FAIRCHILD

SEMICONDUCTOR®

# FGH40T100SMD
1000V, 40A Field Stop Trench IGBT

Features

- High current capability
- Low saturation voltage: $V_{CE(sat)}$ = 1.9V(Typ.) @ I_C = 40A
- High input impedance
- Fast switching
- RoHS compliant

Applications

- UPS, welder, solar application
- PFC application

General Description

Using Novel Field Stop Trench IGBT Technology, Fairchild's new series of Field Stop Trench IGBTs offer the optimum performance for hard switching application such as UPS, welder, solar applications.

100% LEAD-FREE IMPLEMENTATION

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COLLECTOR (FLANGE)

C

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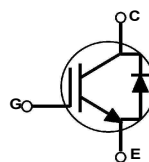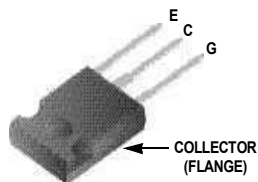
Absolute Maximum Ratings

Symbol	Description		Ratings	Units
V_{CES}	Collector to Emitter Voltage		1000	V
V_{GES}	Gate to Emitter Voltage		$\pm$ 20	V
I_C	Collector Current	@ T_C = 25°C	80	A
	Collector Current	@ T_C = 125°C	40	A
$I_{CM\,(1)}$	Pulsed Collector Current	@ T_C = 25°C	120	A
I_F	Diode Forward Current	@ T_C = 25°C	80	A
	Diode Forward Current	@ T_C = 125°C	40	A
$I_{FM\,(1)}$	Pulsed Diode Forward Current	@ T_C = 25°C	120	A
P_D	Maximum Power Dissipation	@ T_C = 25°C	333	W
	Maximum Power Dissipation	@ T_C = 125°C	111	W
T_J	Operating Junction Temperature		-55 to +175	°C
T_{stg}	Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	°C

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

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	-	0.45	°C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	0.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Eco Status	Packaging Type	Qty per Tube
FGH40T100SMD	FGH40T100SMD	TO-247	RoHS	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_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	1000	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250 uA	-	0.6	-	V/°C
I_{CES}	Collector Cut-Off Current	V_{CE} = V_{CES}, V_{GE} = 0V	-	-	1000	µA
I_{GES}	G-E Leakage Current	V_{GE} = V_{GES}, V_{CE} = 0V	-	-	±500	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 250uA, V_{CE} = V_{GE}	4.2	5.3	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40A, V_{GE} = 15V	-	1.9	2.3	V
		I_C = 40A, V_{GE} = 15V, T_C = 125°C	-	2.3	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	3980	5295	pF
C_{oes}	Output Capacitance		-	124	165	pF
C_{res}	Reverse Transfer Capacitance		-	76	115	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 25°C	-	29	38	ns
t_r	Rise Time		-	42	55	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
t_f	Fall Time		-	23	30	ns
E_{on}	Turn-On Switching Loss		-	2.35	3.1	mJ
E_{off}	Turn-Off Switching Loss		-	1.15	1.5	mJ
E_{ts}	Total Switching Loss		-	3.5	4.6	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 600V, I_C = 40A, R_G = 10Ω, V_{GE} = 15V, Inductive Load, T_C = 175°C	-	27	36	ns
t_r	Rise Time		-	49	64	ns
$t_{d(off)}$	Turn-Off Delay Time		-	285	371	ns
t_f	Fall Time		-	20	26	ns
E_{on}	Turn-On Switching Loss		-	4.4	5.7	mJ
E_{off}	Turn-Off Switching Loss		-	1.9	2.5	mJ
E_{ts}	Total Switching Loss		-	6.3	8.2	mJ
Q_g	Total Gate Charge	V_{CE} = 600V, I_C = 40A, V_{GE} = 15V	-	265	398	nC
Q_{ge}	Gate to Emitter Charge		-	32	48	nC
Q_{gc}	Gate to Collector Charge		-	135	203	nC

