

SP10T Antenna Switch Module for 6TRx/2Tx/2Rx with SPI I/F

# CXM3588UR

## Description

The CXM3588UR is a SP10T antenna switch module for GSM/UMTS/CDMA/LTE multi-mode handset. The CXM3588UR has a built-in dual low pass filter and a +1.8 V CMOS compatible decoder with SPI function.

The Sony GaAs junction gate pHEMT (JPHEMT) MMIC process is used for low insertion loss and high linearity. The device has low BOM with no DC blocking Capacitor.

## Features

- ◆ Low Insertion Loss: 0.50 dB (Typ.) TRx (Cellular Band)  
0.70 dB (Typ.) TRx (IMT Tx Band)
- ◆ High Linearity: IIP3=68 dBm
- ◆ Low Voltage Operation: Vdd=2.5 V
- ◆ Supports CMOS control for serial interface
- ◆ No DC Blocking Capacitors except sourcing DC bias
- ◆ Small Package Size: UQFN-26P (2.6 mm x 3.4 mm x 0.625 mm Max.)
- ◆ Lead-Free and RoHS Compliant

## Structure

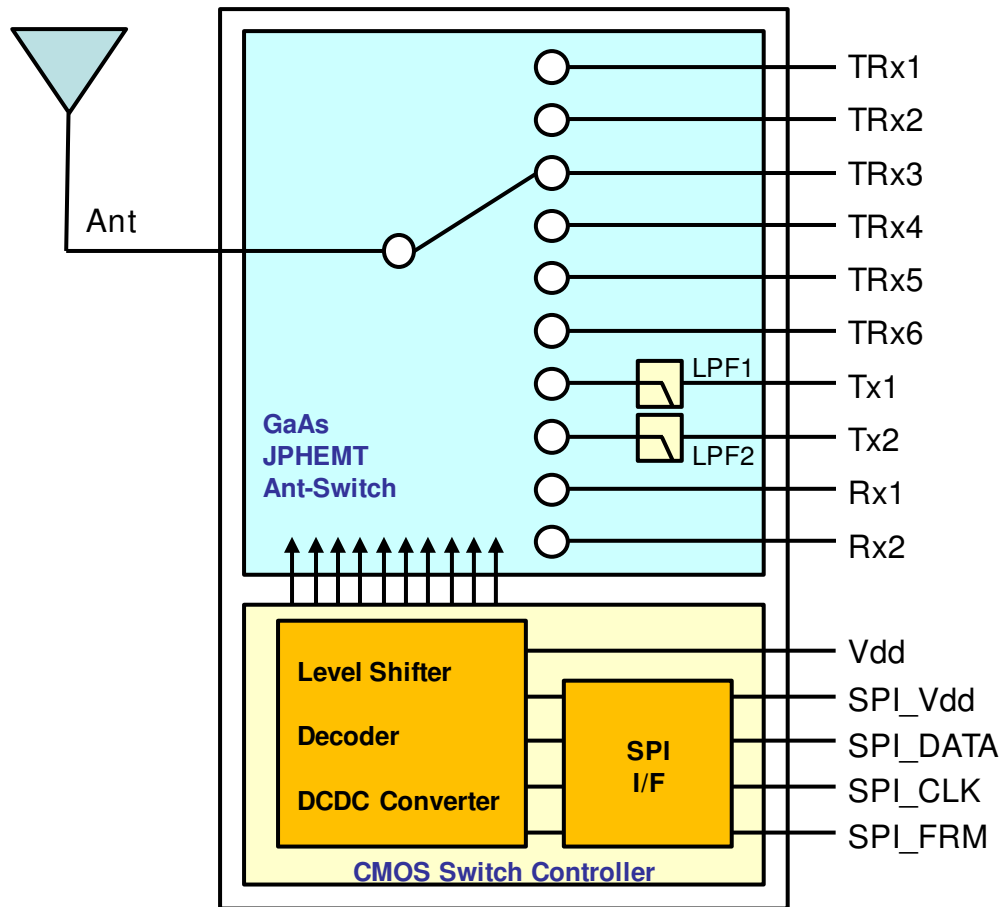
GaAs Junction Gate pHEMT (JPHEMT) MMIC Switch, CMOS Decoder

## Absolute Maximum Ratings

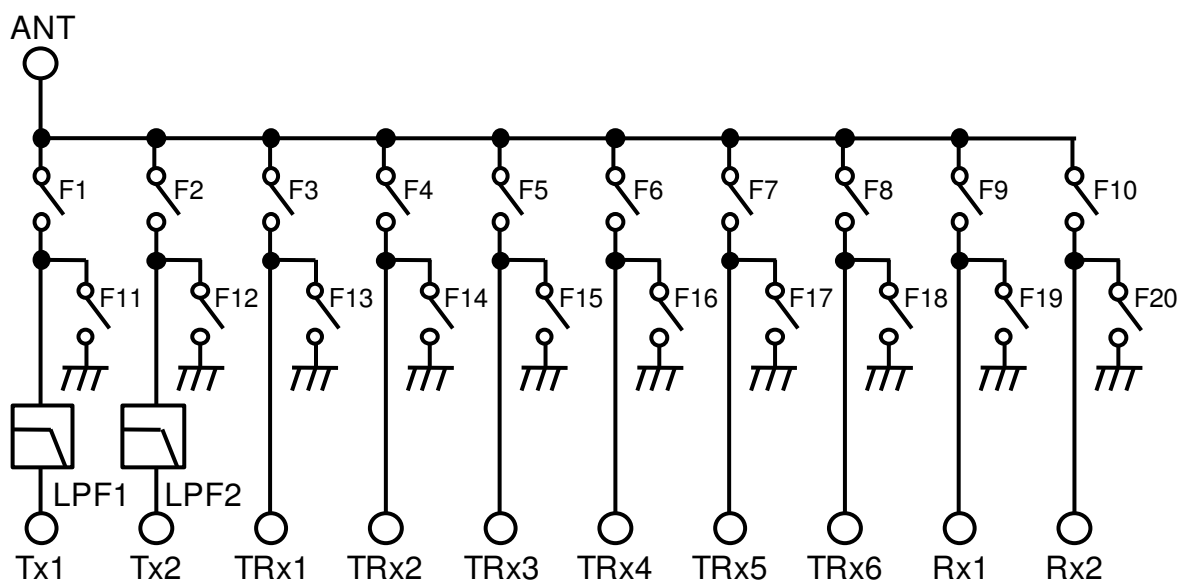
- |                          |                    |                                                 |
|--------------------------|--------------------|-------------------------------------------------|
| ◆ Bias Voltage           | Vdd                | 4 V (Ta = 25 °C)                                |
| ◆ Supply Voltage for SI  | SPI_Vdd            | 3.6 V (Ta=25 °C)                                |
| ◆ Control Voltage for SI | SPI_CLK, FRM, DATA | 3.6 V (Ta = 25 °C)                              |
| ◆ Maximum input power    | [Tx1]              | 36 dBm (Duty cycle = 12.5% to 50%) (Ta = 25 °C) |
|                          | [Tx2]              | 34 dBm (Duty cycle = 12.5% to 50%) (Ta = 25 °C) |
|                          | [TRx]              | 32 dBm (Ta = 25 °C)                             |
|                          | [Rx]               | 13 dBm (Ta = 25 °C)                             |
| ◆ Operating Temperature  |                    | -35 °C to +90 °C                                |
| ◆ Storage Temperature    |                    | -65 °C to +150 °C                               |

This IC is ESD sensitive device. Special handling precautions are required.

