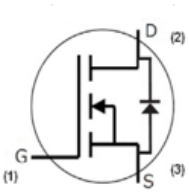
SiC Power MOSFET Transistor

AMR1k0V170E1



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**
- **RoHS compliant**

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

Symbol	Parameter	Test Conditions	Value	Unit
V_{DSmax}	Drain-source voltage	V_{GS} = 0V, I_D = 100μA, T_C = 25℃	1700	V
V_{GSmax}	Gate-source voltage, max. transient voltage	$t_p \leq$ 0.5us, D < 1%, T_C = 25℃	-10/+27	
V_{GSmax}	Gate-source voltage, max. static voltage	T_C = 25℃	-8/+24	
V_{GSop}	Gate-source voltage	Recommended operation values, T_C = 25℃	-5/+20	
I_D	Continuous drain current	V_{GS} = 20V, T_C = 25℃	6.8	A
		V_{GS} = 20V, T_C = 100℃	4.8	
$I_{D(pulse)}$	Pulsed drain current	Pulse width t_p limited by T_{jmax}	21	A
P_{tot}	Power dissipation	T_C = 25℃	100	W
T_j	Operating junction temperature		-55~175	˚C
T_{stg}	Storage temperature		-55~175	˚C
T_L	Soldering temperature	1.6mm from case for 10s	260	℃
M	Mounting torque	M3 screw	0.7	Nm

Thermal Resistances

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance	-	1.25	-	°C/W
$R_{\theta JA}$	Junction-to-ambient thermal Resistance	-	-	40	°C/W

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 100µA	1700	-	-	V
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.5mA	2	2.6	4	V
		V_{DS} = V_{GS}, I_D = 0.5mA, T_j = 175ºC	-	1.8	-	
I_{DSS}	Drain-Source Leakage current	V_{DS} = 1700V, V_{GS} = 0V	-	1	100	µA
I_{GSS}	Gate-Source leakage current	V_{GS} = 20V, V_{DS} = 0V	-	1	250	nA
$R_{DS(on)}$	Drain-Source ON Resistance	V_{GS} = 20V, I_D = 2A	-	1.0	1.2	Ω
		V_{GS} = 20V, I_D = 2A, T_j = 175ºC	-	1.5	-	
g_{fs}	Transconductance	V_{DS} = 20V, I_D = 2A	-	1.0	-	S
		V_{DS} = 20V, I_D = 2A, T_j = 175ºC	-	1.2	-	
$R_{g(int)}$	Internal gate resistance	f = 1MHz, V_{AC} = 25mV	-	6	-	Ω
E_{AS}	Avalance Energy	L = 5mH, V_{DD} = 50V	-	150	-	mJ

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 = 1MHz, V_{AC} = 25mV	-	227	-	pF
C_{oss}	Output capacitance		-	12.5	-	
C_{rss}	Reverse transfer capacitance		-	2	-	
E_{oss}	C_{OSS} stored energy		-	7.7	-	µJ
Q_{GS}	Gate to source charge	V_{DD} = 1200V, V_{GS} = -5/+20V, I_D = 2A, I_{GS} = 1mA	-	1.67	-	nC
Q_{GD}	Gate to drain charge		-	9.2	-	
Q_G	Total gate charge		-	16.7	-	

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} = 1200V, V_{GS} = -5/+20V, I_D = 2A, $R_{G(ext)}$ =12Ω, L = 1364μH	-	18	-	ns
t_r	Rise time		-	16	-	
$t_{d(off)}$	Turn-off delay time		-	24	-	
t_f	Fall time		-	79	-	
E_{on}	Turn-on switching energy		-	63	-	μJ
E_{off}	Turn-off switching energy		-	29	-	
$t_{d(on)}$	Turn-on delay time	V_{DD} = 1200V, V_{GS} = -5/+20V, I_D = 2A, $R_{G(ext)}$ = 12Ω, L = 1364μH, T_j = 175°C	-	17	-	ns
t_r	Rise time		-	16	-	
$t_{d(off)}$	Turn-off delay time		-	29	-	
t_f	Fall time		-	84	-	
E_{on}	Turn-on switching energy		-	88	-	μJ
E_{off}	Turn-off switching energy		-	29	-	

Reverse SiC Diode Characteristics ($T_A = 25\ °C$, unless specified otherwise)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{SD}	Diode forward voltage	V_{GS} = -5V, I_{SD} = 1A	-	3.6	-	V
		V_{GS} = -5V, I_{SD} = 1A, T_j = 175°C	-	3.2	-	
I_S	Continuous diode forward current	V_{GS} = -5V, T_C = 25°C	-	-	5	A
$I_{S,\ pulse}$	Diode pulse current	V_{GS} = -5V, pulse width t_p limited by T_{jmax}	-	-	21	A
t_{rr}	Reverse recovery time	V_{GS} = -5V, I_{SD} = 2A, V_R = 1200V, di_f/dt = 0.19kA/μs	-	34	-	ns
Q_{rr}	Reverse recovery charge		-	0.04		μC
I_{rrm}	Peak reverse recovery current		-	1.85	-	A
t_{rr}	Reverse recovery time	V_{GS} = -5V, I_{SD} = 2A, V_R = 1200V, T_j = 175°C, di_f/dt = 0.19kA/μs	-	39	-	ns
Q_{rr}	Reverse recovery charge		-	0.08	-	μC
I_{rrm}	Peak reverse recovery current		-	3.57	-	A

