

CXA1875AP/AM

8-bit D/A Converter Compatible with I²C Bus

Description

The CXA1875AP/AM is developed as a 8-bit 5 ch D/A converter compatible with I²C bus.

Features

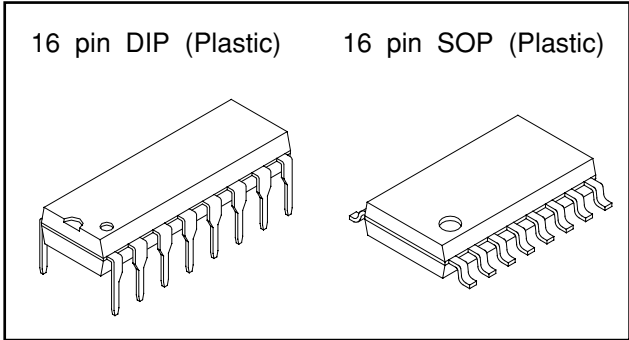
- Serial control through I²C bus
- 5 channels of 8-bit D/A converter
- 4 built-in general purpose I/O ports (Digital I/O)
- I/O can be specified to respective ports independently
- Selection of 8 slave addresses possible through address select pins (3 pins)

Applications

I²C bus can control ICs that do not correspond to I²C bus by connecting the DC control pins of them.

Structure

Bipolar silicon monolithic IC



Absolute Maximum Ratings (Ta=25°C)

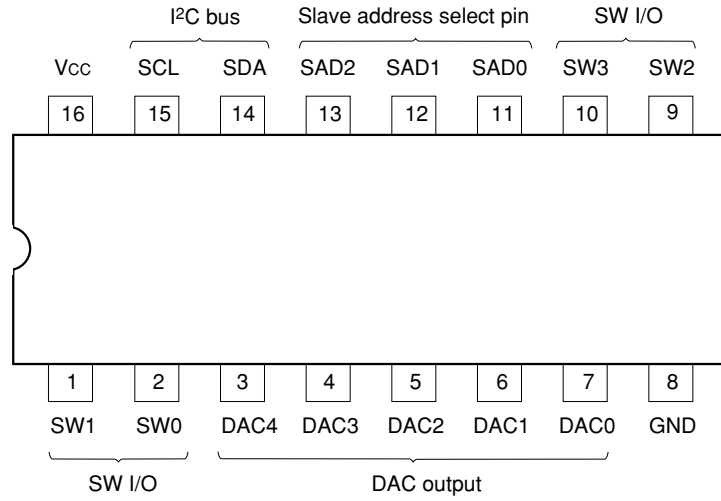
| | | | |
|-------------------------------|------------------|-------------|----|
| • Supply voltage | V _{CC} | 7 | V |
| • Operating temperature | T _{opr} | -20 to +75 | °C |
| • Storage temperature | T _{stg} | -65 to +150 | °C |
| • Allowable power dissipation | P _D | 960 | mW |

