



BMx65N190UC1

Super Junction Power MOSFET

650 V, 20 A, 190 mΩ

Description

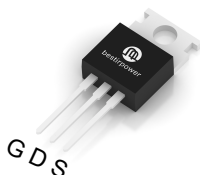
BMx65N190UC1 is power MOSFET using bestirpower's advanced super junction technology that can realize very low on-resistance and gate charge. It will provide much high efficiency by using optimized charge coupling technology. These user friendly devices give an advantage of Low EMI to designers as well as low switching loss.

Features

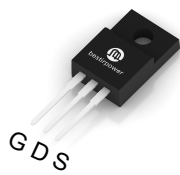
$BV_{DSS, Tc=25^{\circ}C}$	$I_D, Tc=25^{\circ}C$	$R_{DS(on),max. Tc=25^{\circ}C}$	$Q_{g,typ}$
650 V	20 A	190 mΩ	40 nC

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

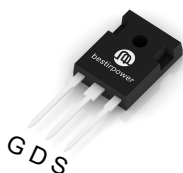
TO220



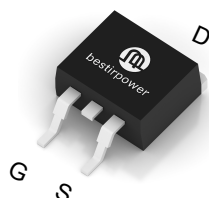
TO220F



TO247

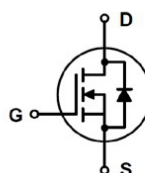


D²pak



Applications

- PC power.
- AC/DC power supply.
- Telecom/Server.
- Solar inverter.



Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method
BMP65N190UC1	BMP65N190UC1	TO220	Tube
BMF65N190UC1	BMF65N190UC1	TO220F	Tube
BMB65N190UC1	BMB65N190UC1	TO263	Tape & Reel
BMW65N190UC1	BMW65N190UC1	TO247	Tube

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

Symbol	Parameter	Value	Unit
V_{DSS}	Drain to Source Voltage ¹⁾	650	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
		$V_{GS} = 10\text{ V}, (T_C = 100^\circ\text{C})$	12
I_{DM}	Drain Current	Pulsed ($T_C = 25^\circ\text{C}$)	58
P_D	Power Dissipation For TO-220F	34	W
	Power Dissipation For TO-220, TO-247, TO-263	152	
E_{AS}	Single Pulsed Avalanche Energy ³⁾	306	mJ
dv/dt	Diode Recovery dv/dt ⁴⁾	50	V/ns
I_S	Continuous diode forward current $T_C = 25^\circ\text{C}$	20	A
$I_{S,pulse}$	Diode pulse current ²⁾	58	A
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
T_J	Maximum Operating Junction Temperature	150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10	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) $V_{DClink}=400\text{V}$; $V_{DS,peak} < V_{(BR)DSS}$; identical low side and high side switch with identical R_G .

Thermal Characteristics (FullPAK) TO220F

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

Thermal Characteristics (Non FullPAK) TO220, TO247, TO263

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.82	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62	

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	800	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	-	-	10	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	3.0	4.0	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 7\text{ A}$	-	170	190	mΩ
R_G	Gate Resistance	$V_{DD} = 0\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	-	4	-	Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}, f = 250\text{ kHz}$	-	1690	-	pF
C_{oss}	Output Capacitance		-	78	-	pF
C_{riss}	Reverse Transfer Capacitance		-	3.3	-	pF
$C_{o(er)}$	Effective output capacitance, energy related ¹⁾	$V_{GS} = 0\text{ V}, V_{DS} = 0\text{ to }400\text{ V}$	-	50	-	pF
$C_{o(tr)}$	Effective output capacitance, time related ²⁾		-	245	-	pF
Q_g	Total Gate Charge	$V_{GS} = 0\text{ to }10\text{ V},$ $V_{DD} = 400\text{ V}, I_D = 7\text{ A}$	-	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

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 400\text{ V},$ $I_D = 7\text{ A}, V_{GS} = 10\text{ V}$	-	10	-	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

Reverse Diode Characteristics

V_{SD}	Diode Forward Voltage	$I_F = 7\text{ A}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	-	0.85	-	V
t_{rr}	Reverse Recovery Time	$V_R = 400\text{ V}, I_F = 7\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$	-	120	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.6	-	μC
I_{rm}	Peak Reverse Recovery Current		-	10	-	A

