H3M120Q016

Silicon Carbide MOSFET
N-CHANNEL ENHANCEMENT MODE

V_{DS}	1200V
$I_{D(@25^{\circ}C)}$	141A
$R_{DS(on)}$	16mΩ

Features

- Low On-Resistance and High Current Density
- Low Capacitance for High Frequency Operation
- Positive Temperature Coefficient Device
- Low impedance Kelvin source pin-out
- RoHS Compliant and Halogen Free

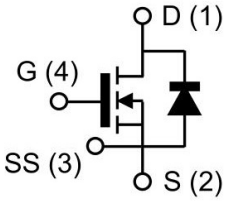
Benefits

- Higher System Efficiency
- Increase Parallel Device Convenience
- Capable of 175°C High T_j Application
- Allow High Frequency Operation
- Realize Compact and Lightweight Systems

Applications

- Switching Mode Power Supply
- DC/DC Converters, UPS, and PFC
- Power Inverters
- Auxiliary Power Supplies
- Solar/Wind Renewable Energy

Circuit Diagram



Part Number	Package	Marking
H3M120Q016	TO-247-4L	H3M120Q016

Description

The H3M120Q016 1200V, 16mΩ 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}=100μA	1200	V
Continuous Drain Current	I_D	V_{GS}=18V, T_C=25°C	141	A
		V_{GS}=18V, T_C=110°C	95	
Pulse Drain Current	$I_{D, pulse}$	t_{PW} limitation per Fig.17	301	
Avalanche energy, Single Pulse	E_{AS}	V_{DD}=100V, I_D=19.68A,L=25mH	4841	mJ
Power Dissipation	P_D	T_C=25°C	517	W
Recommend Gate Source Voltage	$V_{GS, op}$	Static, recommended DC operating values	-5 to 18	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	
Mounting Torque	M_D	M3 or 6-32 screw	1.0	Nm

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$		0.29		°C/W

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}=100μA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_{DS}=28mA	2	2.8	4	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=1200V, V_{GS}=0V		<1	50	μA
		V_{DS}=1200V, V_{GS}=0V, T_j=175°C		10		
Gate-Source Leakage Current	I_{GSS}	V_{GS}=18V, V_{DS}=0V			250	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS}=15V, I_{DS}=100A		16	21	mΩ
		V_{GS}=18V, I_{DS}=100A		14	18	
		V_{GS}=18V, I_{DS}=100A, T_j=175°C		25		
Transconductance	g_{fs}	V_{DS}=10V, I_{DS}=100A		55		S
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=800V f =1MHz, V_{AC}=25mV		5830		pF
Output Capacitance	C_{oss}			235		
Reverse Transfer Capacitance	C_{rss}			21		
Effective Output Capacitance, Energy Related	$C_{o(er)}$	V_{GS}=0V, V_{DS}=0 to 800V		310		
Effective Output Capacitance, Time Related	$C_{o(tr)}$	I_D=const., V_{GS}=0V, V_{DS}=0 to 800V		463		
Turn On Delay Time	$t_{d(on)}$	V_{DS}=800V, V_{GS}=-3/+18V, I_D=100A, L=50μH, $R_{G(ext)}$= 2.7 Ω		23		ns
Rise Time	t_r			34		
Turn Off Delay Time	$t_{d(off)}$			48		
Fall Time	t_f			13		
C_{oss} Stored Energy	E_{oss}	V_{GS}=0V, V_{DS}=800V f =1MHz, V_{AC}=25mV		99		μJ
Turn-on Switching Energy	E_{on}	V_{DS}=800V, V_{GS}=-3/18V, I_D=100A, L=50μH, $R_{G(ext)}$= 2.7 Ω		1034		
Turn-off Switching Energy	E_{off}			972		
Internal Gate Resistance	$R_{G(int.)}$	f =1MHz, V_{AC}=25mV		1.5		Ω

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}=50A	3.4	V
Continuous Diode Forward Current	I_S	V_{GS}=0V, T_C=25°C	141	A
Pulse Diode Forward Current	$I_{S,\ pulse}$	Pulse width t_{PW} limited by T_{jmax}	301	A
Reverse Recovery Time	t_{rr}	V_{GS}=-3V, I_{SD}=100A, V_R=800V, di/dt=1700A/μs	24	ns
Reverse Recovery Charge	Q_{rr}		308	nC
Peak Reverse Recovery Current	I_{rrm}		21	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}=-3/+18V, I_D=100A	77	nC
Gate to Drain Charge	Q_{GD}		107	
Total Gate Charge	Q_G		287	
Gate plateau voltage	V_{pl}		8.1	V

