

60V P-Channel Fast Switching MOSFET

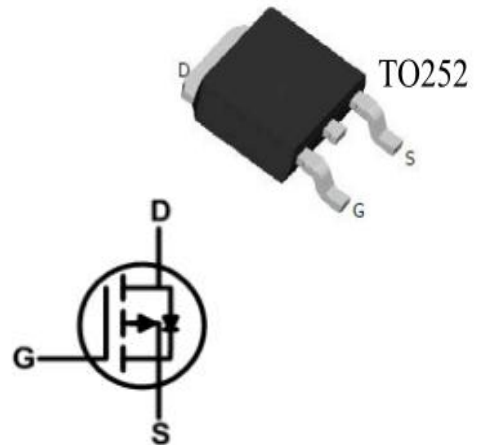
Features

- $V_{DS} = -60V$ $I_D = -35A$
- $R_{DS(ON)} = 25m\Omega(\text{max.}) @ V_{GS} = -10V$
- $R_{DS(ON)} = 33m\Omega(\text{max.}) @ V_{GS} = -4.5V$
- Low On-Resistance
- Excellent CdV/dt effect decline
- Super Low Gate Charge
- 100% EAS Guaranteed
- Green Device Available
- Advanced high cell density Trench technology

Applications

- Lithium-Ion Secondary Batteries
- Load Switch
- DC-DC converters and Off-line UPS

PIN DESCRIPTION



Part Number	Package	ROHS Status	Packing
SI6115D	TO-252	Halogen-Free	Tape&Reel

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

Symbol	Parameter	Ratings	Unit	
V_{DS}	Drain-Source Voltage	-60	V	
V_{GS}	Gate-Source Voltage	± 20	V	
I_D	Continuous Drain Current, $V_{GS} = -10V$	$T_c = 25^\circ C$	-35	A
		$T_c = 100^\circ C$	-27	A
I_{DM}	Pulsed Drain Current	-70	A	
I_{AS}	Avalanche Current	-47.6	A	
E_{AS}	Single Pulse Avalanche Energy	113	mJ	
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ C$	
P_D	Total Power Dissipation	$T_c = 25^\circ C$	51.2	W

THERMAL RESISTANCE RATINGS

Symbol	Parameter	Typical	Max	Unit
$R_{\theta JA}$	Maximum Junction-to-Ambient	-	62	$^\circ C/W$
$R_{\theta JC}$	Maximum Junction-to-Case	-	2.4	

Electrical Characteristics (T_J=25°C unless otherwise Ratings)

Symbol	Parameter	Test Conditions	Min.	TYP.	Max.	Unit
Static Characteristics						
B _V DSS	Drain-source breakdown voltage	V _{GS} =0V, I _{DS} = -250uA	-60	-	-	V
V _{GS(th)}	Gate threshold voltage	V _{DS} =V _{GS} , I _{DS} =-250uA	-1.0	-	-2.5	V
I _{DSS}	Drain-Source Leakage Current	V _{DS} =-48V, V _{GS} =0V T _J =25°C	-	-	-1	uA
		V _{DS} =-48V, V _{GS} =0V, T _J =55°C	-	-	-5	uA
I _{GSS}	Gate-source leakage current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(on)}	Drain-source on-state resistance	V _{GS} =-10V, I _D =-18A	-	-	25	mΩ
		V _{GS} = -4.5V, I _D =-12A	-	-	33	mΩ
G _{fs}	Forward Transconductance	V _{DS} =-10V , I _D =-18A	-	12.6	-	S
R _g	Gate Resistance	V _{DS} =0V, V _{GS} =0V , f=1MHz	-	7	-	Ω
Dynamic Characteristic						
Q _g	Total Gate Charge	V _{GS} =-4.5V, V _{DS} =-20V I _{DS} =-12A	-	25	-	nC
Q _{gs}	Gate-Source Charge		-	6.7	-	nC
Q _{gd}	Gate-Drain Charge		-	5.5	-	nC
T _{d(on)}	Turn-on delay time	I _D =-1A, V _{GS} =-10V V _{DD} =-15V, R _G =3.3Ω	-	38	-	nS
T _r	Rise time		-	23.6	-	nS
T _{d(off)}	Turn-off delay time		-	100	-	nS
T _f	Fall time		-	6.8	-	nS
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =-15V f=1.0MHz	-	3635	-	pF
C _{oss}	Output Capacitance		-	224	-	pF
C _{rss}	Reverse Transfer Capacitance		-	141	-	pF
Source-Drain Diode						
V _{SD}	Diode Forward Voltage	V _{GS} =0V, I _S =-1A	-	-	-1	V
I _{SM}	Pulsed Source Current	V _G =V _D =0V Force Current	-	-	-70	A
I _S	Continuous Source Current		-	-	-35	A

