

BMx60N650UC1

N-Channel Power MOSFET

650 V, 8 A, 650 mΩ



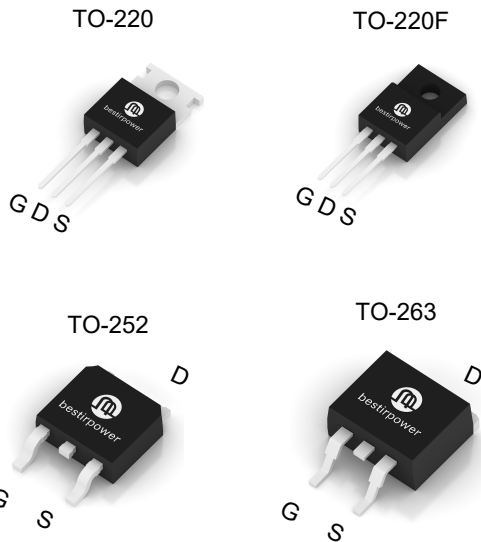
Description

BMx60N650UC1 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

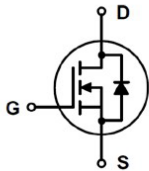
$BV_{DSS}, T_c=25^{\circ}C$	$I_D, T_c=25^{\circ}C$	$R_{DS(on),max}, T_c=25^{\circ}C$	$Q_{g,typ}$
600 V	8 A	650 mΩ	15 nC

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



Applications

- PFC.
- Adapter.
- LCD TV.
- LED lighting.
- UPS.



Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method
BMP60N650UC1	BMP60N650UC1	TO220	Tube
BMF60N650UC1	BMF60N650UC1	TO220F	Tube
BMB60N650UC1	BMB60N650UC1	TO263	Tape & Reel
BMD60N650UC1	BMD60N650UC1	TO252	Tape & Reel

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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		600	V
V_{GSS}	Gate to Source Voltage		± 30	V
I_D	Drain Current ¹⁾	Continuous ($T_C = 25^\circ\text{C}$)	8	A
		Continuous ($T_C = 125^\circ\text{C}$)	4	
I_{DM}	Drain Current	Pulsed	24	A
P_D	Power Dissipation For TO-220F		25.5	W
	Power Dissipation For TO-220, TO-252, TO-263		62.5	
E_{AS}	Single Pulsed Avalanche Energy ²⁾	$I_D = 1.5\text{A}, V_{DD} = 50\text{V}$	81	mJ
dv/dt	MOSFET dv/dt ruggedness	$V_{DS} = 0$ to 520V	50	V/ns
I_S	Continuous diode forward current $T_C = 25^\circ\text{C}$		8	A
$I_{S,pulse}$	Diode pulse current ¹⁾		24	A
dv/dt	Diode Recovery dv/dt ³⁾	$V_{DS} = 0$ to 400V, $I_{SD} \leq I_S$, $T_J = 25^\circ\text{C}$	15	V/ns
diff/dt	Maximum diode commutation speed ³⁾	$V_{DS} = 0$ to 400V, $I_{SD} \leq I_S$, $T_J = 25^\circ\text{C}$	500	A/ μs
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) Pulse width t_p limited by $T_{J,max}$.

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

3) $V_{DClink} = 400\text{V}$; $V_{DS,peak} < V_{(BR)DSS}$; 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,max	4.9	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient,max	49	

Thermal Characteristics (Non FullPAK) TO220, TO252, TO263

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case,max	2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient,max	62	

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 = 250μA	600	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V T _J =25°C	-	-	1	μA
		V _{DS} = 600 V, V _{GS} = 0 V T _J =150°C	-	-	10	μA
I _{GSS}	Gate-Source Leakage Current	V _{GS} = ±20 V, V _{DS} = 0 V	-	-	±100	nA

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 250μA	3.0	4.0	5.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 3.5A, T _J =25°C	-	550	650	mΩ
R _G	Gate Resistance	V _{DD} = 0V, V _{GS} = 0V, f = 1.0MHz	-	3.6	-	Ω

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =50V, f=1MHz	-	406	-	pF
C _{oss}	Output Capacitance		-	25	-	pF
C _{rss}	Reverse Transfer Capacitance		-	1.16	-	pF
C _{o(er)}	Effective output capacitance, energy related ¹⁾	V _{GS} =0V, V _{DS} = 0 to 400V	-	16	-	pF
C _{o(tr)}	Effective output capacitance, time related ²⁾		-	82	-	pF
Q _g	Total Gate Charge	V _{GS} = 0 to 10V, V _{DD} =480V, I _D =4A	-	15	-	nC
Q _{gs}	Gate to Source Charge		-	2.4	-	nC
Q _{gd}	Gate to Drain "Miller" Charge		-	9	-	nC
V _{plateau}	Gate plateau voltage		-	6	-	V