Electrical Characteristic Diagrams

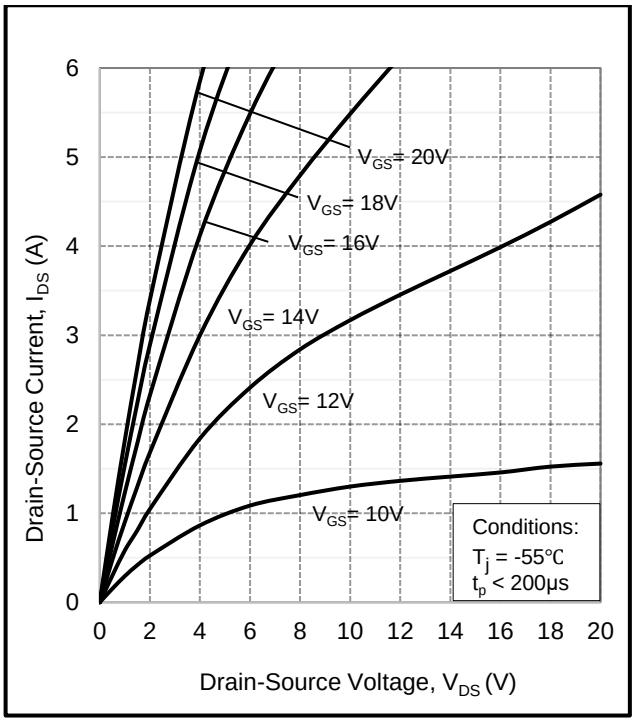


Figure 1. Output characteristics at T_j = -55℃

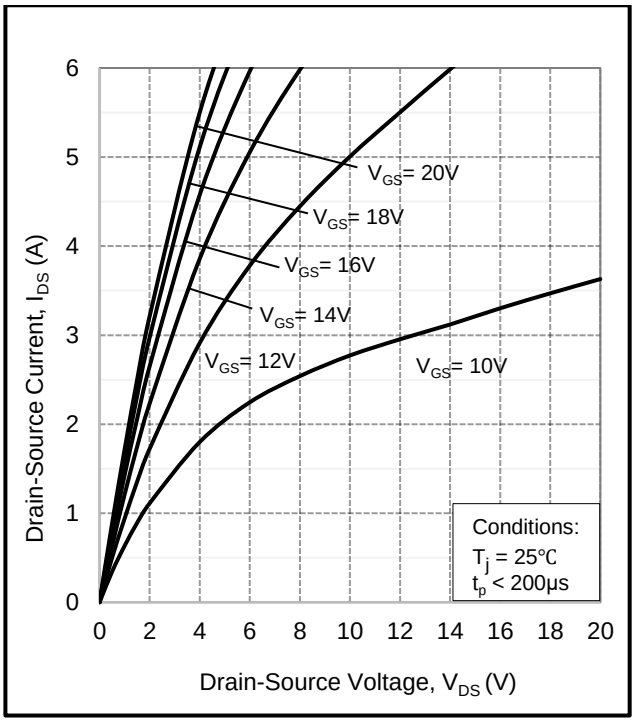


Figure 2. Output characteristics at T_j = 25℃

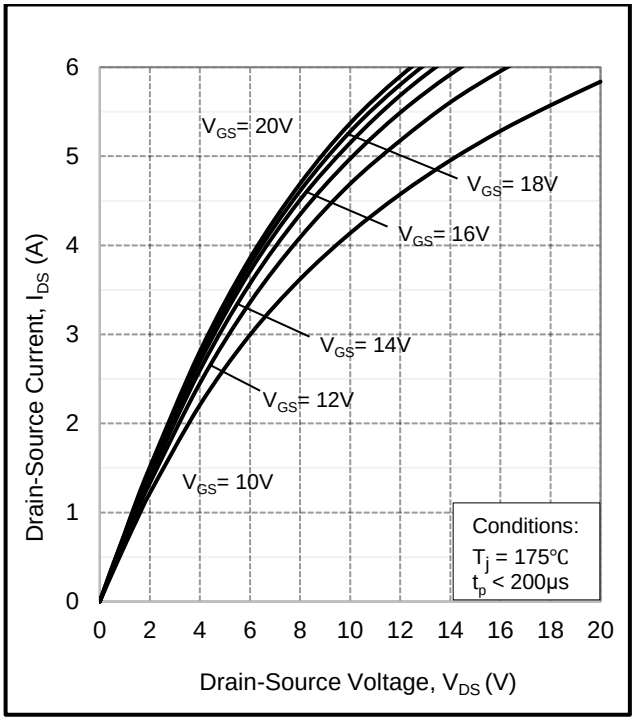


Figure 3. Output characteristics at T_j = 175℃

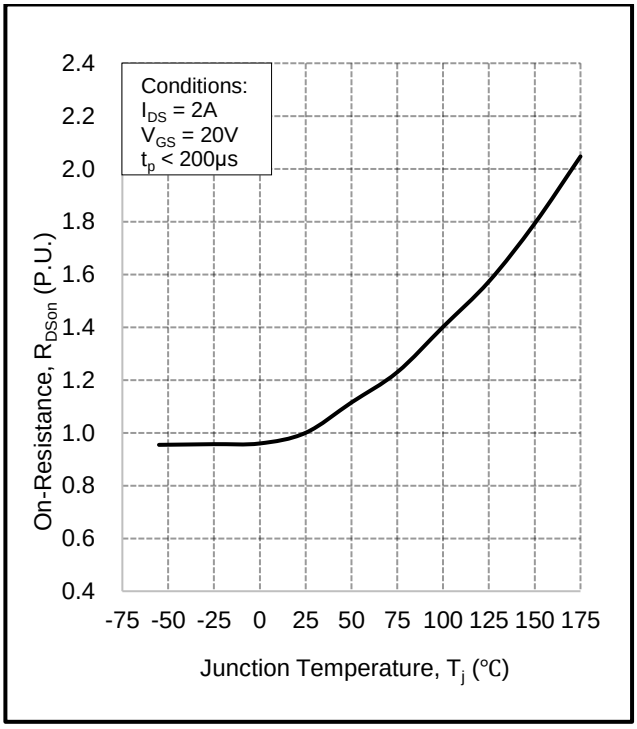


Figure 4. Normalized on-resistance vs. temperature

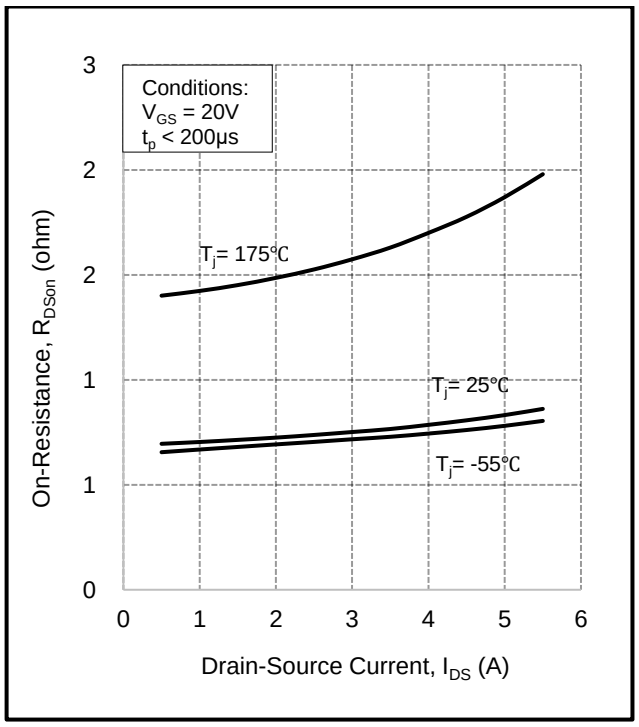


