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November 2014

# FGPF4565 650 V Field Stop Trench IGBT

## Features

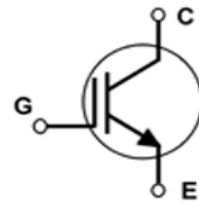
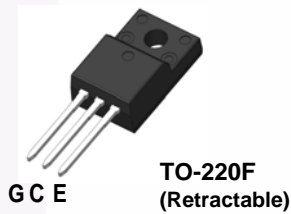
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.5 \text{ V(Typ.)} @ I_C = 30 \text{ A}$
- High Input Impedance
- RoHS Compliant

## Applications

- IPL (Intense Pulsed Light)

## General Description

Using innovative field stop IGBT technology, Fairchild's new series of field stop trench IGBTs offer the optimum performance for IPL (Intense Pulsed Light).



## Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	650	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
$I_{C \text{ pulse (1)*}}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	170	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	30	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	12	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	$^\circ\text{C}$

## Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	-	4.1	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	-	62.5	$^\circ\text{C/W}$

### Notes:

1. Half sine wave:  $D < 0.01$ , pulse width  $< 1 \mu\text{sec}$ ,

\*  $I_C$  pulse limit by max  $T_J$

**Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGPF4565	FGPF4565	TO-220F	Tube	N/A	N/A	50

**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	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	-	0.65	-	V/ $^\circ\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$	3.0	4.0	5.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20\text{ A}, V_{GE} = 15\text{ V}$	-	1.35	-	V
		$I_C = 30\text{ A}, V_{GE} = 15\text{ V}$	-	1.50	1.88	V
		$I_C = 30\text{ A}, V_{GE} = 15\text{ V}, T_C = 150^\circ\text{C}$	-	1.75	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	-	1650	-	pF
$C_{oes}$	Output Capacitance		-	34	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	17	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 5\ \Omega, V_{GE} = 15\text{ V},$ Resistive Load, $T_C = 25^\circ\text{C}$	-	11.2	-	ns
$t_r$	Rise Time		-	44.8	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	40.8	-	ns
$t_f$	Fall Time		-	153	-	ns
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 5\ \Omega, V_{GE} = 15\text{ V},$ Resistive Load, $T_C = 150^\circ\text{C}$	-	12.8	-	ns
$t_r$	Rise Time		-	59.2	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	40.8	-	ns
$t_f$	Fall Time		-	202	-	ns
$Q_g$	Total Gate Charge	$V_{CE} = 400\text{ V}, I_C = 30\text{ A}, V_{GE} = 15\text{ V}$	-	40.3	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	8.8	-	nC
$Q_{gc}$	Gate to Collector Charge		-	10.4	-	nC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

