

FGW40XS120C

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Discrete IGBT

Discrete IGBT (XS-series)

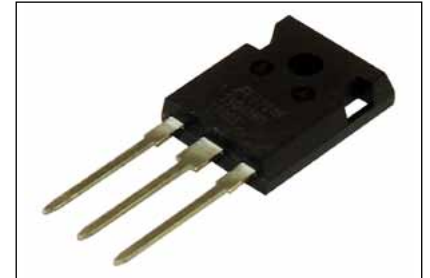
1200V / 40A

Features

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

Applications

Uninterrupted Power Supply, PV Power Conditioner,
Inverter welding machine



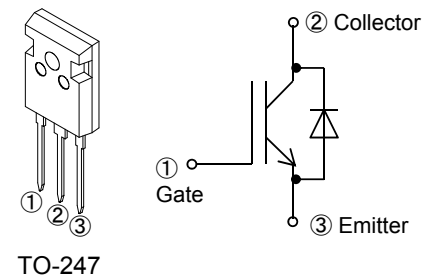
Maximum Ratings and Characteristics

● Absolute Maximum Ratings at $T_{vj} = 25^\circ\text{C}$ (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	V	$t_p < 1 \mu\text{s}$
DC Collector Current	$I_{C@25}$	63	A	$T_c = 25^\circ\text{C}$
	$I_{C@100}$	40	A	$T_c = 100^\circ\text{C}$
Pulsed Collector Current	I_{CP}	160	A	Note *1
Turn-Off Safe Operating Area	-	160	A	$V_{CE} \leq 1200 \text{ V}$ $T_{vj} \leq 175^\circ\text{C}$
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	$T_c = 25^\circ\text{C}$
FWD Max. Power Dissipation	P_{tot_FWD}	127	W	$T_c = 25^\circ\text{C}$
Operating Junction Temperature	T_{vj}	$-40 \sim +175$	$^\circ\text{C}$	
Storage Temperature	T_{stg}	$-55 \sim +175$	$^\circ\text{C}$	

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

Equivalent circuit



● Electrical Characteristics at $T_{vj} = 25^\circ\text{C}$ (unless otherwise specified)

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

● 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 1. IGBT Power Dissipation vs T_c
 $T_{vj} \leq 175^\circ\text{C}$

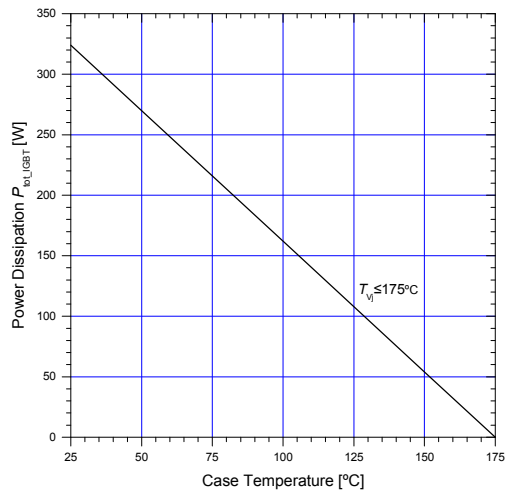


Figure 2. DC Collector Current vs T_c
 $V_{GE} \geq +15\text{ V}$, $T_{vj} \leq 175^\circ\text{C}$

