



November 2013

## SGL50N60RUF

### 600 V, 50 A Short Circuit Rated IGBT

#### General Description

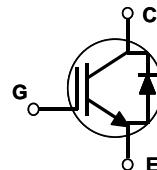
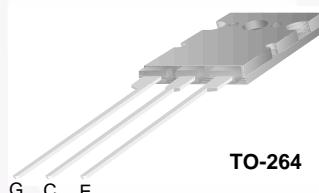
Fairchild's RUF series of Insulated Gate Bipolar Transistors (IGBTs) provide low conduction and switching losses as well as short circuit ruggedness. The RUF series is designed for applications such as motor control, uninterrupted power supplies (UPS) and general inverters where short circuit ruggedness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

#### Features

- 50 A, 600 V,  $T_C = 100^\circ\text{C}$
- Low Saturation Voltage:  $V_{CE(\text{sat})} = 2.2 \text{ V} @ I_C = 50 \text{ A}$
- Typical Fall Time. . . . . 261ns 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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction-to-Case	--	0.5	$^\circ\text{C/W}$
$R_{\theta JC}(\text{DIODE})$	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

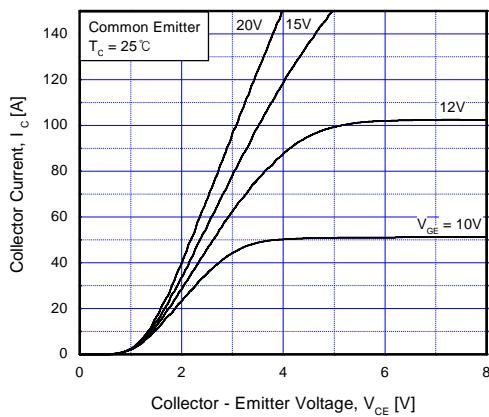
$T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0 \text{ V}$ , $I_C = 250 \text{ uA}$	600	--	--	V
$\Delta B_{VCES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0 \text{ V}$ , $I_C = 1 \text{ mA}$	--	0.6	--	$\text{V}/^\circ\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}$ , $V_{GE} = 0 \text{ V}$	--	--	250	$\text{uA}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}$ , $V_{CE} = 0 \text{ V}$	--	--	$\pm 100$	$\text{nA}$
<b>On Characteristics</b>						
$V_{GE(\text{th})}$	G-E Threshold Voltage	$I_C = 50 \text{ mA}$ , $V_{CE} = V_{GE}$	5.0	6.0	8.5	V
$V_{CE(\text{sat})}$	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
<b>Dynamic Characteristics</b>						
$C_{ies}$	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
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300 \text{ V}$ , $I_C = 50 \text{ A}$ , $R_G = 5.9 \Omega$ , $V_{GE} = 15 \text{ V}$ , 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		--	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	--	--	us
$Q_g$	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	--	nH

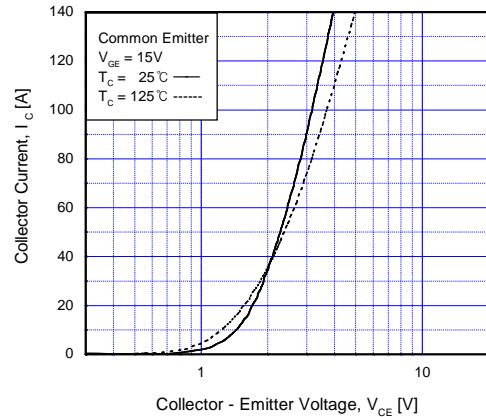
## Electrical Characteristics of DIODE

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

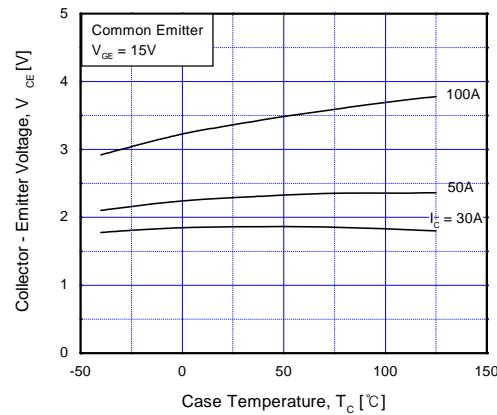
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{FM}$	Diode Forward Voltage	$I_F = 30 \text{ A}$	$T_C = 25^\circ\text{C}$	--	1.9	2.8
			$T_C = 100^\circ\text{C}$	--	1.8	--
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 30 \text{ A}$ , $dI_F/dt = 200 \text{ A/us}$	$T_C = 25^\circ\text{C}$	--	70	100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



