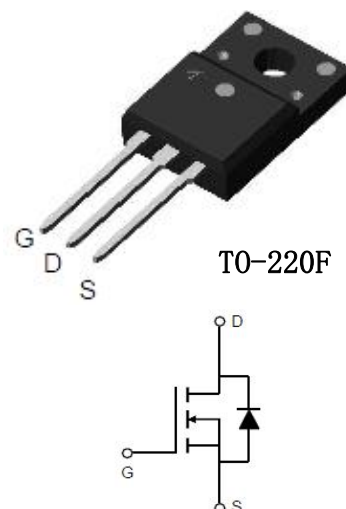


## 650V N-Channel POWER MOSFET

### Features

- $V_{DSS}=650V$   $I_D=12A$   
 $R_{DS(ON)}=0.8\Omega(\text{Max.})@V_{GS}=10V$
- Fast Switching
- 100% avalanche tested
- RoHS compliant
- Low ON Resistance

### PIN DESCRIPTION



### Applications

- LED power supplies
- Cell Phone Charger
- Standby Power

Part Number	Package	Marking	ROHS Status	Packing
SI12N65F	TO-220F	SI12N65F	Pb-Free	Box (Tube)

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

Symbol	Parameter	Typical	Unit
$V_{DSS}$	Drain-Source Voltage	650	V
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$I_D$	Drain Current	$T_C=25^\circ\text{C}$ 12	A
$I_{DM}$	Pulsed Drain Current	48	A
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	43	W
$I_{AR}$	Avalanche Current	5	A
$E_{AS}$	Single Pulse Avalanche Energy	700	mJ
$E_{AR}$	Repetitive Avalanche Energy	330	mJ
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$

### Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal resistance, junction – Case.	$R_{\theta JC}$	2.5	$^\circ\text{C}/\text{W}$
Thermal resistance, junction – Ambient.	$R_{\theta JA}$	65	

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

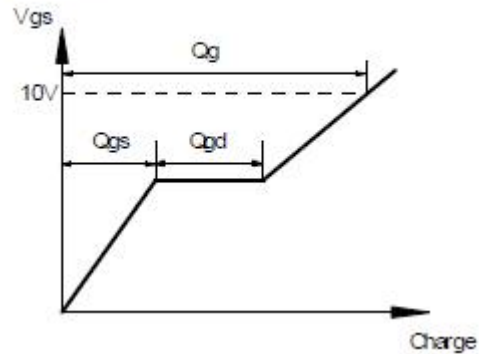
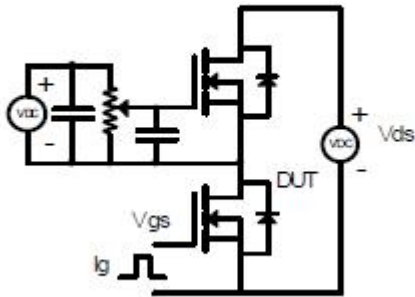
Symbol	Parameter	Test Conditions	Min	TYP	Max	Unit
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain-source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	650	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	-	-	1	$\mu A$
$I_{GSS}$	Gate-Source Leakage	$V_{GS}=\pm 30V, V_{DS}=0V$	-	-	$\pm 100$	nA
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2	-	4	V
$R_{DS(on)}$	Drain-Source On-Resistance	$V_{GS}=10V, I_D=6A$	-	-	0.8	$\Omega$
$g_{fs}$	Forward Transconductance	$V_{DS}=15V, I_D=6A$	-	8.5	-	S
<b>Dynamic Characteristic</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=25V,$ $f=1MHz$	-	1550	-	pF
$C_{oss}$	Output Capacitance		-	82	-	
$C_{rss}$	Reverse Transfer Capacitance		-	28	-	
$Q_G$	Gate Total Charge	$V_{DS}=520V, I_D=12A,$ $V_{GS}=10V,$	-	40	-	nC
$Q_{gs}$	Gate-Source charge		-	9.5	-	
$Q_{gd}$	Gate-Drain charge		-	17.5	-	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=325V, I_D=12A,$ $R_G=25\Omega, V_{GS}=10V$	-	36	-	nS
$t_r$	Rise time		-	77	-	
$t_{d(off)}$	Turn-off delay time		-	120	-	
$t_f$	Fall time		-	65	-	
<b>Drain-Source Body Diode Characteristics</b>						
$V_{SD}$	Body Diode Forward Voltage	$V_{GS}=0V, I_s=12A$	-	-	1.2	V
$t_{rr}$	Body Diode Reverse Recovery Time	$V_{GS}=0V, I_F=12A,$ $di_F/dt=100A/\mu s$	-	210	-	nS
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	7.5	-	$\mu C$
$I_S$	Maximum Continuous Drain-Source Diode Forward Current		-	-	12	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		-	-	48	A

