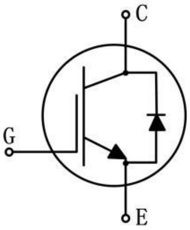
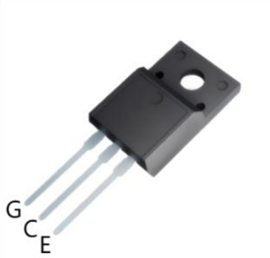
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	30	A
$V_{CE(sat)}$	1.69	V





TO-220F

Features

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

Applications

- Motor drives
- Air Condition
- Inverters

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	60	A
Continuous collector current(T_C=100℃)		30	A
Pulsed collector current,tp limited by T_{vjmax}	I_{CM}	90	A
Diode continuous forward current(T_C=25℃)	I_F	60	A
Diode continuous forward current(T_C=100℃)		30	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	90	A
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	$R_{th(j-c)}$	-	0.83	℃/W
Thermal resistance,junction to case for Diode	$R_{th(j-c)}$	-	0.65	℃/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=30A	-	1.69	2	V
		V_{GE}=15V,IC=30A,T_{vj}=125℃	-	1.9	-	V
		V_{GE}=15V,I_C=30A,T_{vj}=175℃	-	2.05	-	V

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f=1MHz	-	1853	-	pF
Output capacitance	C_{oes}		-	72	-	pF
Reverse transfer capacitance	C_{res}		-	55	-	pF
Total gate charge	Q_g	V_{CC}=520V V_{GE}=15V I_C=30A	-	98	-	nC
Gate-Emitter Charge	Q_{ge}		-	18	-	nC
Gate-Collector Charge	Q_{gc}		-	47	-	nC
Short circuit collector current Max.1000 short circuits, times between short circuits:≥1.0s	$t_{(SC)}$	V_{GE}=15V V_{CC}≤400V T_J≤175℃	-	8	-	μs

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=30A R_G=5Ω Inductive load	-	16	-	ns
Rise time	t_r		-	46	-	ns
Turn-off delay time	$t_{d(off)}$		-	72	-	ns
Fall time	t_f		-	80	-	ns
Turn-on energy	E_{on}		-	0.52	-	mJ
Turn-off energy	E_{off}		-	0.77	-	mJ
Total switching energy	E_{ts}		-	1.29	-	mJ
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V	-	18	-	ns
Rise time	t_r		-	54	-	ns

Turn-off delay time	$t_{d(off)}$	I_C=30A R_G=5Ω Inductive load T_{vj}=175℃	-	90	-	ns
Fall time	t_f		-	75	-	ns
Turn-on energy	E_{on}		-	0.97	-	mJ
Turn-off energy	E_{off}		-	1.36	-	mJ
Total switching energy	E_{ts}		-	2.33	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F=30A	-	2	2.3	V
		I_F=30A T_{vj}=125℃	-	1.7	-	V
		I_F=30A T_{vj}=175℃	-	1.5	-	V
Diode reverse recovery time	t_{rr}	I_F=30A diF/dt=-200A/μs	-	48	-	ns
Diode peak reverse recovery current	Q_{rr}		-	80	-	nC
Diode reverse recovery charge	I_{rrm}		-	5.1	-	A
Diode reverse recovery time	t_{rr}	I_F=30A diF/dt=-200A/μs T_{vj}=175℃	-	39	-	ns
Diode peak reverse recovery current	Q_{rr}		-	127	-	nC
Diode reverse recovery charge	I_{rrm}		-	8.5	-	A

