HMM15R120NC2

Silicon Carbide MOSFET Power Module
N-CHANNEL ENHANCEMENT MODE

Features

- Low Conduction and Switching Loss
- Zero Reverse Recovery
- Temperature Independent Switching Behavior
- Positive Temperature Coefficient Device
- High Surge Current Capability
- RoHS Compliant and Halogen Free

Benefits

- Higher System Efficiency
- Increase Parallel Device Convenience
- Temperature Independent Switching Behavior
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems

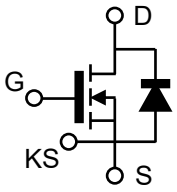
Applications

- Switching Mode Power Supply
- PFC
- UPS
- Motor Drives
- Flywheel diode in Power Inverters
- Solar/Wind Renewable Energy

Product Summary

V_{DS}	1200V
$I_{D(@25^{\circ}C)}$	156A*
$R_{DS(on)}$	15mΩ

Circuit Diagram



Description

The HMM15R120NC2 1200V, 15mΩ silicon carbide power MOSFET is an N-channel enhancement mode device. Exploiting the outstanding wide bandgap material properties, this device shows high current density and great switching behavior. Thanks for the excellent thermal conductivity and many advantages of SiC, this device significantly improved in thermal capability and temperature independent switching behavior.

Absolute Maximum Ratings (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Value	Unit
Drain – Source Voltage	$V_{DS, max}$	V_{GS}=0V, I_{DS}=200μA	1200	V
Continuous Drain Current	I_D	V_{GS}=20V, T_C=25°C	156*	A
		V_{GS}=20V, T_C=110°C	107*	
Pulse Drain Current	$I_{D, pulse}$	t_{PW} limitation per Fig.15	600*	
Avalanche energy, Single Pulse	E_{AS}	V_{DD}=100V, I_D=20A	5000*	mJ
Power Dissipation	P_D	T_C=25°C	750*	W
Recommend Gate Source Voltage	$V_{GS, op}$	Static, recommended DC operating values	-5 to 20	V
Maximum Gate Source Voltage	$V_{GS, max}$	Transient operating limit (AC f > 1Hz, duty cycle < 1%)	-10 to 25	
Junction & Storage Temperature	T_j , T_{stg}		-55 to 175	°C
Soldering Temperature	T_L		260	

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

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V, I_{DS}=200μA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=10V, I_{DS}=100mA		3.2		V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		<1	100	μA
		V_{DS}=1200V, V_{GS}=0V T_J=175°C		20	1000	
Gate-Source Leakage Current	I_{GSS}	V_{GS}=20V, V_{DS}=0V			250	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS}=20V, I_{DS}=80A		15	20	mΩ
		V_{GS}=20V, I_{DS}=80A, T_J=175°C		27		
Transconductance	g_{fs}	V_{DS}=15V, I_{DS}=80A		34		S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=800V f =1MHz, V_{AC}=25mV		9818*		pF
Output Capacitance	C_{oss}			396*		
Reverse Transfer Capacitance	C_{rss}			68*		
Effective Output Capacitance, Energy Related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0 to 800V		514*		
Effective Output Capacitance, Time Related	$C_{o(tr)}$	I_D=const., V_{GS}=0V, V_{DS}=0 to 800V		718*		
Turn On Delay Time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-4/+20V, I_D=80A, R_L=10Ω, $R_{G(ext)}$= 1.4 Ω		46*		ns
Rise Time	t_r			70*		
Turn Off Delay Time	$t_{d(off)}$			23*		
Fall Time	t_f			27*		
C_{oss} Stored Energy	E_{oss}	V_{GS}=0V, V_{DS}=800V f =1MHz, V_{AC}=25mV		161*		μJ
Turn-on Switching Energy	E_{on}	V_{DS}=800V, V_{GS}=0/20V, I_D=80A, $R_{G(ext)}$= 1.4 Ω		353**		
Turn-off Switching Energy	E_{off}			541**		
Internal Gate Resistance	$R_{G(int.)}$	f =1MHz, V_{AC}=25mV		0.4		Ω

*By estimation

**Based on the results of calculation, note that the energy loss caused by the reverse recovery of free-wheeling diode is not included in E_{on}.

