

BCZ170N45P1

N-Channel Silicon Carbide Power MOSFET

1700 V, 60 A, 45 mΩ



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

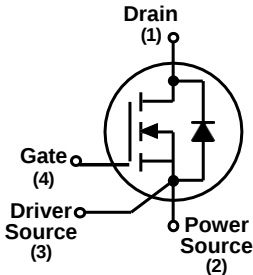
$BV_{DSS, T_C=25^{\circ}C}$	$I_D, T_C=25^{\circ}C$	$R_{DS(on), typ}$	$Q_{g, typ}$
1700 V	60 A	45 mΩ	172.5 nC

Benefits

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

Applications

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



Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

Symbol	Parameter		Value	Unit
V _{DSS}	Drain to Source Voltage		1700	V
V _{GS}	Gate to Source Voltage (DC)		-10 / +25	V
V _{GSop}	Recommended Operation Value		-5 / +20	V
I _D	Drain Current	V _{GS} = 20 V, (T _C = 25°C)	60	A
		V _{GS} = 20 V, (T _C = 100°C)	42.7	
I _{DM}	Drain Current	Pulsed (Note1)	120	A
P _D	Power Dissipation	(T _C = 25°C)	347	W/°C
		(T _J = 175°C)		
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +175	°C

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.43	°C/W
T _{sold}	Soldering temperature, wave soldering only allowed at leads	260	°C

Electrical Characteristics (T_J = 25°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 V, I _D = 100 μA	1700	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 1700 V, V _{GS} = 0 V	-	1	100	μA
I _{GSS}	Gate-Source Leakage Current	V _{GS} = +20 V, V _{DS} = 0 V	-	-	+250	nA

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 18 mA	2.0	3.0	4.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 20 V, I _D = 50 A	-	45	60	mΩ
		V _{GS} = 20 V, I _D = 50 A, T _J = 175°C	-	95	-	
g _{fs}	Transconductance	V _{DS} = 20 V, I _D = 50 A	-	20.4	-	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 1500 V, V _{GS} = 0V, f = 1MHz, V _{AC} = 25mV	-	3446	-	pF
C _{oss}	Output Capacitance		-	112	-	
C _{rss}	Reverse Capacitance		-	3	-	
E _{oss}	Stored Energy in Output Capacitance		-	140	-	μJ
Q _{g(tot)}	Total Gate Charge	V _{DS} = 800 V, I _D = 50 A, V _{GS} = -5 V / 18 V, Inductive load	-	172.5	-	nC
Q _{gs}	Gate to Source Charge		-	48	-	
Q _{gd}	Gate to Drain "Miller" Charge		-	65	-	
R _G	Internal Gate Resistance	f = 1 MHz open drain	-	1.24	-	Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DS} = 1000 V, I _D = 50 A, V _{GS} = -5 V / 20 V, R _G = 2.2 Ω, L = 100μH	-	12	-	ns
t _r	Turn-On Rise Time		-	16	-	
t _{d(off)}	Turn-Off Delay Time		-	25	-	
t _f	Turn-Off Fall Time		-	8	-	
E _{on}	Turn-on Switching Energy		-	640.7	-	μJ
E _{off}	Turn-off Switching Energy		-	65.9	-	
E _{tot}	Total Switching Energy		-	715.6	-	

Source-Drain Diode Characteristics

I _S	Maximum Continuous Diode Forward Current		-	75	-	A
V _{SD}	Diode Forward Voltage	V _{GS} = -5 V, I _{SD} = 25A	-	4.1	-	V
		V _{GS} = -5 V, I _{SD} = 25A, T _J = 175 °C	-	3.6	-	
t _{rr}	Reverse Recovery Time	V _R = 800 V, I _{SD} = 25 A,	-	18.4	-	ns
Q _{rr}	Reverse Recovery Charge	V _{GS} = -5 V, dI _F /dt = 5800 A/μs	-	1610	-	nC

