SMARTLAB
USB 16 CHANNELS PHOTO ISOLATOR INPUT/OUTPUT

OPERATION MANUAL

Decision Computer Int'l. Co., Ltd.

TABLE OF CONTENTS

CHAPTERS

APPENDICES

CHAPTER 1
INTRODUCTION

The USB 16 channels photo isolator input/output card provides 16 photo couple digital input/output channels, which allow the input/output signals to be completely floated and prevent the ground loop.

The USB 16 channels photo isolator input/output card provides Plug and Play (PnP) features, it is a programmable I/O interface card 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 photo isolator input/output card are:

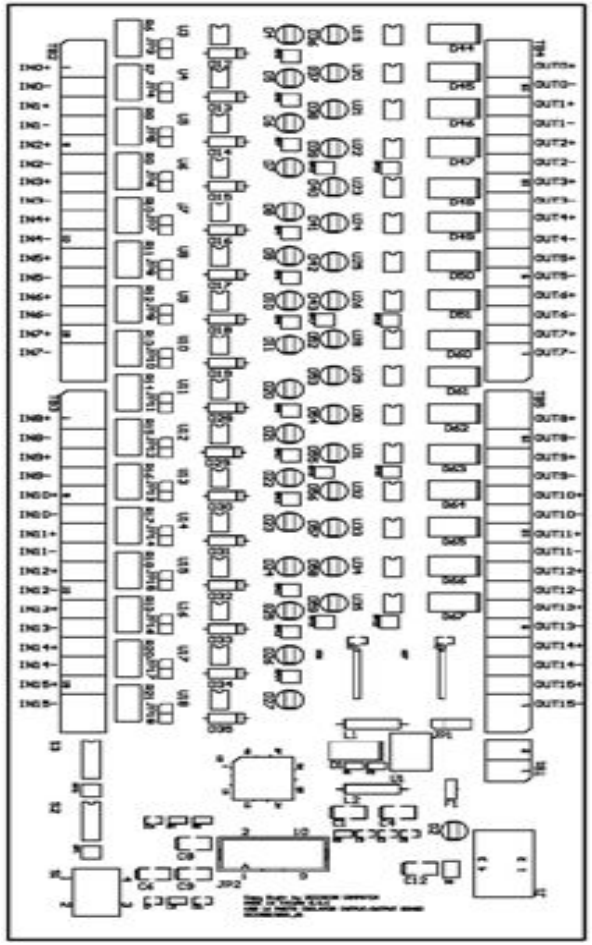
- USB 2.0with Plug and Play (PnP) features.
- High speed 8051 uC core.
- Support USB ID selection to identify USB device.
- Support 16 photo couple input/output channels.
- Allow the photo input/output signals to be completely floated and prevent the ground loops.
- 32 LED correspond to 32 input/output ports activation status.
- By using PC817 photo couple chips.
- Power supplied from USB or external DC +5V.
- 5000V isolation voltage.
- Maximum load voltage is 30V.
- Maximum 50mA forward input current.

- Output voltage : Vcd = 35V, Vec = 6V, and maximum collector current is 50mA. (Maximum current restrict below 30mA.)
- Output voltage range from 0V to 30V, where 0 to 4V is OFF and 5V to 30V is ON.
- 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 33C.
- Relative humidity rage from 0 to 90%.
- Dimension 250mm*120mm*55mm.
- Weight 450Gram.

❖ PACKAGE CONTENTS:

- SMARTLAB USB 16 channels photo couple input/output card.
- USB cable.
- User's manual.
- Decision Studio CD for USB Serial Product.
- Warranty form.

DECISION Computer International Ltd.,



CHAPTER 2

HARDWARE CONFIGURATION

Before you use the USB 16 channels photo couple input/output card, 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.

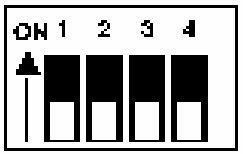
2.1 Switch Settings

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 card ID. Please set different card ID to each card (do not duplicate card ID setting).

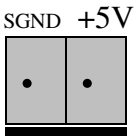
1	2	3	4	Card ID
ON	ON	ON	ON	--
OFF	ON	ON	ON	14
ON	OFF	ON	ON	13
OFF	OFF	ON	ON	12
ON	ON	OFF	ON	11
OFF	ON	OFF	ON	10
ON	OFF	OFF	ON	9
OFF	OFF	OFF	ON	8
ON	ON	ON	OFF	7
OFF	ON	ON	OFF	6
ON	OFF	ON	OFF	5
OFF	OFF	ON	OFF	4
ON	ON	OFF	OFF	3
OFF	ON	OFF	OFF	2
ON	OFF	OFF	OFF	1
OFF	OFF	OFF	OFF	0

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.

