

FGW60N65WD

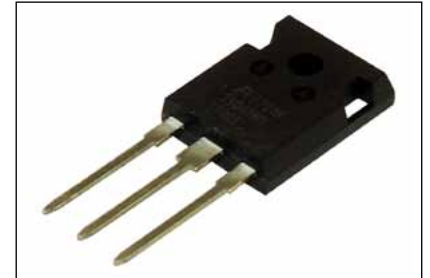
Discrete IGBT (High-Speed W series) 650V / 60A

■ Features

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

■ Applications

- Uninterruptible power supply
- PV Power conditioner
- Inverter welding machine



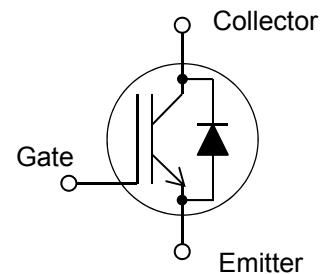
■ Maximum Ratings and Characteristics

● 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	V	T _r <1μs
DC Collector Current	I _{C@25}	83	A	T _c =25°C
	I _{C@100}	60	A	T _c =100°C
Pulsed Collector Current	I _{CP}	240	A	Note *1
Turn-Off Safe Operating Area		240	A	V _{CE} ≤650V
				T _j ≤175°C
Diode Forward Current	I _{F@25}	45	A	
	I _{F@100}	30	A	
Diode Pulsed Current	I _{FP}	240	A	Note *1
IGBT Max. Power Dissipation	P _{D,IGBT}	230	W	T _c =25°C
FWD Max. Power Dissipation	P _{D,FWD}	105	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)

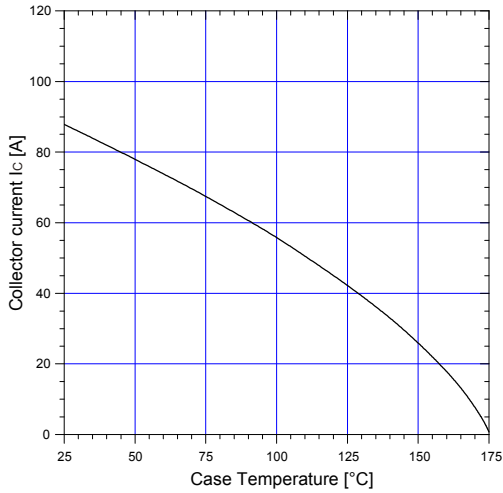
Description	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero Gate Voltage Collector Current	I _{CEs}	V _{CE} = 650V, V _{GE} = 0V	T _j =25°C -	T _j =25°C -	250	μA	
Gate-Emitter Leakage Current	I _{GES}	V _{CE} = 0V, V _{GE} = ±20V	-	-	2	mA	
Gate-Emitter Threshold Voltage	V _{GE(th)}	V _{CE} = 20V, I _C = 60mA	-	-	200	nA	
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _{GE} = 15V, I _C = 60A	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	2150	4300	6450	pF	
Output Capacitance	C _{oes}	V _{GE} =0V	63	125	188		
Reverse Transfer Capacitance	C _{res}	f=1MHz	48	95	143		
Gate Charge	Q _G	V _{CC} = 520V I _C = 60A V _{GE} = 15V	125	250	375	nC	
Turn-On Delay Time	t _{d(on)}	T _j = 25°C, V _{CC} = 400V I _C = 30A, V _{GE} = 15V R _G = 10Ω, L = 500μH Energy loss include "tail" and FWD reverse recovery.	15	29	44	ns	
Rise Time	t _r		20	40	60		
Turn-Off Delay Time	t _{d(off)}		130	260	390		
Fall Time	t _f		39	78	117		
Turn-On Energy	E _{on}	T _j = 150°C, V _{CC} = 400V I _C = 30A, V _{GE} = 15V R _G = 10Ω, L = 500μH Energy loss include "tail" and FWD reverse recovery.	0.30	0.60	0.90	mJ	
Turn-Off Energy	E _{off}		0.34	0.67	1.01		
Turn-On Delay Time	t _{d(on)}		15	29	44		
Rise Time	t _r		20	40	60		
Turn-Off Delay Time	t _{d(off)}	T _j = 150°C, V _{CC} = 400V I _C = 30A, V _{GE} = 15V R _G = 10Ω, L = 500μH Energy loss include "tail" and FWD reverse recovery.	148	295	443	ns	
Fall Time	t _f		34	68	102		
Turn-On Energy	E _{on}		0.48	0.96	1.44		
Turn-Off Energy	E _{off}		0.37	0.73	1.10		
Forward Voltage Drop	V _F	I _F =25A	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 =30A	38	75	113	ns	
Diode Reverse Recovery Charge	Q _{rr}	-di _F /dt=500A/μs, T _j =25°C	0.15	0.30	0.45	μC	
Diode Reverse Recovery Time	t _{rr}	V _{CC} =400V, I _F =30A	53	105	158	ns	
Diode Reverse Recovery Charge	Q _{rr}	-di _F /dt=500A/μs, T _j =150°C	0.45	0.90	1.35	μC	