Built-in SiC Diode Characteristics (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Typ.	Unit
Inverse Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_{SD}=20A	3.0	V
Continuous Diode Forward Current	I_S	V_{GS}=0V, T_C=25°C	114*	A
Reverse Recovery Time	t_{rr}	V_{GS}=0V, I_{SD}=30A, V_{DS}=400V, di/dt=300A/μs	160*	ns
Reverse Recovery Charge	Q_{rr}		568*	nC
Peak Reverse Recovery Current	I_{rrm}		14*	A

Gate Charge Characteristics (T_c = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Value	Unit
Gate to Source Charge	Q_{GS}	V_{DS}=800V, V_{GS}=-5/+20V, I_D=80A	182	nC
Gate to Drain Charge	Q_{GD}		176	
Total Gate Charge	Q_G		610	
Gate plateau voltage	V_{pl}		7.9	V

Thermal Characteristics

Parameter	Symbol	Test Conditions	Value	Unit
Max. MOSFET Junction Temperature	T_{Jmax_MOS}		175	˚C
Max. Diode Junction Temperature	T_{Jmax_Di}		175	
Operating Temperature	T_{Jop}		-55~175	
Storage Temperature	T_{stg}		-55~175	
Thermal Resistance, Junction to Case	$R_{th(j-c)}$	JESD51-14	0.2*	˚C/W

*By estimated

Mechanical Characteristics

Parameter	Symbol	Test Conditions	Value	Unit
Isolation Breakdown Voltage	V_{iso}	AC, 50Hz (R.M.S), t=1minute	2500	V
Comparative Tracking Index	CTI		TBD	
Terminal connection Torque	τ_{tc}	Recommended (M4 screw)	1.3	Nm
Weight	W		30	g

