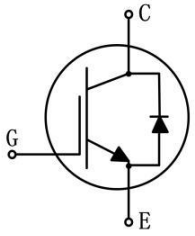
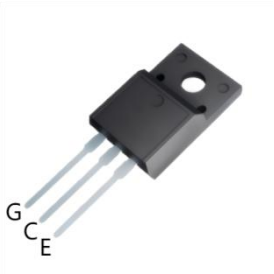
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	10	A
$V_{CE(sat)}$	1.5	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}	±30	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}	30	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}	30	A
Short Circuit with Stand Time V_{GE}=15V,V_{CC}≤400V,Allowed Number of Short Circuits＜1000,Times Between Short Circuits≥1.0s,T_J≤175℃	t_{sc}	7	μs
Power dissipation(T_C=25℃)	P_{tot}	91	W
Operating junction temperature range	T_{Jmax},T_{Stg}	-55 to+175	℃
Maximum Temperature for Soldering	T_L	260	℃

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance,junction to case for IGBT	$R_{th(j-C)}$	1.65	℃/W
Thermal resistance,junction to case for Diode	$R_{th(j-C)}$	2.13	℃/W
Thermal resistance,junction to ambient	$R_{th(j-C)}$	62.5	℃/W

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

Static characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	B_{VCES}	V_{GE}=0V,I_C=250μA	650	-	-	V
Collector-emitter leakage current	I_{CES}	V_{CE}=650V,V_{GE}=0V	-	-	10	μA
Gate leakage current,forward	I_{GES}	V_{GE}=±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=10A,T_{vj}=25℃	-	1.5	1.85	V
		V_{GE}=15V,I_C=10A,T_{vj}=125℃	-	1.79	-	V
		V_{GE}=15V,I_C=10A,T_{vj}=175℃	-	1.92	-	V
Diode forward voltage	V_F	I_F=10A,T_{vj}=25℃	-	1.6	2	V
		I_F=10A,T_{vj}=125℃	-	1.35	-	V
		I_F=10A,T_{vj}=175℃	-	1.29	-	

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f=1MHz	-	835	-	pF
Output capacitance	C_{oes}		-	35	-	pF
Reverse transfer capacitance	C_{res}		-	22	-	pF
Total gate charge	Q_g	V_{CC}=520V V_{GE}=15V I_C=10A	-	45	-	nC
Gate-Emitter Charge	Q_{ge}		-	8	-	nC
Gate-Collector Charge	Q_{gc}		-	22	-	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=10A R_G=5Ω Inductive load	-	10	-	ns
Rise time	t_r		-	8	-	ns
Turn-off delay time	$t_{d(off)}$		-	36	-	ns
Fall time	t_f		-	84	-	ns
Turn-on energy	E_{on}		-	0.08	-	mJ
Turn-off energy	E_{off}		-	0.2	-	mJ
Total switching energy	E_{ts}		-	0.28	-	mJ
Turn-on delay time	$t_{d(on)}$		-	11	-	ns

Rise time	t_r	V_{CC}=400V V_{GE}=15V I_C=10A R_G=5Ω Inductive load T_{vj}=150℃	-	12	-	ns
Turn-off delay time	$t_{d(off)}$		-	46	-	ns
Fall time	t_f		-	77	-	ns
Turn-on energy	E_{on}		-	0.12	-	mJ
Turn-off energy	E_{off}		-	0.38	-	mJ
Total switching energy	E_{ts}		-	0.50	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Diode reverse recovery time	t_{rr}	V_R=400V I_F=10A diF/dt=-200A/μs	-	38	-	ns
Diode peak reverse recovery current	I_{rrm}		-	4.2	-	A
Diode reverse recovery charge	Q_{rr}		-	65	-	nC
Diode reverse recovery time	t_{rr}	V_R=400V I_F=10A diF/dt=-200A/μs T_{vj}=175℃	-	57	-	ns
Diode peak reverse recovery current	I_{rrm}		-	6.1	-	A
Diode reverse recovery charge	Q_{rr}		-	84	-	nC

