Fuji Electric

Innovating Energy Technology

FGW40XS120C

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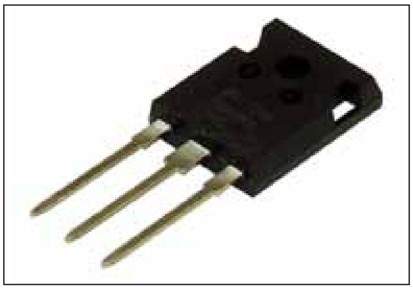
Discrete IGBT

Discrete IGBT (XS-series)
1200V / 40A

Features
Pb-free lead terminal; RoHS compliant
Halogen-free molding compound

Applications
Uninterrupted Power Supply, PV Power Conditioner,
Inverter welding machine



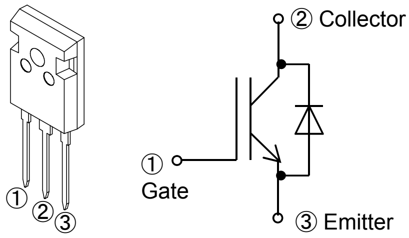
Maximum Ratings and Characteristics

● **Absolute Maximum Ratings at T_{vj} = 25 °C (unless otherwise specified)**

Parameter	Symbol	Value	Unit	Remarks
Collector-Emitter Voltage	V_{CES}	1200	V	
Gate-Emitter Voltage	V_{GES}	± 20	V	
Transient Gate-Emitter Voltage		± 30		t_p < 1 μs
DC Collector Current	$I_{C@25}$	63	A	T_C = 25 °C
	$I_{C@100}$	40	A	T_C = 100 °C
Pulsed Collector Current	I_{CP}	160	A	Note *1
Turn-Off Safe Operating Area	-	160	A	V_{CE} ≤ 1200 V T_{vj} ≤ 175 °C
Diode Forward Current	$I_{F@25}$	63	A	
	$I_{F@100}$	40	A	
Diode Pulsed Current	I_{FP}	160	A	Note *1
IGBT Max. Power Dissipation	P_{tot_IGBT}	351	W	T_C = 25 °C
FWD Max. Power Dissipation	P_{tot_FWD}	127	W	T_C = 25 °C
Operating Junction Temperature	T_{vj}	-40 ~ +175	°C	
Storage Temperature	T_{stg}	-55 ~ +175	°C	

Note *1 : Pulse width limited by $T_{vj\,max}$.

Equivalent circuit



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● **Electrical Characteristics at T_{vj} = 25 °C (unless otherwise specified)**

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 1200 V	T_{vj} = 25 °C	-	-	250	μA
		V_{GE} = 0 V	T_{vj} = 175 °C	-	-	2	mA
Gate-Emitter Leakage Current	I_{GES}	V_{CE} = 0 V V_{GE} = ± 20 V		-	-	200	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	V_{CE} = 20 V I_C = 40 mA		4.9	5.5	6.1	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_{GE} = 15 V I_C = 40 A	T_{vj} = 25 °C	-	1.60	1.90	V
			T_{vj} = 125 °C	-	2.05	-	
			T_{vj} = 175 °C	-	2.15	-	
Input Capacitance	C_{ies}	V_{CE} = 25 V		-	4700	-	pF
Output Capacitance	C_{oes}	V_{GE} = 0 V		-	66	-	
Reverse Transfer Capacitance	C_{res}	f = 1 MHz		-	38	-	
Gate Charge	Q_G	V_{CC} = 600 V I_C = 40 A V_{GE} = 15 V		-	250	-	nC
Turn-On Delay Time	$t_{d(on)}$	T_{vj}= 25 °C		-	45	-	ns
Rise Time	t_r	V_{CC} = 600 V		-	32	-	
Turn-Off Delay Time	$t_{d(off)}$	I_C = 40 A		-	250	-	
Fall Time	t_f	V_{GE} = 15 V		-	60	-	
Turn-On Energy	E_{on}	R_G = 10 Ω		-	1.4	-	mJ
Turn-Off Energy	E_{off}	Energy loss include “tail” and FWD reverse recovery.		-	1.7	-	
Turn-On Delay Time	$t_{d(on)}$	T_{vj} = 175 °C		-	44	-	ns
Rise Time	t_r	V_{CC} = 600 V		-	26	-	
Turn-Off Delay Time	$t_{d(off)}$	I_C = 40 A		-	280	-	
Fall Time	t_f	V_{GE} = 15 V		-	130	-	
Turn-On Energy	E_{on}	R_G = 10 Ω		-	2.2	-	mJ
Turn-Off Energy	E_{off}	Energy loss include “tail” and FWD reverse recovery.		-	2.0	-	
Forward Voltage Drop	V_F	I_F = 40 A	T_{vj} = 25 °C	-	2.90	3.30	V
			T_{vj} = 125 °C	-	3.20	-	V
			T_{vj} = 175 °C	-	3.20	-	V
Diode Reverse Recovery Time	t_{rr}	V_{CC} = 600 V		-	230	-	ns
Diode Reverse Recovery Charge	Q_{rr}	I_F = 40 A -di_F/dt = 300 A/μs T_{vj} = 25 °C		-	1.10	-	μC
Diode Reverse Recovery Time	t_{rr}	V_{CC} = 600 V		-	500	-	ns
Diode Reverse Recovery Charge	Q_{rr}	I_F = 40 A -di_F/dt = 300 A/μs T_{vj} = 175 °C		-	2.30	-	μC

