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Y. Hasegawa	May 16, 1994
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T Yoshikawa	May 16, 1994

SHARP

ELECTRONIC COMPONENTS
GROUP SHARP CORPORATION

SPECIFICATION

SPEC. No.	ED-94030 5/20
ISSUE	May 16, 1994
PAGE	14 Pages

REPRESENTATIVE DIVISION

OPTO-ELECTRONIC
DEVICES DIV.

REFERENCE

DEVICE SPECIFICATION FOR

PHOTOCOUPRER

MODEL No.

PC928

(Business dealing mme : PC928)

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2. Please obey the instructions mentioned below for actual use of this device.
Con tact a SHARP representative of sales office in advance when you intend to usc SHARP devices for any applications other than those applications for general electronic equipment recommend by SHARP at (I).

(1) This device is designed for general electronic equipment.
Main uses of this device are as follows:

. OA equipment .AV equipment .Home appliance • Telecommunication
[eq. "pine].: (Terminal) .Measuring equipment • Tooling machine .Computer, etc.

(2) Please take proper steps in order to maintain reliability and safety, in case this device is used for the uses mentioned below which require high reliability.

.Unit concerning control and safety of a vehicle (air plane. train, automobile etc.)
• Gas leak detection breaker .Traffic signal • Fire box and burglar alarm box
[• Other safety equipment, etc.

(3) Please do not use for the uses mentioned below which require extremely high reliability.

. Space equipment • Telecommunication equipment (Trunk)
[• Nuclear control equipment .Medical equipment etc.

CUSTOMER'S APPROVAL

DATE

BY

DATE
PRESENTED
BY T. Matsumura

T. Matsumura,
Department General Manager of
Engineering Dept.,II
Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION

SHARP CORPORATION

RECORDS OF REVISION

MODEL No.	PC928
FIRST ISSUE	May 16, 1994
IDENT. DATA No.	ED-94030

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DATE	REF. PAGE PARAGRAPH DRAWING NO	REVISEI No.	SUMMARY	CHECK & APPROVAL
May. 1(1994			Establish	J.M

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1. Application

This specification applies to the outline and characteristics of photocoupler, Model No. PC928.

2. Outline

Refer to the attached drawing No. CY6805K02.

3. Ratings and characteristics

Refer to the attached sheet, page 5 to 11.

4. Reliability

Refer to the attached sheet, page 12.

5. Incoming inspection

Refer to the attached sheet, page 13.

6. Supplement

6.1 Isolation voltage shall be measured in the following method,

(1) Short between pins 1 and 7 on the primary side and between pins 8 to 14 on the secondary side.

(2) The dielectric withstand tester with zero-cross circuit shall be used.

(3) The wave form of applied voltage shall be a sine wave.
(It is recommended that the isolation voltage be measured in insulation oil.)

6.2 The business dealing name used for this product when ordered or delivered shall be PC928.

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6.3 The block diagram, Truth table

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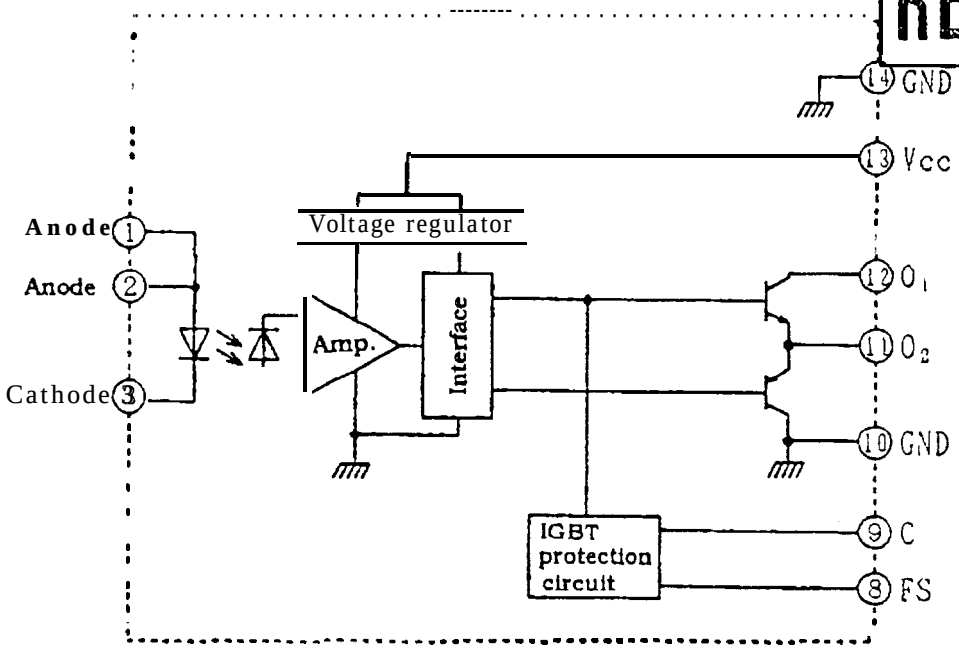

Troth table

Input	c input-output	0_2 output	FS output	
ON	Low level	High level	High level	
	High level	Low level	Low level	At operating protection function
OFF	Low level	Low level	High level	
	High level	Low level	High level	

6.4 This product is not designed against irradiation.

This product is assembled with electrical tnput and output,

This product Incorporates non-coherent light emitting diode.

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7. Notes

7.1 For cleaning

(11 Solvent cleaning : Solvent temperature 45°C or less
Immersion 3 min. or less

(2) Ultrasonic cleaning : The affect to device by ultrasonic cleaning Is different by cleaning bath size, ultrasonic power output, cleaning time, PWB size or device mounting condition etc. Please test it in actual using condition and confirm that doesn't occur any defect before starting the ultrasonic cleaning.

Applicable solvent : Ethyl alcohol, Methyl alcohol
Freon TE・TF, Diflon-solvent S3-E

Please refrain form using Chloro Fluoro Carbon type solvent to clean devise as much as possible since it is internationally restricted to protect the ozonosphere. Before you use alternative solvent you are requested to confirm that it does not attack package resin.

