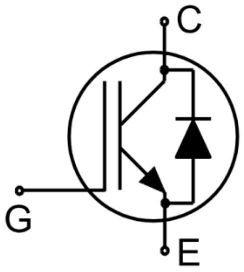
TP07TD60BF

600V, 7A, Trench FS II Fast IGBT



Schematic diagram

General Description:

Using Topdiodes proprietary trench design and advanced FS (Field Stop) second generation technology, the 600V Trench FSII IGBT offers superior conduction and switching performances, and easy parallel operation;

Features

Trench FSII Technology offering

Very low $V_{CE\ (sat)}$

High speed switching

Positive temperature coefficient in $V_{CE\ (sat)}$

Very tight parameter distribution

High ruggedness, temperature stable behavior

TO-220F

Application

Air Condition

Inverters

Motor drives

Package Marking and Ordering Information

Device	Device Package	Device Marking
TP07TD60BF	TO-220F	07TD60BF

Absolute Maximum Ratings (T_C=25$_o$C unless otherwise noted)

Symbol	Parameter	Value	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate- Emitter Voltage	±30	V
I_C	Collector Current	14	A
	Collector Current @T_C = 100 °C	7	A
I_{Cplus}	Pulsed Collector Current，t_p limited by T_{jmax}	21	A
-	turn off safe operating area，V_{CE}=600V，T_J=150°C	21	A
I_F	Diode Continuous Forward Current @T_C = 100 °C	7	A
I_{FM}	Diode Maximum Forward Current	21	A
P_D	Power Dissipation @ T_C = 25°C	32	W
	Power Dissipation @T_C = 100 °C	12	W
T_J,T_{stg}	Operating Junction and Storage Temperature Range	-55 to +150	°C
T_L	Maximum Temperature for Soldering	260	°C
t_{sc}	Short circuit withstand time V_{GE}=15V, V_{CC}⩽400V, Allowed number of short circuits<1000Time between short circuits:⩾1.0s,T_j⩽150°C	3	us

Thermal Characteristic

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction to case for IGBT	3.90	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to case for Diode	4.10	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	78	°C/W

Electrical Characteristics (T_C=25°C unless otherwise noted)

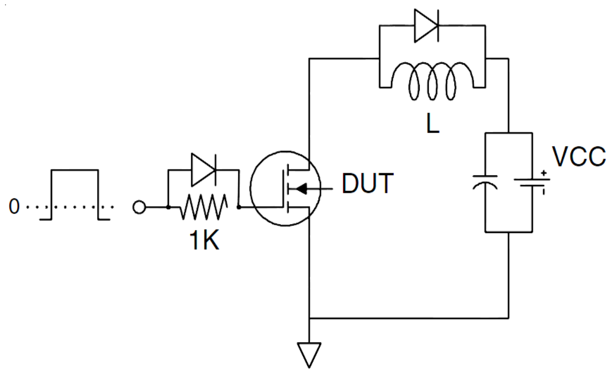
Symbol	Parameter	Test Conditions	Value			Units
			Min.	Typ.	Max.	
Static Characteristics						
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	V_{GE}=0V,I_{CE}=1mA	600	--	--	V
I_{CES}	Collector-Emitter Leakage Current	V_{GE} =0V,V_{CE}=600V	--	--	4	uA
$I_{GES(F)}$	Gate to Emitter Forward Leakage	V_{GE}=+30V,V_{CE}=0V	--	--	100	nA
$I_{GES(R)}$	Gate to Source Reverse Leakage	V_{GE}=-30V,V_{CE} =0V	--	--	100	nA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C=5A Tj=25°C	--	1.7	1.9	V
		V_{GE}=15V Tj=100°C	--	1.9	--	V
$V_{GE(th)}$	Gate Threshold Voltage	I_C=1mA,V_{CE}=V_{GE}	4.0	5.0	6.0	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE}=25V, V_{GE}=0V, f=1MHz	--	675	--	pF
C_{oes}	Output Capacitance		--	22	--	
C_{res}	Reverse Transfer Capacitance		--	13	--	
Q_g	Total Gate Charge	V_{CC}=480V, I_C=7A, V_{GE}=15V	--	28	--	nC
Q_{ge}	Gate to Emitter Charge		--	8	--	
Q_{gc}	Gate to Collector Charge		--	13	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits Time between short circuits: ⩾1.0s	V_{GE}=15V,V_{CC}⩽400V, t_{SC}⩽3us,Tj⩽150°C	--	34	--	A
Switching Characteristics						
$t_{d(ON)}$	Turn-on Delay Time	V_{CC}=400V, I_C=7A, V_{GE}=0/15V, R_g=5Ω, Inductive Load	--	20	--	ns
t_r	Rise Time		--	15	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	73	--	
t_f	Fall Time		--	18	--	
E_{on}	Turn-On Switching Loss		--	0.21	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.10	--	
E_{ts}	Total Switching Loss		--	0.31	--	

