

# SGW5N60RUF

## Short Circuit Rated IGBT

### General Description

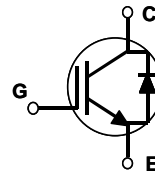
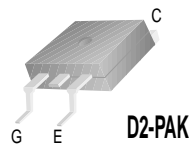
Fairchild's RUF series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness is a required feature.

### Features

- Short circuit rated 10us @  $T_C = 100^\circ\text{C}$ ,  $V_{GE} = 15\text{V}$
- High speed switching
- Low saturation voltage :  $V_{CE(sat)} = 2.2\text{V}$  @  $I_C = 5\text{A}$
- High input impedance
- CO-PAK, IGBT with FRD :  $t_{rr} = 37\text{ns}$  (typ.)

### Applications

AC & DC motor controls, general purpose inverters, robotics, and servo controls.



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol      | Description   | SGW5N60RUF  | Units            |
|-------------|---|-------------|------------------|
| $V_{CES}$   | Collector-Emitter Voltage   | 600         | V                |
| $V_{GES}$   | Gate-Emitter Voltage  | $\pm 20$    | V                |
| $I_C$       | Collector Current @ $T_C = 25^\circ\text{C}$                            | 8           | A                |
|             | Collector Current @ $T_C = 100^\circ\text{C}$                           | 5           | A                |
| $I_{CM(1)}$ | Pulsed Collector Current  | 15          | A                |
| $I_F$       | Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$            | 8           | A                |
| $I_{FM}$    | Diode Maximum Forward Current   | 56          | A                |
| $T_{SC}$    | Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$                | 10          | us               |
| $P_D$       | Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$                    | 60          | W                |
|             | Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$                   | 25          | 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. | Units              |
|-------------------------|---|------|------|--------------------|
| $R_{\theta JC}$ (IGBT)  | Thermal Resistance, Junction-to-Case                    | --   | 2.0  | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ (DIODE) | Thermal Resistance, Junction-to-Case                    | --   | 3.5  | $^\circ\text{C/W}$ |
| $R_{\theta JA}$         | Thermal Resistance, Junction-to-Ambient (PCB Mount) (2) | --   | 40   | $^\circ\text{C/W}$ |

**Notes :**

(2) Mounted on 1" square PCB (FR4 or G-10 Material)

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

| Symbol                       | Parameter                                    | Test Conditions                 | Min. | Typ. | Max.      | Units        |
|------------------------------|--|---------------------------------|------|------|-----------|--------------|
| <b>Off Characteristics</b>   |  |                                 |      |      |           |              |
| $BV_{CES}$                   | Collector-Emitter Breakdown Voltage          | $V_{GE} = 0V, I_C = 250\mu A$   | 600  | --   | --        | V            |
| $\Delta BV_{CES}/\Delta T_J$ | Temperature Coefficient of Breakdown Voltage | $V_{GE} = 0V, I_C = 1mA$        | --   | 0.6  | --        | $V/^\circ C$ |
| $I_{CES}$                    | Collector Cut-Off Current                    | $V_{CE} = V_{CES}, V_{GE} = 0V$ | --   | --   | 250       | $\mu A$      |
| $I_{GES}$                    | G-E Leakage Current                          | $V_{GE} = V_{GES}, V_{CE} = 0V$ | --   | --   | $\pm 100$ | nA           |

**On Characteristics**

|               |   |                              |     |     |     |   |
|---------------|---|------------------------------|-----|-----|-----|---|
| $V_{GE(th)}$  | G-E Threshold Voltage                   | $I_C = 5mA, V_{CE} = V_{GE}$ | 5.0 | 6.0 | 8.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C = 5A, V_{GE} = 15V$     | --  | 2.2 | 2.8 | V |
|               |   | $I_C = 8A, V_{GE} = 15V$     | --  | 2.5 | --  | V |

**Dynamic Characteristics**

|           |                              |  |    |     |    |    |
|-----------|------------------------------|--|----|-----|----|----|
| $C_{ies}$ | Input Capacitance            | $V_{CE} = 30V, V_{GE} = 0V,$<br>$f = 1MHz$ | -- | 354 | -- | pF |
| $C_{oes}$ | Output Capacitance           |  | -- | 67  | -- | pF |
| $C_{res}$ | Reverse Transfer Capacitance |  | -- | 14  | -- | pF |

