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# FGA50N100BNTD2

## 1000 V NPT Trench IGBT

### Features

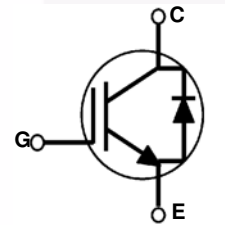
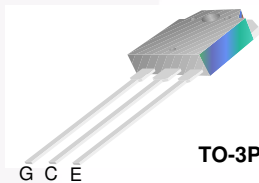
- High Speed Switching
- Low Saturation Voltage :  $V_{CE(sat)} = 2.5 \text{ V @ } I_C = 60 \text{ A}$
- High Input Impedance
- Built-in Fast Recovery Diode
- RoHS Compliant

### Applications

- UPS, Welder

### General Description

Using Fairchild's proprietary trench design and advanced NPT technology, the 1000V NPT IGBT offers superior conduction and switching performances, high avalanche ruggedness and easy parallel operation. This device offers the optimum performance for hard switching application such as UPS, welder applications.



### Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	1000	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	50	A
	Collector Current @ $T_C = 100^\circ\text{C}$	35	A
$I_{CM(1)}$	Pulsed Collector Current	200	A
$I_F$	Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$	30	A
	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	15	A
$I_{FM}$	Diode Maximum Forward Current	150	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	156	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	63	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

**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	-	0.8	$^\circ\text{C/W}$
$R_{\theta JC}(\text{DIODE})$	Thermal Resistance, Junction to Case	-	1.2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40.0	$^\circ\text{C/W}$

**Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGA50N100BNTD2	FGA50N100BNTD2	TO-3P	Tube	N/A	N/A	30

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

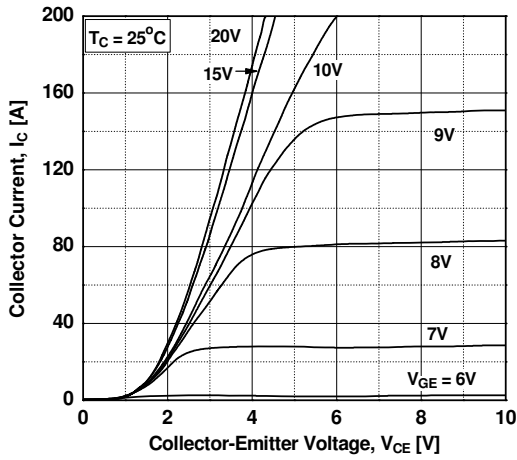
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	1000	-	-	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = 1000\text{ V}, V_{GE} = 0\text{ V}$	-	-	1.0	mA
$I_{GES}$	G-E Leakage Current	$V_{GE} = \pm 25\text{ V}, V_{CE} = 0\text{ V}$	-	-	$\pm 500$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 60\text{ mA}, V_{CE} = V_{GE}$	4.0	5.5	7.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 10\text{ A}, V_{GE} = 15\text{ V}$	-	1.5	1.8	V
		$I_C = 60\text{ A}, V_{GE} = 15\text{ V}$	-	2.5	2.9	V
		$I_C = 60\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$	-	3.3	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 10\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	6000	-	pF
$C_{oes}$	Output Capacitance		-	260	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	200	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 60\text{ A}, R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	-	34	-	ns
$t_r$	Rise Time		-	68	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	243	-	ns
$t_f$	Fall Time		-	65	100	ns
$Q_g$	Total Gate Charge	$V_{CE} = 600\text{ V}, I_C = 60\text{ A}, V_{GE} = 15\text{ V}, T_C = 25^\circ\text{C}$	-	257	350	nC
$Q_{ge}$	Gate to Emitter Charge		-	45	-	nC
$Q_{gc}$	Gate to Collector Charge		-	95	-	nC

