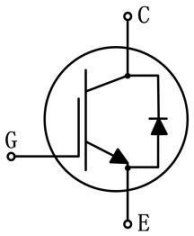
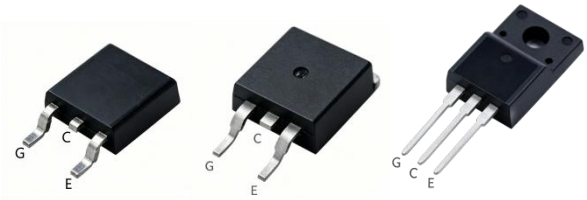
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	600	V
I_C	6	A
$V_{CE(sat)}$	1.75	V



Features

- Positive temperature coefficient
- Fast Switching
- Low $V_{CE(sat)}$
- Reliable and Rugged



TO-252 TO-263 TO-220F

Applications

- Motor drives
- Uninterrupted Power Supply
- General purpose inverters

Key Performance and Package Parameters

Part No.	V_{CE}	I_C	T_{vjmax}	Package	Packing form
HT6T60FX100	600V	6A	175℃	TO-252	Reel
HT6T60SX100	600V	6A	175℃	TO-263	Reel
HT6T60TFX100	600V	6A	175℃	TO-220F	Tube

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	600	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current (T_C=25℃)	I_C	12	A
Continuous collector current (T_C=100℃)		6	A
Pulsed Collector Current (Note 1)	I_{CM}	18	A
Diode continuous forward current (T_C=25℃)	I_F	12	A
Diode continuous forward current (T_C=100℃)		6	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	18	A
Maximum Power Dissipation (T_C=25℃) (Note 2)	P_{tot}	89	W
Maximum Power Dissipation (T_C=100℃) (Note 2)		44	W
Short Circuit Withstand Time	t_{sc}	7	us
Operating Junction Temperature Range	T_J	-40 to+175	℃
Storage Temperature Range	T_{STG}	-55 to+150	℃

Thermal Characteristics

Parameter	Symbol	Conditions	Max.	Unit
Thermal Resistance, Junction to Case for IGBT	$R_{\theta JC}$	TO-252	1.6	℃/W
		TO-263	1.6	℃/W
		TO-220F	3.6	℃/W
Thermal Resistance, Junction to Case for Diode	$R_{\theta JC}$	TO-252	2.2	℃/W
		TO-263	2.6	℃/W
		TO-220F	3.7	℃/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	TO-252	69	℃/W
		TO-263	51	℃/W
		TO-220F	60	℃/W

Electrical Characteristics of IGBT (T_{vj}=25℃ unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Collector-Emitter Breakdown Voltage	BV_{CES}	V_{GE}=0V, I_C=200uA	600	-	-	V
Collector-Emitter Leakage Current	I_{CES}	V_{CE}=600V, V_{GE}=0V	-	-	40	uA
Gate Leakage Current, Forward	I_{GES}	V_{GE}=20V, V_{CE}=0V	-	-	100	nA
Gate Leakage Current, Reverse		V_{GE}=-20V, V_{CE}=0V	-	-	100	nA
Gate Threshold Voltage	$V_{GE(th)}$	V_{GE}=VCE , I_C=200uA	3.2	4.0	4.8	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=6A, T_j=25℃	-	1.75	2.1	V
		V_{GE}=15V, I_C=6A, T_j=150℃	-	2.05	-	V
Total Gate Charge	Q_g	V_{CC}=400V V_{GE}=15V I_C=6A	-	11.5	-	nC
Gate-Emitter Charge	Q_{ge}		-	3.5	-	nC
Gate-Collector Charge	Q_{gc}		-	3.5	-	nC
Turn-on Delay Time	$t_{d(on)}$	V_{CC}=400V V_{GE}=±15V I_C=6A R_G=10Ω Inductive Load T_C=25℃	-	12	-	ns
Turn-on Rise Time	t_r		-	6	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	14	-	ns
Turn-off Fall Time	t_f		-	154	-	ns
Turn-on Switching Loss	E_{on}		-	91	-	uJ
Turn-off Switching Loss	E_{off}		-	95	-	uJ
Total Switching Loss	E_{ts}		-	186	-	uJ
Input Capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f =1MHz	-	313	-	pF
Output Capacitance	C_{oes}		-	34	-	pF
Reverse Transfer Capacitance	C_{res}		-	5	-	pF
Short Circuit Safe Operation Area	SCSOA	V_{GE}=15V, V_{CC}≤400V, $T_{J,start}$≤25℃	5	-	-	us

Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	I_F=6A, T_j=25℃	-	1.45	1.8	V
		I_F=6A, T_j=150℃	-	1.25	-	V
Diode Reverse Recovery Time	t_{rr}	V_R=400V, I_F=6A dIF/dt=200A/us T_C=25℃	-	75	-	ns
Diode peak Reverse Recovery Current	I_{rr}		-	3.3	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	102	-	nC

