ALPHA & OMEGA SEMICONDUCTOR

AOBB040V120X2Q

1200 V 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 18 V)
- Low reverse recovery diode (Qrr)
- AEC-Q101 Automotive Qualified

Product Summary

V_{DS} @ $T_{J,\ max}$	1200 V
I_{DM}	100 A
$R_{DS(ON),\ typ}$	40 mΩ
Q_{rr}	160 nC
E_{OSS} @ 800 V	44 µJ
100% UIS Tested	

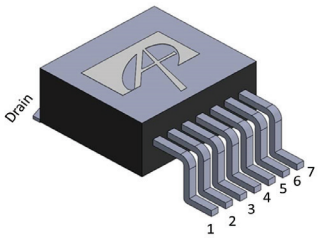
Applications

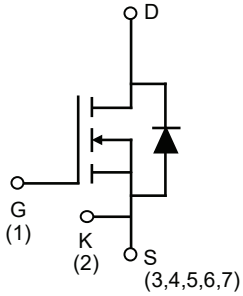
- xEV Charger
- Electric Vehicle Supply Equipment (EVSE)
- Motor Drives
- Automotive Inverters

AEC Qualified

GREEN Product

Pin Configuration





Ordering Part Number	Package Type	Form	Shipping Quantity
AOBB040V120X2Q	TO-263-7L	Tape & Reel	800/Reel

Absolute Maximum Ratings

(T_A = 25°C, unless otherwise noted)

Symbol	Parameter		AOBB040V120X2Q	Units
V_{DS}	Drain-Source Voltage		1200	V
$V_{GS,OP,TRANS}$	Gate Source Voltage	Max Transient[A]	-8/+22	V
$V_{GS,OP}$		Recommended Operating Range[B]	-5/+18	
I_D	Continuous Drain Current	T_C = 25°C, V_{GS} = 18 V	51	A
		T_C = 100°C, V_{GS} = 18 V	36	
I_{DM}	Pulsed Drain Current[C]		100	
I_{SD}	Continuous Body Diode Forward Current (V_{GS} =-5V)		52	
EAS	Single Pulsed Avalanche Energy[D]		640	mJ
P_D	Power Dissipation[C]		241	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		245	°C

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient(E,F)		40	°C/W
$R_{\theta JC}$	Maximum Junction-to-Case(G)	0.52	0.62	°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=150°C		1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V, V_{GS}=0V, T_J=25°C				100	µA
I_{GSS}	Gate-Body Leakage Current	V_{DS}=0V, V_{GS}=+15/-5V				±200	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} , I_D=13.2mA		1.8	2.8	3.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=15V, I_D=13.2A	T_J=25°C		45	59	mΩ
			T_J=175°C		71		mΩ
		V_{GS}=18V, I_D=13.2A	T_J=25°C		40	52	mΩ
			T_J=175°C		70		mΩ
g_{FS}	Forward Transconductance	V_{DS}=20V, I_D=13.2A			10		S
V_{SD}	Diode Forward Voltage	I_S=13.2A, V_{GS}=-5V			4	5	V
DYNAMIC							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=800V, f=1MHz			2316		pF
C_{oss}	Output Capacitance				103		pF
C_{rss}	Reverse Transfer Capacitance				14		pF
E_{oss}	Coss Stored Energy				44		µJ
R_G	Gate Resistance	f=1MHz		0.7	1.5	3.1	Ω
SWITCHING							
Q_g	Total Gate Charge	V_{GS}=-5/+18V, V_{DS}=800V, I_D=13.2A			91		nC
Q_{gs}	Gate Source Charge				28		nC
Q_{gd}	Gate Drain Charge				27		nC
$t_{d(on)}$	Turn-On Delay Time	V_{GS}=-5V/+18V, V_{DS}=800V, I_D=13A, R_G=2Ω, L=60µH, FWD: AOBB040V120X2Q			9		ns
t_r	Turn-On Rise Time				8		ns
$t_{d(off)}$	Turn-Off Delay Time				34		ns
t_f	Turn-Off Fall Time				17		ns
E_{on}	Turn-On Energy				170		µJ
E_{off}	Turn-Off Energy				33		µJ
E_{tot}	Total Switching Energy				203		µJ
t_{rr}	Body Diode Reverse Recovery Time	I_F=13A, dI/dt=1500A/us, V_{GS}=-5V, V_{DS}=800V			32		ns
I_{rm}	Peak Reverse Recovery Current				12		A
Q_{rr}	Body Diode Reverse Recovery Charge				160		nC

Notes:

A. t_{pulse}<1µs, f>1Hz

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. 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.

