N-Channel 650V (D-S) SiC Power MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	650	
$R_{DS(on)}$ at 25 °C (Ω)	V_{GS} = 18 V	0.05
Q_g (nC)	90	

FEATURES

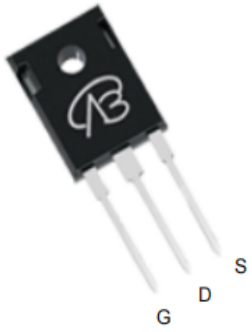
- Low figure-of-merit (FOM) R_{on} x Q_g
- Low input capacitance (C_{iss})
- Reduced switching and conduction losses
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)

RoHS

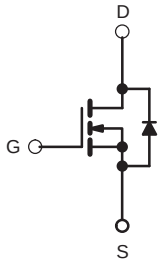
APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- DC/DC converter

TO-247



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)					
PARAMETER			**SYMBOL**	**LIMIT**	**UNIT**
Drain-Source Voltage			V_{DS}	650	V
Gate-Source Voltage			V_{GS}	-10 / +22	
Continuous Drain Current (T_J = 150 °C)	V_{GS} at 18 V	T_C = 25 °C	I_D	40	A
		T_C = 100 °C		32	
Pulsed Drain Current [a]			I_{DM}	120	
Linear Derating Factor				2.1	W/°C
Single Pulse Avalanche Energy [b]			E_{AS}	225	mJ
Maximum Power Dissipation			P_D	187	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	°C
Drain-Source Voltage Slope	T_J = 125 °C		dV/dt	50	V/ns
Reverse Diode dV/dt [d]				15	
Soldering Recommendations (Peak Temperature) [c]	for 10 s			260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. V_{DD} = 100 V, starting T_J = 25 °C, L = 0.5mH, R_g = 25 Ω, I_{AS} = 30A.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting T_J = 25 °C.

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum Junction-to-Ambient	R_{thJA}	-	40	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	0.8	

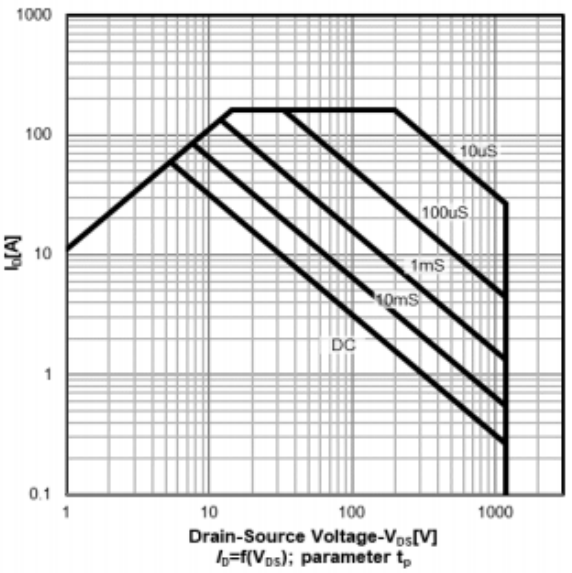
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 1 mA	650	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA	2	-	5	V
Gate-Source Leakage	I_{GSS}	V_{GS} = +22 V	-	-	100	nA
		V_{GS} = -10 V	-	-	100	µA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0 V	-	10	-	µA
		V_{DS} = 650 V, V_{GS} = 0 V, T_J = 125 °C	-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 20A	-	0.05	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = 0 V, I_D = 30 A	-	12	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 600 V, f = 1 MHz	-	2000	-	pF
Output Capacitance	C_{oss}		-	175	-	
Reverse Transfer Capacitance	C_{rss}		-	9	-	
Effective Output Capacitance, Energy Related [a]	$C_{o(er)}$	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	156	-	
Effective Output Capacitance, Time Related [b]	$C_{o(tr)}$		-	268	-	
Total Gate Charge	Q_g	V_{GS} = -5/18 V, I_D = 20 A, V_{DS} = 400 V	-	70	-	nC
Gate-Source Charge	Q_{gs}		-	20	-	
Gate-Drain Charge	Q_{gd}		-	23	-	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 20A, V_{GS} = -5/18 V , R_g = 2 Ω	-	12	15	ns
Rise Time	t_r		-	10	13	
Turn-Off Delay Time	$t_{d(off)}$		-	20	-	
Fall Time	t_f		-	10	-	
Gate Input Resistance	R_g	f = 1 MHz, open drain	-	2.2	-	Ω
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	40	A
Pulsed Diode Forward Current	I_{SM}		-	-	120	
Diode Forward Voltage	V_{SD}	T_J = 25 °C, I_S = 20 A, V_{GS} = 0	-	-	4.1	V
Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = I_S = 20 A, dI/dt = 1000 A/µs, V_R = 400 V	-	20	-	ns
Reverse Recovery Charge	Q_{rr}		-	60	-	µC
Reverse Recovery Current	I_{RRM}		-	10	-	A

