

SGF23N60UFD

Ultra-Fast IGBT

General Description

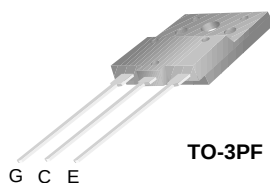
Fairchild's Insulated Gate Bipolar Transistor(IGBT) UFD series provides low conduction and switching losses. UFD series is designed for the applications such as motor control and general inverters where High Speed Switching is required.

Features

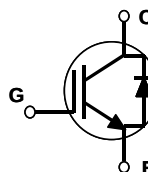
- High Speed Switching
- Low Saturation Voltage : $V_{CE(sat)} = 2.1\text{ V @ } I_C = 12\text{ A}$
- High Input Impedance
- CO-PAK, IGBT with FRD : $t_{rr} = 42\text{ ns (typ.)}$

Application

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



TO-3PF



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

Symbol	Description	SGF23N60UFD	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	23	A
	Collector Current @ $T_C = 100^\circ\text{C}$	12	A
$I_{CM(1)}$	Pulsed Collector Current	92	A
I_F	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	12	A
I_{FM}	Diode Maximum Forward Current	92	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	75	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	30	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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction-to-Case	--	1.6	$^\circ\text{C/W}$
$R_{\theta JC}(\text{DIODE})$	Thermal Resistance, Junction-to-Case	--	3.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C/W}$

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
ΔBV _{CES} /ΔT _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 = 12mA, V _{CE} = V _{GE}	3.5	4.5	6.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 12A, V _{GE} = 15V	--	2.1	2.6	V
		I _C = 23A, V _{GE} = 15V	--	2.6	--	V

Dynamic Characteristics

C _{ies}	Input Capacitance	V _{CE} = 30V, V _{GE} = 0V, f = 1MHz	--	720	--	pF
C _{oes}	Output Capacitance		--	100	--	pF
C _{res}	Reverse Transfer Capacitance		--	25	--	pF

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{CC} = 300 V, I _C = 12A, R _G = 23Ω, V _{GE} = 15V, Inductive Load, T _C = 25°C	--	17	--	ns
t _r	Rise Time		--	27	--	ns
t _{d(off)}	Turn-Off Delay Time		--	60	130	ns
t _f	Fall Time		--	70	150	ns
E _{on}	Turn-On Switching Loss		--	115	--	uJ
E _{off}	Turn-Off Switching Loss	V _{CC} = 300 V, I _C = 12A, R _G = 23Ω, V _{GE} = 15V, Inductive Load, T _C = 125°C	--	135	--	uJ
E _{ts}	Total Switching Loss		--	250	400	uJ
t _{d(on)}	Turn-On Delay Time		--	23	--	ns
t _r	Rise Time		--	32	--	ns
t _{d(off)}	Turn-Off Delay Time		--	100	200	ns
t _f	Fall Time		--	220	250	ns
E _{on}	Turn- On Switching Loss	V _{CE} = 300 V, I _C = 12A, V _{GE} = 15V	--	205	--	uJ
E _{off}	Turn- Off Switching Loss		--	320	--	uJ
E _{ts}	Total Switching Loss		--	525	800	uJ
Q _g	Total Gate Charge		--	49	80	nC
Q _{ge}	Gate-Emitter Charge		--	11	17	nC
Q _{gc}	Gate-Collector Charge	Measured 5mm from PKG	--	14	22	nC
L _e	Internal Emitter Inductance		--	14	--	nH

Electrical Characteristics of DIODE T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Units
V _{FM}	Diode Forward Voltage	I _F = 12A	T _C = 25°C	--	1.4	1.7	V
			T _C = 100°C	--	1.3	--	
t _{rr}	Diode Reverse Recovery Time	I _F = 12A, di/dt = 200A/us	T _C = 25°C	--	42	60	ns
			T _C = 100°C	--	80	--	
I _{rr}	Diode Peak Reverse Recovery Current		T _C = 25°C	--	3.5	6.0	A
			T _C = 100°C	--	5.6	--	
Q _{rr}	Diode Reverse Recovery Charge		T _C = 25°C	--	80	180	nC
			T _C = 100°C	--	220	--	

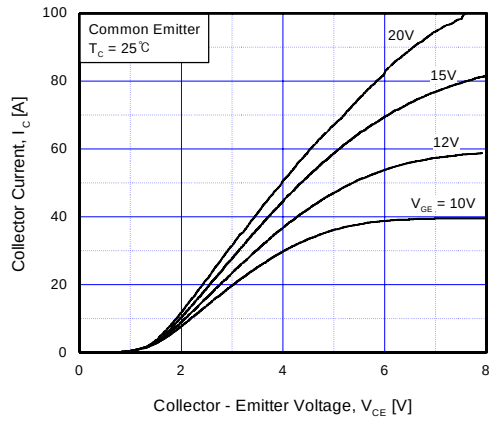


Fig 1. Typical Output Characteristics

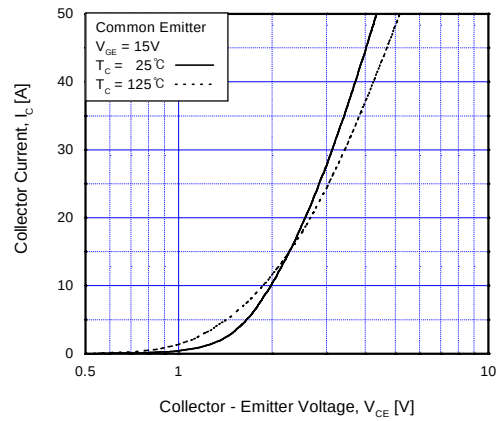


Fig 2. Typical Saturation Voltage Characteristics

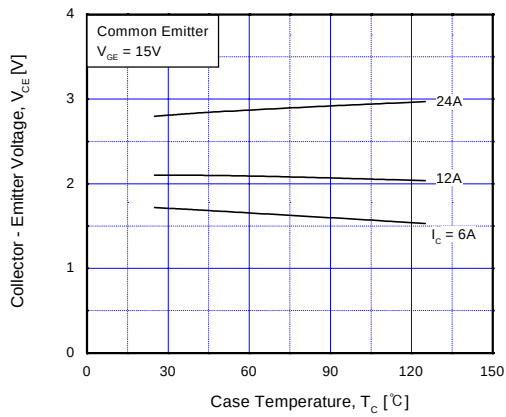


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

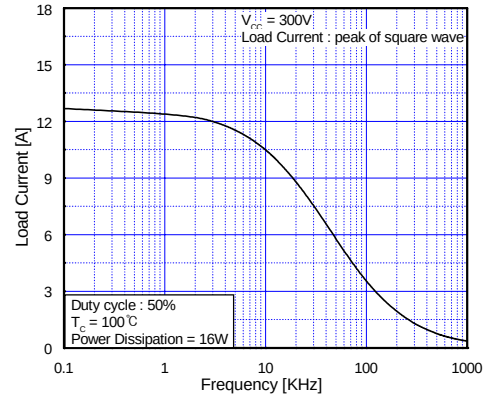
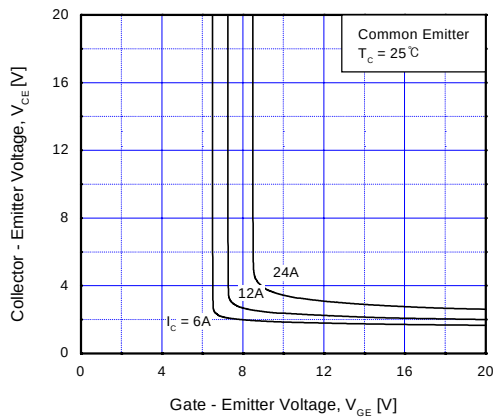
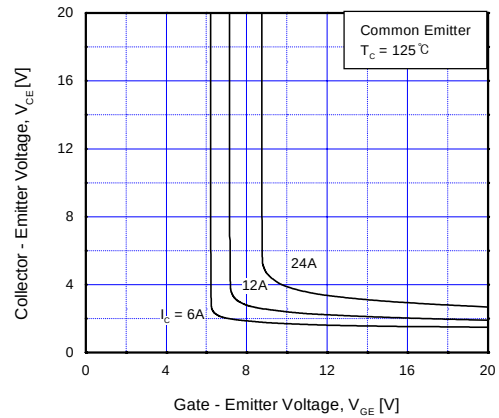


Fig 4. Load Current vs. Frequency

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

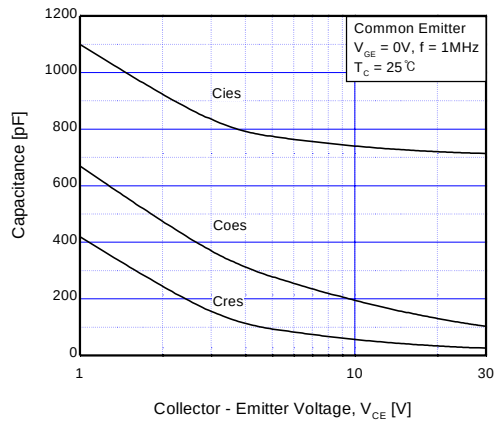


Fig 7. Capacitance Characteristics

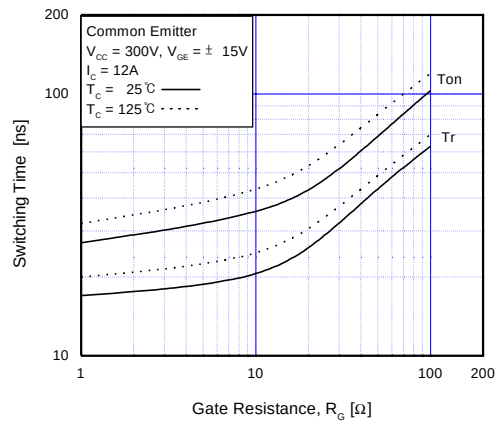


Fig 8. Turn-On Characteristics vs. Gate Resistance

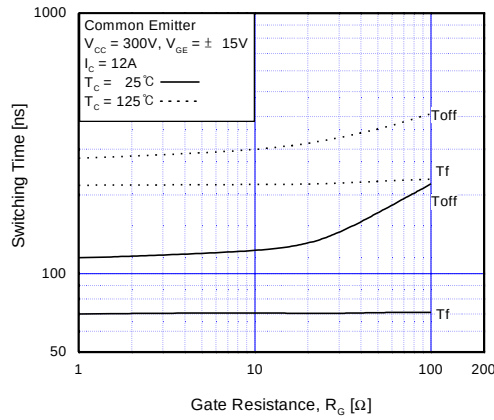


Fig 9. Turn-Off Characteristics vs. Gate Resistance

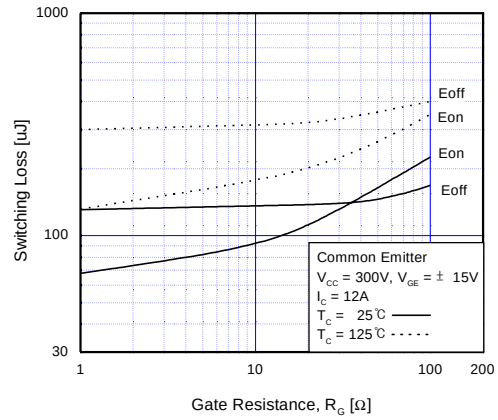


Fig 10. Switching Loss vs. Gate Resistance

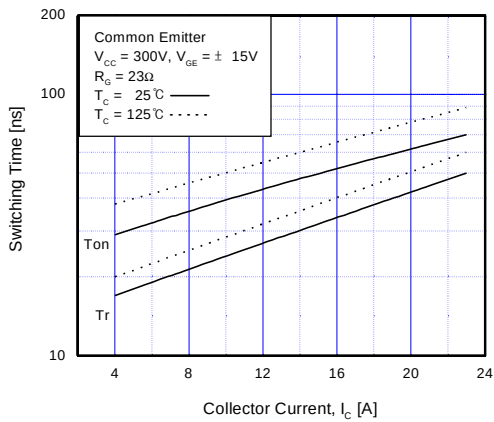


Fig 11. Turn-On Characteristics vs. Collector Current

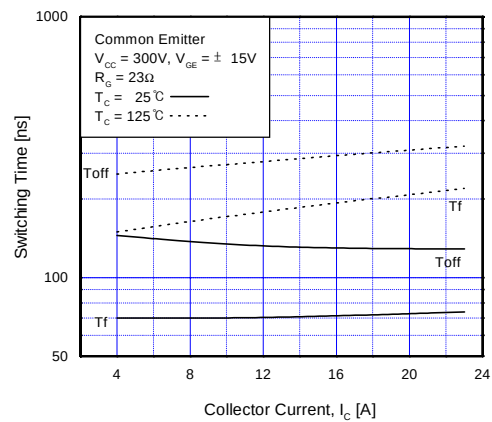


Fig 12. Turn-Off Characteristics vs. Collector Current

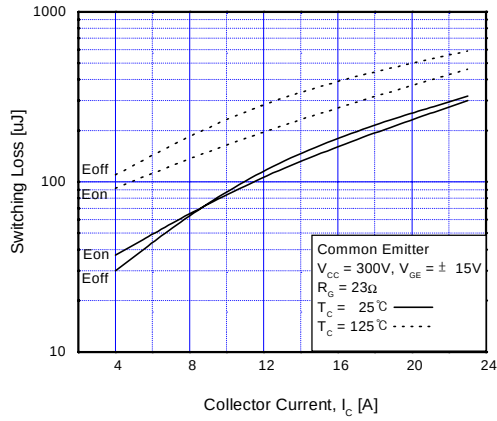


Fig 13. Switching Loss vs. Collector Current

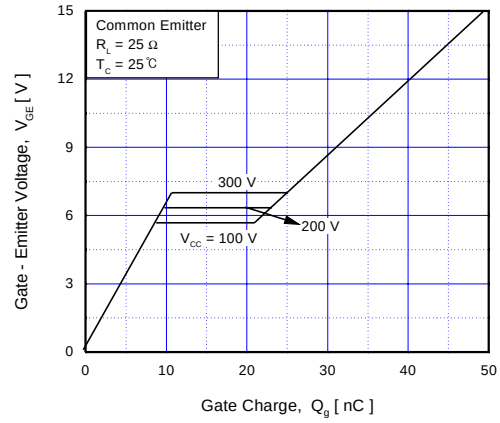


Fig 14. Gate Charge Characteristics

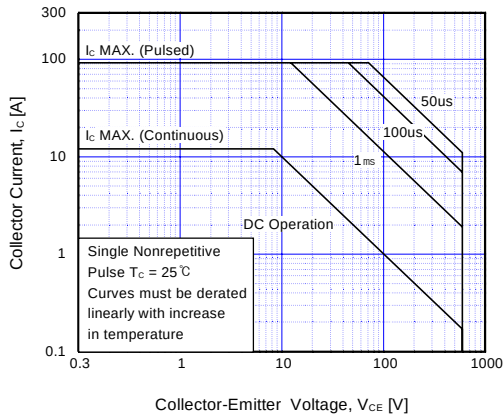


Fig 15. SOA Characteristics

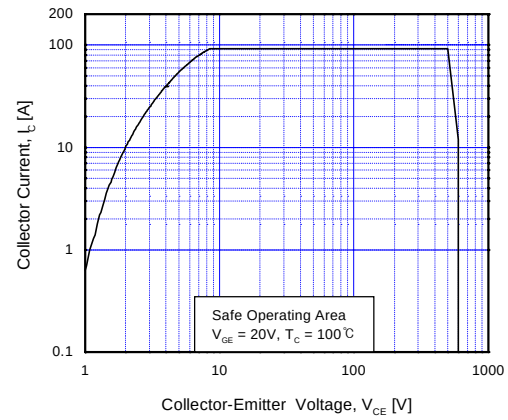


Fig 16. Turn-Off SOA Characteristics

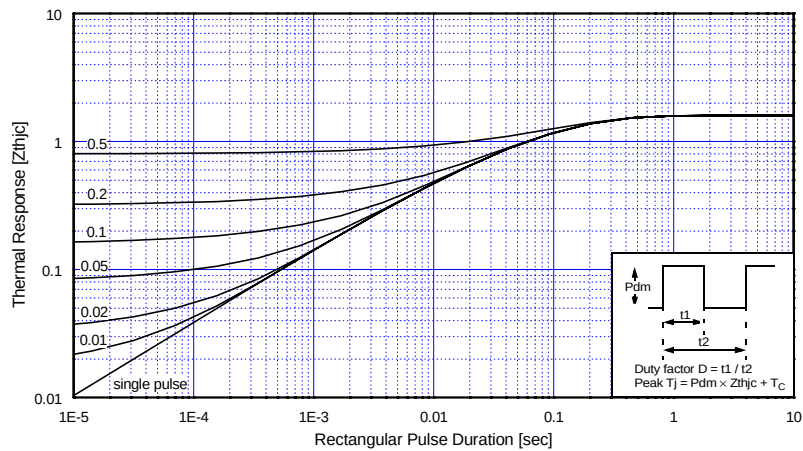


Fig 17. Transient Thermal Impedance of IGBT

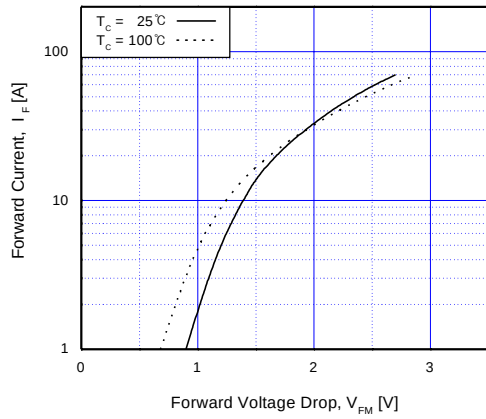


Fig 18. Forward Characteristics

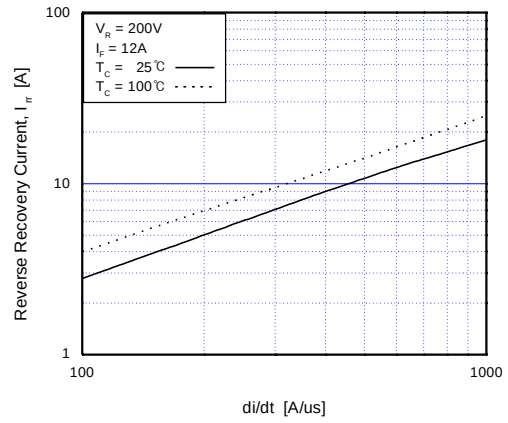


Fig 19. Reverse Recovery Current

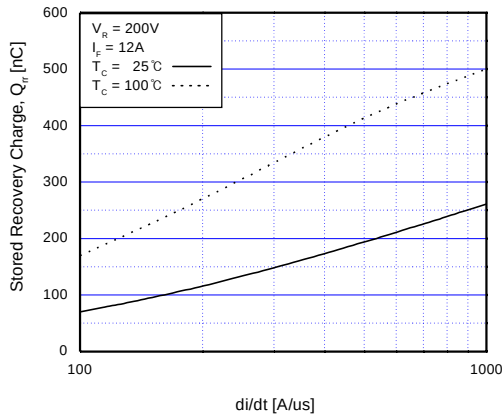


Fig 20. Stored Charge

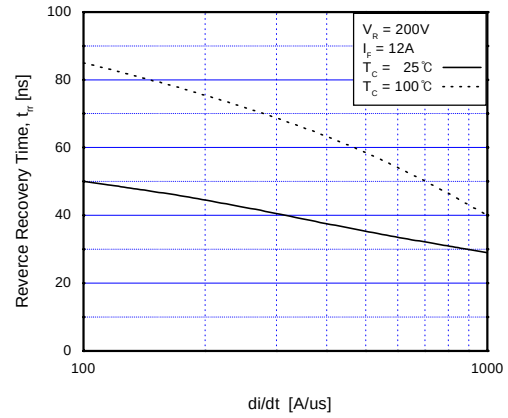


Fig 21. Reverse Recovery Time

Technical drawing of a mechanical part, showing three views: Front View, Side View, and Top View. Dimensions are in millimeters (mm) with tolerances.

Front View Dimensions:

- Overall Width: 15.50 ± 0.20
- Overall Height: 26.50 ± 0.20
- Top Section Height: 4.50 ± 0.20
- Section Height: 16.50 ± 0.20
- Section Height: 14.50 ± 0.20
- Section Height: 2.00 ± 0.20
- Bottom Section Height: 2.50 ± 0.20
- Overall Height (including base): 14.80 ± 0.20
- Base Section Height: 2.00 ± 0.20
- Base Section Height: 2.00 ± 0.20
- Base Section Height: 4.00 ± 0.20
- Base Section Height: $0.75^{+0.20}_{-0.10}$
- Material: 5.45TYP [5.45 ± 0.30]

Side View Dimensions:

- Overall Width: 5.50 ± 0.20
- Overall Height: 23.00 ± 0.20
- Top Section Height: 3.00 ± 0.20
- Section Height: 10.00 ± 0.20
- Section Height: 16.50 ± 0.20
- Section Height: 1.50 ± 0.20
- Section Height: 2.00 ± 0.20
- Section Height: 3.30 ± 0.20
- Section Height: $0.90^{+0.20}_{-0.10}$
- Chamfer: 10°
- Chamfer: 0.85 ± 0.03

Top View Dimensions:

- Overall Width: 3.30 ± 0.20
- Overall Height: 2.00 ± 0.20
- Overall Width: 5.50 ± 0.20

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