

MITSUBISHI GATE COMMUTATED TURN-OFF THYRISTOR UNIT

# GCU08AA-130

HIGH POWER INVERTER USE  
PRESS PACK TYPE

## GCU08AA-130



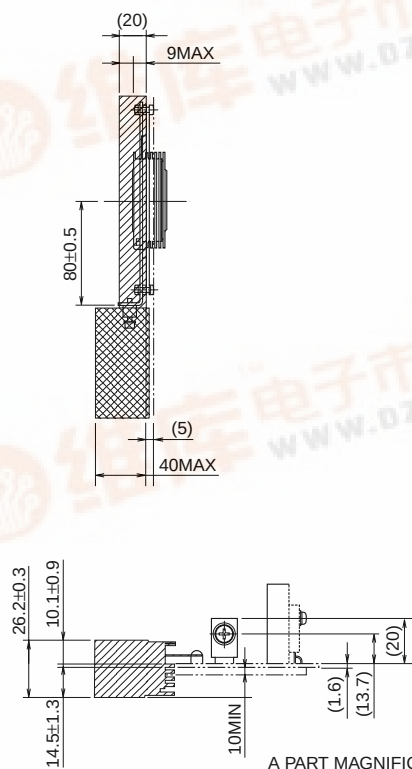
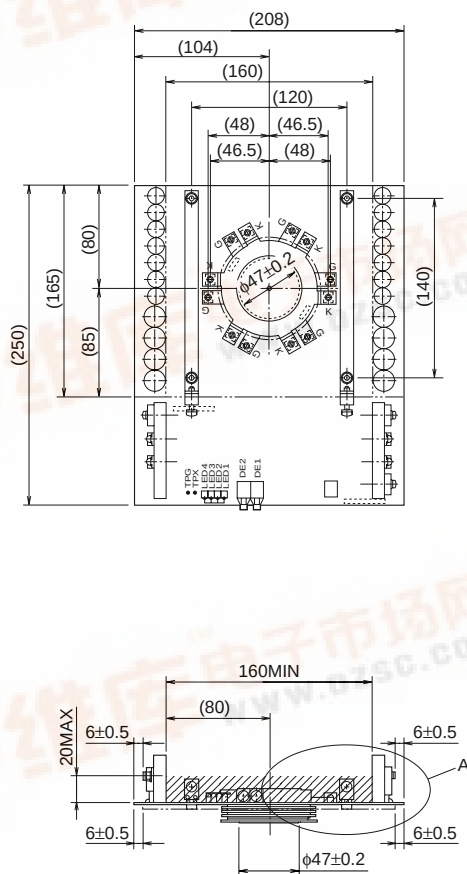
- Symmetrical GCT
- GCT and Gate driver are connected
- ITQRM Repetitive controllable on-state current ..... 800A
- IT(AV) Average on-state current ..... 330A
- VDRM Repetitive peak off-state voltage ..... 6500V

## APPLICATION

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

## OUTLINE DRAWING

Dimensions in mm



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GCT PART (Type name : FGC800A-130DS)

## MAXIMUM RATINGS

| Symbol | Parameter                             | Conditions                     | Voltage class | Unit |
|--------|---------------------------------------|--------------------------------|---------------|------|
| VRRM   | Repetitive peak reverse voltage       | —                              | 6500          | V    |
| VSRM   | Non-repetitive peak reverse voltage   | —                              | 6500          | V    |
| VDRM   | Repetitive peak off-state voltage     | VGK = -2V                      | 6500          | V    |
| VDSM   | Non-repetitive peak off-state voltage | VGK = -2V                      | 6500          | V    |
| VLDS   | Long term DC stability voltage        | VGK = -2V, $\lambda = 100$ Fit | 3600          | V    |

| Symbol           | Parameter                                 | Conditions                                                                                                        | Ratings           | Unit             |
|------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------|------------------|
| ITQRM            | Repetitive controllable on-state current  | VDM = 3/4 VDRM, VD = 3000V, LC = 0.3 $\mu$ H, VRG = 20V<br>Tj = 25/115°C, With GU-D08 (see Fig. 1, 3)             | 800               | A                |
| IT(RMS)          | RMS on-state current                      | Applied for all conduction angles                                                                                 | 520               | A                |
| IT(AV)           | Average on-state current                  | f = 60Hz, sinewave $\theta = 180^\circ$ , Tr = 55°C                                                               | 330               | A                |
| ITSM             | Surge on-state current                    | One half cycle at 60Hz, Tj = 115°C Start                                                                          | 4.8               | kA               |
| I <sup>2</sup> t | Current-squared, time integration         |                                                                                                                   | 9.6 $\times 10^4$ | A <sup>2</sup> s |
| diT/dt           | Critical rate of rise of on-state current | VD = 3000V, IT = 800A, Cs = 0.1 $\mu$ F, Rs = 10 $\Omega$<br>Tj = 25/115°C, f = 60Hz, With GU-D08 (see Fig. 1, 2) | 1000              | A/ $\mu$ s       |
| VFGM             | Peak forward gate voltage                 |                                                                                                                   | 10                | V                |
| VRGM             | Peak reverse gate voltage                 |                                                                                                                   | 21                | V                |
| IFGM             | Peak forward gate current                 |                                                                                                                   | 500               | A                |
| IRGM             | Peak reverse gate current                 |                                                                                                                   | 800               | A                |
| PFGM             | Peak forward gate power dissipation       |                                                                                                                   | 5                 | kW               |
| PRGM             | Peak reverse gate power dissipation       |                                                                                                                   | 17                | kW               |
| PFG(AV)          | Average forward gate power dissipation    |                                                                                                                   | 100               | W                |
| PRG(AV)          | Average reverse gate power dissipation    |                                                                                                                   | 120               | W                |
| Tj               | Junction temperature                      |                                                                                                                   | -20 ~ +115        | °C               |
| Tstg             | Storage temperature                       |                                                                                                                   | -20 ~ +150        | °C               |
| —                | Mounting force required                   | (Recommended value 13kN)                                                                                          | 11.1 ~ 15.8       | kN               |
| —                | Weight                                    | Typical value                                                                                                     | 530               | g                |

## ELECTRICAL CHARACTERISTICS

| Symbol   | Parameter                                  | Conditions                                                                                          | Limits |     |       | Unit       |
|----------|--------------------------------------------|-----------------------------------------------------------------------------------------------------|--------|-----|-------|------------|
|          |                                            |                                                                                                     | Min    | Typ | Max   |            |
| VTM      | On-state voltage                           | IT = 800A, Tj = 115°C                                                                               | —      | —   | 6.8   | V          |
| IRRM     | Repetitive peak reverse current            | VRM = 6500V, Tj = 115°C                                                                             | —      | —   | 150   | mA         |
| IDRM     | Repetitive peak off-state current          | VDM = 6500V, VGK = -2V, Tj = 115°C                                                                  | —      | —   | 100   | mA         |
| IGRM     | Reverse gate current                       | VRG = 21V, Tj = 115°C                                                                               | —      | —   | 50    | mA         |
| dv/dt    | Critical rate of rise of off-state voltage | VD = 3000V, VGK = -2V, Tj = 115°C<br>(Expo. wave) (see Fig. 4)                                      | 3000   | —   | —     | V/ $\mu$ s |
| tgt      | Turn-on time                               | IT = 800A, VD = 3000V, di/dt = 1000A/ $\mu$ s, Tj = 115°C                                           | —      | —   | 5.0   | $\mu$ s    |
| td       | Delay time                                 | Cs = 0.1 $\mu$ F, Rs = 10 $\Omega$                                                                  | —      | —   | 1.0   | $\mu$ s    |
| Eon      | Turn-on switching energy                   | With GU-D08 (see Fig. 1, 2)                                                                         | —      | —   | 1.6   | J/P        |
| ts       | Storage time                               | IT = 800A, VDM = 3/4 VDRM, VD = 3000V<br>Cs = 0.1 $\mu$ F, Rs = 10 $\Omega$ , VRG = 20V, Tj = 115°C | —      | —   | 3.0   | $\mu$ s    |
| Eoff     | Turn-off switching energy                  | With GU-D08 (see Fig. 1, 5)                                                                         | —      | —   | 6.0   | J/P        |
| QRR      | Reverse recovery charge                    | VR = 3000V, IT = 800A, di/dt = 1000A/ $\mu$ s                                                       | —      | —   | 1650  | $\mu$ C    |
| Erec     | Reverse recovery energy                    | Cs = 0.1 $\mu$ F, Rs = 10 $\Omega$ , Tj = 115°C (see Fig. 5, 6)                                     | —      | —   | 5.0   | J/P        |
| IGT      | Gate trigger current                       | DC METHOD : VD = 24V, RL = 0.1 $\Omega$ , Tj = 25°C                                                 | —      | —   | 0.5   | A          |
| VGT      | Gate trigger voltage                       |                                                                                                     | —      | —   | 1.5   | V          |
| Rth(j-f) | Thermal resistance                         | Junction to fin                                                                                     | —      | —   | 0.025 | °C/W       |

# GCU08AA-130

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Fig. 1 Turn-on and Turn-off waveform

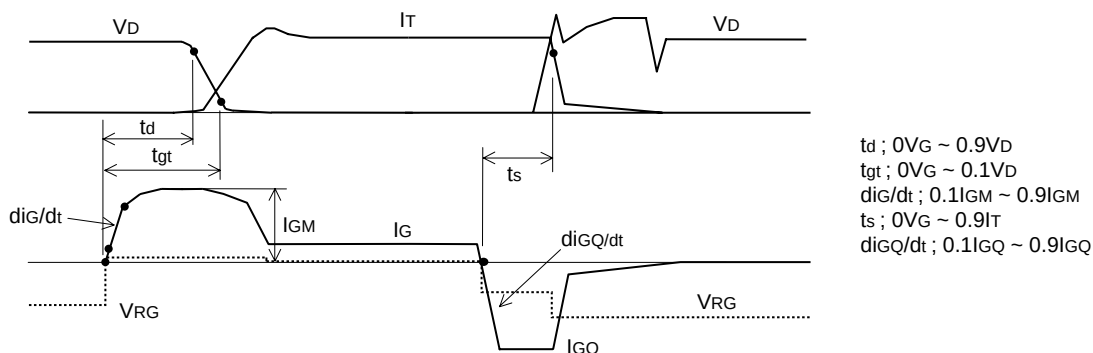


Fig. 2 Turn-on test circuit

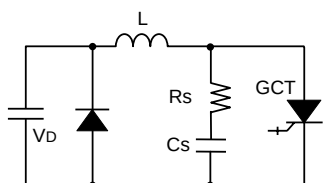


Fig. 3 Turn-off test circuit  
(With clamp circuit)

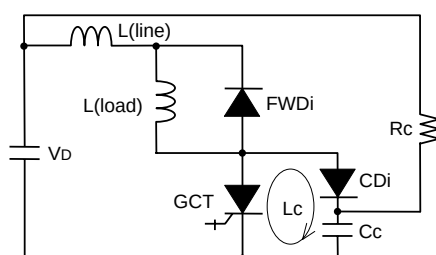


Fig. 4 dv/dt test waveform

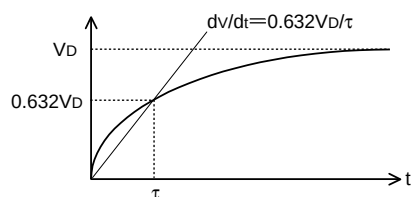
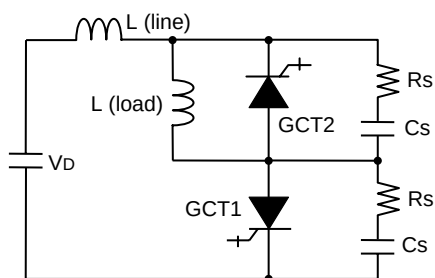
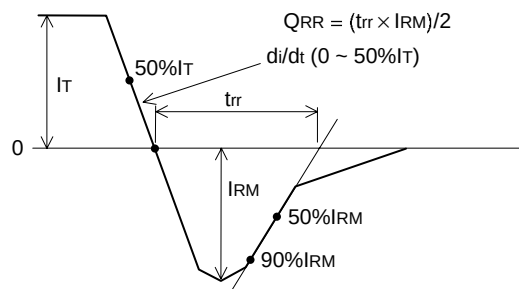


