

## CXM3517BER

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### Description

This switch is one of a range of low insertion loss, good linearity and high power MMIC antenna switch modules for GSM/UMTS or CDMA dual-mode handsets.

The Sony A.S.M. contains SP7T switch, a 1.8V CMOS decoder and a dual-LPF on GSM transmit paths.

The Sony GaAs junction gate pHEMT (JPHEMT) process is used for very low insertion loss and high linearity. The excellent insertion loss contributes to good sensitivity and longer talk time.

\* A.S.M. = Antenna Switch Module

(Applications: Quad Band GSM and Single Band UMTS or CDMA Dual-Mode Handset)

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### Features

- ◆ Low insertion loss: 0.80dB (Typ.) on Tx1 (GSM Low Band Tx)  
0.80dB (Typ.) on Tx2 (GSM High Band Tx)  
0.33dB (Typ.) on TRx (UMTS Band I)
- ◆ High attenuation: 30dB (Typ.) Tx1 @ 2nd Harmonic freq.  
30dB (Typ.) Tx2 @ 2nd Harmonic freq.
- ◆ No DC blocking capacitors (Small device footprint)  
Small package: VQFN-22P (2.6mm × 3.4mm × 0.8mm Typ.)
- ◆ Low voltage operation:  $V_{DD} = +2.65V$
- ◆ CMOS control line (CTLA/CTLB/CTLC)
- ◆ RX paths are changeable for band assignment
- ◆ Lead-free and RoHS compliant

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### Structure

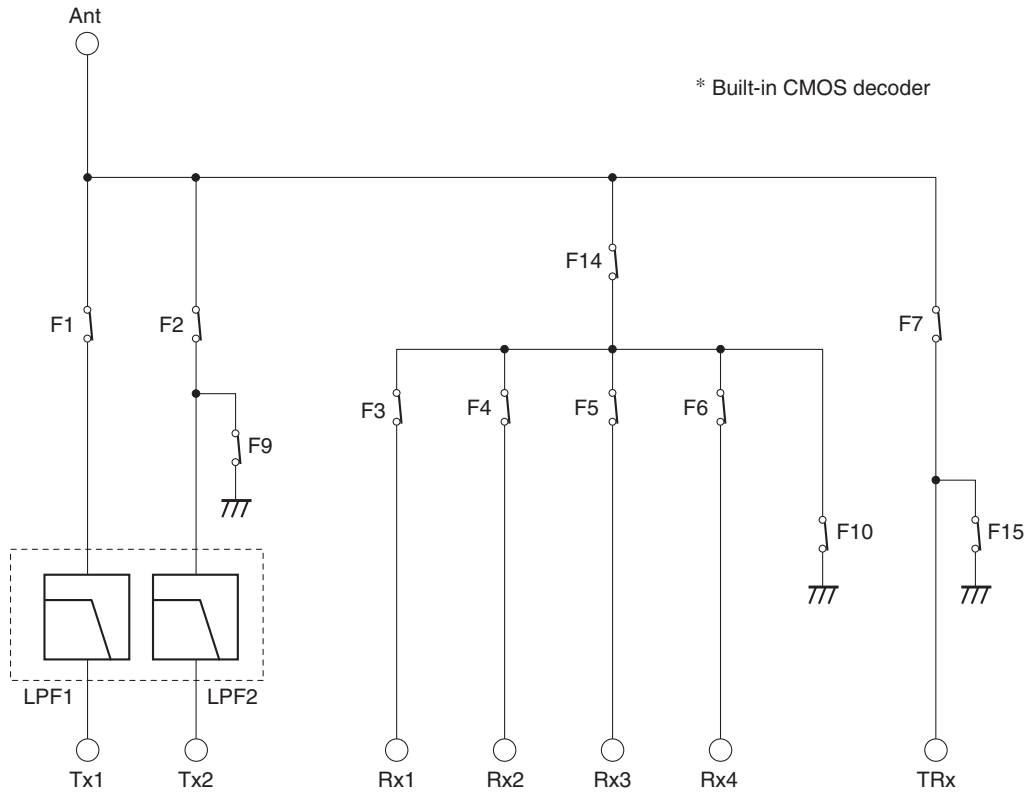
GaAs Junction Gate pHEMT (JPHEMT) Switch, CMOS Decoder and Dual-LPF

