S2M120R040W

SiC Power MOSFET

Features:

- 1200V High Blocking Voltage
- Low On-Resistance
- High Speed Switching
- Easy to Parallel

Benefits:

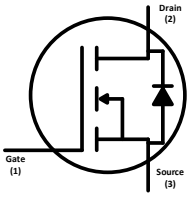
- Increased frequency
- Minimal switching loss
- Higher Efficiency
- Low cooling requirement

Symbol	Value	Unit
V_{DS}	1200	V
I_{DS} (Tc=25ºC)	80	A
R_{DSon}	40	mΩ

Outline

TO-247-3

Circuit



Applications:

- Switch Mode Power Supply
- High Voltage DC/DC Converters
- Solar Inverters
- Motor Drivers

Maximum Ratings (Tc=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain-Source Voltage	1200	V	V_{GS}=0V, I_{DS}=100μA
V_{GSmax}	Gate-Source Voltage	-10/+25	V	Absolute Maximum values
V_{GSop}	Gate-Source Voltage	-5/+20	V	Recommended operational values
I_{DS}	Continuous Drain Current	80 50	A	V_{GS}=20V, T_C =25°C V_{GS}=20V, T_C =100°C
$I_{DS(pulse)}$	Pulsed Drain Current	160	A	Pulse width t_p limited by T_{Jmax}
P_D	Power Dissipation	312	W	T_C =25°C, T_J =150°C
$T_{J,max}$	Operating Junction Temperature	150	°C	
T_{stg}	Storage Temperature Range	-55 to 150	°C	

Thermal characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Thermal resistance	–	0.40	–	°C/W

Electrical Characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200		–	V	V_{GS}=0V, I_{DS}=100μA
$V_{GS(th)}$	Gate Threshold Voltage	1.2 –	2.2 1.5	3 –	V	V_{DS}=V_{GS}, I_{DS}=10mA, T_J =25°C V_{DS}=V_{GS}, I_{DS}=10mA, T_J=150°C
I_{DSS}	Zero Gate Voltage Drain Current	–	5	100	μA	V_{DS}=1200V, V_{GS}=0V
I_{GSS}	Gate-Source Leakage Current	–		250	nA	V_{GS}=20V, V_{DS}=0V
R_{DSon}	Drain-Source On-State Resistance	– –	38 60	50 –	mΩ	V_{GS}=20V, I_{DS}=40A, T_J =25°C V_{GS}=20V, I_{DS}=40A, T_J=150°C
g_{fs}	Transconductance	–	13.3	–	S	V_{DS}=20V, I_{DS}=40A
$R_{G,int}$	Internal Gate Resistance	–	1.25	–	Ω	f=1 MHz, V_{AC}=25mV
C_{ISS}	Input Capacitance	–	3012	–	pF	V_{DS}=1000V, V_{GS}=0V f=1 MHz, V_{AC}=25mV
C_{OSS}	Output Capacitance	–	196	–		
C_{RSS}	Reverse Transfer Capacitance	–	19	–		
E_{OSS}	C_{OSS} Stored Energy	–	120	–	μJ	
E_{on}	Turn-On Switching Energy	–	719	–	μJ	V_{DD}=800V, V_{GS}=-5/20V, I_{DS}=40A, $R_{G(EXT)}$=1Ω, L=0.5mH
E_{off}	Turn-off Switching Energy	–	79	–		
$t_{d(on)}$	Turn-On Delay Time	–	16	–	ns	V_{DD}=800V, V_{GS}=-5/20V, I_{DS}=40A, $R_{G(EXT)}$=1Ω, R_L=20 Ω, Timing relative to V_{DS}
t_r	Rise Time	–	18	–		
$t_{d(off)}$	Turn-off Delay Time	–	30	–		
t_f	Fall Time	–	13	–		
Q_{GS}	Gate to Source Charge	–	52	–	nC	V_{GS}=-5/20V, V_{DS}=800V, I_{DS}=40A
Q_{GD}	Gate to Drain Charge	–	86	–		
Q_G	Total Gate Charge	–	216	–		

Body Diode Characteristics

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
V_{SD}	Diode Forward Voltage	– –	4.3 3.8	– –	V	V_{GS}=-5V, I_{SD}=10A, T_J =25°C V_{GS}=-5V, I_{SD}=10A, T_J=150°C
I_{SD}	Continuous Diode Current	–	57	–	A	
t_{rr}	Reverse Recovery Time	–	68	–	ns	V_{GS}=-5V, I_{SD}=40A, VR=800V, di/dt=1250A/μs
Q_{rr}	Reverse Recovery Charge	–	408	–	nC	

