

# FGW40N120H

Discrete IGBT

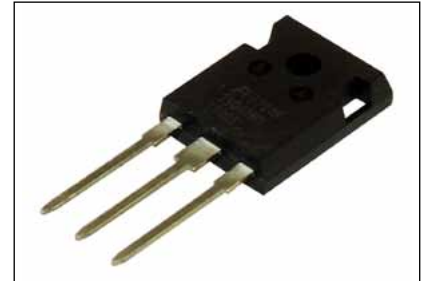
## Discrete IGBT (High-Speed V series) 1200V / 40A

### ■ Features

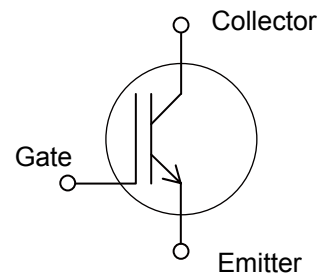
- Low power loss
- Low switching surge and noise
- High reliability, high ruggedness (RBSOA, SCSOA etc.)

### ■ Applications

- Uninterruptible power supply
- Power conditioner
- Power factor correction circuit



### ■ 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>	1200	V	
Gate-Emitter Voltage	V <sub>GES</sub>	±20	V	
DC Collector Current	I <sub>C@25</sub>	70	A	T <sub>c</sub> =25°C, T <sub>j</sub> =150°C
	I <sub>C@100</sub>	40	A	T <sub>c</sub> =100°C, T <sub>j</sub> =150°C
Pulsed Collector Current	I <sub>CP</sub>	120	A	Note *1
Turn-Off Safe Operating Area	-	120	A	V <sub>CE</sub> ≤1200V, T <sub>j</sub> ≤175°C
Short Circuit Withstand Time	t <sub>sc</sub>	5	μs	V <sub>CC</sub> ≤600V, V <sub>GE</sub> =12V, T <sub>j</sub> ≤150°C
Maximum Power Dissipation	P <sub>D</sub>	340	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)

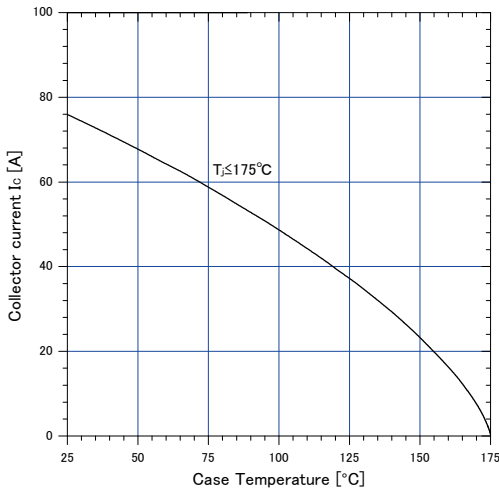
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Collector-Emitter Breakdown Voltage	V <sub>BR(V)CES</sub>	I <sub>C</sub> = 50μA, V <sub>GE</sub> = 0V	1200	-	-	V
Zero Gate Voltage Collector Current	I <sub>CES</sub>	V <sub>CE</sub> = 1200V, V <sub>GE</sub> = 0V	-	-	250	μA
		T <sub>j</sub> =25°C	-	-	2	mA
		T <sub>j</sub> =175°C	-	-	-	-
Gate-Emitter Leakage Current	I <sub>GES</sub>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V	-	-	200	nA
Gate-Emitter Threshold Voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = +20V, I <sub>C</sub> = 40mA	4.0	5.0	6.0	V
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	V <sub>GE</sub> = +15V, I <sub>C</sub> = 40A	-	1.8	2.34	V
		T <sub>j</sub> =25°C	-	2.3	-	-
		T <sub>j</sub> =175°C	-	-	-	-
Input Capacitance	C <sub>ies</sub>	V <sub>CE</sub> =25V	-	3000	-	pF
Output Capacitance	C <sub>oes</sub>	V <sub>GE</sub> =0V	-	130	-	-
Reverse Transfer Capacitance	C <sub>res</sub>	f=1MHz	-	100	-	-
Gate Charge	Q <sub>G</sub>	V <sub>CC</sub> = 600V I <sub>C</sub> = 40A V <sub>GE</sub> = 15V	-	300	-	nC
Turn-On Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> = 25°C	-	35	-	ns
Rise Time	t <sub>r</sub>	V <sub>CC</sub> = 600V	-	60	-	
Turn-Off Delay Time	t <sub>d(off)</sub>	I <sub>C</sub> = 40A	-	315	-	
Fall Time	t <sub>f</sub>	V <sub>GE</sub> = 15V	-	40	-	
Turn-On Energy	E <sub>on</sub>	R <sub>G</sub> = 10Ω	-	2.8	-	mJ
Turn-Off Energy	E <sub>off</sub>	L = 500μH Energy loss include "tail" and FWD (FDRW30S120J) reverse recovery.	-	1.8	-	
Turn-On Delay Time	t <sub>d(on)</sub>	T <sub>j</sub> = 175°C	-	35	-	
Rise Time	t <sub>r</sub>	V <sub>CC</sub> = 600V	-	60	-	
Turn-Off Delay Time	t <sub>d(off)</sub>	I <sub>C</sub> = 40A	-	350	-	ns
Fall Time	t <sub>f</sub>	V <sub>GE</sub> = 15V	-	75	-	
Turn-On Energy	E <sub>on</sub>	R <sub>G</sub> = 10Ω	-	4.8	-	
Turn-Off Energy	E <sub>off</sub>	L = 500μH Energy loss include "tail" and FWD (FDRW30S120J) reverse recovery.	-	3.0	-	

