

600V, 30A, Trench FS II Fast IGBT
General Description:

Using NCE's proprietary trench design and advanced FS (Field Stop) second generation technology, the 600V Trench FSIIIGBT 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

Application

- Air Condition
- Inverters
- Motor drives


Schematic diagram
Package Marking and Ordering Information

Device	Device Package	Device Marking
NCE30TD60B	TO-220	NCE30TD60B
NCE30TD60BF	TO-20F	NCE30TD60BF


TO-220

TO-220F
Absolute Maximum Ratings ($T_C=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	TO-220	TO-220F	Units
V_{CES}	Collector-Emitter Voltage	600		V
V_{GES}	Gate- Emitter Voltage	± 30		V
I_C	Collector Current	60	60*	A
	Collector Current @ $T_C = 100^\circ\text{C}$	30	30*	A
I_{Cplus}	Pulsed Collector Current, t_p limited by T_{jmax}	90	90*	A
-	turn off safe operating area, $V_{CE}=600\text{V}$, $T_j=150^\circ\text{C}$	90	90*	A
I_F	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	30	30*	A
I_{FM}	Diode Maximum Forward Current	90	90*	A
P_D	Power Dissipation @ $T_C = 25^\circ\text{C}$	190	35.5	W
	Power Dissipation @ $T_C = 100^\circ\text{C}$	76	14.2	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum Temperature for Soldering	260		$^\circ\text{C}$
t_{sc}	Short circuit withstand time $V_{GE}=15\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits<1000Time between short circuits: $\geq 1.0\text{s}$, $T_j\leq 150^\circ\text{C}$	3		us

Thermal Characteristic

Symbol	Parameter	TO-220	TO-220F	Units
R _{θJC}	Thermal Resistance, Junction to case for IGBT	0.65	2.65	°C/W
R _{θJC}	Thermal Resistance, Junction to case for Diode	1.08	3.9	°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient	40	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	μA
I _{GES(F)}	Gate to Emitter Forward Leakage	V _{GE} =+30V, V _{CE} =0V	--	--	200	nA
I _{GES(R)}	Gate to Source Reverse Leakage	V _{GE} =-30V, V _{CE} =0V	--	--	200	nA
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C =30A, T _J =25°C	--	1.7	1.9	V
		V _{GE} =15V, T _J =150°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	--	3552	--	pF
C _{oes}	Output Capacitance		--	106	--	
C _{res}	Reverse Transfer Capacitance		--	67	--	
Q _g	Total Gate Charge	V _{CC} =480V, I _C =30A V _{GE} =15V	--	132	--	nC
Q _{ge}	Gate to Emitter Charge		--	28	--	
Q _{gc}	Gate to Collector Charge		--	54	--	
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, T _J ≤150°C	--	190	--	A
Switching Characteristics						
t _{d(ON)}	Turn-on Delay Time	V _{CC} =400V, I _C =30A V _{GE} =0/15V, R _g =5Ω Inductive Load	--	19	--	ns
t _r	Rise Time		--	17	--	
t _{d(OFF)}	Turn-Off Delay Time		--	166	--	
t _f	Fall Time		--	16	--	
E _{on}	Turn-On Switching Loss		--	0.36	--	mJ
E _{off}	Turn-Off Switching Loss		--	0.32	--	
E _{ts}	Total Switching Loss		--	0.68	--	

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

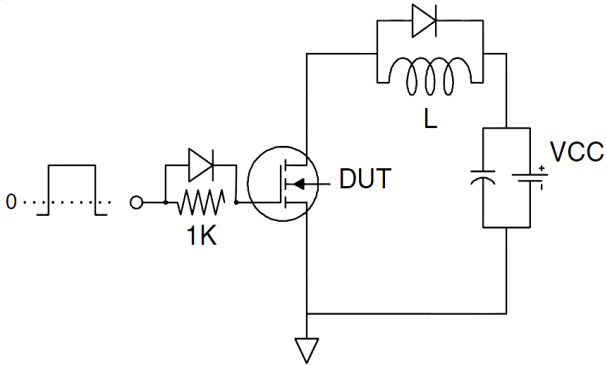
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
V _{FM}	Diode Forward Voltage	I _F =30A	--	1.7	1.9	V
T _{rr}	Reverse Recovery Time	I _F =30A, di/dt=200A/us	--	178	--	ns
I _{RRM}	Diode Peak Reverse Recovery Current		--	4	--	A
Q _{rr}	Reverse Recovery Charge		--	0.4	--	μC

