SMARTLAB
USB 16 CHANNELS RELAY OUTPUT
16 CHANNELS PHOTO ISOLATOR
INPUT BOARD

OPERATION MANUAL

Decision Computer Int'l. Co., Ltd.

TABLE OF CONTENTS

CHAPTERS

APPENDICES

CHAPTER 1
INTRODUCTION

USB 16 channels relay output / photo isolator input board provides photo couple digital input and relay output channels. The photo isolator input part provides 16 photo couple digital input channels, which allow the input signals to be completely floated and prevent the ground loop. The relay output part provides 16 relays to drive 16 different output channels. Each relay channel can be used to control ON/ OFF of external devices, to drive external power relays, to activate alarms… etc.

The USB 16 channels relay output / photo isolator input board provides Plug and Play (PnP) features, it is a programmable I/O interface board for PC/486, Pentium, or compatibles. The on board high speed 8051 uC provides USB functions run at 12Mbps full speed or 1.5Mbps low speed.

❖ **The features of USB 16 channels relay output / photo isolator input board are:**

- USB2.0 with Plug and Play (PnP) features.
- High speed 8051 uC core.
- Support USB ID selection to identify USB device.
- Support 16 photo couple input channels and 16 relay output channels.
- Allow the photo input signals to be completely floated and prevent the ground loops.
- 32 LED correspond to 16 input and 16 output ports activation status.
- By using PC817 photo couple chips.
- Power supplied from External DC +5V.

- For photo couple input channel, the isolation voltage is 5000V, maximum load voltage is 30V, maximum input current is 50mA forward.
- 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
- For relay output channel, maximum contact rating is 100V/DC 500mA, minimum response time is 1ms.
- Suitable for Linux, MS/Windows ... etc.
- Operating temperature range from 0 to 33C.
- Relative humidity rage from 0 to 90%.

❖ **PACKAGE CONTENTS:**

- SMARTLAB USB 16 channels relay output / photo isolator input 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

CHAPTER 2

HARDWARE CONFIGURATION

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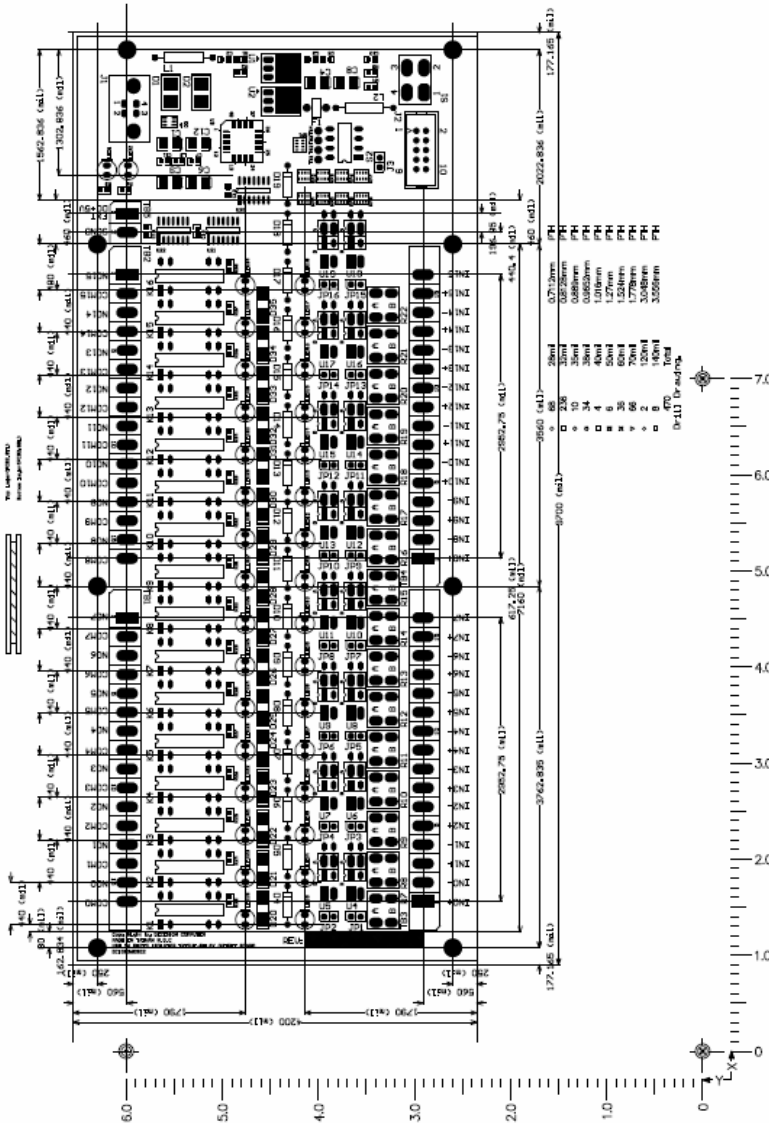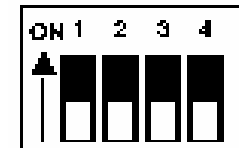
2.1 Switch Settings

