

650V N-Channel Silicon Carbide Power MOSFET

FEATURES

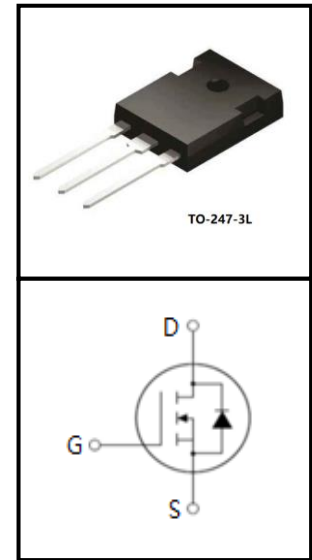
- Low On-Resistance
- Low Capacitance
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

BENEFITS

- Higher System Efficiency
- Parallel Device Convenience
- High Temperature Application
- High Frequency Operation

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Power Factor Correction (PFC)
- Uninterruptible Power Supply (UPS)
- EV Charging station & Motor Drives
- Solar/ Wind Renewable Energy
- Power Inverters & DC/DC Converters



Device Marking and Package Information

Device	Package	Marking
C2M065W060	TO-247-3L	C2M065W060

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Value	Unit
Drain-Source Voltage	V_{DS}	$V_{GS}=0V, I_{DS}=100\mu A$	650	V
Continuous Drain Current	I_D	$V_{GS}=20V, T_C=25^\circ\text{C}$	45	A
Pulsed Drain Current	I_{DM}	t_{PW} limitation per Fig.17	180	
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	338	W
Recommend Gate Source Voltage	$V_{GS, op}$	Static	-5/+20	V
Maximum Gate Source Voltage	$V_{GS, max}$	AC ($f > 1\text{Hz}$)	-10/+25	
Soldering Temperature	T_L		260	$^\circ\text{C}$
Operating Junction and Storage Temperature Range	T_J, T_{stg}		-55/+150	

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.37	K/W

Specifications $T_J = 25^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0V, I _D = 100μA	650	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V, V _{GS} = 0V, T _J = 25°C	--	<1	100	μA
		V _{DS} = 650V, V _{GS} = 0V, T _J = 150°C	--	10	500	
Gate-Source Leakage	I _{GSS}	V _{GS} = 20V, V _{DS} = 0V	--	--	200	nA
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = 10V, I _D = 5mA	2	--	3.5	V
Drain-Source On-Resistance	R _{DS(on)}	V _{GS} = 20V, I _D = 22.5A	--	60	72	mΩ
Dynamic						
Input Capacitance	C _{iss}	V _{GS} = 0V V _{DS} = 400V f = 1.0MHz V _{AC} =25mV	--	1231	--	pF
Output Capacitance	C _{oss}		--	147	--	
Reverse Transfer Capacitance	C _{rss}		--	24	--	
Effective Output Capacitance, Energy Related	Co(er)	V _{GS} =0V V _{DS} =0 to 450V		187		
Effective Output Capacitance, Time Related	Co(tr)	I _D =const., V _{GS} =0V V _{DS} =0 to 450V		253		
Total Gate Charge	Q _g	V _{DS} =300V, V _{GS} =0/+15V, I _D =45A	--	94	--	nC
Gate-Source Charge	Q _{gs}		--	16.8	--	
Gate-Drain Charge	Q _{gd}		--	44	--	
Gate plateau voltage	V _{pl}		--	12	--	V
Turn-on Delay Time	t _{d(on)}	V _{DS} =300V V _{GS} =0/15V I _D =45A R _{G(ext)} = 2.5Ω	--	41	--	ns
Turn-on Rise Time	t _r		--	142	--	
Turn-off Delay Time	t _{d(off)}		--	50	--	
Turn-off Fall Time	t _f		--	11	--	
Coss Stored Energy	E _{oss}	V _{GS} =0V, V _{DS} =650V f =1MHz, V _{AC} =25mV	--	119	--	μJ
Turn-on Switching Energy	E _{on}	V _{DS} =650V, V _{GS} =0/15V, I _D =20A, R _{G(ext)} = 2.5Ω	--	194*	--	
Turn-off Switching Energy	E _{off}		--	326*	--	
Internal Gate Resistance	R _{G(int.)}	f =1MHz, V _{AC} =25mV	--	6	--	Ω

*Base on the results of calculation, note that the energy loss caused by the reverse recovery of FWD is not included in E_{on} .

