

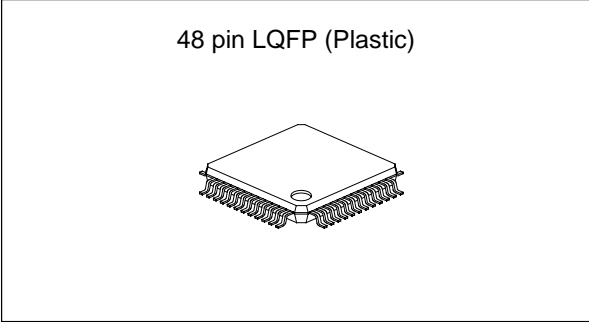
8-bit 160MSPS Flash A/D Converter

**Description**

The CXA3286R is an 8-bit high-speed flash A/D converter capable of digitizing analog signals at the maximum rate of 160MSPS. ECL, PECL or TTL can be selected as the digital input level in accordance with the application. The TTL digital output level allows 1:2 demultiplexed output.

**Features**

- Differential linearity error:  $\pm 0.5\text{LSB}$  or less
- Integral linearity error:  $\pm 0.5\text{LSB}$  or less
- Maximum conversion rate of 160MSPS
- Low input capacitance: 10pF
- Power saving function
- Wide analog input bandwidth: 250MHz
- Low power consumption: 550mW
- 1:2 demultiplexed output
- 1/2 frequency-divided clock output (with reset function)
- Compatible with ECL, PECL and TTL digital input levels
- TTL output "H" levels: 2.8V (Typ.)
- Output voltage control function (VOCLP)
- +3.3V line CMOS IC direct connecting available
- Single +5V power supply operation available
- Ultra-small surface mounting package (48-pin LQFP)



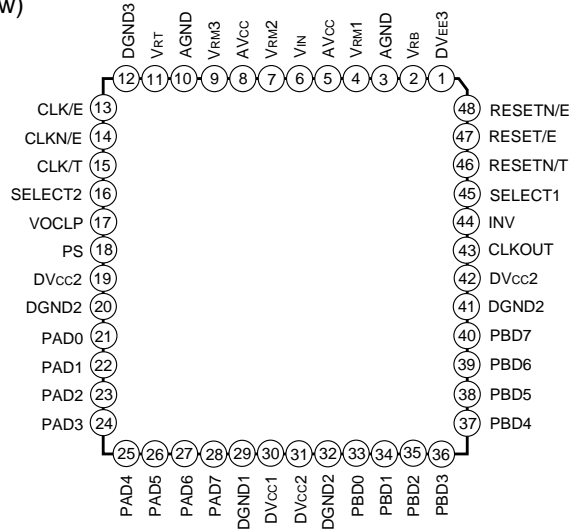
**Structure**

Bipolar silicon monolithic IC

**Applications**

- LCD monitors
- LCD projectors

**Pin Configuration (Top View)**



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**Absolute Maximum Ratings** (Ta = 25°C)

|                               |                         |                            | Unit |
|-------------------------------|-------------------------|----------------------------|------|
| • Supply voltage              | AVcc, DVcc1, DVcc2      | -0.5 to +7.0               | V    |
|                               | DGND3                   | -0.5 to +7.0               | V    |
|                               | DVEE3                   | -7.0 to +0.5               | V    |
|                               | DGND3 – DVEE3           | -0.5 to +7.0               | V    |
| • Analog input voltage        | VIN                     | VRT – 2.7 to AVcc          | V    |
| • Reference input voltage     | VRT                     | 2.7 to AVcc                | V    |
|                               | VRB                     | VIN – 2.7 to AVcc          | V    |
|                               | VRT – VRB               | 2.5                        | V    |
| • Digital input voltage       | ECL/PECL input pin      | DVEE3 – 0.5 to DGND3 + 0.5 | V    |
|                               | TTL input pin           | DGND1 – 0.5 to DVcc1 + 0.5 | V    |
|                               | SELECT2 pin             | DGND1 – 0.5 to DVcc1 + 0.5 | V    |
|                               | VOCLP pin               | DGND1 – 0.5 to DVcc1 + 0.5 | V    |
|                               | VID*1 (I***/E – ***N/E) | 2.7                        | V    |
| • Storage temperature         | Tstg                    | -65 to +150                | °C   |
| • Allowable power dissipation | Pd                      | 1.4                        | W    |

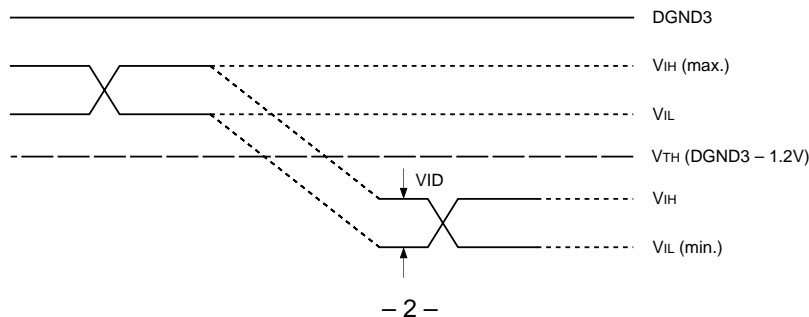
(when mounted on a two-layer glass fabric base epoxy board with dimensions of 50mm × 50mm, 1.6mm thick)

**Recommended Operating Conditions**

|  |                    | With a single power supply |             |       | With dual power supply |             |       | Unit      |   |
|--|--------------------|----------------------------|-------------|-------|------------------------|-------------|-------|-----------|---|
|  |                    | Min.                       | Typ.        | Max.  | Min.                   | Typ.        | Max.  |           |   |
| • Supply voltage                             | DVcc1, DVcc2, AVcc | +4.75                      | +5.0        | +5.25 | +4.75                  | +5.0        | +5.25 | V         |   |
|  | DGND1, DGND2, AGND | -0.05                      | 0           | +0.05 | -0.05                  | 0           | +0.05 | V         |   |
|  | DGND3              | +4.75                      | +5.0        | +5.25 | -0.05                  | 0           | +0.05 | V         |   |
|  | DVEE3              | -0.05                      | 0           | +0.05 | -5.5                   | -5.0        | -4.75 | V         |   |
| • Analog input voltage                       | VIN                | VRB                        |             | VRT   | VRB                    |             | VRT   | V         |   |
| • Reference input voltage                    | VRT                | +2.9                       |             | +4.1  | +2.9                   |             | +4.1  | V         |   |
|  | VRB                | +1.4                       |             | +2.6  | +1.4                   |             | +2.6  | V         |   |
|  | VRT – VRB          | 1.5                        |             | 2.1   | 1.5                    |             | 2.1   | V         |   |
| • Digital input voltage                      | ECL/PECL input pin | : VIH                      | DVEE3 + 1.5 |       | DGND3                  | DVEE3 + 1.5 |       | DGND3     | V |
|  |                    | : VIL                      | DVEE3 + 1.1 |       | VIH – 0.4              | DVEE3 + 1.1 |       | VIH – 0.4 | V |
|  | TTL input pin      | : VIH                      | 2.0         |       | 2.0                    |             |       |           | V |
|  |                    | : VIL                      |             |       | 0.8                    |             |       | 0.8       | V |
|  | SELECT2 pin        | : VIH                      |             | DVcc1 |                        | DVcc1       |       |           | V |
|  |                    | : VIL                      |             | DGND1 |                        | DGND1       |       |           | V |
|  | VOCLP pin          |                            | DGND1 + 2.4 |       | DVcc1                  | DGND1 + 2.4 |       | DVcc1     | V |
| • Maximum conversion rate Fc (Straight mode) |                    | 125                        |             |       | 125                    |             |       | MSPS      |   |
|  | (DMUX mode)        | 160                        |             |       | 160                    |             |       | MSPS      |   |
| • Ambient temperature                        | Ta                 | -20                        |             | +75   | -20                    |             | +75   | °C        |   |