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**Block Diagram of SP10T Antenna Switch Module with SPI**

## Block Diagram of SP10T 6TRx/2Tx/2Rx



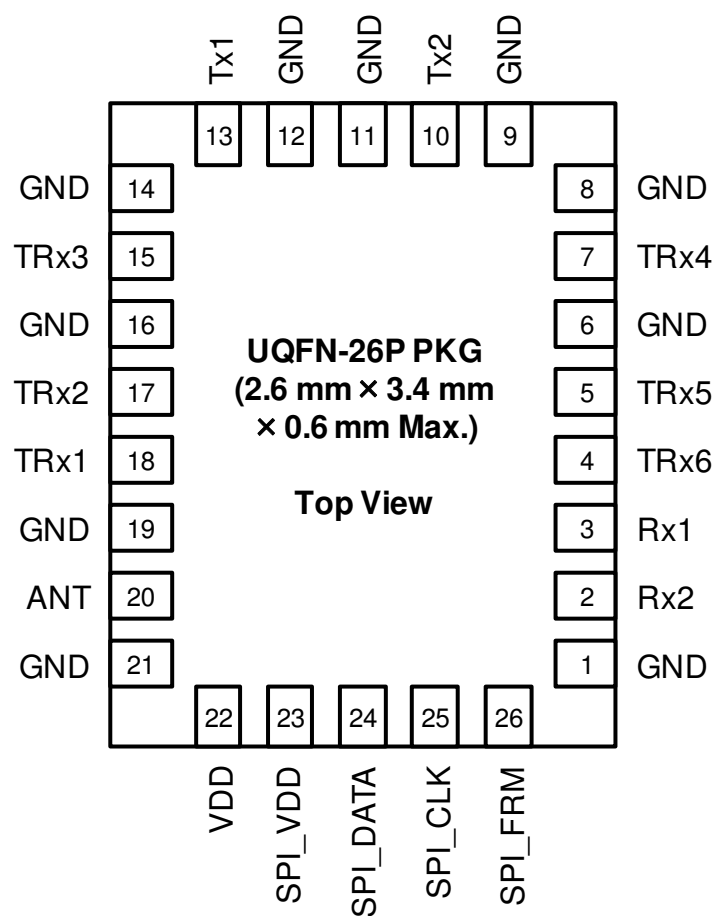
## Truth Table

| State | Active Path | SPI_Bit |     |     |     | SW State(*1) |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |
|-------|-------------|---------|-----|-----|-----|--------------|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|       |             | D14     | D13 | D12 | D11 | F1           | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | F10 | F11 | F12 | F13 | F14 | F15 | F16 | F17 | F18 | F19 | F20 |
| 1     | Tx1         | 0       | 0   | 1   | 0   | H            | L  | L  | L  | L  | L  | L  | L  | L  | L   | L   | H   | H   | H   | H   | H   | H   | H   | H   | H   |
| 2     | Tx2         | 0       | 0   | 0   | 1   | L            | H  | L  | L  | L  | L  | L  | L  | L  | L   | H   | L   | H   | H   | H   | H   | H   | H   | H   | H   |
| 3     | TRx1        | 0       | 1   | 0   | 0   | L            | L  | H  | L  | L  | L  | L  | L  | L  | L   | H   | H   | L   | H   | H   | H   | H   | H   | H   | H   |
| 4     | TRx2        | 0       | 1   | 0   | 1   | L            | L  | L  | H  | L  | L  | L  | L  | L  | L   | H   | H   | H   | L   | H   | H   | H   | H   | H   | H   |
| 5     | TRx3        | 0       | 1   | 1   | 0   | L            | L  | L  | L  | H  | L  | L  | L  | L  | L   | H   | H   | H   | H   | L   | H   | H   | H   | H   | H   |
| 6     | TRx4        | 1       | 0   | 0   | 0   | L            | L  | L  | L  | L  | H  | L  | L  | L  | L   | H   | H   | H   | H   | H   | L   | H   | H   | H   | H   |
| 7     | TRx5        | 1       | 0   | 0   | 1   | L            | L  | L  | L  | L  | L  | H  | L  | L  | L   | H   | H   | H   | H   | H   | H   | L   | H   | H   | H   |
| 8     | TRx6        | 1       | 0   | 1   | 0   | L            | L  | L  | L  | L  | L  | L  | H  | L  | L   | H   | H   | H   | H   | H   | H   | L   | H   | H   | H   |
| 9     | Rx1         | 1       | 1   | 0   | 0   | L            | L  | L  | L  | L  | L  | L  | L  | L  | H   | L   | H   | H   | H   | H   | H   | H   | L   | H   | L   |
| 10    | Rx2         | 1       | 1   | 0   | 1   | L            | L  | L  | L  | L  | L  | L  | L  | L  | H   | H   | H   | H   | H   | H   | H   | H   | L   | L   | H   |
| 11    | Idle(*2)    | 0       | 0   | 0   | 0   | -            | -  | -  | -  | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| 12    | Isolation   | 1       | 1   | 1   | 1   | L            | L  | L  | L  | L  | L  | L  | L  | L  | L   | H   | H   | H   | H   | H   | H   | H   | H   | H   | H   |

(\*1) State "L" means a switch "OFF", State "H" means a switch "ON"

(\*2) State "Idle" means that the DC/DC Converter is "OFF", and the switch paths are in an undefined state.

## Pin Configuration



## DC Bias Conditions

Ta = 25 °C

| Item         | Min.                         | Typ. | Max.                         | Unit |
|--------------|------------------------------|------|------------------------------|------|
| Vdd          | 2.5                          | 2.9  | 3.3                          | V    |
| SPI_Vdd      | 1.35                         | 1.8  | 1.98                         | V    |
| SPI_Vctl (H) | $\text{SPI\_Vdd} \times 0.7$ | —    | $\text{SPI\_Vdd} + 0.3$      | V    |
| SPI_Vctl (L) | -0.3                         | —    | $\text{SPI\_Vdd} \times 0.3$ | V    |

