

**FAIRCHILD**  
SEMICONDUCTOR®

**IGBT**

## SGR6N60UF

### Ultra-Fast IGBT

#### General Description

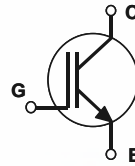
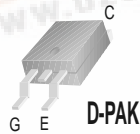
Fairchild's UF series of Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses. The UF series is designed for applications such as motor control and general inverters where high speed switching is a required feature.

#### Features

- High speed switching
- Low saturation voltage :  $V_{CE(sat)} = 2.1\text{ V @ } I_C = 3\text{ A}$
- 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	SGR6N60UF	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	6	A
	Collector Current @ $T_C = 100^\circ\text{C}$	3	A
$I_{CM(1)}$	Pulsed Collector Current	25	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	30	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	12	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	--	4.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (PCB Mount) (2)	--	50	$^\circ\text{C/W}$

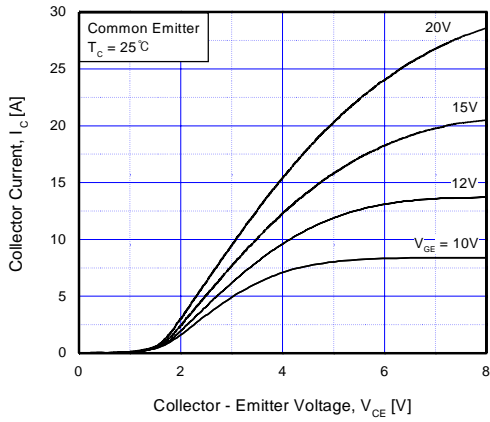
**Notes :**

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

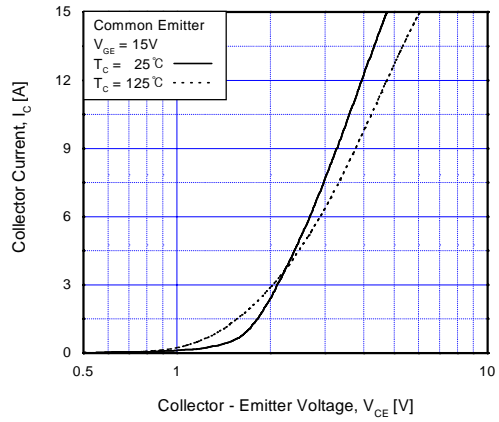


## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted

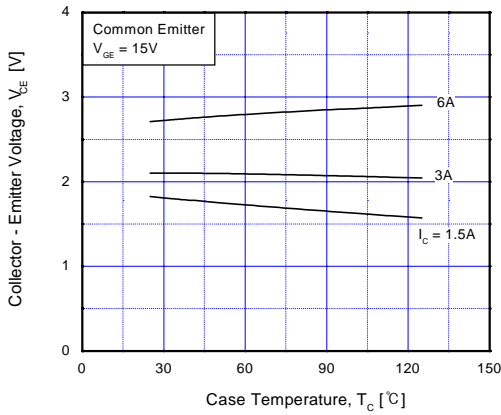
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
<b>Off Characteristics</b>							
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	V	
$\Delta B_{V_{CES}} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	V/°C	
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	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	$I_C = 3mA, V_{CE} = V_{GE}$	3.5	4.5	6.5	V	
$V_{CE(sat)}$	Collector to Emitter	$I_C = 3A, V_{GE} = 15V$	--	2.1	2.6	V	
	Saturation Voltage	$I_C = 6A, V_{GE} = 15V$	--	2.6	--	V	
<b>Dynamic Characteristics</b>							
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	220	--	pF	
$C_{oes}$	Output Capacitance		--	22	--	pF	
$C_{res}$	Reverse Transfer Capacitance		--	7	--	pF	
<b>Switching Characteristics</b>							
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 3A,$ $R_G = 80\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ C$	--	15	--	ns	
$t_r$	Rise Time		--	25	--	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	60	130	ns	
$t_f$	Fall Time		--	70	150	ns	
$E_{on}$	Turn-On Switching Loss		--	57	--	$\mu J$	
$E_{off}$	Turn-Off Switching Loss		--	25	--	$\mu J$	
$E_{ts}$	Total Switching Loss		--	82	120	$\mu J$	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC} = 300V, I_C = 3A,$ $R_G = 80\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ C$	--	22	--	ns
$t_r$	Rise Time			--	32	--	ns
$t_{d(off)}$	Turn-Off Delay Time			--	80	200	ns
$t_f$	Fall Time	--		122	300	ns	
$E_{on}$	Turn-On Switching Loss	--		65	--	$\mu J$	
$E_{off}$	Turn-Off Switching Loss	--		46	--	$\mu J$	
$E_{ts}$	Total Switching Loss	--		111	170	$\mu J$	
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 3A,$ $V_{GE} = 15V$		--	15	22	nC
$Q_{ge}$	Gate-Emitter Charge			--	5	8	nC
$Q_{gc}$	Gate-Collector Charge			--	4	6	nC
$L_e$	Internal Emitter Inductance	Measured 5mm from PKG	--	7.5	--	nH	



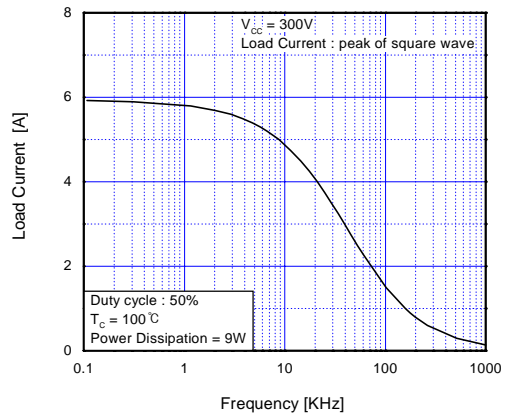
**Fig 1. Typical Output Characteristics**



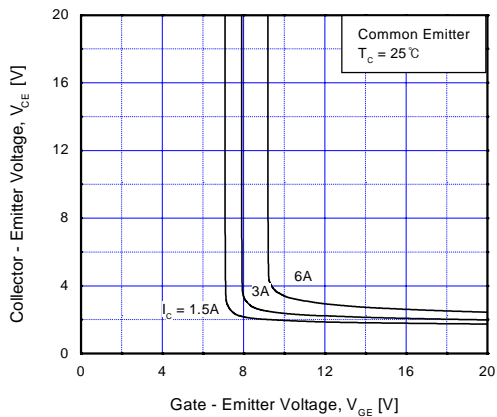
**Fig 2. Typical Saturation Voltage Characteristics**



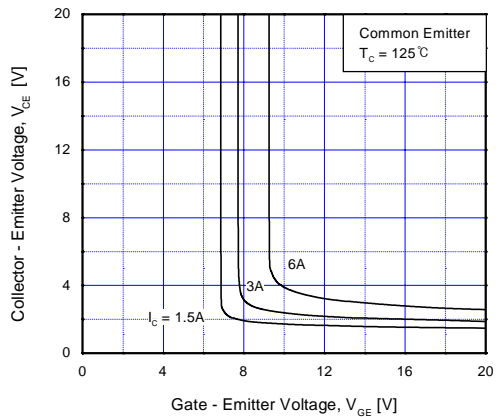
**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**



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



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



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

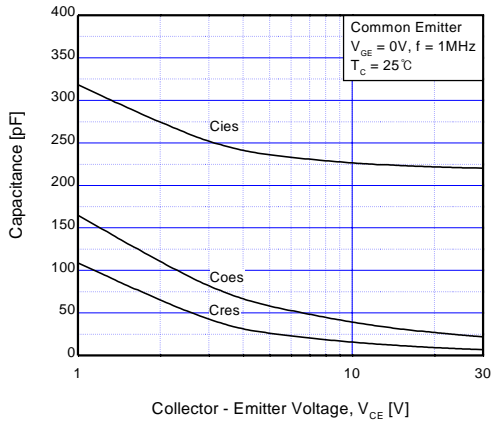


Fig 7. Capacitance Characteristics

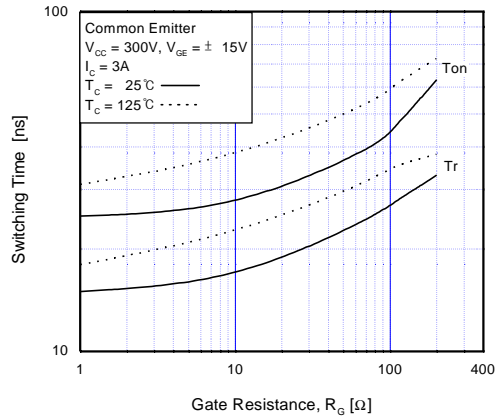


Fig 8. Turn-On Characteristics vs. Gate Resistance

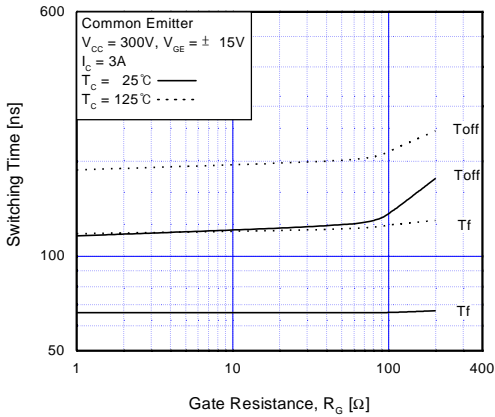


Fig 9. Turn-Off Characteristics vs. Gate Resistance

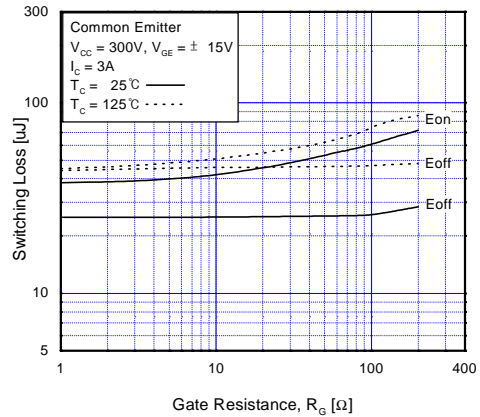


Fig 10. Switching Loss vs. Gate Resistance

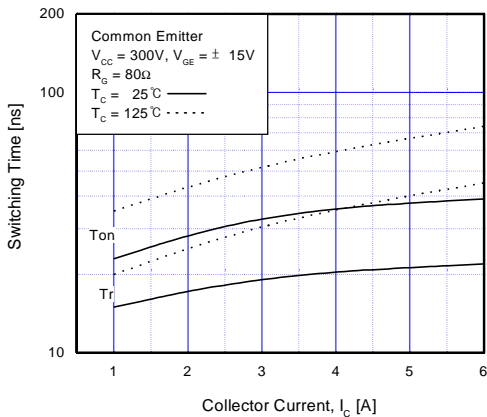


Fig 11. Turn-On Characteristics vs. Collector Current

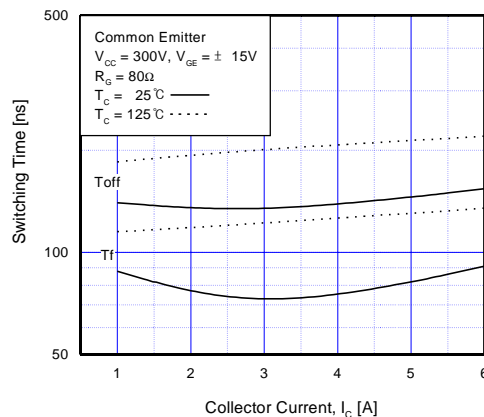
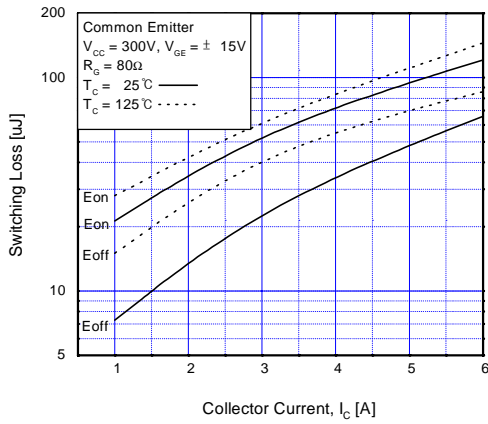
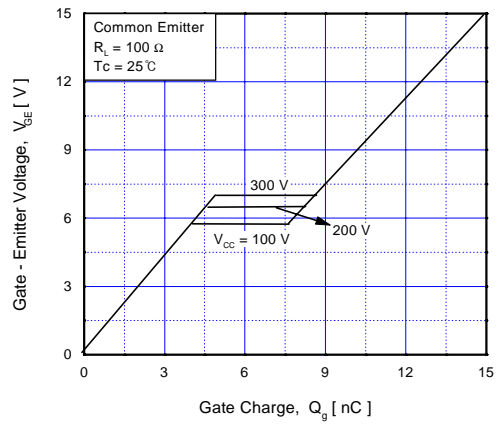


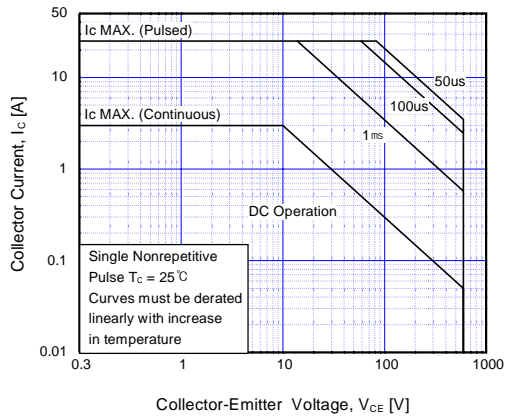
Fig 12. Turn-Off Characteristics vs. Collector Current



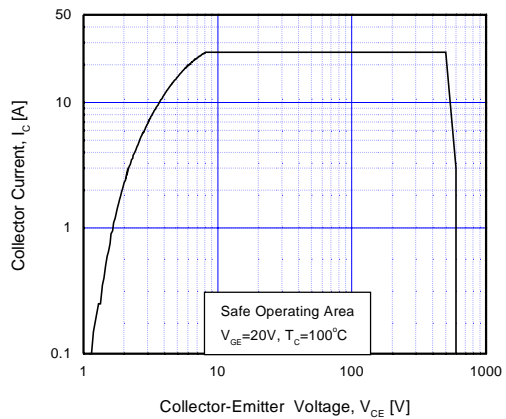
**Fig 13. Switching Loss vs. Collector Current**