D. L=5mH, I_{AS}=16A, R_G=25Ω, Starting T_J=25°C.

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

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

G. 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(H)

T_A = 25 °C, unless otherwise specified.

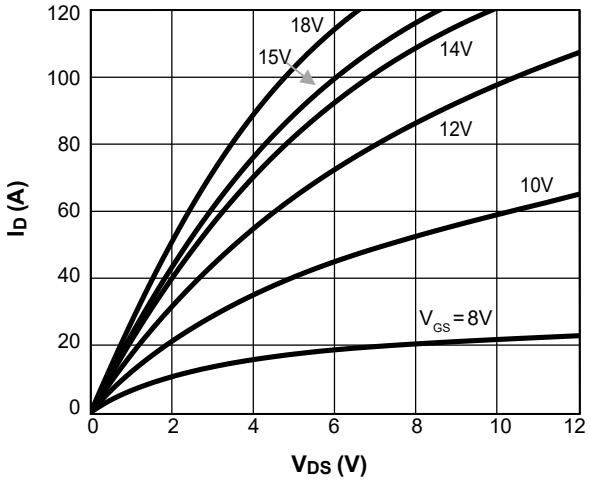


Figure 1. On-Region Characteristics T_J = 25°C

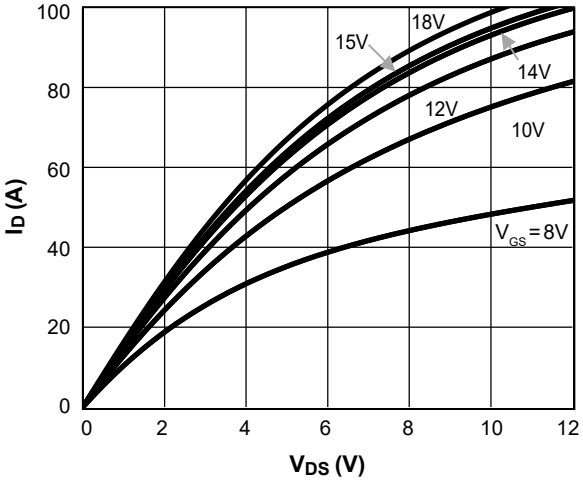


Figure 2. On-Region Characteristics T_J = 175°C

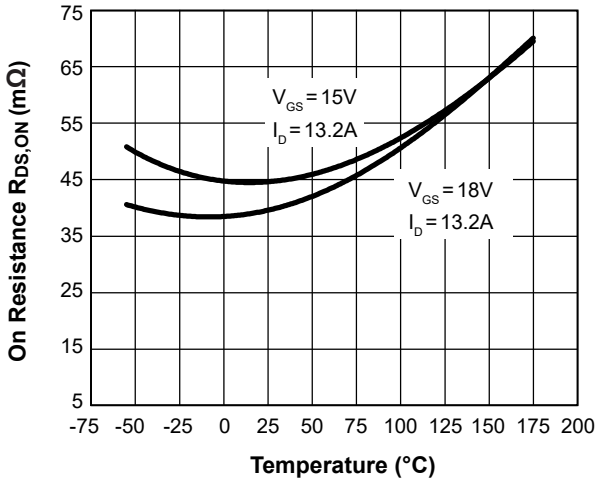


Figure 3. On Resistance vs. Junction Temperature

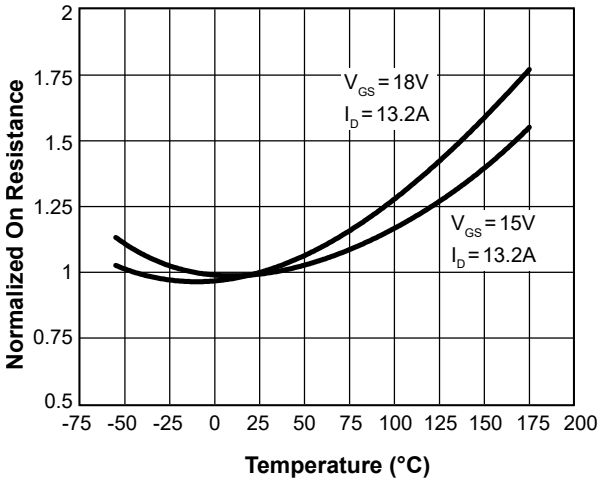


Figure 4. Normalized On Resistance vs. Junction Temperature

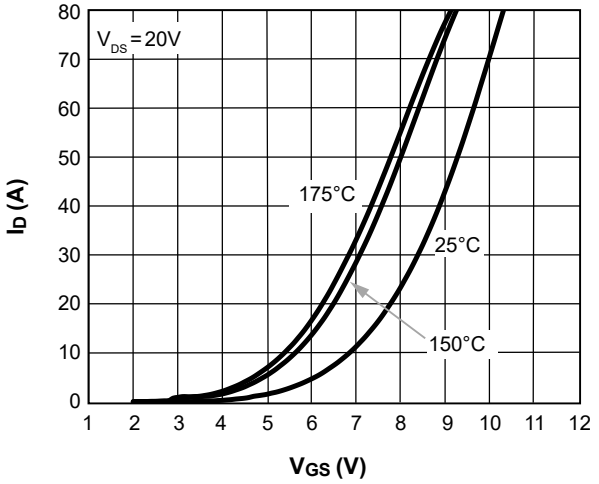


Figure 5. Transfer Characteristics

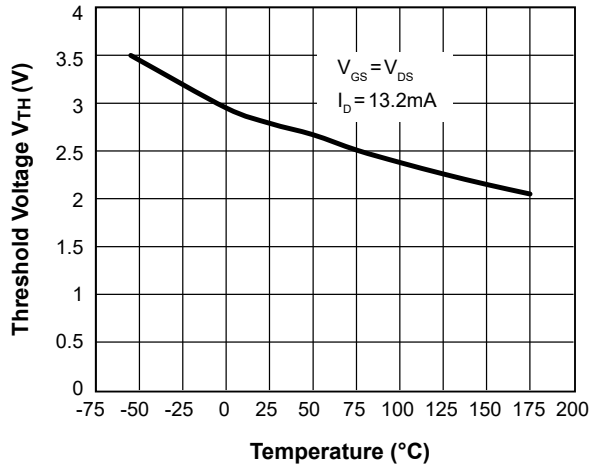


Figure 6. Threshold Voltage vs. Junction Temperature

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

T_A = 25 °C, unless otherwise specified.

