

BCW120N60M2

N-Channel Silicon Carbide Power MOSFET

1200 V, 57 A, 60 mΩ

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

$BV_{DSS}, T_c=25^{\circ}\text{C}$	$I_D, T_c=25^{\circ}\text{C}$	$R_{DS(on), typ}$	$Q_{g, typ}$
1200 V	57 A	60 mΩ	97.3 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



Absolute Maximum Ratings ($T_J = 25^{\circ}\text{C}$ 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 / +18	V
I_D	Drain Current	$V_{GS} = 18 \text{ V} (T_c = 25^{\circ}\text{C})$	57	A
		$V_{GS} = 18 \text{ V} (T_c = 100^{\circ}\text{C})$	40	
I_{DM}	Drain Current	Pulsed (Note1)	198	A
P_D	Power Dissipation	($T_c = 25^{\circ}\text{C}$)	306	W
		Derate Above 25°C	2.04	W/ $^{\circ}\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	$^{\circ}\text{C}$

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.49	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	26.55	
T_{sold}	Soldering temperature, wave soldering only allowed at leads	260	$^{\circ}\text{C}$

Electrical Characteristics ($T_J = 25^\circ\text{C}$ 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	10	μA
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$	-	-	100	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$	-	-	+200	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	-	-	-200	

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 10\text{ mA}$	2	2.6	3.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 15\text{ V}, I_D = 30\text{ A}$	-	60	70	mΩ
		$V_{GS} = 15\text{ V}, I_D = 30\text{ A}, T_J = 175^\circ\text{C}$	-	98	-	
		$V_{GS} = 18\text{ V}, I_D = 30\text{ A}$	-	50	60	
		$V_{GS} = 18\text{ V}, I_D = 30\text{ A}, T_J = 175^\circ\text{C}$	-	93	-	
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 30\text{ A}$	-	18	-	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	-	2236	-	pF
C_{oss}	Output Capacitance		-	89	-	
C_{rss}	Reverse Capacitance		-	2	-	
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$	-	75	-	μJ
$C_{o(er)}$	Energy Related Output Capacitance		-	188	-	pF
$C_{o(tr)}$	Time Related Output Capacitance		-	226	-	
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 800\text{ V}, I_D = 30\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, \text{ Inductive load}$	-	97.3	-	nC
Q_{gs}	Gate to Source Charge		-	22.7	-	
Q_{gd}	Gate to Drain "Miller" Charge		-	23.2	-	
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV open drain}$	-	3.5	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 800\text{ V}, I_D = 30\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ $R_G = 3.3\Omega,$ FWD : body diode at $V_{GS} = -5\text{ V},$ Inductive load	-	11.15	-	ns
t_r	Turn-On Rise Time		-	23.25	-	
$t_{d(off)}$	Turn-Off Delay Time		-	17.91	-	
t_f	Turn-Off Fall Time		-	8	-	
E_{on}	Turn-on Switching Energy		-	402	-	μJ
E_{off}	Turn-off Switching Energy		-	40.07	-	
E_{tot}	Total Switching Energy		-	442.07	-	

Source-Drain Diode Characteristics

I _S	Maximum Continuous Diode Forward Current		-	-	57	A
I _{SM}	Maximum Pulsed Diode Forward Current		-	-	198	
V _{SD}	Diode Forward Voltage	V _{GS} = -5 V, I _{SD} = 30 A	-	4.5	-	V
t _{rr}	Reverse Recovery Time	V _{DD} = 800 V, I _{SD} = 30 A, dI _F /dt = 3000 A/μs, Includes Q _{OSS}	-	11.1	-	ns
Q _{rr}	Reverse Recovery Charge		-	58.83	-	nC
I _{rrm}	Peak Reverse Recovery Current		-	10.6	-	A

