

FGW60N65WE

<http://www.fujielectric.com/products/semiconductor/>
Discrete IGBT

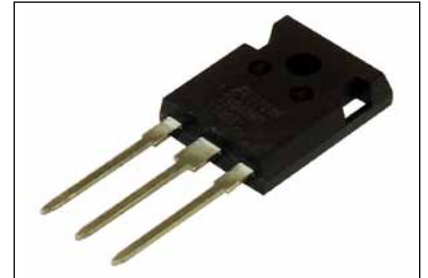
Discrete IGBT (High-Speed W series) 650V / 60A

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



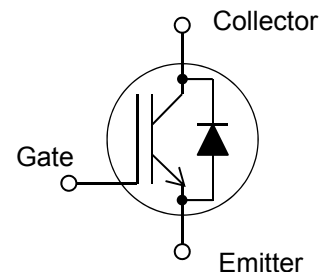
Maximum Ratings and Characteristics

Absolute Maximum Ratings at $T_J=25^\circ\text{C}$ (unless otherwise specified)

Items	Symbols	Characteristics	Unit	Remarks
Collector-Emitter Voltage	V_{CES}	650	V	
Gate-Emitter Voltage	V_{GES}	± 20	V	
Transient Gate-Emitter Voltage		± 30	V	$T_r < 1\mu\text{s}$
DC Collector Current	$I_{C@25}$	83	A	$T_c=25^\circ\text{C}$
	$I_{C@100}$	60	A	$T_c=100^\circ\text{C}$
Pulsed Collector Current	I_{CP}	240	A	Note *1
Turn-Off Safe Operating Area	-	240	A	$V_{CE} \leq 650\text{V}$ $T_J \leq 175^\circ\text{C}$
Diode Forward Current	$I_F@25$	88	A	
	$I_F@100$	60	A	
Diode Pulsed Current	I_{FP}	240	A	Note *1
IGBT Max. Power Dissipation	P_{D_IGBT}	405	W	$T_c=25^\circ\text{C}$
FWD Max. Power Dissipation	P_{D_FWD}	220	W	$T_c=25^\circ\text{C}$
Operating Junction Temperature	T_J	$-40 \sim +175$	$^\circ\text{C}$	
Storage Temperature	T_{stg}	$-55 \sim +175$	$^\circ\text{C}$	

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

Equivalent circuit



Electrical characteristics at $T_J = 25^\circ\text{C}$ (unless otherwise specified) Static Characteristics

