General

Ver
1.2_Conrad

T-200 series is the world's smallest CO_2 sensor module. Its Persistent Stability and Temperature Effect Resistance besides easy management are much favored by customers in stocks raising, greenhouse, scientific projects, etc.

ELT Sensor
Data Sheet for T-200

Features

- Non-Dispersive Infrared (NDIR) technology used to measure CO_2 levels.
- The world's smallest size
- Pre-calibrated
- Available output : TTL-UART, I2C

  (PWM/Analog Voltage option)
- Gold-plated sensor provides long-term calibration stability.
- Installed Calibration function
- ACDL (Periodical Automatic Calibration) and MCDL (Non-Periodical Manual Calibration)are available..

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- Size : 19.4mmx30mmx10.3mm
- Weight : 5 grams

T-200 Specifications

General Performance

Operating Temperature : -20℃ ~ 60℃

Operating Humidity : 0 ~ 95% RH (Non-condensing)

Operating Environment : Residential, Commercial spaces

Storage Temperature : -30℃~70℃

CO_2 Measurement

Sensing Method : NDIR (Non-dispersive Infrared)

Measurement Range : 400 ~ 2,000
Accuracy : ± 50ppm ± 3%of reading
Response Time(1/e) : 40 seconds (c.f. T_{90} : 65 seconds)

Signal Update : 3 seconds

Warming-up Time : < 6 seconds (for Operation), 5 minutes (for Accuracy)

Electrical Data

Power Input : 5.0VDC ± 5%[(2)]
Current Consumption: Normal mode : 22mA, Peak : 250 mA

Pin Map of J1 Side hole.

Pin No.	T-200
1	VDD (+5V VCC)
2	GND
3	TTL-RXD(← CPU of Master Board)
4	Reserved
5	TTL-TXD(→ CPU of Master Board)
6	ACDL(Automatic Calibration)
7	Reserved
8	I2C SCL
9	I2C SDA
10	MCDL(10 min. Manual Calibration)

※ J1 Side Hole : 1.27mm pitch

UART

38,400BPS, 8bit, No parity, 1 stop bit, TTL Level Voltage

I2C

Slave mode only, 10kΩ pull up resister
TTL Level Voltage : $0 \le V_{IL} \le 0.8$, $2 \le V_{IH} \le V_{DD}$, $0 \le V_{OL} \le 0.4$, $2.4 \le V_{OH} \le V_{DD}$(Volt)

