SMARTLAB
USB 16 CHANNELS PHOTO ISOLATOR INPUT/SSR OUTPUT BOARD

OPERATION MANUAL

Decision Group Inc.

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CHAPTERS

APPENDICES

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- Output break down voltage : +-60V
- Continuous load current : +-400mA
- Maximum 50mA forward input current.
- Input voltage range from 0V to 30V.
- Activation voltage of photo input:
  When short jumpers (input range from 0 to 20V DC)
  　　0 to 3.3V　inactive
  　　4.5 to 20V　active
  When open jumpers (input range from 0 to 30V DC)
  　　0 to 17.6V　inactive
  　　18 to 30V　active
- Suitable for Linux, MS/Windows ... etc.
- Operating temperature range from 0 to 55º C.
- Relative humidity rage from 0 to 90%.

❖ **PACKAGE CONTENTS:**

- SMARTLAB USB 16 channels photo isolator input/ SSR output board.
- USB cable.
- Decision Studio and User's manual CD.
- Two Different Connecter Types can be selected:
  　　Standard: European P.C.B type terminal blocks
  　　Professional: Pluggable terminal blocks

Optional

- Extension board with DB9 : RS232 or RS422/485
- PCB Carrier

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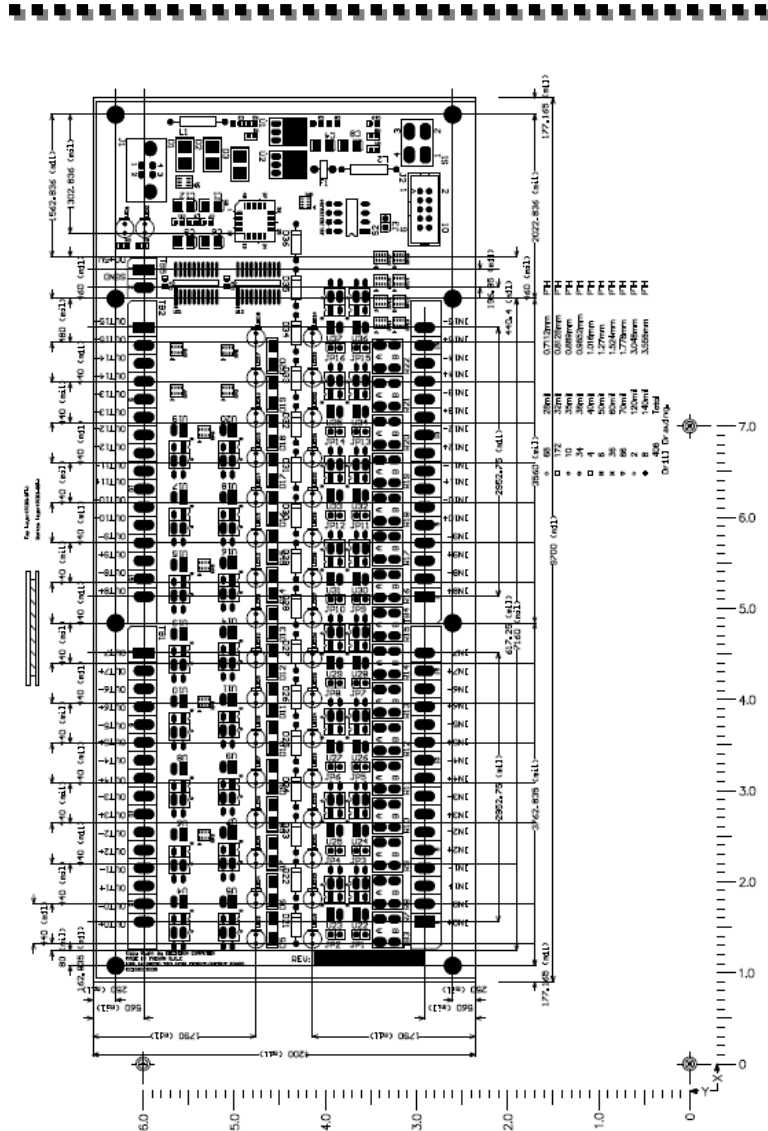
CHAPTER 2

HARDWARE CONFIGURATION

Before you use the USB 16 channels photo couple input/output board, Please ensure that the jumpers and switches setting. The proper jumper and switches settings for the 16 channels photo couple input/output adapter are described in the following.
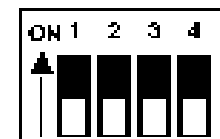
2.1 Switch Settings

1. S1 Reset

The S1 switch is used to reset 8051, the signal assignments are shown in the following.

Pin	Signals
3,4	Reset SW+
1,2	Reset SW-

2. S2 USB ID

The S2 switch is used to identify USB board ID. Please set different board ID to each board (do not duplicate board ID setting).

| 1	2	3	4	ID
ON	ON	ON	ON	--
OFF	ON	ON	ON	14
ON	OFF	ON	ON	13
OFF	OFF	ON	ON	12
ON	ON	OFF	ON	11
OFF	ON	OFF	ON	10
ON	OFF	OFF	ON	9
OFF	OFF	OFF	ON	8
ON	ON	ON	OFF	7
OFF	ON	ON	OFF	6
ON	OFF	ON	OFF	5
OFF	OFF	ON	OFF	4
ON	ON	OFF	OFF	3
OFF	ON	OFF	OFF	2
ON	OFF	OFF	OFF	1
OFF	OFF	OFF	OFF	0

3. Down load revised firmware

When the S2 switch is set to ON ON ON ON status, means down load revised firmware. please follow the steps shown in the following:
1. Set S2 to ON ON ON ON.
2. Run USBBootloader program to download revised firmware.

2.2 Jumper Settings

Input Voltage Range Selection (JP1 to JP16)
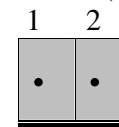
JP1 to JP16 are used to select input voltage range. The JP1 is used to select photo couple input channel 0, and JP2 is used to select photo couple input channel 1, … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input voltage range from 0 to 30V, and the active voltage from 18 to 30V.

Jumper	Input Voltage	Inactive Voltage	Active Voltage
open	0 to 30V	0 to 17.6V	18 to 30V
short	0 to 20V	0 to 3.3V	4.5 to 20V

2.3 USB Connector

1. USB Connector

The USB connector is connected to computer USB port by using USB cable.
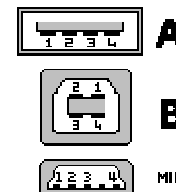
2.4 LED Status

1. LED1
The LED1 is an indicator to show the power is supplied normally.
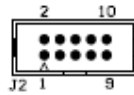2. LED2

The LED2 is an indicator to warning the USB link status. When it lights, it means USB connection works normally, otherwise it is fail.

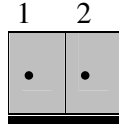## 2.5 Connector and Jumper for Serial Communication

If there isn't a 2x5 header on the board, it means this version doesn't support for serial communication.

1. The connector of serial communication(J2)

To use RS422/RS485/RS232, please connect J2 to extension board by 10 pins flat cable. (Optional)

2. Enable Serial Port (J3)

J3 is used enable serial port communication, when short the J3, means enable serial port, otherwise, when open the J3, the serial port communication is disable.

2.6 Connector Assignments

The photo isolator input signal and output signal pin assignments are shown in the below.

1. **Input Signal Assignments**

Pin	Signal	Description
1	IN-00+	Opto-isolator Ch. 00 + Input
2	IN-00-	Opto-isolator Ch. 00 - Input
3	IN-01+	Opto-isolator Ch. 01 + Input
4	IN-01-	Opto-isolator Ch. 01 - Input
5	IN-02+	Opto-isolator Ch. 02 + Input
6	IN-02-	Opto-isolator Ch. 02 - Input
7	IN-03+	Opto-isolator Ch. 03 + Input
8	IN-03-	Opto-isolator Ch. 03 - Input
9	IN-04+	Opto-isolator Ch. 04 + Input
10	IN-04-	Opto-isolator Ch. 04 - Input
11	IN-05+	Opto-isolator Ch. 05 + Input
12	IN-05-	Opto-isolator Ch. 05 - Input
13	IN-06+	Opto-isolator Ch. 06 + Input
14	IN-06-	Opto-isolator Ch. 06 - Input
15	IN-07+	Opto-isolator Ch. 07 + Input
16	IN-07-	Opto-isolator Ch. 07 - Input

Pin	Signal	Description
1	IN-08+	Opto-isolator Ch. 08 + Input
2	IN-08-	Opto-isolator Ch. 08 - Input
3	IN-09+	Opto-isolator Ch. 09 + Input
4	IN-09-	Opto-isolator Ch. 09 - Input

5	IN-10+	Opto-isolator Ch. 10 + Input
6	IN-10-	Opto-isolator Ch. 10 - Input
7	IN-11+	Opto-isolator Ch. 11 + Input
8	IN-11-	Opto-isolator Ch. 11 - Input
9	IN-12+	Opto-isolator Ch. 12 + Input
10	IN-12-	Opto-isolator Ch. 12 - Input
11	IN-13+	Opto-isolator Ch. 13 + Input
12	IN-13-	Opto-isolator Ch. 13 - Input
13	IN-14+	Opto-isolator Ch. 14 + Input
14	IN-14-	Opto-isolator Ch. 14 - Input
15	IN-15+	Opto-isolator Ch. 15 + Input
16	IN-15-	Opto-isolator Ch. 15 - Input

2. Output Signal Assignments

Pin	Signal	Description
1	OUT-00+	SSR Ch. 00 + Output
2	OUT-00-	SSR Ch. 00 - Output
3	OUT-01+	SSR Ch. 01 + Output
4	OUT-01-	SSR Ch. 01 - Output
5	OUT-02+	SSR Ch. 02 + Output
6	OUT-02-	SSR Ch. 02 - Output
7	OUT-03+	SSR Ch. 03 + Output
8	OUT-03-	SSR Ch. 03 - Output
9	OUT-04+	SSR Ch. 04 + Output
10	OUT-04-	SSR Ch. 04 - Output
11	OUT-05+	SSR Ch. 05 + Output
12	OUT-05-	SSR Ch. 05 - Output
13	OUT-06+	SSR Ch. 06 + Output
14	OUT-06-	SSR Ch. 06 - Output
15	OUT-07+	SSR Ch. 07 + Output

16	OUT-07-	SSR Ch. 07 - Output

| Pin	Signal	Description
1	OUT-08+	SSR Ch. 08 + Output
2	OUT-08-	SSR Ch. 08 - Output
3	OUT-09+	SSR Ch. 09 + Output
4	OUT-09-	SSR Ch. 09 - Output
5	OUT-10+	SSR Ch. 10 + Output
6	OUT-10-	SSR Ch. 10 - Output
7	OUT-11+	SSR Ch. 11 + Output
8	OUT-11-	SSR Ch. 11 - Output
9	OUT-12+	SSR Ch. 12 + Output
10	OUT-12-	SSR Ch. 12 - Output
11	OUT-13+	SSR Ch. 13 + Output
12	OUT-13-	SSR Ch. 13 - Output
13	OUT-14+	SSR Ch. 14 + Output
14	OUT-14-	SSR Ch. 14 - Output
15	OUT-15+	SSR Ch. 15 + Output
16	OUT-15-	SSR Ch. 15 - Output

2.7 Loopback Diagnostic

To test your 16 channel photo isolator input/output board, we recommend you use loopback circuit shown in below. Where IA*+ means input channel+ and IA*- means input channel-, OA*+ means output channel+ and OA*- means output channel-. * means channel number. Please note that, if you use IA2+, you must connect its pair IA2- …,otherwise if may short the circuit.

In this experiment, if VCC larger than 10V, then it input HIGH to input channel, otherwise it input LOW; your program can get this digital signal easily. If no VCC voltage input, the output channel will be loopback to input channel, it means when output HIGH then input channel get HIGH, when output LOW then input channel get LOW.
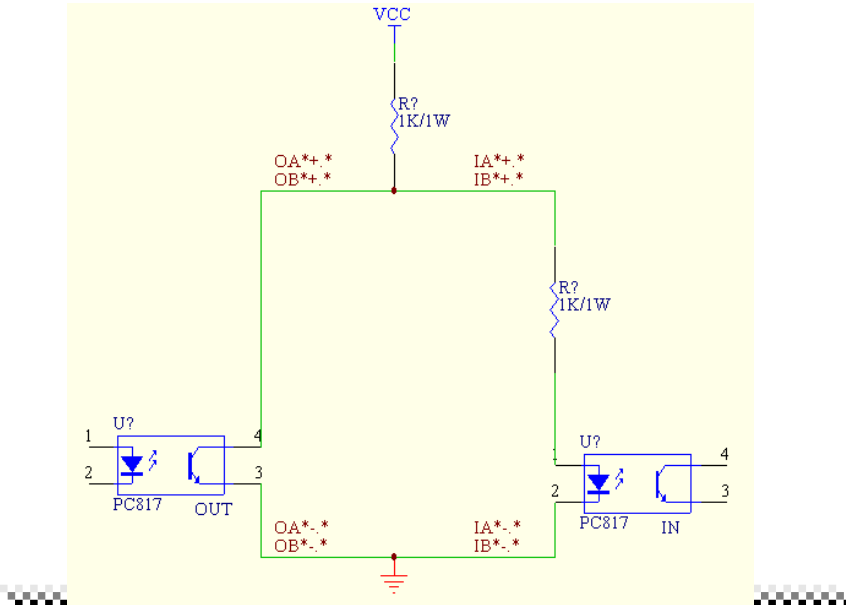
CHAPTER 3
DIAGNOSTIC UNDER WINDOWS

USB Test Program.exe is a diagnostic program to test your USB devices under Windows/XP.