#### ● Thermal resistance characteristics

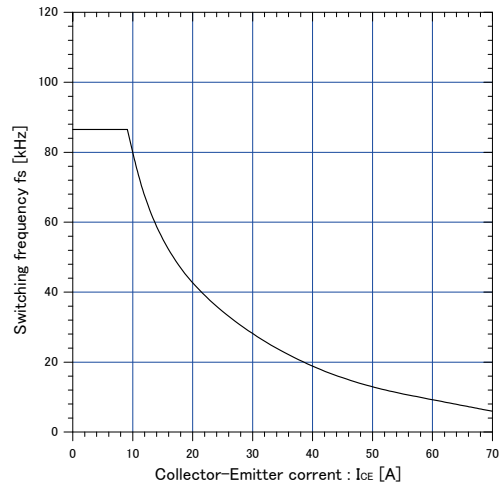
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	R <sub>th(j-a)</sub>	-	-	-	50	°C/W
Thermal Resistance, Junction to Case	R <sub>th(j-c)_IGBT</sub>	-	-	-	0.439	

■ Characteristics (Representative)

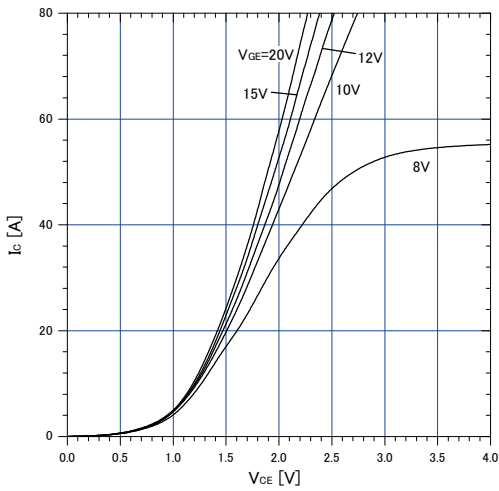
Graph.1  
DC Collector Current vs  $T_c$   
 $V_{GE} \geq +15V, T_j \leq 175^\circ C$



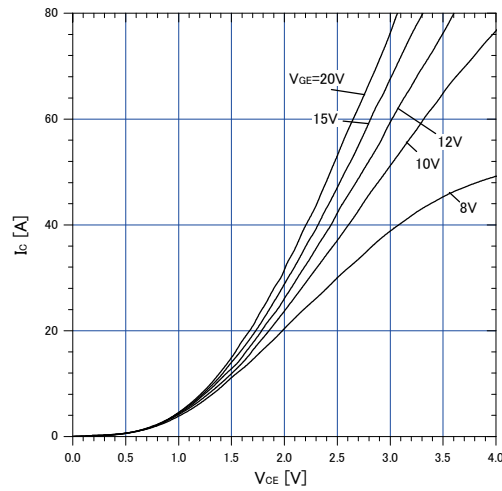
Graph.2  
Collector Current vs. switching frequency  
 $V_{GE} = +15V, T_c \leq 175^\circ C, V_{CC} = 600V, D = 0.5, R_G = 10\Omega, T_c = 100^\circ C$



