ALPHA & OMEGA SEMICONDUCTOR

AOH011V12AM2

1200V αSiC Silicon Carbide Half-Bridge Module

Features

- Proprietary αSiC MOSFET technology
- 1200V/11mΩ Half-Bridge topology
- High-frequency & high-efficiency performance
- Integrated thermistor & press-fit pin features

Product Summary

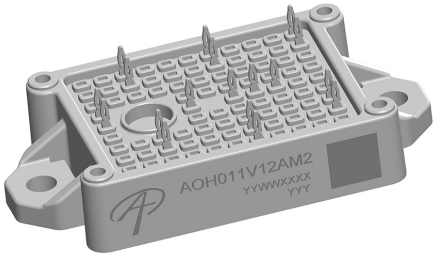
V_{DS} @ $T_{J, max}$	1200V
I_{DM}	200A
$R_{DS(ON), TYP}$	11mΩ
Q_{rr}	256nC
E_{OSS} @ 800V	175μJ

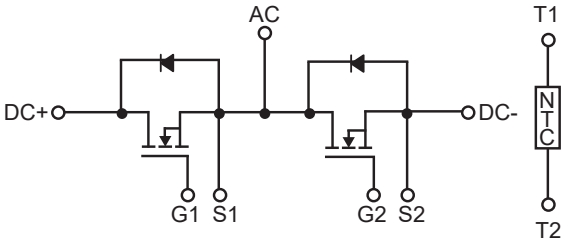
Applications

- Solar inverters
- EV charging stations
- Industrial motor drives
- Energy storage

GREEN Product

Pin Configuration





Ordering Part Number	Package Type	Configuration
AOH011V12AM2	AlphaModule™	Half-Bridge

Absolute Maximum Ratings

(T_A = 25°C, unless otherwise noted)

Symbol	Parameter		AOH011V12AM2	Units
V_{DS}	Drain-Source Voltage		1200	V
$V_{GS, MAX}$	Gate-Source Voltage	Maximum	-8/+18	V
$V_{GS,OP,TRANS}$		Max Transient (A)	-8/+20	
$V_{GS,OP}$		Recommended Operating (B)	-5/+15	
I_D	Continuous Drain Current	T_{VJ} = 150°C, T_H = 95°C	77	A
		T_{VJ} = 175°C, T_H = 95°C	93	
I_{DM}	Pulsed Drain Current (C)		200	
T_{VJM}	Virtual Junction Temperature (Maximum)		-55 to 175	°C
T_{VJ}	Virtual Junction Temperature (Recommended Operating Range)		-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance Junction-to-Heat Sink	0.42	0.50	°C/W

Electrical Characteristics

(T_J = 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				300	µA
I_{GSS}	Gate-Body Leakage Current	V_{DS}=0V, V_{GS}=+15/-5V				±300	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=52.5mA		1.8	2.8	3.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=15V, I_D=60A	T_J=25°C		11	14.3	mΩ
			T_J=175°C		15		
V_{SD}	Diode Forward Voltage	I_S=52.5A, V_{GS}=-5V			4	5	V
DYNAMIC PARAMETERS							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=800V, f=1MHz			9.5		nF
C_{oss}	Output Capacitance				403		pF
C_{rss}	Reverse Transfer Capacitance				20		pF
E_{oss}	C_{oss} Stored Energy				175		µJ
R_g	Gate Resistance	f=1MHz			0.81		Ω
SWITCHING PARAMETERS							
Q_g	Total Gate Charge	V_{GS}=-5/+15V, V_{DS}=600V, I_D=60A			305		nC
Q_{gs}	Gate Source Charge				110		nC
Q_{gd}	Gate Drain Charge				72		nC
$t_{D(on)}$	Turn-On Delay Time	V_{GS}=-5V/+15V, V_{DS}=600V, I_D=100A, R_G=2Ω, L_a=30µH			19		ns
t_r	Turn-On Rise Time				24		ns
$t_{D(off)}$	Turn-Off Delay Time				42		ns
t_f	Turn-Off Fall Time				9		ns
E_{on}	Turn-On Energy				1.01		mJ
E_{off}	Turn-Off Energy				0.13		mJ
E_{tot}	Total Switching Energy				1.15		mJ
t_{rr}	Body Diode Reverse Recovery Time	I_F=100A, dI/dt=1500A/µs, V_{GS}=5V, V_{DS}=600V			21		ns
I_{rm}	Peak Reverse Recovery Current				20		A
Q_{rr}	Body Diode Reverse Recovery Charge				256		nC

