MITSUBISHI GATE COMMUTATED TURN-OFF THYRISTOR UNIT

GCU40AA-90

HIGH POWER INVERTER USE
PRESS PACK TYPE

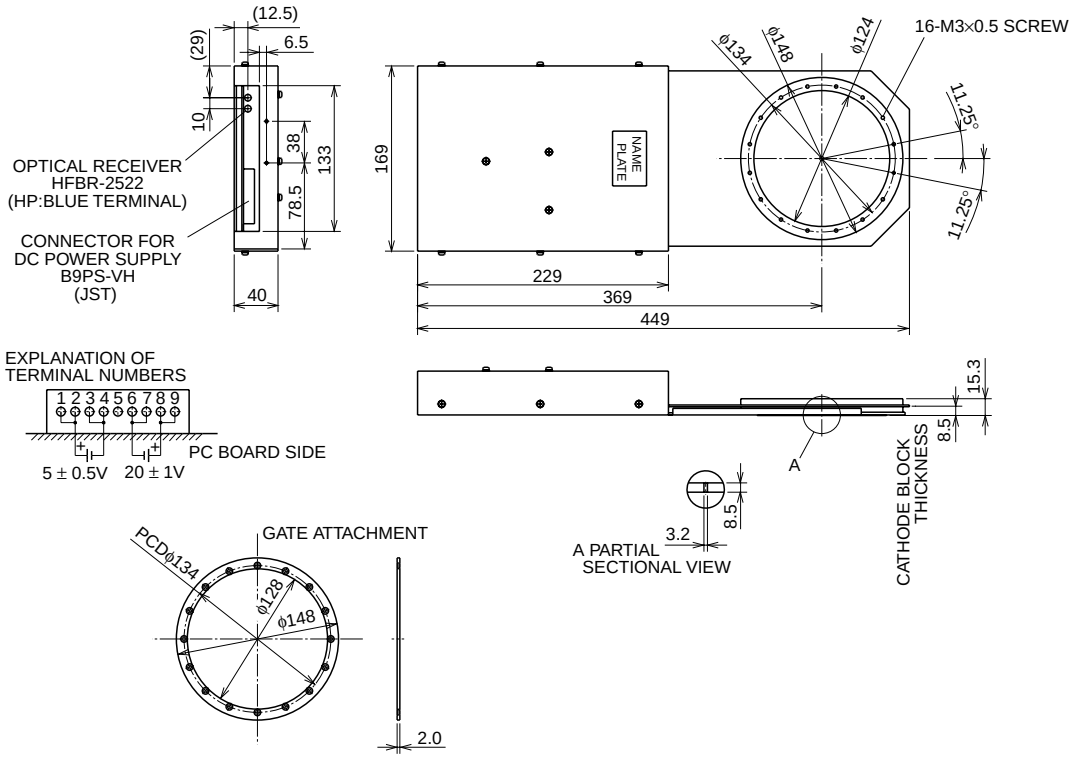
GCU40AA-90

- Asymmetrical GCU unit
- GCT and Gate driver are connected
- I_{TQRM} Repetitive controllable on-state current 4000A
- $I_{T(AV)}$ Average on-state current 1200A
- V_{DRM} Repetitive peak off-state voltage 4500V
- V_{RRM} Repetitive peak reverse voltage 21V

APPLICATION

Inverters, DC choppers, Induction heaters, DC to DC converters.

OUTLINE DRAWING **Dimensions in mm**



MITSUBISHI ELECTRIC

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GCT PART (Type name : FGC4000BX-90DS)

MAXIMUM RATINGS

Symbol	Parameter	Conditions	Voltage class	Unit
V_{RRM}	Repetitive peak reverse voltage	—	21	V
V_{RSM}	Non-repetitive peak reverse voltage	—	21	V
V_{DRM}	Repetitive peak off-state voltage	V_{GK} = –2V	4500	V
V_{DSM}	Non-repetitive peak off-state voltage	V_{GK} = –2V	4500	V
V_{LTDS}	Long term DC stability voltage	V_{GK} = –2V, λ = 100 Fit	3600	V