## Electrical Characteristics

Vdd=2.5V , Ta=25 °C

| Item           | Symbol | Path       | Condition  | Min. | Typ. | Max. | Unit |
|----------------|--------|------------|------------|------|------|------|------|
| Insertion Loss | IL     | Ant - TRx1 | *1, *2, *3 | -    | 0.47 | 0.57 | dB   |
|                |        |            | *4         | -    | 0.70 | 0.85 |      |
|                |        |            | *5         | -    | 0.80 | 0.95 |      |
|                |        |            | *6         | -    | 0.90 | 1.10 |      |
|                |        |            | *7         | -    | 1.20 | 1.40 |      |
|                |        | Ant - TRx2 | *1, *2, *3 | -    | 0.47 | 0.57 |      |
|                |        |            | *4         | -    | 0.65 | 0.80 |      |
|                |        |            | *5         | -    | 0.70 | 0.85 |      |
|                |        |            | *6         | -    | 0.80 | 1.00 |      |
|                |        |            | *7         | -    | 1.00 | 1.20 |      |
|                |        | Ant - TRx3 | *1, *2, *3 | -    | 0.47 | 0.57 |      |
|                |        |            | *4         | -    | 0.60 | 0.75 |      |
|                |        |            | *5         | -    | 0.65 | 0.80 |      |
|                |        |            | *6         | -    | 0.75 | 0.95 |      |
|                |        |            | *7         | -    | 1.00 | 1.20 |      |
|                |        | Ant - TRx4 | *1, *2, *3 | -    | 0.45 | 0.55 |      |
|                |        |            | *4         | -    | 0.55 | 0.70 |      |
|                |        |            | *5         | -    | 0.60 | 0.75 |      |
|                |        |            | *6         | -    | 0.70 | 0.90 |      |
|                |        |            | *7         | -    | 0.95 | 1.15 |      |
|                |        | Ant - TRx5 | *1, *2, *3 | -    | 0.47 | 0.57 |      |
|                |        |            | *4         | -    | 0.70 | 0.85 |      |
|                |        |            | *5         | -    | 0.75 | 0.90 |      |
|                |        |            | *6         | -    | 0.80 | 1.00 |      |
|                |        |            | *7         | -    | 1.00 | 1.20 |      |
|                |        | Ant - TRx6 | *1, *2, *3 | -    | 0.47 | 0.57 |      |
|                |        |            | *4         | -    | 0.65 | 0.80 |      |
|                |        |            | *5         | -    | 0.70 | 0.85 |      |
|                |        |            | *6         | -    | 0.80 | 1.00 |      |
|                |        |            | *7         | -    | 1.05 | 1.25 |      |
|                |        | Ant - Tx1  | *8         | -    | 1.15 | 1.30 |      |
|                |        | Ant - Tx2  | *9         | -    | 1.15 | 1.35 |      |
|                |        | Ant - Rx1  | *10        | -    | 0.75 | 0.85 |      |
|                |        |            | *11        | -    | 0.90 | 1.05 |      |
|                |        | Ant - Rx2  | *10        | -    | 0.75 | 0.85 |      |
|                |        |            | *11        | -    | 0.90 | 1.05 |      |

Vdd=2.5 V, Ta=25 °C

| Item                                      | Symbol | Path                                                           | Condition                                  | Min. | Typ. | Max. | Unit |
|-------------------------------------------|--------|----------------------------------------------------------------|--------------------------------------------|------|------|------|------|
| Isolation                                 | ISO    | Tx1 - TRx1, 2, 3, 4, 5, 6, Rx1, 2<br>(Tx1 Active)              | *8                                         | 35   | -    | -    | dB   |
|                                           |        | Tx2 - TRx1, 2, 3, 4, 5, 6, Rx1, 2<br>(Tx2 Active)              | *9                                         | 32   | -    | -    |      |
|                                           |        | TRx1, 2, 3 - TRx4, 5, 6<br>(The port of the input is Active. ) | 600 to 2170 MHz                            | 35   | -    | -    |      |
|                                           |        | TRx1 - TRx2<br>(TRx1 or TRx2 Active)                           | 600 to 2170 MHz                            | 20   | -    | -    |      |
|                                           |        | TRx1 - TRx3<br>(TRx1 or TRx3 Active)                           | 600 to 2170 MHz                            | 30   | -    | -    |      |
|                                           |        | TRx2 - TRx3<br>(TRx2 or TRx3 Active)                           | 600 to 2170 MHz                            | 25   | -    | -    |      |
|                                           |        | TRx4 - TRx5<br>(TRx4 or TRx5 Active)                           | 600 to 2170 MHz                            | 25   | -    | -    |      |
|                                           |        | TRx4 - TRx6<br>(TRx4 or TRx6 Active)                           | 600 to 2170 MHz                            | 30   | -    | -    |      |
|                                           |        | TRx5 - TRx6<br>(TRx5 or TRx6 Active)                           | 600 to 2170 MHz                            | 20   | -    | -    |      |
| VSWR                                      | VSWR   | All Ports in Active Paths                                      | 600 to 2170 MHz                            | -    | -    | 1.50 | -    |
| Harmonics                                 | 2fo    | Ant - TRx1, 2, 3, 4, 5, 6                                      | *3, *4                                     | -    | -    | -39  | dBm  |
|                                           | 3fo    |                                                                |                                            | -    | -    | -39  |      |
|                                           | 2fo    | Ant - Tx1                                                      | *8                                         | -    | -    | -36  |      |
|                                           | 3fo    |                                                                |                                            | -    | -    | -35  |      |
|                                           | 2fo    | Ant - Tx2                                                      | *9                                         | -    | -    | -33  |      |
|                                           | 3fo    |                                                                |                                            | -    | -    | -33  |      |
| Attenuation                               | ATT    | Tx1 - Ant                                                      | 1648 to 1805 MHz                           | 25   | -    | -    | dB   |
|                                           |        |                                                                | 1805 to 1830 MHz                           | 30   | -    | -    |      |
|                                           |        |                                                                | 2472 to 2745 MHz                           | 25   | -    | -    |      |
|                                           |        |                                                                | 2745 to 4575 MHz                           | 20   | -    | -    |      |
|                                           |        |                                                                | 4575 to 6405 MHz                           | 15   | -    | -    |      |
|                                           |        | Tx2 - Ant                                                      | 6405 to 12750 MHz                          | 20   | -    | -    |      |
|                                           |        |                                                                | 3420 to 3820 MHz                           | 25   | -    | -    |      |
|                                           |        |                                                                | 5130 to 5730 MHz                           | 25   | -    | -    |      |
| Inter Modulation Product Power in Rx Band | IMD2   | Ant - TRx1, 2, 3, 4, 5, 6                                      | *12, 13, 14, 17, 18, 21, 22                | -    | -    | -107 | dBm  |
|                                           | IMD3   |                                                                | *12, 15, 16, 19, 20, 23, 24                | -    | -    | -107 |      |
| Input IP3                                 | IIP3   | Ant - TRx1, 2, 3, 4, 5, 6                                      | *12, 25, 26                                | 65   | 68   | -    | dBm  |
| Switching Time                            | Ts     | Active Mode                                                    | 50 % Ctl to 90 % RF                        | -    | 3    | 5    | µs   |
| Wake Up Time                              | Tw     |                                                                | Wake Up Time from Idle Mode to Active Mode | -    | 30   | 50   | µs   |
| Supply Current                            | Idd    | Active Mode                                                    | Vdd=2.5 V                                  | -    | -    | 0.40 | mA   |
|                                           |        | Idle Mode                                                      | Vdd=2.5 V                                  | -    | -    | 20   | µA   |

Electrical Characteristics are measured with all RF ports terminated in 50  $\Omega$ .