Operating Conditions

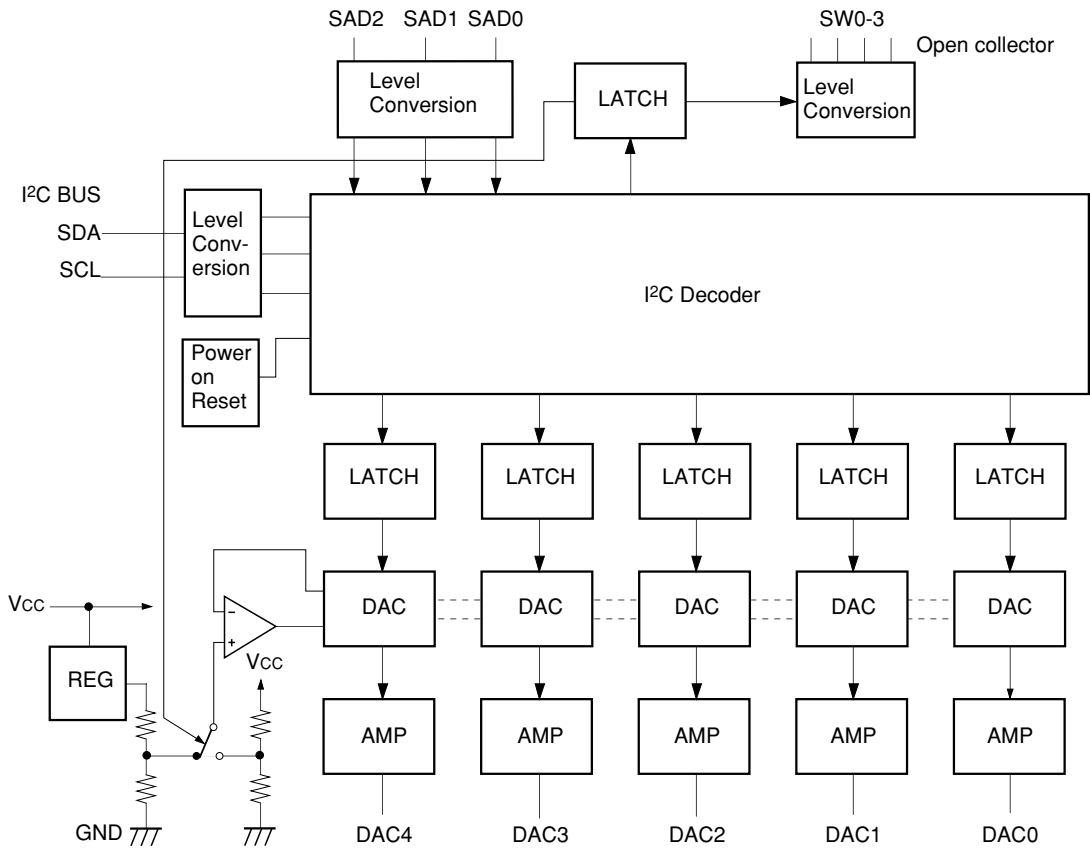
| | | | |
|-------------------------|------------------|------------|----|
| • Supply voltage | V _{CC} | 5±0.5 | V |
| • Operating temperature | T _{opr} | -20 to +75 | °C |

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Pin Configuration (Top View)



Block Diagram



Pin Description

| No. | Symbol | Equivalent circuit | Description |
|-----------------------|--------------------------------------|--------------------|---|
| 1 2 9 10 | SW1 SW0 SW2 SW3 | | I/O pin for general purpose I/O port V_{ILmax} : 1.5 V V_{IHmin} : 3 V V_{OLmax} : 0.4 V |
| 14 15 | SDA SCL | | SDA I/O pin for I ² C bus |
| 3 4 5 6 7 | DAC4 DAC3 DAC2 DAC1 DAC0 | | D/A converter output pin |
| 8 | GND | | GND pin |
| 11 12 13 | SAD0 SAD1 SAD2 | | Slave address input pin Input at positive logic V_{ILmax} : 1.5 V V_{IHmin} : 3 V |
| 16 | Vcc | | Power supply pin |

Electrical Characteristics (Ta=25 °C, Vcc=5 V)

D/A Converter Block

| No. | Item | Symbol | Test circuit | Test contents | Min. | Typ. | Max. | Unit |
|-----|-----------------|-----------------|--------------|----------------|------|------|------|------|
| 1 | Circuit current | I _{cc} | 1 | DAC 0 to 4=127 | 6 | 9 | 12 | mA |

| | | | | | | | | |
|---|------------------------|------------------|---|---|-----|-----|-----|-----|
| 2 | Differential linearity | DLE | 1 | $\frac{V(\text{DAC0 to 4=n+1}) - V(\text{DAC0 to 4=N})}{V(\text{DAC0 to 4=191}) - V(\text{DAC0 to 4=63})} \times 128 - 1$ n=0 to 127 | -1 | 0 | +1 | LSB |
| 3 | Minimum output voltage | V _{min} | 1 | DAC 0 to 4=0 | 0.1 | 0.4 | 0.7 | V |
| 4 | Maximum output voltage | V _{max} | 1 | DAC 0 to 4=255 | 4.3 | 4.6 | 4.9 | V |
| 5 | Output current | I _{out} | 2 | Current that can be flowed from Pins 3 to 7 | -1 | | +1 | mA |
| 6 | Output impedance | Z _o | 2 | DAC 0 to 4=127, $\frac{V(-1 \text{ mA}) - V(1 \text{ mA})}{2 \text{ mA}}$ | 0 | 3 | 6 | Ω |

