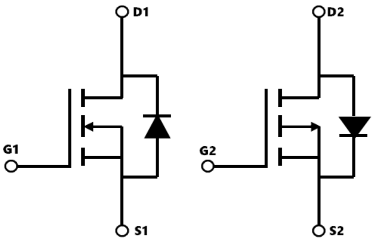
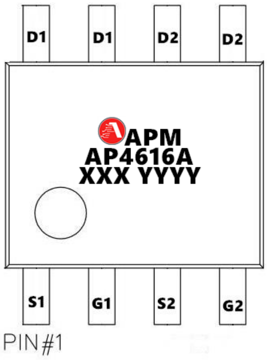
30V N+P-Channel Enhancement Mode MOSFET

Description

The AP4616A 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.





General Features

V_{DS} = 30V I_D =8.8A

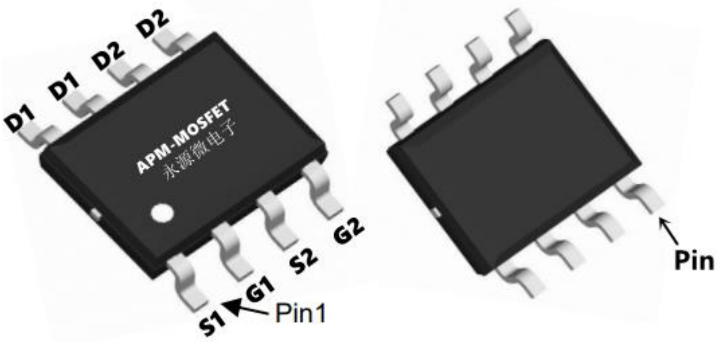
$R_{DS(ON)}$ < 22mΩ @ V_{GS}=10V （Type：15mΩ）

V_{DS} = -30V I_D =-8.2A

$R_{DS(ON)}$ < 38mΩ @ V_{GS}=-10V（Type：33mΩ）

Application

BLDC



Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP4616A	SOP-8L	AP4616A XXX YYYY	3000

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

Symbol	Parameter	N-Ch	P-Ch	Units
VDS	Drain-Source Voltage	30	-30	V
VGS	Gate-Source Voltage	±20	±20	V
I_D@T_A=25℃	Continuous Drain Current, V_{GS} @ 10V[1]	8.8	-8.2	A
I_D@T_A=70℃	Continuous Drain Current, V_{GS} @ 10V[1]	5.5	-5.2	A
IDM	Pulsed Drain Current[2]	24	-26	A
EAS	Single Pulse Avalanche Energy[3]	26.6	37	mJ
IAS	Avalanche Current	12.7	10	A
P_D@T_A=25℃	Total Power Dissipation[4]	1.5	1.5	W
TSTG	Storage Temperature Range	-55 to 150		℃
T_J	Operating Junction Temperature Range	-55 to 150		℃
$R_{\theta}JA$	Thermal Resistance Junction-Ambient [1]	85		℃/W
$R_{\theta}JC$	Thermal Resistance Junction-Case[1]	60		℃/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	V_{GS}=0V , I_D=250uA	30	34	---	V
△BVDSS/△TJ	BVDSS Temperature Coefficient	Reference to 25℃ , I_D=1mA	---	0.023	---	V/℃
RDS(ON)	Static Drain-Source On-Resistance[2]	V_{GS}=10V , I_D=5A	---	15	22	mΩ
		V_{GS}=4.5V , I_D=3A	---	22	30	
VGS(th)	Gate Threshold Voltage	V_{GS}=V_{DS} , I_D =250uA	1.0	1.6	2.5	V
△$V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-4.2	---	mV/℃
IDSS	Drain-Source Leakage Current	V_{DS}=24V , V_{GS}=0V , T_J=25℃	---	---	1	uA
		V_{DS}=24V , V_{GS}=0V , T_J=55℃	---	---	5	
IGSS	Gate-Source Leakage Current	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA
gfs	Forward Transconductance	V_{DS}=5V , I_D=6A	---	5.8	---	S
R_g	Gate Resistance	V_{DS}=0V , V_{GS}=0V , f=1MHz	---	2.3	---	Ω
Q_g	Total Gate Charge (4.5V)	V_{DS}=20V , V_{GS}=4.5V , I_D=6A	---	5	---	nC
Q_{gs}	Gate-Source Charge		---	1.11	---	
Q_{gd}	Gate-Drain Charge		---	2.61	---	
Td(on)	Turn-On Delay Time	V_{DD}=12V , V_{GS}=10V , R_G=3.3Ω I_D=6A	---	7.7	---	ns
T_r	Rise Time		---	46	---	
Td(off)	Turn-Off Delay Time		---	11	---	
T_f	Fall Time		---	3.6	---	
C_{iss}	Input Capacitance	V_{DS}=15V , V_{GS}=0V , f=1MHz	---	416	---	pF
Coss	Output Capacitance		---	62	---	
Crss	Reverse Transfer Capacitance		---	51	---	
I_S	Continuous Source Current[1,6]	V_G=V_D=0V , Force Current	---	---	6.2	A
ISM	Pulsed Source Current[2,6]		---	---	24	A
VSD	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 power dissipation is limited by 150℃ junction temperature

