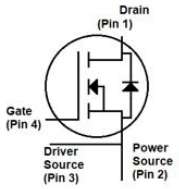
High Power SiC MOSFET Transistor

AMR020V120H1



Applications:

- **Solar Inverters**
- **Uninterrupted power supplies**
- **Switch mode power supplies**
- **Motor drives**

Features:

- **High blocking voltage with low on-resistance**
- **High switching speed with low capacitance**
- **Very low switching losses**
- **Excellent avalanche ruggedness**
- **Very fast and robust intrinsic body diode with low reverse recovery**

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

Symbol	Parameter	AMR020V120H1	Unit
V_{DS}	DC Reverse Voltage	1200	V
V_{GSmax}	Gate-source voltage, max. transient voltage	-10/+22	
V_{GSmax}	Gate-source voltage, max. static voltage	-8/+19	
V_{GSop}	Gate-source voltage	-4/ +15	
I_D	Continuous drain current (V_{GS} = 15V), T_C = 25℃	111	A
	Continuous drain current (V_{GS} = 15V), T_C = 100℃	79	
$I_{D(pulse)}$	Pulsed drain current	231	A
P_{tot}	Power dissipation	600	W
T_j	Operating junction temperature	-55 to 175	˚C
T_{stg}	Storage temperature	-55 to 175	˚C
M	Mounting torque	1	Nm

Thermal and Mechanical Characteristics

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance		-	0.25	-	℃/W
$R_{\theta JA}$	Junction-to-ambient thermal Resistance		-	-	40	℃/W

Static Electrical Characteristics (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 uA	1200	-	-	V
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 17.7mA	1.8	2.6	3.6	V
		V_{DS} = V_{GS}, I_D = 17.7mA, T_j = 175ºC	-	1.8	-	V
I_{DSS}	Drain-Source Leakage current	V_{DS} = 1200V, V_{GS} = 0V	-	1	50	uA
I_{GSS}	Gate-Source leakage current	V_{GS} =15V, V_{DS} =0V	-	1	250	nA
$R_{DS(on)}$	Drain-Source ON Resistance	V_{GS} = 15 V, I_D = 40A	-	20	28	mΩ
		V_{GS} = 15 V, I_D = 40A, T_J = 175°C	-	37	-	mΩ
g_{fs}	Transconductance	V_{DS}=20V $I_{D=}$ 40A	-	36	-	S
		V_{DS}=20V $I_{D=}$ 40A, T_J = 175°C	-	29	-	S
$R_{g(int)}$	Internal gate resistance	f=1MHz, V_{AC}=25mV	-	2.6	-	Ω

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

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 1000V, f = 100kHz, V_{AC} = 25mV	-	5037	-	pF
C_{rss}	Reverse Transfer Capacitance		-	8	-	pF
C_{oss}	Output Capacitance		-	214	-	pF
E_{oss}	C_{oss} stored energy		-	123	-	µJ
Q_{gs}	Gate-Source Gate Charge	V_{DD} = 800V, V_{GS} = -4/+15V, I_D = 50A, I_{GS} = 1mA	-	62	-	nC
Q_{gd}	Gate-Drain Gate Charge		-	49	-	nC
Q_g	Total Gate Charge		-	181	-	nC

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_{DD} = 800V, V_{GS} = -4/+15V, I_D = 50A, $R_{G(ext)}$ = 1Ω, L = 110μH, T_j = 25℃	-	19	-	ns
T_r	Rise time		-	23	-	
$T_{d(off)}$	Turn-off delay time		-	82	-	
T_f	Fall time		-	54	-	
E_{on}	Turn On Switching Energy		-	689	-	μJ
E_{off}	Turn Off Switching Energy		-	1497	-	
$T_{d(on)}$	Turn-on delay time	V_{DD} = 800V, V_{GS} = -4/+15V, I_D = 50A, $R_{G(ext)}$ = 1Ω, L = 110μH, T_j = 175℃	-	17	-	ns
T_r	Rise time		-	28	-	
$T_{d(off)}$	Turn-off delay time		-	94	-	
T_f	Fall time		-	80	-	
E_{on}	Turn On Switching Energy		-	978	-	μJ
E_{off}	Turn Off Switching Energy		-	2140	-	

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

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{SD}	Body Diode Forward Voltage	V_{GS} = -4V, I_{SD} = 25A		4.1		V
		V_{GS} = -4V, I_{SD} = 25A, T_j = 175℃		3.7		
I_S	Continuous diode forward current	T_C = 25℃	-	-	210	A
t_{rr}	Reverse recovery time	V_{GS} = -4V, I_{SD} = 50A, V_R = 800V, di_f/dt = 2.97kA/μs, T_j = 25℃	-	17	-	ns
Q_{rr}	Reverse recovery charge		-	0.4		uC
I_{rrm}	Peak reverse recovery current		-	37	-	A
t_{rr}	Reverse recovery time	V_{GS} = -4V, I_{SD} = 50A, V_R = 800V, di_f/dt = 3.10kA/μs, T_j = 175℃	-	29	-	ns
Q_{rr}	Reverse recovery charge		-	1.1	-	uC
I_{rrm}	Peak reverse recovery current		-	58	-	A