\*1 VID: Input Voltage Differential

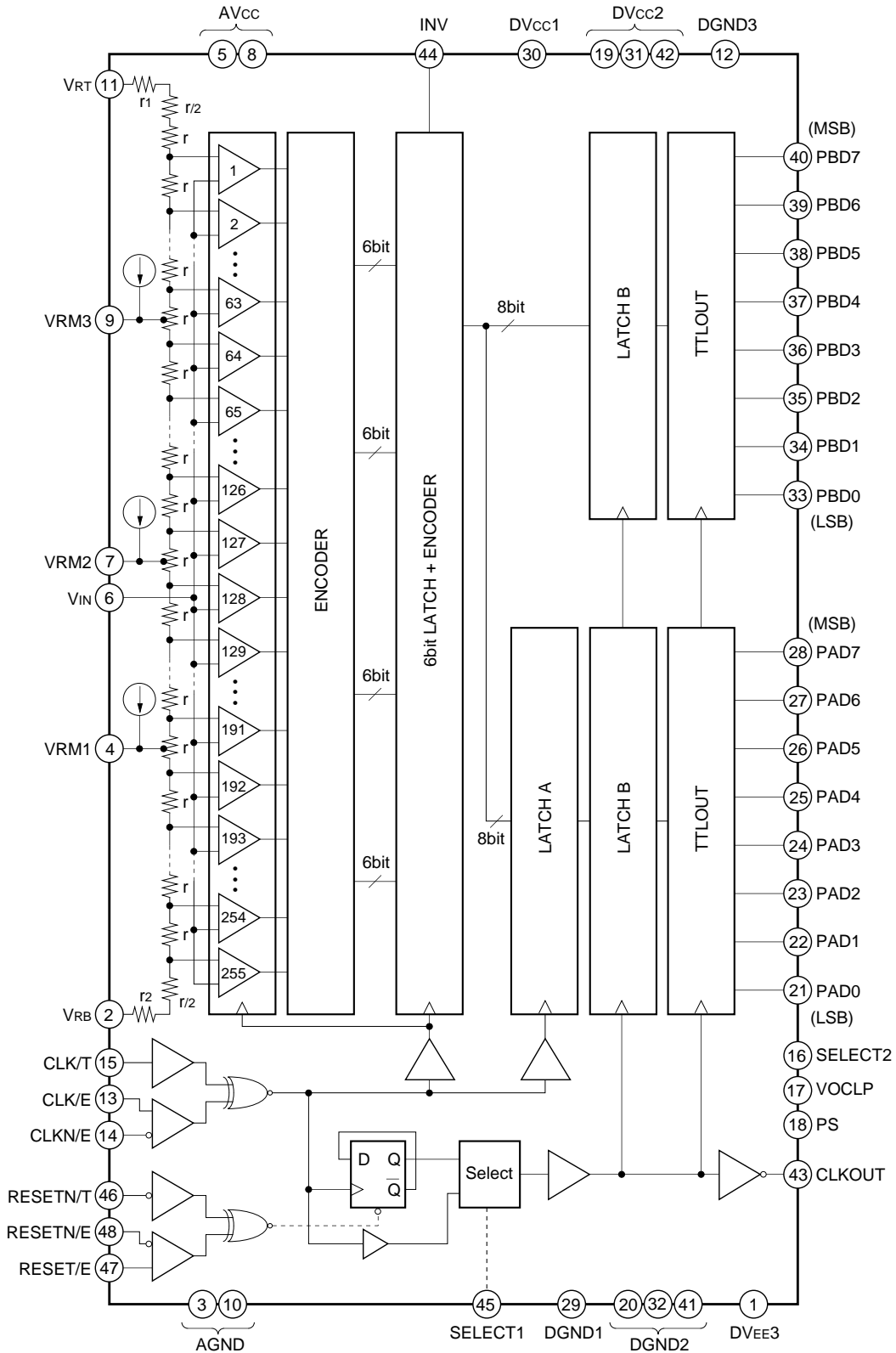
**ECL and PECL input signal switching level**



## Pin Description

| [Symbol]           | [Pin No.] | [Description]                  | [Typical voltage level with a single power supply] | [Typical voltage level with dual power supply] |
|--------------------|-----------|--------------------------------|--|--|
| DVEE3              | 1         | Digital power supply           | 0V   | -5.0V  |
| V <sub>RB</sub>    | 2         | Bottom reference voltage       | 1.4 to 2.6V  | 1.4 to 2.6V                                    |
| AGND               | 3         | Analog ground                  | 0V   | 0V   |
| V <sub>RM1</sub>   | 4         | Reference voltage mid point    | —  | —  |
| AV <sub>CC</sub>   | 5         | Analog power supply            | +5V  | +5V  |
| V <sub>IN</sub>    | 6         | Analog signal input            | V <sub>RB</sub> to V <sub>RT</sub>                 | V <sub>RB</sub> to V <sub>RT</sub>             |
| V <sub>RM2</sub>   | 7         | Reference voltage mid point    | —  | —  |
| AV <sub>CC</sub>   | 8         | Analog power supply            | +5V  | +5V  |
| V <sub>RM3</sub>   | 9         | Reference voltage mid point    | —  | —  |
| AGND               | 10        | Analog ground                  | 0V   | 0V   |
| V <sub>RT</sub>    | 11        | Top reference voltage          | 2.9 to 4.1V  | 2.9 to 4.1V                                    |
| DGND3              | 12        | Digital power supply           | +5V  | 0V   |
| CLK/E              | 13        | ECL/PECL clock input           | PECL   | ECL  |
| CLKN/E             | 14        | ECL/PECL clock input           | PECL   | ECL  |
| CLK/T              | 15        | TTL clock input                | TTL  | TTL  |
| SELECT2            | 16        | Data output switching          | DGND1 or open or DV <sub>CC</sub> 1                | DGND1 or open or DV <sub>CC</sub> 1            |
| VOCLP              | 17        | TTL high level clamp           | Clamp voltage                                      | Clamp voltage                                  |
| PS                 | 18        | Power saving                   | TTL  | TTL  |
| DV <sub>CC</sub> 2 | 19        | Digital power supply           | +5V  | +5V  |
| DGND2              | 20        | Digital ground                 | 0V   | 0V   |
| PAD0 to PAD7       | 21 to 28  | PA side data output            | TTL  | TTL  |
| DGND1              | 29        | Digital ground                 | 0V   | 0V   |
| DV <sub>CC</sub> 1 | 30        | Digital power supply           | +5V  | +5V  |
| DV <sub>CC</sub> 2 | 31        | Digital power supply           | +5V  | +5V  |
| DGND2              | 32        | Digital ground                 | 0V   | 0V   |
| PBD0 to PBD7       | 33 to 40  | PB side data output            | TTL  | TTL  |
| DGND2              | 41        | Digital ground                 | 0V   | 0V   |
| DV <sub>CC</sub> 2 | 42        | Digital power supply           | +5V  | +5V  |
| CLKOUT             | 43        | Clock output                   | TTL  | TTL  |
| INV                | 44        | Data output polarity inversion | TTL  | TTL  |
| SELECT1            | 45        | Output mode selection          | TTL  | TTL  |
| RESETN/T           | 46        | TTL reset input                | TTL  | TTL  |
| RESET/E            | 47        | ECL/PECL reset input           | PECL   | ECL  |
| RESETN/E           | 48        | ECL/PECL reset input           | PECL   | ECL  |

Block Diagram



Pin Description and I/O Pin Equivalent Circuit

| Pin No.          | Symbol         | I/O | Standard voltage level                     | Equivalent circuit | Description  |
|------------------|----------------|-----|--|--------------------|--|
| 3, 10            | AGND           |     | GND  |                    | Analog ground.<br>Separated from the digital ground.   |
| 5, 8             | AVcc           |     | +5V (typ.)                                 |                    | Analog power supply.<br>Separated from the digital power supply.   |
| 20, 29<br>32, 41 | DGND1<br>DGND2 |     | GND  |                    | Digital ground.  |
| 19, 30<br>31, 42 | DVcc1<br>DVcc2 |     | +5V (typ.)                                 |                    | Digital power supply.  |
| 12               | DGND3          |     | +5V (typ.)<br>(With a single power supply) |                    | Digital power supply.<br>Ground for ECL input.<br>+5V for PECL and TTL inputs.   |
|                  |                |     | GND<br>(With dual power supply)            |                    |  |
| 1                | DVEE3          |     | GND<br>(With a single power supply)        |                    | Digital power supply.<br>-5V for ECL input.<br>Ground for PECL and TTL inputs.   |
|                  |                |     | -5V (typ.)<br>(With dual power supply)     |                    |  |
| 16               | SELECT2        | I   | DVcc1 or Open or DGND1                     |                    | Data output switching.<br>When left open, data are output from both PA and PB side output ports.<br>For DVcc1 level, PA side output port outputs data and PB side is in the high impedance state.<br>For DGND1 level, PB side output port outputs data and PA side is in the high impedance state. |
| 17               | VOCLP          | I   | Clamp voltage                              |                    | TTL output high level clamping.<br>The TTL high level voltage is clamped to the value almost equivalent to the voltage applied to this pin.<br>Even if this pin is left open, the TTL high level is clamped to approximately 2.8V.   |

| Pin No. | Symbol   | I/O | Standard voltage level | Equivalent circuit  | Description   |
|---------|----------|-----|------------------------|---|---|
| 18      | PS       | I   | TTL                    |   | <p>Power saving.<br/>When left open, this pin goes to high level.<br/>When set to low level, the power saving state is established.</p>   |
| 13      | CLK/E    | I   | ECL/<br>PECL           |   | <p>Clock input.</p>   |
| 14      | CLKN/E   | I   |                        |   | <p>CLK/E complementary input.<br/>When left open, this pin goes to the threshold voltage.<br/>Only CLK/E can be used for operation, but complementary inputs are recommended to attain fast and stable operation.</p> |
| 48      | RESETN/E | I   |                        |   | <p>Reset signal input.<br/>When set to low level, the built-in CLK frequency divider circuit can be reset.</p>  |
| 47      | RESET/E  | I   |                        | <p>RESETN/E complementary input.<br/>When left open, this pin goes to the threshold voltage. Only RESETN/E can be used for operation.</p> |   |
| 15      | CLK/T    | I   | TTL                    |   | <p>Clock input.</p>   |
| 46      | RESETN/T | I   |                        |   | <p>Reset signal input.<br/>When left open, this pin goes to high level. When set to low level, the built-in CLK frequency divider circuit can be reset.</p>   |
| 44      | INV      | I   | TTL                    |   | <p>Data output polarity inversion input.<br/>When left open, this input goes to high level.<br/>(See Table 1. I/O Correspondence Table.)</p>  |
| 45      | SELECT1  |     | Vcc<br>or<br>GND       |   | <p>Data output mode selection.<br/>(See Table 2. Operation Mode Table.)</p>   |

