HMG15N65/D/F

650V /15A Trench Field Stop IGBT

Features

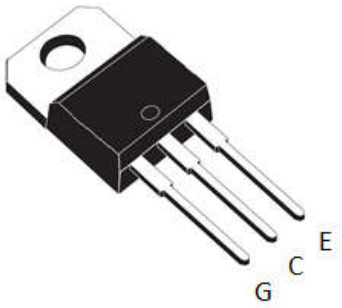
- Max Junction Temperature 150°C
- High breakdown voltage up to 650V for improved reliability
- Short Circuit Rated
- Very Low Saturation Voltage:

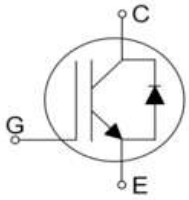
  $V_{CE(SAT)}$ = 1.65V (Typ.) @ I_C = 15A
- Soft current turn-off waveforms

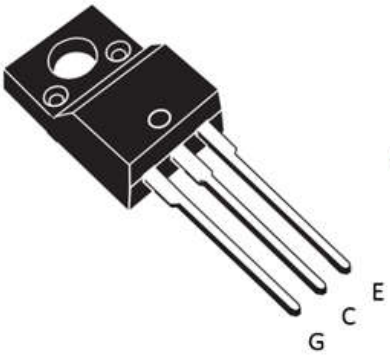
V_{CE}	**650**	**V**
I_C	**15**	**A**
$V_{CE(SAT)}$ I_C=15A	**1.65**	**V**

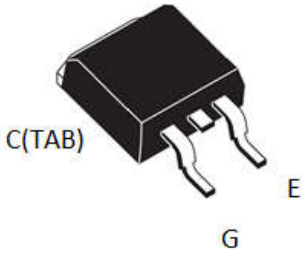
Applications

- Soft switching applications
- Air conditioning
- Motor drive inverter









Product	Package	Packaging
HMG15N65	TO-220	Tube
HMG15N65D	TO-263	Tube
HMG15N65F	TO-220F	Tube

Maximum Ratings （T_j= 25℃ unless otherwise specified）

Parameter	Symbol	Value	Unit
Collector-Emitter Breakdown Voltage	V_{CE}	650	V
DC collector current, limited by T_{jmax} T_C = 25°C T_C = 100°C	I_C	 30 15	A
Diode Forward current, limited by T_{jmax} T_C = 25°C T_C = 100°C	I_F	 30 15	A
Continuous Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage	V_{GE}	±30	V
Turn off safe operating area V_{CE} ≤650V, T_j ≤ 150°C	-	60	A
Pulsed collector current, V_{GE}=15V, t_p limited by T_{jmax}	I_{CM}	45	A
Short Circuit Withstand Time, V_{GE}= 15V, V_{CE}≤ 400V	T_{sc}	5	μs
TO-220F Power dissipation , T_j=25℃	Ptot	27	W
TO-220,TO-263, Power dissipation , T_j=25℃	Ptot	105	W
Operating junction temperature	T_j	-40...+150	°C
Storage temperature	T_s	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s	-	260	°C

Thermal Resistance

Parameter	Symbol	TO-220,TO-263	TO-220F	Unit
IGBT thermal resistance, junction - case	R_{θ}(j-c)	1.2	4.9	K/W
Diode thermal resistance, junction - case	R_{θ}(j-c)	2.38	5.8	K/W
Thermal resistance, junction - ambient	R_{θ}(j-a)	62.5		K/W

Electrical Characteristics of the IGBT（T_j= 25℃ unless otherwise specified）

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Static Characteristics (Tested on wafers)						
BV_{CES}	Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	650	-	-	V
$V_{CE(SAT)}$	Collector to Emitter Saturation Voltage	I_C = 15A, V_{GE} = 15V	-	1.65	1.95	V
$V_{GE(th)}$	G-E Threshold Voltage	V_{GE} = V_{CE}, I_C = 250μA	4.1	5.0	5.7	V
I_{CES}	Collector Cut-Off Current	V_{CE} = 650V, V_{GE} = 0V	-	-	25	μA
I_{GES}	G-E Leakage Current	V_{GE} = ±20V, V_{CE} = 0V	-	-	±200	nA
g_{fs}	Transconductance	V_{CE}=20V, I_C=15A	-	10	-	S

