

FGW25N120WD

Discrete IGBT

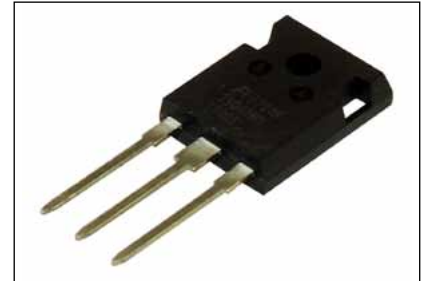
Discrete IGBT (High-Speed W series) 1200V / 25A

■ 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 $T_c=25^\circ\text{C}$ unless otherwise specified)

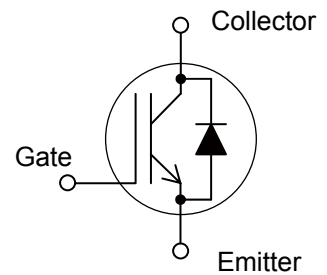
Items	Symbols	Characteristics	Units	Remarks
Collector-Emitter voltage	V_{CES}	1200	V	
Gate-Emitter voltage	V_{GES}	± 20	V	
DC Collector Current	$I_{C@25}$	40	A	$T_c=25^\circ\text{C}, T_j=150^\circ\text{C}$
	$I_{C@100}$	25	A	$T_c=100^\circ\text{C}, T_j=150^\circ\text{C}$
Pulsed Collector Current	I_{CP}	100	A	Note *1
Turn-Off Safe Operating Area	-	100	A	$V_{CE} \leq 1200\text{V}, T_j \leq 175^\circ\text{C}$
Diode Forward Current	$I_{F@25}$	22	A	
	$I_{F@100}$	12	A	
Diode Pulsed Current	I_{FP}	100	A	Note *1
Short Circuit Withstand Time	t_{SC}	5	μs	$V_{CC} \leq 600\text{V}, V_{GE} = 15\text{V}$ $T_j \leq 150^\circ\text{C}$
IGBT Max. Power Dissipation	P_{D_IGBT}	270	W	$T_c=25^\circ\text{C}$
FWD Max. Power Dissipation	P_{D_FWD}	75	W	$T_c=25^\circ\text{C}$
Operating Junction Temperature	T_j	$-40 \sim +175$	$^\circ\text{C}$	
Storage Temperature	T_{sg}	$-55 \sim +175$	$^\circ\text{C}$	

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

● Electrical characteristics (at $T_j=25^\circ\text{C}$ unless otherwise specified)

