



April 2015

# FGH60N60SFDTU\_F085

## 600 V, 60 A Field Stop IGBT



### Features

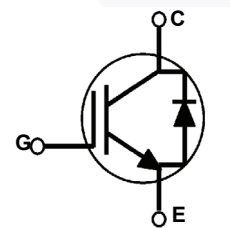
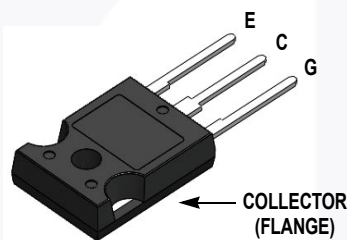
- High Current Capability
- Low Saturation Voltage:  $V_{CE(sat)} = 2.2 \text{ V @ } I_C = 60 \text{ A}$
- High Input Impedance
- Fast Switching
- RoHS Compliant
- Qualified to Automotive Requirements of AEC-Q101

### General Description

Using Novel Field Stop IGBT Technology, Fairchild's new series of Field Stop IGBTs offer the optimum performance for Automotive Chargers, Inverter, and other applications where low conduction and switching losses are essential.

### Applications

- Automotive chargers, Converters, High Voltage Auxiliaries
- Inverters, PFC, UPS



### Absolute Maximum Ratings

| Symbol      | Description   | Ratings     | Unit             |
|-------------|---|-------------|------------------|
| $V_{CES}$   | Collector to Emitter Voltage  | 600         | V                |
| $V_{GES}$   | Gate to Emitter Voltage   | $\pm 20$    | V                |
|             | Transient Gate-to-Emitter Voltage                                       | $\pm 30$    |                  |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 120         | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 60          | A                |
| $I_{CM(1)}$ | Pulsed Collector Current @ $T_C = 25^\circ\text{C}$                     | 180         | A                |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 378         | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 151         | 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 test, Pulse width limited by max. junction temperature

### Thermal Characteristics

| Symbol                        | Parameter                               | Typ. | Unit               |
|-------------------------------|---|------|--------------------|
| $R_{\theta JC}(\text{IGBT})$  | Thermal Resistance, Junction to Case    | 0.33 | $^\circ\text{C/W}$ |
| $R_{\theta JC}(\text{Diode})$ | Thermal Resistance, Junction to Case    | 1.1  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$               | Thermal Resistance, Junction to Ambient | 40   | $^\circ\text{C/W}$ |

FGH60N60SFDTU\_F085 — 600 V, 60 A Field Stop IGBT

## Package Marking and Ordering Information

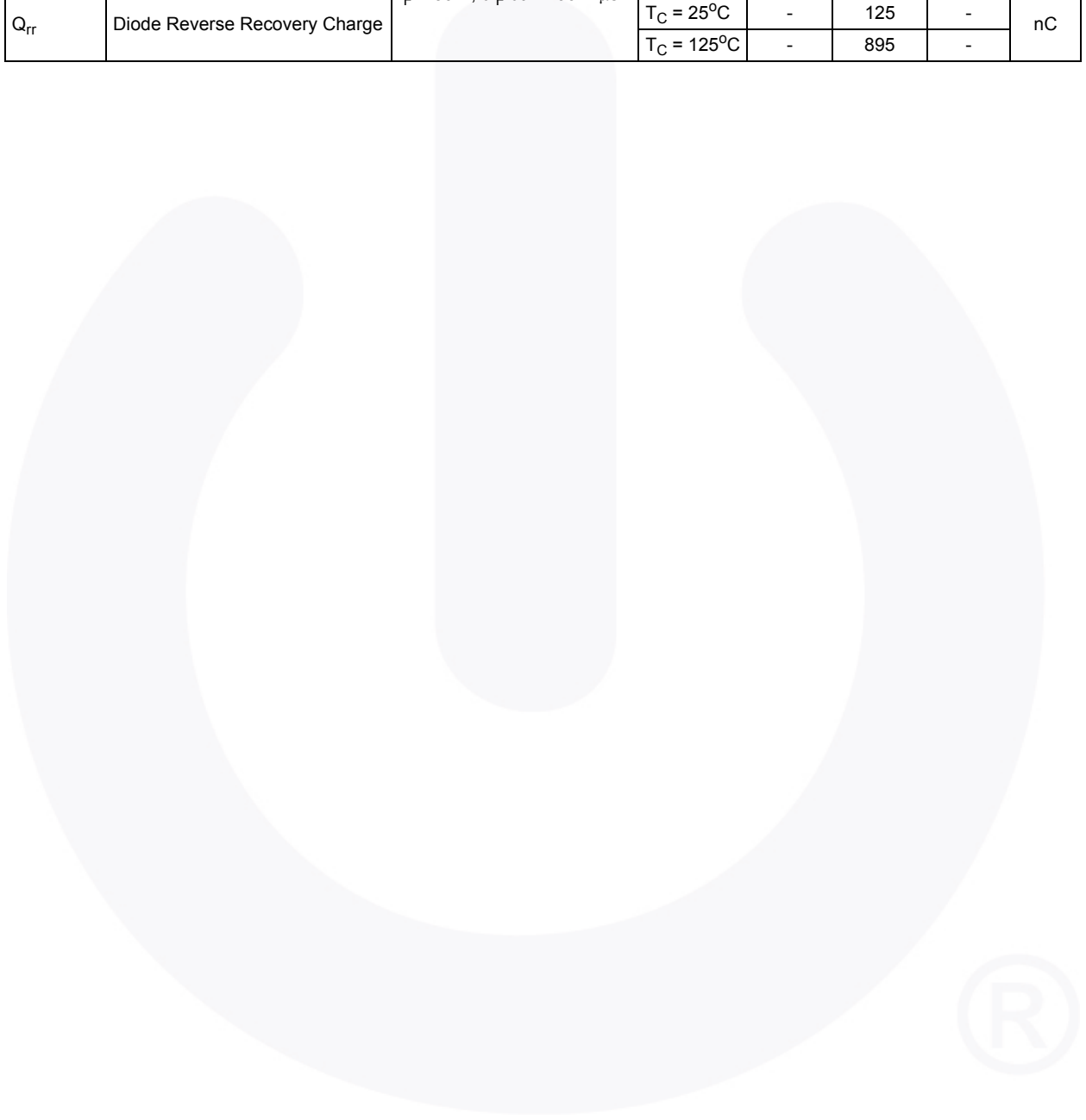
| Part Number        | Top Mark    | Package | Packing Method | Reel Size | Tape Width | Quantity |
|--------------------|-------------|---------|----------------|-----------|------------|----------|
| FGH60N60SFDTU_F085 | FGH60N60SFD | TO-247  | Tube           | N/A       | N/A        | 30       |

