

## **SGH15N120RUF**

### **Short Circuit Rated IGBT**

#### **General Description**

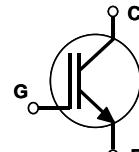
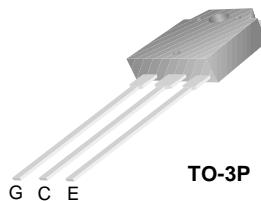
Fairchild's RUF series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness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

#### **Features**

- Short circuit rated  $10\mu\text{s}$  @  $T_C = 100^\circ\text{C}$ ,  $V_{GE} = 15\text{V}$
- High speed switching
- Low saturation voltage :  $V_{CE(\text{sat})} = 2.3\text{ V}$  @  $I_C = 15\text{A}$
- High input impedance

#### **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	SGH15N120RUF	Units
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 25$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	24	A
	Collector Current @ $T_C = 100^\circ\text{C}$	15	A
$I_{CM(1)}$	Pulsed Collector Current	45	A
$T_{SC}$	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	$\mu\text{s}$
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	180	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	72	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
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.69	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C}/\text{W}$

## 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	$V_{GE} = 0\text{V}$ , $I_C = 1\text{mA}$	1200	--	--	V
$\Delta B_{V_{CES}}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{V}$ , $I_C = 1\text{mA}$	--	0.6	--	$\text{V}/^\circ\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}$ , $V_{GE} = 0\text{V}$	--	--	1	mA
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}$ , $V_{CE} = 0\text{V}$	--	--	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GE(\text{th})}$	G-E Threshold Voltage	$I_C = 15\text{mA}$ , $V_{CE} = V_{GE}$	3.5	5.5	7.5	V
$V_{CE(\text{sat})}$	Collector to Emitter Saturation Voltage	$I_C = 15\text{A}$ , $V_{GE} = 15\text{V}$	--	2.3	3.0	V
		$I_C = 24\text{A}$ , $V_{GE} = 15\text{V}$	--	2.8	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$	--	1400	--	pF
$C_{oes}$	Output Capacitance		--	135	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	45	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}$ , $I_C = 15\text{A}$ , $R_G = 20\Omega$ , $V_{GE} = 15\text{V}$ , Inductive Load, $T_C = 25^\circ\text{C}$	--	20	--	ns
$t_r$	Rise Time		--	60	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	110	ns
$t_f$	Fall Time		--	150	300	ns
$E_{on}$	Turn-On Switching Loss		--	1.0	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.98	--	mJ
$E_{ts}$	Total Switching Loss		--	1.98	2.8	mJ
$t_{d(on)}$	Turn-On Delay Time		--	20	--	ns
$t_r$	Rise Time	$V_{CC} = 600\text{ V}$ , $I_C = 15\text{A}$ , $R_G = 20\Omega$ , $V_{GE} = 15\text{V}$ , Inductive Load, $T_C = 125^\circ\text{C}$	--	70	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	80	150	ns
$t_f$	Fall Time		--	200	400	ns
$E_{on}$	Turn-On Switching Loss		--	1.13	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	1.50	--	mJ
$E_{ts}$	Total Switching Loss		--	2.63	3.81	mJ
$T_{sc}$	Short Circuit Withstand Time	$V_{CC} = 600\text{ V}$ , $V_{GE} = 15\text{V}$ $\text{at } T_C = 100^\circ\text{C}$	10	--	--	$\mu\text{s}$
$Q_g$	Total Gate Charge	$V_{CE} = 600\text{ V}$ , $I_C = 15\text{A}$ , $V_{GE} = 15\text{V}$	--	72	108	nC
$Q_{ge}$	Gate-Emitter Charge		--	10	15	nC
$Q_{gc}$	Gate-Collector Charge		--	30	45	nC
$L_e$	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

