

Features

- Proprietary α SiC 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 (Q_{rr})
- AEC-Q101 Automotive Qualified

Product Summary

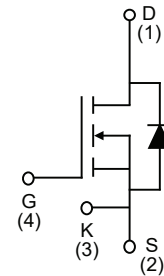
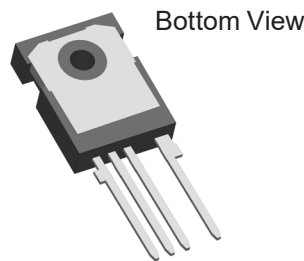
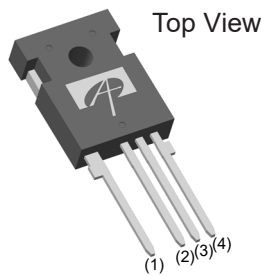
$V_{DS} @ T_{J, max}$	1200V
I_{DM}	100A
$R_{DS(ON), TYP}$	40m Ω
Q_{rr}	71nC
$E_{OSS} @ 800V$	32 μ J
100% UIS Tested	

Applications

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



Pin Configuration



Ordering Part Number	Package Type	Form	Shipping Quantity
AOM040V120X3Q	TO-247-4L	Tube	30/Tube

Absolute Maximum Ratings

($T_A = 25^\circ C$, unless otherwise noted)

Symbol	Parameter		AOM040V120X3Q	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)	$T_C = 25^\circ C, V_{GS} = 18V$	46	A
		$T_C = 100^\circ C, V_{GS} = 18V$	32	
I_{DM}	Pulsed Drain Current ^(D)		100	
I_{SD}	Continuous Body Diode Forward Current $V_{GS} = -3V, T_C = 25^\circ C$		37	A
E_{AS}	Single Pulsed Avalanche Energy ^(E)		422	mJ
P_D	Power Dissipation ^(D)		164	W
T_J, T_{STG}	Junction and Storage Temperature Range		-55 to 175	$^\circ C$
T_L	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		300	$^\circ C$

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)	0.76	0.91	°C/W

Electrical Characteristics

($T_A = 25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$, $T_J = 25^\circ\text{C}$	1200			V
		$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$, $T_J = 175^\circ\text{C}$	1200			
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{V}$, $V_{GS} = 0\text{V}$			100	μA
I_{GSS}	Gate-Body Leakage Current	$V_{DS} = 0\text{V}$, $V_{GS} = +18/-3\text{V}$			± 200	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 14\text{mA}$	1.8	3	4.3	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 15\text{V}$, $I_D = 14\text{A}$	$T_J = 25^\circ\text{C}$	47	70	m Ω
			$T_J = 175^\circ\text{C}$	80		
		$V_{GS} = 18\text{V}$, $I_D = 14\text{A}$	$T_J = 25^\circ\text{C}$	40	58	
			$T_J = 175^\circ\text{C}$	77		
g_{FS}	Forward Transconductance	$V_{DS} = 20\text{V}$, $I_D = 14\text{A}$		10		S
V_{SD}	Diode Forward Voltage	$I_S = 14\text{A}$, $V_{GS} = -3\text{V}$		4	5	V
DYNAMIC						
C_{iss}	Input Capacitance	$V_{GS} = 0\text{V}$, $V_{DS} = 800\text{V}$, $f = 100\text{kHz}$		1830		pF
C_{oss}	Output Capacitance			80		pF
C_{rss}	Reverse Transfer Capacitance			6		pF
E_{oss}	C_{oss} Stored Energy			32		μJ
$C_{o(er)}$	Effective output capacitance, energy related ^(K)	$V_{GS} = 0\text{V}$, $V_{DS} = 0$ to 800V , $f = 100\text{kHz}$		101		pF
$C_{o(tr)}$	Effective output capacitance, time related ^(L)			134		pF
R_G	Gate Resistance	$f = 1\text{MHz}$		1.7		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 = 14A		79		nC
Q _{gs}	Gate Source Charge			20		nC
Q _{gd}	Gate Drain Charge			26		nC
t _{d(on)}	Turn-On Delay Time	V _{GS} = -3V/+18V, V _{DS} = 800V, I _D = 13A, R _G = 2Ω L _a = 60μH		8		ns
t _r	Turn-On Rise Time			8		ns
t _{D(off)}	Turn-Off Delay Time			19		ns
t _f	Turn-Off Fall Time			13		ns
E _{on}	Turn-On Energy			135		μJ
E _{off}	Turn-Off Energy			36		μJ
E _{tot}	Total Switching Energy	FWD: AOM040V120X3Q		171		μJ
t _{rr}	Body Diode Reverse Recovery Time	I _F = 13A, dI/dt = 1500A/μs, V _{GS} = -3V V _{DS} = 800V		14		ns
I _{rm}	Peak Reverse Recovery Current			9		A
Q _{rr}	Body Diode Reverse Recovery Charge			71		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_{θJC} and typical R_{DS(on)} 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_{θJA} is measured with the device in a still air environment with T_A = 25°C.
- G. The R_{θJA} is the sum of the thermal impedance from junction to case R_{θJC} and case to ambient.
- H. The value of R_{θJC} 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⁽¹⁾

$T_A = 25^\circ\text{C}$, unless otherwise specified.