**Note:**

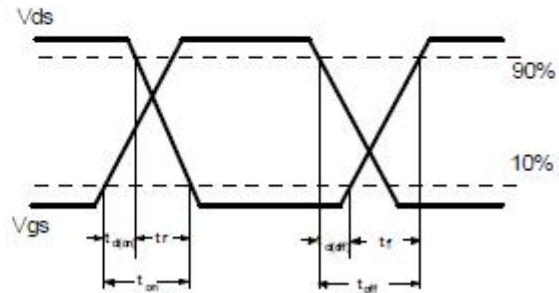
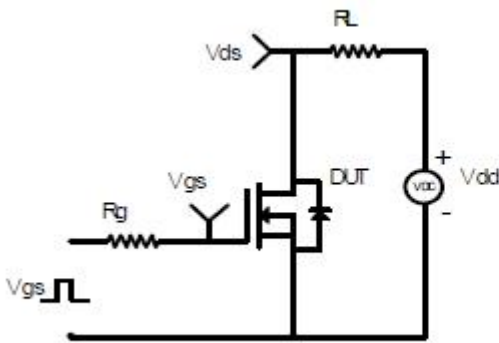
- The value of  $R_{\theta JA}$  is measured with the device in a still air environment with  $T_A=25^\circ\text{C}$ .
- The static characteristics in Figures 1 to 6 are obtained using  $<300\mu s$  pulses, duty cycle 2% max

## Switching Time Test Circuit and Wave forms

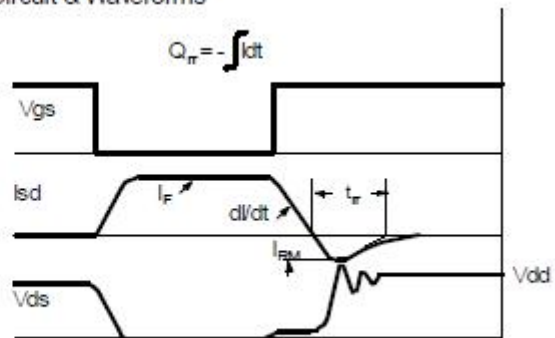
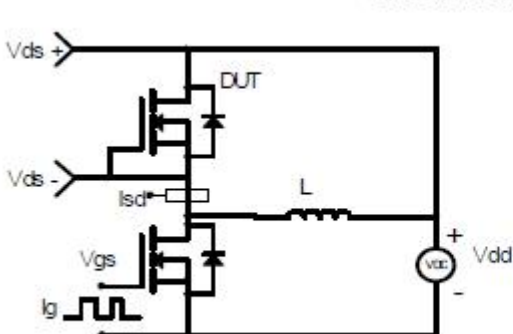
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



