FAIRCHILD
SEMICONDUCTOR®

*IGBT*

# SGH20N120RUFD

## Short Circuit Rated IGBT

### General Description

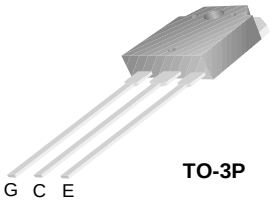
Fairchild's RUFD series of Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses as well as short circuit ruggedness. The RUFD series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness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

### Features

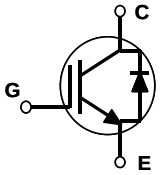
- Short circuit rated 10µs @ $T_C$ = 100°C, $V_{GE}$ = 15V
- High speed switching
- Low saturation voltage : $V_{CE(sat)}$ = 2.3 V @ $I_C$ = 20A
- High input impedance
- CO-PAK, IGBT with FRD : $t_{rr}$ = 80ns (typ.)

### Applications

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




TO-3P




## Absolute Maximum Ratings

$T_C$ = 25°C unless otherwise noted

| Symbol | Description | | SGH20N120RUFD | Units |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | | ± 25 | V |
| $I_C$ | Collector Current | @ $T_C$ = 25°C | 32 | A |
| | Collector Current | @ $T_C$ = 100°C | 20 | A |
| $I_{CM\ (1)}$ | Pulsed Collector Current | | 60 | A |
| $I_F$ | Diode Continuous Forward Current | @ $T_C$ = 100°C | 20 | A |
| $I_{FM}$ | Diode Maximum Forward Current | | 120 | A |
| $T_{SC}$ | Short Circuit Withstand Time | @ $T_C$ = 100°C | 10 | µs |
| $P_D$ | Maximum Power Dissipation | @ $T_C$ = 25°C | 230 | W |
| | Maximum Power Dissipation | @ $T_C$ = 100°C | 92 | W |
| $T_J$ | Operating Junction Temperature | | -55 to +150 | °C |
| $T_{stg}$ | Storage Temperature Range | | -55 to +150 | °C |
| $T_L$ | Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds | | 300 | °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 | -- | 0.54 | °C/W |
| $R_{\theta JC}$(DIODE) | Thermal Resistance, Junction-to-Case | -- | 0.84 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -- | 40 | °C/W |

## Electrical Characteristics of the IGBT $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | 1200 | -- | -- | V |
| $\Delta B_{VCES}/\Delta T_J$ | Temperature Coefficient of Breakdown Voltage | $V_{GE}$ = 0V, $I_C$ = 1mA | -- | 0.6 | -- | V/°C |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | -- | -- | 1 | mA |
| $I_{GES}$ | G-E Leakage Current | $V_{GE}$ = $V_{GES}$, $V_{CE}$ = 0V | -- | -- | ± 100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GE(th)}$ | G-E Threshold Voltage | $I_C$ = 20mA, $V_{CE}$ = $V_{GE}$ | 3.5 | 5.5 | 7.5 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$ = 20A, $V_{GE}$ = 15V | -- | 2.3 | 3.0 | V |
| | | $I_C$ = 32A, $V_{GE}$ = 15V | -- | 2.8 | -- | V |
| **Dynamic Characteristics** | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 30V, $V_{GE}$ = 0V, f = 1MHz | -- | 2000 | -- | pF |
| $C_{oes}$ | Output Capacitance | | -- | 170 | -- | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | -- | 60 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 20A, $R_G$ = 15Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 25°C | -- | 30 | -- | ns |
| $t_r$ | Rise Time | | -- | 60 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 70 | 130 | ns |
| $t_f$ | Fall Time | | -- | 150 | 300 | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 1.30 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 1.30 | -- | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 2.60 | 3.65 | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$ = 600 V, $I_C$ = 20A, $R_G$ = 15Ω, $V_{GE}$ = 15V, Inductive Load, $T_C$ = 125°C | -- | 30 | -- | ns |
| $t_r$ | Rise Time | | -- | 70 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 90 | 165 | ns |
| $t_f$ | Fall Time | | -- | 200 | 400 | ns |
| $E_{on}$ | Turn-On Switching Loss | | -- | 1.50 | -- | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | -- | 2.00 | -- | mJ |
| $E_{ts}$ | Total Switching Loss | | -- | 3.50 | 5.08 | mJ |
| $T_{sc}$ | Short Circuit Withstand Time | $V_{CC}$ = 600 V, $V_{GE}$ = 15V @ $T_C$ = 100°C | 10 | -- | -- | µs |
| $Q_g$ | Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 20A, $V_{GE}$ = 15V | -- | 95 | 140 | nC |
| $Q_{ge}$ | Gate-Emitter Charge | | -- | 15 | 25 | nC |
| $Q_{gc}$ | Gate-Collector Charge | | -- | 43 | 65 | nC |
| $L_e$ | Internal Emitter Inductance | Measured 5mm from PKG | -- | 14 | -- | nH |

