

This specification is applied to ROHM custom type of intelligent TPH SE3002-DC73B.

Production Place : China

1. Functions:

1. Max 6 Level of Pulse width control is possible by monitoring the status of Future, history and adjacent Dot.
2. Max 3 Level of Pre-Heating Dot control is possible by Future control function.

2. Outlines

(1)	Dimensional Outline	Fig.1	
(2)	Heat Element Structure	2	heaters/dot
(3)	Number of Heat Elements	640	dots
(4)	Heat Element Pitch	0.0847mm pitch	(11.81 dots/mm)
(5)	Print Width	54.208mm	
(6)	Average Resistance Value (R_{ave})	650	\pm 15 %
(7)	Circuit Diagram	Fig.2	
(8)	Rave Rank Table	Table1	
(9)	Pinout Diagram	Table2	
(10)	Timing Chart	Fig.3-1, Fig.3-2	
(11)	Electrical Characteristics of Circuit	Table3	
(12)	Level Classification	Table4	
(13)	Thermistor Specification	Table5	

The product described in this specification is designed to be used with ordinary electronic equipment or devices.

Should you intend to use the product with equipment or devices that require an extremely high level of reliability and the malfunction of which would directly endanger human life, please be sure to consult with our sales representative in advance.

*** CAUTION ***

This Printhead does not have a capacitor on VH line for noise protection because of the request from Futurelogic, Inc.

Therefore, noise may cause malfunction, damage and/or firing in the worst case.

Customer is required to implement sufficient countermeasure to prevent such a problem.

DESIGN	CHECK	APPROVAL	DATE: 9 th Jun., 2010	SPECIFICATION No.	10SE3002-DC73B
K.Muraki	Y.Yoshikawa	M.Nakanishi	REV. : B	<div style="border: 2px solid red; padding: 5px; text-align: center;"> PRINT ISSUE ROHM Co., Ltd. Jun. 14. 2010. ROHM CO., LTD. </div>	

3. Maximum Conditions at 25

Item		Maximum Conditions						Unit	Conditions
Supply Voltage (V _{DD})		VSS -0.3 ~ +7.0						V	T _{sub} = 25
Supply Energy (E ₀ MAX)	LEVEL	1	2	3	4	5	6	mJ/dot	Scanning Line Time (S.L.T.) = 0.28ms/line
	E ₀	0.147	0.132	0.117	0.101	0.086	0.086		
Supply Voltage (V _H)		26.4						V	V _p : Peak of V _H < 30V
Substrate Temp. (T _{sub})		60							Thermistor Temperature
Number of Burning Dots at Same Time(N)		640						dots	(NOTE 1)

4. Standard Printing Conditions at 25

(1) Mechanical Conditions (NOTE 2)

Item	Mechanical Conditions	Unit
Platen Pressure	14.7 ± 4.9	N / print width
Platen Hardness	40 ± 5	Shore A
Platen Diameter	10 ~ 20	mm
Paper Feed Pitch	0.0847	mm/line
	11.81	line / mm

2) Printing Media

Method	Printing Media		
Thermal Transfer	Film	RICOH	B120E
	Receiving Paper	OJI	TKP-40
Direct	Thermal Paper	RICOH	150LA-1
		OJI	KL40-GA

(3) Electrical Conditions (NOTE 3)

Item	Symbol	Electrical Conditions						Unit	
Supply Power	P _o	0.73						W/dot	
Supply Voltage	V _H	24.0						V	
Scanning Line Time	S.L.T.	0.28						ms/line	
Supply Energy (On Time) Refer to Table-3	LEVEL	1	2	3	4	5	6		
	E ₀	0.113	0.101	0.089	0.078	0.066	0.009	mJ/dot	Tsub=25
	T _{ON}	0.155	0.139	0.122	0.107	0.091	0.012	ms	
Supply Current	I _o total	21.4						A	
Conditions		Rave= 650 ohm, 640 dots are fired at same time.							

5. Ambient Conditions

Item	Symbol	Ambient Conditions	Unit on Conditions
Storage Temp	T _{sto}	-25 ~ 70	Degree
Operation Temp	T _{ope}	5 ~ 45	Degree
Humidity	-	10 ~ 90	%RH No Condensation

6. Print Quality on Standard Printing Conditions

The Print Quality limit specified below is available in the case that print is performed under the conditions shown in section 4 and at ambient temperature 25 degree.

(1) Optical Density Min.1.0 *1

(2) Variation of Density Max.0.3 *1

*1 Density is measured at the full black pattern by Macbeth Densitometer RD-914.

Full black pattern means all dots printing pattern (100% black area) printed under correct paper speed and correct platen contact.

7. PrintHead Life on Standard Printing Conditions

Life is defined that resistance value of any dots changes more than or equal to 15% from the initial value. Head temperature shall not exceed the maximum 60-degree with thermistor reading.

