

HD151TS302ARP

Spread Spectrum Clock for EMI Solution

HITACHI

ADE-205-690D (Z)

Preliminary
Rev.4
Dec. 2002

Description

The HD151TS302A is a high-performance Spread Spectrum Clock modulator. It is suitable for low EMI solution.

Features

- Supports 10 MHz to 60 MHz operation. (Designed for XIN = 24 MHz and 48 MHz)
- 1 copy of clock out with spread spectrum modulation @3.3 V
- 1 copy of reference clock @3.3 V
- Programmable spread spectrum modulation (−0.5%, −1.0%, −3.0% down spread modulation and spread spectrum disable mode.)
- SOP-8pin
- Pin to pin compatible with HD151TS302RP

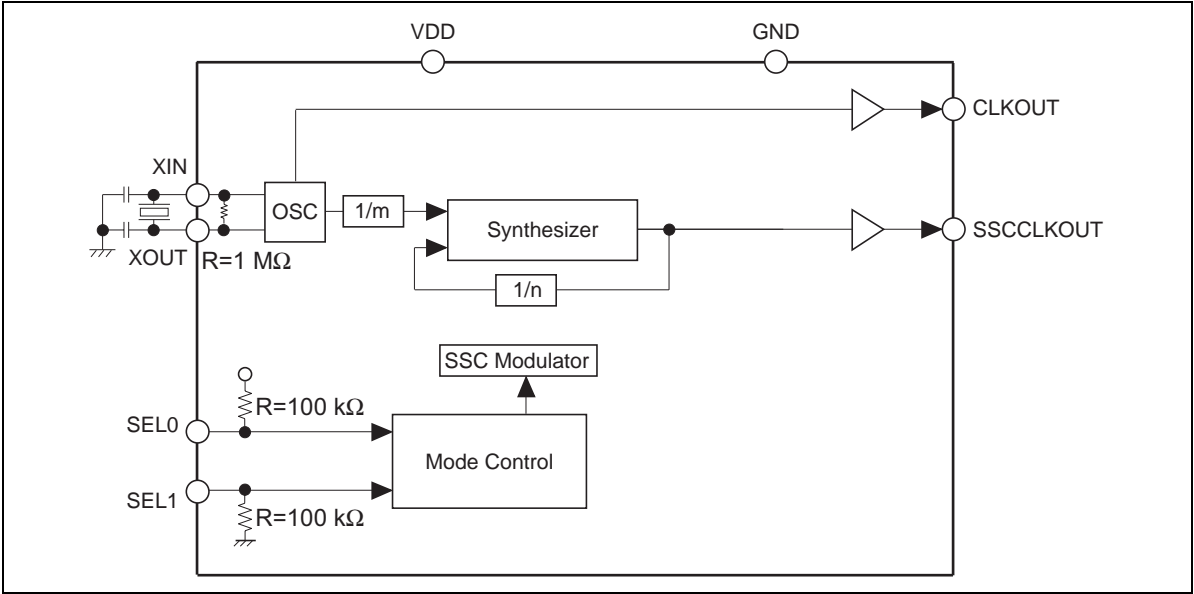
Key Specifications

- Supply voltages : VDD = 3.3 V \pm 0.165 V
- Ta = 0 to 70°C operating range
- Clock output duty cycle = 50 \pm 5%
- Cycle to cycle jitter = \pm 250 ps typ.
- Output slew rate = 0.8V/ns min.
- Ordering Information