**Switching Characteristics**

|              |                              |   |  |     |     |         |    |
|--------------|------------------------------|---|--|-----|-----|---------|----|
| $t_{d(on)}$  | Turn-On Delay Time           | $V_{CC} = 300V, I_C = 5A,$<br>$R_G = 40\Omega, V_{GE} = 15V,$<br>Inductive Load, $T_C = 25^\circ C$ | --   | 13  | --  | ns      |    |
| $t_r$        | Rise Time                    |   | --   | 24  | --  | ns      |    |
| $t_{d(off)}$ | Turn-Off Delay Time          |   | --   | 34  | 50  | ns      |    |
| $t_f$        | Fall Time                    |   | --   | 136 | 200 | ns      |    |
| $E_{on}$     | Turn-On Switching Loss       |   | --   | 88  | --  | $\mu J$ |    |
| $E_{off}$    | Turn-Off Switching Loss      |   | --   | 107 | --  | $\mu J$ |    |
| $E_{ts}$     | Total Switching Loss         |   | --   | 195 | 280 | $\mu J$ |    |
| $t_{d(on)}$  | Turn-On Delay Time           |   | $V_{CC} = 300V, I_C = 5A,$<br>$R_G = 40\Omega, V_{GE} = 15V,$<br>Inductive Load, $T_C = 125^\circ C$ | --  | 13  | --      | ns |
| $t_r$        | Rise Time                    |   |  | --  | 26  | --      | ns |
| $t_{d(off)}$ | Turn-Off Delay Time          |   |  | --  | 40  | 60      | ns |
| $t_f$        | Fall Time                    | --  |  | 250 | 350 | ns      |    |
| $E_{on}$     | Turn-On Switching Loss       | --  |  | 103 | --  | $\mu J$ |    |
| $E_{off}$    | Turn-Off Switching Loss      | --  |  | 220 | --  | $\mu J$ |    |
| $E_{ts}$     | Total Switching Loss         | --  |  | 323 | --  | $\mu J$ |    |
| $T_{sc}$     | Short Circuit Withstand Time | $V_{CC} = 300V, V_{GE} = 15V$<br>@ $T_C = 100^\circ C$  | 10   | --  | --  | $\mu s$ |    |
| $Q_g$        | Total Gate Charge            | $V_{CE} = 300V, I_C = 5A,$<br>$V_{GE} = 15V$  | --   | 16  | 24  | nC      |    |
| $Q_{ge}$     | Gate-Emitter Charge          |   | --   | 3   | 6   | nC      |    |
| $Q_{gc}$     | Gate-Collector Charge        |   | --   | 7   | 14  | nC      |    |
| $L_e$        | Internal Emitter Inductance  | Measured 5mm from PKG   | --   | 7.5 | --  | nH      |    |

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

| Symbol   | Parameter                           | Test Conditions                     | Min.                | Typ. | Max. | Units |    |
|----------|-------------------------------------|-------------------------------------|---------------------|------|------|-------|----|
| $V_{FM}$ | Diode Forward Voltage               | $I_F = 8A$                          | $T_C = 25^\circ C$  | --   | 1.4  | 1.7   | V  |
|          |                                     |                                     | $T_C = 100^\circ C$ | --   | 1.3  | --    |    |
| $t_{rr}$ | Diode Reverse Recovery Time         | $I_F = 8A,$<br>$di/dt = 200A/\mu s$ | $T_C = 25^\circ C$  | --   | 37   | 55    | ns |
|          |                                     |                                     | $T_C = 100^\circ C$ | --   | 55   | --    |    |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | $I_F = 8A,$<br>$di/dt = 200A/\mu s$ | $T_C = 25^\circ C$  | --   | 3.5  | 5.0   | A  |
|          |                                     |                                     | $T_C = 100^\circ C$ | --   | 4.5  | --    |    |
| $Q_{rr}$ | Diode Reverse Recovery Charge       | $I_F = 8A,$<br>$di/dt = 200A/\mu s$ | $T_C = 25^\circ C$  | --   | 65   | 138   | nC |
|          |                                     |                                     | $T_C = 100^\circ C$ | --   | 124  | --    |    |