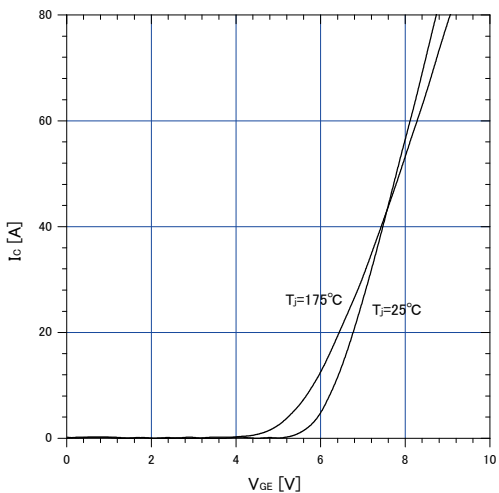
Graph.3  
Typical Output Characteristics ( $V_{CE}-I_c$ )  
 $T_j = 25^\circ C$



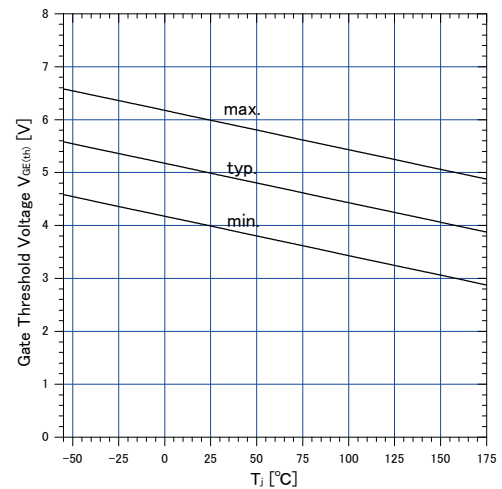
Graph.4  
Typical Output Characteristics ( $V_{CE}-I_c$ )  
 $T_j = 175^\circ C$



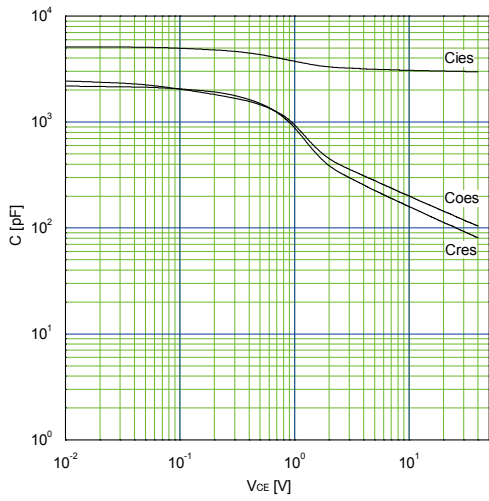
Graph.5  
Typical Transfer Characteristics  
 $V_{GE} = +15V$



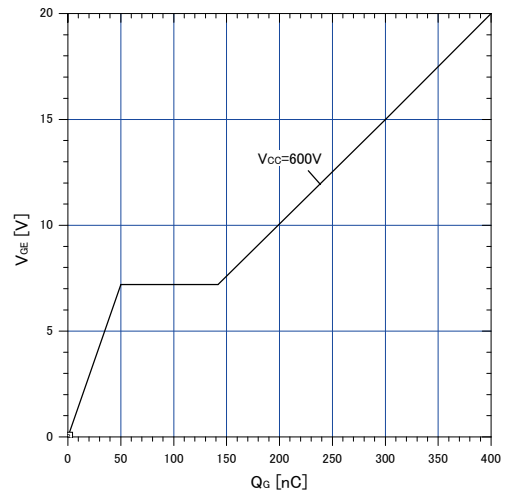
Graph.6  
Gate Threshold Voltage vs.  $T_j$   
 $I_c = 40mA, V_{CE} = 20V$



