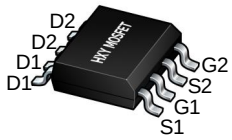
SI4559ADY

Dual N+P-Channel Enhancement Mode MOSFET

Description

The SI4559ADY uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



SOP-8

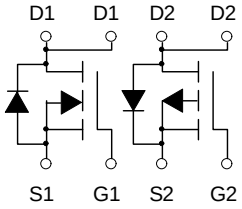
General Features

V_{DS} = 60V I_D =6A

$R_{DS(ON)}$ < 48mΩ @ V_{GS}=10V

V_{DS} = -60V I_D =-5A

$R_{DS(ON)}$ < 85 mΩ @ V_{GS}=-10V



N-Channel and P-Channel

Application

Wireless charging

Boost driver

Brushless motor

Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
SI4559ADY	SOP-8	4559XXX	3000

Absolute Maximum Ratings (T_C=25℃unless otherwise noted)

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
VDS	Drain-Source Voltage	60	-60	V
VGS	Gate-Source Voltage	±20	±20	V
I_D@T_A=25℃	Continuous Drain Current, V_{GS} @ 10V[1]	6.0	-5.0	A
I_D@T_A=70℃	Continuous Drain Current, V_{GS} @ 10V[1]	4.0	-3.5	A
IDM	Pulsed Drain Current[2]	11	-8.5	A
EAS	Single Pulse Avalanche Energy[3]	22.5	35.3	mJ
IAS	Avalanche Current	22.6	-26.6	A
P_D@T_A=25℃	Total Power Dissipation[4]	2.5	2.5	W
TSTG	Storage Temperature Range	-55 to 150	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	℃
$R_{\theta}JA$	Thermal Resistance Junction-Ambient [1]	85		℃/W
$R_{\theta}JC$	Thermal Resistance Junction-Case[1]	62.5		℃/W

N-Channel Electrical Characteristics (T_J=25 , unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	60	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=60V, V_{GS} = 0V,	-	-	1.0	μA
I_{GSS}	Gate to Body Leakage Current	V_{DS}=0V, V_{GS} = ±20V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250μA	1.0	1.6	2.5	V
$R_{DS(on)}$	Static Drain-Source on-Resistance note3	V_{GS}=10V, I_D=5A	-	40	48	mΩ
		V_{GS}=4.5V, I_D=3A	-	48	60	
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS}=25V, V_{GS}=0V, f=1.0MHz	-	1148	-	pF
C_{oss}	Output Capacitance		-	58.5	-	pF
C_{rss}	Reverse Transfer Capacitance		-	49.4	-	pF
Q_g	Total Gate Charge	V_{DS}=30V, I_D=2.5A, V_{GS}=10V	-	20.3	-	nC
Q_{gs}	Gate-Source Charge		-	3.7	-	nC
Q_{gd}	Gate-Drain(“Miller”) Charge		-	5.3	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{DS}=30V, I_D=5A, R_G=1.8Ω, V_{GS}=10V	-	7.6	-	ns
t_r	Turn-on Rise Time		-	20	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	15	-	ns
t_f	Turn-off Fall Time		-	24	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	6	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	20	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS}=0V, I_S=5A	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	I_F=5A, dI/dt=100A/μs	-	29	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	43	-	nC

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. EAS condition : T_J=25℃,V_{DD}=30V,V_G=10V,L=0.5mH,Rg=25Ω,I_{AS}=8.7A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