Corresponding Band of TRx(UMTS/CDMA)

- \*1 Pin = 26 dBm, 452 to 468 MHz (Band Class 5)
- \*2 Pin = 25 dBm, 704 to 787 MHz (Band 13, Band 17)
- \*3 Pin = 26 dBm, 824 to 960 MHz (Band 5, Band 8)
- \*4 Pin = 26 dBm, 1710 to 1990 MHz (Band 1 Tx, Band 2 Tx, Band 3 Tx, Band4 Tx)
- \*5 Pin = 10 dBm, 2110 to 2170 MHz (Band 1 Rx, Band 4 Rx)
- \*6 Pin = 26 dBm, 2300 to 2400 MHz (Band 40)
- \*7 Pin = 26 dBm, 2500 to 2690 MHz (Band 7)
- \*8 Pin = 35 dBm, 824 to 915 MHz (GSM850/900 Tx)
- \*9 Pin = 32 dBm, 1710 to 1910 MHz (GSM1800/1900 Tx)
- \*10 Pin = 10 dBm, 869 to 960 MHz (GSM850/900 Rx)
- \*11 Pin = 10 dBm, 1805 to 1990 MHz (GSM1800/1900 Rx)
- \*12 Measured with the recommended circuit

### IMD Condition

| Band    | fRx<br>on TRx | fTx<br>+20 dBm on TRx | fBlocker<br>-15 dBm on Ant |          | IMD Condition |
|---------|---------------|-----------------------|----------------------------|----------|---------------|
| Band I  | 2140 MHz      | 1950 MHz              | IMD2(fRx - fTx)            | 190 MHz  | *13           |
|         |               |                       | IMD2(fRx + fTx)            | 4090 MHz | *14           |
|         |               |                       | IMD3(2fTx - fRx)           | 1760 MHz | *15           |
|         |               |                       | IMD3(2fTx + fRx)           | 6040 MHz | *16           |
| Band II | 1960 MHz      | 1880 MHz              | IMD2(fRx - fTx)            | 80 MHz   | *17           |
|         |               |                       | IMD2(fRx + fTx)            | 3840 MHz | *18           |
|         |               |                       | IMD3(2fTx - fRx)           | 1800 MHz | *19           |
|         |               |                       | IMD3(2fTx + fRx)           | 5720 MHz | *20           |
| Band V  | 880 MHz       | 835 MHz               | IMD2(fRx - fTx)            | 45 MHz   | *21           |
|         |               |                       | IMD2(fRx + fTx)            | 1715 MHz | *22           |
|         |               |                       | IMD3(2fTx - fRx)           | 790 MHz  | *23           |
|         |               |                       | IMD3(2fTx + fRx)           | 2550 MHz | *24           |

### IIP3 Condition

| Band   | f1<br>+27 dBm on TRx | f2<br>+27 dBm on TRx | IIP3 Condition<br>IIP3=(3*Pout-IM3)/2 |
|--------|----------------------|----------------------|---------------------------------------|
| Band I | 1950 MHz             | 1951 MHz             | *25                                   |
| Band V | 835 MHz              | 836 MHz              | *26                                   |

## Triple Beat Ratio

Vdd=2.5 V , Ta=25 °C

| Item              | Symbol | Path                      | Condition              |                        |                         |                                | Min. | Typ. | Max. | Unit |
|-------------------|--------|---------------------------|------------------------|------------------------|-------------------------|--------------------------------|------|------|------|------|
|                   |        |                           | Tx1<br>at TRx* 21.5dBm | Tx2<br>at TRx* 21.5dBm | Jammer<br>at Ant -30dBm | Triple Beat Product<br>at TRx* |      |      |      |      |
| Triple Beat Ratio | TBR    | Ant - TRx1, 2, 3, 4, 5, 6 | 835.5 MHz              | 836.5 MHz              | 881.5 MHz               | 881.5±1 MHz                    | 81   | -    | -    | dBc  |
|                   |        |                           | 1880 MHz               | 1881 MHz               | 1960 MHz                | 1960±1 MHz                     | 81   | -    | -    |      |

Electrical Characteristics are measured with all RF ports terminated in 50 Ω.

Measured with the recommended circuit

## Input IP2

Vdd=2.5 V , Ta=25 °C

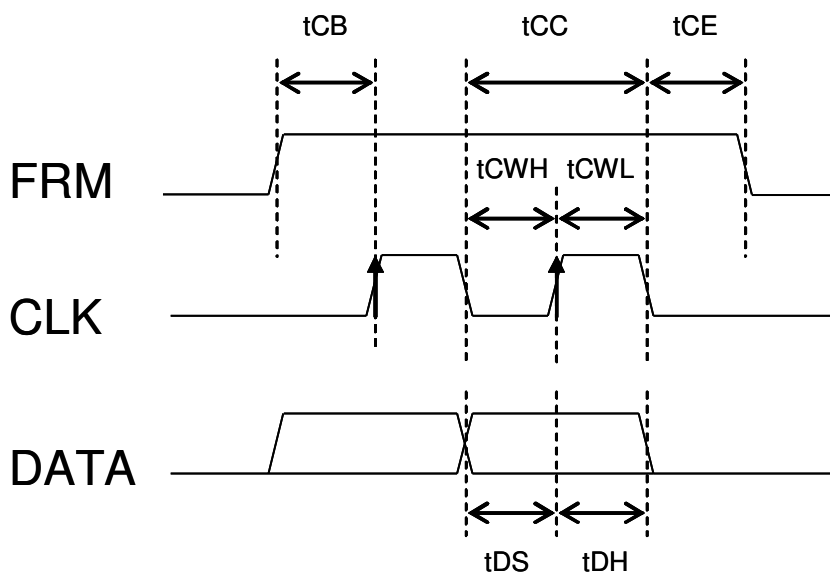
| Item      | Symbol | Path                      | Condition           |                         |                        | Min.  | Typ. | Max. | Unit |
|-----------|--------|---------------------------|---------------------|-------------------------|------------------------|-------|------|------|------|
|           |        |                           | Tx<br>at TRx* 24dBm | Jammer<br>at Ant -20dBm | IM2 Product<br>at TRx* |       |      |      |      |
| Input IP2 | IIP2   | Ant - TRx1, 2, 3, 4, 5, 6 | 836.61              | 1718.61                 | 881.61                 | 113.5 | -    | -    | dBm  |
|           |        |                           | 836.61              | 45                      | 881.61                 | 95.5  | -    | -    |      |
|           |        |                           | 1885                | 3850                    | 1965                   | 95.5  | -    | -    |      |
|           |        |                           | 1885                | 80                      | 1965                   | 95.5  | -    | -    |      |
|           |        |                           | 1732.5              | 3865                    | 2132.5                 | 95.5  | -    | -    |      |
|           |        |                           | 1732.5              | 400                     | 2132.5                 | 95.5  | -    | -    |      |

Electrical Characteristics are measured with all RF ports terminated in 50 Ω.

Measured with the recommended circuit

## SPI Timing Characteristic

| Item                          | Unit                                 | Condition                                | SPEC                 |      |      | Unit |
|-------------------------------|--------------------------------------|------------------------------------------|----------------------|------|------|------|
|                               |                                      |                                          | Min.                 | Typ. | Max. |      |
| SPI Bias Current              | SPI_I <sub>dd</sub>                  | SPI_V <sub>dd</sub> =1.8 V               | -                    | 200  | 400  | μA   |
| SPI Ctrl Current              | SPI_I <sub>ctl</sub>                 | SPI_V <sub>dd</sub> =1.8 V               | -                    | -    | 10   | μA   |
| SPI_Enable                    | SPI_EN                               | SPI_V <sub>dd</sub> ↑ (90 %) to SPI_FRM↑ | 10                   | -    | -    | μs   |
| Clock Frequency               | CLK_Freq                             | SPI_V <sub>dd</sub> Enable               | -                    | -    | 26   | MHz  |
| Clock Cycle                   | t <sub>CC</sub>                      | CLK_Freq=26 MHz                          | 34                   | 38.4 | 42   | ns   |
| Clock Begin Time              | t <sub>CB</sub>                      |                                          | t <sub>CC</sub> /2   | -    | -    | ns   |
| Clock End Time                | t <sub>CE</sub>                      |                                          | t <sub>CC</sub> /2   | -    | -    | ns   |
| Clock Width H                 | t <sub>CWH</sub>                     |                                          | t <sub>CC</sub> ×0.4 | -    | -    | ns   |
| Clock Width L                 | t <sub>CWL</sub>                     |                                          | t <sub>CC</sub> ×0.4 | -    | -    | ns   |
| Data Setup Time               | t <sub>DS</sub>                      |                                          | 5                    | -    | -    | ns   |
| Data Hold Time                | t <sub>DH</sub>                      |                                          | 5                    | -    | -    | ns   |
| SPI_V <sub>dd</sub> rise time | T <sub>SPI_V<sub>dd</sub></sub> Rise | 10 % to 90 % SPI_V <sub>dd</sub>         | 2.2                  | -    | -    | μs   |



## SPI Control Specification

| Parameter                 | Specification |
|---------------------------|---------------|
| Address bits              | 14 bits       |
| Data bits                 | 16 bits       |
| Total bits                | 30 bits total |
| Clock Edge(data sampling) | Rising Edge   |

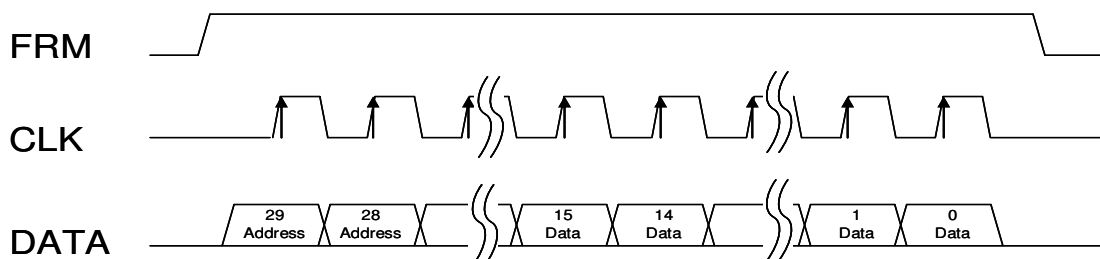
| Address   | Control Data      |
|-----------|-------------------|
| 29<br>MSB | 16 15<br>0<br>LSB |

| Port Symbol | 29  | 28             | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20               | 19 | 18 | 17 | 16 |
|-------------|-----|----------------|----|----|----|----|----|----|----|------------------|----|----|----|----|
|             | R/W | Device address |    |    |    |    |    |    |    | Register address |    |    |    |    |
| Idle        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Tx1         | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Tx2         | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx1        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx2        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx3        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx4        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx5        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| TRx6        | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Rx1         | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Rx2         | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Isolation   | 0   | 0              | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 0                | 0  | 0  | 0  | 0  |
| Idle        | 0   | 1              | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1                | 1  | 1  | 1  | 1  |

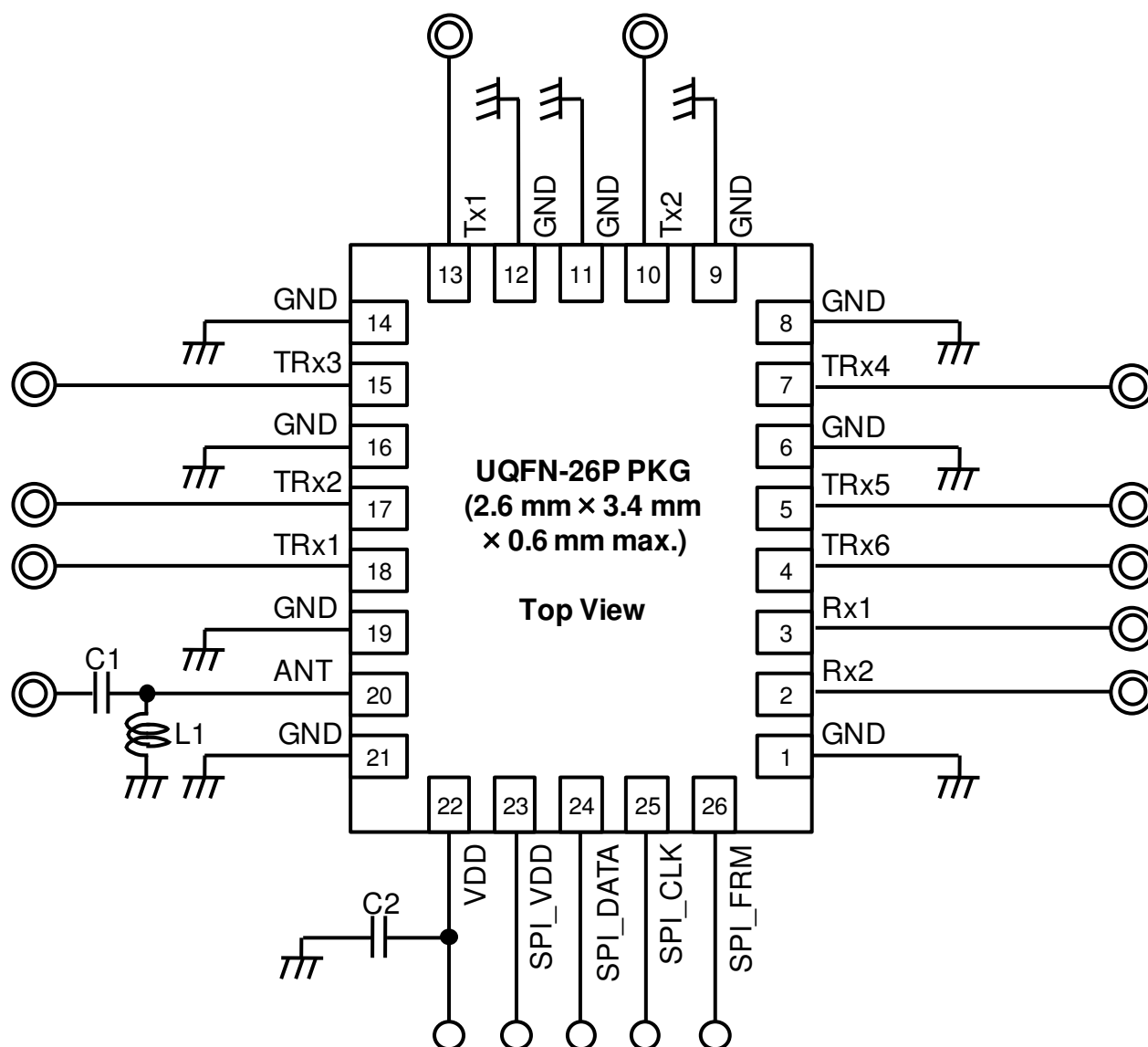
| Port Symbol | 15   | 14  | 13  | 12  | 11  | 10  | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0  |
|-------------|------|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
|             | Data |     |     |     |     |     |    |    |    |    |    |    |    |    |    |    |
|             | D15  | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| Idle        | x    | 0   | 0   | 0   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Tx1         | x    | 0   | 0   | 1   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Tx2         | x    | 0   | 0   | 0   | 1   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx1        | x    | 0   | 1   | 0   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx2        | x    | 0   | 1   | 0   | 1   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx3        | x    | 0   | 1   | 1   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx4        | x    | 1   | 0   | 0   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx5        | x    | 1   | 0   | 0   | 1   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| TRx6        | x    | 1   | 0   | 1   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Rx1         | x    | 1   | 1   | 0   | 0   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Rx2         | x    | 1   | 1   | 0   | 1   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Isolation   | x    | 1   | 1   | 1   | 1   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |
| Idle        | x    | x   | x   | x   | x   | x   | x  | x  | x  | x  | x  | x  | x  | x  | x  | x  |