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	Card 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 down load revised firmware.

2.2 Jumper Settings

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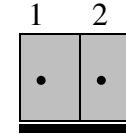
JP1 to JP16 are used to select input voltage range. The JP1 is used to select photo couple input channel 0, and JP2 is used to select photo couple input channel 1 … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input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

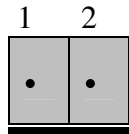## 2.5 Connector and Jumper for Serial Communication

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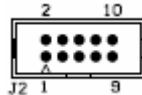
To use RS422/RS485/RS232, please connect J2 to extension board by 10 pins flat cable. (Optional)

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 relay output signal pin assignments are shown in the below.

1. **Input Signal Assignments**

Pin	Signal	Description
1	IN0+	Opto-isolator Ch. 00 + Input
2	IN0-	Opto-isolator Ch. 00 - Input
3	IN1+	Opto-isolator Ch. 01 + Input
4	IN1-	Opto-isolator Ch. 01 - Input
5	IN2+	Opto-isolator Ch. 02 + Input
6	IN2-	Opto-isolator Ch. 02 - Input
7	IN3+	Opto-isolator Ch. 03 + Input
8	IN3-	Opto-isolator Ch. 03 - Input
9	IN4+	Opto-isolator Ch. 04 + Input
10	IN4-	Opto-isolator Ch. 04 - Input
11	IN5+	Opto-isolator Ch. 05 + Input
12	IN5-	Opto-isolator Ch. 05 - Input
13	IN6+	Opto-isolator Ch. 06 + Input
14	IN6-	Opto-isolator Ch. 06 - Input
15	IN7+	Opto-isolator Ch. 07 + Input
16	IN7-	Opto-isolator Ch. 07 - Input

Pin	Signal	Description
1	IN8+	Opto-isolator Ch. 08 + Input
2	IN8-	Opto-isolator Ch. 08 - Input
3	IN9+	Opto-isolator Ch. 09 + Input
4	IN9-	Opto-isolator Ch. 09 - Input
5	IN10+	Opto-isolator Ch. 10 + Input
6	IN10-	Opto-isolator Ch. 10 - Input
7	IN11+	Opto-isolator Ch. 11 + Input

Pin	Signal	Description
8	IN11-	Opto-isolator Ch. 11 - Input
9	IN12+	Opto-isolator Ch. 12 + Input
10	IN12-	Opto-isolator Ch. 12 - Input
11	IN13+	Opto-isolator Ch. 13 + Input
12	IN13-	Opto-isolator Ch. 13 - Input
13	IN14+	Opto-isolator Ch. 14 + Input
14	IN14-	Opto-isolator Ch. 14 - Input
15	IN15+	Opto-isolator Ch. 15 + Input
16	IN15-	Opto-isolator Ch. 15 - Input

