

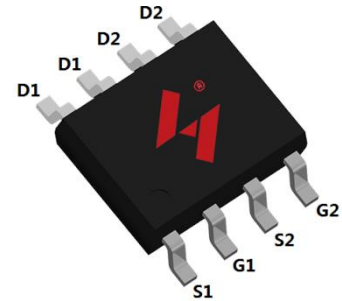
# HYG190C04LA1S

## 40V Complementary MOSFET

### Feature

N- Channel	P - Channel
Vds = 40V	Vds = -40V
9 A (Vgs= 10V)	-6.2 A (Vgs= -10V)
15 mΩ (Vgs= 10V)	32 mΩ (Vgs= -10V)
20 mΩ (Vgs= 4.5V)	47 mΩ (Vgs= -4.5V)
<ul style="list-style-type: none"> <li>● 100% Avalanche Tested</li> <li>● Reliable and Rugged</li> <li>● Halogen Free and Green Devices Available (RoHS Compliant)</li> </ul>	

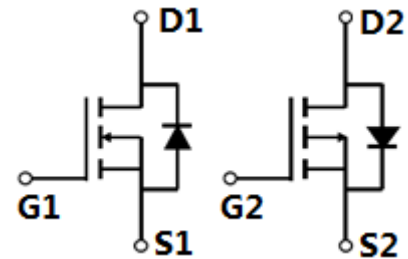
### Pin Description



SOP8L

### Applications

- Synchronous Rectifiers
- Wireless Power
- H-bridge Motor Drive



N-Channel

P-Channel

### Ordering and Marking Information

 <b>S</b> <b>G190C04</b> XYWXXXXXX	Package Code S: SOP8L  Date Code XYWXXXXXX
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Note:HUAYI lead-free products contain molding compounds/die attach materials and 100% matte tin plateTerminationfinish;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	N- Channel	P- Channel	Unit	
<b>Common Ratings (Tc=25°C Unless Otherwise Noted)</b>					
V <sub>DSS</sub>	Drain-Source Voltage	40	-40	V	
V <sub>GSS</sub>	Gate-Source Voltage	±20		V	
T <sub>J</sub>	Junction Temperature Range	-55 to 175		°C	
T <sub>STG</sub>	Storage Temperature Range	-55 to 175		°C	
I <sub>S</sub>	Source Current-Continuous(Body Tc=25°C)	9	-6.2	A	
<b>Mounted on Large Heat Sink</b>					
I <sub>DM</sub>	Pulsed Drain Current *	Tc=25°C	36	-24.8	A
I <sub>D</sub>	Continuous Drain Current	Tc=25°C	9	-6.2	A
		Tc=100°C	6.3	-4.3	A
P <sub>D</sub>	Maximum Power Dissipation	Tc=25°C	3.0	3.0	W
		Tc=100°C	1.5	1.5	W
R <sub>ΘJA</sub>	Thermal Resistance, Junction-to-Ambient	50	50	°C/W	
E <sub>AS</sub>	SinglePulsed-Avalanche Energy **	L=0.3mH	23.8	26.2	mJ

Note: \* Repetitive rating; pulse width limited by max.junction temperature.

\*\* Limited by T<sub>Jmax</sub> , starting T<sub>J</sub>=25°C, L = 0.3mH, R<sub>G</sub>= 25Ω, V<sub>GS</sub> =10V (N- Channel) /V<sub>GS</sub> =-10V (P-Channel) .

## N-Mosfet Electrical Characteristics (T<sub>c</sub> =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG190C04LA1			Unit
			Min	Typ.	Max	
<b>Static Characteristics</b>						
B <sub>VDS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA	40	-		V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> =40, V <sub>GS</sub> =0V	-	-	1	μA
		T <sub>J</sub> =125°C	-	-	50	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA	1	1.8	3	V
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
R <sub>DS(ON)</sub> *	Drain-Source On-State Resistance	V <sub>GS</sub> =10V, I <sub>DS</sub> =10A	-	15	19	mΩ
		V <sub>GS</sub> =4.5V, I <sub>DS</sub> =8A		20	25	
<b>Diode Characteristics</b>						
V <sub>SD</sub> *	Diode Forward Voltage	I <sub>SD</sub> =1A, V <sub>GS</sub> =0V	-	0.72	1.0	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> =10A, dI <sub>SD</sub> /dt=100A/μs	-	6.3	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	2.3	-	nC

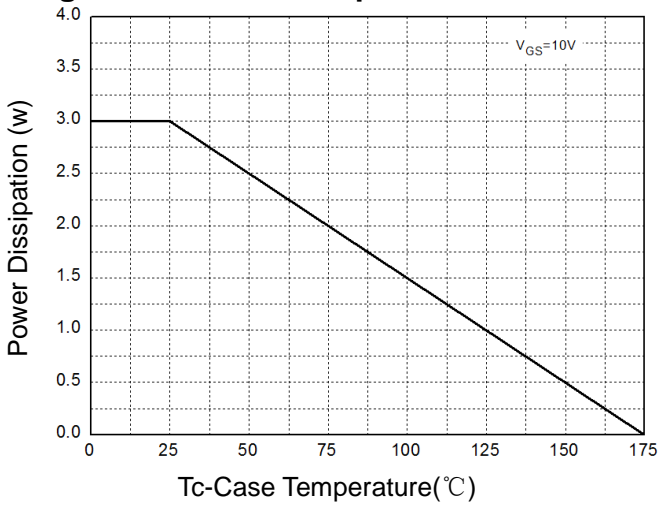
## N-Mosfet Electrical Characteristics (Cont.) (T<sub>c</sub> =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG190C04LA1			Unit
			Min	Typ.	Max	
<b>Dynamic Characteristics</b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Frequency=1.0MHz	-	3.8	-	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, Frequency=1.0MHz	-	631	-	pF
C <sub>oss</sub>	Output Capacitance		-	63	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	46	-	
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =20V, R <sub>G</sub> =4Ω, I <sub>DS</sub> =6A, V <sub>GS</sub> =10V	-	6.4	-	ns
T <sub>r</sub>	Turn-on Rise Time		-	22.8	-	
t <sub>d(OFF)</sub>	Turn-off Delay Time		-	15.7	-	
T <sub>f</sub>	Turn-off Fall Time		-	4.6	-	
<b>Gate Charge Characteristics</b>						
Q <sub>g</sub>	Total Gate Charge (V <sub>GS</sub> =10V)	V <sub>DS</sub> =32V, I <sub>D</sub> =10A	-	14.3	-	nC
Q <sub>g</sub>	Total Gate Charge (V <sub>GS</sub> =4.5V)		-	8.5	-	
Q <sub>gs</sub>	Gate-Source Charge		-	2.5	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	4.7	-	

