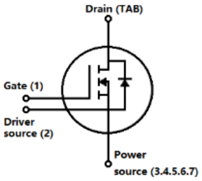
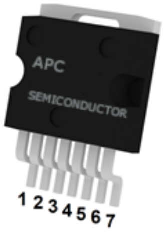
High Power SiC MOSFET Transistor AAR075V120K1

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	AAR075V120K1	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℃	35	A
	Continuous drain current (V_{GS} = 15V), T_C = 100℃	25	
$I_{D(pulse)}$	Pulsed drain current	88	A
P_{tot}	Power dissipation	208	W
T_j	Operating junction temperature	-55 to 175	˚C
T_{stg}	Storage temperature	-55 to 175	˚C

Thermal and Mechanical Characteristics

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal Resistance		-	0.60	-	℃/W
$R_{\theta JA}$	Junction-to-ambient thermal Resistance		-	-	62	℃/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 µA	1200	-	-	V
$V_{GS(th)}$	Gate-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 5mA	2	2.9	4	
		V_{DS} = V_{GS}, I_D = 5mA, T_j = 175ºC	-	2.0	-	
I_{DSS}	Drain-Source Leakage current	V_{DS} = 1200V, V_{GS} = 0V	-	1	50	µA
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 = 18A	-	75	92	mΩ
		V_{GS} = 15 V, I_D = 18A, T_J = 175ºC	-	105	-	
g_{fs}	Transconductance	V_{DS}=20V I_{D}= 18A	-	12	-	S
		V_{DS}=20V I_D = 18A, T_J = 175ºC	-	16	-	
$R_{g(int)}$	Internal gate resistance	f=1MHz, V_{AC}=25mV	-	1.9	-	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	-	1484	-	pF
C_{rss}	Reverse Transfer Capacitance		-	1	-	
C_{oss}	Output Capacitance		-	79	-	
E_{oss}	C_{oss} stored energy		-	44	-	µJ
Q_{gs}	Gate-Source Gate Charge	V_{DD} = 800V, V_{GS} = -4/+15V, I_D = 18A, I_{GS} = 1mA	-	18	-	nC
Q_{gd}	Gate-Drain Gate Charge		-	20	-	
Q_g	Total Gate Charge		-	58	-	

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 = 20A, $R_{G(ext)}$ =5.1Ω, L = 110μH, T_j = 25℃	-	10	-	ns
T_r	Rise time		-	21	-	
$T_{d(off)}$	Turn-off delay time		-	22	-	
T_f	Fall time		-	8	-	
E_{on}	Turn On Switching Energy		-	245	-	μJ
E_{off}	Turn Off Switching Energy		-	74	-	
$T_{d(on)}$	Turn-on delay time	V_{DD} = 800V, V_{GS} = -4/+15V, I_D = 20A, $R_{G(ext)}$ = 5.1Ω, L = 110μH, T_j = 175℃	-	10	-	ns
T_r	Rise time		-	19	-	
$T_{d(off)}$	Turn-off delay time		-	24	-	
T_f	Fall time		-	8	-	
E_{on}	Turn On Switching Energy		-	221	-	μJ
E_{off}	Turn Off Switching Energy		-	72	-	

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} = 9A		3.5		V
		V_{GS} = -4V, I_{SD} = 9A, T_j = 175℃		3.2		
I_S	Continuous diode forward current	T_C = 25℃	-	-	35	A
t_{rr}	Reverse recovery time	V_{GS} = -4V, I_{SD} = 20A, V_R = 800V, di_f/dt =3kA/μs, T_j = 25℃	-	13	-	ns
Q_{rr}	Reverse recovery charge		-	0.25		μC
I_{rrm}	Peak reverse recovery current		-	32	-	A
t_{rr}	Reverse recovery time	V_{GS} = -4V, I_{SD} = 20A, V_R = 800V, di_f/dt = 3kA/μs, T_j = 175℃	-	14	-	ns
Q_{rr}	Reverse recovery charge		-	0.31	-	μC
I_{rrm}	Peak reverse recovery current		-	36	-	A

