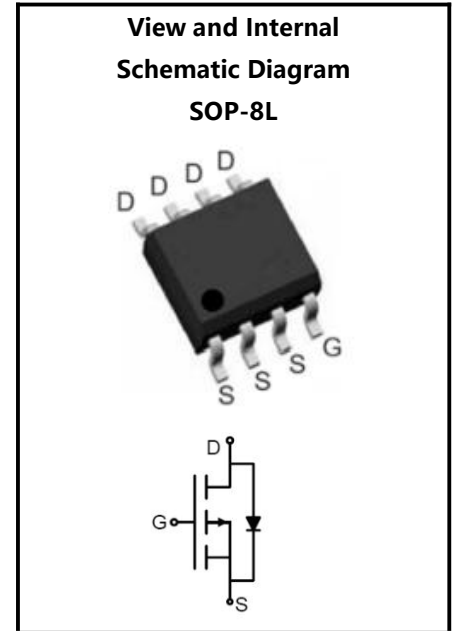


MOSFET

-20A, -30V, 6.4mΩ, P-CHANNEL MOSFET

Description and Applications

- ◆ Trench Power MOSFET technology
- ◆ Low $R_{DS(ON)}$ and high current capability
- ◆ Load switch or battery protection charge/discharge application



Parameter	Values	Unit
BV_{DSS}	-30	V
I_D	-20	A
$R_{Dson(max)}$	6.4	mΩ
$V_{GS(th)}(Typ)$	-1.45	V

Ordering Code	Marking	Package	Packaging
X213051A	X213051A	SOP-8L	Tape & Reel

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

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Voltage	V_{DSS}	-	-	-30	V	$V_{GS}=0V$
Gate-Source Voltage	V_{GS}	-20	-	20	V	$V_{DS}=0V$
Continuous Drain Current	I_D	-	-	-20	A	$T_A=25^{\circ}C$
		-	-	-14	A	$T_A=70^{\circ}C$
Pulsed Drain Current(Note 3)	I_{DM}	-	-	-300	A	-
Maximum Power Dissipation(Note 2)	P_D	-	-	3.1	W	$T_A=25^{\circ}C$
		-	-	2	W	$T_A=70^{\circ}C$
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55	-	150	$^{\circ}C$	-

Thermal Characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Thermal resistance , Junction to Ambient(Note 1)	$R_{th(J-a)}$	-	29	40	$^{\circ}C/W$	$t \leq 10s$
Thermal resistance , Junction to Ambient(Note 1,4)		-	60	75	$^{\circ}C/W$	-
Thermal resistance , Junction to Lead	$R_{th(J-L)}$	-	14	24	$^{\circ}C/W$	-

Electrical Characteristics ($T_j=25^{\circ}\text{C}$, unless otherwise noted)
Static characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Drain-Source Breakdown Voltage	BV_{DSS}	-30	-	-	V	$V_{GS}=0V, I_D=-250\mu A$
Zero Gate Voltage Drain Current	I_{DSS}	-	-	-1	μA	$V_{DS}=-30V, V_{GS}=0V$
Gate-Body Leakage Current, Forward	I_{GSSF}	-	-	100	nA	$V_{GS}=20V, V_{DS}=0V$
Gate-Body Leakage Current, Reverse	I_{GSSR}	-	-	-100	nA	$V_{GS}=-20V, V_{DS}=0V$
Gate-Source Threshold Voltage	$V_{GS(th)}$	-1	-	-2	V	$V_{DS}=V_{GS}, I_D=-250\mu A$
Drain-Source On-State Resistance	$R_{DS(on)}$	-	3.6	6.4	m Ω	$V_{GS}=-10V, I_D=-20A$
		-	5	9.6	m Ω	$V_{GS}=-4.5V, I_D=-20A$
Gate resistance	R_g	-	4	-	Ω	$V_{GS}=0V, V_{DS}=0V, f=1\text{MHz}$
Forward Transconductance	g_{fs}	-	72	-	S	$V_{DS}=-5V, I_D=-20A$