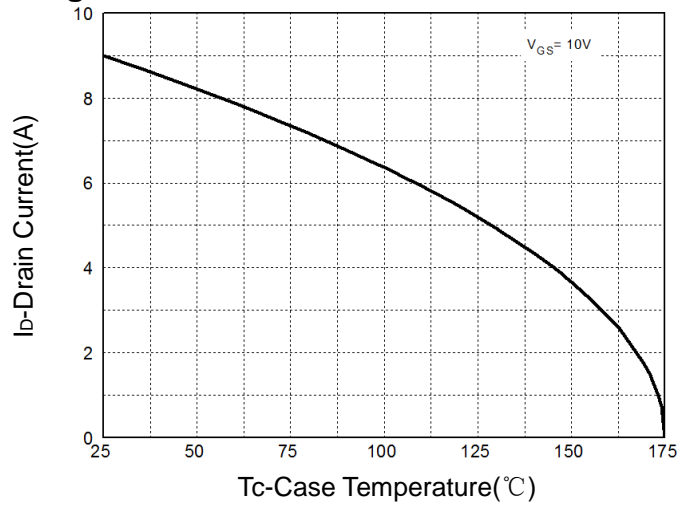
Note: \*Pulse test, pulse width ≤ 300us, duty cycle ≤ 2%