Electrical Characteristics of the Diode(T_C= 25°C unless otherwise specified):

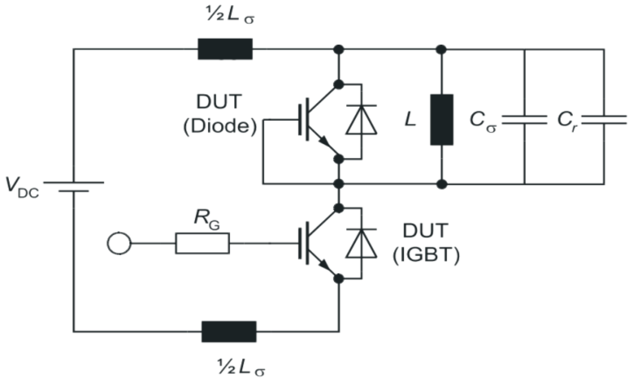
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V_{FM}	Diode Forward Voltage	I_F=7A	--	1.5	1.7	V
T_{rr}	Reverse Recovery Time	I_F=7A, di/dt=200A/us	--	230	--	ns
I_{RRM}	Diode Peak Reverse Recovery Current		--	3.5	--	A
Q_{rr}	Reverse Recovery Charge		--	0.44	--	uC
Pulse width t_{tp}≤380μs,δ≤2%						

