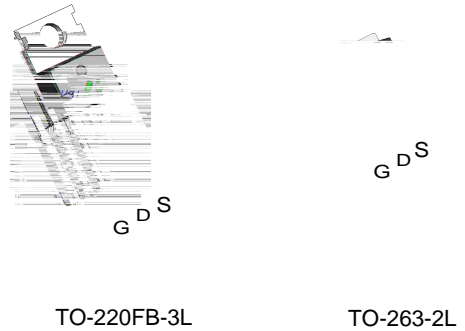


N-Channel Enhancement Mode MOSFET

**Features**

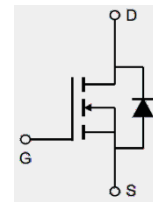
- 60V / 120 A,  
 $R_{DS(ON)} = 6.0\ m\ (\text{typ.}) @ V_{GS} = 10V$
- Avalanche Rated
- Reliable and Rugged
- Lead Free and Green Devices Available  
 (RoHS Compliant)

**Pin Description**




**Applications**

Power Management for Inverter Systems.



N-Channel MOSFET

**Ordering and Marking Information**

 <p><b>P</b> <b>HY1906</b> YYXXXJWW G</p>	 <p><b>B</b> <b>HY1906</b> YYXXXJWW G</p>	<p>Package Code P : TO-220FB-3L      B: TO-263-2L</p> <p>Date Code YYXXX WW      Assembly Material G : Lead Free Device</p>	
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Note: HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plate Termination finish; which are fully compliant with RoHS. HUAYI lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020 for MSL classification at lead-free peak reflow temperature. HUAYI 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).

HUAYI reserves the right to make changes, corrections, enhancements, modifications, and improvements to this product and/or to this document at any time without notice.

## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
<b>Common Ratings</b> ( $T_C=25^\circ\text{C}$ Unless Otherwise Noted)			
$V_{DSS}$	Drain-Source Voltage	60	V
$V_{GSS}$	Gate-Source Voltage	$\pm 25$	
$T_J$	Maximum Junction Temperature	175	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 175	$^\circ\text{C}$
$I_S$	Diode Continuous Forward Current	$T_C=25^\circ\text{C}$ 120	A
<b>Mounted on Large Heat Sink</b>			
$I_{DM}$		$T_C=25^\circ\text{C}$ 380**	A
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$ 120	A
		$T_C=100^\circ\text{C}$ 80	
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$ 188	W
		$T_C=100^\circ\text{C}$ 94	
$R_{JC}$	Thermal Resistance-Junction to Case	0.8	$^\circ\text{C/W}$
$R_{JA}$	Thermal Resistance-Junction to Ambient	62.5	
<b>Avalanche Ratings</b>			
$E_{AS}$	Avalanche Energy, Single Pulsed	$L=0.5\text{mH}$ 600***	mJ

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

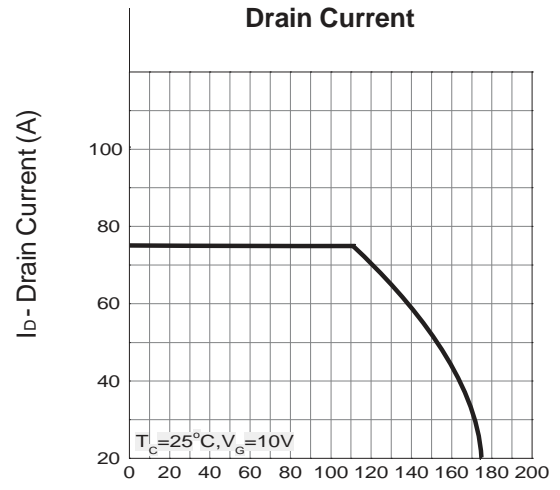
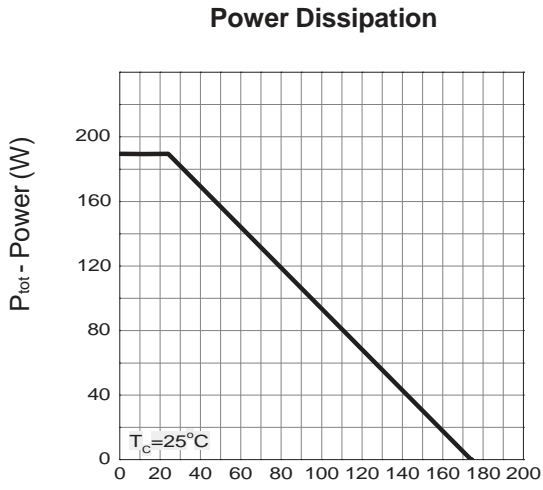
Symbol	Parameter	Test Conditions	HY1906			Unit
			Min.	Typ.	Max.	
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}, I_{DS}=250\text{ A}$	60			