Electrical Characteristic Diagrams

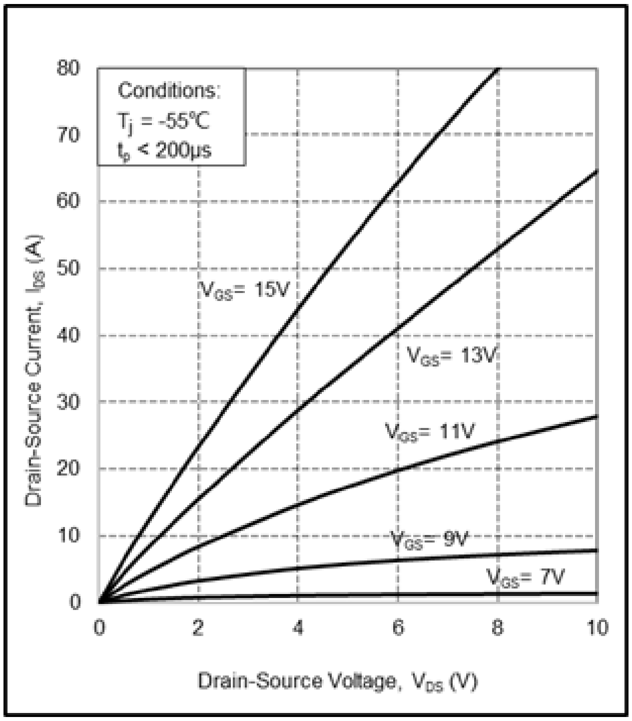


Figure 1. Output characteristics at T_j = -55℃

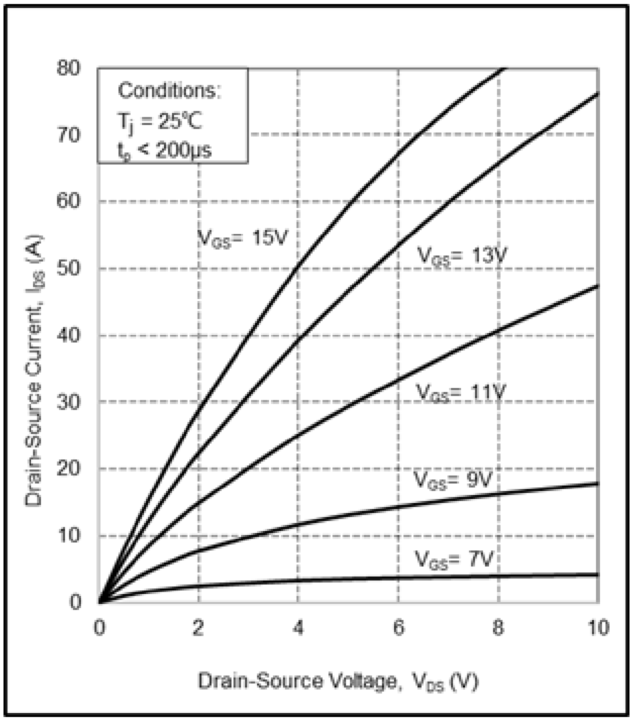


Figure 2. Output characteristics at T_j = 25℃

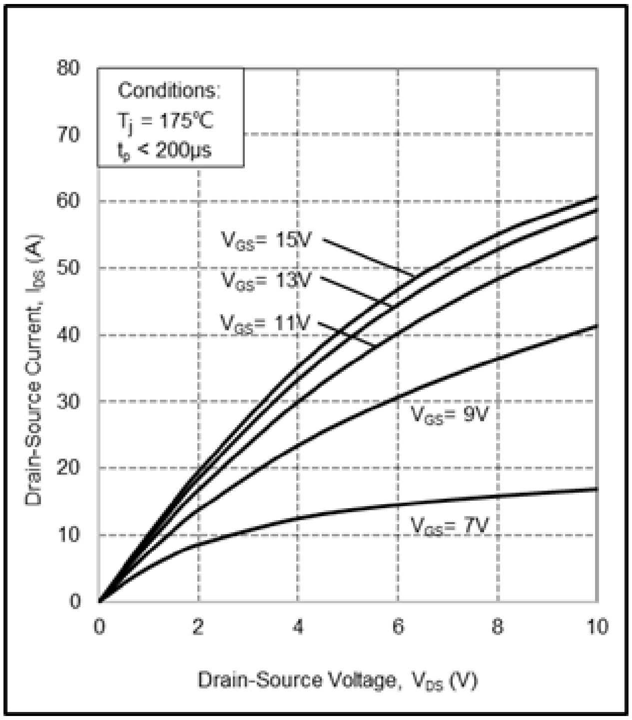


Figure 3. Output characteristics at T_j = 175℃

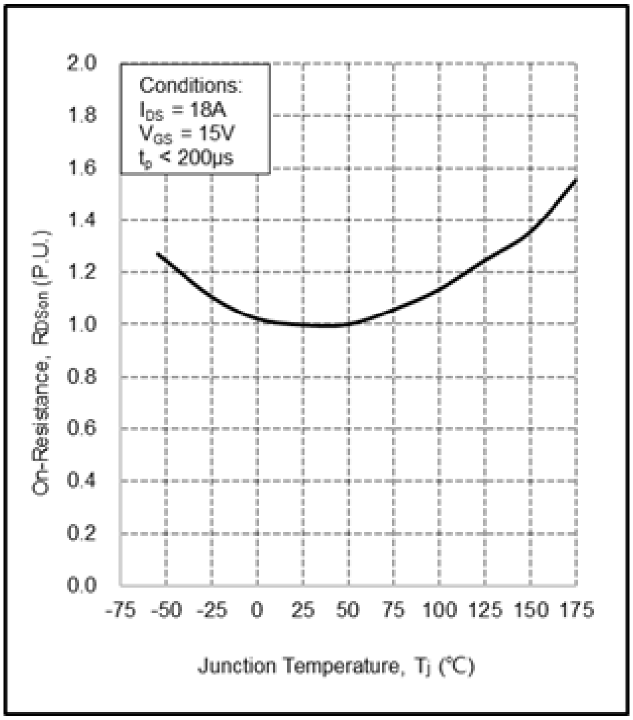


Figure 4. Normalized on-resistance vs. temperature

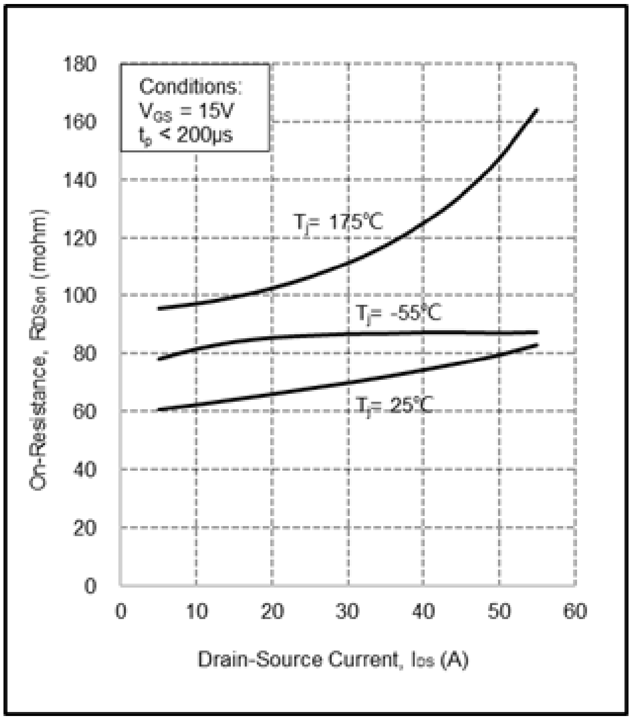


Figure 5. On-resistance vs. drain current

for various temperatures

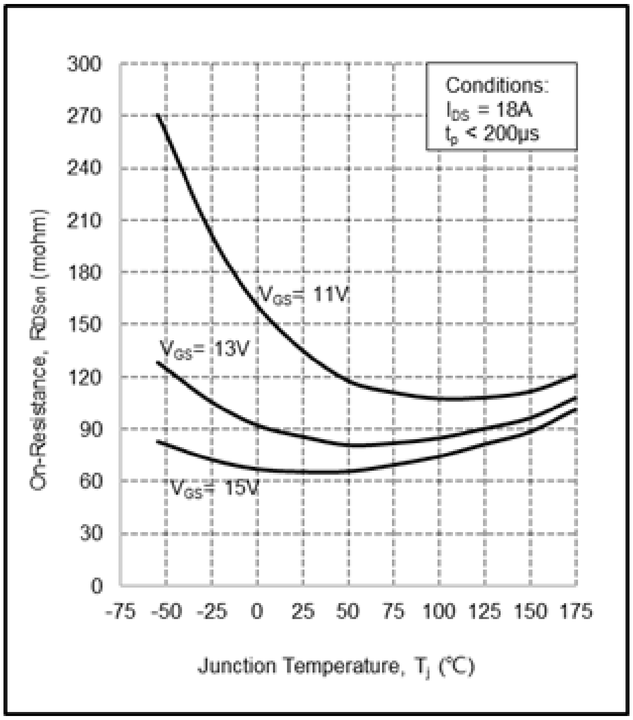


Figure 6. On-resistance vs. temperature

for various gate voltages

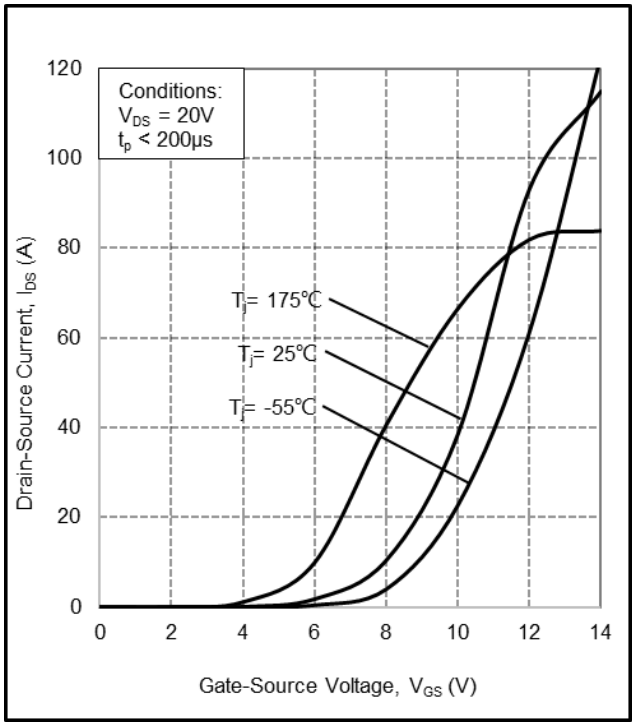


Figure 7. Transfer characteristic

for various junction temperatures

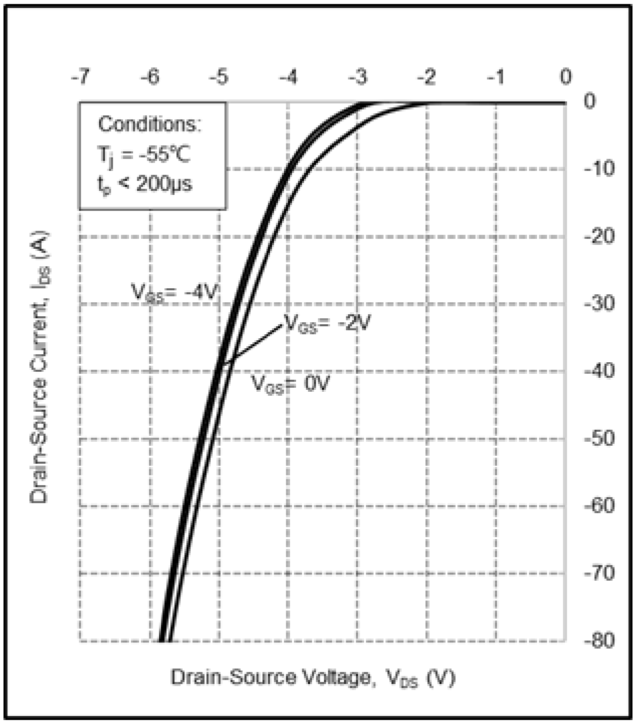


Figure 8. Body diode characteristic at T_j = -55℃

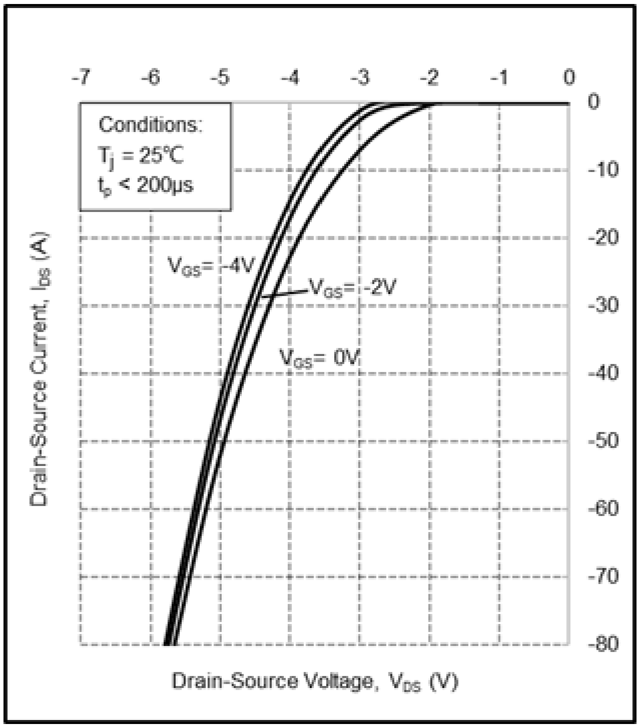


Figure 9. Body diode characteristic at T_j = 25℃

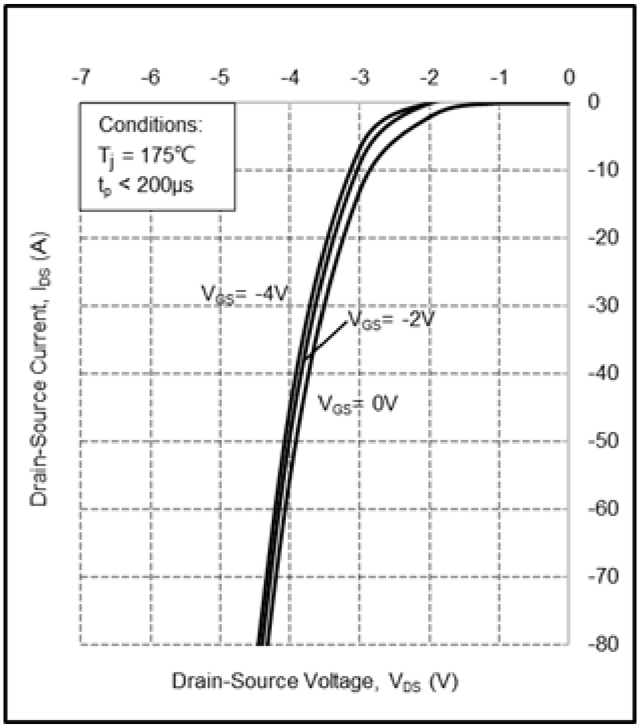


Figure 10. Body diode characteristic at T_j = 175℃

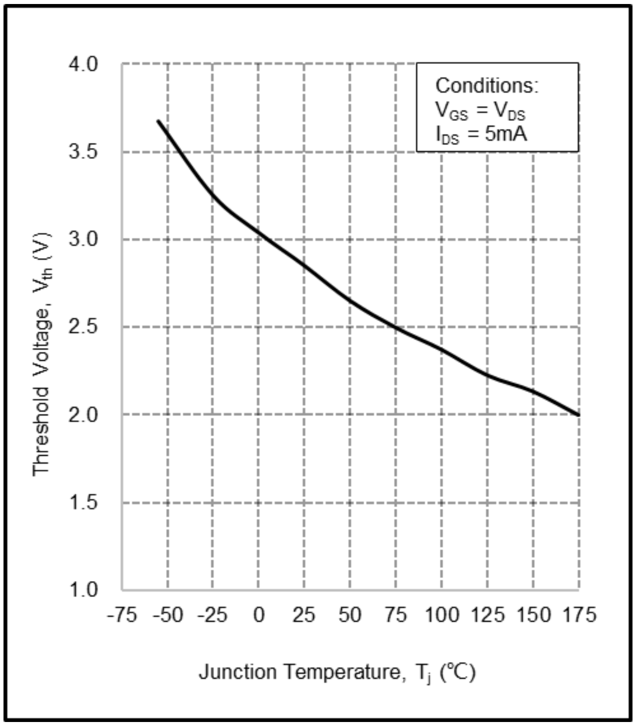


Figure 11. Threshold voltage vs. temperature

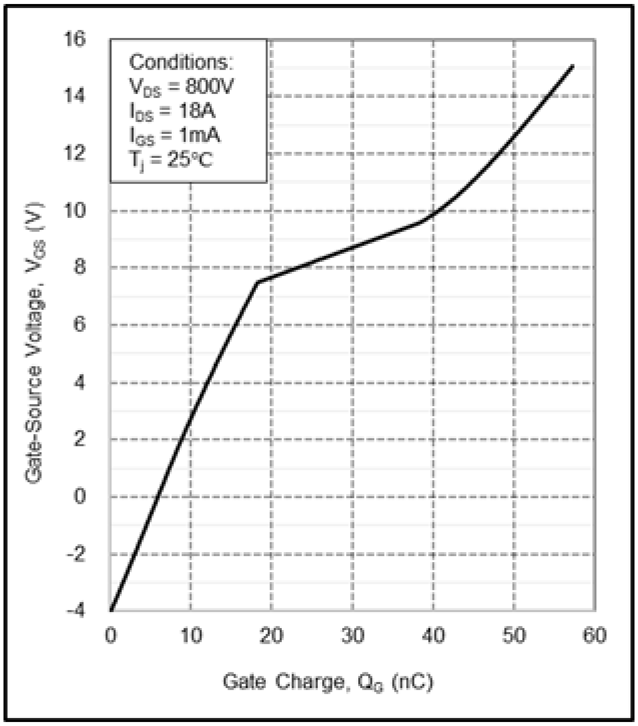


Figure 12. Gate charge characteristics

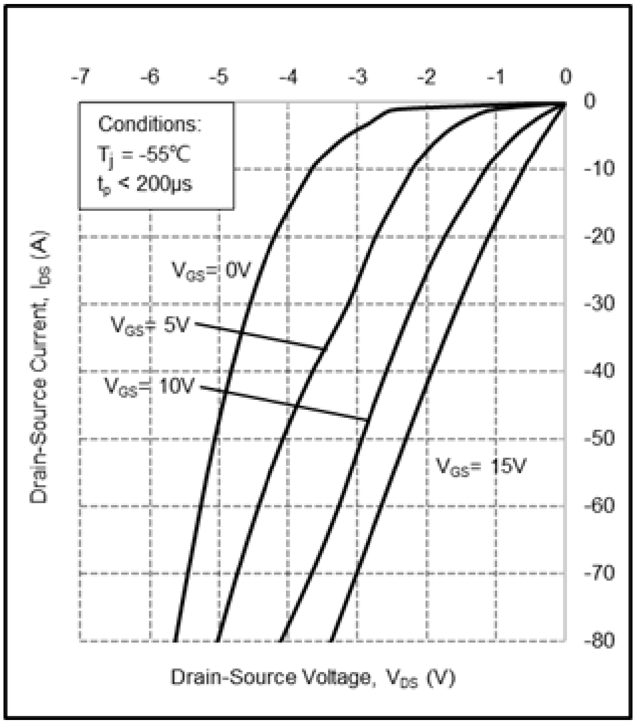


Figure 13. 3rd quadrant characteristic

at T_j = -55℃

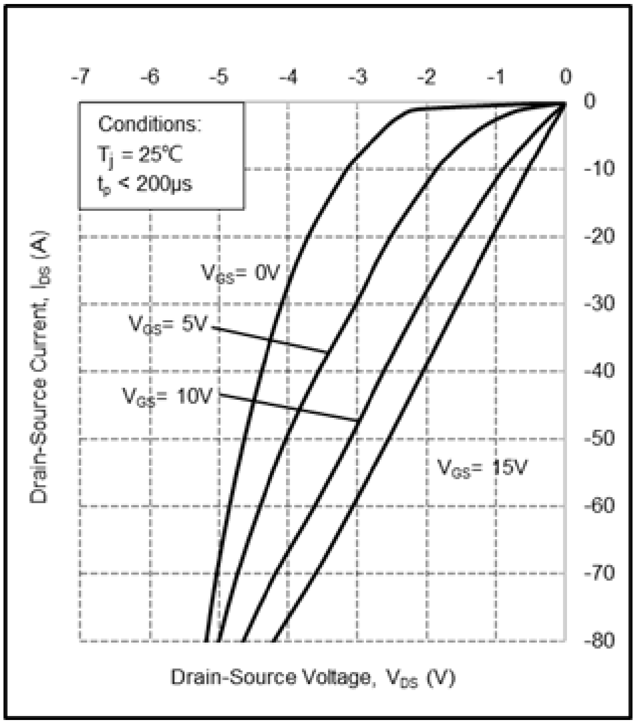


Figure 14. 3rd quadrant characteristic

at T_j = 25℃

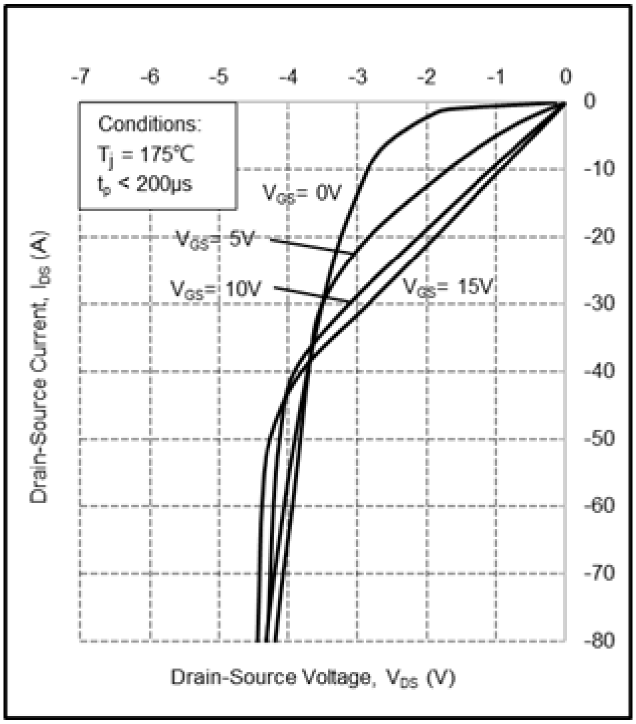


Figure 15. 3rd quadrant characteristic

at T_j = 175℃

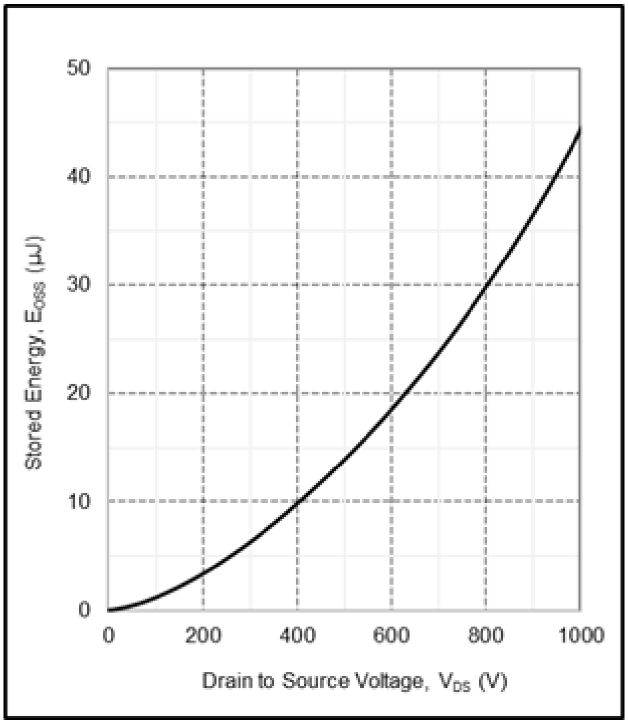


Figure 16. Output capacitor stored energy

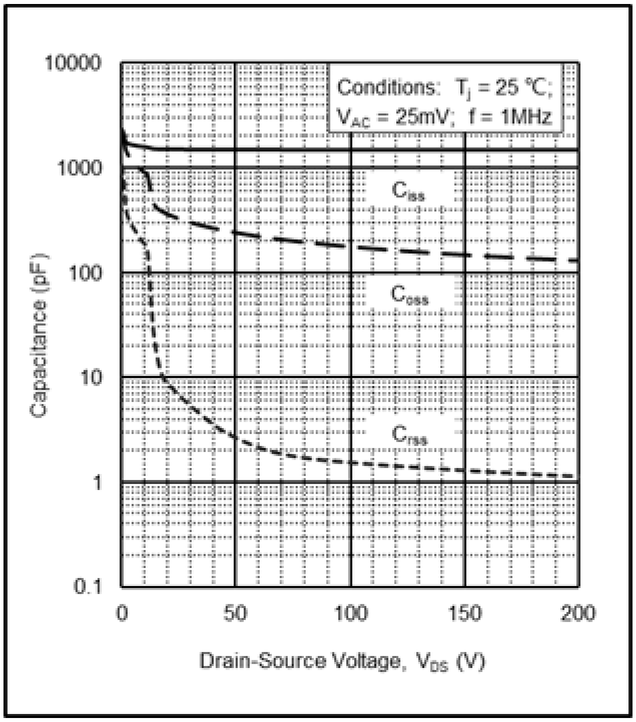


Figure 17. Capacitance vs. drain-source voltage

(0 - 200V)

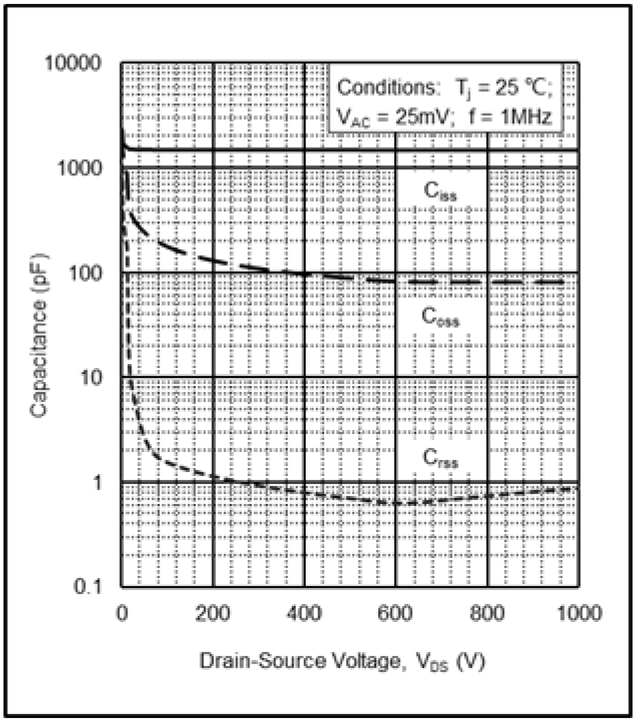


Figure 18. Capacitance vs. drain-source voltage

(0 - 1000V)

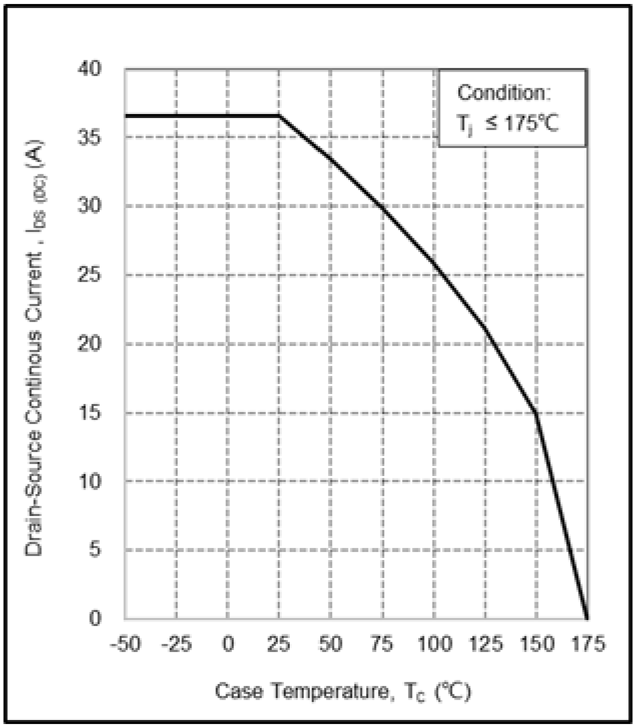


Figure 19. Continuous drain current derating

vs. temperature

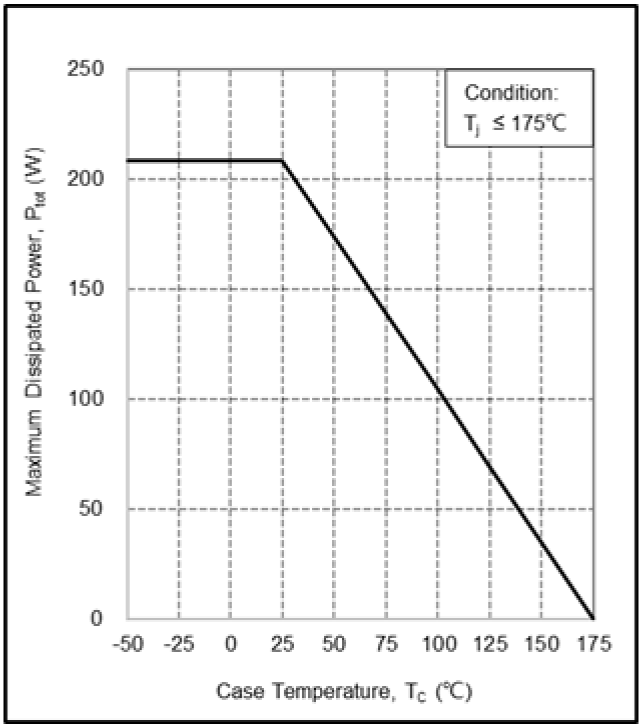


Figure 20. Maximum power dissipation derating

vs. temperature

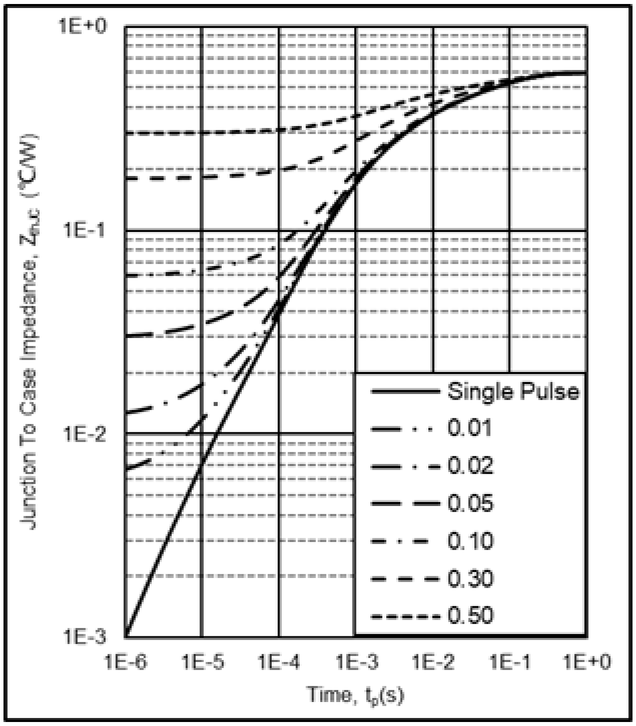


Figure 21. Transient thermal impedance

(Junction - Case)