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

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

Typical Performance Characteristics

Figure 1: Transient Thermal Impedance For TO-220F

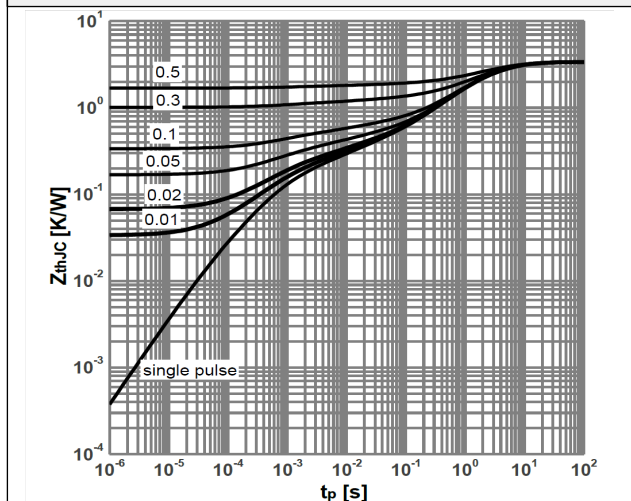


Figure 2: Power dissipation For TO-220F

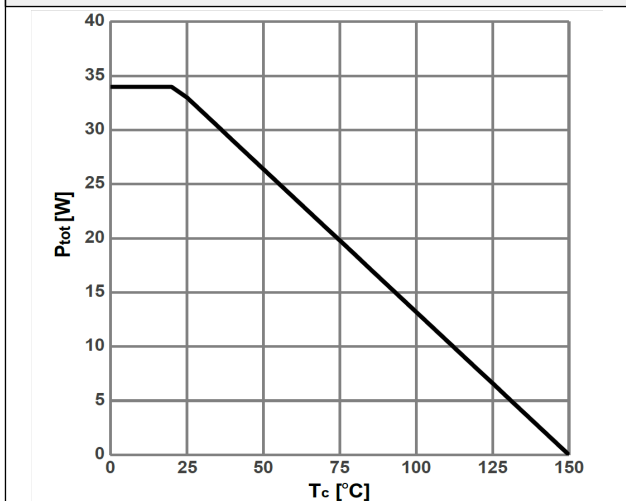