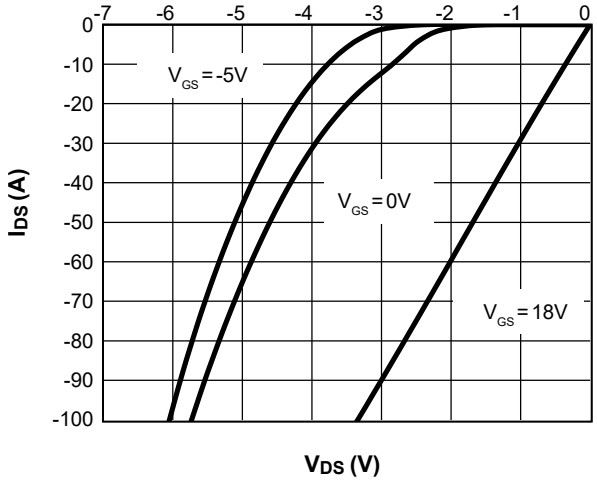


Figure 7. Body-diode Characteristics at 25°C

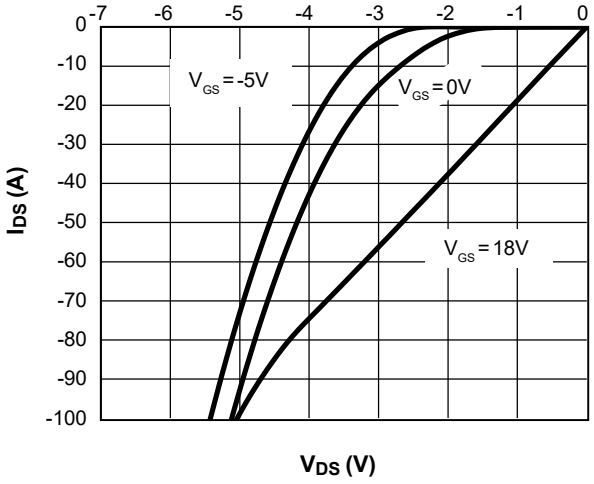


Figure 8. Body-diode Characteristics at 175°C

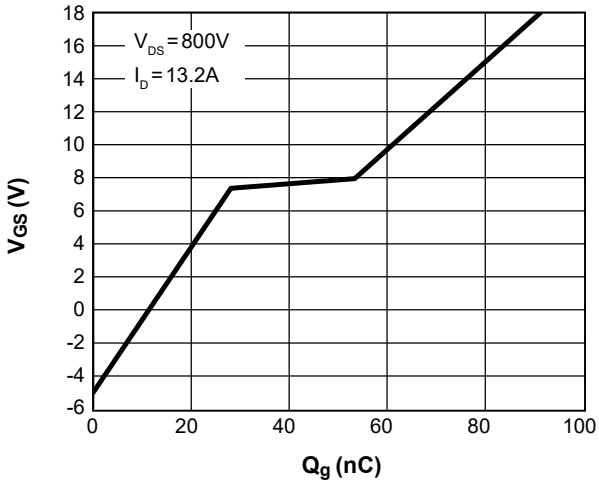


Figure 9. Gate-charge Characteristics

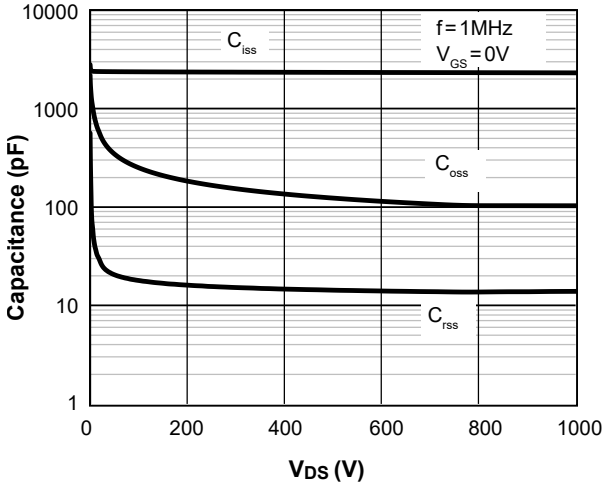


Figure 10. Capacitance Characteristics

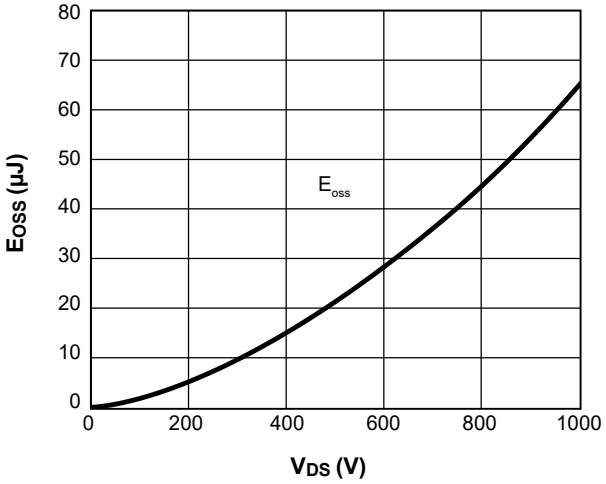


Figure 11. Coss Stored Energy

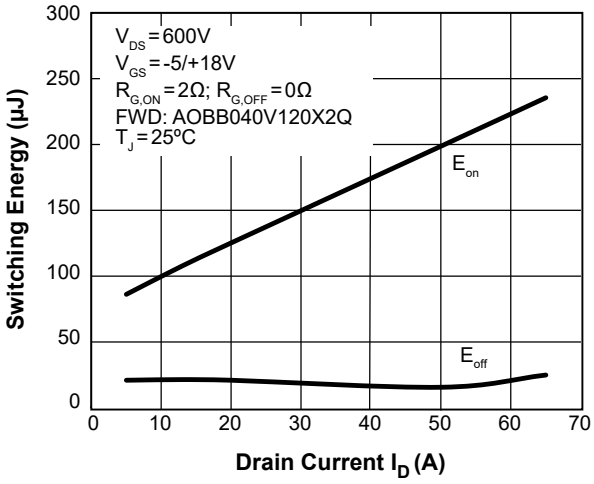


Figure 12. Switching Energy vs. Drain Current

Typical Electrical and Thermal Characteristics *(Continued)*

T_A = 25 °C, unless otherwise specified.