Typical Characteristics

Figure 1: Power Dissipation

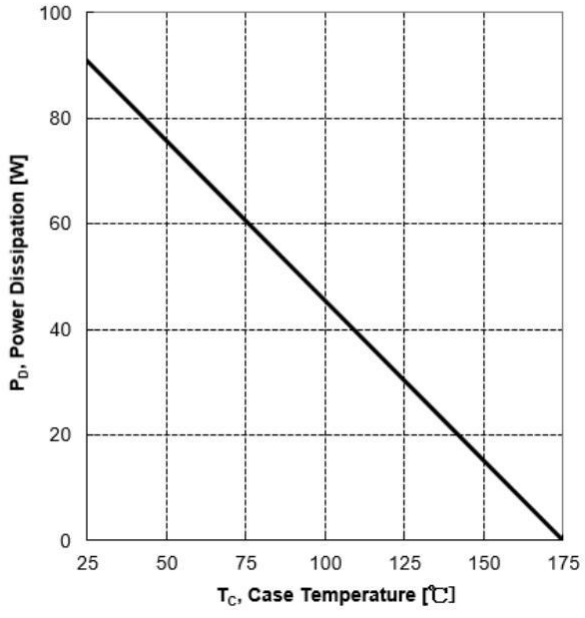


Figure 2: Collector Current vs. Case Temperature

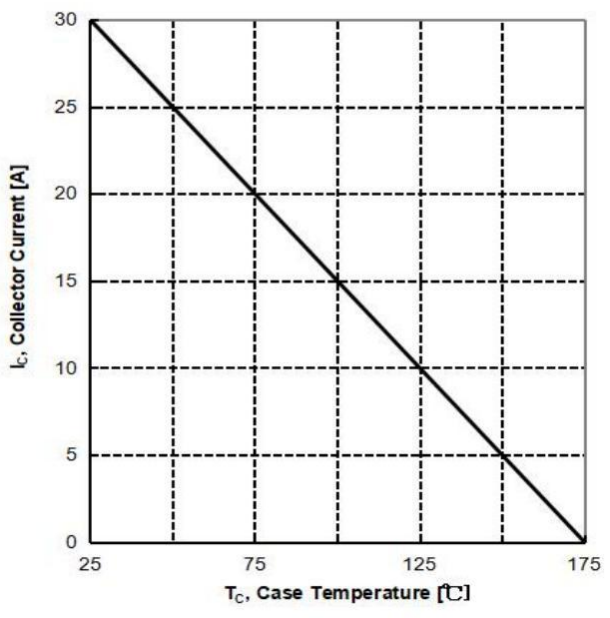


Figure 3: Safe Operation Area

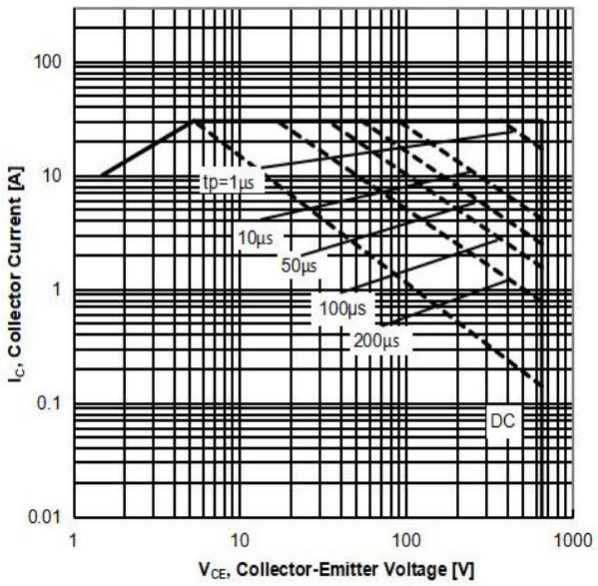


Figure 4: Typical Transfer Characteristics

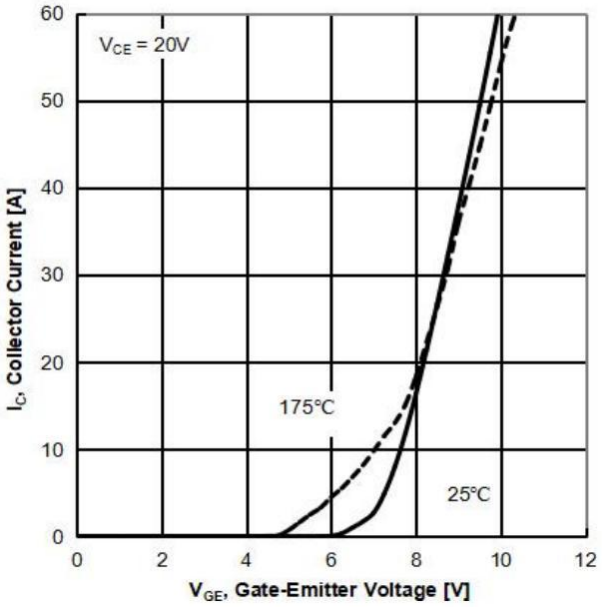


