

20V N-Channel MOSFET

General Description

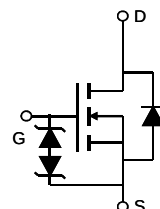
The BC3416 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch or in PWM applications. It is ESD protected.

Product Summary

MARKING: 3416

SOT-23

1. GATE
2. SOURCE
3. DRAIN



$T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
	V	20	V
Gate-Source Voltage	V_{GS}	± 8	V
Continuous Drain Current	I_D	6.5	A
		5.2	
Pulsed Drain Current ^C	I_{DM}	30	
Power Dissipation ^B	P_D	1.4	W
		0.9	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics					
Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10\text{s}$	$R_{\theta JA}$	70	90	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^{A D}	Steady-State		100	125	$^\circ\text{C/W}$
Maximum Junction-to-Lead	Steady-State	$R_{\theta JL}$	63	80	$^\circ\text{C/W}$

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	20			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=20\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}$, $V_{GS}=\pm 8\text{V}$			± 10	μA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	0.4	0.7	1.1	V
$I_{D(ON)}$	On state drain current	$V_{GS}=4.5\text{V}$, $V_{DS}=5\text{V}$	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=4.5\text{V}$, $I_D=6.5\text{A}$ $T_J=125^\circ\text{C}$		16 22	22 30	$\text{m}\Omega$
		$V_{GS}=2.5\text{V}$, $I_D=5.5\text{A}$		18	26	$\text{m}\Omega$
		$V_{GS}=1.8\text{V}$, $I_D=5\text{A}$		21	34	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}$, $I_D=6.5\text{A}$		50		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}$, $V_{GS}=0\text{V}$		0.62	1	V
I_S	Maximum Body-Diode Continuous Current				2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=10\text{V}$, $f=1\text{MHz}$		1295	1650	pF
C_{oss}	Output Capacitance			160		pF
C_{rss}	Reverse Transfer Capacitance			87		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		1.8		K Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=4.5\text{V}$, $V_{DS}=10\text{V}$, $I_D=6.5\text{A}$		10		nC
Q_{gs}	Gate Source Charge			4.2		nC
Q_{gd}	Gate Drain Charge			2.6		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=4.5\text{V}$, $V_{DS}=10\text{V}$, $R_L=1.54\Omega$, $R_{GEN}=3\Omega$		280		ns
t_r	Turn-On Rise Time			328		ns
$t_{D(off)}$	Turn-Off DelayTime			3.76		us
t_f	Turn-Off Fall Time			2.24		us
t_{rr}	Body Diode Reverse Recovery Time	$I_F=6.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		31	41	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=6.5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		6.8		nC

- A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design.
- B. The power dissipation P_D is based on $T_{J(MAX)}=150^\circ\text{C}$, using $\leq 10\text{s}$ junction-to-ambient thermal resistance.
- C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}=150^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.
- D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to lead $R_{\theta JL}$ and lead to ambient.
- E. The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.
- F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}=150^\circ\text{C}$. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

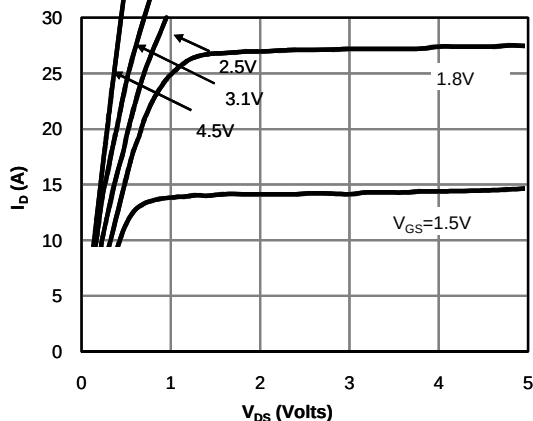


Figure 1: On-Region Characteristics (Note E)

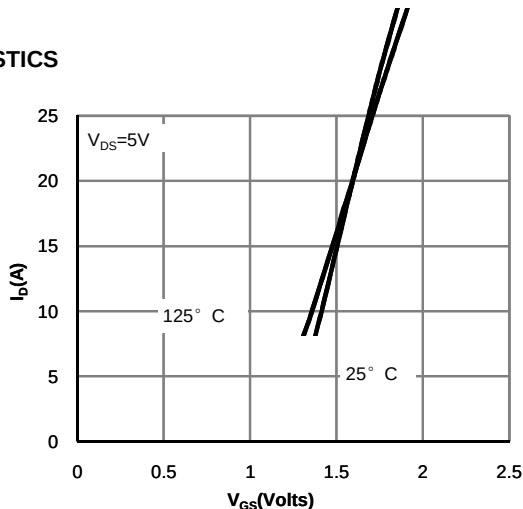


Figure 2: Transfer Characteristics (Note E)