Typical Performance Characteristics

Figure 1. On-Region Characteristics $T_J = 25^\circ\text{C}$

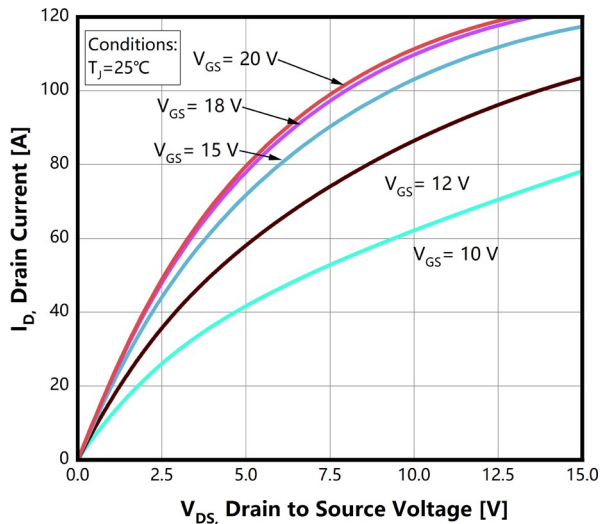


Figure 2. On-Region Characteristics $T_J = 175^\circ\text{C}$

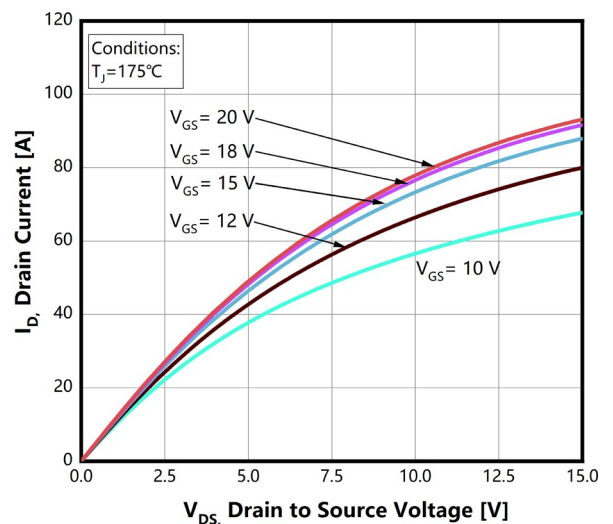


Figure 3. On-Resistance Characteristics vs. Temperature

