

BCF65N180X1

N-Channel Silicon Carbide Power MOSFET

650 V, 20 A, 180 mΩ



bestirpower

Features

- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Halogen Free, and RoHS Compliant

$BV_{DSS}, T_C=25^{\circ}\text{C}$	$I_D, T_C=25^{\circ}\text{C}$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	20 A	180 mΩ	28.6 nC

Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort



Applications

- Solar inverter / ESS / UPS
- EV charging station
- Server & Telecom power
- Industrial power supply



Absolute Maximum Ratings ($T_J = 25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		0 / +18	V
I_D	Drain Current	$V_{GS} = 15\text{ V}, (T_C = 25^{\circ}\text{C})$	20	A
		$V_{GS} = 15\text{ V}, (T_C = 100^{\circ}\text{C})$	18	
I_{DM}	Drain Current	$V_{GS} = 15\text{ V}, (T_C = 25^{\circ}\text{C})$	40	A
P_{tot}	Power Dissipation	$(T_C = 25^{\circ}\text{C}, T_J=175^{\circ}\text{C})$	33	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	$^{\circ}\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	4.5	$^{\circ}\text{C/W}$

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 500\text{ }\mu\text{A}$	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	-	-	10	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +18\text{ V}, V_{DS} = 0\text{ V}$	-	-	250	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 3.5\text{ mA}$	2.7	-	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 15\text{ V}, I_D = 8.5\text{ A}$		180	240	mΩ
		$V_{GS} = 15\text{ V}, I_D = 8.5\text{ A}, T_J = 175^\circ\text{C}$		160		
		$V_{GS} = 18\text{ V}, I_D = 8.5\text{ A}$	-	120	-	
		$V_{GS} = 18\text{ V}, I_D = 8.5\text{ A}, T_J = 175^\circ\text{C}$	-	130	-	

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}, T_J = 25^\circ\text{C}$	-	491	-	pF
C_{oss}	Output Capacitance		-	39	-	
C_{rss}	Reverse Capacitance		-	4.2	-	
$Q_{g(tot)}$	Total Gate Charge	$V_{GS} = 0/15\text{ V}, V_{DS} = 500\text{ V}, I_D = 8.5\text{ A}, T_J = 25^\circ\text{C}$	-	28.6	-	nC
Q_{gs}	Gate to Source Charge		-	8.3	-	
Q_{gd}	Gate to Drain "Miller" Charge		-	13.8	-	
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	-	6.5	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 0/15\text{ V}, V_{DD} = 500\text{ V}, I_D = 8.5\text{ A}, R_G = 10\text{ }\Omega,$	-	16	-	ns
t_r	Turn-On Rise Time		-	55	-	
$t_{d(off)}$	Turn-Off Delay Time		-	34	-	
t_f	Turn-Off Fall Time		-	71	-	

Source-Drain Diode Characteristics

I_S	Maximum Continuous Diode Forward Current		-	20	-	A
V_{SD}	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 5\text{ A}, T_J = 25^\circ\text{C}$	-	3.4	-	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_{SD} = 8.5\text{ A}, V_R = 500\text{ V}, dI/dt = 530\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$	-	17.6	-	ns
Q_{rr}	Reverse Recovery Charge		-	43	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	4.2	-	A

