

# IGBT - PT

600 V, 30 A

## FGH30N60LSD

### Description

Using ON Semiconductor's advanced PT technology, the FGA30N60LSD IGBT offers superior conduction performances, which offer the optimum performance for medium switching application such as solar inverter, UPS applications where low conduction losses are the most important factor.

### Features

- Low Saturation Voltage:  $V_{CE(sat)} = 1.1 \text{ V @ } I_C = 30 \text{ A}$
- High Input Impedance
- Low Conduction Loss
- This Device is Pb-Free and is RoHS Compliant

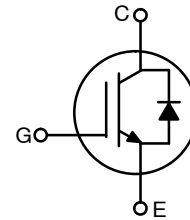
### Applications

- Solar Inverter, UPS



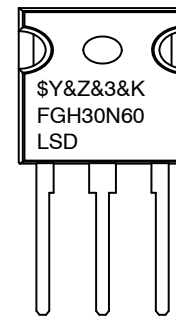
**ON Semiconductor®**

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TO-247-3LD  
CASE 340CK

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
&Z = Assembly Plant Code  
&3 = Numeric Date Code  
&K = Lot Code  
FGH30N60LSD = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# FGH30N60LSD

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Description		Symbol	Rating	Unit
Collector to Emitter Voltage		V <sub>CES</sub>	600	V
Gate to Emitter Voltage		V <sub>GES</sub>	±20	V
Collector Current	T <sub>C</sub> = 25°C	I <sub>C</sub>	60	A
Collector Current	T <sub>C</sub> = 100°C		30	A
Pulsed Collector Current		I <sub>CM</sub> (Note 1)	90	A
Non-repetitive Peak Surge Current 60 Hz Single Half-Sine Wave		I <sub>FSM</sub>	150	A
Maximum Power Dissipation	T <sub>C</sub> = 25°C	P <sub>D</sub>	480	W
Maximum Power Dissipation	T <sub>C</sub> = 100°C		192	W
Operating Junction Temperature		T <sub>J</sub>	-55 to +150	°C
Storage Temperature Range		T <sub>stg</sub>	-55 to +150	°C
Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		T <sub>L</sub>	300	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive Rating: Pulse width limited by max. junction temperature.

## THERMAL CHARACTERISTICS

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub> (IGBT)	-	0.26	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub> (Diode)	-	0.92	°C/W
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	-	40	°C/W

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGH30N60LSDTU	FGH30N60LSD	TO-247	Tube	N/A	N/A	30

## ELECTRICAL CHARACTERISTICS OF THE IGBT (T<sub>C</sub> = 25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

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

### ON CHARACTERISTICS

G-E Threshold Voltage	V <sub>GE(th)</sub>	I <sub>C</sub> = 250 μA, V <sub>CE</sub> = V <sub>GE</sub>	4.0	5.5	7.0	V
Collector to Emitter Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V	-	1.1	1.4	V
		I <sub>C</sub> = 30 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 125°C	-	1.0	-	V
		I <sub>C</sub> = 60 A, V <sub>GE</sub> = 15 V	-	1.3	-	V

# FGH30N60LSD

## ELECTRICAL CHARACTERISTICS OF THE IGBT ( $T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ies}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	–	3550	–	pF
Output Capacitance	$C_{oes}$		–	245	–	pF
Reverse Transfer Capacitance	$C_{res}$		–	90	–	pF

## SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 6.8\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	–	18	–	ns
Rise Time	$t_r$		–	46	–	ns
Turn-Off Delay Time	$t_{d(off)}$		–	250	–	ns
Fall Time	$t_f$		–	1.3	2.0	$\mu\text{s}$
Turn-On Switching Loss	$E_{on}$		–	1.1	–	mJ
Turn-Off Switching Loss	$E_{off}$		–	21	–	mJ
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 30\text{ A}, R_G = 6.8\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 125^\circ\text{C}$	–	17	–	ns
Rise Time	$t_r$		–	45	–	ns
Turn-Off Delay Time	$t_{d(off)}$		–	270	–	ns
Fall Time	$t_f$		–	2.6	–	$\mu\text{s}$
Turn-On Switching Loss	$E_{on}$		–	1.1	–	mJ
Turn-Off Switching Loss	$E_{off}$		–	36	–	mJ
Total Gate Charge	$Q_g$	$V_{CE} = 600\text{ V}, I_C = 30\text{ A}, V_{GE} = 15\text{ V}$	–	225	–	nC
Gate to Emitter Charge	$Q_{ge}$		–	30	–	nC
Gate to Collector Charge	$Q_{gc}$		–	105	–	nC
Internal Emitter Inductance	$L_e$	Measured 5 mm from PKG	–	7	–	nH