**Electrical Characteristics (Cont.)** ( $T_C = 25\text{ }^\circ\text{C}$  Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HY1906			Unit
			Min.	Typ.	Max.	
<b>Dynamic Characteristics<sup>b</sup></b>						
$R_G$	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	-	1.0	-	
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=25V,$ Frequency=1.0MHz	-	4577	-	pF
$C_{oss}$	Output Capacitance		-	876	-	
$C_{rss}$	Reverse Transfer Capacitance		-	276	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=30V, R_G = 6\ \Omega,$ $I_{DS}=60A, V_{GS}=10V,$	-	13	26	ns
$T_r$	Turn-on Rise Time		-	11	20	
$t_{d(OFF)}$	Turn-off Delay Time		-	40	66	
$T_f$	Turn-off Fall Time		-	60	95	
<b>Gate Charge Characteristics<sup>b</sup></b>						
$Q_g$	Total Gate Charge	$V_{DS}=30V, V_{GS}=10V,$ $I_{DS}=60A$	-	96	-	nC
$Q_{gs}$	Gate-Source Charge		-	21	-	
$Q_{gd}$	Gate-Drain Charge		-	23	-	

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

# Typical Operating Characteristics



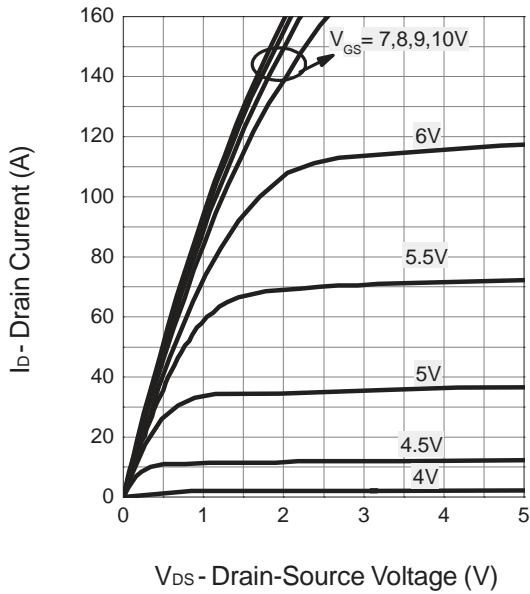
## Safe Operation Area

I<sub>D</sub> - Drain Current (A)

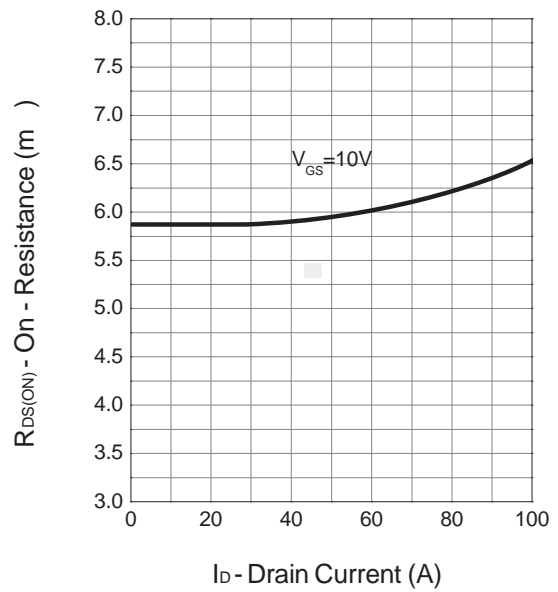
V<sub>DS</sub> - Drain - Source Voltage (V)