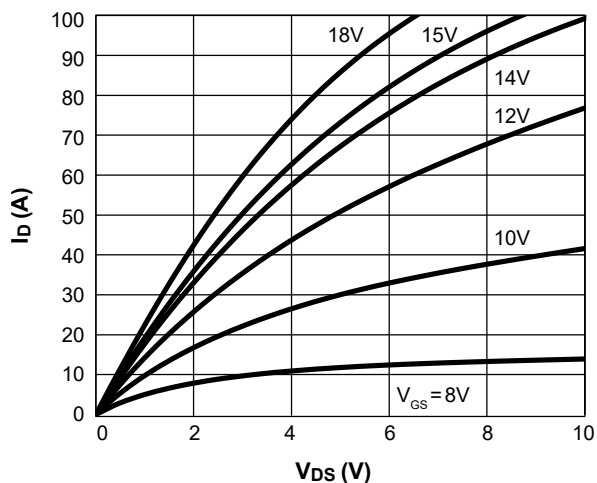


Figure 1. On-Region Characteristics $T_J = 25^\circ\text{C}$

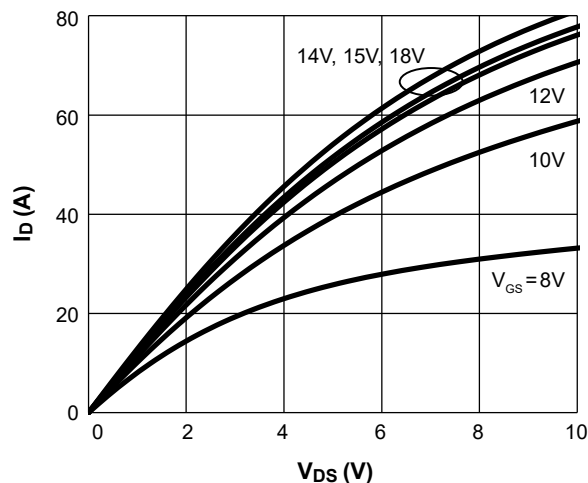


Figure 2. On-Region Characteristics $T_J = 175^\circ\text{C}$

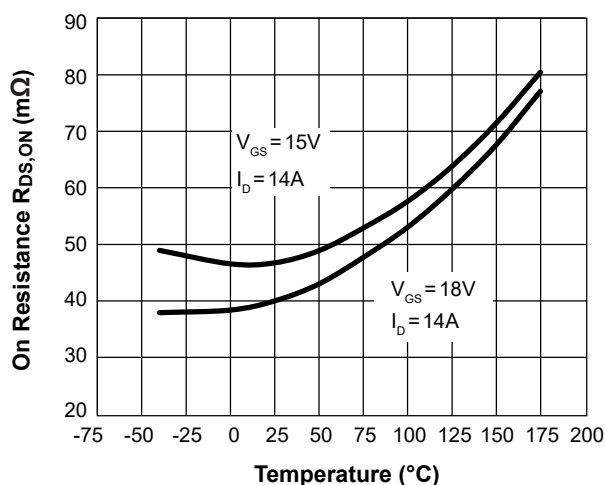


Figure 3. On-Resistance vs. Junction Temperature

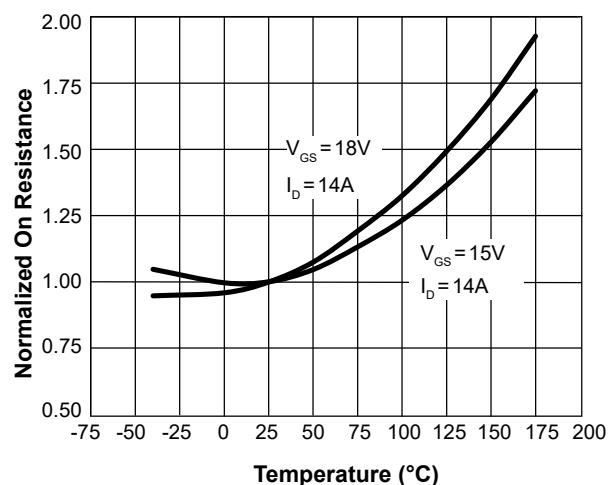


Figure 4. Normalized On-Resistance vs. Junction Temperature

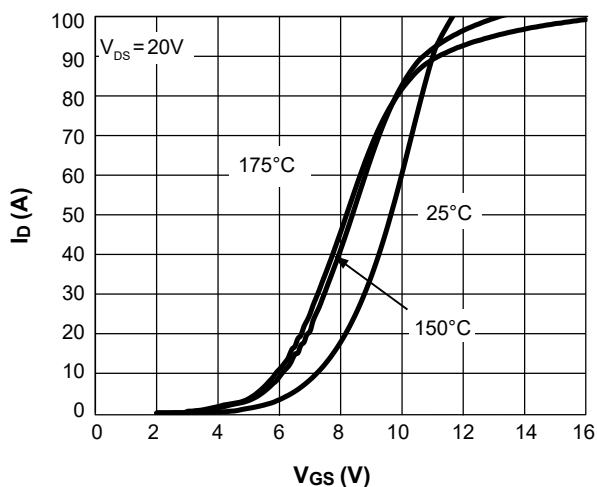


Figure 5. Transfer Characteristics

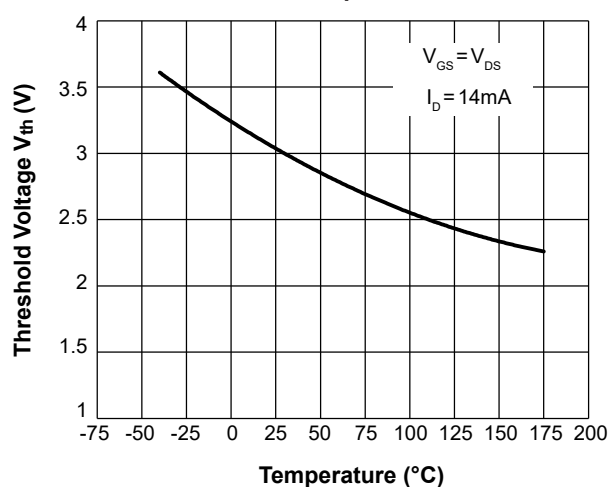


Figure 6. Threshold Voltage vs. Junction Temperature

Typical Electrical and Thermal Characteristics⁽¹⁾ (Continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified.