Electrical Characteristics of Diode $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
V_{FM}	Diode Forward Voltage	$I_F = 40A$	$T_C = 25°C$	-	3.4	4.4	V
			$T_C = 175°C$	-	2.6	-	
E_{rr}	Diode Reverse Recovery Energy	$I_F = 40A$, $dI_F/dt = 200A/\mu s$	$T_C = 175°C$	-	100	130	uJ
t_{rr}	Diode Reverse Recovery Time	$I_F = 40A$, $dI_F/dt = 200A/\mu s$	$T_C = 25°C$	-	60	78	ns
			$T_C = 175°C$	-	256	-	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25°C$	-	185	260	nC
			$T_C = 175°C$	-	1512	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics
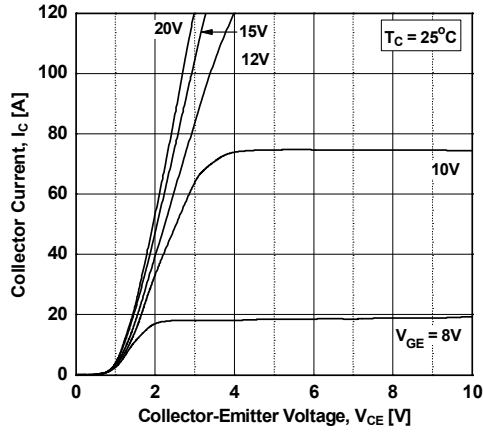
Figure 2. Typical Output Characteristics
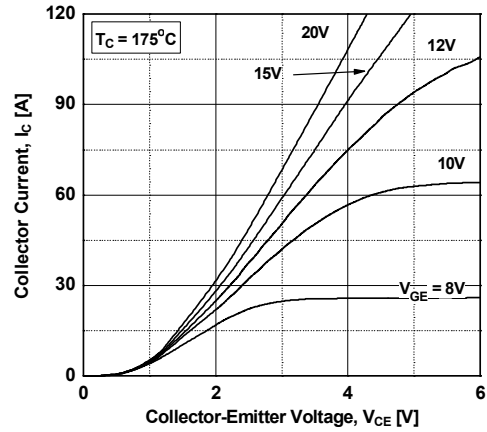
Figure 3. Typical Saturation Voltage Characteristics
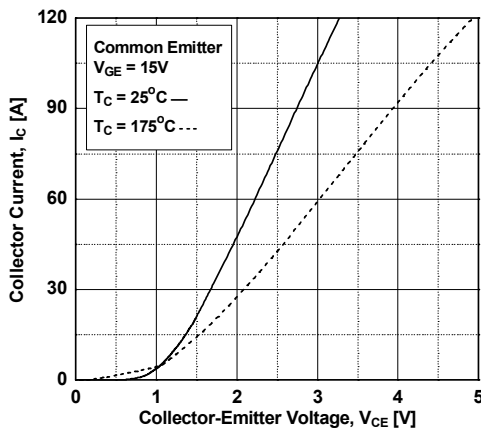
Figure 4. Transfer Characteristics
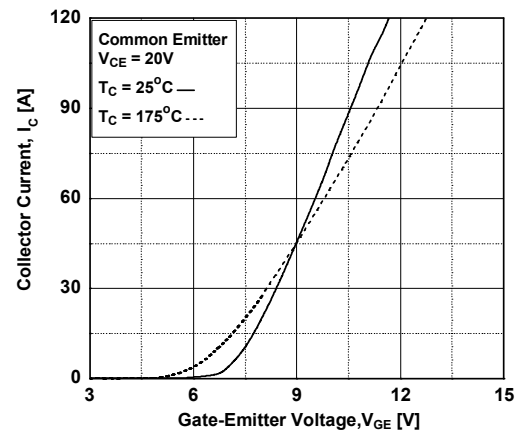
Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level
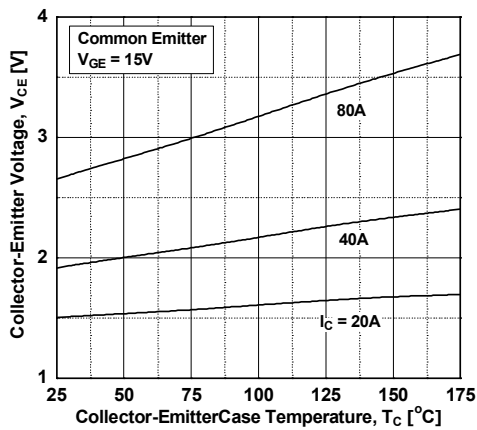
Figure 6. Saturation Voltage vs. V_{GE}
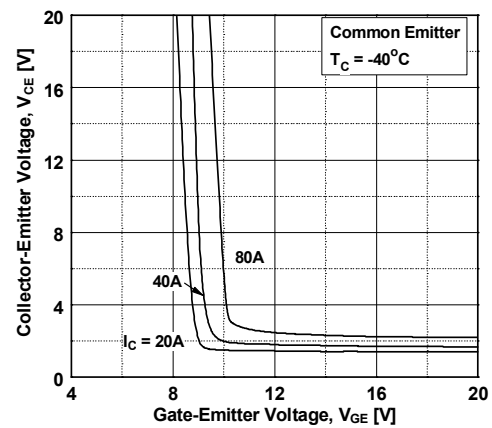
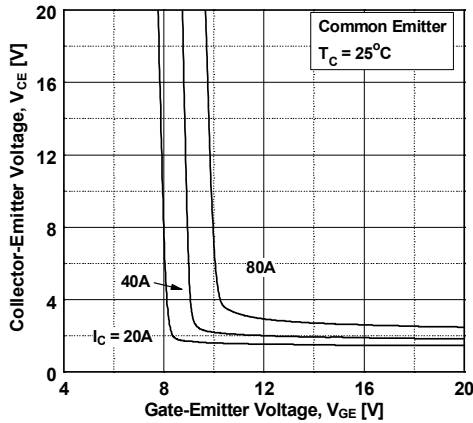## Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