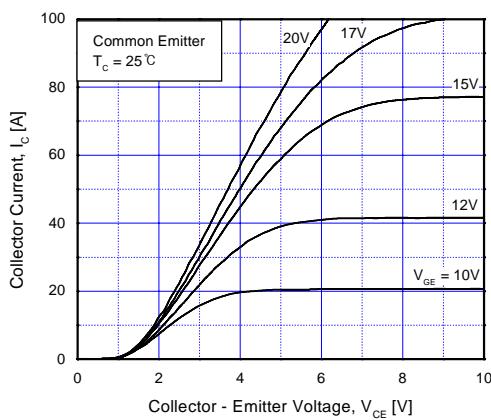


Fig 1. Typical Output Characteristics

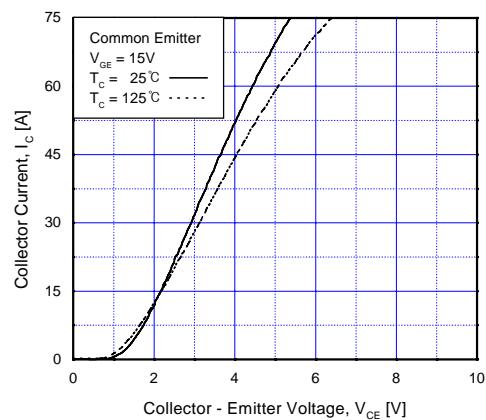


Fig 2. Typical Saturation Voltage Characteristics

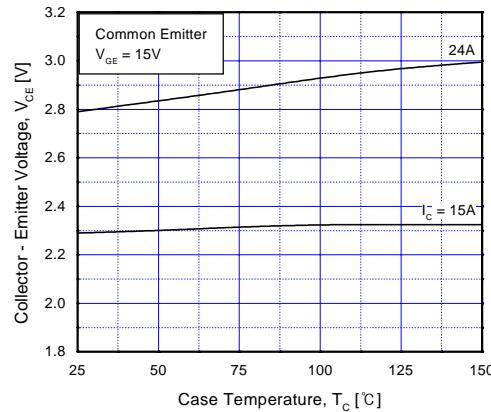


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

