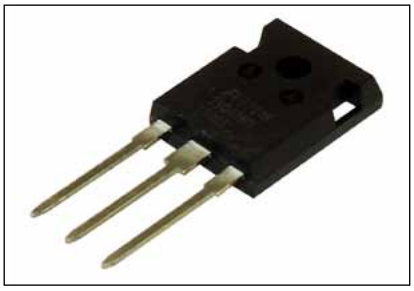
FGW40N120VD

Discrete IGBT

Discrete IGBT (High-Speed V series)
1200V / 40A

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

Applications
Inverter for Motor drive
AC and DC Servo drive amplifier
Uninterruptible power supply



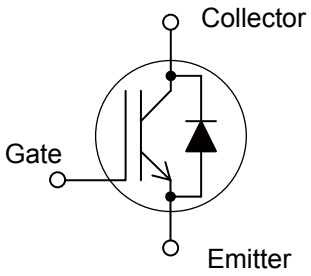
Maximum Ratings and Characteristics

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

Items	Symbols	Characteristics	Units	Remarks
Collector-Emitter voltage	V_{CES}	1200	V	
Gate-Emitter voltage	V_{GES}	±20	V	
DC Collector Current	$I_{C@25}$	63	A	T_C=25°C, T_j=150°C
	$I_{C@100}$	40	A	T_C=100°C, T_j=150°C
Pulsed Collector Current	I_{CP}	80	A	Note *1
Turn-Off Safe Operating Area	-	80	A	V_{CE}≤1200V, T_j≤175°C
Diode Forward Current	$I_{F@25}$	58	A	
	$I_{F@100}$	30	A	
Diode Pulsed Current	I_{FP}	80	A	Note *1
Short Circuit Withstand Time	t_{SC}	10	μs	V_{CC}≤640V, V_{GE}=15V T_j≤150°C
IGBT Max. Power Dissipation	P_{D_IGBT}	340	W	T_C=25°C
FWD Max. Power Dissipation	P_{D_FWD}	220		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 Tjmax.

Equivalent circuit



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

Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Unit
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	I_C = 50μA, V_{GE} = 0V		1200	-	-	V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE} = 1200V, 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		6.0	6.5	7.0	V
Collector-Emitter Saturation Voltage	$V_{CE\ (sat)}$	V_{GE} = +15V, I_C = 40A	T_j=25°C	-	1.85	2.4	V
			T_j=175°C	-	2.4	-	
Input Capacitance	C_{ies}	V_{CE}=25V		-	2230	-	pF
Output Capacitance	C_{oes}	V_{GE}=0V		-	135	-	
Reverse Transfer Capacitance	C_{res}	f=1MHz		-	105	-	
Gate Charge	Q_G	V_{CC} = 600V I_C = 40A V_{GE} = 15V		-	320	-	nC
Turn-On Delay Time	$t_{d(on)}$	T_j = 25°C		-	38	-	ns
Rise Time	t_r	V_{CC} = 600V		-	75	-	
Turn-Off Delay Time	$t_{d(off)}$	I_C = 40A		-	310	-	
Fall Time	t_f	V_{GE} = 15V		-	55	-	
Turn-On Energy	E_{on}	R_G = 10Ω		-	4.3	-	mJ
Turn-Off Energy	E_{off}	L = 500μH Energy loss include “tail” and FWD reverse recovery.		-	2.2	-	
Turn-On Delay Time	$t_{d(on)}$	T_j = 175°C		-	38	-	ns
Rise Time	t_r	V_{CC} = 600V		-	68	-	
Turn-Off Delay Time	$t_{d(off)}$	I_C = 40A		-	360	-	
Fall Time	t_f	V_{GE} = 15V		-	85	-	
Turn-On Energy	E_{on}	R_G = 10Ω		-	6.5	-	mJ
Turn-Off Energy	E_{off}	L = 500μH Energy loss include “tail” and FWD reverse recovery.		-	3.8	-	
Forward Voltage Drop	V_F	I_F=30A	T_j=25°C	-	1.7	2.21	V
			T_j=175°C	-	1.8	-	V
Diode Reverse Recovery Time	t_{rr1}	V_{CC}=30V I_F = 3.0A -di/dt=200A/μs		-	79	103	ns
Diode Reverse Recovery Time	t_{rr2}	V_{CC}=600V I_F=30A		-	0.33	-	μs
Diode Reverse Recovery Charge	Q_{rr}	-di_F/dt=200A/μs T_j=25°C		-	1.45	-	μC