#### Note on Handling

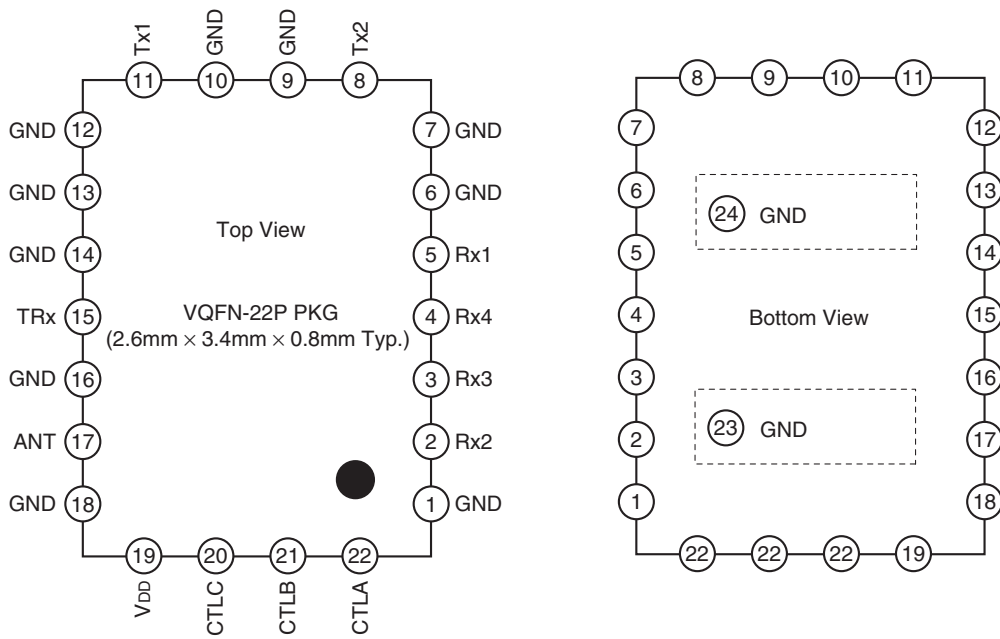
- GaAs MMIC's are ESD sensitive devices. Special handling precautions are required.

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Block Diagram



Pin Configuration



**Pin Description**

| Pin No. | Symbol             | Pin No. | Symbol           |
|---------|--------------------|---------|------------------|
| 1       | GND                | 13      | GND              |
| 2       | Rx2                | 14      | GND              |
| 3       | Rx3                | 15      | TRx              |
| 4       | Rx4                | 16      | GND              |
| 5       | Rx1                | 17      | ANT              |
| 6       | GND                | 18      | GND              |
| 7       | GND                | 19      | V <sub>DD</sub>  |
| 8       | Tx2 (GSM1800/1900) | 20      | CTL <sub>C</sub> |
| 9       | GND                | 21      | CTL <sub>B</sub> |
| 10      | GND                | 22      | CTL <sub>A</sub> |
| 11      | Tx1 (GSM850/900)   | 23      | GND (Bottom)     |
| 12      | GND                | 24      | GND (Bottom)     |

