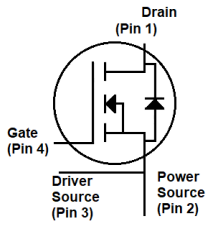
High Power SiC MOSFET Transistor

AAR009V075H2

HF

RoHS

AEC-Q101



Applications:

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

Features:

- **AEC-Q101 qualified**
- **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	Value	Unit
V_{DS}	DC Reverse Voltage	750	V
V_{GSmax}	Gate-source voltage, max. transient voltage	-11/+25	
V_{GSmax}	Gate-source voltage, max. static voltage	-10/+22	
V_{GSop}	Gate-source voltage (Recommended operation values)	-5/+18	
I_D	Continuous drain current (VGS = 18V)	172	A
	Continuous drain current (VGS = 18V), T_C = 100°C	122	
$I_{D(pulse)}$	Pulsed drain current	430	A
P_{tot}	Power dissipation	500	W
T_j	Operating junction temperature	-55 to 175	°C
T_{stg}	Storage temperature	-55 to 175	°C

Thermal and Mechanical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance	-	0.25	-	°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
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 100μA	750	-	-	V
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 20mA	1.8	2.9	4.2	V
		V_{DS} = V_{GS}, I_D = 20mA, T_j = 175ºC	-	2.0	-	V
I_{DSS}	Drain-Source Leakage current	V_{DS} = 750V, V_{GS} = 0V	-	1	50	μA
I_{GSS}	Gate-Source leakage current	V_{GS} = 18V, V_{DS} = 0V	-	1	250	nA
$R_{DS(on)}$	Drain-Source ON Resistance	V_{GS} = 15V, I_D = 80A	-	12	-	mΩ
		V_{GS} = 18V, I_D = 80A	-	9	12	mΩ
		V_{GS} = 18V, I_D = 80A, T_j = 175ºC	-	12	-	mΩ
g_{fs}	Transconductance	V_{DS} = 20V, I_D = 80A	-	47	-	S
		V_{DS} = 20V, I_D = 80A, T_j = 175ºC	-	48	-	S
$R_{g(int)}$	Internal gate resistance	f = 1MHz, V_{AC} = 25mV	-	6.5	-	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} = 700V, f = 100kHz, V_{AC} = 25mV	-	5107	-	pF
C_{oss}	Output Capacitance		-	387	-	pF
C_{rss}	Reverse Transfer Capacitance		-	24	-	pF
E_{oss}	C_{oss} stored energy		-	105	-	μJ
Q_{gs}	Gate-Source Gate Charge	V_{DD} = 500V, V_{GS} = -5/+18V, I_D = 80A, I_{GS} = 1mA	-	73	-	nC
Q_{gd}	Gate-Drain Gate Charge		-	50	-	nC
Q_g	Total Gate Charge		-	218	-	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} = 500V, V_{GS} = -5/+18V, I_D = 80A, $R_{G(ext)}$ = 2.4Ω, L = 110μH	-	21	-	ns
T_r	Rise time		-	45	-	
$T_{d(off)}$	Turn-off delay time		-	91	-	
T_f	Fall time		-	17	-	
E_{on}	Turn On Switching Energy		-	967	-	μJ
E_{off}	Turn Off Switching Energy		-	449	-	
$T_{d(on)}$	Turn-on delay time	V_{DD} = 500V, V_{GS} = -5/+18V, I_D = 80A, $R_{G(ext)}$ = 2.4Ω, L = 110μH, T_j = 175°C	-	19	-	ns
T_r	Rise time		-	44	-	
$T_{d(off)}$	Turn-off delay time		-	120	-	
T_f	Fall time		-	20	-	
E_{on}	Turn On Switching Energy		-	1028	-	μJ
E_{off}	Turn Off Switching Energy		-	582	-	

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} = -5V, I_{SD} = 50A	-	3.9	-	V
		V_{GS} = -5V, I_{SD} = 50A, T_j = 175°C	-	3.5	-	
I_S	Continuous diode forward current	V_{GS} = -5V, T_C = 25°C	-	-	172	A
$I_{S,\ pulse}$	Diode Pulse Current	V_{GS} = -5V, pulse width t_p limited by T_{jmax}		-	430	A
t_{rr}	Reverse recovery time	V_{GS} = -5V, I_{SD} = 80A, V_R = 500V, di_f/dt =1.03kA/μs	-	29	-	ns
Q_{rr}	Reverse recovery charge		-	0.37		μC
I_{rrm}	Peak reverse recovery current		-	27	-	A
t_{rr}	Reverse recovery time	VGS = -5V, ISD = 80A, VR = 500V, Tj = 175°C, dif/dt =1.03kA/μs	-	36	-	ns
Q_{rr}	Reverse recovery charge		-	0.67		μC
I_{rrm}	Peak reverse recovery current		-	34	-	A

