



# BCW120N16M1

## N-Channel Silicon Carbide Power MOSFET

1200 V, 129 A, 16 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

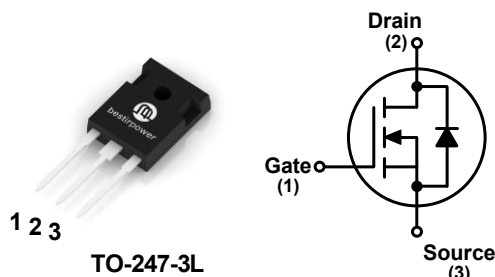
$BV_{DSS, T_C=25^\circ C}$	$I_D, T_C=25^\circ C$	$R_{DS(on), typ}$	$Q_{g, typ}$
1200 V	129 A	16 mΩ	152 nC

### 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 ( $T_C = 25^\circ C$ 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...-3 / +18	V
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ C$ ) (Note1)	129
		Continuous ( $T_C = 100^\circ C$ )	91
$I_{DM}$	Drain Current	Pulsed (Note1)	322
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	500
		Derate Above 25°C	3.3
$T_J, T_{STG}$	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

### Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.30	°C/W
$R_{\theta JA}$	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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		1	100	$\mu\text{A}$
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		10		
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			+100	$\text{nA}$
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 24\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$ )	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 50\text{ A}$		16.0	22.4	$\text{m}\Omega$
		$V_{GS} = 18\text{ V}, I_D = 50\text{ A}, T_J = 175^\circ\text{C}$		25.6		
		$V_{GS} = 15\text{ V}, I_D = 50\text{ A}$		21.5		
$g_{fs}$	Transconductance	$V_{DS} = 20\text{ V}, I_D = 50\text{ A}$		32.7		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance			4063		$\text{pF}$
$C_{oss}$	Output Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		227		
$C_{riss}$	Reverse Capacitance			3		
$E_{oss}$	Stored Energy in Output Capacitance			94		$\mu\text{J}$
$C_{o(er)}$	Energy Related Output Capacitance	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$		295		$\text{pF}$
$C_{o(tr)}$	Time Related Output Capacitance			476		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 800\text{ V}, I_D = 50\text{ A},$ $V_{GS} = -3\text{ V} / 18\text{ V},$ Inductive load		152		$\text{nC}$
$Q_{gs}$	Gate to Source Charge			49		
$Q_{gd}$	Gate to Drain "Miller" Charge			29		
$R_G$	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 30\text{ mV}$		2.7		$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-on Delay Time	$V_{DS} = 800\text{ V}, I_D = 50\text{ A},$ $V_{GS} = -3\text{ V} / 18\text{ V}, R_G = 4.7\ \Omega,$ FWD : BCH120S20D2, Inductive load		34		$\text{ns}$
$t_r$	Turn-on Rise Time			54		
$t_{d(off)}$	Turn-off Delay Time			68		
$t_f$	Turn-off Fall Time			13		
$E_{on}$	Turn-on Switching Energy			1325		$\mu\text{J}$
$E_{off}$	Turn-off Switching Energy			455		
$E_{tot}$	Total Switching Energy			1780		

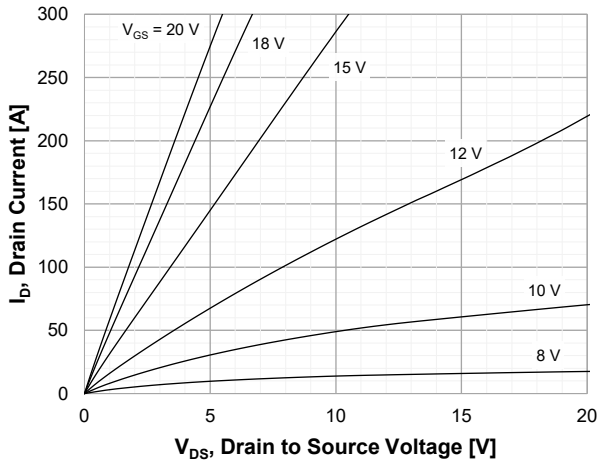
**Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Source-Drain Diode Characteristics</b>						
$I_S$	Continuous Diode Forward Current	$V_{GS} = -3\text{ V}$ (Note1)			122	A
$I_{SM}$	Pulsed Diode Forward Current	$V_{GS} = -3\text{ V}$ (Note1)			322	
$V_{SD}$	Diode Forward Voltage	$V_{GS} = -3\text{ V}, I_{SD} = 50\text{ A}$		4.0		V
$t_{rr}$	Reverse Recovery Time	$V_{DD} = 800\text{ V}, I_{SD} = 50\text{ A},$ $di_F/dt = 1200\text{ A}/\mu\text{s},$ Includes $Q_{oss}$		43		ns
$Q_{rr}$	Reverse Recovery Charge			420		nC
$I_{rrm}$	Peak Reverse Recovery Current			17		A

