



# SGH10N60RUF

## 600V, 10 A Short Circuit Rated IGBT

### Features

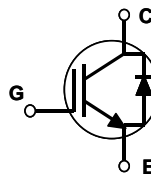
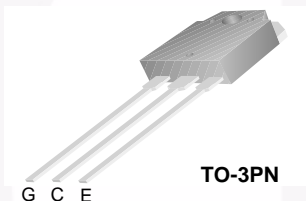
- Short Circuit Rated 10 us @  $T_C = 100^\circ\text{C}$ ,  $V_{GE} = 15\text{ V}$
- High Speed Switching
- Low Saturation Voltage :  $V_{CE(sat)} = 2.2\text{ V}$  @  $I_C = 10\text{ A}$
- High Input Impedance
- CO-PAK, IGBT with FRD :  $t_{rr} = 42\text{ ns}$  (typ.)

### 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.

### Applications

AC & DC Motors Controls, General Purpose Inverters, and Robotics, and Servo Controls



### 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 @ $T_C = 25^\circ\text{C}$	16	A
	Collector Current @ $T_C = 100^\circ\text{C}$	10	A
$I_{CM(1)}$	Pulsed Collector Current	30	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	12	A
$I_{FM}$	Diode Maximum Forward Current	92	A
$T_{SC}$	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	us
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	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.	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction-to-Case	--	1.6	$^\circ\text{C/W}$
$R_{\theta JC}$ (DIODE)	Thermal Resistance, Junction-to-Case	--	2.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
SGH10N60RUFD	SGH10N60RUFD	TO-3PN	Tube	N/A	N/A	30 units

## Electrical Characteristics of the IGBT T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### Off Characteristics

BV <sub>CES</sub>	Collector-Emitter Breakdown Voltage	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 250 uA	600	--	--	V
ΔB <sub>VCES</sub> / ΔT <sub>J</sub>	Temperature Coefficient of Breakdown Voltage	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1 mA	--	0.6	--	V/°C
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V	--	--	250	uA
I <sub>GES</sub>	G-E Leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V	--	--	± 100	nA

### On Characteristics

V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 10 mA, V <sub>CE</sub> = V <sub>GE</sub>	5.0	6.0	8.5	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15 V	--	2.2	2.8	V
		I <sub>C</sub> = 16 A, V <sub>GE</sub> = 15 V	--	2.5	--	V

### Dynamic Characteristics

C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1 MHz	--	660	--	pF
C <sub>oes</sub>	Output Capacitance		--	115	--	pF
C <sub>res</sub>	Reverse Transfer Capacitance		--	25	--	pF

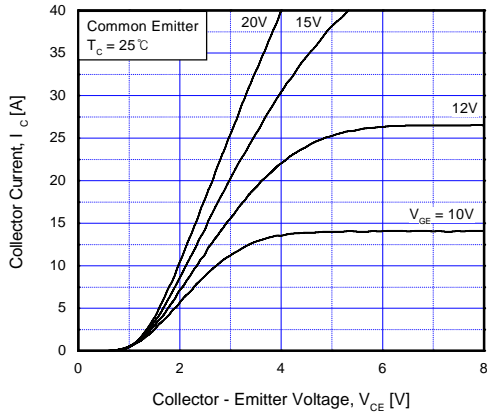
### Switching Characteristics

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 300 V, I <sub>C</sub> = 10 A, R <sub>G</sub> = 20 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 25°C	--	15	--	ns
t <sub>r</sub>	Rise Time		--	30	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	36	50	ns
t <sub>f</sub>	Fall Time		--	158	200	ns
E <sub>on</sub>	Turn-On Switching Loss		--	141	--	uJ
E <sub>off</sub>	Turn-Off Switching Loss		--	215	--	uJ
E <sub>ts</sub>	Total Switching Loss	--	356	500	uJ	
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 300 V, I <sub>C</sub> = 10 A, R <sub>G</sub> = 20 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 125°C	--	16	--	ns
t <sub>r</sub>	Rise Time		--	33	--	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		--	42	60	ns
t <sub>f</sub>	Fall Time		--	242	350	ns
E <sub>on</sub>	Turn-On Switching Loss		--	161	--	uJ
E <sub>off</sub>	Turn-Off Switching Loss		--	452	--	uJ
E <sub>ts</sub>	Total Switching Loss	--	613	860	uJ	
T <sub>sc</sub>	Short Circuit Withstand Time	V <sub>CC</sub> = 300 V, V <sub>GE</sub> = 15 V @ T <sub>C</sub> = 100°C	10	--	--	us
Q <sub>g</sub>	Total Gate Charge	V <sub>CE</sub> = 300 V, I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15 V	--	30	45	nC
Q <sub>ge</sub>	Gate-Emitter Charge		--	5	10	nC
Q <sub>gc</sub>	Gate-Collector Charge		--	8	16	nC
L <sub>e</sub>	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

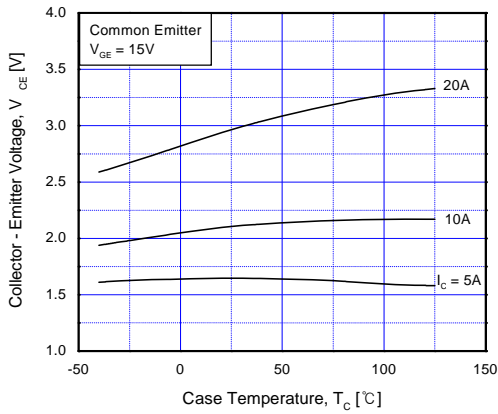
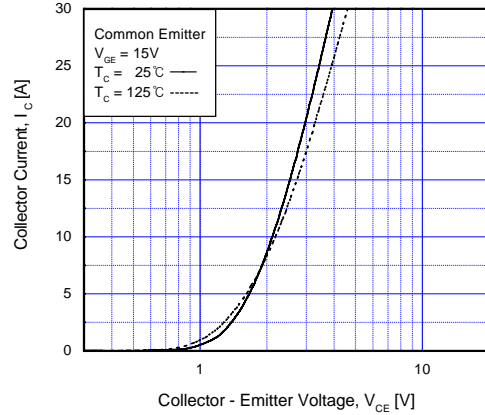
## Electrical Characteristics of DIODE T<sub>C</sub> = 25°C unless otherwise noted.

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

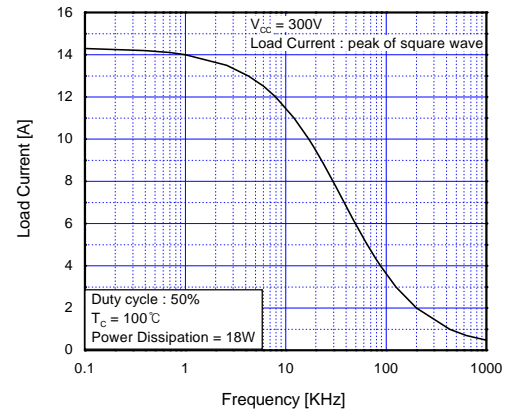
## Typical Characteristics



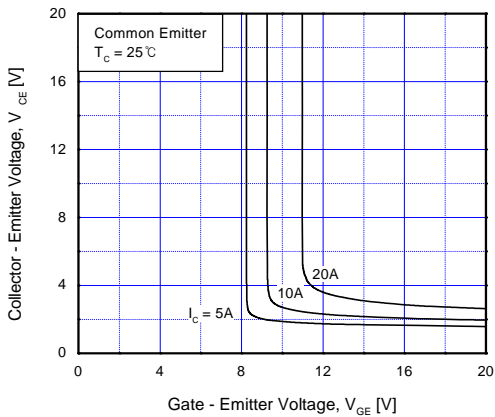
**Fig 1. Typical Output Characteristics**



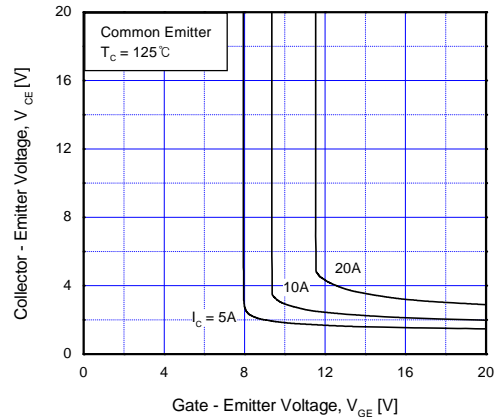
**Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level**



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

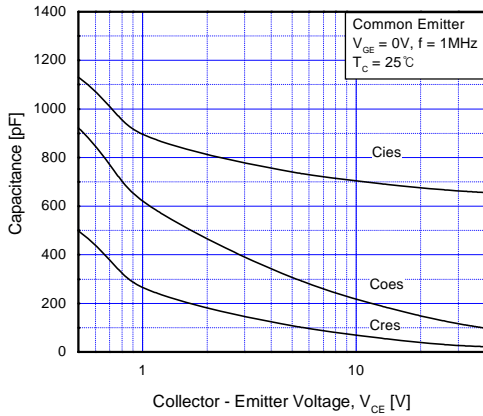


**Fig 5. Saturation Voltage vs.  $V_{GE}$**

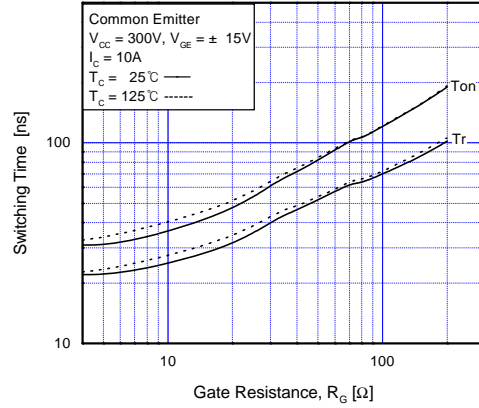


**Fig 6. Saturation Voltage vs.  $V_{GE}$**

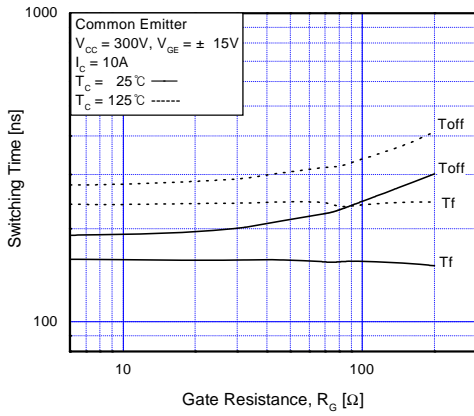
**Typical Characteristics** (continued)



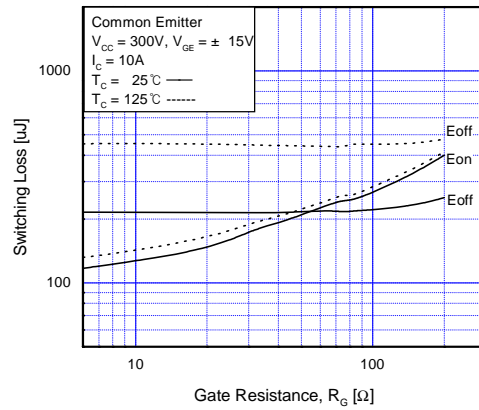
**Fig 7. Capacitance Characteristics**



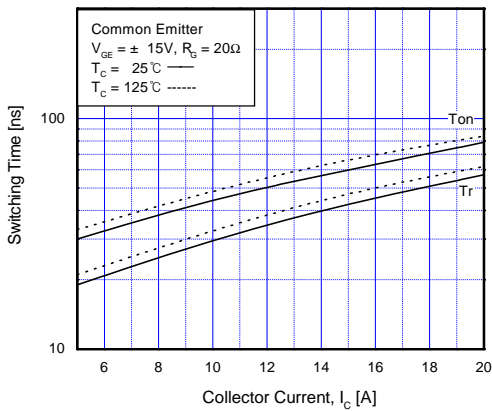
**Fig 8. Turn-On Characteristics vs. Gate Resistance**



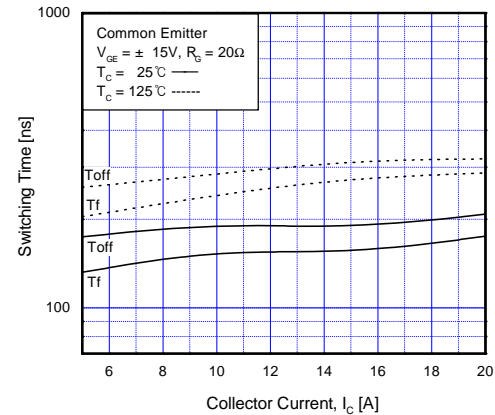
**Fig 9. Turn-Off Characteristics vs. Gate Resistance**



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

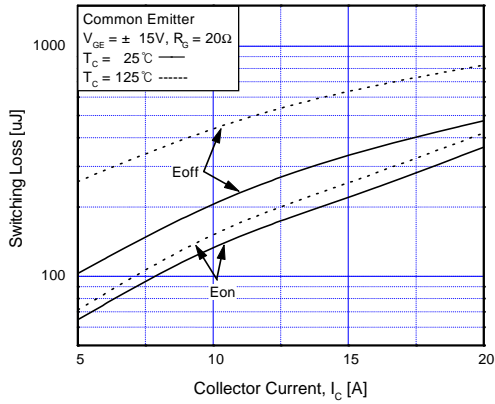


**Fig 11. Turn-On Characteristics vs. Collector Current**

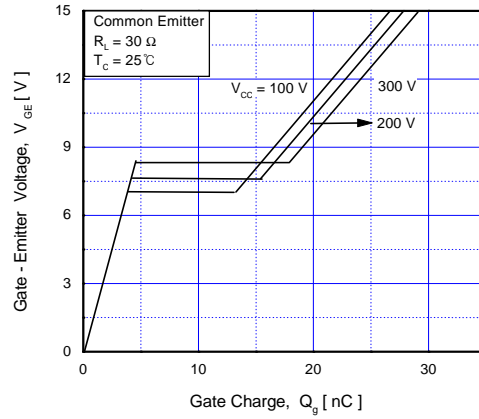


**Fig 12. Turn-Off Characteristics vs. Collector Current**

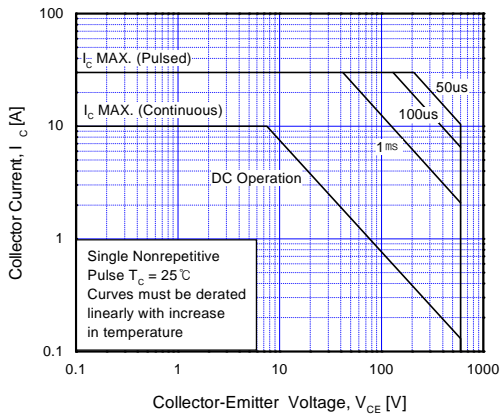
**Typical Characteristics** (continued)



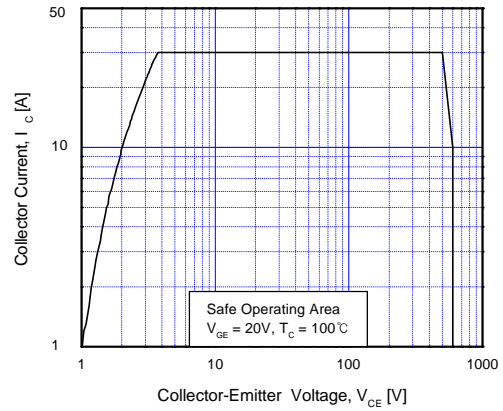
**Fig 13. Switching Loss vs. Collector Current**