## 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             |
| $\Delta BV_{CES} / \Delta T_J$   | Temperature Coefficient of Breakdown Voltage | $V_{GE} = 0\text{ V}, I_C = 250\ \mu\text{A}$   | -    | 0.4  | -    | V/°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                          | $V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$   | -    | -    | ±400 | nA            |
| <b>On Characteristics</b>        |  |   |      |      |      |               |
| $V_{GE(th)}$                     | G-E Threshold Voltage                        | $I_C = 250\ \mu\text{A}, V_{CE} = V_{GE}$   | 4.0  | 5.1  | 6.6  | V             |
| $V_{CE(sat)}$                    | Collector to Emitter Saturation Voltage      | $I_C = 60\text{ A}, V_{GE} = 15\text{ V}$   | -    | 2.2  | 2.9  | V             |
|                                  |  | $I_C = 60\text{ A}, V_{GE} = 15\text{ V}, T_C = 125^\circ\text{C}$  | -    | 2.4  | -    | V             |
| <b>Dynamic Characteristics</b>   |  |   |      |      |      |               |
| $C_{ies}$                        | Input Capacitance                            | $V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$   | -    | 2940 | -    | pF            |
| $C_{oes}$                        | Output Capacitance                           |   | -    | 310  | -    | pF            |
| $C_{res}$                        | Reverse Transfer Capacitance                 |   | -    | 100  | -    | pF            |
| <b>Switching Characteristics</b> |  |   |      |      |      |               |
| $t_{d(on)}$                      | Turn-On Delay Time                           | $V_{CC} = 400\text{ V}, I_C = 60\text{ A}, R_G = 5\ \Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 25^\circ\text{C}$  | -    | 26   | -    | ns            |
| $t_r$                            | Rise Time                                    |   | -    | 54   | -    | ns            |
| $t_{d(off)}$                     | Turn-Off Delay Time                          |   | -    | 134  | -    | ns            |
| $t_f$                            | Fall Time                                    |   | -    | 18   | 62   | ns            |
| $E_{on}$                         | Turn-On Switching Loss                       |   | -    | 1.97 | -    | mJ            |
| $E_{off}$                        | Turn-Off Switching Loss                      |   | -    | 0.57 | -    | mJ            |
| $E_{ts}$                         | Total Switching Loss                         |   | -    | 2.54 | -    | mJ            |
| $t_{d(on)}$                      | Turn-On Delay Time                           | $V_{CC} = 400\text{ V}, I_C = 60\text{ A}, R_G = 5\ \Omega, V_{GE} = 15\text{ V},$<br>Inductive Load, $T_C = 125^\circ\text{C}$ | -    | 26   | -    | ns            |
| $t_r$                            | Rise Time                                    |   | -    | 50   | -    | ns            |
| $t_{d(off)}$                     | Turn-Off Delay Time                          |   | -    | 142  | -    | ns            |
| $t_f$                            | Fall Time                                    |   | -    | 24   | -    | ns            |
| $E_{on}$                         | Turn-On Switching Loss                       |   | -    | 2.5  | -    | mJ            |
| $E_{off}$                        | Turn-Off Switching Loss                      |   | -    | 0.8  | -    | mJ            |
| $E_{ts}$                         | Total Switching Loss                         |   | -    | 3.2  | -    | mJ            |
| $Q_g$                            | Total Gate Charge                            | $V_{CE} = 400\text{ V}, I_C = 60\text{ A}, V_{GE} = 15\text{ V}$  | -    | 188  | -    | nC            |
| $Q_{ge}$                         | Gate to Emitter Charge                       |   | -    | 21   | -    | nC            |
| $Q_{gc}$                         | Gate to Collector Charge                     |   | -    | 98   | -    | nC            |