Figure 8. Saturation Voltage vs. V_{GE}
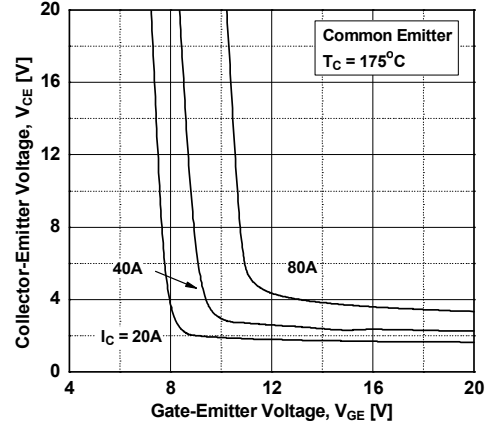
Figure 9. Capacitance Characteristics
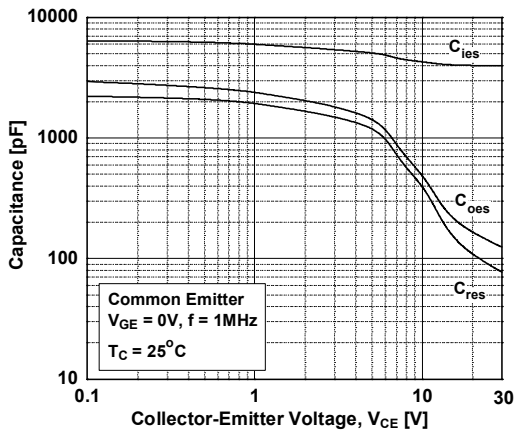
Figure 10. Gate charge Characteristics
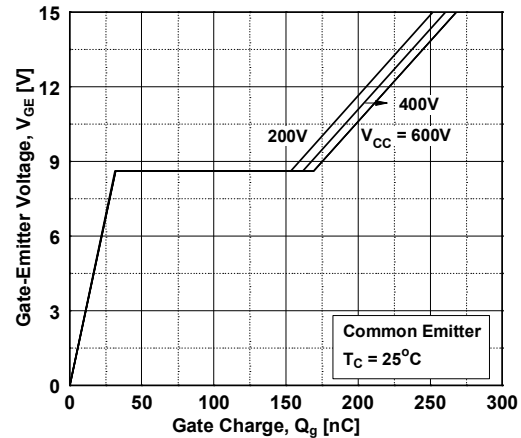
Figure 11. SOA Characteristics
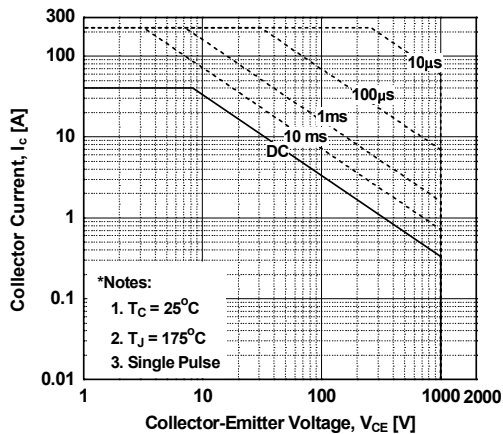
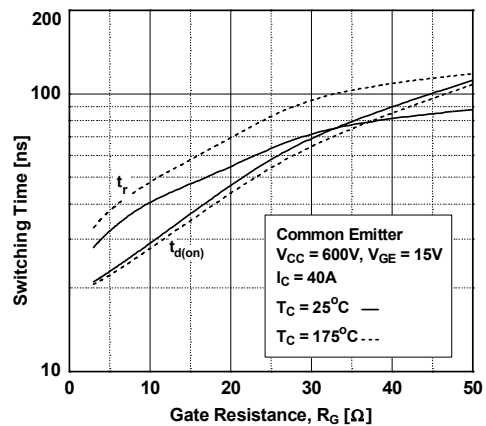### Figure 12. Turn-on Characteristics vs. Gate Resistance