Description	Symbols	Conditions	Characteristics			Unit	
			min.	typ.	max.		
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}$	$T_j=25^\circ\text{C}$	-	-	250	μA
			$T_j=175^\circ\text{C}$	-	-	2	mA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = \pm 20\text{V}$	-	-	200	nA	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}, I_C = 25\text{mA}$	5.0	6.0	7.0	V	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{V}, I_C = 25\text{A}$	$T_j=25^\circ\text{C}$	1.4	2.0	2.6	V
			$T_j=175^\circ\text{C}$	-	2.6	-	
Input Capacitance	C_{ies}	$V_{CE}=25\text{V}$	825	1650	2475	pF	
Output Capacitance	C_{oes}	$V_{GE}=0\text{V}$	37	75	113		
Reverse Transfer Capacitance	C_{res}	$f=1\text{MHz}$	11	23	35		
Gate Charge	Q_G	$V_{CC} = 400\text{V}$ $I_C = 25\text{A}$ $V_{GE} = 15\text{V}$	40	80	120	nC	
Turn-On Delay Time	$t_{d(on)}$	$T_j = 25^\circ\text{C}$	14	28	42	ns	
Rise Time	t_r	$V_{CC} = 600\text{V}$	16	32	48		
Turn-Off Delay Time	$t_{d(off)}$	$I_C = 25\text{A}$	61	122	183		
Fall Time	t_f	$V_{GE} = 15\text{V}$	16	32	48		
Turn-On Energy	E_{on}	$R_G = 10\Omega$ $L = 500\mu\text{H}$	0.45	0.9	1.35	mJ	
Turn-Off Energy	E_{off}	Energy loss include "tail" and FWD (FDRW12S120J) reverse recovery.	0.65	1.3	1.95		
Turn-On Delay Time	$t_{d(on)}$	$T_j = 150^\circ\text{C}$	14	28	42	ns	
Rise Time	t_r	$V_{CC} = 600\text{V}$	16	32	48		
Turn-Off Delay Time	$t_{d(off)}$	$I_C = 25\text{A}$	89	178	267		
Fall Time	t_f	$V_{GE} = 15\text{V}$	30	60	90		
Turn-On Energy	E_{on}	$R_G = 10\Omega$ $L = 500\mu\text{H}$	0.75	1.5	2.25	mJ	
Turn-Off Energy	E_{off}	Energy loss include "tail" and FWD (FDRW12S120J) reverse recovery.	1.1	2.2	3.3		
Forward Voltage Drop	V_F	$I_F=12\text{A}$	$T_j=25^\circ\text{C}$	1.3	2.2	2.8	V
			$T_j=175^\circ\text{C}$	1.0	1.8	2.6	V
Diode Reverse Recovery Time	t_{rr1}	$V_{CC}=30\text{V}$ $I_F = 1.2\text{A}$ $-di/dt=200\text{A}/\mu\text{s}$	16.5	33	42	ns	
Diode Reverse Recovery Time	t_{rr2}	$V_{CC}=600\text{V}$ $I_F=12\text{A}$	$-di/dt=200\text{A}/\mu\text{s}$	0.12	0.30	0.48	μs
			$T_j=25^\circ\text{C}$	0.24	0.60	0.96	
Diode Reverse Recovery Charge	Q_{rr}	$T_j=25^\circ\text{C}$				μC	

■ Equivalent circuit



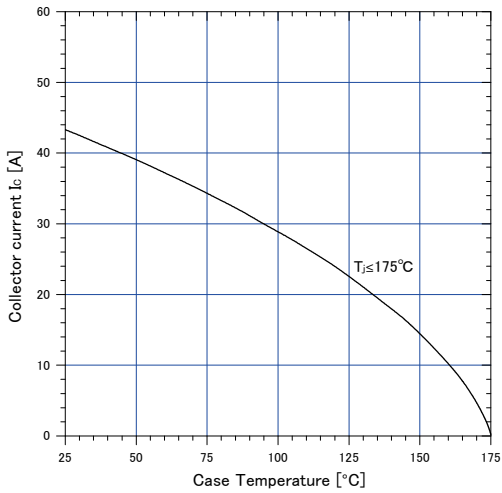
Description	Symbols	Conditions	Characteristics			Unit
			min.	typ.	max.	
Diode Reverse Recovery Time	t_{rr2}	$V_{CC}=600V$ $I_F=12A$	0.22	0.55	0.88	μs
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=200A/\mu s$ $T_j=175^\circ C$	1.2	3.0	4.8	μC

● **Thermal resistance**

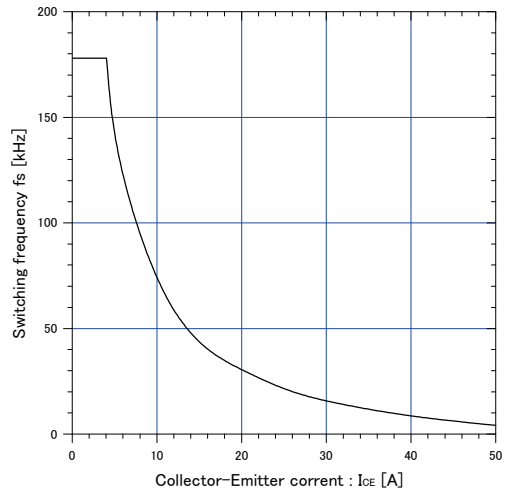
Items	Symbols	Characteristics			Unit
		min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	$^\circ C/W$
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	0.546	
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)}_{FWD}$	-	-	1.923	

