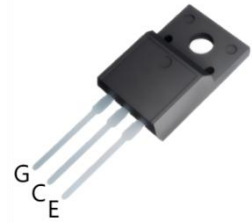
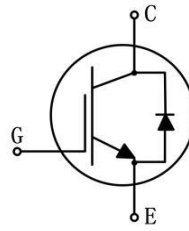


Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	15	A
$V_{CE(sat)}$	1.6	V



TO-220F

Features

- Positive temperature coefficient.
- Fast Switching
- LOW $V_{CE(sat)}$
- Reliable and Rugged
- Halogen Free and Green Devices Available

Applications

- UPS
- Motor drives
- Boost
- PFC

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	± 30	V
Continuous collector current($T_C=25^\circ C$)	I_C	30	A
Continuous collector current($T_C=100^\circ C$)		15	A
Pulsed collector current,tp limited by T_{vjmax}	I_{CM}	45	A
Diode continuous forward current($T_C=25^\circ C$)	I_F	30	A
Diode continuous forward current($T_C=100^\circ C$)		15	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	45	A
Power Dissipation @ $T_C=25^\circ C$	P_D	48	W
Short Circuit with Stand Time $V_{GE}=15V, V_{CC}\leq 400V$, Allowed Number of Short Circuits < 1000, Times Between Short Circuits $\geq 1.0s, T_J \leq 175^\circ C$	t_{sc}	7	μs
Operating junction temperature range	T_{vj}	-55 to +175	$^\circ C$
Storage temperature range	T_{Stg}	-55 to +175	$^\circ C$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance,junction to case for IGBT	$R_{th(j-c)}$	3.1	$^\circ C/W$
Thermal resistance,junction to case for Diode	$R_{th(j-c)}$	3.16	$^\circ C/W$
Thermal resistance,junction to ambient	$R_{th(j-a)}$	62.5	$^\circ C/W$

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

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	$B_{V_{CES}}$	$V_{GE}=0V, I_C=250\mu A$	650	-	-	V
Collector-emitter leakage current	I_{CES}	$V_{CE}=650V, V_{GE}=0V$	-	-	10	μA
Gate leakage current, forward	I_{GES}	$V_{GE}=\pm 20V, V_{CE}=0V$	-	-	± 200	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1mA$	4.1	5.1	6.1	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=15A, T_{vj}=25^{\circ}\text{C}$	-	1.6	1.95	V
		$V_{GE}=15V, I_C=15A, T_{vj}=125^{\circ}\text{C}$	-	1.93	-	V
		$V_{GE}=15V, I_C=15A, T_{vj}=175^{\circ}\text{C}$	-	2.06	-	V

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	$V_{CE}=25V$	-	791	-	pF
Output capacitance	C_{oes}	$V_{GE}=0V$	-	47	-	pF
Reverse transfer capacitance	C_{res}	$f=1MHz$	-	22	-	pF
Total gate charge	Q_g	$V_{CC}=520V$	-	45	-	nC
Gate-Emitter Charge	Q_{ge}	$V_{GE}=15V$	-	7	-	nC
Gate-Collector Charge	Q_{gc}	$I_C=15A$	-	23	-	nC

Switching Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=15A$ $R_G=5\Omega$ Inductive load	-	12	-	ns
Rise time	t_r		-	14	-	ns
Turn-off delay time	$t_{d(off)}$		-	40	-	ns
Fall time	t_f		-	74	-	ns
Turn-on energy	E_{on}		-	0.15	-	mJ
Turn-off energy	E_{off}		-	0.26	-	mJ
Total switching energy	E_{ts}		-	0.41	-	mJ
Turn-on delay time	$t_{d(on)}$	$V_{CC}=400V$ $V_{GE}=15V$ $I_C=15A$ $R_G=5\Omega$ Inductive load	-	13	-	ns
Rise time	t_r		-	16	-	ns
Turn-off delay time	$t_{d(off)}$		-	59	-	ns
Fall time	t_f		-	70	-	ns