**Truth Table**

| State | Active path        | Vctl state |   |   | Switch state* <sup>2</sup> |    |    |    |    |    |    |    |     |     |     |   |
|-------|--------------------|------------|---|---|----------------------------|----|----|----|----|----|----|----|-----|-----|-----|---|
|       |                    | A          | B | C | F1                         | F2 | F3 | F4 | F5 | F6 | F7 | F9 | F10 | F14 | F15 |   |
| 1     | Tx1                | H          | H | L | H                          | L  | L  | L  | L  | L  | L  | L  | H   | H   | L   | H |
| 2     | Tx2                | H          | L | L | L                          | H  | L  | L  | L  | L  | L  | L  | L   | H   | L   | H |
| 3     | Rx1 * <sup>1</sup> | L          | L | L | L                          | L  | H  | L  | L  | L  | L  | L  | H   | L   | H   | H |
| 4     | Rx2 * <sup>1</sup> | L          | L | H | L                          | L  | L  | H  | L  | L  | L  | L  | H   | L   | H   | H |
| 5     | Rx3 * <sup>1</sup> | L          | H | H | L                          | L  | L  | L  | H  | L  | L  | L  | H   | L   | H   | H |
| 6     | Rx4 * <sup>1</sup> | L          | H | L | L                          | L  | L  | L  | L  | H  | L  | L  | H   | L   | H   | H |
| 7     | TRx                | H          | L | H | L                          | L  | L  | L  | L  | L  | L  | H  | H   | H   | L   | L |

\*<sup>1</sup> Each RX path can be used from 869MHz to 1990MHz frequency, user can select these RX paths changeably.

\*<sup>2</sup> State "L" means a switch "OFF", state "H" means a switch "ON".

## Electrical Characteristics

### Supply Voltage Value

(Ta = +25°C)

| Item                            | Min. | Typ.  | Max. | Unit |
|---------------------------------|------|-------|------|------|
| Bias voltage (V <sub>DD</sub> ) | +2.5 | +2.65 | +3.3 | V    |

### Logic Value

(Ta = +25°C)

| Item                        | State | Min. | Typ. | Max. | Unit |
|-----------------------------|-------|------|------|------|------|
| Control voltage (CTL-A/B/C) | High  | +1.5 | +1.8 | +3.3 | V    |
|                             | Low   | 0    | —    | +0.3 |      |

### Absolute Maximum Ratings

| Item                                     | Ratings                                   |
|--|---|
| Bias voltage (V <sub>DD</sub> )          | 4.3V (Ta: +25°C)                          |
| Control voltage (CTL-A/B/C)              | 4.3V (Ta: +25°C)                          |
| Input power max. [Tx1] *1                | +36.5dBm (Duty cycle: 25%)<br>(Ta: +25°C) |
| Input power max. [Tx2] *1                | +34.5dBm (Duty cycle: 25%)<br>(Ta: +25°C) |
| Input power max. [TRx] *1                | +32dBm (Ta: +25°C)                        |
| Input power max. [Rx1, Rx2, Rx3, Rx4] *1 | +13dBm (Ta: +25°C)                        |
| Operating temperature range              | −30 to +90°C                              |
| Storage temperature range                | −65 to +150°C                             |

\*1 FR-4 (4 layers), 30mm Sqr., t = 0.8mm

(V<sub>DD</sub> = 2.65V, V<sub>ctl</sub> = 0/1.8V, Ta: +25°C)