**Typical Operating Characteristics (Cont.)**

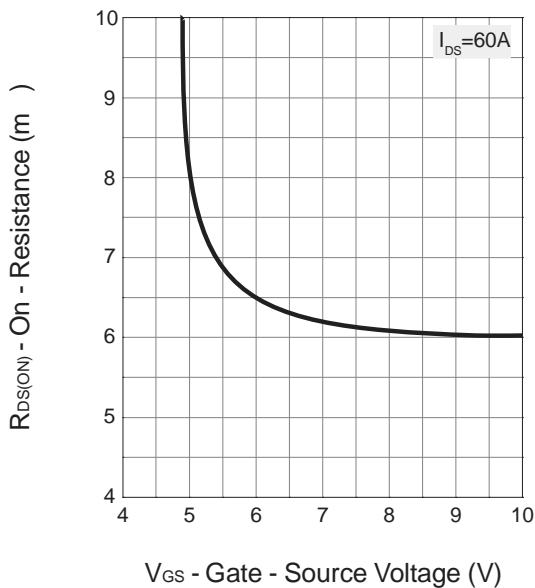
**Output Characteristics**



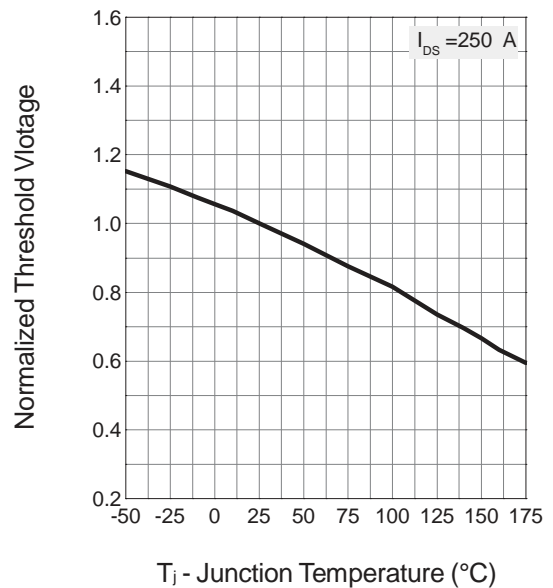
**Drain-Source On Resistance**



**Drain-Source On Resistance**

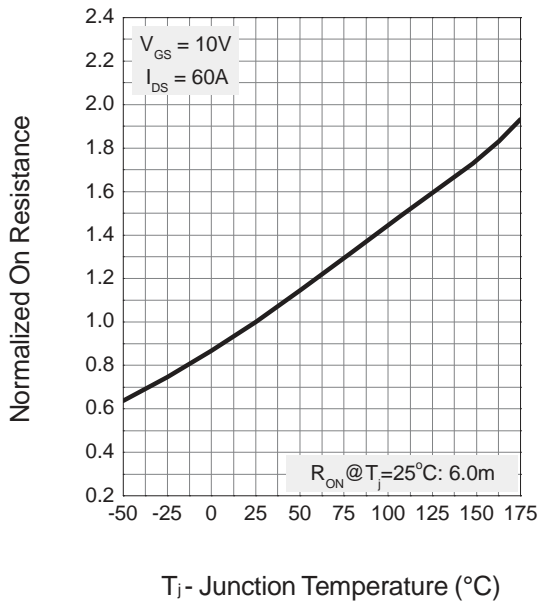


**Gate Threshold Voltage**

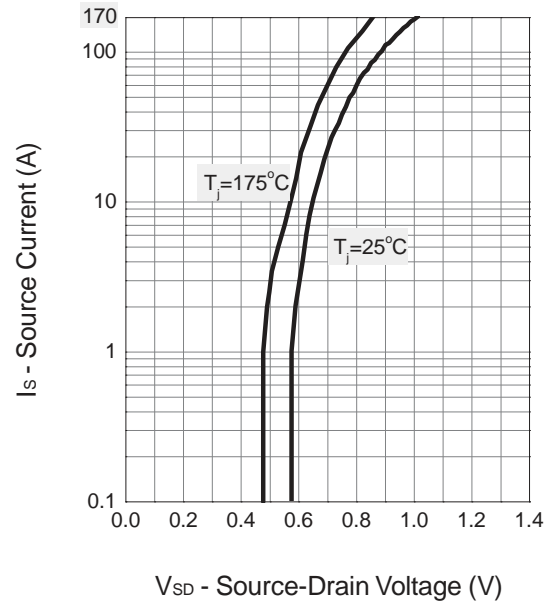


**Typical Operating Characteristics (Cont.)**

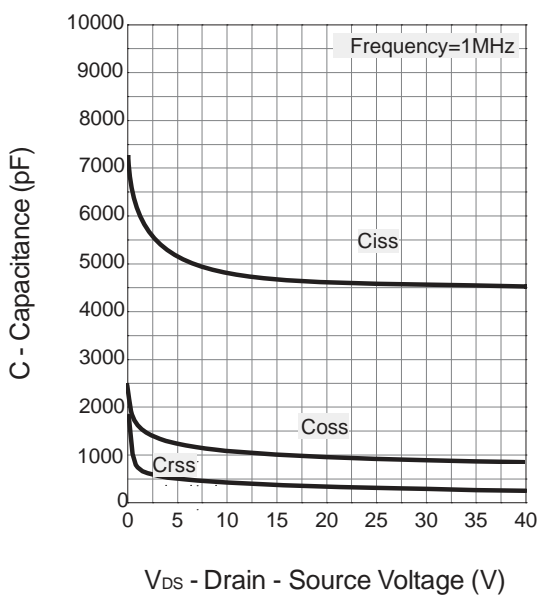