Figure 3: Transient Thermal Impedance For TO220, TO247, TO263

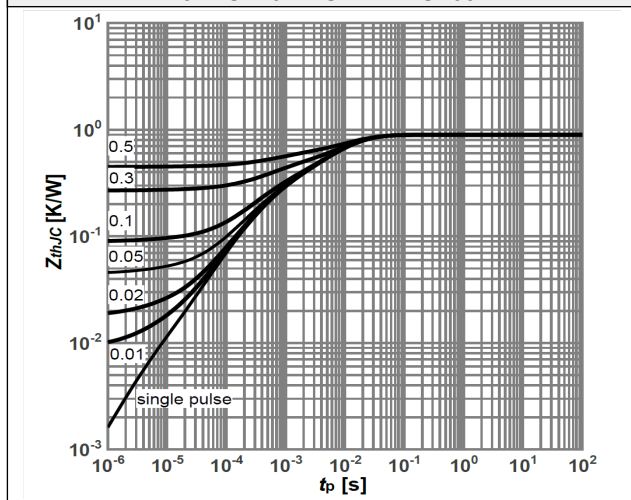


Figure 4: Power dissipation For TO220, TO247, TO263

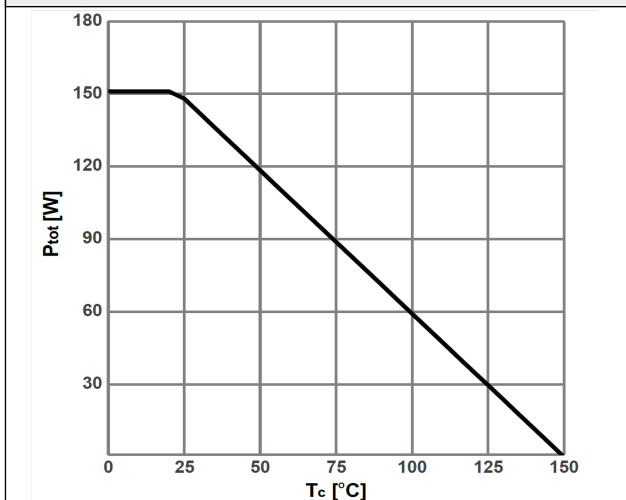


Figure 5: Safe operating area For TO220, TO247, TO263

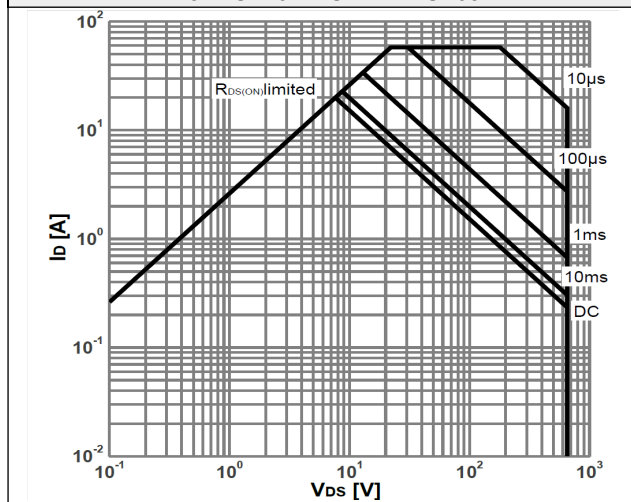
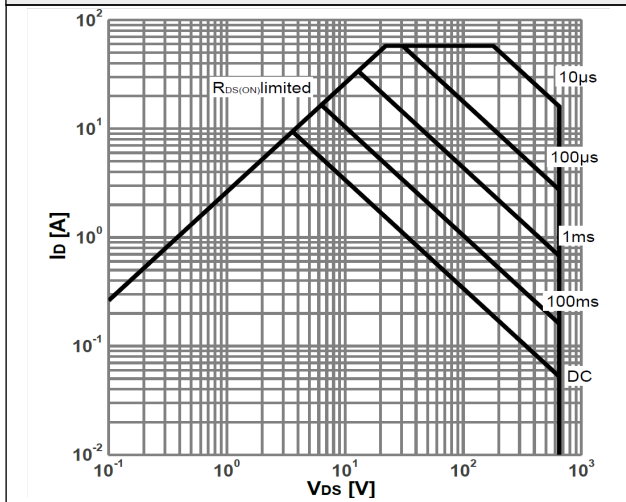


