# XC25BS5 Series

## PLL Clock Generator ICs with Built-In Divider/Multiplier Circuits (For Low Frequency Range)

## ■GENERAL DESCRIPTION

The XC25BS5 series are high frequency, low power consumption PLL clock generator ICs with divider circuit & multiplier PLL circuit.
Laser trimming gives the option of being able to select from divider ratios (M) of 1,3 to 2047 and multiplier ratios (N) of 6 to 2047.
Output frequency (Q0) is equal to reference oscillation (fCLKin) multiplied by N/M, within a range of 3MHz to 30MHz. Q1 output is selectable from input reference frequency (f0), input reference frequency/2 (f0/2), ground (GND), and comparative frequency (f0/M). Further, comparative frequencies, within a range of 12KHz to 500KHz, can be obtained by dividing the reference oscillation. By halting operation via the CE pin, consumption current can be controlled and output will be one of high-impedance.

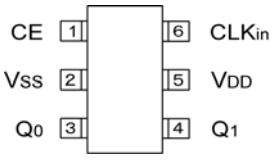
## ■APPLICATIONS

- ●Crystal oscillation modules
- ●Personal computers
- ●PDAs
- ●Portable audio systems
- ●Various system clocks

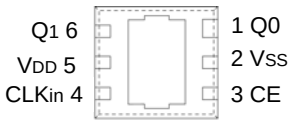
## ■FEATURES

**Output Frequency** : 3MHz ~ 30MHz (Q0=fCLKin×N/M)
**Input Frequency (fCLKin)**
: 12kHz ~ 35MHz
**Divider Ratio (M)** : Selectable from divisions of 1, 3~2047
**Multiplier Ratio (N)** : Selectable from multiplications of 6~2047
**Output** : 3-State
Q1 output selectable from input reference oscillation, input reference oscillation/2, GND, comparative frequency.
**Operating Voltage Range**
: 2.97V ~ 5.5V
**Low Power Consumption**
: CMOS (stand-by function included)*1
**Comparative Frequency**
: 12kHz~500kHz
**Package** : SOT-26, USP-6B
*1 High output impedance during standby
**Environmentally Friendly**: EU RoHS Compliant, Pb Free

## ■PIN CONFIGURATION



SOT-26
(TOP VIEW)



USP-6B
(BOTTOM VIEW)

*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release.
If the pad needs to be connected to other pins, it should be connected to the VDD pin.

## ■PIN ASSIGNMENT

| PIN NUMBER | | PIN NAME | FUNCTION |
|---|---|---|---|
| SOT-26 | USP-6B | | |
| 1 | 3 | CE | Chip Enable |
| 2 | 2 | VSS | GND |
| 3 | 1 | Q0 | PLL Output |
| 4 | 6 | Q1 | Reference Oscillation, Reference Oscillation/2, GND, or Comparative Frequency Output |
| 5 | 5 | VDD | Power Supply |
| 6 | 4 | CLKin | Reference Clock Input |

## ■FUNCTION LIST

| C E | FUNCTION |
|---|---|
| "H" | Q0, Q1 Clock Output |
| "L" | Stand-by. Output Pin = High Impedance |
| Open | Stand-by. Output Pin = High Impedance (VSS Pin Pull-Down Due to IC's Internal Resistor) |

"H" = High level
"L" = Low level

## ■PRODUCT CLASSIFICATION

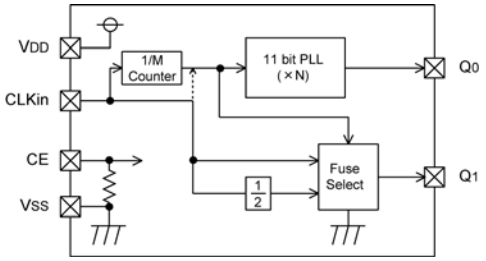
●Ordering Information

XC25BS5①②③④⑤-⑥(*1)

| DESIGNATOR | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| ①②③ | Product Number | Integer | Based on internal standards<br>e.g. Product number 001 → ①②③ = 001 |
| ④⑤-⑥ | Packages<br>Taping Type (*2) | MR | SOT-26 |
| | | MR-G | SOT-26 |
| | | DR | USP-6B |
| | | DR-G | USP-6B |

(*1) The "-G" suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.
(*2) The device orientation is fixed in its embossed tape pocket. For reverse orientation, please contact your local Torex sales office or representative. (Standard orientation: ④R-⑥, Reverse orientation: ④L-⑥)