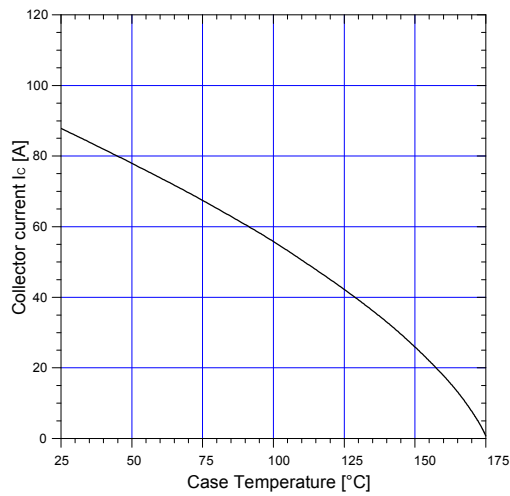
Description	Symbol	Conditions	min.	typ.	max.	Unit
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 650\text{V}, V_{GE} = 0\text{V}$ $T_J=25^\circ\text{C}$ $T_J=175^\circ\text{C}$	-	-	250 2	μA mA
Gate-Emitter Leakage Current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = \pm 20\text{V}$	-	-	200	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}, I_C = 60\text{mA}$	3.0	4.0	5.0	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = 15\text{V}, I_C = 60\text{A}$ $T_J=25^\circ\text{C}$ $T_J=125^\circ\text{C}$ $T_J=175^\circ\text{C}$	-	1.80 2.05 2.10	2.20 -	V
Input Capacitance	C_{ies}	$V_{CE}=25\text{V}$	-	4300	-	pF
Output Capacitance	C_{oes}	$V_{GE}=0\text{V}$	-	125	-	
Reverse Transfer Capacitance	C_{res}	$f=1\text{MHz}$	-	95	-	
Gate Charge	Q_G	$V_{CC} = 520\text{V}$ $I_C = 60\text{A}$ $V_{GE} = 15\text{V}$	-	250	-	nC
Turn-On Delay Time	$t_{d(on)}$	$T_J = 25^\circ\text{C}, V_{CC} = 400\text{V}$ $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $R_G = 10\Omega, L = 500\mu\text{H}$ Energy loss include "tail" and FWD reverse recovery.	-	29	-	ns
Rise Time	t_r		-	45	-	
Turn-Off Delay Time	$t_{d(off)}$		-	260	-	
Fall Time	t_f		-	78	-	
Turn-On Energy	E_{on}		-	0.60	-	mJ
Turn-Off Energy	E_{off}		-	0.67	-	
Turn-On Delay Time	$t_{d(on)}$	$T_J = 150^\circ\text{C}, V_{CC} = 400\text{V}$ $I_C = 30\text{A}, V_{GE} = 15\text{V}$ $R_G = 10\Omega, L = 500\mu\text{H}$ Energy loss include "tail" and FWD reverse recovery.	-	29	-	ns
Rise Time	t_r		-	45	-	
Turn-Off Delay Time	$t_{d(off)}$		-	295	-	
Fall Time	t_f		-	68	-	
Turn-On Energy	E_{on}		-	1.05	-	mJ
Turn-Off Energy	E_{off}		-	0.73	-	
Forward Voltage Drop	V_F	$I_F=60\text{A}$ $T_J=25^\circ\text{C}$ $T_J=125^\circ\text{C}$ $T_J=175^\circ\text{C}$	-	2.5 1.9 1.7	3.2 -	V V V
Diode Reverse Recovery Time	t_{rr}	$V_{CC}=400\text{V}, I_F=30\text{A}$	-	120	-	ns
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=500\text{A}/\mu\text{s}, T_J=25^\circ\text{C}$	-	0.33	-	μC
Diode Reverse Recovery Time	t_{rr}	$V_{CC}=400\text{V}, I_F=30\text{A}$	-	170	-	ns
Diode Reverse Recovery Charge	Q_{rr}	$-di_F/dt=500\text{A}/\mu\text{s}, T_J=150^\circ\text{C}$	-	1.30	-	μC

● Thermal Resistance

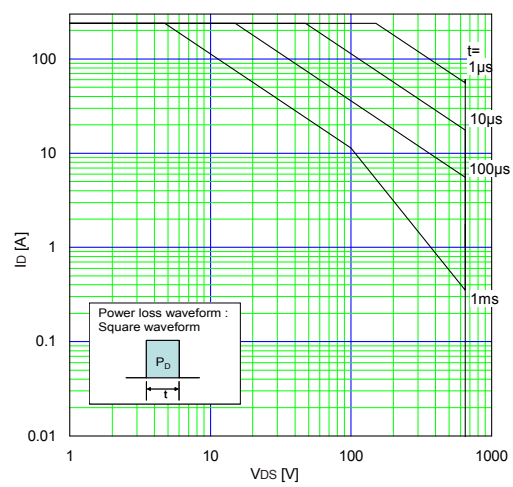
Description	Symbol	min.	typ.	max.	Unit
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	50	°C/W
Thermal Resistance, IGBT Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	0.366	°C/W
Thermal Resistance, FWD Junction to Case	$R_{th(j-c)}_{FWD}$	-	-	0.676	°C/W

■ Characteristics (Representative)

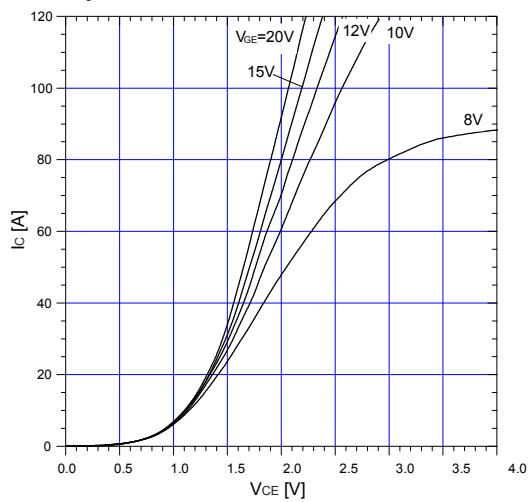
Graph.1
DC Collector Current vs T_c
 $V_{GE} \geq +15V$, $T_j \leq 175^\circ C$



