



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at

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. 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.



FGY160T65SPD_F085

650V, 160A Field Stop Trench IGBT With Soft Fast Recovery Diode

Features

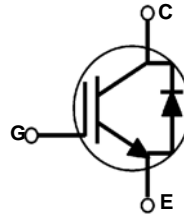
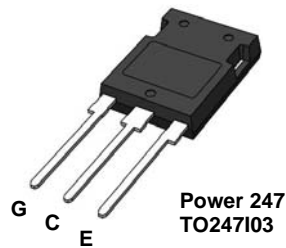
- Automotive Qualified
- Very low saturation voltage : $V_{CE(sat)} = 1.6 \text{ V(Typ.)} @ I_C = 160 \text{ A}$
- Maximum junction temperature : $T_J = 175 \text{ }^\circ\text{C}$
- Positive temperature Co-efficient
- Tight parameter distribution
- High input impedance
- 100% of the parts are dynamically tested
- Short circuit ruggedness $> 6 \mu\text{s} @ 25 \text{ }^\circ\text{C}$
- Copacked with soft, fast recovery Extremerfast diode

Benefits

- Very Low conduction and switching losses for a high efficiency operation in various applications
- Rugged transient reliability
- Outstanding parallel operation performance with balance current sharing
- Low EMI

Applications

- Traction inverter for HEV/EV
- Auxiliary DC/AC converter
- Motor drives
- Other power-train applications requiring high power switch



Absolute Maximum Ratings

Symbol	Description	Ratings	Units	
V_{CES}	Collector to Emitter Voltage	650	V	
V_{GES}	Gate to Emitter Voltage	± 20	V	
I_C	Collector Current (Note1)	@ $T_C = 25 \text{ }^\circ\text{C}$	240	A
	Collector Current	@ $T_C = 100 \text{ }^\circ\text{C}$	220	A
$I_{Nominal}$	Nominal Current	160	A	
I_{CM}	Pulsed Collector Current	480	A	
I_F	Diode Forward Current (Note1)	@ $T_C = 25 \text{ }^\circ\text{C}$	240	A
	Diode Forward Current	@ $T_C = 100 \text{ }^\circ\text{C}$	188	A
P_D	Maximum Power Dissipation	@ $T_C = 25 \text{ }^\circ\text{C}$	882	W
	Maximum Power Dissipation	@ $T_C = 100 \text{ }^\circ\text{C}$	441	W
SCWT	Short Circuit Withstand Time	@ $T_C = 25 \text{ }^\circ\text{C}$	6	μs
dV/dt	Voltage Transient Ruggedness (Note2)	10	V/ns	
T_J	Operating Junction Temperature	-55 to +175	$^\circ\text{C}$	
T_{stg}	Storage Temperature Range	-55 to +175	$^\circ\text{C}$	
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$	

Notes:
 1: Limited by bondwire
 2: $V_{CC} = 400 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_{CE} = 480 \text{ A}$, Inductive Load

FGY160T65SPD_F085 650V 160A Field Stop Trench IGBT With Soft Fast Recovery Diode

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case	-	0.17	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction to Case	-	0.32	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^{\circ}\text{C}/\text{W}$

Package Marking and Ordering Information

Device Marking	Device	Package	Packing Type	Qty per Tube
FGY160T65SPD	FGY160T65SPD_F085	TP-247	Tube	30ea