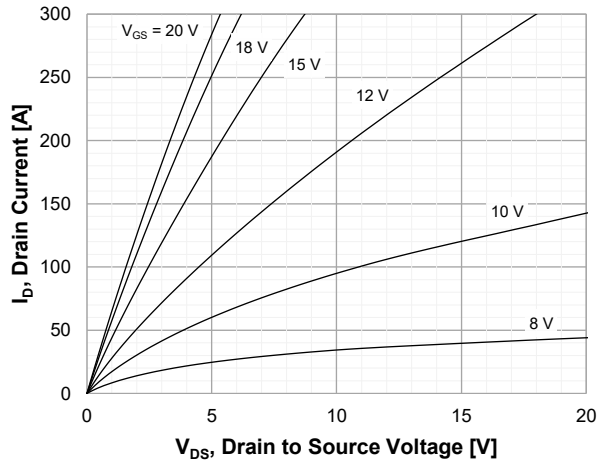
※Note 1 : Limited by maximum junction temperature.

### Typical Performance Characteristics

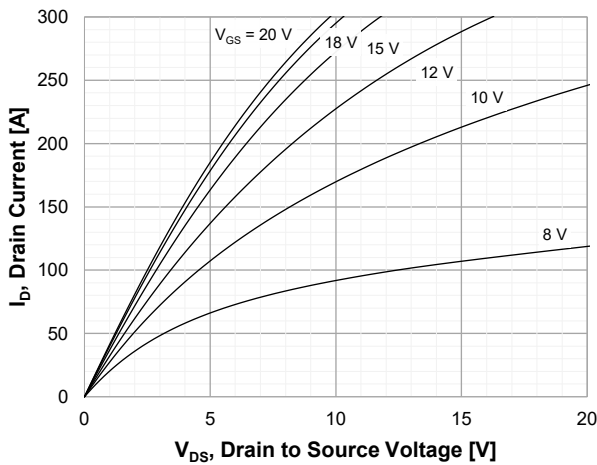
**Figure 1. On-Region Characteristics  $T_J = -40^\circ\text{C}$**



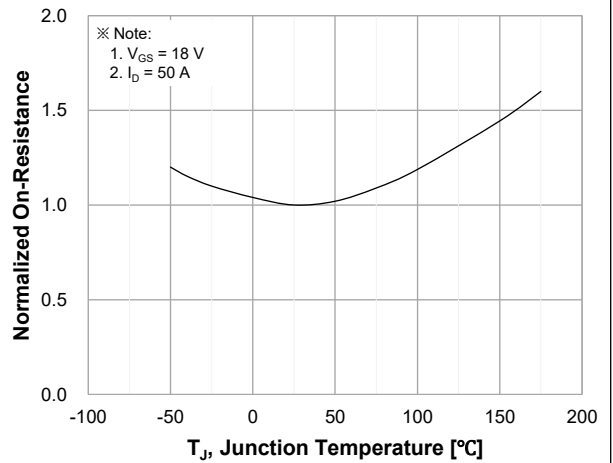
**Figure 2. On-Region Characteristics  $T_J = 25^\circ\text{C}$**



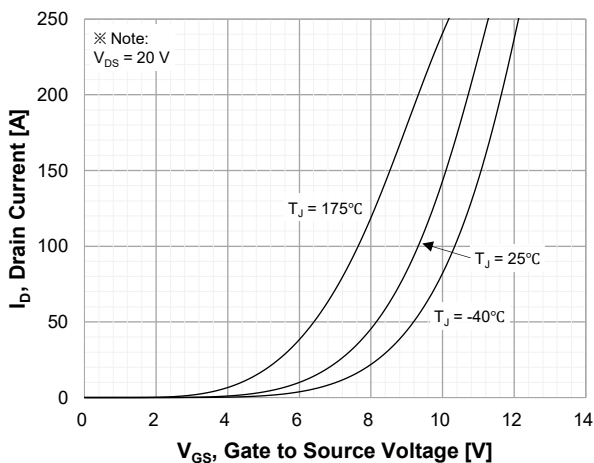
**Figure 3. On-Region Characteristics  $T_J = 175^\circ\text{C}$**



