



# FGPF7N60RUF

## 600V, 7A RUF IGBT CO-PAK

### Features

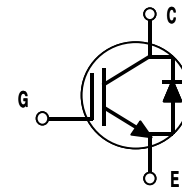
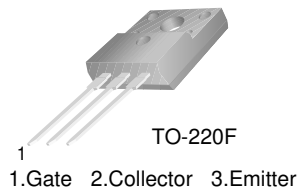
- High speed switching
- Low saturation voltage :  $V_{CE(sat)} = 1.95\text{ V @ } I_C = 7\text{ A}$
- High input impedance
- CO-PAK, IGBT with FRD :  $t_{rr} = 50\text{ ns (typ.)}$
- Short Circuit rated,  $10\mu\text{s @ } T_C=100^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=300\text{V}$

### Applications

Motor controls and general purpose inverters.

### Description

Fairchild's Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses. The device is designed for Motor applications where ruggedness is a required feature.



### Absolute Maximum Ratings

Symbol	Description	FGP7N60RUF	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	14	A
	Collector Current @ $T_C = 100^\circ\text{C}$	7	A
$I_{CM(1)}$	Pulsed Collector Current	21	A
$I_F$	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	12	A
$I_{FM}$	Diode Maximum Forward Current	60	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	41	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	16	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
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction-to-Case	--	3.0	$^\circ\text{C/W}$
$R_{\theta JC}(\text{DIODE})$	Thermal Resistance, Junction-to-Case	--	4.2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C/W}$

## Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGPF7N60RUF D	FGPF7N60RUF DTU	TO-220F	Rail / Tube	50ea	-

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

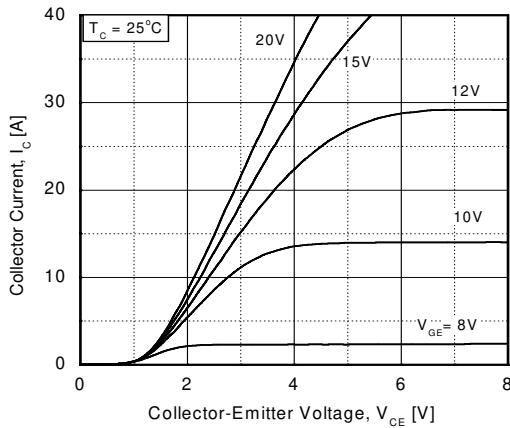
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$V_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	V
$\frac{\Delta V_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 3mA$	--	0.6	--	V/°C
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	$\mu A$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 7mA, V_{CE} = V_{GE}$	5.0	6.5	8.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 7A, V_{GE} = 15V$	--	1.95	2.8	V
		$I_C = 7A, V_{GE} = 15V, T_C = 125^\circ C$	--	2.1	--	V
		$I_C = 14A, V_{GE} = 15V$	--	2.65	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V, f = 1MHz$	--	510	--	pF
$C_{oes}$	Output Capacitance		--	55	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	15	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 7A, R_G = 30\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 25^\circ C$	--	60	--	ns
$t_r$	Rise Time		--	60	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	80	ns
$t_f$	Fall Time		--	170	280	ns
$E_{on}$	Turn-On Switching Loss		--	0.23	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.10	--	mJ
$E_{ts}$	Total Switching Loss		--	0.33	0.5	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 7A, R_G = 30\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 125^\circ C$	--	65	--	ns
$t_r$	Rise Time		--	70	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	55	--	ns
$t_f$	Fall Time		--	350	--	ns
$E_{on}$	Turn-On Switching Loss		--	0.25	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	0.27	--	mJ
$E_{ts}$	Total Switching Loss		--	0.52	--	mJ
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 7A, V_{GE} = 15V$	--	24	36	nC
$Q_{ge}$	Gate-Emitter Charge		--	4	6	nC
$Q_{gc}$	Gate-Collector Charge		--	10	15	nC
$L_e$	Internal Emitter Inductance	Measured 5mm from PKG	--	7.5	--	nH

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

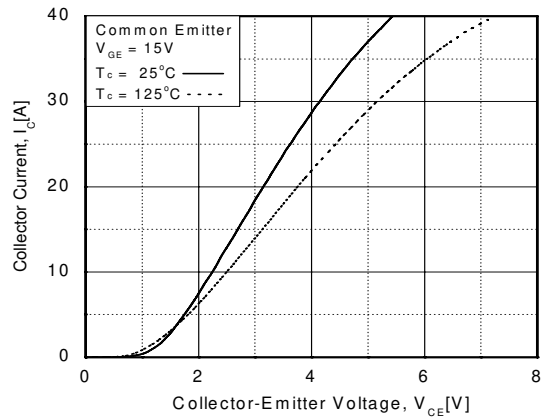
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units	
$V_{FM}$	Diode Forward Voltage	$I_F = 7\text{A}$	$T_C = 25^\circ\text{C}$	--	1.65	2.1	V
			$T_C = 100^\circ\text{C}$	--	1.58	--	
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 7\text{A}$ $di/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	50	65	ns
			$T_C = 100^\circ\text{C}$	--	58	--	
$I_{rr}$	Diode Peak Reverse Recovery Current	$I_F = 7\text{A}$ $di/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	2.5	3.75	A
			$T_C = 100^\circ\text{C}$	--	3.3	--	
$Q_{rr}$	Diode Reverse Recovery Charge	$I_F = 7\text{A}$ $di/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	--	62.5	122	nC
			$T_C = 100^\circ\text{C}$	--	95.7	--	

## Typical Performance Characteristics

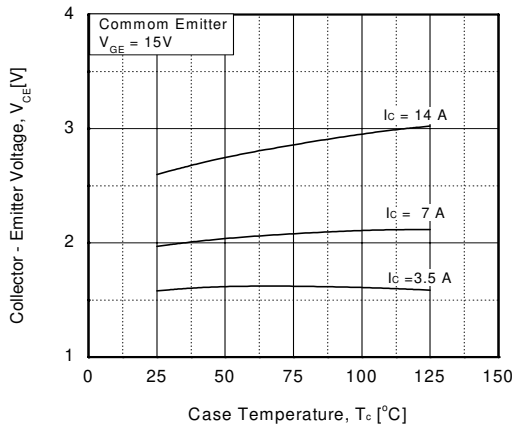
**Figure 1. Typical Output Characteristics**



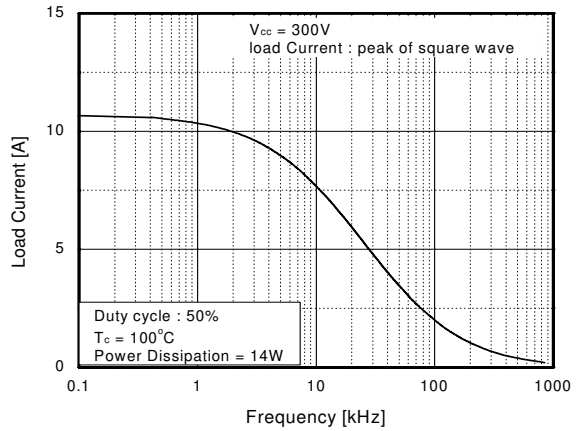
**Figure 2. Typical Saturation Voltage Characteristics**



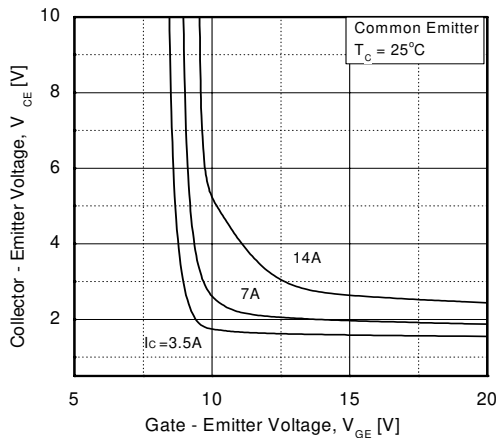
**Figure 3. Saturation Voltage vs Case Temperature at Variant Current Level**



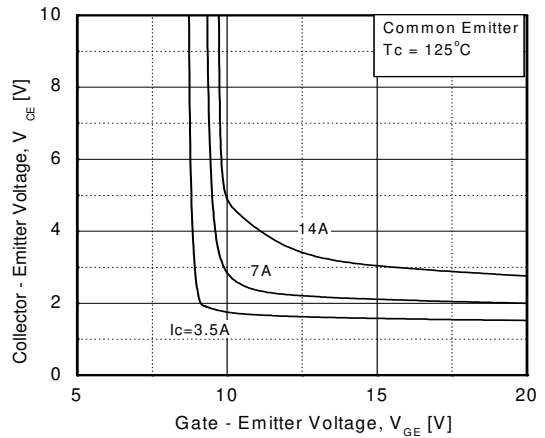
**Figure 4. Load Current vs Frequency**



**Figure 5. Saturation Voltage vs. Vge**

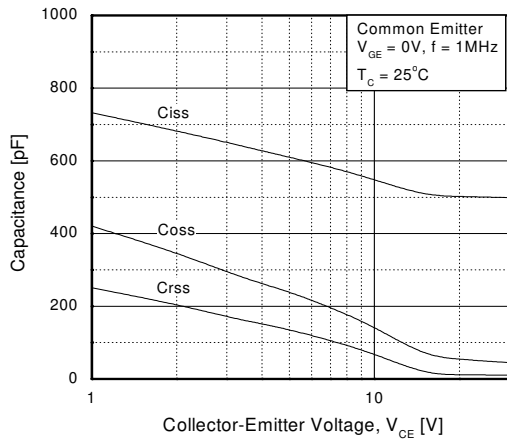


**Figure 6. Saturation Voltage vs. Vge**

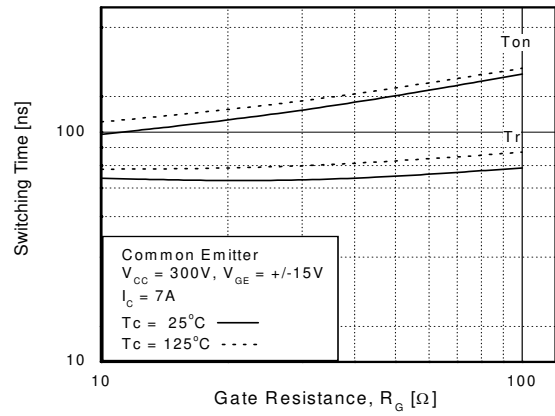


## Typical Performance Characteristics (Continued)

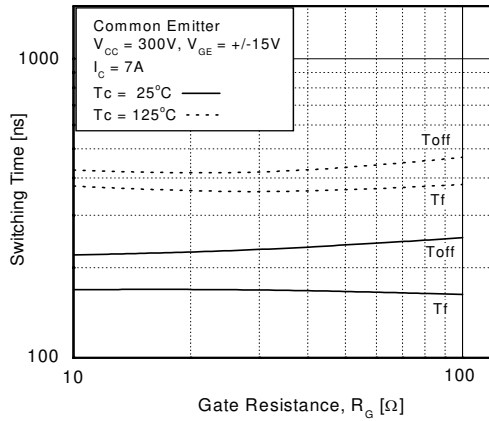
**Figure 7. Capacitance Characteristics Temperature at Variant Current Level**



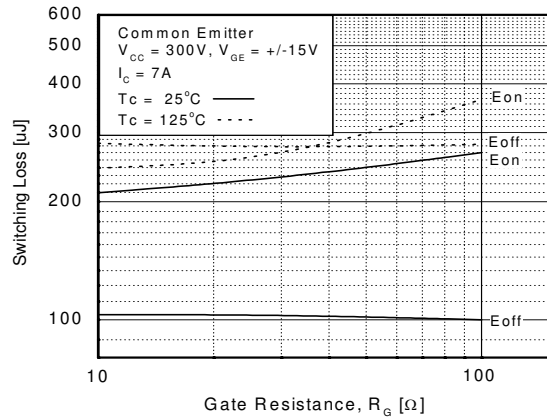
**Figure 8. Turn-On Characteristics vs. Gate Resistance**



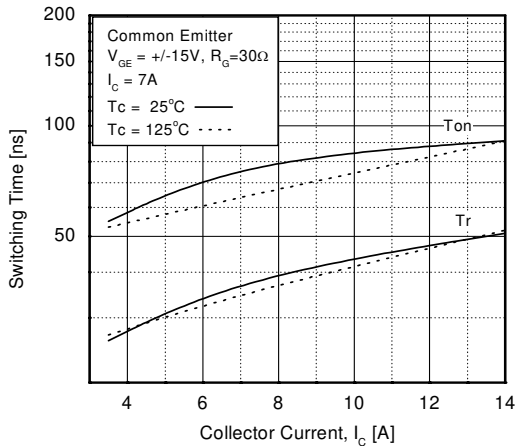
**Figure 9. Turn-Off Characteristics vs. Gate Resistance**