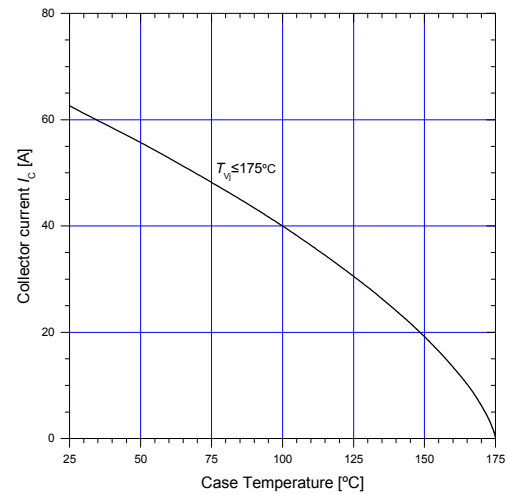


Figure 3. Typical output characteristics
 $T_{vj} = 25^\circ\text{C}$

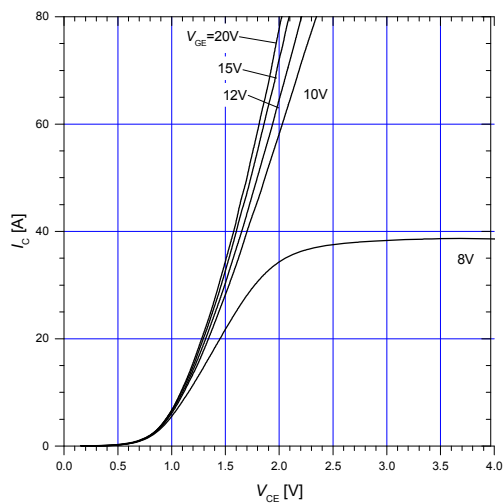


Figure 4. Typical output characteristics
 $T_{vj} = 175^\circ\text{C}$

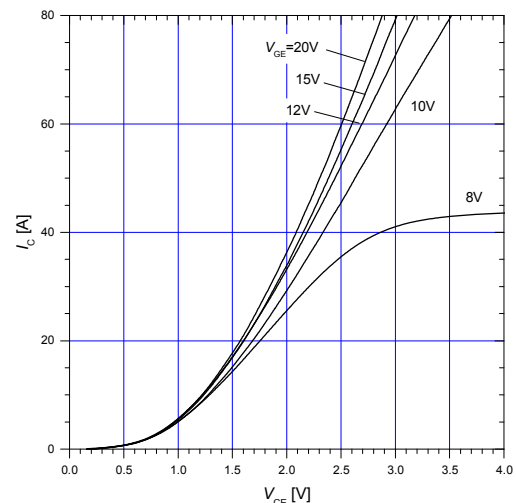


Figure 5. Typical transfer characteristics
 $V_{CE} = 20\text{ V}$

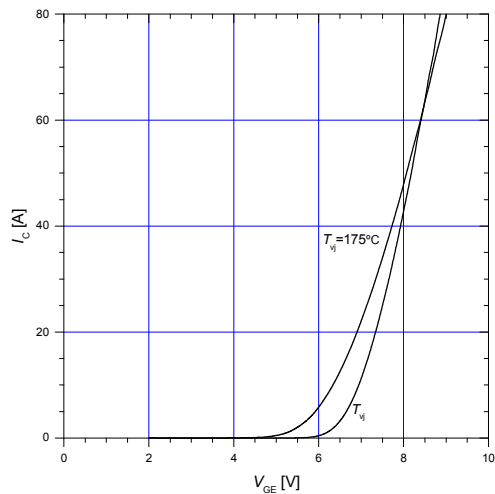


Figure 6. Gate threshold voltage
 $I_C = 40\text{ mA}$, $V_{CE} = 20\text{ V}$

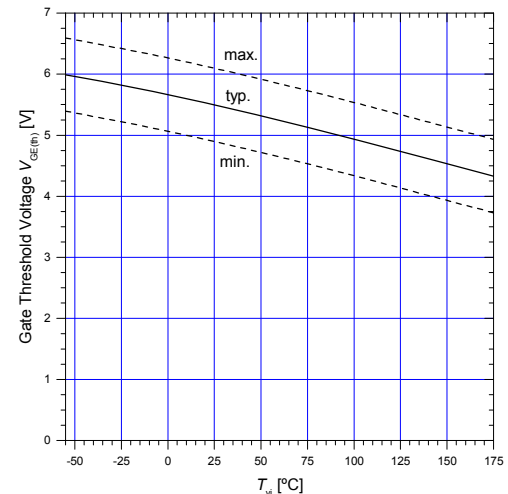


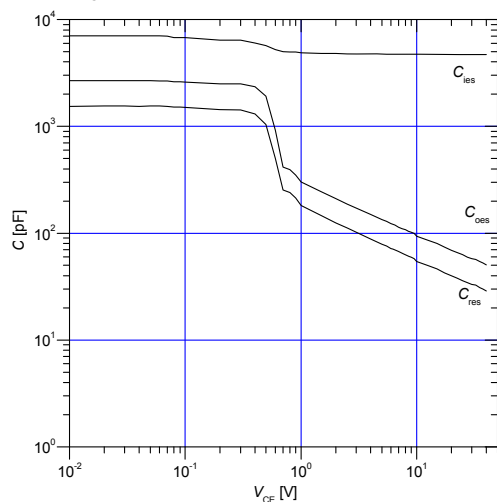
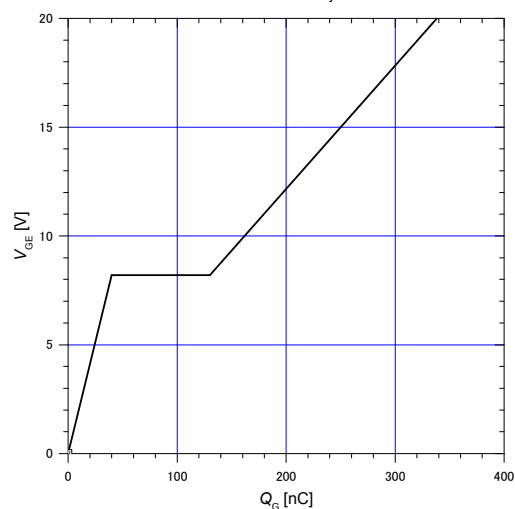
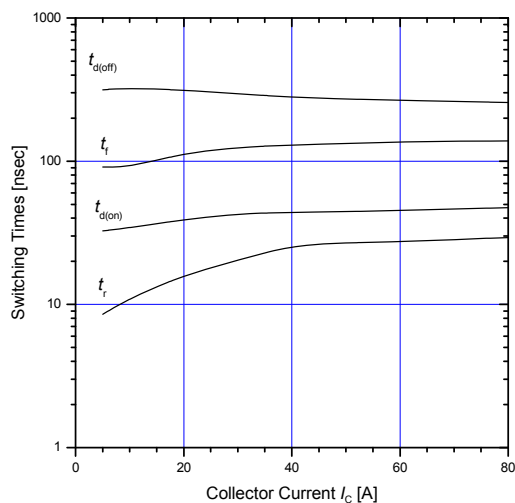
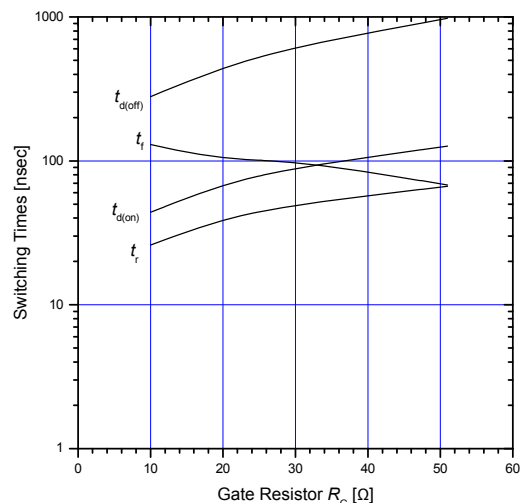
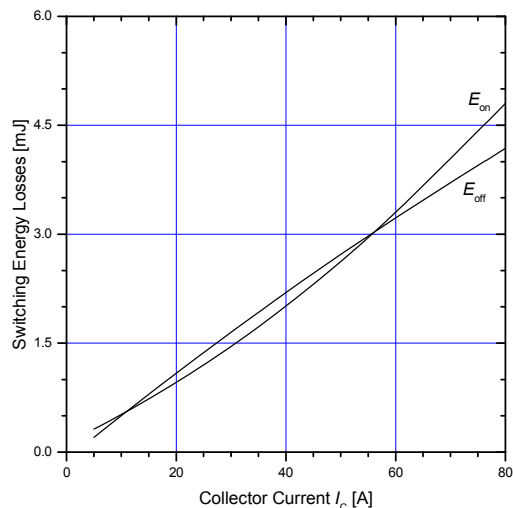
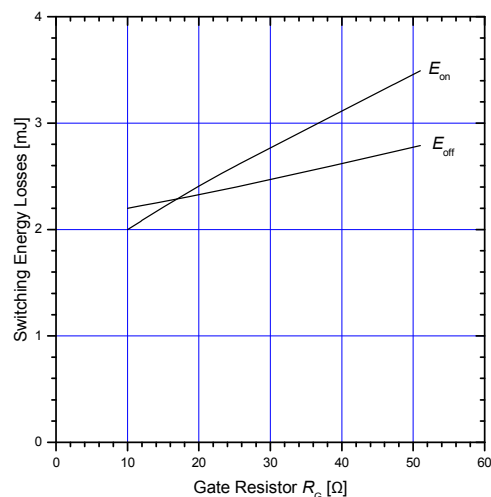
Figure 7. Typical capacitance $V_{GE} = 0 \text{ V}, f = 1 \text{ MHz}$ **Figure 8. Typical gate charge** $I_C = 40 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 25^\circ\text{C}$ **Figure 9. Typical switching times vs. I_C** $V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, R_G = 10 \Omega, T_{vj} = 175^\circ\text{C}$ **Figure 10. Typical switching times vs. R_G** $V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, I_C = 40 \text{ A}, T_{vj} = 175^\circ\text{C}$ **Figure 11. Typical switching losses vs. I_C** $V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, R_G = 10 \Omega, T_{vj} = 175^\circ\text{C}$ **Figure 12. Typical switching losses vs. R_G** $V_{CC} = 600 \text{ V}, V_{GE} = 15 \text{ V}, I_C = 40 \text{ A}, T_{vj} = 175^\circ\text{C}$ 