Electrical Characteristics

(T_J = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
MODULE PHYSICAL PARAMETERS						
V_{ISO}	Isolation Voltage(All Terminals Shorted)	DC Test Voltage, t=3s	4.5			kV
CTI	Comparative Tracking Index		200			
W	Weight			25		
M_S	Mounting Torque		1		1.2	nM
	Creepage Distance	Terminal to Heatsink		11.5		mm
		Terminal to Terminal		6.3		
	Clearance	Terminal to Heatsink		10		mm
		Terminal to Terminal		5		
NTC THERMISTOR CHARACTERISTICS						
R_{25}	Rated Resistance	T_{NTC}=25°C		5		kΩ
ΔR/R	Deviation of Resistance	V_{GS}=0V, V_{DS}=600V, f=1MHz	-5		5	%
$\beta_{25/50}$	Beta Value	$R_2=R_{25}\exp[\beta_{25/50}(1/T2-1/298)$		3380		K
$\beta_{25/80}$		$R_2=R_{25}\exp[\beta_{25/80}(1/T2-1/298)$		3440		K
$\beta_{25/100}$		$R_2=R_{25}\exp[\beta_{25/100}(1/T2-1/298)$		3545		K
P_{MAX}	Maximum Power Dissipation	T_{NTC}=25°C			10	mW

Notes:

A. t_{ON}<1% *(Duty Cycle)/(Frequency), t<25hrs over lifetime.

B. Device can be operated at V_{GS}=0/15V. Actual operating VGS will depend on application specifics such as parasitic inductance and dV/dt but should not exceed maximum ratings.

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

D.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 $T_{J(MAX)}$ =150°C.

