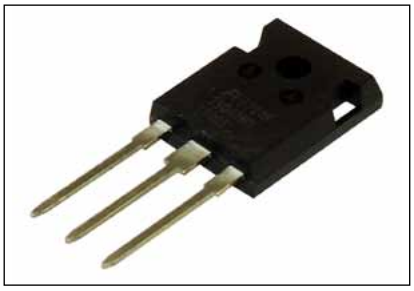
FGW40N65WD

Discrete IGBT (High-Speed W series)
650V / 40A

Features
Low power loss
Low switching surge and noise
High reliability, high ruggedness (RBSOA, SCSOA etc.)

Applications
Uninterruptible power supply
PV Power coditionner
Inverter welding machine



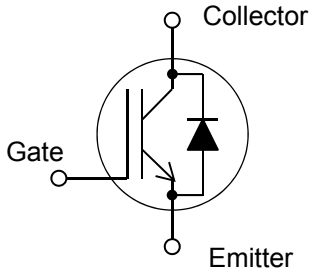
Maximum Ratings and Characteristics

● **Absolute Maximum Ratings (at T_c=25°C unless otherwise specified)**

Items	Symbols	Characteristics	Units	Remarks
Collector-Emitter Voltage	V_{CES}	650	V	
Gate-Emitter Voltage	V_{GES}	±20	V	
Transient Gate-Emitter Voltage		±30		T_p<1μs
DC Collector Current	$I_{C@25}$	56	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}≤650V T_j≤175°C
Diode Forward Current	$I_{F@25}$	31	A	
	$I_{F@100}$	20	A	
Diode Pulsed Current	I_{FP}	160	A	Note *1
IGBT Max. Power Dissipation	P_{D_IGBT}	155	W	T_C=25°C
FWD Max. Power Dissipation	P_{D_FWD}	75	W	T_C=25°C
Operating Junction Temperature	T_j	-40 ~ +175	°C	
Storage Temperature	T_{stg}	-55 ~ +175	°C	

Note *1 : Pulse width limited by T_{jmax}.