Figure 13. Typical forward characteristics of FWD

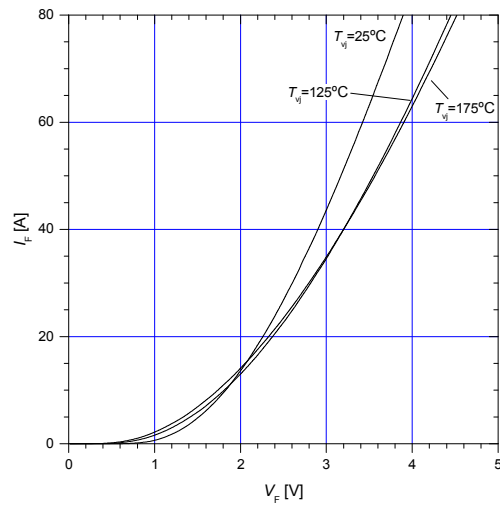


Figure 14.

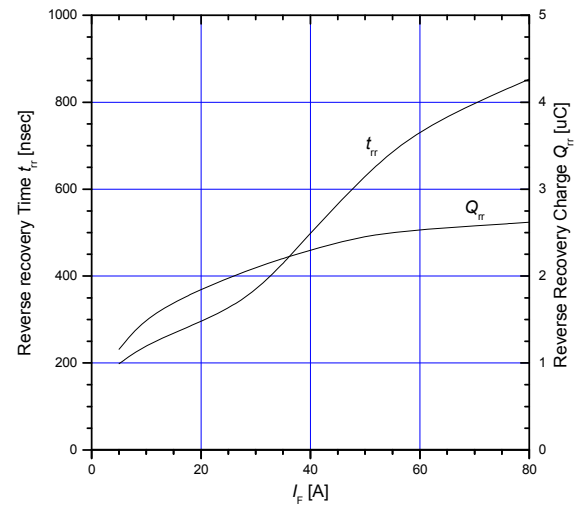
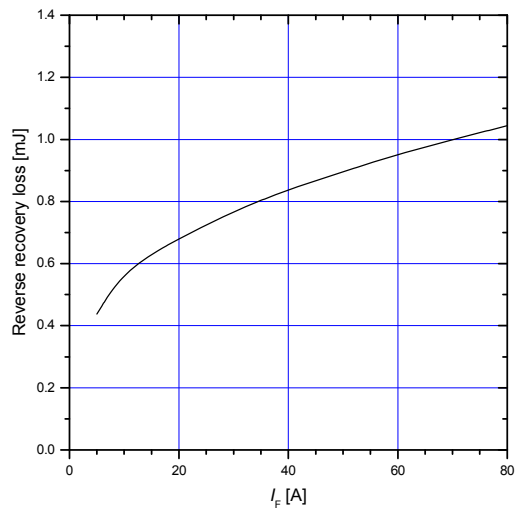
Typical reverse recovery characteristics vs. I_F $V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \text{ }\Omega$, $T_{vj} = 175^\circ\text{C}$ Figure 15. Typical reverse recovery loss vs. I_F $V_{CC} = 600 \text{ V}$, $V_{GE} = 15 \text{ V}$, $R_G = 10 \text{ }\Omega$, $T_{vj} = 175^\circ\text{C}$ 