I_{rrm}	Peak Reverse Recovery Current		14		A	

Typical Performance

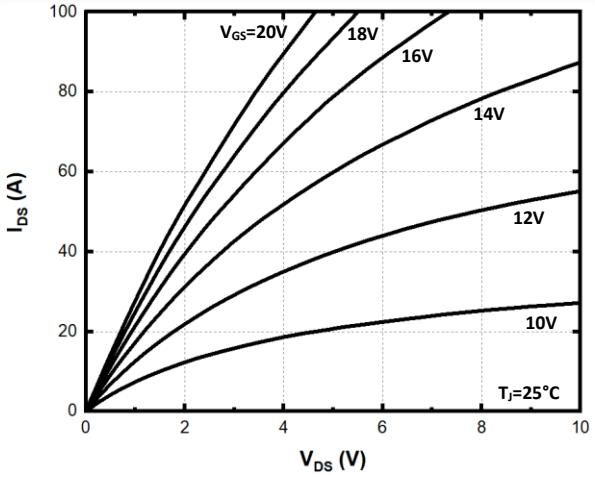


Fig. 1 Output Characteristics, T_J=25°C

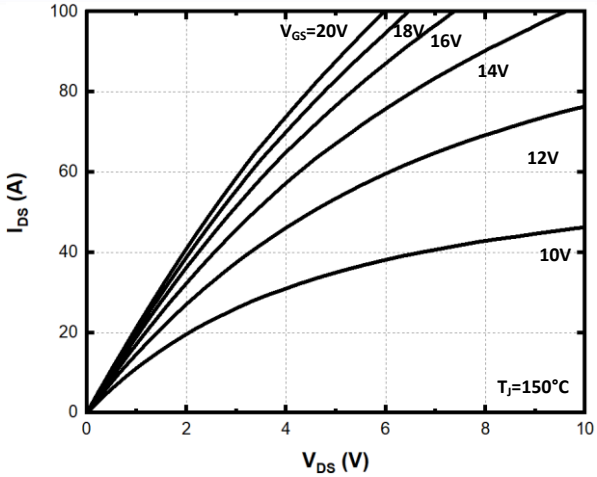


Fig. 2 Output Characteristics, T_J=150°C

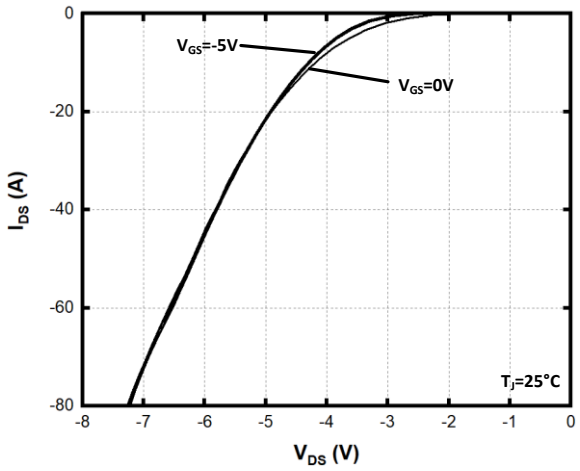


Fig. 3 Body Diode Characteristics, T_J=25°C

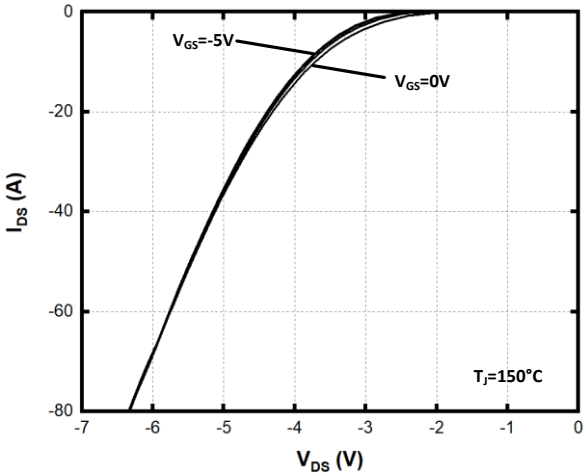
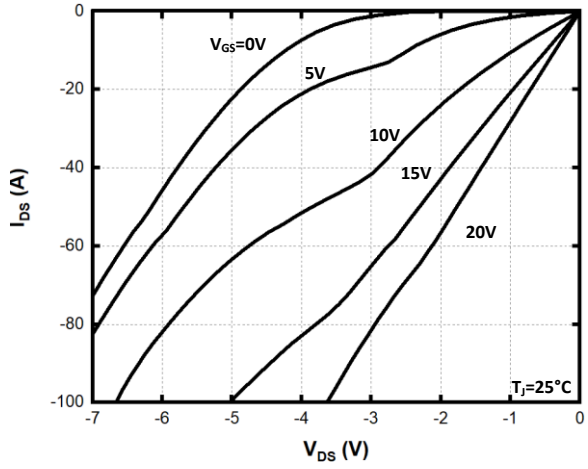


