Silicon Carbide Power MOSFET

(N Channel Enhancement Mode)

Product Summary

V_{DS}	$R_{DS(on)}$	ID
3300V	70mΩ	50A

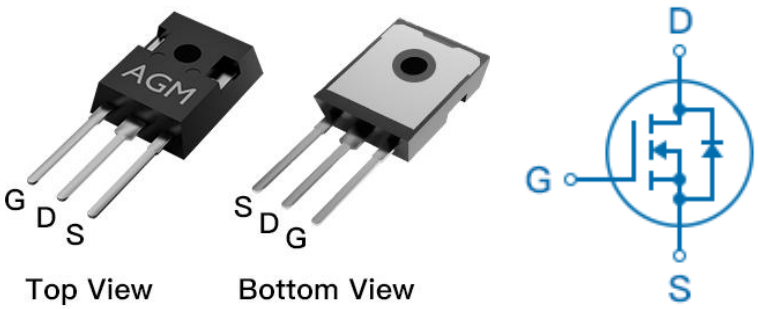
Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low On-Resistance
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

TO-247 Pin Configuration



Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives

Maximum Ratings (T_C = 25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Voltage	3300	V	V_{GS} = 0 V, I_D = 100 μA	
V_{GSmax}	Gate-Source Voltage	-10/+25	V	Absolute maximum values	
V_{GSop}	Gate-Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	50	A	V_{GS} = 20 V, T_C = 25˚C	Fig.15
		36		V_{GS} = 20 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	125	A	Pulse width t_P limited by T_{jmax}	Fig.14
P_D	Power Dissipation	600	W	T_C =25˚C, T_J =175˚C	Fig.16
T_J , T_{stg}	Operating Junction and Storage Temperature	-55 to +175	˚C		
T_L	Solder Temperature	260	˚C	1.6mm (0.063”) from case for 10s	
M_d	Mounting Torque	1 8.8	Nn lbf-in	M3 or 6-32 screw	

Electrical Characteristics (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	3300		-	V	V_{GS} = 0 V, I_D = 1 mA	
$V_{GS(th)}$	Gate threshold Voltage	2	3.4	4.5	V	V_{DS} = V_{GS}, I_D = 10mA	Fig.9
			2.4		V	V_{DS} = V_{GS}, I_D = 10mA, T_J=175°C	
I_{DSS}	Zero Gate Voltage Drain Current			10	μA	V_{DS} = 3300 V, V_{GS} = 0 V	
I_{GSS}	Gate Source Leakage Current			100	nA	V_{GS} = 25V, V_{DS} = 0 V	
R_{DSON}	Drain-Source On-State Resistance		70		mΩ	V_{GS} = 20 V, I_D = 20A	Fig.5-8
			189			V_{GS} =20 V, I_D = 20A, T_J=175°C	
g_{fs}	Transconductance		7.1		S	V_{DS} = 10 V, I_D = 20A	Fig.4
			8.0			V_{DS} = 10 V, I_D = 20A, T_J=175°C	
C_{iss}	Input Capacitance		5199		pF	V_{DS}=1000V,T_J=25°C,f=1MHz	Fig.11
C_{oss}	Output Capacitance		100				
C_{rss}	Reverse Capacitance		16				
E_{oss}	C_{oss} Stored Energy		66		μJ		Fig.12
E_{on}	Turn on Switching Energy		826		μJ	V_{DS} = 1200 V, V_{GS} = -5/20 V, I_D = 20A, $R_{G(ext)}$ =3Ω	Fig.22, 26
E_{off}	Turn off Switching Energy		209				
t_{don}	Turn on delay time		39		ns	V_{DS} = 1200 V, V_{GS} = -5/20 V, I_D =20A, $R_{G(ext)}$= 3Ω	
t_r	Rise time		26				
t_{doff}	Turn off delay time		55				
t_f	Fall time		22				
R_{gint}	Internal Gate Resistance		0.85		Ω	V_{AC}=25mV, f=1MHz	
Q_{gs}	Gate to Source Charge		56		nC	V_{DS} = 1000 V, V_{GS} = -5/ 20 V, I_D = 20A	Fig.10
Q_{gd}	Gate to Drain Charge		57				
Q_g	Total Gate Charge		290				

Electrical Characteristics (Tc = 25°C unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage		6.5	7	V	V_{GS} = -5 V, I_{SD} = 20A	Fig.17,18
			5.1			V_{GS} = -5 V, I_{SD} = 20A,T_J=175°C	
I_S	Continuous Diode Forward Current		20		A	T_C=25°C	
t_{rr}	Reverse Recovery Time		30		ns	V_R= 1200 V, V_{GS} = -5V, I_D = 20A, di/dt=500A/μs,T_J=25°C	
Q_{rr}	Reverse Recovery Charge		150		nC		
I_{rrm}	Peak Reverse Recovery Current		8.9		A		
t_{rr}	Reverse Recovery Time		41		ns	V_R= 1200 V, V_{GS} = -5V, I_D = 20A, di/dt=500A/μs,T_J=150°C	
Q_{rr}	Reverse Recovery Charge		1345		nC		
I_{rrm}	Peak Reverse Recovery Current		10.5		A		

Thermal Characteristics

Symbol	Parameter	Value	Unit	Note
$R_{\theta JC}$	Thermal Resistance(Junction to Case)	0.25	°C/W	
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	28		