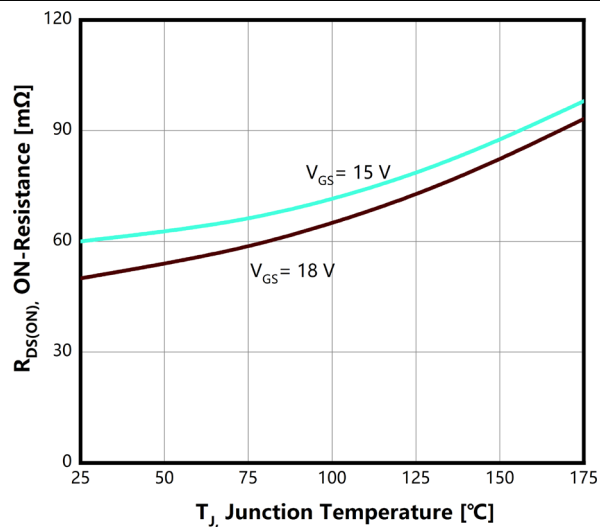


Figure 4. Transfer Characteristics

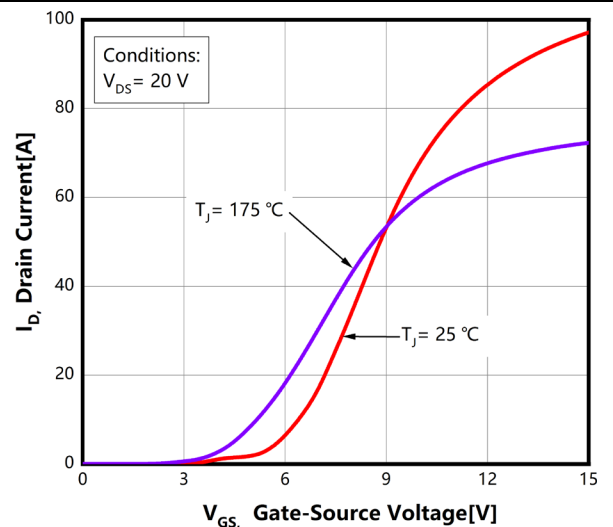


Figure 5. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^\circ\text{C}$

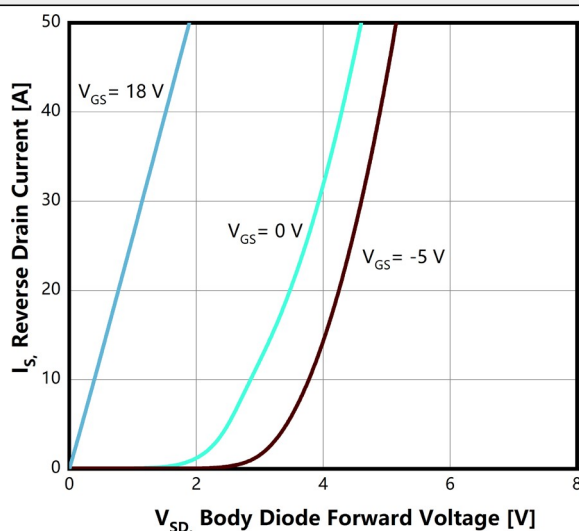
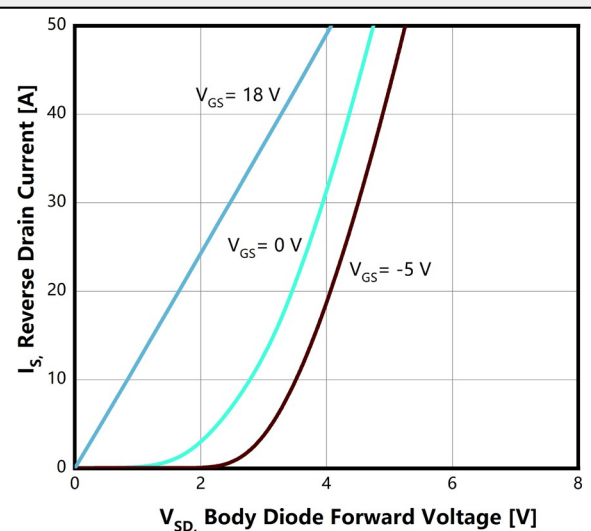