Note1: Repetitive rating, pulse width limited by maximum junction temperature

Note2: For TO-263

Typical Characteristics

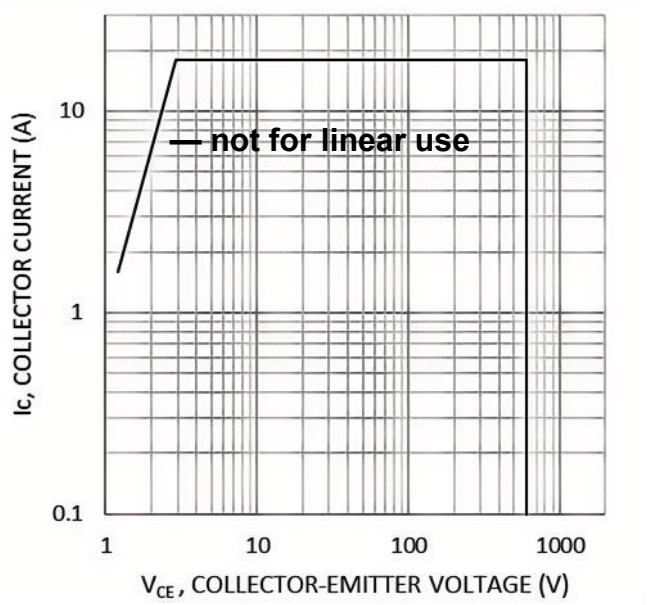


Fig. 1 Forward bias safe operating area (D=0, T_C=25℃, T_{vj}=175℃, V_{GE}=15V Single Pulse)

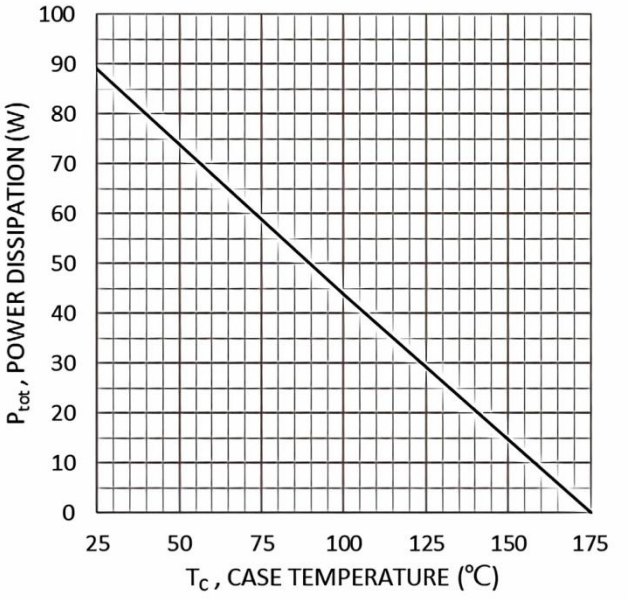


Fig. 2 Power dissipation as a function of case temperature (T_{vj}≤175℃)

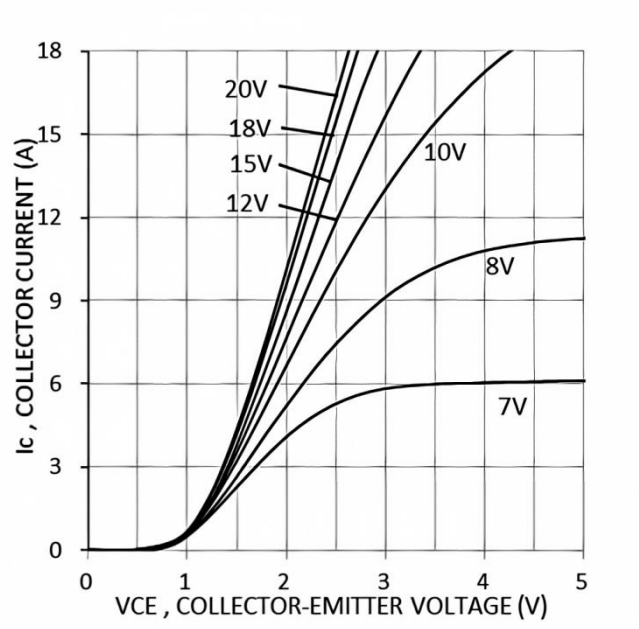


Fig. 3 Typical output characteristic (T_{vj}=25℃)

