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December 2014

# FGL12040WD

## 1200 V, 40 A Field Stop Trench IGBT

### Features

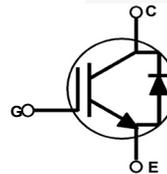
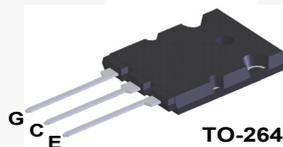
- Maximum Junction Temperature :  $T_J = 150^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- Low Saturation Voltage:  $V_{CE(sat)} = 2.3 \text{ V @ } I_C = 40 \text{ A}$
- 100% of The Parts Tested for  $I_{LM}^{(1)}$
- Short Circuit Ruggedness  $> 5 \text{ us @ } 150^\circ\text{C}$
- High Input Impedance
- RoHS Compliant

### General Description

Using novel field stop IGBT technology, Fairchild's new series of field stop 2<sup>nd</sup> generation IGBTs offer the optimum performance for welder applications where low conduction and switching losses are essential.

### Applications

- Only for Welder



### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Description	FGL12040WD	Unit
$V_{CES}$	Collector to Emitter Voltage	1200	V
$V_{GES}$	Gate to Emitter Voltage	$\pm 25$	V
	Transient Gate to Emitter Voltage	$\pm 30$	V
$I_C$	Collector Current @ $T_C = 25^\circ\text{C}$	80	A
	Collector Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{LM}^{(1)}$	Clamped Inductive Load Current @ $T_C = 25^\circ\text{C}$	100	A
$I_{CM}^{(2)}$	Pulsed Collector Current	100	A
$I_F$	Diode Continuous Forward Current @ $T_C = 25^\circ\text{C}$	80	A
	Diode Continuous Forward Current @ $T_C = 100^\circ\text{C}$	40	A
$I_{FM}^{(2)}$	Diode Maximum Forward Current	100	A
SCWT (3)	Short Circuit Withstand Time @ $T_C = 150^\circ\text{C}$	5	us
$P_D$	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	391	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	156	W
$T_J$	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

**Notes:**

1.  $V_{CC} = 600 \text{ V}$ ,  $V_{GE} = 15 \text{ V}$ ,  $I_C = 100 \text{ A}$ ,  $R_G = 23 \Omega$ , Inductive Load
2. Repetitive rating : Pulse width limited by max. junction temperature
3.  $V_{CC} = 600 \text{ V}$ ,  $V_{GE} = 12 \text{ V}$

FGL12040WD — 1200 V, 40 A Field Stop Trench IGBT

## Thermal Characteristics

Symbol	Parameter	FGL12040WD	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case	0.32	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$ (Diode)	Thermal Resistance, Junction to Case	1.0	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	25	$^{\circ}\text{C}/\text{W}$

## Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FGL12040WD	FGL12040WD	TO-264	Tube	-	-	25

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
$BV_{CES}$	Collector to Emitter Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	1200	-	-	V
$\Delta BV_{CES} / \Delta T_J$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	-	1.2	-	$\text{V}/^{\circ}\text{C}$
$I_{CES}$	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$	-	-	250	$\mu\text{A}$
$I_{GES}$	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$	-	-	$\pm 400$	nA
<b>On Characteristics</b>						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 40\text{ mA}, V_{CE} = V_{GE}$	4.8	6.4	8.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}$ $T_C = 25^{\circ}\text{C}$	-	2.3	2.9	V
		$I_C = 40\text{ A}, V_{GE} = 15\text{ V},$ $T_C = 150^{\circ}\text{C}$	-	2.5	-	V
<b>Dynamic Characteristics</b>						
$C_{ies}$	Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V},$ $f = 1\text{ MHz}$	-	2800	-	pF
$C_{oes}$	Output Capacitance		-	105	-	pF
$C_{res}$	Reverse Transfer Capacitance		-	60	-	pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A},$ $R_G = 23\text{ }\Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^{\circ}\text{C}$	-	45	-	ns
$t_r$	Rise Time		-	70	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	560	-	ns
$t_f$	Fall Time		-	15	-	ns
$E_{on}$	Turn-On Switching Loss		-	4.1	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	1.0	-	mJ
$E_{ts}$	Total Switching Loss		-	5.1	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 40\text{ A},$ $R_G = 23\text{ }\Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 150^{\circ}\text{C}$	-	40	-	ns
$t_r$	Rise Time		-	65	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	472	-	ns
$t_f$	Fall Time		-	51	-	ns
$E_{on}$	Turn-On Switching Loss		-	6.1	-	mJ
$E_{off}$	Turn-Off Switching Loss		-	1.7	-	mJ
$E_{ts}$	Total Switching Loss		-	7.8	-	mJ