Typical Performance Characteristics

Figure 1. Output Characteristics $T = 25^{\circ}\text{C}$

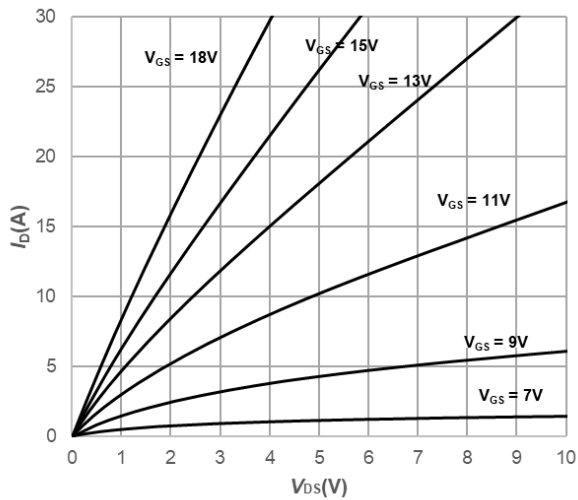


Figure 2. Output Characteristics $T = 175^{\circ}\text{C}$

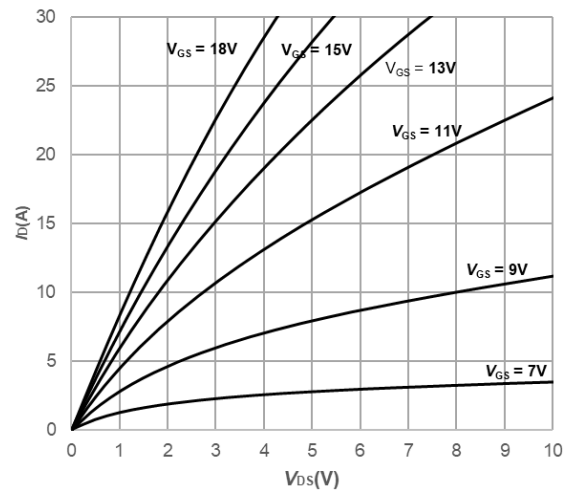


Figure 3. Typical Transfer Characteristics

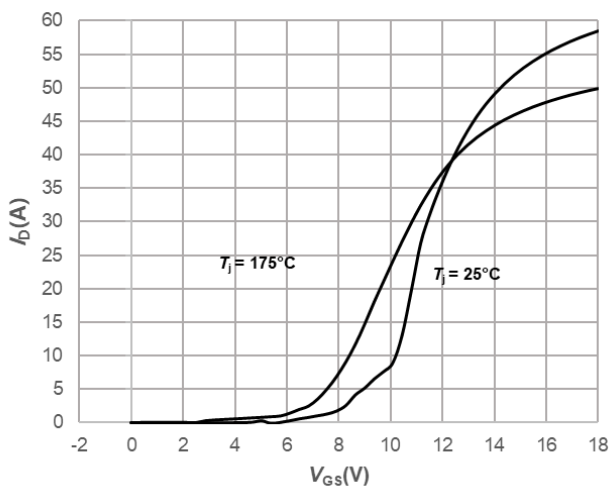


Figure 4. Normalized On Resistance vs. Temperature

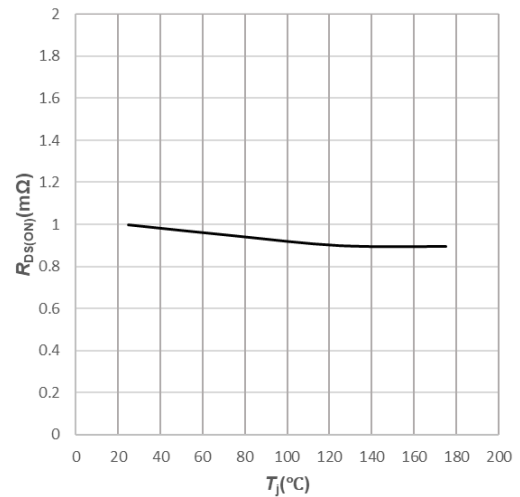


Figure 5. Normalized On Resistance vs. Drain Current For Various Temperatures

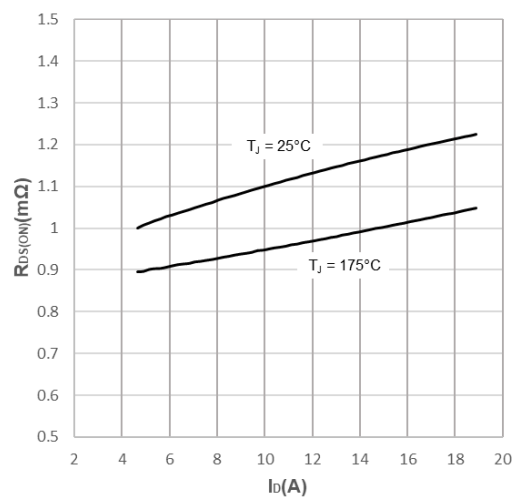
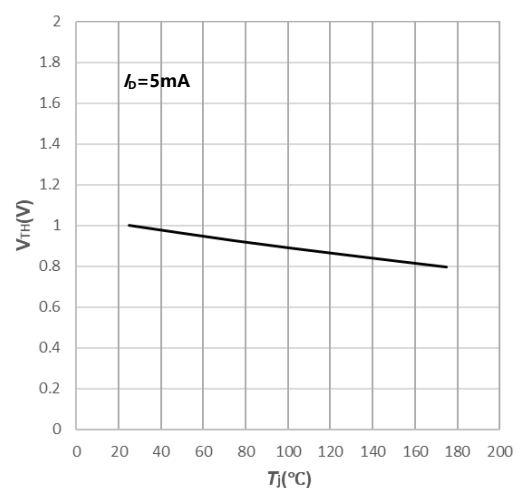


