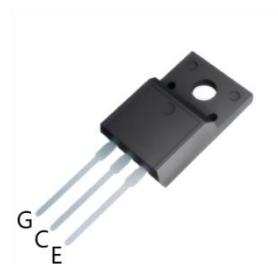
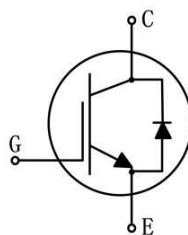


Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	15	A
$V_{CE(sat)}$	1.8	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($T_C=25^\circ\text{C}$)	I_C	30	A
Continuous collector current($T_C=100^\circ\text{C}$)		15	A
Pulsed collector current, tp limited by T_{vjmax}	I_{CM}	60	A
Diode continuous forward current($T_C=25^\circ\text{C}$)	I_F	30	A
Diode continuous forward current($T_C=100^\circ\text{C}$)		15	A
Diode maximum current, tp limited by T_{vjmax}	I_{FM}	60	A
Power dissipation($T_C=25^\circ\text{C}$)	P_{tot}	94	W
Power dissipation($T_C=100^\circ\text{C}$)		47	W
Operating Junction Temperature Range	T_J	-40 to +175	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	1.8	$^\circ\text{C/W}$
Thermal resistance, junction to case for Diode	$R_{th(j-c)}$	2.9	$^\circ\text{C/W}$

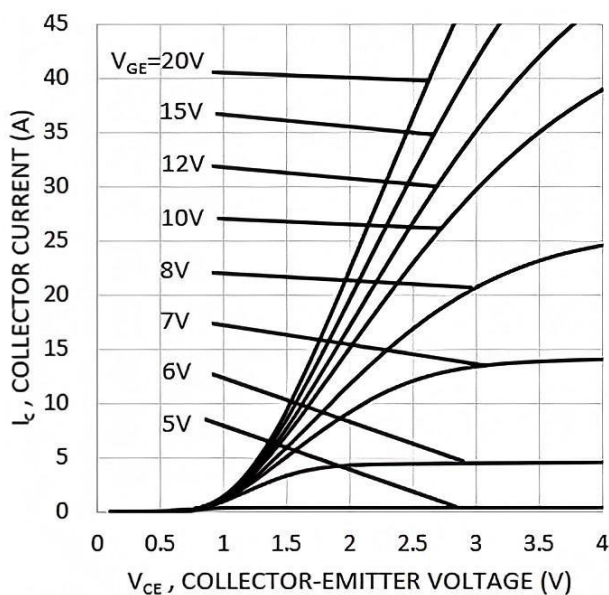
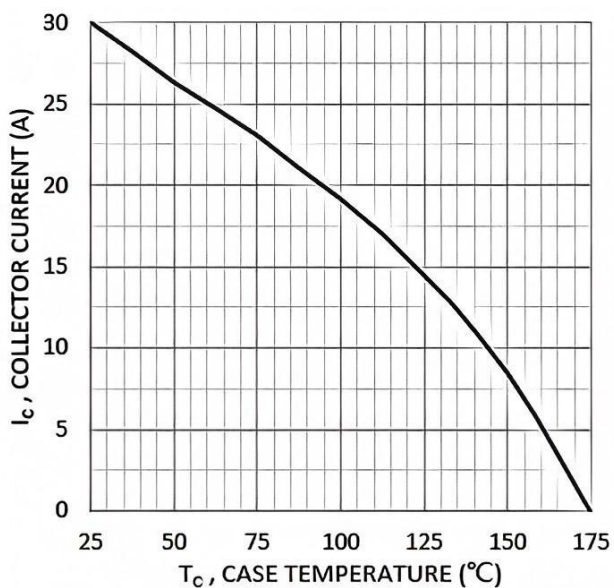
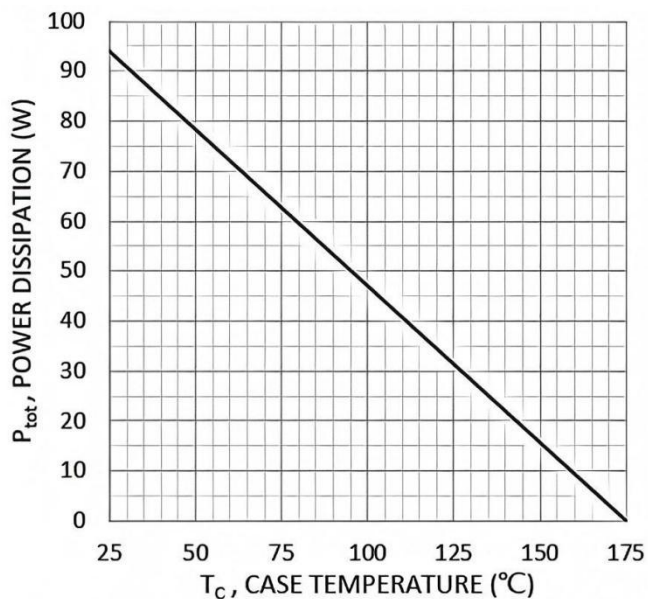
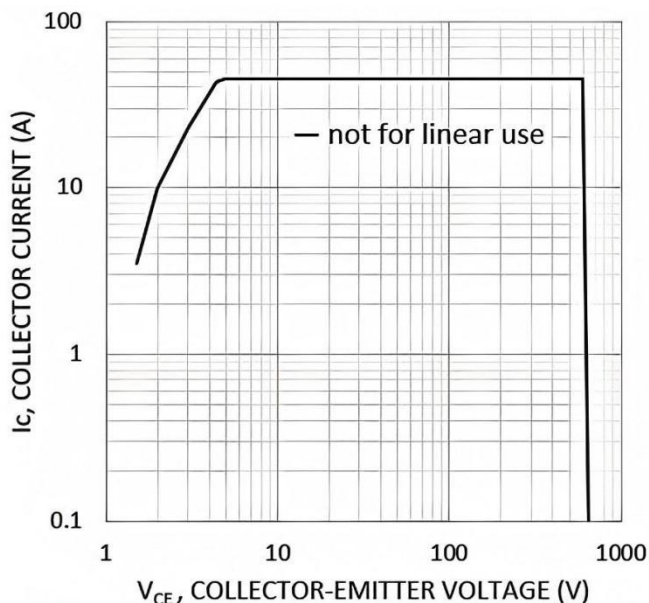
Electrical Characteristics of IGBT ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	$B_{V_{CES}}$	$V_{GE}=0V, I_C=200\mu A$	650	-	-	V
Collector-emitter leakage current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	40	μA
Gate leakage current, forward	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 100	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=150\mu A$	3.2	4.0	4.8	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=15A, T_{vj}=25^{\circ}\text{C}$	-	1.8	2.2	V
		$V_{GE}=15V, I_C=15A, T_{vj}=125^{\circ}\text{C}$	-	2.2	-	V
Input capacitance	C_{ies}	$V_{CE}=25V$	-	703	-	pF
Output capacitance	C_{oes}	$V_{GE}=0V$	-	91	-	pF
Reverse transfer capacitance	C_{res}	$f=1\text{MHz}$	-	6	-	pF
Total gate charge	Q_g	$V_{CC}=520V$	-	24.38	-	nC
Gate-Emitter Charge	Q_{ge}	$V_{GE}=15V$	-	3.62	-	nC
Gate-Collector Charge	Q_{gc}	$I_C=15A$	-	8.0	-	nC
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=15A$ $R_G=39\Omega$ Inductive load $T_C=25^{\circ}\text{C}$	-	14.5	-	ns
Rise time	t_r		-	15	-	ns
Turn-off delay time	$t_{d(off)}$		-	42	-	ns
Fall time	t_f		-	60	-	ns
Turn-on energy	E_{on}		-	0.15	-	mJ
Turn-off energy	E_{off}		-	0.37	-	mJ
Total switching energy	E_{ts}		-	0.52	-	mJ
Short Circuit Safe Operation Area	SCSOA	$V_{CC}=400V$ $V_{GE}=15V$ $T_{J,start}\leq 25^{\circ}\text{C}$	5	-	-	μS

Diode Characteristics

Parameter	Symbol	Test condition	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_F	$I_F=15A, T_J=25^{\circ}\text{C}$	-	1.45	2.2	V
		$I_F=15A, T_J=150^{\circ}\text{C}$	-	1.25	2.0	V
Diode Reverse Recovery Time	t_{rr}	$V_R=400V, I_F=15A$ $dI_F/dt=300A/\mu s, T_C=25^{\circ}\text{C}$	-	72	-	ns
Diode peak Reverse Recovery Current	I_{rr}		-	17.6	-	A
Diode Reverse Recovery Charge	Q_{rr}		-	700	-	nC

Typical Characteristics



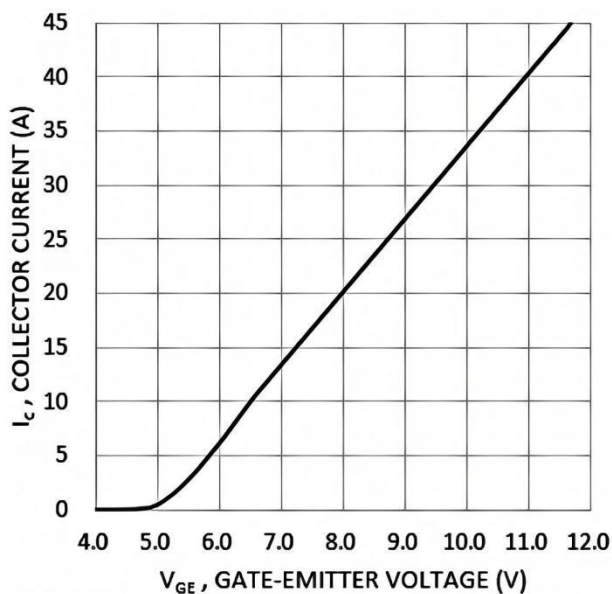


Fig. 5 Typical transfer characteristics ($V_{CE}=20V$)

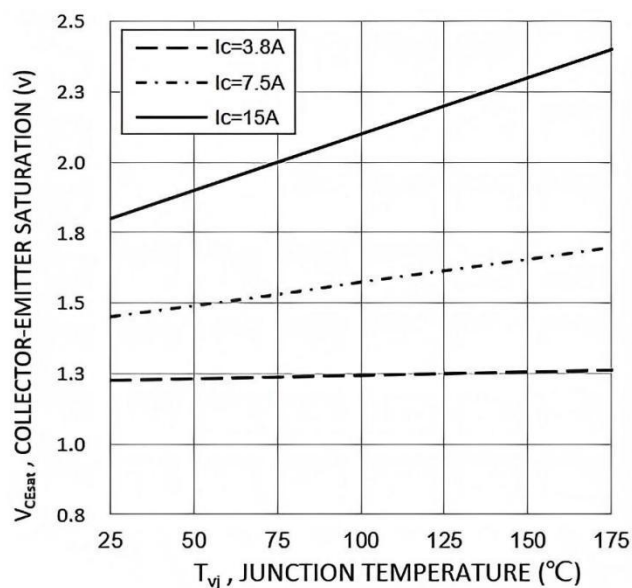


Fig. 6 Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15V$)

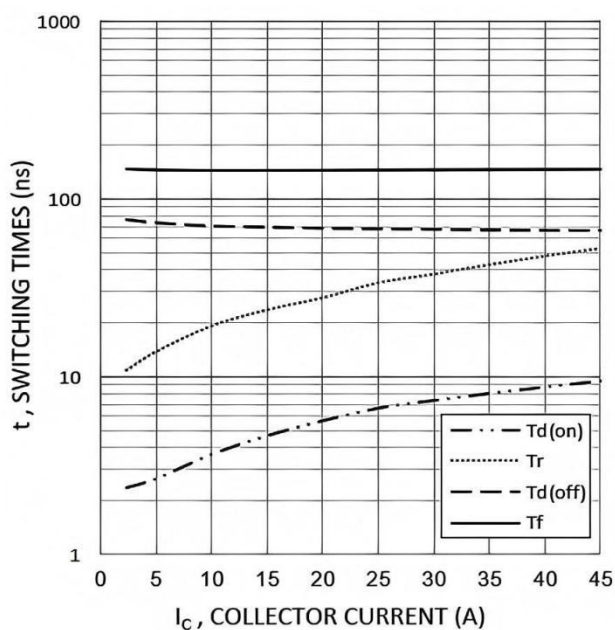


Fig. 7 Typical switching times as a function of collector current (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=39\Omega$)

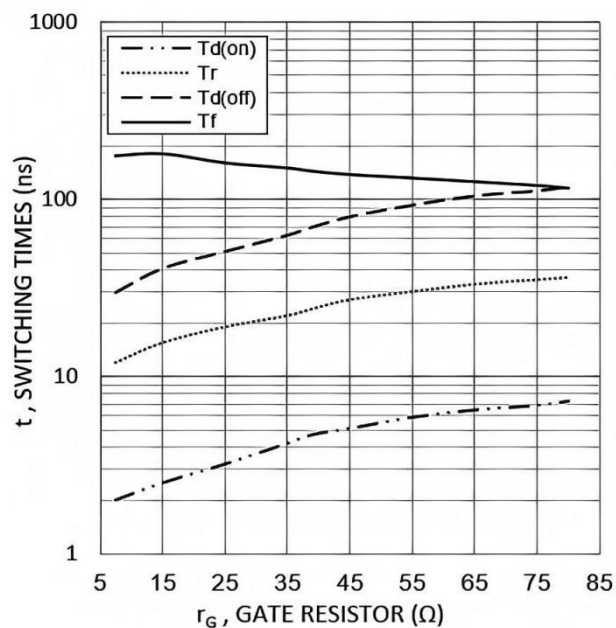


Fig. 8 Typical switching times as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$)

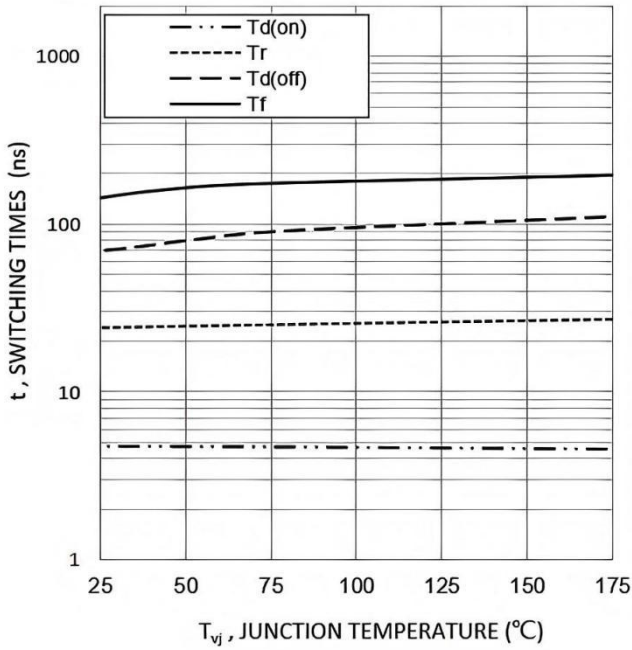


Fig. 9 Typical switching times as a function of junction temperature (inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$, $R_G=39\Omega$)

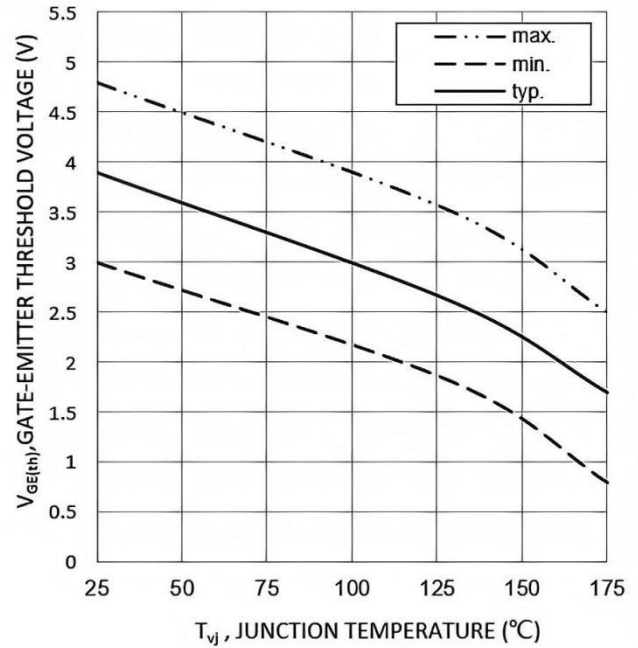


Fig. 10 Gate-emitter threshold voltage as a function of junction temperature ($I_C=0.15mA$)

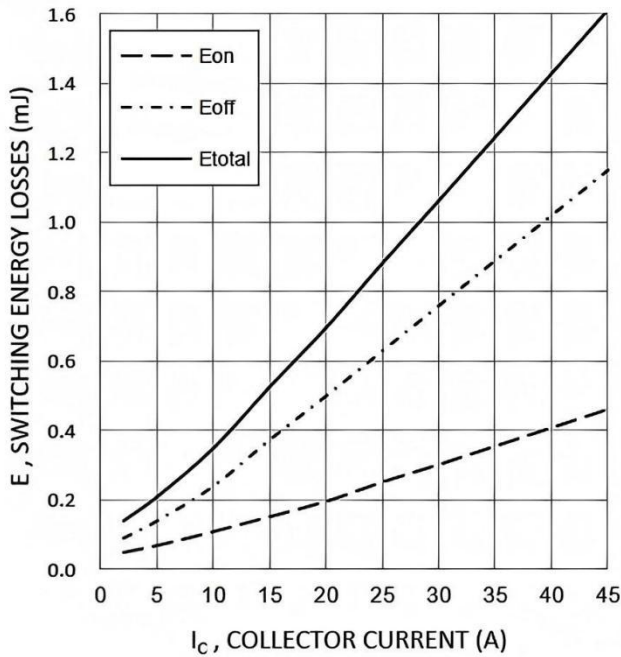


Fig. 11 Typical switching energy losses as a function of collector current (inductive load, $T_{vj}=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=39\Omega$)

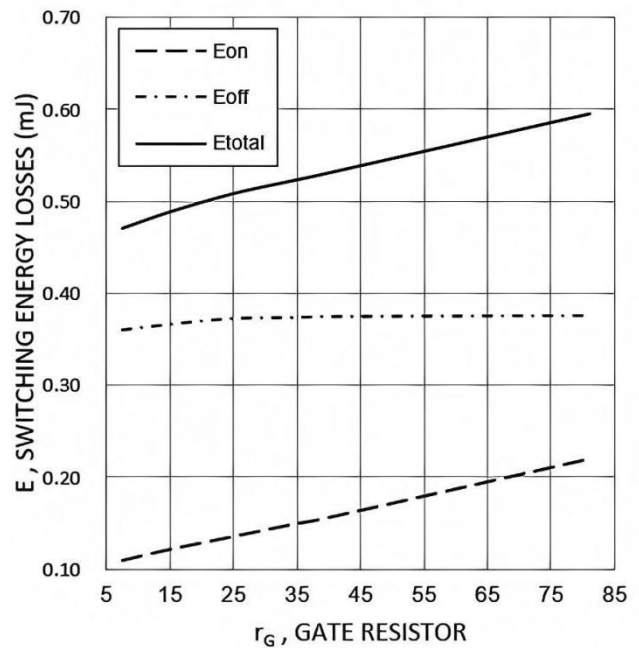


Fig. 12 Typical switching energy losses as a function of gate resistor (inductive load, $T_{vj}=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$)

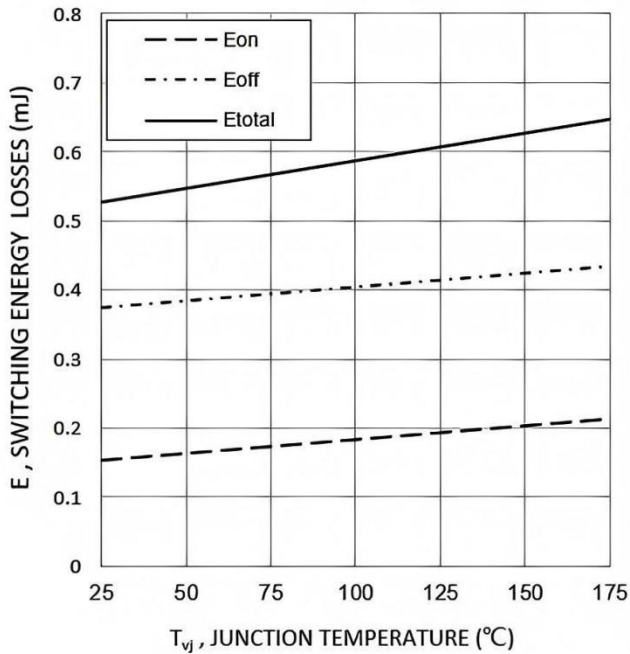


Fig. 13 Typical switching energy losses as a function of junction temperature (inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$, $R_G=39\Omega$)

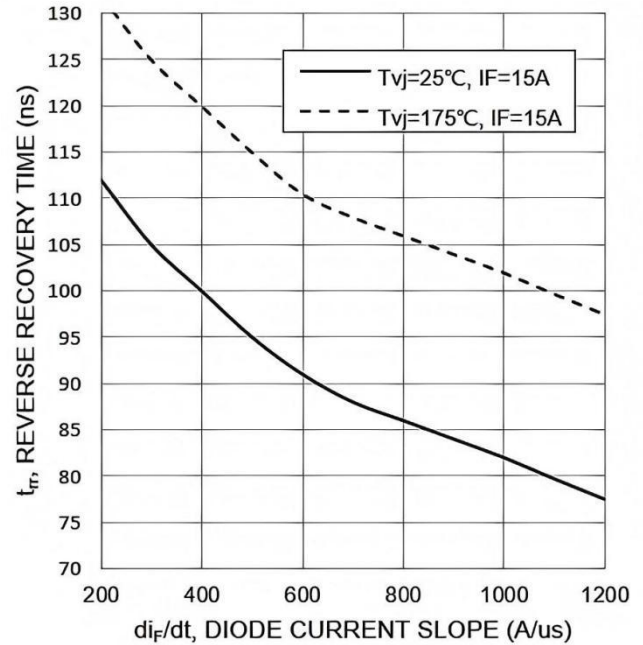


Fig. 14 Typical reverse recovery time as a function of diode current slope ($V_R=400V$)

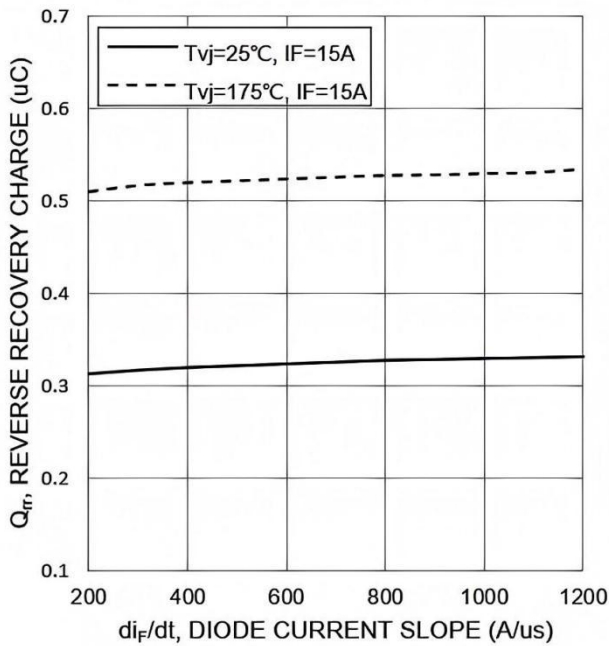


Fig. 15 Typical reverse recovery charge as a function of diode current slope ($V_R=400V$)

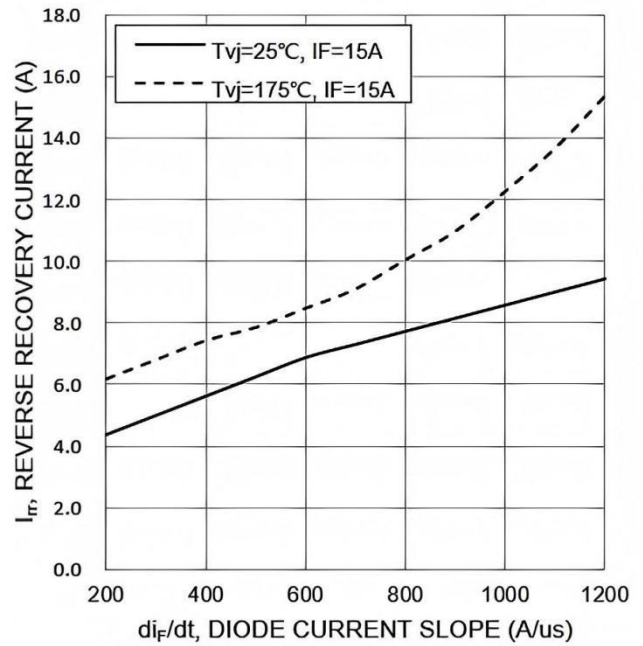


Fig. 16 Typical reverse recovery current as a function of diode current slope ($V_R=400V$)

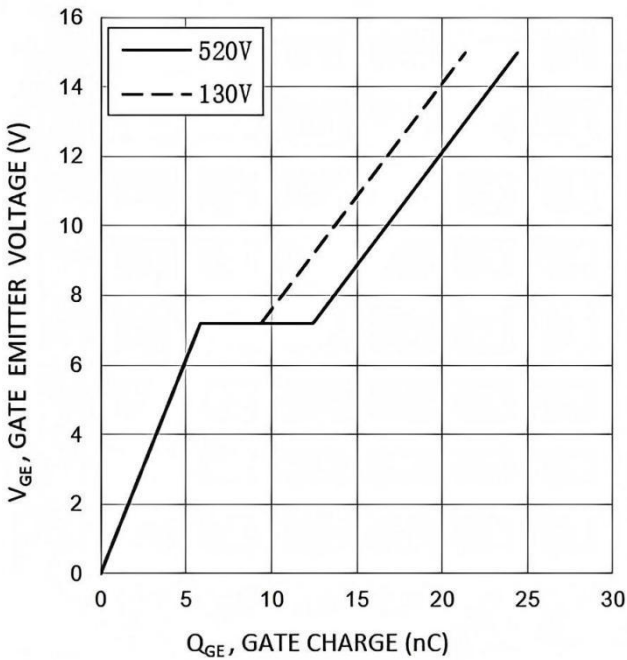


Fig. 17 Typical gate charge ($I_C=15A$)

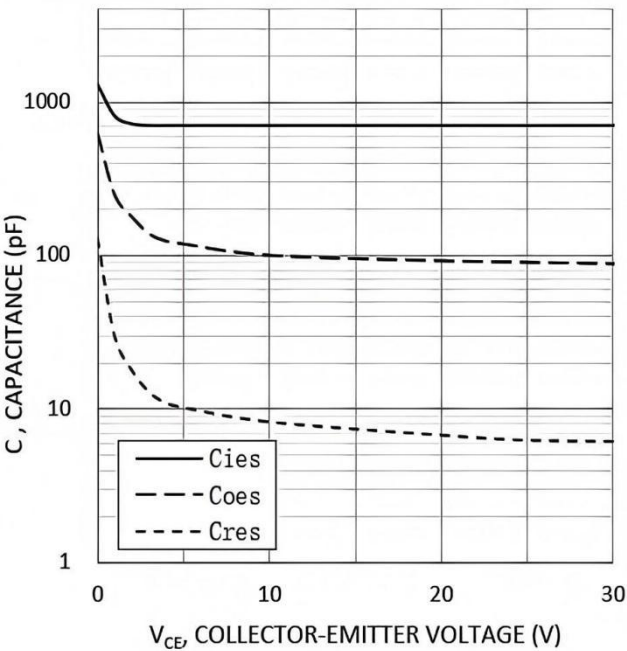
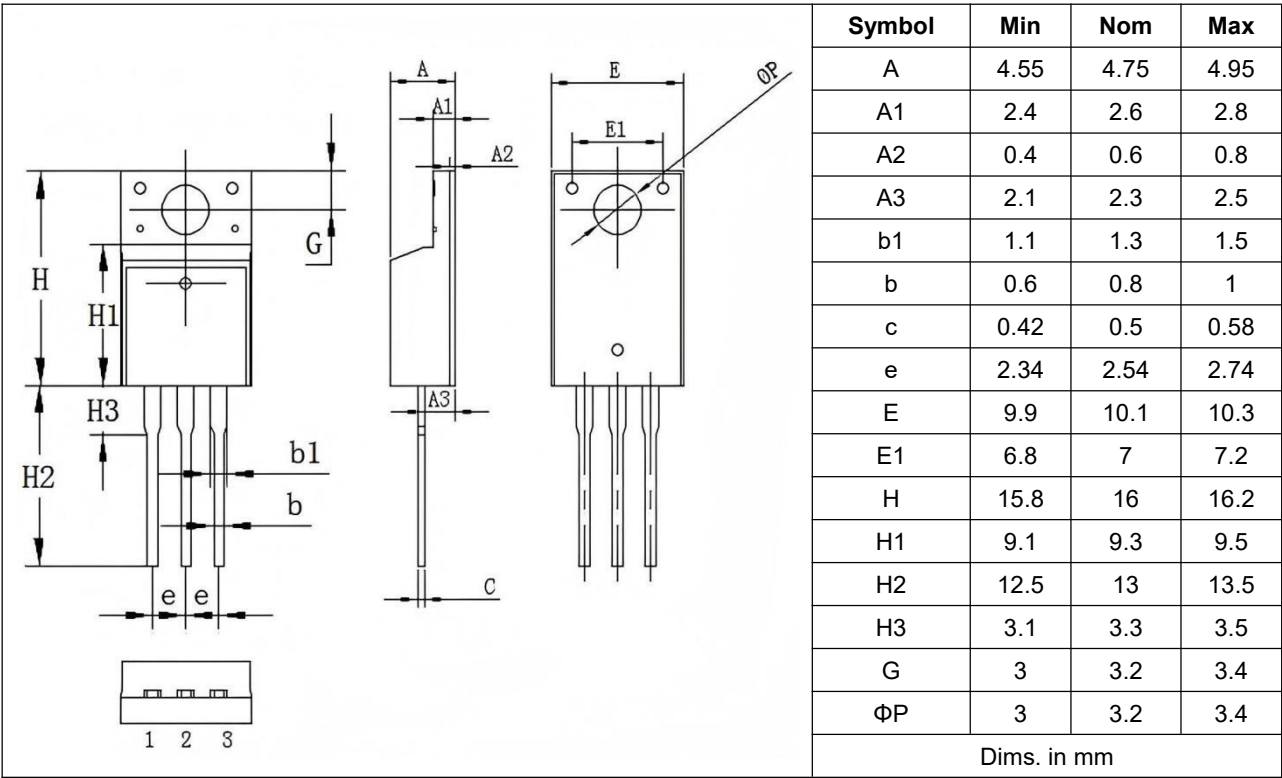


Fig. 18 Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

Package Outlines (Unit: mm)

TO-220F



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