## ELECTRICAL CHARACTERISTICS OF THE DIODE ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Conditions		Min	Typ	Max	Unit
$V_{FM}$	$I_F = 15\text{ A}$	$T_C = 25^\circ\text{C}$	–	1.8	2.2	V
	$I_F = 15\text{ A}$	$T_C = 125^\circ\text{C}$	–	1.6	–	
$I_{RM}$	$V_R = 600\text{ V}$	$T_C = 25^\circ\text{C}$	–	–	100	$\mu\text{A}$
$t_{rr}$	$I_F = 1\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	$T_C = 25^\circ\text{C}$	–	–	35	ns
	$I_F = 15\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}, V_R = 390\text{ V}$	$T_C = 25^\circ\text{C}$	–	–	40	
$t_a$	$I_F = 15\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}, V_R = 390\text{ V}$	$T_C = 25^\circ\text{C}$	–	18	–	ns
$t_b$		$T_C = 25^\circ\text{C}$	–	13	–	
$Q_{rr}$		$T_C = 25^\circ\text{C}$	–	27.5	–	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL PERFORMANCE CHARACTERISTICS

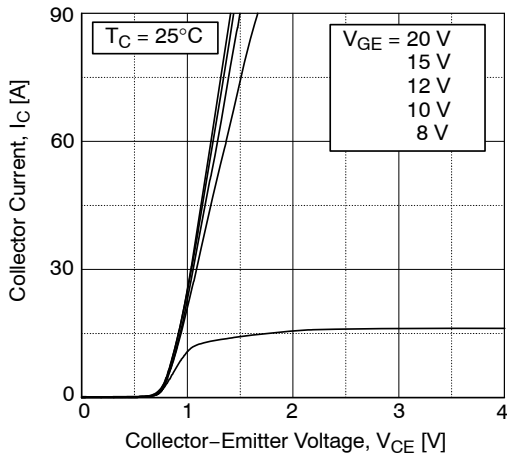


Figure 1. Typical Output Characteristics

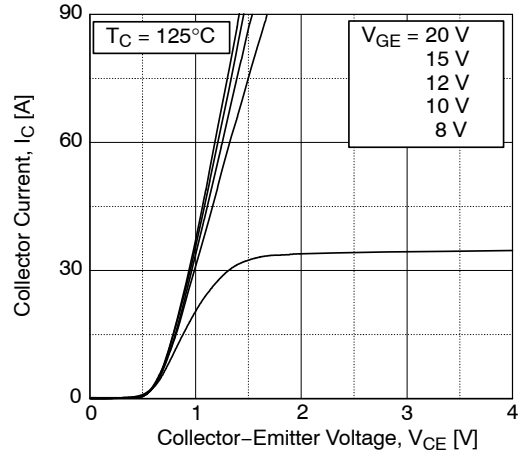


Figure 2. Typical Saturation Voltage Characteristics

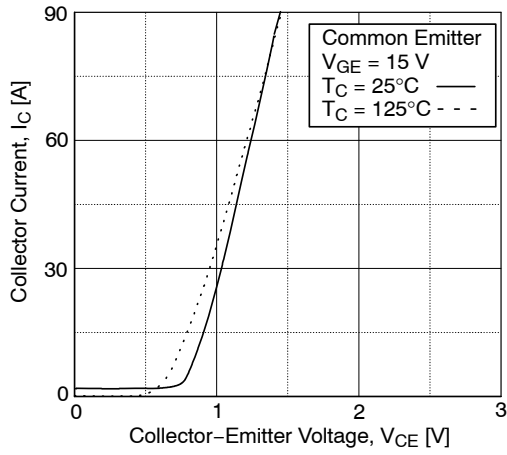


Figure 3. Typical Saturation Voltage Characteristics

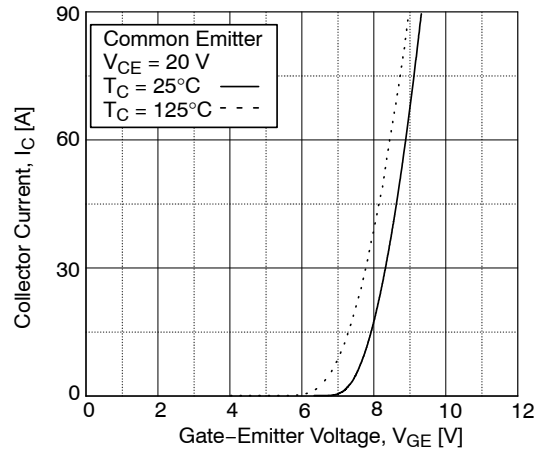


Figure 4. Transfer Characteristics

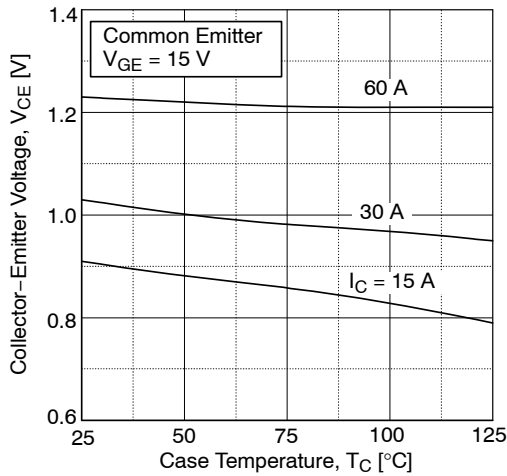


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

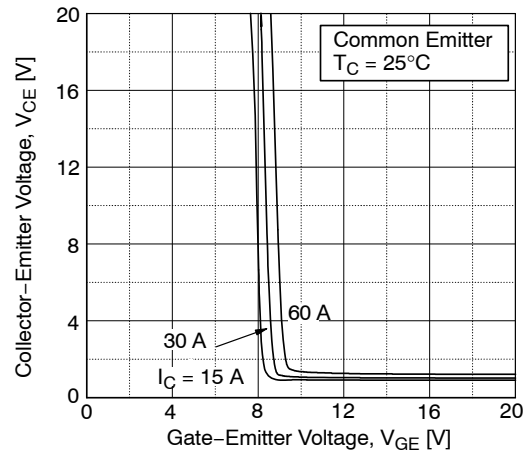