Figure 5. On-resistance vs. drain current for various temperatures

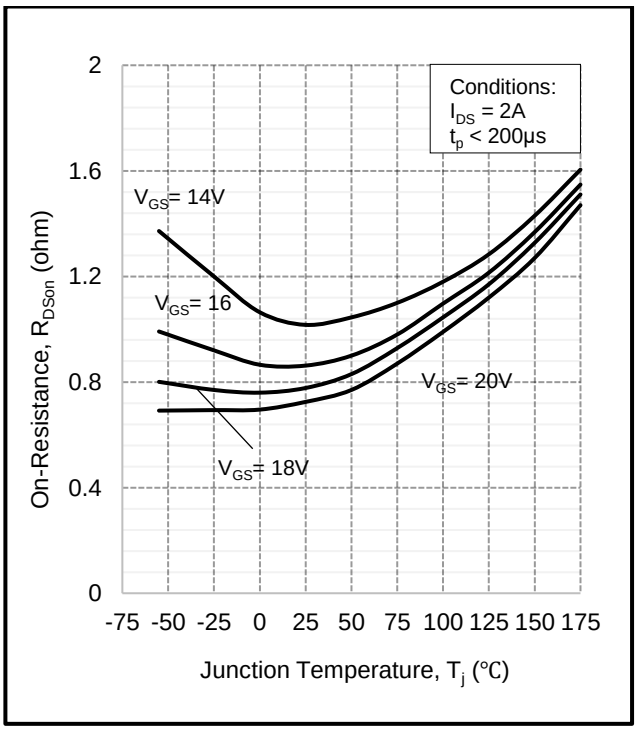


Figure 6. On-resistance vs. temperature for various gate voltages

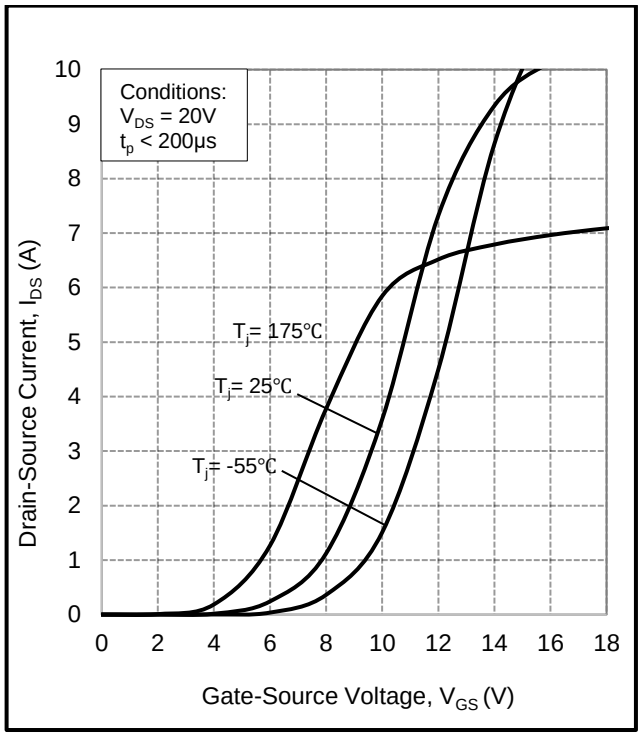


Figure 7. Transfer characteristic for various junction temperatures

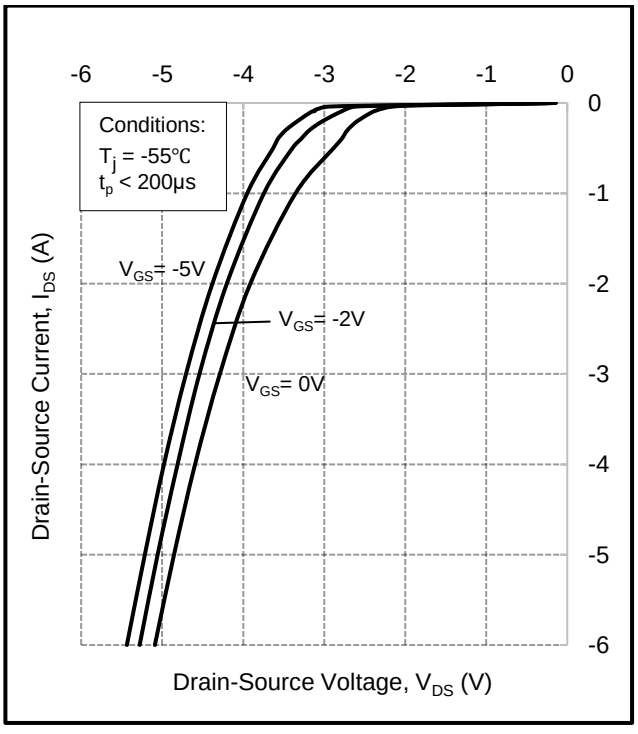


Figure 8. Body diode characteristic at T_j = -55℃

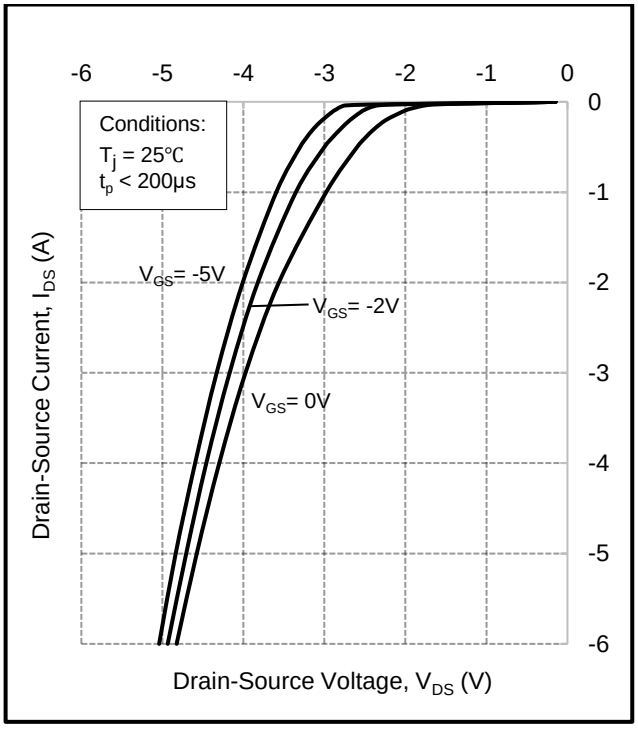