| Pin No.  | Symbol           | I/O | Standard voltage level                  | Equivalent circuit | Description   |
|----------|------------------|-----|---|--------------------|---|
| 11       | V <sub>RT</sub>  | I   | 4.0V (typ.)                             |                    | Top reference voltage.<br>By-pass to AGND with a 1μF tantalum capacitor and a 0.1μF chip capacitor.                   |
| 9        | V <sub>RM3</sub> |     | $V_{RB} + \frac{3}{4}(V_{RT} - V_{RB})$ |                    | Reference voltage mid point.<br>By-pass to AGND with a 0.1μF chip capacitor.  |
| 7        | V <sub>RM2</sub> |     | $V_{RB} + \frac{2}{4}(V_{RT} - V_{RB})$ |                    | Reference voltage mid point.<br>By-pass to AGND with a 0.1μF chip capacitor.  |
| 4        | V <sub>RM1</sub> |     | $V_{RB} + \frac{1}{4}(V_{RT} - V_{RB})$ |                    | Reference voltage mid point.<br>By-pass to AGND with a 0.1μF chip capacitor.  |
| 2        | V <sub>RB</sub>  | I   | 2.0V (typ.)                             |                    | Bottom reference voltage.<br>By-pass to AGND with a 1μF tantalum capacitor and a 0.1μF chip capacitor.                |
| 6        | V <sub>IN</sub>  | I   | V <sub>RT</sub> to V <sub>RB</sub>      |                    | Analog input.   |
| 21 to 28 | PAD0 to PAD7     | O   | TTL                                     |                    | Port A side data output.<br>TTL output; the high level is clamped to approximately 2.8V.                              |
| 33 to 40 | PBD0 to PBD7     | O   |   |                    | Port B side data output.<br>TTL output; the high level is clamped to approximately 2.8V.                              |
| 43       | CLKOUT           | O   |   |                    | Clock output.<br>(See Table 2. Operation Mode Table.)<br>TTL output; the high level is clamped to approximately 2.8V. |

**Electrical Characteristics**

( AV<sub>CC</sub>, DV<sub>CC</sub>1, 2, DGND3 = +5V, AGND, DGND1, 2, DV<sub>EE</sub>3 = 0V, V<sub>RT</sub> = 4V, V<sub>RB</sub> = 2V, Ta = 25°C)

| Item                                | Symbol              | Conditions   | Min.                     | Typ.        | Max.                  | Unit |    |
|-------------------------------------|---------------------|--|--------------------------|-------------|-----------------------|------|----|
| Resolution                          |                     |  |                          | 8           |                       | bits |    |
| DC characteristics                  |                     |  |                          |             |                       |      |    |
| Integral linearity error            | E <sub>IL</sub>     | V <sub>IN</sub> = 2Vp-p, F <sub>c</sub> = 5MSPS                  |                          |             | ±0.5                  | LSB  |    |
| Differential linearity error        | E <sub>DL</sub>     |  |                          |             | ±0.5                  | LSB  |    |
| Analog input                        |                     |  |                          |             |                       |      |    |
| Analog input capacitance            | C <sub>IN</sub>     | V <sub>IN</sub> = +3.0V + 0.07V <sub>rms</sub>                   |                          | 10          |                       | pF   |    |
| Analog input resistance             | R <sub>IN</sub>     |  | 7                        | 15          | 35                    | kΩ   |    |
| Analog input current                | I <sub>IN</sub>     |  | 0                        | 100         | 285                   | μA   |    |
| Reference input                     |                     |  |                          |             |                       |      |    |
| Reference resistance                | R <sub>ref</sub> *2 |  | 400                      | 600         | 740                   | Ω    |    |
| Reference current                   | I <sub>ref</sub> *3 |  | 2.7                      | 3.3         | 5.0                   | mA   |    |
| Offset voltage V <sub>RT</sub> side | E <sub>OT</sub>     |  | 6                        | 8           | 10                    | mV   |    |
| Offset voltage V <sub>RB</sub> side | E <sub>OB</sub>     |  | 0                        | 1.5         | 3                     | mV   |    |
| Digital input (ECL, PECL)           |                     |  |                          |             |                       |      |    |
| Digital input voltage: High         | V <sub>IH</sub>     | V <sub>IH</sub> = DGND3 – 0.8V<br>V <sub>IL</sub> = DGND3 – 1.6V | DV <sub>EE</sub> 3 + 1.5 |             | DGND3                 | V    |    |
| : Low                               | V <sub>IL</sub>     |  | DV <sub>EE</sub> 3 + 1.1 |             | V <sub>IH</sub> – 0.4 | V    |    |
| Threshold voltage                   | V <sub>TH</sub>     |  |                          | DGND3 – 1.2 |                       | V    |    |
| Digital input current : High        | I <sub>IH</sub>     |  |                          | –50         |                       | 20   | μA |
| : Low                               | I <sub>IL</sub>     |  |                          | –50         |                       | 20   | μA |
| Digital input capacitance           |                     |  |                          |             |                       | 5    | pF |
| Digital input (TTL)                 |                     |  |                          |             |                       |      |    |
| Digital input voltage: High         | V <sub>IH</sub>     | V <sub>IH</sub> = 3.5V<br>V <sub>IL</sub> = 0.2V                 | 2.0                      |             | 0.8                   | V    |    |
| : Low                               | V <sub>IL</sub>     |  |                          |             |                       | V    |    |
| Threshold voltage                   | V <sub>TH</sub>     |  |                          | 1.5         |                       | V    |    |
| Digital input current : High        | I <sub>IH</sub>     |  |                          | –10         |                       | 5    | μA |
| : Low                               | I <sub>IL</sub>     |  |                          | –20         |                       | 0    | μA |
| Digital input capacitance           |                     |  |                          |             |                       | 5    | pF |
| Digital output (TTL)                |                     |  |                          |             |                       |      |    |
| Digital output voltage : High       | V <sub>OH</sub>     | I <sub>OH</sub> = –2mA   | 2.4                      |             |                       | V    |    |
| : Low                               | V <sub>OL</sub>     | I <sub>OL</sub> = 1mA  |                          |             | 0.5                   | V    |    |
| Switching characteristics           |                     |  |                          |             |                       |      |    |
| Maximum conversion rate             | F <sub>c</sub>      | DMUX mode  | 160                      |             |                       | MSPS |    |
| Aperture jitter                     | T <sub>aj</sub>     |  |                          | 10          |                       | ps   |    |
| Sampling delay                      | T <sub>ds</sub>     |  | 1.2                      | 1.3         | 1.5                   | ns   |    |
| Clock high pulse width              | T <sub>pw1</sub>    | CLK  | 2.5                      |             |                       | ns   |    |
| Clock low pulse width               | T <sub>pw0</sub>    | CLK  | 2.9                      |             |                       | ns   |    |
| Reset signal setup time             | T <sub>rs</sub>     | RESETN – CLK   | 1.0                      |             |                       | ns   |    |
| Reset signal hold time              | T <sub>rh</sub>     | RESETN – CLK   | –0.5                     |             |                       | ns   |    |
| Clock output delay                  | T <sub>d_clk</sub>  | (C <sub>L</sub> = 5pF)   | 3.0                      | 4.0         | 6.5                   | ns   |    |
| Data output delay                   | T <sub>do1</sub>    | DMUX mode (C <sub>L</sub> = 5pF)                                 |                          | T*4 + 0.5   |                       | ns   |    |
|                                     | T <sub>do2</sub>    | (C <sub>L</sub> = 5pF)   | 3.5                      | 4.5         | 7.0                   | ns   |    |
| Output rise time                    | T <sub>r</sub>      | 0.8 to 2.0V (C <sub>L</sub> = 5pF)                               |                          | 1           |                       | ns   |    |
| Output fall time                    | T <sub>f</sub>      | 0.8 to 2.0V (C <sub>L</sub> = 5pF)                               |                          | 1           |                       | ns   |    |

\* These characteristics are for PECL input unless otherwise specified.