Figure 6. Saturation Voltage vs V<sub>GE</sub>

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

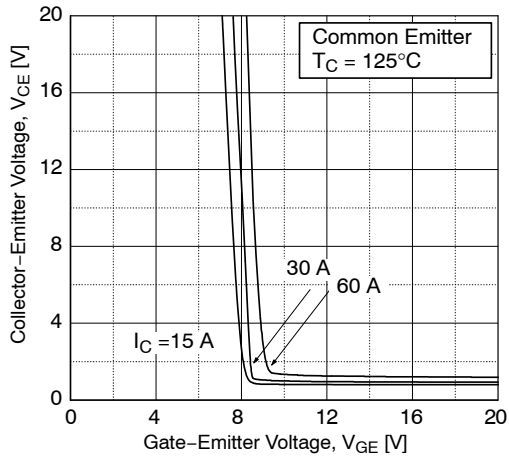


Figure 7. Saturation Voltage vs.  $V_{GE}$

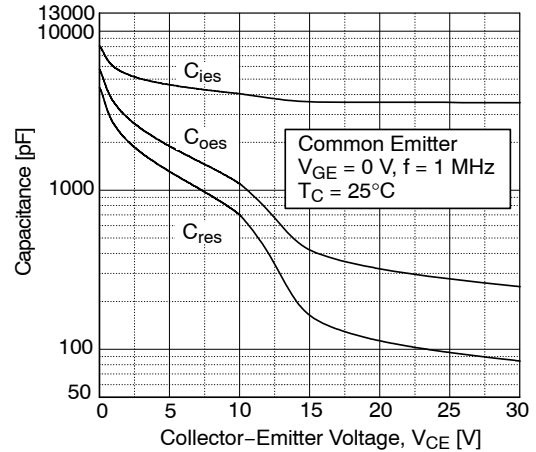


Figure 8. Capacitance Characteristic

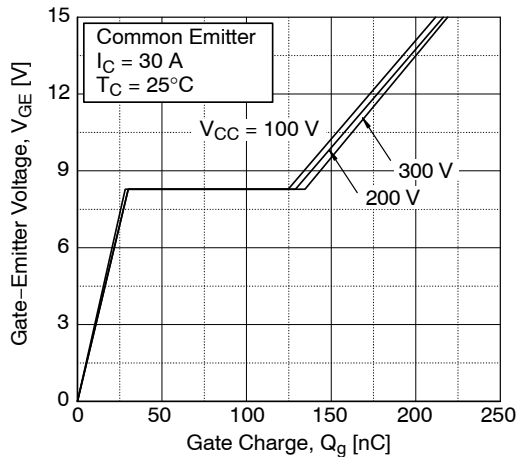


Figure 9. Gate Charge Characteristics

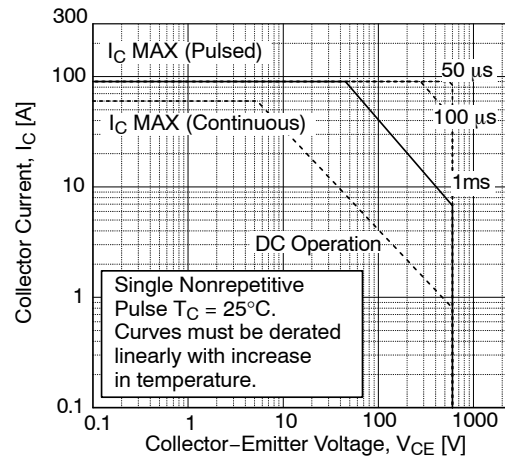


Figure 10. SOA Characteristics

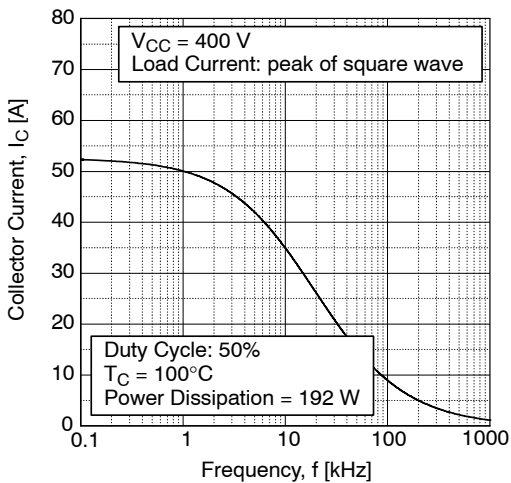


Figure 11. Load Current vs. Frequency

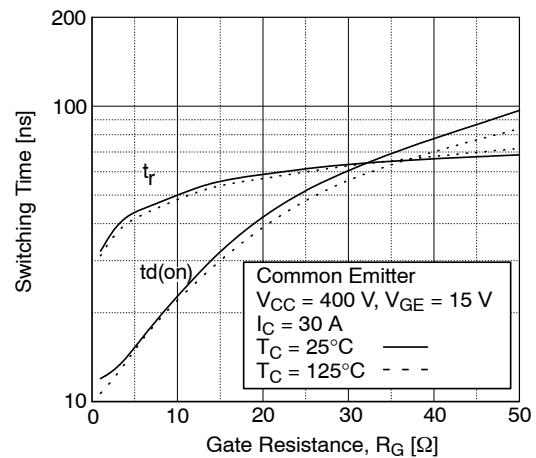


Figure 12. Turn-On Characteristics vs. Gate Resistance

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

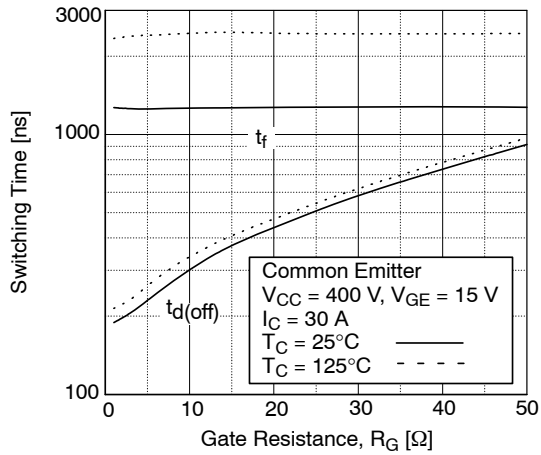