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Typical Performance Characteristics

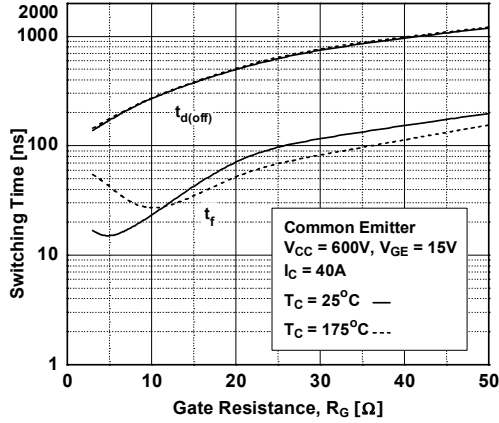### Figure 13. Turn-off Characteristics vs. Gate Resistance

Figure 14. Turn-on Characteristics vs. Collector Current
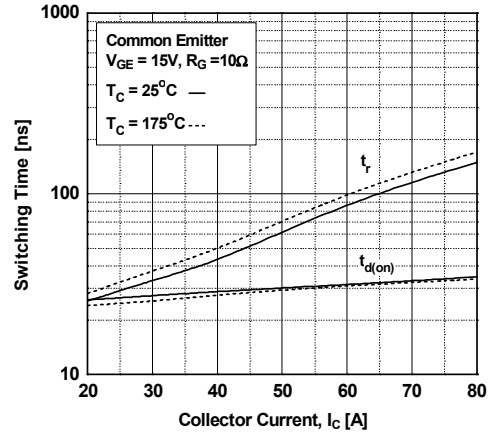

Figure 15. Turn-off Characteristics vs. Collector Current
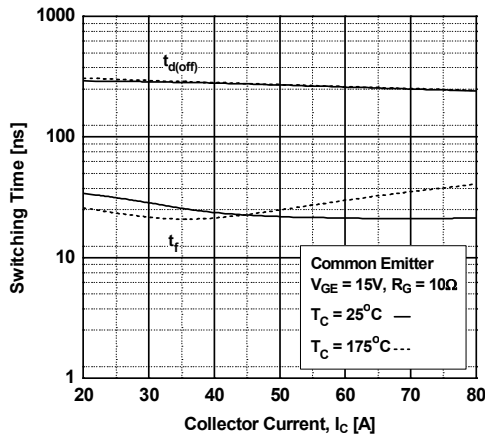

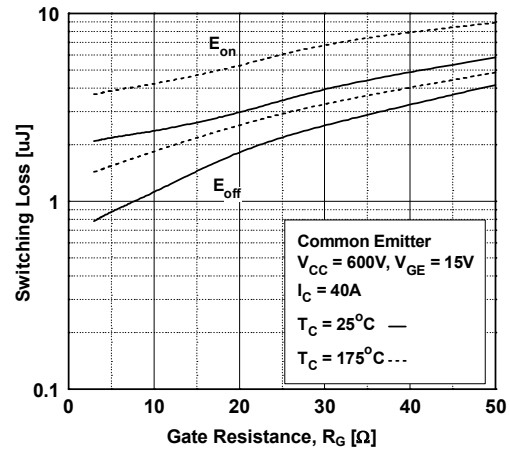
Figure 16. Switching Loss vs. Gate Resistance

