

# FGP15N60UNDF

## 600V, 15A

### Short Circuit Rated IGBT

#### Features

- Short circuit rated 10us
- High current capability
- High input impedance
- Fast switching
- RoHS compliant

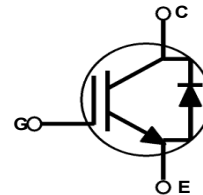
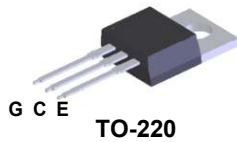


#### Applications

- Home appliance inverter-driven application  
- Air Conditioner, Washing Machine, Refrigerator, Dish Washer
- Industrial Inverter - Sewing Machine, CNC

#### 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 feature are essential.



#### Absolute Maximum Ratings

Symbol	Description	Ratings	Units
$V_{CES}$	Collector to Emitter Voltage	600	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	30	A
	Collector Current @ $T_C = 100^\circ\text{C}$	15	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	45	A
$I_F$	Diode Forward Current @ $T_C = 25^\circ\text{C}$	15	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	178	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	71	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 test , Pulse width=100usec , Duty=0.2,  $V_{GE}=13.5V$

#### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}(IGBT)$	Thermal Resistance, Junction to Case		0.7	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case		2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)		62.5	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGP15N60UNDF	FGP15N60UNDF	TO220	Tube	50ea	-

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	-	-	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	-	-	1	mA
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	-	-	±10	μA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 15mA, V_{CE} = V_{GE}$	5.5	6.8	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 15A, V_{GE} = 15V$	-	2.2	2.7	V
		$I_C = 15A, V_{GE} = 15V, T_C = 125^\circ C$	-	2.7	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$	-	619	-	pF
$C_{oes}$	Output Capacitance		-	80	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	24	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 15A, R_G = 10\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 25^\circ C$	-	9.3	-	ns
$t_r$	Rise Time		-	9.8	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	54.8	-	ns
$t_f$	Fall Time		-	9.9	12.8	ns
$E_{on}$	Turn-On Switching Loss		-	0.37	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	0.067	-	mJ
$E_{ts}$	Total Switching Loss		-	0.44	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 15A, R_G = 10\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 125^\circ C$	-	8.9	-	ns
$t_r$	Rise Time		-	9.9	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	56.6	-	ns
$t_f$	Fall Time		-	13.2	-	ns
$E_{on}$	Turn-On Switching Loss		-	0.54	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	0.11	-	mJ
$E_{ts}$	Total Switching Loss		-	0.65	-	mJ
$T_{sc}$	Short Circuit Withstand Time	$V_{CC} = 350V, R_G = 100\Omega, V_{GE} = 15V, T_C = 150^\circ C$	10	-	-	μs

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

$Q_g$	Total Gate Charge	$V_{CE} = 400\text{V}, I_C = 15\text{A},$ $V_{GE} = 15\text{V}$	-	43	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	6	-	nC
$Q_{gc}$	Gate to Collector Charge		-	26	-	nC

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Units	
$V_{FM}$	Diode Forward Voltage	$I_F = 15\text{A}$	$T_C = 25^\circ\text{C}$	-	1.6	2.2	V
			$T_C = 125^\circ\text{C}$	-	1.5	-	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 15\text{A}, dI_F/dt = 200\text{A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	82.4	-	ns
			$T_C = 125^\circ\text{C}$	-	142	-	
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	213	-	nC
			$T_C = 125^\circ\text{C}$	-	541	-	

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

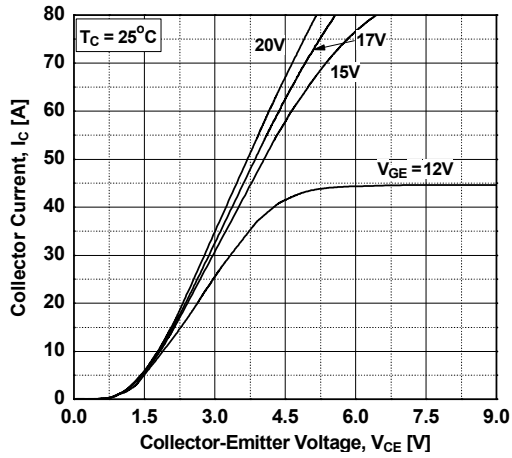


Figure 2. Typical Output Characteristics

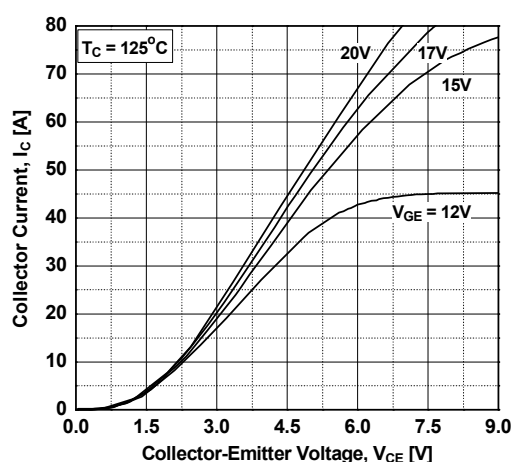


Figure 3. Typical Saturation Voltage Characteristics

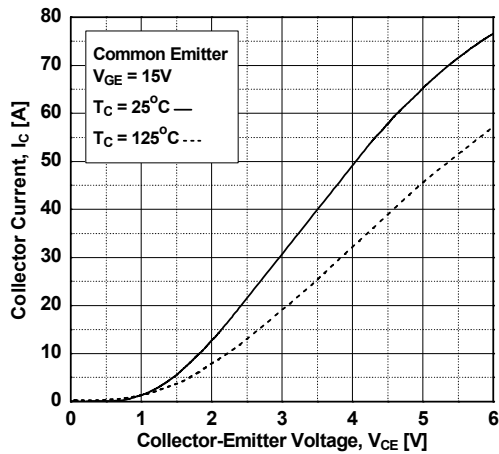


Figure 4. Transfer Characteristics

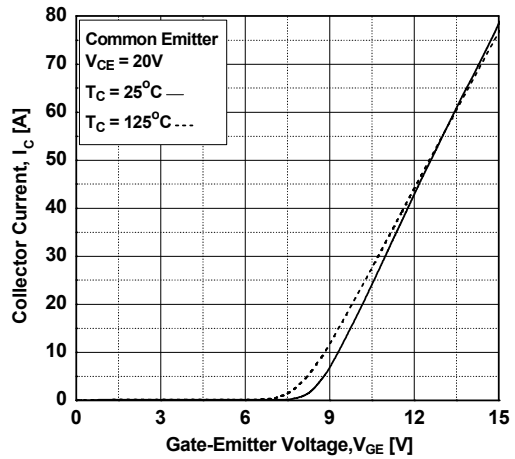


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

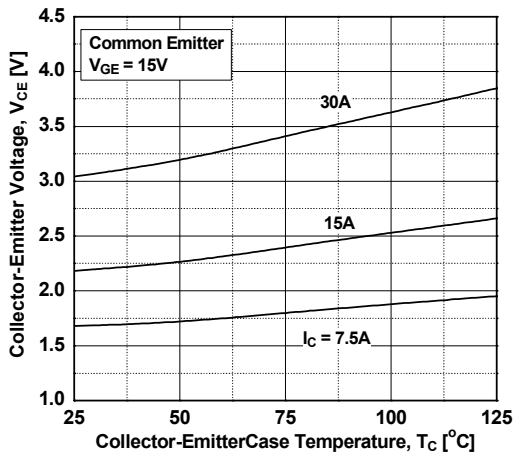
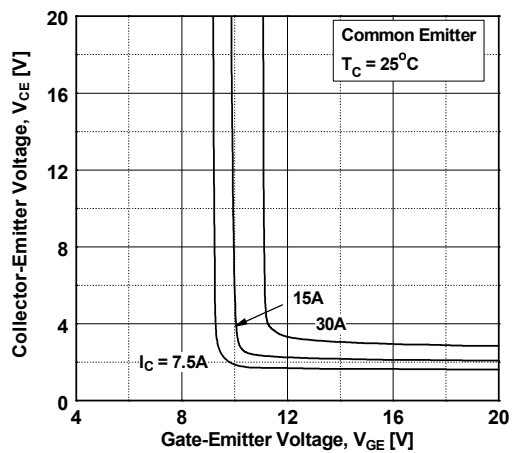


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

Figure 7. Saturation Voltage vs.  $V_{GE}$

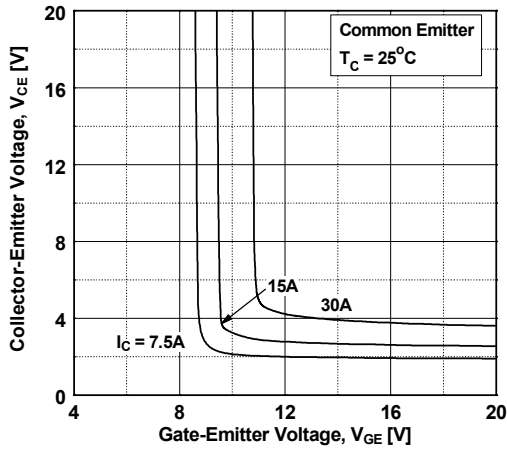


Figure 8. Capacitance Characteristics

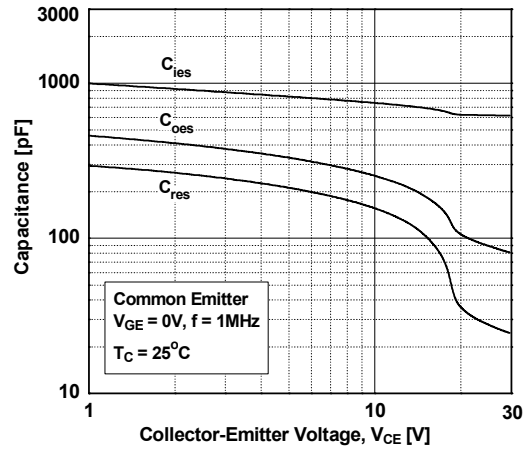


Figure 9. Gate charge Characteristics

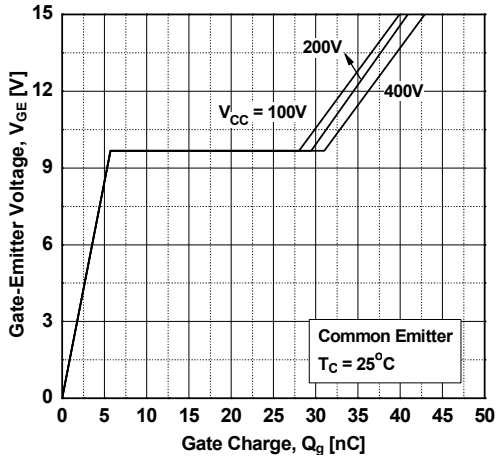


Figure 10. SOA Characteristics

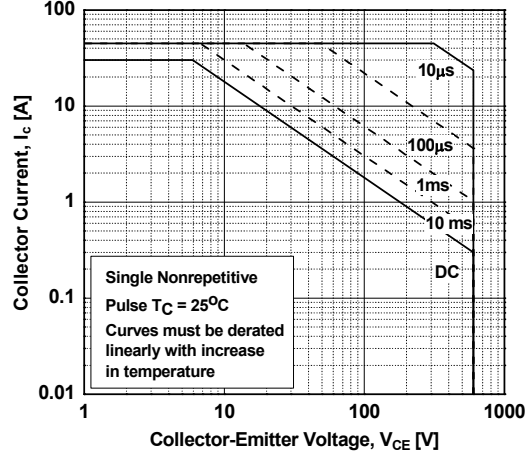


Figure 11. Turn-on Characteristics vs. Gate Resistance

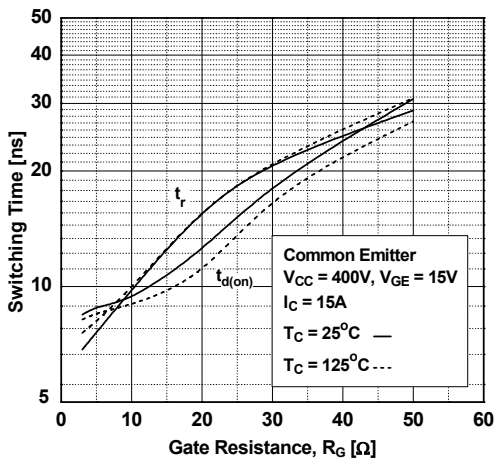
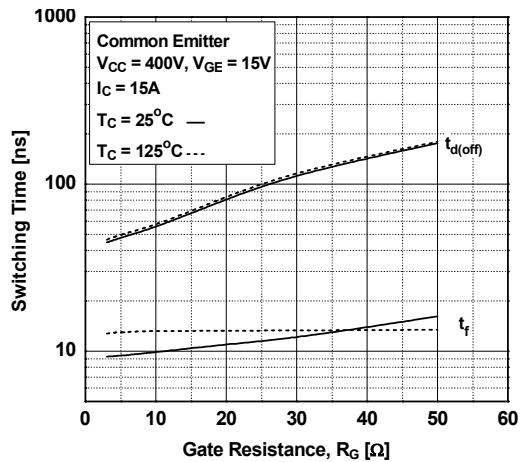
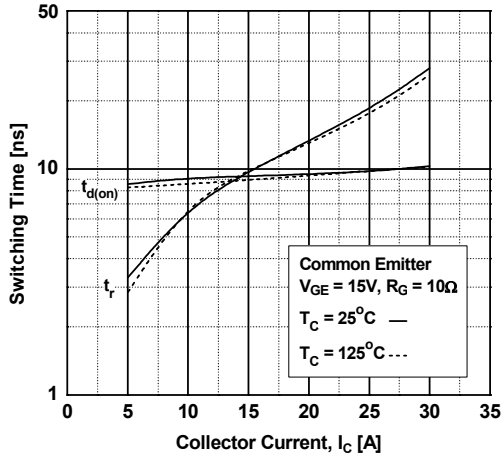


Figure 12. Turn-off Characteristics vs. Gate Resistance

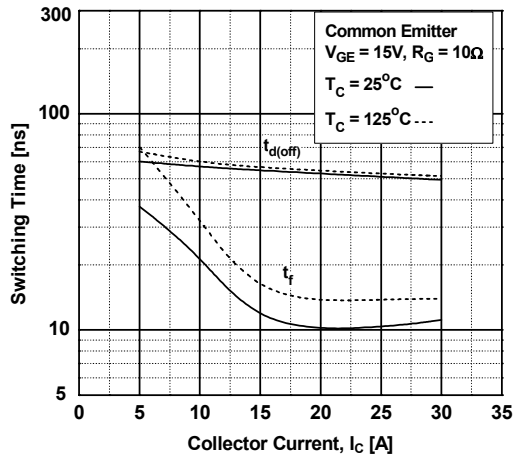


### Typical Performance Characteristics

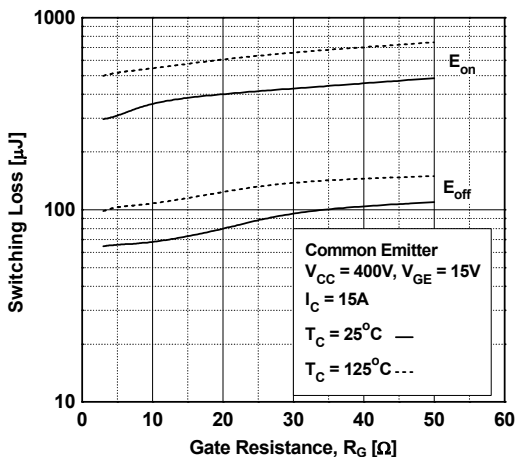
**Figure 13. Turn-on Characteristics vs. Collector Current**



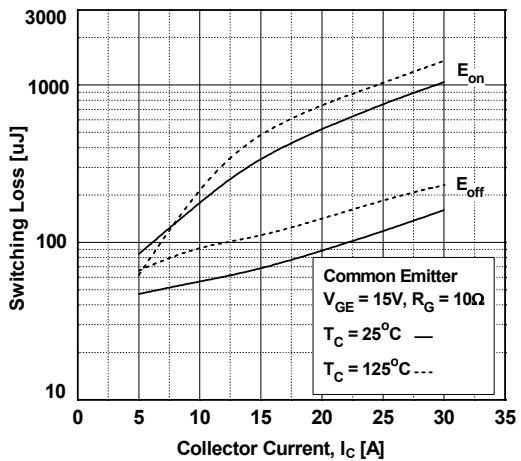
**Figure 14. Turn-off Characteristics vs. Collector Current**



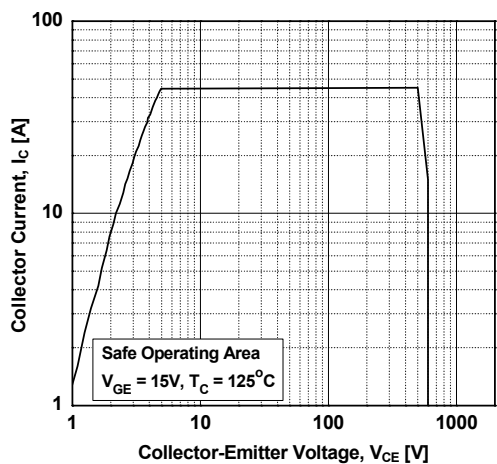
**Figure 15. Switching Loss vs. Gate Resistance**