Figure 13. Turn-Off Characteristics vs. Gate Resistance

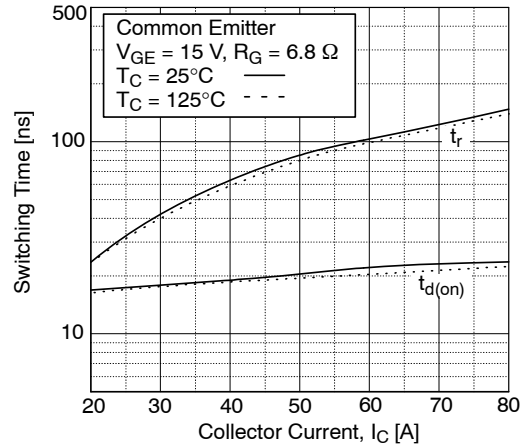


Figure 14. Turn-On Characteristics vs. Collector Current

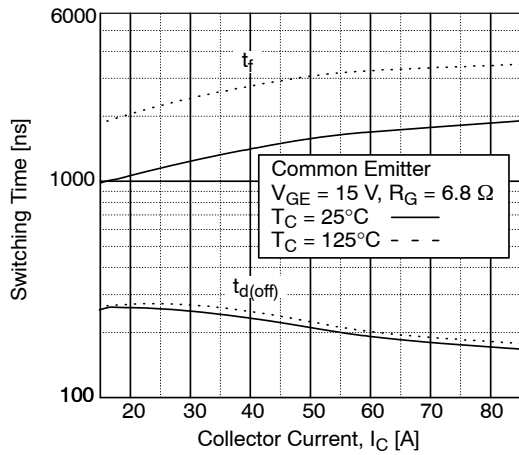


Figure 15. Turn-Off Characteristics vs. Collector Current

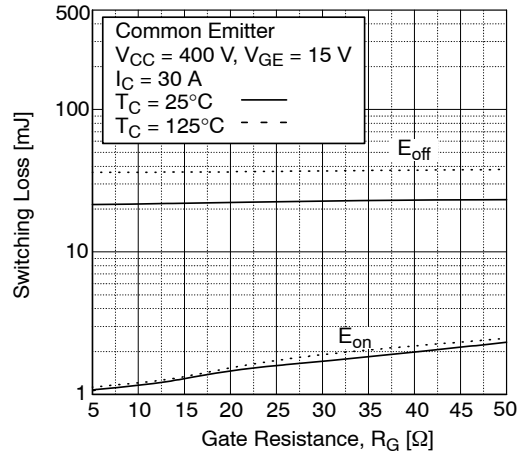


Figure 16. Switching Loss vs. Gate Resistance

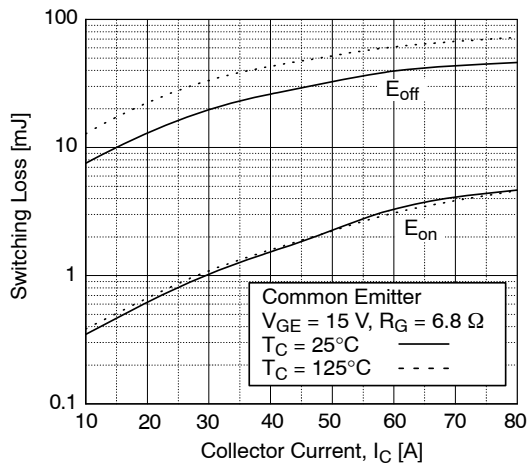


Figure 17. Switching Loss vs. Collector Current

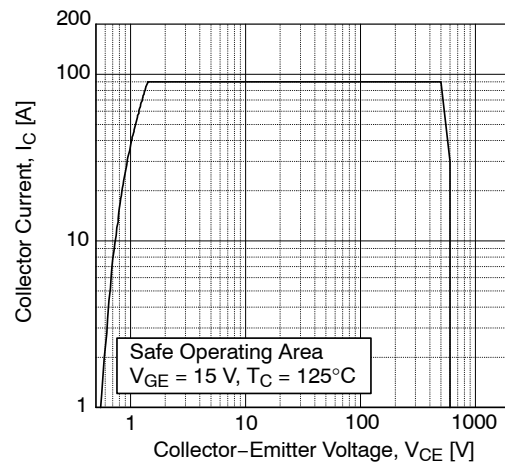
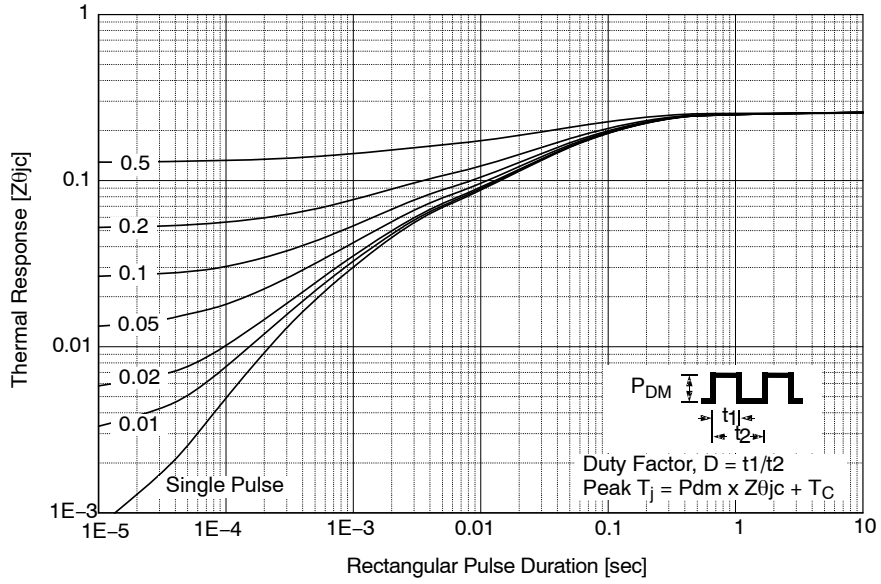


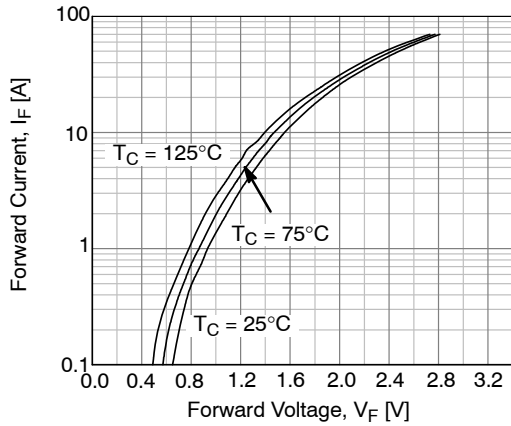
Figure 18. Turn-Off Switching SOA Characteristics

# FGH30N60LSD

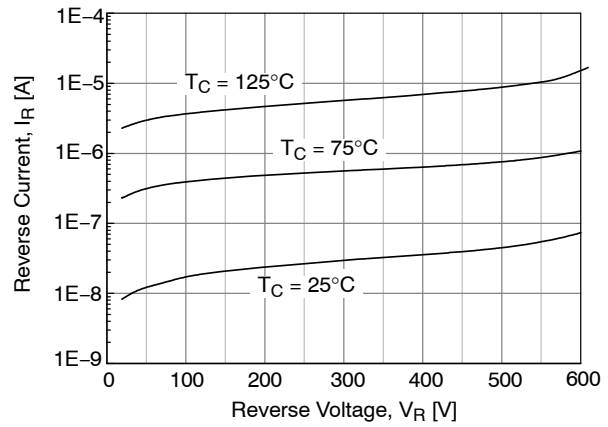
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



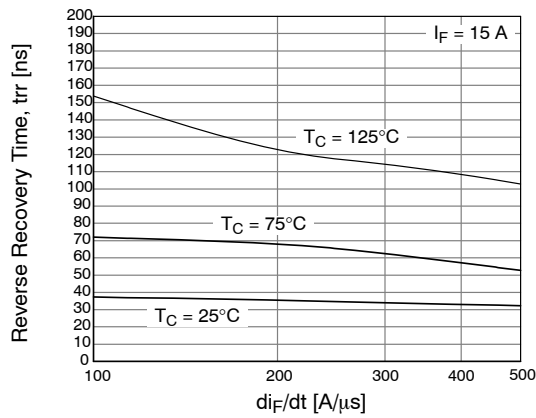
**Figure 19. Transient Thermal Impedance of IGBT**



**Figure 20. Forward Characteristics**



**Figure 21. Reverse Current**



**Figure 22. Reverse Recovery Time**

**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

DATE 31 JAN 2019



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

**GENERIC MARKING DIAGRAM\***



- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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<b>DESCRIPTION:</b>	<b>TO-247-3LD SHORT LEAD</b>	<b>PAGE 1 OF 1</b>

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