

VBP165C40 Datasheet

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

PRODUCT SUMMARY

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

FEATURES

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



RoHS

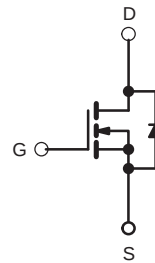
APPLICATIONS

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

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Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)

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

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.5\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 30\text{ A}$.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, $dI/dt = 100\text{ A}/\mu\text{s}$, starting $T_J = 25\text{ }^\circ\text{C}$.

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	

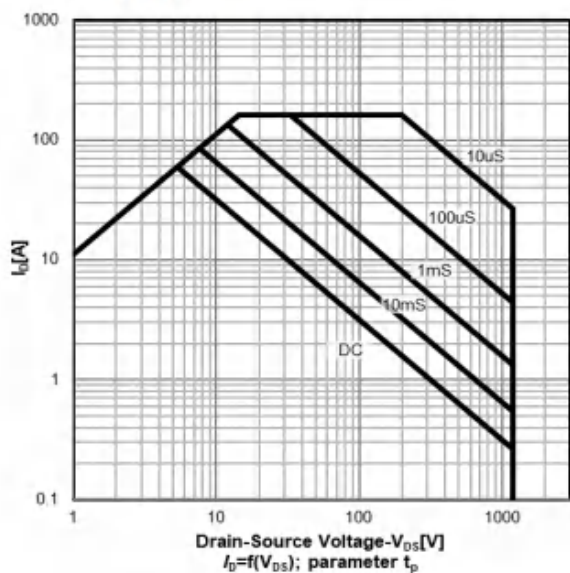
SPECIFICATIONS ($T_J = 25\text{ °C}$, unless otherwise noted)

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	ΔV _{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

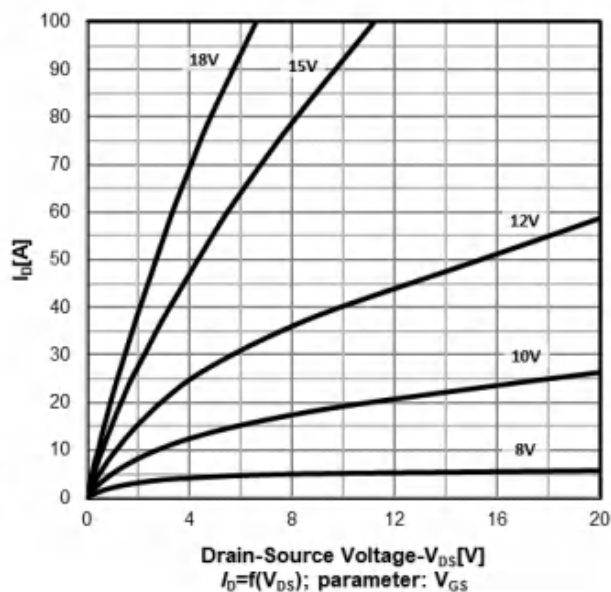
Notes

- 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} .

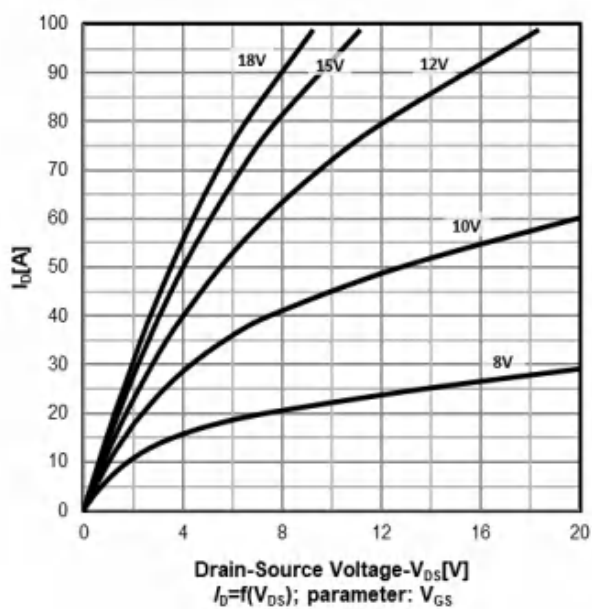
Safe operating area $T_c=25^\circ\text{C}$
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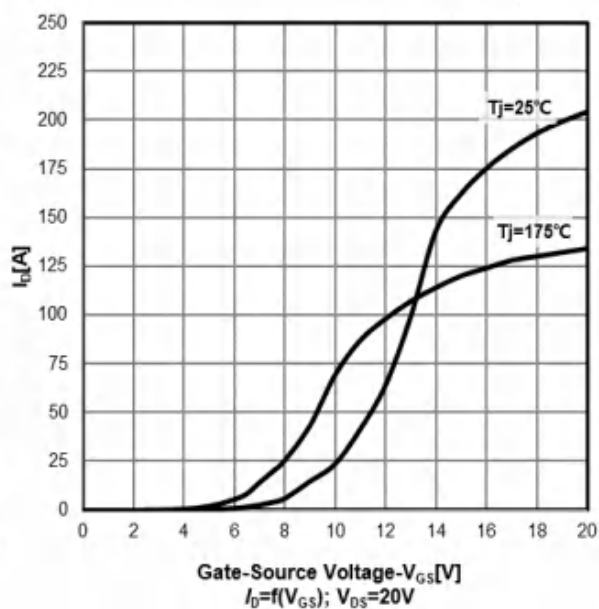
On-Region characteristics $T_j=25^\circ\text{C}$