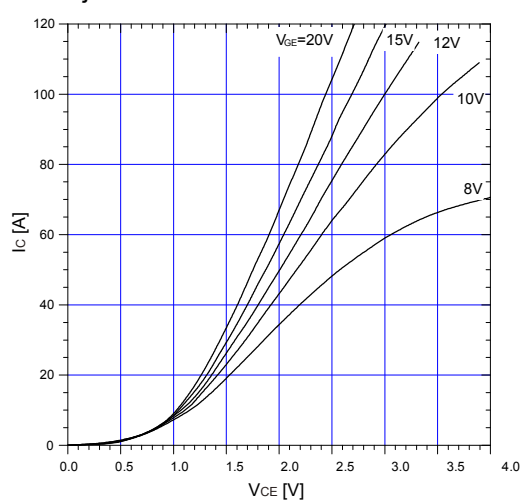
Graph.2
FBSOA
Duty=0(Single pulse), $T_c=25^\circ C$



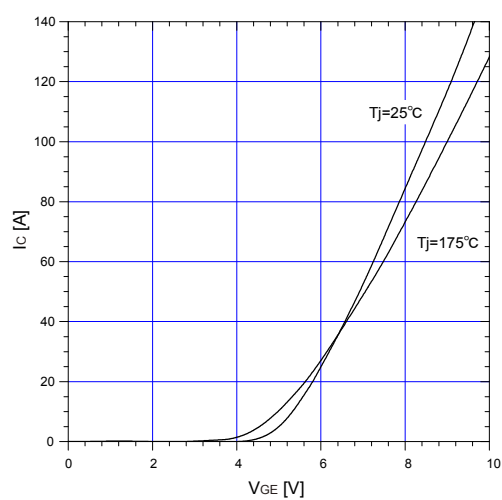
Graph.3
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_j=25^\circ C$



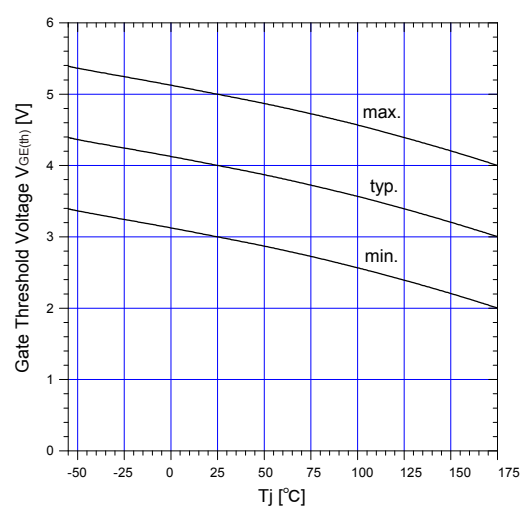
Graph.4
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_j=175^\circ C$



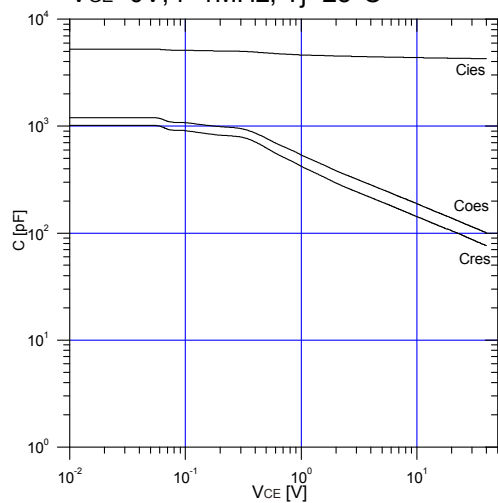
Graph.5
Typical Transfer Characteristics
 $V_{CE}=10V$



