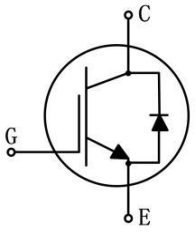
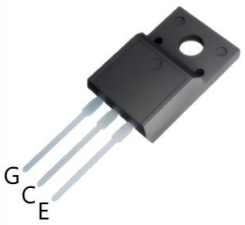
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	20	A
$V_{CE(sat)}$	1.75	V





TO-220F

Features

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

Applications

- Motor drives
- Air Condition
- Inverters

Maximum Ratings

Parameter	Symbol	Value	Unit
		220F	
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±30	V
Continuous collector current(T_C=25℃)	I_C	40	A
Continuous collector current(T_C=100℃)		20	A
Pulsed collector current,tp limited by T_{vjmax}	I_{CM}	60	A
Diode continuous forward current(T_C=25℃)	I_F	40	A
Diode continuous forward current(T_C=100℃)		20	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	60	A
Short Circuit withstand Time	t_{sc}	10	μs
Power dissipation(T_C=25℃)	P_{tot}	176	W
Operating junction temperature range	T_{vj}	-55 to+175	℃
Storage temperature range	T_{Stg}	-55 to+175	℃

Thermal Characteristics

Parameter	Symbol	Value		Unit
		Typ	Max.	
Thermal resistance,junction to case for IGBT	$R_{th(j-c)}$	-	0.85	℃/W
Thermal resistance,junction to case for Diode	$R_{th(j-c)}$	-	0.98	℃/W
Thermal resistance,junction to ambient	$R_{th(j-a)}$	-	40	℃/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	4.3	5.3	6.3	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=20A	-	1.75	2.05	V
		V_{GE}=15V,I_C=20A,T_{vj}=175℃	-	1.98	-	V

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f=1MHz	-	780	-	pF
Output capacitance	C_{oes}		-	46	-	pF
Reverse transfer capacitance	C_{res}		-	22	-	pF
Total gate charge	Q_g	V_{CC}=520V V_{GE}=15V I_C=20A	-	45	-	nC
Gate-Emitter Charge	Q_{ge}		-	9	-	nC
Gate-Collector Charge	Q_{gc}		-	22	-	nC

Switching Characteristics

Parameter	Symbol	Test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V I_C=20A R_G=5Ω Inductive load	-	12	-	ns
Rise time	t_r		-	24	-	ns
Turn-off delay time	$t_{d(off)}$		-	40	-	ns
Fall time	t_f		-	68	-	ns
Turn-on energy	E_{on}		-	0.26	-	mJ
Turn-off energy	E_{off}		-	0.39	-	mJ
Total switching energy	E_{ts}		-	0.65	-	mJ
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V I_C=20A R_G=5Ω Inductive load T_{vj}=175℃	-	14	-	ns
Rise time	t_r		-	32	-	ns
Turn-off delay time	$t_{d(off)}$		-	81	-	ns
Fall time	t_f		-	60	-	ns
Turn-on energy	E_{on}		-	0.4	-	mJ
Turn-off energy	E_{off}		-	0.57	-	mJ
Total switching energy	E_{ts}		-	0.97	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F=20A	-	1.46	1.76	V
		I_F=20A T_{vj}=175℃	-	1.3	-	V
Diode reverse recovery time	t_{rr}	V_R=400V I_F=20A diF/dt=-200A/μs	-	47	-	ns
Diode peak reverse recovery current	I_{rrm}		-	4.8	-	A
Diode reverse recovery charge	Q_{rr}		-	67	-	nC
Diode reverse recovery time	t_{rr}	V_R=400V I_F=20A diF/dt=-200A/μs T_{vj}=175℃	-	62	-	ns
Diode peak reverse recovery current	I_{rrm}		-	6.3	-	A
Diode reverse recovery charge	Q_{rr}		-	102	-	nC