**Electrical Characteristics of the Diode** T<sub>C</sub> = 25°C unless otherwise noted

| Symbol          | Parameter                     | Test Conditions                                       | Min.                   | Typ. | Max | Unit |    |
|-----------------|-------------------------------|---|------------------------|------|-----|------|----|
| V <sub>FM</sub> | Diode Forward Voltage         | I <sub>F</sub> = 30 A                                 | T <sub>C</sub> = 25°C  | -    | 1.9 | 2.6  | V  |
|                 |                               |   | T <sub>C</sub> = 125°C | -    | 1.7 | -    |    |
| t <sub>rr</sub> | Diode Reverse Recovery Time   | I <sub>F</sub> = 30 A, di <sub>F</sub> /dt = 200 A/μs | T <sub>C</sub> = 25°C  | -    | 55  | -    | ns |
|                 |                               |   | T <sub>C</sub> = 125°C | -    | 204 | -    |    |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge | I <sub>F</sub> = 30 A, di <sub>F</sub> /dt = 200 A/μs | T <sub>C</sub> = 25°C  | -    | 125 | -    | nC |
|                 |                               |   | T <sub>C</sub> = 125°C | -    | 895 | -    |    |



## Typical Performance Characteristics

Figure 1. Typical Output Characteristics

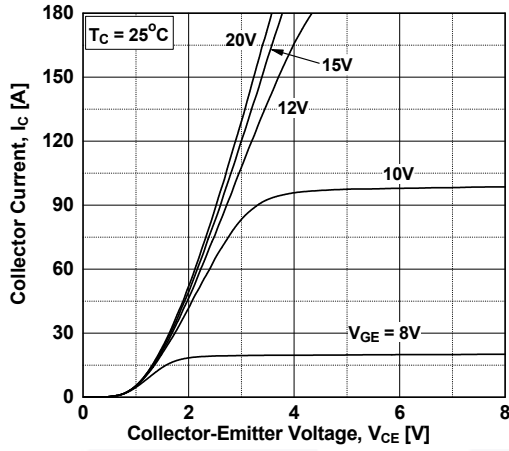


Figure 2. Typical Output Characteristics

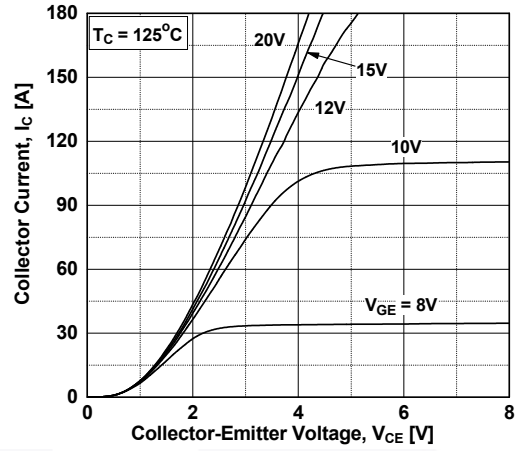


Figure 3. Typical Saturation Voltage Characteristics

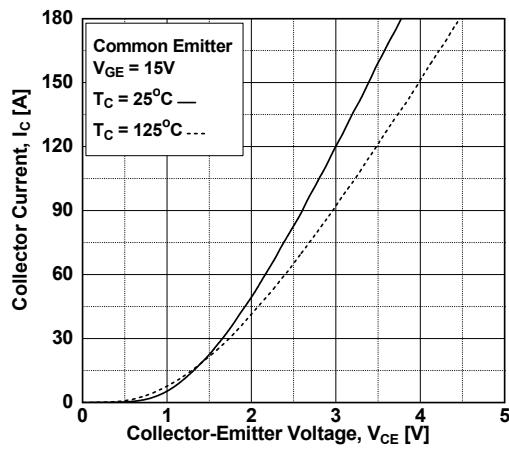


Figure 4. Transfer Characteristics

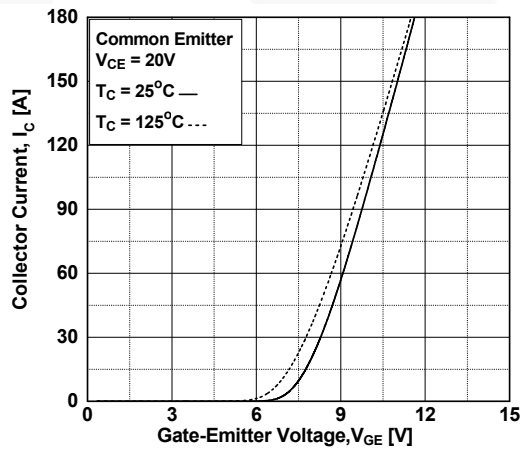


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

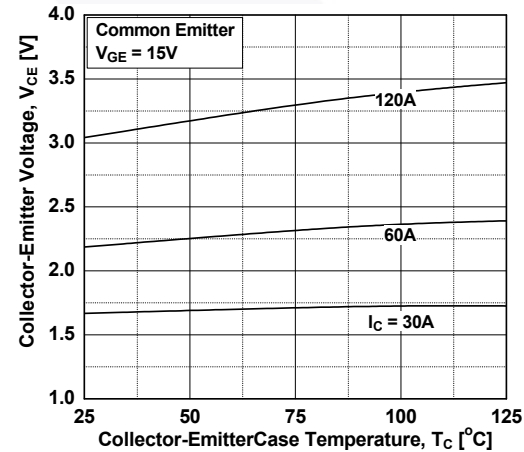
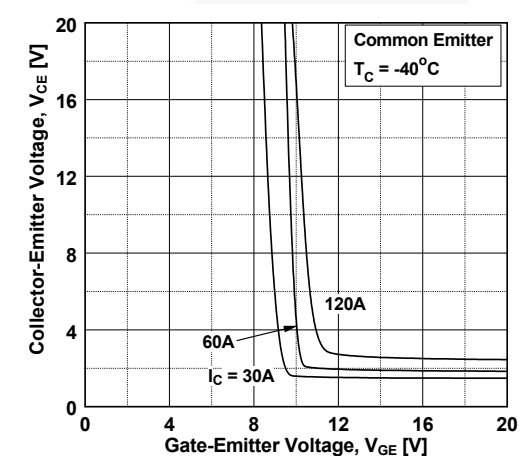