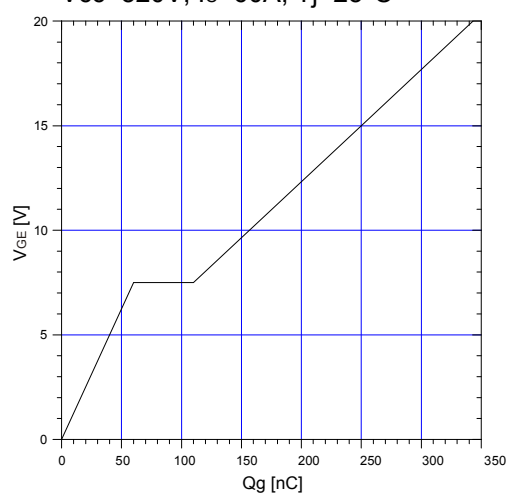
Graph.6
Gate Threshold Voltage vs. T_j
 $I_C=60mA$, $V_{CE}=20V$



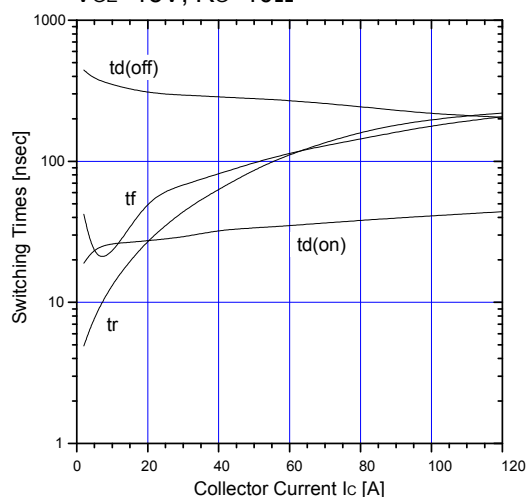
Graph.7
Typical Capacitance
 $V_{GE}=0V$, $f=1MHz$, $T_j=25^\circ C$



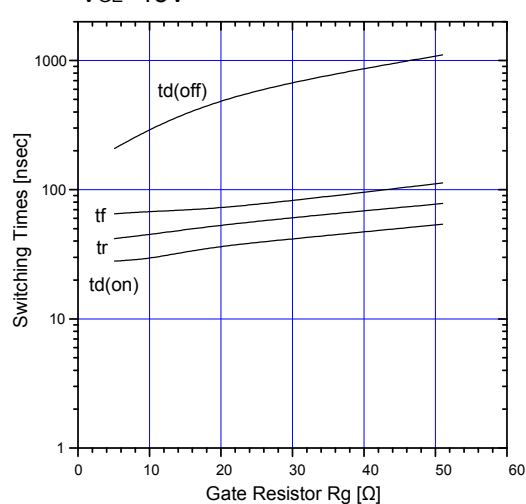
Graph.8
Typical Gate Charge
 $V_{cc}=520V$, $I_c=60A$, $T_j=25^\circ C$



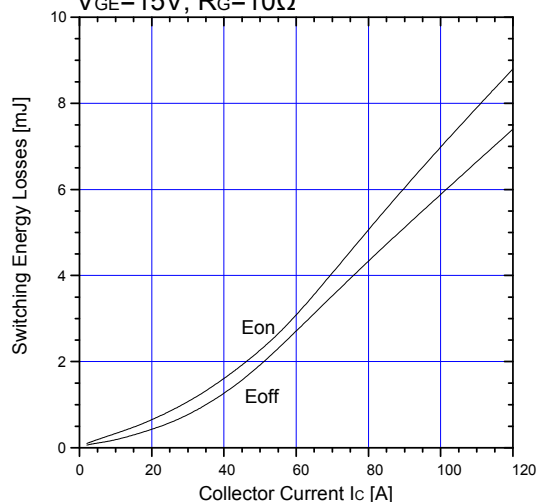
Graph.9
Typical switching time vs. I_c
 $T_j=150^\circ C$, $V_{cc}=400V$, $L=500\mu H$
 $V_{GE}=15V$, $R_G=10\Omega$