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DD} = 400V, I _D = 4A, V _{GS} =0 to 10V	-	26	-	ns
t _r	Turn-On Rise Time		-	28	-	ns
t _{d(off)}	Turn-Off Delay Time		-	40	-	ns
t _f	Turn-Off Fall Time		-	16	-	ns

Reverse Diode Characteristics

V _{SD}	Diode Forward Voltage	I _F =4A, V _{GS} = 0V T _F =25°C	-	0.91	-	V
t _{rr}	Reverse Recovery Time	V _R = 400V, I _F =5A di _F /dt = 100A/μs	-	80	-	ns
Q _{rr}	Reverse Recovery Charge		-	0.39	-	μC
I _{rm}	Peak Reverse Recovery Current		-	9.2	-	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

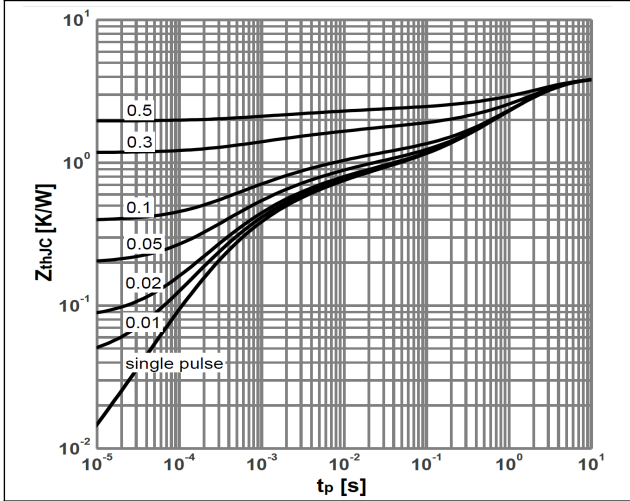


Figure 2: Power dissipation For TO-220F

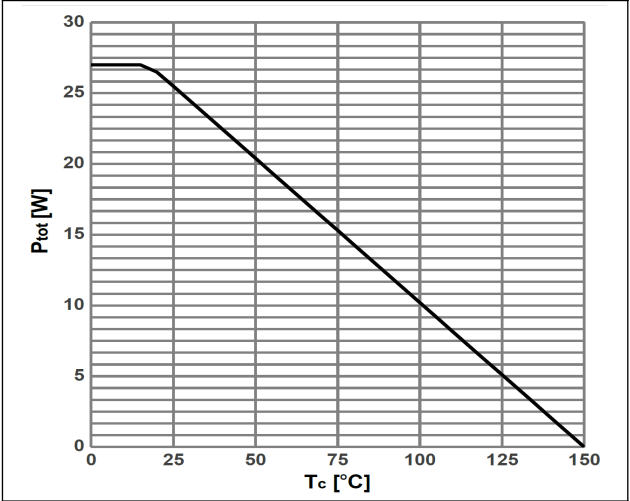


Figure 3: Transient Thermal Impedance For TO-220、TO-252、TO-263

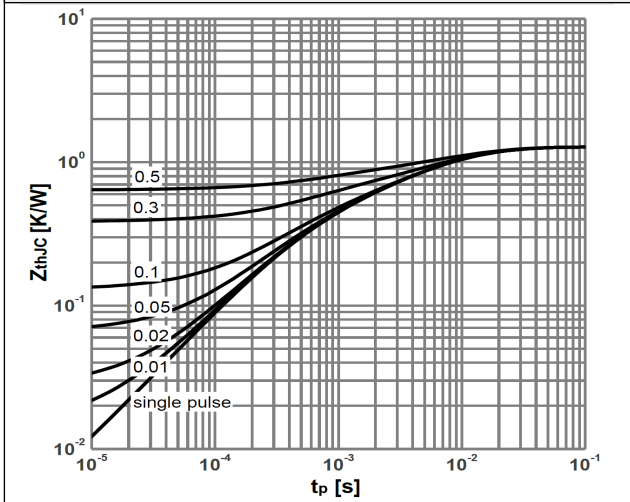


Figure 4: Power dissipation For TO-220、TO-252、TO-263

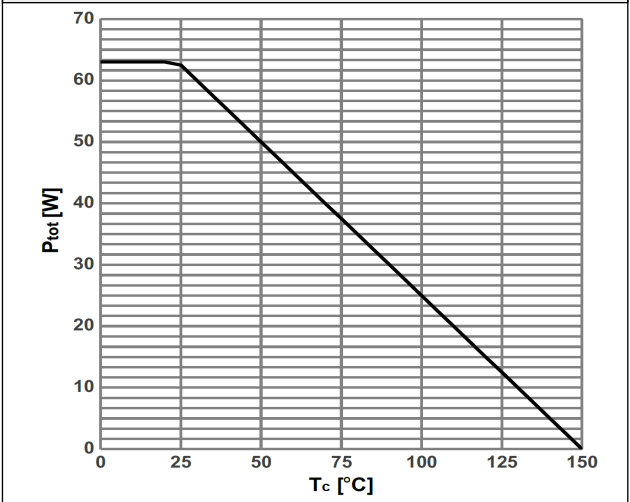


Figure 5: Safe operating area For TO-220、TO-252、TO-263

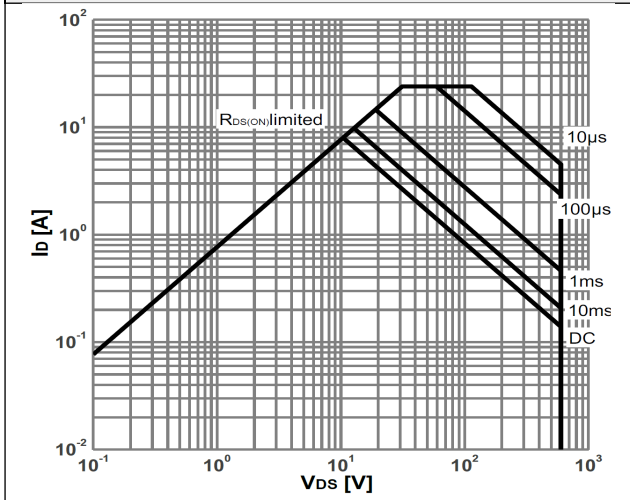
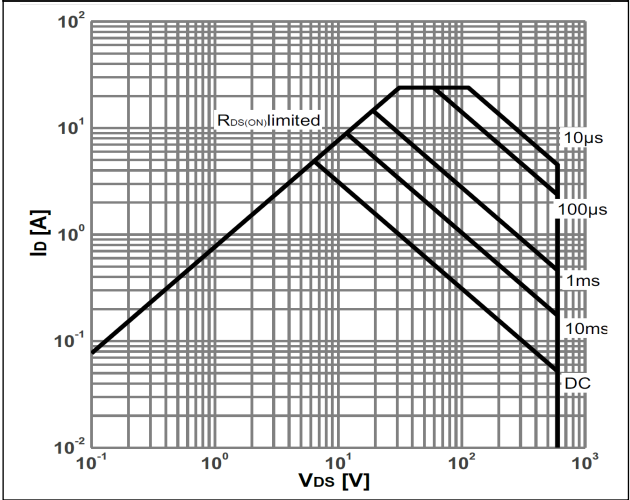