Typical Device Performance

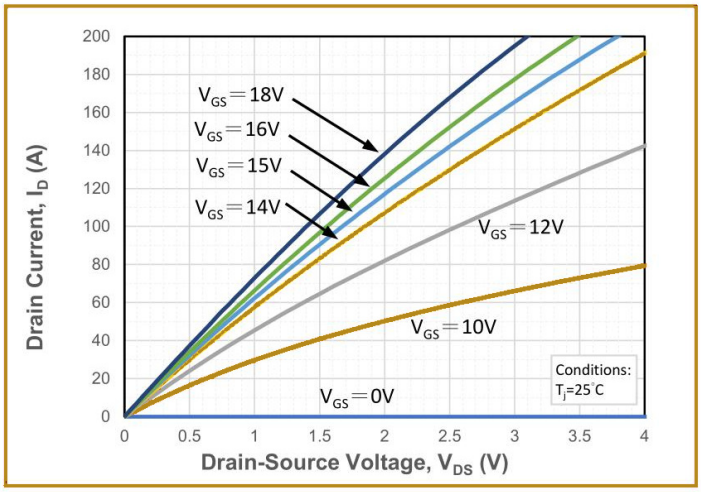


Fig.1 Forward Output Characteristics at T_j=25˚C

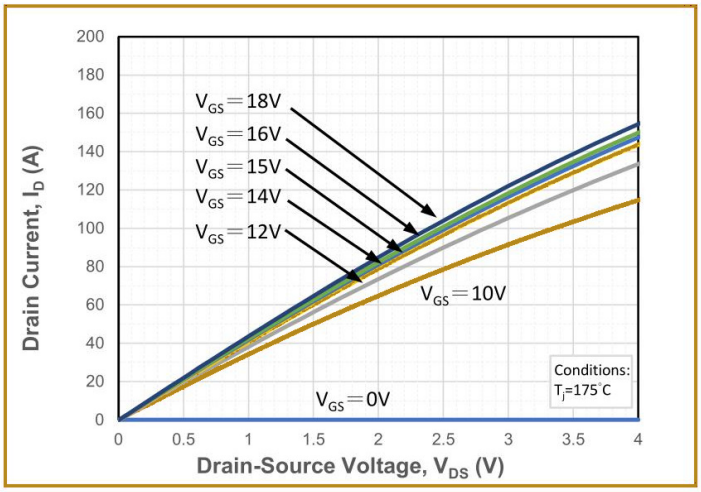


Fig.2 Forward Output Characteristics at T_j=175˚C

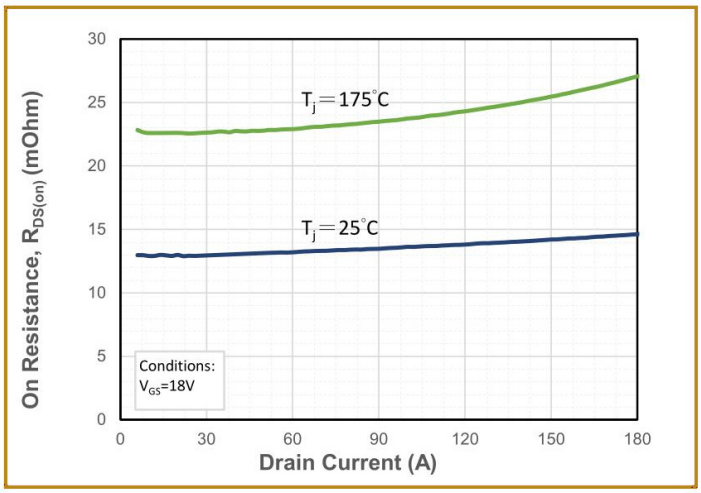


Fig.3 On-Resistance vs. Drain Current for Various T_j

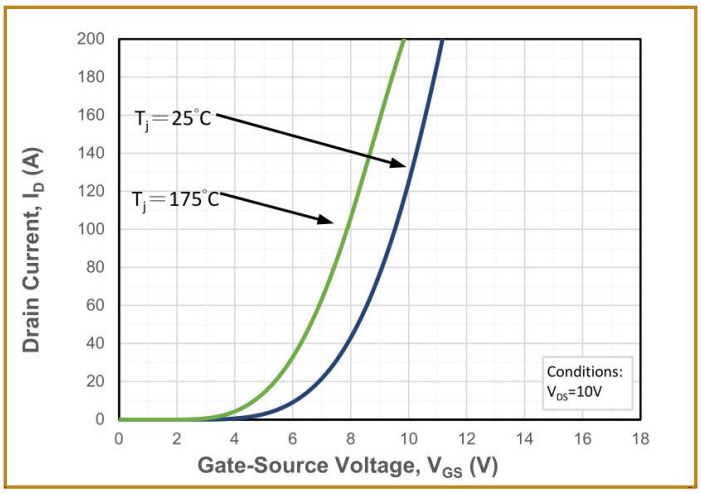