Typical Performance

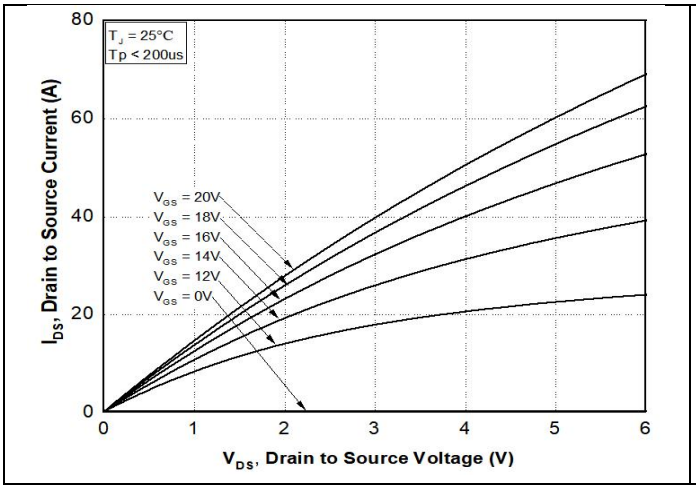


Figure 1. Output Characteristics T_J = 25°C

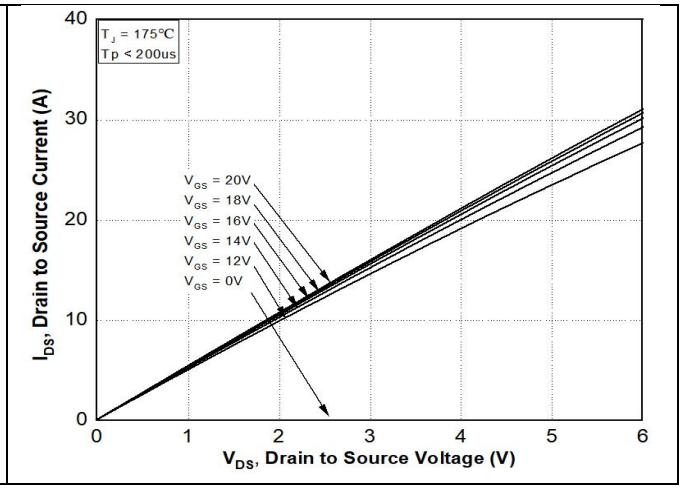


Figure 2. Output Characteristics T_J = 175 °C

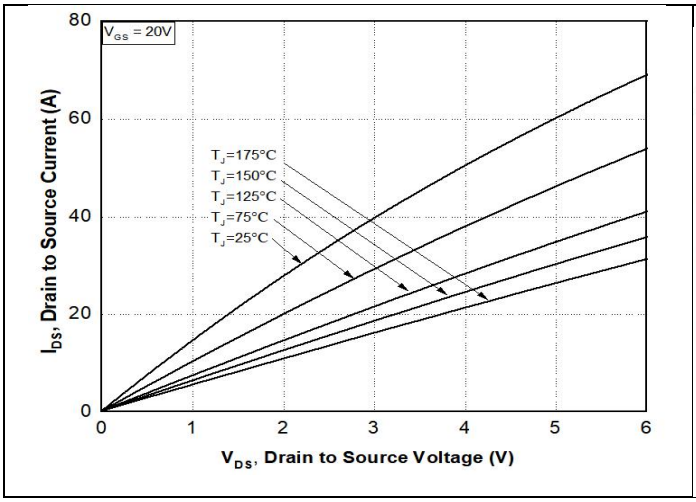


Figure 3. Output Characteristics (V_{GS} =20V)