Equivalent circuit



● **Electrical characteristics (at T_j= 25°C unless otherwise specified)**

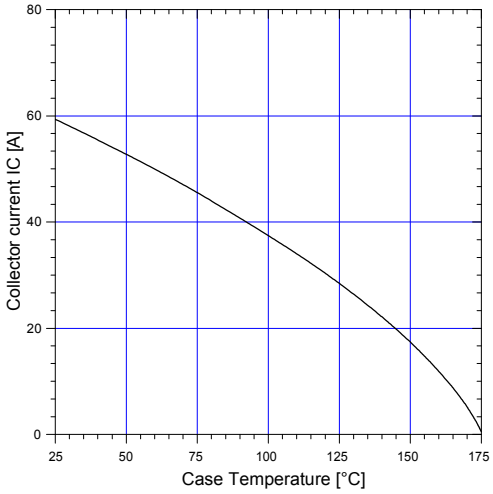
Description	Symbols	Conditions		Characteristics min.	typ.	max.	Units
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 650V, V_{GE} = 0V	T_j=25°C	-	-	250	μA
			T_j=175°C	-	-	2	mA
Gate-Emitter Leakage Current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V		-	-	200	nA
Gate-Emitter Threshold Voltage	$V_{GE\ (th)}$	V_{CE} = 20V, I_C = 40mA		3.0	4.0	5.0	V
Collector-Emitter Saturation Voltage	$V_{CE\ (sat)}$	V_{GE} = 15V, I_C = 40A	T_j=25°C	1.40	1.80	2.20	V
			T_j=125°C	-	2.05	-	
			T_j=175°C	-	2.10	-	
Input Capacitance	C_{ies}	V_{CE}=25V		1500	3000	4500	pF
Output Capacitance	C_{oes}	V_{GE}=0V		43	85	128	
Reverse Transfer Capacitance	C_{res}	f=1MHz		32	64	96	
Gate Charge	Q_G	V_{CC} = 520V I_C = 40A V_{GE} = 15V		90	180	270	nC
Turn-On Delay Time	$t_{d(on)}$	T_j = 25°C, V_{CC} = 400V I_C = 20A, V_{GE} = 15V R_G = 10Ω, L = 500μH Energy loss include “tail” and FWD reverse recovery.		12	24	36	ns
Rise Time	t_r			13	25	38	
Turn-Off Delay Time	$t_{d(off)}$			93	185	278	
Fall Time	t_f			24	47	71	
Turn-On Energy	E_{on}			0.15	0.29	0.44	mJ
Turn-Off Energy	E_{off}			0.15	0.29	0.44	
Turn-On Delay Time	$t_{d(on)}$	T_j = 150°C, V_{CC} = 400V I_C = 20A, V_{GE} = 15V R_G = 10Ω, L = 500μH Energy loss include “tail” and FWD reverse recovery.		12	24	36	ns
Rise Time	t_r			13	25	38	
Turn-Off Delay Time	$t_{d(off)}$			108	215	323	
Fall Time	t_f			20	40	60	
Turn-On Energy	E_{on}			0.25	0.50	0.75	mJ
Turn-Off Energy	E_{off}			0.16	0.32	0.48	
Forward Voltage Drop	V_F	I_F=20A	T_j=25°C	1.8	2.5	3.2	V
			T_j=125°C	-	1.9	-	V
			T_j=175°C	-	1.7	-	V
Diode Reverse Recovery Time	t_{rr}	V_{CC}=400V, I_F=20A		31	62	93	ns
Diode Reverse Recovery Charge	Q_{rr}	-di_F/dt=500A/μs, T_j=25°C		0.13	0.26	0.39	μC
Diode Reverse Recovery Time	t_{rr}	V_{CC}=400V, I_F=20A		43	85	128	ns
Diode Reverse Recovery Charge	Q_{rr}	-di_F/dt=500A/μs, T_j=150°C		0.36	0.72	1.08	μC

● Thermal resistance characteristics

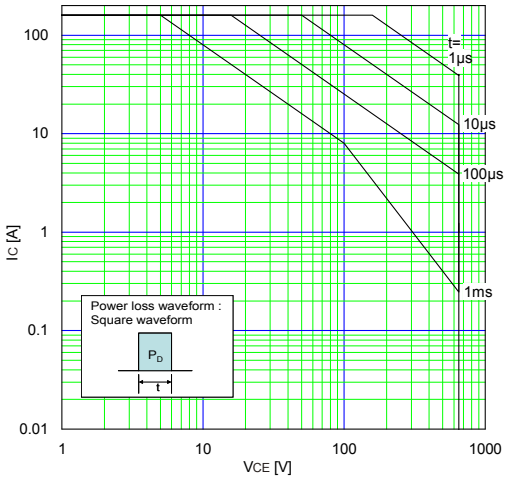
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)\_IGBT}$	-	-	-	0.962	
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)\_FWD}$	-	-	-	1.923	

Characteristics (Representative)

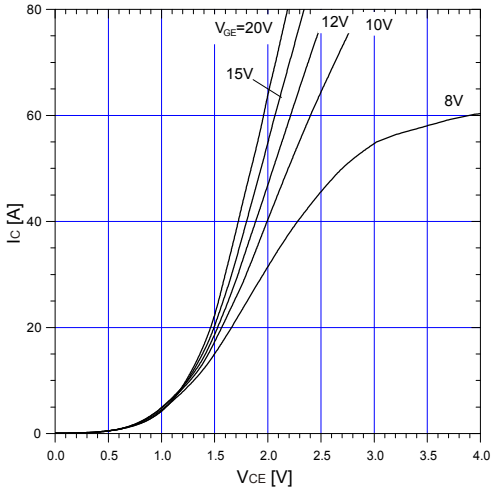
Graph.1
DC Collector Current vs Tc
V_{GE}≥+15V, Tj≤175°C