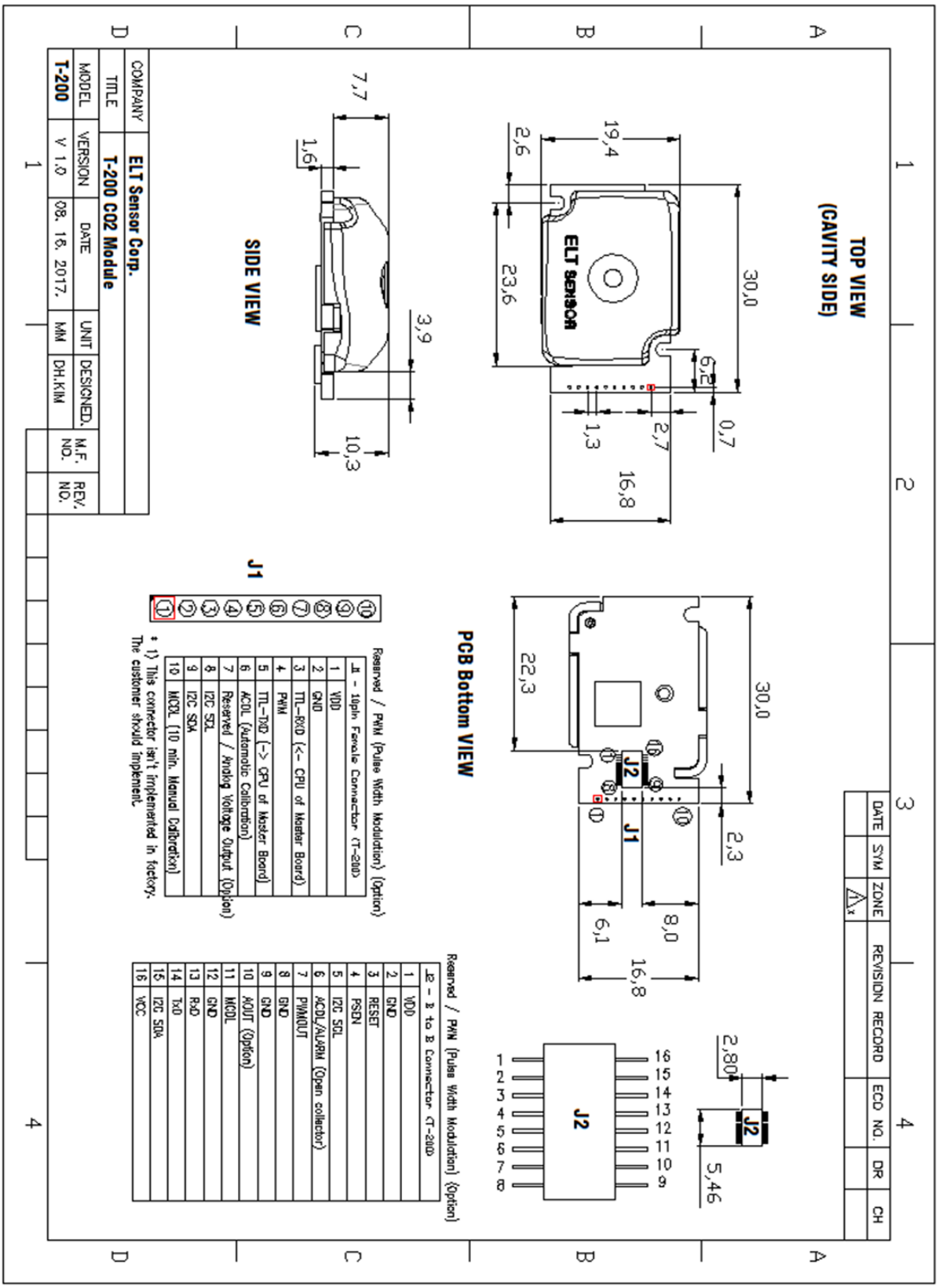
Pin Map of J2 Board to Board Connector.

Pin No.	T-200
1/16	VDD (+5V VCC)
2/8/9/12	GND
3	Reset (Active High)
4	Reserved
5	I2C SCL
6	ACDL
7	PWM : Option
10	A-OUT : Option
11	MCDL(10 min. Manual Calibration)
13	TTL-RXD(← CPU of Master Board)
14	TTL-TXD(→ CPU of Master Board)
15	I2C SDA