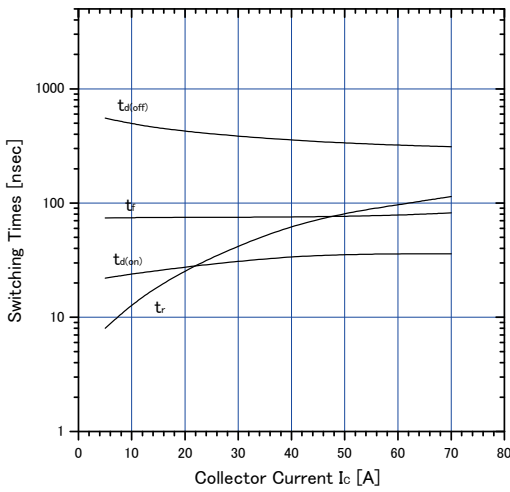
**Graph.7**  
 Typical Capacitance  
 $V_{GE}=0V, f=1MHz, T_J=25^{\circ}C$



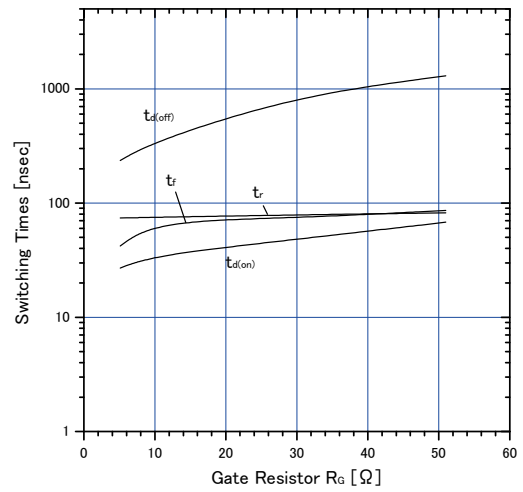
**Graph.8**  
 Typical Gate Charge  
 $V_{CC}=600V, I_c=40A, T_J=25^{\circ}C$



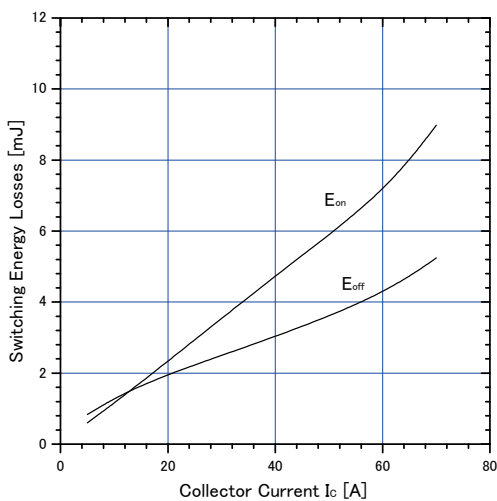
**Graph.9**  
 Typical switching time vs.  $I_c$   
 $T_J=175^{\circ}C, V_{CC}=600V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



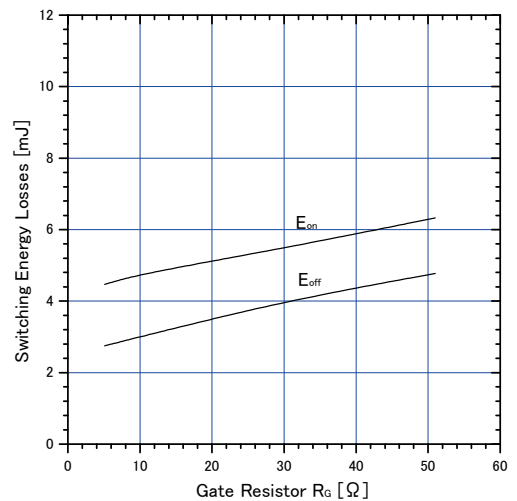
**Graph.10**  
 Typical switching time vs.  $R_G$   
 $T_J=175^{\circ}C, V_{CC}=600V, I_c=40A, L=500\mu H$   
 $V_{GE}=15V$



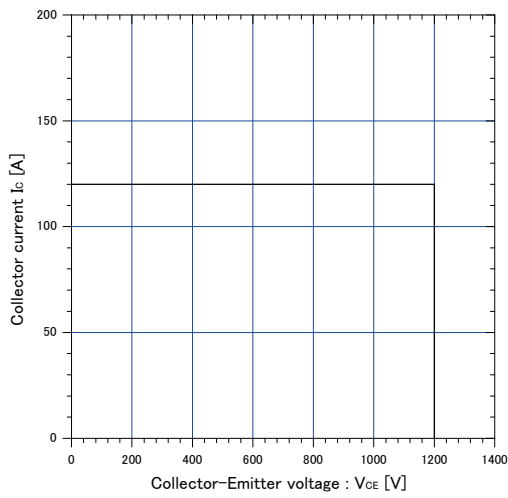
**Graph.11**  
 Typical switching losses vs.  $I_c$   
 $T_J=175^{\circ}C, V_{CC}=600V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



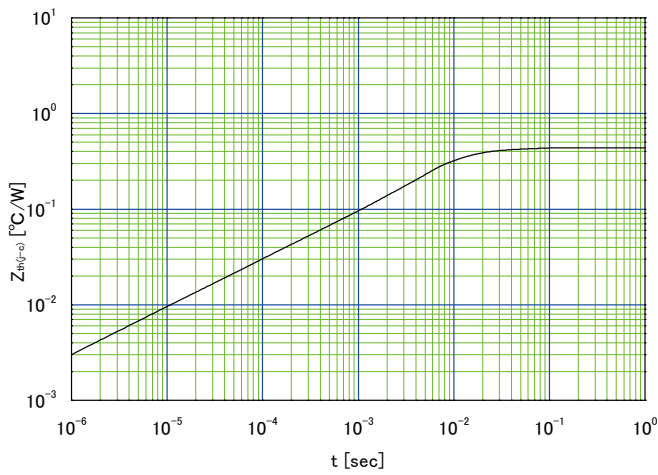
**Graph.12**  
 Typical switching losses vs.  $R_G$   
 $T_J=175^{\circ}C, V_{CC}=600V, I_c=40A, L=500\mu H$   
 $V_{GE}=15V$



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

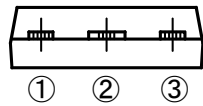
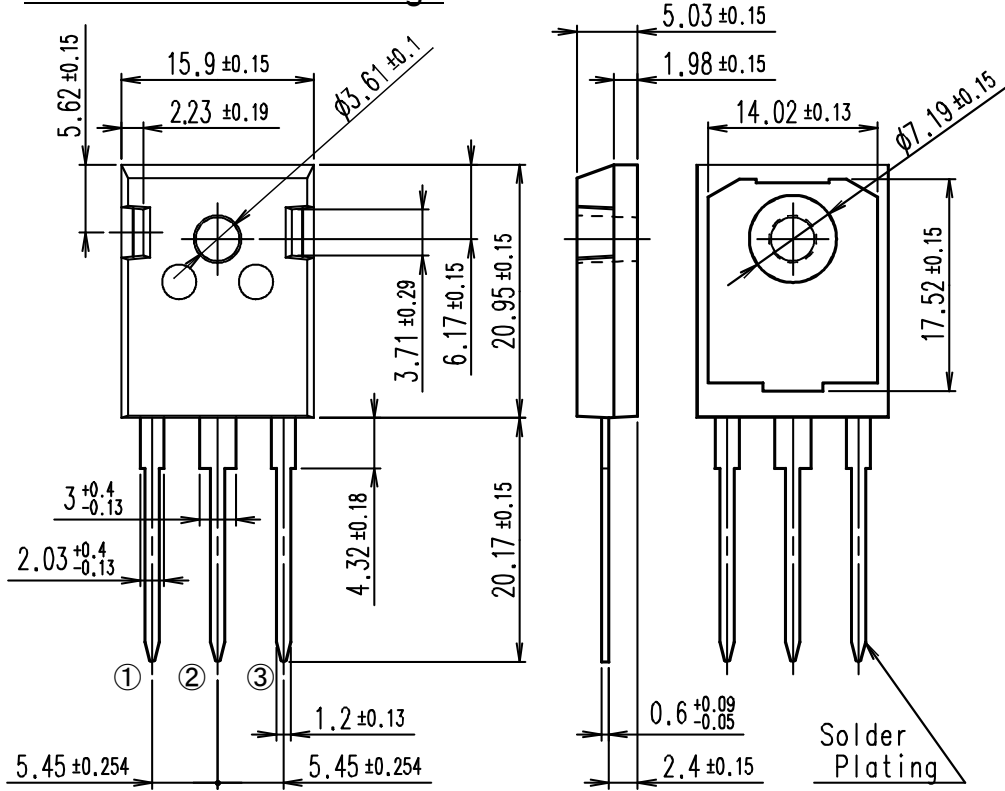


Graph.14  
Transient thermal resistance of IGBT



■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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