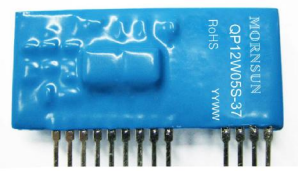
MORNSUN®

QP12W05S-37

Hybrid Integrated IGBT Driver



RoHS

QP12W05S-37 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

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

Application

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

Recommended modules

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

MORNSUN Science & Technology Co.,Ltd.
Address: No. 5, Kehui St. 1, Kehui development center, Science Ave., Guangzhou Science City, Luogang district, Guangzhou,P.R.China.
Tel: 86-20-38601850
Fax:86-20-38601272
Http://www.mornsun-power.com

Absolute Maximum Ratings

Item		Test Conditions	Ratings	Units
Supply Voltage	V_D	DC	16	V
Input Current	Iin	Between pin3 and pin4	25	mA
Output Voltage	V_O	When the Output voltage “H”	V_{CC}	V
Output Current	$I_{g\ on}$	Pulse width 2μs Frequency f=20kHz	+5	A
	$I_{g\ off}$		-5	A
Isolation Voltage	V_{iso}	Sine wave voltage 50Hz/60 Hz,1 min.	3750	V
Operation Temperature	T_{op}		-40 ~ +70	℃
Storage Temperature	T_{st}		-50 ~ +125	℃
Fault Output Current	I_{FO}	Pin5 input current	20	mA
Input Voltage	V_{R1}	Applied pin13	50	V

Notes: 1. Ta=25℃; V_D=15V, unless otherwise specified.

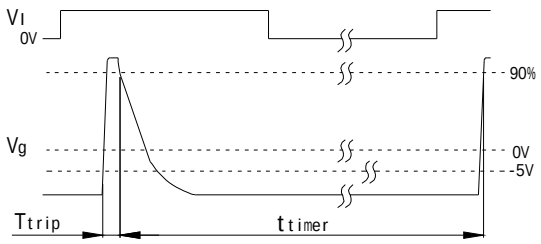
Electrical Characteristic

Characteristics		Test Conditions	Limit			Units
			Min	Typ.	Max	
Supply Voltage	V_D	Recommended Range	14.5	15	15.5	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=15V	14.5		18.0	V
	V_{EE}	V_D=15V	-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=15V		9.5		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_{cf}	PIN 13≥15V, Pin 14:open		4.5		μs
SC detect voltage	V_{SC}	Collector voltage of module	15			V

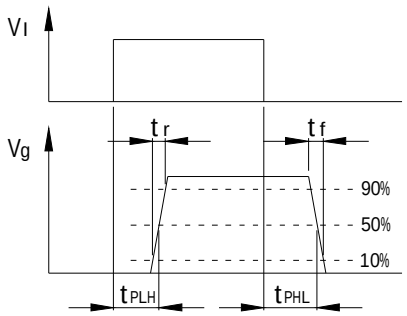
Notes: 1. Ta=25 °C, V_D=15V, Rg=5Ω. unless otherwise specified
2.”H” represents high level; “L” represents low level.

Definition of Characteristics

1) Operation of short circuit protection



2) Switching operation

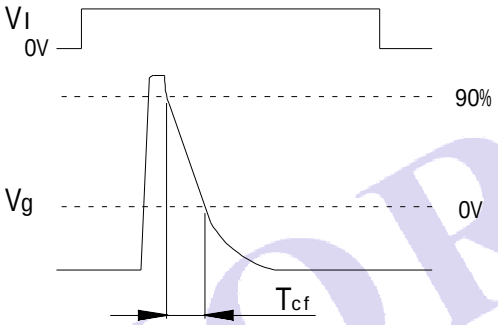


Definition of Adjustment

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 increase the soft turn-off time and connecting Cf will decrease the soft turn-off time.) The soft turn-off time must be set 2.5μS< T_{cf} <10μS. Please refer to the below table.

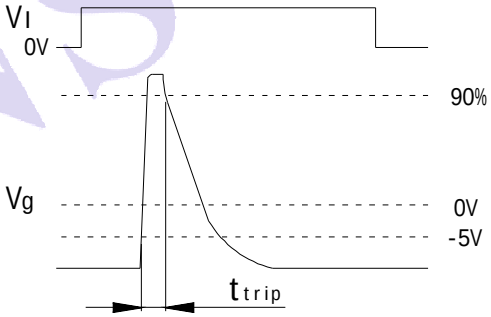


The soft turn-off time & R_f ,C_f			
R_f (Ω)	T_{cf} (μS)	C_f (nF)	T_{cf}(μS)
—	4.5	—	4.5
1500	4.0	1	4.9
500	3.5	3.3	5.3
300	3.0	10	6.5
110	2.5	22	9.3