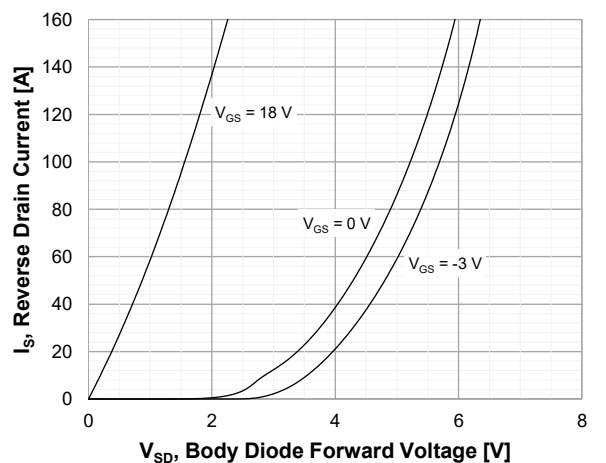
**Figure 4. Normalized On-Resistance Characteristics vs. Temperature**



**Figure 5. Transfer Characteristics**



**Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current  $T_J = -40^\circ\text{C}$**



### Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current  $T_J = 25^\circ\text{C}$

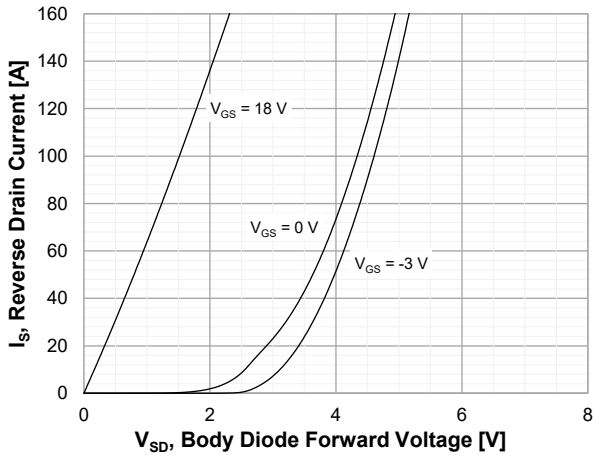


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current  $T_J = 175^\circ\text{C}$