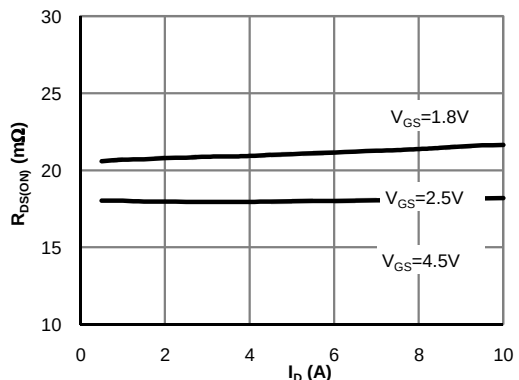


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

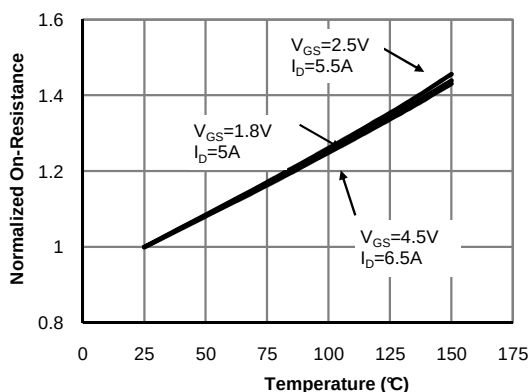


Figure 4: On-Resistance vs. Junction Temperature (Note E)