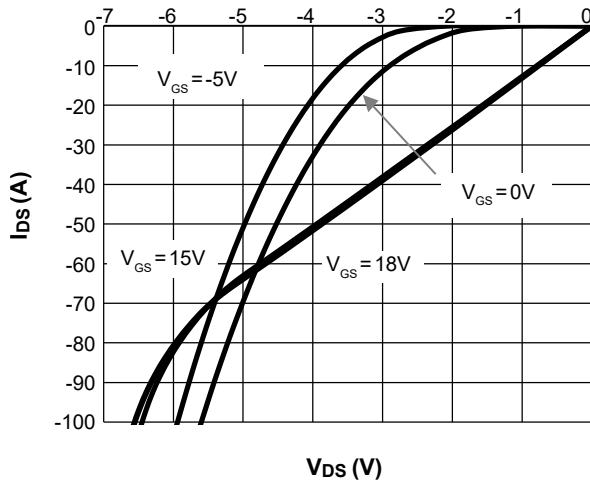


Figure 7. Body-Diode Characteristics at 25°C

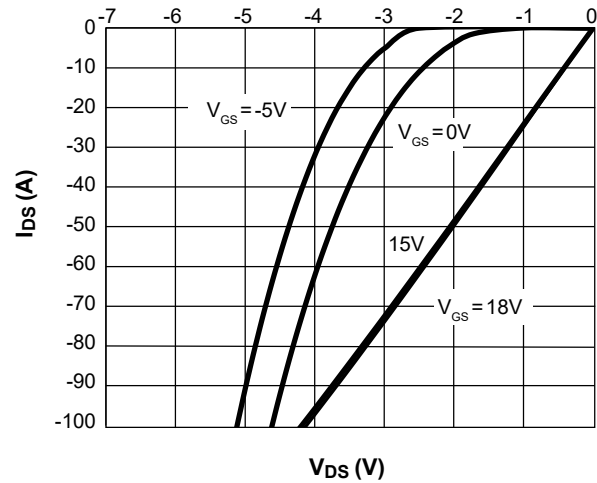


Figure 8. Body-Diode Characteristics at 175°C

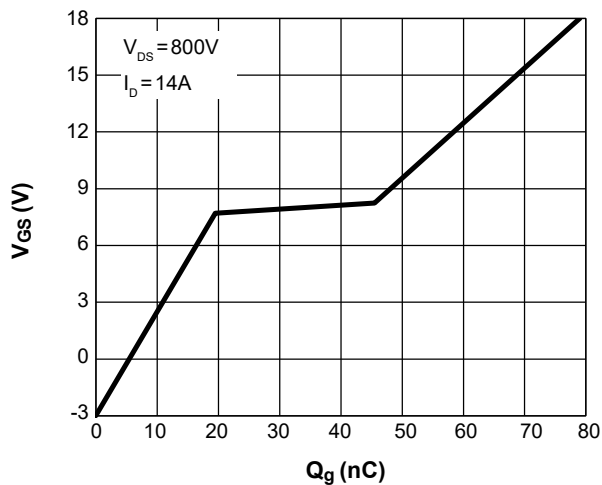


Figure 9. Gate-Charge Characteristics

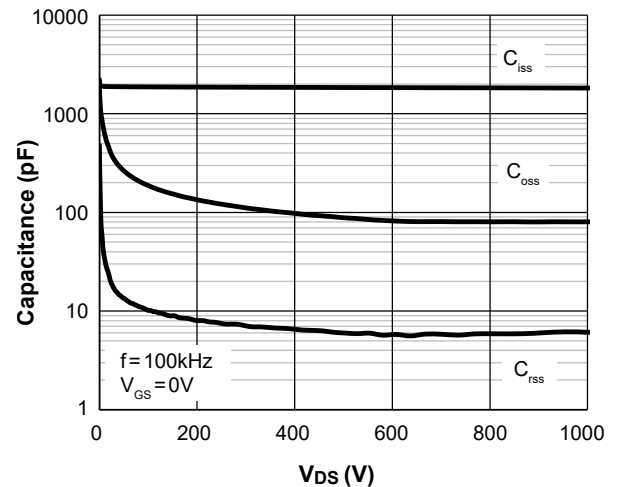


