

Dual N-Channel Enhancement Mode MOSFET

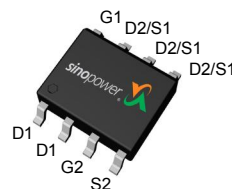
Features

- Channel 1
30V/11A,
 $R_{DS(ON)} = 11.5m\Omega$ (max.) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 15m\Omega$ (max.) @ $V_{GS} = 4.5V$
- Channel 2
30V/12A,
 $R_{DS(ON)} = 10.5m\Omega$ (max.) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 14.5m\Omega$ (max.) @ $V_{GS} = 4.5V$
- Reliable and Rugged
- Lead Free Available (RoHS Compliant)
- 100% UIS tested

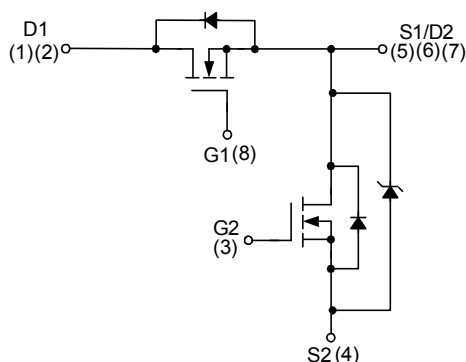
Applications

- Power Management in Notebook Computer,
Portable Equipment and Battery Powered
Systems

Pin Description

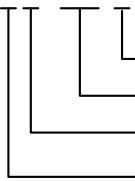


Top View of SOP – 8



N-Channel MOSFET

Ordering and Marking Information

SM4912TS □□-□□□  Assembly Material Handling Code Temperature Range Package Code	Package Code K : SOP-8 Operating Junction Temperature Range C : -55 to 150 °C Handling Code TR : Tape & Reel (2500ea/reel) Assembly Material G : Halogen and Lead Free Device
SM4912TS K : SM4912 XXXXX	XXXXXX - Lot Code

Note : SINOPOWER lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS. SINOPOWER lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J-STD-020D for MSL classification at lead-free peak reflow temperature. SINOPOWER 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).

SINOPOWER reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

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

Symbol	Parameter		Channel 1	Channel 2	Unit
V _{DSS}	Drain-Source Voltage		30	30	V
V _{GSS}	Gate-Source Voltage		±20	±20	
I _D ^a	Continuous Drain Current		11	12	A
I _{DM} ^a	Pulsed Drain Current		40	48	
T _{STG}	Storage Temperature Range		-55 to 150		°C
P _D ^a	Power Dissipation	T _A =25°C	2	2	W
		T _A =70°C	1.3	1.3	
R _{θJA} ^a	Thermal Resistance-Junction to Ambient	t ≤ 10s	60		°C/W
		Steady State	90		
R _{θJL}	Thermal Resistance-Junction to Lead		40		
I _{AS} ^b	Avalanche Current, Single pulse (L=0.5mH)		10	15	A
E _{AS} ^b	Avalanche Energy, Single pulse (L=0.5mH)		25	56	mJ

Notes :

a : Surface Mounted on 1in^2 pad area, $t \leq 10\text{sec}$.b : UIS tested and pulse width limited by maximum junction temperature 150°C (initial temperature $T_J=25^\circ\text{C}$).

Electrical Characteristics (T_A = 25°C unless otherwise noted)

Channel 1

Symbol	Parameter	Test Conditions	Channel 1			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1.5	1.8	2.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^a	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =9A	-	9.5	11.5	mΩ
		V _{GS} =4.5V, I _{DS} =5A	-	12	15	
Diode Characteristics						
V _{SD} ^a	Diode Forward Voltage	I _{SD} =2.5A, V _{GS} =0V	-	0.7	1.1	V
t _{rr}	Reverse Recovery Time	I _{DS} =9A, dI _{SD} /dt=100A/μs	-	12	-	ns
Q _{rr}	Reverse Recovery Charge		-	3.6	-	nC
Dynamic Characteristics ^b						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	2.5	-	Ω
C _{iSS}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, Frequency=1.0MHz	-	770	-	pF
C _{oss}	Output Capacitance		-	130	-	
C _{rss}	Reverse Transfer Capacitance		-	77	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =15V, R _L =15Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	8	13	ns
t _r	Turn-on Rise Time		-	8	14	
t _{d(OFF)}	Turn-off Delay Time		-	22	32	
t _f	Turn-off Fall Time		-	5.2	8	
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =10V, I _{DS} =9A	-	16	20	nC
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =4.5V, I _{DS} =9A	-	7	-	
Q _{gs}	Gate-Source Charge		-	3	-	
Q _{gd}	Gate-Drain Charge		-	2.7	-	
Q _{gth}	Threshold Gate Charge		-	1.83	-	

Notes :

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

b : Guaranteed by design, not subject to production testing.

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

Channel 2

Symbol	Parameter	Test Conditions	Channel 2			Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V	-	-	50	μA
		T _J =85°C	-	-	5	mA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	1.3	1.7	2.5	V
I _{GSS}	Gate Leakage Current	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^a	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =12A	-	8.7	10.5	mΩ
		V _{GS} =4.5V, I _{DS} =7A	-	11	14.5	
Diode Characteristics						
V _{SD} ^a	Diode Forward Voltage	I _{SD} =1A, V _{GS} =0V	-	0.4	0.55	V
		I _{SD} =10A, V _{GS} =0V	-	0.77	1.1	
t _{rr}	Reverse Recovery Time	I _{DS} =12A, dI _{SD} /dt=100A/μs	-	15	-	ns
Q _{rr}	Reverse Recovery Charge		-	4.5	-	nC
Dynamic Characteristics ^b						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	1.55	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, Frequency=1.0MHz	-	1300	-	pF
C _{oss}	Output Capacitance		-	272	-	
C _{rss}	Reverse Transfer Capacitance		-	125	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =15V, R _L =15Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	10	17	ns
t _r	Turn-on Rise Time		-	10	17	
t _{d(OFF)}	Turn-off Delay Time		-	40	55	
t _f	Turn-off Fall Time		-	13	20	
Gate Charge Characteristics ^b						
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =10V, I _{DS} =12A	-	24	35	nC
Q _g	Total Gate Charge	V _{DS} =15V, V _{GS} =4.5V, I _{DS} =12A	-	11.4	-	
Q _{gs}	Gate-Source Charge		-	3.6	-	
Q _{gd}	Gate-Drain Charge		-	4.3	-	
Q _{gth}	Threshold Gate Charge		-	1.8	-	