## ■ BLOCK DIAGRAM




## ■ ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

| PARAMETER | | SYMBOL | CONDITIONS | UNITS |
|---|---|---|---|---|
| Supply Voltage | | $V_{DD}$ | $V_{SS}$-0.3 ~ $V_{SS}$+7.0 | V |
| CLKin Pin Voltage | | $V_{CK}$ | $V_{SS}$-0.3 ~ $V_{DD}$+0.3 | V |
| CE Pin Voltage | | $V_{CE}$ | $V_{SS}$-0.3 ~ $V_{DD}$+0.3 | V |
| Q0 Pin Voltage | | $V_{Q0}$ | $V_{SS}$-0.3 ~ $V_{DD}$+0.3 | V |
| Q1 Pin Voltage | | $V_{Q1}$ | $V_{SS}$-0.3 ~ $V_{DD}$+0.3 | V |
| Q0 Output Current | | $I_{Q0}$ | ±50 | mA |
| Q0 Output Current | | $I_{Q1}$ | ±50 | mA |
| Power Dissipation | SOT-26 | Pd | 150 | mW |
| | USP-6B | | 100 | |
| Operating Temperature Range | | Topr | - 30 ~ + 80 | ℃ |
| Storage Temperature Range | | Tstg | - 40 ~ +125 | ℃ |

# ■ FREQUENCY CONFIGURATION: EXAMPLE 1

XC25BS51XXMR

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|
| Input Frequency | f CLKin | 11.0000 | - | 16.9344 | MHz |
| Multiplier/Divider Ratio | N/M | - | 1.594 | - | - |
| PLL Output Frequency | fQ0 | 17.5383 | - | 27.0000 | MHz |
| Q1 Output Frequency | Q1 | GND | | | - |

● Electrical Characteristics (DC)

XC25BS51xxMR

fCLKin = 16.9344MHz, Multiplier/Divider Ratio = 1.594, Ta = 25℃, No Load

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | 2.97 | 3.30 | 3.63 | V |
| Input Voltage "High" | $V_{IH}$ | | 2.7 | - | - | V |
| Input Voltage "Low" | $V_{IL}$ | | - | - | 0.6 | V |
| Input Current "High" | $I_{IH}$ | $V_{CK}$ = 3.3V | - | - | 3.0 | μA |
| Input Current "Low" | $I_{IL}$ | $V_{CK}$ = 0V | -3.0 | - | - | μA |
| Output Voltage "High" | $V_{OH}$ | $V_{DD}$ = 2.97V, $I_{OH}$ = -8mA | 2.5 | - | - | V |
| Output Voltage "Low" | $V_{OL}$ | $V_{DD}$ = 2.97V, $I_{OL}$ = 8mA | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | CE = 3.3V | - | 3.0 | 6.0 | mA |
| Supply Current 2 | $I_{DD2}$ | CE = 0V | - | - | 5.0 | μA |
| CE "High" Voltage | $V_{CEH}$ | | 2.7 | - | - | V |
| CE "Low" Voltage | $V_{CEL}$ | | - | - | 0.45 | V |
| CE Pull-Down Resistance 1 | Rp1 | CE = 3.3V | 0.5 | 1.5 | 2.5 | MΩ |
| CE Pull-Down Resistance 2 | Rp2 | CE = 0.3V | 20.0 | 50.0 | 80.0 | kΩ |

● Electrical Characteristics (AC)

XC25BS51xxMR

fCLKin=16.9344MHz, Multiplier/Divider Ratio=1.594, Ta=25℃, CL=15pF

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Output Rise Time | $T_{TLH}$ | $V_{DD}$=3.3V(20% to 80%) (*1) | - | 5.0 | - | ns |
| Output Fall Time | $T_{THL}$ | $V_{DD}$=3.3V(20% to 80%) (*1) | - | 5.0 | - | ns |
| Duty Ratio | DUTY | | 40 | 50 | 60 | % |
| Output Start Time | Ton | (*1) | - | - | 20 | ms |
| PLL Output Jitter | Tj | 1σ (*1) | - | 40 | - | ps |

*1 R&D guarantee

## ■ FREQUENCY CONFIGURATION: EXAMPLE 2

XC25BS51XXMX

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|
| Input Frequency | f CLKin | 52.0000 | - | 78.0000 | kHz |
| Multiplier/Divider Ratio | N/M | - | 256.000 | - | - |
| PLL Output Frequency | fQ0 | 13.312 | - | 19.968 | MHz |
| Q1 Output Frequency | Q1 | GND | | | - |

●Electrical Characteristics (DC)