Figure 10. Capacitance Characteristics

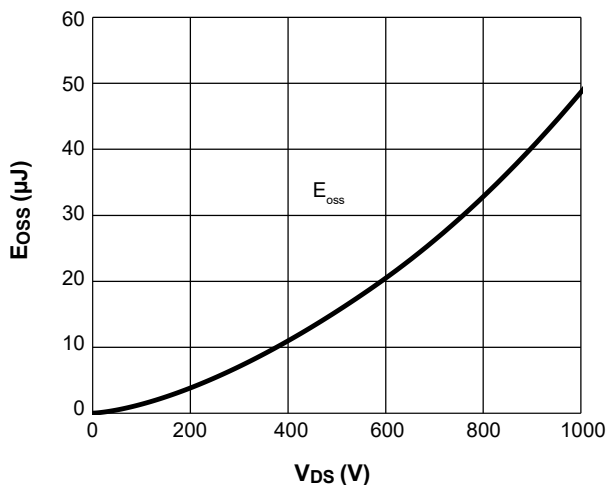


Figure 11. C_{oss} Stored Energy

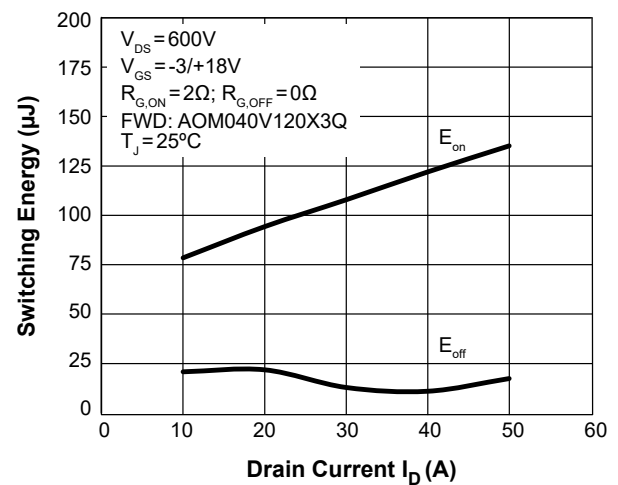


Figure 12. Switching Energy vs. Drain Current

Typical Electrical and Thermal Characteristics (Continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified.