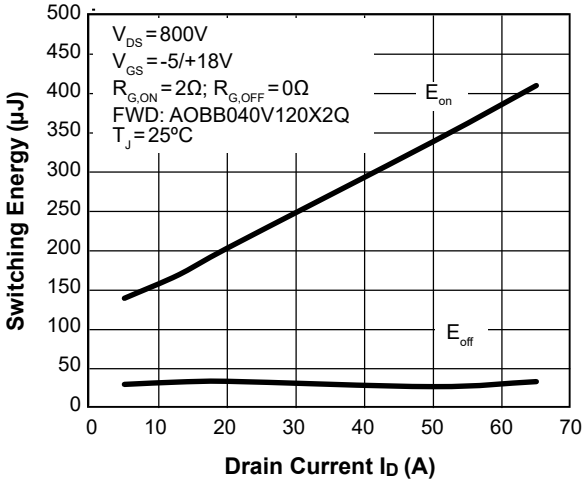


Figure 13. Switching Energy vs. Drain Current

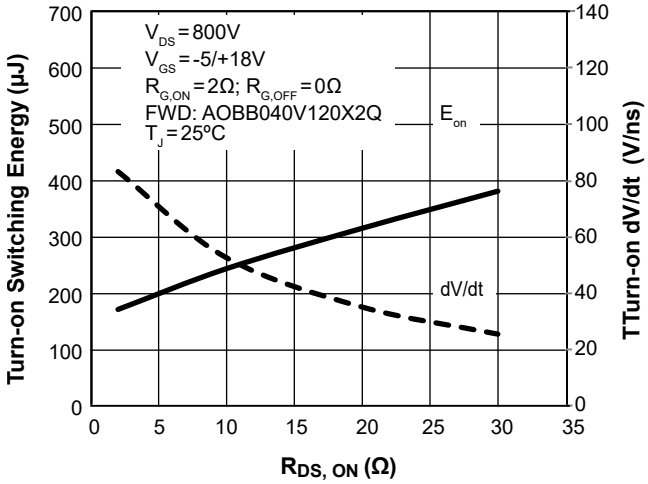


Figure 14. Turn-On Energy and dV/dt vs. External Gate Resistance

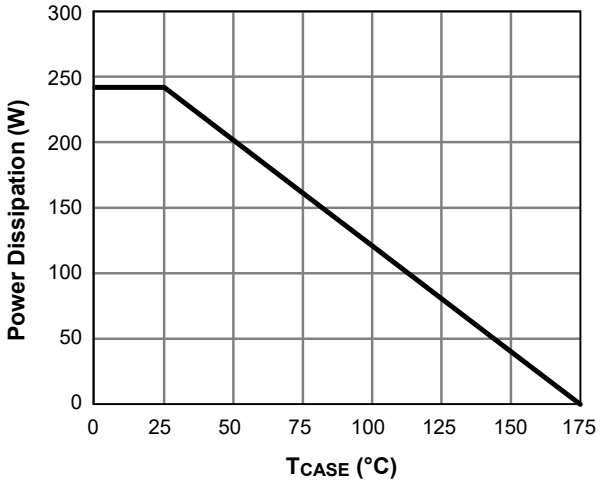


Figure 15. Power De-rating (Note I)

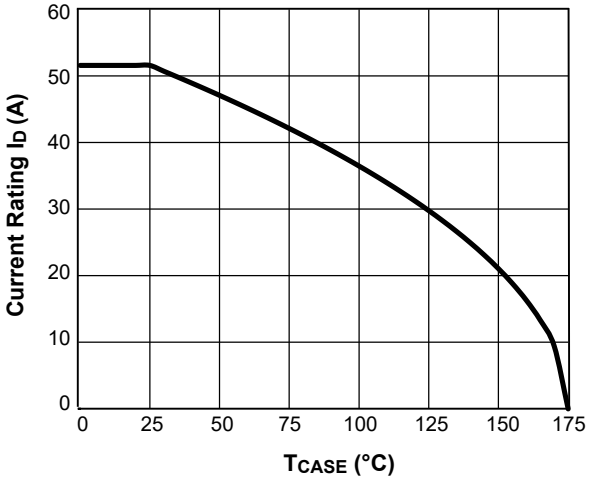


Figure 16. Current De-rating (Note I)

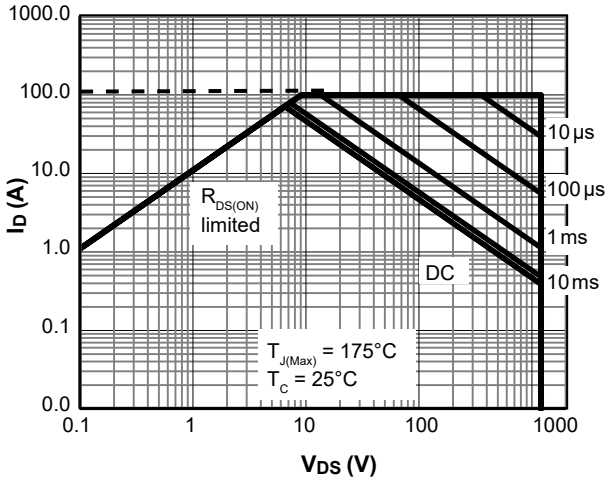


Figure 17. Maximum Forward Biased Safe Operating Area for AOBB040V120X2Q (Note I)

Typical Electrical and Thermal Characteristics *(Continued)*

T_A = 25 °C, unless otherwise specified.