Figure 6: Safe operating area For TO-220F



Typical Performance Characteristics

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

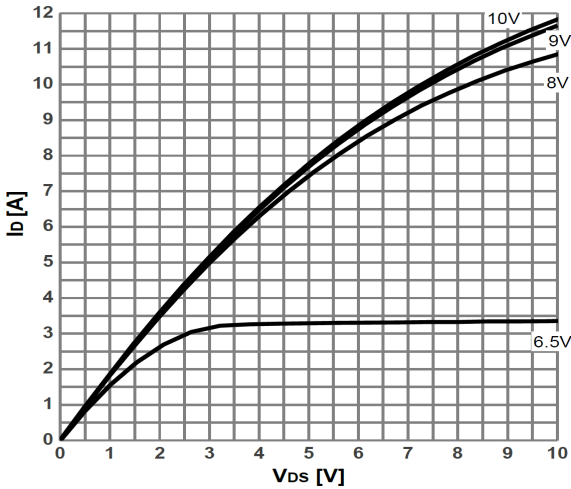


Figure 8: Typ. output characteristics @ $T_j=125^{\circ}\text{C}$

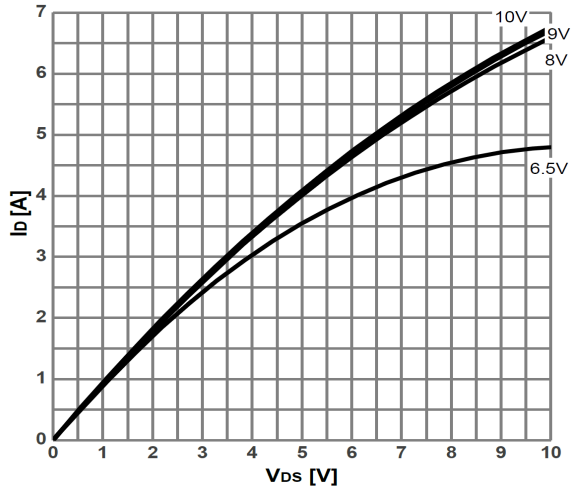


Figure 9: Typ. drain-source on-state resistance

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

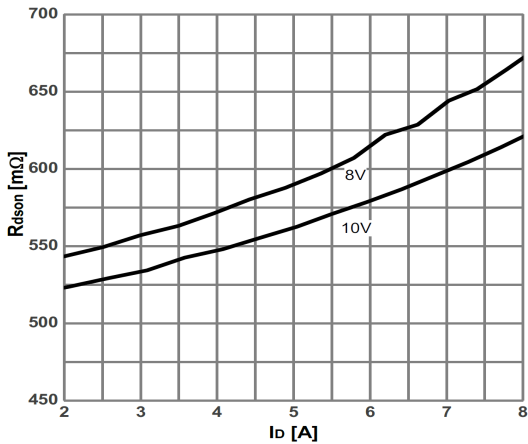


Figure 10: Drain-source on-state resistance

$R_{DS(on)}=f(T_j)$; $I_D=3.5\text{A}$; $V_{GS}=10\text{V}$

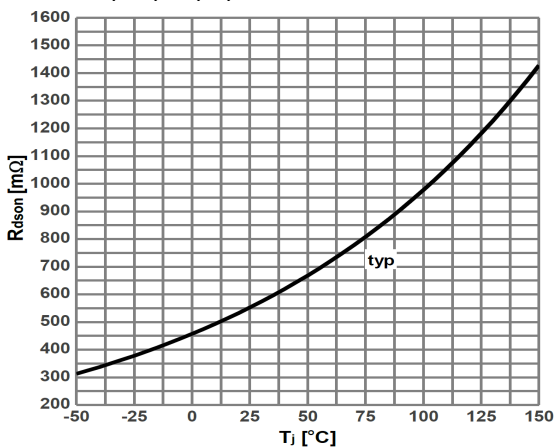


Figure 11: Typ. transfer characteristics

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

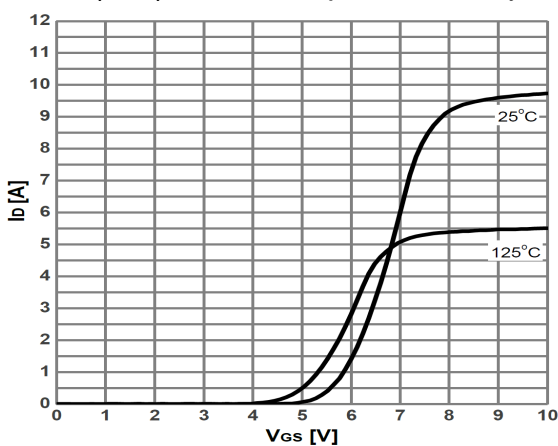
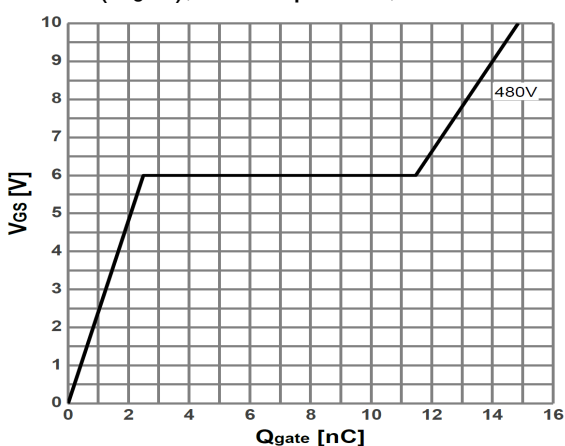


Figure 12: Typ. gate charge

$V_{GS}=f(Q_{gate})$; $I_D=4\text{A}$ pulsed; $V_{DS}=480\text{V}$



Typical Performance Characteristics

Figure 13: Forward characteristics of reverse diode

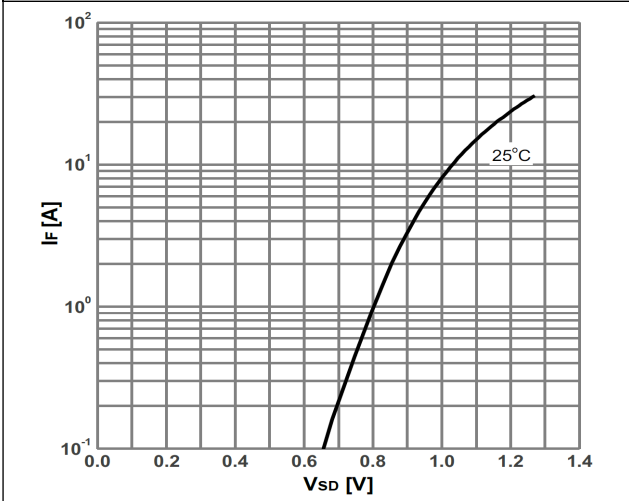


Figure 14: Drain-source breakdown voltage

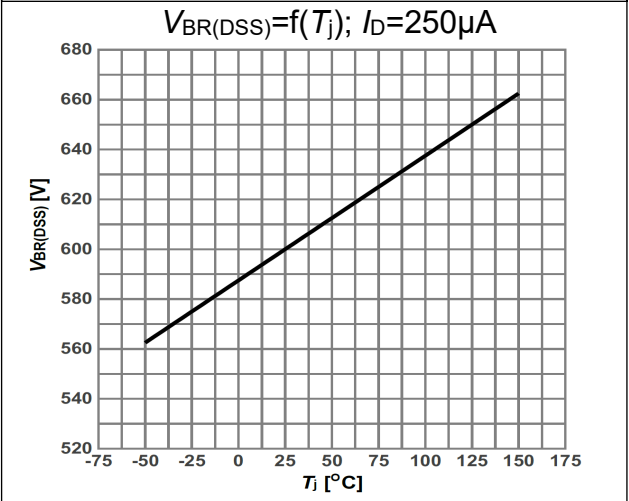


Figure 15: Typ. capacitances

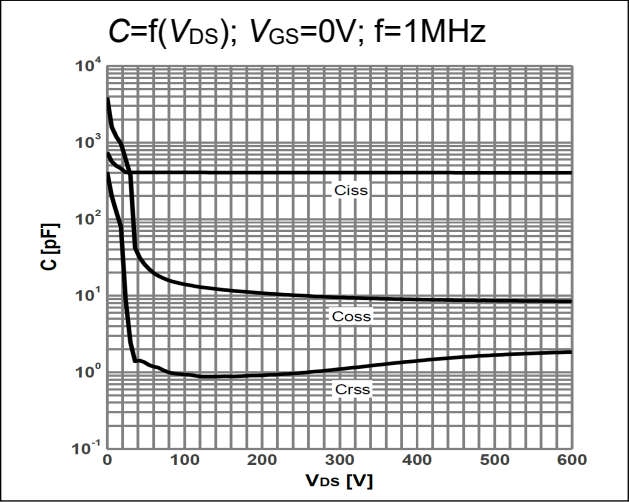
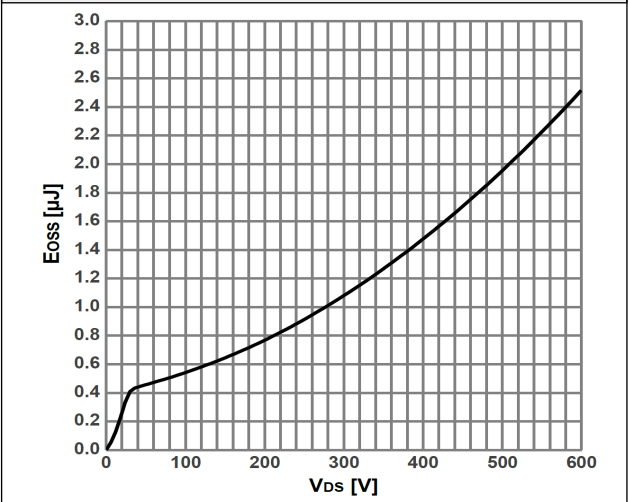


Figure 16: Typ. Coss stored energy



Test Circuits

Figure 17. Diode Characteristics

Test circuit for diode characteristics and Diode recovery waveform

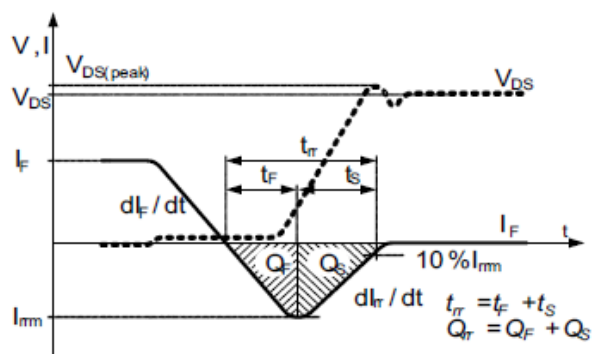
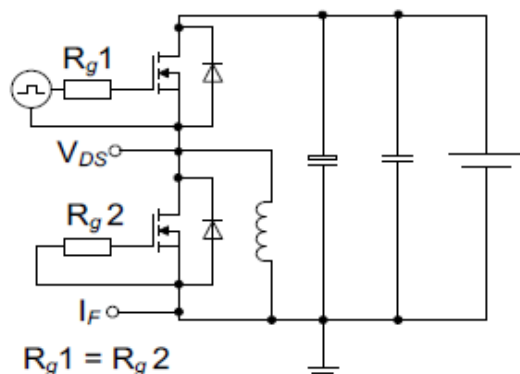


Figure 18. Switching Times

Switching times test circuit for inductive load and Switching times waveform

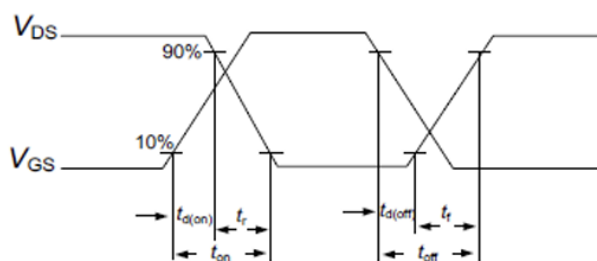
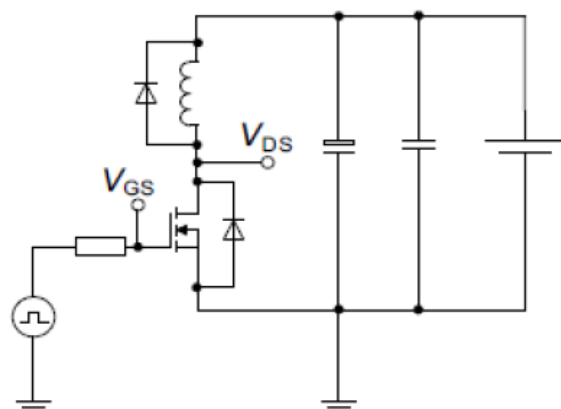
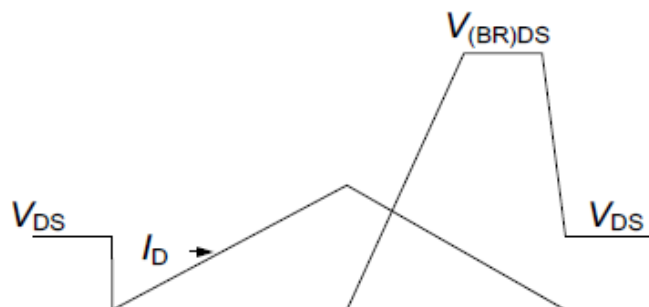
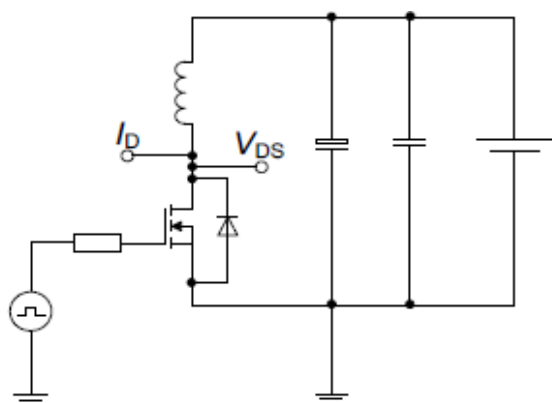