Typical Electrical and Thermal Characteristics

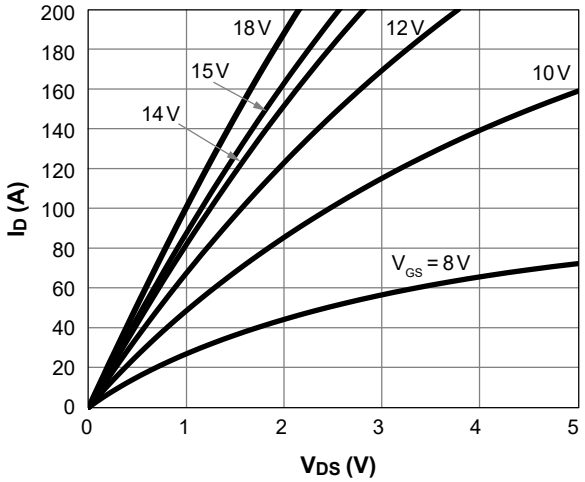


Figure 1. On-Region Characteristics T_J = 25°C

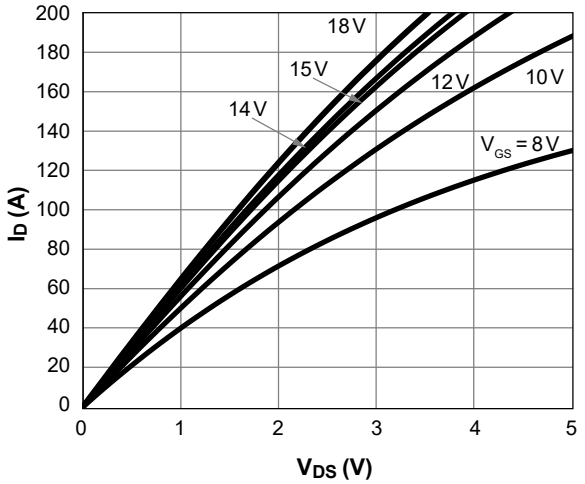


Figure 2. On-Region Characteristics T_J = 175°C

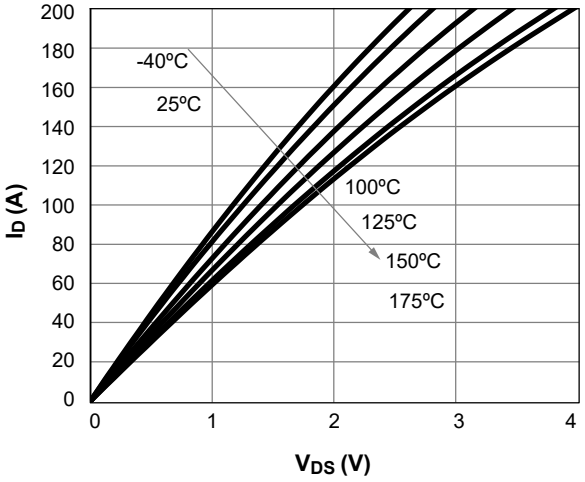


Figure 3. Output Characteristics for Various Junction Temperatures V_{GS} = 15V

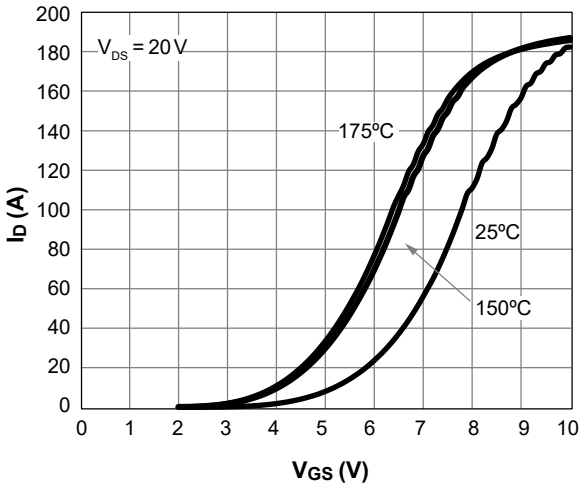


Figure 4. Transfer Characteristics

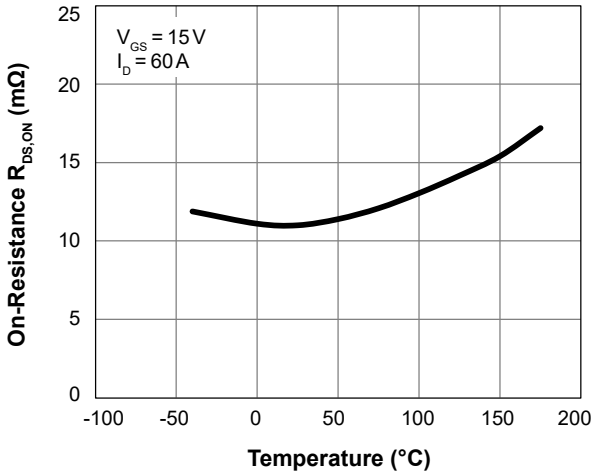