XC25BS51xxMR

fCLKin=78kHz, Multiplier/Divider Ratio=256, Ta=25℃, No Load

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | 2.97 | 3.30 | 3.63 | V |
| Input Voltage "High" | $V_{IH}$ | | 2.7 | - | - | V |
| Input Voltage "Low" | $V_{IL}$ | | - | - | 0.6 | V |
| Input Current "High" | $I_{IH}$ | $V_{CK}$=3.3V | - | - | 3.0 | μA |
| Input Current "Low" | $I_{IL}$ | $V_{CK}$=0V | -3.0 | - | - | μA |
| Output Voltage "High" | $V_{OH}$ | $V_{DD}$=2.97V, $I_{OH}$= - 8mA | 2.5 | - | - | V |
| Output Voltage "Low" | $V_{OL}$ | $V_{DD}$=2.97V, $I_{OL}$=8mA | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | CE=0.3V | - | 2.0 | 4.0 | mA |
| Supply Current 2 | $I_{DD2}$ | CE=0V | - | - | 5.0 | μA |
| CE " High " Voltage | $V_{CEH}$ | | 2.7 | - | - | V |
| CE "Low" Voltage | $V_{CEL}$ | | - | - | 0.45 | V |
| CE Pull-Down Resistance 1 | Rp1 | CE=3.3V | 0.5 | 1.5 | 2.5 | MΩ |
| CE Pull-Down Resistance 2 | Rp2 | CE=0.3V | 20.0 | 50.0 | 80.0 | KΩ |

● Electrical Characteristics (AC)

XC25BS51xxMR

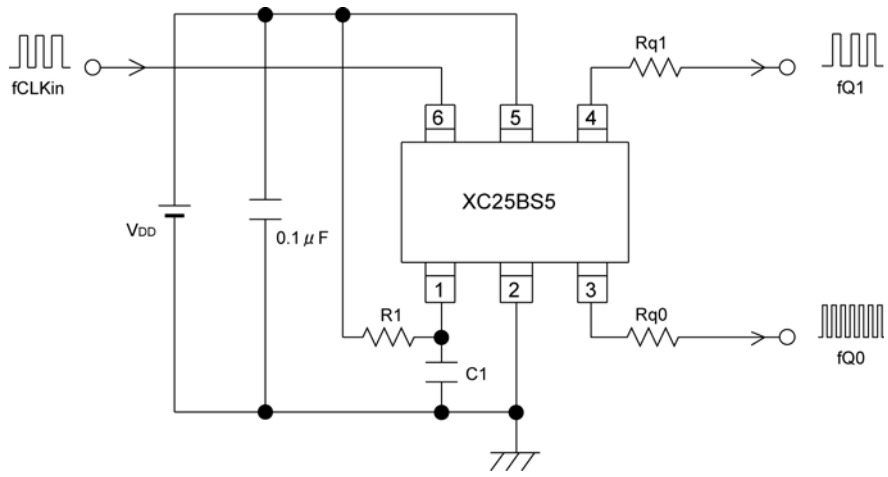
fCLKin=78kHz, Multiplier/Divider Ratio=256, Ta=25℃, CL=15pF

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Output Rise Time | $T_{TLH}$ | $V_{DD}$=3.3V(20% to 80%) (*1) | - | 5.0 | - | ns |
| Output Fall Time | $T_{THL}$ | $V_{DD}$=3.3V(20% to 80%) (*1) | - | 5.0 | - | ns |
| Duty Ratio | DUTY | | 40 | 50 | 60 | % |
| Output Start Time | Ton | (*1) | - | - | 20 | ms |
| PLL Output Jitter | Tj | 1σ (*1) | - | 20 | - | ps |