| Item                            | Symbol            | Conditions  | Min. | Typ. | Max.                | Unit  |
|---------------------------------|-------------------|---|------|------|---------------------|-------|
| Dynamic characteristics         |                   |   |      |      |                     |       |
| Input bandwidth                 |                   | $V_{IN} = 2V_{p-p}, -3dB$   | 250  |      |                     | MHz   |
| S/N ratio                       |                   | $\left\{ \begin{array}{l} F_c = 160MSPS, \\ fin = 1kHz Fs \\ DMUX mode \end{array} \right.$                           |      | 46   |                     | dB    |
|                                 |                   | $\left\{ \begin{array}{l} F_c = 160MSPS, \\ fin = 9.999MHz Fs \\ DMUX mode \end{array} \right.$                       |      | 42   |                     | dB    |
| Error rate                      |                   | $\left\{ \begin{array}{l} F_c = 160MSPS, \\ fin = 1kHz Fs \\ DMUX mode \\ Error > 16LSB \end{array} \right.$          |      |      | $1 \times 10^{-12}$ | TPS*5 |
|                                 |                   | $\left\{ \begin{array}{l} F_c = 160MSPS, \\ fin = 9.999MHz Fs \\ DMUX mode \\ Error > 16LSB \end{array} \right.$      |      |      | $2 \times 10^{-8}$  | TPS   |
|                                 |                   | $\left\{ \begin{array}{l} F_c = 125MSPS, \\ fin = 31.249MHz Fs \\ Straight mode \\ Error > 16LSB \end{array} \right.$ |      |      | $1 \times 10^{-9}$  | TPS   |
| Power supply                    |                   |   |      |      |                     |       |
| Supply current                  | $I_{CC} + I_{EE}$ |   | 89   | 108  | 140                 | mA    |
| AVcc pin supply current         | $I_{ACC}$         |   | 62   |      | 87                  | mA    |
| DVcc1 pin supply current        | $I_{DCC1}$        |   | 22   |      | 36                  | mA    |
| DVcc2 pin supply current        | $I_{DCC2}$        |   | 4.0  |      | 15                  | mA    |
| DGND3 pin supply current        | $I_{EE}$          |   | 0.5  |      | 1.5                 | mA    |
| Supply current for PS           | $I_{CC} + I_{EE}$ |   |      |      | 5                   | mA    |
| AVcc pin supply current for PS  | $I_{ACC}$         |   |      |      | 1.5                 | mA    |
| DVcc1 pin supply current for PS | $I_{DCC1}$        |   |      |      | 1.5                 | mA    |
| DVcc2 pin supply current for PS | $I_{DCC2}$        |   |      |      | 1.5                 | mA    |
| DGND3 pin supply current for PS | $I_{EE}$          |   |      |      | 0.5                 | mA    |
| Power consumption               | $P_d^{*6}$        |   | 480  | 550  | 700                 | mW    |
| Power consumption for PS        | $P_d^{*7}$        |   | 0.3  |      | 25                  | mW    |

\*2 Rref: Resistance value between  $V_{RT}$  and  $V_{RB}$

$$*3 I_{ref} = \frac{V_{RT} - V_{RB}}{R_{ref}}$$

$$*4 T = \frac{1}{F_c}$$

\*5 TPS: Times Per Sample

$$*6 P_d = (I_{CC} + I_{EE}) \cdot V_{CC} + \frac{(V_{RT} - V_{RB})^2}{R_{ref}}$$

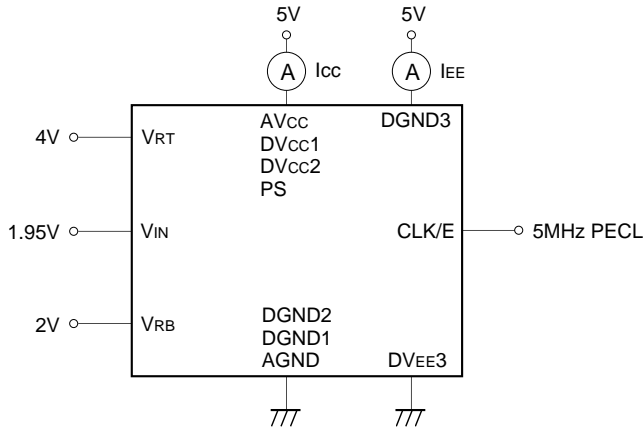
$$*7 P_d = (I_{CC} + I_{EE}) \cdot V_{CC}$$

| VIN  | Step | INV |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |
|------|------|-----|---|---|---|---|---|---|----|---|---|---|---|---|---|---|---|
|      |      | 1   |   |   |   |   |   |   | 0  |   |   |   |   |   |   |   |   |
|      |      | D7  |   |   |   |   |   |   | D0 |   |   |   |   |   |   |   |   |
| VRT  | 255  | 1   | 1 | 1 | 1 | 1 | 1 | 1 | 1  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|      | 254  | 1   | 1 | 1 | 1 | 1 | 1 | 1 | 0  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
|      | ⋮    | ⋮   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |
| VRM2 | 128  | 1   | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|      | 127  | 0   | 1 | 1 | 1 | 1 | 1 | 1 | 1  | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|      | ⋮    | ⋮   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |
| VRB  | 1    | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 1  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
|      | 0    | 0   | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Table 1. I/O Correspondence Table

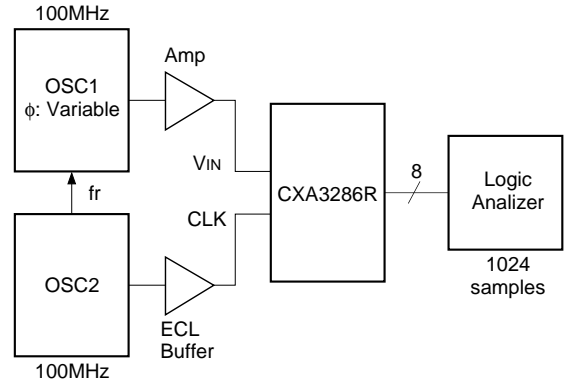
**Electrical Characteristics Measurement Circuit**

**Current Consumption Measurement Circuit**



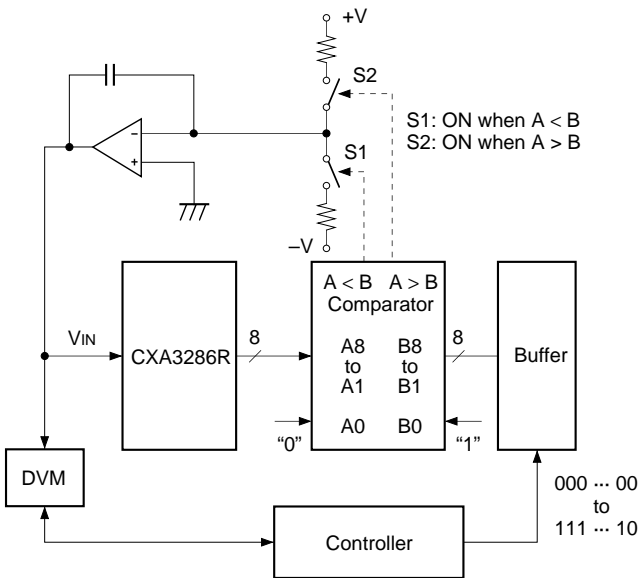
**Sampling Delay Measurement Circuit**

**Aperture Jitter Measurement Circuit**

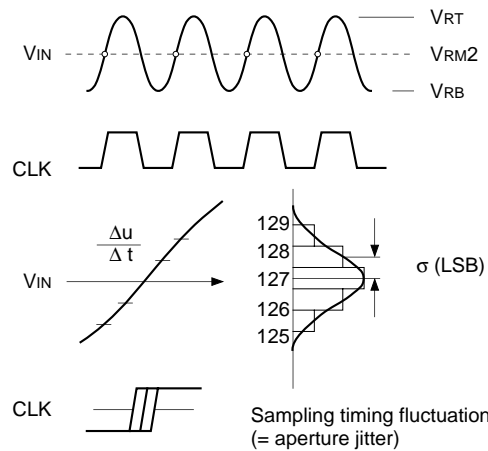


**Integral Linearity Error Measurement Circuit**

**Differential Linearity Error Measurement Circuit**



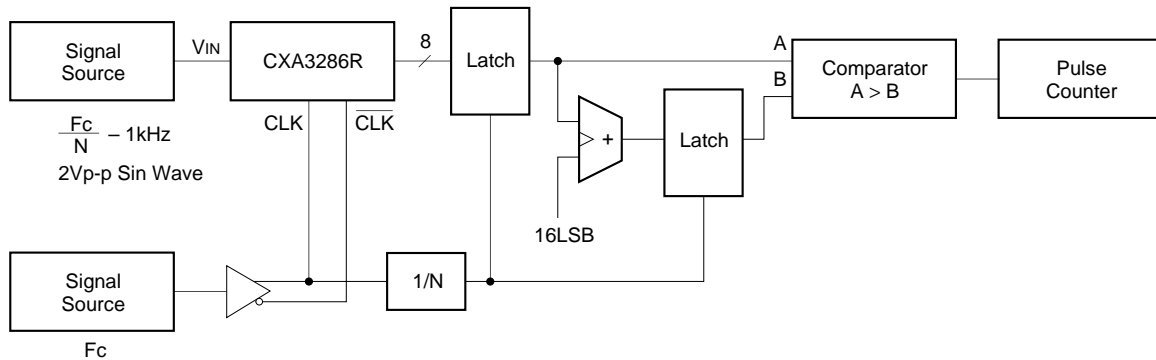
**Aperture Jitter Measurement Method**



Where  $\sigma$  (LSB) is the deviation of the output codes when the largest slew rate point is sampled at the clock which has exactly the same frequency as the analog input signal, the aperture jitter  $T_{aj}$  is:

$$T_{aj} = \sigma / \frac{\Delta v}{\Delta t} = \sigma / \left( \frac{256}{2} \times 2\pi f \right)$$