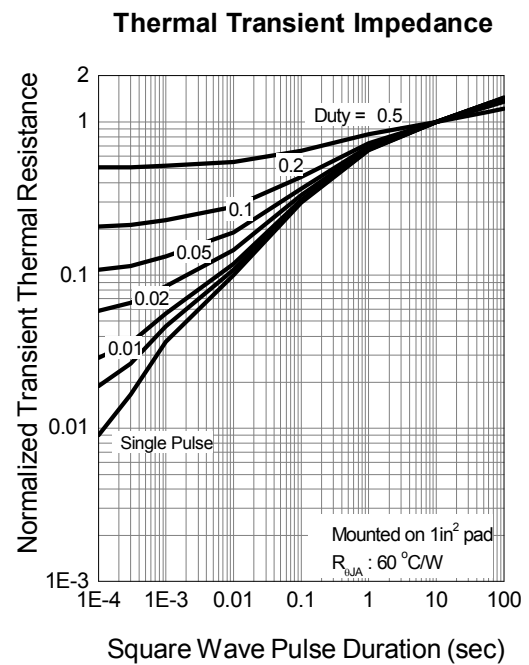
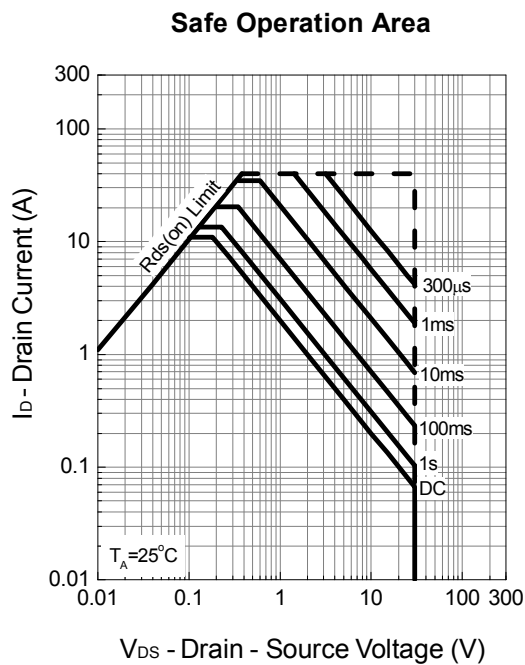
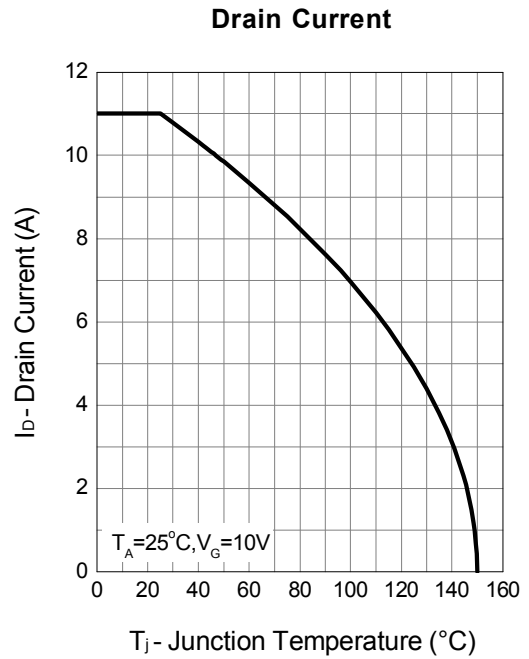
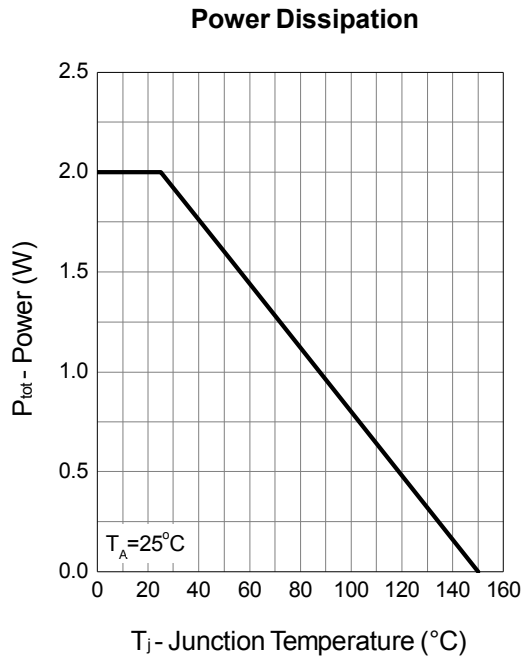
Notes :

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

b : Guaranteed by design, not subject to production testing.

Typical Characteristics

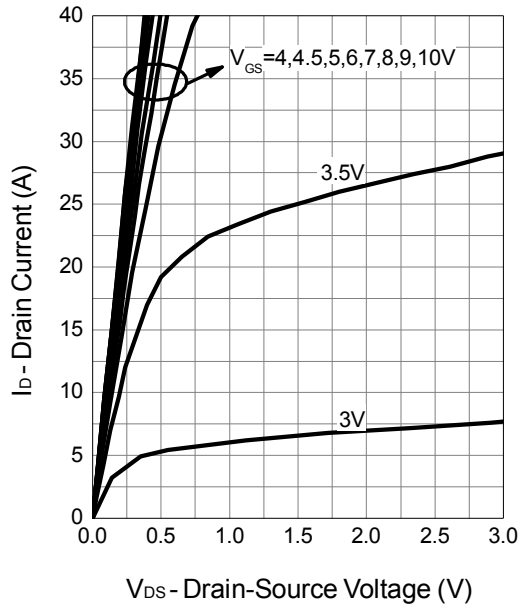
Channel 1



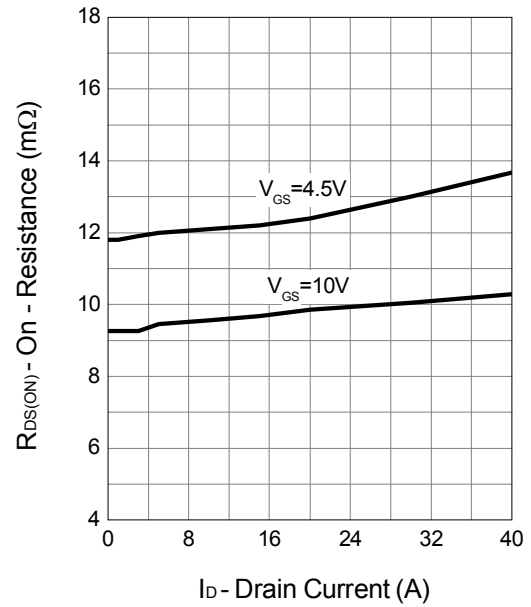
Typical Characteristics (Cont.)

