

# FGP15N60UNDF

## 600 V, 15 A

### Short Circuit Rated IGBT



#### Features

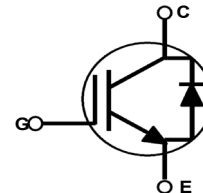
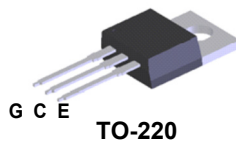
- Short Circuit Rated 10us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

#### 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	$\pm 20$	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
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	71	W
$P_D$	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=100 usec , Duty=0.2,  $V_{GE}=13.5\text{ V}$

#### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}(\text{IGBT})$	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.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	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
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 15\text{ mA}, V_{CE} = V_{GE}$	5.5	6.8	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 15\text{ A}, V_{GE} = 15\text{ V}$	-	2.2	2.7	V
		$I_C = 15\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$	-	2.7	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	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	$V_{CC} = 400\text{ V}, I_C = 15\text{ A}, R_G = 10\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 25^\circ\text{C}$	-	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	$V_{CC} = 400\text{ V}, I_C = 15\text{ A}, R_G = 10\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}, T_C = 125^\circ\text{C}$	-	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	$V_{CC} = 350\text{ V}, R_G = 100\ \Omega, V_{GE} = 15\text{ V}, T_C = 150^\circ\text{C}$	10	-	-	μs

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

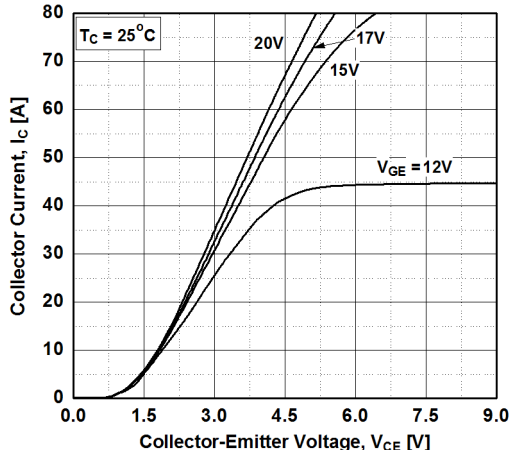
$Q_g$	Total Gate Charge	$V_{CE} = 400\text{ V}, I_C = 15\text{ A},$ $V_{GE} = 15\text{ V}$	-	43	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	6	-	nC
$Q_{gc}$	Gate to Collector Charge		-	26	-	nC

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

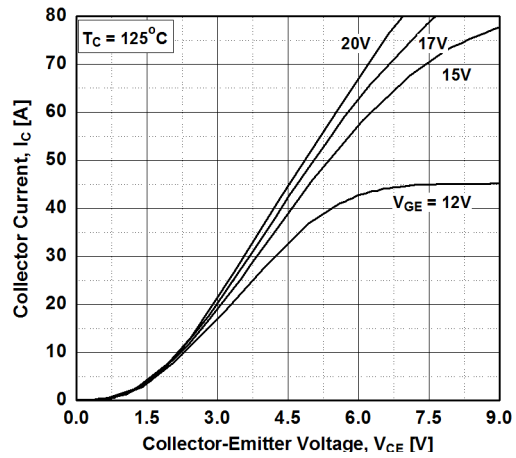
Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
$V_{FM}$	Diode Forward Voltage	$I_F = 15\text{ A}$	$T_C = 25^\circ\text{C}$	-	1.6	2.2	V
			$T_C = 125^\circ\text{C}$	-	1.5	-	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 15\text{ A}, dI_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	82.4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

## Typical Performance Characteristics

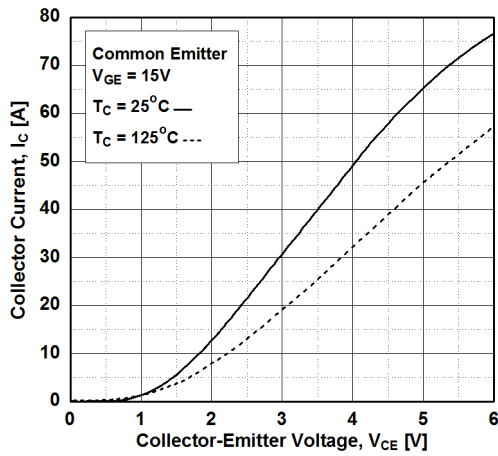
**Figure 1. Typical Output Characteristics**