Electrical Characteristic Diagrams

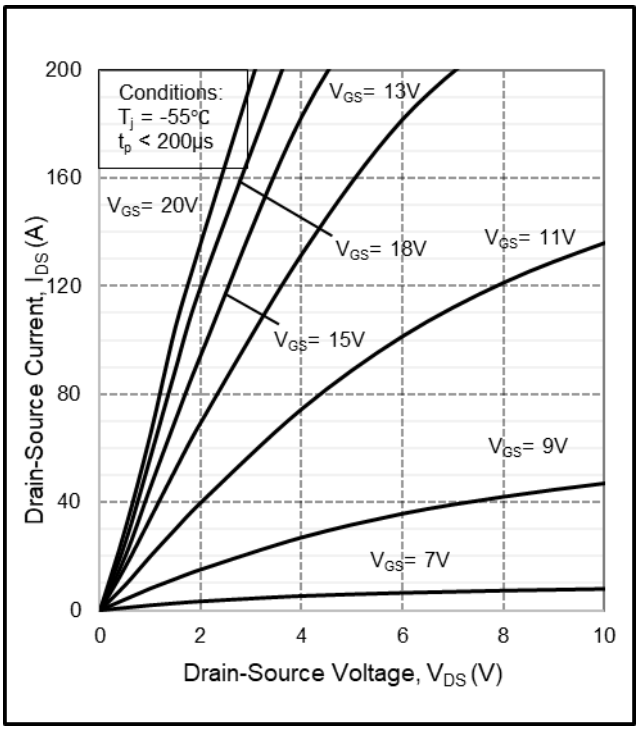


Figure 1. Output characteristics at T_j = -55℃

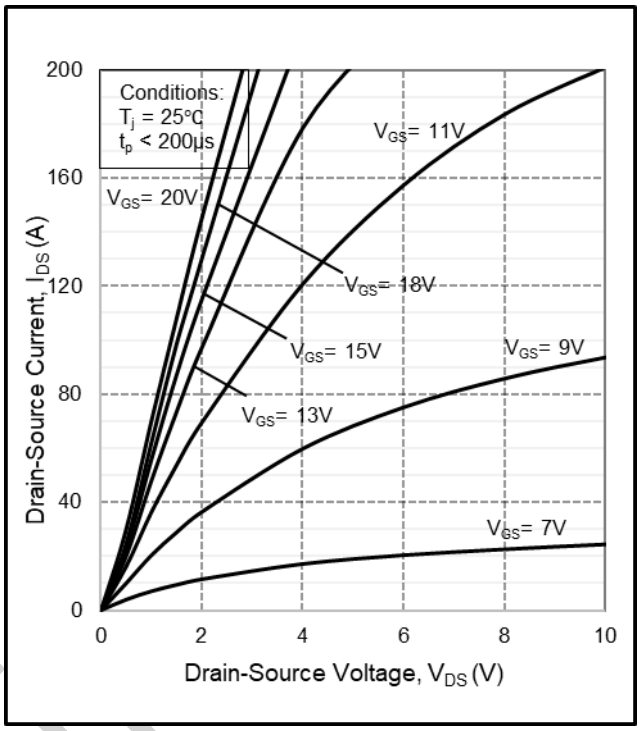


Figure 2. Output characteristics at T_j = 25℃

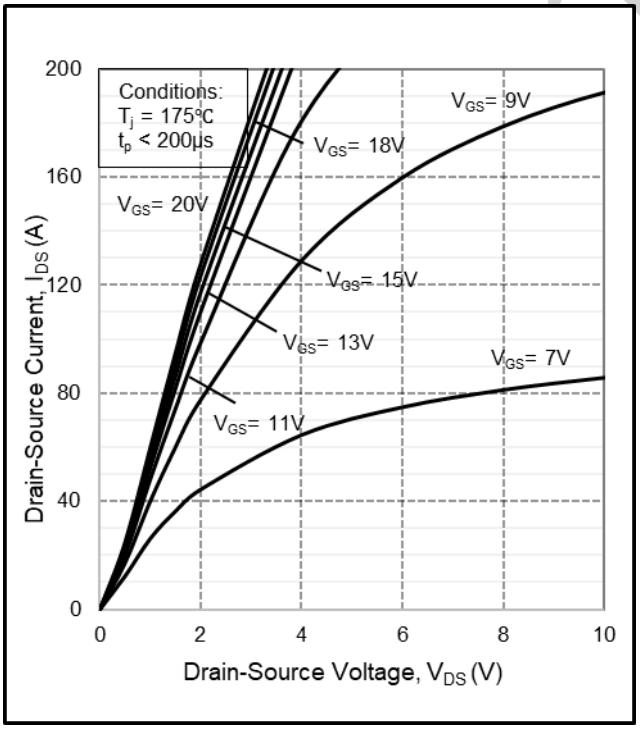


Figure 3. Output characteristics at T_j = 175℃

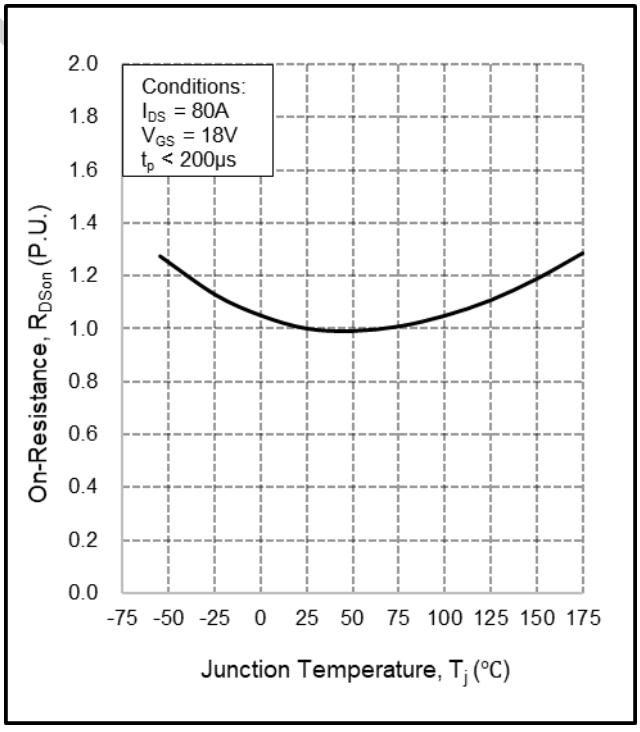


