BCZ65N45M1

N-Channel Silicon Carbide Power MOSFET

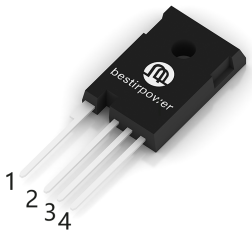
650 V, 42 A, 45 mΩ

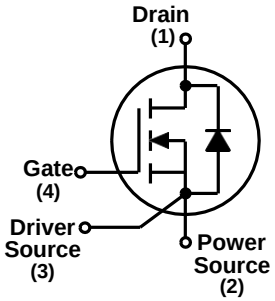
bestirpower

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

$BV_{DSS, Tc=25℃}$	$I_{D, Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	44 A	45 mΩ	55 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

RoHS compliant

HF

Absolute Maximum Ratings (T_J = 25℃ 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		-5 / +18	V
I_D	Drain Current	V_{GS} = 18 V, (T_C = 25℃)	44	A
		V_{GS} = 18 V, (T_C = 100℃)	31	
I_{DM}	Drain Current	Pulsed (Note1)	117	A
P_D	Power Dissipation	(T_C = 25℃)	150	W
		Derate Above 25℃	1.0	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	℃

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.0	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	
Tsold	Soldering temperature, wave soldering only allowed at leads	260	℃

Electrical Characteristics (T_J = 25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	-	1	100	µA
		V_{DS} = 650 V, V_{GS} = 0 V, T_J = 175℃	-	10	-	
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +22 V, V_{DS} = 0 V	-	-	+100	nA
		V_{GS} = -10 V, V_{DS} = 0 V	-	-	-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 7 mA	1.8	2.8	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 18 V, I_D = 20 A	-	45	63	mΩ
		V_{GS} = 18 V, I_D = 20 A, T_J = 175℃	-	59	-	
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 20 A	-	13.4	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0V, f = 1 MHz	-	1048	-	pF
C_{oss}	Output Capacitance		-	131	-	
C_{rss}	Reverse Capacitance		-	9.1	-	
E_{oss}	Stored Energy in Output Capacitance	V_{DS} = 0 V to 400 V, V_{GS} = 0 V	-	13.0	-	µJ
$C_{o(er)}$	Energy Related Output Capacitance		-	162.0	-	pF
$C_{o(tr)}$	Time Related Output Capacitance		-	236	-	
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 400 V, I_D = 20 A, V_{GS} = -5 V / 18 V, Inductive load	-	56	-	nC
Q_{gs}	Gate to Source Charge		-	14	-	
Q_{gd}	Gate to Drain “Miller” Charge		-	15	-	
R_G	Internal Gate Resistance	f = 1MHz, V_{AC}=30mV open drain	-	4.0	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 400 V, I_D = 20 A, V_{GS} = -5 V / 18 V, R_G = 2 Ω, FWD : BCH65S012D1, Inductive load	-	13	-	ns
t_r	Turn-On Rise Time		-	10	-	
$t_{d(off)}$	Turn-Off Delay Time		-	26	-	
t_f	Turn-Off Fall Time		-	5	-	
E_{on}	Turn-on Switching Energy		-	27	-	µJ
E_{off}	Turn-off Switching Energy		-	18	-	
E_{tot}	Total Switching Energy		-	45	-	
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current		-	-	42	A
I_{SM}	Maximum Pulsed Diode Forward Current		-	-	117	
V_{SD}	Diode Forward Voltage	V_{GS} = -5 V, I_{SD} = 20 A	-	4.2	-	V
t_{rr}	Reverse Recovery Time	V_{DD} = 400 V, I_{SD} = 20 A, dI_F/dt = 1000 A/µs, Includes Q_{OSS}	-	17	-	ns
Q_{rr}	Reverse Recovery Charge		-	104	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	10	-	A