P-Channel Electrical Characteristics (T_J=25 , unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS}=0V , I_D=-250uA	-60	---	---	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance[2]	V_{GS}=-10V , I_D=-3.5A	---	70	100	mΩ
		V_{GS}=-4.5V , I_D=-3.1A	---	100	115	
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS}=V_{DS} , I_D =-250uA	-1.0	---	-2.5	V
I_{DSS}	Drain-Source Leakage Current	V_{DS}=-48V , V_{GS}=0V , T_J=25℃	---	---	1	uA
		V_{DS}=-48V , V_{GS}=0V , T_J=55℃	---	---	5	
I_{GSS}	Gate-Source Leakage Current	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA
gfs	Forward Transconductance	V_{DS}=-5V , I_D=-3A	---	8.5	---	S
Q_g	Total Gate Charge (-4.5V)	V_{DS}=-48V , V_{GS}=-4.5V , I_D=-3A	---	12.1	---	nC
Q_{gs}	Gate-Source Charge		---	2.2	---	
Q_{gd}	Gate-Drain Charge		---	6.3	---	
$T_{d(on)}$	Turn-On Delay Time	V_{DD}=-15V , V_{GS}=-10V , R_G=3.3Ω, I_D=-1A	---	9.2	---	ns
T_r	Rise Time		---	20.1	---	
$T_{d(off)}$	Turn-Off Delay Time		---	46.7	---	
T_f	Fall Time		---	9.4	---	
C_{iss}	Input Capacitance	V_{DS}=-15V , V_{GS}=0V , f=1MHz	---	1137	---	pF
C_{oss}	Output Capacitance		---	76	---	
C_{rss}	Reverse Transfer Capacitance		---	50	---	
I_S	Continuous Source Current[1,5]	V_G=V_D=0V , Force Current	---	---	-6.0	A
V_{SD}	Diode Forward Voltage[2]	V_{GS}=0V , I_S=-1A , T_J=25℃	---	---	-1.2	V

Note :
1.The data tested by surface mounted on a 1 inch^2 FR-4 board with 2OZ copper.
2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3.The EAS data shows Max. rating . The test condition is V_{DD}=-25V,V_{GS}=-10V,L=0.1mH,I_{AS}=-24A
4.The power dissipation is limited by 150℃ 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.