Figure 4. Normalized on-resistance vs. temperature

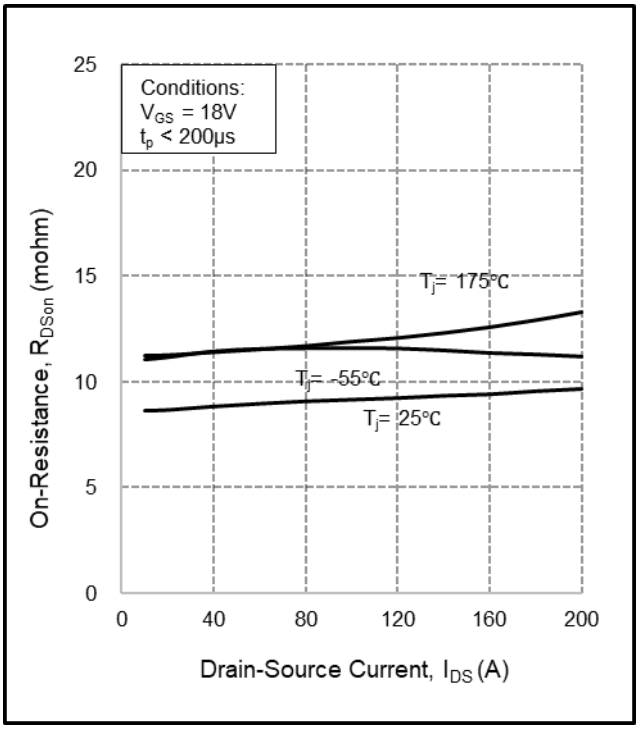


Figure 5. On-resistance vs. drain current for various temperatures

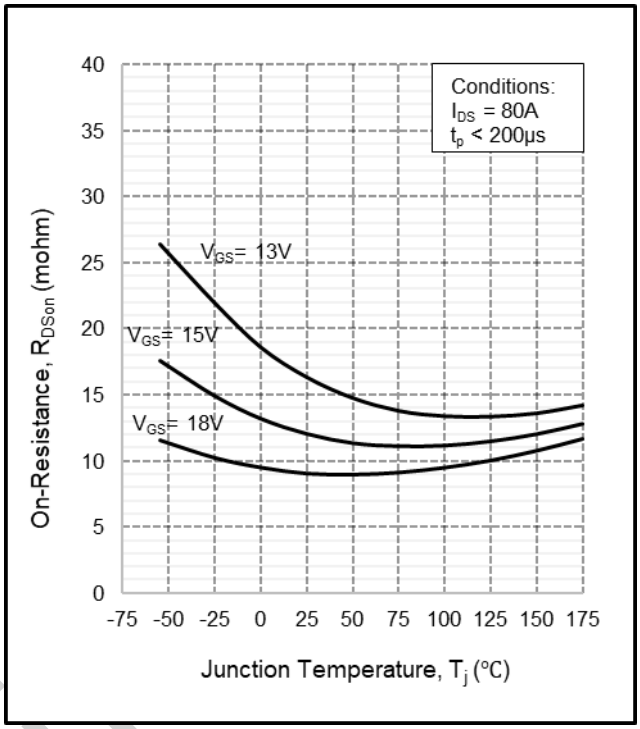


Figure 6. On-resistance vs. temperature for various gate voltages

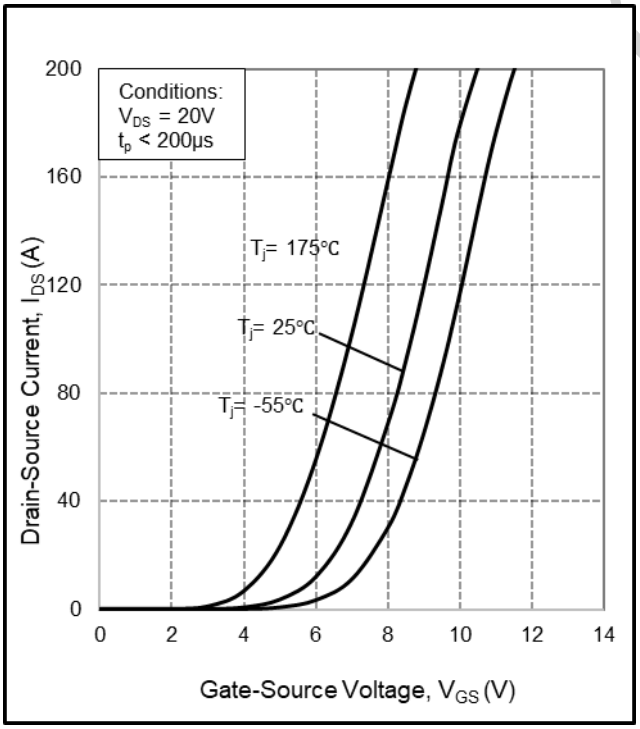


Figure 7. Transfer characteristic for various junction temperatures