Fig. 4 Body Diode Characteristics, T_J=150°C



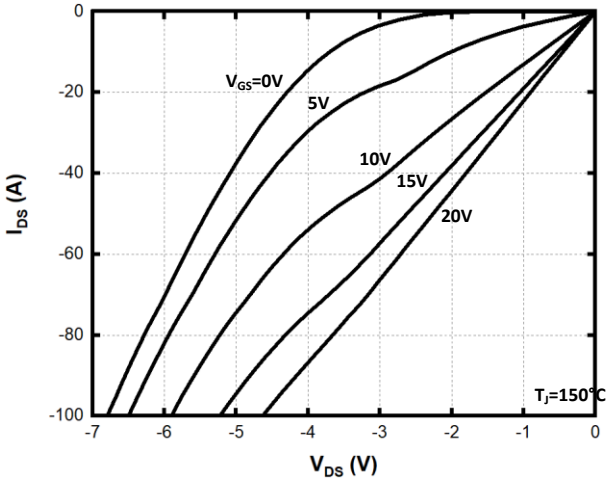


Fig. 5 3rd Quadrant Characteristics, T_J=25°C

Fig. 6 3rd Quadrant Characteristics, T_J=150°C

Typical Performance

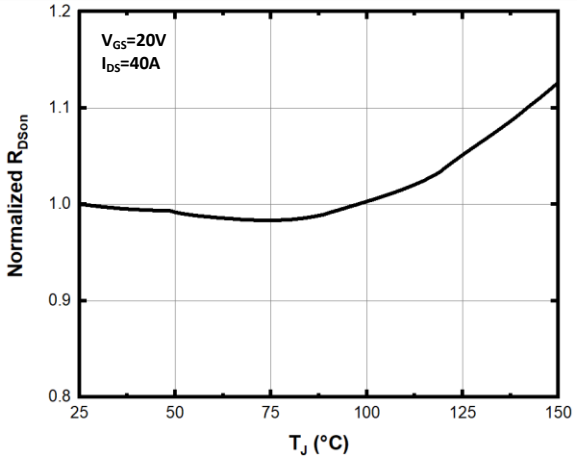


Fig. 7 Normalized On-Resistance vs Temperature

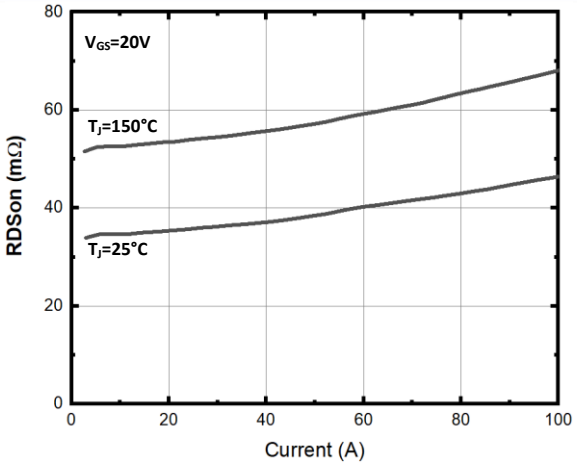


Fig. 8 On-Resistance vs Drain Current

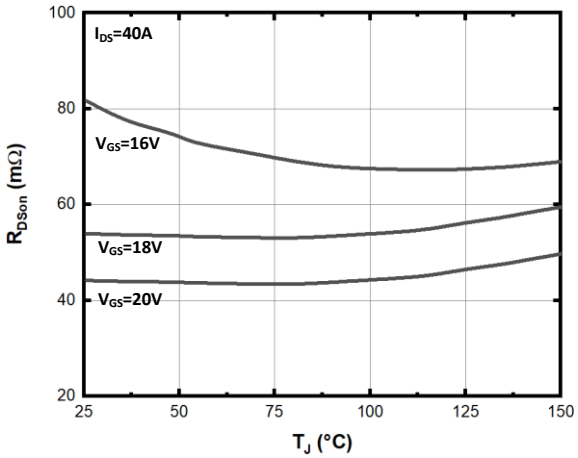


