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Read and agreed by   _____

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

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OSAKA   JAPAN

REVISED RECORD

Date	Document No.	Contents of Revision	Page
2004.01.23	MES-DG60C153A	Added ・3.9 Installation ・9.2（1）Coercive force (Hc) : 2.4 × 10⁵ A/m ・10.1　Life of the magnetic head and IC contact pins 　　　*Condition ・11.2.3 Installation（5） Removed ・11.2.2 Cleaning（1）Recommended cleaning card	3 12 13 13
2004.08.18	MIS-DG60C153B	・Added Note ・6.4.2（1）note.1 　Added the comments regarding capacitor.	9

CONTENTS

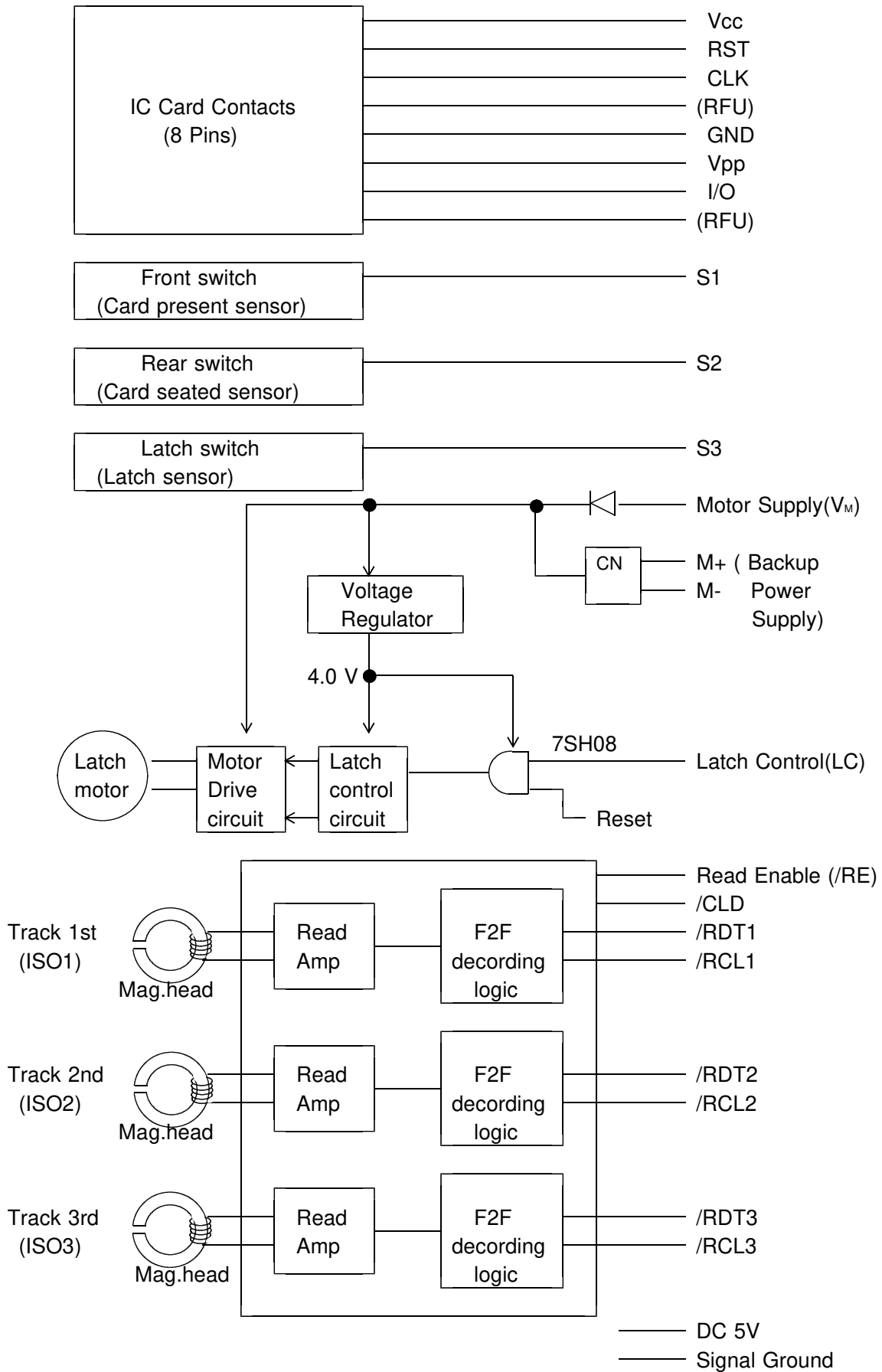# IC Card Reader / Writer with magnetic Reader

1. Abstract

IC Card Reader / Writer (ZU-98330SEA) consists as follows.

(1) Card Reader can access the contacts on IC Card and read magnetic stripe .

(2) Decoding circuit for magnetic stripes up to 3 tracks.

(3) Electro-mechanical latching mechanism. The mechanism shall be used to lock
   an IC Card in place while a transaction in progress.

(4) These mechanical switches detect 3 states the presence of the card within card slot,
   the state of the latch and the card is inserted to the rear end which is placed to the
   right position.