Channel 1

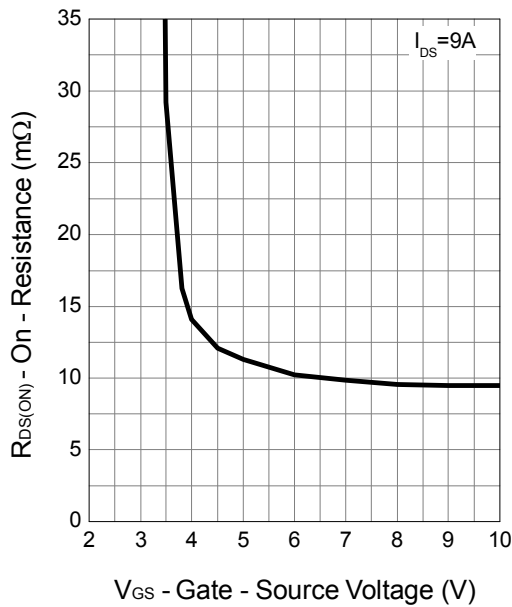
Output Characteristics



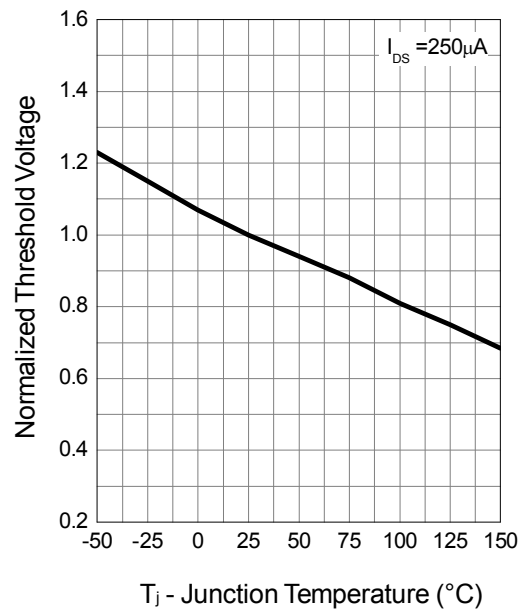
Drain-Source On Resistance



Gate-Source On Resistance



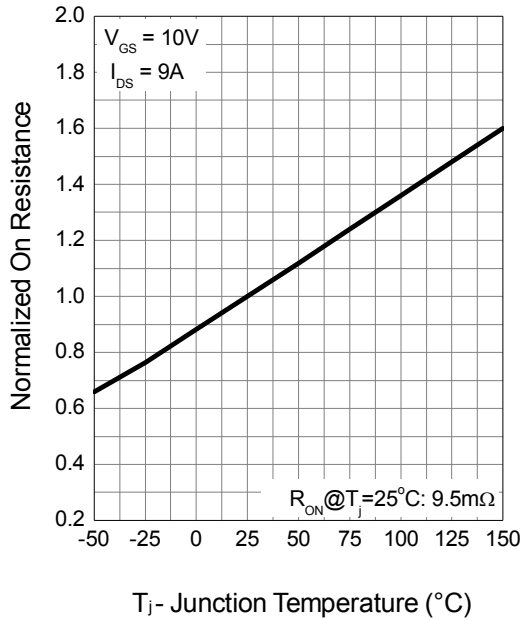
Gate Threshold Voltage



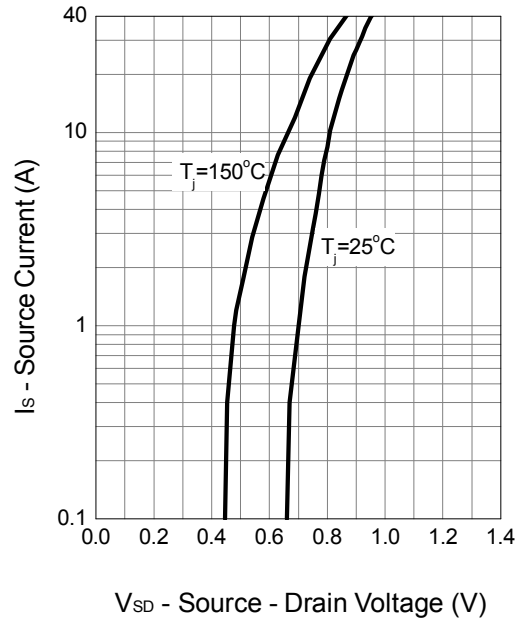
Typical Characteristics (Cont.)

