



April 2015

# FGA50T65SHD

## 650 V, 50 A Field Stop Trench IGBT

### Features

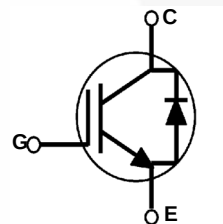
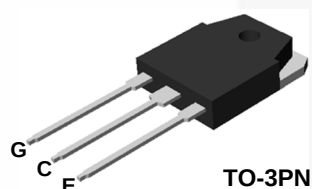
- Maximum Junction Temperature :  $T_J = 175^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 1.6\text{ V(Typ.)}$  @  $I_C = 50\text{ A}$
- 100% of the Parts Tested for  $I_{LM}(1)$
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant

### General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 3<sup>rd</sup> generation IGBTs offer the optimum performance for solar inverter, UPS, welder, telecom, ESS and PFC applications where low conduction and switching losses are essential.

### Applications

- Solar Inverter, UPS, Welder, Telecom, ESS, PFC



### Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol      | Description                                                             | FGA50T65SHD | Unit             |
|-------------|-------------------------------------------------------------------------|-------------|------------------|
| $V_{CES}$   | Collector to Emitter Voltage                                            | 650         | V                |
| $V_{GES}$   | Gate to Emitter Voltage                                                 | $\pm 20$    | V                |
|             | Transient Gate to Emitter Voltage                                       | $\pm 30$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 100         | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 50          | A                |
| $I_{LM}(1)$ | Pulsed Collector Current @ $T_C = 25^\circ\text{C}$                     | 150         | A                |
| $I_{CM}(2)$ | Pulsed Collector Current                                                | 150         | A                |
| $I_F$       | Diode Forward Current @ $T_C = 25^\circ\text{C}$                        | 60          | A                |
|             | Diode Forward Current @ $T_C = 100^\circ\text{C}$                       | 30          | A                |
| $I_{FM}(2)$ | Pulsed Diode Maximum Forward Current                                    | 150         | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 319         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 160         | W                |
| $T_J$       | Operating Junction Temperature                                          | -55 to +175 | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature Range                                               | -55 to +175 | $^\circ\text{C}$ |
| $T_L$       | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | 300         | $^\circ\text{C}$ |

#### Notes:

1.  $V_{CC} = 400\text{ V}$ ,  $V_{GE} = 15\text{ V}$ ,  $I_C = 150\text{ A}$ ,  $R_G = 30\ \Omega$ , Inductive Load
2. Repetitive rating: Pulse width limited by max. junction temperature

## Thermal Characteristics

| Symbol                        | Parameter                                     | FGA50T65SHD | Unit                        |
|-------------------------------|-----------------------------------------------|-------------|-----------------------------|
| $R_{\theta JC}(IGBT)$         | Thermal Resistance, Junction to Case, Max.    | 0.47        | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction to Case, Max.    | 1.25        | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction to Ambient, Max. | 40          | $^{\circ}\text{C}/\text{W}$ |

## Package Marking and Ordering Information

| Pare Number | Top Mark    | Package | Packing Method | Reel Size | Tape Width | Quantity |
|-------------|-------------|---------|----------------|-----------|------------|----------|
| FGA50T65SHD | FGA50T65SHD | TO-3PN  | Tube           | -         | -          | 30       |

## Electrical Characteristics of the IGBT $T_C = 25^{\circ}\text{C}$ 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> = 0V, I <sub>C</sub> = 1 mA                                                                                          | 650  | -    | -    | V    |
| ΔBV <sub>CES</sub> /ΔT <sub>J</sub> | Temperature Coefficient of Breakdown Voltage | I <sub>C</sub> = 1 mA, Reference to 25°C                                                                                             | -    | 0.6  | -    | 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> = 50 mA, V <sub>CE</sub> = V <sub>GE</sub>                                                                            | 4.0  | 5.5  | 7.5  | V    |
| V <sub>CE(sat)</sub>                | Collector to Emitter Saturation Voltage      | I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V                                                                                        | -    | 1.6  | 2.1  | V    |
|                                     |                                              | I <sub>C</sub> = 50 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 175°C                                                                | -    | 2.14 | -    | V    |
| Dynamic Characteristics             |                                              |                                                                                                                                      |      |      |      |      |
| C <sub>ies</sub>                    | Input Capacitance                            | V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1MHz                                                                              | -    | 2516 | -    | pF   |
| C <sub>oes</sub>                    | Output Capacitance                           |                                                                                                                                      | -    | 100  | -    | pF   |
| C <sub>res</sub>                    | Reverse Transfer Capacitance                 |                                                                                                                                      | -    | 31   | -    | pF   |
| Switching Characteristics           |                                              |                                                                                                                                      |      |      |      |      |
| t <sub>d(on)</sub>                  | Turn-On Delay Time                           | V <sub>CC</sub> = 400 V, I <sub>C</sub> = 50 A, R <sub>G</sub> = 6 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 25°C  | -    | 22.4 | -    | ns   |
| t <sub>r</sub>                      | Rise Time                                    |                                                                                                                                      | -    | 38.4 | -    | ns   |
| t <sub>d(off)</sub>                 | Turn-Off Delay Time                          |                                                                                                                                      | -    | 73.6 | -    | ns   |
| t <sub>f</sub>                      | Fall Time                                    |                                                                                                                                      | -    | 12.8 | -    | ns   |
| E <sub>on</sub>                     | Turn-On Switching Loss                       |                                                                                                                                      | -    | 1280 | -    | μJ   |
| E <sub>off</sub>                    | Turn-Off Switching Loss                      |                                                                                                                                      | -    | 384  | -    | μJ   |
| E <sub>ts</sub>                     | Total Switching Loss                         |                                                                                                                                      | -    | 1664 | -    | μJ   |
| t <sub>d(on)</sub>                  | Turn-On Delay Time                           | V <sub>CC</sub> = 400 V, I <sub>C</sub> = 50 A, R <sub>G</sub> = 6 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 175°C | -    | 20.8 | -    | ns   |
| t <sub>r</sub>                      | Rise Time                                    |                                                                                                                                      | -    | 36.8 | -    | ns   |
| t <sub>d(off)</sub>                 | Turn-Off Delay Time                          |                                                                                                                                      | -    | 79.2 | -    | ns   |
| t <sub>f</sub>                      | Fall Time                                    |                                                                                                                                      | -    | 11.2 | -    | ns   |
| E <sub>on</sub>                     | Turn-On Switching Loss                       |                                                                                                                                      | -    | 1920 | -    | μJ   |
| E <sub>off</sub>                    | Turn-Off Switching Loss                      |                                                                                                                                      | -    | 556  | -    | μJ   |
| E <sub>ts</sub>                     | Total Switching Loss                         |                                                                                                                                      | -    | 2476 | -    | μJ   |