Dynamic characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Input Capacitance	C_{iss}	-	5418	-	pF	$V_{DS}=-15V, V_{GS}=0V, f=1.0\text{MHz}$
Output Capacitance	C_{oss}	-	694	-	pF	
Reverse Transfer Capacitance	C_{rss}	-	466	-	pF	
Turn-On Delay Time	$t_{d(on)}$	-	12	-	ns	$V_{DD}=-15V, R_G=3\Omega,$ $V_{GS}=-10V, R_L=0.75\Omega,$
Turn-On Rise Time	t_r	-	79	-	ns	
Turn-Off Delay Time	$t_{d(off)}$	-	128	-	ns	
Turn-Off Fall Time	t_f	-	81	-	ns	

Gate charge characteristics

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Total Gate Charge	Q_g	-	104	-	nC	$V_{DS}=-15V, I_D=-20A, V_{GS}=-10V$
Gate-Source Charge	Q_{gs}	-	18	-	nC	
Gate-Drain Charge	Q_{gd}	-	21	-	nC	

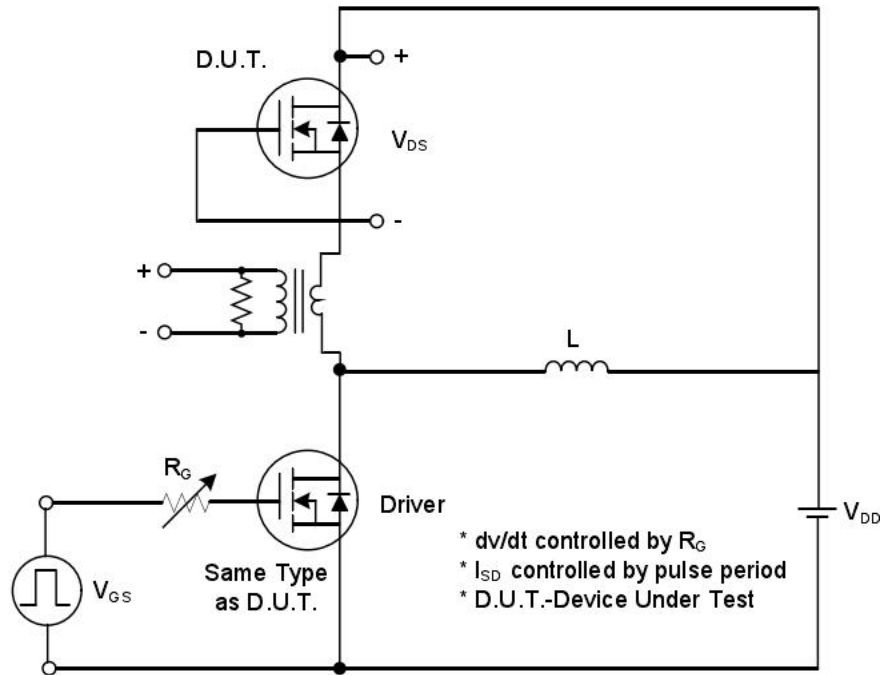
Reverse diode

Parameter	Symbol	Values			Unit	Note/Test Conditions
		Min	Typ	Max		
Continuous Diode Forward Current	I_S	-	-	-20	A	-
Diode Forward Voltage	V_{SD}	-	-	-1	V	$I_S=-1A, V_{GS}=0V$
Body Diode Reverse Recovery Time	t_{rr}	-	26	-	ns	$V_{GS}=0V, I_S=-20.0A, di/dt=-100A/\mu s$
Body Diode Reverse Recovery Charge	Q_{rr}	-	12	-	nC	