Fig. 9 On-Resistance vs Temperature

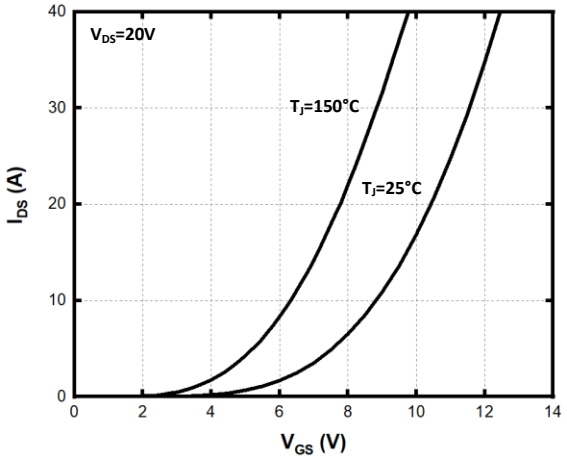


Fig. 10 Transfer Characteristics

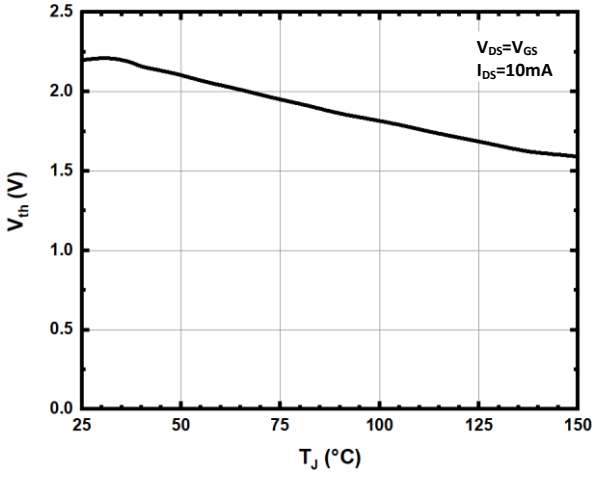


Fig. 11 Threshold Voltage vs. Temperature

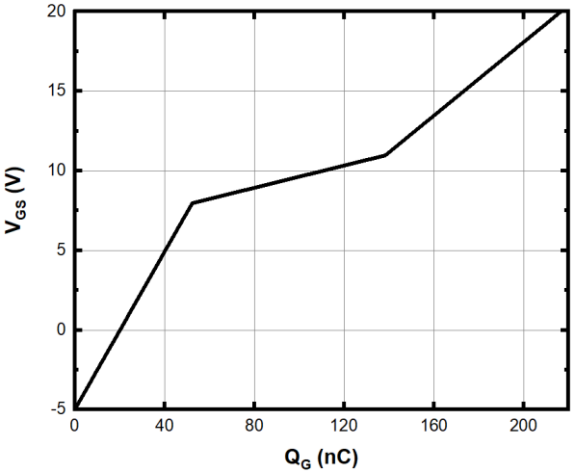


Fig. 12 Gate Charge Characteristics

Typical Performance

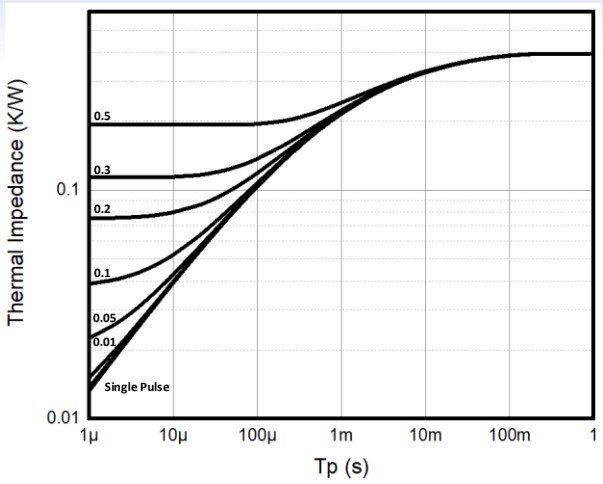


Fig. 13 Transient Thermal Impedance

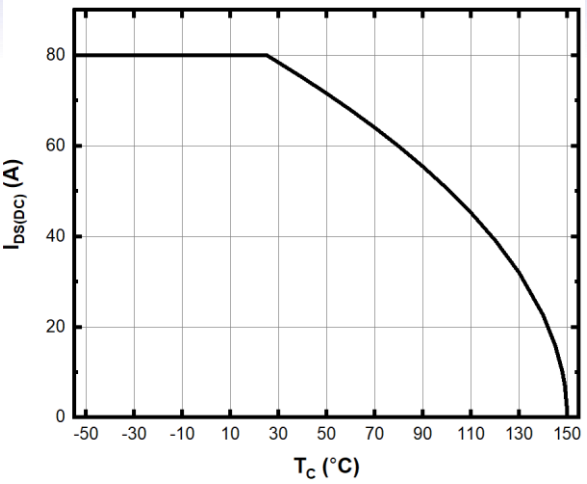


Fig. 14 Continuous Drain Current Derating