SW, SAD Pins

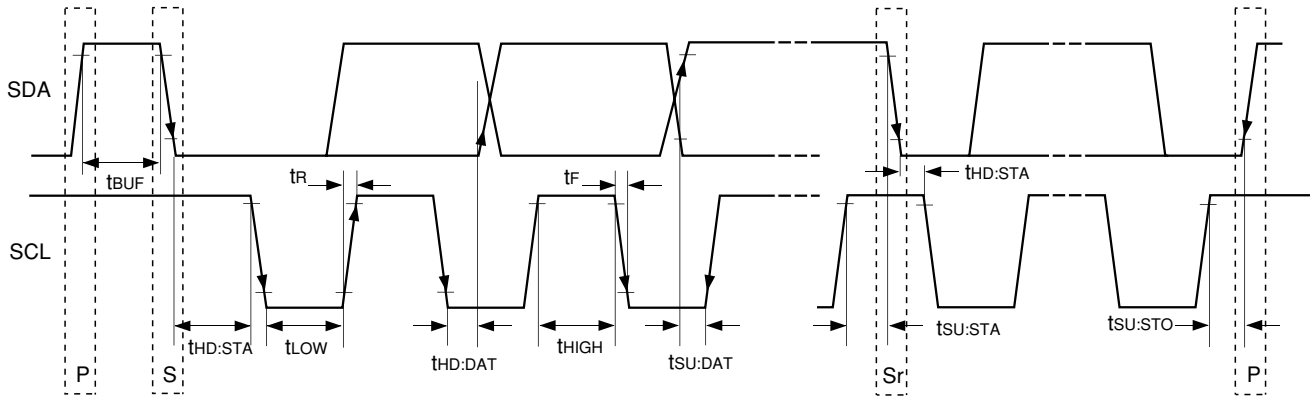
| No. | Item | Symbol | Text circuit | Test contents | Min. | Typ. | Max. | Unit |
|-----|--------------------------|-----------------|--------------|--|------|------|------|------|
| 7 | Low level input voltage | V _{IL} | 3 | ST 0 to 3 an input voltage that turns to '0' | — | — | 1.5 | V |
| 8 | High level input voltage | V _{IH} | 3 | ST 0 to 3 an input voltage that turns to '1' | 3.0 | — | — | V |
| 9 | Low level input current | I _{IL} | 3 | Input current when 0.4 V is applied | -10 | 0 | +10 | μA |
| 10 | High level input current | I _{IH} | 3 | Input current when 4.5 V is applied | -10 | 0 | +10 | μA |
| 11 | Low level input voltage | V _{OL} | 4 | SW 0 to 3=1, Output voltage when 1 mA flows in | 0 | 0.2 | 0.4 | V |

I²C Bus Block Items (SDA, SCL)

| No. | Item | Symbol | Min. | Typ. | Max. | Unit |
|-----|--|---------------------|------|------|------|------|
| 12 | High level input voltage | V _{IH} | 3.0 | — | 5.0 | V |
| 13 | Low level input voltage | V _{IL} | 0 | — | 1.5 | V |
| 14 | High level input current | I _{IH} | — | — | 10 | μA |
| 15 | Low level input current | I _{IL} | — | — | 10 | μA |
| 16 | Low level output voltage At 3 mA flow to SDA (Pin 14) | V _{OL} | 0 | — | 0.4 | V |
| 17 | Maximum flowing current | I _{OL} | 3 | — | — | mA |
| 18 | Input capacitance | C _I | — | — | 10 | pF |
| 19 | Maximum clock frequency | f _{SCL} | 0 | — | 100 | kHz |
| 20 | Data change minimum waiting time | t _{BUF} | 4.7 | — | — | μs |
| 21 | Data transfer start minimum waiting time | t _{HD:STA} | 4.0 | — | — | μs |
| 22 | Low level clock pulse width | t _{LOW} | 4.7 | — | — | μs |
| 23 | High level clock pulse width | t _{HIGH} | 4.0 | — | — | μs |
| 24 | Minimum start preparation waiting time | t _{SU:STA} | 4.7 | — | — | μs |
| 25 | Minimum data hold time | t _{HD:DAT} | 5 | — | — | μs |
| 26 | Minimum data preparation time | t _{SU:DAT} | 250 | — | — | ns |
| 27 | Rise time | t _R | — | — | 1 | μs |
| 28 | Fall time | t _F | — | — | 300 | ns |
| 29 | Minimum stop preparation waiting time | t _{SU:STO} | 4.7 | — | — | μs |