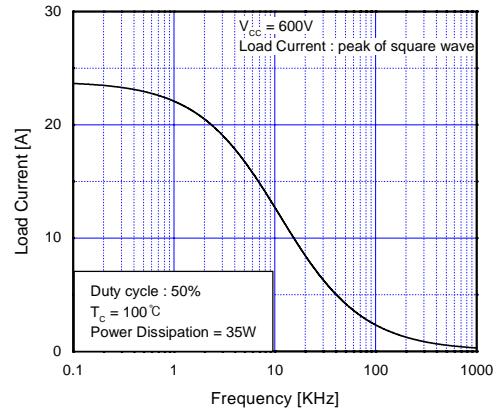
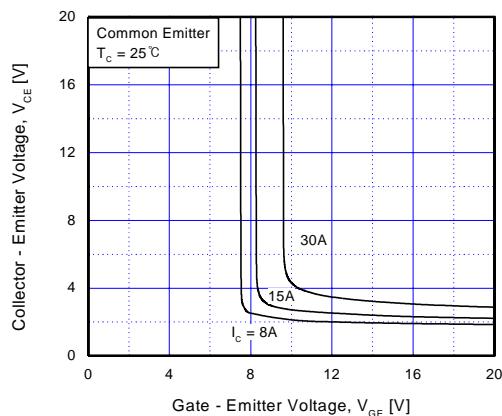
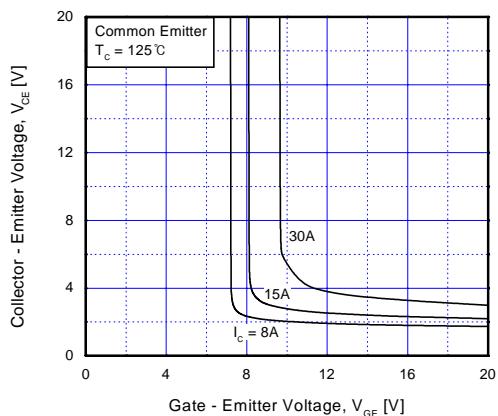
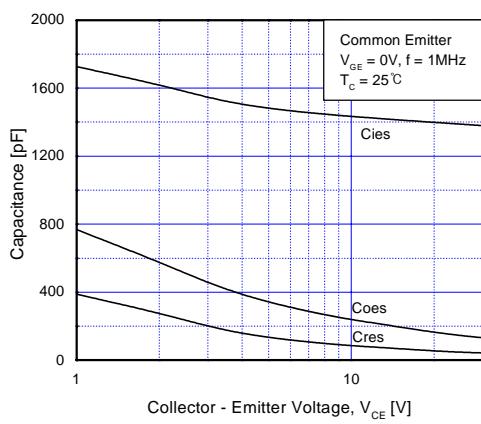
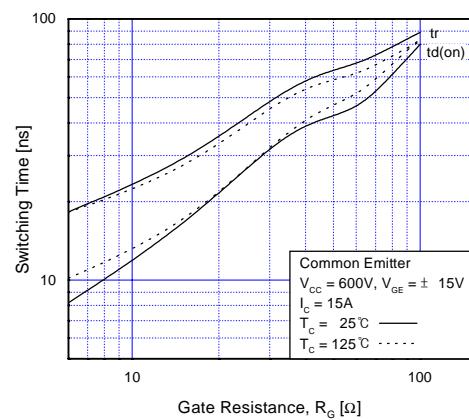
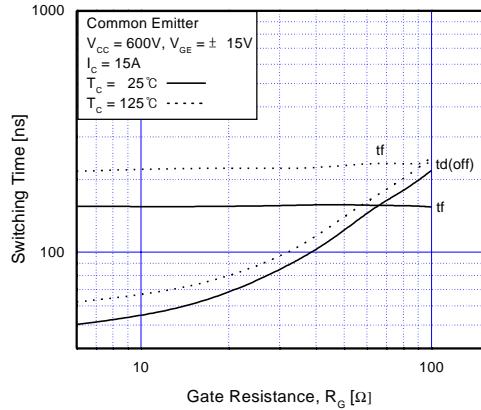
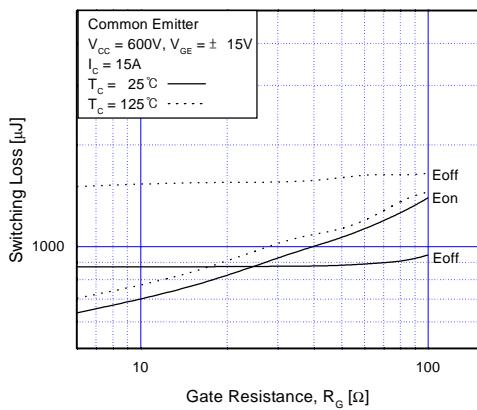