(5) Card present sensor (front switch) is being operated while detecting card width.

(6) The opening hole which allows alien substances, such as coins or dust to either fall
   or to be forced out of the card slot.

(7) Location of contacts relative to the face of the card.
   The contacts area shall be on the front face of the card at the location specified in
   ISO 7816-2.

(8) Magnetic reading when usually pulling out (ejection) the card.

(9) Magnetic card stripe based on ISO 7811.

Card standard	ISO1	ISO2	ISO3
Track used	Track 1st	Track 2nd	Track 3rd
Recording method	F2F	F2F	F2F
Recording density	210 BPI	75 BPI	210 BPI
Recording capacity	79 characters (7 bit code)	40 characters (5 bit code)	107 characters (5 bit code)

(10) PCB coating for dew condensation-proof.

2. Constructions

IC Card Contacts
(8 Pins) — Vcc
RST
CLK
(RFU)
GND
Vpp
I/O
(RFU)

Front switch
(Card present sensor) — S1

Rear switch
(Card seated sensor) — S2

Latch switch
(Latch sensor) — S3

Motor Supply(V$_M$)

Voltage
Regulator

CN — M+ (Backup
M-   Power
        Supply)

4.0 V

Latch
motor — Motor
Drive
circuit ← Latch
control
circuit — 7SH08 — Latch Control(LC)

Reset

Read Enable (/RE)
/CLD

Track 1st
(ISO1)
Mag.head — Read
Amp — F2F
decording
logic — /RDT1
/RCL1

Track 2nd
(ISO2)
Mag.head — Read
Amp — F2F
decording
logic — /RDT2
/RCL2

Track 3rd
(ISO3)
Mag.head — Read
Amp — F2F
decording
logic — /RDT3
/RCL3

DC 5V
Signal Ground

3. Specifications

3.1 Physical dimensions

Dimensions	: (W) 100.8 mm x (D) 118 mm x (H) 31.7 mm
Mass	: Approx. 120 g

3.2 Power source

3.2.1 Logic circuit

Voltage		: DC 5 V (tolerance ±10%), Ripple 250 mV p-p
Current	Stand-by	: 1.2 µA Max
	Operation	: 15 mA Max

3.2.2 Motor Supply

Voltage		: DC 4.5 V ~ 7.5V
Current	Stand-by	: 0 µA
	Operation	: 500 mA Max (at DC 5 V)

(Note): Motor supply

Time of supplying power to the motor is approx.80ms and should be taken more than 10 s interval for testing.

3.3 Card

IC card	: ISO 7816-2
Magnetic card	: ISO 7810,7811
	(ISO1,2&3)

3.4 Interface

IC card	: Direct to contacts
Magnetic card	: CMOS level (0 V ~ 5 V)
Controls	: CMOS level (0 V ~ 5 V)

3.5 Contact resistance

IC card contact	: 500 m-ohm Max

3.6 Connector

: I/O connector (CN5)

IC card reader/writer   Box type, 2 mm pitch, Dual line, 0.5 square pin
  & Magnetic card reader   (CTEC) MBH26GR3 or (TZT) 9-HDM-2-D-26-R-02

: Connector for Buck up power supply   (CN1)
    Molex 7478-02A

3.7 Environments

Operating temperature	: -25 °C ~ +70 °C
Operating humidity	: 10 % ~ 90 % RH (non condensing)
Storage temperature	: -30 °C ~ +75 °C
Storage humidity	: 5 % ~ 95 % RH (non condensing)

3.8 Reading speed of magnetic stripe

: 10 cm/s ~ 80 cm/s

3.9 Installation

:   Horizontally with printed circuit board side upward

4. Connector and signals

4.1 I/O connector (I/O connector CN5)

No	Signal name	Contents	Direction R/W Terminal
1	Vcc *1	Power supply	←
2	/RST *3	Reset signal supply	←
3	CLK	Clocking signal supply	←
4	(RFU)	(Reserved for future use)	—
5	GND	Power and signal ground	←
6	Vpp *2	Programing power supply	←
7	I/O *4	Serial data input/output	←→
8	(RFU)	(Reserved for future use)	—
9	S1	Card is detected (card detect sensor 1)	→
10	S2	Card is loaded (rear detect sensor 2)	→
11	DC 5V	Circuit power supply	←
12	LC	Latch control	←
13	SG	Circuit ground	←
14	- -		—
15	/RDT2	Magnetic read data 2	→
16	/RCL2	Magnetic read clock 2	→
17	MG	Motor ground	←
18	S3	Card latch detect sensor 3	→
19	+V_M	Motor power supply	←
20	/RE	Magnetic read enable	←
21	- -		—
22	/CLD	Magnetic is loaded	→
23	/RDT1	Magnetic read data 1	→
24	/RCL1	Magnetic read clock 1	→
25	/RDT3	Magnetic read data 3	→
26	/RCL3	Magnetic read clock 3	→