Typical Characteristics

Figure 1: Power Dissipation

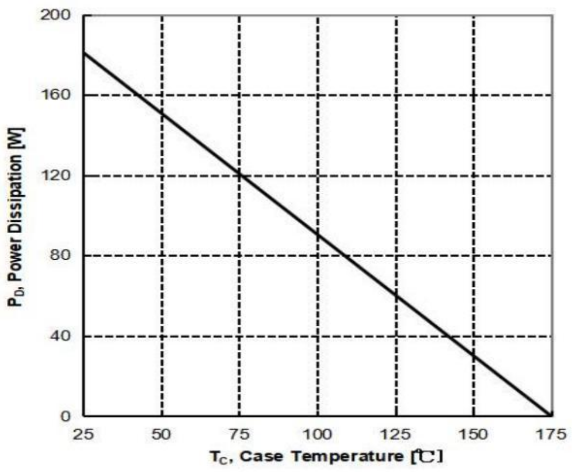


Figure 2: Collector Current vs. Case Temperature

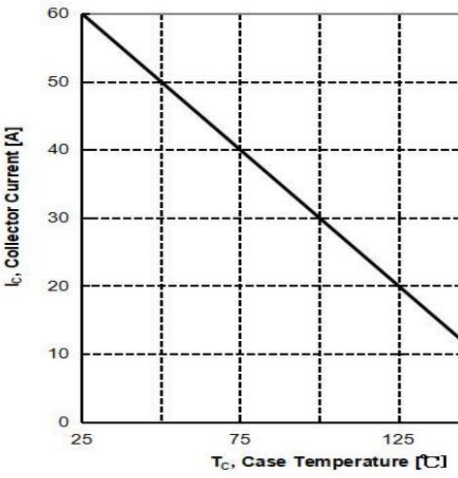


Figure 3: Safe Operation Area

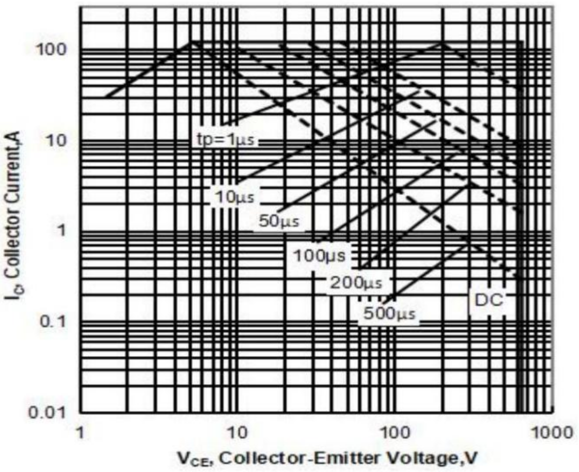


Figure 4: Typical Transfer Characteristics

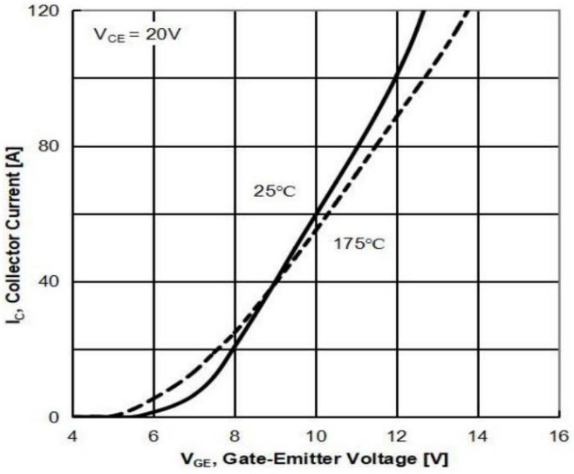


Figure 5: Typical Output Characteristics

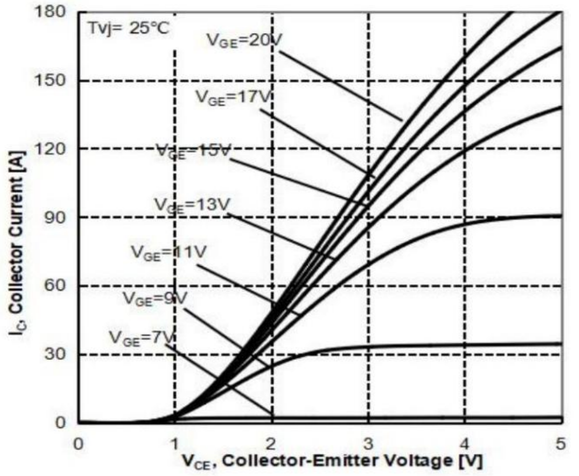


