



April 2001

# IGBT

## SGS10N60RUF Short Circuit Rated IGBT

### General Description

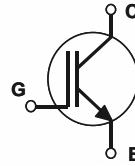
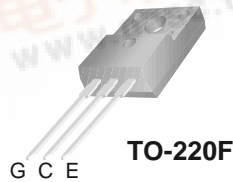
Fairchild's RUF series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness 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 :  $V_{CE(sat)} = 2.2\text{V}$  @  $I_C = 10\text{A}$
- High input impedance

### Application

AC & DC Motor controls, general purpose inverters, robotics, servo controls



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

Symbol	Description	SGS10N60RUF	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	16	A
	Collector Current @ $T_C = 100^\circ\text{C}$	10	A
$I_{CM(1)}$	Pulsed Collector Current	30	A
$T_{SC}$	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	$\mu\text{s}$
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	55	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	22	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	--	2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C/W}$



**Electrical Characteristics of 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 Coeff. of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	V/ $^\circ\text{C}$
$I_{CES}$	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
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 10mA, V_{CE} = V_{GE}$	5.0	6.0	8.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 10A, V_{GE} = 15V$	--	2.2	2.8	V
		$I_C = 16A, V_{GE} = 15V$	--	2.5	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	660	--	pF
$C_{oes}$	Output Capacitance		--	115	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	25	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 10A,$ $R_G = 20\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ\text{C}$	--	15	--	ns
$t_r$	Rise Time		--	30	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	36	50	nS
$t_f$	Fall Time		--	158	200	ns
$E_{on}$	Turn-On Switching Loss		--	141	--	$\mu J$
$E_{off}$	Turn-Off Switching Loss		--	215	--	$\mu J$
$E_{ts}$	Total Switching Loss	--	356	500	$\mu J$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 10A,$ $R_G = 20\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ\text{C}$	--	16	--	ns
$t_r$	Rise Time		--	33	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	42	60	ns
$t_f$	Fall Time		--	242	350	ns
$E_{on}$	Turn-On Switching Loss		--	161	--	$\mu J$
$E_{off}$	Turn-Off Switching Loss		--	452	--	$\mu J$
$E_{ts}$	Total Switching Loss	--	613	860	$\mu J$	
$T_{sc}$	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ\text{C}$	10	--	--	$\mu s$
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 10A,$ $V_{GE} = 15V$	--	30	45	nC
$Q_{ge}$	Gate-Emitter Charge		--	5	10	nC
$Q_{gc}$	Gate-Collector Charge		--	8	16	nC
$L_e$	Internal Emitter Inductance	Measured 5mm from PKG	--	7.5	--	nH

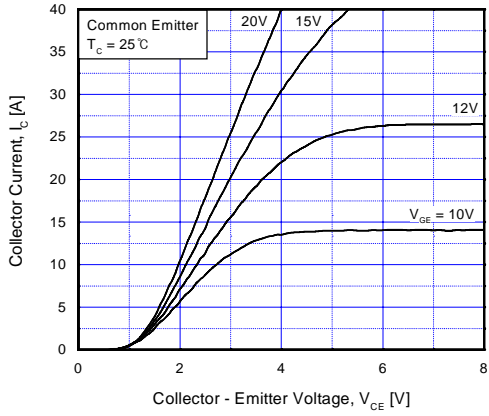


Fig 1. Typical Output Characteristics

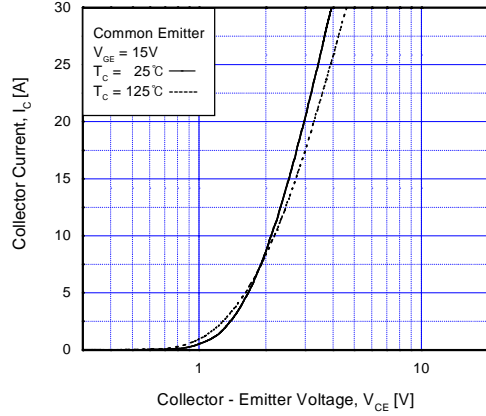


Fig 2. Typical Saturation Voltage Characteristics

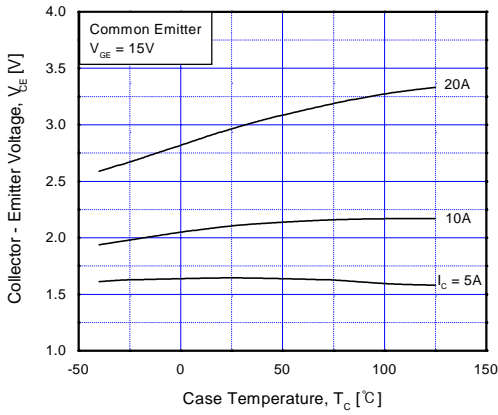


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

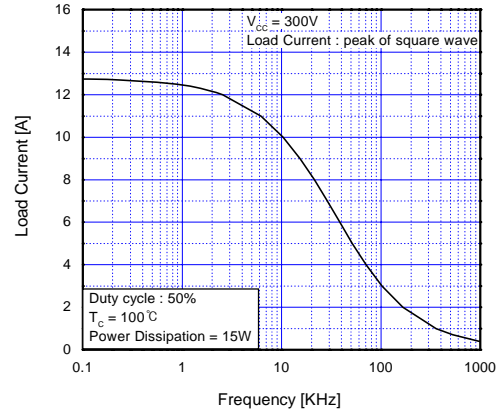


Fig 4. Load Current vs. Frequency

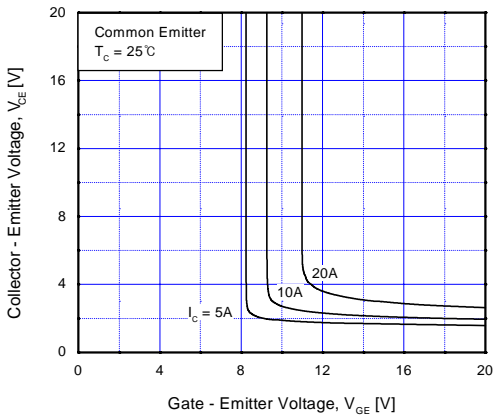


Fig 5. Saturation Voltage vs.  $V_{GE}$

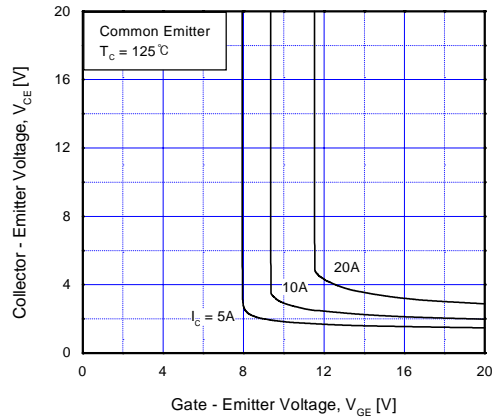
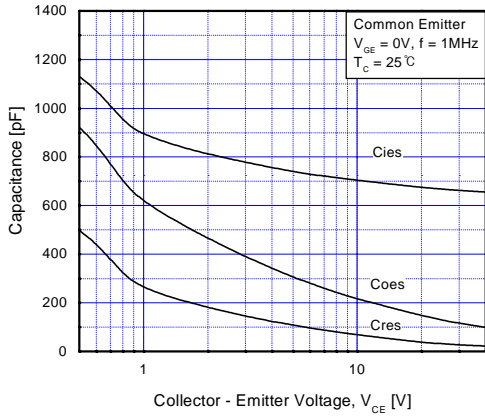
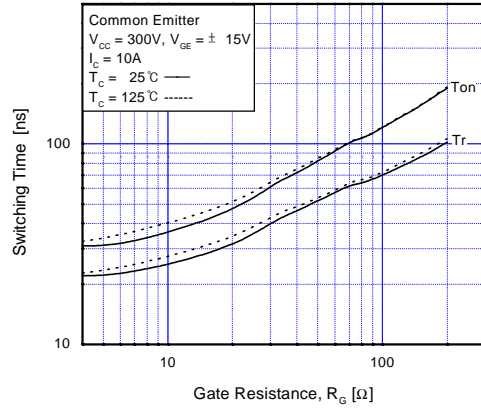


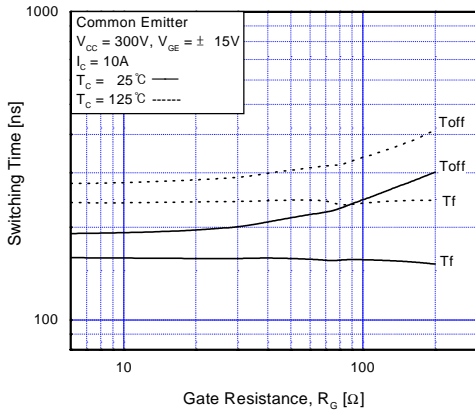
Fig 6. Saturation Voltage vs.  $V_{GE}$



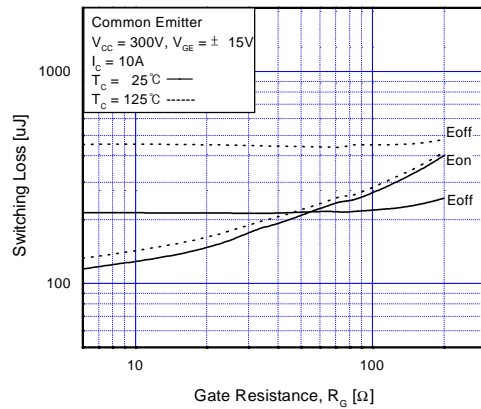
**Fig 7. Capacitance Characteristics**



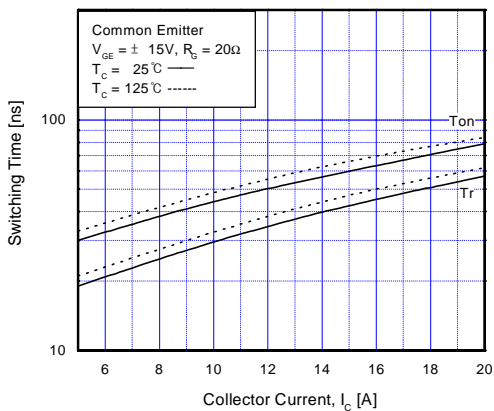
**Fig 8. Turn-On Characteristics vs. Gate Resistance**



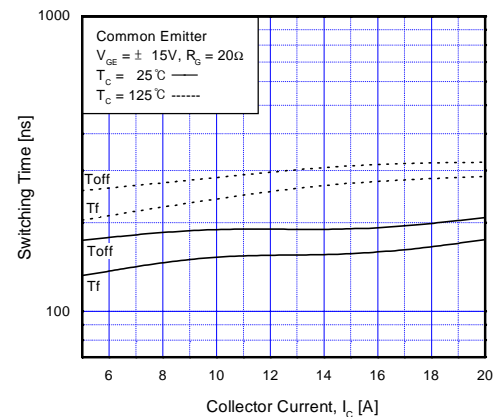
**Fig 9. Turn-Off Characteristics vs. Gate Resistance**



