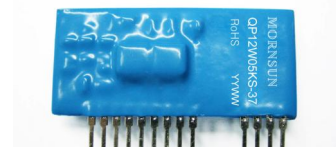


QP12W05KS-37

Hybrid Integrated IGBT Driver

QP12W05KS-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.



RoHS

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	16	V
Input Current	I_{in} 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 $I_{g off}$ Frequency f=20kHz	+5	A
		-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_F Pin5 input current	20	mA
Input Voltage	V_R Applied pin13	50	V

Notes: 1. $T_a=25^{\circ}C$; $V_D=15V$, unless otherwise specified.

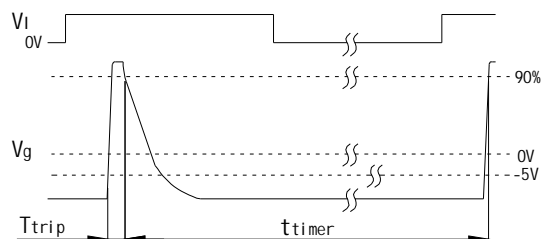
Electrical Characteristic

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_C $V_D=15V$	14.5		18.0	V
	V_E $V_D=15V$	-7		-10	V
"H" output voltage	V_O 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_{time} 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_S Collector voltage of module	15			V

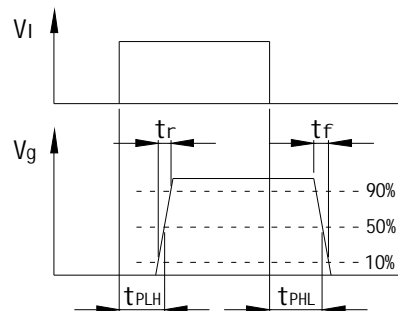
Notes: 1. $T_a=25^{\circ}C$, $V_D=15V$, $R_g=5\Omega$, unless otherwise specified
2."H" represents high level; "L" represents low level.

Definition of Characteristics

1) Operation of short circuit protection



2) Switching operation

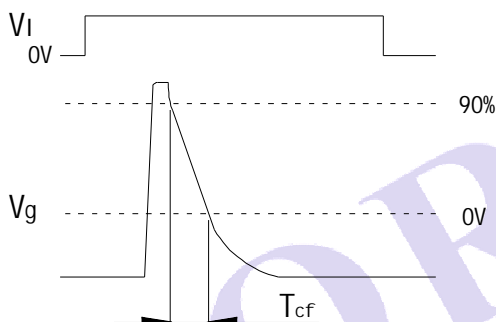


Definition of Adjustment

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 4.5 μ S. You can connect an R_f or C_f to adjust the Soft turn-off time. (Connecting R_f will decrease the soft turn-off time and connecting C_f will increase the soft turn-off time.) The soft turn-off time must be set 2.5 μ S < T_{cf} < 10 μ S. Please refer to the below table. (the data only for refer)

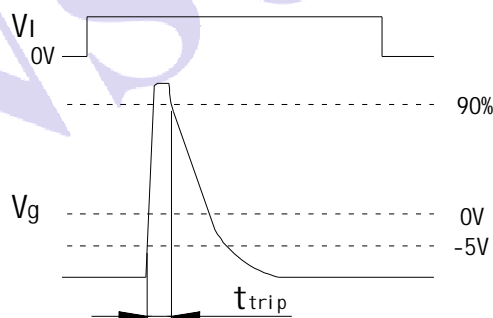


The soft turn-off time & R _f , C _f			
R _f (Ω)	T _{cf} (μ S)	C _f (nF)	T _{cf} (μ S)
—	4.5	—	4.5
1500	4.0	1	4.9
500	3.5	3.3	5.3
300	3.0	10	6.5
110	2.5	22	9.3

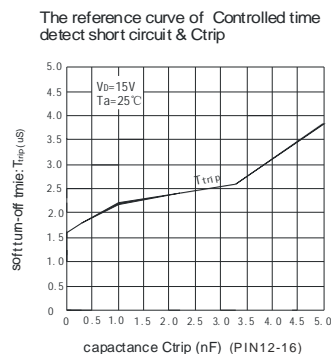
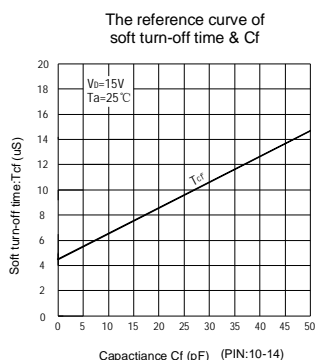
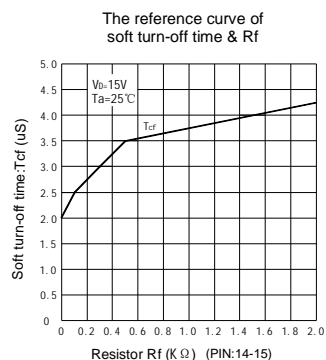
2) Adjustment of short-circuit detection time delay