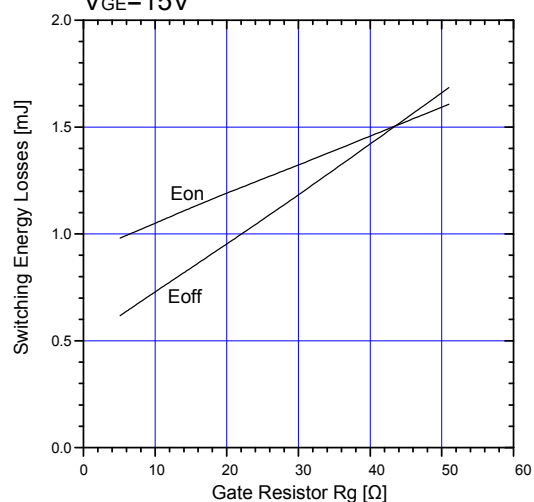
Graph.10
Typical switching time vs. R_g
 $T_j=150^\circ C$, $V_{cc}=400V$, $I_c=30A$, $L=500\mu H$
 $V_{GE}=15V$



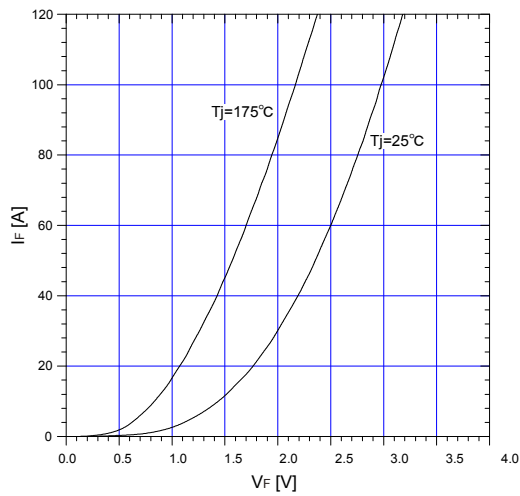
Graph.11
Typical switching losses vs. I_c
 $T_j=150^\circ C$, $V_{cc}=400V$, $L=500\mu H$
 $V_{GE}=15V$, $R_G=10\Omega$



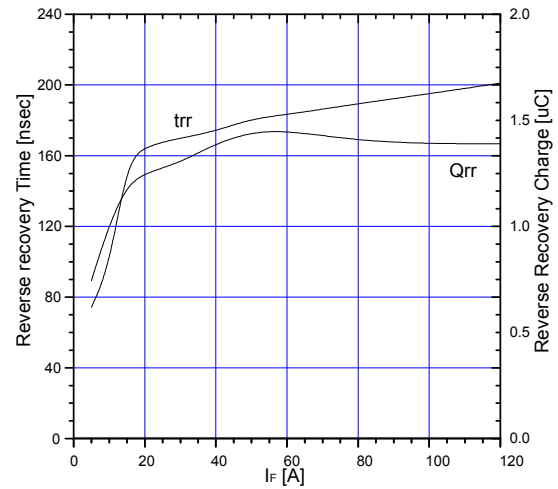
Graph.12
Typical switching losses vs. R_g
 $T_j=150^\circ C$, $V_{cc}=400V$, $I_c=30A$, $L=500\mu H$
 $V_{GE}=15V$



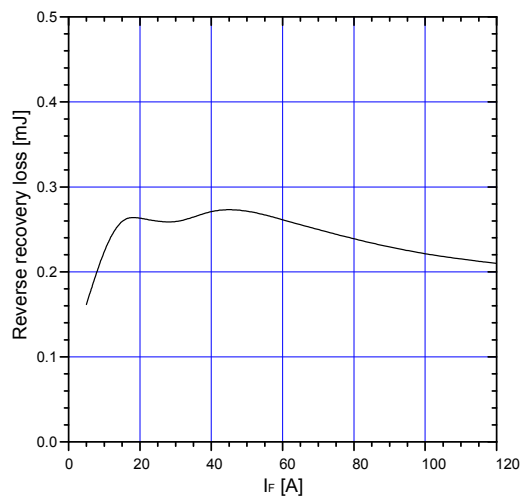
Graph.13
FWD Forward voltage drop (V_F - I_F)