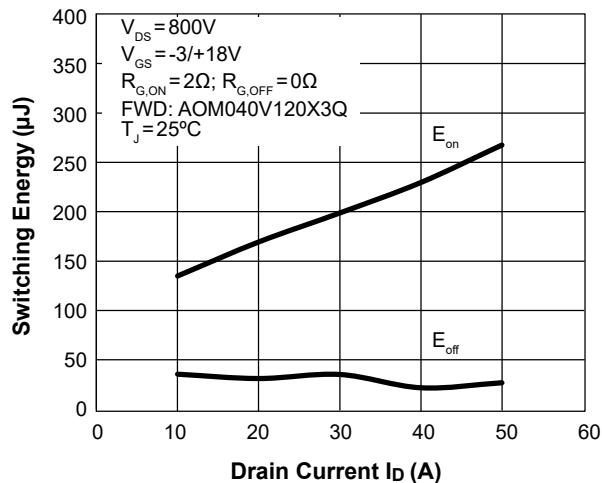


Figure 13. Switching Energy vs. Drain Current

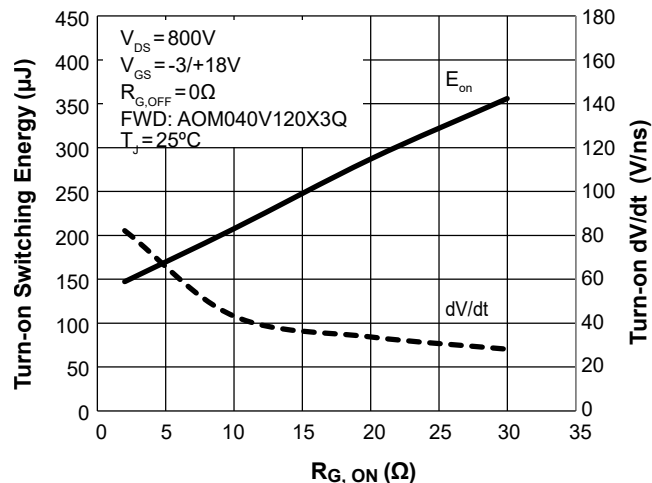


Figure 14. Turn-On Energy and dV/dt vs. External Gate Resistance

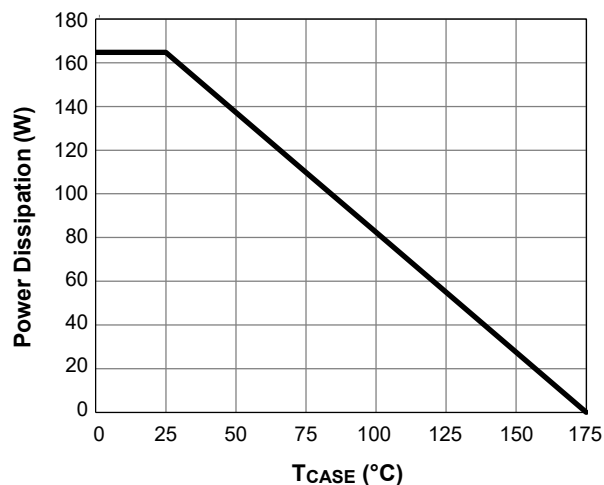


Figure 15. Power De-rating (Note J)

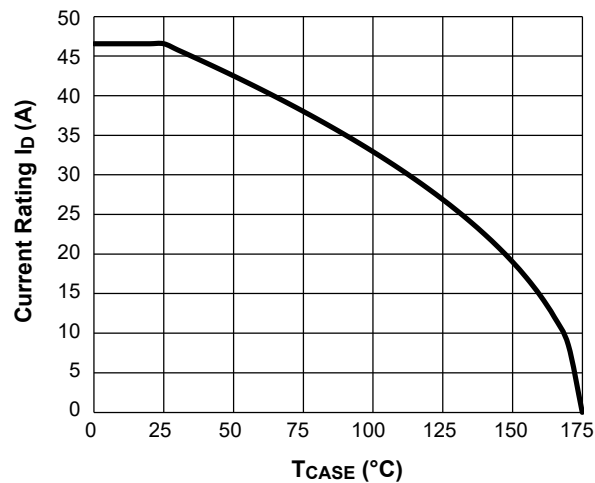


Figure 16. Current De-rating (Note C, J)

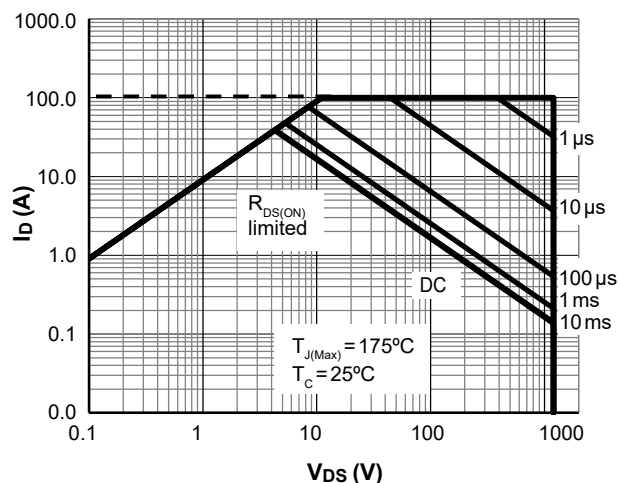


Figure 17. Maximum Forward Biased Safe Operating Area for AOM040V120X3Q (Note J)

Typical Electrical and Thermal Characteristics (Continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified.