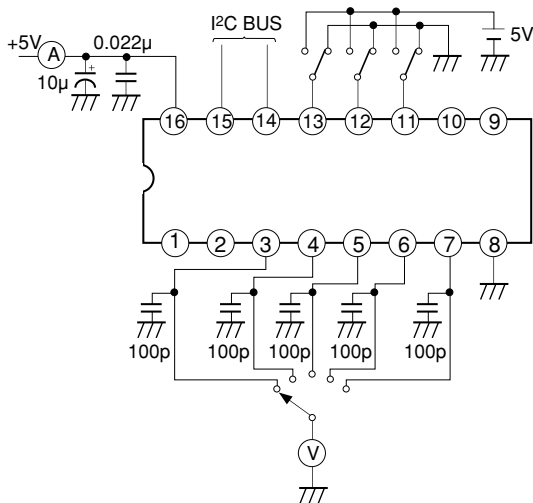
I²C bus load conditions: Pull up resistance 4 kΩ (Connected to +5 V)
Load capacitance 200 pF (Connected to GND)

I²C Bus Control Signal

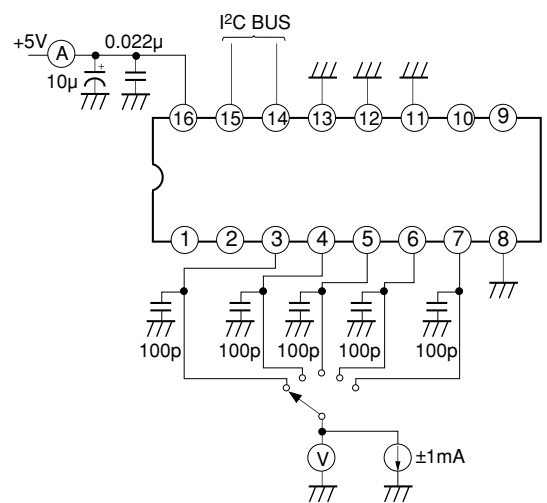


Electrical Characteristics Test Circuit

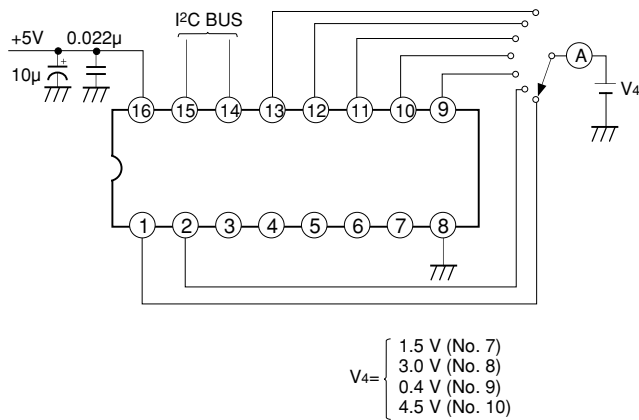
Test circuit 1



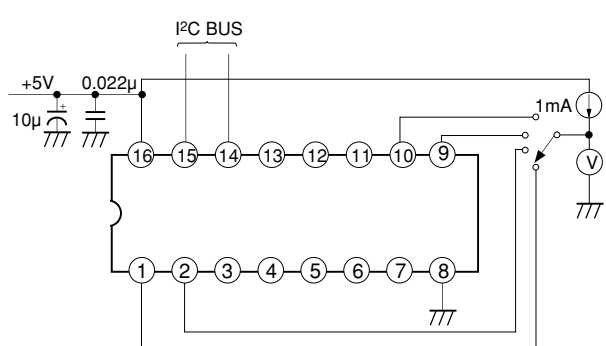
Test circuit 2



Test circuit 3



Test circuit 4



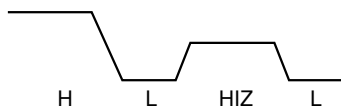
<Registers> In brackets () number of bits