**N-Mosfet Typical Operating Characteristics**

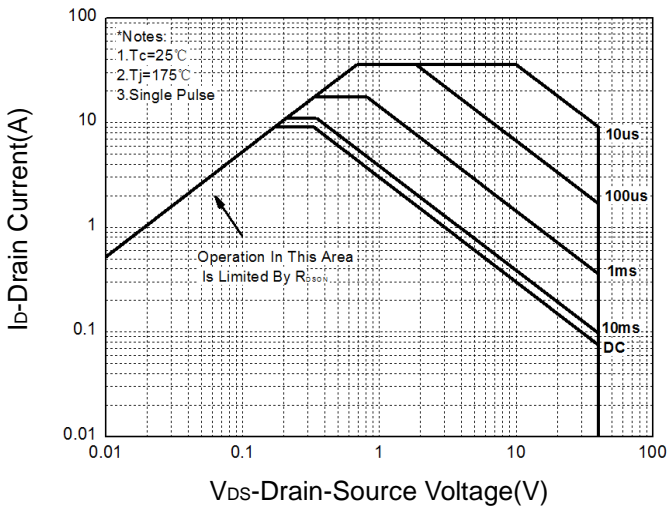
**Figure 1: Power Dissipation**



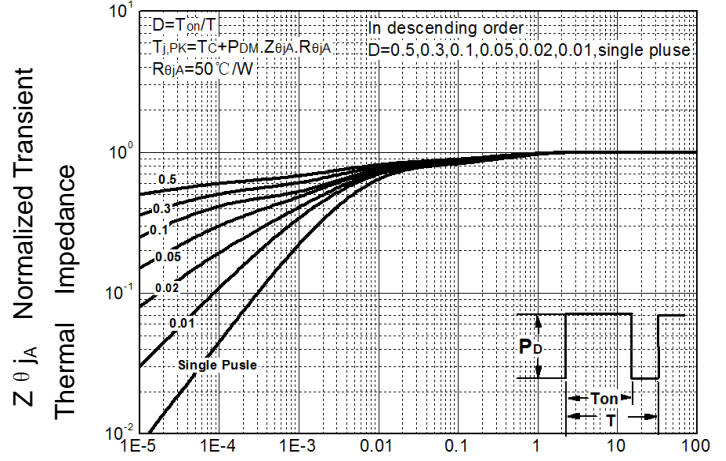
**Figure 2: Drain Current**



**Figure 3: Safe Operation Area**

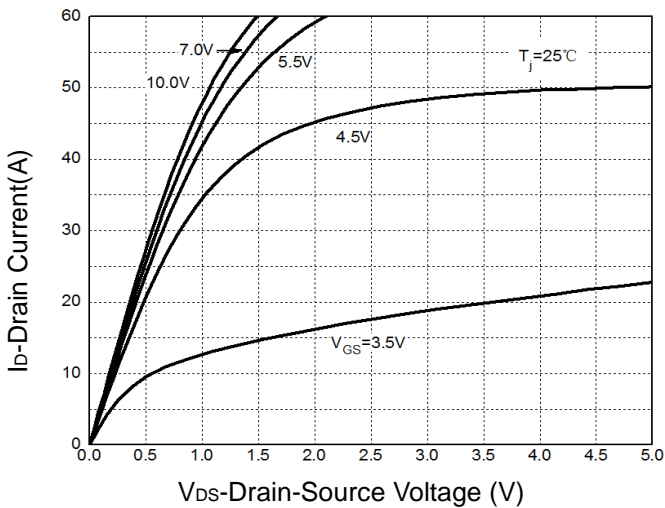


**Figure 4: Thermal Transient Impedance**

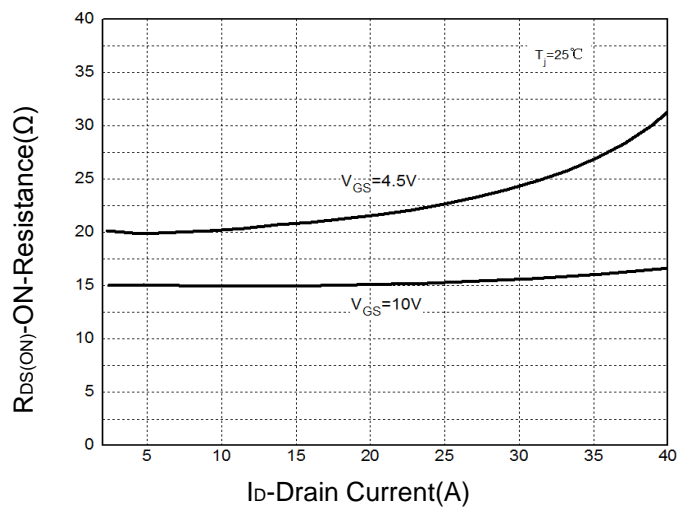


Maximum Effective Transient Thermal Impedance, Junction-to-Case

**Figure 5: Output Characteristics**

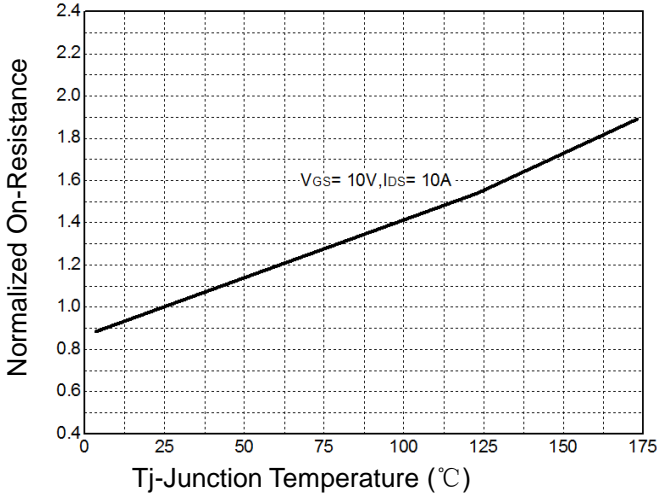


**Figure 6: Drain-Source On Resistance**

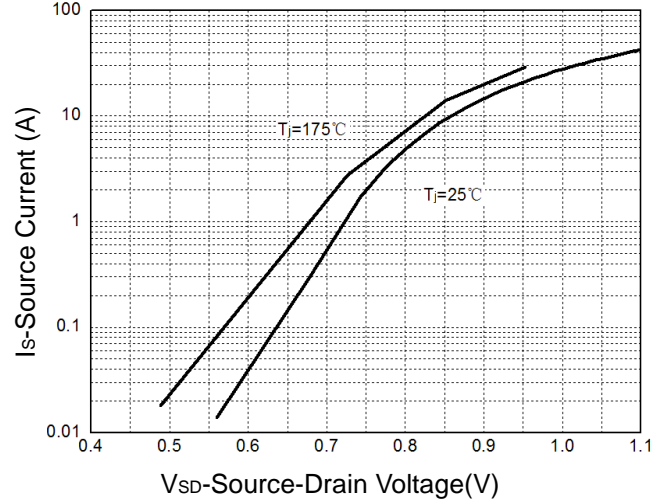


**N-Mosfet Typical Operating Characteristics**

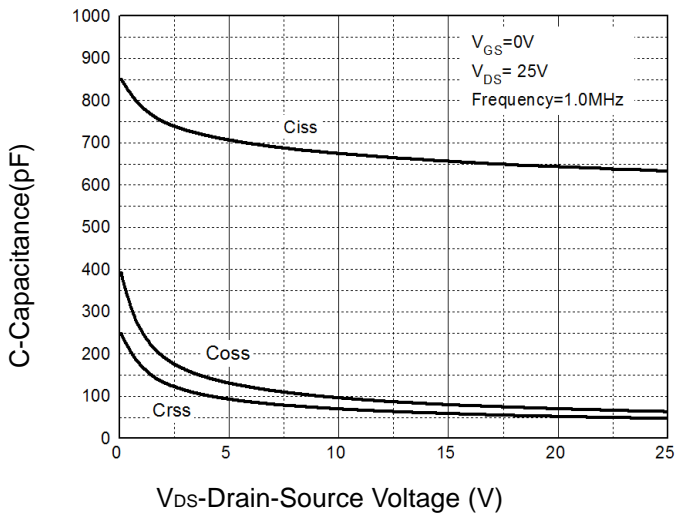
**Figure 7: On-Resistance vs. Temperature**



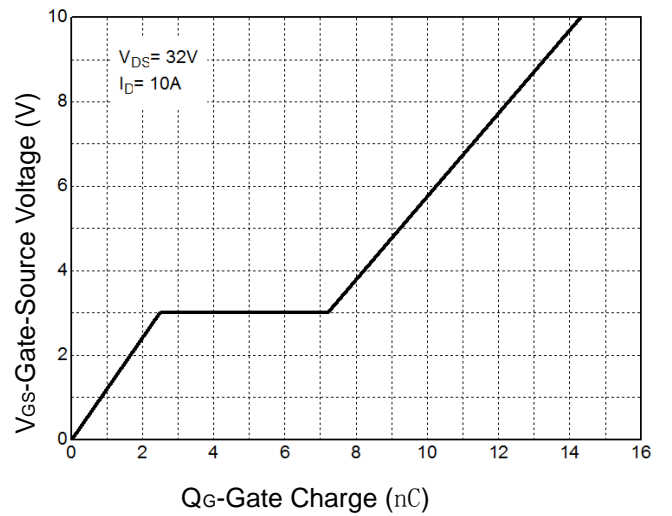
**Figure 8: Source-Drain Diode Forward**



**Figure 9: Capacitance Characteristics**

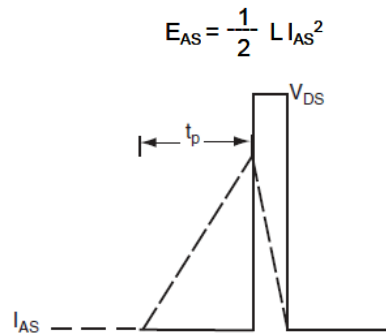
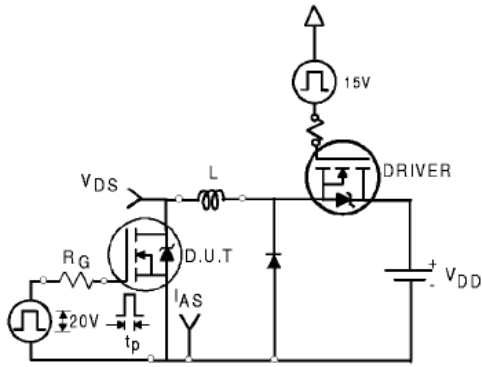