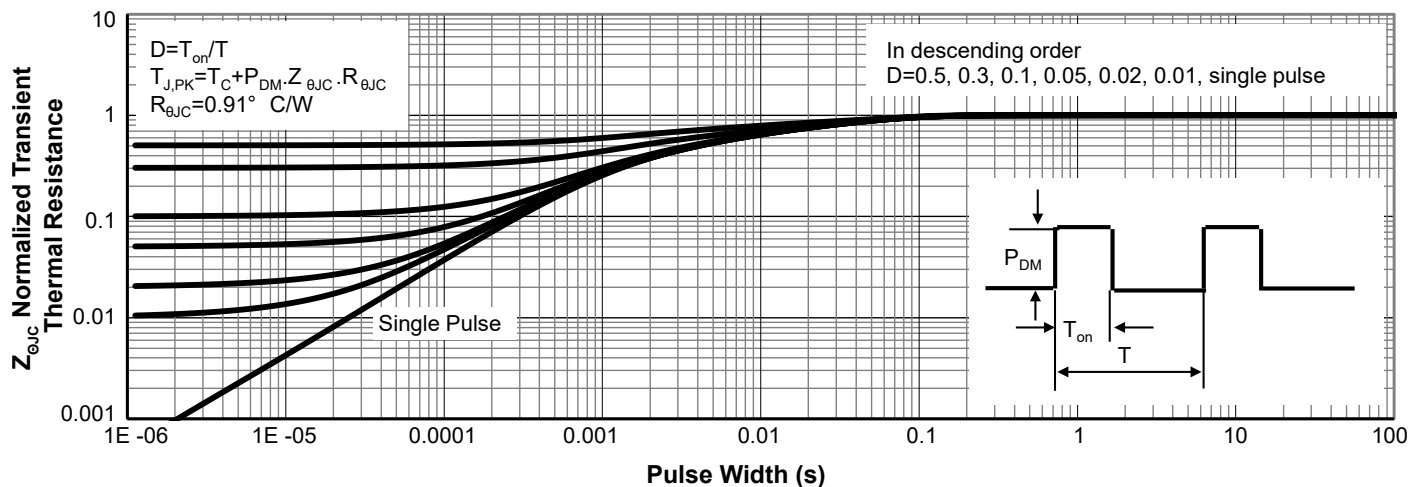


Figure 18. Normalized Maximum Transient Thermal Impedance for AOM040V120X3Q (Note J)

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 $T_{J(MAX)} = 175^\circ\text{C}$. 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

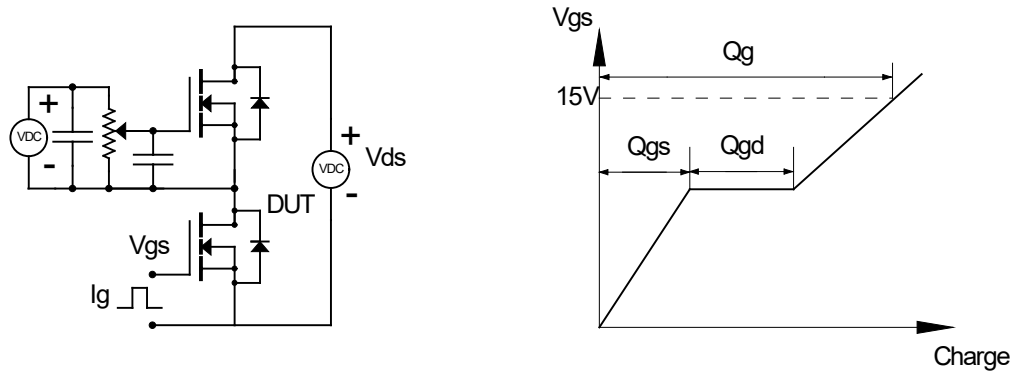


Figure 19. Gate Charge Test Circuits and Waveforms

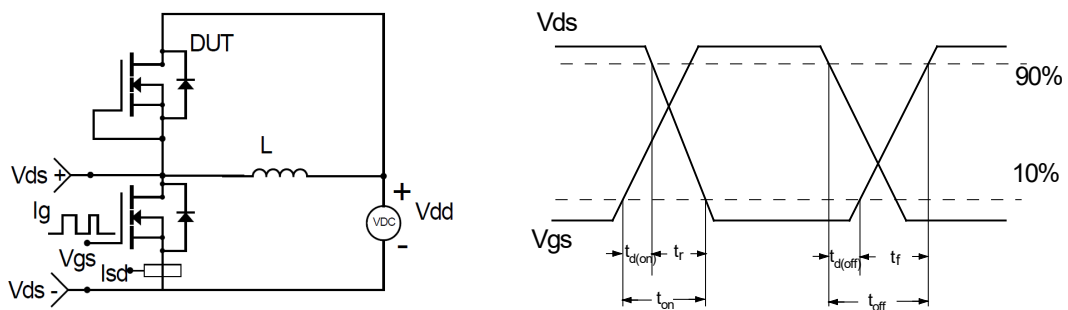


Figure 20. Inductive Switching Test Circuit and Waveforms

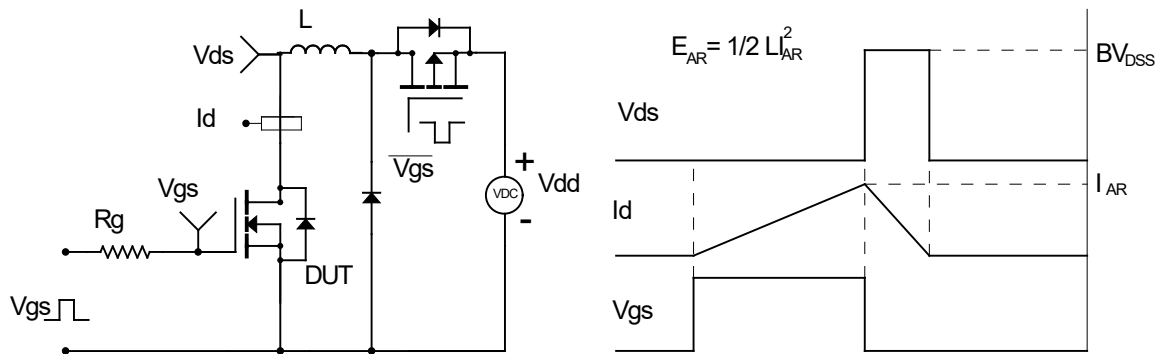


Figure 21. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms

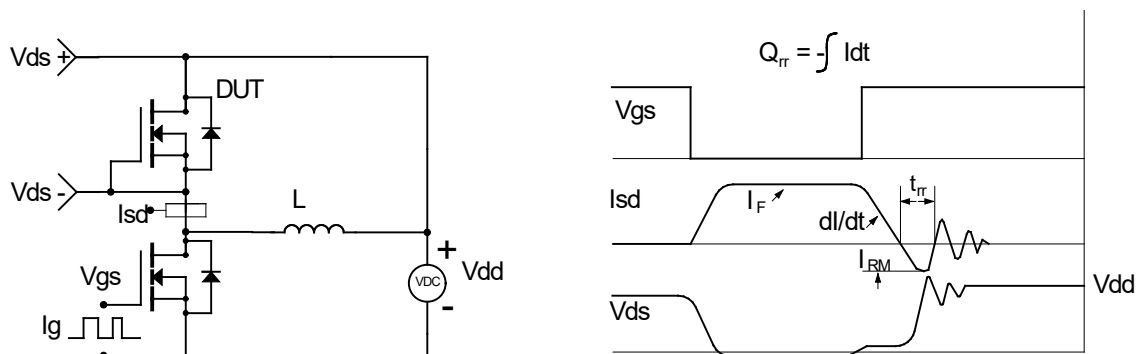
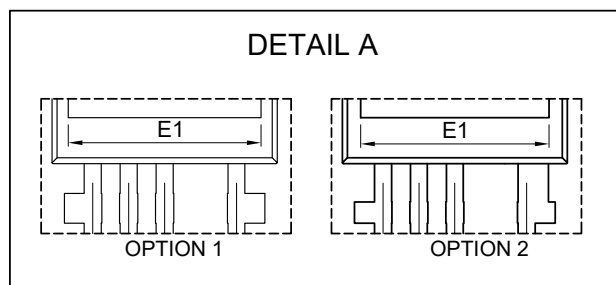