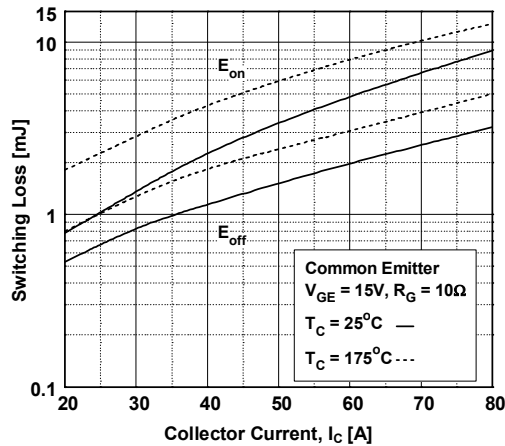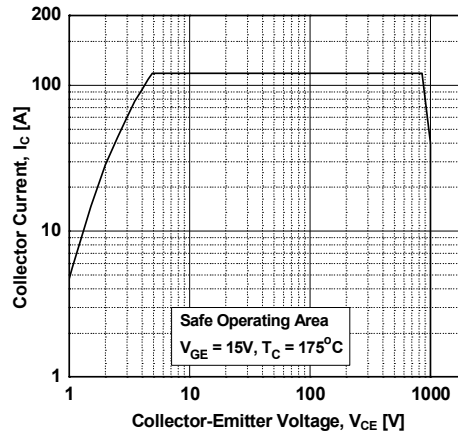### Figure 17. Switching Loss vs. Collector Current

Figure 18. Turn off Switching SOA Characteristics

Typical Performance Characteristics
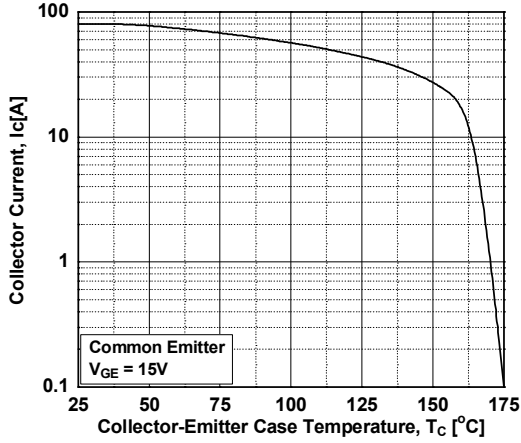
Figure 19. Current Derating

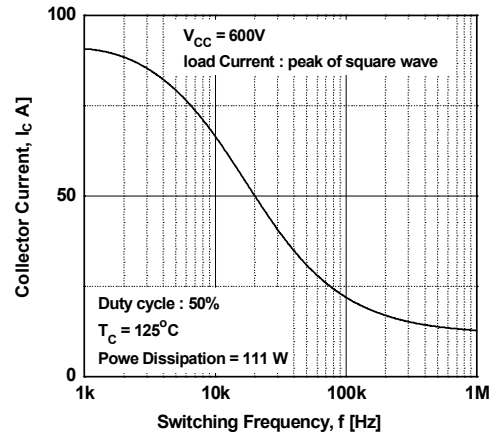### Figure 20. Load Current Vs. Frequence
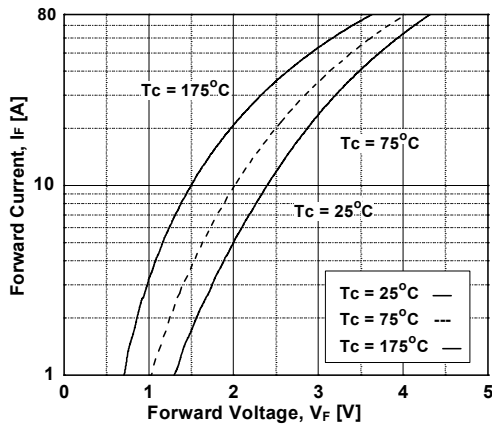

Figure 21. Diode Forward Characteristics

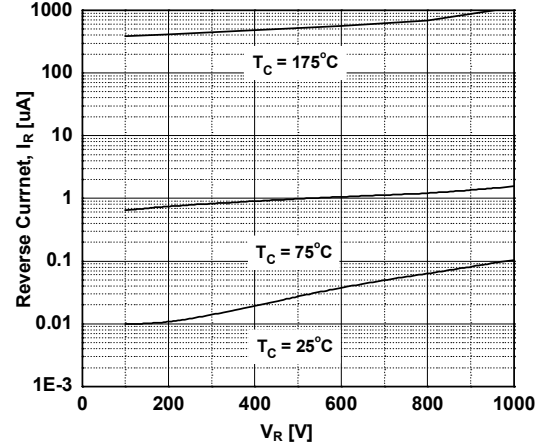### Figure 22. Reverse Current
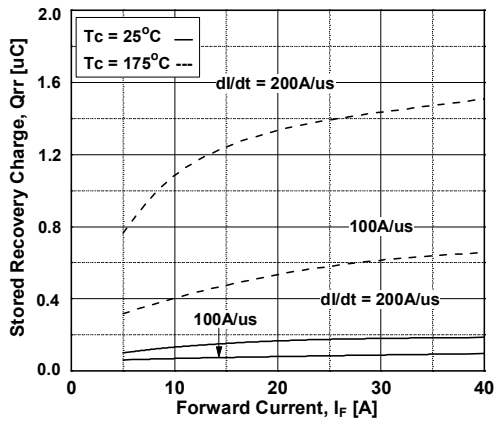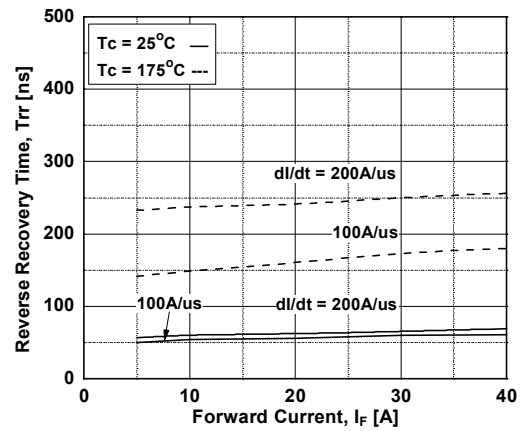