- REF (1): Switches D/A converter reference voltage
 0:Standardizes the inner regulator
 1:Standardizes voltage resistance divided from V_{CC}
- SW0 to 3 (1): Selects ON/OFF of Pins 1, 2, 9 and 10
 (Each pin is the open collector output of NPN transistor)
 0:OFF
 1:ON
- DAC0 to 4 (8): Digital data input register of D/A converter
 0:Output voltage turns to minimum
 255:Output voltage turns to maximum
- PONRES (1): Detects POWER ON RESET
 0:Master passes from the bus and is reset to 0 after having read this status
 1:Set to 1 when power supply is turned on or when there has been a power dip
- ST0 to 3 (1): Detects and registers the voltage condition of Pins 1, 2, 9 and 10
 0:1.5 V and below
 1:3.0 V and above
 Note) SW0 to 3 effective during 0

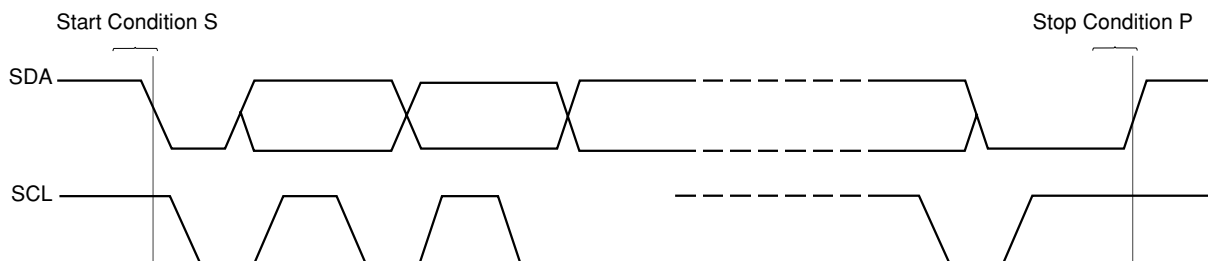
I²C Bus Signal

There are 2 signals in I²C bus. SDA (Serial DATA) and SCL (Serial Clock).
 SDA is double-way.

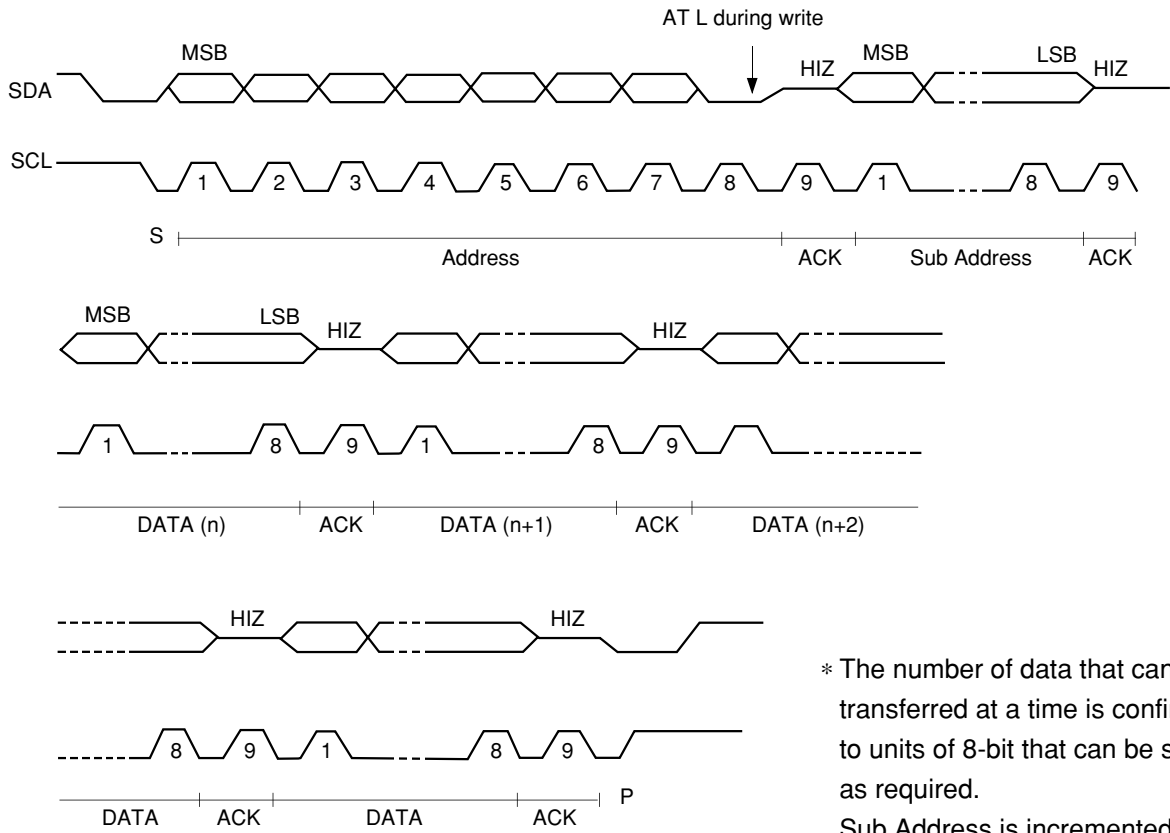
- As SDA is double-way it has 3 state outputs, H, L and HIZ.