**Figure 10: Gate Charge Characteristics**

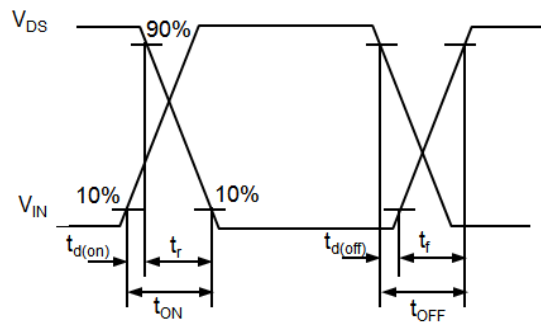
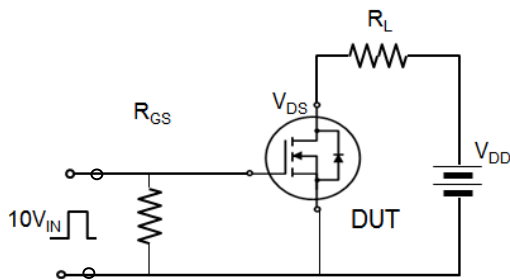


# HYG190C04LA1S

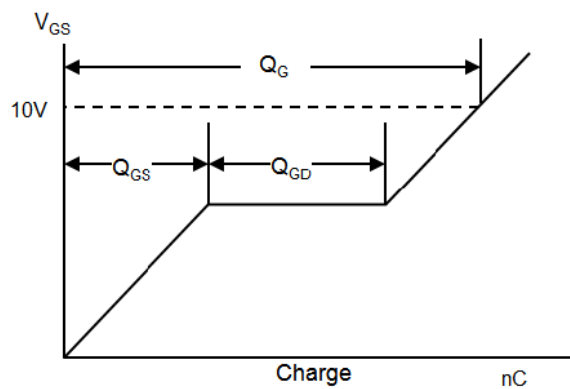
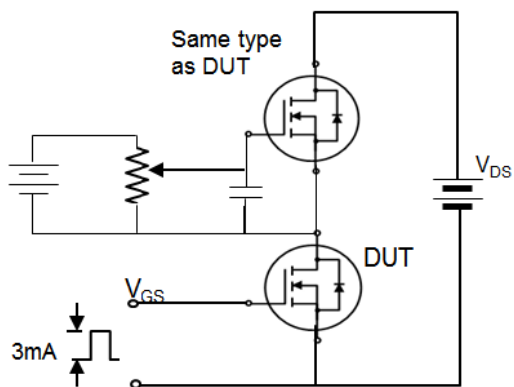
## Avalanche Test Circuit



## Switching Time Test Circuit



## Gate Charge Test Circuit



## P-Mosfet Electrical Characteristics (T<sub>c</sub> =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG190C04LA1			Unit
			Min	Typ.	Max	
<b>Static Characteristics</b>						
B <sub>VDS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>DS</sub> =-250μA	- 40	-		V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> =-40, V <sub>GS</sub> =0V		-	-1	μA
		T <sub>J</sub> =125°C		-	-50	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =-250μA	-1	-1.6	-3	V
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =± 20V, V <sub>DS</sub> =0V	-	-	±100	nA
R <sub>DS(ON)</sub> *	Drain-Source On-State Resistance	V <sub>GS</sub> =-10V, I <sub>DS</sub> =-6A	-	32	40	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>DS</sub> =-4A		47	59	
<b>Diode Characteristics</b>						
V <sub>SD</sub> *	Diode Forward Voltage	I <sub>SD</sub> =-1A, V <sub>GS</sub> =0V	-	-0.75	-1.0	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>SD</sub> =-6A, dI <sub>SD</sub> /dt=100A/μs	-	10	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	5	-	nC

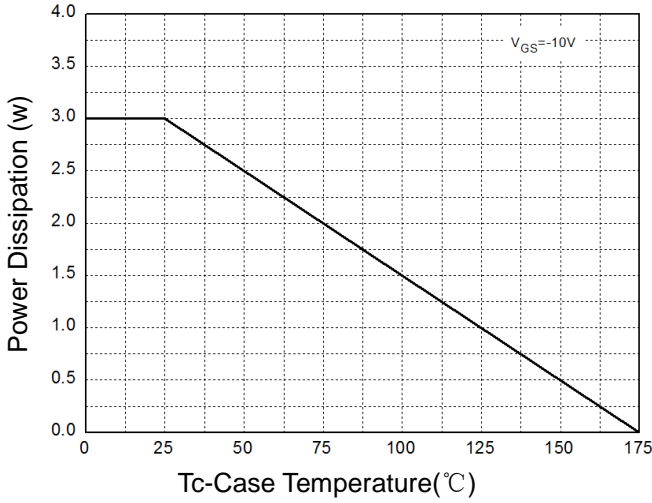
## P-Mosfet Electrical Characteristics (Cont.) (T<sub>c</sub> =25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	HYG190C04LA1			Unit
			Min	Typ.	Max	
<b>Dynamic Characteristics</b>						
R <sub>G</sub>	Gate Resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, Frequency=1.0MHz	-	18	-	Ω
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, Frequency=1.0MHz	-	1012	-	pF
C <sub>oss</sub>	Output Capacitance		-	79	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	63	-	
t <sub>d(ON)</sub>	Turn-on Delay Time	V <sub>DD</sub> =-20V, R <sub>G</sub> =4Ω, I <sub>DS</sub> =-6A, V <sub>GS</sub> =-10V	-	6.8	-	ns
T <sub>r</sub>	Turn-on Rise Time		-	17	-	
t <sub>d(OFF)</sub>	Turn-off Delay Time		-	38	-	
T <sub>f</sub>	Turn-off Fall Time		-	35	-	
<b>Gate Charge Characteristics</b>						
Q <sub>g</sub>	Total Gate Charge (V <sub>GS</sub> =-10V)	V <sub>DS</sub> =-32V, I <sub>D</sub> =-6A	-	20.1	-	nC
Q <sub>g</sub>	Total Gate Charge (V <sub>GS</sub> =-4.5V)			10.5		
Q <sub>gs</sub>	Gate-Source Charge		-	3.8	-	
Q <sub>gd</sub>	Gate-Drain Charge		-	4.4	-	