Figure 6: Typical Output Characteristics

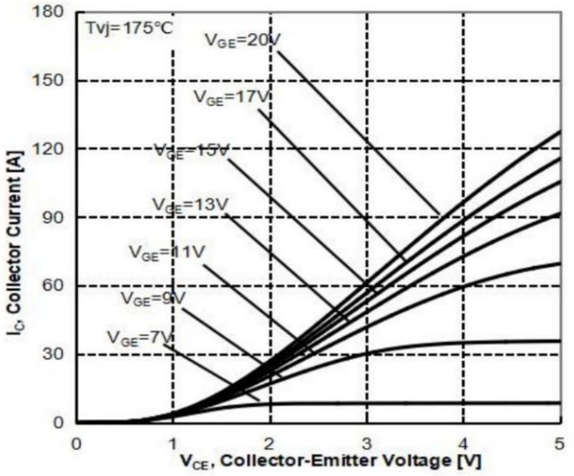


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

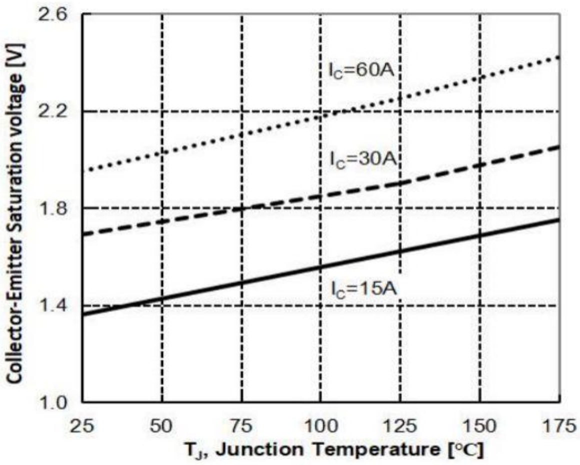


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

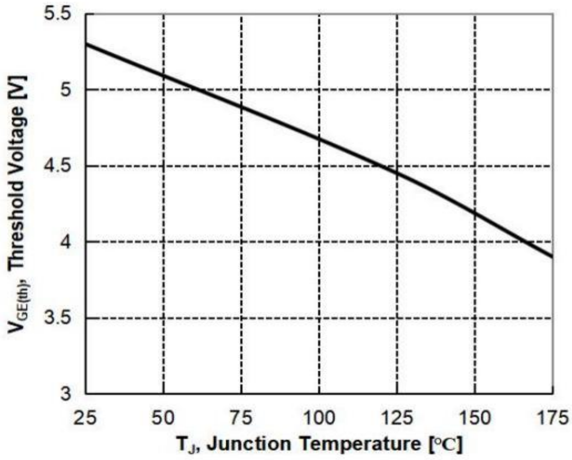


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=30A)

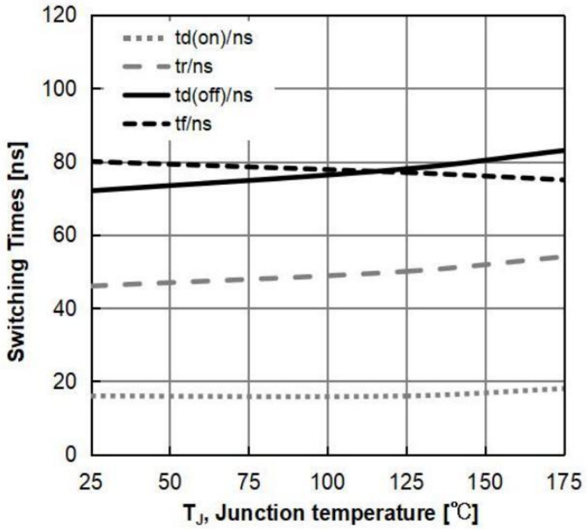


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=30A)