User can get USB Test Program.exe programs from Decision Studio CD.

CHAPTER 4
SOFTWARE PROGRAMMING UNDER WINDOWS   AND LINUX

Under Windows, we provide function library and dll file for users to program the device in supported language. You can find manual "USBDII_Manual.pdf" and demo code in VB/VC/Delphi from Decision Studio CD.

Under Linux, we provide C source to allow user directly to access device. You can find manual and example in "dcihid-0.5.2.tgz".

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APPENDIX A
WARRANTY INFORMATION

A.1 Copyright

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A.2 Warranty Information

SmartLab warrants that for a period of one year from the date of purchase (unless otherwise specified in the warranty card) that the goods supplied   will   perform according to the specifications defined in the user manual. Furthermore

that the SmartLab product will be supplied free from defects in materials and workmanship and be fully functional under normal usage.

In the event of the failure of   a SmartLab   product   within the specified warranty period, SmartLab will, at its option, replace or repair the item at no additional charge. This limited warranty does not cover damage resulting from incorrect use, electrical interference, accident, or modification of the product.

All goods returned for warranty repair must have the serial number intact. Goods without serial numbers attached will not be covered by the warranty.

The purchaser must pay transportation costs for goods returned. Repaired goods will be dispatched at the expense of SmartLab.

To ensure that your SmartLab product is covered by the warranty provisions, it is necessary that you return the Warranty card.

Under this Limited Warranty, SmartLab's obligations will be limited to repair or replacement only, of goods found to be defective a specified above during   the warranty   period. SmartLab is not liable to the purchaser for any damages or losses of any kind, through the use of, or inability to use, the SmartLab product. SmartLab reserves the right to determine what constitutes warranty repair or replacement.

Return Authorization: It is necessary that any returned goods are clearly marked with an RA number that has been issued by

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SmartLab. Goods returned without this authorization will not be attended to.

APPENDIX B DATA SHEET

SHARP   PC817 Series

■ Absolute Maximum Ratings   (Ta= 25°C)

	Parameter	Symbol	Rating	Unit
Input	Forward current	I_F	50	mA
	*¹Peak forward current	I_{FM}	1	A
	Reverse voltage	V_R	6	V
	Power dissipation	P	70	mW
Output	Collector-emitter voltage	V_{CEO}	35	V
	Emitter-collector voltage	V_{ECO}	6	V
	Collector current	I_C	50	mA
	Collector power dissipation	P_C	150	mW
	Total power dissipation	P_{tot}	200	mW
	*²Isolation voltage	V_{iso}	5 000	V_{rms}
	Operating temperature	T_{opr}	- 30 to + 100	°C
	Storage temperature	T_{stg}	- 55 to + 125	°C
	*³Soldering temperature	T_{sol}	260	°C

*1 Pulse width<=100µs, Duty ratio : 0.001
*2 40 to 60% RH, AC for 1 minute
*3 For 10 seconds

■ Electro-optical Characteristics   (Ta= 25°C)

	Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage	V_F	I_F= 20mA	-	1.2	1.4	V
	Peak forward voltage	V_{FM}	I_{FM}= 0.5A	-	-	3.0	V
	Reverse current	I_R	V_R= 4V	-	-	10	µA
	Terminal capacitance	C_t	V= 0, f= 1kHz	-	30	250	pF
Output	Collector dark current	I_{CEO}	V_{CE}= 20V	-	-	10^{-7}	A
Transfer charac-teristics	*⁴Current transfer ratio	CTR	I_F= 5mA, V_{CE}= 5V	50	-	600	%
	Collector-emitter saturation voltage	$V_{CE(sat)}$	I_F= 20mA, I_C= 1mA	-	0.1	0.2	V
	Isolation resistance	R_{ISO}	DC500V, 40 to 60% RH	5×10^{10}	10^{11}	-	Ω
	Floating capacitance	C_f	V= 0, f= 1MHz	-	0.6	1.0	pF
	Cut-off frequency	f_c	V_{CE}= 5V, I_C= 2mA, R_L= 100Ω, - 3dB	-	80	-	kHz
	Response time — Rise time	t_r	V_{CE}= 2V, I_C= 2mA, R_L= 100Ω	-	4	18	µs
	Response time — Fall time	t_f		-	3	18	µs

*4 Classification table of current transfer ratio is shown below.

Model No.	Rank mark	CTR (%)
PC817A	A	80 to 160
PC817B	B	130 to 260
PC817C	C	200 to 400
PC817D	D	300 to 600
PC8●7AB	A or B	80 to 260
PC8●7BC	B or C	130 to 400
PC8●7CD	C or D	200 to 600
PC8●7AC	A, B or C	80 to 400
PC8●7BD	B, C or D	130 to 600
PC8●7AD	A, B, C or D	80 to 600
PC8●7	A, B, C, D or No mark	50 to 600

● : 1 or 2 or 3 or 4
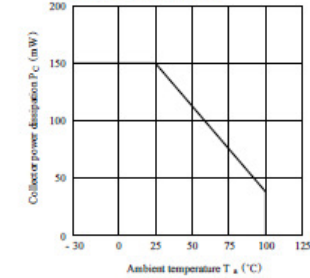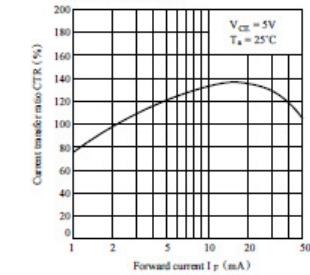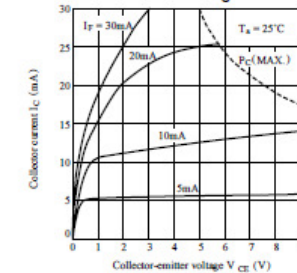
Fig. 1 Forward Current vs. Ambient Temperature
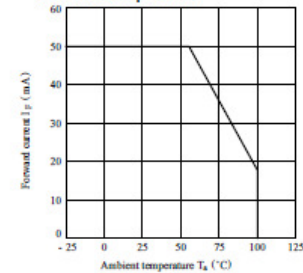
SHARP   PC817 Series

Fig. 2 Collector Power Dissipation vs. Ambient Temperature

Fig. 3 Peak Forward Current vs. Duty Ratio

Fig. 4 Current Transfer Ratio vs. Forward Current
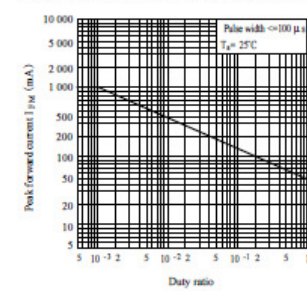
Fig. 5 Forward Current vs. Forward Voltage

Fig. 6 Collector Current vs. Collector-emitter Voltage
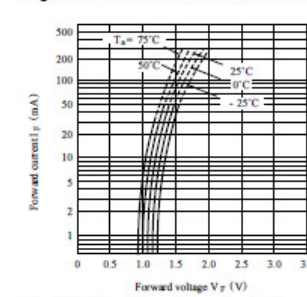
Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature
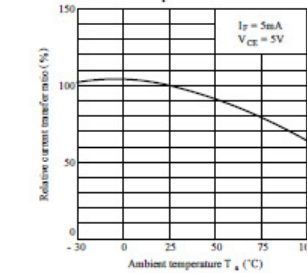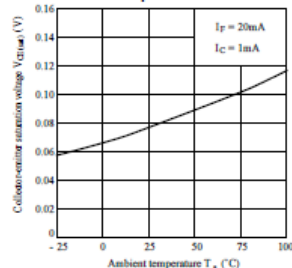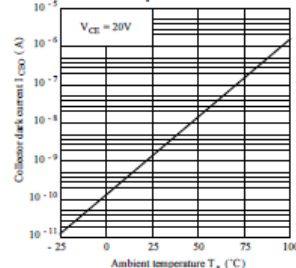
SHARP　　　　　　　　　　　　　　　　　　PC817 Series

Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature

Fig. 9 Collector Dark Current vs. Ambient Temperature

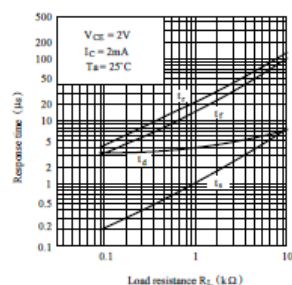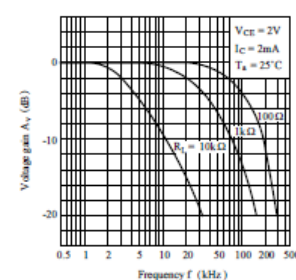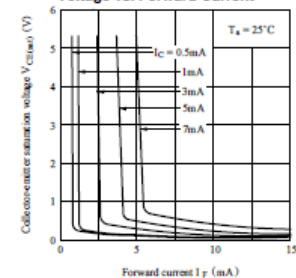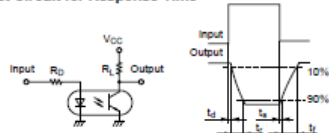Fig.10 Response Time vs. Load Resistance

Fig.11 Frequency Response

Test Circuit for Response Time

Test Circuit for Frepuency Response

Fig.12 Collector-emitter Saturation Voltage vs. Forward Current
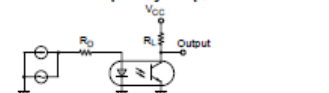
● Please refer to the chapter "Precautions for Use"

PRODUCT SPECIFICATION

DATE : 04/29/2011

| **cosmo** ELECTRONICS CORPORATION | SOLID STATE RELAY - MOSFET OUTPUT KAQY212 | NO.60M00009 SHEET 1 OF 7 | REV. 2 |

● **OUTSIDE DIMENSION :**

Unit : mm
Tolerance : ±0.2mm

● **Turn On / Turn Off time**

1 FORM A NORMALLY OPEN

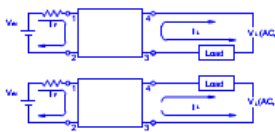● **Absolute Maximum Ratings**　　　　　　　（Ta=25℃）

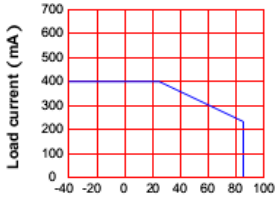| Emitter（Input）		Detector（Output）	
Reverse Voltage	5.0V	Output Breakdown Voltage	± 60V
Continuous Forward Current	50mA	Continuous Load Current	± 400mA
Peak Forward Current	1A	Power Dissipation	500mW
Power Dissipation	100mW		
Derate Linearly from 25℃	1.3Mw/℃		
General Characteristics			
Isolation Test Voltage	3750VACrms	Storage Temperature Range	-40℃ to +125℃
Isolation Resistance		Operating Temperature Range ...	-40℃ to +85℃
Vio=500V・Ta=25℃	≧ 10¹⁰Ω	Junction Temperature	100℃
Total Power Dissipation	550mW	Soldering Temperature・	
Derate Linearly from 25℃	2.5mW/℃	2mm from case・10 sec	260℃
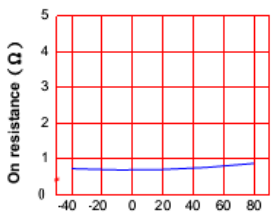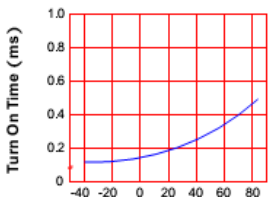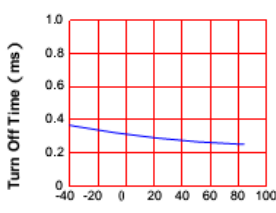
PRODUCT SPECIFICATION

DATE : 04/29/2011

cosmo ELECTRONICS CORPORATION	SOLID STATE RELAY - MOSFET OUTPUT KAQY212	NO.60M00009	REV. 2
		SHEET 2 OF 7	

● Electro-optical Characteristics

(Ta=25℃)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit.
Emitter（Input）						
Forward Voltage	V_F	I_F=10mA		1.2	1.5	V
Operation Input Current	IF_{ON}	V_L=±20V・I_L=100mA・t=10ms			5	mA
Recovery Input Current	IF_{OFF}	V_L=±20V・I_L≦5μA	0.2			mA
Detector（Output）						
Output Breakdown Voltage	V_B	I_B=50μA	60			V
Output Off-State Leakage	IT_{OFF}	V_T=60V・I_F=0mA		0.2	1	μA
I/O Capacitance	C_{ISO}	I_F=0・f=1MHz		6		pF
ON Resistance	R_{ON}	I_L=100mA・I_F=10mA		0.83	2.5	Ω
Turn-On Time	T_{ON}	I_F=10mA・V_L=±20V		0.2	1.5	ms
Turn-Off Time	T_{OFF}	t=10ms・I_L=±100mA		0.3	1.5	ms

● Schematic and Wiring Diagrams

Schematic	Output Configuration	Load	Connection	Wiring Diagrams
	1a	AC/DC	-	

PRODUCT SPECIFICATION

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cosmo ELECTRONICS CORPORATION	SOLID STATE RELAY - MOSFET OUTPUT KAQY212	NO.60M00009	REV. 2
		SHEET 3 OF 7	

● Data Curve

Load current vs. ambient temperature
Allowable ambient Temperature :
-40℃ to +85℃

On resistance vs. ambient temperature
across terminals 3 and 4 pin
LED current : 5mA
Continuous load current : 400mA（DC）

Turn On Time vs. ambient temperature
Load voltage 60V（DC）
LED current : 5mA
Continuous load current : 400mA（DC）

Turn Off Time vs. ambient temperature
Load voltage 60V（DC）
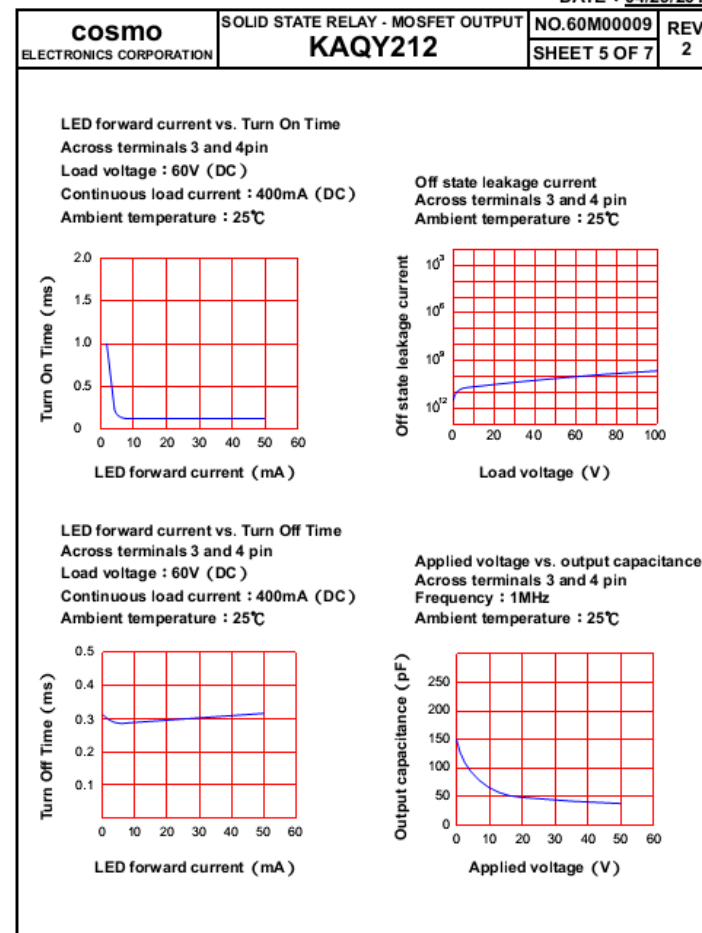LED current : 5mA
Continuous load current : 400mA（DC）

PRODUCT SPECIFICATION

DATE : 04/29/2011

cosmo ELECTRONICS CORPORATION	SOLID STATE RELAY - MOSFET OUTPUT KAQY212	NO.60M00009 SHEET 4 OF 7	REV. 2

LED operate current vs. ambient temperature
Load Voltage : 60V (DC)
Continuous load current : 400mA (DC)

LED Turn Off current vs. ambient temperature
Load Voltage : 60V (DC)
Continuous load current : 400mA (DC)

LED dropout voltage vs. ambient temperature
LED current : 5 to 50mA

Voltage vs. current characteristics of output at MOSFET portion
Measured portion : across terminals 3 and 4 pin
Ambient temperature : 25℃

PRODUCT SPECIFICATION

DATE : 04/29/2011

cosmo ELECTRONICS CORPORATION	SOLID STATE RELAY - MOSFET OUTPUT KAQY212	NO.60M00009 SHEET 5 OF 7	REV. 2

LED forward current vs. Turn On Time
Across terminals 3 and 4pin
Load voltage : 60V (DC)
Continuous load current : 400mA (DC)
Ambient temperature : 25℃

Off state leakage current
Across terminals 3 and 4 pin
Ambient temperature : 25℃

LED forward current vs. Turn Off Time
Across terminals 3 and 4 pin
Load voltage : 60V (DC)
Continuous load current : 400mA (DC)
Ambient temperature : 25℃

Applied voltage vs. output capacitance
Across terminals 3 and 4 pin
Frequency : 1MHz
Ambient temperature : 25℃

APPENDIX C

External Power Installation

**Optional for Decision Group USB I/O series of items

** The materials of the external power for Decision Group USB I/O series items are customer-self-supplied or optional purchase, they are not covered in the standard package of Decision Group USB I/O series items.

1. The Materials of the external power (*customer-self-supplied*)

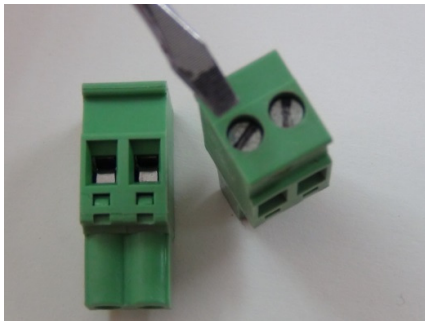* 5V / 1A AC adapter (*Power plug type is subject to the different varieties in different country.*).
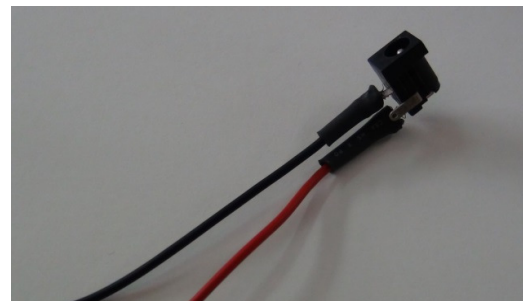
* AC power cord

2. Terminal blocks built-in on Decision Group USB I/O series of Items:
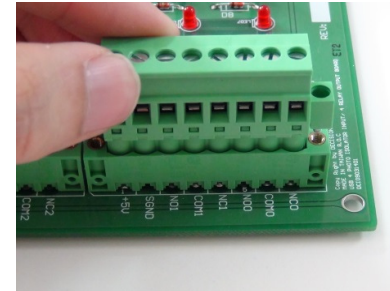

e.g. PCB pluggable terminal blocks. (for PRO type only)
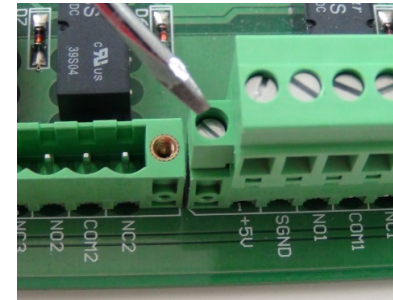
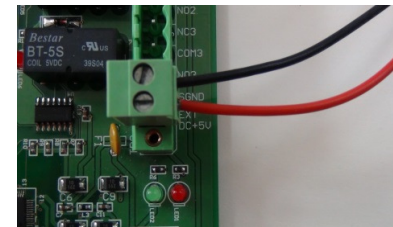## 3. External Power Installation procedure:

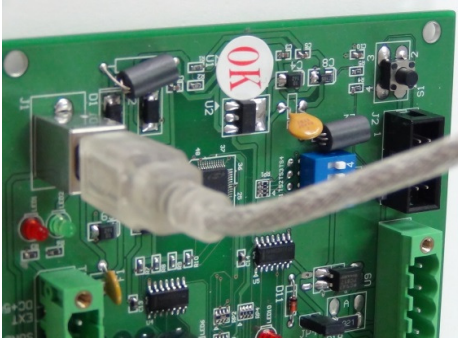To tight / loose the terminal with a minus screwdriver.

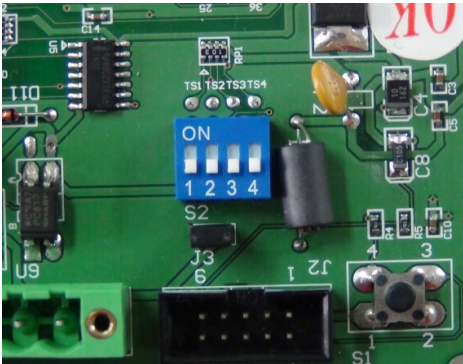Plug the terminal blocks into the socket. (PRO type only)

Fasten both sides of the screws (PRO type only)

Attach the **black** cord to the **SGND** and the **red** cord to the **EXT DC+5V.,** as well as the signals cords

Connect your device to the computer with a USB cable

To confirm all the switches and jumper setting are correct in compliance