Fig.4 Transfer Characteristics for Various T_j

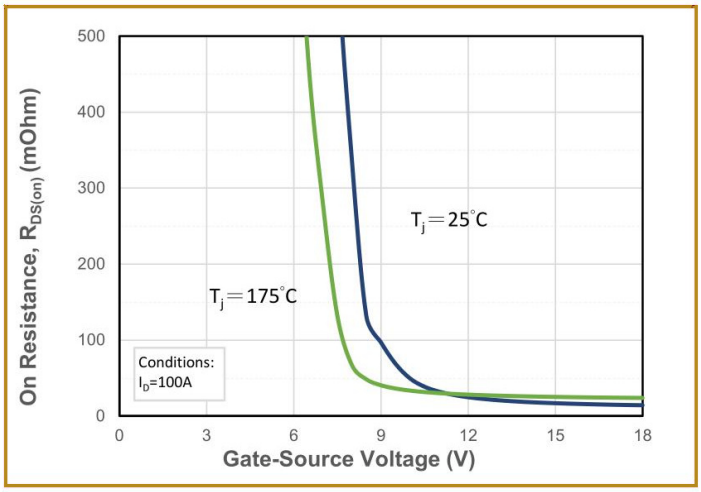


Fig.5 On-Resistance vs. Gate Voltage for Various T_j

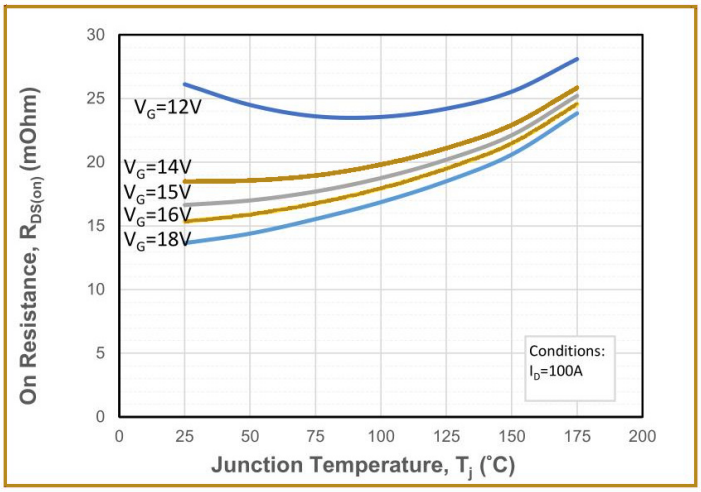


Fig.6 On-Resistance vs. Temperature for Various Gate Voltage

Typical Device Performance

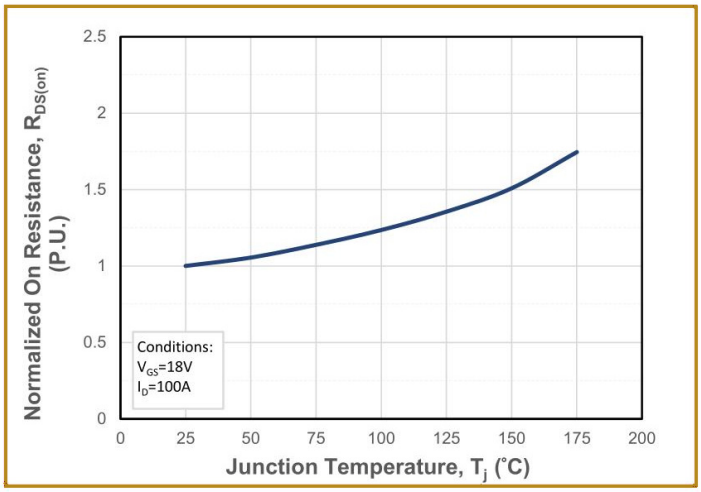


Fig.7 Normalized On-Resistance vs. Temperature