7.2 Please use the same as normal integration circuit about static electricity in order that this device is OPIC photocoupler.

7.3 In order to stabilize power supply line, we recommend to connect a by-pass capacitor of 0.01 μF or more between Vcc and GND near the device.

7,4 Precaution for Soldering Photocoupler

Refer to the attached sheet, page 14.

8. Others

Any doubt as to this specification shall be determined in good faith upon mutual consultation of the both parties.

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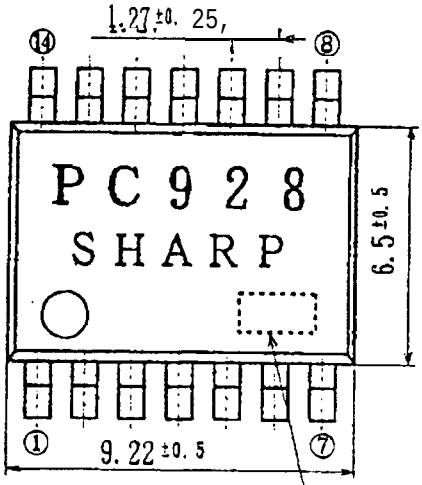
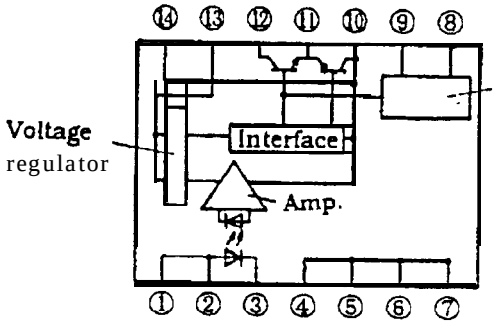
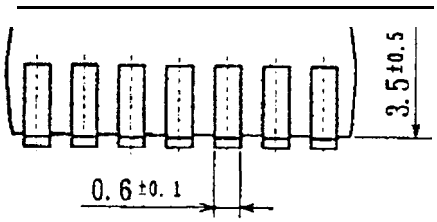


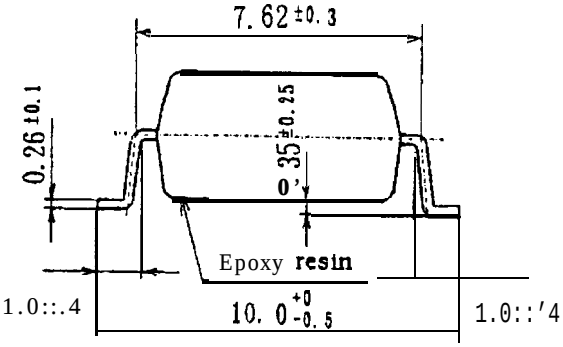
Pin Nos. and internal connection diagram



①	bode	⑧	F S
②	Anode	⑨	C
③	Cathode	⑩	G N D
④	N. C.	⑪	02
⑤	N. C. *	⑫	01
⑥	N. C.	⑬	Vcc
⑦	N, C.	⑭	G N D

● 4 to 7 pin : Common





• 1) 2-digit number marked according to DIN standard.

UNIT: 1/1 mm	
Name	PC928 Outline Dimensions
Drawing No.	CY6805K02

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3. Ratings and characteristics

3.1 Absolute maximum ratings

Parameter		Symbol	Rating	Unit
Input	*1 Forward current	I_F	25	mA
	Reverse voltage	V_R	6 (Ta=25 'C)	v
output	s upply voltage	Vcc	35	v
	O_1 Output current	Io_1	0.1	A
	"4 O_1 Peak output current	10_{1P}	0.4	A
	O_2 Output current	Io_2	0.1	A
	*4 O_2 Peak output current	Io_{2P}	0.4	A
	O_1 Output voltage	Vo_1	35	v
	*2 Power dissipation	Po	600	mW
	Overcurrent detection voltage	Vc	Vcc	v
	Overcurrent detection current	Ic	30	mA
	Error signal output voltage	V_{FS}	Vcc	V
	Error signal output current	I_{FS}	20	mA
"3 Total power dissipation		Ptot	550	mW
● 5 Isolation voltage		, Viso	4.0	kVrms
Operating temperature		Topr	-25 to +80	"c
Storage temperature		Tstg	-55 to 125	'C
Soldering temperature		Tsol	260(for 10s)	"c

● 1, 2, 3 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig. 1,2,3.

*4 Pulse width≦0.15 μs, Duty ratio : 0.01

*5 AC for min., 40 to 60%RH, Ta.25°C

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(Unspecified : Ta=Topr)

3.2.1 Electro-optical characteristics(l)

	Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Fig.	Conditions
Input	Forward voltage	V_{F1}	-	1.2	1.4	V	.	I_F=20mA, Ta=25 ℃
		V_{F2}	0.6	0.9	-	V	.	I_F=0.2mA, Ta=25 "C
	Reverse current	I_R	-	-	10	μA	.	Ta=25℃, V_R=4V
	Terminal capacitance	Ct	-	30	250	pF	-	Ta=25°C, V=O, f=1kHz
Output	Operating supply voltage range	Vcc	15	-	30	V	.	Ta=-10 to 60℃
			15	-	24	v		
	O_1 Low level output voltage	V_{O1L}	.	0.2	0.4	V	1	Vcc_1 = 12V, Vcc_2=- 12V FS=OPEN I_{O1}=0.1A, I_F=10mA, Vc=0V
	O_2 High level output voltage	V_{O2H}	20	22	.	V	2	Vcc=V_{O1}=24V, I_{O2}=-0.1A I_F= 10mA, FS=OPEN, VC=OV
	O_2 Low level output vu ltage	V_{02L}	.	1.2	2,0	V	3	Vcc=V_{O1}=24V, I_{O2}=0. IA I_F=0mA, FS=OPEN, Vc=0V
	O_1 Leak current	I_{O1L}	.	.	500	μA	4	Ta=25"C, Vcc=V_{O1} .35v I_F= 0mA, FS=OPEN, Vc=0V
	High level supply current	I_{CCH}		10	17	MA	6	Ta=25°C, Vcc=V_{O1}=24V I_F=10mA, FS=OPEN, Vc=0V
			-		19	mA		Vcc=V_{O1}=24V I_F=10mA, FS=OPEN, VC=OV
	Low level supply current	I_{CCL}		11	18	mA		Ta=25°C, Vcc=V_{O1} .24V I_F=0mA, FS=OPEN, Vc=0V
					20	mA		Vcc=V_{O1}=24V I_F=0mA, FS=OPEN, VC=OV

