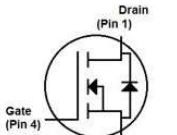
SiC Power MOSFET with Ceramic Isolated Baseplate Tab

AMR013V120H3i



Applications:

- **H/EV Power Train and Chargers**
- **PV and industrial applications**
- **Microgrid systems**
- **Induction heating and welding**
- **UPS, DC/DC Converters**

Features:

- **Low Terminal Capacitances**
- **Very low $R_{DS,on}$ over the entire temperature range**
- **High Speed Switching Characteristics**
- **Fast and Reliable Body Diode**
- **High Avalanche Energy**
- **High Operating Junction Temperature**
- **0V turn-off V_{gs} for gate driving ease**
- **RoHS compliant**

Absolute Maximum Ratings (T_{amb}=25^{0}C, unless specified otherwise)

Symbol	Parameter	Value	Unit
V_{DS}	Maximum DC Reverse Voltage	1200	V
V_{RRM}	Maximum Peak Repetitive Reverse Voltage		
I_D	Continuous Drain Current (T_C = 25 °C)	160	A
I_{DMax}	Maximum Drain Current (T_C = 100 °C)	125	
V_{gs}	Gate Source Voltage	23 to -10	V
PD	Total Power Dissipation (T_C = 25 °C)	750	W
T_j	Operating junction temperature range	-55 to 175	°C
T_{stg}	Storage temperature range	-55 to 175	
T_L	Lead temperature, soldering	260	

Thermal and Mechanical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance	-	TBD	-	°C/W

Static Electrical Characteristics ($T_C = T_A = 25$ °C, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{gs} = 0$ V, $I_d = 100$ µA	1200	1450	-	V
$R_{DS,on}$	Drain-Source ON Resistance	$V_{gs} = 18$ V, $I_d = 100$ A	-	12.5	16	mΩ
		$V_{gs} = 18$ V, $I_d = 100$A, $T_j = 175$°C	-	20.5	25	
V_{th}	Gate-Source Threshold Voltage	$V_{gs} = V_{ds}$, $I_d = 30$ mA [a]	2.0	2.8	3.6	V
		$V_{gs} = V_{ds}$, $I_d = 30$mA, $T_j = 175$°C [a]	1.8	2.1	-	
I_{DSS}	Drain-Source Leakage current	$V_{gs} = 0$ V, $V_{ds} = 1200$ V	-	0.8	100	µA
		$V_{gs} = 0$ V, $V_{ds} = 1200$ V, $T_C = 175$ °C	-	10	500	
g_{fs}	Trans-conductance	$V_{ds} = 20\,V$, $I_d = 100$ A,	-	61	-	S
		$V_{ds} = 20V$, $I_d = 100$ A, $T_j = 175$°C	-	52.8	-	
I_{GSS}	Gate-Source Leakage Current	-10 V $< V_{gs} <$ 23 V	-	1	100	nA

[a] Pre-condition Vth, as per JEDEC standard JEP183A, (Revision of JEP183 January 2021)

Dynamic Characteristics ($T_C = T_A = 25$ °C, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{gs} = 0$ V, $V_{ds} = 1000$ V, $f = 1$ MHz	-	5100	-	pF
C_{rss}	Reverse Transfer Capacitance		-	6.7	-	
C_{oss}	Output Capacitance		-	270	-	
Q_{gs}	Gate-Source Gate Charge	$V_{ds} = 800$ V, $I_d = 80$ A, $V_{gs,off} = -5$ V, $V_{gs,on} = 18$ V	-	78	-	nC
Q_{gd}	Gate-Drain Gate Charge		-	46	-	
Q_g	Total Gate Charge		-	213	-	

Switching Characteristics ($T_A = 25$ °C, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{ds} = 800$ V, $V_{gs} = -5/18$ V [b] Id = 80A, Rg = 2.2Ω, L=110uH, Tj=25˚C	-	18.5	-	ns
t_r	Rise time		-	24.7	-	
$t_{d(off)}$	Turn-off delay time		-	43.6	-	
t_f	Fall time		-	8.3	-	
E_{on}	Turn On Switching Energy		-	869	-	μJ
E_{off}	Turn Off Switching Energy		-	264	-	
$t_{d(on)}$	Turn-on delay time	$V_{ds} = 800$ V, $V_{gs} = -5/18$ V [b] Id = 80A, Rg = 2.2Ω, L=110uH, Tj=175˚C	-	16.8	-	ns
t_r	Rise time		-	28.2	-	
$t_{d(off)}$	Turn-off delay time		-	54.4	-	
t_f	Fall time		-	9.4	-	
E_{on}	Turn On Switching Energy		-	1030	-	μJ
E_{off}	Turn Off Switching Energy		-	325	-	
R_g	Gate Series Resistance	Vds=Vgs=0V, f=1MHz, Ta=25˚C	-	1.7	-	Ω
EAS	Avalanche Energy, Single Pulse	Vdd=50 V, L=5mH	-	4400	-	mJ

[b] This SIC MOSFET can switch with driver pulses 0V to 20V with optimized PCB layouts and gate drive circuits.

Body Diode Characteristics ($T_C = T_A = 25$ °C, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{sd}	Diode Forward Voltage	$V_{gs} = -5$ V, $I_{sd} = 80$ A,	-	5.01	-	V
		$V_{gs} = -5$ V, $I_{sd} = 80$ A, $T_j = 175$°C	-	4.44	-	
I_s	Continuous Diode Forward Current		-	-	140	A
t_{rr}	Reverse Recovery Time	$V_{ds} = 800$ V, $I_d = 80$ A, $V_{gs} = -5$ V, $V_{gs,on} = 18$ V, di/dt = 5400 A/μs,	-	16.6	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.7	-	μC
I_{mm}	Peak Reverse Recovery Current		-	64.2	-	A
t_{rr}	Reverse Recovery Time	$V_{ds} = 800$ V, $I_d = 80$ A, $V_{gs} = -5$ V, $V_{gs,on} = 18$ V, di/dt = 5400 A/μs, $T_j = 175$°C	-	26.1	-	ns
Q_{rr}	Reverse Recovery Charge		-	1.7	-	μC
I_{mm}	Peak Reverse Recovery Current		-	107.4	-	A

Electrical Characteristic Diagrams

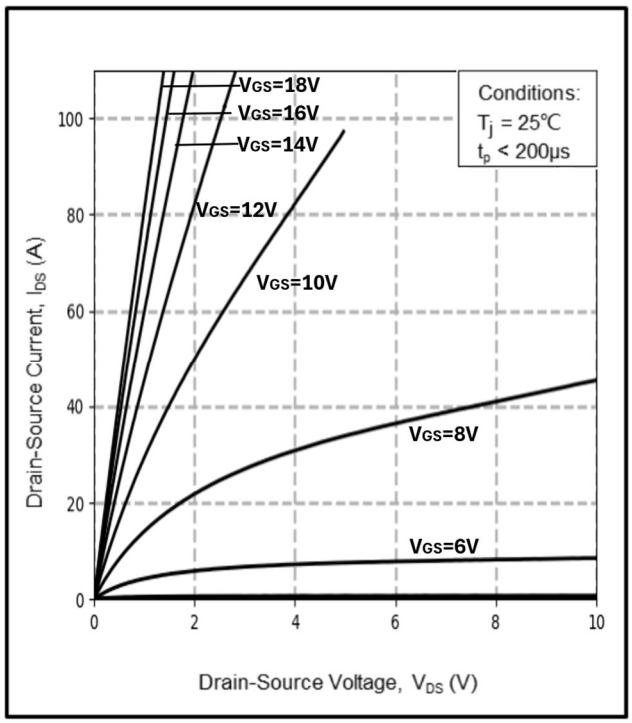


Figure 1. Output characteristics at T_j = 25℃

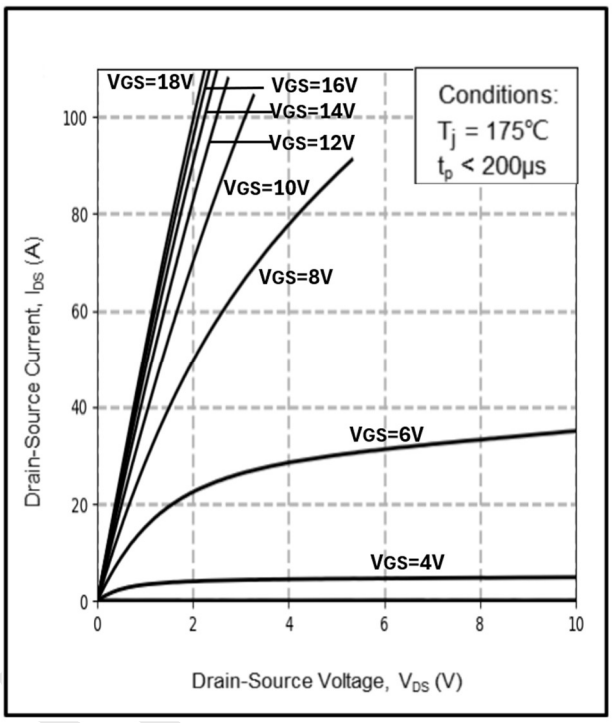


Figure 2. Output characteristics at T_j = 175℃

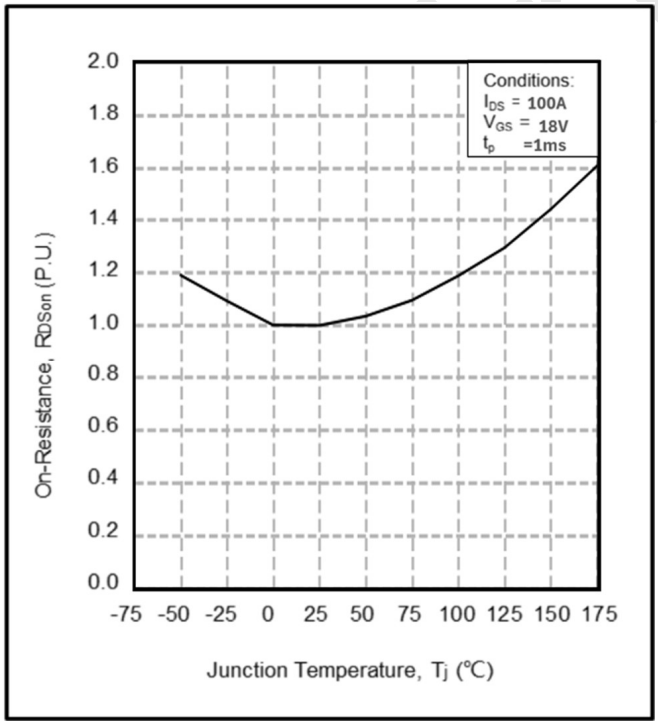


Figure 3. On-resistance vs. temperature

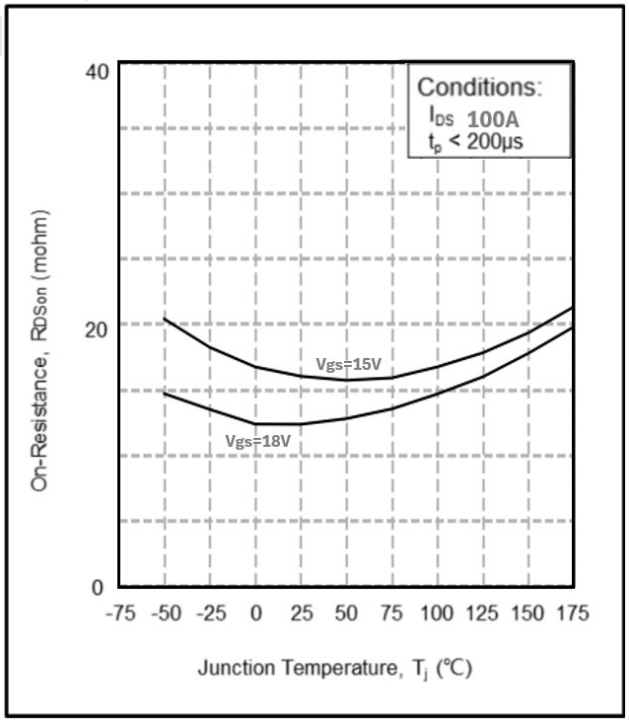


Figure 4. On-resistance vs. temperature for various gate voltages

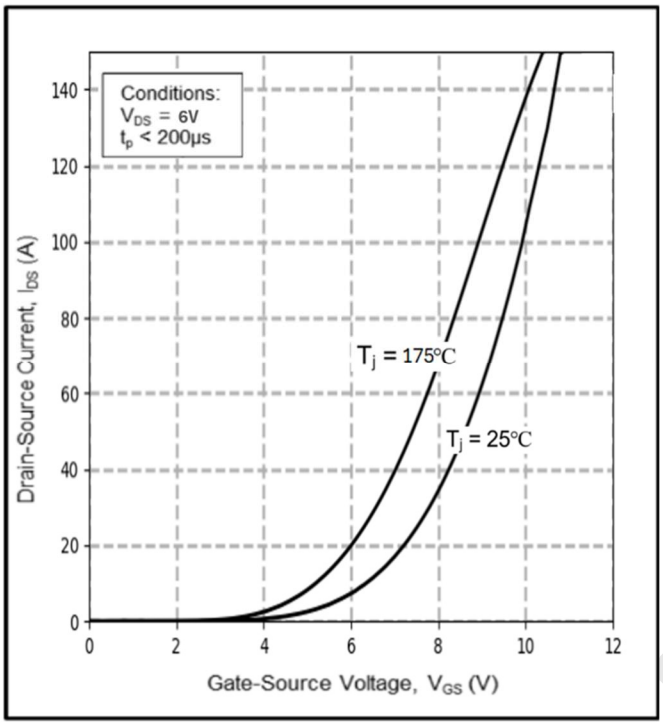


Figure 5. Transfer characteristic for various junction temperatures

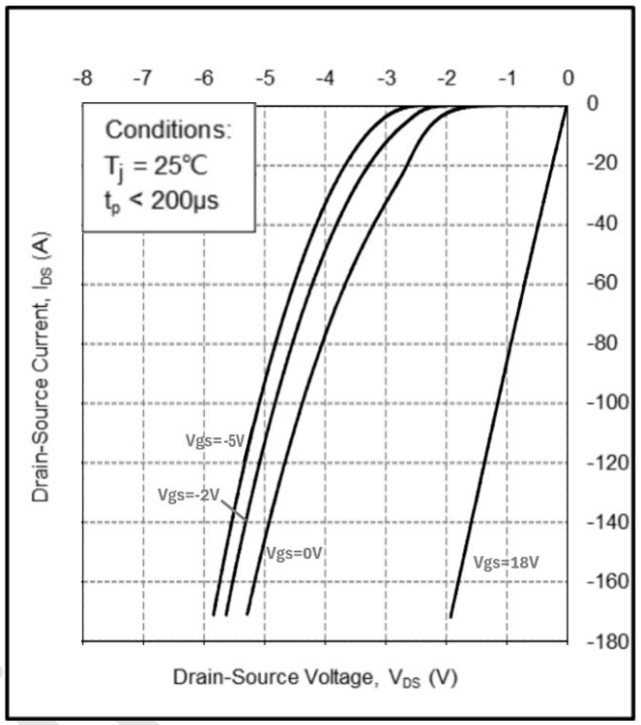


Figure 6. Body diode characteristic at T_j = 25℃

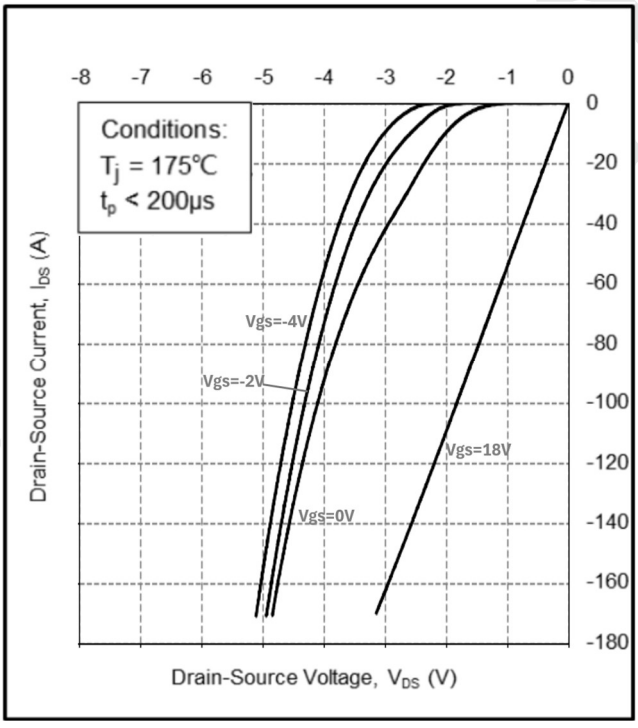


Figure 7. Body diode characteristic at T_j = 175℃

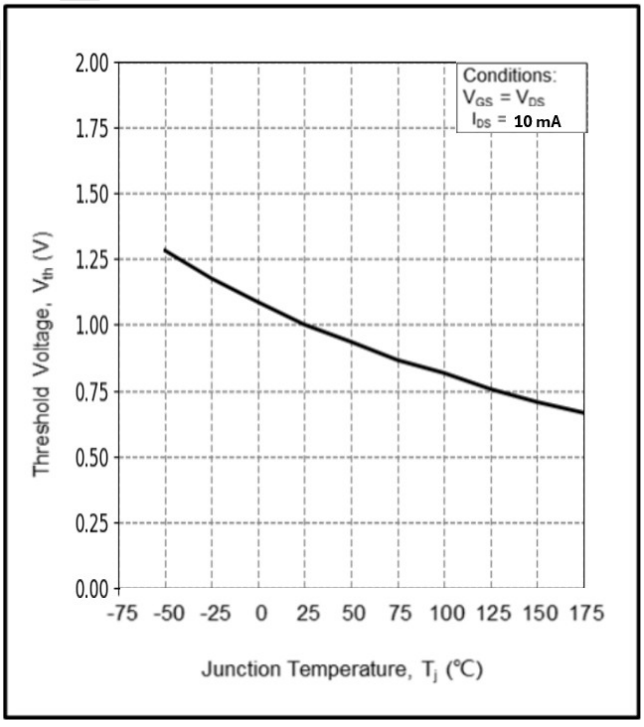


Figure 8. Threshold voltage vs. temperature

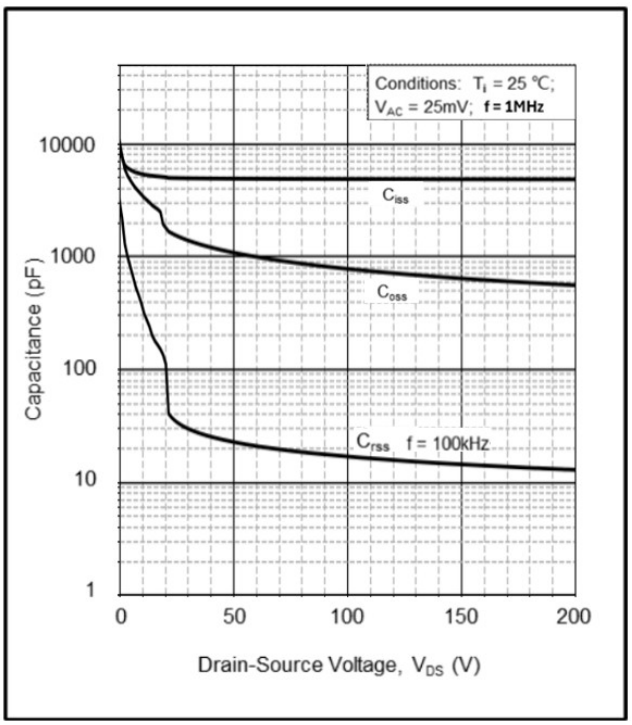


Figure 9. Capacitance vs. drain-source voltage (0 - 200V)

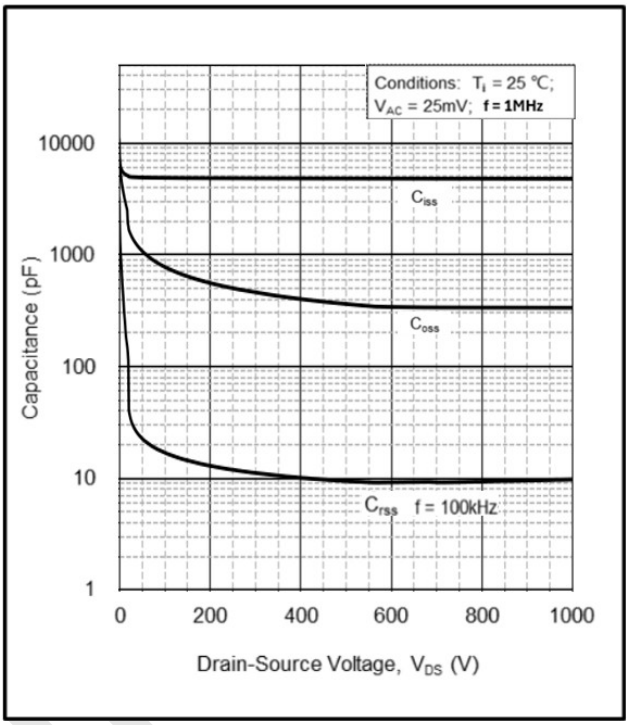


Figure 10. Capacitance vs. drain-source voltage (0 - 1000V)

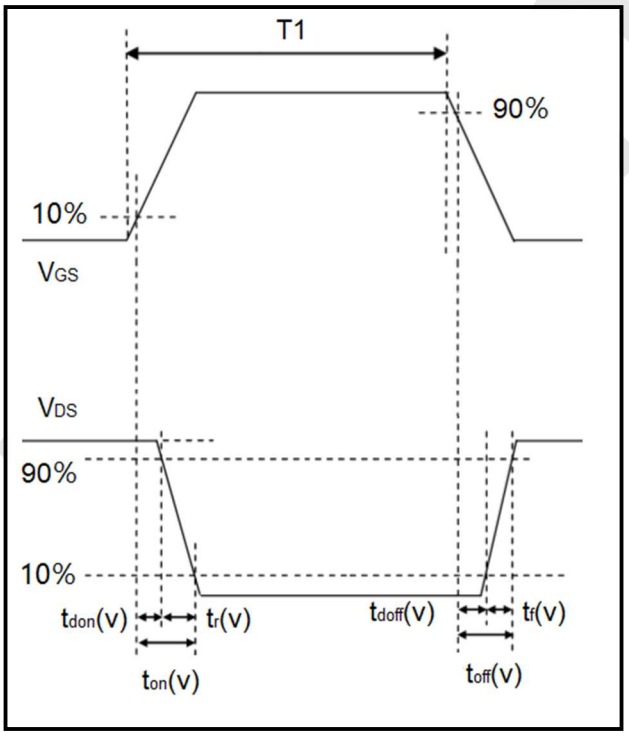


Figure 11. Switching times definition

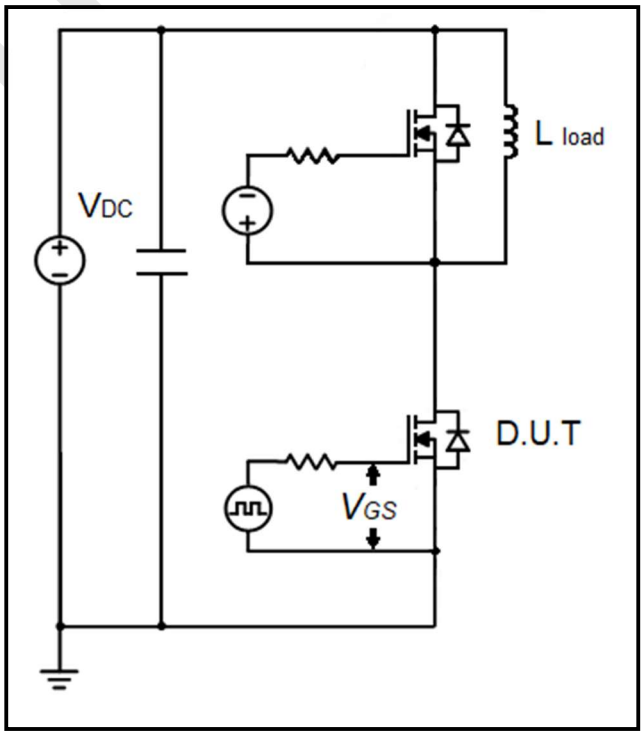


Figure 12. Clamped inductive switching waveform test circuit

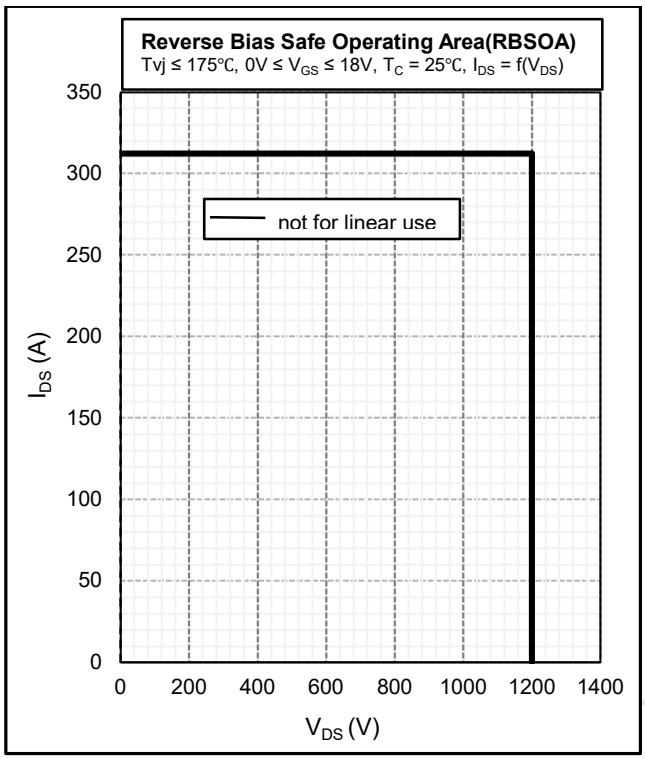
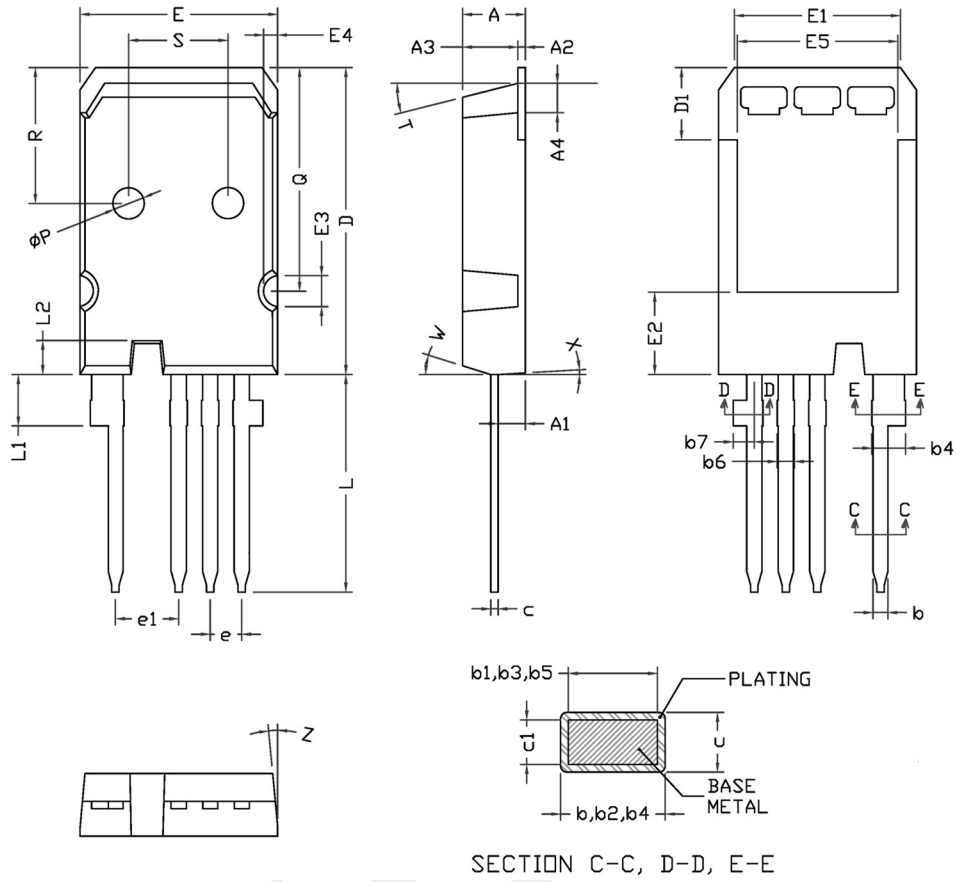


Figure 13. Reverse Bias Safe Operating Area

Package Information:



SECTION C-C, D-D, E-E

AREA	MIN	NOM	MAX
A	4,84	5.03	5.22
Al	2.29	2.39	2.49
A2	0.65	0.70	0.78
A3	4.20	4.33	4.46
A4	2.07	2.20	2.33
D	24,60	24,75	24,85
D1	5,68	5,83	5,98
E	15,71	15,90	16.09
El	13.22	13.35	13.48
E2	5,93	6,63	7.33
E3	1.82	2.53	3.24
E4	0,81	1.04	1.24
E5	12.37	12,90	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.27	17,52	17,77
L1	3,97	4.17	4.37
L2	2.35	2.50	2.65

AREA	MIN	NOM	MAX
b	1.07	-	1.33
b1	1.07	1.20	1.28
b2	2.39	-	2,64
b3	2.39	-	2.69
b4	2.39	-	2,94
b5	2.39	2.53	2.84
b6	1.07	-	1.60
b7	1.30	-	1.70
c	0.65	-	0.78
c1	0,65	0.70	0.75
ΦP	2.40	2.50	2.70
Q	17,77	18.02	18.27
R	10,78	10,98	11.18
S	7,80	8.00	8.20
T	14° REF		
W	21° REF		
X	3° REF		
Z	5° REF		

Ordering Information

Part number	AMR013V120H3i
Package	TO-247-4L (Isolated)
Unit quantity	300 EA
Packing type	Tube

For more information, visit https://www.apowerc2.com