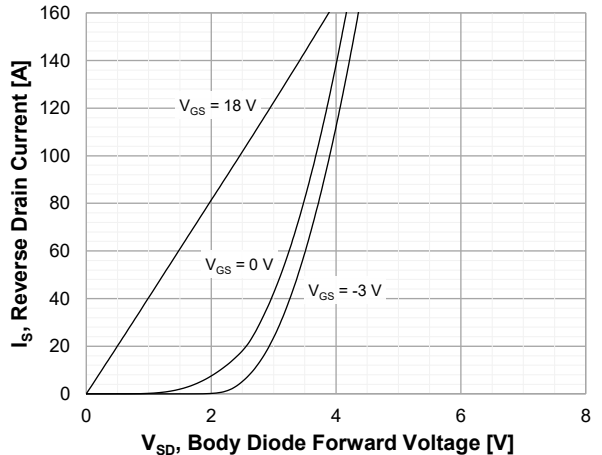


Figure 9. Threshold Voltage vs. Temperature

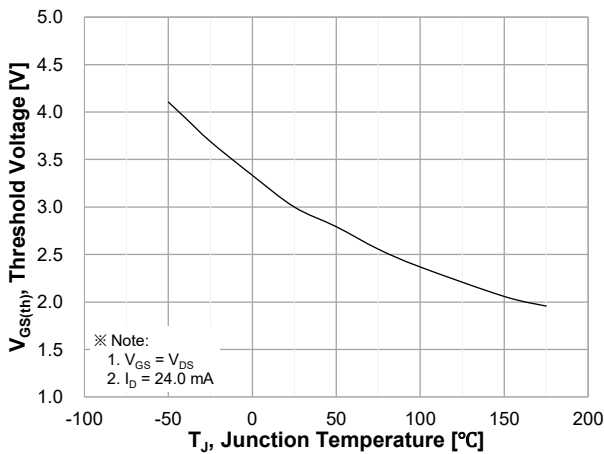


Figure 10. Gate Charge Characteristics

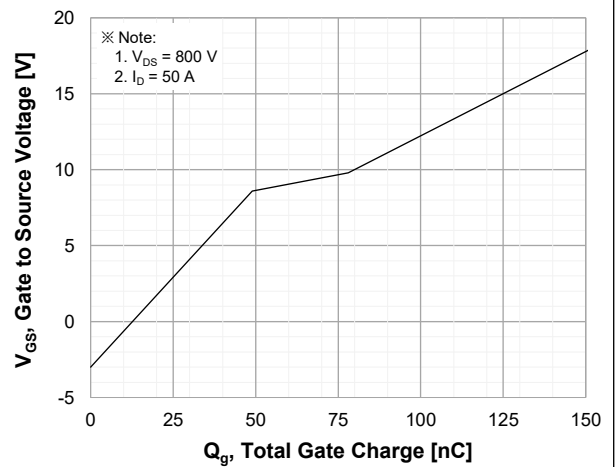


Figure 11. Stored Energy in Output Capacitance

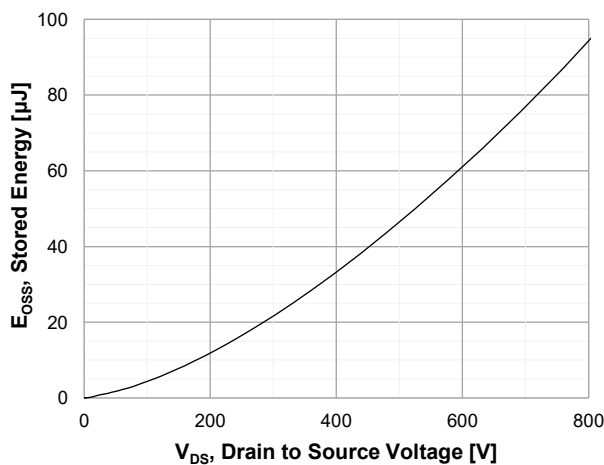
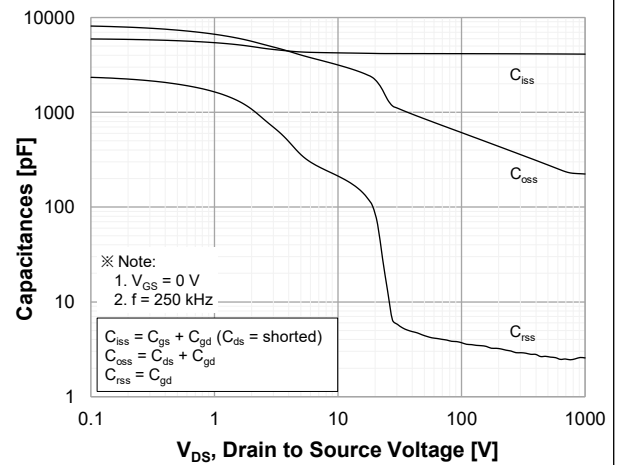