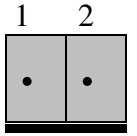
2.2 Jumper Settings

1. External Power Input (TB1)



The power of USB 16 channels photo couple input/output card can be supplied from USB, however, if USB can not supply enough power, the external power is need. TB1 is used to input external DC +5V power. Be careful to input DC +5V power.

2. Input Voltage Range Selection (JP3 to JP18)

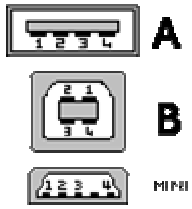


JP3 to JP18 are used to select input voltage range. The JP3 is used to select photo couple input channel 0, and JP4 is used to select photo couple input channel 1, … etc. When short the jumper, the input voltage range from 0 to 20V, and the active voltage form 4.5 to 20V. When open the jumper, the input 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 Connector Assignments

1. TB2 and TB3 Input Signal Assignments

The photo isolator input signal is assigned in the TB2 and TB3 connector, its pin assignments are show in the below.

TB2

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

TB3

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. TB4 and TB5 Output Signal Assignments

The photo isolator output signal is assigned in TB4 and TB5 connector, its pin assignments are show in the below.

TB4

Pin	Signal	Description
1	OUT-00+	Opto-isolator Ch. 00 + Output
2	OUT-00-	Opto-isolator Ch. 00 - Output
3	OUT-01+	Opto-isolator Ch. 01 + Output
4	OUT-01-	Opto-isolator Ch. 01 - Output
5	OUT-02+	Opto-isolator Ch. 02 + Output

6	OUT-02-	Opto-isolator Ch. 02 - Output
7	OUT-03+	Opto-isolator Ch. 03 + Output
8	OUT-03-	Opto-isolator Ch. 03 - Output
9	OUT-04+	Opto-isolator Ch. 04 + Output
10	OUT-04-	Opto-isolator Ch. 04 - Output
11	OUT-05+	Opto-isolator Ch. 05 + Output
12	OUT-05-	Opto-isolator Ch. 05 - Output
13	OUT-06+	Opto-isolator Ch. 06 + Output
14	OUT-06-	Opto-isolator Ch. 06 - Output
15	OUT-07+	Opto-isolator Ch. 07 + Output
16	OUT-07-	Opto-isolator Ch. 07 - Output