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3.2 Electro-optical characteristics (1)

(Unspecified : Ta=10pr)

	Parameter	Symbol	MIN.	TYP,	MAX.	Unit	Fig.	Conditions
Transfer characteristics	"L→H" threshold Input current "2	I_{FLH}	1.0	4,0	7.0	mA	5	Ta=25℃, Vcc=V_{O1}=24V FS=OPEN, Vc=0V
			0.6	-	10			Vcc=V_{O1}=24V FS=OPEN, Vc=0V
	Isolation resistance	Riso	5×10^{10}	10^{11}	.	Ω	-	Ta=25℃, DC=500V RH=40to 60%
	Response time "L→H" propagation time	t_{PLH}	-	1.0	2.0	μs	8	Ta=25℃ Vcc=V_{O1}=24V, I_F=10mA R_G=47Ω, C_G=3000pF FS=OPEN, Vc=0V
	Response time "H→L" propagation time	t_{PHL}	-	1.0	2.0			
	Response time Rise time	tr	-	0.2	0,5			
	Response time Fall time	tf	-	0.2	0.5			
	Instantaneous common mode rejection voltage (High level output)	CM_H	-1500	-		v/μs	7	Ta=25℃ I_F=10mA, Vcc=V_{O1}=24V ΔVo_{2H}=2.0V, FS=OPEN Vc=0V, V_{CM}=600V(peak)
	Instantaneous common mode rejection voltage (Low level output)	CM_L	1500	-		v/μs		Ta=25℃ I_F=0mA, Vcc=V_{O1}=24V ΔVo_{2L}=2.0V, FS=OPEN Vc=0V, V_{CM}=600V(peak)

● 1 It shall connect a by-pass capacitor of 0.01 μF or more between Vcc(Pin No, 13) and GND(Pin No. 10, 14) near the device, when it measures the transfer characteristics and the output side characteristics.

*2 I_{FLH} Is the value of forward current when output becomes from "L" to "H".

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(Unspecified : Ta=Topr)

3.2.2 Electro-optical characteristics(2)

	Parameter	Symbol	MIN.	TYP.	MAX.	unit	Conditions	Fig
Over current detection	Overcurrent detection voltage *4	V_{CTH}	Vcc-6.1	Vcc-6	Vcc-5.5	v	Ta=25℃, I_F=10mA Vcc=V_{O1}=24V R_G=47Ω C_G=3000pF FS=OPEN	
	Overcurrent detection voltage hysteresis width	V_{CHS}	1	2	3	v		
Protection output	O_2 "H-L" propagation time at overcurrent protection	t_{PCOHL}	-	4	10	μs	Ta.25°C Vcc=V_{O1}=24V I_F=10mA R_G=47Ω C_G=3000pF R_C=1kΩ C_P=1000pF FS=OPEN	
	O_2 Fall time at overcurrent protection	t_{PCOf}	2	5		μs		
	O_2 output voltage at overcurrent protection	V_{OE}	1-	-	2	v		
Error signal output	Low level error signal voltage	V_{FSL}		0.2	0,4	V	Ta=25℃ Vcc=V_{O1}=24V I_F=10mA I_{FS}=10mA, R_G=47Ω C_G=3000pF C=OPEN	
	High level error signal current	I_{FSH}			100	μA	Ta=25°C Vcc=V_{O1}=24V I_F=10mA V_{FS}=24V, R_G=47Ω C_G=3000pF Vc=0	
	Error signal "H-L" propagation time	t_{PCFHL}	-	1	5	μs	Ta=25℃ Vcc=V_{O1}=24V I_F=10mA R_{FS}=1.8kΩ R_G=47Ω, R_C=1kΩ C_G=3000pF C_P=1000pF	
	Error signal output pulse width	Δt_{FS}	20	35		μs		

● 3 It shall connect a by-pass capacitor of 0.01 μF or more between Vcc(Pin No.13) and GND(Pin No. 10, 14) near the device, when it measures the over current characteristics, protection output characteristics, and error signal output characteristics.

*4 V_{CTH} is the value of C(Pin No. 9) voltage when output becomes from "H" to "L".

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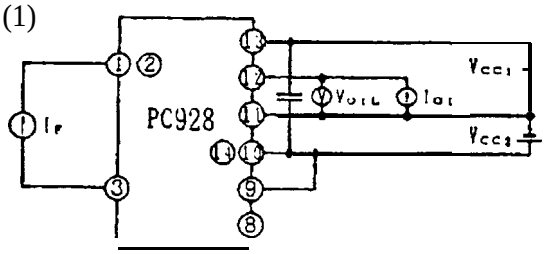
Test circuit (I)

(1)



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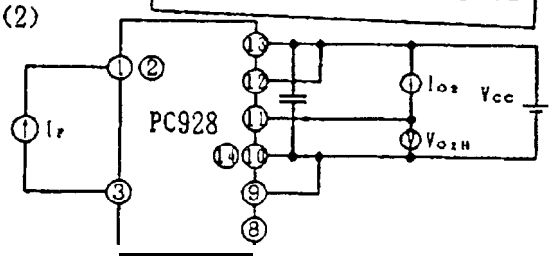

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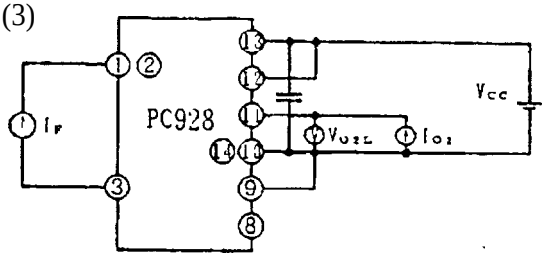

