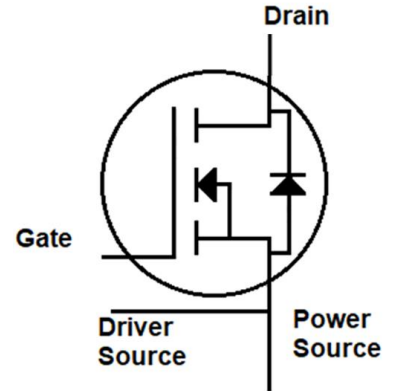


650V 50mΩ Silicon Carbide Power MOSFET

Features

- AEC-Q101 qualified
- High blocking voltage with low on-resistance
- High switching speed with low capacitance
- Very fast and robust intrinsic body diode with low reverse recovery
- Very low switching losses
- Excellent avalanche ruggedness
- RoHS compliant



Benefits

- Greater system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency
- Easy to parallel and simple to drive

Die Size(mm)
2.80*2.80 mm ²

Potential Applications

- Solar inverters
- Uninterrupted power supplies
- Switch mode power supplies
- Motor drives



Description

The Sanan Semiconductor 650V/50mΩ silicon carbide power MOSFET uses advanced SiC MOSFET technology with low on-resistance, low switching losses, and a high operation temperature of 175°C. It is suitable for use in high frequency circuits and provides a reduction in overall system size, increased efficiency and increased switching frequency. It has been widely used in applications including solar inverters, uninterrupted power supplies, switch mode power supplies, and motor drives. Using RoHS compliant components and being AEC-Q101 qualified, it is qualified for use in industrial application.

Product Specifications

Device	V _{DS}	I _D (25°C)	R _{(DS)on}	Q _{rr}
AMS0650050B	650V	45A	50mΩ	0.17μC

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Table 1. Maximum Ratings

(T_c = 25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit	Test conditions
Drain-source voltage	V _{DSmax}	650	V	V _{GS} = 0V, I _D = 100μA, T _C = 25°C
Gate-source voltage, max. transient voltage	V _{GSmax}	-10/+25		t _p ≤ 0.5us, D < 1%, T _C = 25°C
Gate-source voltage, max. static voltage	V _{GSmax}	-8/+22		T _C = 25°C
Gate-source voltage	V _{GSop}	-5/+18		Recommended operation values, T _C = 25°C
Continuous drain current	I _D	45	A	V _{GS} = 18V, T _C = 25°C
		32		V _{GS} = 18V, T _C = 100°C
Pulsed drain current	I _{D(pulse)}	111	A	Pulse width t _p limited by T _{jmax}
Operating junction temperature	T _j	-55~175	°C	
Storage temperature	T _{stg}	-55~175	°C	

Table 2. Static Electrical Characteristics

(T_j = 25°C, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Drain-source breakdown voltage	V _{(BR)DSS}	650	/	/	V	V _{GS} = 0V, I _D = 100μA
Gate threshold voltage	V _{GS(th)}	1.8	2.8	4.2		V _{DS} = V _{GS} , I _D = 6.5mA
		/	1.9	/		V _{DS} = V _{GS} , I _D = 6.5mA, T _j = 175°C
Drain-source leakage current	I _{DSS}	/	1	50	μA	V _{DS} = 650V, V _{GS} = 0V
Gate-source leakage current	I _{GSS}	/	1	250	nA	V _{GS} = 18V, V _{DS} = 0V
Drain-source on-state resistance	R _{DS(on)}	/	65	/	mΩ	V _{GS} = 15V, I _D = 20A
		/	50	65		V _{GS} = 18V, I _D = 20A
		/	62	/		V _{GS} = 18V, I _D = 20A, T _j = 175°C
Transconductance	g _{fs}	/	14	/	S	V _{DS} = 20V, I _D = 20A
		/	13	/		V _{DS} = 20V, I _D = 20A, T _j = 175°C
Internal gate resistance	R _{g(int)}	/	1.6	/	Ω	f = 1MHz, V _{AC} = 25mV

Table 3. Dynamic Electrical Characteristics

(T_j = 25°C, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Input capacitance	C _{iss}	/	1415	/	pF	V _{GS} = 0V, V _{DS} = 600V, f = 1MHz, V _{AC} = 25mV
Output capacitance	C _{oss}	/	135	/		
Reverse transfer capacitance	C _{rss}	/	2	/		
Coss stored energy	E _{oss}	/	26	/	μJ	
Gate to source charge	Q _{gs}	/	19	/	nC	V _{DD} = 400V, V _{GS} = -5/+18V, I _D = 20A, I _{Gs} = 1mA
Gate to drain charge	Q _{gd}	/	16	/		
Total gate charge	Q _g	/	58	/		