Typical Device Performance

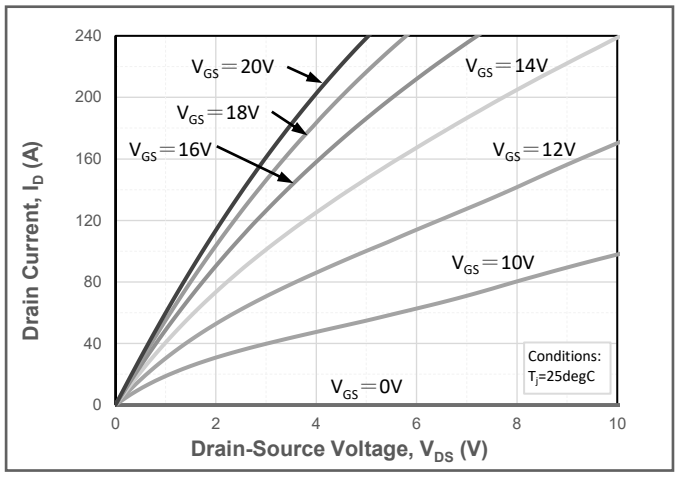


Fig.1 Forward Output Characteristics at T_j=25˚C

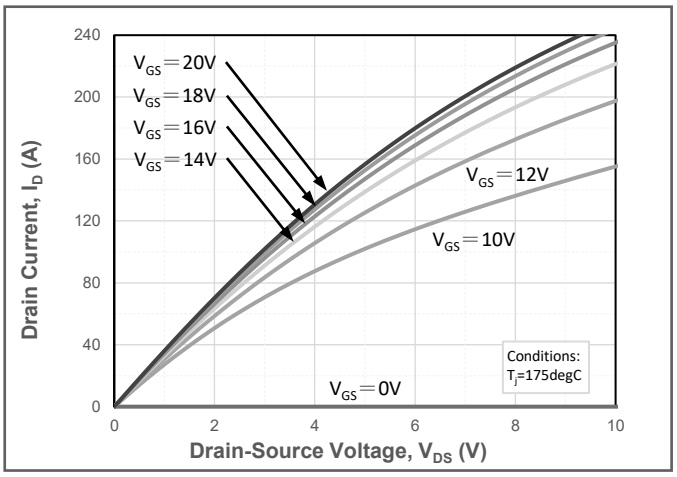


Fig.2 Forward Output Characteristics at T_j=175˚C

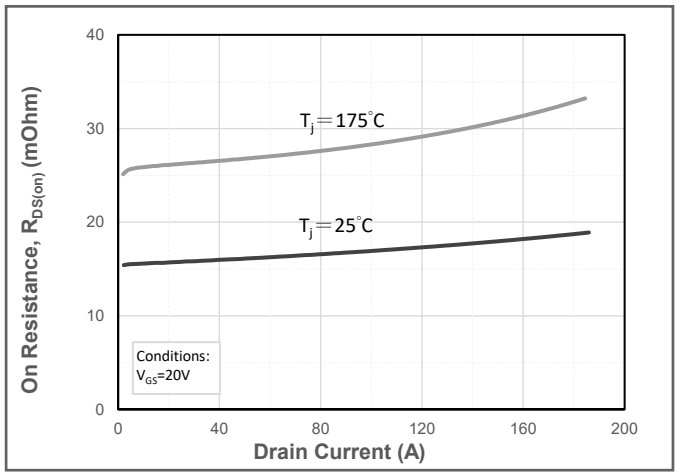


Fig.3 On-Resistance vs. Drain Current for Various T_j

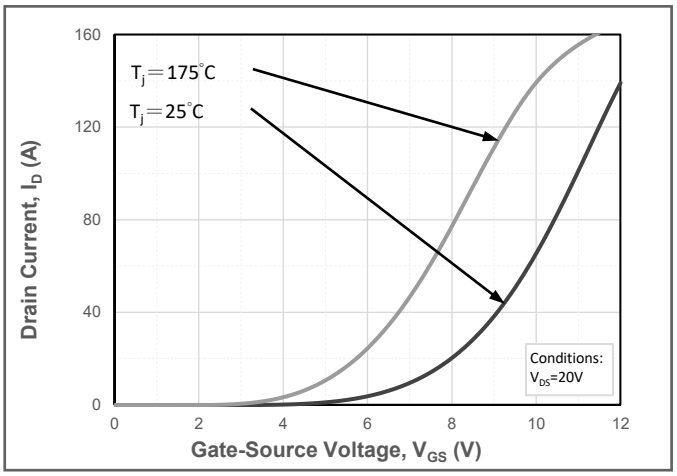


Fig.4 Transfer Characteristics for Various T_j

