

BMF60N190C1

Super Junction Power MOSFET

600 V, 20 A, 190 mΩ

Description

BMF60N190C1 is power MOSFET using bestirpower's advanced super junction technology that can realize very low on resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of Low EMI to designers as well as low switching loss.

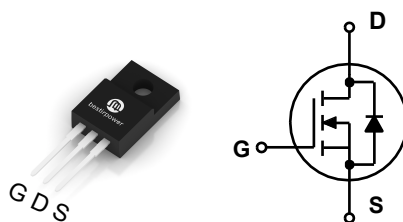
Applications

- PC power.
- Server power supply.
- Telecom.
- Solar inverter.
- Super charger for automobiles.

Features

$BV_{DSS} @ T_{J,max}$	I_D	$R_{DS(on),max}$	$Q_{g,typ}$
650V	20 A	190 mΩ	40 nC

- Ultra-fast body diode.
- Extremely low losses due to very low FOM
- $R_{dson} \cdot Q_g$ and E_{oss} .
- Very high commutation ruggedness.



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage ¹⁾		600	V
V_{GSS}	Gate to Source Voltage		± 30	V
I_D	Drain Current ²⁾	$V_{GS} = 10 \text{ V}, (T_C = 25^\circ\text{C})$	20	A
		$V_{GS} = 10 \text{ V}, (T_C = 100^\circ\text{C})$	12	
I_{DM}	Drain Current	Pulsed	60	A
E_{AS}	Single Pulsed Avalanche Energy ³⁾		282	mJ
I_{AR}	Avalanche Current		7.5	A
dv/dt	MOSFET dv/dt		50	V/ns
	Peak Diode Recovery dv/dt ⁴⁾		50	
P_D	Power Dissipation	$(T_C = 25^\circ\text{C})$	34	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds		260	$^\circ\text{C}$

1) Limited by T_J max. Maximum duty cycle $D=0.75$.

2) Pulse width t_p limited by $T_{J,max}$.

3) $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$.

4) $V_{DClk}=400\text{V}$; $V_{DS,peak} < V_{(BR)DSS}$; identical low side and high side switch with identical R_G .

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.67	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

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 = 1 mA	600	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V, T _J = 25°C	-	-	1	μA
I _{GSS}	Gate-Source Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V	-	-	±100	nA

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	2.5	3.5	4.5	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 23 A, T _J = 25°C	-	160	190	mΩ

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{GS} = 0 V, V _{DS} = 50V, f = 250 kHz	-	1690	-	pF
C _{oss}	Output Capacitance		-	78	-	pF
C _{rss}	Reverse transfer capacitance		-	3.3	-	pF
C _{o(tr)}	Time Related Output Capacitance ¹⁾	V _{DS} = 0 V to 400 V, V _{GS} = 0 V	-	245	-	pF
C _{o(er)}	Energy Related Output Capacitance ²⁾		-	50	-	pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DD} = 400 V, I _D = 7 A, V _{GS} = 0 to 10 V	-	40	-	nC
Q _{gs}	Gate to Source Charge		-	9	-	nC
Q _{gd}	Gate to Drain "Miller" Charge		-	17	-	nC
V _{plateau}	Gate plateau voltage		-	6	-	V
R _G	Gate resistance	f = 1 MHz, open drain	-	7	-	Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400 V, I _D = 7 A, V _{GS} = 10 V	-	64	-	ns
t _r	Turn-On Rise Time		-	16	-	ns
t _{d(off)}	Turn-Off Delay Time		-	55	-	ns
t _f	Turn-Off Fall Time		-	14	-	ns

Source-Drain Diode Characteristics

V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _F = 10A, T _J = 25°C	-	0.85	-	V
t _{rr}	Reverse Recovery Time	V _R = 400 V, I _F = 10A, di _F /dt = 100 A/μs	-	320	-	ns
Q _{rr}	Reverse Recovery Charge		-	2.5	-	μC
I _{rrm}	Peak reverse recovery current		-	14	-	A

- 1) C_{o(tr)} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 400V.
 2) C_{o(er)} is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 400V.