● Thermal resistance characteristics

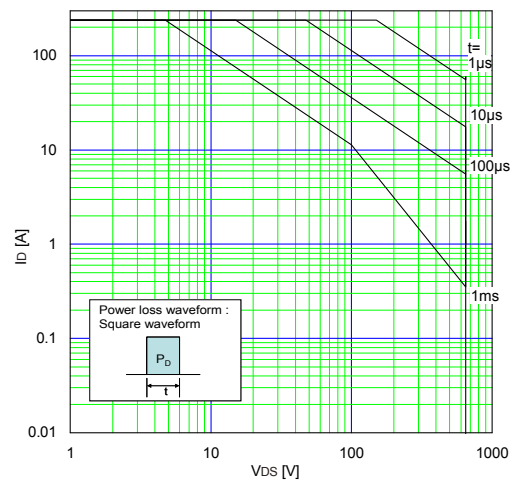
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	-	0.641	
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)}_{FWD}$	-	-	-	1.389	

Characteristics (Representative)

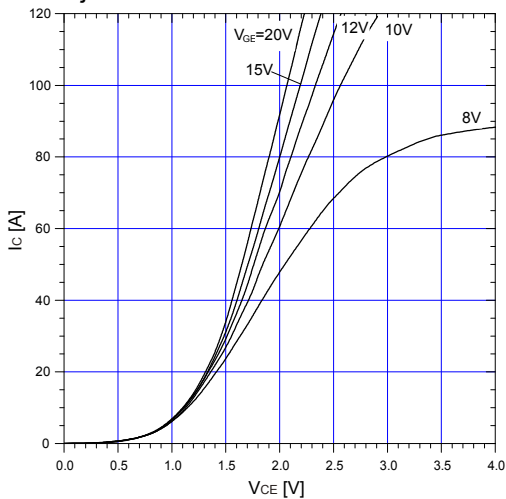
Graph.1
DC Collector Current vs Tc
 $V_{GE} \geq +15V, T_j \leq 175^\circ C$



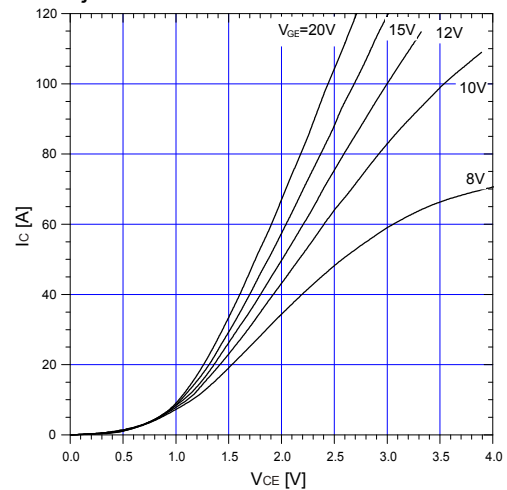
Graph.2
FBSOA
Duty=0(Single pulse), Tc=25°C



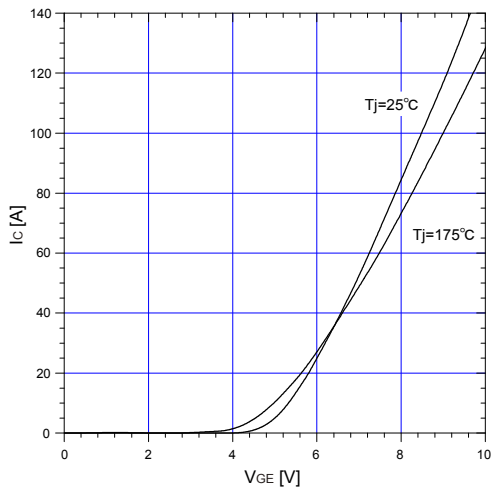
Graph.3
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_j=25^\circ C$



