ALPHA & OMEGA SEMICONDUCTOR

AOM020V120X3Q

1200V αSiC Silicon Carbide Power MOSFET

Features

- Proprietary αSiC MOSFET technology
- Low loss, with low $R_{DS,\ ON}$
- Fast switching with low R_G and low capacitance
- Flexible gate voltage range (V_{GS} = 15 to 18V)
- Low reverse recovery diode (Qrr)
- AEC-Q101 Automotive Qualified

Product Summary

V_{DS} @ $T_{J,\ max}$	1200V
I_{DM}	200A
$R_{DS(ON),\ TYP}$	20mΩ
Q_{rr}	128nC
E_{OSS} @ 800V	60µJ
100% UIS Tested	

Applications

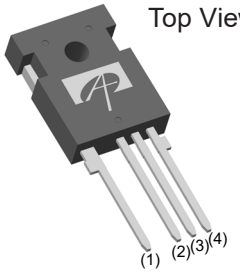
- xEV Charger
- Electric Vehicle Supply Equipment (EVSE)
- Motor Drives
- Automotive Inverters

AEC Qualified

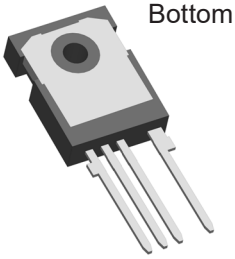
GREEN Product

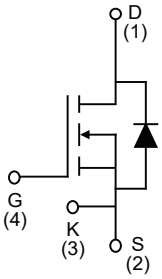
Pin Configuration

Top View



Bottom View





Ordering Part Number	Package Type	Form	Shipping Quantity
AOM020V120X3Q	TO-247-4L	Tube	30/Tube

Absolute Maximum Ratings

(T_A = 25°C, unless otherwise noted)

Symbol	Parameter		AOM020V120X3Q	Units
V_{DS}	Drain-Source Voltage		1200	V
$V_{GS,MAX}$	Gate Source Voltage	Maximum	-8/+23	V
$V_{GS,OP,TRANS}$		Max Transient[A]	-10/+25	
$V_{GS,OP,ON}$		Recommended Operating Range[B]	15...18	
$V_{GS,OP,OFF}$			-5...-3	
I_D	Continuous Drain Current[C]	T_C = 25°C, V_{GS} = 18V	112	A
		T_C = 100°C, V_{GS} = 18V	79	
I_{DM}	Pulsed Drain Current[D]		200	
I_{SD}	Continuous Body Diode Forward Current V_{GS} = -3V, T_C = 25°C		93	A
E_{AS}	Single Pulsed Avalanche Energy[E]		1.1	J
P_D	Power Dissipation[D]		483	W
T_J, T_{STG}	Junction and Storage Temperature Range		-55 to 175	°C
T_L	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient[F,G]		40	°C/W
$R_{\theta JC}$	Maximum Junction-to-Case[H]	0.26	0.31	°C/W

Electrical Characteristics

(T_A = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250µA, V_{GS}=0V, T_J=25°C		1200			V
		I_D=250µA, V_{GS}=0V, T_J=175°C		1200			
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V, V_{GS}=0V				100	µA
I_{GSS}	Gate-Body Leakage Current	V_{DS}=0V, V_{GS}=+18/-3V				±200	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} , I_D=27mA		1.8	3	4.3	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=15V, I_D=27A	T_J=25°C		23.5	35	mΩ
			T_J=175°C		40		
		V_{GS}=18V, I_D=27A	T_J=25°C		20	29	
			T_J=175°C		38		
g_{FS}	Forward Transconductance	V_{DS}=20V, I_D=27A			20		S
V_{SD}	Diode Forward Voltage	I_S=27A, V_{GS}=-3V			4	5	V
DYNAMIC							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=800V, f=100kHz			3622		pF
C_{oss}	Output Capacitance				148		pF
C_{rss}	Reverse Transfer Capacitance				13		pF
E_{oss}	C_{oss} Stored Energy				60		µJ
$C_{o(er)}$	Effective output capacitance, energy related[K]	V_{GS}=0V, V_{DS}=0 to 800V, f=100kHz			186		pF
$C_{o(tr)}$	Effective output capacitance, time related[L]				247		pF
R_G	Gate Resistance	f=1MHz			1.5		Ω