N-Channel Typical Characteristics

Figure1: Output Characteristics

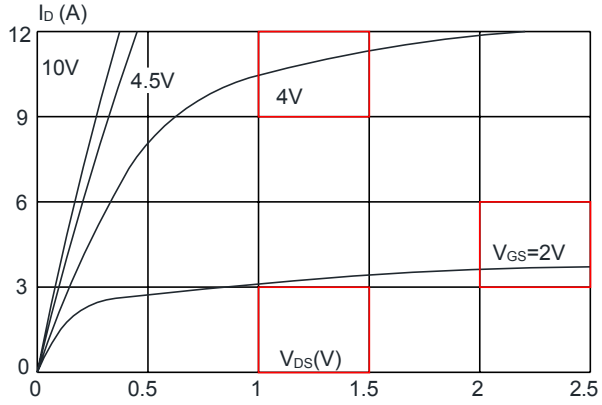


Figure 2: Typical Transfer Characteristics

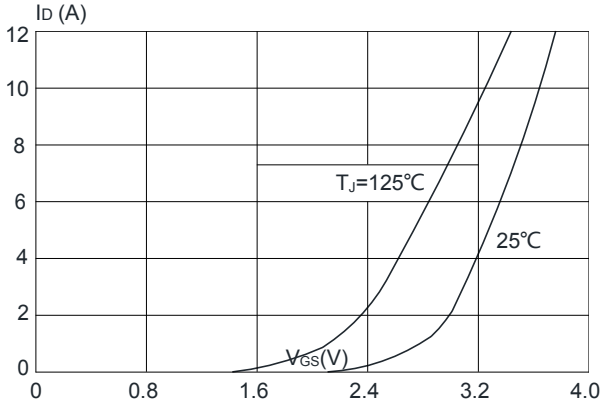


Figure 3: On-resistance vs. Drain Current

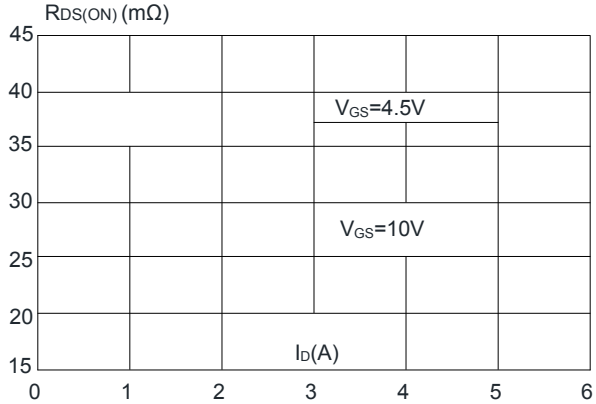


Figure 4: Body Diode Characteristics

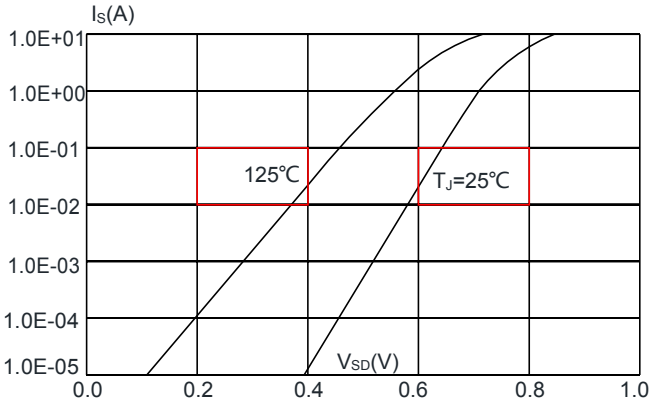


Figure 5: Gate Charge Characteristics

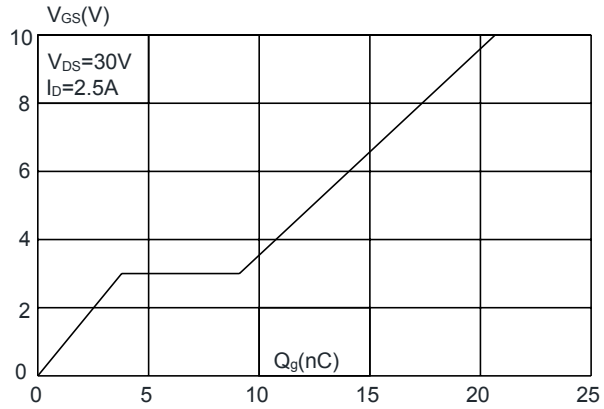


Figure 6: Capacitance Characteristics