Test Circuit

1) Gate Charge Test Circuit

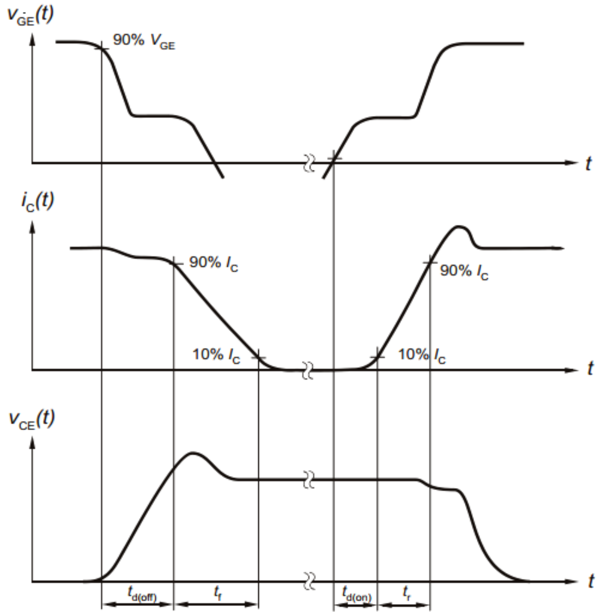


2) Switch Time Test Circuit

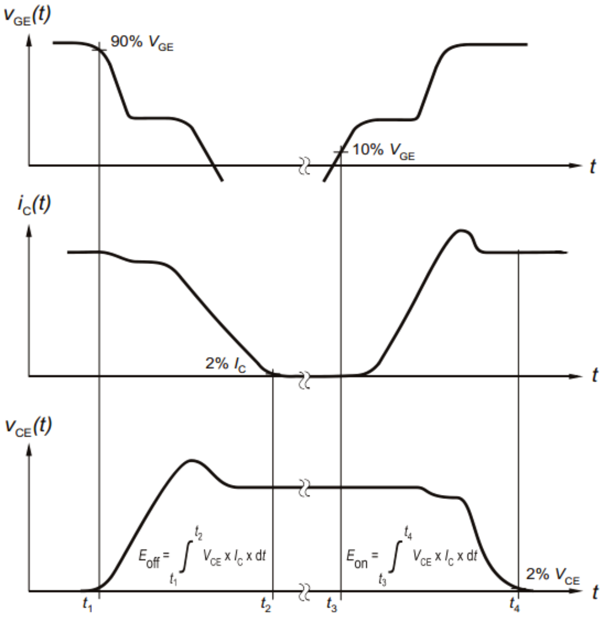


Switching characteristics

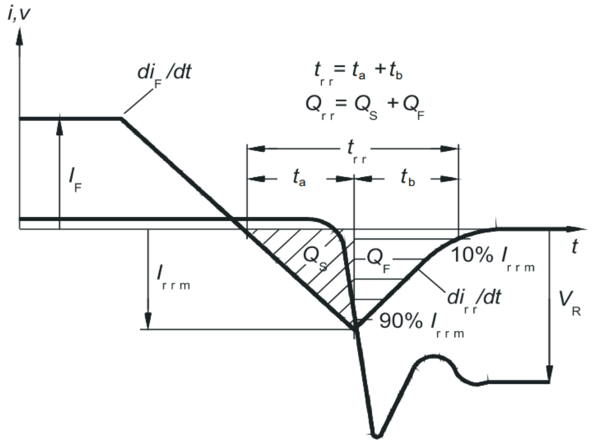
1) definition of switching times



2) definition of switching losses



3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

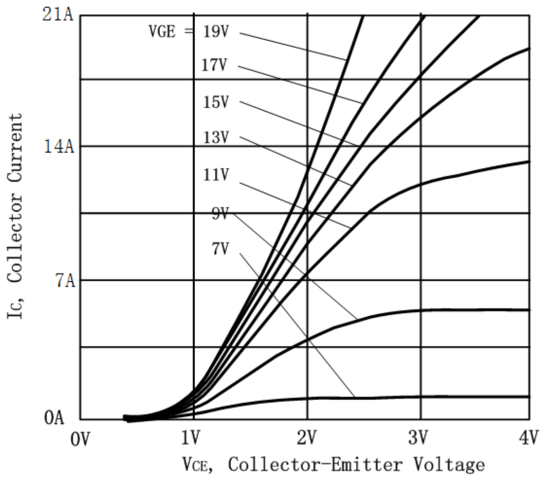