**Error Rate Measurement Circuit**



**Description of Operation Modes**

The CXA3286R has two types of operation modes which are selected with Pin 45 (SELECT1).

| Operation mode | SELECT1 pin | Maximum conversion rate | Data output                    | Clock output  |
|----------------|-------------|-------------------------|--------------------------------|---|
| DMUX mode      | Vcc         | 160MSPS                 | Demultiplexed output<br>80Mbps | The input clock is 1/2 frequency divided and output.<br>80MHz |
| Straight mode  | GND         | 125MSPS                 | Straight output<br>125Mbps     | The input clock is inverted and output.<br>125MHz             |

**Table 2. Operation Mode Table**

**1. DMUX mode** (See Application Circuit 1-(1), (2) and (3).)

Set the SELECT1 pin to Vcc for this mode. In this mode, the clock frequency is divided by 2 in the IC, and the data is output after being demultiplexed by this 1/2 frequency-divided clock. The 1/2 frequency-divided clock, which has adequate setup time and hold time for the output data, is output from the clock output pin.

When using the multiple CXA3286R in DMUX mode, the start timing of the 1/2 frequency-divided clocks becomes out of phase, producing operation such as that shown in the example on the next page. As a countermeasure, the CXA3286R has a function that resets the 1/2 frequency-divided clocks.

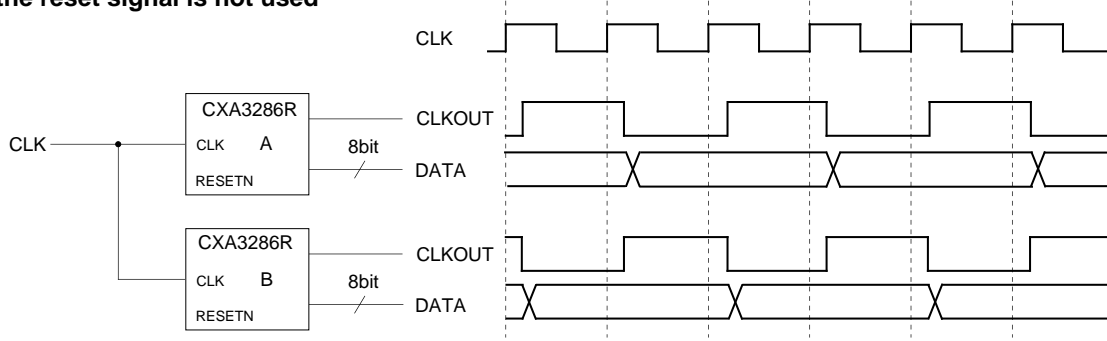
When resetting this 1/2 frequency-divided clock, the low level of the reset signal should be input to the RESETN pin (Pin 46 or 48). The reset signal requires the setup time ( $T_{rs} \geq 1.0ns$ ) and hold time ( $T_{rh} \geq -0.5ns$ ) to the clock rising edge because it is synchronized with and taken in the clock.

The reset period can be extended by making the low level period of the reset signal longer because the clock output pin is fixed to low (reset) during the low level period at the clock rising edge. If the reset start timing is regarded as not important, the timing where the reset signal is set from high to low is not so consequence. However, when the reset is released the timing where the reset signal is set from low to high must become significant because the timing is used to commence the 1/2 frequency-divided clock. In this case, the setup time ( $T_{rs}$ ) is also necessary.

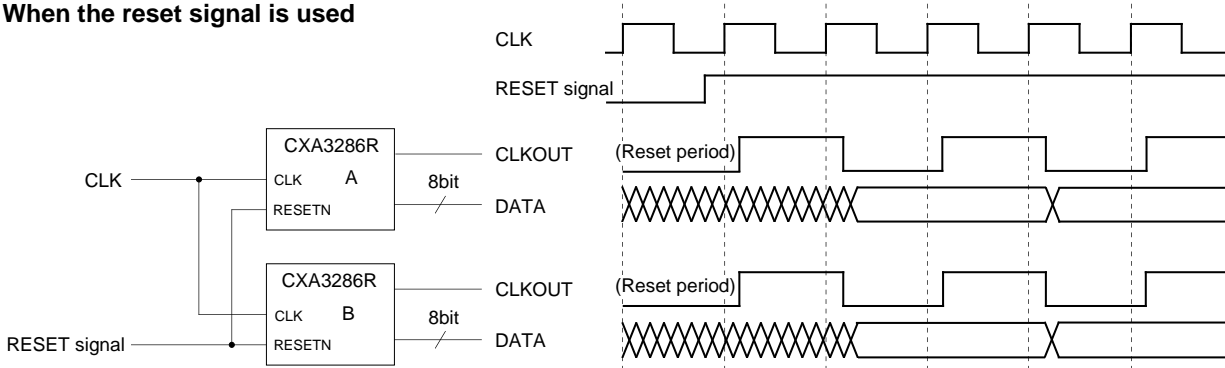
See the timing chart for detail. (This chart shows the example of reset for 2T.)

The A/D converter can operate at  $F_c$  (min.) = 160MSPS in this mode.

**When the reset signal is not used**



**When the reset signal is used**



**2. Straight mode** (See Application Circuits 1-(4), (5) and (6).)

Set the SELECT1 pin to GND for this mode. In this mode, data output can be obtained in accordance with the clock frequency applied to the A/D converter for applications which use the clock applied to the A/D converter as the system clock.

The A/D converter can operate at  $F_c$  (min.) = 125MSPS in this mode.

**Digital input level and supply voltage settings**

The logic input level for the CXA3286R supports ECL, PECL and TTL levels.

The power supplies (DV<sub>EE3</sub>, DGND3) for the logic input block must be set to match the logic input (CLK and reset signals) level.

| Digital input level | DV <sub>EE3</sub> | DGND3 | Supply voltage | Application circuits |
|---------------------|-------------------|-------|----------------|----------------------|
| ECL                 | -5V               | 0V    | ±5V            | (1) (4)              |
| PECL                | 0V                | +5V   | +5V            | (2) (5)              |
| TTL                 | 0V                | +5V   | +5V            | (3) (6)              |

**Table 3. Logic Input Level and Power Supply Settings**

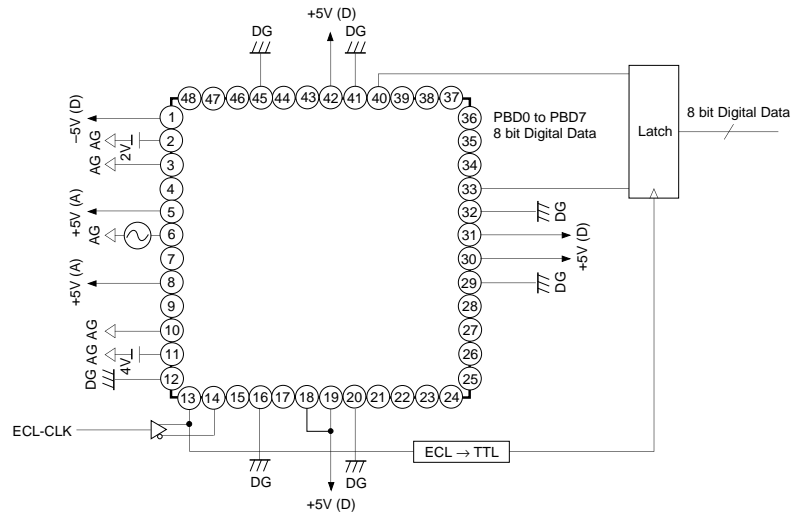
**Description of SELECT2 pin**

The CXA3286R has two systems of data outputs and the port where the data is output can be selected by the SELECT2 pin.