(Operation of short circuit protection)

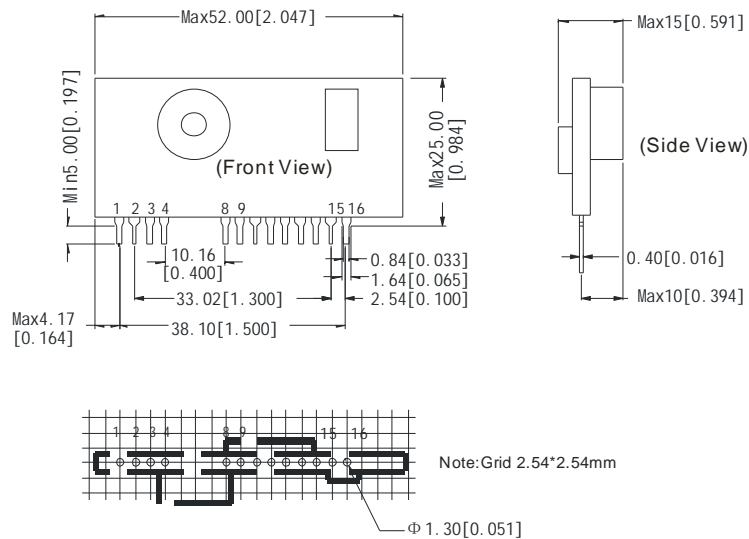
The short-circuit detection time delay is defined between the time in which a desaturation is detected and the time in which the gate voltage fall down to 90% of extent. This diver have a minimum short-circuit detection time delay, and you can adjust the short-circuit detection time delay by connecting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



The short-circuit detection time delay & capacitor C _{trip}	
C _{trip} (nF)	T _{trip} (μ S)
—	1.6
0.33	1.8
1.0	2.2
2.2	2.4
3.3	2.6



Outline Dimensions

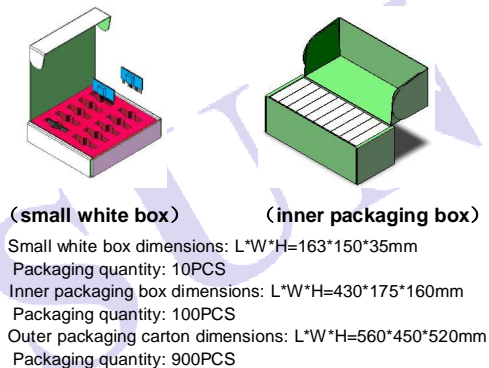


Note:
Unit: mm[inch]
Pin section tolerances: $\pm 0.10\text{mm}[\pm 0.004\text{inch}]$
General tolerances $\pm 0.30\text{mm}[\pm 0.012\text{inch}]$

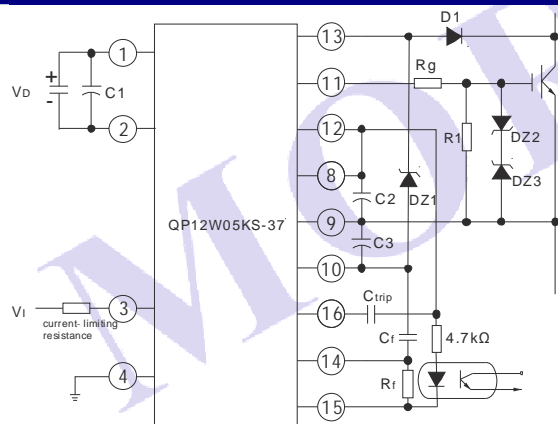
Pin Function

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



Application Examples



V_D=15V
V_I=5V±5%
C1:100μF (Low impedance)
C2:100μF (Low impedance)
C3:100 μ F (Low impedance)
C_{trip}: Depend on need.
C_f: Depend on need
R_f: Depend on need
R_g:5Ω (Adjustable)
R1: 10KΩ 0.25W
DZ1:30V
DZ2, DZ3:18V
D1: Fast recovery diode (trr≤0.2μs)

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 use twisted-pair;
- 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 4.7kΩ 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:

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