Typical Performance Characteristics

Figure 1. Output Characteristics $T_J = -55^{\circ}\text{C}$

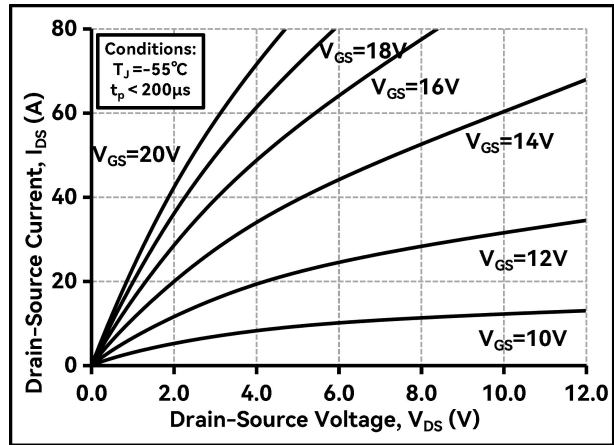


Figure 2. Output Characteristics $T_J = 25^{\circ}\text{C}$

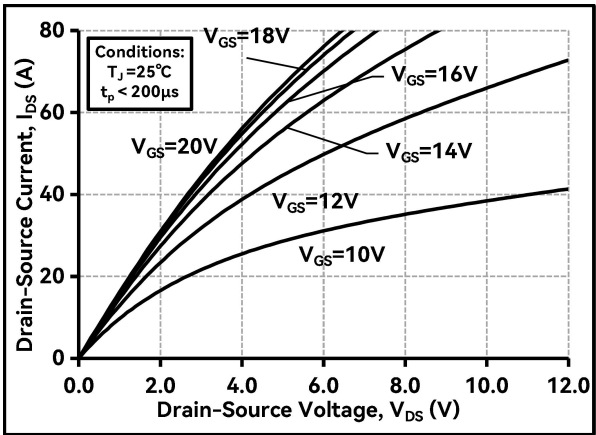


Figure 3. Output Characteristics $T_J = 175^{\circ}\text{C}$

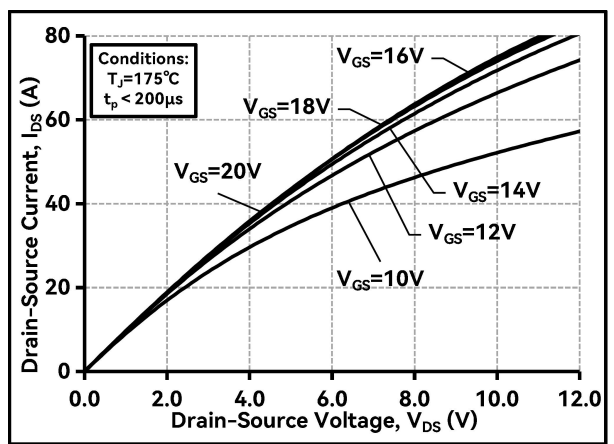


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

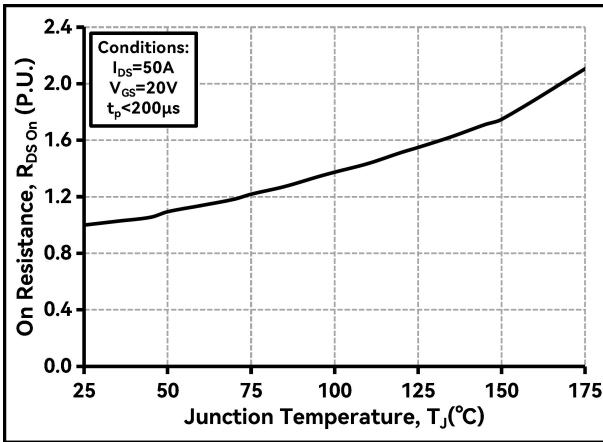


Figure 5. On-Resistance vs Drain Current For Various Temperatures

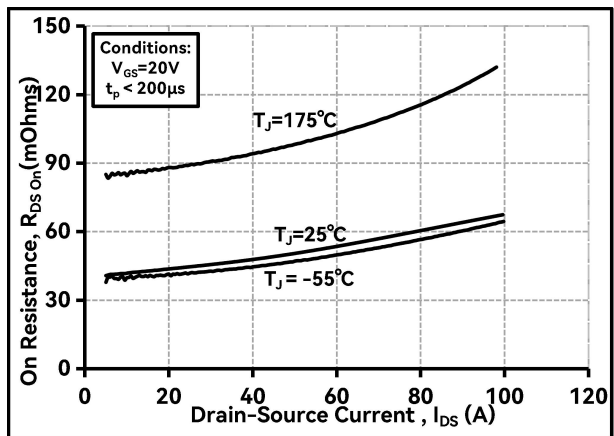
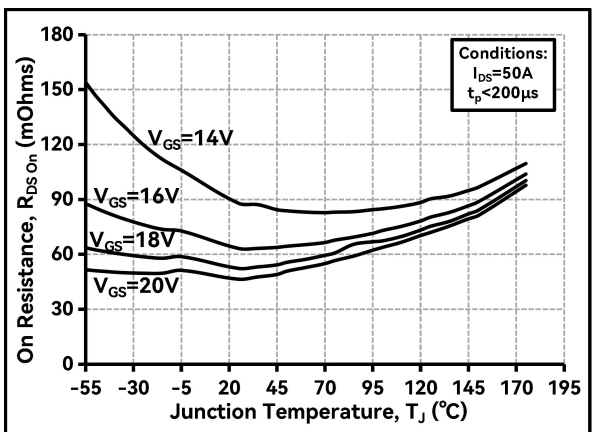