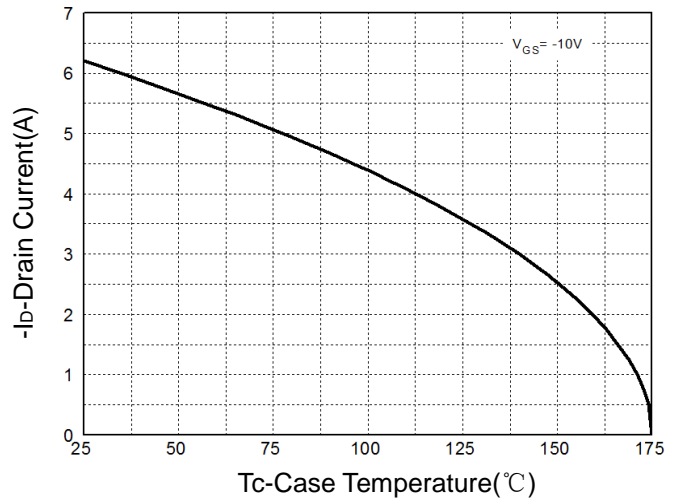
Note: \*Pulse test, pulse width ≤ 300us, duty cycle ≤ 2%

**P-Mosfet Typical Operating Characteristics**

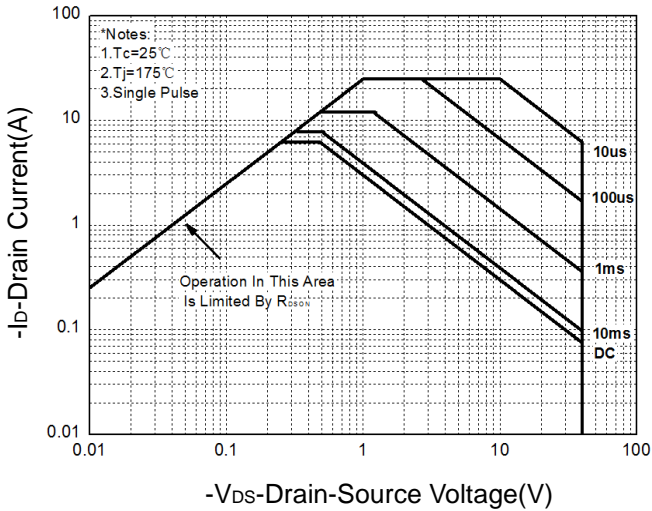
**Figure 1: Power Dissipation**



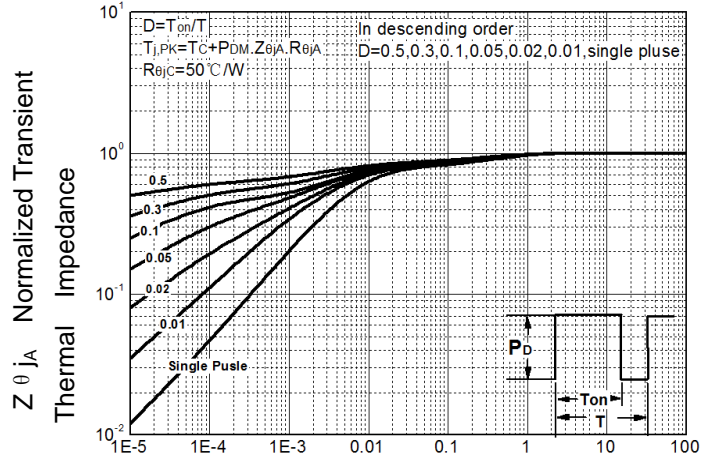
**Figure 2: Drain Current**



**Figure 3: Safe Operation Area**

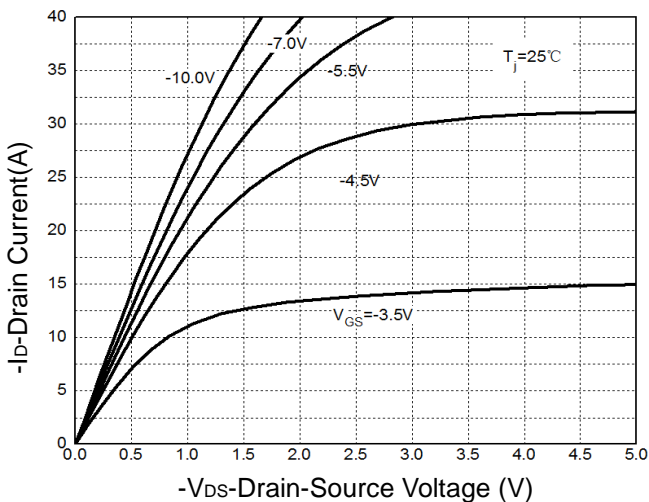


**Figure 4: Thermal Transient Impedance**

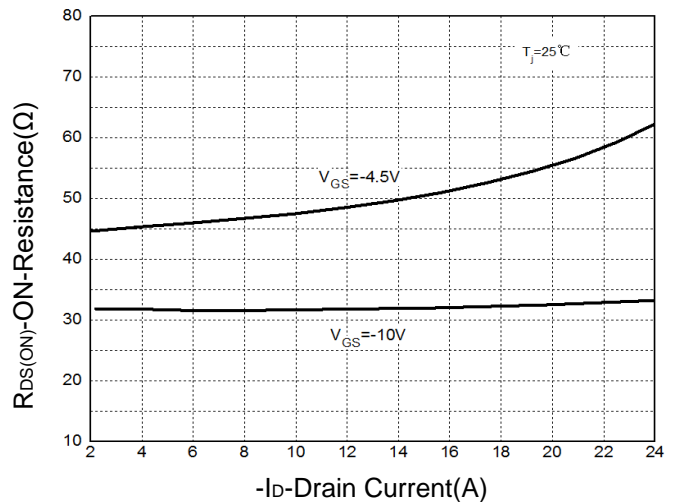


Maximum Effective Transient Thermal Impedance, Junction-to-Case

**Figure 5: Output Characteristics**



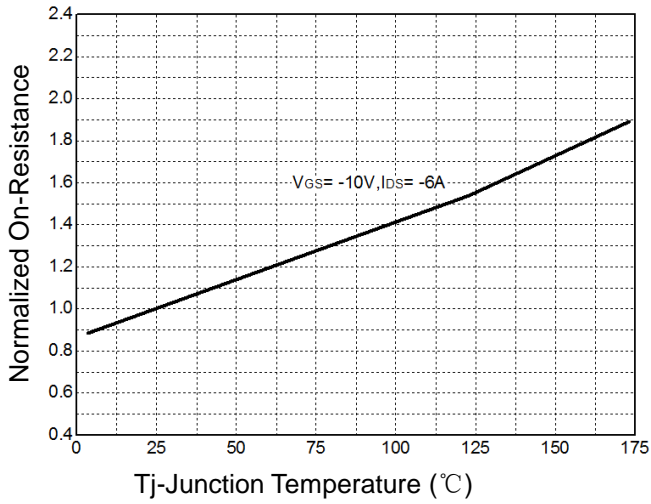
**Figure 6: Drain-Source On Resistance**