Typical Performance Characteristics

Figure 1. Power dissipation

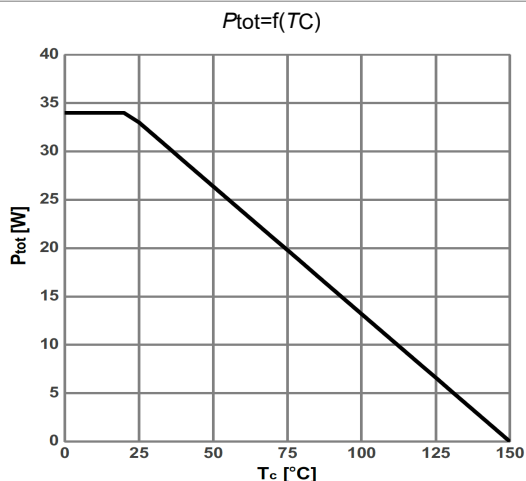


Figure 2. Max. transient thermal impedance

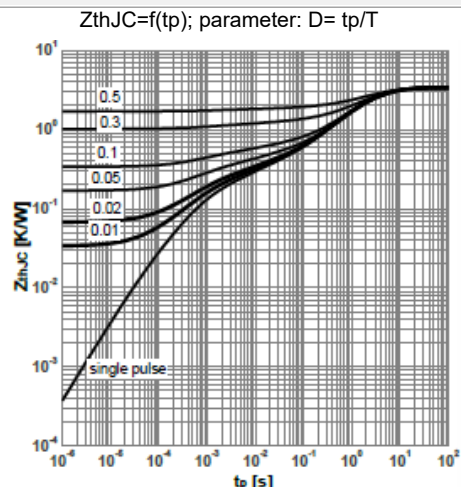


Figure 3. Safe operating area

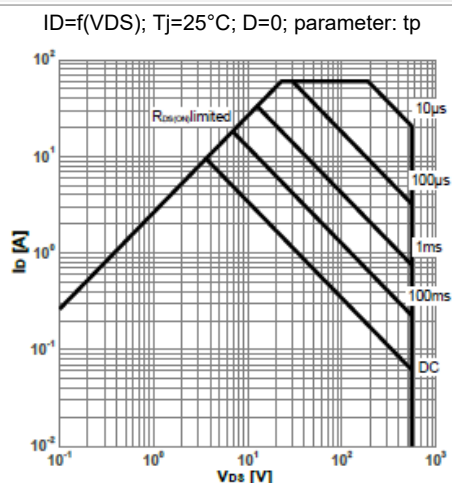


Figure 4. Typ. output characteristics

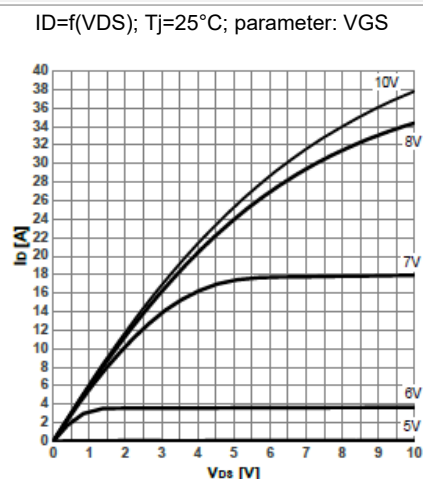


Figure 5. Typ. output characteristics

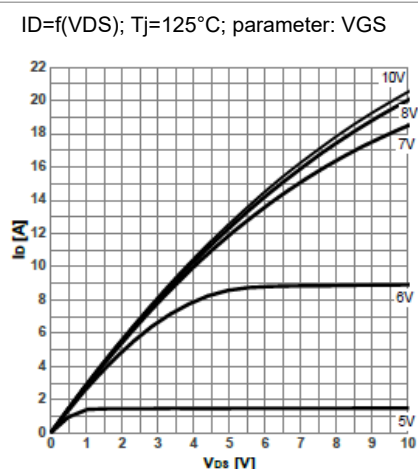
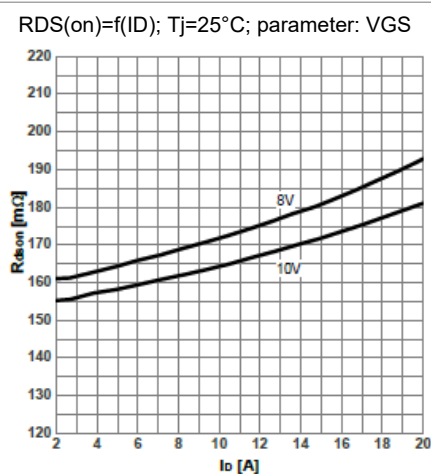


