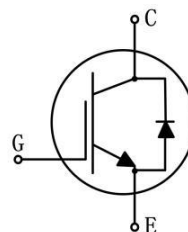


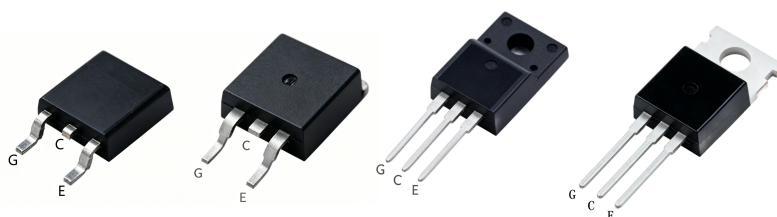
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	10	A
$V_{CE(sat)}$	1.6	V



Features

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



TO-252

TO-263

TO-220F

TO-220

Applications

- UPS
- Motor drives
- General purpose inverters

Key Performance and Package Parameters

Part No.	V_{CE}	I_C	T_{vjmax}	Package	Packing form
HT10T65FX100	650V	10A	175°C	TO-252	Reel
HT10T65SX100	650V	10A	175°C	TO-263	Reel
HT10T65TX100	650V	10A	175°C	TO-220	Tube
HT10T65TFX100	650V	10A	175°C	TO-220F	Tube

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current($T_C=25^\circ\text{C}$)	I_C	20	A
Continuous collector current($T_C=100^\circ\text{C}$)		10	A
Pulsed Collector Current (Note 1)	I_{CM}	40	A
Diode continuous forward current($T_C=25^\circ\text{C}$)	I_F	20	A
Diode continuous forward current($T_C=100^\circ\text{C}$)		10	A
Diode maximum current, tp limited by T_{vjmax}	I_{FM}	40	A
Maximum Power Dissipation ($T_C=25^\circ\text{C}$) (Note 2)	P_{tot}	141	W
Maximum Power Dissipation ($T_C=100^\circ\text{C}$) (Note 2)		79	W
Short Circuit Withstand Time	t_{sc}	7	us
Operating Junction Temperature Range	T_J	-40 to+175	°C
Storage Temperature Range	T_{STG}	-55 to+150	°C

Thermal Characteristics

Parameter	Symbol	Conditions	Max.	Unit
Thermal Resistance, Junction to Case for IGBT	$R_{\theta JC}$	TO-252	2.0	$^{\circ}\text{C}/\text{W}$
		TO-263	1.1	$^{\circ}\text{C}/\text{W}$
		TO-220	1.1	$^{\circ}\text{C}/\text{W}$
		TO-220F	1.2	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to Case for Diode	$R_{\theta JC}$	TO-252	4.2	$^{\circ}\text{C}/\text{W}$
		TO-263	2.1	$^{\circ}\text{C}/\text{W}$
		TO-220	2.4	$^{\circ}\text{C}/\text{W}$
		TO-220F	2.5	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	TO-252	75	$^{\circ}\text{C}/\text{W}$
		TO-263	60	$^{\circ}\text{C}/\text{W}$
		TO-220	62	$^{\circ}\text{C}/\text{W}$
		TO-220F	65	$^{\circ}\text{C}/\text{W}$

Electrical Characteristics of IGBT ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Collector-Emitter Breakdown Voltage	$B_{V_{CES}}$	$V_{GE}=0\text{V}, I_C=200\mu\text{A}$	650	-	-	V
Collector-Emitter Leakage Current	I_{CES}	$V_{CE}=650\text{V}, V_{GE}=0\text{V}$	-	-	40	μA
Gate Leakage Current, Forward	I_{GES}	$V_{GE}=20\text{V}, V_{CE}=0\text{V}$	-	-	100	nA
Gate Leakage Current, Reverse		$V_{GE}=-20\text{V}, V_{CE}=0\text{V}$	-	-	100	nA
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=200\mu\text{A}$	4.0	5.0	6.0	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15\text{V}, I_C=10\text{A}, T_J=25^{\circ}\text{C}$	-	1.6	2.0	V
		$V_{GE}=15\text{V}, I_C=10\text{A}, T_J=150^{\circ}\text{C}$	-	1.9	-	V
Total Gate Charge	Q_g	$V_{CC}=400\text{V}$ $V_{GE}=15\text{V}, I_C=10\text{A}$	-	19.3	-	nC
Gate-Emitter Charge	Q_{ge}		-	3.0	-	nC
Gate-Collector Charge	Q_{gc}		-	10.6	-	nC
Turn-on Delay Time	$t_{d(on)}$	$V_{CC}=400\text{V}$ $V_{GE}=\pm 15\text{V}$ $I_C=10\text{A}$ $R_G=10\Omega$ Inductive Load $T_C=25^{\circ}\text{C}$	-	11	-	ns
Turn-on Rise Time	t_r		-	15	-	ns
Turn-off Delay Time	$t_{d(off)}$		-	41	-	ns
Turn-off Fall Time	t_f		-	65	-	ns
Turn-on Switching Loss	E_{on}		-	0.275	-	mJ
Turn-off Switching Loss	E_{off}		-	0.11	-	mJ
Total Switching Loss	E_{ts}		-	0.385	-	mJ
Input Capacitance	C_{ies}	$V_{CE}=25\text{V}$ $V_{GE}=0\text{V}$ $f=1\text{MHz}$	-	529	-	pF
Output Capacitance	C_{oes}		-	39	-	pF
Reverse Transfer Capacitance	C_{res}		-	5.8	-	pF
Short Circuit Collector Current	I_{SC}	$V_{GE}=15\text{V}, V_{CC}=400\text{V}, T_{J,start}\leq 25^{\circ}\text{C}$	-	100	-	A

Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F=10A, T_J=25^{\circ}C$	-	1.7	2.1	V
		$I_F=10A, T_J=150^{\circ}C$	-	1.4	-	V
Diode Reverse Recovery Time	t_{rr}	$V_R=400V, I_F=10A$ $dI_F/dt=100A/us, T_C=25^{\circ}C$	-	53	-	ns
Diode peak Reverse Recovery Current	I_{rr}		-	2	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	39	-	nC

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

Note2: For TO-263

Typical Characteristics

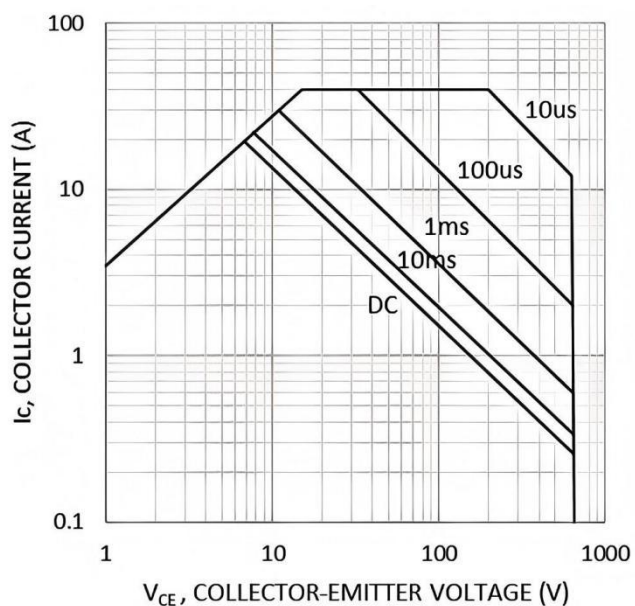


Fig. 1 Forward bias safe operating area
($T_C=25^{\circ}C, T_{vj}=175^{\circ}C$, Single Pulse)

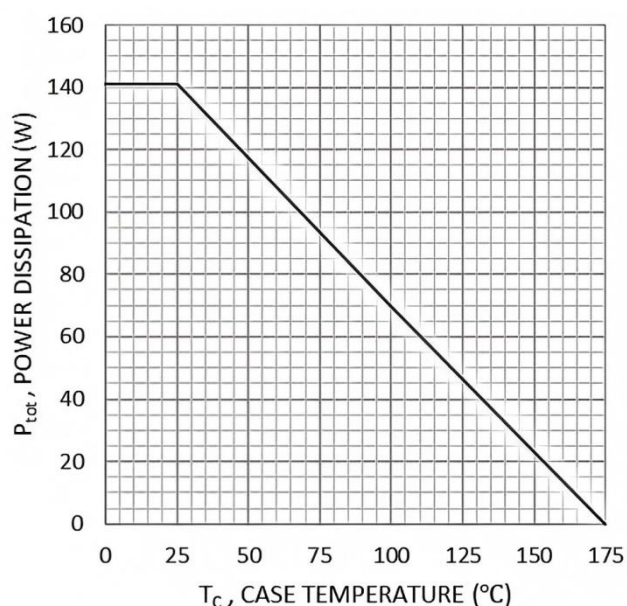


Fig. 2 Power dissipation as a function of case
temperature ($T_{vj} \leq 175^{\circ}C$)

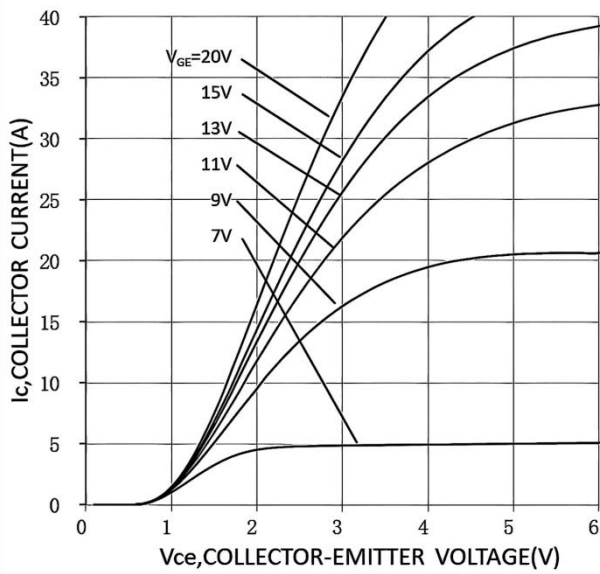


Fig. 3 Typical output characteristic ($T_{vj}=25^\circ\text{C}$)

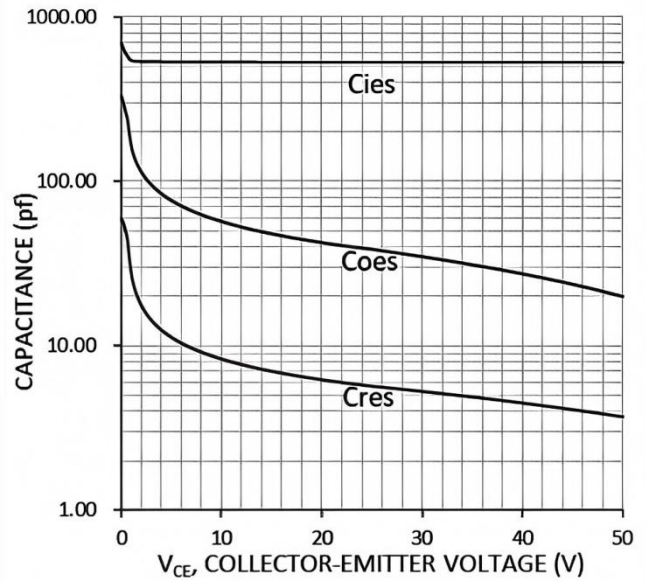


Fig. 4 Typical capacitance as a function of collector-emitter voltage ($V_{ge}=0\text{V}$, $f=1\text{MHz}$)

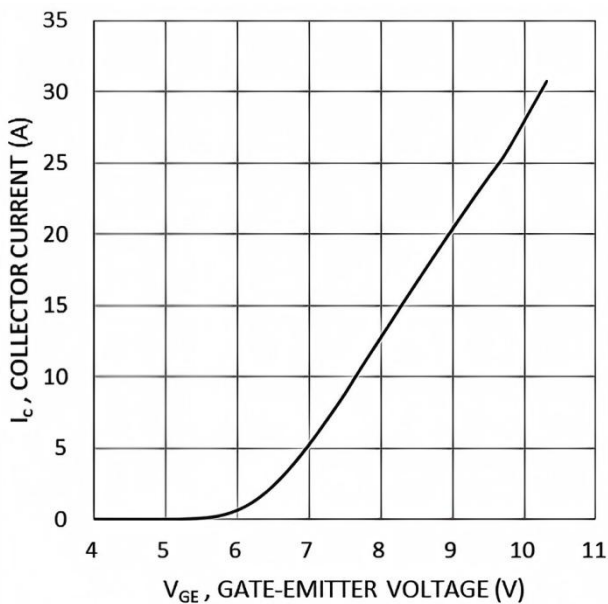


Fig. 5 Typical transfer characteristics ($V_{ce}=10\text{V}$)

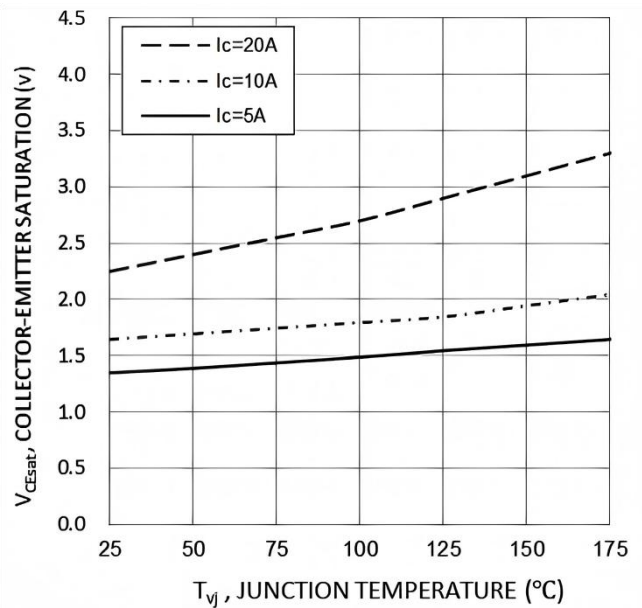


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature ($V_{ge}=15\text{V}$)

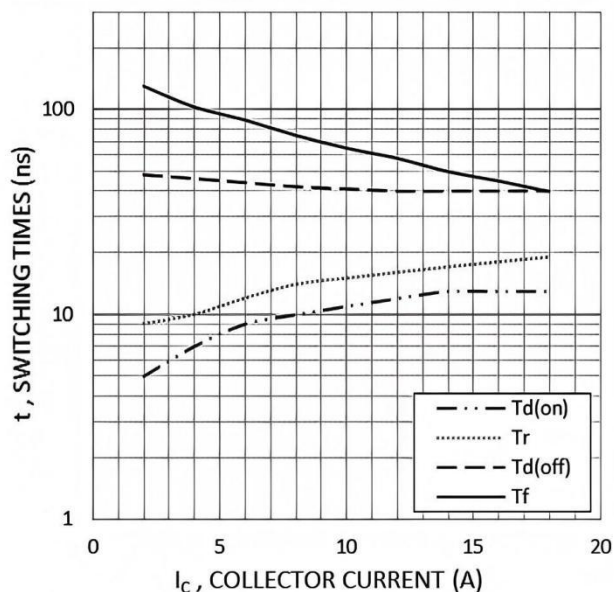


Fig. 7 Typical switching times as a function of collector current (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=10\Omega$)

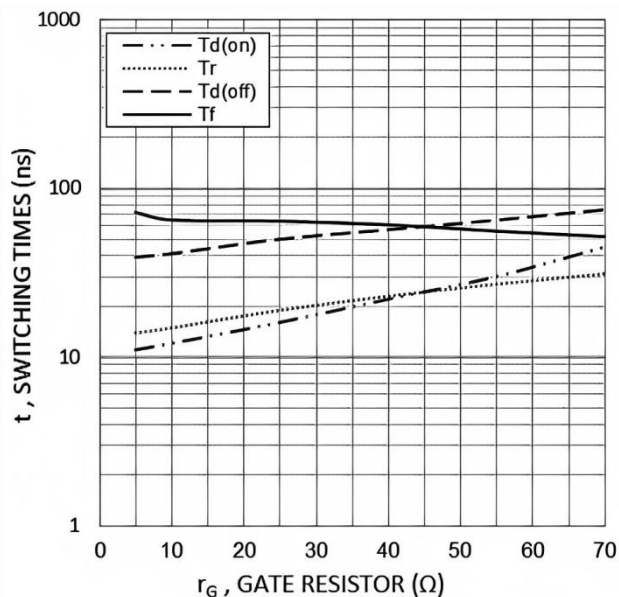


Fig. 8 Typical switching times as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=10\text{A}$)

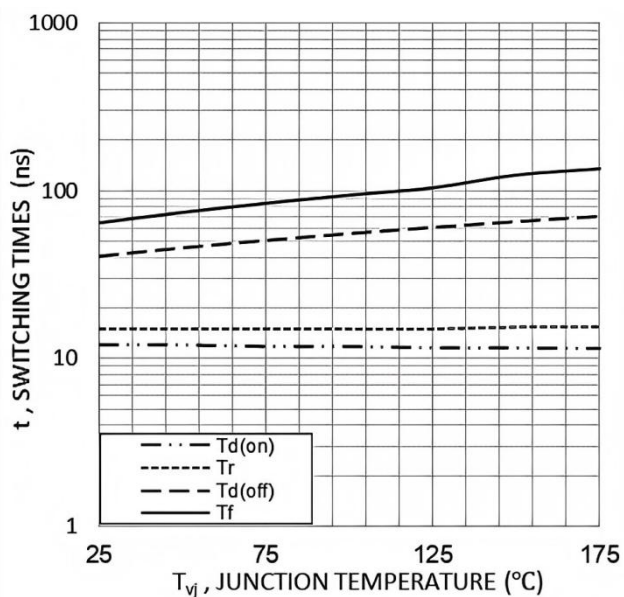


Fig. 9 Typical switching times as a function of junction temperature (inductive load, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=10\text{A}$, $R_G=10\Omega$)

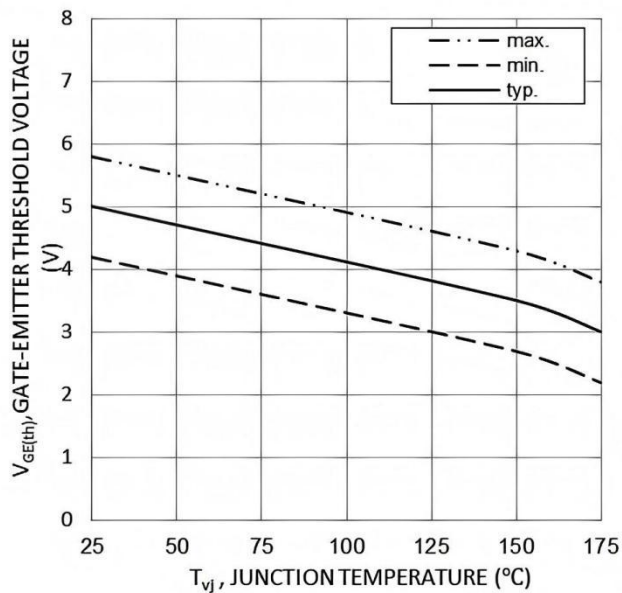


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature ($I_C=0.2\text{mA}$)

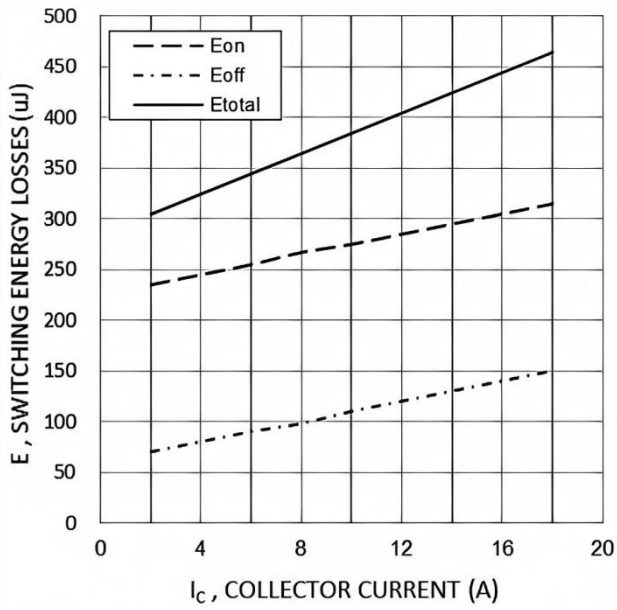


Fig. 11 Typical switching energy losses as a function of collector current (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=10\Omega$)

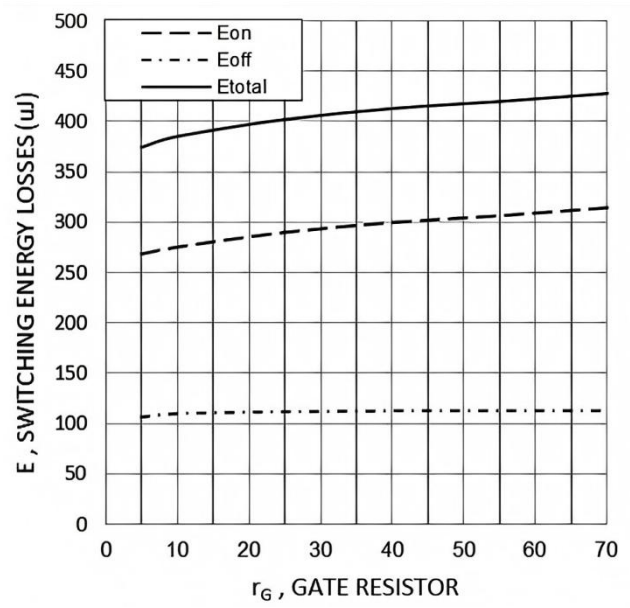


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=10\text{A}$)

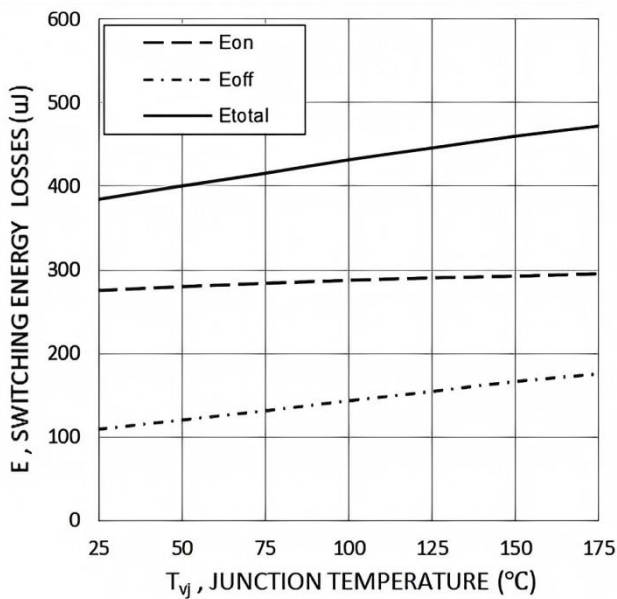


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=10\text{A}$, $R_G=10\Omega$)

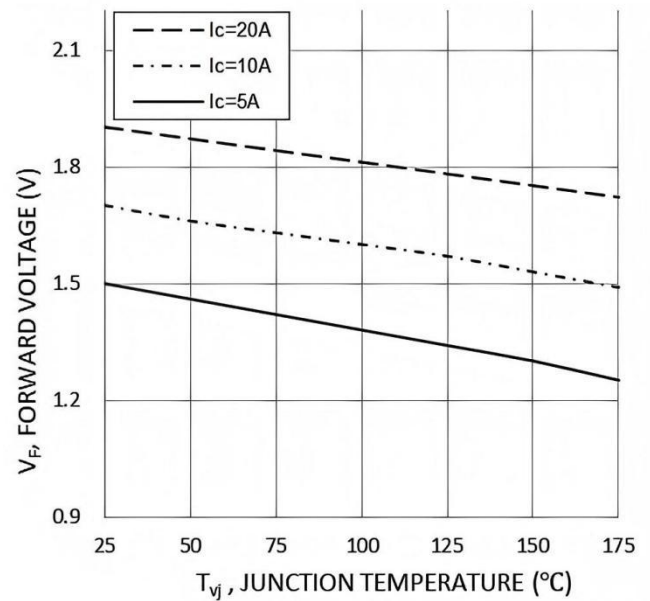


Fig. 14 Typical diode forward voltage as a function of junction temperature

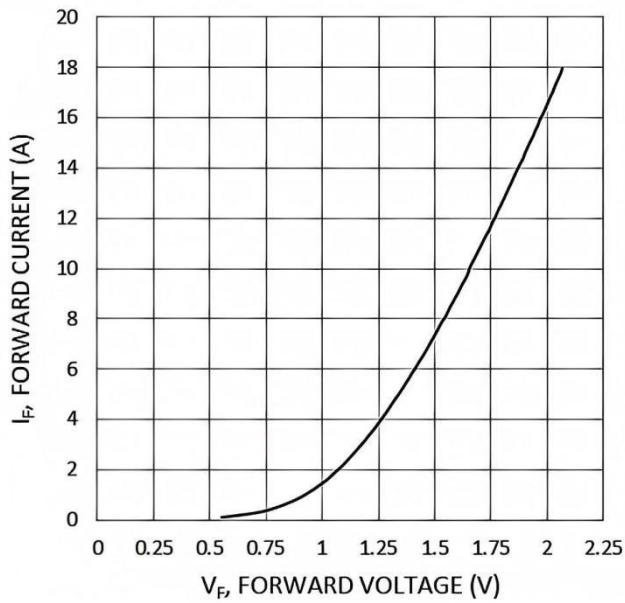


Fig. 15 Typical diode forward current as a function of forward voltage

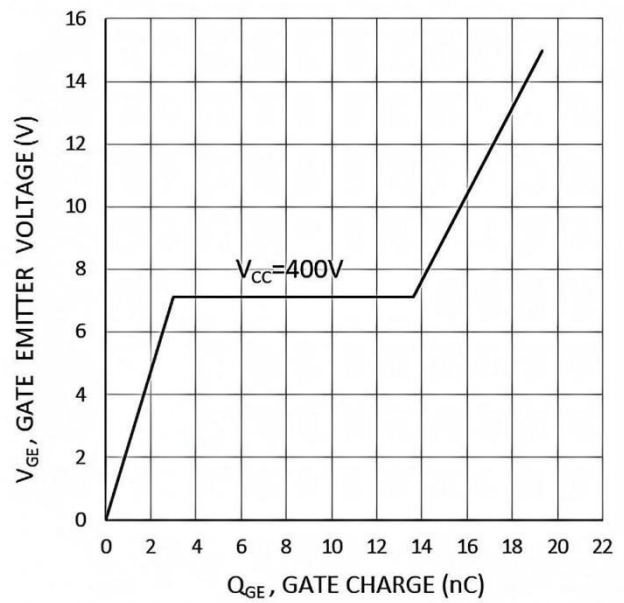


Fig. 16 Typical gate charge ($I_C=10A$)

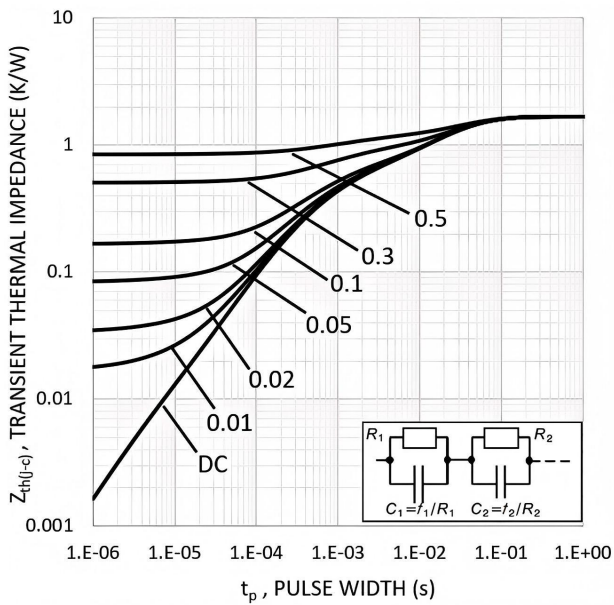


Fig. 17 IGBT transient thermal impedance ($D=tp/T$) (TO-263)

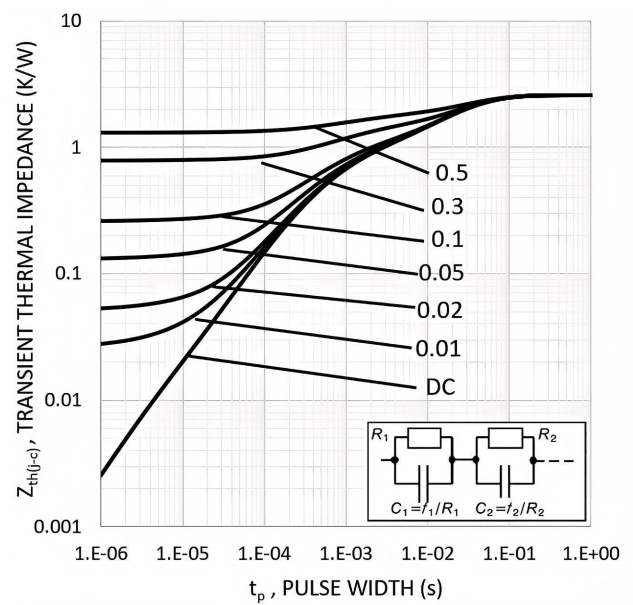
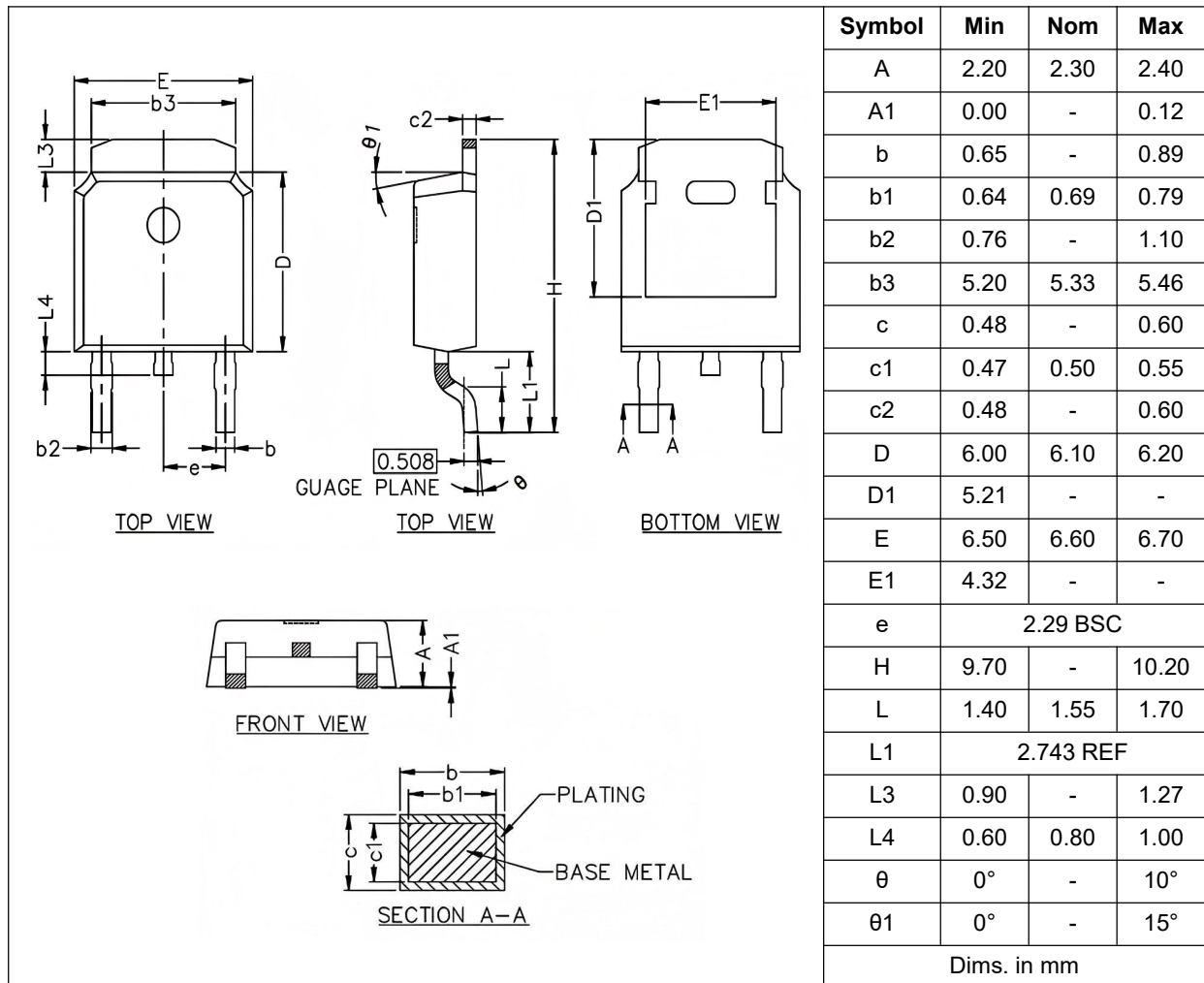


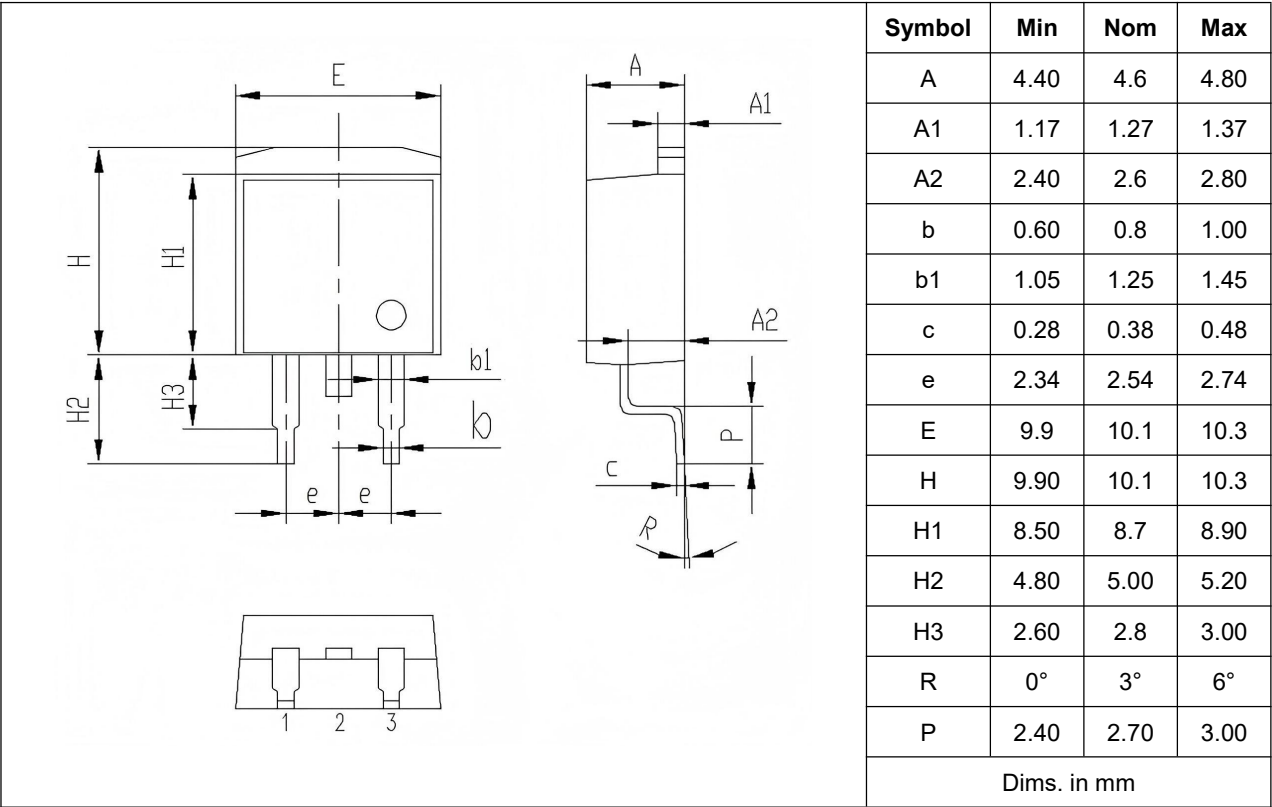
Fig. 18 FRD transient thermal impedance ($D=tp/T$) (TO-263)

Package Outlines (Unit: mm)

