FAIRCHILD SEMICONDUCTOR®

April 2013

FGH40T65UPD

650 V, 40 A Field Stop Trench IGBT

Features

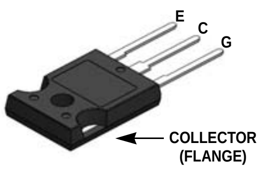
- Maximum Junction Temperature : $T_J = 175^oC$
- Positive Temperaure Co-efficient for easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.65 V(Typ.) @ I_C = 40 A
- 100% of Parts Tested $I_{LM(2)}$
- High Input Impedance
- Tightened Parameter Distribution
- RoHS Compliant
- Short-circuit Ruggedness > 5us @25^{o}C

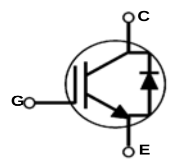
General Description

Using innovative field stop trench IGBT technology, Fairchild®'s new series of field stop trench IGBTs offer optimum performance for solar inverter, UPS, welder, and digital power generator where low conduction and switching losses are essential.

Applications

- Solar Inverter, UPS, Welder, Digital Power Generator
- Telecom, ESS





Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	650	V
V_{GES}	Gate to Emitter Voltage	± 20	V
I_C	Collector Current @ T_C = 25^{o}C	80	A
	Collector Current @ T_C = 100^{o}C	40	A
$I_{CM\ (1)}$	Pulsed Collector Current	120	A
$I_{LM\ (2)}$	Clamped Inductive Load Current @ T_C = 25^{o}C	120	A
I_F	Diode Forward Current @ T_C = 25^{o}C	40	A
	Diode Forward Current @ T_C = 100^{o}C	20	A
$I_{FM(1)}$	Pulsed Diode Maximum Forward Current	120	A
P_D	Maximum Power Dissipation @ T_C = 25^{o}C	268	W
	Maximum Power Dissipation @ T_C = 100^{o}C	134	W
SCWT	Short Circuit Withstand Time @ T_C = 25^{o}C	5	us
T_J	Operating Junction Temperature	-55 to +175	^{o}C
T_{stg}	Storage Temperature Range	-55 to +175	^{o}C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	^{o}C

Notes:
1: Repetitive rating: Pulse width limited by max. junction temperature
2: Ic = 120A, Vce = 400V, Rg = 15Ω

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	-	0.56	^{o}C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	1.71	^{o}C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	^{o}C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Eco Status	Packing Type	Qty per Tube
FGH40T65UPD	FGH40T65UPD	TO-247	-	-	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.	Unit
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250uA	-	0.6	-	V/^{o}C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0V	-	-	250	µA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, V_{CE} = 0V	-	-	±400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 40mA, $V_{CE} = V_{GE}$	4.0	6.0	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40A, V_{GE} = 15V	-	1.65	2.3	V
		I_C = 40A, V_{GE} = 15V, T_C = 175^{o}C	-	2.1	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	2730	3630	pF
C_{oes}	Output Capacitance		-	82	110	pF
C_{res}	Reverse Transfer Capacitance		-	48	72	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 40A, R_G = 7Ω, V_{GE} = 15V, Inductive Load, T_C = 25^{o}C	-	20	26	ns
t_r	Rise Time		-	26	34	ns
$t_{d(off)}$	Turn-Off Delay Time		-	144	187	ns
t_f	Fall Time		-	17	22	ns
E_{on}	Turn-On Switching Loss		-	1.59	2.1	mJ
E_{off}	Turn-Off Switching Loss		-	0.58	0.76	mJ
E_{ts}	Total Switching Loss		-	2.17	2.86	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 40A, R_G = 7Ω, V_{GE} = 15V, Inductive Load, T_C = 175^{o}C	-	19	-	ns
t_r	Rise Time		-	38	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	153	-	ns
t_f	Fall Time		-	60	-	ns
E_{on}	Turn-On Switching Loss		-	1.84	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.98	-	mJ
E_{ts}	Total Switching Loss		-	2.82	-	mJ
T_{SC}	Short Circuit Withstand Time	V_{GE} = 15V, V_{CC} =400V, R_G = 10Ω	5	-	-	us