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

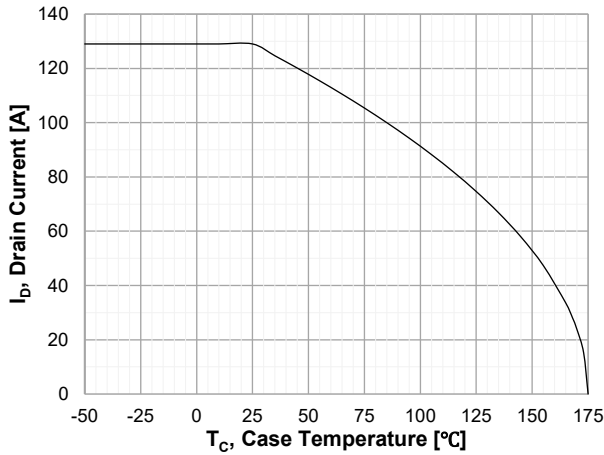


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

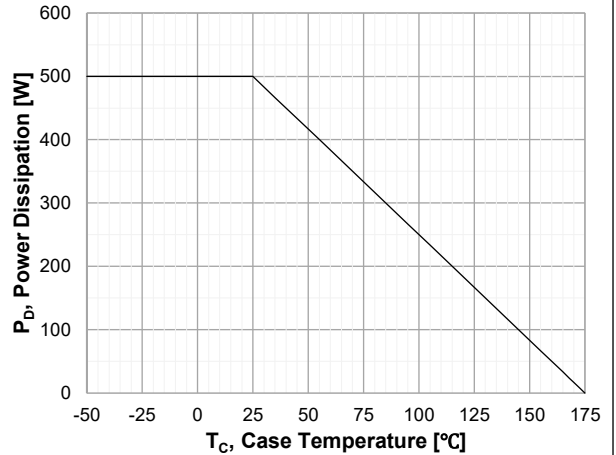


Figure 15. Typ. Switching Losses vs. Drain Current

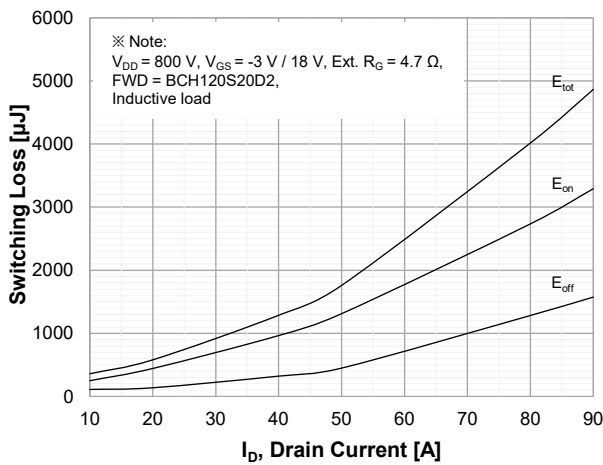


Figure 16. Typ. Switching Losses vs. Gate Resistance

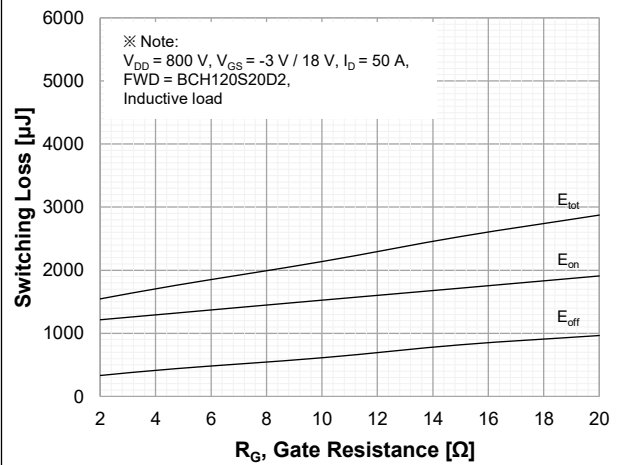


Figure 17. Typ. Switching Losses vs. Drain Current

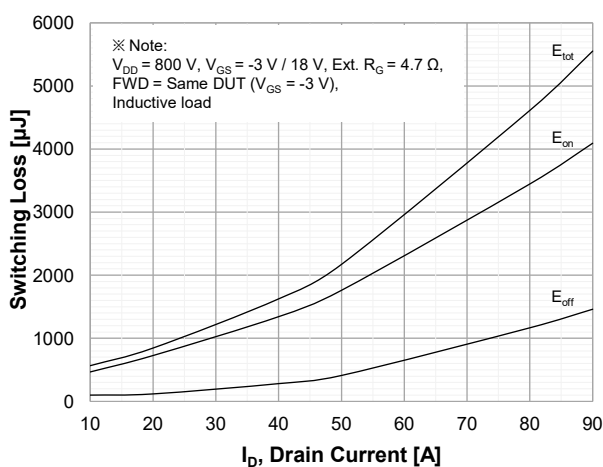
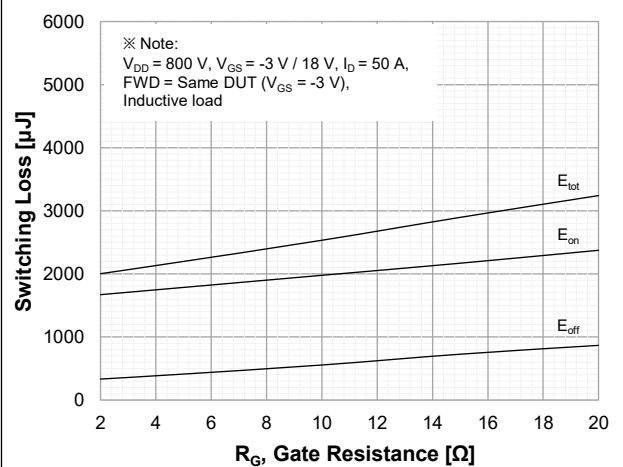
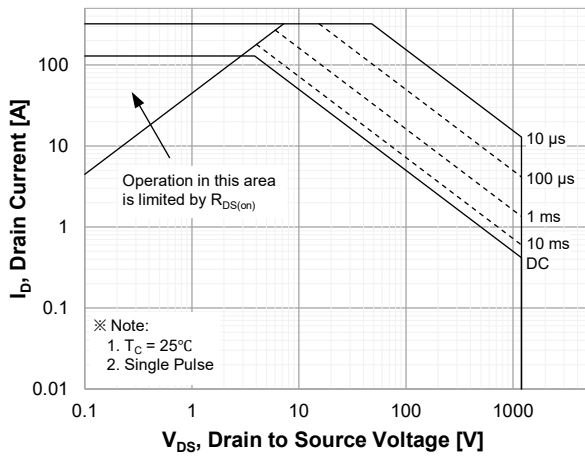