*1,*2 : Connected on 0.1 µF ceramic capacitor
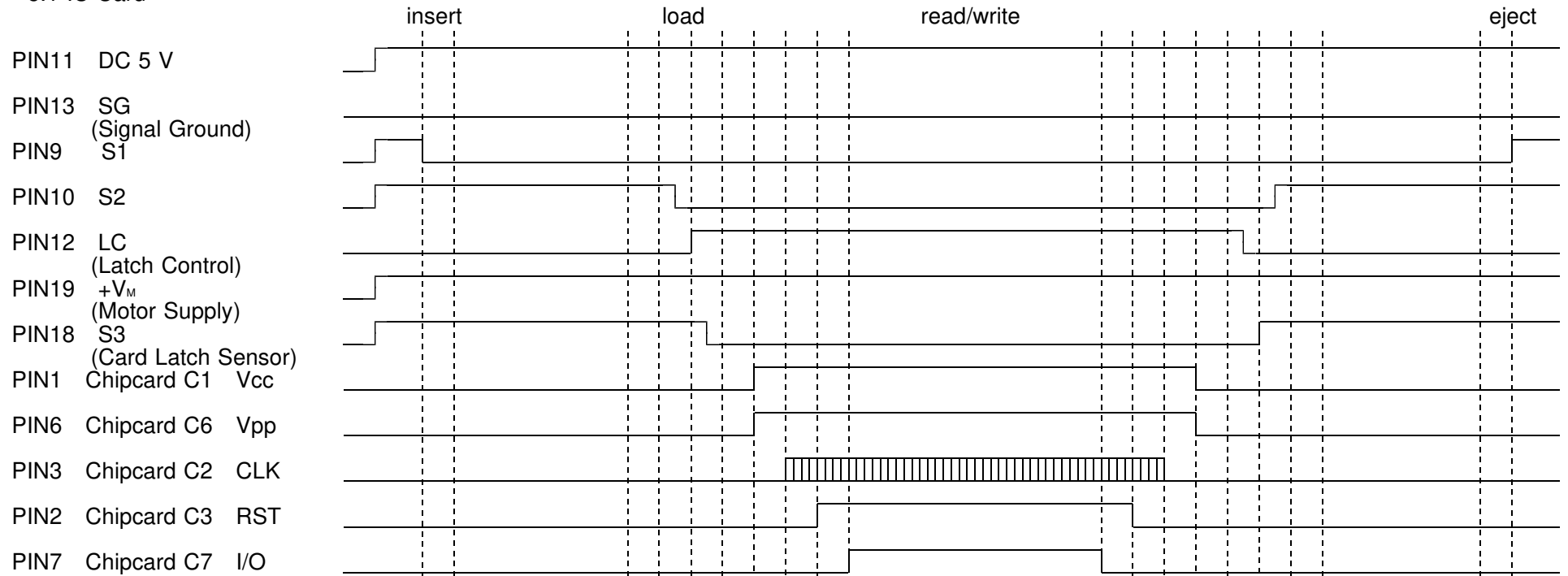
*3   : Connected on 1 nF ceramic capacitor

*4   : Connected on 56 pF ceramic capacitor
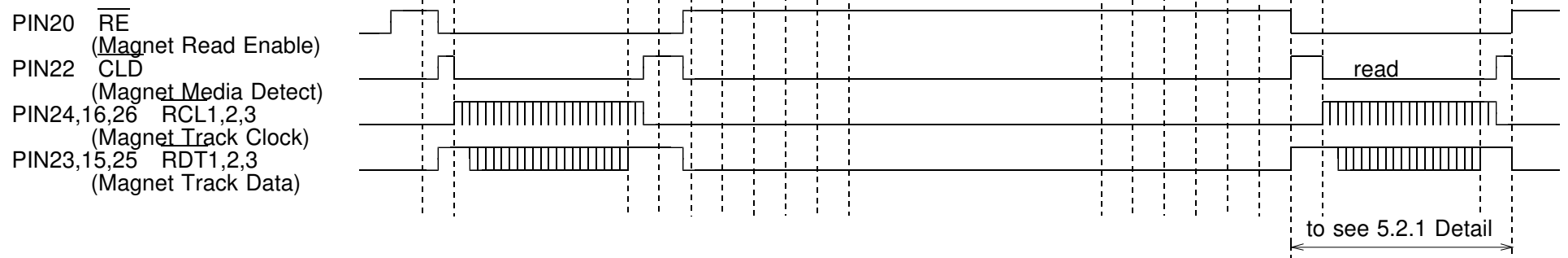
4.2 Buck up power supply connector (CN1)

No	Signal name	Contents	Direction R/W Host
1	M+	Back-up power supply (ex. capacitor)	←
2	M-	Ground	←

5. Timing chart

5.1 IC Card

insert　　　　　load　　　　　　read/write　　　　　　　　　eject

PIN11　DC 5 V

PIN13　SG
　　　　(Signal Ground)
PIN9　　S1

PIN10　S2

PIN12　LC
　　　　(Latch Control)
PIN19　+V$_M$
　　　　(Motor Supply)
PIN18　S3
　　　　(Card Latch Sensor)
PIN1　Chipcard C1　Vcc