(1) Pulse Life : 1×10^8 pulses

(2) Abrasion Life : 150 km 【at continuous paper used】

(A condition of bad influential factors are not included in media)

NOTE 1)

The maximum number of dots which can be energized simultaneously while satisfying the print quality described in Section 3.

NOTE 2)

The mechanical condition described in Section 4-(1) is one of conditions to satisfy the print quality in Section 6. It may not restrict the change of actual usage.

NOTE 3)

Calculation formula for On Time, T_{on} and Supply Voltage, V_H .

On Time, T_{on} and Supply Voltage, V_H in the Table of standard printing conditions are obtained by following formula.

$$P_0 = I_0^2 \times R_{ave} = \frac{V_H^2 \times R_{ave}}{(R_{pb} \times N + R_{com} + R_{ave} + R_{ic} + R_{lead})^2}$$

$$T_{on} = E_0 \div P_0$$

or

$$P_0 = E_0 \div T_{on}$$

$$V_H = \sqrt{(P_0 \div R_{ave}) \times (R_{pb} \times N + R_{com} + R_{ave} + R_{ic} + R_{lead})}$$

R_{ave} :	(Ex.)	650	()
R_{pb}		0.02	()
R_{com} :		28	()
R_{ic} :		15	()
R_{lead} :		11	()
N :	Number of Burining Dots at Same Time (N)	640	(dots)

Table 1 Rave Rank Table

Rave Resistance ()	sens1	sens2	sens3
553 ~ 575	0	0	0
576 ~ 600	0	0	1
601 ~ 625	0	1	0
626 ~ 650	0	1	1
651 ~ 675	1	0	0
676 ~ 700	1	0	1
701 ~ 725	1	1	0
726 ~ 748	1	1	1

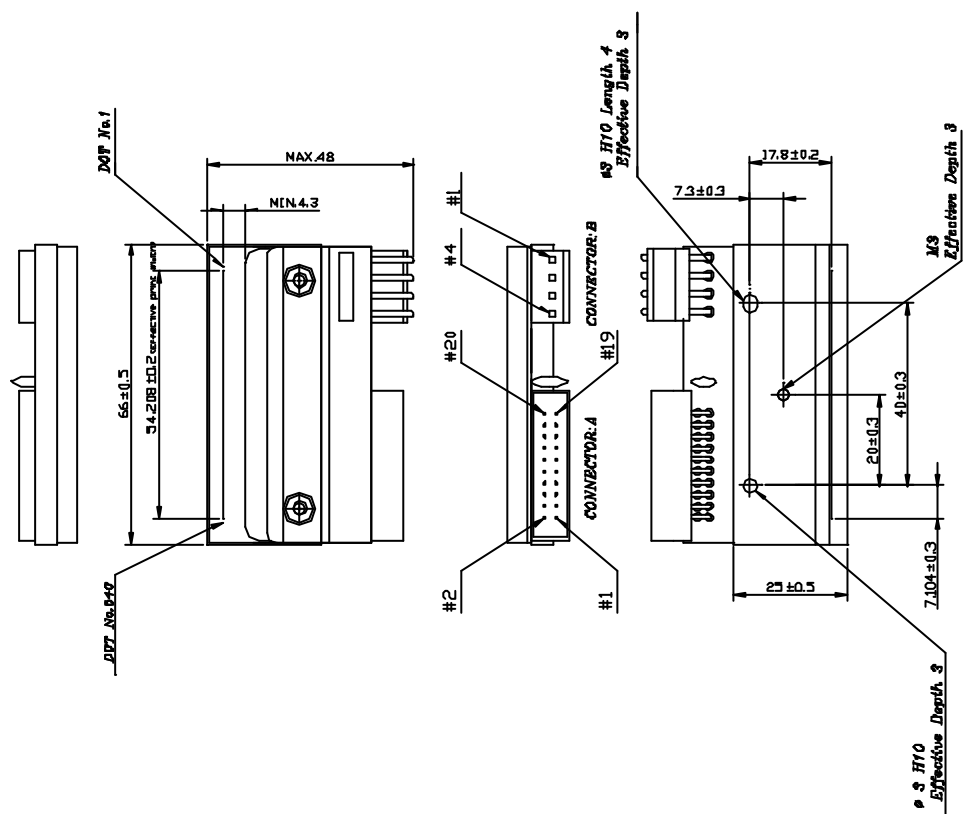
(Note) "1" shows OPEN. "0" shows short to GND.

NOTE 4)

When thermal transfer ribbon is used, print conditions may be changed to meet with ribbon sensitivity. Please contact us in this case.