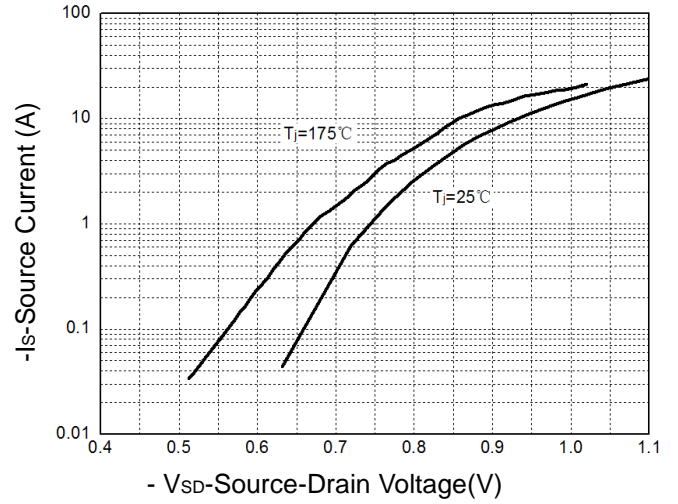


**P-Mosfet Typical Operating Characteristics**

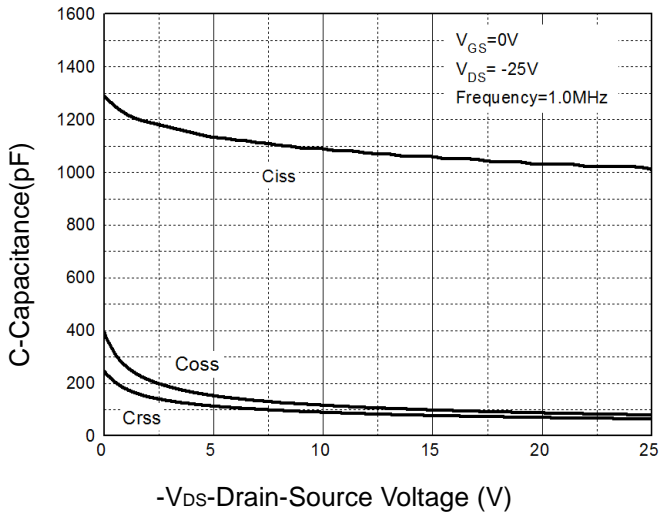
**Figure 7: On-Resistance vs. Temperature**



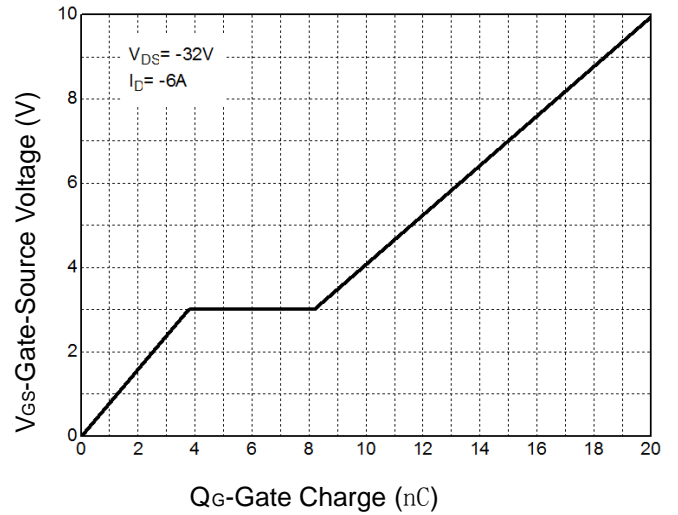
**Figure 8: Source-Drain Diode Forward**



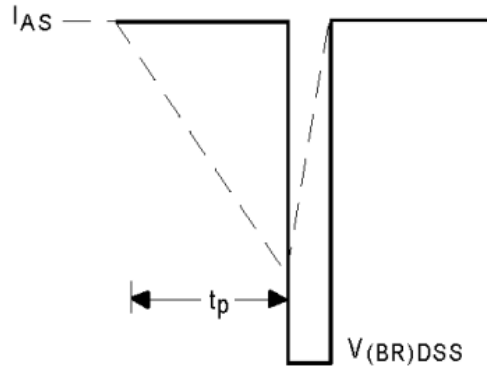
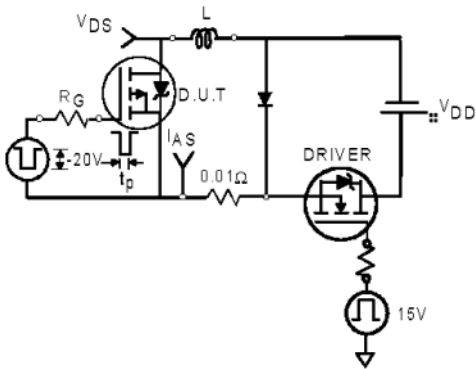
**Figure 9: Capacitance Characteristics**