PIN6　Chipcard C6　Vpp

PIN3　Chipcard C2　CLK

PIN2　Chipcard C3　RST

PIN7　Chipcard C7　I/O

5.2 Magnetic Card

PIN20　$\overline{RE}$
　　　　(Magnet Read Enable)
PIN22　CLD
　　　　(Magnet Media Detect)
PIN24,16,26　RCL1,2,3
　　　　(Magnet Track Clock)
PIN23,15,25　RDT1,2,3
　　　　(Magnet Track Data)

read

to see 5.2.1 Detail

5.2.1 Caution of magnetic reading

(1) Be sure to perform sampling of /RDT (read data) at the falling edge of /RCL (read clock).
Pulse width of the period "L" of /RCL is about 7.7 μs for the card conformable to ISO1, ISO3 (210 BPI specification), and about 19 μs in case of ISO2 (75 BPI specification).
If sampling method other than edge sampling (such as a method detecting "L" of /RCL by means of polling) is used, please check with us since data may not be read depending on polling frequency at the host side.

(2) In case that /RCL is set to read /RDT at the interrupt port of CPU, with the interruption action of the software in sampling of /RDT using the falling edge of /RCL, be sure to perform the interruption actionwithin the /RDT available time period.
For the /RDT available time period, please refer to the following figure.

/RCL*

T_0 T_0 T_0 T_0

/RDT*

0   1   0   0

T

Data available period
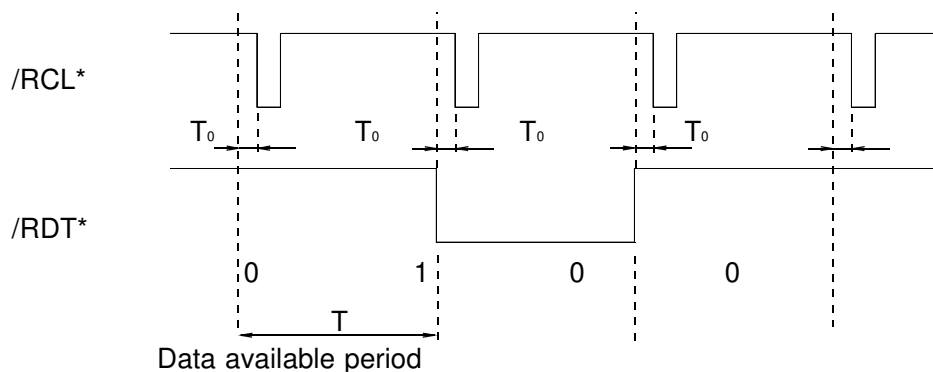
Where, T_0 (fixed) is
approx. 3 μs in case of ISO1, ISO3 type card reader, and
approx. 9 μs in case of ISO2 type card reader.

However, T varies with recording density and running speed.
Refer to the following formula to calculate suitable T value for the applied card recording density and required maximum card running speed. Then set the interruption action time with sufficient margin.

Formula :

$$T(s) = \frac{2.54 \text{ cm/inch}}{\text{Recording density (BPI)}} \times \frac{1}{\text{Card running speed (cm/s)}}$$

Reference :

Recording density (Jitter = 0)	210 BPI	75 BPI
Card running time	18 cm/s	
T	670 μs	1.9 ms

6. INPUT/OUTPUT SIGNALS

The input/output signals for this IC Card reader/writer with magnetic
reader consist of: Vcc, Vpp, RST, CLK, I/O, S1, S2, S3, /RE, LC, /RDT1, /RCL1
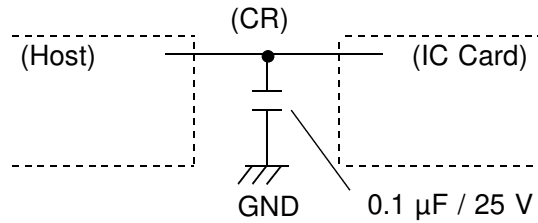/RDT2, /RCL2, /RDT3, /RCL3, /CLD

6.1 Signals for IC Card
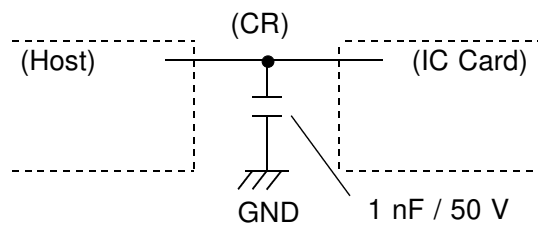
Vcc, Vpp, RST, CLK and I/O are signals for IC Card.
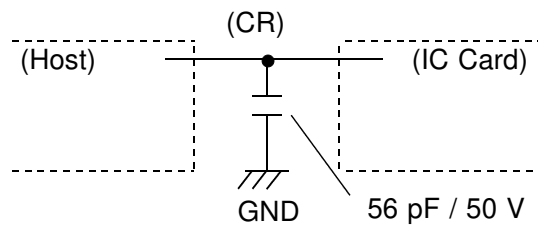Please refer to standard ISO/IEC 7816-3 in detailed specifications.

