

# FGW60N65W

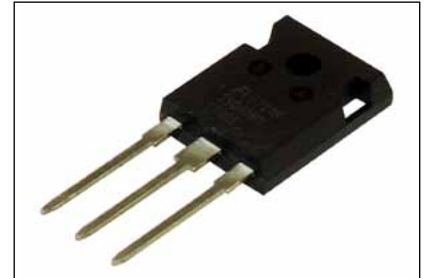
## Discrete IGBT (High-Speed W series) 650V / 60A

### ■ Features

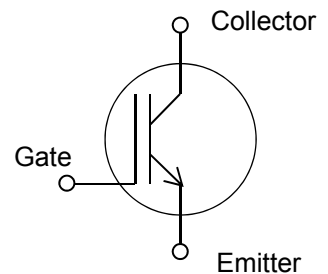
- Low power loss
- Low switching surge and noise
- High reliability, high ruggedness (RBSOA, SCSOA etc.)

### ■ Applications

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



### ■ Equivalent circuit



### ■ Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings (at T<sub>c</sub>=25°C unless otherwise specified)

Items	Symbols	Characteristics	Units	Remarks
Collector-Emitter Voltage	V <sub>CEs</sub>	650	V	
Gate-Emitter Voltage	V <sub>GES</sub>	±20	V	T <sub>p</sub> < 1μs
Transient Gate-Emitter Voltage		±30		
DC Collector Current	I <sub>C@25</sub>	83	A	T <sub>c</sub> = 25°C
	I <sub>C@100</sub>	60	A	T <sub>c</sub> = 100°C
Pulsed Collector Current	I <sub>CP</sub>	240	A	Note *1
Turn-Off Safe Operating Area	-	240	A	V <sub>CE</sub> ≤ 650V T <sub>j</sub> ≤ 175°C
Max. Power Dissipation	P <sub>D</sub>	230	W	T <sub>c</sub> = 25°C
Operating Junction Temperature	T <sub>j</sub>	-40 ~ +175	°C	
Storage Temperature	T <sub>stg</sub>	-55 ~ +175	°C	

Note \*1 : Pulse width limited by T<sub>jmax</sub>.

#### ● Electrical characteristics (at T<sub>j</sub> = 25°C unless otherwise specified)

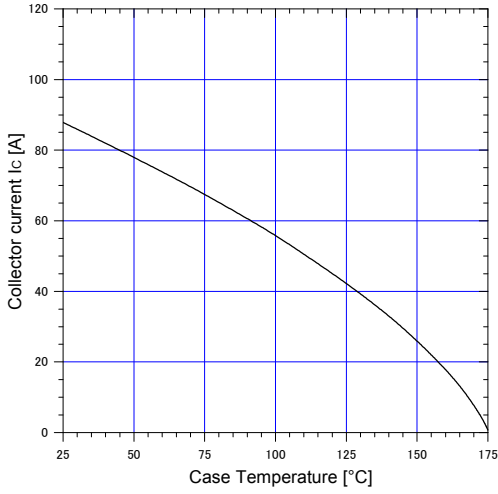
Description	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero Gate Voltage Collector Current	I <sub>CEs</sub>	V <sub>CE</sub> = 650V, V <sub>GE</sub> = 0V	-	-	250	μA	
		T <sub>j</sub> = 25°C	-	-	2	mA	
		T <sub>j</sub> = 175°C	-	-	200	nA	
Gate-Emitter Leakage Current	I <sub>GES</sub>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V	-	-	-	-	
Gate-Emitter Threshold Voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V, I <sub>C</sub> = 60mA	3.0	4.0	5.0	V	
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	V <sub>GE</sub> = 15V, I <sub>C</sub> = 60A	T <sub>j</sub> = 25°C	1.40	1.80	2.20	V
			T <sub>j</sub> = 125°C	-	2.05	-	
			T <sub>j</sub> = 175°C	-	2.10	-	
Input Capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 25V	2150	4300	6450	pF	
Output Capacitance	C <sub>oes</sub>	V <sub>GE</sub> = 0V	63	125	188		
Reverse Transfer Capacitance	C <sub>res</sub>	f = 1MHz	48	95	143		
Gate Charge	Q <sub>G</sub>	V <sub>CC</sub> = 520V I <sub>C</sub> = 60A V <sub>GE</sub> = 15V	125	250	375	nC	
Turn-On Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> = 25°C, V <sub>CC</sub> = 400V I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 500μH	15	29	44	ns	
Rise Time	t <sub>r</sub>		20	40	60		
Turn-Off Delay Time	t <sub>d(off)</sub>		130	260	390		
Fall Time	t <sub>f</sub>	Energy loss include "tail" and FWD (FGW60N65WD) reverse recovery.	39	78	117	mJ	
Turn-On Energy	E <sub>on</sub>		0.30	0.60	0.90		
Turn-Off Energy	E <sub>off</sub>		0.34	0.67	1.01		
Turn-On Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> = 150°C, V <sub>CC</sub> = 400V I <sub>C</sub> = 30A, V <sub>GE</sub> = 15V R <sub>G</sub> = 10Ω, L = 500μH	15	29	44	ns	
Rise Time	t <sub>r</sub>		20	40	60		
Turn-Off Delay Time	t <sub>d(off)</sub>		148	295	443		
Fall Time	t <sub>f</sub>	Energy loss include "tail" and FWD (FGW60N65WD) reverse recovery.	34	68	102	mJ	
Turn-On Energy	E <sub>on</sub>		0.48	0.96	1.44		
Turn-Off Energy	E <sub>off</sub>		0.37	0.73	1.10		

