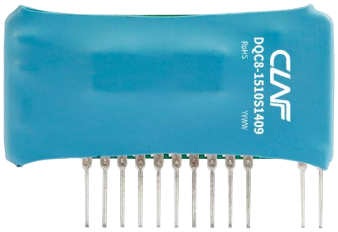
Descriptions

IGBT Driver



RoHS

3 Years Warranty

Features

- Built-in high CMRR opto-coupler
- (CMR: 30kV/μs typ., 15kV/μs min.)
- Built in bi-polar power supply
- Input signal compatible with CMOS & TTL level
- High-isolation voltage opto-coupler (3750Vrms/min)
- Short-circuit protection and output fault function
- Soft shut-down and reset timer can be used during over-current fault
- Adjustable controlled time for detecting short circuit
- Switching frequency up to 40kHz
- Drop-in replacement to M57962AL (See compatibility notes)

Applications

- General inverter
- AC servo drive system
- Uninterruptible power supply (UPS)
- Electric welding machine

Maximum ratings

Item	Symbol	Test Conditions	Value	Unit
Power Supply Input Voltage	V_{CC}	DC	18	V
	V_{EE}		-15	
Input Current During High Level Signal Status	I_{IH}	Between pin 13 and 14	25	mA
Input Voltage During High Level Signal Status	V_{IH}	No Limiting Current Resistance	5.25	V
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 : 2μs Frequency f = 20kHz	+8	A
	$I_{g\,off}$		-8	
Input & Output Isolation Test	V_{ISO}	Sine Wave 50Hz / 60 Hz, 1min., Leakage Current <1mA	3750	VAC
Fault Output Current	I_{FO}	Pin 8 Input Current	20	mA
Max. Input Voltage to Fault Detect Pin	V_{R1}	Pin 1 Input Voltage	50	V
Operating Temperature	T_{OP}		-40℃ to +70℃	--
Storage Temperature	T_{ST}		-50℃ to +125℃	

Note:

1. Ambient temperature is Ta=25℃, unless otherwise specified;

2. 20V <VCC-VEE<28V.

Specifications

Product feature	Item	Symbol	Testing Conditions	Min.	Typ.	Max.	Unit
Input Specifications	Power Supply Input Voltage	VCC	DC input	14	15	--	V
		VEE	DC input	-7	-10	--	
	Input Current During High Level Signal Status	I_{IH}	Between pin 13 and pin 14	10	16	20	mA
Output Specifications	Voltage Output During High Level Signal Status	V_{OH}	f=20kHz, Vcc=15V, VEE=-10V	13	14	--	V
	Voltage Output During Low Level Signal Status	V_{OL}		-6	-9	--	
General Specifications	Switching Frequency	f	Rg =5Ω	0	20	40	kHz
	Gate Resistance	R_g		2	--	--	Ω
	Turn-on Delay Time	T_{PLH}	I_{IH} = 16mA Vcc = 15V VEE = -10V Rg = 5Ω f=20kHz	--	0.4	1	μs
	Turn-on Rise Time	T_R		--	0.7	1	
	Turn-off Delay Time	T_{PHL}		--	0.6	1.3	
	Turn-off Fall Time	T_F		--	0.4	0.8	
	Threshold Voltage Protection	V_{OCP}	Vcc = 15V; VEE = -10V	--	9.2	--	V
	Protective Reset Time	T_{timer}	Duration From Start to End of Protective Signal	1	1.3	2	ms
	Fault Output Current	I_{FO}	Pin 8 Input Current, R = 4.7kΩ	--	5	--	mA
	Short Circuit Detecting Time (Blind Zone Time)	T_{trip}	During the protection operation, the voltage at pin1≥15V, pin2 is left floating	--	2.6	--	μs
	Protective Soft Turn-off Time	T_{CF}	During the protection operation, the voltage at pin1≥15V	--	5	--	
	Output of Quantity of Electric Charge	Q_g	Rg=2Ω, Cg=160nF, Vcc=15V, VEE=-10V	--	3.4	4.0	μC
	Rated Power of The Module	P_{in}	Rg=2Ω, Cg=160nF, Vcc=15V, VEE=-10V, f=20kHz	--	3.4	--	W
	Weight	W		--	5.1	--	g