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

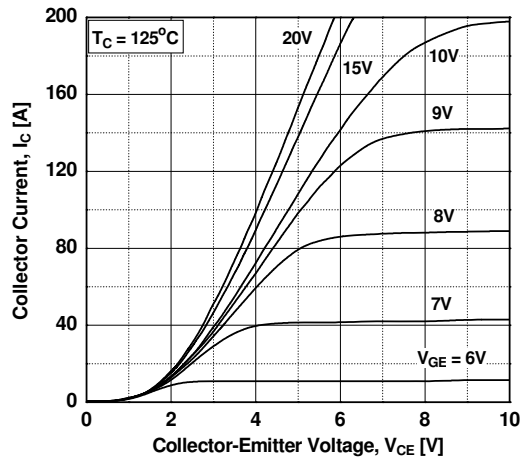
$V_{FM}$	Diode Forward Voltage	$I_F = 15\text{ A}$	-	2.9	3.2	V
		$I_F = 60\text{ A}$	-	4.0	4.7	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 60\text{ A}, di_F/dt = 100\text{ A/us}$	-	60	75	ns
$I_R$	Instantaneous Reverse Current	$V_{RRM} = 1000\text{ V}$	-	-	2	$\mu\text{A}$

## Typical Performance Characteristics

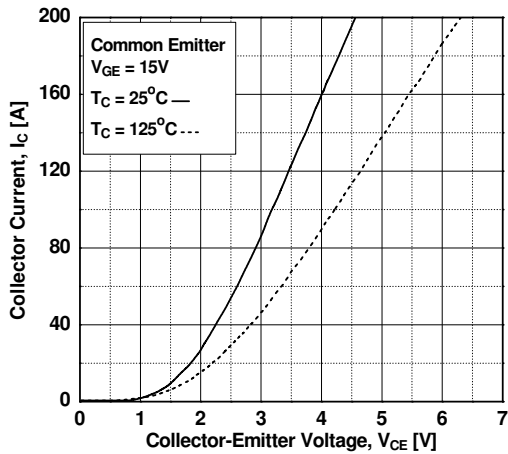
**Figure 1. Typical Output Characteristics**



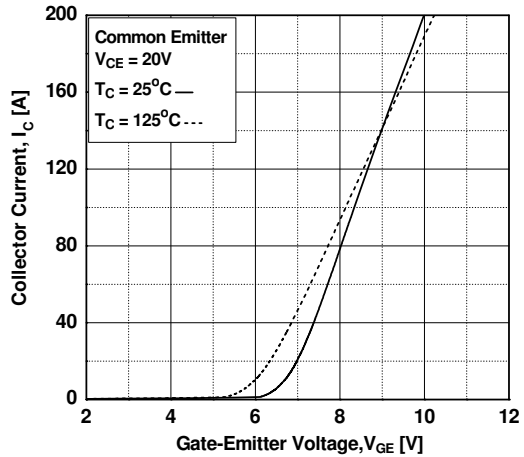
**Figure 2. Typical Output Characteristics**



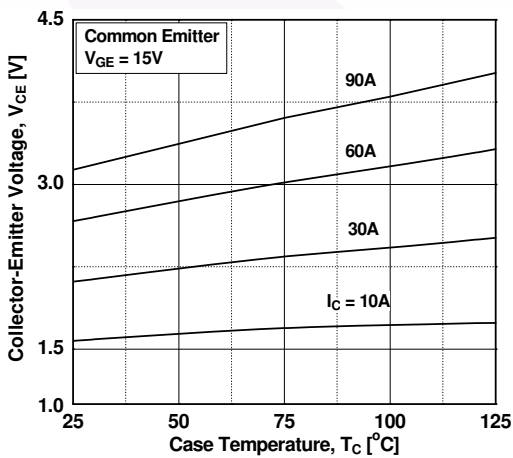
**Figure 3. Typical Saturation Voltage Characteristics**



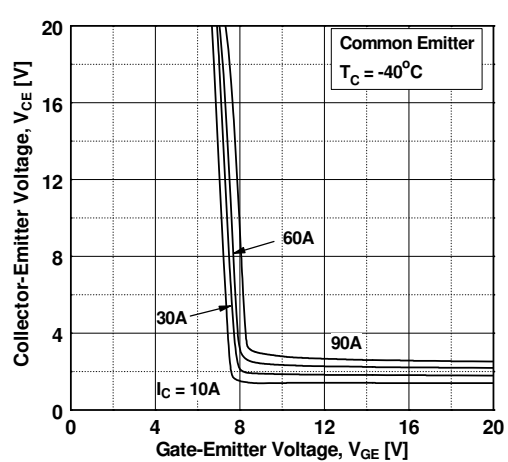
**Figure 4. Transfer Characteristics**



**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.  $V_{GE}$

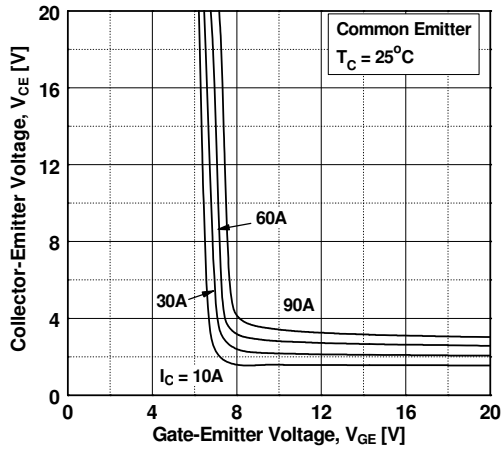


Figure 8. Saturation Voltage vs.  $V_{GE}$

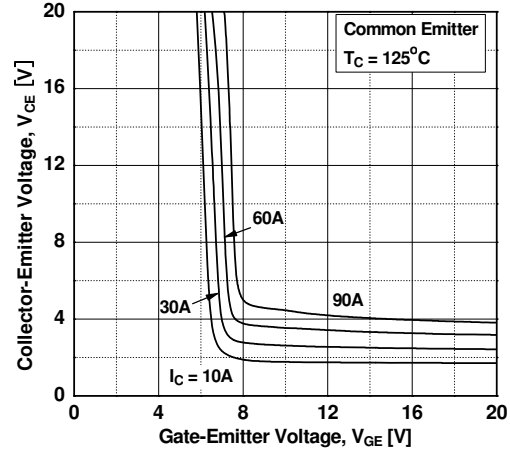


Figure 9. Capacitance Characteristics

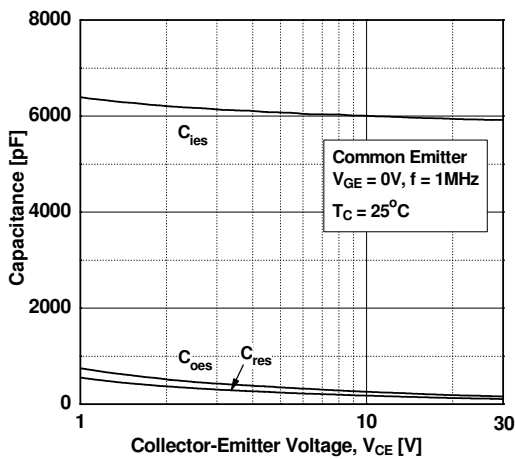


Figure 10. Gate charge Characteristics

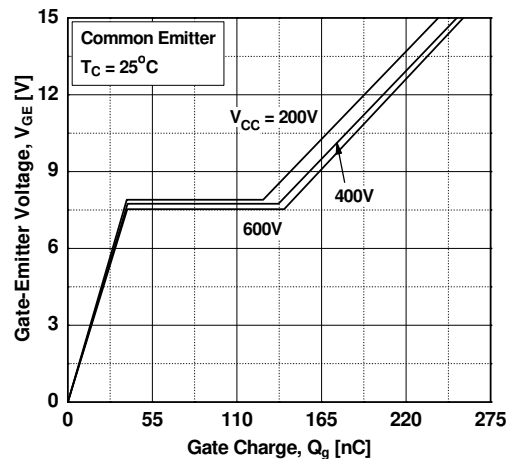


Figure 11. SOA Characteristics

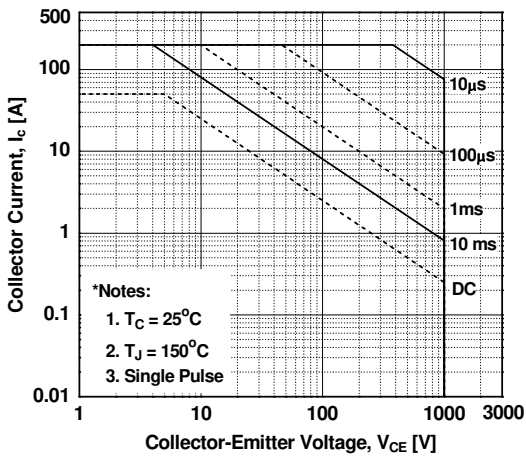
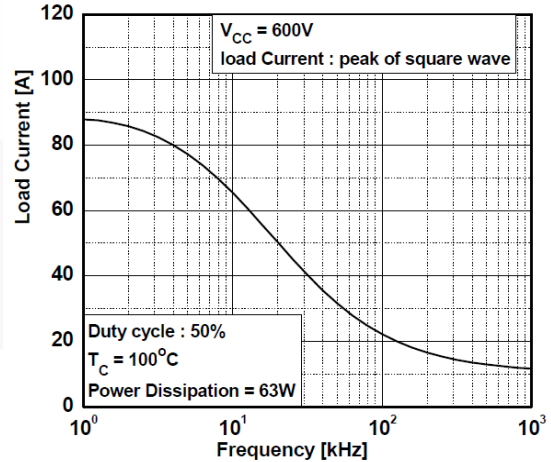
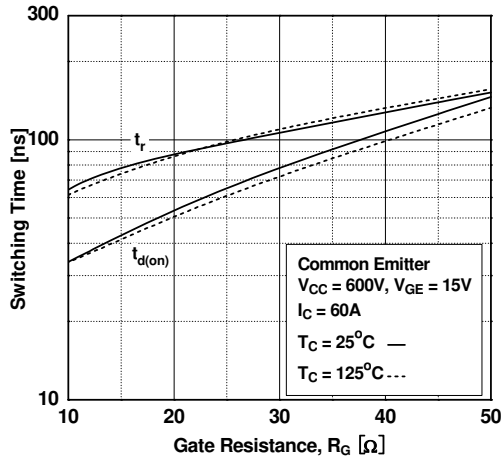


Figure 12. Load Current vs. Frequency

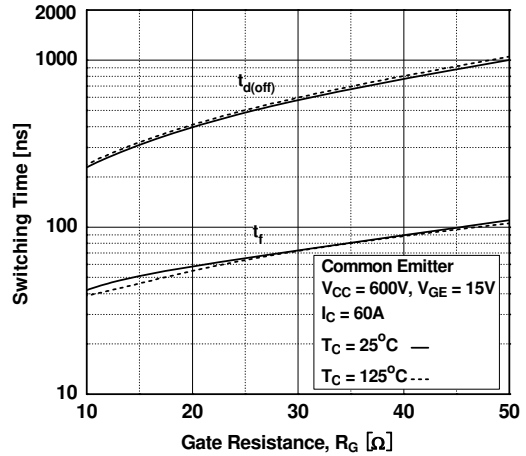


## Typical Performance Characteristics

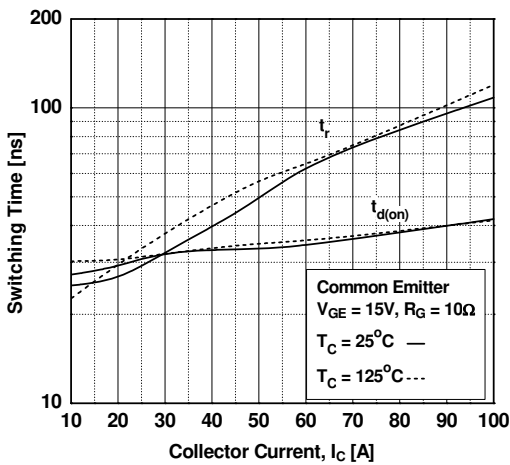
**Figure 13. Turn-on Characteristics vs. Gate Resistance**



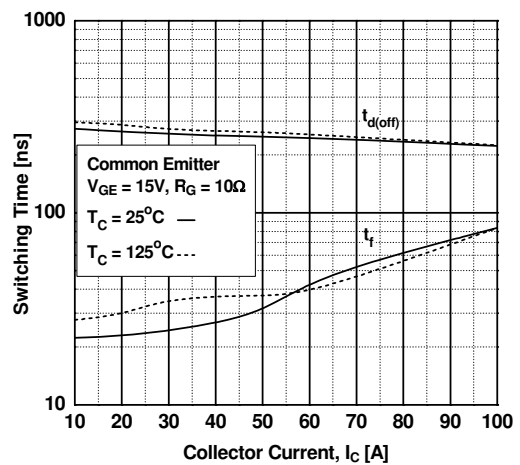
**Figure 14. Turn-off Characteristics vs. Gate Resistance**



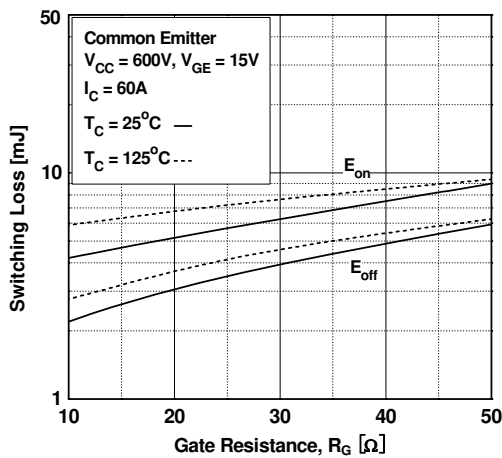
**Figure 15. Turn-on Characteristics vs. Collector Current**



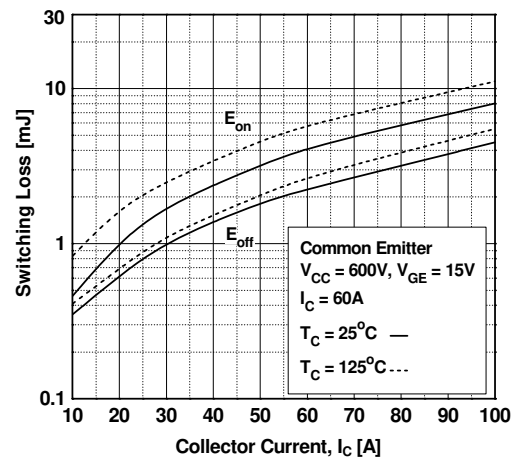
**Figure 16. Turn-off Characteristics vs. Collector Current**



**Figure 17. Switching Loss vs. Gate Resistance**



**Fig 18. Switching Loss vs. Collector Current**



## Typical Performance Characteristics

Figure 19. Turn off Switching SOA Characteristics

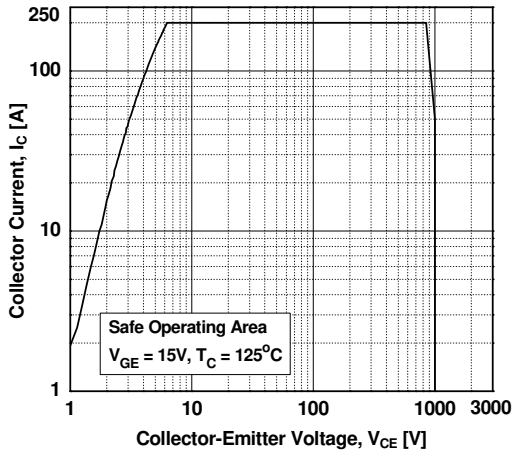


Figure 20. Forward Characteristics

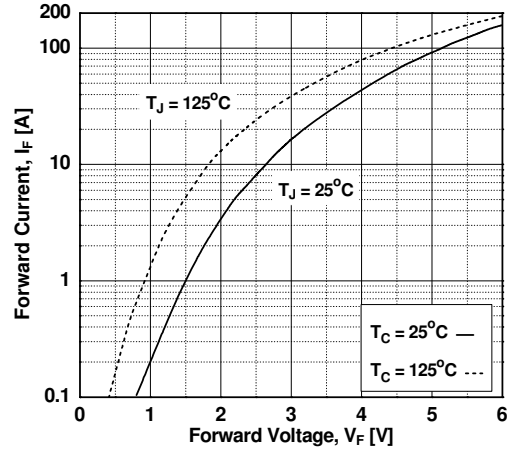


Figure 21. Reverse Current

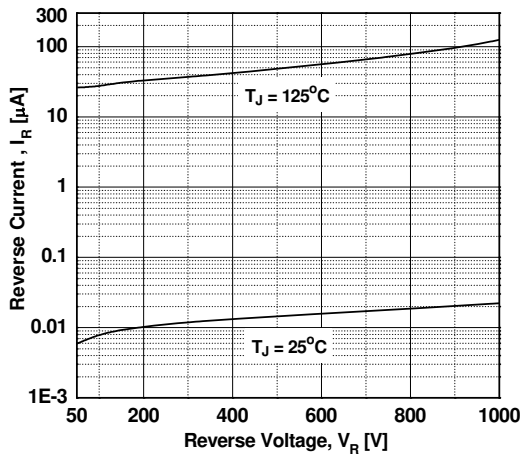


Figure 22. Reverse Recovery Characteristics vs.  $di_F/dt$

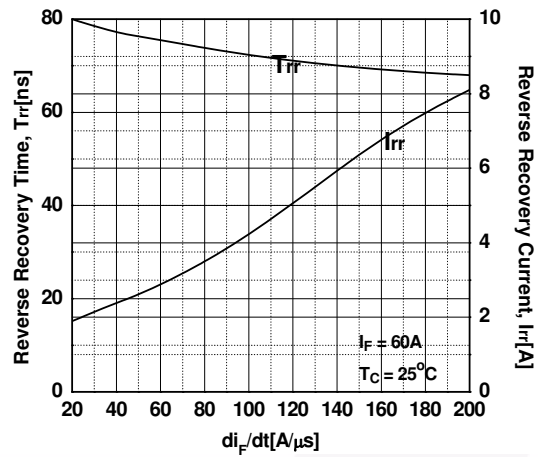
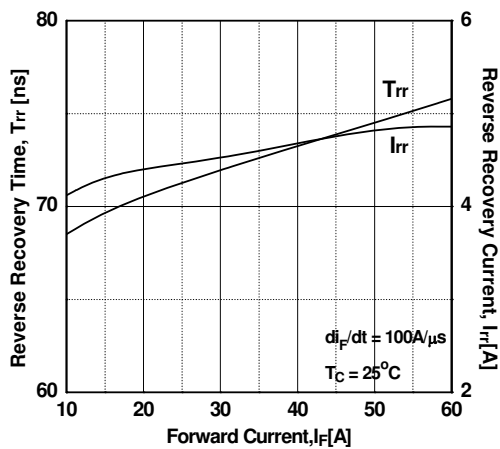
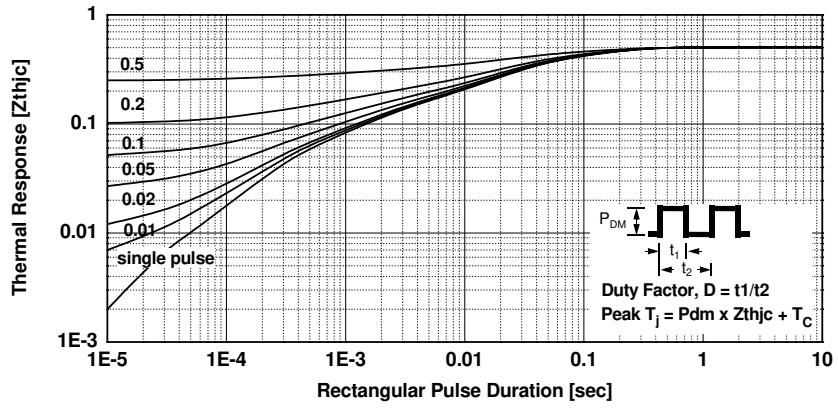


Figure 23. Reverse Recovery Characteristics vs. Forward Current



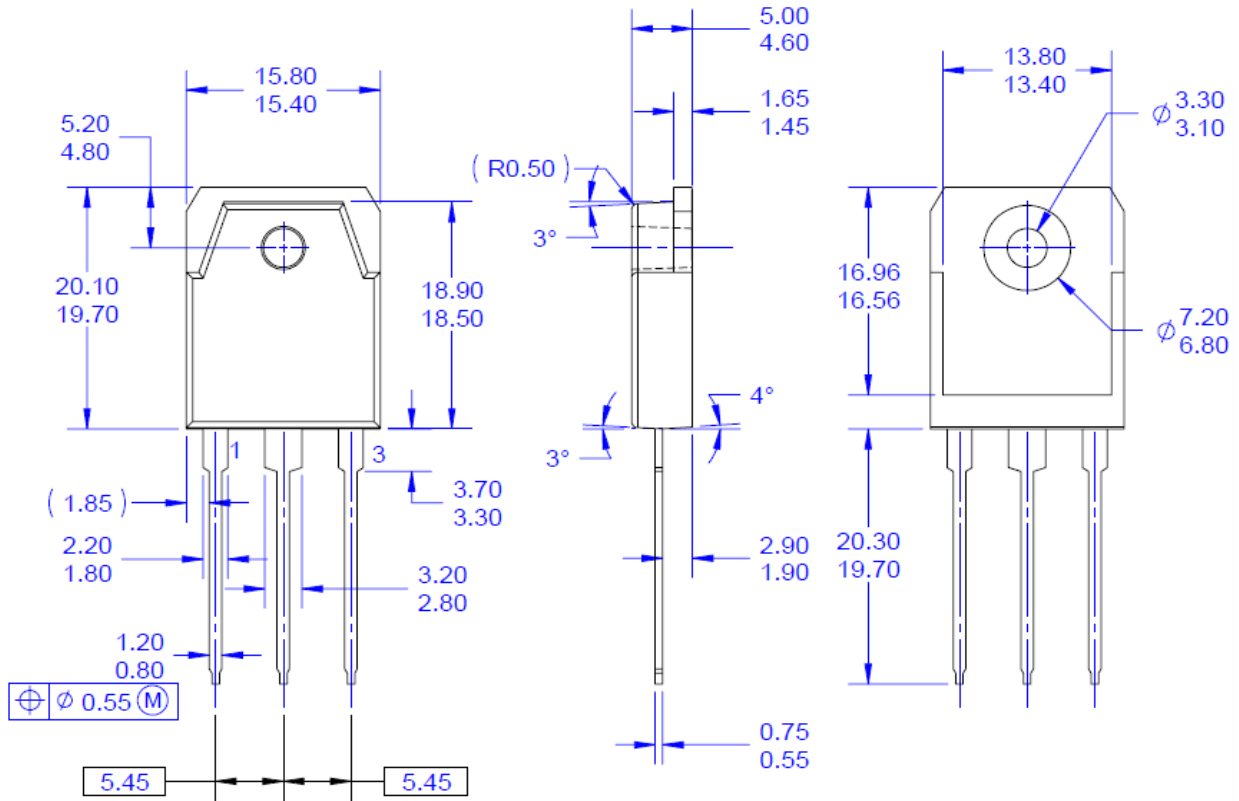
Typical Performance Characteristics

Figure 24. Transient Thermal Impedance of IGBT





### Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- E) THIS PACKAGE IS INTENDED ONLY FOR T03PN.
- F) DRAWING FILE NAME: T03P03AREV4.

**Figure 25. TO-3P 3L - 3LD, T03, PLASTIC, EIAJ SC-65**

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| AX-CAP®*                                                                                     | FRFET®                                          | PowerXS™                                                                                                                |  SYSTEM GENERAL®* |
| BitSiC™                                                                                      | Global Power Resource <sup>SM</sup>             | Programmable Active Droop™                                                                                              | TinyBoost®                                                                                           |
| Build it Now™                                                                                | GreenBridge™                                    | QFET®                                                                                                                   | TinyBuck®                                                                                            |
| CorePLUS™                                                                                    | Green FPS™                                      | QS™                                                                                                                     | TinyCalc™                                                                                            |
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|  Fairchild® | MicroPak™                                       | SuperFET®                                                                                                               |  SerDes®          |
| Fairchild Semiconductor®                                                                     | MicroPak2™                                      | SuperSOT™-3                                                                                                             | UHC®                                                                                                 |
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| FACT®                                                                                        | MotionMax™                                      | SuperSOT™-8                                                                                                             | UniFET™                                                                                              |
| FAST®                                                                                        | mWSaver®                                        | SupreMOS®                                                                                                               | VCX™                                                                                                 |
| FastvCore™                                                                                   | OptoHiT™                                        | SyncFET™                                                                                                                | VisualMax™                                                                                           |
| FETBench™                                                                                    | OPTOLOGIC®                                      |                                                                                                                         | VoltagePlus™                                                                                         |
| FPS™                                                                                         | OPTOPLANAR®                                     |                                                                                                                         | XS™                                                                                                  |

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