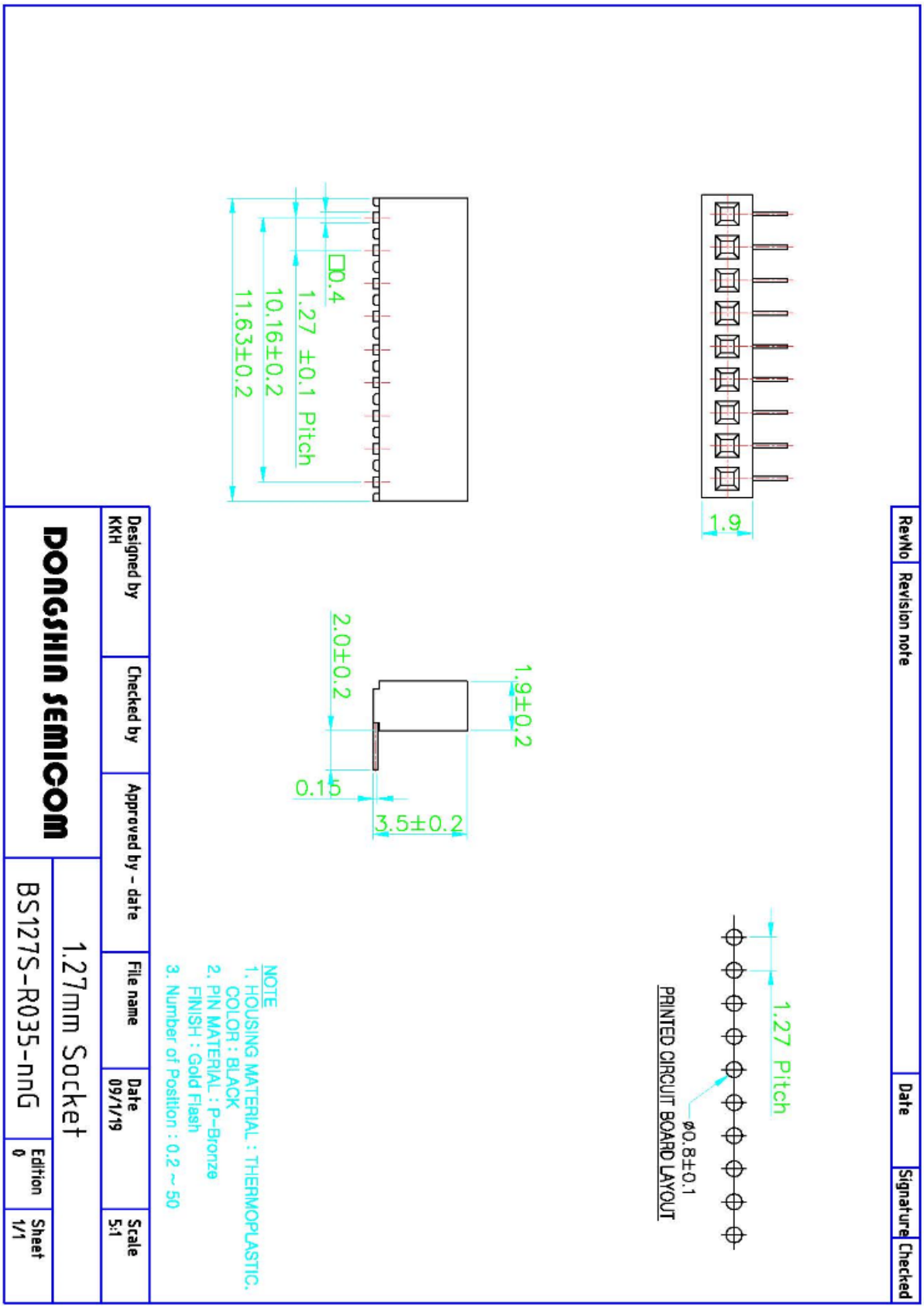
※ B-to-B Connector mating should be enhanced with additional Locking method.
(T-200 has two of screw type-locking hole - 2Ø U-type hole)

※ T-200 has B-TO-B connecting PLUG (Molex: 55560-0168) on PCB. And mating B-TO-B Receptacle **(Molex: 54722-0164)** should be on Main PCB. Mating Receptacle with PLUG should be done very carefully. Only the gripping of side plane of T-200 is allowed while as pressing on Top plane or Bottom of T-200 is strictly restricted.

Cavity Dimensions (unit : mm)



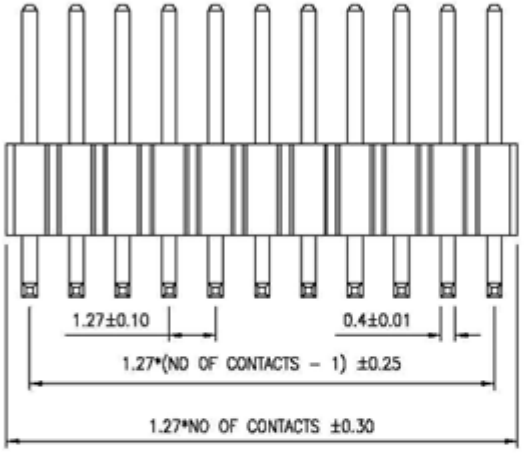
1.27mm pitch socket is recommended for T-200 for convenience of connection.

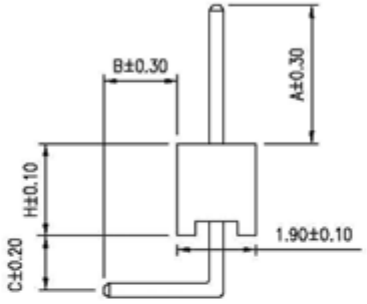


And 1.27mm center pin header recommended for mating with Socket of T-200.

1.27mm Pitch Pin Header(PH15 Series)

REV	ECN NO.	APP.	DATE
A	NEW DESIGN		





SPECIFICATION

- Current Rating: 1 A
- Withstanding Voltage: 600 VAC (1 min.)
- Insulation Resistance: 1000 Megohms MIN.
- Contact Resistance: 30 Milliohms MAX.
- Operating Temperature: −40°C to +85°C
- Retention Force: 450g MIN.