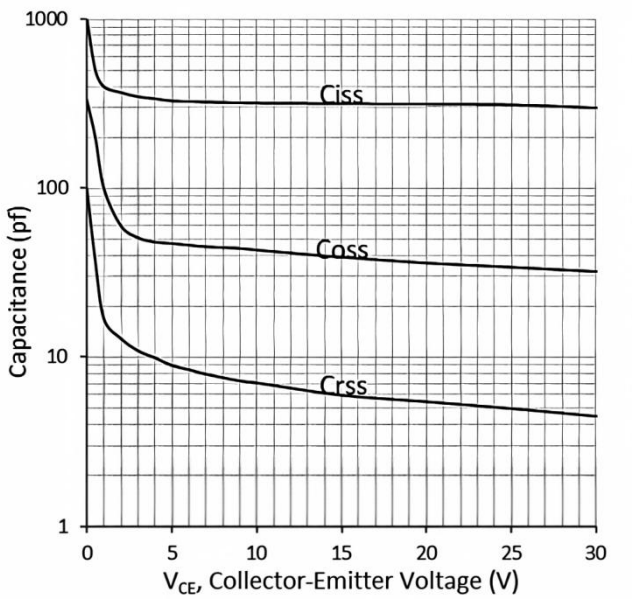


Fig. 4 Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V, f=1MHz)

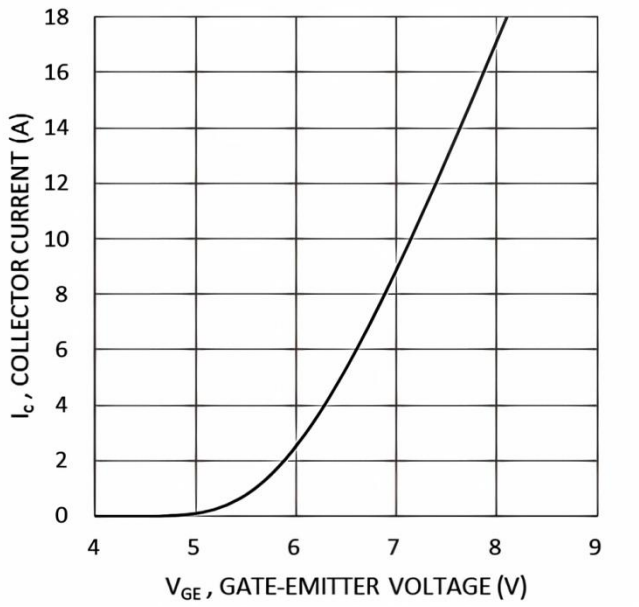


Fig. 5 Typical transfer characteristics (V_{CE}=10V)

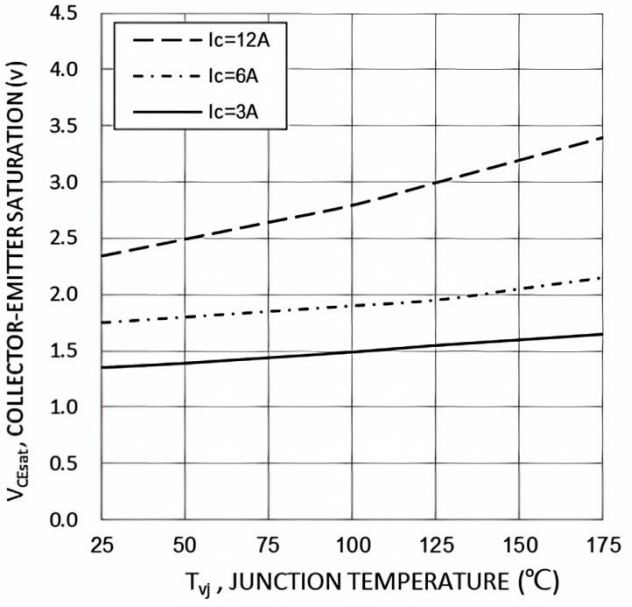


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature (V_{GE}=15V)

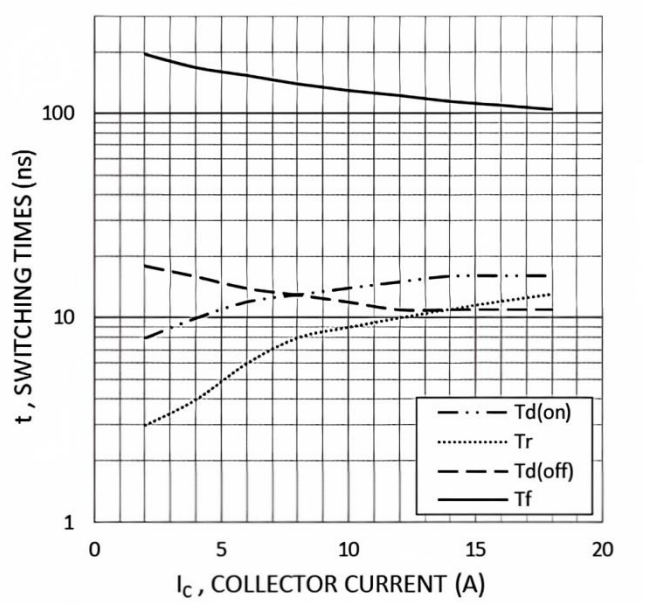


Fig. 7 Typical switching times as a function of collector current (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, R_G=10Ω)