Channel 1

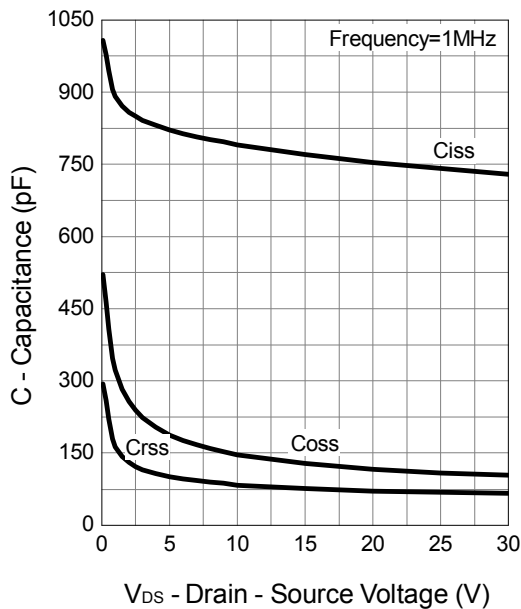
Drain-Source On Resistance



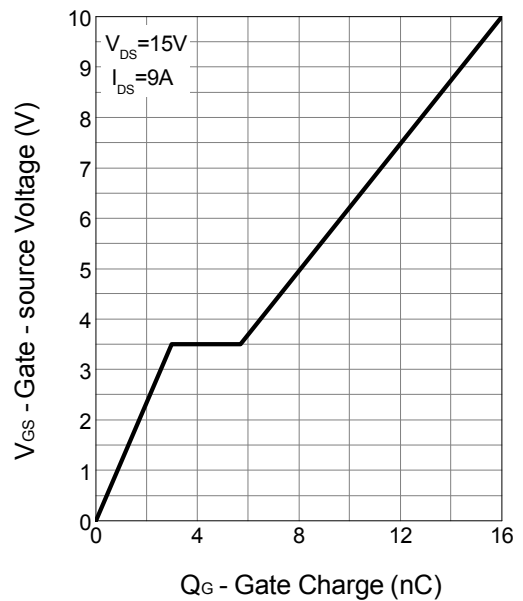
Source-Drain Diode Forward



Capacitance



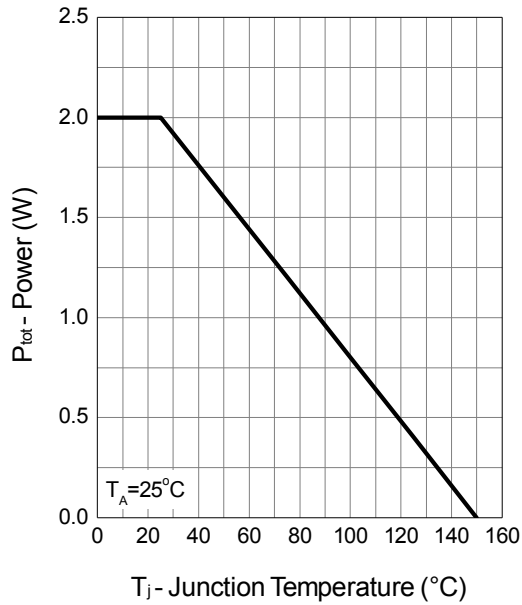
Gate Charge



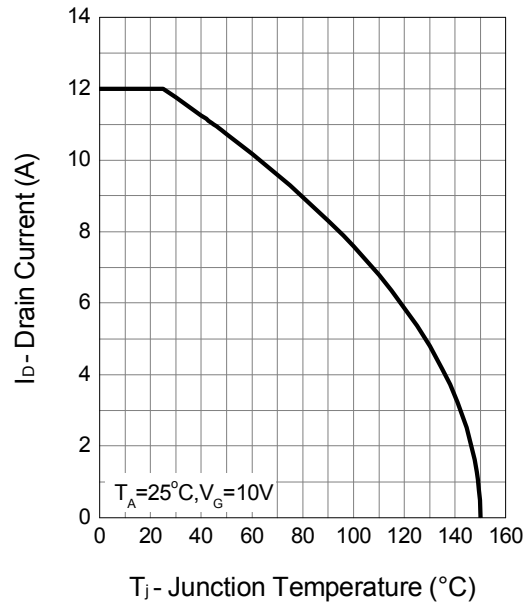
Typical Characteristics (Cont.)