Electrical Characteristic Diagrams

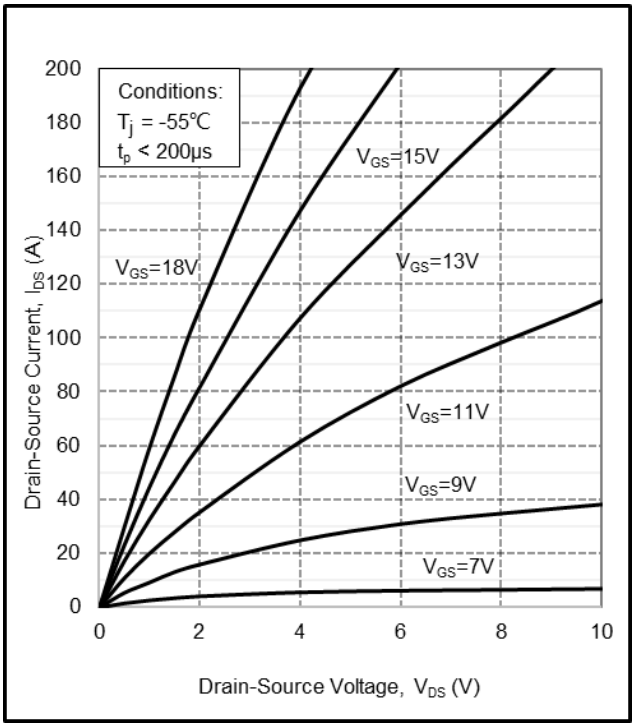


Figure 1. Output characteristics at T_j = -55℃

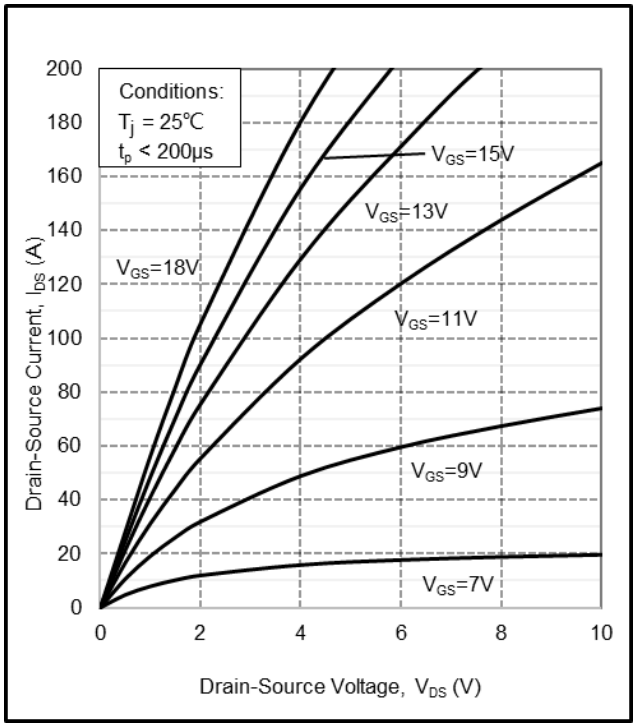


Figure 2. Output characteristics at T_j = 25℃

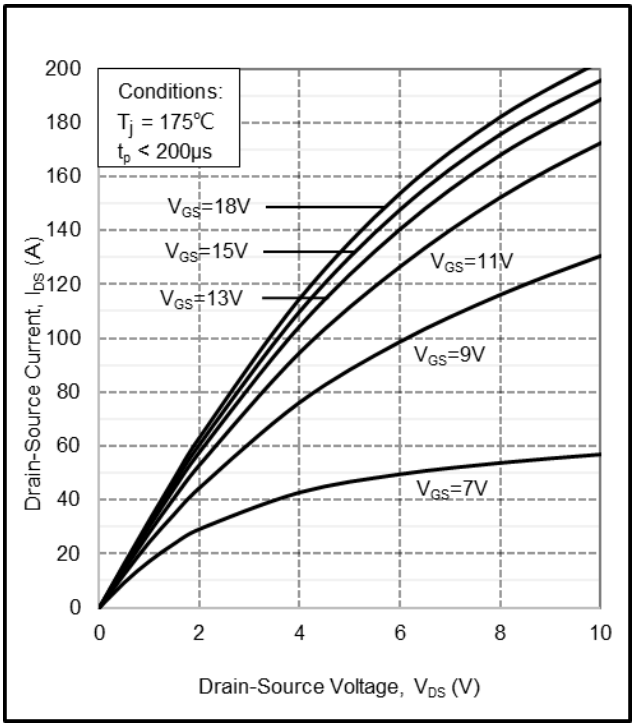


Figure 3. Output characteristics at T_j = 175℃

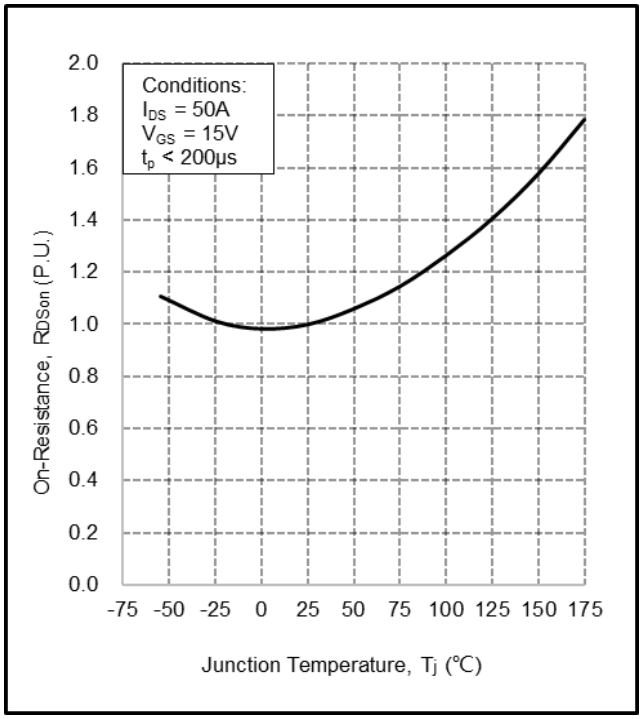


