FAIRCHILD SEMICONDUCTOR®

October 2011

FGA60N65SMD

650V, 60A Field Stop IGBT

Features

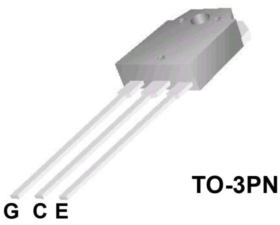
- Maximum Junction Temperature : $T_J = 175^oC$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.9V$(Typ.) @ $I_C = 60A$
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant

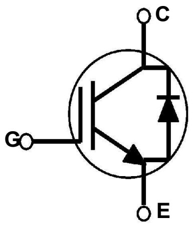
Applications

- Solar Inverter, UPS, SMPS, Welder, PFC

General Description

Using Novel Field Stop IGBT Technology, Fairchild's new series of Field Stop IGBTs offer the optimum performance for Solar Inverter, UPS, SMPS, Welder and PFC applications where low conduction and switching losses are essential.





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	@ $T_C = 25^oC$	120	A
	Collector Current	@ $T_C = 100^oC$	60	A
$I_{CM\ (1)}$	Pulsed Collector Current		180	A
I_F	Diode Forward Current	@ $T_C = 25^oC$	60	A
	Diode Forward Current	@ $T_C = 100^oC$	30	A
$I_{FM\ (1)}$	Pulsed Diode Maximum Forward Current		180	A
P_D	Maximum Power Dissipation	@ $T_C = 25^oC$	600	W
	Maximum Power Dissipation	@ $T_C = 100^oC$	300	W
T_J	Operating Junction Temperature		-55 to +175	^oC
T_{stg}	Storage Temperature Range		-55 to +175	^oC
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	^oC

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	-	0.25	^{o}C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	1.1	^{o}C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	^{o}C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGA60N65SMD	FGA60N65SMD	TO-3PN	-	-	30

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 = 250μA	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 250μA	-	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 = 250μA, $V_{CE} = V_{GE}$	3.5	4.5	6.0	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 60A, V_{GE} = 15V	-	1.9	2.5	V
		I_C = 60A, 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	-	2915	-	pF
C_{oes}	Output Capacitance		-	270	-	pF
C_{res}	Reverse Transfer Capacitance		-	85	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 60A, R_G = 3Ω, V_{GE} = 15V, Inductive Load, T_C = 25^{o}C	-	18	27	ns
t_r	Rise Time		-	47	70	ns
$t_{d(off)}$	Turn-Off Delay Time		-	104	146	ns
t_f	Fall Time		-	50	68	ns
E_{on}	Turn-On Switching Loss		-	1.54	2.31	mJ
E_{off}	Turn-Off Switching Loss		-	0.45	0.60	mJ
E_{ts}	Total Switching Loss		-	1.99	2.91	mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 60A, R_G = 3Ω, V_{GE} = 15V, Inductive Load, T_C = 175^{o}C	-	18	-	ns
t_r	Rise Time		-	41	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	115	-	ns
t_f	Fall Time		-	48	-	ns
E_{on}	Turn-On Switching Loss		-	2.08	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.78	-	mJ
E_{ts}	Total Switching Loss		-	2.86	-	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 = 60A, V_{GE} = 15V	-	189	284	nC
Q_{ge}	Gate to Emitter Charge		-	20	30	nC
Q_{gc}	Gate to Collector Charge		-	91	137	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
V_{FM}	Diode Forward Voltage	I_F = 30A	T_C = 25°C	-	2.1	2.6	V
			T_C = 175°C	-	1.7	-	
E_{rec}	Reverse Recovery Energy	I_F =30A, dI_F/dt = 200A/µs	T_C = 175°C	-	127	-	uJ
t_{rr}	Diode Reverse Recovery Time		T_C = 25°C	-	47	-	ns
			T_C = 175°C	-	212	-	
I_{rr}	Diode Peak Reverse Recovery Current		T_C = 25°C	-	3.7	-	A
			T_C = 175°C	-	8.8	-	
Q_{rr}	Diode Reverse Recovery Charge		T_C = 25°C	-	87	-	nC
			T_C = 175°C	-	933	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