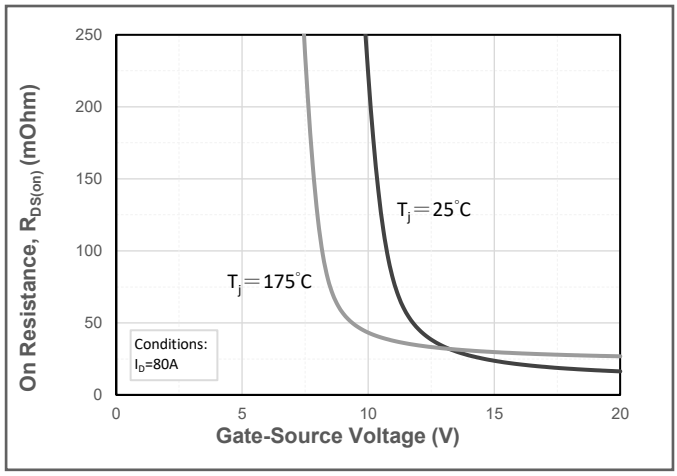


Fig.5 On-Resistance vs. Gate Voltage for Various T_j

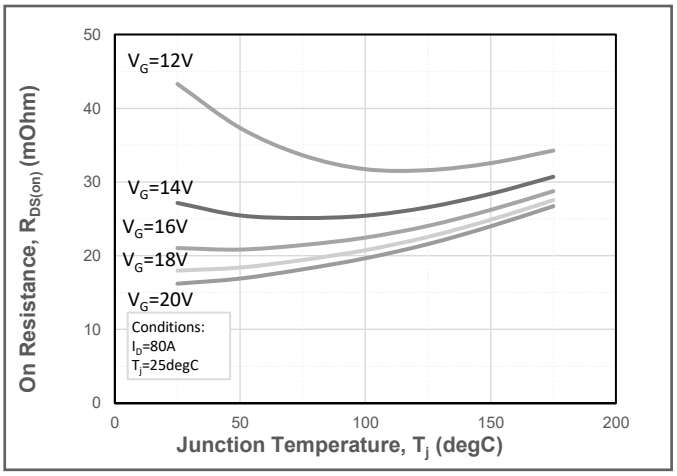


Fig.6 On-Resistance vs. Temperature for Various Gate Voltage

Typical Device Performance

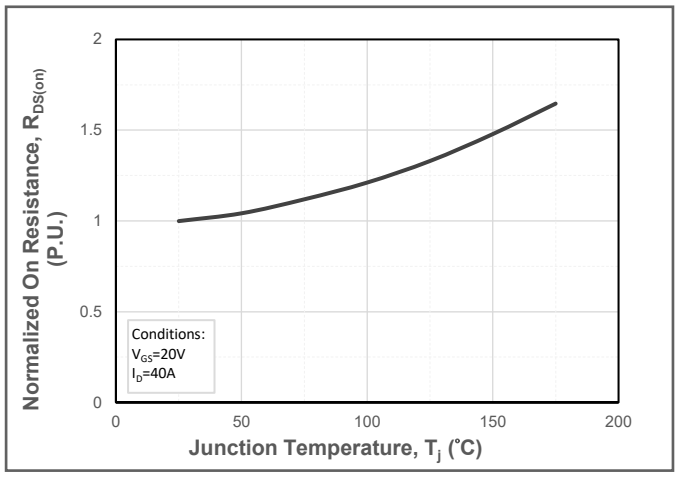


Fig.7 Normalized On-Resistance vs. Temperature

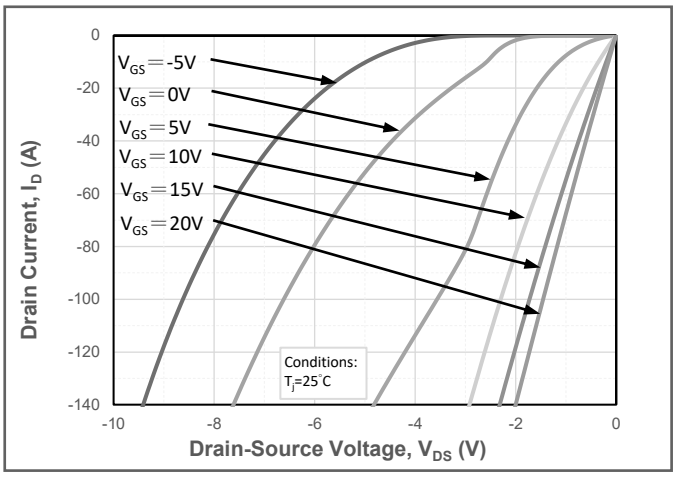


Fig.8 Reverse Output Characteristics at T_j = 25°C

