

FAIRCHILD
SEMICONDUCTOR®

IGBT

SGL50N60RUF D
Short Circuit Rated IGBT

General Description

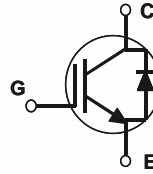
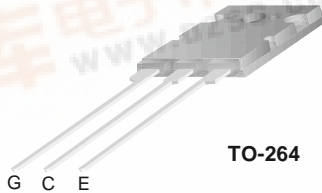
Fairchild's RUF D series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF D series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness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

Features

- Short circuit rated 10us @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- High speed switching
- Low saturation voltage : $V_{CE(sat)} = 2.2\text{V}$ @ $I_C = 50\text{A}$
- High input impedance
- CO-PAK, IGBT with FRD : $t_{rr} = 50\text{ns}$ (typ.)

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	SGL50N60RUF D	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	80	A
	Collector Current @ $T_C = 100^\circ\text{C}$	50	A
$I_{CM(1)}$	Pulsed Collector Current	150	A
I_F	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	30	A
I_{FM}	Diode Maximum Forward Current	90	A
T_{SC}	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	us
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	250	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	100	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	--	0.5	$^\circ\text{C/W}$
$R_{\theta JC}$ (DIODE)	Thermal Resistance, Junction-to-Case	--	1.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	25	$^\circ\text{C/W}$



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	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	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	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	± 100	nA

On Characteristics

$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 50mA, V_{CE} = V_{GE}$	5.0	6.0	8.5	V
$V_{CE(sat)}$	Collector to Emitter	$I_C = 50A, V_{GE} = 15V$	--	2.2	2.8	V
	Saturation Voltage	$I_C = 80A, V_{GE} = 15V$	--	2.5	--	V

Dynamic Characteristics

C_{ies}	Input Capacitance	$V_{CE}=30V, V_{GE} = 0V,$ $f = 1MHz$	--	3311	--	pF
C_{oes}	Output Capacitance		--	399	--	pF
C_{res}	Reverse Transfer Capacitance		--	139	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ\text{C}$	--	26	--	ns	
t_r	Rise Time		--	89	--	ns	
$t_{d(off)}$	Turn-Off Delay Time		--	66	100	ns	
t_f	Fall Time		--	118	200	ns	
E_{on}	Turn-On Switching Loss		--	1.68	--	mJ	
E_{off}	Turn-Off Switching Loss		--	1.03	--	mJ	
E_{ts}	Total Switching Loss		--	2.71	3.8	mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ\text{C}$	--	28	--	ns
t_r	Rise Time			--	91	--	ns
$t_{d(off)}$	Turn-Off Delay Time			--	68	110	ns
t_f	Fall Time	--		261	400	ns	
E_{on}	Turn-On Switching Loss	--		1.7	--	mJ	
E_{off}	Turn-Off Switching Loss	--		2.31	--	mJ	
E_{ts}	Total Switching Loss	--		4.01	5.62	mJ	
T_{sc}	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ\text{C}$		10	--	--	us
Q_g	Total Gate Charge	$V_{CE} = 300V, I_C = 50A,$ $V_{GE} = 15V$	--	145	210	nC	
Q_{ge}	Gate-Emitter Charge		--	25	35	nC	
Q_{gc}	Gate-Collector Charge		--	70	100	nC	
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	18	--	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	$I_F = 30A$	$T_C = 25^\circ\text{C}$	--	1.9	2.8	V
			$T_C = 100^\circ\text{C}$	--	1.8	--	
t_{rr}	Diode Reverse Recovery Time	$I_F = 30A,$ $di/dt = 200A/us$	$T_C = 25^\circ\text{C}$	--	70	100	ns
			$T_C = 100^\circ\text{C}$	--	140	--	
I_{rr}	Diode Peak Reverse Recovery Current	$I_F = 30A,$ $di/dt = 200A/us$	$T_C = 25^\circ\text{C}$	--	6	7.8	A
			$T_C = 100^\circ\text{C}$	--	8	--	
Q_{rr}	Diode Reverse Recovery Charge	$I_F = 30A,$ $di/dt = 200A/us$	$T_C = 25^\circ\text{C}$	--	200	360	nC
			$T_C = 100^\circ\text{C}$	--	580	--	