For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{V}, I_C = 1\text{mA}$	650	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{V}, I_C = 1\text{mA}$	-	0.6	-	$\text{V}/^{\circ}\text{C}$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{V}$	-	-	40	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{V}$	-	-	± 250	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 160\text{mA}, V_{CE} = V_{GE}$	4.3	5.3	6.3	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 160\text{A}, V_{GE} = 15\text{V}$	-	1.6	2.05	V
		$I_C = 160\text{A}, V_{GE} = 15\text{V}, T_J = 175^{\circ}\text{C}$	-	2.15	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	6710	-	pF
C_{oes}	Output Capacitance		-	450	-	pF
C_{res}	Reverse Transfer Capacitance		-	55	-	pF
R_G	Internal Gate Resistance	$f = 1\text{MHz}$	-	3	-	Ω
Switching Characteristics						
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{V}, I_C = 160\text{A}, R_G = 5\Omega, V_{GE} = 15\text{V}, \text{Inductive Load}, T_J = 25^{\circ}\text{C}$	-	53	-	ns
T_r	Rise Time		-	197	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	98	-	ns
T_f	Fall Time		-	141	-	ns
E_{on}	Turn-On Switching Loss		-	12.4	-	mJ
E_{off}	Turn-Off Switching Loss		-	5.7	-	mJ
E_{ts}	Total Switching Loss		-	18.1	-	mJ
$T_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400\text{V}, I_C = 160\text{A}, R_G = 5\Omega, V_{GE} = 15\text{V}, \text{Inductive Load}, T_J = 175^{\circ}\text{C}$	-	52	-	ns
T_r	Rise Time		-	236	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	104	-	ns
T_f	Fall Time		-	204	-	ns
E_{on}	Turn-On Switching Loss		-	21	-	mJ
E_{off}	Turn-Off Switching Loss		-	8.5	-	mJ
E_{ts}	Total Switching Loss		-	29.5	-	mJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Units
Q_g	Total Gate Charge	$V_{CE} = 400V, I_C = 160A,$ $V_{GE} = 15V$	-	163	245	nC
Q_{ge}	Gate to Emitter Charge		-	50	-	nC
Q_{gc}	Gate to Collector Charge		-	49	-	nC

Electrical Characteristics of the Diode $T_J = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Units	
V_{FM}	Diode Forward Voltage	$I_F = 160A$	$T_J = 25^\circ C$	-	1.4	1.7	V
			$T_J = 175^\circ C$	-	1.35	-	
E_{rec}	Reverse Recovery Energy	$V_{CE} = 400V, I_F = 160A,$ $di_F/dt = 1000A/\mu s$	$T_J = 25^\circ C$	-	598	-	μJ
			$T_J = 175^\circ C$	-	4000	-	
T_{rr}	Diode Reverse Recovery Time	$V_{CE} = 400V, I_F = 160A,$ $di_F/dt = 1000A/\mu s$	$T_J = 25^\circ C$	-	132	-	ns
			$T_J = 175^\circ C$	-	245	-	
Q_{rr}	Diode Reverse Recovery Charge	$V_{CE} = 400V, I_F = 160A,$ $di_F/dt = 1000A/\mu s$	$T_J = 25^\circ C$	-	3.3	-	μC
			$T_J = 175^\circ C$	-	12.5	-	