Table 4. Reverse SiC Diode Characteristics

(T_j = 25°C, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Diode forward voltage	V _{SD}	/	4.2	/	V	V _{GS} = -5V, I _{SD} = 20A
		/	3.7	/		V _{GS} = -5V, I _{SD} = 20A, T _j = 175°C
Continuous diode forward current	I _S	/	/	45	A	V _{GS} = -5V, T _C = 25°C
Diode pulse current	I _{S, pulse}	/	/	111	A	V _{GS} = -5V, pulse width t _p limited by T _{jmax}
Reverse recovery time	t _{rr}	/	15	/	ns	V _{GS} = -5V, I _{SD} = 20A, V _R = 400V, di _r /dt = 1.58kA/μs
Reverse recovery charge	Q _{rr}	/	0.17	/	μC	
Peak reverse recovery current	I _{rrm}	/	19	/	A	

Electrical Characteristic Diagrams : All the graphs are based on the TO-247-4L (which has higher thermal resistance than most packages used with topside sinter/solder)

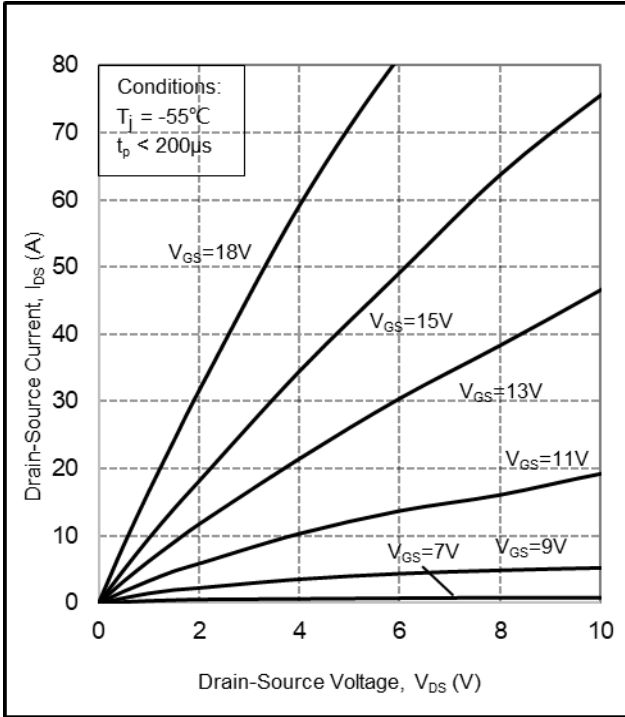


Figure 1. Output characteristics at $T_j = -55^\circ\text{C}$

