FAIRCHILD
SEMICONDUCTOR®

August 2007

FGH30N60LSD

Features

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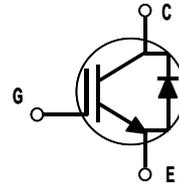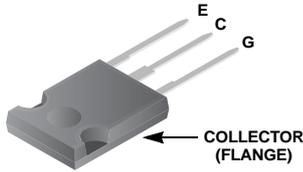- Low Conduction Loss

Applications

- Solar Inverters
- UPS, Welder

General Description

The FGH30N60LSD 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.

COLLECTOR
(FLANGE)

Absolute Maximum Ratings

Symbol	Description		FGH30N60LSD	Units
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		$\pm$ 20	V
I_C	Collector Current	@ T_C = 25°C	60	A
	Collector Current	@ T_C = 100°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°C	480	W
	Maximum Power Dissipation	@ T_C = 100°C	192	W
T_J	Operating Junction Temperature		-55 to +150	°C
T_{stg}	Storage Temperature Range		-55 to +150	°C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°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	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction-to-Case	--	0.92	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGH30N60LSD	FGH30N60LSDTU	TO-247	Tube	30ea	-

Electrical Characteristics of the IGBT T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 250uA	600	--	--	V
$\Delta B_{VCES}/\Delta T_J$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250uA	--	0.6	--	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0V	--	--	250	uA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, V_{CE} = 0V	--	--	±250	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 250uA, $V_{CE} = V_{GE}$	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°C	--	1.0	--	V
		I_C = 60 A, V_{GE} = 15V	--	1.3	--	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	--	3550	--	pF
C_{oes}	Output Capacitance		--	245	--	pF
C_{res}	Reverse Transfer Capacitance		--	90	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400 V, I_C = 30A, R_G = 6.8Ω, V_{GE} = 15V, Inductive Load, T_C = 25°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	us
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} = 400 V, I_C = 30A, R_G = 6.8Ω, V_{GE} = 15V, Inductive Load, T_C = 125°C	--	17	--	ns
t_r	Rise Time		--	45	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	270	--	ns
t_f	Fall Time		--	2.6	--	us
E_{on}	Turn-On Switching Loss		--	1.1	--	mJ
E_{off}	Turn-Off Switching Loss		--	36	--	mJ
Q_g	Total Gate Charge	V_{CE} = 600 V, 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 $T_C = 25°C$ unless otherwise noted

FGH30N60LSD

Parameter	Conditions		Min.	Typ.	Max	Units
V_{FM}	I_F = 15A	T_C = 25 °C	-	1.8	2.2	V
	I_F = 15A	T_C = 125 °C	-	1.6	-	V
I_{RM}	V_R = 600V	T_C = 25 °C	-	-	100	μA
t_{rr}	I_F =1A, di/dt = 100A/μs, V_{CC} = 30V	T_C = 25 °C	-	-	35	ns
	I_F =15A, di/dt = 100A/μs, V_{CC} = 390V	T_C = 25 °C	-	-	40	ns
t_a	I_F =15A, di/dt = 100A/μs, V_{CC} = 390V	T_C = 25 °C	-	18	-	ns
t_b		T_C = 25 °C	-	13	-	ns
Q_{rr}		T_C = 25 °C	-	27.5	-	nC

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Typical Performance Characteristics

Figure 1.Typical Output Characteristics

$T_C = 25^oC$

$V_{GE} = 20V$
15V
12V
10V
8V

Collector Current, I_C [A]
Collector-Emitter Voltage, V_{CE} [V]

Figure 2. Typical Saturation Voltage Characteristics

$T_C = 125^oC$

$V_{GE} = 20V$
15V
12V
10V
8V

Collector Current, I_C [A]
Collector-Emitter Voltage, V_{CE} [V]