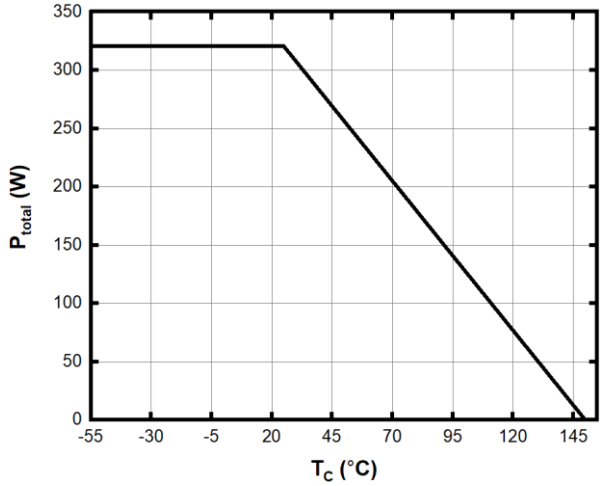


Fig. 15 Power Derating

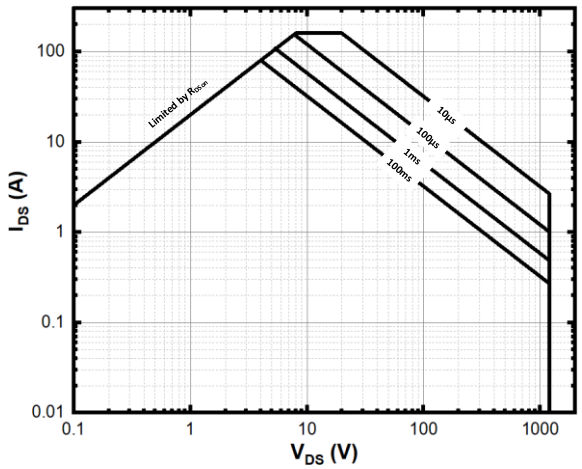


Fig. 16 Safe Operating Area

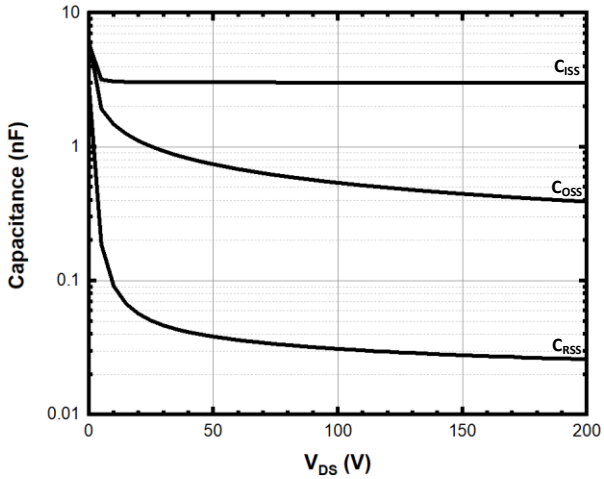


Fig. 17 Capacitances vs V_{DS} (200V)

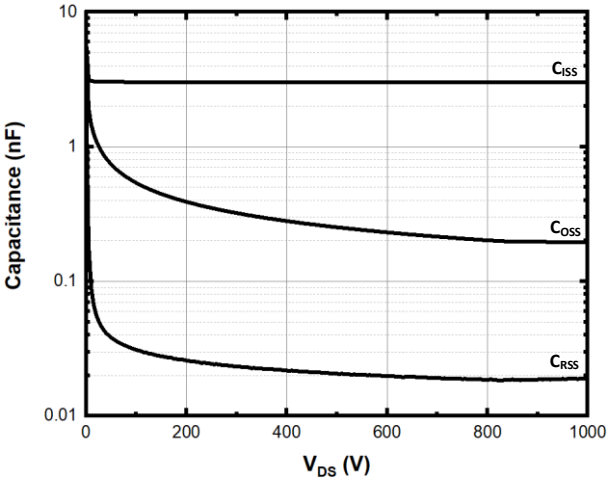


Fig. 18 Capacitances vs V_{DS} (800V)

Typical Performance

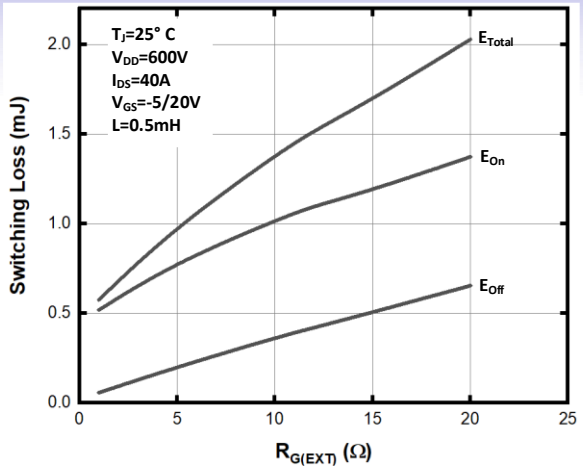


Fig. 19 Switching Loss vs $R_{G(EXT)}$ (600V)

