November 2013

FGAF40N60UF

600 V PT IGBT

General Description

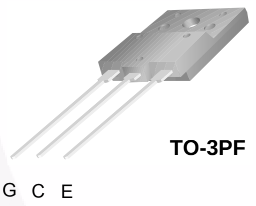
Fairchild's UF series of IGBTs provide low conduction and switching losses. The UF series is designed for applications such as general inverters and PFC where high speed switching is a required feature.

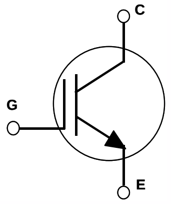
Features

- High Speed Switching
- Low Saturation Voltage: $V_{CE(sat)}$ = 2.3 V @ I_C = 20 A
- High Input Impedance

Applications

General Inverter, PFC





Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Description		Ratings	Unit
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 20	V
I_C	Collector Current	@ T_C = 25°C	40	A
	Collector Current	@ T_C = 100°C	20	A
$I_{CM\ (1)}$	Pulsed Collector Current		160	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	100	W
	Maximum Power Dissipation	@ T_C = 100°C	40	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.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction-to-Case	--	1.2	°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.	Unit
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0 V, I_C = 250 uA	600	--	--	V
$\Delta B_{VCES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	--	0.6	--	V/°C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0 V	--	--	250	uA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0 V	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 20 mA, V_{CE} = V_{GE}	3.5	5.1	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 20 A, V_{GE} = 15 V	--	2.3	3.0	V
		I_C = 40 A, V_{GE} = 15 V	--	3.1	--	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	--	1075	--	pF
C_{oes}	Output Capacitance		--	170	--	pF
C_{res}	Reverse Transfer Capacitance		--	50	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 20 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	--	15	--	ns
t_r	Rise Time		--	30	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	65	130	ns
t_f	Fall Time		--	35	100	ns
E_{on}	Turn-On Switching Loss		--	470	--	uJ
E_{off}	Turn-Off Switching Loss		--	130	--	uJ
E_{ts}	Total Switching Loss		--	600	1000	uJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 300 V, I_C = 20 A, R_G = 10 Ω, V_{GE} = 15 V, Inductive Load, T_C = 125°C	--	30	--	ns
t_r	Rise Time		--	37	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	110	200	ns
t_f	Fall Time		--	80	250	ns
E_{on}	Turn-On Switching Loss		--	500	--	uJ
E_{off}	Turn-Off Switching Loss		--	310	--	uJ
E_{ts}	Total Switching Loss		--	810	1200	uJ
Q_g	Total Gate Charge	V_{CE} = 300 V, I_C = 20 A, V_{GE} = 15 V	--	77	150	nC
Q_{ge}	Gate-Emitter Charge		--	20	30	nC
Q_{gc}	Gate-Collector Charge		--	25	40	nC
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

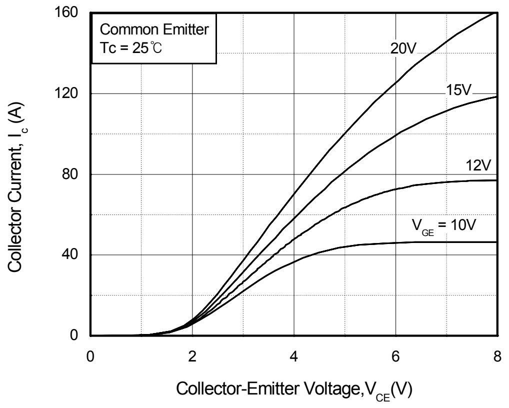


Fig 1. Typical Output Characteristics

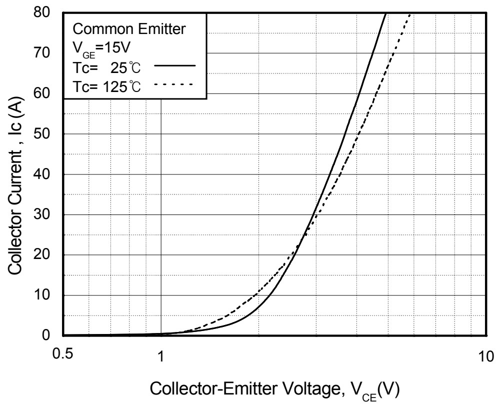


Fig 2. Typical Saturation Voltage Characteristics

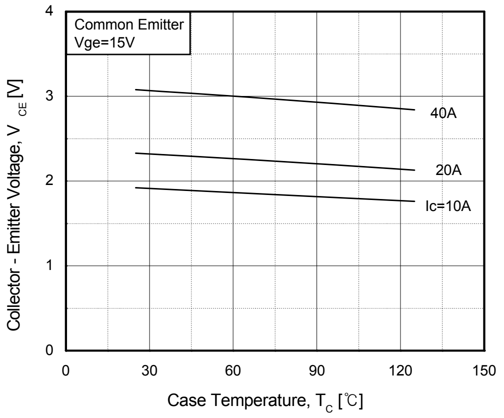


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

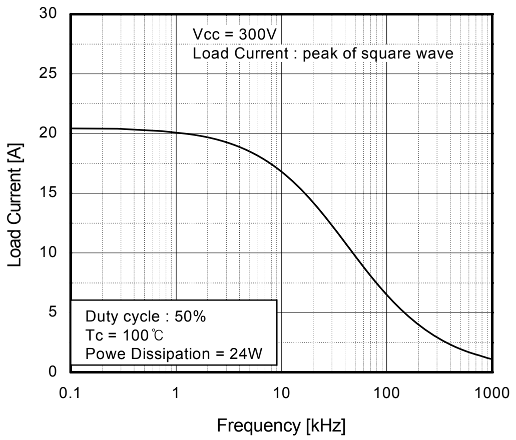


Fig 4. Load Current vs. Frequency

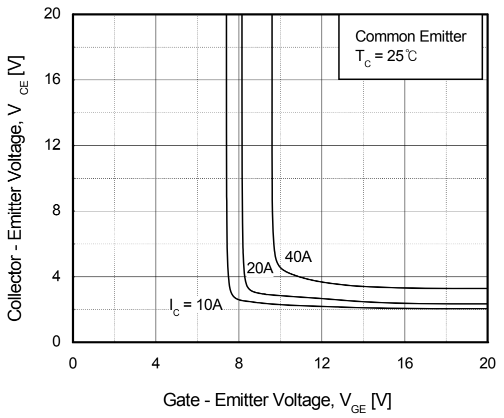


Fig 5. Saturation Voltage vs. V_{GE}

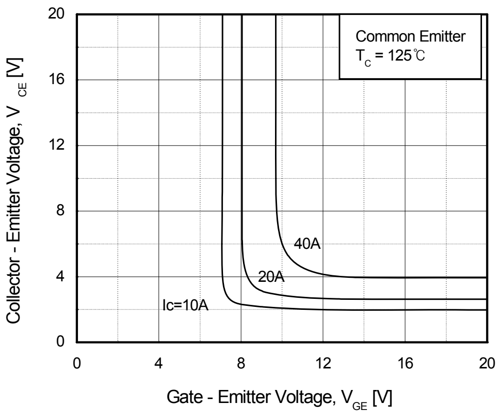