Figure 3. Typical Saturation Voltage Characteritics

Common Emitter
$V_{GE} = 15V$
$T_C = 25^oC$ —
$T_C = 125^oC$ ··

Collector Current, I_C [A]
Collector-Emitter Voltage, V_{CE} [V]
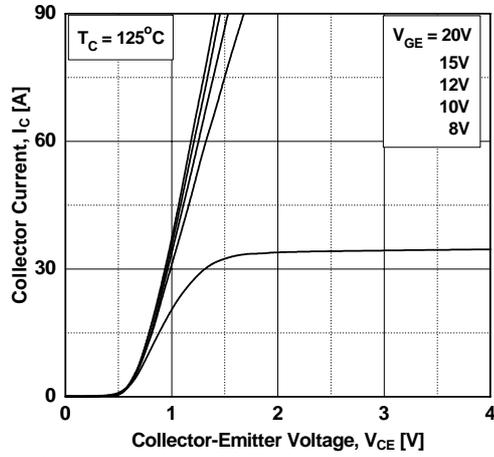
Figure 4. Transfer characteristics

Common Emitter
$V_{CE} = 20V$
$T_C = 25^oC$ —
$T_C = 125^oC$ ··

Collector Current, I_C [A]
Gate-Emitter Voltage,V_{GE} [V]

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

Common Emitter
$V_{GE} = 15V$

60A
30A
$I_C = 15A$

Collector-Emitter Voltage, V_{CE} [V]
Collector-EmitterCase Temperature, T_C [^oC]
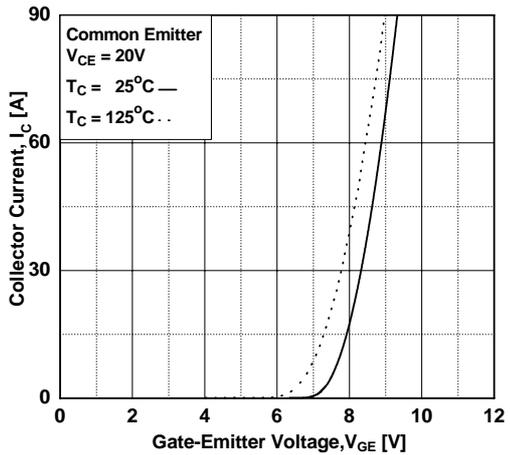
Figure 6. Saturation Voltage vs. Vge

Common Emitter
$T_C = 25^oC$

60A
30A
$I_C = 15A$

Collector-Emitter Voltage, V_{CE} [V]
Gate-Emitter Voltage, V_{GE} [V]

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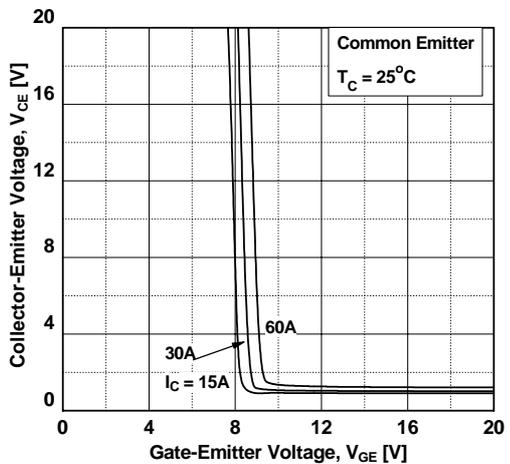
Typical Performance Characteristics (Continued)