Typical Characteristics

Figure 1: Power Dissipation

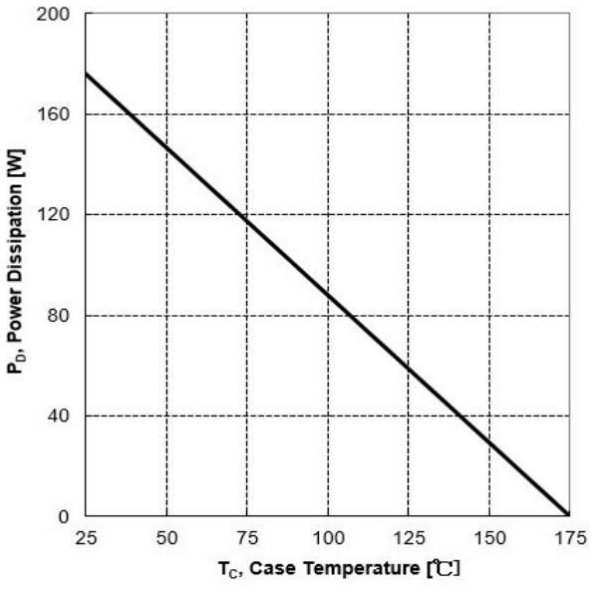


Figure 2: Collector Current vs. Case Temperature

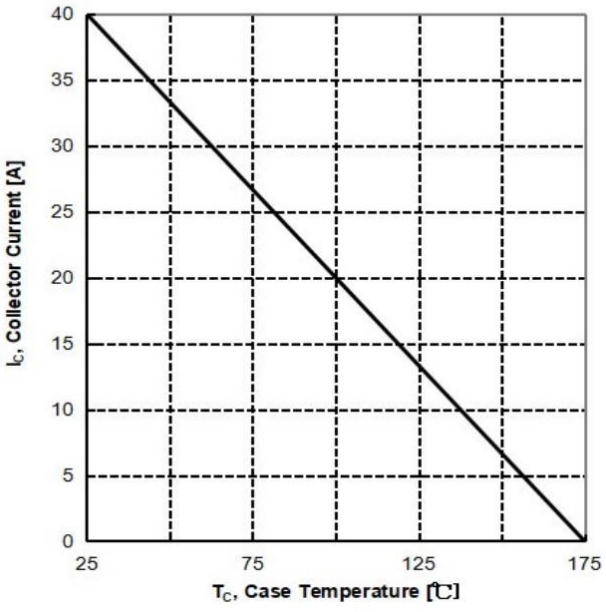


Figure 3: Safe Operation Area

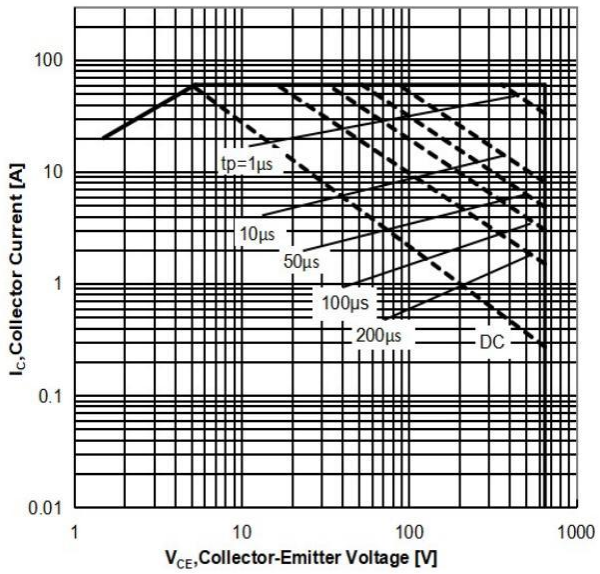


Figure 4: Typical Transfer Characteristics

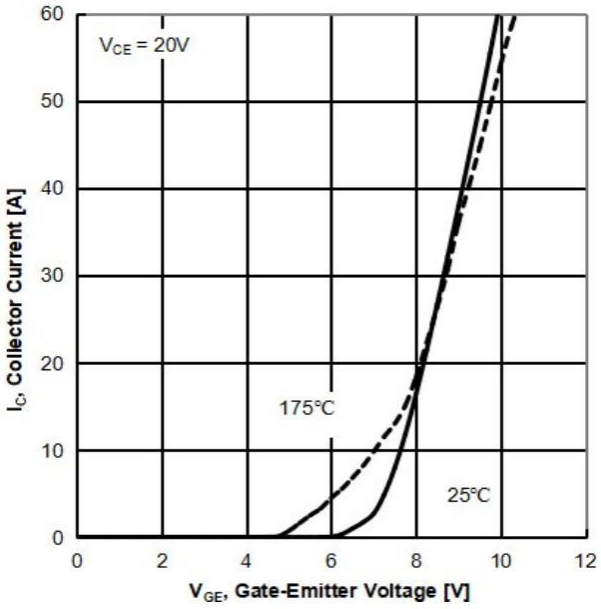