Figure 5: Typical Output Characteristics

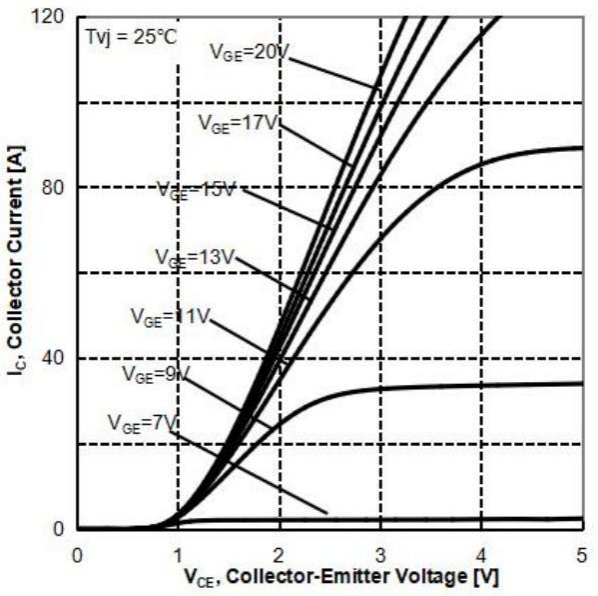


Figure 6: Typical Output Characteristics

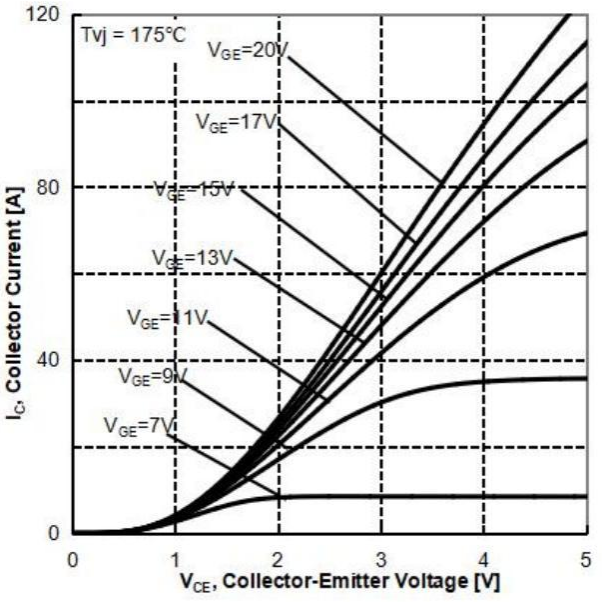


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

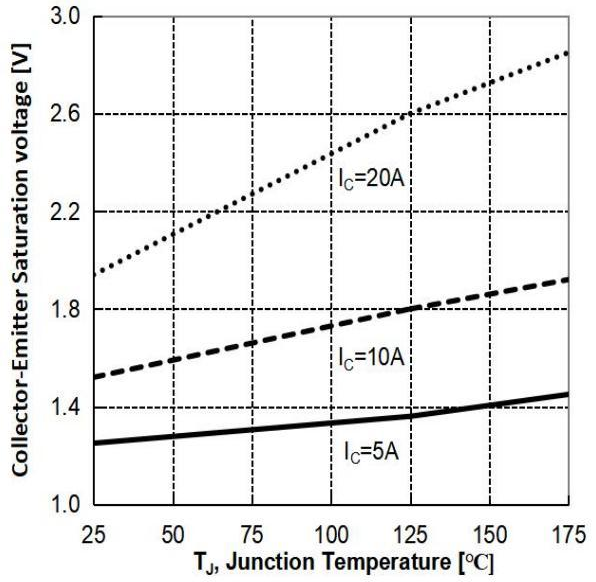


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

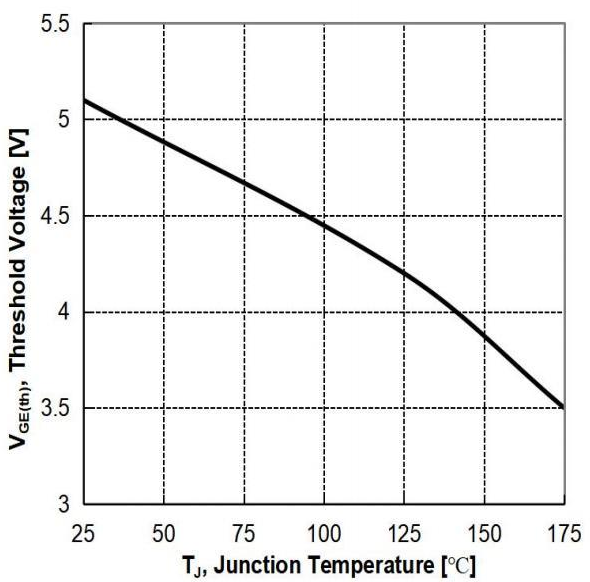


Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=10A)

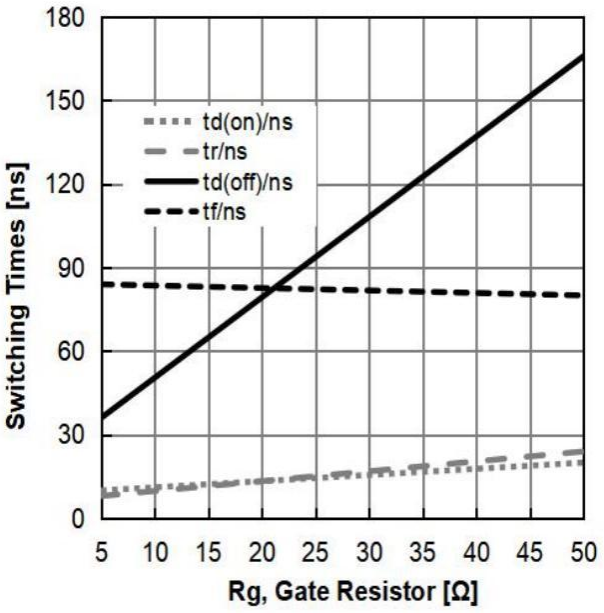


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=10A)

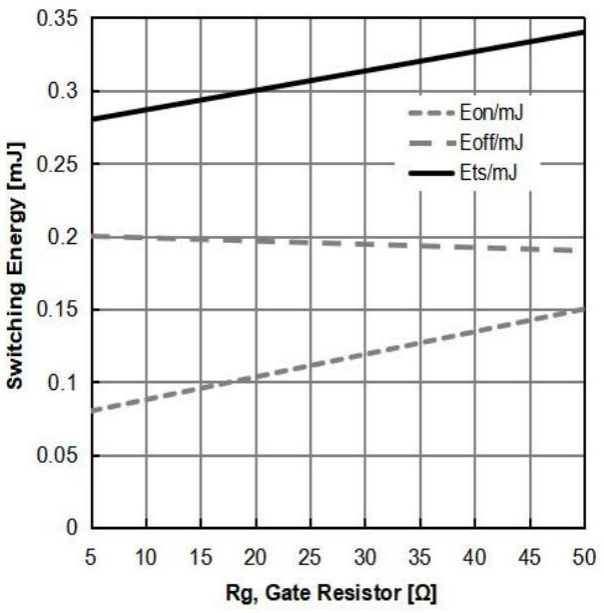


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=10A,Rg=5Ω)

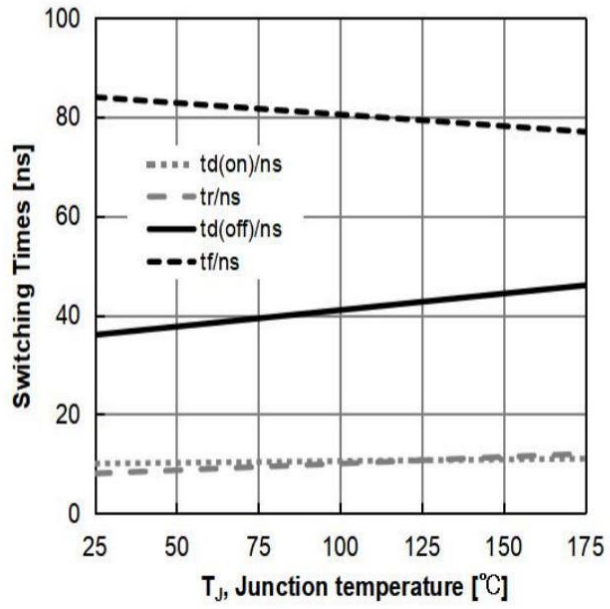


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=10A,Rg=5Ω)

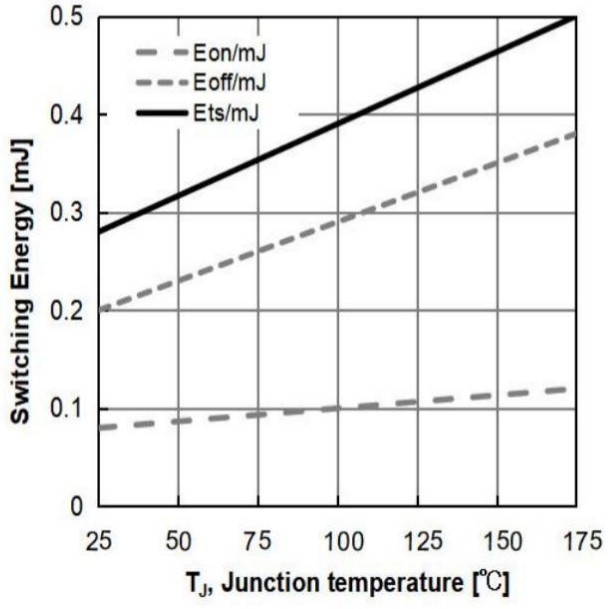


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

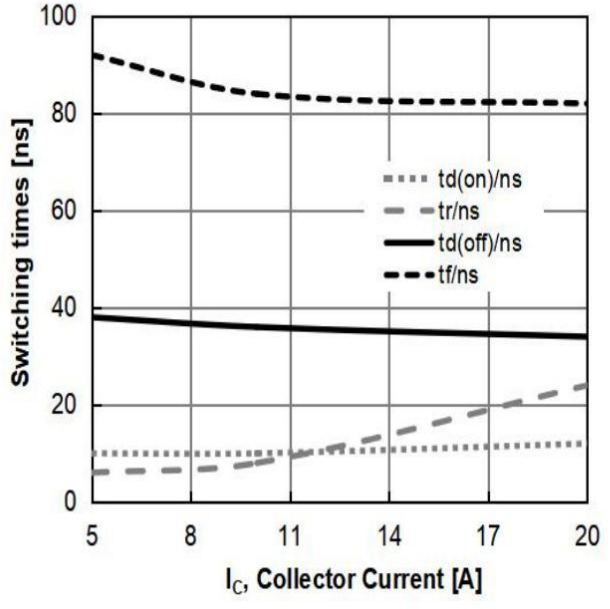


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

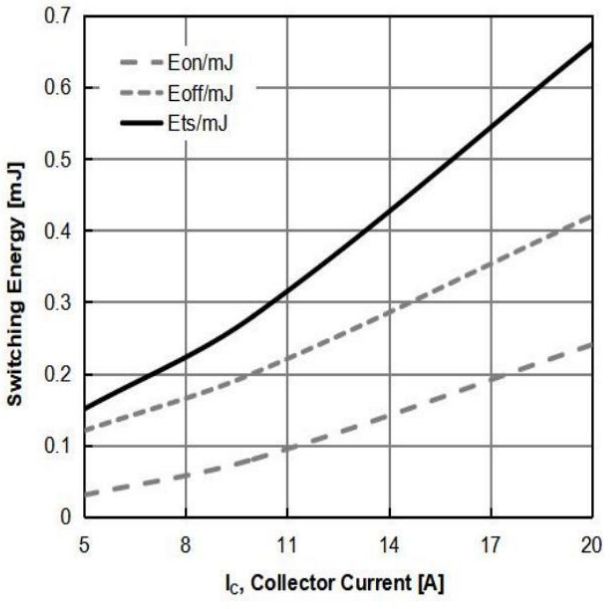


Figure 15: Typical Switching Times vs. VCE (T_J=25℃, V_{GE}=15V, I_C=10A,Rg=5Ω)

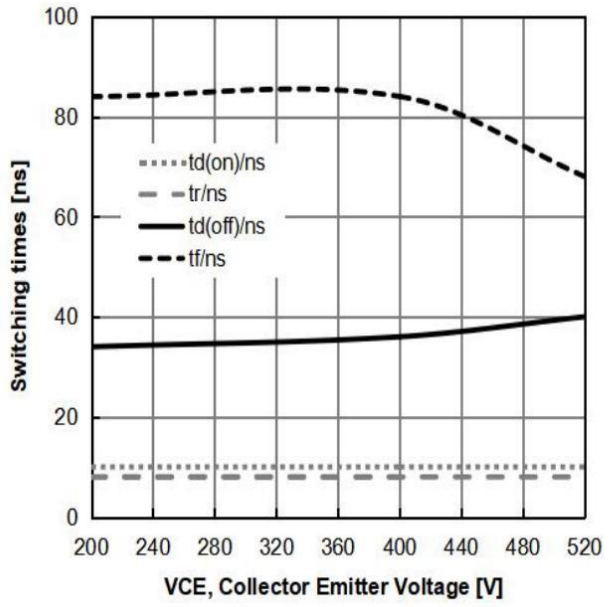


Figure 16: Typical Switching Energy vs. VCE (T_J=25℃, V_{GE}=15V, I_C=10A,Rg=5Ω)

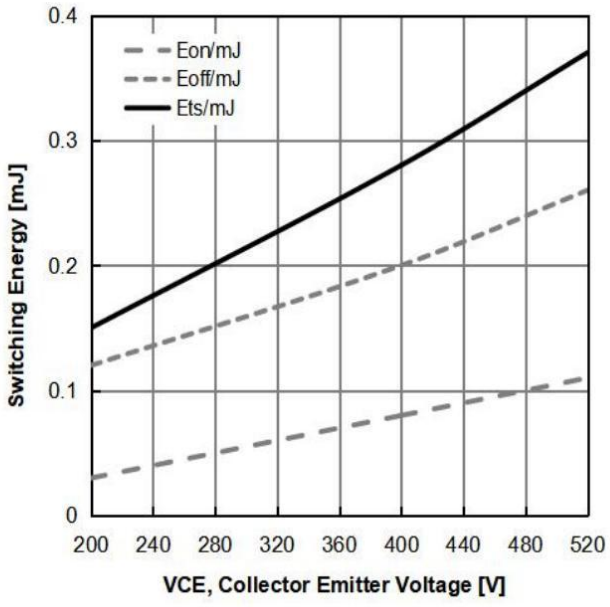


Figure 17: Typical Capacitance vs. Collector- Emitter Voltage

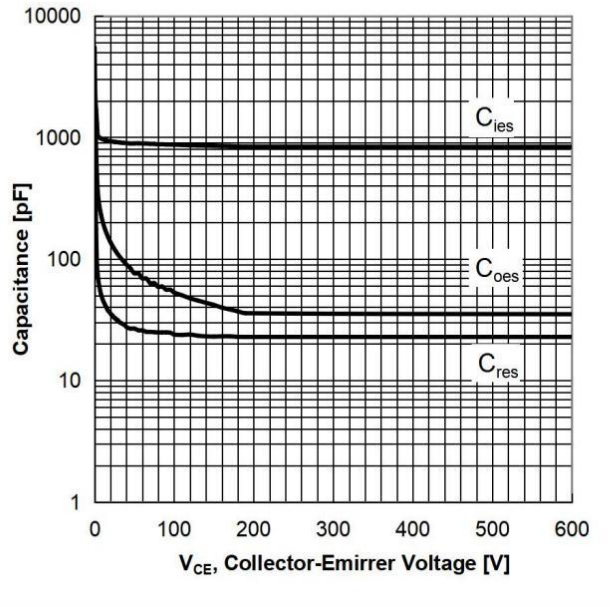


Figure 18: Typical Gate Charge

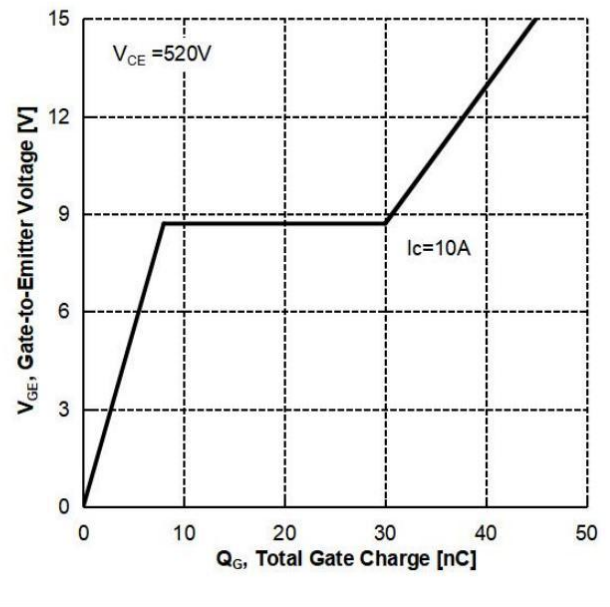


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

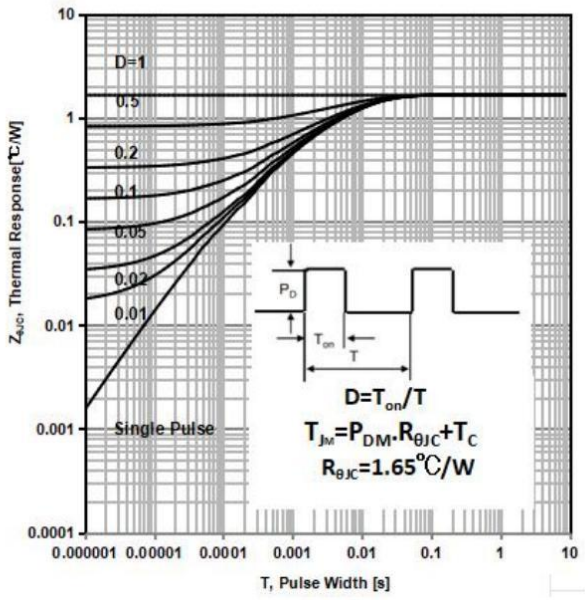


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

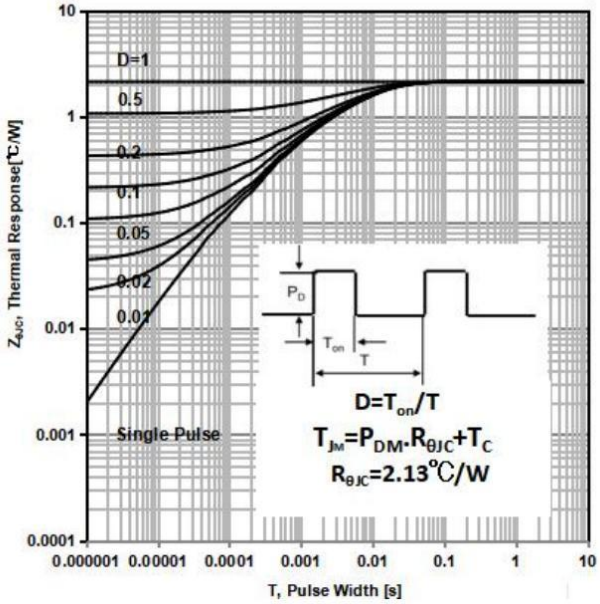
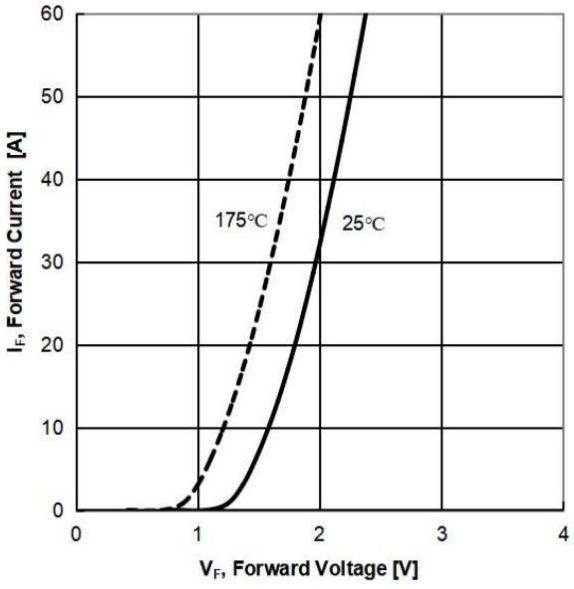
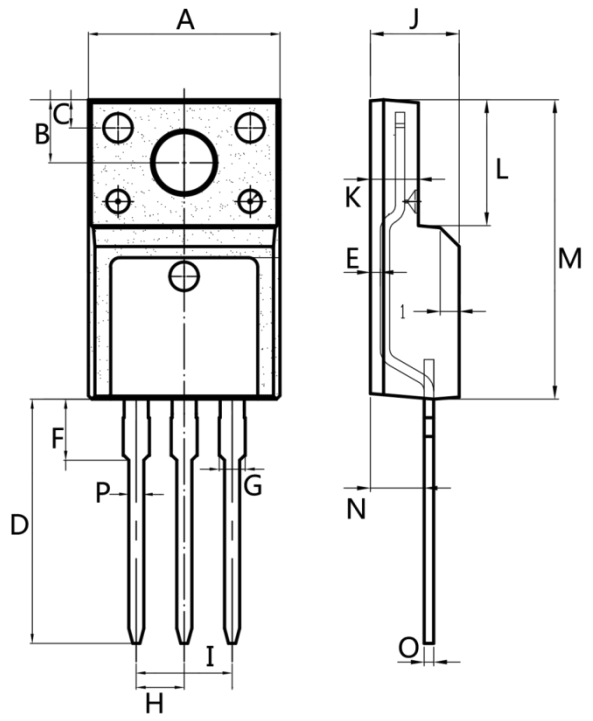


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outlines (Unit：mm)

TO-220F



Dim.	Min.	Max.
A	9.95	10.35
B	2.95	3.25
C	1.25	1.45
D	12.8	13.2
E	0.4	0.6
F	2.8	3.5
G	1.3	1.45
H	Typ 2.54	
I	Typ 5.08	
J	4.5	5
K	2.45	2.65
L	6.5	6.8
M	15.4	16
N	2.75	3.05
O	0.45	0.55
P	0.7	0.9

All Dimensions in millimeter

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