## Electrical Characteristics of DIODE $T_C$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_{FM}$ | Diode Forward Voltage | $I_F$ = 20A | $T_C$ = 25°C | -- | 2.8 | 3.5 | V |
| | | | $T_C$ = 100°C | -- | 2.5 | -- | |
| $t_{rr}$ | Diode Reverse Recovery Time | $I_F$ = 20A dI/dt = 200 A/µs | $T_C$ = 25°C | -- | 80 | 110 | ns |
| | | | $T_C$ = 100°C | -- | 95 | -- | |
| $I_{rr}$ | Diode Peak Reverse Recovery Current | | $T_C$ = 25°C | -- | 8.0 | 10.0 | A |
| | | | $T_C$ = 100°C | -- | 9.5 | -- | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | | $T_C$ = 25°C | -- | 320 | 500 | nC |
| | | | $T_C$ = 100°C | -- | 450 | -- | |

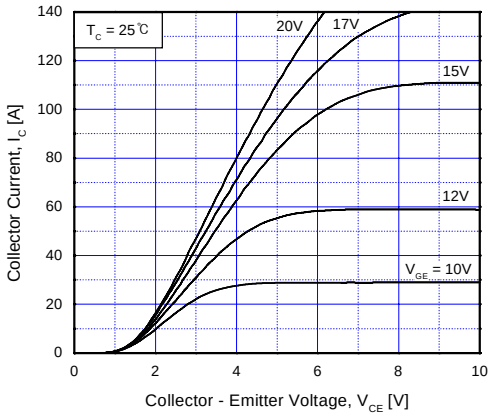



**Fig 1. Typical Output Characteristics**

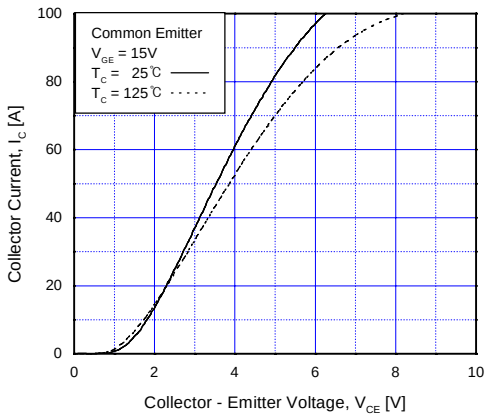