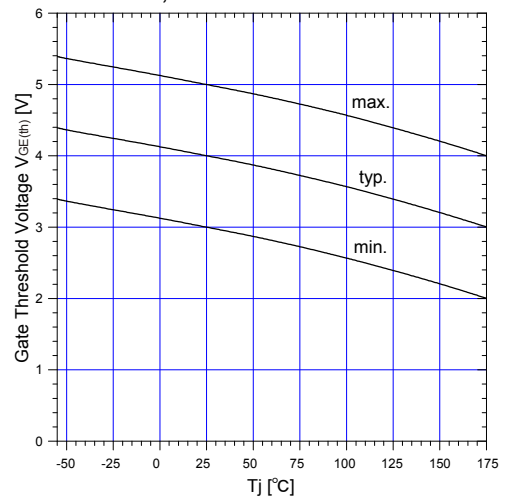
Graph.4
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_j=175^\circ C$



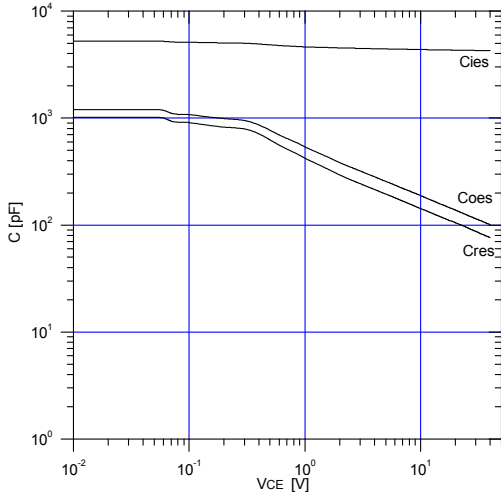
Graph.5
Typical Transfer Characteristics
 $V_{CE}=10V$



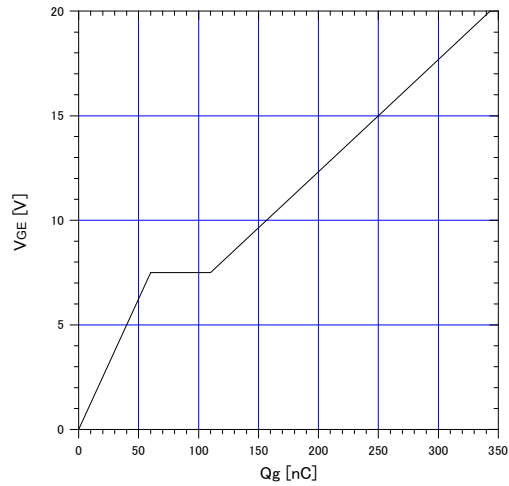
Graph.6
Gate Threshold Voltage vs. Tj
 $I_C=60mA, V_{CE}=20V$



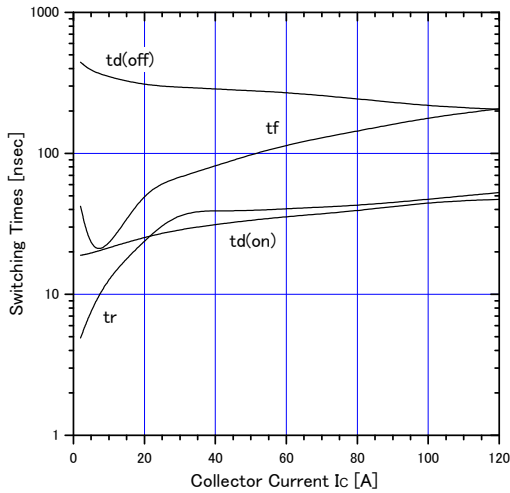
Graph.7
Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_j=25^\circ C$