#### ● Thermal resistance characteristics

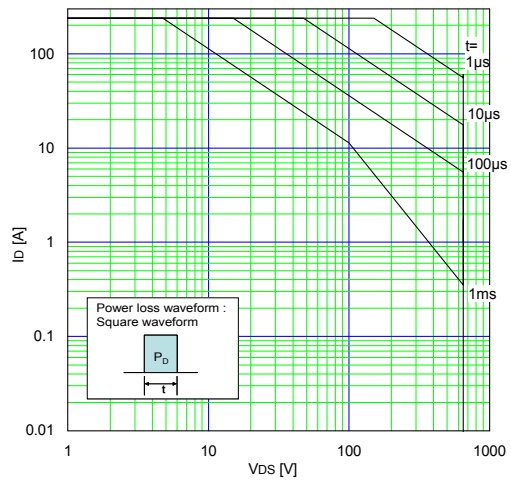
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	R <sub>th(j-a)</sub>	-	-	-	50	°C/W
Thermal Resistance, Junction to Case	R <sub>th(j-c)</sub>	-	-	-	0.641	

■ Characteristics (Representative)

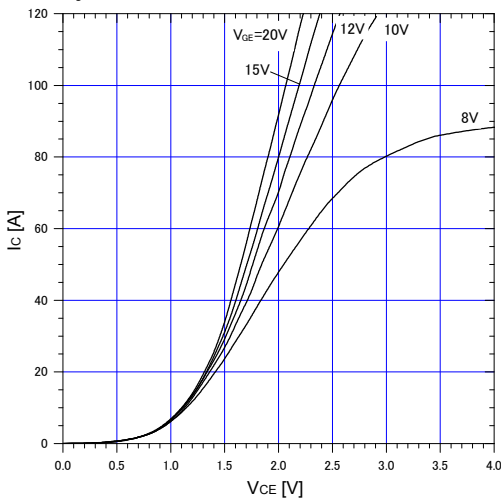
Graph.1  
DC Collector Current vs Tc  
V<sub>GE</sub> ≥ +15V, T<sub>j</sub> ≤ 175°C



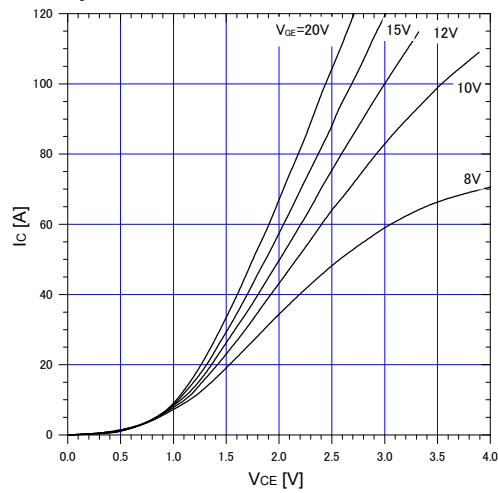
Graph.2  
FBSOA  
Duty=0(Single pulse), T<sub>c</sub>=25°C



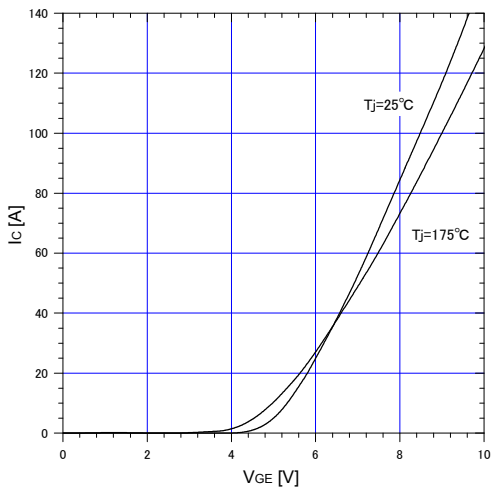
Graph.3  
Typical Output Characteristics (V<sub>CE</sub>-I<sub>C</sub>)  
T<sub>j</sub>=25°C