Figure 6. Saturation Voltage vs. Vge



## Typical Performance Characteristics

Figure 7. Saturation Voltage vs.  $V_{GE}$

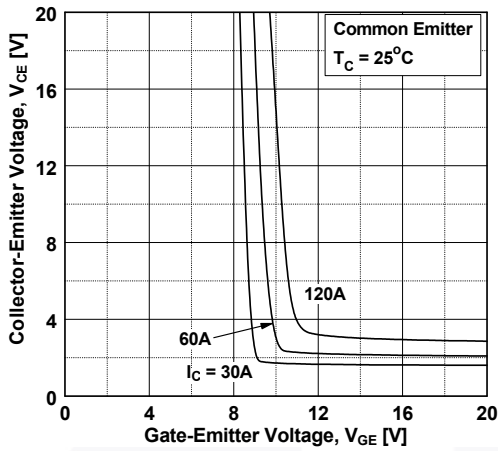


Figure 8. Saturation Voltage vs.  $V_{GE}$

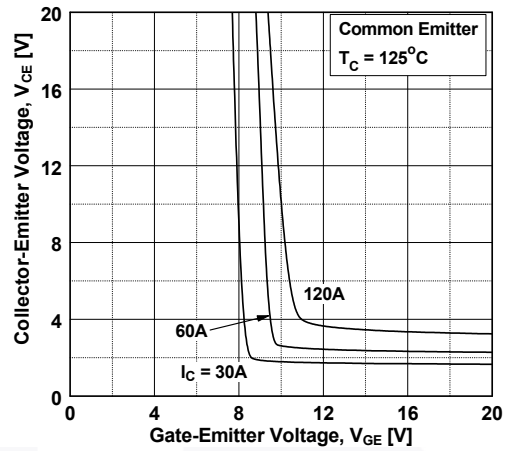


Figure 9. Capacitance Characteristics

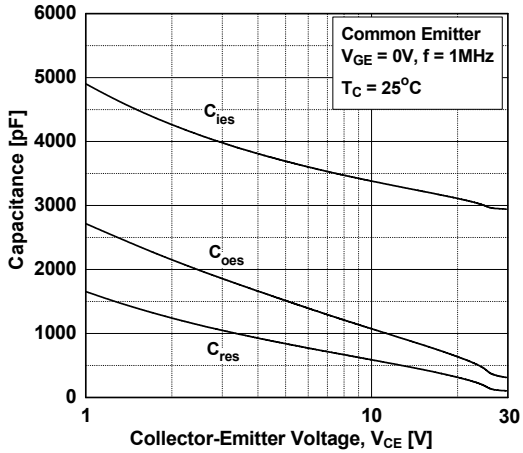


Figure 10. Gate charge Characteristics

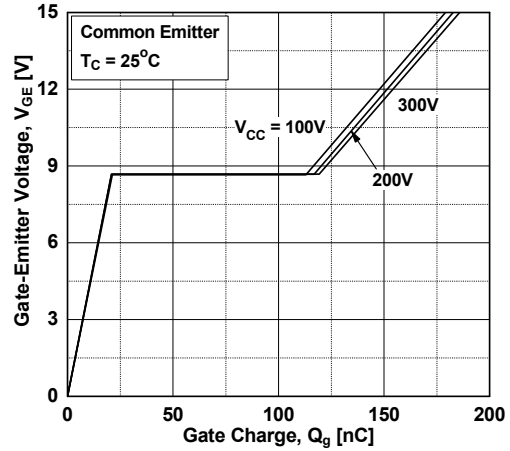