## Typical Performance Characteristics

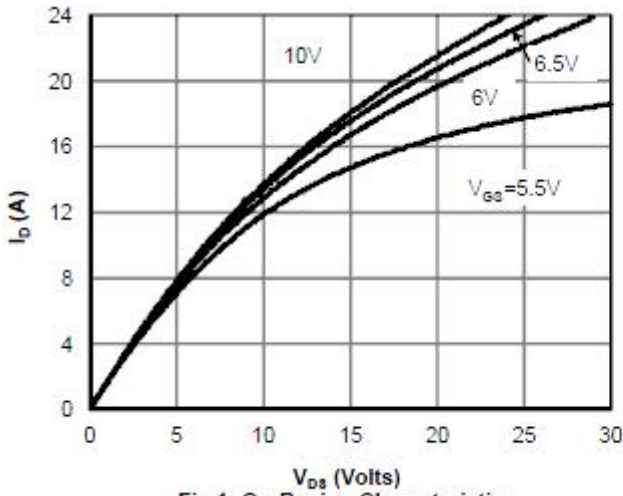


Fig 1: On-Region Characteristics

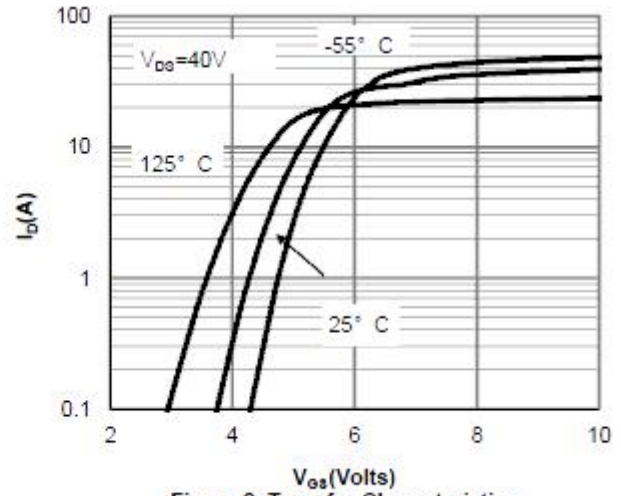


Figure 2: Transfer Characteristics

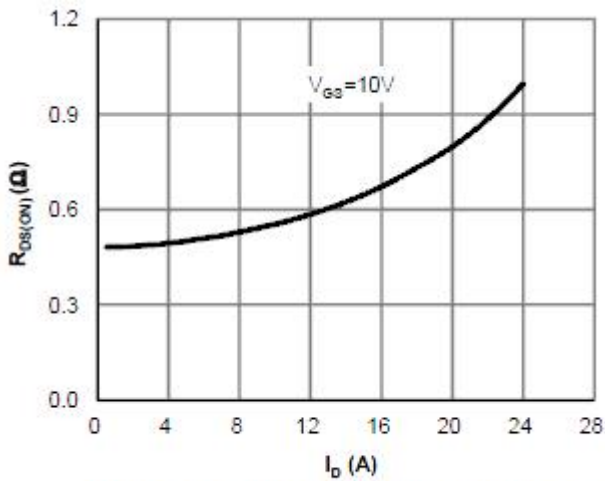


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