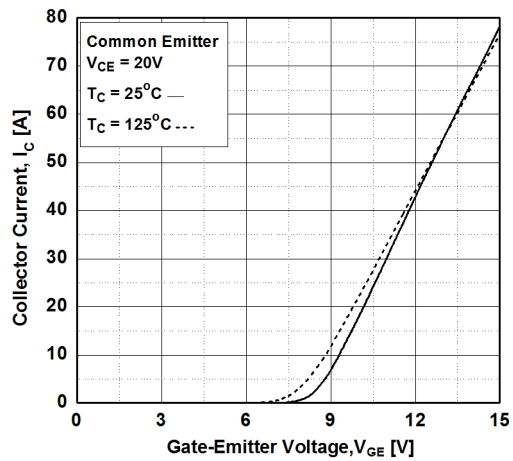
**Figure 2. Typical Output Characteristics**



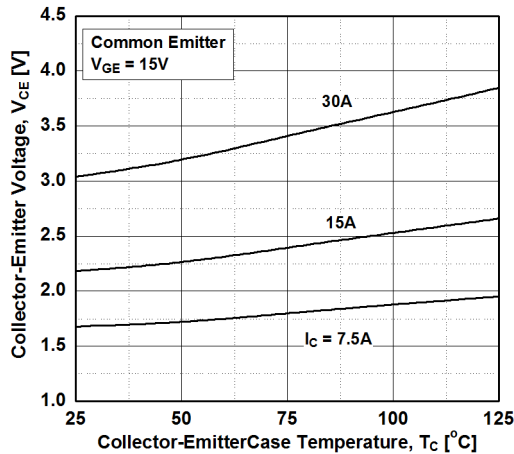
**Figure 3. Typical Saturation Voltage Characteristics**