Figure 5. On-Resistance vs. Junction Temperature

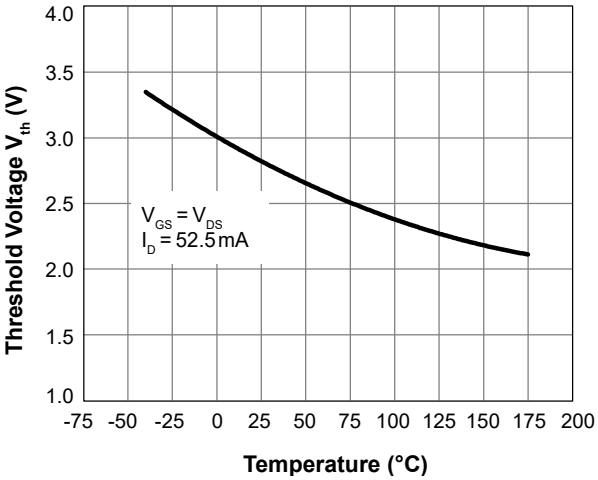


Figure 6. Threshold Voltage vs. Junction Temperature

Typical Electrical and Thermal Characteristics *(Continued)*

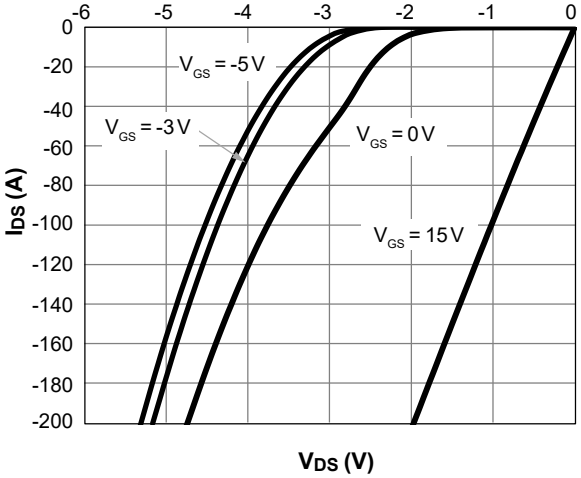


Figure 7. Body-Diode Characteristics at 25°C

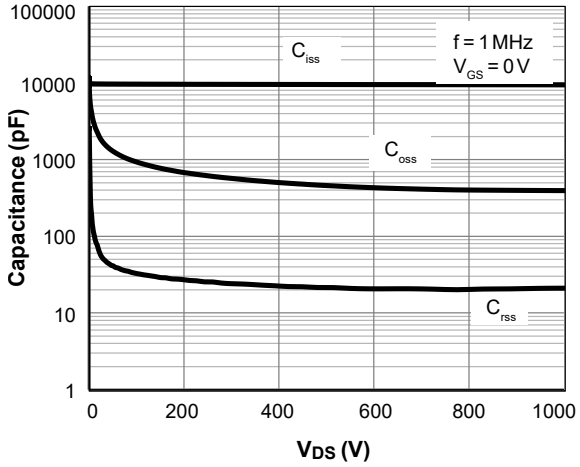


Figure 8. Capacitance Characteristics

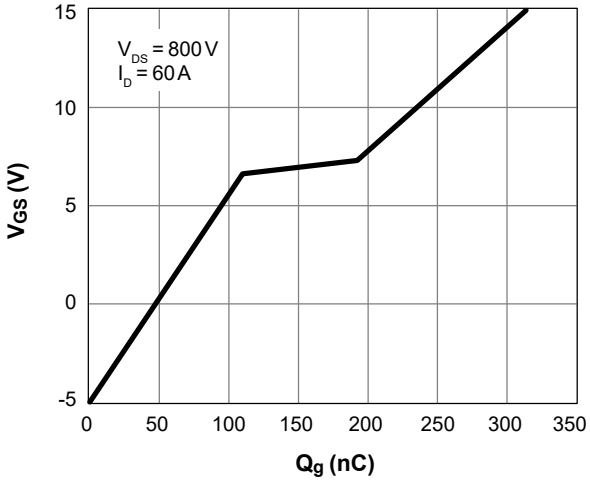


Figure 9. Gate-Charge Characteristics

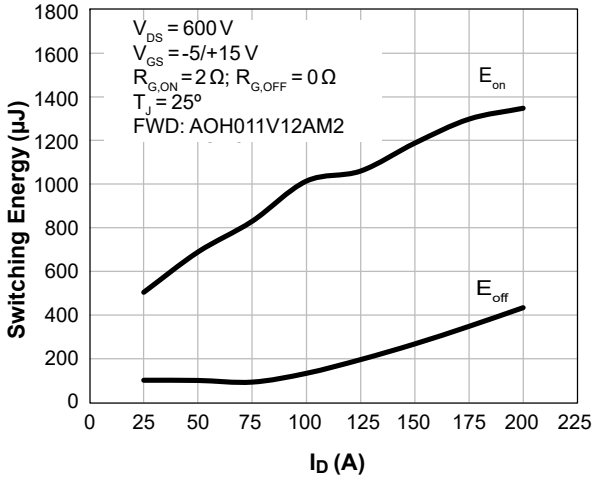