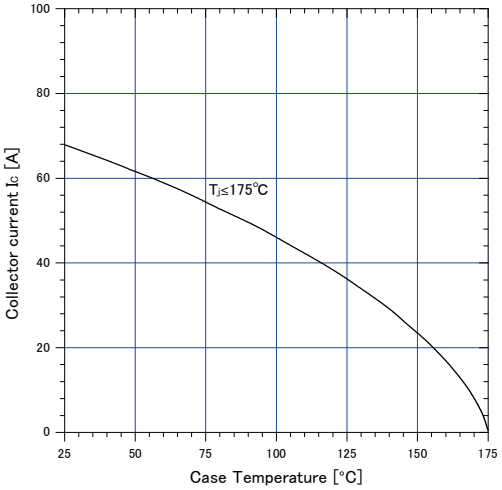
Items	Symbols	Conditions	Characteristics			Unit
			min.	typ.	max.	
Diode Reverse Recovery Time	t_{rr2}	V_{CC}=600V I_F=30A	-	0.75	-	µs
Diode Reverse Recovery Charge	Q_{rr}	-di_F/dt=200A/µs T_j=175°C	-	4.30	-	µC

● **Thermal resistance**

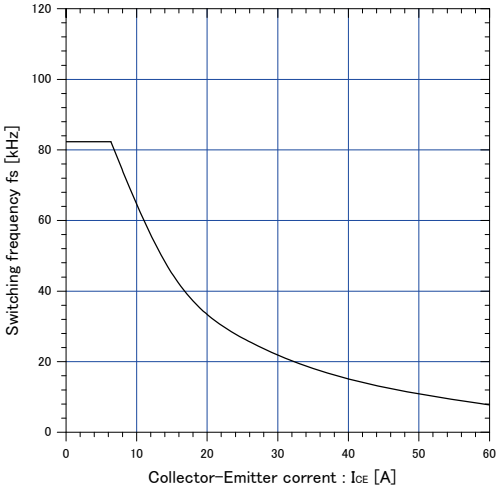
Items	Symbols	Characteristics			Unit
		min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)\_IGBT}$	-	-	0.439	
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)\_FWD}$	-	-	0.676	

■ Characteristics (Representative)

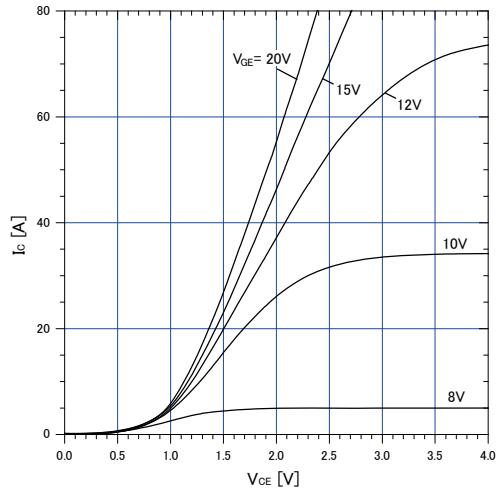
Graph.1
DC Collector Current vs T_C
V_{GE}≥+15V, T_j≤175°C



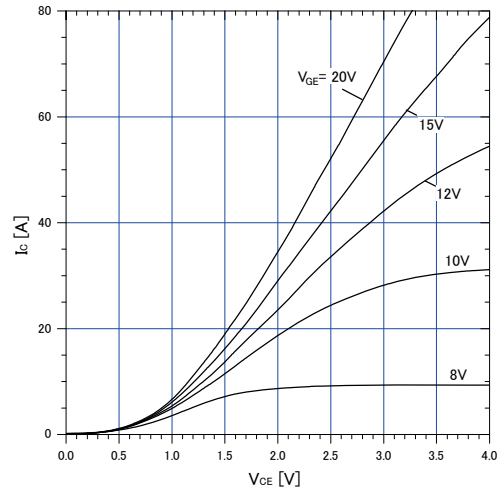
Graph.2
Collector Current vs. switching frequency
V_{GE}=+15V, T_C≤175°C, V_{CC}=600V, D=0.5,
R_G=10Ω, T_C=100°C