### Electrical Characteristics of the IGBT (Continued)

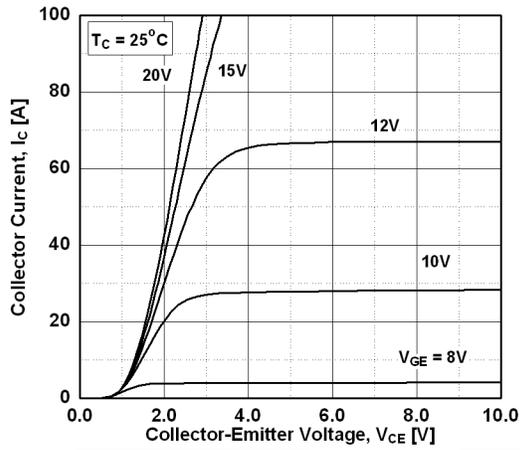
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$Q_g$	Total Gate Charge	$V_{CE} = 600\text{ V}, I_C = 40\text{ A},$ $V_{GE} = 15\text{ V}$	-	226	-	nC
$Q_{ge}$	Gate to Emitter Charge		-	18	-	nC
$Q_{gc}$	Gate to Collector Charge		-	155	-	nC

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

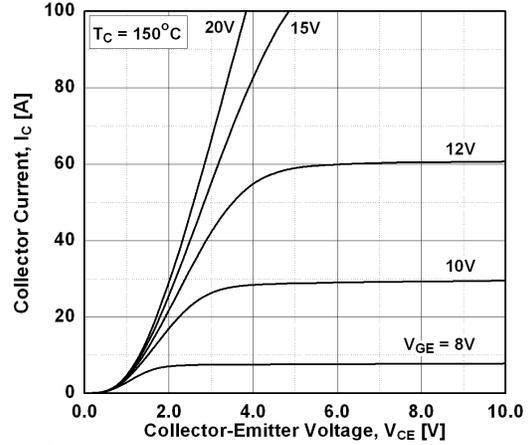
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{FM}$	Diode Forward Voltage	$I_F = 40\text{ A}, T_C = 25^\circ\text{C}$	-	3.6	4.7	V
		$I_F = 40\text{ A}, T_C = 150^\circ\text{C}$	-	3.0	-	V
$t_{rr}$	Diode Reverse Recovery Time	$V_R = 600\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 200\text{ A/us}, T_C = 25^\circ\text{C}$	-	71	-	ns
$I_{rr}$	Diode Peak Reverse Recovery Current		-	6.8	-	A
$Q_{rr}$	Diode Reverse Recovery Charge		-	242	-	nC
$E_{rec}$	Reverse Recovery Energy	$V_R = 600\text{ V}, I_F = 40\text{ A},$ $di_F/dt = 200\text{ A/us}, T_C = 150^\circ\text{C}$	-	440	-	uJ
$t_{rr}$	Diode Reverse Recovery Time		-	339	-	ns
$I_{rr}$	Diode Peak Reverse Recovery Current		-	14	-	A
$Q_{rr}$	Diode Reverse Recovery Charge		-	2373	-	nC

## Typical Performance Characteristics

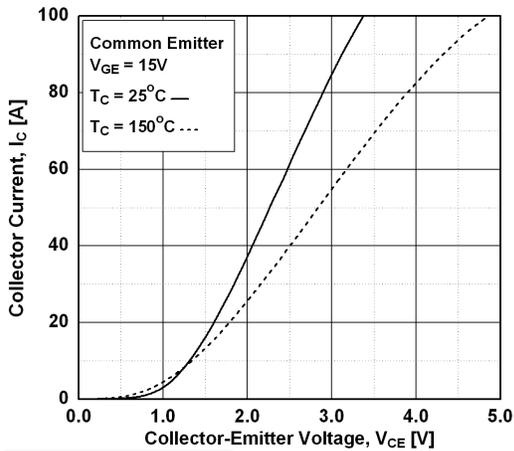
**Figure 1. Typical Output Characteristics**