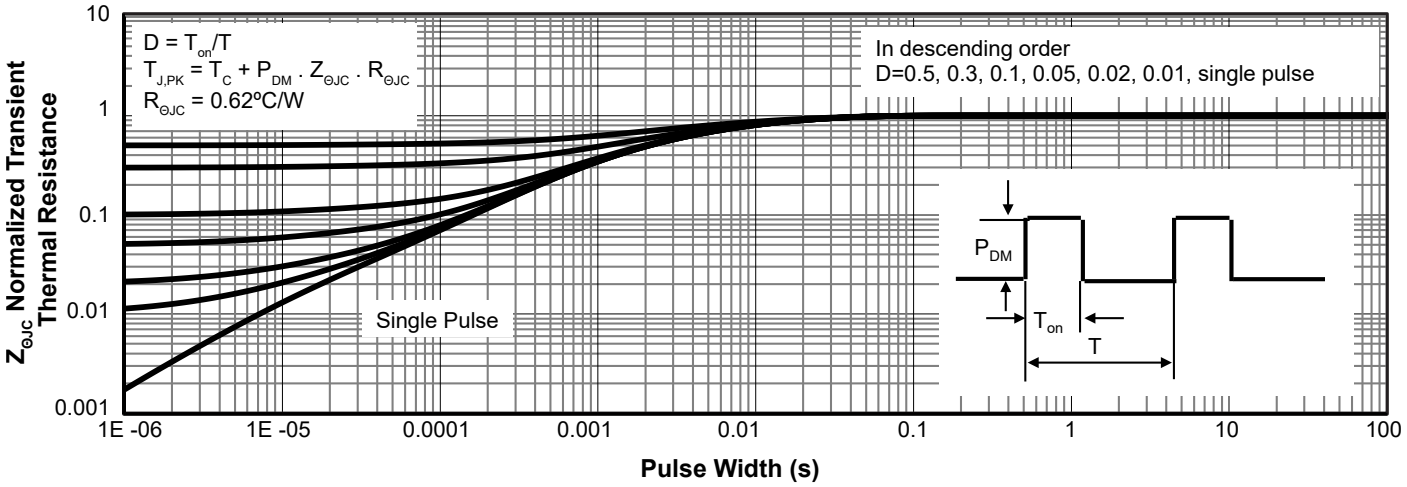


Figure 18. Normalized Maximum Transient Thermal Impedance for AOBB040V120X2Q (Note I)

Notes:

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

I. 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.

Test Circuits and Waveforms

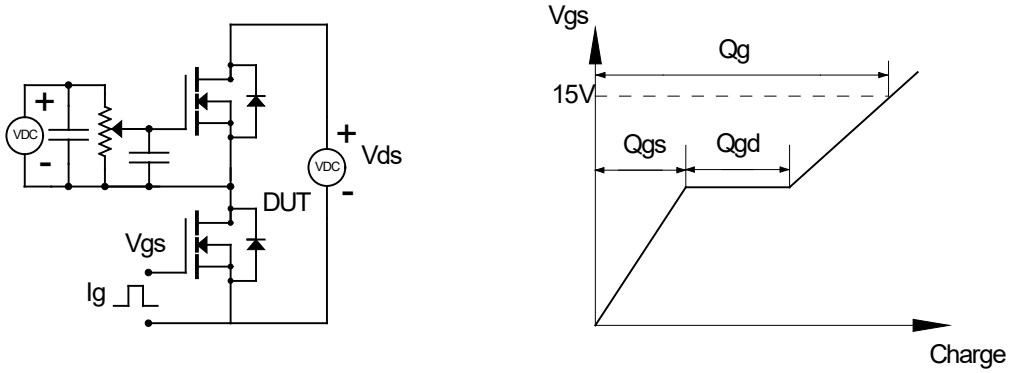


Figure 19. Gate Charge Test Circuits and Waveforms

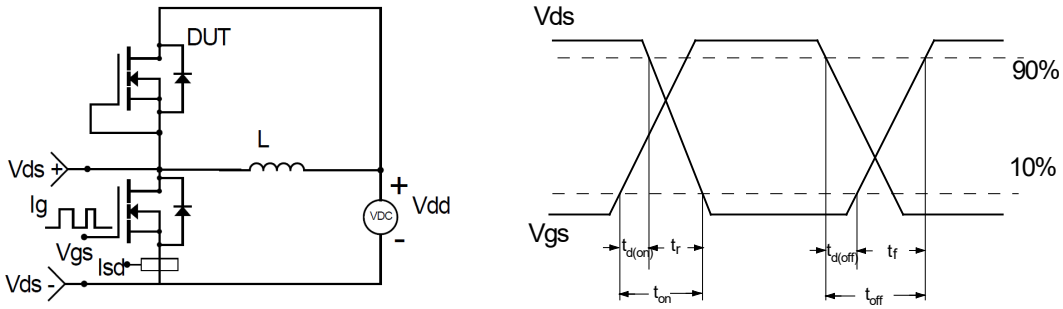


