BCZ120N40M1

N-Channel Silicon Carbide Power MOSFET

1200 V, 60 A, 40 mΩ

bestirpower

$BV_{DSS,\ Tc=25℃}$	$I_{D,\ Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
1200 V	60 A	40 mΩ	109nC

Features

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

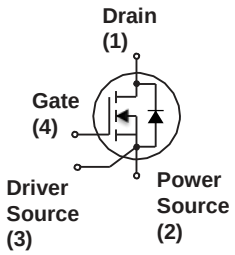
Benefits

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

Applications

- Solar inverter
- EV charging station
- UPS
- Industrial power supply

TO-247-4L



Absolute Maximum Ratings (T_J = 25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	Continuous (V_{GS}=18V, T_C = 25℃)	60	A
		Continuous (V_{GS}=18V, T_C = 100℃)	42	
I_{DM}	Drain Current	Pulsed (Note1)	160	A
E_{AS}	Avalanche Capability	VDD=100V, VGS=20V, L=2mH	1000	mJ
I_{AV}	Avalanche Capability	VDD=100V, VGS=20V, L=2mH	30	A
P_D	Power Dissipation	(T_C = 25℃)	375	W
		Derate Above 25℃	2.5	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	℃

※Note 1 : Limited by maximum junction temperature.

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.4	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	34	
Tsold	Soldering temperature, wave soldering only allowed at leads	260	℃

Electrical Characteristics (T_C = 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	1200	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200 V, V_{GS} = 0 V	-	1	100	μA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 175℃	-	5	-	
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	

Electrical Characteristics (T_J = 25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 10 mA	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 18 V, I_D = 30 A	-	40	56	mΩ
		V_{GS} = 18 V, I_D = 30 A, T_J = 175℃	-	51	-	
		V_{GS} = 15 V, I_D = 30 A	-	50	-	
		V_{GS} = 15 V, I_D = 30 A, T_J = 150℃	-	53	-	
		V_{GS} = 15 V, I_D = 30 A, T_J = 175℃	-	59	-	
		V_{GS} = 18 V, I_D = 40 A	-	40	-	
		V_{GS} = 18 V, I_D = 40 A, T_J = 150℃	-	54	-	
		V_{GS} = 18 V, I_D = 40 A, T_J = 175℃	-	58	-	
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 30 A	-	15	-	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 800 V, V_{GS} = 0V, f = 250 kHz	-	1960	-	pF
C_{oss}	Output Capacitance		-	125	-	
C_{rss}	Reverse Capacitance		-	5	-	
E_{oss}	Stored Energy in Output Capacitance	V_{DS} = 0 V to 800 V, V_{GS} = 0 V	-	50	-	μJ
$C_{o(er)}$	Energy Related Output Capacitance		-	146	-	pF
$C_{o(tr)}$	Time Related Output Capacitance		-	258	-	
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 800 V, I_D = 30 A, V_{GS} = -5 V / 18 V	-	109	-	nC
Q_{gs}	Gate to Source Charge		-	28	-	
Q_{gd}	Gate to Drain “Miller” Charge		-	35	-	
R_G	Internal Gate Resistance	f = 1MHz, V_{AC}=30mV open drain	-	3.5	-	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 800 V, I_D = 30 A, V_{GS} = -5 V / 18 V, R_G = 2.5Ω , FWD : BCH120S020D1, Inductive load	-	18	-	ns
t_r	Turn-On Rise Time		-	13	-	
$t_{d(off)}$	Turn-Off Delay Time		-	35	-	
t_f	Turn-Off Fall Time		-	8	-	
E_{on}	Turn-on Switching Energy		-	232	-	μJ
E_{off}	Turn-off Switching Energy		-	73	-	
E_{tot}	Total Switching Energy		-	305	-	
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current		-	-	60	A
I_{SM}	Maximum Pulsed Diode Forward Current		-	-	160	
V_{SD}	Diode Forward Voltage	V_{GS} = -5 V, I_{SD} = 30 A	-	4.2	-	V
t_{rr}	Reverse Recovery Time	V_{DD} = 800 V, I_{SD} = 30 A, dI_F/dt = 3000 A/μs	-	22	-	ns
Q_{rr}	Reverse Recovery Charge		-	348	-	nC
t_{rr}	Reverse Recovery Time	V_{GS}=-5V,V_{DD} = 800 V, I_{SD} = 40 A, dI_F/dt = 4200 A/μs	-	13	-	ns
Q_{rr}	Reverse Recovery Charge		-	182	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	23	-	A