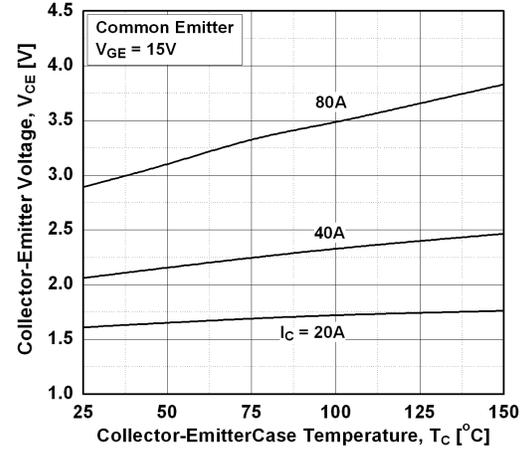
**Figure 2. Typical Output Characteristics**



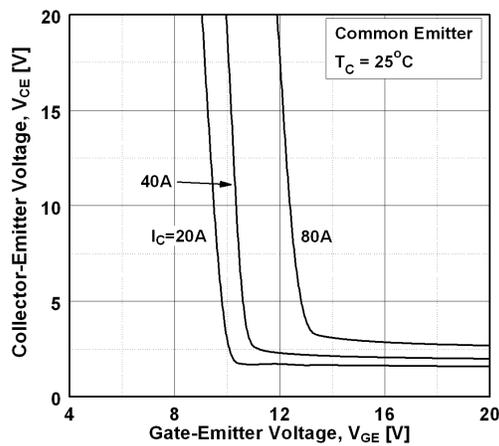
**Figure 3. Typical Saturation Voltage Characteristics**



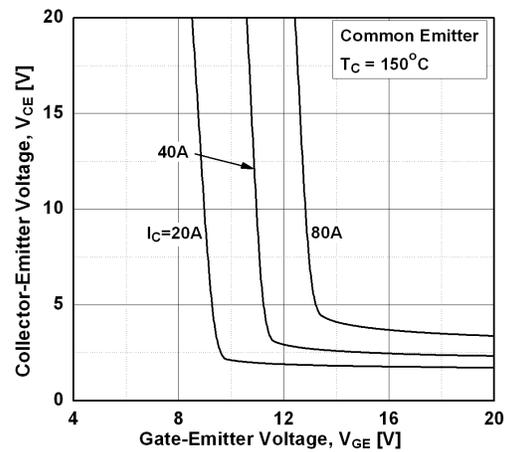
**Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level**