Channel 2

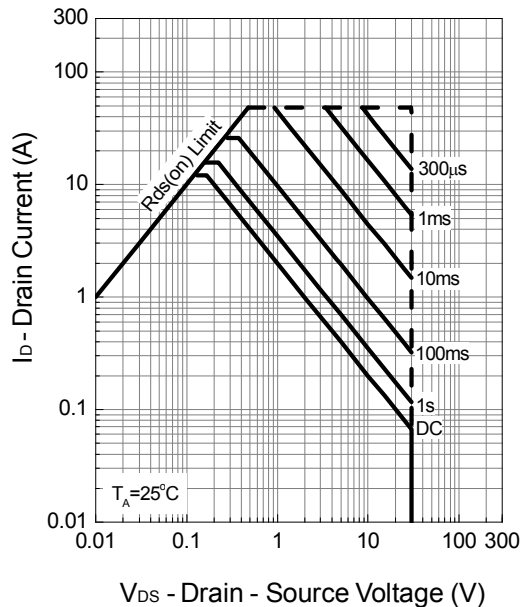
Power Dissipation



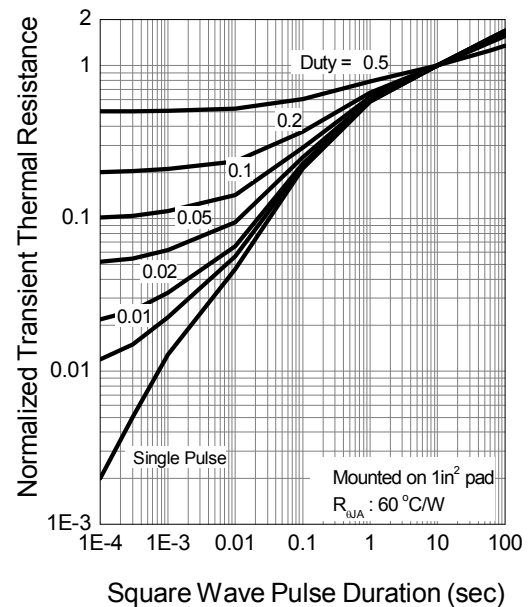
Drain Current



Safe Operation Area



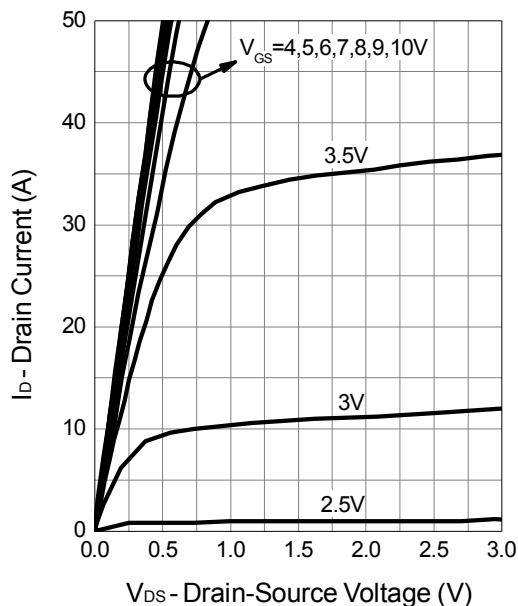
Thermal Transient Impedance



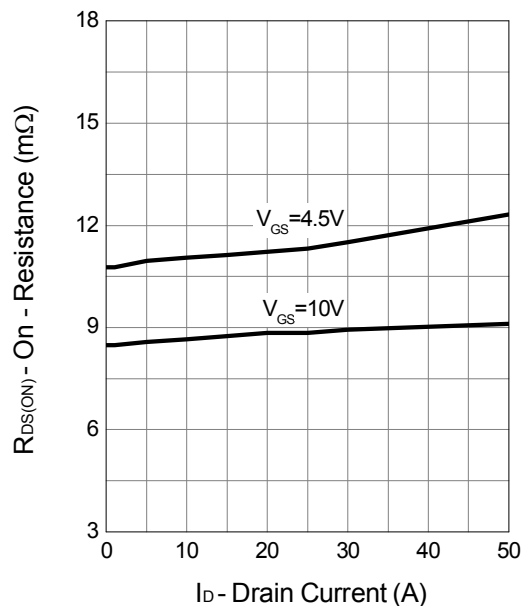
Typical Characteristics (Cont.)

Channel 2

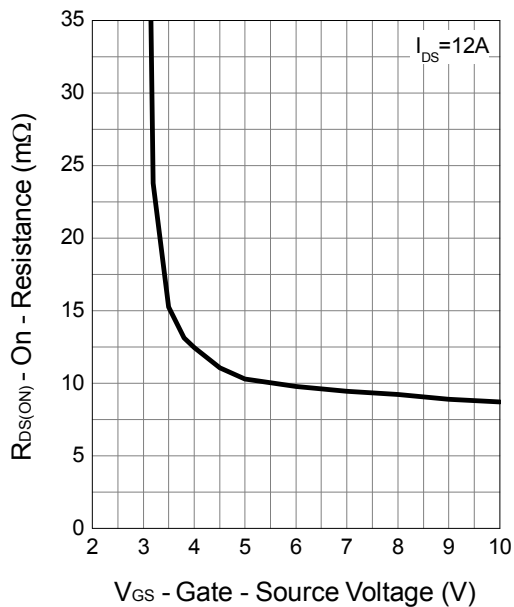
Output Characteristics



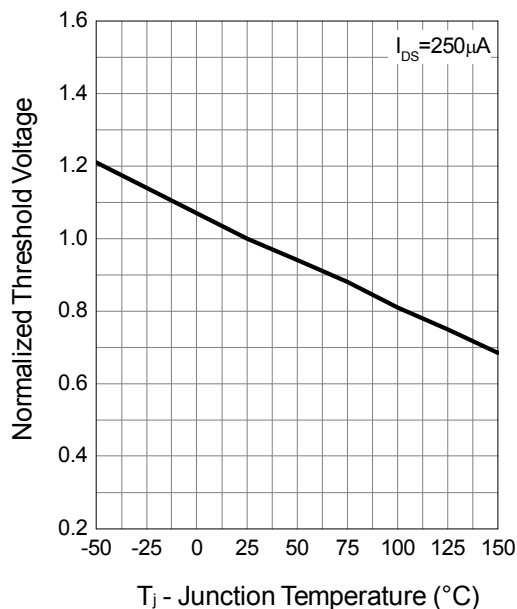
Drain-Source On Resistance



Gate-Source On Resistance



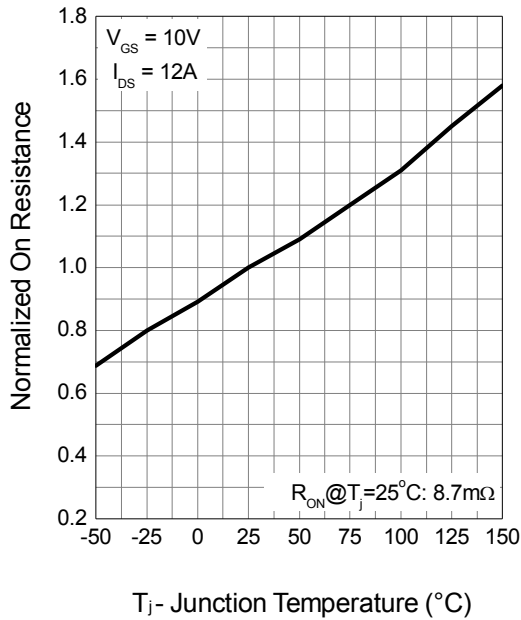
Gate Threshold Voltage



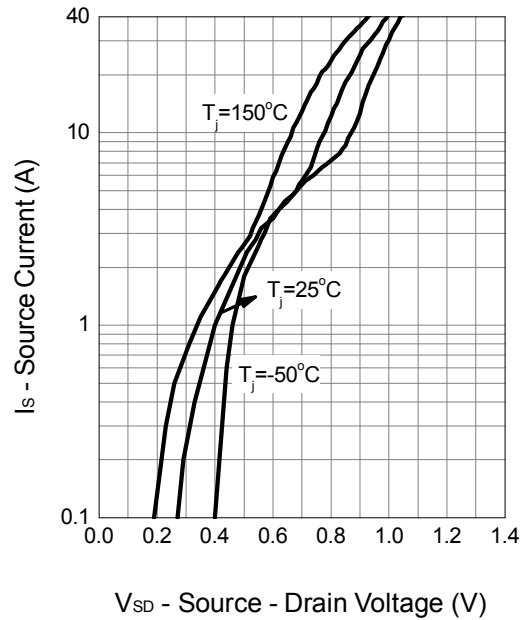
Typical Characteristics (Cont.)