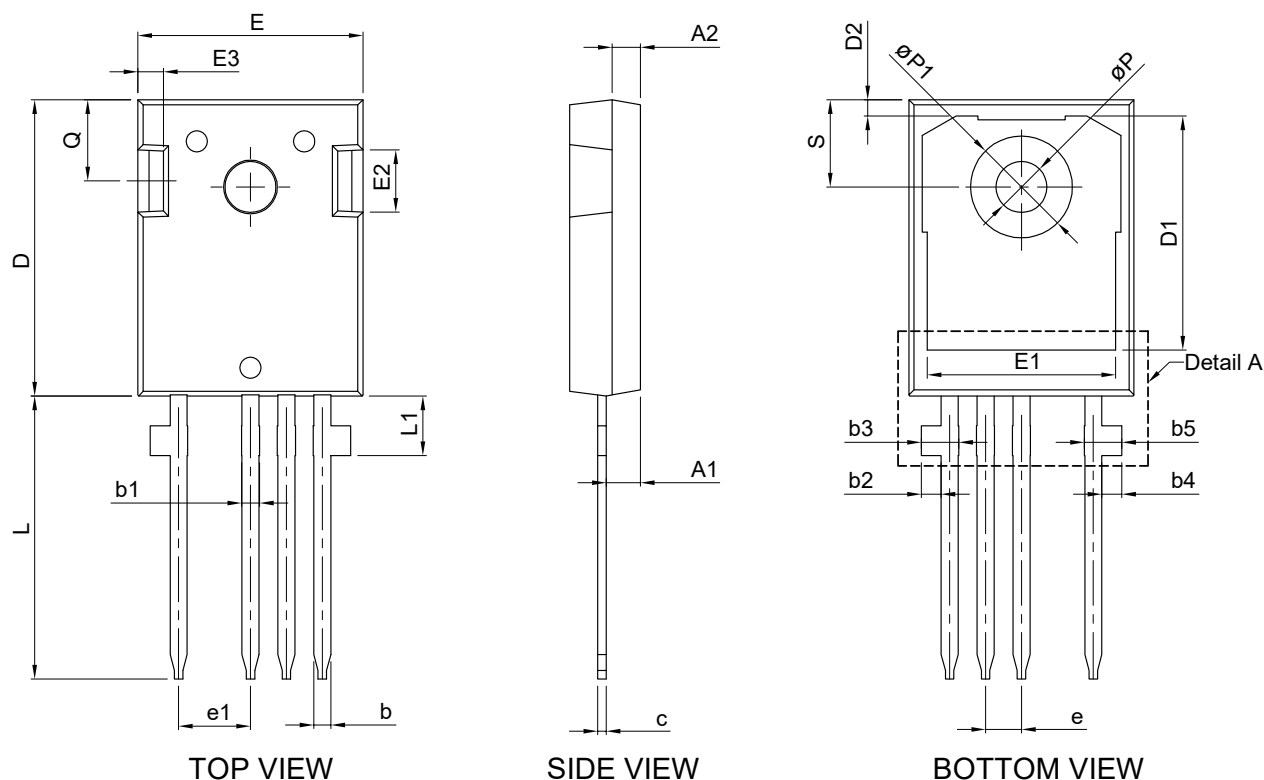
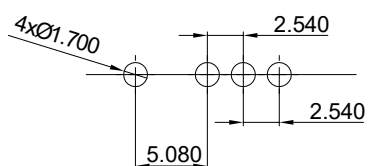


Figure 22. Diode Recovery Test Circuits and Waveforms

Package Dimensions, TO-247-4L



SIDE VIEW



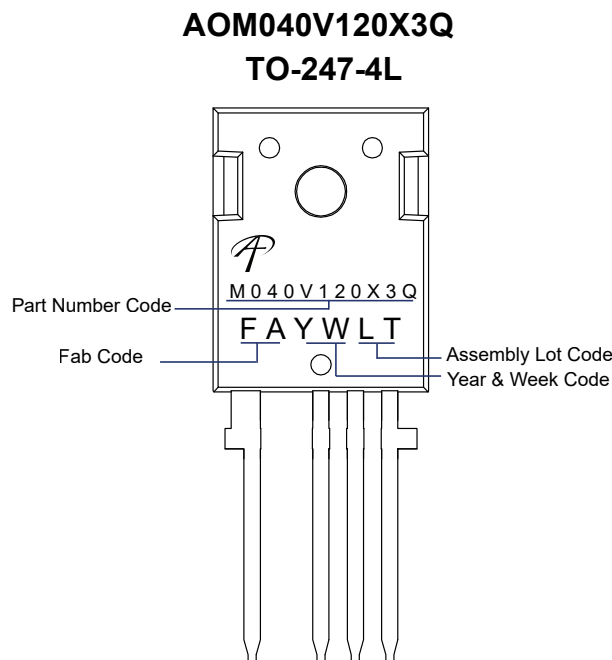
RECOMMENDED THROUGH HOLES FOR LAND PATTERN

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



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