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	990	-	pF
Output capacitance	C_{oes}		-	56	-	
Reverse transfer capacitance	C_{res}		-	30	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 15A, V_{GE} = 15V	-	92	-	nC
Short circuit collector current	$I_{C(SC)}$	V_{GE}=15V,t_{SC}≤5us V_{CC}=400V, $T_{j,\ start}$=25°C	-	98	-	A

Switching Characteristic, Inductive Load（T_j= 25℃ unless otherwise specified）

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Dynamic						
Turn-on Delay Time	$t_{d(on)}$	T_j=25°C V_{CC} = 400V, I_C = 15A, V_{GE} = 0/15V, Rg=12Ω	-	15	-	ns
Rise Time	t_r		-	25	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	60	-	ns
Fall Time	t_f		-	46	-	ns
Turn-on Energy	E_{on}		-	0.75	-	mJ
Turn-off Energy	E_{off}		-	0.1	-	mJ

Electrical Characteristics of the DIODE（T_j= 25℃ unless otherwise specified）

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Dynamic						
Diode Forward Voltage	V_{FM}	I_F = 15A	-	1.7	-	V
Reverse Recovery Time	*Trr*	I_F= 15A VR = 300V, di/dt =200A/μs	-	50	-	ns
Reverse Recovery Current	*Irr*		-	4	-	A
Reverse Recovery Charge	*Qrr*		-	83	-	nC