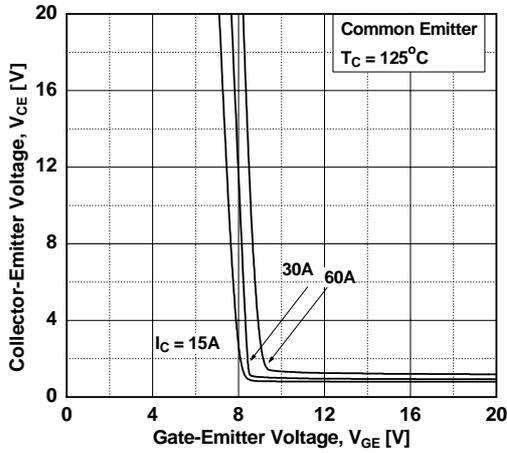### Figure 7. Saturation Voltage vs. Vge

Figure 8. Capacitance characteristics
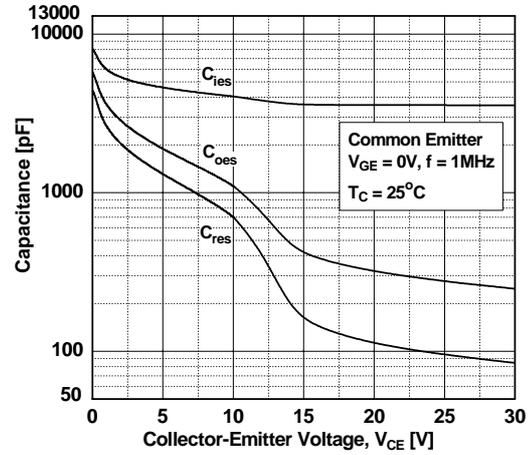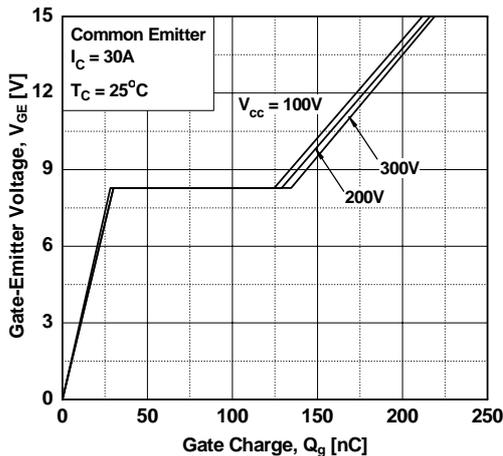

Figure 9. Gate Charge Characteristics

Figure 10. SOA Characteeristics
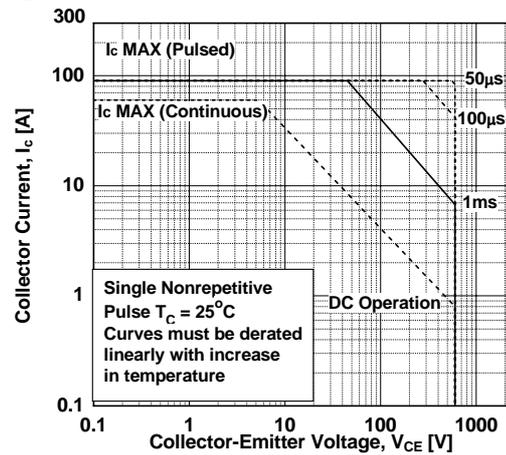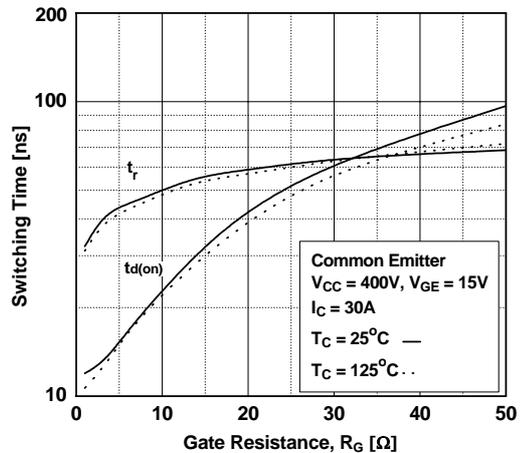

Figure 11. Load Current Vs. Frequency
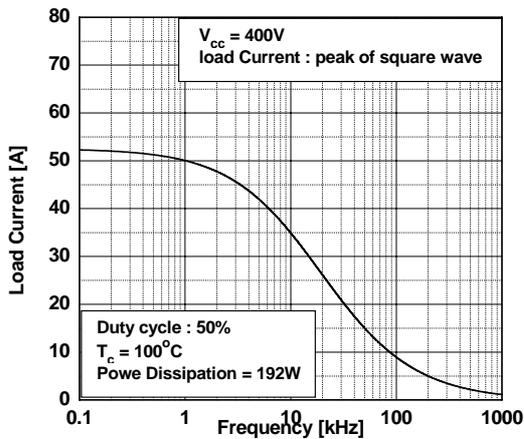
Figure 12. Turn-On Characteristics vs. Gate Resistance

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Typical Performance Characteristics (Continued)

Figure 13. Turn-Off Characteristics vs. Gate Resistance

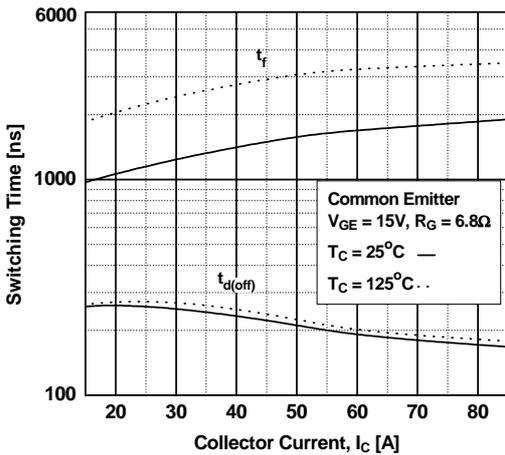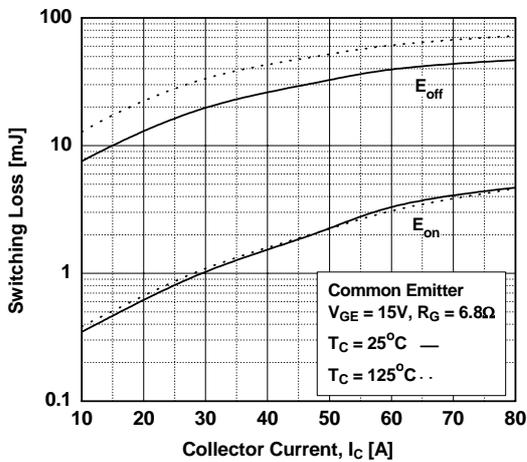### Figure 14. Turn-On Characteristics vs. Collector Current

Figure 15. Turn-Off Characteristics vs. Collector Current
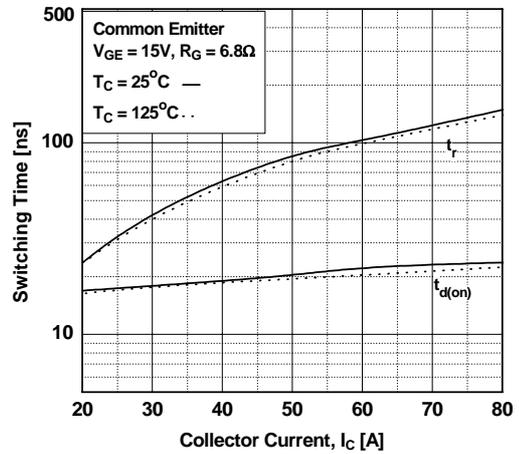
Figure 16. Switching Loss vs Gate Resistance
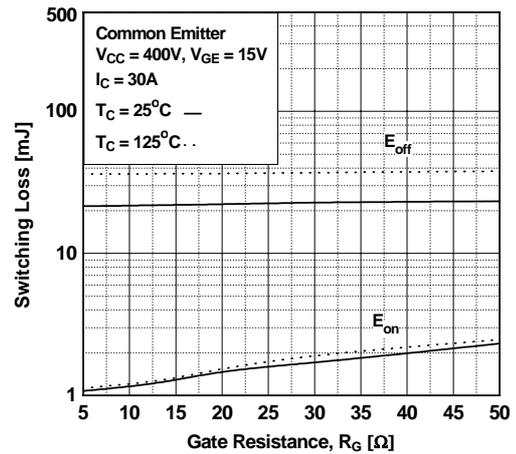