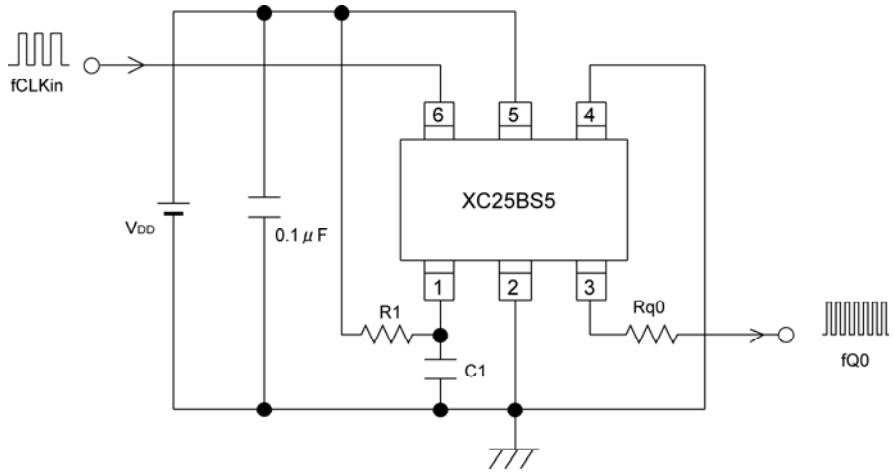
*1 R&D guarantee

## ■TYPICAL APPLICATION CIRCUITS

① Q1 Pin - reference oscillation, reference oscillation/2, comparative frequency




② Q1 Pin - GND

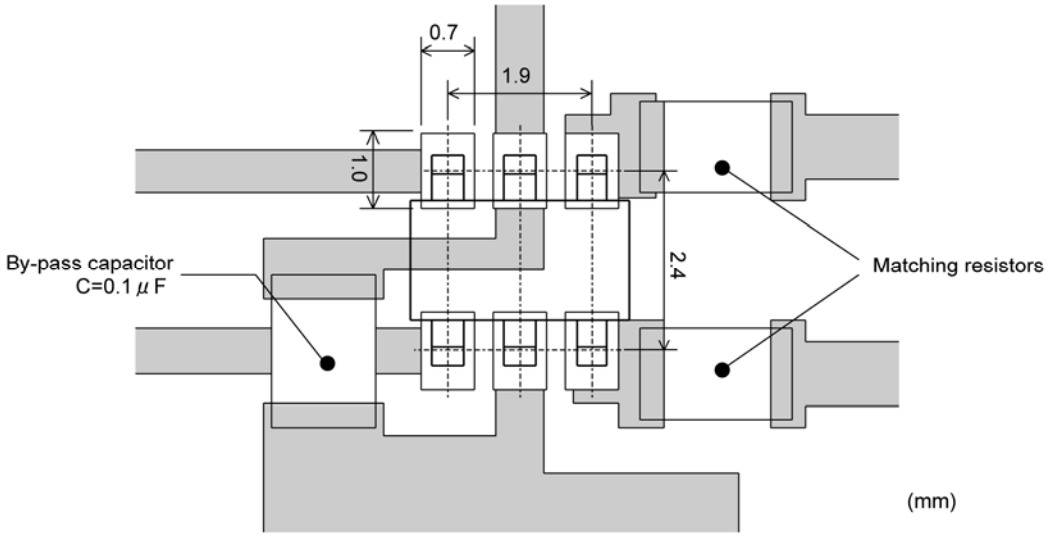



## ■NOTE

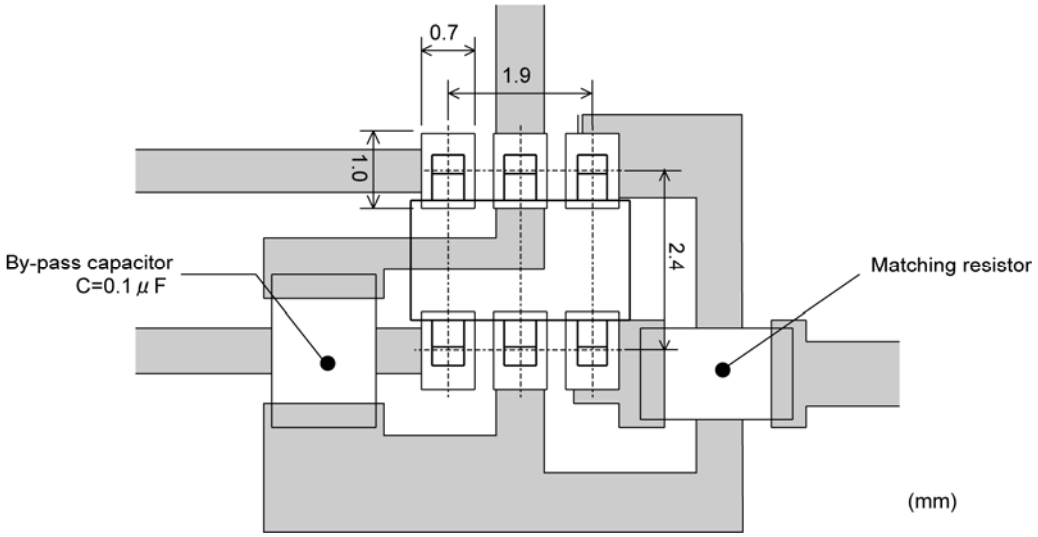
(1) Please insert a by-pass capacitor of 0.1μF.
(2) Rq0 and Rq1 are matching resistors. Their use is recommended in order to counter unwanted radiations.
(3) Please place a by-pass capacitor and matching resistors as close to the IC as possible. It may be that the output cannot be locked if the by-pass capacitor is not close enough to the IC. Further, there is a possibility of unwanted radiation occurrence between the resistor and the IC pin if the matching resistor is not close enough to the IC.
(4) When selecting GND for the Q1 pin, although the output of Q1 pin is GND level, it is also recommended that the Q1 pin be connected to GND pattern on the PCB.
(5) When the CE pin is not controlled by external signals, it is recommended that a time constant circuit of R1=1kΩ ×C1 = 0.1μF be added for stability.
(6) With this IC, output is achieved by dividing and multiplying the reference oscillation by means of the PLL circuit. In cases where this output is further used as a reference oscillation of another PLL circuit, it may be that the final output signal's jitter increases, so all necessary precautions should be taken to avoid this.
(7) It is recommended that a low noise power supply, such as a series regulator, be used for the supply voltage. Using a power supply such as a switching regulator might lead to a larger jitter, which in turn may lead to an inability to lock due to the ripple of the switching regulator.
(8) As for this IC, synchronization of input and output signal's edge is not guaranteed though the input frequency operates to the output frequency multiply.