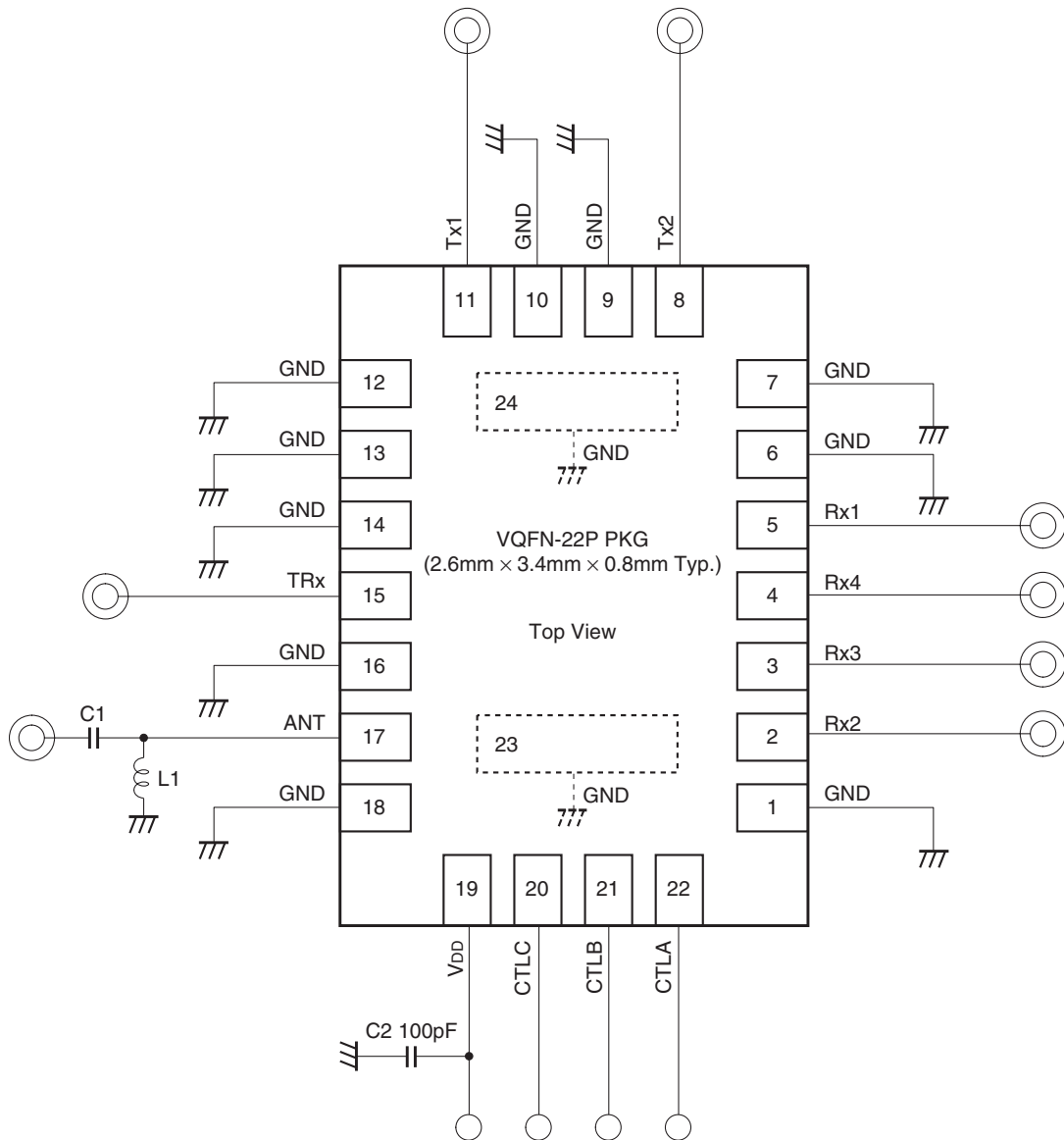
| Item           | Symbol | Path                     | Conditions          | Min.                          | Typ.            | Max. | Unit |    |      |   |
|----------------|--------|--------------------------|---------------------|-------------------------------|-----------------|------|------|----|------|---|
| Insertion loss | I.L    | Ant - Tx1                | *1                  | —                             | 0.80            | 1.00 | dB   |    |      |   |
|                |        | Ant - Tx2                | *2                  | —                             | 0.80            | 1.00 |      |    |      |   |
|                |        | Ant - Rx1, Rx2, Rx3, Rx4 | *3                  | —                             | 0.65            | 0.80 |      |    |      |   |
|                |        |                          | *4                  | —                             | 0.85            | 1.00 |      |    |      |   |
|                |        | Ant - TRx                | *5                  | —                             | 0.33            | 0.50 |      |    |      |   |
|                |        |                          | *8                  | —                             | 0.25            | 0.40 |      |    |      |   |
| Isolation      | Iso    | Tx1 - Rx1, Rx2, Rx3, Rx4 | *1 824 to 915MHz    | State 1                       | 45              | 55   | —    | dB |      |   |
|                |        | Tx1 - TRx                | *1 824 to 915MHz    | State 1                       | 30              | 40   | —    |    |      |   |
|                |        | Tx1 - Tx2                | *1 824 to 915MHz    | State 1                       | 18              | 21   | —    |    |      |   |
|                |        | Tx1 - Ant                | *1 880 to 915MHz    | State 3/4/5/6                 | 22              | 26   | —    |    |      |   |
|                |        |                          | *10 1710 to 1910MHz | State 3/4/5/6                 | 30              | 40   | —    |    |      |   |
|                |        | Tx2 - Ant                | *1 1760 to 1830MHz  | State 1                       | 26              | 31   | —    |    |      |   |
|                |        |                          | *1 2640 to 2745MHz  | State 1                       | 26              | 31   | —    |    |      |   |
|                |        |                          | *11 824 to 915MHz   | State 3/4/5/6                 | 20              | 28   | —    |    |      |   |
|                |        |                          | *2 1710 to 1910MHz  | State 3/4/5/6                 | 19              | 23   | —    |    |      |   |
|                |        | Tx2 - Rx1, Rx2, Rx3, Rx4 | *2 1710 to 1910MHz  | State 2                       | 40              | 50   | —    |    |      |   |
|                |        | Tx2 - TRx                | *2 1710 to 1910MHz  | State 2                       | 25              | 30   | —    |    |      |   |
|                |        | Tx2 - Tx1                | *2 1710 to 1910MHz  | State 2                       | 28              | 31   | —    |    |      |   |
|                |        | TRx - Rx1, Rx2, Rx3, Rx4 | *5 1920 to 2170MHz  | State 7                       | 40              | 50   | —    |    |      |   |
|                |        |                          | *8 824 to 894MHz    | State 7                       | 45              | 55   | —    |    |      |   |
|                |        |                          | *9 1710 to 1990MHz  | State 7                       | 45              | 55   | —    |    |      |   |
|                |        | TRx - Tx1                | *5 1920 to 2170MHz  | State 7                       | 30              | 39   | —    |    |      |   |
|                |        |                          | *8 824 to 894MHz    | State 7                       | 20              | 26   | —    |    |      |   |
|                |        |                          | *9 1710 to 1990MHz  | State 7                       | 30              | 39   | —    |    |      |   |
|                |        | TRx - Tx2                | *5 1920 to 2170MHz  | State 7                       | 20              | 24   | —    |    |      |   |
|                |        |                          | *8 824 to 894MHz    | State 7                       | 30              | 38   | —    |    |      |   |
|                |        |                          | *9 1710 to 1990MHz  | State 7                       | 20              | 25   | —    |    |      |   |
|                |        | V.S.W.R.                 | VSWR                | Ant - Tx1                     | 824 to 915MHz   | —    | 1.30 |    | 1.60 | — |
|                |        |                          |                     | Ant - Tx2                     | 1710 to 1910MHz | —    | 1.45 |    |      |   |
|                |        |                          |                     | Ant - Rx1, Rx2, Rx3, Rx4, TRx | 824 to 2170MHz  | —    | 1.20 |    |      |   |
| Harmonic level | 2fo    | Tx1 - Ant                | *1                  | —                             | -48             | -36  | dBm  |    |      |   |
|                | 3fo    |                          |                     | —                             | -48             | -36  |      |    |      |   |
|                | 2fo    | Tx2 - Ant                | *2                  | —                             | -52             | -36  |      |    |      |   |
|                | 3fo    |                          |                     | —                             | -43             | -36  |      |    |      |   |
|                | 2fo    | TRx - Ant                | *5                  | —                             | -54             | -36  |      |    |      |   |
|                | 3fo    |                          |                     | —                             | -53             | -36  |      |    |      |   |
|                | 2fo    | TRx - Ant                | *8                  | —                             | -60             | -36  |      |    |      |   |
|                | 3fo    |                          |                     | —                             | -58             | -36  |      |    |      |   |