Figure 6: Safe operating area For TO220F



Typical Performance Characteristics

Figure 7: Typ. output characteristics @ $T_j=25^\circ\text{C}$

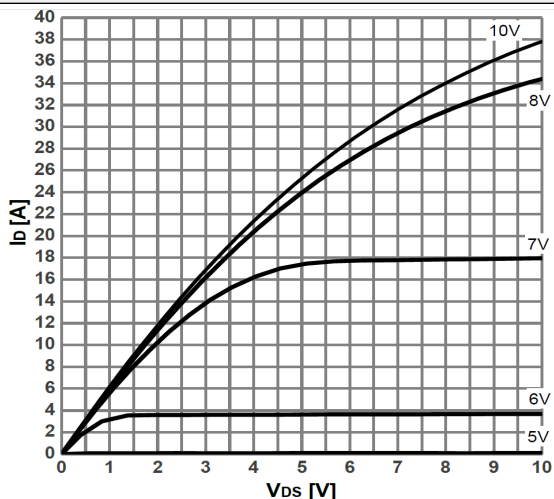


Figure 8: Typ. output characteristics @ $T_j=125^\circ\text{C}$

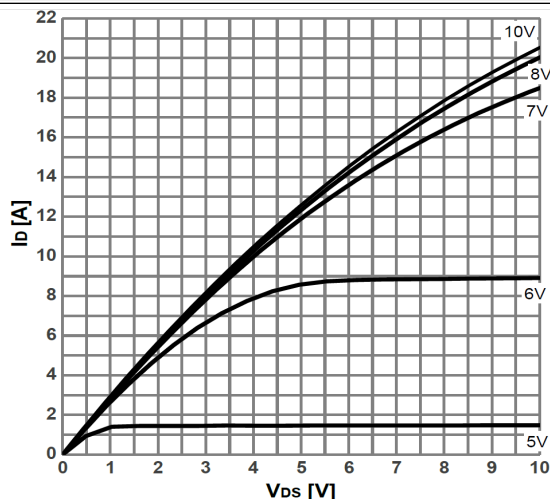


Figure 9: Typ. drain-source on-state resistance

$R_{DS(on)}=f(I_D)$; $T_j=25^\circ\text{C}$; parameter: V_{GS}

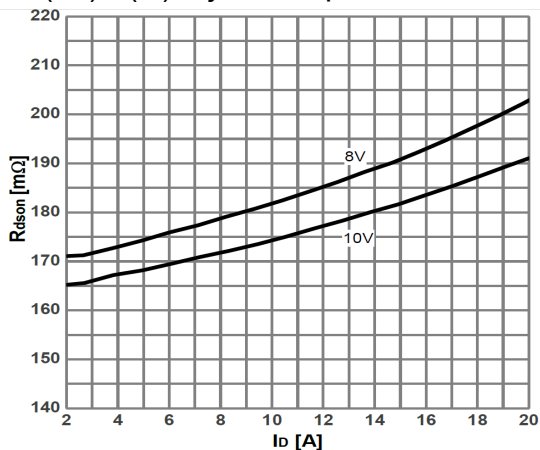


Figure 10: Drain-source on-state resistance

$R_{DS(on)}=f(T_j)$; $I_D=7\text{A}$; $V_{GS}=10\text{V}$

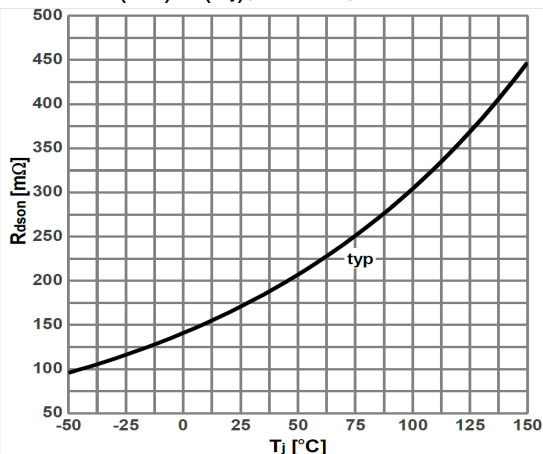


Figure 11: Breakdown Voltage vs Junction Temperature

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

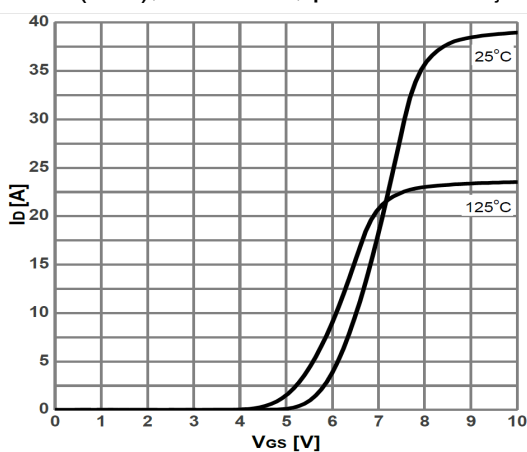
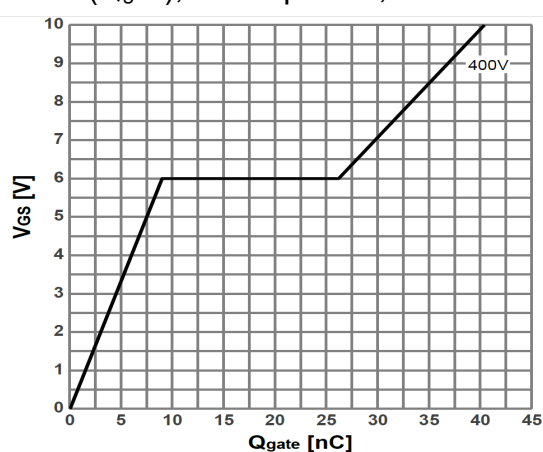