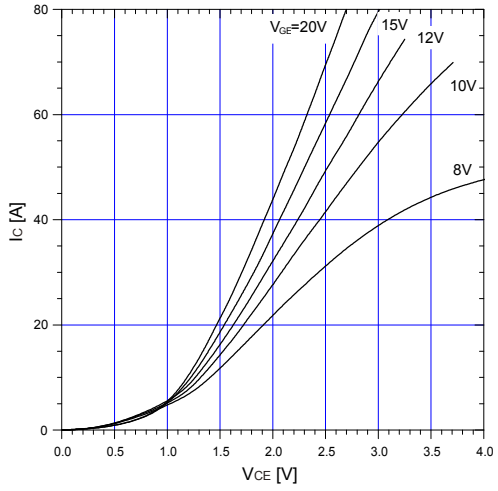
Graph.2
SOA
Duty=0(Single pulse), Tc=25°C



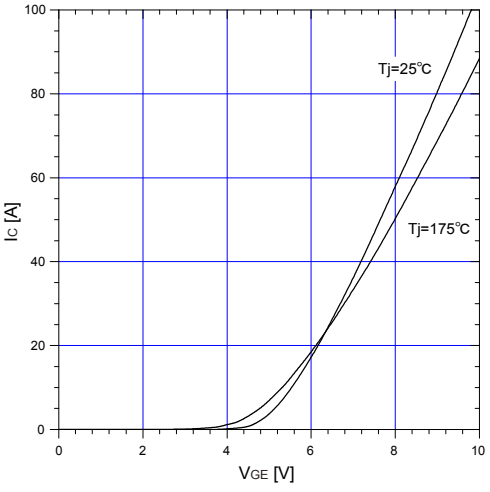
Graph.3
Typical Output Characteristics (V_{CE}-I_C)
Tj=25°C



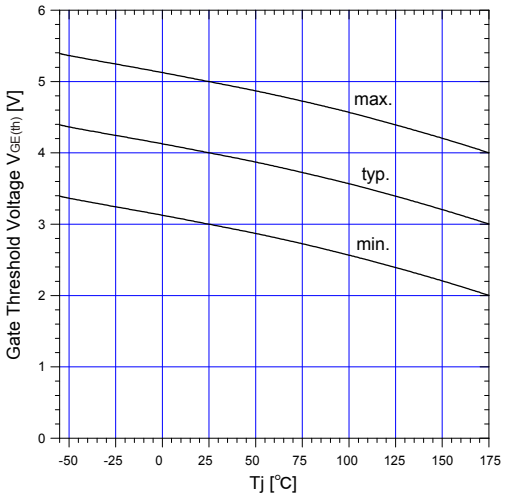
Graph.4
Typical Output Characteristics (V_{CE}-I_C)
Tj=175°C



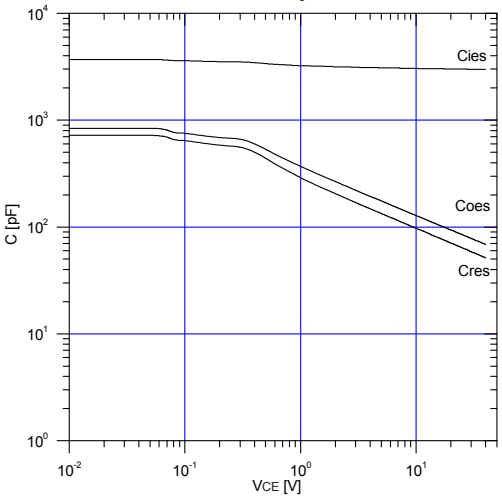
Graph.5
Typical Transfer Characteristics
V_{CE}=10V