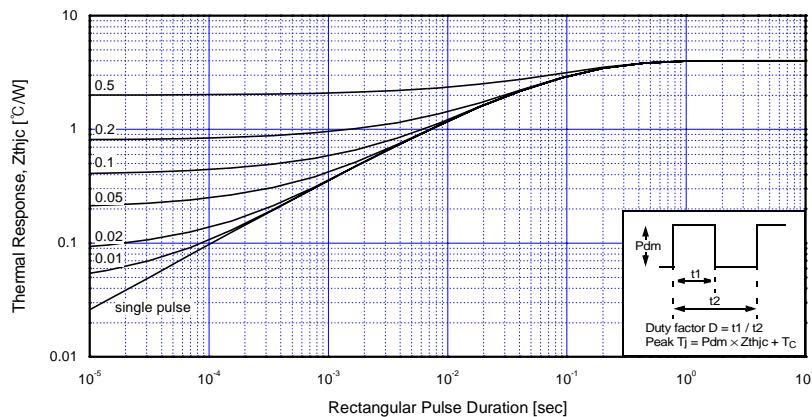
**Fig 14. Gate Charge Characteristics**



**Fig 15. SOA Characteristics**



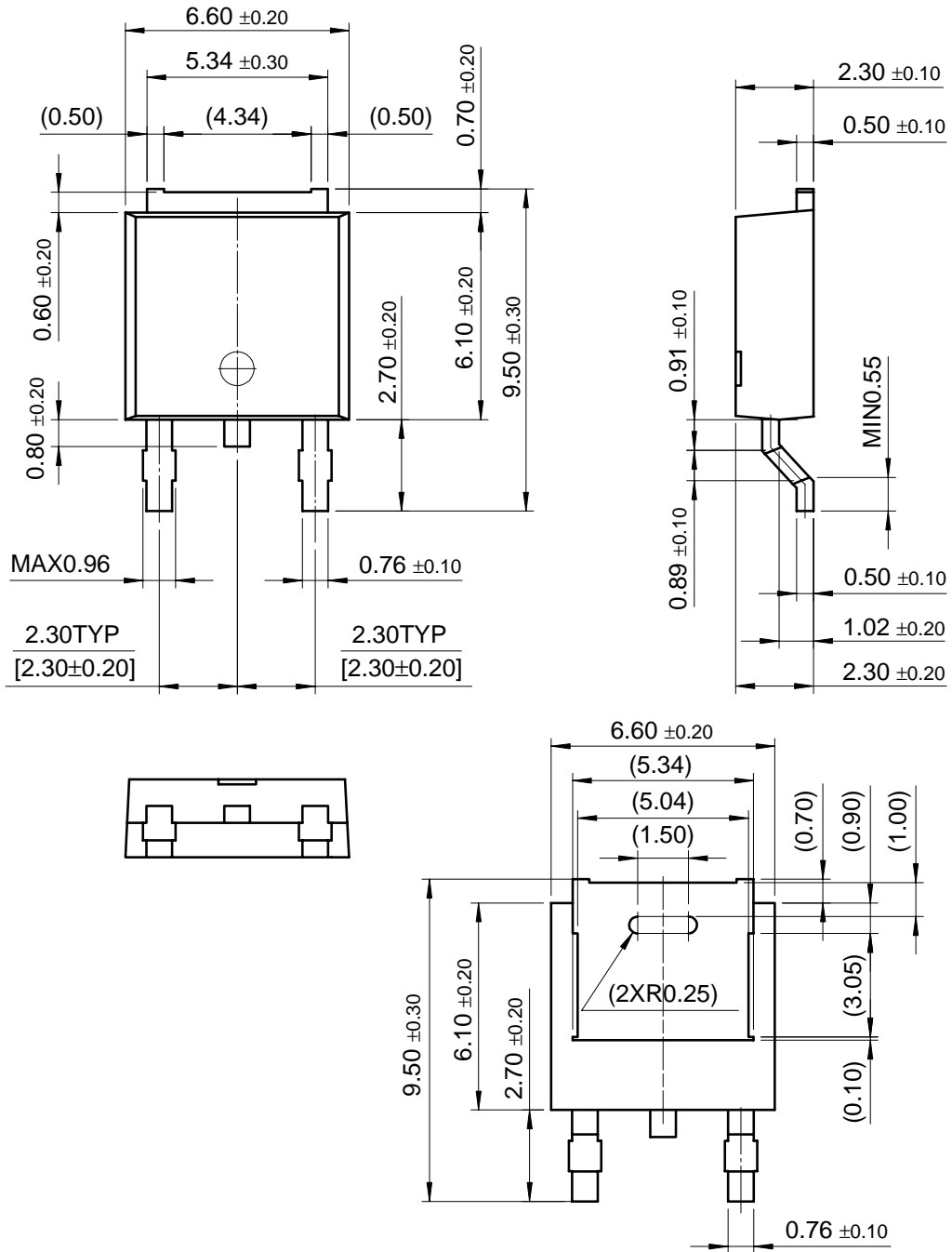
**Fig 16. Turn-Off SOA Characteristics**



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

Package Dimension

D-PAK



Dimensions in Millimeters

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DOME™	HiSeC™	Power247™	SuperSOT™-3	
EcoSPARK™	I <sup>2</sup> C™	PowerTrench®	SuperSOT™-6	
E <sup>2</sup> C MOS™	ISOPLANAR™	QFET™	SuperSOT™-8	
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