Figure 20. Inductive Switching Test Circuit and Waveforms

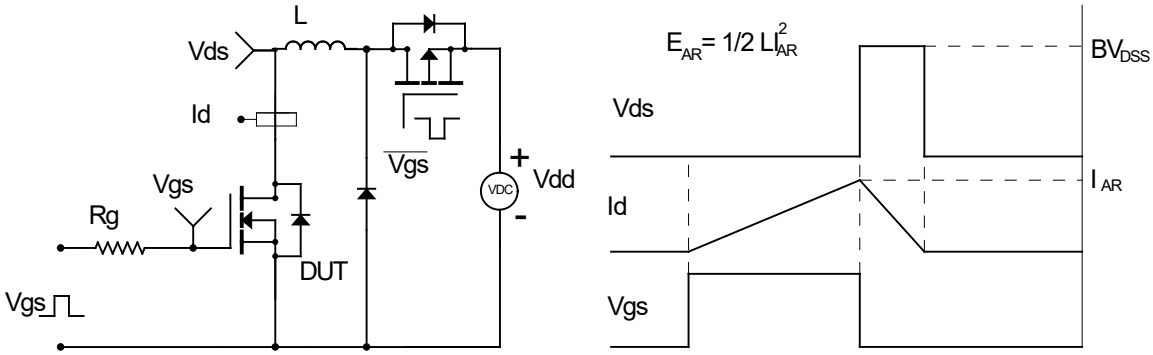


Figure 21. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms

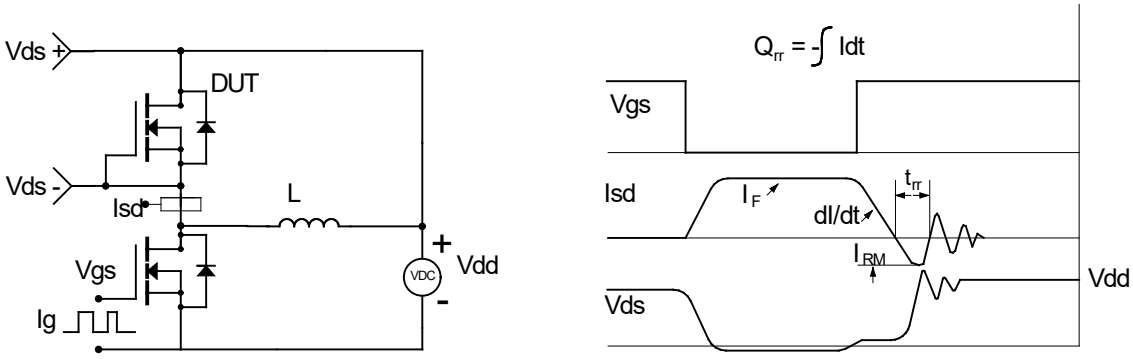
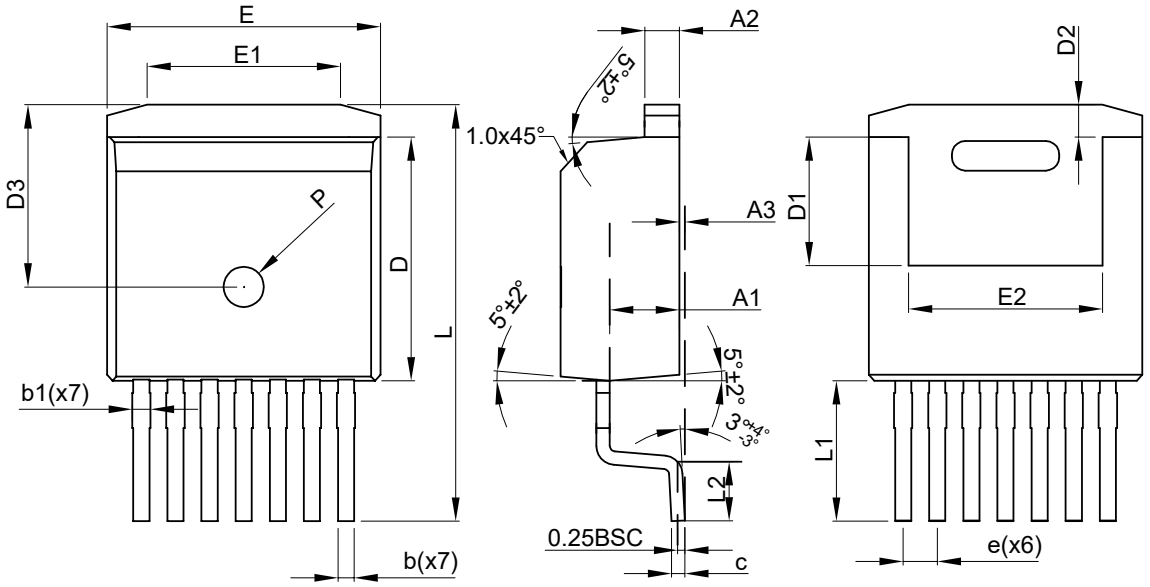
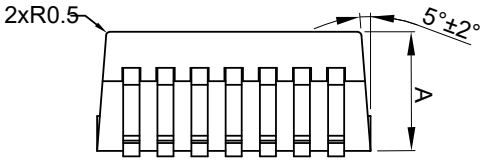


