

# FGW40N120W

**Discrete IGBT**

## Discrete IGBT (High-Speed V series)

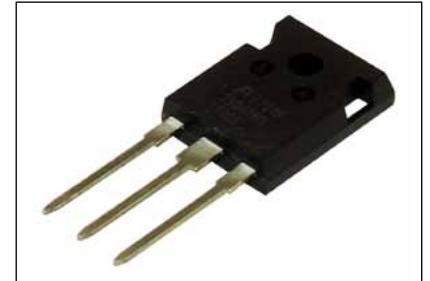
### 1200V / 40A

#### ■ Features

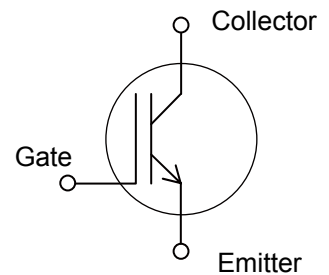
- Low power loss
- Low switching surge and noise
- High reliability, high ruggedness (RBSOA, SCSOA etc.)

#### ■ Applications

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



#### ■ Equivalent circuit



#### ■ 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	$V_{GES}$	$\pm 20$	V	
DC Collector Current	$I_{C@25}$	65	A	$T_c=25^\circ\text{C}, T_j=150^\circ\text{C}$
	$I_{C@100}$	40	A	$T_c=100^\circ\text{C}, T_j=150^\circ\text{C}$
Pulsed Collector Current	$I_{CP}$	160	A	Note *1
Turn-Off Safe Operating Area	-	160	A	$V_{CE} \leq 1200\text{V}, T_j \leq 175^\circ\text{C}$
Short Circuit Withstand Time	$t_{SC}$	5	$\mu\text{s}$	$V_{CC} \leq 600\text{V}, V_{GE} = 15\text{V}$ $T_j \leq 150^\circ\text{C}$
IGBT Max. Power Dissipation	$P_D$	360	W	$T_c=25^\circ\text{C}$
Operating Junction Temperature	$T_j$	-40 ~ +175	$^\circ\text{C}$	
Storage Temperature	$T_{sig}$	-55 ~ +175	$^\circ\text{C}$	

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

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

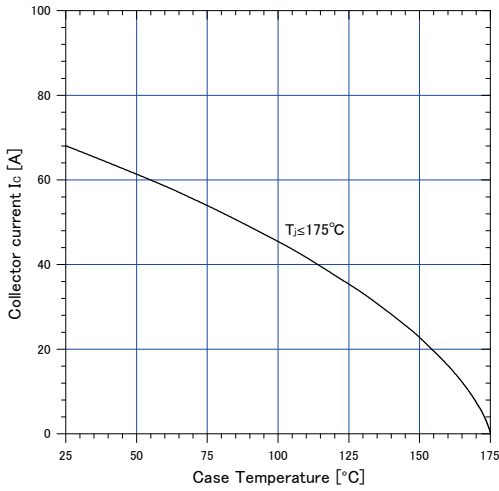
Description	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero Gate Voltage Collector Current	$I_{CES}$	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}$	$T_j=25^\circ\text{C}$	-	-	250	$\mu\text{A}$
			$T_j=175^\circ\text{C}$	-	-	2	mA
Gate-Emitter Leakage Current	$I_{GES}$	$V_{CE} = 0\text{V}, V_{GE} = \pm 20\text{V}$		-	-	200	nA
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE} = +20\text{V}, I_C = 40\text{mA}$		5.0	6.0	7.0	V
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE} = +15\text{V}, I_C = 40\text{A}$	$T_j=25^\circ\text{C}$	1.4	2.0	2.6	V
			$T_j=175^\circ\text{C}$	-	2.6	-	
Input Capacitance	$C_{ies}$	$V_{CE}=25\text{V}$		1250	2500	3750	pF
Output Capacitance	$C_{oes}$	$V_{GE}=0\text{V}$		55	110	165	
Reverse Transfer Capacitance	$C_{res}$	$f=1\text{MHz}$		17	34	51	
Gate Charge	$Q_G$	$V_{CC} = 400\text{V}$ $I_C = 40\text{A}$ $V_{GE} = 15\text{V}$		60	120	180	nC
Turn-On Delay Time	$t_{d(on)}$	$T_j = 25^\circ\text{C}$		16	32	48	ns
Rise Time	$t_r$	$V_{CC} = 600\text{V}$		27	54	81	
Turn-Off Delay Time	$t_{d(off)}$	$I_C = 40\text{A}$		89	178	267	
Fall Time	$t_f$	$V_{GE} = 15\text{V}$		20	40	60	
Turn-On Energy	$E_{on}$	$R_G = 10\Omega$ $L = 500\mu\text{H}$		1.4	2.8	4.2	
Turn-Off Energy	$E_{off}$	Energy loss include "tail" and FWD (FDRW20S120J) reverse recovery.		0.8	1.6	2.4	
Turn-On Delay Time	$t_{d(on)}$	$T_j = 150^\circ\text{C}$		16	32	48	ns
Rise Time	$t_r$	$V_{CC} = 600\text{V}$		24	48	72	
Turn-Off Delay Time	$t_{d(off)}$	$I_C = 40\text{A}$		110	220	330	
Fall Time	$t_f$	$V_{GE} = 15\text{V}$		28	56	84	
Turn-On Energy	$E_{on}$	$R_G = 10\Omega$ $L = 500\mu\text{H}$		2.3	4.6	6.9	
Turn-Off Energy	$E_{off}$	Energy loss include "tail" and FWD (FDRW20S120J) reverse recovery.		1.2	2.4	3.6	

##### ● Thermal resistance characteristics

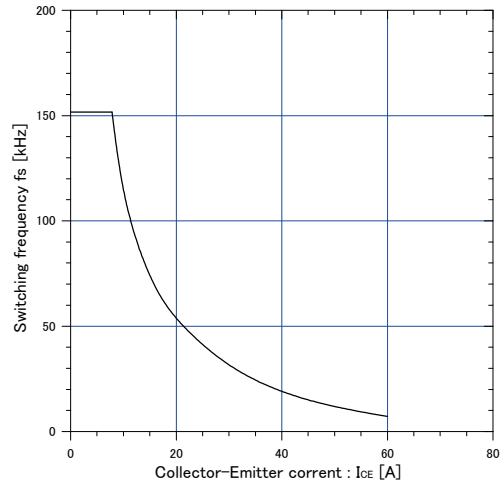
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	-	50	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	-	0.417	

■ Characteristics (Representative)

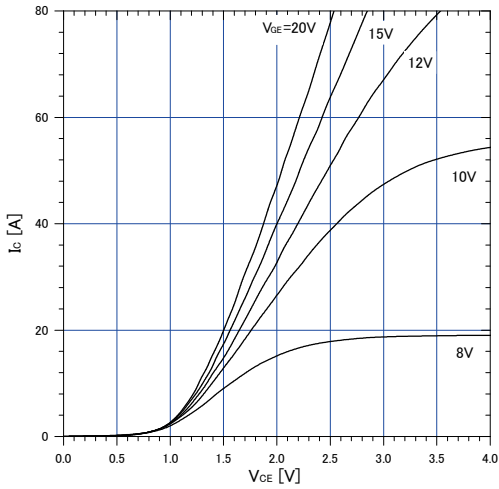
Graph.1  
DC Collector Current vs  $T_c$   
 $V_{GE} \geq +15V, T_j \leq 175^\circ C$



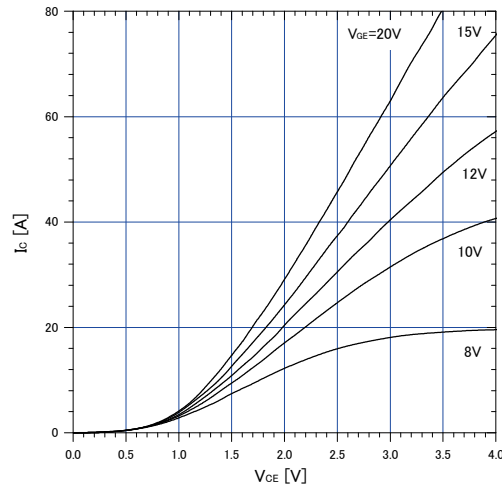
Graph.2  
Collector Current vs. switching frequency  
 $V_{GE} = +15V, T_c \leq 175^\circ C, V_{CC} = 600V, D = 0.5, R_G = 10\Omega, T_c = 100^\circ C$