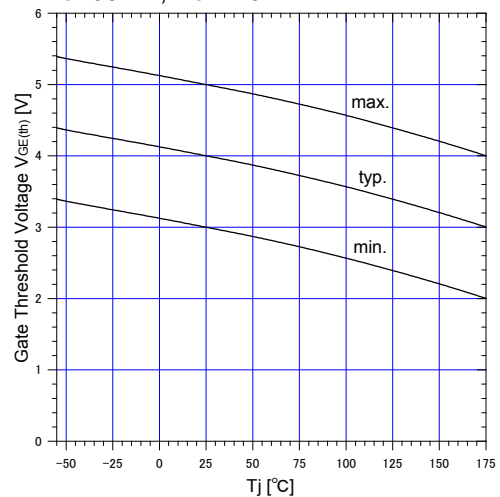
Graph.4  
Typical Output Characteristics (V<sub>CE</sub>-I<sub>C</sub>)  
T<sub>j</sub>=175°C



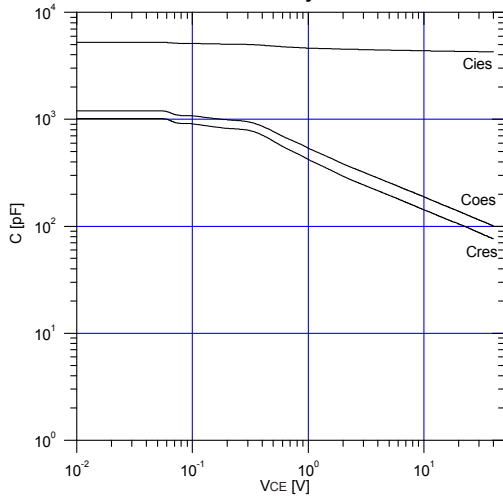
Graph.5  
Typical Transfer Characteristics  
V<sub>CE</sub>=10V



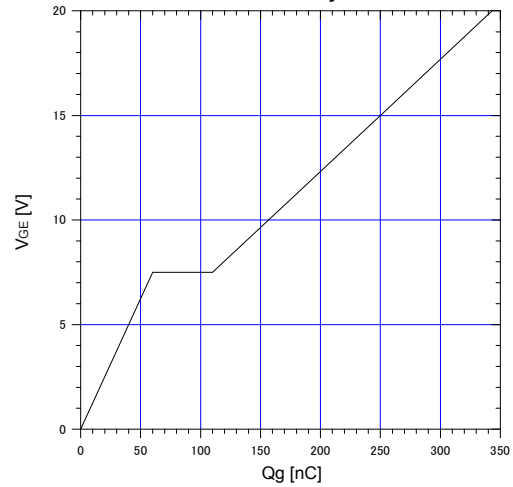
Graph.6  
Gate Threshold Voltage vs. T<sub>j</sub>  
I<sub>C</sub>=60mA, V<sub>CE</sub>=20V



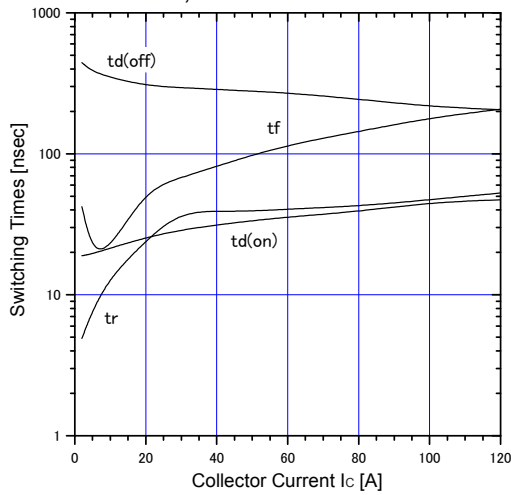
Graph.7  
Typical Capacitance  
 $V_{GE}=0V, f=1MHz, T_j=25^\circ C$