Built-in SiC Diode Characteristics						
Continuous Diode Forward Current	I_S	$V_{GS} = 0V$	--	45	--	A
Inverse Diode Forward Voltage	V_{SD}	$I_{SD} = 13.5A, V_{GS} = -5V$	--	--	6	V
Reverse Recovery Time	t_{rr}	$I_F = 20A, V_{DS}=140V,$ $di_F/dt = 500A/\mu s$	--	23	--	ns
Reverse Recovery Charge	Q_{rr}		--	54.5	--	nC
Peak Reverse Recovery Current	IRM		--	3.7	--	A

Typical Device Performance

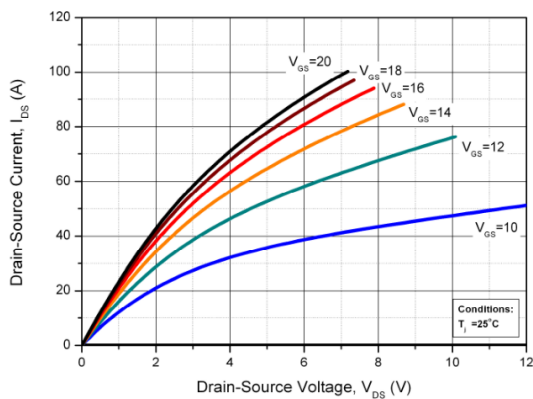


Fig. 1 Forward Output Characteristics at $T_j = 25^\circ C$

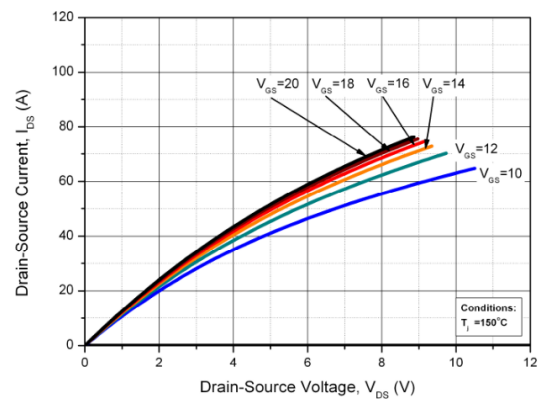


Fig. 2 Forward Output Characteristics at $T_j = 150^\circ C$

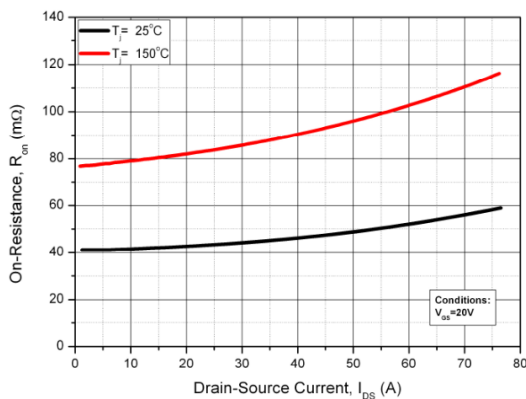


Fig. 3 On-Resistance vs. Drain Current for Various T_j

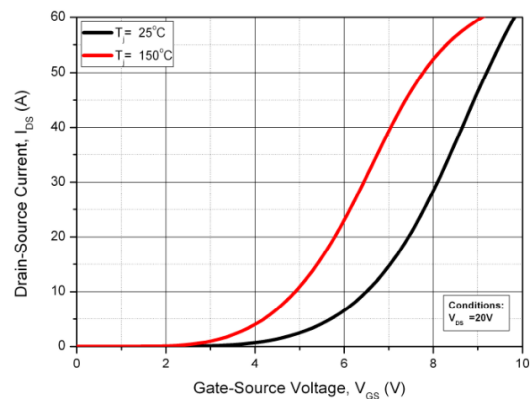


Fig. 4 Transfer Characteristics for Various T_j

Typical Device Performance

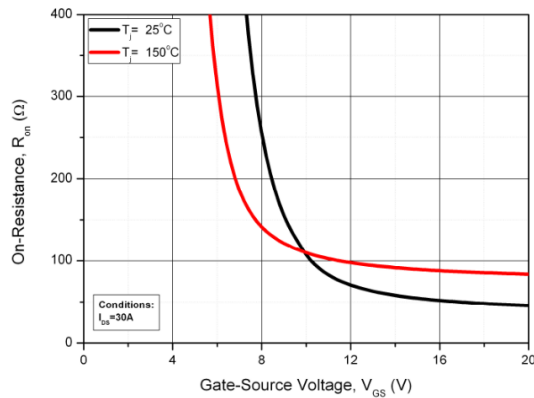


Fig. 5 On-Resistance vs. Gate Voltage for Various T_j

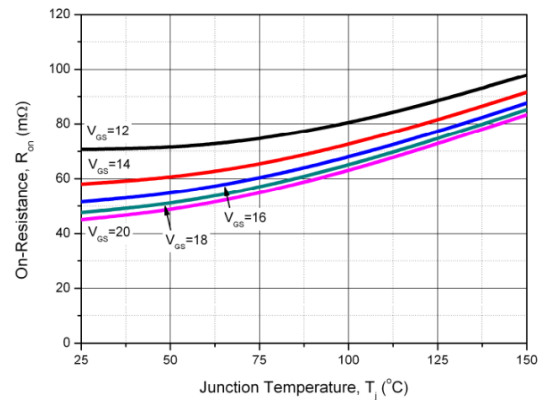


Fig. 6 On-Resistance vs. Temperature for Various Gate Voltage

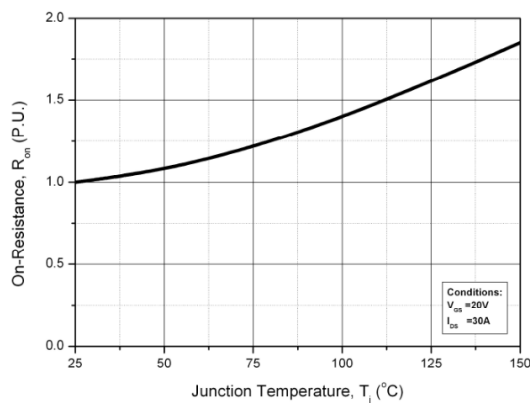


Fig. 7 Normalized On-Resistance vs. Temperature

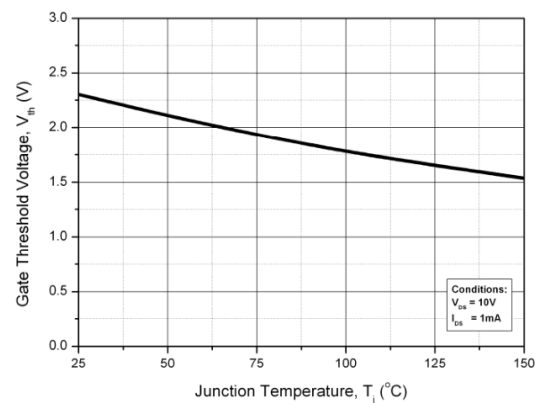


Fig. 8 Threshold Voltage vs. Temperature

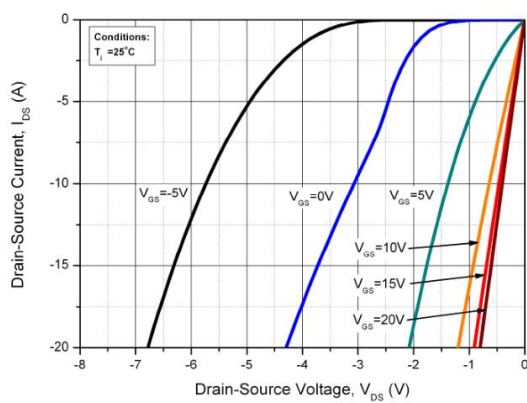


Fig. 9 Reverse Output Characteristics at $T_j = 25^\circ\text{C}$

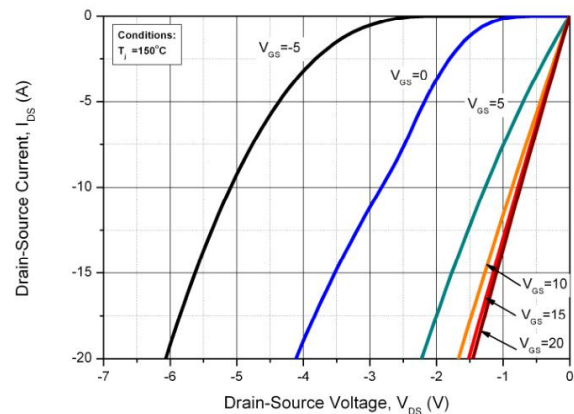


Fig. 10 Reverse Output Characteristics at $T_j = 150^\circ\text{C}$

Typical Device Performance

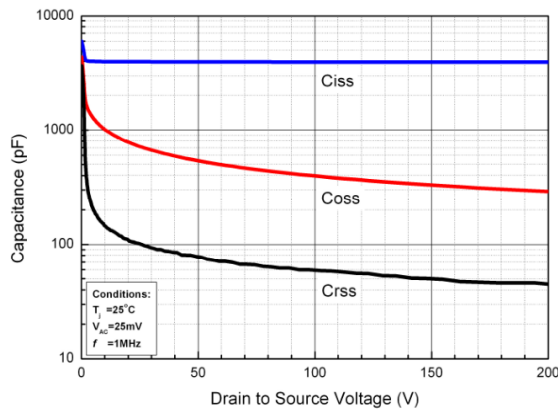


Fig. 11 Capacitances vs. Drain to Source Voltage (0 - 200V)

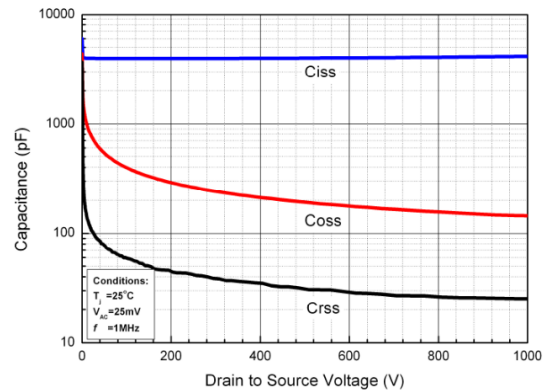


Fig. 12 Capacitances vs. Drain to Source Voltage (0 - 1000V)