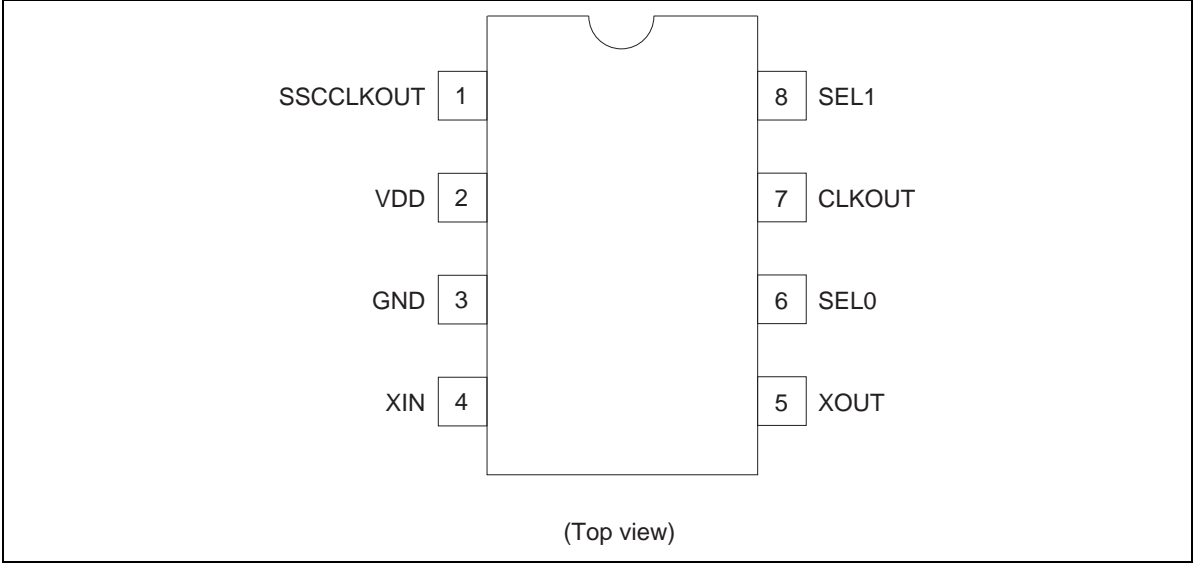
| Part Name | Package Type | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|-----------------|-------------------|--------------|----------------------|--------------------------------|
| HD151TS302ARPEL | SOP-8 pin (JEDEC) | FP-8DC | RP | EL (2,500 pcs / Reel) |

Note: Please consult the sales office for the above package availability.

Block Diagram



Pin Arrangement



SSC Function Table

| SEL1 :0 | Spread Percentage |
|---------|-------------------|
| 0 0 | −1.0% |
| 0 1 | −3.0% |
| 1 0 | SSC OFF |
| 1 1 | −0.5% |

Note: −3.0% SSC is selected for default by internal pull-up & down resistors.

Clock Frequency Table

| XIN(MHz) | SSCCLKOUT(MHz) | CLKOUT(MHz) |
|----------|------------------|------------------|
| 48 | 48 ^{*1} | 48 ^{*2} |
| 24 | 24 ^{*1} | 24 ^{*2} |

Notes: 1. With spread spectrum modulation.
2. Without spread spectrum modulation.

Pin Descriptions

| Pin name | No. | Type | Description |
|-----------|-----|--------|---|
| GND | 3 | Ground | GND pin |
| VDD | 2 | Power | Power supplies pin. Normally 3.3 V. |
| CLKOUT | 7 | Output | Normally 3.3 V reference clock output. |
| SSCCLKOUT | 1 | Output | Spread spectrum modulated clock output. |
| XIN | 4 | Input | Oscillator input. |
| XOUT | 5 | Output | Oscillator output. |
| SEL0 | 6 | Input | SSC mode select pin. LVCMOS level input. Pull-up by internal resistor. (100 kΩ). |
| SEL1 | 8 | Input | SSC mode select pin. LVCMOS level input. Pull-down by internal resistor (100 kΩ). |

Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Conditions |
|--|------------------|-----------------|------|---------------------------|
| Supply voltage | VDD | −0.5 to 4.6 | V | |
| Input voltage | V _I | −0.5 to 4.6 | V | |
| Output voltage ^{*1} | V _O | −0.5 to VDD+0.5 | V | |
| Input clamp current | I _{IK} | −50 | mA | V _I < 0 |
| Output clamp current | I _{OK} | −50 | mA | V _O < 0 |
| Continuous output current | I _O | ±50 | mA | V _O = 0 to VDD |
| Maximum power dissipation at Ta = 55°C (in still air) | | 0.7 | W | |
| Storage temperature | T _{stg} | −65 to +150 | °C | |

Notes: Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

Recommended Operating Conditions

| Item | Symbol | Min | Typ | Max | Unit | Conditions |
|--------------------------|-----------------|-------|-----|---------|------|------------|
| Supply voltage | VDD | 3.135 | 3.3 | 3.465 | V | |
| DC input signal voltage | | −0.3 | — | VDD+0.3 | V | |
| High level input voltage | V _{IH} | 2.0 | — | VDD+0.3 | V | |
| Low level input voltage | V _{IL} | −0.3 | — | 0.8 | V | |
| Operating temperature | T _a | 0 | — | 70 | °C | |
| Input clock duty cycle | | 45 | 50 | 55 | % | |