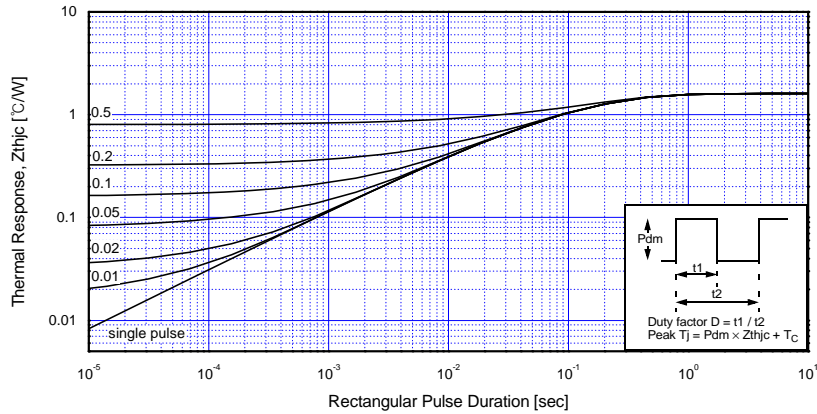
**Fig 14. Gate Charge Characteristics**



**Fig 15. SOA Characteristics**

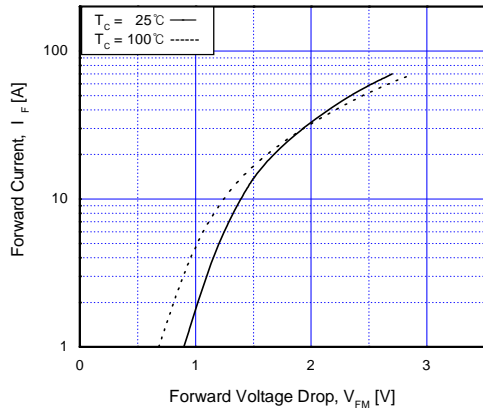


**Fig 16. Turn-Off SOA Characteristics**

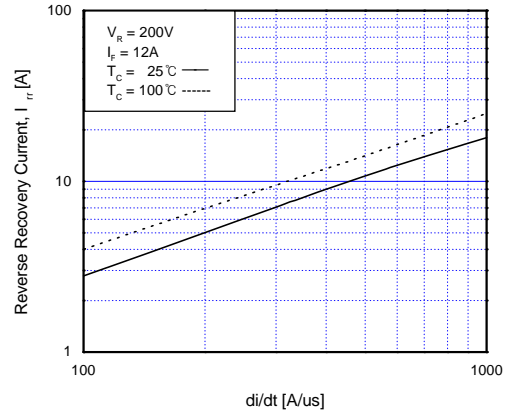


**Fig 17. Transient Thermal Impedance of IGBT**

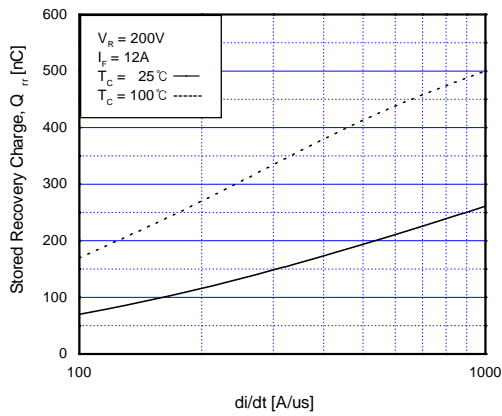
**Typical Characteristics** (continued)



