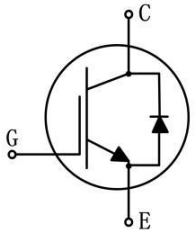
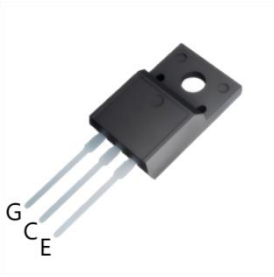
Trench Field-stop IGBT Discrete

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





TO-220F

Features

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

Applications

- UPS
- Motor drives
- Boost
- PFC

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℃)	I_C	20	A
Continuous collector current(T_C=100℃)		10	A
Pulsed collector current,tp limited by T_{vjmax}	I_{CM}	40	A
Diode continuous forward current(T_C=25℃)	I_F	20	A
Diode continuous forward current(T_C=100℃)		10	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	40	A
Power dissipation(T_C=25℃)	P_{tot}	141	W
Power dissipation(T_C=100℃)		79	W
Operating Junction Temperature Range	T_J	-40 to+175	℃
Storage Temperature Range	T_{STG}	-55 to+150	℃

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance,junction to case for IGBT	$R_{th(j-C)}$	1.2	℃/W
Thermal resistance,junction to case for Diode	$R_{th(j-C)}$	2.5	℃/W
Thermal resistance,junction to ambient	$R_{th(j-C)}$	65	℃/W

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

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	B_{VCES}	V_{GE}=0V,I_C=200μA	650	-	-	V
Collector-emitter leakage current	I_{CES}	V_{CE}=650V,V_{GE}=0V	-	-	40	μA
Gate leakage current,forward	I_{GES}	V_{GE}=±20V,V_{CE}=0V	-	-	±100	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE},I_C=200uA	4.0	5.0	6.0	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=10A,T_{vj}=25℃	-	1.6	2.0	V
		V_{GE}=15V,I_C=10A,T_{vj}=150℃	-	1.9	-	V
Input capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f=1MHz	-	529	-	pF
Output capacitance	C_{oes}		-	39	-	pF
Reverse transfer capacitance	C_{res}		-	5.8	-	pF
Total gate charge	Q_g	V_{CC}=400V V_{GE}=15V I_C=10A	-	19.3	-	nC
Gate-Emitter Charge	Q_{ge}		-	3	-	nC
Gate-Collector Charge	Q_{gc}		-	10.6	-	nC
Short Circuit Collector Current	I_{SC}	V_{CC}=400V V_{GE}=15V T_J,start≤25℃	-	100	-	A
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V I_C=10A R_G=10Ω Inductive load T_C=25℃	-	11	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	41	-	ns
Fall time	t_f		-	65	-	ns
Turn-on energy	E_{on}		-	0.275	-	mJ
Turn-off energy	E_{off}		-	0.11	-	mJ
Total switching energy	E_{ts}		-	0.385	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	I_F=10A, T_j=25℃	-	1.7	2.1	V
		I_F=10A, T_j=150℃	-	1.4	-	V
Diode Reverse Recovery Time	t_{rr}	V_R=400V, I_F=10A dIF/dt=100A/us T_C=25℃	-	53	-	ns
Diode peak Reverse Recovery Current	I_{rr}		-	2	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	39	-	nC