Figure 10. Switching Energy vs. Drain Current

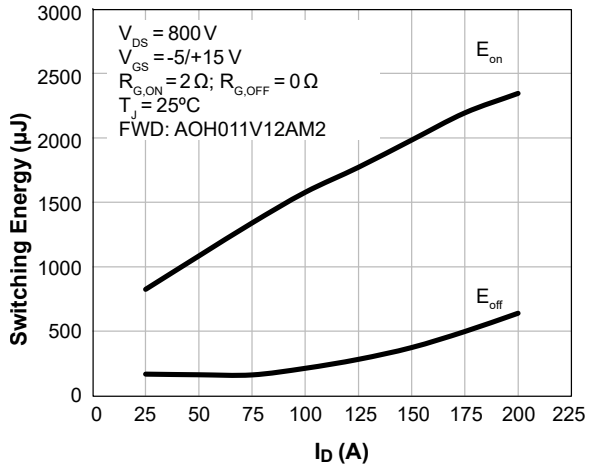


Figure 11. Switching Energy vs. Drain Current

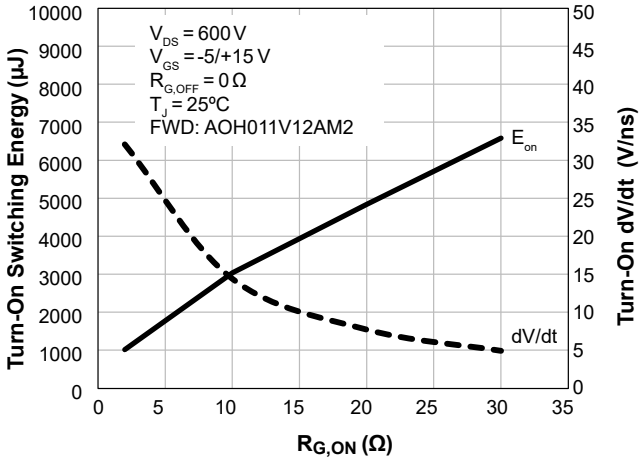


Figure 12. Turn-On Energy and dV/dt vs. External Gate Resistance

Typical Electrical and Thermal Characteristics *(Continued)*

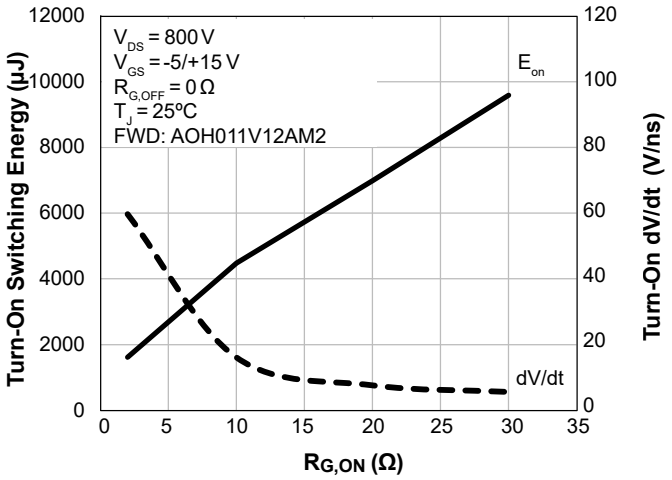


Figure 13. Turn-On Energy and dV/dt vs. External Gate Resistance

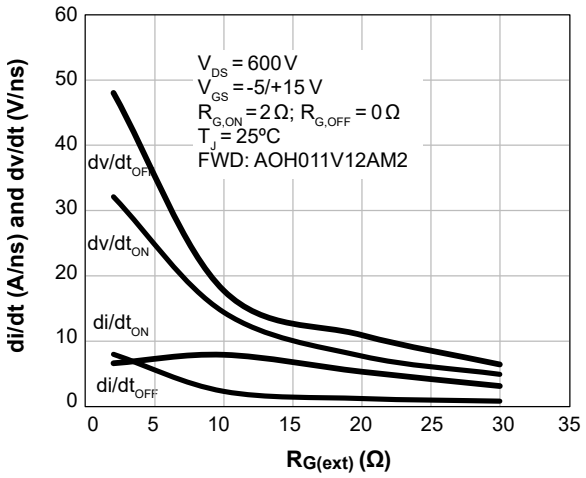


Figure 14. dv/dt and di/dt vs. External Gate Resistance