Typical Performance Characteristics

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

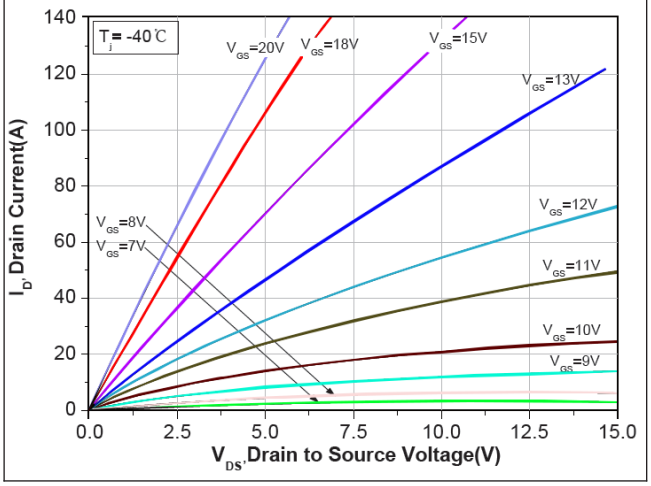


Figure 2. On-Region Characteristics T_J = 25℃

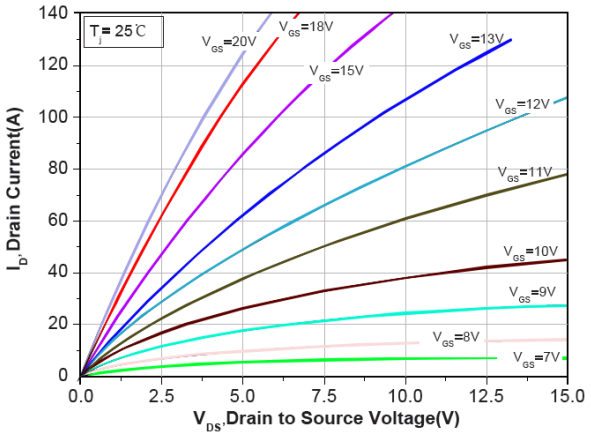


Figure 3. On-Region Characteristics T_J = 175℃

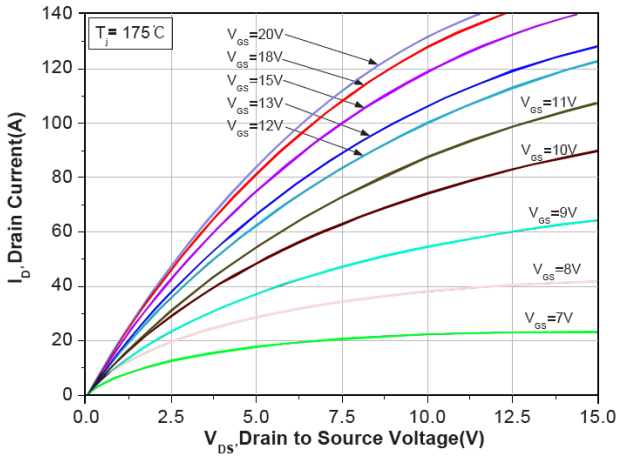


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

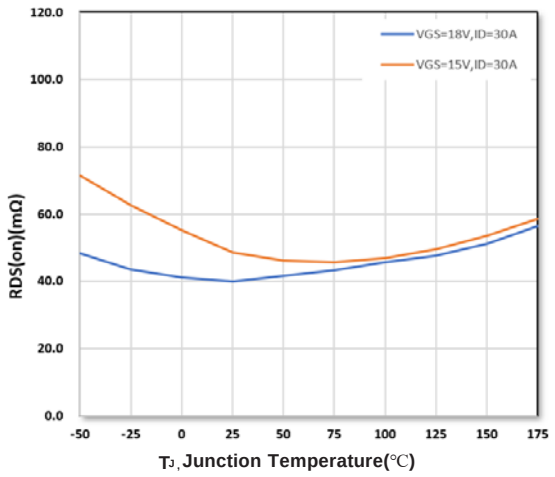


Figure 5. Transfer Characteristics

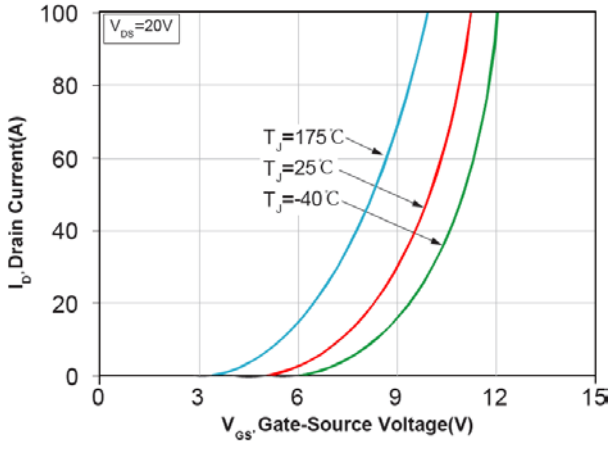
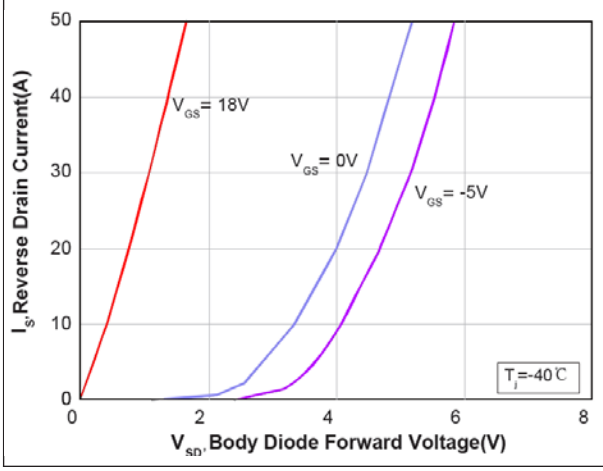