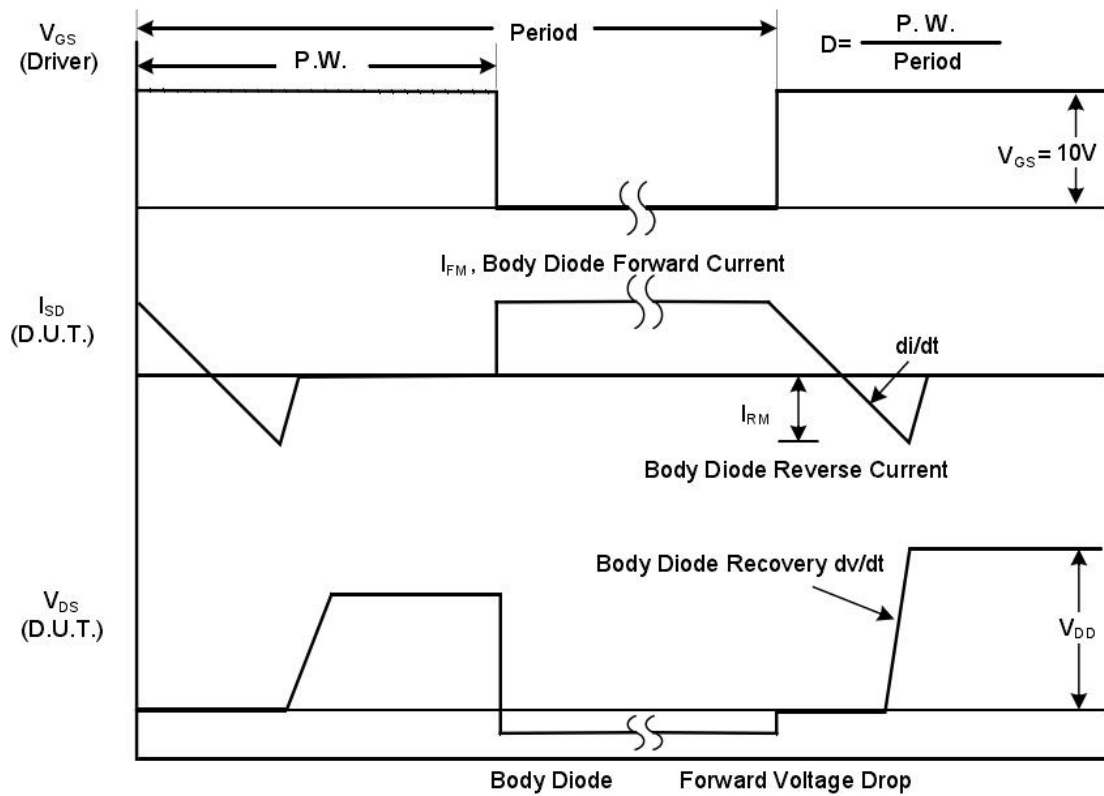
Notes

1. The value of $R_{th(j-a)}$ is measured with the device mounted on 1in² FR-4 board with 1oz. Copper, in a still air environment with $T_A = 25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design.
2. The power dissipation P D is based on $T_{j(MAX)} = 150^{\circ}\text{C}$, using $\leq 10\text{s}$ junction-to-ambient thermal resistance.
3. Repetitive rating, pulse width limited by junction temperature $T_{j(MAX)} = 150^{\circ}\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_j = 25^{\circ}\text{C}$.
4. The $R_{th(j-a)}$ is the sum of the thermal impedance from junction to lead $R_{th(j-l)}$ and lead to ambient.
- 5 The static characteristics in Figures 1 to 6 are obtained using $< 300\mu\text{s}$ pulses, duty cycle 0.5% max.
6. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 1oz. Copper, assuming a maximum junction temperature of $T_{j(MAX)} = 150^{\circ}\text{C}$. The SOA curve provides a single pulse rating.