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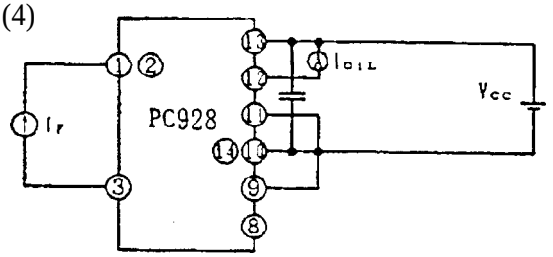

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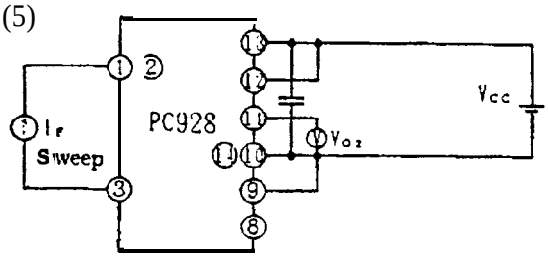

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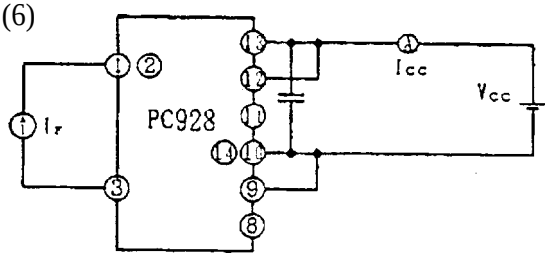

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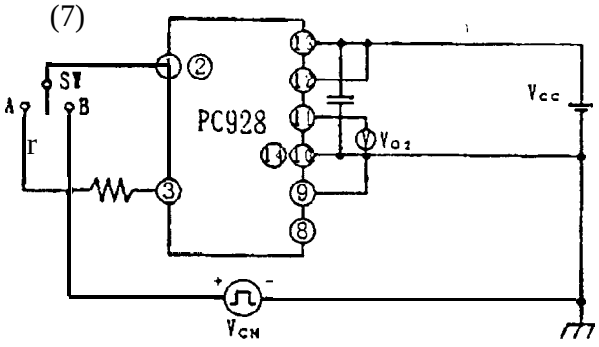

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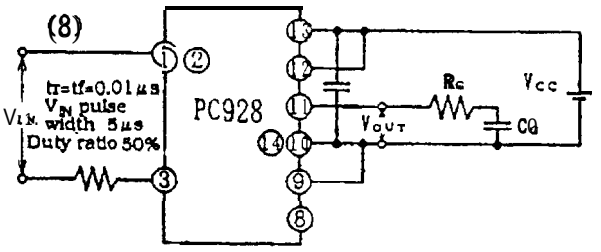

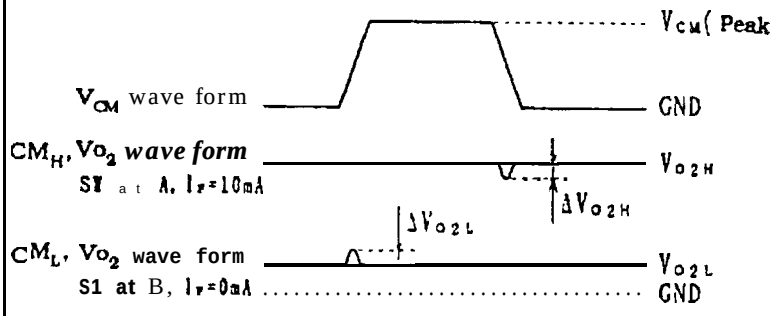

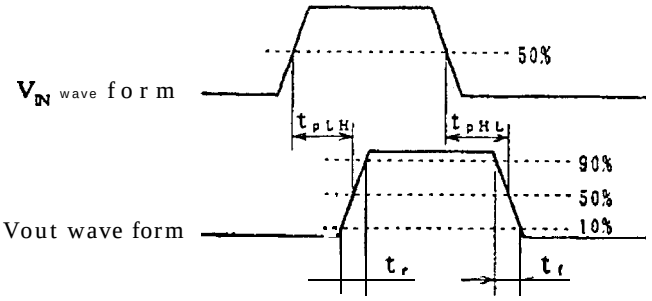

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Test circuit(B)

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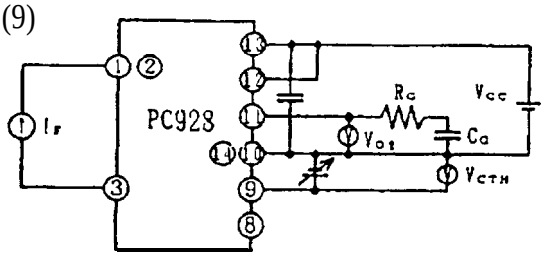
(9)



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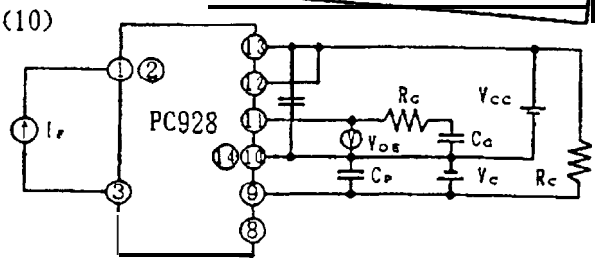

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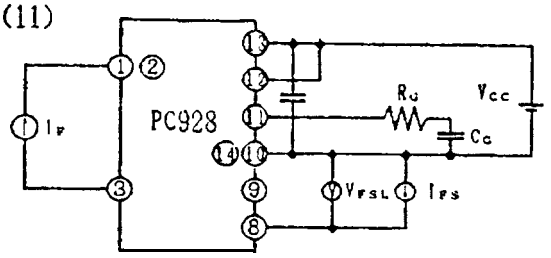