■ Characteristics (Representative)

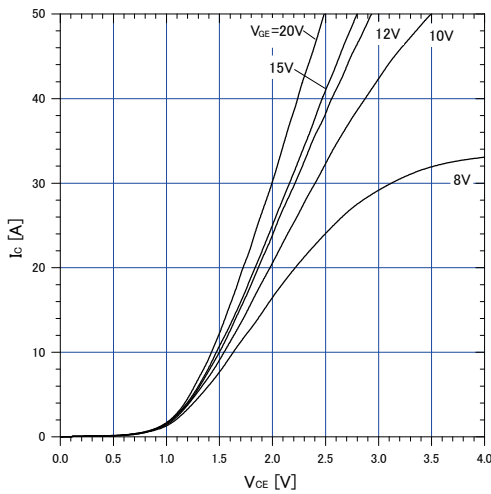
Graph.1
DC Collector Current vs T_c
 $V_{GE} \geq +15V, T_j \leq 175^\circ C$



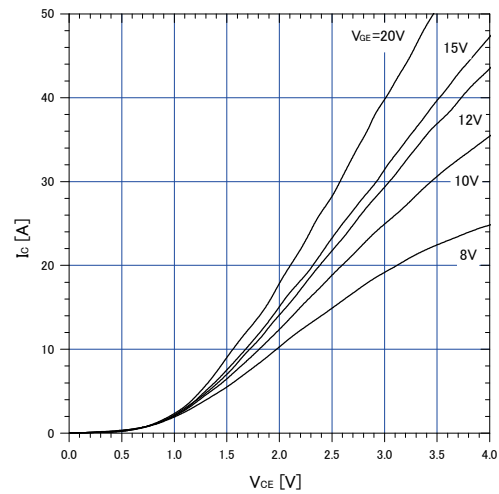
Graph.2
Collector Current vs. switching frequency
 $V_{GE} = +15V, T_c \leq 175^\circ C, V_{CC} = 600V, D = 0.5, R_G = 10\Omega, T_c = 100^\circ C$



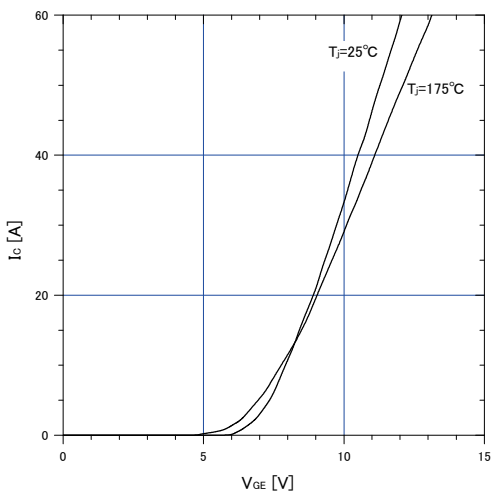
Graph.3
Typical Output Characteristics ($V_{CE} - I_c$)
 $T_j = 25^\circ C$



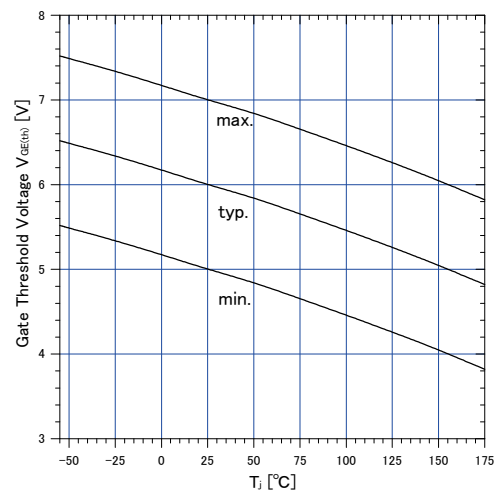
Graph.4
Typical Output Characteristics ($V_{CE} - I_c$)
 $T_j = 175^\circ C$