Typical Performance Characteristics

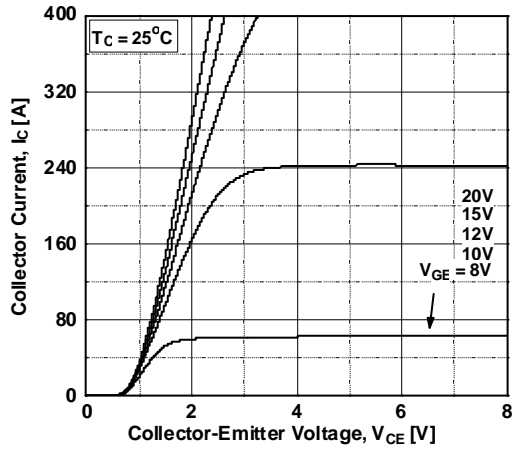


Figure 1. Typical Output Characteristics

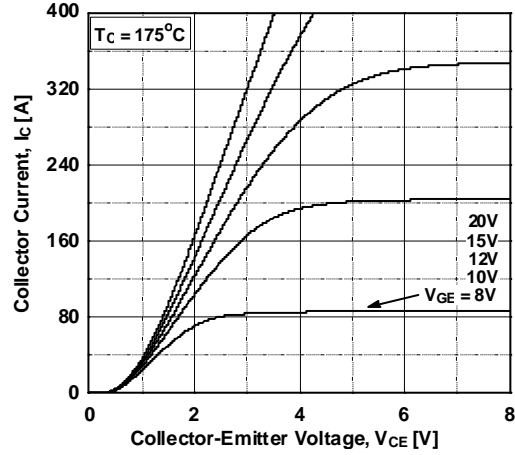


Figure 2. Typical Output Characteristics

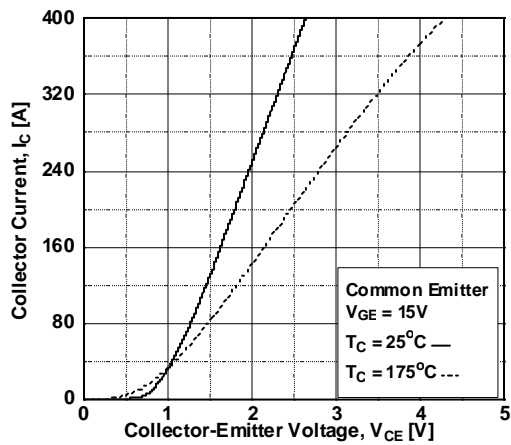


Figure 3. Typical Saturation Voltage

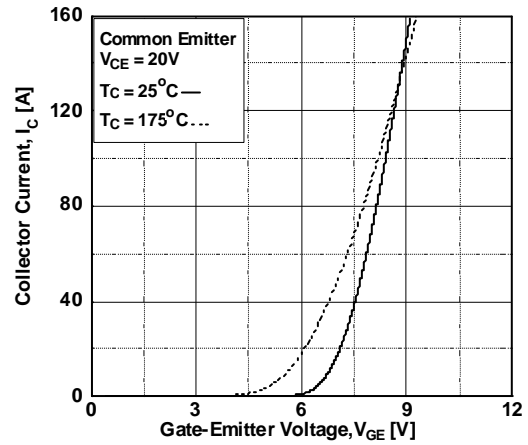


Figure 4. Transfer Characteristics

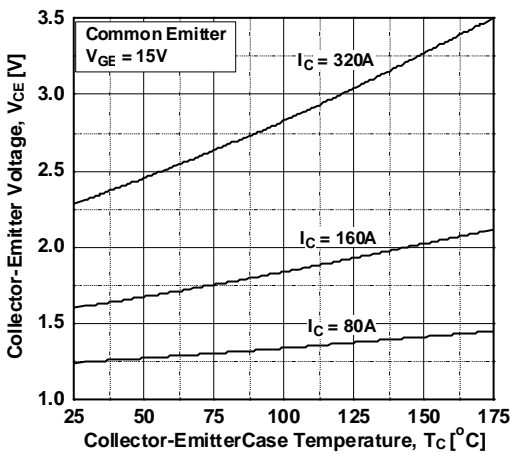


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