Channel 2

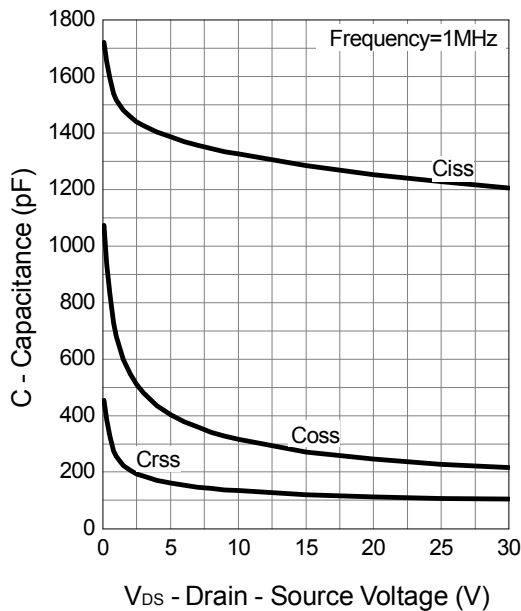
Drain-Source On Resistance



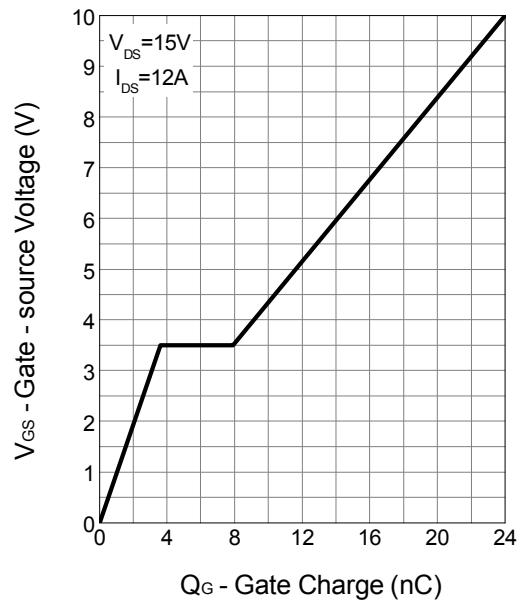
Source-Drain Diode Forward



Capacitance

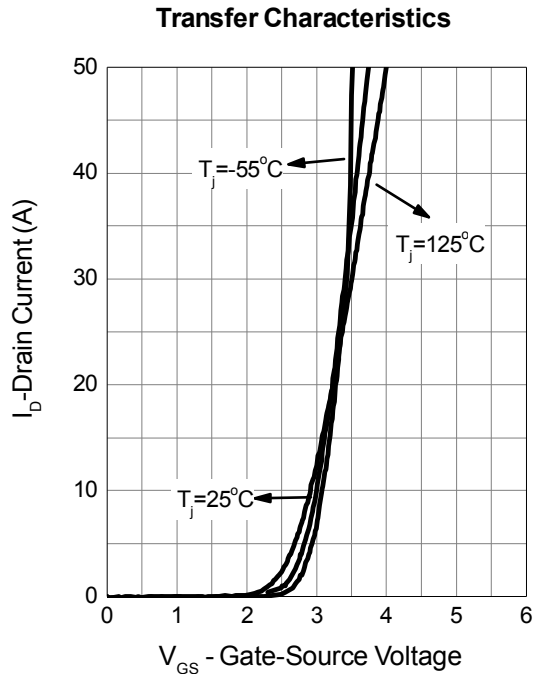


Gate Charge



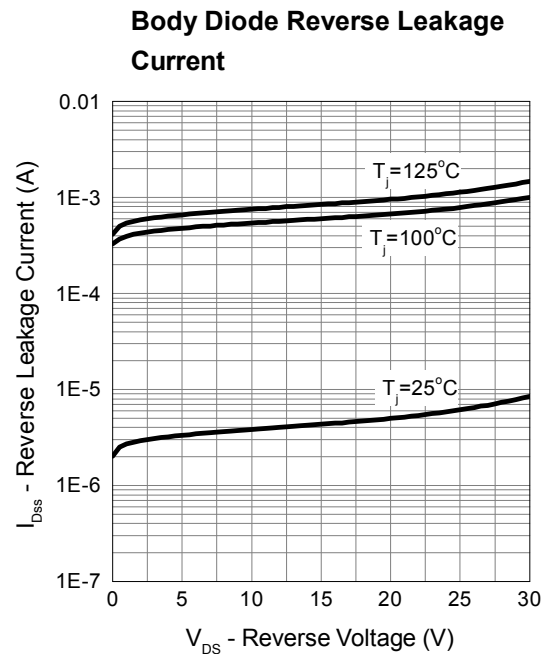
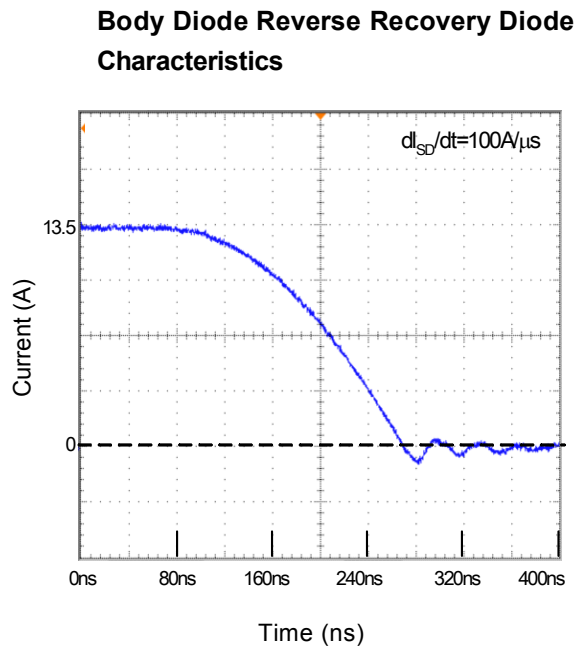
Typical Characteristics (Cont.)

Channel 2

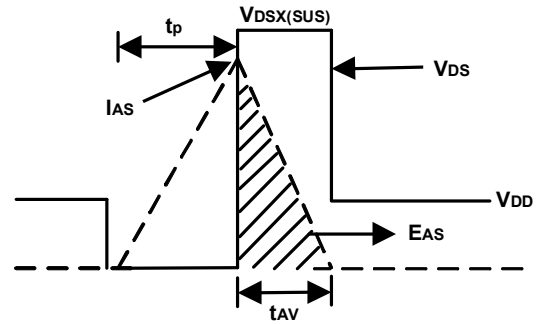
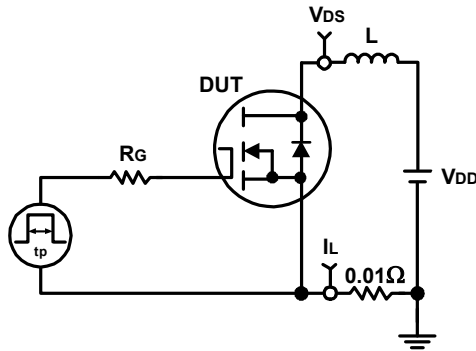