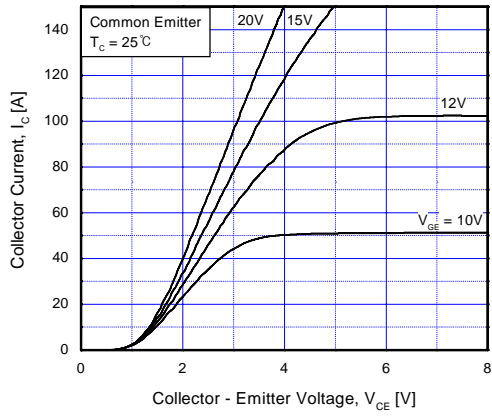


Fig 1. Typical Output Characteristics

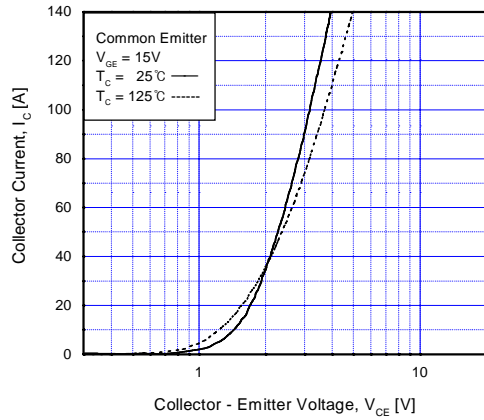


Fig 2. Typical Saturation Voltage Characteristics

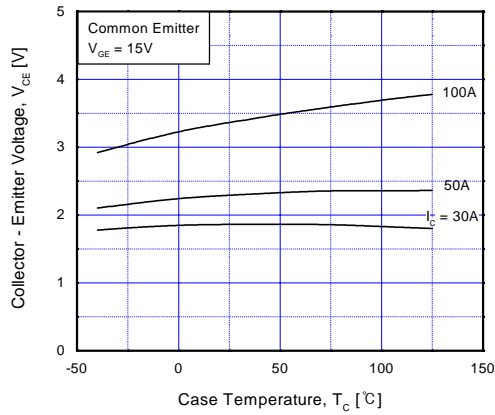


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

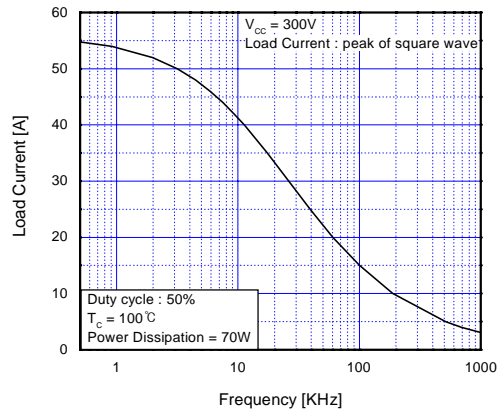


Fig 4. Load Current vs. Frequency

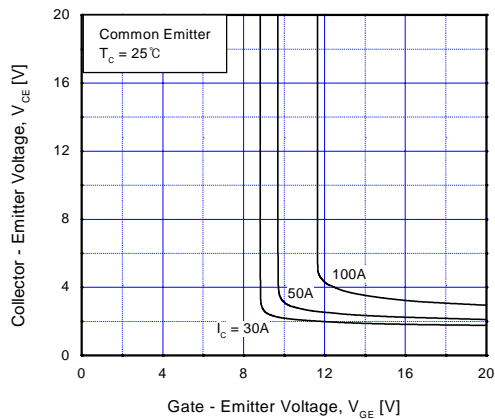


Fig 5. Saturation Voltage vs. V_{GE}

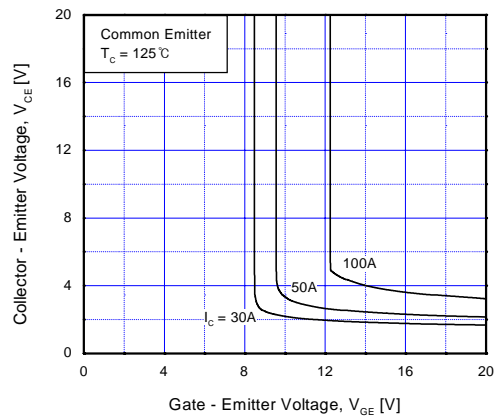


Fig 6. Saturation Voltage vs. V_{GE}

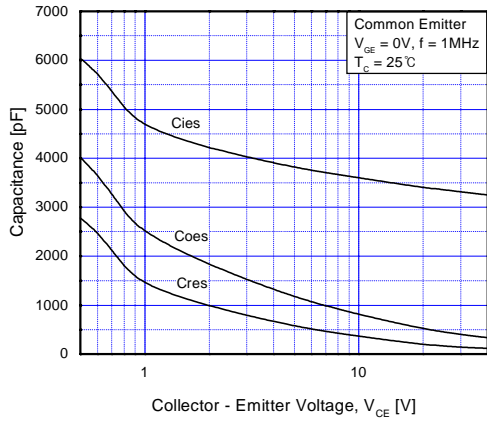


Fig 7. Capacitance Characteristics

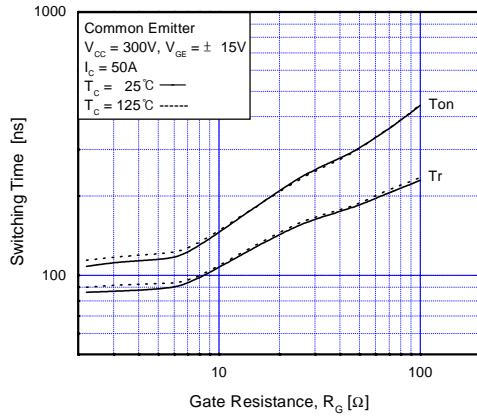


Fig 8. Turn-On Characteristics vs. Gate Resistance

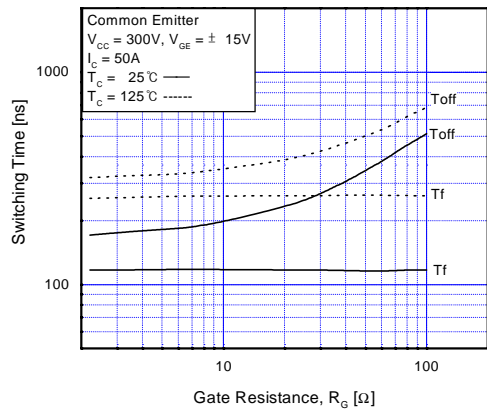


Fig 9. Turn-Off Characteristics vs. Gate Resistance

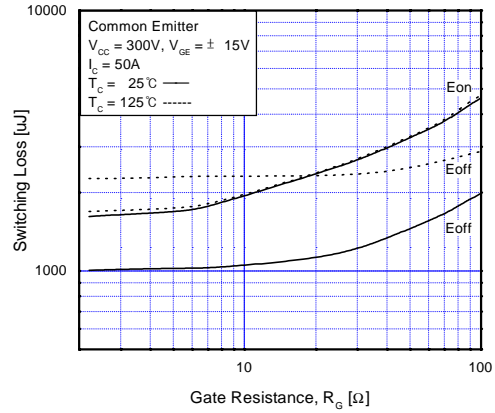


Fig 10. Switching Loss vs. Gate Resistance

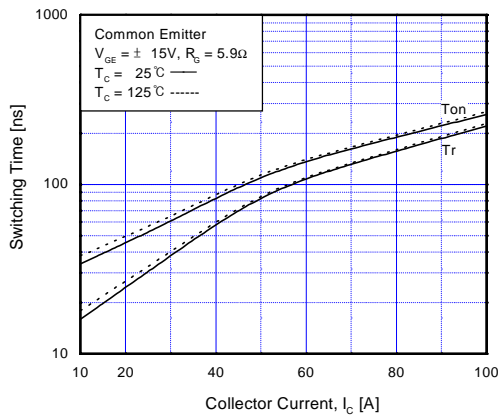


Fig 11. Turn-On Characteristics vs. Collector Current

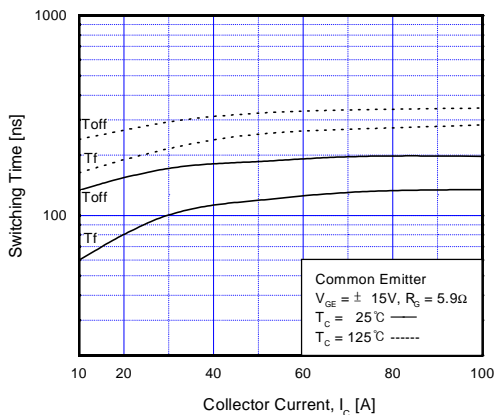


Fig 12. Turn-Off Characteristics vs. Collector Current

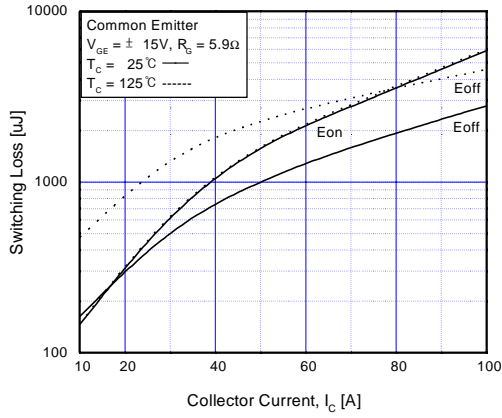


Fig 13. Switching Loss vs. Collector Current

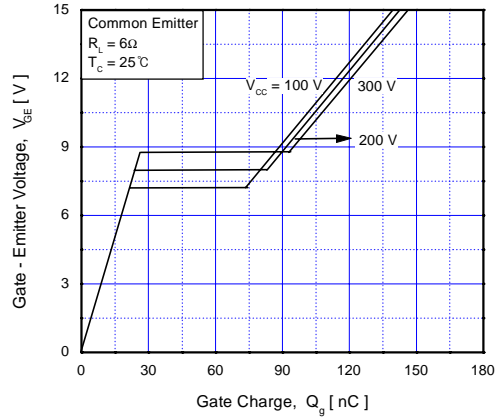


Fig 14. Gate Charge Characteristics

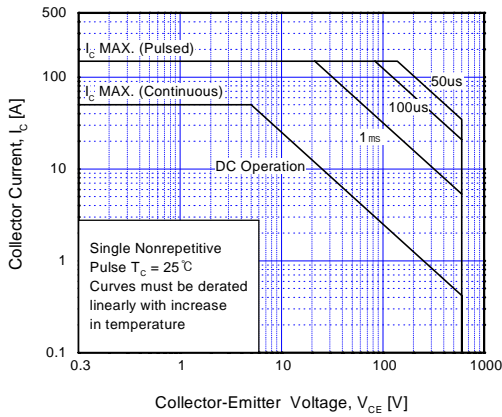


Fig 15. SOA Characteristics

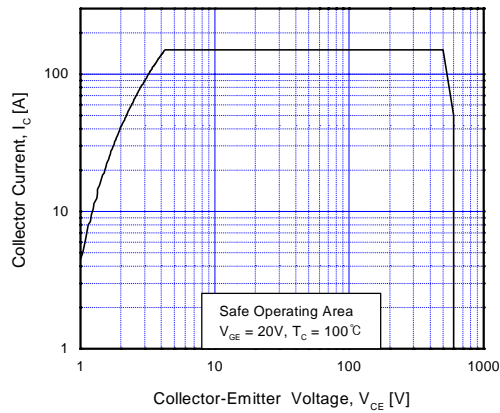


Fig 16. Turn-Off SOA Characteristics

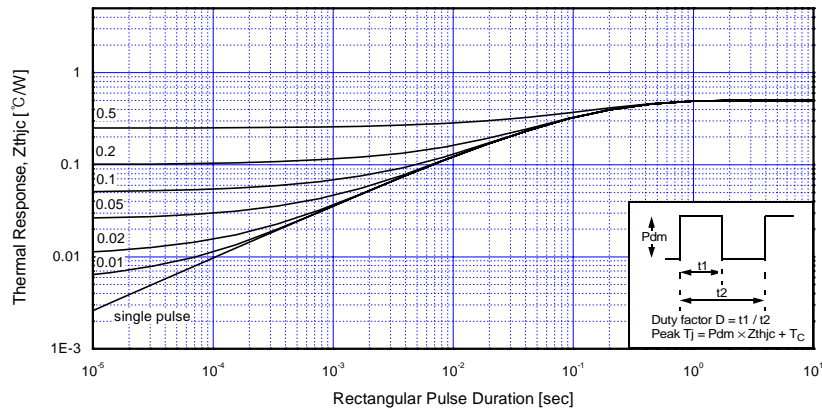


Fig 17. Transient Thermal Impedance of IGBT

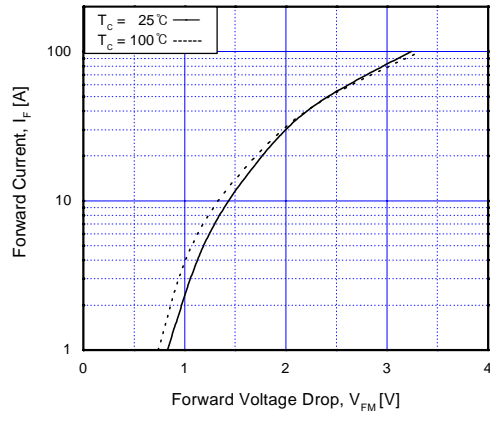


Fig 18. Forward Characteristics

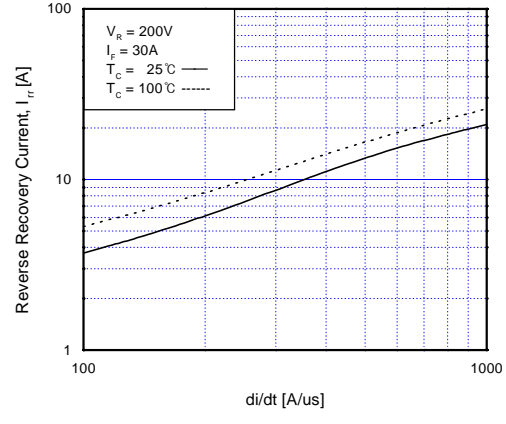


Fig 19. Reverse Recovery Current

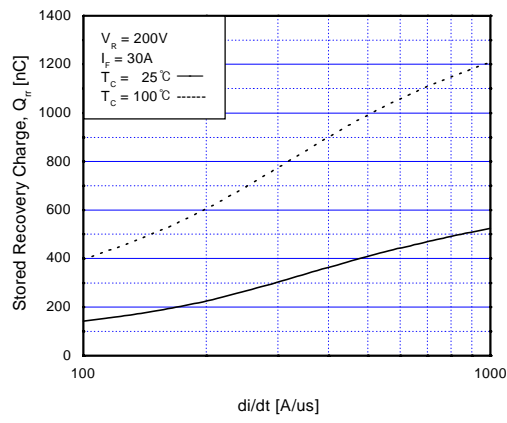


Fig 20. Stored Charge

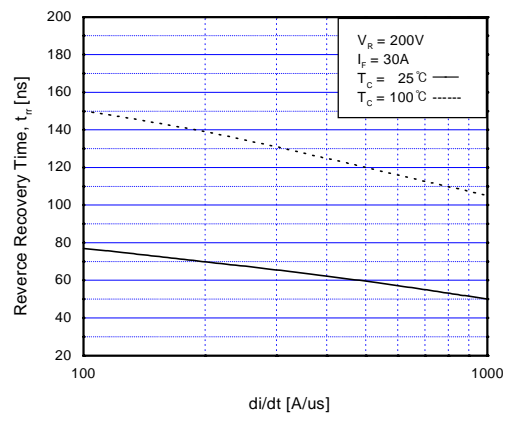
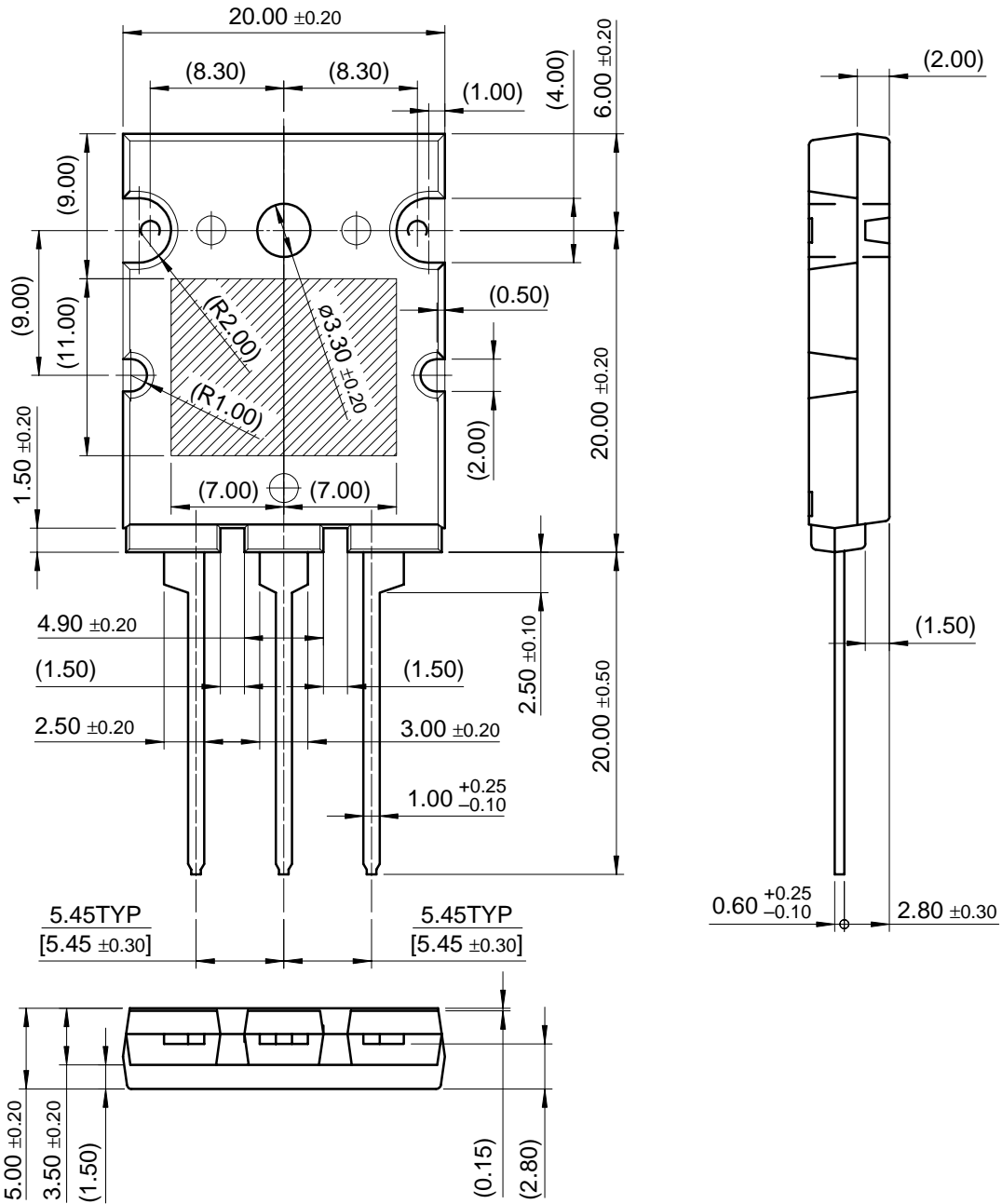


Fig 21. Reverse Recovery Time

Package Dimension

TO-264



SGL50N60RUF D

Dimensions in Millimeters

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