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● Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)\_IGBT}$	-	-	0.427	°C/W
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)\_FWD}$	-	-	1.176	°C/W

Characteristics (Representative)

Figure 4. IGBT Power Dissipation vs T_c

T_{vj} ≤ 175ºC

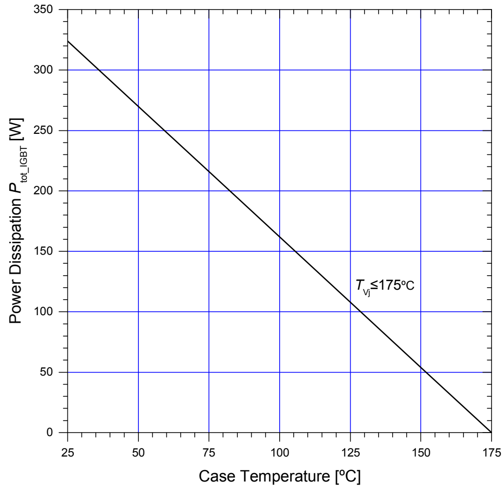


Figure 5. DC Collector Current vs T_c

V_{GE} ≥ +15 V, T_{vj} ≤ 175ºC

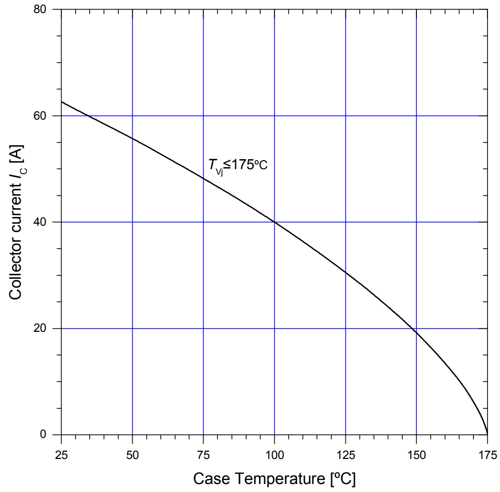


Figure 6. Typical output characteristics

T_{vj} = 25ºC

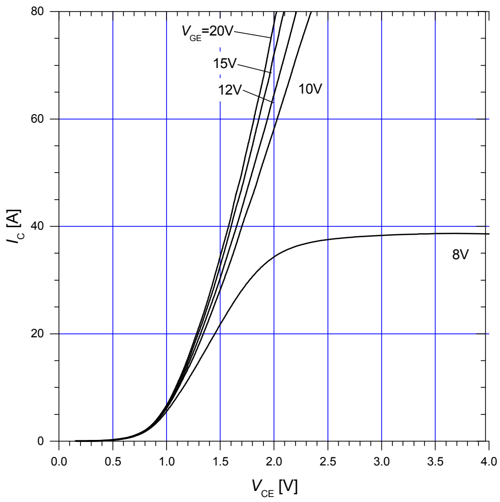