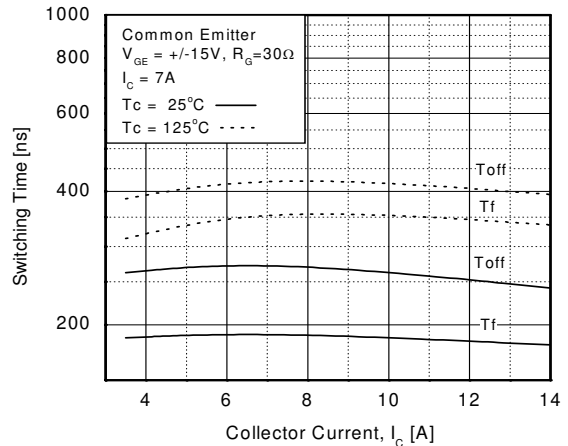
**Figure 10. Switching Loss vs. Gate Resistance**



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

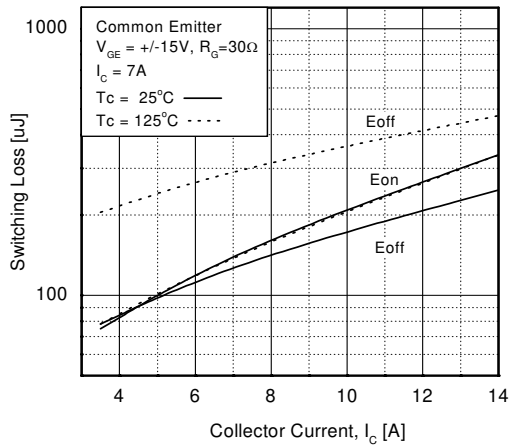


**Figure 12. Turn-Off Characteristics vs. Collector Current**

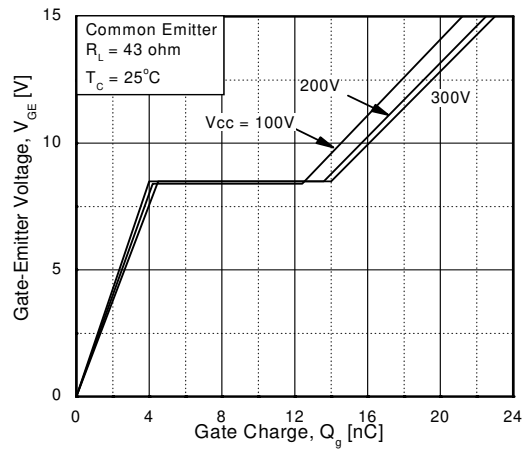


## Typical Performance Characteristics (Continued)

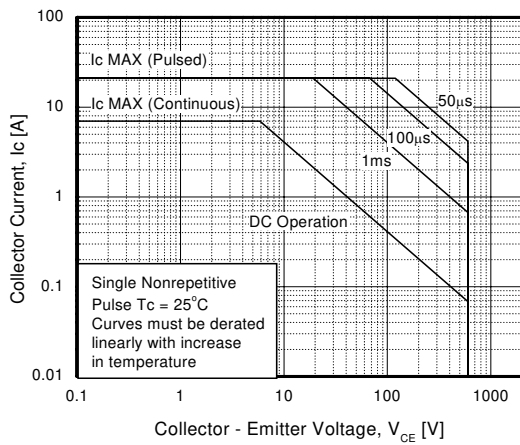
**Figure 13. Switching Loss vs. Collector Current**



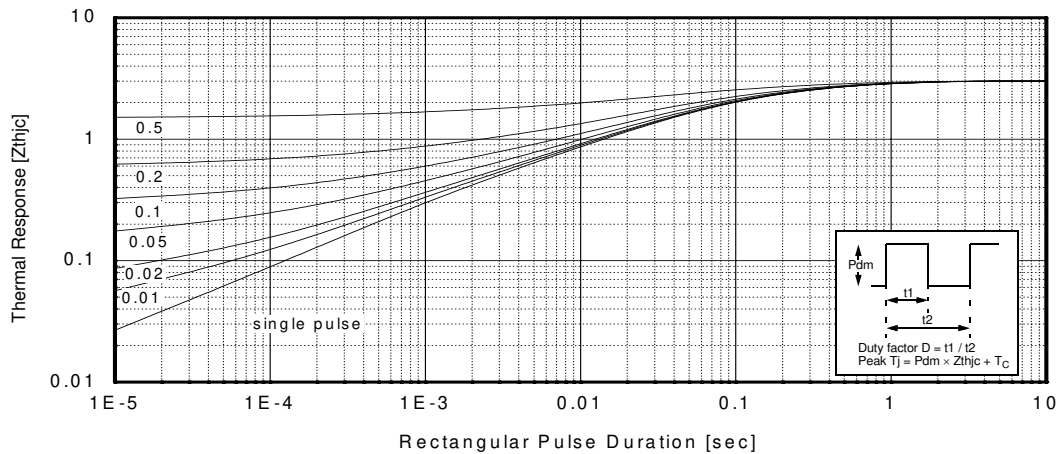
**Figure 14. Gate Charge Characteristics**



**Figure 15. SOA Characteristics**

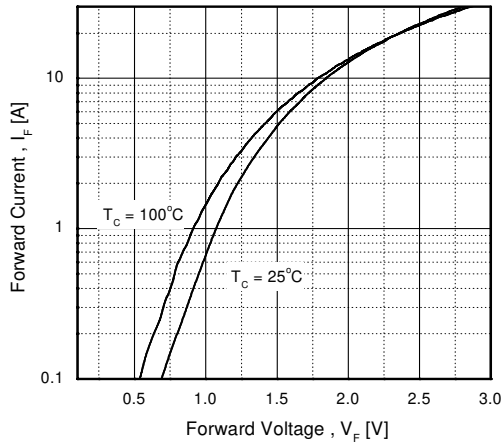


**Figure 16. Transient Thermal Impedance of IGBT**

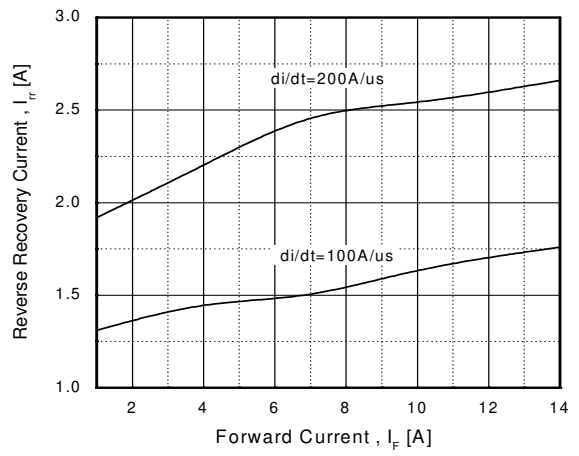


**Typical Performance Characteristics** (Continued)

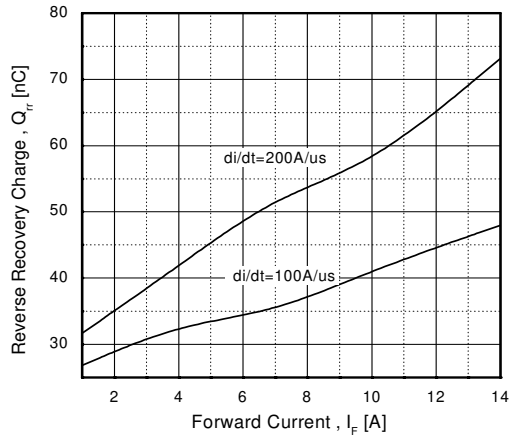
**Figure 17. Forward Voltage Characteristics**



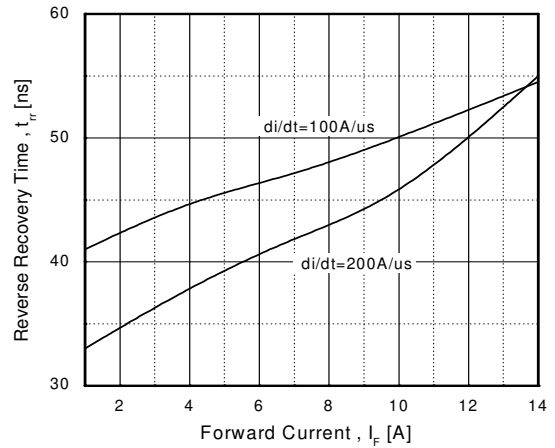
**Figure 18. Reverse Recovery Current**



**Figure 19. Stored Charge**



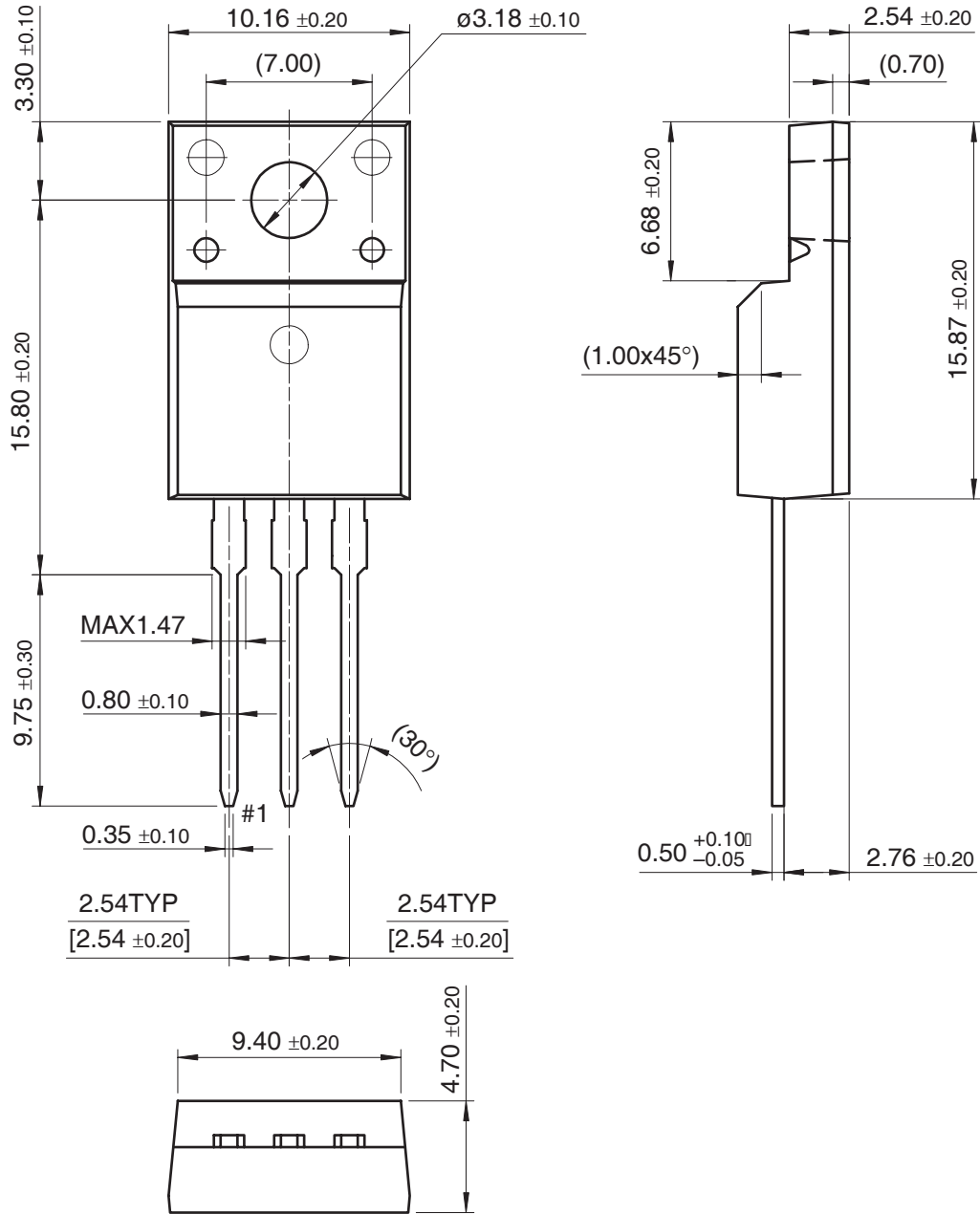
**Figure 20. Reverse Recovery Time**



Dimensions in Millimeters

Mechanical Dimensions

TO-220F





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