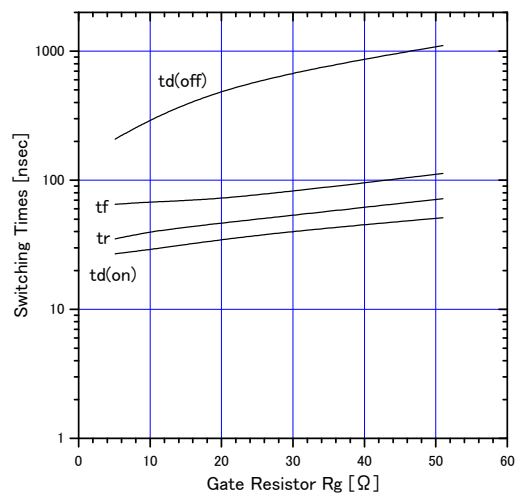
Graph.8
Typical Gate Charge
 $V_{cc}=520V, I_c=60A, T_j=25^\circ C$



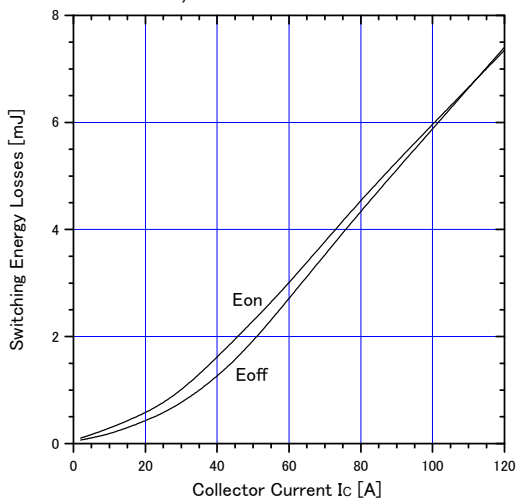
Graph.9
Typical switching time vs. I_c
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



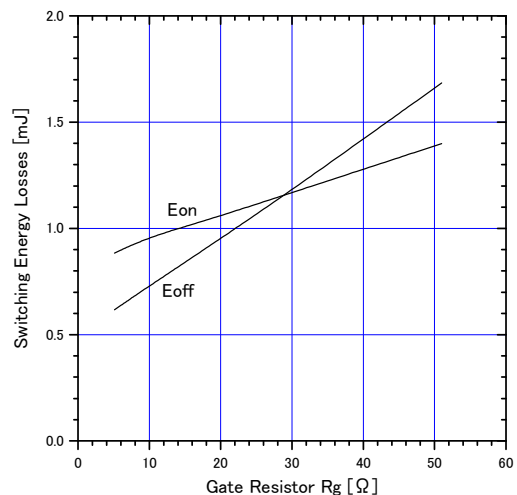
Graph.10
Typical switching time vs. R_g
 $T_j=150^\circ C, V_{cc}=400V, I_c=30A, L=500\mu H$
 $V_{GE}=15V$



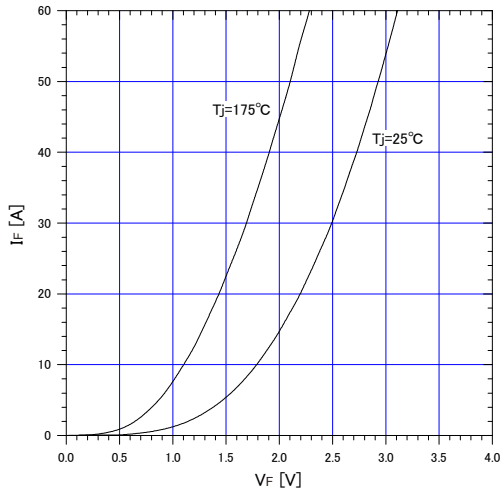
Graph.11
Typical switching losses vs. I_c
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



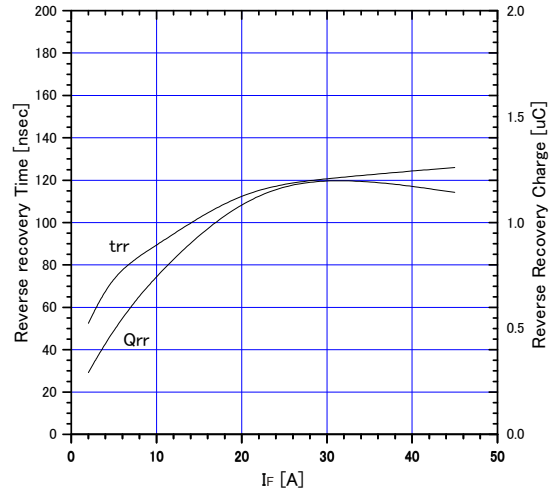
Graph.12
Typical switching losses vs. R_g
 $T_j=150^\circ C, V_{cc}=400V, I_c=30A, L=500\mu H$
 $V_{GE}=15V$