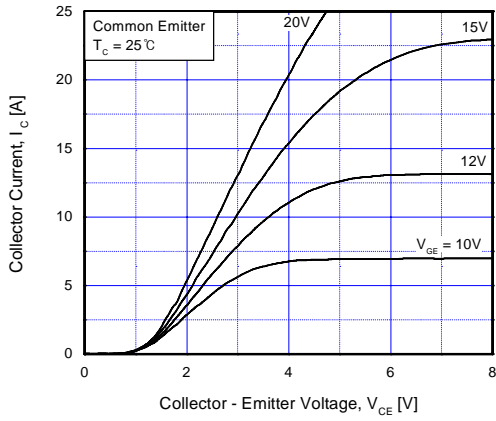


Fig 1. Typical Output Characteristics

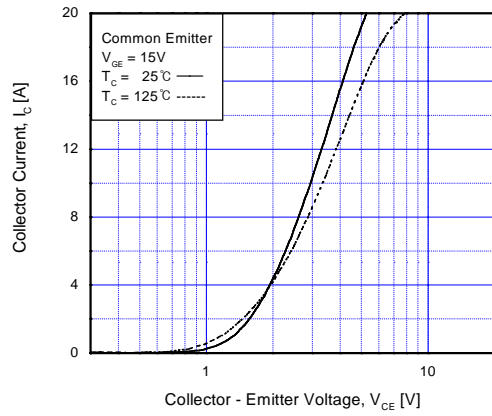


Fig 2. Typical Saturation Voltage Characteristics

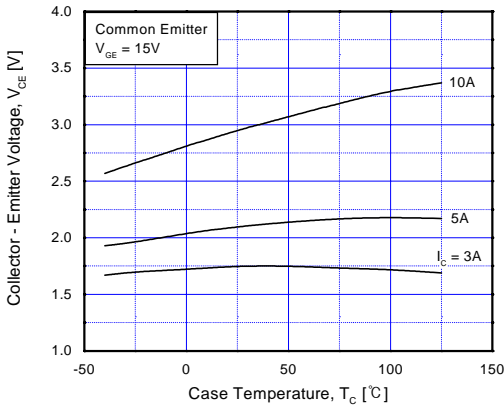


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

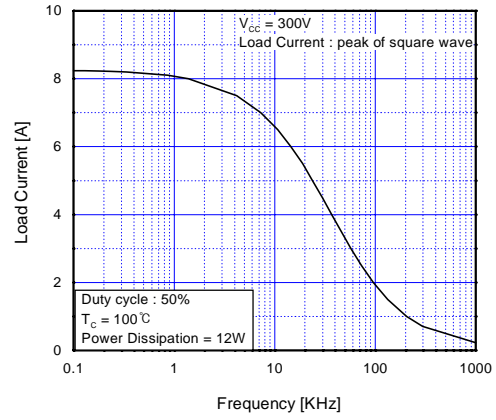


Fig 4. Load Current vs. Frequency

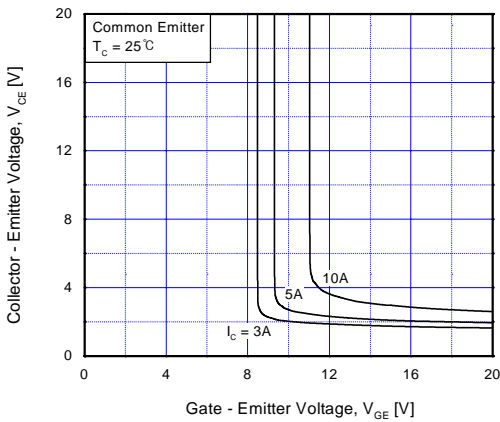