MATERIAL

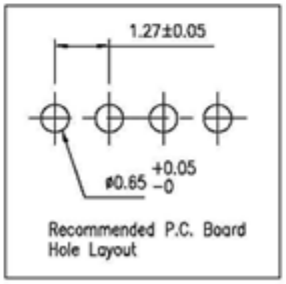
- Contact: Phosphor Bronze , 0.40mm square post
- Insulator: NYLON 66 & 30% G.F.
- Plating: Selective Gold or All Gold

Base Height

Base	H
1	1.00
2	1.50
3	2.00
4	2.40
5	3.00

Pin Chart

Pin	A	B	C
1	2.50	1.50	1.00
2			
3			
4			
5			

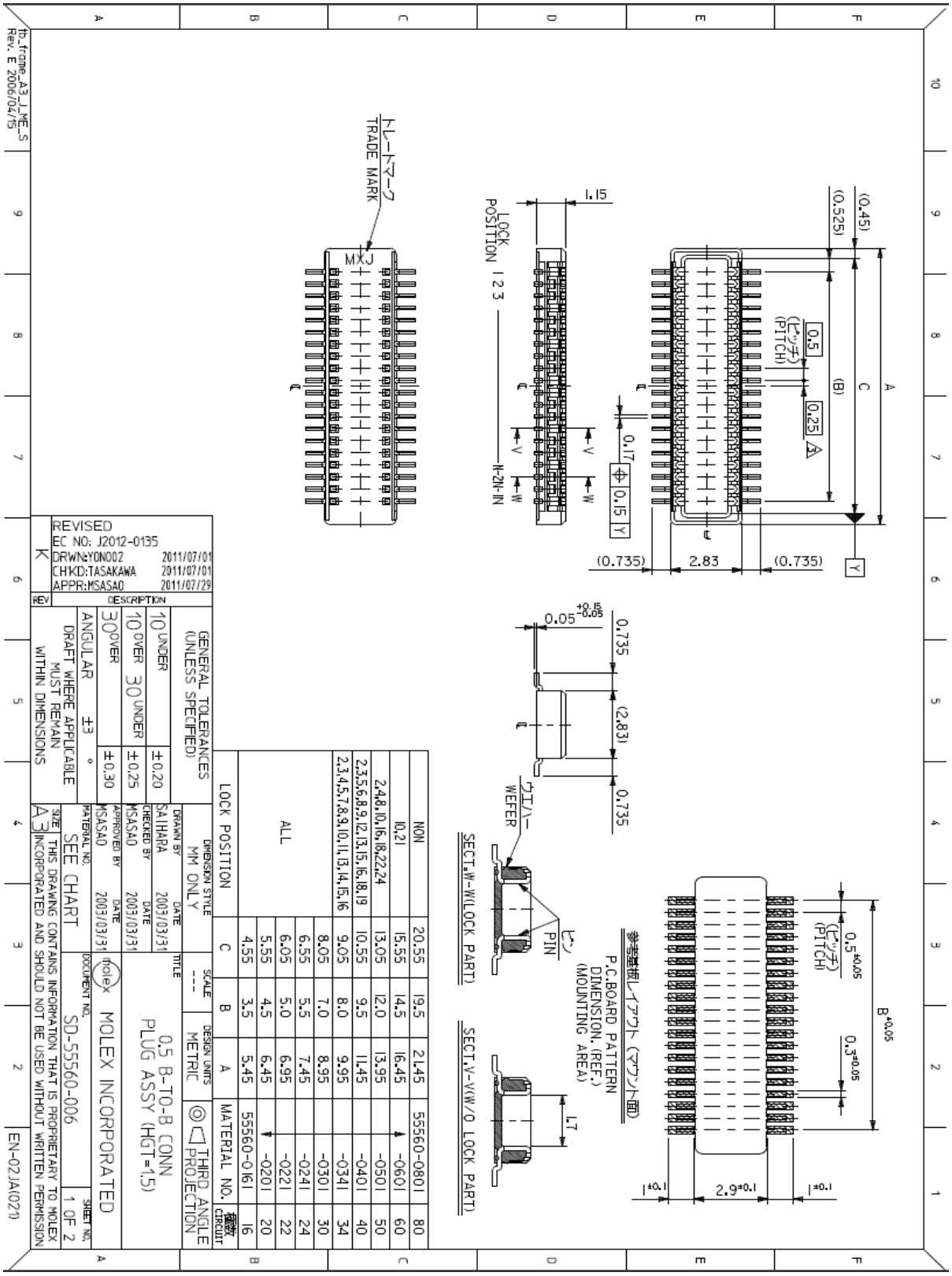