Figure 6. Typ. drain-source on-state resistance



Typical Performance Characteristics

Figure 7. Drain-source on-state resistance

$R_{DS(on)}=f(T_J)$; $I_D=10A$; $V_{GS}=10V$

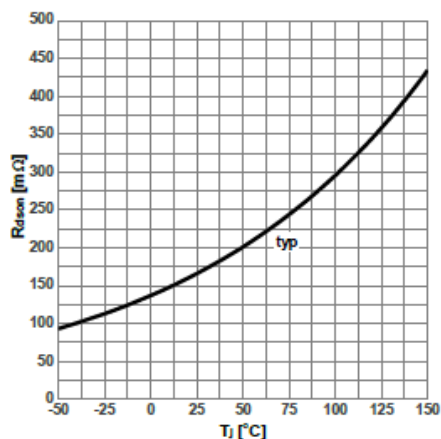


Figure 8. Typ. transfer characteristics

$I_D=f(V_{GS})$; $V_{DS}=20V$; parameter: T_J

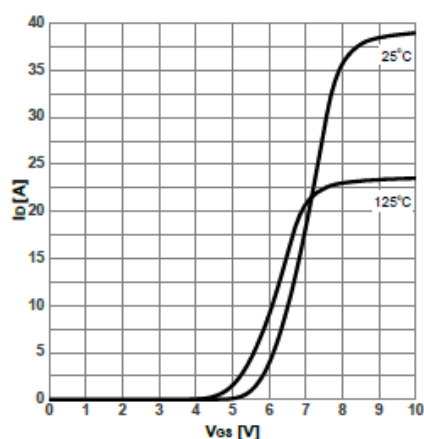


Figure 9. Typ. gate charge

$V_{GS}=f(Q_{gate})$; $I_D=7A$ pulsed; $V_{DS}=400V$

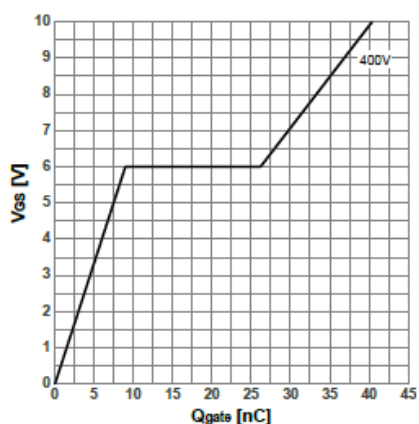


Figure 10. Forward characteristics of reverse diode

$I_F=f(V_{SD})$; parameter: T_J

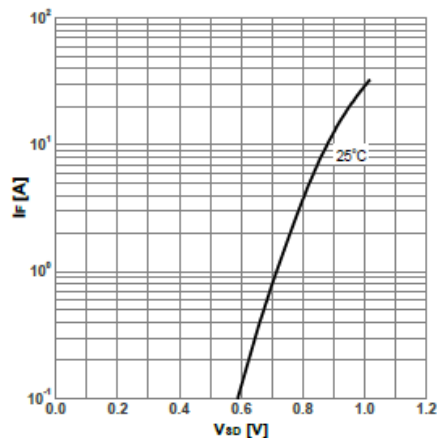


Figure 11. Drain-source breakdown voltage

$V_{BR(DSS)}=f(T_J)$; $I_D=1mA$

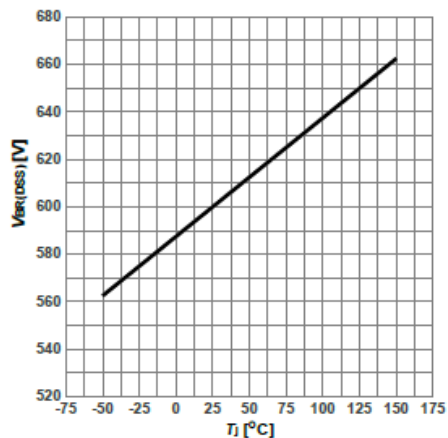
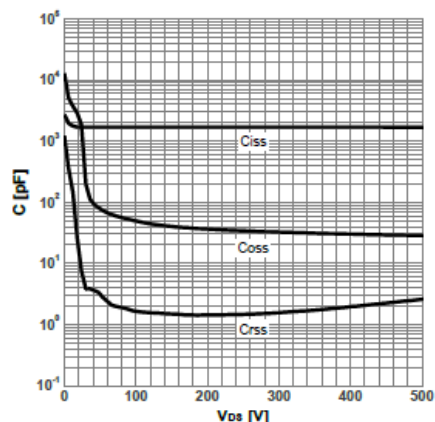