Fig 5. Saturation Voltage vs.  $V_{GE}$

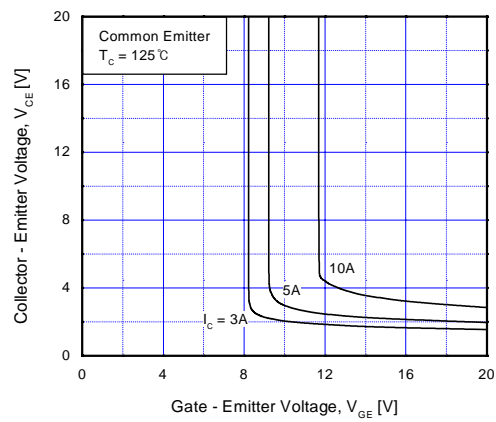
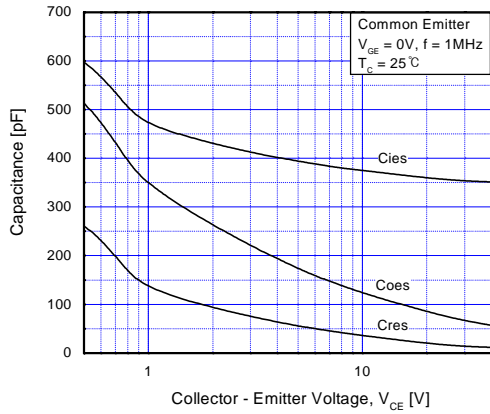
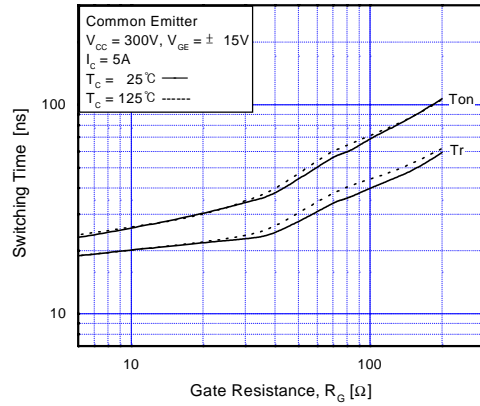


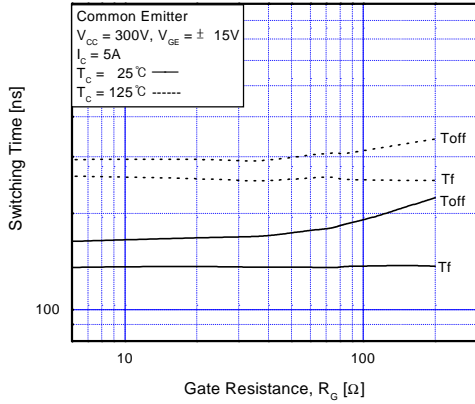
Fig 6. Saturation Voltage vs.  $V_{GE}$



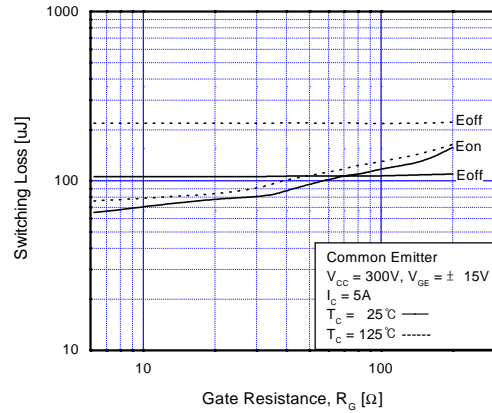
**Fig 7. Capacitance Characteristics**



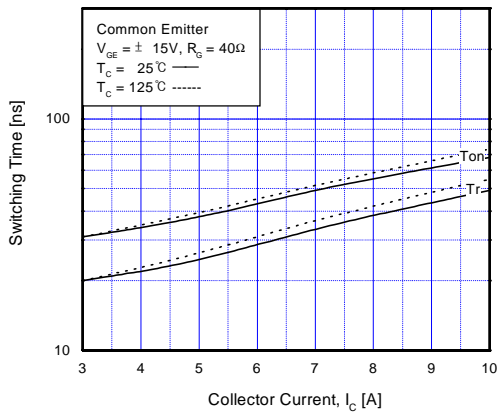
**Fig 8. Turn-On Characteristics vs. Gate Resistance**