4、The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BVDSS	Drain-Source Breakdown Voltage	V_{GS}=0V , I_D=-250uA	-30	-32	---	V
△BVDSS/△TJ	BVDSS Temperature Coefficient	Reference to 25℃ , I_D=-1mA	---	-0.02	---	V/℃
RDS(ON)	Static Drain-Source On-Resistance[2]	V_{GS}=-10V , I_D=-4.1A	---	33	38	mΩ
		V_{GS}=-4.5V , I_D=-3.5A	---	44	52	
VGS(th)	Gate Threshold Voltage	V_{GS}=V_{DS} , I_D =-250uA	-1.0	-1.7	-2.5	V
△$V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.32	---	mV/℃
IDSS	Drain-Source Leakage Current	V_{DS}=-24V , V_{GS}=0V , T_J=25℃	---	---	-1	uA
		V_{DS}=-24V , V_{GS}=0V , T_J=55℃	---	---	-5	
IGSS	Gate-Source Leakage Current	V_{GS}=±20V , V_{DS}=0V	---	---	±100	nA
gfs	Forward Transconductance	V_{DS}=-5V , I_D=-3A	---	4.7	---	S
R_g	Gate Resistance	V_{DS}=0V, V_{GS}=0V, f=1MHz	---	24	---	Ω
Q_g	Total Gate Charge (-4.5V)	V_{DS}=-20V, V_{GS}=-4.5V, I_D=-5A	---	5.22	---	nC
Q_{gs}	Gate-Source Charge		---	1.25	---	
Q_{gd}	Gate-Drain Charge		---	2.3	---	
Td(on)	Turn-On Delay Time	V_{DD}=-15V, V_{GS}=-10V , R_G=3.3Ω,I_D=-1A	---	18.4	---	ns
T_r	Rise Time		---	11.4	---	
Td(off)	Turn-Off Delay Time		---	39.4	---	
T_f	Fall Time		---	5.2	---	
C_{iss}	Input Capacitance	V_{DS}=-15V, V_{GS}=0V, f=1MHz	---	463	---	pF
Coss	Output Capacitance		---	82	---	
Crss	Reverse Transfer Capacitance		---	68	---	
I_S	Continuous Source Current[1,6]	V_G=V_D=0V, Force Current	---	---	-4	A
ISM	Pulsed Source Current[2,6]		---	---	-24	A
VSD	Diode Forward Voltage[2]	V_{GS}=0V, I_S=-1A , T_J=25℃	---	---	-1	V

Note :

1、The data tested by surface mounted on a 1 inch FR-4 board with 2OZ copper.
2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3、The power dissipation is limited by 150℃ junction temperature
4、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