- I²C transfer begins with Start Condition and ends with Stop Condition.

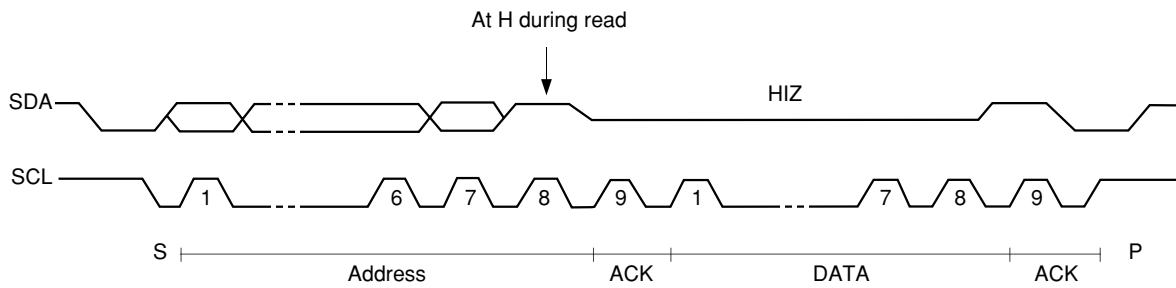


• I²C data write (Write from I²C controller to IC)

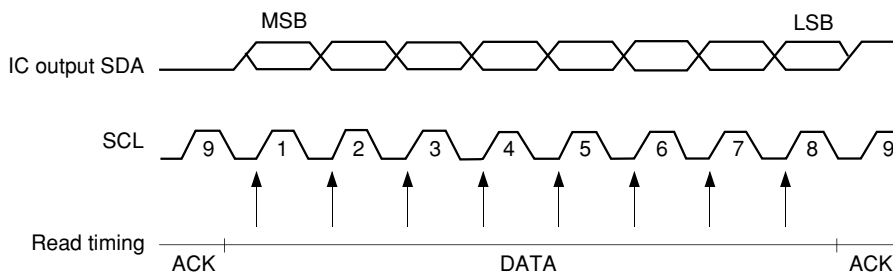


* The number of data that can be transferred at a time is confined to units of 8-bit that can be set as required. Sub Address is incremented automatically.

• I²C data read (Read from IC to I²C controller)