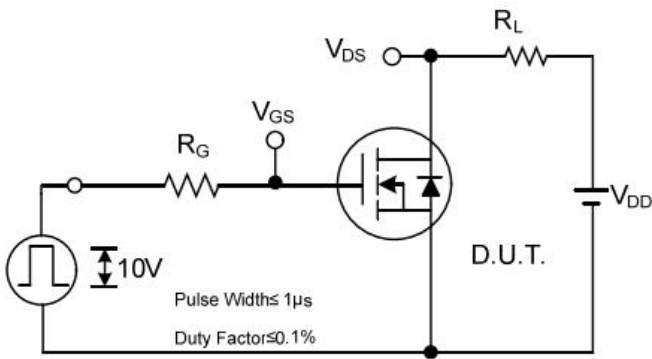
RATING AND CHARACTERISTIC CURVES



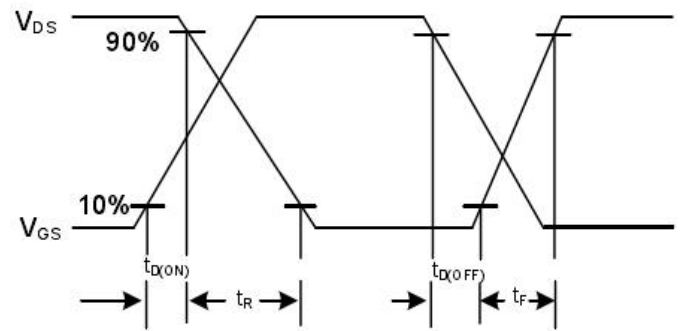
Peak Diode Recovery dv/dt Test Circuit



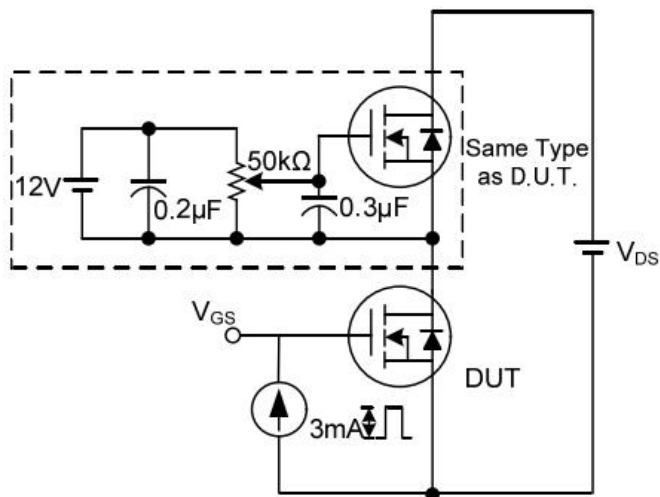
Peak Diode Recovery dv/dt Waveforms



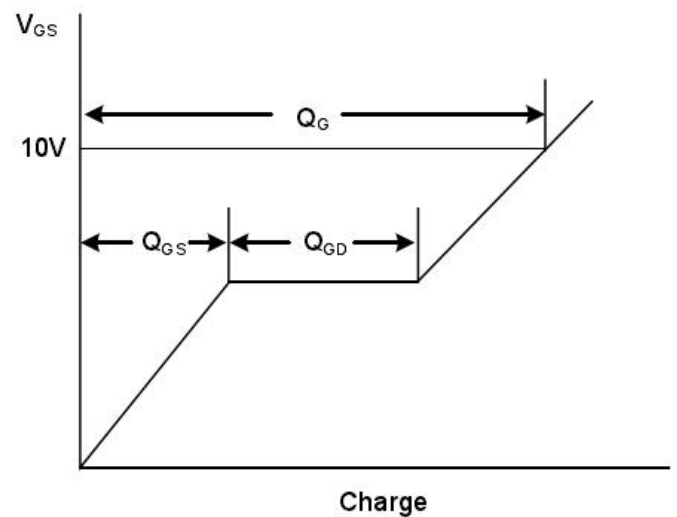
Switching Test Circuit



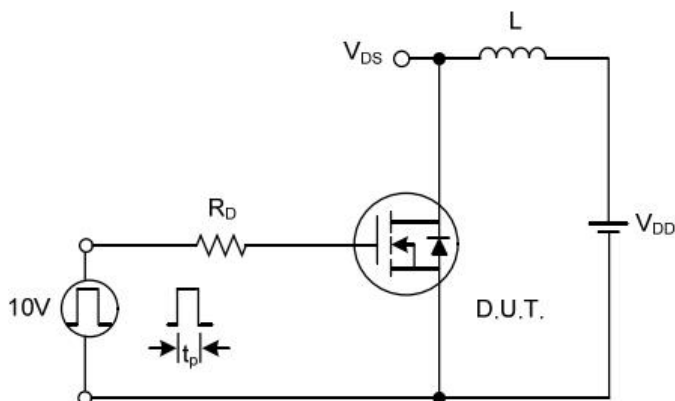
Switching Waveforms



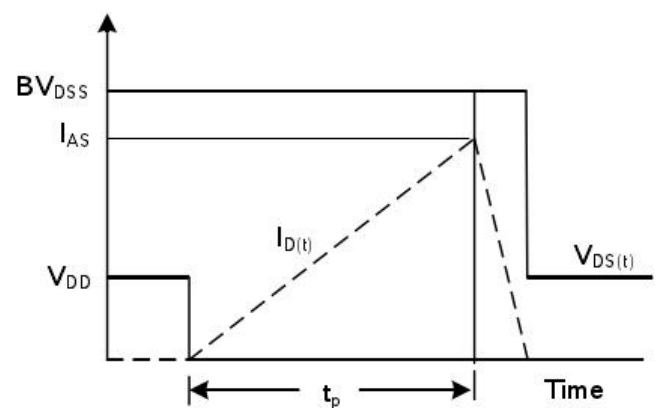
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