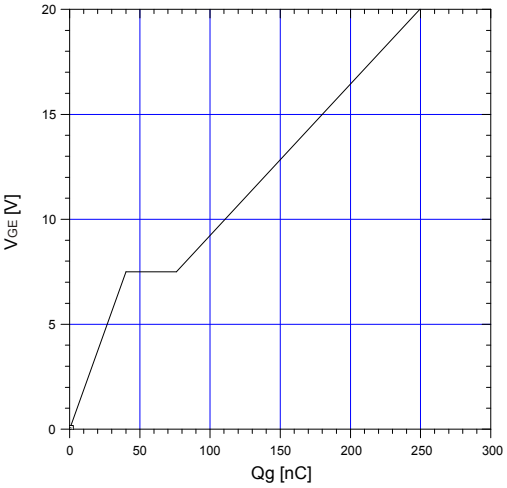
Graph.6
Gate Threshold Voltage vs. Tj
I_C=40mA, V_{CE}=20V



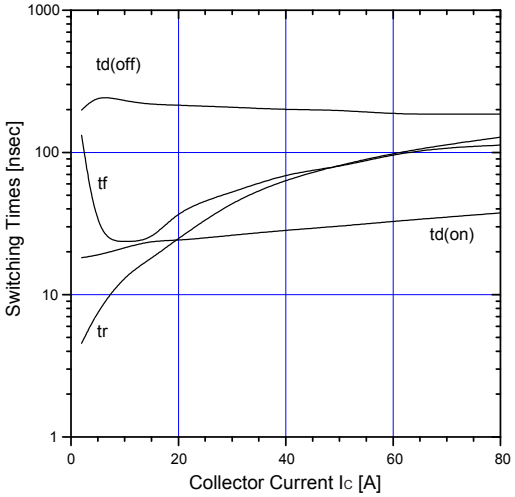
Graph.7
Typical Capacitance
V_{GE}=0V, f=1MHz, Tj=25°C



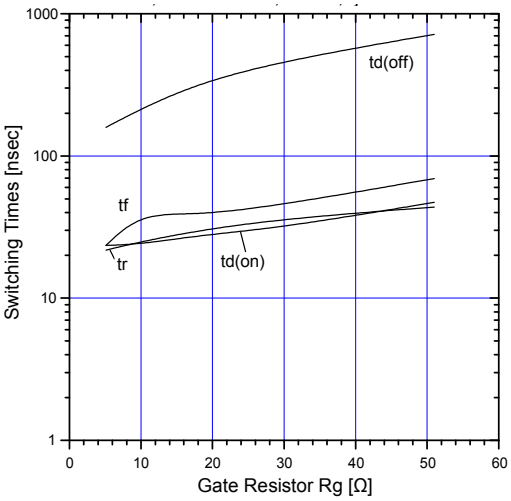
Graph.8
Typical Gate Charge
Vcc=520V, I_C=40A, Tj=25°C



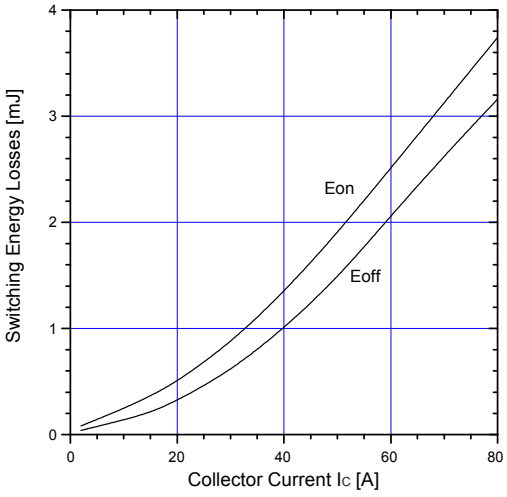
Graph.9
Typical switching time vs. Ic
Tj=150°C, Vcc=400V, L=500µH
V_{GE}=15V, R_G=10Ω



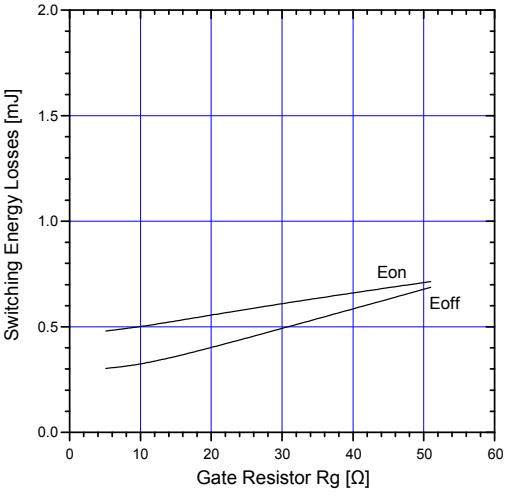
Graph.10
Typical switching time vs. Rg
Tj=150°C, Vcc=400V, I_C=20A, L=500µH
V_{GE}=15V



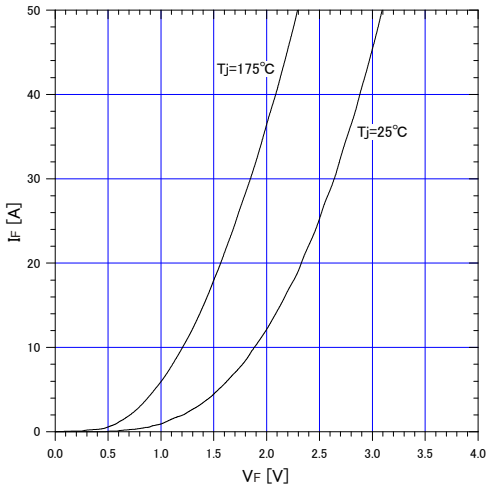
Graph.11
Typical switching losses vs. Ic
Tj=150°C, Vcc=400V, L=500µH
V_{GE}=15V, R_G=10Ω



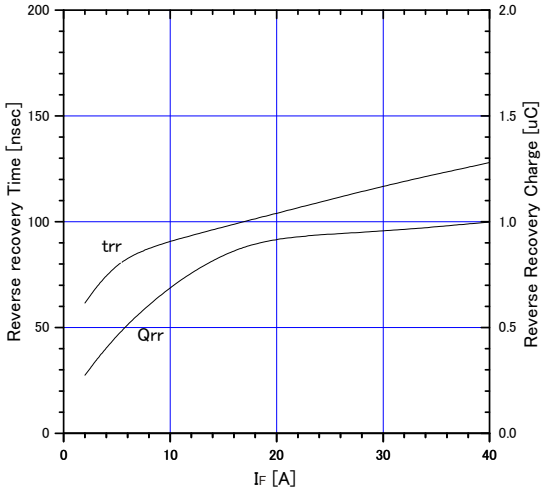
Graph.12
Typical switching losses vs. Rg
Tj=150°C, Vcc=400V, I_C=20A, L=500µH
V_{GE}=15V



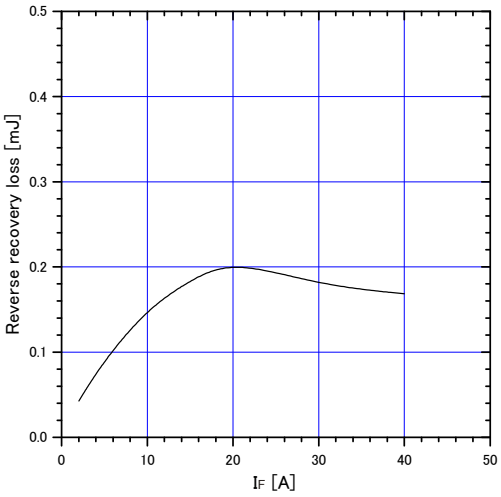
Graph.13
FWD Forward voltage drop (V_F-I_F)



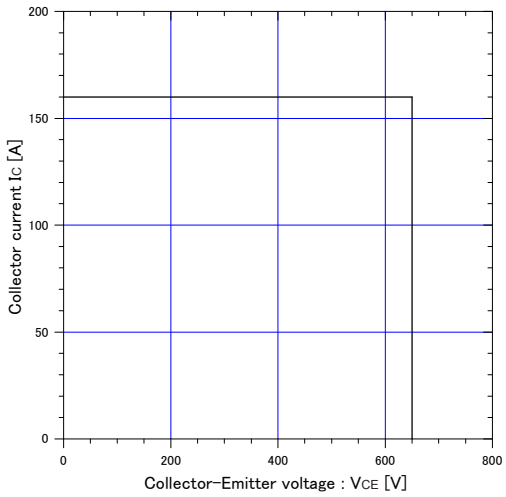
Graph.14
Typical reverse recovery characteristics vs. I_F
Tj=15°C, Vcc=400V, L=500μH
V_{GE}=15V, R_G=10Ω



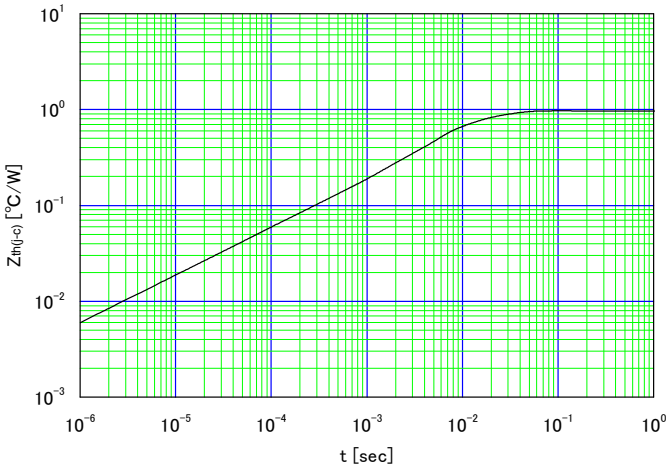
Graph.15
Typical reverse recovery loss vs. I_F
Tj=150°C, Vcc=400V, L=500μH
V_{GE}=15V, R_G=10Ω



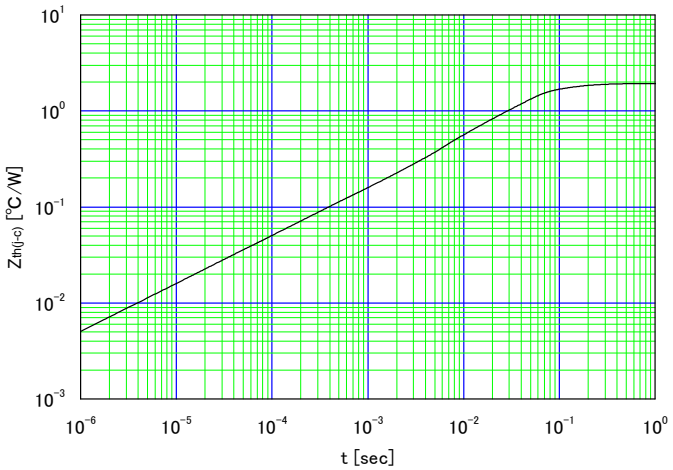
Graph.16
Reverse biased Safe Operating Area
Tj≤175C, V_{GE}=+15V/0V, R_G=10Ω