**Figure 5. Saturation Voltage vs. Vge**

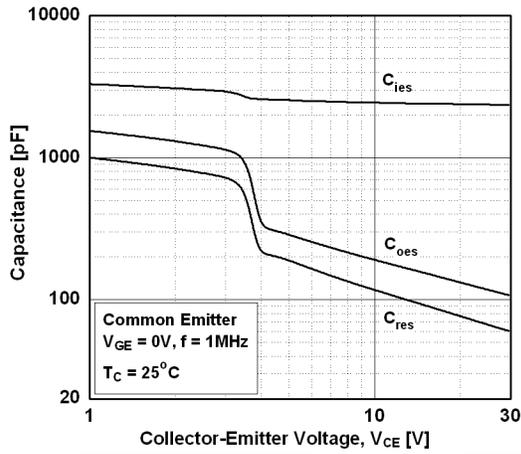


**Figure 6. Saturation Voltage vs. Vge**

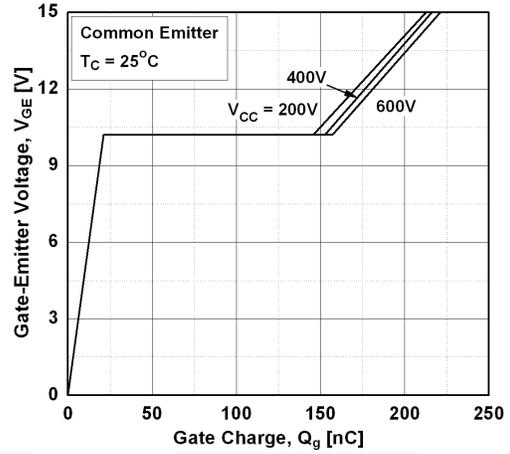


## Typical Performance Characteristics

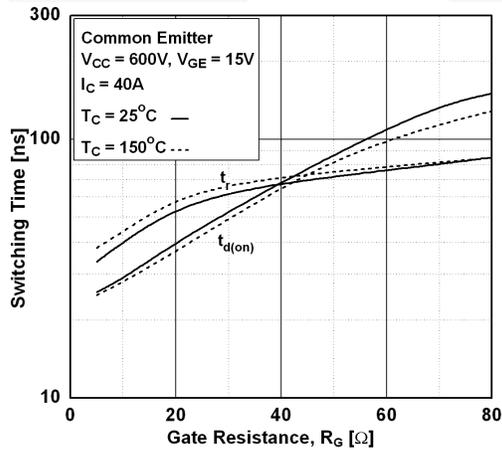
**Figure 7. Capacitance Characteristics**



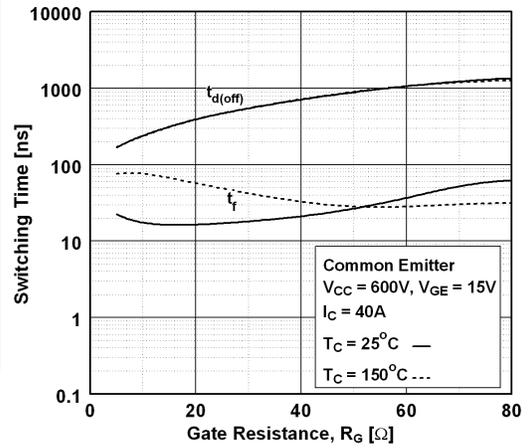
**Figure 8. Gate Charge Characteristics**



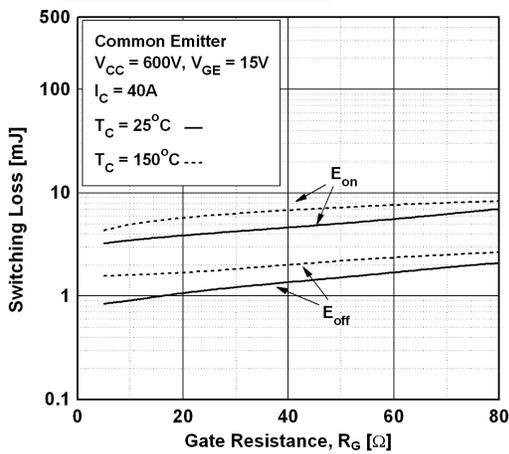
**Figure 9. Turn-on Characteristics vs. Gate Resistance**



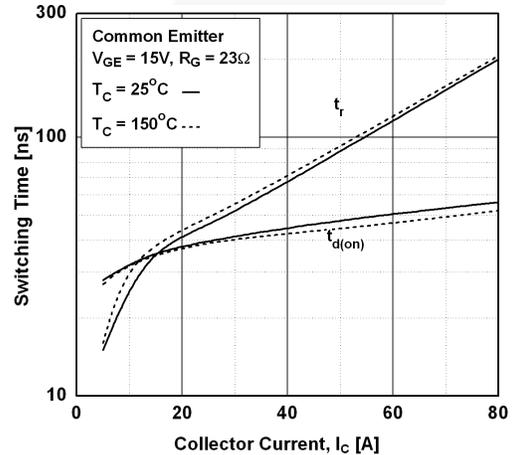
**Figure 10. Turn-off Characteristics vs. Gate Resistance**