Turn-on energy	E_{on}	$T_{vj}=175^{\circ}C$	-	0.26	-	mJ
Turn-off energy	E_{off}		-	0.37	-	mJ
Total switching energy	E_{ts}		-	0.63	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F=15A \quad T_{vj}=25^{\circ}C$	-	1.4	1.8	V
		$I_F=15A \quad T_{vj}=125^{\circ}C$	-	1.3	-	V
		$I_F=15A \quad T_{vj}=125^{\circ}C$	-	1.25	-	V
Diode reverse recovery time	t_{rr}	$I_F=15A$ $diF/dt=-200A/\mu s$	-	53	-	ns
Diode peak reverse recovery current	Q_{rr}		-	69	-	nC
Diode reverse recovery charge	I_{rrm}		-	5.8	-	A
Diode reverse recovery time	t_{rr}	$I_F=15A$ $diF/dt=-200A/\mu s \quad T_{vj}=175^{\circ}C$	-	76	-	ns
Diode peak reverse recovery current	Q_{rr}		-	83	-	nC
Diode reverse recovery charge	I_{rrm}		-	8.7	-	A

Typical Characteristics

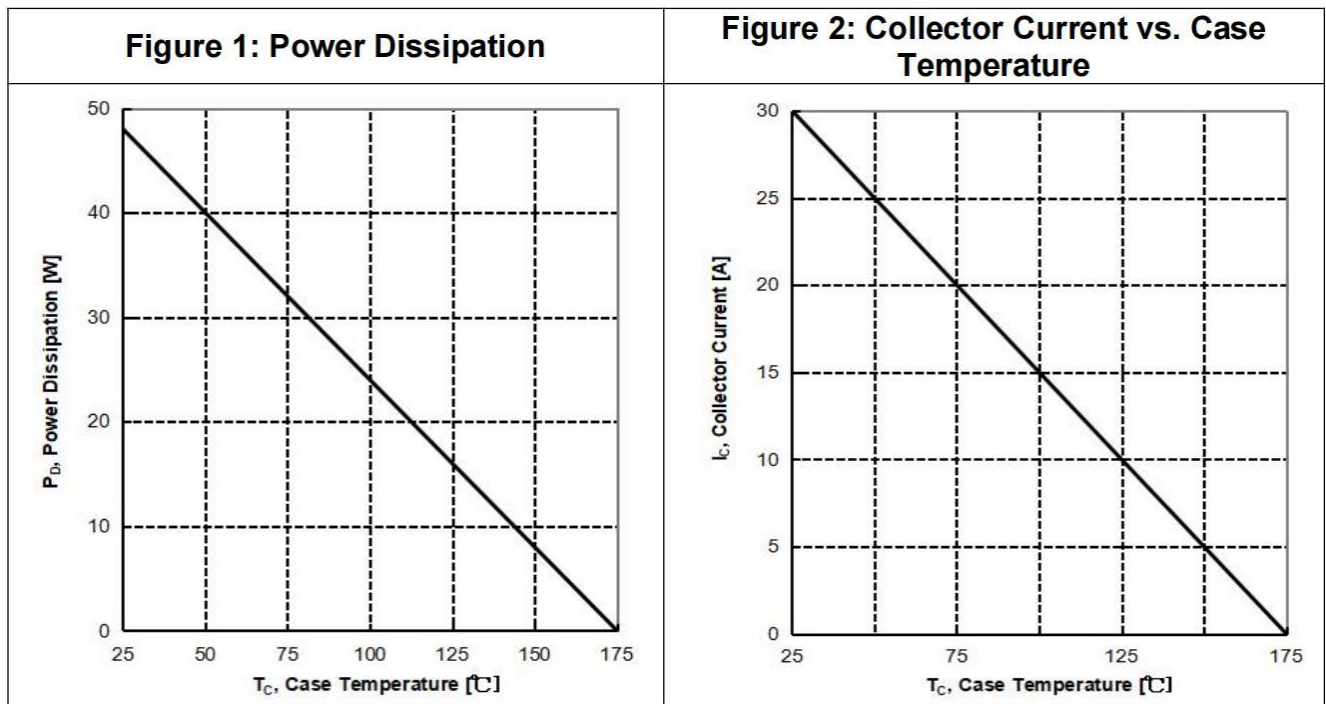


Figure 3: Safe Operation Area

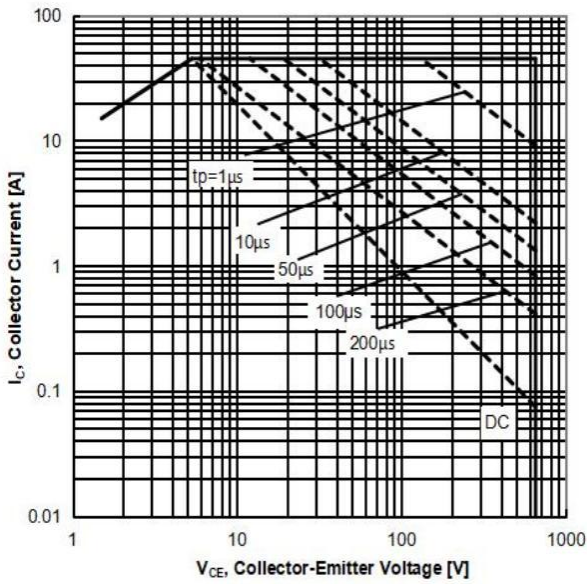


Figure 4: Typical Transfer Characteristics

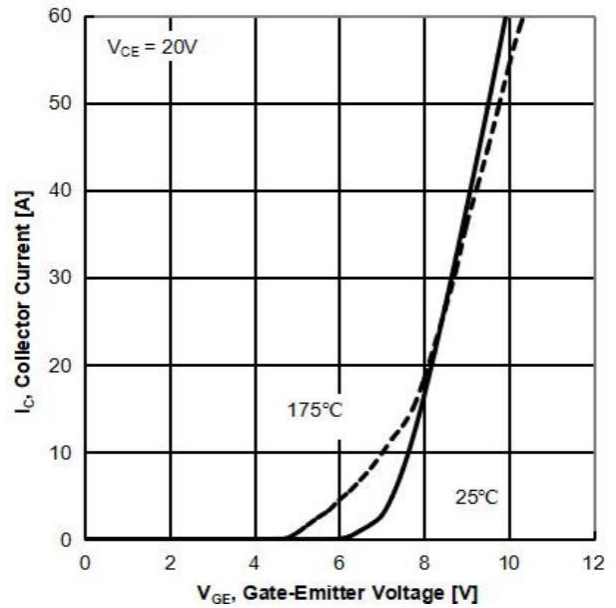


Figure 5: Typical Output Characteristics

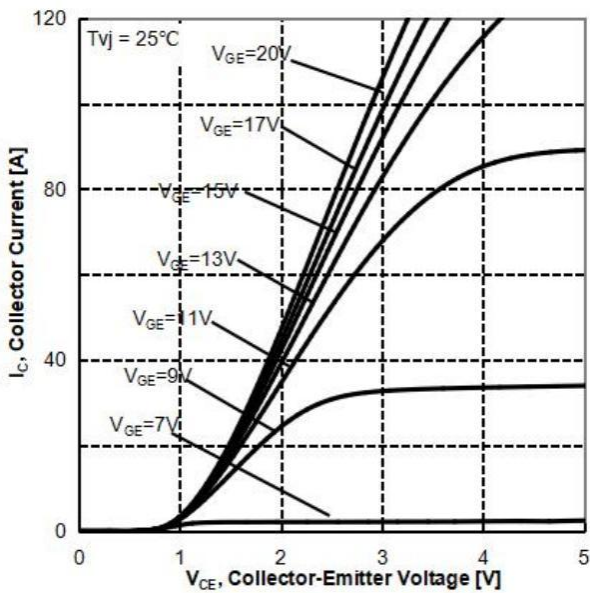


Figure 6: Typical Output Characteristics

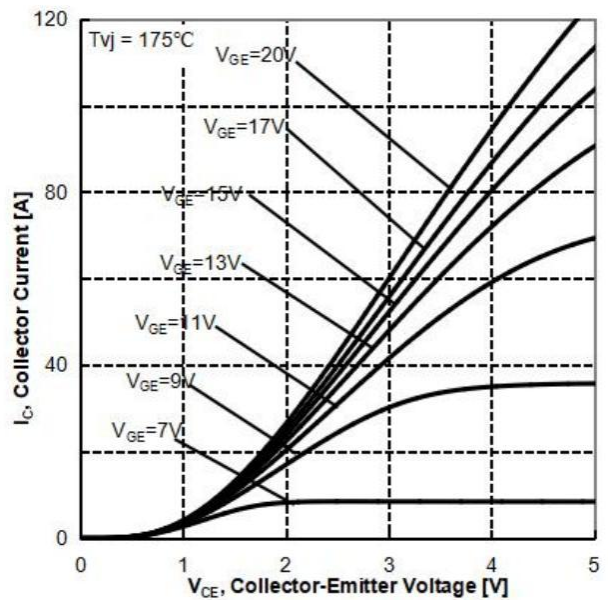


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

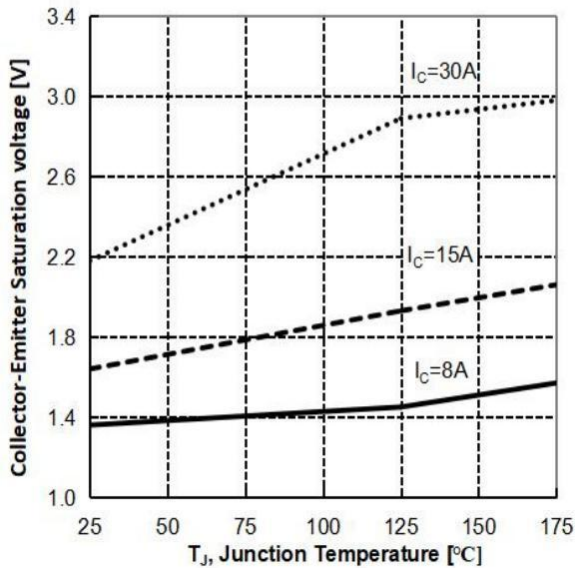


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

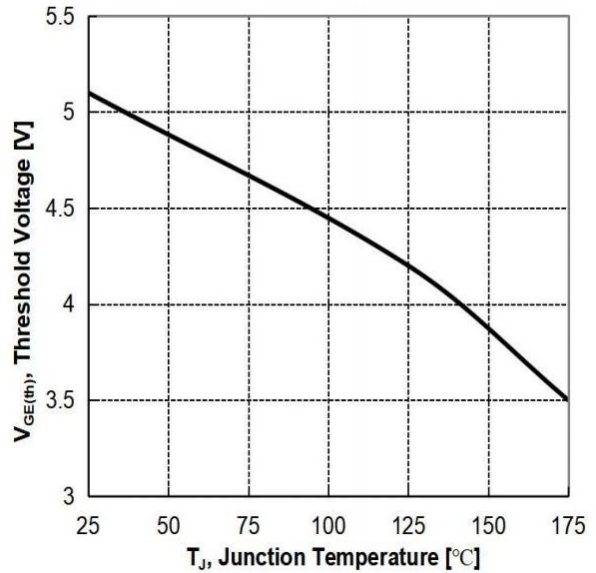


Figure 9: Typical Switching Times vs. Gate Resistor ($T_J = 25^\circ C$, $V_{CE} = 400V$, $V_{GE} = 15V$, $I_C = 15A$)

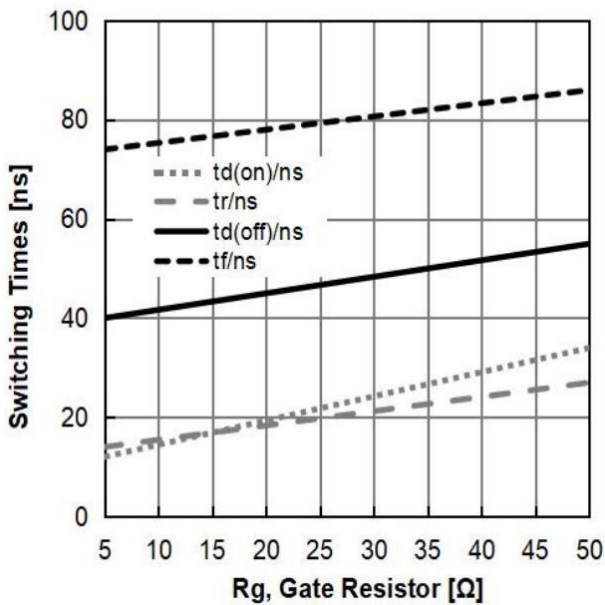


Figure 10: Typical Switching Energy vs. Gate Resistor ($T_J = 25^\circ C$, $V_{CE} = 400V$, $V_{GE} = 15V$, $I_C = 15A$)

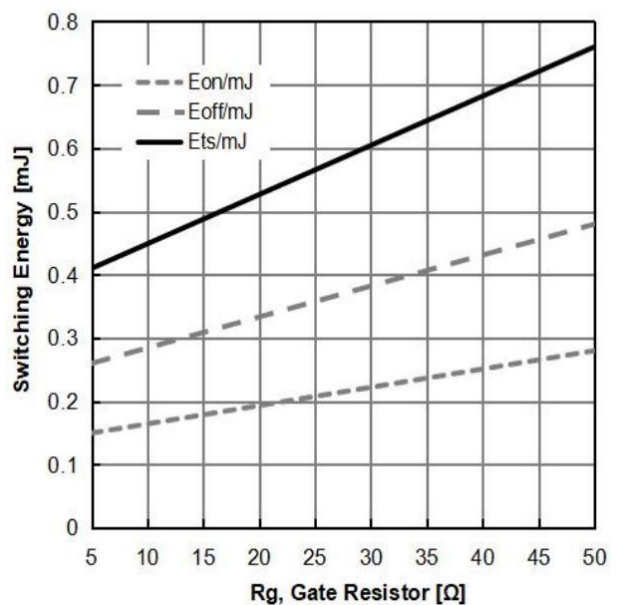


Figure 11: Typical Switching Times vs. Junction Temperature ($V_{CE}=400V$, $V_{GE}=15V$, $I_C=15A$, $R_g=5\Omega$)