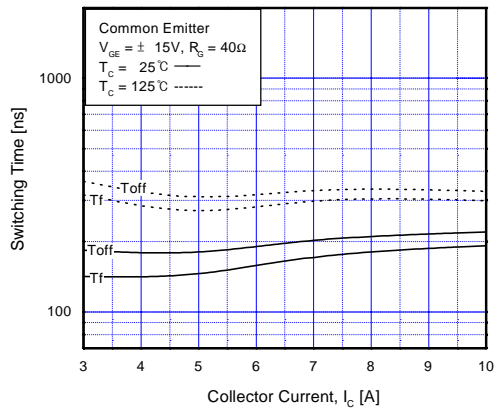
**Fig 9. Turn-Off Characteristics vs. Gate Resistance**



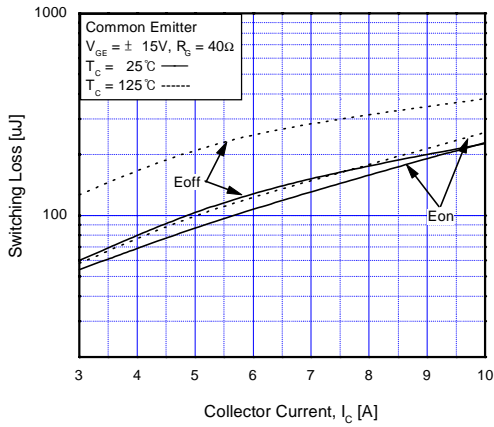
**Fig 10. Switching Loss vs. Gate Resistance**



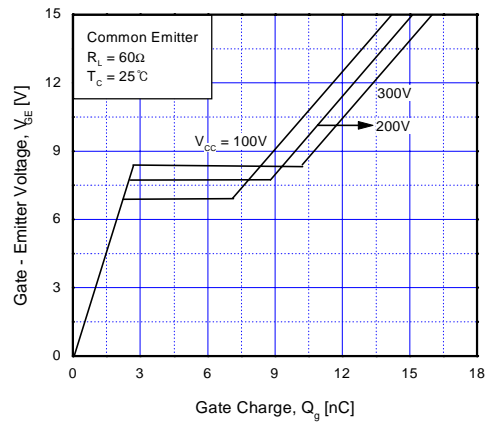
**Fig 11. Turn-On Characteristics vs. Collector Current**



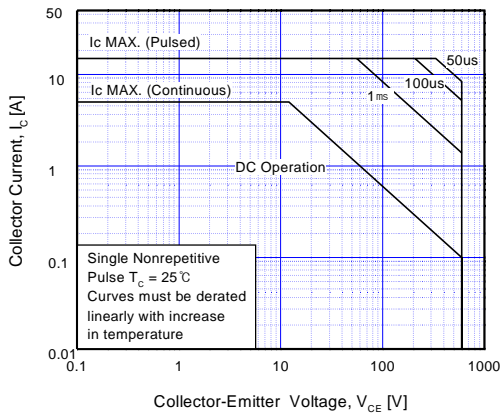
**Fig 12. Turn-Off Characteristics vs. Collector Current**



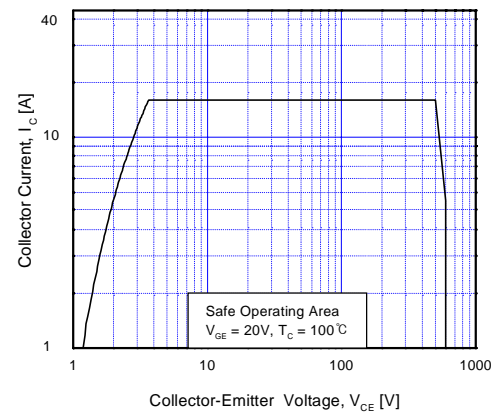
**Fig 13. Switching Loss vs. Collector Current**