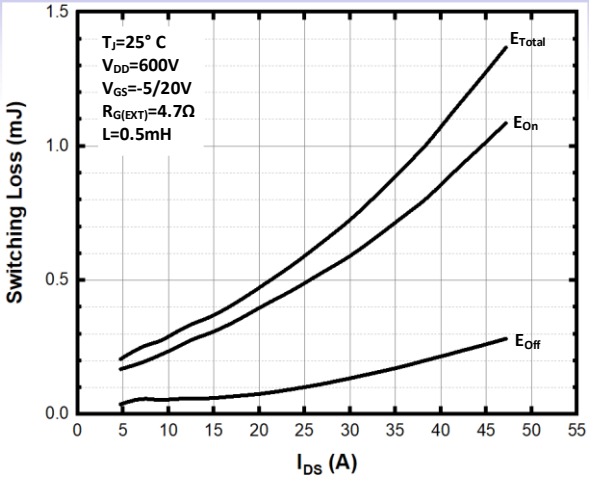


Fig. 20 Switching Loss vs Drain Current (600V)

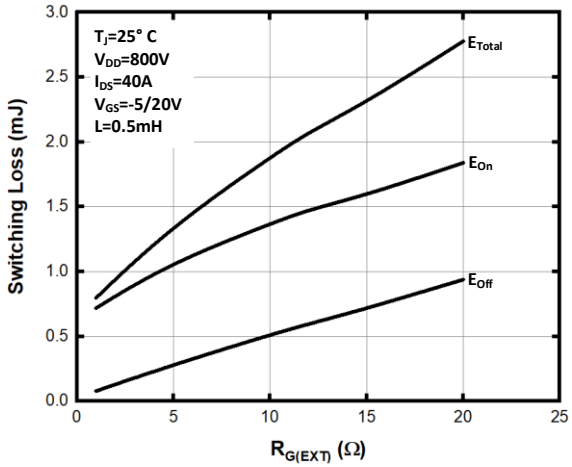


Fig. 21 Switching Loss vs $R_{G(EXT)}$ (800V)

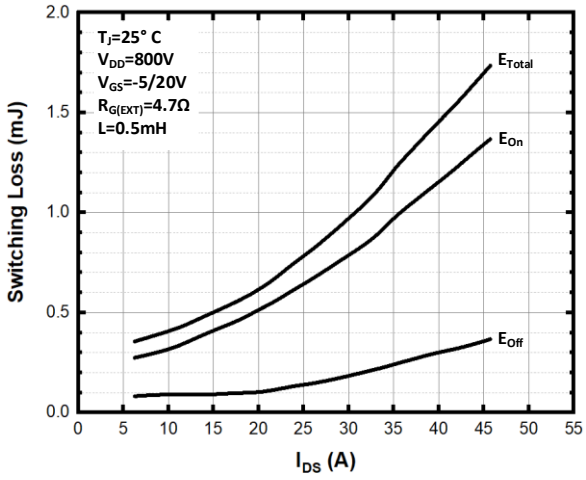


Fig. 22 Switching Loss vs Drain Current (800V)