Notes

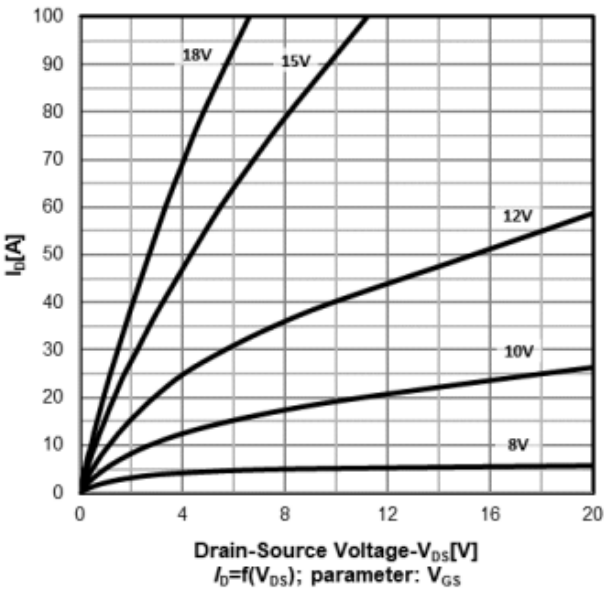
a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 60 % V_{DSS}.

b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 60 % V_{DSS}.