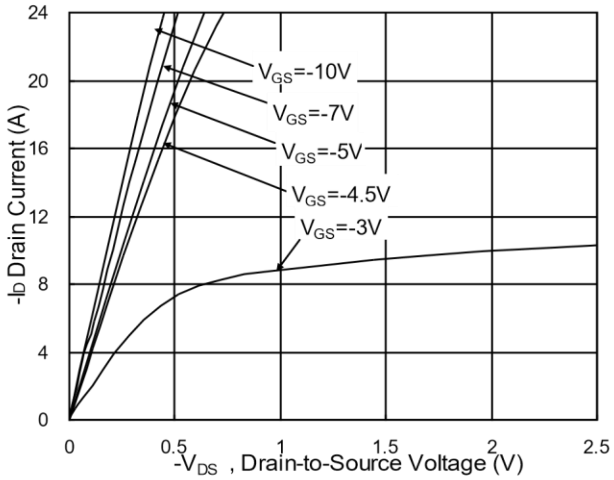


Fig.1 Typical Output Characteristics

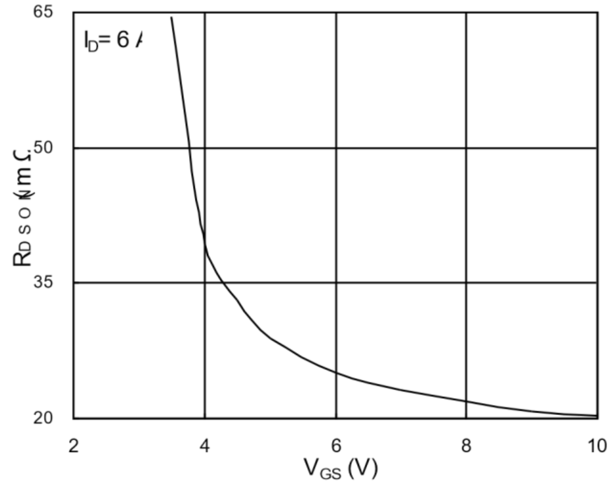


Fig.2 On-Resistance vs. Gate-Source

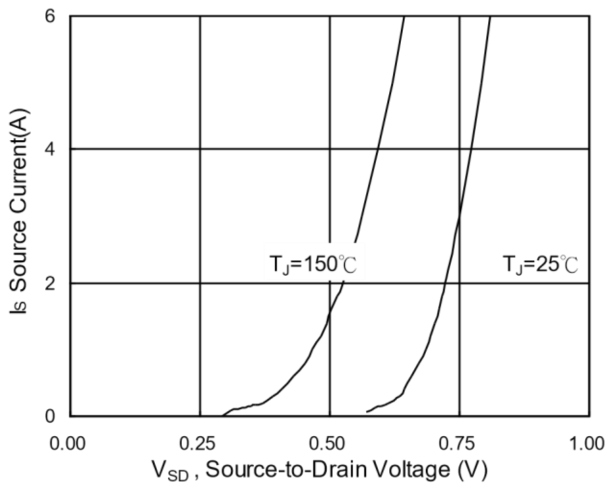


Fig.3 Forward Characteristics Of Reverse

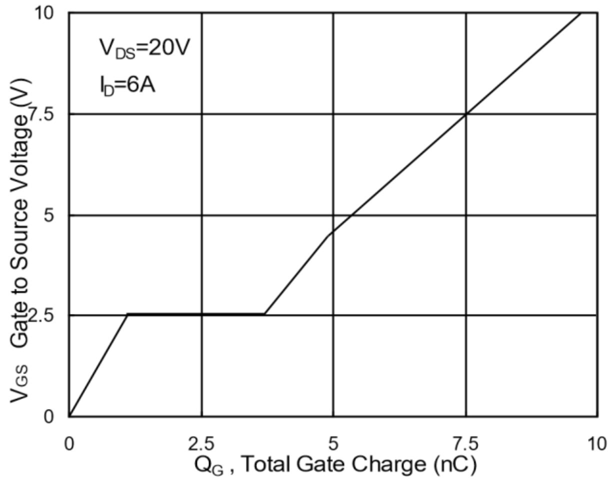


Fig.4 Gate-Charge Characteristics

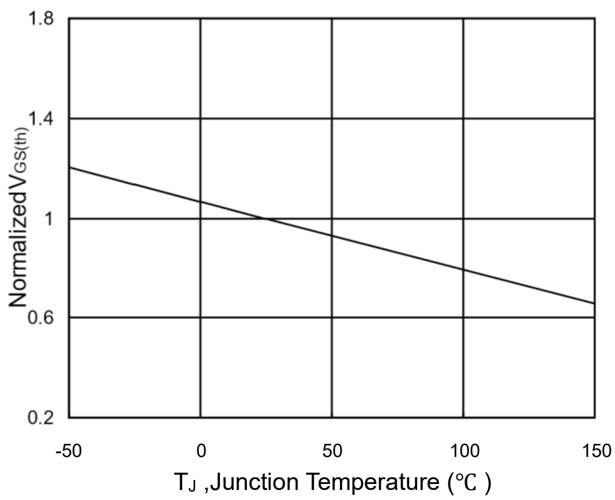