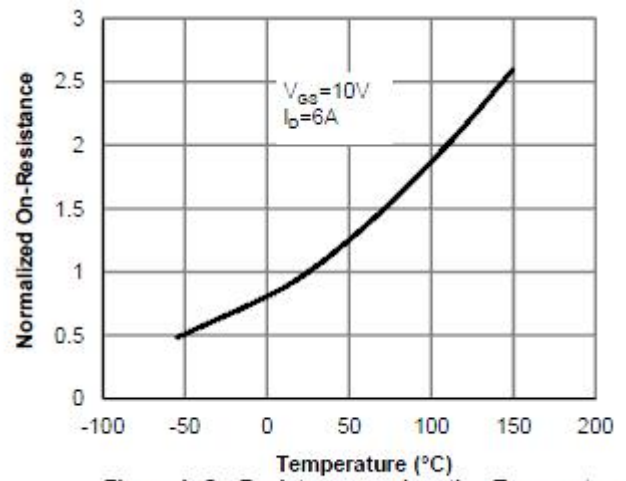


Figure 4: On-Resistance vs. Junction Temperature

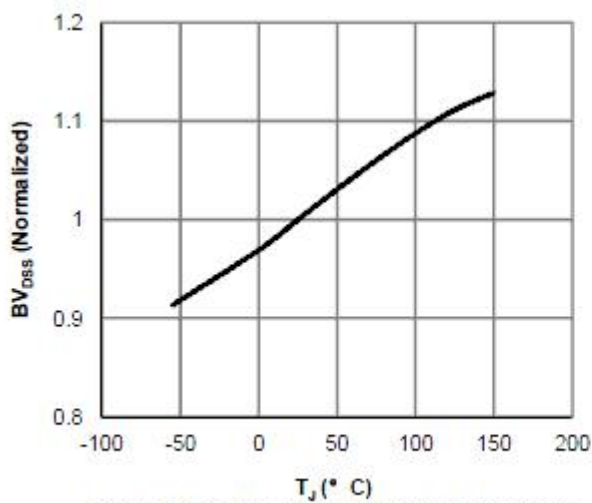


Figure 5: Break Down vs. Junction Temperature

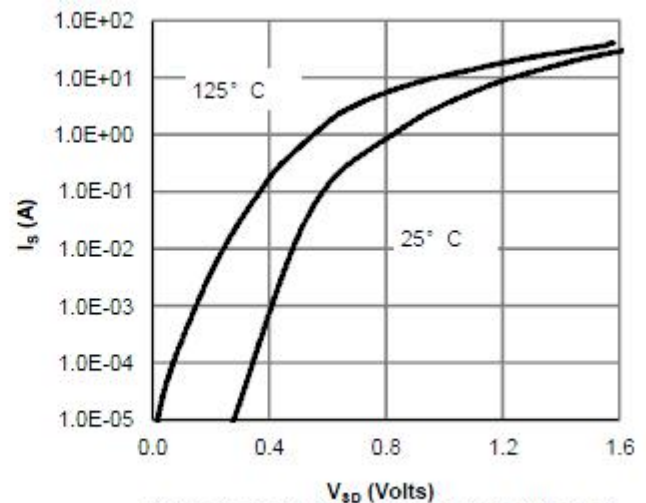


Figure 6: Body-Diode Characteristics (Note E)