Figure 12: On-Resistance vs Temperature

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



Typical Performance Characteristics

Figure 13: Forward characteristics of reverse diode

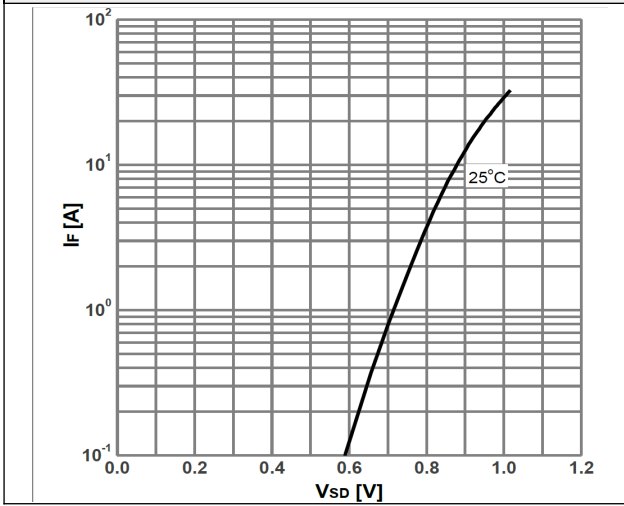


Figure 14: Drain-source breakdown voltage

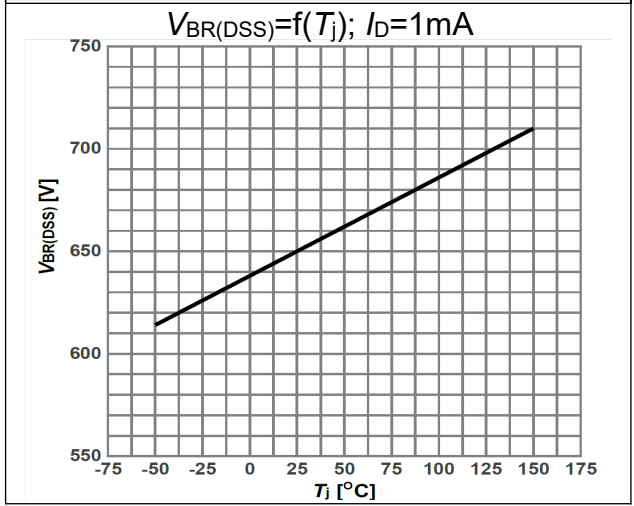


Figure 15: Typ. Coss stored energy

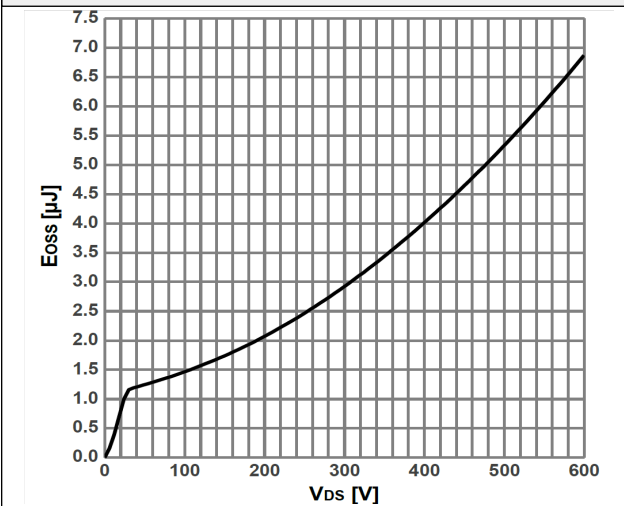
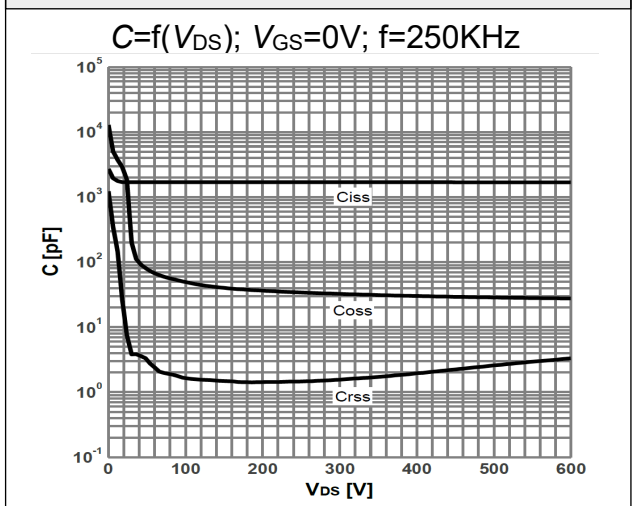


Figure 16: Typ. capacitances



Test Circuits

Figure 17. Diode Characteristics

Test circuit for diode characteristics and Diode recovery waveform

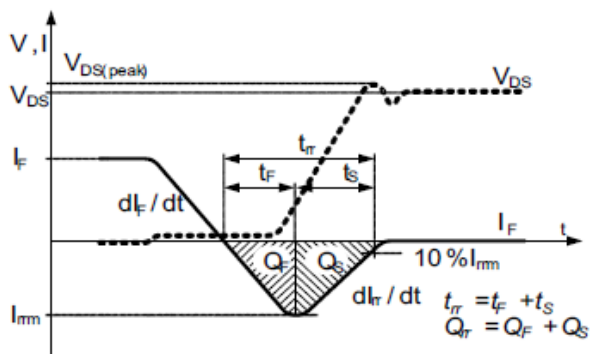
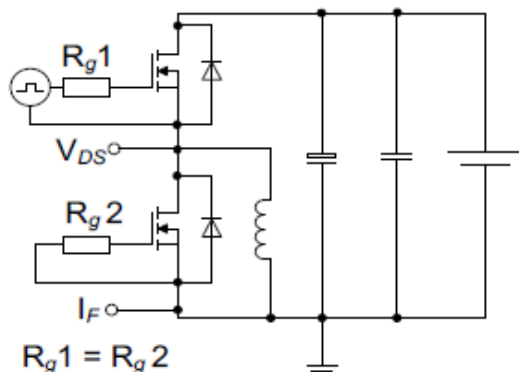