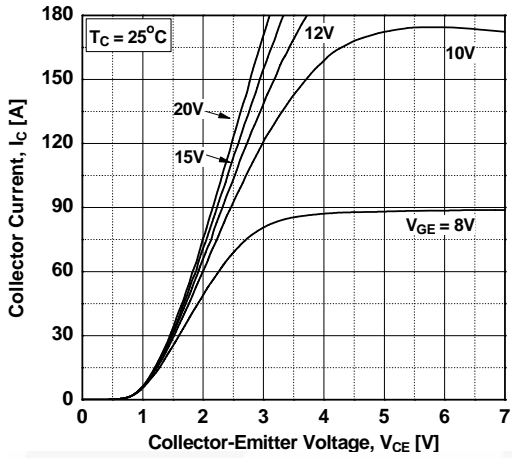


Figure 2. Typical Output Characteristics

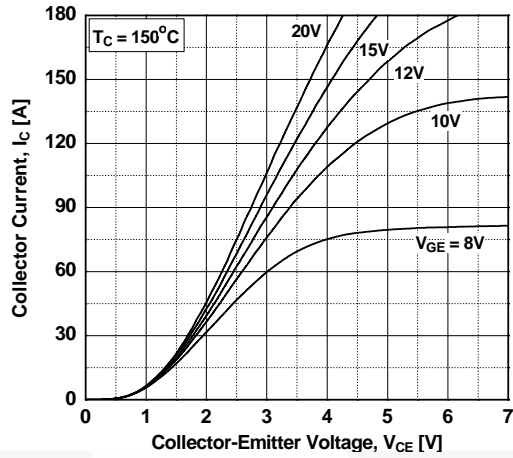


Figure 3. Typical Saturation Voltage Characteristics

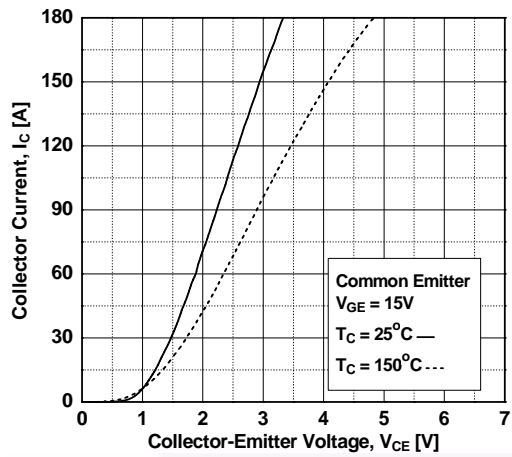


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

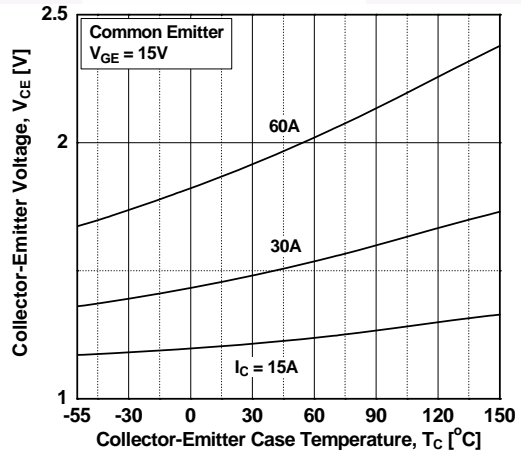


Figure 5. Saturation Voltage vs.  $V_{GE}$

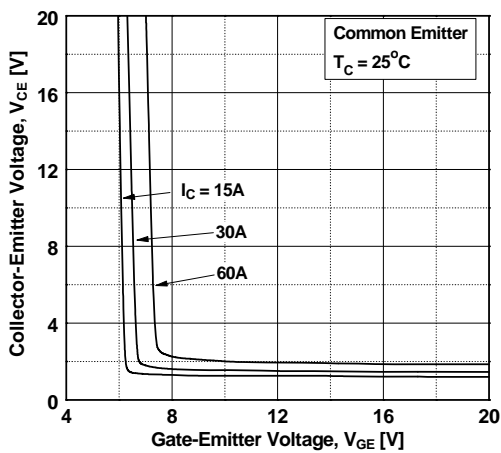
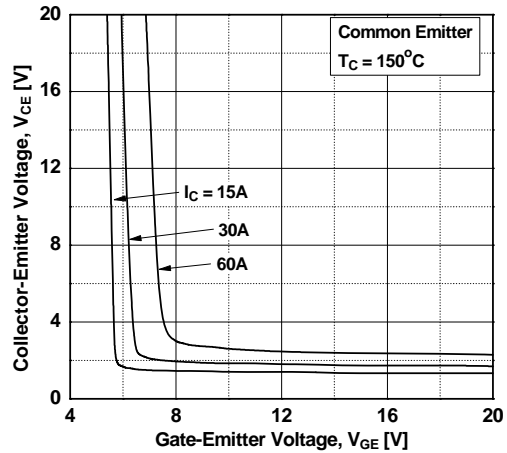
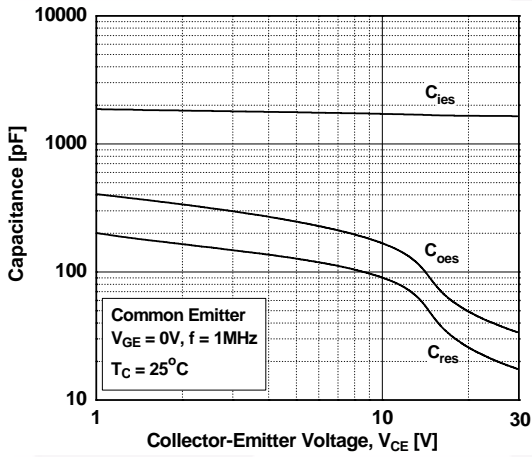


Figure 6. Saturation Voltage vs.  $V_{GE}$

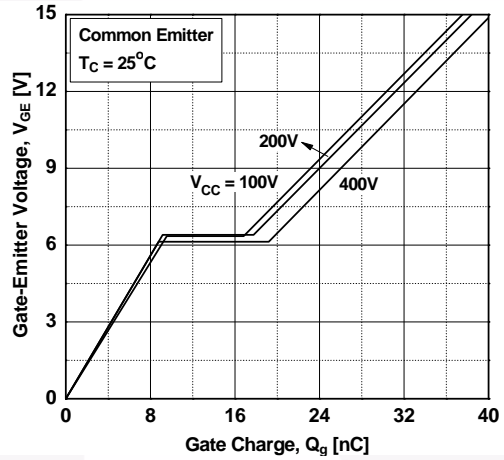


## Typical Performance Characteristics

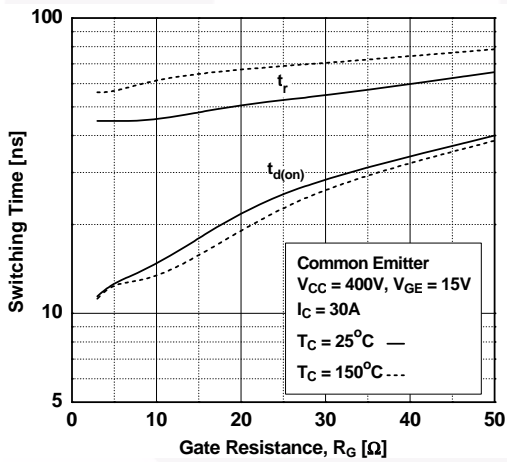
**Figure 7. Capacitance Characteristics**



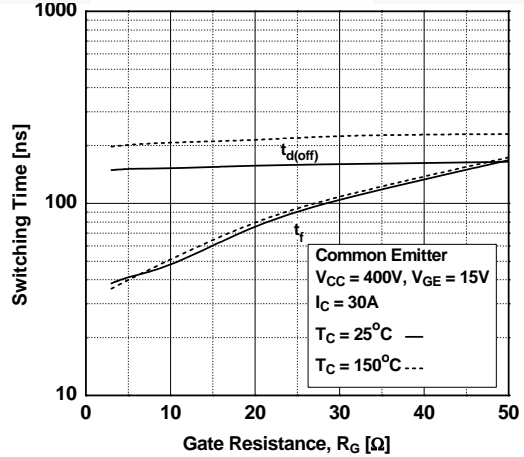
**Figure 8. Gate charge Characteristics**



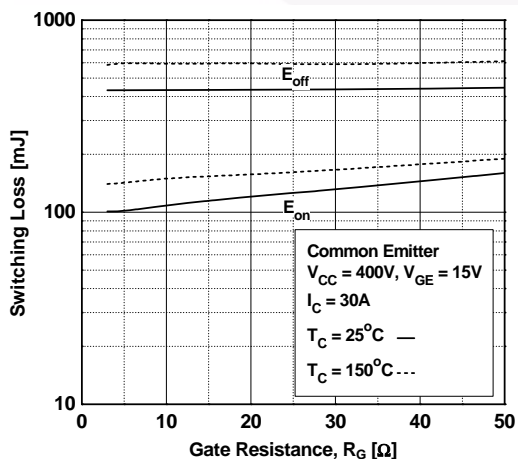
**Figure 9. Turn-on Characteristics vs. Gate Resistance**