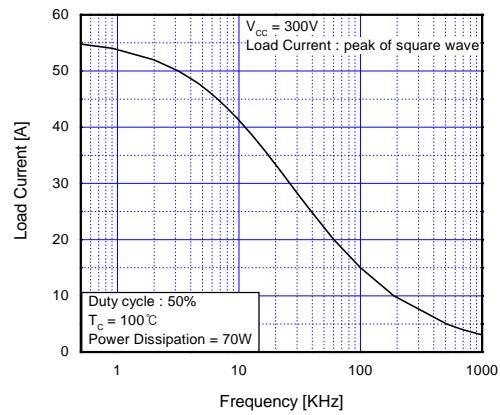
**Fig 1. Typical Output Characteristics**



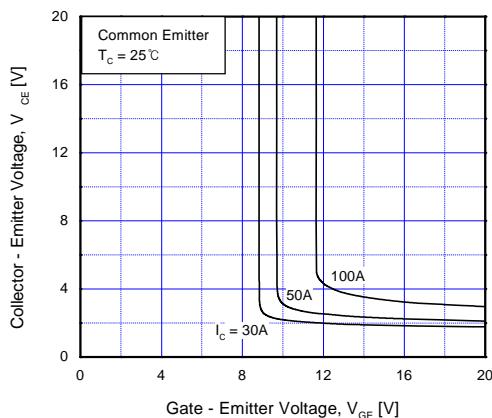
**Fig 2. Typical Saturation Voltage Characteristics**



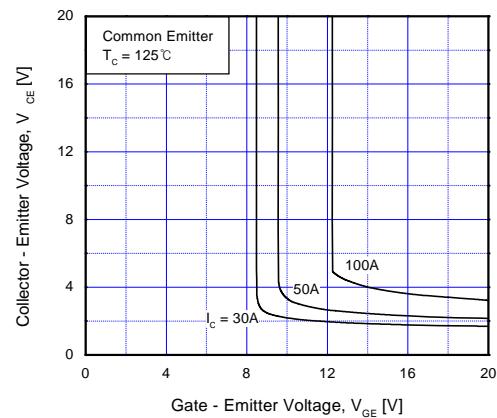
**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**



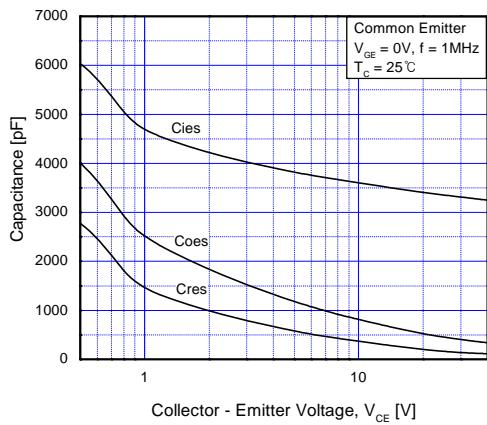
**Fig 4. Load Current vs. Frequency**



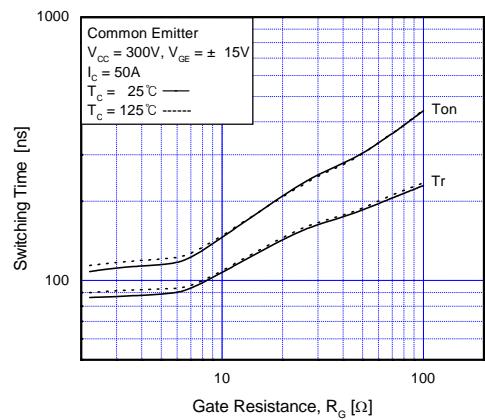
**Fig 5. Saturation Voltage vs.  $V_{GE}$**