**Figure 11. Switching Loss vs. Gate Resistance**

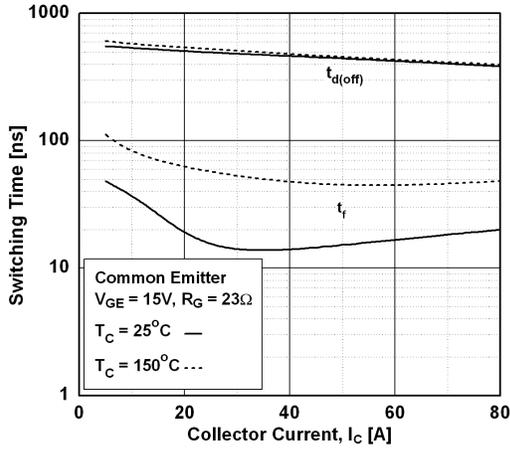


**Figure 12. Turn-on Characteristics vs. Collector Current**

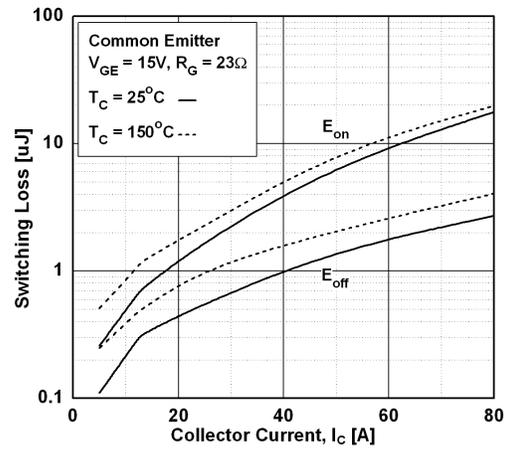


## Typical Performance Characteristics

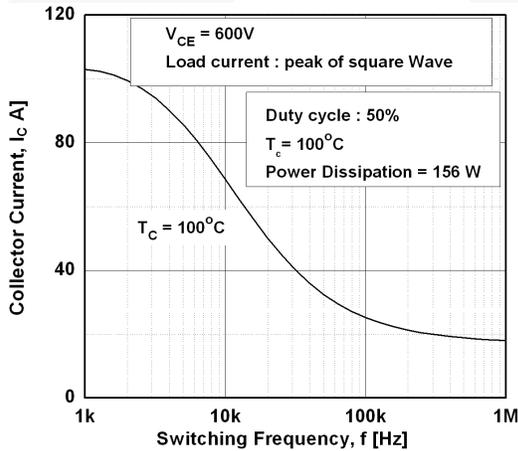
**Figure 13. Turn-off Characteristics vs. Collector Current**



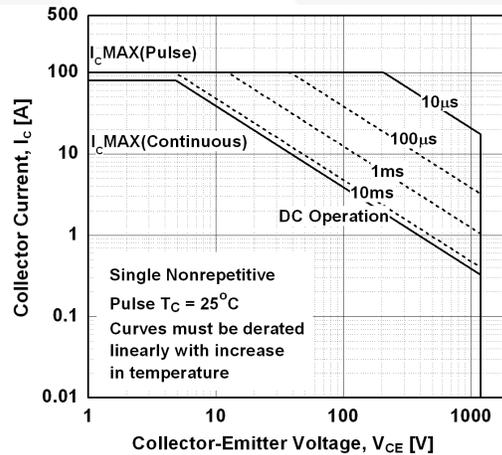
**Figure 14. Switching Loss vs. Collector Current**



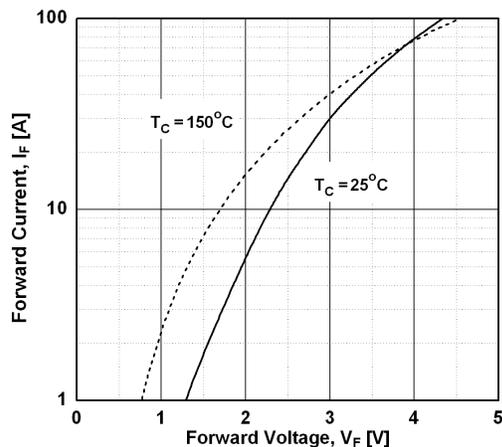
**Figure 15. Load Current vs. Frequency**