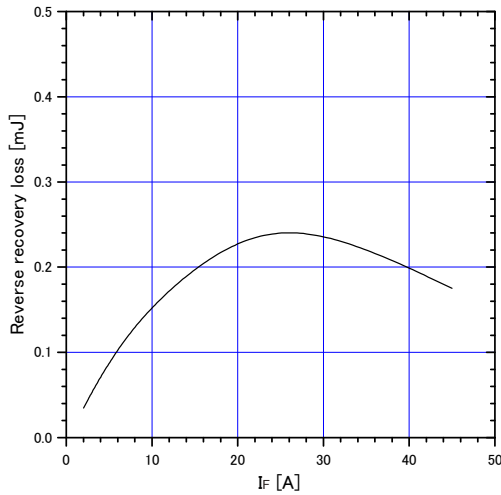
Graph.13
FWD Forward voltage drop (V_F-I_F)



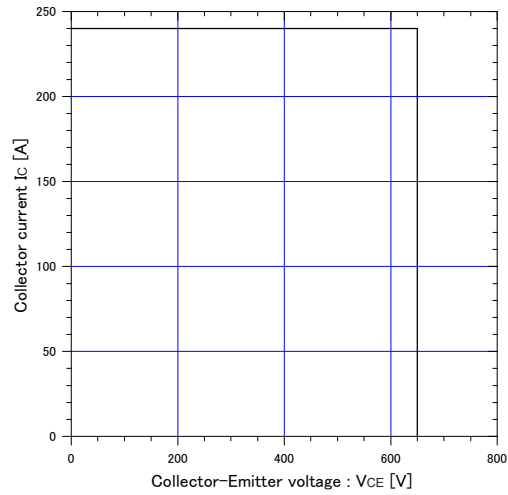
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_j=150^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



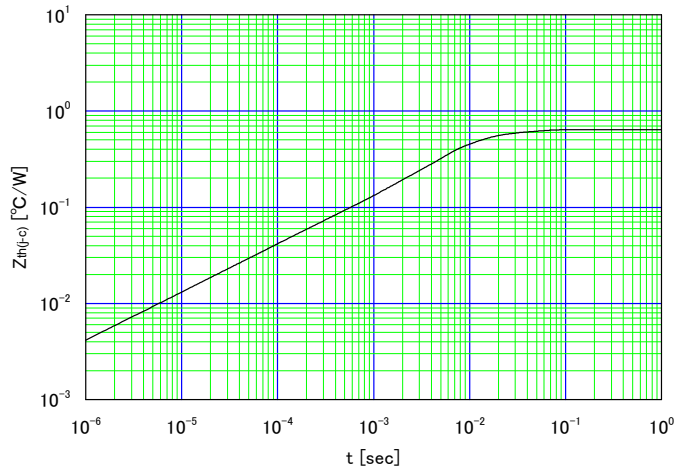
Graph.15
Typical reverse recovery loss vs. I_F
 $T_j=150^\circ\text{C}$, $V_{CC}=400\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



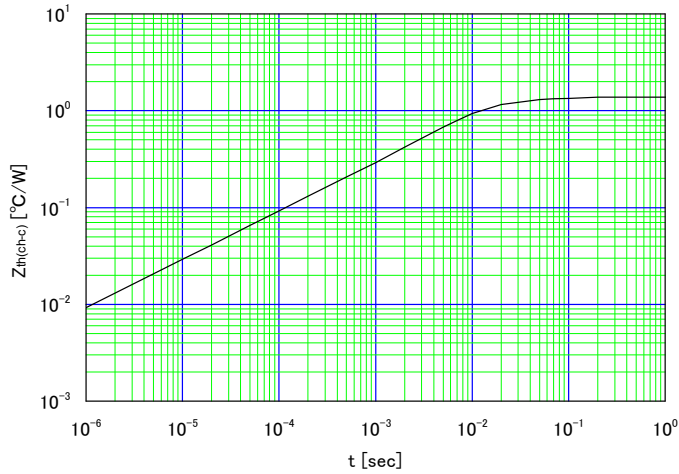
Graph.16
Reverse biased Safe Operating Area
 $T_j \leq 175^\circ\text{C}$, $V_{GE}=+15\text{V}/0\text{V}$, $R_G=10\Omega$