Figure 18. Switching Times

Switching times test circuit for inductive load and Switching times waveform

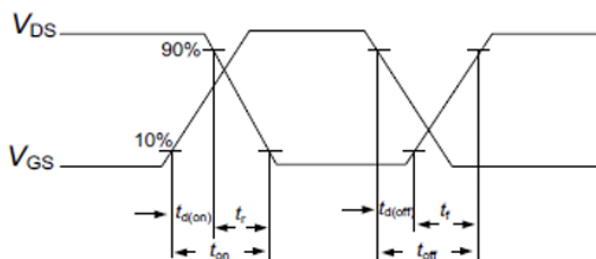
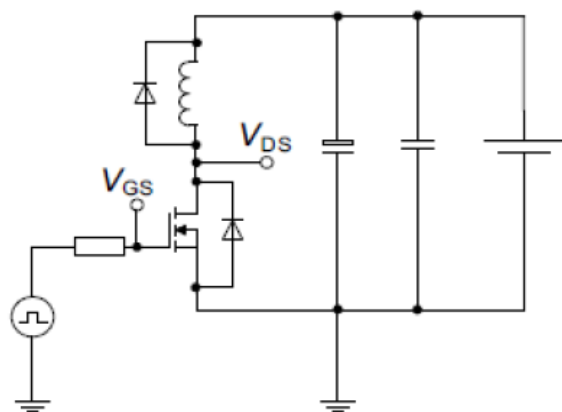
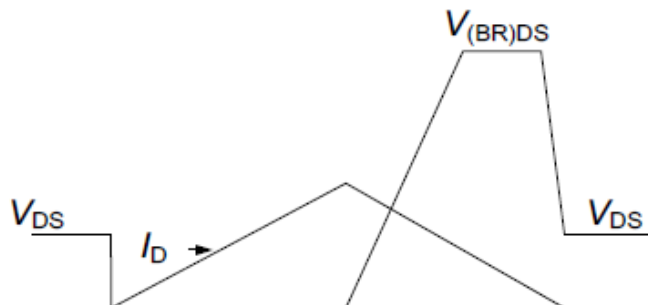
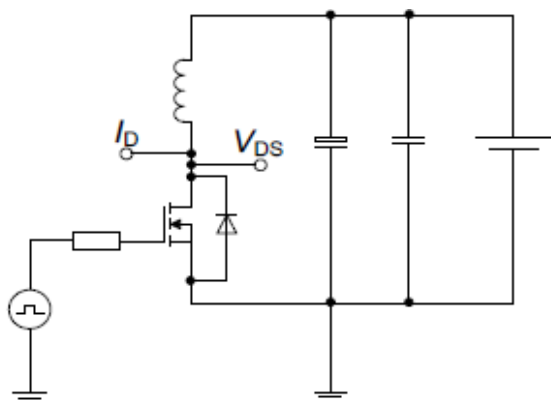