Typical Performance Characteristics

Figure 1. On-Region Characteristics T_J = -40℃

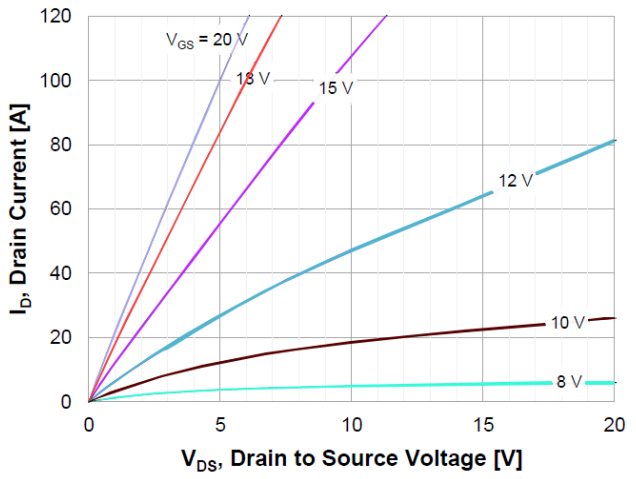


Figure 2. On-Region Characteristics T_J = 25℃

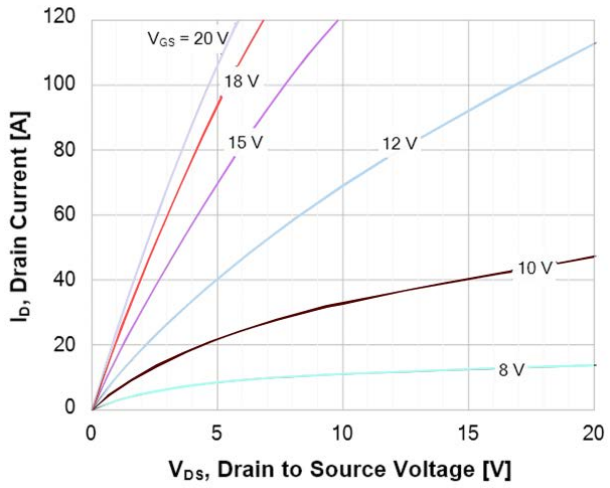


Figure 3. On-Region Characteristics T_J = 125℃

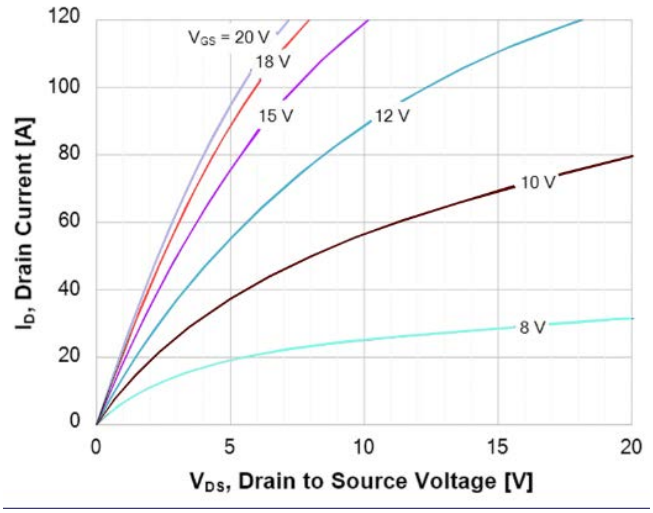


Figure 4. On-Region Characteristics T_J = 175℃

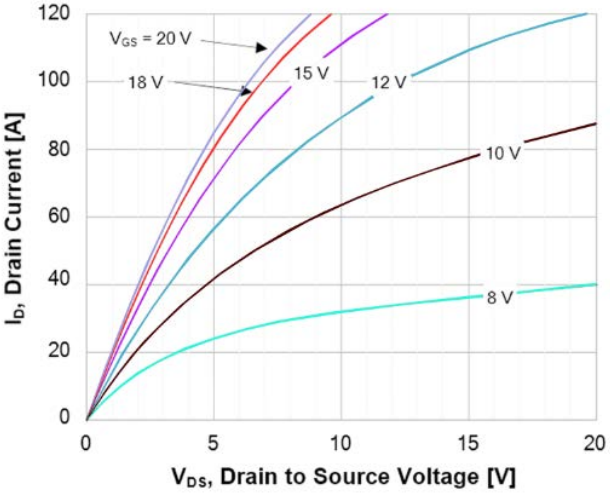


Figure 5. On-Resistance Characteristics vs. Temperature

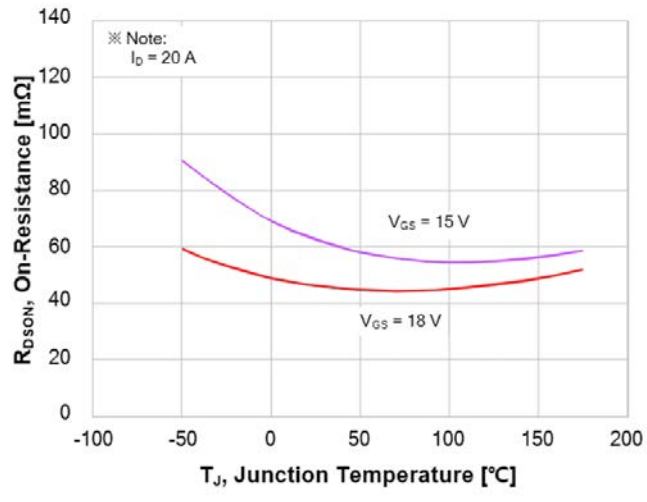
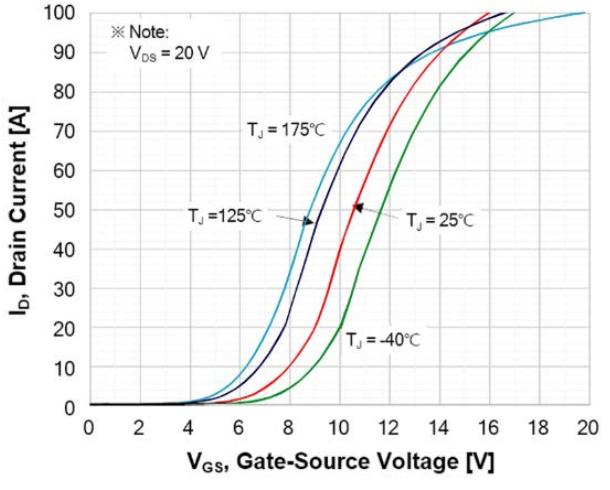