Figure 6. On-Resistance vs Temperature For Various Gate Voltage



Typical Performance Characteristics

Figure 7. Transfer Characteristic for Various Junction Temperatures

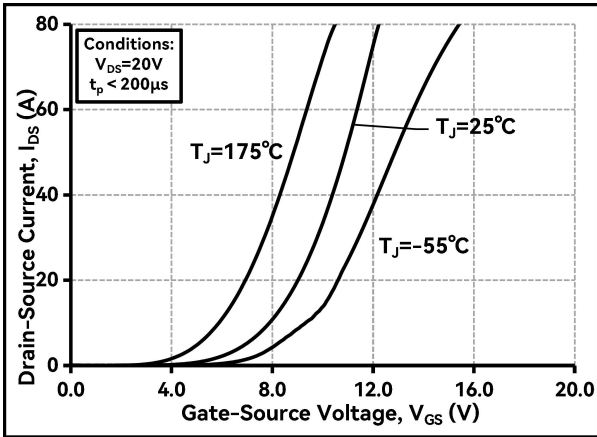


Figure 8. Body Diode Characteristic $T_J = -55^\circ\text{C}$

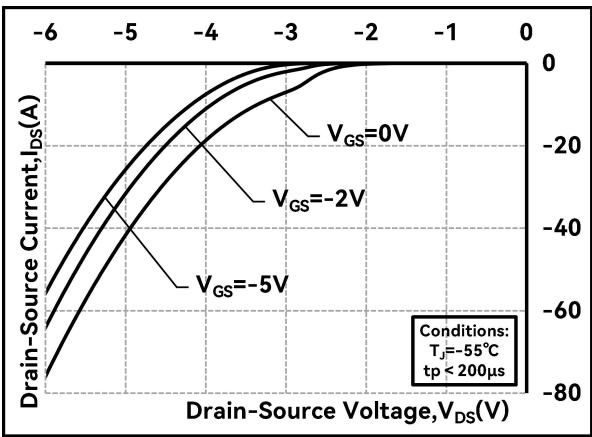


Figure 9. Body Diode Characteristic $T_J = 25^\circ\text{C}$

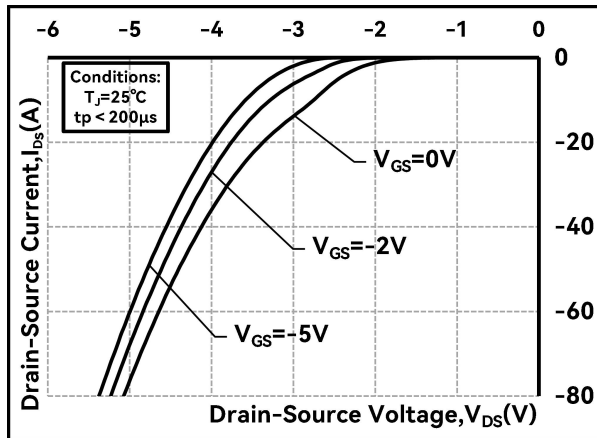


Figure 10. Body Diode Characteristic $T_J = 175^\circ\text{C}$

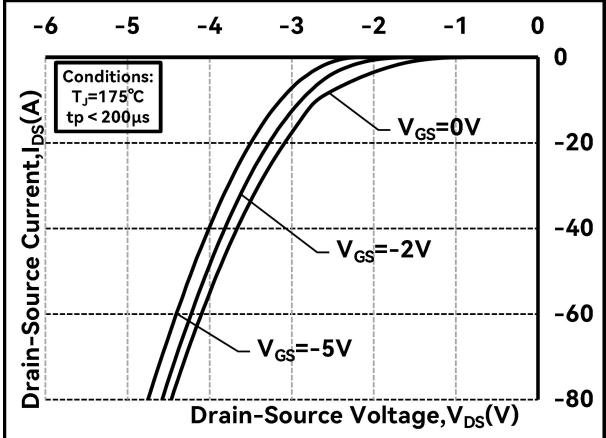


Figure 11. Threshold Voltage vs Temperature

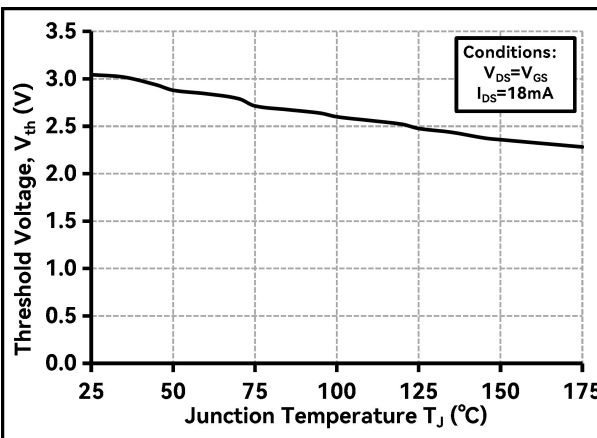
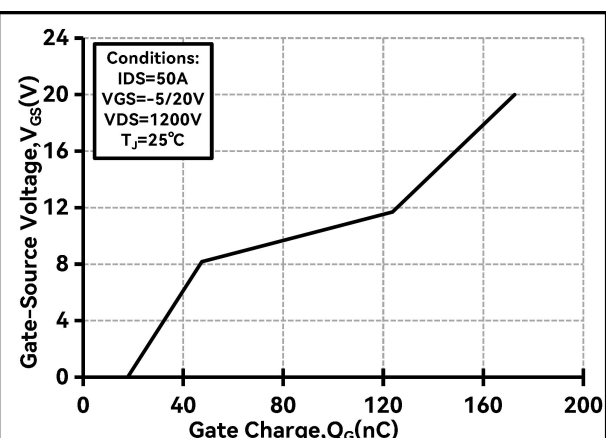