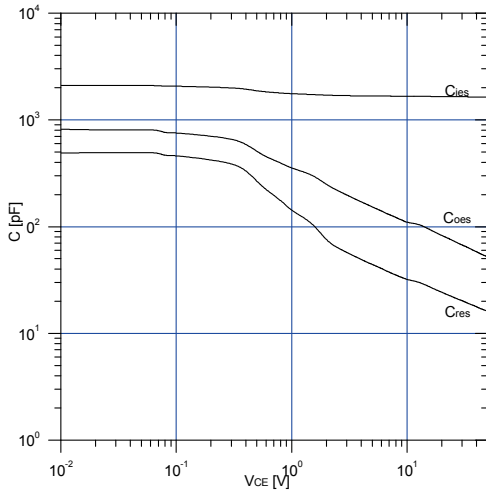
Graph.5
Typical Transfer Characteristics
 $V_{CE} = +15V$



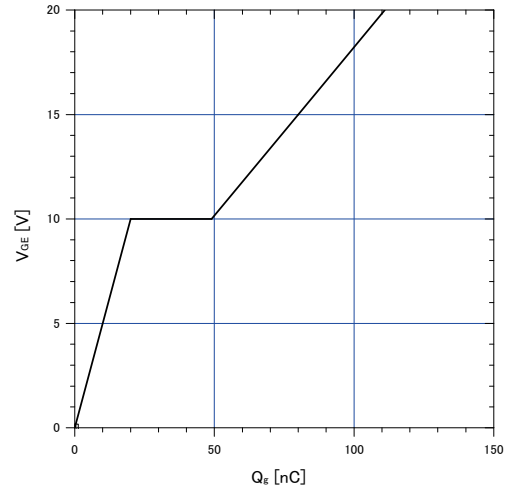
Graph.6
Gate Threshold Voltage vs. T_j
 $I_c = 25mA, V_{CE} = 20V$



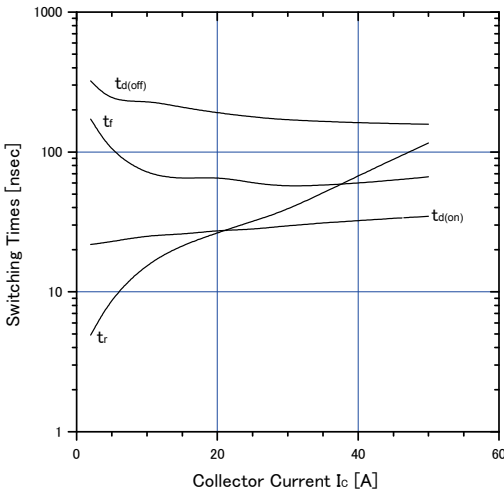
Graph.7
 Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_j=25^\circ C$



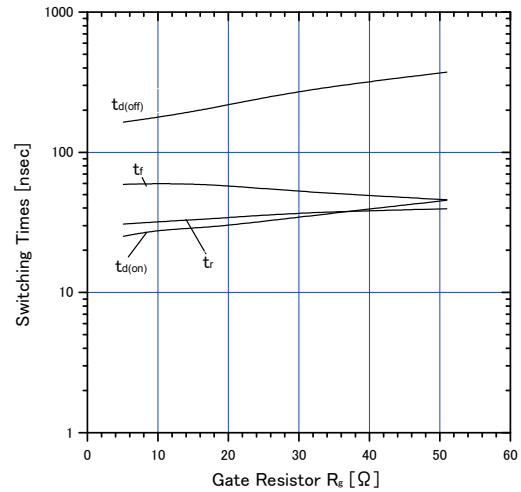
Graph.8
 Typical Gate Charge
 $V_{CC}=600V, I_c=25A, T_j=25^\circ C$