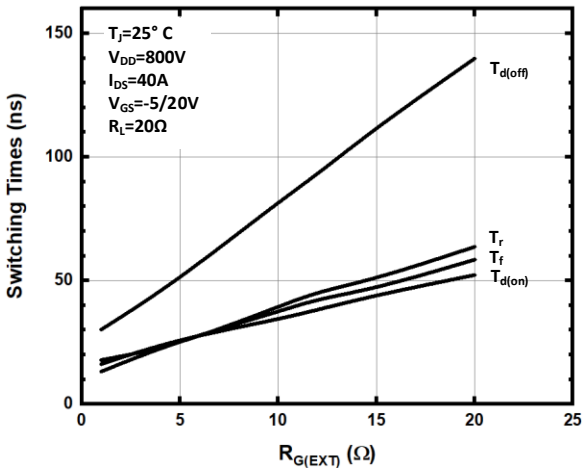


Fig. 23 Switching Time vs $R_{G(EXT)}$

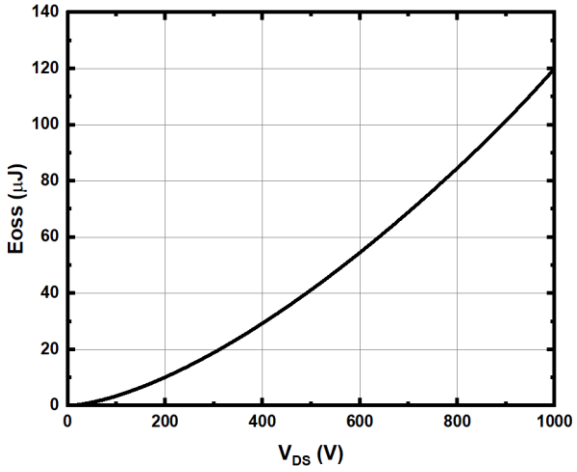


Fig. 24 Output Capacitor Stored Energy

Methodologies

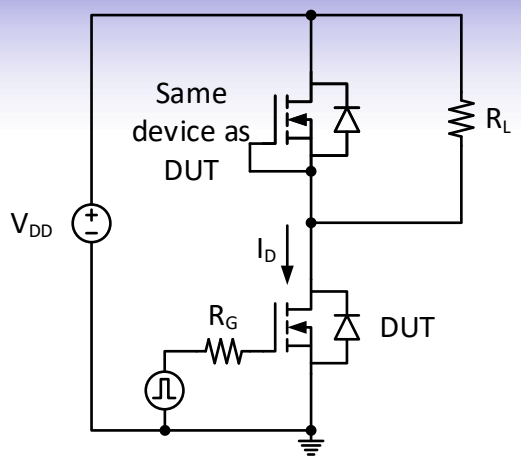


Fig. 25 Resistive Load Switching

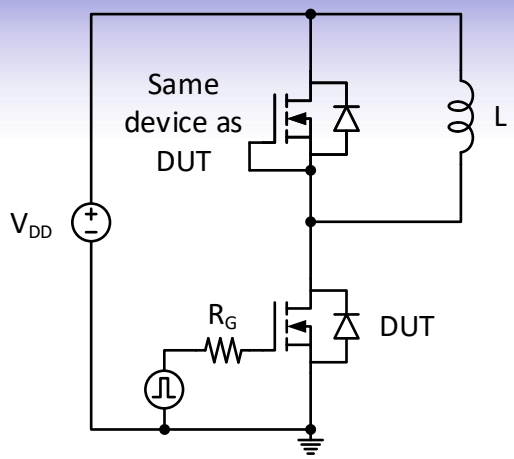


Fig. 26 Clamped Inductive Switching

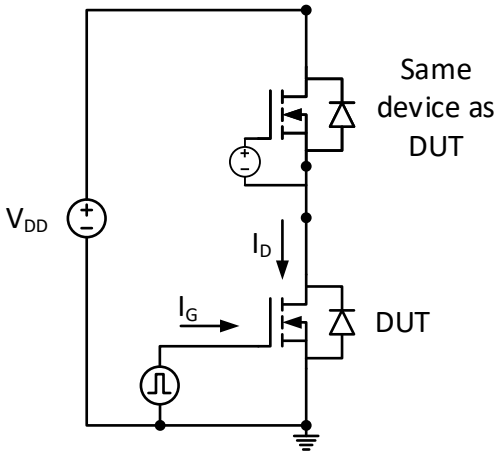


Fig. 27 Gate Charge

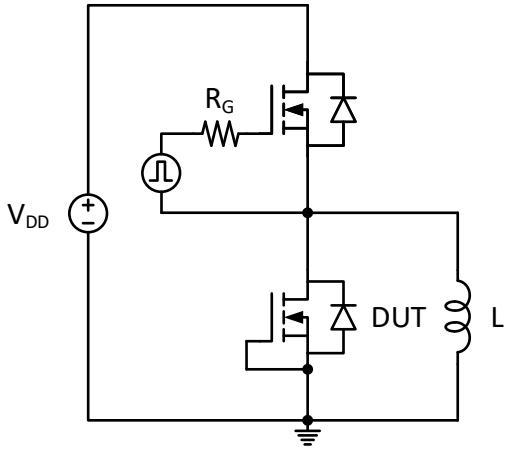


Fig. 28 Body Diode Reverse Recovery

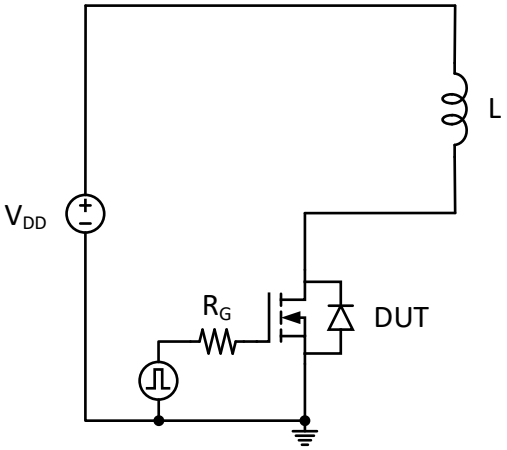


Fig. 29 Unclamped Inductive Switching

Definitions

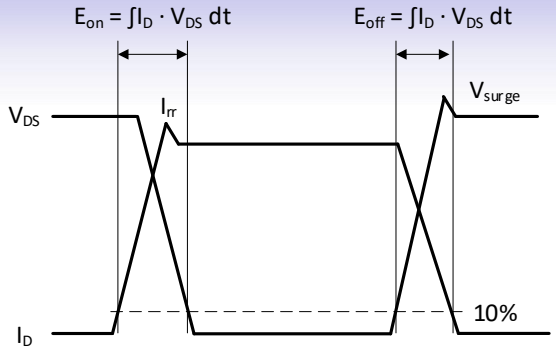


Fig. 30 Switching Losses

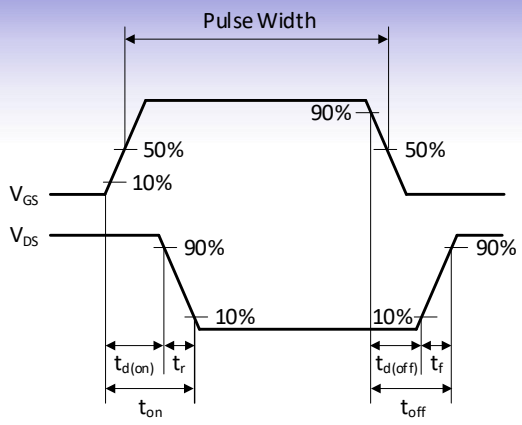


Fig. 31 Switching Times

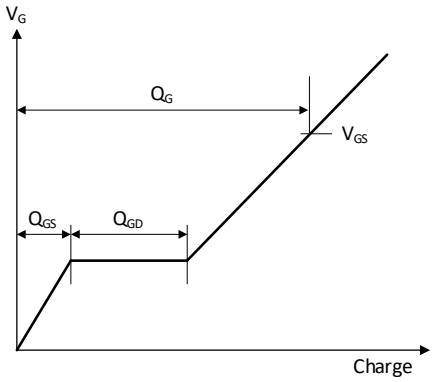