Fig. 5 Turn-off and Recovery test circuit



GCT1 : For turn-off test  
GCT2 : For Recovery test

Fig. 6 Reverse recovery waveform



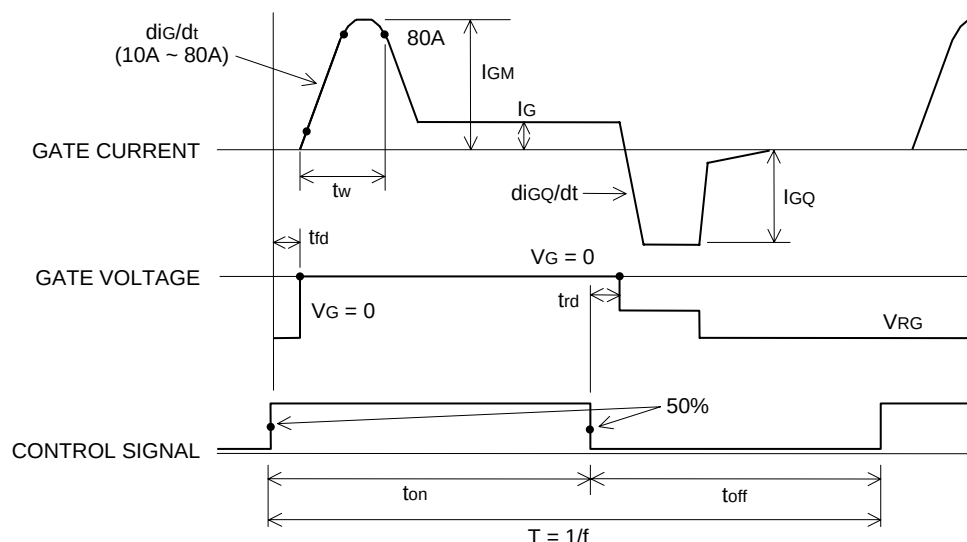
# GCU08AA-130

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## GATE DRIVER PART (Type name : GU-D08)

| Symbol           | Parameter                                 | Conditions                                                                           | Limits |      |     | Unit |
|------------------|-------------------------------------------|--------------------------------------------------------------------------------------|--------|------|-----|------|
|                  |                                           |                                                                                      | Min    | Typ  | Max |      |
| Vc               | Power supply (Note 1)                     | DC power supply                                                                      | 19     | 20   | 21  | V    |
| P                | Power consumption (Note 2)                | —                                                                                    | 2.5    | —    | —   | W    |
| —                | Control signal (Note 3)                   | Optical fiber data link<br>Transmitter : HFBR-1521 (HP)<br>Receiver : HFBR-2521 (HP) | —      | —    | —   | —    |
| f                | Frequency                                 | I <sub>T</sub> = 330A, Duty 33%                                                      | —      | —    | 780 | Hz   |
| t <sub>fd</sub>  | Delay time of on gate current             |                                                                                      | —      | —    | 3.0 | μs   |
| t <sub>rd</sub>  | Delay time of off gate current            |                                                                                      | —      | —    | 3.0 | μs   |
| diG/dt           | Critical rate of rise of on gate current  |                                                                                      | 50     | —    | —   | A/μs |
| I <sub>GM</sub>  | Peak on gate current                      |                                                                                      | —      | 90   | —   | A    |
| t <sub>w</sub>   | Width of on high gate current             |                                                                                      | 3      | —    | —   | μs   |
| I <sub>G</sub>   | On gate current                           | T <sub>j</sub> ≥ -10°C                                                               | 1.25   | —    | —   | A    |
| diGQ/dt          | Critical rate of rise of off gate current | V <sub>RG</sub> = 20V                                                                | —      | 1200 | —   | A/μs |
| D <sub>max</sub> | Maximum duty                              |                                                                                      | —      | —    | 100 | %    |
| T <sub>a</sub>   | Temperature                               | Operation temperature (Recommend : ≤ 40°C)                                           | -10    | —    | +60 | °C   |
| —                | Status signal (Note 4)                    |                                                                                      | —      | —    | —   | —    |

Fig. 7 Gate current, gate voltage and control signal waveform



Note 1. (1) Guaranteed power supply voltage for operation is 19V minimum and 21V maximum.

(2) When over voltage occurs, GDU voltage bus (G-K voltage for GCT) is clamped to be 21V if mamimum voltage for input gata voltage from power supply is 25V and maximum duration of over voltage higher than 21V from power supply is 0.4 sec when control signal is on (Please see Fig. 8).

(3) When over voltage occurs, GDU voltage bus is clamped to be 21V with no time limitation if maximum voltage from power supply is 25V and control signal is off (Please see Fig. 8).

Note 2. GCT is off state and no gate signal is supplied for gate driver. No leakage current flows between gate and cathode of GCT.

Note 3. Optic fiber data link HFBR-1521 and HFBR-2521 are interlocked each other.

# GCU08AA-130

HIGH POWER INVERTER USE  
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Note 4.

## 1. Status signal from LED

### (1) Status signal

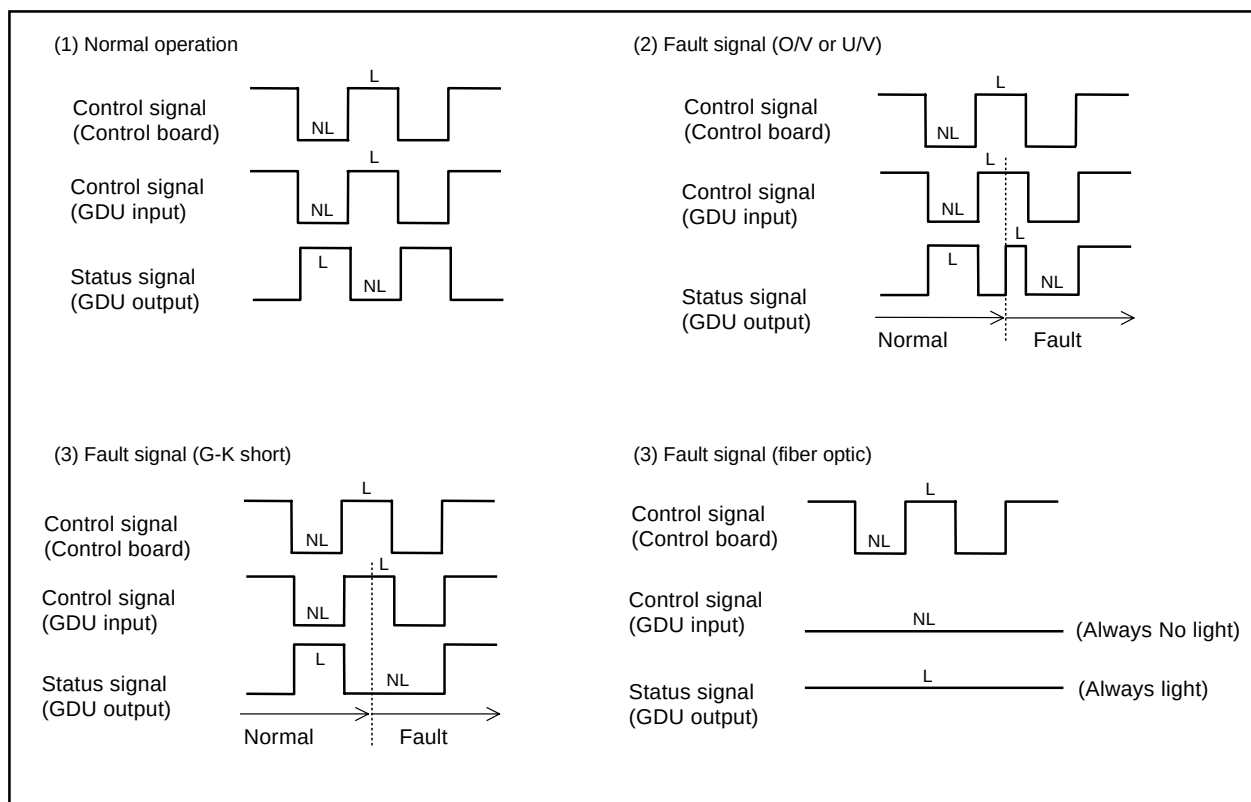
| Status of GCT | LED 1<br>(Red) | LED 2<br>(Yellow) |
|---------------|----------------|-------------------|
| On state      | OFF            | ON                |
| Off state     | ON             | OFF               |

### (2) Fault signal

| Status | G-K       | PS           | PS LED<br>(LED 4)     | G-K LED<br>(LED 3)                         |
|--------|-----------|--------------|-----------------------|--------------------------------------------|
| Normal | Normal    | 20±1V        | On                    | On                                         |
| Fault  | Normal    | Voltage down | Off, V < 17.5V (Typ.) | Off (If V > 12.5V (Typ.) then LED 3 is on) |
| Fault  | G-K short | 20±1V        | On                    | Off                                        |
| Fault  | G-K short | Voltage down | Off, V < 17.5V (Typ.) | Off                                        |

## 2. Status signal from Transmitter (Note 5)

(L : Light NL : No light)

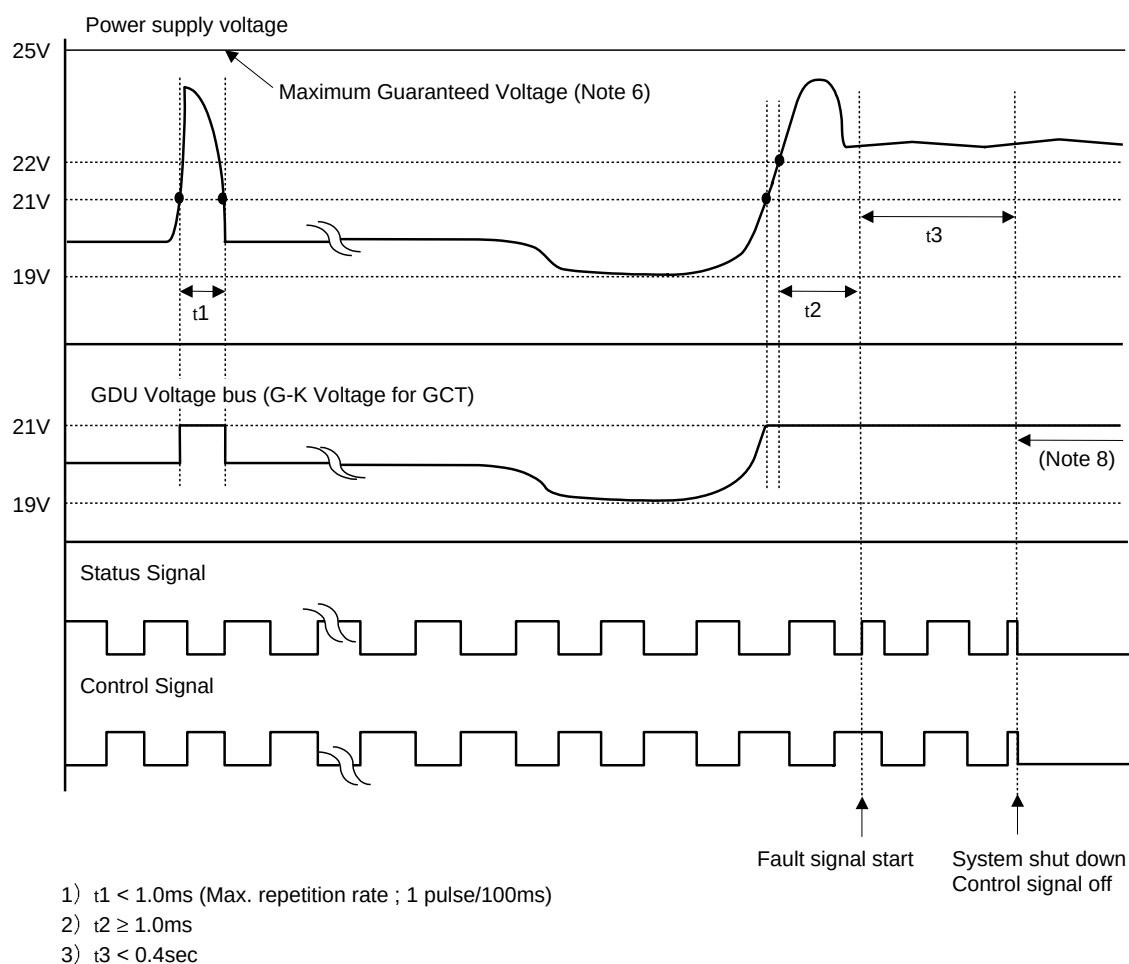


Note 5. About over voltage fault signal, please see Fig. 8.

# GCU08AA-130

HIGH POWER INVERTER USE  
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Fig. 8 Over voltage fault signal timing chart



Note 6. Maximum peak voltage of GDU input voltage from power supply should be lower than 25V.

Note 7. If the period for over voltage  $< 1.0\text{ms}$  (period  $t1$ ), no fault signal is sent.

If the period for over voltage  $\geq 1.0\text{ms}$ , fault signal starts after period  $t2$  from 22V of power supply voltage. System should be shut down (Control signal should be off) within period  $t3$  from fault signal start.

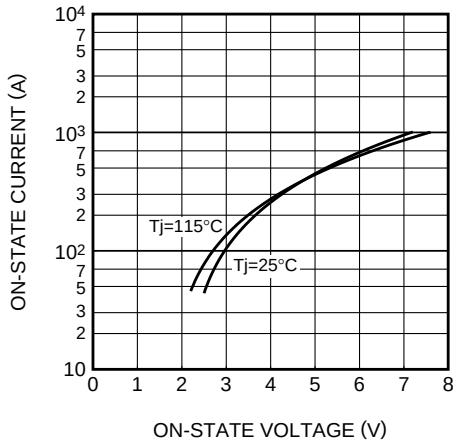
Note 8. GDU Voltage bus (G-K Voltage for GCT) is clamped to be 21V if power supply voltage is higher than 21V after system shut down (control signal off).

# GCU08AA-130

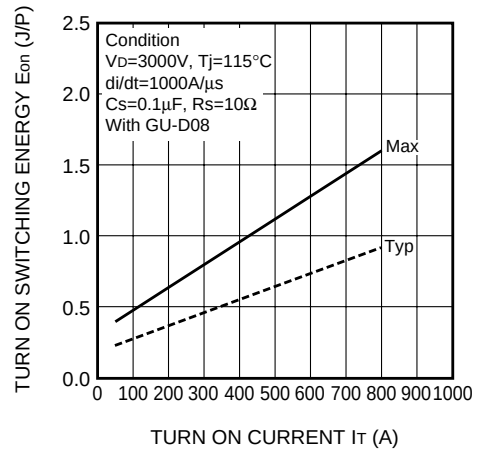
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## PERFORMANCE CURVES

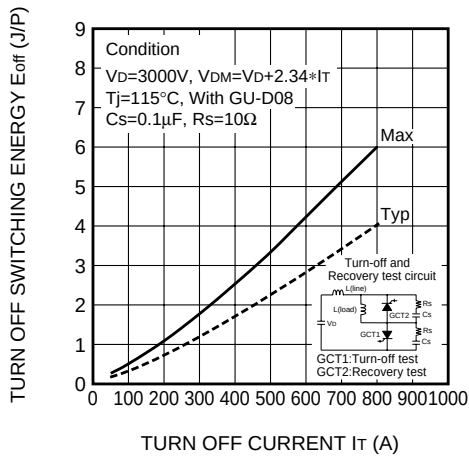
MAXIMUM ON-STATE CHARACTERISTIC



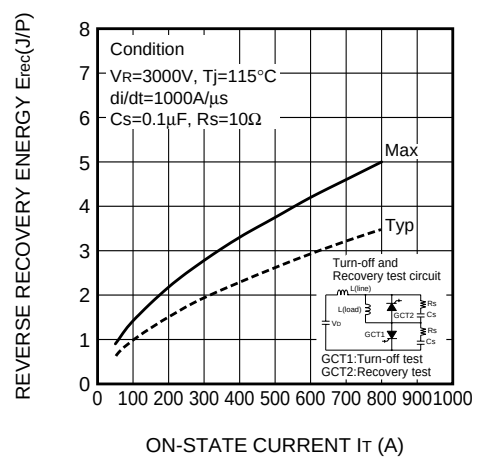
$E_{on}$  VS  $I_t$



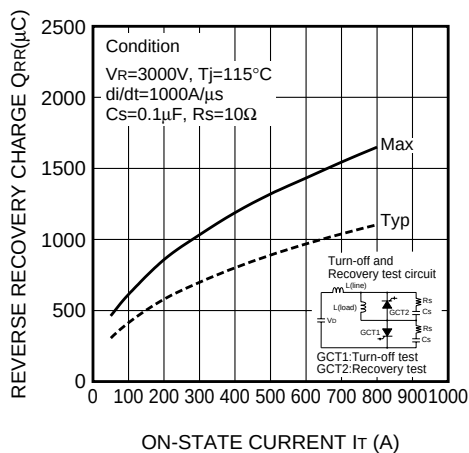
$E_{off}$  VS  $I_t$



$E_{rec}$  VS  $I_t$



$Q_{RR}$  VS  $I_t$



MAXIMUM THERMAL IMPEDANCE  
CHARACTERISTIC  
(JUNCTION TO FIN)