| Item                        | Symbol           | Path      | Conditions                                       | Min. | Typ. | Max. | Unit |
|-----------------------------|------------------|-----------|--|------|------|------|------|
| Inter modulation distortion | IMD2             | TRx - Ant | *6, *12  | —    | -107 | -105 | dBm  |
|                             | IMD3             | TRx - Ant | *7, *12  | —    | -106 | -102 |      |
| Attenuation                 | ATT              | Tx1 - Ant | 1648 to 1830MHz                                  | 25   | 30   | —    | dB   |
|                             |                  |           | 2472 to 2745MHz                                  | 25   | 41   | —    |      |
|                             |                  |           | 3296 to 3660MHz                                  | 20   | 26   | —    |      |
|                             |                  | Tx2 - Ant | 3420 to 3820MHz                                  | 25   | 30   | —    |      |
|                             |                  |           | 5130 to 5730MHz                                  | 25   | 33   | —    |      |
| Switching time              | T <sub>s</sub>   |           | 90% OFF – 90% ON                                 | —    | 3    | 5    | μs   |
| Control current             | I <sub>ctl</sub> |           | V <sub>DD</sub> = 2.65V, V <sub>ctl</sub> = 1.8V | —    | 5    | 20   | μA   |
| Supply current              | I <sub>dd</sub>  |           | Active Mode                                      | —    | 0.18 | 0.40 | mA   |