Notes:

1. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
2. The data tested by pulsed , pulse width ≅ 300us , duty cycle ≅ 2%
3. The E_{AS} data shows Max.rating .The test condition is V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-47.6A
4. The power dissipation is limited by 150 °C junction temperature
5. The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

Typical Performance Characteristics

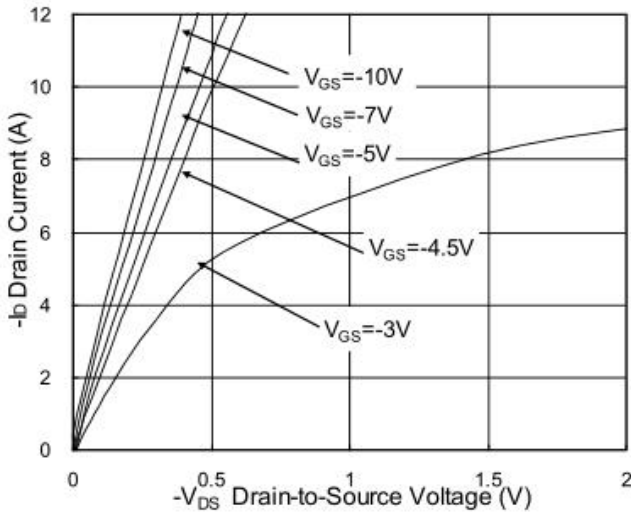


Fig.1 Typical Output Characteristics