Figure 11. SOA Characteristics

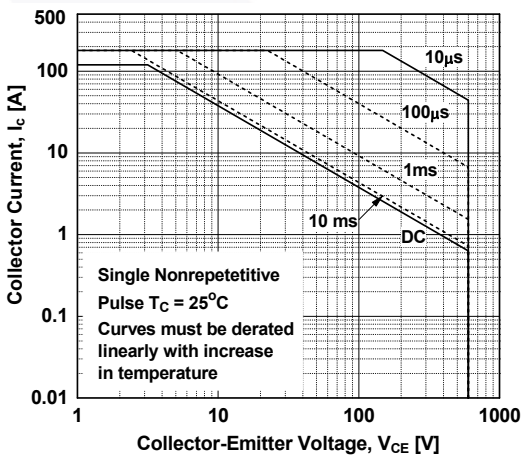
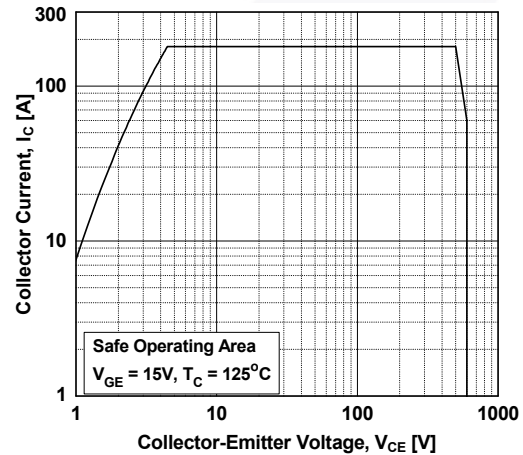
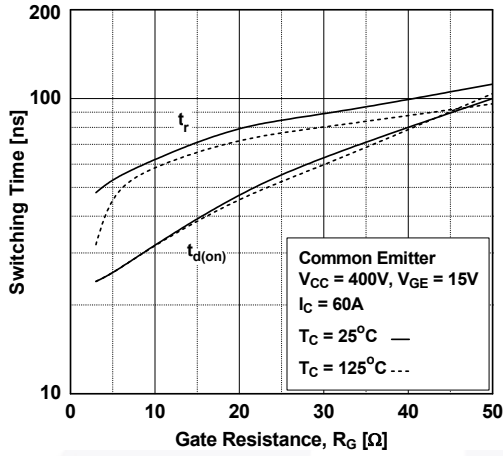


Figure 12. Turn off Switching SOA Characteristics

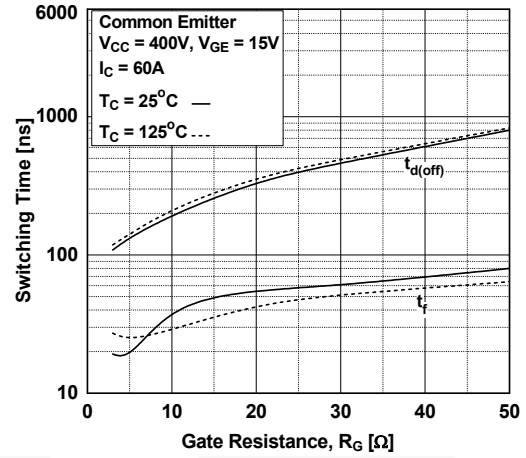


## Typical Performance Characteristics

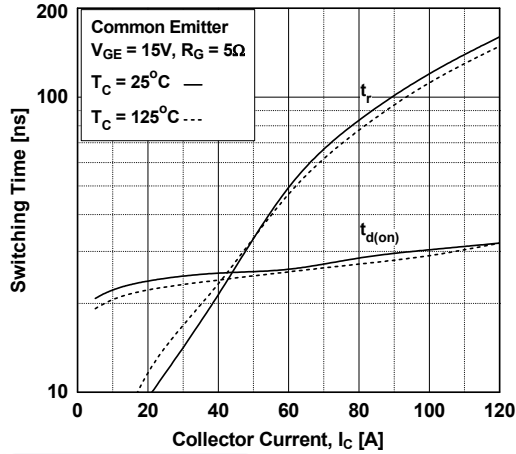
**Figure 13. Turn-on Characteristics vs. Gate Resistance**