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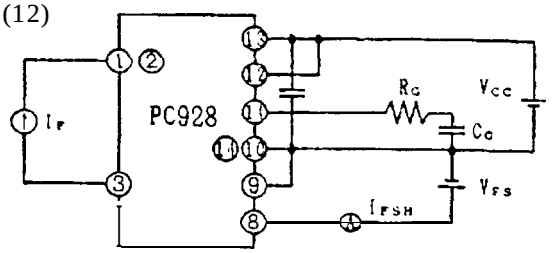

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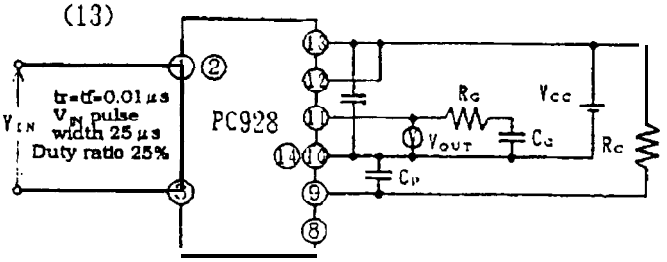

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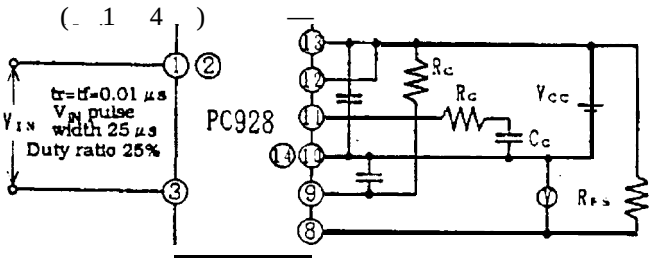

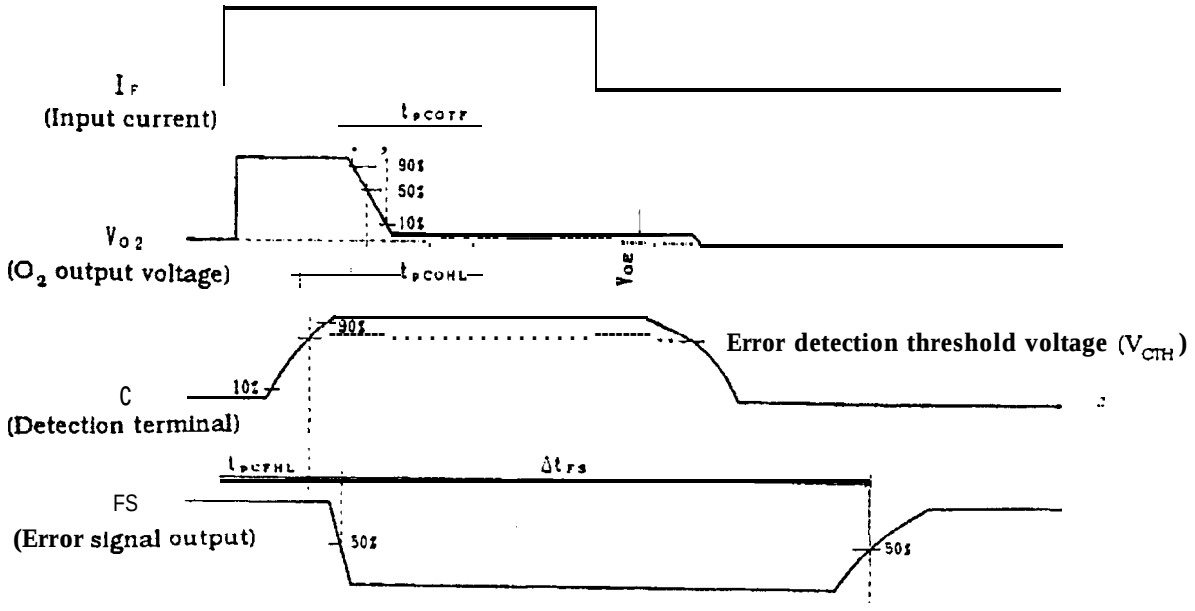

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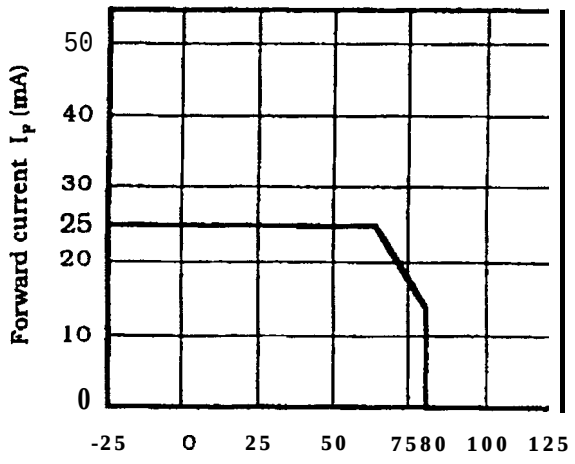
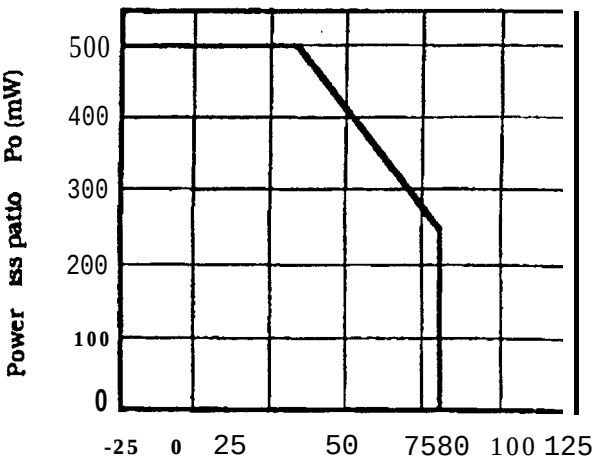
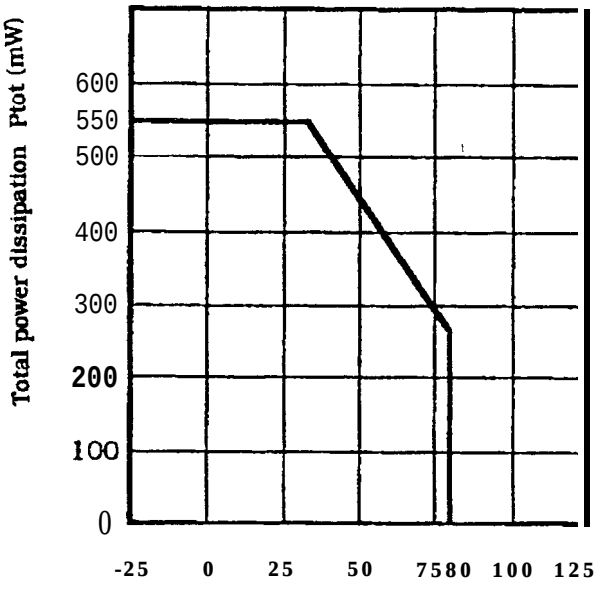
(Fig. 1) Forward current vs. ambient temperature