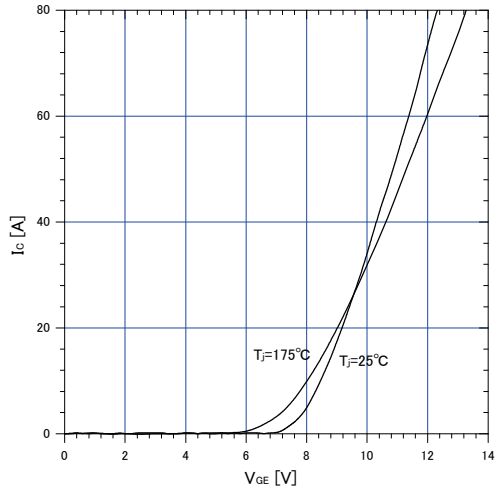
Graph.3
Typical Output Characteristics (V_{CE}-I_C)
T_j=25°C



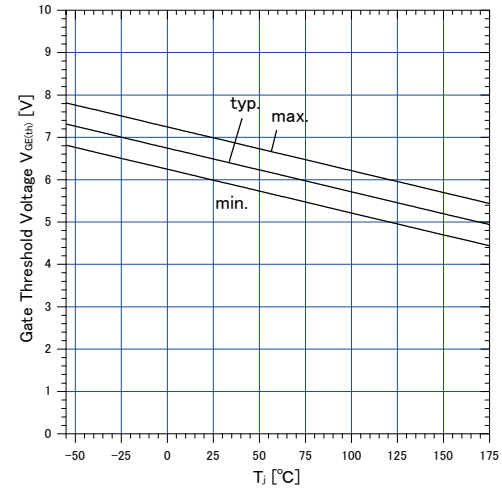
Graph.4
Typical Output Characteristics (V_{CE}-I_C)
T_j=175°C



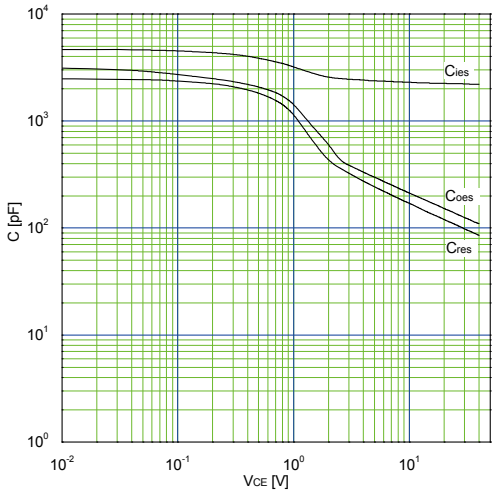
Graph.5
Typical Transfer Characteristics
V_{GE}=+15V



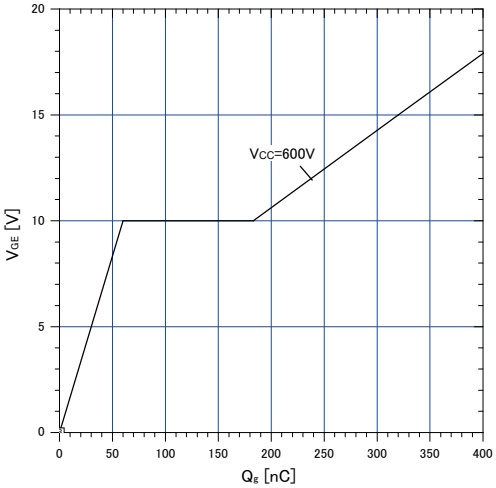
Graph.6
Gate Threshold Voltage vs. T_j
I_C=40mA, V_{CE}=20V



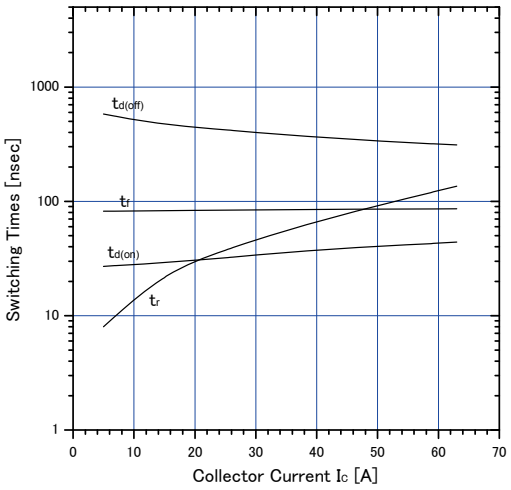
Graph.7
Typical Capacitance
V_{GE}=0V, f=1MHz, T_j=25°C