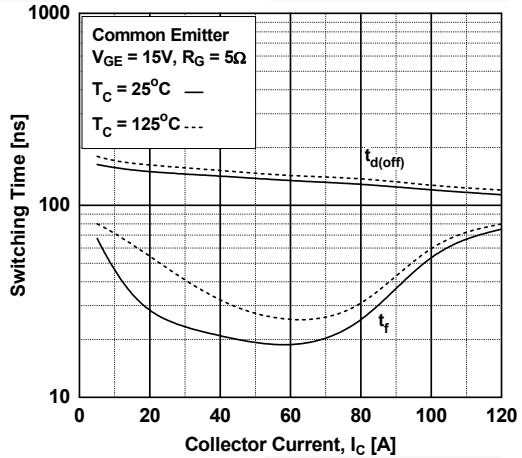
**Figure 14. Turn-off Characteristics vs. Gate Resistance**



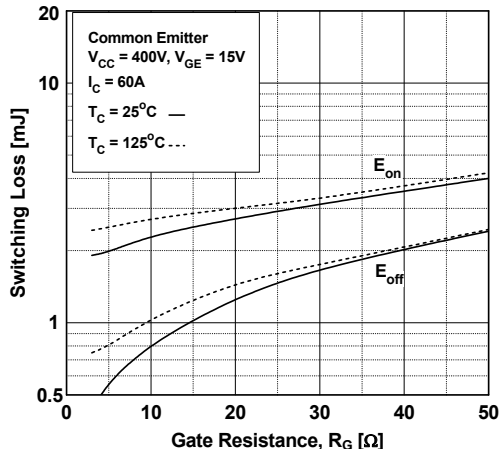
**Figure 15. Turn-on Characteristics vs. Collector Current**



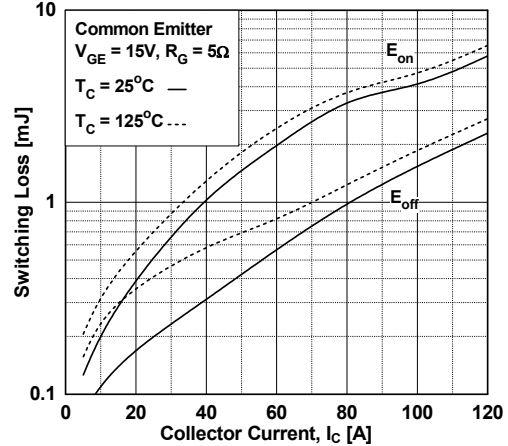
**Figure 16. Turn-off Characteristics vs. Collector Current**