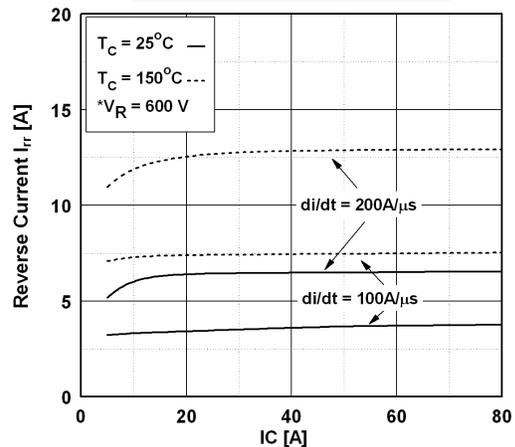
**Figure 16. SOA Characteristics**



**Figure 17. Forward Characteristics**



**Figure 18. Reverse Recovery Current**



## Typical Performance Characteristics

Figure 19. Reverse Recovery Time

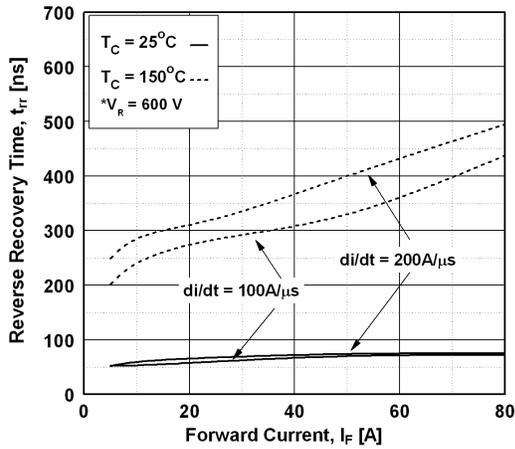


Figure 20. Stored Charge

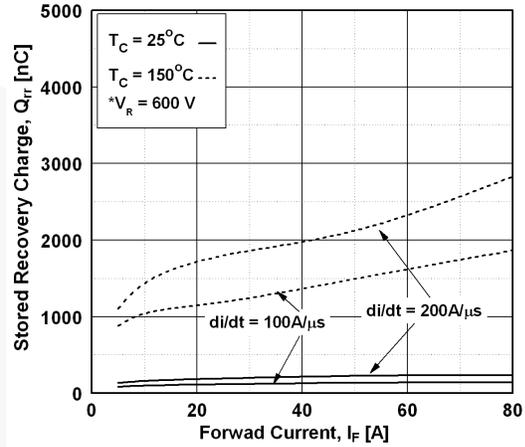