Fig. 1 FBSOA characteristics for TO-220F

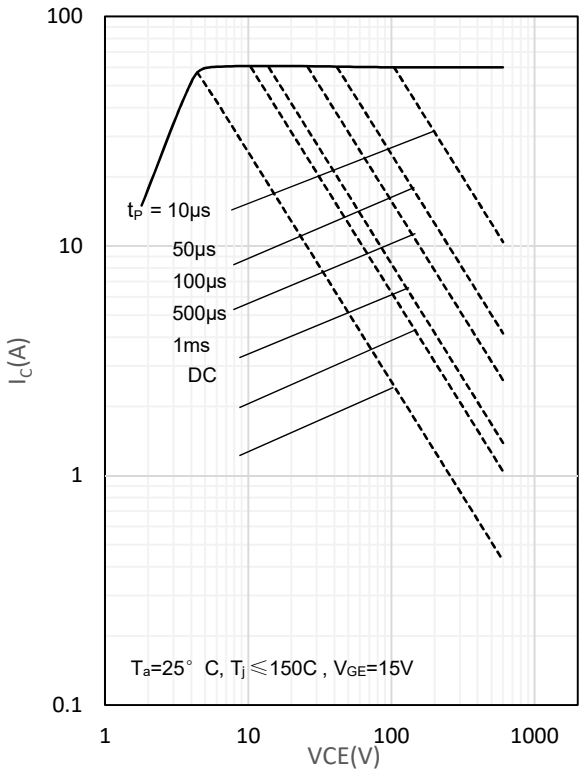


Fig. 2 FBSOA characteristics for TO-220 and TO-263

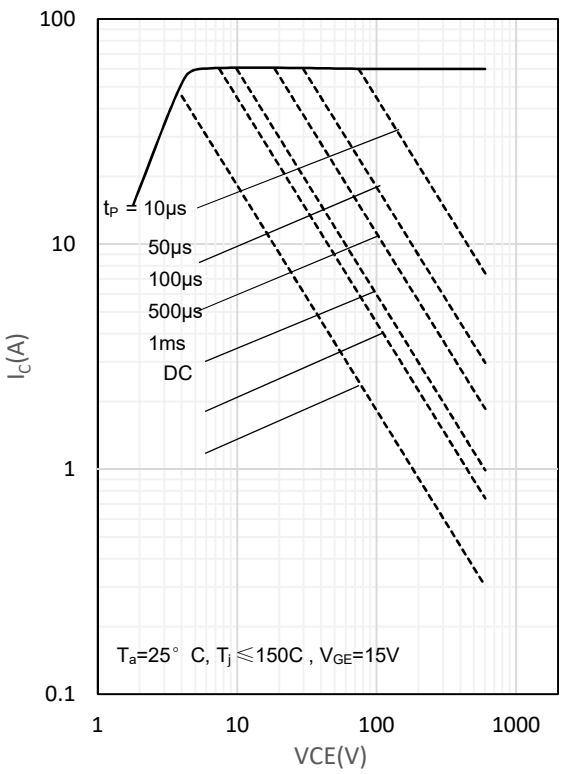


Fig. 3 Load Current vs. Frequency for TO-220F

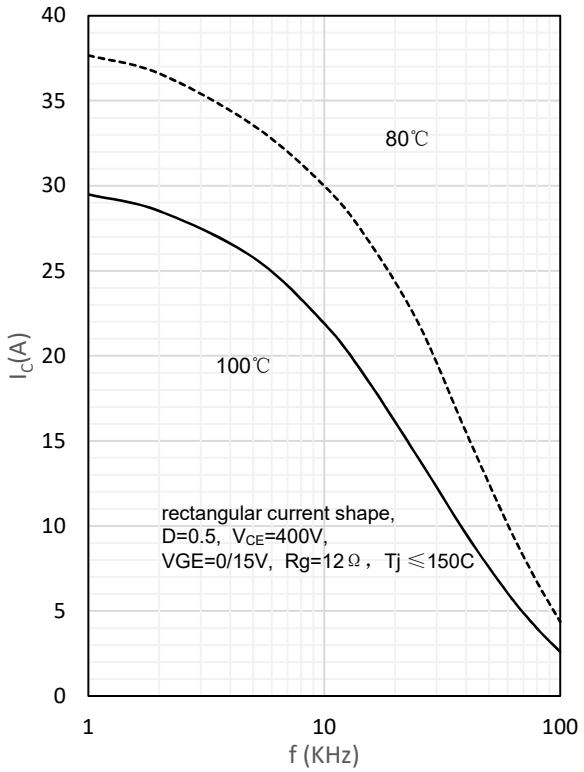