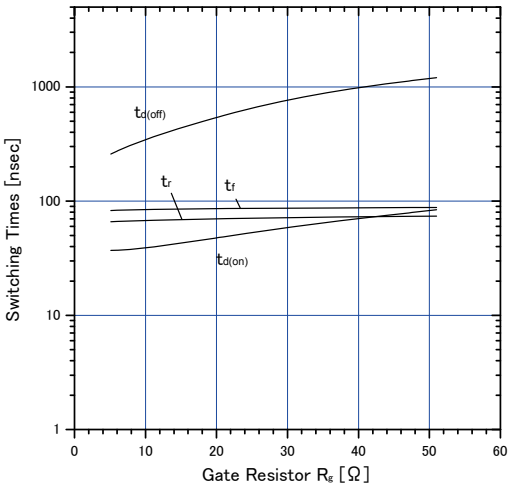
Graph.8
Typical Gate Charge
V_{CC}=600V, I_C=40A, T_j=25°C



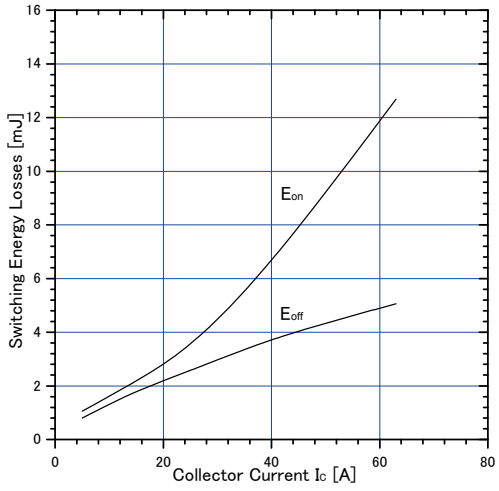
Graph.9
Typical switching time vs. I_C
T_j=175°C, V_{CC}=600V, L=500µH
V_{GE}=15V,R_G=10Ω



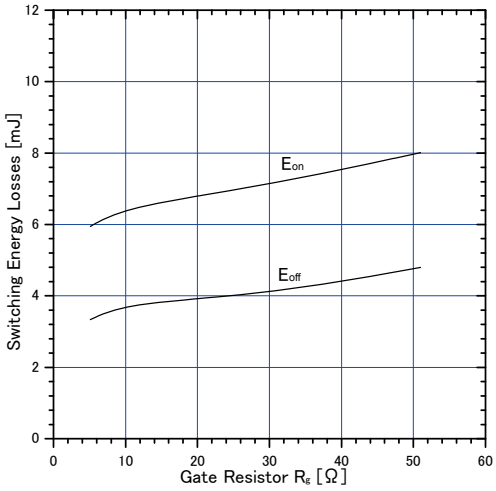
Graph.10
Typical switching time vs. R_G
T_j=175°C, V_{CC}=600V, I_C=40A, L=500µH
V_{GE}=15V



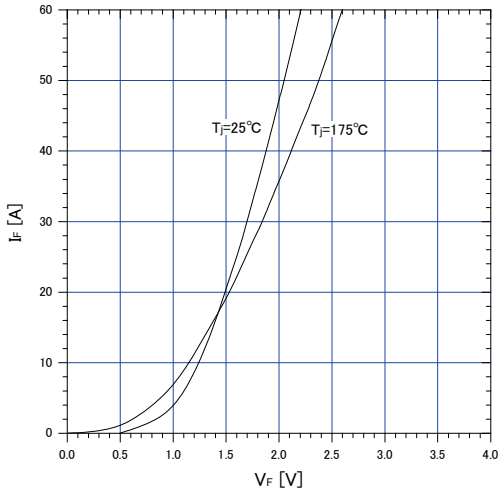
Graph.11
Typical switching losses vs. I_C
T_j=175°C, V_{CC}=600V, L=500µH
V_{GE}=15V, R_G=10Ω