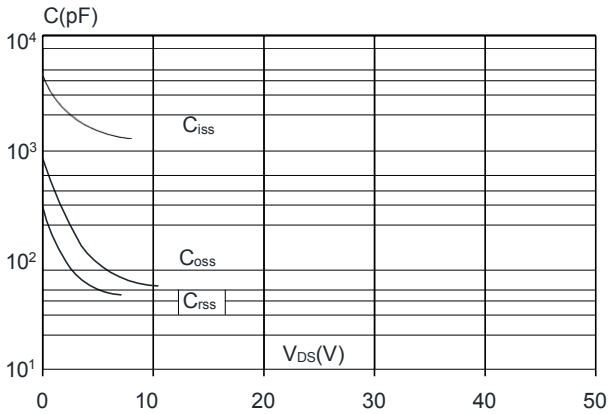


Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

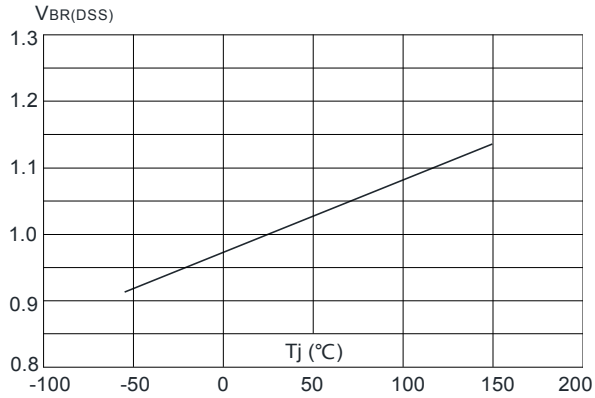


Figure 8: Normalized on Resistance vs. Junction Temperature

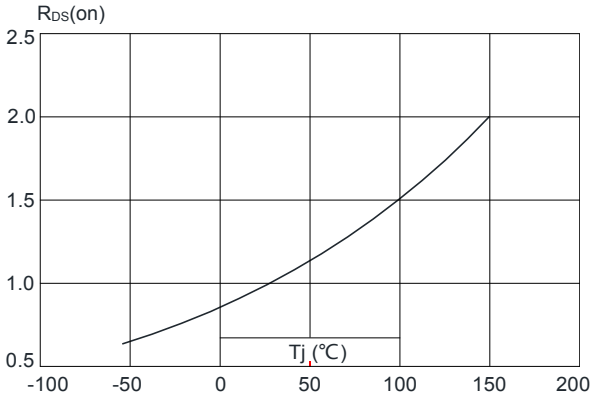


Figure 9: Maximum Safe Operating Area

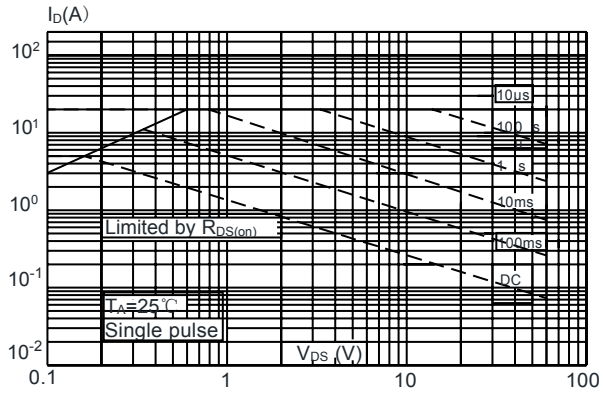


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

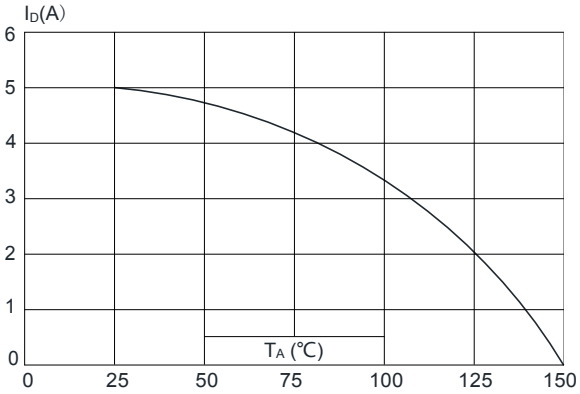
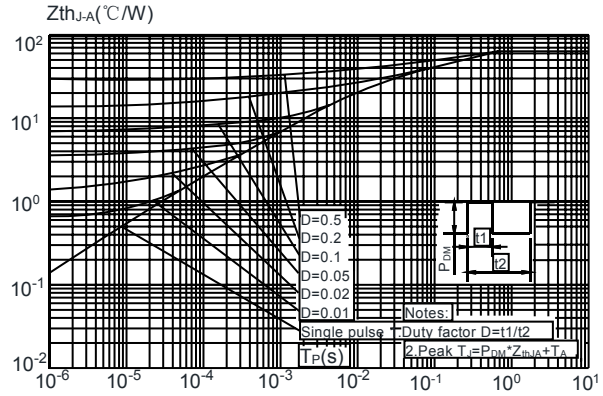