Figure 17. Switching Loss vs Collector Current

Figure 18. Turn-Off Switching SOA Characteristics
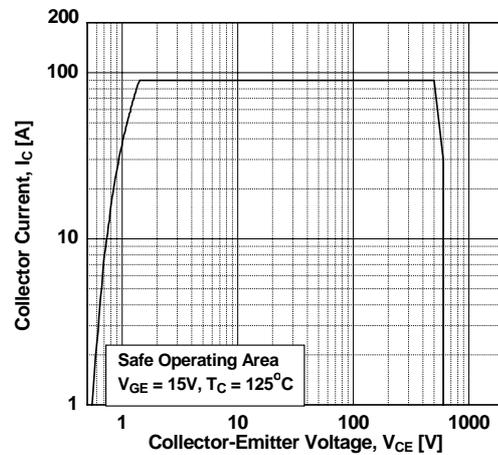
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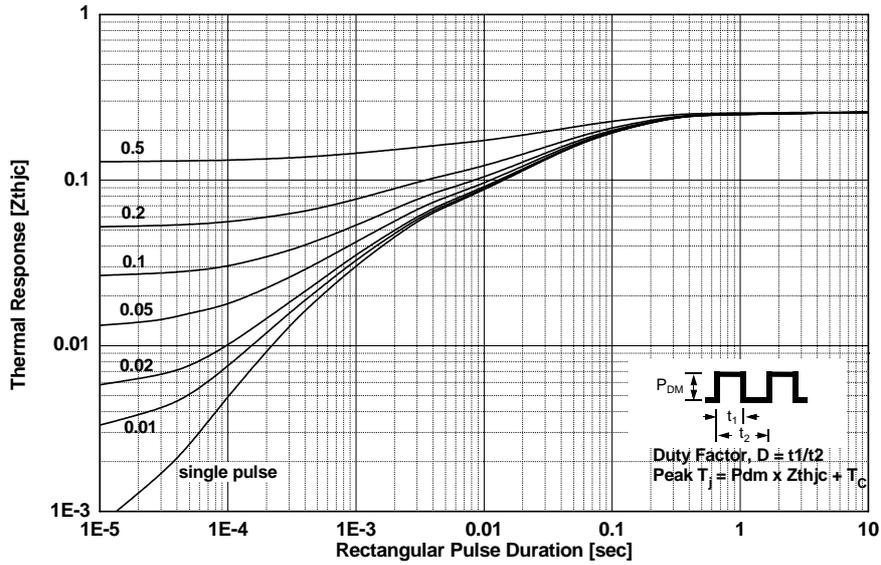
Figure 19. Transient Thermal Impedance of IGBT
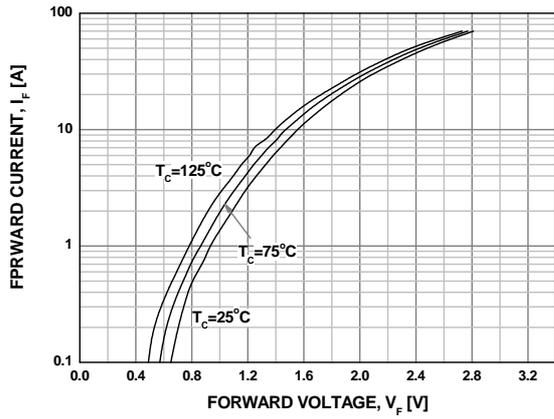