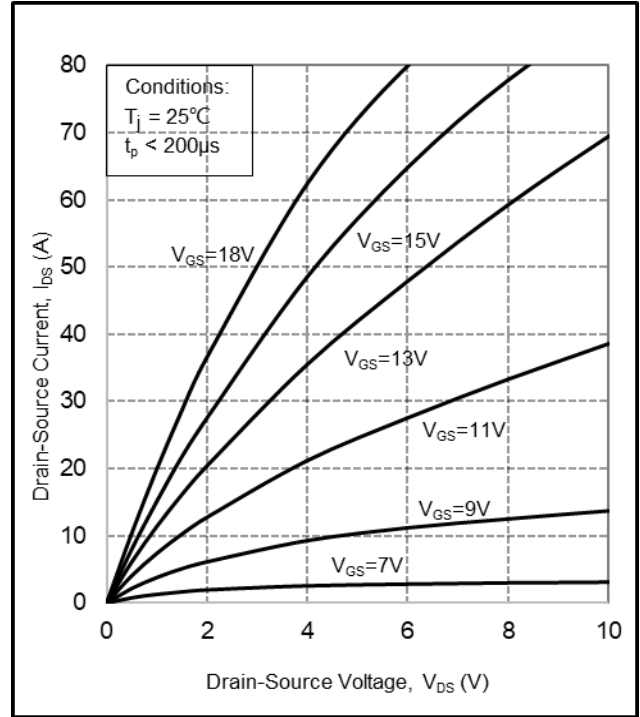


Figure 2. Output characteristics at $T_j = 25^\circ\text{C}$

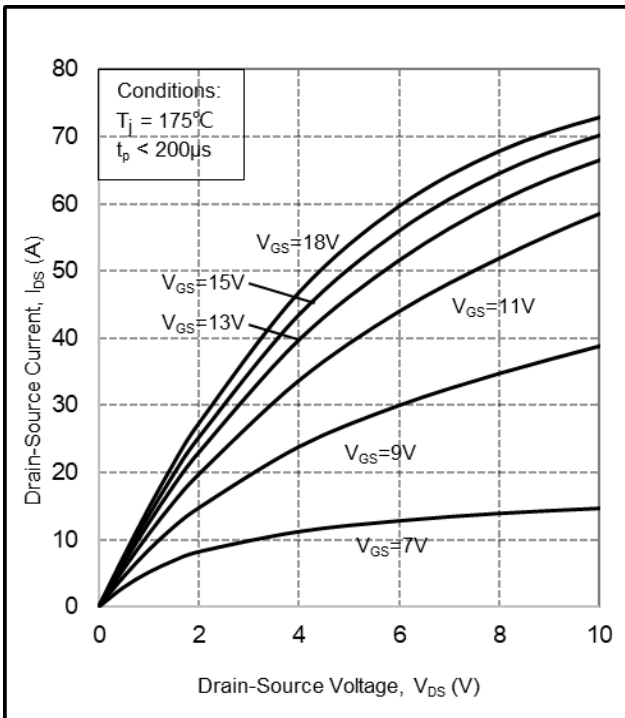


Figure 3. Output characteristics at $T_j = 175^\circ\text{C}$

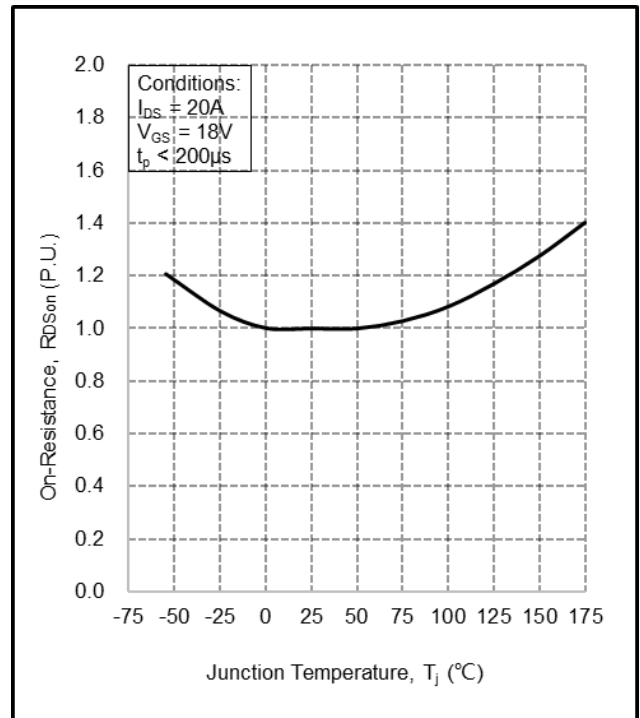


Figure 4. Normalized on-resistance vs. temperature

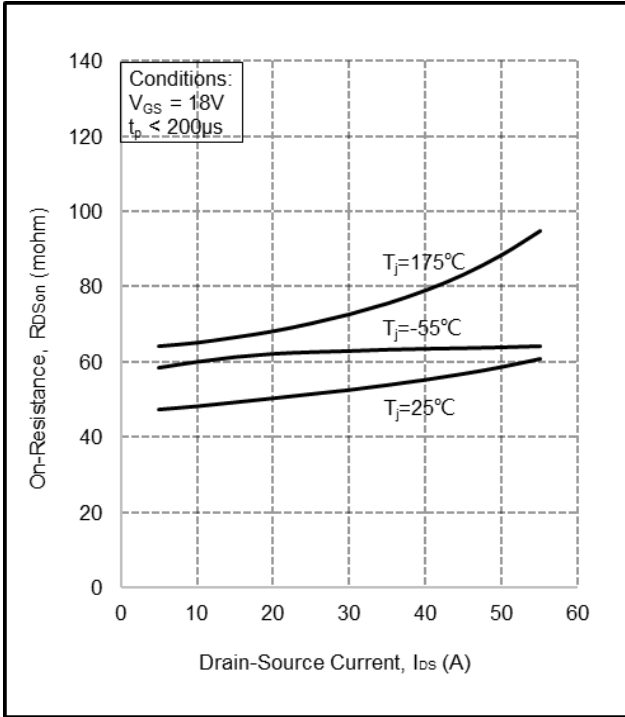


Figure 5. On-resistance vs. drain current for various temperatures

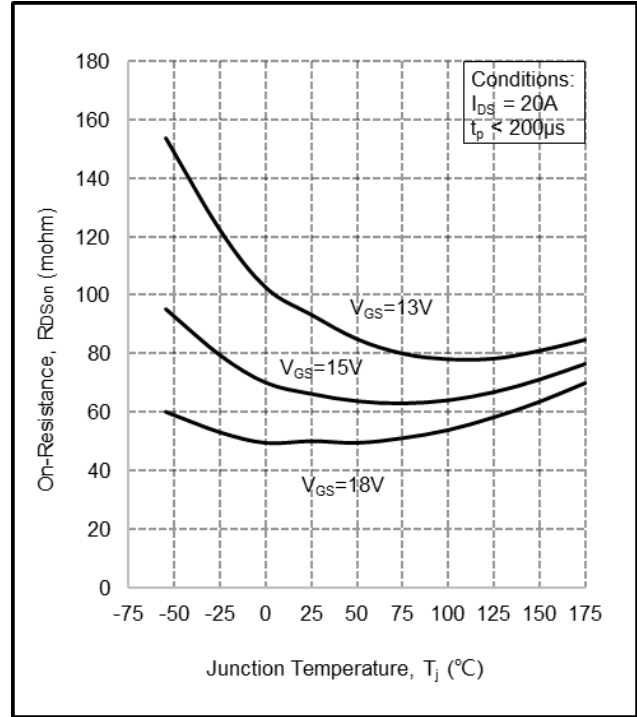