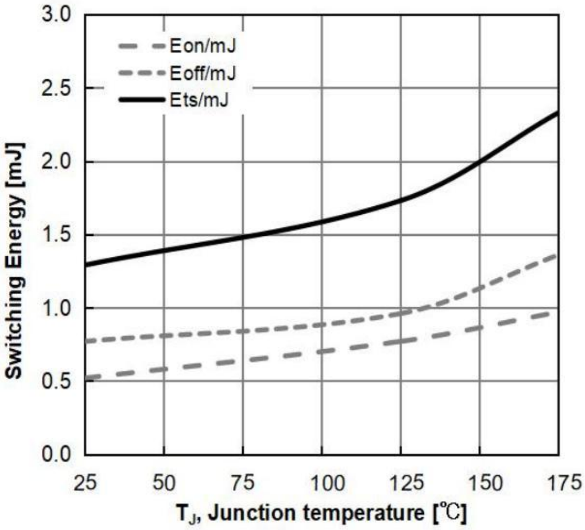


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

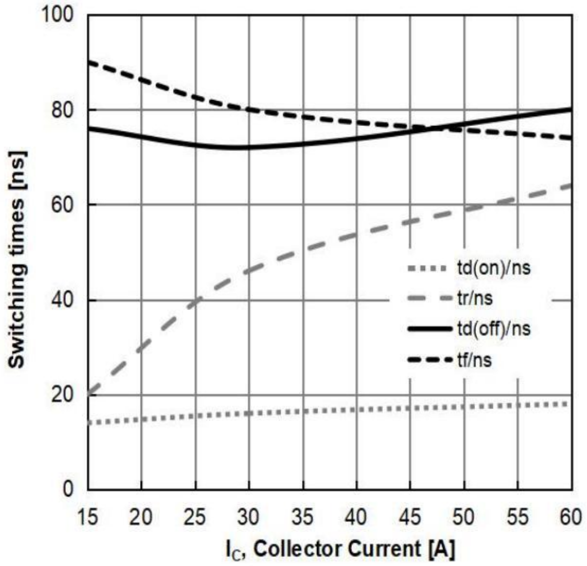


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

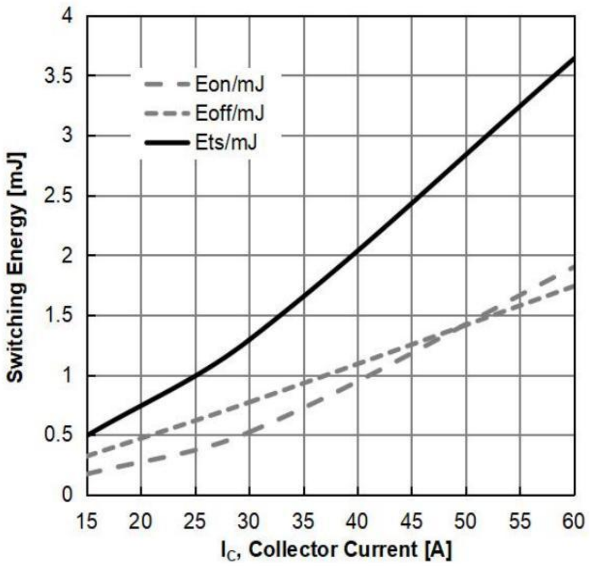


Figure 15: Typical Switching Times vs. VCE (T_J=25℃,V_{GE}=15/0V, I_C=30A)

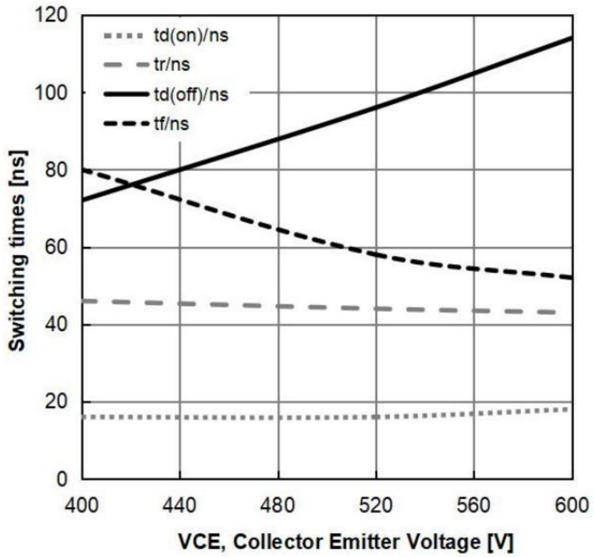


Figure 16: Typical Switching Energy vs. VCE (T_J=25℃, V_{GE}=15/0V, I_C=30A)