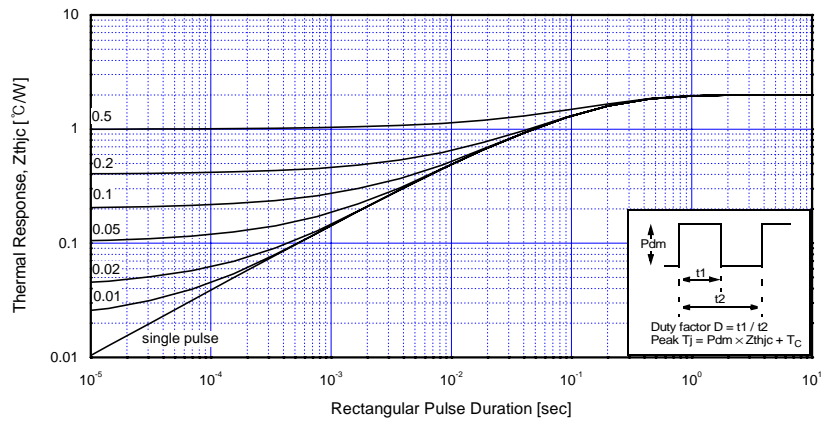
**Fig 14. Gate Charge Characteristics**



**Fig 15. SOA Characteristic**



**Fig 16. Turn-Off SOA Characteristics**



**Fig 17. Transient Thermal Impedance of IGBT**

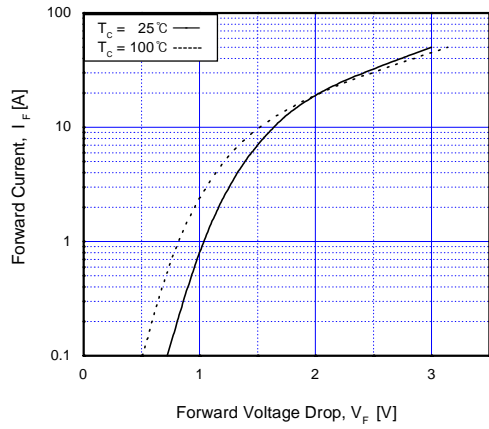


