

## **Chapter One: GAOTEK-MCK 2812 High Voltage Driven Board's Overview**

GAOTEK-MCK 2812 High Voltage Driven Board is TMS320F2812 Evaluation Board based on TI Company's DSP chip. This evaluation board is to help users to understand DSP's basic features of C28X series quickly and master the application of motor control field. And this GAOTEK-MCK2812 evaluation board can provide a quick solution to customers, a full digital server motion control system which is constituted by external DC brush or non-brush motor, asynchronous AC motor, permanent magnet synchronous motor and step motor.

### **1.1 Main Features**

- Configuration of 256K (Program 64K, data 64K) non-delay SRAM, clock frequency at 150MHz on board;
- 16-Channel 12 bit A/D internal converter;
- 128K Flash ROM is re-programmable;
- In-chip event organizer directly controls 12-channel PWM pulse outputs. 6 hardware acquisition units can connect to Hall signal and photoelectric encoder signal.
- In-chip SPI slot exchanges data with serial EEPROM for boot load function
- 250Kbps communication's rate between RS232C interface and host
- On-board IEEE1149.1 JTAG slot supports system emulation and Flash ROM program
- On-board optical encoder input slot and Hall input slot
- AC 220V input, supplying power to control system
- Completely separation of digital ground and simulation ground, supporting output interface of testing point

## **Chapter Two: GAOTEK-MCK 2812 High Voltage Driven Board's Layout**

### **2.1 GAOTEK-MCK2812 High Voltage Driven Board's Layout**

MCK2812 high voltage driven board connects with MCK2812HV and MCBUS1 of EVM2812 board to group up an electric motor driving system, and connects with MCBUS2 of IO2812 and EVM2812 to display revolution figure.

## 2.2 GAOTEK-MCK2812 High Voltage Driver Board Operation

The whole driving system needs +310V, +15V, +5V or +3.3V (DC power supply). +310V is for electric motor. +15V supports IPM module. +5V and +3.3V supports DSP chips and other control circuits.

User provides 220V AC power when using the board. The power on board can generate two way isolation voltage 5V and five way isolation voltage 15V, and LM1117-3.3 generates 3.3V voltage.

Please directly provide 220V power supply to J4 slot, and pay attention to polarity. If **LED1 and D11** LEDs are on, it means power supply has been successfully connected to the whole driver board.

**J1** of MCK2812HV and **JP11** of EVM2812 CANNOT be powered simultaneously, because that would cause the damage of evaluation board and high voltage board.

**U, V, W** of **J1** correspond to PWM (1,2), PWM (3,4) and PWM (5,6) bridge output; **J3 and J5** correspond to acquisition units of file manager EVA/EVB or GPIO can directly input Hall signal and photoelectric encoder separately, or simultaneously.

If only Hall signal is inputted, CAP of file manager would capture the input, and **JP2, JP3 and JP4** jump to Pin 2 and Pin 3, and **JP5, JP6 and JP7** are off. If only photo encoder signal is connected, CAP of file manager would capture the input, and **JP2, JP3 and JP4** jump to pin 1 and pin 2, and **JP5, JP6 and JP7** are off. If both Hall and photoelectric signal are connected, JP4, JP5 and JP6 can **JP2, JP3 and JP4** jump to pin1 and pin2, and connect photoelectric to CAP, and jump on **JP5, JP6 and JP7**, then connect Hall signal to corresponding GPIO port. By doing this, it is possible to use only one EVM2812 board to drive two MCK2812LC boards simultaneously.

**J2** is the MCBUS port of MCK2812, which connects with EVM2812's **JP1** or **JP2** to form a complete control system. Please note that when hooking up the circuit, pay attention to pin order.

## 2.3 Power Supply Connection

A 220V power supply can be directly provided to **J1**. Please pay attention to connection order: emulator is connected to EVM2812 board by JTAG, after EVM2812 and MCK2812HV are connected, power up **J1**. It is essential to power off the evaluation board before JTAG is pulled out.

If the board is powered by **J1**, the +5V power can not be connected to other +5V power source to prevent current from flowing back.