Electrical Characteristics *(Continued)*

(T_A = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
SWITCHING						
Q_g	Total Gate Charge	V_{GS}=-3/+18V, V_{DS}=800V, I_D=27A		150		nC
Q_{gs}	Gate Source Charge			38		nC
Q_{gd}	Gate Drain Charge			42		nC
$t_{d(on)}$	Turn-On Delay Time	V_{GS}=-3V/+18V, V_{DS}=800V, I_D=30A, R_G=2Ω, L_a=60µH, FWD: AOM020V120X3Q		12		ns
t_r	Turn-On Rise Time			13		ns
$t_{D(off)}$	Turn-Off Delay Time			24		ns
t_f	Turn-Off Fall Time			10		ns
E_{on}	Turn-On Energy			320		µJ
E_{off}	Turn-Off Energy			58		µJ
E_{tot}	Total Switching Energy			378		µJ
t_{rr}	Body Diode Reverse Recovery Time	I_F=30A, dI/dt=1500A/µs, V_{GS}=-3V V_{DS}=800V		20		ns
I_{rm}	Peak Reverse Recovery Current			12		A
Q_{rr}	Body Diode Reverse Recovery Charge			128		nC

Notes:

A. t_{ON}< 1µs, t<25hrs over lifetime. t_{ON} is duration of V_{GS} transient and t is total time spent at $V_{GS,OP,TRANS}$ over product lifetime.

B. Device can be operated at V_{GS}=0/18V. Actual operating V_{GS} will depend on application specifics such as parasitic inductance and dV/dt but should not exceed maximum ratings.

C. Continuous drain current is calculated based on maximum $R_{\theta JC}$ and typical R_{DSON} at 175°C.

D. The power dissipation P_D is based on $T_{J(MAX)}$=175°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

E. L=5mH, I_{AS}=21A, R_G=25Ω, Starting T_J=25°C.

F. The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A =25°C.

G. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.

H. The value of $R_{\theta JC}$ is measured with the device mounted to a large heat-sink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.

Typical Electrical and Thermal Characteristics[I]

T_A = 25°C, unless otherwise specified.