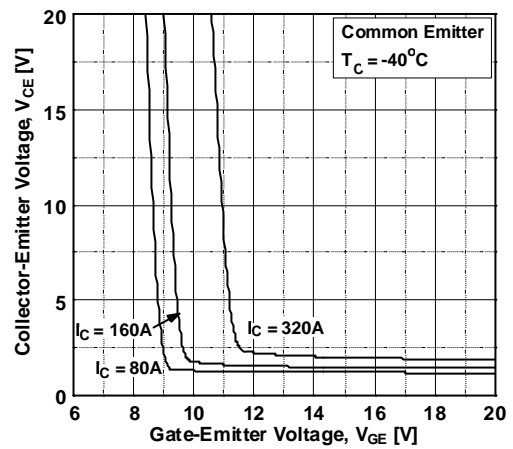


Figure 6. Saturation Voltage vs. VGE

Typical Performance Characteristics

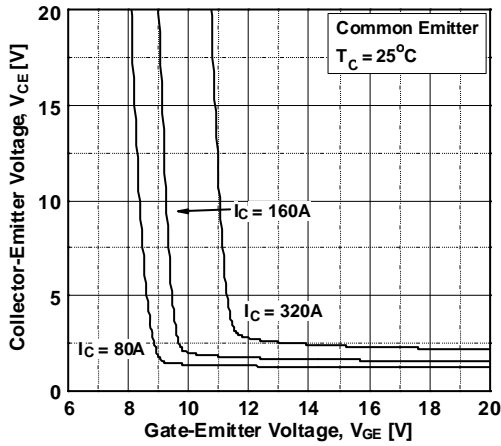


Figure 7. Saturation Voltage vs. VGE

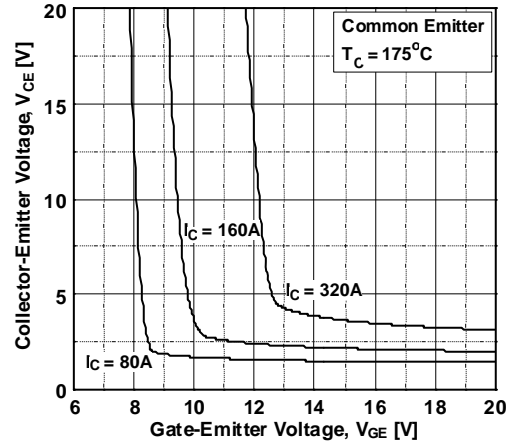


Figure 8. Saturation Voltage vs. VGE

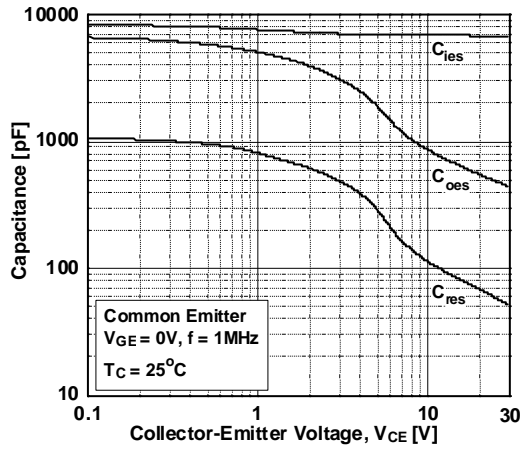


Figure 9. Capacitance Characteristics

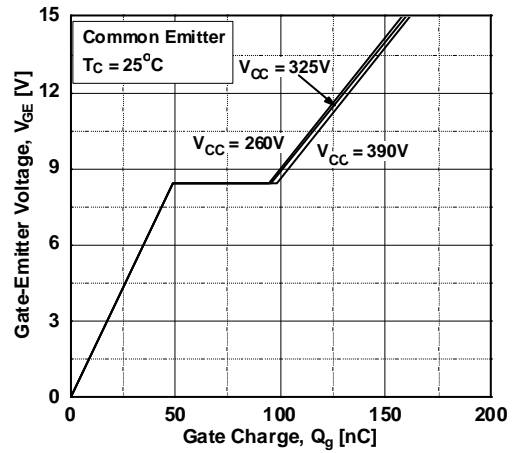


Figure 10. Gate Charge Characteristics

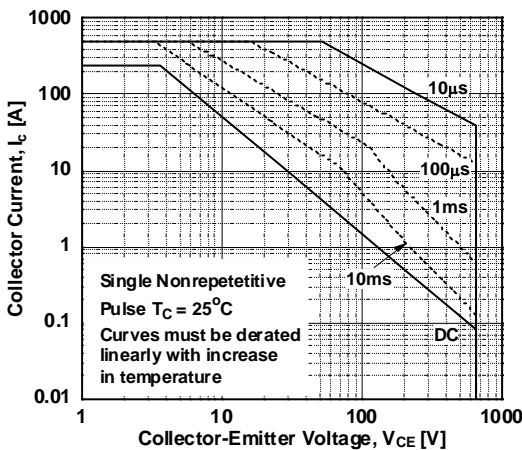