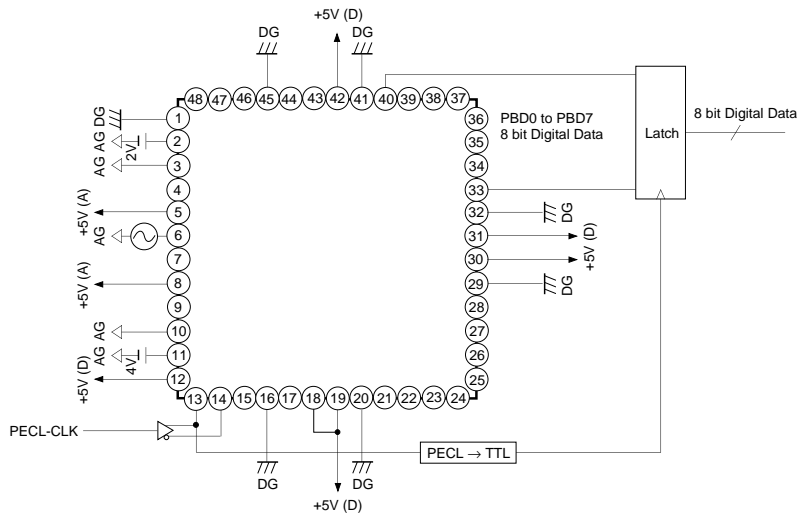
| SELECT2 pin      | Data output  |
|------------------|--|
| Open             | PA and PB both sides output possible               |
| V <sub>cc1</sub> | PA side output possible; PB side in high impedance |
| GND1             | PB side output possible; PA side in high impedance |



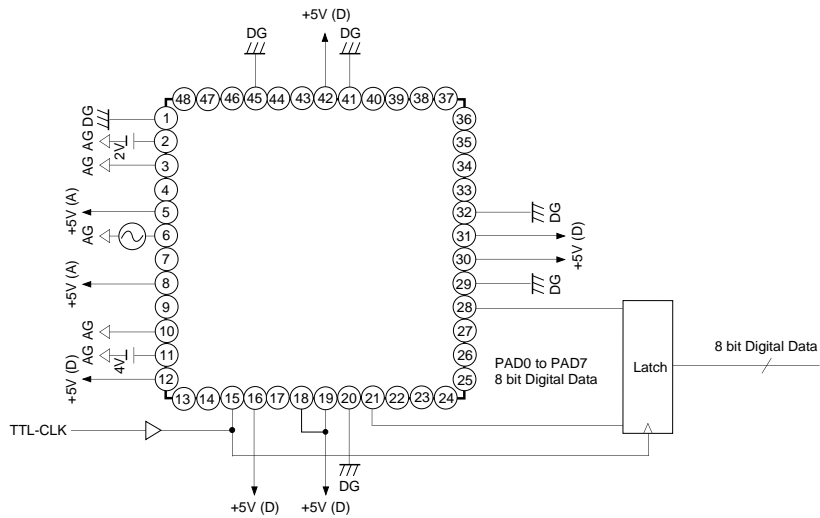
(4) Straight ECL input



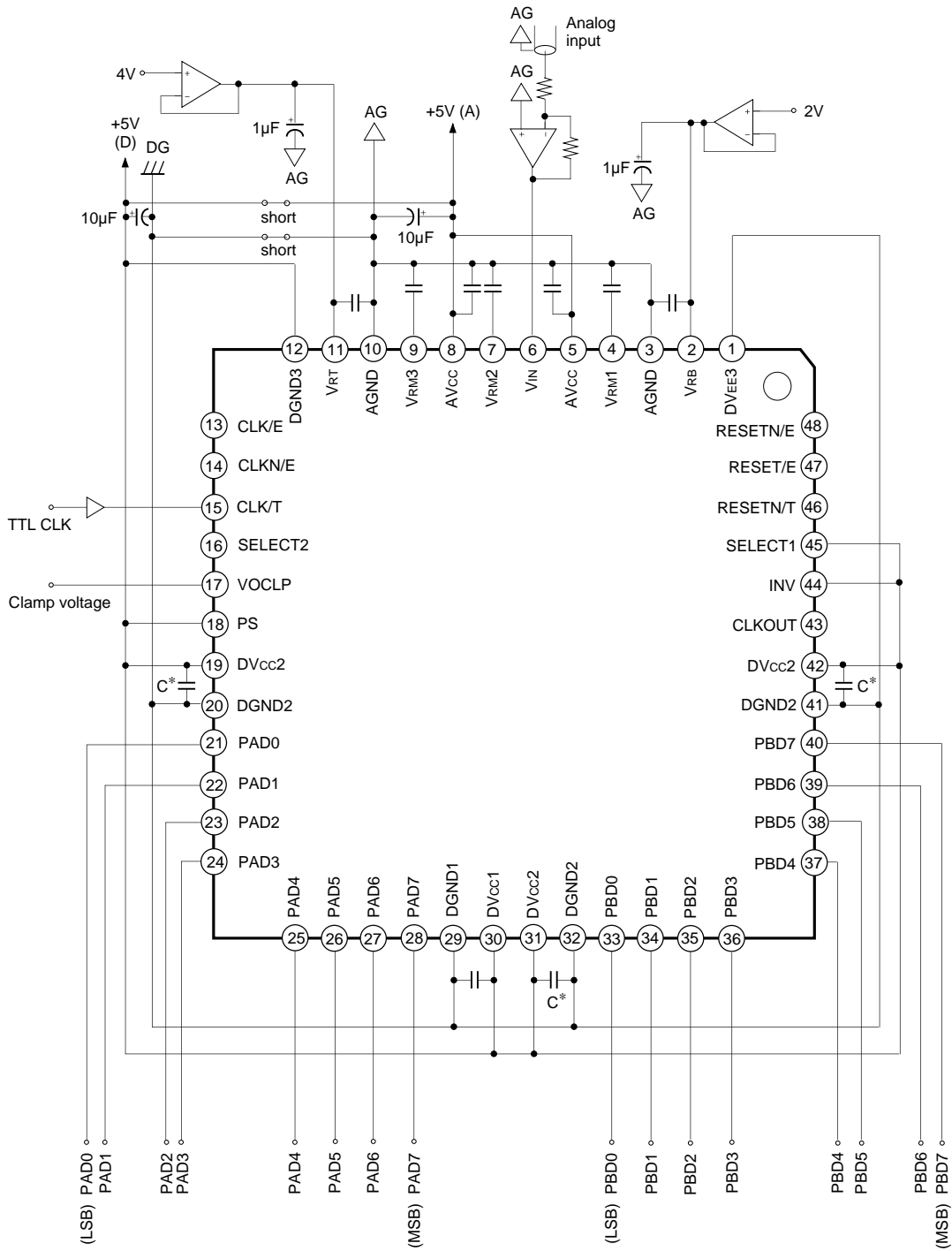
(5) Straight PECL input



(6) Straight TTL input



Application Circuit 2 DMUX Mode TTL I/O (When a single power supply is used)

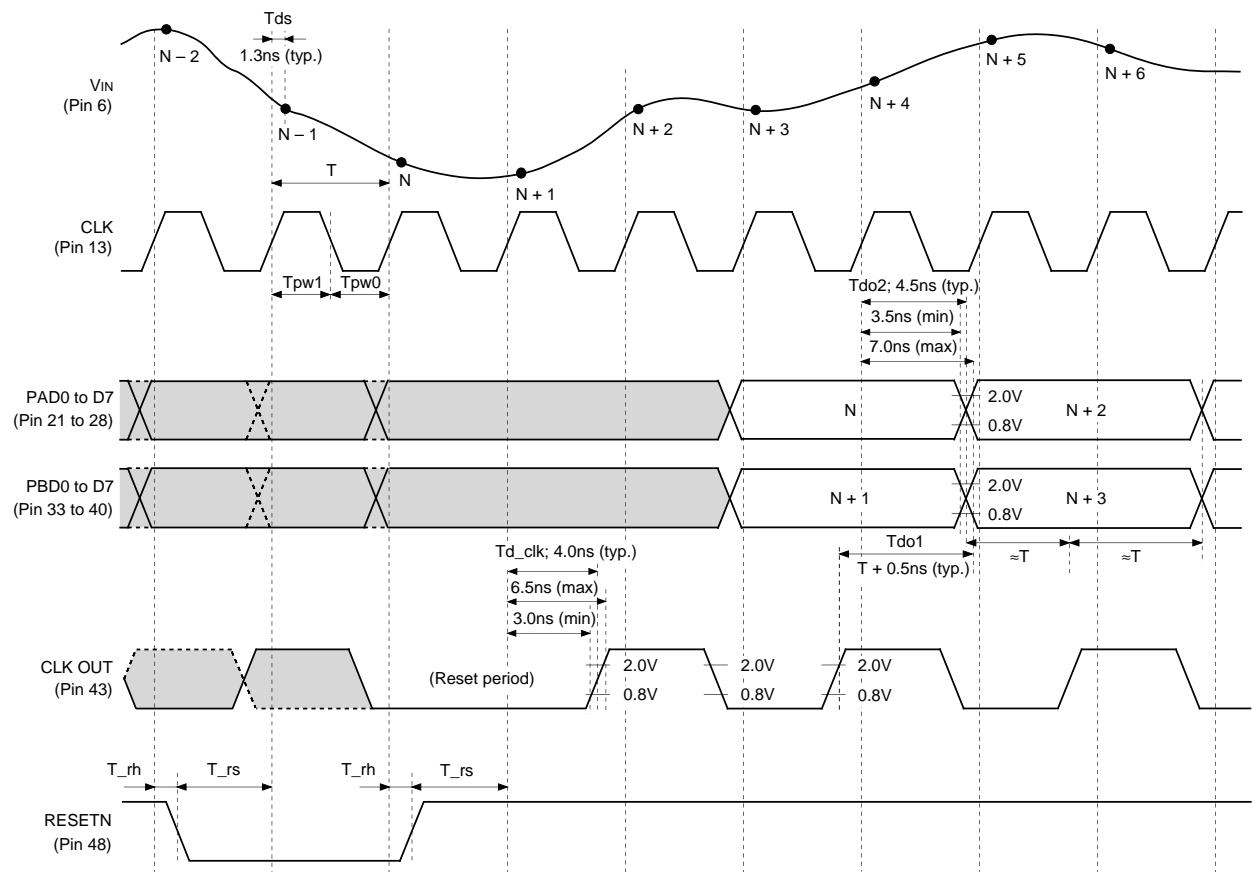


- Short the analog system and digital system at one point immediately under the A/D converter. See the Notes on Operation.
- ||— is the chip capacitor of 0.1µF. Also, C\* is important to suppress the noise generated during the TTL output circuit is operating. Place C\* at the fixed position between the pins with the shortest distance.