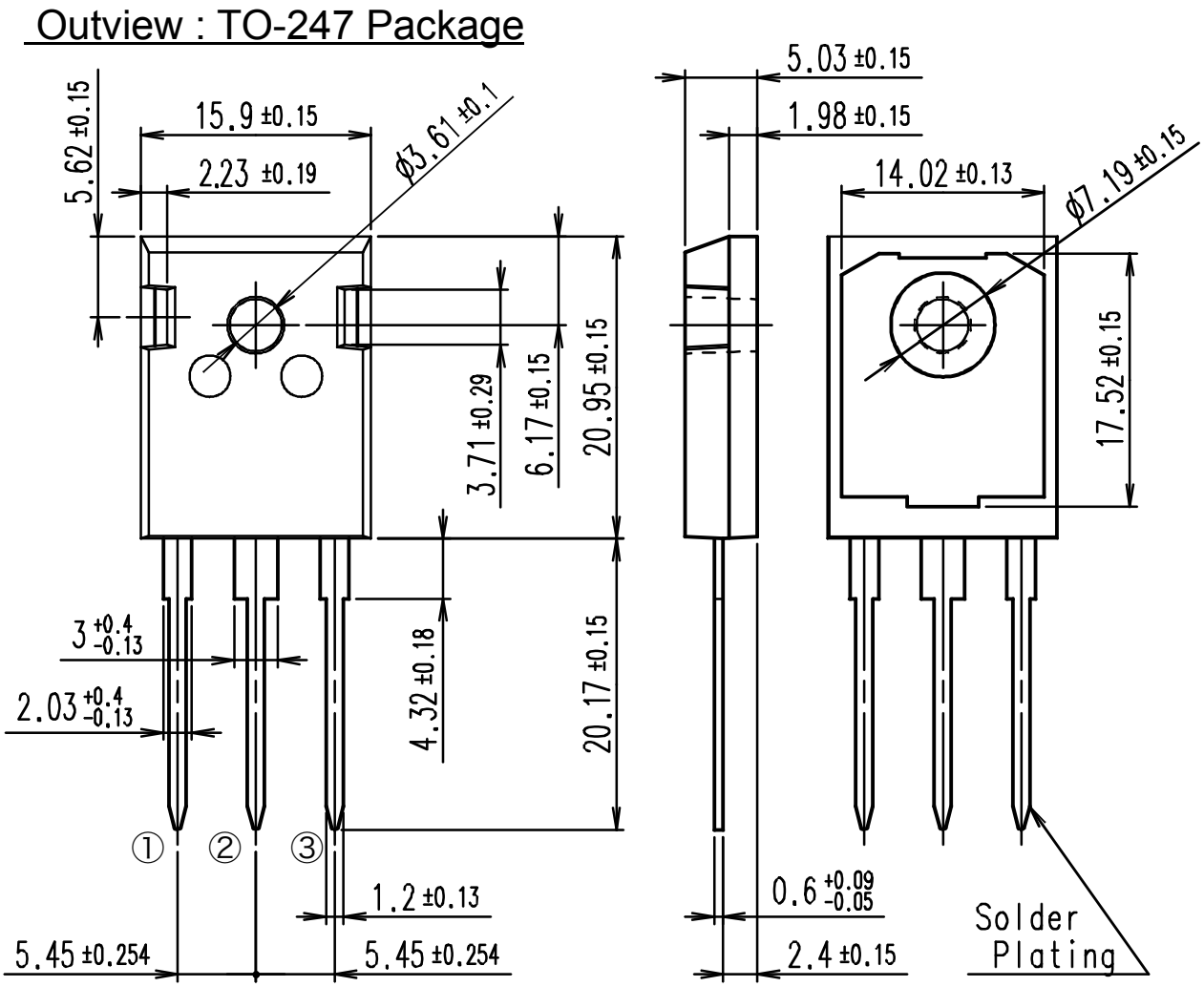
Graph.17
Transient thermal resistance of IGBT

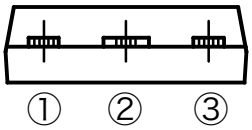


Graph.18
Transient thermal resistance of FWD



Outline Drawings, mm





CONNECTION
① GATE
② COLLECTOR
③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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