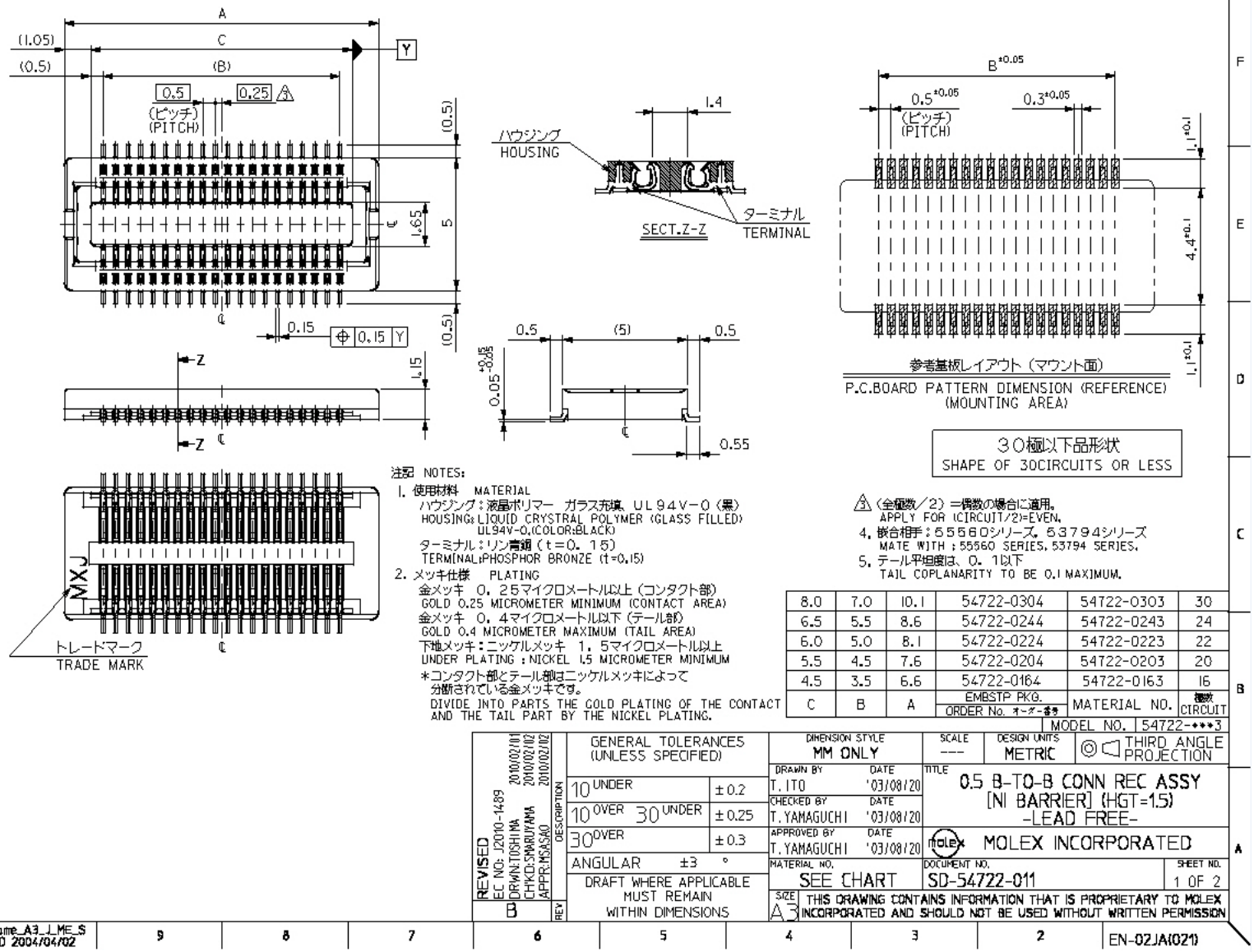
Recommended P.C. Board Hole Layout

ELEPARTS Co.,Ltd

0.0±	SCALE:	TITLE: 1.27MM CENTER PIN HEADER 0.40m/m R/A single Row	PART NO:
0.00±	UNIT: MM		APP BY:
0.000±		MATL: NYLON 66 + 30% GF	CHK BY:
		DWG. NO. HA02	DR BY:

T-200 has B-TO-B connecting PLUG (Molex: 55560-0168) on PCB.