## Typical Performance Characteristics (CONT.)

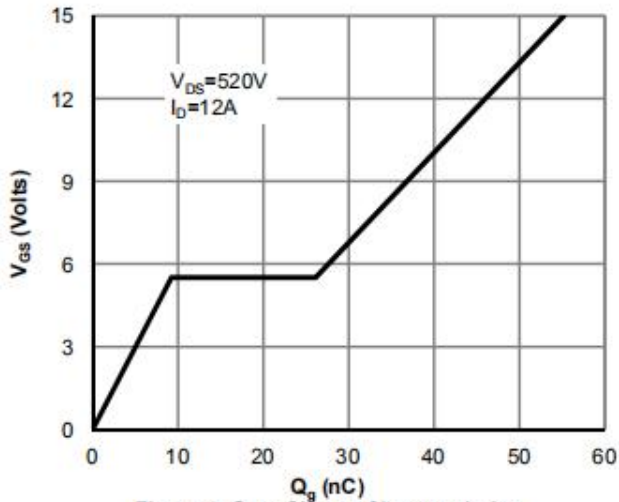


Figure 7: Gate-Charge Characteristics

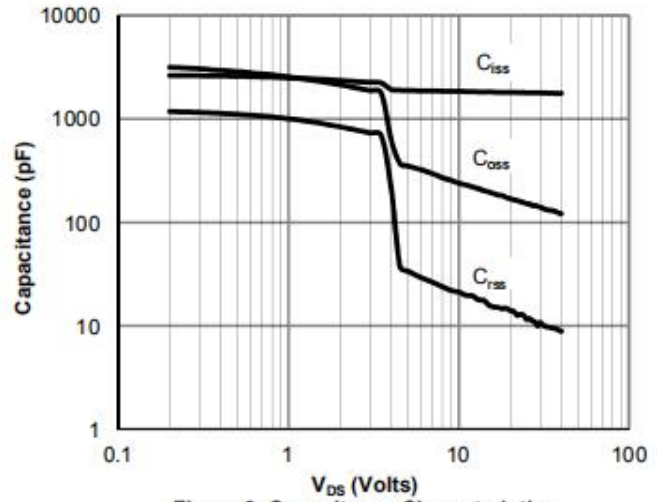


Figure 8: Capacitance Characteristics

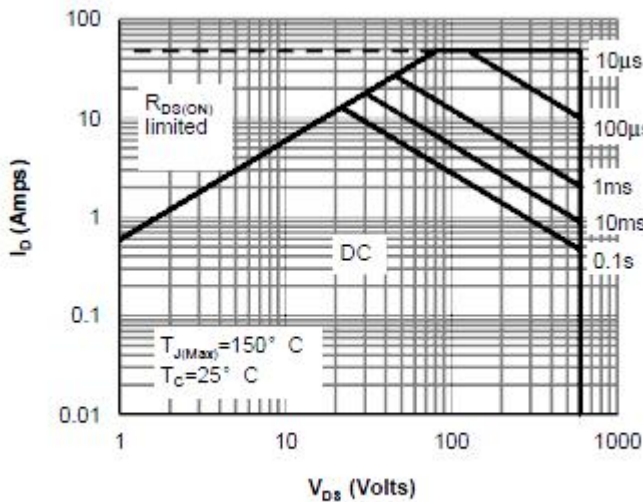


Figure 9: Maximum Forward Biased Safe Operating Area for AOT12N60FD/AOB12N60FD (Note F)

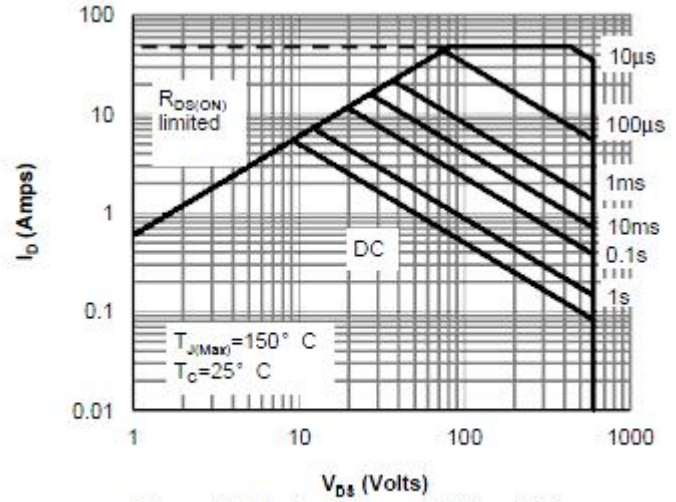


Figure 10: Maximum Forward Biased Safe Operating Area for AOTF12N60FD (Note F)