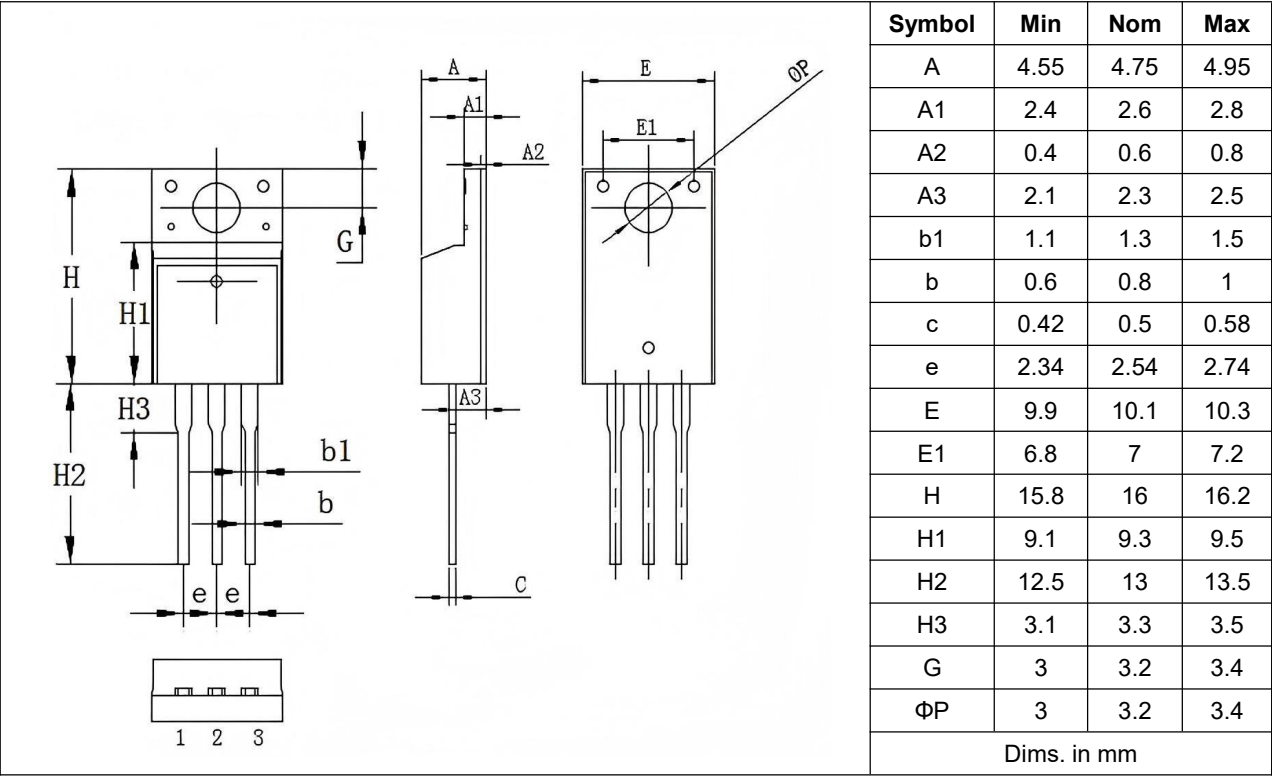
TO-252



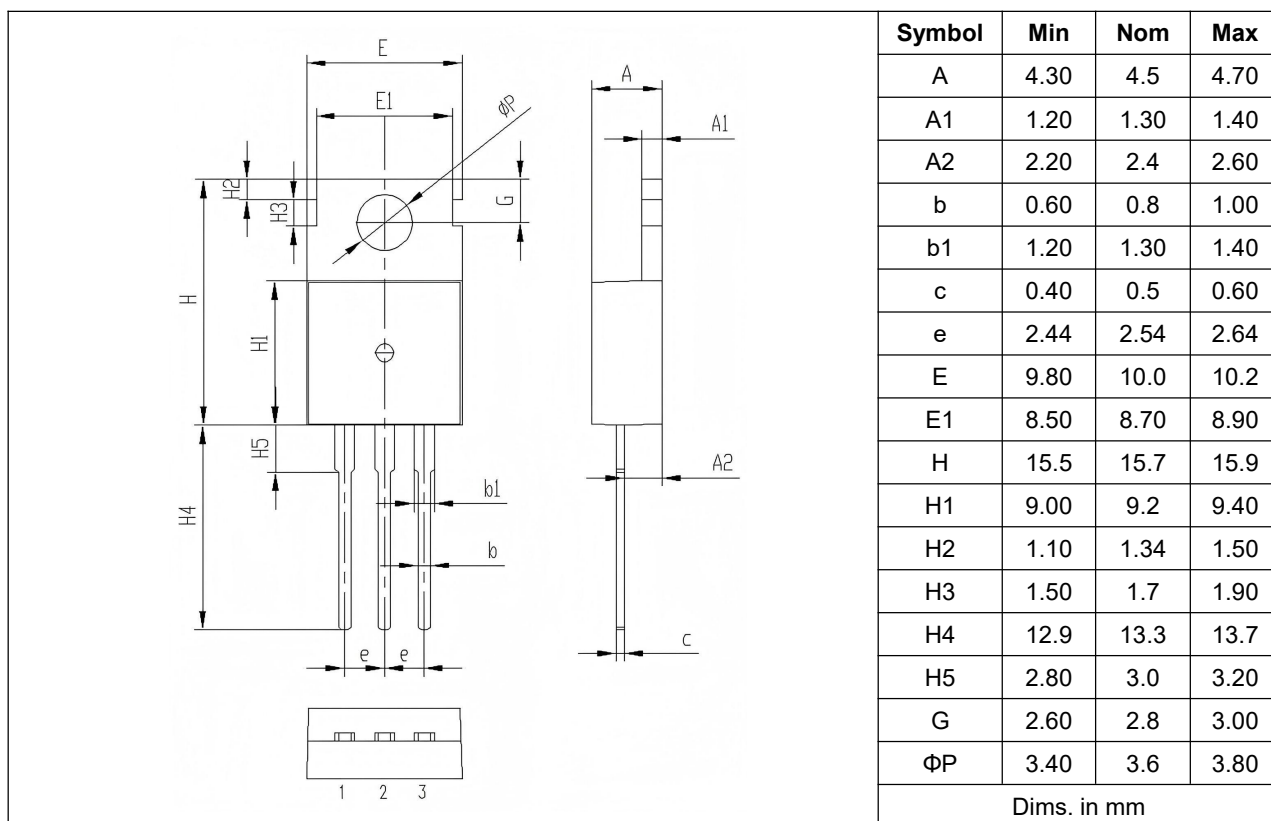
TO-263



TO-220F



TO-220



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