

# IGBT MODULE

# GAE75BA60



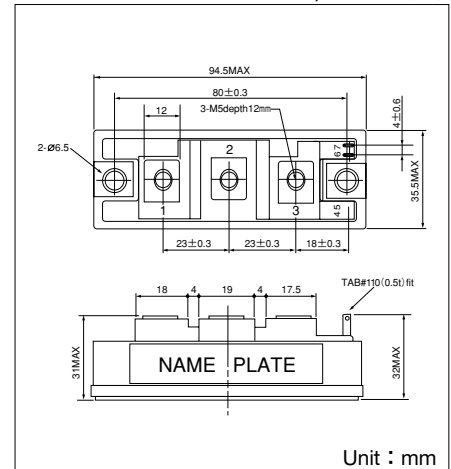
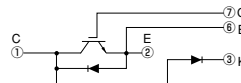
UL;E76102 (M)

**SanRex** IGBT Module **GAE75BA60** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1 \mu s$ ) reverse connected across IGBT.

- $I_C=75A$   $V_{CES}=600V$
- $V_{CE(sat)} = 2.4V$  Typ
- $t_f=0.10 \mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

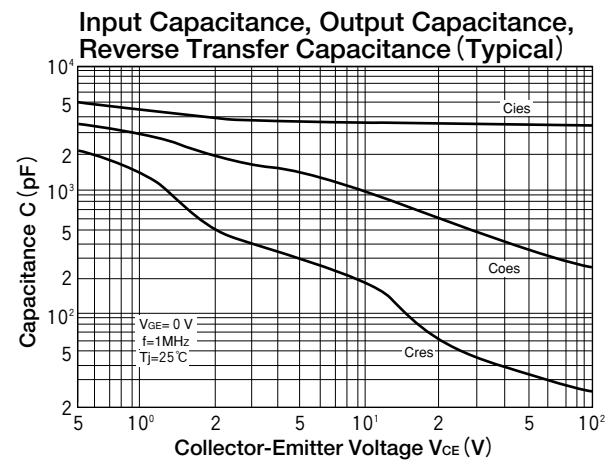
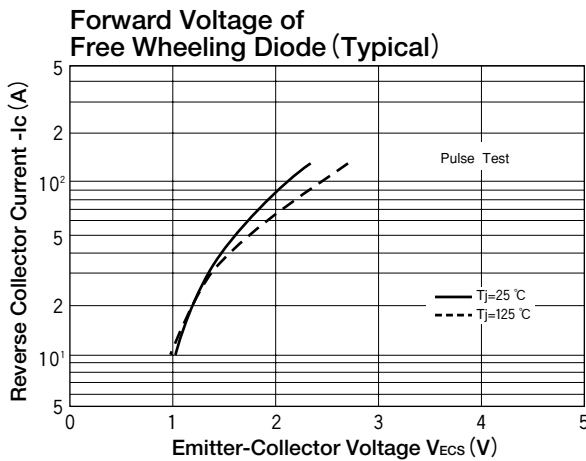
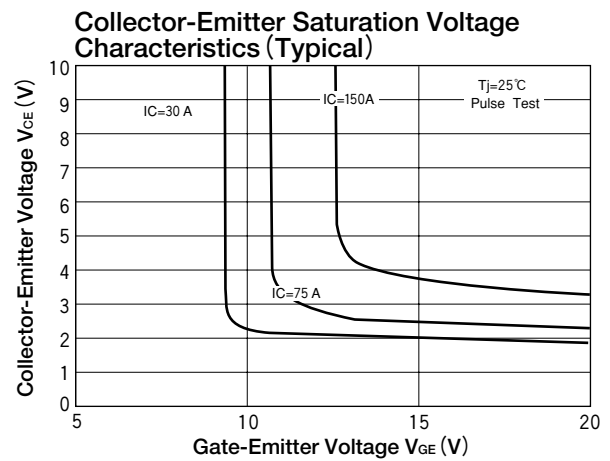
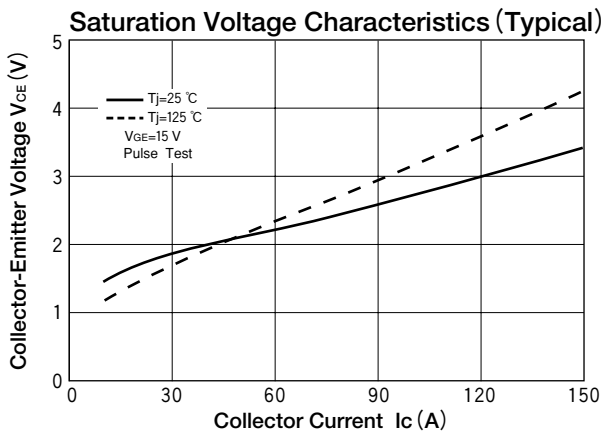
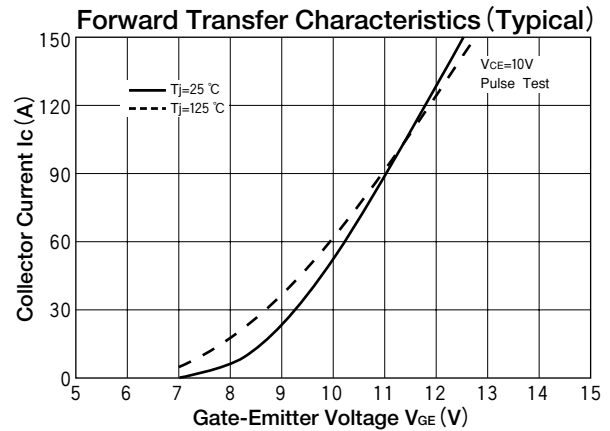
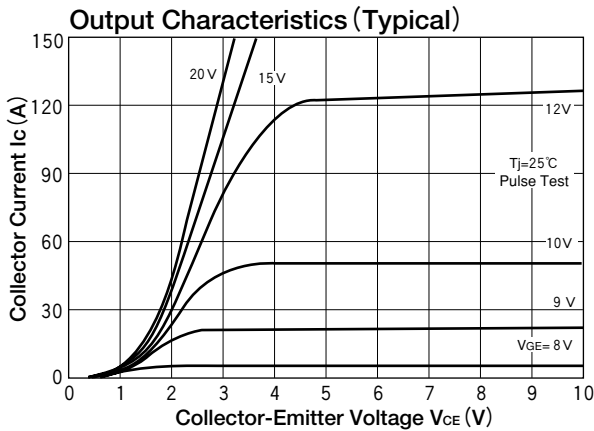
**Maximum Ratings**

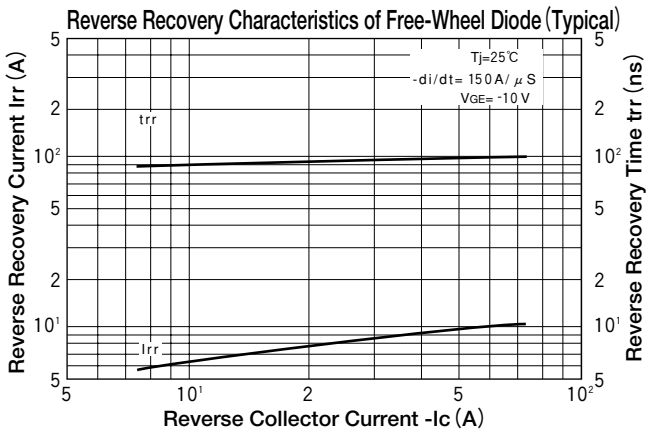
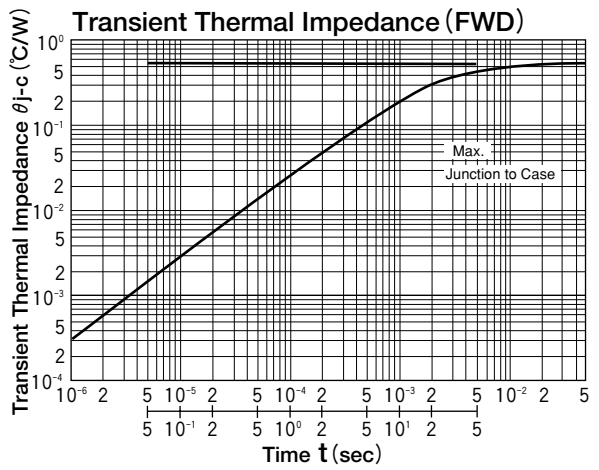
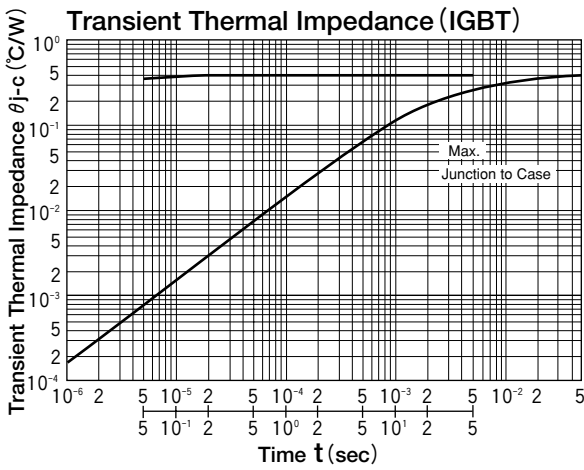
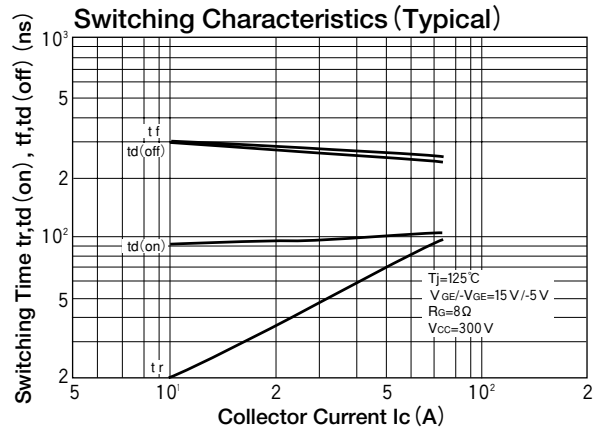
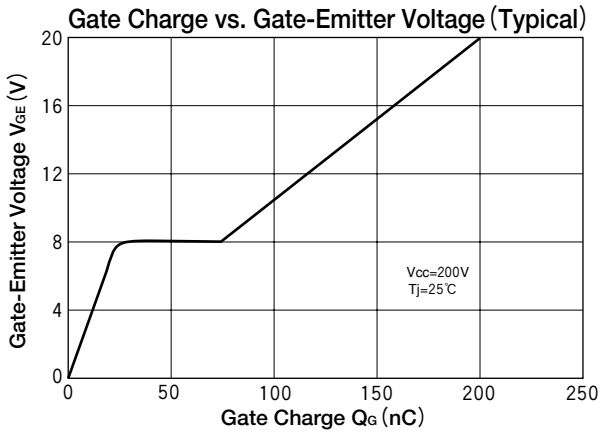
( $T_j=25^\circ C$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE75BA60		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		75		A
$I_{CP}$		Pulse ( 1 ms)		150		
$-I_C$	Reverse Collector Current			75		A
$P_C$	Total Power Dissipation		$T_c=25^\circ C$	315		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{ISO}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	210		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=600V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1mA$	600			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=7.5mA$	3.0		7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=75A, V_{GE}=15V$		2.4	2.8	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		4	7.5	nF
$t_r$	Switching Time	Rise Time	$I_C=75A, V_{GE}=+15V/-5V$ $V_{CC}=300V, R_G=8\Omega$		0.10	0.20	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.40	
$t_f$		Fall Time			0.10	0.20	
$t_{d(off)}$		Turn-off Delay Time			0.40	0.80	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=75A, V_{GE}=0V$		1.80	2.80	V
$t_{rr}$	Reverse Recovery Time		$-I_C=75A, V_{GE}=-10V, di/dt=150A/\mu s$		0.1	0.15	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.40	$^\circ C/W$
			Diode-Case			0.55	
$V_{FM}$	Forward Voltage Drop		$I_F=75A, \text{At Clamp Diode}$		1.80	2.80	V
$t_{rr}$	Reverse Recovery Time		$I_F=75A, di_F/dt=-150A/\mu s, \text{At Clamp Diode}$		0.1	0.15	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.55	$^\circ C/W$





# IGBT MODULE

# GAE100BA60



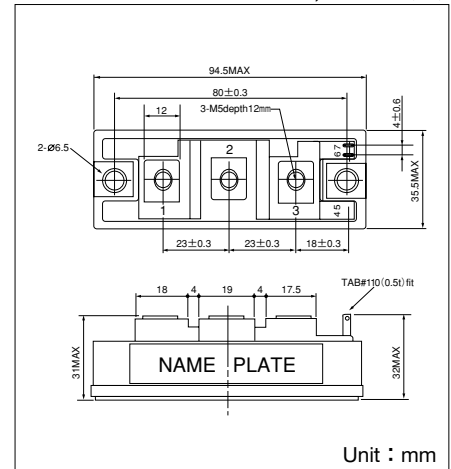
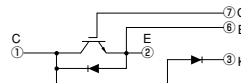
UL;E76102 (M)

**SanRex** IGBT Module **GAE100BA60** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1\ \mu s$ ) reverse connected across IGBT.

- $I_C=100A$   $V_{CES}=600V$
- $V_{CE(sat)}=2.3V$  Typ
- $t_f=0.10\ \mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

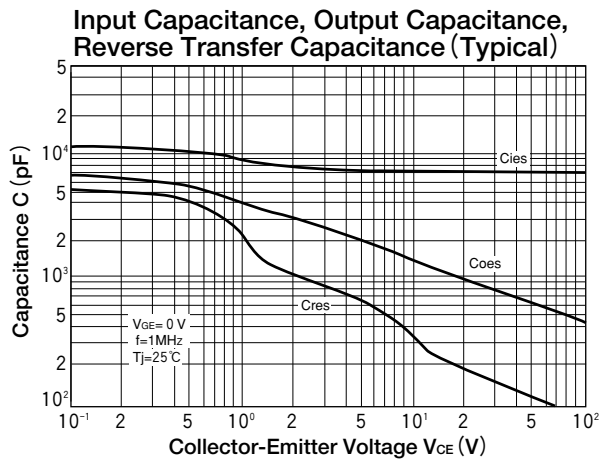
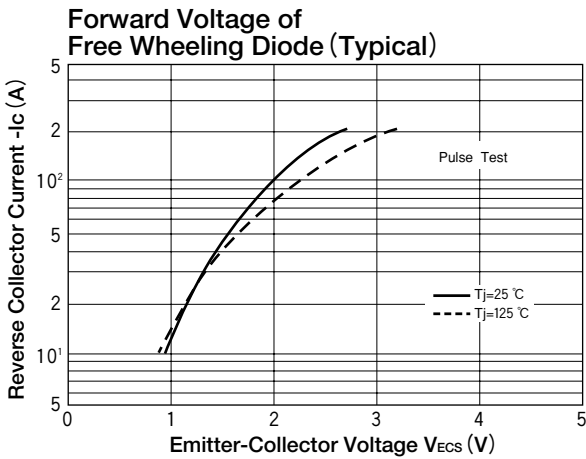
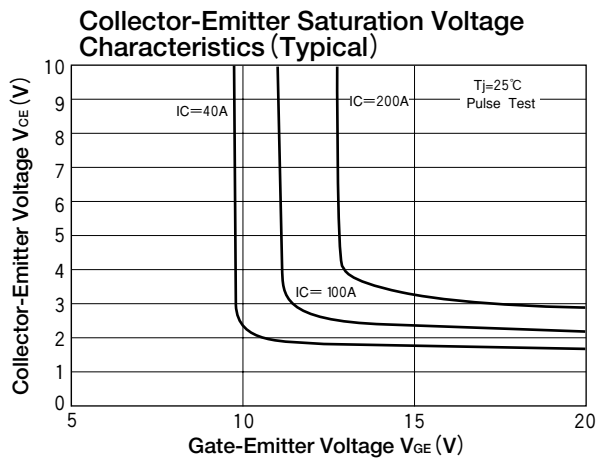
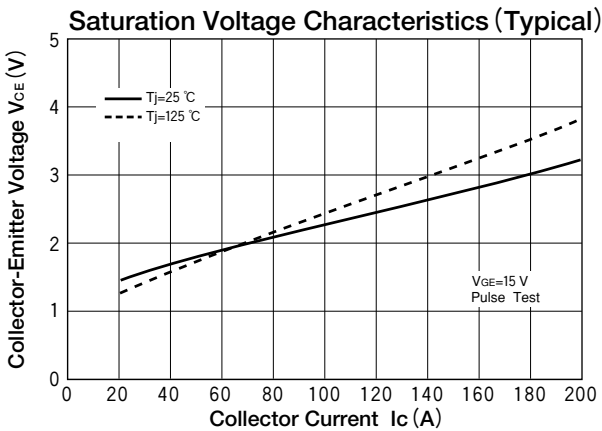
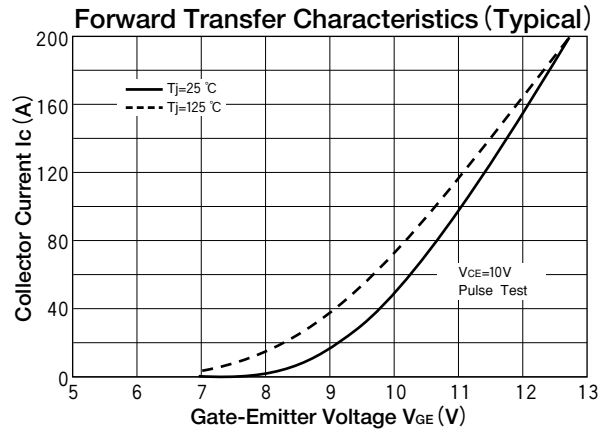
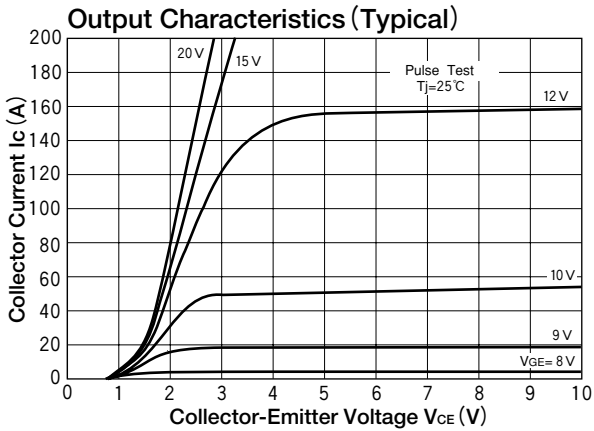
**Maximum Ratings**

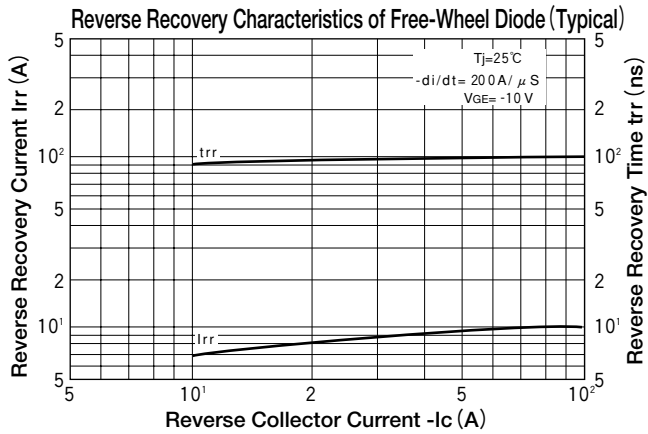
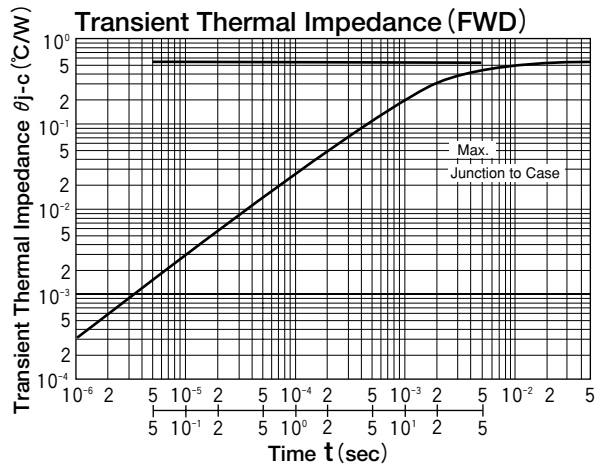
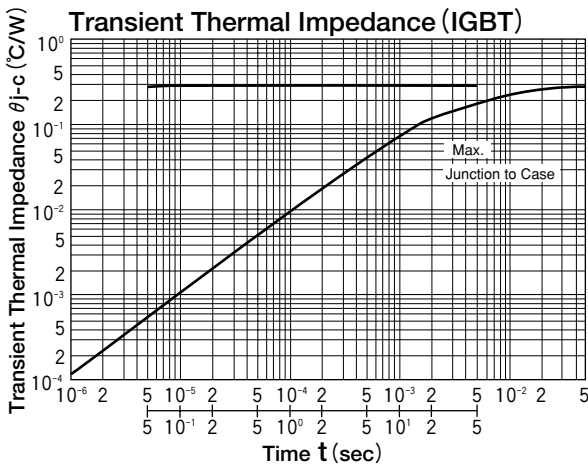
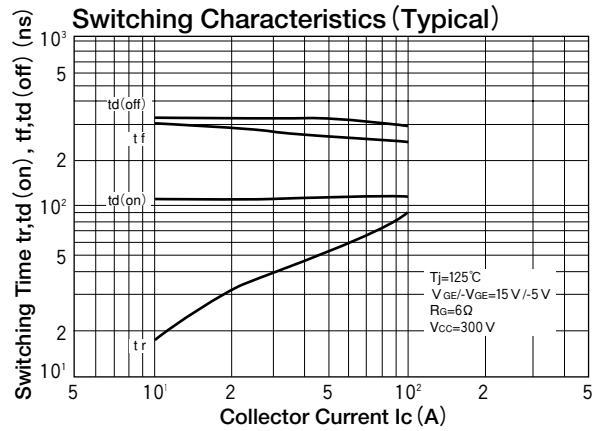
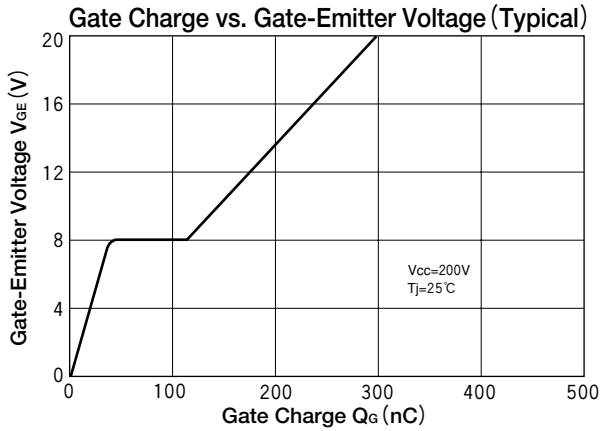
( $T_j=25^\circ C$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE100BA60		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		100		A
$I_{CP}$		Pulse ( 1 ms)		200		
$-I_C$	Reverse Collector Current			100		A
$P_C$	Total Power Dissipation		$T_c=25^\circ C$	400		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{ISO}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	210		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=600V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1\ mA$	600			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=10mA$	3.0		7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=100A, V_{GE}=15V$		2.3	2.8	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		7	10	nF
$t_r$	Switching Time	Rise Time	$I_C=100A, V_{GE}=+15V/-5V$ $V_{CC}=300V, R_G=6\ \Omega$		0.10	0.20	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.40	
$t_f$		Fall Time			0.10	0.20	
$t_{d(off)}$		Turn-off Delay Time			0.40	0.80	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=100A, V_{GE}=0V$		2.00	2.80	V
$t_{rr}$	Reverse Recovery Time		$-I_C=100A, V_{GE}=-10V, di/dt=200A/\mu s$		0.1	0.15	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.31	$^\circ C/W$
			Diode-Case			0.55	
$V_{FM}$	Forward Voltage Drop		$I_F=100A, \text{At Clamp Diode}$		2.00	2.80	V
$t_{rr}$	Reverse Recovery Time		$I_F=100A, di_F/dt=-200A/\mu s, \text{At Clamp Diode}$		0.1	0.15	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.55	$^\circ C/W$





# IGBT MODULE

# GAE150BA60



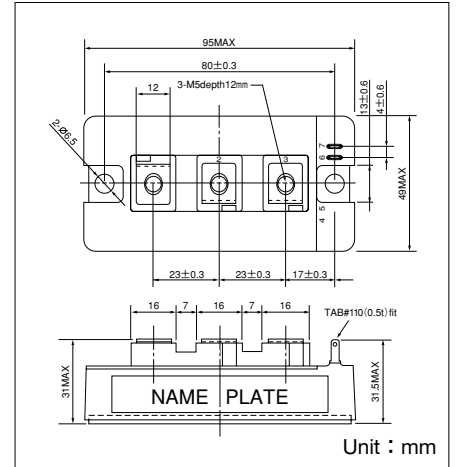
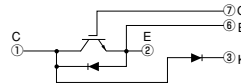
UL;E76102 (M)

**SanRex** IGBT Module **GAE150BA60** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1\ \mu\text{s}$ ) reverse connected across IGBT.

- $I_C=150\text{A}$   $V_{CES}=600\text{V}$
- $V_{CE(sat)}=2.4\text{V Typ}$
- $t_f=0.10\ \mu\text{s Typ}$
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



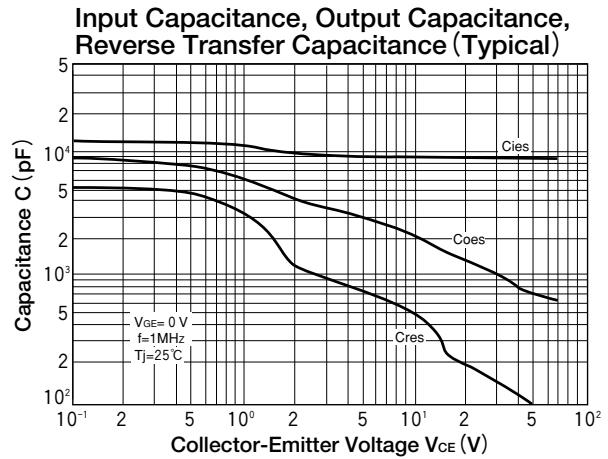
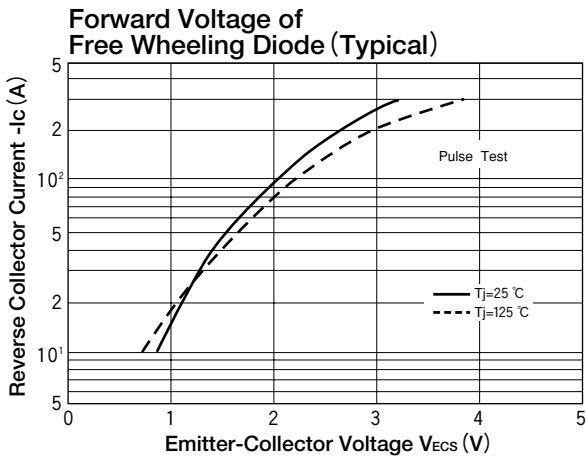
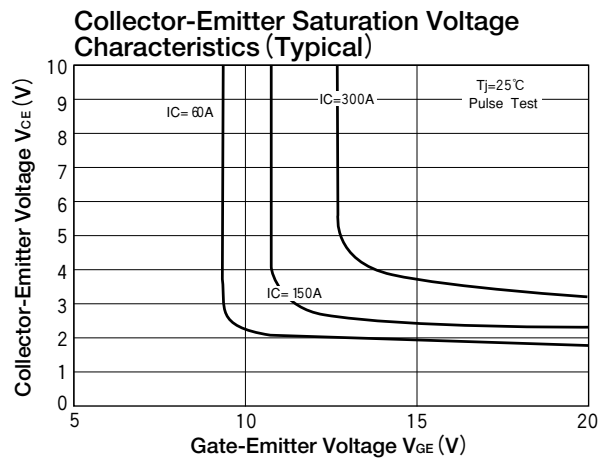
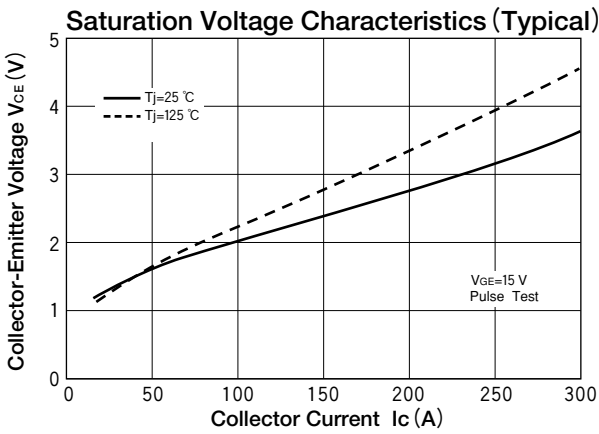
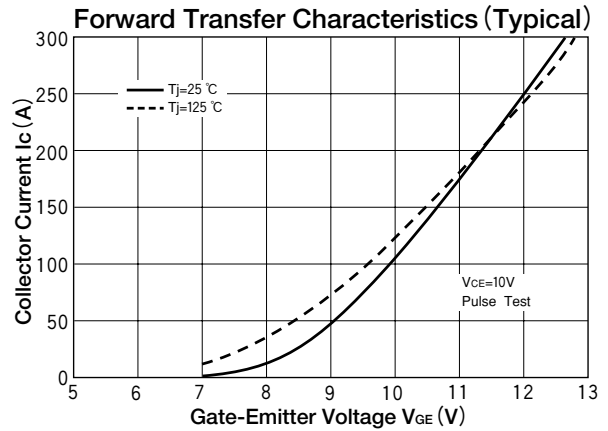
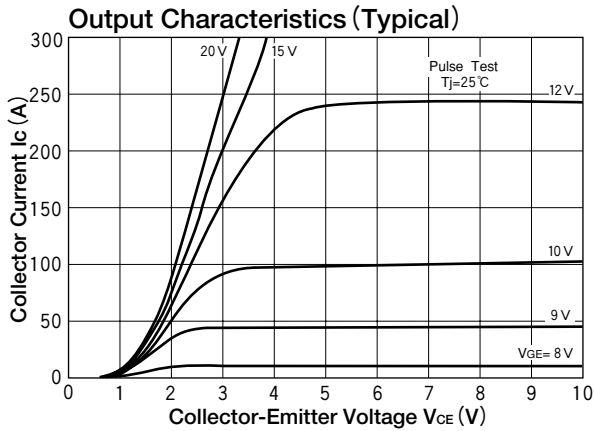
**Maximum Ratings**

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

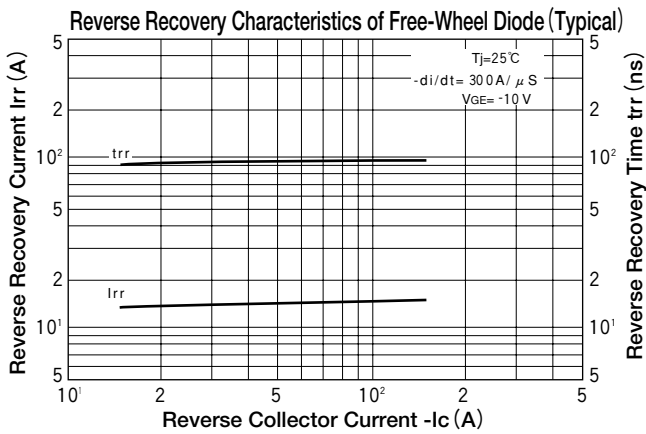
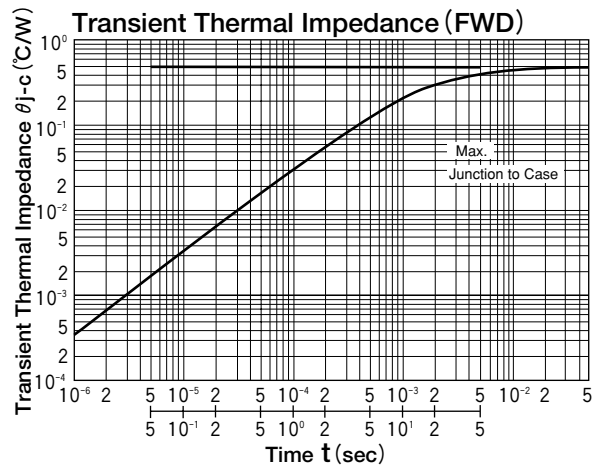
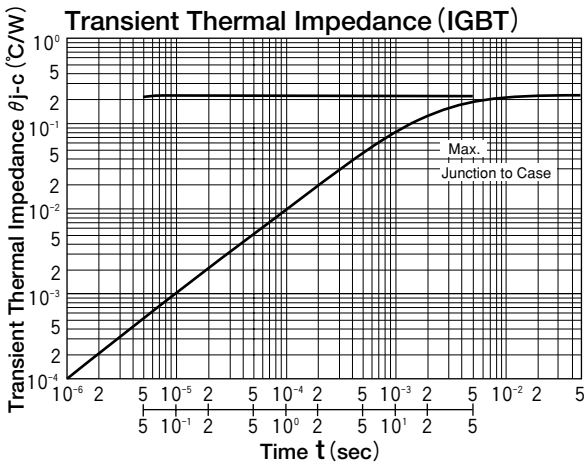
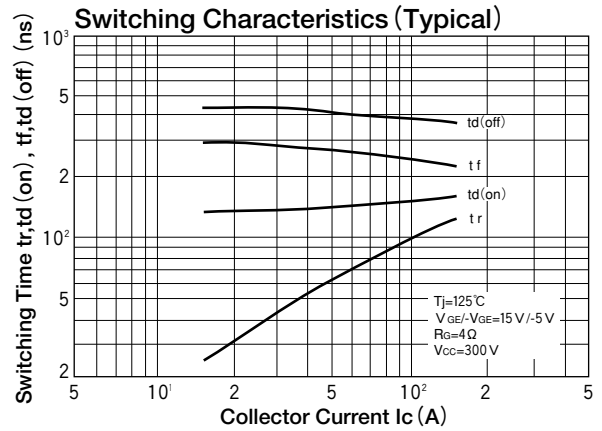
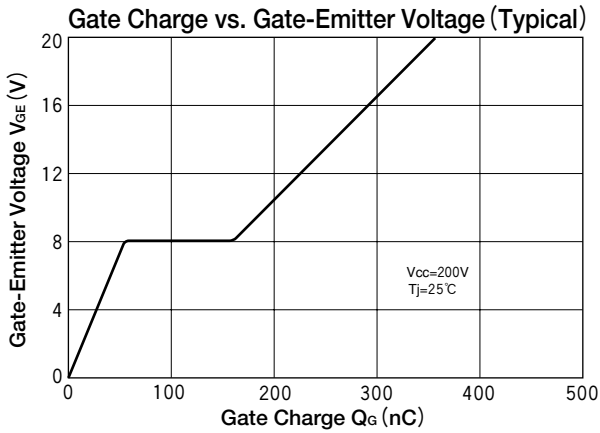
Symbol	Item		Conditions	Ratings		Unit
				GAE150BA60		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		150		A
$I_{CP}$		Pulse ( 1 ms)		300		
$-I_C$	Reverse Collector Current			150		A
$P_C$	Total Power Dissipation		$T_c=25^\circ\text{C}$	600		W
$T_j$	Junction Temperature			150		$^\circ\text{C}$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ\text{C}$
$V_{iso}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	225		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=600\text{V}$ , $V_{GE}=0\text{V}$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0\text{V}$ , $I_C=1\text{mA}$	600			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10\text{V}$ , $I_C=15\text{mA}$	3.0		7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=150\text{A}$ , $V_{GE}=15\text{V}$		2.4	2.8	V
$C_{ies}$	Input Capacitance		$V_{CE}=10\text{V}$ , $V_{GE}=0\text{V}$ , $f=1\text{MHz}$		9	15	nF
$t_r$	Switching Time	Rise Time	$I_C=150\text{A}$ , $V_{GE}=+15\text{V}/-5\text{V}$ $V_{CC}=300\text{V}$ , $R_G=4\ \Omega$		0.10	0.20	$\mu\text{s}$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.40	
$t_f$		Fall Time			0.10	0.20	
$t_{d(off)}$		Turn-off Delay Time			0.40	0.80	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=150\text{A}$ , $V_{GE}=0\text{V}$		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$-I_C=150\text{A}$ , $V_{GE}=-10\text{V}$ , $di/dt=300\text{A}/\mu\text{s}$		0.1	0.15	$\mu\text{s}$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.21	$^\circ\text{C}/\text{W}$
			Diode-Case			0.50	
$V_{FM}$	Forward Voltage Drop		$I_F=150\text{A}$ , At Clamp Diode		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$I_F=150\text{A}$ , $di_F/dt=-300\text{A}/\mu\text{s}$ , At Clamp Diode		0.1	0.15	$\mu\text{s}$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.50	$^\circ\text{C}/\text{W}$







# IGBT MODULE

# GAE200BA60



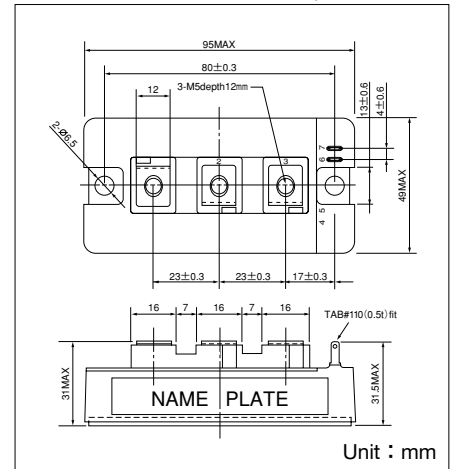
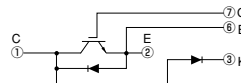
UL;E76102 (M)

**SanRex** IGBT Module **GAE200BA60** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1\ \mu\text{s}$ ) reverse connected across IGBT.

- $I_C=200\text{A}$   $V_{CES}=600\text{V}$
- $V_{CE(sat)}=2.3\text{V Typ}$
- $t_f=0.10\ \mu\text{s Typ}$
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

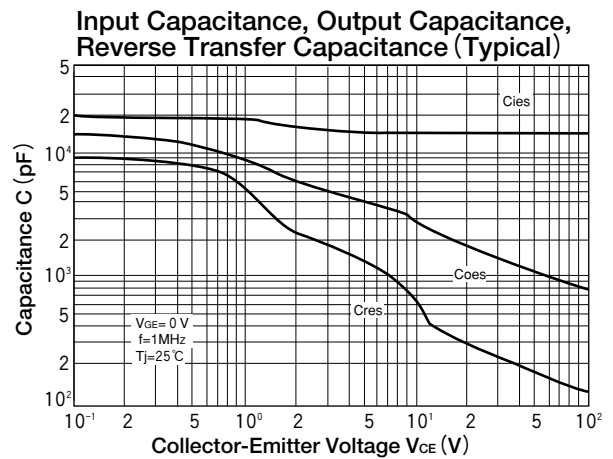
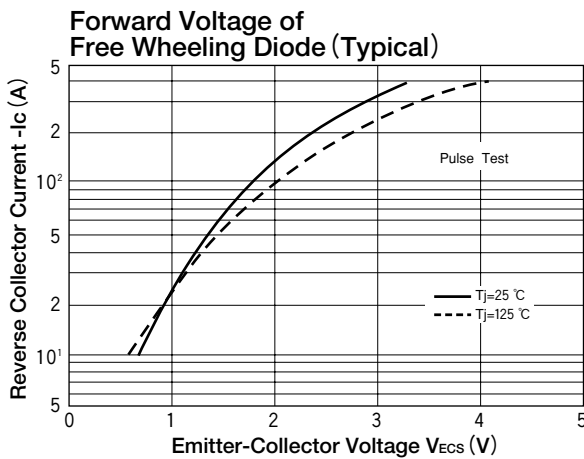
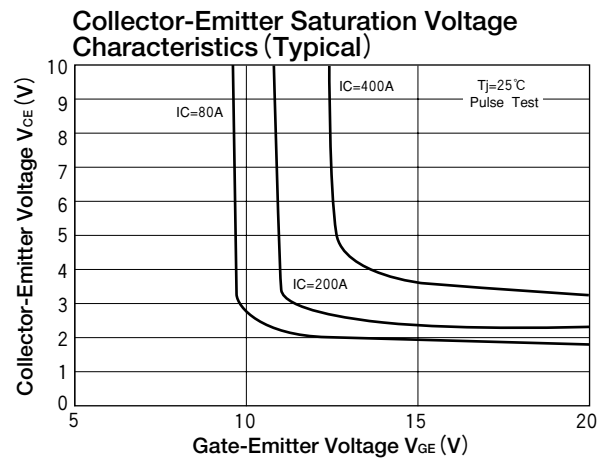
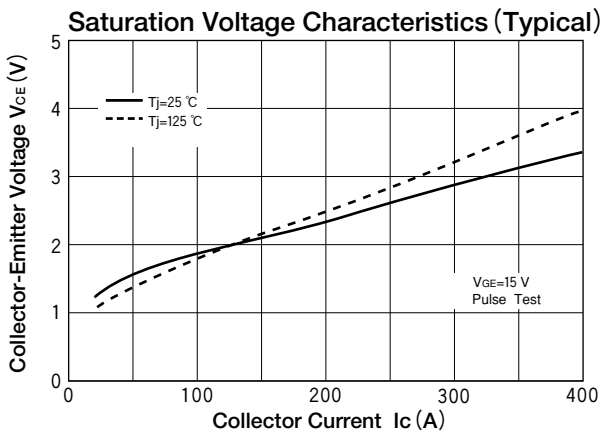
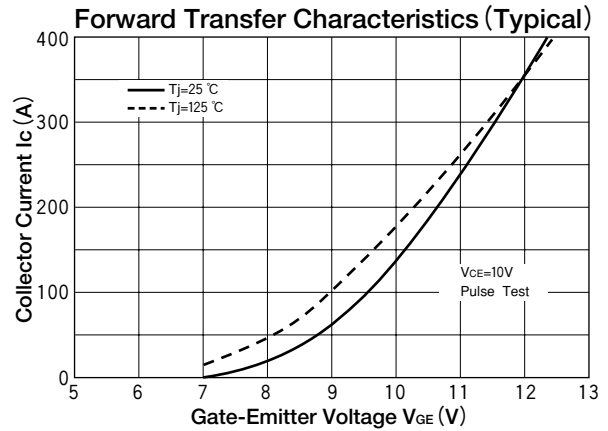
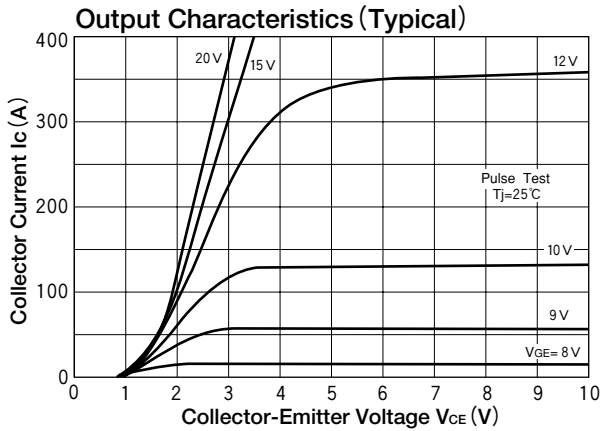
**Maximum Ratings**

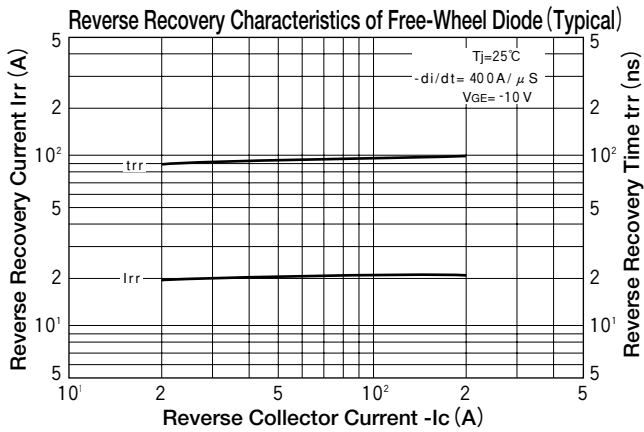
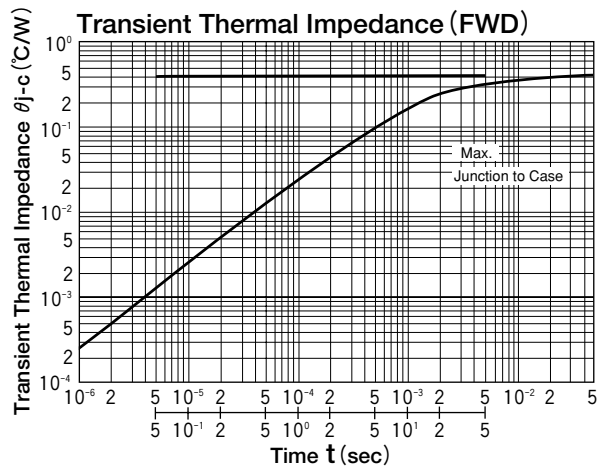
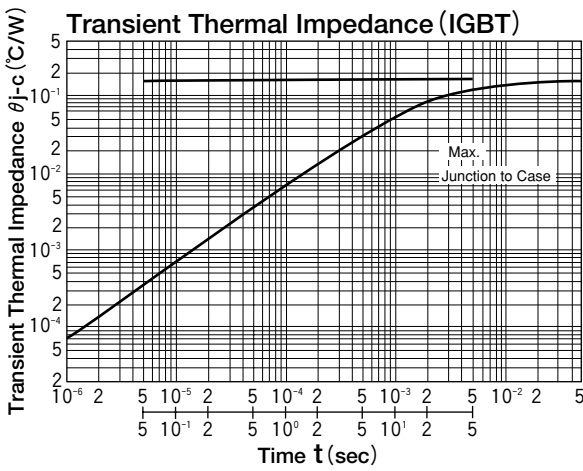
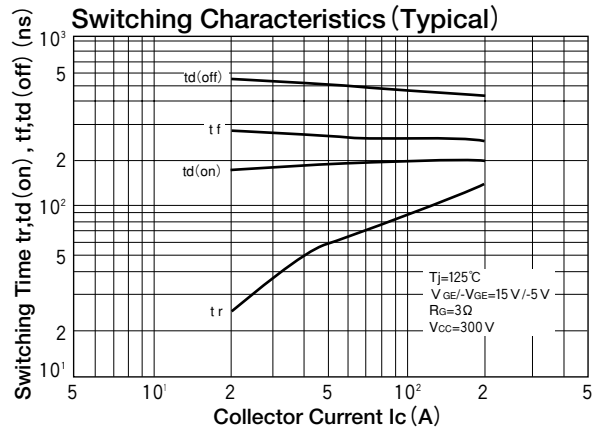
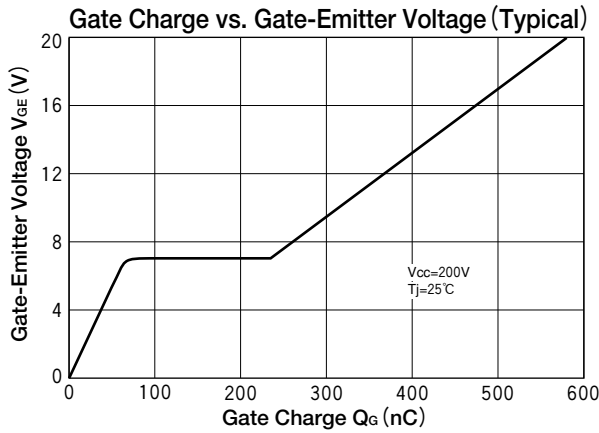
( $T_j=25^\circ\text{C}$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE200BA60		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		200		A
$I_{CP}$		Pulse ( 1 ms)		400		
$-I_C$	Reverse Collector Current			200		A
$P_C$	Total Power Dissipation		$T_c=25^\circ\text{C}$	780		W
$T_j$	Junction Temperature			150		$^\circ\text{C}$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ\text{C}$
$V_{iso}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	225		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20\text{V}$ , $V_{CE}=0\text{V}$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=600\text{V}$ , $V_{GE}=0\text{V}$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0\text{V}$ , $I_C=1\text{mA}$	600			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10\text{V}$ , $I_C=20\text{mA}$	3.0		7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=200\text{A}$ , $V_{GE}=15\text{V}$		2.3	2.8	V
$C_{ies}$	Input Capacitance		$V_{CE}=10\text{V}$ , $V_{GE}=0\text{V}$ , $f=1\text{MHz}$		15	20	nF
$t_r$	Switching Time	Rise Time	$I_C=200\text{A}$ , $V_{GE}=+15\text{V}/-5\text{V}$ $V_{CC}=300\text{V}$ , $R_G=3\ \Omega$		0.10	0.20	$\mu\text{s}$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.40	
$t_f$		Fall Time			0.10	0.20	
$t_{d(off)}$		Turn-off Delay Time			0.40	0.80	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=200\text{A}$ , $V_{GE}=0\text{V}$		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$-I_C=200\text{A}$ , $V_{GE}=-10\text{V}$ , $di/dt=400\text{A}/\mu\text{s}$		0.1	0.15	$\mu\text{s}$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.16	$^\circ\text{C}/\text{W}$
			Diode-Case			0.40	
$V_{FM}$	Forward Voltage Drop		$I_F=200\text{A}$ , At Clamp Diode		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$I_F=200\text{A}$ , $di_F/dt=-400\text{A}/\mu\text{s}$ , At Clamp Diode		0.1	0.15	$\mu\text{s}$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ\text{C}/\text{W}$





# IGBT MODULE

# GAE300BA60



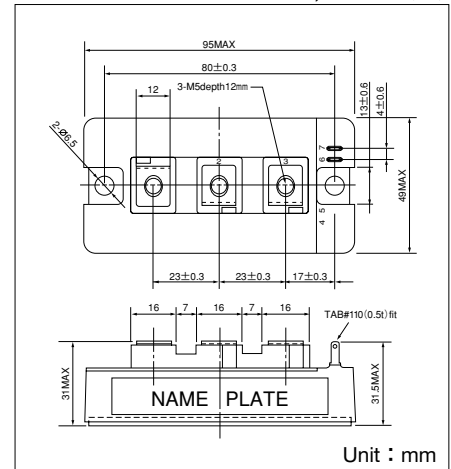
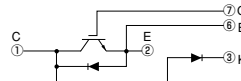
UL;E76102 (M)

**SanRex** IGBT Module **GAE300BA60** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1\mu s$ ) reverse connected across IGBT.

- $I_C=300A$   $V_{CES}=600V$
- $V_{CE(sat)}=2.4V$  Typ
- $t_f=0.10\mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

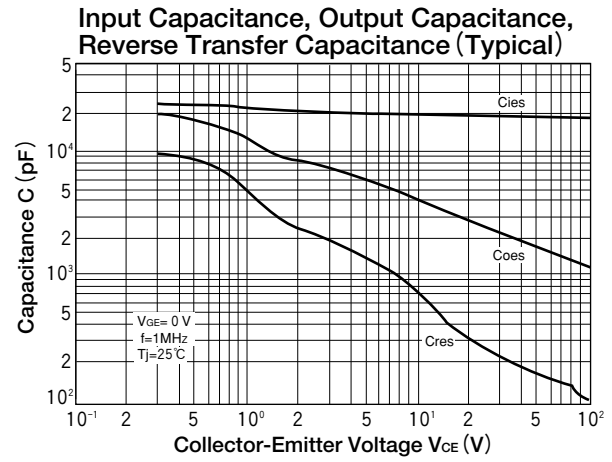
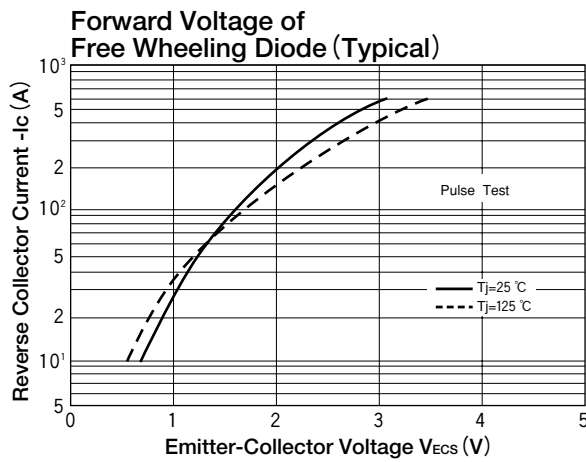
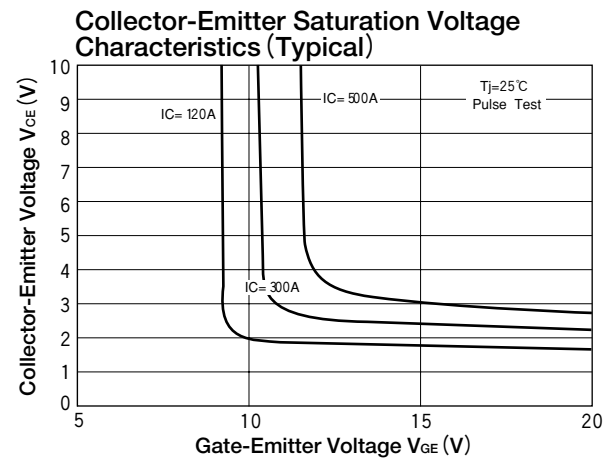
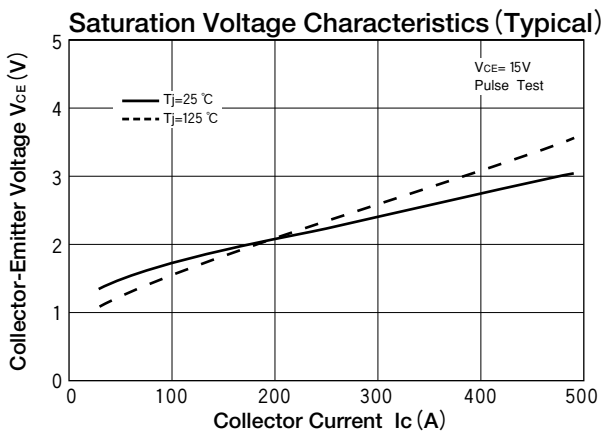
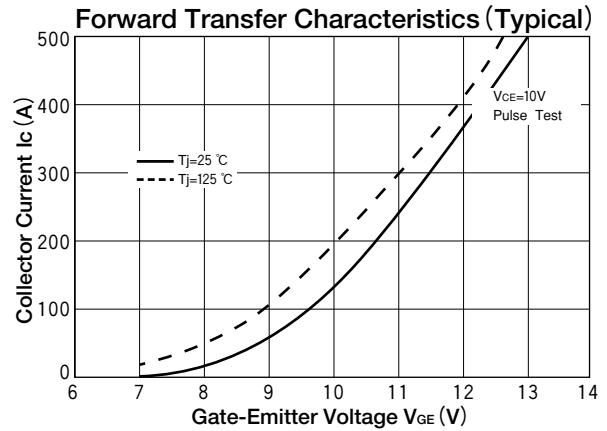
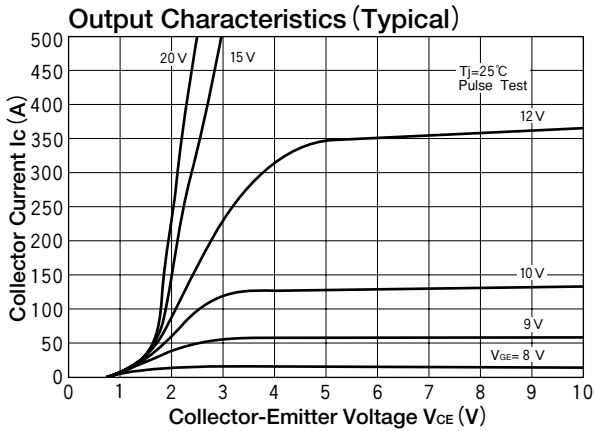
**Maximum Ratings**

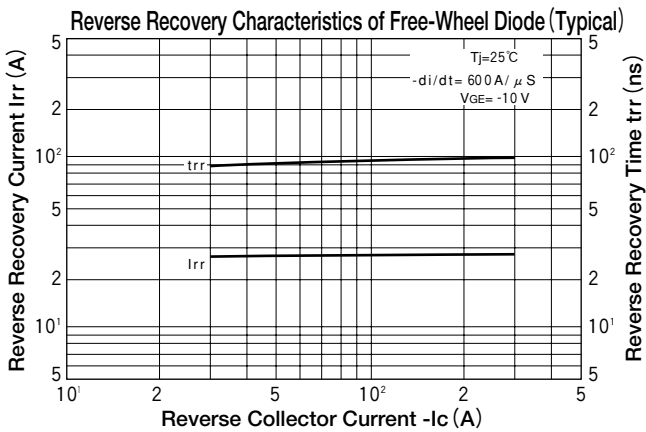
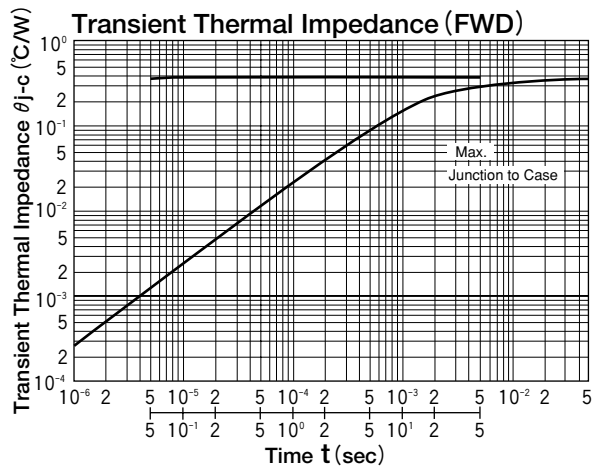
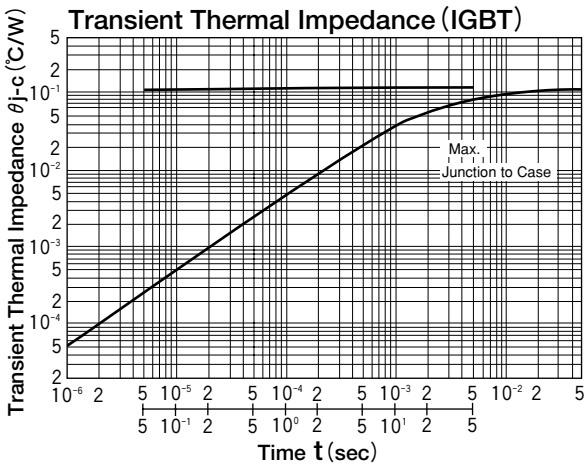
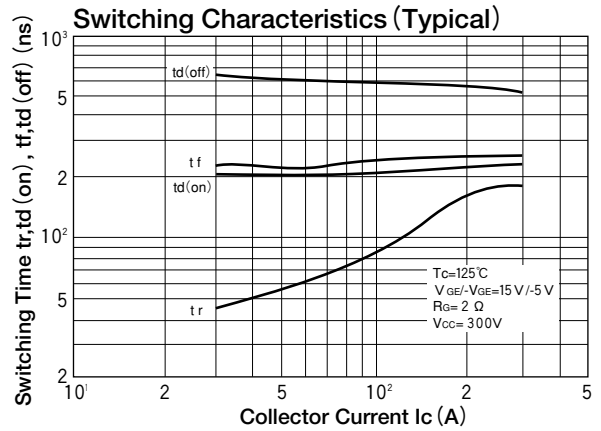
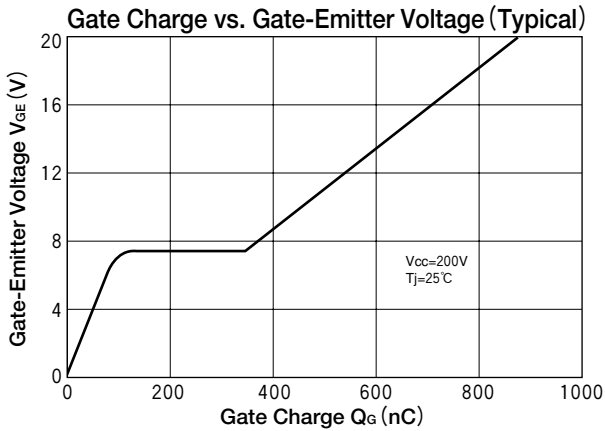
( $T_j=25^\circ C$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE300BA60		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		300		A
$I_{CP}$		Pulse ( 1 ms)		600		
$-I_C$	Reverse Collector Current			300		A
$P_C$	Total Power Dissipation		$T_c=25^\circ C$	1100		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{iso}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	225		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=600V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1mA$	600			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=30mA$	3.0		7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=300A, V_{GE}=15V$		2.4	2.8	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		20		nF
$t_r$	Switching Time	Rise Time	$I_C=300A, V_{GE}=+15V/-5V$ $V_{CC}=300V, R_G=2\Omega$		0.10	0.20	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.40	
$t_f$		Fall Time			0.10	0.20	
$t_{d(off)}$		Turn-off Delay Time			0.40	0.80	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=300A, V_{GE}=0V$		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$-I_C=300A, V_{GE}=-10V, di/dt=600A/\mu s$		0.1		$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.11	$^\circ C/W$
			Diode-Case			0.40	
$V_{FM}$	Forward Voltage Drop		$I_F=300A, At$ Clamp Diode		2.30	2.80	V
$t_{rr}$	Reverse Recovery Time		$I_F=300A, di_F/dt=-600A/\mu s, At$ Clamp Diode		0.1	0.15	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ C/W$





# IGBT MODULE

# GAE75AA120



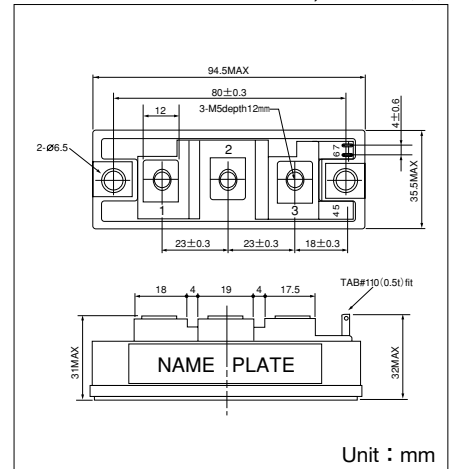
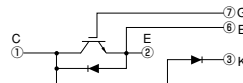
UL;E76102 (M)

**SanRex** IGBT Module **GAE75AA120** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1 \mu s$ ) reverse connected across IGBT.

- $I_C=75A$   $V_{CES}=1200V$
- $V_{CE(sat)} = 3.0V$  Typ
- $t_f=0.10 \mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

**Maximum Ratings**

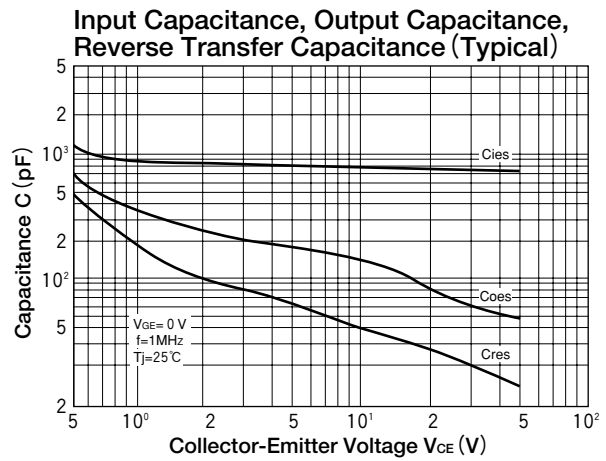
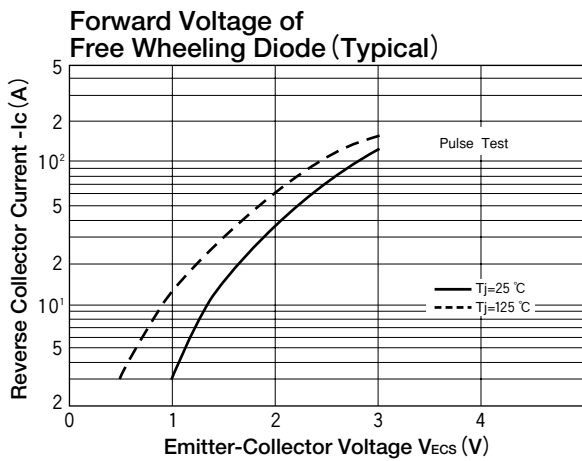
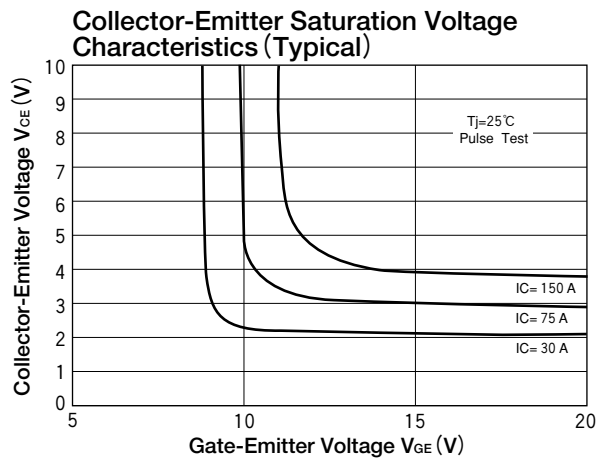
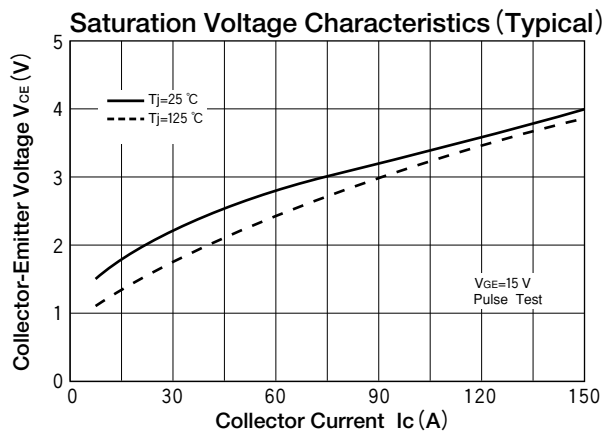
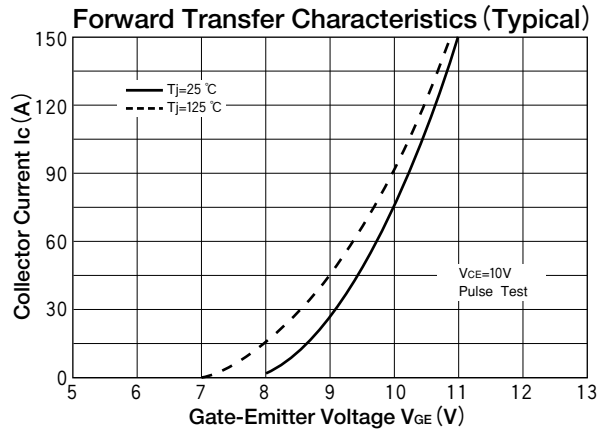
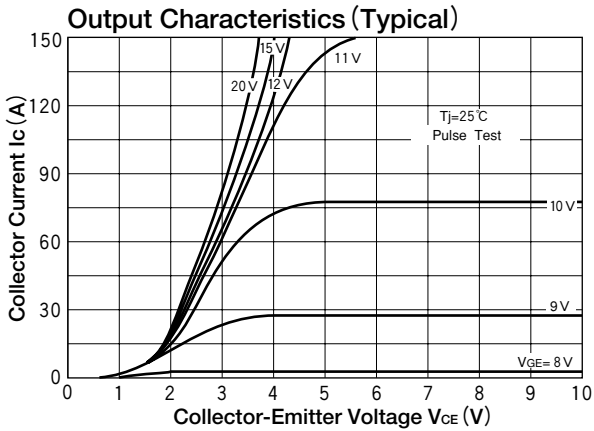
( $T_j=25^\circ C$  unless otherwise specified)

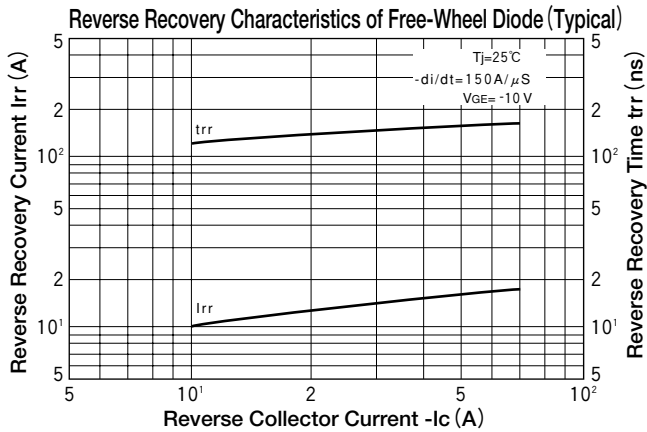
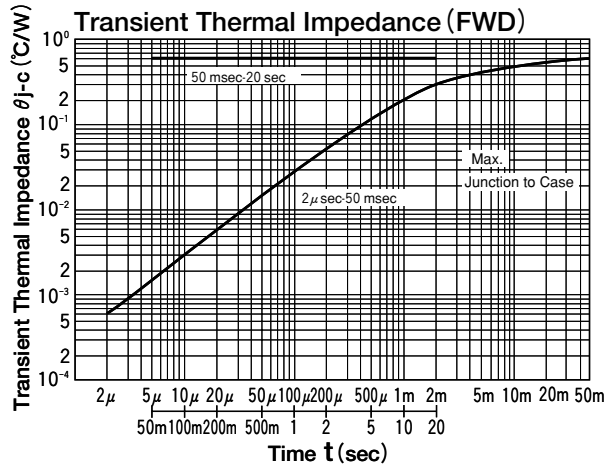
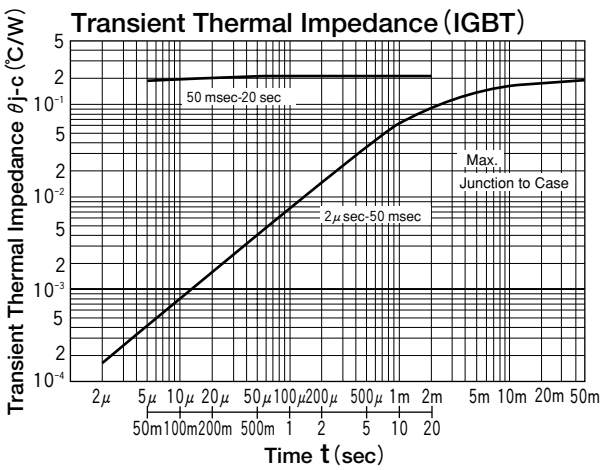
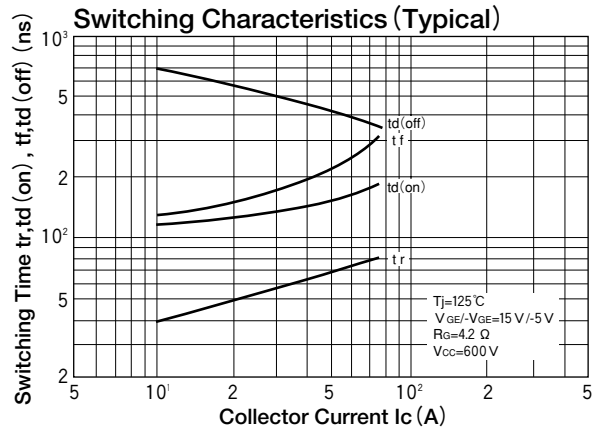
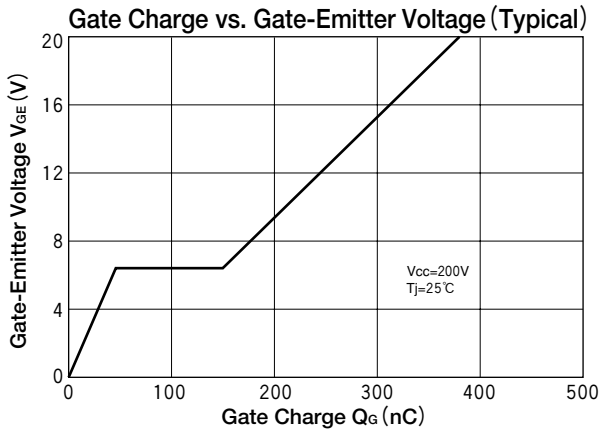
Symbol	Item		Conditions	Ratings		Unit
				GAE75AA120		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	1200		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		75		A
$I_{CP}$		Pulse ( 1 ms)		150		
$-I_C$	Reverse Collector Current			75		A
$P_C$	Total Power Dissipation		$T_c=25^\circ C$	600		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{iso}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	210		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=1200V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1mA$	1200			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=7.5mA$	4.5		7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=75A, V_{GE}=15V$		3.0	3.4	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		8	15	nF
$t_r$	Switching Time	Rise Time	$I_C=75A, V_{GE}=+15V/-5V$ $V_{CC}=600V, R_G=4.2\Omega$		0.10	0.25	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.35	
$t_f$		Fall Time			0.10	0.35	
$t_{d(off)}$		Turn-off Delay Time			0.25	0.30	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=75A, V_{GE}=0V$		2.50	3.50	V
$t_{rr}$	Reverse Recovery Time		$-I_C=75A, V_{GE}=-10V, di/dt=150A/\mu s$		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.21	$^\circ C/W$
			Diode-Case			0.6	
$V_{FM}$	Forward Voltage Drop		$I_F=75A, At$ Clamp Diode		2.50	3.50	V
$t_{rr}$	Reverse Recovery Time		$I_F=75A, di_F/dt=-150A/\mu s, At$ Clamp Diode		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.6	$^\circ C/W$







# IGBT MODULE

# GAE100AA120



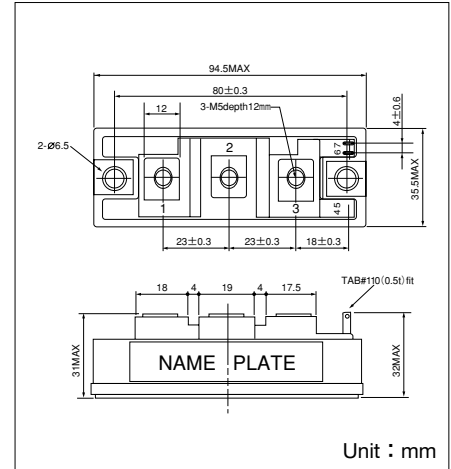
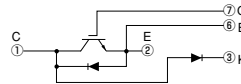
UL;E76102 (M)

**SanRex** IGBT Module **GAE100AA120** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series, soft recovery diode ( $t_{rr}=0.1\ \mu s$ ) reverse connected across IGBT.

- $I_C=100A$   $V_{CES}=1200V$
- $V_{CE(sat)}=3.0V$  Typ
- $t_f=0.10\ \mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



Unit : mm

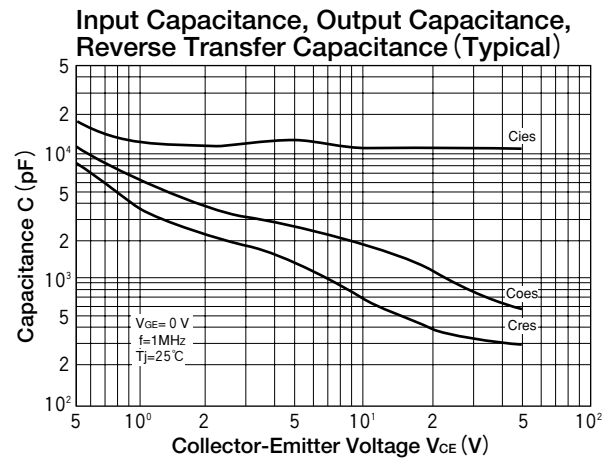
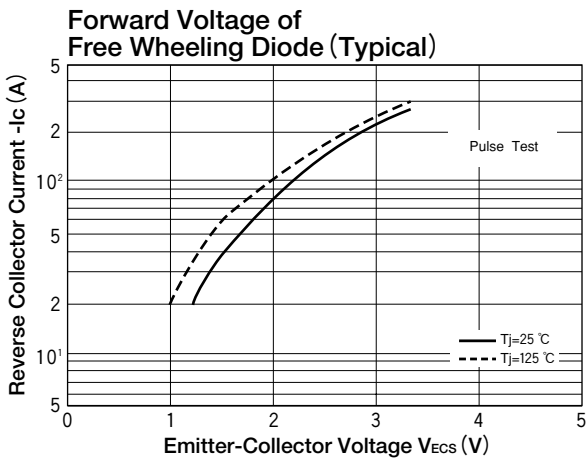
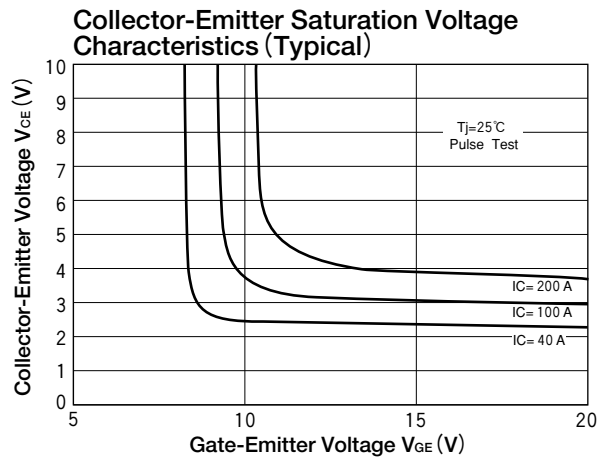
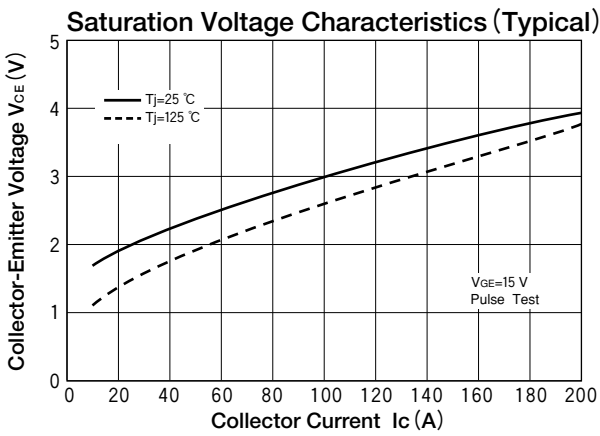
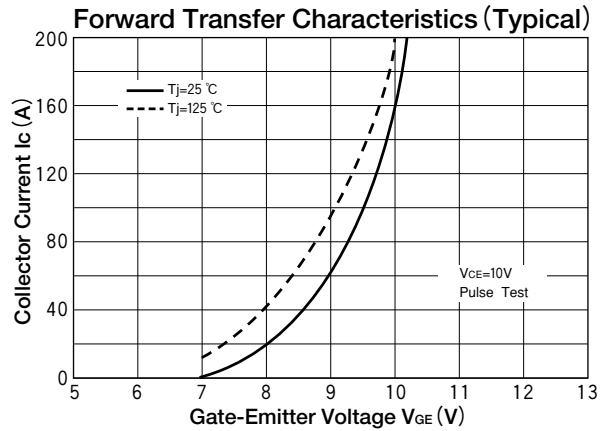
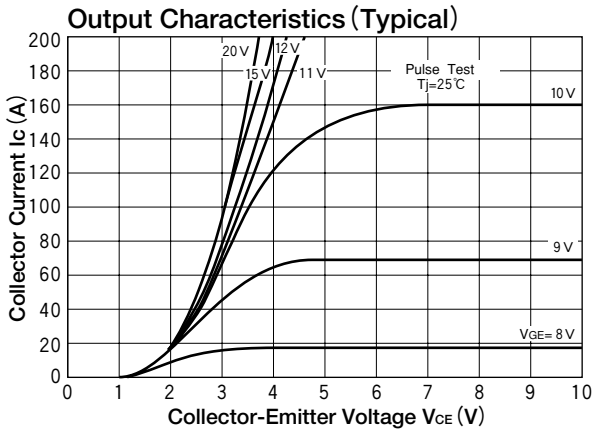
**Maximum Ratings**

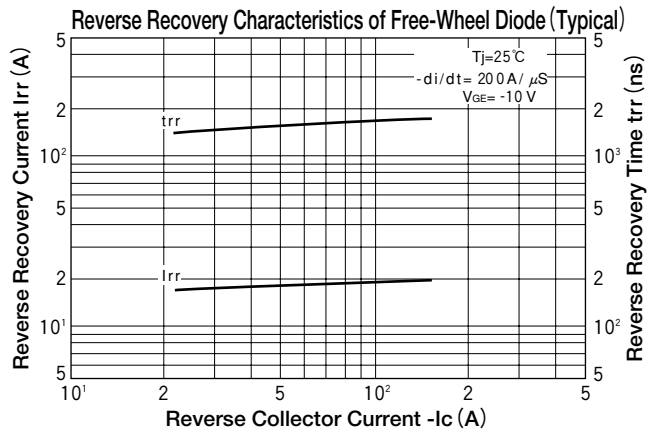
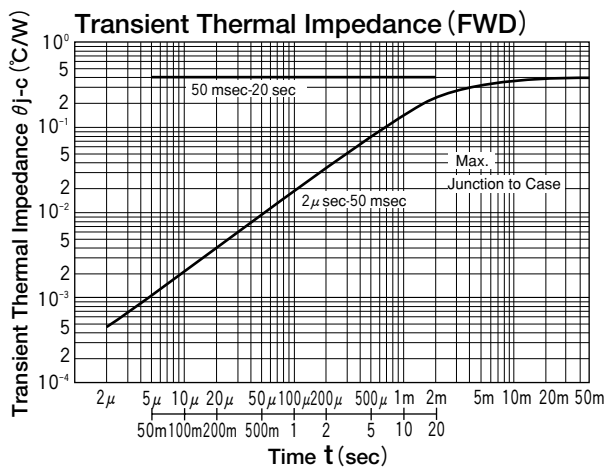
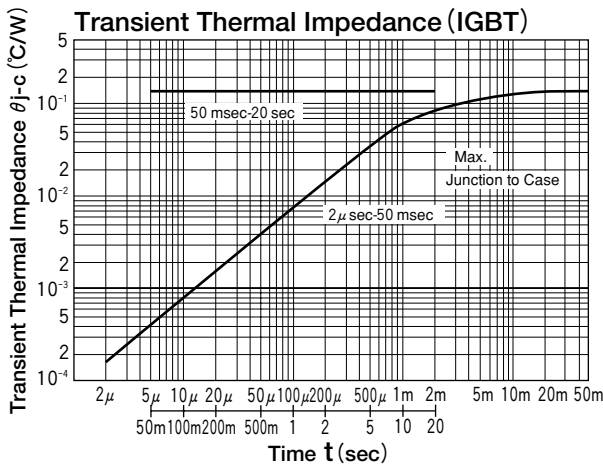
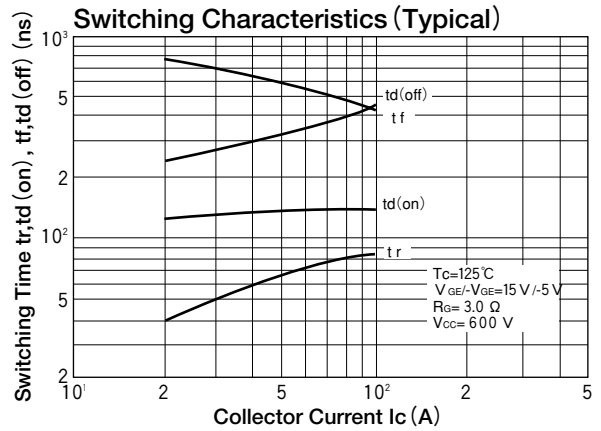
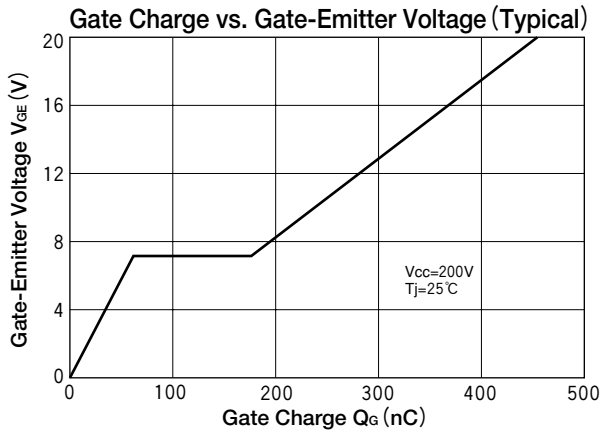
( $T_j=25^\circ C$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE100AA120		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	1200		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		100		A
$I_{CP}$		Pulse ( 1 ms)		200		
$-I_C$	Reverse Collector Current			100		A
$P_c$	Total Power Dissipation		$T_c=25^\circ C$	780		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{iso}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	225		g

**Electrical Characteristics**

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=1200V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1\ mA$	1200			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=10mA$	4.5		7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=100A, V_{GE}=15V$		3.0	3.4	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		11	20	nF
$t_r$	Switching Time	Rise Time	$I_C=100A, V_{GE}=+15V/-5V$ $V_{CC}=600V, R_G=3.0\ \Omega$		0.10	0.25	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.20	0.35	
$t_f$		Fall Time			0.10	0.35	
$t_{d(off)}$		Turn-off Delay Time			0.25	0.30	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=100A, V_{GE}=0V$		2.20	3.50	V
$t_{rr}$	Reverse Recovery Time		$-I_C=100A, V_{GE}=-10V, di/dt=200A/\mu s$		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.16	$^\circ C/W$
			Diode-Case			0.40	
$V_{FM}$	Forward Voltage Drop		$I_F=100A, At\ Clamp\ Diode$		2.20	3.50	V
$t_{rr}$	Reverse Recovery Time		$I_F=100A, di_F/dt=-200A/\mu s, At\ Clamp\ Diode$		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ C/W$





# IGBT MODULE

# GAE150AA120



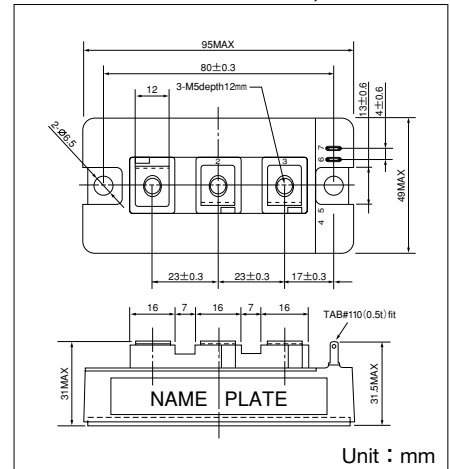
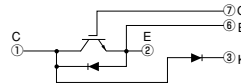
UL;E76102 (M)

**SanRex** IGBT Module **GAE150AA120** is designed for high speed, high current switching applications. This Module is electrically isolated and contains IGBT connected with clamp diode in series with a fast switching, soft recovery diode ( $t_{rr}=0.1 \mu s$ ) reverse connected across IGBT.

- $I_C=150A$   $V_{CES}=1200V$
- $V_{CE(sat)}=3.0V$  Typ
- $t_f=0.10 \mu s$  Typ
- Soft recovery diode

**(Applications)**

Brake for motor control (chopper)



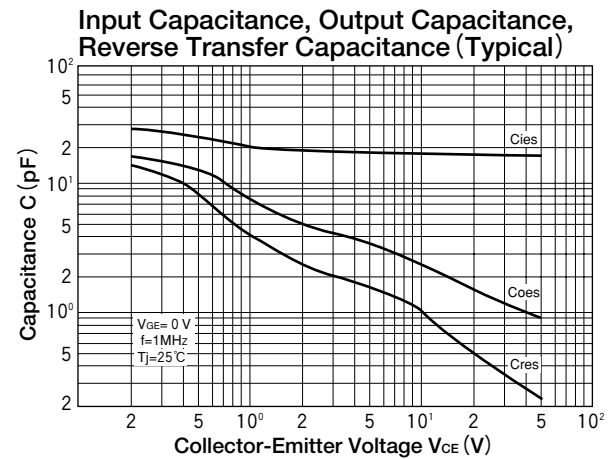
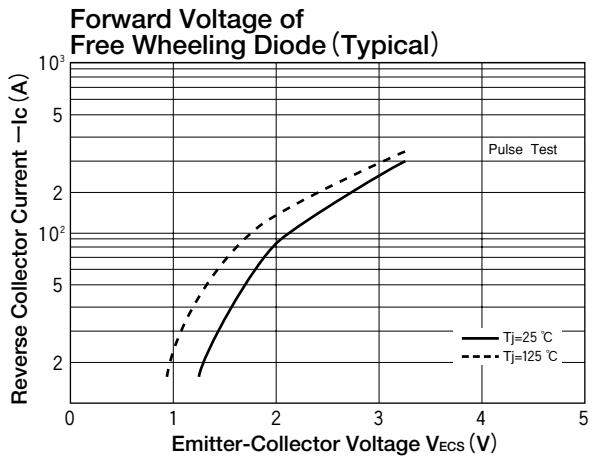
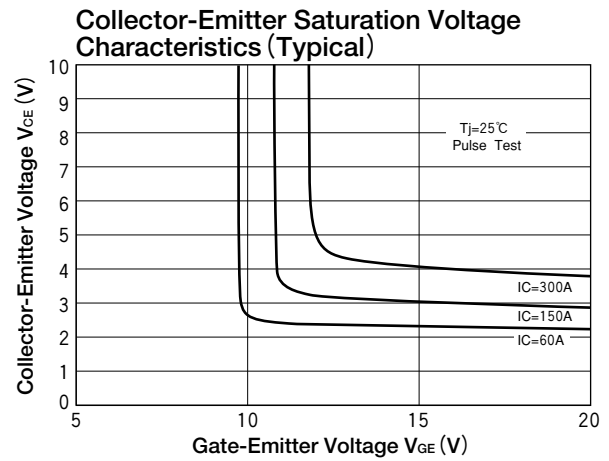
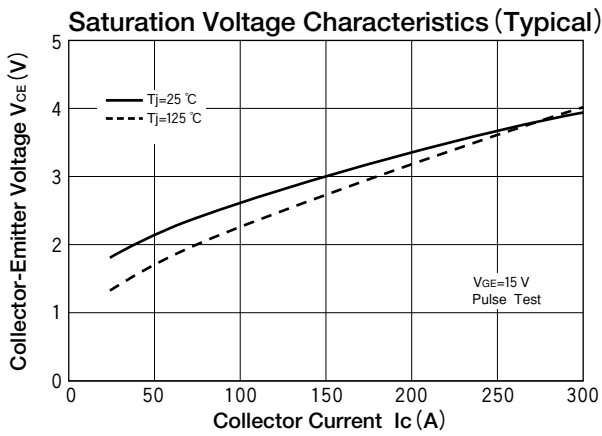
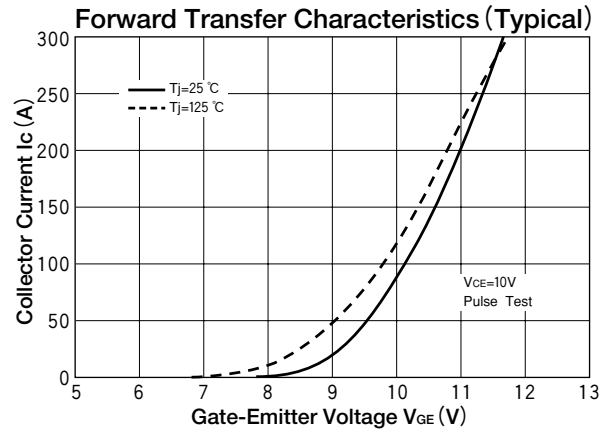
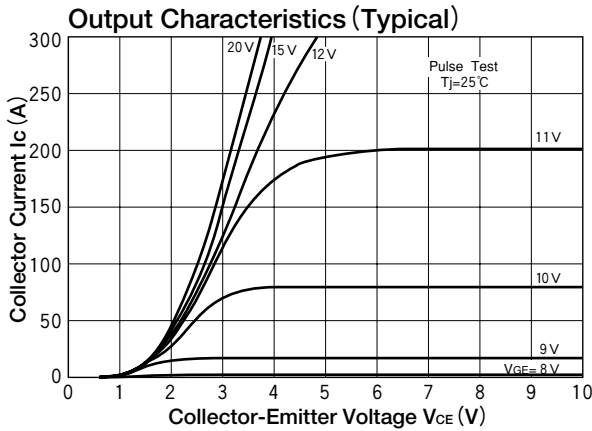
**Maximum Ratings**

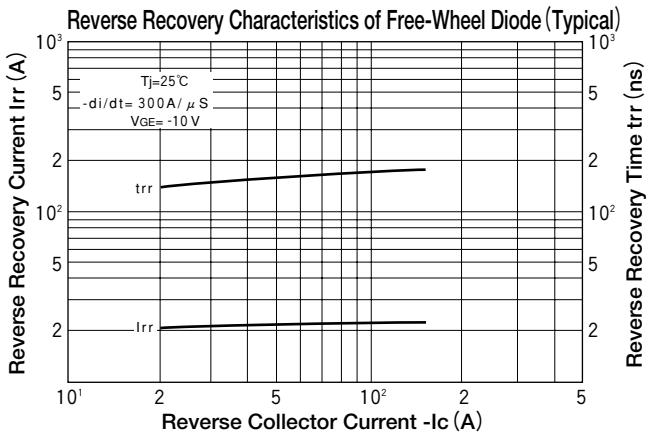
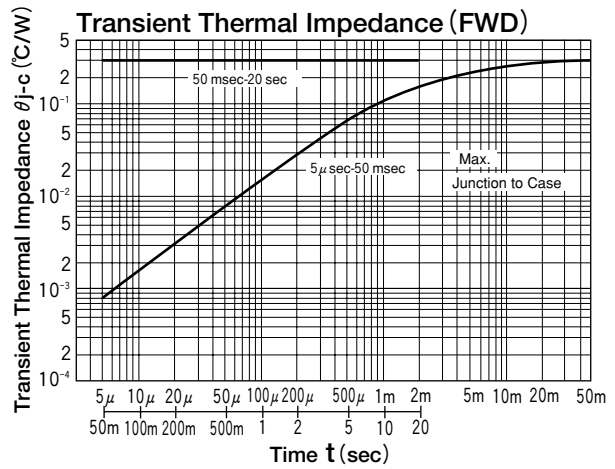
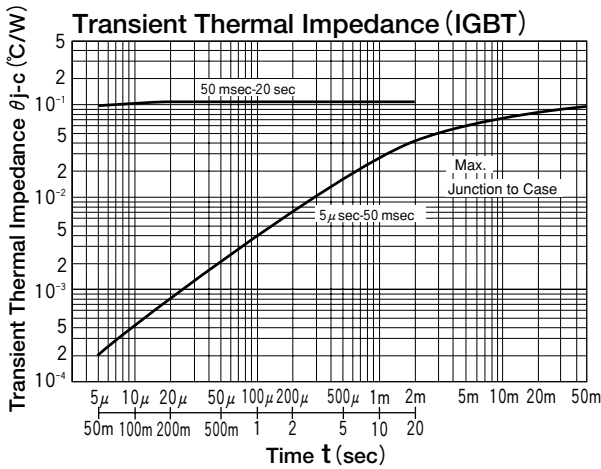
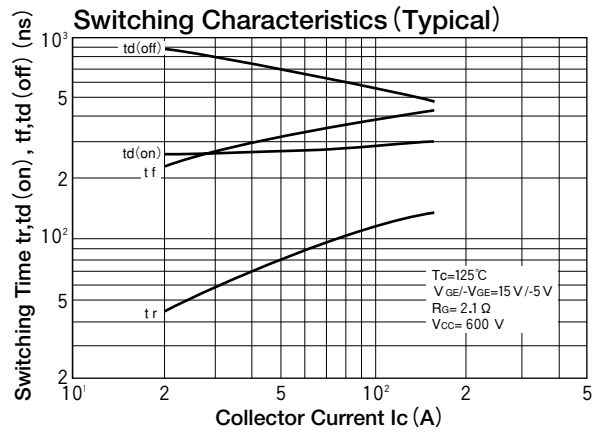
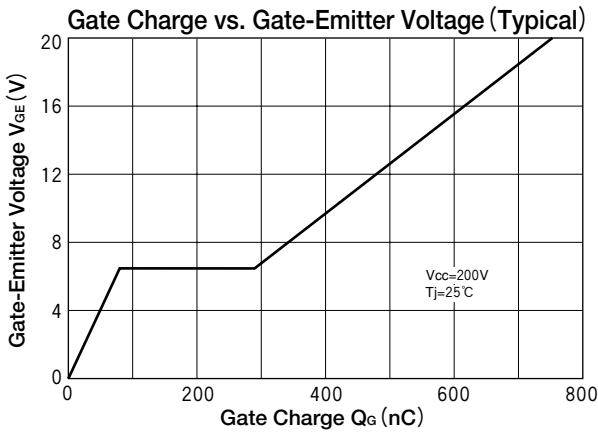
( $T_j=25^\circ C$  unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE150AA120		
$V_{CES}$	Collector-Emitter Voltage		with gate terminal shorted to emitter	1200		V
$V_{GES}$	Gate-Emitter Voltage		with collector shorted to emitter	$\pm 20$		V
$I_C$	Collector Current	DC		150		A
$I_{CP}$		Pulse ( 1 ms)		300		
$-I_C$	Reverse Collector Current			150		A
$P_C$	Total Power Dissipation		$T_c=25^\circ C$	1100		W
$T_j$	Junction Temperature			150		$^\circ C$
$T_{stg}$	Storage Temperature			-40 to +125		$^\circ C$
$V_{ISO}$	Isolation Voltage (R.M.S.)		A.C. 1 minute	2500		V
	Mounting Torque	Mounting (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		N·m (kgf·cm)
		Terminal (M5)	Recommended Value 1.5-2.5 (15-25)	2.7 (28)		
	Mass		Typical Value	225		g

**Electrical Characteristics**

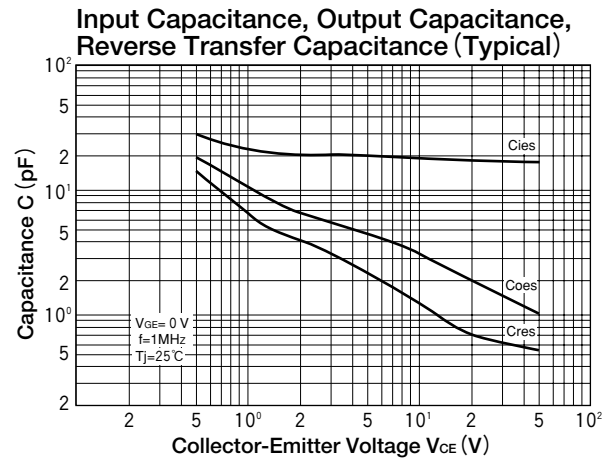
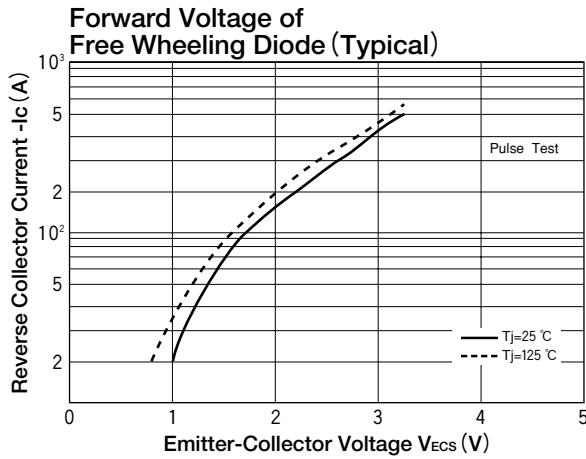
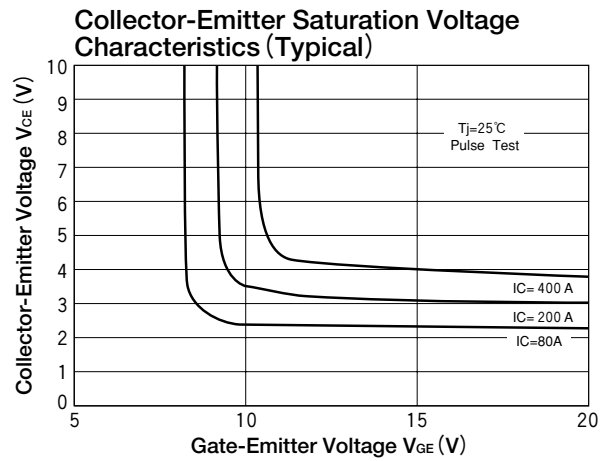
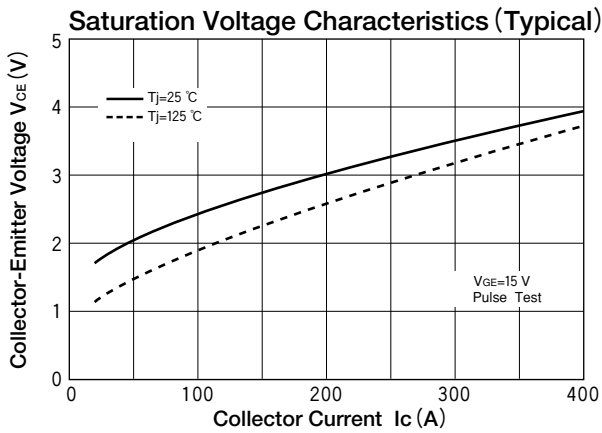
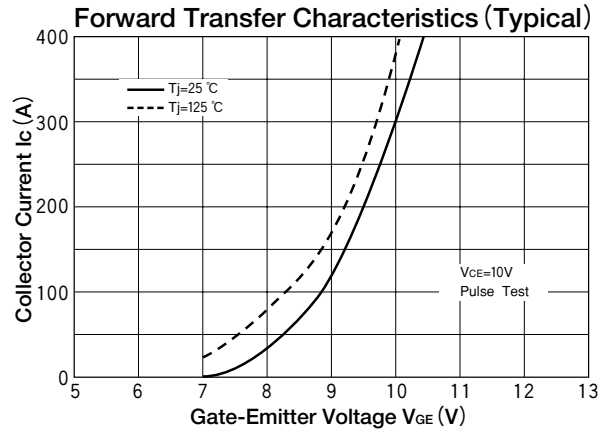
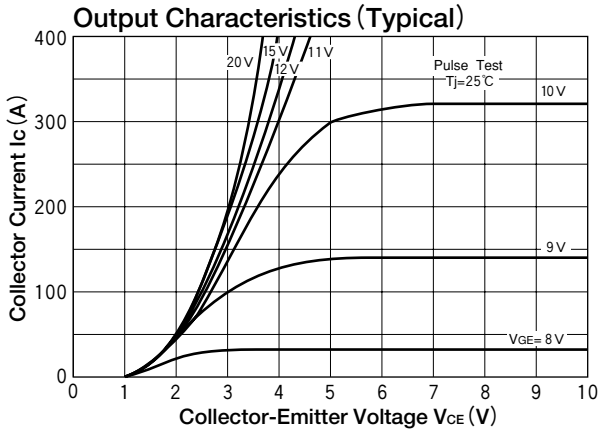
Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
$I_{GES}$	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			$\pm 500$	nA
$I_{CES}$	Collector Cut-Off Current		$V_{CE}=1200V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1mA$	1200			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10V, I_C=15mA$	4.5		7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=150A, V_{GE}=15V$		3.0	3.4	V
$C_{ies}$	Input Capacitance		$V_{CE}=10V, V_{GE}=0V, f=1MHz$		17	30	nF
$t_r$	Switching Time	Rise Time	$I_C=150A, V_{GE}=+15V/-5V$ $V_{CC}=600V, R_G=2.1 \Omega$		0.10	0.25	$\mu s$
$t_{d(on)}$		Turn-on Delay Time			0.15	0.35	
$t_f$		Fall Time			0.10	0.35	
$t_{d(off)}$		Turn-off Delay Time			0.25	0.35	
$V_{ECS}$	Emitter-Collector Voltage		$-I_C=150A, V_{GE}=0V$		2.40	3.50	V
$t_{rr}$	Reverse Recovery Time		$-I_C=150A, V_{GE}=-10V, di/dt=300A/\mu s$		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.11	$^\circ C/W$
			Diode-Case			0.30	
$V_{FM}$	Forward Voltage Drop		$I_F=150A, \text{At Clamp Diode}$		2.40	3.50	V
$t_{rr}$	Reverse Recovery Time		$I_F=150A, di_F/dt=-300A/\mu s, \text{At Clamp Diode}$		0.15	0.25	$\mu s$
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.30	$^\circ C/W$

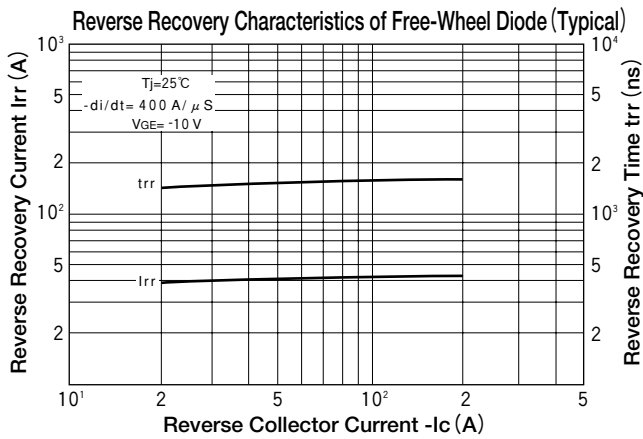
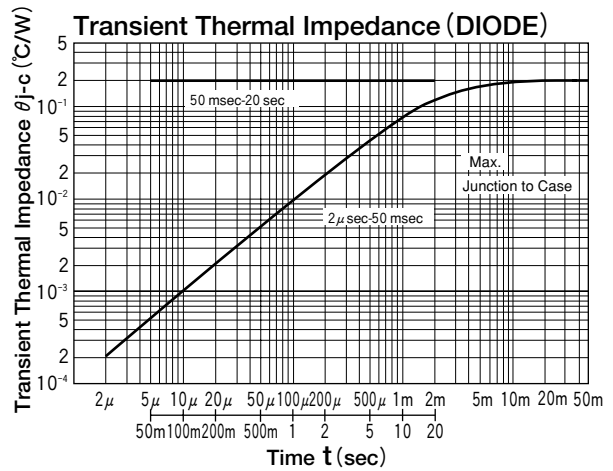
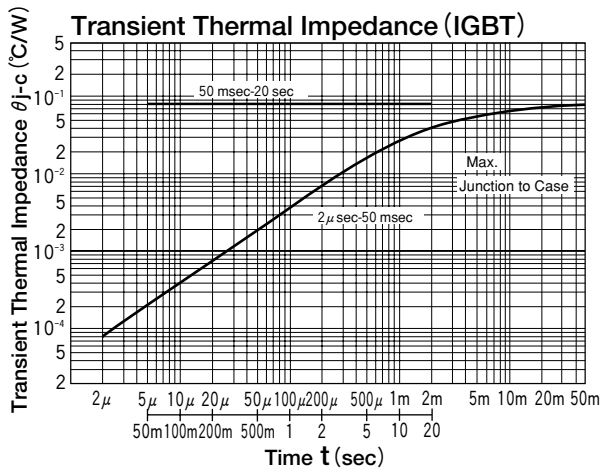
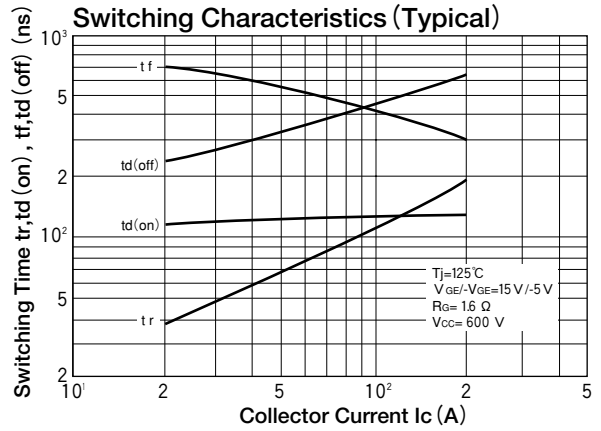
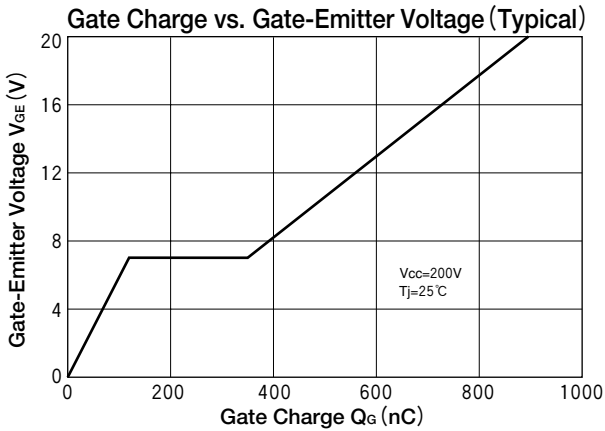












# HYBRID GATE DRIVER IC FOR IGBT

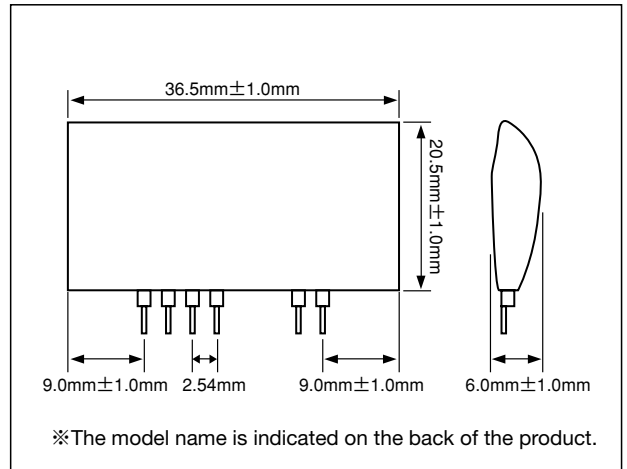
## GH-038

TOP



SanRex GH-038 is Hybrid Gate Driver IC for IGBT.

- High Voltage isolation by Photo Coupler
- Enable to drive IGBT up to dual 600V, 300A module
- Operate with single power source
- Support to high-density system design
- Built-in photo coupler with resistor (330 Ω)

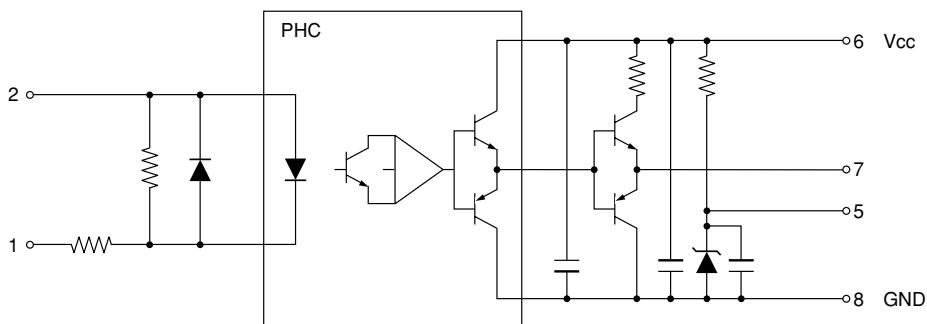


### Maximum Ratings

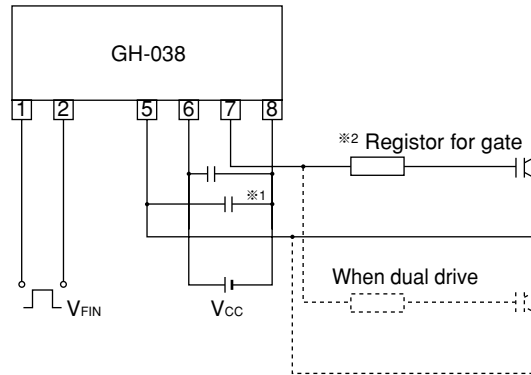
(T<sub>j</sub>=25°C unless otherwise specified)

Symbol	Item	Conditions	Ratings			Unit
			Min.	Typ.	Max.	
V <sub>CC</sub>	Supply Voltage		23.0	26.0	28.0	V
V <sub>OH</sub>	Forward Bias Output Voltage	V <sub>CC</sub> =26.0V	16.0	18.0	19.0	V
V <sub>RB</sub>	Reverse Bias Supply Voltage	V <sub>CC</sub> =26.0V	7.0	8.0	9.0	V
V <sub>FIN</sub>	Photo Coupler Input Voltage			5.0	7.0	V
I <sub>F</sub>	Photo Coupler Input Current	V <sub>FIN</sub> =5.0V	9.0	10.6	12.2	mA
I <sub>g1</sub>	Output Forward Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
I <sub>g2</sub>	Output Reverse Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
t <sub>PLH</sub>	Switching Time-High side	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.5	μs
t <sub>PHL</sub>	Switching Time-Low side	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.5	μs
t <sub>r</sub>	Rise Time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.0	μs
t <sub>f</sub>	Fall Time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.0	μs
dv/dt	Noise immunity		5k	10k		V/μs
Visc	Input/Output Isolation Voltage	AC50/60Hz, 1minute	AC2500			V
T <sub>opr</sub>	Operational Ambient Temperature		-25 to +80			°C
T <sub>stg</sub>	Storage Temperature		-40 to +125			°C

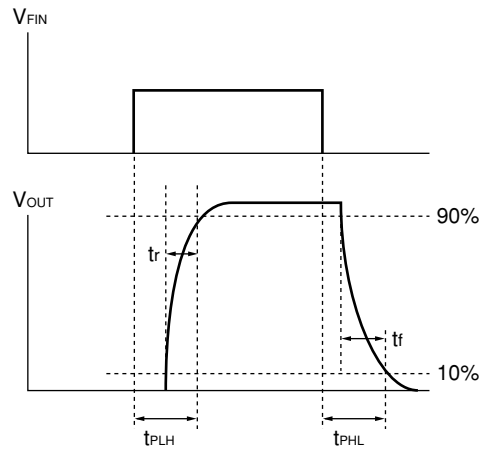
### Equivalent Circuit



■ Example of Application



- ※1 Design the capacitor (more than 10  $\mu$ F) for stabilized voltage to be connected as close to the Driver IC as possible.
- ※2 For the value of resistor for gate, the resistance value described in IGBT Module specification is recommended. The gate resistance should be determined at less than 6A of peak output current judging from signal delay time and surge voltage.



• Switching wave form

# HYBRID GATE DRIVER IC FOR IGBT

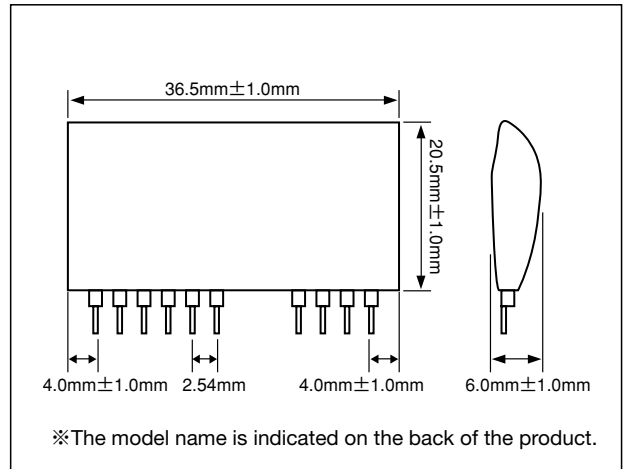
## GH-039

TOP



SanRex GH-039 is Hybrid Gate Driver IC for IGBT.

- High Voltage isolation by Photo Coupler
- Enable to drive IGBT up to dual 600V, 300A module
- Operate with single power source
- Support to high-density system design
- Built-in Photo Coupler with resistor (330Ω)
- Built-in over current protection circuit with soft shutdown characteristic
- Output terminals on over current detection

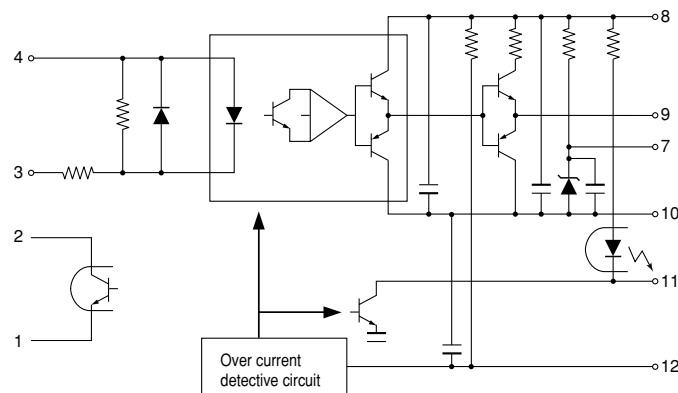


### Maximum Ratings

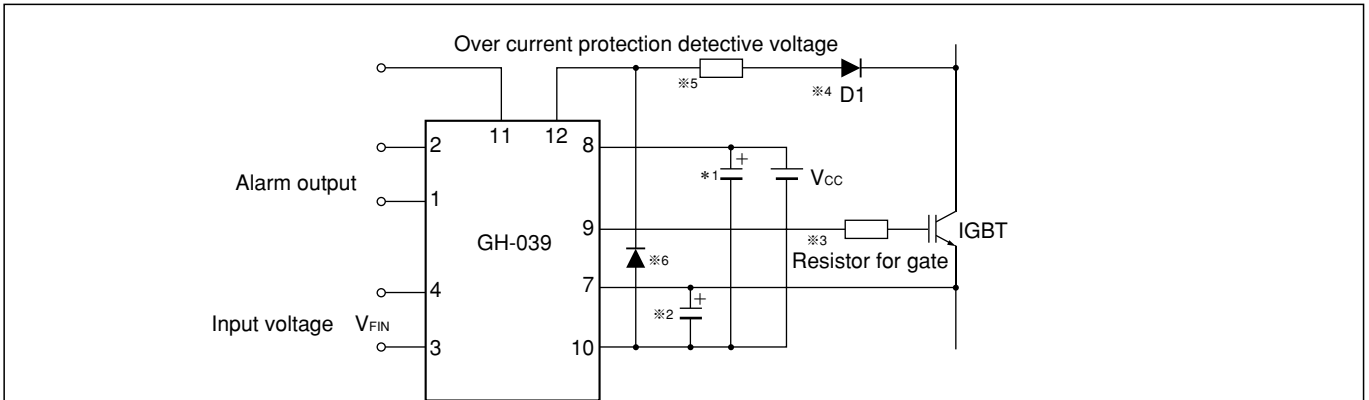
(T<sub>j</sub>=25°C unless otherwise specified)

Symbol	Item	Conditions	Ratings			Unit
			Min.	Typ.	Max.	
V <sub>CC</sub>	Supply Voltage		23.0	26.0	28.0	V
V <sub>OH</sub>	Forward Bias Output Voltage	V <sub>CC</sub> =26.0V	15.4	17.5	18.0	V
V <sub>RB</sub>	Reverse Bias Supply Voltage	V <sub>CC</sub> =26.0V	7.0	8.0	10.0	V
V <sub>FIN</sub>	Photo Coupler Input Voltage			5.0	7.0	V
I <sub>F</sub>	Photo Coupler Input Current	V <sub>FIN</sub> =5.0V	9.0	10.0	11.5	mA
I <sub>g1</sub>	Output Forward Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
I <sub>g2</sub>	Output Reverse Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
t <sub>PLH</sub>	Switching Time-High side	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.5	μs
t <sub>PHL</sub>	Switching Time-Low side	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.5	μs
t <sub>r</sub>	Rise Time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.0	μs
t <sub>f</sub>	Fall Time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA			1.0	μs
V <sub>OC</sub>	Overcurrent trip level	V <sub>CC</sub> =26.0V	11.5	12.0	12.5	V
t <sub>OCP</sub>	OCP delay time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA		4.0	10.0	μs
t <sub>pcoff</sub>	OCP rise and fall time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA	2.0	5.0		μs
t <sub>ALM</sub>	Alarm output delay time	V <sub>CC</sub> =26.0V, I <sub>F</sub> =10mA		1.0	5.0	μs
I <sub>FO</sub>	Fault output current			10.0	17.0	mA
dv/dt	Noise immunity		5k	10k		V/μs
Visc	Input/Output Isolation Voltage	AC50/60Hz, 1minute	AC3750			V
Topr	Operational Ambient Temperature		-25 to + 80			°C
Tstg	Storage Temperature		-40 to +125			°C

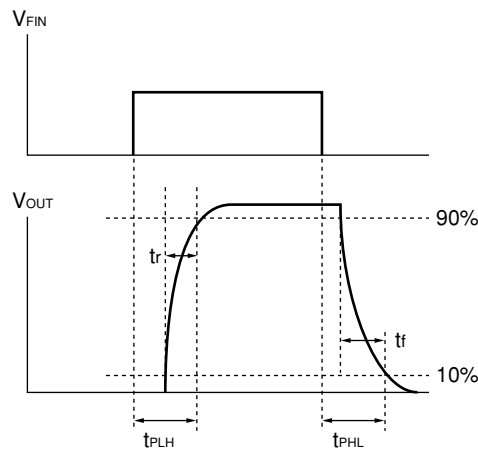
### Equivalent Circuit



**Example of Application**



- ※1, ※2 Design the capacitor (more than 10  $\mu$ F) for stabilized voltage to be connected as close to the Driver IC as possible.
- ※3 For the value of resistor of gate, resistor the resistance value described in IGBT Module specification is recommended. The gate resistance should be determined at less than 6A of peak output current judging from signal delay time and surge voltage.
- ※4 The fast recovery diode with same blocking voltage as IGBT (main device) is required for D1.
- ※5, ※6 To prevent malfunction of detection for over current protection, use resistor and diode of 100  $\Omega$



**Definition of over current protection function**