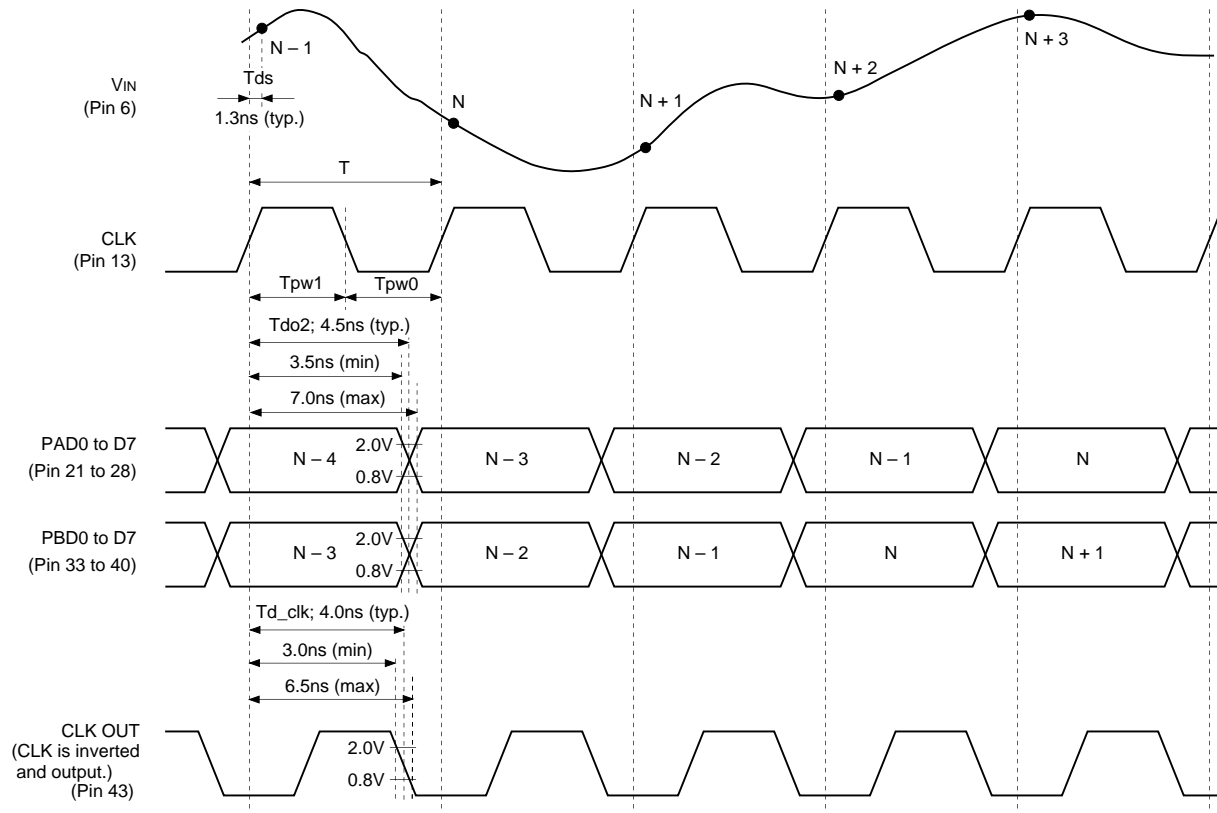
Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.



DMUX Mode Timing Chart (Select = Vcc)



**Straight Mode Timing Chart (Select = GND)**

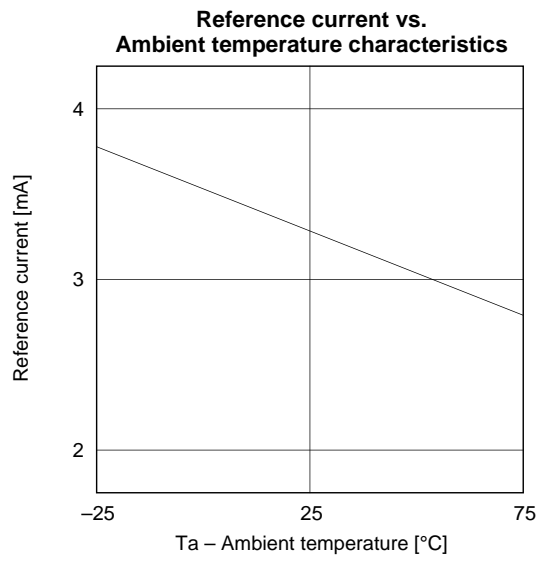
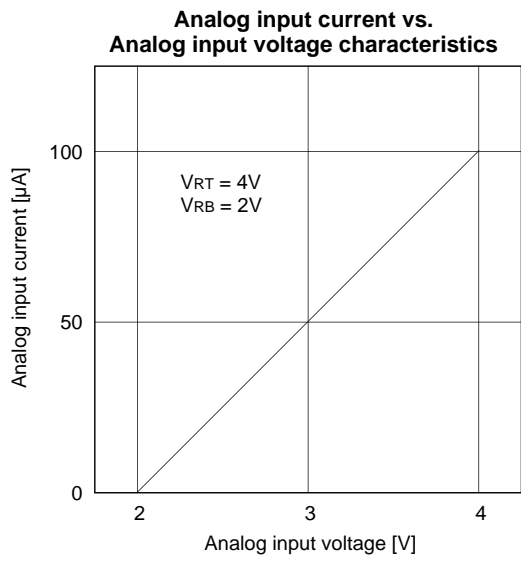
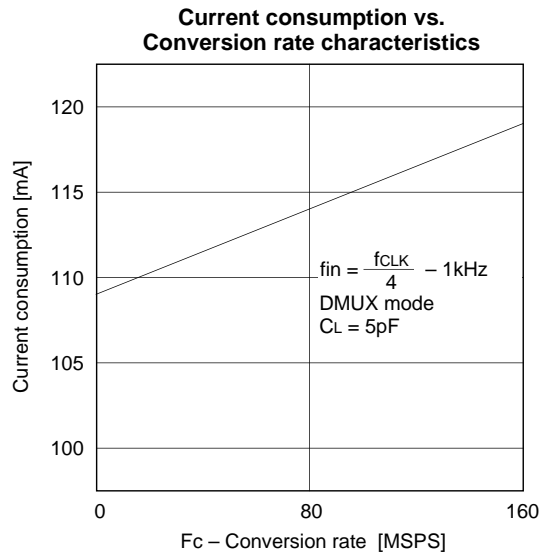
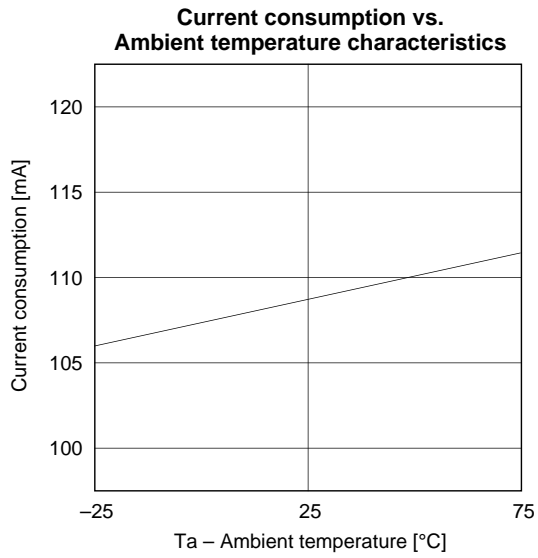