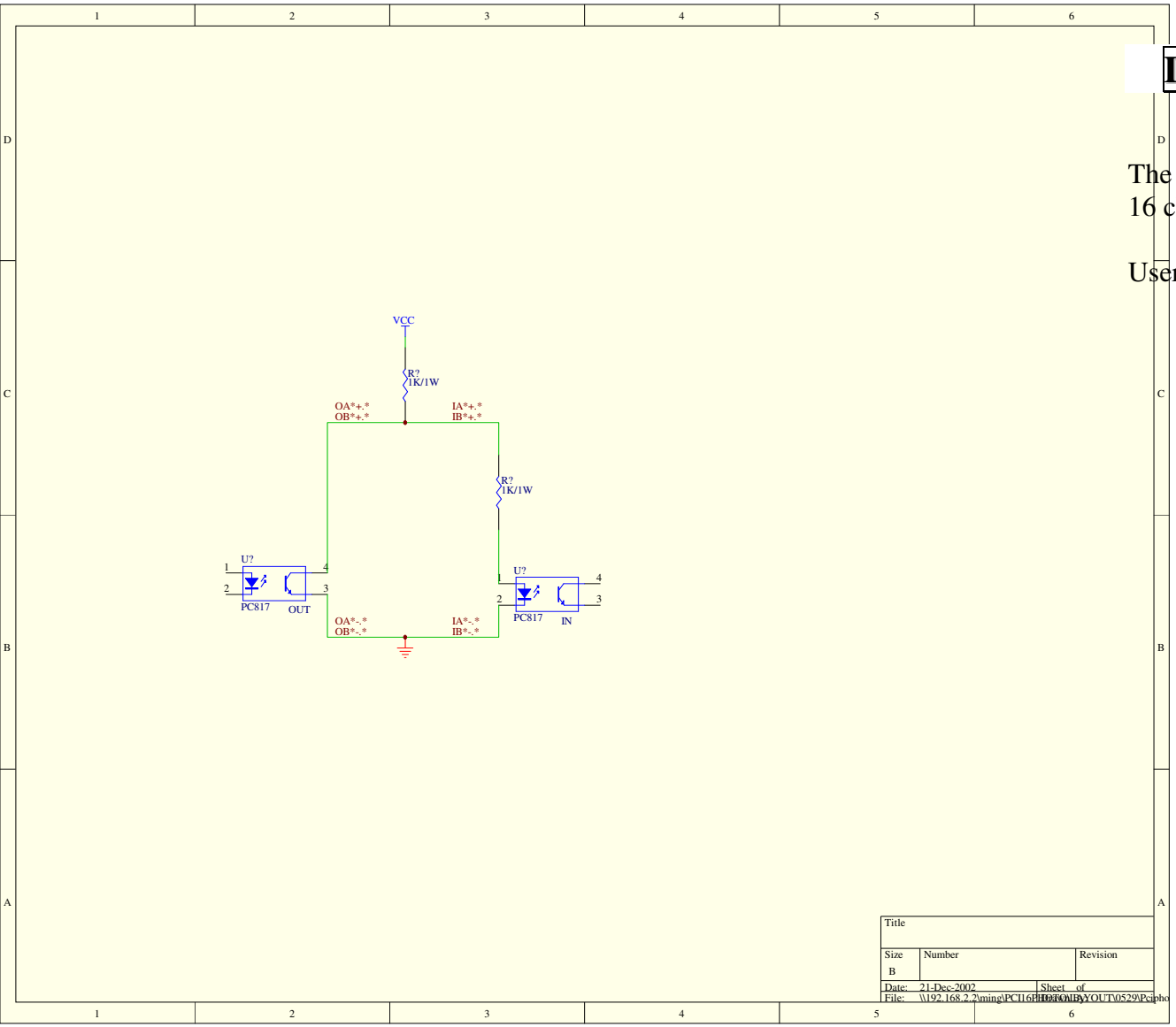
TB5

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

2.4 Loopback Diagnostic

To test your 16 channel photo isolator input/output card, 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/XP

The USB Test Program.exe is a diagnostic program to test your 16 channel photo isolator input/output under Windows/XP.

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

Operations Manual USB 16 Channel Photo Isolator Input/Output

CHAPTER 4

SOFTWARE PROGRAMMING UNDER WINDOWS/XP AND LINUX

To input data from photo couple channel or output data to photo couple output channel, please use Hid API functions. User can get Hid API functions from Decision Studio package.

APPENDIX A

WARRANTY INFORMATION

A.1 Copyright

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)
※※ TÜV (VDE0884) approved type is also available as an option.

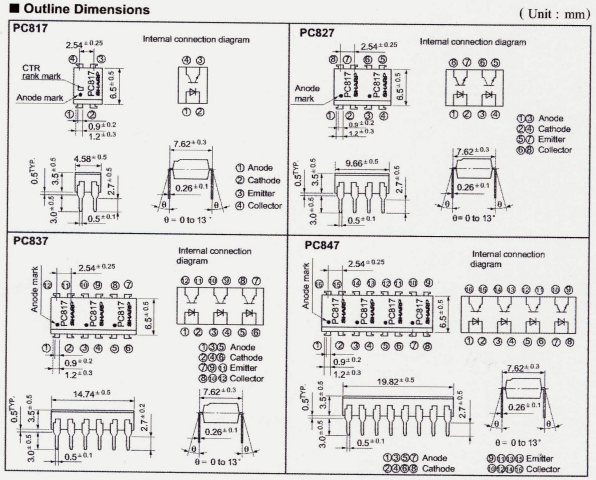
■ Features

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)



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 characteristics	*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
		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