Figure 6. On-resistance vs. temperature for various gate voltages

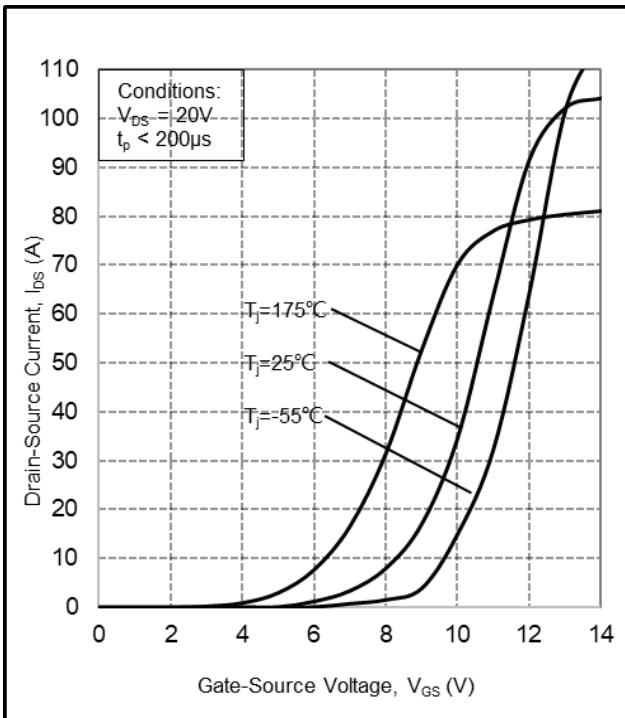


Figure 7. Transfer characteristic for various junction temperatures

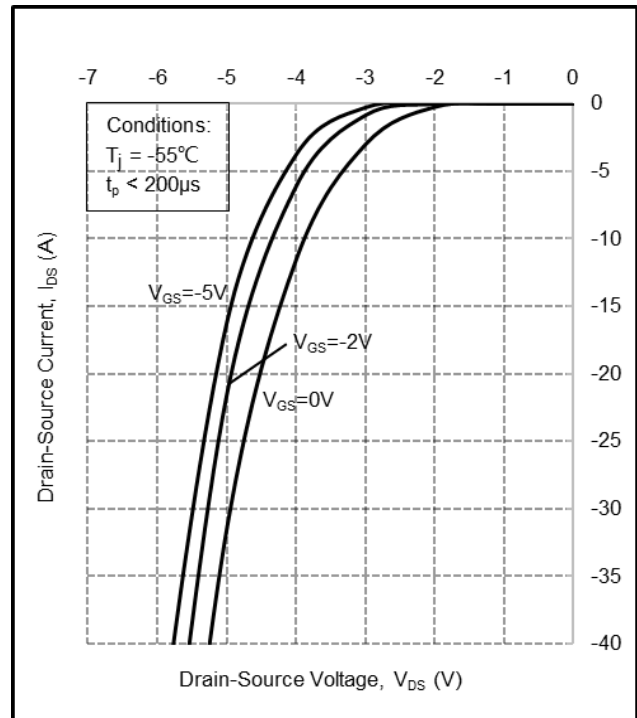


Figure 8. Body diode characteristic at $T_J = -55^\circ\text{C}$

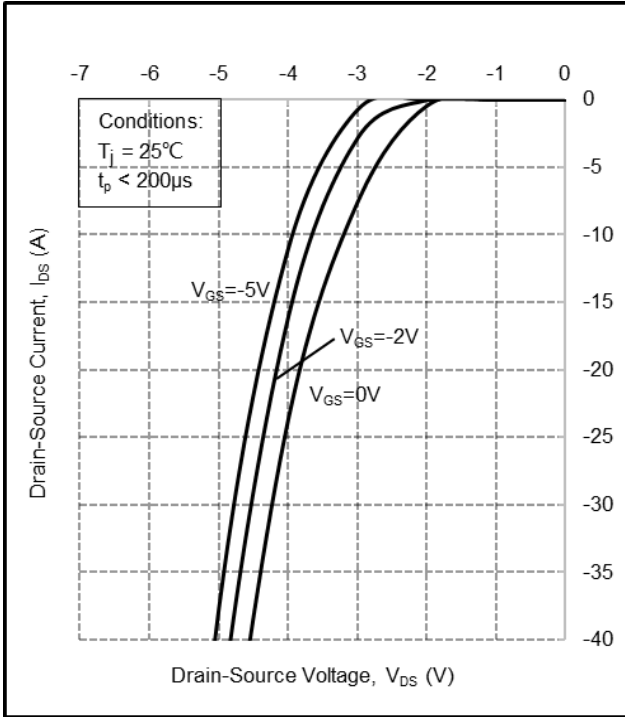


Figure 9. Body diode characteristic at $T_j = 25^\circ\text{C}$

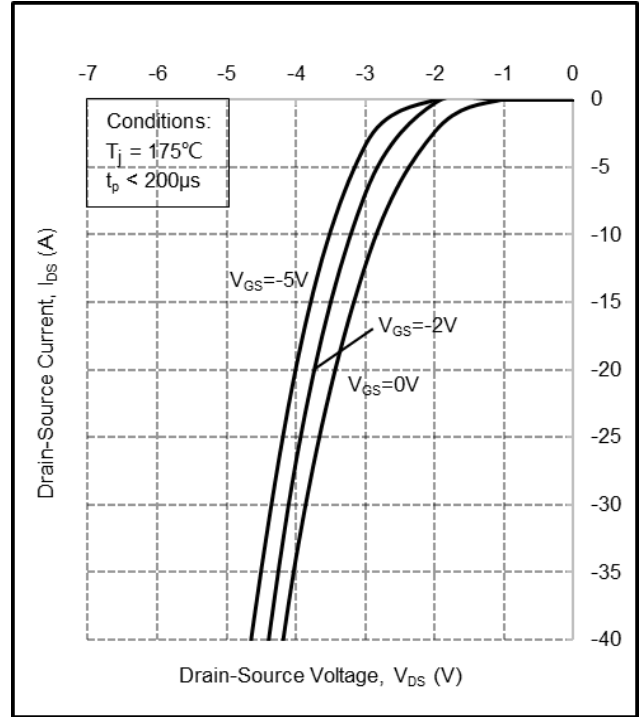