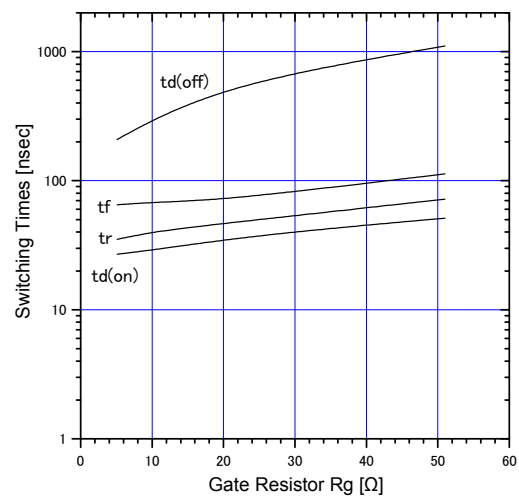
Graph.8  
Typical Gate Charge  
 $V_{cc}=520V, I_c=60A, T_j=25^\circ C$



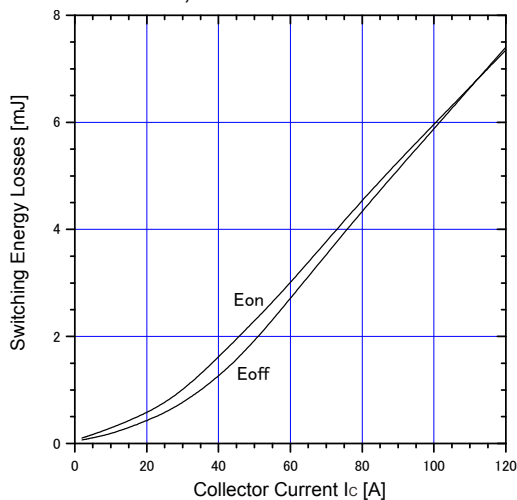
Graph.9  
Typical switching time vs.  $I_c$   
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



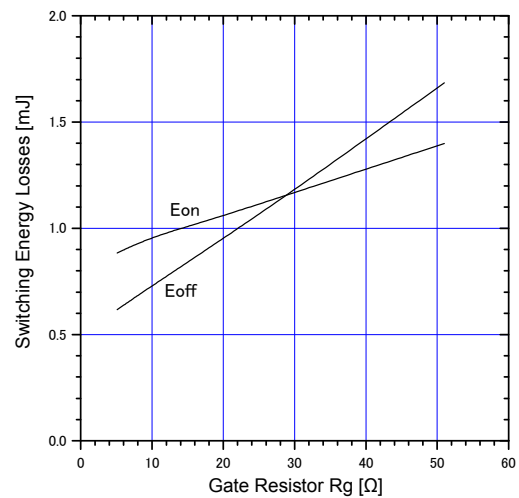
Graph.10  
Typical switching time vs.  $R_g$   
 $T_j=150^\circ C, V_{cc}=400V, I_c=30A, L=500\mu H$   
 $V_{GE}=15V$



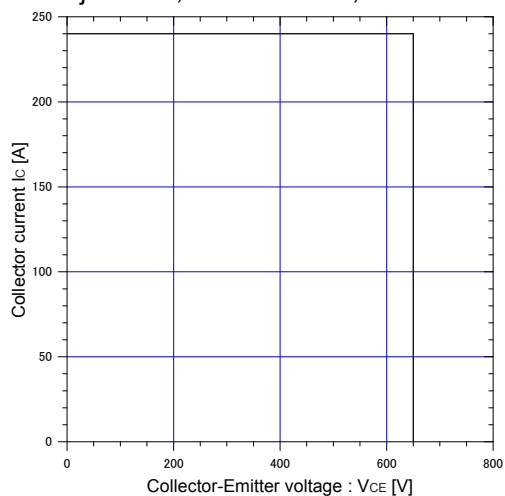
Graph.11  
Typical switching losses vs.  $I_c$   
 $T_j=150^\circ C, V_{cc}=400V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



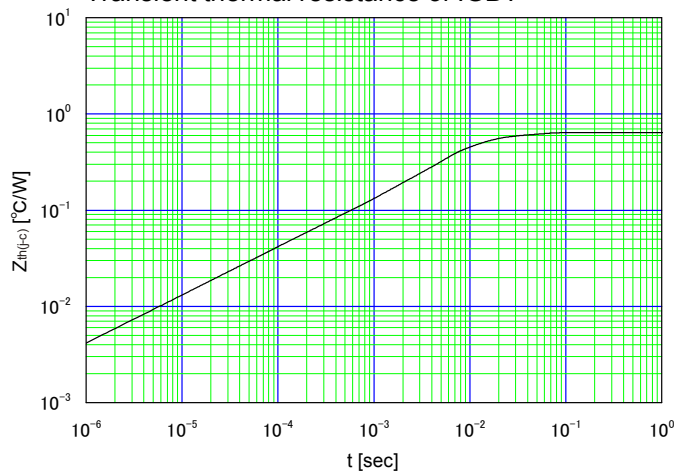
Graph.12  
Typical switching losses vs.  $R_g$   
 $T_j=150^\circ C, V_{cc}=400V, I_c=30A, L=500\mu H$   
 $V_{GE}=15V$