(Fig. 2) Output power dissipation vs. ambient temperature



(Fig. 3) Total power dissipation vs. ambient temperature



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4. Reliability

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The reliability of products shall be satisfied with items listed below.

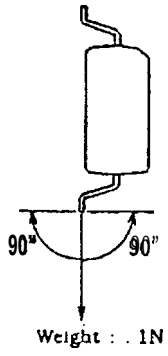
Confidence level : 90%
LTPD : 10°A/20%

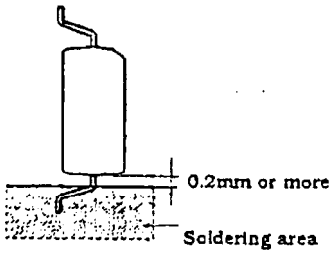
Test Items	Test Conditions	Failure Judgement Criteria	Samples [n] Defective(C)
Solderability "1	230℃, 5s	——	n=11, C=0
Soldering heat ●2	260℃, 10 s	V_F>U×1.2	n=11, C=0
Terminal strength ●3 (Bending)	Weight :1 N 1 time/each terminal	I_R>U×2	n=11, C=O
Mechanical shock	15000 m/s², 0.5ms 3 times/ ±X, ±Y, ±Z direction	V_{O1L}>U×1.2 I_{O2H}<L×0.8	n=11, C=O
Variable frequency vibration	100 to 2000 to 100Hz/4min. 200m/s² 4 ties/ X, Y, Z direction	V_{O2L}>U×1.2 V_{O1L}>U×1.2	n=11, C=0
Temperature cycling	1 cycle -55 "C to + 125℃ (30min.) (30*.) 20 cycle test	I_{CCH}>U×1.2 I_{CCL}>U×1.2	n=22, C=0
High temp. and high humidity storage	+60℃, 90%RH, 1000h	I_{FLH}>U×1.3	n=22, C=0
High temp. storage	+125℃, 1000h	U : Upper specification limit	n=22, C=0
Low temp. storage	-55℃, 1000h		n=22 , C=0
Operation life	I_F=20mA, Vcc=24V Ta=25°C, 10OOh	L : Lower specification limit	n=22, C=0

*1 Solder shall adhere at the area of 95% or more of immersed portion of lead and pin hole or other holes shall not be concentrated on one portion.

*2 The lead pin depth dipped into solder shall be away 0.2mm from the root of lead pins. (Refer to the below)

● 3 Terminal bending direction is shown below,





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SHARP CORPORATION

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5. Incoming inspection

5.1 Inspection Items

(1) Electrical characteristics

V_F, I_R, V_{O1L}, V_{O2H}, V_{O2L}, I_{O1L}, I_{CCH}, I_{CCL}, I_{FLH}, Riso, Viso

(2) Appearance

5.2 Sampling method and Inspection level

A single sampling plan, normal inspection level II based on MIL-STD- 105D is applied. The AQL according to the inspection items are shown below.

Defect	Inspection item	Inspection level	AQL (%)
Major defect	Electrical characteristics Unreadable marking	Normal inspection 11	0.1
Minor defect	Appearance defect except the above mentioned,	Normal inspection 11	0.4

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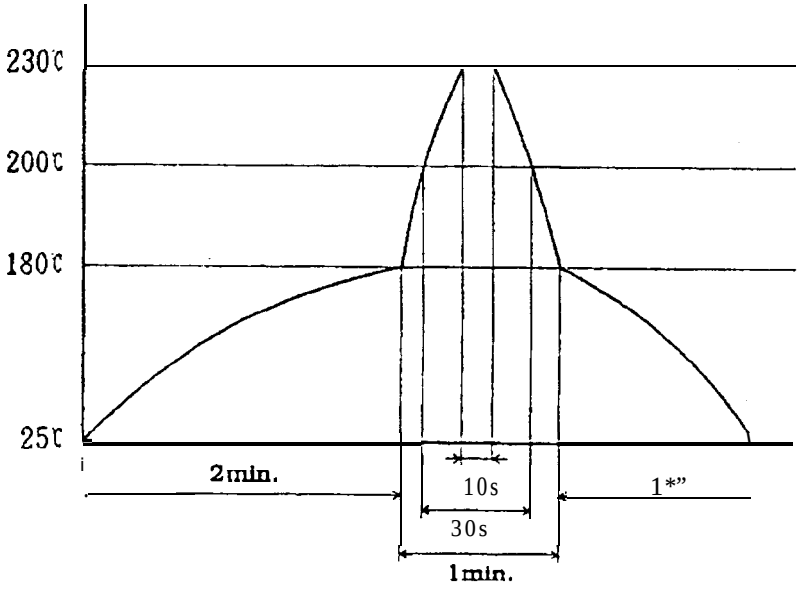
Precautions for Soldering Photocouplers

REFERENCE

1. If solder reflow :

It is recommended that only one soldering be done at the temperature and the time within the temperature profile as shown in the figure.



2. Other precautions

An infrared lamp used to heat up for soldering may cause a localized temperature rise in the resin, So keep the package temperature within that specified in Item 1, Also avoid immersing the resin part in the solder.

SHARP

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RELIABILITY TEST REPORT

Model No. : PC 928

Please obey the instructions mentioned below for actual use of this device.
SHARP takes no responsibility for damage caused by improper use of the devices.

(1) This device is designed for general electronic equipment.
Main uses of this device are as follows;
[* Computer ● OA equipment .Telecommunication equipment (Terminal)
.Measuring equipment .Tooling machine .AV equipment .Home appliance, etc.]

(2) please take proper steps in order to maintain reliability and safety, in case this device is used for the uses mentioned below which require high reliability.
[• Unit concerning control and sefety of a vehicle (air plane, train, automobile etc.)
.Traffic signal .Gas leak detection breaker .Fire box and burglar alarm box
● Other safety equipment, etc.]

(3) Please do not use for the uses mentioned below which require extremely high reliability.
[● Space equipment .Telecommunication equipment (Trunk)
"Nuclear control equipment .Medical equipment etc.]

Contact a SHARP representative of sales office in advance when you intend to use SHARP devices for any applications other than those applications for general electronic equipment recommend by SHARP at(l).

Prepared by	M. Sato M. Sato	Date : July. 25, 1995	Dept. Q&RCC
Approved by Assistant Manager	Y. Uchida	Date : July 25, '95	Dept. Q&RCC
Approved by Manager	Y. Kiyota Y. Kiyota	Date : July 25 '95	Dept. Q&RCC

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Electronic Components Group
282-l, Hajikami, Shinjo-cho, Kitakatsuragi-gun
Nara 639-21 JAPAN

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No: EPC-95740

RELIABILITY TEST REPORT

TYPE : PC 928

<RESULTS OF RELIABILITY TEST>

No.	Test Items	Test Conditions	Sample Size	Qty. of Failures	
1	Solderability	230 ±5℃, 5 ± 0.5s	11	0	※1
2	Soldering Heat	260 ± 5"C, 10s	11	0	
3	Terminal Strength (Bending)	Weight = 1N 0° → 90° → 0° 1cycles	11	0	※2
4	Mechanical Shock	15000m/s², 0.5ms, ±X, Y, Z/3cycles	11	0	
5	Vibration (Variable Frequency)	200m/s², 100 ~ 2000 ~100Hz/4min X, Y, Z/4cycles	11	0	
6	Temperature Cycling	−55℃(30min)~125℃(30min) 20cycles	22	0	
7	Thermal Shock	0℃ ~ 100"C (5min)(5s)(5min) 20cycles	22 22	0 0	
8	Moisture Resistance	−20℃ ~ 70℃, 90%RH (2h) (lb) (2H) 40cycles	22	0	
9	Humidity (Steady State)	Ta = 60℃, RH = 90%, t=1000h	22	0	
10	High Temp. Storage	Ta = 125℃, t=1000h	22	0	
11	Low Temp. Storage	Ta =– 55℃, t=1000h	22	0	
12	Operation Life	Ta = 25℃, t=1000h I_F = 20mA, V_{CC} = 24V	22	0	

ceptance limits of Parameters:

No.	Parameter	Acceptance limit	
1	Forward voltage : V_F	U.S.L. × 1.2	※3
2	Reverse current : I_R	U.S.L. × 2.0	
3	Low level supply current : I_{CCL}	U.S.L. × 1.2	
4	High level supply current : I_{CCH}	U.S.L. × 1.2	
5	O_1 low level output voltage : V_{O1L}	U.S.L. × 1.2	
6	O_2 low level output voltage : V_{O2L}	U.S.L. × 1.2	
7	O_2 High level output voltage: V_{O2H}	L.S.L. × 0.8	※4
8	O_1 leak current : I_{OIL}	U.S.L. × 1.2	
9	Threshold input current : I_{FLH}	U.S.L. × 1.3	
10	O_2 "H-L" propagation time at overcurrent protection : t_{PCOHL}	U.S.L. × 1.2	
11	Overcurrent detection voltage : V_{CTH}	L.S.L. x 0.8 ~ U.S.L. x1.2	
12	Isolation voltage : Viso	5kVrms • AC 1 ❑ in .RH= 40 ~ 60% current limit ≦0.2mA	

TE: ● XI The soldering area of terminal shall be covered greater than 95 percent.

※2 There shall be no evidence of breakage, loosening or relative ❑ otion between the terminal and package,

※3 The sign of U.S.L. represents Upper Specification limit,

※4 The sign of L.S.L. represents Lower Specification limit,

.Measuring condition of above parameters are based on this model's specification.

