

FAIRCHILD
SEMICONDUCTOR®

IGBT

SGH20N120RUF D

Short Circuit Rated IGBT

General Description

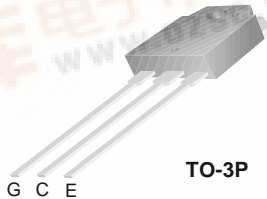
Fairchild's RUF D series of Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses as well as short circuit ruggedness. The RUF D series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness is a required feature.

Features

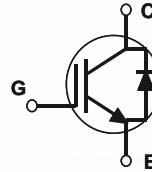
- Short circuit rated 10µs @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- High speed switching
- Low saturation voltage : $V_{CE(sat)} = 2.3\text{V}$ @ $I_C = 20\text{A}$
- High input impedance
- CO-PAK, IGBT with FRD : $t_{rr} = 80\text{ns}$ (typ.)

Applications

AC & DC motor controls, general purpose inverters, robotics, and servo controls.



TO-3P



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

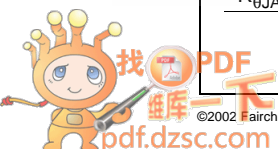
Symbol	Description	SGH20N120RUF D	Units
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	± 25	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	32	A
	Collector Current @ $T_C = 100^\circ\text{C}$	20	A
$I_{CM(1)}$	Pulsed Collector Current	60	A
I_F	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	20	A
I_{FM}	Diode Maximum Forward Current	120	A
T_{SC}	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	µs
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	230	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	92	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
$R_{\theta JC(IGBT)}$	Thermal Resistance, Junction-to-Case	--	0.54	$^\circ\text{C/W}$
$R_{\theta JC(DIODE)}$	Thermal Resistance, Junction-to-Case	--	0.84	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C/W}$



Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	1200	--	--	V
$\Delta BV_{CES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	V/ $^\circ\text{C}$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	1	mA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	± 100	nA

On Characteristics

$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 20mA, V_{CE} = V_{GE}$	3.5	5.5	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 20A, V_{GE} = 15V$	--	2.3	3.0	V
		$I_C = 32A, V_{GE} = 15V$	--	2.8	--	V

Dynamic Characteristics

C_{ies}	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	2000	--	pF
C_{oes}	Output Capacitance		--	170	--	pF
C_{res}	Reverse Transfer Capacitance		--	60	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600V, I_C = 20A,$ $R_G = 15\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ\text{C}$	--	30	--	ns
t_r	Rise Time		--	60	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	70	130	ns
t_f	Fall Time		--	150	300	ns
E_{on}	Turn-On Switching Loss		--	1.30	--	mJ
E_{off}	Turn-Off Switching Loss		--	1.30	--	mJ
E_{ts}	Total Switching Loss	--	2.60	3.65	mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600V, I_C = 20A,$ $R_G = 15\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ\text{C}$	--	30	--	ns
t_r	Rise Time		--	70	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	90	165	ns
t_f	Fall Time		--	200	400	ns
E_{on}	Turn-On Switching Loss		--	1.50	--	mJ
E_{off}	Turn-Off Switching Loss		--	2.00	--	mJ
E_{ts}	Total Switching Loss	--	3.50	5.08	mJ	
T_{sc}	Short Circuit Withstand Time	$V_{CC} = 600V, V_{GE} = 15V$ @ $T_C = 100^\circ\text{C}$	10	--	--	μs
Q_g	Total Gate Charge	$V_{CE} = 600V, I_C = 20A,$ $V_{GE} = 15V$	--	95	140	nC
Q_{ge}	Gate-Emitter Charge		--	15	25	nC
Q_{gc}	Gate-Collector Charge		--	43	65	nC
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

Electrical Characteristics of DIODE $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
V_{FM}	Diode Forward Voltage	$I_F = 20A$	$T_C = 25^\circ\text{C}$	--	2.8	3.5	V
			$T_C = 100^\circ\text{C}$	--	2.5	--	
t_{rr}	Diode Reverse Recovery Time	$I_F = 20A$	$T_C = 25^\circ\text{C}$	--	80	110	ns
			$T_C = 100^\circ\text{C}$	--	95	--	
I_{rr}	Diode Peak Reverse Recovery Current	$dI/dt = 200A/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	8.0	10.0	A
			$T_C = 100^\circ\text{C}$	--	9.5	--	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	--	320	500	nC
			$T_C = 100^\circ\text{C}$	--	450	--	

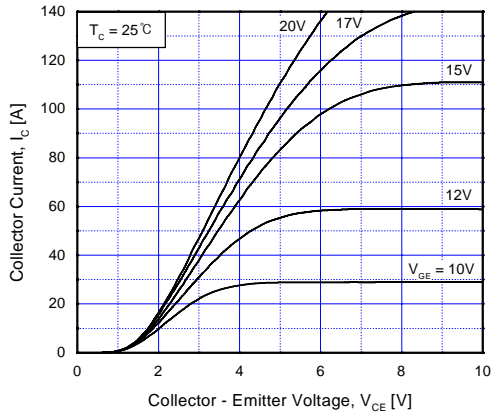


Fig 1. Typical Output Characteristics

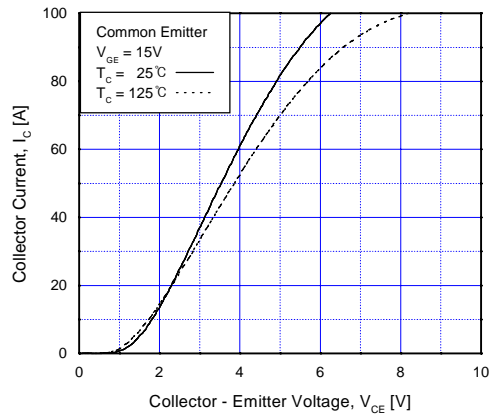


Fig 2. Typical Saturation Voltage Characteristics

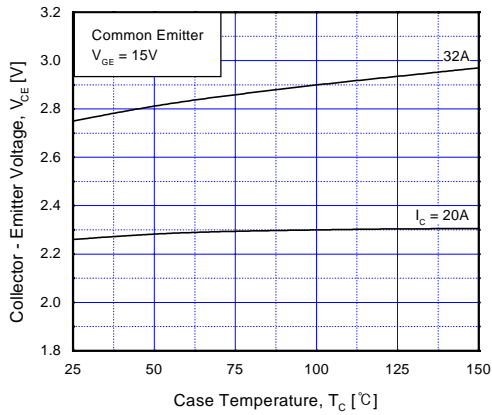


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

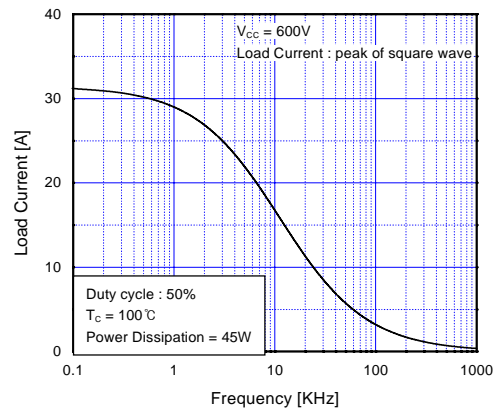


Fig 4. Load Current vs. Frequency

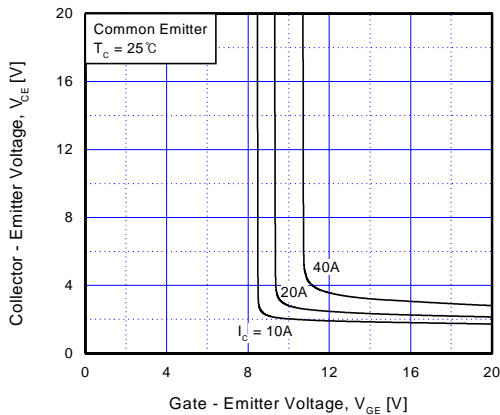


Fig 5. Saturation Voltage vs. V_{GE}

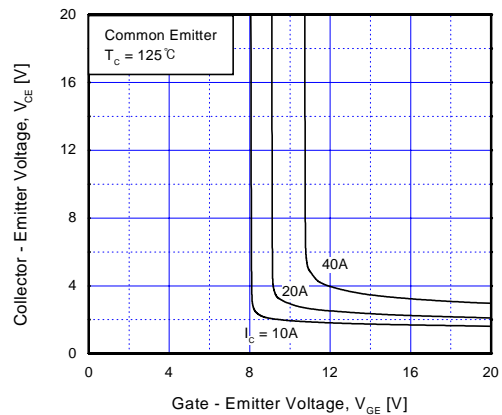


Fig 6. Saturation Voltage vs. V_{GE}

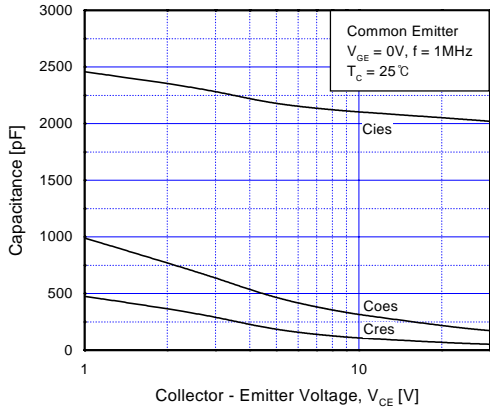


Fig 7. Capacitance Characteristics

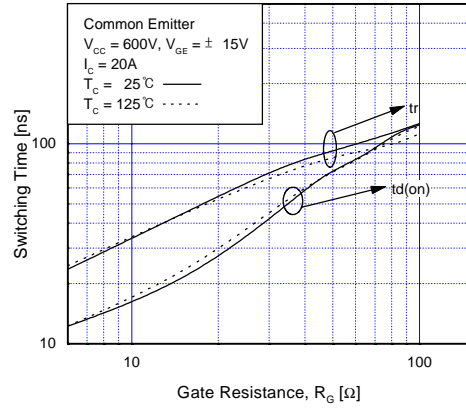


Fig 8. Turn-On Characteristics vs. Gate Resistance

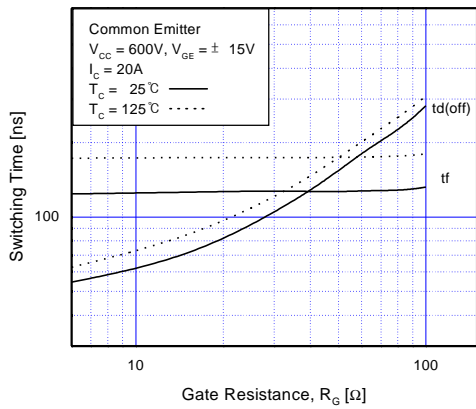


Fig 9. Turn-Off Characteristics vs. Gate Resistance

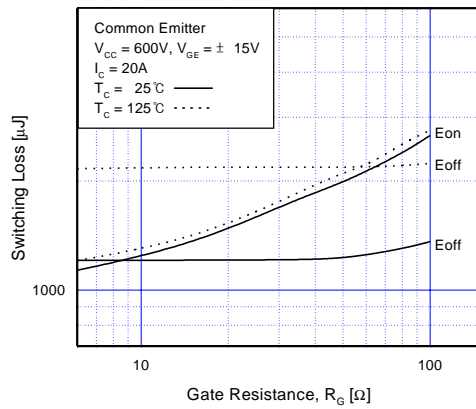


Fig 10. Switching Loss vs. Gate Resistance

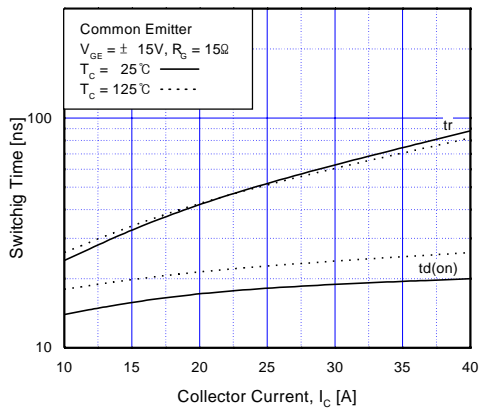


Fig 11. Turn-On Characteristics vs. Collector Current

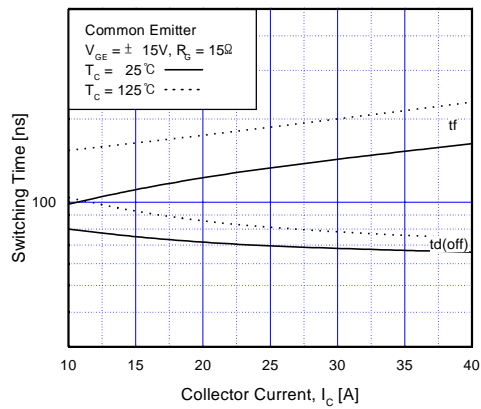


Fig 12. Turn-Off Characteristics vs. Collector Current

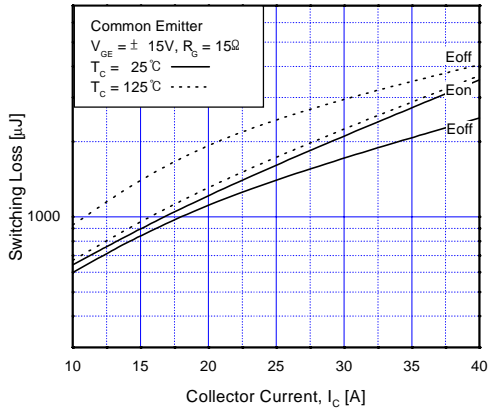


Fig 13. Switching Loss vs. Collector Current

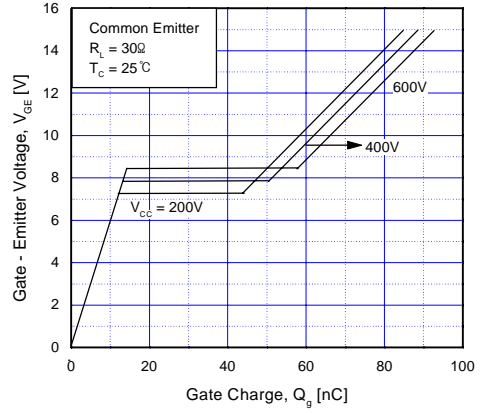


Fig 14. Gate Charge Characteristics

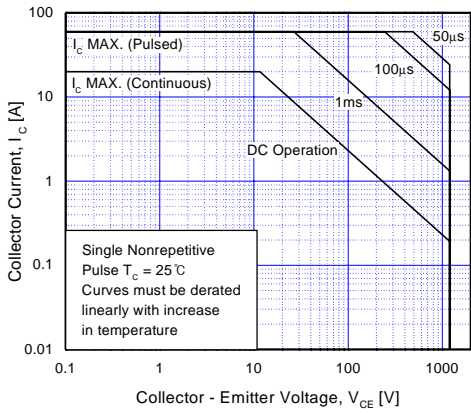


Fig 15. SOA Characteristics

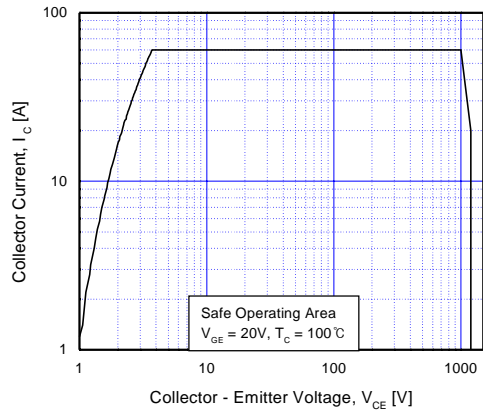


Fig 16. Turn-Off SOA

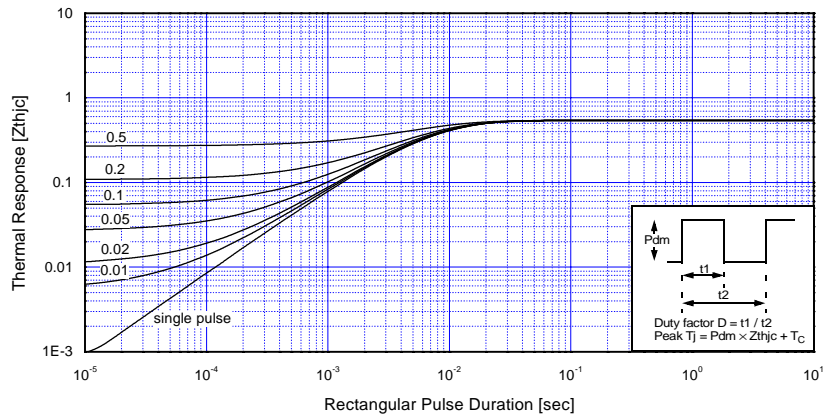


Fig 17. Transient Thermal Impedance of IGBT

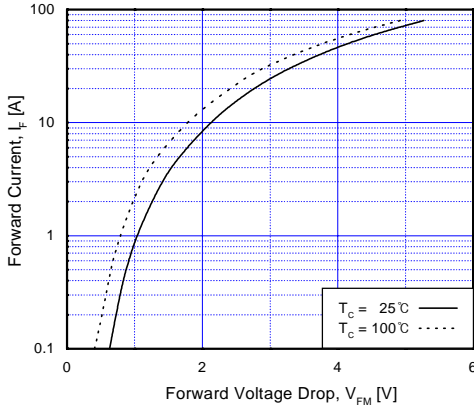


Fig 18. Forward Characteristics

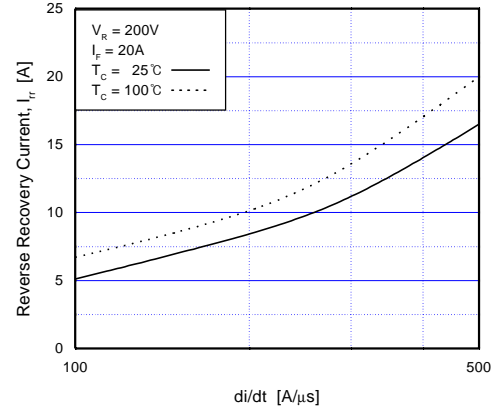


Fig 19. Reverse Recovery Current

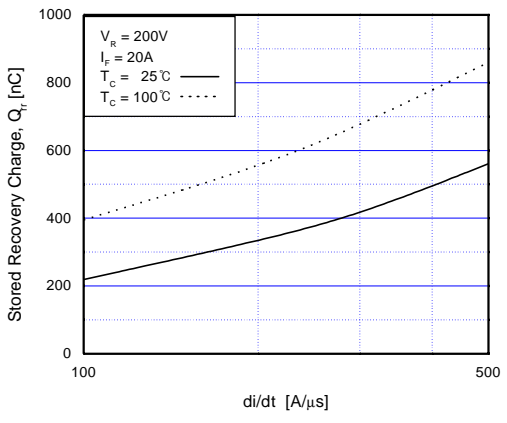


Fig 20. Stored Charge

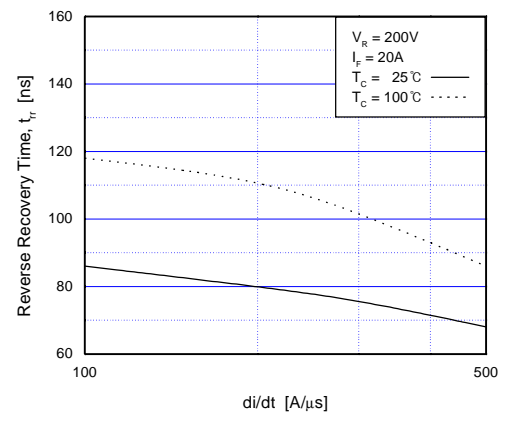
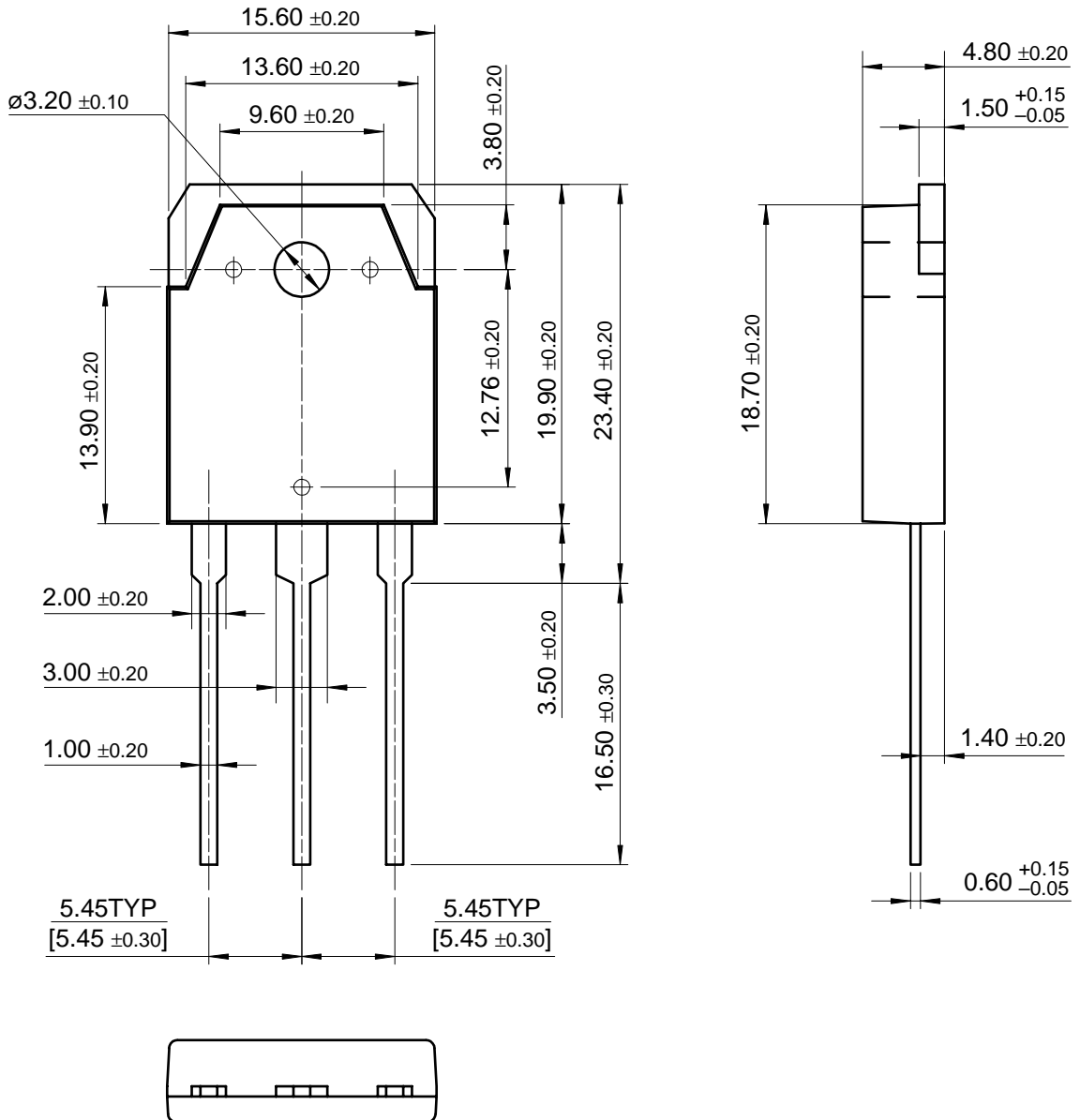


Fig 21. Reverse Recovery Time

Package Dimension

TO-3P (FS PKG CODE AF)



Dimensions in Millimeters

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