

BCBF65N15M1

N-Channel Silicon Carbide Power MOSFET

650 V, 126 A, 15 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

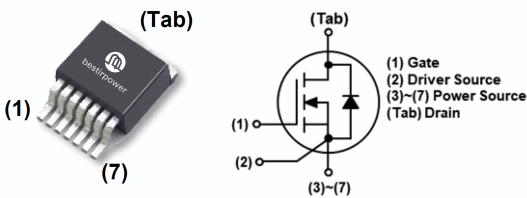
$BV_{DSS}, T_c=25^{\circ}C$	$I_D, T_c=25^{\circ}C$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	126 A	15 mΩ	146 nC

Benefits

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

Applications

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



TO-263-7L



Absolute Maximum Ratings (T_C = 25°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		-5 / +18	V
I _D	Drain Current	Continuous (T _C = 25°C)	126	A
		Continuous (T _C = 100°C)	89	
I _{DM}	Drain Current	Pulsed (Note1)	339	A
P _D	Power Dissipation	(T _C = 25°C)	440	W
		Derate Above 25°C	2.94	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to 175	°C
T _L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds		260	°C

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
R _{θJC}	Thermal Resistance, Junction to Case, Max.	0.34	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient, Max.	40	

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		10		
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			+100	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 20.3\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$)	2.0	2.8	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 60\text{ A}$		15	21	mΩ
		$V_{GS} = 18\text{ V}, I_D = 60\text{ A}, T_J = 175^\circ\text{C}$		20		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 60\text{ A}$		40.8		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		3525		pF
C_{oss}	Output Capacitance			297		
C_{rss}	Reverse Capacitance			16		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		36.5		μJ
$C_{o(er)}$	Energy Related Output Capacitance			456		pF
$C_{o(tr)}$	Time Related Output Capacitance			648		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 60\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ Inductive load		146		nC
Q_{gs}	Gate to Source Charge			45		
Q_{gd}	Gate to Drain "Miller" Charge			36		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}$		2.2		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400\text{ V}, I_D = 60\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, R_G = 5.6\text{ }\Omega,$ FWD : BCH65S20D2, Inductive load		28.8		ns
t_r	Turn-On Rise Time			25.7		
$t_{d(off)}$	Turn-Off Delay Time			60.1		
t_f	Turn-Off Fall Time			10.5		
E_{on}	Turn-on Switching Energy			146		μJ
E_{off}	Turn-off Switching Energy			279		
E_{tot}	Total Switching Energy			425		

Source-Drain Diode Characteristics

I_S	Maximum Continuous Diode Forward Current			126	A
I_{SM}	Maximum Pulsed Diode Forward Current			339	
V_{SD}	Diode Forward Voltage	$V_{GS} = -5\text{ V}, I_{SD} = 60\text{ A}$		4.4	V
t_{rr}	Reverse Recovery Time	$V_{DD} = 400\text{ V}, I_{SD} = 60\text{ A},$ $di_F/dt = 1000\text{ A}/\mu\text{s},$ Includes Q_{OSS}		29.5	ns
Q_{rr}	Reverse Recovery Charge			303	nC
I_{rrm}	Peak Reverse Recovery Current			17.4	A