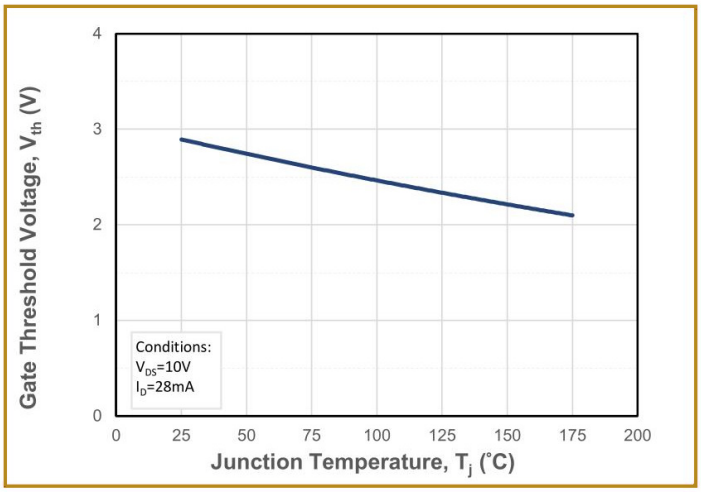


Fig.8 Threshold Voltage vs. Temperature

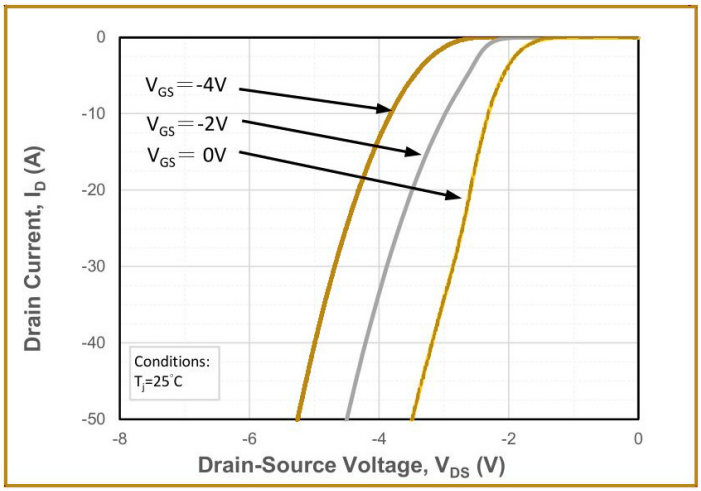


Fig.9 Body Diode Characteristics at T_j = 25°C

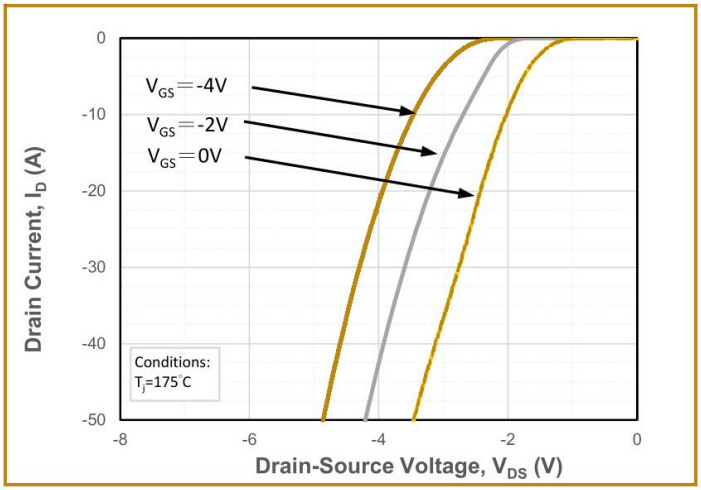


Fig.10 Body Diode Characteristics at T_j = 175°C

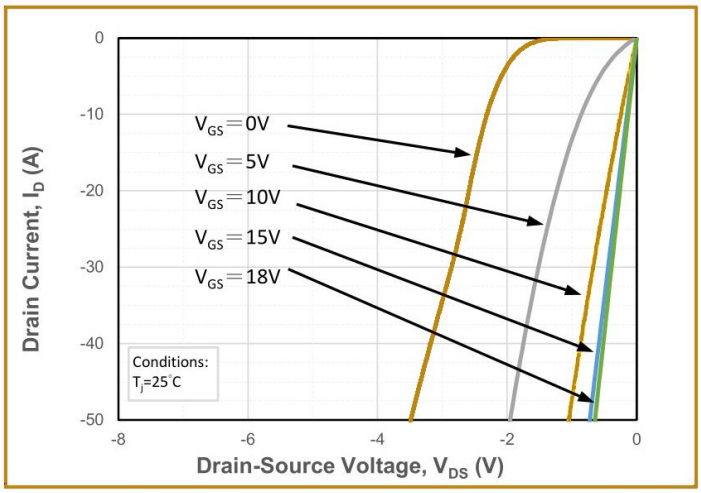


Fig.11 3rd Quadrant Characteristics at T_j = 25°C

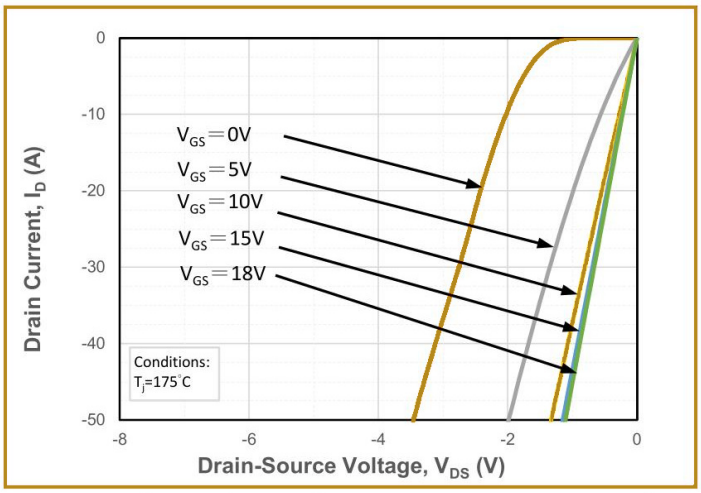