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

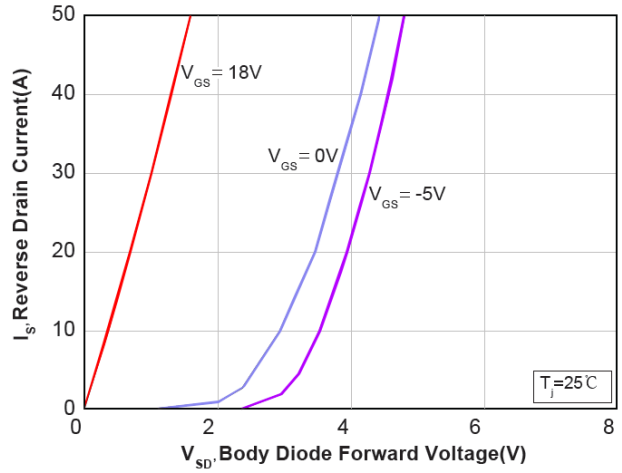


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

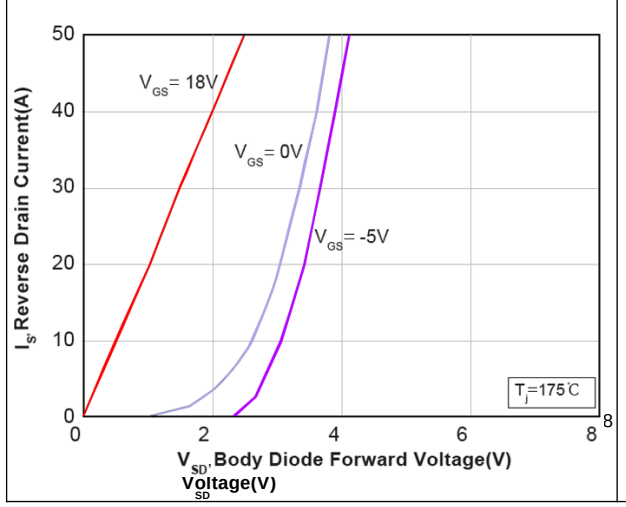


Figure 9. Threshold Voltage vs. Temperature

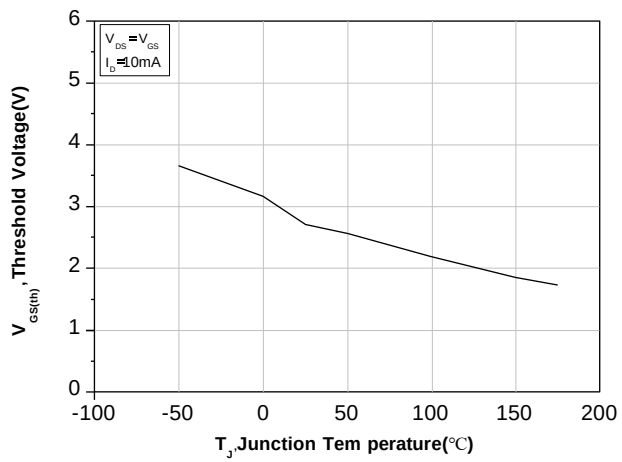


Figure 10. Gate Charge Characteristics

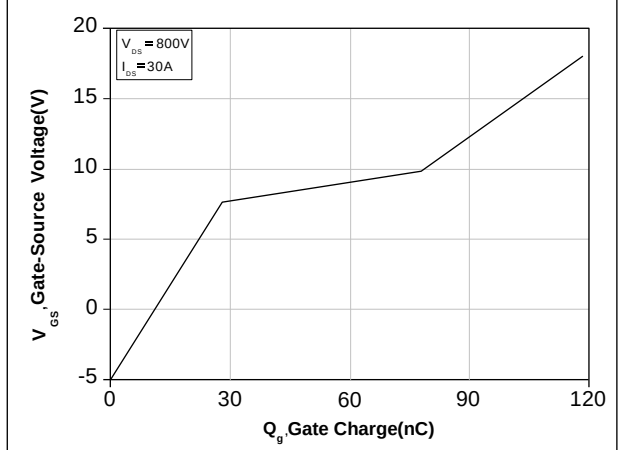


Figure 11. Stored Energy in Output Capacitance (0~800V)

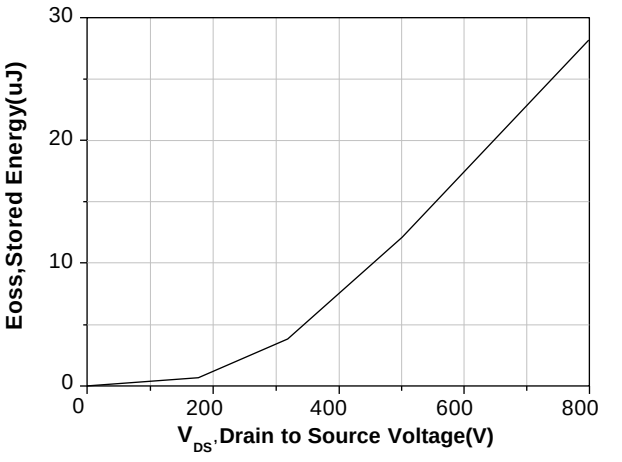
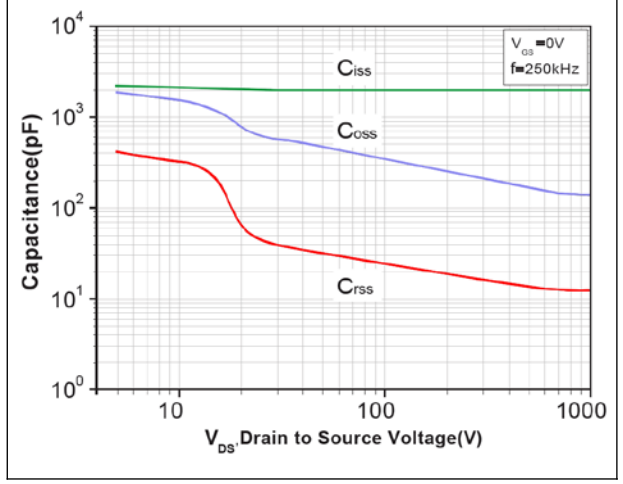


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

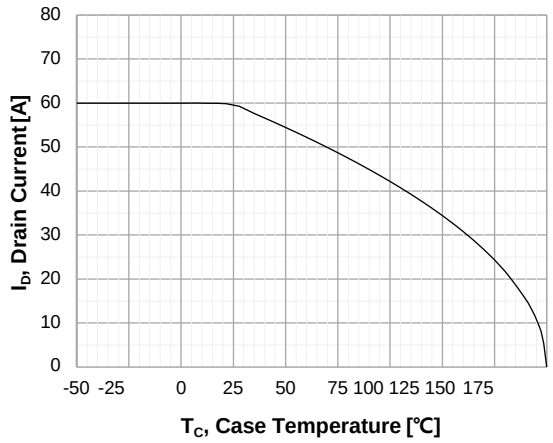


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

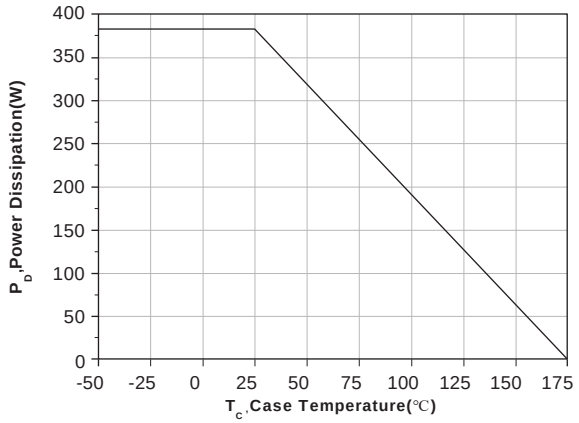


Figure 15. Typ. Switching losses vs. Drain current

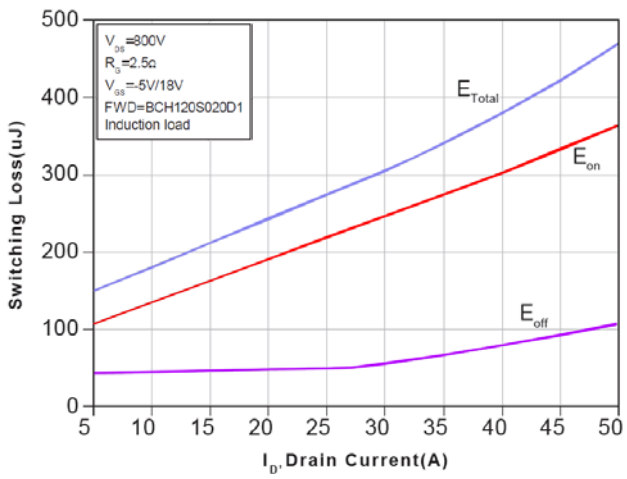


Figure 16. Typ. Switching losses vs. Gate resistance

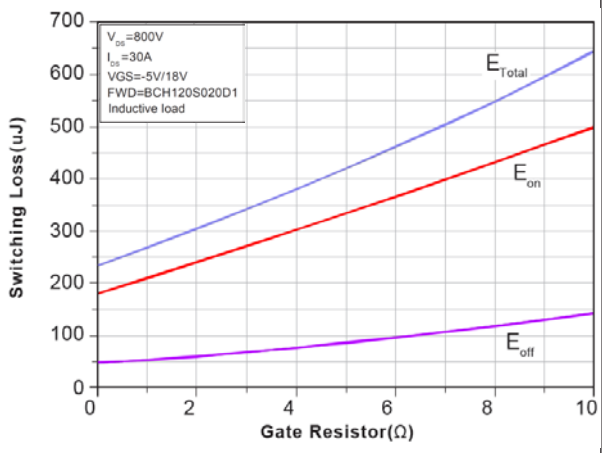


Figure 17. Typ. Switching losses vs. Drain current

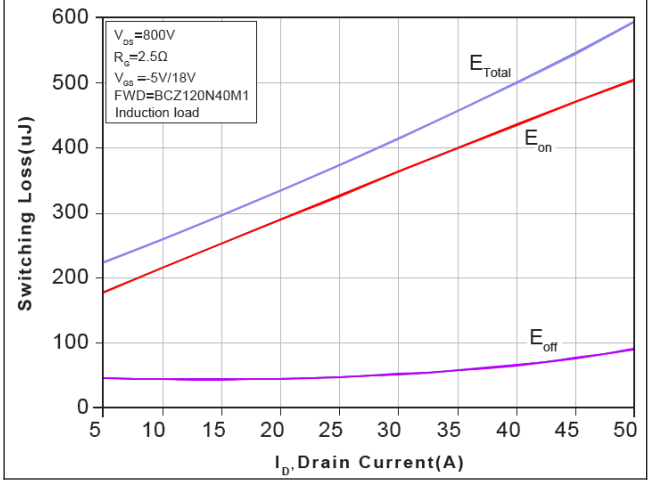
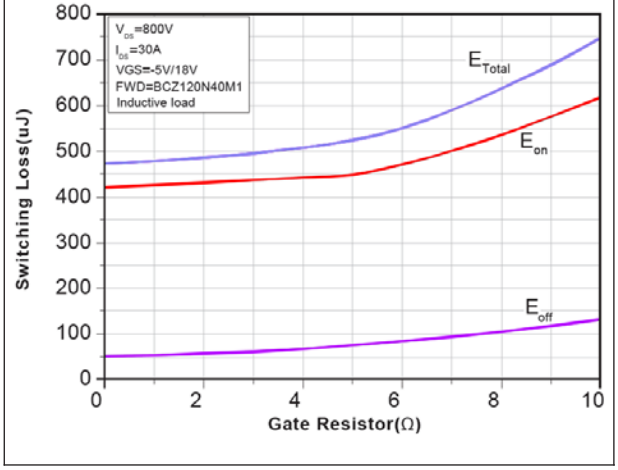