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



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



## Typical Performance Characteristics

Figure 19. Forward Characteristics

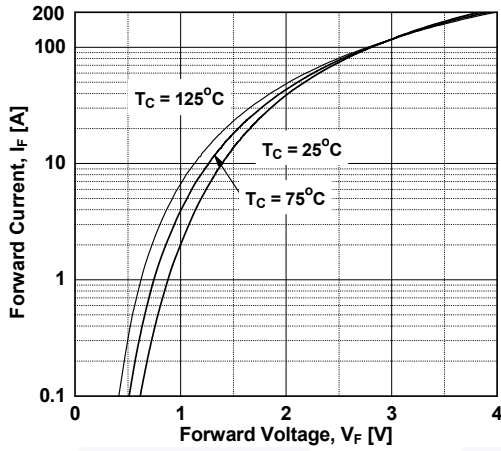


Figure 20. Reverse Current

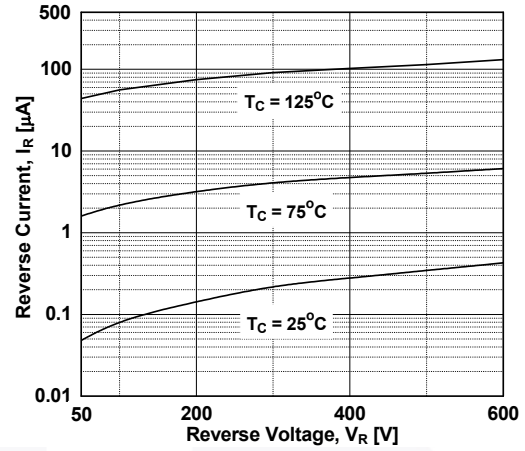


Figure 21. Stored Charge

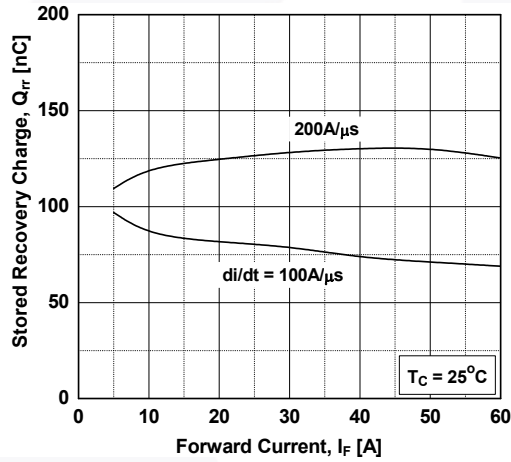


Figure 22. Reverse Recovery Time

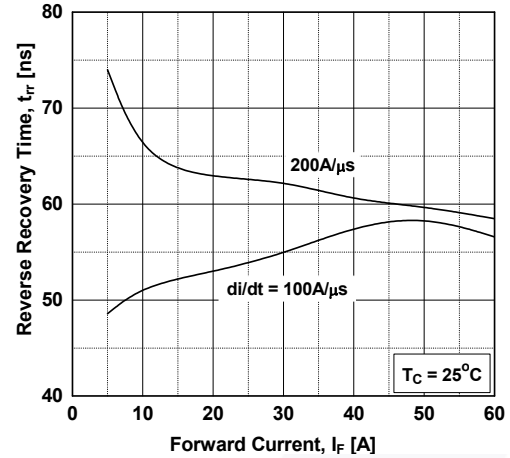
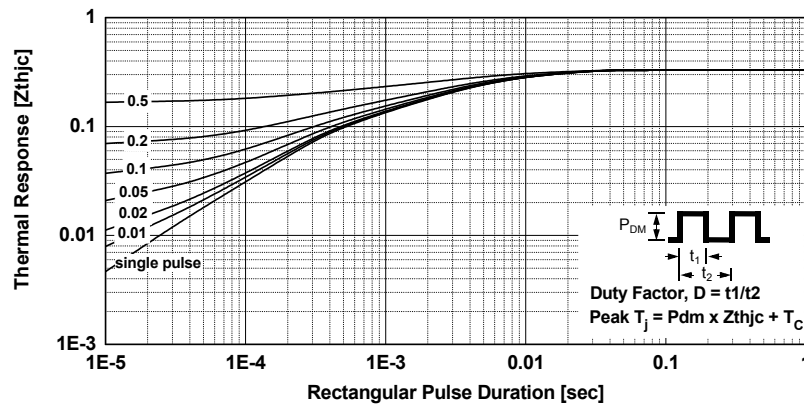
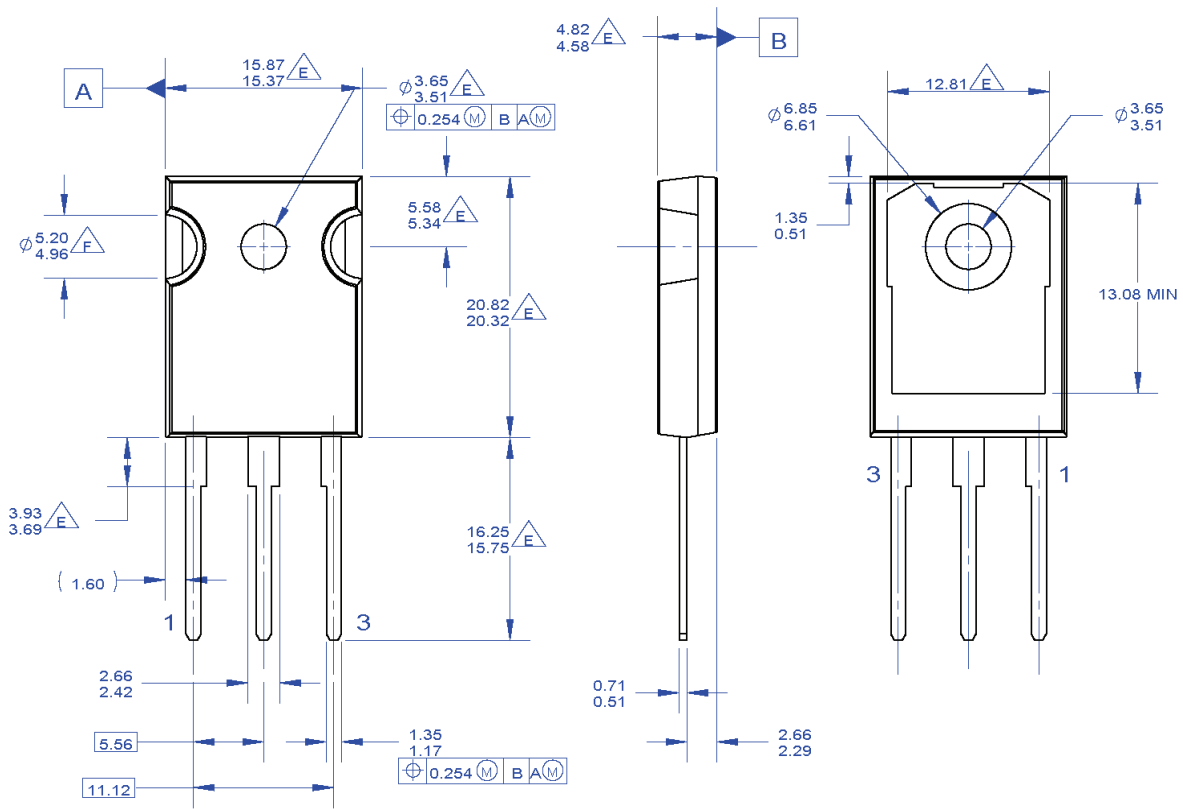