## 2.4 Digital/Simulation IO Signal Input / Output

TMS320F2812 provides 16-way 10 bit A/D inputs, 14 of which are led by corresponding ports (AD0-AD7 are led by J5 and AD8-AD13 are led by J6).

Internal AD assignment:

AD0 is U phase mid-voltage monitor input. Hall Sensor output 0-5V voltage, divided input to AD port

AD1 is V phase mid-voltage monitor input. Hall Sensor output 0-5V voltage, divided input to AD port

AD2 is W phase mid-voltage monitor input. Hall Sensor output 0-5V voltage, divided input to AD port

## 2.7 Hall Signal and Orthogonal Encoding Signal Input

Hall signal and orthogonal encoding signal are both 5V TTL or CMOS inputs. On-board voltage divider would transfer 5V input into 3.3V input.

There is a pull-up resistor on MCK2812 board, which connects between OC output or direct output Hall signal and photoelectric encoding signal.

**J5** is Hall signal input (6 pins input), and **J3** is orthogonal encoding photoelectric input port (8pins).

## 2.8 Over-Current Protection

GAOTEK-MCK2812 owns an over-current protection hardware (to directly cut off the Driver output), which conducts forcible cut-off of the IPM module in case of accidental short-circuits. The default on-board over-current is 20A and is set mainly depending on the IPM module. In addition, GAOTEK-MCK2812HV boasts user-adjustable over-current protection function; its T2CTrip, as an I/O port, can cut off all the output on optical-coupler low-voltage side through CPLD. Performing this function, it needs to adjust the wire jumperJP9 at pin2 and pin3; if this function is off, it needs to adjust the wire jumperIP9 at pin1 and pin2. When the operating current is excessive, the over-current, through a 0.015ohm sampling impedance, will cut off IGBT by IPM and send out FALT signal, and then the CPLD on the low voltage side will cut off all the PWM output and optical -coupler output, the DS1 indicator will be on.

## 2.9 Straight-through Protection

CPLD on board is integrated with straight-through protection program to prevent IPM damage by straight-through between the up and down bridges resulted from program mistakes during the operation. If the straight-through happens, the DSS indicator will be on.

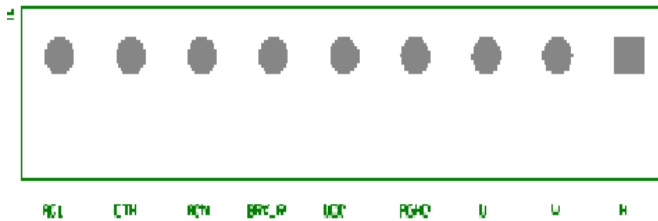
## 2.10 OVP and UVP

LM339 performs over-voltage protection (OVP) and under-voltage protection (UVP) by comparing with generatrix. When the input voltage exceeds 400V, it means over-voltage, the DS2 indicator will be on to indicate over-voltage. When the input voltage is under 100V or so, the DS3 indicator will be on to indicate under-voltage. DS2 indicator will be on after 15s power-off.