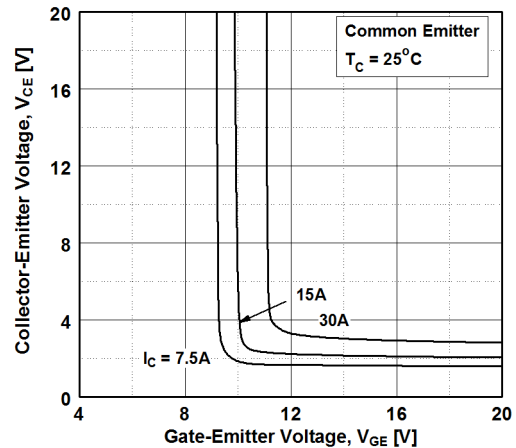
**Figure 4. Transfer Characteristics**



**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.  $V_{GE}$

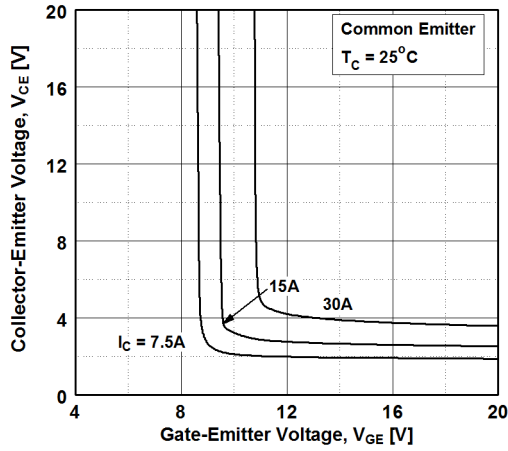


Figure 8. Capacitance Characteristics

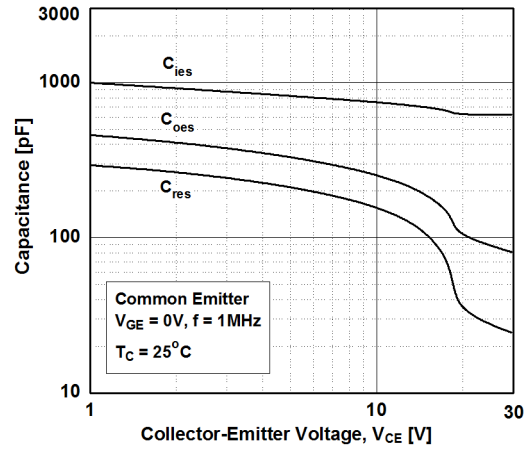


Figure 9. Gate charge Characteristics

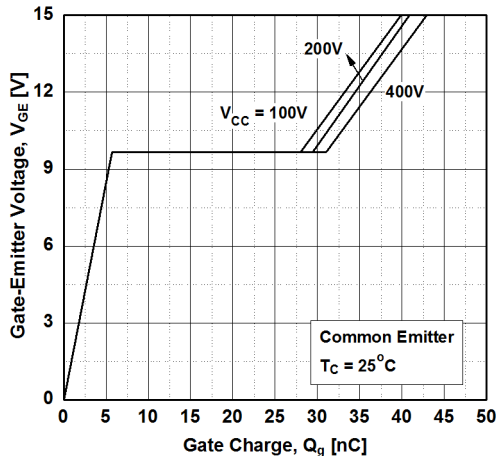


Figure 10. SOA Characteristics

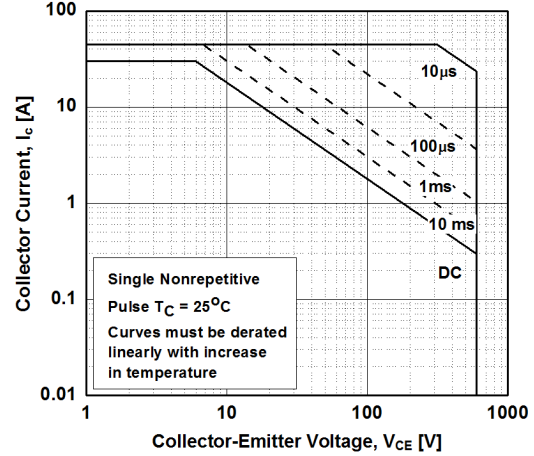


Figure 11. Turn-on Characteristics vs. Gate Resistance

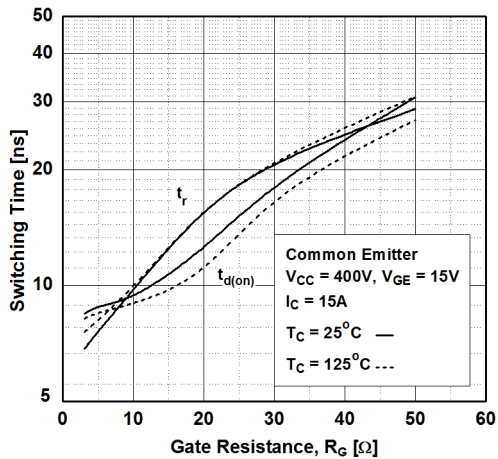
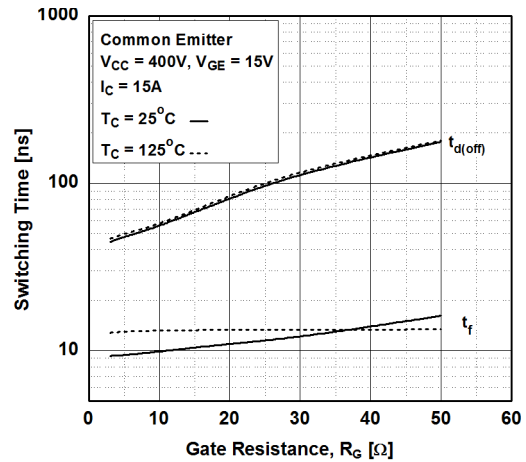
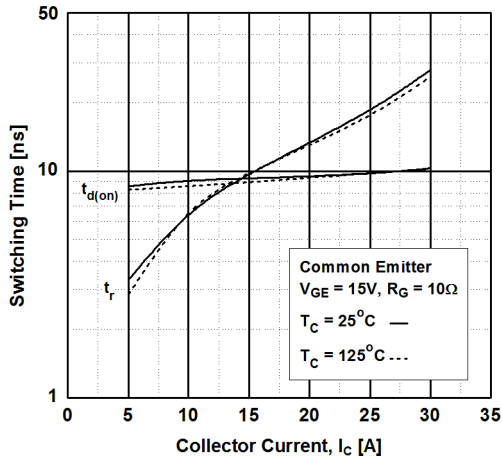


Figure 12. Turn-off Characteristics vs. Gate Resistance

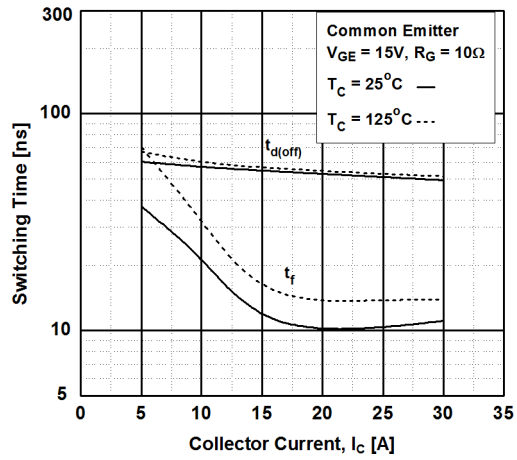


## Typical Performance Characteristics

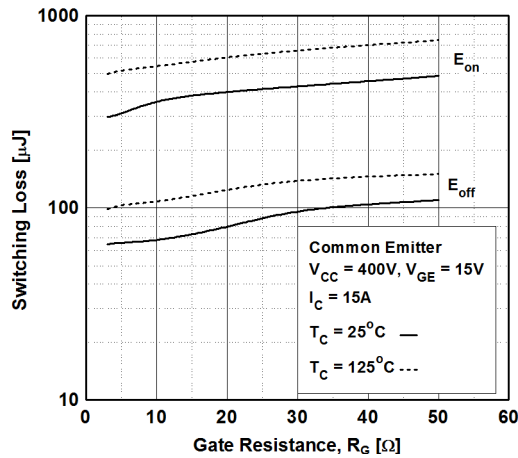
**Figure 13. Turn-on Characteristics vs. Collector Current**



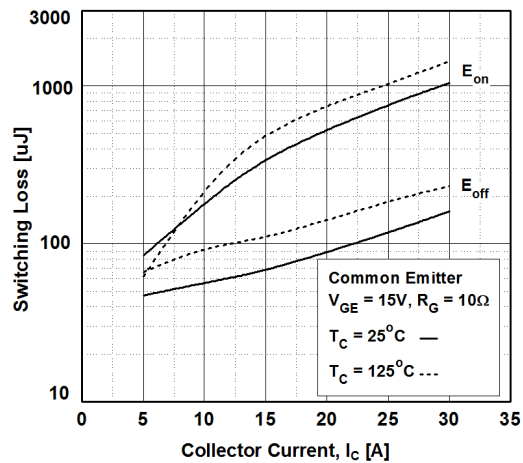
**Figure 14. Turn-off Characteristics vs. Collector Current**



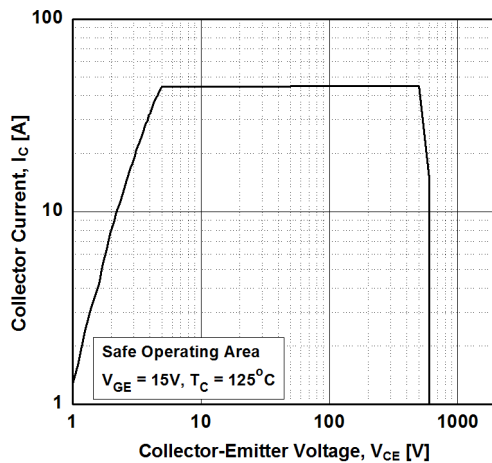
**Figure 15. Switching Loss vs. Gate Resistance**



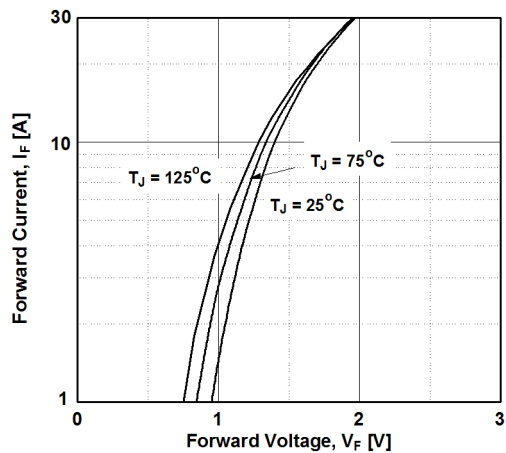
**Figure 16. Switching Loss vs. Collector Current**



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



**Figure 18. Forward Characteristics**



## Typical Performance Characteristics

Figure 19. Reverse Recovery Current

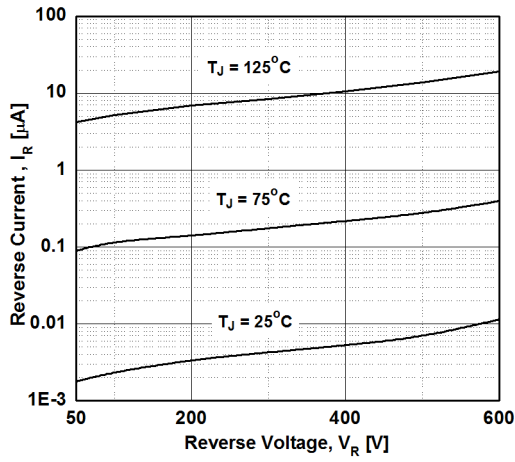


Figure 20. Stored Charge

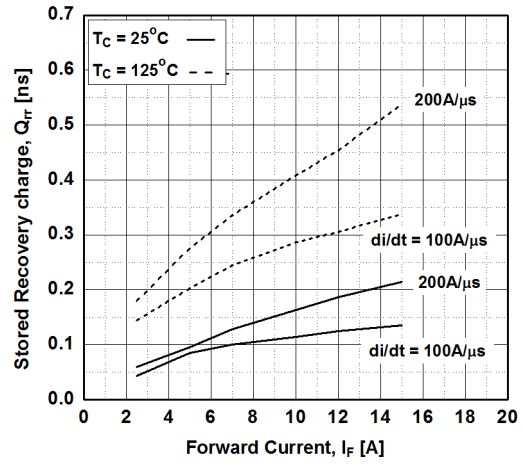


Figure 21. Reverse Recovery Time

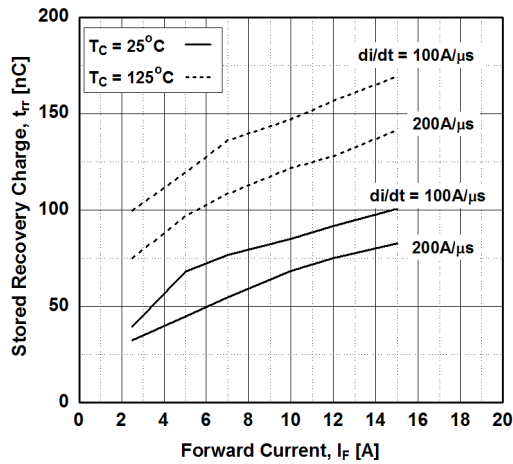
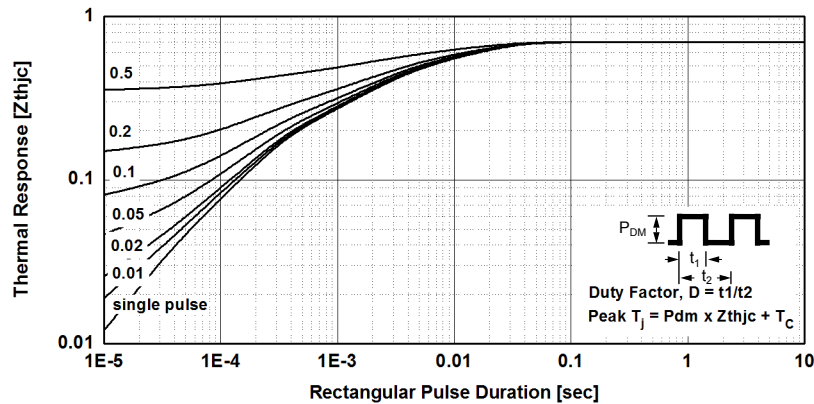
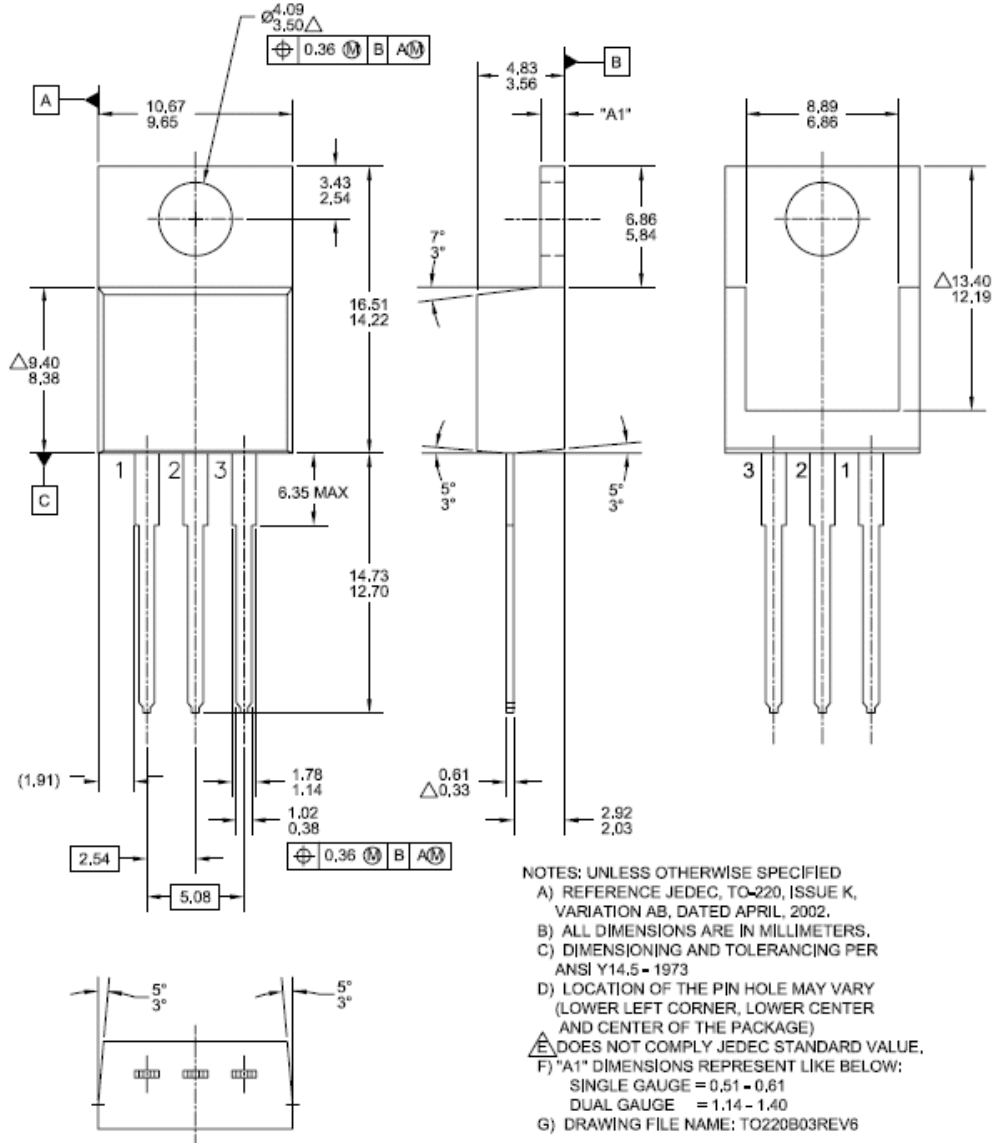


