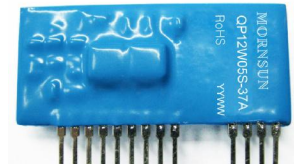


## QP12W05S-37A Hybrid Integrated IGBT Driver



RoHS

QP12W05S-37A is a hybrid integrated IGBT driver designed for driving IGBT modules. 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 an over-current protection function based on desaturation detection and fault output.

### Features

- I Built in high CMRR opto-coupler (CMR: Typical: 30kV/μs, Min.: 15kV/μs)
- I Single supply drive topology
- I Built in the isolated type DC/DC converter for gate drive
- I SIP package
- I CMOS&TTL compatible
- I Electrical isolation voltage between input and output is 3750VRMS (for 1 minute)
- I Built in short circuit protection circuit with a pin for fault output
- I Soft turn-off time is adjustable
- I The drive signal is ignored in the blocking time and the protection circuit reset at the end of it
- I Controlled time detect short circuit is adjustable
- I Switching frequency up to 20kHz

### Application

- I General-purpose Inverter
- I AC Servo Systems
- I Uninterruptable Power Supplies(UPS)
- I Welding Machines

### Recommended modules

- I 600V Series IGBT(up to 600A)
- I 1200V Series IGBT(up to 400A)
- I 1700V Series IGBT(up to 200A)

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### Absolute Maximum Ratings

Item	Test Conditions	Ratings	Units
Supply Voltage	$V_D$ DC	13	V
Input Current	$I_{in}$ Between pin3 and pin4	25	mA
Out Voltage	$V_O$ When the Output voltage "H"	$V_{CC}$	V
Output Current	$I_{g\ on}$ Pulse width 2μs	+5	A
	$I_{g\ off}$ Frequency f=20kHz	-5	A
Isolation Voltage	$V_{iso}$ Sine wave voltage 50Hz/60 Hz, 1 min.	3750	V
Operation Temperature	$T_{op}$	-40 ~ +70	°C
Storage Temperature	$T_{st}$	-50 ~ +125	°C
Fault Output Current	$I_{FO}$ Pin15 input current	20	mA
Input Voltage	$V_{R1}$ Applied pin13	50	V

Notes: 1.  $T_a=25^{\circ}C$ ;  $V_D=12V$ , unless otherwise specified

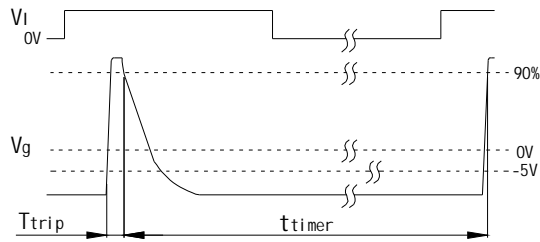
### Electrical Characteristic

Characteristics	Test Conditions	Limit			Units
		Min	Typ.	Max	
Supply Voltage	$V_D$ Recommended Range	11.6	12	12.4	V
"H" input current	$I_{IH}$ Recommended Range	10	16	20	mA
Switching frequency	$f$ Recommended Range	0		20	kHz
Gate resistant	$R_g$ Recommended Range	2			Ω
Gate supply voltage	$V_{CC}$ $V_D=12V$	14.5		18.0	V
	$V_{EE}$ $V_D=12V$	-7		-10	V
"H" output voltage	$V_{OH}$ 10KΩconnected between pin9-11	13.5	15.3	17.0	V
"L" output voltage	$V_{OL}$ 10KΩconnected between pin9-11	-6		-10	V
"L-H" propagation delay time	$t_{PLH}$ $I_{IH}=10mA$		0.5	1	μs
"L-H" rise time	$t_r$ $I_{IH}=10mA$		0.3	1	μs
"H-L" propagation delay time	$t_{PHL}$ $I_{IH}=10mA$		1	1.3	μs
"H-L" fall time	$t_f$ $I_{IH}=10mA$		0.3	1	μs
Protection threshold voltage	$V_{OCP}$ $V_D=12V$		9.5	15	V
Protection reset time	$t_{timer}$ Between start and cancel	1	1.4	2	ms
Fault output current	$I_{FO}$ Pin15 input current, R=4.7K		5		mA
Short-circuit detection time delay	$T_{trip1}$ Pin 13: ≥15V, Pin 16: open		1.6		μs
Soft turn-off time	$T_{of}$ PIN 13≥15V, Pin 14: open		4.5		μs
SC detect voltage	$V_{SC}$ Collector voltage of module	15			V