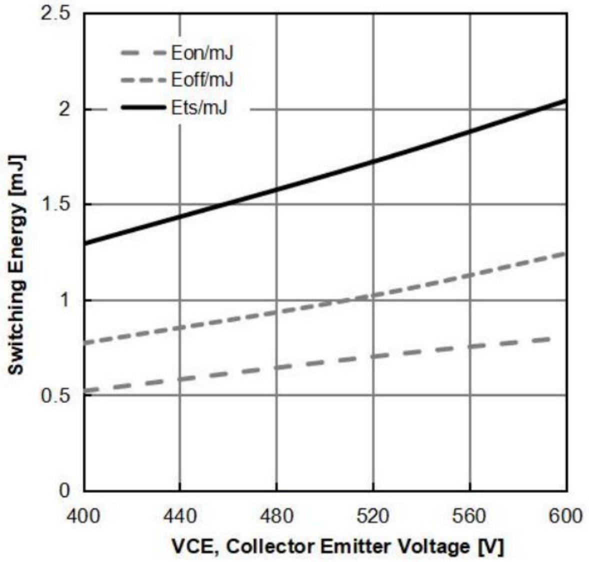


Figure 17: Typical Gate Charge

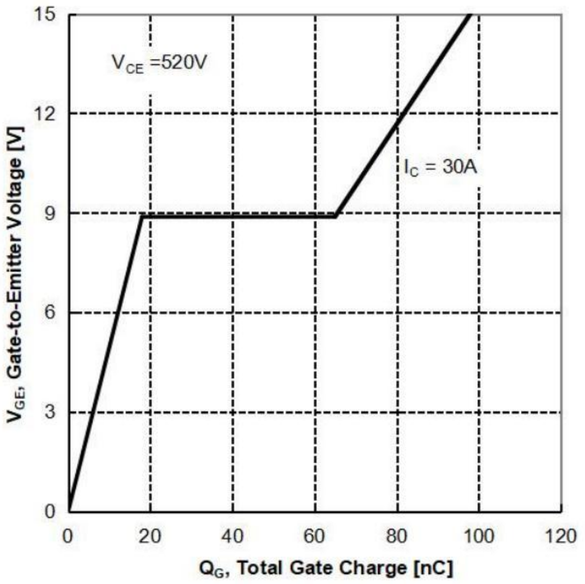


Figure 18: Typical Capacitance vs. Collector- Emitter Voltage

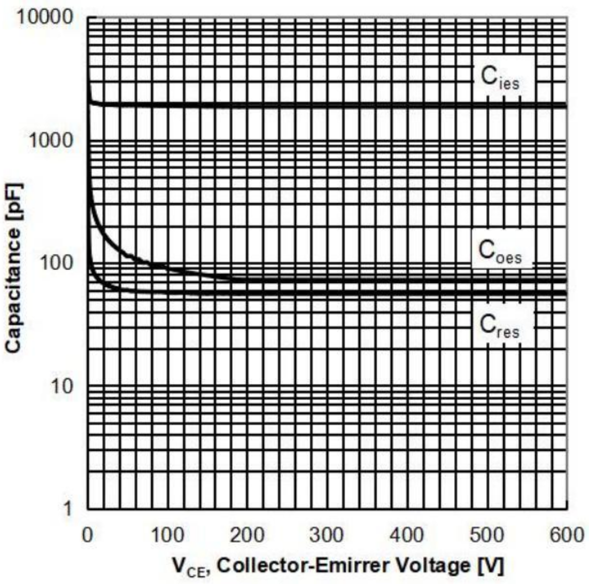


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

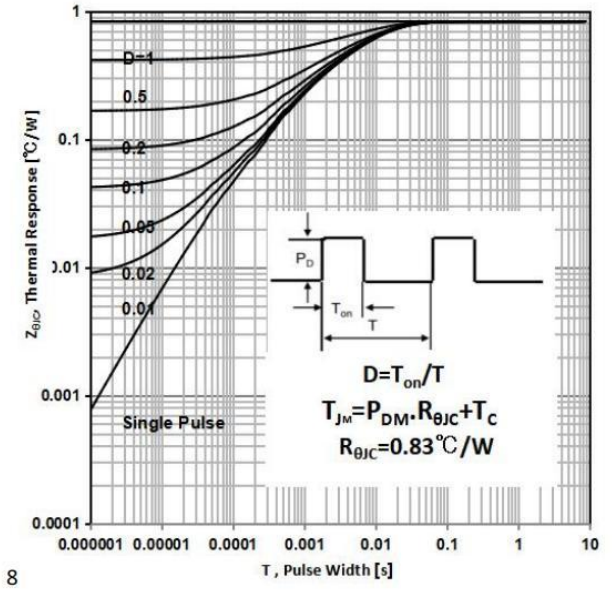