Figure 9. Body diode characteristic at T_j = 25℃

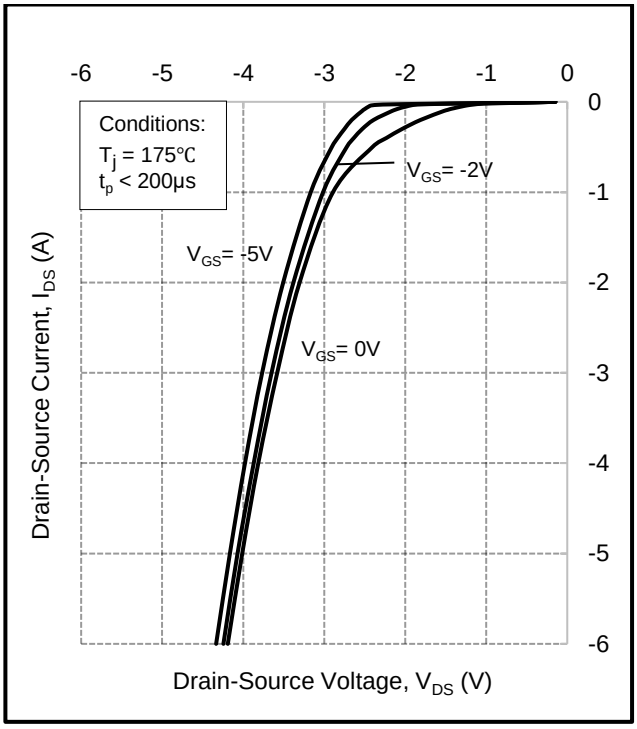


Figure 10. Body diode characteristic at T_j = 175℃

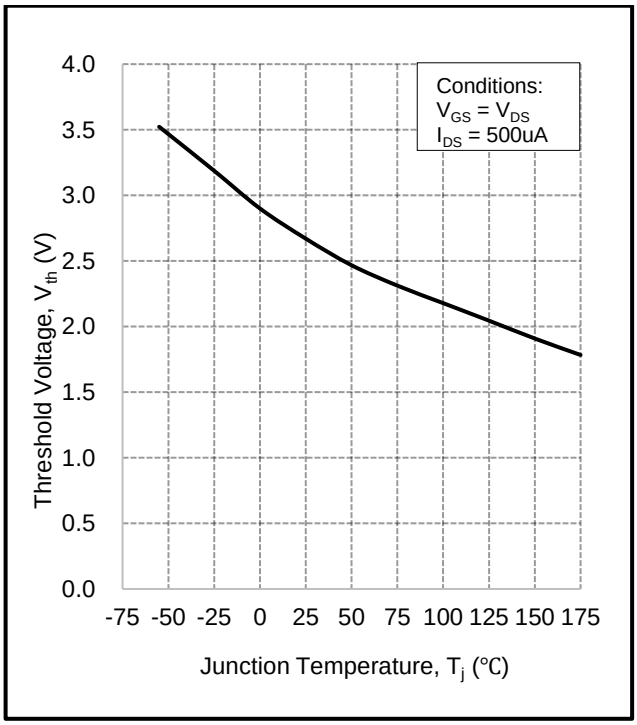


Figure 11. Threshold voltage vs. temperature

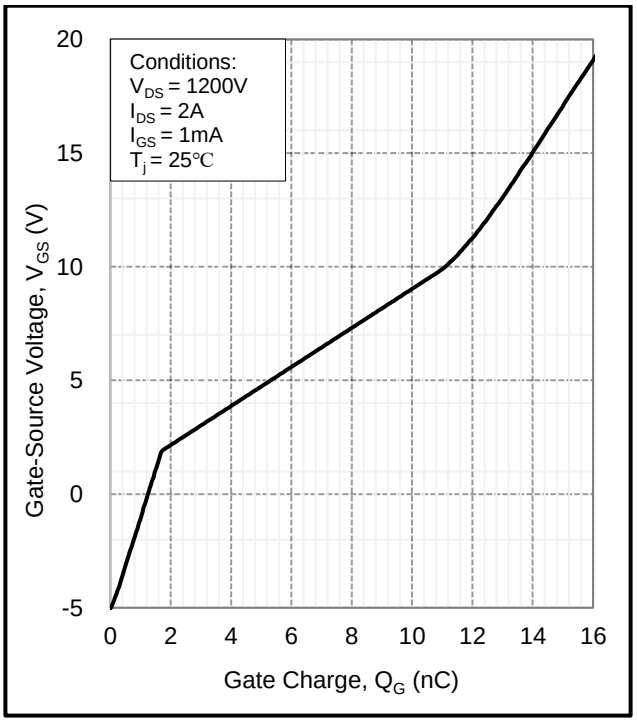


Figure 12. Gate Charge Characteristic

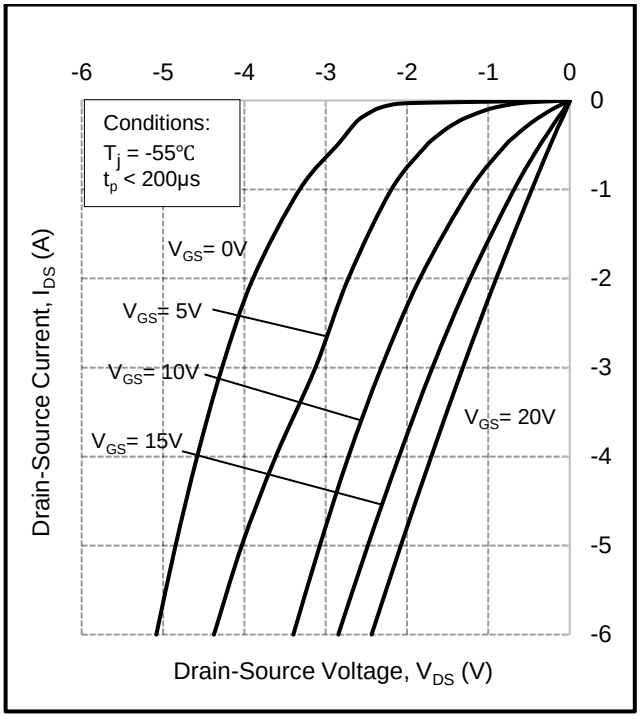


Figure 13. 3rd quadrant characteristic at T_j = -55℃

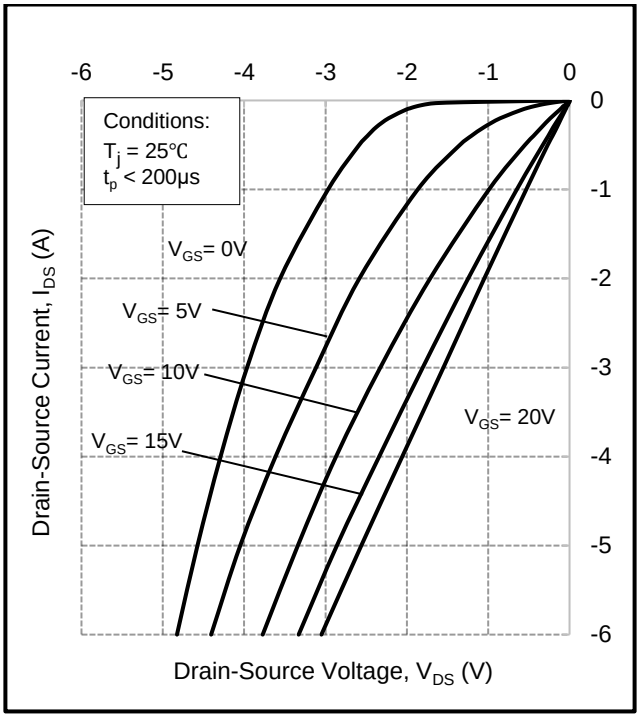