**Fig 2. Typical Saturation Voltage Characteristics**

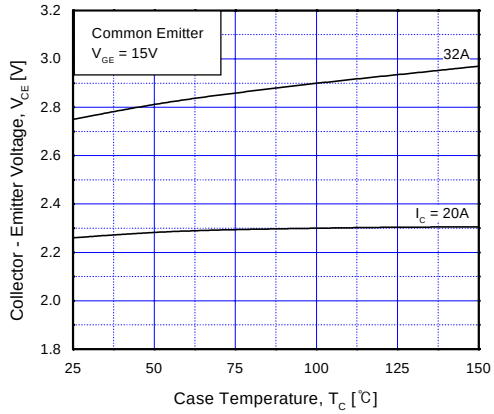



**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**

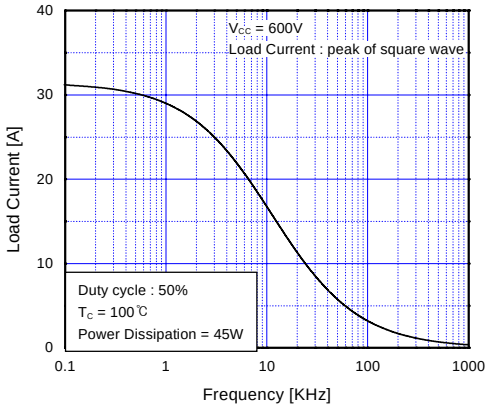



**Fig 4. Load Current vs. Frequency**

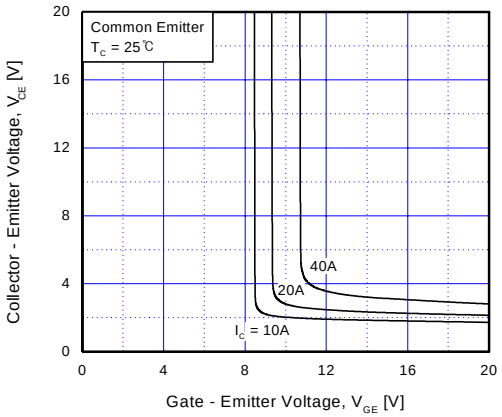



**Fig 5. Saturation Voltage vs. $V_{GE}$**

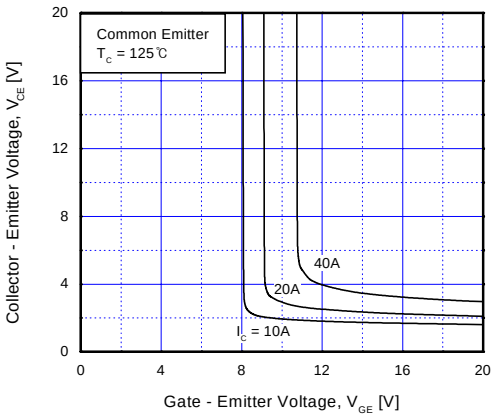



**Fig 6. Saturation Voltage vs. $V_{GE}$**

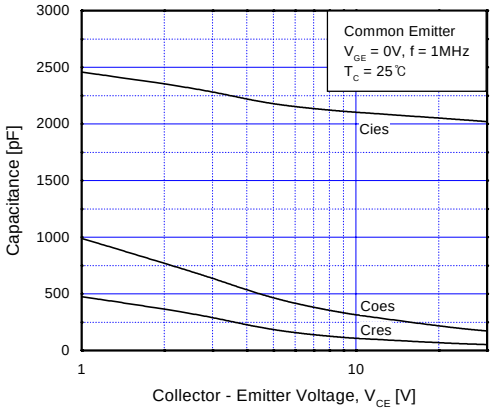



**Fig 7. Capacitance Characteristics**

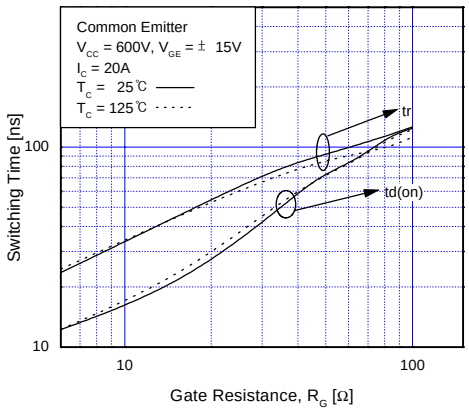



**Fig 8. Turn-On Characteristics vs. Gate Resistance**

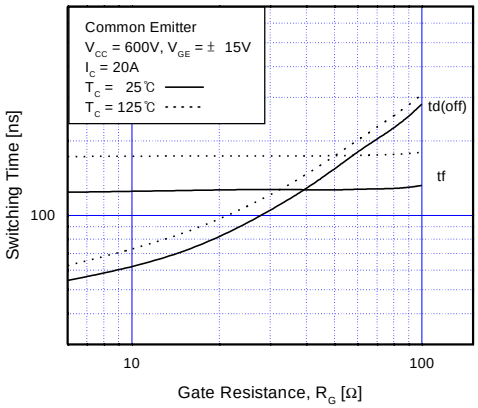



**Fig 9. Turn-Off Characteristics vs. Gate Resistance**

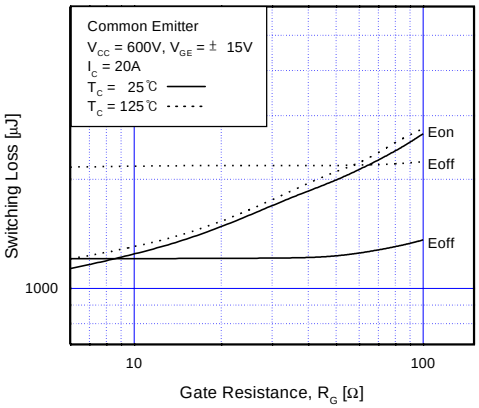



**Fig 10. Switching Loss vs. Gate Resistance**

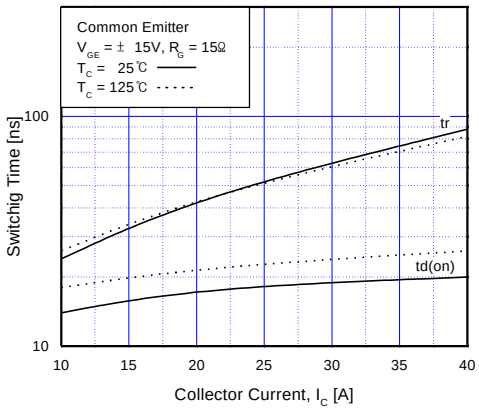