**Drain-Source On Resistance**



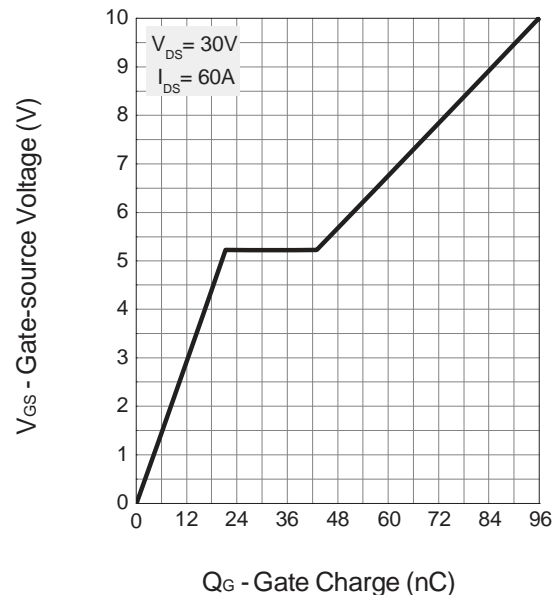
**Source-Drain Diode Forward**



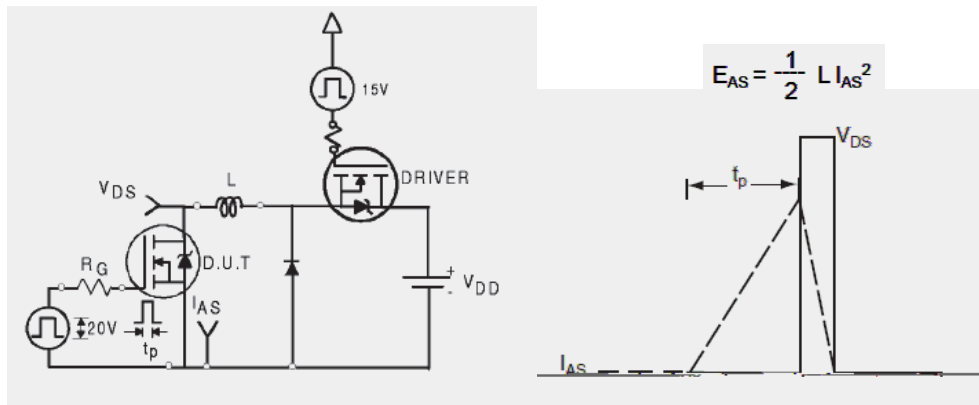
**Capacitance**



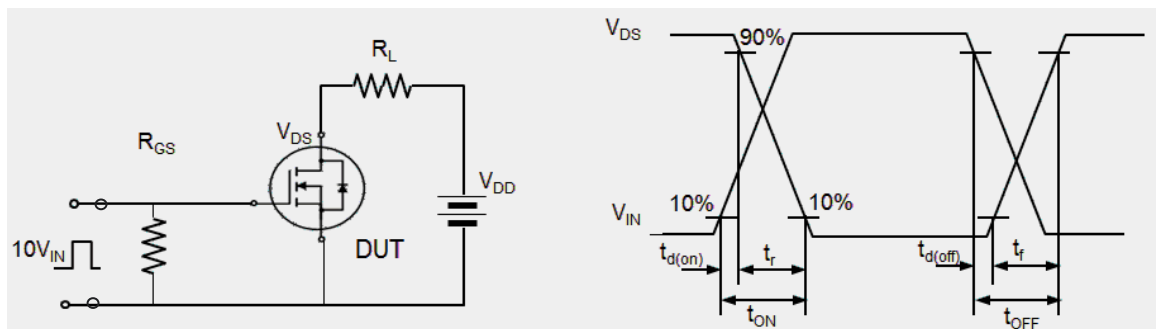
**Gate Charge**



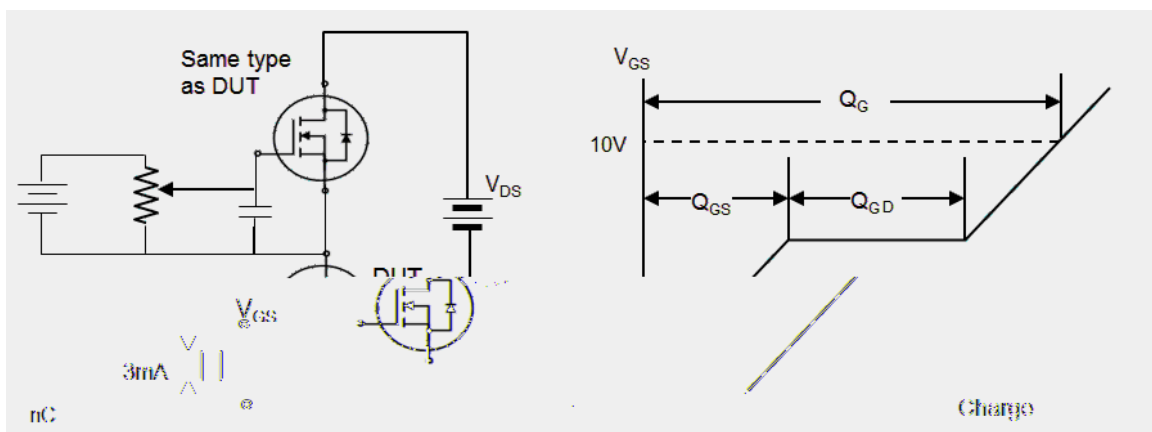
### Avalanche Test Circuit



### Switching Time Test Circuit



### Gate Charge Test Circuit

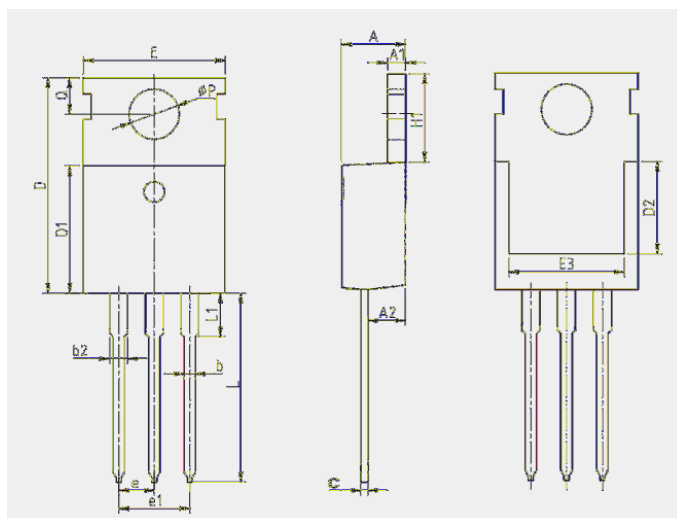


## Device Per Unit

Package Type	Unit	Quantity
TO-220FB-3L	Tube	50

## Package Information

### TO-220FB-3L



#### COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.25	1.30	1.45
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.40	0.50	0.65
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
P	3.40	3.60	3.80
Q	2.60	2.80	3.00