Schottky Body Diode Characteristics

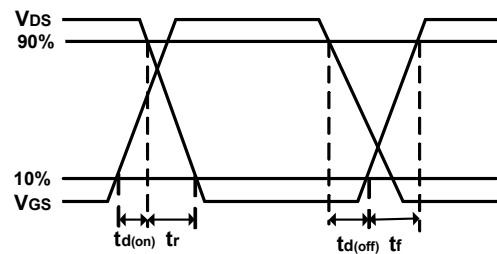
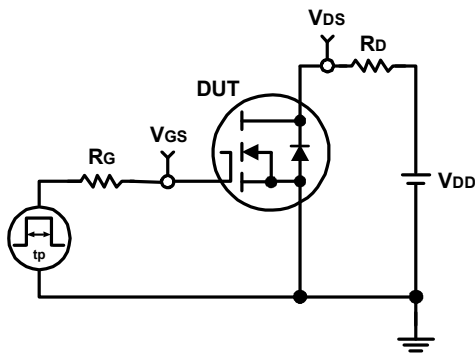
Channel 2



Avalanche Test Circuit and Waveforms

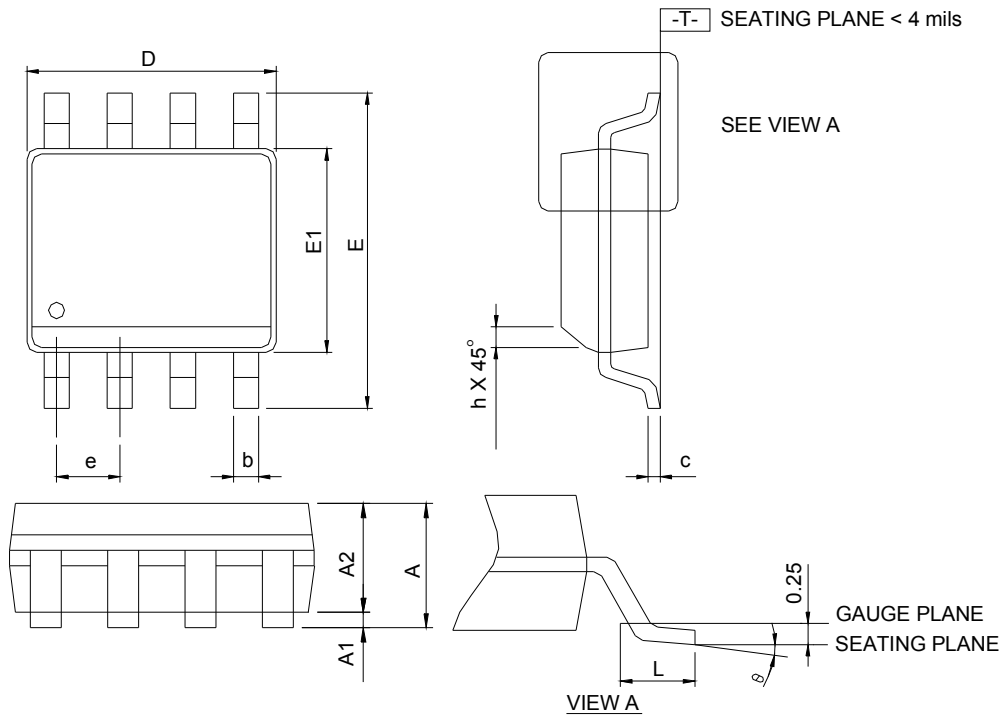


Switching Time Test Circuit and Waveforms



Package Information

SOP-8



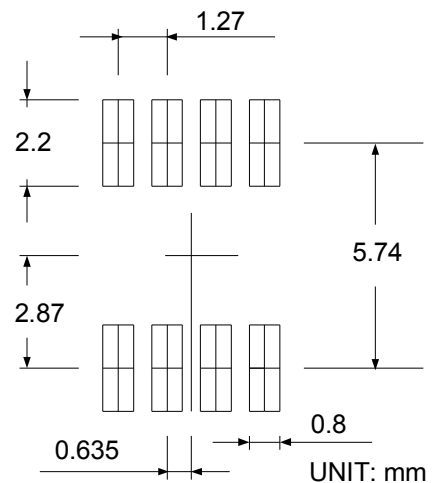
SOP-8	SOP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.75		0.069
A1	0.10	0.25	0.004	0.010
A2	1.25		0.049	
b	0.31	0.51	0.012	0.020
c	0.17	0.25	0.007	0.010
D	4.80	5.00	0.189	0.197
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050
θ	0°	8°	0°	8°

Note: 1. Follow JEDEC MS-012 AA.

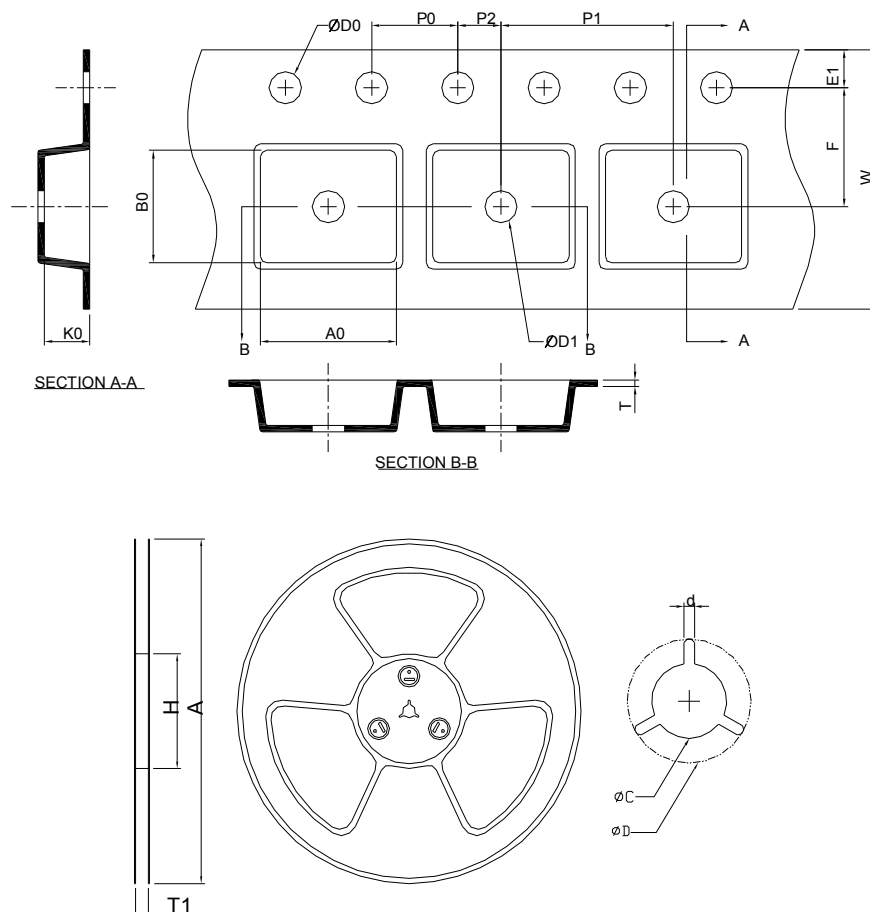
2. Dimension "D" does not include mold flash, protrusions or gate burrs.
Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.