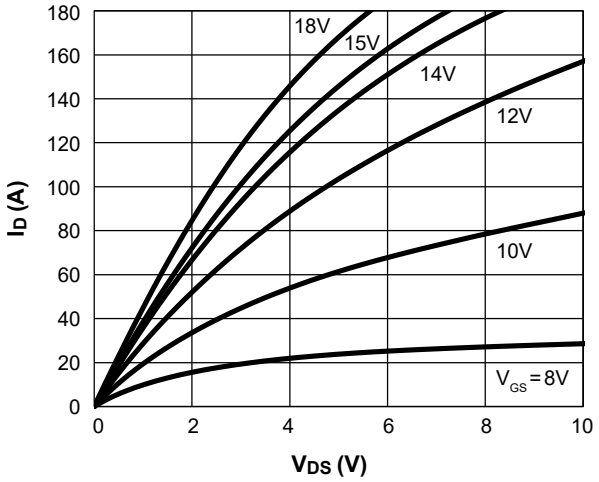


Figure 1. On-Region Characteristics T_J = 25°C

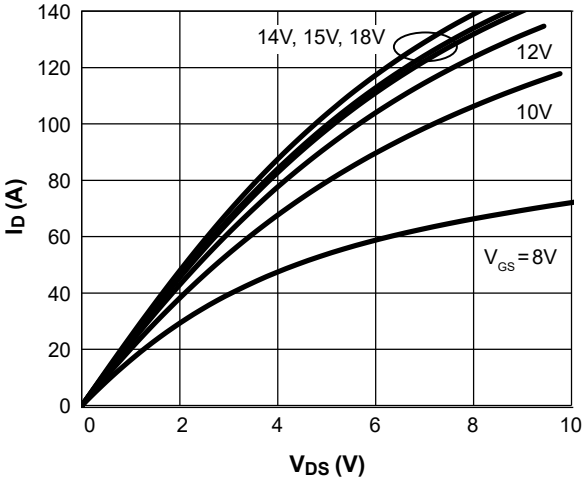


Figure 2. On-Region Characteristics T_J = 175°C

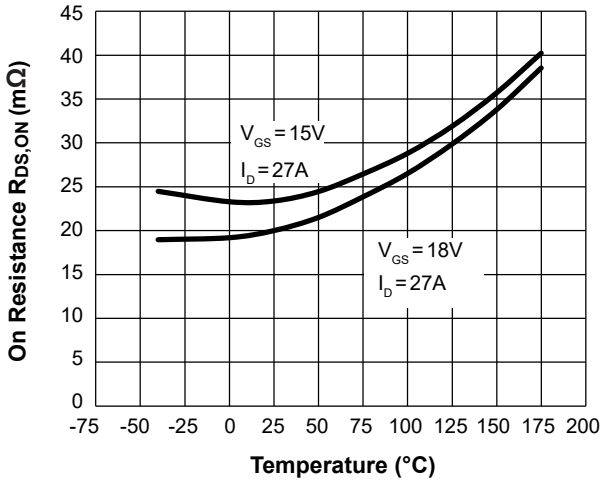


Figure 3. On-Resistance vs. Junction Temperature

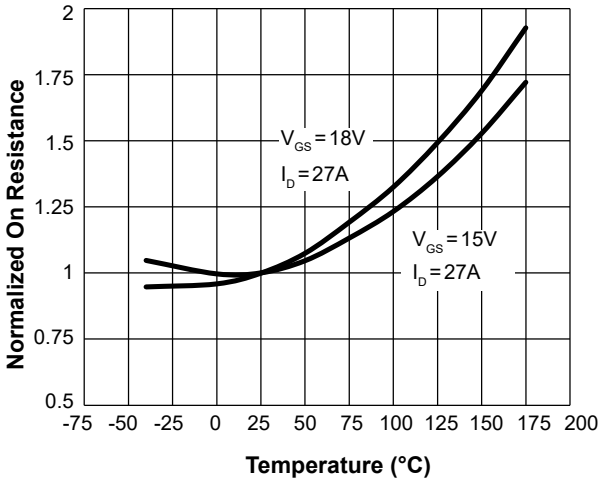


Figure 4. Normalized On-Resistance vs. Junction Temperature

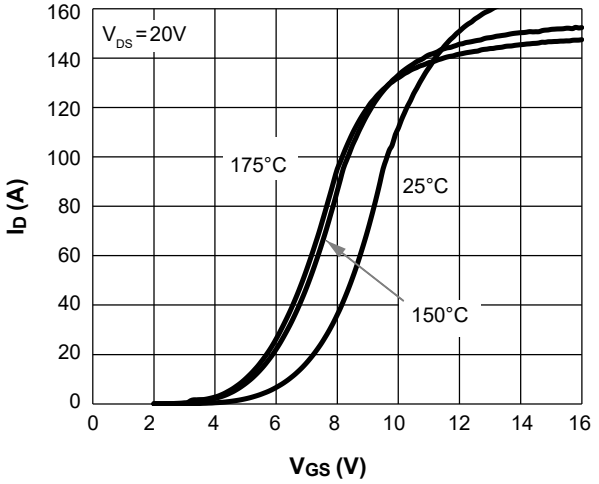


Figure 5. Transfer Characteristics

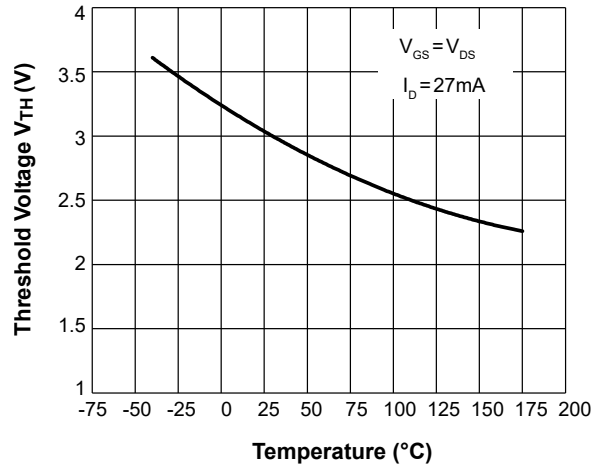


Figure 6. Threshold Voltage vs. Junction Temperature

Typical Electrical and Thermal Characteristics[I] *(Continued)*

T_A = 25°C, unless otherwise specified.