Fig.12 3rd Quadrant Characteristics at T_j = 175°C

Typical Device Performance

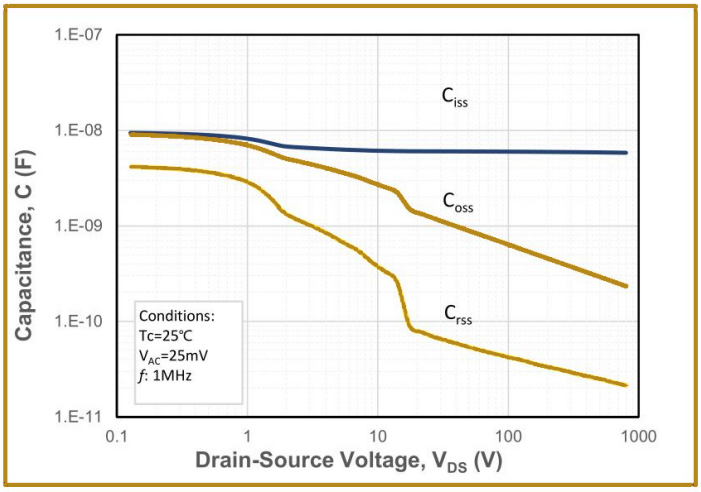


Fig.13 Capacitances vs. Drain to Source Voltage

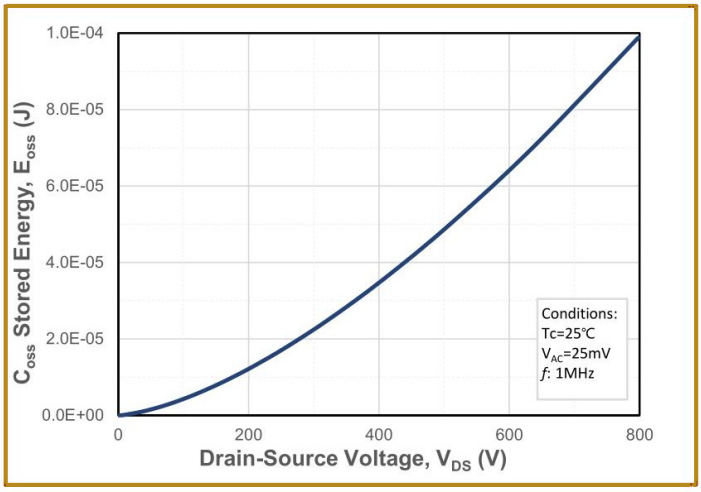


Fig.14 Output Capacitor Stored Energy

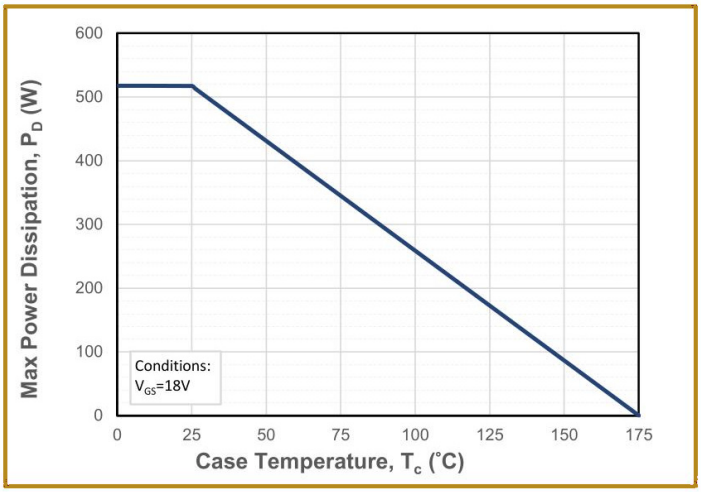


Fig.15 Maximum Power Dissipation Derating vs. Case Temperature