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



P-Channel Typical Characteristics

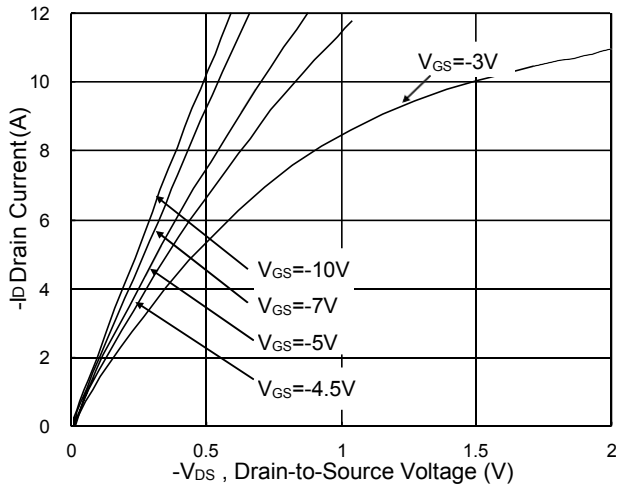


Fig.1 Typical Output Characteristics

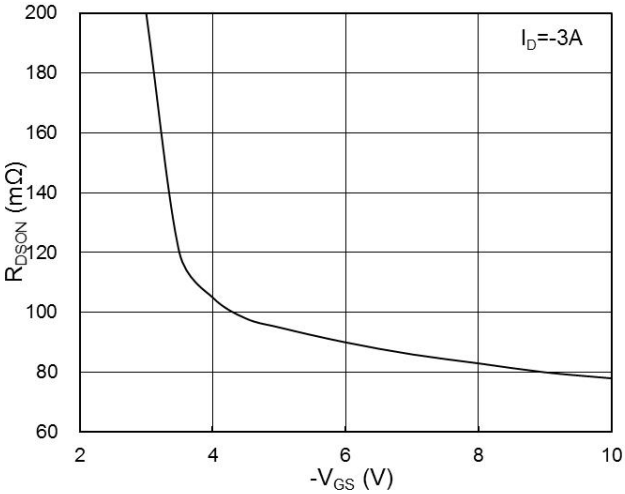


Fig.2 On-Resistance vs. G-S Voltage

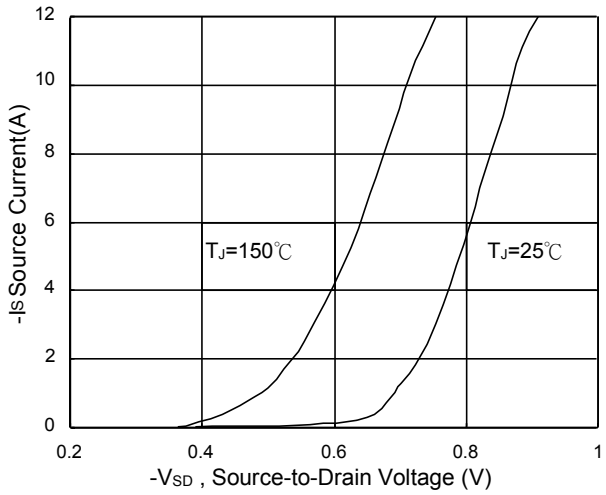


Fig.3 Source Drain Forward Characteristics

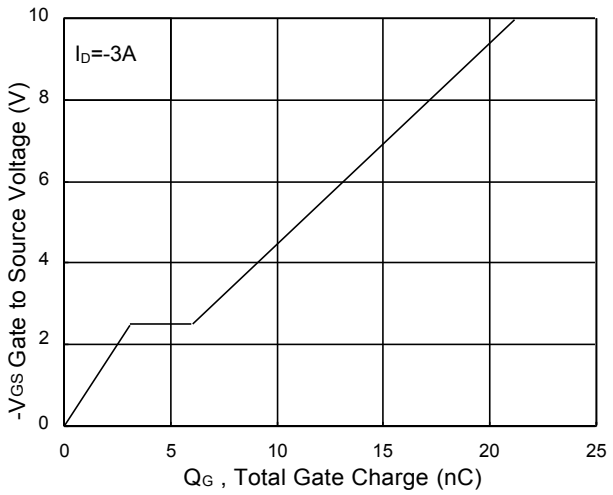


Fig.4 Gate-Charge Characteristics

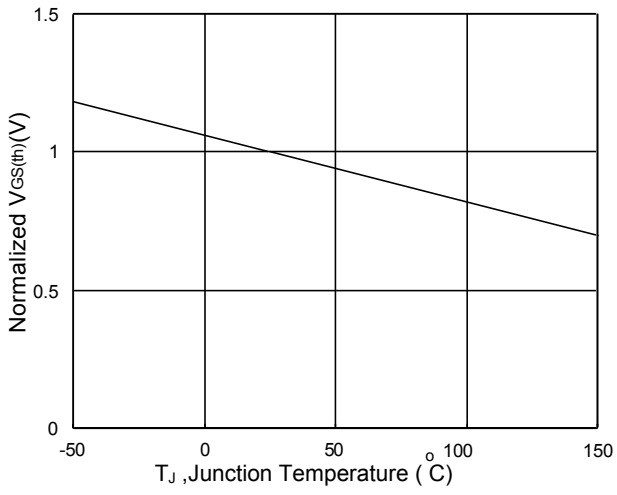


