FAIRCHILD

SEMICONDUCTOR®

IGBT

SGF80N60UF

## Ultra-Fast IGBT

General Description

Fairchild's Insulated Gate Bipolar Transistor(IGBT) UF series provides low conduction and switching losses.
UF series is designed for the applications such as motor control and general inverters where High Speed Switching is required.
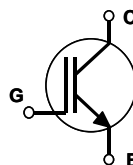
Features

- High Speed Switching
- Low Saturation Voltage : $V_{CE(sat)}$ = 2.1 V @ I_C = 40A
- High Input Impedance

Application

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

TO-3PF

G C E

C

G

E
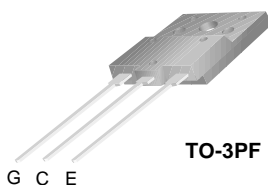
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

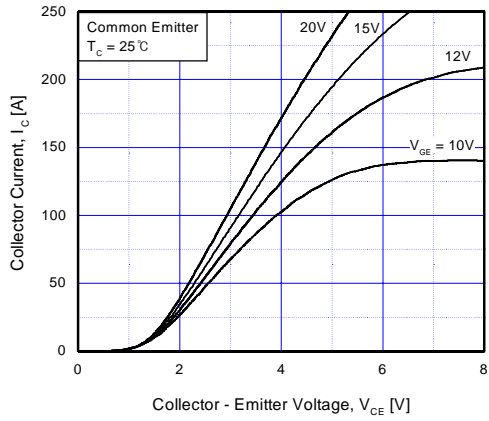| Symbol	Description		SGF80N60UF	Units
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Collector Current	@ T_C = 25°C	80	A
	Collector Current	@ T_C = 100°C	40	A
$I_{CM (1)}$	Pulsed Collector Current		220	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	110	W
	Maximum Power Dissipation	@ T_C = 100°C	45	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 :
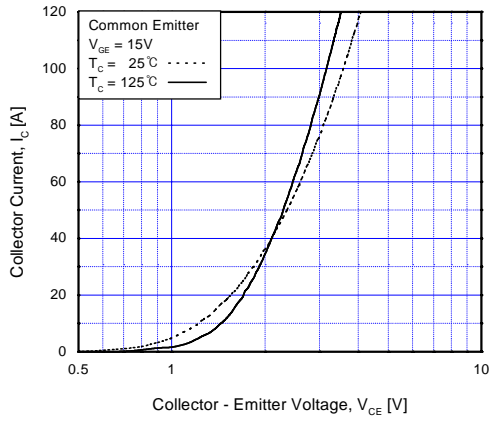(1) Repetitive rating : Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.1	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

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

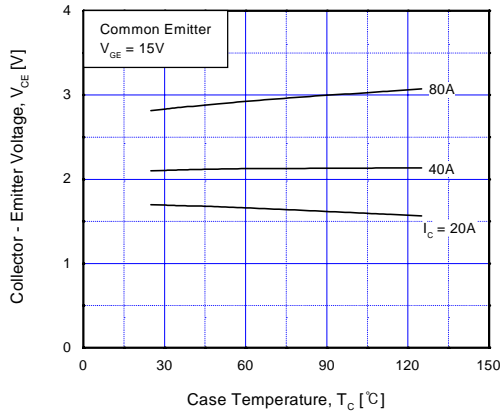| Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V$, $I_C = 250uA$	600	--	--	V
$\Delta B_{VCES} / \Delta T_J$	Temperature Coeff. of Breakdown Voltage	$V_{GE} = 0V$, $I_C = 1mA$	--	0.6	--	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, $V_{GE} = 0V$	--	--	250	uA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, $V_{CE} = 0V$	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 40mA$, $V_{CE} = V_{GE}$	3.5	4.5	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40A$, $V_{GE} = 15V$	--	2.1	2.6	V
		$I_C = 80A$, $V_{GE} = 15V$	--	2.6	--	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V$, $V_{GE} = 0V$, f = 1MHz	--	2790	--	pF
C_{oes}	Output Capacitance		--	350	--	pF
C_{res}	Reverse Transfer Capacitance		--	100	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300$ V, $I_C = 40A$, $R_G = 5\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 25°C$	--	23	--	ns
t_r	Rise Time		--	50	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	90	130	ns
t_f	Fall Time		--	50	150	ns
E_{on}	Turn-On Switching Loss		--	570	--	uJ
E_{off}	Turn-Off Switching Loss		--	590	--	uJ
E_{ts}	Total Switching Loss		--	1160	1500	uJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300$ V, $I_C = 40A$, $R_G = 5\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 125°C$	--	30	--	ns
t_r	Rise Time		--	55	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	150	200	ns
t_f	Fall Time		--	160	250	ns
E_{on}	Turn- On Switching Loss		--	630	--	uJ
E_{off}	Turn- Off Switching Loss		--	940	--	uJ
E_{ts}	Total Switching Loss		--	1580	2000	uJ
Q_g	Total Gate Charge	$V_{CE} = 300$ V, $I_C = 40A$, $V_{GE} = 15V$	--	175	250	nC
Q_{ge}	Gate-Emitter Charge		--	25	40	nC
Q_{gc}	Gate-Collector Charge		--	60	90	nC
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

Fig 1. Typical Output Characteristics

Common Emitter
$T_C = 25\,°C$

Collector Current, I_C [A]

Collector - Emitter Voltage, V_{CE} [V]

20V 15V 12V $V_{GE} = 10V$

Fig 2. Typical Saturation Voltage Characteristics

Common Emitter
$V_{GE} = 15V$
$T_C = 25\,°C$ ....
$T_C = 125\,°C$ ——

Collector Current, I_C [A]

Collector - Emitter Voltage, V_{CE} [V]

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

Common Emitter
$V_{GE} = 15V$

Collector - Emitter Voltage, V_{CE} [V]

80A
40A
$I_C = 20A$

Case Temperature, T_C [°C]
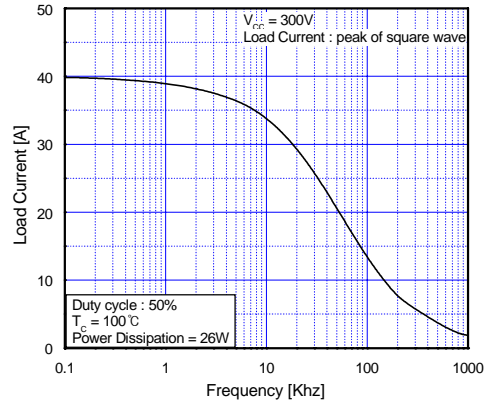
Fig 4. Load Current vs. Frequency

$V_{CC} = 300V$
Load Current : peak of square wave

Load Current [A]

Duty cycle : 50%
$T_C = 100\,°C$
Power Dissipation = 26W

Frequency [Khz]

Fig 5. Saturation Voltage vs. V_{GE}

Common Emitter
$T_C = 25\,°C$

Collector - Emitter Voltage, V_{CE} [V]

80A
40A
$I_C = 20A$

Gate - Emitter Voltage, V_{GE} [V]

Fig 6. Saturation Voltage vs. V_{GE}

Common Emitter
$T_C = 125\,°C$

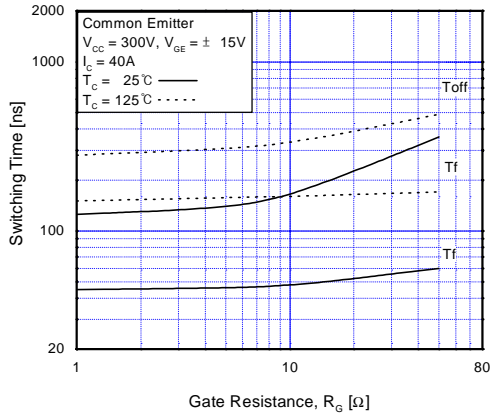Collector - Emitter Voltage, V_{CE} [V]

80A
40A
$I_C = 20A$
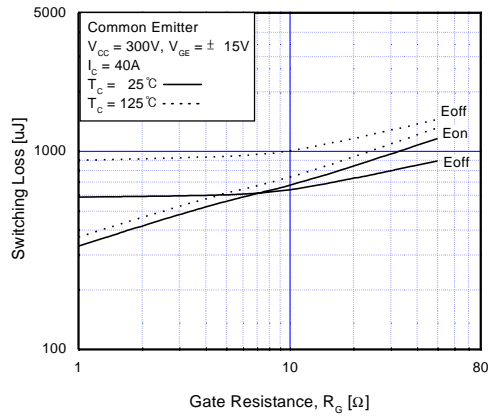
Gate - Emitter Voltage, V_{GE} [V]
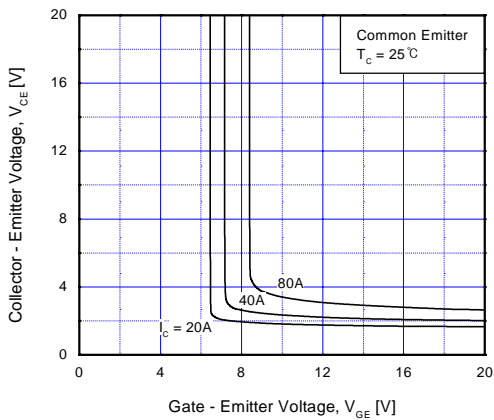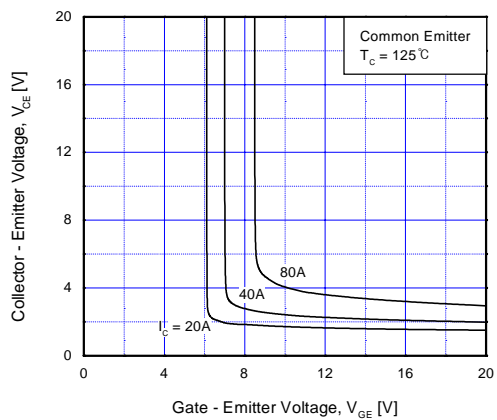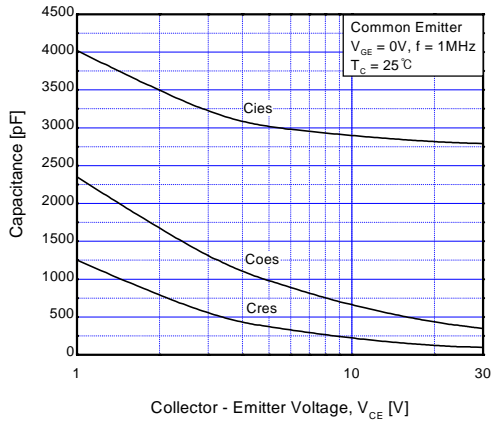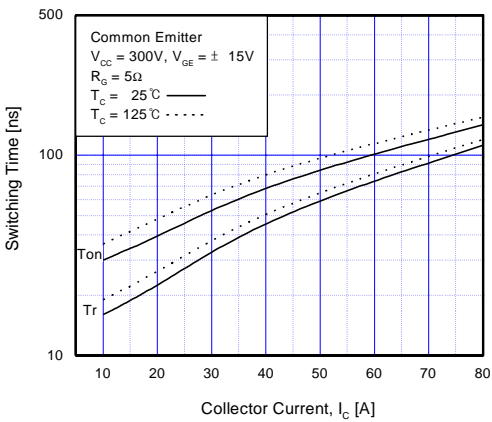
Fig 7. Capacitance Characteristics
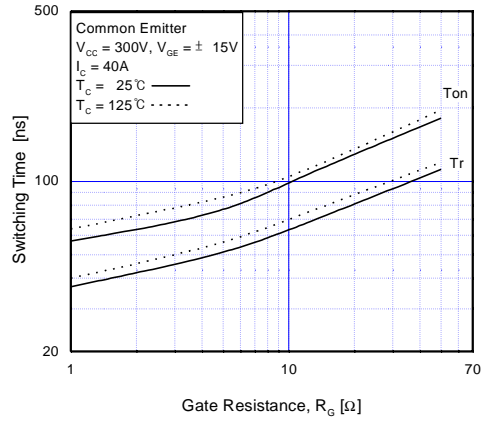
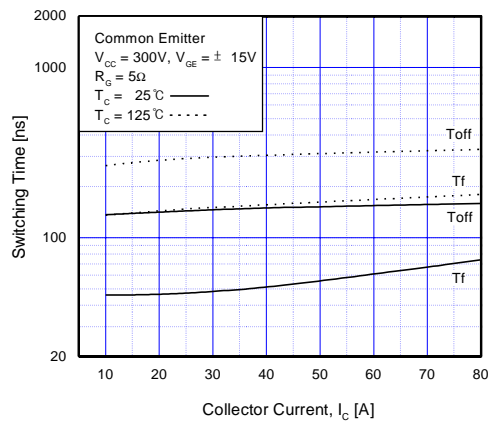**Fig 8. Turn-On Characteristics vs. Gate Resistance**