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
Q_g	Total Gate Charge	V_{CE} = 400V, I_C = 40A, V_{GE} = 15V	-	177	265	nC
Q_{ge}	Gate to Emitter Charge		-	23	35	nC
Q_{gc}	Gate to Collector Charge		-	100	150	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
V_{FM}	Diode Forward Voltage	I_F = 20A	T_C = 25^{o}C	-	2.1	2.7	V
			T_C = 175^{o}C	-	1.9	-	
E_{rec}	Reverse Recovery Energy	I_F = 20A, dI_F/dt = 200A/µs	T_C = 175^{o}C	-	96	-	uJ
t_{rr}	Diode Reverse Recovery Time		T_C = 25^{o}C	-	33	43	ns
			T_C = 175^{o}C	-	128	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25^{o}C	-	53	74	nC
			T_C = 175^{o}C	-	341	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

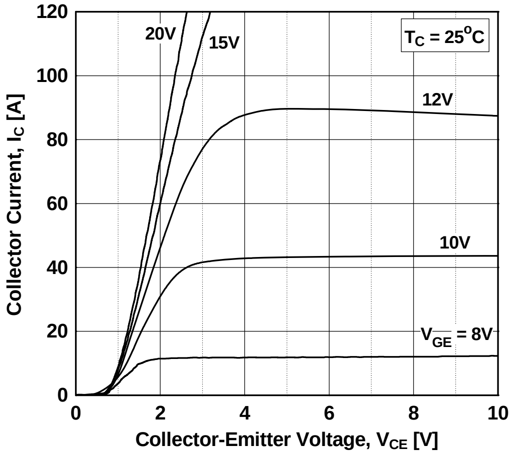


Figure 2. Typical Output Characteristics

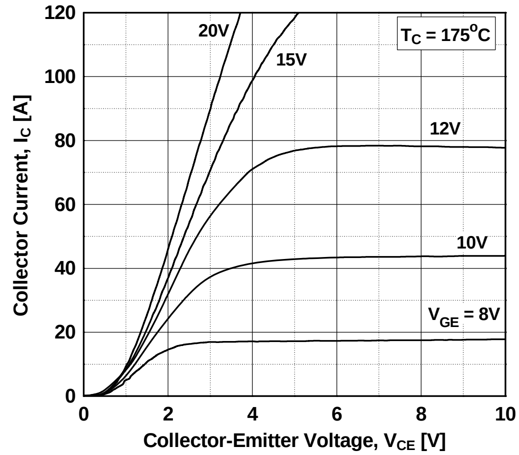


Figure 3. Typical Saturation Voltage Characteristics

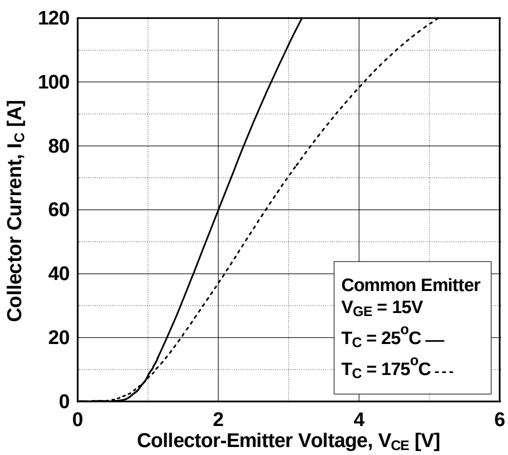


Figure 4. Transfer Characteristics

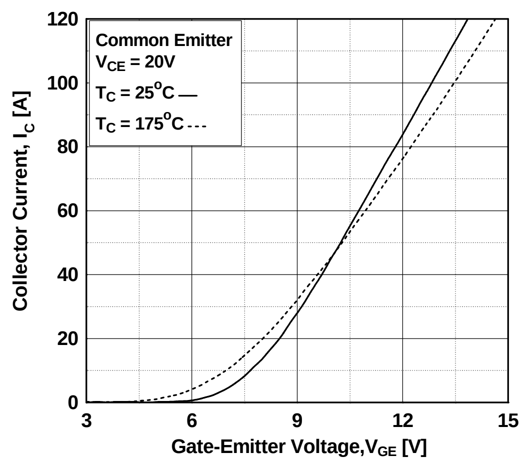


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

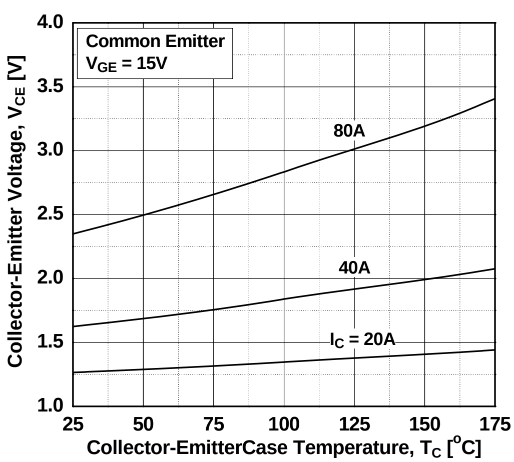
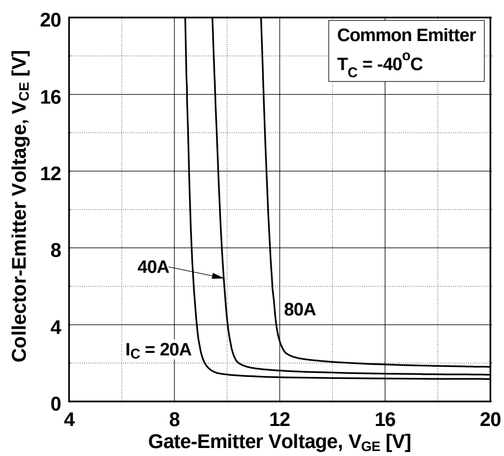


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

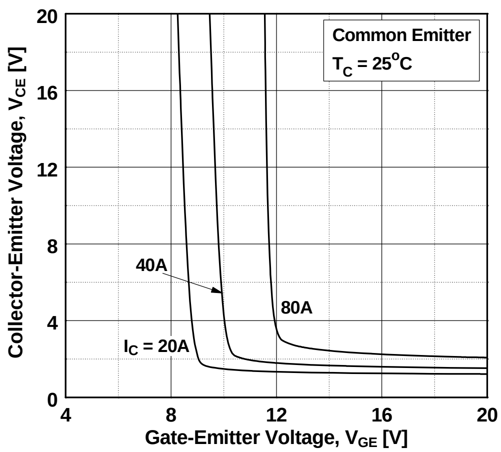


Figure 8. Saturation Voltage vs. V_{GE}

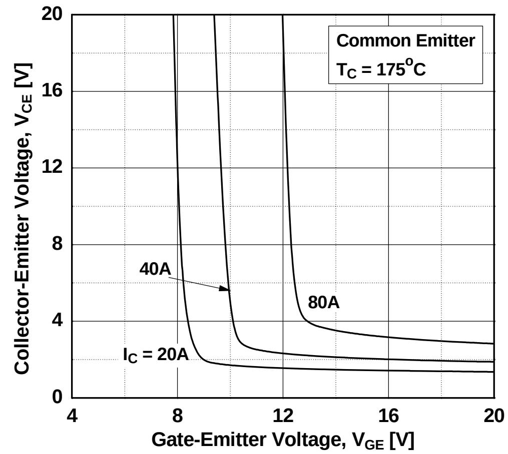


Figure 9. Capacitance Characteristics

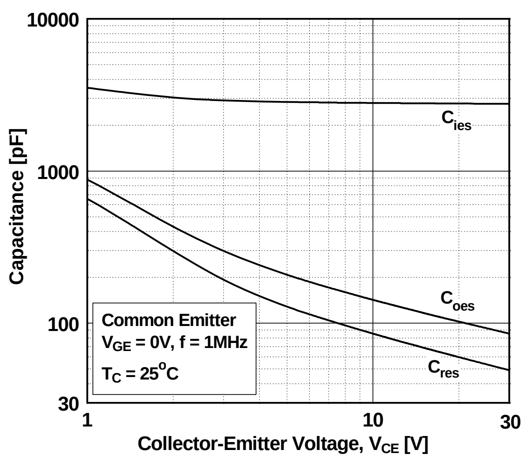


Figure 10. Gate charge Characteristics

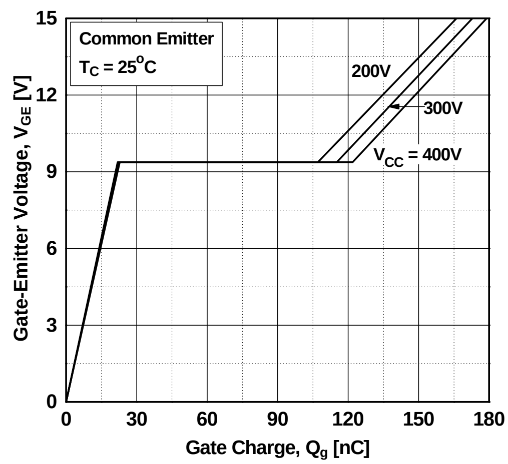


Figure 11. SOA Characteristics

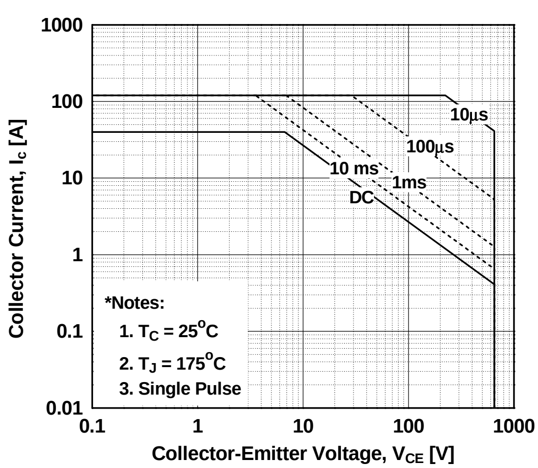
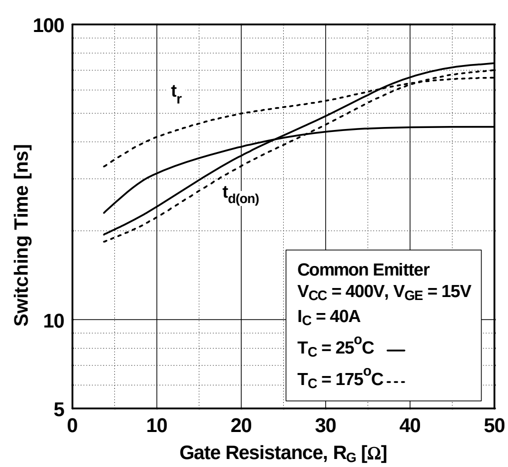


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

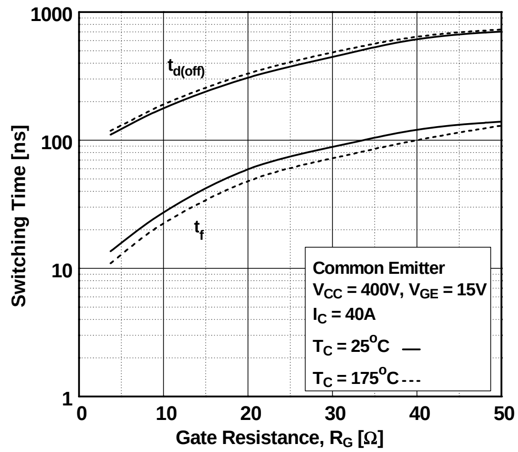


Figure 14. Turn-on Characteristics vs. Collector Current

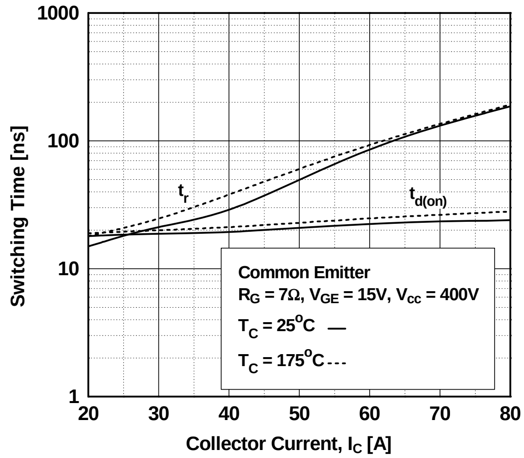


Figure 15. Turn-off Characteristics vs. Collector Current

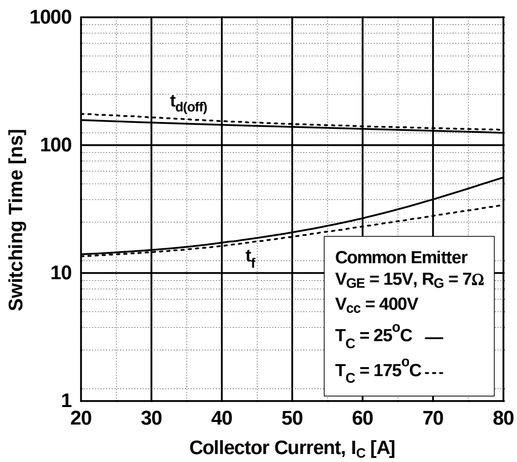


Figure 16. Switching Loss vs. Gate Resistance

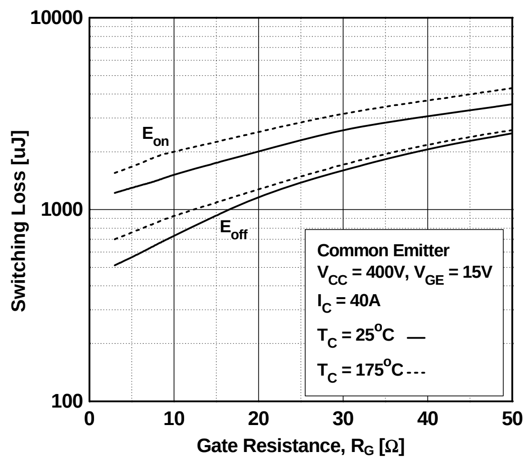


Figure 17. Switching Loss vs. Collector Current

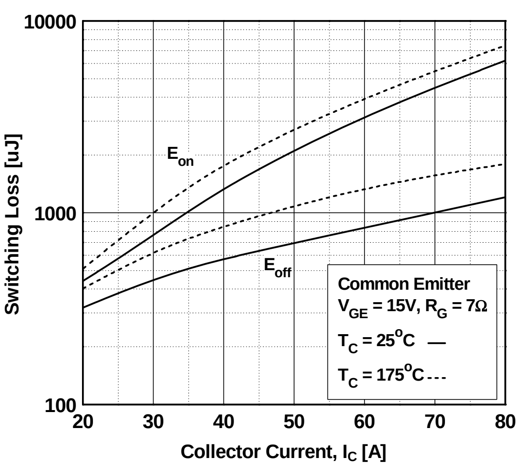
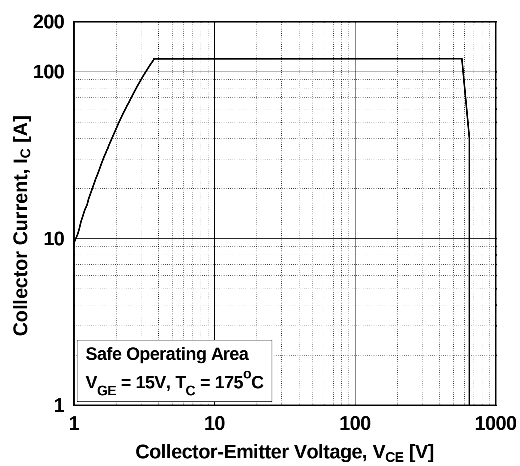


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Current Derating

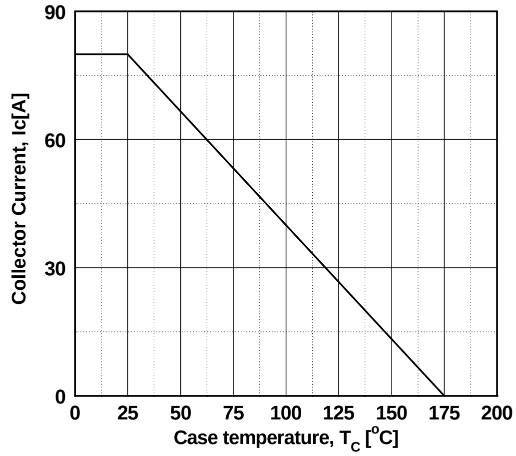


Figure 20. Load Current Vs. Frequence

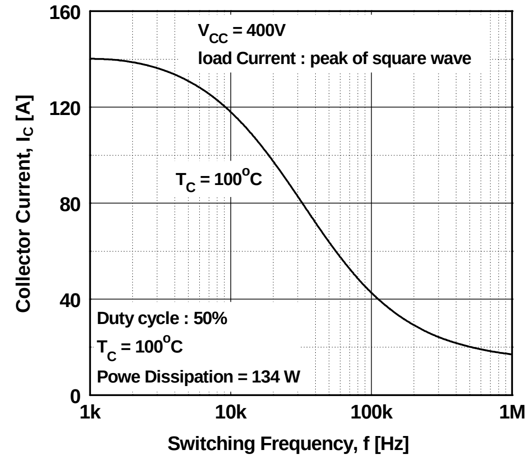


Figure 21. Forward Characteristics

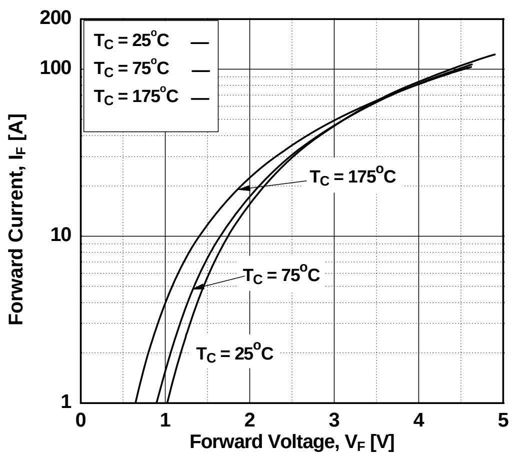


Figure 22. Reverse Recovery Current

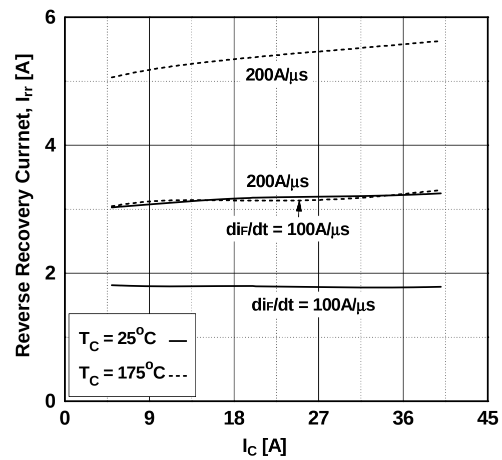


Figure 23. Stored Charge

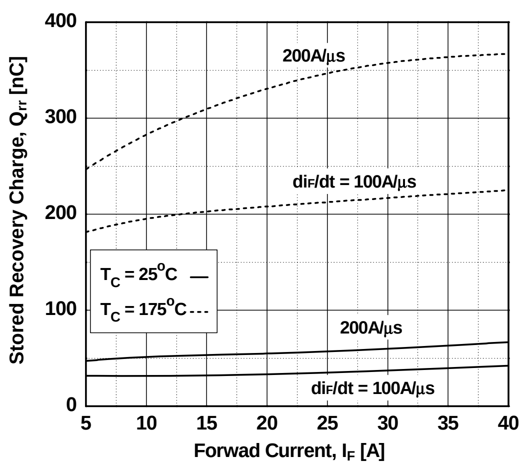
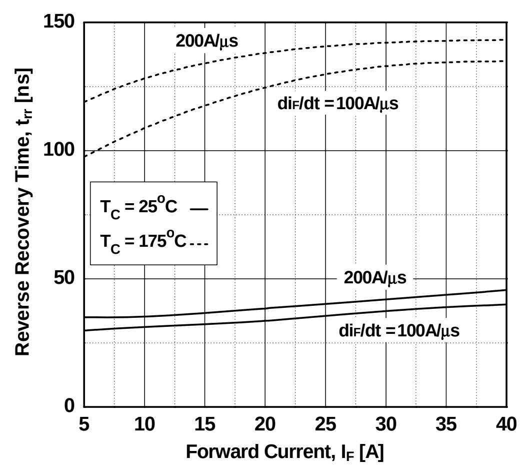


Figure 24. Reverse Recovery Time



Typical Performance Characteristics

Figure 25. Transient Thermal Impedance of IGBT

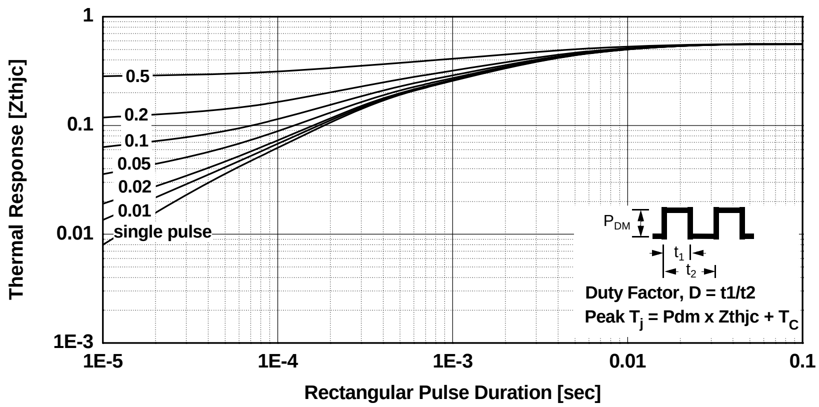
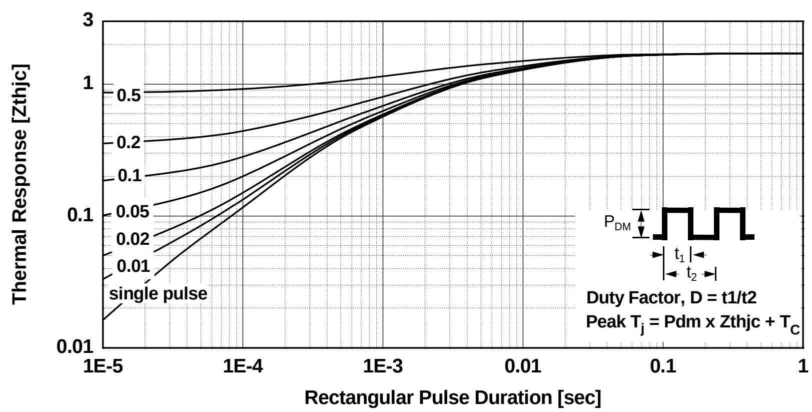
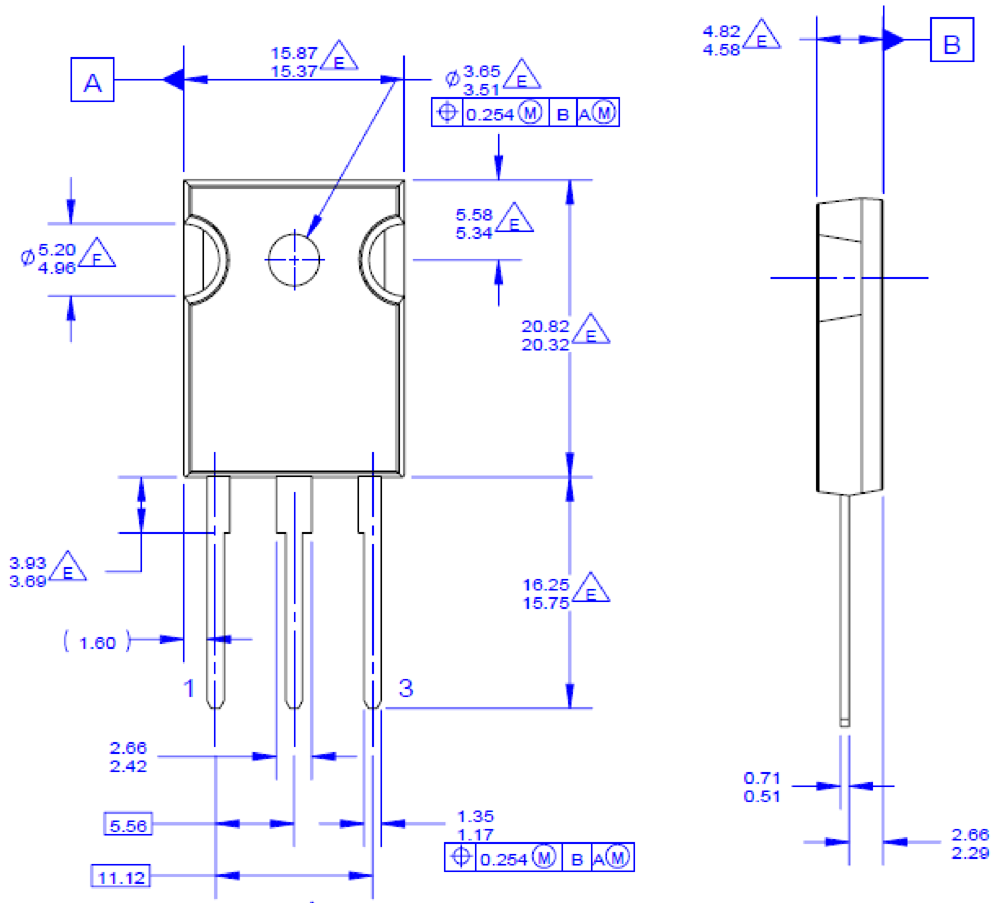


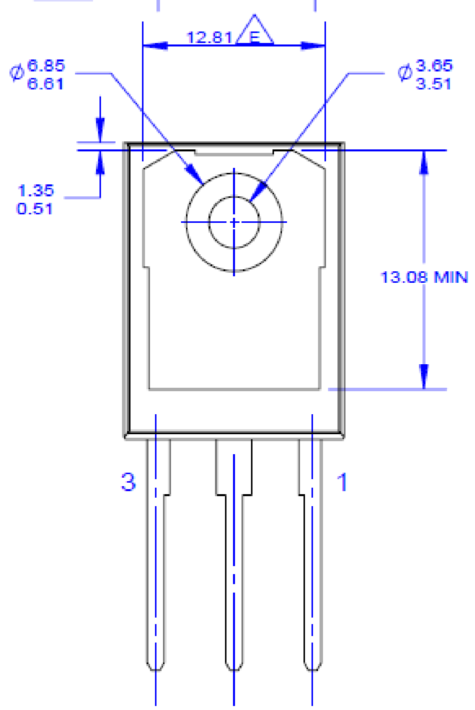
Figure 26.Transient Thermal Impedance of Diode



Mechanical Dimensions

TO - 247A03





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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.
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