## Chapter 3: Input / Output Socket Instructions

### 3.1 J1 Pins of Socket Instruction

J1 is Hall sensor input pin



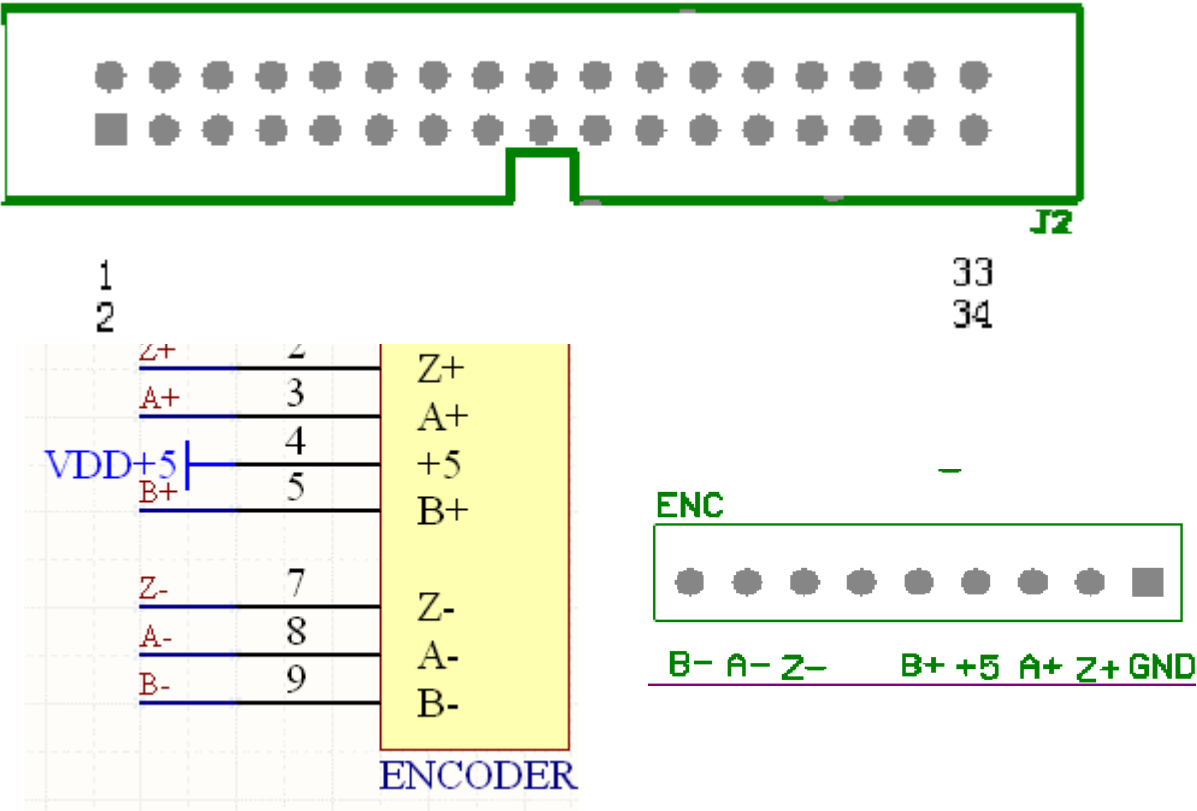
J1's wiring instruction is shown as below:

J1-9	Power AC 220V Input L
J1-8	Power GND
J1-7	Power AC 220V Input N
J1-6	Braking Resistor Port
J1-5	DC -330V
J1-4	DC +330V
J1-3	Phase U of Motor
J1-2	Phase V of Motor
J1-1	Phase W of Motor

Pin #	Signal	Pin #	Signal
1	PWM1	2	PWM2
3	PWM3	4	PWM4
5	PWM5	6	PWM6
7	T1PWM	8	T2PWM
9	CAP1	10	CAP2
11	CAP3	12	TDIRA
13	TCKINA	14	/T1CTRIP
15	XINT2	16	/T2CTRIP
17	(empty)	18	(empty)
19	(empty)	20	(empty)
21	GND	22	GND

23	+5V	24	+5V
25	(empty)	26	ADCLO
27	ADINA6	28	ADINA7
29	ADINA4	30	ADINA5
31	ADINA2	32	ADINA3
33	ADINA0	34	ADINA1

3.2 J2 Pin Assignment



### 3.3 J4 CPLD Interface

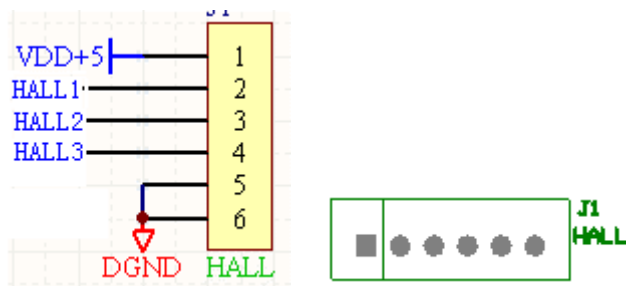
This interface can be used for download of CPLD program. In order to prevent modification of CPLD program from user, we have carried out a special deal with the interface and it is not exposed to users.

### 3.4 J4 Pin Assignment

J4 is for CPLD download firmware.

### 3.5 J5 Pin Assignment

J5 is Hall sensors input.