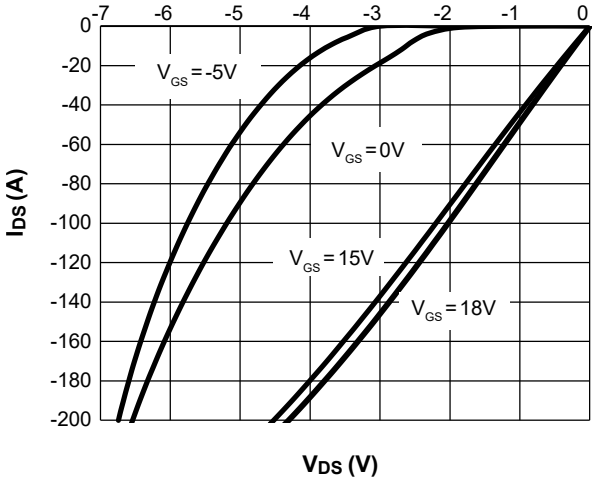


Figure 7. Body-Diode Characteristics at 25°C

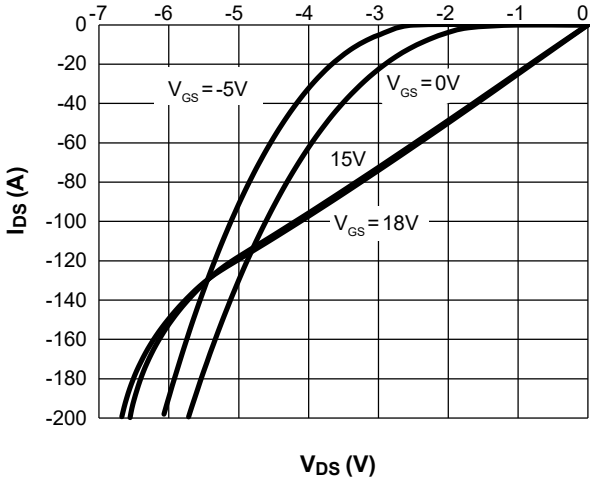


Figure 8. Body-Diode Characteristics at 175°C

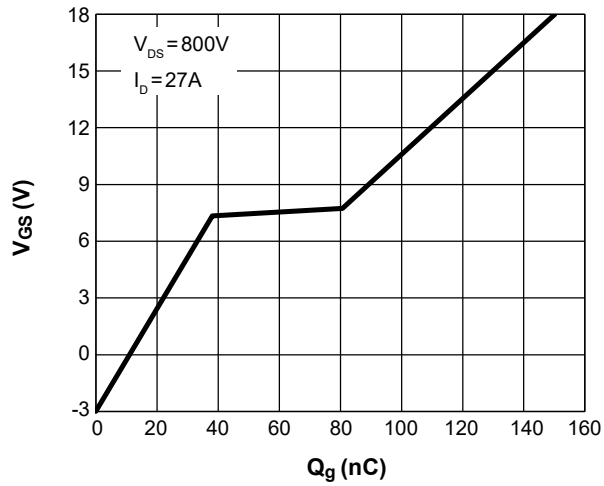


Figure 9. Gate-Charge Characteristics

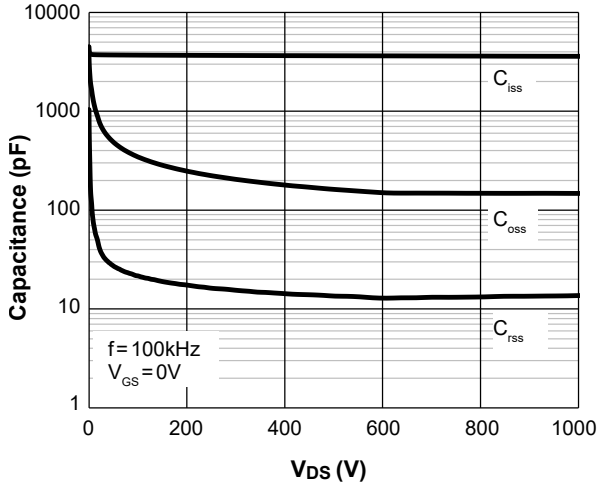


Figure 10. Capacitance Characteristics

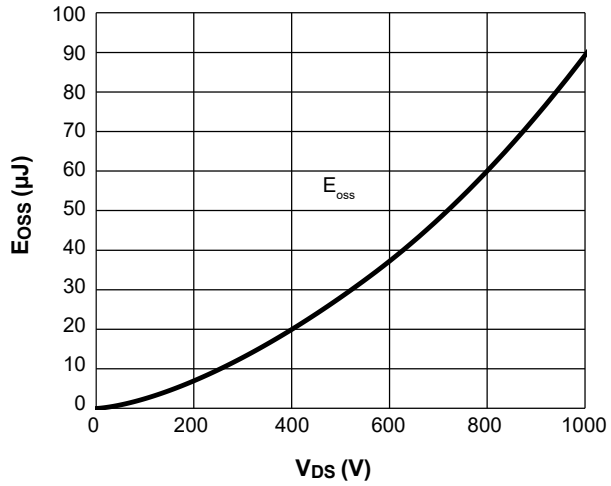


Figure 11. Coss Stored Energy

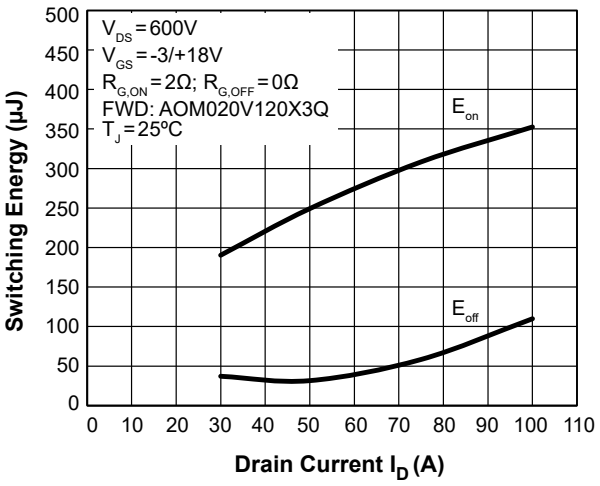


Figure 12. Switching Energy vs. Drain Current

Typical Electrical and Thermal Characteristics *(Continued)*

T_A = 25°C, unless otherwise specified.