RATING AND CHARACTERISTIC CURVES

Figure.1 On-Region Characteristics (Note 5)

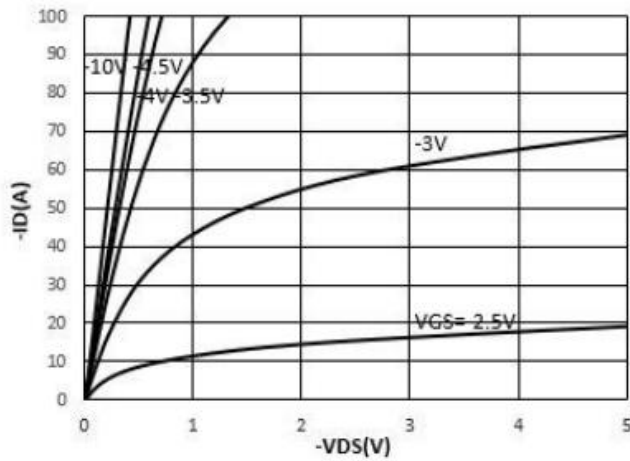


Figure.2 Transfer Characteristics (Note 5)

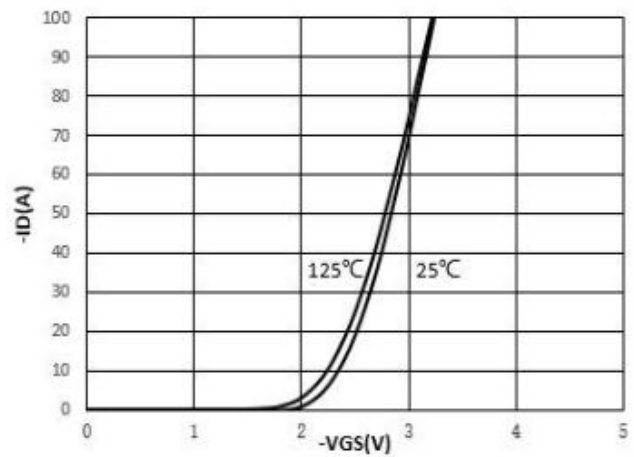


Figure.3 On-Resistance vs. Drain Current and Gate Voltage (Note 5)

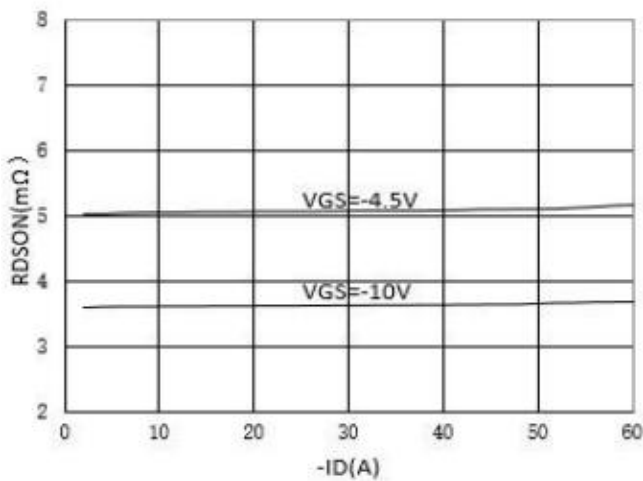


Figure.4 On-Resistance vs. Junction Temperature (Note 5)

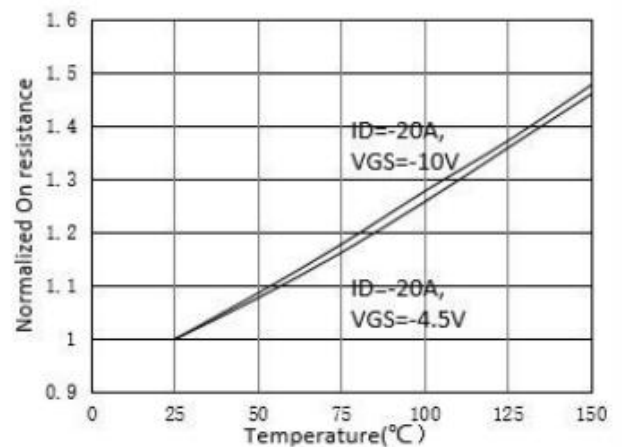


Figure.5 On-Resistance vs. Gate-Source Voltage(Note 5)