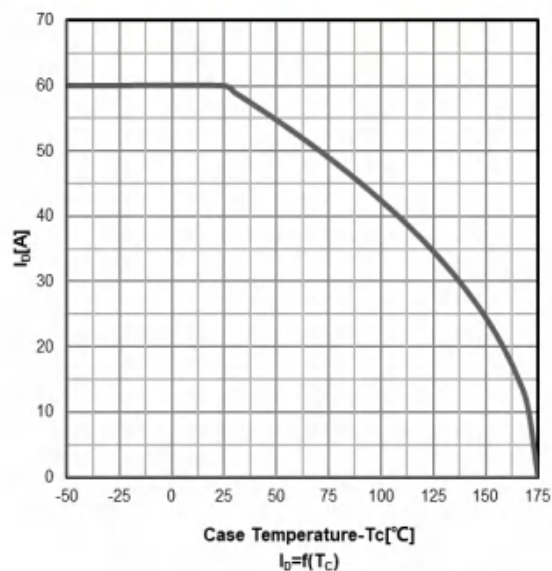
On-Region characteristics $T_j=175^\circ\text{C}$



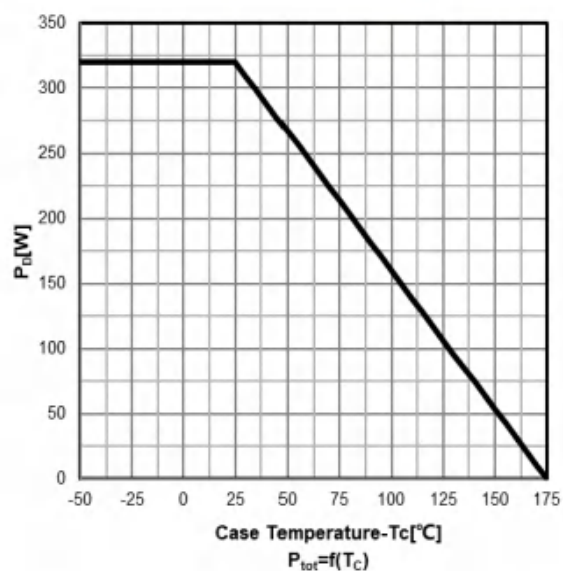
Transfer characteristics



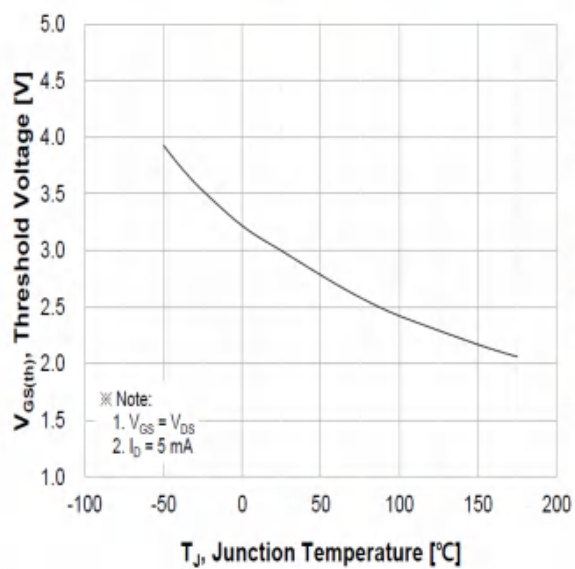
Drain current vs temperature



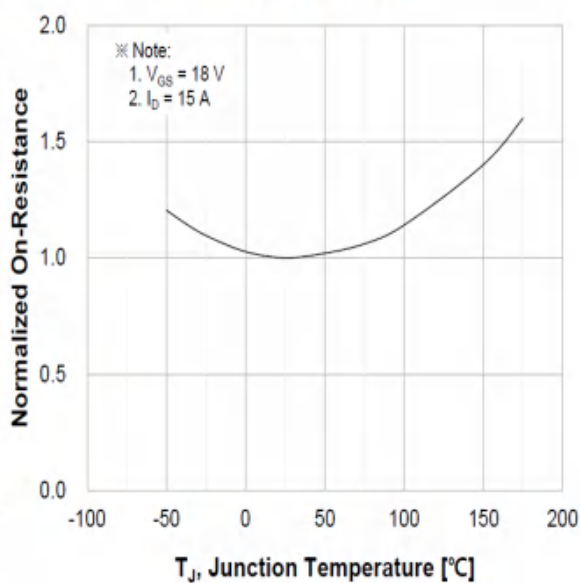