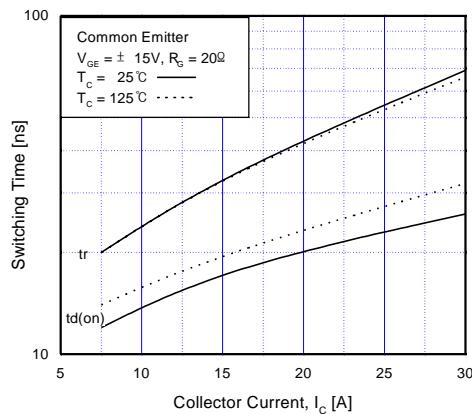
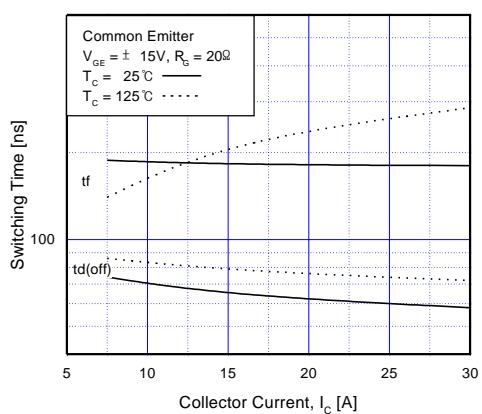
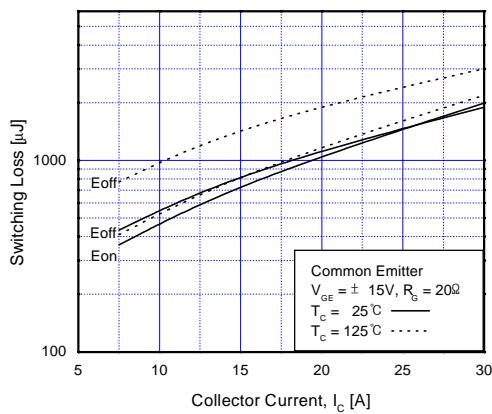
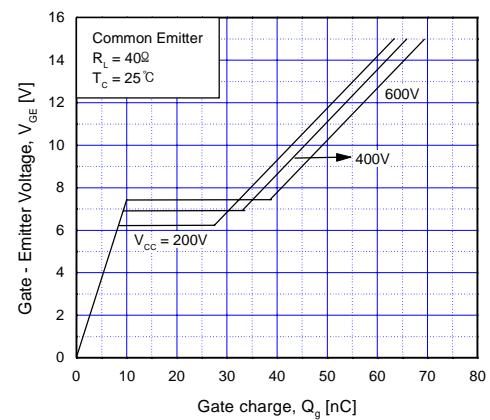
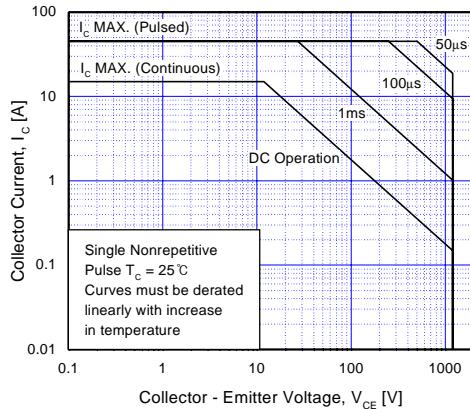
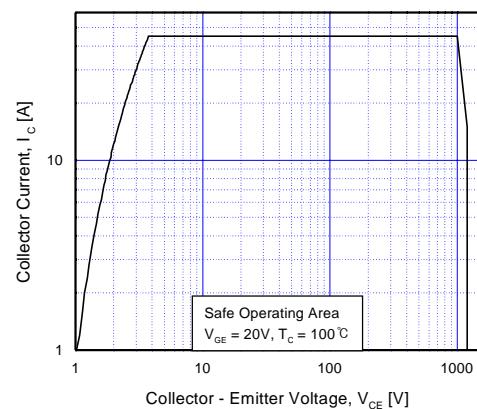
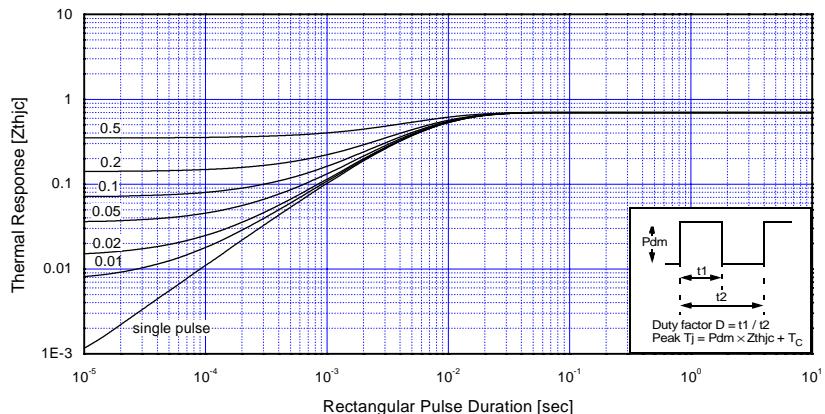