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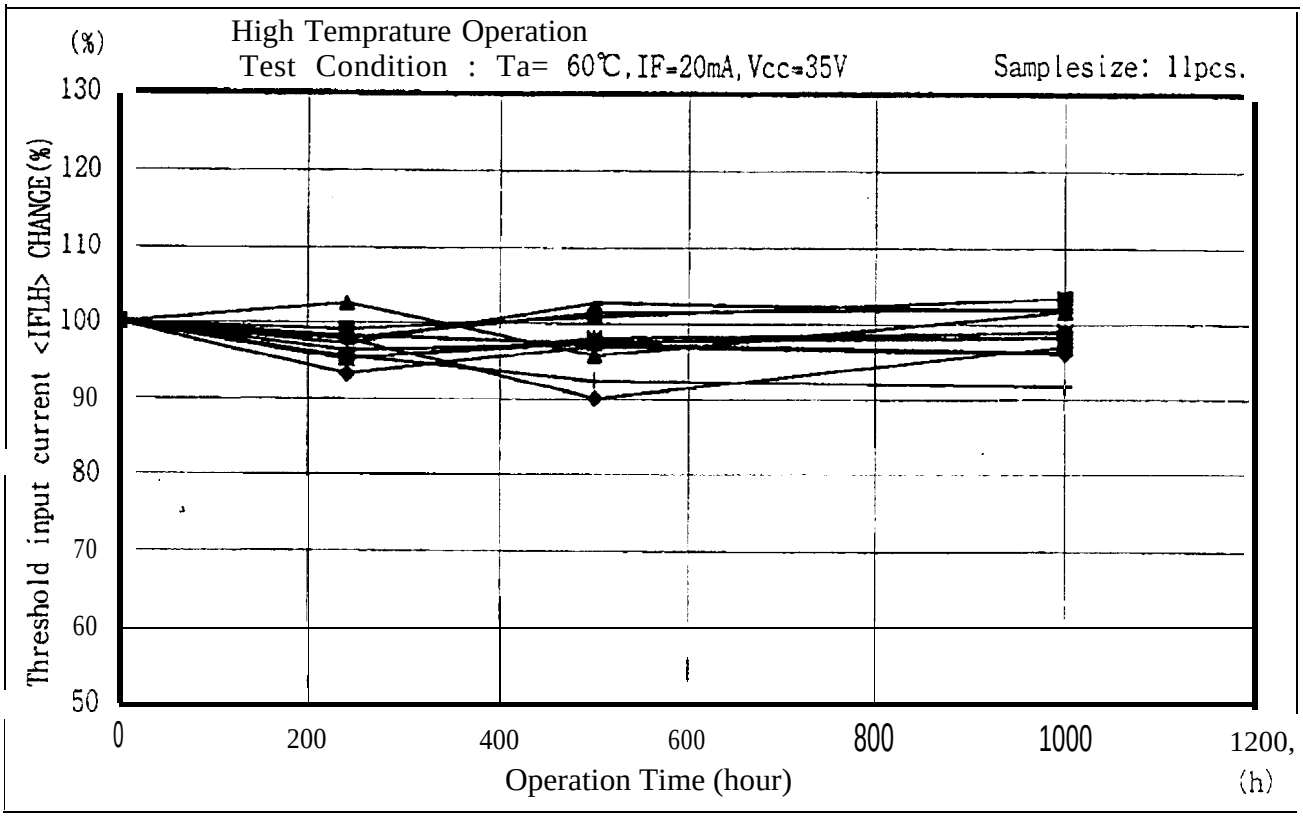
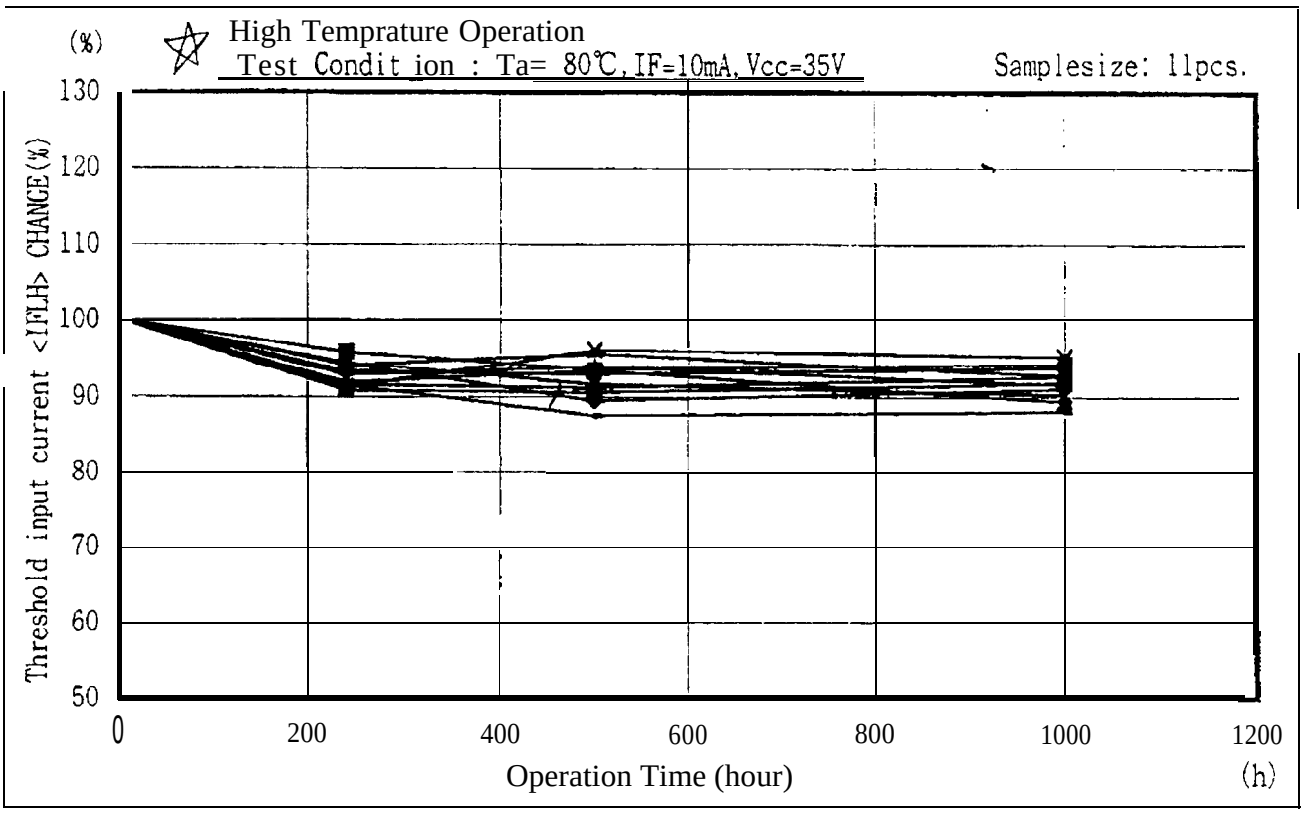

(%)
High Temprature Operation
Test Condition : Ta= 60℃, IF=20mA, Vcc=35V
Samplesize: 11pcs.
Threshold input current <IFLH> CHANGE(%)
130
120
110
100
90
80
70
60
50
0
200
400
600
800
1000
1200,
Operation Time (hour)
(h)


(%)
High Temprature Operation
Test Condit ion : Ta= 80℃, IF=10mA, Vcc=35V
Samplesize: 11pcs.
Threshold input current <IFLH> CHANGE(%)
130
120
110
100
90
80
70
60
50
0
200
400
600
800
1000
1200
Operation Time (hour)
(h)