Figure 11. SOA Characteristics

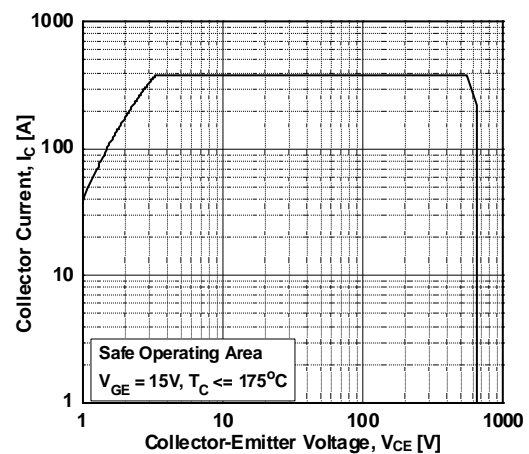


Figure 12. Turn off Switching SOA Characteristics

Typical Performance Characteristics

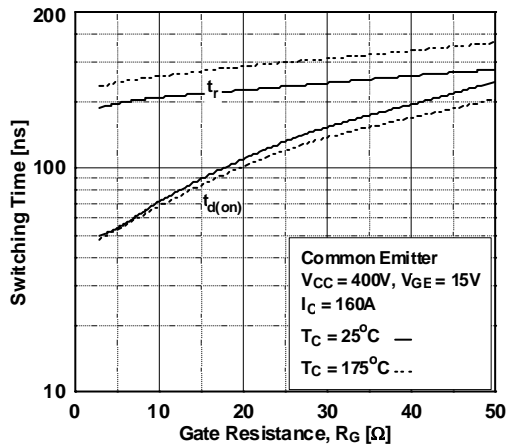


Figure 13. Turn-on Charateristics vs. Gate

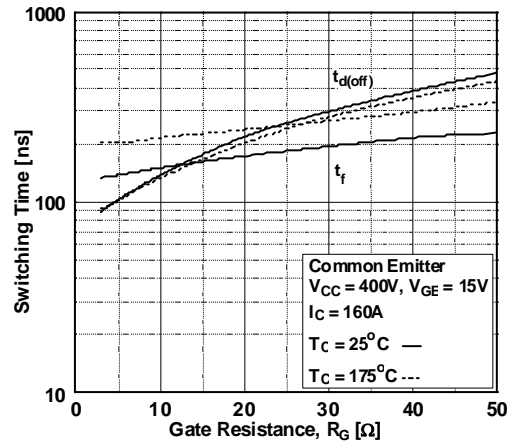


Figure 14. Turn-off Charateristics vs. Gate

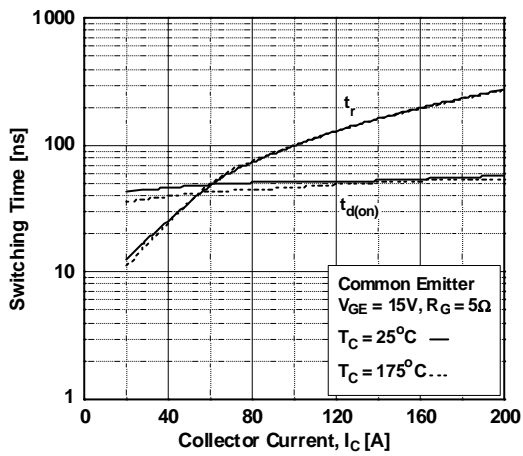


Figure 15. Turn-on Charateristics vs. Collector Current