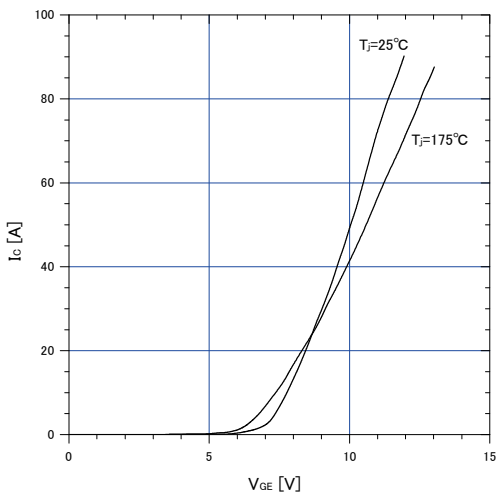
Graph.3  
Typical Output Characteristics ( $V_{CE}-I_c$ )  
 $T_j = 25^\circ C$



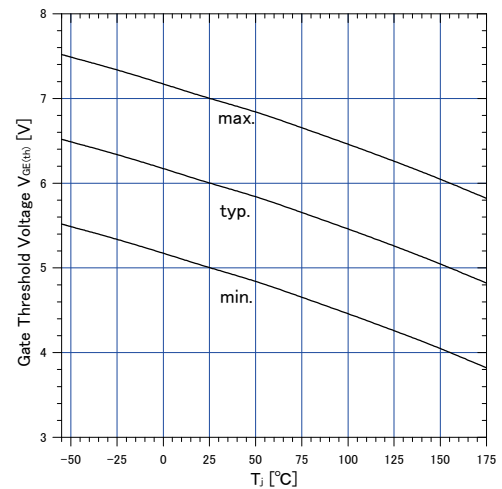
Graph.4  
Typical Output Characteristics ( $V_{CE}-I_c$ )  
 $T_j = 175^\circ C$



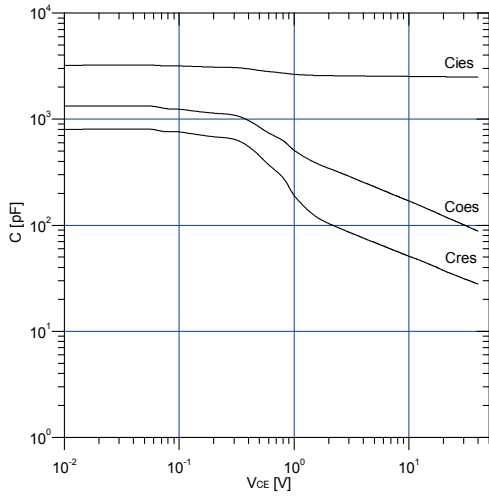
Graph.5  
Typical Transfer Characteristics  
 $V_{GE} = +15V$



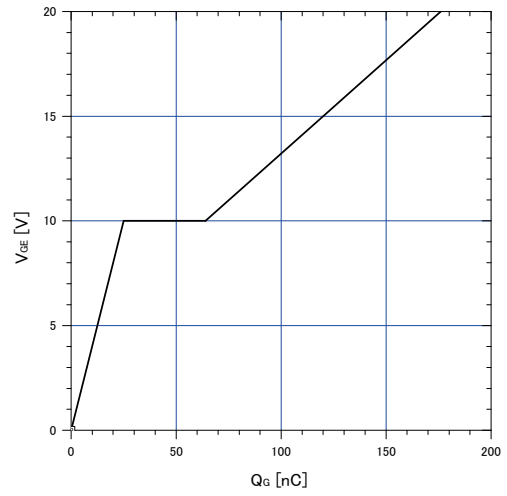
Graph.6  
Gate Threshold Voltage vs.  $T_j$   
 $I_c = 40mA, V_{CE} = 20V$



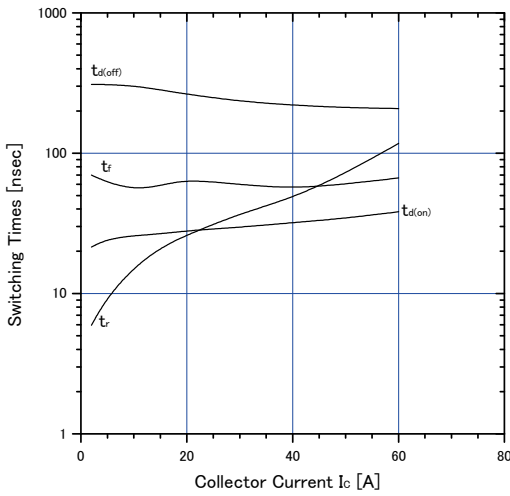
**Graph.7**  
 Typical Capacitance  
 $V_{GE}=0V, f=1MHz, T_J=25^\circ C$



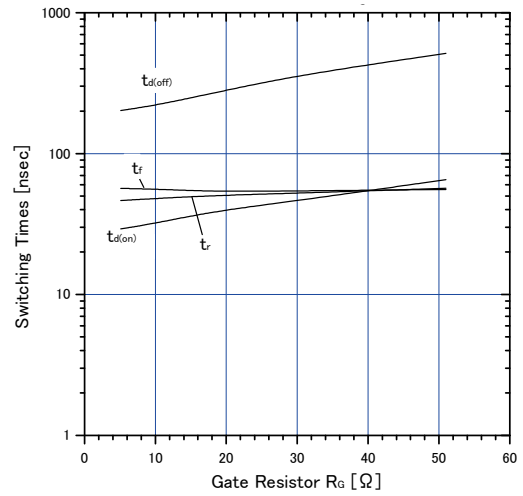
**Graph.8**  
 Typical Gate Charge  
 $V_{cc}=600V, I_c=40A, T_J=25^\circ C$



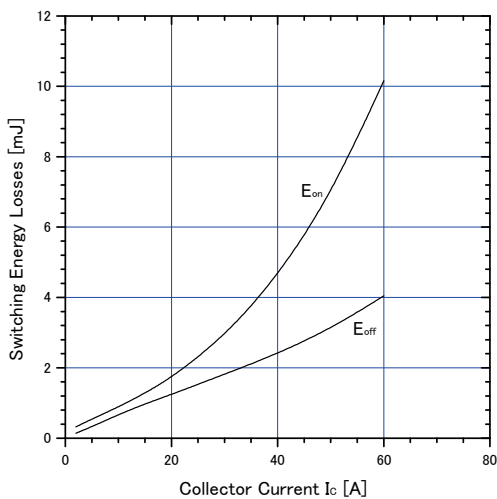
**Graph.9**  
 Typical switching time vs.  $I_c$   
 $T_J=175^\circ C, V_{cc}=600V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



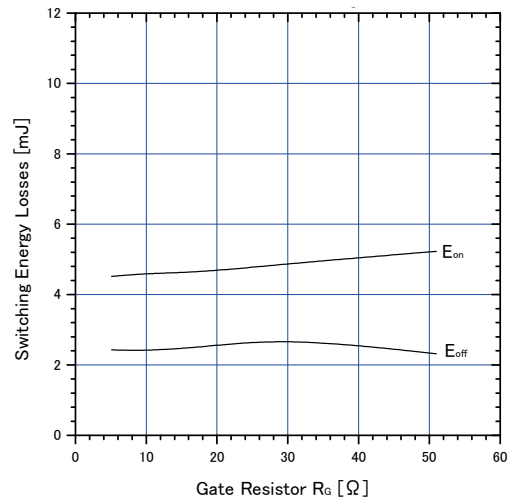
**Graph.10**  
 Typical switching time vs.  $R_G$   
 $T_J=175^\circ C, V_{cc}=600V, I_c=40A, L=500\mu H$   
 $V_{GE}=15V$



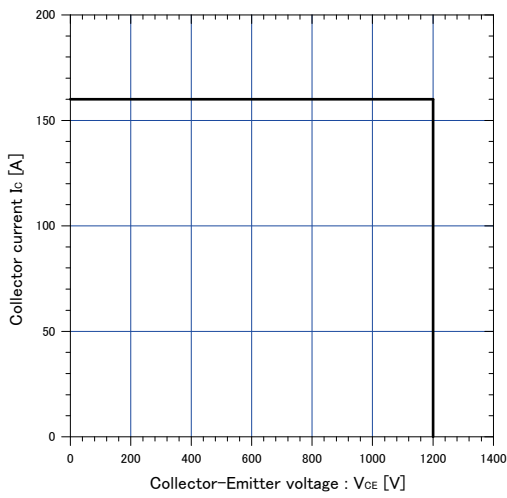
**Graph.11**  
 Typical switching losses vs.  $I_c$   
 $T_J=175^\circ C, V_{cc}=600V, L=500\mu H$   
 $V_{GE}=15V, R_G=10\Omega$