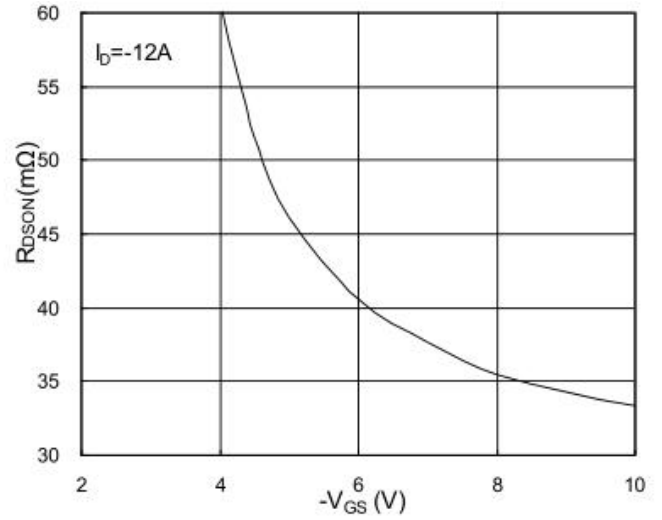


Fig.2 On-Resistance v.s Gate-Source

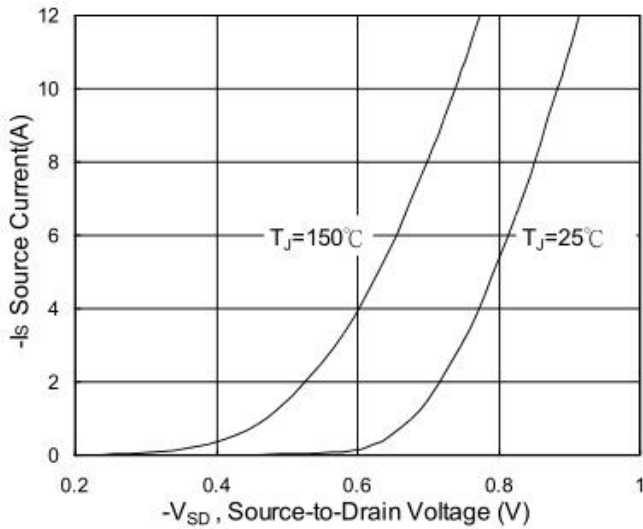


Fig.3 Forward Characteristics of Reverse

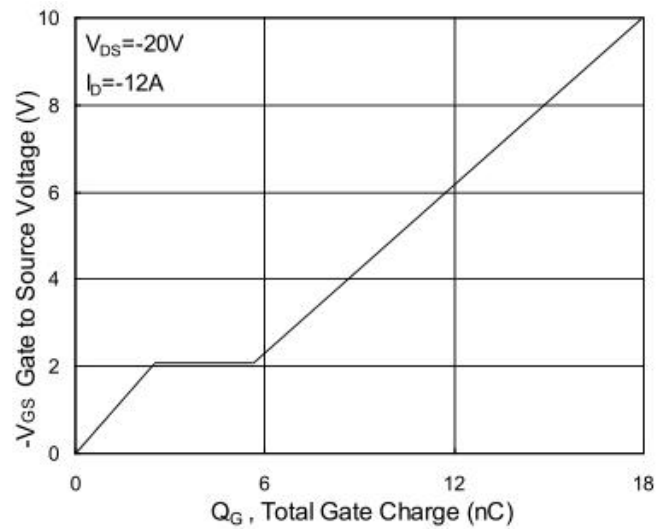


Fig.4 Gate-Charge Characteristics

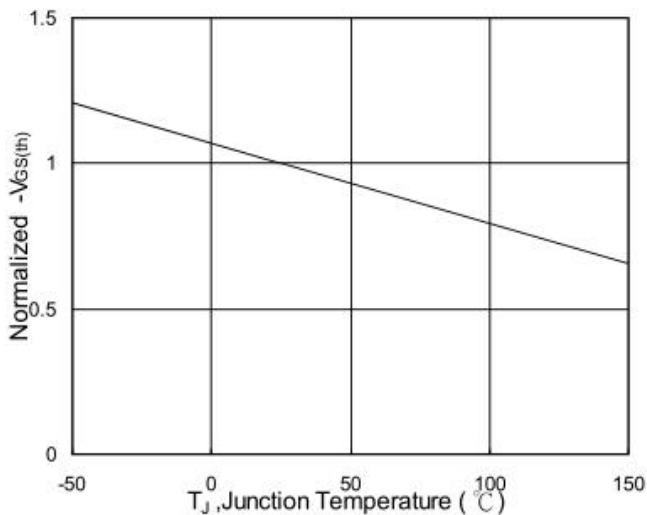


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

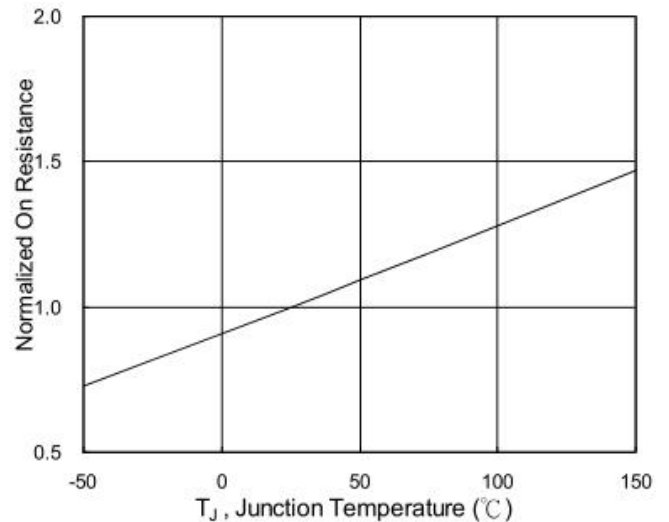


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

Typical Performance Characteristics (Cont.)