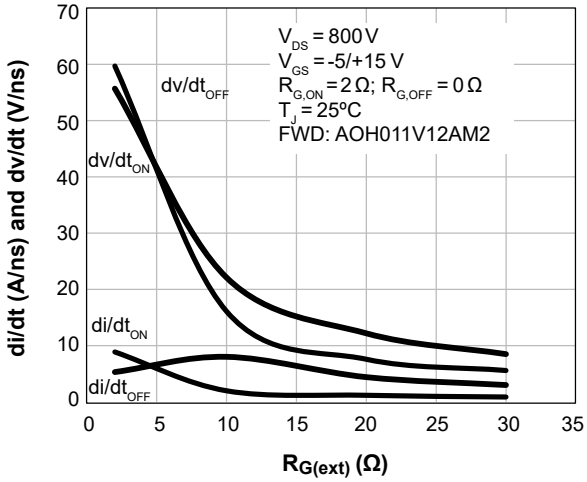


Figure 15. dv/dt and di/dt vs. External Gate Resistor

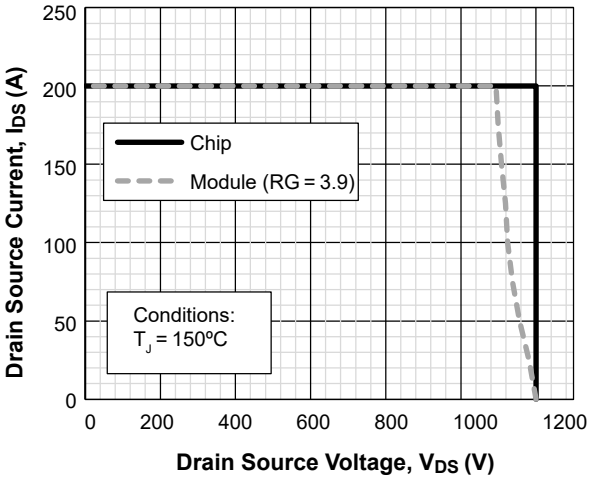


Figure 16. Reverse Bias Safe Operating Area

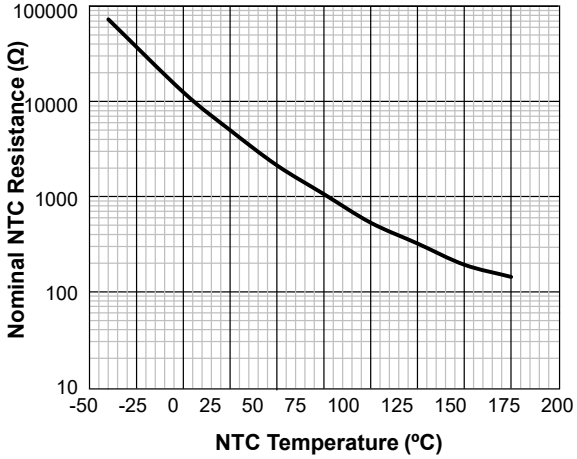


Figure 17. Nominal NTC Resistance vs. NTC Temperature

Typical Characteristics and Thermal Characteristics *(Continued)*

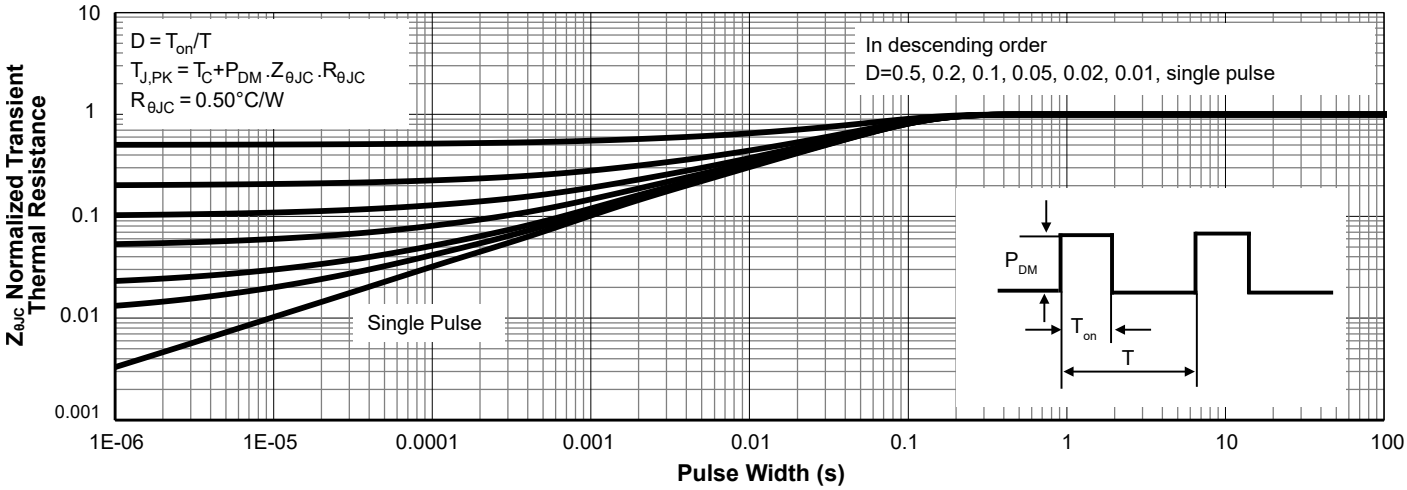


Figure 18. Normalized Maximum Transient Thermal Impedance for AOH011V12AM2 (Note D)

Test Circuits and Waveforms

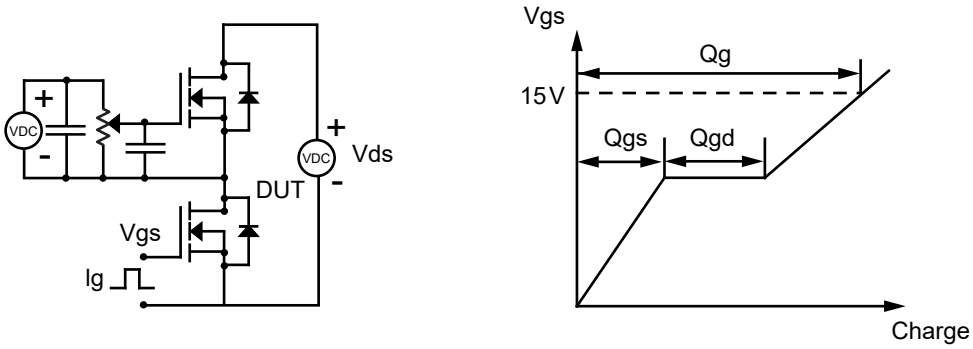


Figure 19. Gate Charge Test Circuits and Waveforms

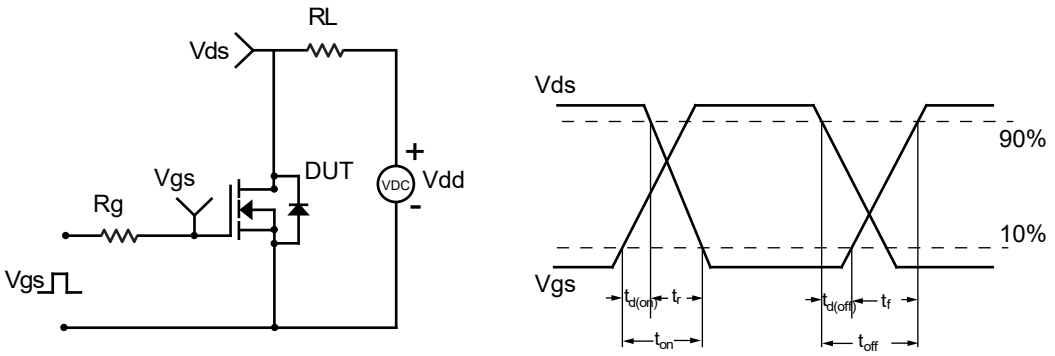


Figure 20. Resistive Switching Test Circuit & Waveforms

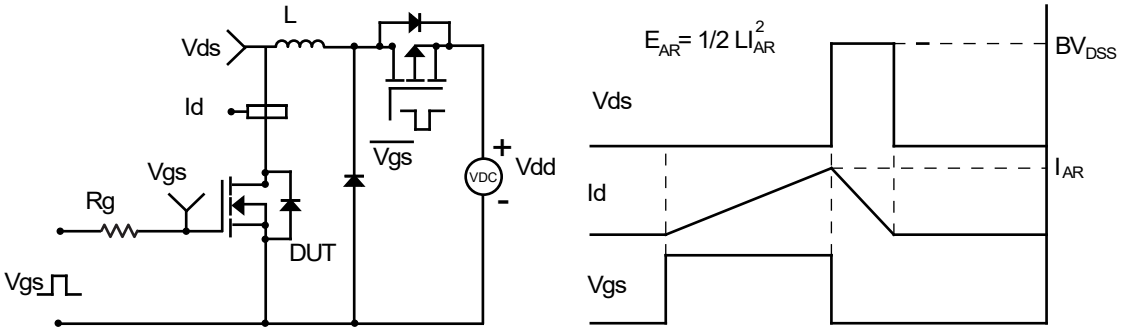


Figure 21. Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

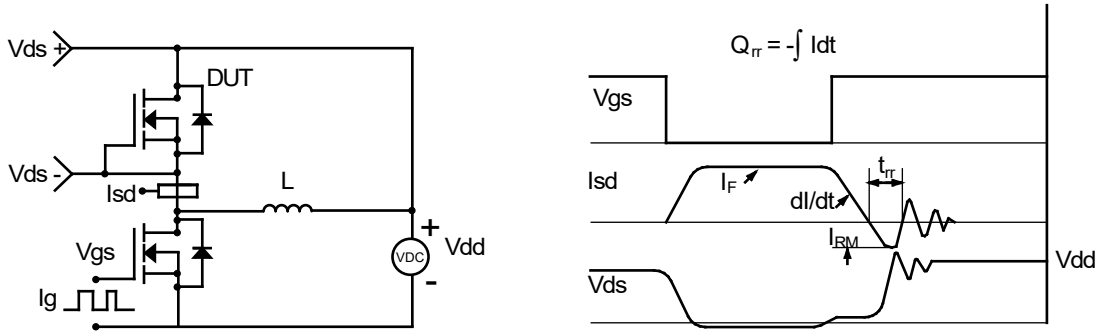
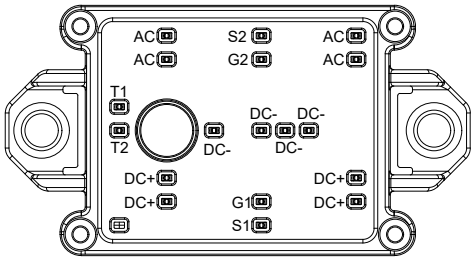
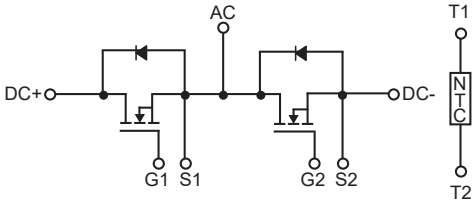


Figure 22. Diode Recovery Test Circuit & Waveforms

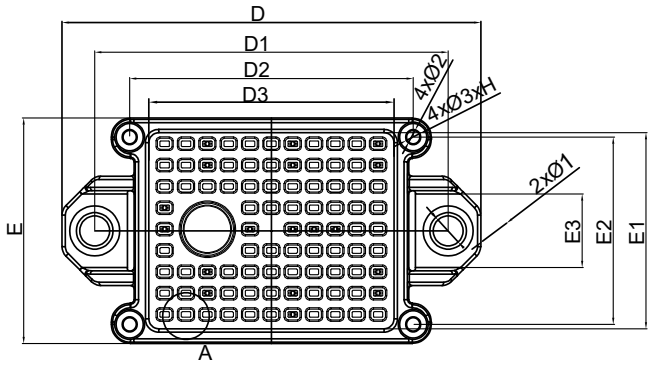
Package Dimensions, AlphaModule™

SCHEMATIC AND PIN OUT

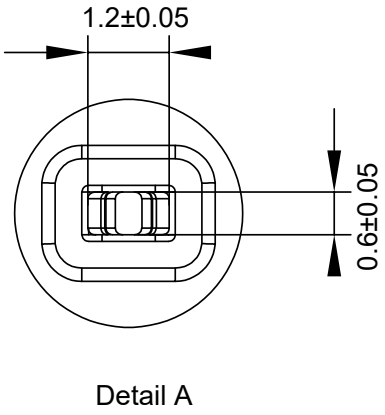




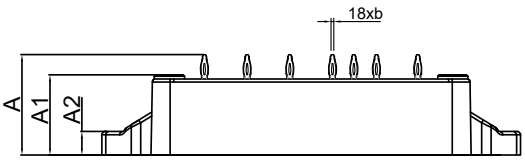
Package Outline, AlphaModule™



TOP VIEW



Detail A

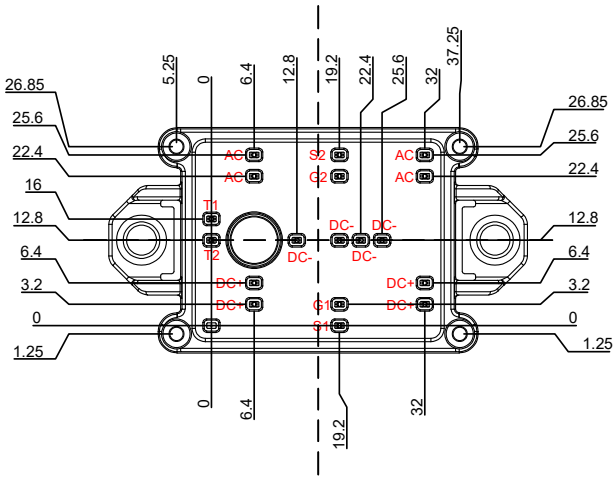


SIDE VIEW

SYMBOLS	DIMENSION IN MILLIMETRES			DIMENSION IN INCHS		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	14.500	15.000	15.500	0.571	0.591	0.610
A1	11.700	12.000	12.300	0.461	0.472	0.484
A2	3.200	3.500	3.800	0.126	0.138	0.150
b	1.150	1.200	1.250	0.045	0.047	0.049
D	62.500	62.800	63.100	2.461	2.472	2.484
D1	52.800	53.000	53.200	2.079	2.087	2.094
D2	42.300	42.500	42.700	1.665	1.673	1.681
D3	36.500	36.800	37.100	1.437	1.449	1.461
E	33.300	33.800	34.300	1.311	1.331	1.350
E1	29.100	29.400	29.700	1.146	1.157	1.169
E2	28.300	28.600	28.900	1.114	1.126	1.138
E3	11.700	12.000	12.300	0.461	0.472	0.484
H	8.200	8.500	8.800	0.323	0.335	0.346
ϕ1	4.200	4.500	4.800	0.165	0.177	0.189
ϕ2	1.800	2.000	2.200	0.071	0.079	0.087
ϕ3	2.100	2.300	2.500	0.083	0.091	0.098

UNIT: mm

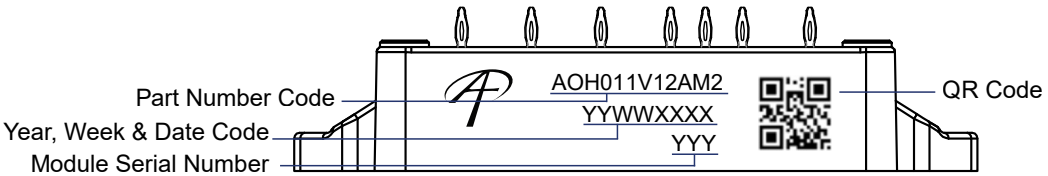
LAND PATTERN RECOMMENDATIONS



NOTES

1. TOLERANCE 0.200 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. CONTROLLING DIMENSION IS MILLIMETER, CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
3. ( ) IS REFERENCE.

Part Marking



LEGAL DISCLAIMER

Applications or uses as critical components in life support devices or systems are not authorized. Alpha and Omega Semiconductor does not assume any liability arising out of such applications or uses of its products. AOS reserves the right to make changes to product specifications without notice. It is the responsibility of the customer to evaluate suitability of the product for their intended application. Customer shall comply with applicable legal requirements, including all applicable export control rules, regulations and limitations.

AOS' products are provided subject to AOS' terms and conditions of sale which are set forth at:
http://www.aosmd.com/terms_and_conditions_of_sale

LIFE SUPPORT POLICY

ALPHA AND OMEGA SEMICONDUCTOR PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.

2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.