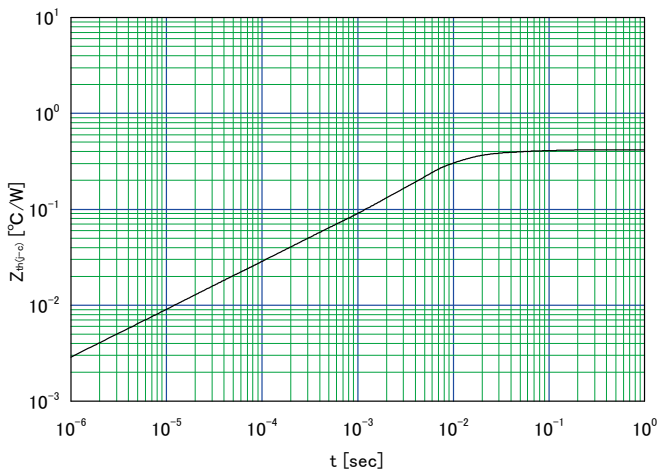
**Graph.12**  
 Typical switching losses vs.  $R_G$   
 $T_J=175^\circ C, V_{cc}=600V, I_c=40A, L=500\mu H$   
 $V_{GE}=15V$



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

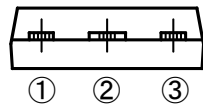
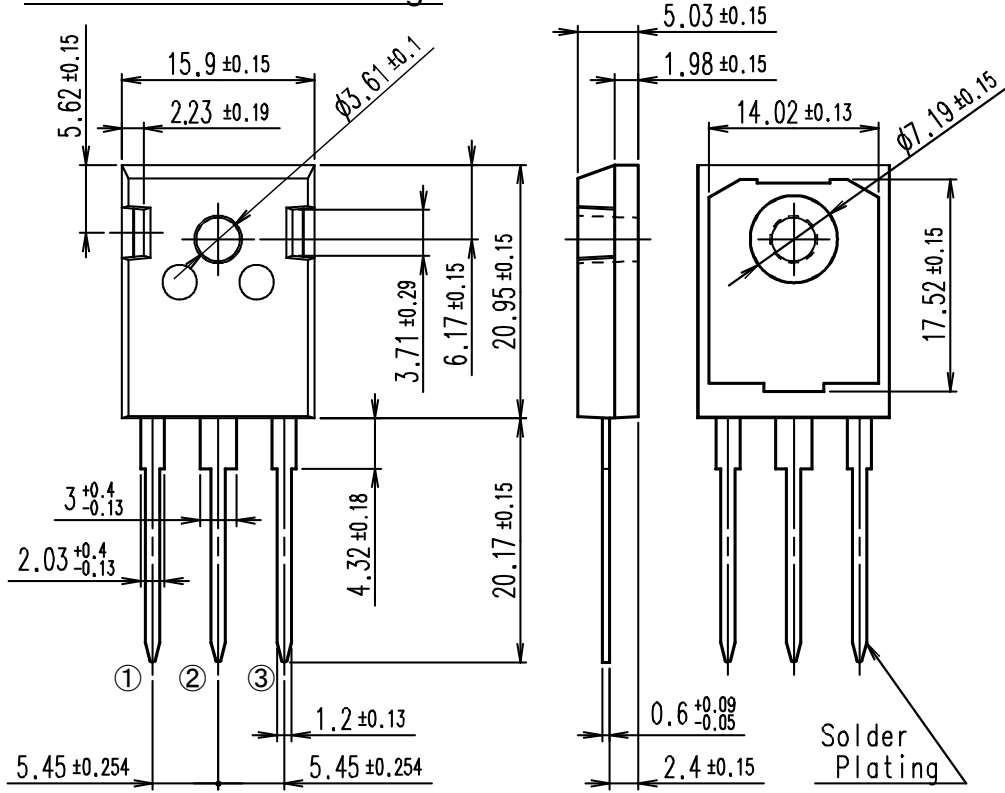


Graph.14  
Transient thermal resistance



■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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