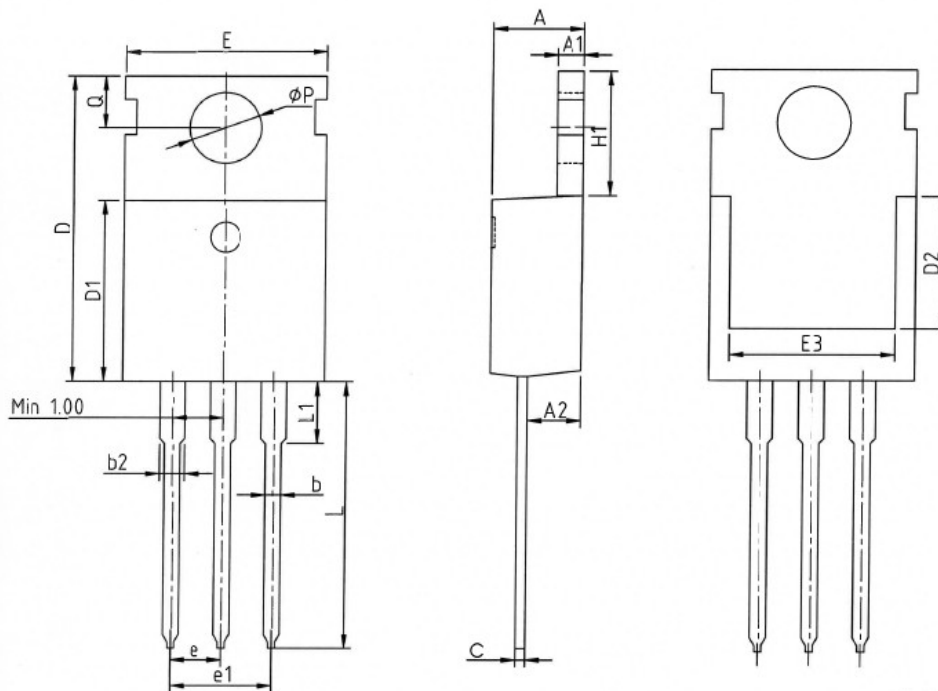
Figure 19. Unclamped Inductive Load

Unclamped inductive load test circuit and Unclamped inductive waveform



Package Outlines

TO220

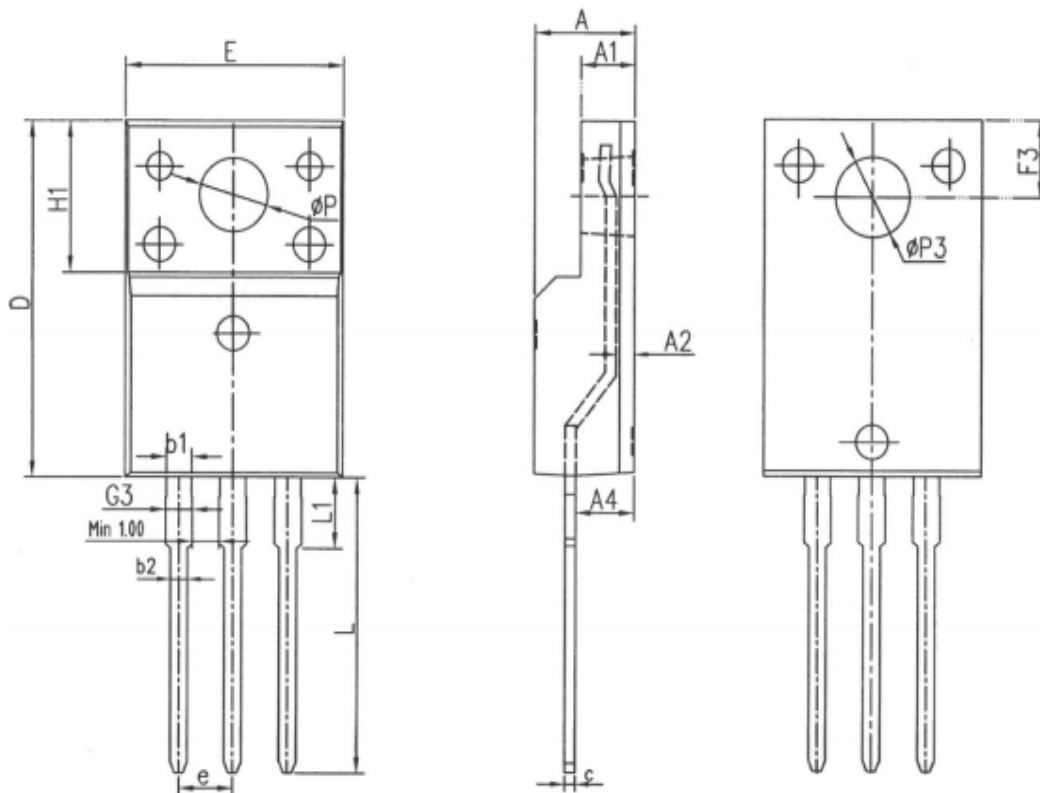


SYMBOL	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	6.30	7.10
E	9.70	10.00	10.30
E3	7.00	7.80	8.60
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