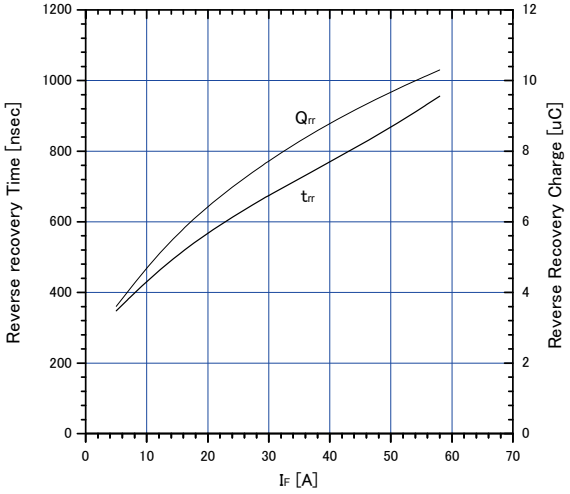
Graph.12
Typical switching losses vs. R_G
T_j=175°C, V_{CC}=600V, I_C=40A, L=500µH
V_{GE}=15V



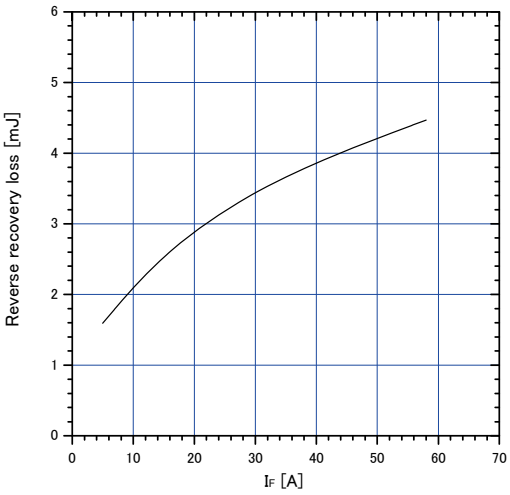
Graph.13
FWD Forward voltage drop (V_F-I_F)



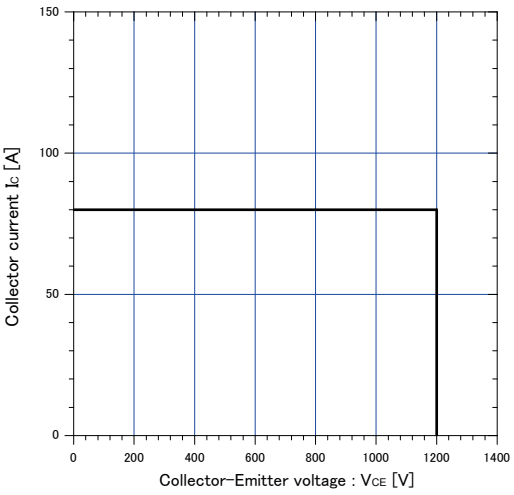
Graph.14
Typical reverse recovery characteristics vs. I_F
T_J=175°C, V_{CC}=600V, L=500μH,
V_{GE}=15V,R_G=10Ω



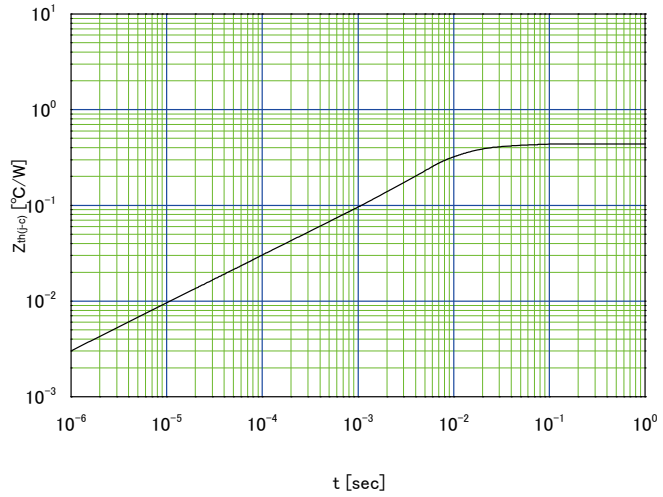
Graph.15
Typical reverse recovery loss vs. I_F
T_J=175°C,V_{CC}=600V,L=500μH
V_{GE}=15V,R_G=10Ω