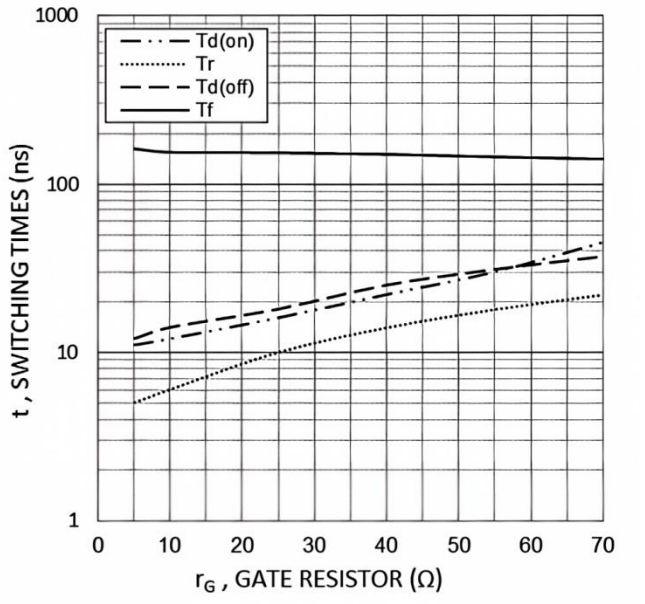


Fig. 8 Typical switching times as a function of gate resistor (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=6A)

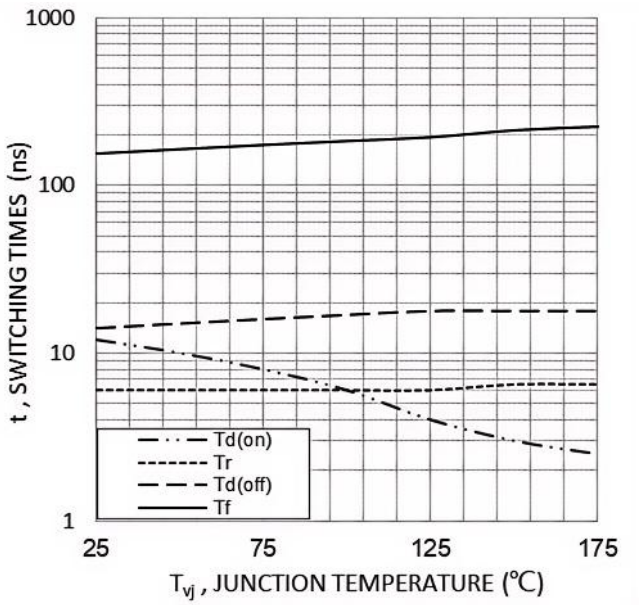


Fig. 9 Typical switching times as a function of junction temperature (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=6A, R_G=10Ω)

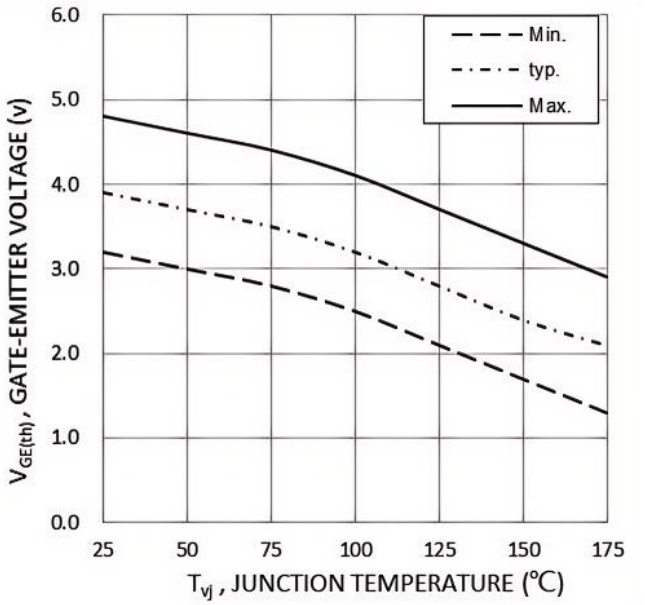


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature (I_C=0.2mA)