Figure 12. Gate Charge Characteristics



Typical Performance Characteristics

Figure 13. 3rd Quadrant Characteristic $T_J = -55^{\circ}\text{C}$

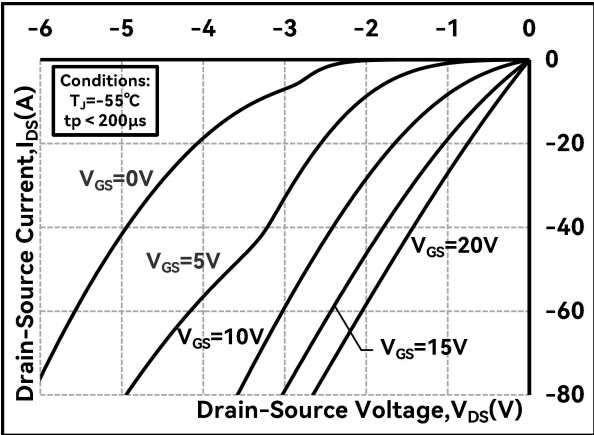


Figure 14. 3rd Quadrant Characteristic $T_J = 25^{\circ}\text{C}$

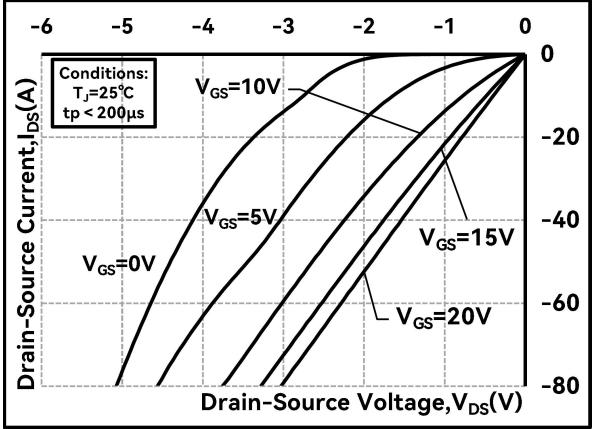


Figure 15. 3rd Quadrant Characteristic $T_J = 175^{\circ}\text{C}$

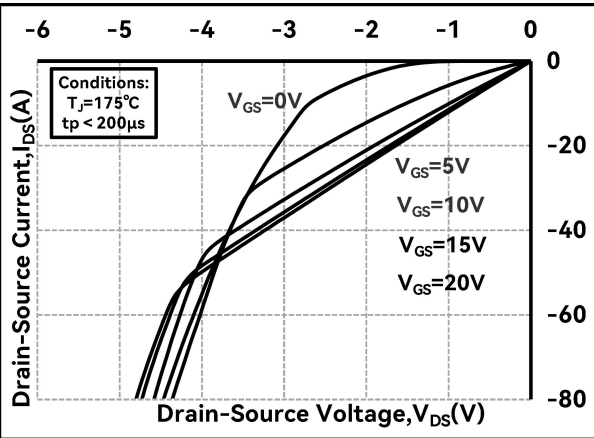


Figure 16. Output Capacitor Stored Energy

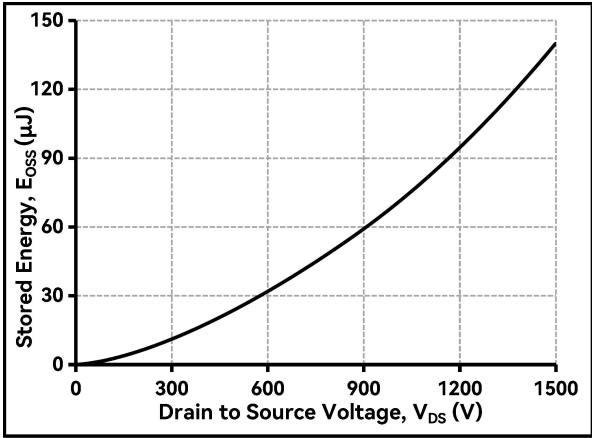


Figure 17. Capacitance vs Drain-Source Voltage (0-200 V)

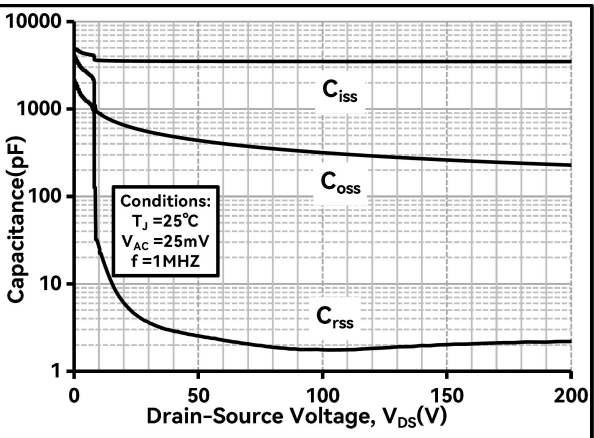
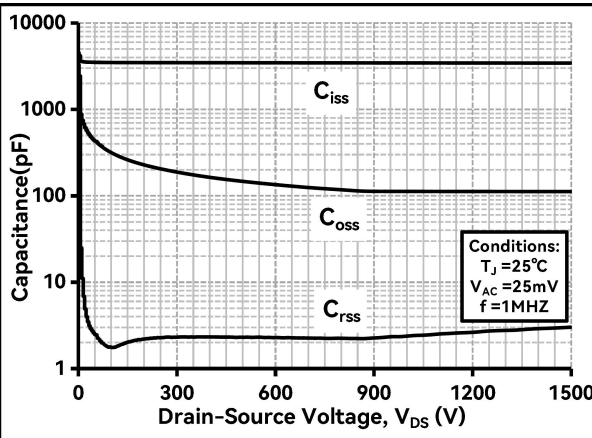


Figure 18. Capacitance vs Drain-Source Voltage (0-1500 V)



Typical Performance Characteristics

Figure 19. Continuous Drain Current Derating vs Case Temperature

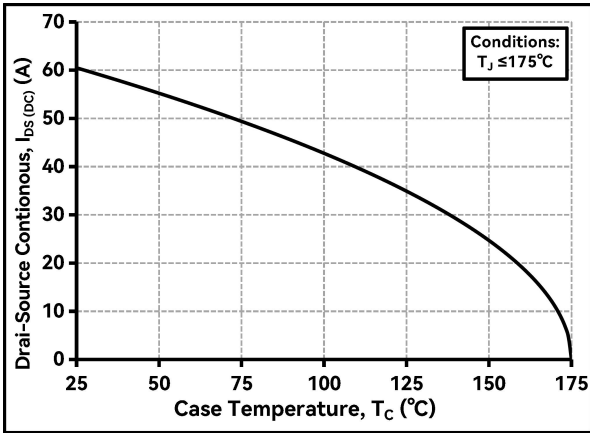


Figure 20. Maximum Power Dissipation Derating vs Case Temperature

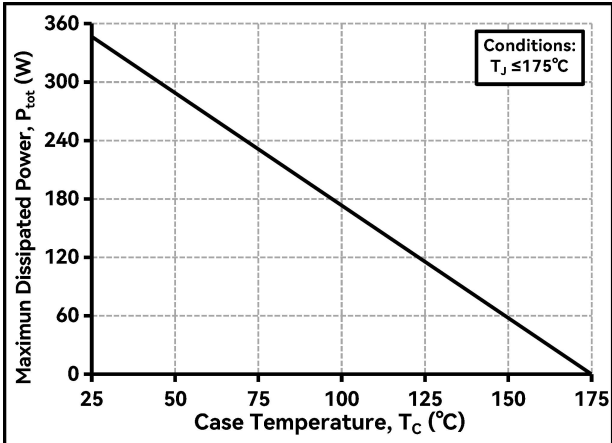


Figure 21. Transient Thermal Impedance (Junction - Case)