3. Dimension "E" does not include inter-lead flash or protrusions.
Inter-lead flash and protrusions shall not exceed 10 mil per side.

RECOMMENDED LAND PATTERN



Carrier Tape & Reel Dimensions

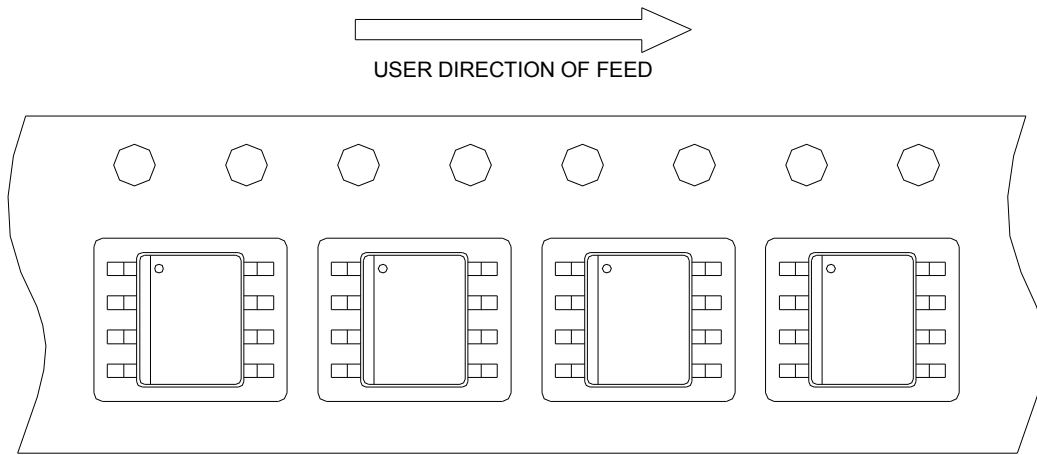


Application	A	H	T1	C	d	D	W	E1	F
SOP-8	330.0±2.00	50 MIN.	12.4+2.00-0.00	13.0+0.50-0.20	1.5 MIN.	20.2 MIN.	12.0±0.30	1.75±0.10	5.5±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0±0.10	8.0±0.10	2.0±0.05	1.5+0.10-0.00	1.5 MIN.	0.6+0.00-0.40	6.40±0.20	5.20±0.20	2.10±0.20

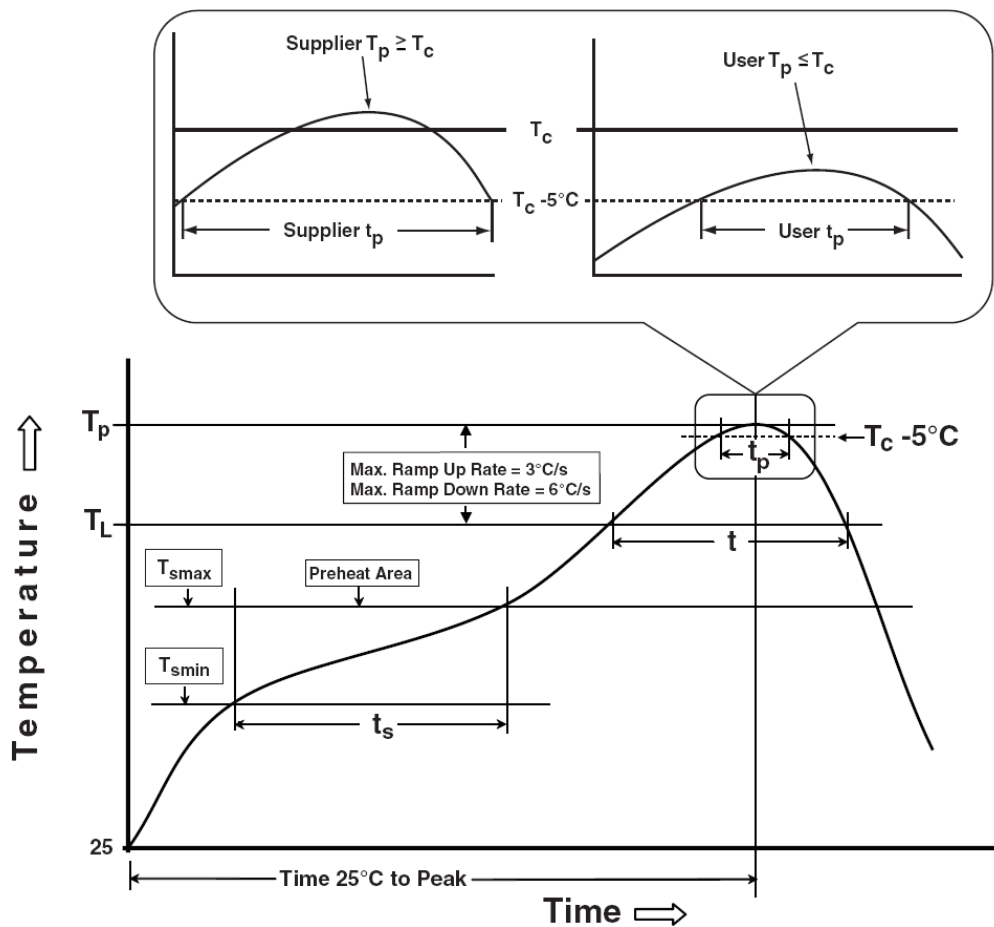
(mm)

Taping Direction Information

SOP-8



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 (T_c)

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 (T_c)

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
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ T_{jmax}
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ T_{jmax}
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121°C
TCT	JESD-22, A104	500 Cycles, -65°C~150°C

Customer Service

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