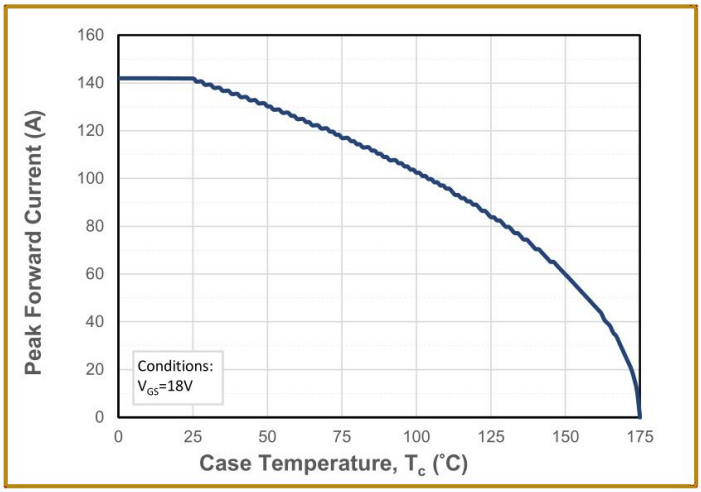


Fig.16 Drain Current Derating vs. Case Temperature

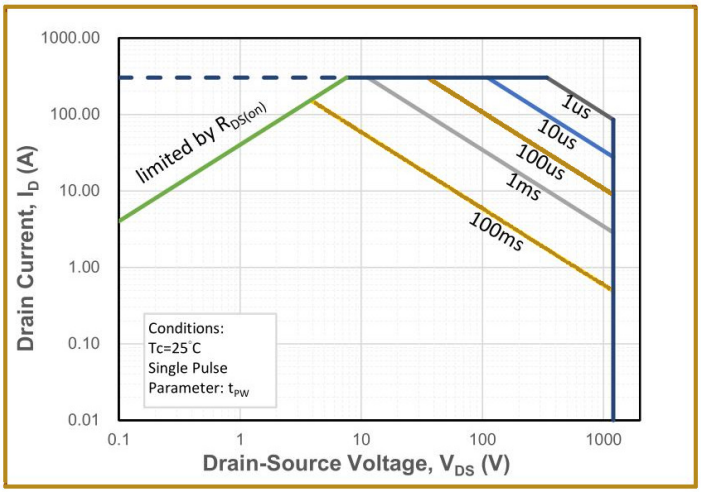


Fig.17 Safe Operating Area

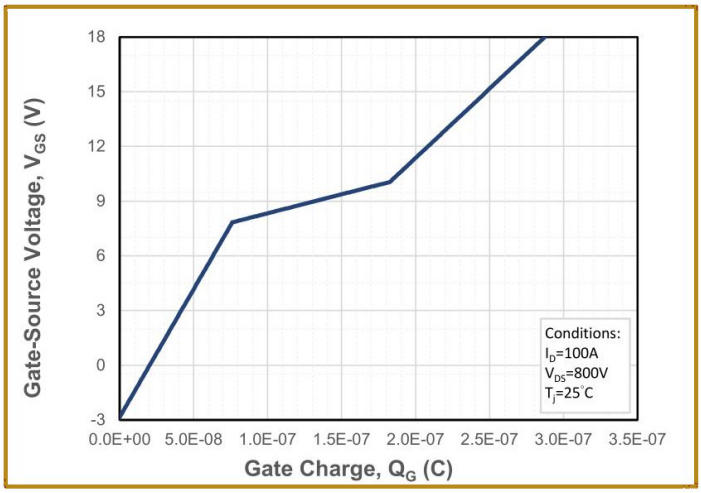


Fig.18 Gate Charge Characteristics

Typical Device Performance

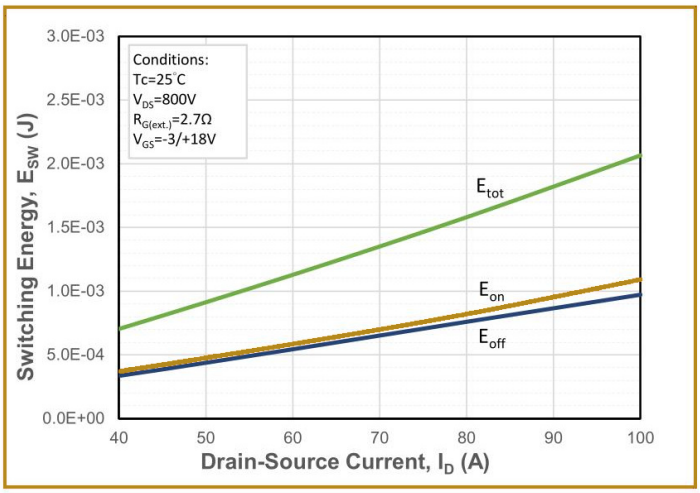


Fig.19 Clamped Inductive Switching Energy vs. Drain Current