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

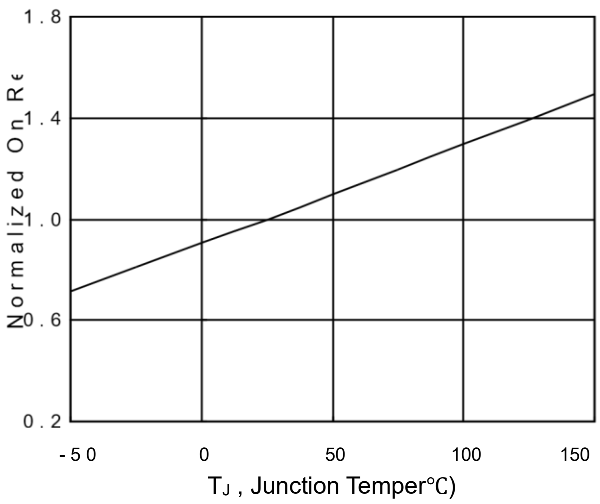


Fig.6 Normalized R_{DSON} vs. T_J

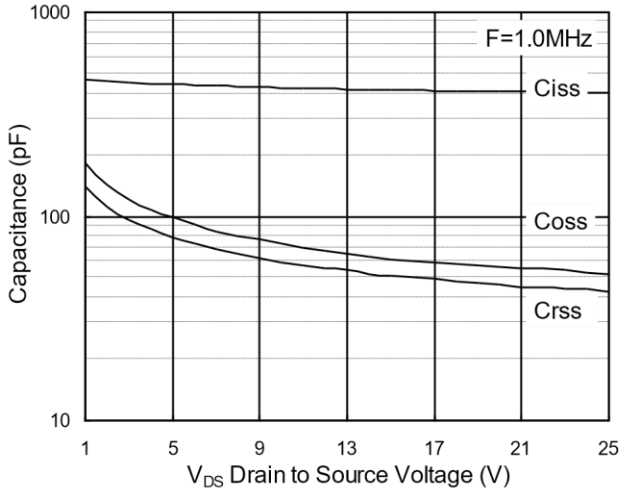


Fig.7 Capacitance

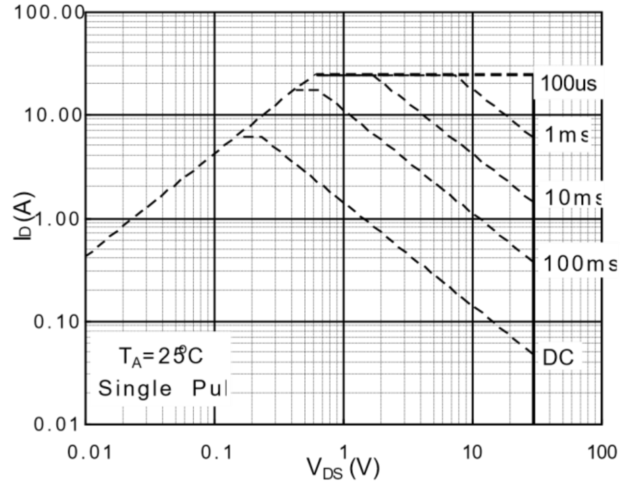


Fig.8 Safe Operating Area

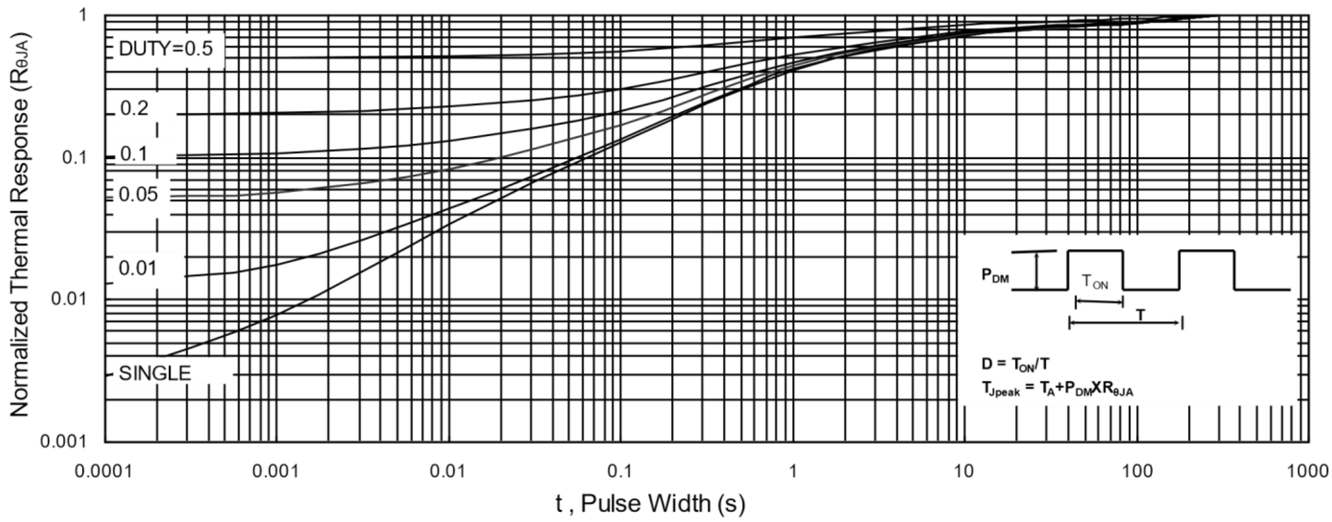


Fig.9 Normalized Maximum Transient Thermal Impedance

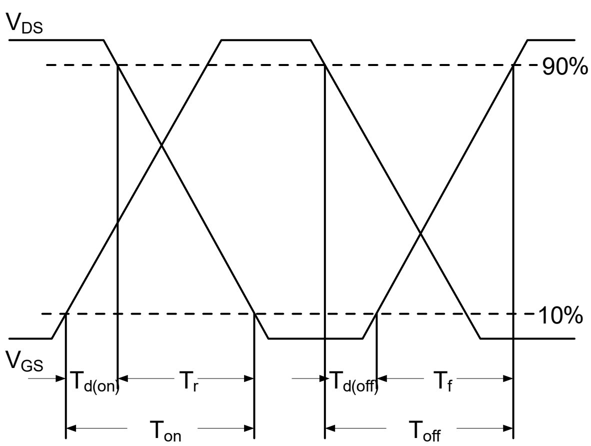


Fig.10 Switching Time Waveform

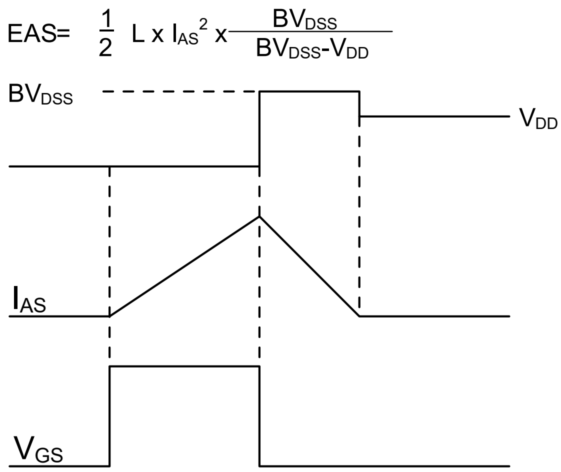


Fig.11 Unclamped Inductive Switching Waveform

P-Channel Typical Characteristics

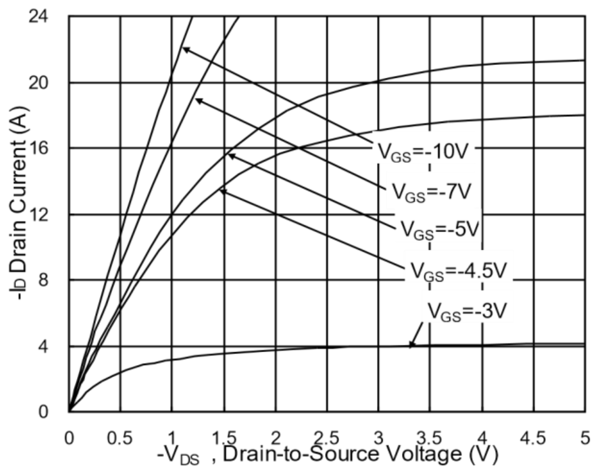


Fig.1 Typical Output Characteristics

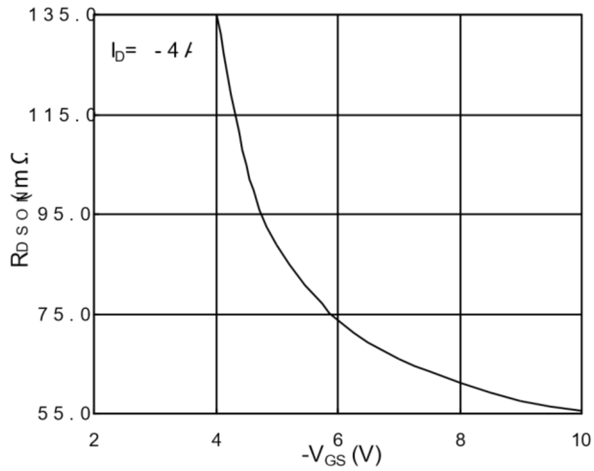


Fig.2 On-Resistance vs. G-S Voltage

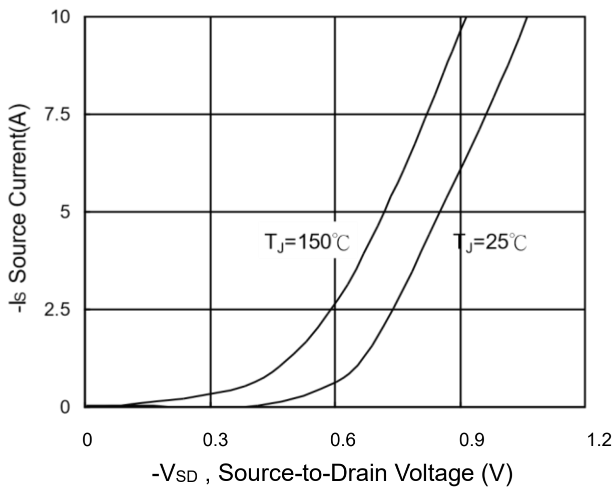