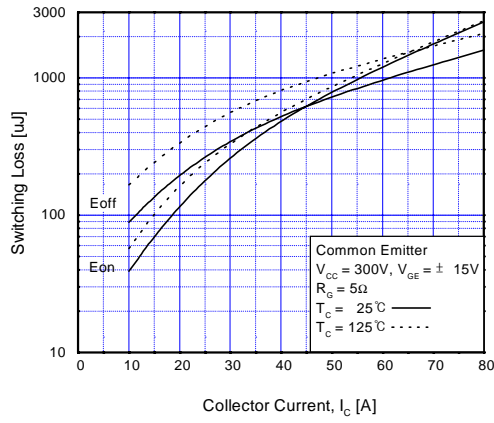**Fig 9. Turn-Off Characteristics vs. Gate Resistance**

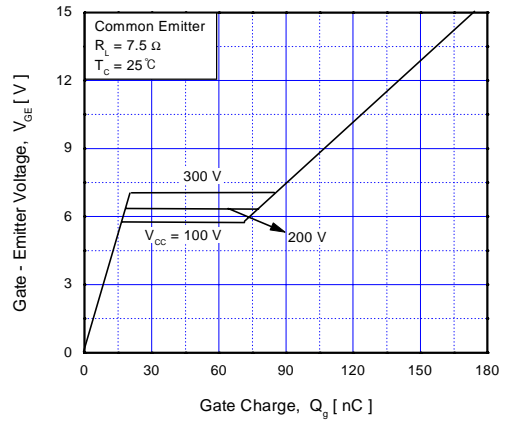**Fig 10. Switching Loss vs. Gate Resistance**

Fig 11. Turn-On Characteristics vs. Collector Current

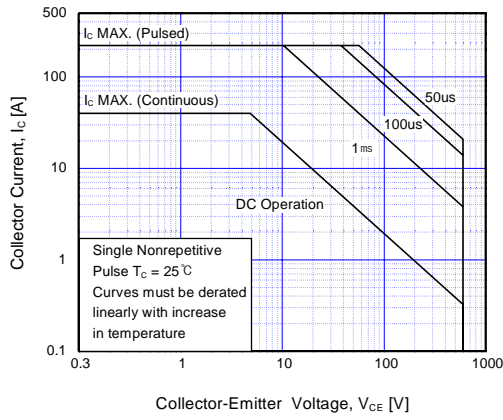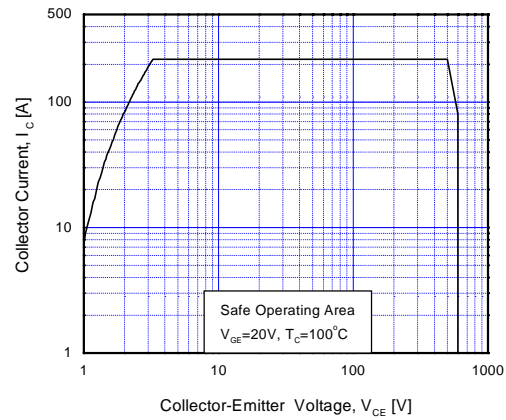**Fig 12. Turn-Off Characteristics vs. Collector Current**

Fig 13. Switching Loss vs. Collector Current

Fig 14. Gate Charge Characteristics

Fig 15. SOA Characteristics

Fig 16. Turn-Off SOA Characteristics
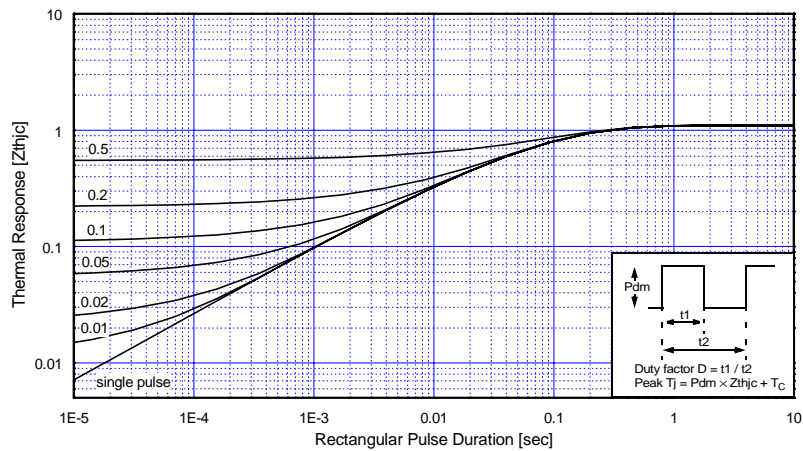
Fig 17. Transient Thermal Impedance of IGBT

Package Dimension

TO-3PF

15.50 ±0.20
4.50 ±0.20
ø3.60 ±0.20
26.50 ±0.20
16.50 ±0.20
14.50 ±0.20
2.00 ±0.20
2.50 ±0.20
14.80 ±0.20
2.00 ±0.20
2.00 ±0.20
4.00 ±0.20
2.00 ±0.20
0.75 +0.20 −0.10

5.45TYP
[5.45 ±0.30]

5.45TYP
[5.45 ±0.30]

5.50 ±0.20
3.00 ±0.20
(1.50)
10.00 ±0.20
10°
0.85 ±0.03
16.50 ±0.20
23.00 ±0.20
22.00 ±0.20
1.50 ±0.20
2.00 ±0.20
3.30 ±0.20
0.90 +0.20 −0.10

3.30 ±0.20
2.00 ±0.20
5.50 ±0.20
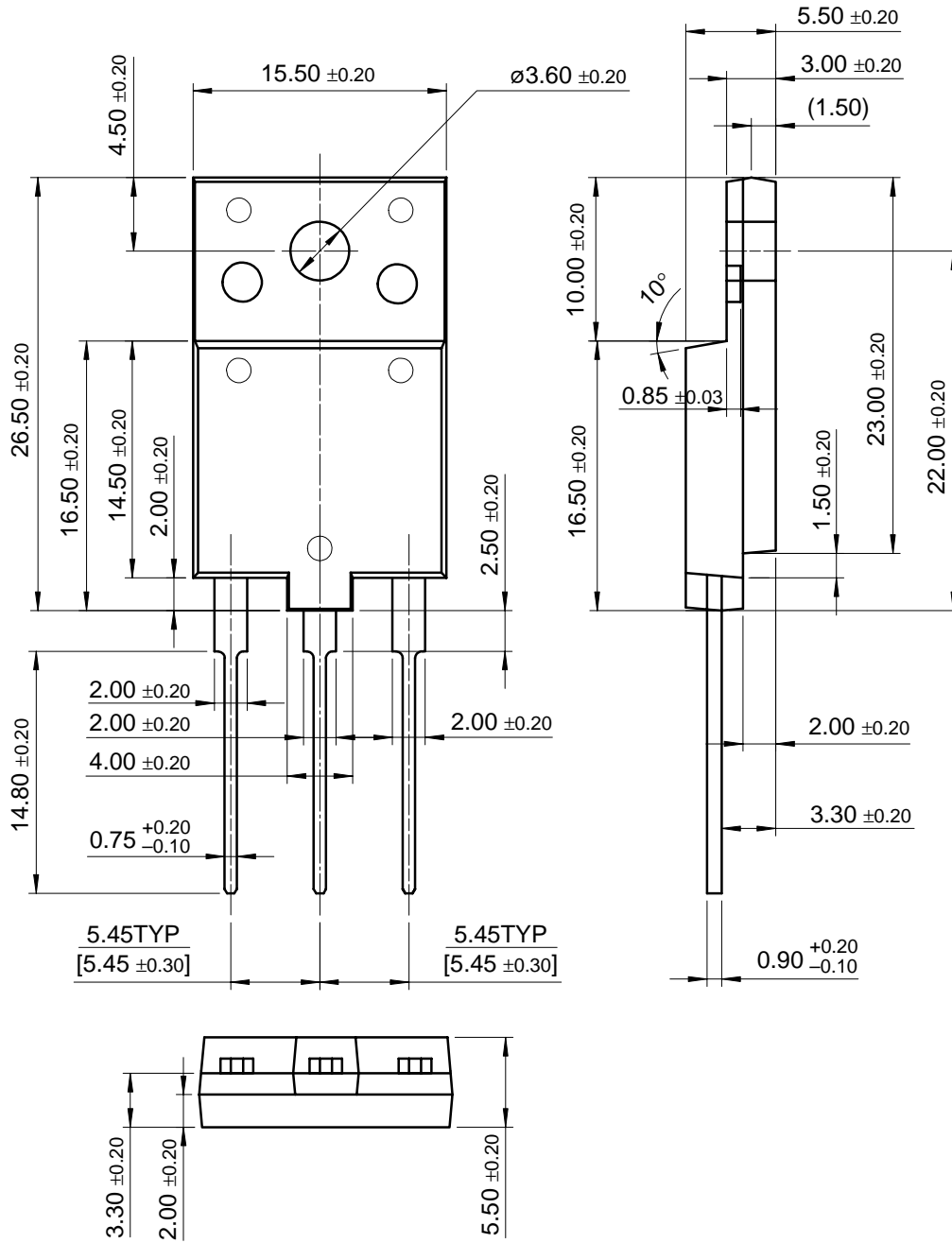
Dimensions in Millimeters

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