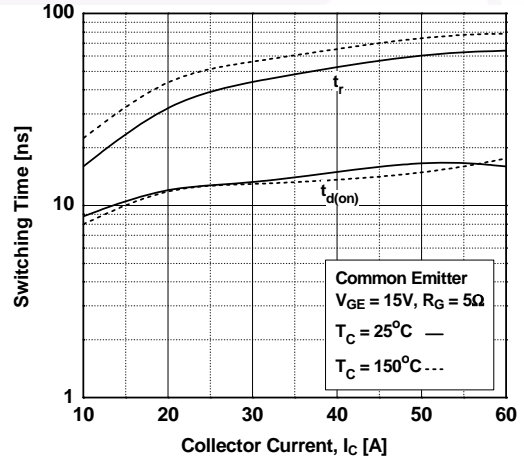
**Figure 10. Turn-off Characteristics vs. Gate Resistance**



**Figure 11. Switching Loss vs. Gate Resistance**

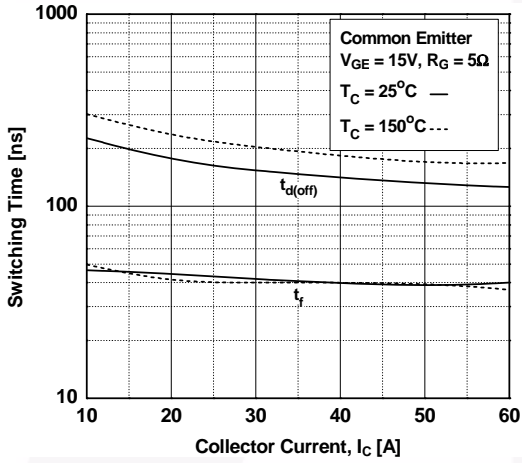


**Figure 12. Turn-on Characteristics vs. Collector Current**

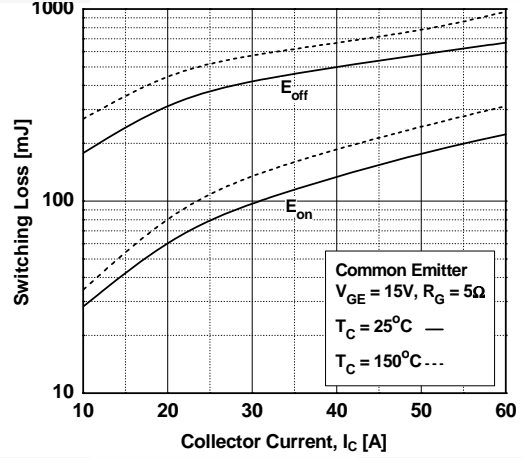


### Typical Performance Characteristics

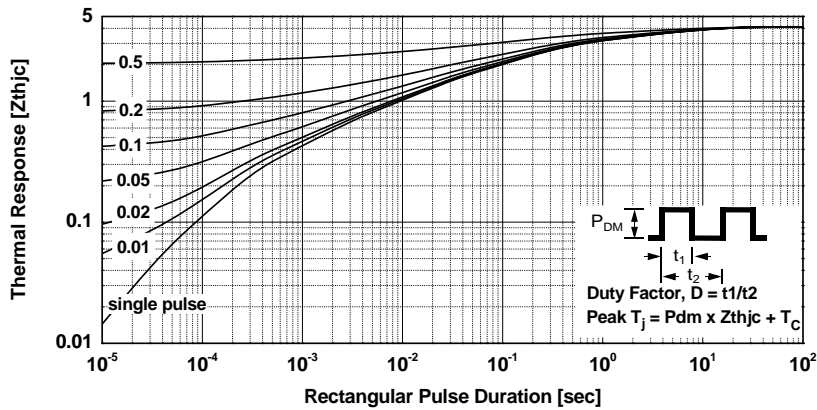
**Figure 13. Turn-off Characteristics vs. Collector Current**

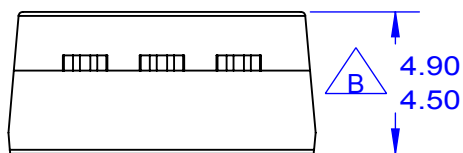
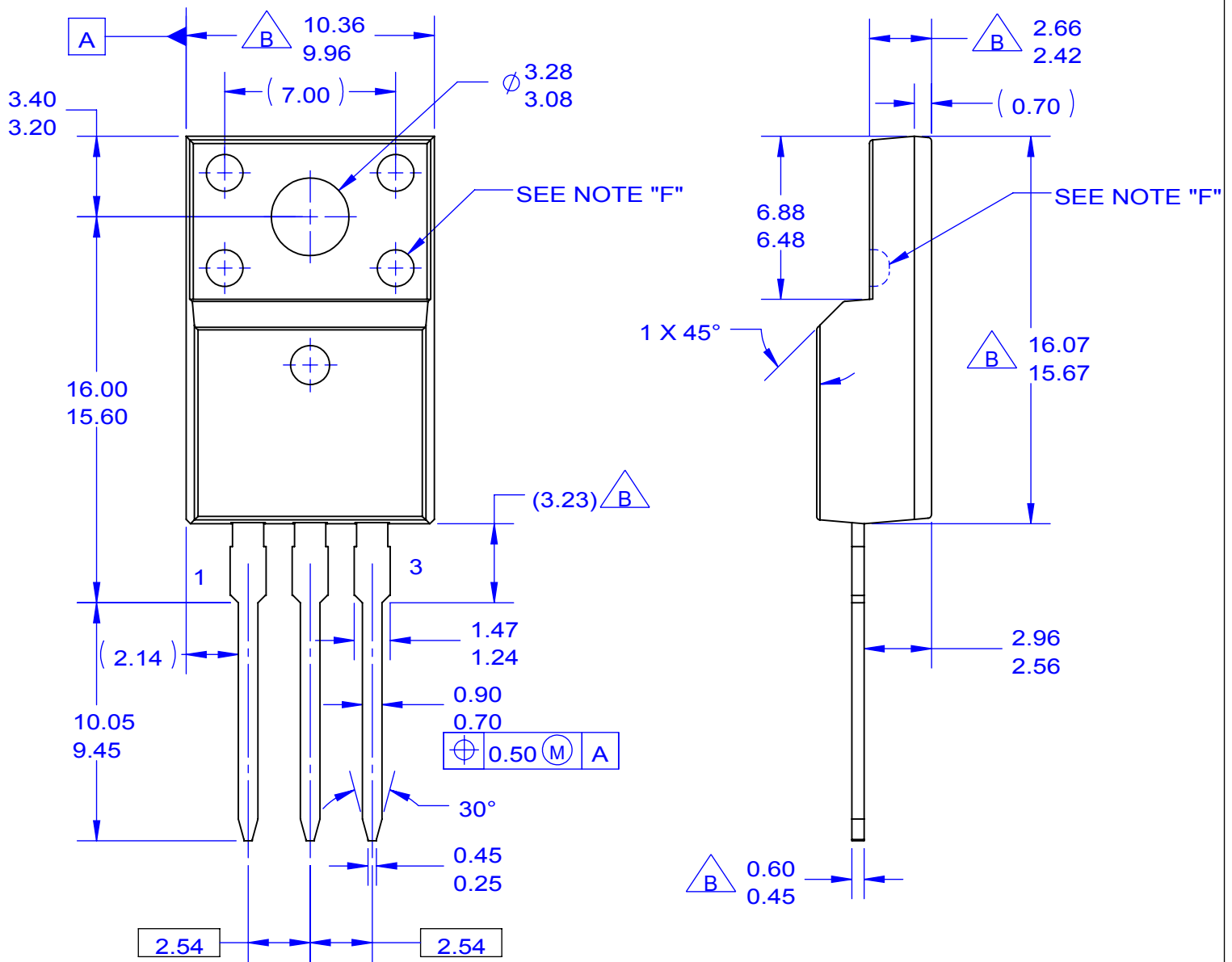


**Figure 14. Switching Loss vs. Collector Current**



**Figure 15. Transient Thermal Impedance of IGBT**





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