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



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



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

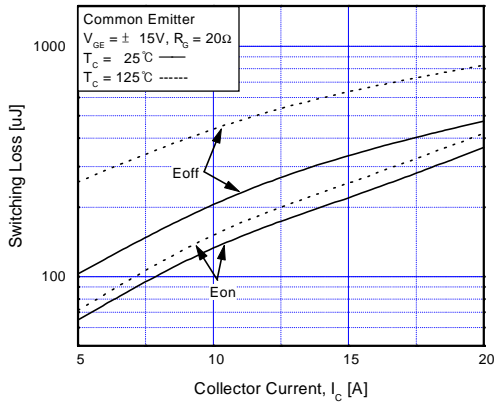


Fig 13. Switching Loss vs. Collector Current

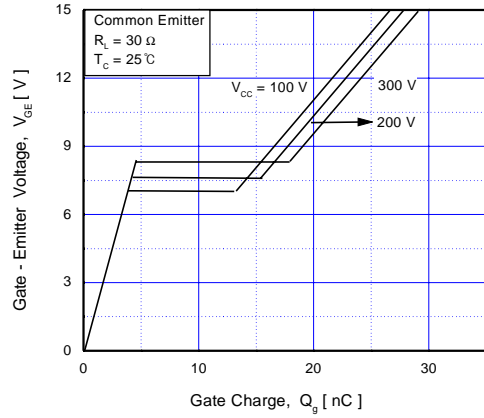


Fig 14. Gate Charge Characteristics

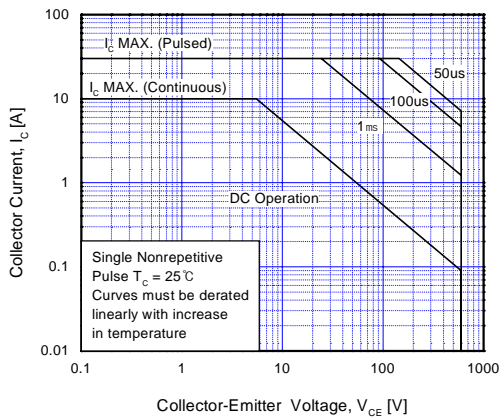