DC Electrical Characteristics

Ta = 0 to 70°C, VDD = 3.3 V \pm 5%

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|--------------------|-----------------|-----|-----|-----------|---------|---|
| Input low voltage | V _{IL} | — | — | 0.8 | V | |
| Input high voltage | V _{IH} | 2.0 | — | — | V | |
| Input current | I _I | — | — | \pm 10 | μ A | V _I = 0 V or 3.465 V, VDD = 3.465 V, XIN pin |
| | | — | — | \pm 100 | | V _I = 0 V or 3.465 V, VDD = 3.465 V, SEL0, SEL1 pins |
| Input capacitance | C _I | — | — | 4 | pF | SEL0, SEL1 |
| Operating current | | — | 7 | — | mA | XIN = 24 MHz, C _L = 0 pF, VDD = 3.3 V |

DC Electrical Characteristics / Clock Output & SSC Clock Output

Ta = 0 to 70°C, VDD = 3.3 V \pm 5%

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions |
|------------------------------|-----------------|-----|-----|-----|------|--------------------------------------|
| Output voltage | V _{OH} | 3.1 | — | — | V | I _{OH} = -1 mA, VDD = 3.3 V |
| | V _{OL} | — | — | 50 | mV | I _{OL} = 1 mA, VDD = 3.3 V |
| Output current* ¹ | I _{OH} | — | -30 | — | mA | V _{OH} = 1.5 V |
| | I _{OL} | — | 30 | — | | V _{OL} = 1.5 V |

Note: 1. Parameters are target of design. Not 100% tested in production.

AC Electrical Characteristics / Clock Output & SSC Clock Output

Ta = 25°C, VDD = 3.3 V, CL = 15 pF

| Item | Symbol | Min | Typ | Max | Unit | Test Conditions | Notes |
|--|------------------|------|-----|------|------|-------------------------------|------------------------------------|
| Cycle to cycle jitter ^{*1, 2} | t _{ccs} | — | 250 | 300 | ps | SSCCLKOUT, 24 MHz | SSCOFF SEL1:0 = 10 Fig1 |
| | | — | 250 | 300 | | SSCCLKOUT, 48 MHz | |
| | | — | 250 | 300 | | SSCCLKOUT, 24 MHz | SSC = -0.5% SEL1:0 = 11 Fig1 |
| | | — | 250 | 300 | | SSCCLKOUT, 48 MHz | |
| | | — | 250 | 300 | | SSCCLKOUT, 24 MHz | SSC = -3.0% SEL1:0 = 01 Fig1 |
| | | — | 250 | 300 | | SSCCLKOUT, 48 MHz | |
| | | — | 250 | 300 | | CLKOUT, 24 MHz & 48 MHz | Fig1 |
| | | — | 250 | 300 | | | |
| Output frequency ^{*1, 2} | | 23.8 | — | 24.2 | MHz | SSCCLKOUT, XIN = 24 MHz | SSCOFF SEL1:0 = 10 |
| | | 47.3 | — | 48.7 | | SSCCLKOUT, XIN = 48 MHz | |
| | | 23.7 | — | 24.2 | | SSCCLKOUT, XIN = 24 MHz | SSC = -0.5% SEL1:0 = 11 |
| | | 47.0 | — | 48.7 | | SSCCLKOUT, XIN = 48 MHz | |
| | | 23.1 | — | 24.2 | | SSCCLKOUT, XIN = 24 MHz | SSC = -3.0% SEL1:0 = 01 |
| | | 45.9 | — | 48.7 | | SSCCLKOUT, XIN = 48 MHz | |
| | | 23.8 | — | 24.2 | | CLKOUT, 24 MHz | |
| | | 47.3 | — | 48.7 | | CLKOUT, 48 MHz | |
| Slew rate ^{*1} | t _{SL} | 0.8 | — | — | V/ns | @48 MHz CLKOUT | 0.4 V to 2.4 V |
| Clock duty cycle ^{*1} | | 45 | 50 | 55 | % | | |
| Output impedance ^{*1} | | — | 40 | — | Ω | | |
| Spread spectrum modulation frequency ^{*1} | | — | 33 | — | KHz | @48 MHz SSCCLKOUT | |
| Input clock frequency | | 10 | — | 60 | MHz | | |
| Stabilization time ^{*1, 3} | | — | — | 2 | ms | | |

Notes: 1. Parameters are target of design. Not 100% tested in production.
2. Cycle to cycle jitter and output frequency are included spread spectrum modulation.
3. Stabilization time is the time required for the integrated circuit to obtain phase lock of its input signal after power up.