Figure 21. Transient Thermal Impedance of IGBT

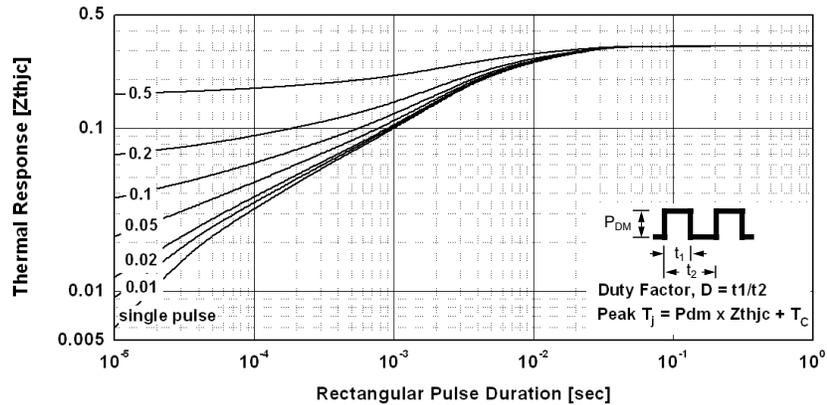
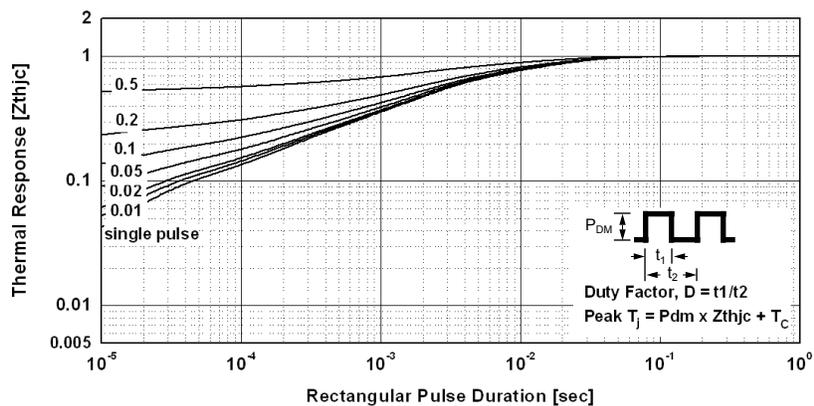
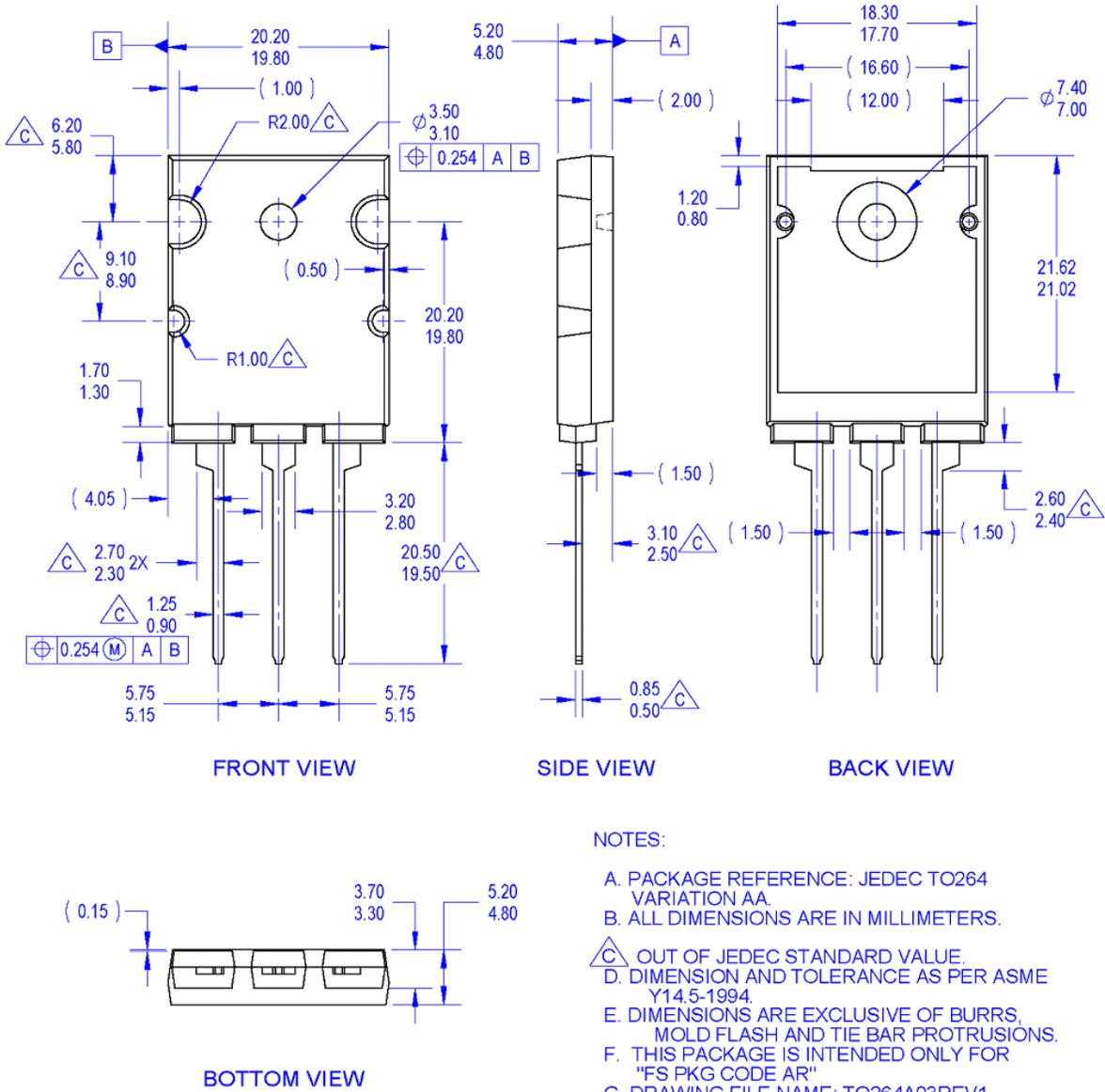


Figure 22. Transient Thermal Impedance of Diode



## Mechanical Dimensions



**Figure 23. TO264, Molded, 3-Lead, Jedec Variation AA**

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