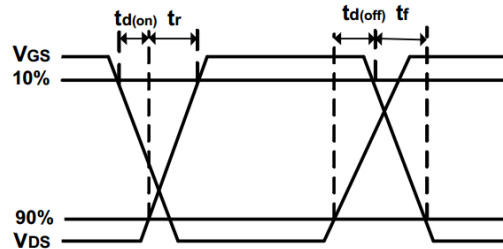
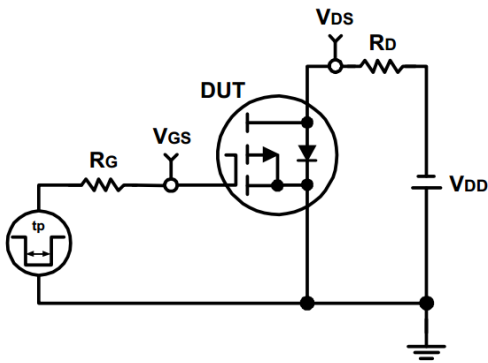
**Figure 10: Gate Charge Characteristics**



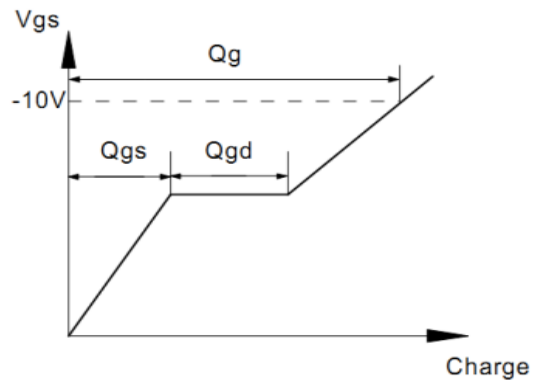
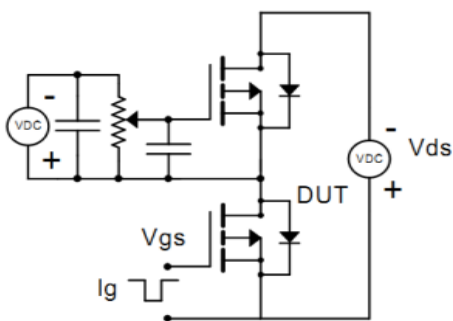
**Avalanche Test Circuit**