Application Information

1. Recommended Circuit Configuration

The power supply circuit of the optimal performance on the application of a system should refer to Fig. 2.

VDD decoupling is important to both reduce Jitter and EMI radiation.

The C1 decoupling capacitor should be placed as close to the VDD pin as possible, otherwise the increased trace inductance will negate its decoupling capability.

The C2 decoupling capacitor shown should be a tantalum type.

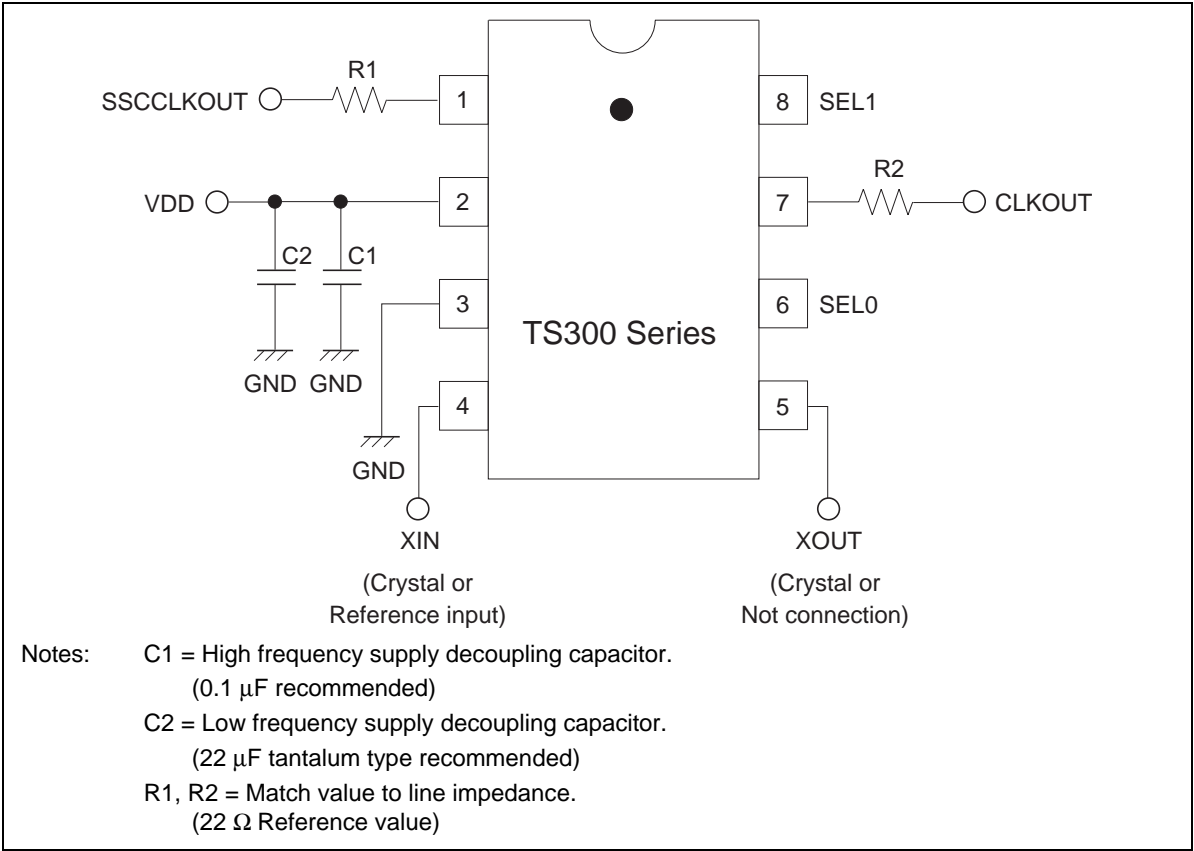


Figure 2 Recommended circuit configuration

2. Example Board Layout Configuration

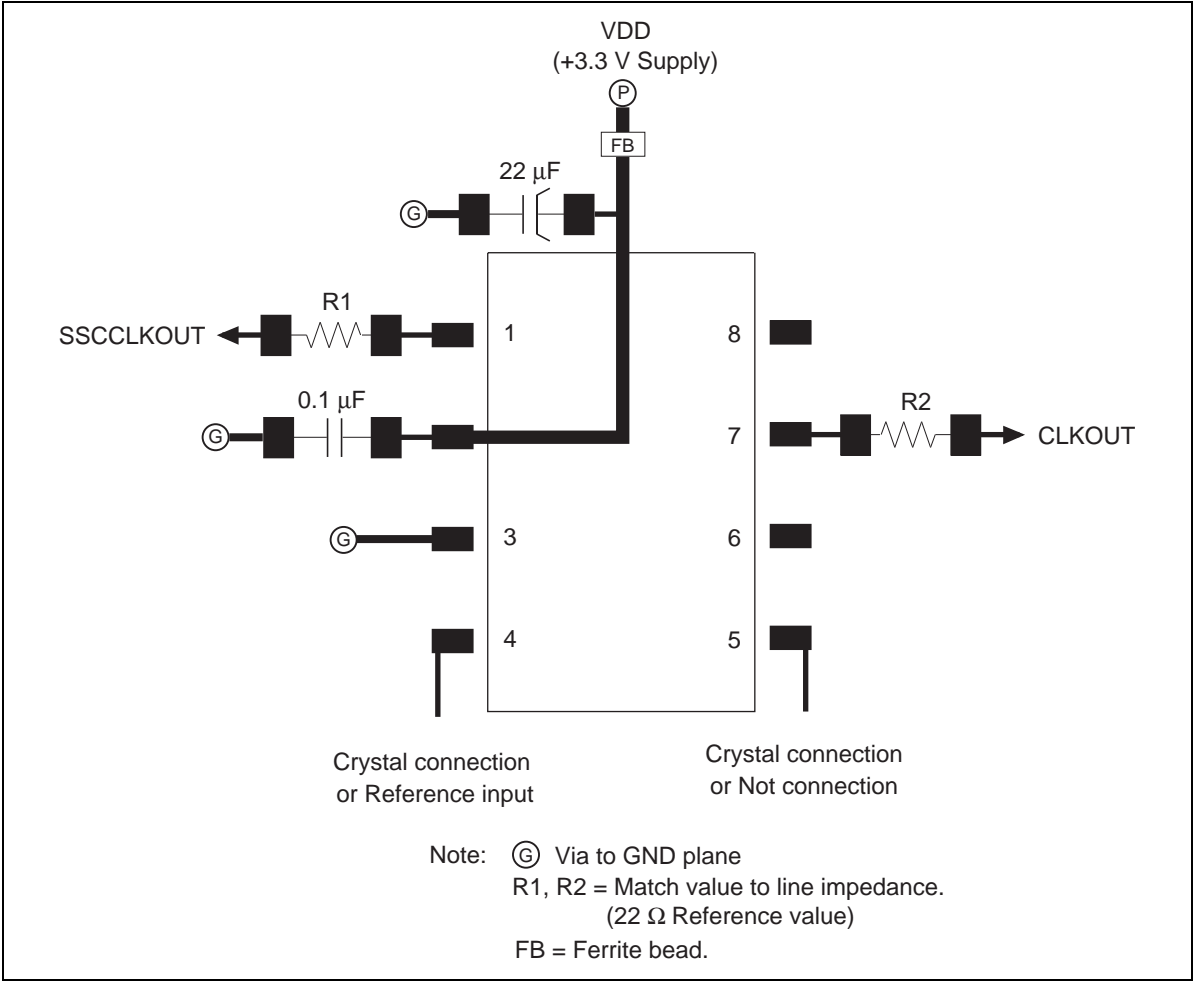


Figure 3 Example Board Layout

3. Example of TS300 EMI Solution IC's Application

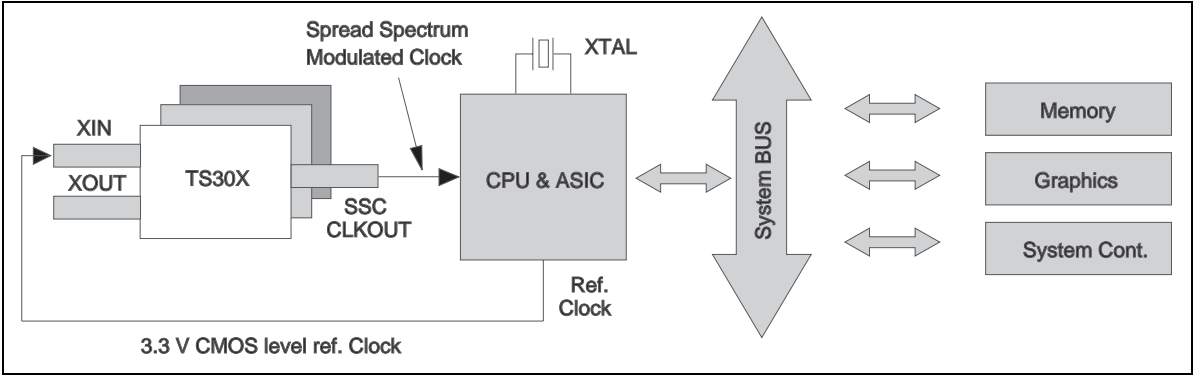


Fig 4 Ref. Clock Input Example

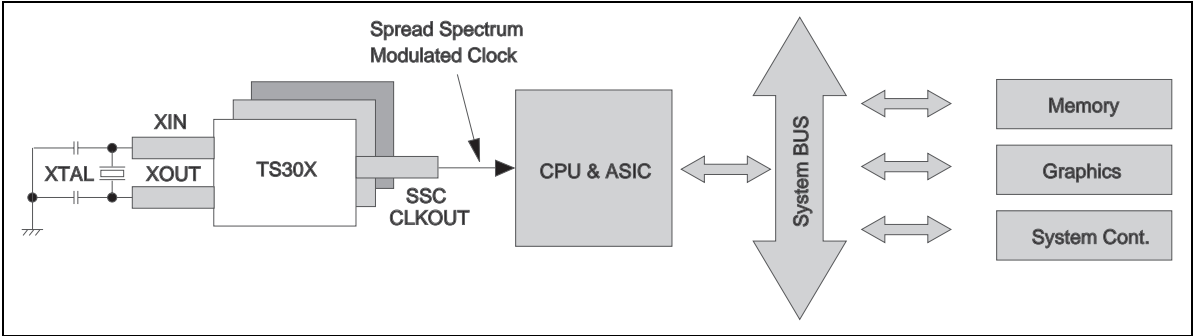