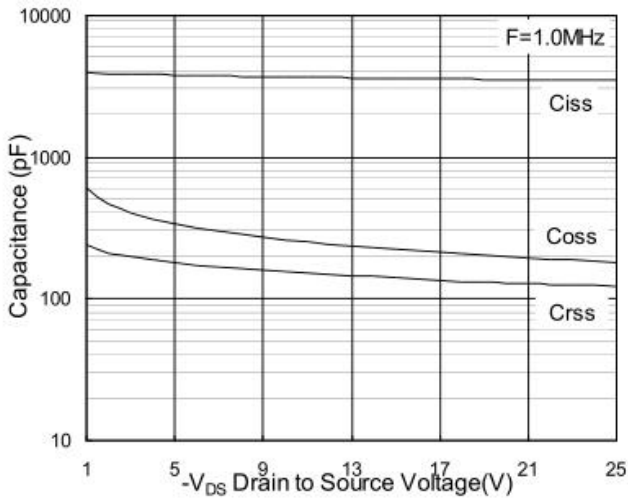


Fig.7 Capacitance

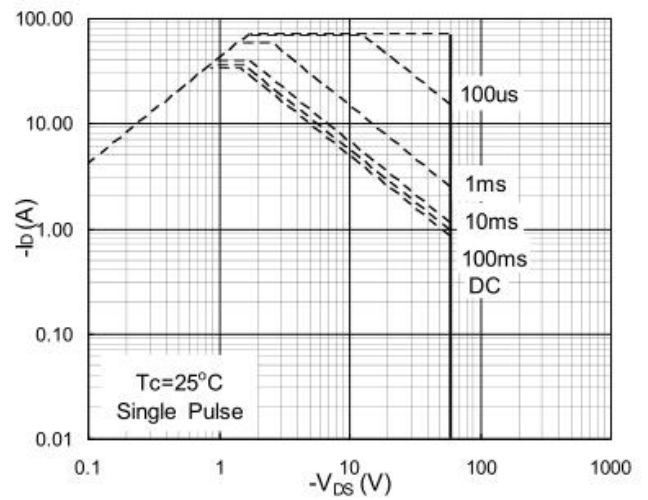


Fig.8 Safe Operating Area

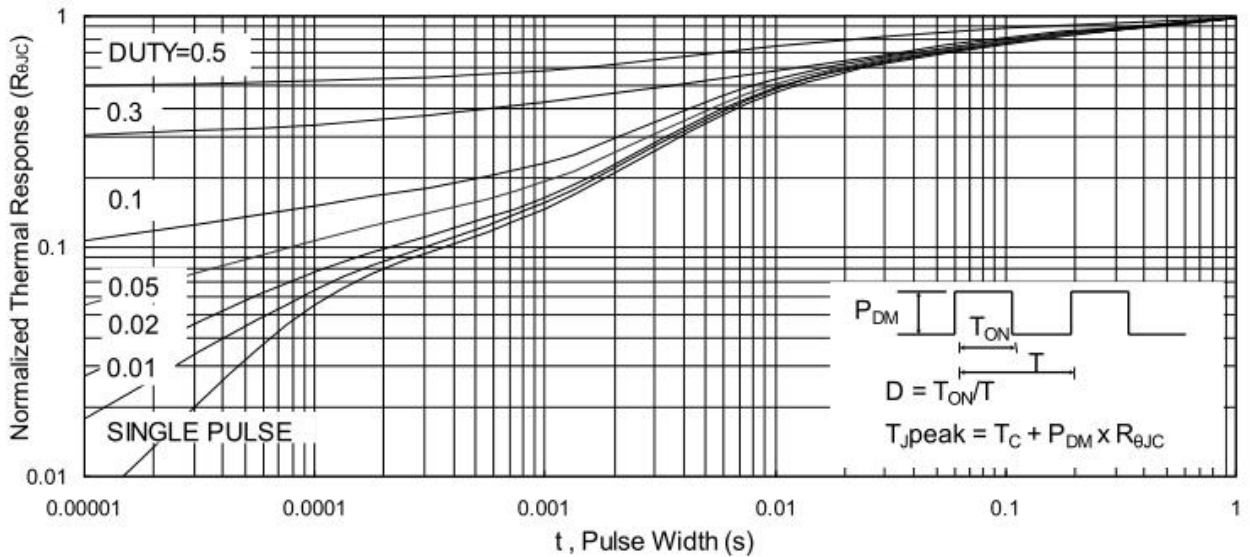