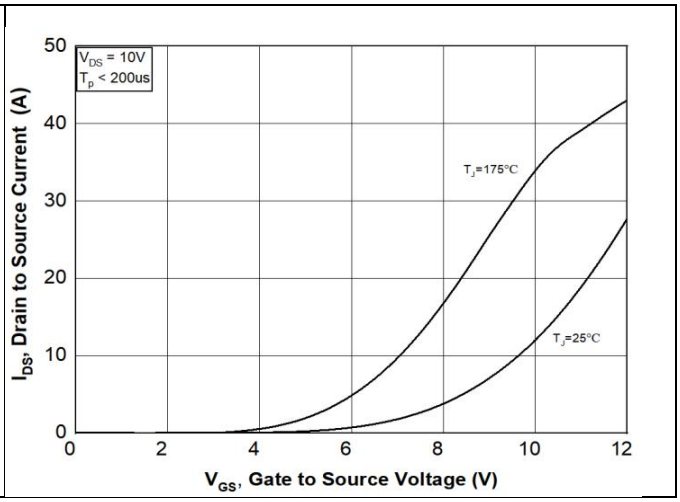


Figure 4. Transfer Characteristics

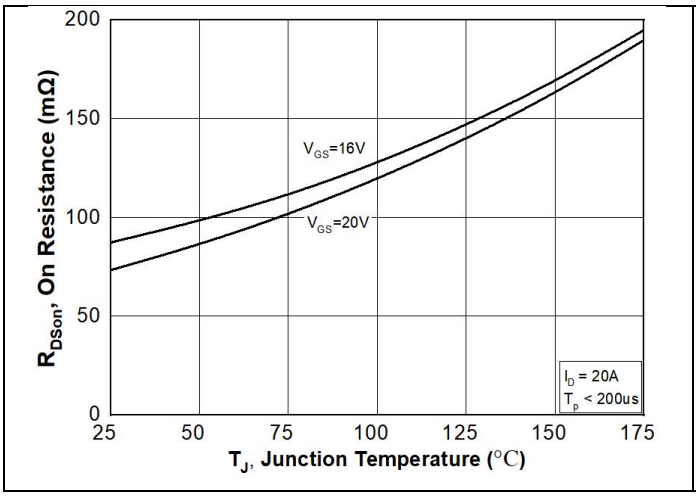


Figure 5. On-Resistance vs. Temperature

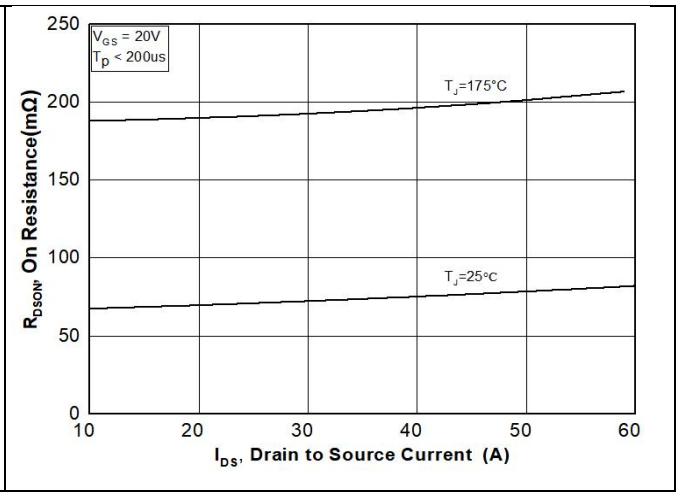


Figure 6. On-State Resistance vs. Drain Current

Typical Performance

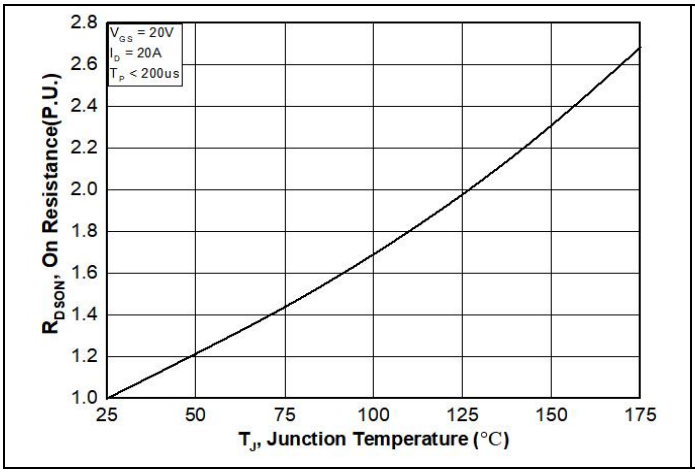


Figure 7. Normalized On-State Resistance vs. Temperature

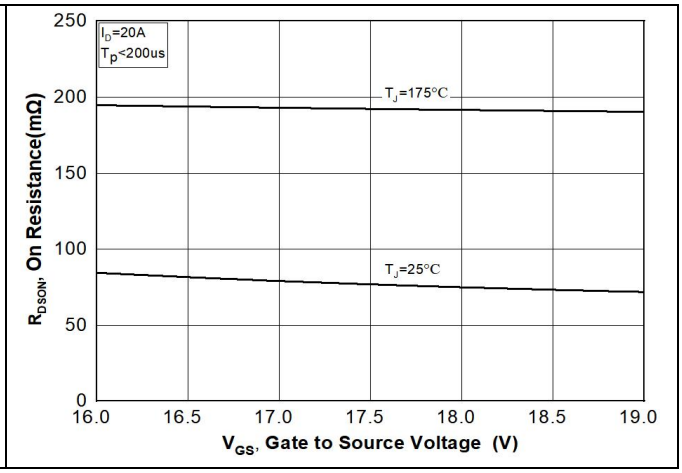


Figure 8. On-State Resistance vs. Gate Voltage

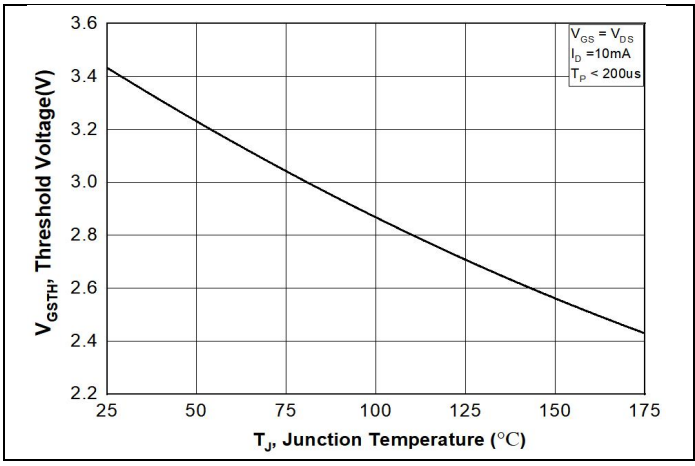