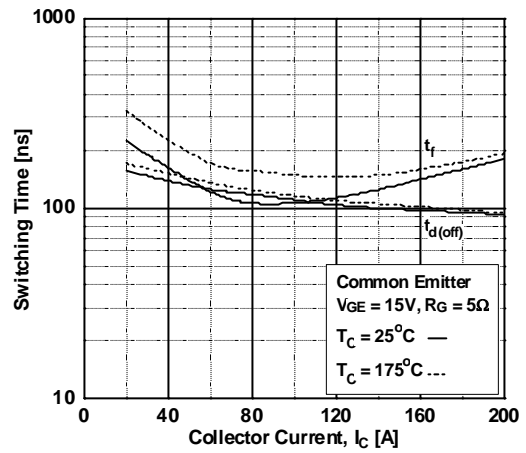


Figure 16. Turn-off Charateristics vs. Collector Current

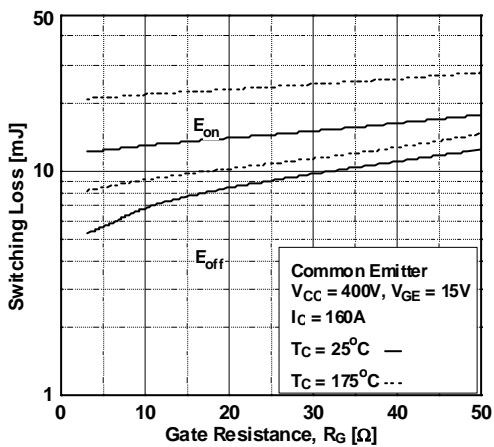


Figure 17. Switching Loss vs. Gate Resistance

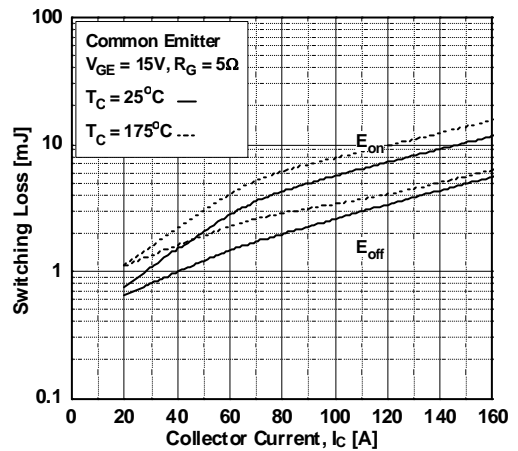


Figure 18. Switching Loss vs. Collector Current

Typical Performance Characteristics

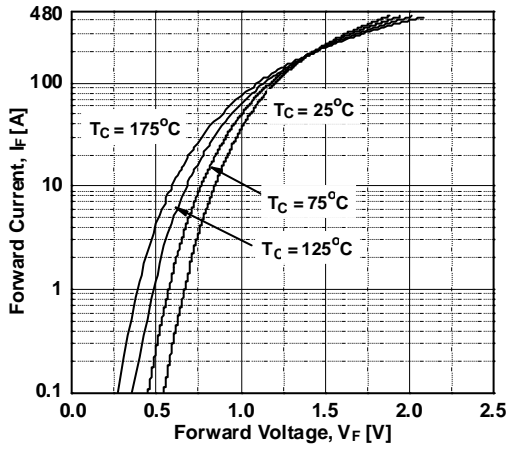


Figure 19. Forward Characteristics

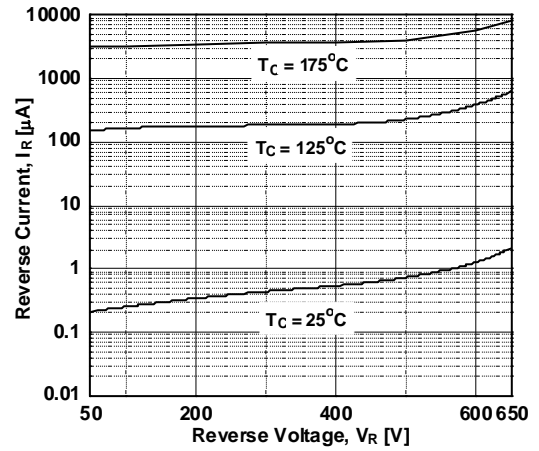


Figure 20. Reverse Current