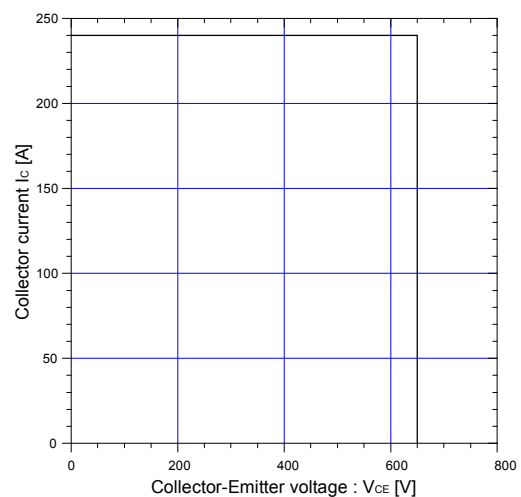
Graph.14
Typical reverse recovery characteristics vs. I_F
 $T_j = 15^\circ\text{C}$, $V_{CC} = 400\text{V}$, $L = 500\mu\text{H}$
 $V_{GE} = 15\text{V}$, $R_G = 10\Omega$

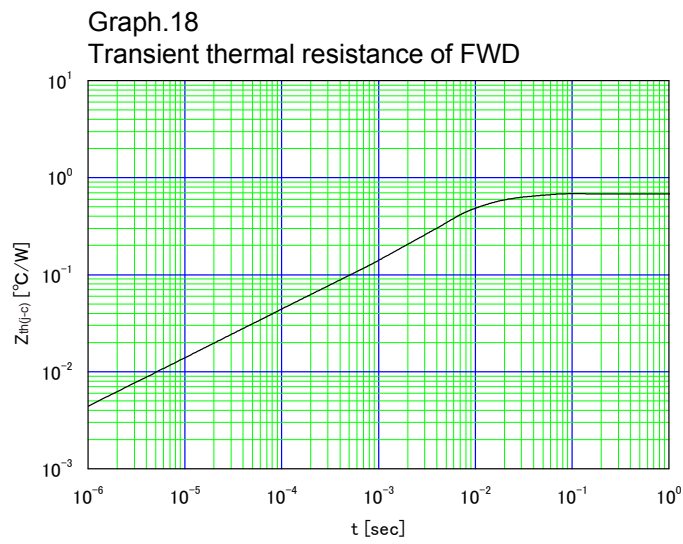
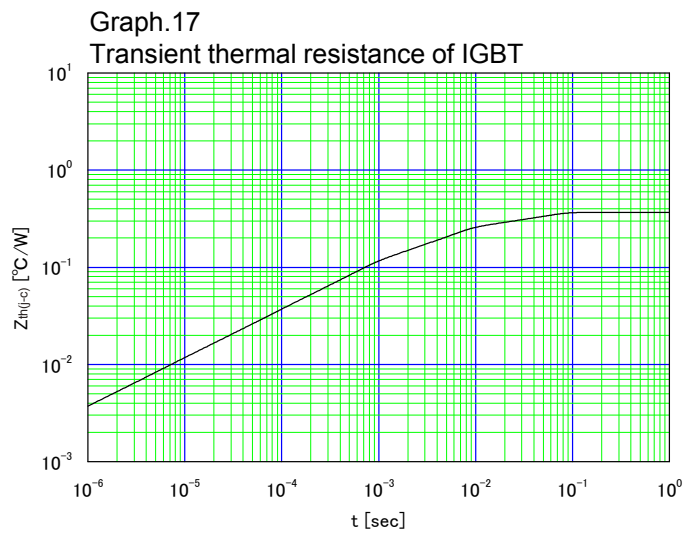


Graph.15
Typical reverse recovery loss vs. I_F
 $T_j = 150^\circ\text{C}$, $V_{CC} = 400\text{V}$, $L = 500\mu\text{H}$
 $V_{GE} = 15\text{V}$, $R_G = 10\Omega$