Typical Performance Characteristics

Figure 1. On-Region Characteristics $T_J = -40^{\circ}\text{C}$

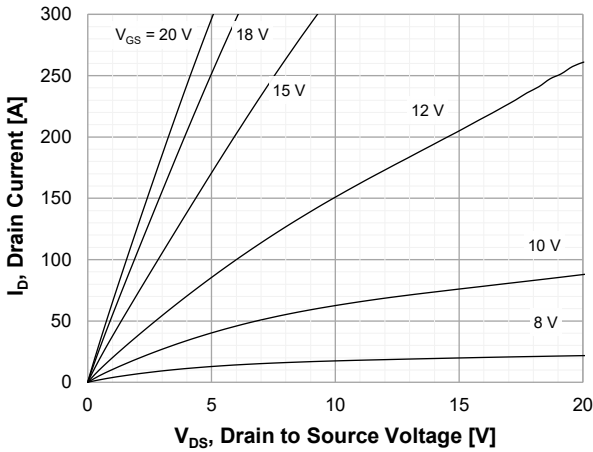


Figure 2. On-Region Characteristics $T_J = 25^{\circ}\text{C}$

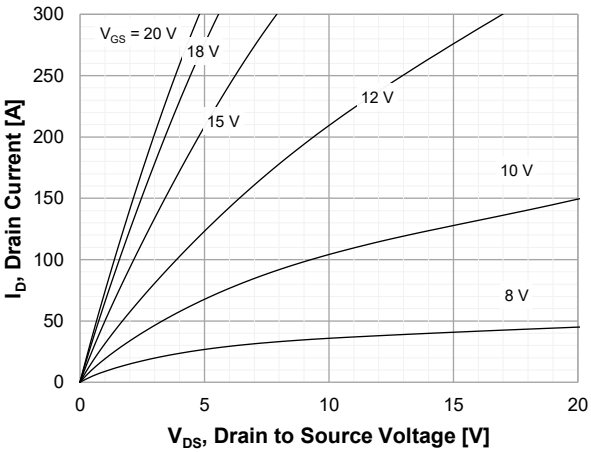


Figure 3. On-Region Characteristics $T_J = 125^{\circ}\text{C}$

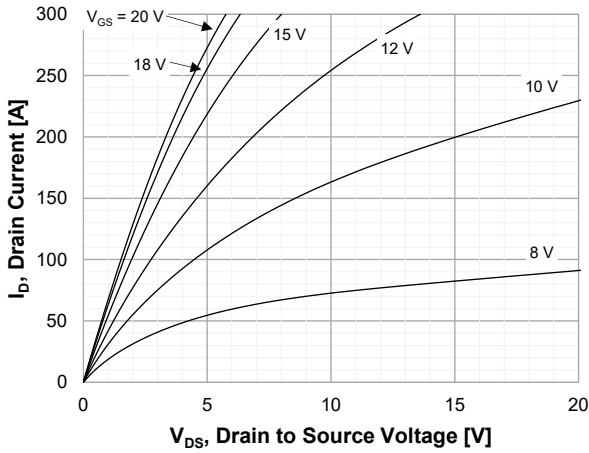


Figure 4. On-Region Characteristics $T_J = 175^{\circ}\text{C}$

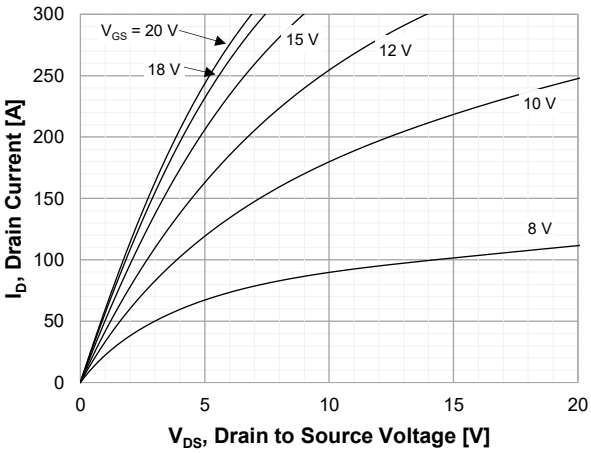


Figure 5. On-Resistance Characteristics vs. Temperature

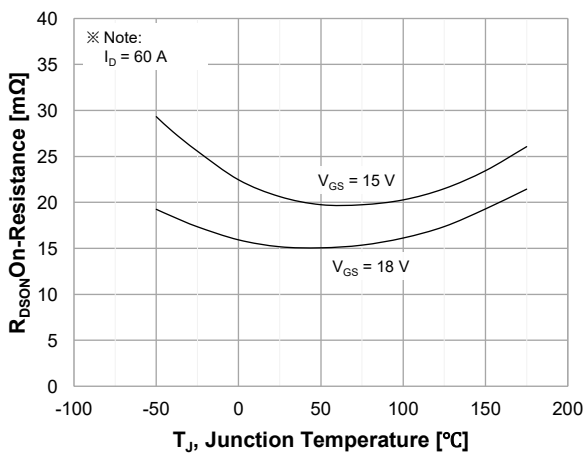
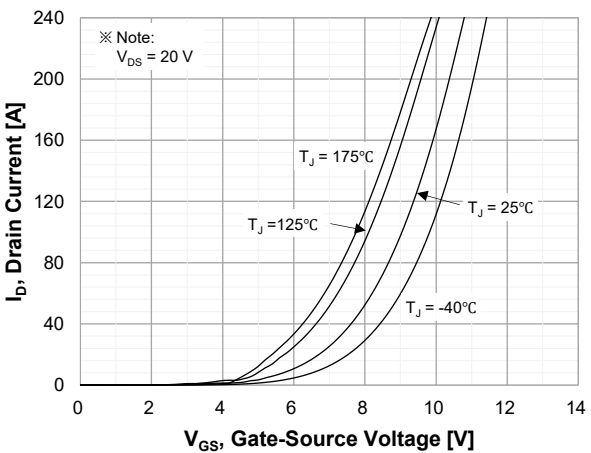


Figure 6. Transfer Characteristics



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^{\circ}\text{C}$

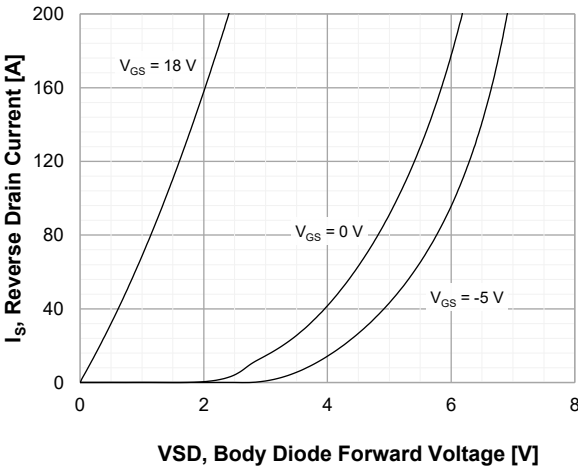


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^{\circ}\text{C}$

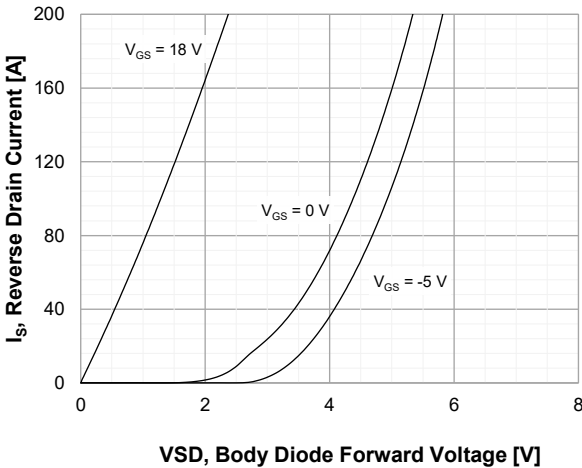


Figure 9. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 125^{\circ}\text{C}$