Electrical characteristics are specified on Sony EVB and with all RF ports terminated with 50Ω.

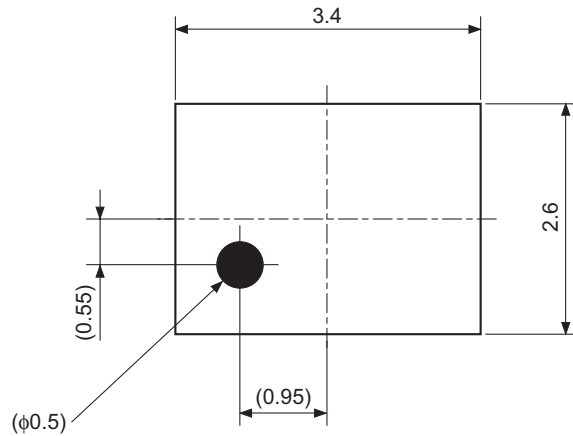
- \*1 Pin on Tx1: +34dBm, 824 to 915MHz, V<sub>DD</sub> = 2.65V
- \*2 Pin on Tx2: +32dBm, 1710 to 1910MHz, V<sub>DD</sub> = 2.65V
- \*3 Pin on Ant: +10dBm, 869 to 960MHz, V<sub>DD</sub> = 2.65V
- \*4 Pin on Ant: +10dBm, 1805 to 1990MHz, V<sub>DD</sub> = 2.65V
- \*5 Pin on TRx: +26dBm, 1920 to 2170MHz, V<sub>DD</sub> = 2.65V
- \*6 Pin on TRx: +20dBm, 1950MHz, Pin on Ant: -15dBm, 190MHz, V<sub>DD</sub> = 2.65V
- \*7 Pin on TRx: +20dBm, 1950MHz, Pin on Ant: -15dBm, 1760MHz, V<sub>DD</sub> = 2.65V
- \*8 Pin on TRx: +26dBm, 824 to 894MHz, V<sub>DD</sub> = 2.65V
- \*9 Pin on TRx: +26dBm, 1710 to 1990MHz, V<sub>DD</sub> = 2.65V
- \*10 Pin on Tx1: +5dBm, 1710 to 1910MHz, V<sub>DD</sub> = 2.65V
- \*11 Pin on Tx2: +5dBm, 824 to 915MHz, V<sub>DD</sub> = 2.65V
- \*12 Measured with recommended circuit

Recommended Circuit



- Note) 1. No DC blocking capacitors are required on all RF ports.  
 2. DC levels of all RF ports are GND.  
 3. L1 (22nH) and C1 (22pF) are recommended on Ant port for ESD protection.

Pin 1 Index

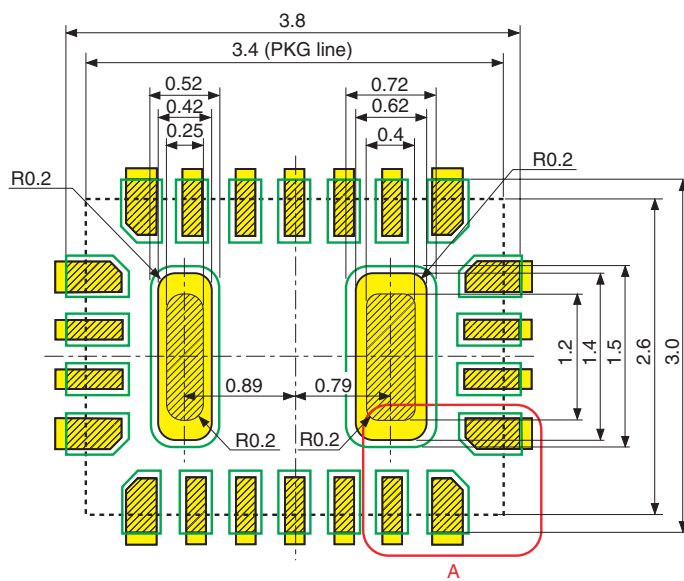


PCB Layout Template

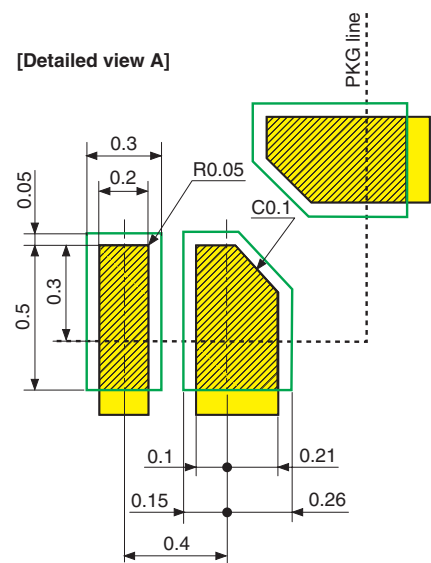
- PKG size: 3.4mm × 2.6mm
- Pin pitch: 0.4mm