Figure 18. Typ. Switching losses vs. Gate resistance



Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

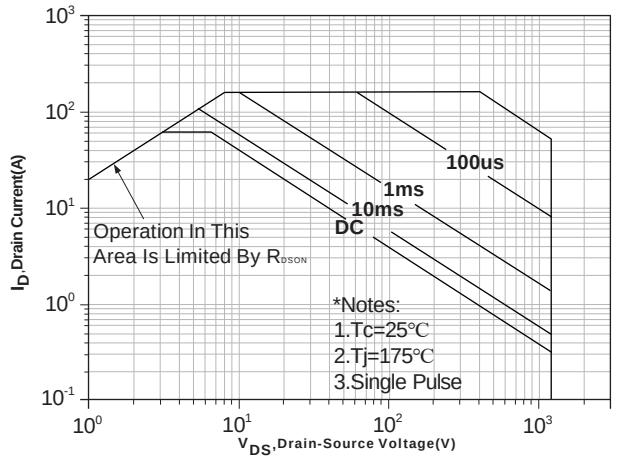


Figure 20. Transient Thermal Response Curve

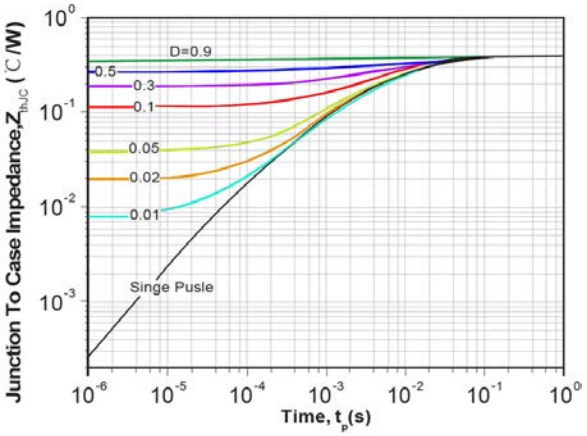


Figure 21. On-Resistance vs. Drain Current For Various Temperature

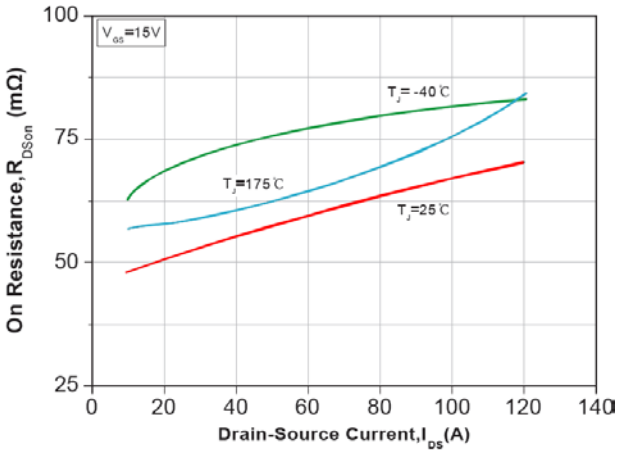


Figure 22. On-Resistance vs. Temperature For Various Gate Voltage

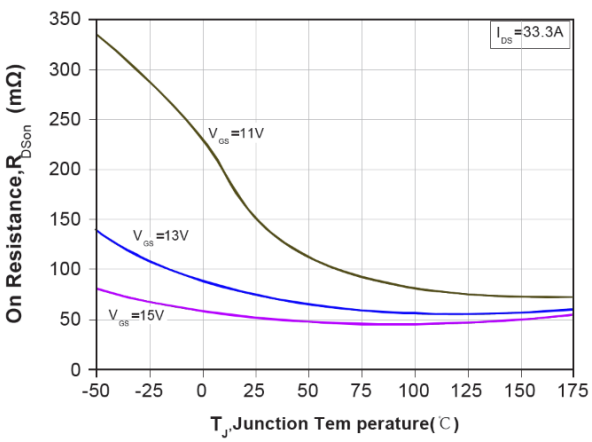


Figure 23. 3rd Quadrant Characteristic at -40℃