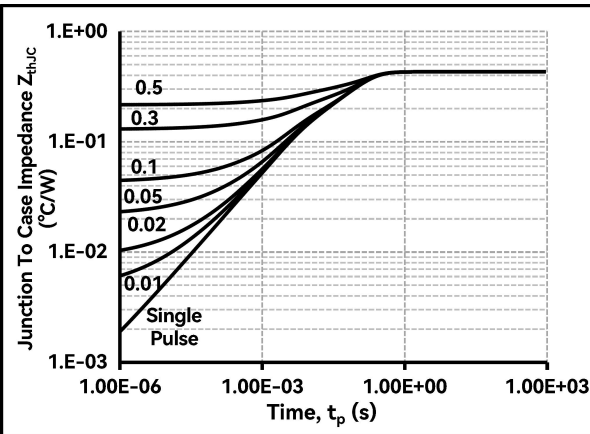


Figure 22. Safe Operating Area

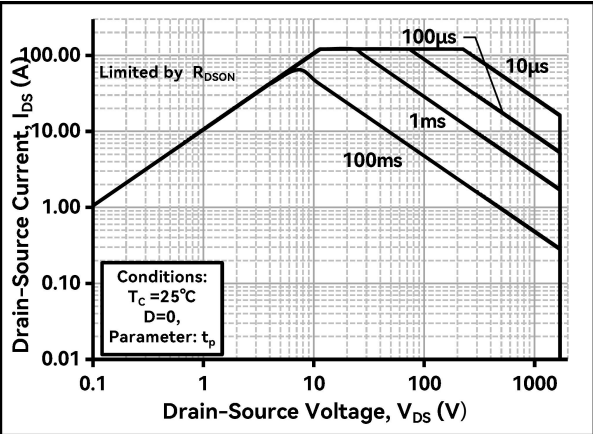


Figure 23. Clamped Inductive Switching Energy vs Drain Current

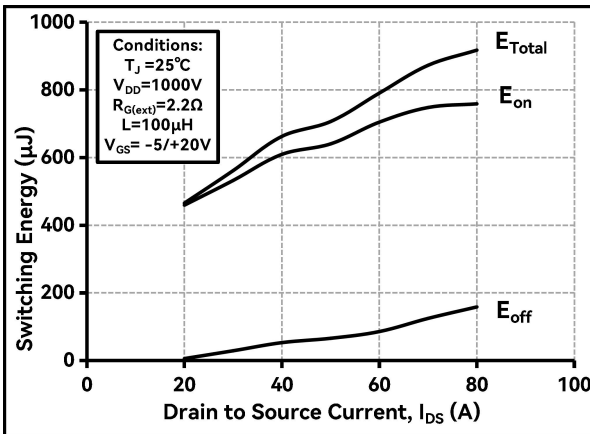
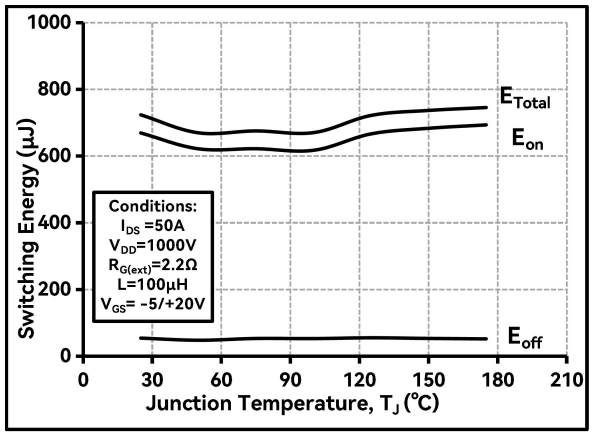