## ■REFERENCE LAND PATTERN

① Q1 Pin - reference oscillation, reference oscillation/2, comparative frequency

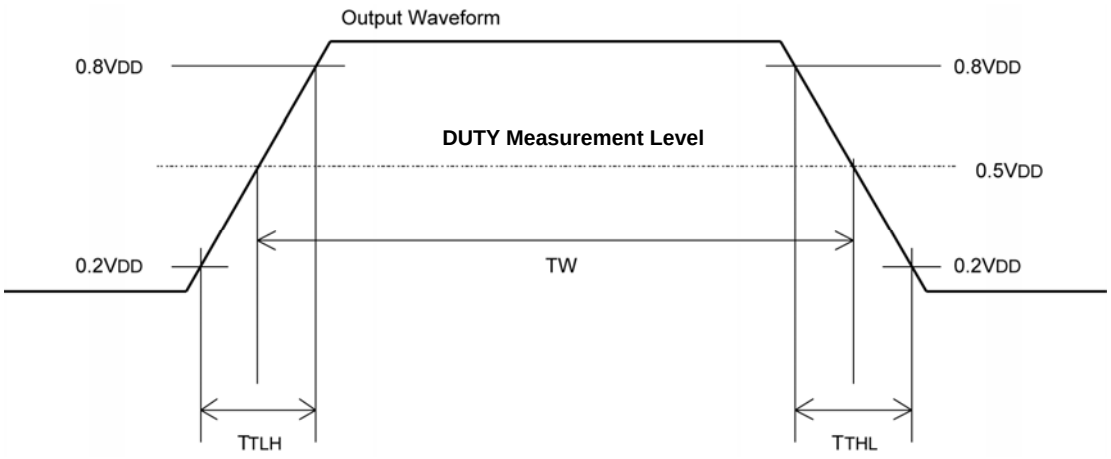



② Q1 Pin - GND

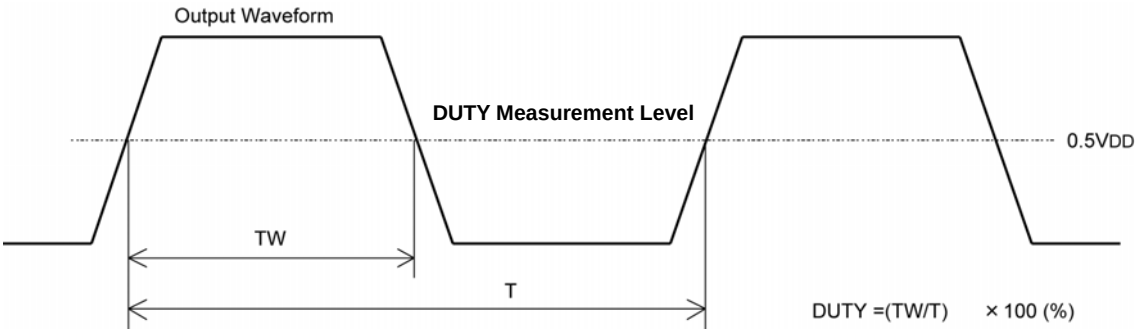


# ■AC CHARACTERISTIC WAVEFORMS

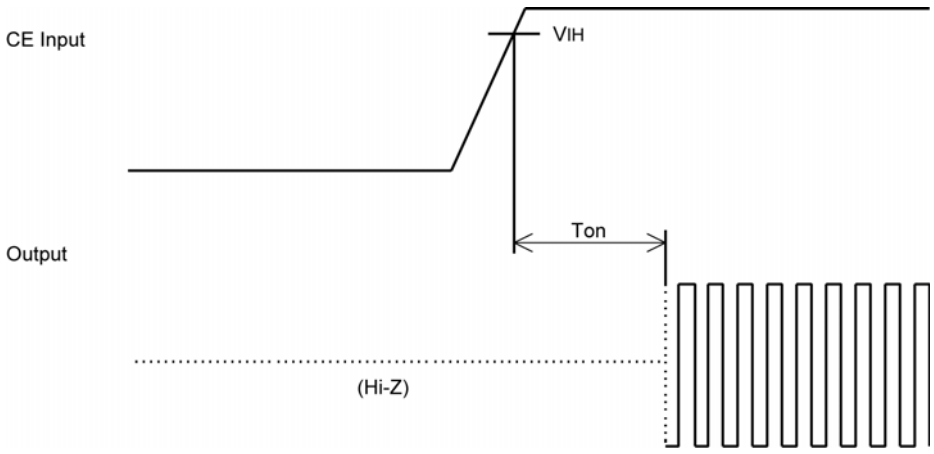
1) Output Rise Time / Output Fall Time




2) Duty Ratio

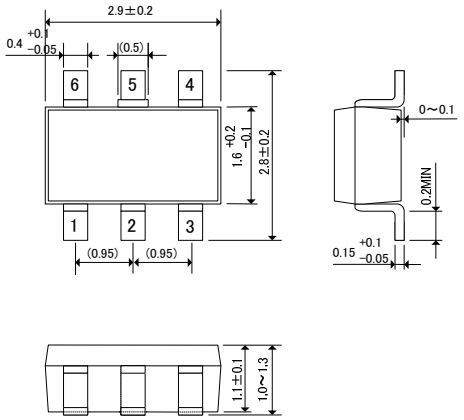



3) Output Start Time

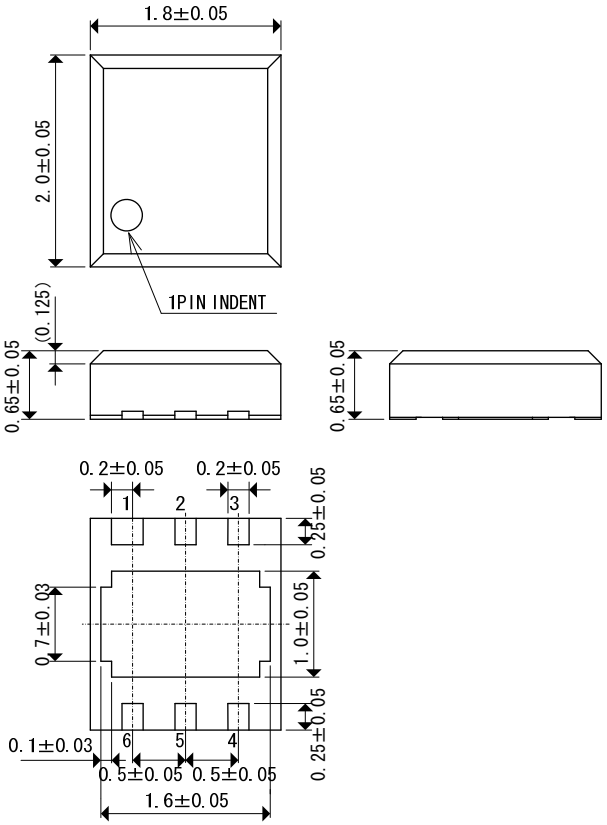


## ■PACKAGING INFORMATION

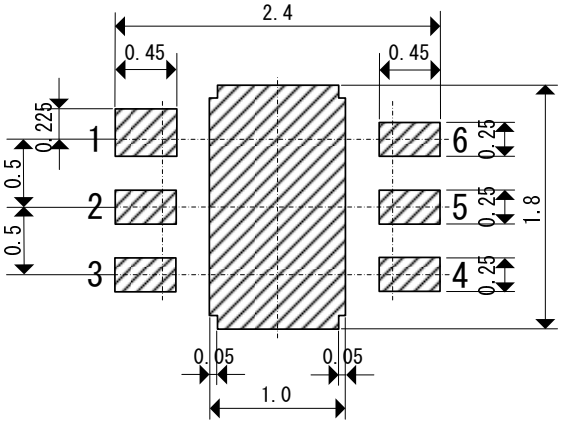
●SOT-26



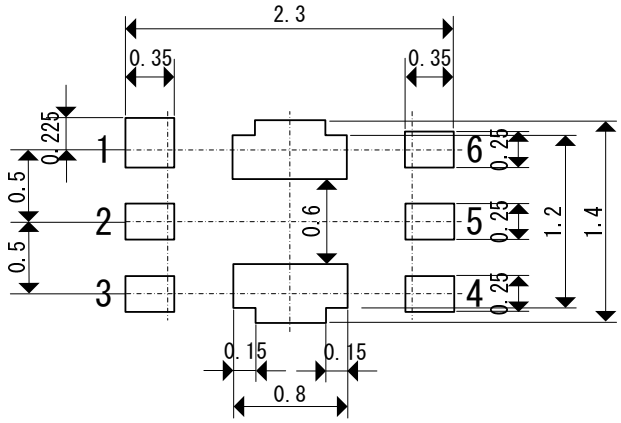

●USP-6B




●USP-6B Reference Pattern Layout

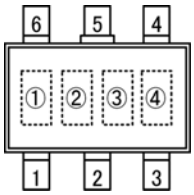



●USP-6B Reference Metal Mask Design



# ■ MARKING RULE

●SOT-26




SOT-26
(TOP VIEW)

