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September 2013

FGPF10N60UNDF

600 V, 10 A

Short Circuit Rated IGBT

Features

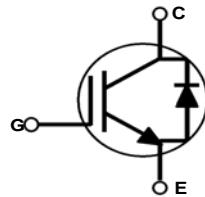
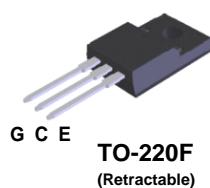
- Short Circuit Rated 10us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

General Description

Using advanced NPT IGBT technology, Fairchild's the NPT IGBTs offer the optimum performance for low-power inverter-driven applications where low-losses and short-circuit ruggedness features are essential, such as sewing machine, CNC, motor control and home appliances.

Applications

- Sewing Machine, CNC, Home Appliances, Motor Control



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	600	V
V_{GES}	Gate to Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	20	A
	Collector Current @ $T_C = 100^\circ\text{C}$	10	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	30	A
I_F	Diode Forward Current @ $T_C = 25^\circ\text{C}$	10	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	5	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	42	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	17	W
T_J	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Notes:

1: Repetitive rating: Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case	-	3.0	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case	-	5.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)	-	62.5	$^\circ\text{C/W}$

Notes:

2: Mountde on 1" square PCB (FR4 or G-10 material)

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGPF10N60UNDF	FGPF10N60UNDF	TO-220F	-	-	50ea

Electrical Characteristics of the IGBT

$T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0 \text{ V}$, $I_C = 250 \mu\text{A}$	600	-	-	V
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, $V_{GE} = 0 \text{ V}$	-	-	1	mA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, $V_{CE} = 0 \text{ V}$	-	-	± 10	μA
On Characteristics						
$V_{GE(\text{th})}$	G-E Threshold Voltage	$I_C = 10 \text{ mA}$, $V_{CE} = V_{GE}$	5.5	6.8	8.5	V
$V_{CE(\text{sat})}$	Collector to Emitter Saturation Voltage	$I_C = 10 \text{ A}$, $V_{GE} = 15 \text{ V}$	-	2	2.45	V
		$I_C = 10 \text{ A}$, $V_{GE} = 15 \text{ V}$, $T_C = 125^\circ\text{C}$	-	2.3	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$	-	517	-	pF
C_{oes}	Output Capacitance		-	65	-	pF
C_{res}	Reverse Transfer Capacitance		-	20	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400 \text{ V}$, $I_C = 10 \text{ A}$, $R_G = 10 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load, $T_C = 25^\circ\text{C}$	-	8.0	-	ns
t_r	Rise Time		-	6.3	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	52.2	-	ns
t_f	Fall Time		-	19.1	24.8	ns
E_{on}	Turn-On Switching Loss		-	0.15	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.05	-	mJ
E_{ts}	Total Switching Loss		-	0.2	-	mJ
$t_{d(on)}$	Turn-On Delay Time		-	8.1	-	ns
t_r	Rise Time	$V_{CC} = 400 \text{ V}$, $I_C = 10 \text{ A}$, $R_G = 10 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load, $T_C = 125^\circ\text{C}$	-	7.3	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	55.1	-	ns
t_f	Fall Time		-	34.2	-	ns
E_{on}	Turn-On Switching Loss		-	0.22	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.08	-	mJ
E_{ts}	Total Switching Loss		-	0.3	-	mJ
T_{sc}	Short Circuit Withstand Time	$V_{CC} = 350 \text{ V}$, $R_G = 100 \Omega$, $V_{GE} = 15 \text{ V}$, $T_C = 150^\circ\text{C}$	10	-	-	μs

Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
Q_g	Total Gate Charge	$V_{CE} = 400 \text{ V}$, $I_C = 10 \text{ A}$, $V_{GE} = 15 \text{ V}$	-	37		nC
Q_{ge}	Gate to Emitter Charge		-	5		nC
Q_{gc}	Gate to Collector Charge		-	21		nC

Electrical Characteristics of the Diode $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
V_{FM}	Diode Forward Voltage	$I_F = 10 \text{ A}$	$T_C = 25^\circ\text{C}$	-	1.8	2.2
			$T_C = 125^\circ\text{C}$	-	1.7	
t_{rr}	Diode Reverse Recovery Time	$I_F = 10 \text{ A}$, $dI_F/dt = 200 \text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	37.7	
			$T_C = 125^\circ\text{C}$	-	78.9	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	75	
			$T_C = 125^\circ\text{C}$	-	221	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

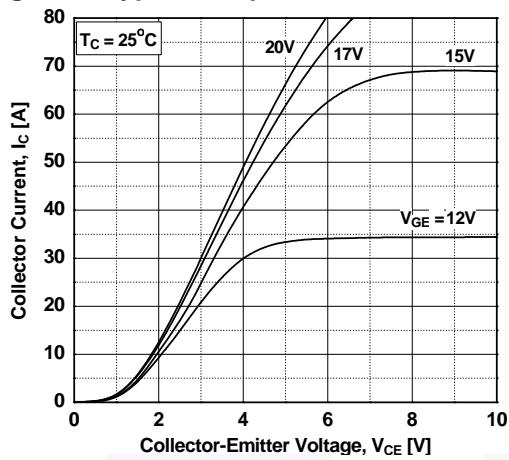


Figure 2. Typical Output Characteristics

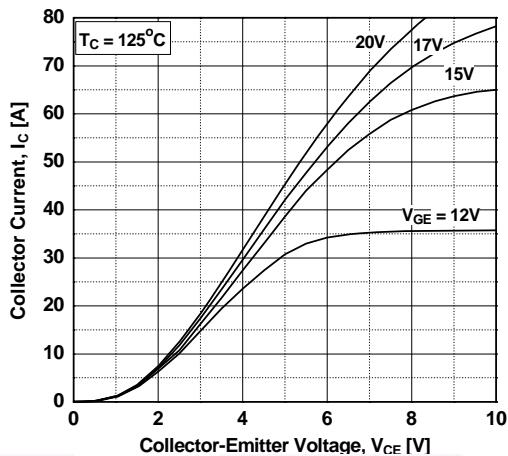


Figure 3. Typical Saturation Voltage Characteristics

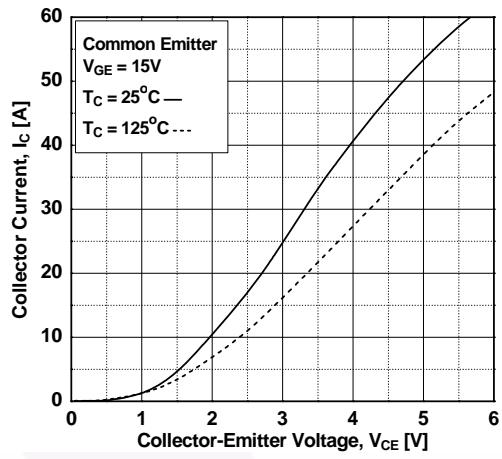


Figure 4. Transfer Characteristics

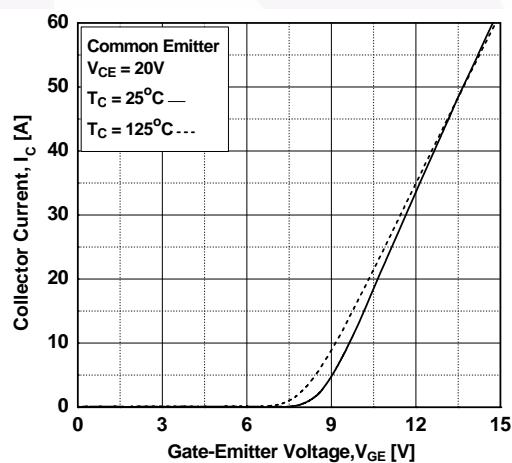


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

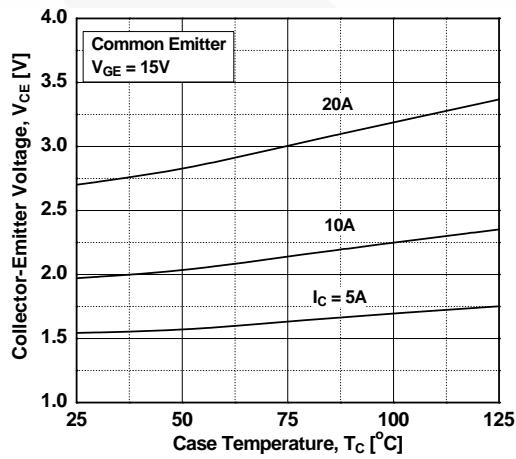
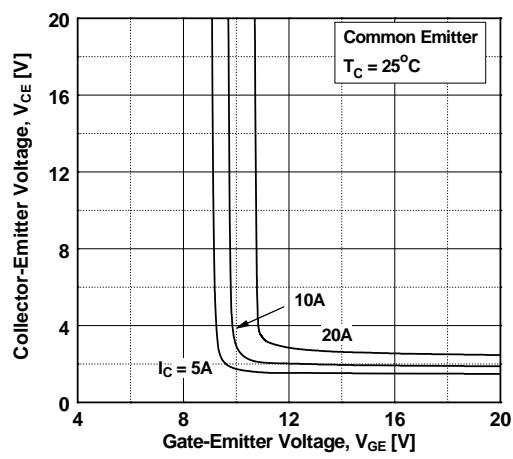


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

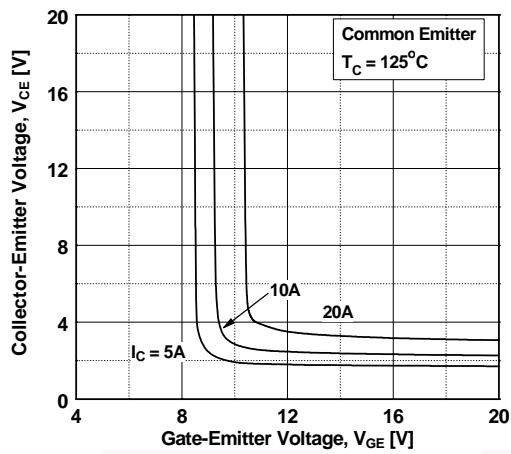


Figure 8. Capacitance Characteristics

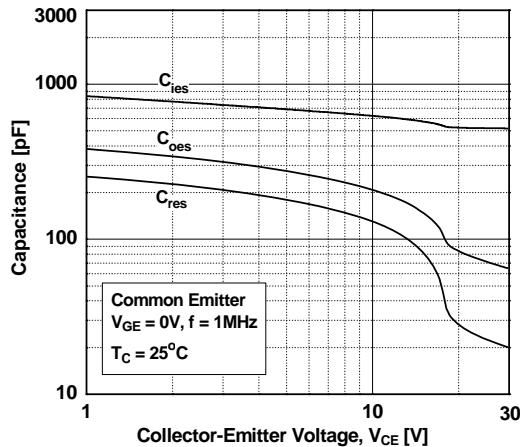


Figure 9. Gate charge Characteristics

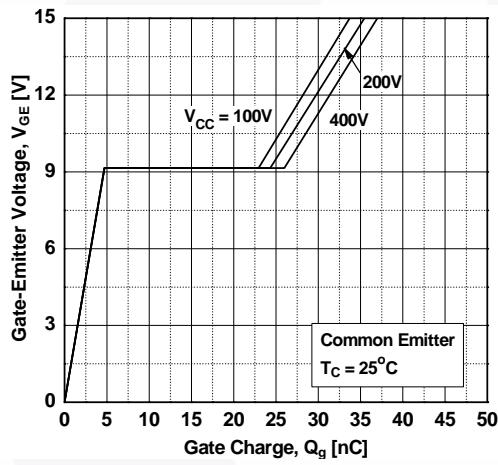


Figure 10. SOA Characteristics

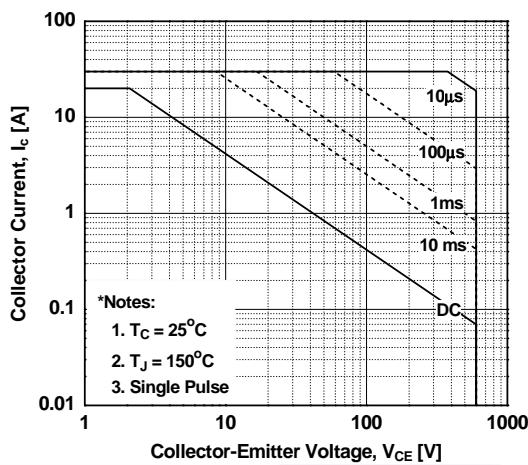


Figure 11. Turn-on Characteristics vs. Gate Resistance

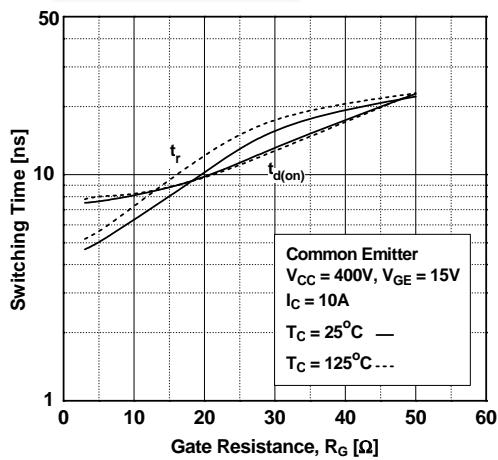
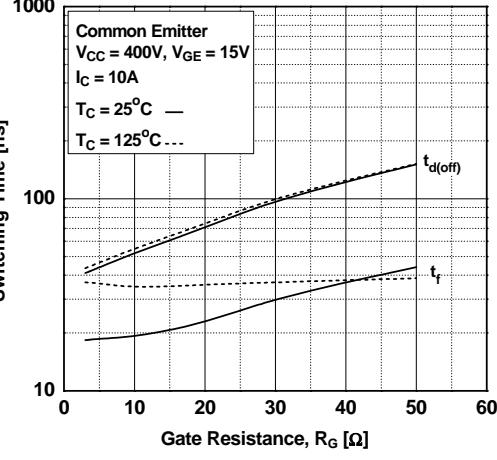


Figure 12. Turn-off Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

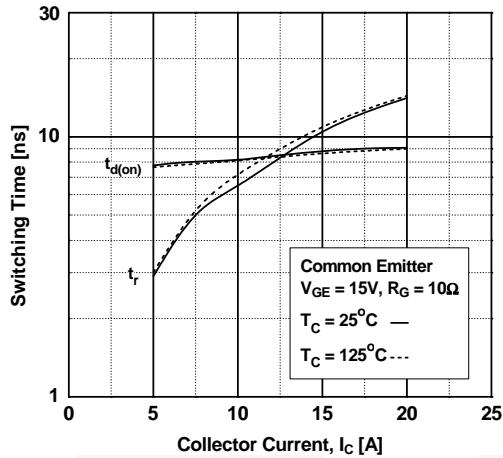


Figure 14. Turn-off Characteristics vs. Collector Current

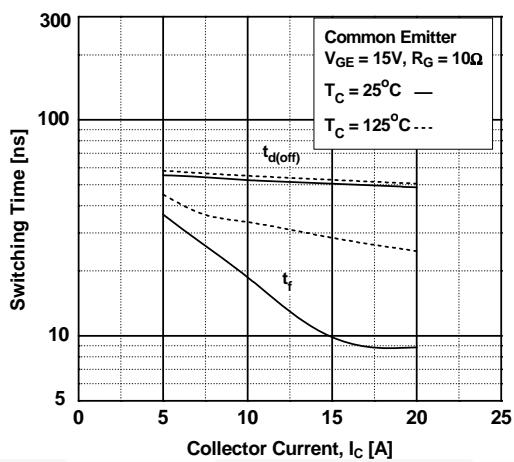


Figure 15. Switching Loss vs. Gate Resistance

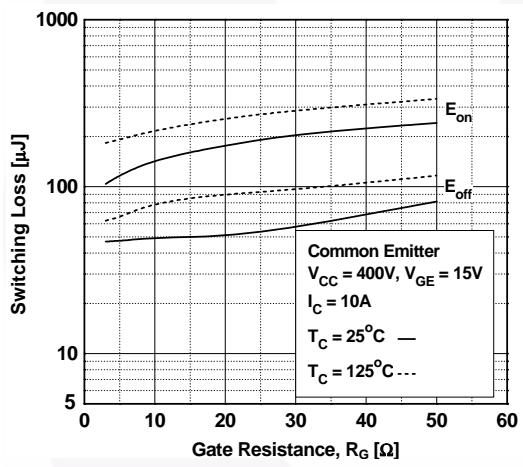


Figure 16. Switching Loss vs. Collector Current

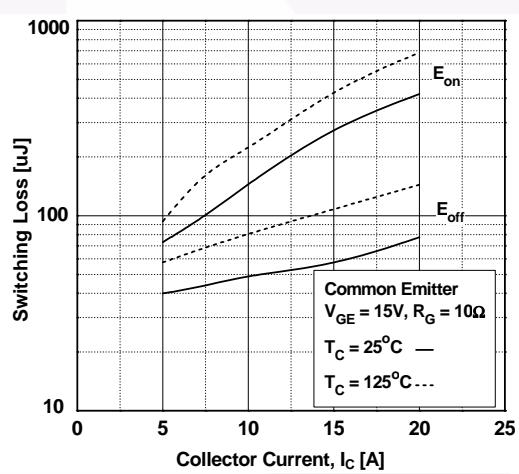


Figure 17. Turn off Switching SOA Characteristics

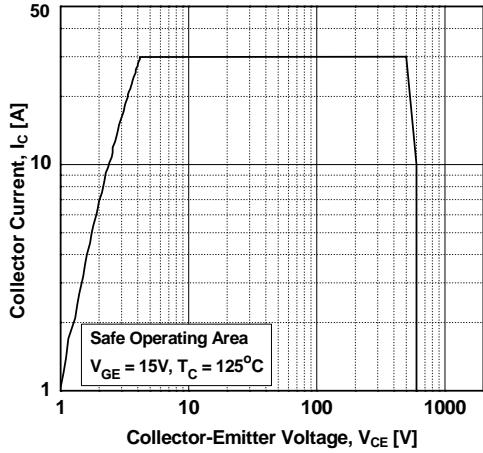
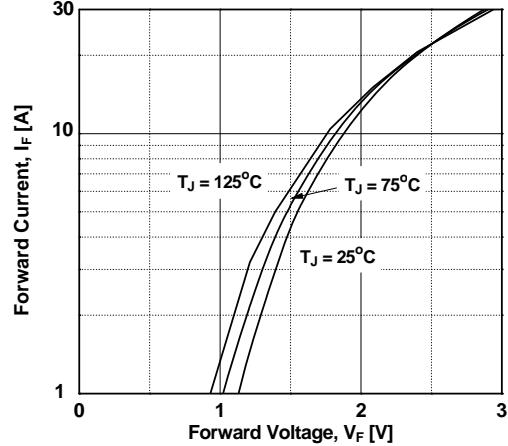


Figure 18. Forward Characteristics



Typical Performance Characteristics

Figure 19. Reverse Current

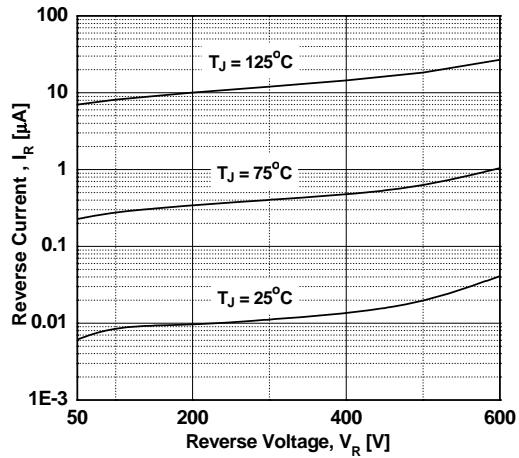


Figure 20. Stored Charge

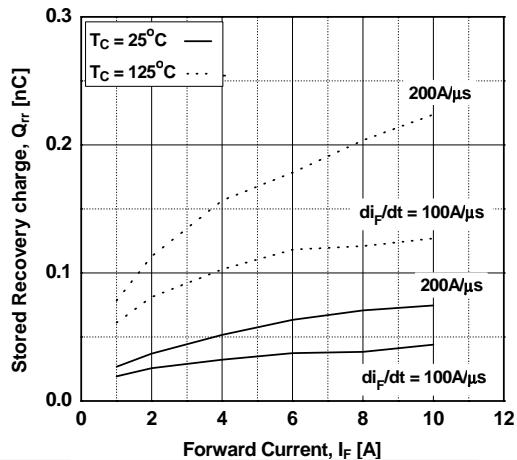


Figure 21. Reverse Recovery Time

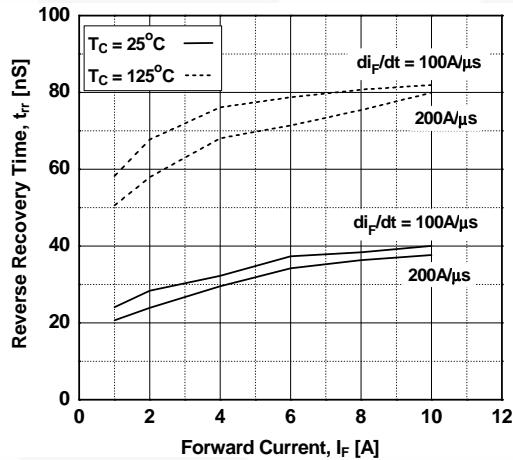
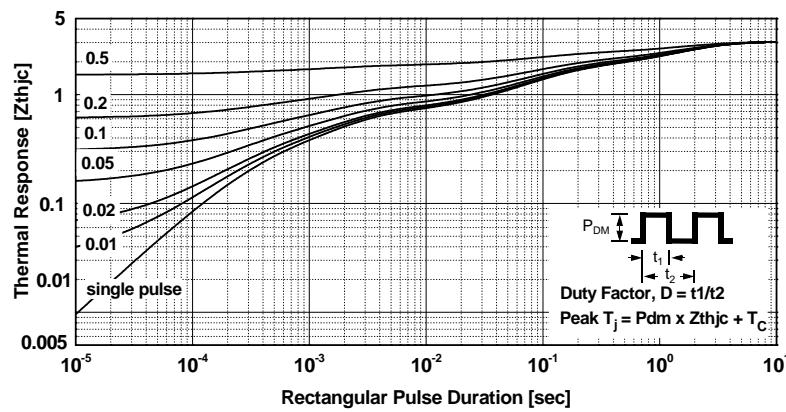


Figure 22. Transient Thermal Impedance of IGBT



Mechanical Dimensions

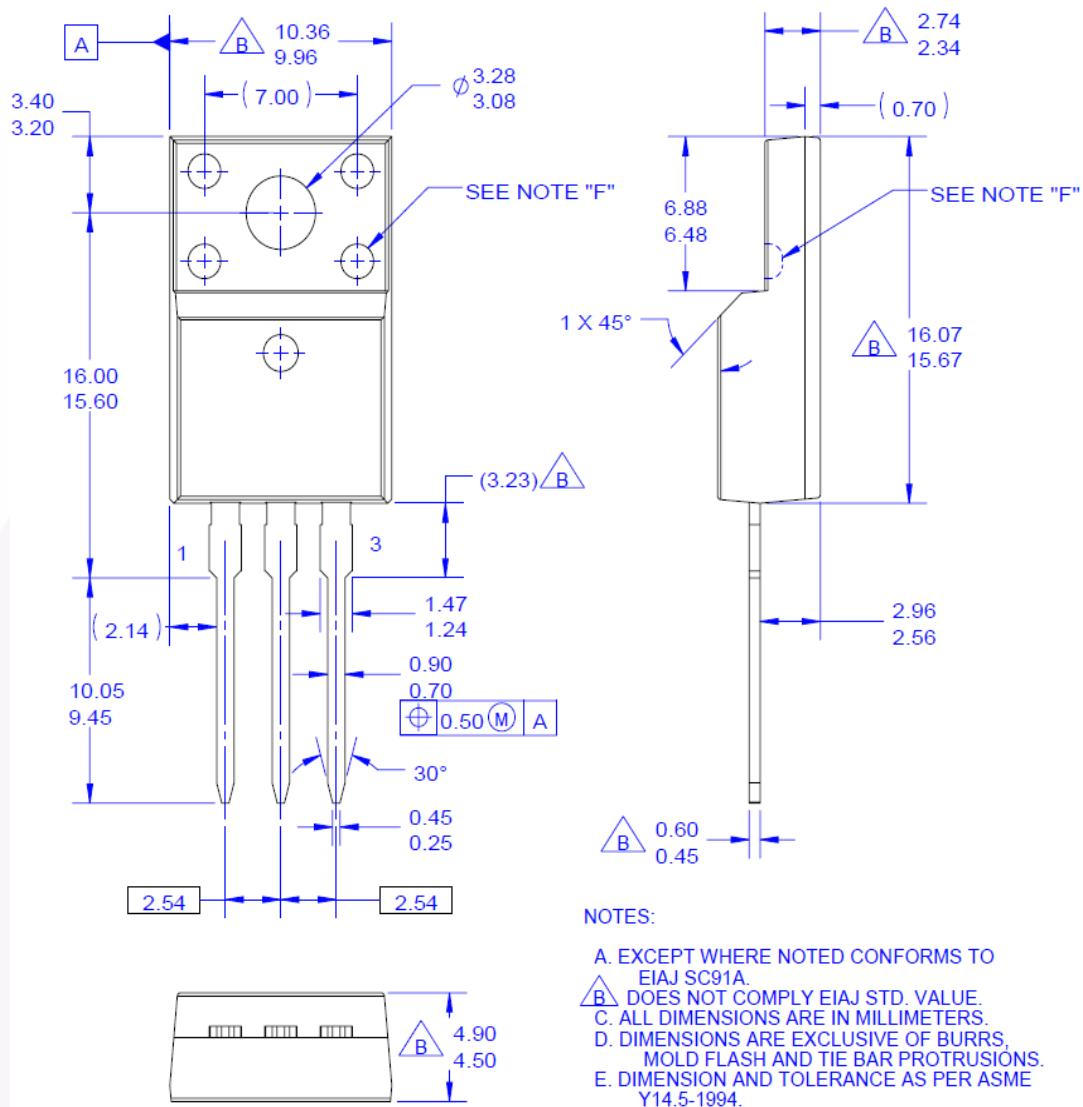


Figure 23. TO-220F 3L - TO220, MOLDED, 3LD, FULL PACK, EIAJ SC91, STRAIGHT LEAD

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Dimensions in Millimeters



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