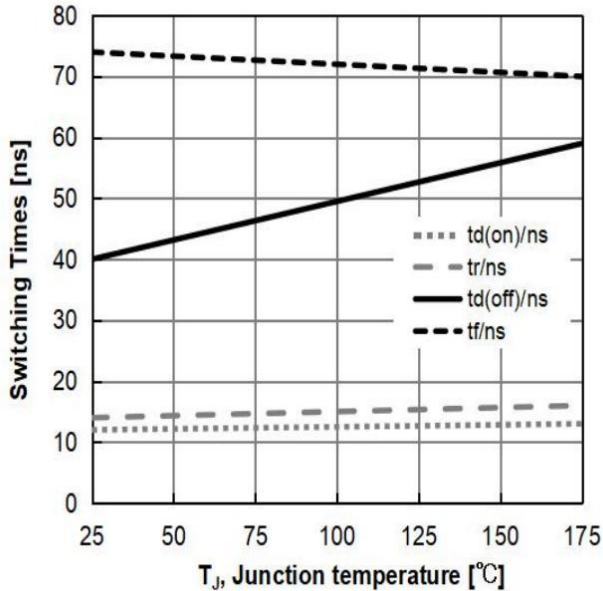


Figure 12: Typical Switching Energy vs. Junction Temperature ($V_{CE}=400V$, $V_{GE}=15V$, $I_C=15A$, $R_g=5\Omega$)

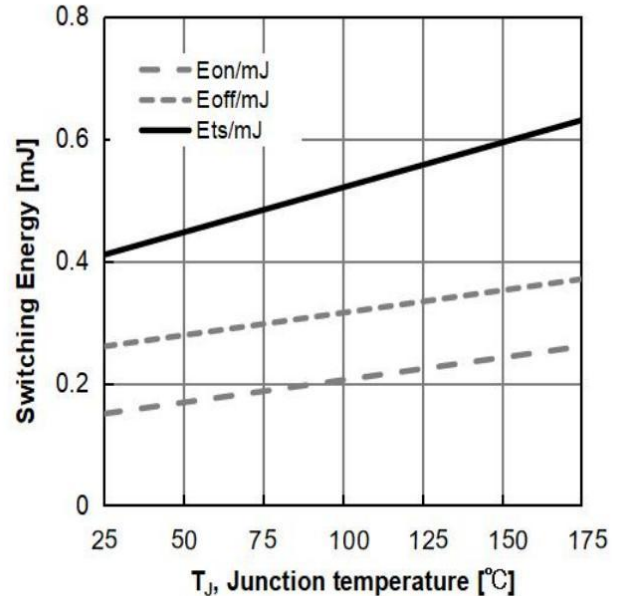


Figure 13: Typical Switching Times vs. Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15V$, $R_g=5\Omega$)

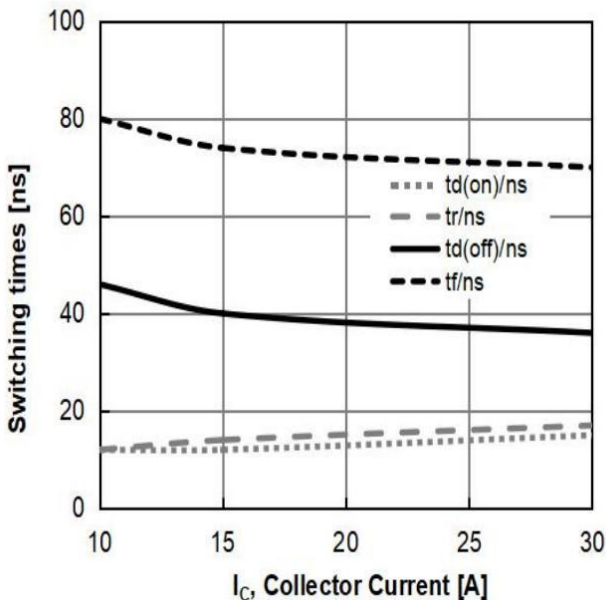


Figure 14: Typical Switching Energy vs. Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15V$, $R_g=5\Omega$)

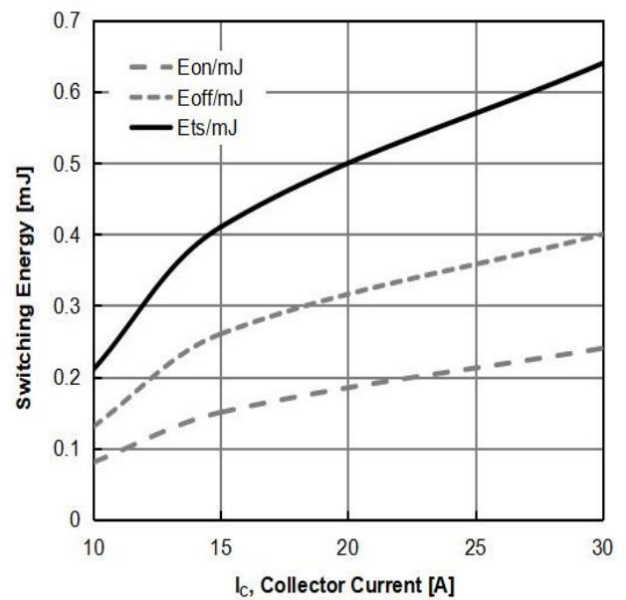


Figure 15: Typical Switching Times vs. VCE (T_J=25°C, V_{GE}=15V, I_C=15A,R_g=5Ω)

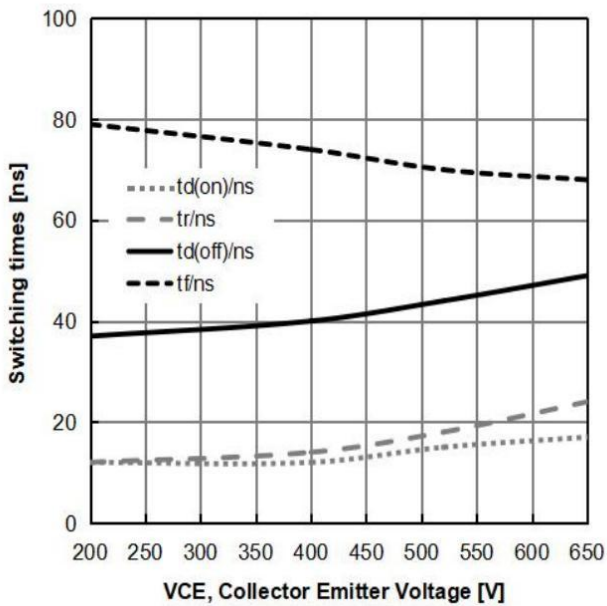


Figure 16: Typical Switching Energy vs. VCE (T_J=25°C, V_{GE}=15V, I_C=15A,R_g=5Ω)

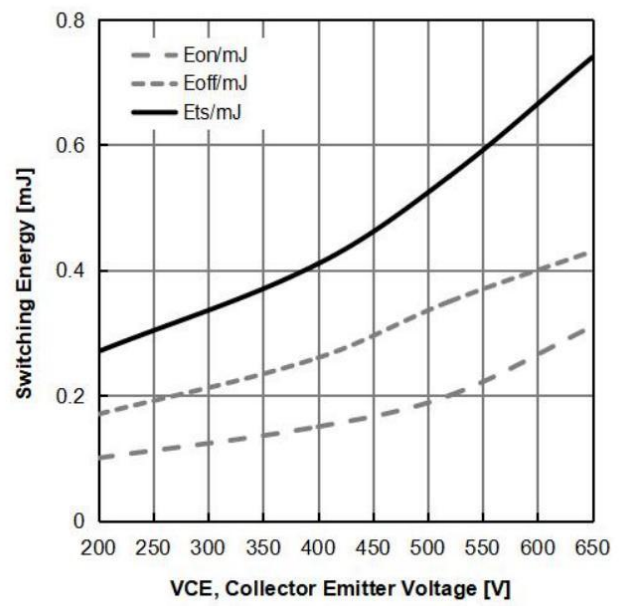


Figure 17: Typical Capacitance vs. Collector- Emitter Voltage

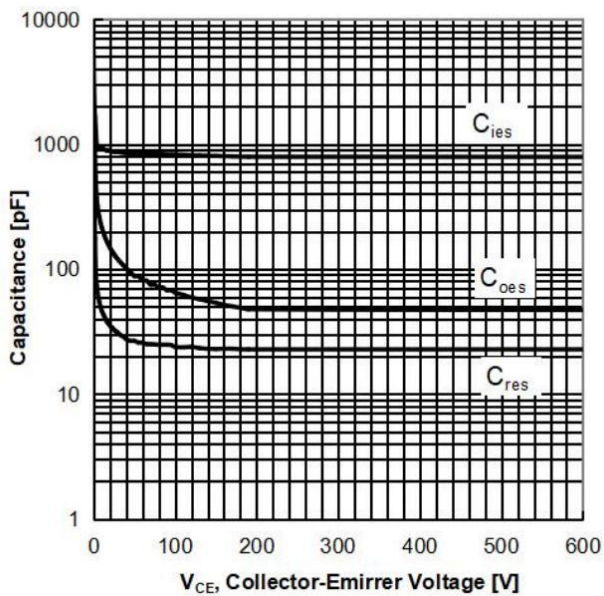


Figure 18: Typical Gate Charge

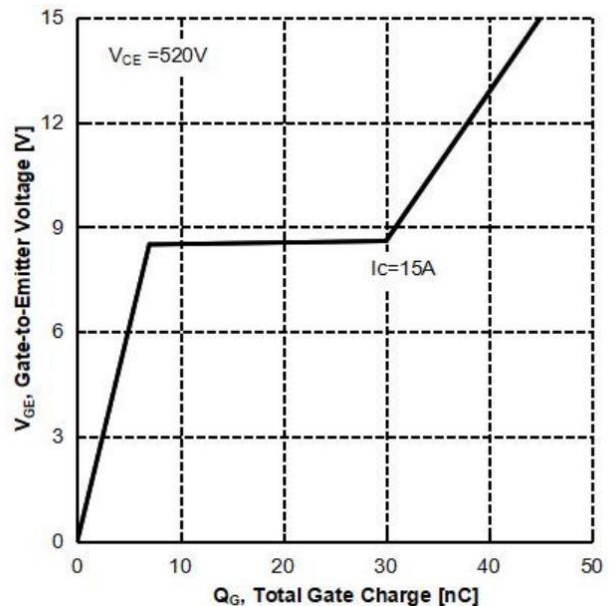


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

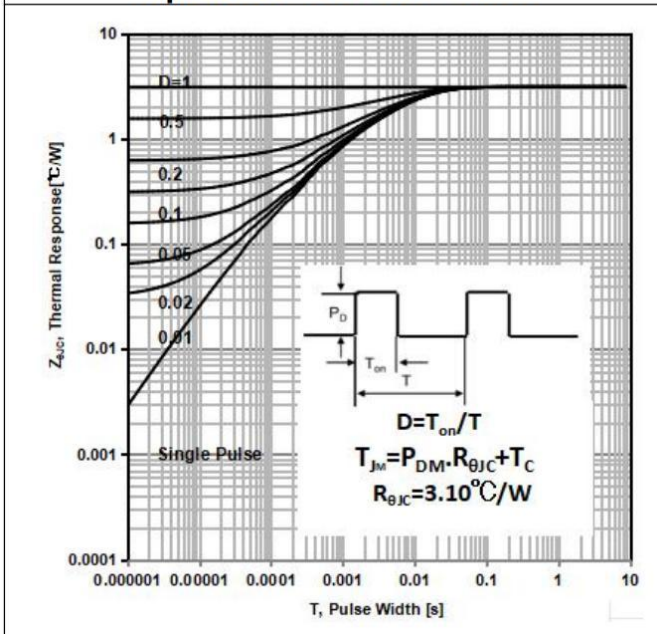


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

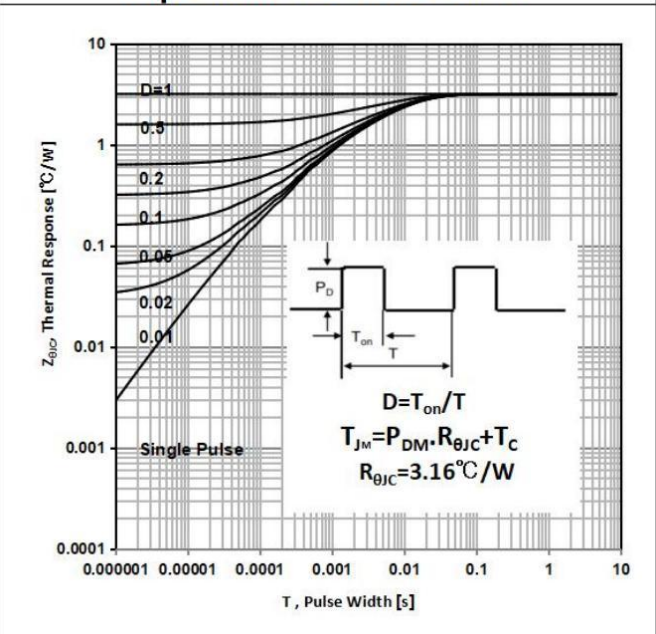
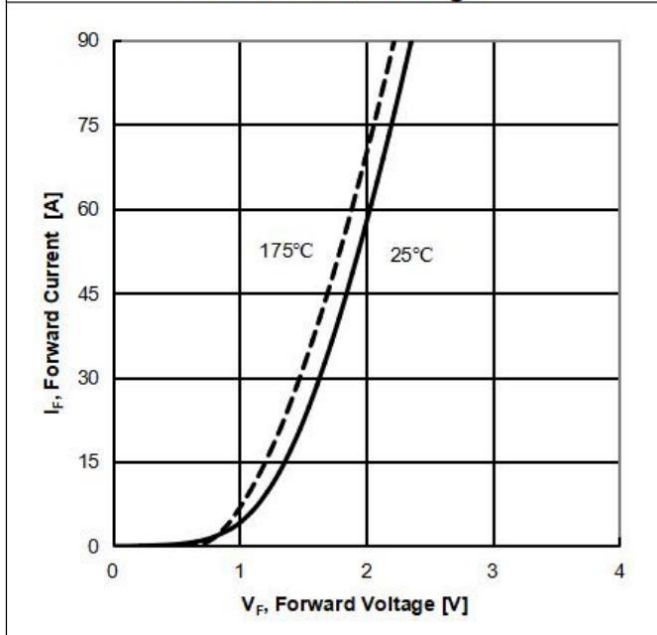
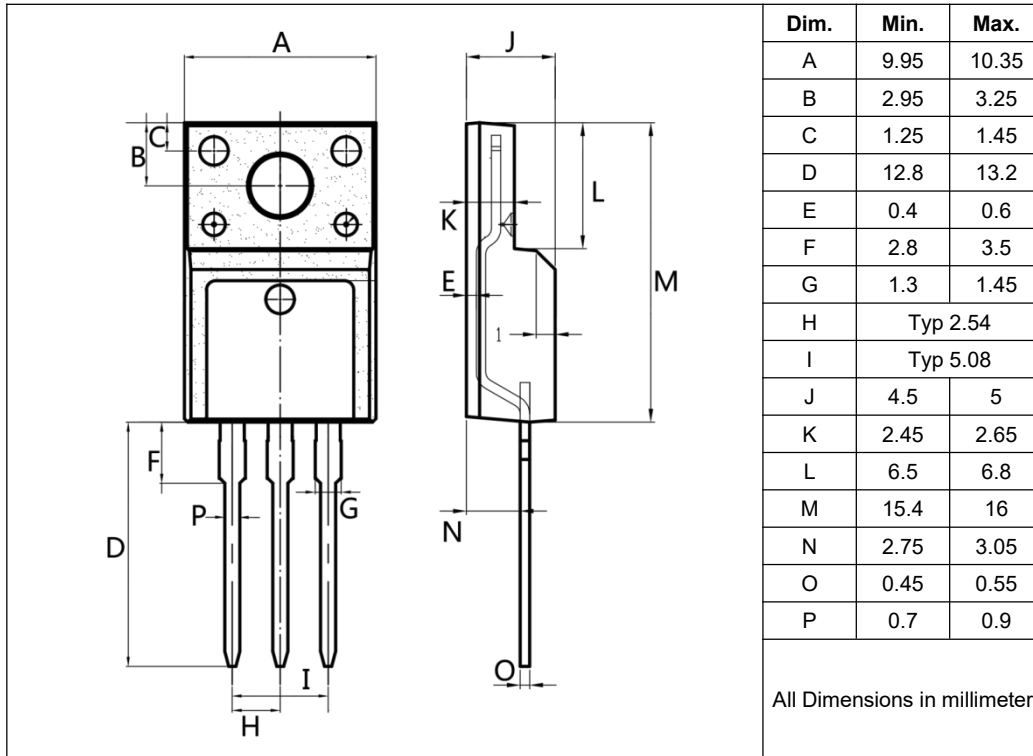


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outlines (Unit: mm)

TO-220F



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