8. Operation precautions

- (1) When continuous printing is performed, the supply energy should be reduced so that the substrate temperature monitored through the thermistor will remain below the maximum temperature show in Section 2. (Maximum Conditions at 25 degrees C)
- (2) Power on and off sequence must be in the following order to prevent the dot element damage;
 Turn on - Apply the logic supply voltage (V_{DD}) first and the printhead supply voltage (V_H).
 Turn off - Switch off the printhead supply voltage (V_H) first and turn the logic supply voltage (V_{DD}) off.
- (3) Interface each signal input (CLK, LAT, STB, DI) with CMOS level (ex. 74HC240). Please keep STB signal to "Disable" during ON/OFF and during no printing condition.
- (4) Heat elements and IC's shall be anti-electrostatic in order to prevent the electrostatic destruction. Do not touch the connector pins by naked hands.
- (5) The printhead substrate surface is coated with glass and mechanical stress or shock (including dust scratch damage) should be avoided to prevent damage.
- (6) When the printhead operation is finished, print supply voltage (including the charged voltage with capacitor) should be reduced to the ground level and remained until next printhead operation.
- (7) Platen roller should be composed of non-conductive materials.
- (8) Condensation should be avoided. If condensation occurred, do not switch on the printhead power until condensation disappeared.
- (9) External force shall not be applied to the connector when it is plugged in or out.
- (10) Print quality would be degraded if paper or ink residue were stuck on the heat element area. For such a case, please use applicator with alcohol to clean up. Do not use any material or equipment, which destroy the heat elements.
- (11) If printing sound, for example sticking sound, occurred, please review and adjust the paper feed mechanism and the electrical pulse program to eliminate the sound.
- (12) The change of printhead flatness (warp) is minimized with temperature change in the free body of one unit. Please pay attention to the warp created by fixing the printhead to the printer unit with screws or clamp.
- (13) Please ensure that the paper used does not include bad element factor to affect the printhead life.
- (14) Printing without paper (Thermal paper etc.) should not be done. It may cause destruction on heat due to overload.
- (15) If printhead operation method is changed, Please inform us in advance to change.
- (16) In order to avoid surge, V_H and GND cable length should be less than 100mm, and aluminum capacitor is required between V_H and GND at controller board side. Ceramic capacitor should be placed between V_{DD} and GND.
- (17) Please design the component in such a way that the printing media (while in printing) and the paper guide do not contact the IC protective coating and the pin protective coating, in order to keep the printing quality.
- (18) Please make designing in such a way to avoid the contact with conductive components like head support plate, because there is an area where the electrode are exposed on the surface and the side of thermal printhead.
- (19) Thermal printhead is heat-generating device, so that it may cause heat element damage or smoke / fire on its components by over heating if there occurs mechanical or electrical abnormalities. So please be sure to perform temperature control by thermistor and also to design the power (V_H , V_{DD}) shutdown system when abnormalities take place to protect the printhead.
- (20) If dusts/foreign particles stuck on the surface of thermal head substrate or printed circuit board, it may cause stained print, faded print and also damage of heat element, smoking and combustion. In this case, the head should be cleaned by ethyl-alcohol after power source for head is shut down and please check if the dusts/foreign articles are completely removed. Yet, make sure that ethyl alcohol is dried up before restarting the operation.
- (21) Please design power source for head (V_H , V_{DD}) to be shutdown when the thermal head surpasses the maximum rated wattage while STB is On, or the printing media does not move like paper jam. Otherwise, heated printing media bums and sticks to the head and may lead to combustion in the worst case.



- 1) THE WARP OF THERMAL HEAD : $-0.06 \sim +0.10\text{mm}$ (MEASURED AT 3 POINT)
- 2) CONNECTOR A: HF8FC-20FA-2.64DS(91) (HIROSE)
CONNECTOR B: B 4PS-VH(LF)(SN) (JST)

Table2 Pinout Diagram

CONNECTOR : A

No.	Circuit	No.	Circuit
1	VDD	2	BEO
3	GND	4	DI
5	GND	6	CLK
7	/LOAD	8	START
9	INC	10	N.C.
11	SEL2	12	SEL1
13	/RESET	14	/STB2
15	/STB1	16	TM
17	TM	18	SENS1
19	SENS2	20	SENS3

CONNECTOR : B

No.	Circuit	No.	Circuit
1	VH	2	VH
3	GND	4	GND

Pin number : Refer to Fig.-1

DI: Data In (Serial Input)
 CLK(CP): Clock Pulse (Max Transfer Frequency)
 /LOAD: Data Loading
 START: Data Transfer & Latch & Error Check
 TM: Thermistor
 /STBn: Strobe
 VDD: Power Supply for Driver IC
 N.C.: Non Connection

Additional Functions;

INC: One increment steps up one level of energy control. (Refer to Fig.3-2)

RESET: Reset Data and System. (ALL CLEAR STATUS) (Refer to Fig.3-2)

SELn: Pre-Heating is done next heated dot by combination of SEL1, SEL2.