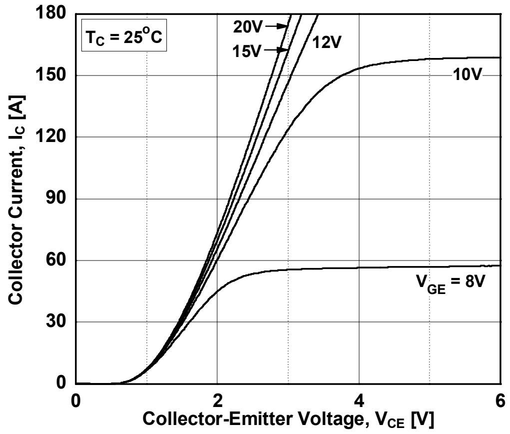


Figure 2. Typical Output Characteristics

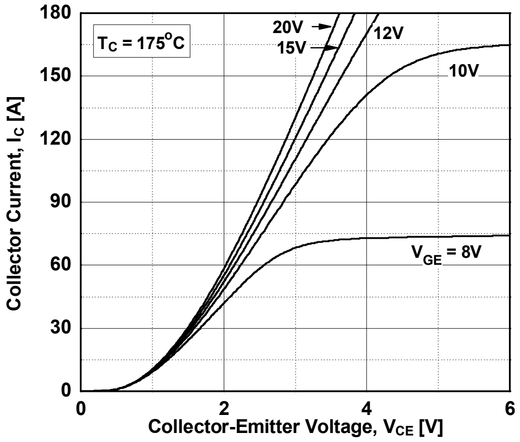


Figure 3. Typical Saturation Voltage Characteristics

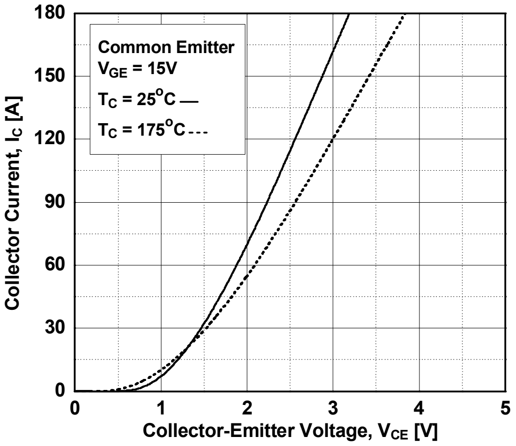


Figure 4. Transfer Characteristics

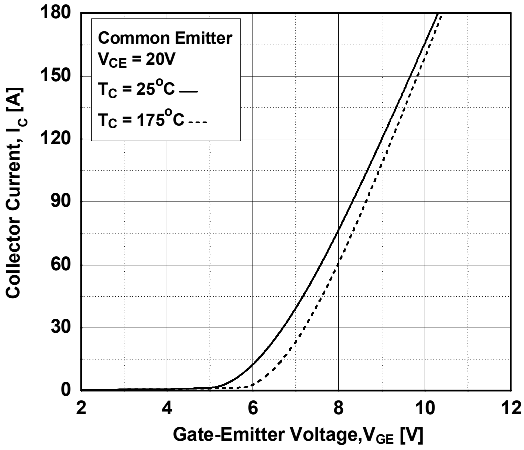


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

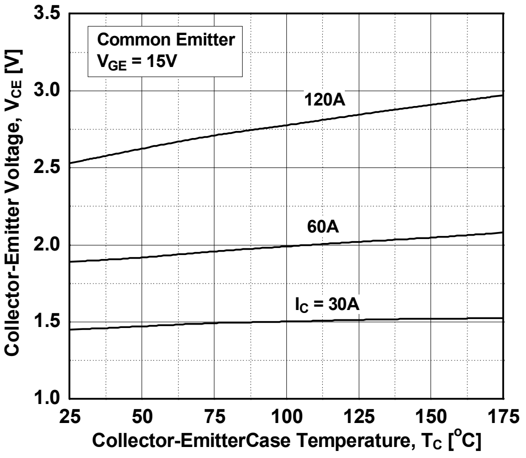
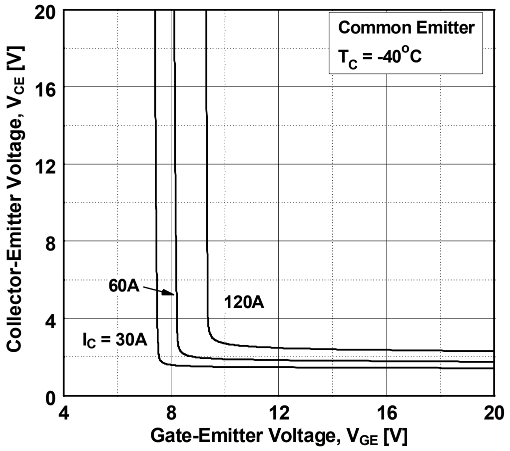


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

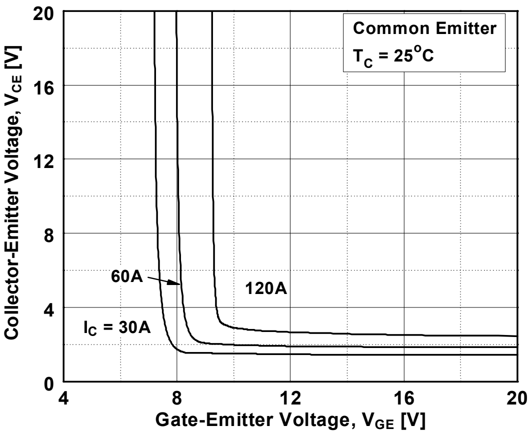


Figure 8. Saturation Voltage vs. V_{GE}

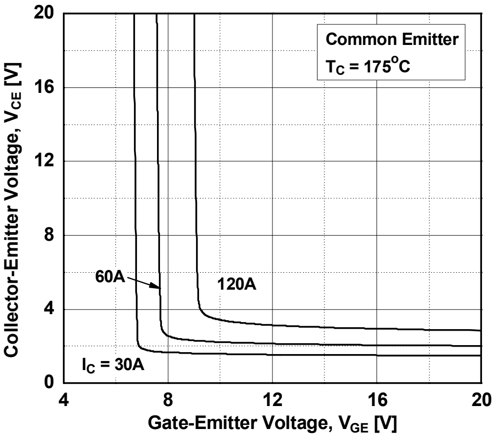


Figure 9. Capacitance Characteristics

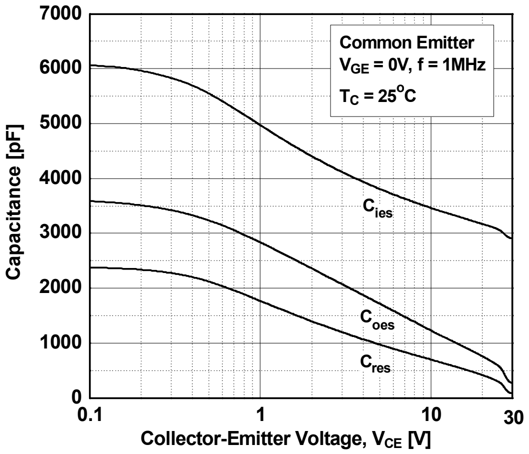


Figure 10. Gate charge Characteristics

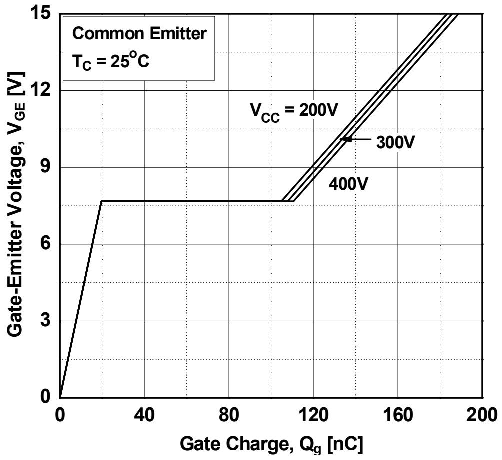


Figure 11. SOA Characteristics

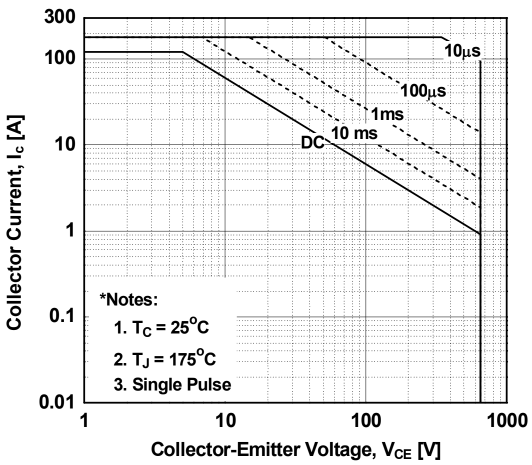
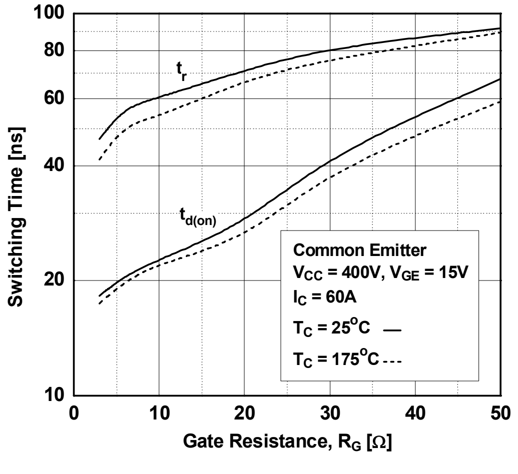


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

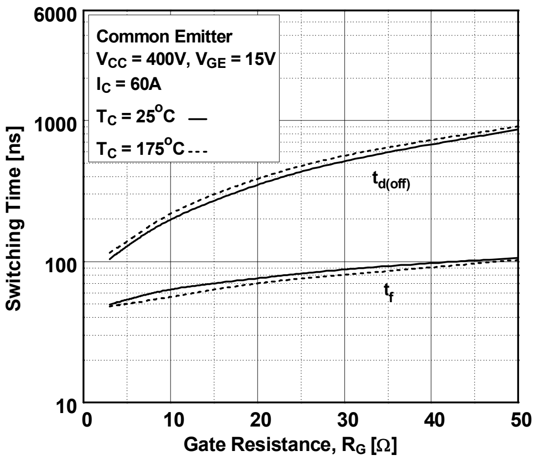


Figure 14. Turn-on Characteristics vs. Collector Current

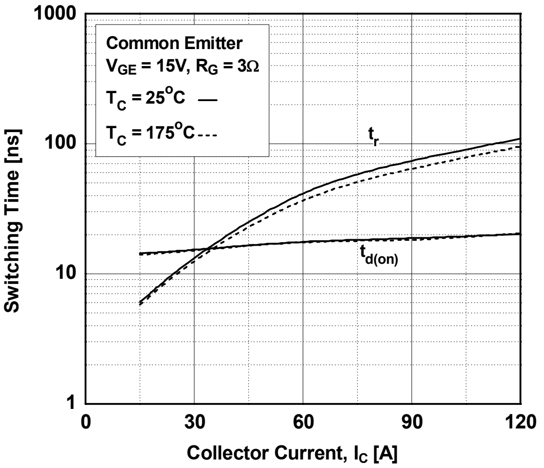


Figure 15. Turn-off Characteristics vs. Collector Current

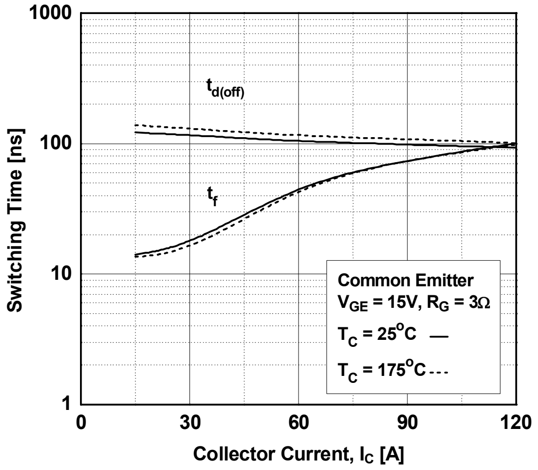


Figure 16. Switching Loss vs. Gate Resistance

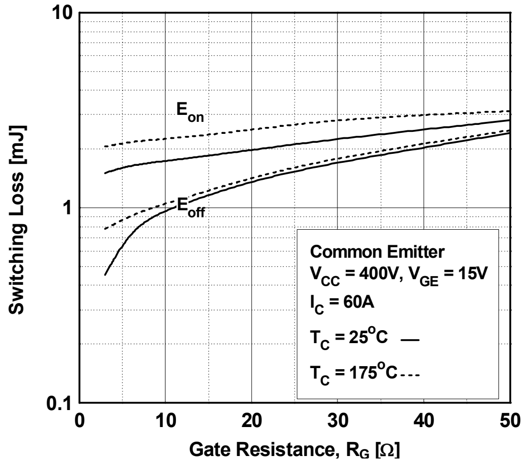


Figure 17. Switching Loss vs. Collector Current

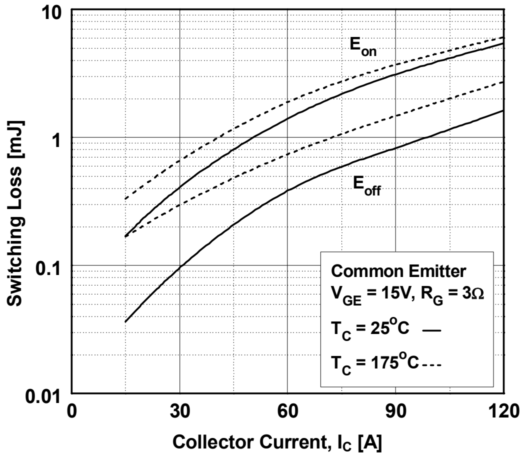
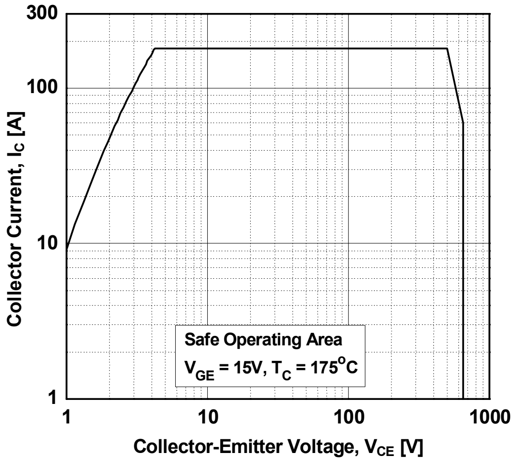


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Current Derating

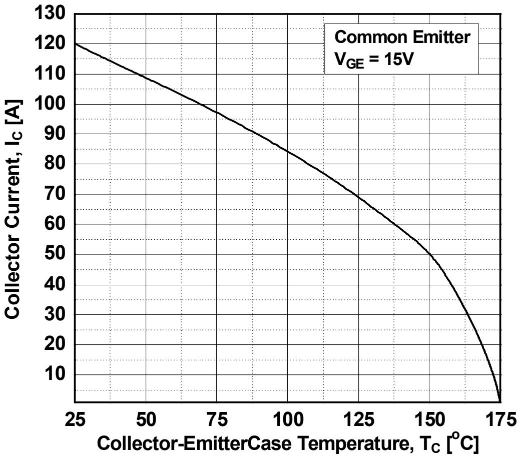


Figure 20. Load Current Vs. Frequency

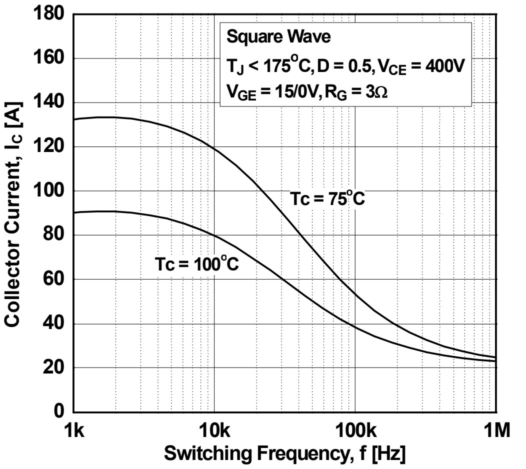


Figure 21. Forward Characteristics

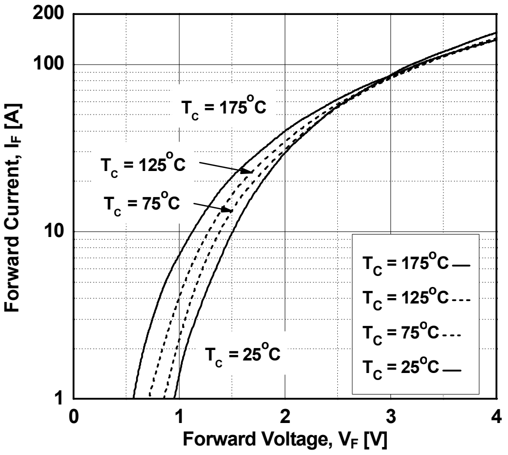


Figure 22. Reverse Recovery Current

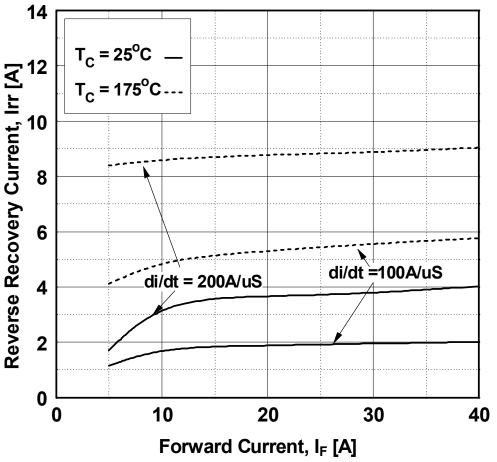


Figure 23. Stored Charge

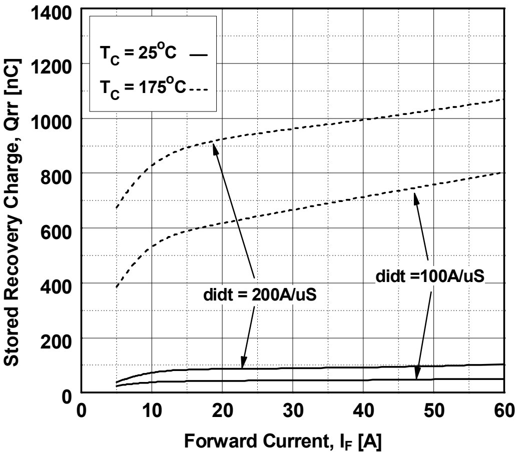
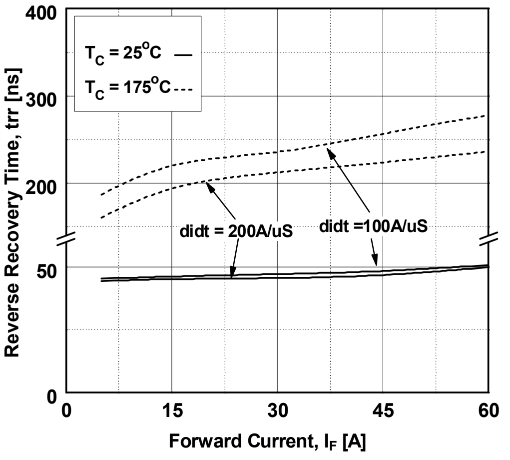


Figure 24. Reverse Recovery Time



Typical Performance Characteristics

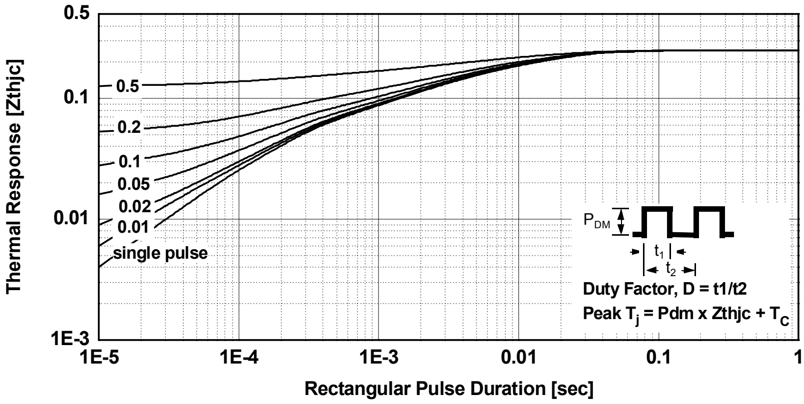


Figure 25.Transient Thermal Impedance of IGBT

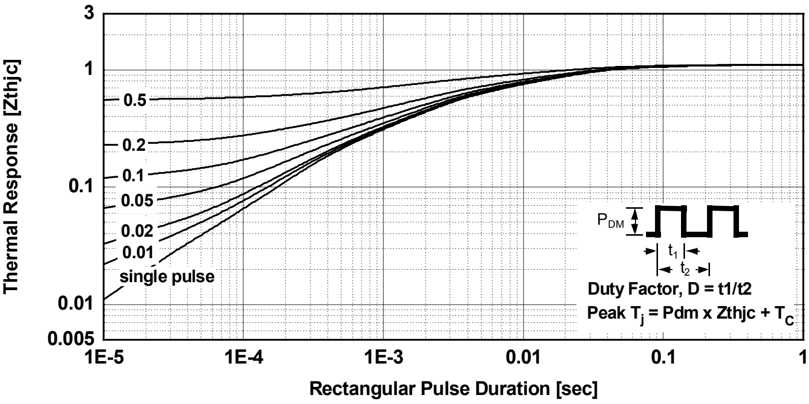
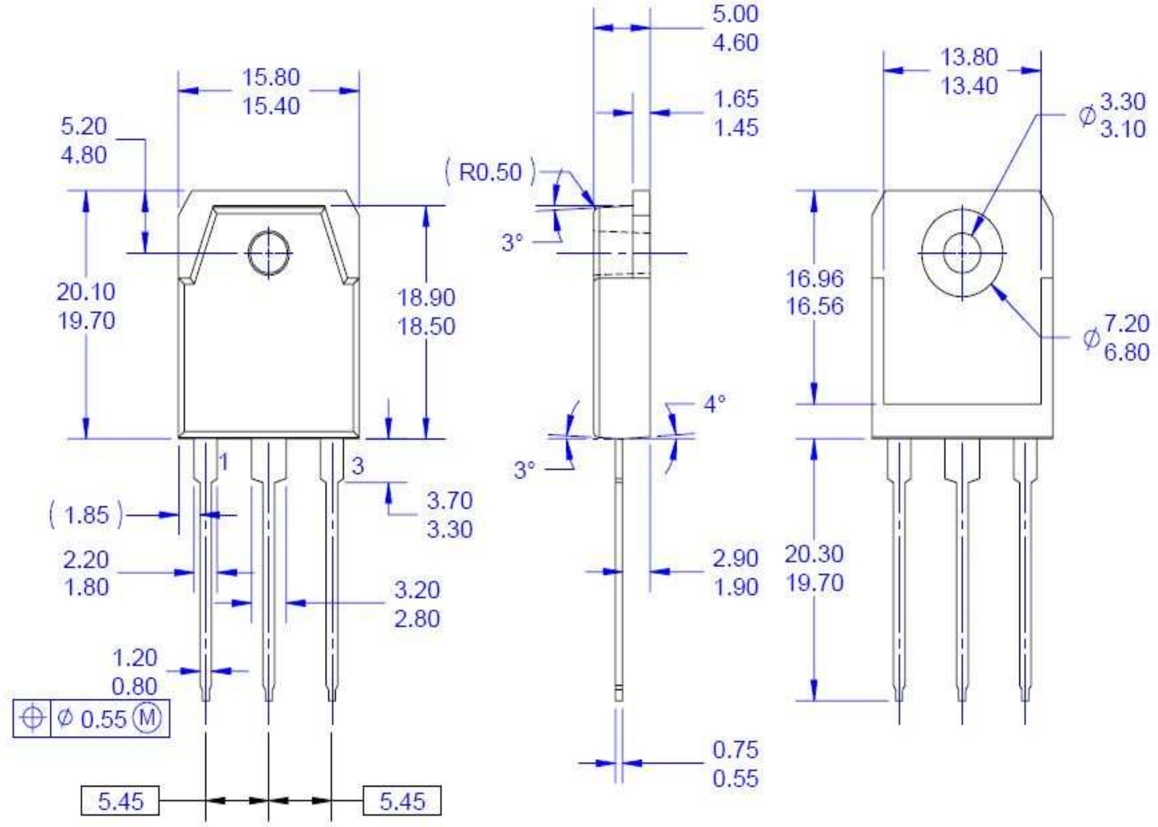
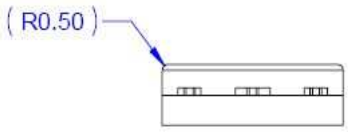


Figure 26.Transient Thermal Impedance of Diode

Mechanical Dimensions

TO-3PN





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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
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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