



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

# FGPF10N60UNDF

## 600 V, 10 A Short Circuit Rated IGBT

### Features

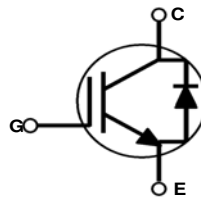
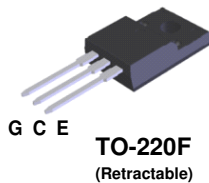
- Short Circuit Rated 10us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

### General Description

Using advanced NPT IGBT technology, Fairchild's the NPT IGBTs offer the optimum performance for low-power inverter-driven applications where low-losses and short-circuit ruggedness features are essential, such as sewing machine, CNC, motor control and home appliances.

### Applications

- Sewing Machine, CNC, Home Appliances, Motor Control



### Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
$V_{CES}$	Collector to Emitter Voltage	600	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	20	A
	Collector Current @ $T_C = 100^\circ\text{C}$	10	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	30	A
$I_F$	Diode Forward Current @ $T_C = 25^\circ\text{C}$	10	A
	Diode Forward Current @ $T_C = 100^\circ\text{C}$	5	A
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	42	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	17	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$

**Notes:**

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

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case	-	3.0	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction to Case	-	5.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)	-	62.5	$^\circ\text{C}/\text{W}$

**Notes:**

2: Mountde on 1" square PCB (FR4 or G-10 material)



## Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGPF10N60UNDF	FGPF10N60UNDF	TO-220F	-	-	50ea

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV <sub>CES</sub>	Collector to Emitter Breakdown Voltage	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 250 μA	600	-	-	V
I <sub>CES</sub>	Collector Cut-Off Current	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0 V	-	-	1	mA
I <sub>GES</sub>	G-E Leakage Current	V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0 V	-	-	±10	μA
On Characteristics						
V <sub>GE(th)</sub>	G-E Threshold Voltage	I <sub>C</sub> = 10 mA, V <sub>CE</sub> = V <sub>GE</sub>	5.5	6.8	8.5	V
V <sub>CE(sat)</sub>	Collector to Emitter Saturation Voltage	I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15 V	-	2	2.45	V
		I <sub>C</sub> = 10 A, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 125°C	-	2.3	-	V
Dynamic Characteristics						
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 30 V, V <sub>GE</sub> = 0 V, f = 1 MHz	-	517	-	pF
C <sub>oes</sub>	Output Capacitance		-	65	-	pF
C <sub>res</sub>	Reverse Transfer Capacitance		-	20	-	pF
Switching Characteristics						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 400 V, I <sub>C</sub> = 10 A, R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 25°C	-	8.0	-	ns
t <sub>r</sub>	Rise Time		-	6.3	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	52.2	-	ns
t <sub>f</sub>	Fall Time		-	19.1	24.8	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.15	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.05	-	mJ
E <sub>ts</sub>	Total Switching Loss		-	0.2	-	mJ
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>CC</sub> = 400 V, I <sub>C</sub> = 10 A, R <sub>G</sub> = 10 Ω, V <sub>GE</sub> = 15 V, Inductive Load, T <sub>C</sub> = 125°C	-	8.1	-	ns
t <sub>r</sub>	Rise Time		-	7.3	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	55.1	-	ns
t <sub>f</sub>	Fall Time		-	34.2	-	ns
E <sub>on</sub>	Turn-On Switching Loss		-	0.22	-	mJ
E <sub>off</sub>	Turn-Off Switching Loss		-	0.08	-	mJ
E <sub>ts</sub>	Total Switching Loss		-	0.3	-	mJ
T <sub>sc</sub>	Short Circuit Withstand Time	V <sub>CC</sub> = 350 V, R <sub>G</sub> = 100 Ω, V <sub>GE</sub> = 15 V, T <sub>C</sub> = 150°C	10	-	-	μs

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
$Q_g$	Total Gate Charge	$V_{CE} = 400\text{ V}, I_C = 10\text{ A},$ $V_{GE} = 15\text{ V}$	-	37		nC
$Q_{ge}$	Gate to Emitter Charge		-	5		nC
$Q_{gc}$	Gate to Collector Charge		-	21		nC