Pulse width t_{tp}≤380μs, δ≤2%

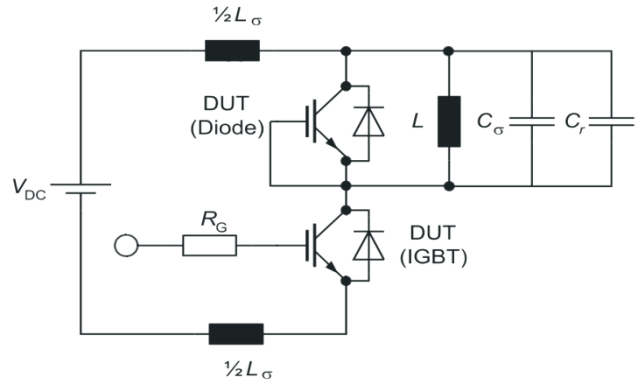
* TO-220F Ic Follow TO-220

Test Circuit

1) Gate Charge Test Circuit

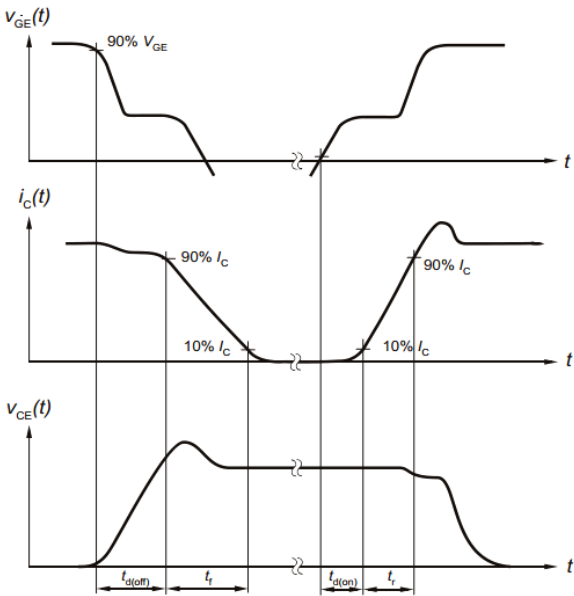


2) Switch Time Test Circuit

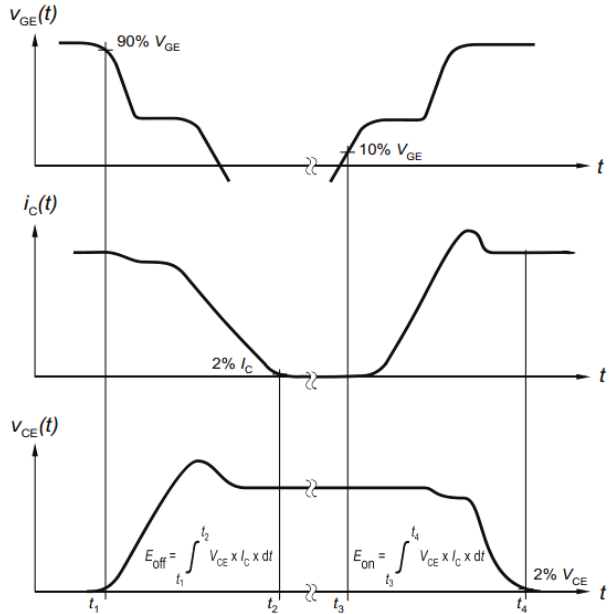


Switching characteristics

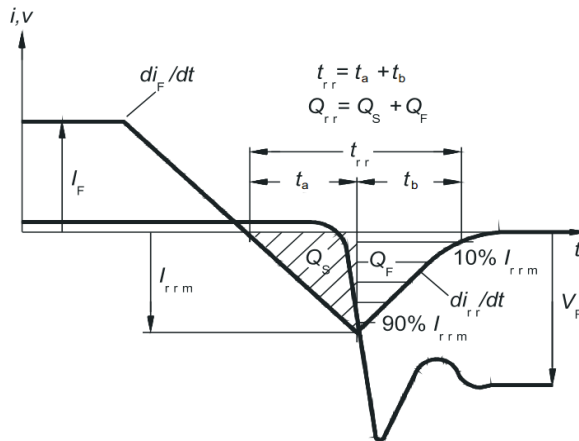
1) definition of switching times



2) definition of switching losses



3) Definition of diode switching characteristics