Typical Characteristics

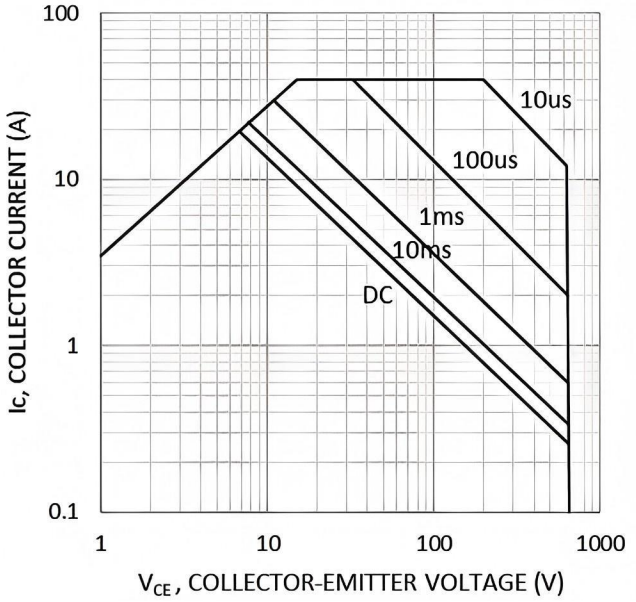


Fig. 1 Forward bias safe operating area (T_C=25℃, T_{vj}=175℃, Single Pulse)

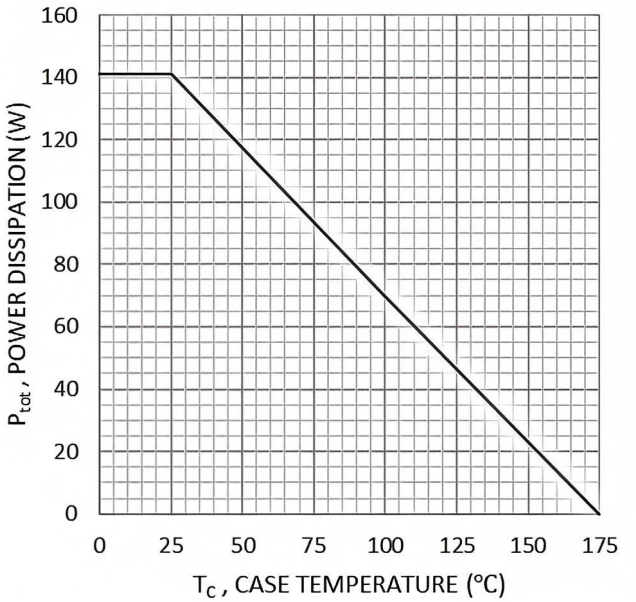


Fig. 2 Power dissipation as a function of case temperature (T_{vj}≤175℃)

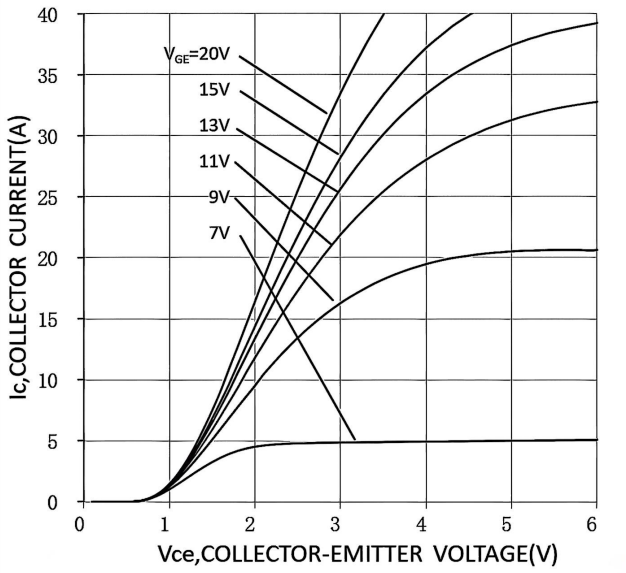


Fig. 3 Typical output characteristic (T_{vj}=25℃)

