

FGW40N120W

Discrete IGBT

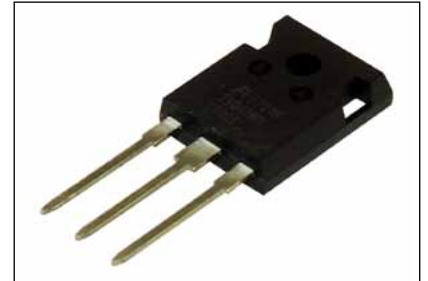
Discrete IGBT (High-Speed W series) 1200V / 40A

■ 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



■ 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	$I_{C@25}$	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	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	360	W	$T_c=25^\circ\text{C}$
Operating Junction Temperature	T_j	$-40 \sim +175$	$^\circ\text{C}$	
Storage Temperature	T_{sig}	$-55 \sim +175$	$^\circ\text{C}$	

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

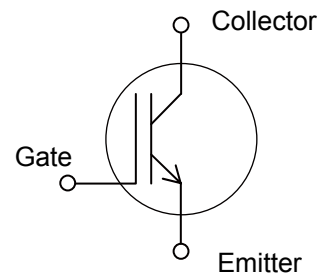
● Electrical characteristics (at $T_j=25^\circ\text{C}$ unless otherwise specified)

Description	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 1200\text{V}$, $V_{GE} = 0\text{V}$	-	-	250	μA
		$T_j=25^\circ\text{C}$	-	-	2	mA
		$T_j=175^\circ\text{C}$	-	-	200	nA
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	$V_{CE(sat)}$	$V_{GE} = +15\text{V}$, $I_C = 40\text{A}$	1.4	2.0	2.6	V
		$T_j=25^\circ\text{C}$	-	2.6	-	
		$T_j=175^\circ\text{C}$	-	-	-	
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	mJ
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	mJ
Turn-Off Energy	E_{off}	Energy loss include "tail" and FWD (FDRW20S120J) reverse recovery.	1.2	2.4	3.6	

● Thermal resistance characteristics

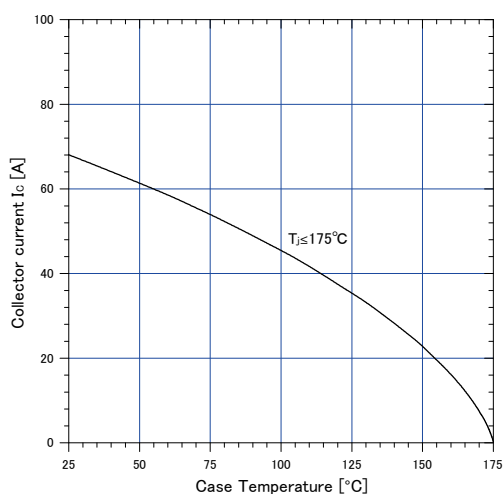
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal Resistance, Junction-Ambient	$R_{th(j-a)}$	-	-	-	50	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{th(j-c)}_{IGBT}$	-	-	-	0.417	

■ Equivalent circuit

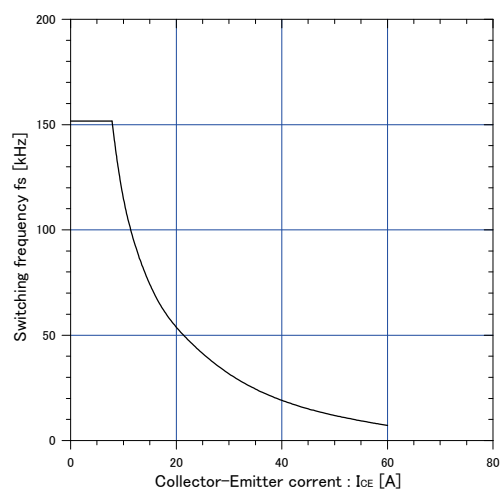


■ Characteristics (Representative)

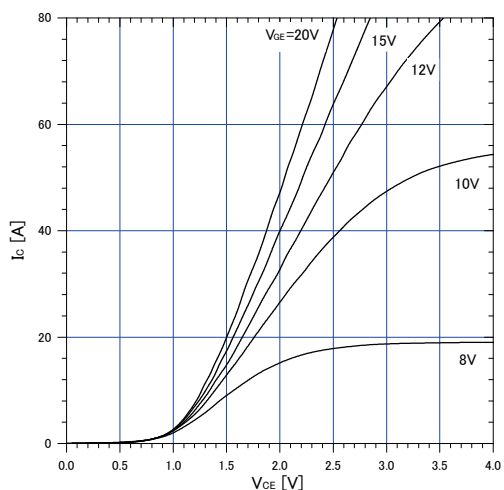
Graph.1
DC Collector Current vs T_c
 $V_{GE} \geq +15V$, $T_J \leq 175^\circ C$



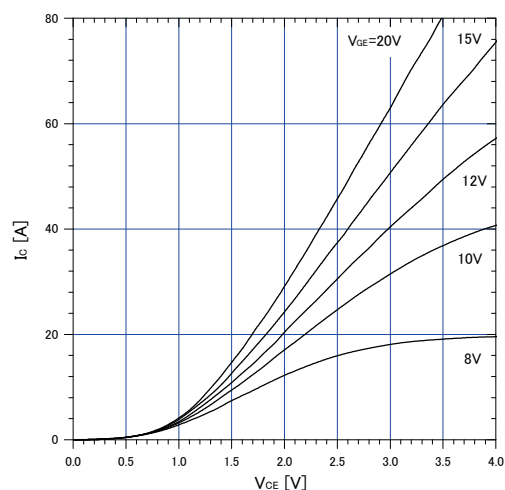
Graph.2
Collector Current vs. switching frequency
 $V_{GE} = +15V$, $T_c \leq 175^\circ C$, $V_{CE} = 600V$, $D = 0.5$,
 $R_G = 10\Omega$, $T_c = 100^\circ C$



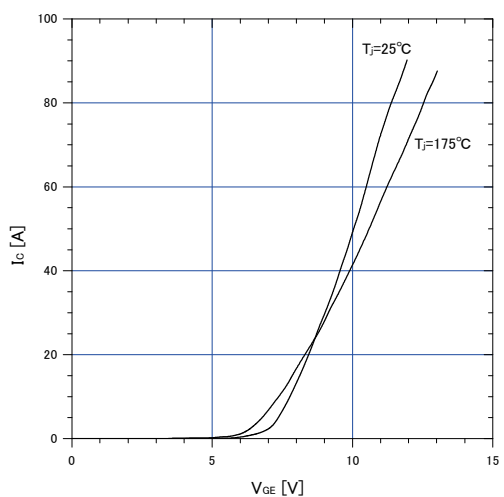
Graph.3
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_J = 25^\circ C$



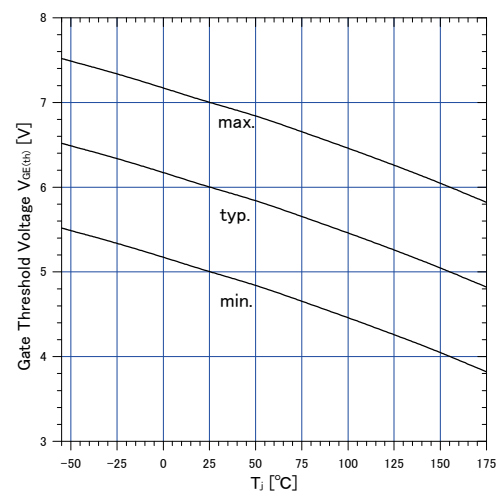
Graph.4
Typical Output Characteristics ($V_{CE}-I_C$)
 $T_J = 175^\circ C$



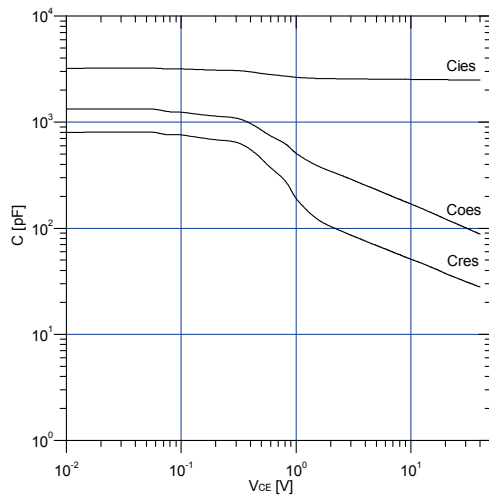
Graph.5
Typical Transfer Characteristics
 $V_{GE} = +15V$



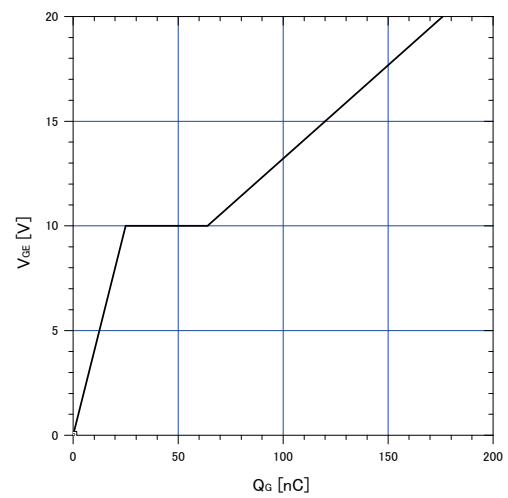
Graph.6
Gate Threshold Voltage vs. T_J
 $I_C = 40mA$, $V_{CE} = 20V$