Figure 5: Typical Output Characteristics

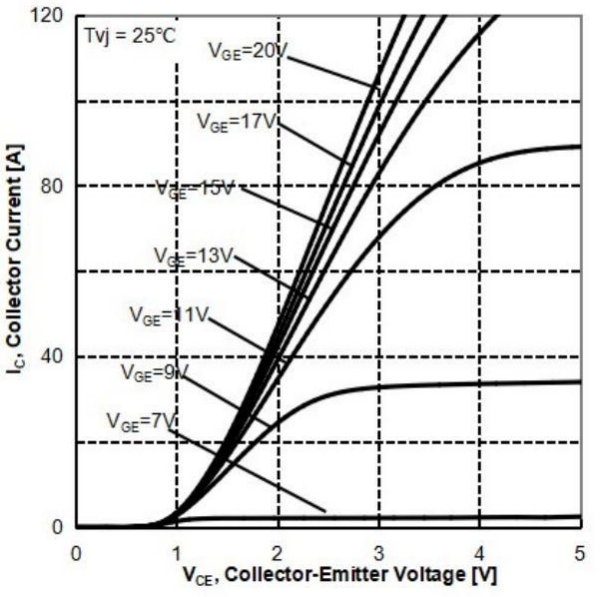


Figure 6: Typical Output Characteristics

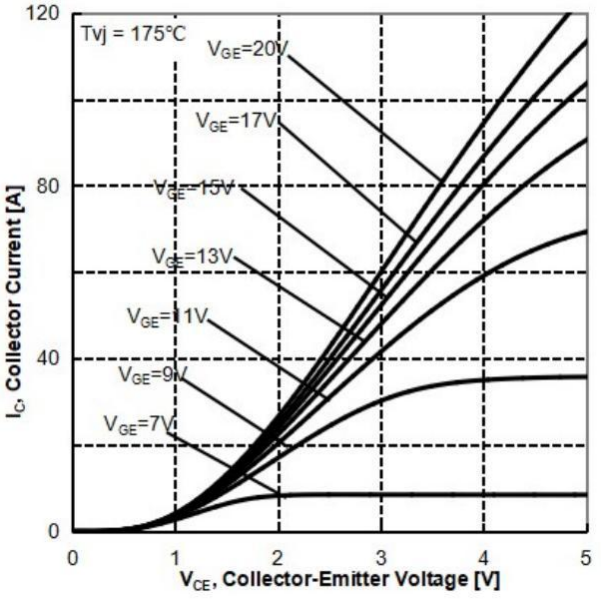


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

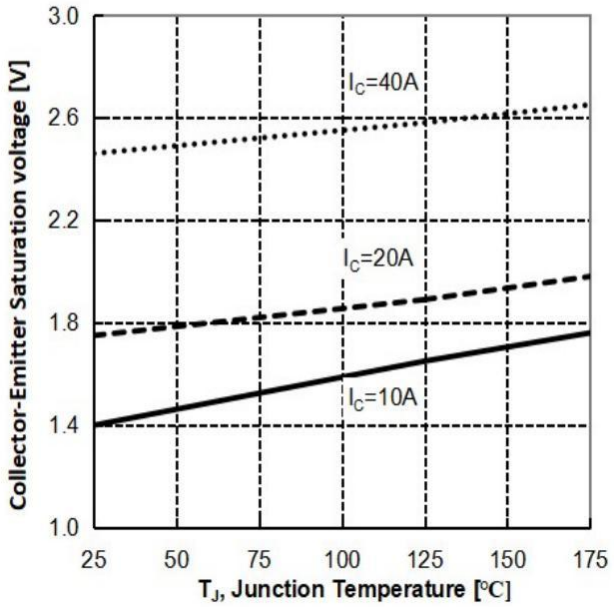


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