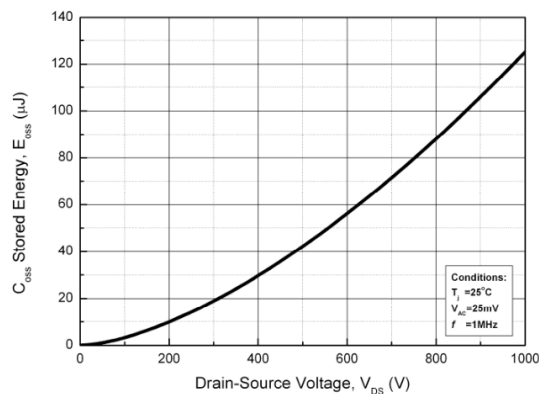


Fig. 13 Output Capacitor Stored Energy

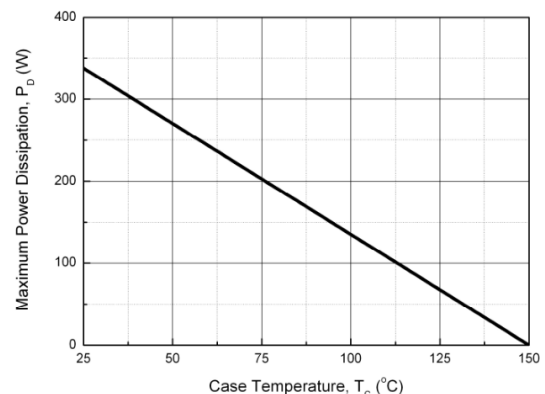


Fig. 14 Maximum Power Dissipation Derating vs. Case Temperature

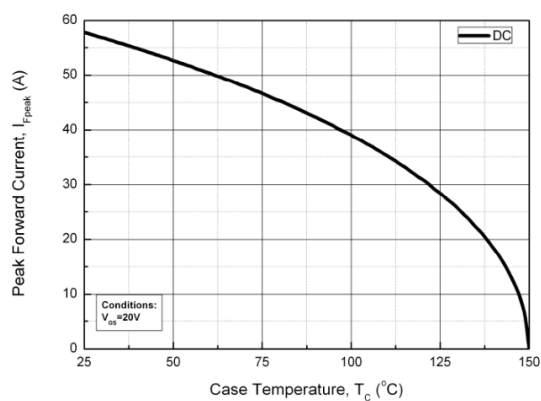


Fig. 15 Drain Current Derating vs. Case Temperature

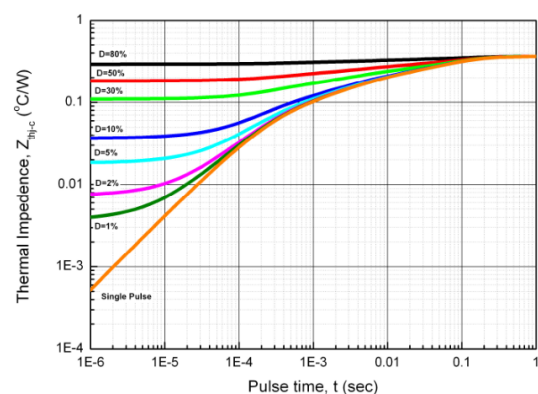


Fig. 16 Transient Junction to Case Thermal Impedance

Typical Device Performance

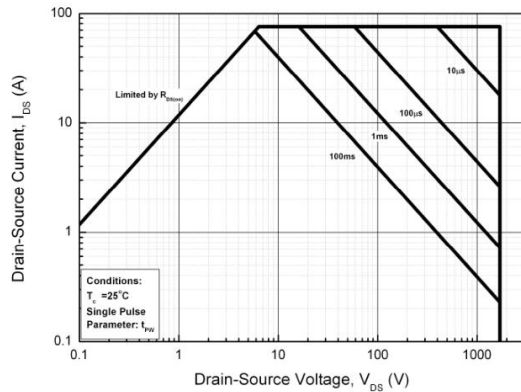


Fig. 17 Safe Operating Area

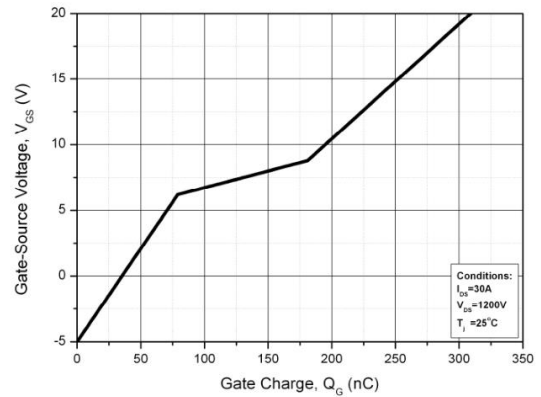