Figure 6. Transfer Characteristics



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃

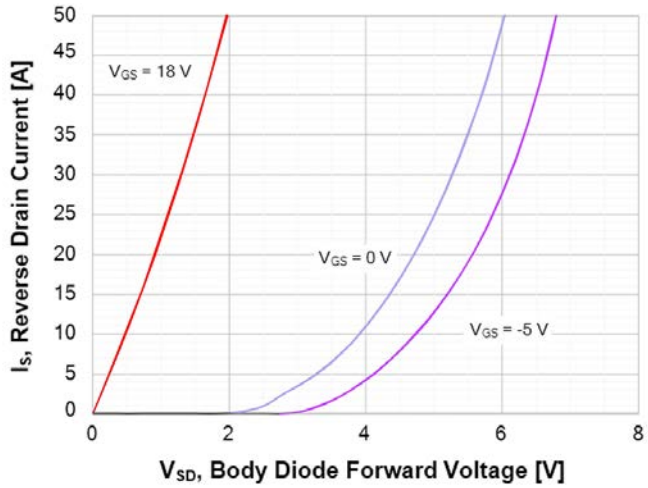


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

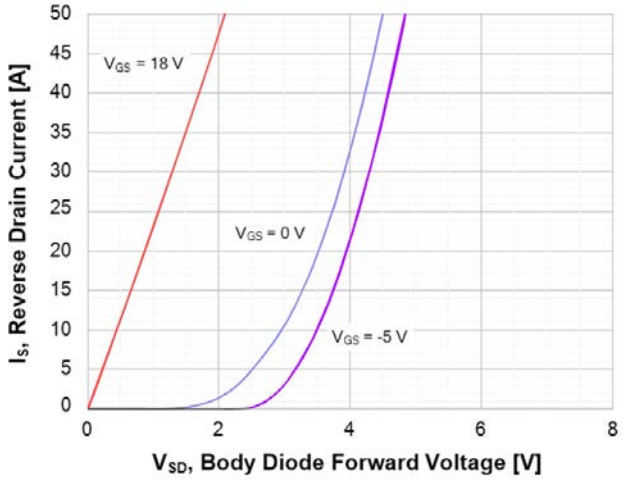


Figure 9. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 125℃