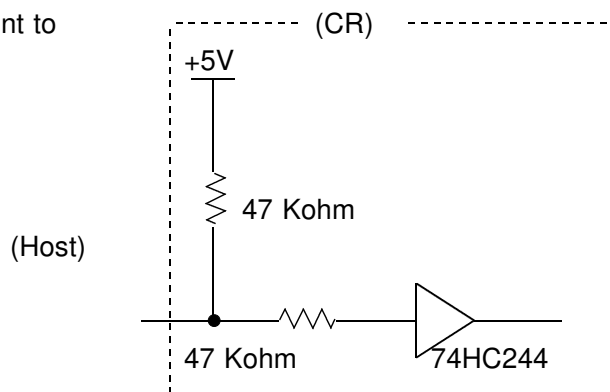#### 6.1.1 Circuit

(1) Vcc, Vpp

    (Host)   (CR)   (IC Card)

GND   0.1 µF / 25 V

(2) RST

    (Host)   (CR)   (IC Card)

GND   1 nF / 50 V

(3) I/O

    (Host)   (CR)   (IC Card)

GND   56 pF / 50 V

6.2 Signals for card feeding

6.2.1 Input circuit

Input signal : /RE

Equivalent to   (CR)

+5V

47 Kohm

(Host)

47 Kohm   74HC244
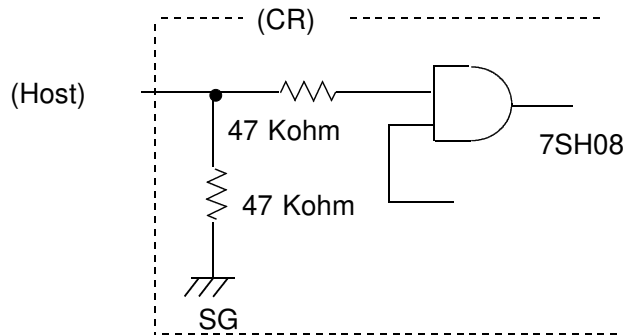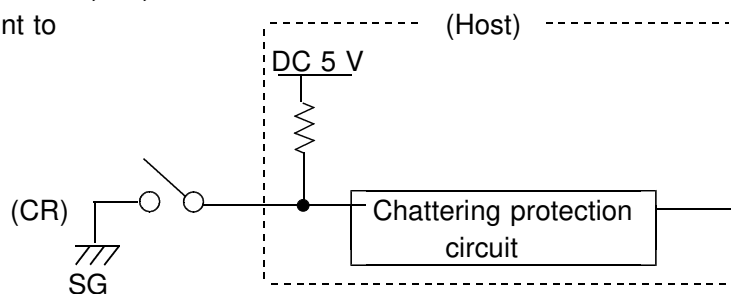
6.2.2 Input circuit
        Input signal : LC
            Equivalent to

6.2.3 Output circuit
        Output signals : S1, S2, S3
            Equivalent to

6.3 Input/Output Voltage

		High Level ("0")	Low level ("1")
Input	/RE , LC	3.5 V min.	1.0 V max.
Output	/RDT1, /RCL1	4.6 V min.	0.3 V max.
	/RDT2, /RCL2	(I_{OH}=-4.0 mA)	(I_{OL}=4.0 mA)
	/RDT3, /RCL3		
	/CLD		

6.4 Signal description

6.4.1 Signal related with position of card
        These sensing switches S1, S2 and S3 are snap action switch.
        The sensing switch outputs connect directly I/O connector CN5.
        So the interface pull-up resistance and chattering protection circuit are required.
        Current range of S1 and S2 switches are defined DC 6 V 5 mA ~ DC 90 V 0.1 A
        to insure proper sensing operation with the environmental condition.
        Current range of S3 switch is defined DC 5 V 0.04 mA ~ DC 16 V 0.1 A
        (recommended operating range DC 5 V 0.1 mA) to insure proper sensing
        operation with the environmental condition.
        So the interface pull-up resistance should be selected to consider the current
        range.

(1) S1

Card present sensor (micro-switch) is positioned at the front of card reader. The switch is normally open, and it is grounded when the card is inserted in the card reader.

(2) S2

The card seated sensor (micro-switch) is positioned at the rear of card reader. The switch is normally open, and it is grounded when the card is fully inserted. When the switch is grounded, IC contact pins of card reader touch the IC chip on the card, and the card is at the specified position to read and write IC.

(3) S3

The latch sensor (leaf-switch) indicates that the latching mechanism is activated and in a locked state. The switch is normally open, and it is grounded when the latch mechanism is activated (=card lock status).

6.4.2 Signal related with latch /unlatch of a card

(1) LC

The latch control signal LC should be normally "L".   And the latch mechanism is actuated to lock the card when the signal goes "H" by detecting a signal from host. The latch mechanism is on unlatched position when the signal goes "L". The state of the latch mechanism can be determined by the state of the card-latch sensor S3.

Note 1: If power is turned off accidentally during the card is latched and is hold inside of the card reader, the card will be released automatically by unlatch pulse which is generated by card reader itself. Back up power supply (ex. capacitor) is required and connected with the card reader.
Panasonic confirmed the performance with 8200 µF capacitor, however, please select right value of capacitor based on actual condition/environment.
In case wrong one is used, unsatisfactory performance may cause.