Power dissipation



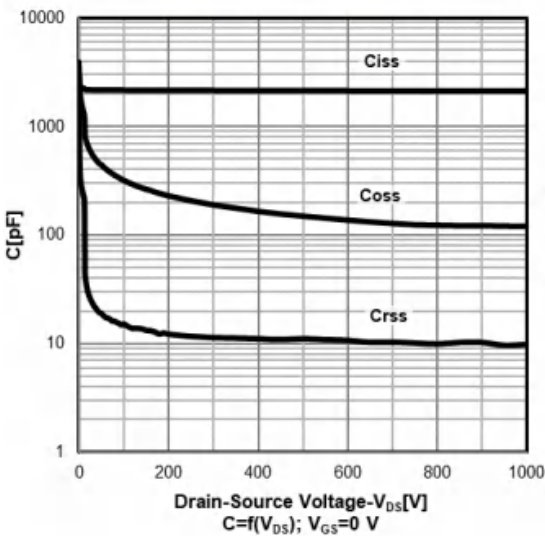
Threshold voltage vs temperature



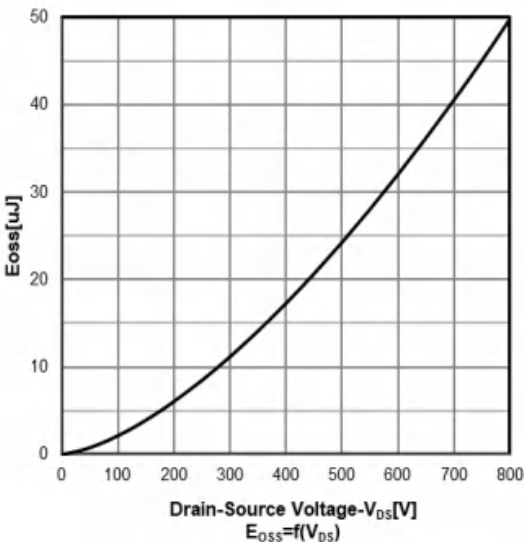
Normalized On-resistance vs temperature



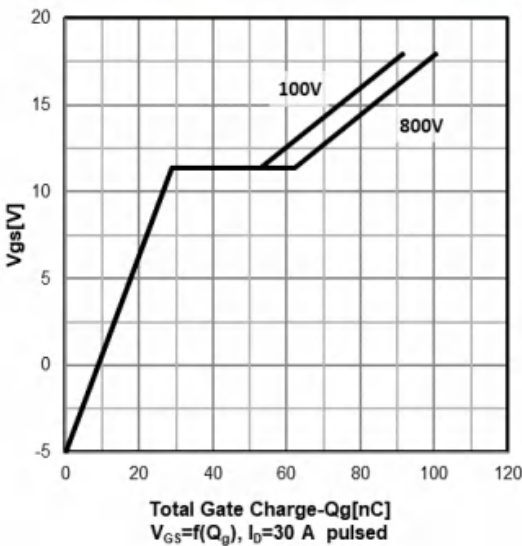
Typ. capacitances



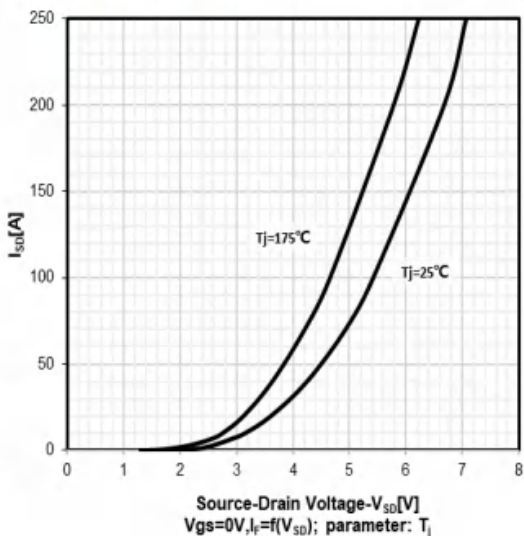