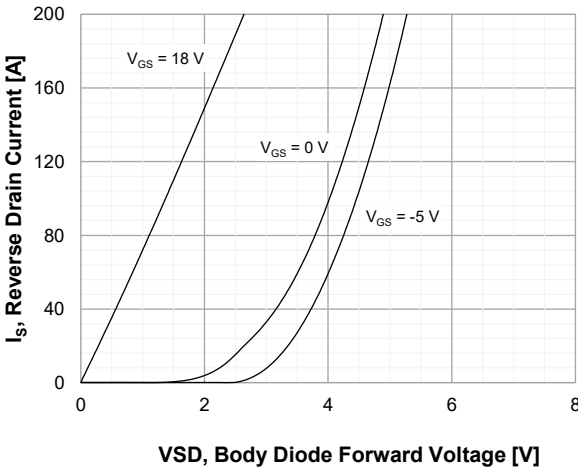


Figure 10. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^{\circ}\text{C}$

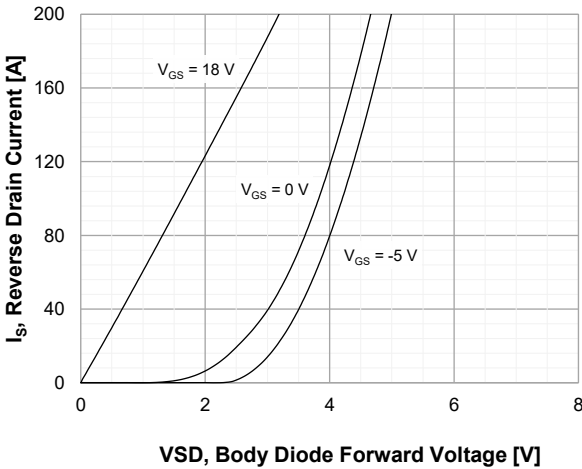


Figure 11. Threshold Voltage vs. Temperature

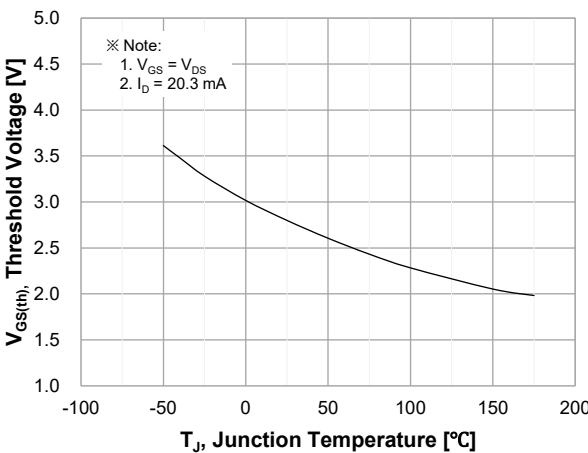
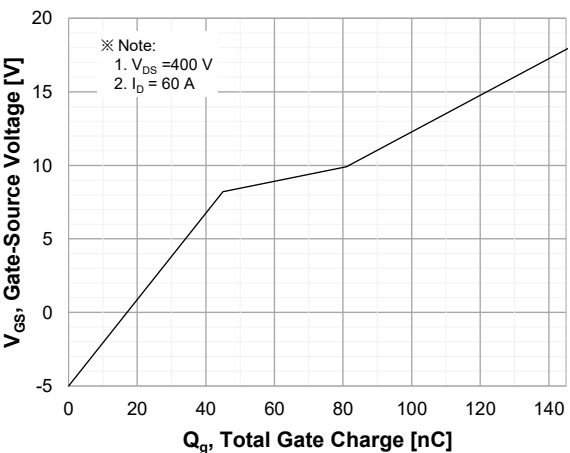