Fig 6. Saturation Voltage vs. V_{GE}

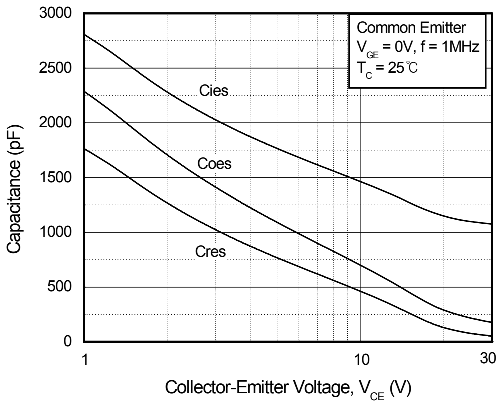


Fig 7. Capacitance Characteristics

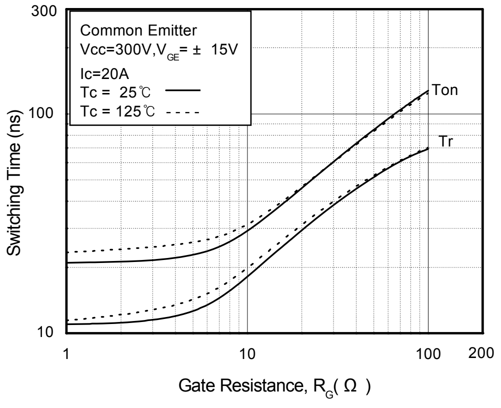


Fig 8. Turn-On Characteristics vs. Gate Resistance

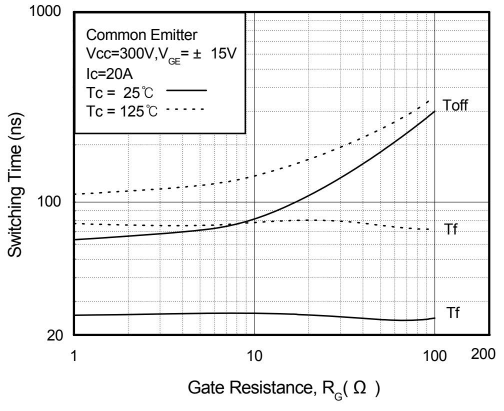


Fig 9. Turn-Off Characteristics vs. Gate Resistance

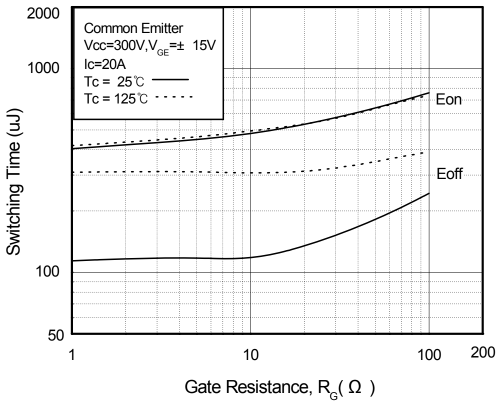


Fig 10. Switching Loss vs. Gate Resistance

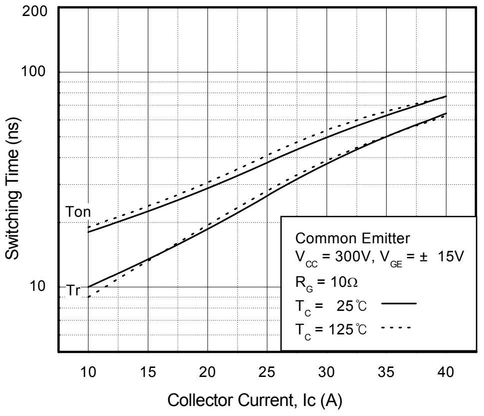


