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# SGL50N60RUFD

## 600 V, 50 A Short Circuit Rated IGBT

### General Description

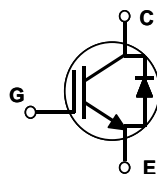
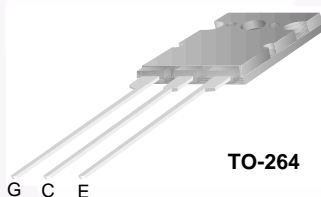
Fairchild's RUFD series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUFD series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness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

### Features

- 50 A, 600 V,  $T_C = 100^\circ\text{C}$
- Low Saturation Voltage:  $V_{CE(sat)} = 2.2\text{ V @ } I_C = 50\text{ A}$
- Typical Fall Time. . . . . 261 ns at  $T_J = 125^\circ\text{C}$
- High Speed Switching
- High Input Impedance
- Short Circuit Rating

### Applications

Motor Control, UPS, General Inverter.



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

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	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 @ $T_C = 25^\circ\text{C}$	60	A
	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.	Unit
$R_{\theta JC}$ (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.	Unit
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	--	--	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	--	0.6	--	V/ $^\circ\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	--	--	250	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	--	--	$\pm 100$	nA

**On Characteristics**

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

**Dynamic Characteristics**

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

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300\text{ V}, I_C = 50\text{ A},$ $R_G = 5.9\text{ }\Omega, V_{GE} = 15\text{ V},$ 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	$V_{CC} = 300\text{ V}, I_C = 50\text{ A},$ $R_G = 5.9\text{ }\Omega, V_{GE} = 15\text{ V},$ 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	$V_{CC} = 300\text{ V}, V_{GE} = 15\text{ V}$ @ $T_C = 100^\circ\text{C}$	10	--	--	$\mu\text{s}$
$Q_g$	Total Gate Charge	$V_{CE} = 300\text{ V}, I_C = 50\text{ A},$ $V_{GE} = 15\text{ V}$	--	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	--

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{FM}$	Diode Forward Voltage	$I_F = 30\text{ A}$	$T_C = 25^\circ\text{C}$	--	1.9	2.8	V
			$T_C = 100^\circ\text{C}$	--	1.8	--	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 30\text{ A},$ $di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	70	100	ns
			$T_C = 100^\circ\text{C}$	--	140	--	
$I_{rr}$	Diode Peak Reverse Recovery Current	$I_F = 30\text{ A},$ $di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	6	7.8	A
			$T_C = 100^\circ\text{C}$	--	8	--	
$Q_{rr}$	Diode Reverse Recovery Charge	$I_F = 30\text{ A},$ $di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	200	360	nC
			$T_C = 100^\circ\text{C}$	--	580	--	

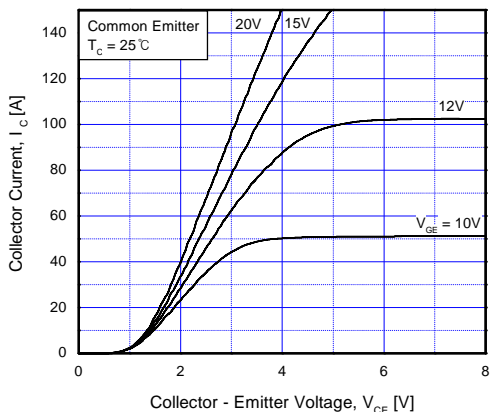


Fig 1. Typical Output Characteristics

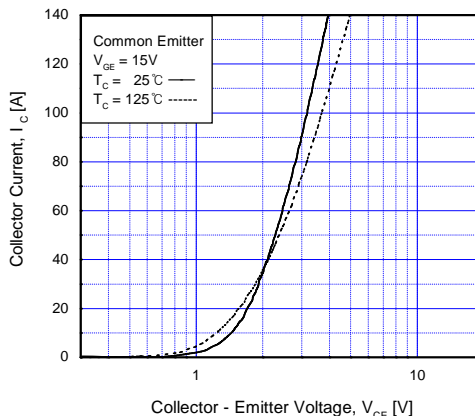


Fig 2. Typical Saturation Voltage Characteristics

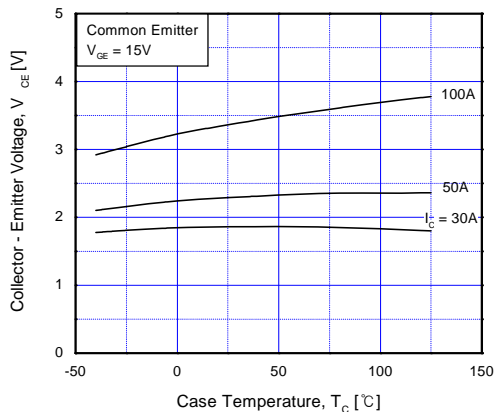


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

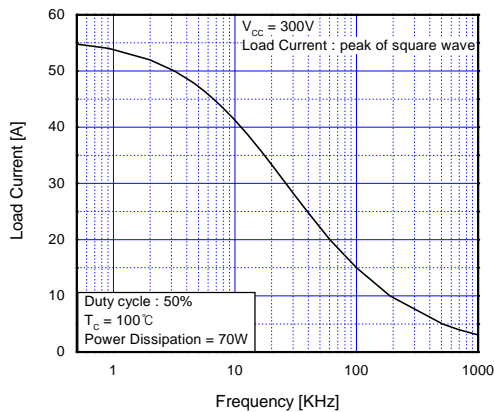


Fig 4. Load Current vs. Frequency

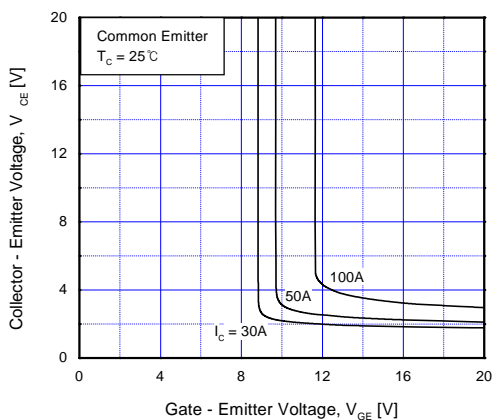


Fig 5. Saturation Voltage vs.  $V_{GE}$

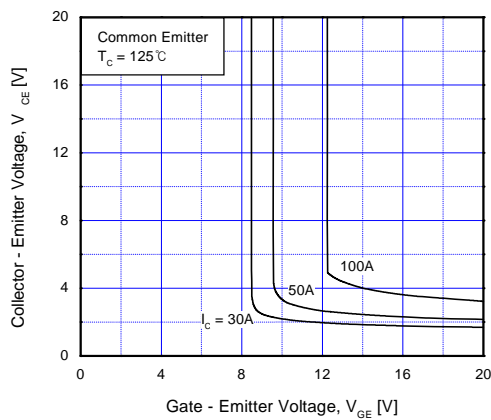


Fig 6. Saturation Voltage vs.  $V_{GE}$

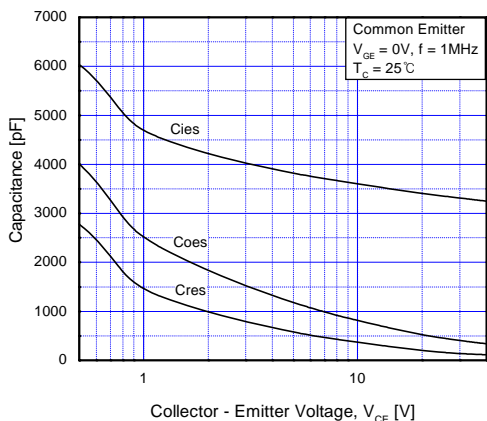


Fig 7. Capacitance Characteristics

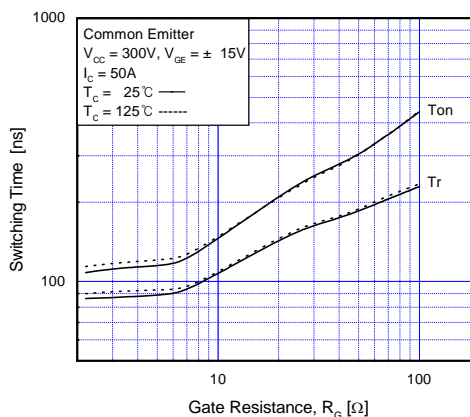


Fig 8. Turn-On Characteristics vs. Gate Resistance

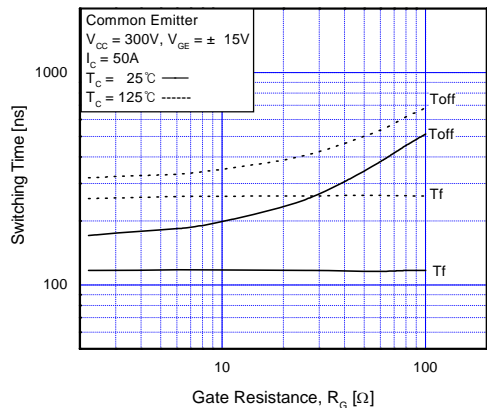


Fig 9. Turn-Off Characteristics vs. Gate Resistance

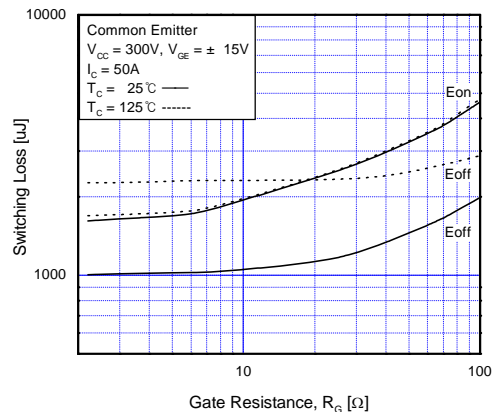


Fig 10. Switching Loss vs. Gate Resistance

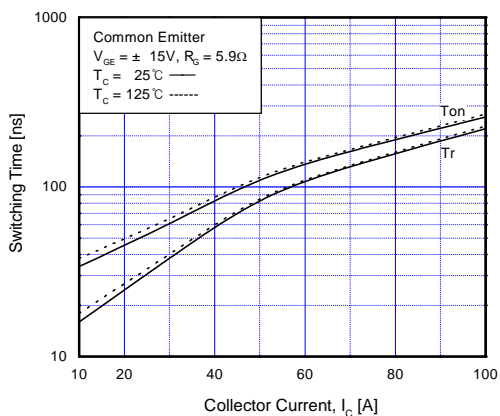


Fig 11. Turn-On Characteristics vs. Collector Current

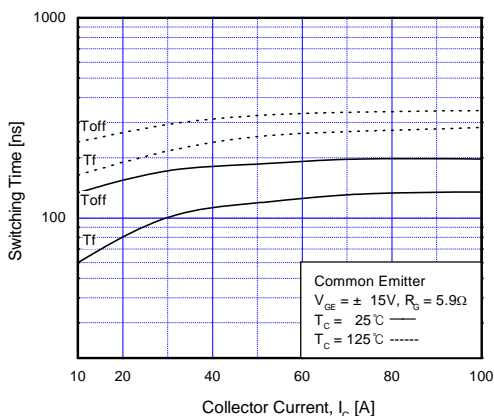


Fig 12. Turn-Off Characteristics vs. Collector Current

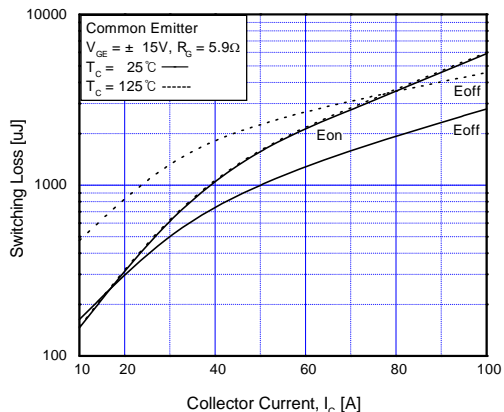


Fig 13. Switching Loss vs. Collector Current

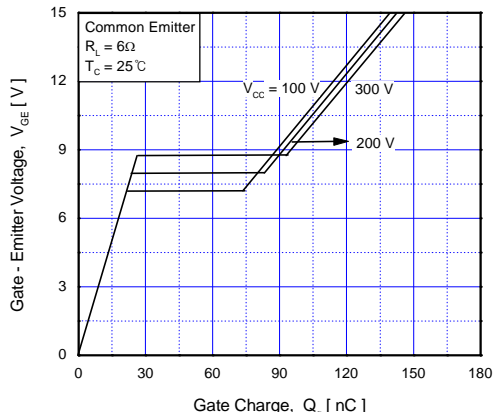


Fig 14. Gate Charge Characteristics

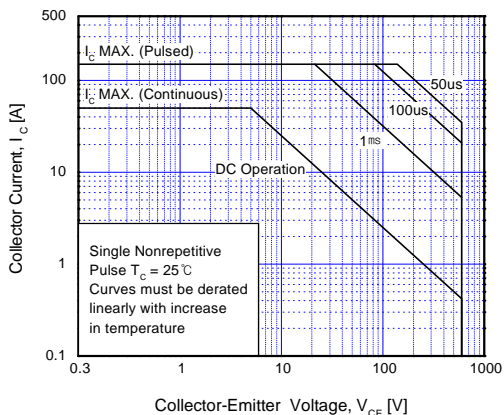


Fig 15. SOA Characteristics

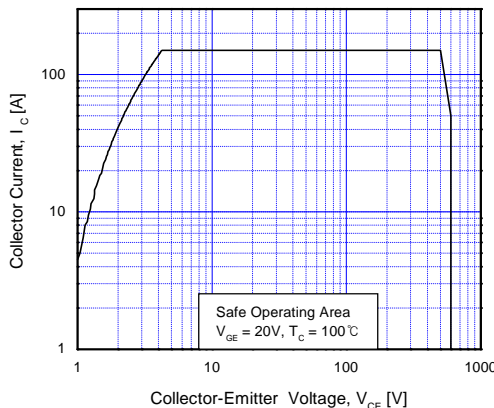


Fig 16. Turn-Off SOA Characteristics

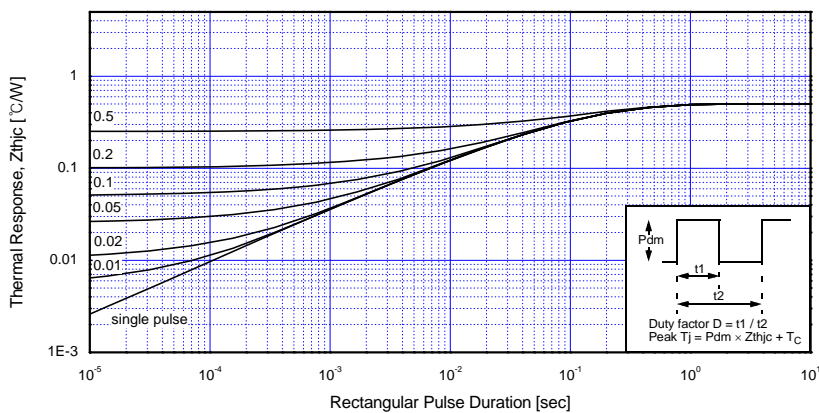


Fig 17. Transient Thermal Impedance of IGBT

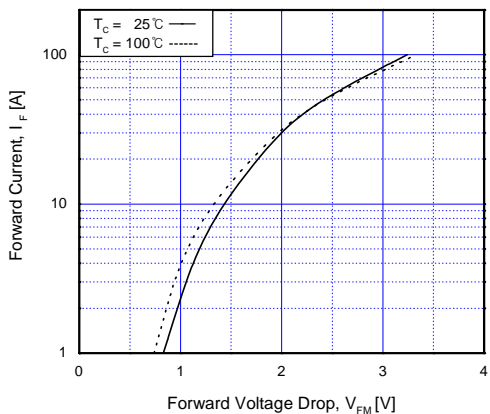


Fig 18. Forward Characteristics

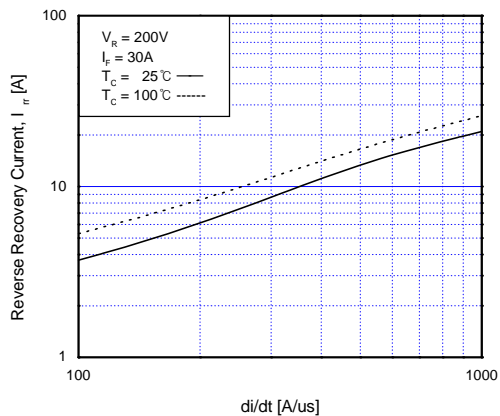


Fig 19. Reverse Recovery Current

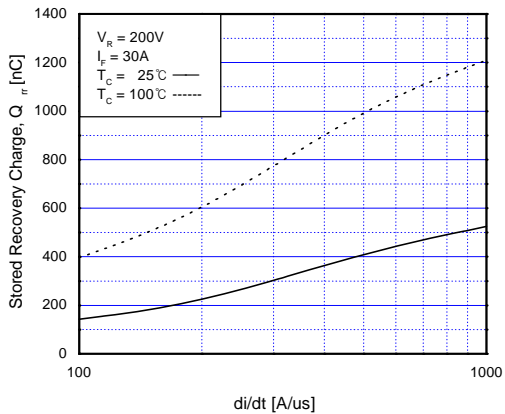


Fig 20. Stored Charge

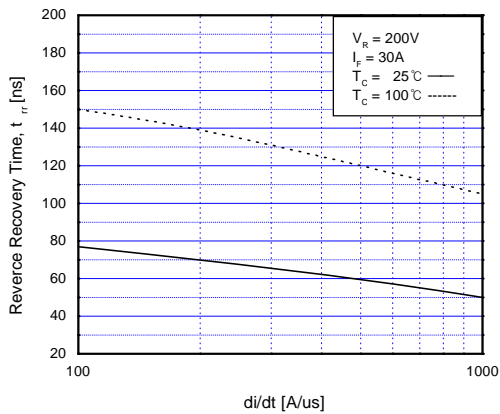
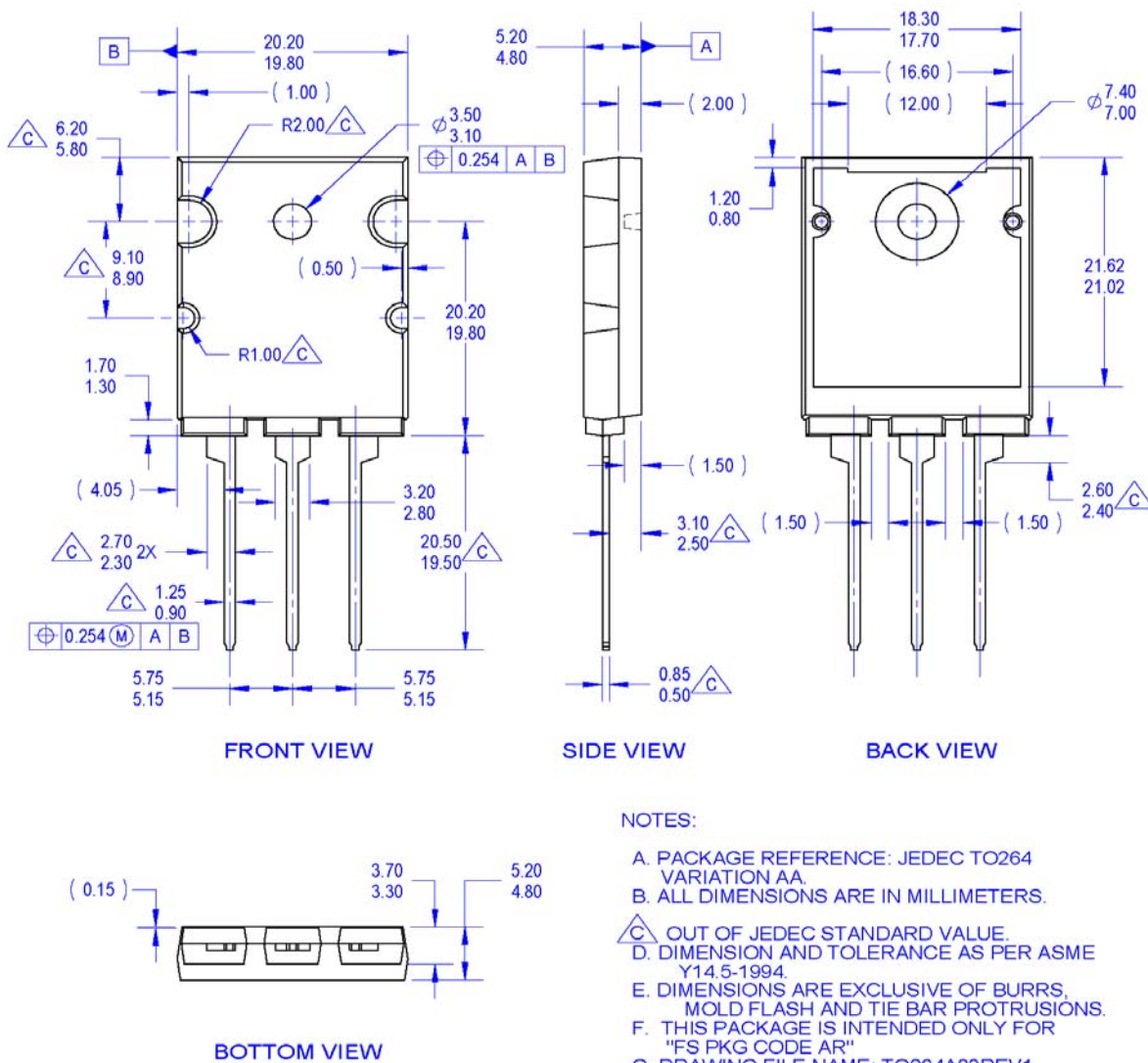


Fig 21. Reverse Recovery Time



## Mechanical Dimensions



**Figure 22. TO-264 3L - 3LD; TO264; MOLDED; JEDEC VARIATION AA**

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