\*Either idle state D11-D14 is 0000, or XXXX

## Clock Block Diagram



## Recommended Circuit



\*1: No DC blocking capacitors are required on all RF ports. (Except sourcing DC bias)

\*2: DC levels of all RF ports are GND.

\*3: L1(22 nH) and C1(22 pF) are recommended on Ant port for ESD protection.

\*4: C2(100 pF) is recommended.

## PCB Layout

### Foot Pattern

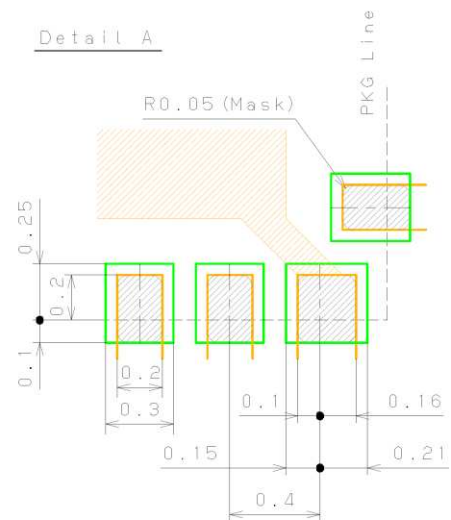
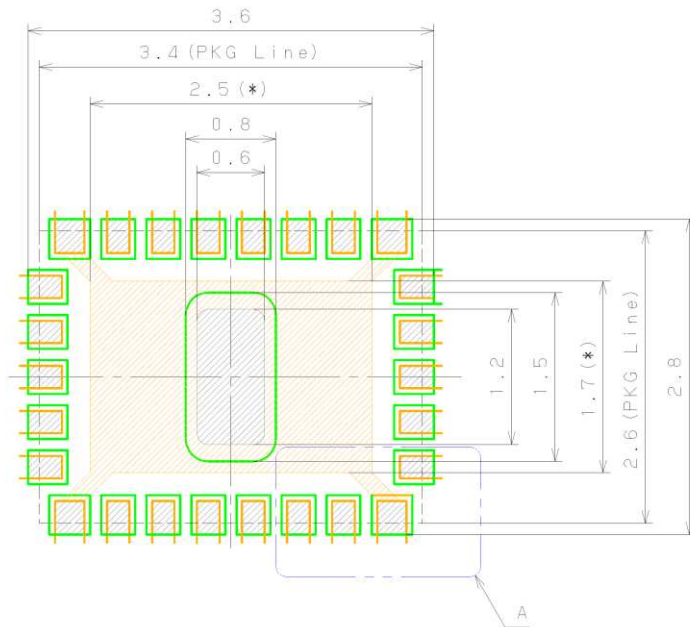
- PKG : 3.4mmx2.6mm
- Pin pitch : 0.4mm

\*Metal mask thickness : 110 $\mu$ m

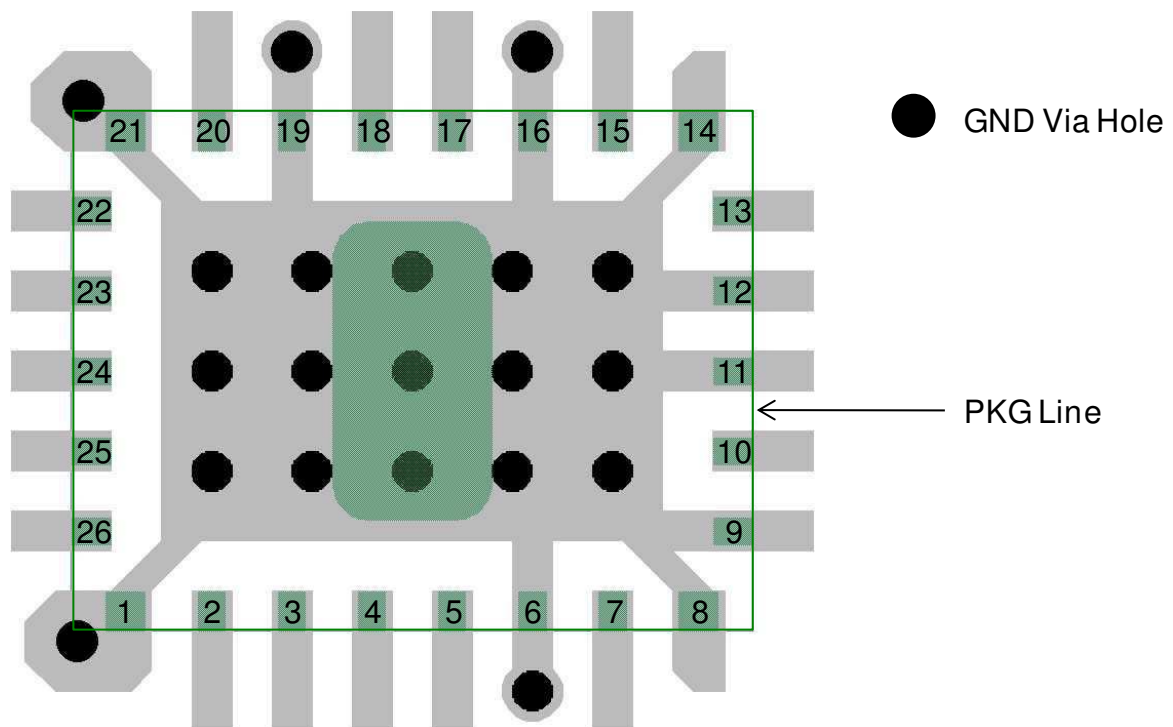
 : Metal area in board (\*1)

\*1: GND plane is recommended

-  : Land
-  : Mask (Open area)
-  : Resist (Open area)



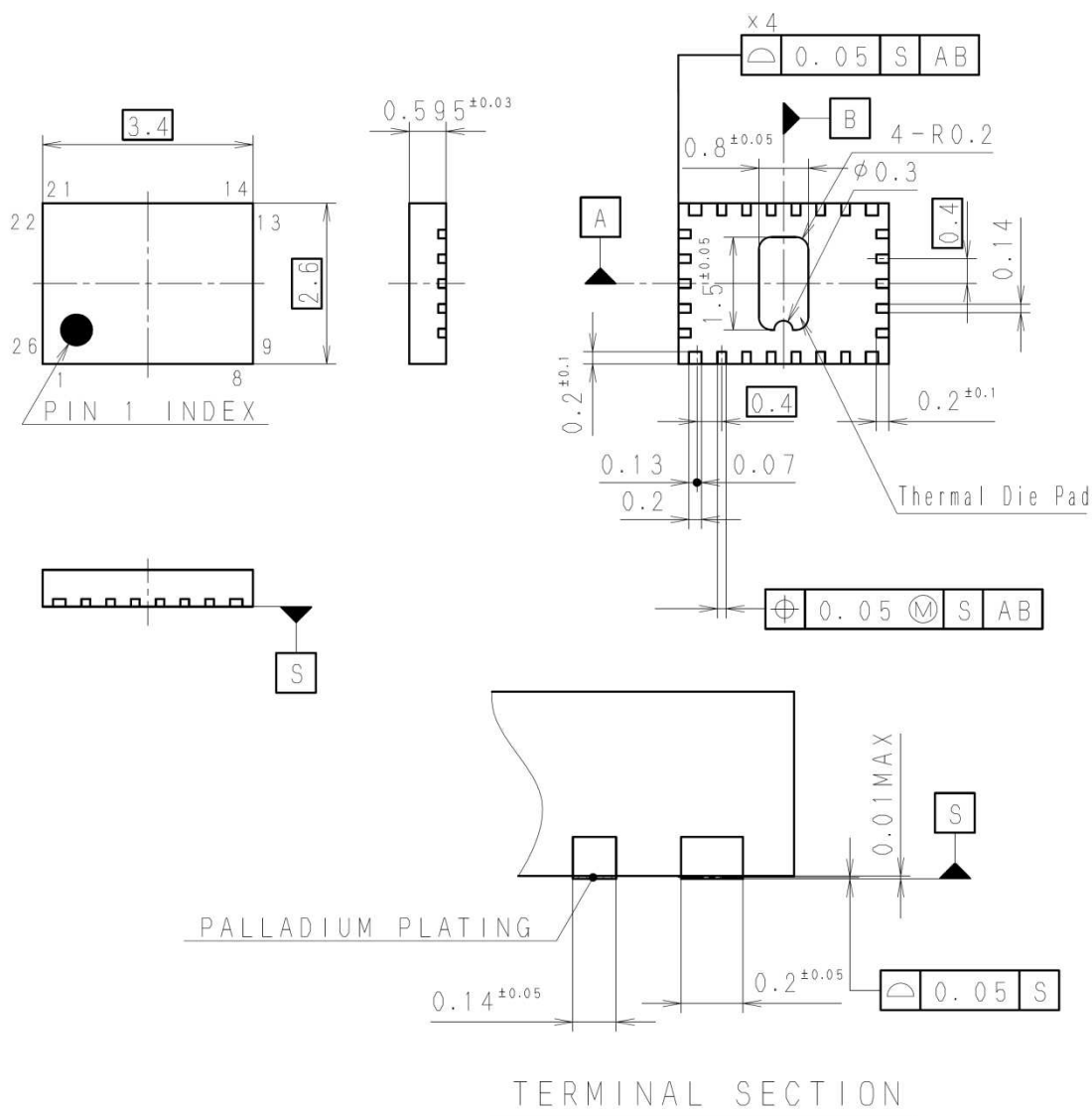
### Recommended PCB Design



## Package Outline

Product Code: 875341595, 875341837(Katoh)

(Unit: mm)



Note: Terminal burr height 0.05mm MAX.