Fig.9 Normalized Maximum Transient Thermal Impedance

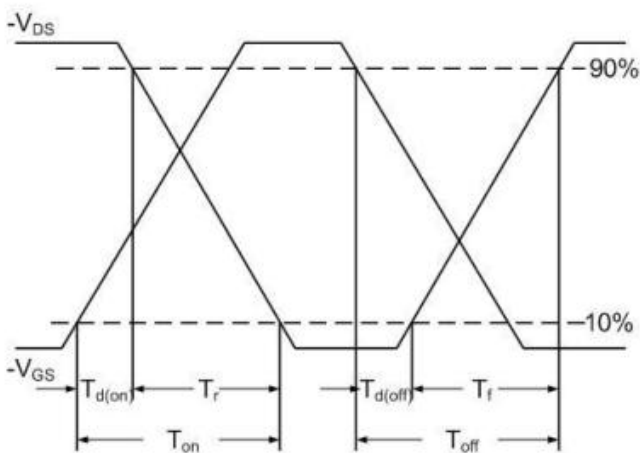


Fig.10 Switching Time Waveform

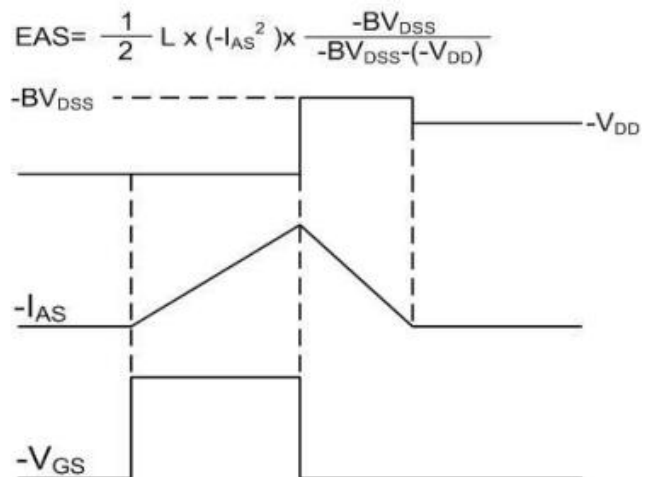
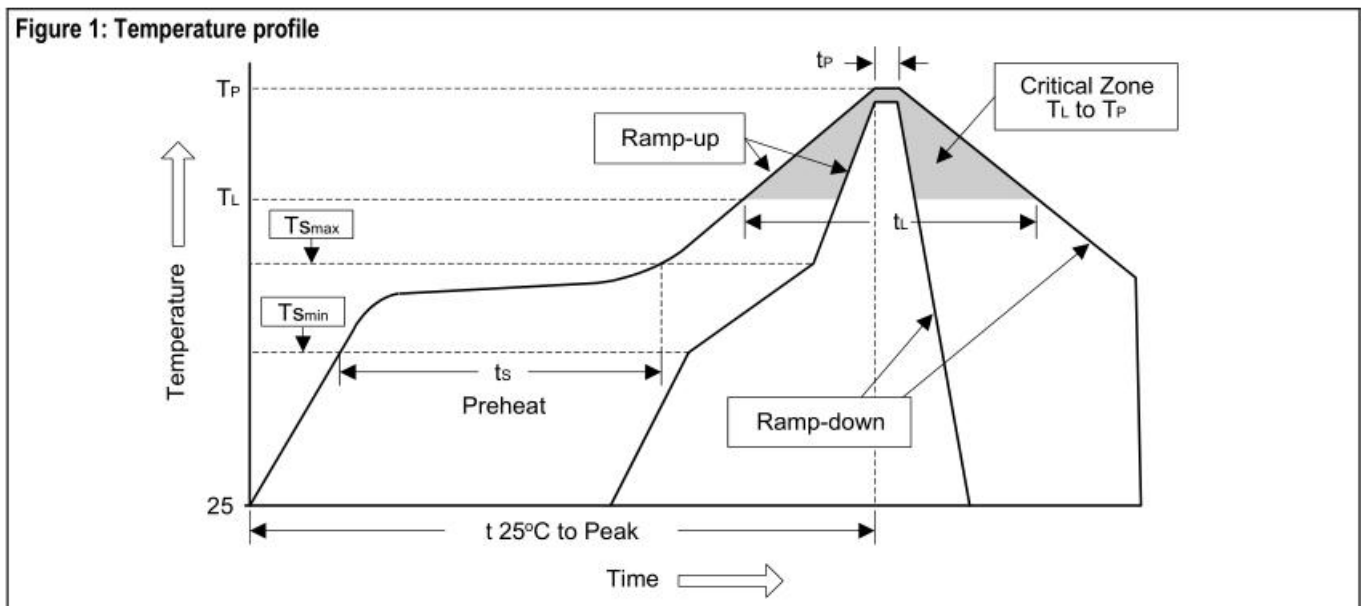