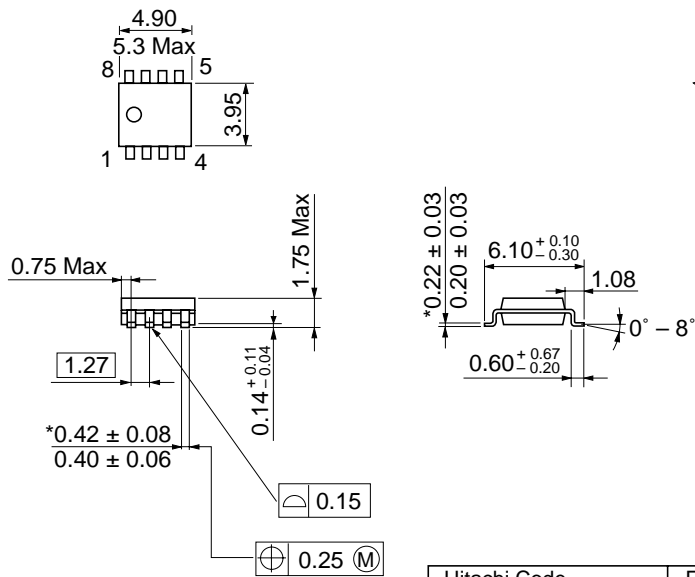


Fig 5 XTAL Ref. Clock Input Example

Package Dimensions

As of July, 2002
Unit: mm



*Dimension including the plating thickness
Base material dimension

| | |
|------------------------|----------|
| Hitachi Code | FP-8DC |
| JEDEC | Conforms |
| JEITA | — |
| Mass (reference value) | 0.085 g |

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