Figure 12. Gate Charge Characteristics



Typical Performance Characteristics

Figure 13. Stored Energy in Output Capacitance

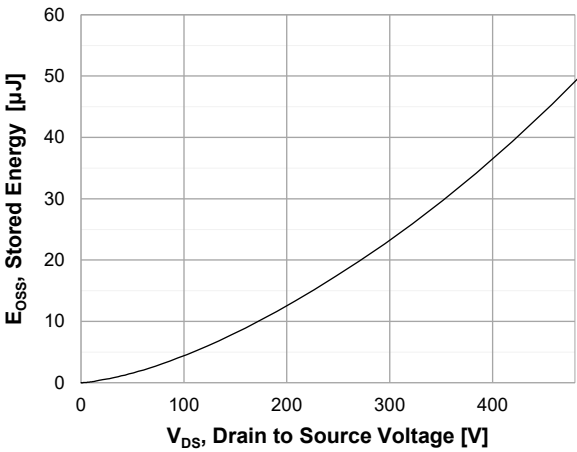


Figure 14. Capacitance Characteristics

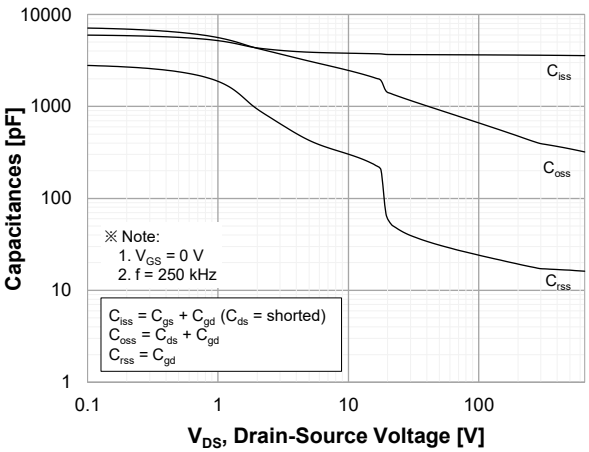


Figure 15. Continuous Drain Current Derating vs. Case Temperature

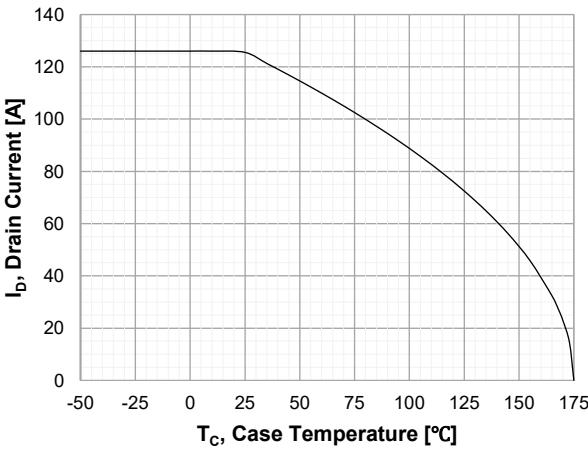


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

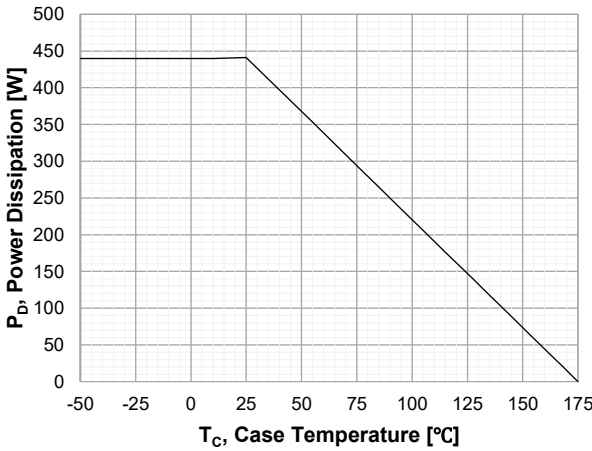


Figure 17. Typ. Switching Losses vs. Drain Current

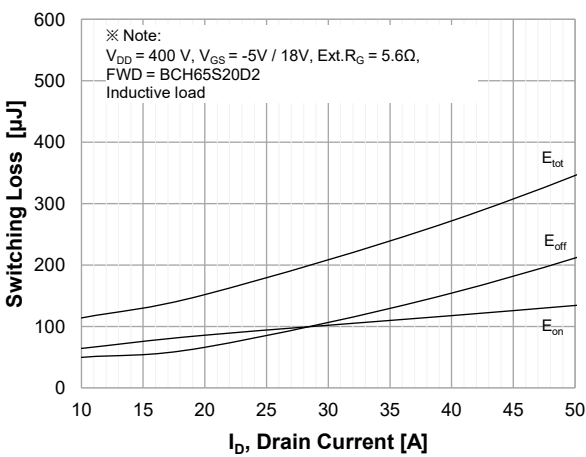
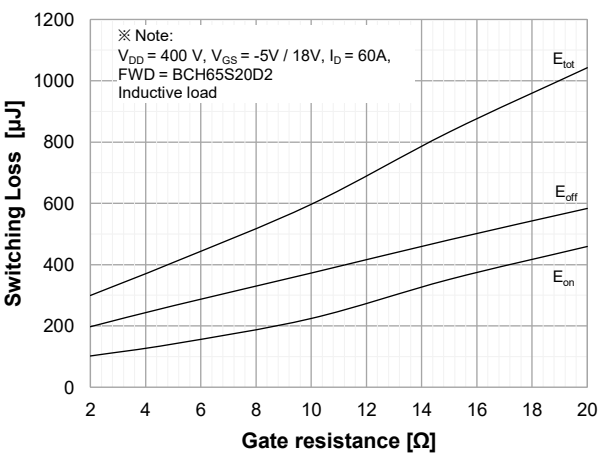


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Typ. Switching Losses vs. Drain Current

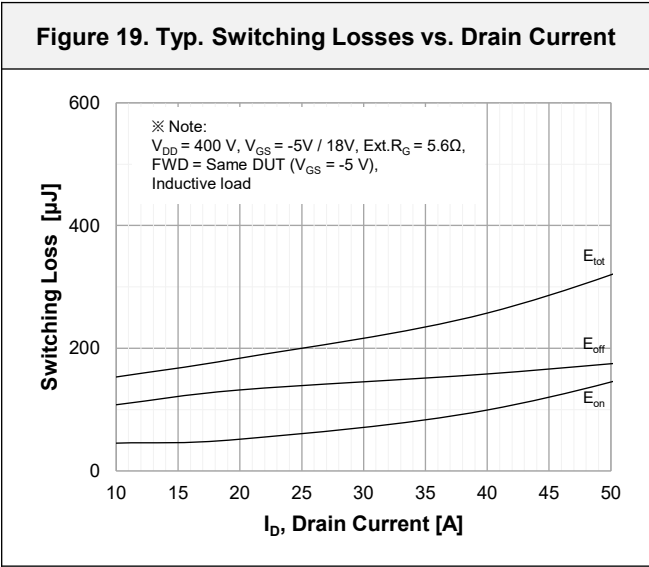


Figure 20. Typ. Switching Losses vs. Gate Resistance

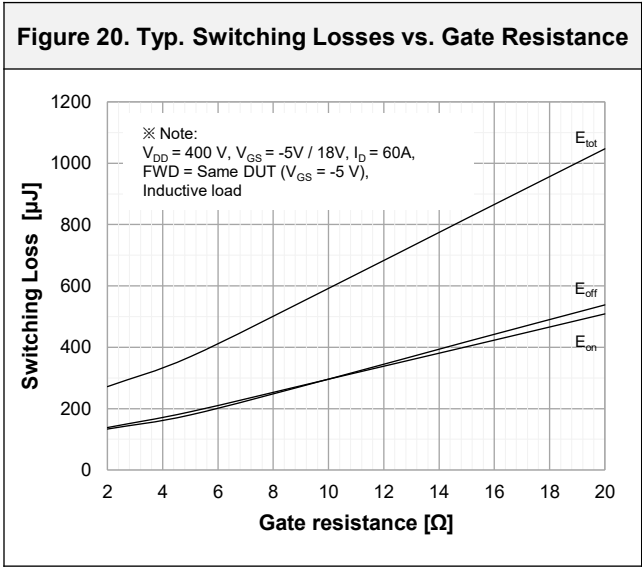


Figure 21. Maximum Safe Operating Area

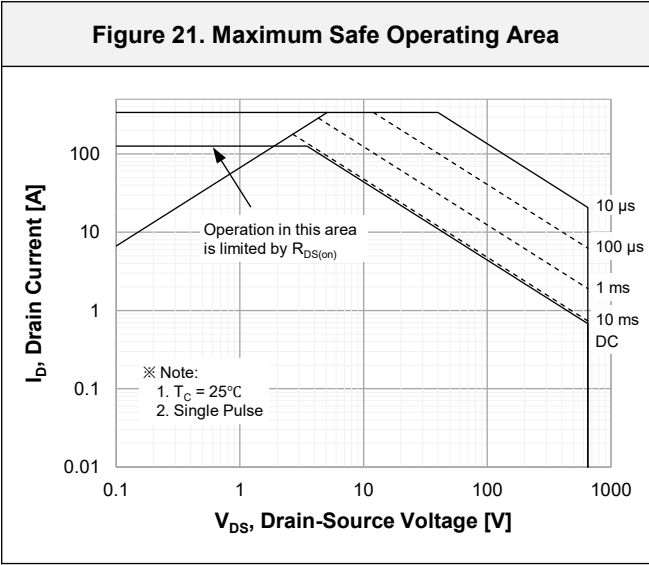
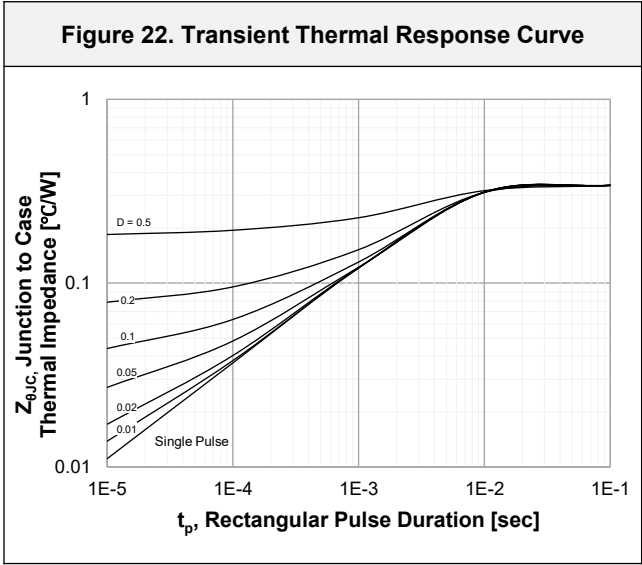