Fig.11 Unclamped Inductive Waveform

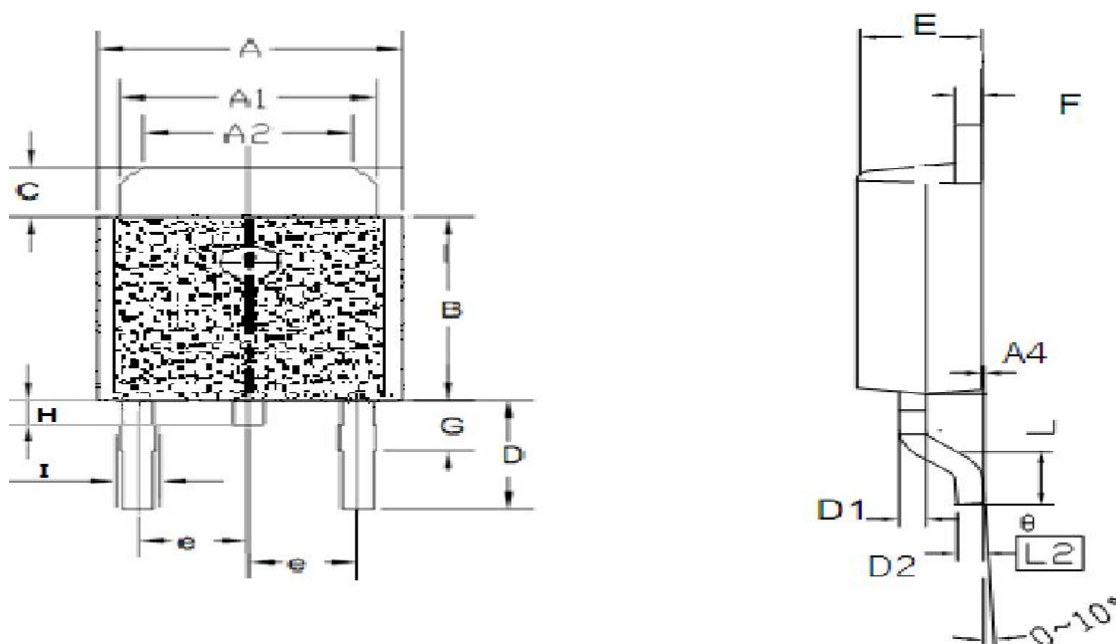
Soldering Methods for Products

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) -Temperature Max(Ts max) -Time(min to max)(ts)	- 100°C 150°C 60 to 120 sec	- 150°C 200°C 60 to 180 sec
Ts max to TL - ramp-up rate	<3°C/sec	<3°C/sec
Time maintained above: -Temperature(TL) -Time(TL)	183°C 60 to 150 sec	217°C 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


unit: mm					
Symbol	Min	Max	Symbol	Min	Max
A	6.40	6.60	D	2.90	3.10
A1	5.20	5.40	D1	0.45	0.55
A2	4.40	4.60	D2	0.45	0.55
A3	4.40	4.60	e	2.3BSC	
A4	0.00	0.15	E	2.20	2.40
A5	4.65	4.95	F	0.49	0.59
B	6.00	6.20	G	1.7BSC	
B1	1.57	1.77	L	1.40	1.60
C	0.90	0.96	θ (度)	0.00	10.00
I	0.80	0.85	H	0.49	0.52

■ Important Notice

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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

Date	Version	Description	Pagination
20160215	A.0	original	7