Figure 9. Threshold Voltage Characteristics

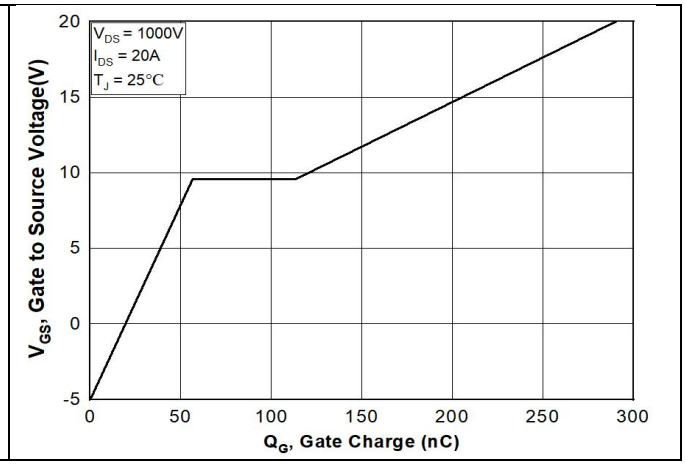


Figure 10. Gate Charge Characteristics

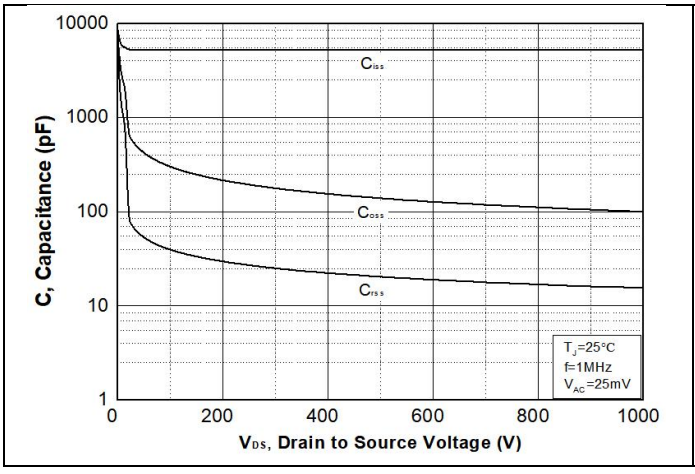


Figure 11. Capacitance vs. Drain-Source Voltage

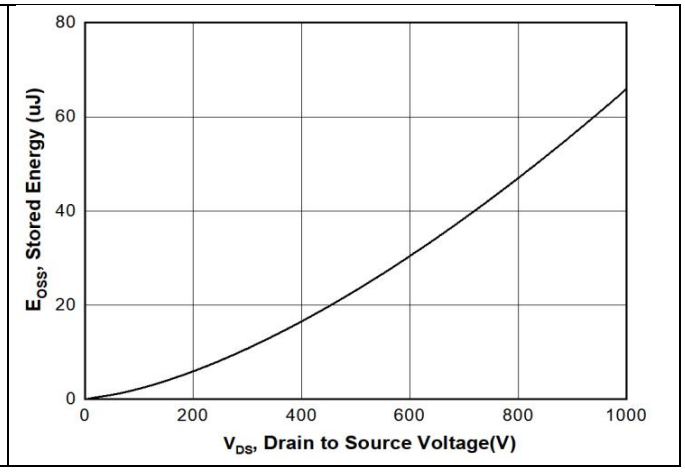


Figure 12. Output Capacitor Stored Energy

Typical Performance

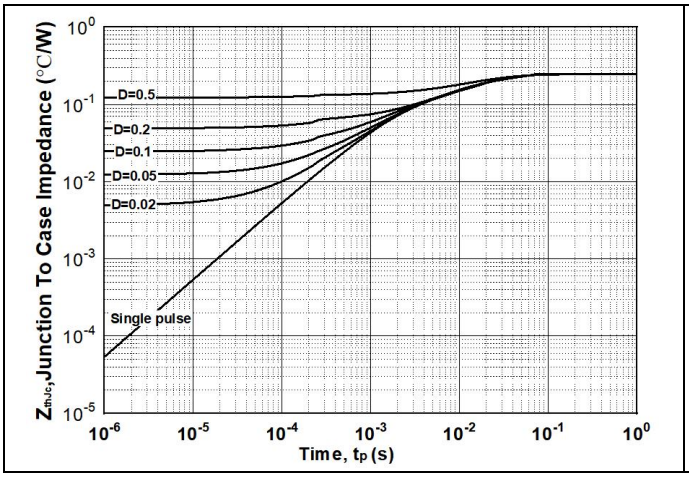


Figure 13. Transient Thermal Impedance (Junction - Case)

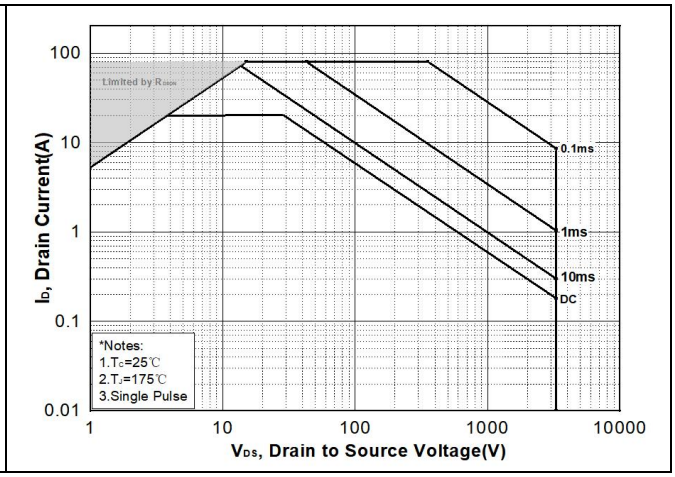


Figure 14. Safe Operating Area(T_c = 25°C)