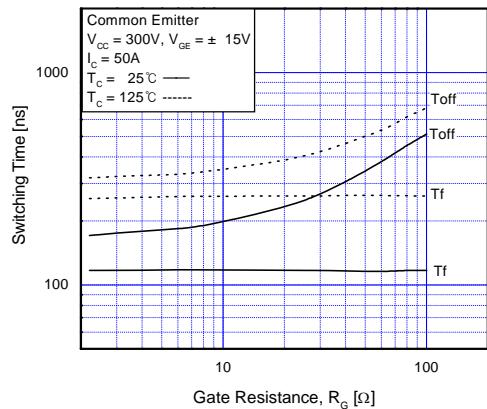
**Fig 6. Saturation Voltage vs.  $V_{GE}$**



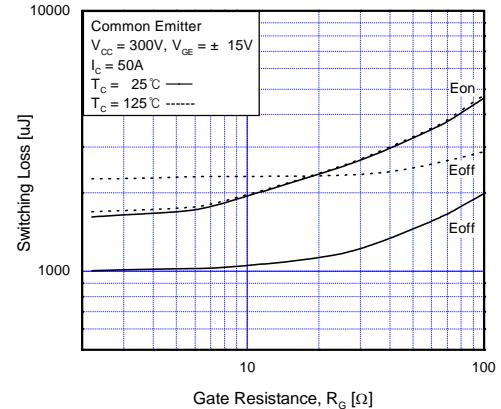
**Fig 7. Capacitance Characteristics**



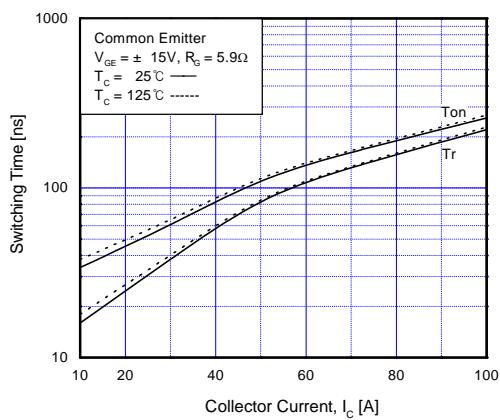
**Fig 8. Turn-On Characteristics vs. Gate Resistance**



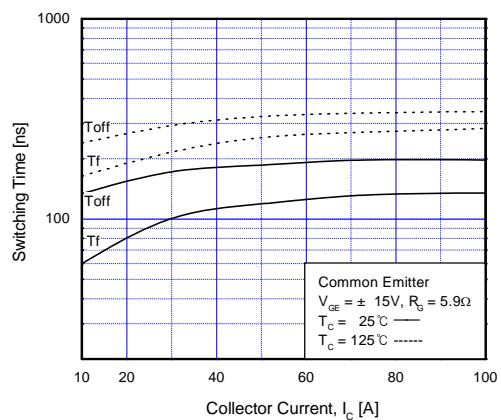
**Fig 9. Turn-Off Characteristics vs. Gate Resistance**



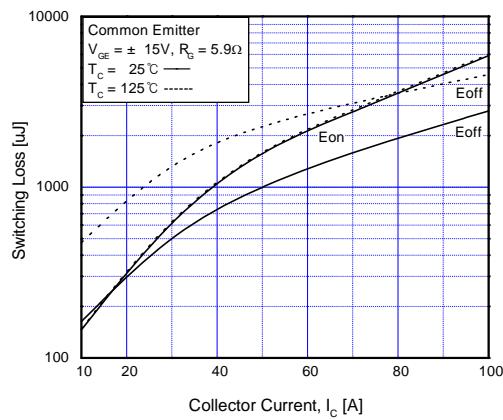
**Fig 10. Switching Loss vs. Gate Resistance**



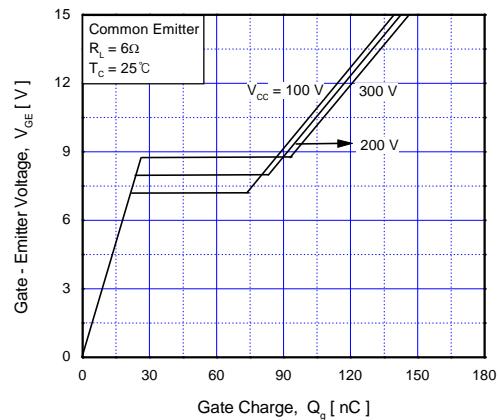
**Fig 11. Turn-On Characteristics vs. Collector Current**