**Fig 11. Turn-On Characteristics vs. Collector Current**

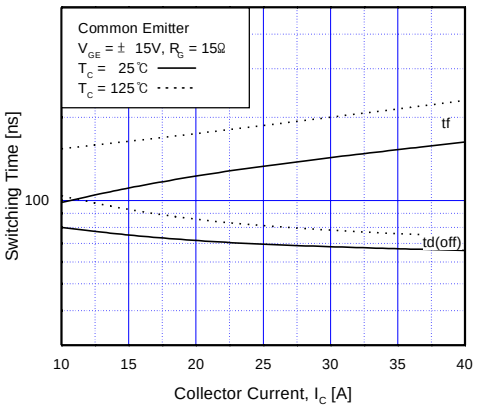



**Fig 12. Turn-Off Characteristics vs. Collector Current**

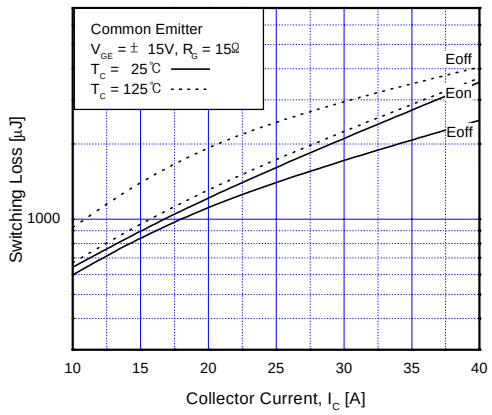



**Fig 13. Switching Loss vs. Collector Current**

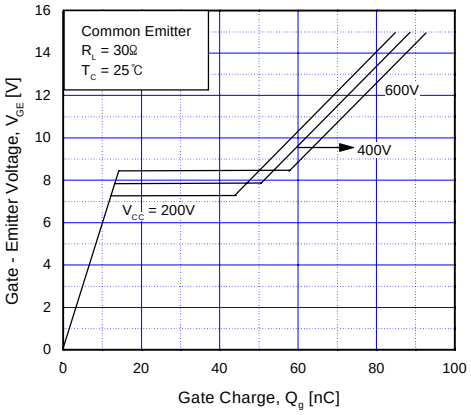



**Fig 14. Gate Charge Characteristics**

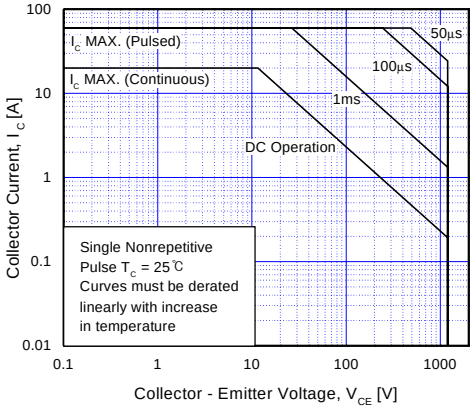



**Fig 15. SOA Characteristics**

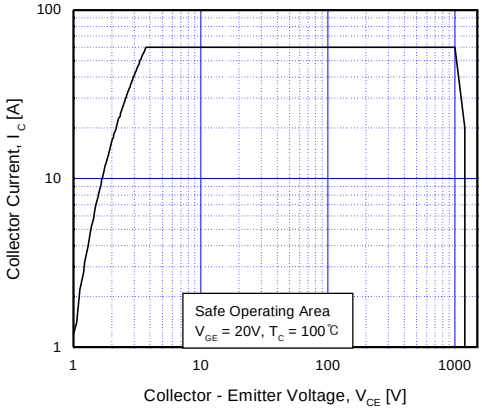



**Fig 16. Turn-Off SOA**

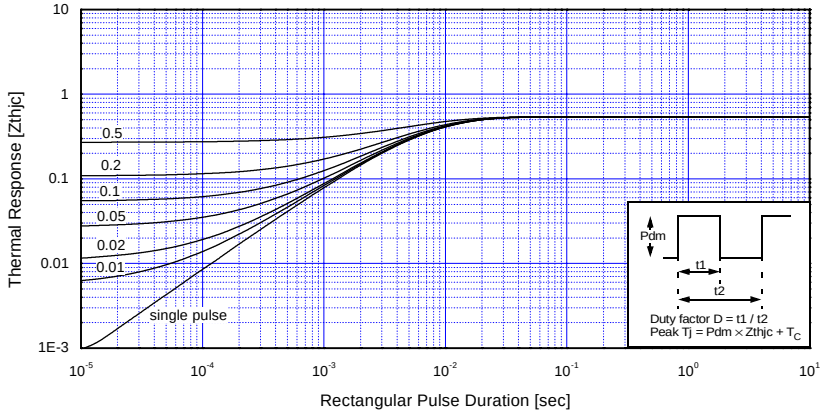



**Fig 17. Transient Thermal Impedance of IGBT**

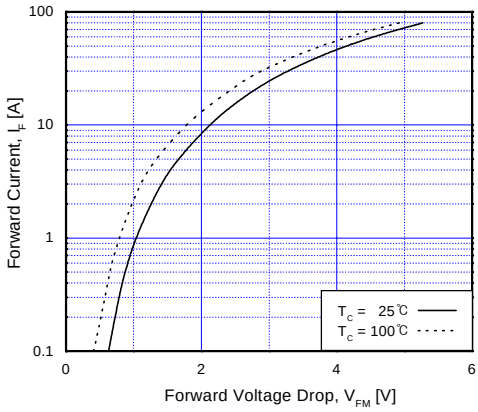



**Fig 18. Forward Characteristics**

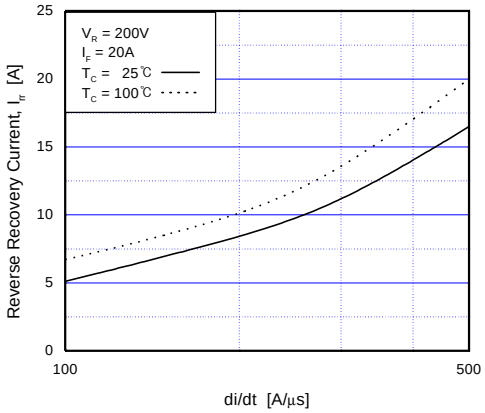



**Fig 19. Reverse Recovery Current**

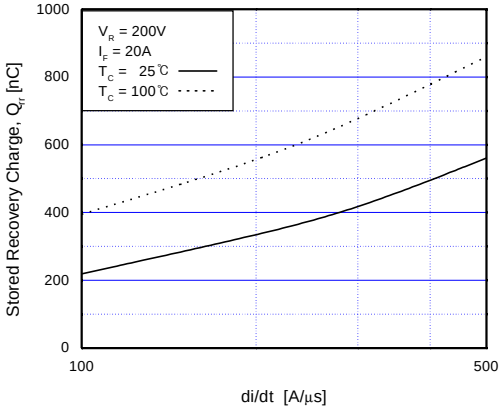