Note: Unless otherwise specified, Ta = 25℃, Vcc = 15V, VEE= -10V。

Design Reference

1.Typical application circuit

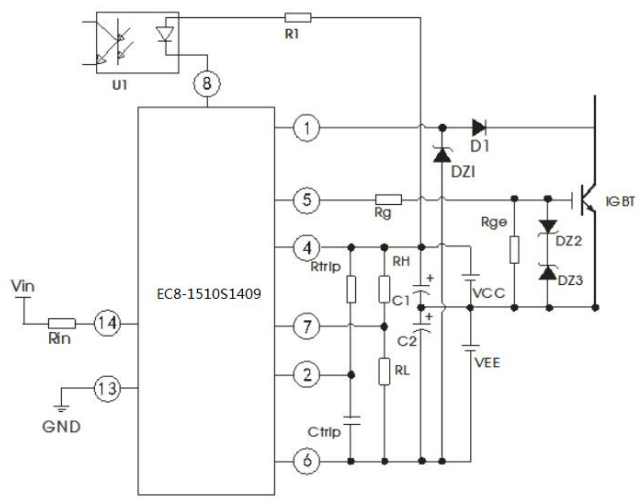


Fig.1 Circuit diagram

TTL & CMOS compatible
f = 20kHz
Vin = 3.3 to 5V
VCC = 15V
VEE= -10V
Rg = 2Ω
D1: fast recovery diode (trr≤0.2μs)
DZ1: 30V TVS
DZ2, DZ3: 18V TVS
R1 = 4.7kΩ
Rge = 10kΩ
C1, C2: 100μF (low ESR)
RH, RL, Rtrip and Ctrip generally do not need to be added, and they can be externally connected as needed.

Note:
1. For further ripple & noise reduction, connect an additional capacitor each with a value between 1μF and 10μF in parallel with capacitors C1 and C2
2. D1 should be selected according to the voltage of the bus. Generally, it should be greater than or equal to twice the voltage of the bus. In practice, selection should be based on the customer's application environment.

2.Description of Characteristic

1、Short circuit protection

DQC8-1510S14 driver's detecting of a short circuit condition can be divided into the three following scenarios:

A.Short circuit protection signal time is less than short circuit protection suppression time:The driver is a normal state that the fault output is forbidden;

B.Short circuit protection signal time is longer than 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 expires.

C.Short circuit signal time is longer than self-recovery time: Driver triggers short circuit protection and restores periodic detection signal issued from the circuit to resume normal operation after short signal expires.

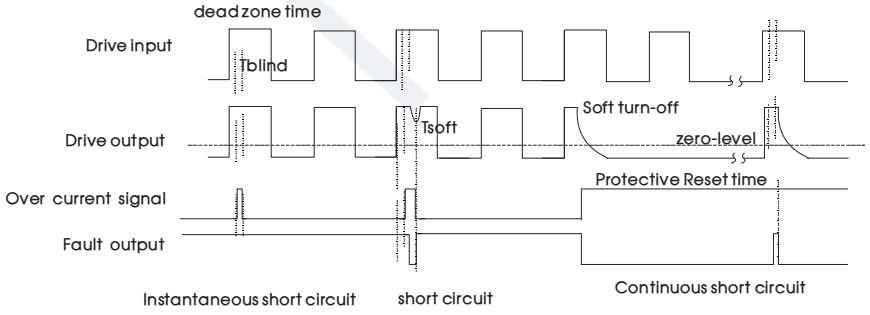


Fig 2. Protection diagram

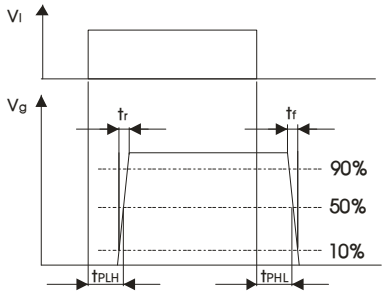


Fig 3. Signal delay test diagram

2. Input and output delay time, rise time and fall time characteristics are defined in Fig.3.

3. Product working temperature and working frequency derating

It is recommended that the user refer to the following ambient temperature and working frequency derating curves when using the product.

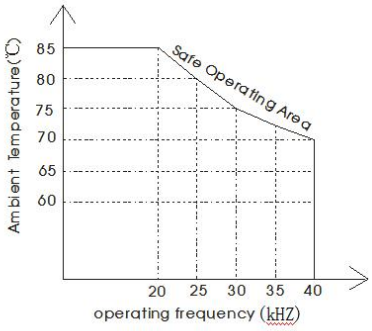


Fig 4. DQC8-1510S14 safe opearting curve

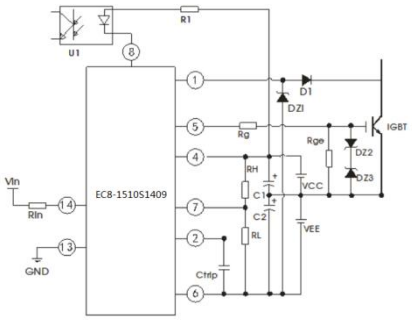


Fig 5. Reduce protection threshold voltage

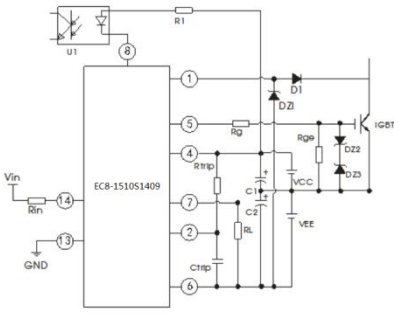


Fig 6. Increase protection threshold voltage

3.Parameter adjustment

1.Over-current protection threshold voltage regulation characteristics:

The over-current protection threshold voltage refers to the threshold level for starting protection when the IGBT driver detects IGBT. The DQC8-1510S14 product has the function of adjusting the protection threshold voltage. Users can adjust the over-current protection threshold voltage through external resistors RH and RL. It is recommended that the adjustment voltage should not be lower than 8V and not higher than 10V. The specific adjustment can refer to the following table. (The data in the table is for reference only, the actual application needs to be measured)

RH(kΩ)	RL(kΩ)	Vocp(V)	Ttrip(μs)	Note
12	---	10.5	2.52	Test conditions Vcc=15V VEE=-10V 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	

The over-current protection threshold voltage is affected by the power supply voltage. The higher the positive power supply voltage is, the higher the over-current protection threshold voltage is. The lower the negative power supply voltage is, the higher the over-current protection threshold voltage is, and vice versa. The voltage also affects the short-circuit protection inhibition time. The higher the protection threshold voltage, the shorter the short-circuit protection inhibition time. In order to obtain a reasonable short-circuit protection inhibition time, the user can adjust the short-circuit protection time by referring to the short-circuit protection inhibition time adjustment characteristics.

2.Short-circuit protection inhibition time adjustment characteristics:

When the IGBT is short-circuited or over-cur6rent, the driver detects the short-circuit or over-current until the gate potential drops to 90% of the normal amplitude. This period of time is called the short-circuit protection suppression (blind zone) time, which is set internally by the driver. The basic short-circuit protection suppression (blind zone) time, the user can adjust the dead zone time through external Ctrip capacitor and Rtrip. It is recommended that the adjustment time should not exceed 3.5μs, and the specific adjustment can refer to the following table. (The data in the table is for reference only, the actual application needs to be measured)

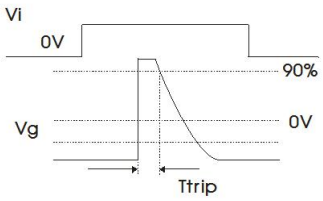


Fig.7: Protective inhibition test

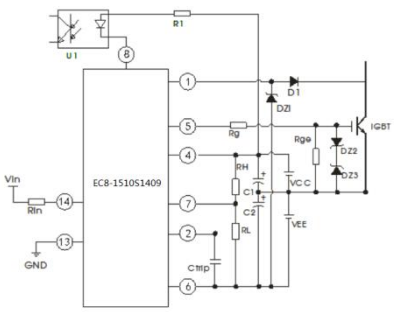


Fig.8: Increase protective inhibition time

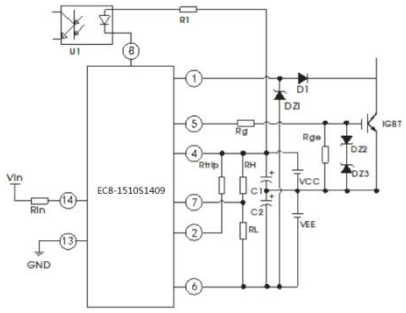


Fig.9: Reduce protective inhibition time

Ctrip (nF)	Rtrip (kΩ)	Ttrip (μs)	Note
---	---	2.34	The test conditions for parameters in this table are: Vcc=15V VEE=-10V f=25kHz Rg=2Ω
---	51	2.06	
---	20	1.80	
4.7	---	3.16	
4.7	51	2.74	
4.7	20	2.34	
10	---	4.30	
10	51	3.70	
10	20	3.14	

4.Compatibility feature

This product's basic parameter and function of pin are compatible with M57962AL series, so it can be directly replaced if without special requirements, and alternative use should pay attention to the following points:

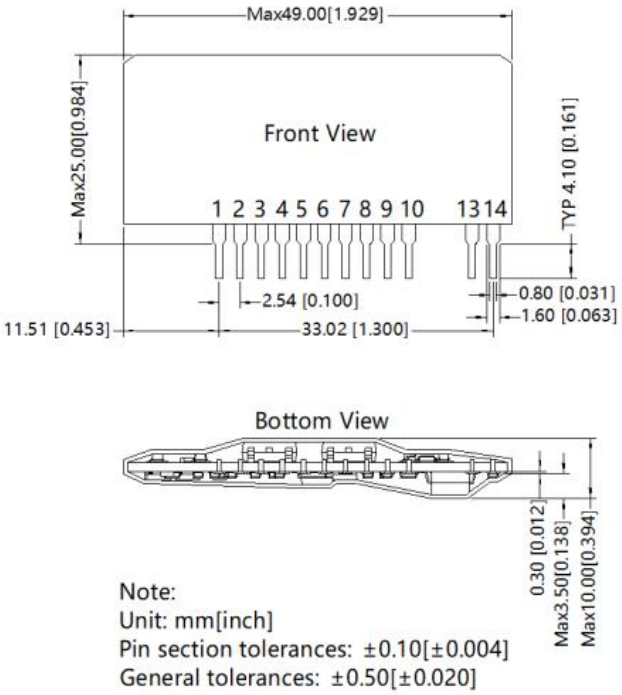
1.Relative to the M57962AL product our DQC8-1510S14 driver has the added threshold protection regulation function at pin 7. To properly use this function please refer to the over current threshold adjustment characteristics and procedure. Leave pin without electrical connection if the adjustment function is not being used.

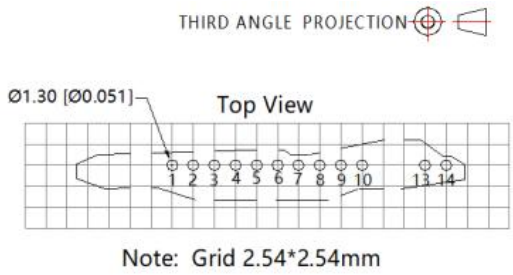
2.Relative to the M57962AL product our DQC8-1510S14 driver has the added short-circuit protection inhibition time adjusting function at pin 2. To properly use this function please refer to the short circuit protection inhibition time adjustment characteristics. Leave pin without electrical connection if the adjustment function is not being used.

3.Pin 3, 9 and 10 are left floating in the application (used in production testing process only);

4.Highest peak output current is with 8A higher than the relative peak output current of M57962AL product. This can be user adjusted according to the actual need by selecting the appropriate gate limit circuit resistance Rg.

Dimensions and Recommended





Note: Grid 2.54*2.54mm

Pin-Out	
Pin	Function
1	Fault detect
2	Reaction time
4	Power supply(+)
5	Drive output
6	Power supply(-)
7	Adjust protection threshold voltage
8	Fault signal output
13	Drive signal input(-)
14	Drive signal input(+)
3,9,10	NC

Note:

1.The driver must be wired as short as possible to the IGBT module's gate and emitter terminals (1m max.);

2.Twisted pair is recommended for the connection of the driver to the gate and emitter of the IGBT;

3.In order to reduce the high peak voltage generated at the collector of the IGBT turn-off, it is recommended to increase the gate resistance appropriately;

4.Pin 3, 9 and 10 are used for the test circuit only and must NOT be connected;

5.The external blocking capacitors must be connected as close as possible to the pins of the driver;

6.Select diode D1 with a peak reverse voltage that is higher than the peak value of the IGBT collector voltage;

7.The distance between capacitor Ctrip and pin 2-6 should be as short as possible, but no longer that 5cm max.;

8.The 30V Zener diode DZ1 is connected between pin 1 and pin 6, protecting the driver from the reverse recovery characteristic of the diode D1 which could generate an excessive voltage on pin 1;

9.Higher input signal voltage results in higher input signal current and therefore higher dissipation. The input port's circuit is composed of a high-speed optocoupler series with a 150ohm resistor. Practically, a current limiting resistor is inserted and its value can be obtained from the following equation: $R_{in} = \frac{Vin - 1.7V}{16mA} - 150\Omega$

10.Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;

11.All index testing methods in this datasheet are based on company corporate standards;

12.The above are the performance indicators of the product models listed in this datasheet. Some indicators of non-standard models will exceed the above requirements;

13.Products are related to laws and regulations: see "Features";

14.Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.