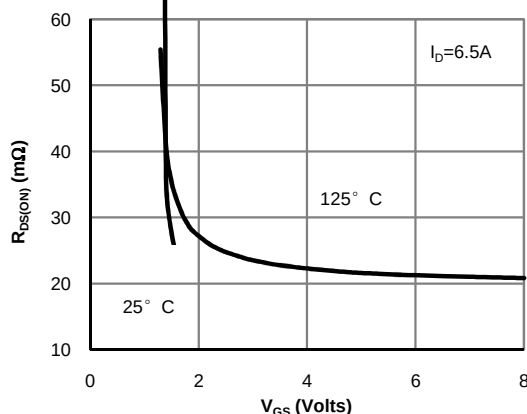


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

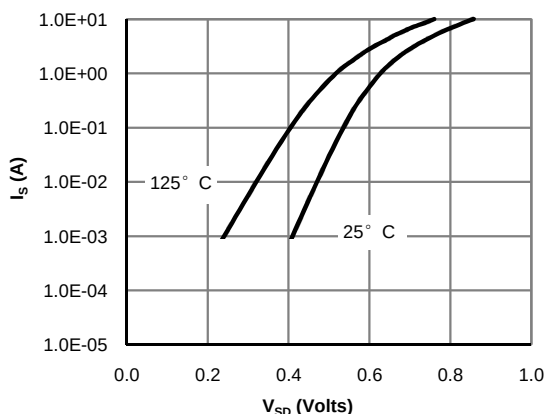
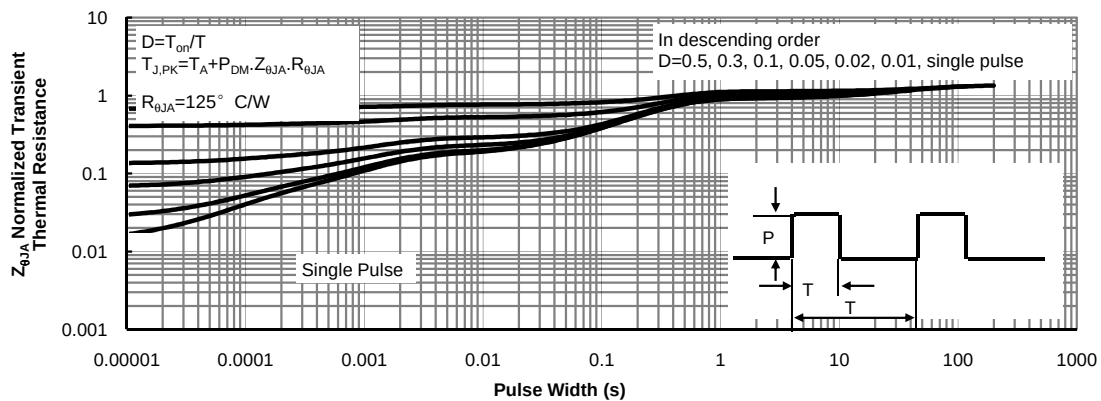
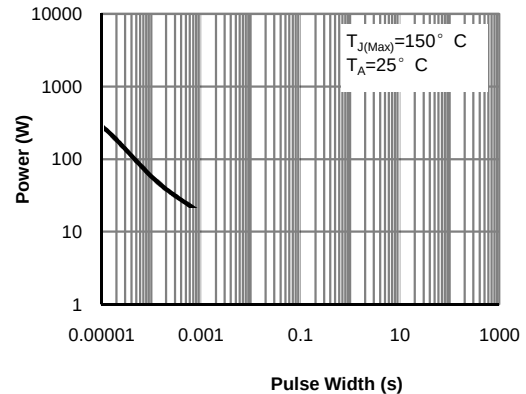
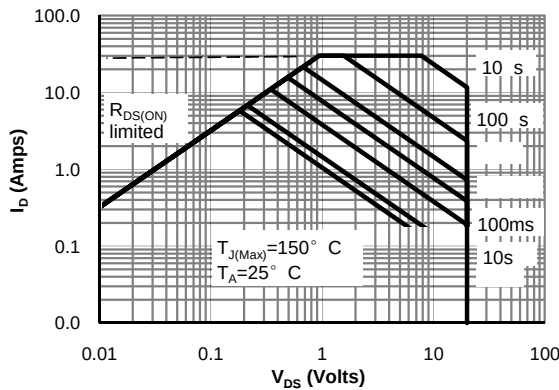
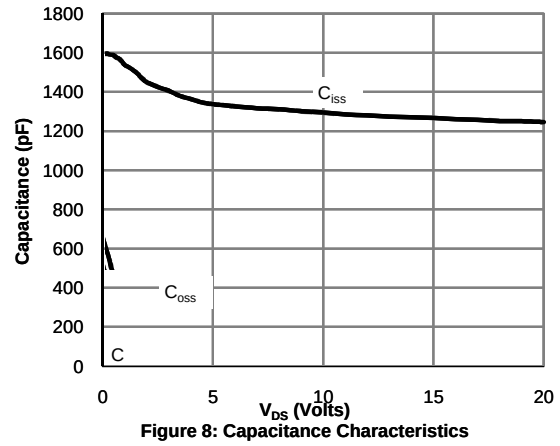
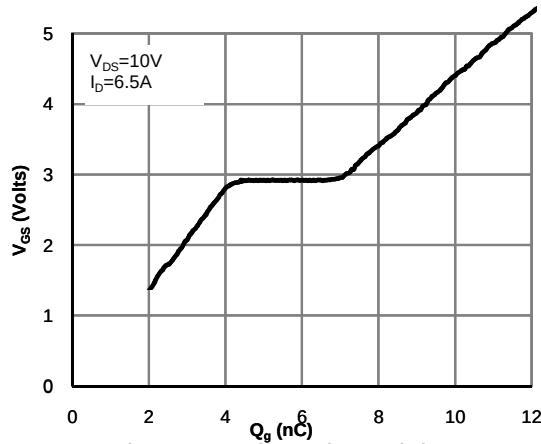
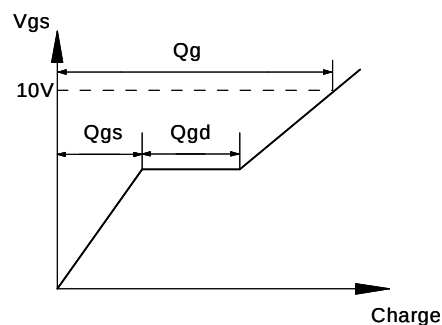
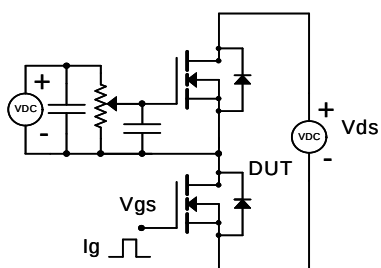


Figure 6: Body-Diode Characteristics (Note E)

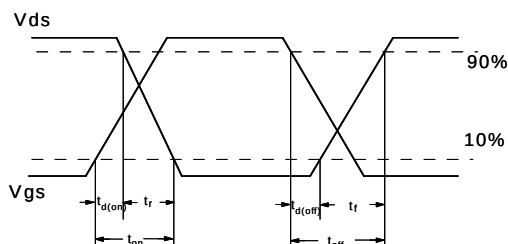
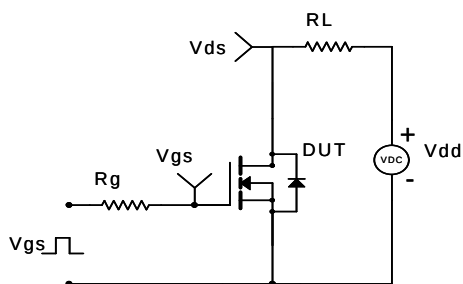
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

