

# IGBT - Field Stop, Trench

1200 V, 25 A

## FGH25N120FTDS

### Description

Using advanced field stop trench technology, ON Semiconductor's 1200 V trench IGBTs offer the optimum performance for hard switching application such as solar inverter, UPS, welder and PFC applications.

### Features

- High Speed Switching
- Low Saturation Voltage:  $V_{CE(sat)} = 1.60 \text{ V @ } I_C = 25 \text{ A}$
- High Input Impedance
- These Device is Pb-Free and is RoHS Compliant

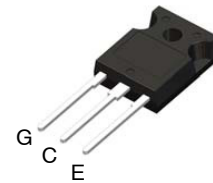
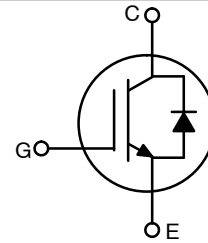
### Applications

- Solar Inverter, UPS, Welder, PFC



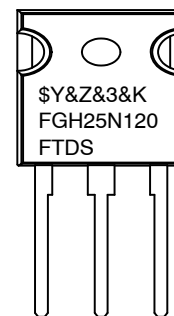
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TO-247-3  
CASE 340CK

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
&Z = Assembly Plant Code  
&3 = Numeric Date Code  
&K = Lot Code  
FGH25N120FTDS = Specific Device Code

### ORDERING INFORMATION

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

# FGH25N120FTDS

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

Description		Symbol	Rating	Unit
Collector to Emitter Voltage		V <sub>CES</sub>	1200	V
Gate to Emitter Voltage		V <sub>GES</sub>	±25	V
Collector Current	T <sub>C</sub> = 25°C	I <sub>C</sub>	50	A
Collector Current	T <sub>C</sub> = 100°C		25	A
Pulsed Collector Current		I <sub>CM</sub> (Note 1)	75	A
Diode Forward Current	T <sub>C</sub> = 25°C	I <sub>F</sub>	50	A
Diode Forward Current	T <sub>C</sub> = 100°C		25	A
Diode Maximum Forward Current		I <sub>FM</sub>	75	A
Maximum Power Dissipation	T <sub>C</sub> = 25°C	P <sub>D</sub>	313	W
Maximum Power Dissipation	T <sub>C</sub> = 100°C		125	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)	-	0.4	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub> (Diode)	-	1.25	°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
FGH25N120FTDS	FGH25N120FTDS	TO-247 (Pb-Free)	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	1200	-	-	V
Collector Cut-Off Current	I <sub>CES</sub>	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V	-	-	1	mA
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> = 25 mA, V <sub>CE</sub> = V <sub>GE</sub>	3.5	6	7.5	V
Collector to Emitter Saturation Voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 25 A, V <sub>GE</sub> = 15 V	-	1.6	2	V
		I <sub>C</sub> = 25 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 125°C	-	1.92	-	V

# FGH25N120FTDS

## 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	$C_{ies}$	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	–	4090	–	pF
Output Capacitance	$C_{oes}$		–	135	–	pF
Reverse Transfer Capacitance	$C_{res}$		–	75	–	pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{ V}, I_C = 25\text{ A},$ $R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$	–	26	35	ns
Rise Time	$t_r$		–	41	53	ns
Turn-Off Delay Time	$t_{d(off)}$		–	151	196	ns
Fall Time	$t_f$		–	102	132	ns
Turn-On Switching Loss	$E_{on}$		–	1.42	1.84	mJ
Turn-Off Switching Loss	$E_{off}$		–	1.16	1.5	mJ
Total Switching Loss	$E_{ts}$		–	2.58	3.34	mJ
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 600\text{ V}, I_C = 25\text{ A},$ $R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 125^\circ\text{C}$	–	22	–	ns
Rise Time	$t_r$		–	41	–	ns
Turn-Off Delay Time	$t_{d(off)}$		–	163	–	ns
Fall Time	$t_f$		–	136	–	ns
Turn-On Switching Loss	$E_{on}$		–	2.04	–	mJ
Turn-Off Switching Loss	$E_{off}$		–	1.58	–	mJ
Total Switching Loss	$E_{ts}$		–	3.62	–	mJ
Total Gate Charge	$Q_g$	$V_{CE} = 600\text{ V}, I_C = 25\text{ A}, V_{GE} = 15\text{ V}$	–	169	225	nC
Gate to Emitter Charge	$Q_{ge}$		–	33	44	nC
Gate to Collector Charge	$Q_{gc}$		–	78	104	nC

