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November 2014

# FGPF4565

## 650 V Field Stop Trench IGBT

### Features

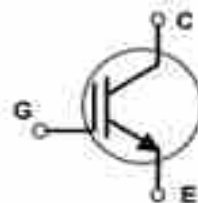
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.5 \text{ V (Typ.) @ } I_C = 30 \text{ A}$
- High Input Impedance
- RoHS Compliant

### 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

$T_C = 25^\circ\text{C}$  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<sub>C</sub> = 25°C unless otherwise noted

| Symbol                                  | Parameter                                    | Test Conditions                                                                                                                      | Min. | Typ. | Max. | Unit |
|-----------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                     |                                              |                                                                                                                                      |      |      |      |      |
| BV <sub>CES</sub>                       | Collector to Emitter Breakdown Voltage       | V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA                                                                                         | 650  | -    | -    | V    |
| ΔBV <sub>CES</sub> /<br>ΔT <sub>J</sub> | Temperature Coefficient of Breakdown Voltage | V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA                                                                                         | -    | 0.65 | -    | V/°C |
| I <sub>CES</sub>                        | Collector Cut-Off Current                    | V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V                                                                           | -    | -    | 250  | μA   |
| I <sub>GES</sub>                        | G-E Leakage Current                          | V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V                                                                           | -    | -    | ±400 | nA   |
| On Characteristics                      |                                              |                                                                                                                                      |      |      |      |      |
| V <sub>GE(th)</sub>                     | G-E Threshold Voltage                        | I <sub>C</sub> = 250 μA, V <sub>CE</sub> = V <sub>GE</sub>                                                                           | 3.0  | 4.0  | 5.0  | V    |
| V <sub>CE(sat)</sub>                    | Collector to Emitter Saturation Voltage      | I <sub>C</sub> = 20 A, V <sub>GE</sub> = 15 V                                                                                        | -    | 1.35 | -    | V    |
|                                         |                                              | I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V                                                                                        | -    | 1.50 | 1.88 | V    |
|                                         |                                              | I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 150°C                                                                | -    | 1.75 | -    | V    |
| Dynamic Characteristics                 |                                              |                                                                                                                                      |      |      |      |      |
| C <sub>ies</sub>                        | Input Capacitance                            | V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1 MHz                                                                             | -    | 1650 | -    | pF   |
| C <sub>oes</sub>                        | Output Capacitance                           |                                                                                                                                      | -    | 34   | -    | pF   |
| C <sub>res</sub>                        | Reverse Transfer Capacitance                 |                                                                                                                                      | -    | 17   | -    | pF   |
| Switching Characteristics               |                                              |                                                                                                                                      |      |      |      |      |
| t <sub>d(on)</sub>                      | Turn-On Delay Time                           | V <sub>CC</sub> = 400 V, I <sub>C</sub> = 30 A, R <sub>G</sub> = 5 Ω, V <sub>GE</sub> = 15 V, Resistive Load, T <sub>C</sub> = 25°C  | -    | 11.2 | -    | ns   |
| t <sub>r</sub>                          | Rise Time                                    |                                                                                                                                      | -    | 44.8 | -    | ns   |
| t <sub>d(off)</sub>                     | Turn-Off Delay Time                          |                                                                                                                                      | -    | 40.8 | -    | ns   |
| t <sub>f</sub>                          | Fall Time                                    |                                                                                                                                      | -    | 153  | -    | ns   |
| t <sub>d(on)</sub>                      | Turn-On Delay Time                           | V <sub>CC</sub> = 400 V, I <sub>C</sub> = 30 A, R <sub>G</sub> = 5 Ω, V <sub>GE</sub> = 15 V, Resistive Load, T <sub>C</sub> = 150°C | -    | 12.8 | -    | ns   |
| t <sub>r</sub>                          | Rise Time                                    |                                                                                                                                      | -    | 59.2 | -    | ns   |
| t <sub>d(off)</sub>                     | Turn-Off Delay Time                          |                                                                                                                                      | -    | 40.8 | -    | ns   |
| t <sub>f</sub>                          | Fall Time                                    |                                                                                                                                      | -    | 202  | -    | ns   |
| Q <sub>g</sub>                          | Total Gate Charge                            | V <sub>CE</sub> = 400 V, I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V                                                               | -    | 40.3 | -    | nC   |
| Q <sub>ge</sub>                         | Gate to Emitter Charge                       |                                                                                                                                      | -    | 8.8  | -    | nC   |
| Q <sub>gc</sub>                         | Gate to Collector Charge                     |                                                                                                                                      | -    | 10.4 | -    | nC   |

## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

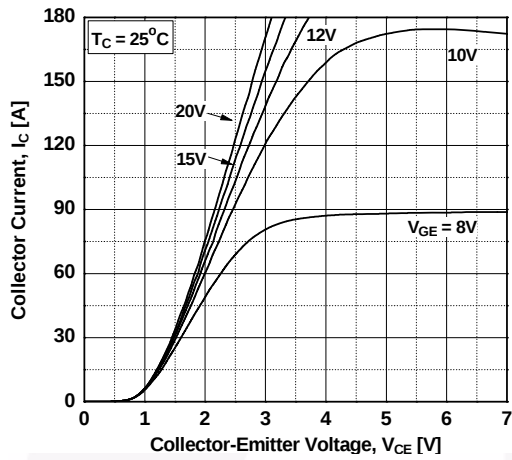


Figure 2. Typical Output Characteristics

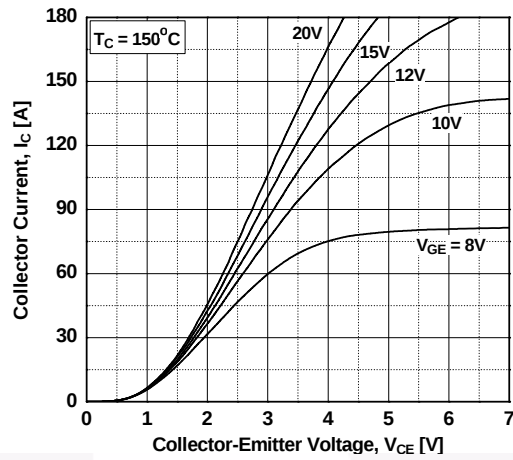


Figure 3. Typical Saturation Voltage Characteristics

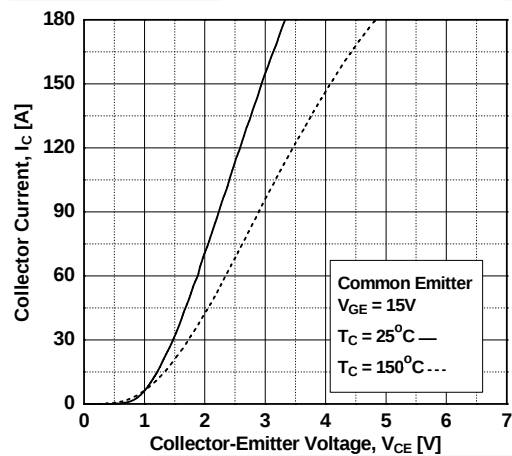


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

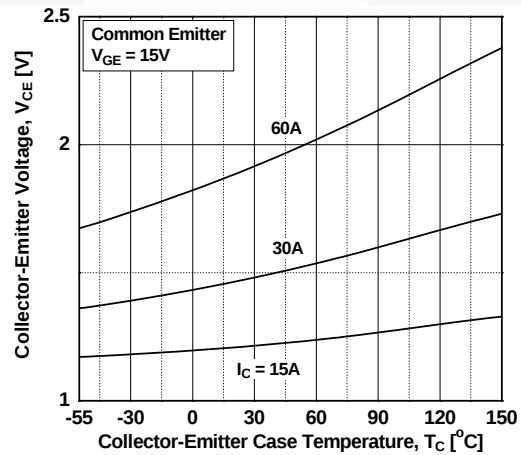


Figure 5. Saturation Voltage vs.  $V_{GE}$

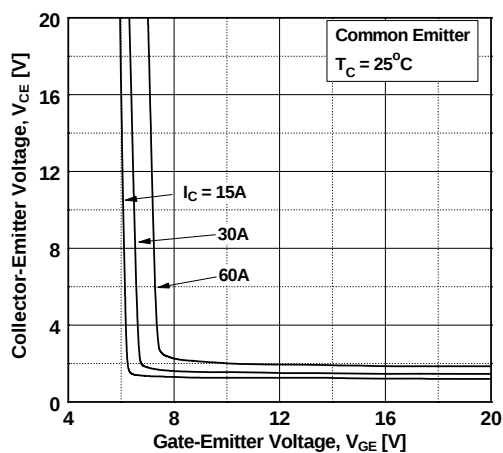
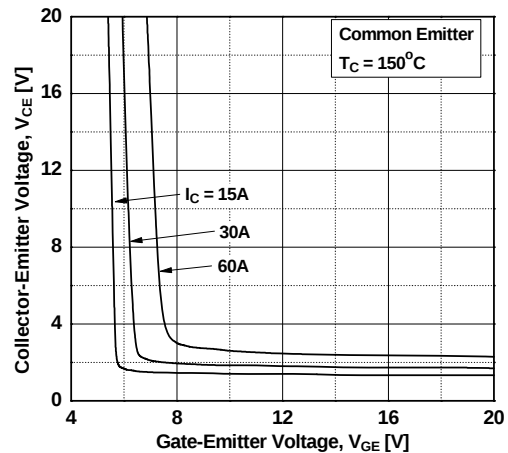