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^\circ\text{C}$



Typical Performance Characteristics

Figure 7. Threshold Voltage vs. Temperature

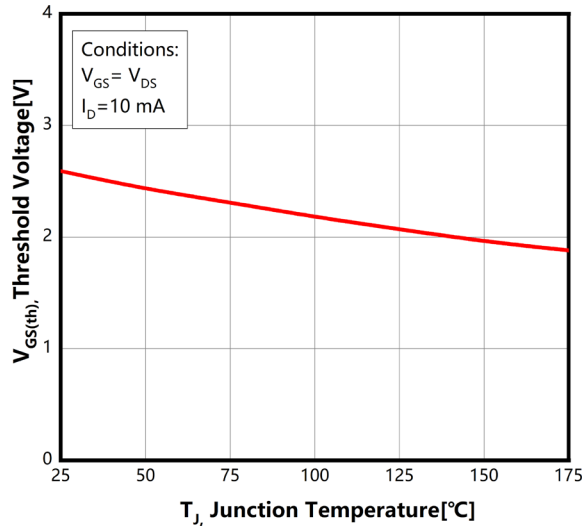


Figure 8. Gate Charge Characteristics

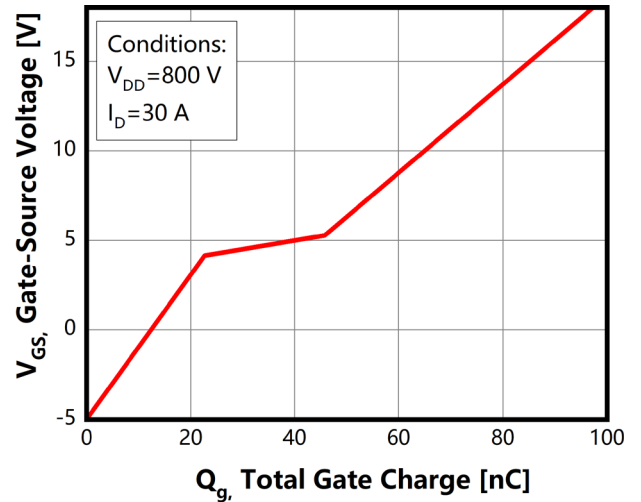


Figure 9. Stored Energy in Output Capacitance

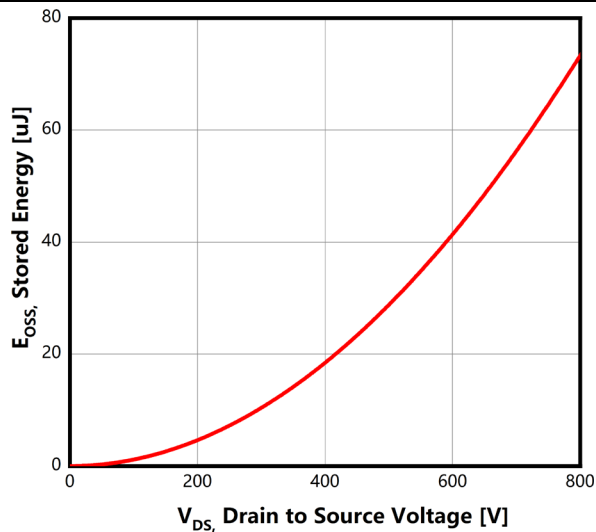


Figure 10. Capacitance Characteristics