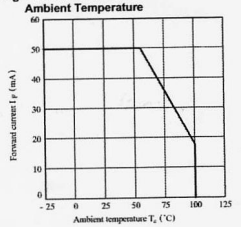


Fig. 2 Collector Power Dissipation vs. Ambient Temperature

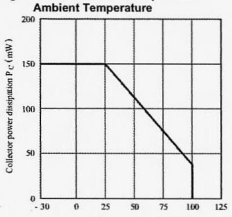


Fig. 3 Peak Forward Current vs. Duty Ratio

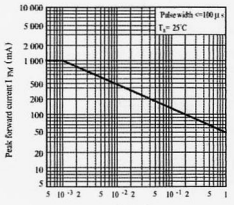


Fig. 4 Current Transfer Ratio vs. Forward Current

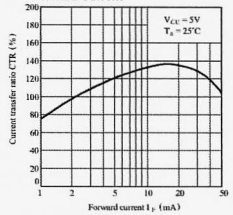


Fig. 5 Forward Current vs. Forward Voltage

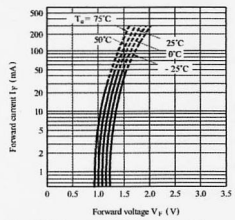


Fig. 6 Collector Current vs. Collector-emitter Voltage

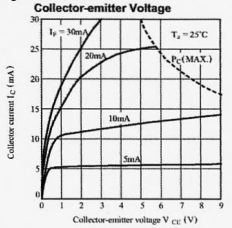


Fig. 7 Relative Current Transfer Ratio vs. Ambient Temperature

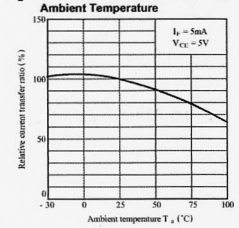


Fig. 8 Collector-emitter Saturation Voltage vs. Ambient Temperature

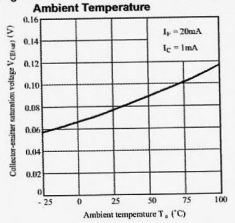


Fig. 9 Collector Dark Current vs. Ambient Temperature

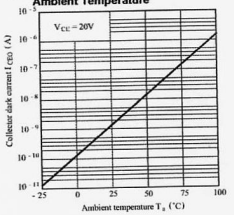


Fig.10 Response Time vs. Load Resistance

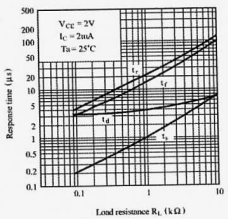
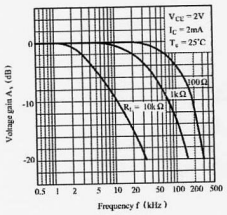


Fig.11 Frequency Response



Test Circuit for Response Time

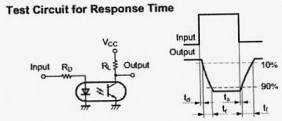
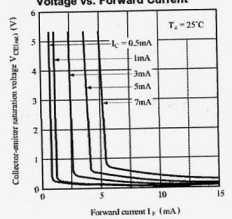
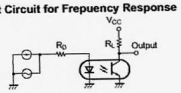


Fig.12 Collector-emitter Saturation Voltage vs. Forward Current



Test Circuit for Frepuency Response



● Please refer to the chapter "Precautions for Use"

Application Circuits

NOTICE

- The circuit application examples in this publication are provided to explain representative applications of SHARP devices and are not intended to guarantee any circuit design or license any intellectual property rights. SHARP takes no responsibility for any problems related to any intellectual property right of a third party resulting from the use of SHARP's devices.
- Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device. SHARP reserves the right to make changes in the specifications, characteristics, data, materials, structure, and other contents described herein at any time without notice in order to improve design or reliability. Manufacturing locations are also subject to change without notice.
- Observe the following points when using any devices in this publication. SHARP takes no responsibility for damage caused by improper use of the devices which does not meet the conditions and absolute maximum ratings to be used specified in the relevant specification sheet nor meet the following conditions:

(i) The devices in this publication are designed for use in general electronic equipment designs such as:
— Personal computers
— Office automation equipment
— Telecommunication equipment [terminal]
— Test and measurement equipment
— Industrial control
— Audio visual equipment
— Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:
— Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
— Traffic signals
— Gas leakage sensor breakers
— Alarm equipment
— Various safety devices, etc.

(iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:
— Space applications
— Telecommunication equipment [trunk lines]
— Nuclear power control equipment
— Medical and other life support equipment (e.g., scuba).

- Contact a SHARP representative in advance when intending to use SHARP devices for any "specific" applications other than those recommended by SHARP or when it is unclear which category mentioned above controls the intended use.
- If the SHARP devices listed in this publication fall within the scope of strategic products described in the Foreign Exchange and Foreign Trade Control Law of Japan, it is necessary to obtain approval to export such SHARP devices.
-
- Contact and consult with a SHARP representative if there are any questions about the contents of this publication.