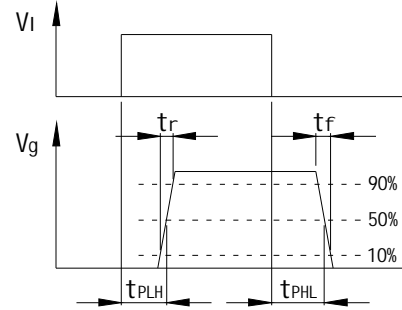
Notes: 1.  $T_a=25^{\circ}C$ ,  $V_D=12V$ ,  $R_g=5\Omega$ , unless otherwise specified  
2. "H" represents high level; "L" represents low level.

## Definition of Characteristics

### 1) Operation of short circuit protection



### 2) Switching operation

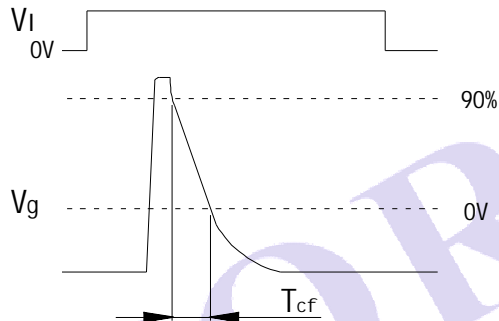


## Definition of Adjustment

### 1) Adjustment of soft turn-off time:

#### (Operation of short circuit protection)

When a desaturation is detected the hybrid gate driver performs a soft shutdown of the IGBT. The Soft turn-off time is 4.5μS. You can connect an Rf or Cf to adjust the Soft turn-off time. (Connecting Rf will decrease the soft turn-off time and connecting Cf will increase the soft turn-off time.) The soft turn-off time must be set  $2.5\mu\text{S} < T_{cf} < 10\mu\text{S}$ . Please refer to the below table.

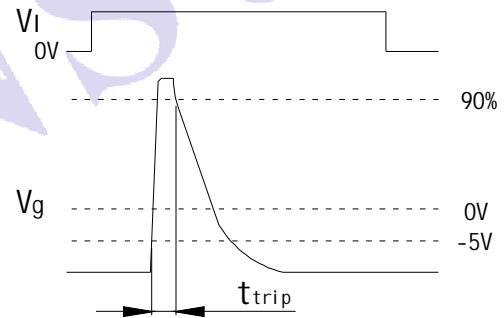


Rf (Ω)	Tcf (μS)	Cf (nF)	Tcf(μS)
—	4.5	—	4.5
1500	4.0	1	4.9
500	3.5	3.3	5.3
300	3.0	10	6.5
110	2.5	22	9.3

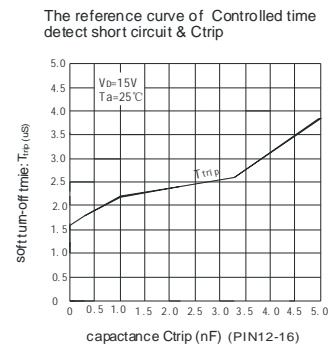
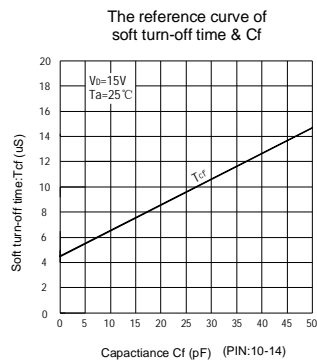
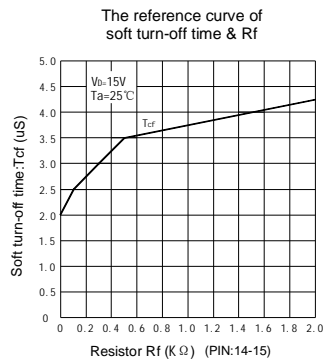
### 2) Adjustment of short-circuit detection time delay