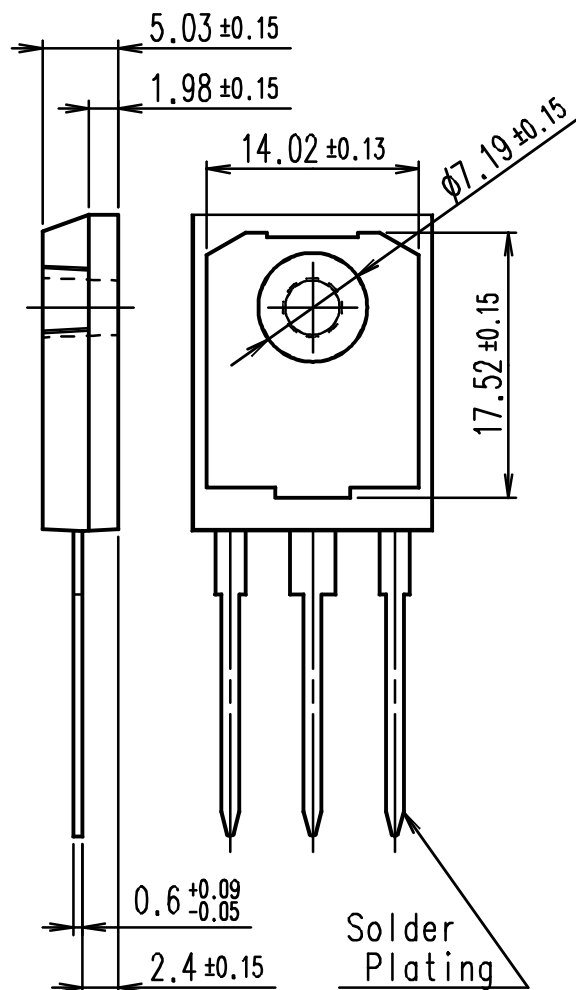
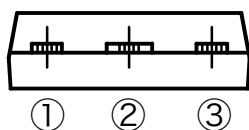
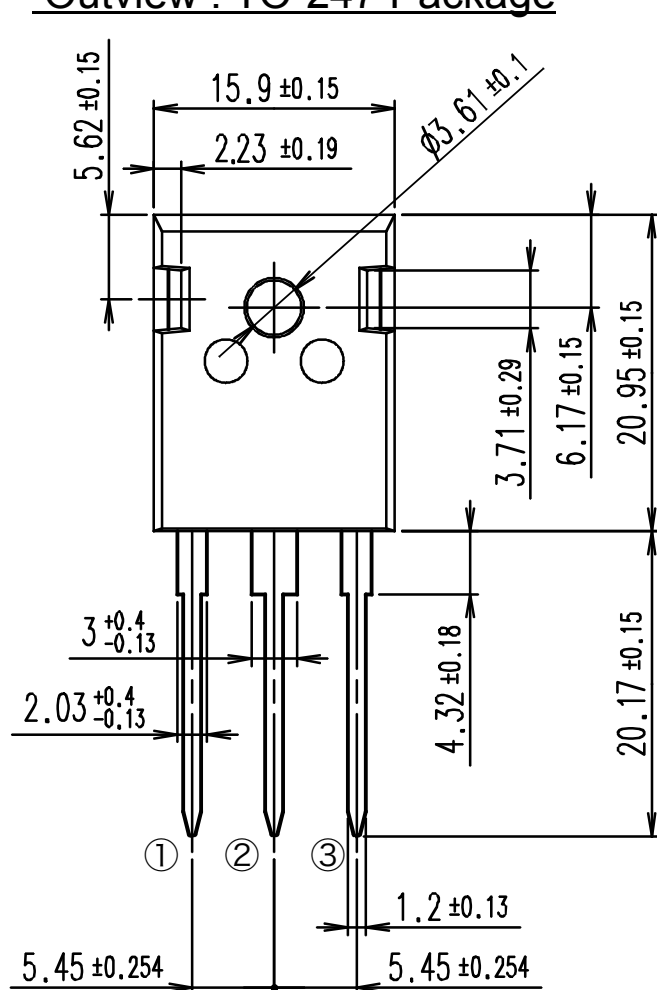
Graph.16
Reverse biased Safe Operating Area
 $T_j \leq 175^\circ\text{C}$, $V_{GE} = +15\text{V}/0\text{V}$, $R_G = 10\Omega$





■ Outline Drawings, mm

Outview : TO-247 Package



Solder
Plating

CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

WARNING

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			• Industrial robots etc.
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IGBT Modules

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