Fig.3 Forward Characteristics of Reverse

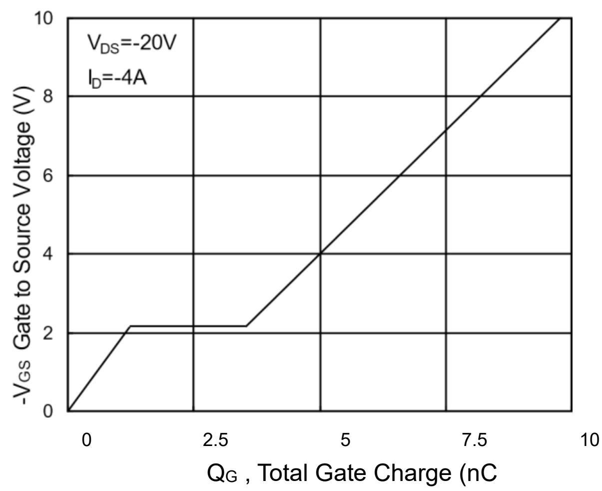


Fig.4 Gate-Charge Characteristics

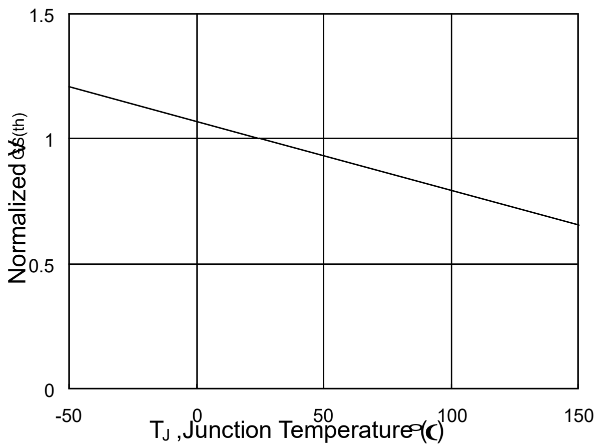


Fig.5 Normalized $V_{GS(th)}$ vs. T_J

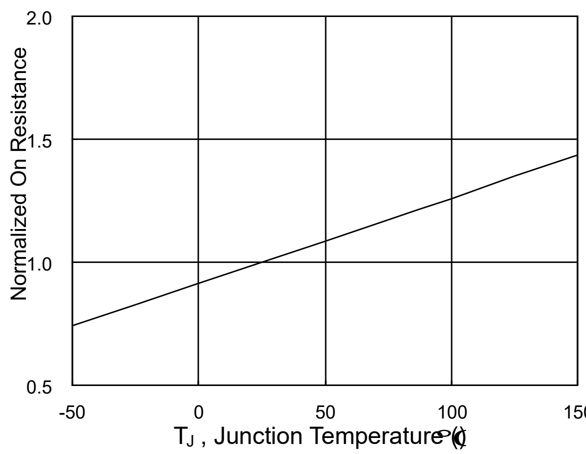


Fig.6 Normalized R_{DSON} vs. T_J

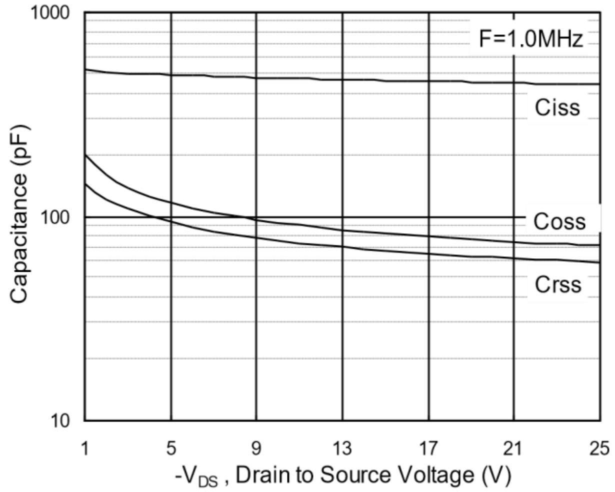


Fig.7 Capacitance

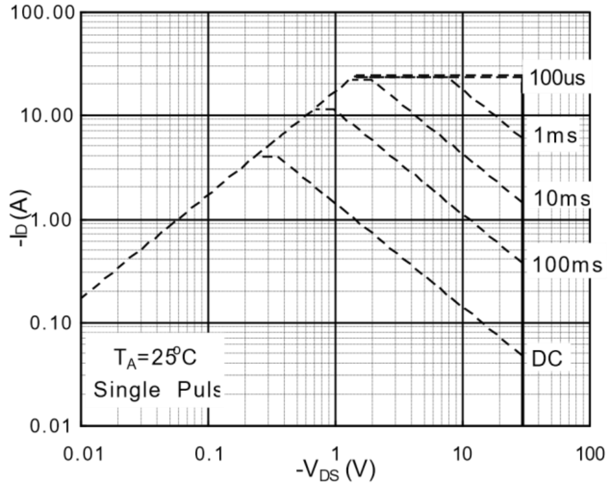