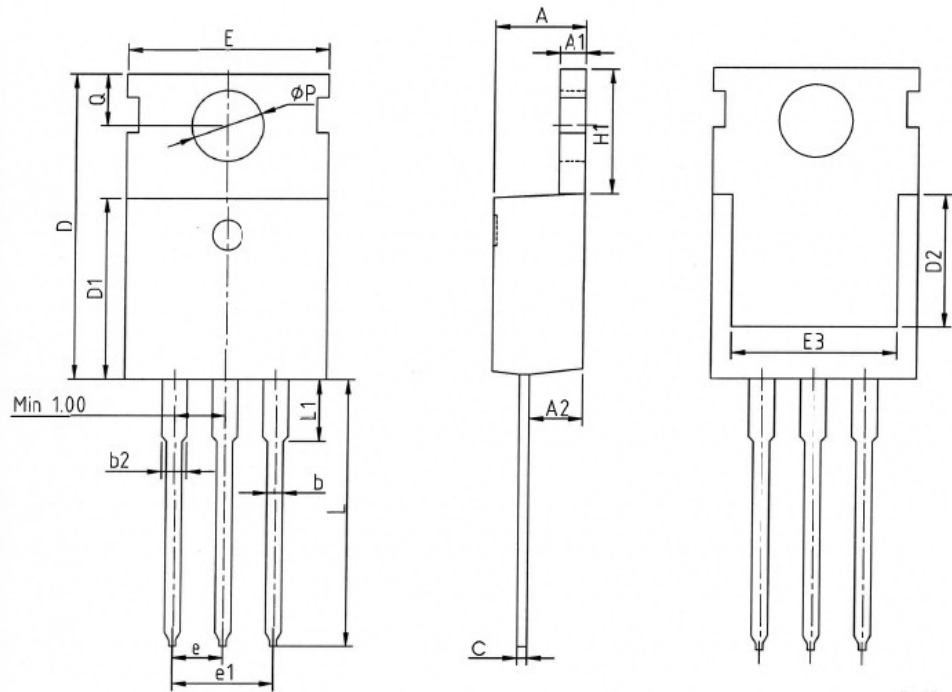
Figure 29. Unclamped Inductive Load

Unclamped inductive load test circuit and Unclamped inductive waveform



Package Outlines

TO-220

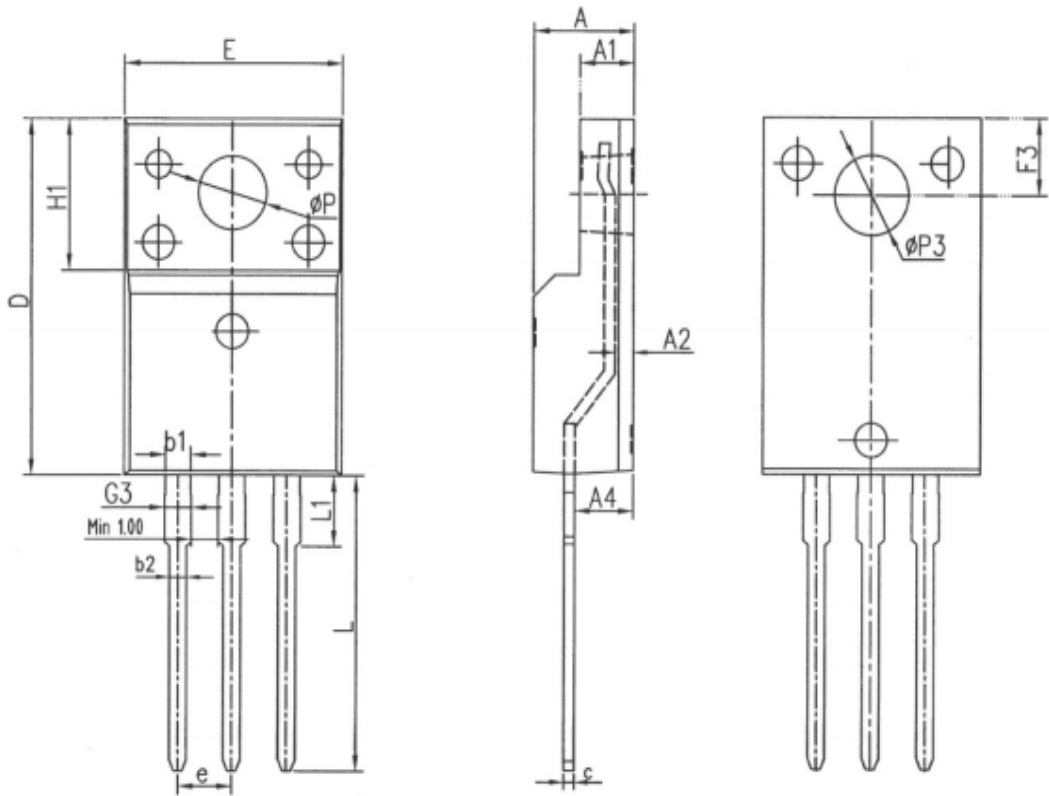


SYMBOL	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	6.30	7.10
E	9.70	10.00	10.30
E3	7.00	7.80	8.60
e	2.54 BSC		
e1	5.08 BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40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

* Dimensions in millimeters

Package Outlines

TO-220F



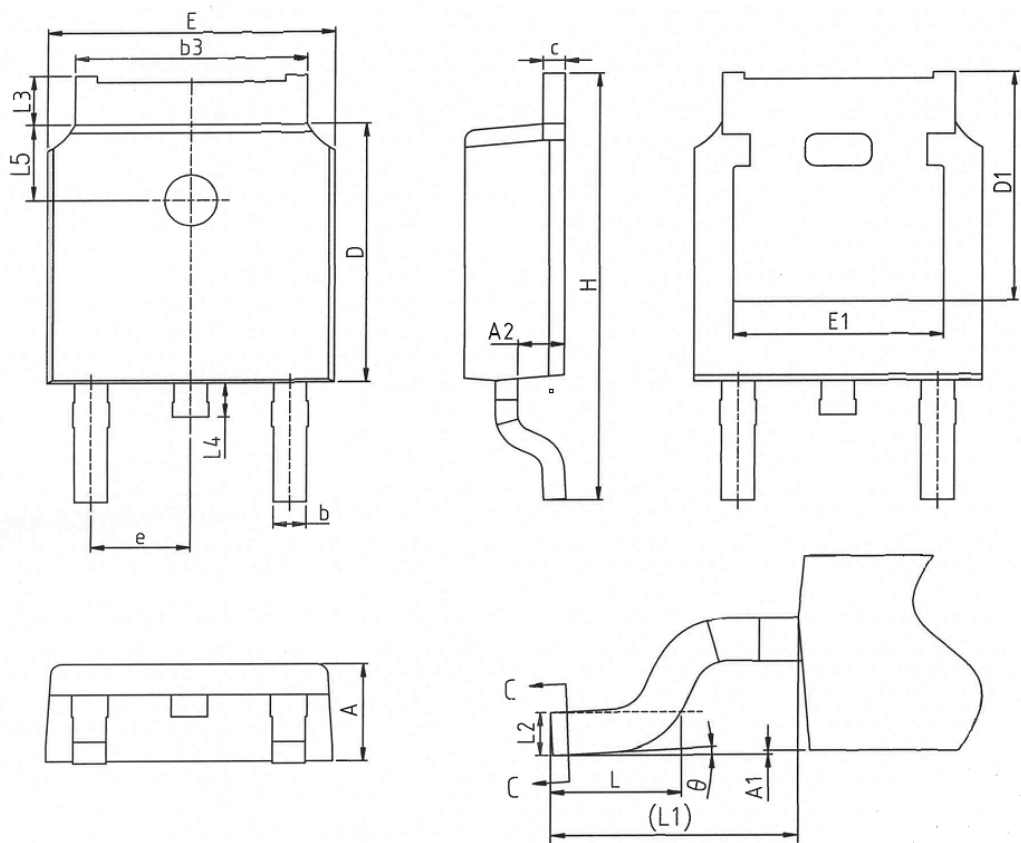
COMMON DIMENSIONS

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 Outlines

TO-252



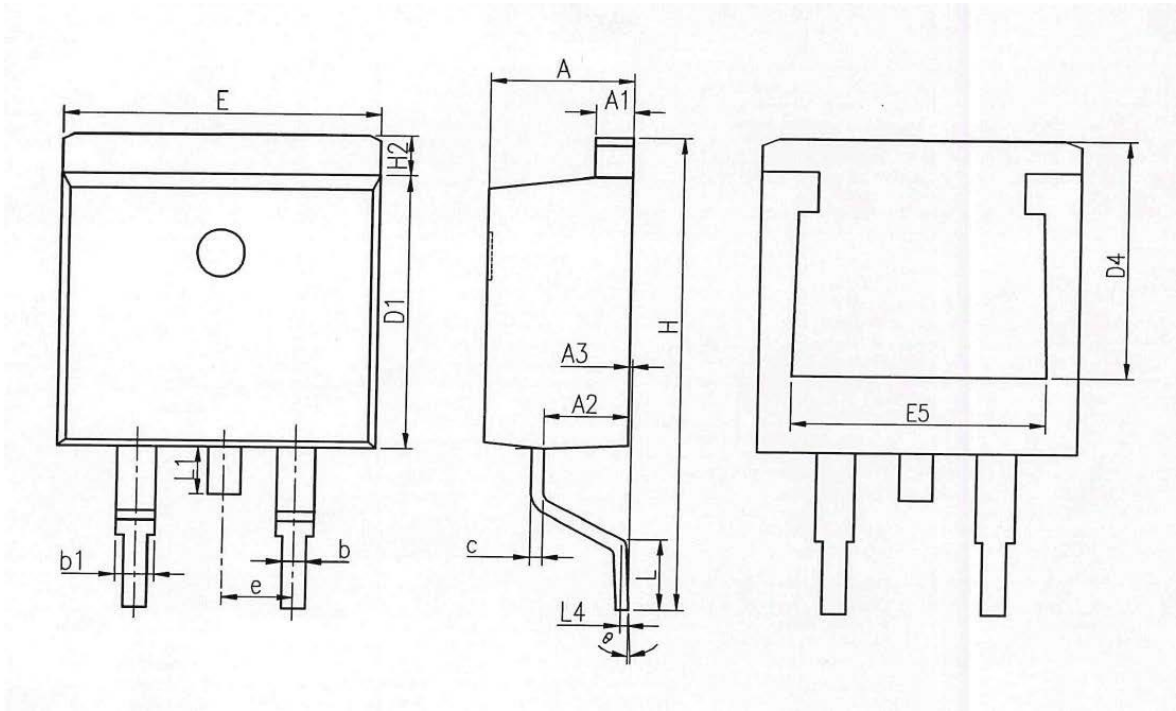
COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.12
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

* Dimensions in millimeters

Package Outlines

TO-263



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

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