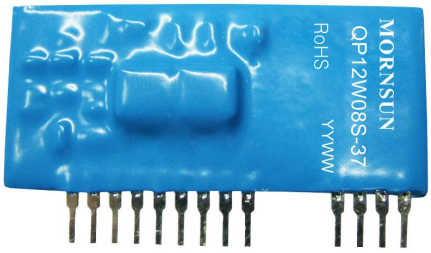
MORNSUN®

Hybrid integrated IGBT driver



Patent protection RoHS

Matched IGBT

- 600V series IGBT (current ≤600A)
- 1,200V series IGBT (current ≤400A)
- 1,700V series IGBT (current ≤200A)

FEATURES

- Built-in isolated DC/DC converter; single supply
- High isolation voltage (3750VAC)
- Input signal frequency up to 20kHz
- Built-in fault circuit with a pin for fault feedback
- The drive signal is ignored in the blocking time and the fault circuit reset at the end of it
- Adjustable Controlled time of detect fault circuit
- Adjustable fault soft turn-off time
- SIP package

Applications

- Universal inverter
- AC servo drive system
- Uninterruptible Power Supply (UPS)
- Electric welding machine

QP12W08S-37 is a hybrid integrated IGBT driver designed with built-in isolation DC/DC converter. This device is a fully isolated gate drive circuit consisting of an optimally isolated gate drive amplifier and an isolated DC-to-DC converter. The gate driver provides a fault protection function based on desaturation detection and fault output.

Selection Guide

Part No.	Input Voltage (VDC)	Output		
		Output High-level Voltage V_{OH}(VDC)	Output Low-level Voltage V_{OL}(VDC)	Max. Driving Current (A)
QP12W08S-37	15	15	-9	±8

Maximum ratings

Item	Symbol	Testing Conditions	Value	Unit
Power Supply Input Voltage	V_D		16	V
Input Impulse High-level Current	I_{IH}		25	mA
Driver Output Peak Current	$I_{g\,on}$		+8	A
	I_{goff}		-8	
Fault Output Current	I_{fo}		20	mA
Max. Input Voltage to Fault Detect Pin	V_{R1}		50	V

Input Specifications

Item		Symbol	Testing Conditions	Min.	Typ.	Max.	Unit
Power Supply	Input Voltage	V_D		14.5	15	15.5	V
	Input Current	I_{in}	V_D=15V, f=20kHz, D=0.5, Q=0uC	--	46	--	mA
			V_D=15V, f=20kHz, D=0.5, Q=3.0uC	--	165	--	
Input Impulse	High-level Voltage	V_I		3.7	--	5.7	V
	High-level Current	I_{IH}		10	--	20	mA

Notes:1.The environment temperature is Ta=25℃;
2.D is the input impulse duty。

Output Specifications

Item		Symbol	Testing Conditions	Min.	Typ.	Max.	Unit
Isolated Power Supply Voltage		V_{CC}	VD=15V, f=20kHz, D=0.5	14.5	16.0	18	V
		V_{EE}	VD=15V, f=20kHz, D=0.5	-7	-8.5	-10	
Drive Output	High-level Voltage	V_{OH}	VD=15V, f=20kHz, D=0.5,Q=3.0uC	14.5	15.0	--	
	Low-level Voltage	V_{OL}	VD=15V, f=20kHz, D=0.5,Q=3.0uC	-7	-9	--	
	Rise Time	t_r		--	0.3	1	μS
	Fall Time	t_f		--	0.3	1	
	Total Charge	Q	VD=15V, f=20kHz, D=0.5	--	--	3.0	uC

Note: The environment temperature is Ta=25℃;