Figure 6. Normalized Threshold Voltage vs. Temperature



Typical Performance Characteristics

Figure 7. Capacitances vs. Drain Source Voltage (0-200 V)

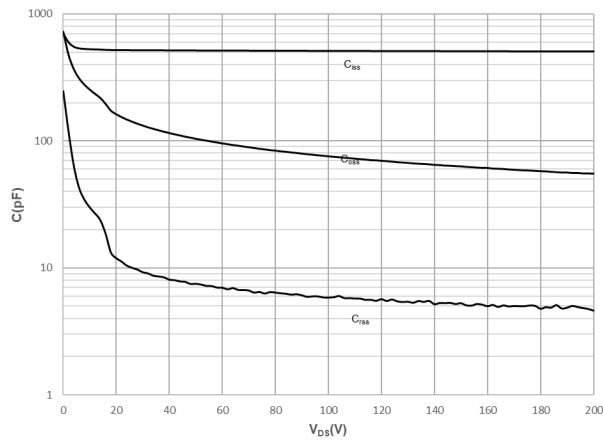


Figure 8. Capacitances vs. Drain Source Voltage (0-600V)

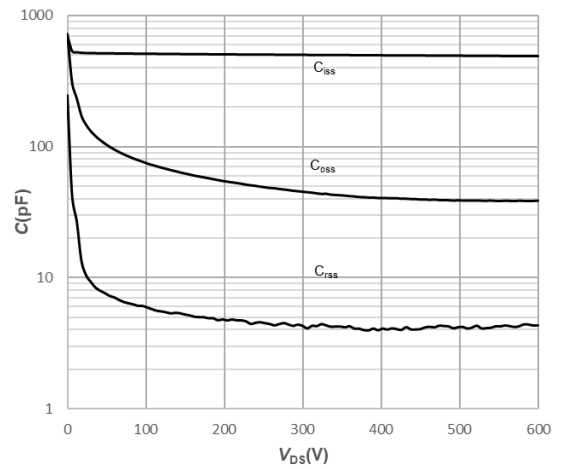


Figure 9. Body Diode Characteristics

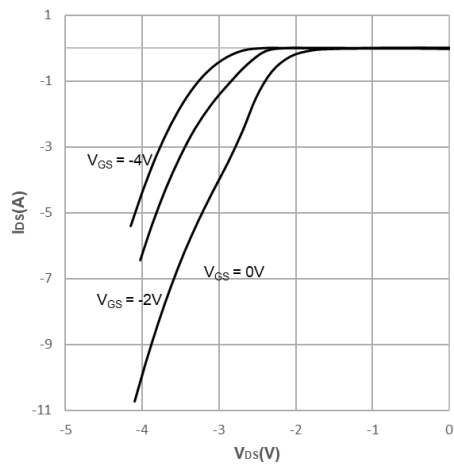
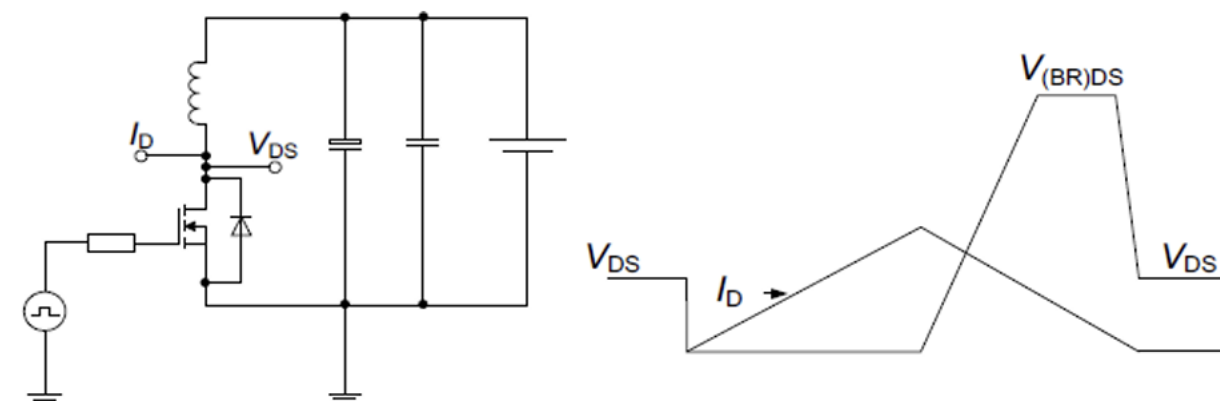
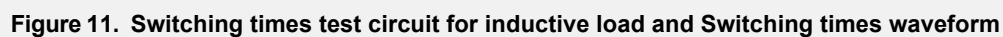
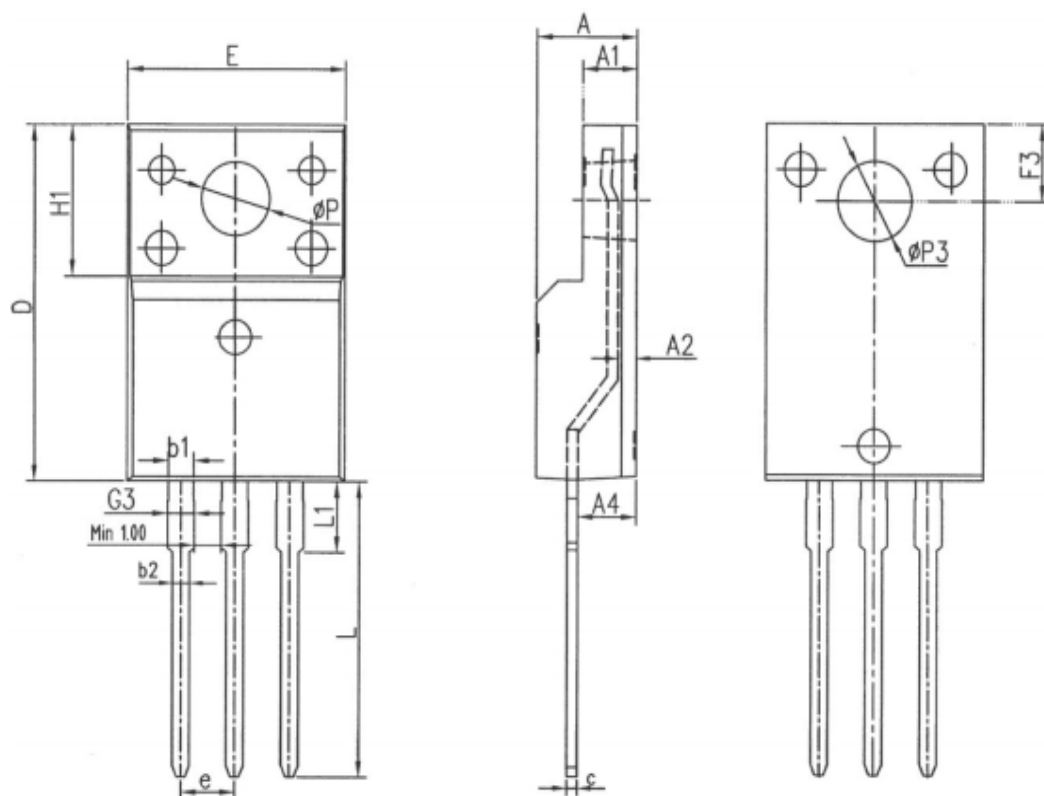


Figure 10. Test circuit for diode characteristics and Diode recovery waveform



Package Outlines

TO-220F



COMMON DIMENSIONS

SYMBOL	MM		
	MTN	NOM	MAX
E	10.00	10.20	10.40
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.65	0.85	1.30
A4	2.55	2.75	2.95
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
ΦP	3.183REF		
L	12.68	12.98	13.28
L1	3.25	3.45	3.65
ΦP3	3.45REF		
F3	3.10	3.30	3.50
G3	1.10	1.30	1.50
b1	1.05	1.20	1.35
b2	0.70	0.80	0.92

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCF65N180X1	BCF65N180X1	TO-220F	Tube	50 units

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