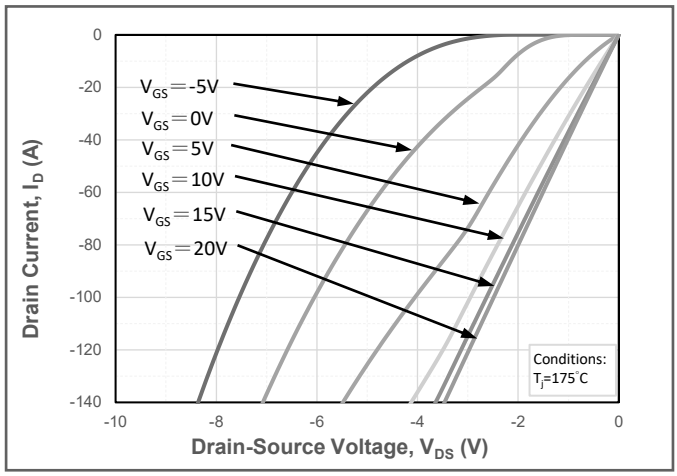


Fig.9 Reverse Output Characteristics at T_j = 175°C

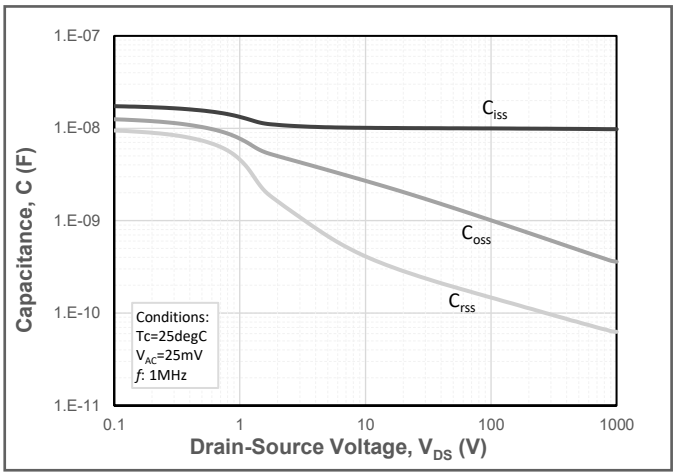


Fig.10 Capacitances vs. Drain to Source Voltage

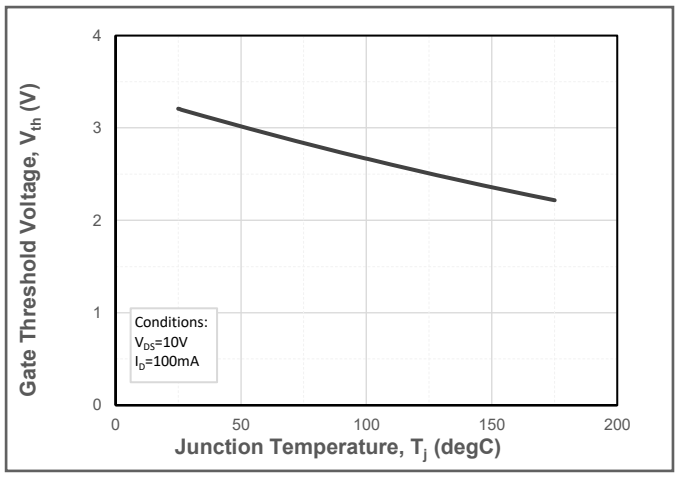


Fig.11 Threshold Voltage vs. Temperature

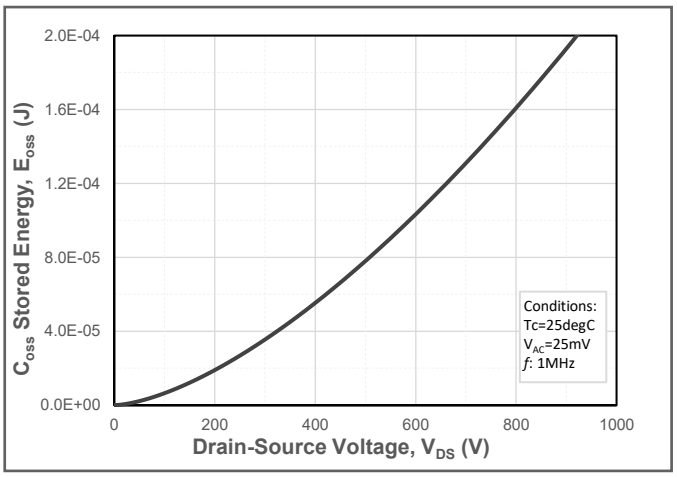


Fig.12 Output Capacitor Stored Energy

Typical Device Performance

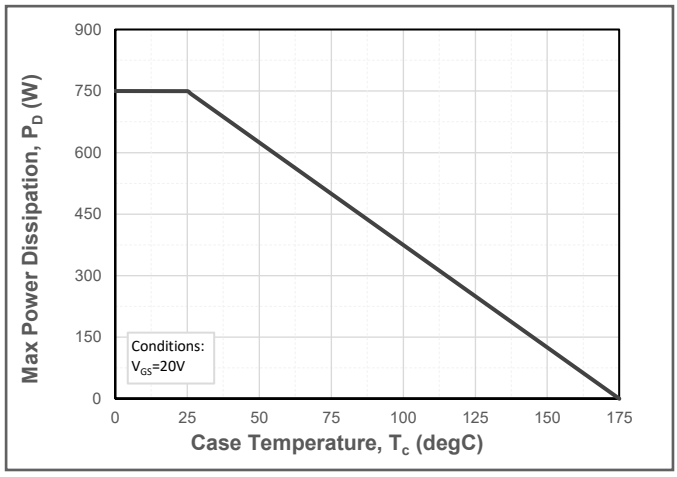


Fig.13 Maximum Power Dissipation Derating vs. Case Temperature

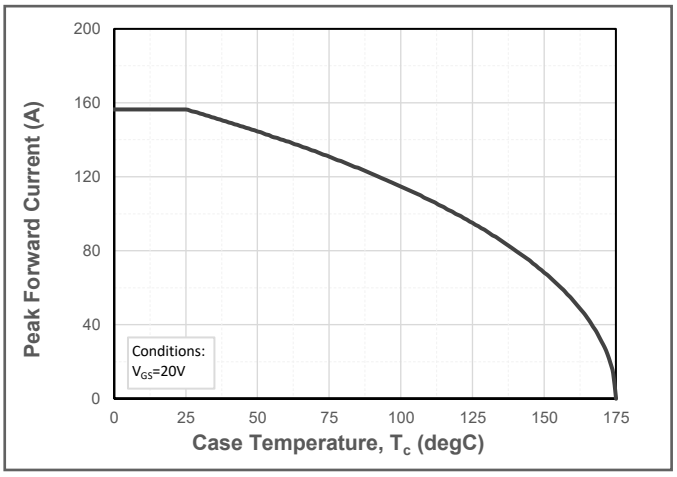


Fig.14 Drain Current Derating vs. Case Temperature

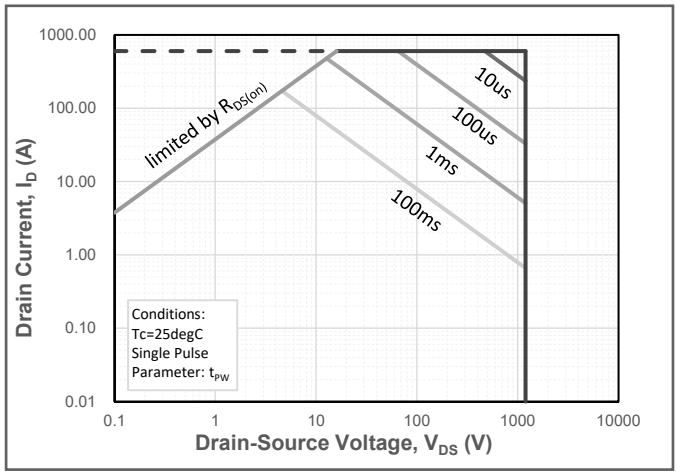


Fig.15 Safe Operating Area

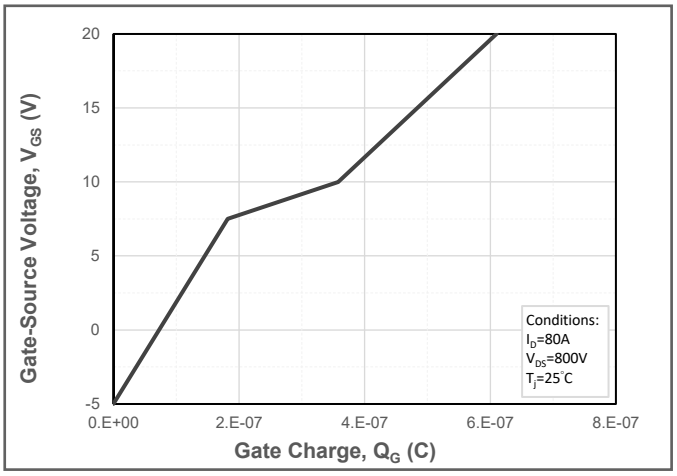


Fig.16 Gate Charge Characteristics

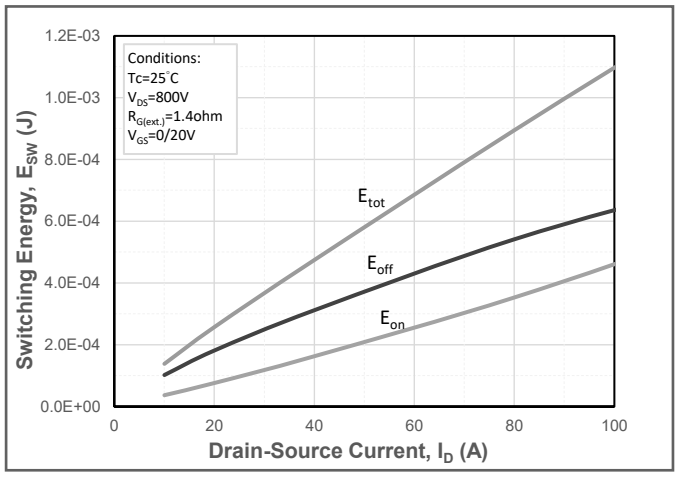


Fig.17 Clamped Inductive Switching Energy vs.