Fig.4 Load Current vs. Frequency TO-220 and TO-263

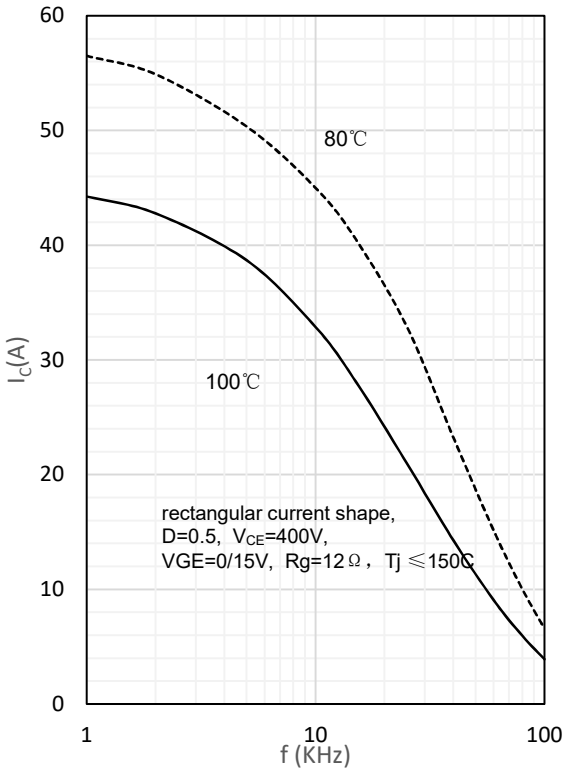


Fig. 5 Output characteristics

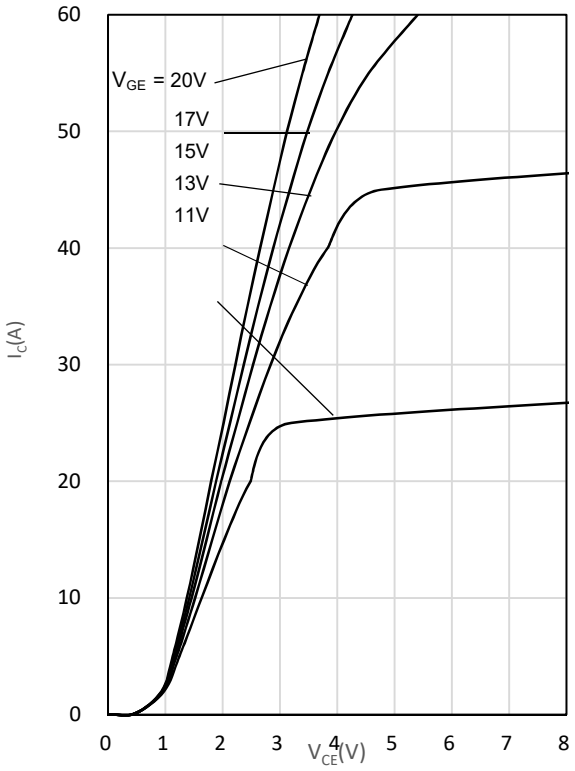


Fig. 6 Saturation voltage characteristics

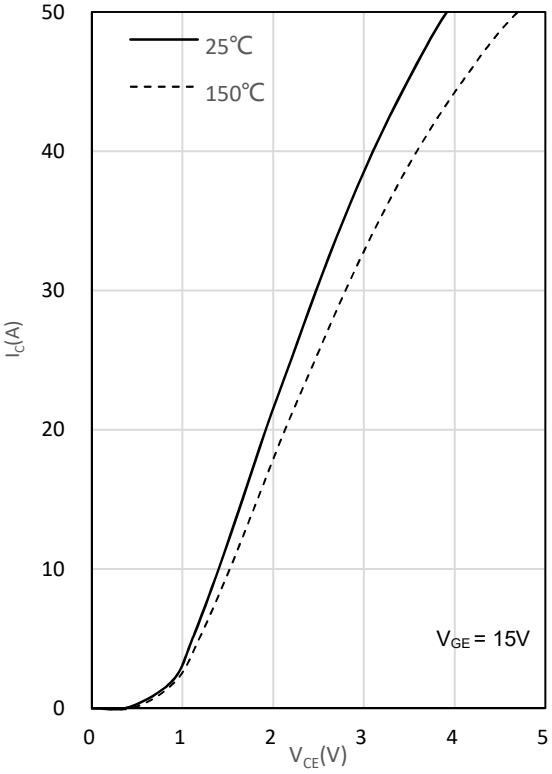