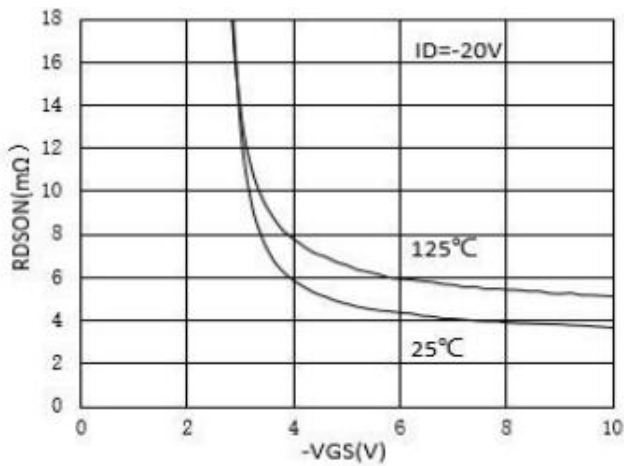


Figure.6 Body-Diode Characteristics (Note 5)

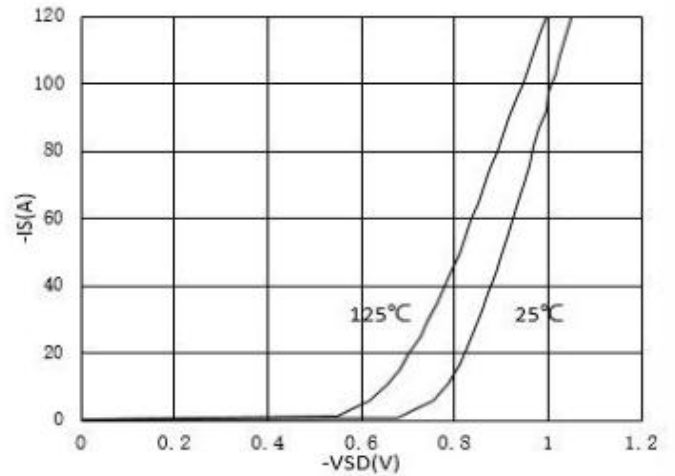


Figure.7 Gate-Charge Characteristics

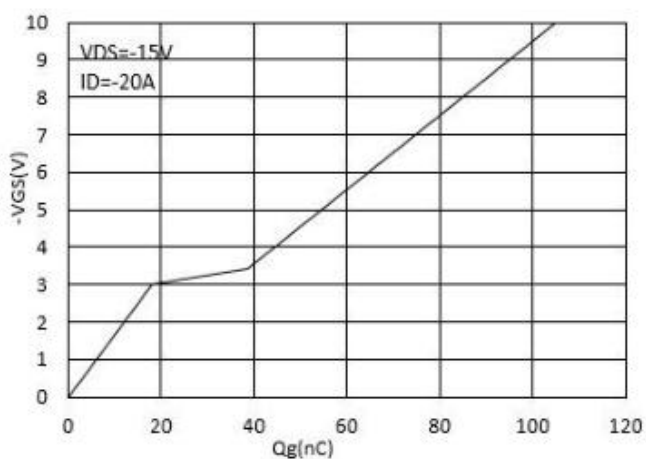


Figure.8 Capacitance Characteristics

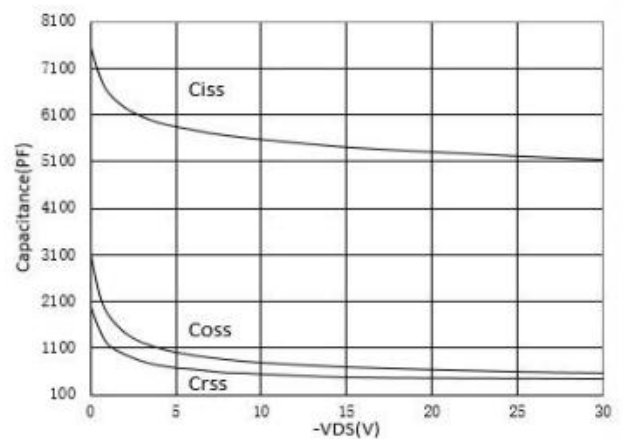


Figure.9 Maximum Forward Biased Safe Operating Area

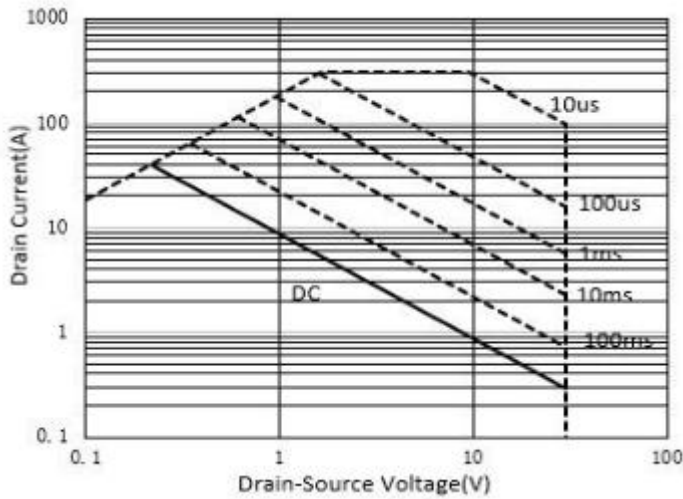


Figure.10 Single Pulse Power Rating Junction-to-Ambient (Note 5)