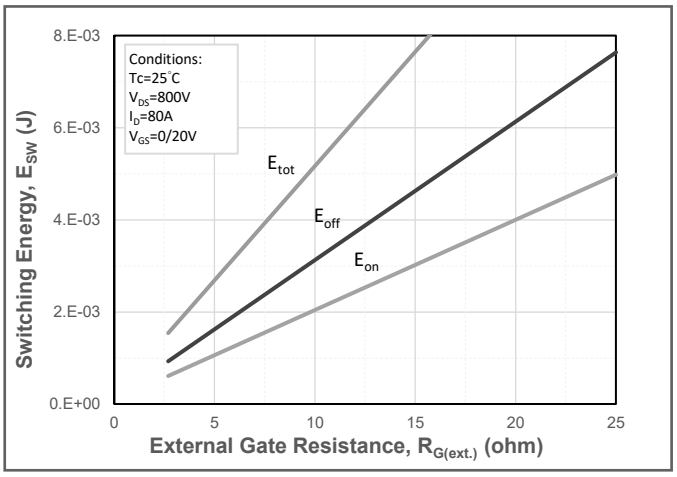
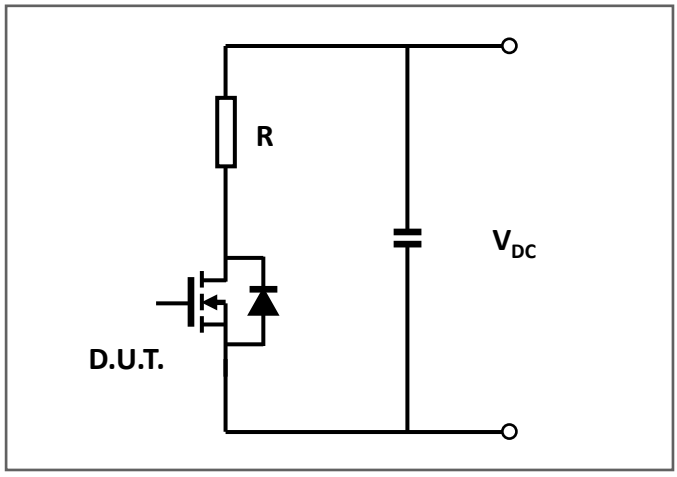


Fig.18 Clamped Inductive Switching Energy vs. External Gate Resistor ($R_{G(ext.)}$)