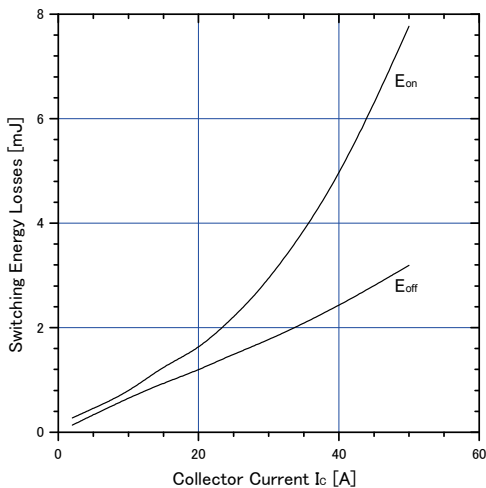
Graph.9
 Typical switching time vs. I_c
 $T_j=175^\circ C, V_{CC}=600V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



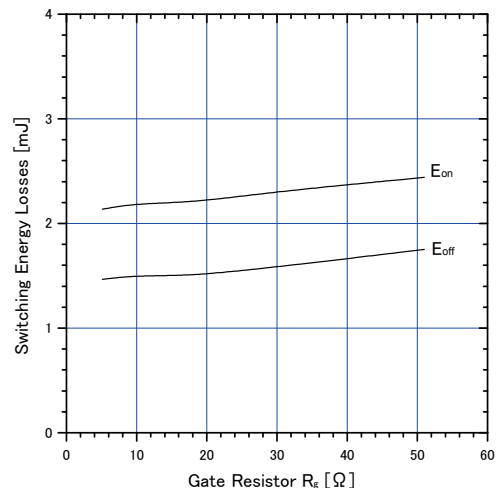
Graph.10
 Typical switching time vs. R_G
 $T_j=175^\circ C, V_{CC}=600V, I_c=25A, L=500\mu H$
 $V_{GE}=15V$



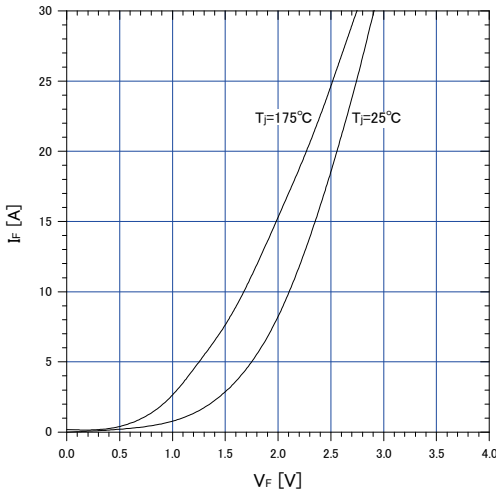
Graph.11
 Typical switching losses vs. I_c
 $T_j=175^\circ C, V_{CC}=600V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



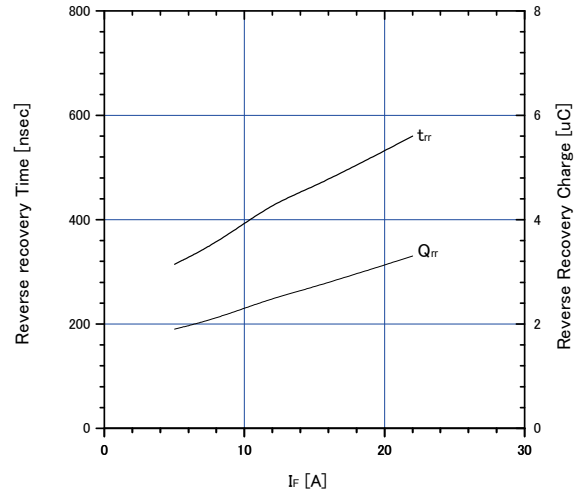
Graph.12
 Typical switching losses vs. R_G
 $T_j=175^\circ C, V_{CC}=600V, I_c=40A, L=500\mu H$
 $V_{GE}=15V$