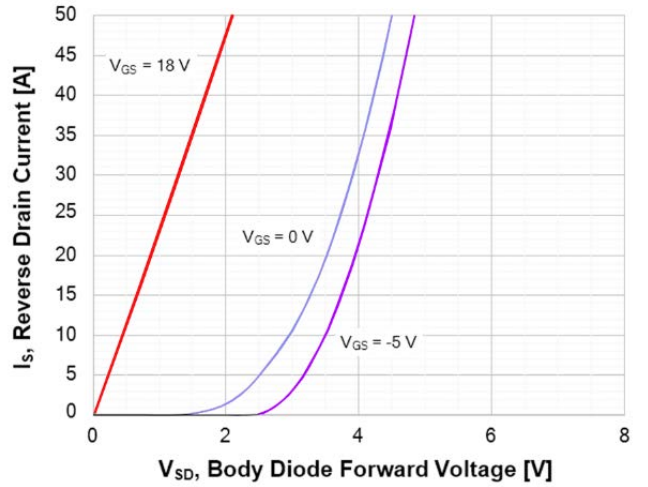


Figure 10. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

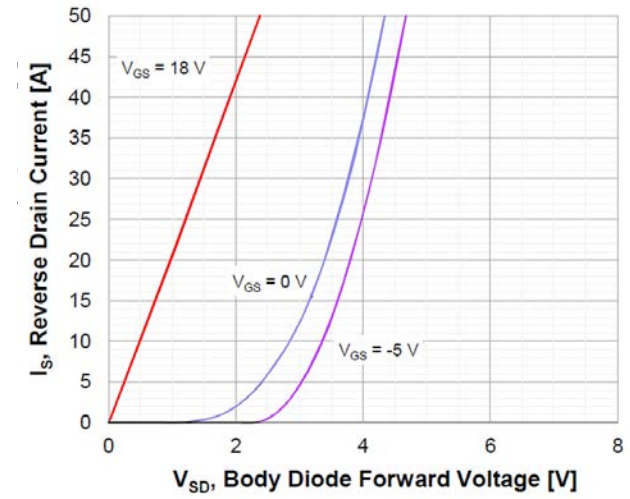


Figure 11. Threshold Voltage vs. Temperature

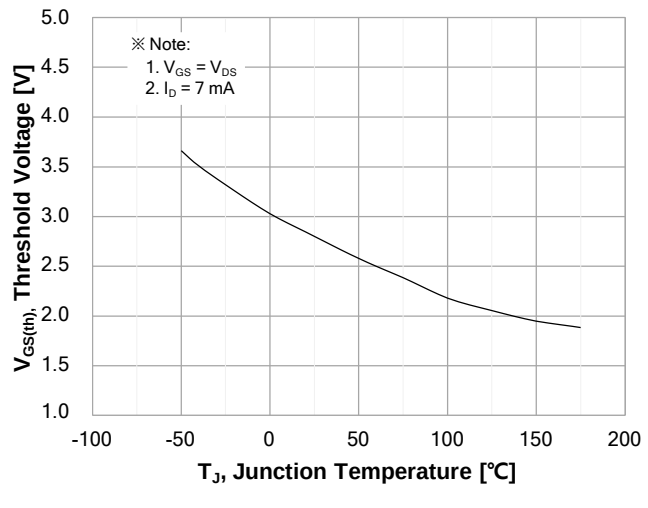
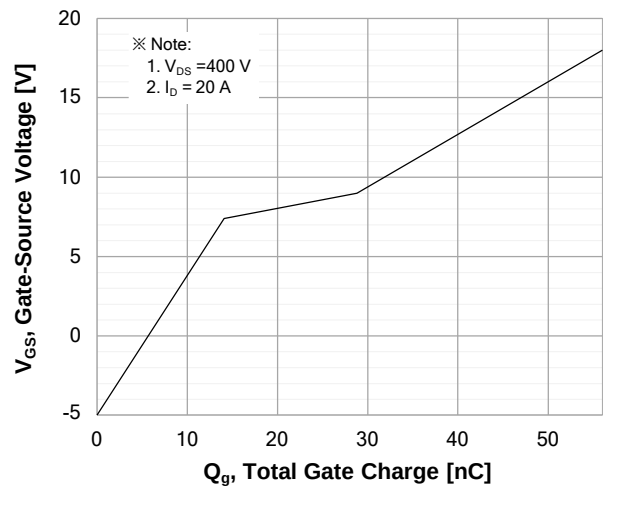


