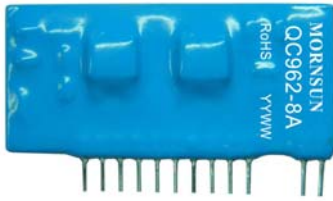


### Hybrid integrated IGBT driver



Patent protection    RoHS

### Recommended modules

- 600V series IGBT (current  $\leq 600A$ )
- 1,200V series IGBT (current  $\leq 400A$ )
- 1,700V series IGBT (current  $\leq 200A$ )

### Applications

- Universal converter
- AC servo drive system
- Un interruptible power supply (UPS)
- Electric welding machine

*QC962-8A is a hybrid integrated IGBT driver designed for driving N-channel IGBT modules in any gate amplifier application. The device provides the required electrical isolation between input and output with the opto-coupler. Short circuit protection is provided by a built-in desaturation detector. A fault signal is provided if the short circuit protection is activate.*

### FEATURES

- Built in high CMRR opto-coupler (CMR: Typ.: 30kV/ $\mu$ s, Min.: 15kV/ $\mu$ s)
- Built in dual power
- TTL & COMS compatible
- High isolation voltage opto-coupler (3750Vrms, 1min)
- Built in Short circuit protection and fault output
- Output soft-shutdown and timer reset when over-current fault
- Adjustable short circuit detection rejection time (dead zone)
- Switching frequency up to 40kHz
- Pin and characteristic are compatible with M57962AL(see compatible explanation)

### Max. Permissible Value

| Item  | Symbol       | Testing Conditions                                 | Value    | Unit |
|---|--------------|--|----------|------|
| Power Supply Input Voltage  | $V_{CC}$     | DC   | 18       | V    |
|   | $V_{EE}$     |  | -15      |      |
| High-level Signal Input Current                                     | $I_{IH}$     | Between terminal 13 and 14                         | 25       | mA   |
| Drive Output Voltage  | $V_o -$      | Input signal is high                               | $V_{CC}$ | V    |
|   | $V_o +$      | Input signal is low                                | $V_{EE}$ |      |
| Output Current  | $I_{g\ on}$  | Pulse width: 2 $\mu$ s<br>Frequency f=20kHz        | +8       | A    |
|   | $I_{g\ off}$ |  | -8       |      |
| Input & Output Isolation Voltage                                    | $V_{ISO}$    | Sine 50Hz/60 Hz, 1min, leak current lower than 1mA | 3750     | V    |
| Fault Output Current  | $I_{FO}$     | PIN8 input current                                 | 20       | mA   |
| Voltage Withstanding of Short Circuit Protection Detecting Terminal | $V_{R1}$     | PIN1 input voltage                                 | 50       | V    |
| Operating Temperature   | $T_{OP}$     |  | -40~+70  | °C   |
| Storage Temperature   | $T_{ST}$     |  | -50~+125 |      |

Note: 1. Unless otherwise specified, the ambient temperature is  $T_a=25^\circ\text{C}$ ;  
2.  $2.20V < V_{CC} - V_{EE} < 28V$ .

### Input Specifications

| Item                       | Symbol   | Testing Conditions                  | Min. | Typ. | Max. | Unit |
|----------------------------|----------|-------------------------------------|------|------|------|------|
| Power Supply Input Voltage | $V_{CC}$ | DC input                            | 14   | 15   | -    | V    |
|                            | $V_{EE}$ | DC input                            | -7   | -10  | -    |      |
| "H" Input Current          | $I_{IH}$ | Between terminal 13 and terminal 14 | 10   | 16   | 20   | mA   |

### Output Specifications

| Item | Symbol | Testing Conditions | Min. | Typ. | Max. | Unit |
|------|--------|--------------------|------|------|------|------|
|------|--------|--------------------|------|------|------|------|

|                    |          |    |    |    |   |
|--------------------|----------|----|----|----|---|
| "H" Output Voltage | $V_{OH}$ | 13 | 14 | -- | V |
| "L" Output Voltage | $V_{OL}$ | -6 | -9 | -- |   |

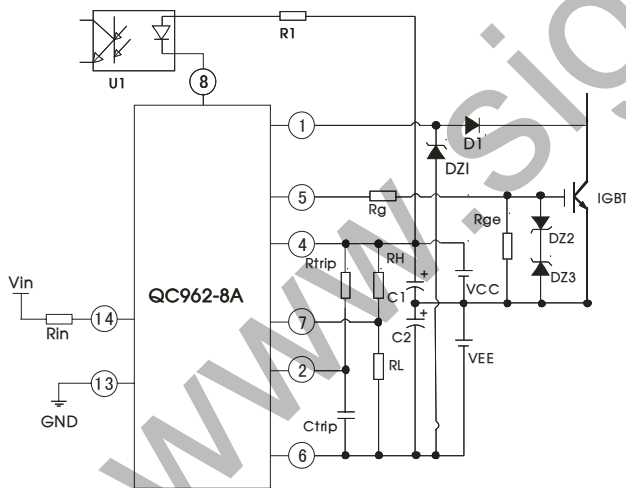
### General Specifications

| Item  | Symbol      | Testing Conditions   | Min. | Typ. | Max. | Unit     |
|---|-------------|--|------|------|------|----------|
| Switching Frequency                                     | $f$         |  | 0    | 20   | 40   | kHz      |
| Gate Resistance   | $R_g$       |  | 2    | --   | --   | $\Omega$ |
| Turn-on Delay Time                                      | $T_{PLH}$   | $I_{IH}=16mA$<br>$V_{CC}=15V$<br>$V_{EE}=-10V$<br>$R_g=2\Omega$        | --   | 0.4  | 1    | $\mu s$  |
| Turn-on Rise Time                                       | $T_R$       |  | --   | 0.6  | 0.8  |          |
| Turn-off Delay Time                                     | $T_{PHL}$   |  | --   | 0.6  | 1.3  |          |
| Turn-off Fall Time                                      | $T_F$       |  | --   | 0.4  | 0.8  |          |
| Protective Threshold Voltage                            | $V_{OCP}$   | $V_{CC}=15V$ $V_{EE}=-10V$   | --   | 9.2  | --   | V        |
| Protective Reset time                                   | $T_{timer}$ | Duration from the start to the end of protective signal                | 1    | 1.3  | 2    | ms       |
| Fault Output Current                                    | $I_{FO}$    | PIN8 input current, $R=4.7K$   | --   | 5    | --   | mA       |
| Short Circuit Detection Rejection Time (dead zone time) | $T_{trip}$  | Pin1: $\geq 15V$ , Pin2: open  | --   | 2.6  | --   | $\mu s$  |
| Protective Soft Turn-off Time                           | $T_{CF}$    | Pin1: $\geq 15V$   | --   | 5    | --   | $\mu s$  |
| Short Circuit Protective Detection Voltage              | $V_{SC}$    | Module collector voltage   | 15   | --   | --   | V        |
| Charge Quantity   | $Q_g$       | $R_g=2\Omega$ , $C_g=160nF$ , $V_{CC}=15V$ , $V_{EE}=-10V$             | --   | 3.4  | 4.0  | $\mu C$  |
| Total Power   | $P_{in}$    | $R_g=2\Omega$ , $C_g=160nF$ , $V_{CC}=15V$ , $V_{EE}=-10V$ , $f=25KHz$ | --   | 3.4  | --   | W        |

Note: Unless otherwise specified,  $T_a=25^\circ C$ ,  $V_{CC}=15V$ ,  $V_{EE}=-10V$ .

### Design Reference

#### 1. Typical application



TTL&COMS compatible

$f=20kHz$

$V_{in}=3.3\sim 5V$

$V_{CC}=15V$

$V_{EE}=-10V$

$R_g=2\Omega$

D1 : fast recovery diode ( $t_{rr}\leq 0.2\mu s$ )

DZ1 : 30V TVS

DZ2, DZ3: 18V

$R1=4.7K\Omega$

$R_g=10K\Omega$  0.25W

C1, C2: 100uF (low ESR)

Note: Connect a capacitance value during  $1\mu F \sim 10\mu F$  in parallel with both ends of the capacitor C1 and C2, to reduce ripple & noise