●XC25BS50

①② represents product series

| MARK | | PRODUCT SERIES |
|---|---|---|
| ① | ② | |
| B | 5 | XC25BS50**M* |

③ represents the 10th digit of product part number

| MARK | PRODUCT SERIES |
|---|---|
| 1 | XC25BS5001M* |
| 5 | XC25BS5005M* |
| 6 | XC25BS5006M* |

●XC25BS51

① represents product series

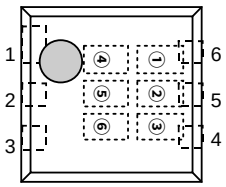
| MARK | PRODUCT SERIES |
|---|---|
| 5 | XC25BS51**M* |

②③ represents the 9th and 10th digits of product part number

| MARK | | PRODUCT SERIES |
|---|---|---|
| ② | ③ | |
| 0 | 7 | XC25BS5107M* |

④ represents production lot number
0 to 9,A to Z reversed character 0 to 9,A to Z repeated (G, I, J, O, Q, W excluded)

●USP-6B




USP-6B
(TOP VIEW)

①,②,③ represents product series

| MARK | | | PRODUCT SERIES |
|---|---|---|---|
| ① | ② | ③ | |
| B | S | 0 | XC25BS50**D* |
| B | S | 1 | XC25BS51**D* |

④⑤ represents the 9th and 10th digit of product part number
Ex)

| MARK | | PRODUCT SERIES |
|---|---|---|
| ④ | ⑤ | |
| 0 | 7 | XC25BS5*07D* |

⑥ represents production lot number
0 to 9,A to Z repeated (G, I, J, O, Q, W excluded)
Note: No character inversion used.

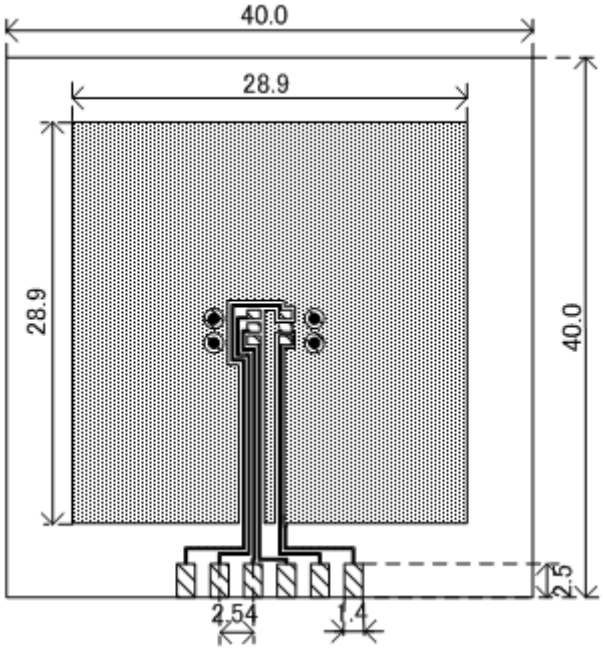
## ■PACKAGING INFORMATION (Continued)

● SOT-26 Power Dissipation

Power dissipation data for the SOT-26 is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead (Pb) free
Board: Dimensions 40 x 40 mm (1600 $mm^2$ in one side)
Copper (Cu) traces occupy 50% of the board area
In top and back faces
Package heat-sink is tied to the copper traces
Material: Glass Epoxy (FR-4)
Thickness: 1.6 mm
Through-hole: 4 x 0.8 Diameter

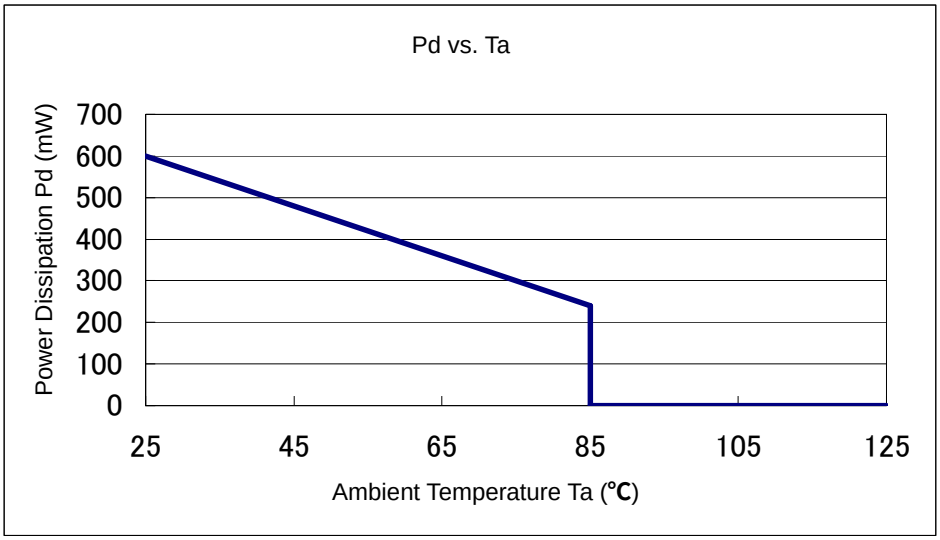



Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 600 | 166.67 |
| 85 | 240 | |