Note 2: The state of card-latch sensor S3 should be check periodically.
If the latch mechanism is on latch position while it must be on unlatched position originally, latch mechanism must be change to unlatched position by following order ;
  1) Change LC signal from "L" to "H" and keep "H" more than 200 ms.
  2) Change LC signal from "H" to "L" in order to an activate the latch mechanism.（set the latch mechanism to unlatch position）
  3) Re-check the state of card latch sensor S3 and confirm the latch mechanism is set to unlatch position.

6.4.3 Signal related to reading of magnetic stripes
 (1) /RDT1, /RDT2, /RDT3 (Read Data)
   When the /RCL* signal changes from "High" level to "Low" level :
    "1" is indicated when the /RDT* signal is at "Low" level.
    "0" is indicated when the /RDT* signal is at "High" level.
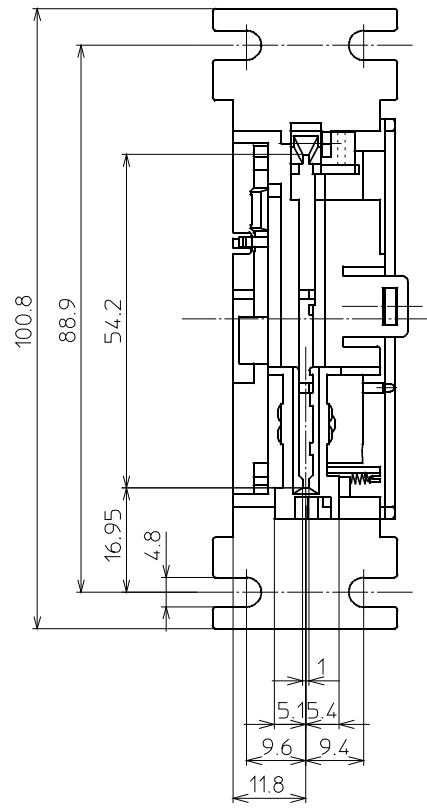 (2) /RCL1, /RCL2, /RCL3 (Read Clock)
   This is used to sample the /RDT* signal at its falling edges.
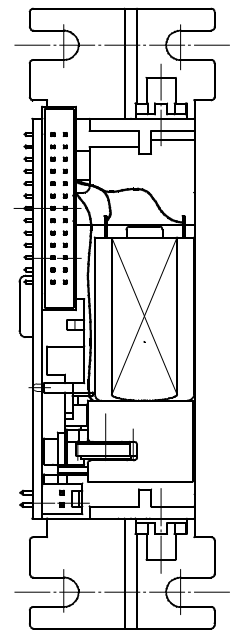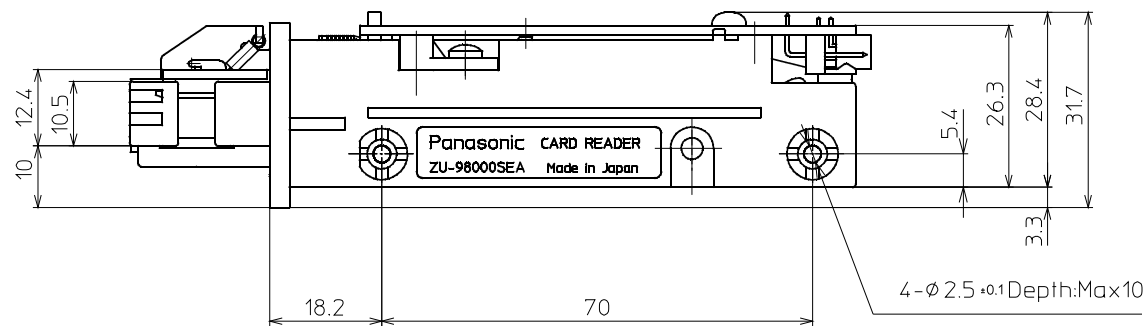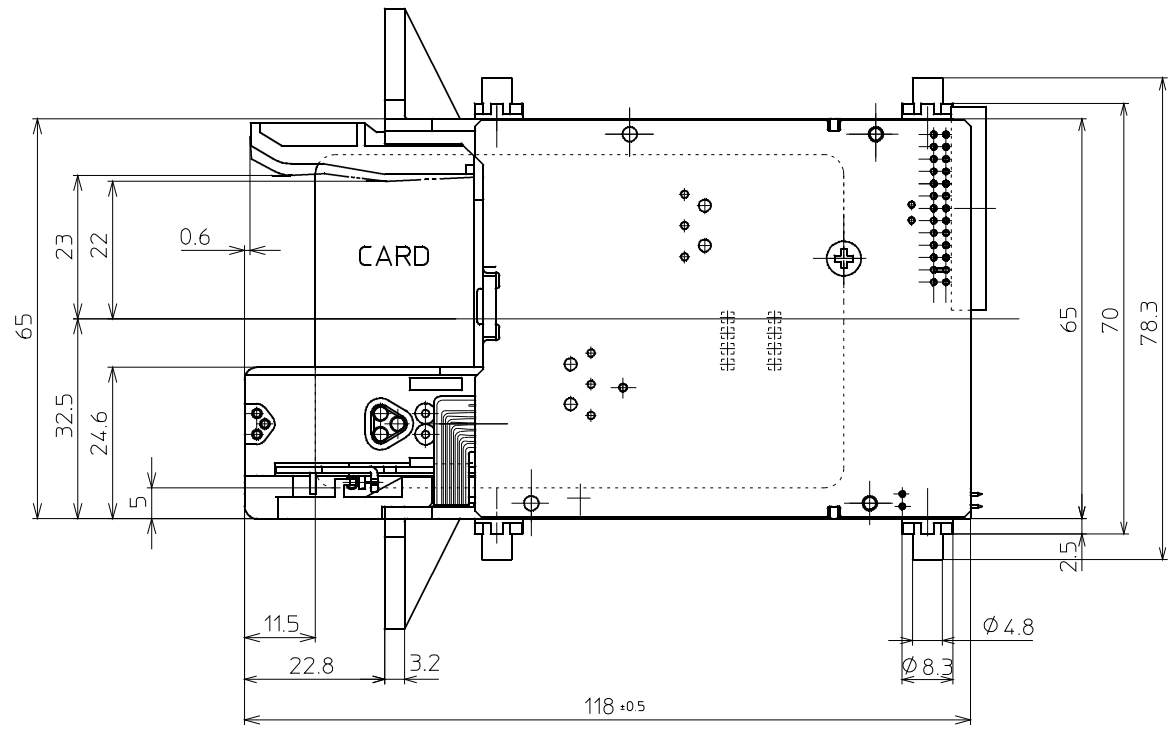 (3) /CLD
   The /CLD line will be low when a magnetic card is running in the card reader.
   The /CLD line will be high when the card is stopped or not present in the card reader.