2. Output Signal Assignments

Pin	Signal	Description
1	NO0	Relay Ch. 00 - Output
2	COM0	Relay Ch. 00 - Output
3	NO1	Relay Ch. 01 - Output
4	COM1	Relay Ch. 01 - Output
5	NO2	Relay Ch. 02 - Output
6	COM2	Relay Ch. 02 - Output
7	NO3	Relay Ch. 03 - Output
8	COM3	Relay Ch. 03 - Output
9	NO4	Relay Ch. 04 - Output
10	COM4	Relay Ch. 04 - Output
11	NO5	Relay Ch. 05 - Output
12	COM5	Relay Ch. 05 - Output
13	NO6	Relay Ch. 06 - Output
14	COM6	Relay Ch. 06 - Output
15	NO7	Relay Ch. 07 - Output
16	COM7	Relay Ch. 07 - Output

Pin	Signal	Description
1	NO8	Relay Ch. 08 - Output
2	COM8	Relay Ch. 08 - Output
3	NO9	Relay Ch. 09 - Output
4	COM9	Relay Ch. 09 - Output
5	NO10	Relay Ch. 10 - Output
6	COM10	Relay Ch. 10 - Output
7	NO11	Relay Ch. 11 - Output
8	COM11	Relay Ch. 11 - Output
9	NO12	Relay Ch. 12 - Output
10	COM12	Relay Ch. 12 - Output
11	NO13	Relay Ch. 13 - Output
12	COM13	Relay Ch. 13 - Output
13	NO14	Relay Ch. 14 - Output
14	COM14	Relay Ch. 14 - Output
15	NO15	Relay Ch. 15 - Output
16	COM15	Relay Ch. 15 - Output

CHAPTER 3

DIAGNOSTIC UNDER WINDOWS/XP

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/XP 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-0.5.1.tgz".

APPENDIX A

WARRANTY INFORMATION

A.1 Copyright

Copyright DECISION COMPUTER INTERNATIONAL CO., LTD. All rights reserved. No part of SmartLab software and manual may be produced, transmitted, transcribed, or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual, or otherwise, without the prior written permission of DECISION COMPUTER INTERNATIONAL CO., LTD.

Each piece of SmartLab package permits user to use SmartLab only on a single computer, a registered user may use he program on a different computer, but may not use the program on more than one computer at the same time.

Corporate licensing agreements allow duplication and distribution of specific number of copies within the licensed institution. Duplication of multiple copies is not allowed except through execution of a licensing agreement. Welcome call for details.

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

APPENDIX B
DATA SHEET

SHARP PC817 Series

PC817 Series — High Density Mounting Type Photocoupler

- Lead forming type (I type) and taping reel type (P type) are also available. (PC817I/PC817P)
- TUV (VDE0884) approved type is also available as an option.

■ Features

1. Current transfer ratio
   (CTR: MIN. 50% at I_F = 5mA, V_{CE}=5V)
2. High isolation voltage between input and output (V_{iso} : 5 000V$_{rms}$)
3. Compact dual-in-line package
   PC817 : 1-channel type
   PC827 : 2-channel type
   PC837 : 3-channel type
   PC847 : 4-channel type
4. Recognized by UL, file No. E64380

■ Applications

1. Computer terminals
2. System appliances, measuring instruments
3. Registers, copiers, automatic vending machines
4. Electric home appliances, such as fan heaters, etc.
5. Signal transmission between circuits of different potentials and impedances

■ Outline Dimensions   (Unit : mm)
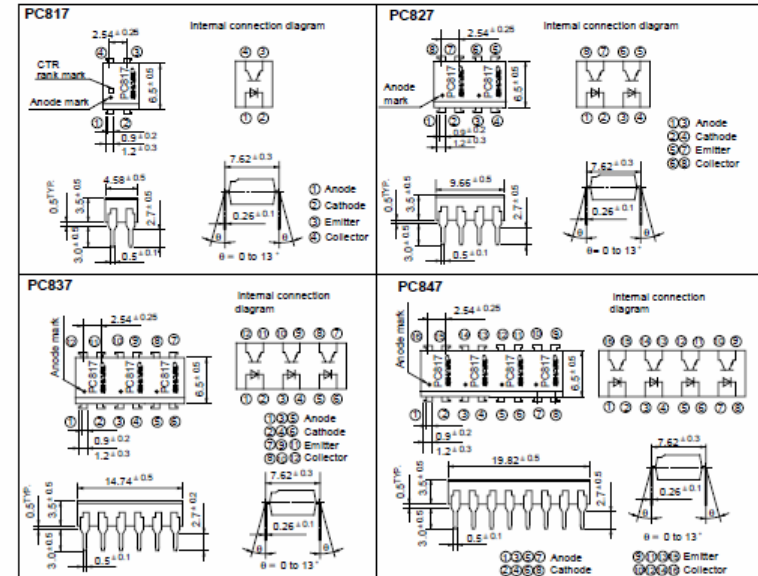
" In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that occur in equipment using any of SHARP's devices, shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest version of the device specification sheets before using any SHARP's device. "