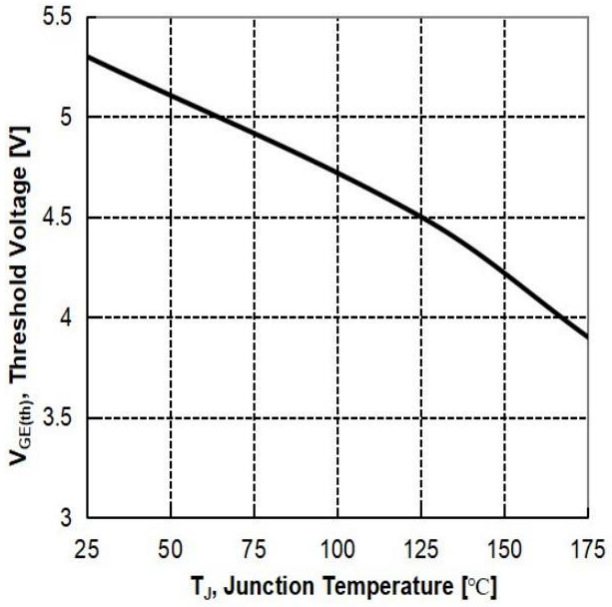


Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=20A)

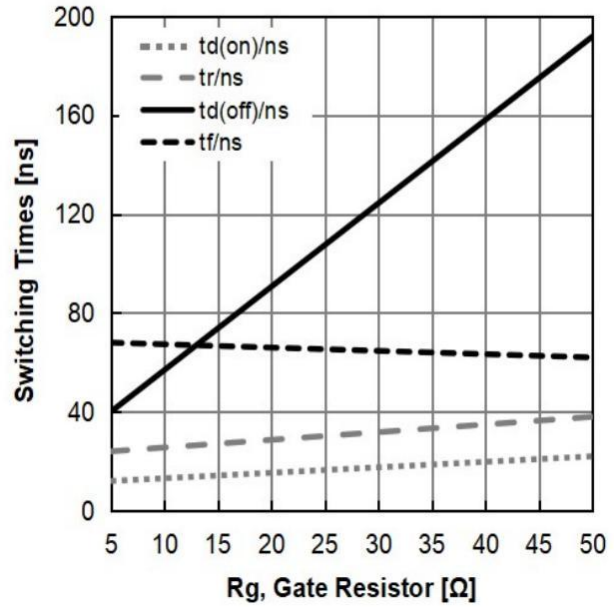


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=20A)

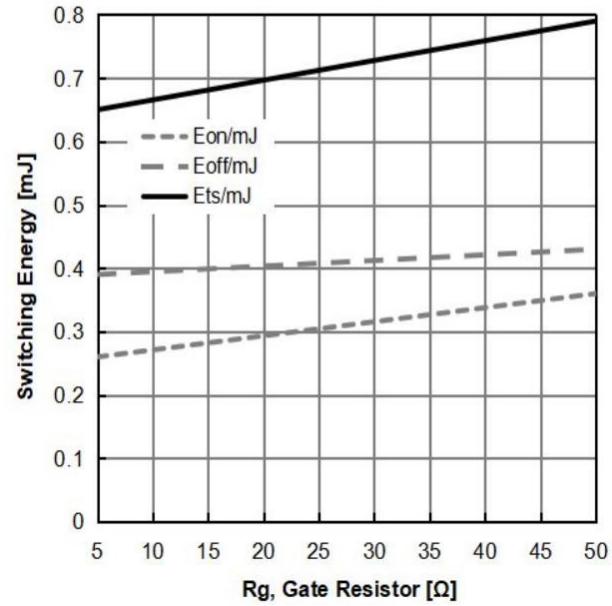


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=20A,Rg=5Ω)

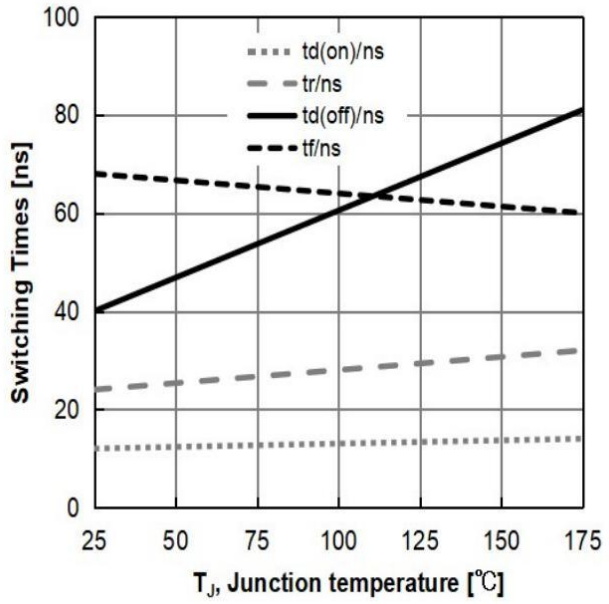


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=20A,Rg=5Ω)

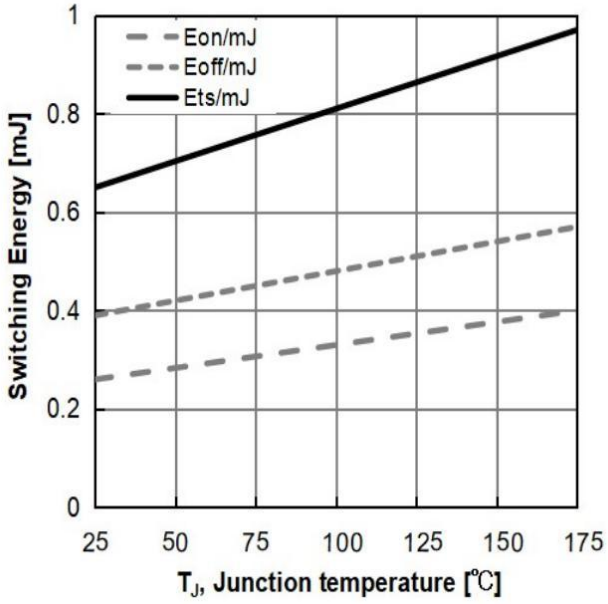


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

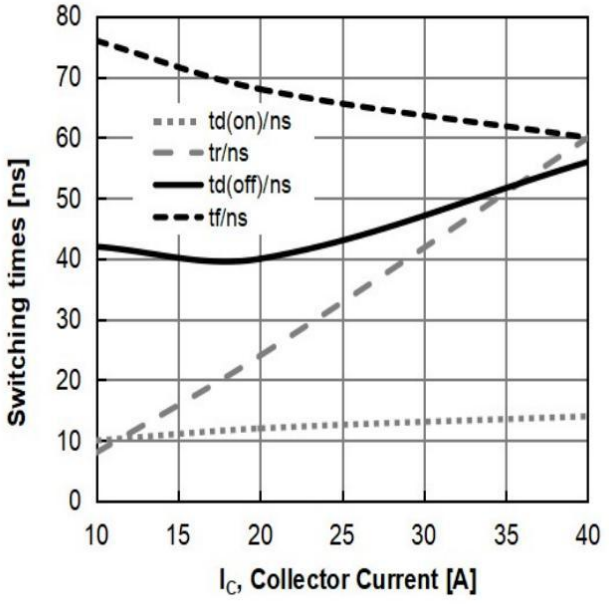


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

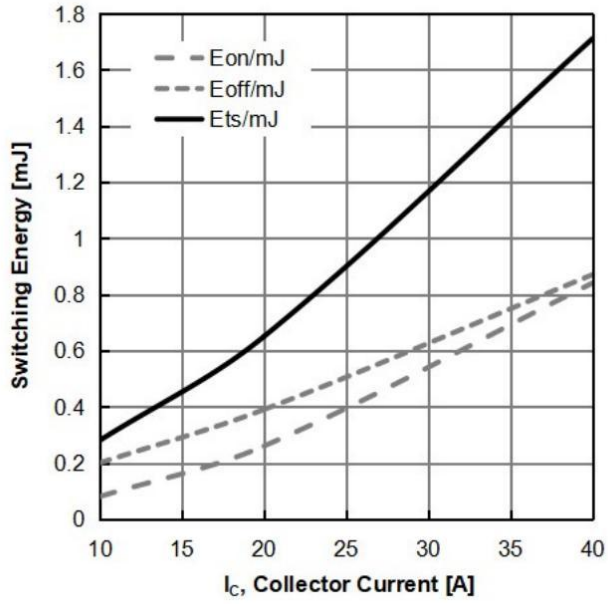


Figure 15: Typical Switching Times vs. VCE (T_J=25℃, V_{GE}=15V, I_C=20A,Rg=5Ω)

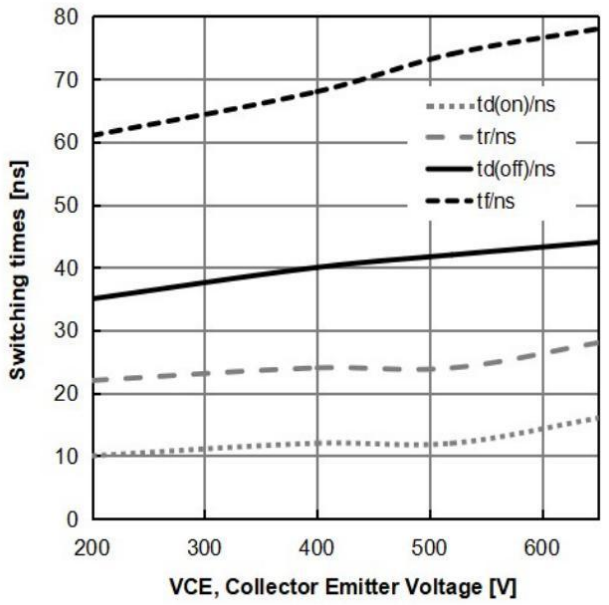


Figure 16: Typical Switching Energy vs. VCE (T_J=25℃, V_{GE}=15V, I_C=20A,Rg=5Ω)

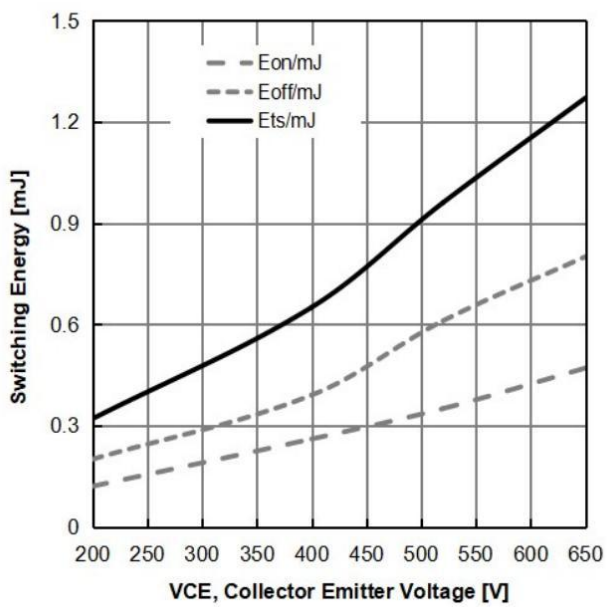


Figure 17: Typical Capacitance vs. Collector- Emitter Voltage

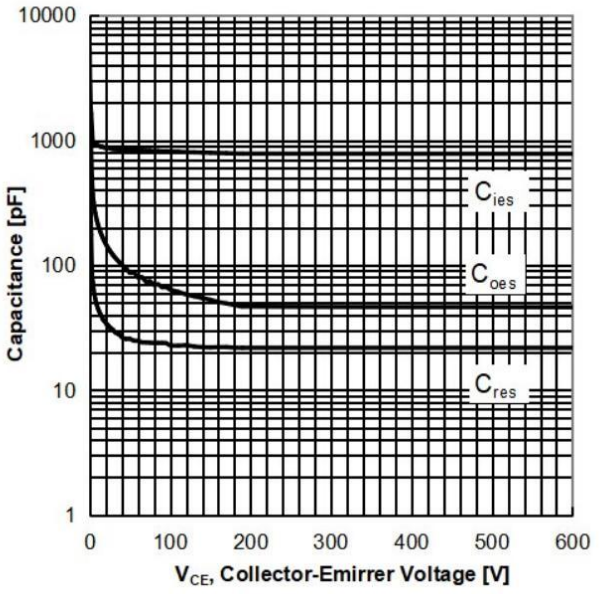


Figure 18: Typical Gate Charge

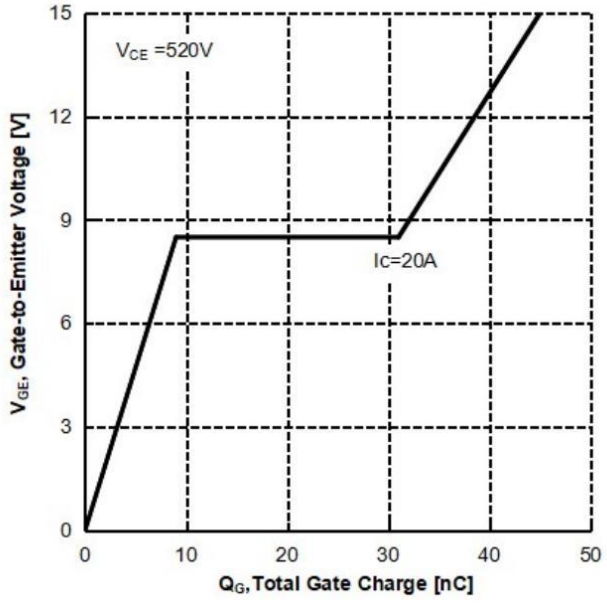


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

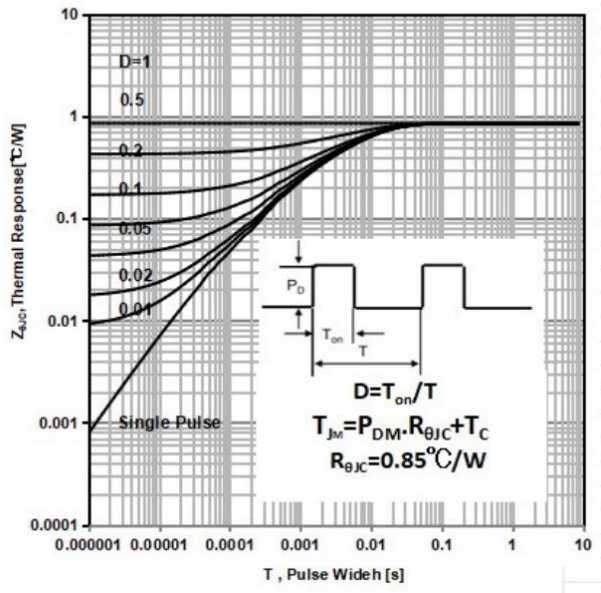


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

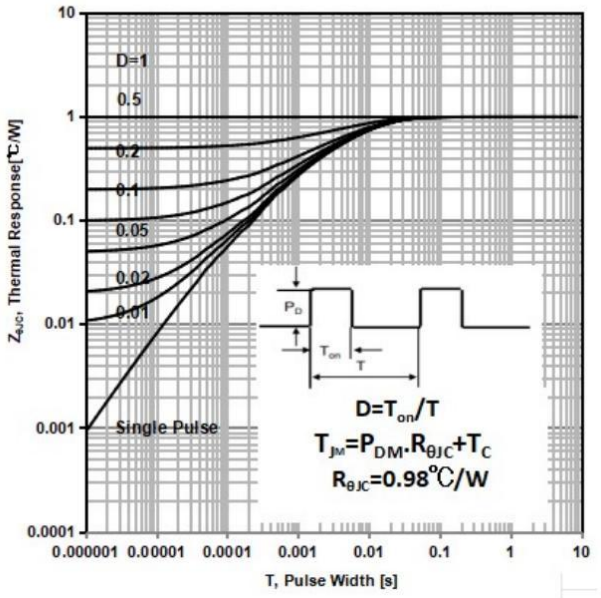
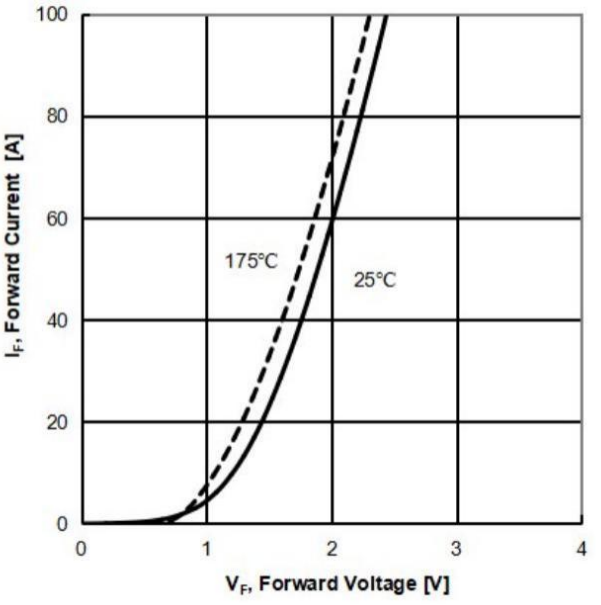
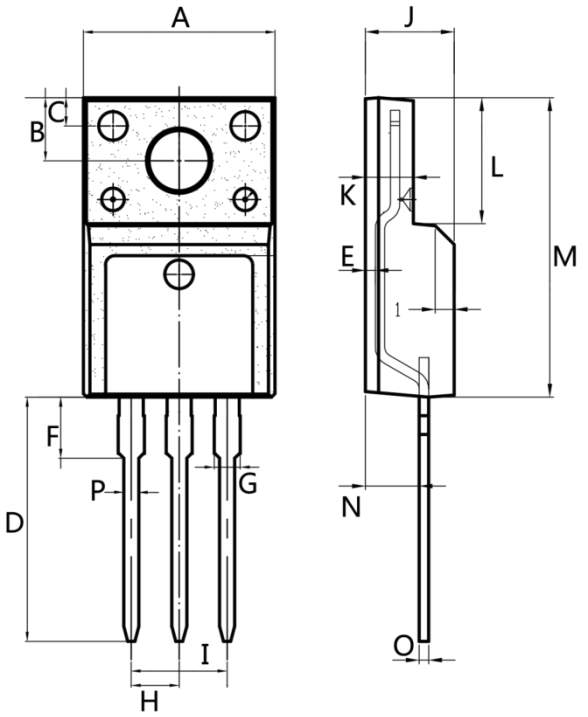


Figure 21: Typical Diode Forward Current vs. Forward Voltage



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		

***Important Usage Information and Disclaimer**

The specifications of Zhuhai Hypersemi Co., Ltd. products are not guarantees of product characteristics. They reflect typical performance expected in standard applications, which may vary with specific uses. Users must conduct prior testing for their applications and make necessary adjustments.
Users are responsible for the safety of applications utilizing our products and must implement adequate safety measures to prevent physical injury, fire, or other risks in case of product failure. It is the user's duty to ensure that application designs comply with all applicable laws and standards. Our products must not be used in any applications where a product failure could reasonably result in personal injury, unless specifically authorized in a signed document by Zhuhai Hypersemi Co., Ltd.
No representations or warranties are made regarding the accuracy or completeness of this information, including any claims of non-infringement of third-party intellectual property rights. Zhuhai Hypersemi Co., Ltd. assumes no liability for any applications or uses of its products and does not grant any licenses to its intellectual property rights or those of others. We also make no claims regarding non-infringement of third-party intellectual property rights that may arise from applications.
Due to technical requirements, our products may contain hazardous substances. For details, please contact your nearest sales office. This document replaces all previous information and may be updated. We reserve the right to make changes.