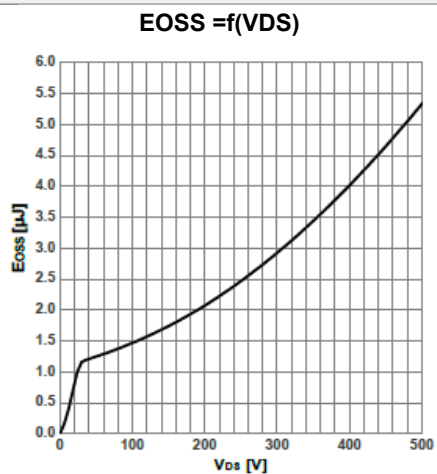
Figure 12. Typ. capacitance

$C=f(V_{DS})$; $V_{GS}=0V$; $f=250KHz$



Typical Performance Characteristics

Figure 13. Typ. Coss stored energy



Test Circuits

Figure 15. Diode Characteristics

Test circuit for diode characteristics and Diode recovery waveform

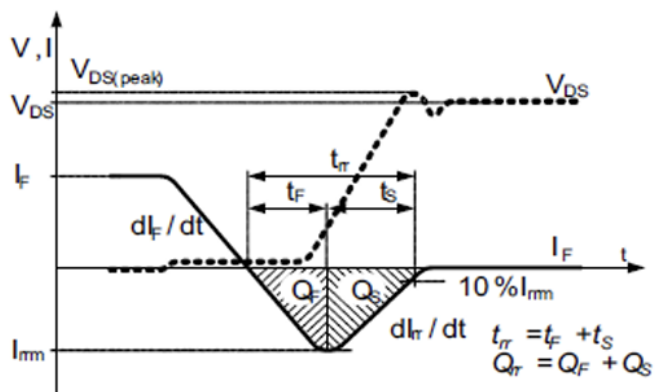
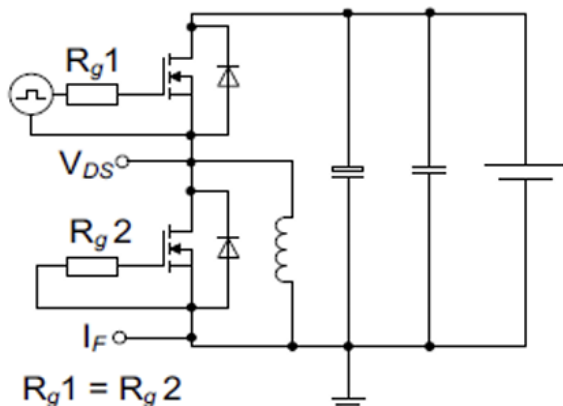


Figure 16. Switching Times

Switching times test circuit for inductive load and Switching times waveform

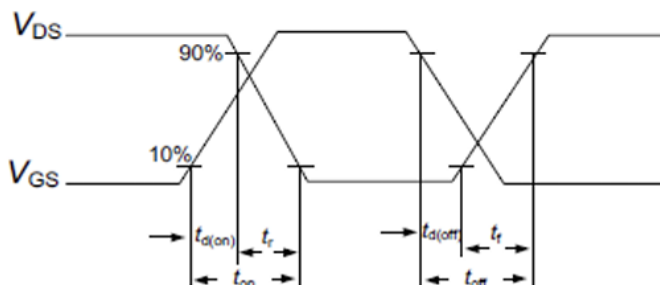
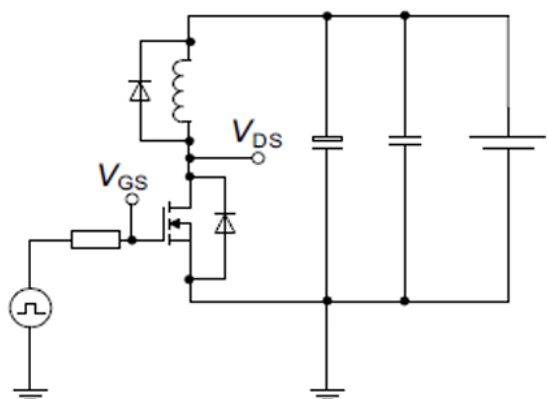
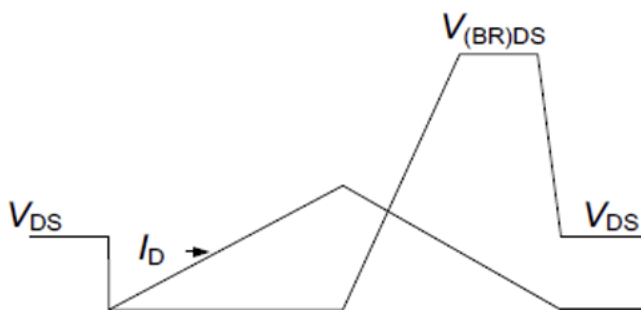
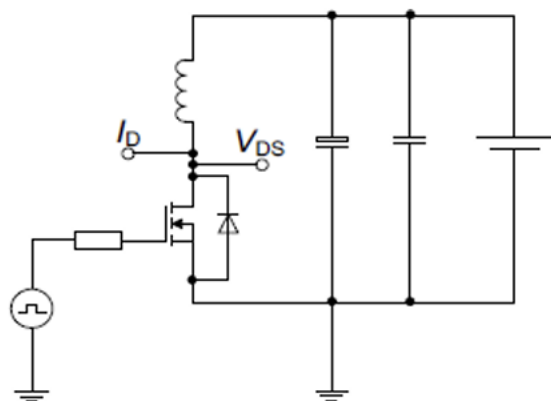