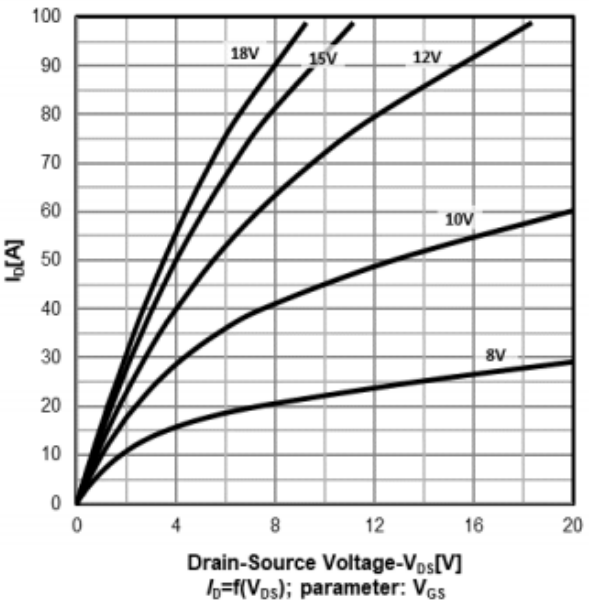
Safe operating area Tc=25 ℃
TO-247



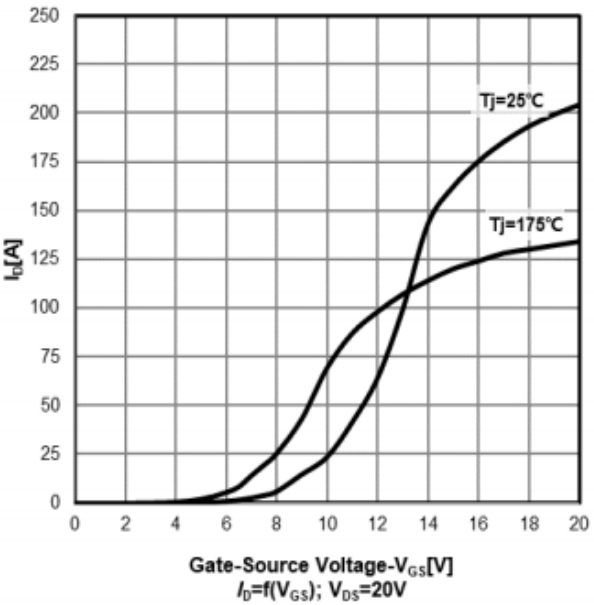
On-Region characteristics Tj=25 ℃



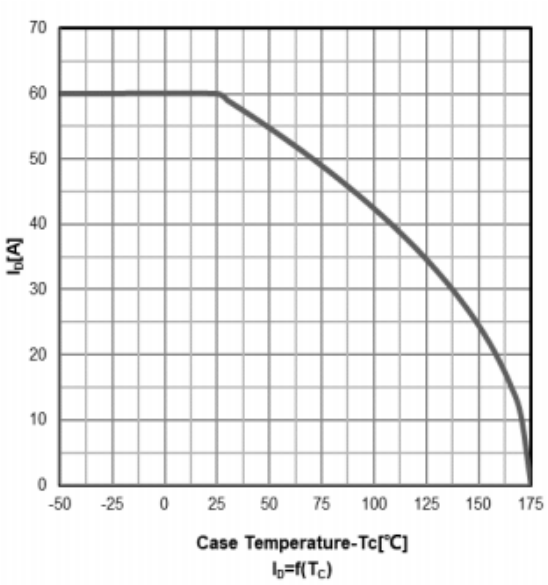
On-Region characteristics Tj=175 ℃



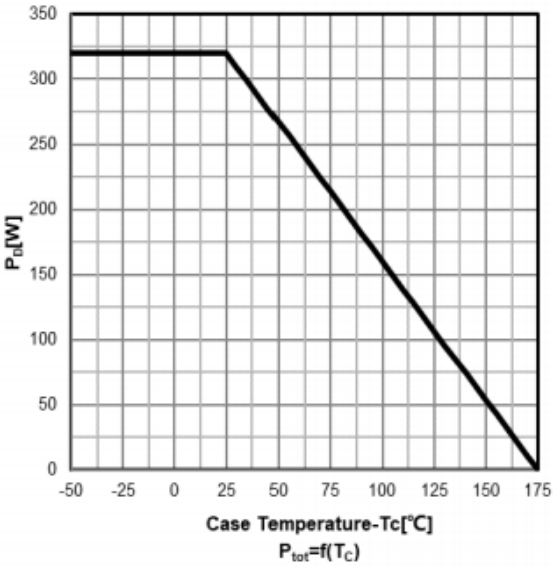
Transfer characteristics



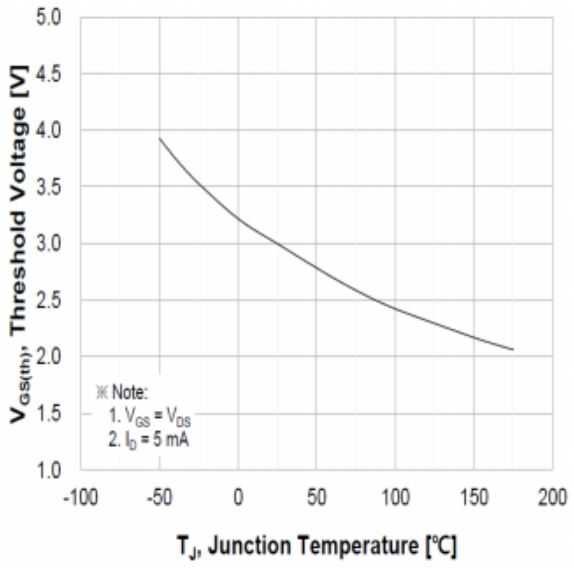
Drain current vs temperature



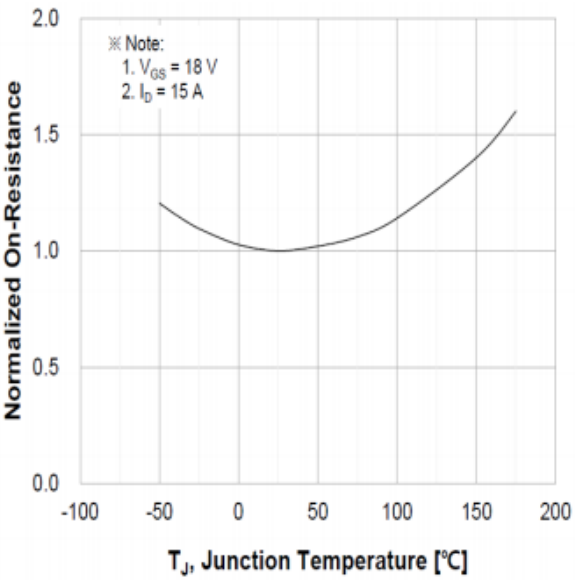
Power dissipation