Symbol	Parameter	Conditions	Ratings	Unit
I_{TQRM}	Repetitive controllable on-state current	V_{DM} = 4500V, V_D = 2250V, V_{RG} = 20V, L_C = 0.3μH T_j = 25/125°C, With GU-C40 (see Fig. 1, 3)	4000	A
$I_{T(RMS)}$	RMS on-state current	Applied for all condition angles	1800	A
$I_{T(AV)}$	Average on-state current	f = 60Hz, sinewave θ = 180°, T_f = 70°C	1200	A
I_{TSM}	Surge on-state current	One half cycle at 60Hz, T_j = 125°C Start	25	kA
I^2t	Current-squared, time integration		2.6×10^6	A^2s
di_T/dt	Critical rate of rise of on-state current	V_D = 2250V, I_T = 4000A, T_j = 25/125°C, f = 60Hz With GU-C40 (see Fig. 1,2)	1000	A/μs
V_{FGM}	Peak forward gate voltage		10	V
V_{RGM}	Peak reverse gate voltage		21	V
I_{FGM}	Peak forward gate current		1000	A
I_{RGM}	Peak reverse gate current		3500	A
P_{FGM}	Peak forward gate power dissipation		10	kW
P_{RGM}	Peak reverse gate power dissipation		120	kW
$P_{FG(AV)}$	Average forward gate power dissipation		200	W
$P_{RG(AV)}$	Average reverse gate power dissipation		630	W
T_j	Operation junction temperature		–20 ~ +125	°C
T_{stg}	Storage temperature		–20 ~ +150	°C
—	Mounting force required	(Recommended value 40kN)	32 ~ 48	kN
—	Weight	Typical value	1500	g

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
V_{TM}	On-state voltage	I_T = 4000A, T_j = 125°C	—	—	4.0	V
I_{RRM}	Repetitive peak reverse current	V_{RM} = 21V, T_j = 125°C	—	—	100	mA
I_{DRM}	Repetitive peak off-state current	V_{DM} = 4500V, V_{GK} = –2V, T_j = 125°C	—	—	150	mA
I_{GRM}	Reverse gate current	V_{RG} = 21V, T_j = 125°C	—	—	100	mA
dv/dt	Critical rate of rise of off-state voltage	V_D = 2250V, V_{GK} = –2V, T_j = 125°C (Expo. wave)	3000	—	—	V/μs
t_{gt}	Turn-on time	V_D = 2250V, I_T = 4000A, di/dt = 1000A/μs, T_j = 125°C	—	—	3.0	μs
t_d	Turn-on delay time	With GU-C40	—	—	1.0	μs
E_{on}	Turn-on switching energy	(see Fig. 1, 2)	—	1.0	—	J/P
t_s	Storage time	V_{DM} = 4500V, V_D = 2250V, I_T = 4000A V_{RG} = 20V, T_j = 125°C	—	—	3.0	μs
E_{off}	Turn-off switching energy	With GU-C40 (see Fig. 1, 3)	—	13	—	J/P
I_{GT}	Gate trigger current	V_D = 24V, R_L = 0.1Ω, T_j = 25°C	—	—	2.5	A
V_{GT}	Gate trigger voltage	DC method	—	—	1.5	V
$R_{th(j-f)}$	Thermal resistance	Junction to Fin	—	—	0.011	K/W

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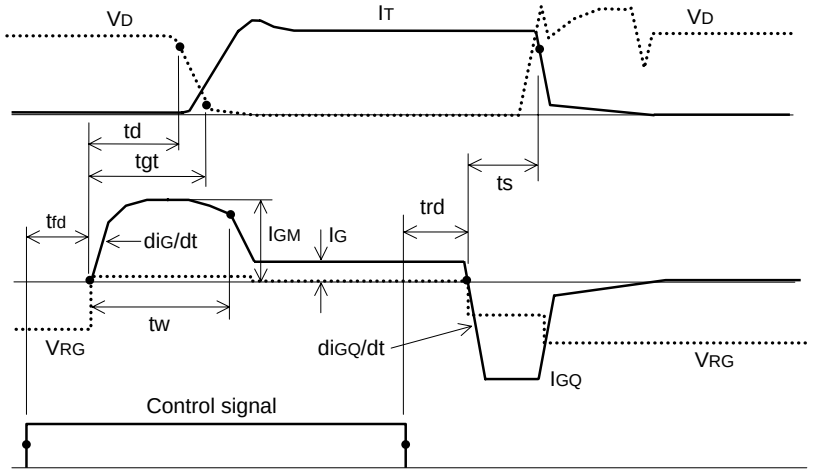
GATE DRIVER PART (Type name : GU-C40)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
+V_C	Power supply (+) (Note 1, 3)	DC power supply 10A	4.5	5.0	5.5	V
−V_C	Power supply (–) (Note 2, 3)	DC power supply 6A	19	20	21	V
—	Control signal	Optical fiber data link Transmitter : HFBR-1522 (HP) Receiver : HFBR-2522 (HP)	—	—	—	—
f	Frequency	I_T = 1500Arms, duty = 0.5	—	—	500	Hz
ton min	Turn-on minimum (Note 4)	Protection is 28 µs min and 32 µs max.	28	30	32	µs
toff min	Turn-off minimum (Note 5)	Protection is 44 µs min and 52 µs max.	44	50	52	µs
t_{fd}	Delay time of on gate current	Ta = 25°C	7	8	9	µs
t_{rd}	Delay time of off gate current	Ta = 25°C	5	6	7	µs
di_G/dt	Critical rate of rise of on gate current		100	—	—	A/µs
I_{GM}	Peak on gate current		—	200	—	A
t_W	Width of on high gate current		5	—	—	µs
I_G	On gate current		10	—	—	A
di_{GQ}/dt	Critical rate of rise of off gate current	V_{RG}= 20V	—	6000	—	A/µs
D_{max}	Maximum duty		—	—	50	%
—	Weight	With FGC4000BX-90DS	—	4600	—	g
Ta	Temperature	Operation temperature (Recommend : ≤ 40°C)	–10	—	+60	°C
Rth	Thermal resistance (Junction to Fin) (Note 6)	With FGC4000BX-90DS	—	—	0.012	K/W



td ; 0V_{RG} ~ 0.9V_D
t_{gt} ; 0V_{RG} ~ 0.1V_D
t_s ; 0V_{RG} ~ 0.9I_T
di_G/dt ; 0.1I_{GM} ~ 0.9I_{GM}
t_W ; 0V_{RG} ~ 0.9I_{GM}
di_{GQ}/dt ; 0.1I_{RG} ~ 0.9I_{RG}
t_{fd} ; 50%on signal ~ 0V_{RG}
t_{rd} ; 50%off signal ~ 0V_{RG}

Fig. 1 Turn-on and Turn-off waveform

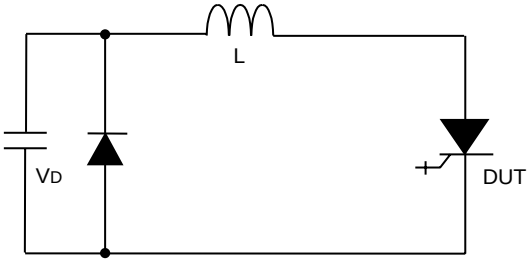


Fig. 2 Turn-on test circuit

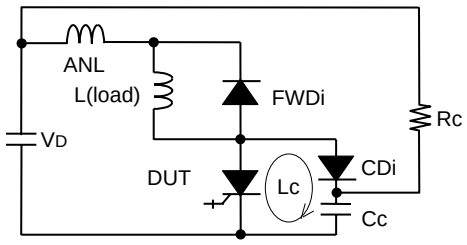


Fig. 3 Turn-off test circuit
(With clamp circuit)

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Note 1. In case of DC power supply which has no current control, please be careful that rush current (peak value 140A, width 2ms) flows at the turn on of power supply in 1m cable for power supply.
2. In case of DC power supply which has no current control, please be careful that rush current (peak value 250A, width 2ms) flows at the turn on of power supply in 1m cable for power supply.
3. Main current condition of GCT Thyristor is 1500Arms and duty = 0.5
4. If input turn-on signal is shorter than ton(min), protection operates and turn on width is 28μs min and 32μs max.
5. If turn-on signal is input during toff(min), protection operates and turn off width is 44μs min and 52μs max.
6. If GU-C40 and FGC4000BX-90DS are used together, Rth(j-f) becomes 0.012K/W.
(Only FGC4000BX-90DS is used, Rth(j-f) becomes 0.011K/W)

Fig. 4 Connection instruction for the gate

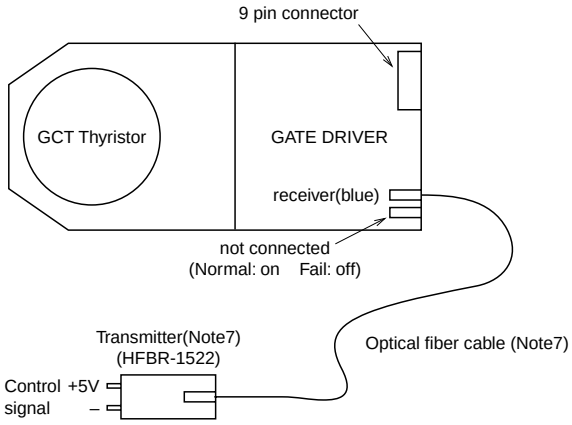
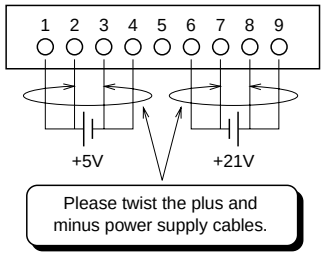


Fig. 5 9pin connector and cable (VHR-9N) (Note 7., 8.)



Note 7. Please prepare these parts beforehand.
8. A cross section of power supply cable is 0.75mm^2 or 0.83mm^2 and twist the positive and ground cable.
The power supply cable is shorter than 2m and lower inductance.

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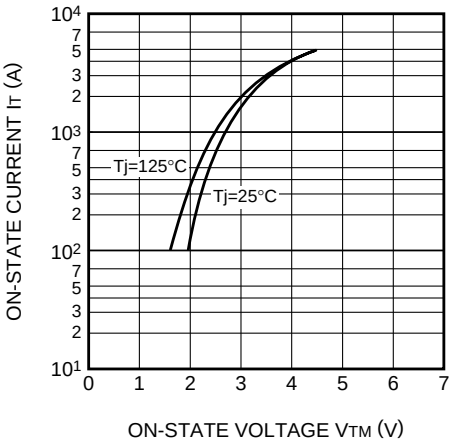
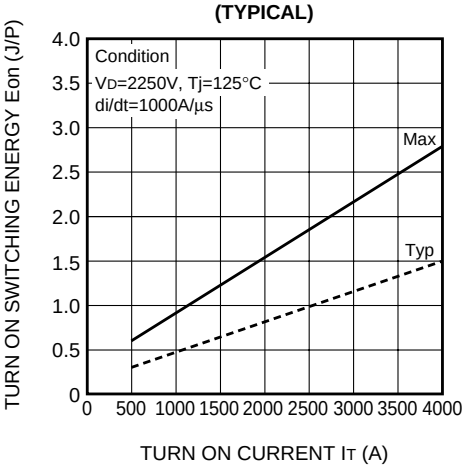
PERFORMANCE CURVES

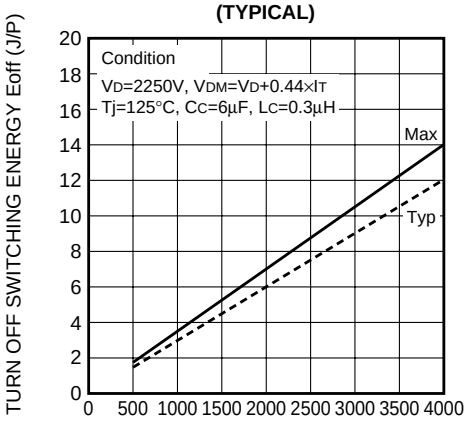
MAXIMUM ON-STATE CHARACTERISTIC



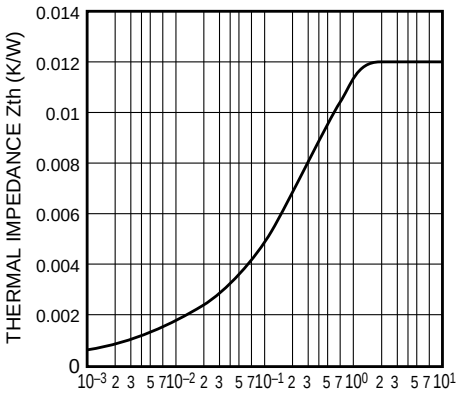
Eon VS IT (TYPICAL)



Eoff VS IT (TYPICAL)



MAXIMUM THERMAL IMPEDANCE CHARACTERISTIC (JUNCTION TO FIN)



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