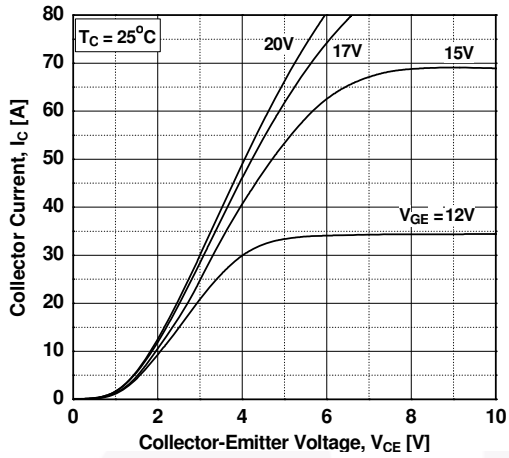
**Electrical Characteristics of the Diode**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit	
$V_{FM}$	Diode Forward Voltage	$I_F = 10\text{ A}$	$T_C = 25^\circ\text{C}$	-	1.8	2.2	V
			$T_C = 125^\circ\text{C}$	-	1.7		
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 10\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}$	$T_C = 25^\circ\text{C}$	-	37.7		ns
			$T_C = 125^\circ\text{C}$	-	78.9		
$Q_{rr}$	Diode Reverse Recovery Charge		$T_C = 25^\circ\text{C}$	-	75		nC
			$T_C = 125^\circ\text{C}$	-	221		

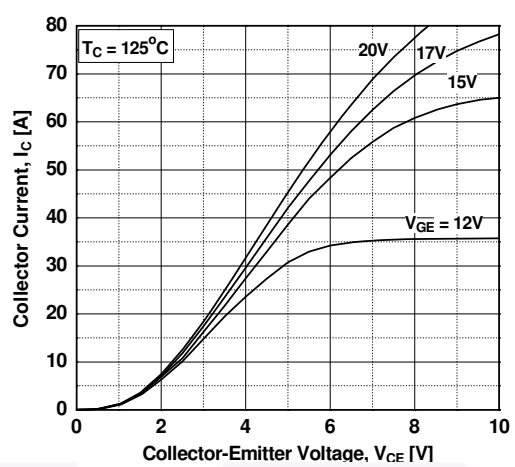


## Typical Performance Characteristics

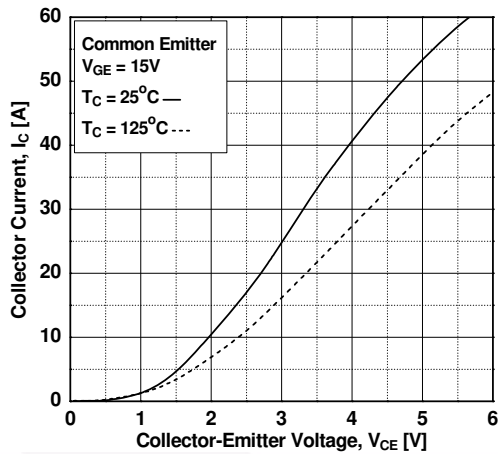
**Figure 1. Typical Output Characteristics**



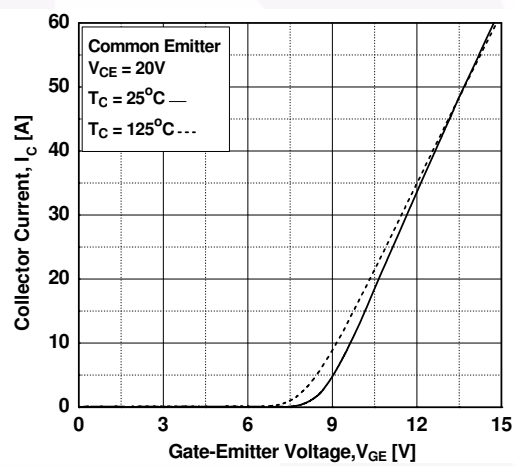
**Figure 2. Typical Output Characteristics**