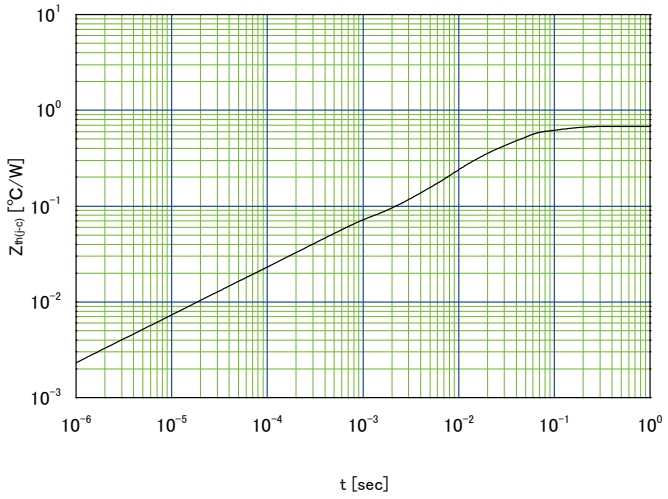
Graph.16
Reverse biased Safe Operating Area
T_J≦175°C,V_{GE}=+15V/0V,R_G=10Ω



Graph.17
Transient thermal resistance of IGBT

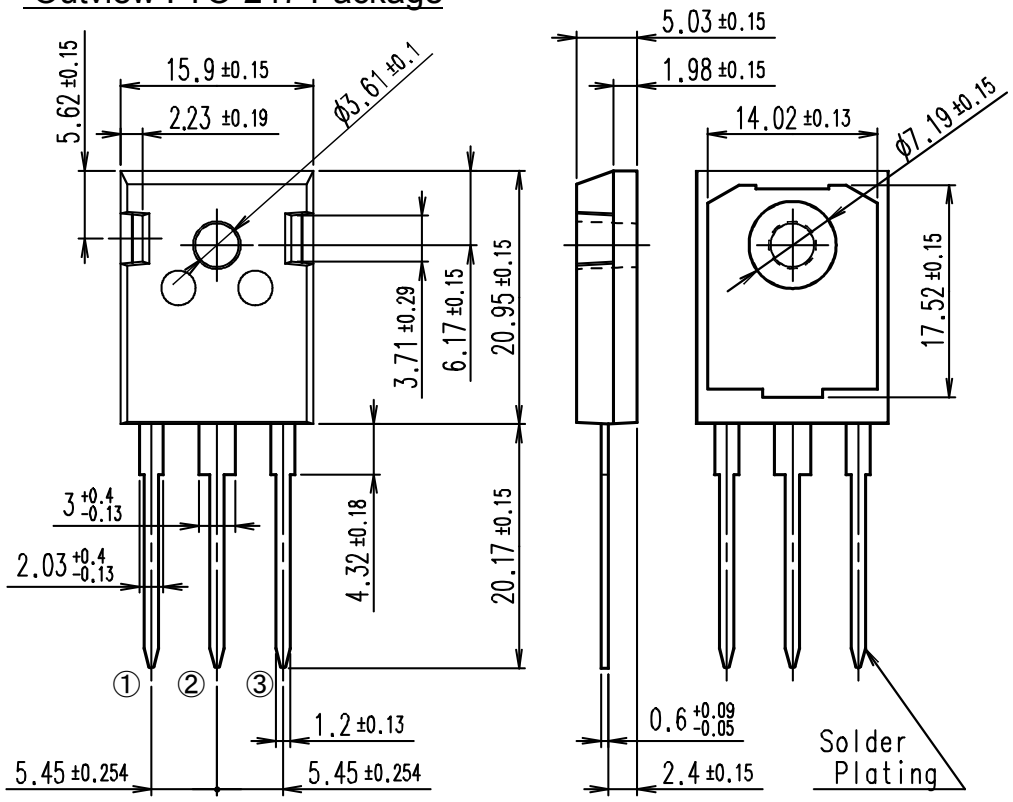


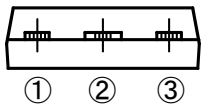
Graph.18
Transient thermal resistance of FWD



■ Outline Drawings, mm

Outview : TO-247 Package





CONNECTION
① GATE
② COLLECTOR
③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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富士電機

Innovating Energy Technology

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