Typical Device Performance



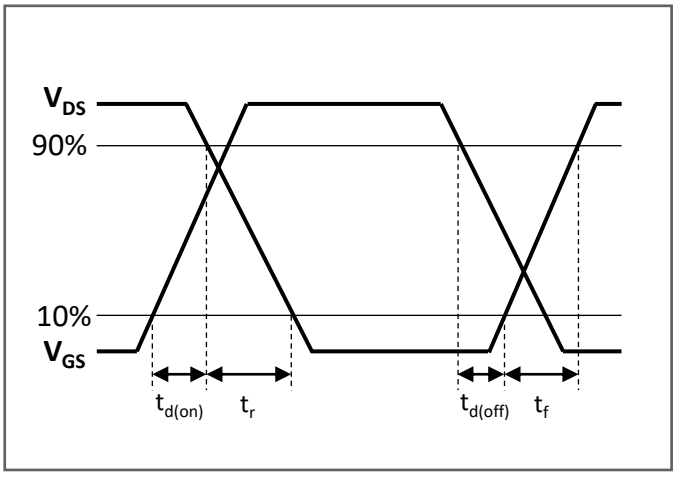


Fig.19 Schematic of Resistive Switching

Fig.20 Switching Times Definition

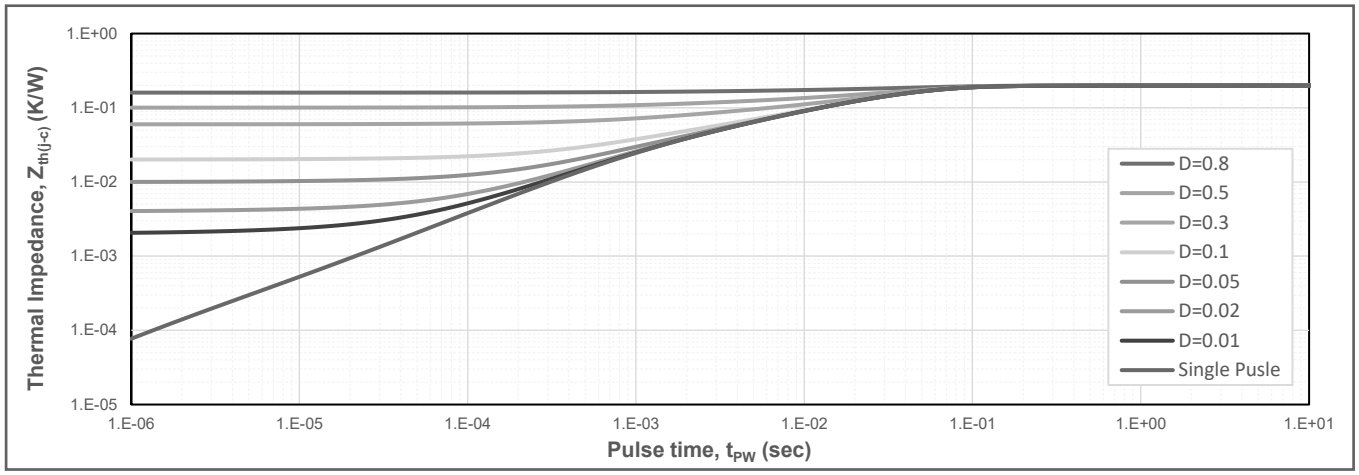
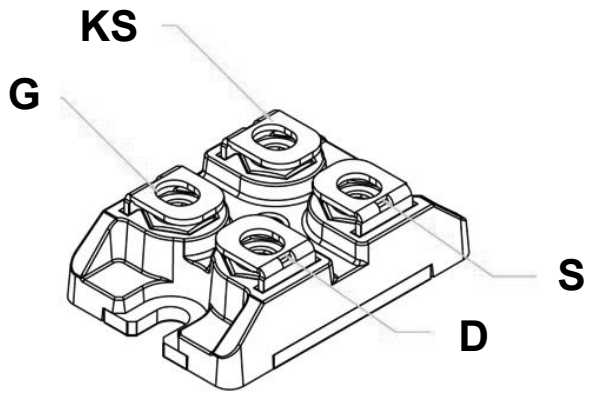
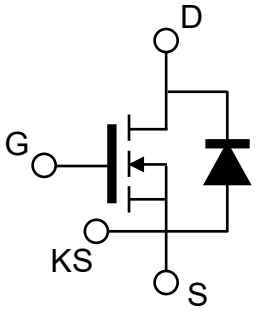
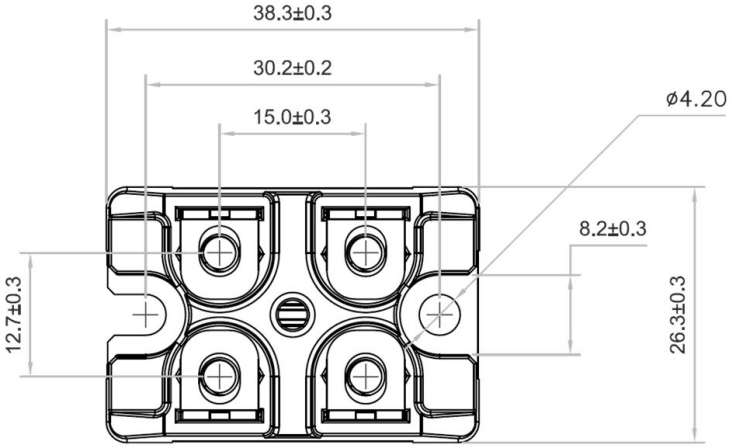


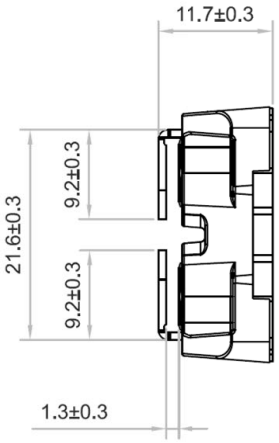
Fig.21 Transient Junction to Case Thermal Impedance

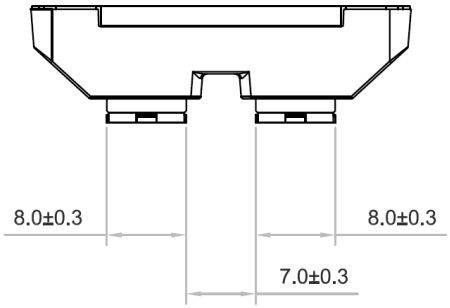
Package Dimensions











Notes

- The information provided herein is subject to change without notice.
- For other information that does not show on this datasheet, please contact us for inquiry.