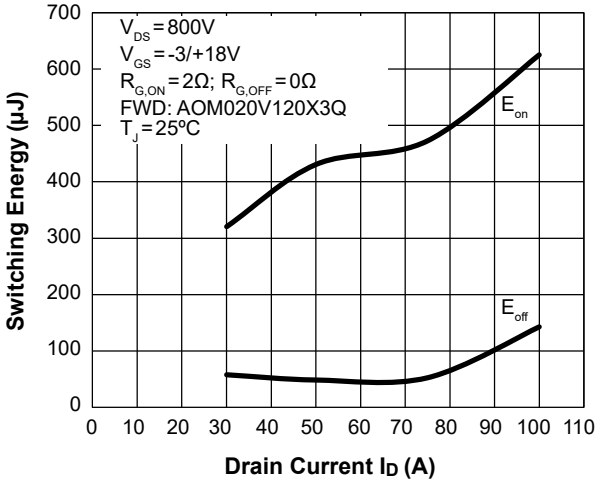


Figure 13. Switching Energy vs. Drain Current

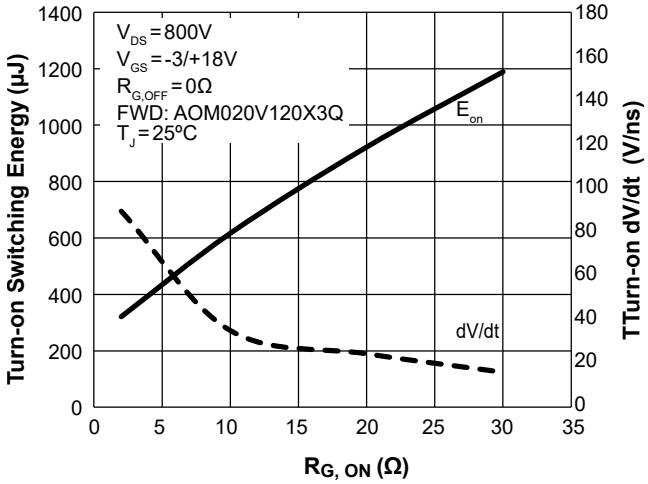


Figure 14. Turn-On Energy and dV/dt vs. External Gate Resistance

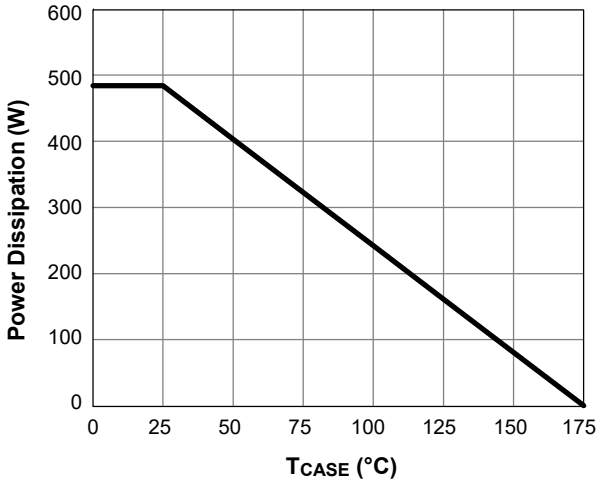


Figure 15. Power De-rating (Note J)

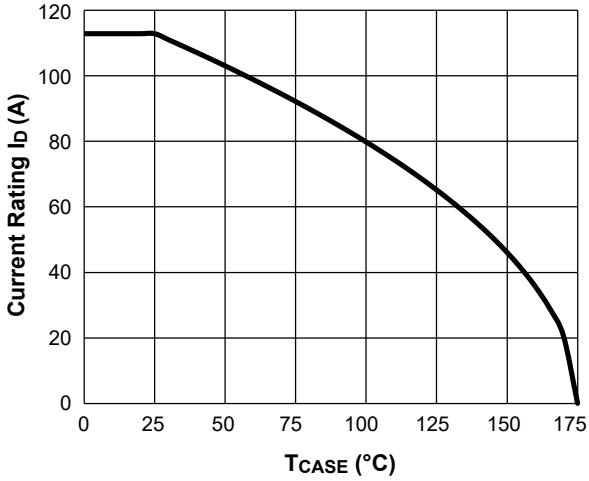


Figure 16. Current De-rating (Note C, J)

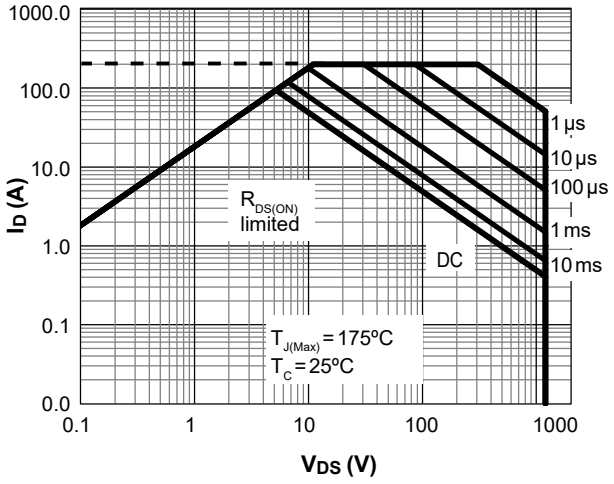


Figure 17. Maximum Forward Biased Safe Operating Area for AOM020V120X3Q (Note J)

Typical Electrical and Thermal Characteristics *(Continued)*

T_A = 25°C, unless otherwise specified.

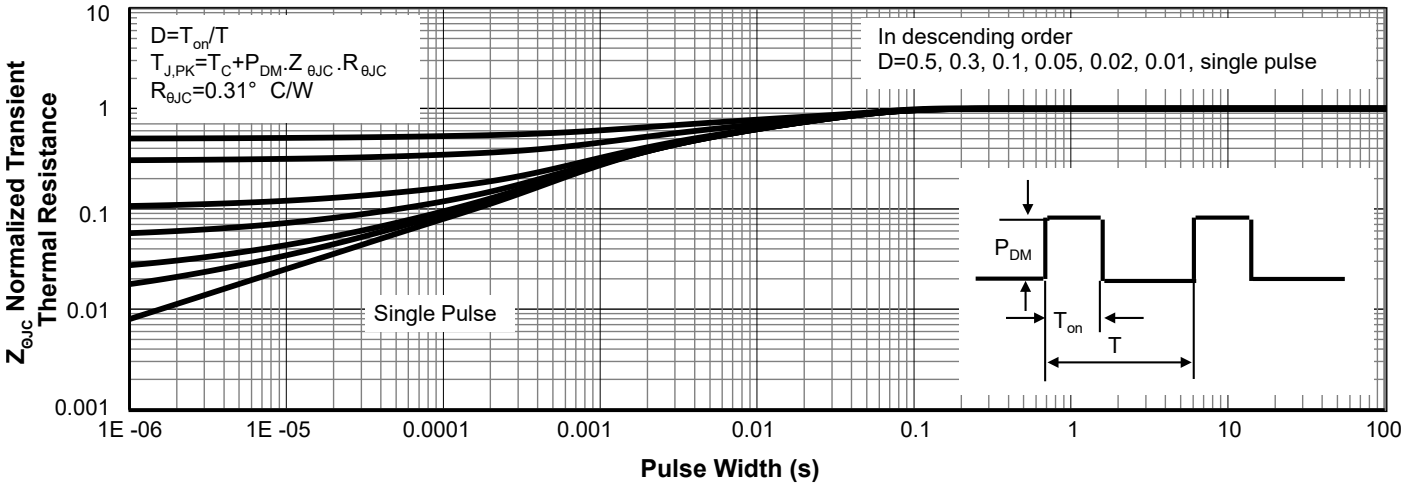


Figure 18. Normalized Maximum Transient Thermal Impedance for AOM020V120X3Q (Note J)

Notes:

I. The static characteristics in Figures 1 to 8 are obtained using < 300 ms pulses, duty cycle 0.5% max.

J. These curves are based on $R_{\theta JC}$ which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$ = 175°C. The SOA curve provides a single pulse rating.

K. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.