Fig.8 Safe Operating Area

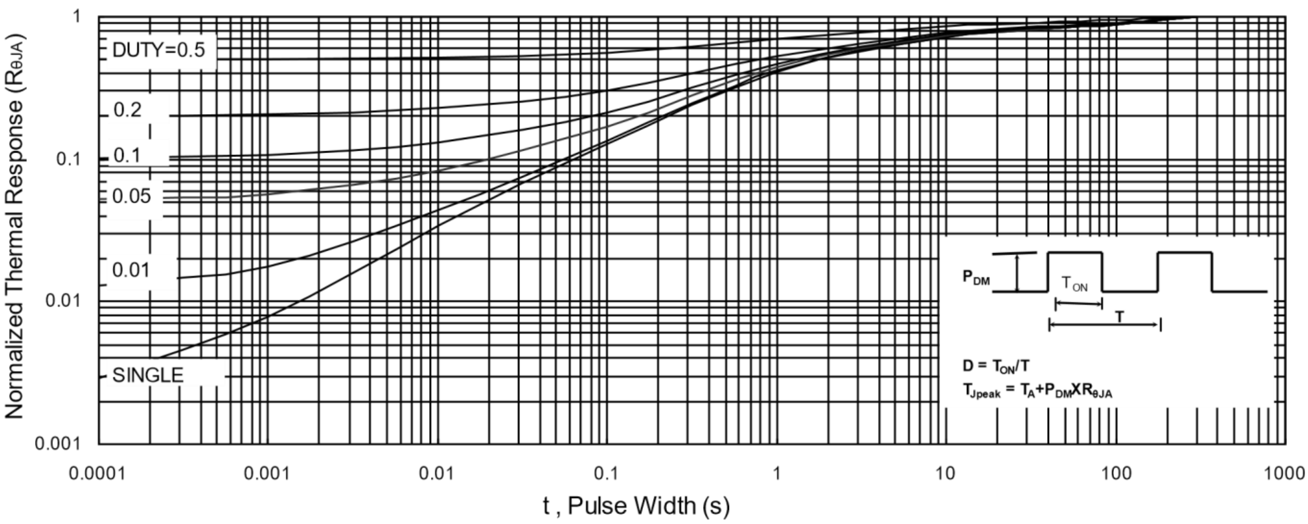


Fig.9 Normalized Maximum Transient Thermal Impedance

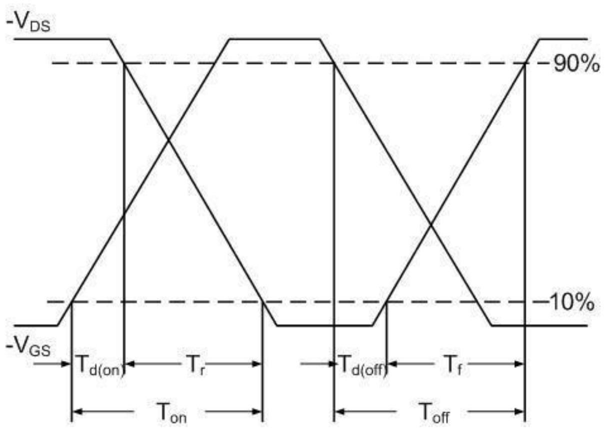


Fig.10 Switching Time Waveform

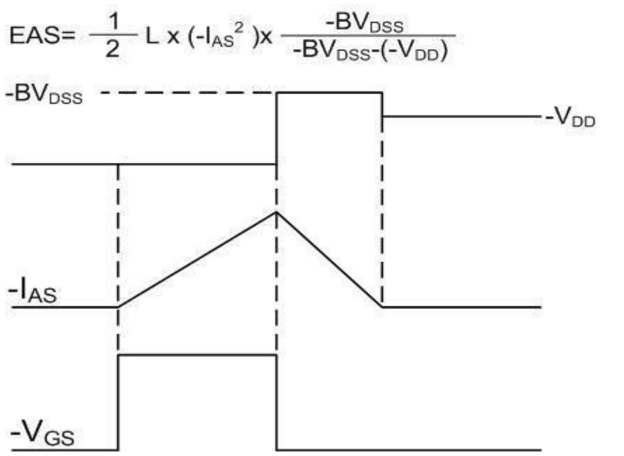
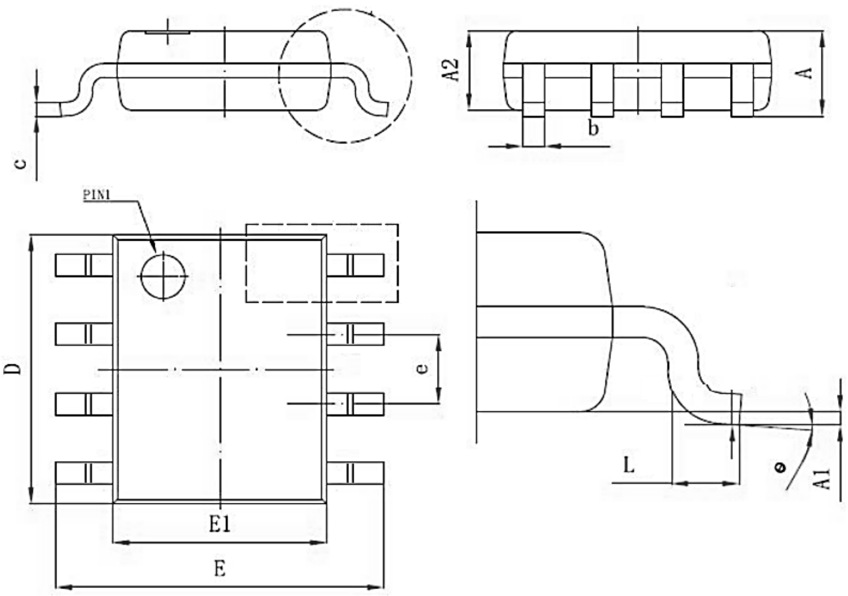


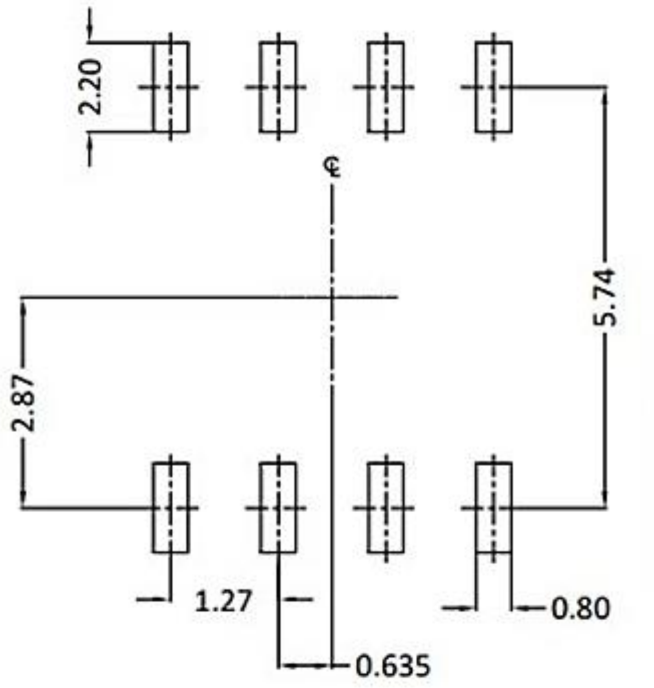
Fig.11 Unclamped Inductive Switching Waveform

Package Mechanical Data-SOP-8L



Symbol	Dim in mm		
	Min	Typ	Max
A	1.35	1.55	1.75
A1	0.02	0.15	0.25
A2	1.425	1.45	1.475
b	0.3	0.4	0.5
c	0.15	0.2	0.25
D	4.8	5	5.2
E	5.8	6	6.2
E1	3.8	4	4.2
e	1.27BSC		
L	0.4		1.27
θ	0°		8°

Recommended Minimum Pads



Dimensions in （mm）

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Edition	Date	Change
REV1.0	2023/12/10	Initial release