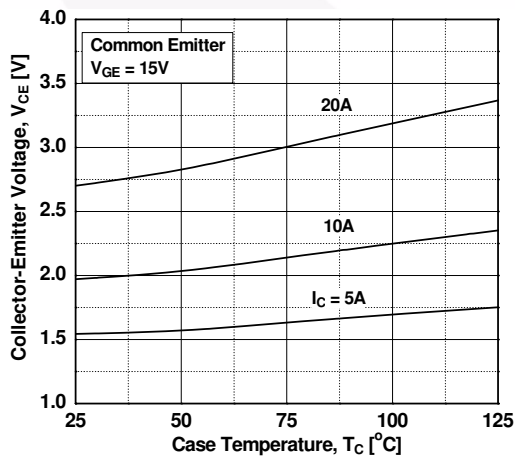
**Figure 3. Typical Saturation Voltage Characteristics**



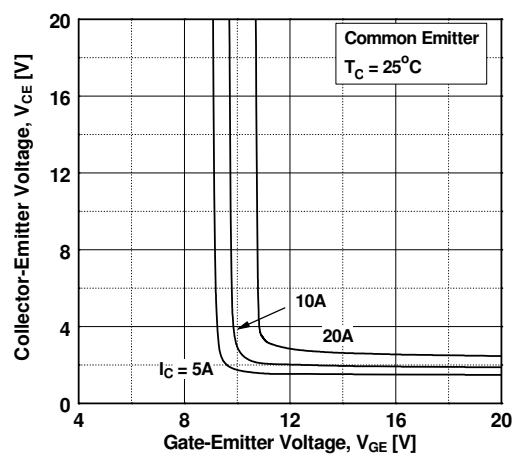
**Figure 4. Transfer Characteristics**



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



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



## Typical Performance Characteristics

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

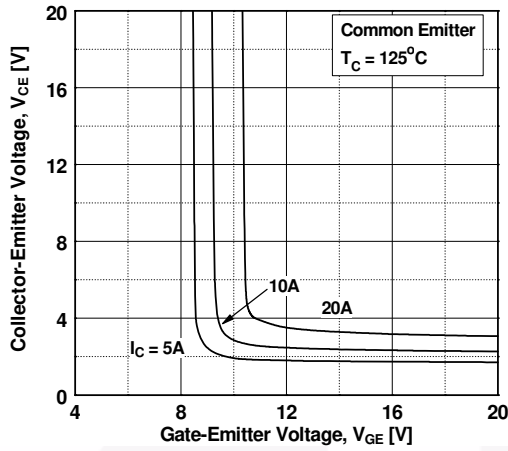


Figure 8. Capacitance Characteristics

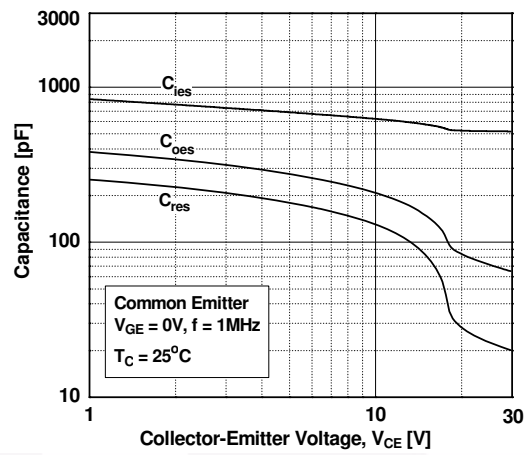


Figure 9. Gate charge Characteristics

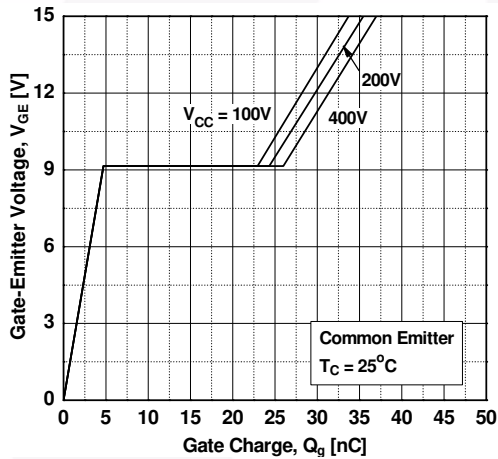


Figure 10. SOA Characteristics

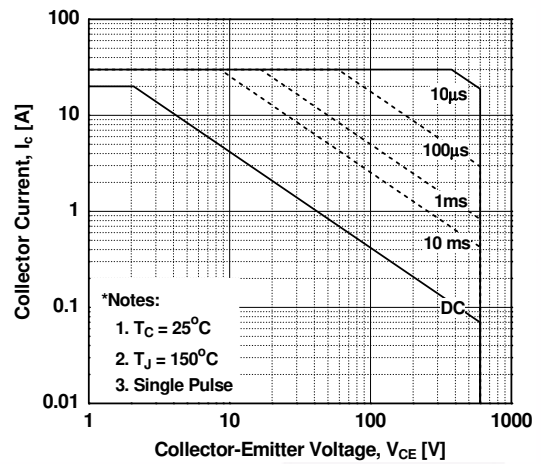


Figure 11. Turn-on Characteristics vs. Gate Resistance

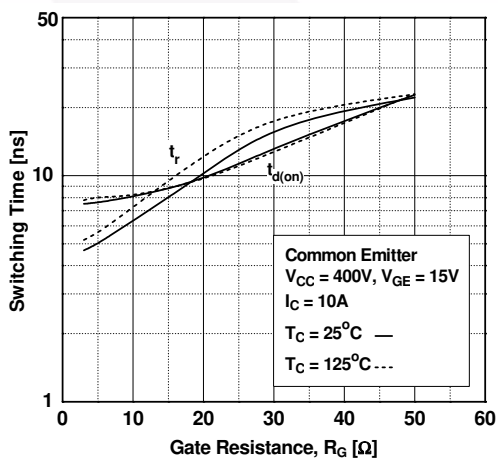
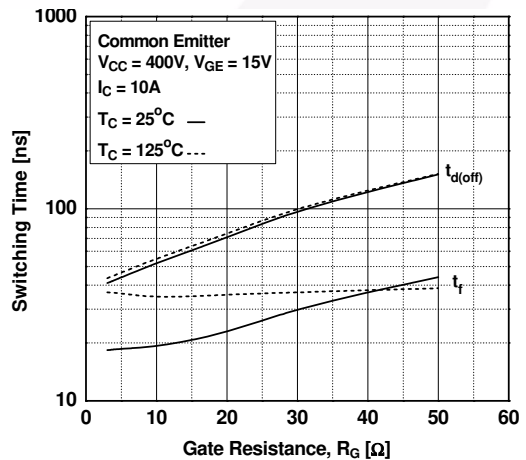
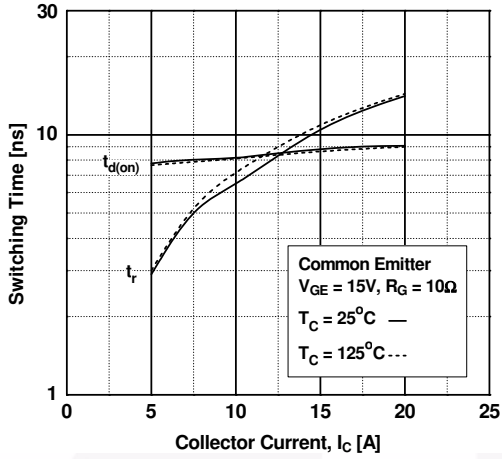