Figure 6. Saturation Voltage vs.  $V_{GE}$



## Typical Performance Characteristics

Figure 7. Capacitance Characteristics

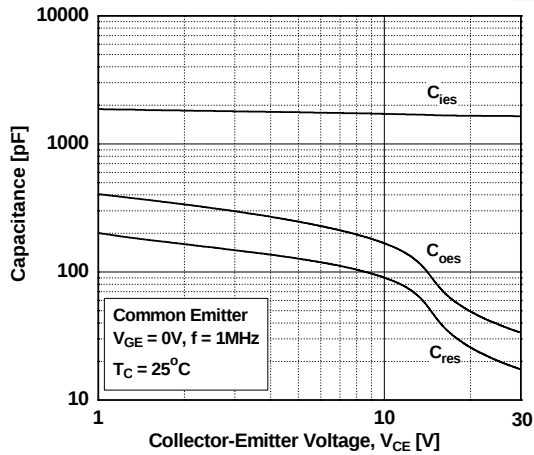


Figure 8. Gate charge Characteristics

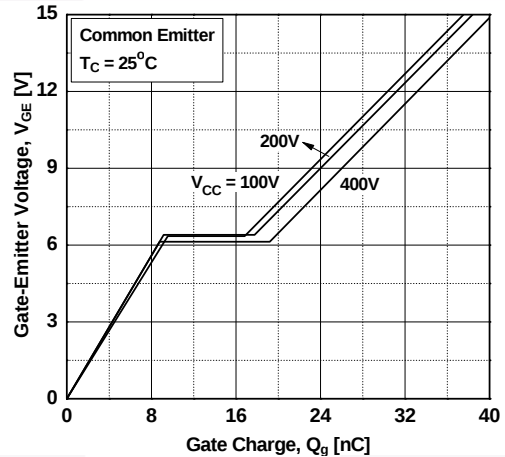


Figure 9. Turn-on Characteristics vs. Gate Resistance

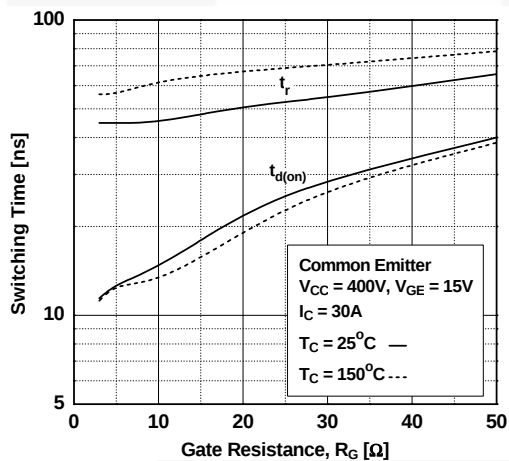


Figure 10. Turn-off Characteristics vs. Gate Resistance

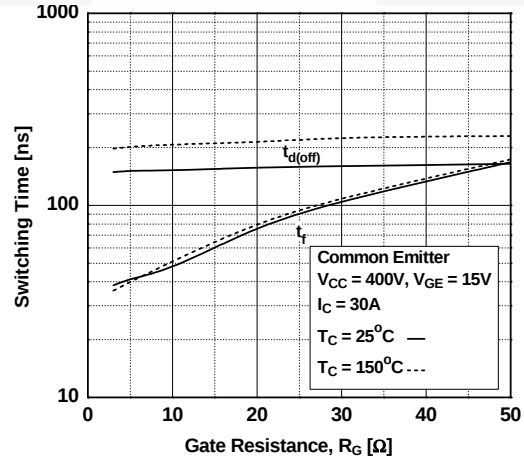


Figure 11. Switching Loss vs. Gate Resistance