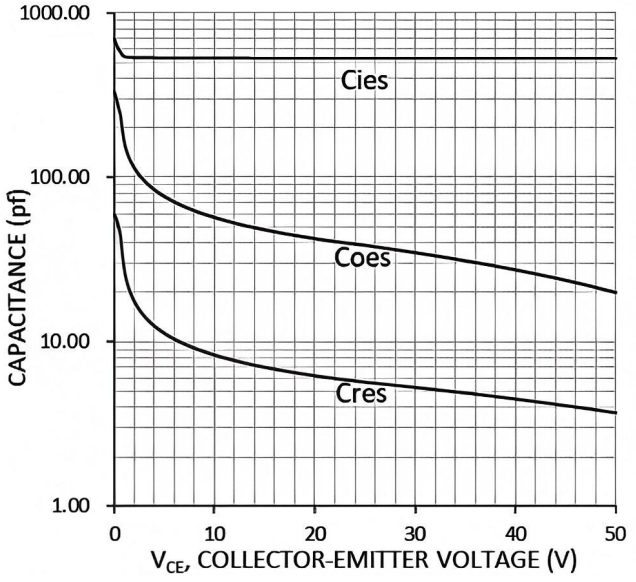


Fig. 4 Typical capacitance as a function of collector-emitter voltage (V_{GE}=0V, f=1MHz)

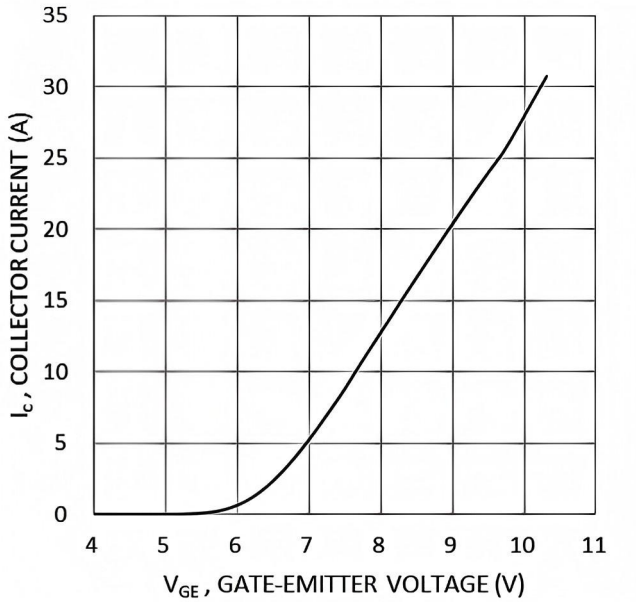


Fig. 5 Typical transfer characteristics (V_{CE}=10V)

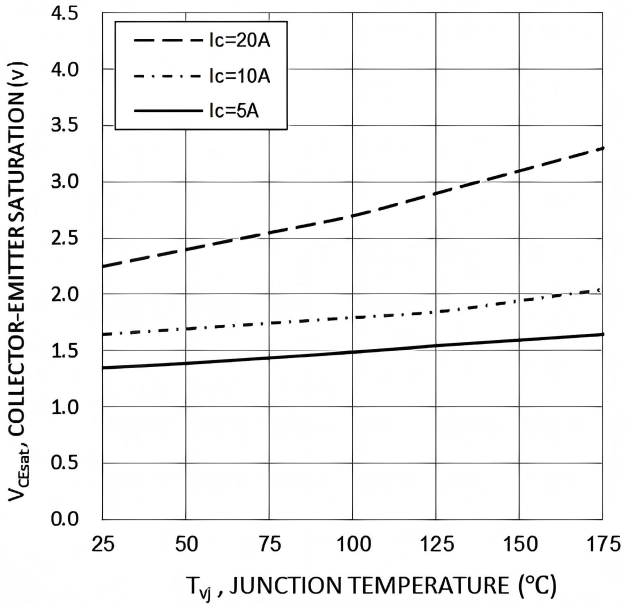


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature (V_{GE}=15V)