Coss stored energy



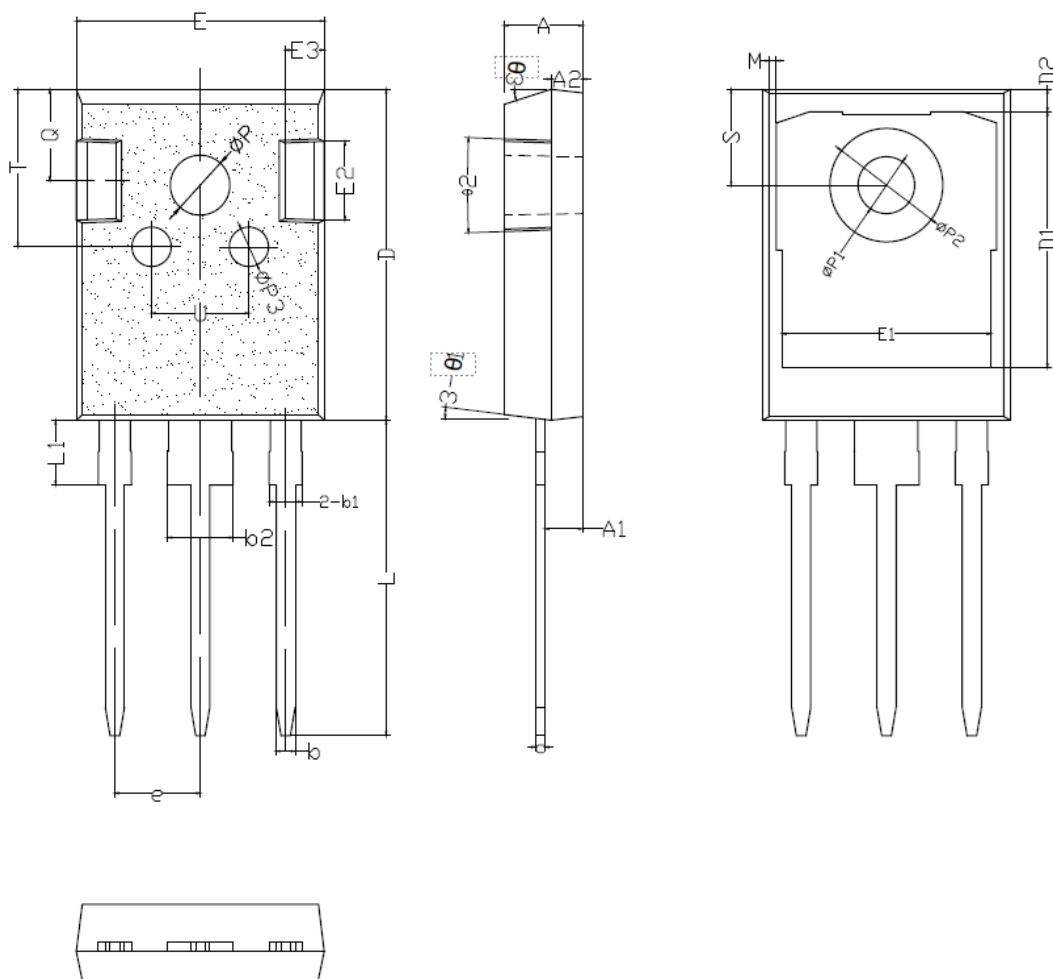
Typ. gate charge characteristics



Diode forward voltage characteristics
 $T_J=25^\circ\text{C}/175^\circ\text{C}$



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

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