J5iØ1	+5V
Input J5iØ2	HALL A
J5iØ3	HALL B
J5iØ4	HALL C
J5iØ5	GND
J1iØ6	GND

## Chapter 4: MCK2812 Jumpers Instruction

Jumper #	Dimensions	Function
JP2	1×3	CAP Pin input HALL/ENC Signal choice
JP3	1×3	CAP Pin input HALL/ENC Signal choice
JP4	1×3	CAP Pin input HALL/ENC Signal choice
JP5	1×2	HALL Signal Input IO Port
JP6	1×2	HALL Signal Input IO Port
JP7	1×2	HALL Signal Input IO Port
JP8	1×3	pull-up /pull-down for 6 channel PWM signal
JP9	1×3	Hardware / Software to close PWM output

### JP2. CAP Pin input HALL/ENC Signal choice

1-2	CAP input photoelectric signal
2-3	CAP input HALL Signal

### JP3. CAP Pin input HALL/ENC Signal choice

1-2	CAP input photoelectric signal
2-3	CAP input HALL Signal

### JP4. CAP Pin input /HALL/ENC Signal choice

1-2	CAP input photoelectric signal
2-3	CAP input HALL Signal

### JP5. HALL Signal Input IO Port

1-2	HALL Signal Input IO Port
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### JP6. HALL Signal Input IO Port

1-2	HALL Signal Input IO Port
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### JP7. HALL Signal Input IO Port

1-2	HALL Signal Input IO Port
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### JP8. pullup /pulldown for 6 channel PWM signal

1-2	PWM signal pullup status
1-3	PWM signal pulldown status

### JP9. Hardware/Software output PWM

1-2	Software 6-channel PWM output
2-3	Hardware 6-channel PWM output

## Chapter 5: Specifications

### 5.1 Maximum limit in normal environment

- Power Supply: 150V to 270V
- $V_{CCP}$ : -0.3V to 5.5V
- Theoretical input voltage range  $V_{IN}$ : -0.3V to 4.6V
- Theoretical output voltage range  $V_O$ : -0.3V to 4.6V
- DSP Input Clamp Current  $I_{IK}$  ( $V_{IN} < 0$  or  $V_{IN} > V_{CC}$ ):  $\pm 20\text{mA}$
- DSP Output Clamp Current  $I_{OK}$  ( $V_O < 0$  or  $V_O > V_{CC}$ ):  $\pm 20\text{mA}$
- Operation Temperature: -40°C to 85°C

### 5.2 Recommended Operating Conditions

		min	medium	max	unit
VDD/VDDO Supply Voltage	VDD=VDDO+0.3v	15	30	63	v
VSS GND		0	0	0	v
PLL VCCA PLL Supply Voltage		3	3.3	3.6	v
VCCA ADC supply Voltage		3	3.3	3.6	v
VCCF Flash supply Voltage		4.75	5	5.25	v
fCLKOUT System Clock		2		40	MHz
VIH High level input Voltage	All input	2		VDD+0.3	v
VIL Low level input Voltage	All input	2		0.8	v
IOH High level input Current $V_{OH}=2.4\text{V}$	Group 1			-2	mA
	Group 2			-4	mA
	Group 3			-8	mA
IOL High level input Current $V_{OL} = V_{OLMAX}$	Group 1			2	mA
	Group 2			4	mA
	Group 3			8	mA
TA Air temperature		-40		85	°C
TJ conjunction temperature		-40	25	150	°C
Nf Flash Array Endurance	-40°C to 85°C	10K			cydes

Group 1: PWM1-PWM6, T1PWM, T2PWM, CAP1-CAP6, TCLKINA, RS, IOPF6, TCK, TDI, TMS, XF, A0-A15

Group 2: PS/DS/IS, RD, W/R, STRB, R/W, VIS\_OE, D0-D15, T3PWM, T4PWM, PWM7-PWM12, CANTX, CANRX, SPICLK, SPISOMI, SPISIMO, SPISTE, EMU0, EMU1, TDO, TMS2

Group 3: TDIRA, TDIRB, SCIPXD, SCITXD, XINT1, XINT2, CLKOUT, TCLKINB