Figure 14. 3rd quadrant characteristic at T_j = 25℃

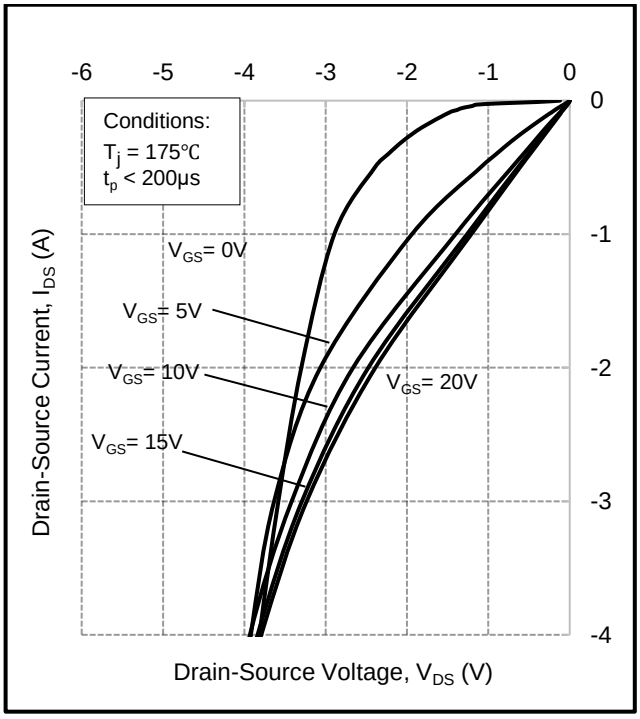


Figure 15. 3rd quadrant characteristic at T_j = 175℃

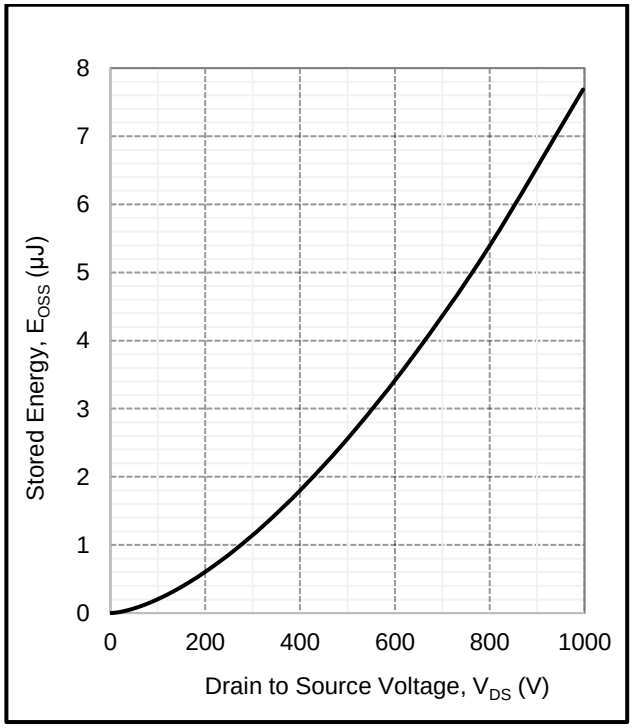


Figure 16. Output capacitor stored energy

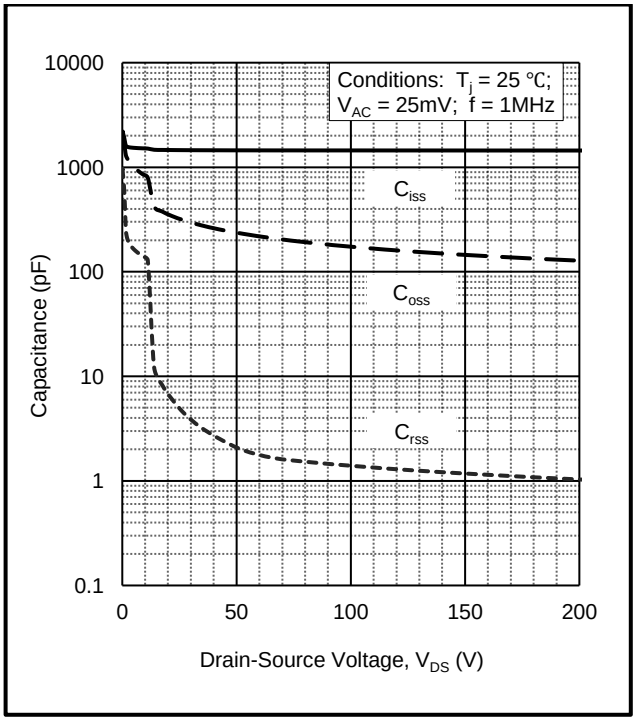


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

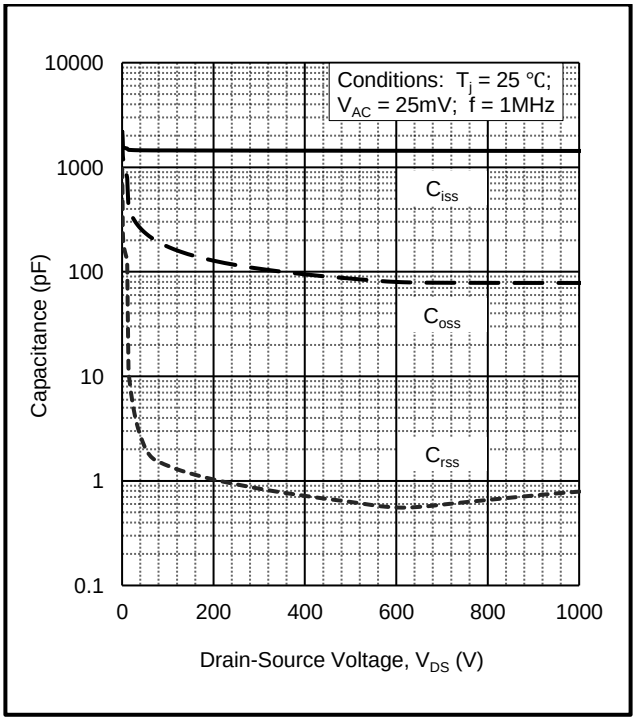


Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