Fig 4. Load Current vs. Frequency

Fig 5. Saturation Voltage vs.  $V_{GE}$ Fig 6. Saturation Voltage vs.  $V_{GE}$

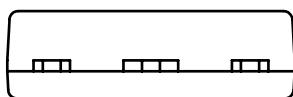
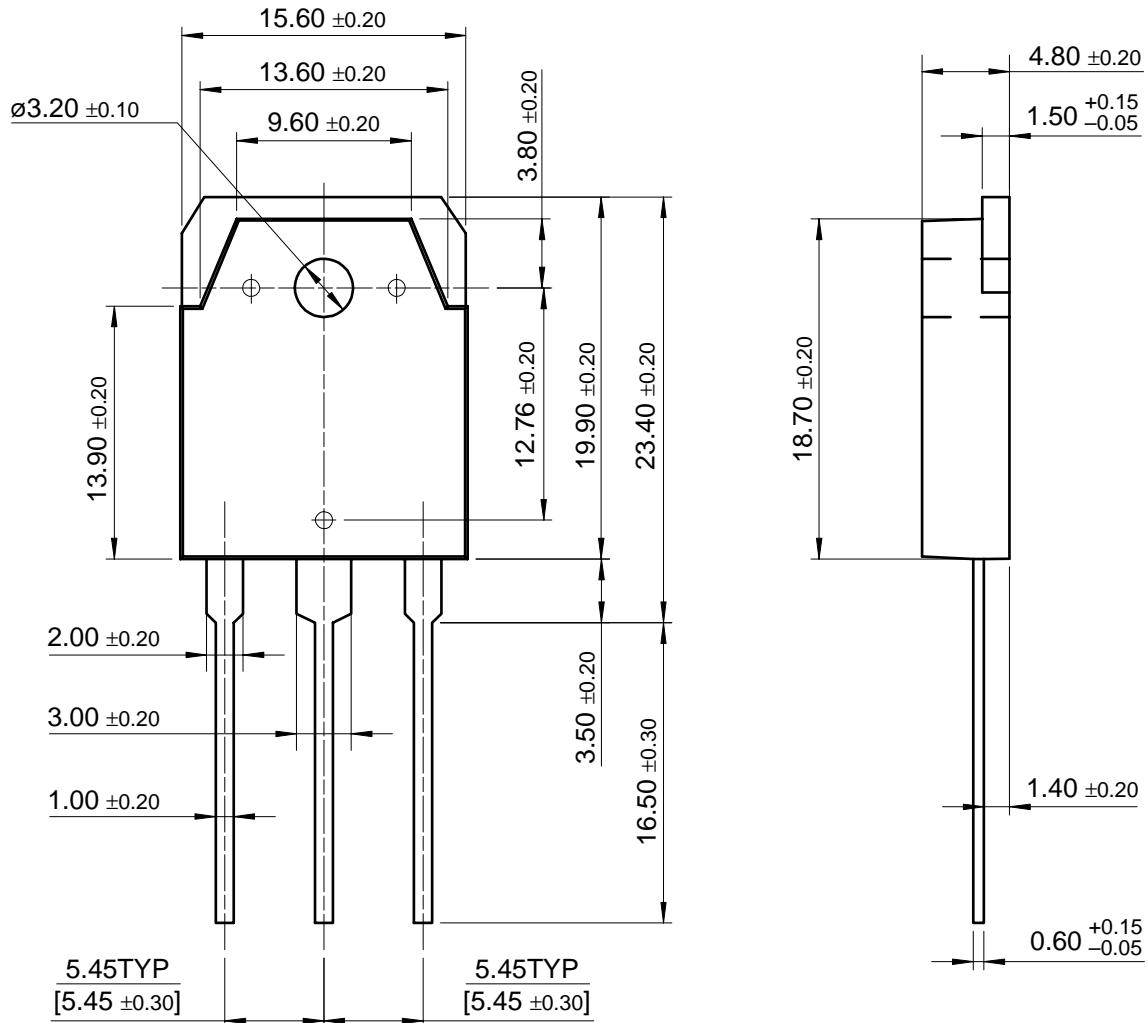

**Fig 7. Capacitance Characteristics**

**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**

SGH15N120RUF

Package Dimension

TO-3P (FS PKG CODE AF)



Dimensions in Millimeters

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