7. Appearance

CARD

Panasonic CARD READER
ZU-98000SEA   Made in Japan

General Tolerance: ± 0.3
unit:mm

4-∅2.5 ±0.1 Depth:Max10

8. IC contact location (ISO type)

（unit : mm）

Upper edge

Left edge

C1	C5
C2	C6
C3	C7
C4	C8

10.25 max.

12.25 min.

17.87 max.

19.87 min.

19.23 max.

20.93 min.

21.77 max.

23.47 min

24.31 max.

26.01 min.

26.85 max.

28.55 min.
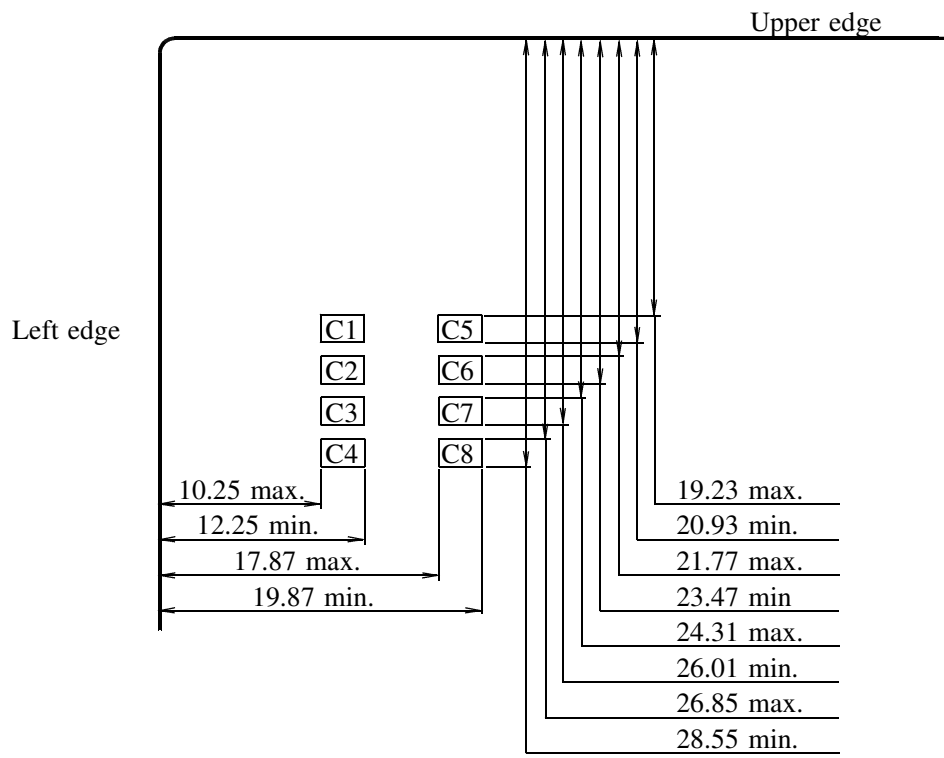
9. Card specification
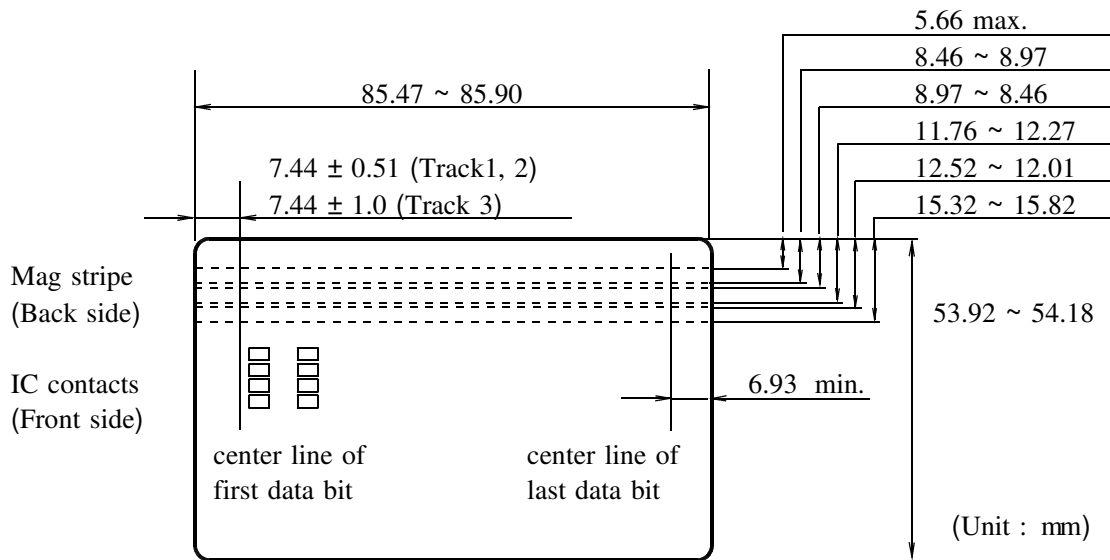
9.1 Physical characteristics
   (1) Thickness   : 0.76 mm (tolerance ± 0.08 mm)
   (2) Warpage   : 2.5 mm max. (include relief height of embossed characters)