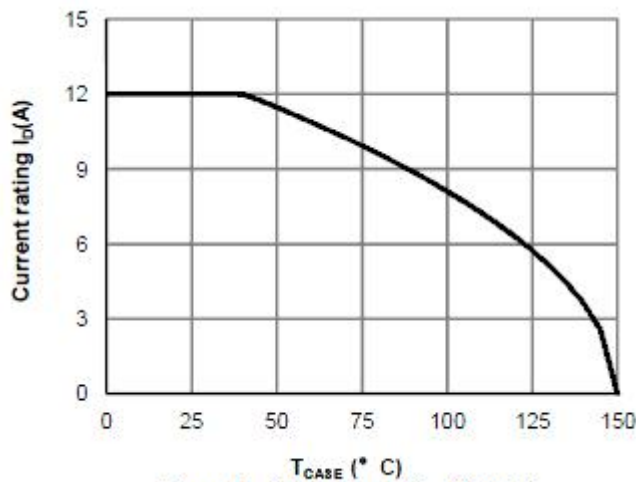
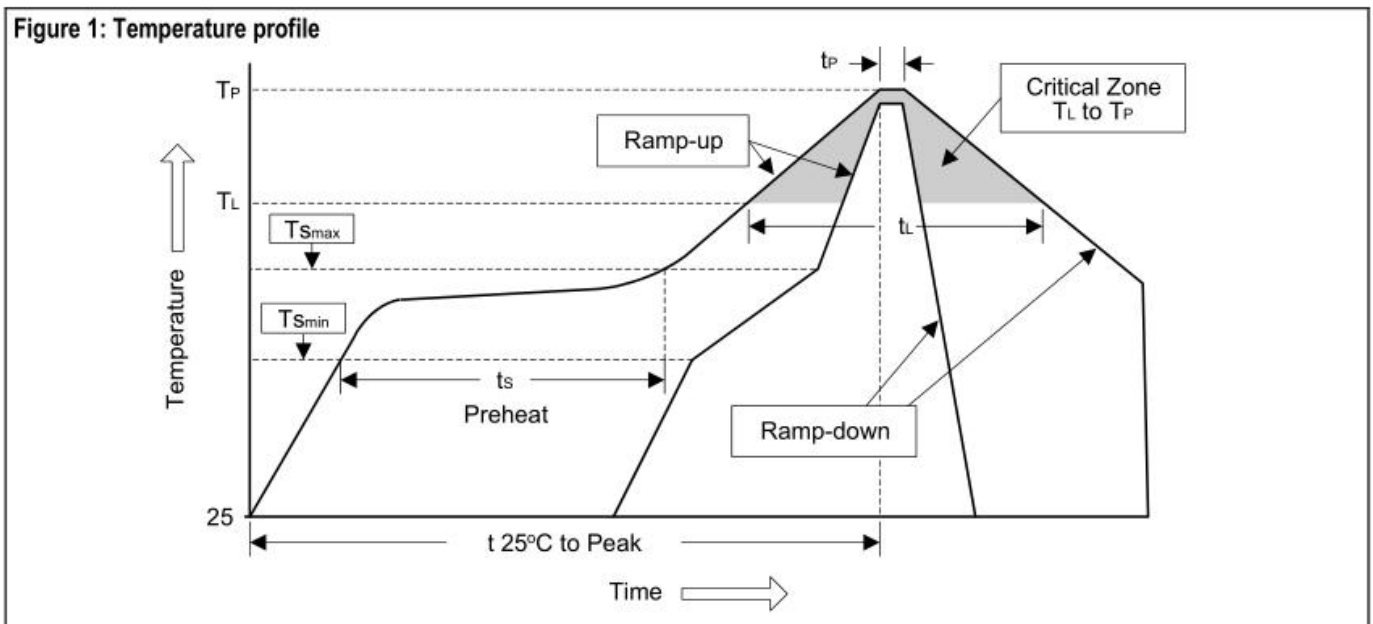


Figure 11: Current De-rating (Note B)

**Soldering Methods for Products**

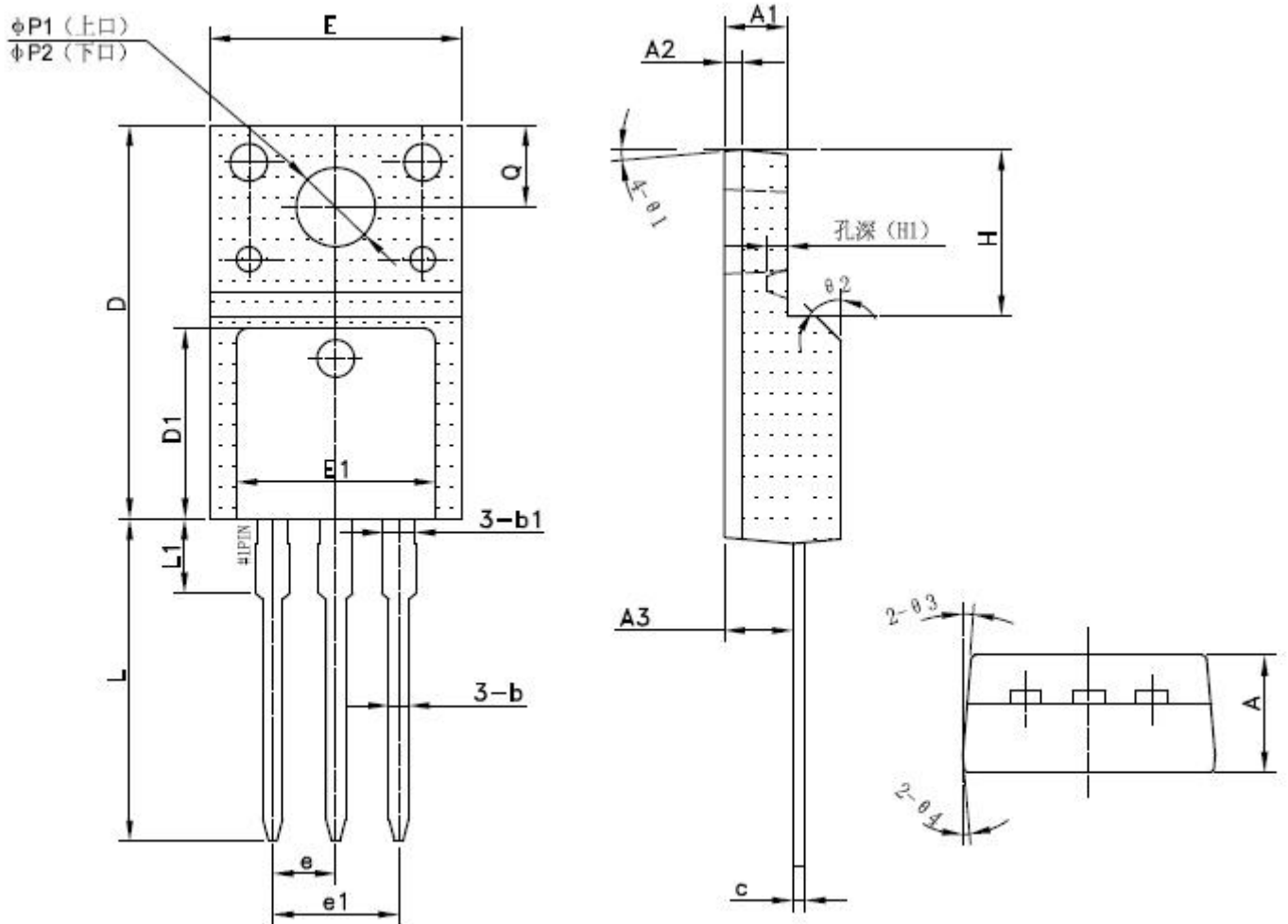
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate(TL to TP)	<3°C/sec	<3°C/sec
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(min to max)(ts)	60 to 120 sec	60 to 180 sec
Tsmax to TL		
- ramp-up rate	<3°C/sec	<3°C/sec
Time maintained above:		
-Temperature(TL)	183°C	217°C
-Time(tL)	60 to 150 sec	60 to 150 sec
Peak Temperature(Tp)	240°C+0/-5°C	250°C+0/-5°C
Time within 5°C of actual Peak Temperature	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25 °C to Peak Temperature	<6 minutes	<8 minutes



**Note :** 1.Storage environment: Temperature=10°C to 35@Humidity=45%±15%

- 2.Reflow soldering of surface-mount devices
- 3.Flow(wave) soldering(solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices	245°C±5°C	5sec±1sec
Pb-free devices	250°C+0/-5°C	5sec±1sec

**Package Outline**


Millimeter(mm)					
Symbol	Min	Max	Symbol	Min	Max
A	4.50	4.90	E	9.96	10.36
A1	2.44	2.64	E1	8.00TYP	
A2	0.60	0.80	e	2.54TYP	
A3	2.56	2.96	e1	5.08TYP	
b	0.70	0.95	H	6.50	6.90
b1	1.28TYP		L	12.48	13.20
c	0.45	0.65	L1	2.93TYP	
D	15.67	16.07	P1	2.98	3.38
D1	7.70TYP		P2	3.20	3.60

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Any semiconductor under specific conditions are possible to certain failure or malfunction rate ; Customers are responsible in the use of Si-Trend products to system design and manufacturing in compliance with safety standards and adopting safety measures, To avoid the potential risk of failure may cause the personal safety and property loss.

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**■ Modify record**

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