Figure 22. Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-220



NOTES: UNLESS OTHERWISE SPECIFIED  
 A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.  
 B) ALL DIMENSIONS ARE IN MILLIMETERS.  
 C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973  
 D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)  
 E) DOES NOT COMPLY JEDEC STANDARD VALUE.  
 F) "A1" DIMENSIONS REPRESENT LIKE BELOW:  
 SINGLE GAUGE = 0.51 - 0.61  
 DUAL GAUGE = 1.14 - 1.40  
 G) DRAWING FILE NAME: TO220B03REV6





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| AccuPower™               | F-PFS™  | SYSTEM GENERAL®  |
| AX-CAP®*                 | FRFET®  | TinyBoost™       |
| BitSiC™                  | Global Power Resource <sup>SM</sup>             | TinyBuck™        |
| Build it Now™            | Green Bridge™                                   | TinyCalc™        |
| CorePLUS™                | Green FPS™                                      | TinyLogic®       |
| CorePOWER™               | Green FPS™ e-Series™                            | TINYOPTO™        |
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|                          | OPTOPLANAR®                                     |                  |
|                          | PowerTrench®                                    |                  |
|                          | PowerXS™  |                  |
|                          | Programmable Active Droop™                      |                  |
|                          | QFET®   |                  |
|                          | QS™   |                  |
|                          | Quiet Series™                                   |                  |
|                          | RapidConfigure™                                 |                  |
|                          | Saving our world, 1mW/W/kW at a time™           |                  |
|                          | SignalWise™                                     |                  |
|                          | SmartMax™                                       |                  |
|                          | SMART START™                                    |                  |
|                          | Solutions for Your Success™                     |                  |
|                          | SPM®  |                  |
|                          | STEALTH™  |                  |
|                          | SuperFET®                                       |                  |
|                          | SuperSOT™-3                                     |                  |
|                          | SuperSOT™-6                                     |                  |
|                          | SuperSOT™-8                                     |                  |
|                          | SupreMOS®                                       |                  |
|                          | SyncFET™  |                  |

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- A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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