Figure 18. Typ. Switching Losses vs. Gate Resistance

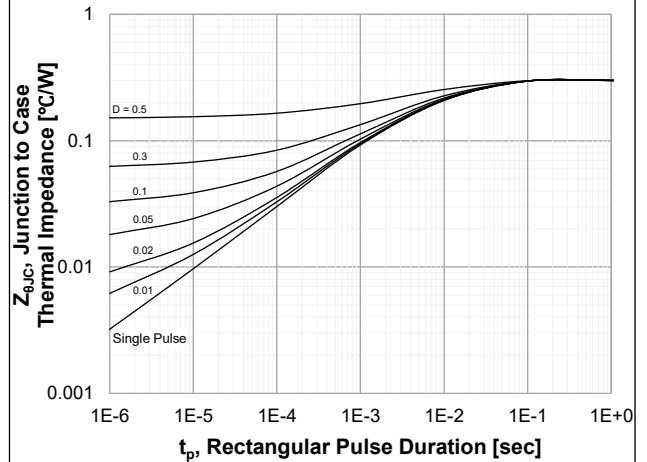


### Typical Performance Characteristics

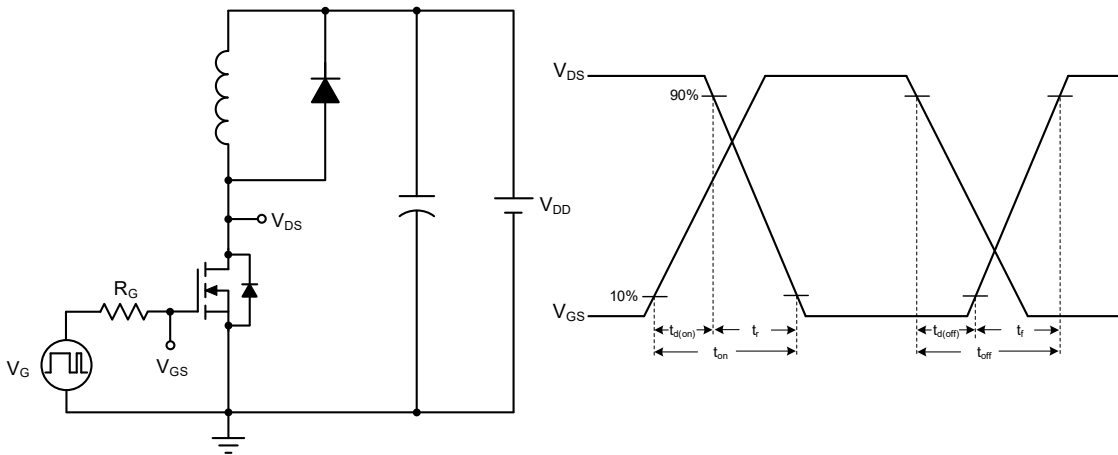
**Figure 19. Maximum Safe Operating Area**