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

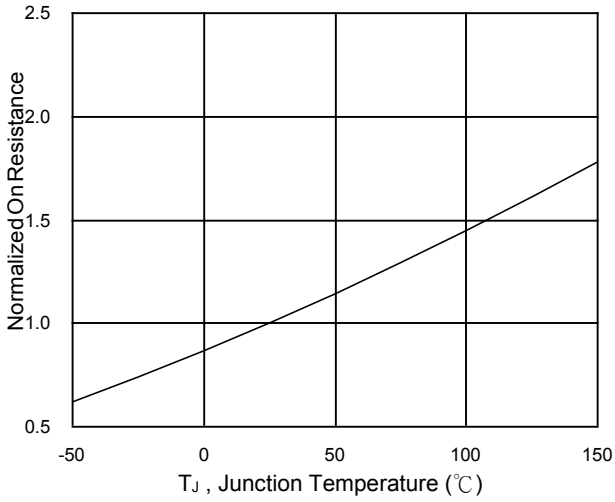


Fig.6 Normalized R_{DSON} vs. T_J

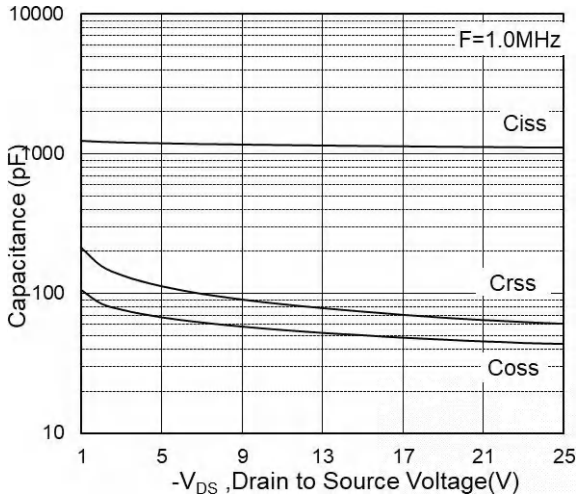


Fig.7 Capacitance

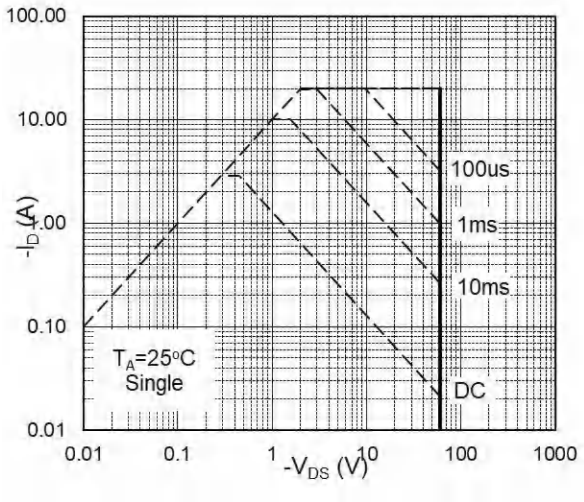


Fig.8 Safe Operating Area

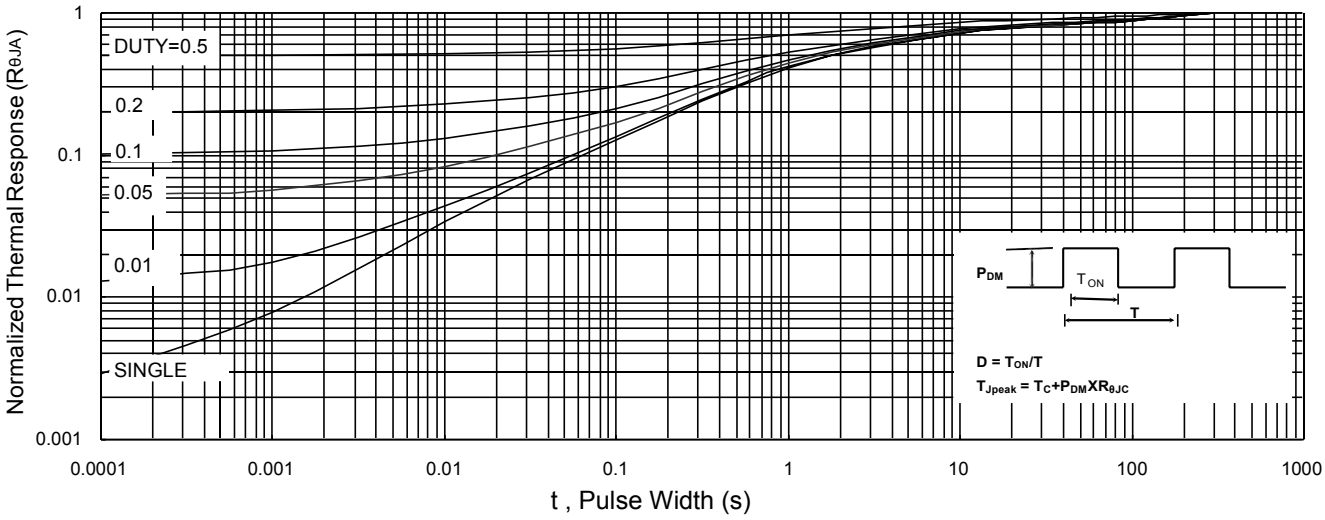


Fig.9 Normalized Maximum Transient Thermal Impedance

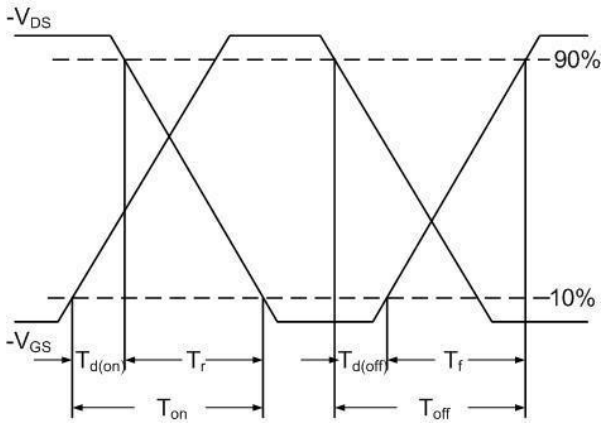


Fig.10 Switching Time Waveform