9.2 Magnetic characteristics
   (1) Coercive force (Hc)   : 2.4×10^4 A/m ~ 2.4×10^5 A/m
   (2) Residual flux (¢r)   : 1.25 Maxwell/cm (tolerance ± 0.15 Maxwell/cm)
   (3) Squareness ratio (¢r/¢m) : More than 0.70

10. Unit life and reliability
   10.1 Life of the magnetic head and IC contact pins
      (1) Magnetic head   : 500,000 operation (2 passes / 1 operation)
      (2) IC contact pin   : 500,000 operation
         （Condition ）········ In a clean office enviroment（room).
                        In damp or dusty atmosphere, the life may be 1/3 to 1/5 of the above figure.

      Above life cycles are the numbers which are tested in a "clean office enviroment".
      These numbers may be shortened depenent on the actual enviroment.
      Especially in a dusty enviroment *, even in the indoor application, dust or sand
      may shorten the life against the mechanical parts and most of the card transport
      mechanisms.
      In these case, warranty of the card reader may be void unless the proper
      protection and countermeasures are performed by the terminal side.

      * Dusty enviroment : Refer to ex.）IEC 68,EN30721-3-3 class 3S2 or worse.

11. PRECAUTIONS
      Keep the following precautions when using this unit.

  11.1 Handling
      (1) Do not drop or give excessive shocks to this unit.
          (There are a few cases that card lock mechanism will be released
            when the excessive shock is given.)
      (2) Do not disassemble this unit.

  11.2 Cautions
    11.2.1 Card
      (1) Use specified card (ISO).
      (2) Store the card carefully so as not to soil, injure or deform it.
          In particular, solid deposit on the magnetic stripe surface may result in a trouble.

    11.2.2 Cleaning
      (1) Clean the magnetic head and IC contact pins by periodically passing a cleaning card.
          For example, in a clean office room, pass the cleaning card about once a week.
          If the magnetic head is heavily stained, clean the head by soaking the cleaning card
          in alcohol properly and pass the card. For example, in the case that the card readers
          are used in the environment full of dust, please make a cleaning of the card reader
          with a cleaning card with alcohol everyday.

    11.2.3 Installation
      (1) Do not install the card reader in dusty, hot or damp place, or near magnetic field or
          object generating inductive noise (printer, LED display unit, CRT, etc.).
          Do not use the unit in a dusty place, otherwise the reading and writing accuracies
          may be deteriorated.
          Keep the unit away from objects generating magnetism, which may cause read errors
          and may damage the magnetic card data.
      (2) Do not touch the printed circuit board with bare hand.
          Note particularly static electricity.
      (3) Do not supply power from other outlet than connector terminal.
          Pay special attention to the polarity of power source and wrong connection of
          connector.
      (4) Do not use the unit in a place where it is exposed to sunlight directly or it is splashed
          by water.
      (5) Install the card reader horizontally with printed circuit board side upward.

    11.2.4 Others
      (1) Check the noise, static electricity, etc., with the card reader being incorporated
          in the equipment.
          Noise from the power supply may cause the reading errors.   Measures to reduce the
          noise from power supply should be made for the equipment which the card reader is
          built in.
          It is especially efficient to put a noise-filter in the AC input line.
      (2) Card operation speed should be within the specification range. Forced stop or
          change of speed during the card operation may cause a read error.
          Appropriate speed to maintain stable operation is 30 cm/s ~ 60 cm/s.