L. $C_{o(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.

Test Circuits and Waveforms

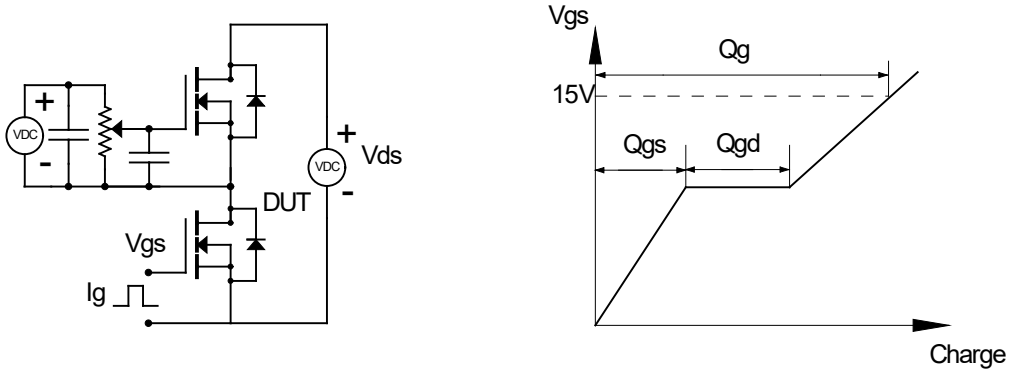


Figure 19. Gate Charge Test Circuits and Waveforms

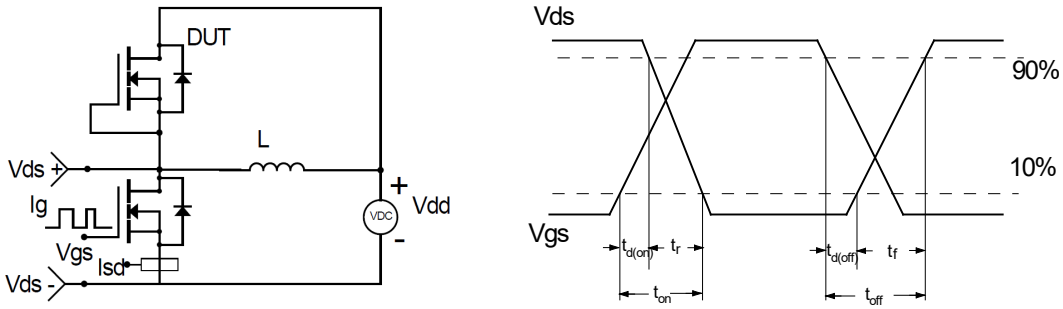


Figure 20. Inductive Switching Test Circuit and Waveforms

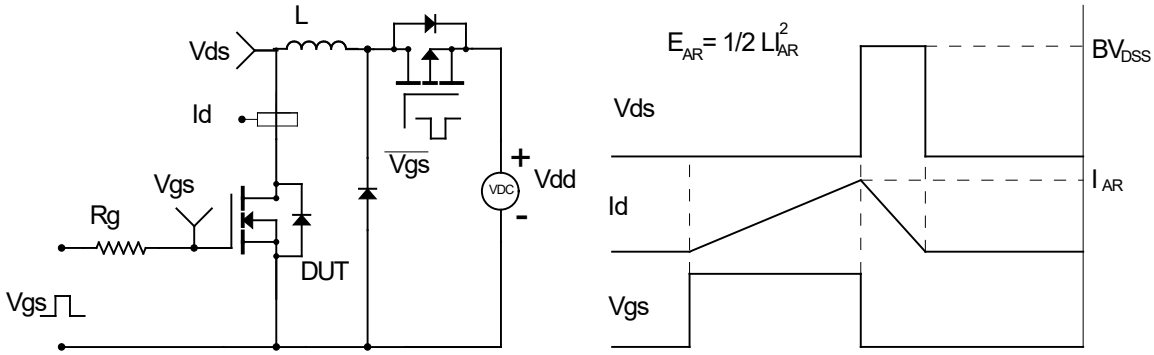


Figure 21. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms

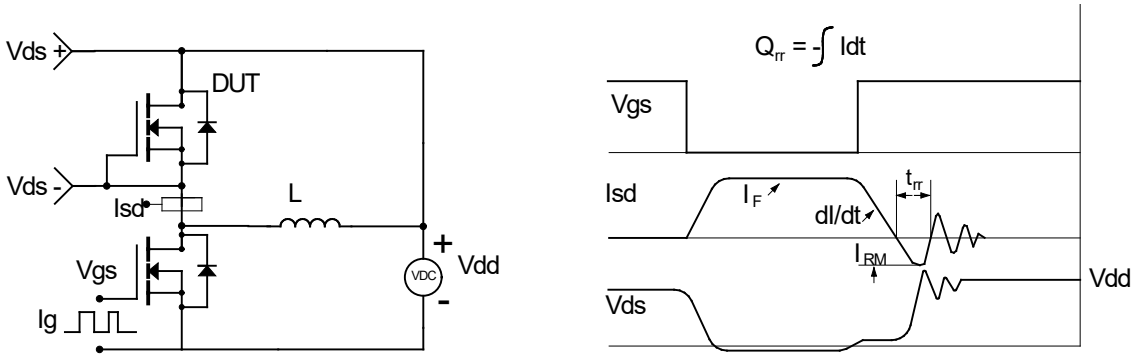
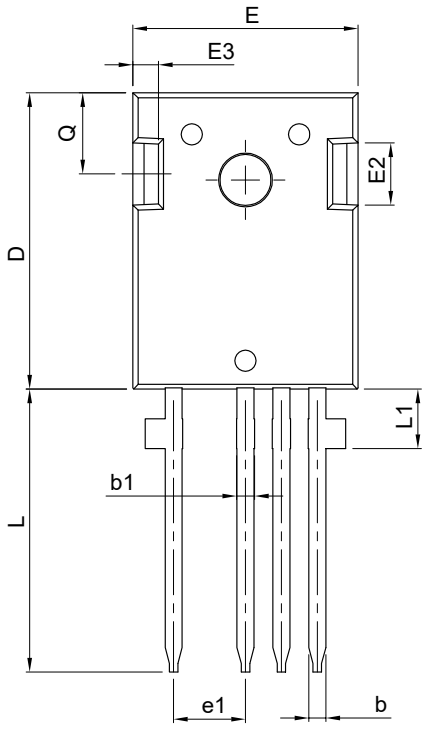
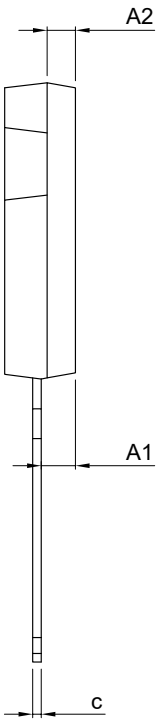