SEL 1	SEL 2	FUNCTION
L	L	NO PRE-HEAT
H or OPEN	L	PRE-HEATING FROM LEVEL 4
L	H or OPEN	PRE-HEATING FROM LEVEL 5
H or OPEN	H or OPEN	PRE-HEATING FROM LEVEL 6

(Note)

Each /LOAD, INC and START signal detect dropping edge.

 START signal shift history data generated in driver IC when dropping and LATCH when standing up.
 (Refer to Fig.3-2)

Table3 Electrical Characteristics

(1) Operating Conditions (25 degree)

Item	Sym.	Min.	Typ.	Max.	Unit	Condition
Supply Voltage	VDD	4.75	5.00	5.25	V	Printing in standard
Supply Current	IDD	-	-	30	mA	All data "H"

(2) DC Characteristics (VDD=5V, VSS=0V, Ta=25 degree)

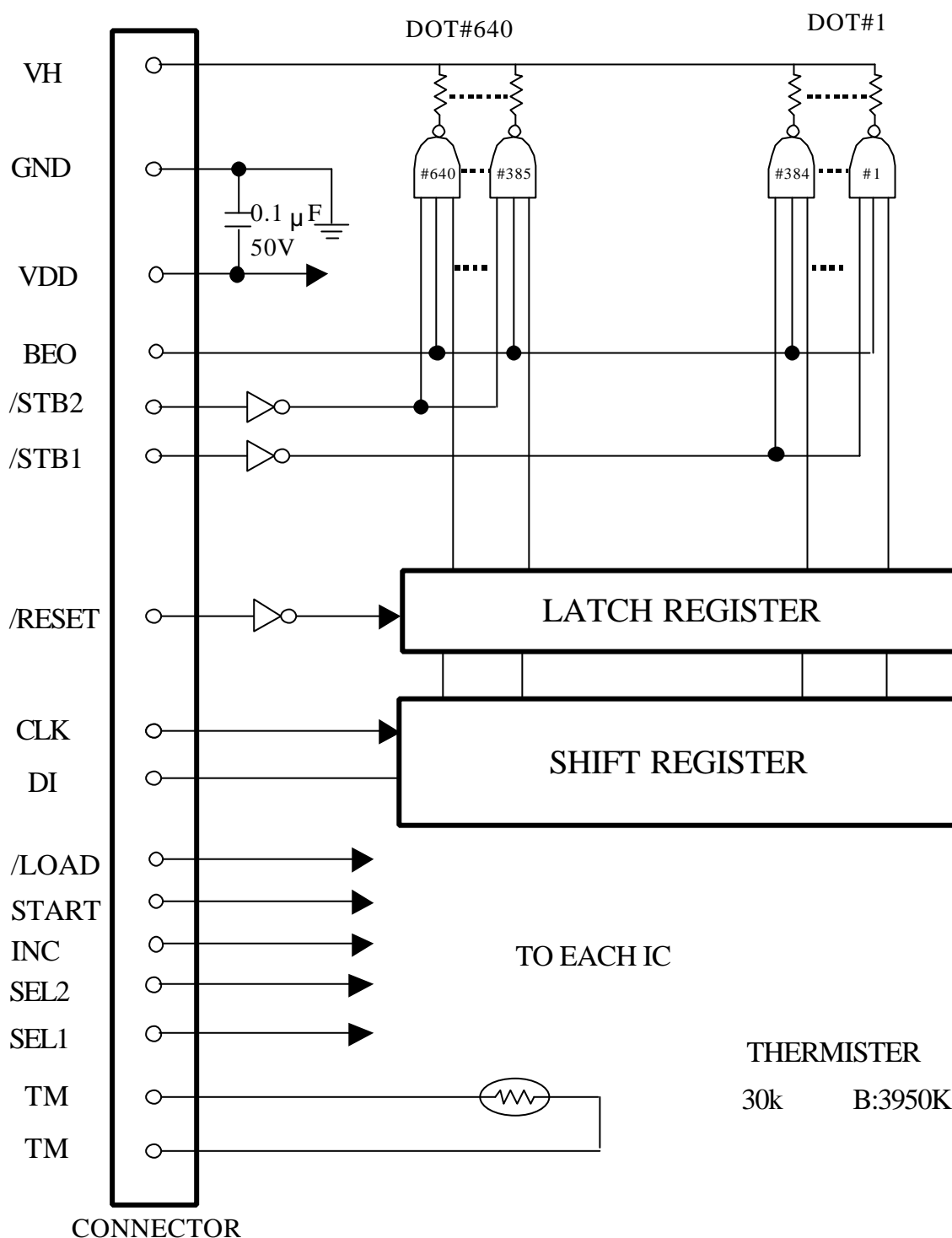
Item	Sym.	Min.	Typ.	Max.	Unit	Condition	I/O
"H" Input Voltage	Vih	3.90	-	VDD	V		DI, CLK
"L" Input Voltage	Vil	0	-	1.1	V		
"H" Trigger Voltage	Voh	4.2	-	-	V		**1
"L" Trigger Voltage	Vol	-	-	0.8	V		
Input Current Data Out "H"	Iih1	15	-	150	uA	Vin=0V	BEO
	Iih2	-	-	7.5	uA		Except above
Input Current Data Out "L"	Iil1	-150	-	-15	uA	Vin=VDD	**2
	Iil2	-7.5	-	-	uA		Except above