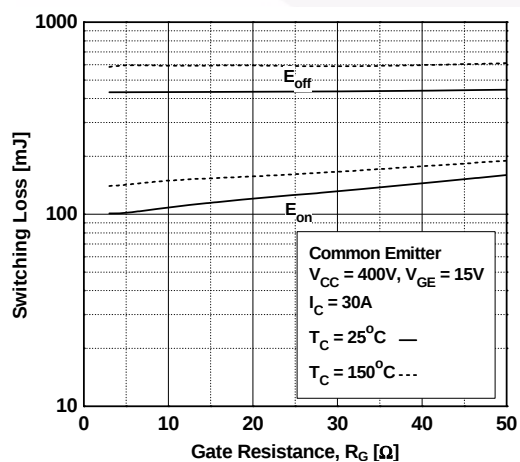
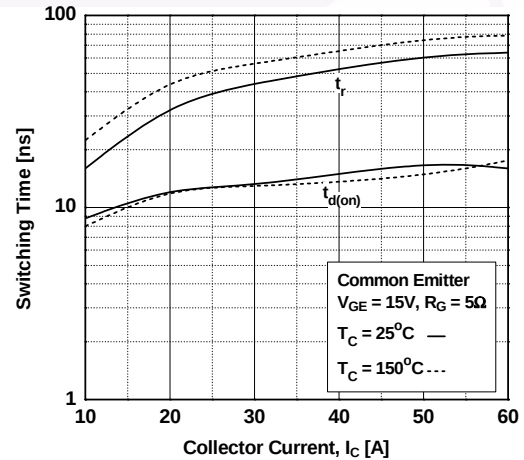


Figure 12. Turn-on Characteristics vs. Collector Current



## Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

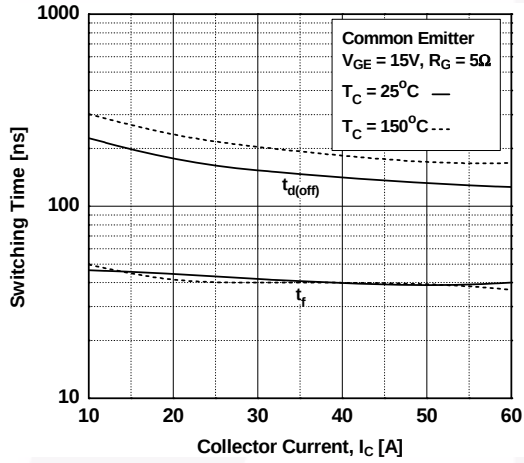


Figure 14. Switching Loss vs. Collector Current

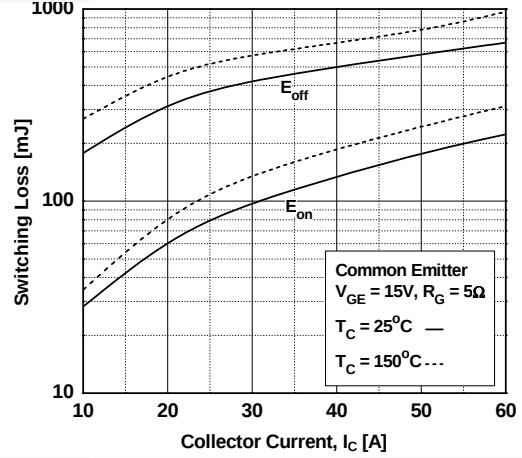
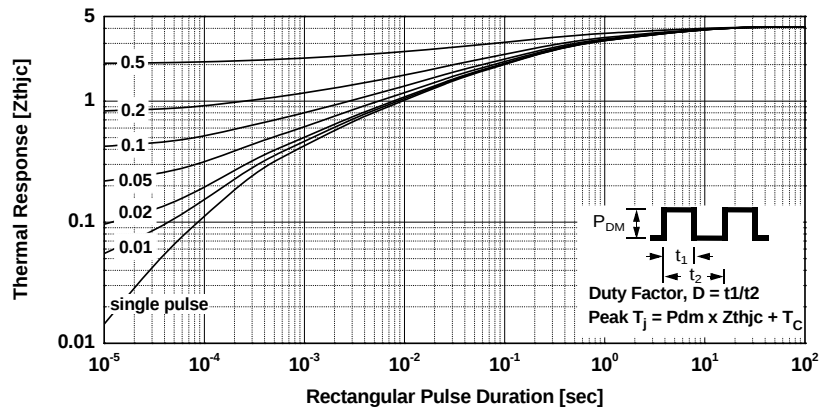


Figure 15. Transient Thermal Impedance of IGBT





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