Typical Electrical and Thermal Characteristics

Figure 1 Output Characteristics

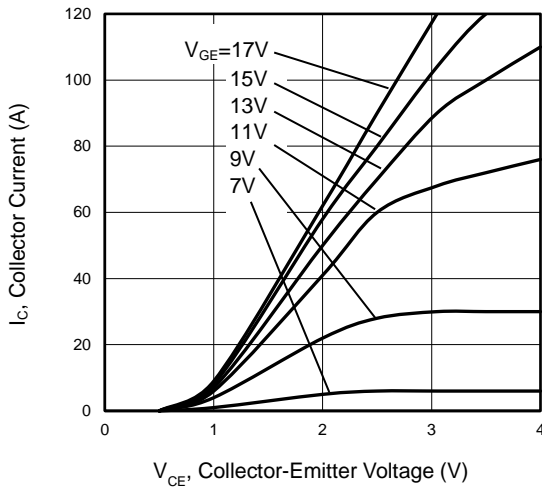


Figure 2 Transfer Characteristics

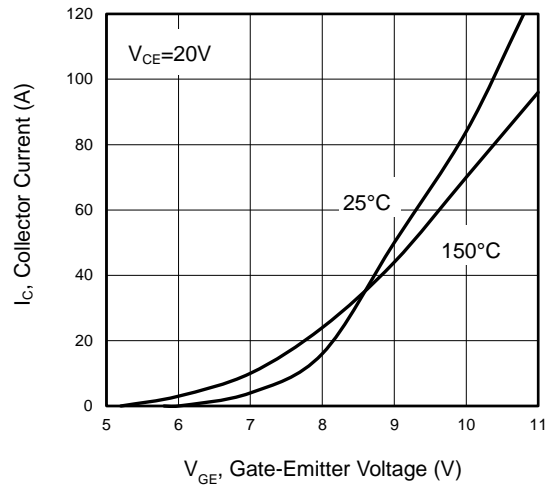


Figure 3 V_{CEsat} vs. Case Temperature

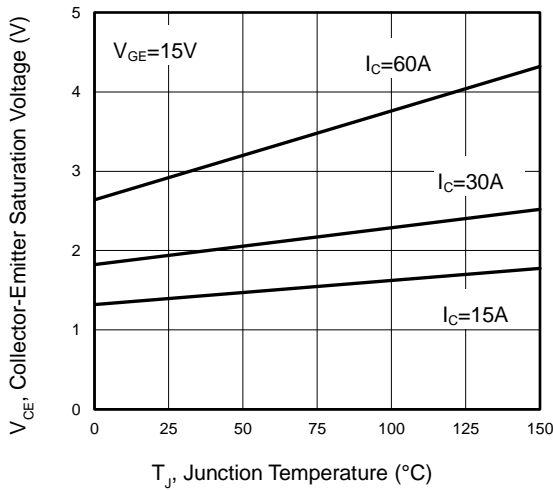


Figure 4 Saturation Voltage vs. V_{GE}

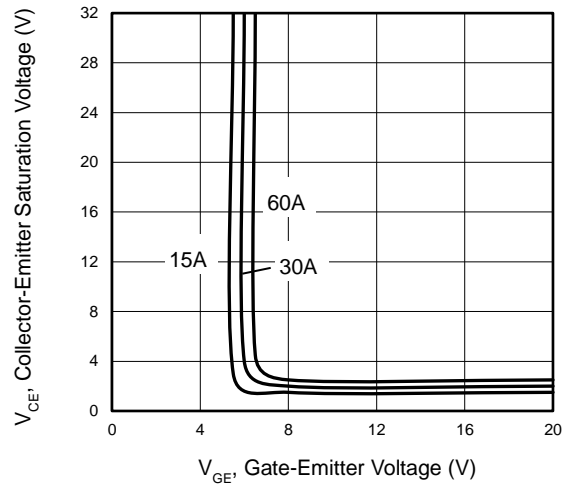


Figure 5 Capacitance Characteristics

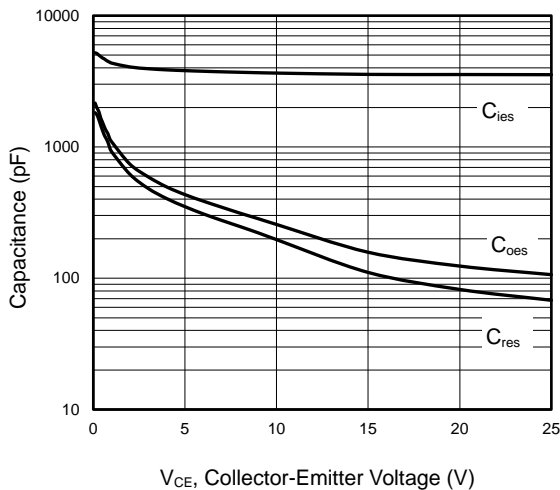
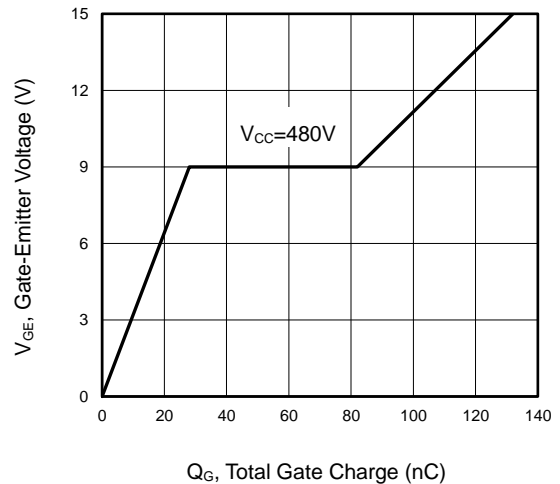


Figure 6 Gate charge waveform



Typical Electrical and Thermal Characteristics

Figure 7 Gate-emitter Threshold Voltage as a Function of Junction Temperature

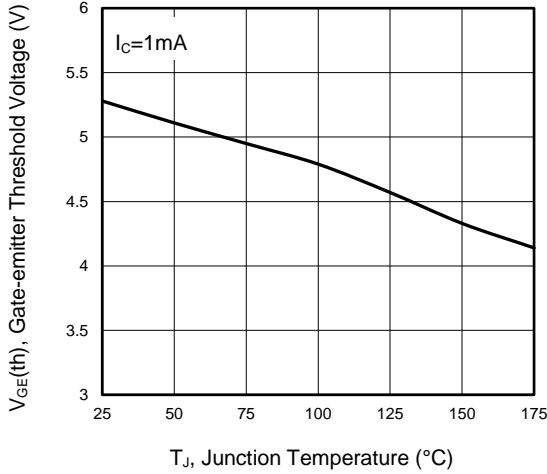


Figure 8 Power Dissipation as a Function of Case Temperature

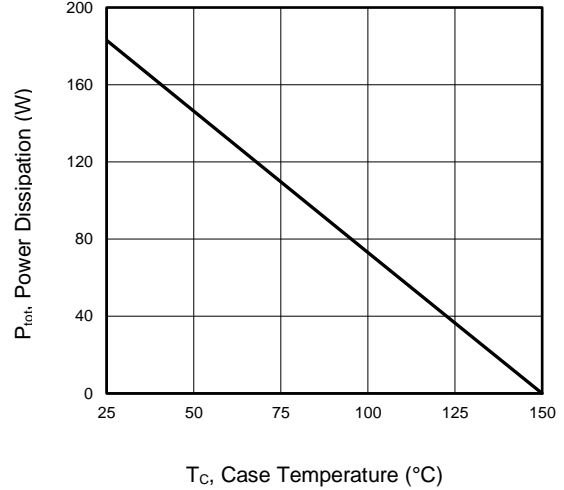


Figure 9 Typical Switching Times as a Function of Gate Resistor

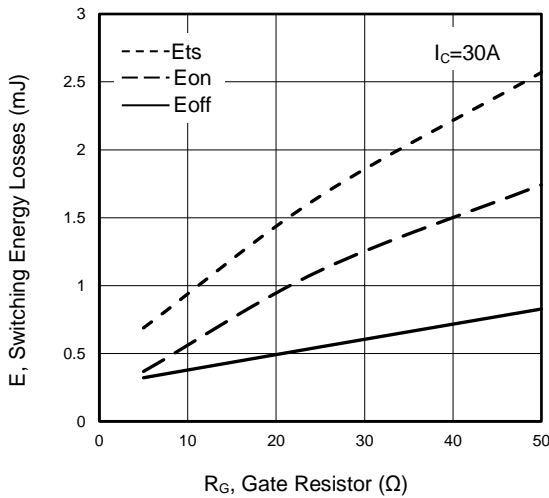


Figure 10 Typical Switching Times as a Function of Junction Temperature

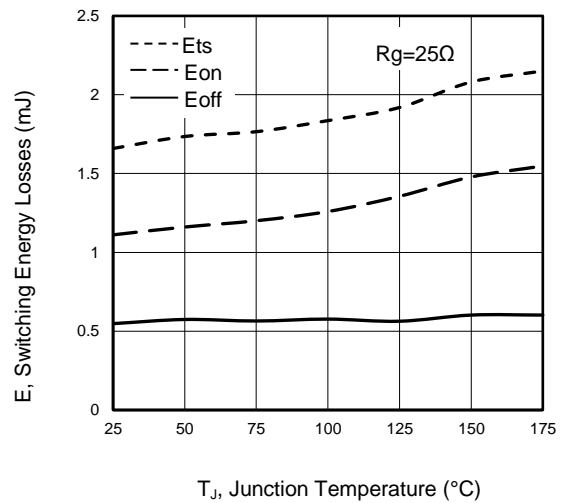


Figure 11 Typical Collector-emitter Saturation Voltage as a function of Collector Current

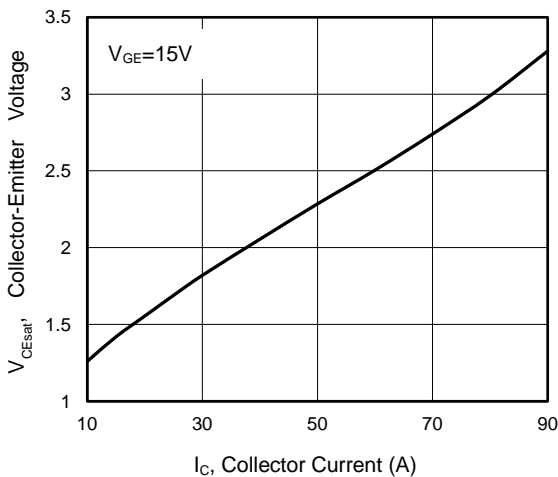
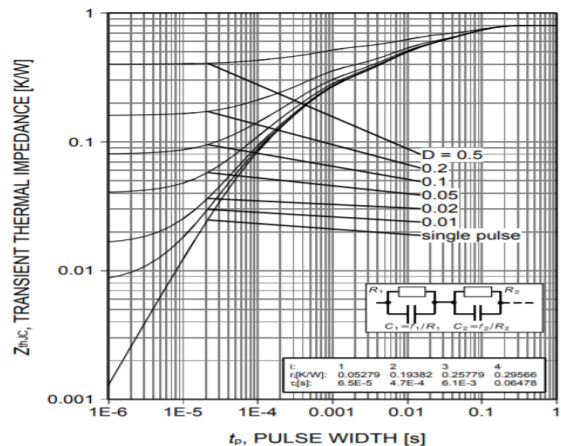
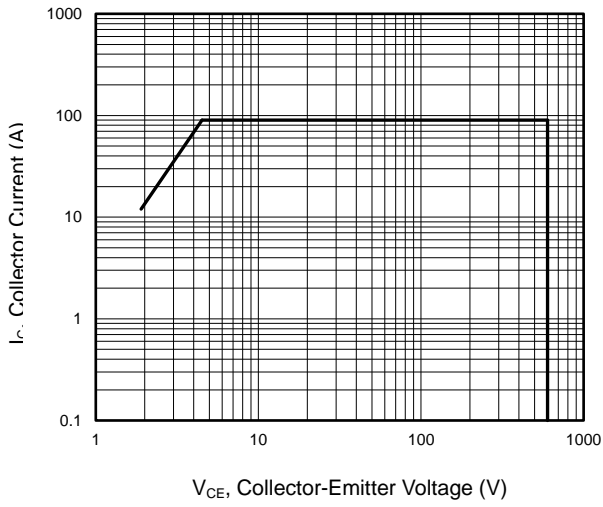