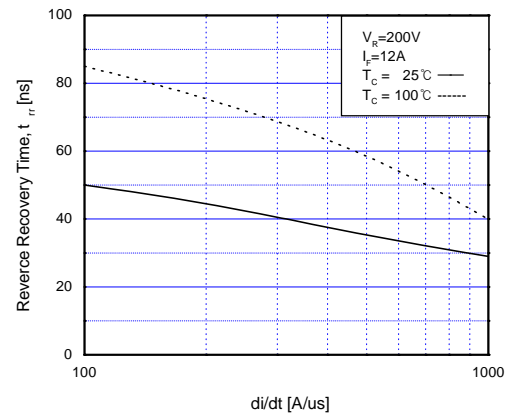
**Fig 18. Forward Characteristics**



**Fig 19. Reverse Recovery Current**

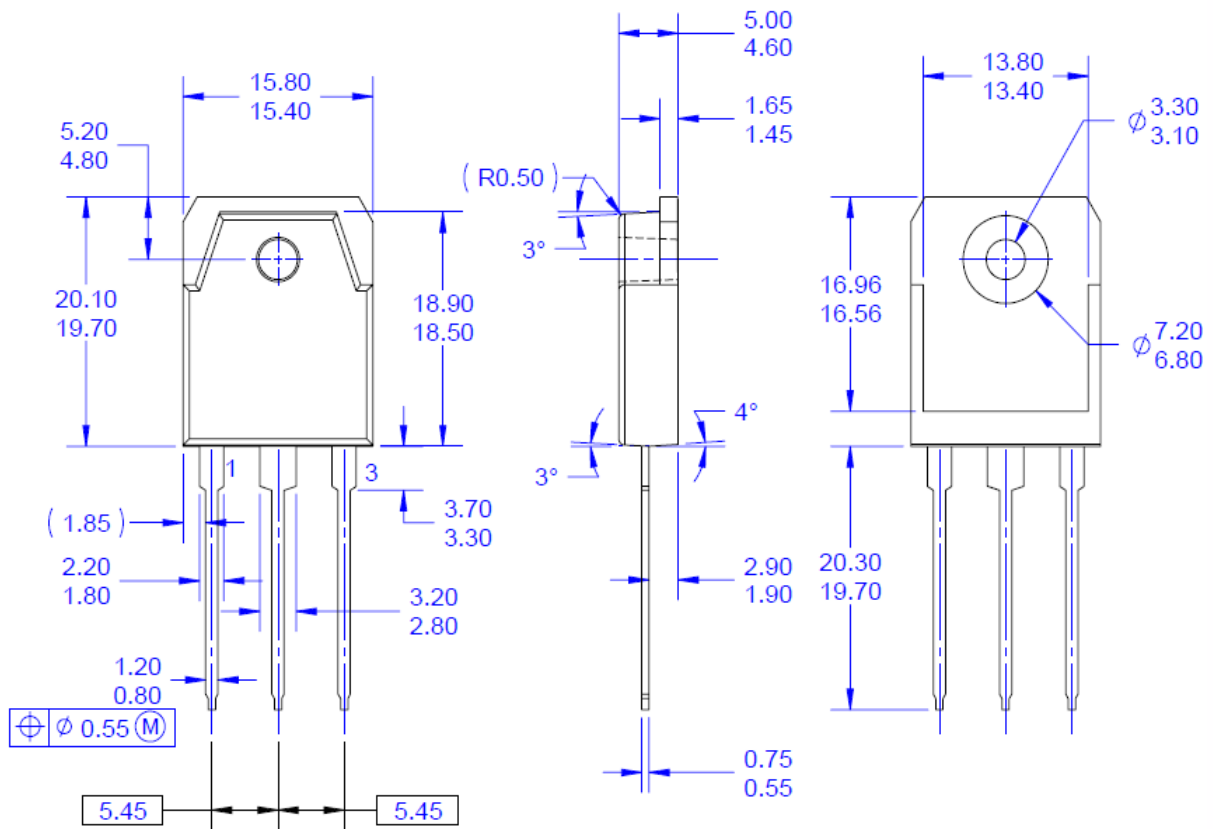


**Fig 20. Stored Charge**



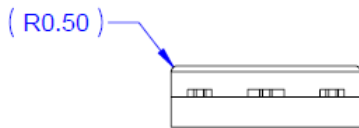
**Fig 21. Reverse Recovery Time**

## Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO EIAJ SC-65 PACKAGING STANDARD.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5
- D) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- E) THIS PACKAGE IS INTENDED ONLY FOR T03PN.
- F) DRAWING FILE NAME: T03P03AREV4.



**Figure 22. TO3, 3-Lead, Plastic, EIAJ SC-65**

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- OPTOPLANAR®
- PowerTrench®
- PowerXST™
- Programmable Active Droop™
- QFET®
- QST™
- Quiet Series™
- RapidConfigure™
- Ⓜ
- Saving our world, 1mW/W/kW at a time™
- SignalWise™
- SmartMax™
- SMART START™
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- SPM®
- STEALTH™
- SuperFET®
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- SuperSOT™-6
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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.

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