Fig 15. SOA Characteristics

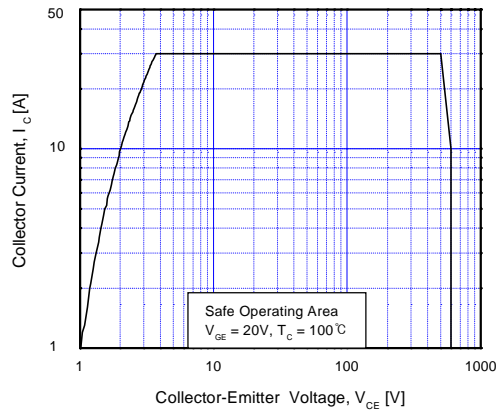


Fig 16. Turn-Off SOA Characteristics

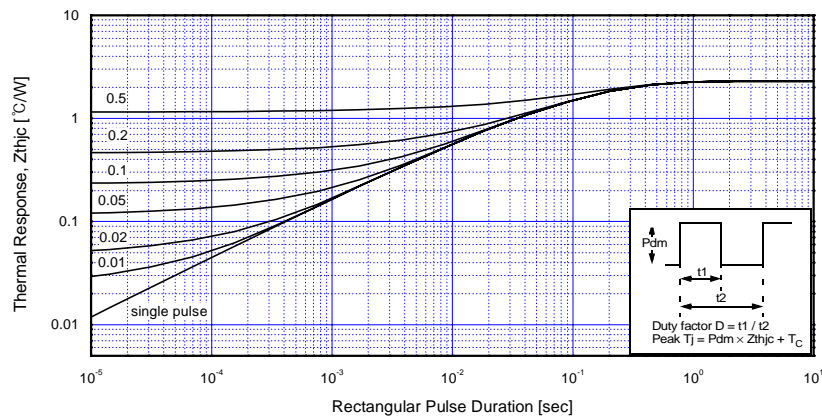
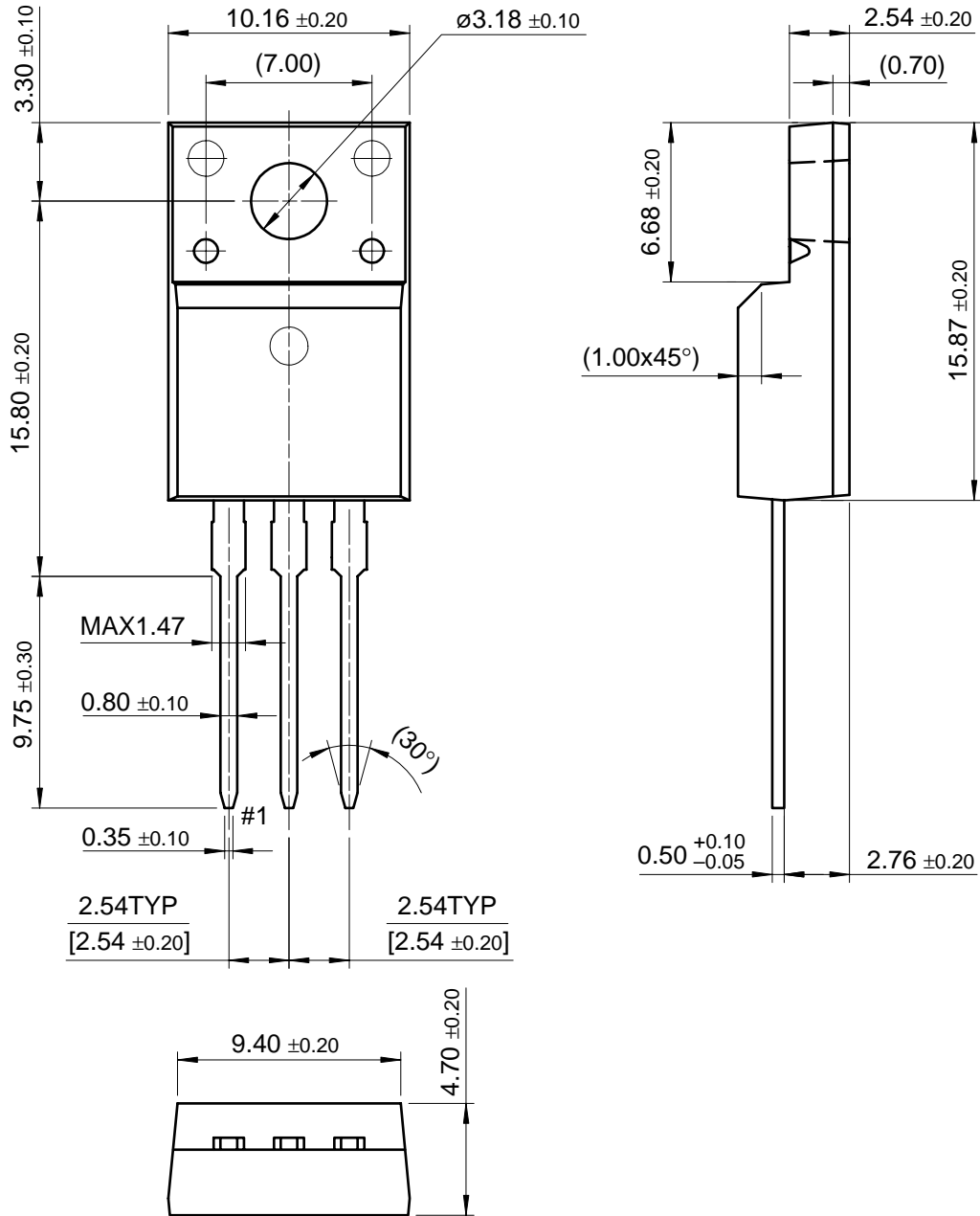


Fig 17. Transient Thermal Impedance of IGBT

# Package Dimension

## TO-220F (FS PKG CODE AQ)



Dimensions in Millimeters

SGS10N60RUF

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