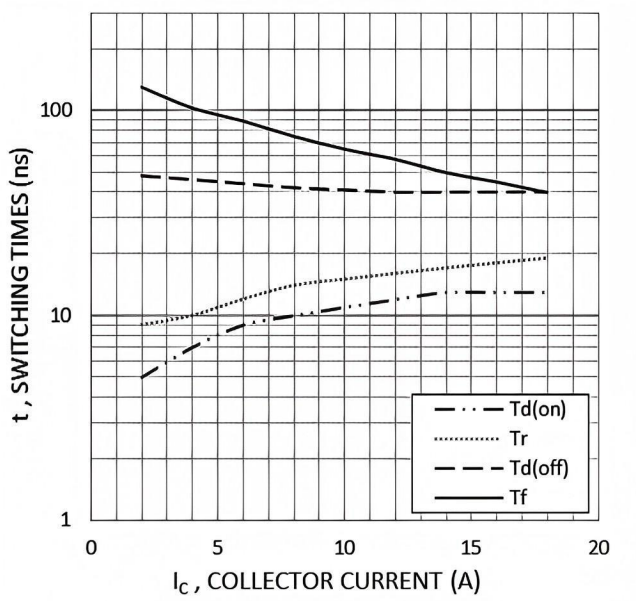


Fig. 7 Typical switching times as a function of collector current (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, R_G=10Ω)

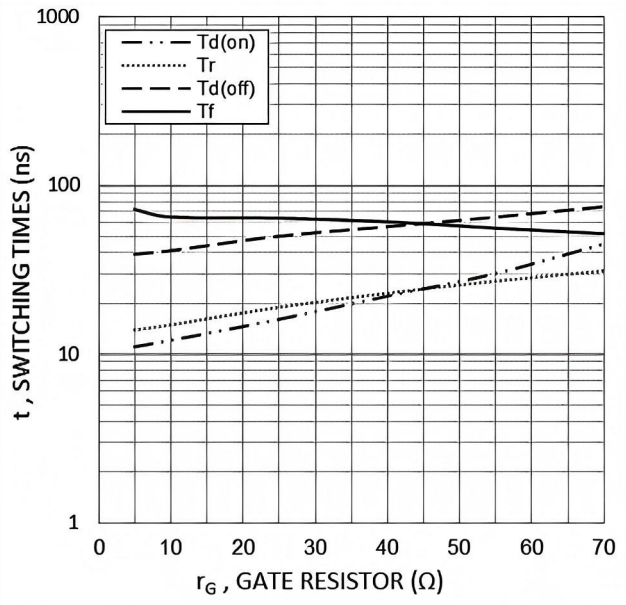


Fig. 8 Typical switching times as a function of gate resistor (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=10A)

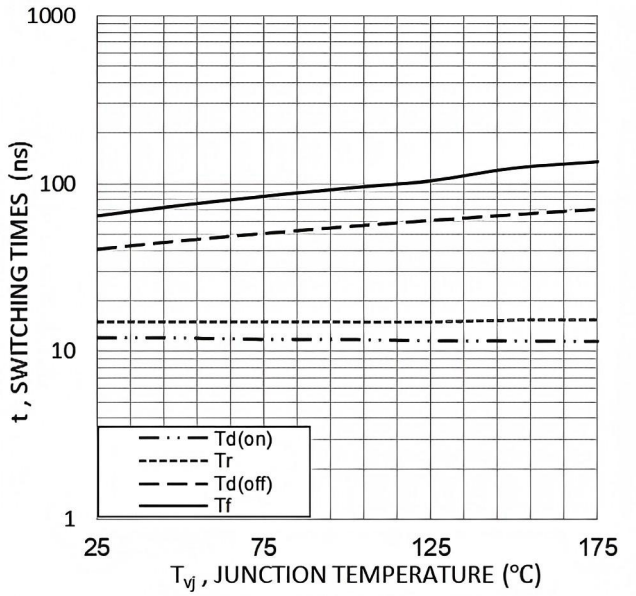


Fig. 9 Typical switching times as a function of junction temperature (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=10A, R_G=10Ω)