* Dimensions in millimeters

Package Outlines

TO220F



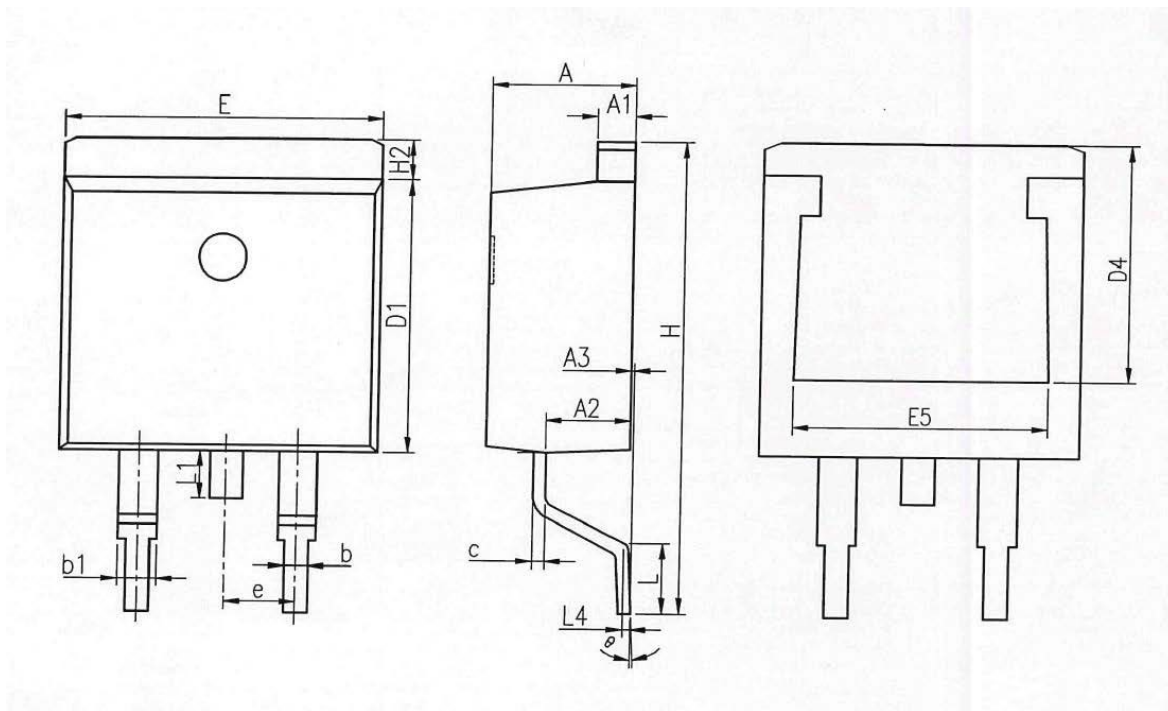
COMMON DIMENSIONS

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		
ϕP	3.183REF		
L	12.68	12.98	13.28
L1	3.25	3.45	3.65
$\phi P3$	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 Outlines

TO263



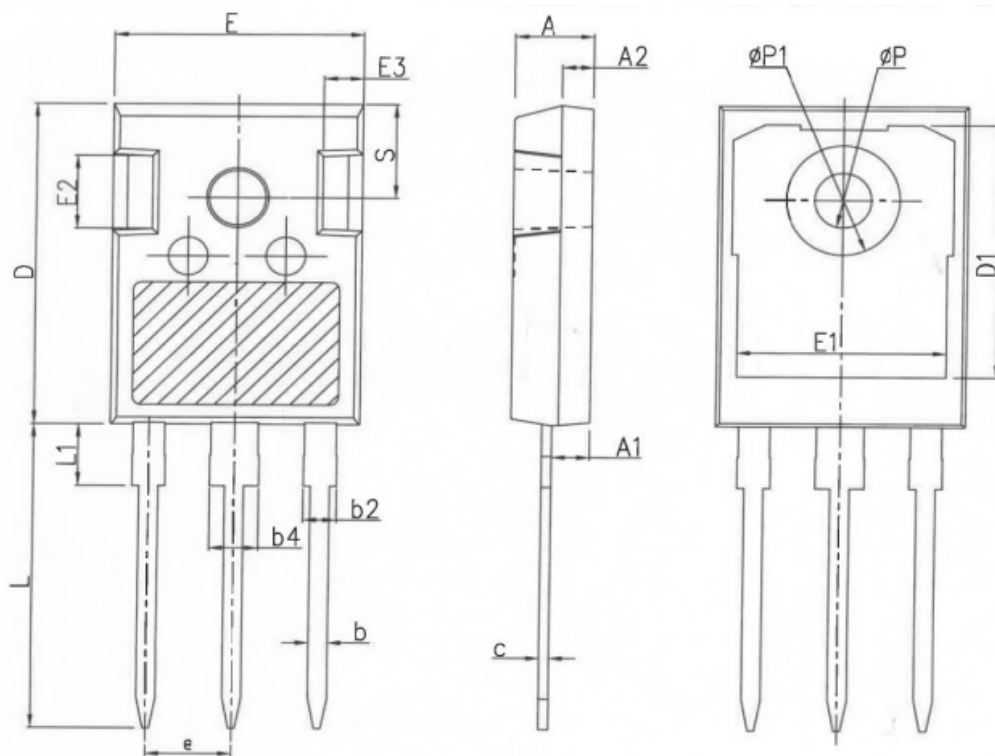
COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e	2.54 BSC		
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4	0.25 BSC		
θ	0°	5°	9°

* Dimensions in millimeters

Package Outlines

TO247-3L



SYMBOL	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	17.43	17.63	17.83
E	15.75	15.94	16.13
E1	13.06	13.26	13.46
E2	4.32	4.58	4.83
e	5.45 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.49
ØP	3.55	3.60	3.65
Q	5.59	5.89	6.19
S	6.15 BSC		

* Dimensions in millimeters

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