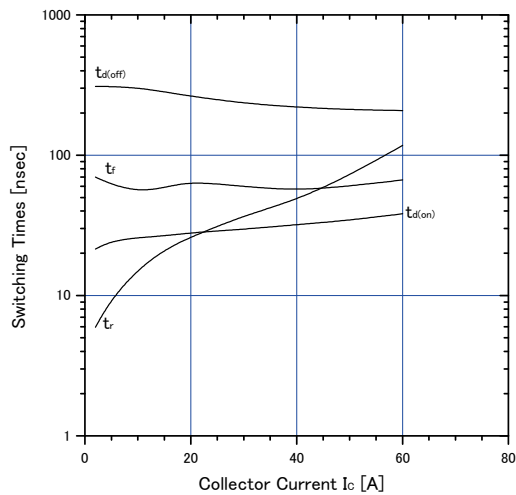
Graph.7
Typical Capacitance
 $V_{GE}=0V, f=1MHz, T_J=25^{\circ}C$



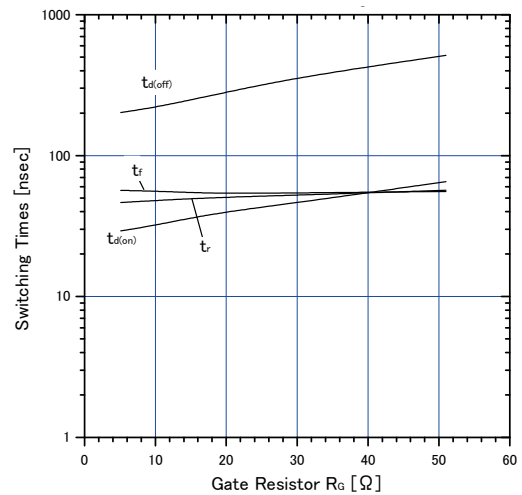
Graph.8
Typical Gate Charge
 $V_{CC}=600V, I_c=40A, T_J=25^{\circ}C$



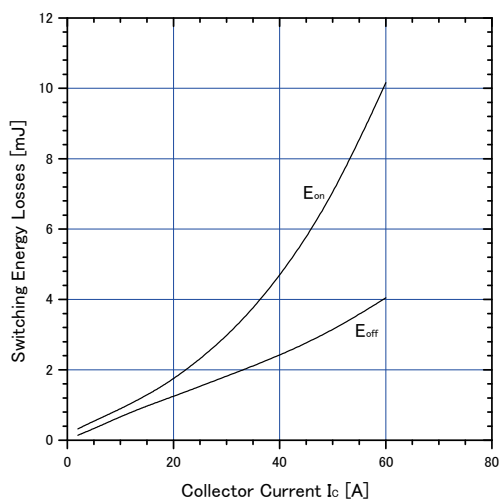
Graph.9
Typical switching time vs. I_c
 $T_J=175^{\circ}C, V_{CC}=600V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



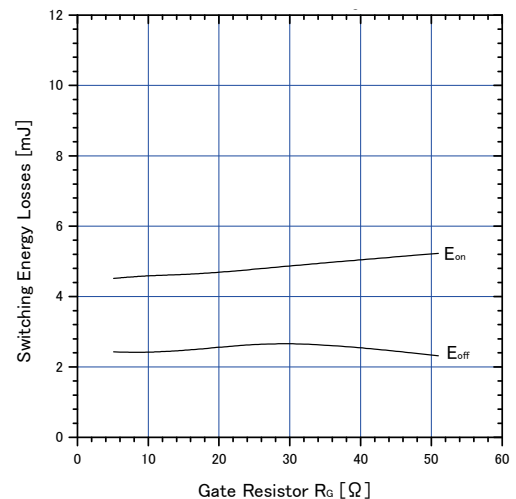
Graph.10
Typical switching time vs. R_G
 $T_J=175^{\circ}C, V_{CC}=600V, I_c=40A, L=500\mu H$
 $V_{GE}=15V$



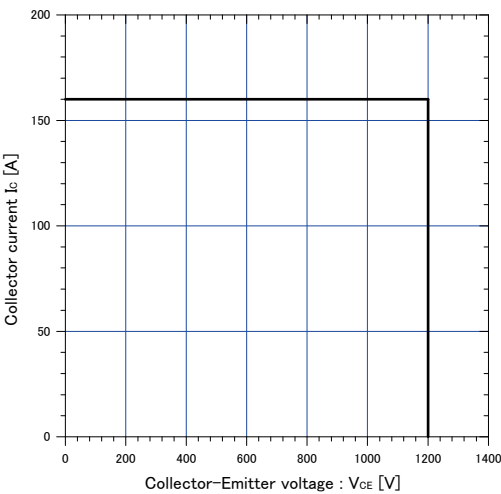
Graph.11
Typical switching losses vs. I_c
 $T_J=175^{\circ}C, V_{CC}=600V, L=500\mu H$
 $V_{GE}=15V, R_G=10\Omega$



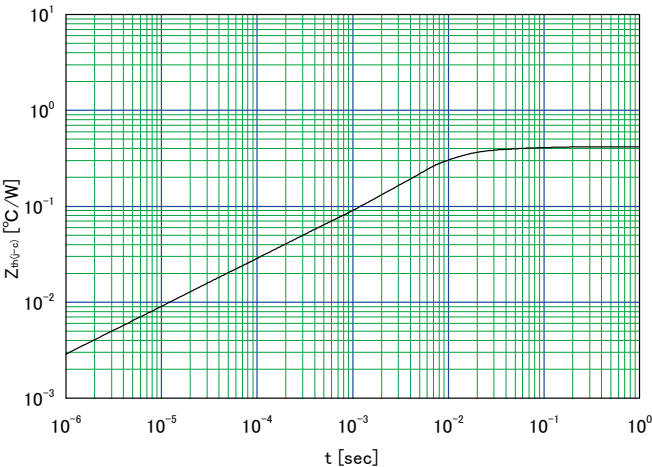
Graph.12
Typical switching losses vs. R_G
 $T_J=175^{\circ}C, V_{CC}=600V, I_c=40A, L=500\mu H$
 $V_{GE}=15V$



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

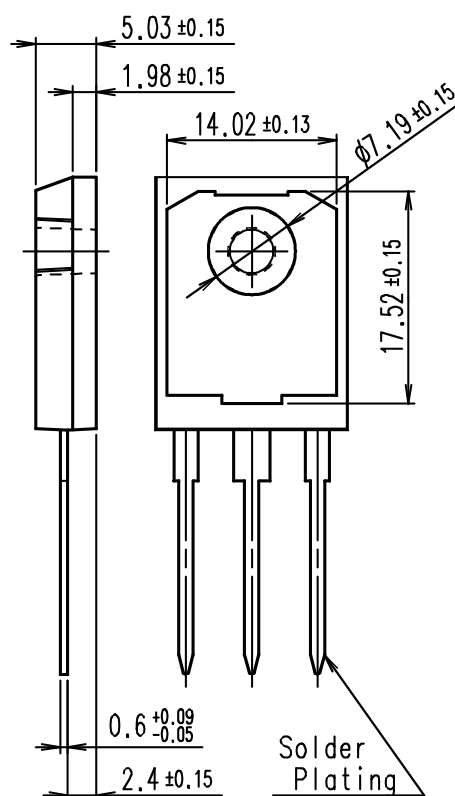
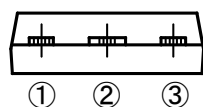
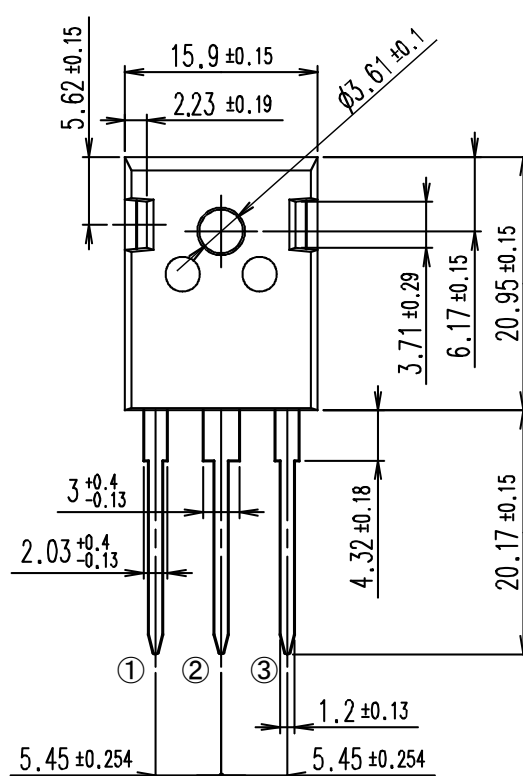


Graph.14
Transient thermal resistance



■ Outline Drawings, mm

Outview : TO-247 Package



CONNECTION

① GATE

② COLLECTOR

③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

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