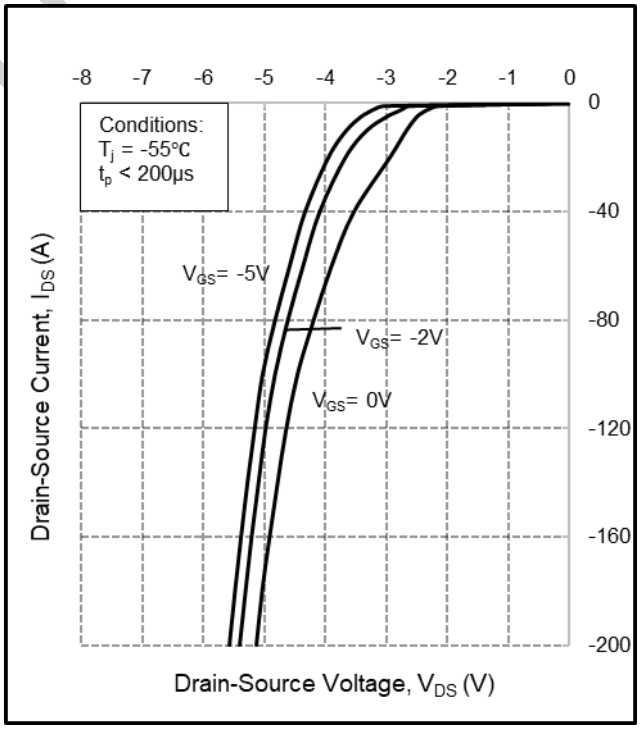


Figure 8. Body diode characteristic at T_j = -55°C

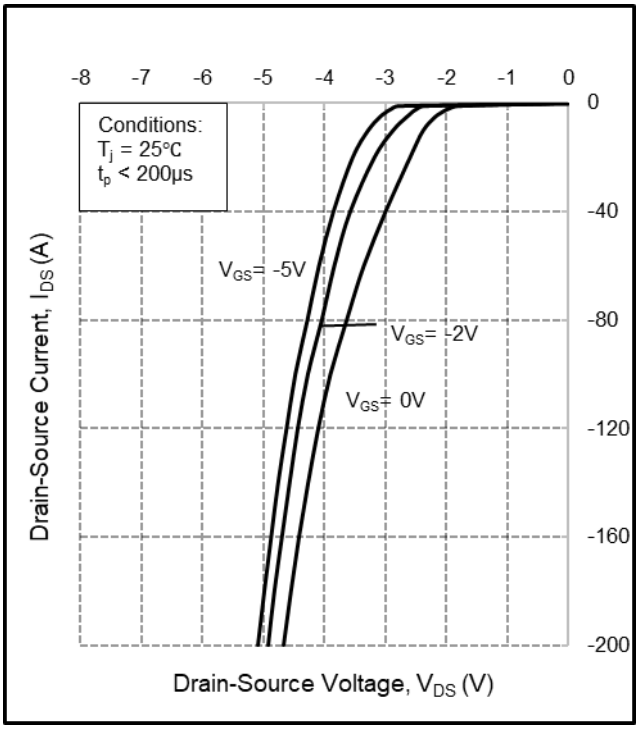


Figure 9. Body diode characteristic at T_j = 25℃

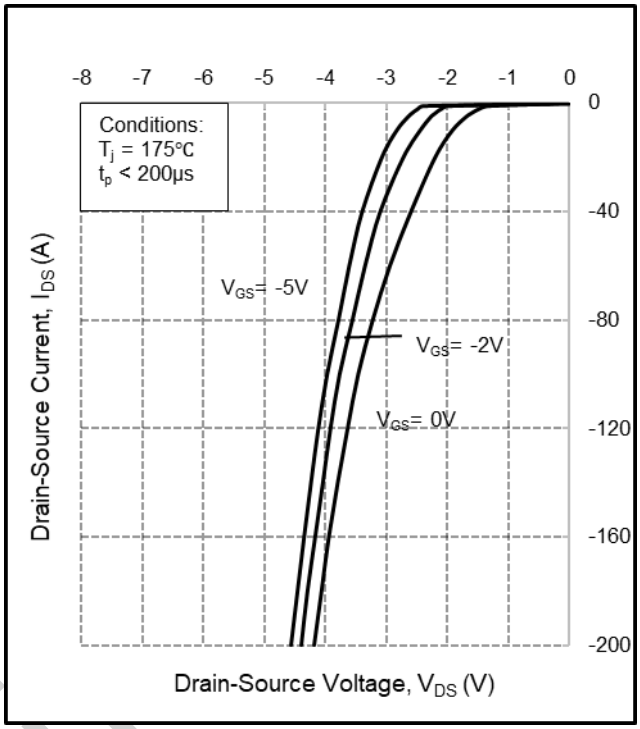


Figure 10. Body diode characteristic at T_j = 175℃

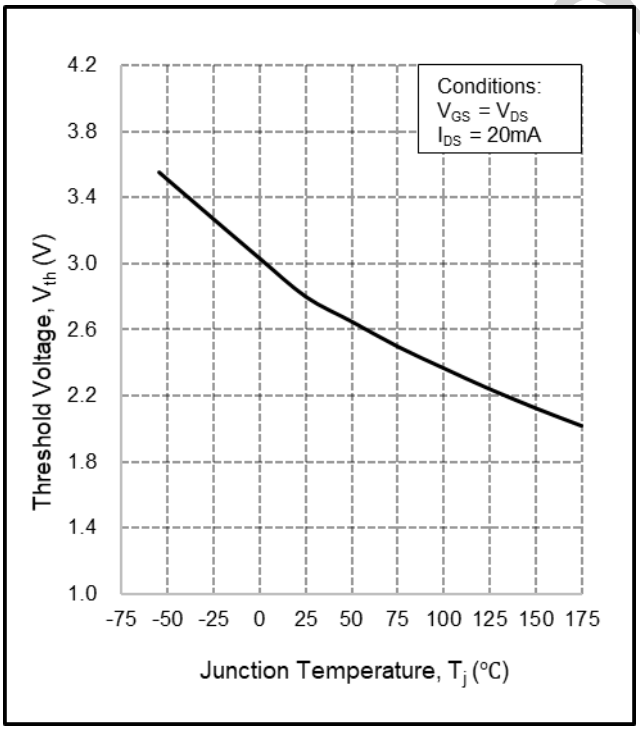