Graph.17
Transient thermal resistance of IGBT

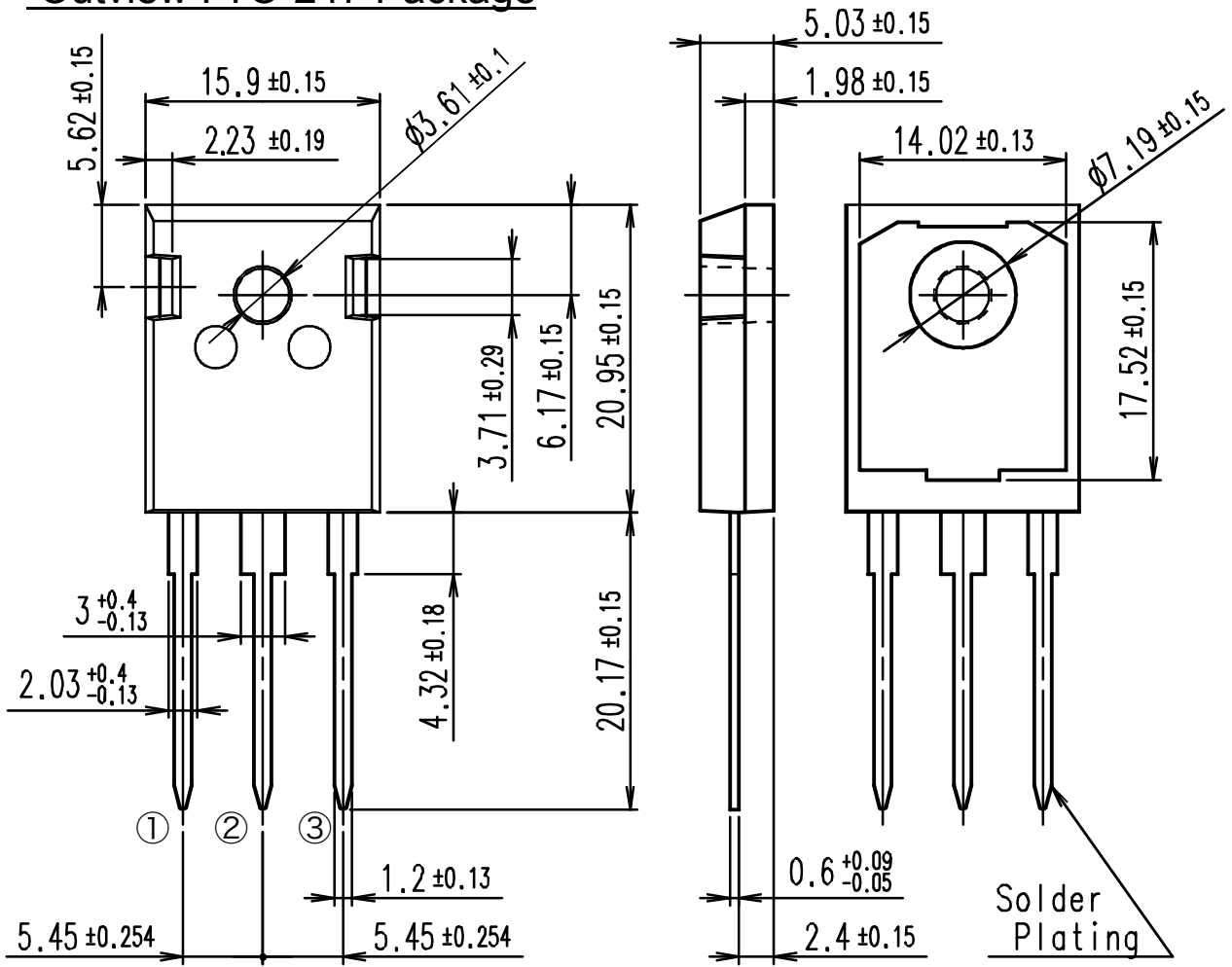


Graph.18
Transient thermal resistance of FWD



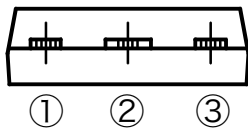
■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER



DIMENSIONS ARE IN MILLIMETERS.

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 - Machine tools
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