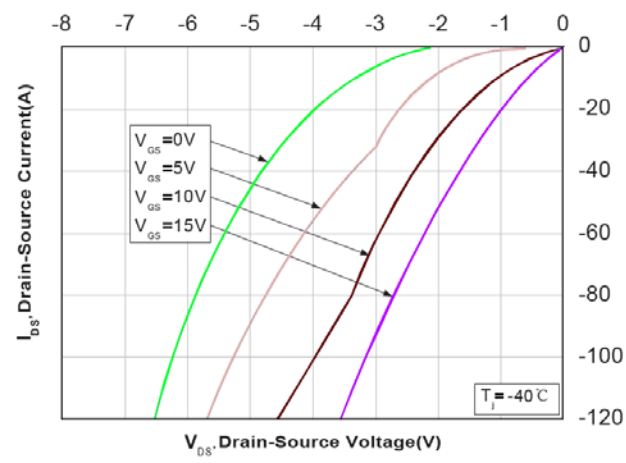
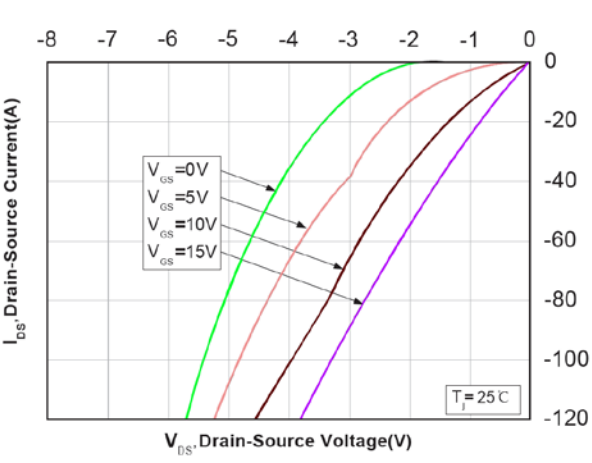


Figure 24. 3rd Quadrant Characteristic at 25℃



Typical Performance Characteristics

Figure 25. 3rd Quadrant Characteristic at 175℃

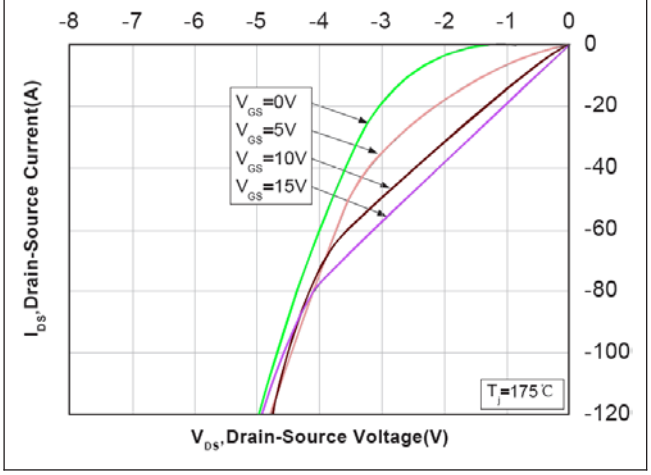


Figure 26. Capacitance vs. Drain-Source Voltage(0~200V)

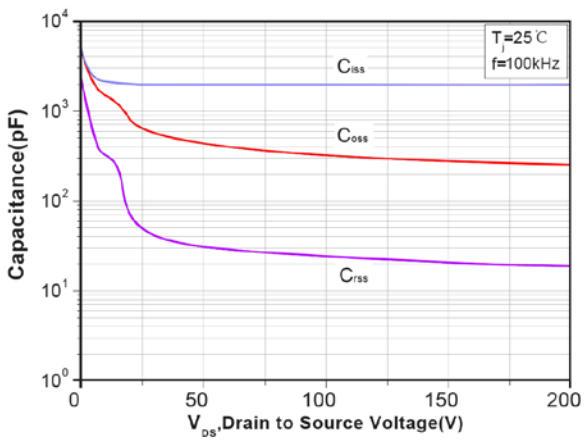


Figure 27. Capacitance vs. Drain-Source Voltage(0~1200V)

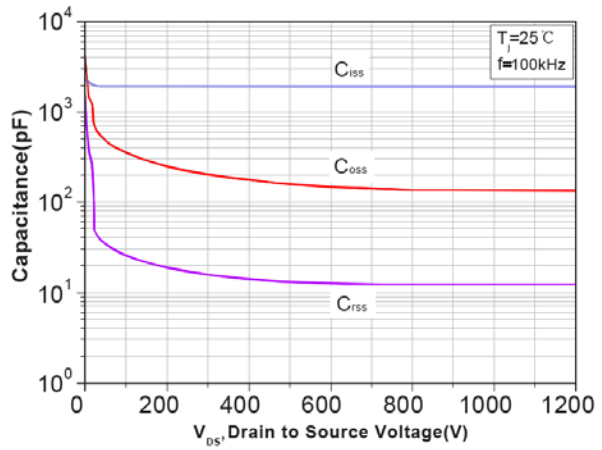


Figure 28. Clamped Inductive Switching Energy vs. Drain current(VDS=600V)