Figure 11. Threshold voltage vs. temperature

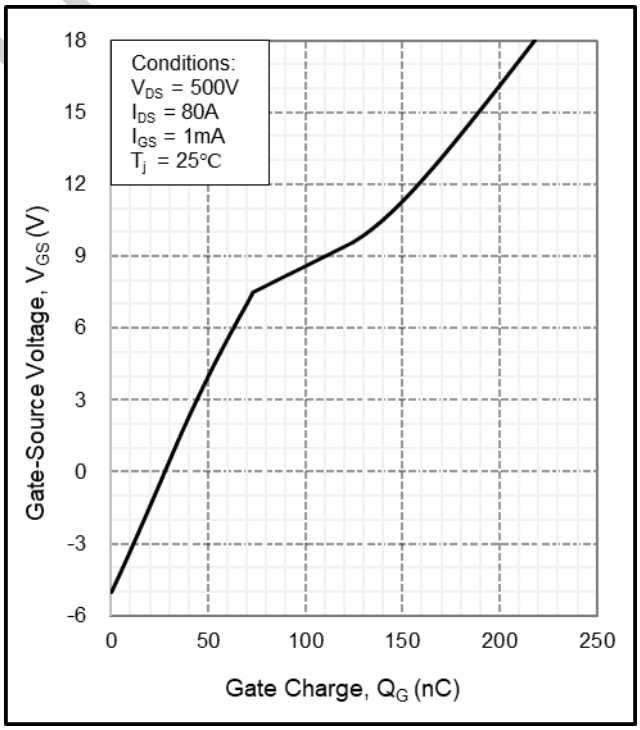


Figure 12. Gate charge characteristics

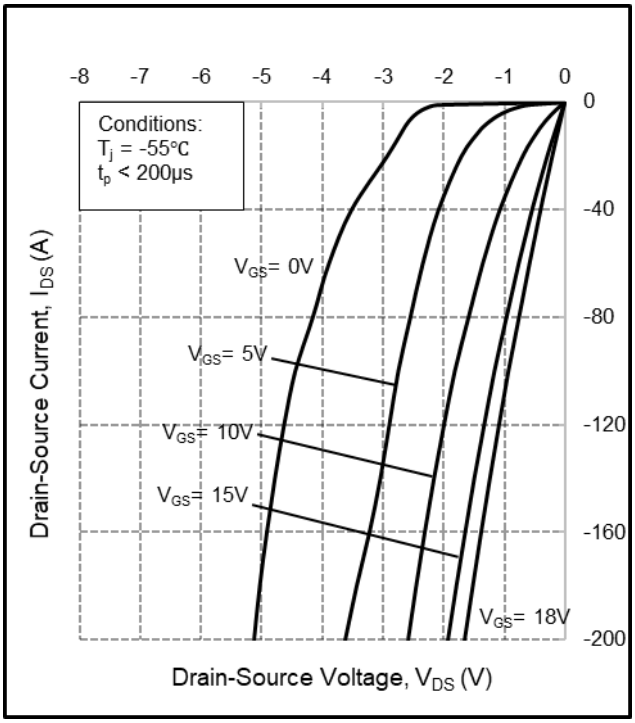


Figure 13. 3rd quadrant characteristic at T_j = -55℃

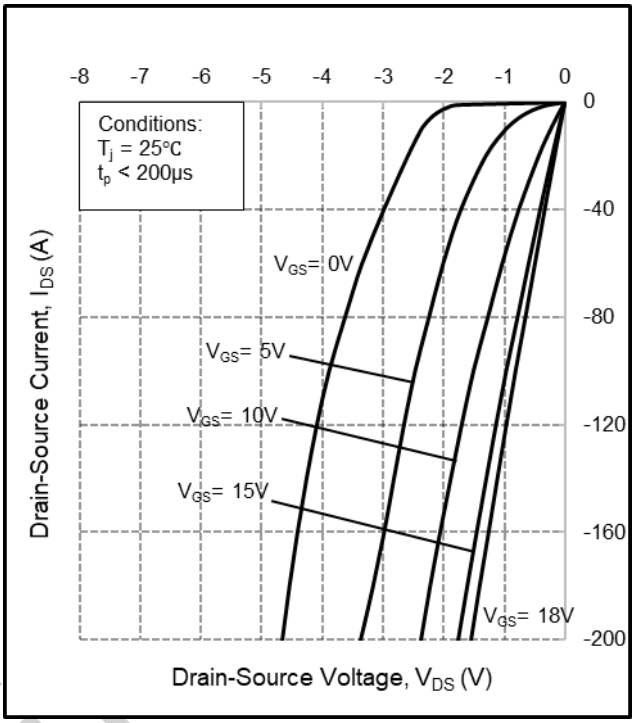


Figure 14. 3rd quadrant characteristic at T_j = 25℃

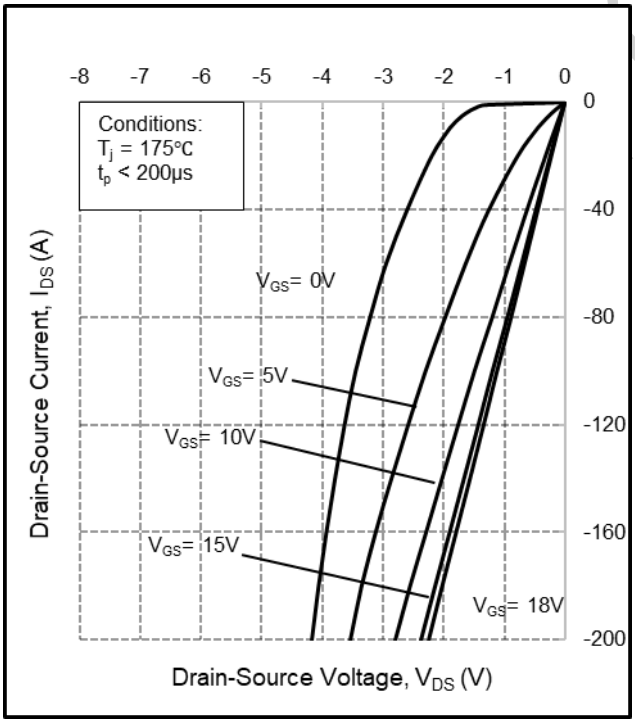