Fig. 7 Switching times vs. gate resistor

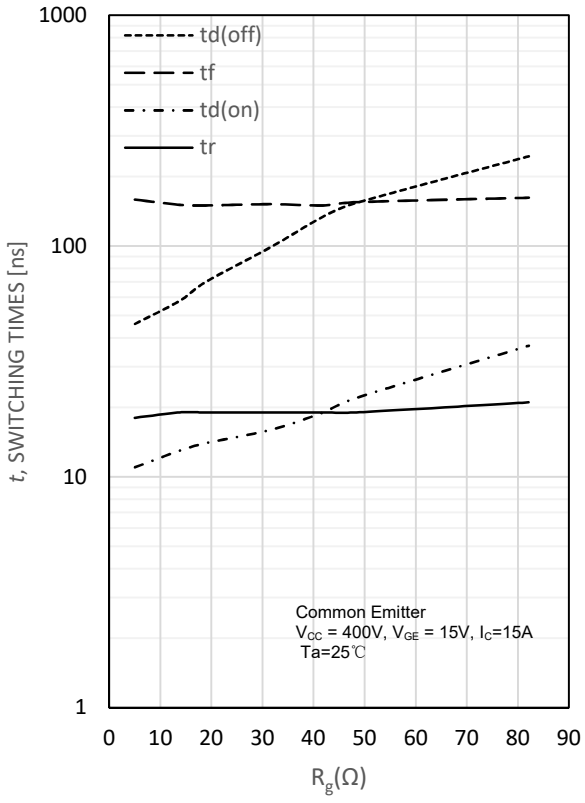


Fig. 8 Switching times vs. collector current

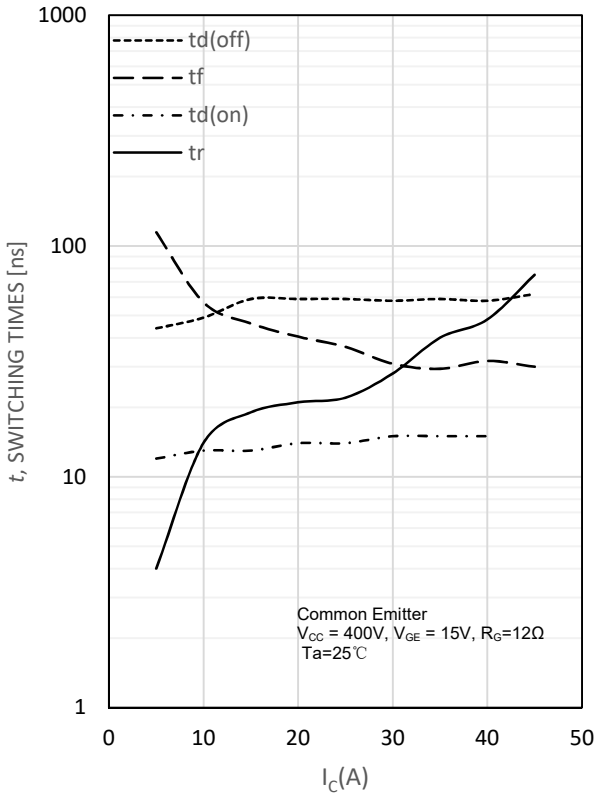


Fig. 9 Switching loss vs. gate resistor

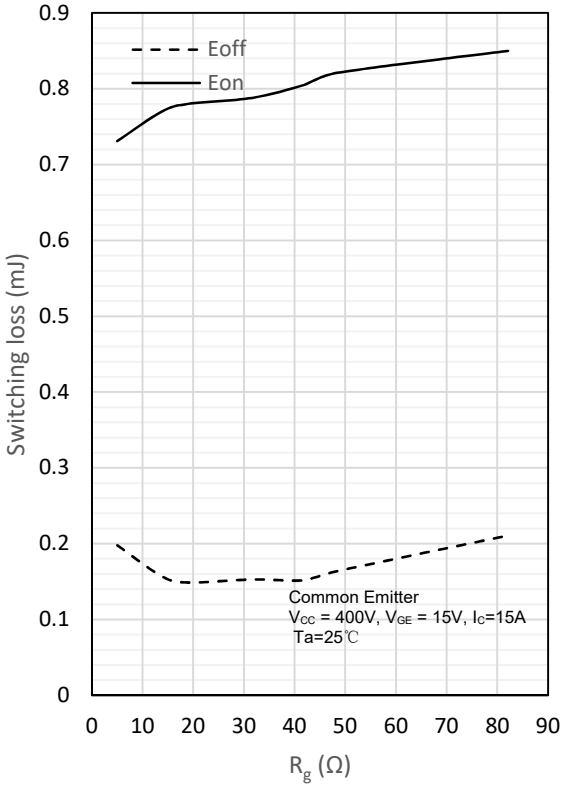


Fig. 10 Switching loss vs. collector current