Figure 12. Turn-off Characteristics vs. Gate Resistance

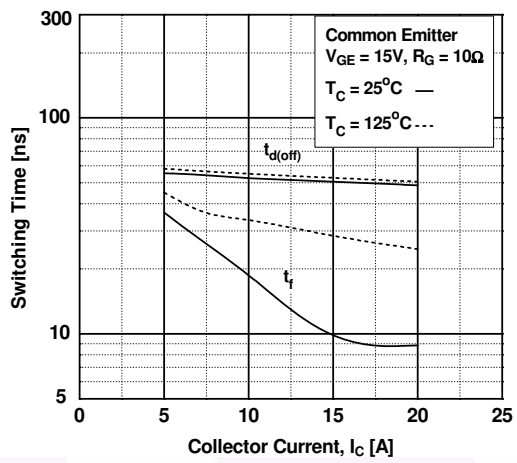


### Typical Performance Characteristics

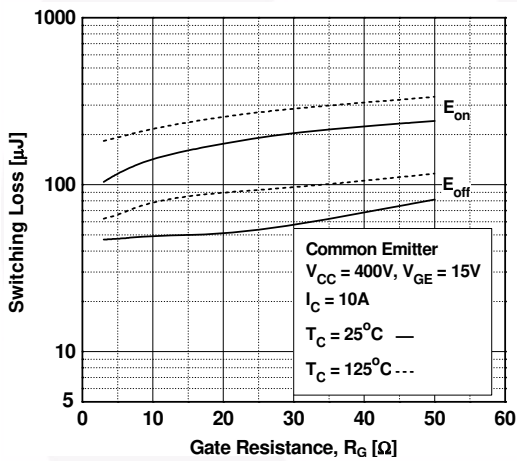
**Figure 13. Turn-on Characteristics vs. Collector Current**



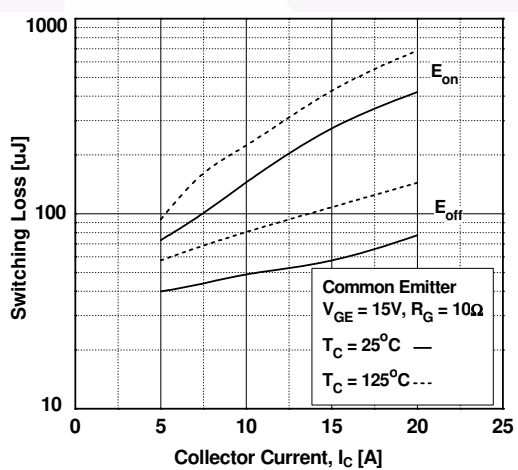
**Figure 14. Turn-off Characteristics vs. Collector Current**



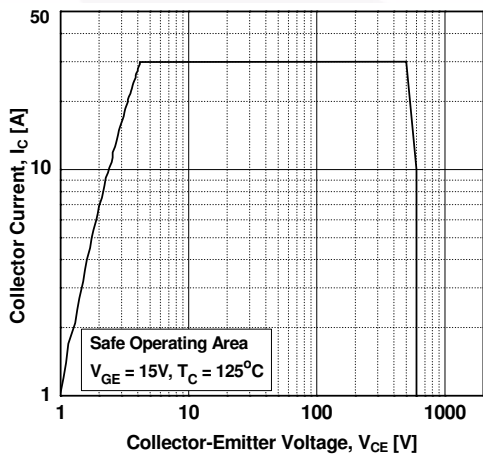
**Figure 15. Switching Loss vs. Gate Resistance**



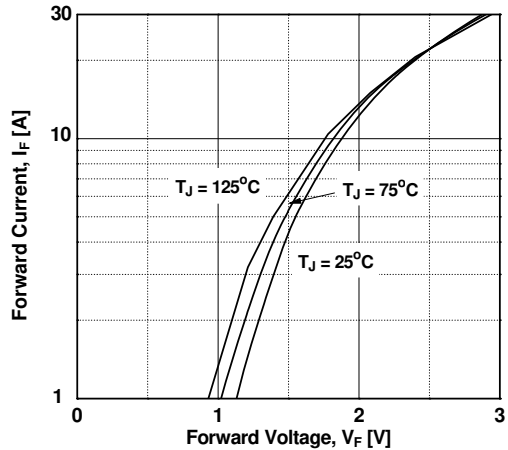
**Figure 16. Switching Loss vs. Collector Current**