Figure 2 Transfer Characteristics

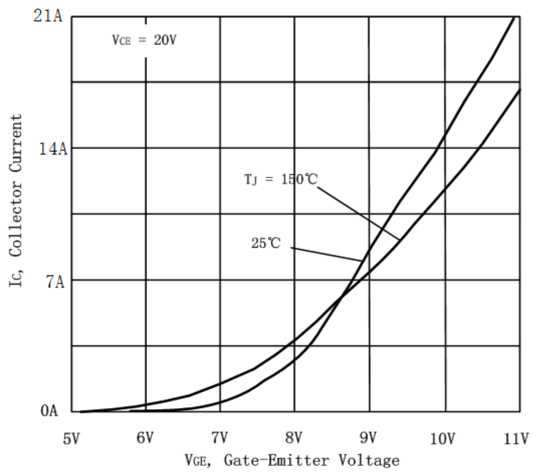


Figure 3 V_{CEsat} vs. Case Temperature

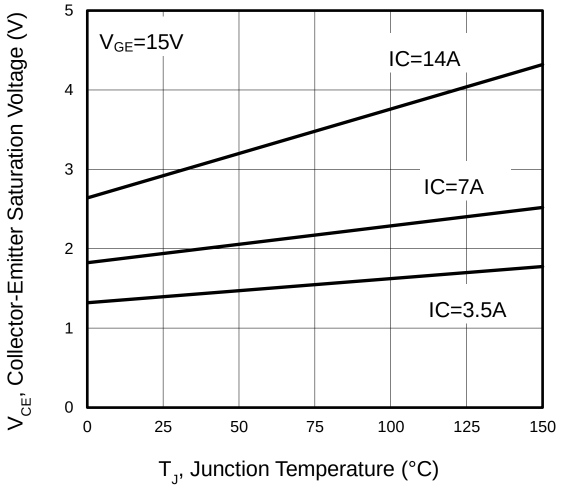


Figure 4 Saturation Voltage vs. VGE

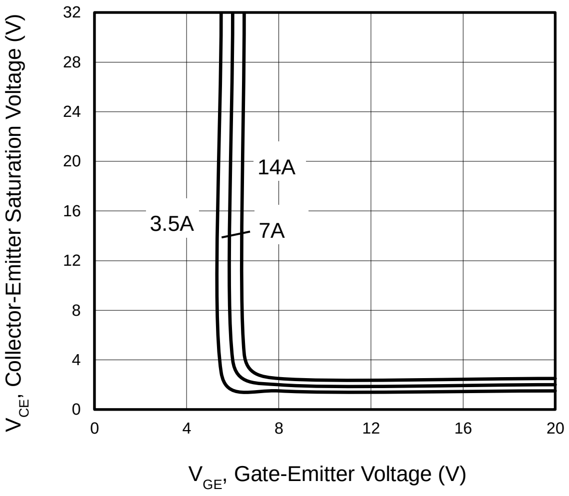


Figure 5 Capacitance Characteristics

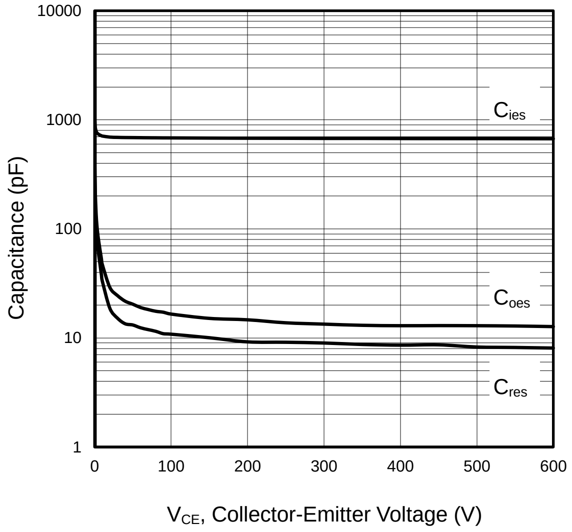
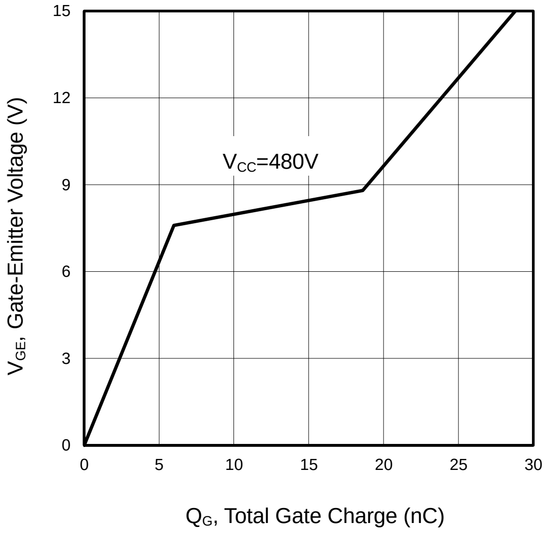


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics

Figure 7 Forward Characteristics

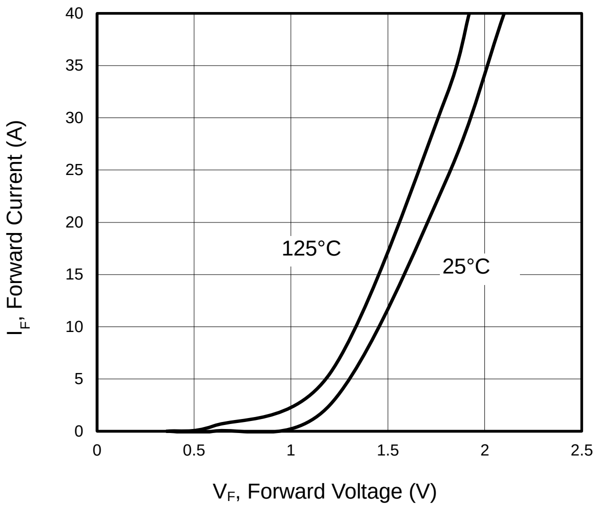


Figure 8 V_F vs. temperature

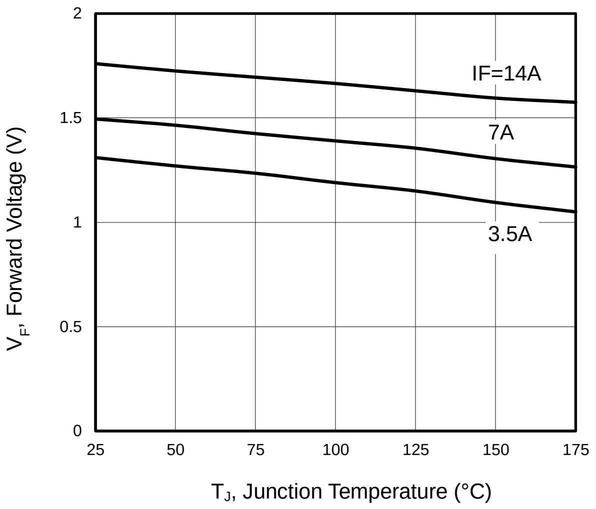


Figure 9 Typical Switching Times as a Function of Gate Resistor

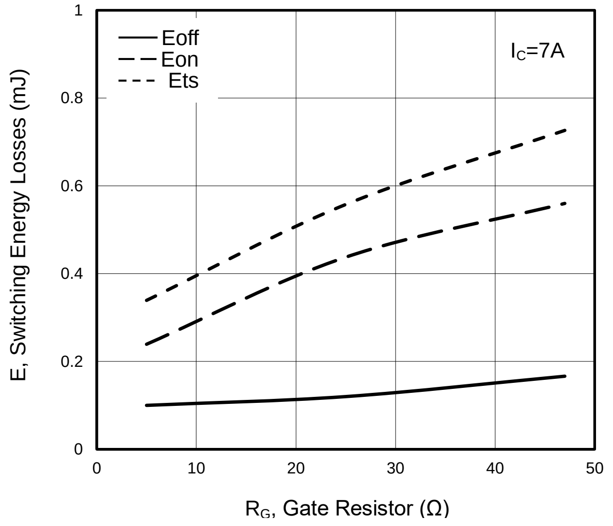


Figure 10 Typical Switching Times as a Function of Junction Temperature

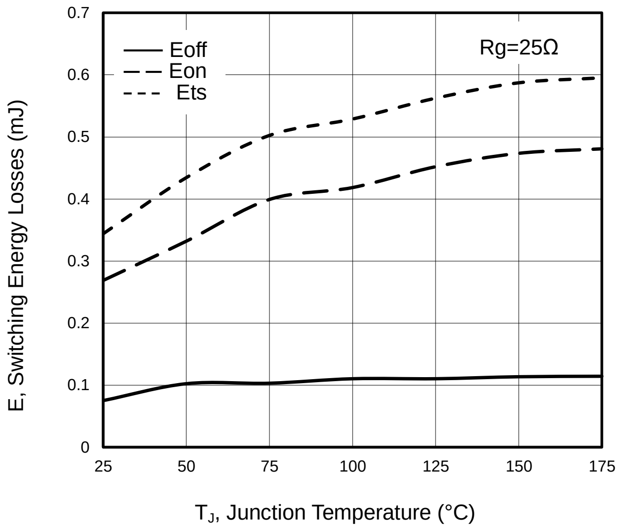


Figure 11 Gate-emitter Threshold Voltage as a Function of Junction Temperature

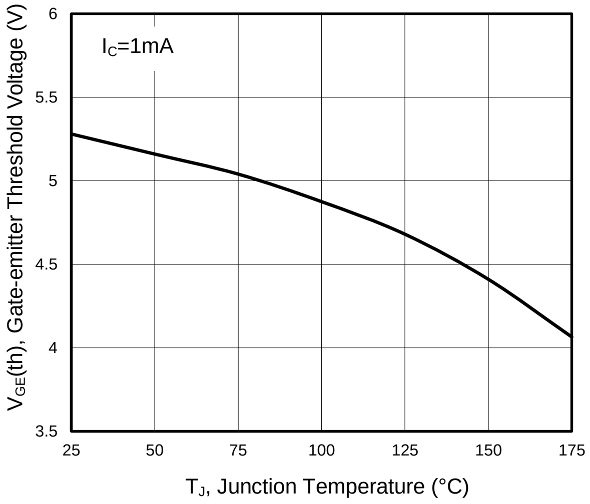
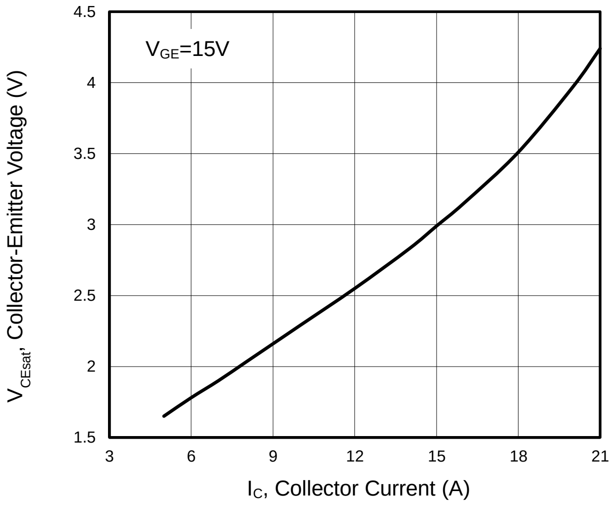
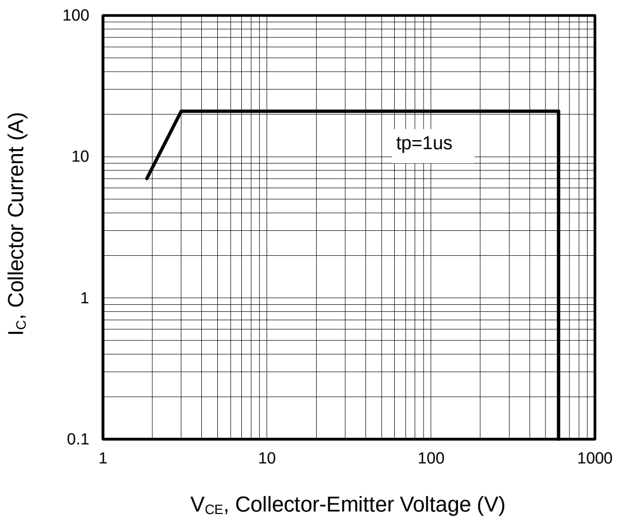