Figure 12. Gate Charge Characteristics



Typical Performance Characteristics

Figure 13. Stored Energy in Output Capacitance

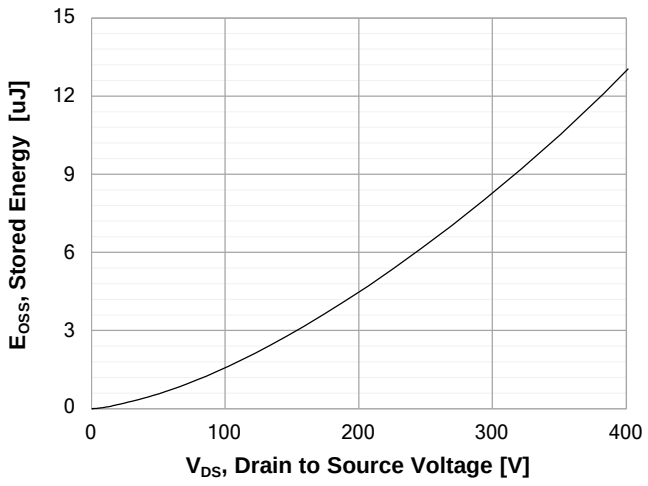


Figure 14. Capacitance Characteristics

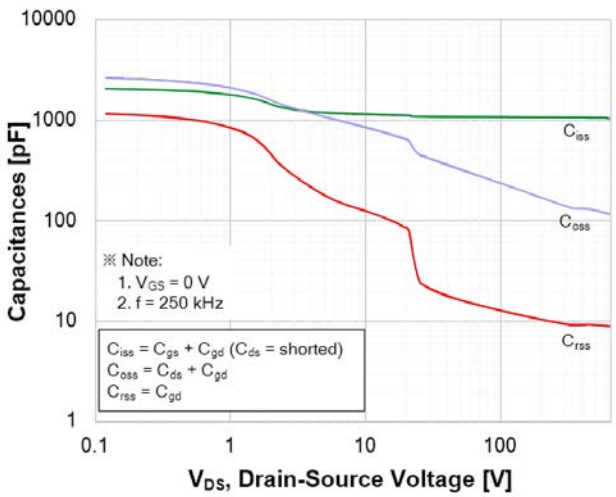


Figure 15. Continuous Drain Current Derating vs. Case Temperature

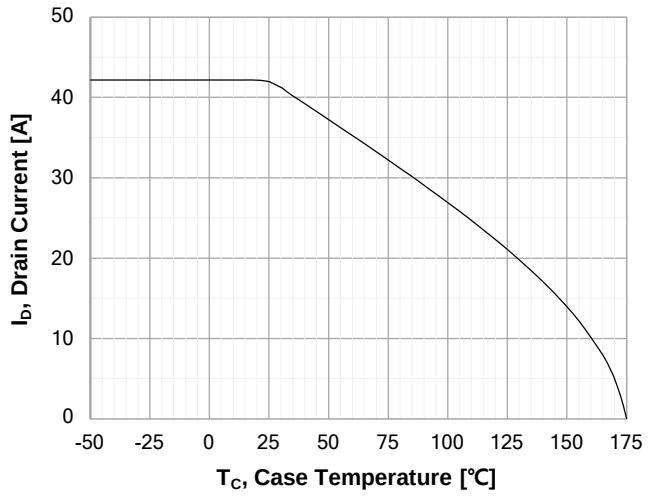


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

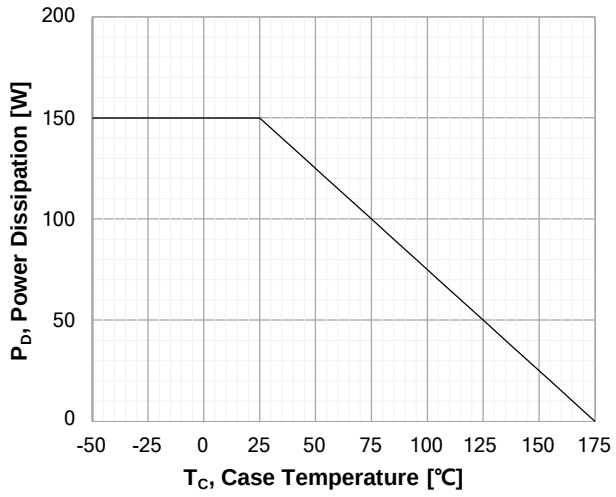


Figure 17. Typ. Switching Losses vs. Drain Current

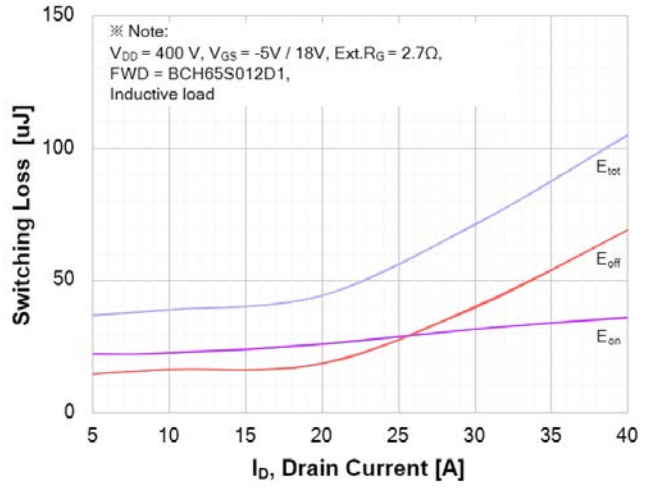
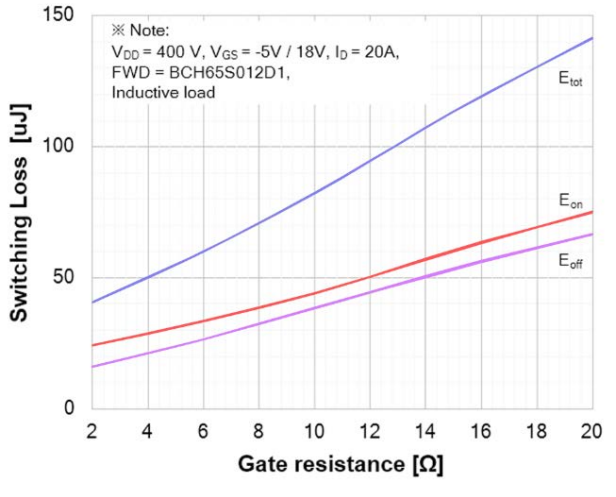