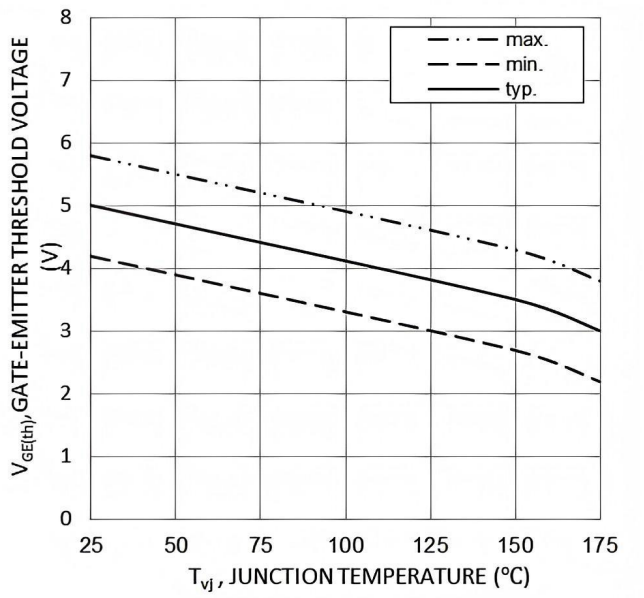


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature (I_C=0.2mA)

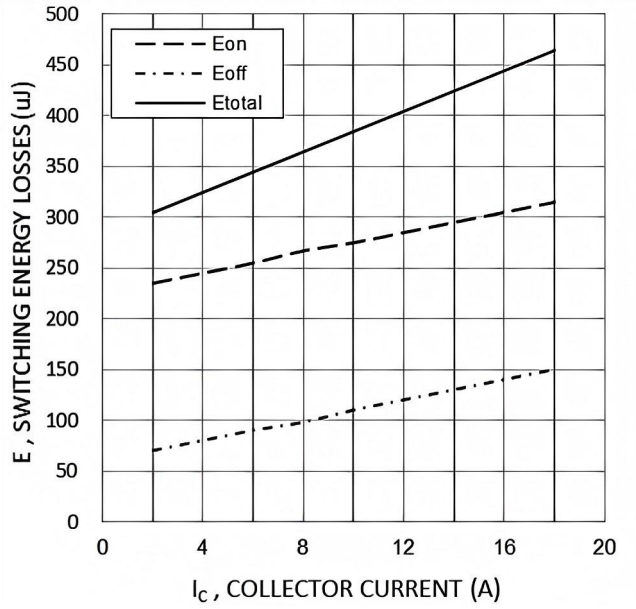


Fig. 11 Typical switching energy losses as a function of collector current (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, R_G=10Ω)

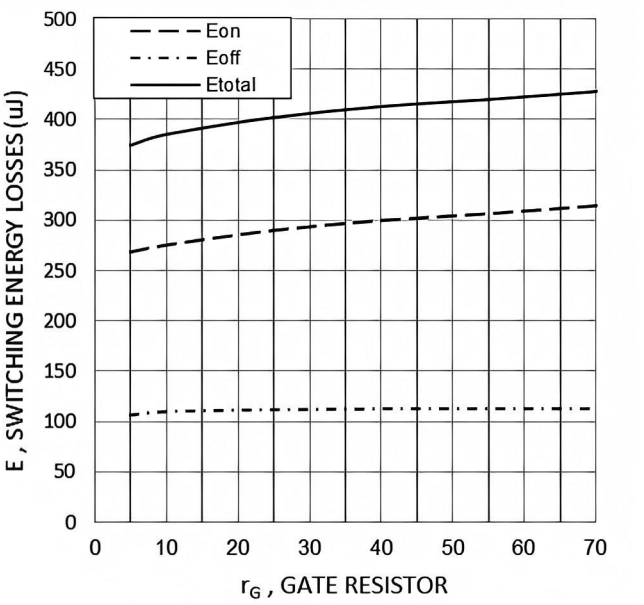


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load, T_{vj}=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=10A)

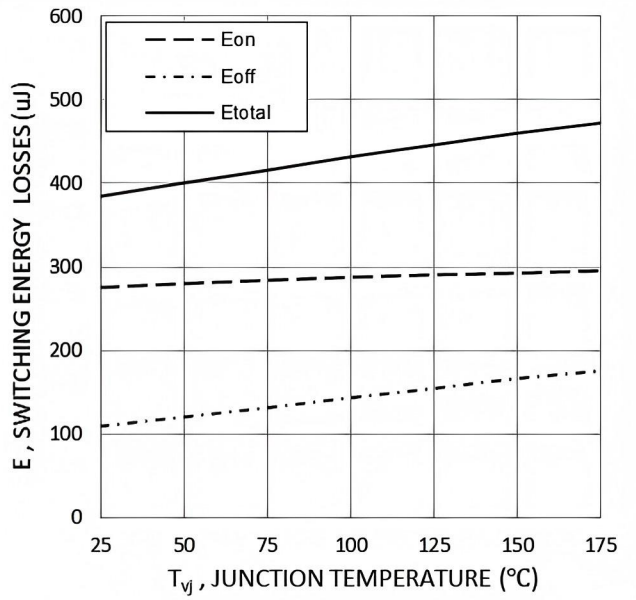


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=10A, R_G=10Ω)

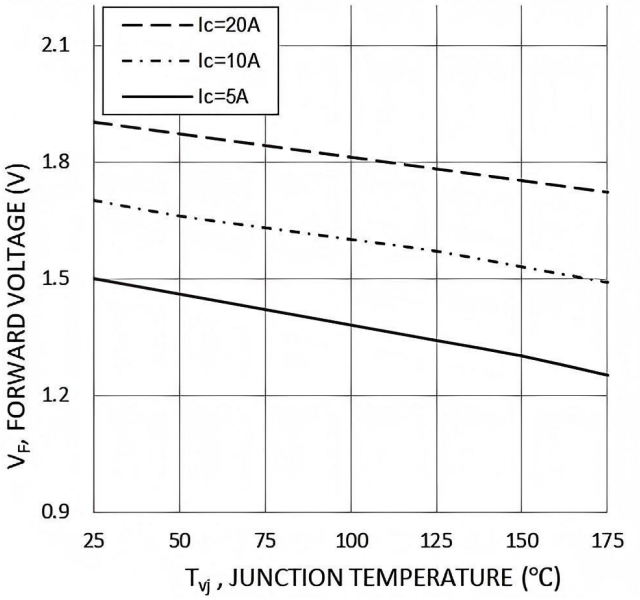


Fig. 14 Typical diode forward voltage as a function of junction temperature

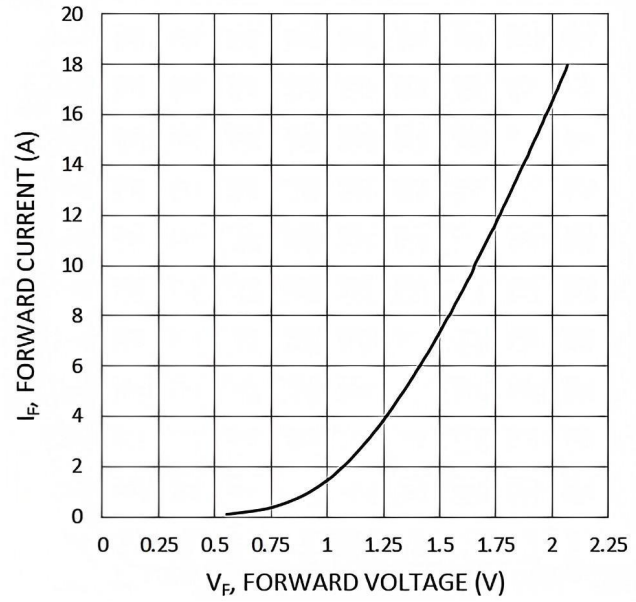


Fig. 15 Typical diode forward current as a function of forward voltage

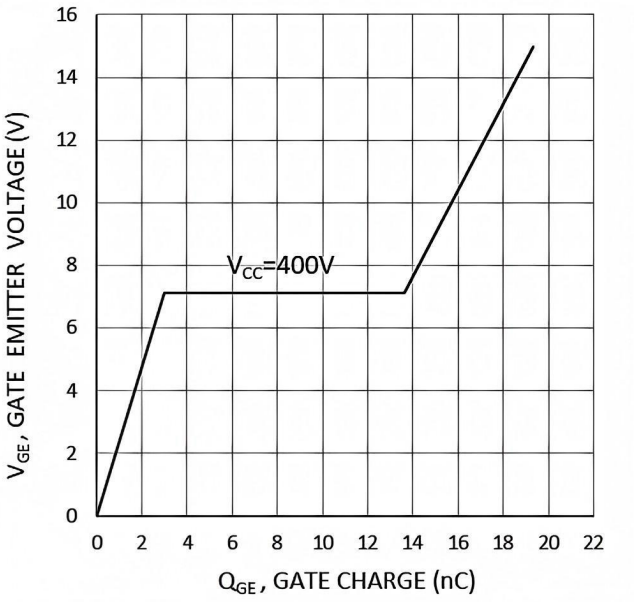
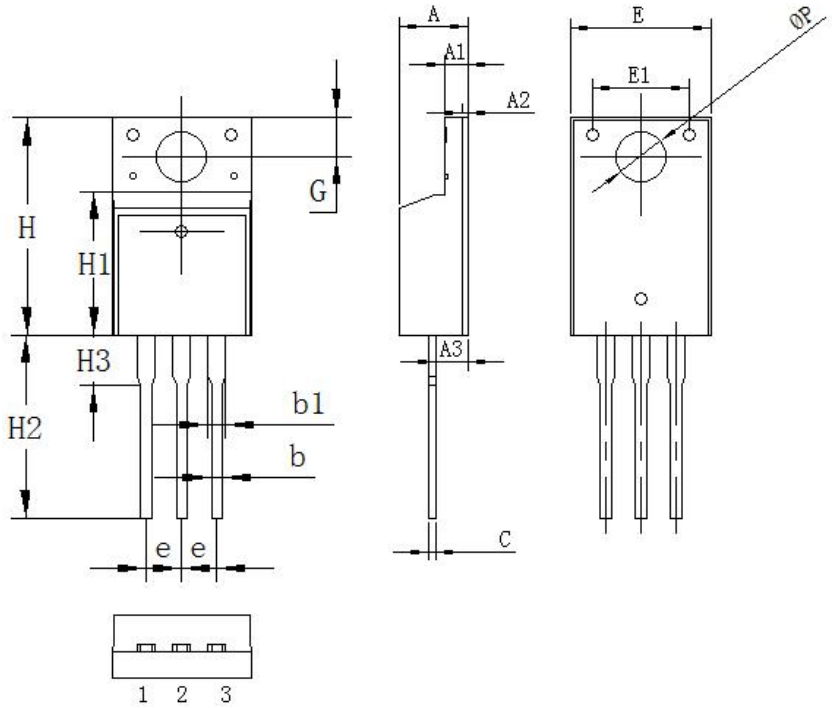


Fig. 16 Typical gate charge (I_C=10A)

Package Outlines (Unit：mm)

TO-220F



Symbol	单位 mm		
	Min	Nom	Max
A	4.55	4.75	4.95
A1	2.40	2.60	2.80
A2	0.40	0.60	0.80
A3	2.10	2.30	2.50
b1	1.10	1.30	1.50
b	0.60	0.80	1.00
c	0.42	0.50	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	16.0	16.2
H1	9.10	9.30	9.50
H2	12.5	13.0	13.5
H3	3.10	3.30	3.50
G	3.00	3.20	3.40
ΦP	3.00	3.20	3.40

*Important Usage Information and Disclaimer

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