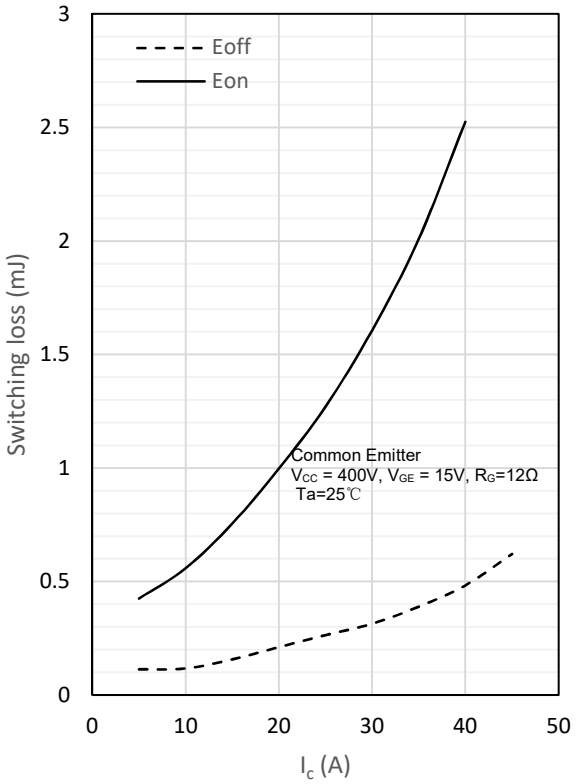


Fig. 11 Gate charge characteristics

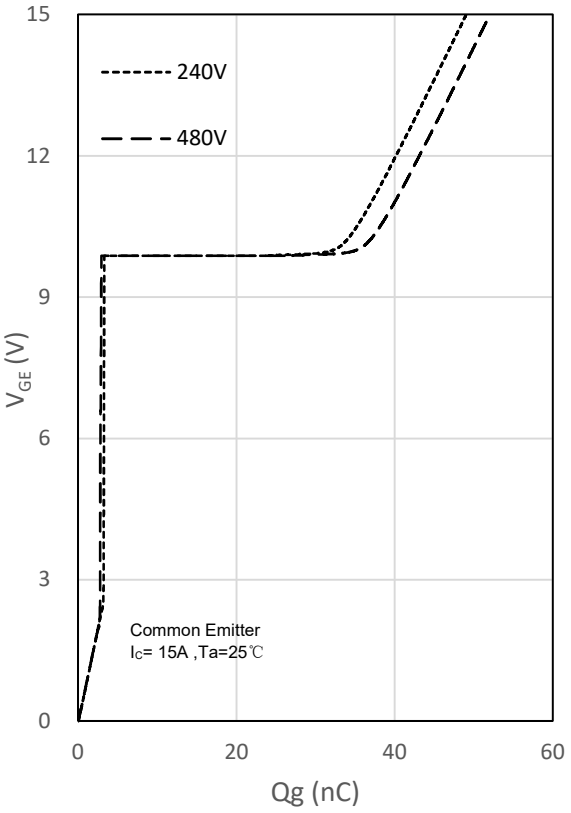
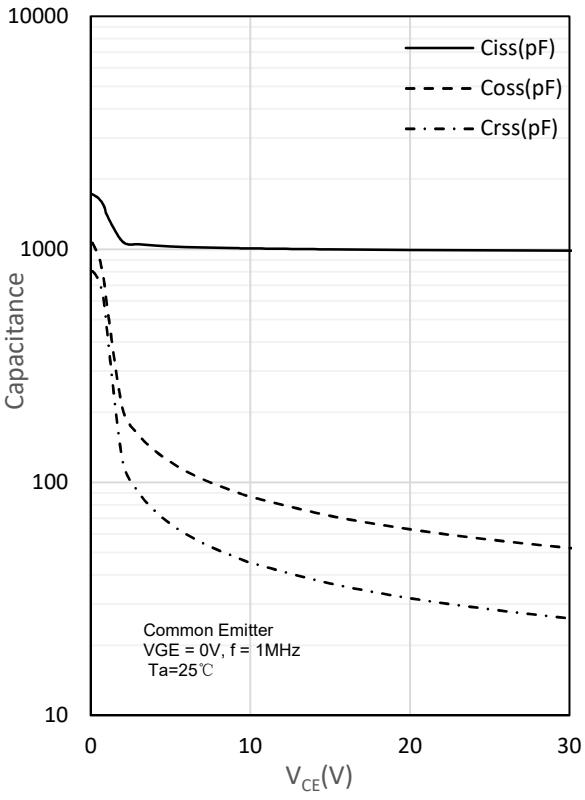
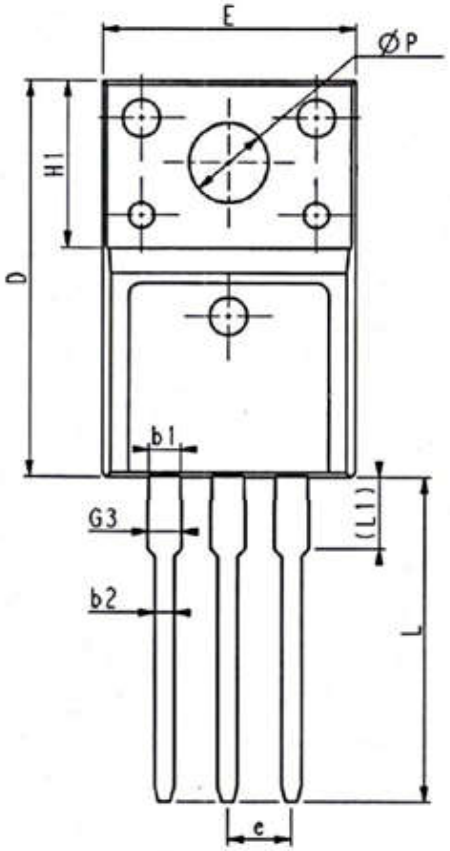
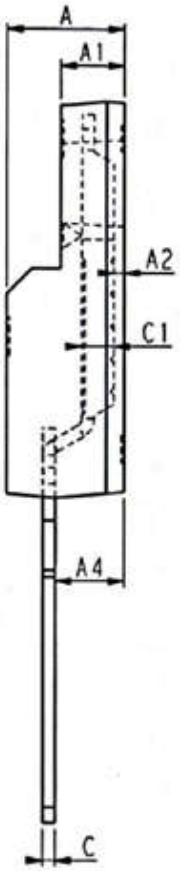