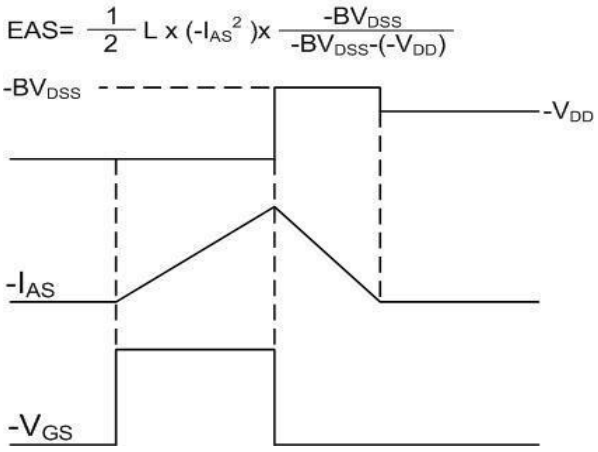
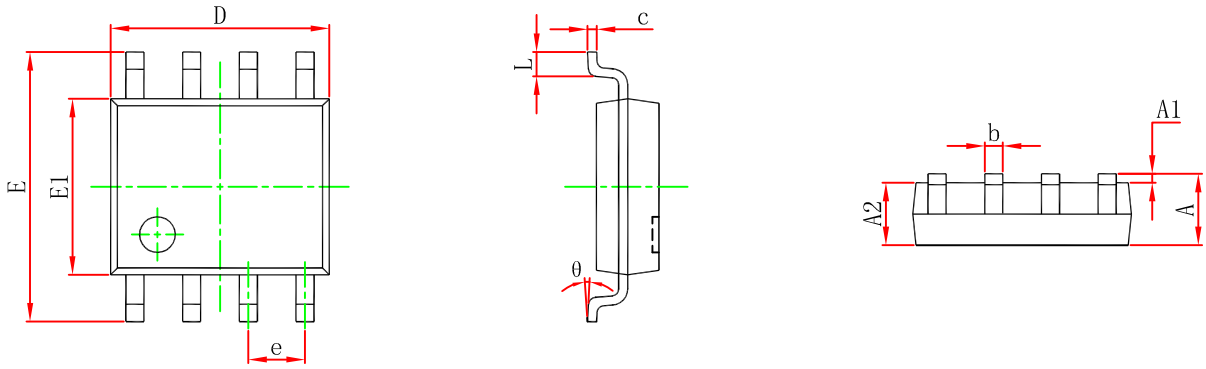
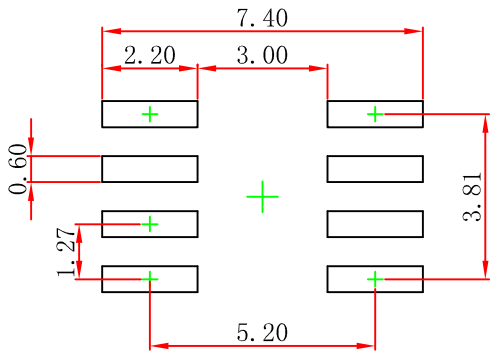


Fig.11 Unclamped Inductive Waveform

SOP-8 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.800	5.000	0.189	0.197
e	1.270 (BSC)		0.050 (BSC)	
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°



Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.

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