Figure 15. 3rd quadrant characteristic at T_j = 175℃

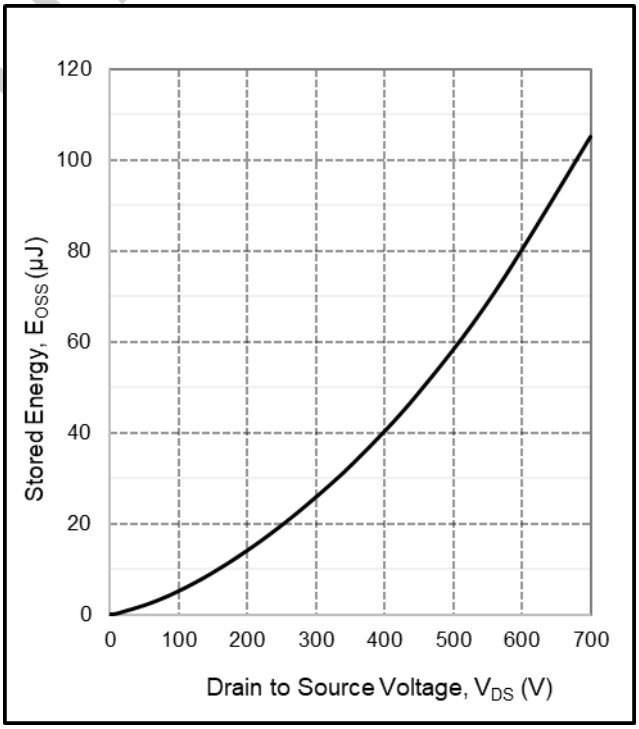


Figure 16. Output capacitor stored energy

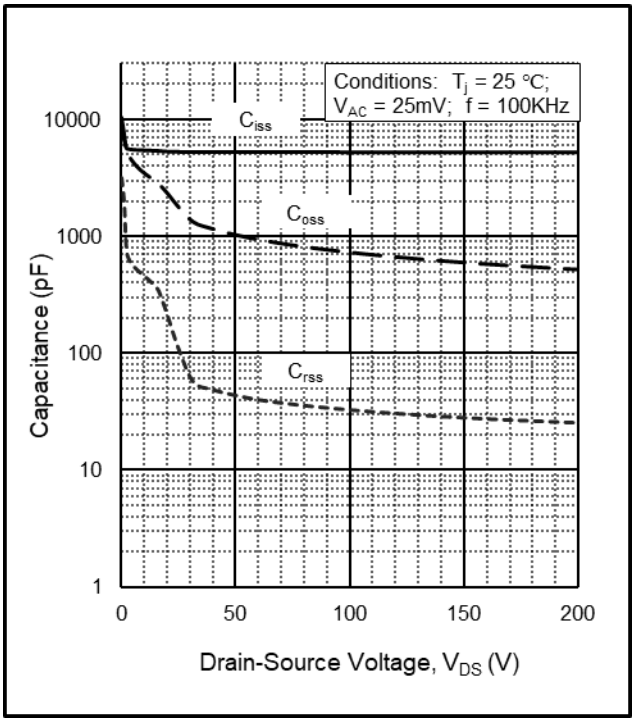


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

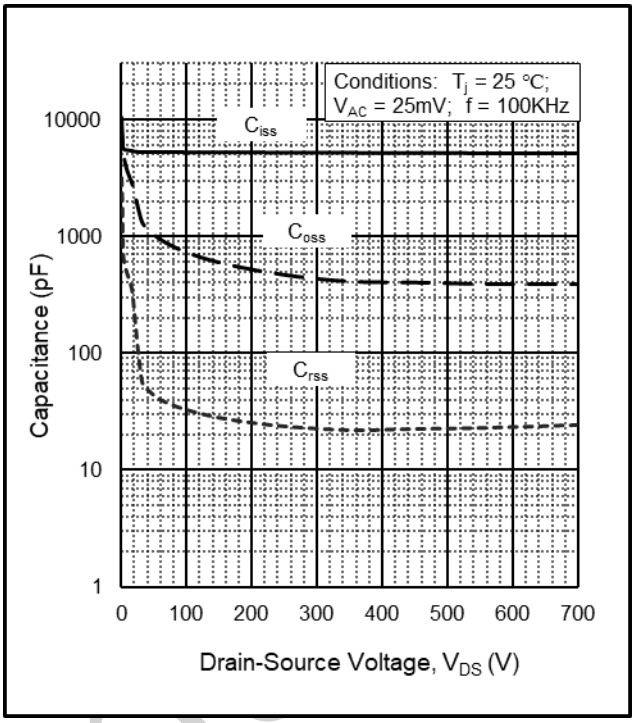


Figure 18. Capacitance vs. drain-source voltage (0 - 600V)