Fig 18. Forward Characteristics

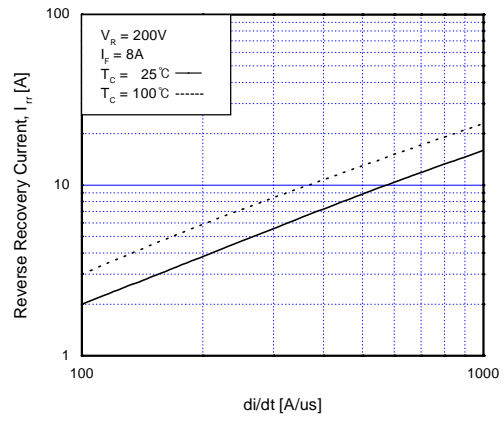


Fig 19. Reverse Recovery Current

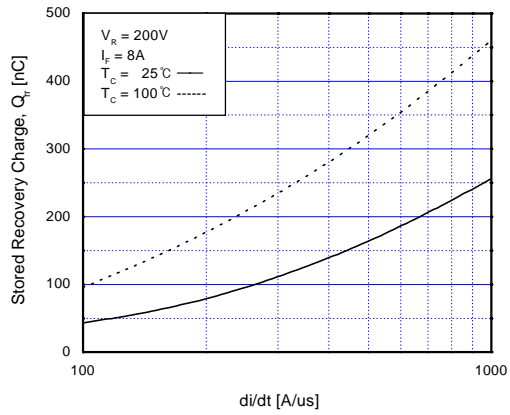


Fig 20. Stored Charge

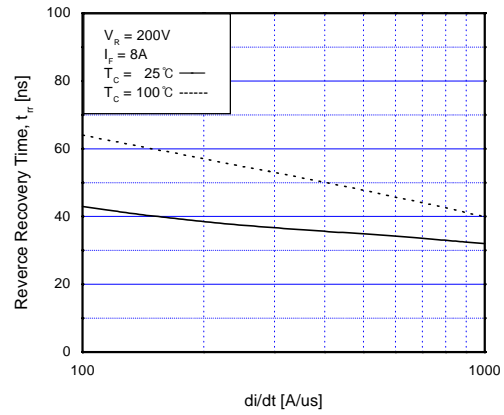
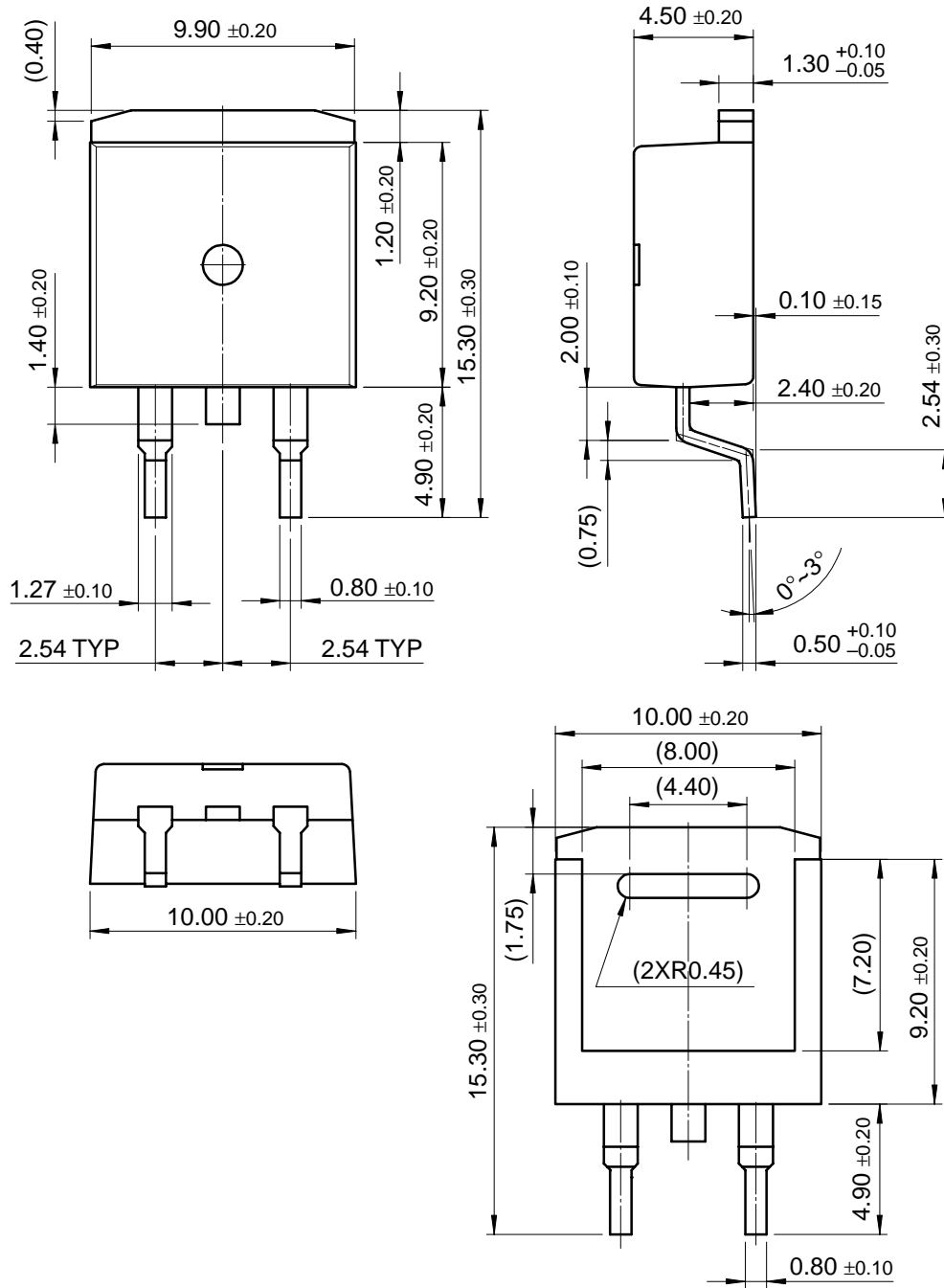