**1 /LOAD, START, INC, /STBn, /RESET, BEO, SEL1, SEL2

**2 /LOAD, START, INC, /STBn, SEL1, SEL2

(3) Switching Characteristics (Ta=25 degree)

Item	Sym.	Min.	Typ.	Max.	Unit	
Max. Transfer Frequency	fCLK	-	-	8	MHz	Refer to Fig.3-2
SetUp Time	tsetup DI	85	-	-	ns	
DataHold Time	thold DI	85	-	-	ns	
ClockWidth	tw CLK	55	-	-	ns	
LOAD Setup time	tsetup/LOAD	90	-	-	ns	
LOAD Width	tw /LOAD	125	-	-	ns	
START Width	tw START	-	90	-	ns	
INC Width	tw INC	-	90	-	ns	
STB Setup time	tsetup /STB		250	-	ns	Refer to Fig.3-1
DI/CLK Closed Time	t1	34	-	-	us	
STARTn/LOAD Closed Time	t2	16	-	-	us	

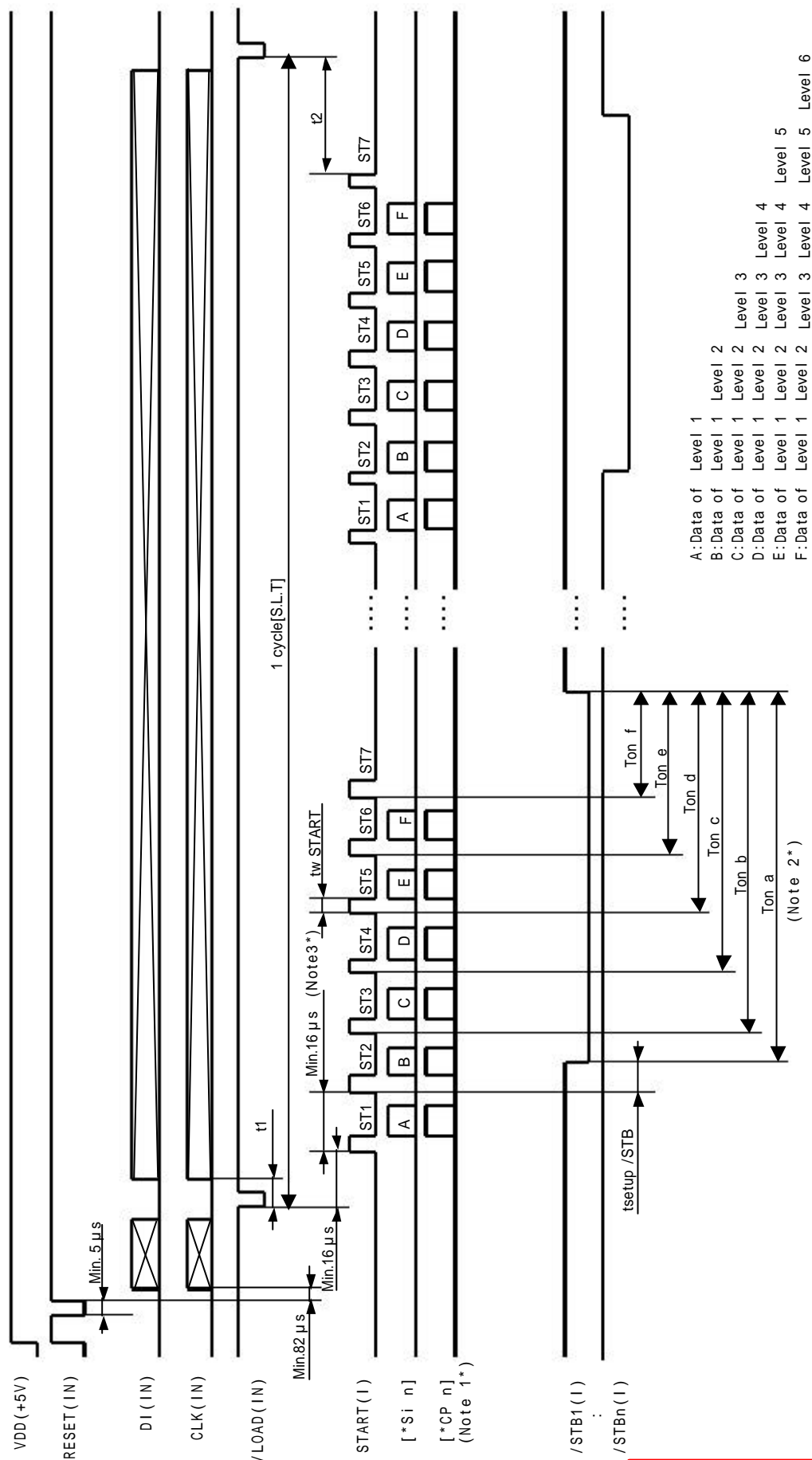
Fig.2 Circuit Diagram


DI,STB DIVISION DOT No. CORRESPONDENCE

DI No.	DOT No.
DI	640 ~ 1

/STB No.	DOT No.
/STB2	640 ~ 385
/STB1	384 ~ 1

Fig.-3-1 Timing Chart 1



(Note*4) NO INC(INCREMENT) ON ST6,ST7.
 (Note*3) NEED MORE THAN 16μs ON EACH START PULSE.
 (Note*2) REFER TO Table-4 FOR Ton a-f.
 (Note*1) SIGNAL WITH ASTERISK IS GENERATED HEAD INSIDE.