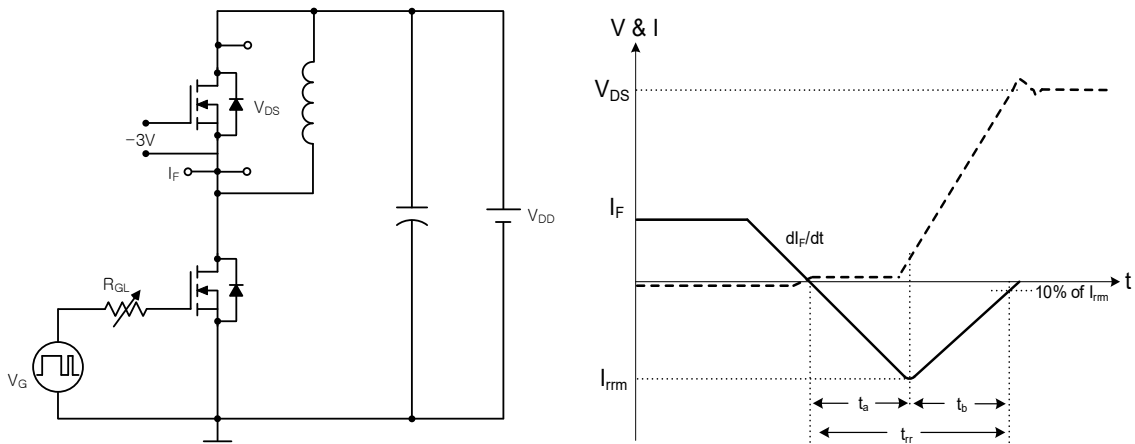
**Figure 20. Transient Thermal Response Curve**



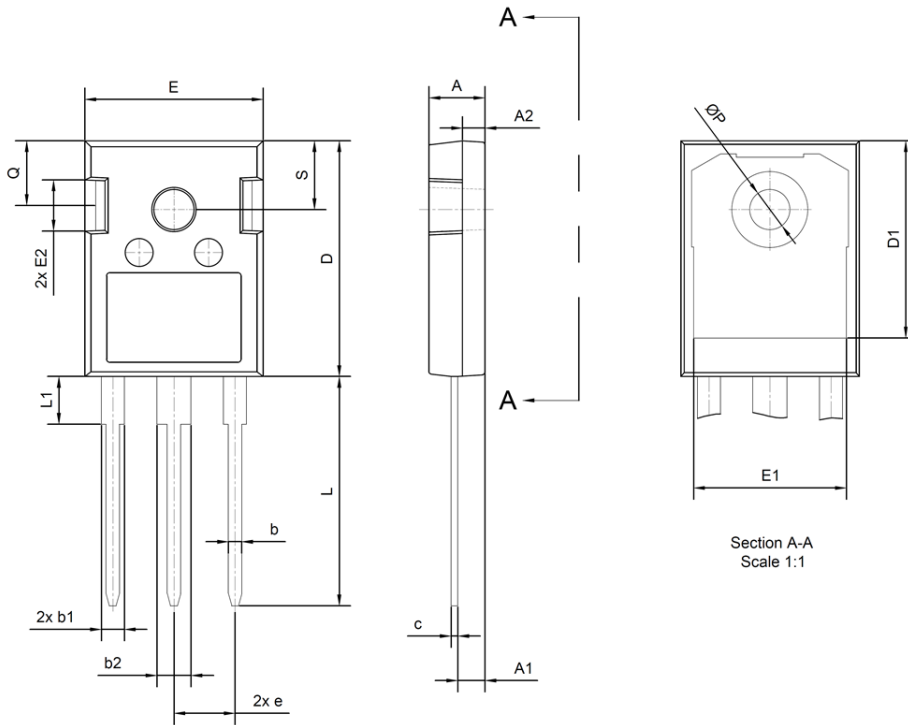
**Figure 21. Inductive Load Switching Test Circuit and Waveforms**



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



**Package Outlines**  
**TO-247-3L**



SYMBOL	Common		
	DIMENSIONS MILLIMETER		
	MIN.	NOM.	MAX.
A	4.80	5.00	5.20
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	1.91	2.06	2.20
b2	2.92	3.06	3.20
c	0.50	0.60	0.70
D	20.80	21.07	21.34
D1	17.23	17.63	18.03
E	15.75	15.94	16.13
E1	13.46	13.66	13.86
E2	4.32	4.58	4.83
e	5.46 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.48
ØP	3.56	3.61	3.66
Q	5.38	5.79	6.20
S	6.15 BSC		

\*Dimensions in millimeters

**Package Marking and Ordering Information**

Part Number	Top Marking	Package	Packing Method	Quantity
BCW120N16M1	BCW120N16M1	TO247-3L	Tube	30 units

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