Fig 21. Reverse Recovery Time

Package Dimension

# D<sup>2</sup>-PAK

SGW5N60RUF<sub>D</sub>



Dimensions in Millimeters

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|                      |                     |                     |                  |           |
|----------------------|---------------------|---------------------|------------------|-----------|
| ACEx™                | FAST®               | MICROWIRE™          | SLIENT SWITCHER® | UHC™      |
| Bottomless™          | FASTr™              | OPTOLOGIC™          | SMART START™     | UltraFET® |
| CoolFET™             | FRFET™              | OPTOPLANAR™         | SPM™             | VCX™      |
| CROSSVOLT™           | GlobalOptoisolator™ | PACMAN™             | STAR*POWER™      |           |
| DenseTrench™         | GTO™                | POPT™               | Stealth™         |           |
| DOMETM               | HiSeC™              | Power247™           | SuperSOT™-3      |           |
| EcoSPARK™            | I <sup>2</sup> C™   | PowerTrench®        | SuperSOT™-6      |           |
| E <sup>2</sup> CMOS™ | ISOPLANAR™          | QFET™               | SuperSOT™-8      |           |
| EnSigna™             | LittleFET™          | QST™                | SyncFET™         |           |
| FACT™                | MicroFET™           | QT Optoelectronics™ | TinyLogic™       |           |
| FACT Quiet Series™   | MicroPak™           | Quiet Series™       | TruTranslation™  |           |

STAR\*POWER is used under license

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. 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.

## 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 herein:

1. 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, or (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 significant injury to the user.
2. A critical component is 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.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition  |
|--------------------------|------------------------|---|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.  |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.   |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.   |



Fairchild Semiconductor

SEARCH | [Parametric](#) | [Cross Reference](#)[space](#)[Product Folders and](#)[Applies](#)[find products](#)[Home >> Find products >>](#)[Products groups](#)[Analog and Mixed](#)[Signal](#)[Discrete](#)[Interface](#)[Logic](#)[Microcontrollers](#)[Non-Volatile](#)[Memory](#)[Optoelectronics](#)[Markets and](#)[applications](#)[New products](#)[Product selection and](#)[parametric search](#)[Cross-reference](#)[search](#)

## SGW5N60RUF

Discrete, Short Circuit Rated IGBT with Diode

## Contents

[General description](#) | [Features](#) | [Applications](#) | [Product status/pricing/packaging](#)

## General description

Fairchild's RUF series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness is a required feature.

## Datasheet

[Download this datasheet](#)[PDF](#)[e-mail this datasheet](#)[\[E-\]](#)This page [Print version](#)

## Related Links

[Request samples](#)[Dotted line](#)[How to order products](#)[Dotted line](#)[Product Change Notices](#)[\(PCNs\)](#)[Dotted line](#)[Support](#)[Dotted line](#)[Distributor and field sales](#)[representatives](#)[Dotted line](#)[Quality and reliability](#)[Dotted line](#)[Design tools](#)[technical information](#)[buy products](#)[technical support](#)[my Fairchild](#)[company](#)[back to top](#)

## Features

- Short Circuit Rated 10us @  $T_C = 100^\circ\text{C}$ ,  $V_{GE} = 15\text{V}$
- High Speed Switching
- Low Saturation Voltage :  $V_{CE(sat)} = 2.2\text{V}$  @  $I_C = 5\text{A}$
- High Input Impedance
- CO-PAK, IGBT with FRD :  $t_{rr} = 37\text{ns}$  (typ.)

[back to top](#)

## Applications

AC & DC Motor controls, General Purpose Inverters, Robotics, Servo Controls

[back to top](#)

Product status/pricing/packaging

| Product       | Product status  | Pricing* | Package type  | Leads | Packing method |
|---------------|-----------------|----------|---------------|-------|----------------|
| SGW5N60RUFDTM | Full Production | \$1.45   | TO-263(D2PAK) | 2     | TAPE REEL      |

\* 1,000 piece Budgetary Pricing

[back to top](#)

[Home](#) | [Find products](#) | [Technical information](#) | [Buy products](#) | [Support](#) | [Company](#) | [Contact us](#) | [Site index](#) | [Privacy policy](#)

© Copyright 2002 Fairchild Semiconductor