Figure 4. Normalized on-resistance vs. temperature

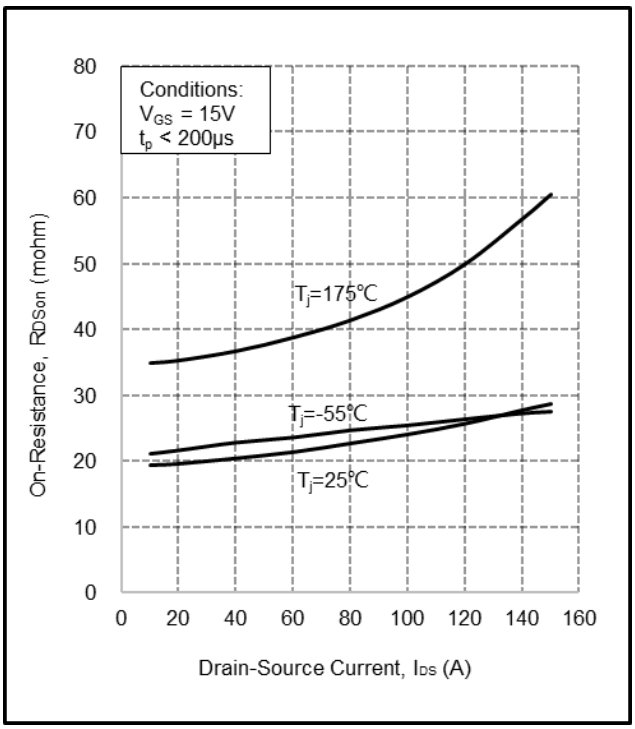


Figure 5. On-resistance vs. drain current for various temperatures

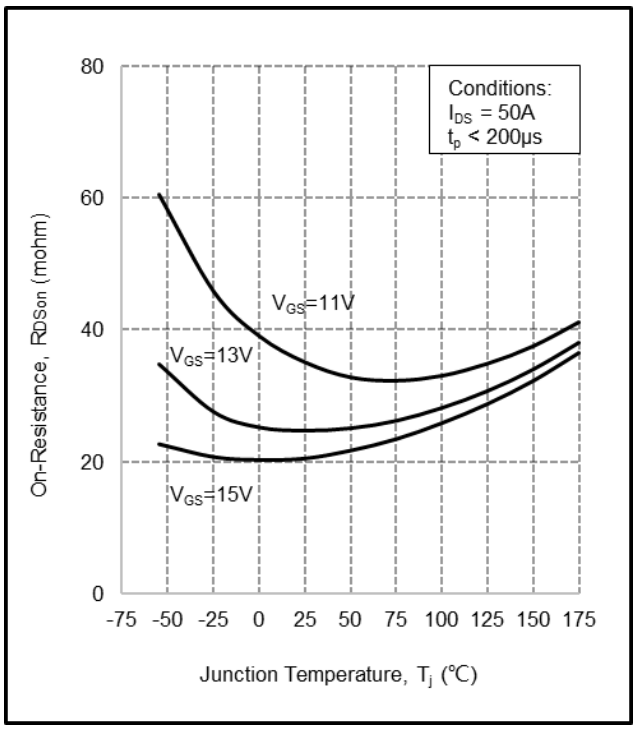


Figure 6. On-resistance vs. temperature for various gate voltages

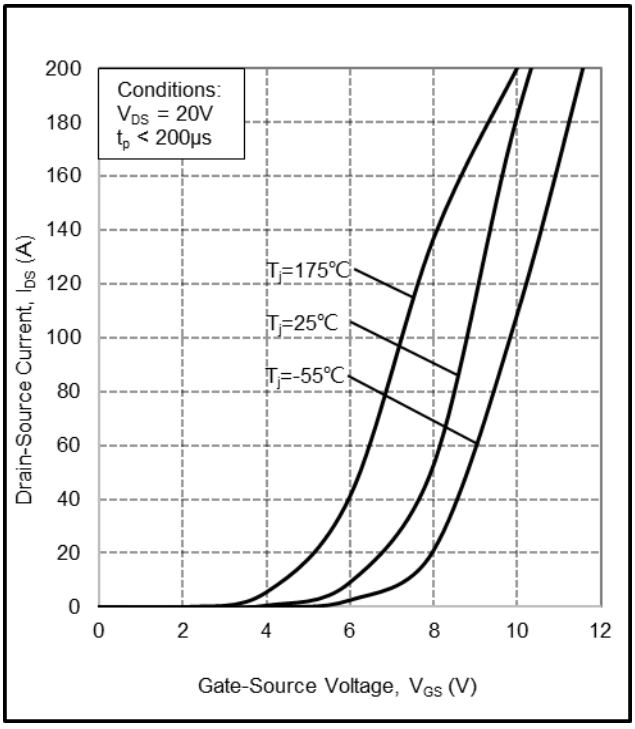