Figure 12 Transient Thermal Impedance for TO-220

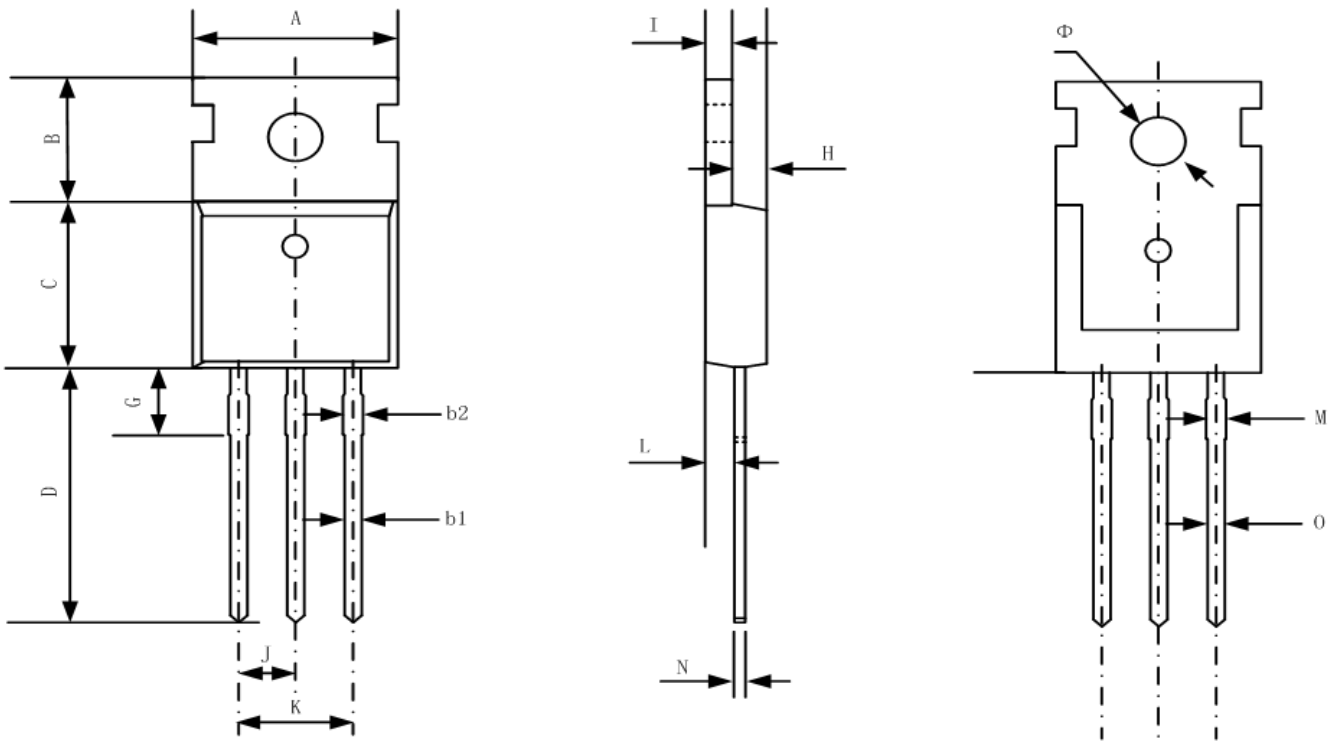


Typical Electrical and Thermal Characteristics

Figure 13 Forward Bias Safe Operating Area

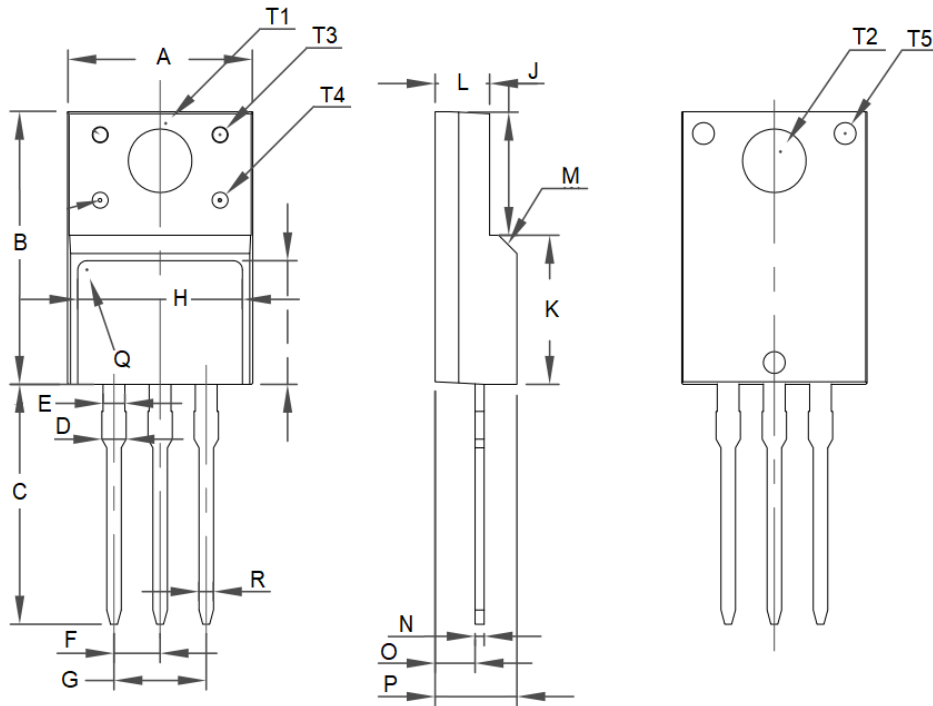


TO-220-3L-C Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	9.70	10.20	0.38	0.40
B	6.30	6.70	0.25	0.26
C	9.00	9.47	0.35	0.37
D	12.78	13.38	0.50	0.53
G	2.65 REF		0.104 REF	
H	3.00	3.40	0.12	0.13
I	1.25	1.40	0.05	0.06
J	2.40	2.70	0.09	0.11
K	5.00	5.15	0.20	0.20
L	2.20	2.60	0.09	0.10
M	1.25	1.45	0.05	0.06
N	0.45	0.60	0.02	0.02
O	0.70	0.90	0.03	0.04
Φ	3.6 REF		0.142 REF	

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	

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