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Typ. Switching Losses vs. Drain Current

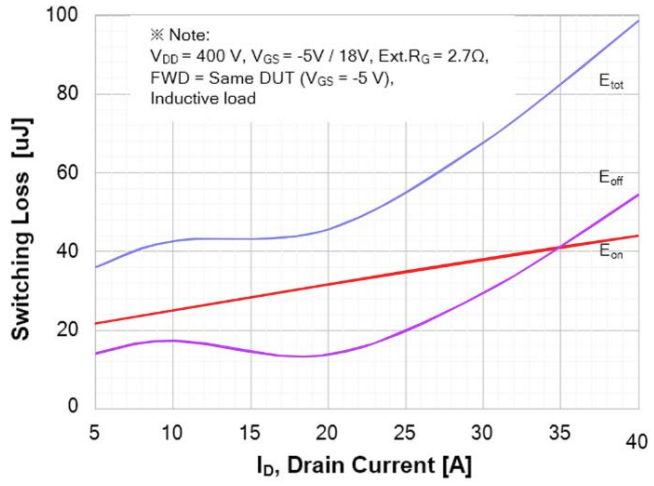


Figure 20. Typ. Switching Losses vs. Gate Resistance

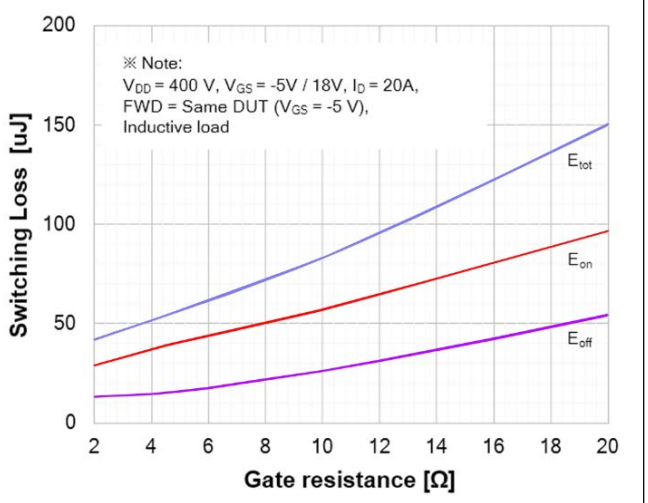


Figure 21. Maximum Safe Operating Area

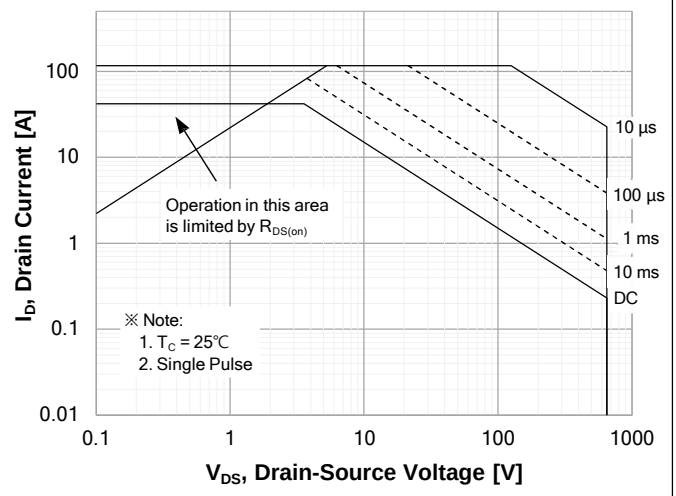
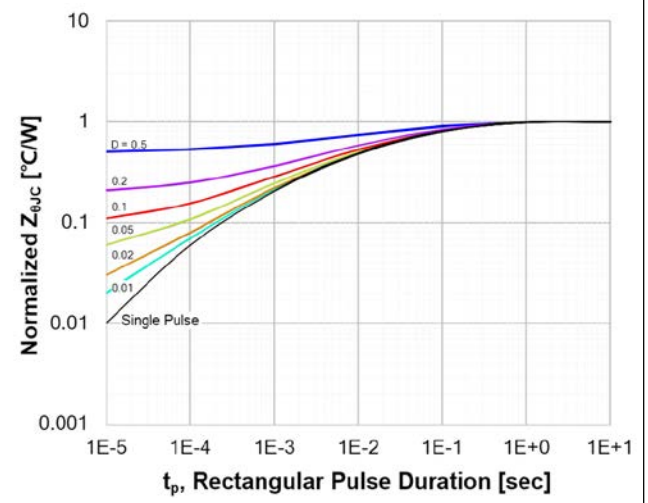