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

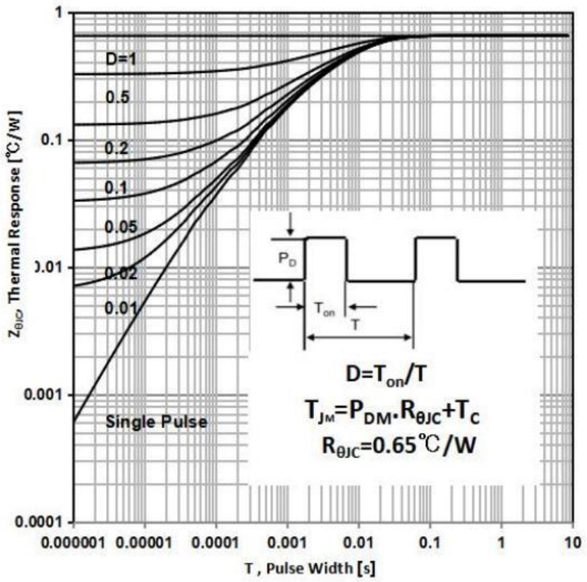
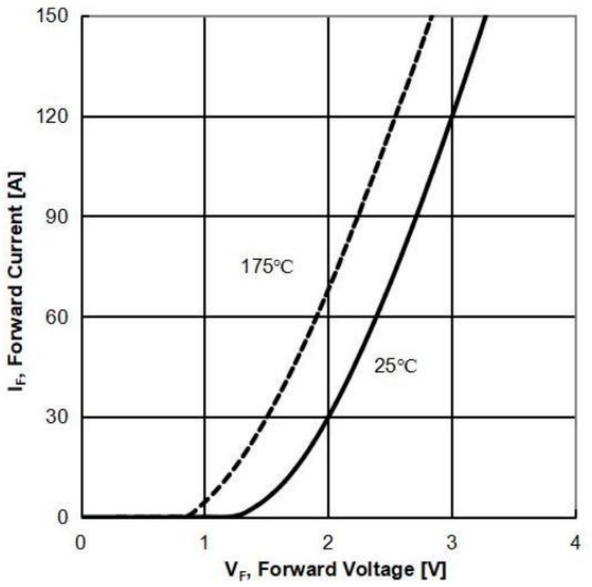
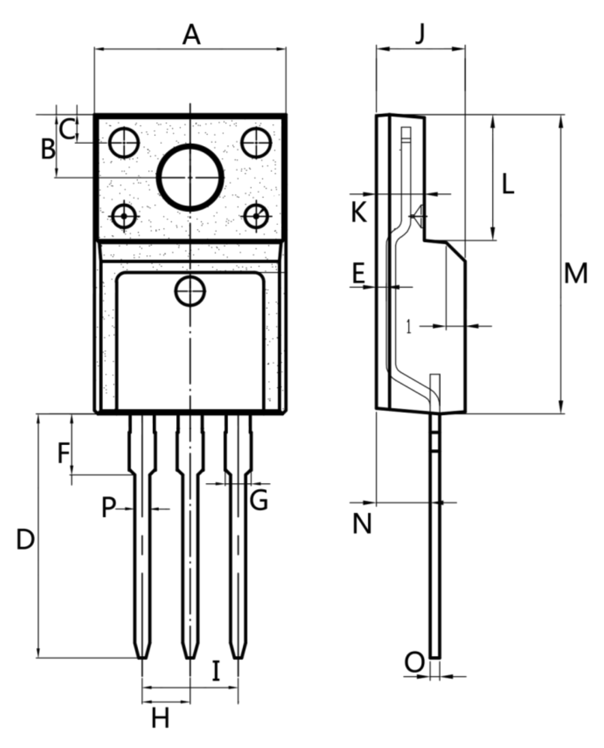


Figure 21: Typical Diode Forward Current vs. Forward Voltage



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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