Fig.-3-2 Timing Chart 2

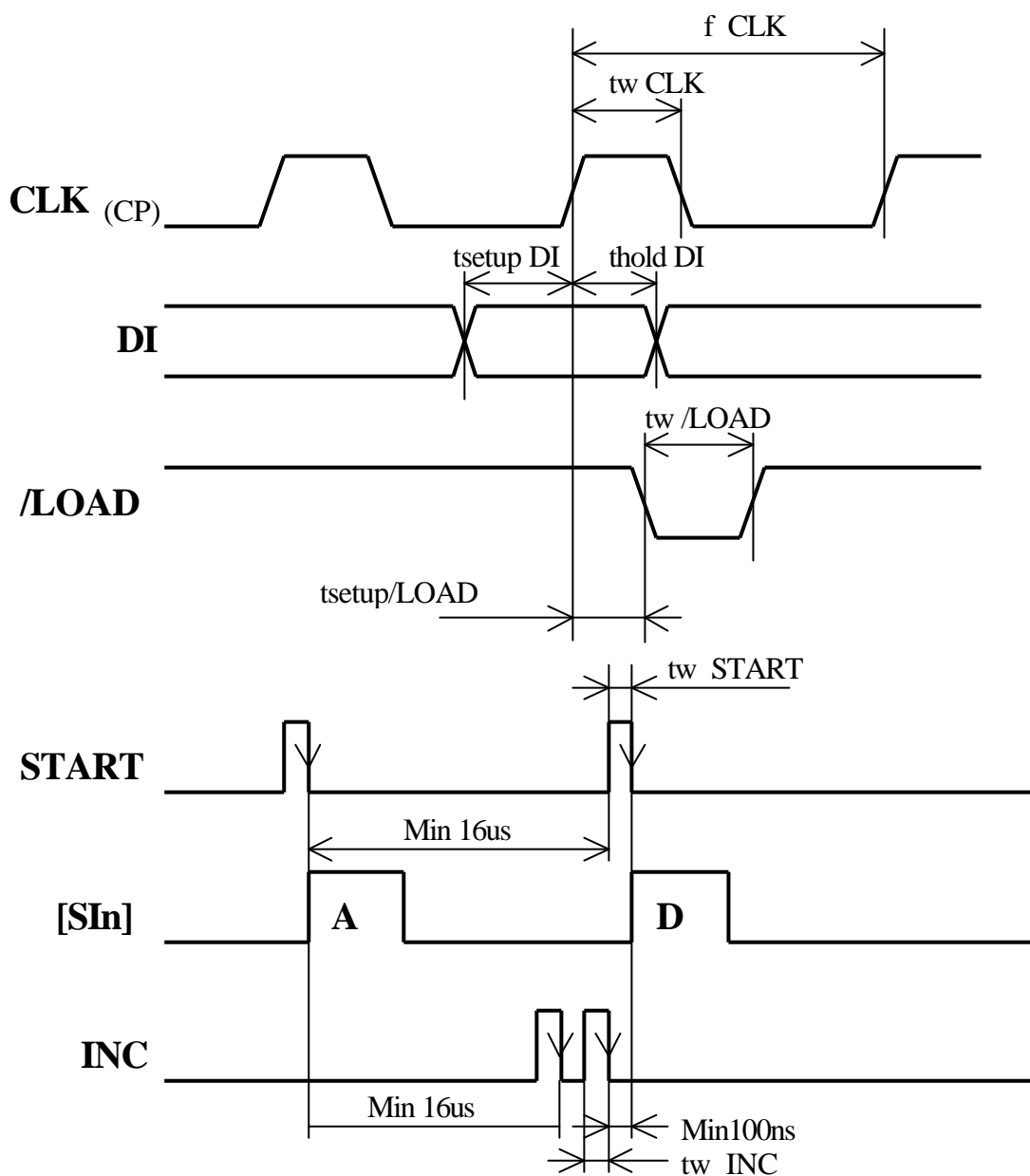


Table 4 Level Classification

	Print Pattern	On Time	S.L.T.=0.28 ms
Level1	* focusing dot just now next focusing dot	Ton a	0.155
Level2	* * * *	Ton b	0.139
Level3	*	Ton c	0.122
Level4	* *	Ton d	0.107
Level5	*	Ton e	0.091
Level6		Ton f	0.012

Print Pattern for preheating	
	Possible to choice level 4 to 6

- (EX) shows not heated dot.
 shows heated dot.
 shows the focusing dot to be controlled.
 * shows next focusing dot will either be heated or not.
 shows some of them are heated dot.

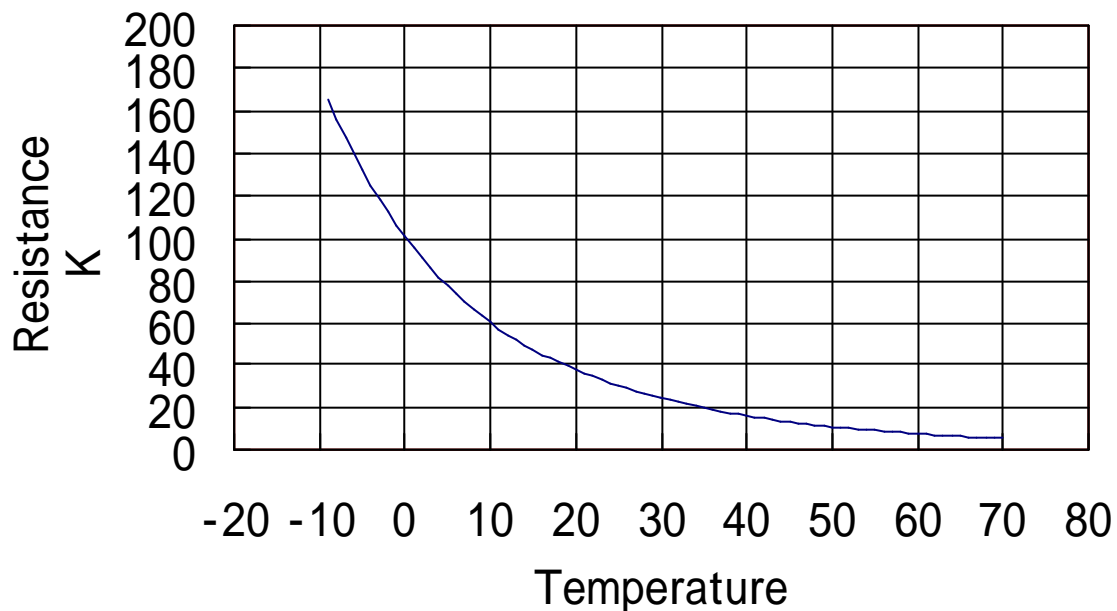
This table shows simple example. Actual table contains the history of adjacent dots.

Table 5 Thermistor Specification
ELECTRICAL REQUIREMENTS;

- 1) RESISTANCE R25 : 30k ± 5% at 25
- 2) B VALUE : 3950K ± 2%
- 3) RESISTANCE vs. TEMPERATURE : Fig.4