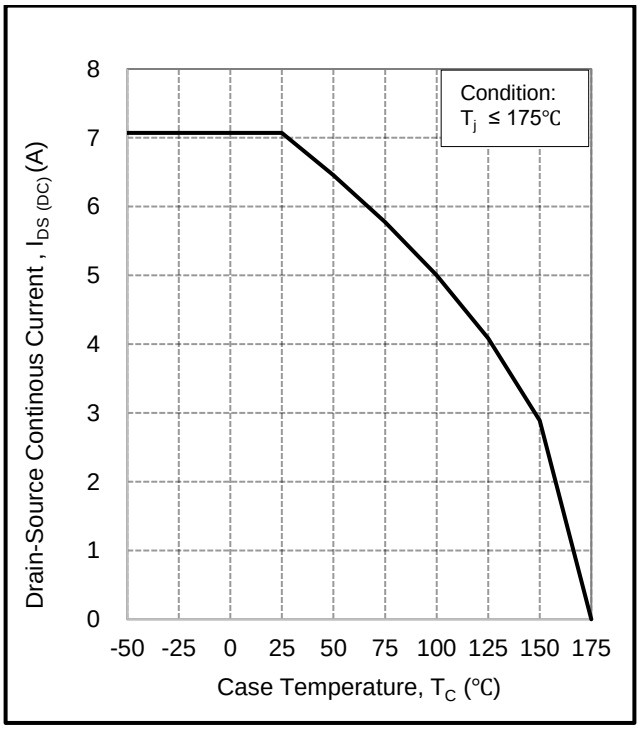


Figure 19. Continuous drain current derating vs. temperature

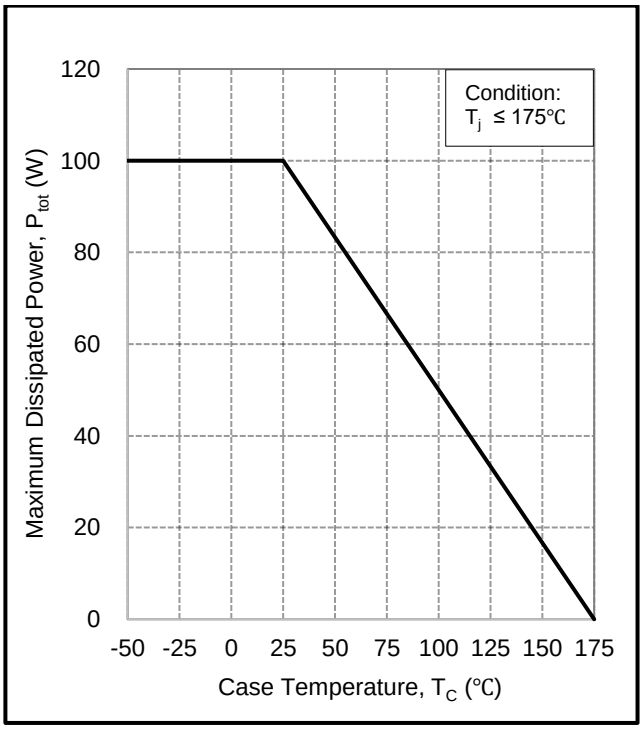


Figure 20. Maximum power dissipation derating vs. temperature

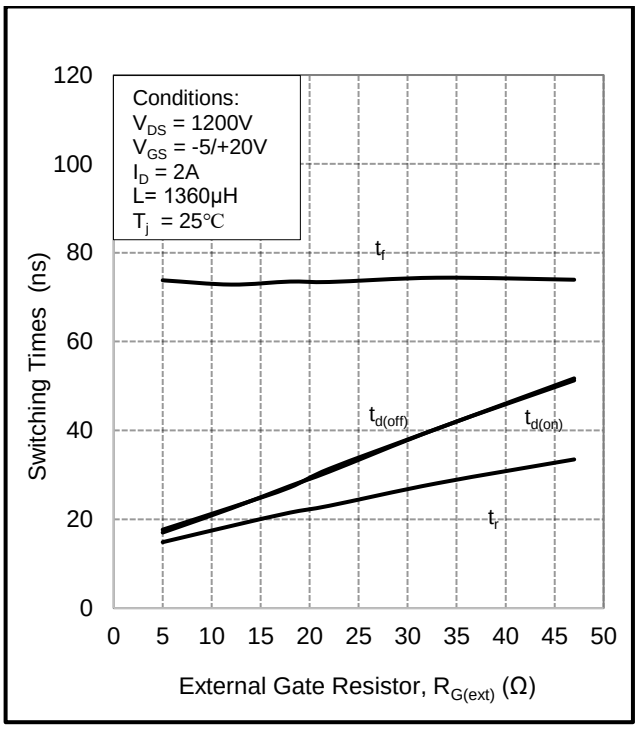


Figure 21. Switching Times vs. $R_{G(ext)}$

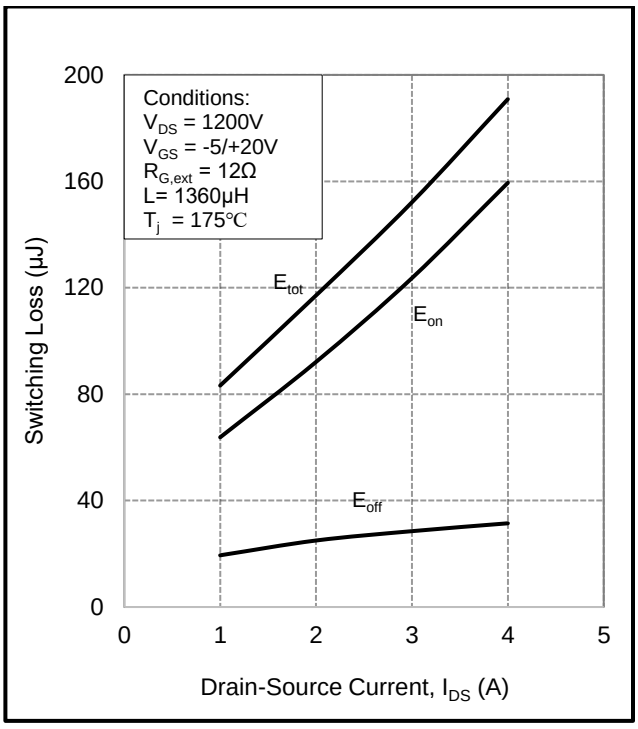


Figure 22. Clamped inductive Switching energy vs. drain current

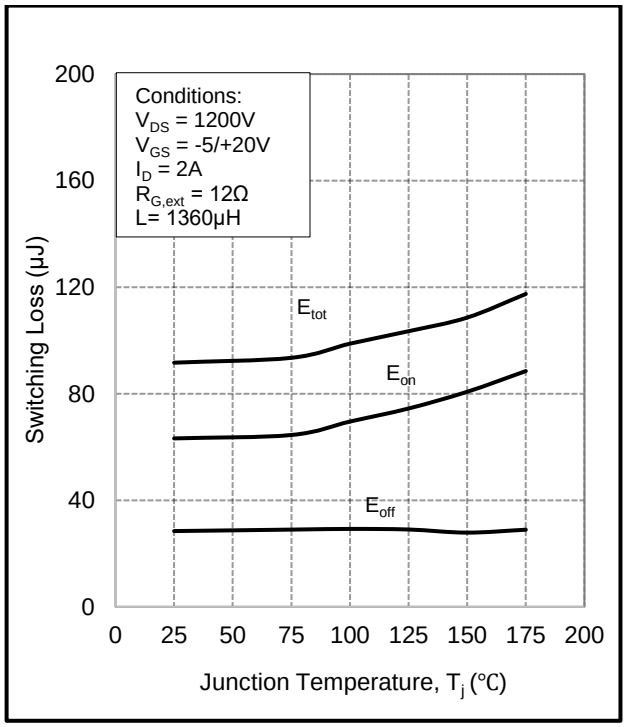