Figure 7. Transfer characteristic for various junction temperatures

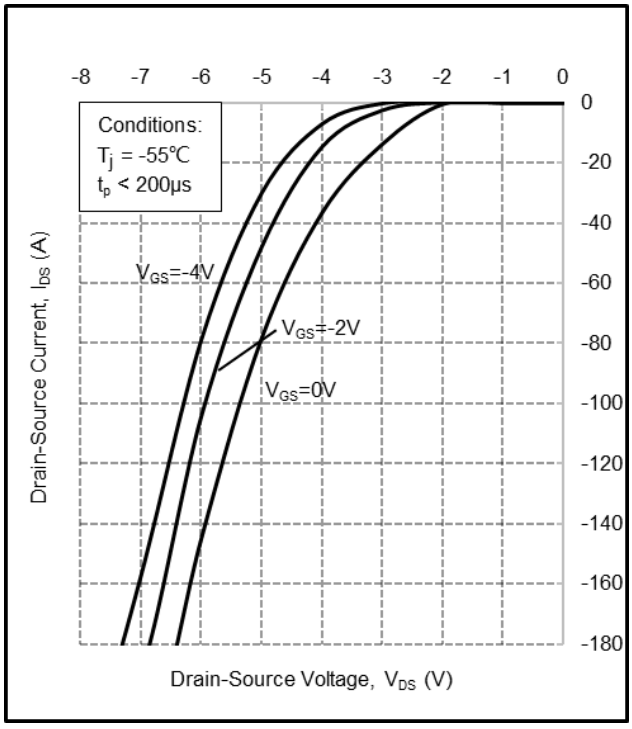


Figure 8. Body diode characteristic at T_j = -55℃

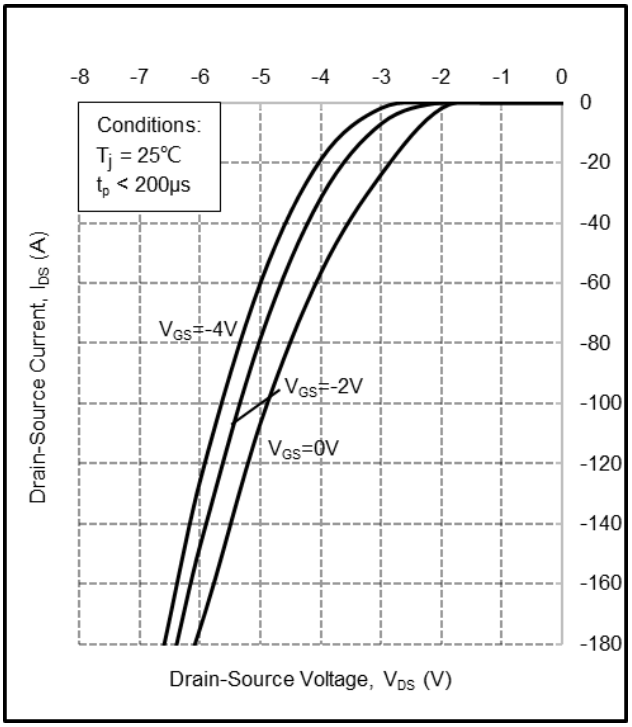


Figure 9. Body diode characteristic at T_j = 25℃

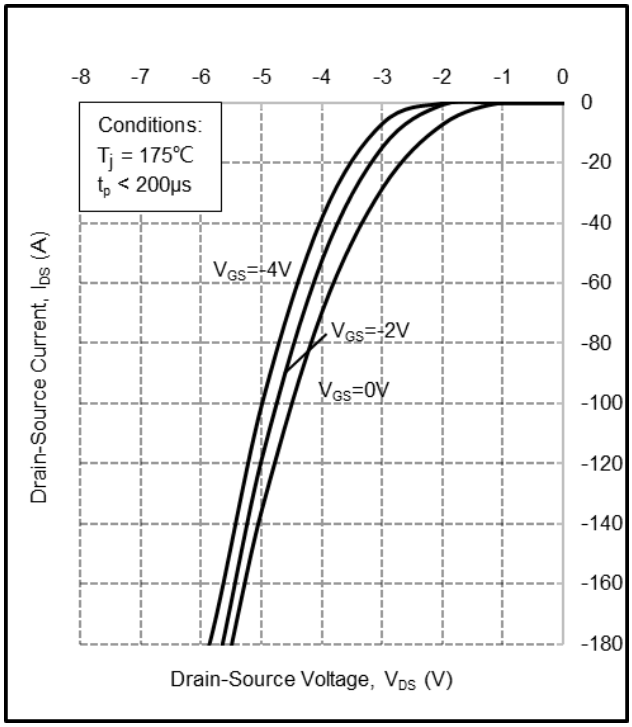


Figure 10. Body diode characteristic at T_j = 175℃

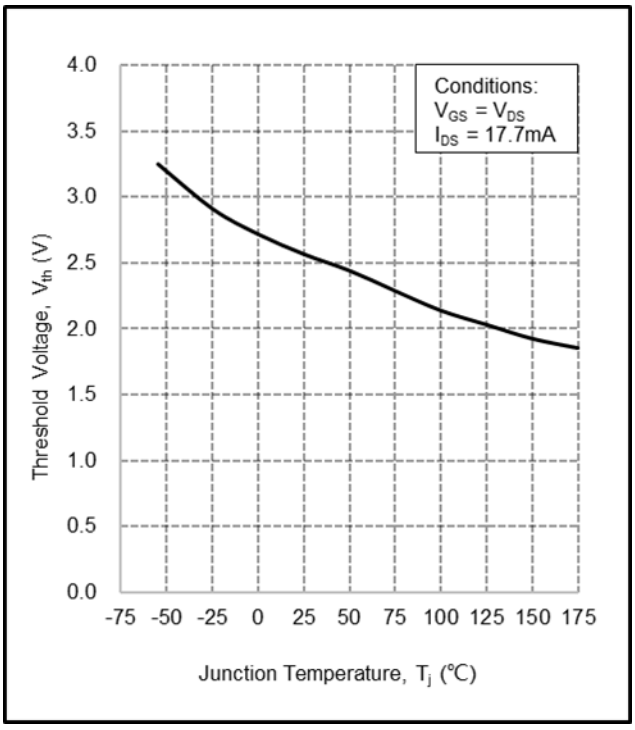


Figure 11. Threshold voltage vs. temperature

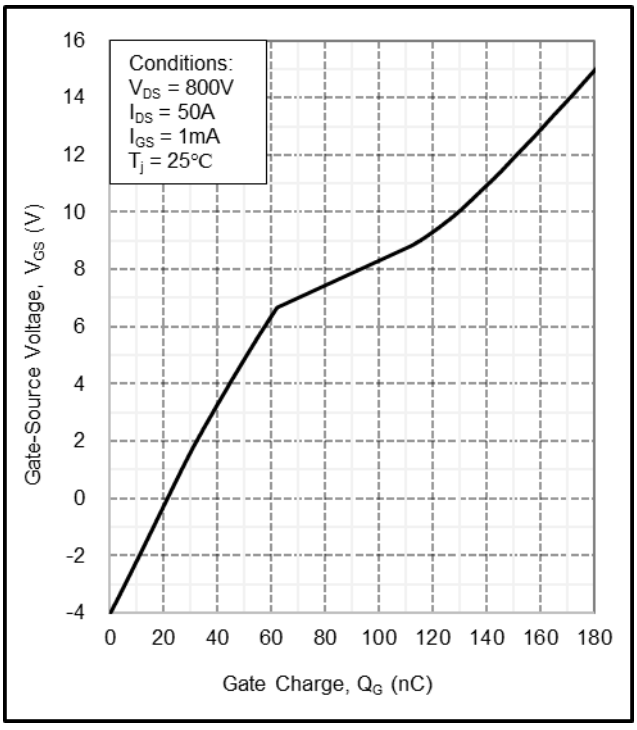


Figure 12. Gate charge characteristics

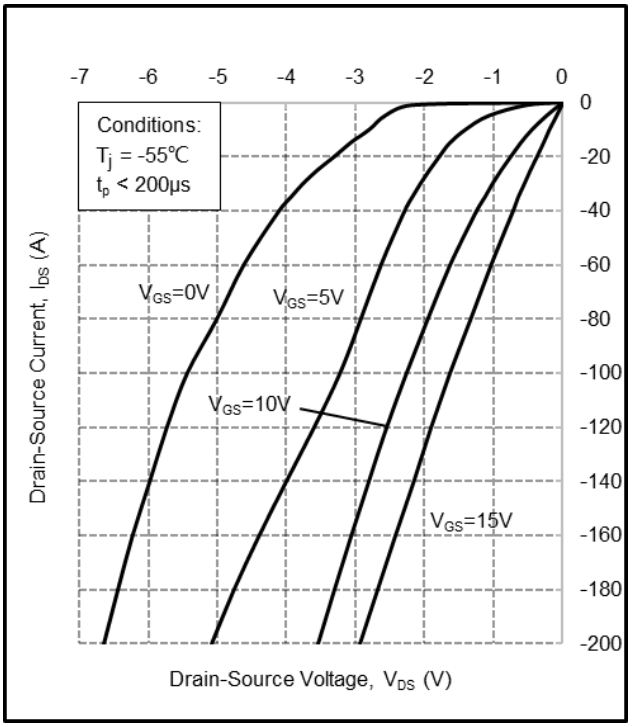


Figure 13. 3rd quadrant characteristic at T_j = -55℃

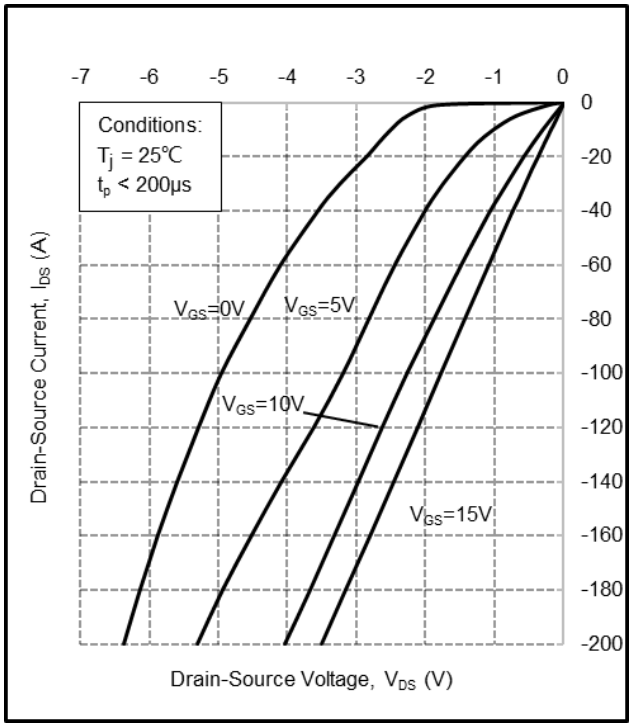


Figure 14. 3rd quadrant characteristic at T_j = 25℃

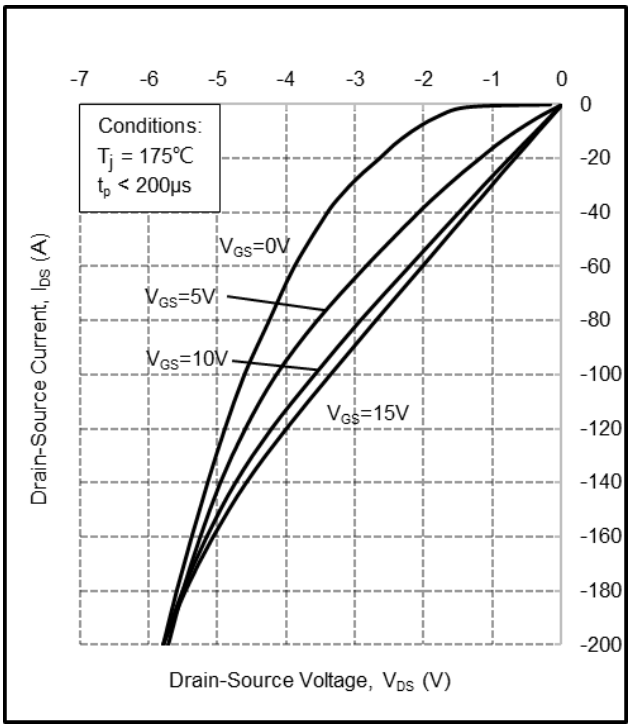


Figure 15. 3rd quadrant characteristic at T_j = 175℃

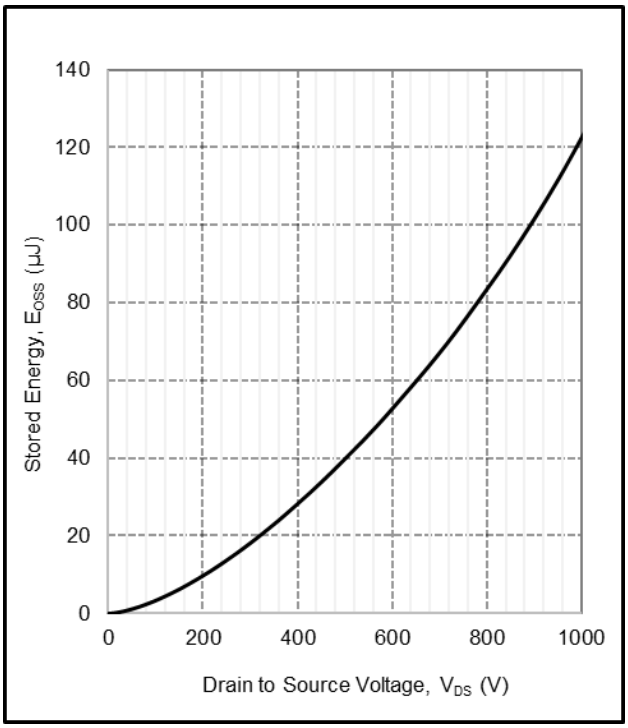


Figure 16. Output capacitor stored energy

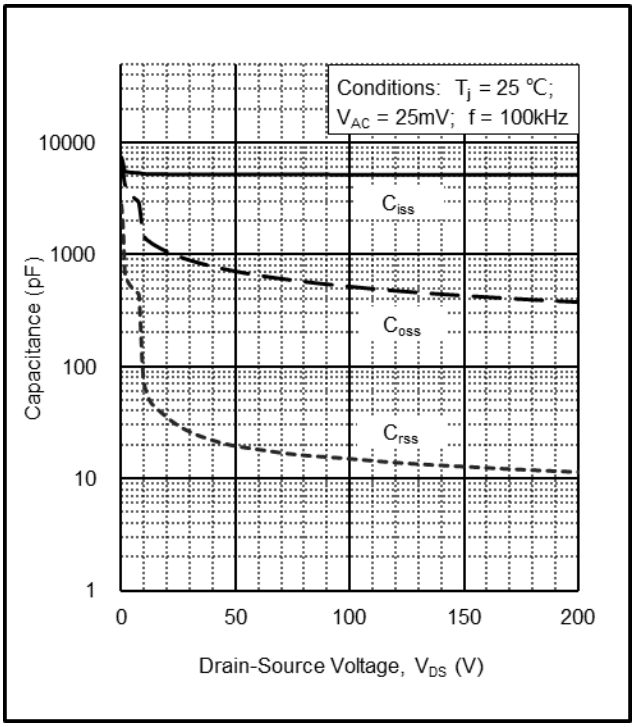


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

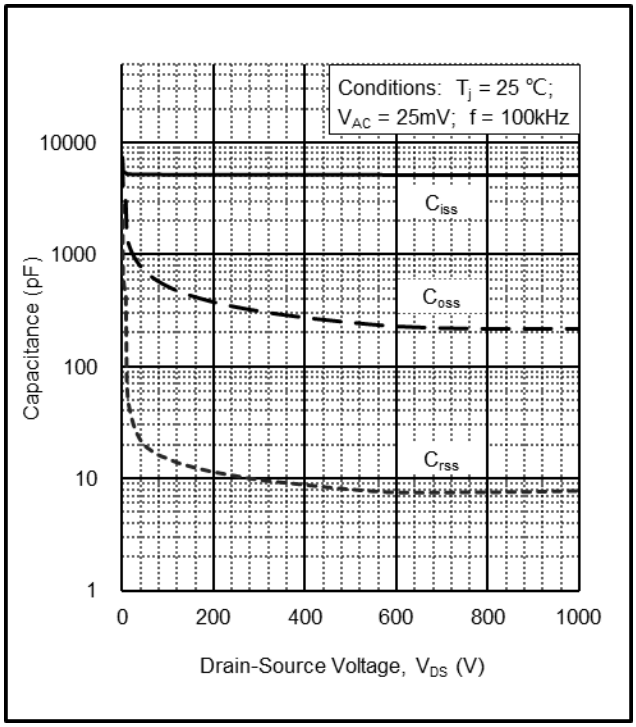


Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

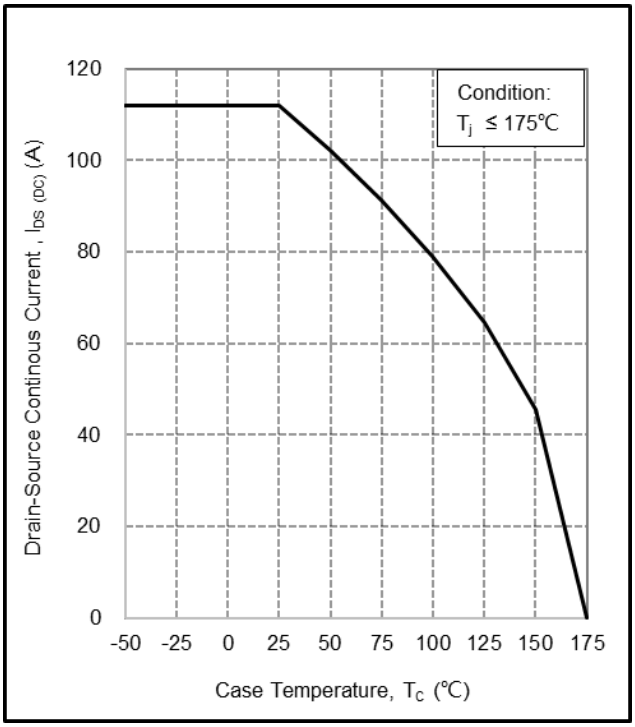


Figure 19. Continuous drain current derating vs. temperature

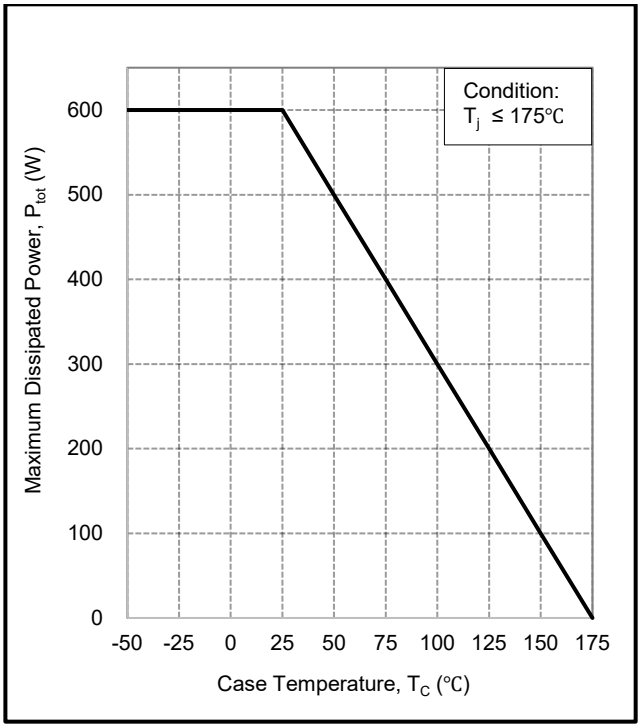


Figure 20. Maximum power dissipation derating vs. temperature

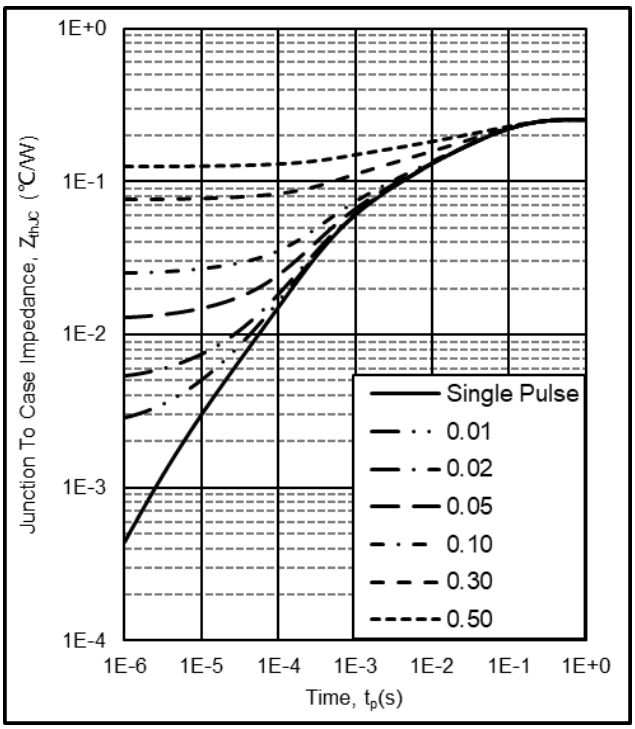


Figure 21. Transient thermal impedance

(Junction - Case)

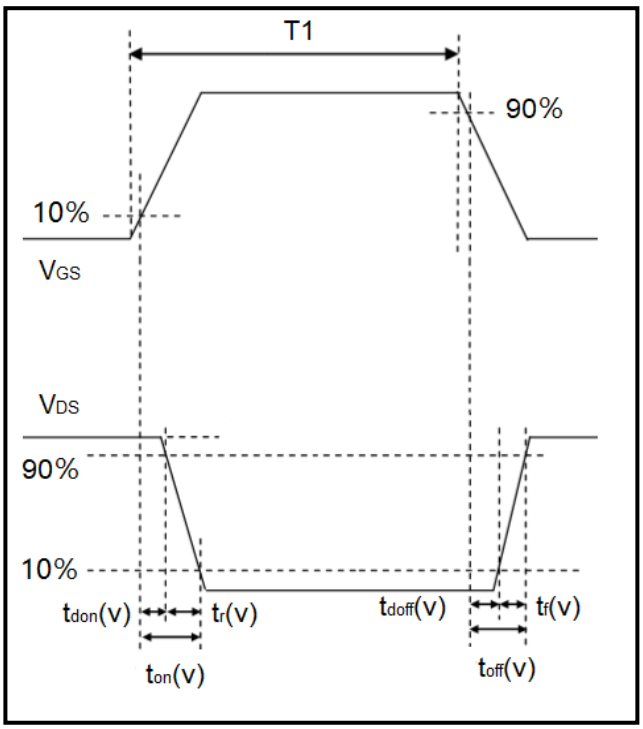


Figure 22. Switching times definition

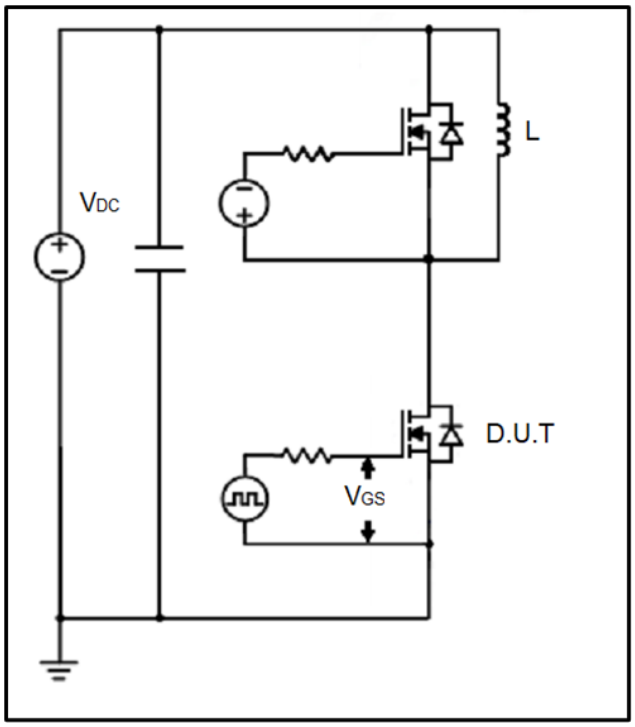
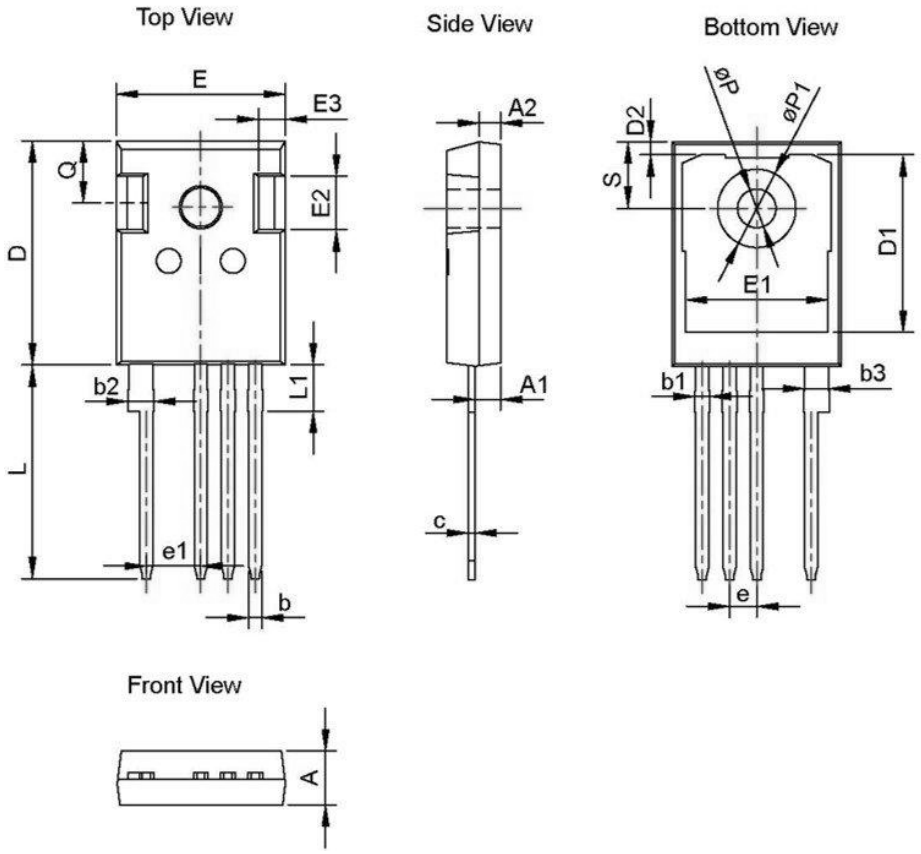


Figure 23. Clamped inductive switching waveform

test circuit

Package Information:

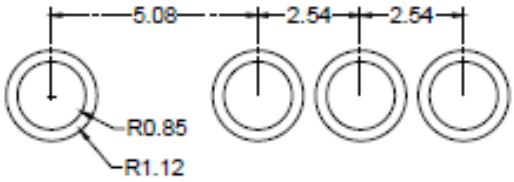


Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	1.11	1.37	1.57
b2	2.24	2.40	2.60
b3	2.11	2.21	2.36
c	0.51	0.60	0.75
D	20.70	20.90	21.30
D1	15.92	16.22	16.52
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	2.54 BSC		
e1	5.08 BSC		

Dimension unit: [mm]			
Symbol	Min	Nom	Max
L	19.62	19.92	20.22
L1	-	-	4.30
øP	3.40	3.60	3.80
øP1	-	-	7.30
Q	5.40	5.80	6.20
S	6.20 BSC		

Recommended Solder Pad Layout

Note: All dimensions are in mm



TO-247-4L

Ordering Information

Part number	AMR020V120H1
Package	TO-247-4L
Unit quantity	300 EA
Packing type	Tube

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