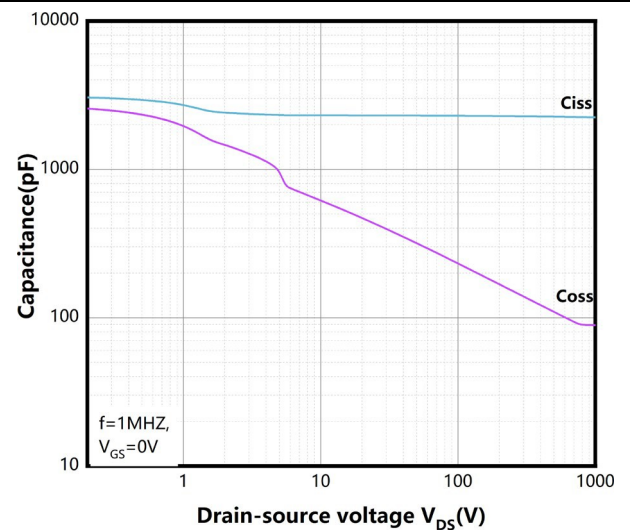


Figure 11. Continuous Drain Current Derating vs. Case Temperature

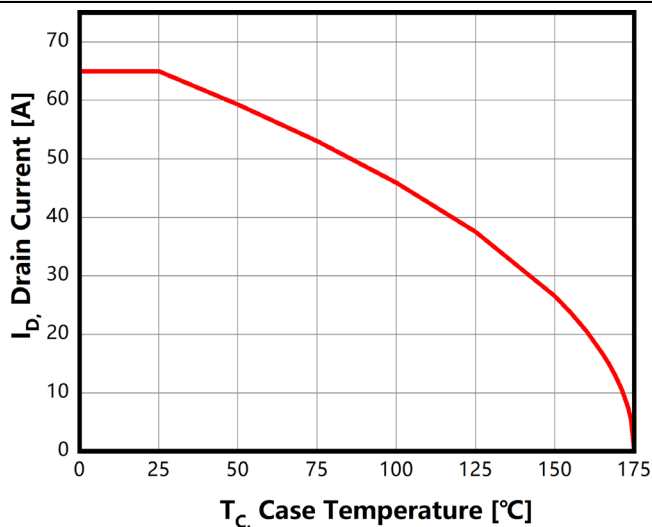
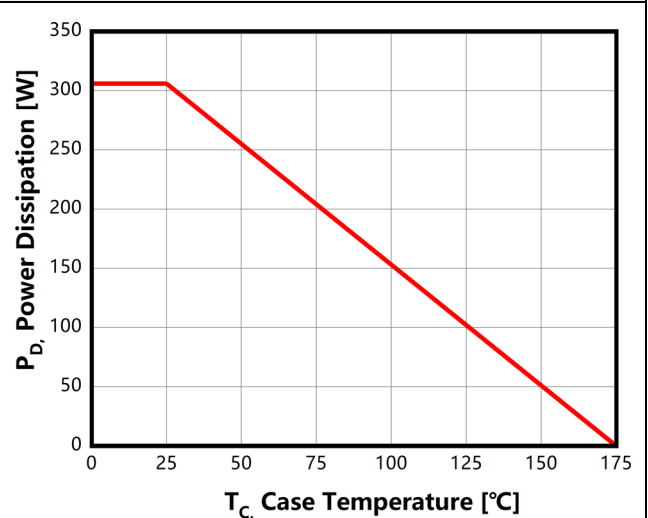


Figure 12. Maximum Power Dissipation Derating vs. Case Temperature



Typical Performance Characteristics

Figure 13. Maximum Safe Operating Area

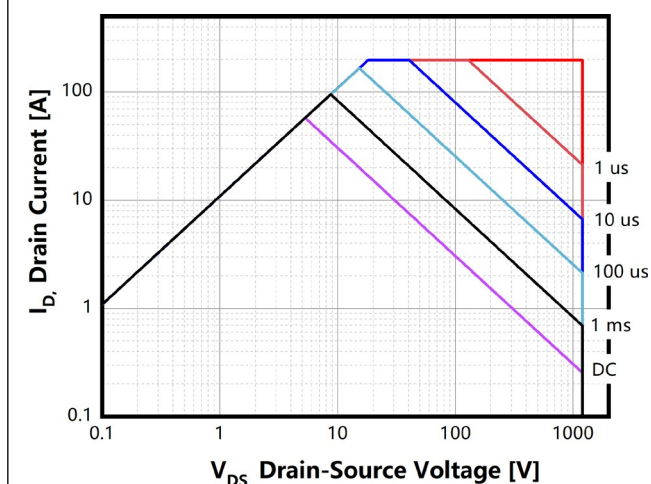
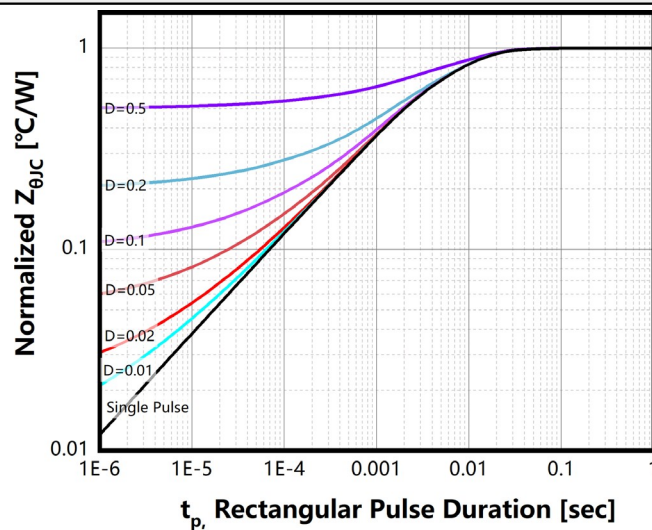