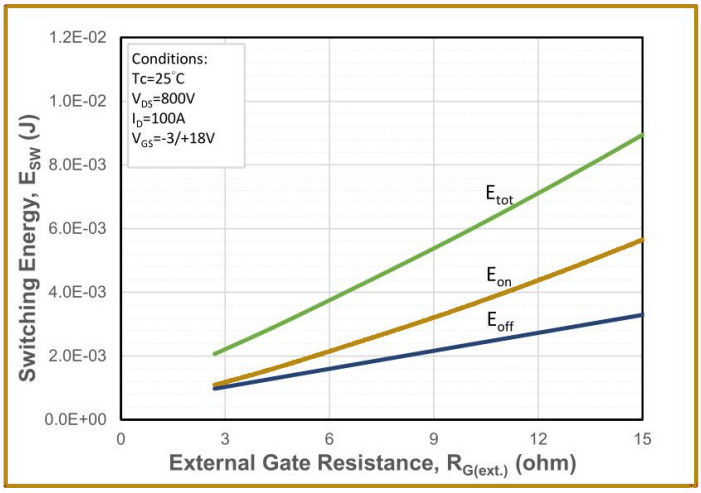


Fig.20 Clamped Inductive Switching Energy vs. External Gate Resistor (RG(ext.))

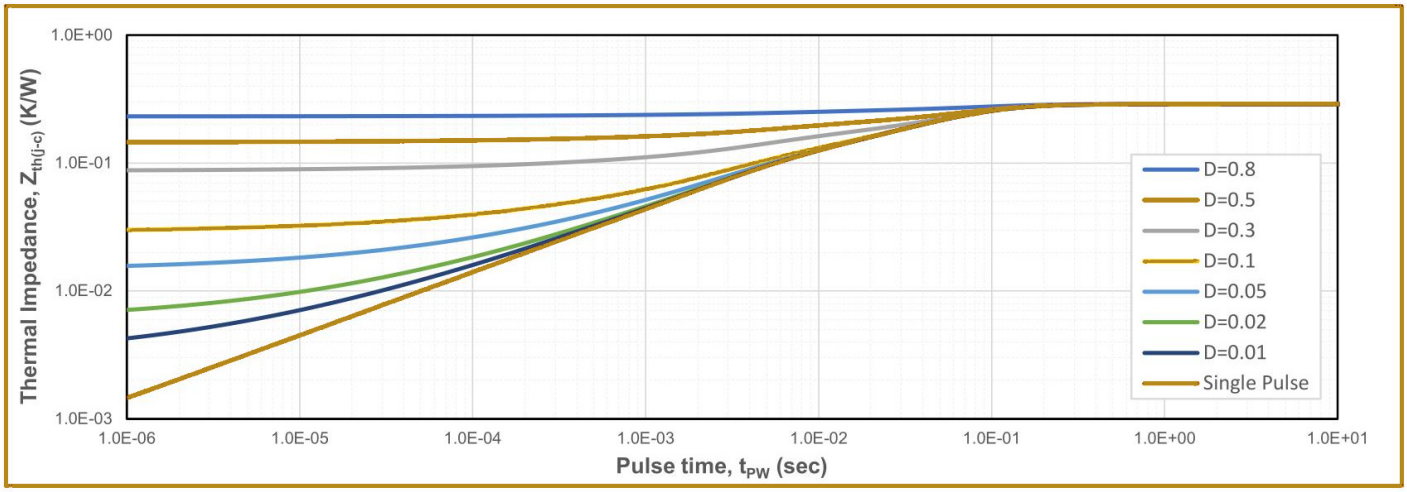


Fig.21 Transient Junction to Case Thermal Impedance

Naming Rule

H3 M 120 Q 016

Generation
H3 = 3rd Gen Discrete

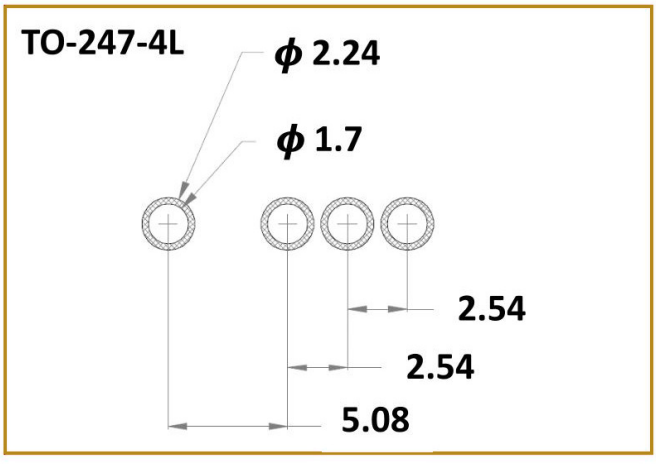
Device Type
M = MOSFET J = JMOS
S = JBS diode