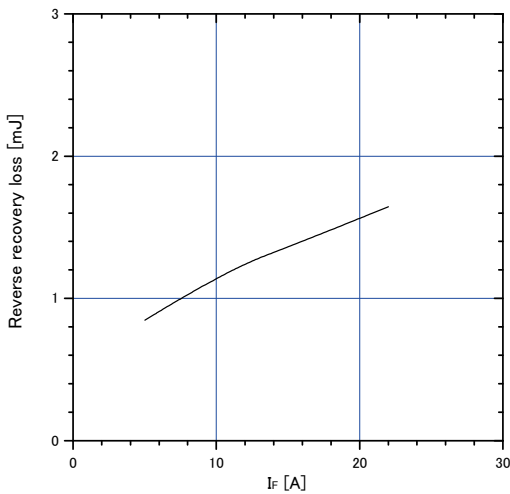
Graph.13
FWD Forward voltage drop (V_F-I_F)



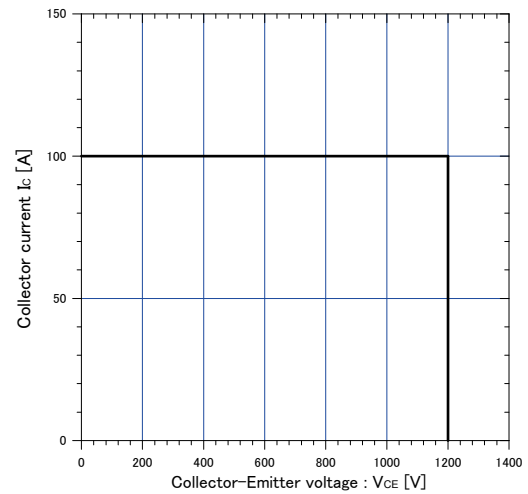
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=600\text{V}$, $L=500\mu\text{H}$,
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



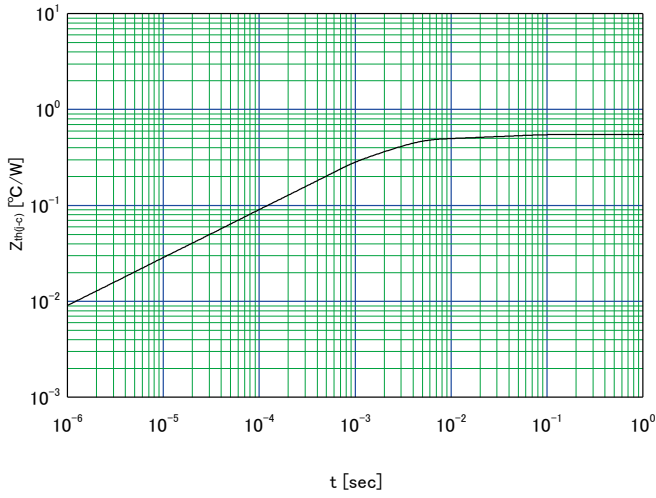
Graph.15
Typical reverse recovery loss vs. I_F
 $T_J=175^\circ\text{C}$, $V_{CC}=600\text{V}$, $L=500\mu\text{H}$
 $V_{GE}=15\text{V}$, $R_G=10\Omega$