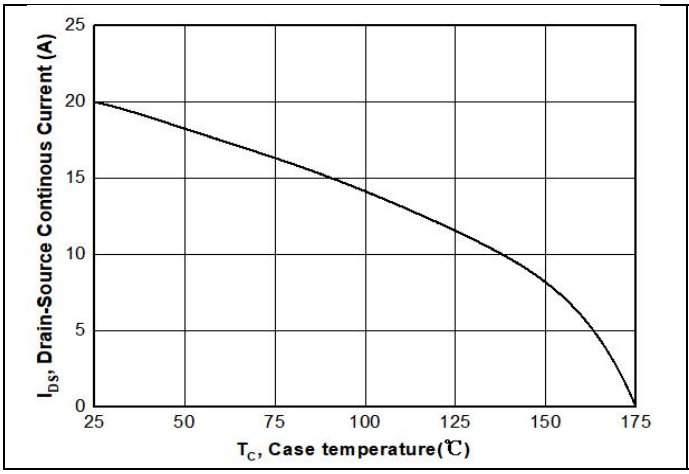


Figure 15. Current De-rating Curve

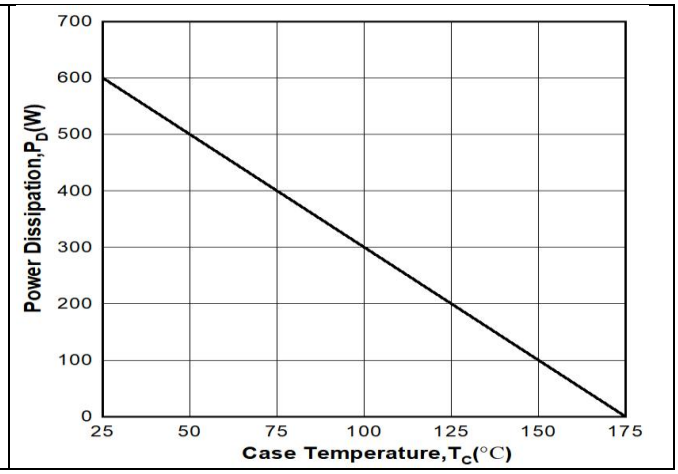


Figure 16. Power De-rating Curve

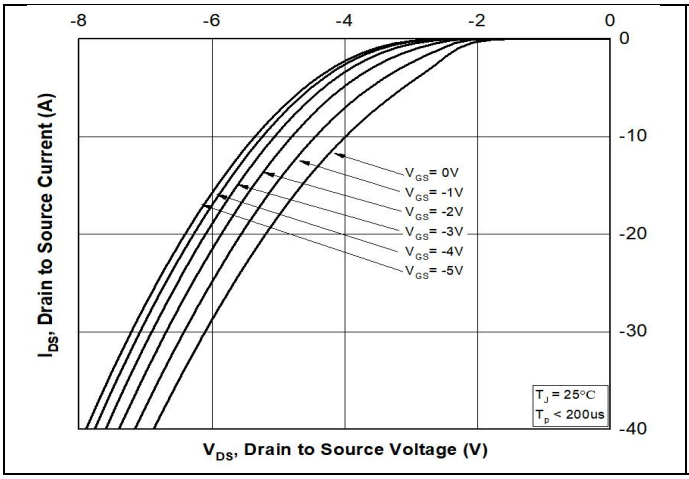


Figure 17. Body Diode Characteristics at T_J = 25 °C

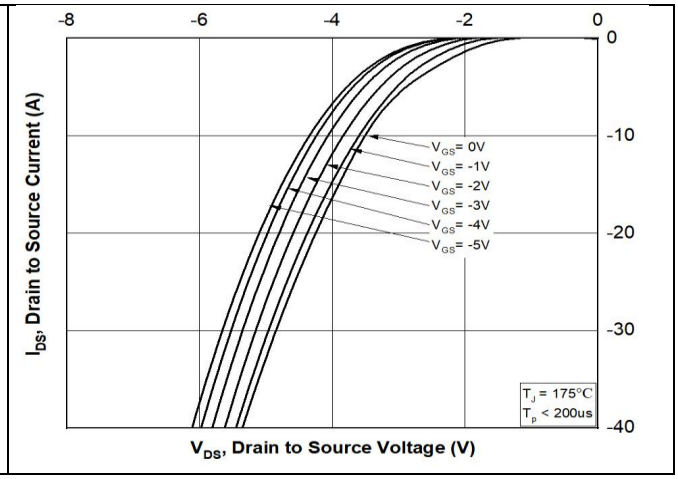


Figure 18. Body Diode Characteristics at T_J = 175 °C

Typical Performance

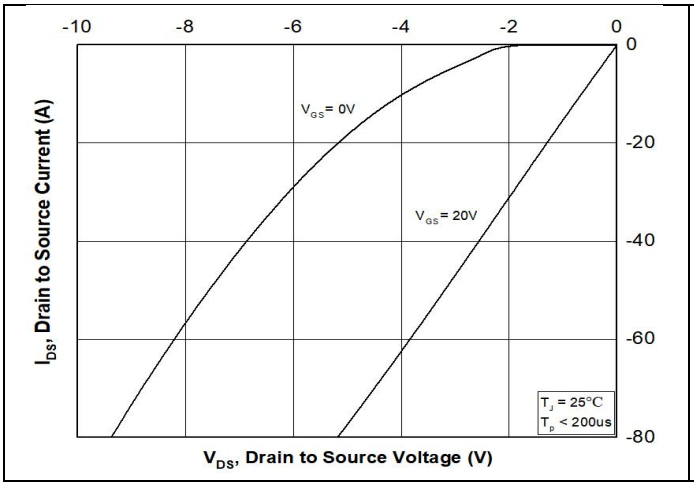