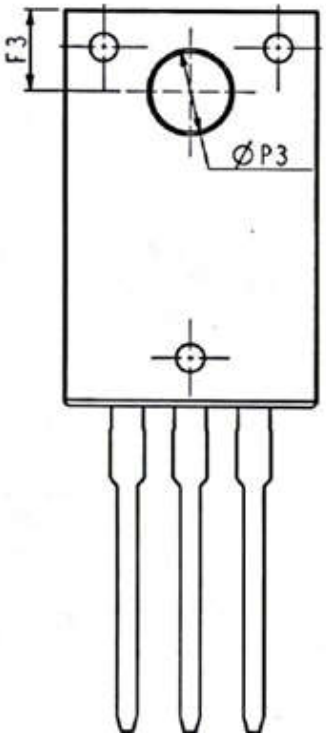
Fig. 12 Capacitance characteristics



TO-220F package information

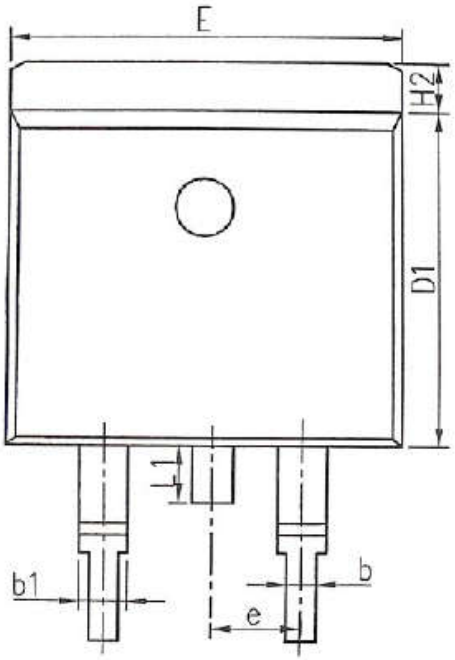


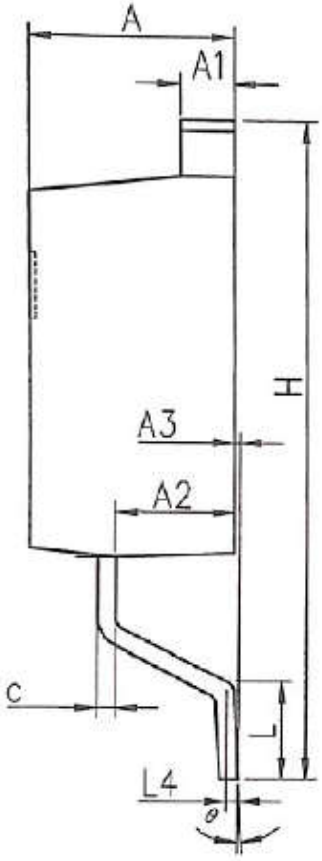


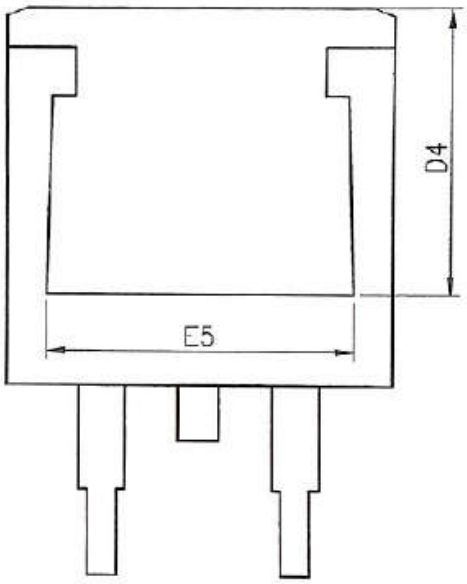


SYMBOL	MIN	NOM	MAX
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.88	3.03	3.18
ΦP	3.03	3.18	3.38
ΦP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

TO-263 package information

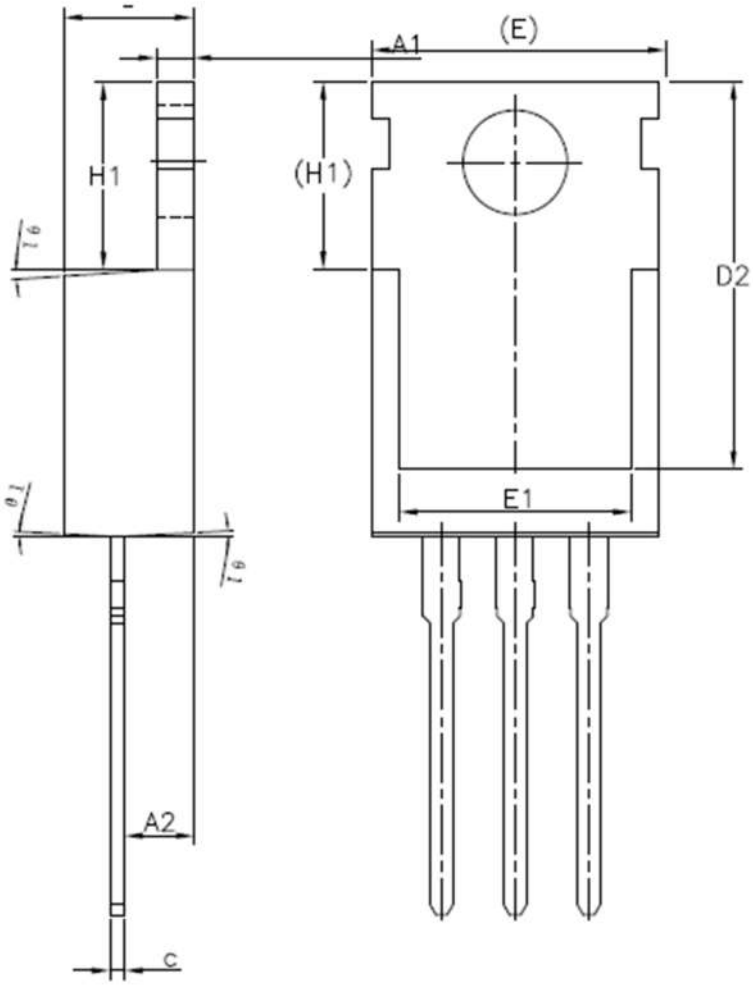
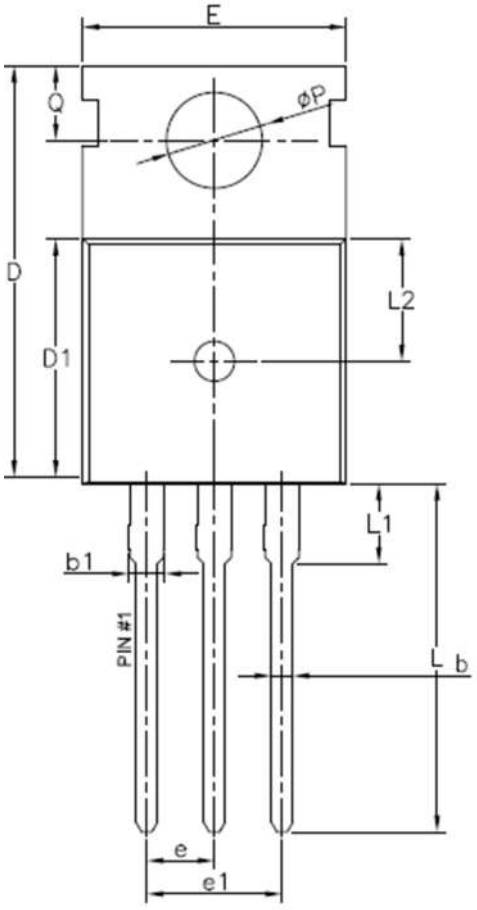
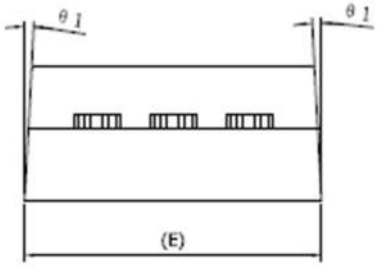






SYMBOL	MM		
	MIN	NOM	MAX
A	4.37	4.57	4.77
A1	1.22	1.27	1.42
A2	2.49	2.69	2.89
A3	0.00	0.13	0.25
b	0.70	0.81	0.96
b1	1.17	1.27	1.47
c	0.30	0.38	0.53
D1	8.50	8.70	8.90
D4	6.60	-	-
E	9.86	10.16	10.36
E5	7.06	-	-
e		2.54 BSC	
H	14.70	15.10	15.50
H2	1.07	1.27	1.47
L	2.00	2.30	2.60
L1	1.40	1.55	1.70
L4		0.25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

TO-220 package information



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	–	0.90
b1	1.27	–	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	–	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54BSC		
e1	5.08BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	–	–	3.50
L2	4.60REF		
øP	3.55	3.60	3.65
Q	2.73	–	2.87
θ1	1°	3°	5°