Figure 22. Diode Recovery Test Circuits and Waveforms

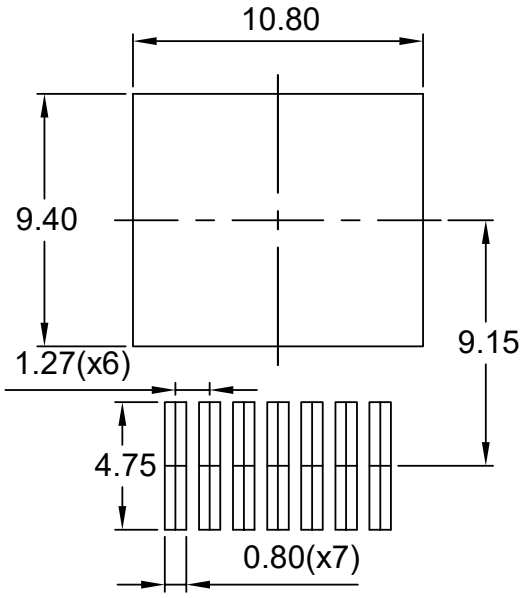
Package Dimensions, TO-263-7L



TOP VIEW SIDE VIEW BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN

SYMBOLS	DIM. IN MM			DIM. IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	4.30	4.43	4.56	0.169	0.174	0.180
A1	2.45	2.60	2.75	0.096	0.102	0.108
A2	1.20	1.30	1.40	0.047	0.051	0.055
A3	0.00	0.13	0.25	0.000	0.005	0.010
b	0.50	0.60	0.70	0.020	0.024	0.028
b1	0.60	0.70	0.90	0.024	0.028	0.035
c	0.45	0.50	0.60	0.018	0.020	0.024
D	8.93	9.08	9.23	0.352	0.357	0.363
D1	4.65	4.80	4.95	0.183	0.189	0.195
D2	0.98	1.20	1.42	0.039	0.047	0.056
D3	6.48	6.78	7.08	0.255	0.267	0.279
E	10.08	10.18	10.28	0.397	0.401	0.405
E1	6.50	7.00	7.50	0.256	0.276	0.295
E2	6.92	7.22	7.52	0.272	0.284	0.296
e	1.27BSC			0.05BSC		
L	15.00	15.50	16.00	0.591	0.610	0.630
L1	5.09	5.22	5.33	0.200	0.206	0.210
L2	1.90	2.20	2.50	0.075	0.087	0.098
P	1.40	1.50	1.60	0.055	0.059	0.063

NOTE:

1. CONTROLLING DIMENSION IS MILLIMETER.
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
2. DOTTED OUTLINE IS GUIDELINE TO BE COMPATIBLE WITH
INDUSTRY COMMON LAYOUT BUT NOT RECOMMENDED BY AOS.

Part Marking

AOBB040V120X2Q
TO-263-7L