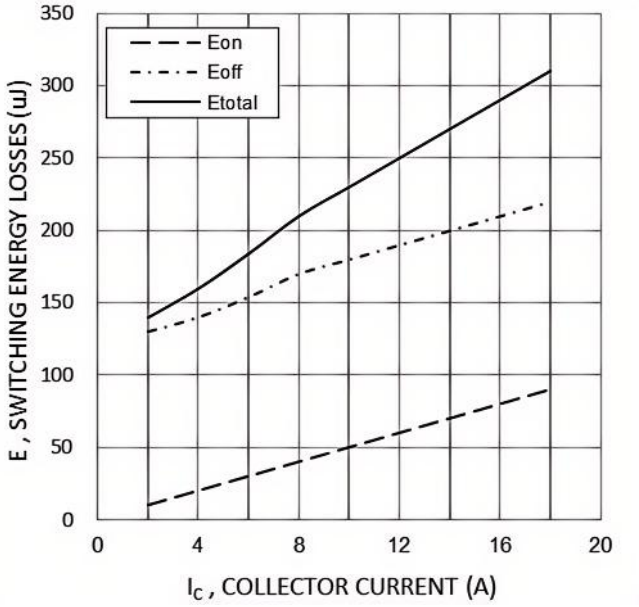


Fig. 11 Typical switching energy losses as a function of collector current (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, R_G=10Ω)

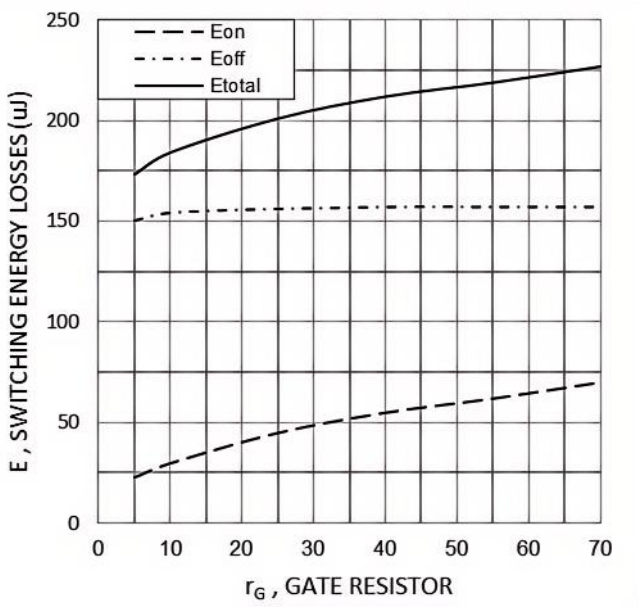


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=6A)

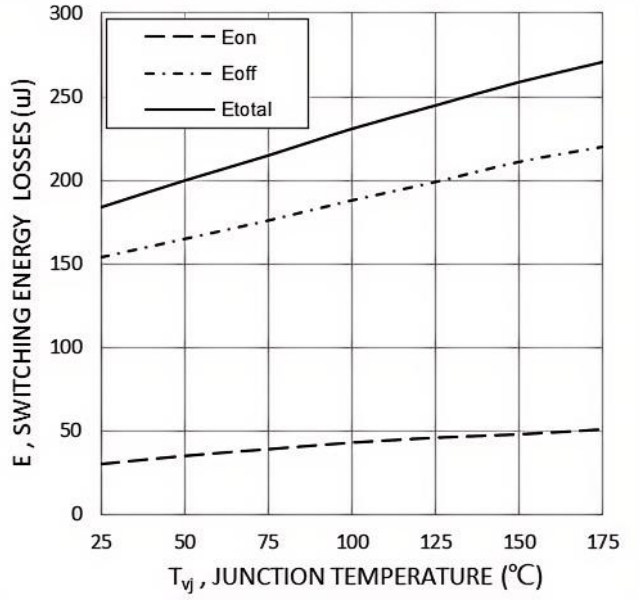


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=6A, R_G=10Ω)

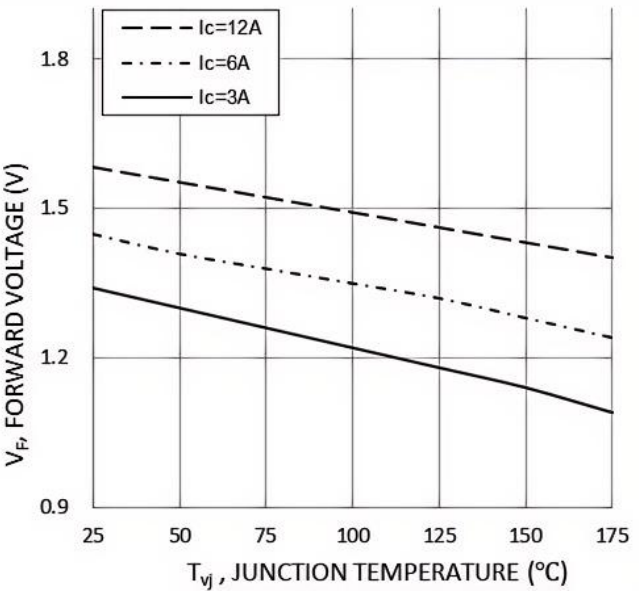


Fig. 14 Typical diode forward voltage as a function of junction temperature

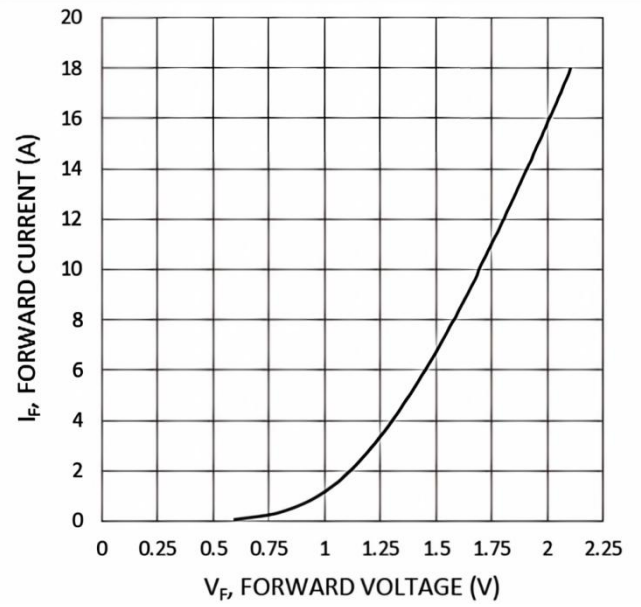


Fig. 15 Typical diode forward current as a function of forward voltage

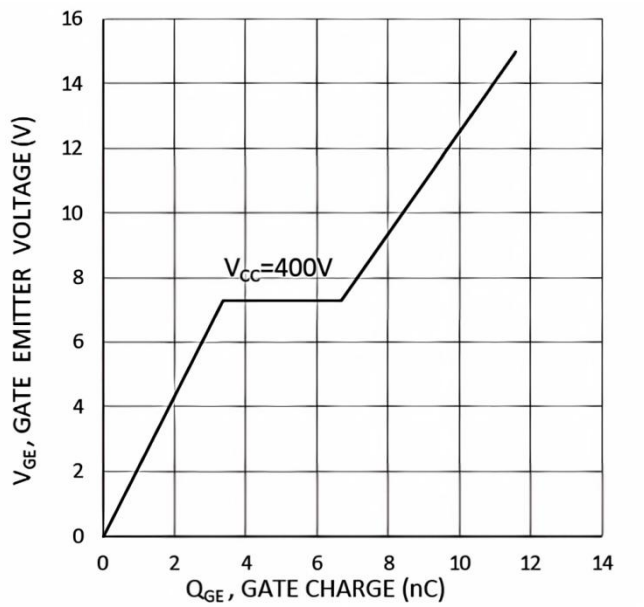


Fig. 16 Typical gate charge (I_C=6A)

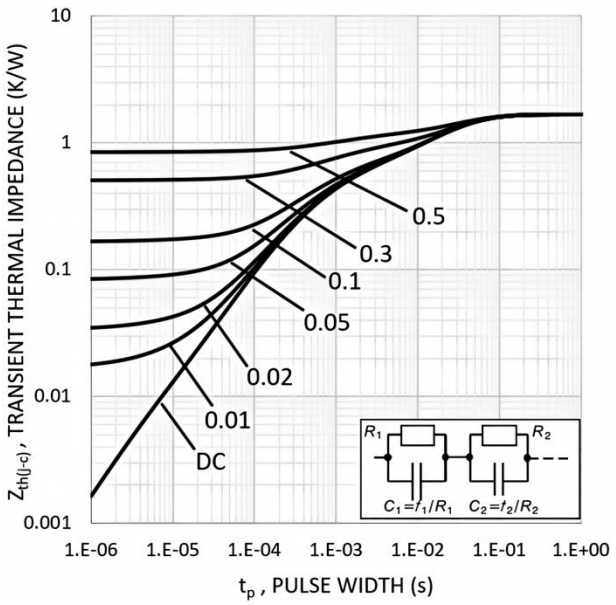


Fig. 17 IGBT transient thermal impedance (D=tp/T)
（TO-263）

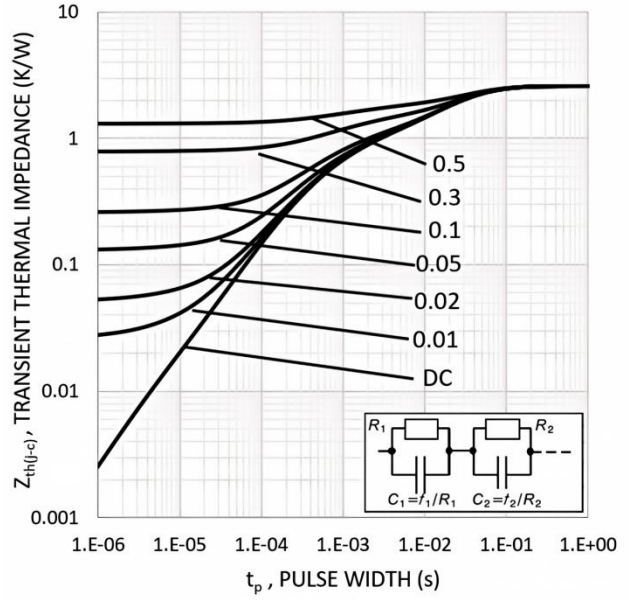
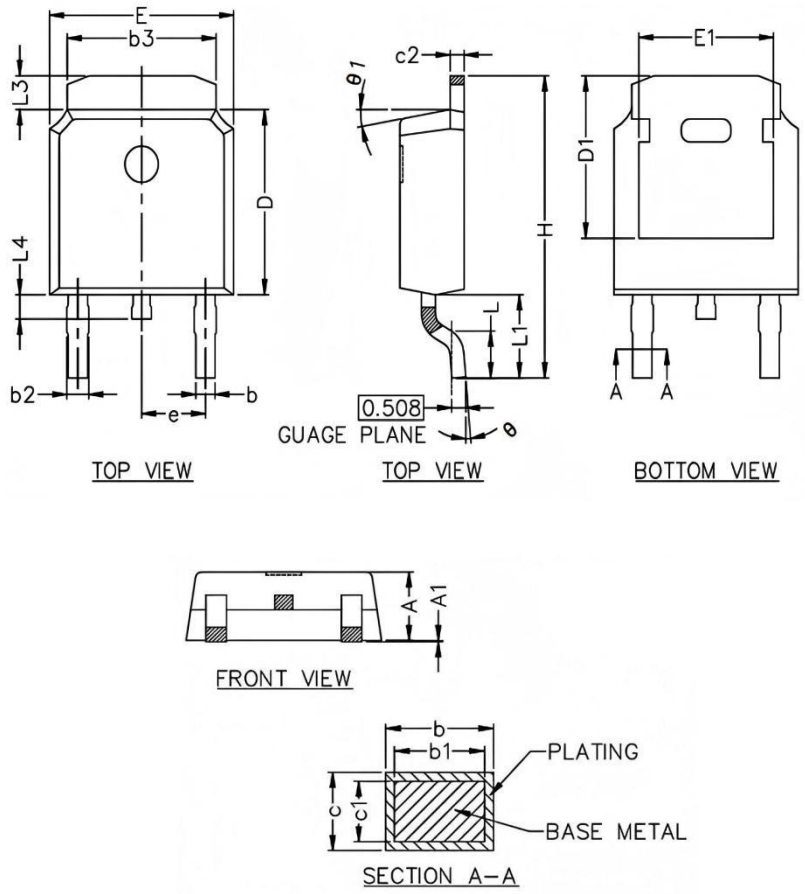


Fig. 18 FRD transient thermal impedance (D=tp/T)
（TO-263）

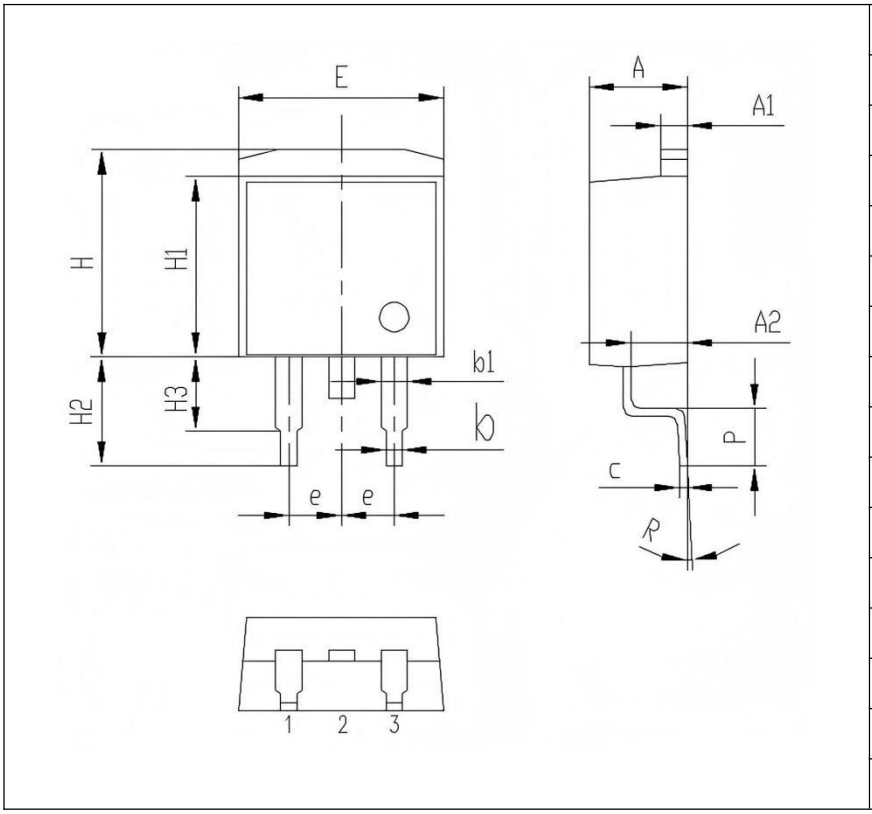
Package Outline (Unit：mm)

TO-252



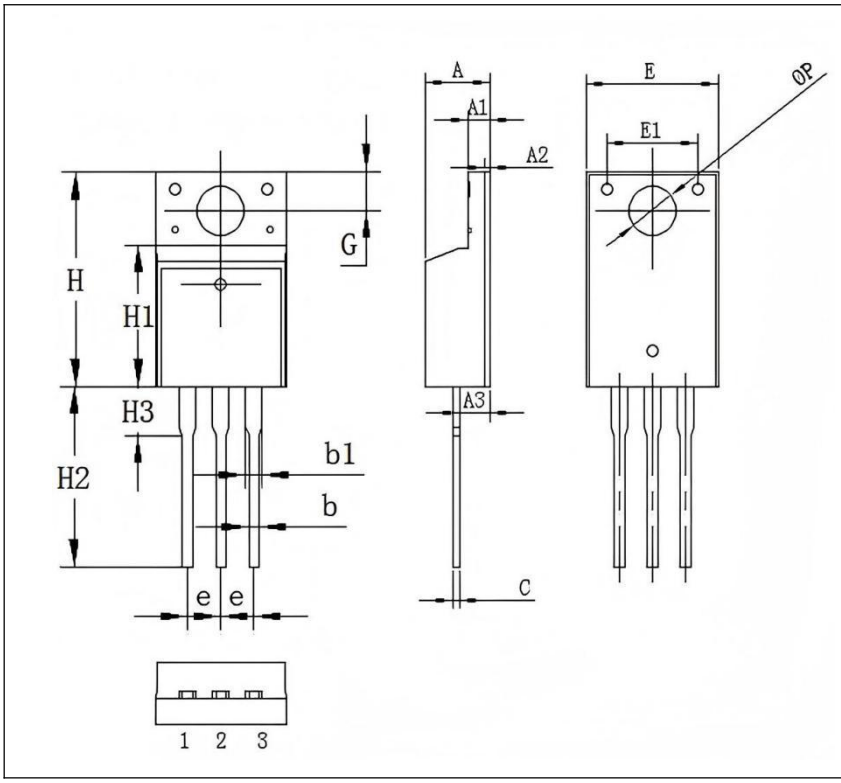
Symbol	Min	Nom	Max
A	2.20	2.30	2.40
A1	0.00	-	0.12
b	0.65	-	0.89
b1	0.64	0.69	0.79
b2	0.76	-	1.10
b3	5.20	5.33	5.46
c	0.48	-	0.60
c1	0.47	0.50	0.55
c2	0.48	-	0.60
D	6.00	6.10	6.20
D1	5.21	-	-
E	6.50	6.60	6.70
E1	4.32	-	-
e	2.29 BSC		
H	9.70	-	10.20
L	1.40	1.55	1.70
L1	2.743 REF		
L3	0.90	-	1.27
L4	0.60	0.80	1.00
θ	0°	-	10°
θ1	0°	-	15°
Dims. in mm			

TO-263



Symbol	Min	Nom	Max
A	4.40	4.6	4.80
A1	1.17	1.27	1.37
A2	2.40	2.6	2.80
b	0.60	0.8	1.00
b1	1.05	1.25	1.45
c	0.28	0.38	0.48
e	2.34	2.54	2.74
E	9.9	10.1	10.3
H	9.90	10.1	10.3
H1	8.50	8.7	8.90
H2	4.80	5.00	5.20
H3	2.60	2.8	3.00
R	0°	3°	6°
P	2.40	2.70	3.00
Dims. in mm			

TO-220F



Symbol	Min	Nom	Max
A	4.55	4.75	4.95
A1	2.4	2.6	2.8
A2	0.4	0.6	0.8
A3	2.1	2.3	2.5
b1	1.1	1.3	1.5
b	0.6	0.8	1
c	0.42	0.5	0.58
e	2.34	2.54	2.74
E	9.9	10.1	10.3
E1	6.8	7	7.2
H	15.8	16	16.2
H1	9.1	9.3	9.5
H2	12.5	13	13.5
H3	3.1	3.3	3.5
G	3	3.2	3.4
ΦP	3	3.2	3.4
Dims. in mm			

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