Figure 16. Reverse biased safe operating area

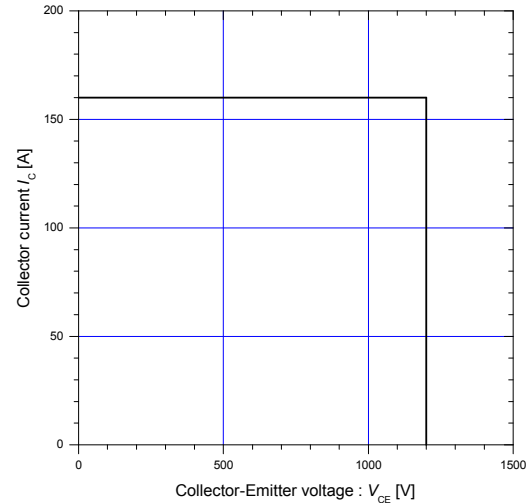
 $V_{GE} = 15 \text{ V} / 0 \text{ V}$, $R_G = 10 \text{ }\Omega$, $T_{vj} \leq 175^\circ\text{C}$ 

Figure 17. Transient Thermal Impedance of IGBT

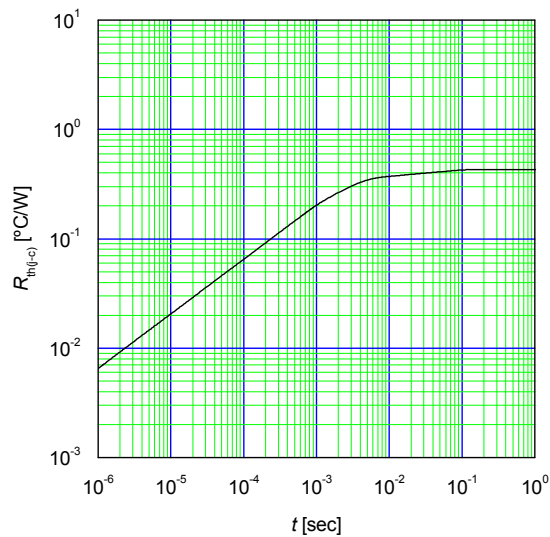