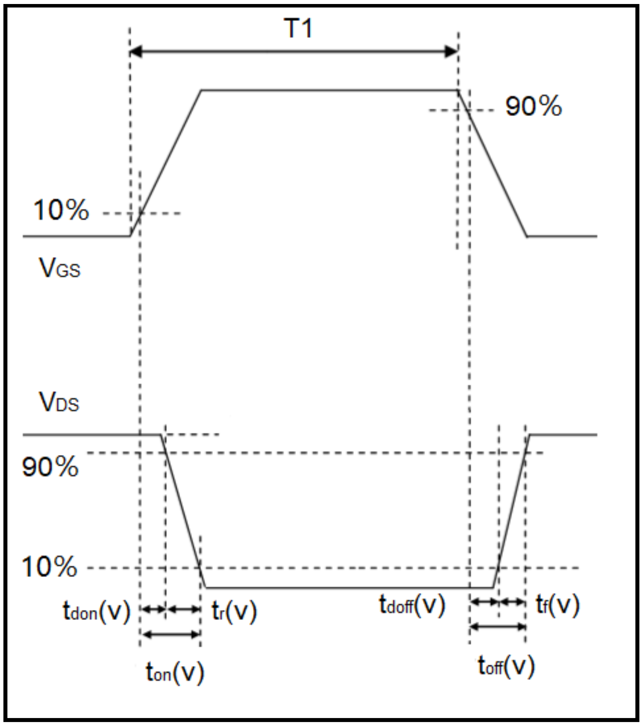


Figure 22. Switching times definition

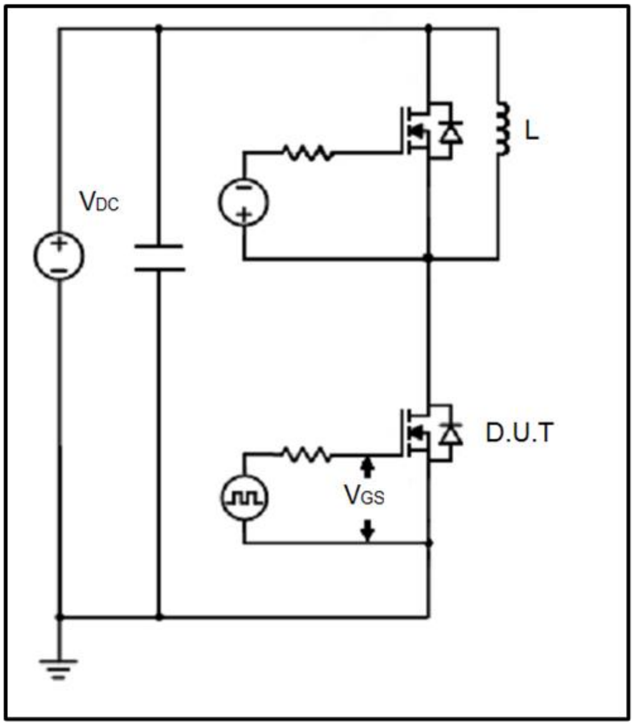
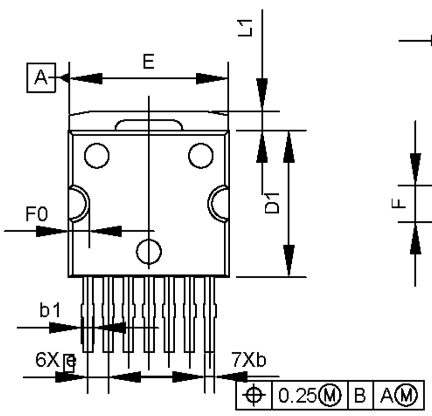


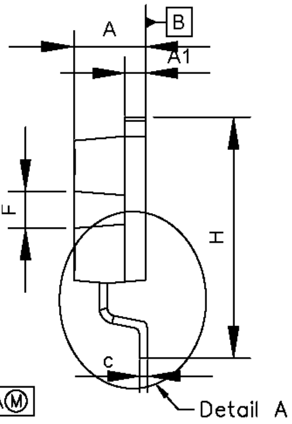
Figure 23. Clamped inductive switching waveform

test circuit

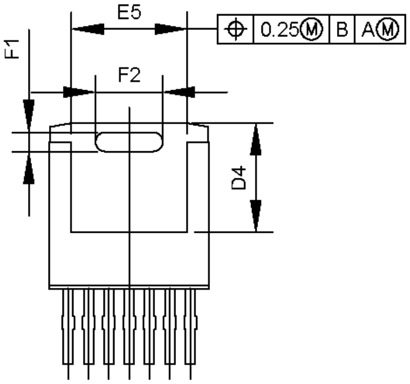
Package Information:



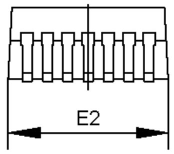
Top View



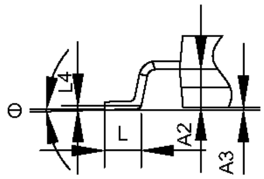
Side View



Bottom View



Front View



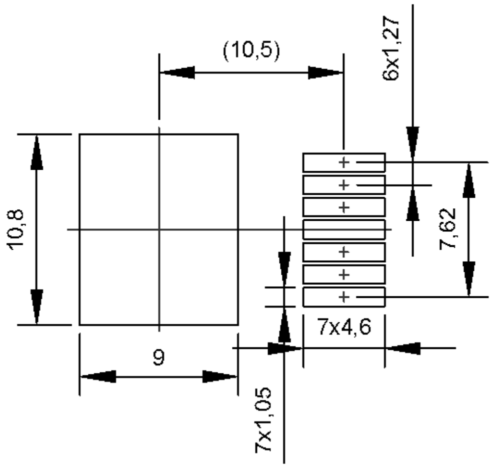
Detail A
Rotated 90°
CW

Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.30	4.50	4.70
A1	1.15	1.30	1.45
A2	2.20	2.40	2.90
A3	0.00	0.13	0.25
b	0.51	0.60	0.70
b1	0.60	0.76	0.85
c	0.45	0.50	0.60
D1	8.59	9.20	9.40
D4	6.86	-	-
E	9.66	9.90	10.28
E2	9.80	10.00	10.20
E5	6.72	-	7.72
e	1.27 BSC		
H	14.70	15.30	15.90
L	2.00	2.30	2.60
L1	-	-	1.676
L4	0.25 BSC		

Dimension unit: [mm]			
Symbol	Min	Nom	Max
F	2.3 REF		
F0	1.2 TYP		
F1	1.2 REF		
F2	4.2 REF		
θ	0°	-	8°

Recommended Solder Pad Layout

Note: All dimensions are in mm



TO-263-7L

Ordering Information

Part number	AAR075V120K1
Package	TO-263-7L
Unit quantity	800 EA
Packing type	Tape & Reel