Figure 20. Typical Forward Voltage Drop
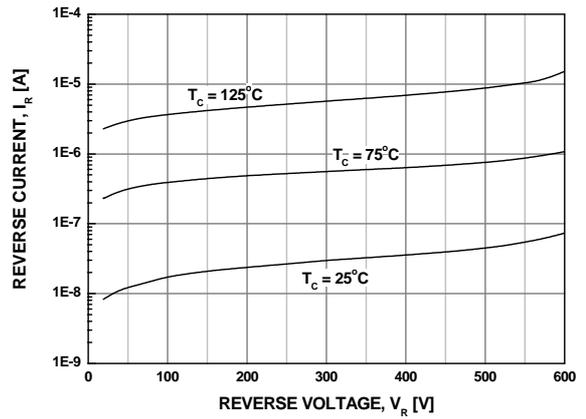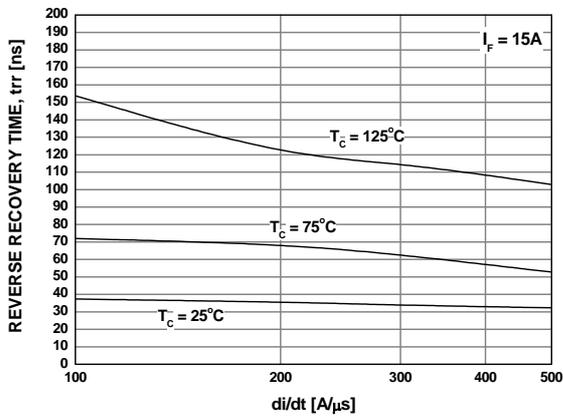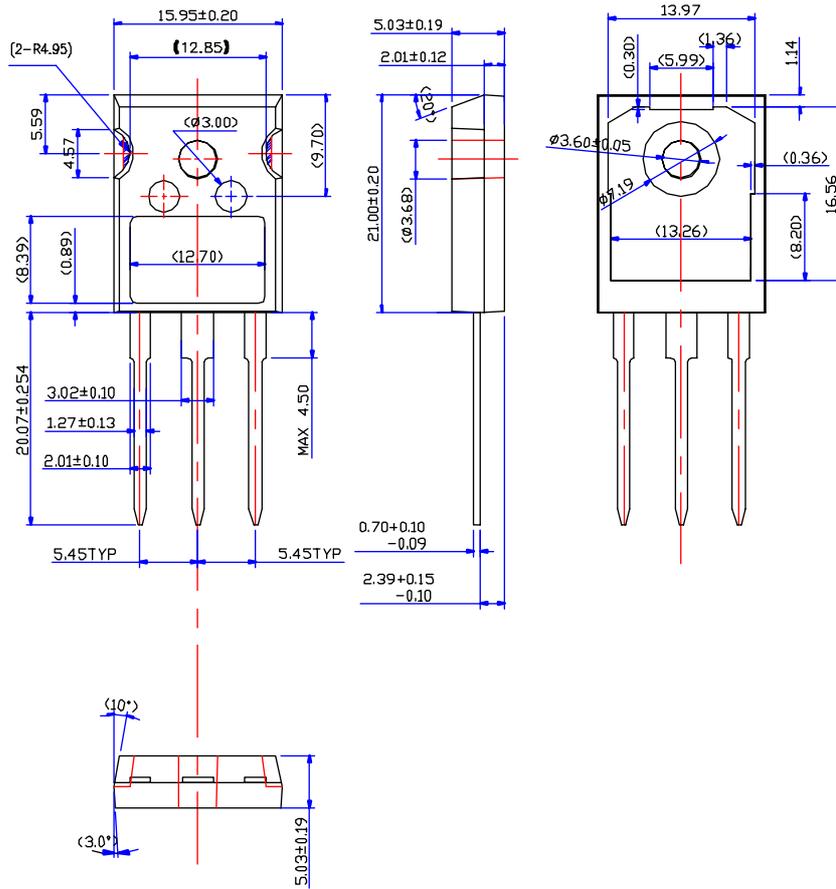

Figure 21. Typical Reverse Current

Figure 22. Typical Reverse Recovery Time

Mechanical Dimensions

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FGH30N60LSD Rev. A1

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