Fig. 32 Gate Charges

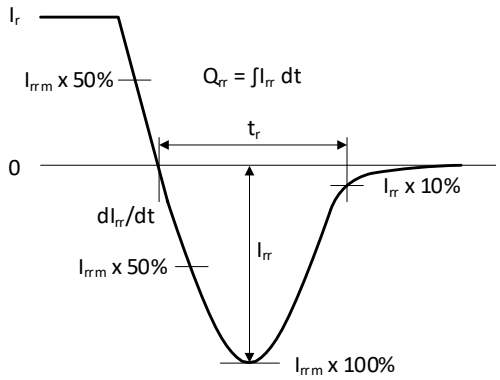
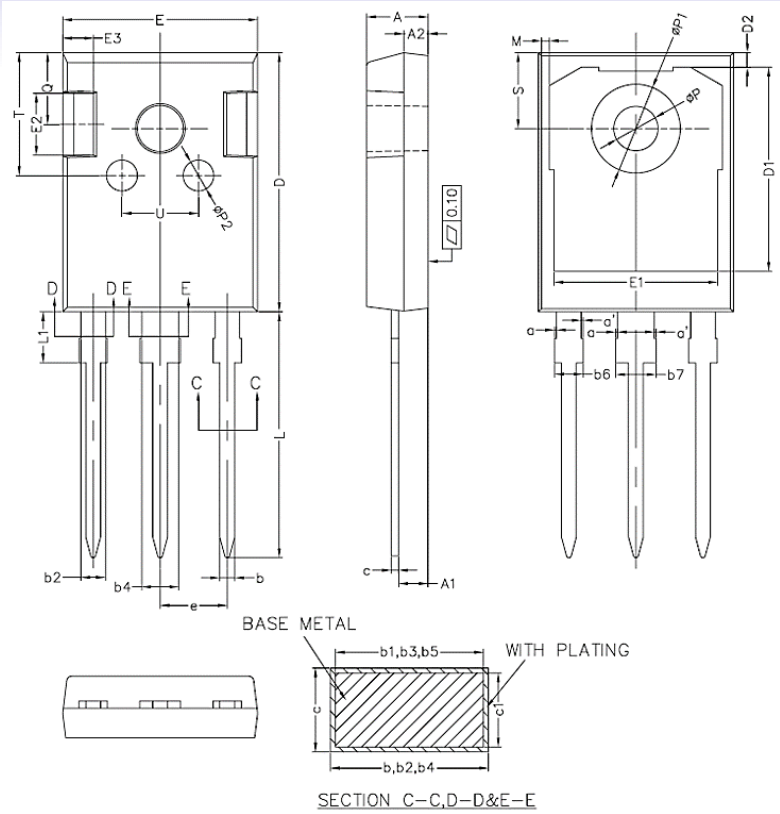


Fig. 33 Body Diode Reverse Recovery

Package TO-247-3 （Unit: mm）



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0	–	0.15
a'	0	–	0.15
b	1.16	–	1.26
b1	1.15	1.2	1.22
b2	1.96	–	2.06
b3	1.95	2.00	2.02
b4	2.96	–	3.06
b5	2.95	3.00	3.02
b6	–	–	2.25
b7	–	–	3.25
c	0.59	–	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1	–	–	4.30
M	0.35	–	0.95
P	3.50	3.60	3.70
P1	7.00	–	7.40
P2	2.40	2.50	2.60
Q	5.60	–	6.00
S	6.05	6.15	6.25
T	9.80	–	10.20
U	6.00	–	6.40

NOTES:
1.ALL DIMENSIONS REFER TO JEDEC STANDARD TO-247 AD DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
2.EJECTION MARK DEPTH $0.10^{+0.15}_{0.05}$

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