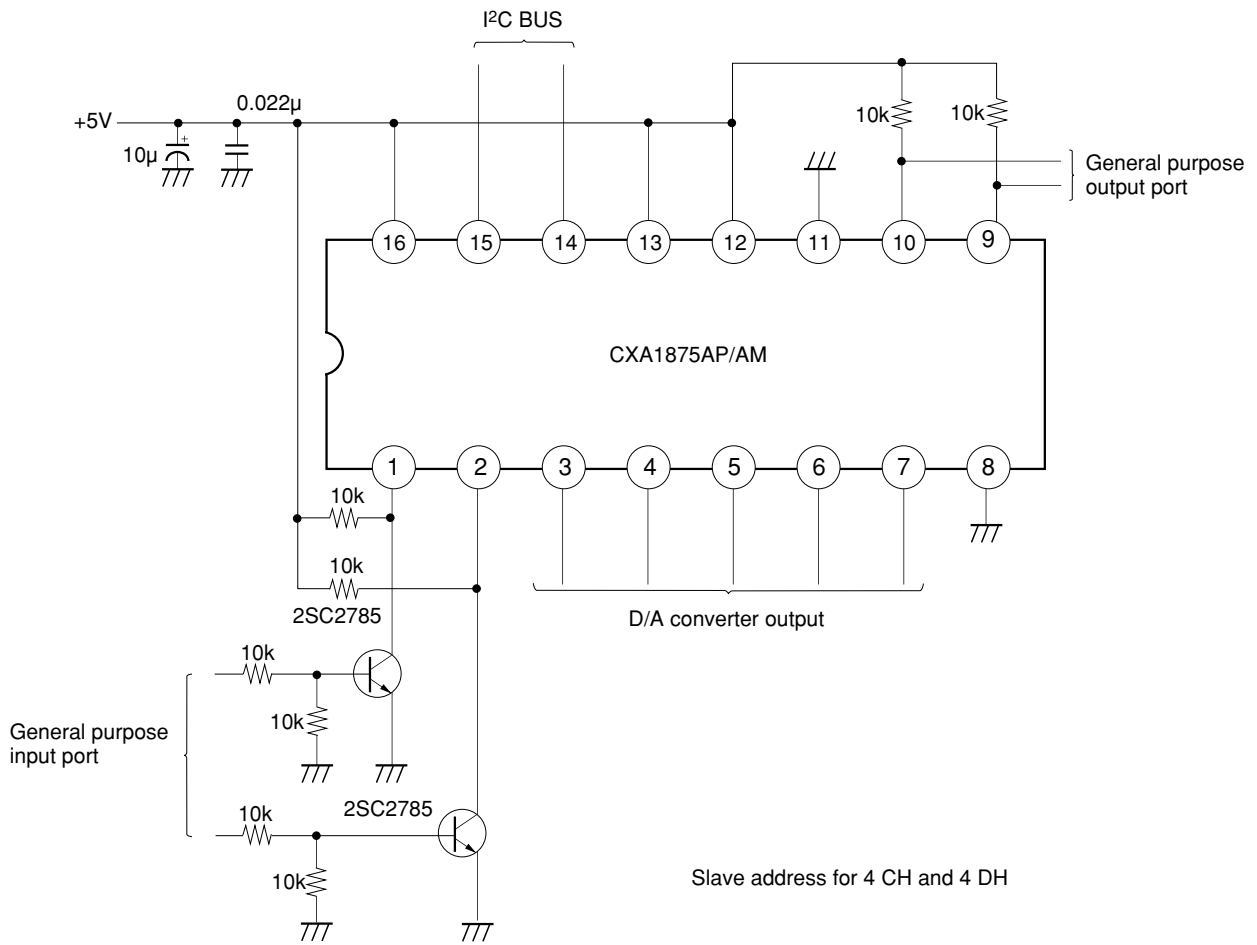


• Read timing



* Data read is performed with SCL rise.

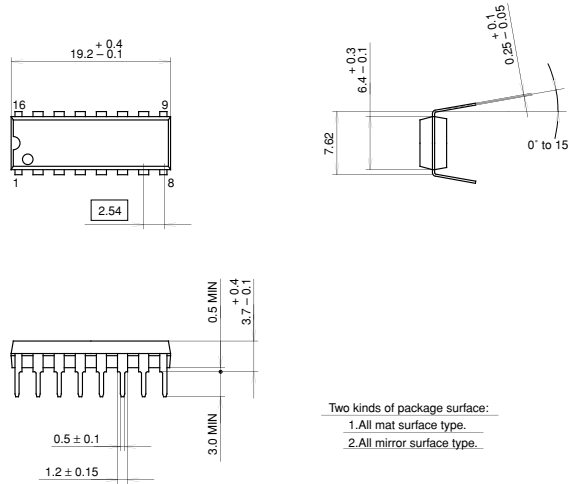
Application Circuit



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Package Outline Unit : mm
CXA1875AP

16PIN DIP (PLASTIC)



Two kinds of package surface:
1. All mat surface type.
2. All mirror surface type.