Figure 19. 3rd Quadrant Characteristics at T_J = 25 °C

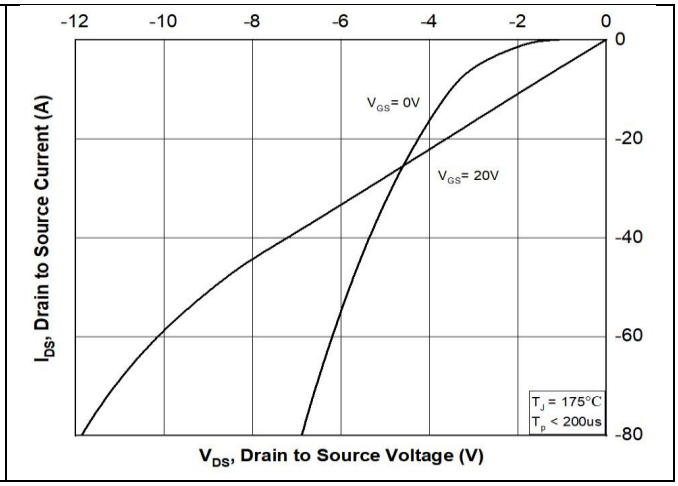


Figure 20. 3rd Quadrant Characteristics at T_J = 175 °C

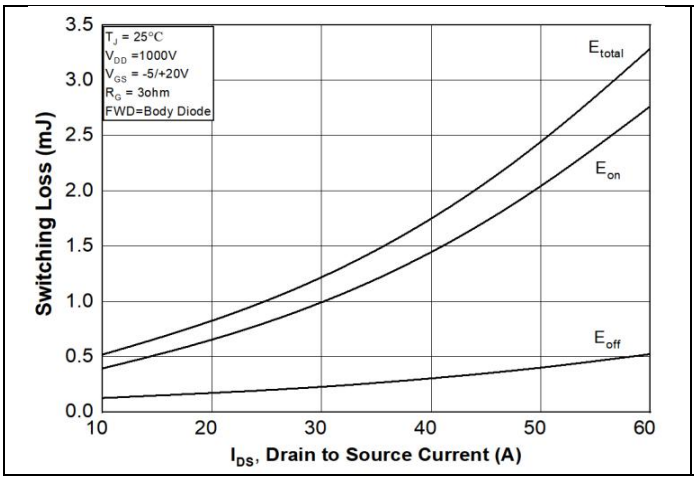


Figure 21. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 1000V)

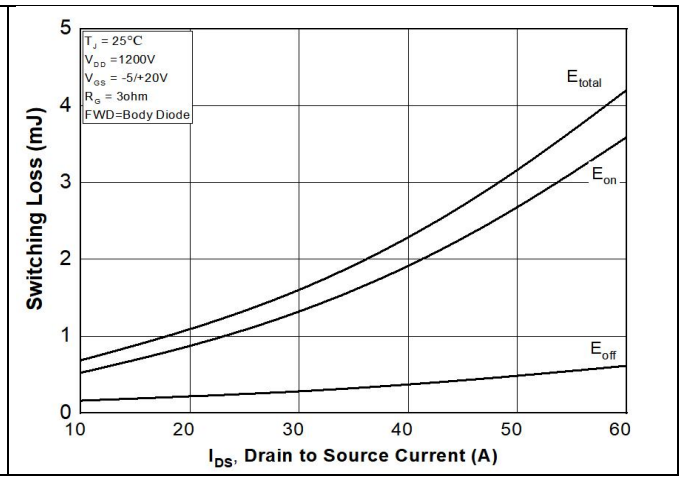


Figure 22. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 1200V)

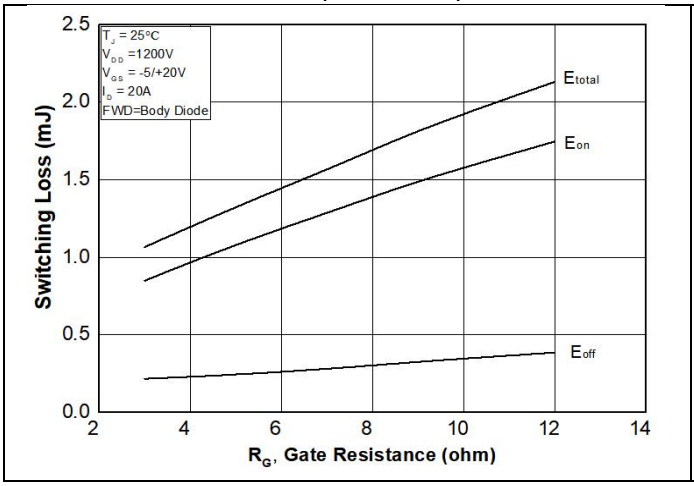


Figure 23.Clamped Inductive Switching Energy vs. $R_{G(ext)}$

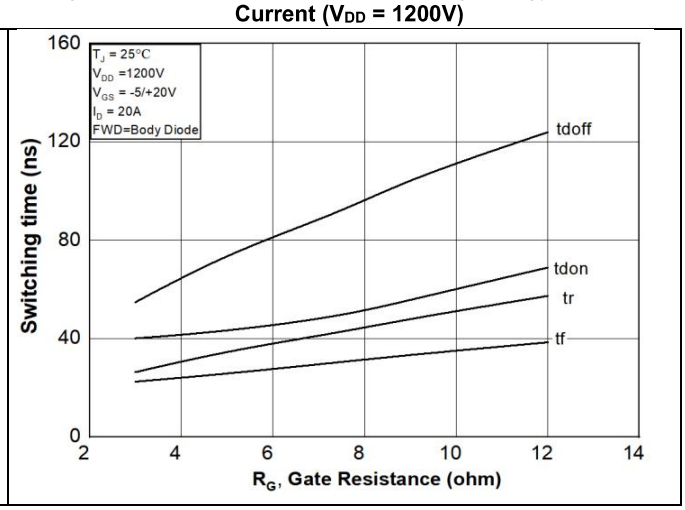


Figure 24. Switching Times vs. $R_{G(ext)}$

Typical Performance

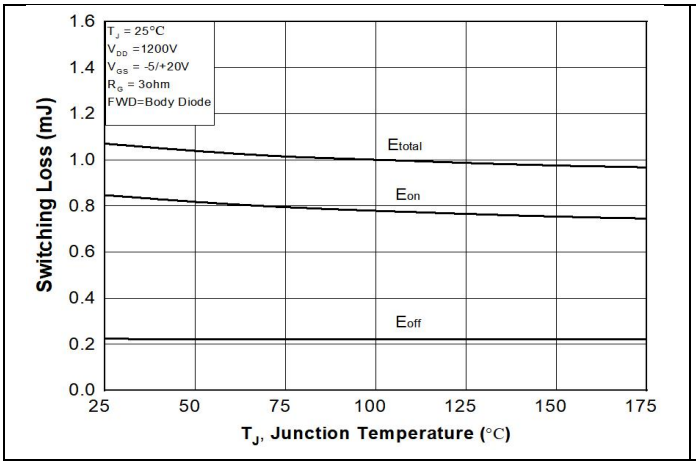


Figure 25. Clamped Inductive Switching Energy vs. Temperature

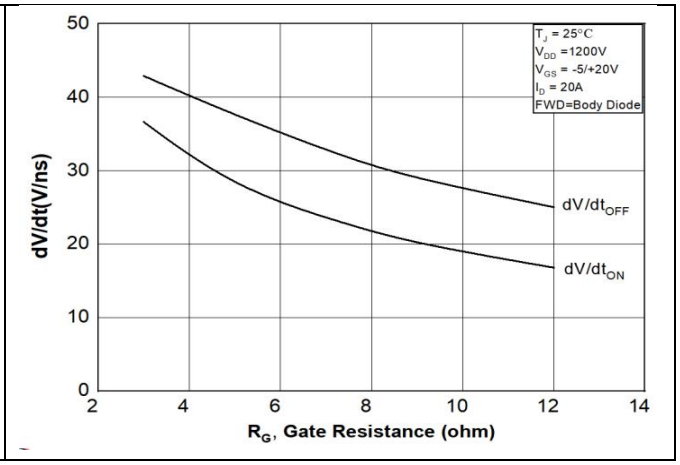
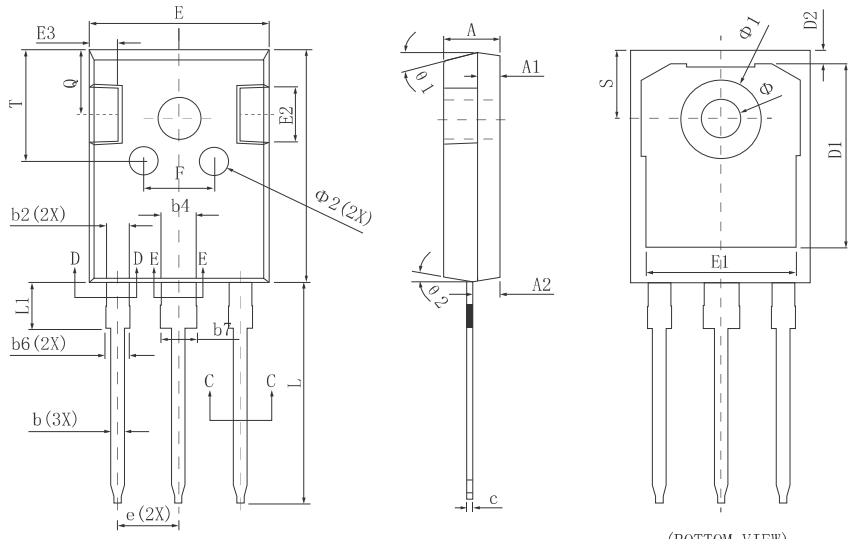
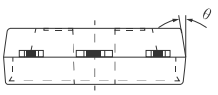
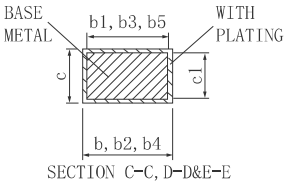


Figure 26.dv/dt v/s $R_{G(ext)}$

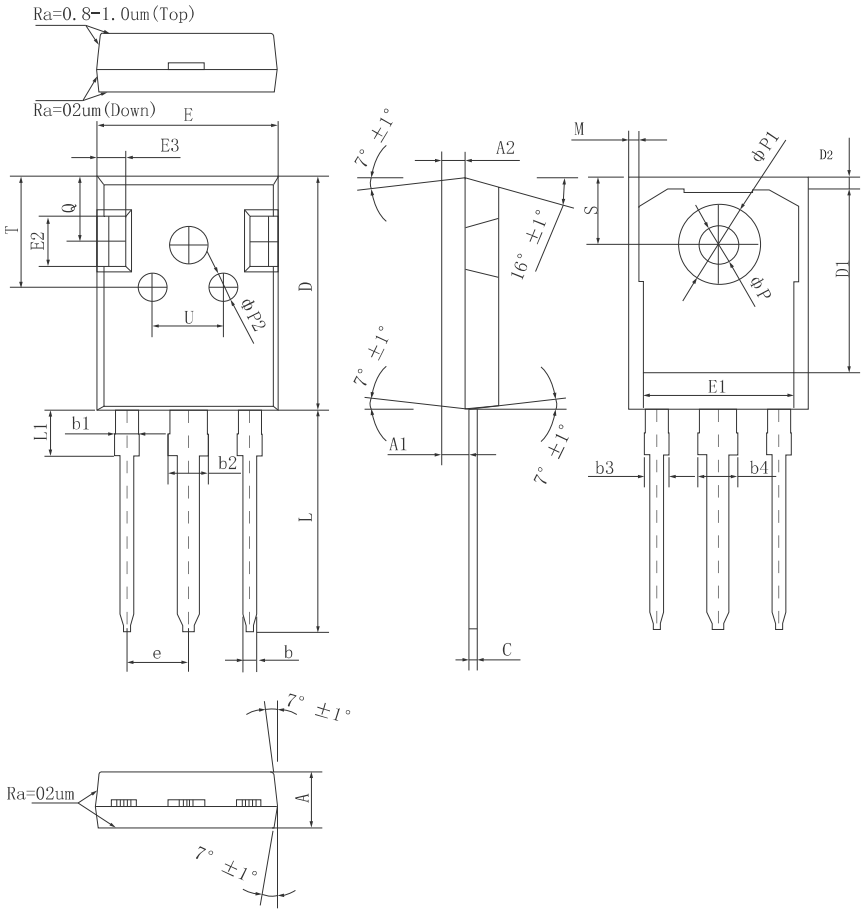
●Dimensions（TO-247）





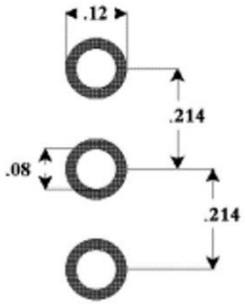


SYMBOL	MILLIMETER		
	MIN	Typ.	MAX
A	4.900	5.000	5.100
A1	1.900	2.000	2.100
A2	2.300	2.400	2.500
b	1.160	–	1.260
b1	1.150	1.200	1.220
b2	1.960	–	2.060
b3	1.950	2.000	2.020
b4	2.960	–	3.060
b5	2.950	3.000	3.020
b6	2.000	2.100	2.250
b7	3.000	3.100	3.250
c	0.590	–	0.660
c1	0.580	0.600	0.620
D	20.900	21.000	21.100
D1	16.250	16.550	16.850
D2	1.052	1.202	1.352
E	15.700	15.800	15.900
E1	13.060	13.260	13.460
E2	4.900	5.000	5.100
E3	2.400	2.500	2.600
e	5.440 BSC		
F	6.000	6.200	6.400
L	19.750	19.950	20.150
L1	–	–	4.300
Φ	3.500	3.600	3.700
Φ1	–	–	7.400
Φ2	2.400	2.500	2.600
Q	5.600	5.800	6.000
S	6.180 BSC		
T	9.800	10.000	10.200
θ	8° REF		
θ1	15° REF		
θ2	8° REF		



DIM.	MIN.	NOM.	MAX.
A	4.90	5.00	5.10
A1	2.25	2.36	2.51
A2	1.90	2.00	2.10
b	1.16	1.20	1.26
b1	1.96	2.00	2.06
b2	2.96	3.00	3.06
b3	–	–	2.25
b4	–	–	3.25
c	0.59	0.60	0.66
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
E	15.70	15.80	15.90
E1	13.10	13.26	13.50
E2	4.40	4.50	4.60
E3	2.40	2.50	2.60
e		5.436BSC	
L	19.80	19.90	20.10
L1	–	–	4.30
M	0.35	0.89	0.95
P	3.40	3.50	3.60
P1	7.00	7.20	7.40
P2	2.40	2.50	2.60
Q	5.60	5.80	6.00
S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
All dimensions in millimeters			

Recommended Solder Pad Layout



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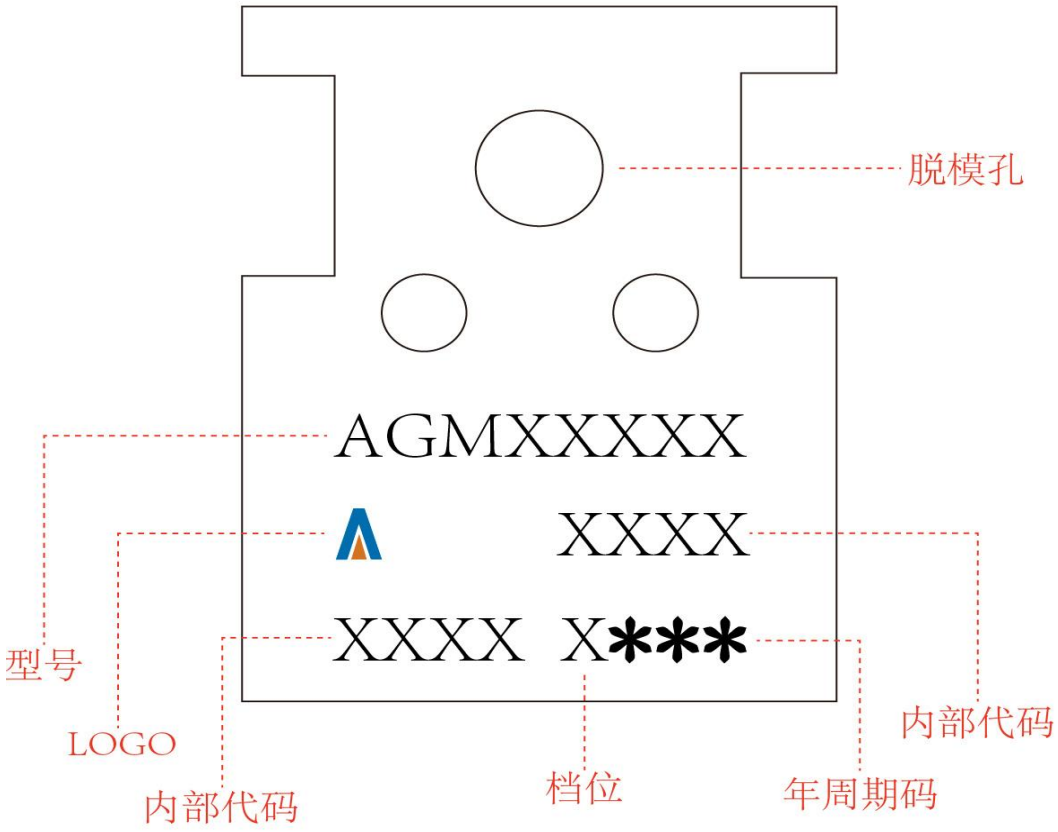
Marking Instructions:



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This document is the first version issued on Oct.10th, 2024. This document replaces all previously provided information.