Figure 24. Clamped Inductive Switching Energy vs Temperature



Typical Performance Characteristics

Figure 25. Clamped Inductive Switching Energy vs $R_{G(ext)}$

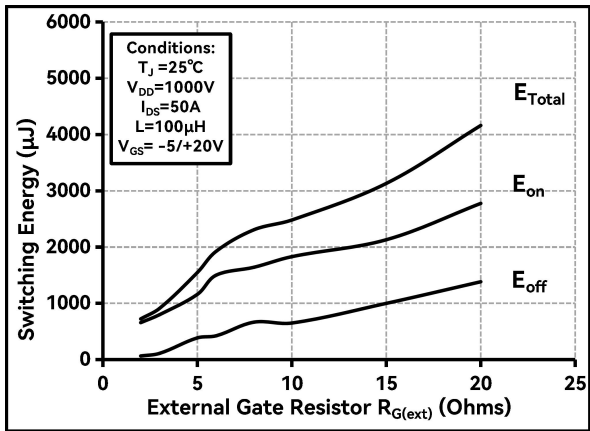
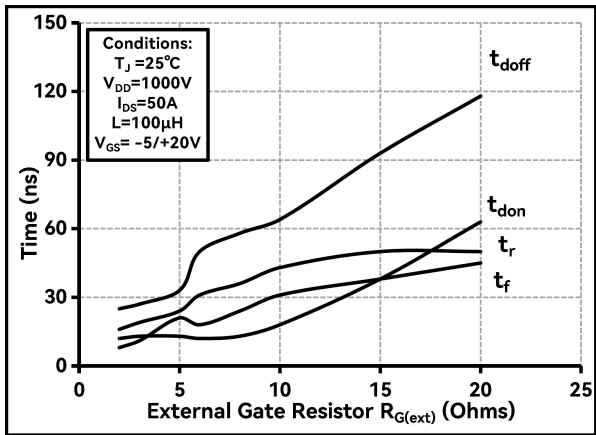
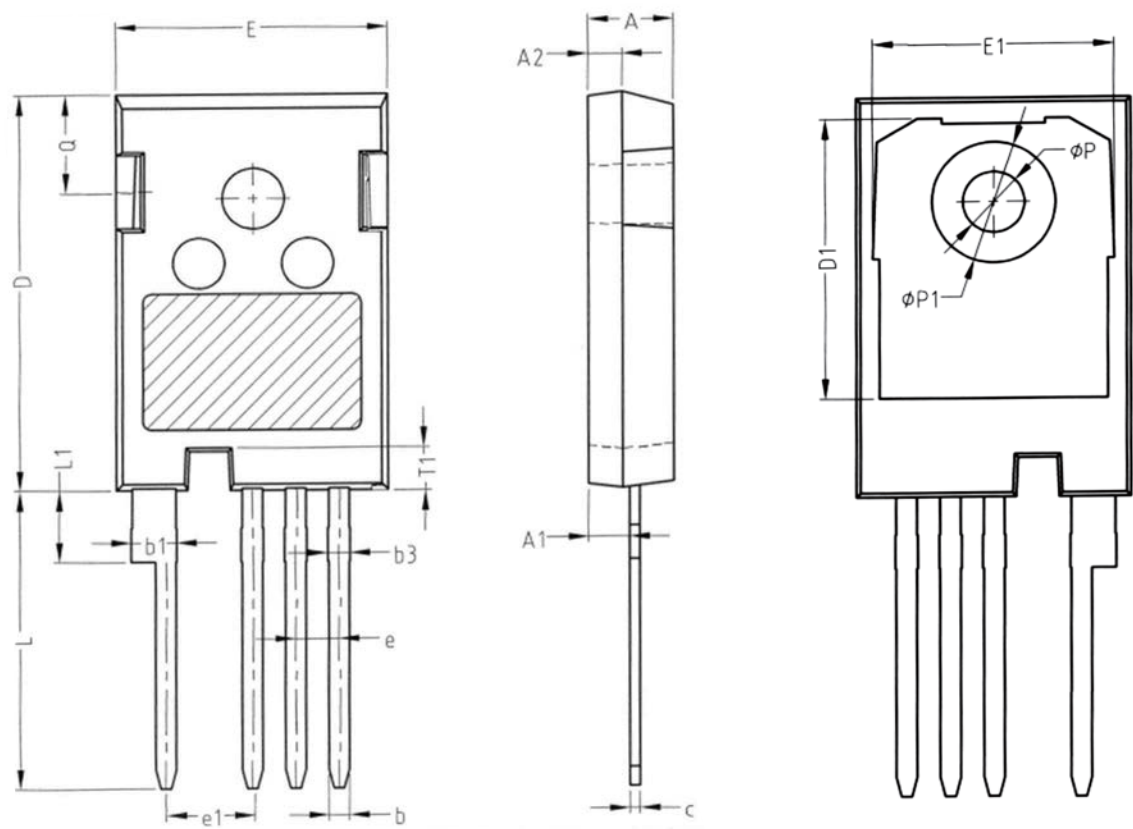


Figure 26. Switching Times vs $R_{G(ext)}$



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
BCZ170N45P1	BCZ170N45P1	TO247-4L	Tube	30 units

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