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Diode Forward Voltage	$V_{FM}$	$I_F = 25\text{ A}$	$T_C = 25^\circ\text{C}$	–	2.5	3.5	V
			$T_C = 125^\circ\text{C}$	–	2.3	–	
Diode Reverse Recovery Time	$t_{rr}$	$I_F = 25\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	–	411	535	ns
			$T_C = 125^\circ\text{C}$	–	496	–	
Diode Peak Reverse Recovery Current	$I_{rr}$		$T_C = 25^\circ\text{C}$	–	5.2	6.8	A
			$T_C = 125^\circ\text{C}$	–	6.9	–	
Diode Reverse Recovery Charge	$Q_{rr}$		$T_C = 25^\circ\text{C}$	–	1.1	1.82	$\mu\text{C}$
			$T_C = 125^\circ\text{C}$	–	1.7	–	

TYPICAL PERFORMANCE CHARACTERISTICS

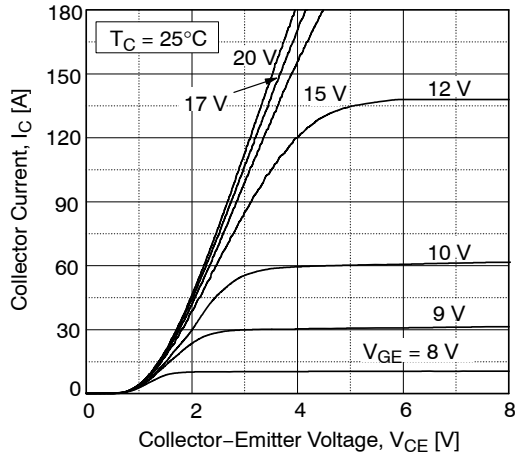


Figure 1. Typical Output Characteristics

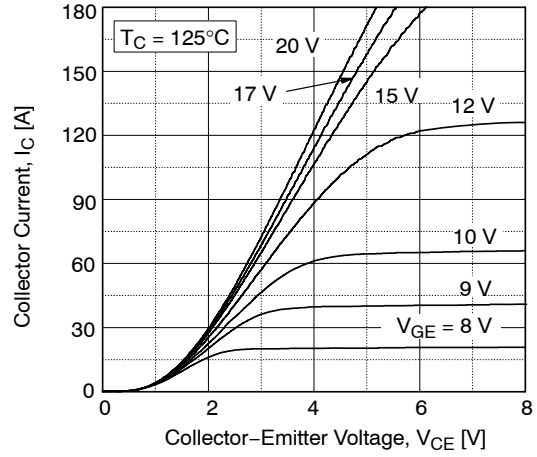


Figure 2. Typical Output Characteristics

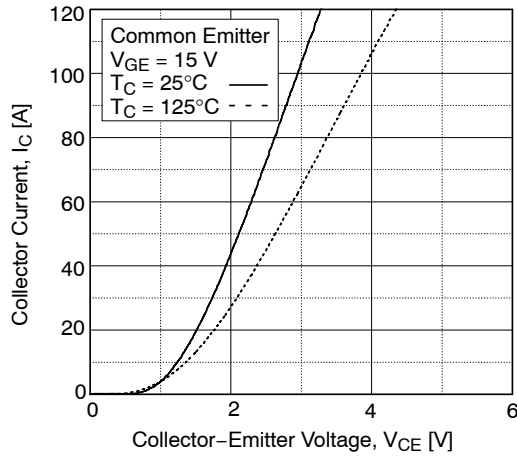


Figure 3. Typical Saturation Voltage Characteristics

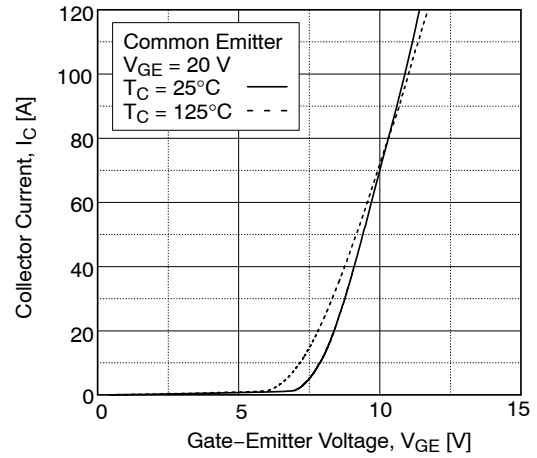


Figure 4. Transfer Characteristics

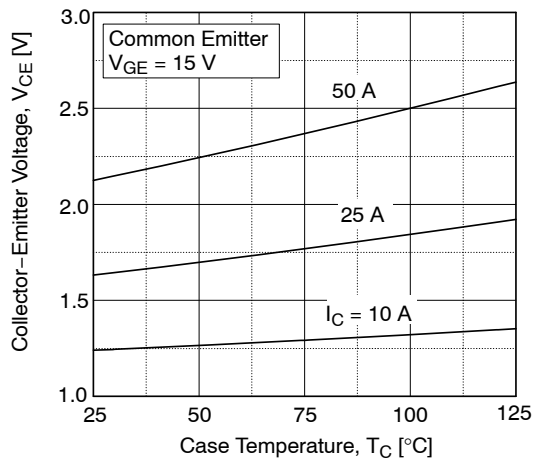


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

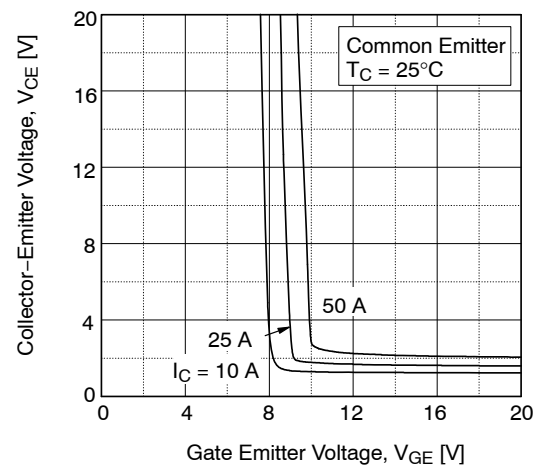


Figure 6. Saturation Voltage vs Vge

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

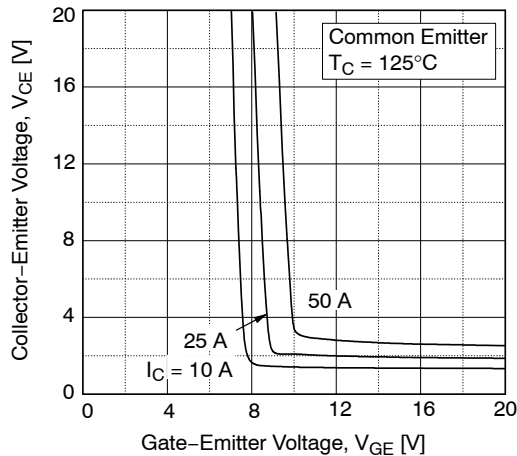


Figure 7. Saturation Voltage vs.  $V_{GE}$

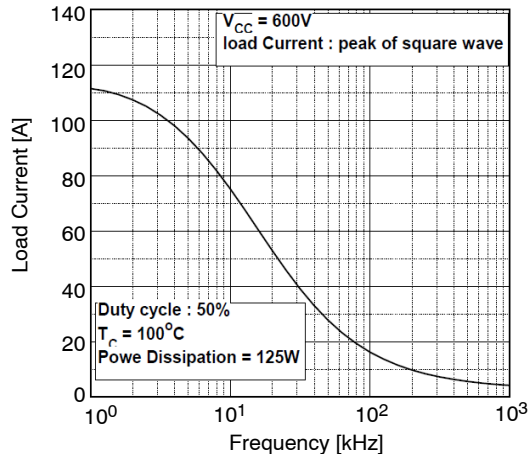


Figure 8. Load Current vs. Frequency

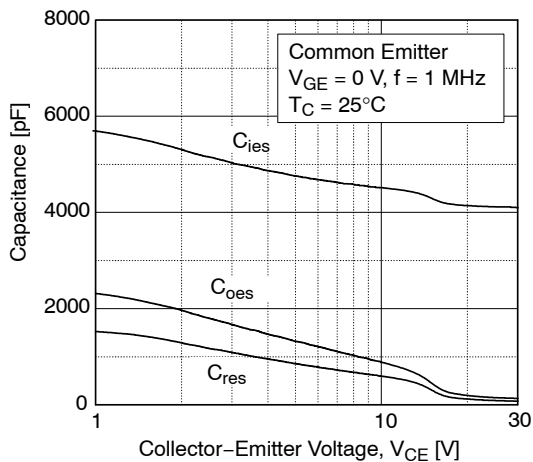


Figure 9. Capacitance Characteristics

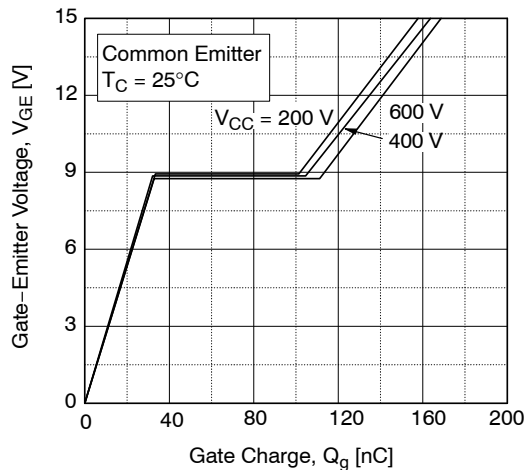


Figure 10. Gate Charge Characteristics

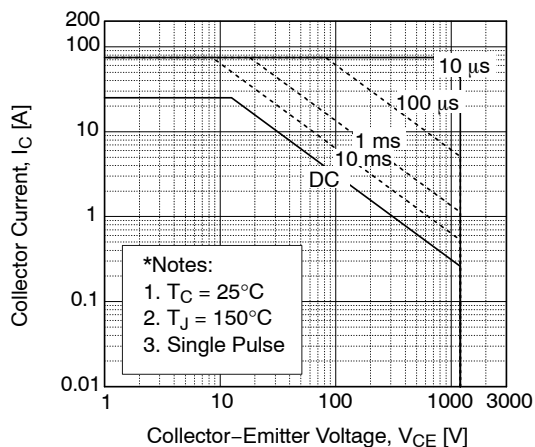


Figure 11. SOA Characteristics Gate Resistance

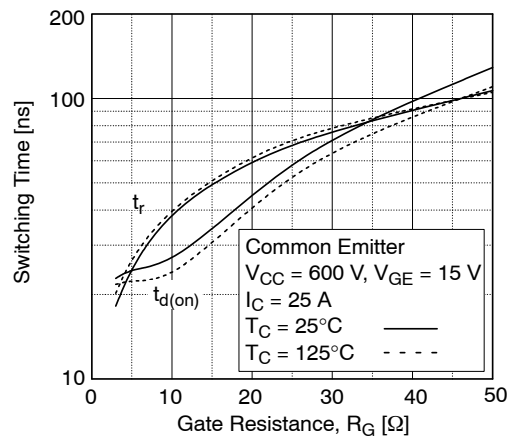


Figure 12. Turn-On Characteristics vs. Gate Resistance

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

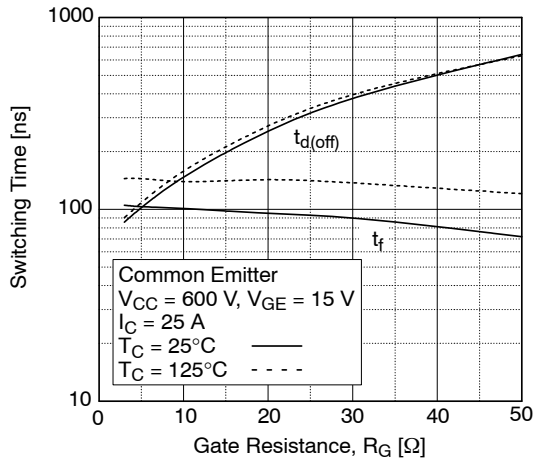


Figure 13. Turn-Off Characteristics vs. Gate Resistance

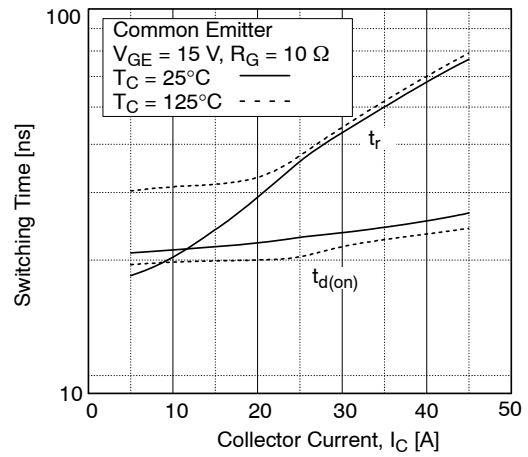


Figure 14. Turn-on Characteristics vs. Collector Current

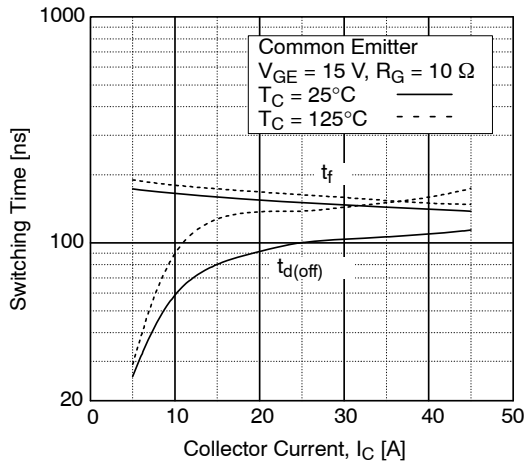


Figure 15. Turn-off Characteristics vs. Collector Current

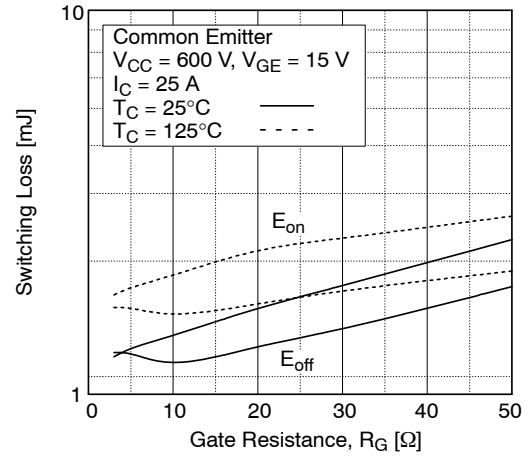


Figure 16. Switching Loss vs. Gate Resistance

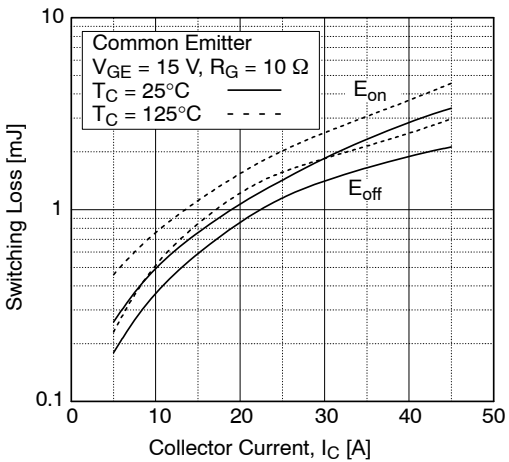


Figure 17. Switching Loss vs. Collector Current

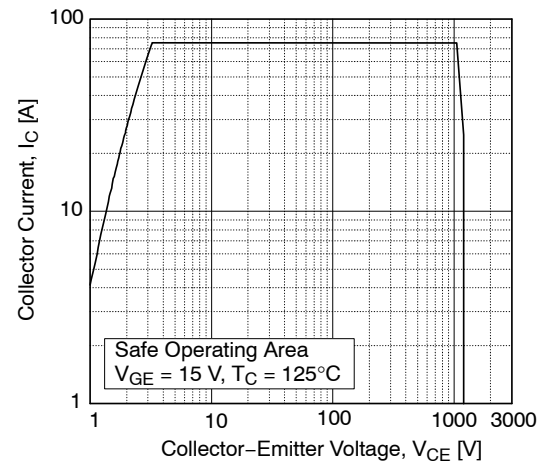


Figure 18. Turn-off Switching SOA Characteristics

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## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