Figure 22. Transient Thermal Response Curve



Typical Performance Characteristics

Figure 21. Inductive Load Switching Test Circuit and Waveforms

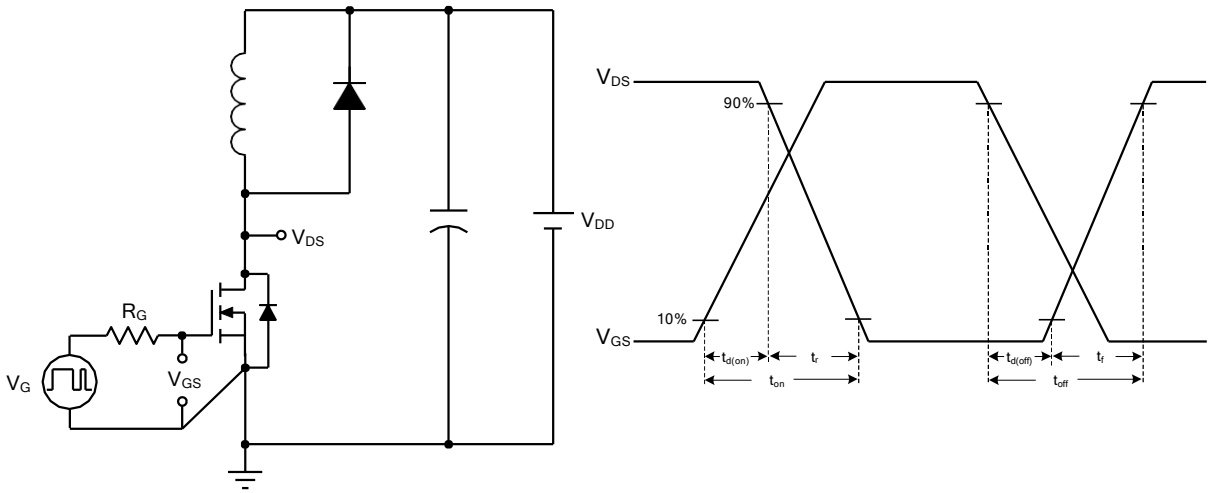
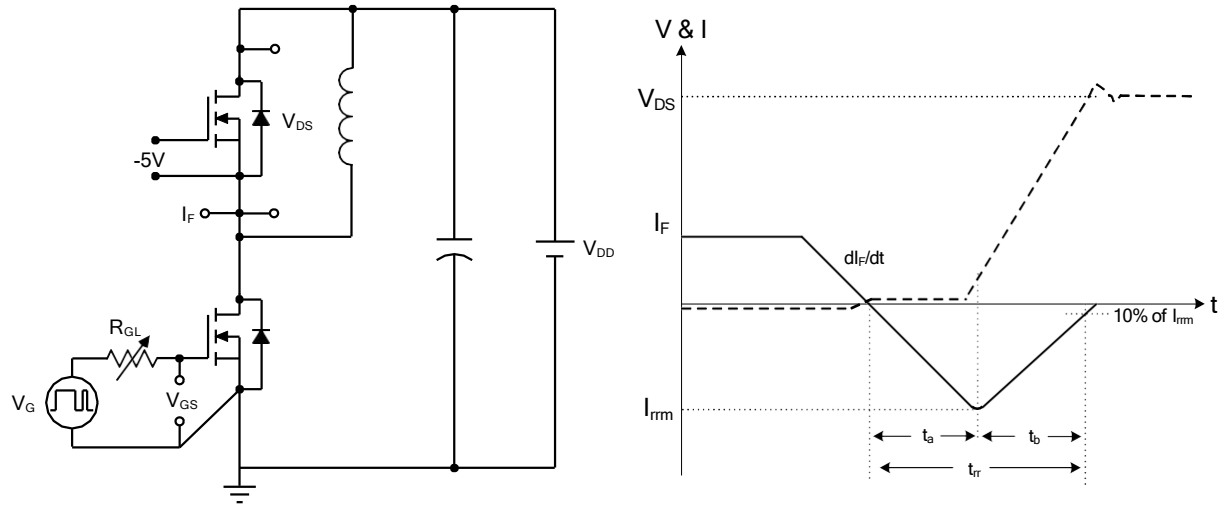
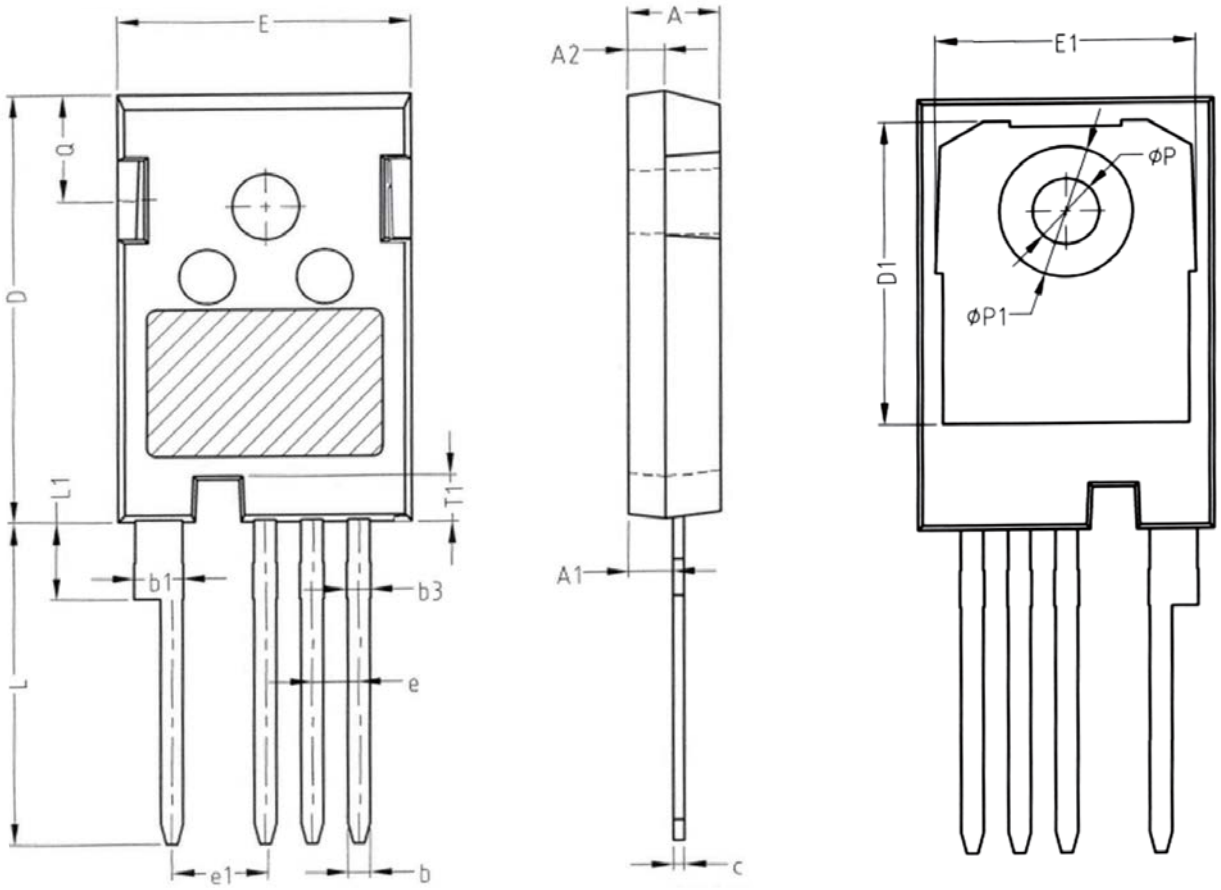


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO247-4



SYMBOL	NM		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.80	2.00	2.20
b	1.06	1.21	1.36
b1	2.33	2.63	2.93
b3	1.07	1.30	1.60
c	0.51	0.61	0.75
D	23.30	23.45	23.60
D1	16.25	16.55	16.85
E	15.74	15.94	16.14
E1	13.72	14.02	14.32
T1	2.35	2.50	2.65
e	2.54 BSC		
e1	5.08 BSC		
Q	5.49	5.79	6.09
L	17.27	17.57	17.87
L1	3.99	4.19	4.39
Φp	3.40	3.60	3.80
Φp1	7.19 REF		

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCZ65N45M1	BCZ65N45M1	TO-247-4L	Tube	30 units

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