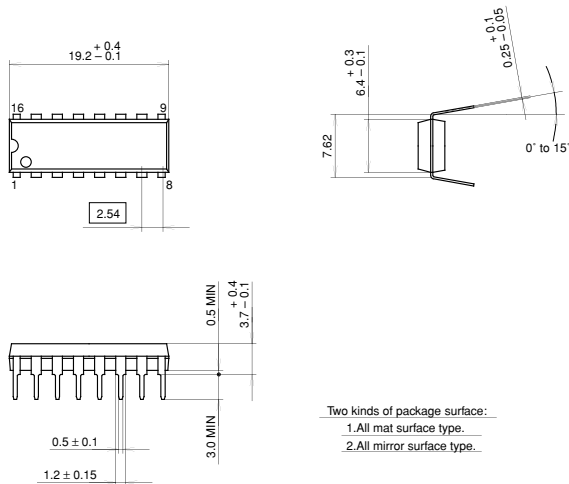
PACKAGE STRUCTURE

| | |
|------------|----------------------|
| SONY CODE | DIP-16P-01 |
| EIAJ CODE | DIP016-P-0300 |
| JEDEC CODE | Similar to MO-001-AE |

| | |
|------------------|----------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER PLATING |
| LEAD MATERIAL | COPPER ALLOY |
| PACKAGE MASS | 1.0 g |

CXA1875AP
Kokubu Ass'y

16PIN DIP (PLASTIC)



Two kinds of package surface:
1. All mat surface type.
2. All mirror surface type.

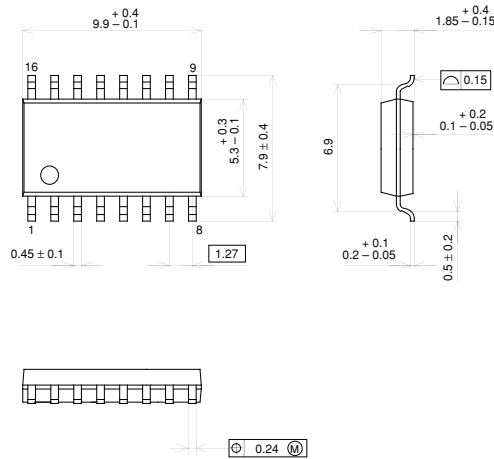
PACKAGE STRUCTURE

| | |
|------------|----------------------|
| SONY CODE | DIP-16P-01 |
| EIAJ CODE | DIP016-P-0300 |
| JEDEC CODE | Similar to MO-001-AE |

| | |
|------------------|----------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER PLATING |
| LEAD MATERIAL | COPPER ALLOY |
| PACKAGE MASS | 1.0 g |

Package Outline Unit : mm
CXA1875AM

16PIN SOP (PLASTIC)



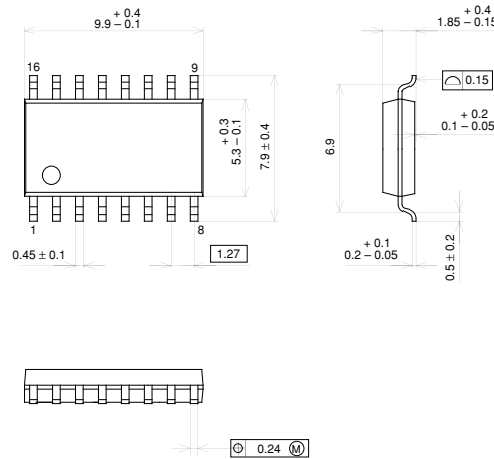
PACKAGE STRUCTURE

| | |
|------------|---------------|
| SONY CODE | SOP-16P-L01 |
| EIAJ CODE | SOP016-P-0300 |
| JEDEC CODE | |

| | |
|------------------|----------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER PLATING |
| LEAD MATERIAL | COPPER ALLOY |
| PACKAGE MASS | 0.2g |

CXA1875AM
SCT Ass'y

16PIN SOP (PLASTIC)



PACKAGE STRUCTURE

| | |
|------------|---------------|
| SONY CODE | SOP-16P-L01 |
| EIAJ CODE | SOP016-P-0300 |
| JEDEC CODE | |

| | |
|------------------|----------------|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER PLATING |
| LEAD MATERIAL | COPPER ALLOY |
| PACKAGE MASS | 0.2g |

LEAD PLATING SPECIFICATIONS

| ITEM | SPEC. |
|--------------------|-----------------|
| LEAD MATERIAL | COPPER ALLOY |
| SOLDER COMPOSITION | Sn-Bi Bi:1-4wt% |
| PLATING THICKNESS | 5-18 μ m |

Purchase of Sony's I²C components conveys a license under the Philips I²C Patent Rights to use these components in an I²C system, provided that the system conforms to the I²C Standard Specifications as defined by Philips.

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Datasheets for electronics components.