Figure 22. Transient Thermal Response Curve



Typical Performance Characteristics

Figure 23. Inductive Load Switching Test Circuit and Waveforms

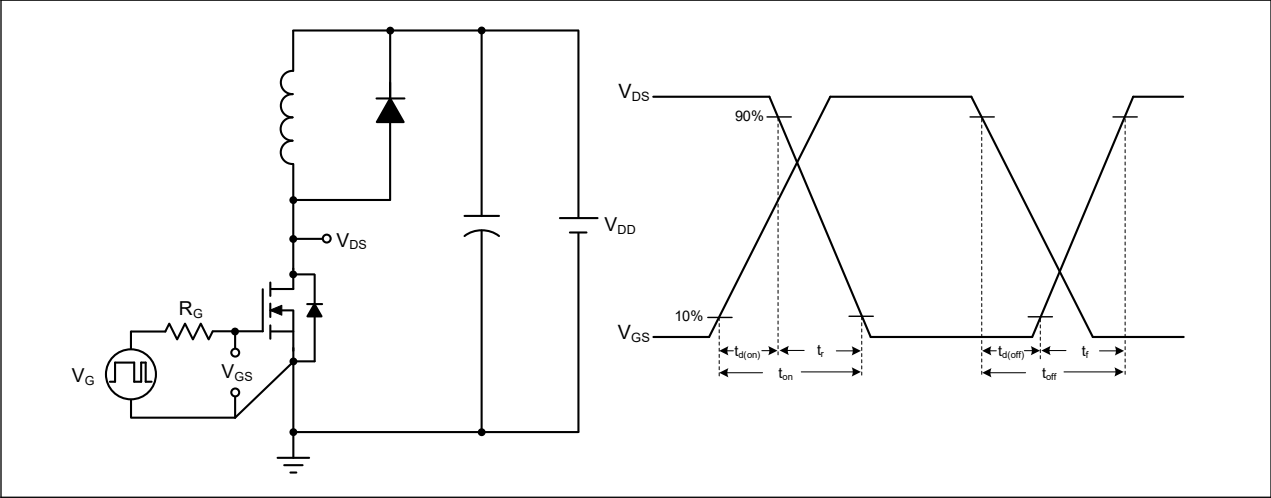
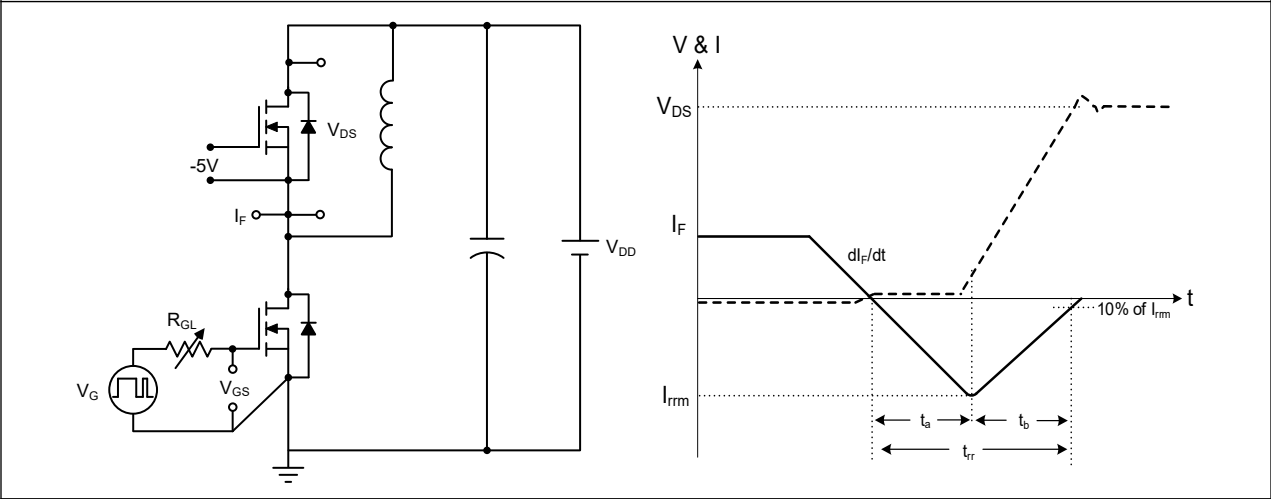
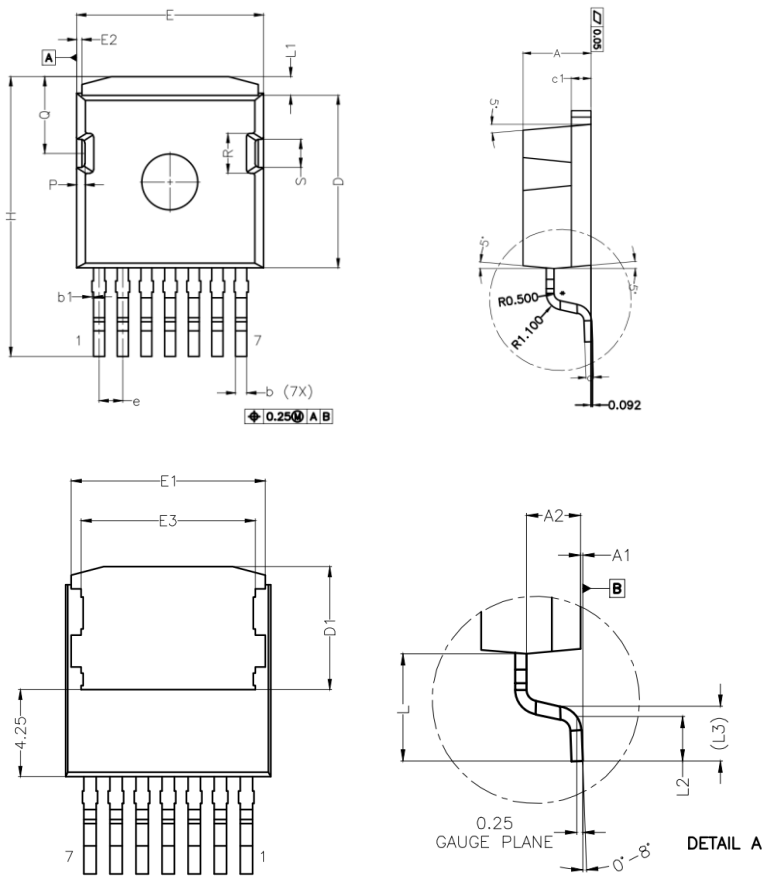


Figure 24. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines
TO-263-7L



SYMBOL	Common		
	DEMINSIONS MILLIMETER		
	MIN.	NOM.	MAX.
A	4.30	4.40	4.50
A1	0.00	0.10	0.20
A2	2.30	2.40	2.50
b	0.50	0.60	0.70
b1	0.00	0.08	0.15
c	0.40	0.50	0.60
c1	1.17	1.27	1.37
D	9.05	9.25	9.45
D1	5.90	6.00	6.10
E	9.80	10.00	10.20
E1	9.36	9.46	9.56
E2	0.00	0.15	0.30
E3	8.40	8.50	8.60
e	1.27		
H	15.00		
L	4.20	4.75	5.20
L1	0.70	1.00	1.30
L2	1.70	2.00	2.30
L3	2.70		
P	0.35	0.45	0.55
Q	4.02	4.12	4.22
R	2.03	2.13	2.23
S	1.40	1.50	1.60

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCBF65N15M1	BCBF65N15M1	TO263-7L	Tape & Reel	800 units

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