Figure 23. Clamped inductive Switching energy vs. temperature

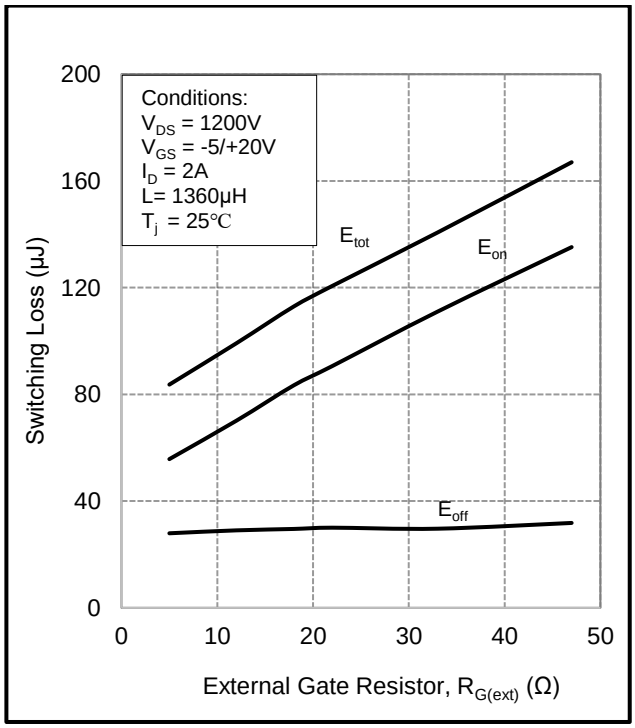


Figure 24. Clamped inductive Switching energy vs. $R_{G(ext)}$

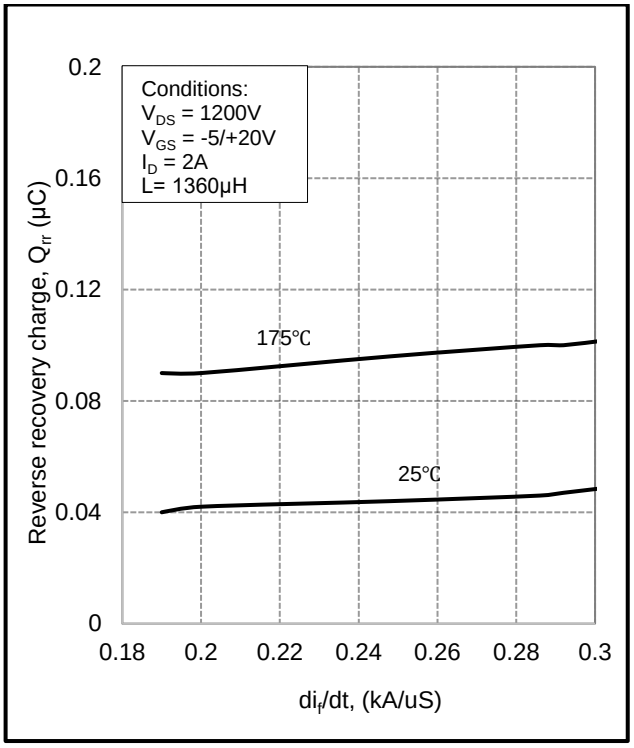


Figure 25. Reverse recovery charge vs. di_f/dt

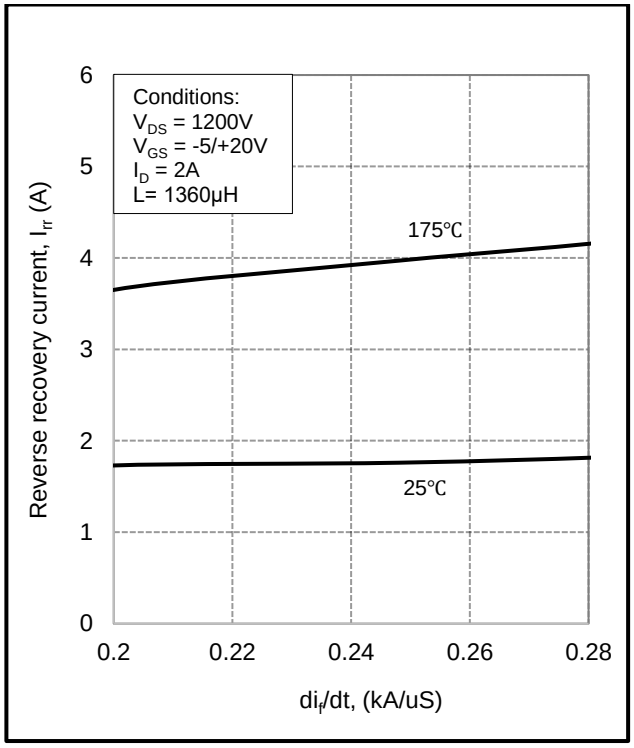


Figure 26. Reverse recovery current vs. di_f/dt

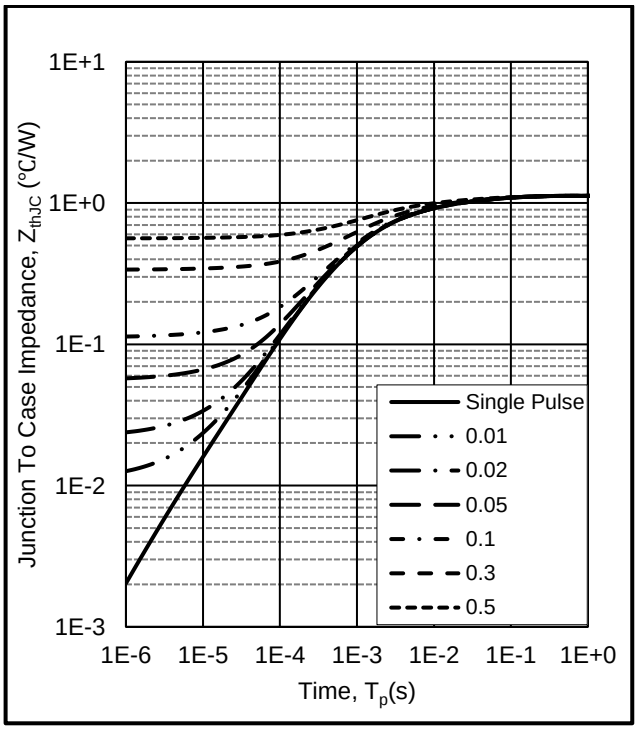


Figure 27. Transient Thermal Impedance

(Junction - Case)