Figure 23. Transient Thermal Impedance of IGBT



**Mechanical Dimensions**



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. PACKAGE REFERENCE: JEDEC TO-247, ISSUE E, VARIATION AB, DATED JUNE, 2004.
- B. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DRAWING CONFORMS TO ASME Y14.5 - 1994

DOES NOT COMPLY JEDEC STANDARD VALUE

NOTCH MAY BE SQUARE

G. DRAWING FILENAME: MKT-TO247A03\_REV03

**Figure 24. TO-247 3L - TO-247,MOLDED,3 LEAD,JEDEC VARIATION AB**

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TO247-003](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO247-003)





**TRADEMARKS**

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

- |                          |   |                                       |                  |
|--------------------------|---|---------------------------------------|------------------|
| AccuPower™               | F-PFS™  | OPTOPLANAR®                           | SYSTEM GENERAL®  |
| AttitudeEngine™          | FRFET®  | ®                                     | TinyBoost®       |
| Awinda®                  | Global Power ResourceSM                         | Power Supply WebDesigner™             | TinyBuck®        |
| AX-CAP®*                 | GreenBridge™                                    | PowerTrench®                          | TinyCalc™        |
| BitSiC™                  | Green FPS™                                      | PowerXS™                              | TinyLogic®       |
| Build it Now™            | Green FPS™ e-Series™                            | Programmable Active Droop™            | TINYOPTO™        |
| CorePLUS™                | Gmax™   | QFET®                                 | TinyPower™       |
| CorePOWER™               | GTO™  | QS™                                   | TinyPWM™         |
| CROSSVOLT™               | IntelliMAX™                                     | Quiet Series™                         | TinyWire™        |
| CTL™                     | ISOPLANAR™                                      | RapidConfigure™                       | TransiC™         |
| Current Transfer Logic™  | Marking Small Speakers Sound Louder and Better™ | ®                                     | TriFault Detect™ |
| DEUXPEED®                | MegaBuck™                                       | Saving our world, 1mW/W/kW at a time™ | TRUECURRENT®*    |
| Dual Cool™               | MICROCOUPLER™                                   | SignalWise™                           | µSerDes™         |
| EcoSPARK®                | MicroFET™                                       | SmartMax™                             | ®                |
| EfficientMax™            | MicroPak™                                       | SMART START™                          | UHC®             |
| ESBC™                    | MicroPak2™                                      | Solutions for Your Success™           | SPM®             |
| <b>F</b> ®               | MillerDrive™                                    | SPM®                                  | STEALTH™         |
| Fairchild®               | MotionMax™                                      | SuperFET®                             | SuperSOT™-3      |
| Fairchild Semiconductor® | MotionGrid®                                     | SuperSOT™-6                           | SuperSOT™-8      |
| FACT Quiet Series™       | MT®   | SupreMOS®                             | SyncFET™         |
| FACT®                    | MTx®  | SyncLock™                             |                  |
| FAST®                    | MVN®  |                                       |                  |
| FastvCore™               | mWSaver®  |                                       |                  |
| FETBench™                | OptoHiT™  |                                       |                  |
| FPS™                     | OPTOLOGIC®                                      |                                       |                  |

\*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

**DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. TO OBTAIN THE LATEST, MOST UP-TO-DATE DATASHEET AND PRODUCT INFORMATION, VISIT OUR WEBSITE AT [HTTP://WWW.FAIRCHILDSEMI.COM](http://www.fairchildsemi.com). FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
- 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.

**ANTI-COUNTERFEITING POLICY**

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.fairchildsemi.com](http://www.fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

**PRODUCT STATUS DEFINITIONS**

**Definition of Terms**

| 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.  |



## Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331