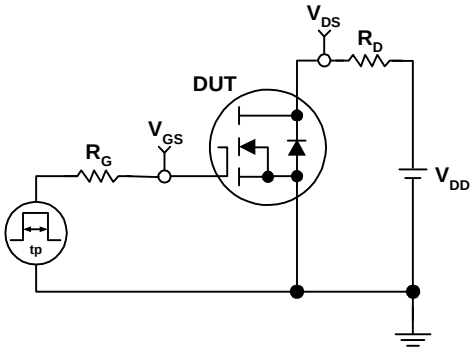


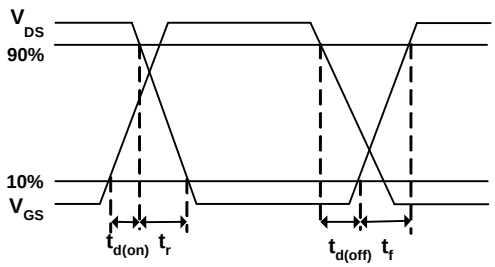
Avalanche Test Circuit and Waveforms





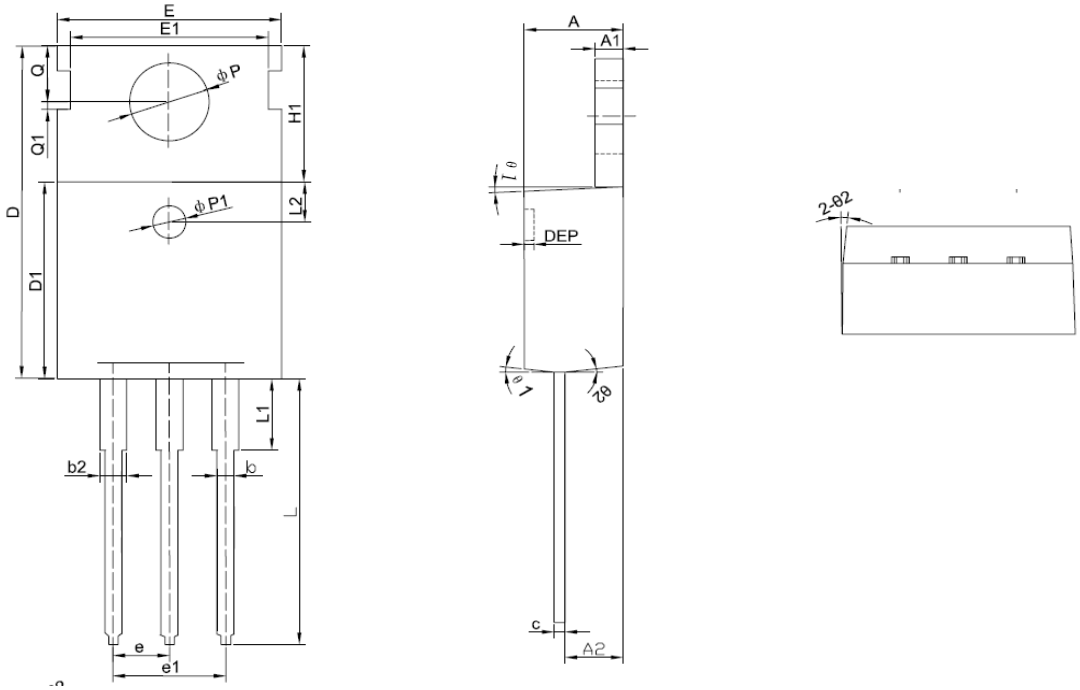
Avalanche Test Circuit and Waveforms





Package Information

TO-220



COMMON DIMENSIONS

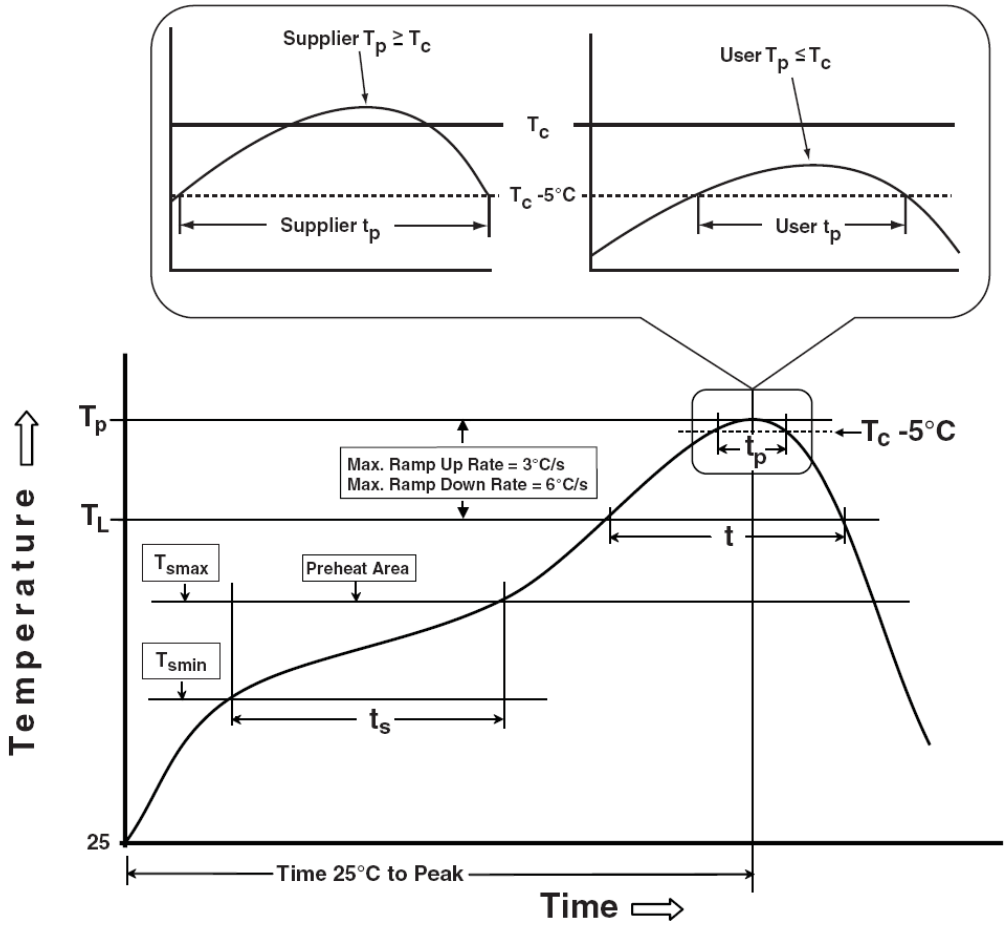
SYMBOL	MILLIMETER			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185
A1	1.27	1.30	1.33	0.050	0.051	0.052
A2	2.59	2.69	2.79	0.102	0.106	0.110
b	0.77	–	0.90	0.030	–	0.035
b2	1.23	–	1.36	0.048	–	0.054
c	0.48	0.50	0.52	0.019	0.020	0.021
D	15.10	15.40	15.70	0.594	0.606	0.618
D1	9.00	9.10	9.20	0.354	0.358	0.362
DEP	0.05	0.10	0.20	0.002	0.004	0.008
E	10.06	10.16	10.26	0.396	0.400	0.404
E1	–	8.70	–	–	0.343	–
Φp1	1.40	1.50	1.60	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
H1	6.10	6.30	6.50	0.240	0.248	0.256
L	12.75	–	13.17	0.502	–	0.519
L1	–	–	3.95	–	–	0.156
L2	1.85REF			0.073REF		
Φp	3.57	3.60	3.63	0.141	0.142	0.143
Q	2.73	2.80	2.87	0.107	0.110	0.113
Q1	–	0.20	–	–	0.008	–
θ1	5°	7°	9°	5°	7°	9°
θ2	1°	3°	5°	1°	3°	5°

NOTES:
1.ALL DIMENSIONS REFER TO JEDEC STANDARD TO220 –3L DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS

Devices Per Unit

Package Type	Unit	Quantity
TO-220	Tube	50

Classification Profile



Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (T_{smin} to T_{smax}) (t_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate (T_{smax} to T_P)	3 °C/second max.	3°C/second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 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 (Tc)

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 (Tc)

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
HOLT	JESD-22, A108	1000 Hrs, Bias @ 125°C
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C