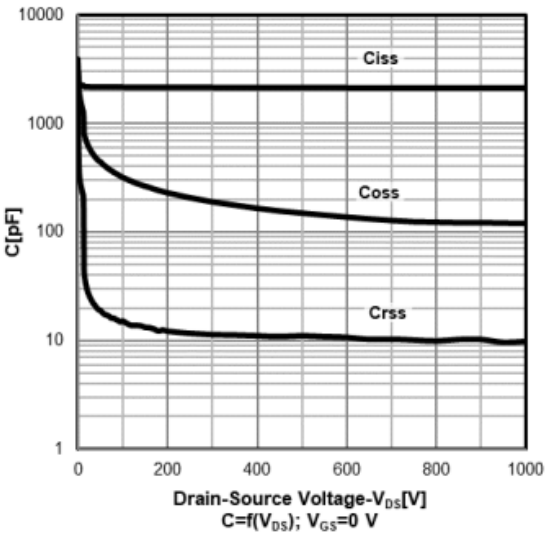
Threshold voltage vs temperature



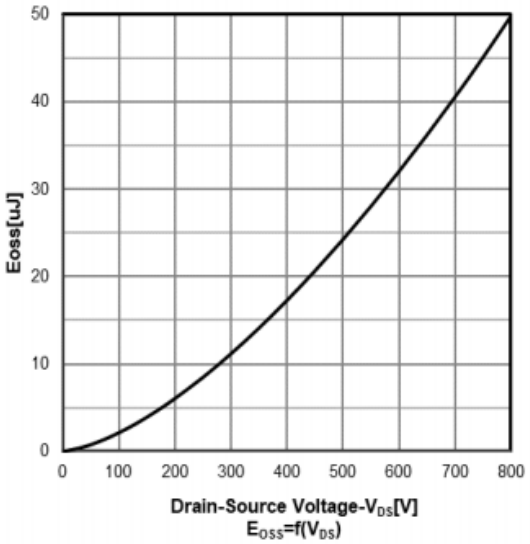
Normalized On-resistance vs temperature



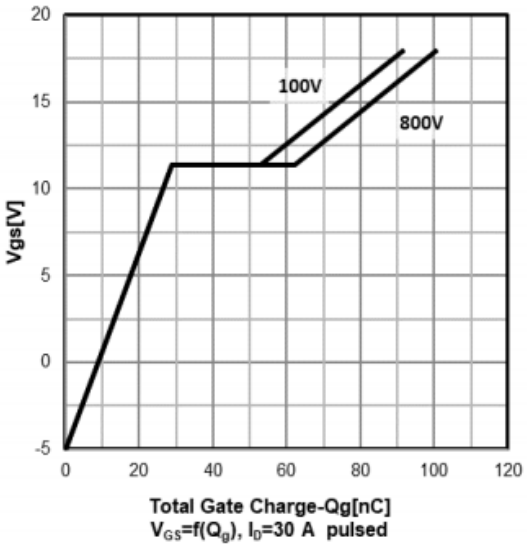
Typ. capacitances



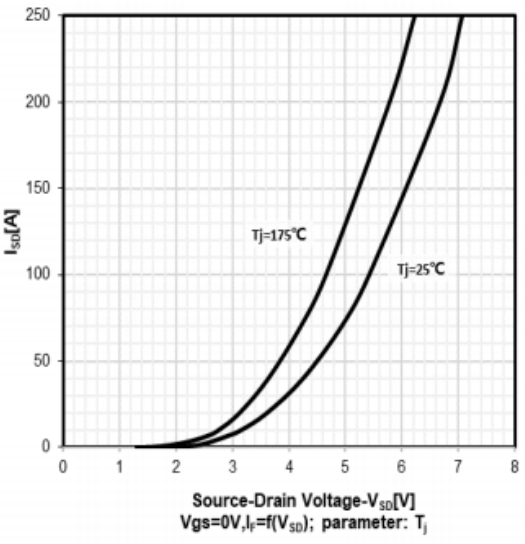
Coss stored energy



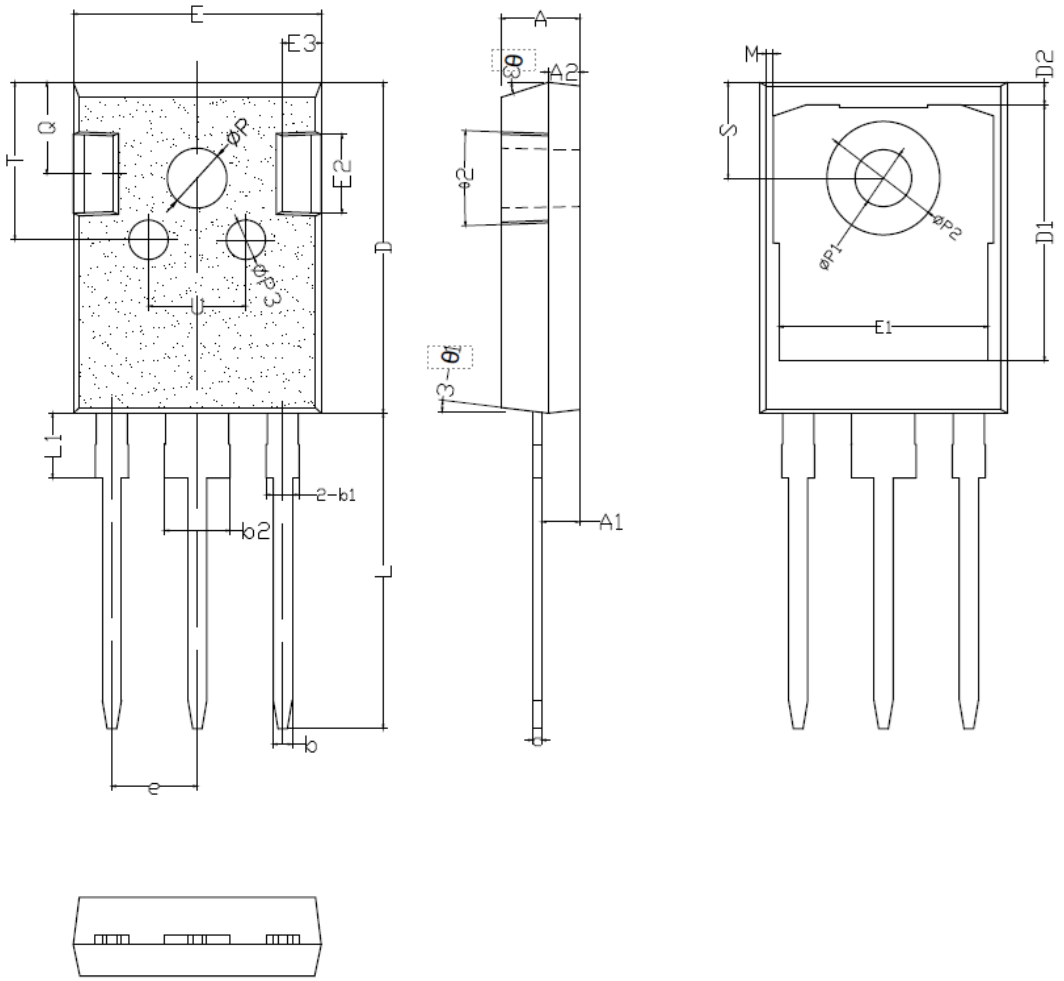
Typ. gate charge characteristics



Diode forward voltage characteristics
Tj=25 ℃/175 ℃



TO-247 PACKAGE OUTLINE DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35

*E	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.85	4.95	5.10
E3	2.40	2.50	2.60
*e	5.40	5.44	5.48
*L	19.80	19.98	20.15
*L1	-	-	4.30
*ΦP	3.40	3.50	3.60
*ΦP1	6.90	7.10	7.30
ΦP2	2.40	2.50	2.60
ΦP3	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
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°

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