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
	*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
Transfer charac- teristics	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
	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
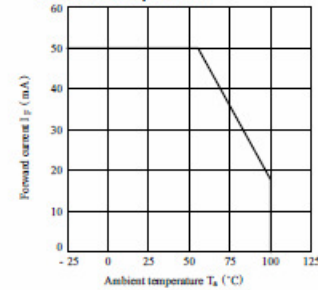

SHARP   PC817 Series

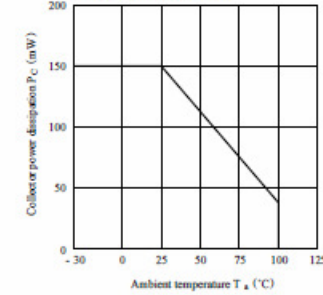**Fig. 2 Collector Power Dissipation vs. Ambient Temperature**

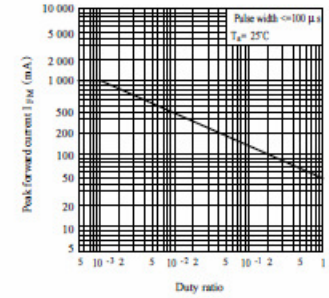**Fig. 3 Peak Forward Current vs. Duty Ratio**

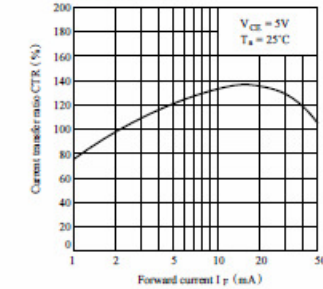**Fig. 4 Current Transfer Ratio vs. Forward Current**

Fig. 5 Forward Current vs. Forward Voltage
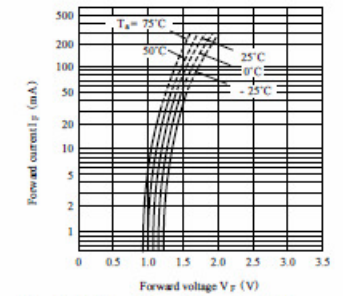

Fig. 6 Collector Current vs. Collector-emitter Voltage
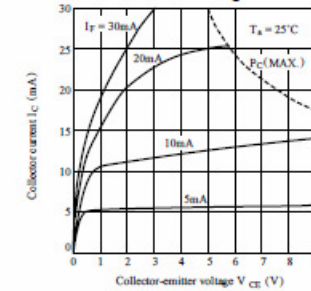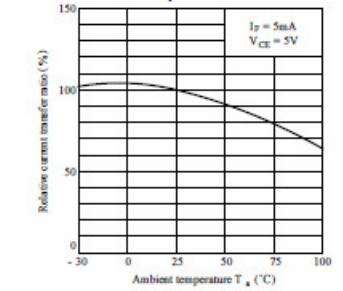

Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

SHARP   PC817 Series

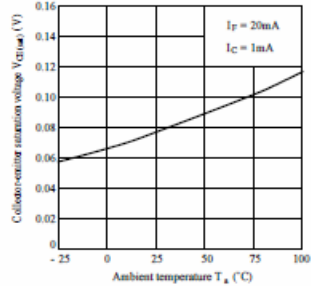Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature
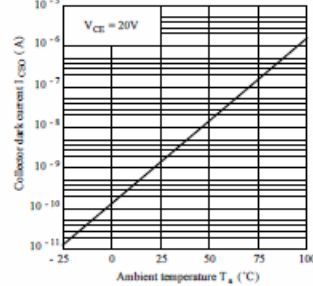
Fig. 9 Collector Dark Current vs. Ambient Temperature
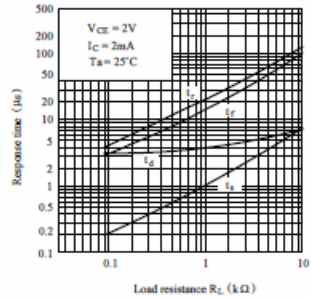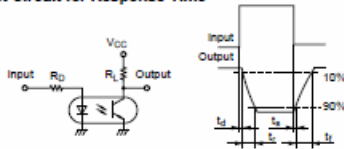
Fig.10 Response Time vs. Load Resistance

Fig.11 Frequency Response
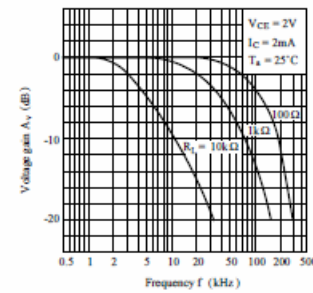
Test Circuit for Response Time

Fig.12 Collector-emitter Saturation Voltage vs. Forward Current

Test Circuit for Frequency Response
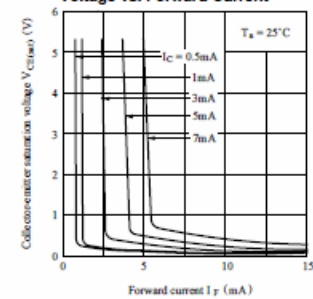
● Please refer to the chapter "Precautions for Use"

■ FEATURES

- 1 Form A Contact
- DIP Terminal
- Application for Fax Modem, Telecommunication, Security Alarm System
- UL File No. E147052
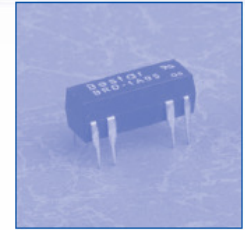
■ COIL RATING (at 20 °C)

Nominal Voltage (VDC)	Coil Resistance ($\Omega \pm 10\%$)	Nominal Current (mA)	Pick-Up Voltage (VDC)	Drop-Out Voltage (VDC)	Maximum Allowable Voltage (VDC)	Power Consumption (mW)
5	500	10.0	3.75	0.6	15	50
12	1000	12.0	9.0	1.44	30	144
24	2150	11.2	18.0	2.88	44	268

■ ORDERING INFORMATION

BRD-1A05-D

Coil Voltage	Option
See Coil Rating	Nil:Standard D:With Diode

■ SPECIFICATIONS

Contact Arrangement		1 Form A
Contact Material		Ru / Rh
Contact Resistance		Max. 150mΩ (initial)
Contact Rating (at Resistive Load)	Max. Switching Voltage	100VDC
	Max. Switching Current	0.5A
	Max. Switching Power	10W (DC) / 10VA (AC)
	Max. Carrying Current	1A
Dielectric Strength		
Between Coil & Contact		1400 VDC (1 minute)
Between Contacts		250VDC (1 minute)
Operate Time		Max. 1.0m Sec.
Release Time		Max. 0.5m Sec.
Ambient Temperature		-40 ˚C~+85 ˚C
Insulation Resistance		Min. 100MΩ at 500VDC
Vibration Resistance		1.5mm D.A. 10-55HZ
Shock	Functional	20G
	Destruction	100G
Mechanical Life		1×10^8 operations (at no load)
Electrical Life		1×10^6 operations (at rated load)
Weight		Approx. 2g

DIMENSIONS(mm)

General Tolerance   ±0.3

WIRING   DIAGRAM
(Bottom   View)

PC board pattern (mm)
(Bottom View)

General   Tolerance   ±0.1