Figure 10. Body diode characteristic at $T_j = 175^\circ\text{C}$

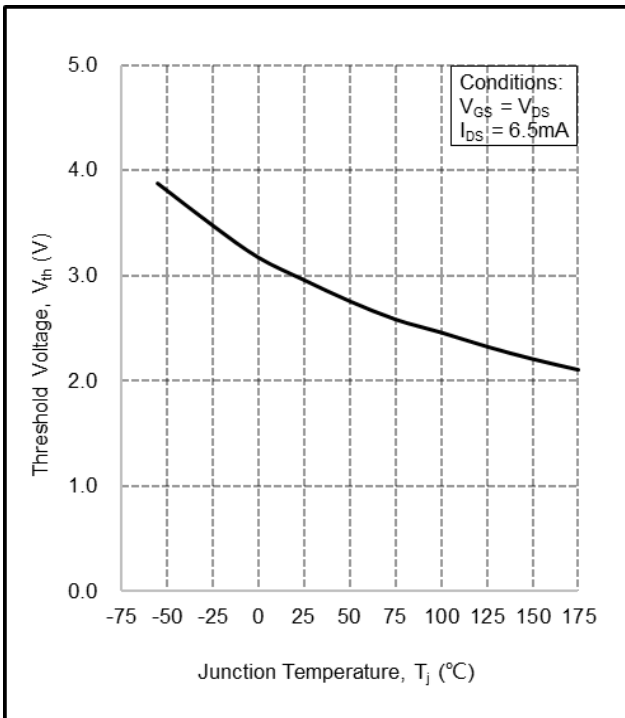


Figure 11. Threshold voltage vs. temperature

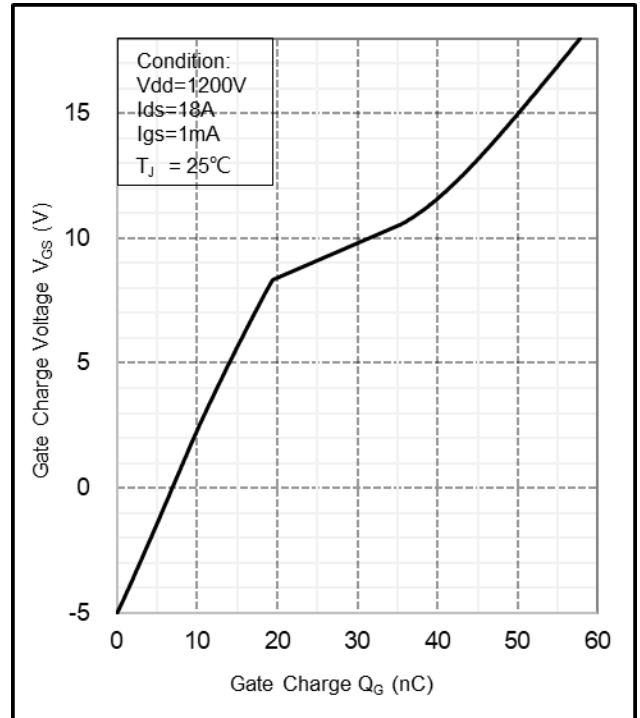


Figure 12. Gate Charge Characteristic

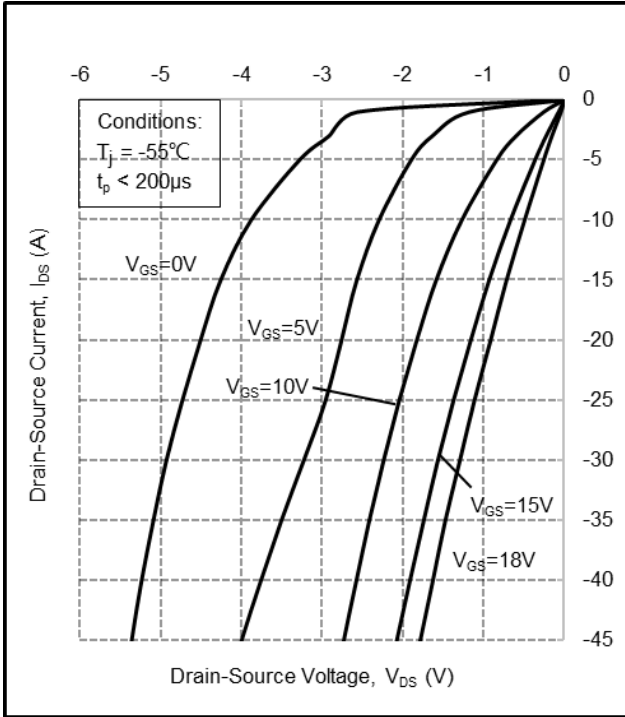


Figure 13. 3rd quadrant characteristic at $T_j = -55^\circ\text{C}$

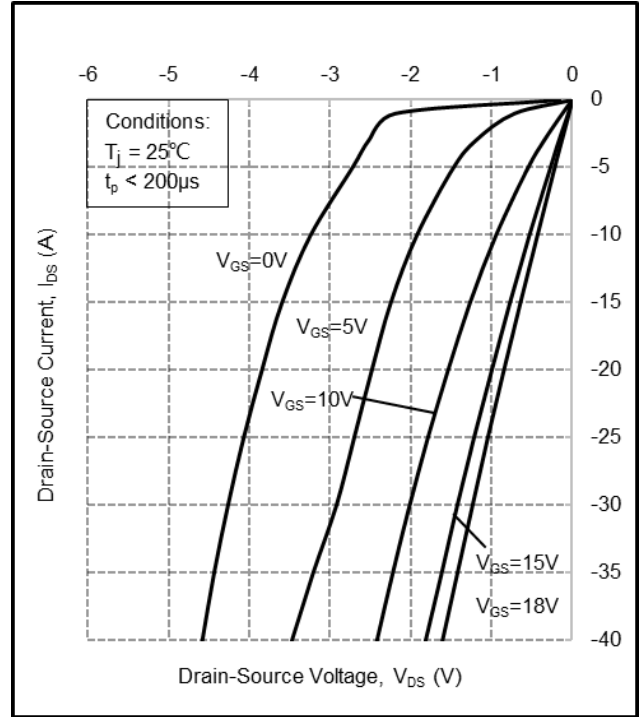


Figure 14. 3rd quadrant characteristic at $T_j = 25^\circ\text{C}$

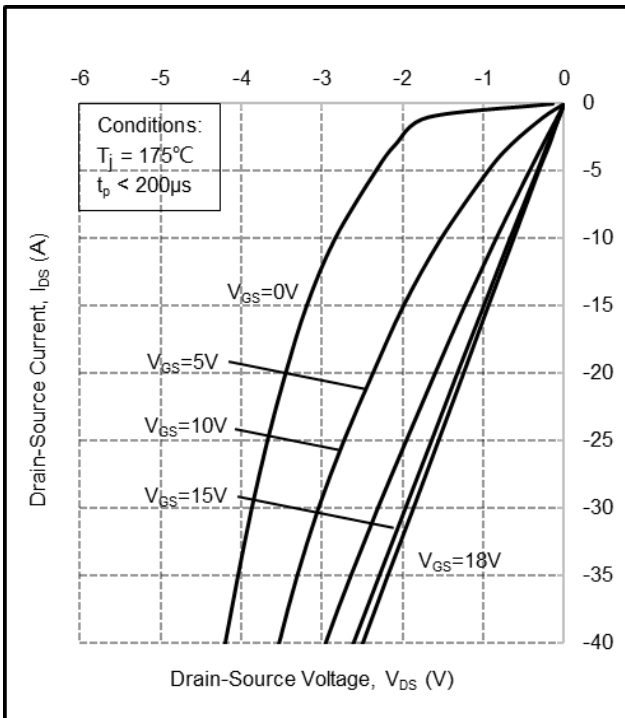


Figure 15. 3rd quadrant characteristic at $T_j = 175^\circ\text{C}$

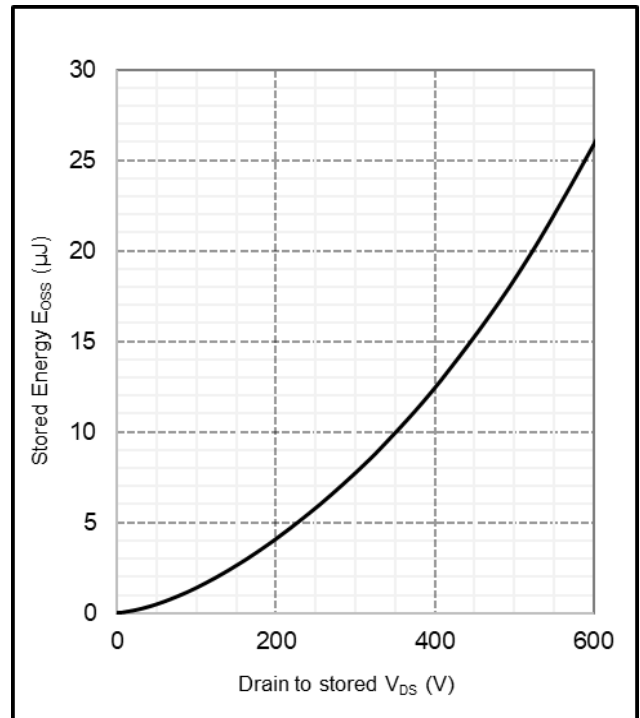


Figure 16. Output capacitor stored energy

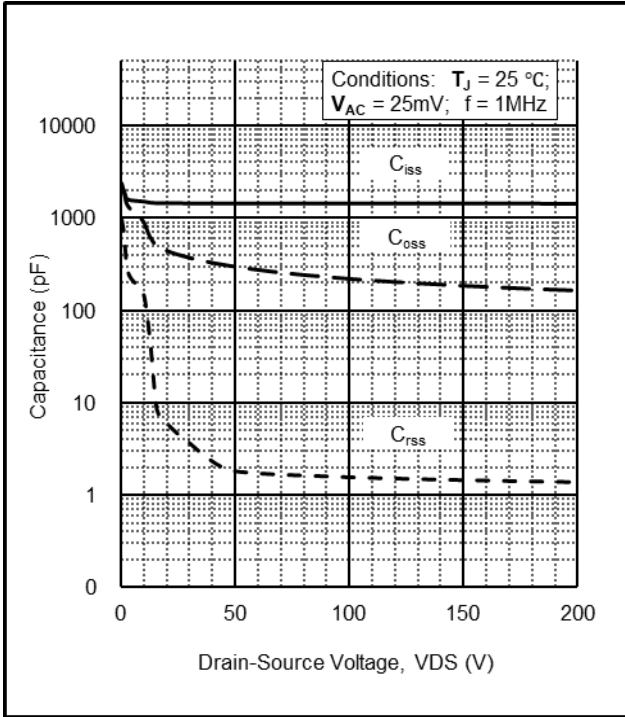


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

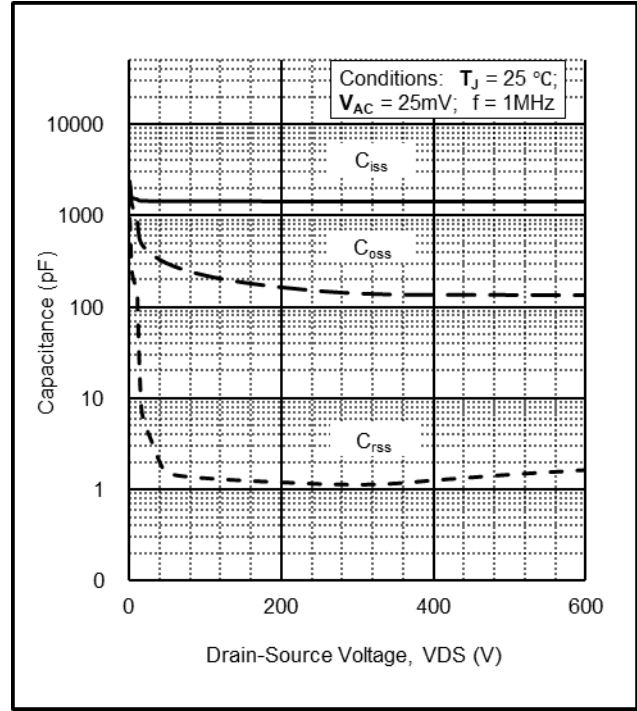


Figure 18. Capacitance vs. drain-source voltage (0 - 600V)