注記 NOTES:

1. 使用材料 MATERIAL
   ハウジング：液晶ポリマー ガラス充填、UL94V-0（黒）
   HOUSING: LIQUID CRYSTRAL POLYMER (GLASS FILLED) UL94V-0,(COLOR:BLACK)
   ターミナル：リン青銅（t=0.15）
   TERMINAL:PHOSPHOR BRONZE (t=0.15)
2. メッキ仕様 PLATING
   金メッキ 0.25マイクロメートル以上（コンタクト部）
   GOLD 0.25 MICROMETER MINIMUM (CONTACT AREA)
   金メッキ 0.4マイクロメートル以下（テール部）
   GOLD 0.4 MICROMETER MAXIMUM (TAIL AREA)
   下地メッキ：ニッケルメッキ 1.5マイクロメートル以上
   UNDER PLATING : NICKEL 1.5 MICROMETER MINIMUM
   *コンタクト部とテール部はニッケルメッキによって分断されている金メッキです。
   DIVIDE INTO PARTS THE GOLD PLATING OF THE CONTACT AND THE TAIL PART BY THE NICKEL PLATING.

△3（全極数／2）=偶数の場合に適用。
APPLY FOR (CIRCUIT/2)=EVEN.
4. 嵌合相手：55560シリーズ、53794シリーズ
MATE WITH : 55560 SERIES, 53794 SERIES.
5. テール平坦度は、0.1以下
TAIL COPLANARITY TO BE 0.1 MAXIMUM.

8.0	7.0	10.1	54722-0304	54722-0303	30
6.5	5.5	8.6	54722-0244	54722-0243	24
6.0	5.0	8.1	54722-0224	54722-0223	22
5.5	4.5	7.6	54722-0204	54722-0203	20
4.5	3.5	6.6	54722-0164	54722-0163	16
C	B	A	EMBSTP PKG. ORDER No. オーダー番号	MATERIAL NO.	極数 CIRCUIT

MODEL NO. 54722-★★★3

REVISED
EC NO: J2010-1489 2010/02/01
DRWN:TOSHIMA 2010/02/02
CHKD:SMARUYAMA
APPR:MSASAKI 2010/02/02
DESCRIPTION
REV B

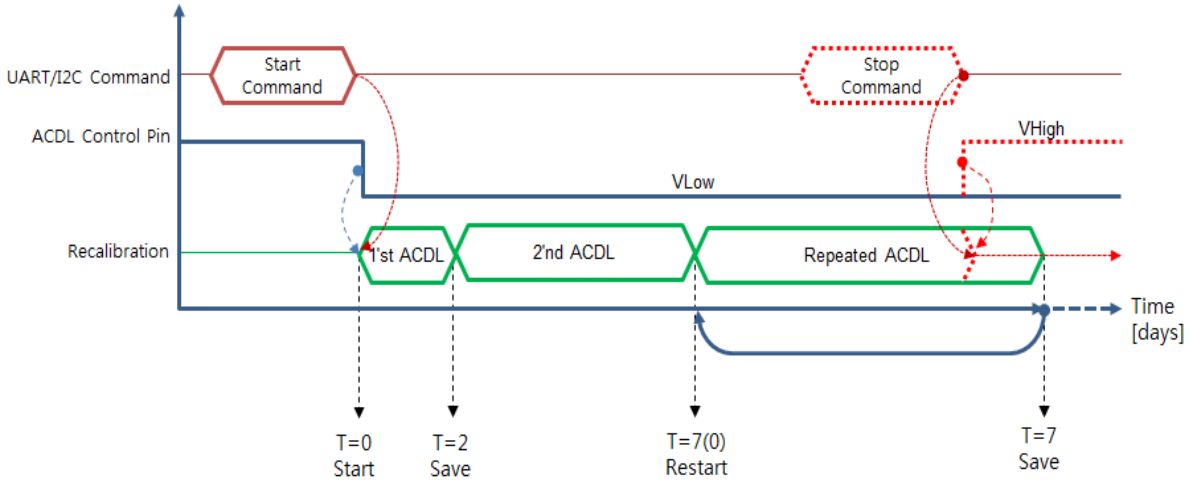
GENERAL TOLERANCES (UNLESS SPECIFIED)	
10 UNDER	±0.2
10 OVER 30 UNDER	±0.25
30 OVER	±0.3
ANGULAR	±3 °