Figure 23. Stored Charge

Figure 24. Reverse Recovery Time

Typical Performance Characteristics

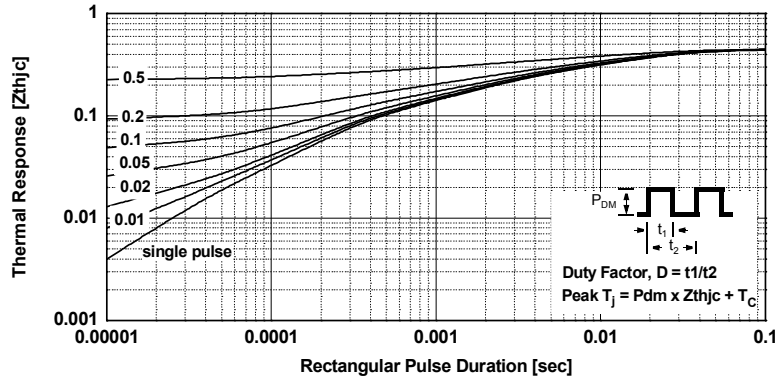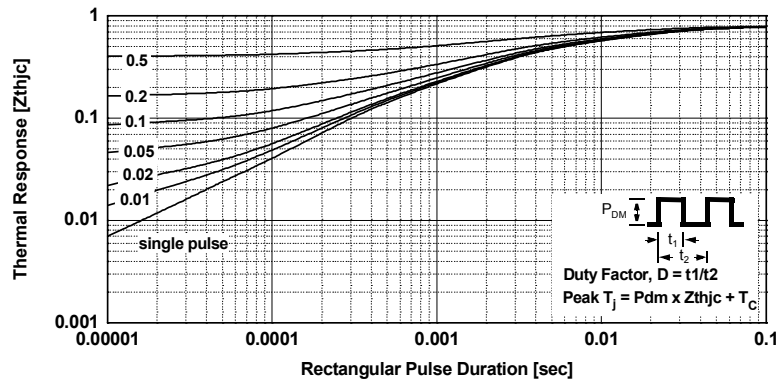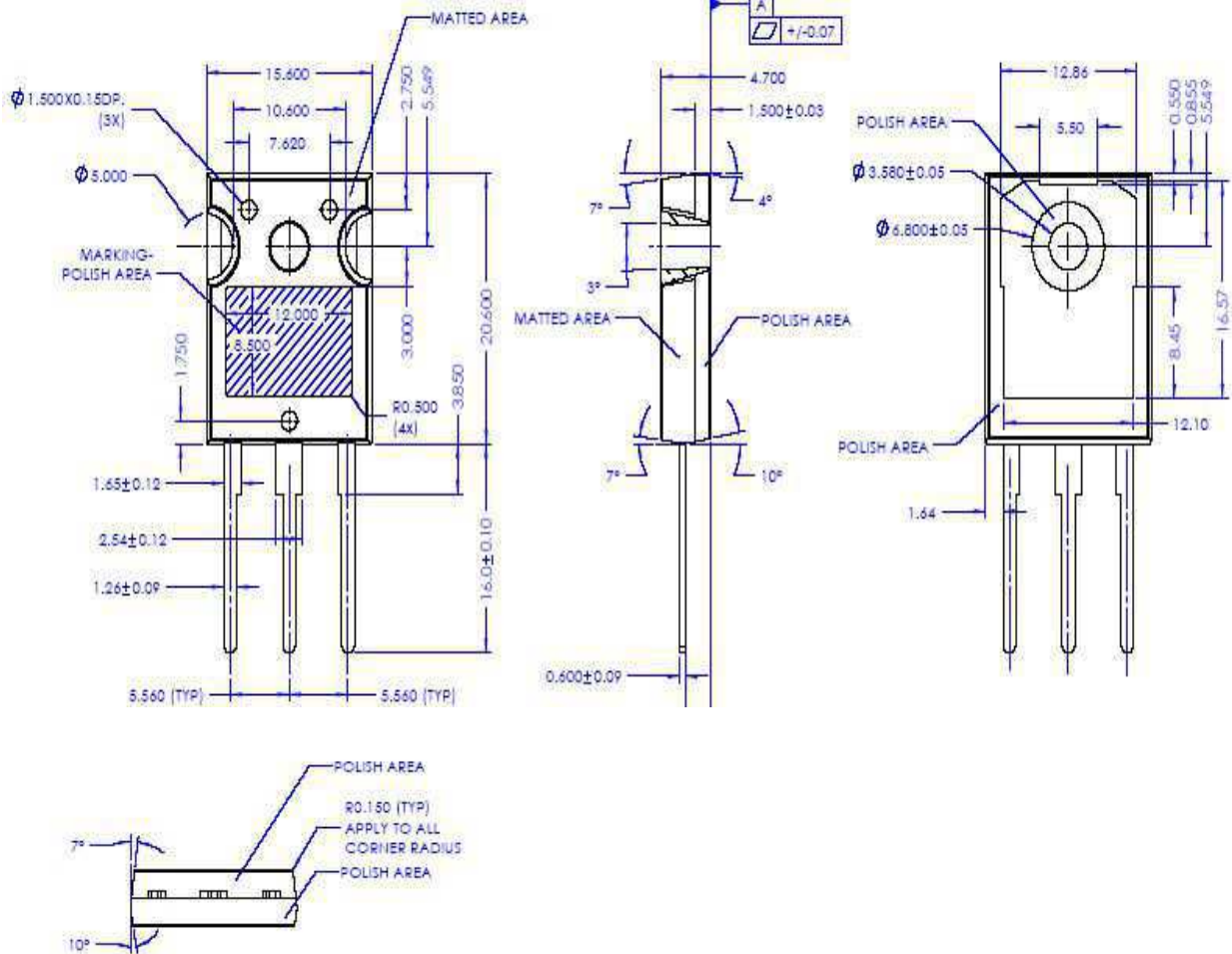**Figure 25. Transient Thermal Impedance of IGBT**

Figure 26.Transient Thermal Impedance of Diode

Mechanical Dimensions

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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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