Figure 12 Typical Collector-emitter Saturation Voltage as a function of Collector Current

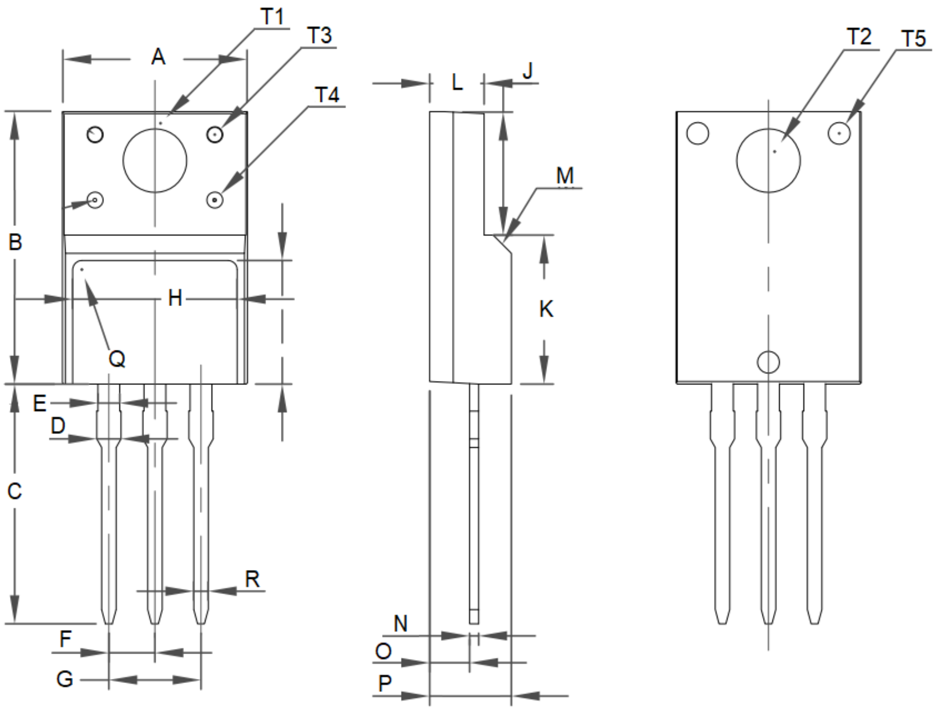


Typical Electrical and Thermal Characteristics

Figure 13 Forward Bias Safe Operating Area



TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.96	10.36	0.39	0.41
B	15.67	16.07	0.62	0.63
C	13.14	13.54	0.52	0.53
D	1.20	1.40	0.05	0.06
E	1.20 BSC		0.05 BSC	
F	2.54 BSC		0.10 BSC	
G	5.08 BSC		0.20 BSC	
H	7.60	8.00	0.30	0.31
I	7.10	7.50	0.28	0.30
J	6.48	6.88	0.26	0.27
K	8.99	9.39	0.35	0.37
L	2.34	2.74	0.09	0.11
M	45°		1.77 BSC	
N	0.49	0.52	0.02	0.02
O	2.15	2.55	0.08	0.10
P	4.50	4.90	0.18	0.19
Q	0.50		0.02 BSC	
R	0.77	0.83	0.03	0.03
S	4°	5°	0.16	0.20
T1	3.45 BSC		0.14 BSC	
T2	3.18 BSC		0.13 BSC	
T3	1.50 BSC		0.06 BSC	
T4	1.20 BSC		0.05 BSC	
T5	1.50 BSC		0.06 BSC	