**Switching Time Test Circuit**



**Gate Charge Test Circuit**

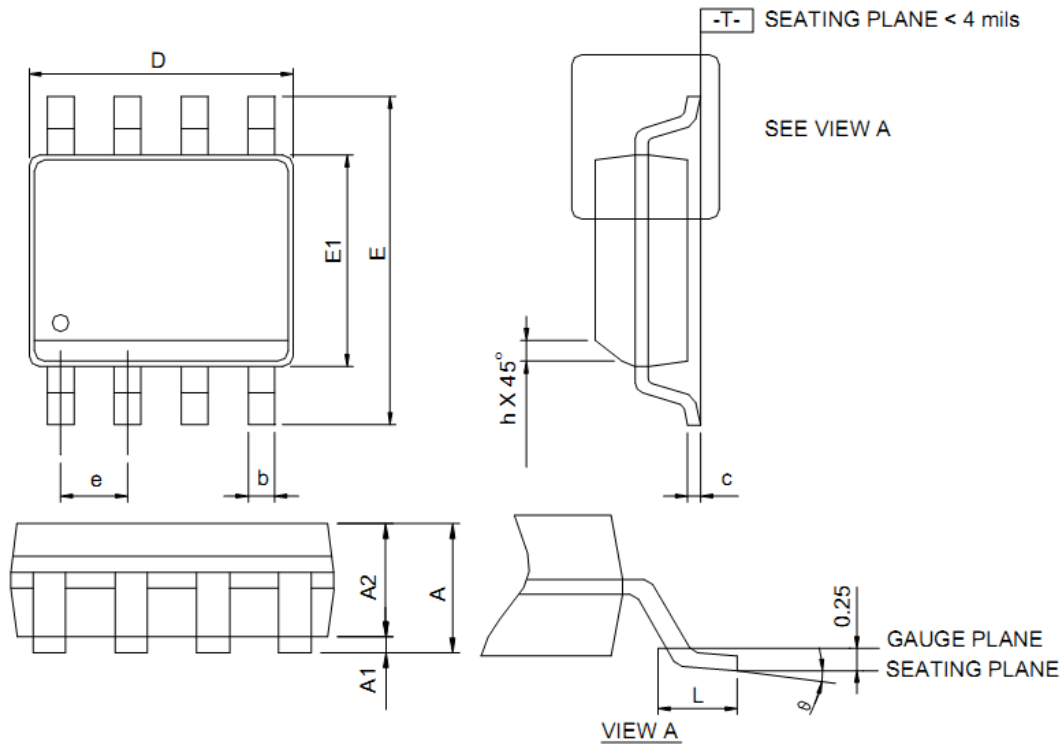


## Device Per Unit

Package Type	Unit	Quantity
SOP8L	Reel	2500

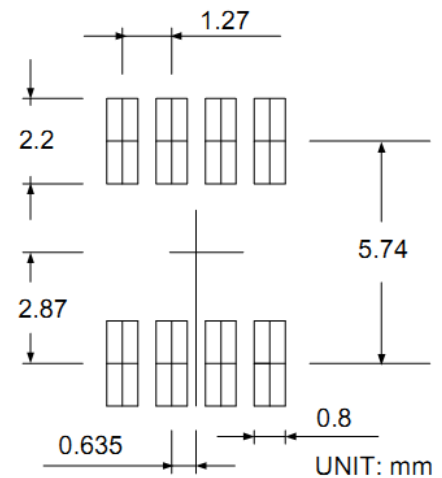
## Package Information

### SOP8L



DIMENSIONS	SOP8L			
	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°

### RECOMMENDED LAND PATTERN



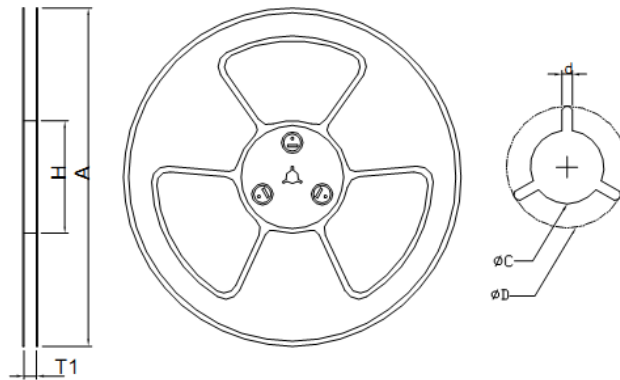
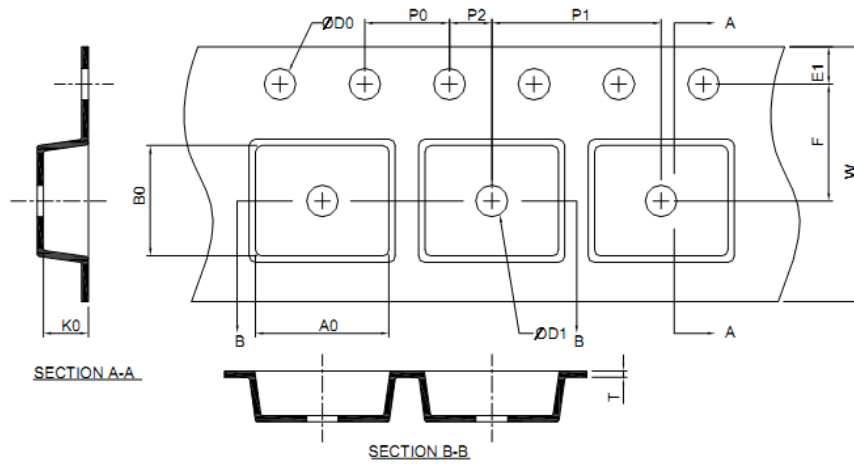
Note: 1. Follow JEDEC MS-012 AA.

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.

# HYG190C04LA1S

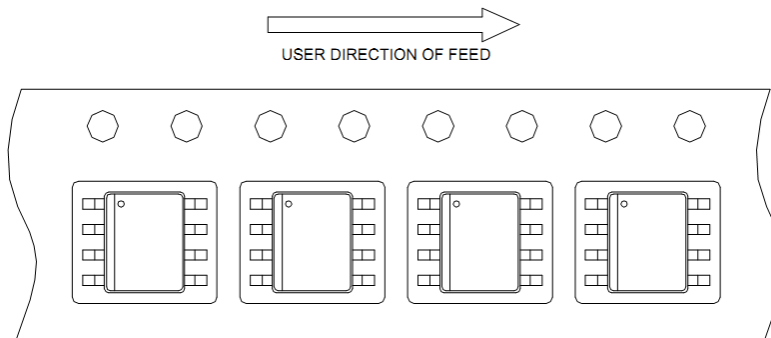
## Carrier Tape & Reel Dimensions



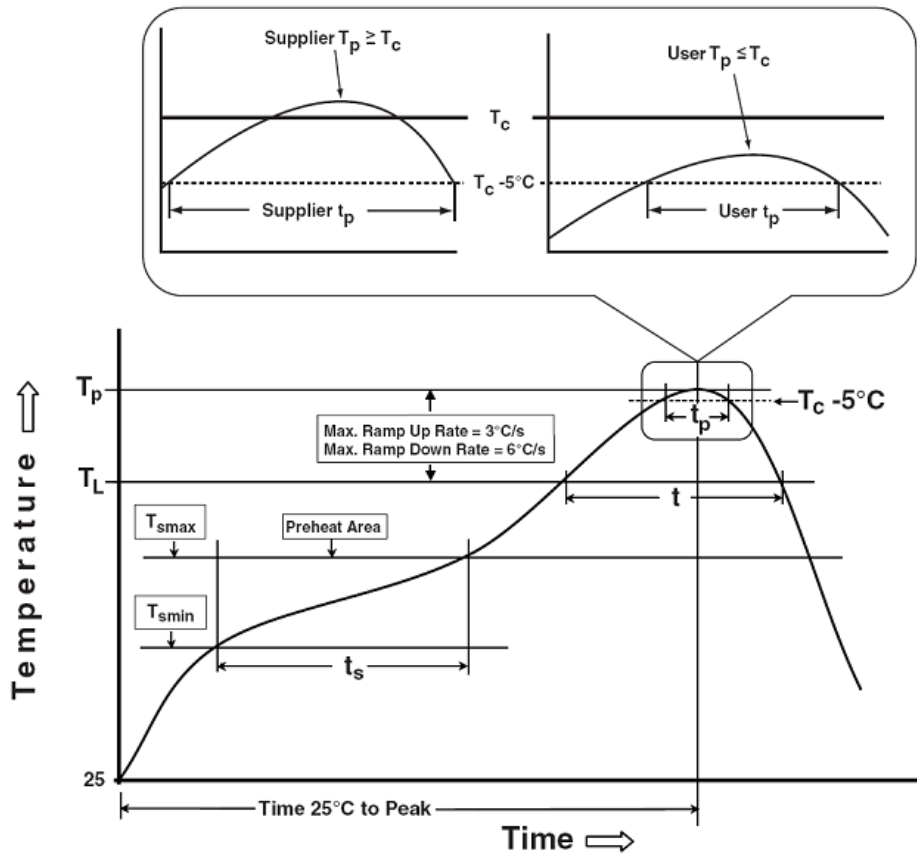
Application	A	H	T1	C	d	D	W	E1	F
SOP8L	330.0 2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0 0.30	1.75 0.10	5.5 0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 0.10	8.0 0.10	2.0 0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.40 0.20	5.20 0.20	2.10 0.20

(mm)

## Taping Direction Information



**Classification Profile**



**Classification Reflow Profiles**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
<b>Preheat &amp; Soak</b>		
Temperature min (T <sub>smin</sub> )	100 °C	150 °C
Temperature max (T <sub>smax</sub> )	150 °C	200 °C
Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )	60-120 seconds	60-120 seconds
Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )	3 °C/second max.	3°C/second max.
Liquidous temperature (T <sub>L</sub> )	183 °C	217 °C
Time at liquidous (t <sub>L</sub> )	60-150 seconds	60-150 seconds
Peak package body Temperature (T <sub>p</sub> )*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t <sub>p</sub> )** within 5°C of the specified classification temperature (T <sub>c</sub> )	20** seconds	30** seconds
Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )	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 <sub>p</sub> ) is defined as a supplier minimum and a user maximum.		
** Tolerance for time at peak profile temperature (t <sub>p</sub> ) 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
HTGB	JESD-22, A108	168 Hrs \ 500Hrs\ 1000 Hrs, Bias @ 125°C
HTRB	JESD-22, A108	168 Hrs \ 500Hrs\ 1000 Hrs, 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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