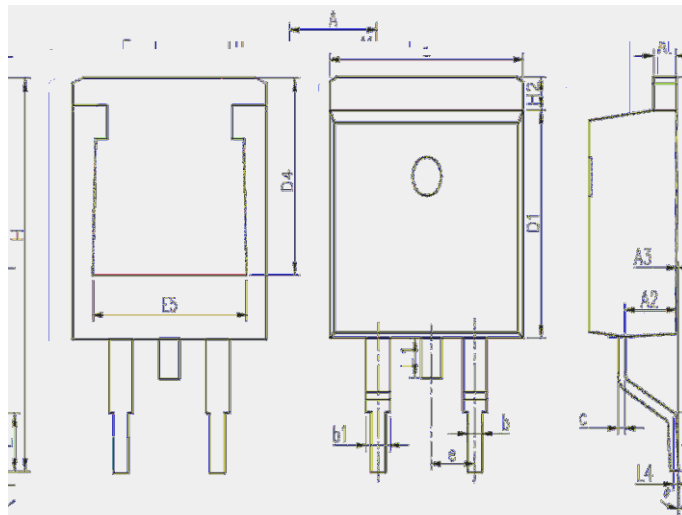


Device Per Unit

Package Type	Unit	Quantity
VUĒĠĪHĒGSĀ	V~ā^Ā	ÍĒĀ

Package Information

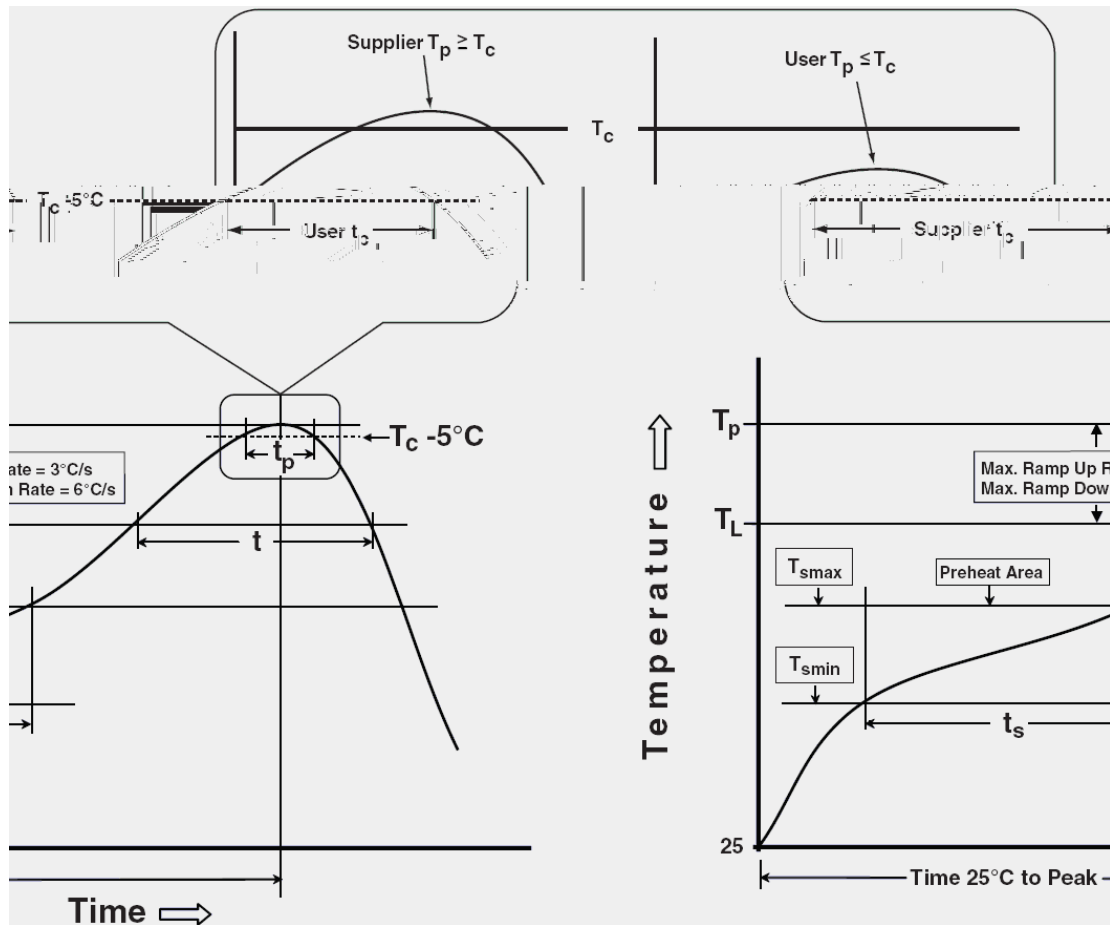
TO-263-2L



ΟΥΤΤΥΡΑΟQ ΤΟΡÙQURÙĀ

ÙŸΤΟΥŠĀ	{ { Ā		
	TQPA	PUTA	TCEŸĀ
ĀĀ	ÍĒĪĀ	ÍĒÍĀ	ÍĒĪĀ
ĀFĀ	FĒGGĀ	FĒGĪĀ	FĒIGĀ
ĀGĀ	GĒIJĀ	GĒĪJĀ	GĒĪJĀ
ĀHĀ	ĒĀ	ĒĒFHĀ	ĒĒGĪĀ
āĀ	ĒĒĪĀ	ĒĒĪFĀ	ĒĒĪĪĀ
āFĀ	FĒFĪĀ	FĒGĪĀ	FĒĪĪĀ
ĀĀ	ĒĒHĀ	ĒĒHĪĀ	ĒĒĪHĀ
ÖFĀ	ĪĒĪĀ	ĪĒĪĀ	ĪĒĪĀ
ÖĪĀ	ĪĒĪĀ	ĒĀ	ĒĀ
ÒĀ	JĒĪĪĀ	FĒĒFĪĀ	FĒĒHĪĀ
ÒĪĀ	ĪĒĒĪĀ	ĒĀ	ĒĀ
^Ā	GĒĪĪÁÓÙŌĀ		
PĀ	FĪĒĪĀ	FĪĒFĀ	FĪĒĪĀ
PGĀ	FĒĒĪĀ	FĒGĪĀ	FĒĪĪĀ
ŠĀ	GĀ	GĒHĀ	GĒĪĀ
ŠFĀ	FĒĪĀ	FĒĪĪĀ	FĒĪĀ
ŠĪĀ	ĒĒGĪĪÁÓÙŌĀ		
Ā	ĒĀ	ĪĀ	JĀ

### 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 (Tc)

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 (Tc)

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	168Hrs/500Hrs/1000Hrs, Bias@125 C
PCT	JESD-22, A102	96 Hrs, 100 RH, 2atm, 121 C
TCT	JESD-22, A104	500 Cycles, -55 C~150 C

### Customer Service

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