**Fig 20. Stored Charge**

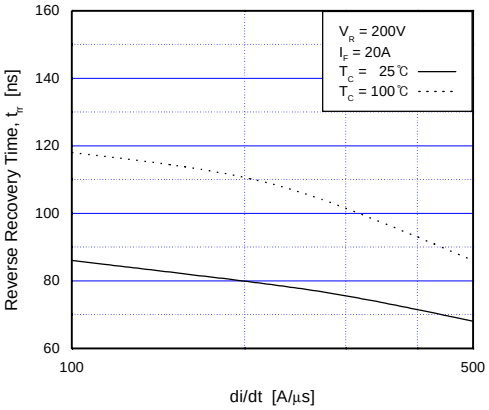
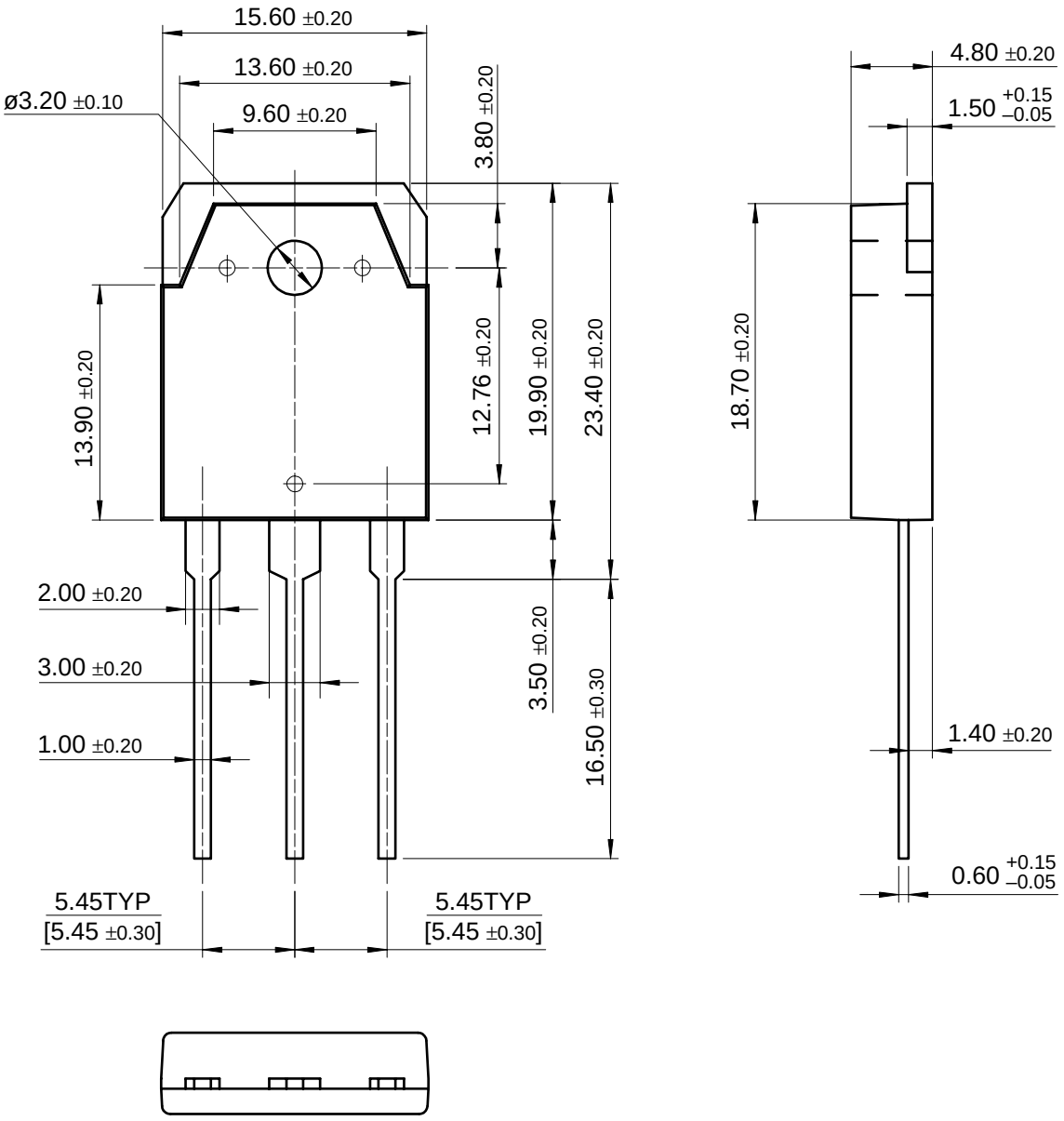



**Fig 21. Reverse Recovery Time**

## Package Dimension

# TO-3P (FS PKG CODE AF)




Dimensions in Millimeters

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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.

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### 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. |

# SGH20N120RUFD

## Discrete, Short Circuit Rated IGBT with Diode

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### General description

Fairchild's Insulated Gate Bipolar Transistor(IGBT) RUF series provides low conduction and switching losses as well as short circuit ruggedness. RUF series is designed for the applications such as motor control, UPS and general inverters where short-circuit ruggedness is required.

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### Features

- Short Circuit Rated 10µs @ $T_C$ = 100°C, $V_{GE}$ = 15V
- High Speed Switching
- Low Saturation Voltage : $V_{CE(sat)}$ = 2.3 V @ $I_C$ = 20A
- High Input Impedance
- CO-PAK, IGBT with FRD : $t_{rr}$ = 80ns (typ.)

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### Applications

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

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Product status/pricing/packaging

| Product | Product status | Pricing* | Package type | Leads | Packing method |
|---|---|---|---|---|---|
| SGH20N120RUFDTU | Full Production | $6.59 | TO-3P | 3 | RAIL |

* 1,000 piece Budgetary Pricing

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