Breakdown Voltage
065 = 650V 170 = 1700V
120 = 1200V 330 = 3300V

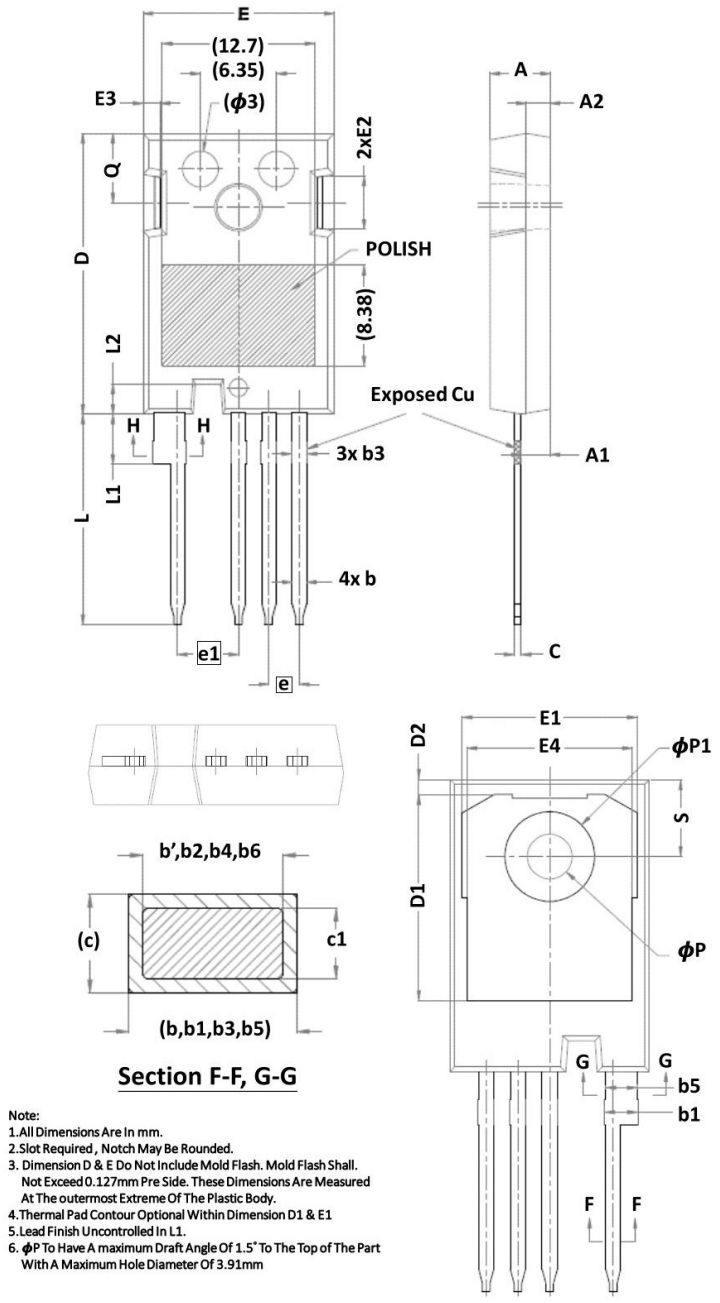
Package
F = TO-247-3L Q = TO-247-4L
B = TO-220-3L T = TO-263-2L

Typical On-Resistance
016 = 16mΩ 040 = 40mΩ 060 = 60mΩ
120 = 120mΩ 240 = 240mΩ

Recommended Solder Pad Layout



Package Dimensions



Note:
1. All Dimensions Are In mm.
2. Slot Required , Notch May Be Rounded.
3. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall. Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The outermost Extreme Of The Plastic Body.
4. Thermal Pad Contour Optional Within Dimension D1 & E1
5. Lead Finish Uncontrolled In L1.
6. ϕP To Have A maximum Draft Angle Of 1.5° To The Top of The Part With A Maximum Hole Diameter Of 3.91mm

Symbol	mm		
	Min.	Typ.	Max.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e		2.54 BSC	
e1		5.08 BSC	
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ϕP	3.51	3.61	3.65
ϕP1		7.19 REF.	
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

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.