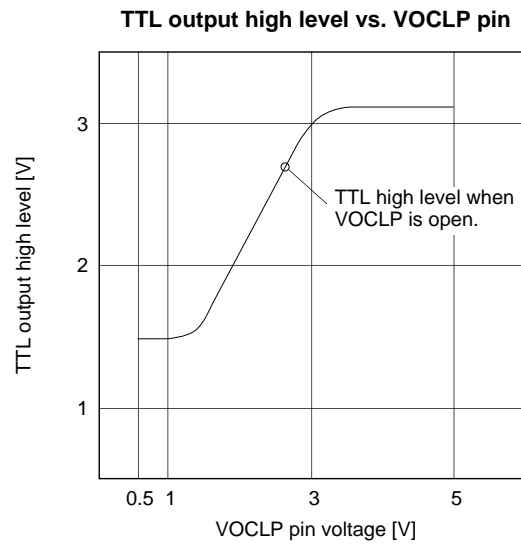
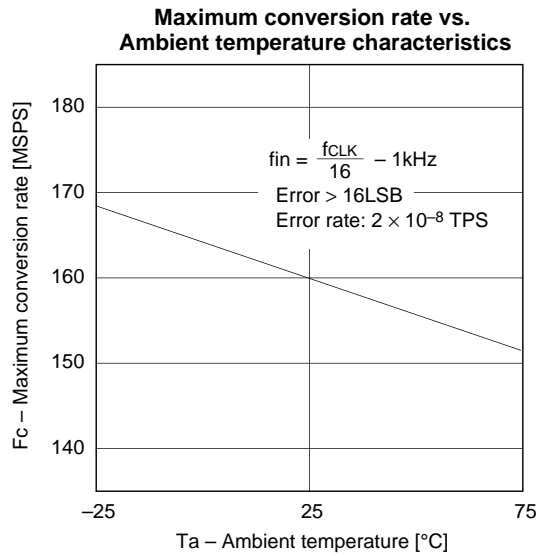
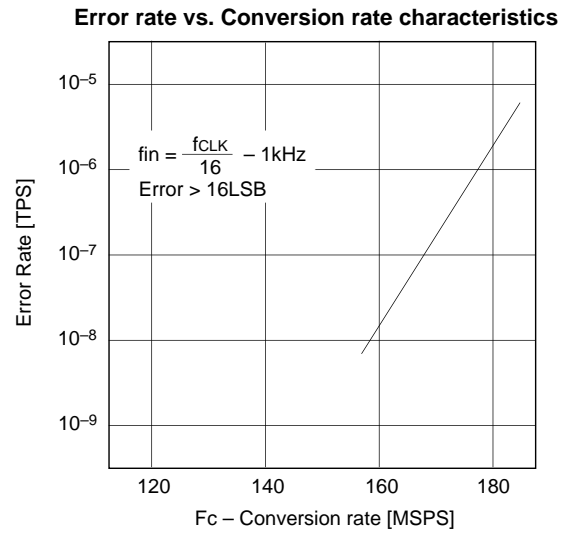
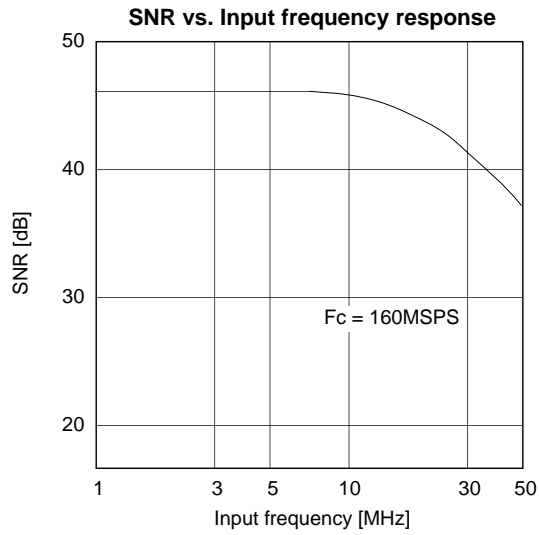
## Notes on Operation

- The CXA3286R has the PECL and TTL input pins for the clock and reset input pins. When the clock is input in PECL level, inputting the reset signal in PECL level is recommended. Also, when the clock is input in TTL level, inputting the reset signal in TTL is recommended.
- The impedance of the input signal should be properly matched to ensure the CXA3286R's stable operation at the high speed.
- The power supply and grounding have a profound influence on converter performance. The power supply and grounding method are particularly important during high-speed operation. General points for caution are as follows.
  - The ground pattern should be as large as possible. It is recommended to make the power supply and ground patterns wider at an inner layer using a multi-layer board.
  - To prevent interference between AGND and DGND and between AVcc and DVcc, make sure the respective patterns are separated. To prevent a DC offset in the power supply pattern, connect the AVcc and DVcc lines at one point each via a ferrite-bead filter, etc. Shorting the AGND and DGND patterns in one place immediately under the A/D converter improves A/D converter performance.
  - Be sure to turn the analog and digital power supplies on simultaneously. If not simultaneously, the IC does not operate correctly.
  - Ground the power supply pins (AVcc, DVcc1, DVcc2, DV<sub>EE3</sub>) as close to each pin as possible with a 0.1 $\mu$ F or larger ceramic chip capacitor.  
(Connect the AVcc pin to the AGND pattern and the DVcc1, DVcc2 and DV<sub>EE3</sub> pins to the DGND pattern.)
  - It is recommended to place the ceramic chip capacitor of 0.1 $\mu$ F or more, in particular, between DVcc2 and DGND2 with the shortest distance. This has the effect to suppress the noise generated when the CXA3286R TTL output circuit operates.
  - The digital output wiring should be as short as possible. If the digital output wiring is long, the wiring capacitance will increase, deteriorating the output slew rate and resulting in reflection to the output waveform since the original output slew rate is quite fast.
- The analog input pin V<sub>IN</sub> has an input capacitance of approximately 10pF. To drive the A/D converter with the proper frequency response, it is necessary to prevent performance deterioration due to parasitic capacitance or parasitic inductance by using a large capacity drive circuit, keeping wiring as short as possible, and using chip parts for resistors and capacitors, etc.
- The V<sub>RT</sub> and V<sub>RB</sub> pins must have adequate by-pass to protect them from high-frequency noise. By-pass them to AGND with approximately 1 $\mu$ F tantalum capacitor and 0.1 $\mu$ F chip capacitor as short as possible.
- If the CLKN/E pin is not used, by-pass this pin to DGND with an approximately 0.1 $\mu$ F capacitor. At this time, approximately DGND3 – 1.2V voltage is generated. However, this is not recommended for use as the threshold voltage V<sub>BB</sub> because it is too weak.

- When the digital input level is ECL or PECL level, **\*\*\***/E pins should be used and **\*\*\***/T pins left open. When the digital input level is TTL, **\*\*\***/T pins should be used and **\*\*\***/E pins left open.
- The CXA3286R TTL output high level is clamped to approximately 2.8 V in the IC. This makes it possible to directly interface with the 3.3V system CMOS IC. However, the CXA3286R has the VOCLP pin which is used to clamp the TTL output high level. See the Example of Representative Characteristics for the relationship between the VOCLP pin and the TTL high level.
- The CXA3026AQ has the output pins P1\*\* and P2\*\*. However, in the CXA3286R, these symbols are changed as PA\*\* and PB\*\*. At this time, the P1 side of the CXA3026AQ is changed to the PB side for the CXA3286R; the P2 side of the CXA3026AQ to the PA side for the CXA3286R.
- The pipeline delay of the CXA3286R is smaller by one clock, compared to that of CXA3026AQ.

Example of Representative Characteristics

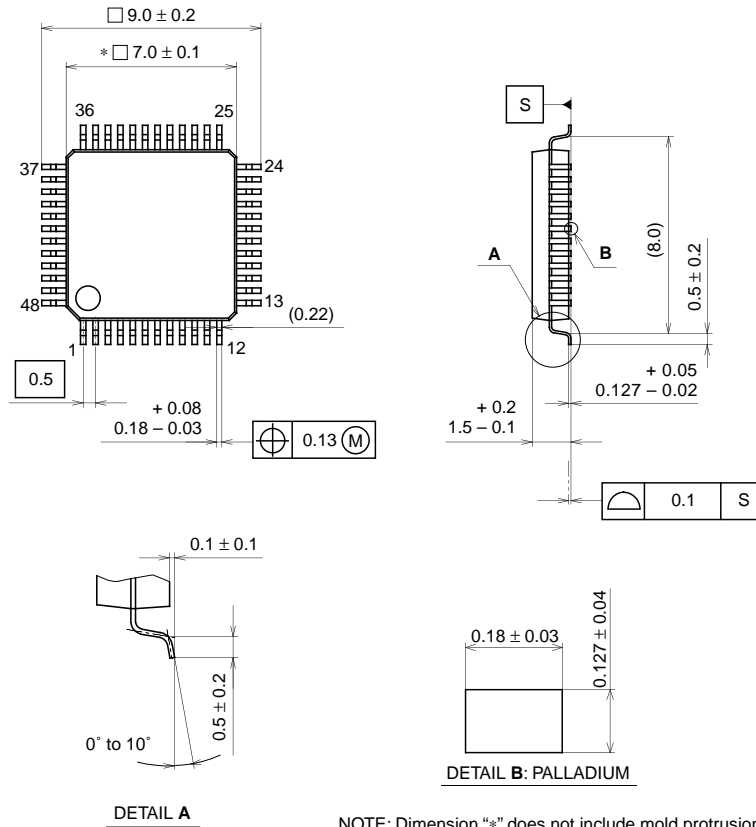




Package Outline

Unit: mm

48PIN LQFP (PLASTIC)



NOTE: Dimension "\*" does not include mold protrusion.

PACKAGE STRUCTURE

|            |                  |
|------------|------------------|
| SONY CODE  | LQFP-48P-L01     |
| EIAJ CODE  | P-LQFP48-7x7-0.5 |
| JEDEC CODE | —                |

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