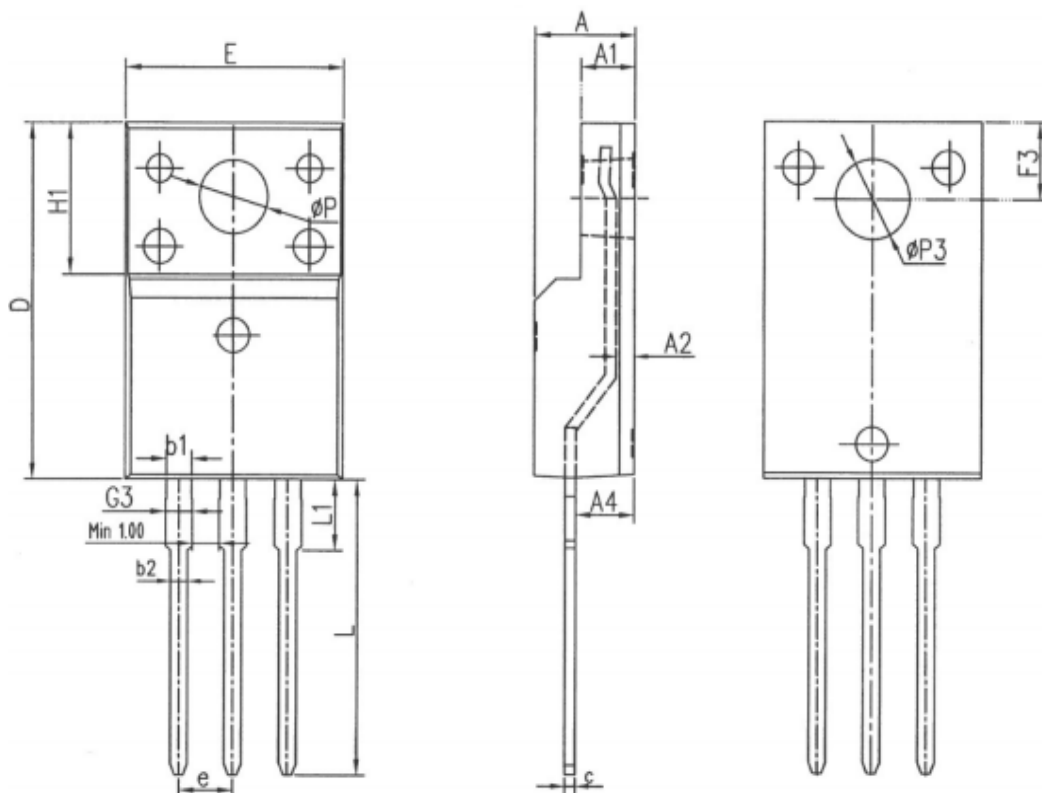
Figure 17. Unclamped Inductive Load

Unclamped inductive load test circuit and Unclamped inductive waveform



Package Outlines

TO-220F



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
E	10.00	10.20	10.40
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.65	0.85	1.30
A4	2.55	2.75	2.95
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
Φ P	3.183REF		
L	12.68	12.98	13.28
L1	3.25	3.45	3.65
Φ P3	3.45REF		
F3	3.10	3.30	3.50
G3	1.10	1.30	1.50
b1	1.05	1.20	1.35
b2	0.70	0.80	0.92

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BMF60N190C1	BMF60N190C1	TO220F-3	Tube	50 units

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