Fig 11. Turn-On Characteristics vs. Collector Current

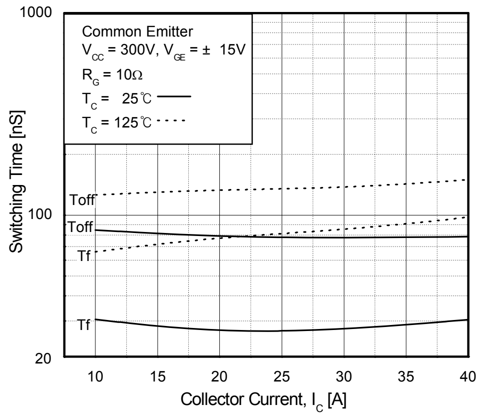


Fig 12. Turn-Off Characteristics vs. Collector Current

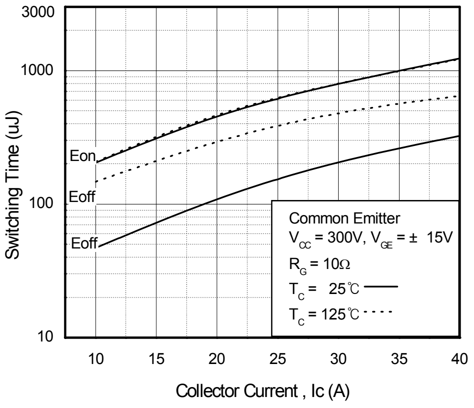


Fig 13. Switching Loss vs. Collector Current

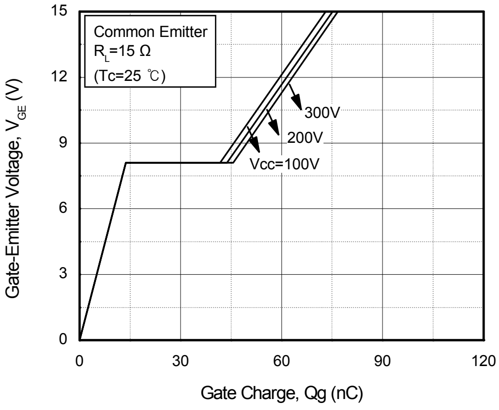


Fig 14. Gate Charge Characteristics

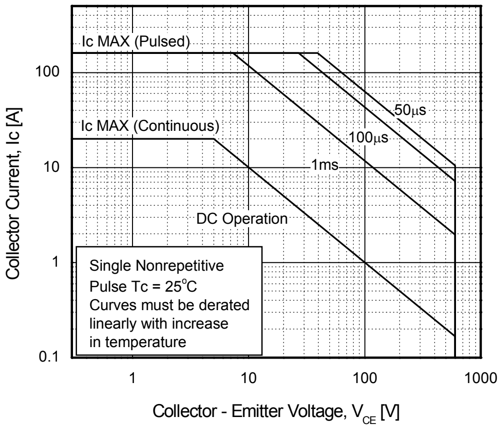


Fig 15. SOA Characteristics

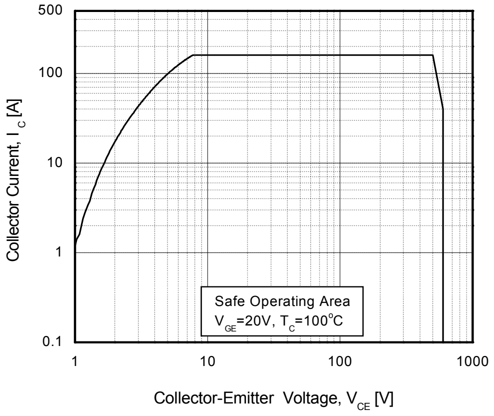


Fig 16. Turn-Off SOA Characteristics