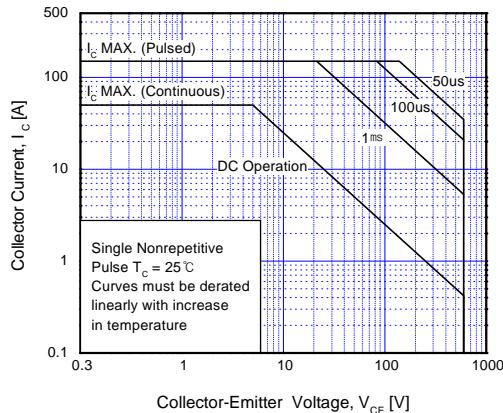
**Fig 12. Turn-Off Characteristics vs. Collector Current**



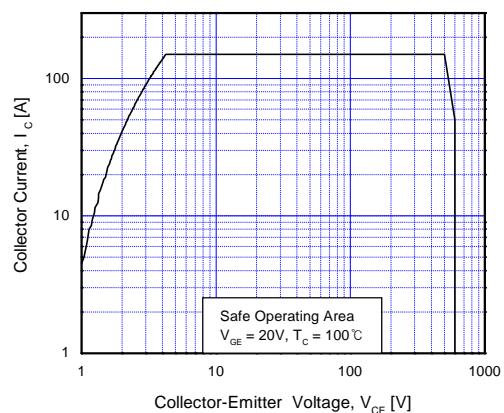
**Fig 13. Switching Loss vs. Collector Current**



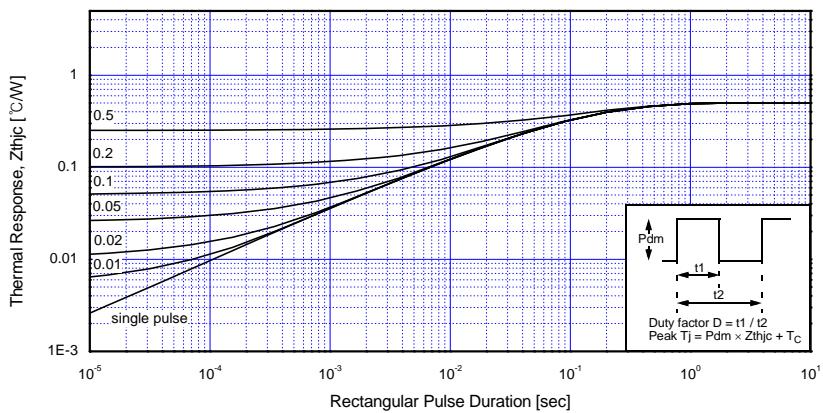
**Fig 14. Gate Charge Characteristics**



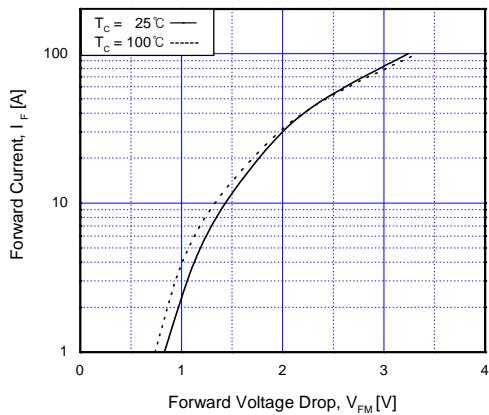
**Fig 15. SOA Characteristics**



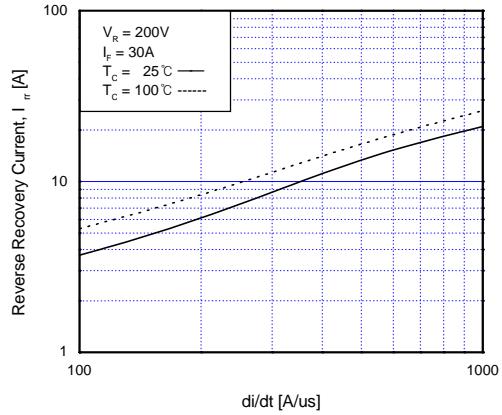
**Fig 16. Turn-Off SOA Characteristics**



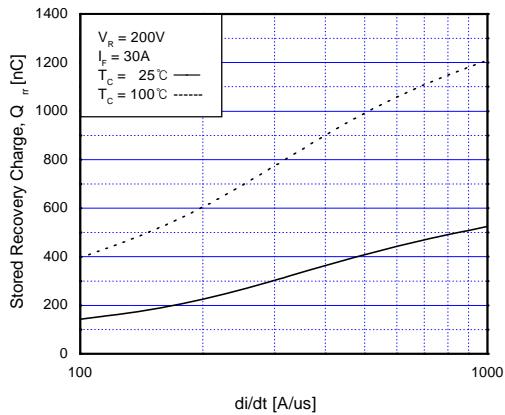
**Fig 17. Transient Thermal Impedance of IGBT**



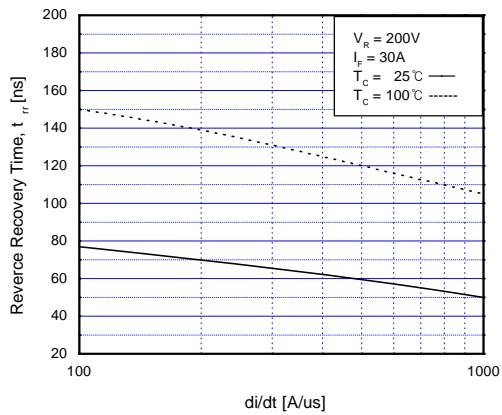
**Fig 18. Forward Characteristics**



**Fig 19. Reverse Recovery Current**

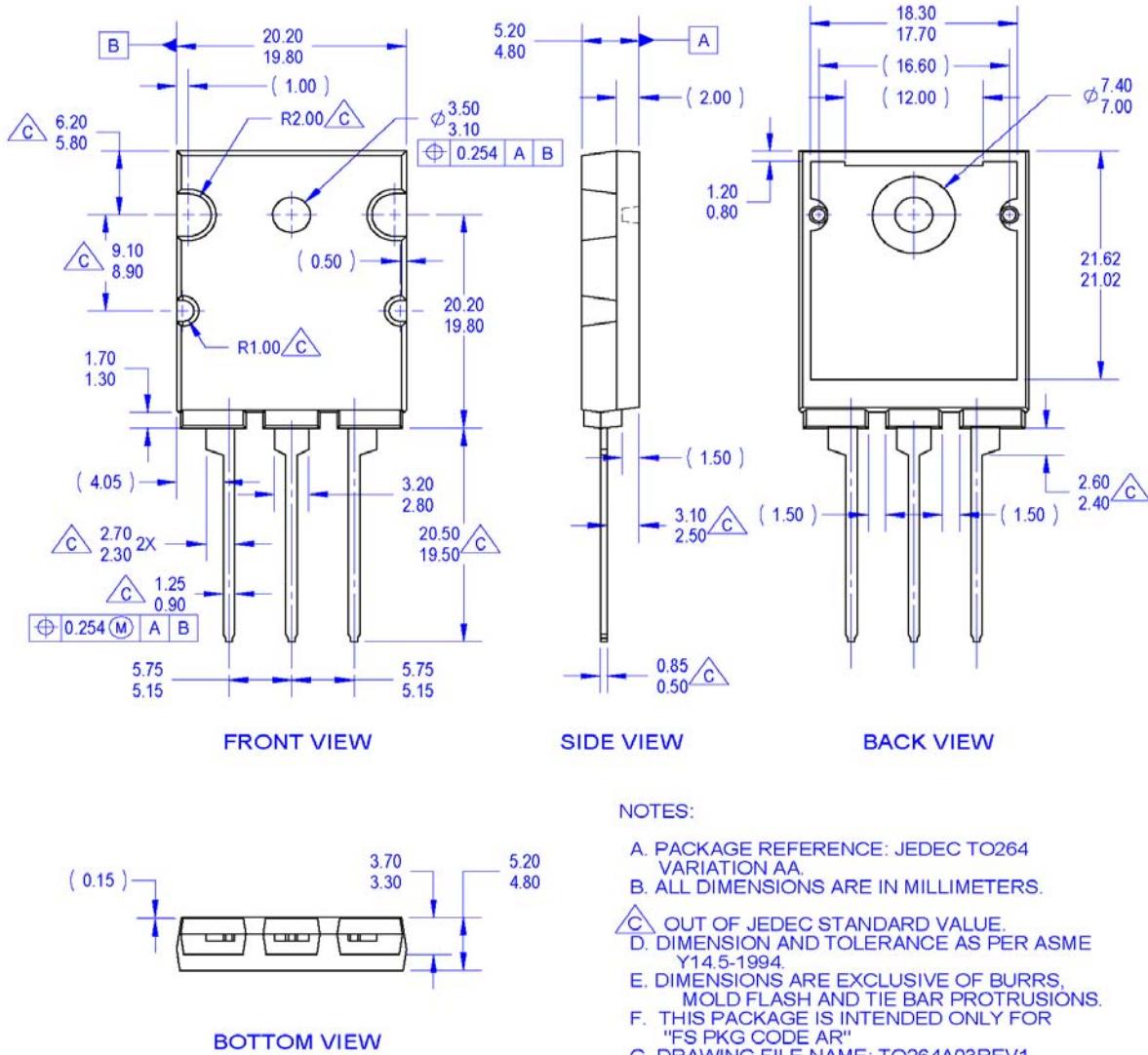


**Fig 20. Stored Charge**



**Fig 21. Reverse Recovery Time**

## Mechanical Dimensions



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

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TO264-003](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO264-003)



## TRADEMARKS

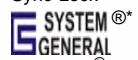
The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™  
 AX-CAP®\*  
 BitSiC™  
 Build it Now™  
 CorePLUS™  
 CorePOWER™  
 CROSSVOLT™  
 CTL™  
 Current Transfer Logic™  
 DEUXPEED®  
 Dual Cool™  
 EcoSPARK®  
 EfficientMax™  
 ESBCTM

  
 Fairchild®  
 Fairchild Semiconductor®  
 FACT Quiet Series™  
 FACT®  
 FAST®  
 FastvCore™  
 FETBench™  
 FPSTM

F-PFSTM  
 FRFET®  
 Global Power Resource™  
 GreenBridge™  
 Green FPS™  
 Green FPS™ e-Series™  
 Gmax™  
 GTO™  
 IntelliMAX™  
 ISOPLANARTM  
 Marking Small Speakers Sound Louder  
 and Better™  
 MegaBuck™  
 MICROCOUPLER™  
 MicroFET™  
 MicroPak™  
 MicroPak2™  
 MillerDrive™  
 MotionMax™  
 mWSaver®  
 OptoHiTT™  
 OPTOLOGIC®  
 OPTOPLANAR®

  
 PowerTrench®  
 PowerXS™  
 Programmable Active Droop™  
 QFET®  
 QS™  
 Quiet Series™  
 RapidConfigure™  
  
 Saving our world, 1mW/W/kW at a time™  
 SignalWise™  
 SmartMax™  
 SMART START™  
 Solutions for Your Success™  
 SPM®  
 STEALTH™  
 SuperFET®  
 SuperSOT™-3  
 SuperSOT™-6  
 SuperSOT™-8  
 SupreMOS®  
 SyncFET™

Sync-Lock™  
  
 TinyBoost®  
 TinyBuck®  
 TinyCalc™  
 TinyLogic®  
 TINYOPTO™  
 TinyPower™  
 TinyPWM™  
 TinyWire™  
 TranSiC™  
 TriFault Detect™  
 TRUECURRENT®\*  
 μSerDes™  
  
 UHC®  
 Ultra FRFET™  
 UniFET™  
 VCX™  
 VisualMax™  
 VoltagePlus™  
 XS™

\*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.Fairchildsemi.com](http://www.Fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

## PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I66

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Fairchild Semiconductor](#):

[SGL50N60RUFDTU](#)