Figure 7. Typical output characteristics

T_{vj} = 175ºC

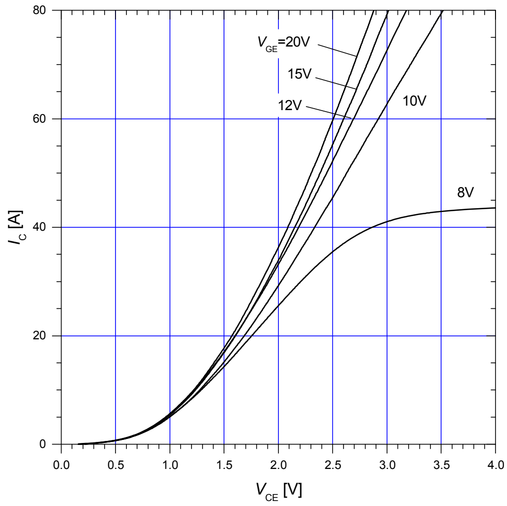


Figure 8. Typical transfer characteristics

V_{CE} = 20 V

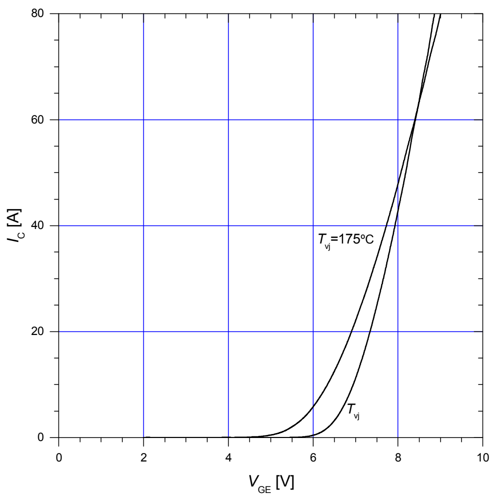


Figure 9. Gate threshold voltage

I_C = 40 mA, V_{CE} = 20 V

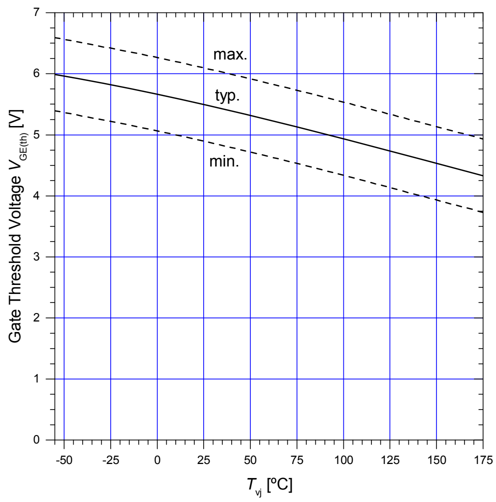


Figure 10. Typical capacitance
V_{GE} = 0 V, f = 1 MHz

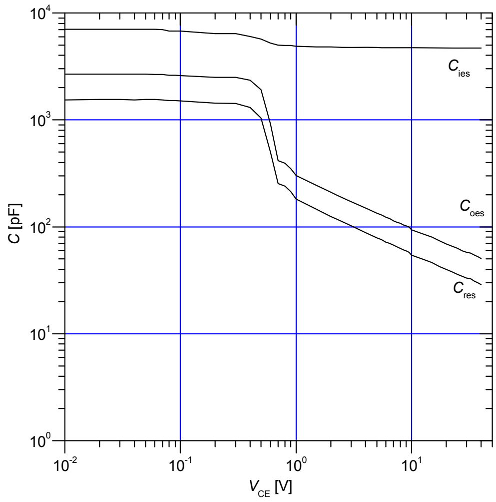


Figure 11. Typical gate charge
I_C = 40 A, V_{CC} = 600 V, T_{vj} = 25ºC

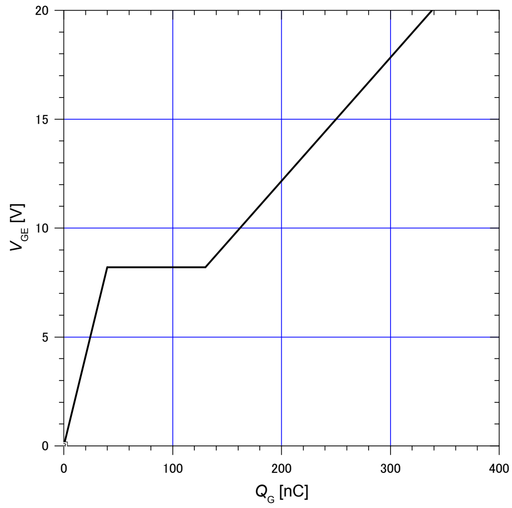


Figure 12. Typical switching times vs. I_C
V_{CC} = 600 V, V_{GE} = 15 V, R_G = 10 Ω, T_{vj} = 175ºC

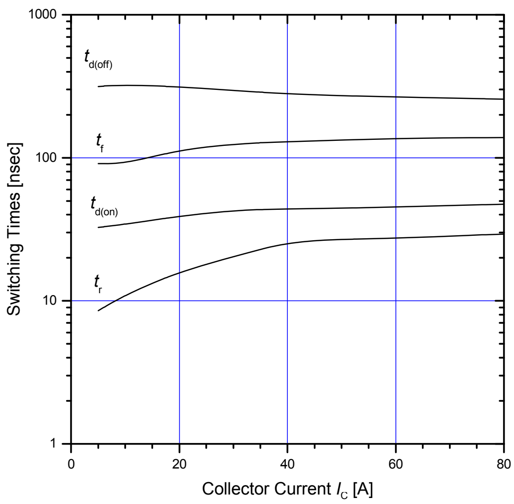


Figure 13. Typical switching times vs. R_G
V_{CC} = 600 V, V_{GE} = 15 V, I_C = 40 A, T_{vj} = 175ºC

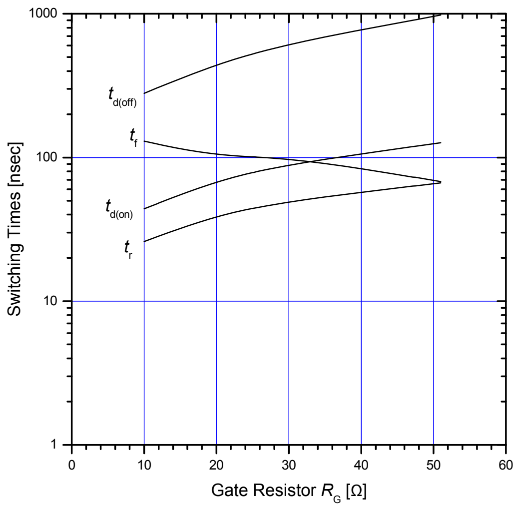


Figure 14. Typical switching losses vs. I_C
V_{CC} = 600 V, V_{GE} = 15 V, R_G = 10 Ω, T_{vj} = 175ºC

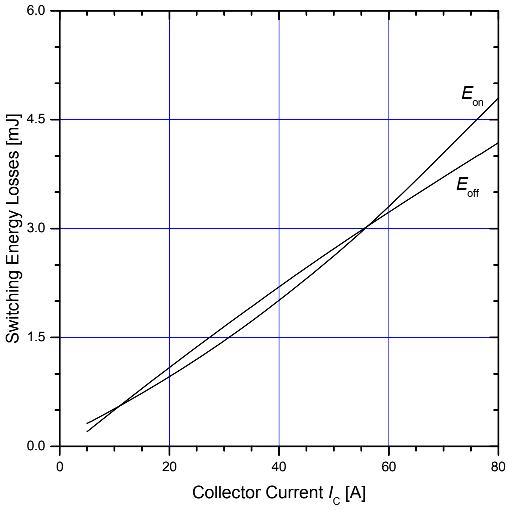


Figure 15. Typical switching losses vs. R_G
V_{CC} = 600 V, V_{GE} = 15 V, I_C = 40 A, T_{vj} = 175ºC

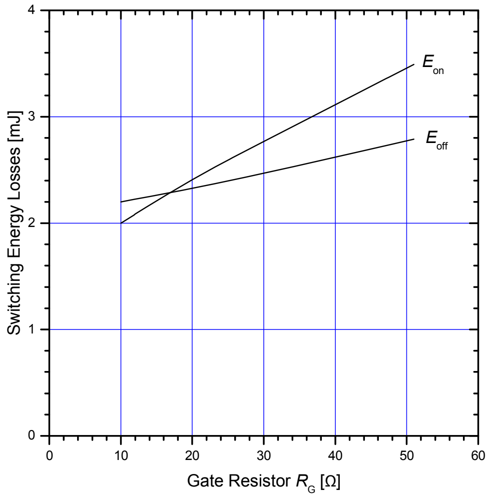


Figure 16. **Typical forward characteristics of FWD**

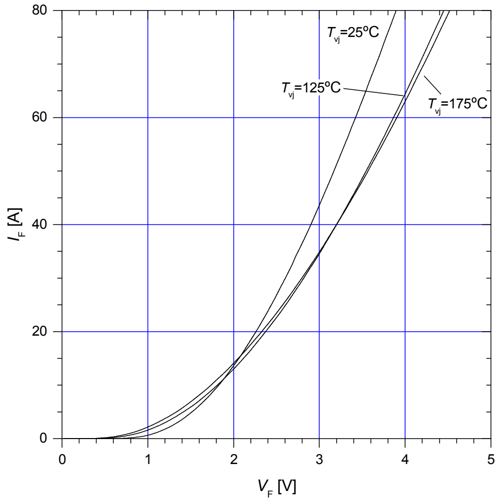


Figure 17.
Typical reverse recovery characteristics vs. I_F
V_{CC} = 600 V, V_{GE} = 15 V, R_G = 10 Ω, T_{vj} = 175ºC

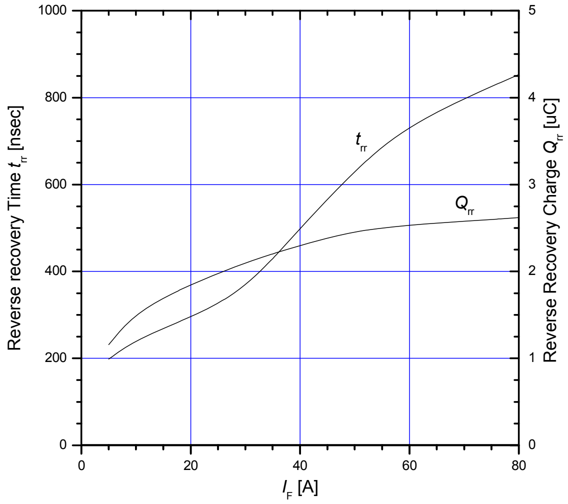


Figure 18. Typical reverse recovery loss vs. I_F
V_{CC} = 600 V, V_{GE} = 15 V, R_G = 10 Ω, T_{vj} = 175ºC

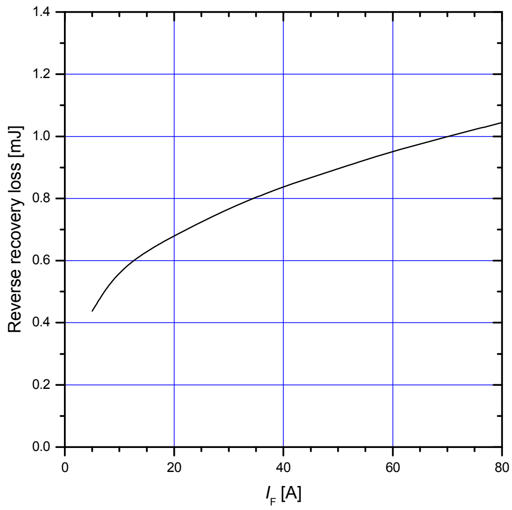


Figure 19. Reverse biased safe operating area
V_{GE} = 15 V / 0 V, R_G = 10 Ω, T_{vj} ≤ 175ºC

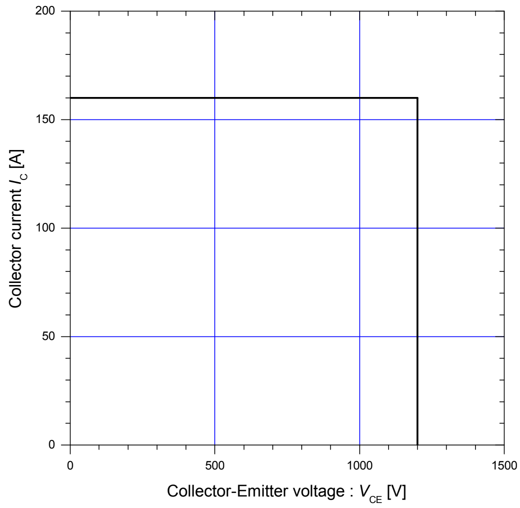


Figure 20. Transient Thermal Impedance of IGBT
D = 0

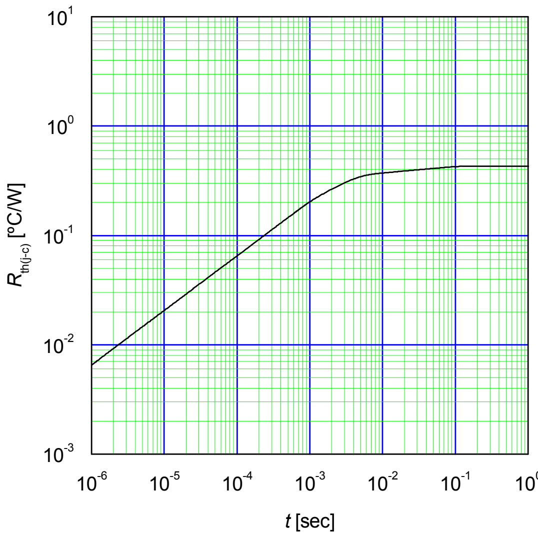
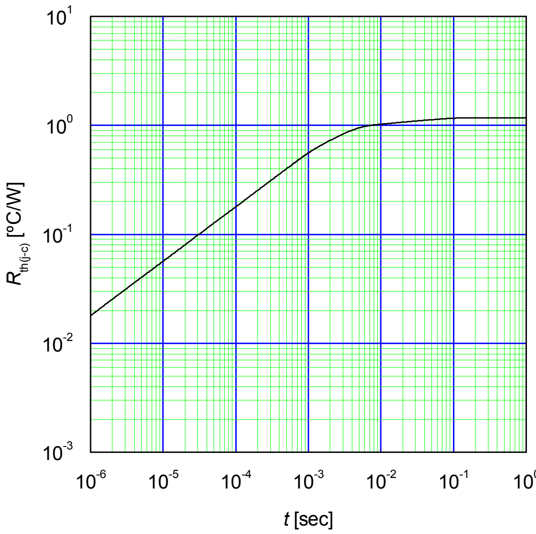
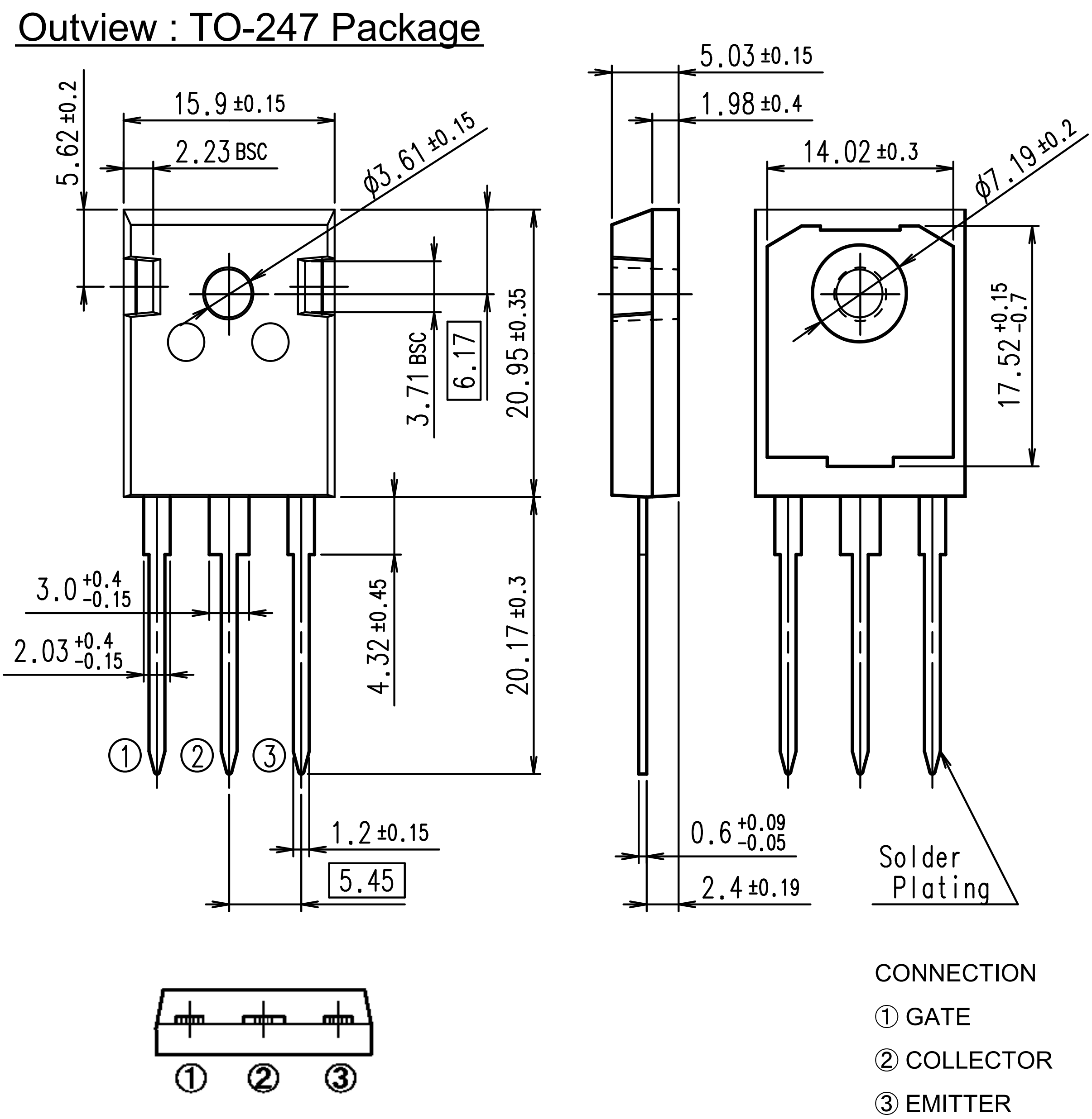


Figure 21. Transient Thermal Impedance of FWD
D = 0



Outline Drawings, mm



CONNECTION
① GATE
② COLLECTOR
③ EMITTER

WARNING

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of March 2020.
The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sur to obtain the latest specifications.

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4. The products introduced in this Catalog are intended for use in the following electronic and electrical equipment which has normal reliability requirements.
   - Computers
   - OA equipment
   - Communications equipment (terminal devices)
   - Measurement equipment
   - Machine tools
   - Audiovisual equipment
   - Electrical home appliances
   - Personal equipment
   - Industrial robots etc.

5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
   - Transportation equipment (mounted on cars and ships)
   - Trunk communications equipment
   - Traffic-signal control equipment
   - Gas leakage detectors with an auto-shut-off feature
   - Emergency equipment for responding to disasters and anti-burglary devices
   - Safety devices
   - Medical equipment

6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
   - Space equipment
   - Aeronautic equipment
   - Nuclear control equipment
   - Submarine repeater equipment

8. If you have any question about any portion in this Catalog, ask Fuji Electric Co., Ltd. or its sales agents before using the product.
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IGBT Modules

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