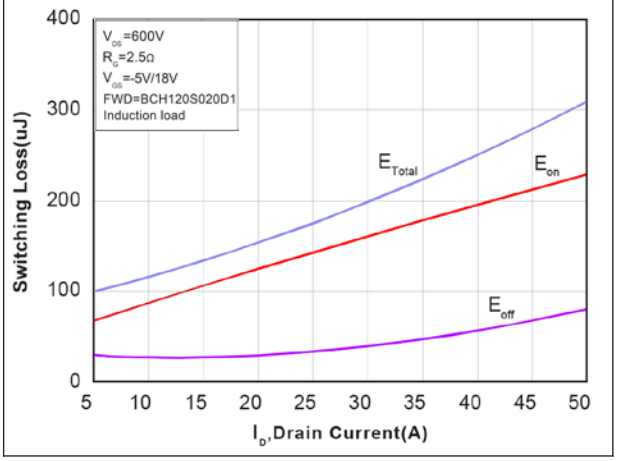


Figure 29. Clamped Inductive Switching Energy vs. Temperature

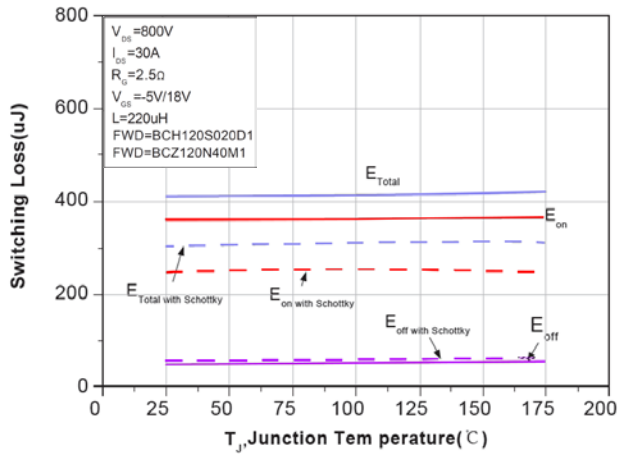
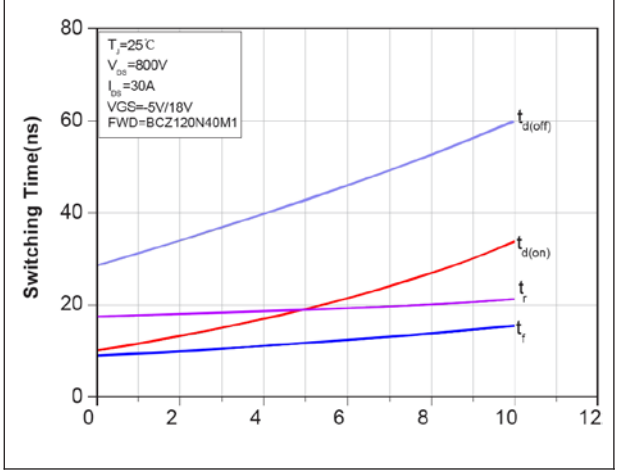


Figure 30. Switching Times vs. $R_{G(ext)}$



Typical Performance Characteristics

Figure 31. Switching Times vs. $R_{G(ext)}$

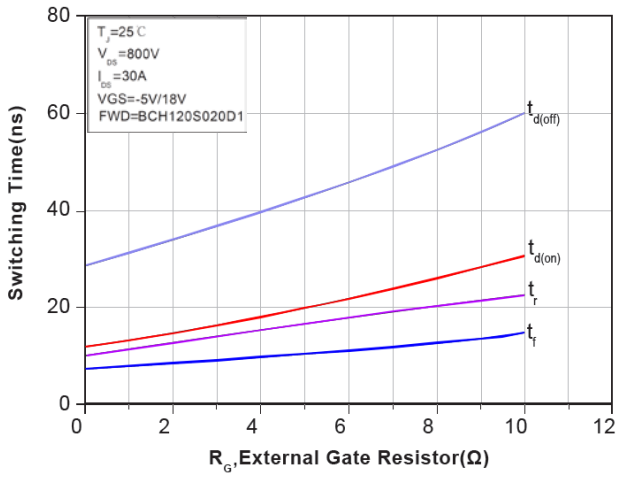


Figure 32. Stored Energy in Output Capacitance (0~1200V)