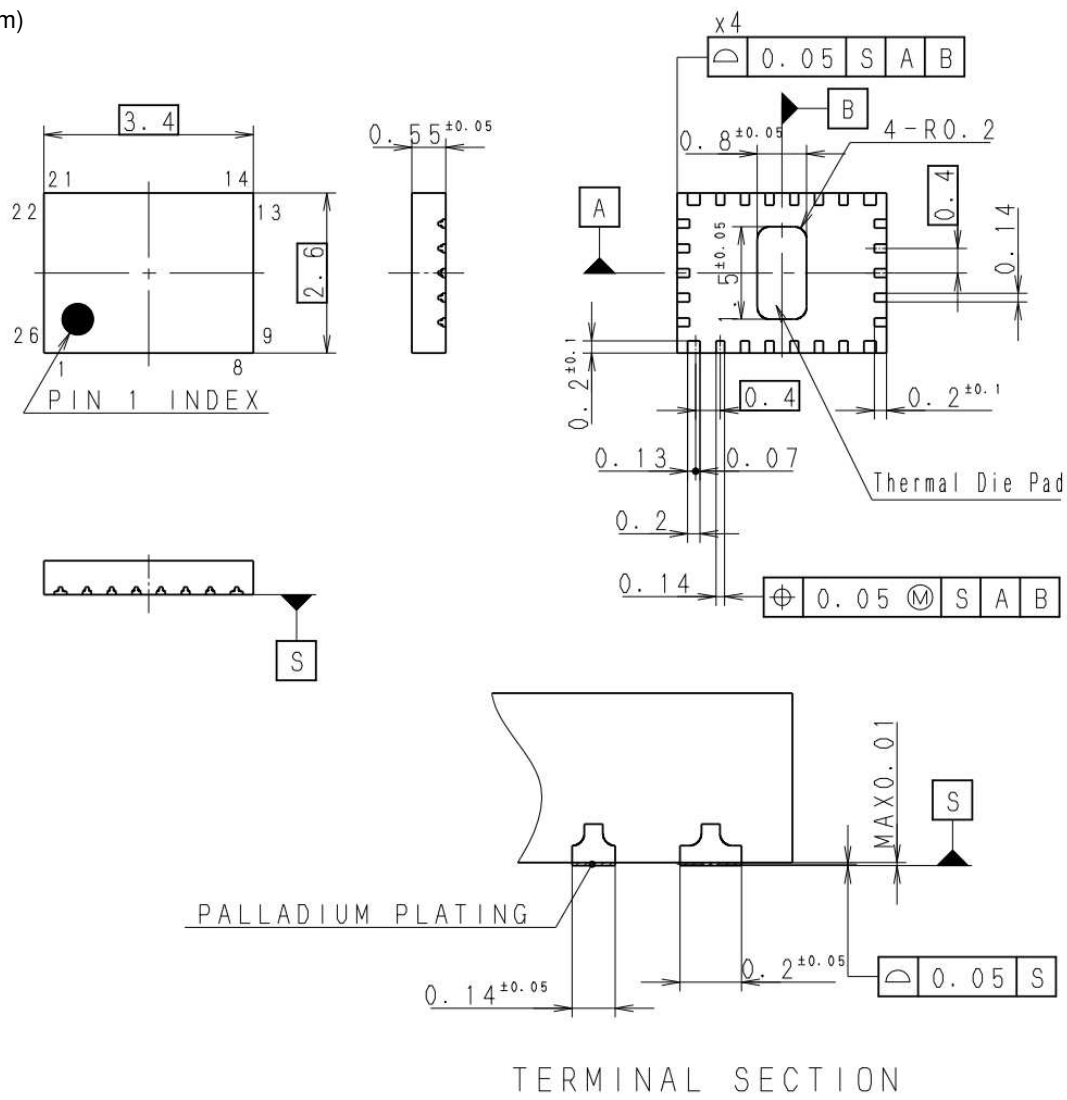
|            |              |
|------------|--------------|
| SONY CODE  | UQFN-26P-541 |
| JEITA CODE | _____        |
| JEDEC CODE | _____        |

|                    |                   |
|--------------------|-------------------|
| PACKAGE MATERIAL   | EPOXY RESIN       |
| TERMINAL TREATMENT | PALLADIUM PLATING |
| TERMINAL MATERIAL  | COPPER ALLOY      |
| PACKAGE MASS       | 0.013g            |

## Package Outline

Product Code: 875342248, 875342253(SDT-Bangna)

(Unit: mm)



Note: Terminal burr height 0.05mm MAX.

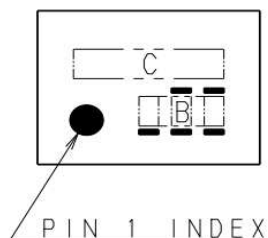
|            |             |
|------------|-------------|
| SONY CODE  | UQFN-26P-01 |
| JEITA CODE | _____       |
| JEDEC CODE | _____       |

## PACKAGE STRUCTURE

|                    |                   |
|--------------------|-------------------|
| PACKAGE MATERIAL   | EPOXY RESIN       |
| TERMINAL TREATMENT | PALLADIUM PLATING |
| TERMINAL MATERIAL  | COPPER ALLOY      |
| PACKAGE MASS       | 0.013 g           |

## Marking

Product Code: 875341595, 875341837(Katoh)



MARKING C: M3588

注1) B部はロット番号 (Max 3文字で通し記号) を配置する。

(規定文字数未満につき省略は省略規定に従う。)

製造年は下記2進法ビット方式により表示する。)

a 部年コード (2進法ビット方式の1ビット目を表示) を配置する。

b 部年コード (2進法ビット方式の2ビット目を表示) を配置する。

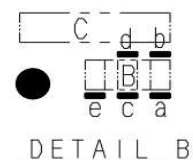
c 部年コード (2進法ビット方式の3ビット目を表示) を配置する。

d 部年コード (2進法ビット方式の4ビット目を表示) を配置する。

注2) C部は製品名 (Max 5文字) を配置する。

(5文字を超える場合は製品名省略標示規定に従う。)

注3) e部は組立場所表記を配置する。



DETAIL B

### < INSTRUCTIONS >

1) LOT NO. ( MAX 3 CHARACTERS : SERIAL CODE ) IN SECTION B.

( FOLLOW RULES FOR ABBREVIATIONS.

MANUFACTURING YEAR IS DISPLAYED BY FOLLOWING BYNARY BIT SYSTEM. )

A YEAR CODE( THE 1ST BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION a.

A YEAR CODE( THE 2ND BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION b.

A YEAR CODE( THE 3RD BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION c.

A YEAR CODE( THE 4TH BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION d.

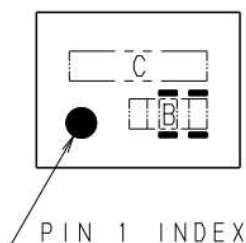
2) TYPE NO. ( MAX 5 CHARACTERS ) IN SECTION C.

( FOR MORE THAN 5 CHARACTERS FOLLOW RULES FOR ABBREVIATIONS. )

3) ASSEMBLY PLACE IN SECTION e.

## Marking

Product Code: 875342248, 875342253(SDT-Bangna)



MARKING C: M3588

注1) B部はロット番号 (Max 3文字で通し記号) を配置する。

(規定文字数未満につき省略は省略規定に従う。)

製造年は下記2進法ビット方式により表示する。)

a 部年コード (2進法ビット方式の1ビット目を表示) を配置する。

b 部年コード (2進法ビット方式の2ビット目を表示) を配置する。

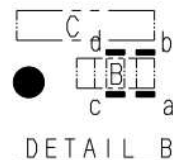
c 部年コード (2進法ビット方式の3ビット目を表示) を配置する。

d 部年コード (2進法ビット方式の4ビット目を表示) を配置する。

注2) C部は製品名 (Max 5文字) を配置する。

(5文字を超える場合は製品名省略標示規定に従う。)

注3) マーク深さは、MAX 0.05 mmの事。



### < INSTRUCTIONS >

1) LOT NO. ( MAX 3 CHARACTERS : SERIAL CODE ) IN SECTION B.

( FOLLOW RULES FOR ABBREVIATIONS.

MANUFACTURING YEAR IS DISPLAYED BY FOLLOWING BYNARY BIT SYSTEM. )

A YEAR CODE( THE 1ST BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION a.

A YEAR CODE( THE 2ND BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION b.

A YEAR CODE( THE 3RD BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION c.

A YEAR CODE( THE 4TH BIT OF A BINARY SYSTEM BIT SYSTEM IS DISPLAYED IN 1 DOT ) IN SECTION d.

2) TYPE NO. ( MAX 5 CHARACTERS ) IN SECTION C.

( FOR MORE THAN 5 CHARACTERS FOLLOW RULES FOR ABBREVIATIONS. )

3) MARK DEPTH MAX 0.05 mm

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