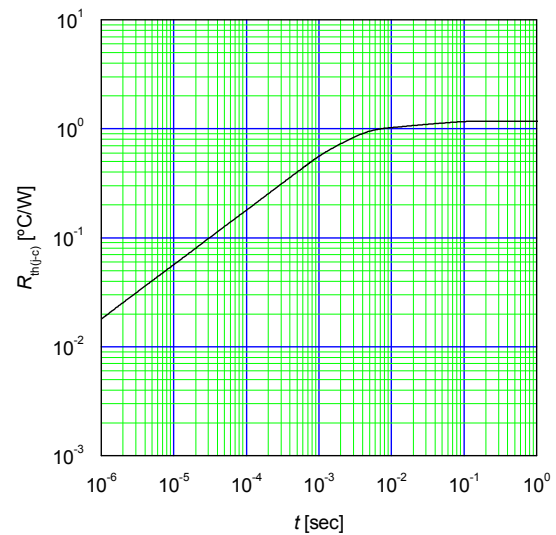
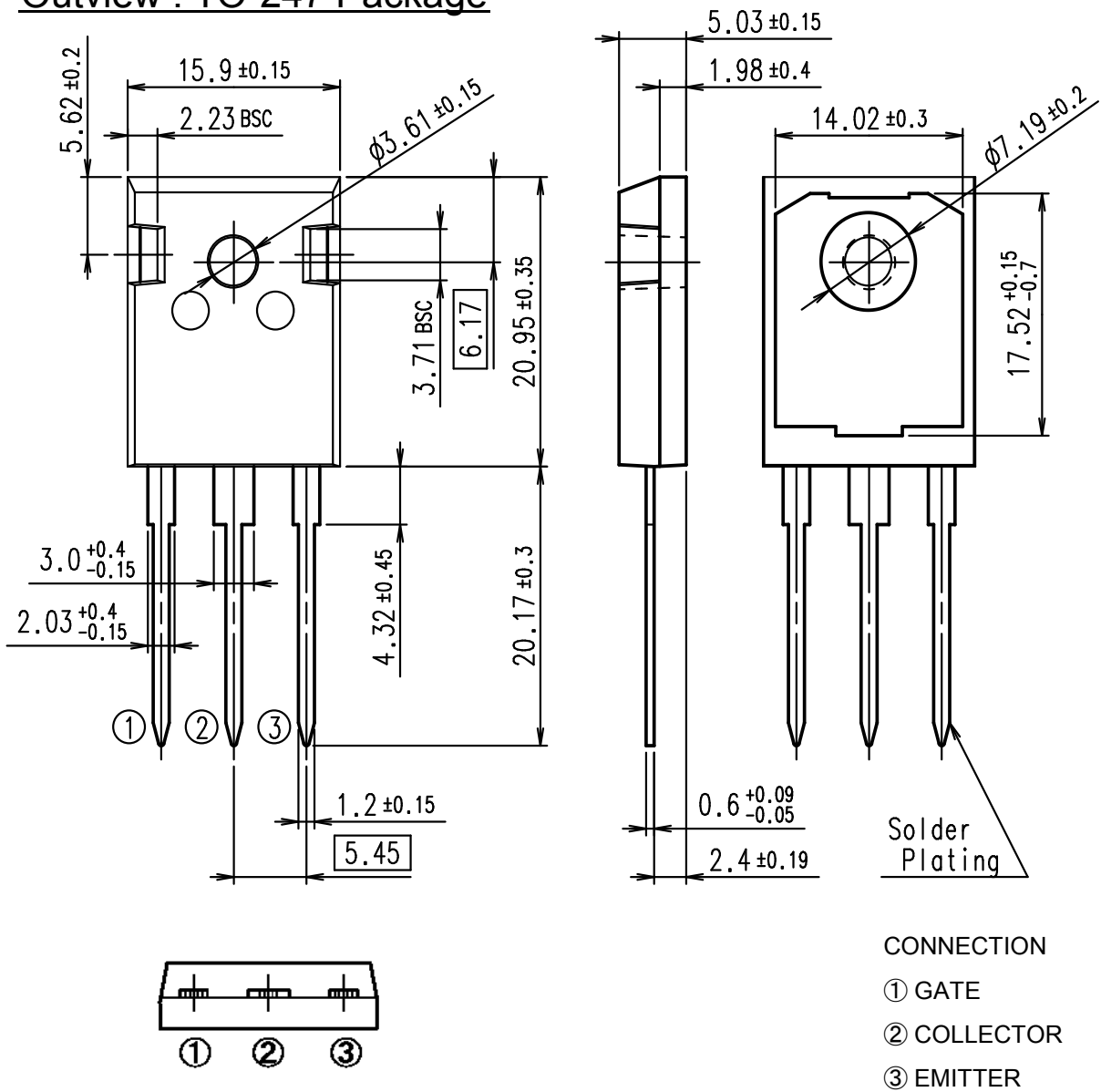
 $D = 0$ 

Figure 18. Transient Thermal Impedance of FWD

 $D = 0$ 

■ Outline Drawings, mm

Outview : TO-247 Package



WARNING

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