Figure 22. Diode Recovery Test Circuits and Waveforms

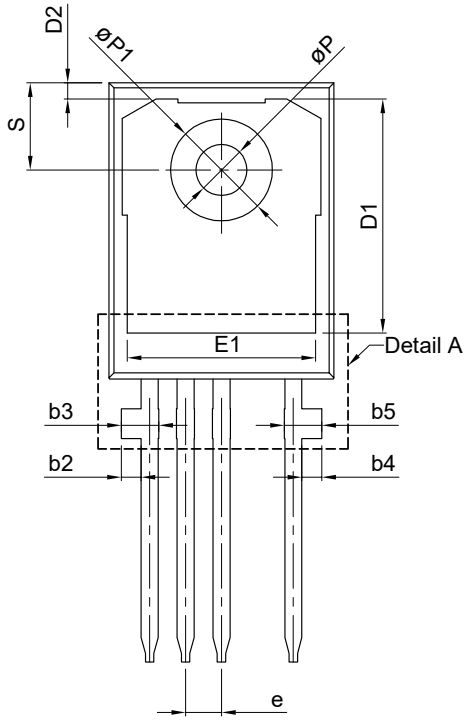
Package Dimensions, TO-247-4L



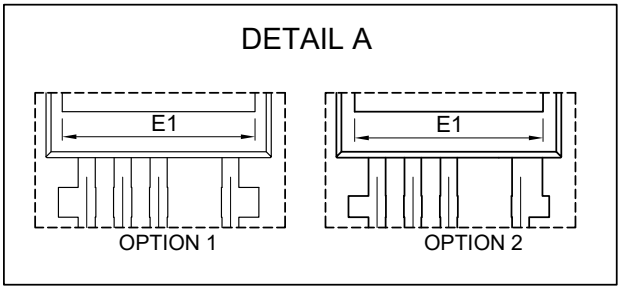
TOP VIEW



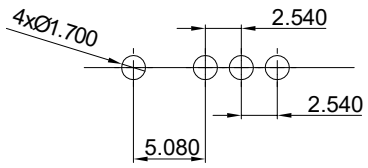
SIDE VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED THROUGH HOLES
FOR LAND PATTERN

SYMBOLS	DIM. IN MM			DIM. IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.90	5.00	5.10	0.193	0.197	0.201
A1	2.29	2.42	2.54	0.090	0.095	0.100
A2	1.90	2.00	2.10	0.075	0.079	0.083
b	1.17	1.22	1.27	0.046	0.048	0.050
b1	1.20	1.30	1.40	0.047	0.051	0.055
b2	1.31	1.41	1.51	0.052	0.056	0.059
b3	2.45	2.65	2.85	0.096	0.104	0.112
b4	1.31	1.41	1.51	0.052	0.056	0.059
b5	2.45	2.65	2.85	0.096	0.104	0.112
c	0.57	0.62	0.67	0.022	0.024	0.026
D	20.80	20.95	21.10	0.819	0.825	0.831
D1	16.25	16.55	16.85	0.640	0.652	0.663
D2	1.00	1.15	1.30	0.039	0.045	0.051
E	15.77	15.92	16.07	0.621	0.627	0.632
E1(Option1)	13.43	13.63	13.83	0.529	0.537	0.544
E1(Option2)	13.18	13.33	13.48	0.519	0.525	0.531
E2	4.29	4.39	4.49	0.169	0.173	0.177
E3	1.70	1.80	1.90	0.067	0.071	0.075
e		2.54BSC			0.1000BSC	
e1		5.08BSC			0.2000BSC	
N		4			4	
L	19.82	20.02	20.22	0.780	0.788	0.796
L1	4.01	4.21	4.41	0.158	0.166	0.174
P	3.50	3.60	3.70	0.138	0.142	0.146
P1	7.00	7.20	7.40	0.276	0.283	0.291
Q	5.65	5.75	5.85	0.222	0.226	0.230
S	6.07	6.17	6.27	0.239	0.243	0.247

NOTE:

1. CONTROLLED DIMENSIONS ARE IN MILLIMETERS.

Part Marking

AOM020V120X3Q
TO-247-4L