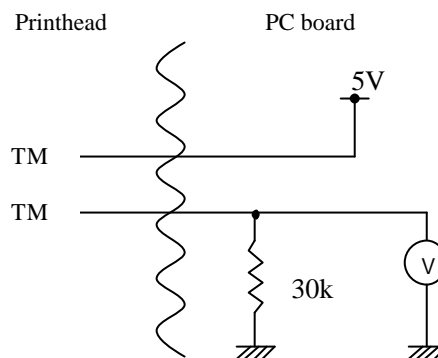
RATING;

- 1) OPERATING TEMPERATURE : -20 ~ +80
- 2) TIME CONSTANT : Max. 30sec (in the air)

Fig.4 Temperature characteristic of Thermistor


$$R_x = R_{25} \cdot \exp\left\{B \cdot \left(\frac{1}{T_x} - \frac{1}{T_{25}}\right)\right\}$$

(T; ABSOLUTE TEMPERATURE)

Recommended Circuit


Limited Warranty

ROHM CO., LTD. ("ROHM") warrants this product against defects in material or workmanship, as follows;

1. For a period of twelve (12) months from the date of purchase, ROHM will repair or replace any products returned in fact, which ROHM shall determine to be defective in material or workmanship upon inspection.
2. The warranty shall be invalidated by any damage due to;
 - 1): Disasters such as fire, earthquake, flood, or robbery.
 - 2): repair, modification, misuse, abuse or negligence.