Fig. 18 Gate Charge Characteristics

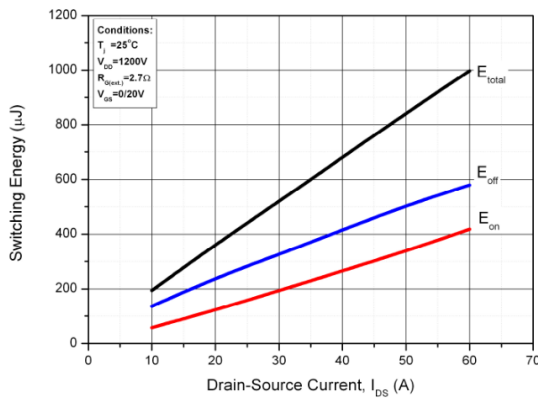


Fig. 19 Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}=1200\text{V}$)*

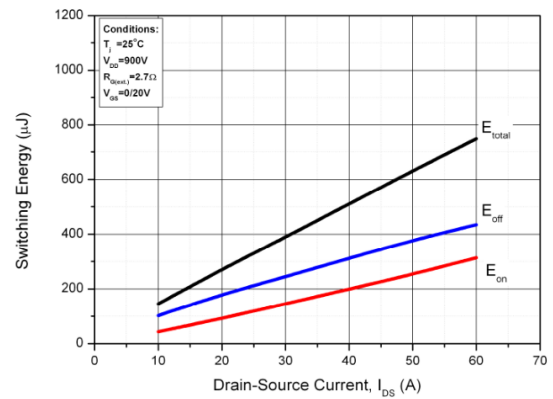


Fig. 20 Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}=900\text{V}$)*

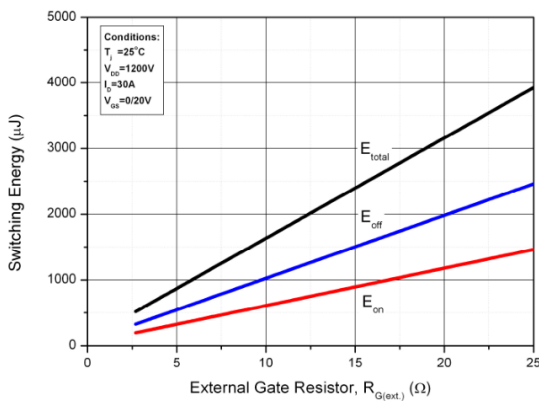
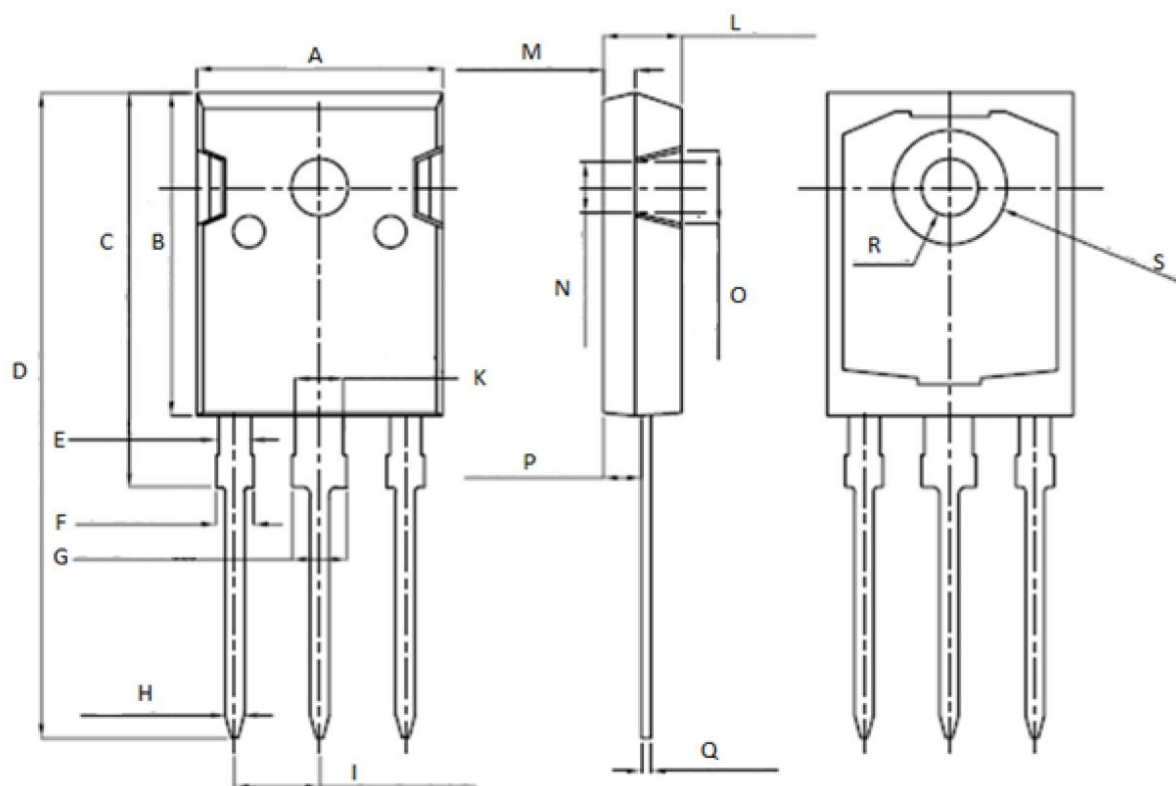


Fig. 21 Clamped Inductive Switching Energy vs. External Gate Resistor ($R_{G(ext.)}$)*

*Base on the results of calculation, note that the energy loss caused by the reverse recovery of FWD is not included in E_{on} .

TO-247



Unit: mm		
Symbol	Min.	Max.
A	15.95	16.25
B	20.85	21.25
C	20.95	21.35
D	40.5	40.9
E	1.9	2.1
F	2.1	2.25
G	3.1	3.25
H	1.1	1.3
I	5.40	5.50

Unit: mm		
Symbol	Min.	Max.
K	2.90	3.10
L	4.90	5.30
M	1.90	2.10
N	4.50	4.70
O	5.40	5.60
P	2.29	2.49
Q	0.51	0.71
R	φ 3.5	φ 3.7
S	φ 7.1	φ 7.3

*The information provided herein is subject to change without notice.

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