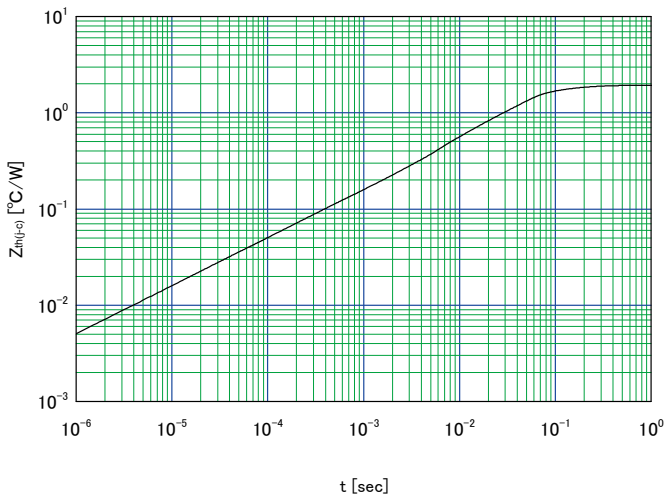
Graph.16
Reverse biased Safe Operating Area
 $T_J \leq 175^\circ\text{C}$, $V_{GE}=+15\text{V}/0\text{V}$, $R_G=10\Omega$



Graph.17
Transient thermal resistance of IGBT

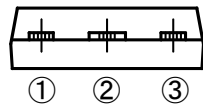
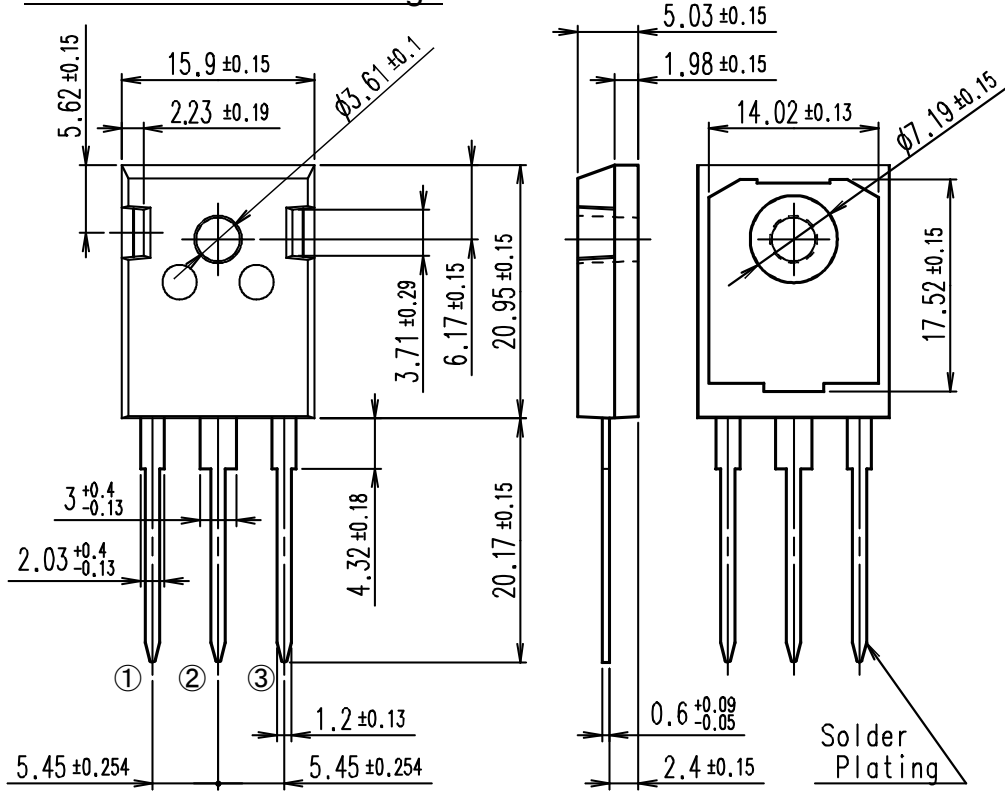


Graph.18
Transient thermal resistance of FWD



■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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