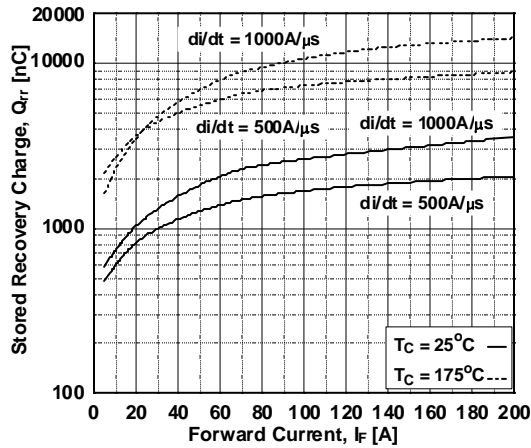


Figure 21. Stored Charge

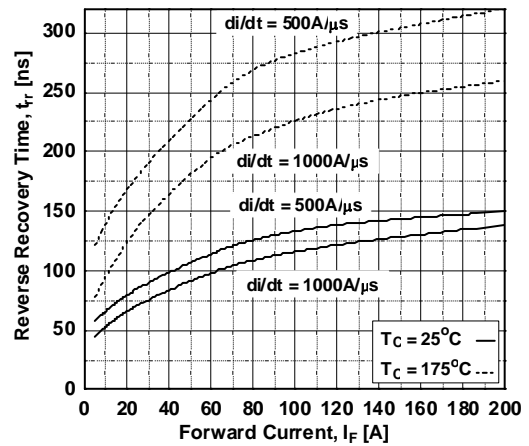


Figure 22. Reverse Recovery Time

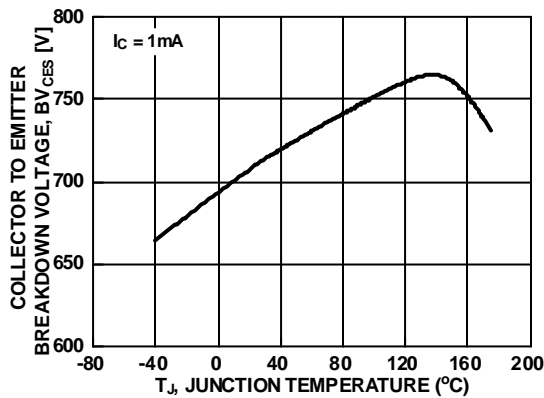


Figure 23. Collector to Emitter Breakdown Voltage vs. Junction Temperature

Typical Performance Characteristics

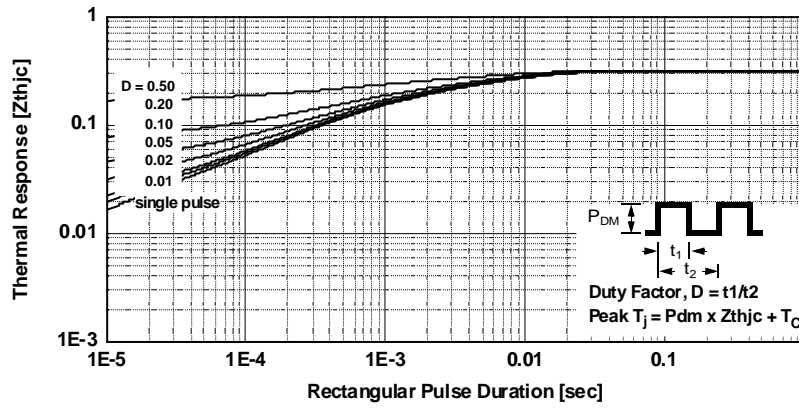


Figure 24. Transient Thermal Impedance of Diode

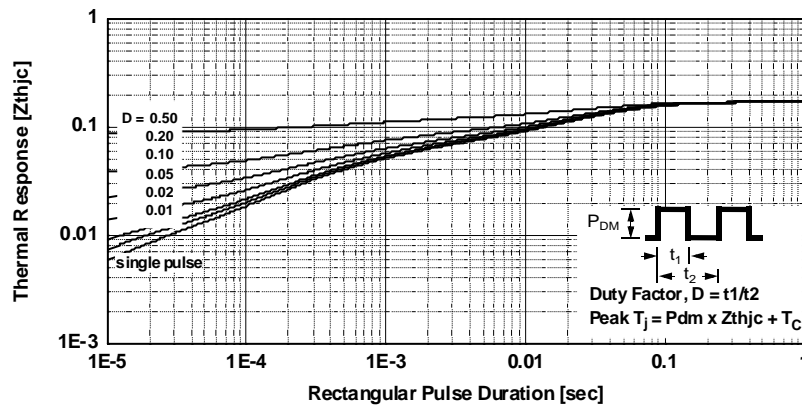
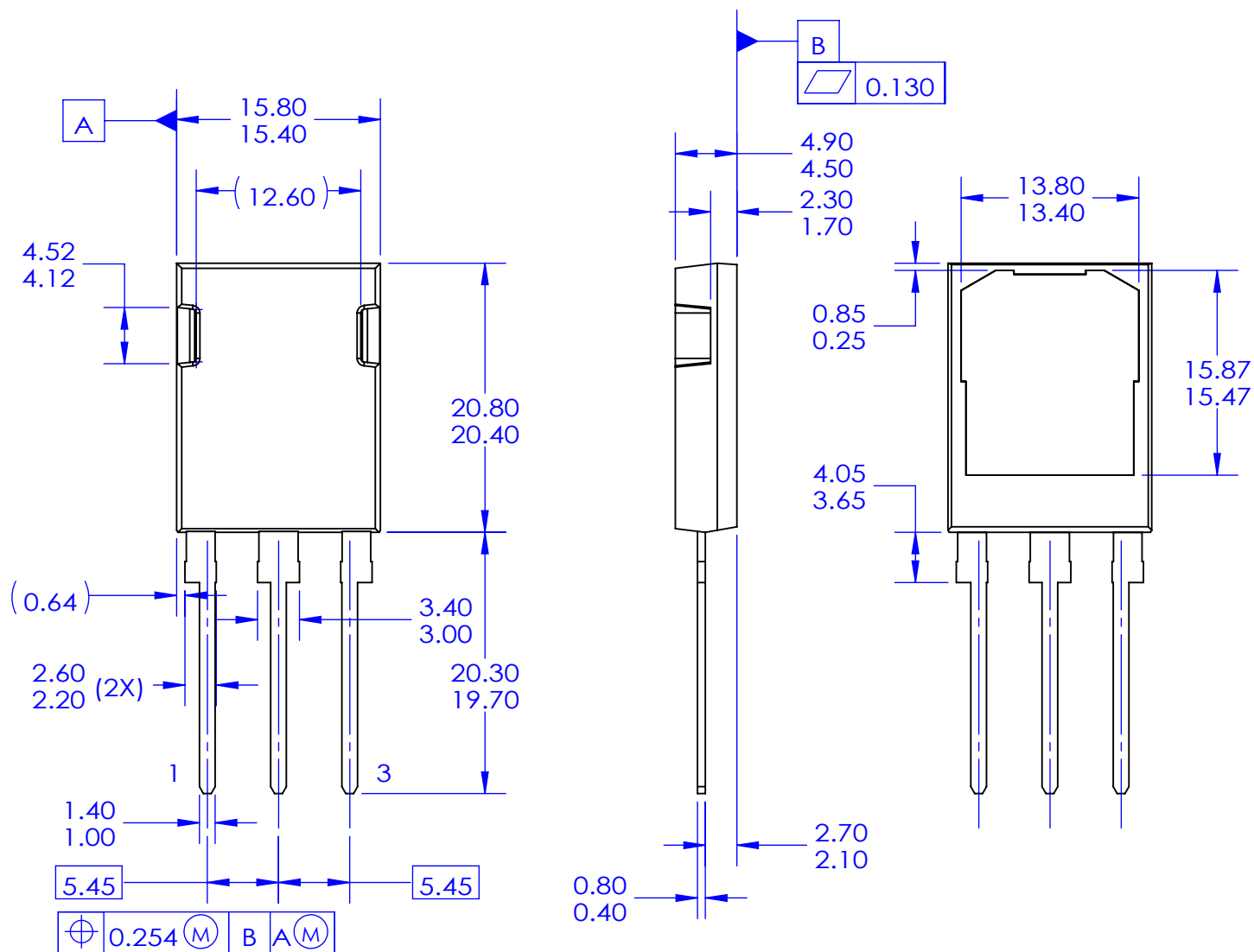


Figure 25. Transient Thermal Impedance of IGBT



NOTES:

- A. NO INDUSTRY STANDARDS APPLIES TO THIS PACKAGE.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- D. DRAWING CONFORMS TO ASME Y14.5-2009.
- F. DRAWING FILE NAME: MKT-TO247I03 REV1



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. 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

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
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative