

IGBT MODULE

GAE75BA60



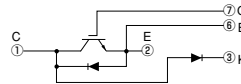
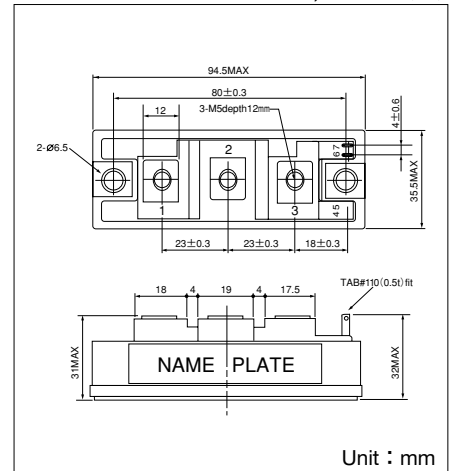
UL;E76102 (M)

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)



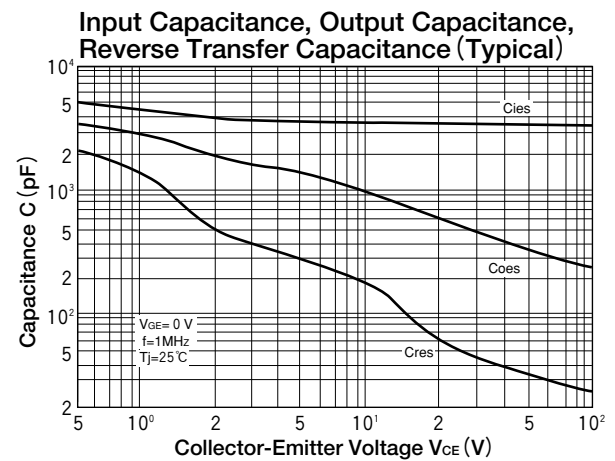
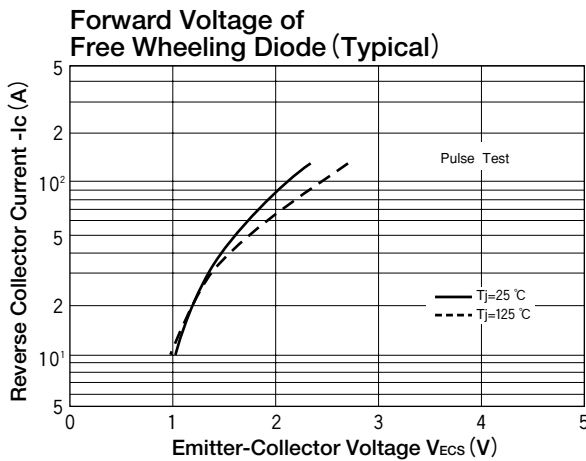
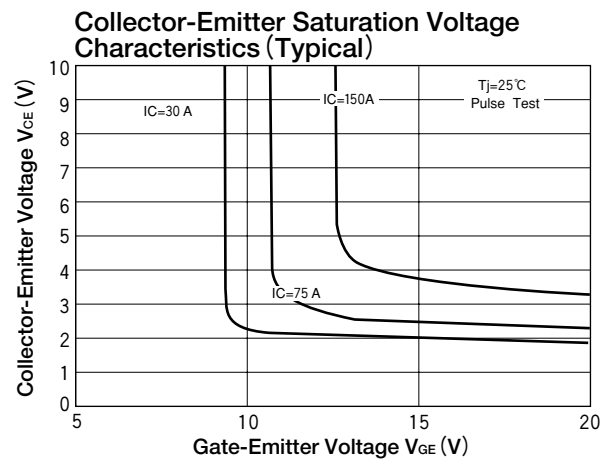
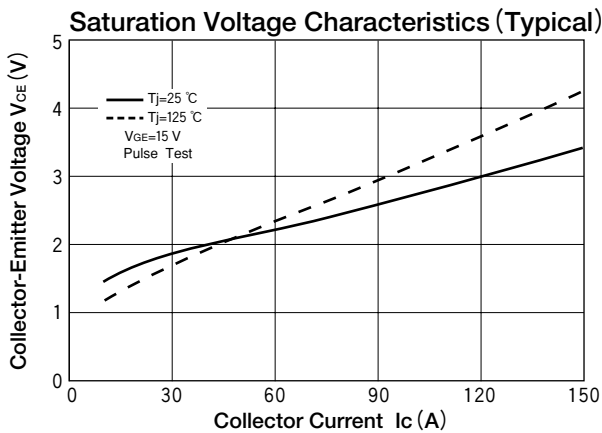
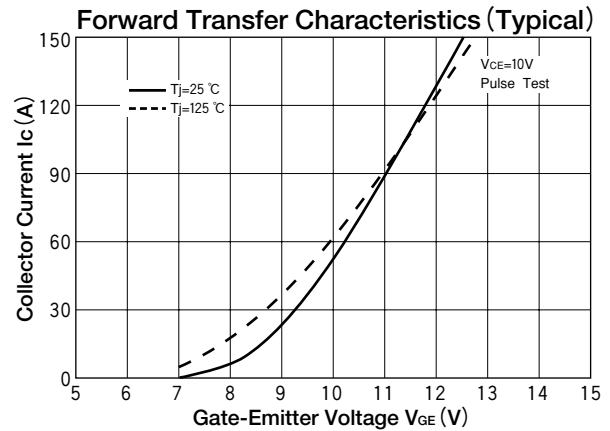
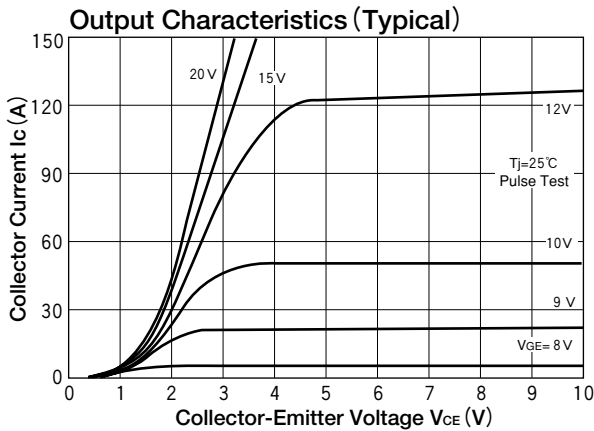
Maximum Ratings

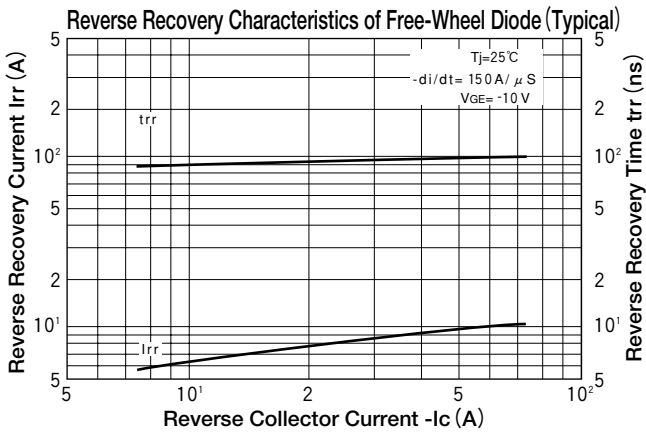
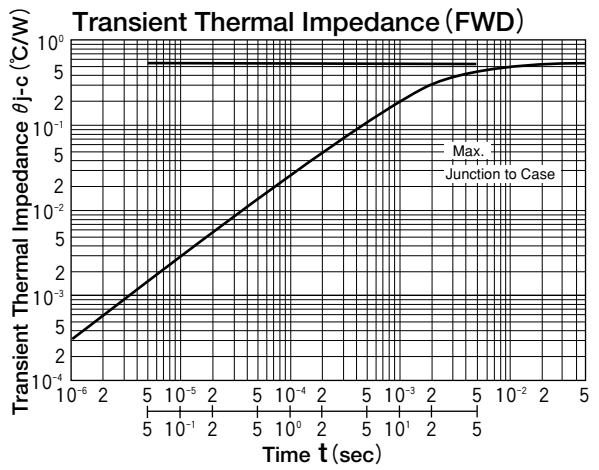
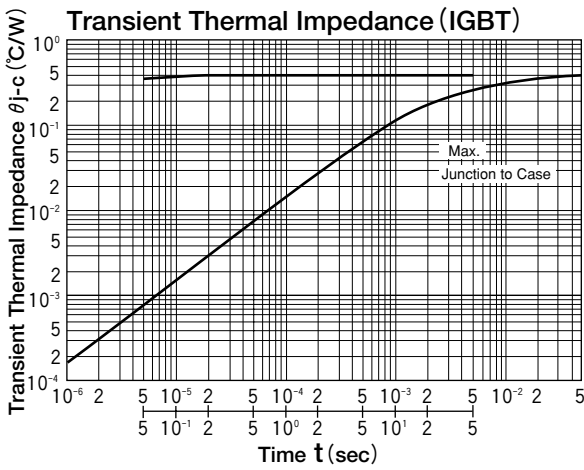
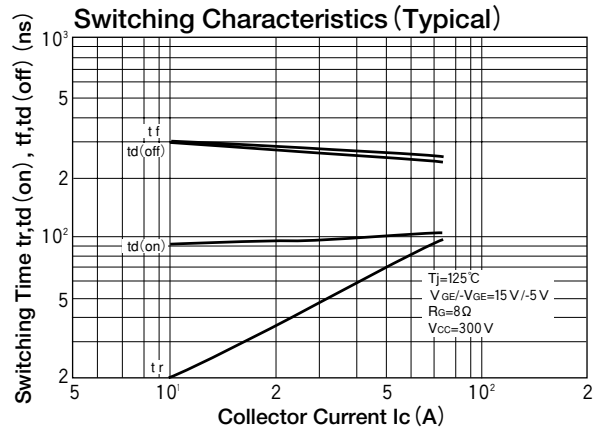
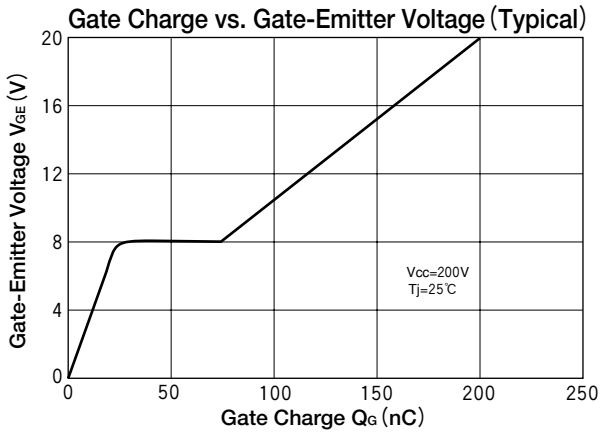
($T_j=25^\circ C$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20V, V_{CE}=0V$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	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	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.55	$^\circ C/W$





IGBT MODULE

GAE100BA60



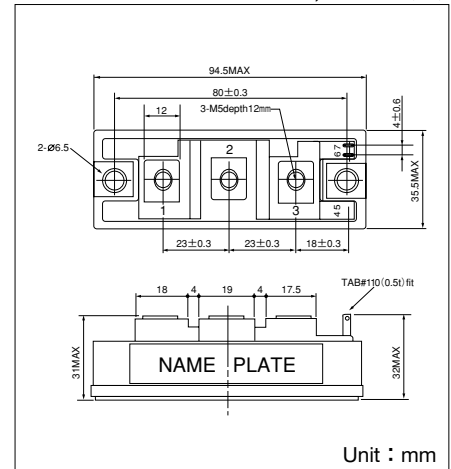
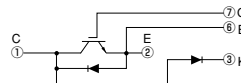
UL;E76102 (M)

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

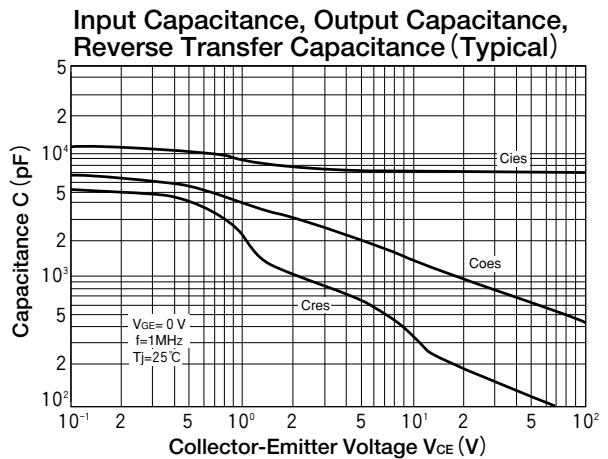
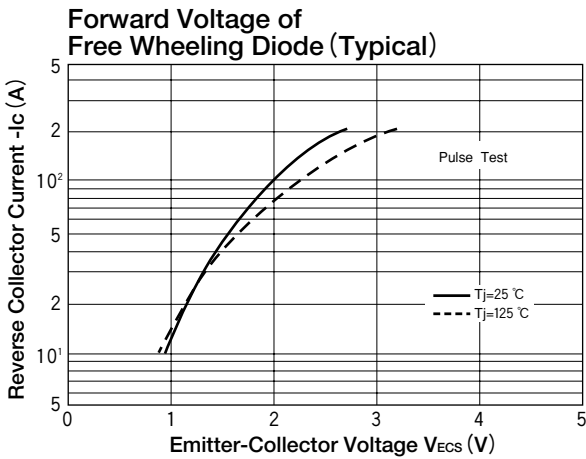
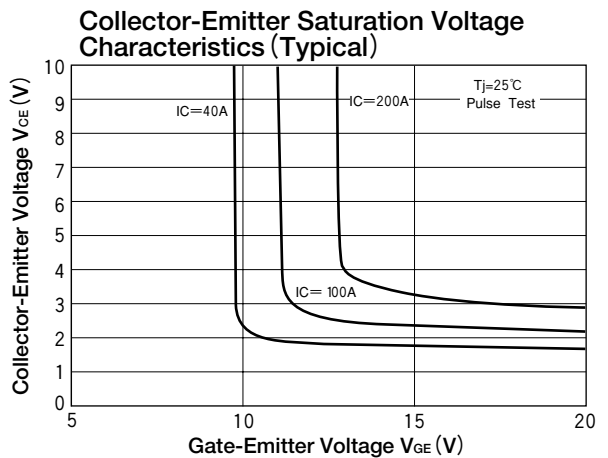
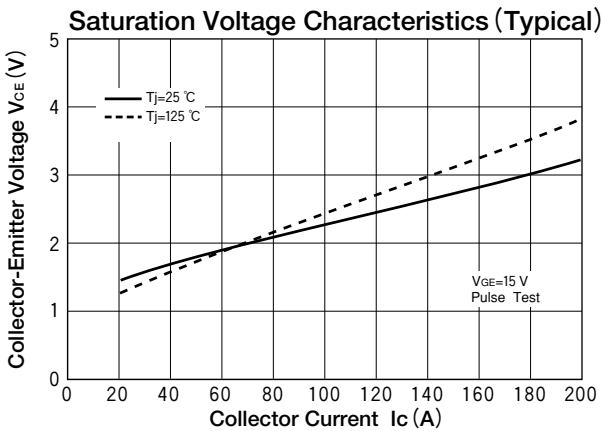
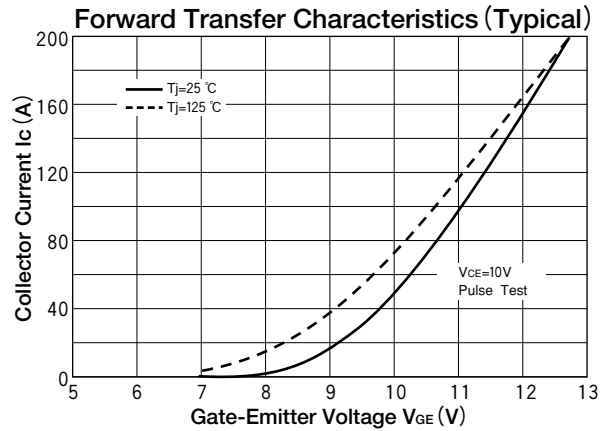
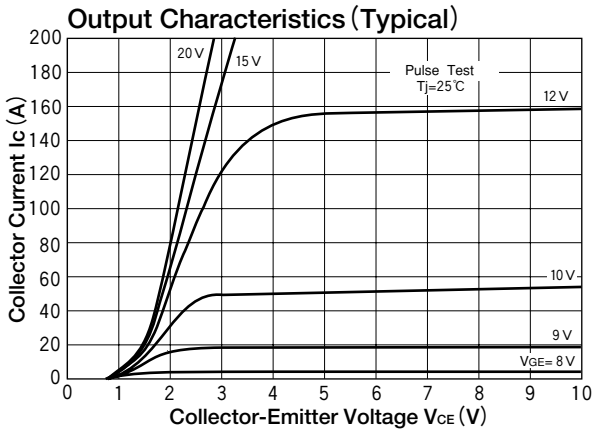
Maximum Ratings

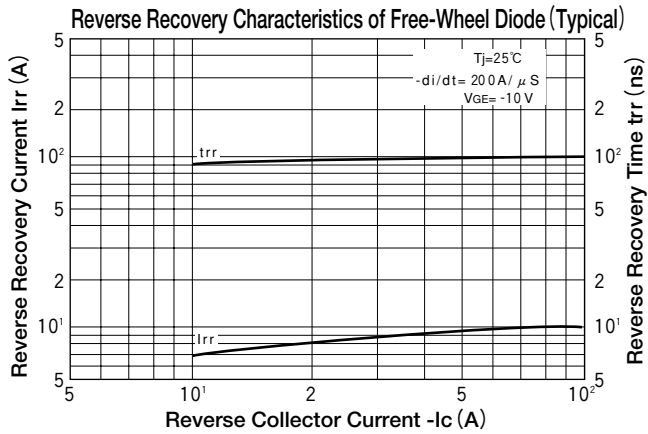
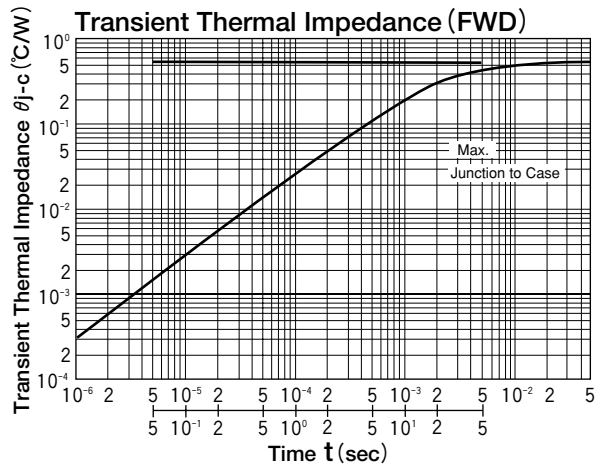
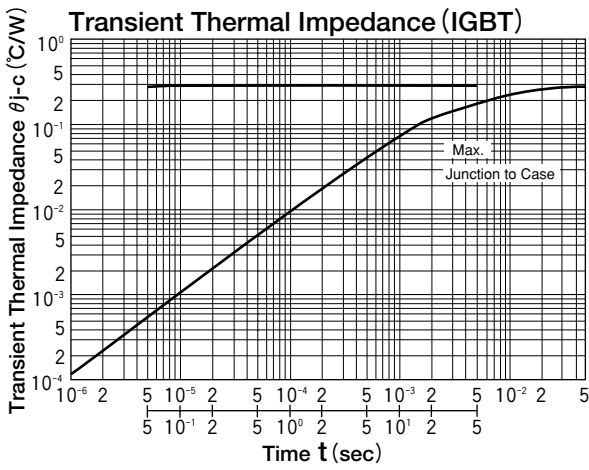
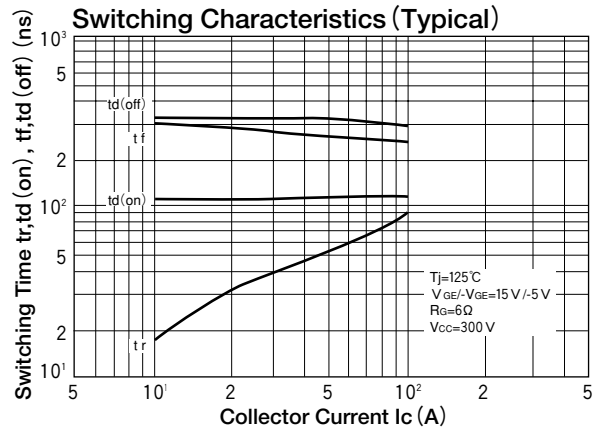
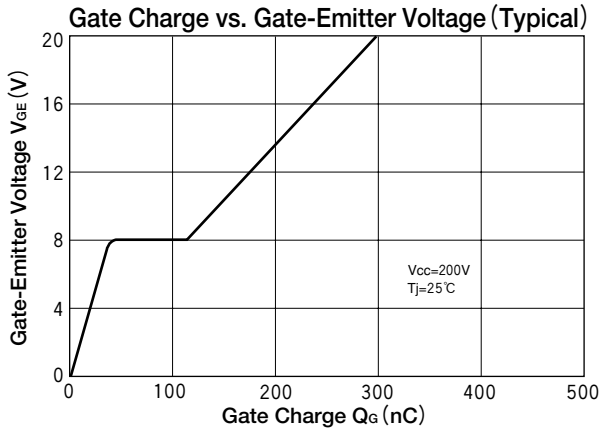
($T_j=25^\circ C$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20V, V_{CE}=0V$			± 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		$V_{CE}=10V, I_C=10mA$	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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.31	$^\circ C/W$
			Diode-Case			0.55	
V_{FM}	Forward Voltage Drop		$I_F=100A, At$ Clamp Diode		2.00	2.80	V
t_{rr}	Reverse Recovery Time		$I_F=100A, di_F/dt=-200A/\mu s, At$ Clamp Diode		0.1	0.15	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.55	$^\circ C/W$





IGBT MODULE

GAE150BA60



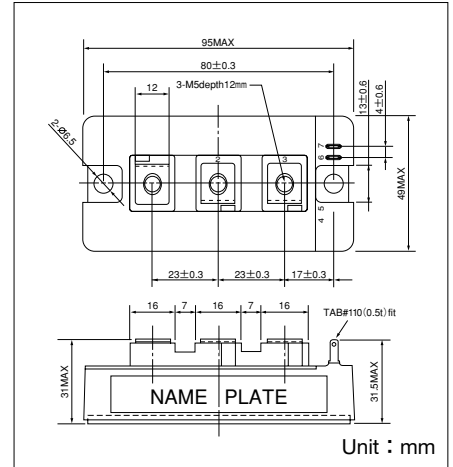
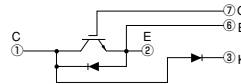
UL;E76102 (M)

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)



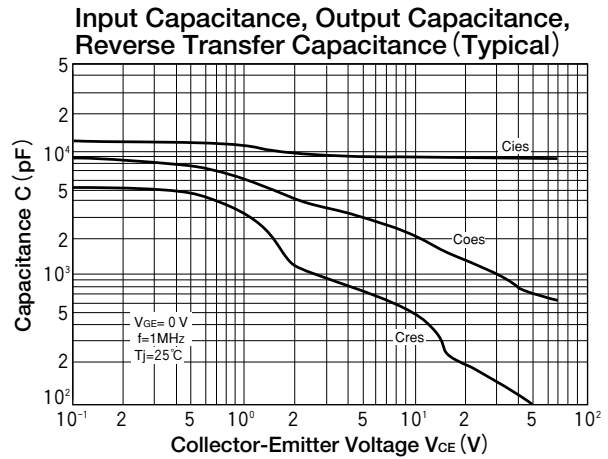
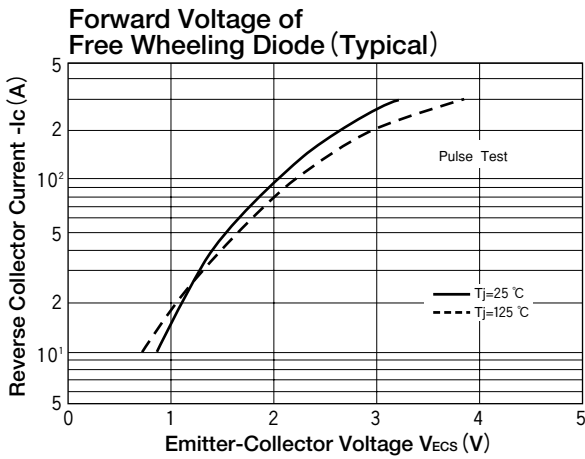
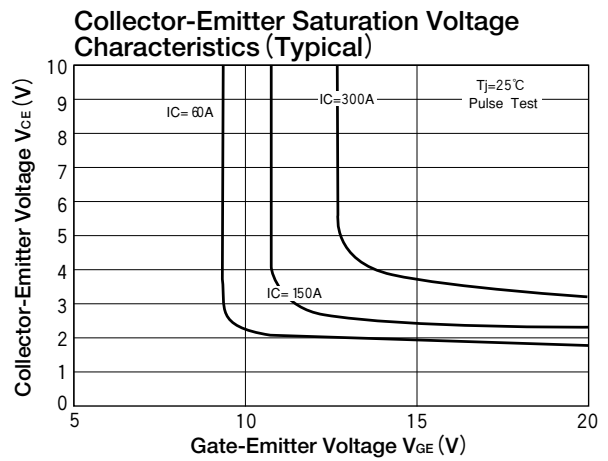
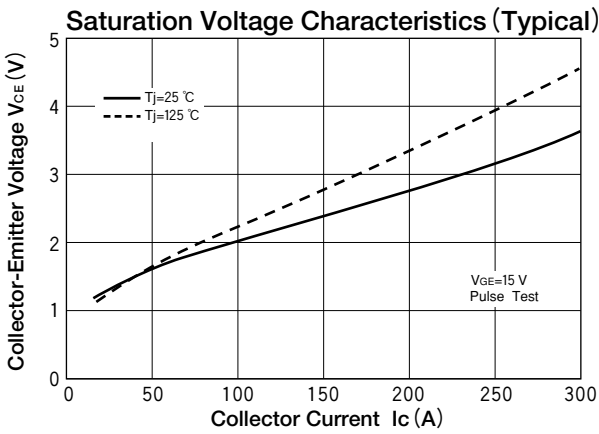
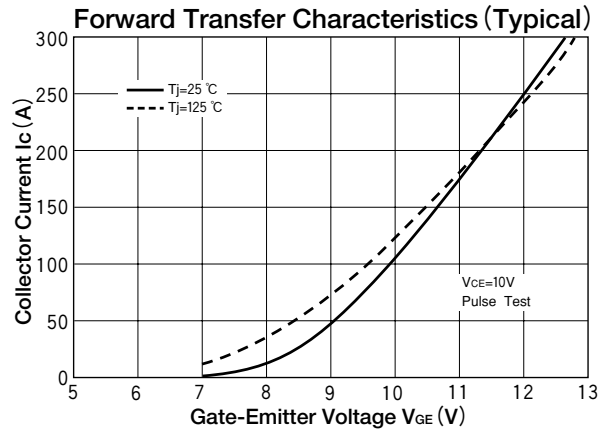
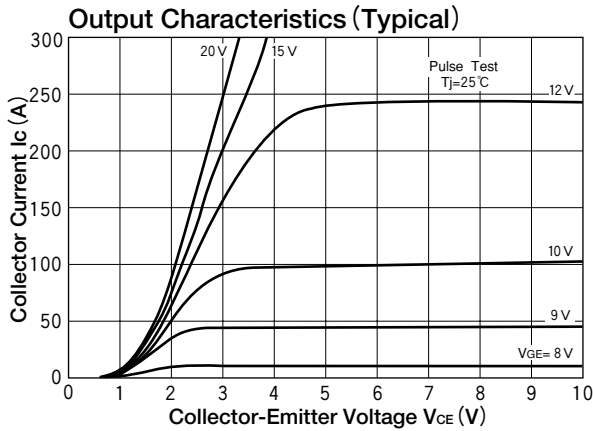
Maximum Ratings

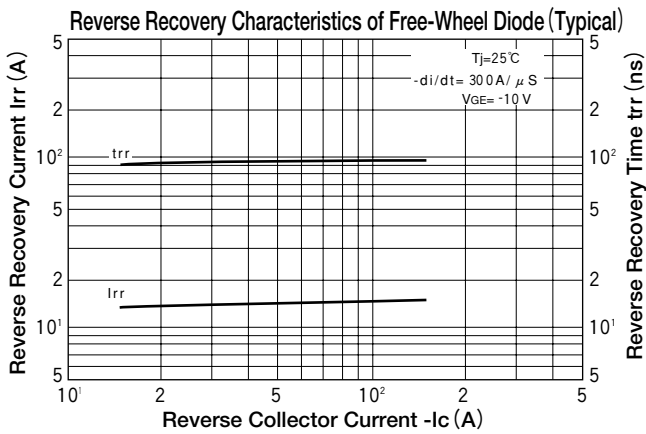
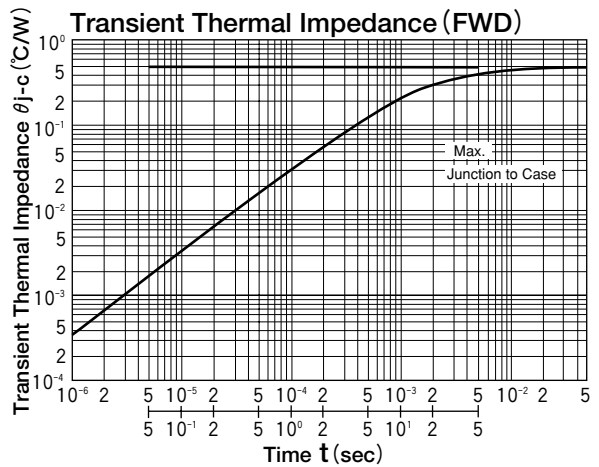
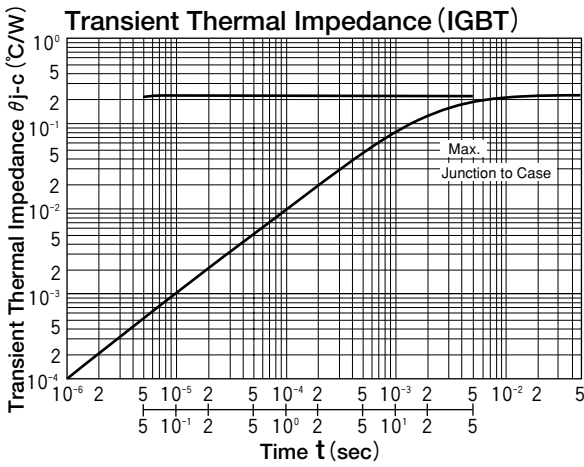
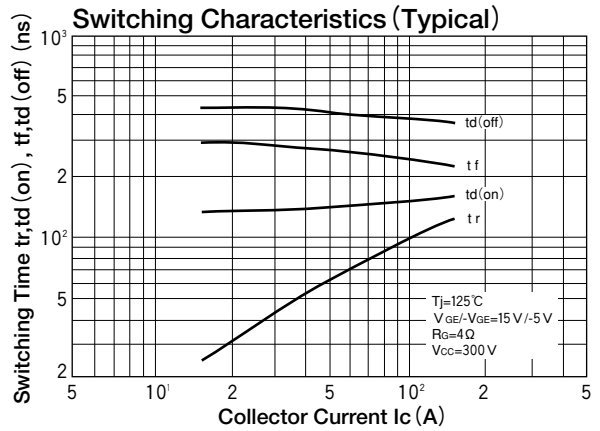
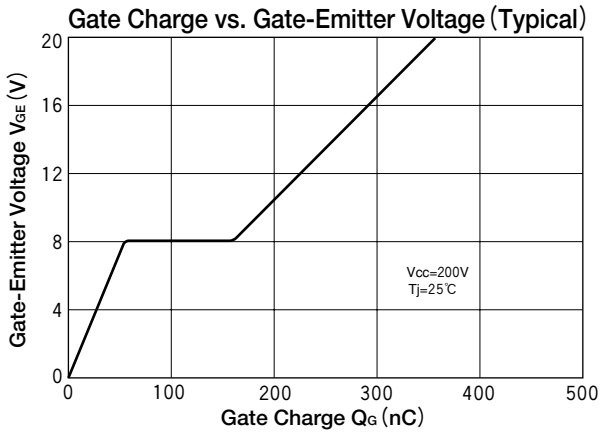
($T_j=25^\circ\text{C}$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	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	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.50	$^\circ\text{C}/\text{W}$





IGBT MODULE

GAE200BA60



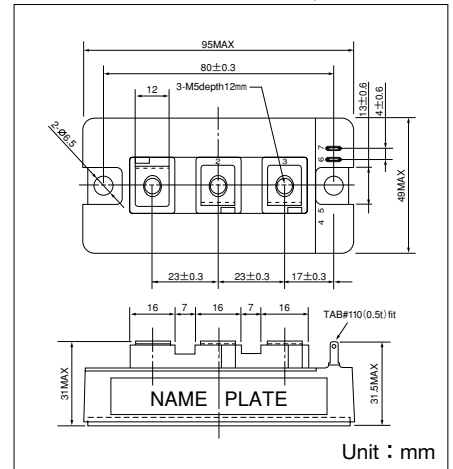
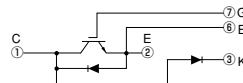
UL;E76102 (M)

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

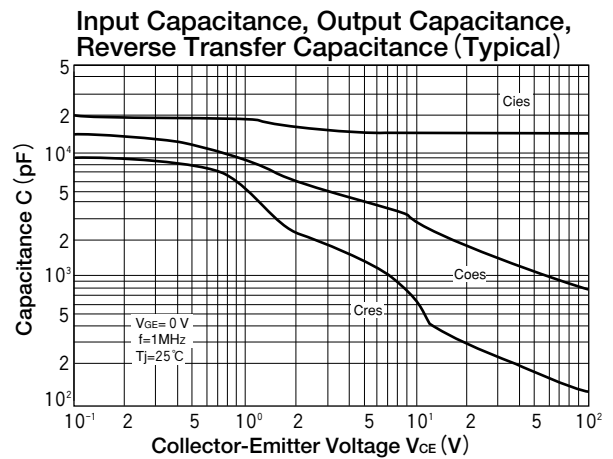
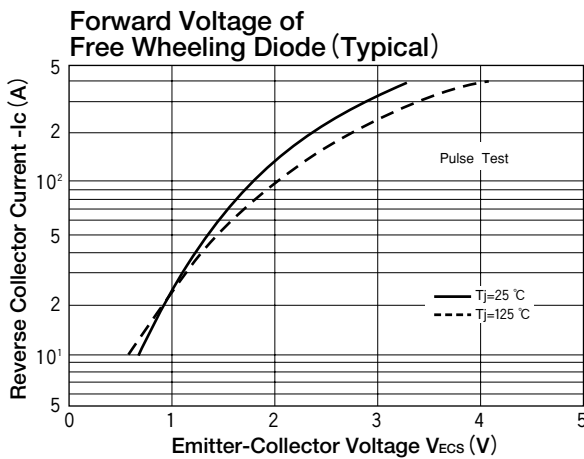
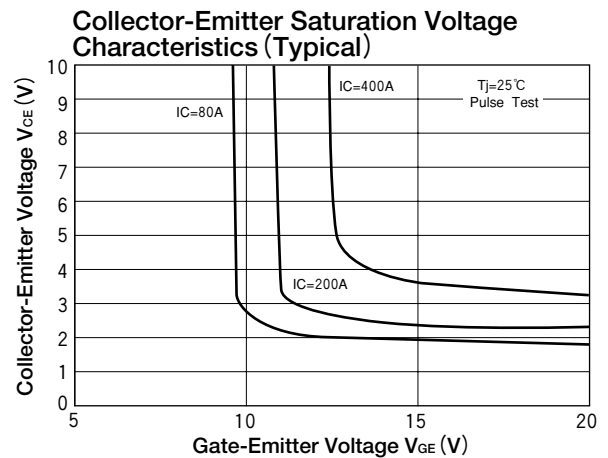
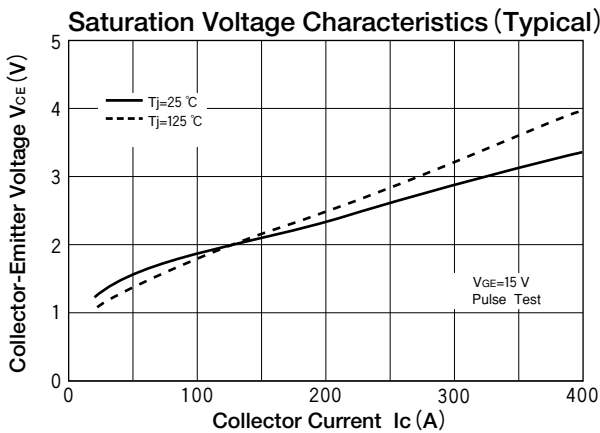
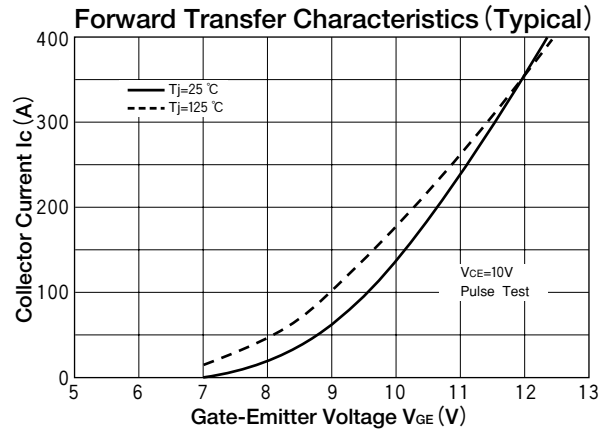
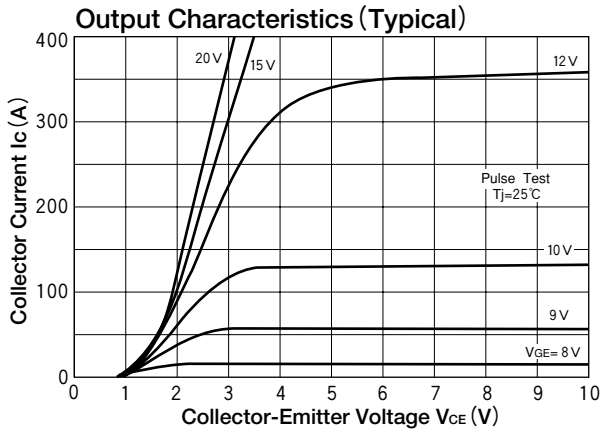
Maximum Ratings

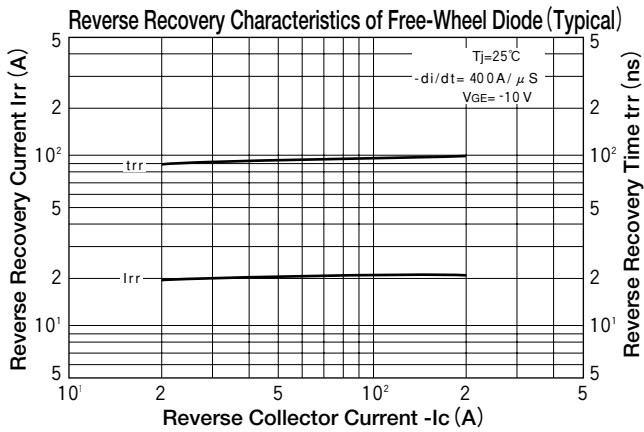
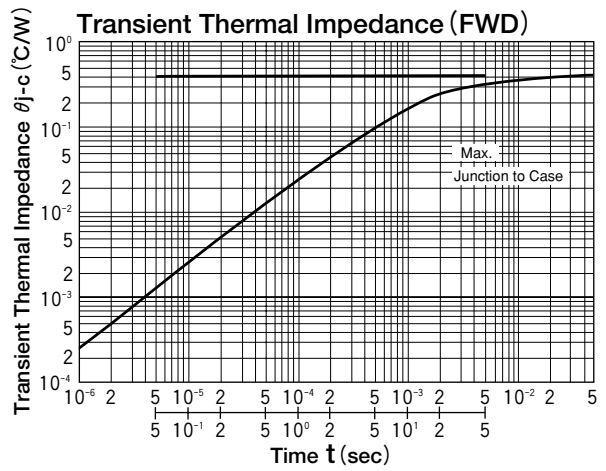
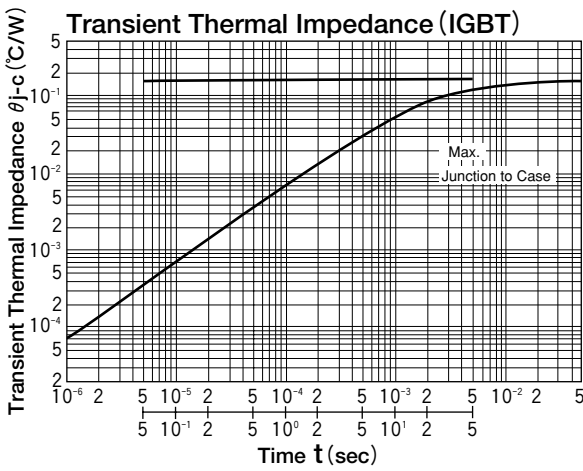
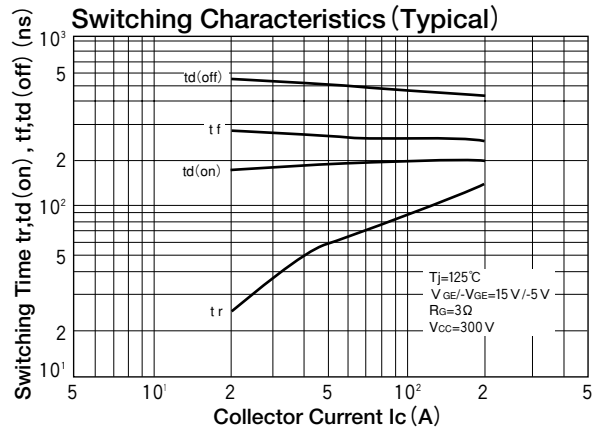
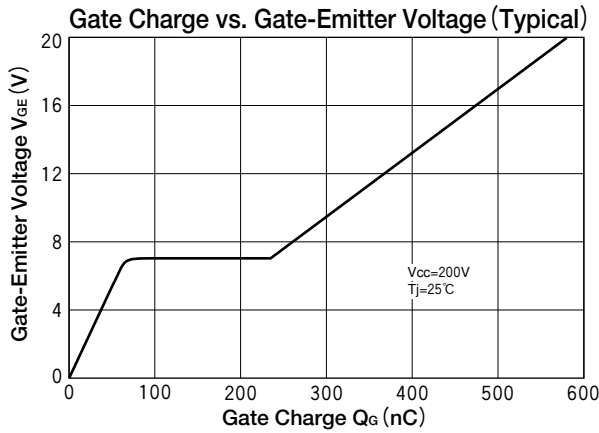
($T_j=25^\circ\text{C}$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	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	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ\text{C}/\text{W}$





IGBT MODULE

GAE300BA60



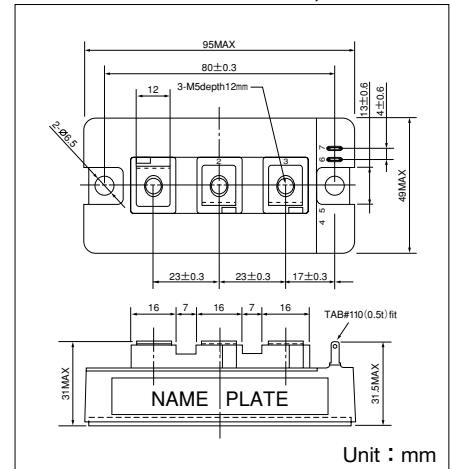
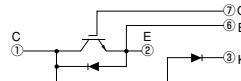
UL;E76102 (M)

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)



Maximum Ratings

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

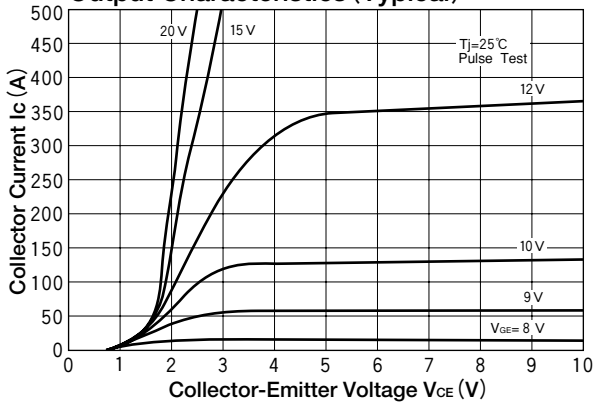
Symbol	Item		Conditions	Ratings		Unit
				GAE300BA60		
V_{CES}	Collector-Emitter Voltage		with gate terminal shorted to emitter	600		V
V_{GES}	Gate-Emitter Voltage		with collector shorted to emitter	± 20		V
I_C	Collector Current	DC		300		A
I_{CP}		Pulse (1 ms)		600		
$-I_C$	Reverse Collector Current			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

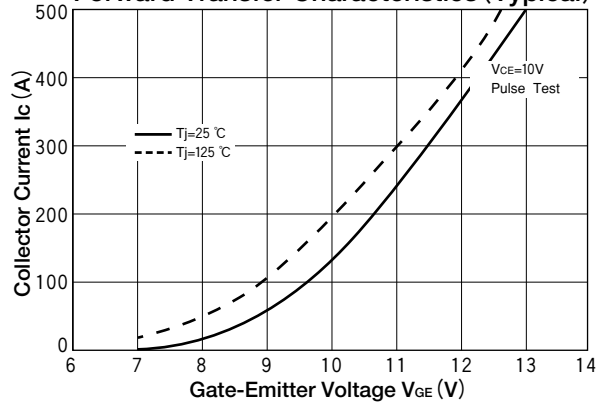
Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
I_{GES}	Gate Leakage Current		$V_{GE}=\pm 20V, V_{CE}=0V$			± 500	nA
I_{CES}	Collector Cut-Off Current		$V_{CE}=600V, V_{GE}=0V$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0V, I_C=1mA$	600			V
$V_{GE(th)}$	Gate Threshold 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	μs
$t_{d(on)}$		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		μs
$R_{th(j-c)}$	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	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ C/W$



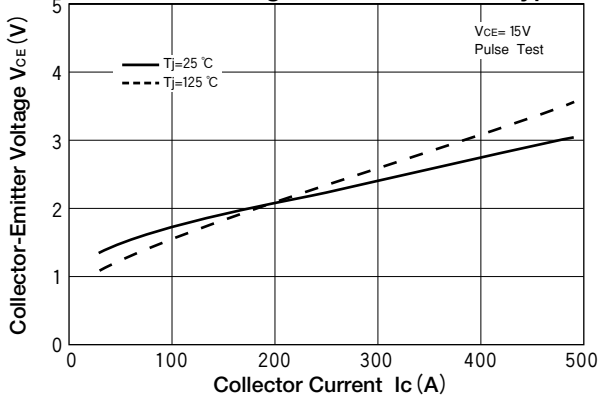
Output Characteristics (Typical)



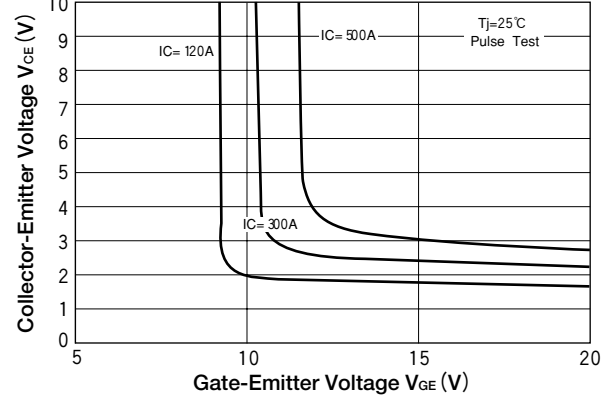
Forward Transfer Characteristics (Typical)



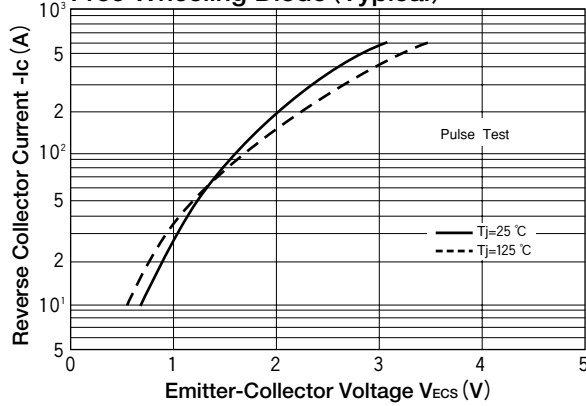
Saturation Voltage Characteristics (Typical)



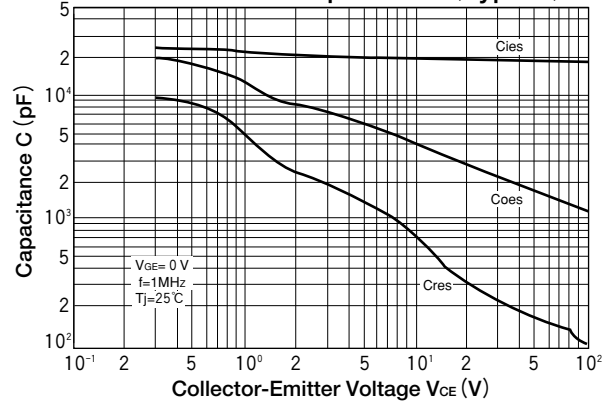
Collector-Emitter Saturation Voltage Characteristics (Typical)

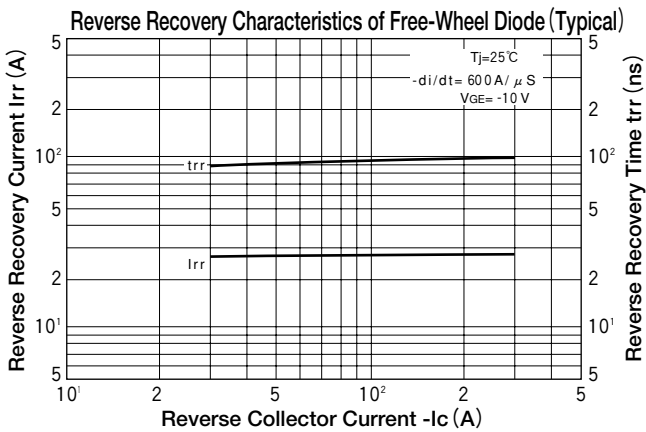
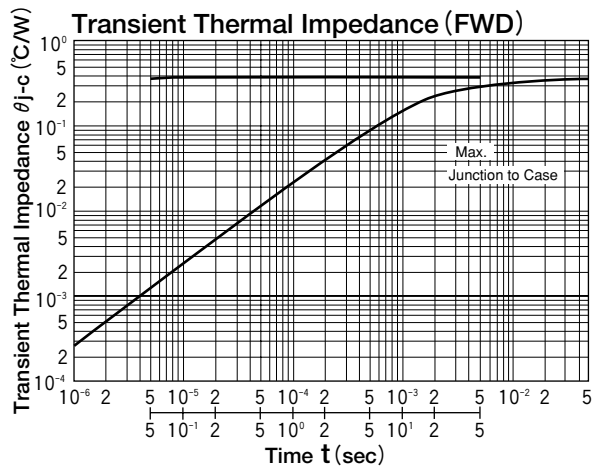
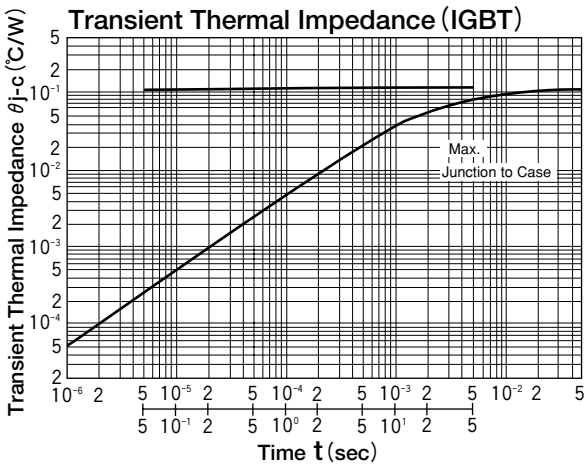
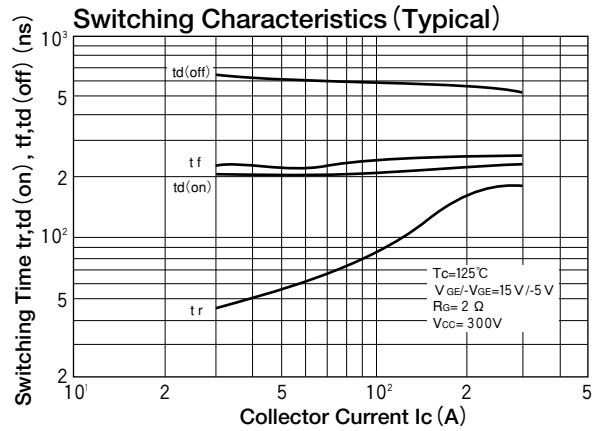
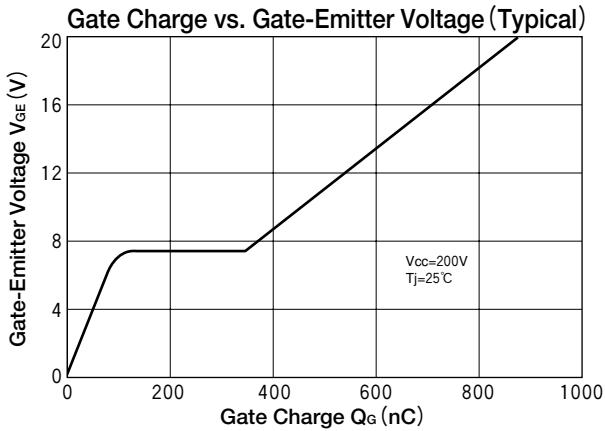


Forward Voltage of Free Wheeling Diode (Typical)



Input Capacitance, Output Capacitance, Reverse Transfer Capacitance (Typical)





IGBT MODULE

GAE75AA120



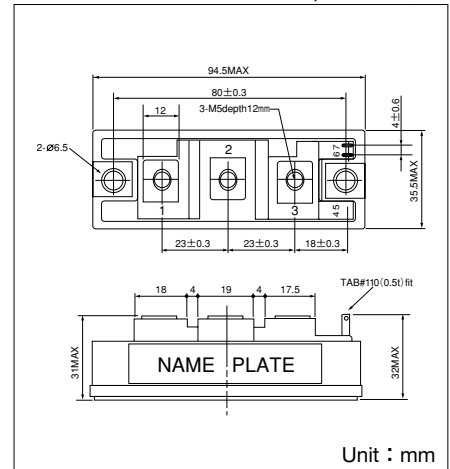
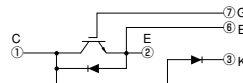
UL;E76102 (M)

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

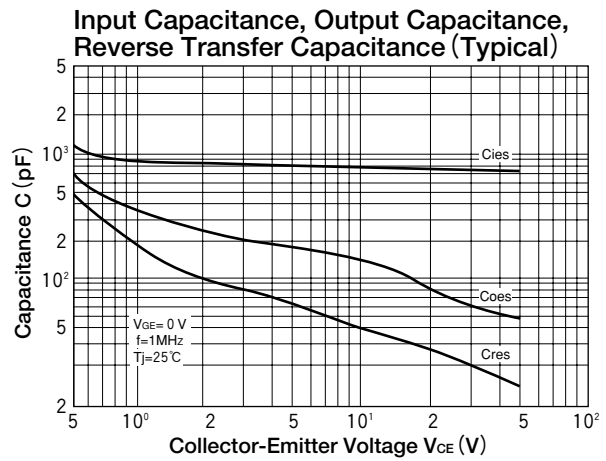
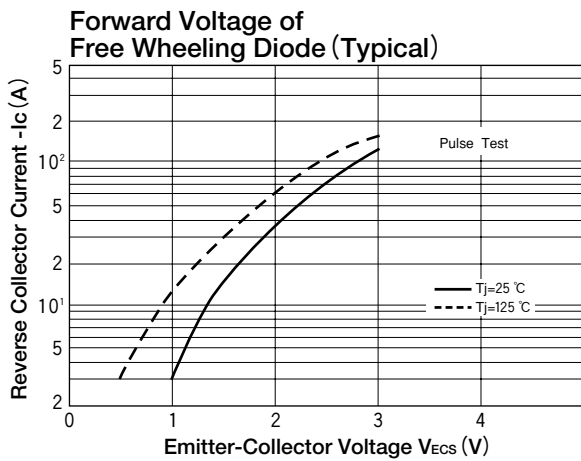
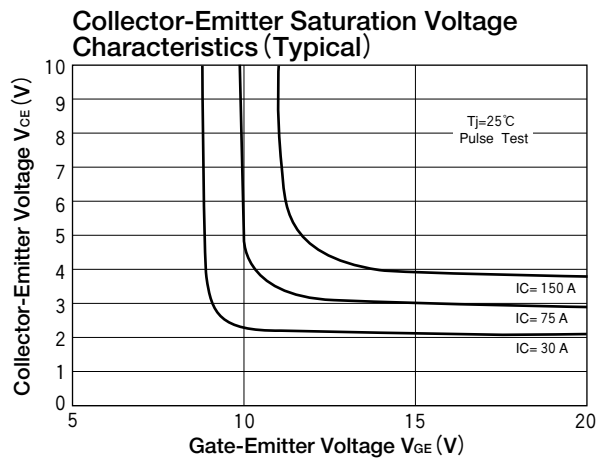
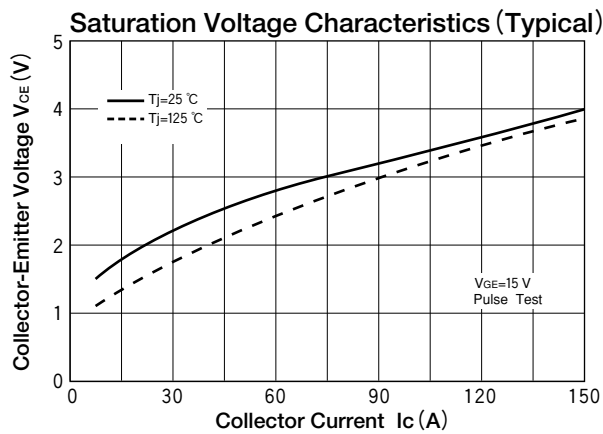
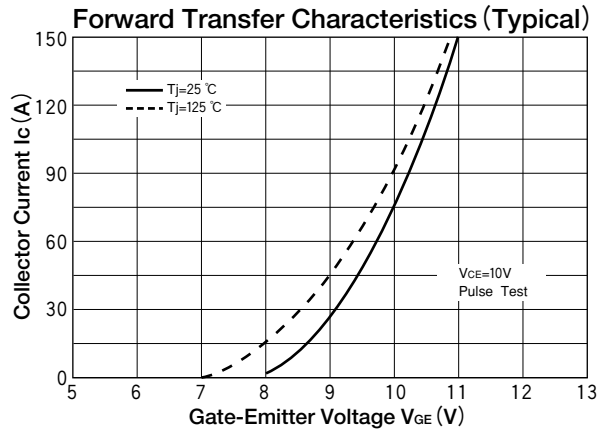
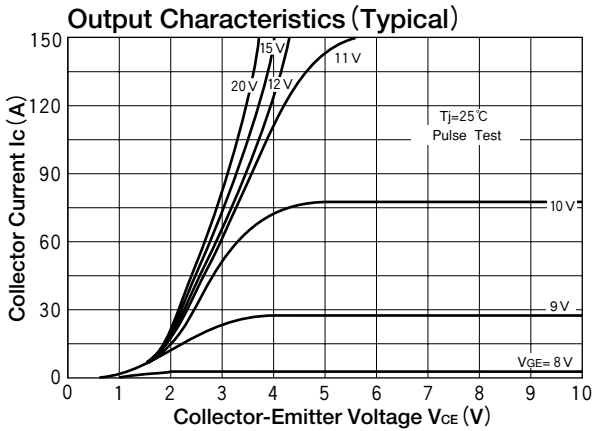
Maximum Ratings

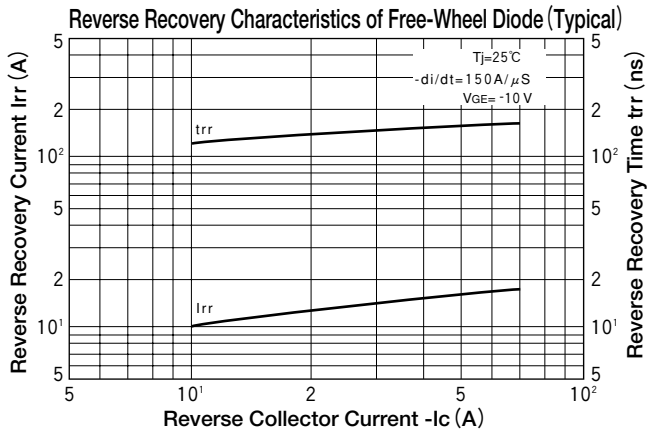
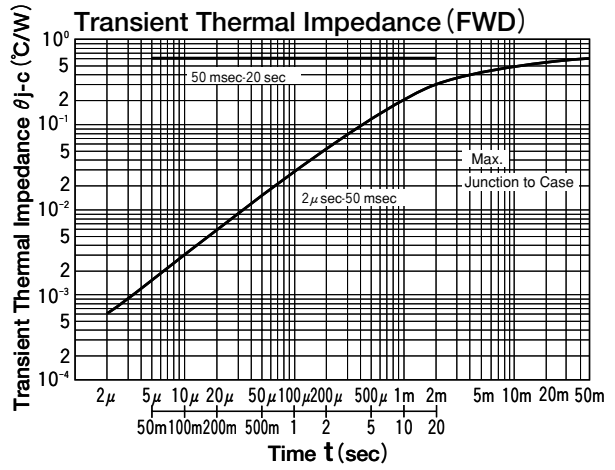
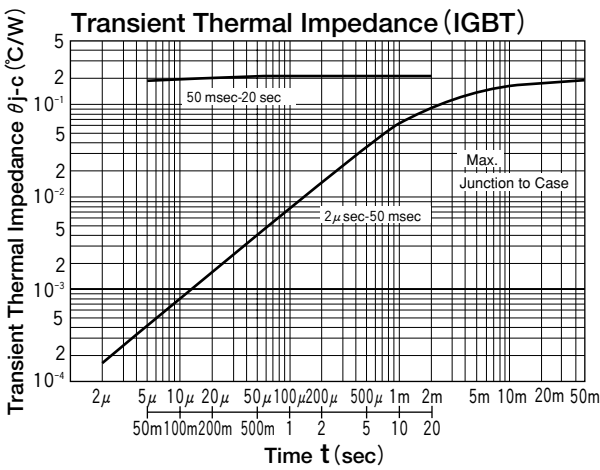
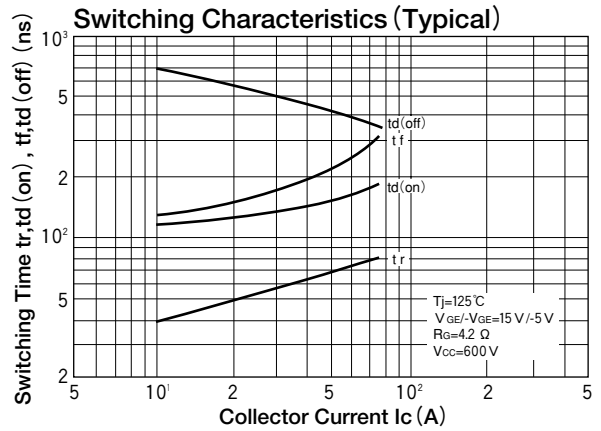
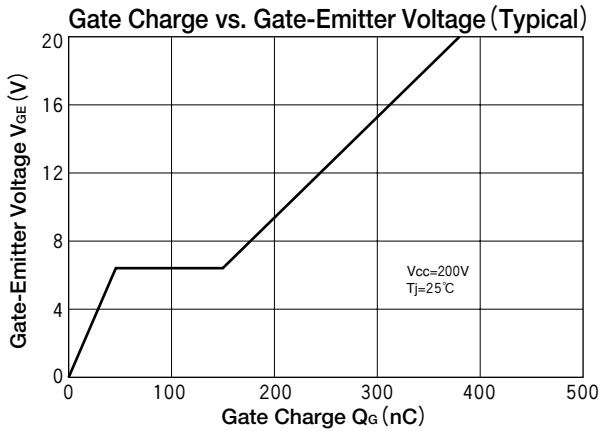
($T_j=25^\circ C$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20V, V_{CE}=0V$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.21	$^\circ C/W$
			Diode-Case			0.6	
V_{FM}	Forward Voltage Drop		$I_F=75A, \text{At Clamp Diode}$		2.50	3.50	V
t_{rr}	Reverse Recovery Time		$I_F=75A, di_F/dt=-150A/\mu s, \text{At Clamp Diode}$		0.15	0.25	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.6	$^\circ C/W$





IGBT MODULE

GAE100AA120



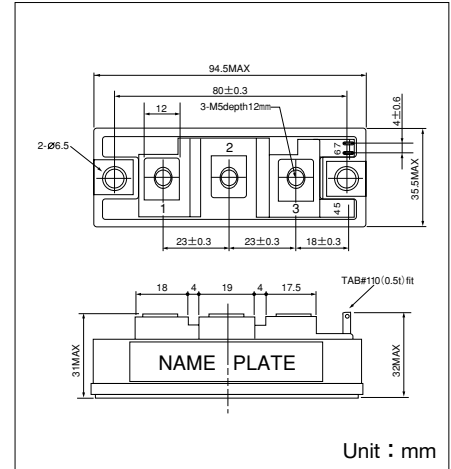
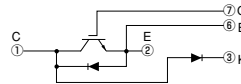
UL;E76102 (M)

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

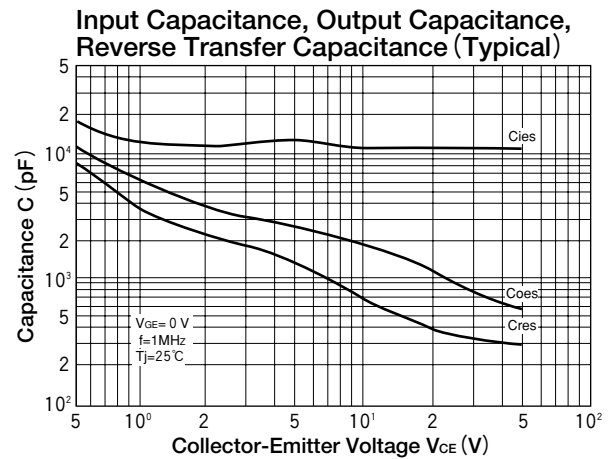
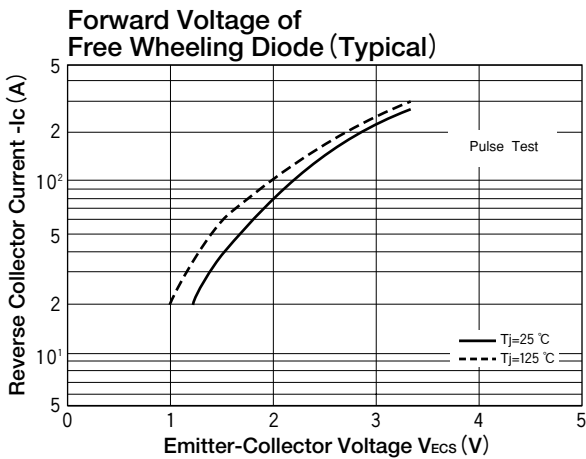
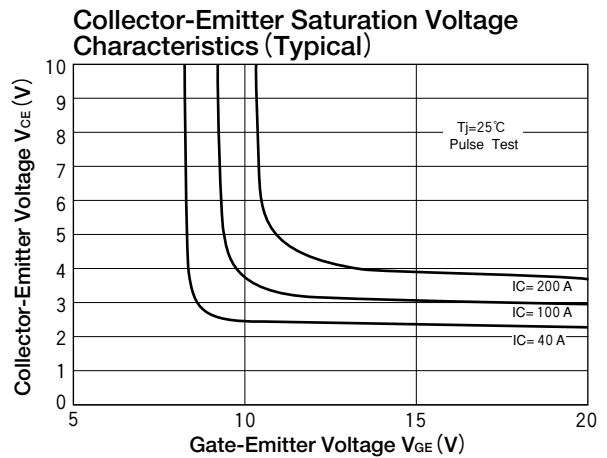
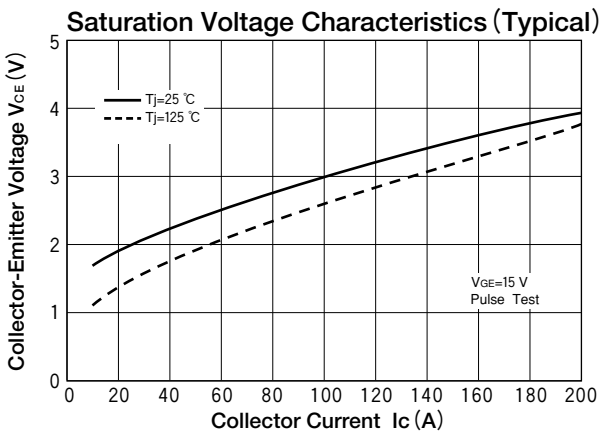
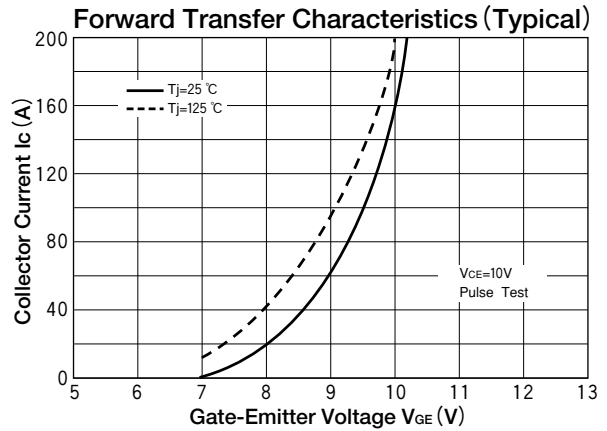
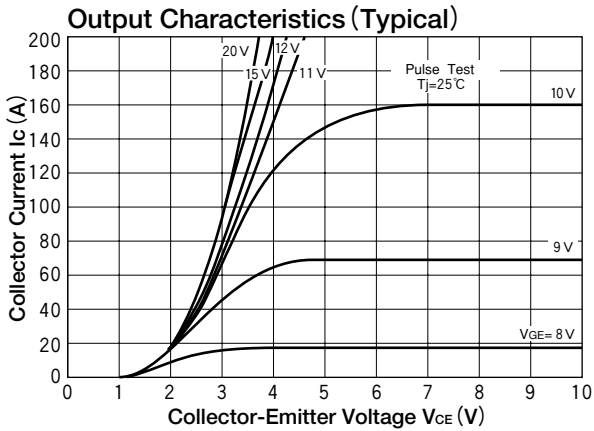
Maximum Ratings

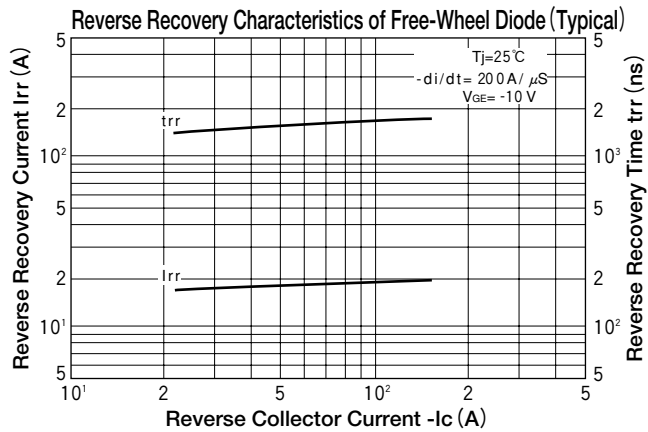
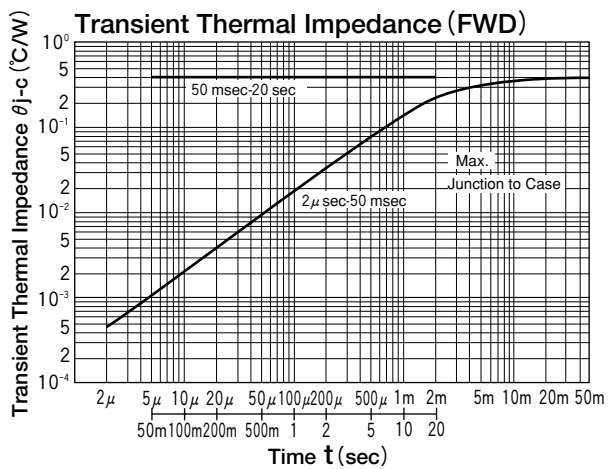
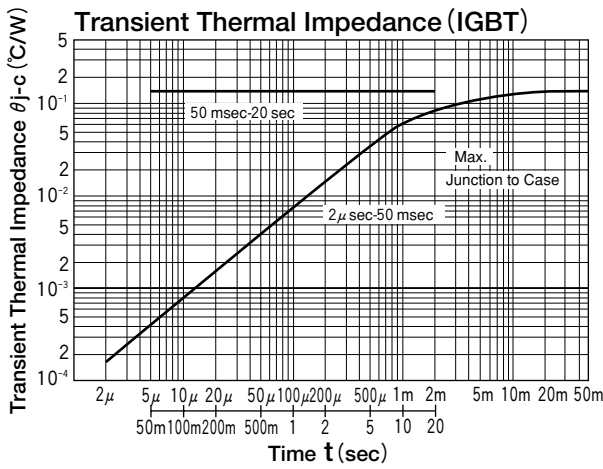
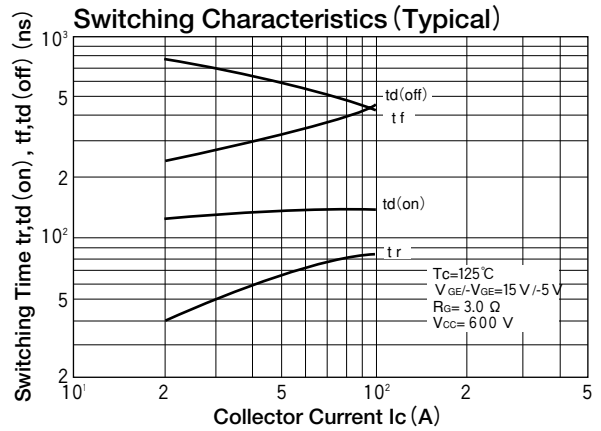
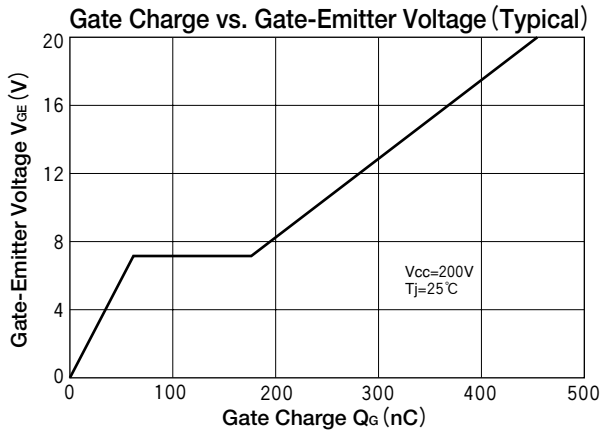
($T_j=25^\circ C$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20V, V_{CE}=0V$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.16	$^\circ C/W$
			Diode-Case			0.40	
V_{FM}	Forward Voltage Drop		$I_F=100A, \text{At Clamp Diode}$		2.20	3.50	V
t_{rr}	Reverse Recovery Time		$I_F=100A, di_F/dt=-200A/\mu s, \text{At Clamp Diode}$		0.15	0.25	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.40	$^\circ C/W$





IGBT MODULE

GAE150AA120



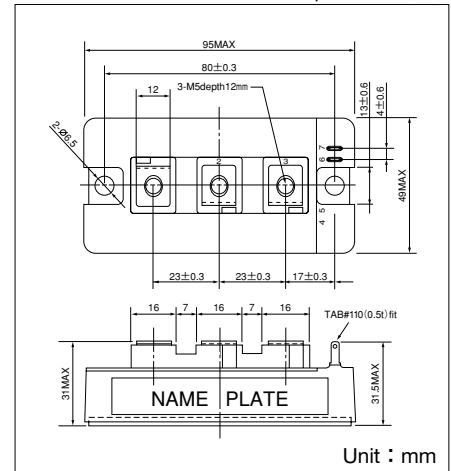
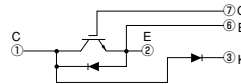
UL;E76102 (M)

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)



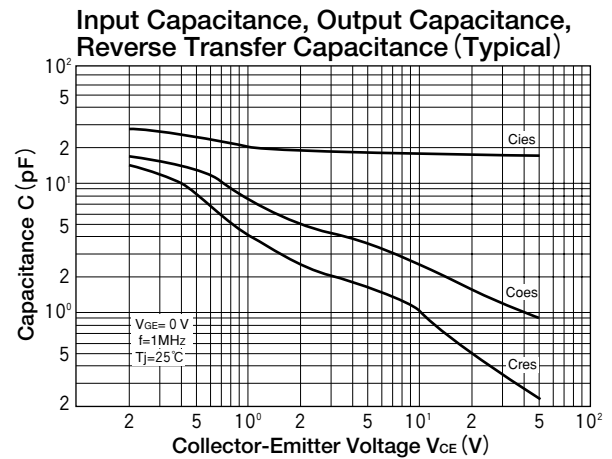
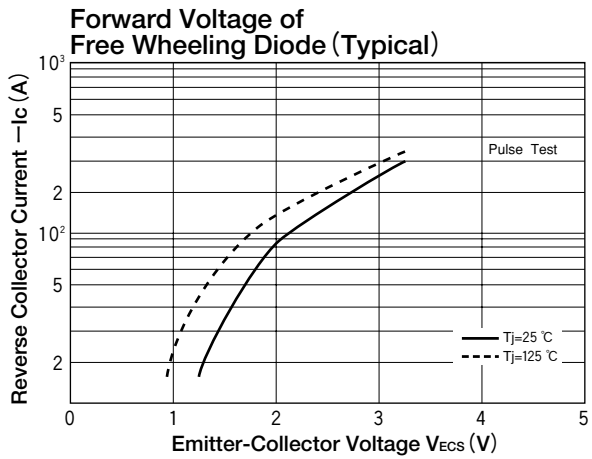
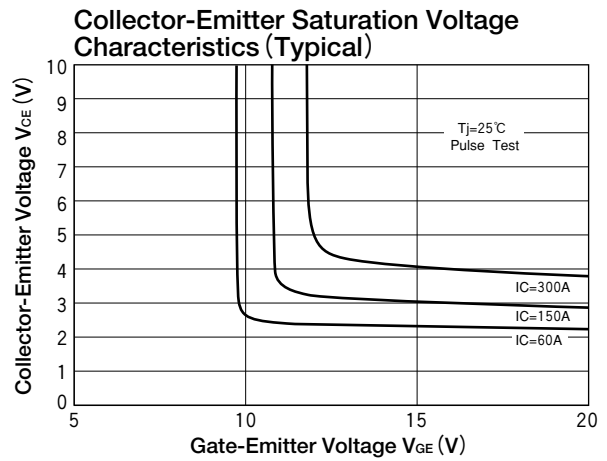
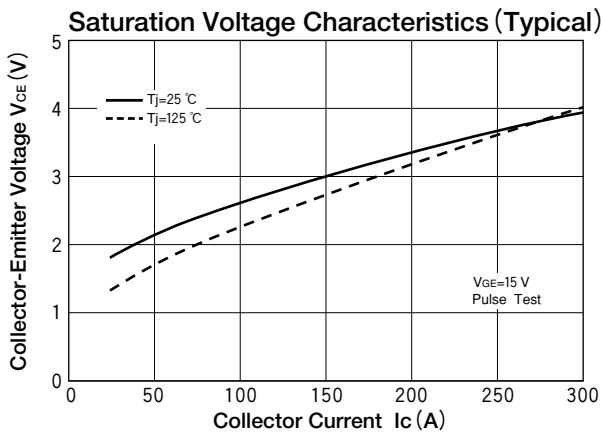
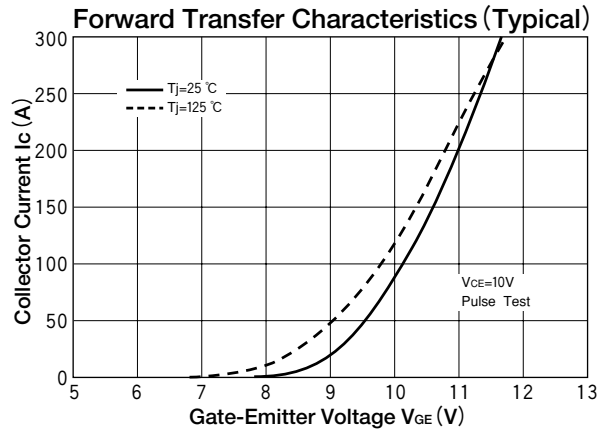
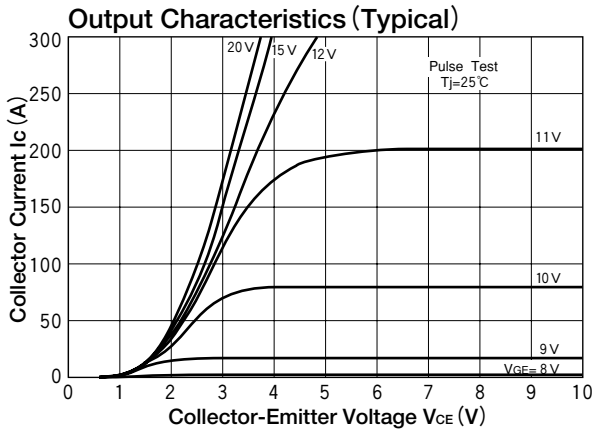
Maximum Ratings

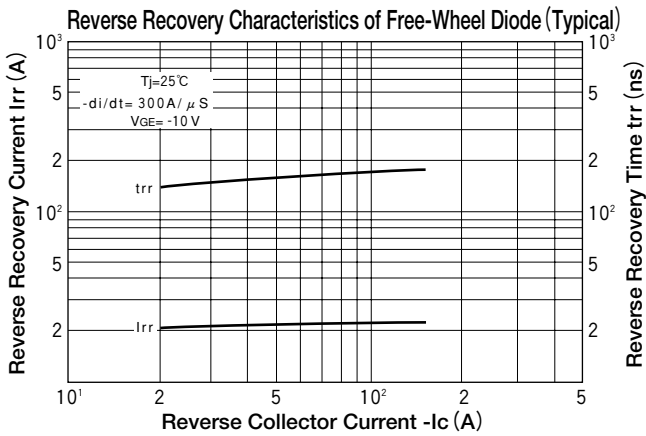
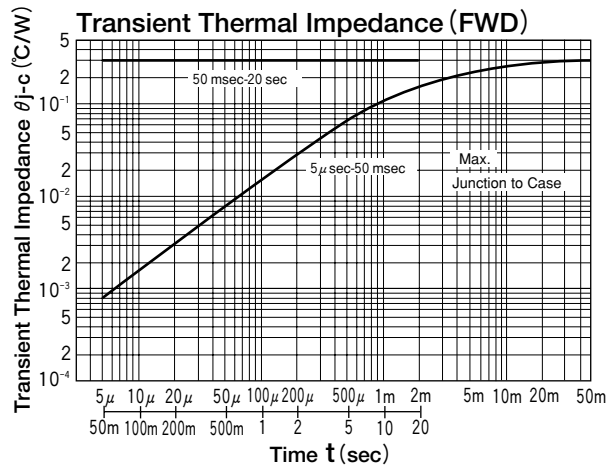
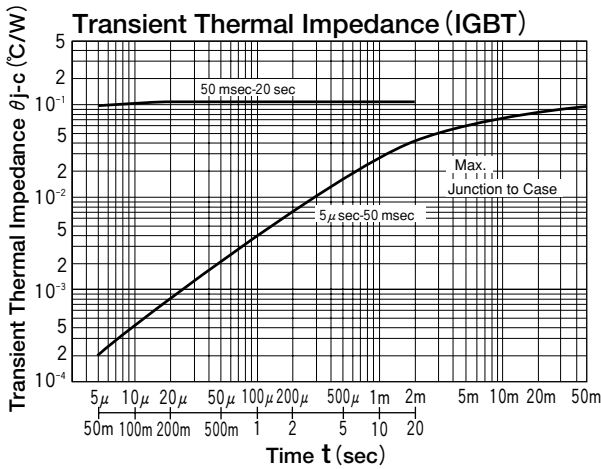
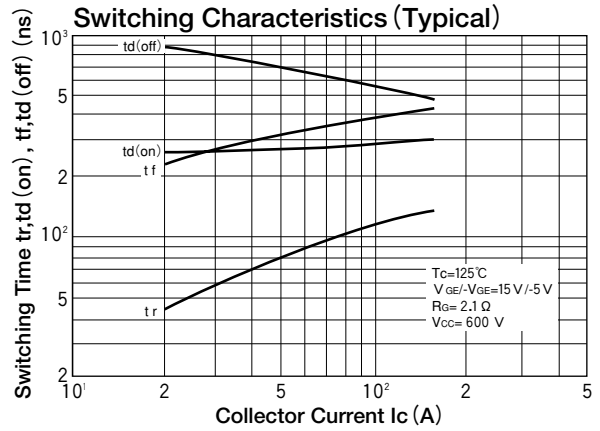
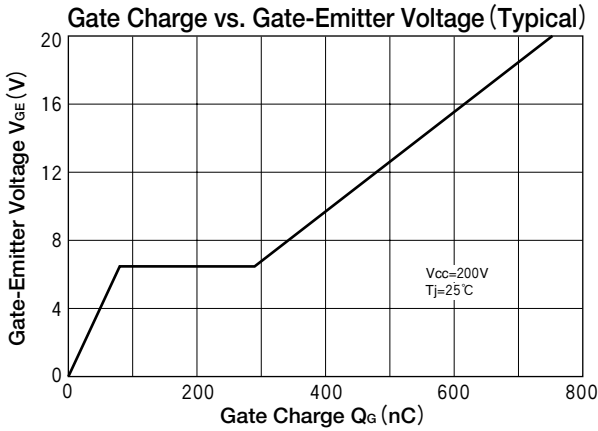
($T_j=25^\circ C$ unless otherwise specified)

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	± 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		$V_{GE}=\pm 20V, V_{CE}=0V$			± 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	μs
$t_{d(on)}$		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	μs
$R_{th(j-c)}$	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	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.30	$^\circ C/W$





IGBT MODULE

GAE200AA120



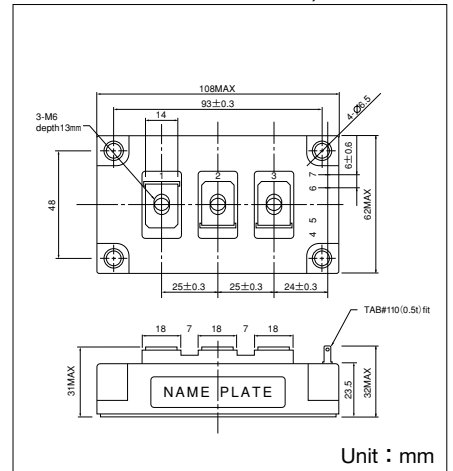
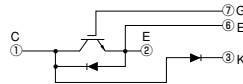
UL;E76102 (M)

SanRex IGBT Module **GAE200AA120** 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.

- $I_C=200\text{A}$ $V_{CES}=1200\text{V}$
- $V_{CE(sat)}=3.0\text{V Typ}$
- $t_f=0.10\ \mu\text{s Typ}$
- Soft recovery diode

(Applications)

Brake for motor control (chopper)



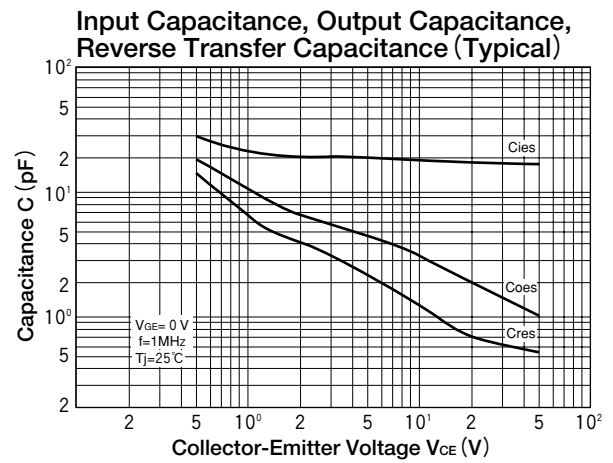
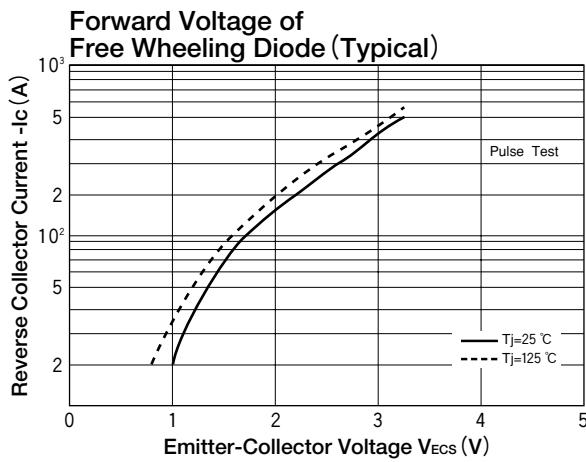
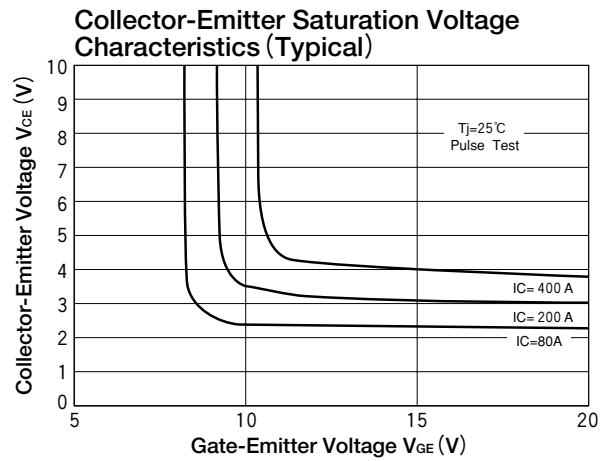
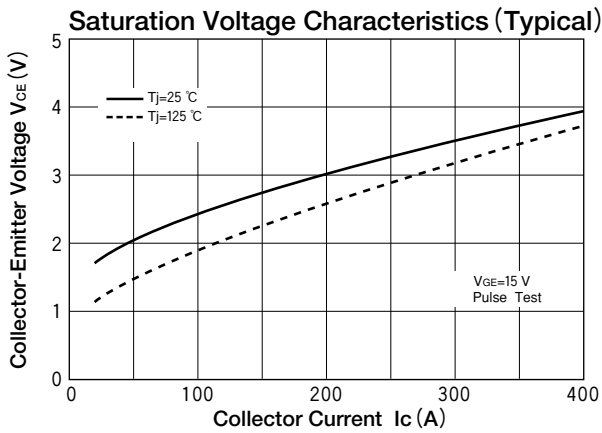
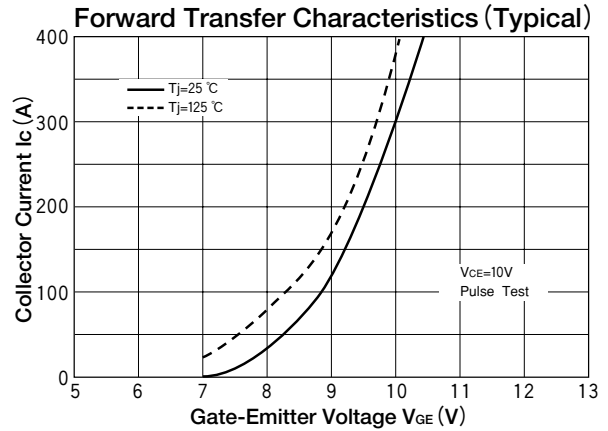
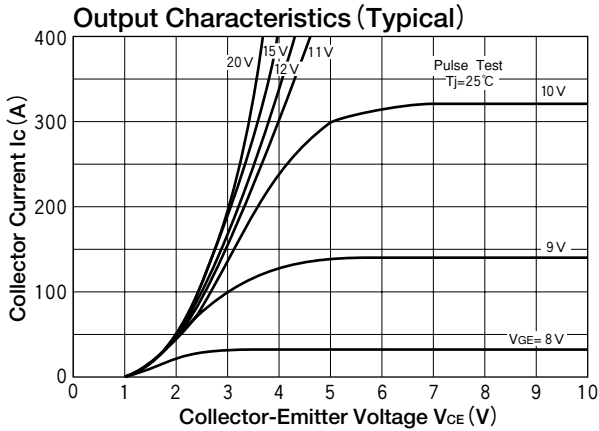
Maximum Ratings

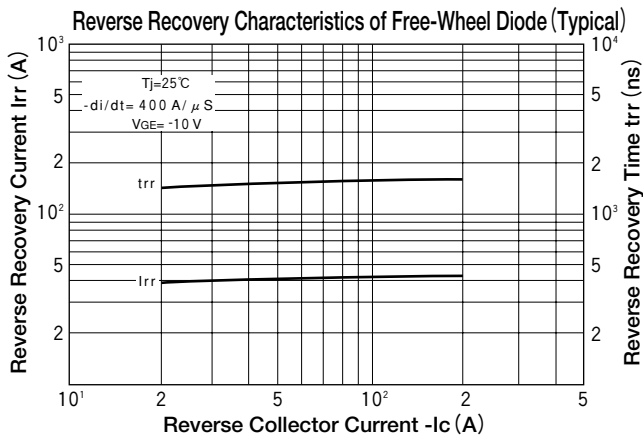
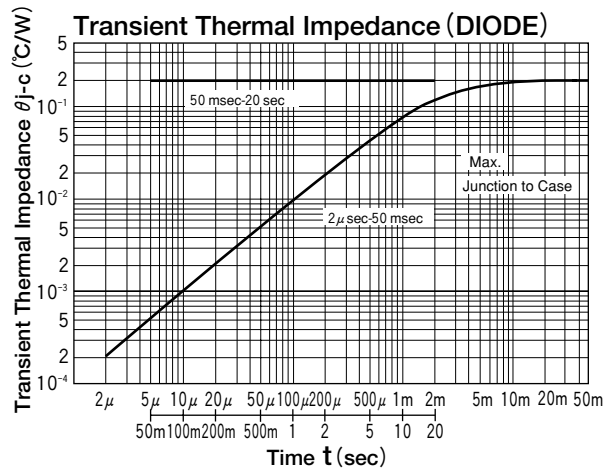
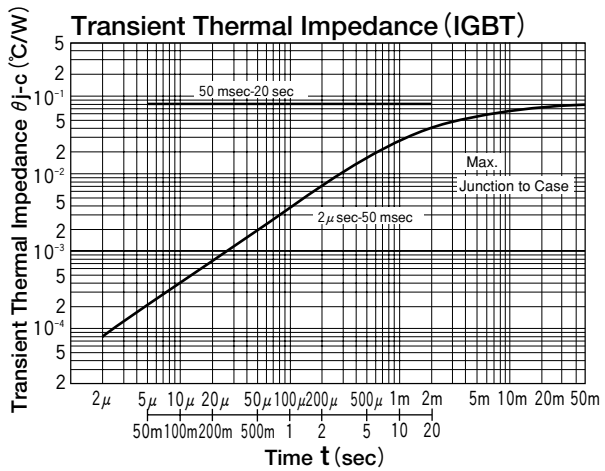
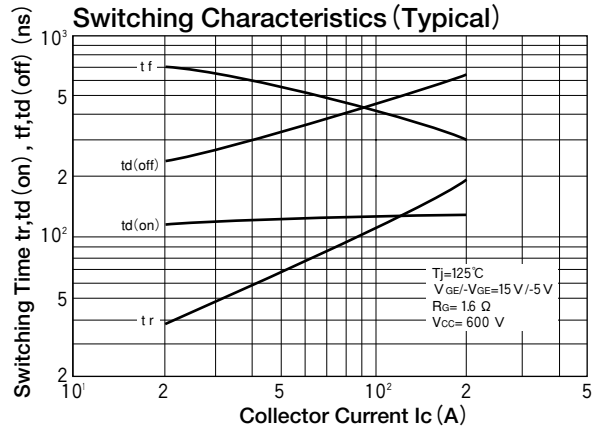
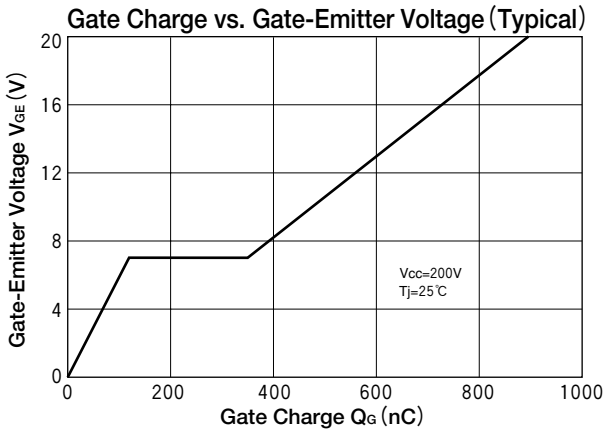
($T_j=25^\circ\text{C}$ unless otherwise specified)

Symbol	Item		Conditions	Ratings		Unit
				GAE200AA120		
V_{CES}	Collector-Emitter Voltage		with gate terminal shorted to emitter	1200		V
V_{GES}	Gate-Emitter Voltage		with collector shorted to emitter	± 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		$T_c=25^\circ\text{C}$	1500		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 (M6)	Recommended Value 2.5-3.9 (25-40)	4.7 (48)		
	Mass		Typical Value	400		g

Electrical Characteristics

Symbol	Item		Conditions	Ratings			Unit
				Min.	Typ.	Max.	
I_{GES}	Gate Leakage Current		$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$			± 500	nA
I_{CES}	Collector Cut-Off Current		$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$			1.0	mA
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage		$V_{GE}=0\text{V}$, $I_C=1\ \text{mA}$	1200			V
$V_{GE(th)}$	Gate Threshold Voltage		$V_{CE}=10\text{V}$, $I_C=20\text{mA}$	4.5		7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage		$I_C=200\text{A}$, $V_{GE}=15\text{V}$		3.0	3.4	V
C_{ies}	Input Capacitance		$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=1\text{MHz}$		20	40	nF
t_r	Switching Time	Rise Time	$I_C=200\text{A}$, $V_{GE}=+15\text{V}/-5\text{V}$ $V_{CC}=600\text{V}$, $R_G=1.6\ \Omega$		0.10	0.25	μs
$t_{d(on)}$		Turn-on Delay Time			0.15	0.35	
t_f		Fall Time			0.10	0.35	
$t_{d(off)}$		Turn-off Delay Time			0.35	0.45	
V_{ECS}	Emitter-Collector Voltage		$-I_C=200\text{A}$, $V_{GE}=0\text{V}$		2.20	3.50	V
t_{rr}	Reverse Recovery Time		$-I_C=200\text{A}$, $V_{GE}=-10\text{V}$, $di/dt=400\text{A}/\mu\text{s}$		0.15	0.25	μs
$R_{th(j-c)}$	Thermal Resistance		IGBT-Case			0.08	$^\circ\text{C}/\text{W}$
			Diode-Case			0.20	
V_{FM}	Forward Voltage Drop		$I_F=200\text{A}$, At Clamp Diode		2.20	3.50	V
t_{rr}	Reverse Recovery Time		$I_F=200\text{A}$, $di_F/dt=-400\text{A}/\mu\text{s}$, At Clamp Diode		0.15	0.25	μs
$R_{th(j-c)}$	Thermal Resistance		Junction-Case, At Clamp Diode			0.20	$^\circ\text{C}/\text{W}$





HYBRID GATE DRIVER IC FOR IGBT

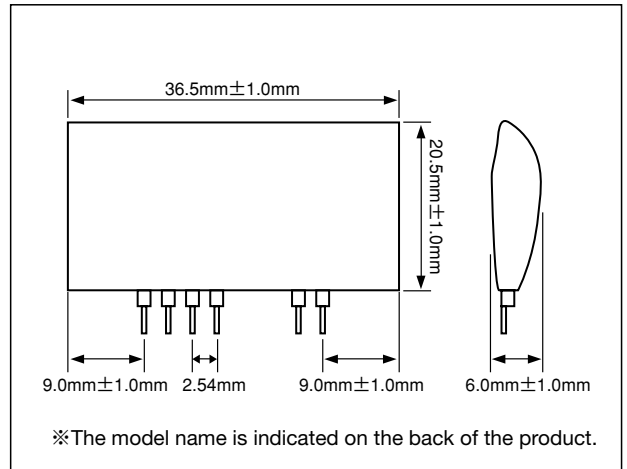
GH-038

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)

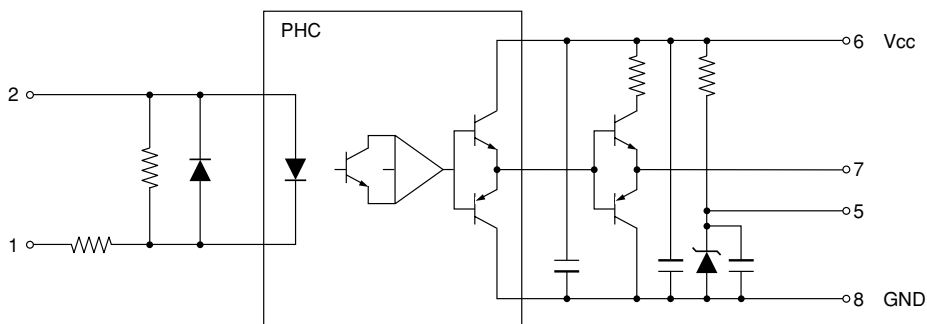


Maximum Ratings

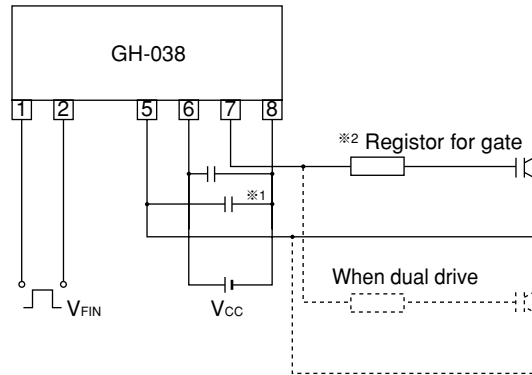
(T_j=25°C unless otherwise specified)

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

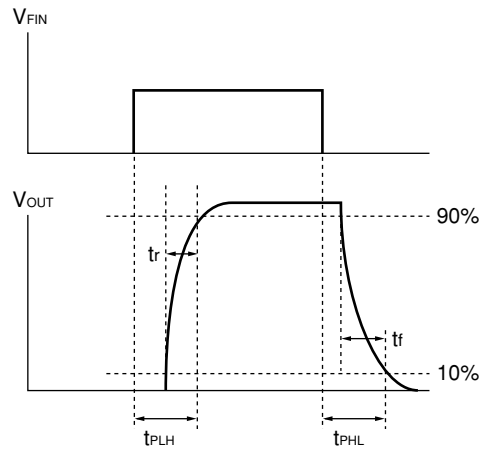
Equivalent Circuit



■ Example of Application



- ※1 Design the capacitor (more than 10 μ 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

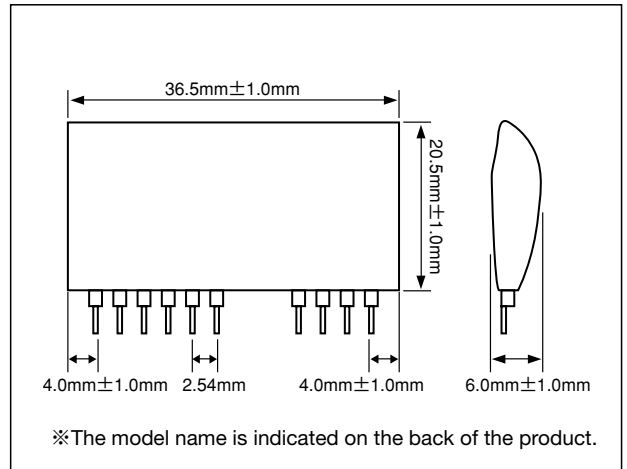
GH-039

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

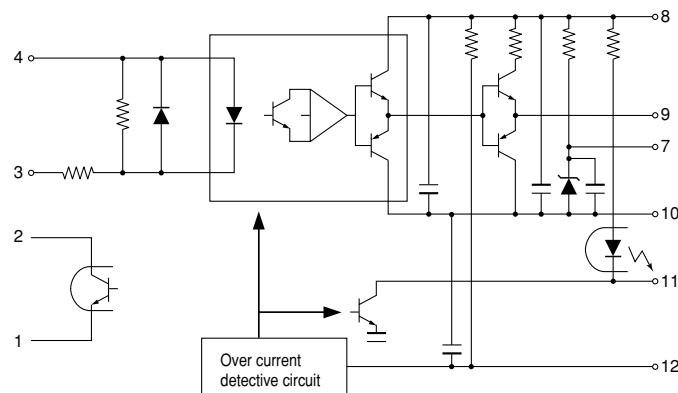


Maximum Ratings

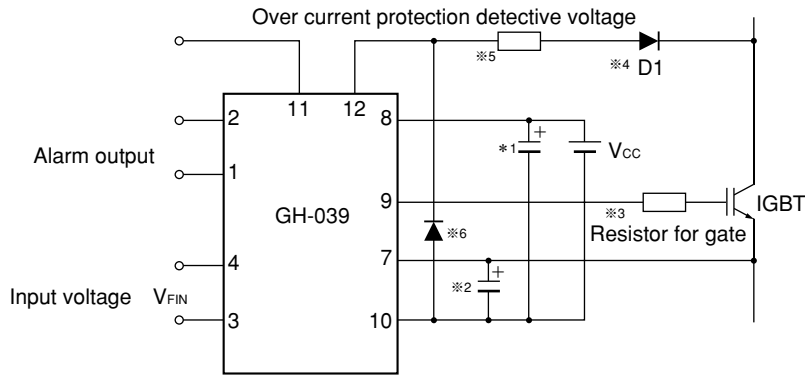
(T_j=25°C unless otherwise specified)

Symbol	Item	Conditions	Ratings			Unit
			Min.	Typ.	Max.	
V _{CC}	Supply Voltage		23.0	26.0	28.0	V
V _{OH}	Forward Bias Output Voltage	V _{CC} =26.0V	15.4	17.5	18.0	V
V _{RB}	Reverse Bias Supply Voltage	V _{CC} =26.0V	7.0	8.0	10.0	V
V _{FIN}	Photo Coupler Input Voltage			5.0	7.0	V
I _F	Photo Coupler Input Current	V _{FIN} =5.0V	9.0	10.0	11.5	mA
I _{g1}	Output Forward Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
I _{g2}	Output Reverse Current	PW=2 μs, Duty cycle=less than 0.05		4.0	6.0	A
t _{PLH}	Switching Time-High side	V _{CC} =26.0V, I _F =10mA			1.5	μs
t _{PHL}	Switching Time-Low side	V _{CC} =26.0V, I _F =10mA			1.5	μs
t _r	Rise Time	V _{CC} =26.0V, I _F =10mA			1.0	μs
t _f	Fall Time	V _{CC} =26.0V, I _F =10mA			1.0	μs
V _{OC}	Overcurrent trip level	V _{CC} =26.0V	11.5	12.0	12.5	V
t _{OCP}	OCP delay time	V _{CC} =26.0V, I _F =10mA		4.0	10.0	μs
t _{pcoff}	OCP rise and fall time	V _{CC} =26.0V, I _F =10mA	2.0	5.0		μs
t _{ALM}	Alarm output delay time	V _{CC} =26.0V, I _F =10mA		1.0	5.0	μs
I _{FO}	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

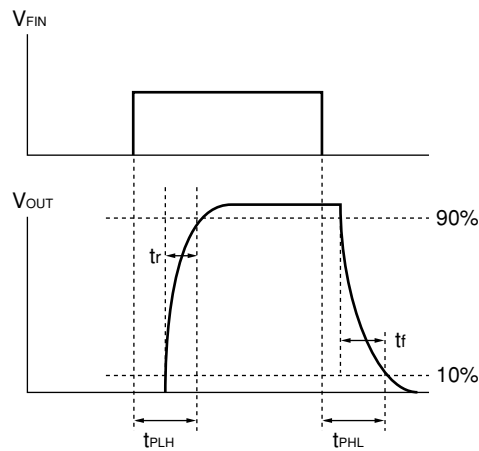
Equivalent Circuit



Example of Application



- ※1, ※2 Design the capacitor (more than 10 μ 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 Ω



Definition of over current protection function