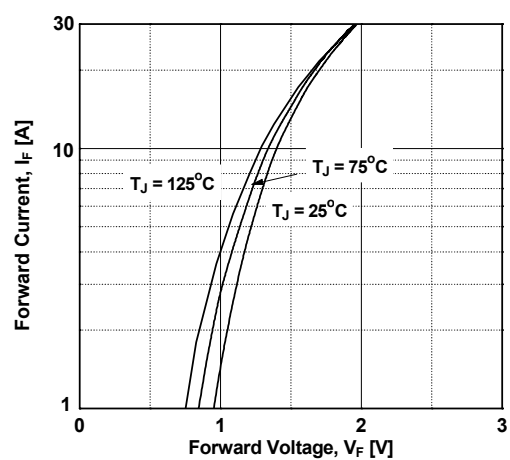
**Figure 16. Switching Loss vs. Collector Current**



**Figure 17. Turn off Switching SOA Characteristics**



**Figure 18. Forward Characteristics**



## Typical Performance Characteristics

Figure 19. Reverse Recovery Current

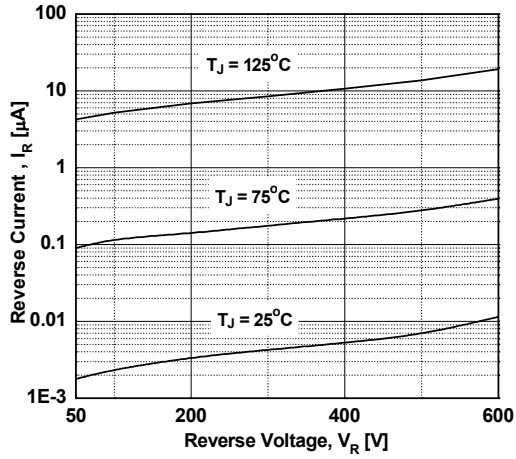


Figure 20. Stored Charge

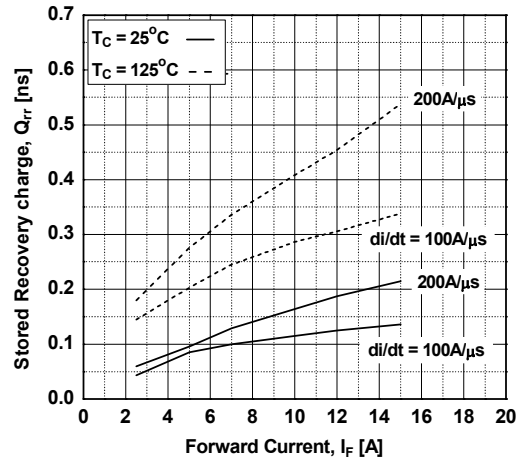


Figure 21. Reverse Recovery Time

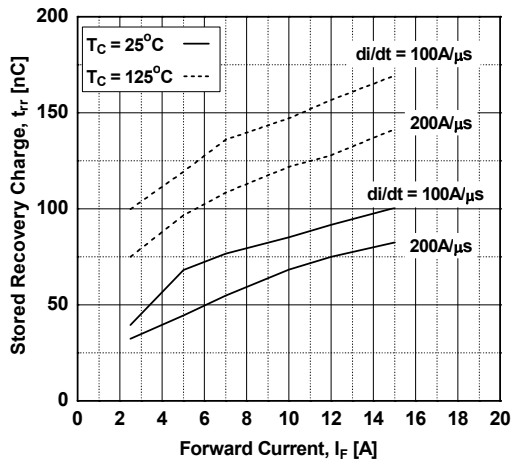
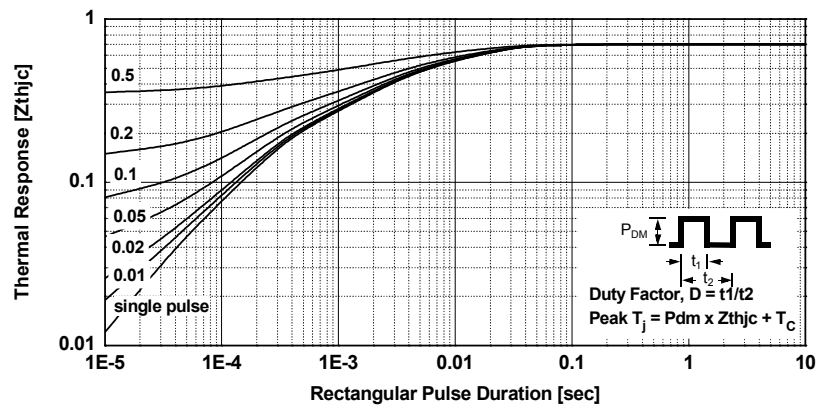
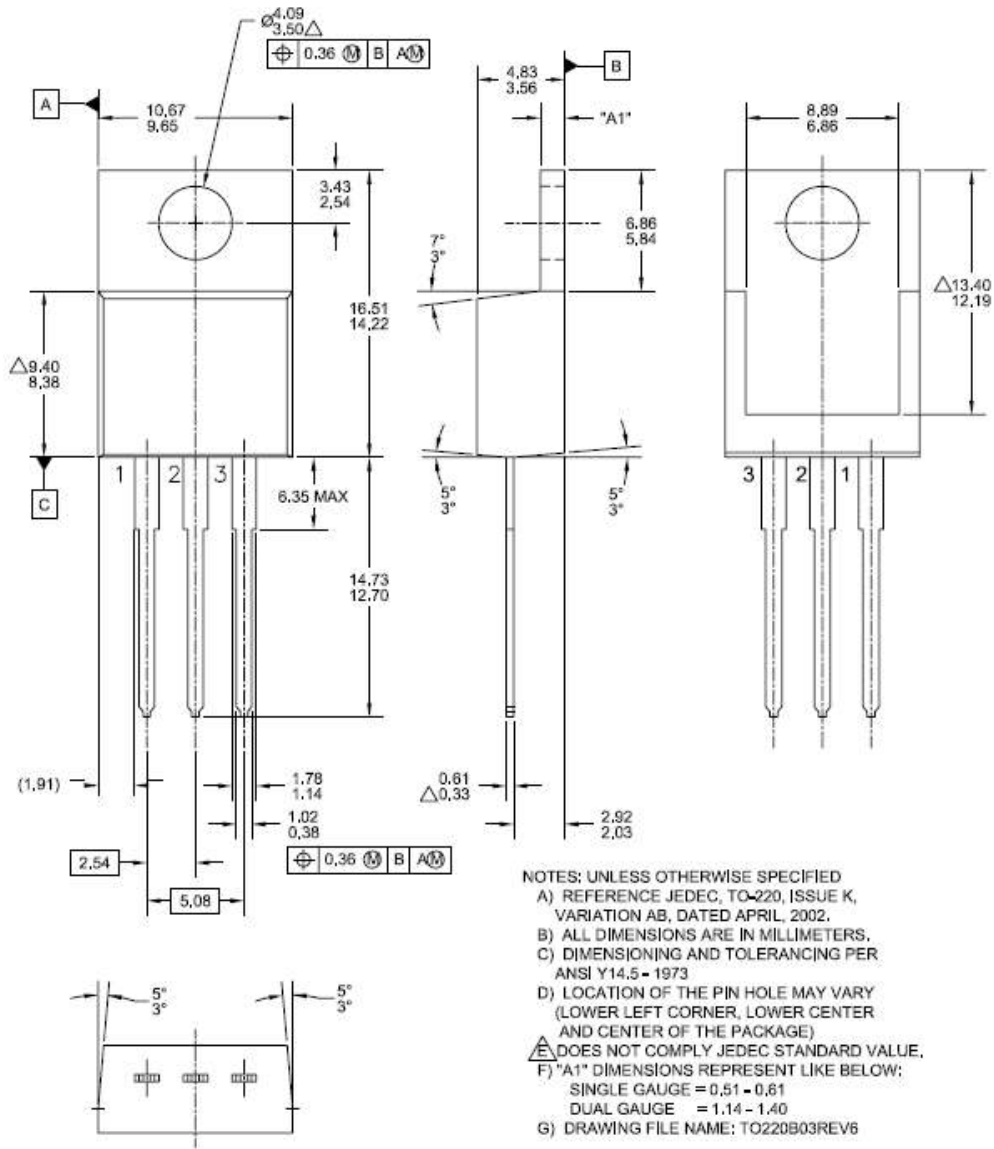


Figure 22. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-220











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| FACT Quiet Series™   | Motion-SPM™                                     | SuperSOT™-3   | UniFET™   |
| FACT®  | mWSaver™  | SuperSOT™-6   | VCX™  |
| FAST®  | OptoHiT™  | SuperSOT™-8   | VisualMax™  |
| FastvCore™   | OPTOLOGIC®                                      | SupreMOS®   | VoltagePlus™  |
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