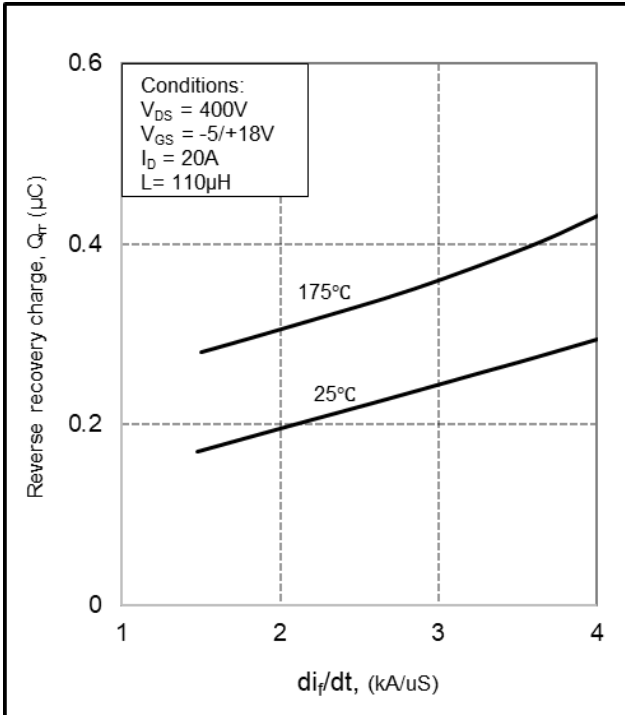


Figure 19. Reverse recovery charge vs. di_T/dt

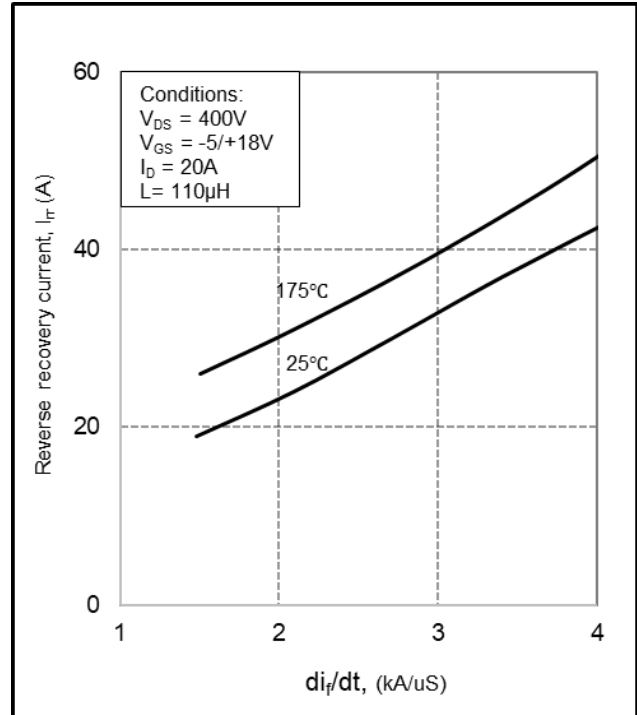
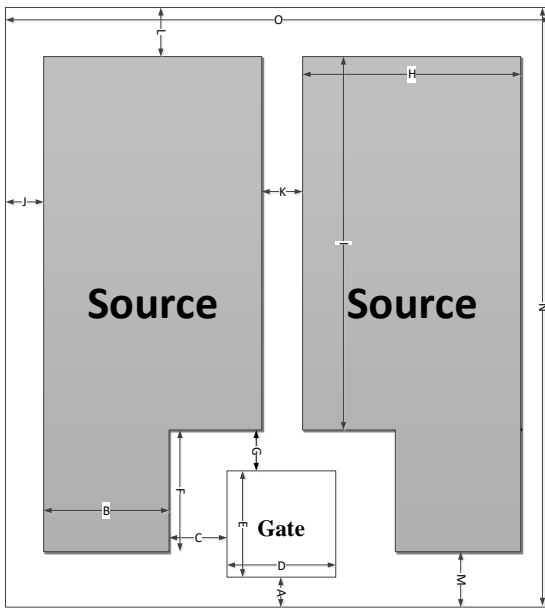


Figure 20. Reverse recovery current vs. di_T/dt

Chip Dimensions



Symbol	Dimensions	
	mm	inch
A	0.23	0.009
B	0.60	0.024
C	0.21	0.008
D	0.48	0.019
E	0.40	0.016
F	0.40	0.016
G	0.24	0.009
H	0.90	0.035
I	1.60	0.063
J	0.35	0.014
K	0.30	0.012
L	0.33	0.013
M	0.47	0.019
N	2.80	0.110
O	2.80	0.110

Ordering Information

Part number	AMS0650050B
Package	Bare Die
Package Method	Wafer
RoHS	Yes

Mechanical Parameters

Parameter	Type	Unit
Die Dimensions(L x W)	2.8*2.8	mm ²
Exposed Source Pad Metal Dimensions(L x W) Each	0.9*1.6+0.6*0.4	mm ²
Gate Pad Dimensions(L x W)	0.48*0.4	mm ²
Die Thickness	150	μm
Top Side Source Metallization(Al)	4	μm
Top Side Gate Metallization(Al)	4	μm
Bottom Drain metallization(Ni / Ag)	0.4/1.2	μm

Important Notices – Read Carefully

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