Figure 14. Transient Thermal Response Curve



Typical Performance Characteristics

Figure 15. Inductive Load Switching Test Circuit and Waveforms

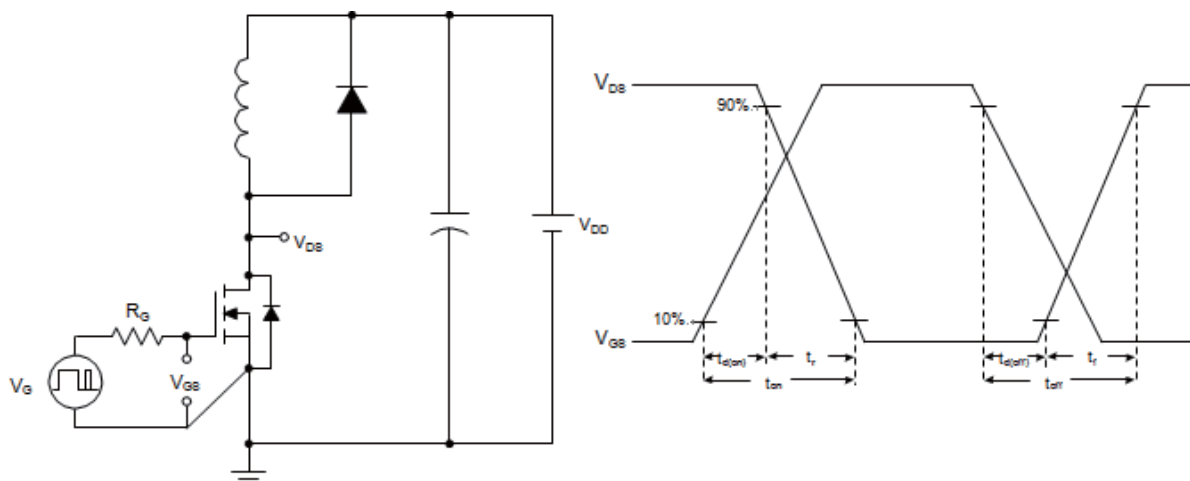
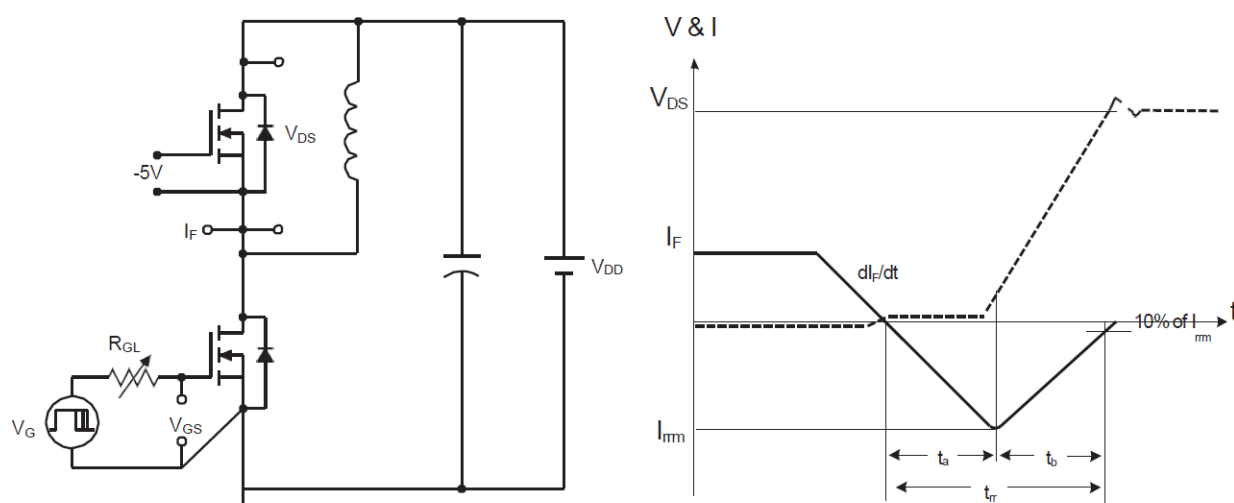
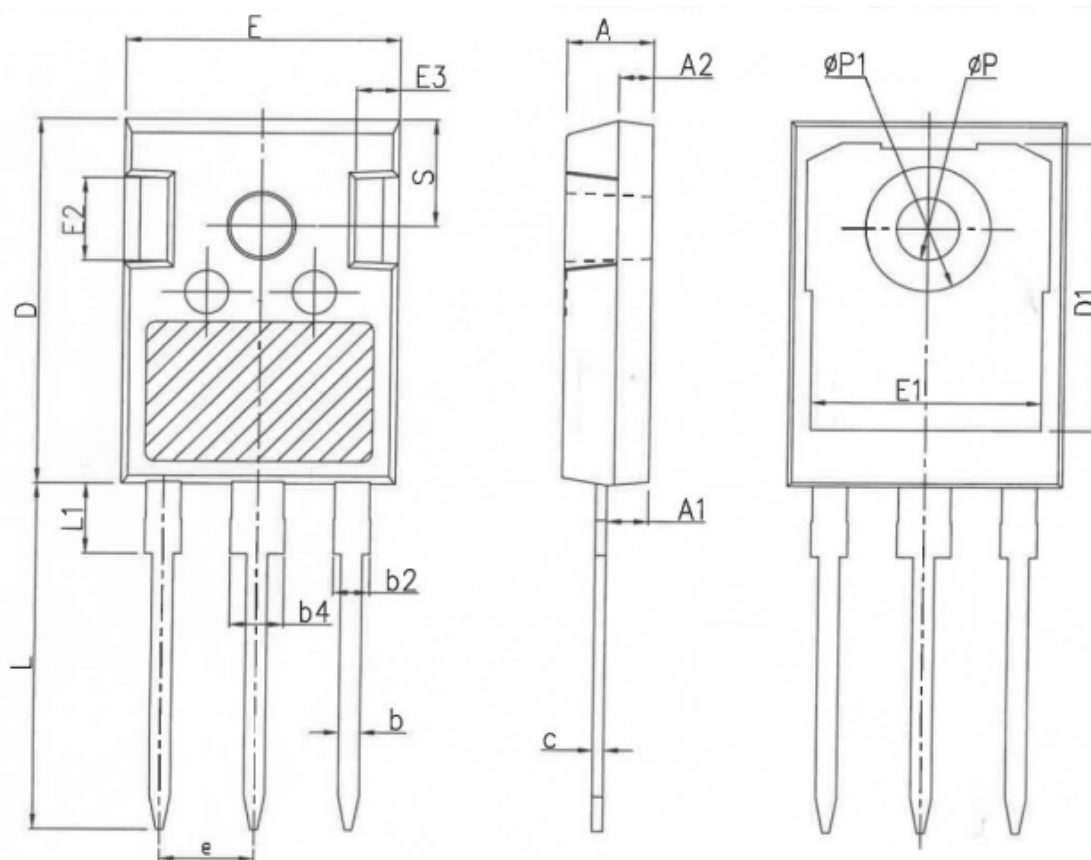


Figure 16. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO247-3



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ϕP	3.40	3.60	3.80
$\phi P1$	-	-	7.30
S	6.15BSC		

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCW120N60M2	BCW120N60M2	TO247-3L	Tube	30 units

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