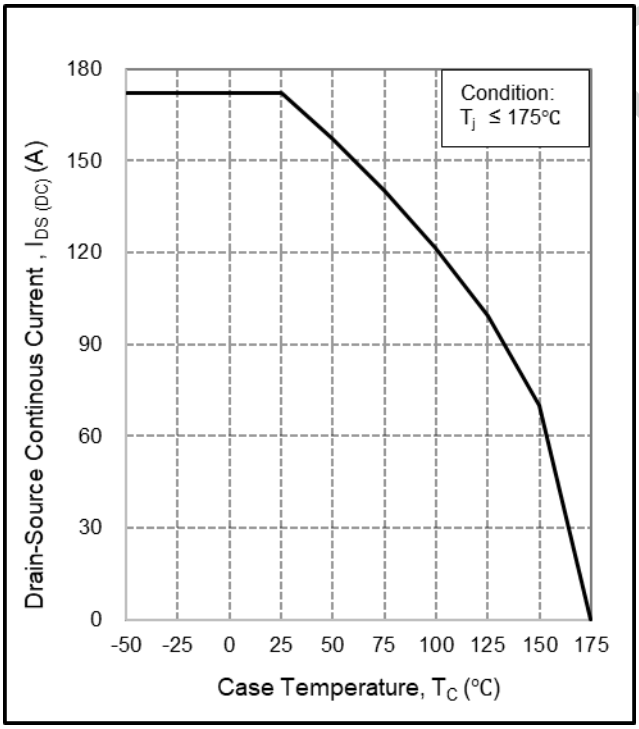


Figure 19. Continuous drain current derating vs. temperature

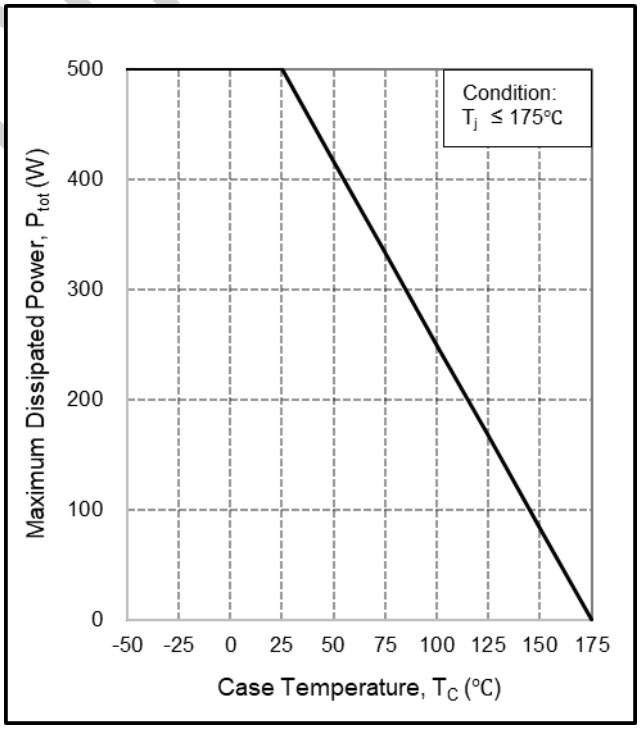


Figure 20. Maximum power dissipation derating vs. temperature

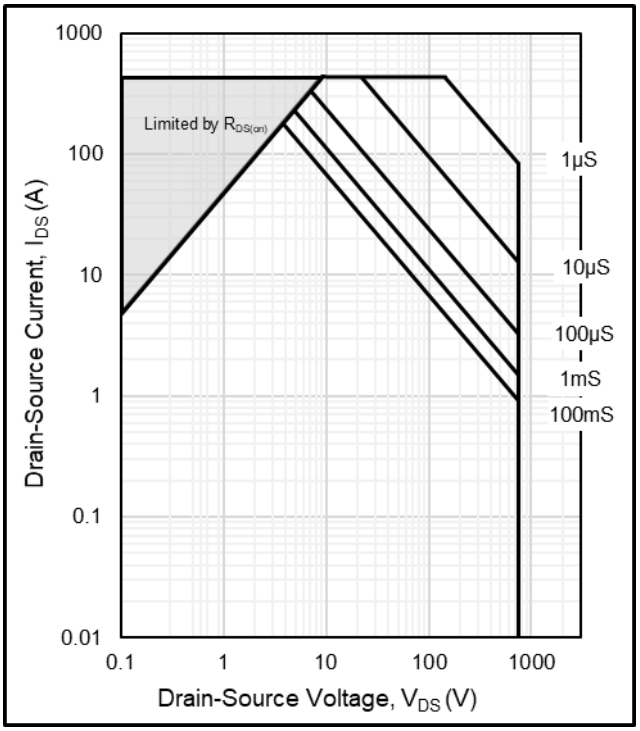


Figure 21. Safe Operating Area

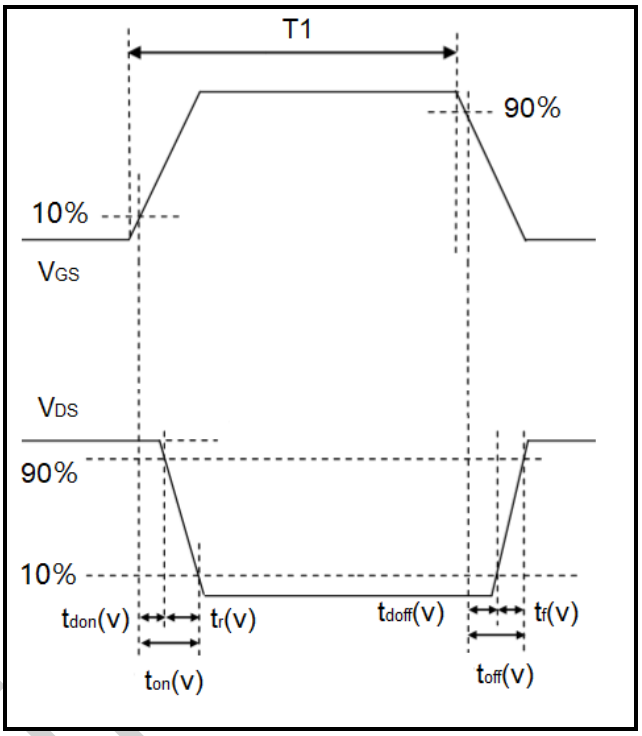


Figure 22. Switching times definition

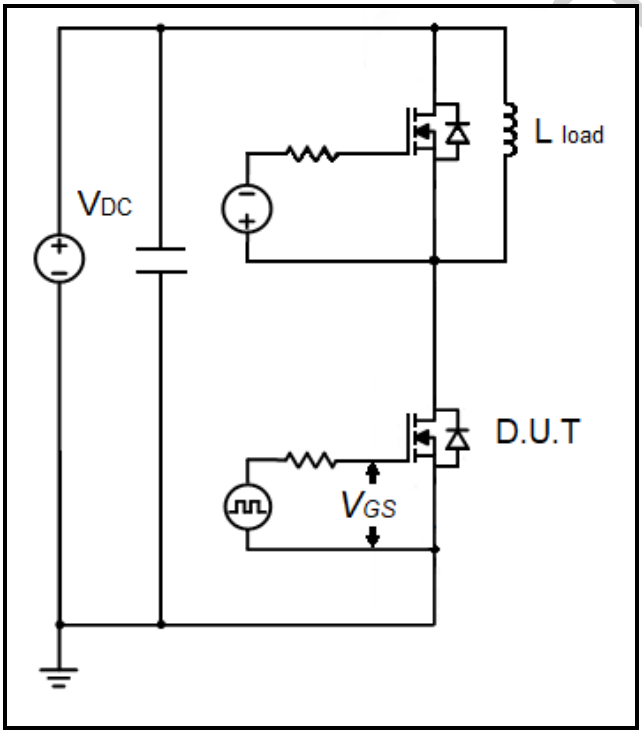
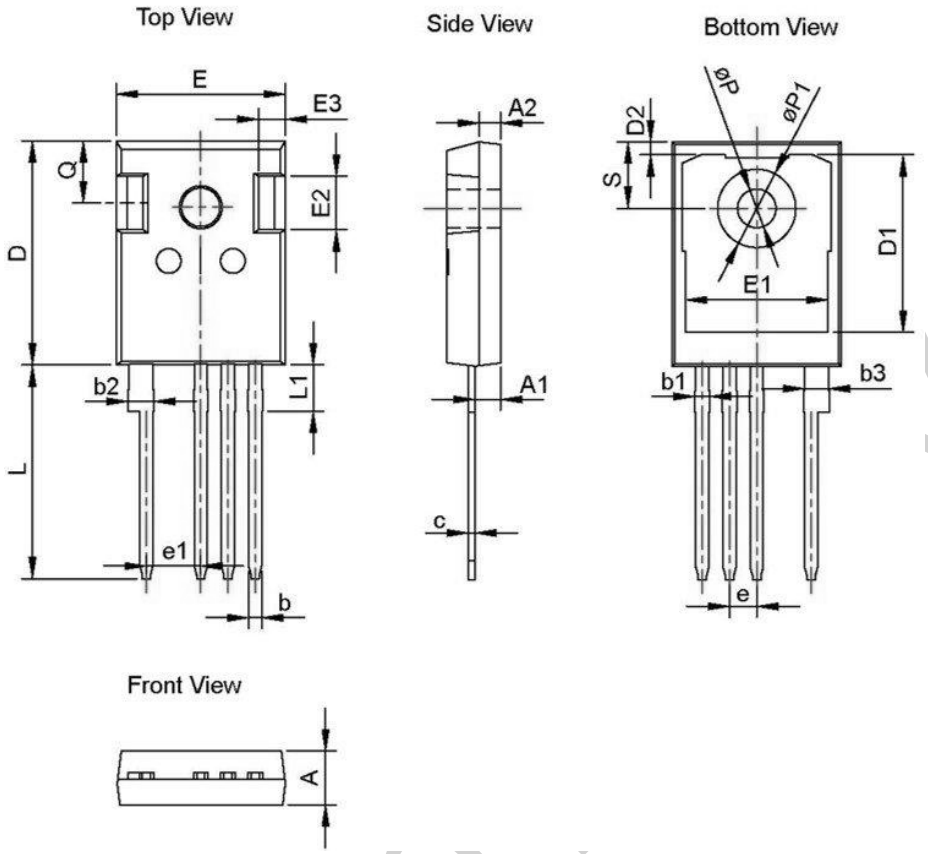


Figure 23. Clamped inductive switching waveform test circuit

Package Information:

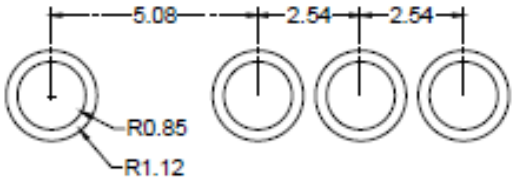


Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	1.11	1.37	1.57
b2	2.24	2.40	2.60
b3	2.11	2.21	2.36
c	0.51	0.60	0.75
D	20.70	20.90	21.30
D1	15.92	16.22	16.52
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
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	AAR009V075H2
Package	TO-247-4L
Unit quantity	300 EA
Packing type	Tube