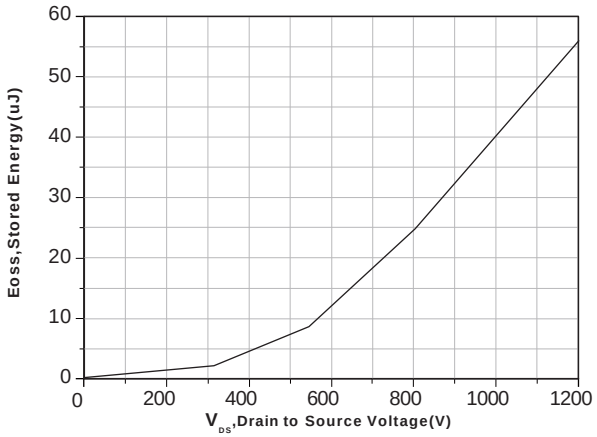


Figure 33. Inductive Load Switching Test Circuit and Waveforms

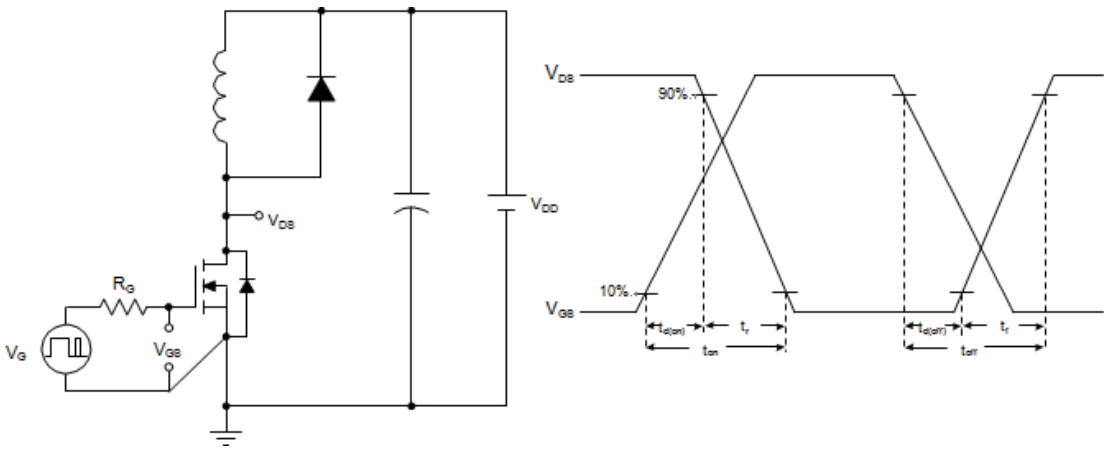
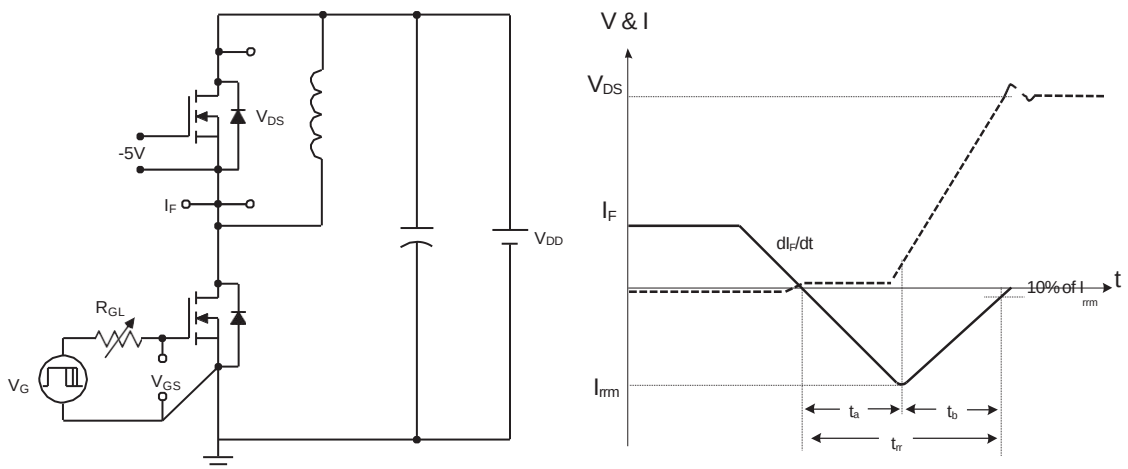
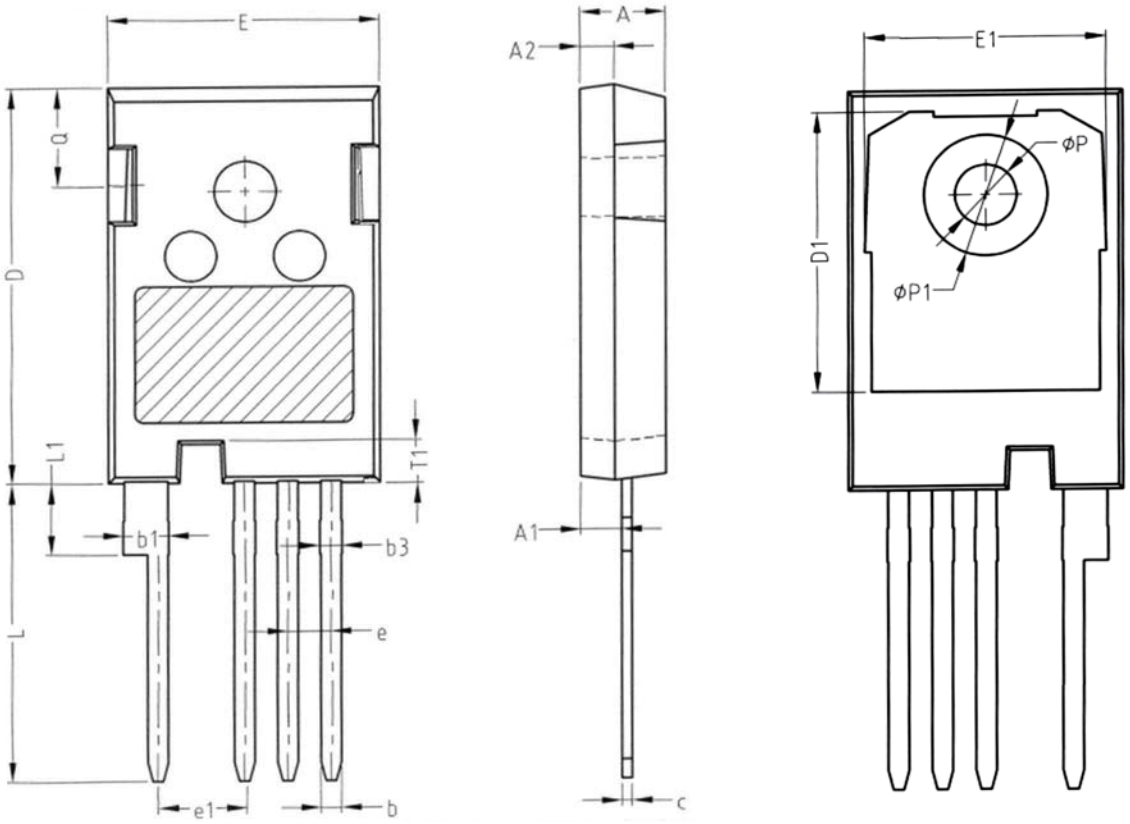


Figure 34. Peak Diode Recovery dv/dt Test Circuit and Waveforms



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
BCZ120N40M1	BCZ120N40M1	TO247-4L	Tube	30 units

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