DRAFT WHERE APPLICABLE MUST REMAIN WITHIN DIMENSIONS

DIMENSION STYLE	MM ONLY
SCALE	---
DESIGN UNITS	METRIC
	THIRD ANGLE PROJECTION
DRAWN BY	T.ITO
DATE	'09/08/20
CHECKED BY	T.YAMAGUCHI
DATE	'09/08/20
APPROVED BY	T.YAMAGUCHI
DATE	'09/08/20
MATERIAL NO.	SEE CHART
TITLE	0.5 B-TO-B CONN REC ASSY [NI BARRIER] (HGT=1.5) -LEAD FREE-
	MOLEX INCORPORATED
DOCUMENT NO.	SD-54722-011
SHEET NO.	1 OF 2
SIZE	A3

Calibration Mode (ACDL/MCDL)

ACDL function(Automatic Calibration Function in Dimming light with period)



Time Diagram of ACDL

Method 1.UART Command Set; J1-3pin (UART-RX) and J1-5pin (UART-TX) to Main-Board.
(J2-13pin and J2-14pin are available for B to B connector User as well)

Method 2.I2C Command Set; J1-8pin (SCL) and J1-9pin (SDA) to Main-Board.

Method 3.Execute Hardware based ACDL.
※ 1. To activate ACDL function, the user's application must be designed to give Low-Active Signal toJ1-6pin with High De-Active Signal to J1-10pin continuously.
(J2-6pin and J2-11pin are available for BtoB connector User as well)

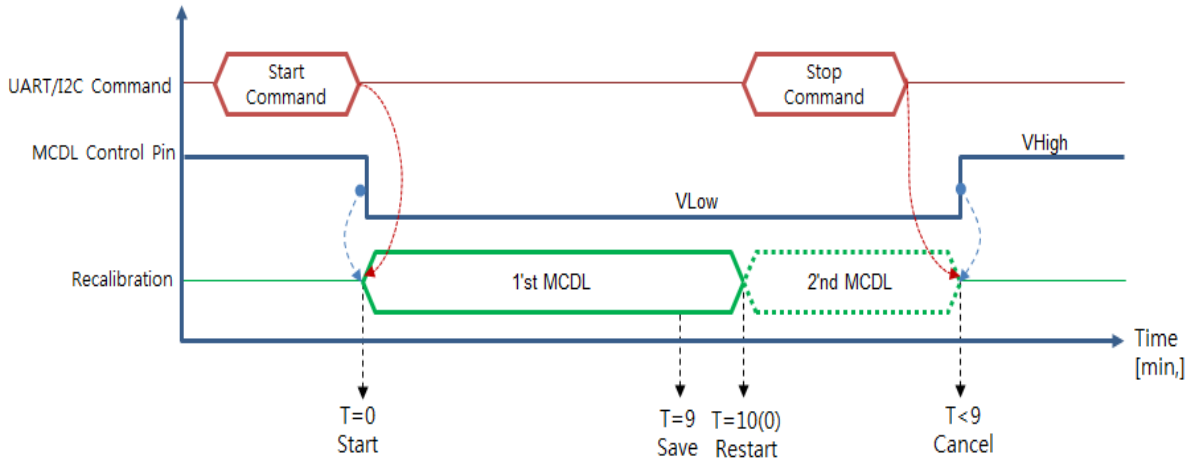
Method 4.Let Sensor install on Jig Board TRB-100ST (Test and Recalibration Board) with ambient air-flow condition and execute by moving jumper with Manual on the website.

Method 5.EK-100TL (Emulation kit, with Emulation program 'ELTWSD') is available, which display and save data on PC through USB connection.

10' MCDL function(10 minute Manual Calibration Function in Dimming light)

MCDL enable customer to calibrate as needed, MCDL keep at least 10 minute once it start and

should be stopped before 18minute to avoid MCDL fetch repetition.



Time Diagram of MCDL

Method 1. UART Command Set; pin-3 (UART-RX) and pin-5 (UART-TX) to Main-Board.
(J2-13pin and J2-14pin are available for BtoB connector User as well)

Method 2. I2C Command Set; pin-8 (SCL) and pin-9 (SDA) to Main-Board.

Method 3.Execute Hardware based MCDL.

1. To activate ACDL function, the user's application must be designed to give Low-Active Signal topin-10 with High De-Active Signal to pin-6 for 10 minutes. Be careful to make it sure to quit MCDL fetch loop before 18minute.
(J2-6pin and J2-11pin are available for BtoB connector User as well)
2. Be careful to make it sure to quit MCDL fetch loop before 18minute.