2) Adjustment of short-circuit detection time delay

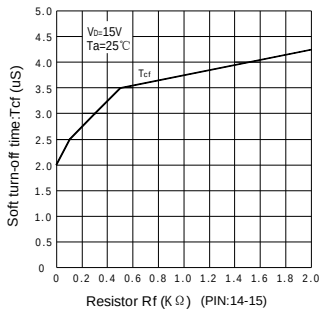
(Operation of short circuit protection)

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)

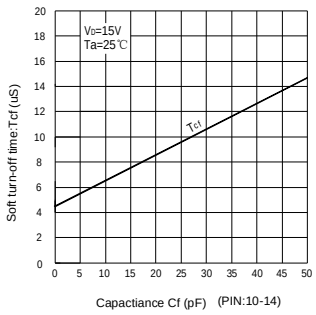


The short-circuit detection time delay & capacitor Ctrip	
Ctrip (nF)	Ttrip(μS)
—	1.6
0.33	1.8
1.0	2.2
2.2	2.4
3.3	2.6

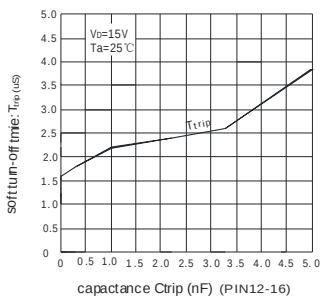
The reference curve of soft turn-off time & Rf



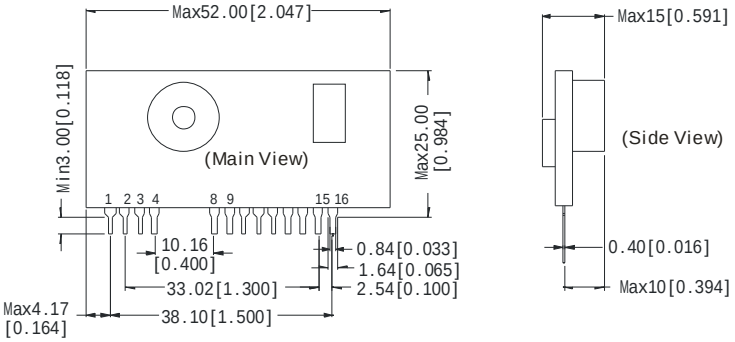
The reference curve of soft turn-off time & Cf

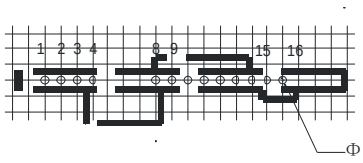


The reference curve of Controlled time detect short circuit & Ctrip



Outline Dimensions





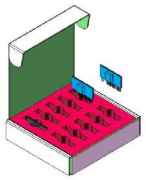
Note:Grid 2.54*2.54mm

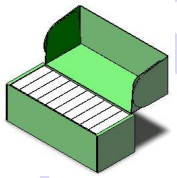
Note:
Unit: mm[inch]
Pin seciton tolerances : ±0.10mm[±0.004inch]
General tolerances :±0.30mm[±0.012inch]

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

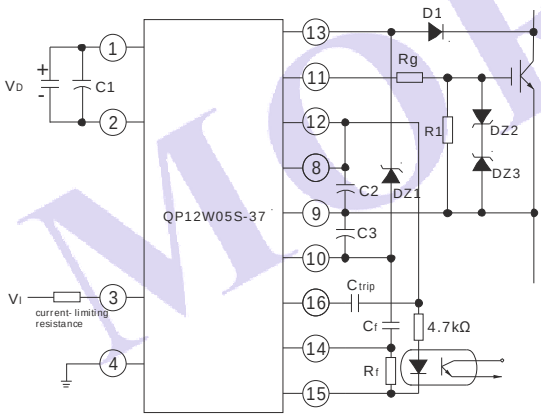




（small white box） **（inner packaging box）**

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_D=15V
V_I=5V±5%
C1:100μF (Low impedance)
C2:100μF (Low impedance)
C3:100μF (Low impedance)
Ctrip: Depend on need.
Cf: Depend on need
Rf: Depend on need
Rg:5Ω (Adjustable)
R1: 10KΩ 0.25W
DZ1:30V
DZ2, DZ3:18V
D1: Fast recovery diode (trr≤0.2μs)

Application Notes

1. The isolated DC/DC converter is only for the gate drive;
2. The IGBT gate-emitter drive loop wiring must be shorter than 1 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, the IGBT gate resistor should be increased;
5. The external capacitors or resistors should be set as close as possible to the Hybrid IC;
6. 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;
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. 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);
9. When the built in short-circuit protection circuit need not be used, please connect resistance of 4.7kΩ between PIN9 and 13(D1and DZ1are not required).
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:

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