



October 2008



# FGA30N60LSD

## Features

- Low saturation voltage:  $V_{CE(sat)} = 1.1V @ I_C = 30A$
- High Input Impedance
- Low Conduction Loss

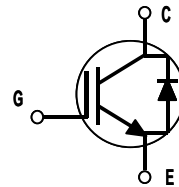
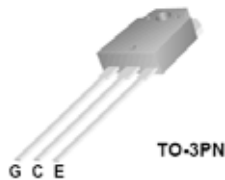
## Applications

- Solar Inverters
- UPS, Welder



## General Description

The FGA30N60LSD is a MOS gated high voltage switching device combining the best features of MOSFETs and bipolar transistors. This device has the high input impedance of a MOSFET and the low on-state conduction loss of a bipolar transistor.



## Absolute Maximum Ratings

Symbol	Description	FGA30N60LSD	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ C$	60	A
	Collector Current @ $T_C = 100^\circ C$	30	A
$I_{CM(1)}$	Pulsed Collector Current	90	A
$I_{FSM}$	Non-repetitive Peak Surge Current 60Hz Single Half-Sine Wave	150	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ C$	480	W
	Maximum Power Dissipation @ $T_C = 100^\circ C$	192	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ C$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ C$

**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	--	0.26	$^\circ C/W$
$R_{\theta JC}(Diode)$	Thermal Resistance, Junction-to-Case	--	0.92	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ C/W$

**Package Marking and Ordering Information**

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGA30N60LSD	FGA30N60LSDTU	TO-3PN	Tube	30ea	-

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{CES}$	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	$V_{GE} = 0V, I_C = 250\mu A$	--	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	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	$\pm 250$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\mu A, V_{CE} = V_{GE}$	4.0	5.5	7.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 30A, V_{GE} = 15V$	--	1.1	1.4	V
		$I_C = 30A, V_{GE} = 15V, T_C = 125^\circ\text{C}$	--	1.0	--	V
		$I_C = 60A, V_{GE} = 15V$	--	1.3	--	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V, f = 1\text{MHz}$	--	3550	--	pF
$C_{oes}$	Output Capacitance		--	245	--	pF
$C_{res}$	Reverse Transfer Capacitance		--	90	--	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 30A, R_G = 6.8\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 25^\circ\text{C}$	--	18	--	ns
$t_r$	Rise Time		--	46	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	250	--	ns
$t_f$	Fall Time		--	1.3	2.0	$\mu s$
$E_{on}$	Turn-On Switching Loss		--	1.1	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	21	--	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V, I_C = 30A, R_G = 6.8\Omega, V_{GE} = 15V, \text{Inductive Load}, T_C = 125^\circ\text{C}$	--	17	--	ns
$t_r$	Rise Time		--	45	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	270	--	ns
$t_f$	Fall Time		--	2.6	--	$\mu s$
$E_{on}$	Turn-On Switching Loss		--	1.1	--	mJ
$E_{off}$	Turn-Off Switching Loss		--	36	--	mJ
$Q_g$	Total Gate Charge	$V_{CE} = 300V, I_C = 30A, V_{GE} = 15V$	--	225	--	nC
$Q_{ge}$	Gate-Emitter Charge		--	30	--	nC
$Q_{gc}$	Gate-Collector Charge		--	105	--	nC
$L_e$	Internal Emitter Inductance	Measured 5mm from PKG	--	7	--	nH

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

Parameter	Conditions	Min.	Typ.	Max	Units	
V <sub>FM</sub>	I <sub>F</sub> = 15A	-	1.8	2.2	V	
	I <sub>F</sub> = 15A	-	1.6	-	V	
I <sub>RM</sub>	V <sub>R</sub> = 600V	-	-	100	μA	
t <sub>rr</sub>	I <sub>F</sub> = 1A, di/dt = 100A/μs, V <sub>CC</sub> = 30V	-	-	35	ns	
	I <sub>F</sub> = 15A, di/dt = 100A/μs, V <sub>CC</sub> = 390V	-	-	40	ns	
t <sub>a</sub> t <sub>b</sub> Q <sub>rr</sub>	I <sub>F</sub> = 15A, di/dt = 100A/μs, V <sub>CC</sub> = 390V	T <sub>C</sub> = 25 °C	-	18	-	ns
		T <sub>C</sub> = 25 °C	-	13	-	ns
		T <sub>C</sub> = 25 °C	-	27.5	-	nC

### Typical Performance Characteristics

Figure 1. Typical Output Characteristics

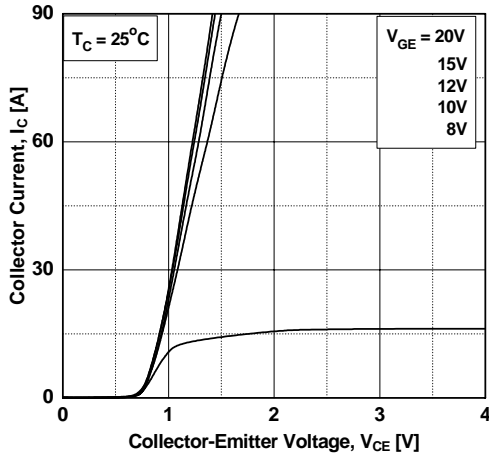


Figure 3. Typical Saturation Voltage Characteristics

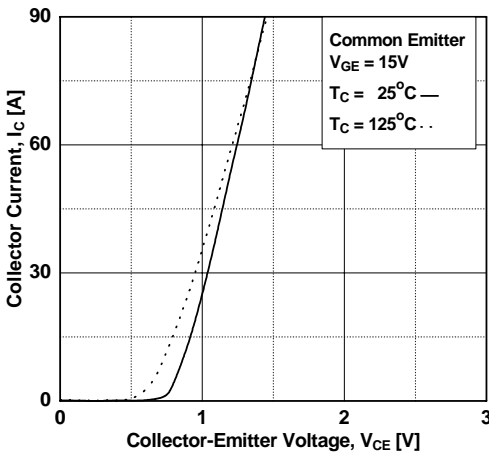


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

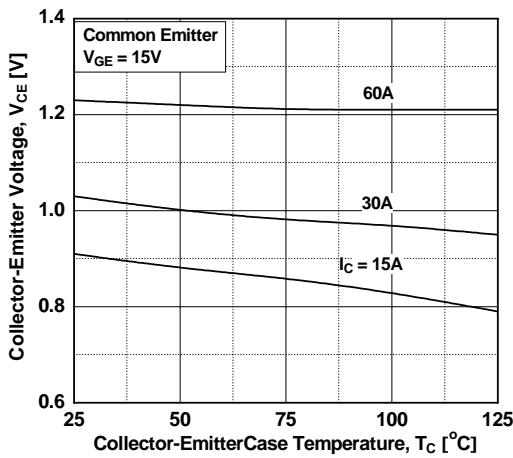


Figure 2. Typical Saturation Voltage Characteristics

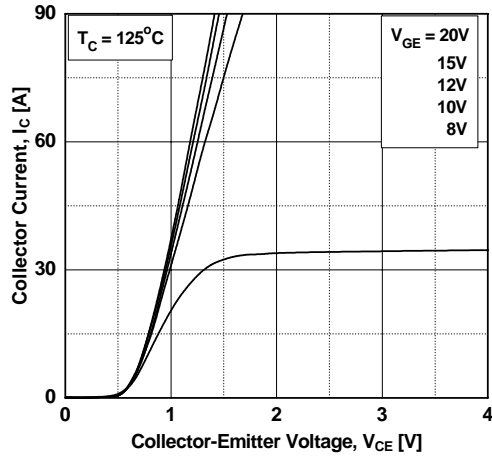


Figure 4. Transfer characteristics

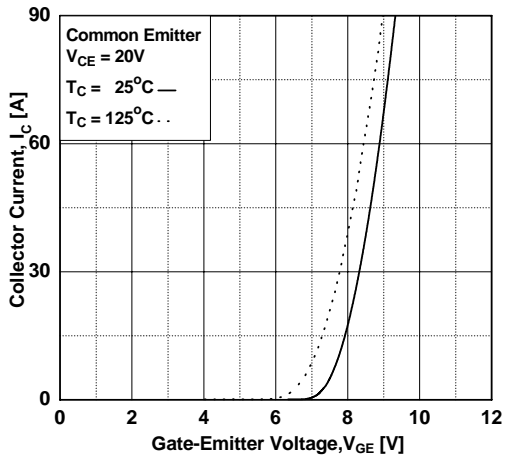
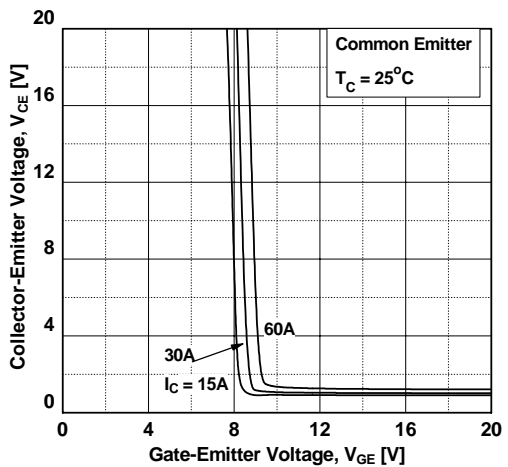


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics (Continued)

Figure 7. Saturation Voltage vs. V<sub>GE</sub>

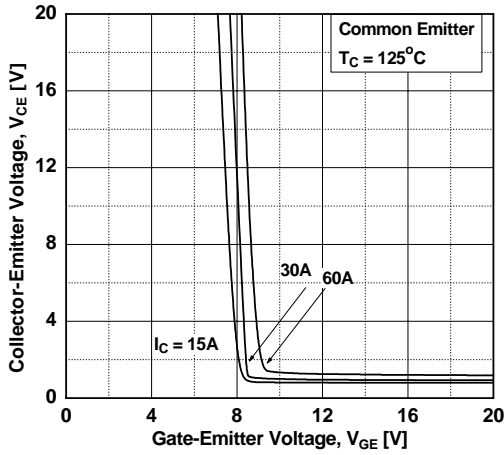


Figure 8. Capacitance characteristics

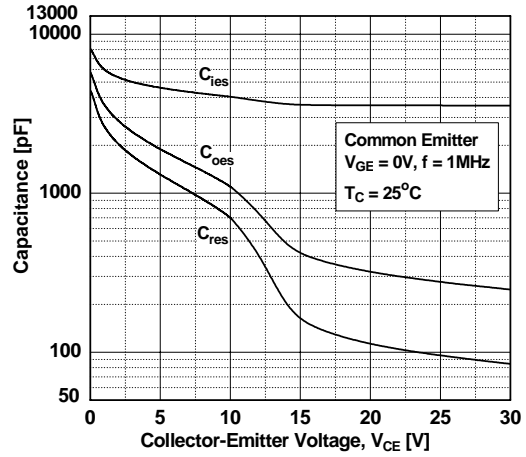


Figure 9. Gate Charge Characteristics

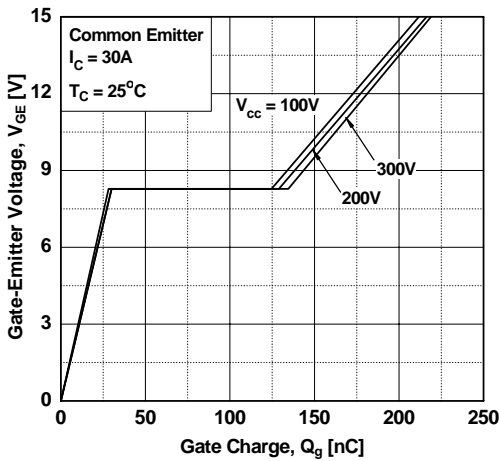


Figure 10. SOA Characteristics

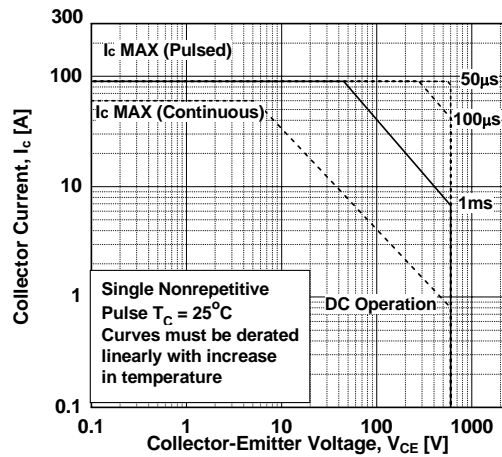


Figure 11. Load Current vs. Frequency

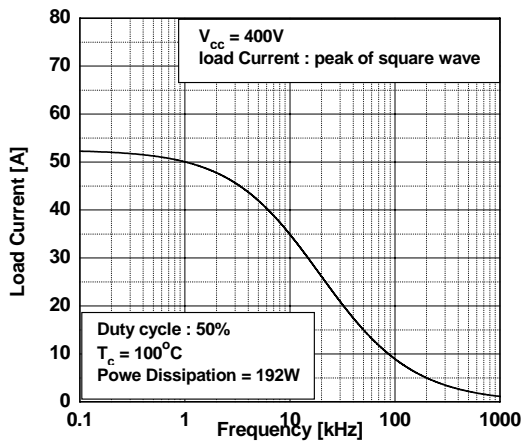
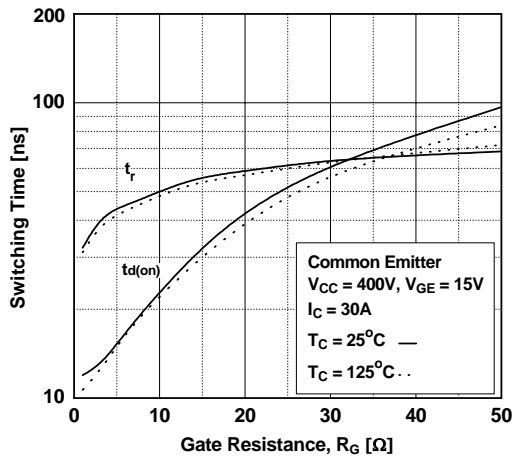


Figure 12. Turn-On Characteristics vs. Gate Resistance



Typical Performance Characteristics (Continued)

Figure 13. Turn-Off Characteristics vs. Gate Resistance

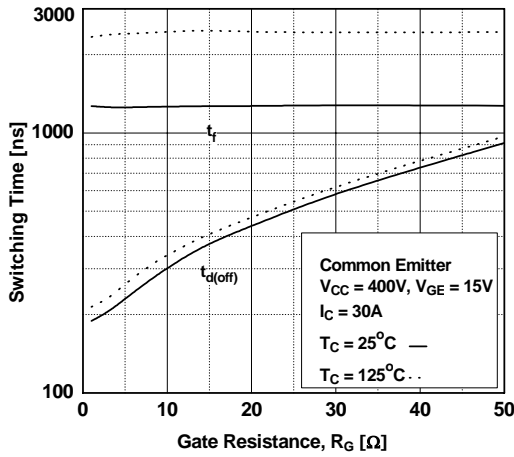


Figure 15. Turn-Off Characteristics vs. Collector Current

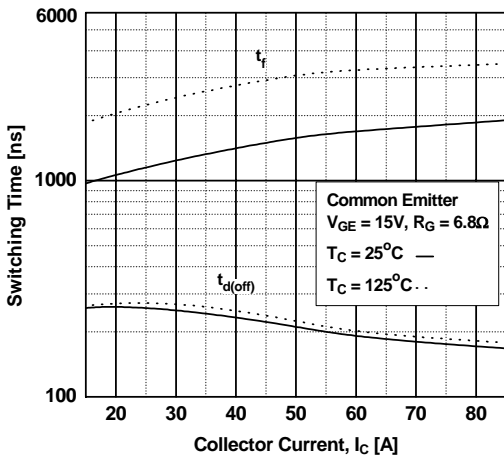


Figure 17. Switching Loss vs Collector Current

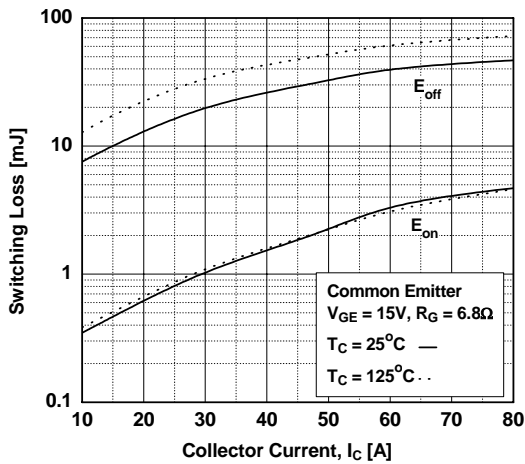


Figure 14. Turn-On Characteristics vs. Collector Current

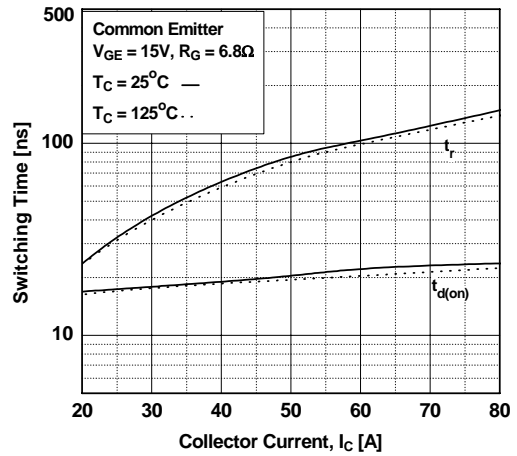


Figure 16. Switching Loss vs Gate Resistance

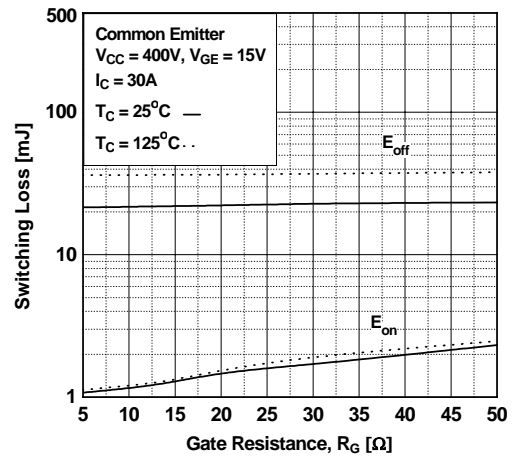


Figure 18. Turn-Off Switching SOA Characteristics

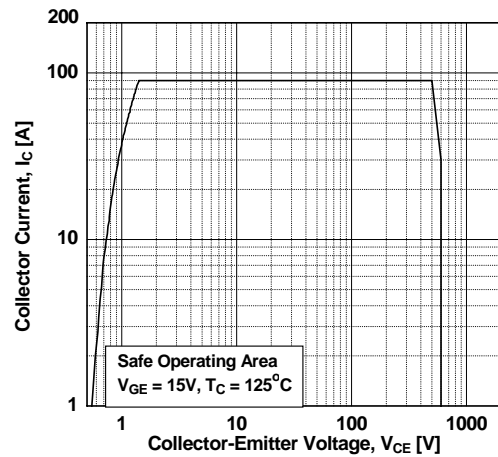


Figure 19. Transient Thermal Impedance of IGBT

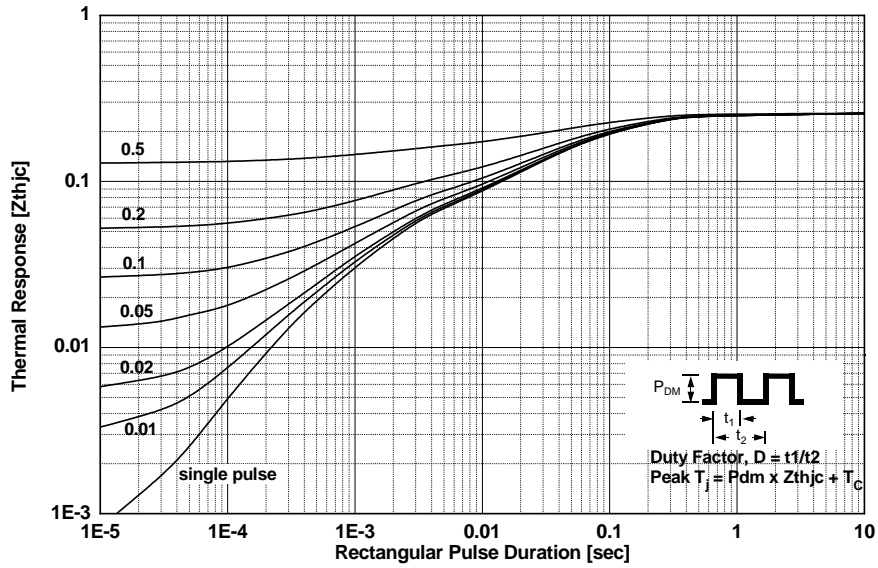


Figure 20. Typical Forward Voltage Drop

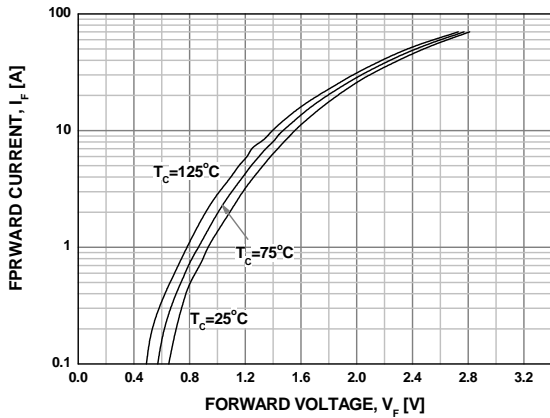


Figure 21. Typical Reverse Current

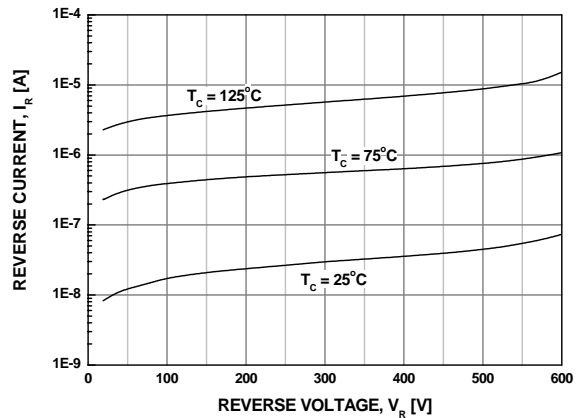
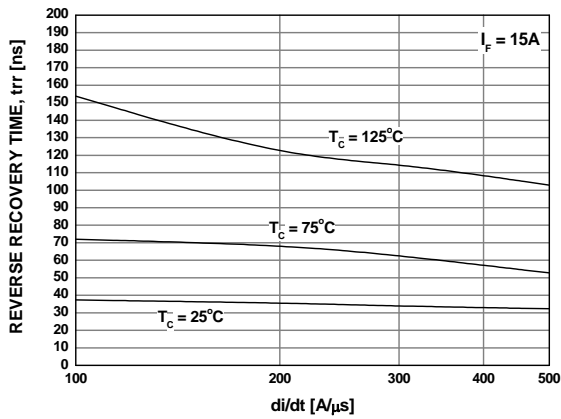
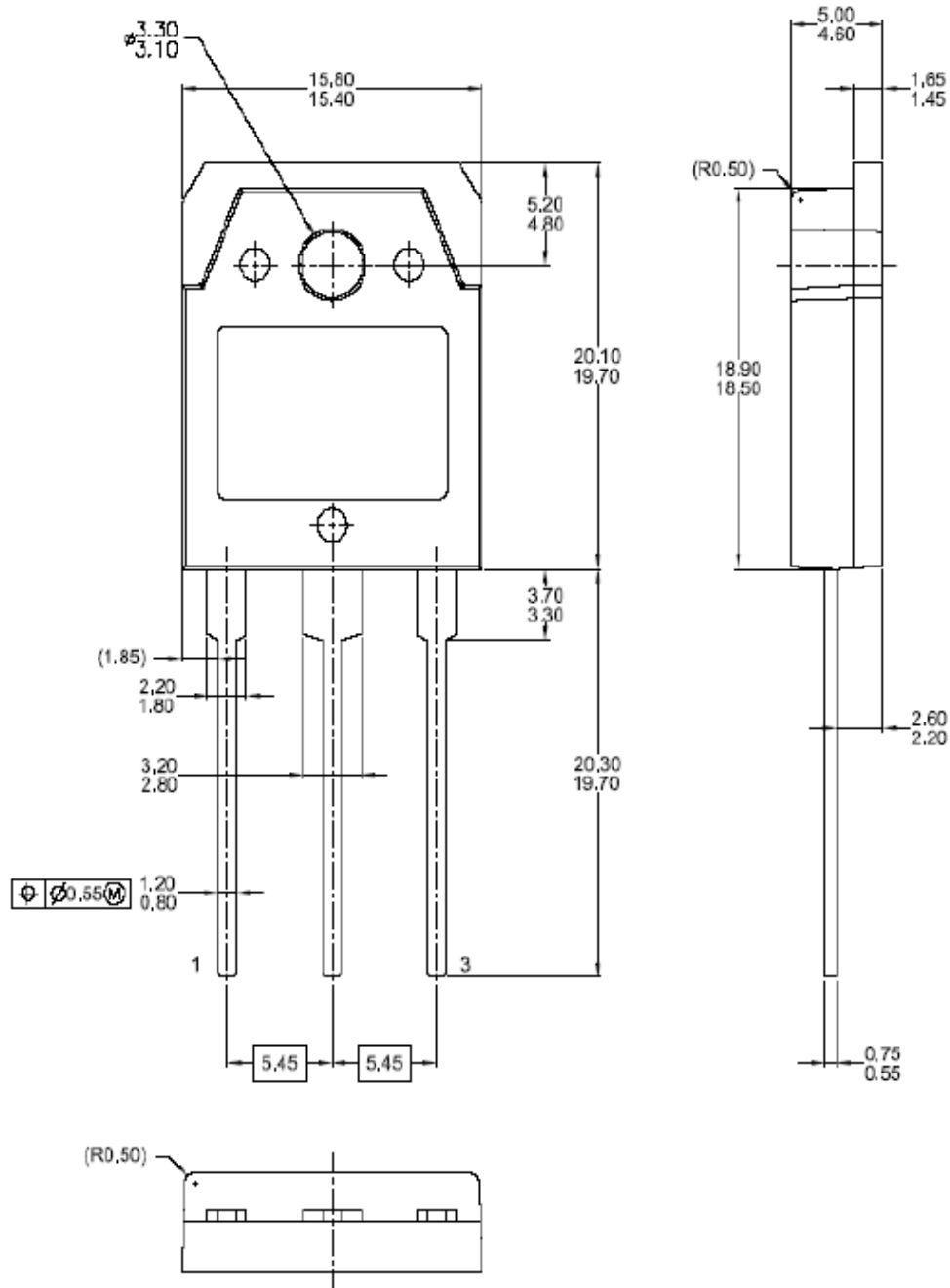


Figure 22. Typical Reverse Recovery Time



Mechanical Dimensions (continued)

TO-3PN



Dimensions in Millimeters





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