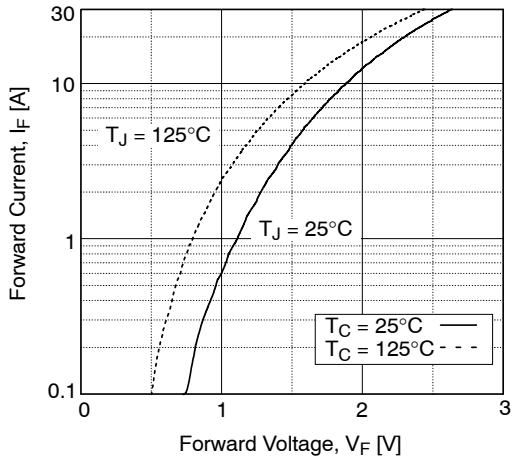


Figure 19. Forward Characteristics

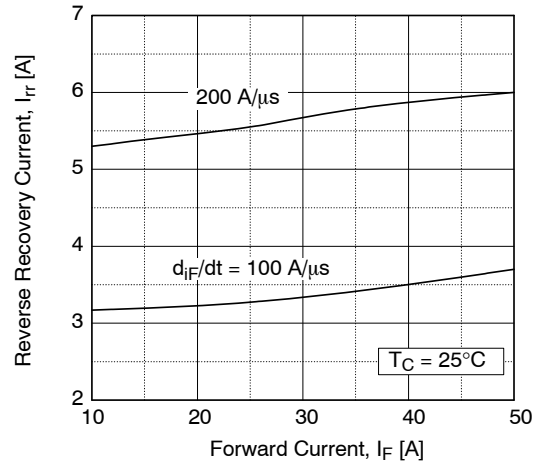


Figure 20. Reverse Recovery Current

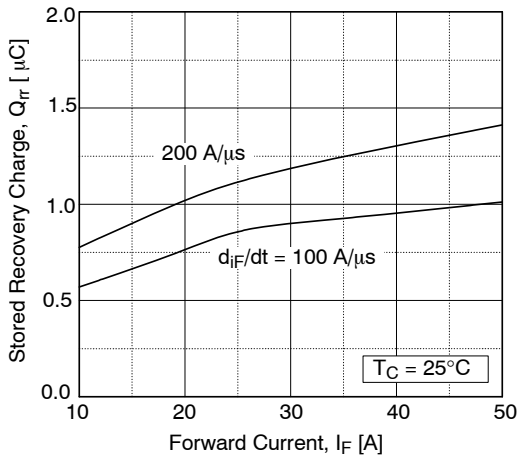


Figure 21. Stored Charge

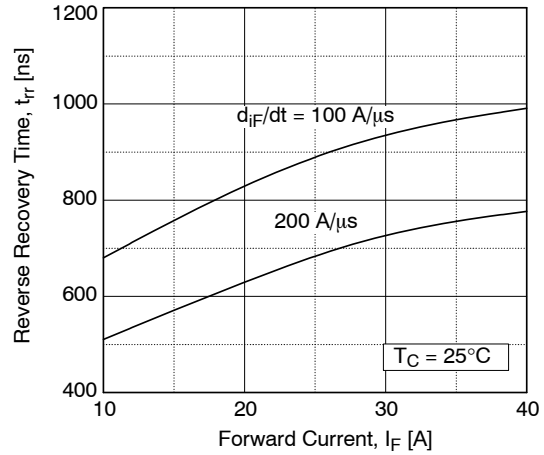


Figure 22. Reverse Recovery Time

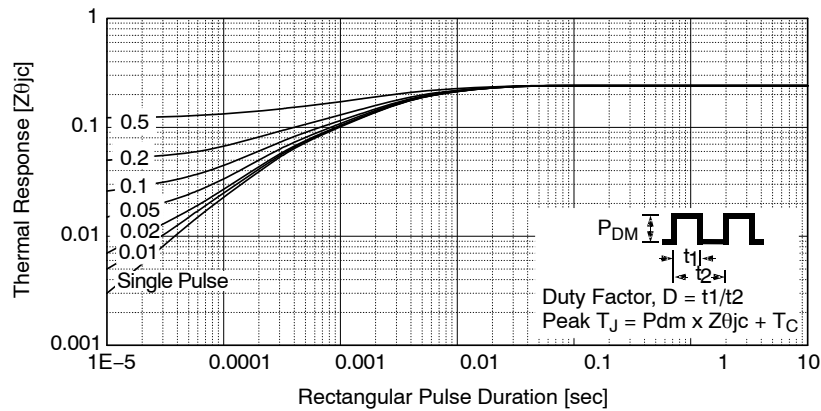


Figure 23. Transient Thermal Impedance of IGBT



**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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