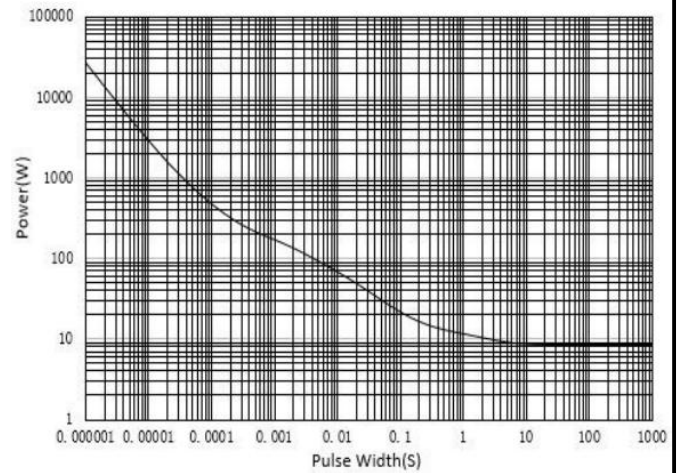
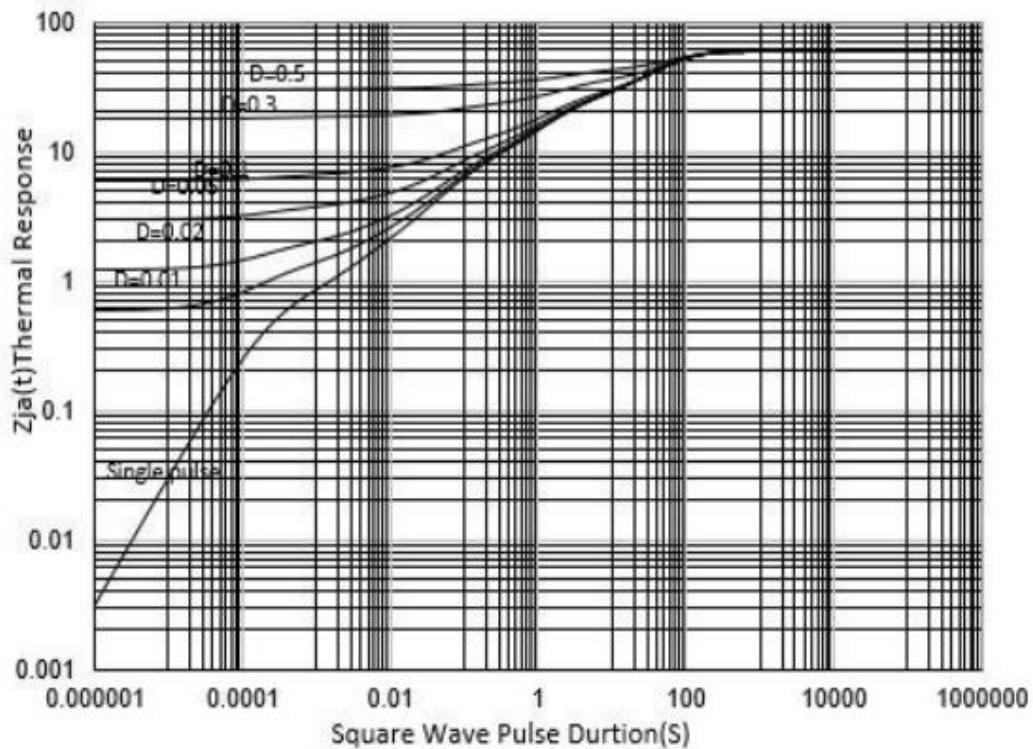
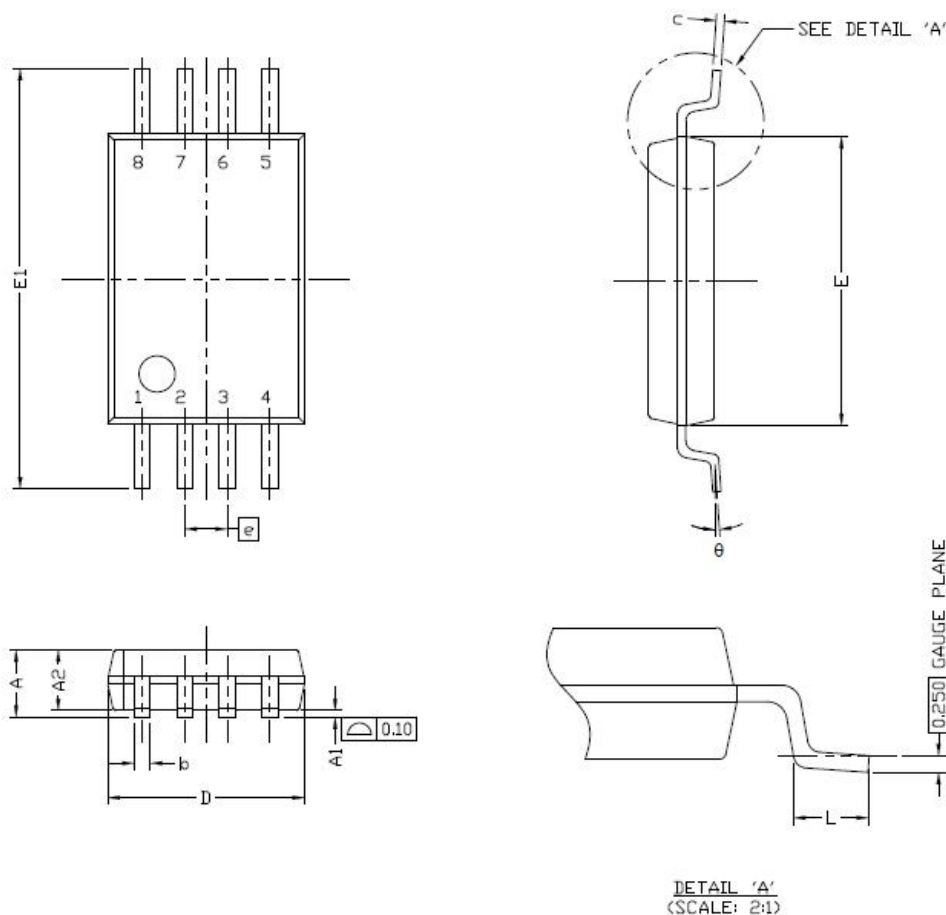


Figure 11: Maximum Transient Thermal Impedance (Note 5)



Package Outline: SOP-8L



DETAIL 'A'
(SCALE: 2:1)

SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.92	-	1.12	0.035	-	0.049
A1	0.05	-	0.15	0.002	-	0.006
A2	0.87	0.92	0.97	0.034	0.036	0.038
b	0.20	0.25	0.30	0.008	0.010	0.012
c	0.08	-	0.20	0.003	-	0.008
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.30	4.40	4.50	0.169	0.173	0.177
e	0.65BSC			0.026BSC		
E1	6.20	6.40	6.60	0.244	0.252	0.260
L	0.45	-	0.75	0.018	-	0.030
θ	0°	-	8°	0°	-	8°

NOTE:

1. CONTROLLING DIMENSION IS MM
2. END FLASH PER SIDE: 0.15 MAX.
3. DIMENSIONS ARE INCLUSIVE OF PLATING