#### (Operation of short circuit protection)

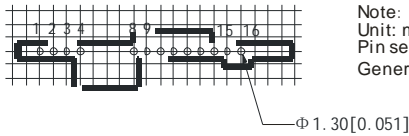
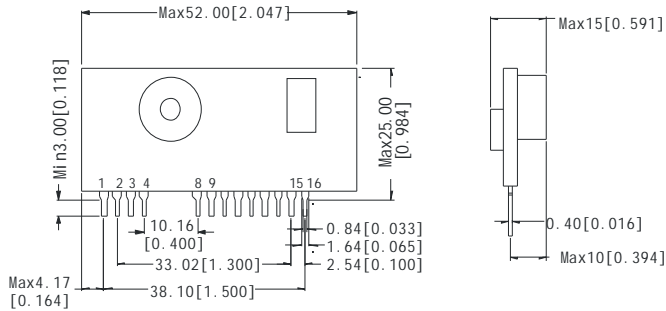
The short-circuit detection time delay is defined between the time in which a desaturation is detected and the time in which the gate voltage fall down to 90% of extent. This diver have a minimum short-circuit detection time delay, and you can adjust the short-circuit detection time delay by connecting the capacitor (Ctrip) between PIN12 and 16. But the short-circuit detection time delay must be set less than 3.5μS. Please refer to below table.(the data only for refer)



Ctrip (nF)	Ttrip(μS)
—	1.6
0.33	1.8
1.0	2.2
2.2	2.4
3.3	2.6



## Outline Dimensions

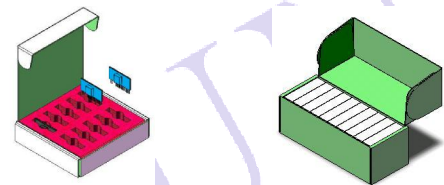


Note:  
Unit: mm[inch]  
Pin section tolerances: ±0.10mm[±0.004inch]  
General tolerances: ±0.30mm[±0.012inch]

## Pin Function

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

## Package diagram



(small white box)

(inner packaging box)

Small white box dimensions: L\*W\*H=163\*150\*35mm

Packaging quantity: 10PCS

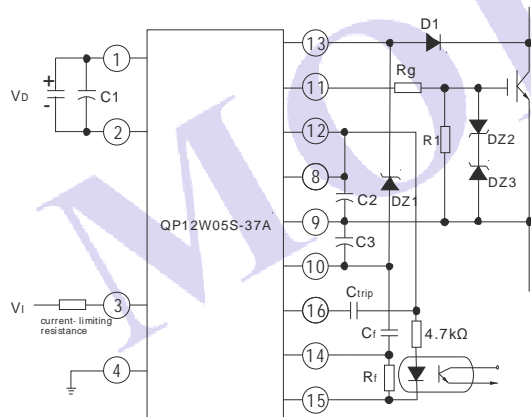
Inner packaging box dimensions: L\*W\*H=430\*175\*160mm

Packaging quantity: 100PCS

Outer packaging carton dimensions: L\*W\*H=560\*450\*520mm

Packaging quantity: 900PCS

## Application Examples



$V_0=12V$

$V_i=5V\pm 5\%$

C1:100 $\mu$ F (Low impedance)

C2:100 $\mu$ F (Low impedance)

C3:100 $\mu$ F (Low impedance)

Ctrip: Depend on need.

Cf: Depend on need

Rf: Depend on need

Rg:5 $\Omega$  (Adjustable)

R1: 10K $\Omega$  0.25W

DZ1:30V

DZ2, DZ3:18V

D1:Fast recovery diode ( $t_{rr} \leq 0.2ms$ )

## Application Notes

- The isolated DC/DC converter is only for the gate drive;
- The IGBT gate-emitter drive loop wiring must be shorter than 1 meter;
- The IGBT gate-emitter drive loop wiring should be twisted;
- If large voltage spike is generated at the collector of the IGBT, the IGBT gate resistor should be increased;
- The external  $C_f$  or  $R_f$  should be set as close as possible to the Hybrid IC, and the value can not exceed the recommended maximum;
- The voltage compensate capacitors should be low impedance and be located as close as possible to the Hybrid IC;
- The peak reverse voltage of the diode D1(to connect PIN13) must be higher than the peak value of the IGBT collector voltage;
- When recovery current flow in D1, PIN13 is applied high voltage. In the case, counterplan for protection which insert a zener diode between PIN10 and 13 are necessary like above diagram(DZ1);
- When the built in short-circuit protection circuit need not be used, please connect resistance of 4.7k $\Omega$  between PIN9 and 13(D1and DZ1are not required.)
- 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:

$$R = \frac{V_{in} - 1.7V}{16mA} - 150ohm$$