ROHM shall not be liable for any incidental or consequential damages (defects of main units, parts replacement, parts transportation) for breach of any express or implied warranty on the product (for example, damages created under the conditions described in section (2) above).

< Specifications (Precautions and Prohibitions) >

Safety Precautions

- 1) The products are designed and produced for application in ordinary electronic equipment (AV equipment, OA equipment, telecommunication equipment, home appliances, amusement equipment, etc.).
 If the products are to be used in devices requiring extremely high reliability (medical equipment, transport equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or operational error may endanger human life and sufficient fail-safe measures, please consult with the Company's sales staff in advance. If product malfunctions may result in serious damage, including that to human life, sufficient fail-safe measures must be taken, including the following:
 - [a] Installation of protection circuits or other protective devices to improve system safety
 - [b] Installation of redundant circuits in the case of single-circuit failure
- 2) The products are designed for use in a standard environment and not in any special environments.
 Application of the products in a special environment can deteriorate product performance. Accordingly, verification and confirmation of product performance, prior to use, is recommended if used under the following conditions:
 - [a] Use in various types of liquid, including water, oils, chemicals, and organic solvents
 - [b] Use outdoors where the products are exposed to direct sunlight, or in dusty places
 - [c] Use in places where the products are exposed to sea winds or corrosive gases, including Cl_2 , H_2S , NH_3 , SO_2 , and NO_2
 - [d] Use in places where the products are exposed to static electricity or electromagnetic waves
 - [e] Use in proximity to heat-producing components, plastic cords, or other flammable items
 - [f] Use involving sealing or coating the products with resin or other coating materials
 - [g] Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering
 - [h] Use of the products in places subject to dew condensation
- 3) The products are not radiation resistant.
- 4) The Company is not responsible for any problems resulting from use of the products under conditions not recommended herein.
- 5) The Company should be notified of any product safety issues. Moreover, product safety issues should be periodically monitored by the customer.

Precautions Regarding Application Examples and External Circuits

- 1) If change is made to the constant of an external circuit, allow a sufficient margin due to variations of the characteristics of the products and external components, including transient characteristics, as well as static characteristics. Please be informed that the Company has not conducted investigations on whether or not particular changes in the application examples or external circuits would result in the infringement of patent rights of a third party
- 2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods. Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

< Specifications (Precautions and Prohibitions) >

Precautions Regarding Foreign Exchange and Foreign Trade Control Law

- 1) The Company has not determined whether or not the products are considered "a controlled product or technology" as specified in the Foreign Exchange and Foreign Trade Control Law.
Accordingly, if exportation of the products, either separately or integrated in another company's products, is intended, or giving the products to persons who are not residents is planned, additional steps are required, based upon the appropriate regulations.

Prohibitions Regarding Industrial Property

- 1) These Specifications contain information related to the Company's industrial property. Any use of them other than pertaining to the usage of appropriate products is not permitted. Duplication of these Specifications and its disclosure to a third party without the Company's permission is prohibited.
- 2) Information and data on products, including application examples, contained in these specifications are simply for reference; the Company does not guarantee any industrial property rights, intellectual property rights, or any other rights of a third party regarding this information or data. Accordingly, the Company does not bear any responsibility for:
 - [a] infringement of the intellectual property rights of a third party
 - [b] any problems incurred by the use of the products listed herein.
- 3) The Company prohibits the purchaser of its products to exercise or use the intellectual property rights, industrial property rights, or any other rights that either belong to or are controlled by the Company, other than the right to use, sell, or dispose of the products.

Precautions on Use of Products

- 1) Verification and confirmation of performance characteristics of products, after on-board mounting, is advised.
- 2) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- 3) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the remainder of flux may negatively affect product performance and reliability.
- 4) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the Company in advance

Precautions Regarding Product Storage

- 1) Product performance and soldered connections may deteriorate if the products are stored in the following places:
 - [a] Where the products are exposed to sea winds or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - [b] Where the temperature or humidity exceeds those recommended by the Company
- 2) The guaranteed period of solder connections and product performance is within one year from shipment by the Company, provided that the above-mentioned storage conditions have been satisfied.

Other Matters

- 1) Please sign these Specifications and return one copy to the Company.
If a copy is not returned within three months after the issued date specified on the front page of these Specifications, the Company will consider the Specifications accepted.
- 2) If any matter related to these Specifications needs to be clarified, discussions shall be held promptly between the two parties concerned to determine the issue.

SPECIFICATION No. : 10SE3002-DC73B