Graph.13  
Reverse biased Safe Operating Area  
 $T_j \leq 175^\circ\text{C}$ ,  $V_{GE} = +15\text{V}/0\text{V}$ ,  $R_G = 10\Omega$

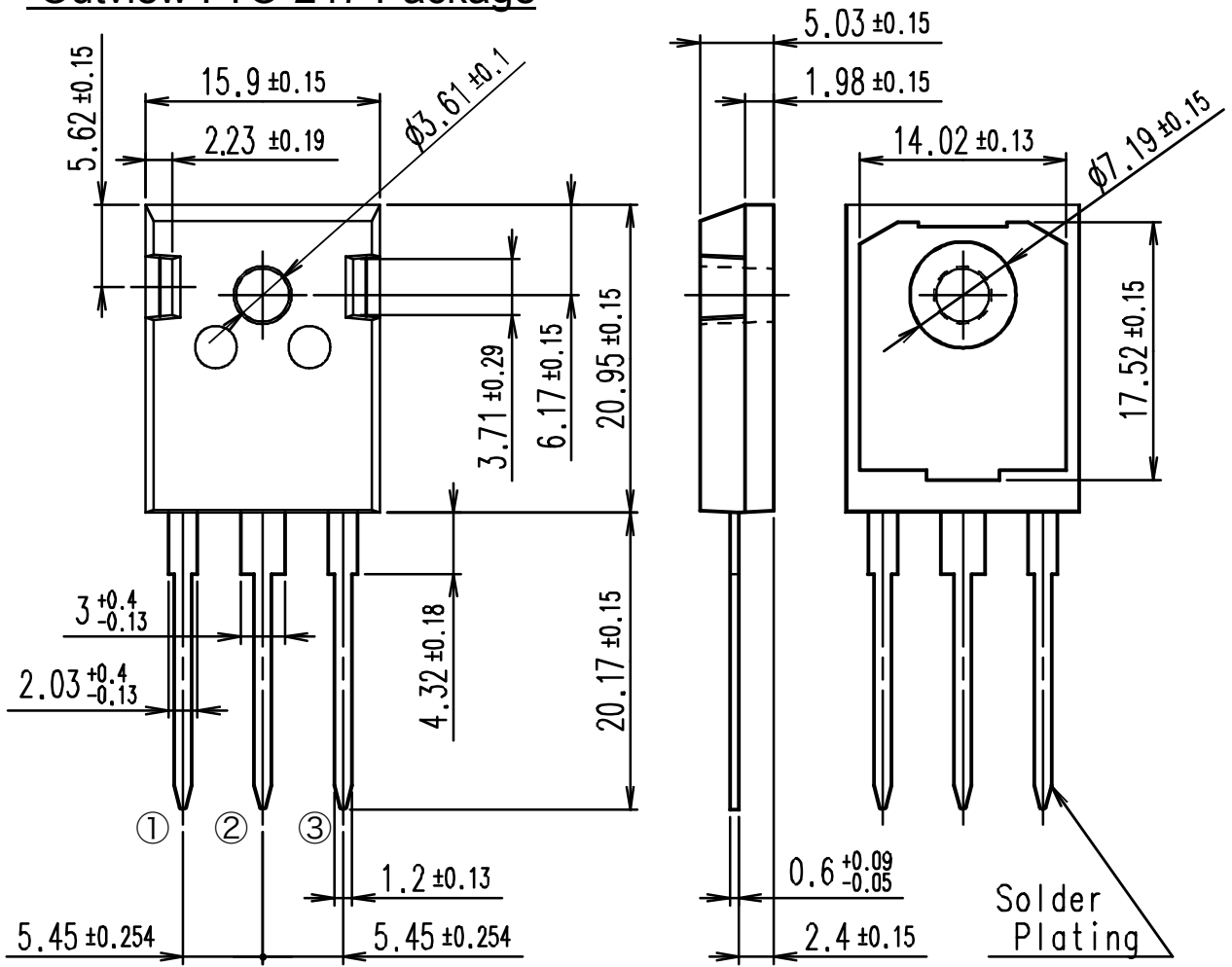


Graph.14  
Transient thermal resistance of IGBT



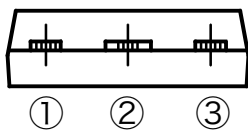
■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER



DIMENSIONS ARE IN MILLIMETERS.

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