General Specifications

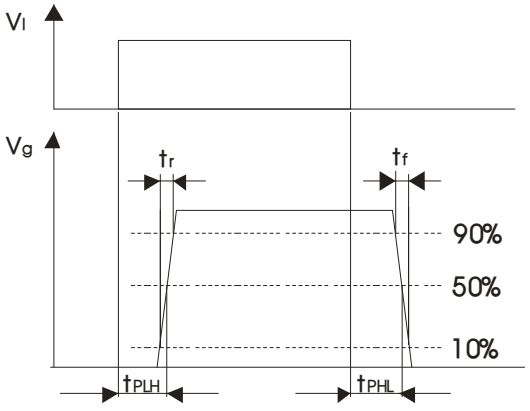
Item		Symbol	Testing Conditions	Min.	Typ.	Max.	Unit
Operating Frequency		f		--	--	20	kHz
Input Impulse And Drive Output	Rise Delay Time	t_{PHL}		--	0.5	1.2	μS
	Fall Delay Time	t_{PHL}		--	1	1.2	
Controlled Time of Detect Fault Circuit		t_{trip}	VD=15V, fault protection function	--	3.5	4.0	
Fault Soft Turn-off Time		t_{cf}	VD =15V, fault protection function	--	4.5	7	
Fault Reset Time		t_{timer}	VD =15V, fault protection function	1	1.4	2	mS
Fault Threshold Voltage		V_{ocp}	VD =15V	--	9.5	--	V
Fault Output Terminal Voltage		V_{fo}	VD =15V, fault protection function	--	-8.0	--	
Insulation Voltage		V_{iso}	Sine 50Hz/60 Hz, 1min	3750	--	--	VAC
Operating Temperature		T_{op}		-40	--	+71	℃
Storage Temperature		T_{st}		-50	--	+125	
Weight		W		--	10.0	--	g

Note: The environment temperature is Ta=25℃.

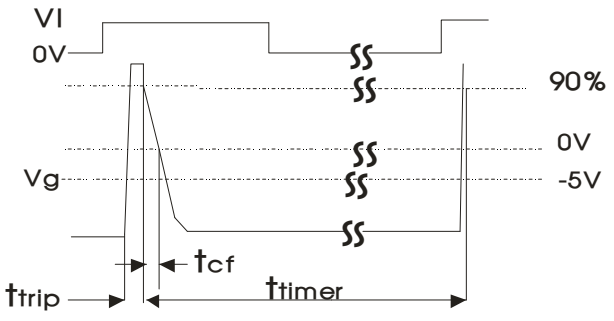
Design Reference

1. Definition of Characteristic

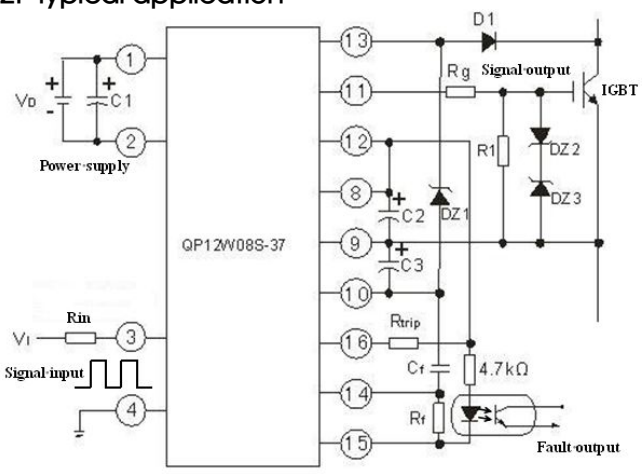
1) Definition of Fault-free Characteristic



2) Definition of Fault Characteristic



2. Typical application



C1	100μF
C2	100μF
C3	100μF
Rtrip	set as required (optional)
Cf	set as required (optional)
Rf	set as required (optional)
Rg	5Ω
R1	10KΩ,0.25W
DZ1	TVS(30V,0.5W)
DZ2, DZ3	TVS(18V,1W)
D1	fast recovery diode (trr≤0.2μs)

Note:

1.To further reduce output ripple, a 1uF ~ 10uF capacitor can be connected in parallel to both ends of C2 and C3.

2.The current-limiting resistance can be adjusted to meet the requirements of input impulse current if the input impulse voltage is too high. The circuit between the signal input terminals consists of high-speed opto-coupler LED and 200Ω resistance connected in series. Therefore, the current-limiting resistance can be calculated based on the following formula:

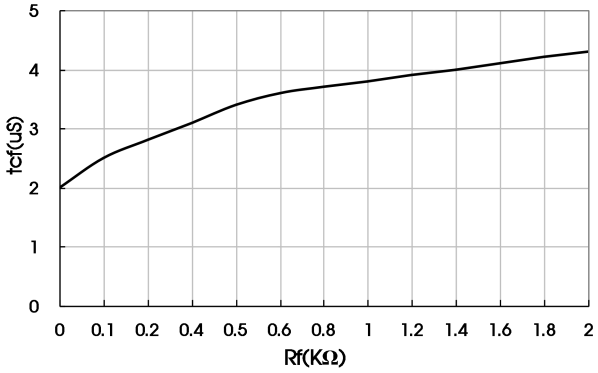
$$R_{in} = \frac{V_I - 1.7V}{I_{IH}} - 200\Omega$$

(1) Fault soft turn-off time adjustment:

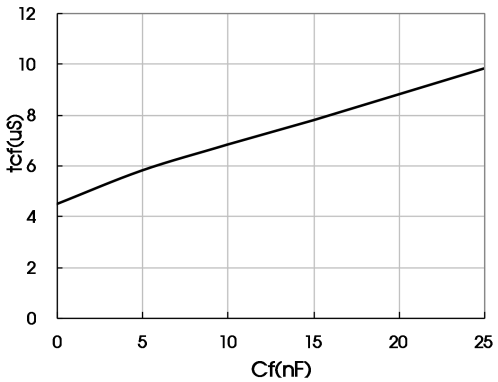
When short-circuit or over-current occurs in application, the driver protection circuit activates and turns off the IGBT slowly. The default turn-off time of 4.5μS, also, the turn-off time can be adjusted by connecting an external Rf (to) or Cf, and can be reduced by Rf, increased by Cf.The adjustable range is 2.5uS to 10uS. Parameter refers to Reference table for protective turn-off time adjustment (data included in the table is only for reference and the actual value adjusts base on application)

Reference table for Fault soft turn-off time adjustment regulation			
R_f(KΩ)	t_{cf}(μS)	C_f(nF)	t_{cf}(μS)
—	4.5	—	4.5
1.5	4.0	1	4.9
0.5	3.5	3.3	5.3
0.3	3.0	10	6.5
0.11	2.5	22	9.3

Reference curve of relation between fault soft turn-off time and Rf



Reference curve of relation between fault soft turn-off time and Cf

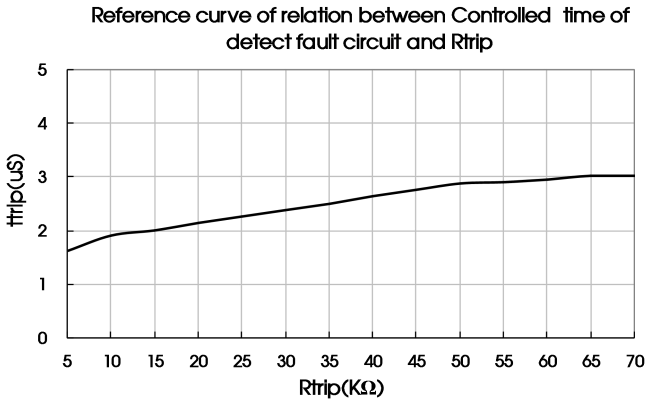


Note: Ta=25℃,V_D=15V.

(2) Controlled time of detect fault circuit adjustment:

When short circuit or over current occurs in application, the time from the driver detecting short circuit or over current to that the gate potential goes down to 90% of normal amplitude is called Controlled Time of Detect fault Circuit. The driver sets the max. controlled time of detect fault circuit as the default and the user can reduce it by externally connecting Rtrip .Minimum can be adjusted to 1.6uS. Parameter refers to Reference table for Controlled time of detect short circuit adjustment (data included in the table is only for reference and the actual value adjusts base on application)

Reference table for Controlled time of detect fault circuit adjustment	
Rtrip (kΩ)	ttrip(μS)
--	3.50
68	3.00
51	2.80
30	2.48
20	2.28
15	2.0
10	1.9
5.1	1.60

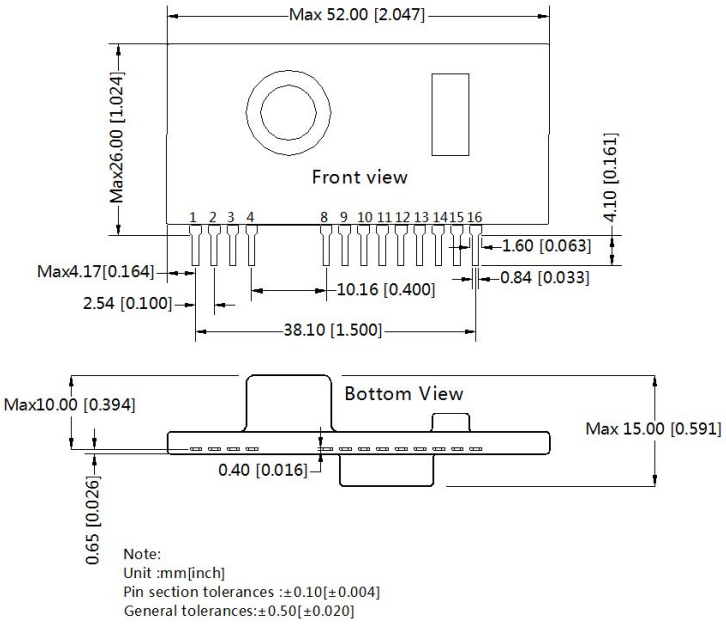


Note: Ta=25℃,VD=15V.

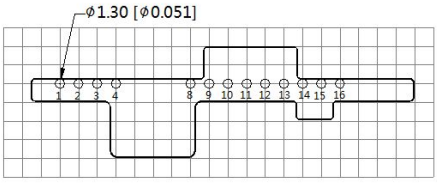
3. For more information please find IGBT Driver application notes on www.mornsun-power.com

Dimensions and Recommended Layout

THIRD ANGLE PROJECTION



Note:
Unit :mm[inch]
Pin section tolerances :±0.10[±0.004]
General tolerances:±0.50[±0.020]



Note:Grid 2.54*2.54mm

Pin-Out			
Pin	Function	Pin	Function
1	Power supply (+)	11	Drive output
2	Power supply (-)	12	Collector of internal power tube
3	Drive signal input(+)	13	Detect of short circuit
4	Drive signal input(-)	14	Adjustment of Soft turn-off time
8	DC/DC converter output (+)	15	Fault signal output
9	DC/DC converter output (COM)	16	Adjustment of short-circuit detection time delay
10	DC/DC converter output (-)		

Notes:

1. Packing information please refer to Product Packing Information which can be downloaded from www.mornsun-power.com. Packing bag number: 58230001;
2. The built-in DC/DC isolation power supply is only used internally by the driver and external connection is not permissible, it is recommend that the output filter capacitor does not exceed 220uF;
3. The driver is expected to be wired as closed as possible to gate terminal and emitter terminal of the IGBT module , no longer than 1m;
4. It is suggested to wire the driver to gate terminal and emitter terminal of the IGBT module by twisted pair.
5. The gate resistance can be properly added in order to reduce the high voltage spike generated at the collector terminal when IGBT is soft turn-off.
6. The additional capacitor or resistor should be as close as possible to the driver and the value should not exceed the recommended maximum when the turn-off time and controlled time of detect short circuit is to be adjusted;
7. Try to select low-internal resistance electrolytic capacitor(s) which should be placed as close as possible to the driver for C2 and C3;
8. The withstanding voltage of the fast recovery diode D1 connecting PIN13 to IGBT collector terminal must be higher than the peak voltage withstood by the collector terminal when IGBT cuts-off;
9. PIN13 may withstand higher voltage due to the reverse recovery characteristics of D1 when the reverse recovery time is long, thus causing damage to the driver. Therefore, it is suggested to add 30V TVS diode DZ1 at the terminals of PIN13 and PIN10;
10. 4.7KΩ resistance can be connected between PIN13 and PIN9 (D1 and DZ1 is not required in this circuit) if short circuit or over-current protective circuit is not required;

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