Method 4.Let Sensor install on Jig Board TRB-100ST (Test and Recalibration Board) with ambient air-flow condition and execute by moving jumper with Manual on the website.

Method 5.EK-100TL (Emulation kit, with Emulation program 'ELTWSD') is available, which display and save data on PC through USB connection.

Set present CO2 value with Target PPM function

1. Deviated CO2 sensors can be adjusted with target PPM function via I2C or UART interface.
(Refer to 'I2C Programming guide' or 'UART Command guide')

2. EK-100SL (Evaluation kit, with Emulation program 'ELTWSD') is available for Target PPM function. (Refer to 'EK-100TL manual')

Output Descriptions

UART Descriptions

Data Format

D6	D5	D4	D3	D2	D1	SP	'p'	'p'	'm'	CR	LF

D6 ~ D1	6 byte CO2 density string
SP	Space: 0x20
'ppm'	'ppm' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

Above 12byte consist by 6 byte hexadecimal digits,<SP>,0x70 0x70 0x6D, <CR><LF> , where decimal '0' (corresponds to hexadecimal digit '0x30') is replaced by space (corresponds to hexadecimal digit '0x20'),

EX) 1,255 ppm, results '0x20 0x20 0x31 0x32 0x35 0x35 0x20 0x70 0x70 0x6D 0x0D 0x0A', which displays '__1255_ppm<CR><LF>'on screen.

In need of detail command set, 'U-ART String Command Guide ' could be provided by contacting Sales Rep.

I2C Communication (Only Slave Mode Operation)

Internal pull up resister

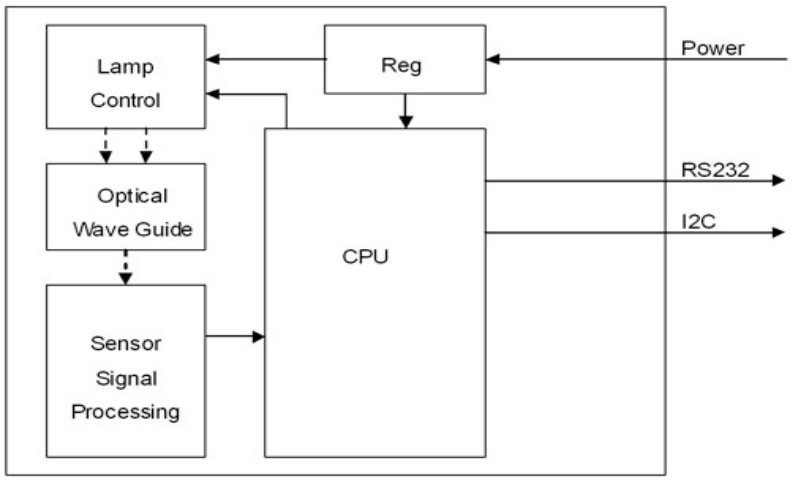
Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1	1	0	0	0	1	R/W Bit

R/W Bit : Read = 1/Write = 0

When reading the data, Slave Address Byte is 0x63, When writing the data, Slave Address Byte is0x62.

Block Diagram



Transmission Sequence in Master

1) I2C Start Condition
2) Write Command(Slave Address + R/W Bit(0) = 0x62) Transmission and Check Acknowledge
3) Write Command(ASCII 'R' : 0x52) Transmission and Check Acknowledge
4) I2C Stop Command
5) I2C Start Command
6) Read Command(Slave Address + R/W Bit(1) = 0x63) Transmission and Check Acknowledge
7) Read 7 Byte Receiving Data from Module and Send Acknowledge

(Delay at least 1ms for reading each byte)

Configuration	CO_2	reserved	reserved	reserved	reserved
1 Byte	2 Byte	0x00	0x00	0x00	0x00

0	0	0	0	1	0	0	0

In need of detail protocol specification and time sequence, 'I2C programming guide' could be provided by contacting Sales Rep.

※ Caution

1. Please hold only 'PCB' of sensor without holding Cavity directly to avoid the physical shock on sensor. Rough handling or Transportation could result in inaccurate reading.

2. Proper ESD protection during handling is important to avoid electrostatic defect occurrence. The storage of sensor should be insulated as well

ELT SENSOR
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Bucheon-ro 198beon-gil, 2015
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