**Figure 17. Turn off Switching SOA Characteristics**



**Figure 18. Forward Characteristics**





### Typical Performance Characteristics

Figure 19. Reverse Current

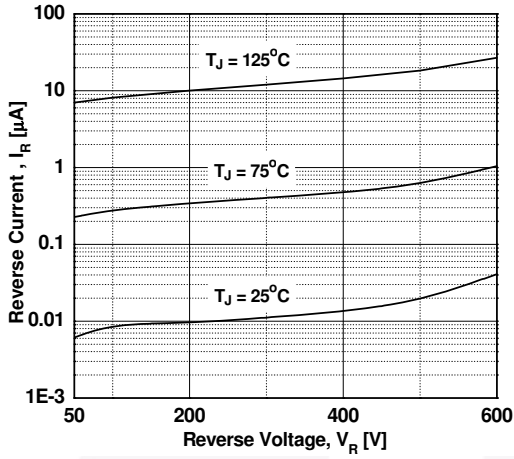


Figure 20. Stored Charge

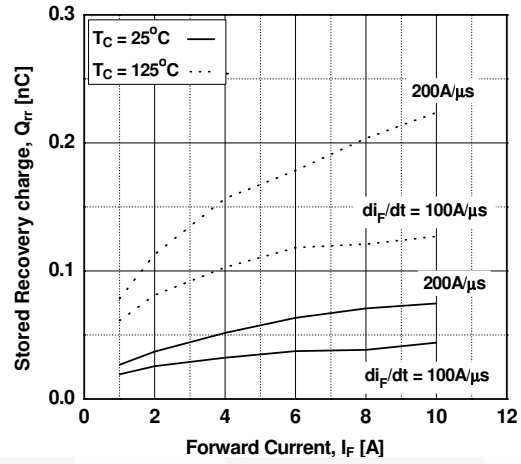


Figure 21. Reverse Recovery Time

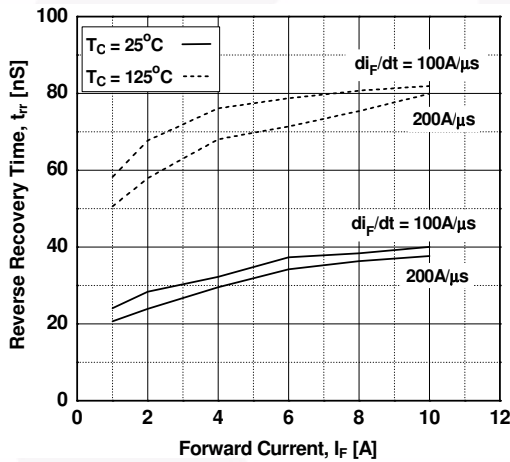
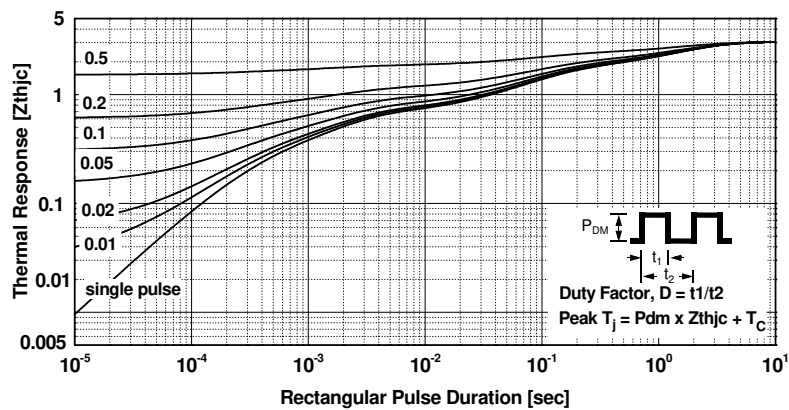


Figure 22. Transient Thermal Impedance of IGBT







ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative