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FAIRCHILD

February 2016

FGA40S65SH

650 V, 40 A Field Stop Trench IGBT

Features

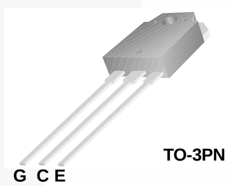
- Maximum Junction Temperature : $T_J = 175^oC$
- Positive Temperaure Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.4$ V (Typ.) @ $I_C = 40$ A
- 100% of the Parts tested for I_{LM}(1)
- High Input Impedance
- Tighten Parameter Distribution
- RoHS Compliant

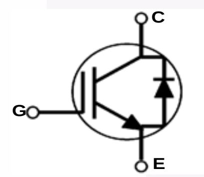
General Description

Using Fairchild's proprietary trench design and advanced field stop IGBT technology, 650V field stop offers superior conduction and switching performance and easy parallel operation. This device is well suited for the resonant or soft switching application such as induction heating and MWO.

Applications

- Induction Heating, MWO





Absolute Maximum Ratings

Symbol	Description		FGA40S65SH	Unit
V_{CES}	Collector to Emitter Voltage		650	V
V_{GES}	Gate to Emitter Voltage		± 20	V
	Transient Gate to Emitter Voltage		± 30	V
I_C	Collector Current	@ $T_C = 25^oC$	80	A
	Collector Current	@ $T_C = 100^oC$	40	A
I_{LM} (1)	Pulsed Collector Current	@ $T_C = 25^oC$	120	A
I_{CM} (2)	Pulsed Collector Current		120	A
I_F	Diode Forward Current	@ $T_C = 25^oC$	40	A
	Diode Forward Current	@ $T_C = 100^oC$	20	A
I_{FM}	Pulsed Diode Maximum Forward Current		240	A
P_D	Maximum Power Dissipation	@ $T_C = 25^oC$	268	W
	Maximum Power Dissipation	@ $T_C = 100^oC$	134	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

Thermal Characteristics

Symbol	Parameter	FGA40S65SH	Unit
$R_{\theta JC}$ (IGBT)	Thermal Resistance, Junction to Case, Max.	0.56	$^oC/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	$^oC/W$

Notes:
1. $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 120$ A, $R_G = 35\ \Omega$, Inductive Load
2. Repetitive rating: Pulse width limited by max. junction temperature

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Qty per Tube
FGA40S65SH	FGA40S65SH	TO-3PN	-	-	30

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} = 0 V, I_C = 1 mA	650	-	-	V
ΔBV_{CES} / ΔT_J	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	-	0.65	-	V/°C
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0 V	-	-	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, V_{CE} = 0 V	-	-	± 400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 40 mA, $V_{CE} = V_{GE}$	4.0	5.3	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 40 A, V_{GE} = 15 V	-	1.40	1.81	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 175°C	-	1.65	-	V
V_{FM}	Diode Forward Voltage	I_F = 20 A, T_C = 25°C	-	1.45	1.95	V
		I_F = 20 A, T_C = 175°C	-	1.65	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	-	2012	-	pF
C_{oes}	Output Capacitance		-	49	-	pF
C_{res}	Reverse Transfer Capacitance		-	26	-	pF
Switching Characteristics						
$T_{d(on)}$	Turn-On Delay Time	V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω, V_{GE} = 15 V, Resistive Load, T_C = 25°C	-	19.2	-	ns
T_r	Rise Time		-	65.6	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	68.8	-	ns
T_f	Fall Time		-	96.8	-	ns
E_{on}	Turn-On Switching Loss		-	194	-	uJ
E_{off}	Turn-Off Switching Loss		-	388	-	uJ
E_{ts}	Total Switching Loss		-	592	-	uJ
$T_{d(on)}$	Turn-On Delay Time	V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω, V_{GE} = 15 V, ResistiveLoad, T_C = 175°C	-	19.2	-	ns
T_r	Rise Time		-	87.2	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	75.2	-	ns
T_f	Fall Time		-	158	-	ns
E_{on}	Turn-On Switching Loss		-	292	-	uJ
E_{off}	Turn-Off Switching Loss		-	633	-	uJ
E_{ts}	Total Switching Loss		-	925	-	uJ
Q_g	Total Gate Charge	V_{CE} = 400 V, I_C = 40 A, V_{GE} = 15 V	-	73	-	nC
Q_{ge}	Gate to Emitter Charge		-	13	-	nC
Q_{gc}	Gate to Collector Charge		-	28	-	nC

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

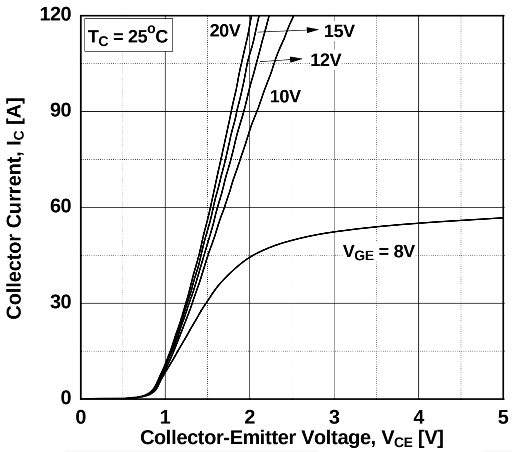


Figure 2. Typical Output Characteristics

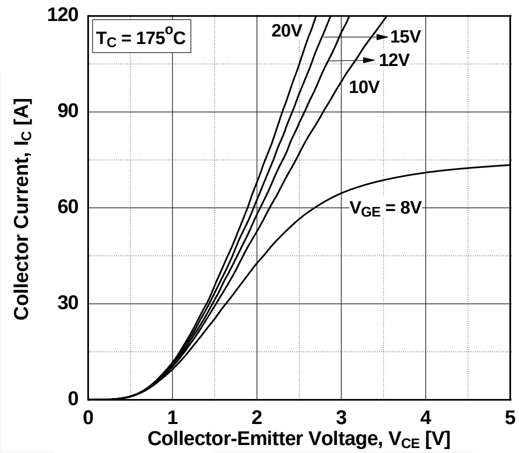


Figure 3. Typical Saturation Voltage Characteristics

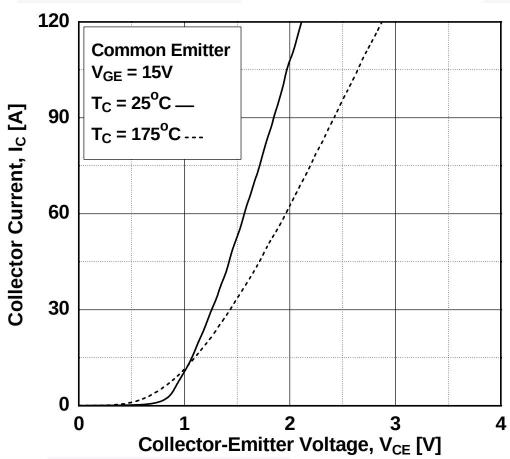


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

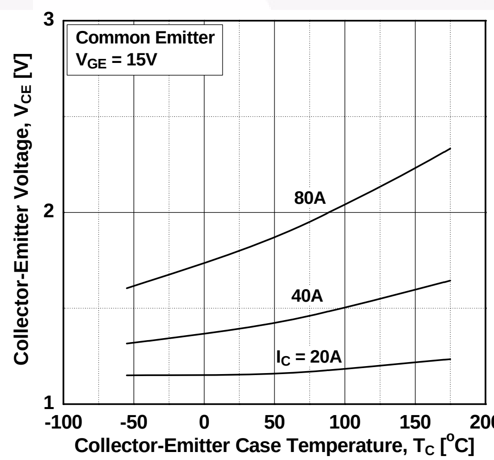


Figure 5. Saturation Voltage vs. V_{GE}

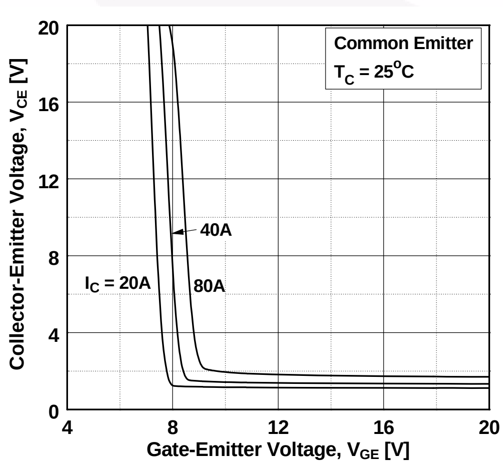
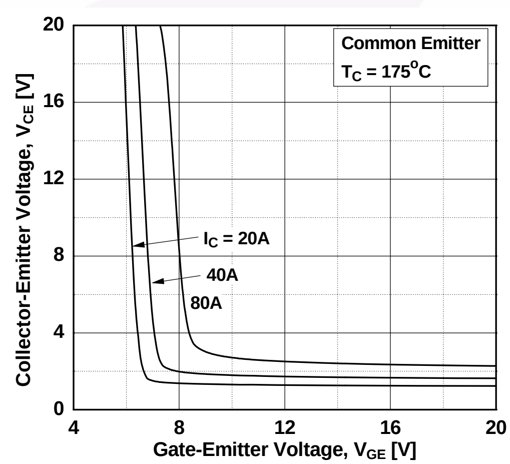


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Capacitance Characteristics

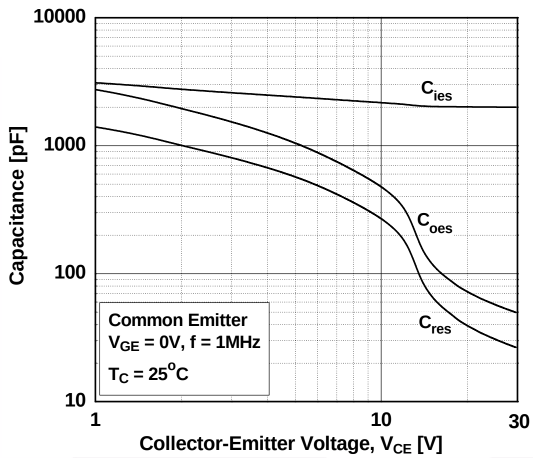


Figure 8. Gate charge Characteristics

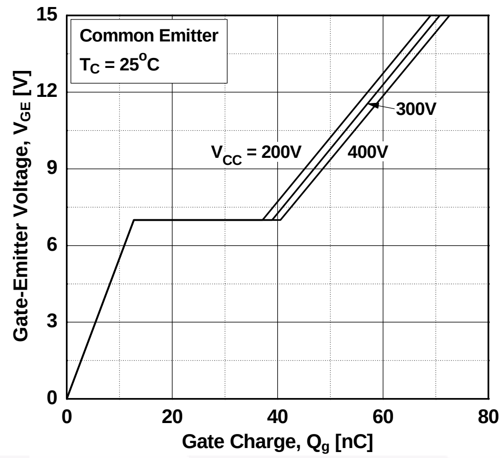


Figure 9. Turn-on Characteristics vs. Gate Resistance

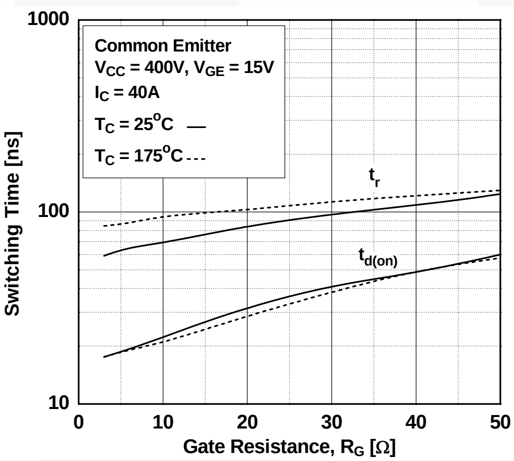


Figure 10. Turn-off Characteristics vs. Gate Resistance

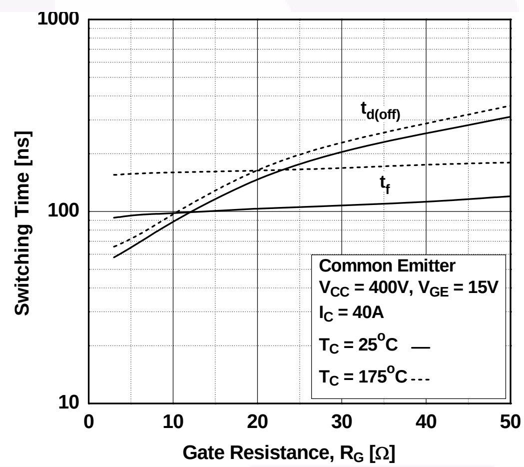


Figure 11. Switching Loss vs. Gate Resistance

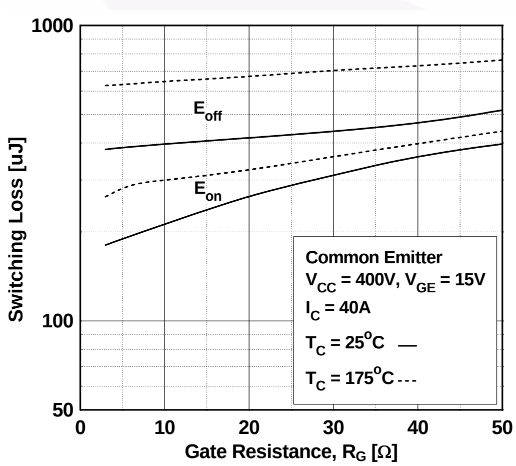
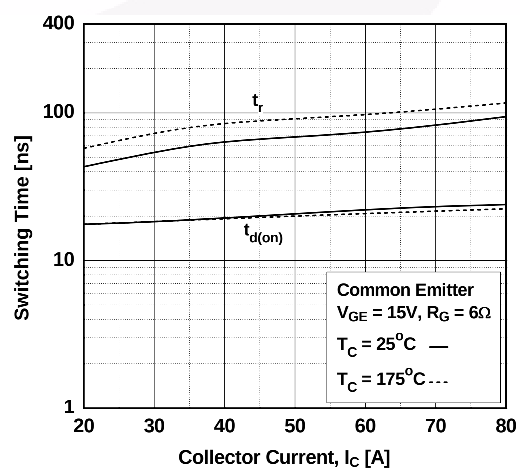


Figure 12. Turn-on Characteristics vs. Collector Current



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Collector Current

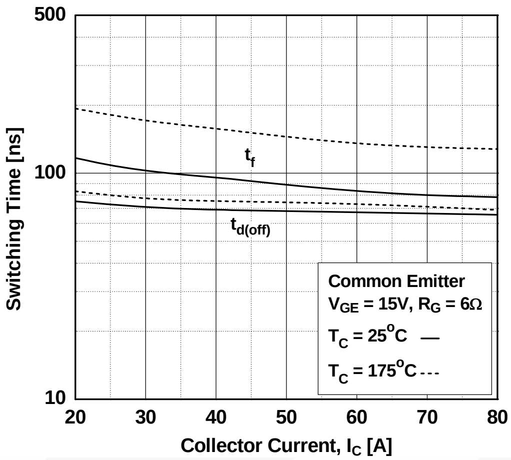


Figure 14. Switching Loss vs. Collector Current

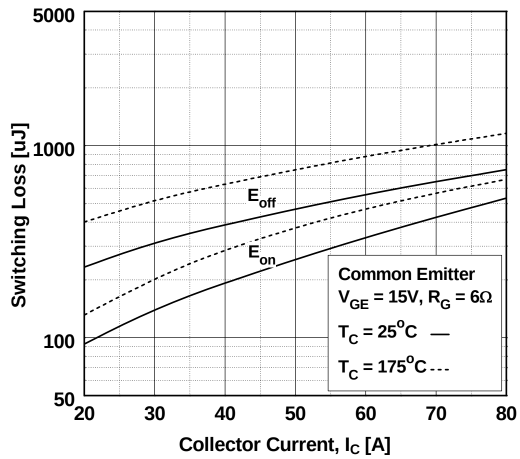


Figure 15. Load Current Vs. Frequency

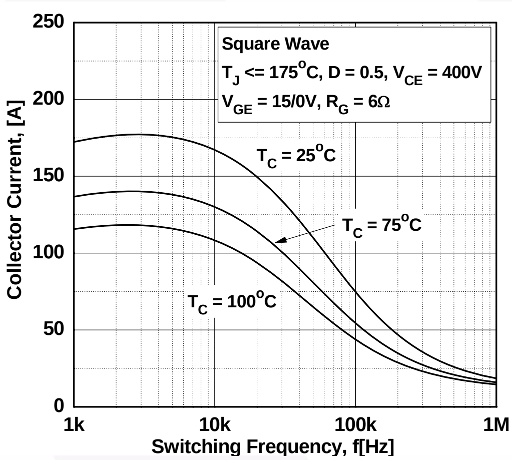


Figure 16. SOA Characteristics

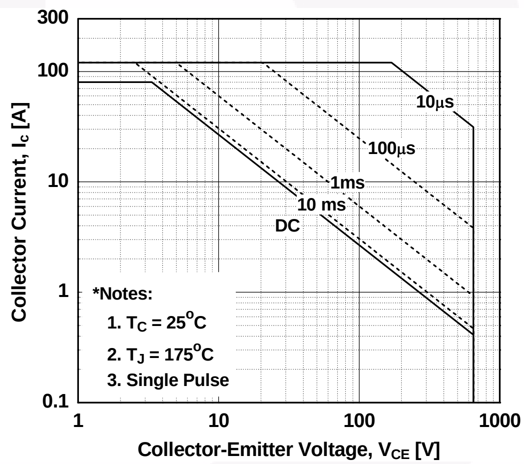
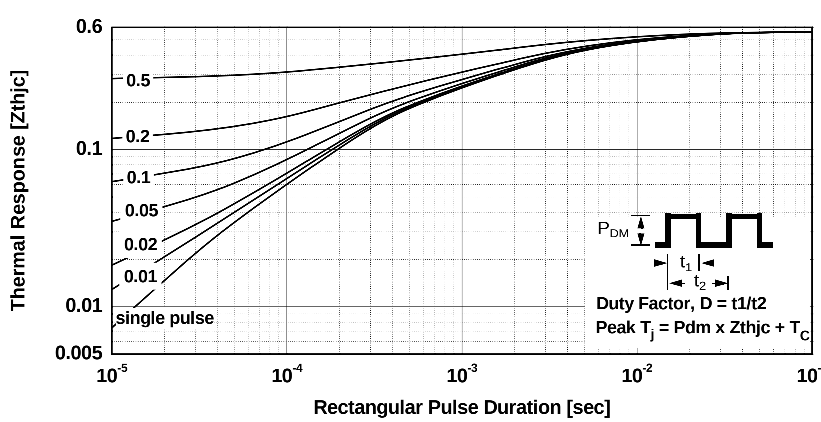
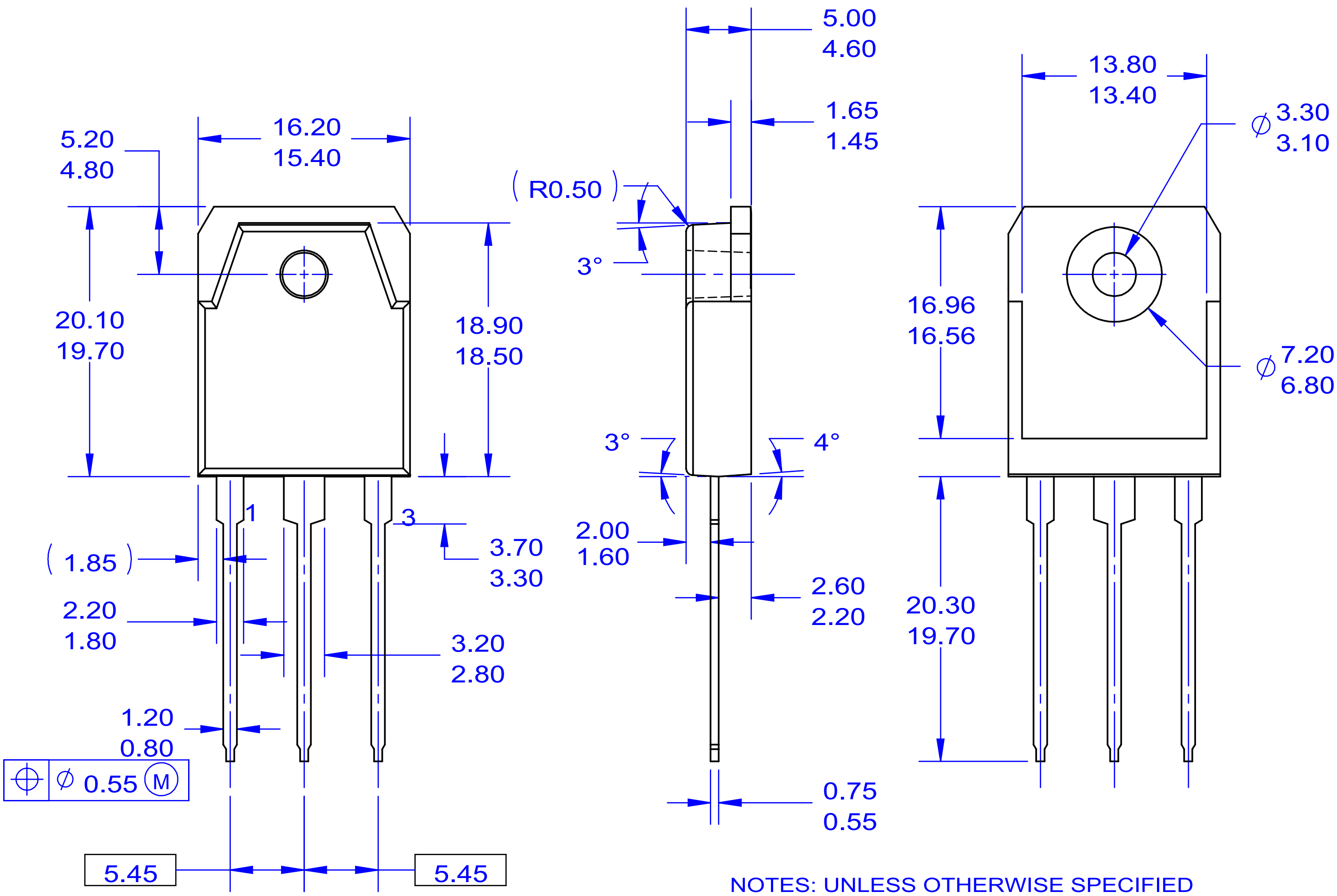
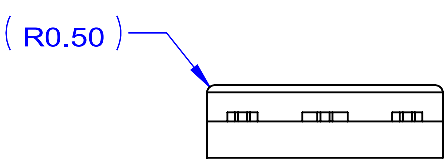


Figure 17. Transient Thermal Impedance of IGBT







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