

## 650V N-Channel POWER MOSFET

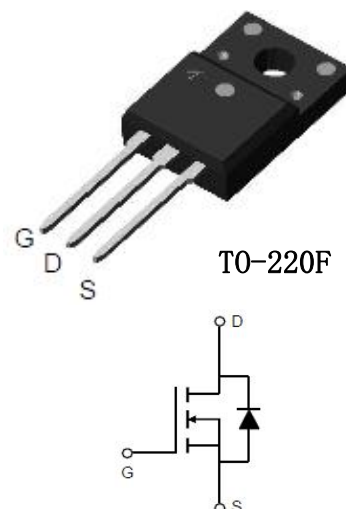
### Features

- $V_{DSS}=650V$   $I_D=16A$
- $R_{DS(ON)}=0.55\Omega(\text{Max.})@V_{GS}=10V$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Low ON Resistance

### Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

### PIN DESCRIPTION



Part Number	Package	Marking	ROHS Status	Packing
SI16N65F	T0-220F	SI16N65F	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
$I_D$	Continuous Drain Current	16	A
$I_{DM}$	Pulsed Drain Current	64	A
$P_D$	Power Dissipation ( $T_C=25^\circ\text{C}$ )	98	W
$I_{AR}$	Avalanche Current	9.6	A
$E_{AS}$	Single Pulse Avalanche Energy	460	mJ
$E_{AR}$	Repetitive Avalanche Energy	276	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.	$R_{thJC}$	1.27	$^\circ\text{C}/\text{W}$
Thermal resistance, Junction – Ambient.	$R_{thJA}$	62.5	

**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	$V_{GS}=\pm 30V$	-	-	$\pm 100$	nA
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	3.0	-	4.0	V
$R_{DS(on)}$	Drain-Source On-Resistance	$V_{GS}=10V, I_D=8A$	-	-	0.55	$\Omega$
<b>Dynamic Characteristic</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$	-	2063	-	pF
$C_{oss}$	Output Capacitance		-	204	-	
$C_{rss}$	Reverse Transfer Capacitance		-	29	-	
$Q_G$	Gate Total Charge	$V_{DS}=520V, I_D=16A, V_{GS}=10V,$	-	74	-	nC
$Q_{gs}$	Gate-Source charge		-	10	-	
$Q_{gd}$	Gate-Drain charge		-	40	-	
$t_{d(on)}$	Turn-on delay time	$V_{DD}=325V, I_D=16A, R_G=25\Omega$	-	54	-	nS
$t_r$	Rise time		-	40	-	
$t_{d(off)}$	Turn-off delay time		-	312	-	
$t_f$	Fall time		-	66	-	
<b>Drain-Source Body Diode Characteristics</b>						
$V_{SD}$	Body Diode Forward Voltage	$V_{GS}=0V, I_{SD}=8A$	-	-	1.4	V
$t_{rr}$	Body Diode Reverse Recovery Time	$V_{GS}=0V, I_S=16A, dI_F/dt=100A/\mu s$	-	682	-	nS
$Q_{rr}$	Body Diode Reverse Recovery Charge		-	4.5	-	$\mu C$
$I_S$	Continuous Drain-Source Diode Forward Current		-	-	16	A
$I_{SM}$	Pulsed Drain-Source Diode Forward Current		-	-	64	A

**Note:**

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature
- 2.L=10.0mH,  $V_{DD}=50V, R_G=25\Omega$ , Starting  $T_J=25^\circ$
- 3.Pulse Test: Pulse width  $\leq 350\mu s$ , Duty Cycle  $\leq 1\%$

## ■ Switching Time Test Circuit and Wave forms

Figure A: Gate Charge Test Circuit and Waveform

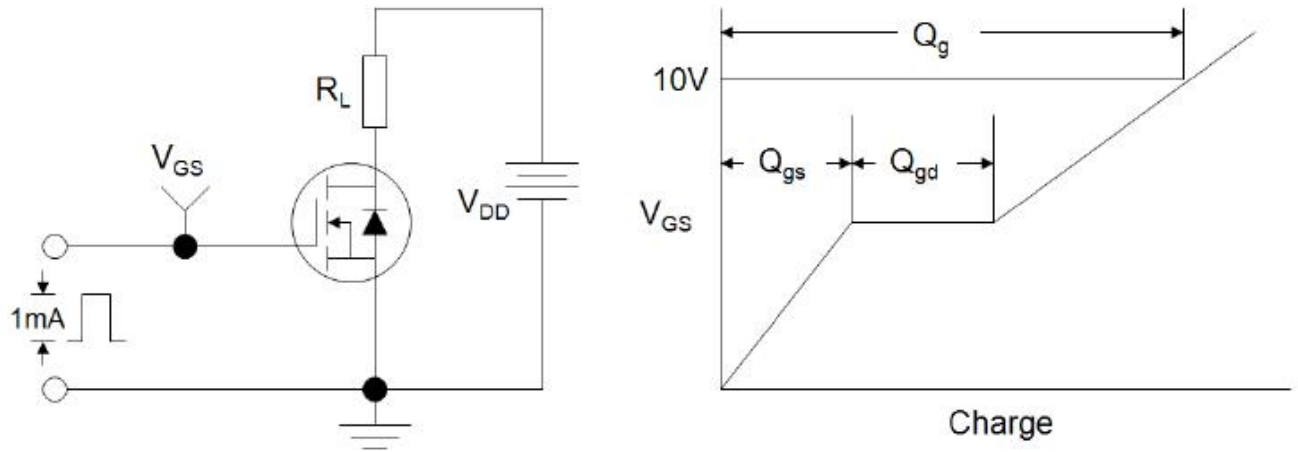


Figure B: Resistive Switching Test Circuit and Waveform

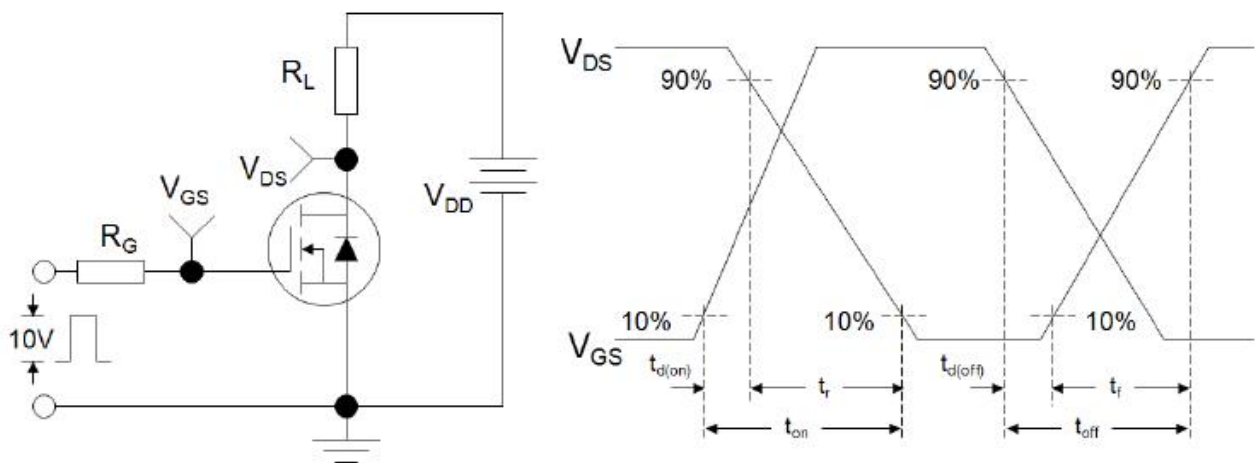
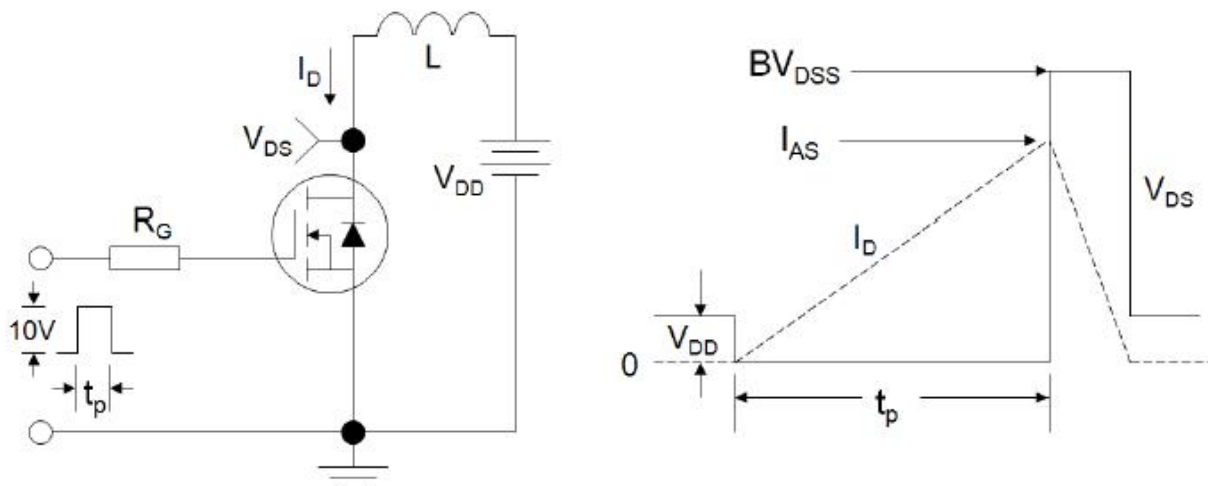
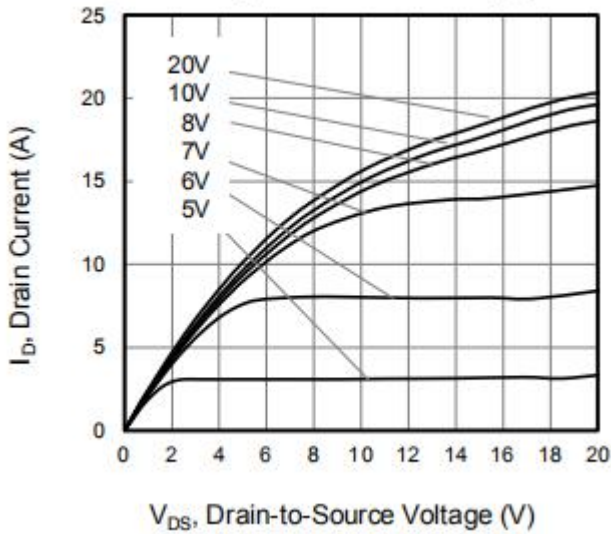
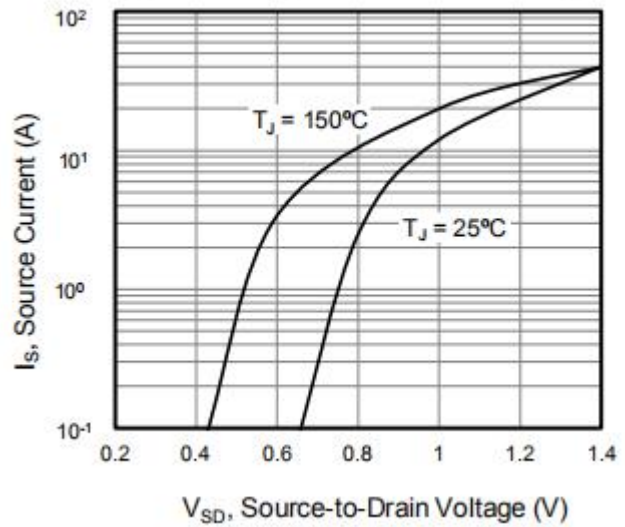
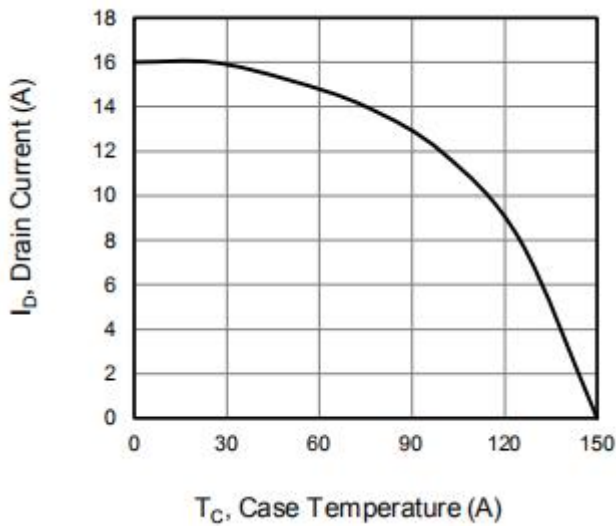
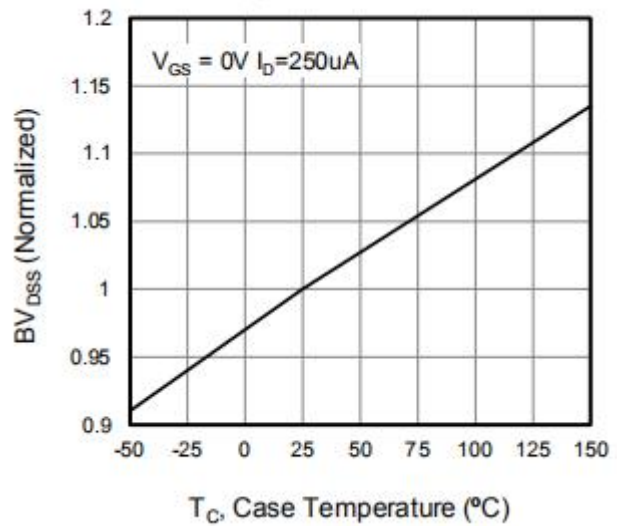
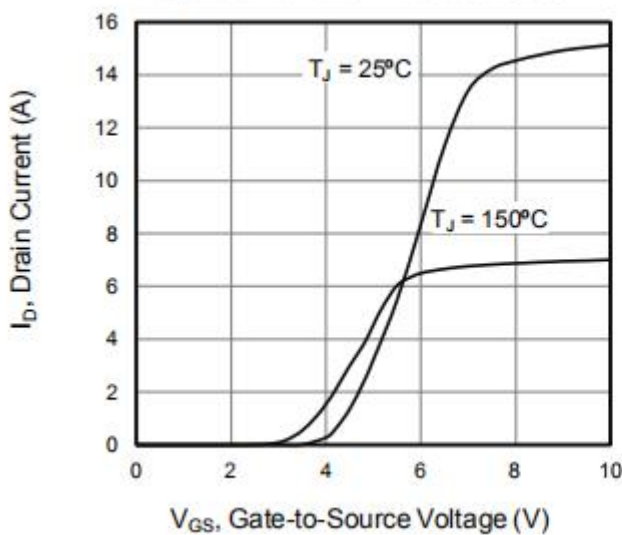
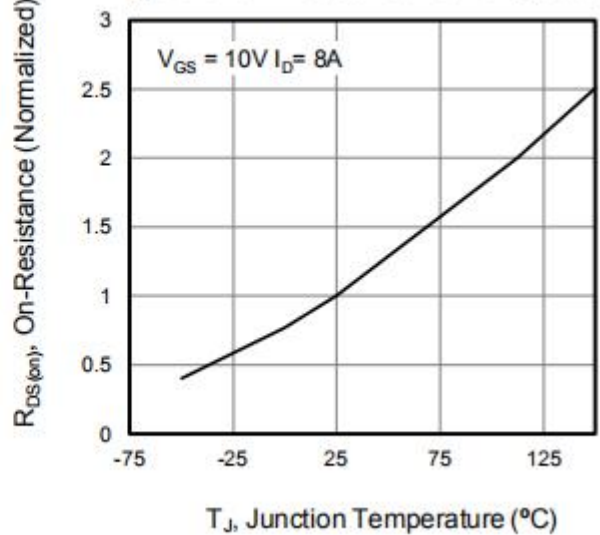


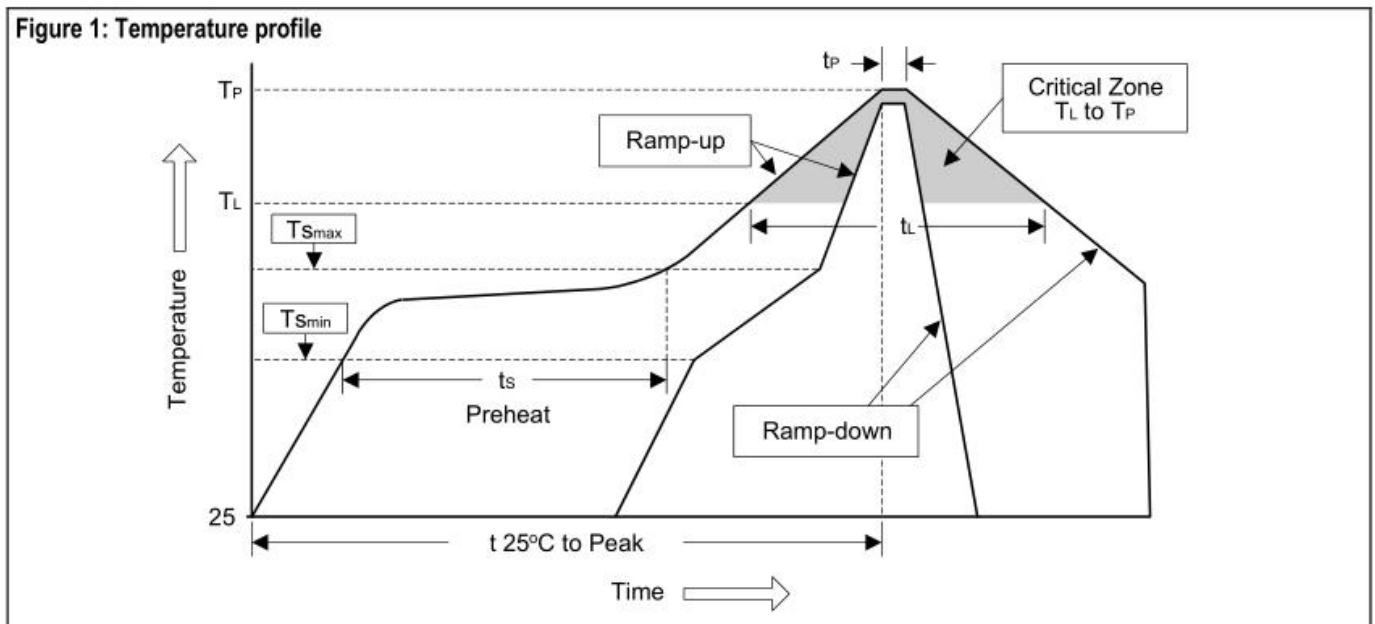
Figure C: Unclamped Inductive Switching Test Circuit and Waveform



**Typical Performance Characteristics**
**Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )**

**Figure 2. Body Diode Forward Voltage**

**Figure 3. Drain Current vs. Temperature**

**Figure 4.  $BV_{DSS}$  Variation vs. Temperature**

**Figure 5. Transfer Characteristics**

**Figure 6. On-Resistance vs. Temperature**


## Soldering Methods for Products

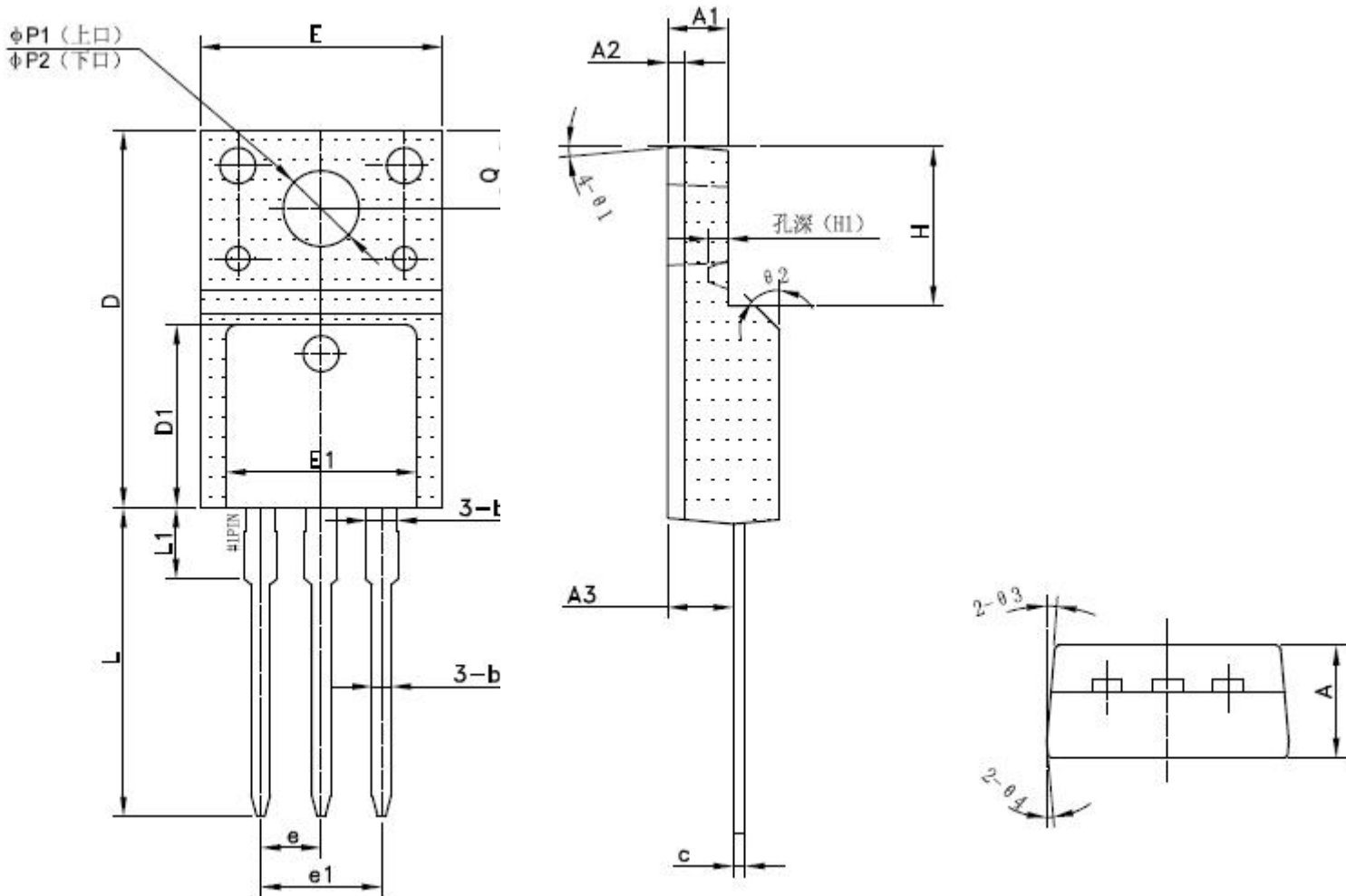
Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate(TL to TP)	<3°C/sec	<3°C/sec
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(min to max)(ts)	60 to 120 sec	60 to 180 sec
Tsmax to TL		
- ramp-up rate	<3°C/sec	<3°C/sec
Time maintained 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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**■ Modify record**

Date	Version	Description	Pagination
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