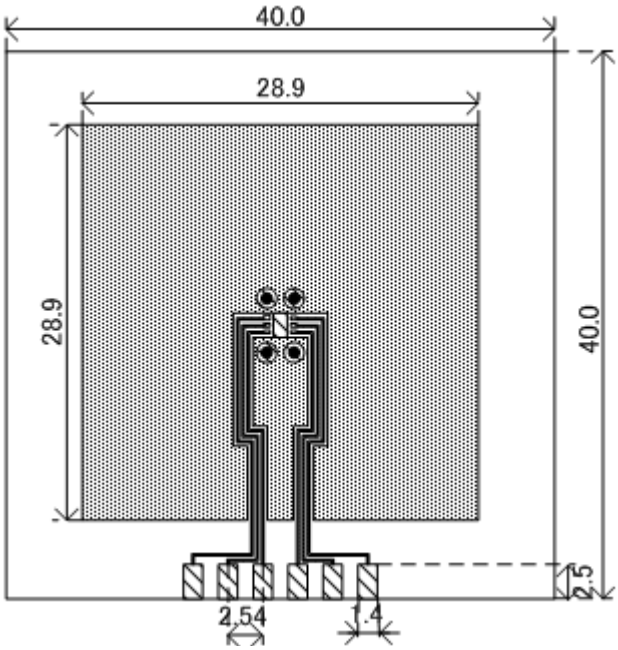
# ■PACKAGING INFORMATION (Continued)

● USP-6B Power Dissipation

Power dissipation data for the USP-6B is shown in this page.
The value of power dissipation varies with the mount board conditions.
Please use this data as one of reference data taken in the described condition.

1. Measurement Condition (Reference data)

Condition: Mount on a board
Ambient: Natural convection
Soldering: Lead (Pb) free
Board: Dimensions 40 x 40 mm (1600 $mm^2$ in one side)
Copper (Cu) traces occupy 50% of the board area
In top and back faces
Package heat-sink is tied to the copper traces
Material: Glass Epoxy (FR-4)
Thickness: 1.6 mm
Through-hole: 4 x 0.8 Diameter

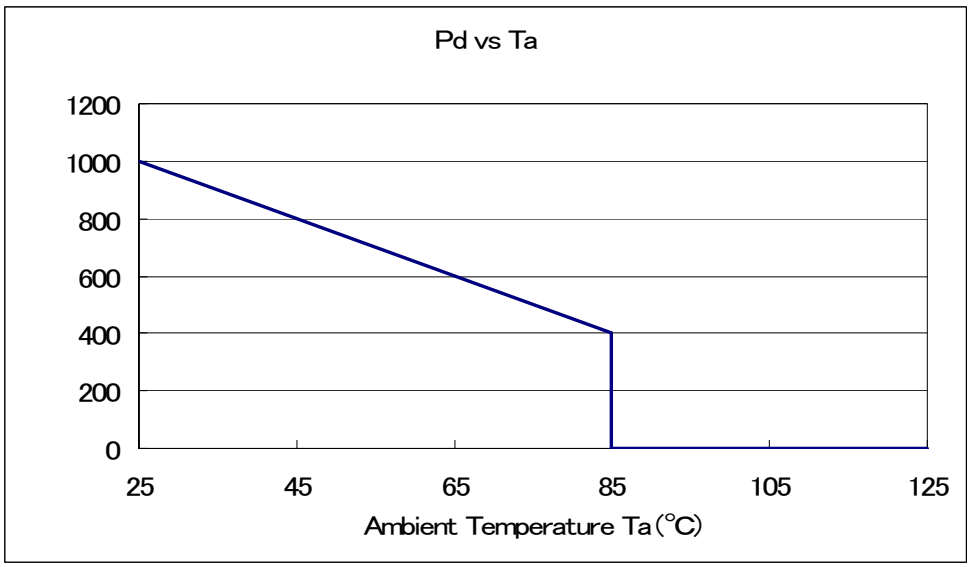


Evaluation Board (Unit: mm)

2. Power Dissipation vs. Ambient Temperature

Board Mount (Tj max = 125℃)

| Ambient Temperature (℃) | Power Dissipation Pd (mW) | Thermal Resistance (℃/W) |
|---|---|---|
| 25 | 1000 | 100.00 |
| 85 | 400 | |



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   Should you wish to use the products under conditions exceeding the specifications, please consult us or our representatives.
6. We assume no responsibility for damage or loss due to abnormal use.
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