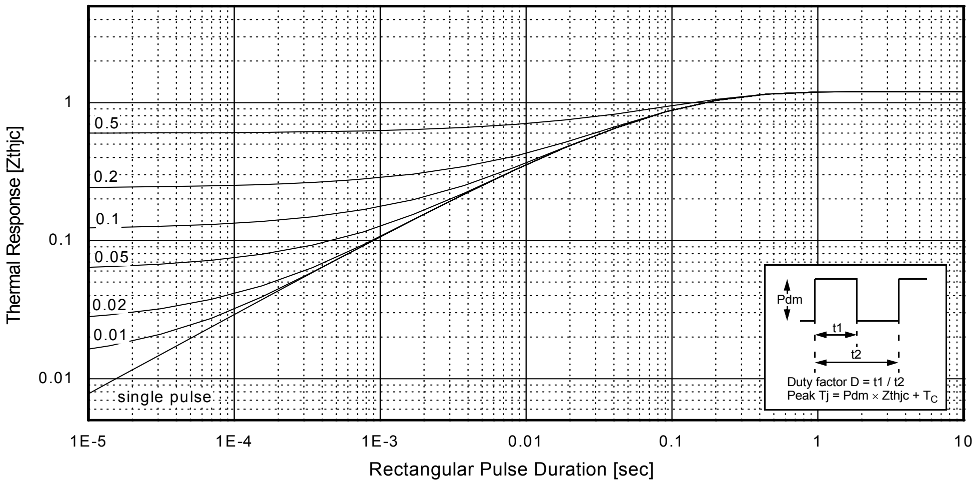
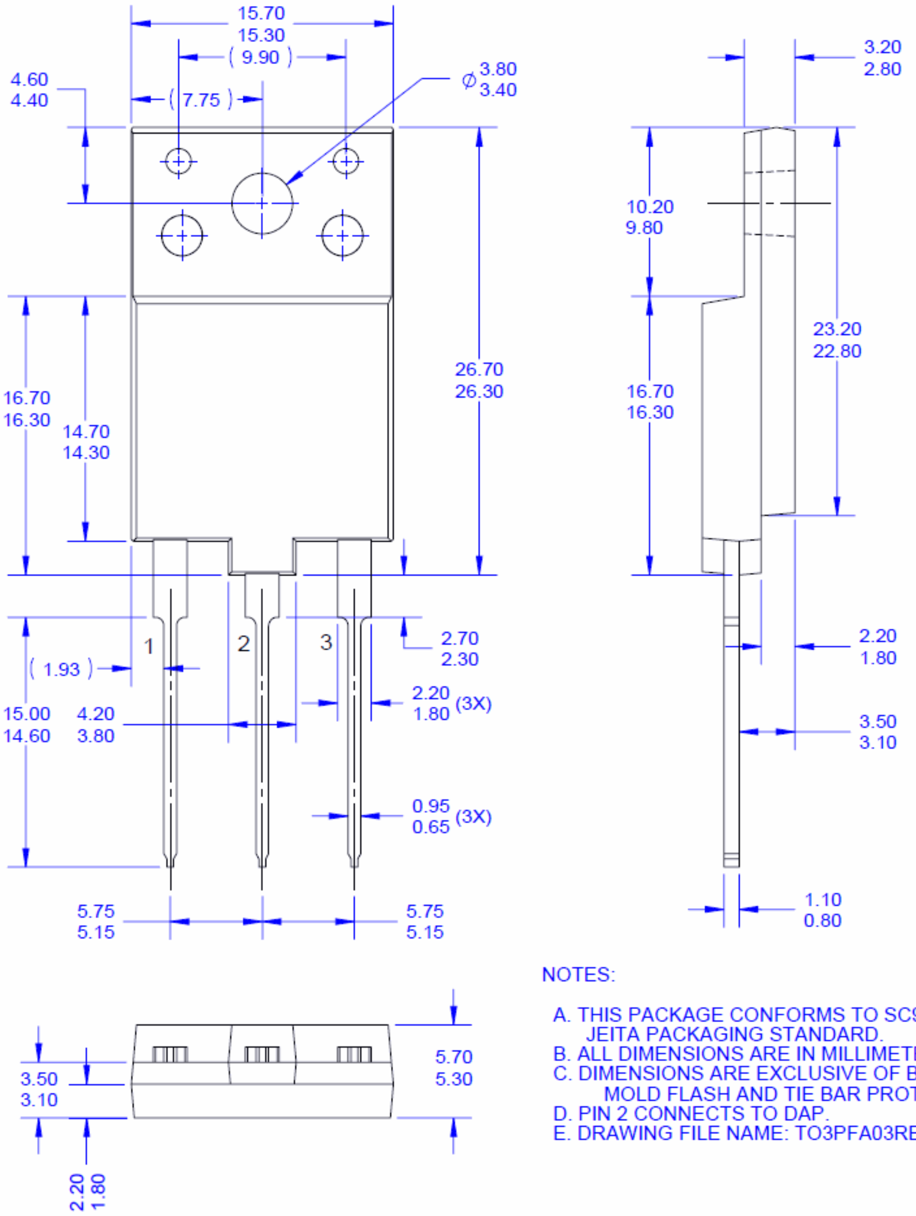


Fig 17. Transient Thermal Impedance of IGBT

Mechanical Dimensions



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C. DIMENSIONS ARE EXCLUSIVE OF BURRS,
MOLD FLASH AND TIE BAR PROTRUSIONS.
D. PIN 2 CONNECTS TO DAP.
E. DRAWING FILE NAME: TO3PFA03REV1

Figure 18. TO3PF,MOLDED,3LD,FULLPACK (AG)

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