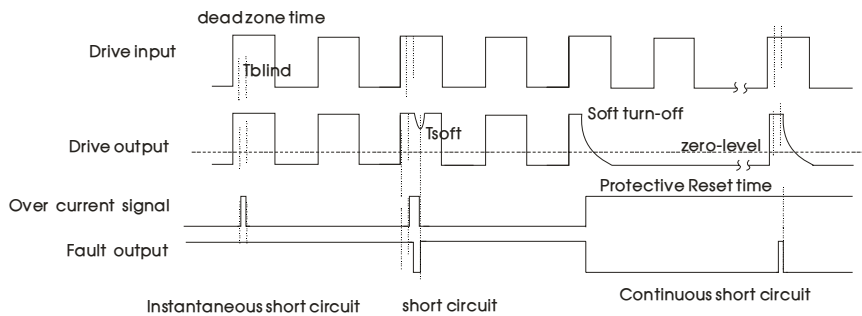
#### 2. Specifications of defined

##### 1) Specifications of short circuit protection

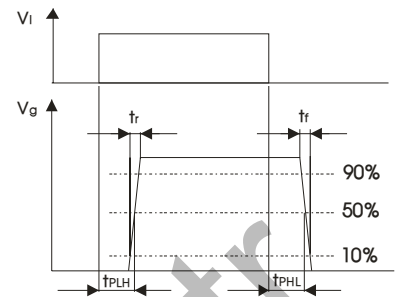
QC962-8A Detecting a short circuit condition can be divided into the following three cases:

- When the short-circuit protection signal time is less than the Short circuit protection suppression time, The driver is a normal state that the fault output is forbidden;
- When the short-circuit protection signal time is longer than the suppression time, The short circuit signal disappears At the course of the drive control signal falls, The driver triggers the Short circuit protection and resume normal work after short circuit signal disappears
- When the short-circuit signal time is longer than the self-recovery time, The driver triggers the Short circuit protection and restores the

periodic detection signal issued from the circuit to resume normal work after short signal disappears.



schematic diagram of protection

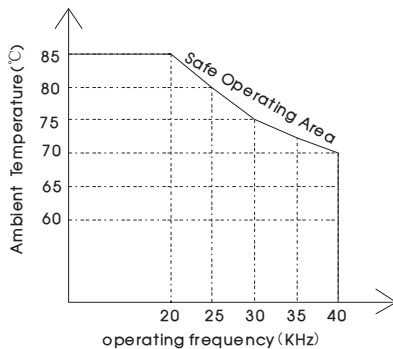


Schematic diagram of signal delay test

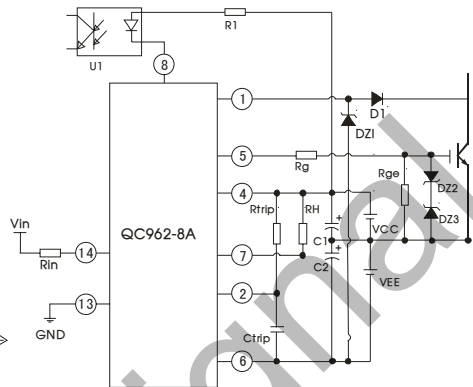
2)Input and Output delay time, rise time, fall time characteristics defined

3)Product operating temperature and operating frequency derate

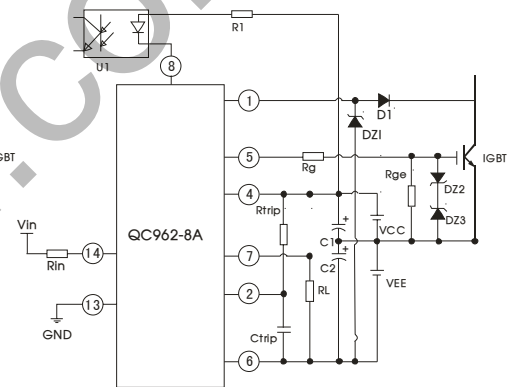
It is suggested that the IGBT driver ambient temperature is decided for environment temperature and signal frequency.



QC962-8A safe operating area



Reduce the protection of threshold voltage



Increase the protection of threshold voltage

### 3. Parameter adjustment

1)Over current protection threshold voltage regulation characteristics

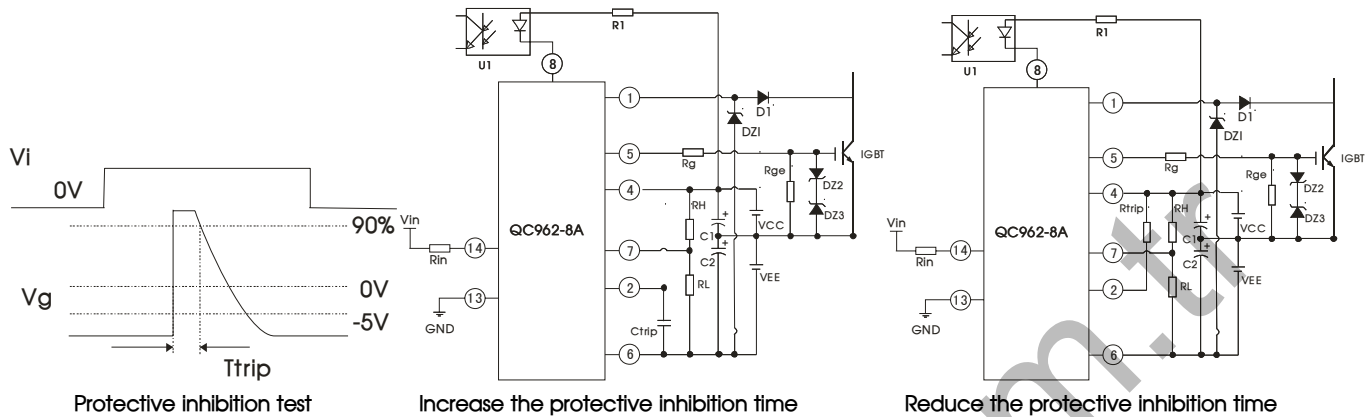
Over current protection threshold voltage is the threshold level of start protection when IGBT drive detecting IGBT over current. QC962-8A product has the function of regulating protection threshold voltage, the user can through the external resistors  $R_h$  and  $R_l$  to regulate the over current protection threshold voltage value, proposed to adjust the voltage value can not be less than 8V, shall not be higher than 10V, the specific adjustment can refer to the following table. (the data in table is for reference only, the actual application should be measured)

| $R_h(K\Omega)$ | $R_l(K\Omega)$ | $V_{ocp}(V)$ | $T_{trip}(\mu s)$ | Note  |
|----------------|----------------|--------------|-------------------|---|
| 12             | —              | 10.5         | 2.52              | Test conditions<br>$V_{cc}=15V$<br>$V_{ee}=-10V$<br>$f=25KHz$ |
| 24             | —              | 10.0         | 2.42              |   |
| —              | —              | 9.4          | 2.32              |   |
| —              | 150            | 8.8          | 2.22              |   |
| —              | 100            | 8.5          | 2.18              |   |
| —              | 51             | 8.0          | 1.90              |   |

Over current protection threshold voltage is affected by power supply voltage, the higher the  $V_{cc}$ , the higher over-current protection threshold voltage; the lower the  $V_{ee}$ , the higher over-current protection threshold voltage. and vice versa, at the same time over current protection threshold voltage size also affects the short circuit protection suppression time size, threshold voltage the higher the inhibition time shorter, short circuit protection, in order to obtain the short circuit protection and reasonable inhibition time, users can refer to short circuit protection inhibition time regulation characteristics adjusting short protection time.

2) Adjustment of short-circuit detection time delay

The short-circuit detection time delay is defined between the time in which a desaturation is detected and the time in which the gate voltage fall down to 90% of extent. This diver have a minimum short-circuit detection time delay, and you can adjust the short-circuit detection time delay by connecting the capacitor (Ctrip). But the short-circuit detection time delay must be set less than 3.5 $\mu$ S. Please refer to below table.(the data only for refer).



| Ctrip(nF) | Rtrip(K $\Omega$ ) | Ttrip( $\mu$ S) | Note            |
|-----------|--------------------|-----------------|-----------------|
| —         | —                  | 2.34            | Test conditions |
| —         | 51                 | 2.06            | Vcc=15V         |
| —         | 20                 | 1.80            | Vee=-10V        |
| 4.7       | —                  | 3.16            | f=25KHz         |
| 4.7       | 51                 | 2.74            | Rg=2 $\Omega$   |
| 4.7       | 20                 | 2.34            |                 |
| 10        | —                  | 4.30            |                 |
| 10        | 51                 | 3.70            |                 |
| 10        | 20                 | 3.14            |                 |

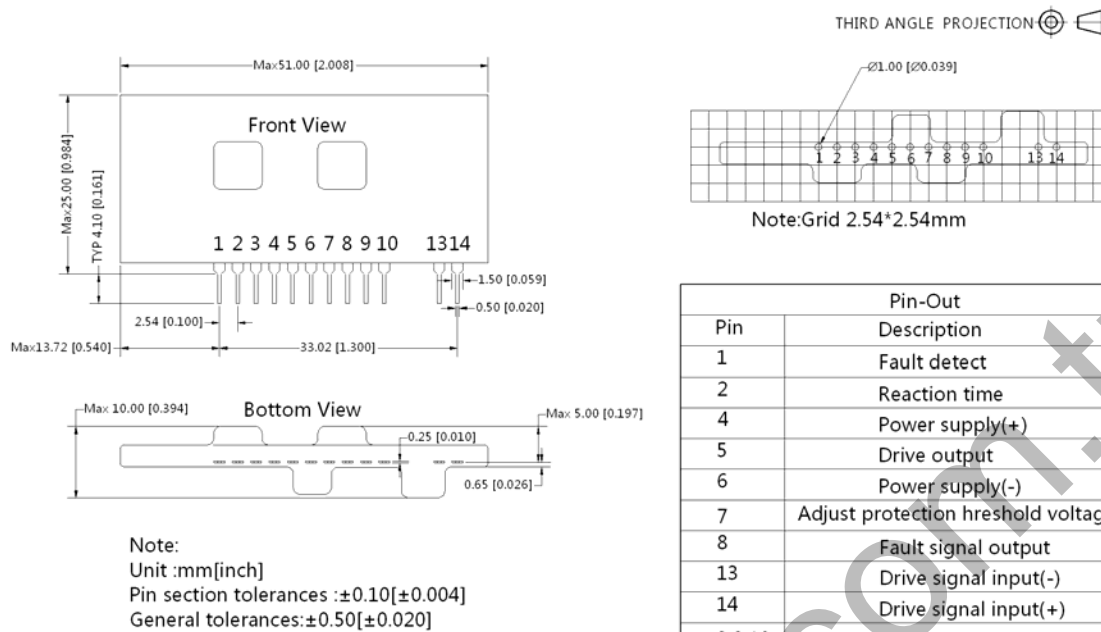
#### 4. Compatibility

This product is the basic parameter and function of pin compatible with M57962AL series of products, users without special requirements can be directly used instead, alternative use should pay attention to the following points

- 1) This product is relative to the M57962AL product to increase the threshold of protection regulation function and pin 7, if users need to use this function can refer to the over current threshold adjusted properly adjusting characteristics, if users need not the adjustment function, please send this pin feet up processing
- 2) This product is relative to the M57962AL product to increase the short-circuit protection inhibition time adjusting function and pin 2, if users need to use this function can refer to the short circuit protection inhibition time properly adjusting characteristics, if users need not this adjustment function, please send this pin feet up processing;
- 3) This product pin 3, 9, 10 for undefined function feet, to be used in production testing process, please 3, 9, 10 pin is left floating in the application;
- 4) The largest peak output current of 8A, relative to the peak output current of M57962AL products has increased, the users can adjusted according to the actual need of appropriate gate limit circuit resistance Rg

5. For more information Please find the application note on [www.mornsun-power.com](http://www.mornsun-power.com)

## Dimensions and Recommended Layout



### Note:

1. Packing Information please refer to 'Product Packing Information'. Packing bag number: 58230001;
2. The IGBT gate-emitter drive loop wiring must be shorter than one meter.
3. The IGBT gate-emitter drive loop wiring should be twisted.
4. If large voltage spike is generated at the collector of the IGBT, increase the IGBT gate resistor;
5. Pin3,9,10 are used only for the test circuit and not be connected with the application circuit;
6. The external blocking capacitors must be connected as close as possible to the driver's pin;
7. The peak reverse voltage of the diode D1(to connect PIN13) must be higher than the peak value of the IGBT collector voltage;
8. The distance between the capacitor Ctrip and pin2-4 should be as short as possible(Max.5cm);
9. Pin1 voltage could be high due to the reverse recovery characteristic of the diode D1 and the 30V zener diode DZ1 is connected between pin1 and pin6 for protecting the driver;
- 10.The input signal voltage must be less than 5.25V. The higher input signal voltage, the higher input signal current. It will result in more dissipation. The input port is a circuit composed of a high-speed optocoupler series with a 150ohm resistor. Practically, a current-limiting resistor is inserted, which value can be obtained according to the following equation:  $R = \frac{V_{in} - 1.7V}{16mA} - 150\Omega$

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