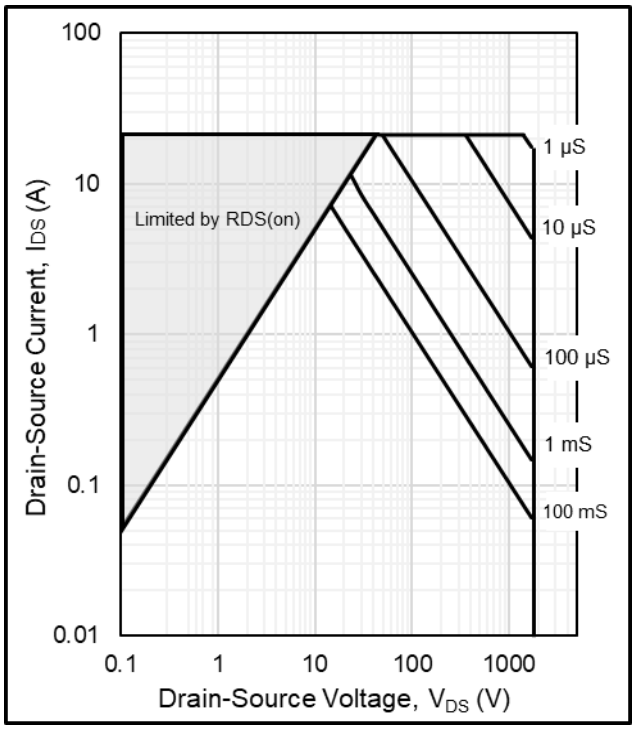


Figure 28. Safe Operating Area

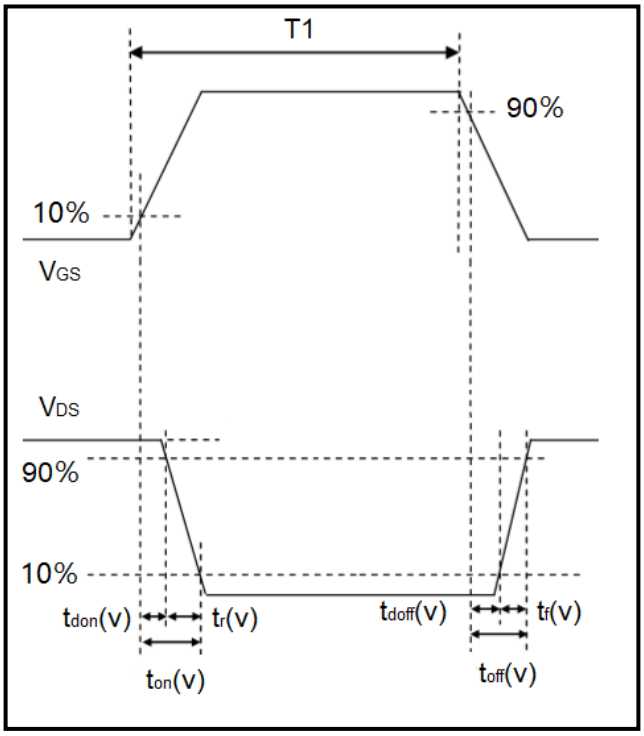


Figure 29. Switching times definition

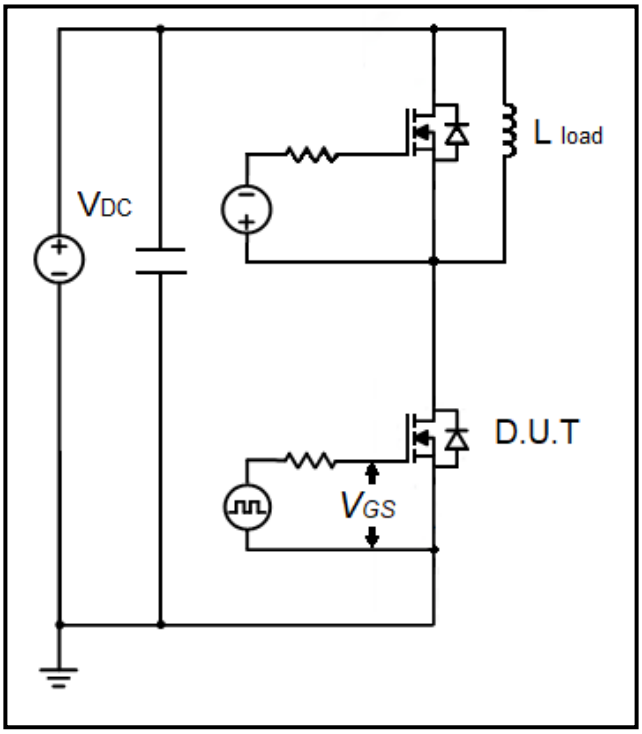
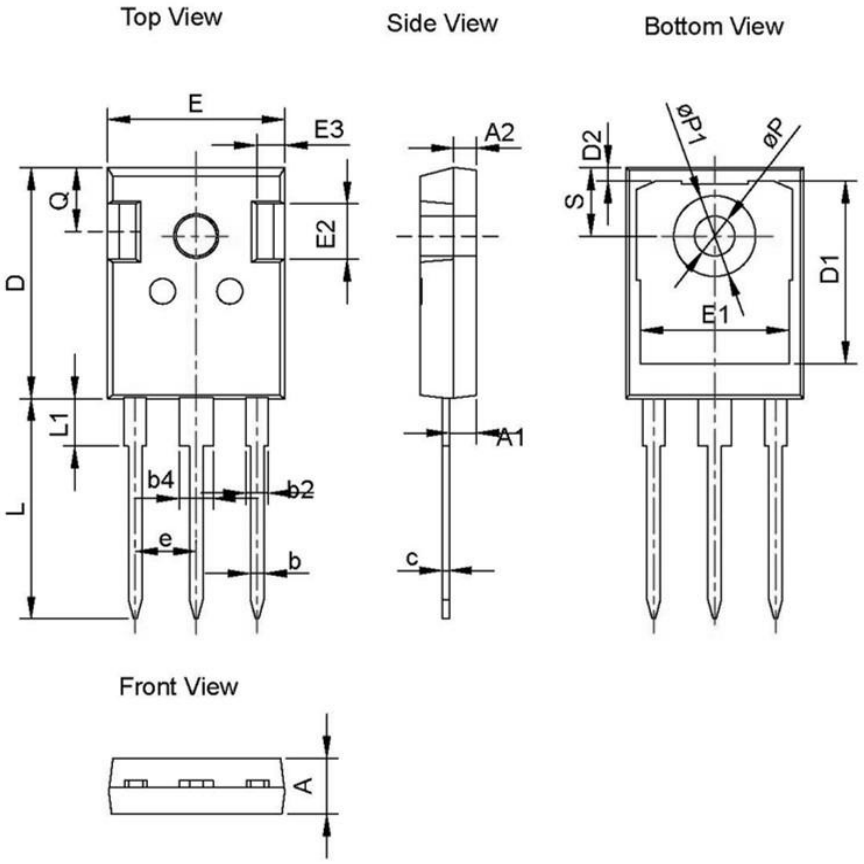


Figure 30. Clamped inductive switching waveform test circuit

Package Information:

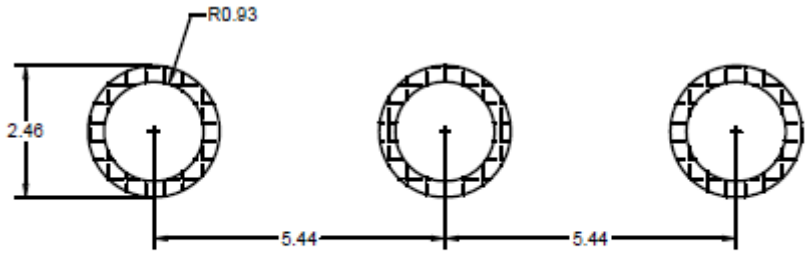


Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.60	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44 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-247-3L

Ordering Information

Part number	AMR1k0V170E1
Package	TO-247-3L
Unit quantity	300 EA
Packing type	Tube