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

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



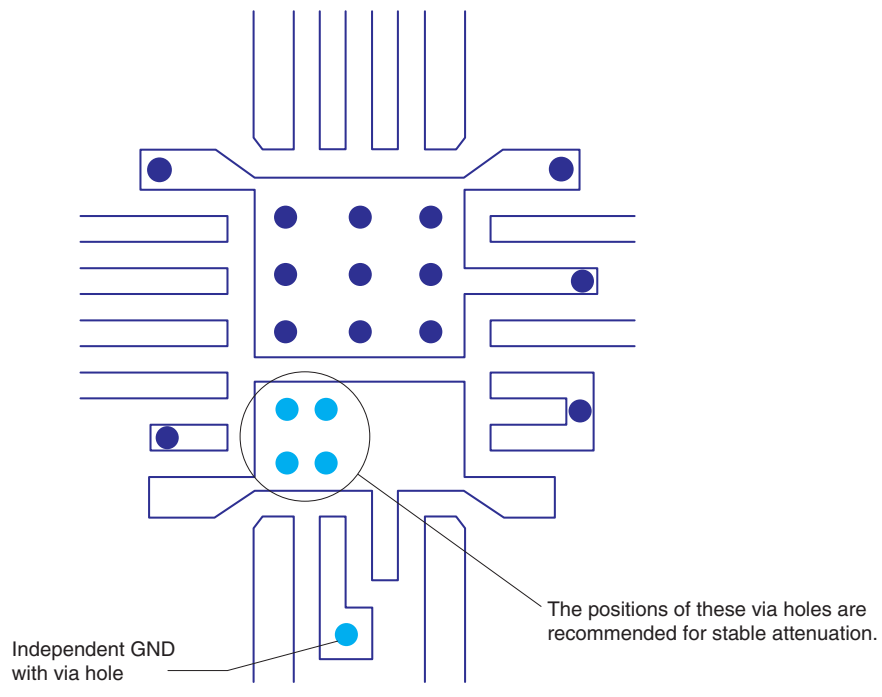
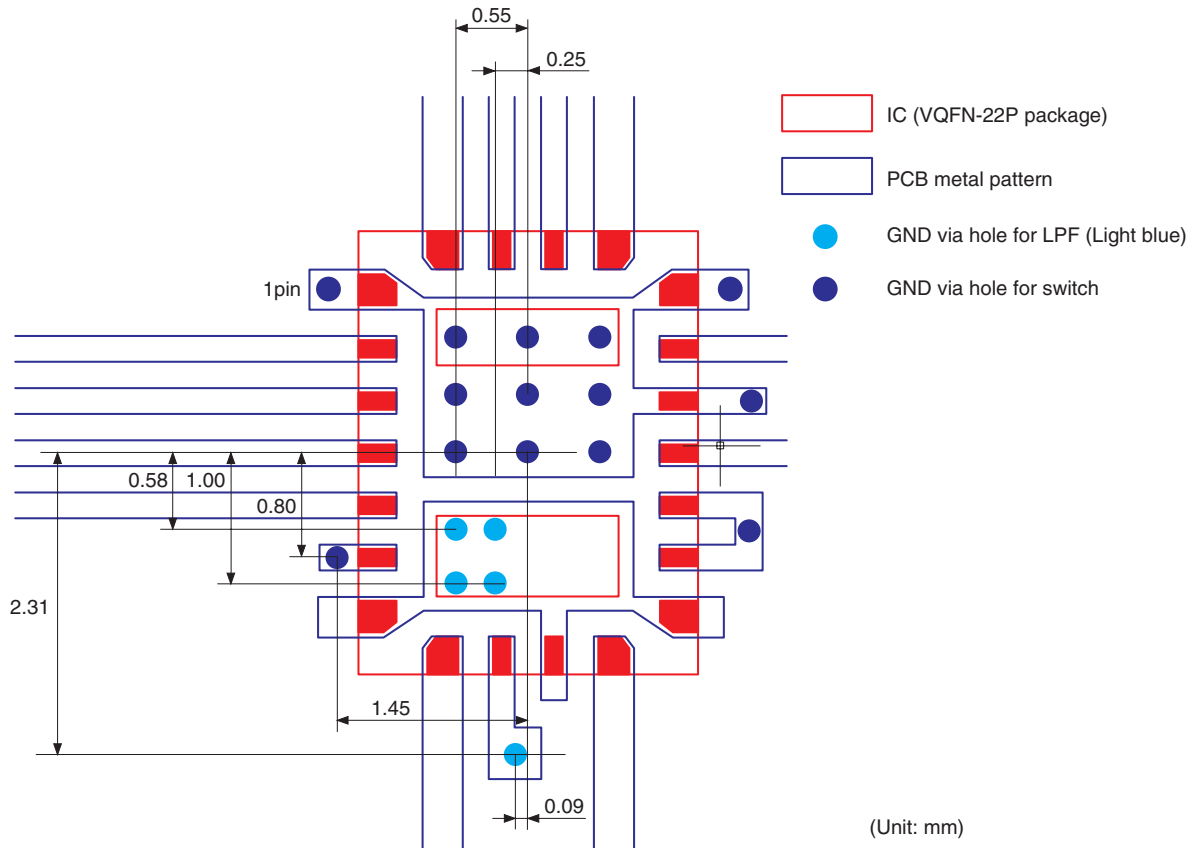
[Detailed view A]



\* Mask corner R = 0.05mm



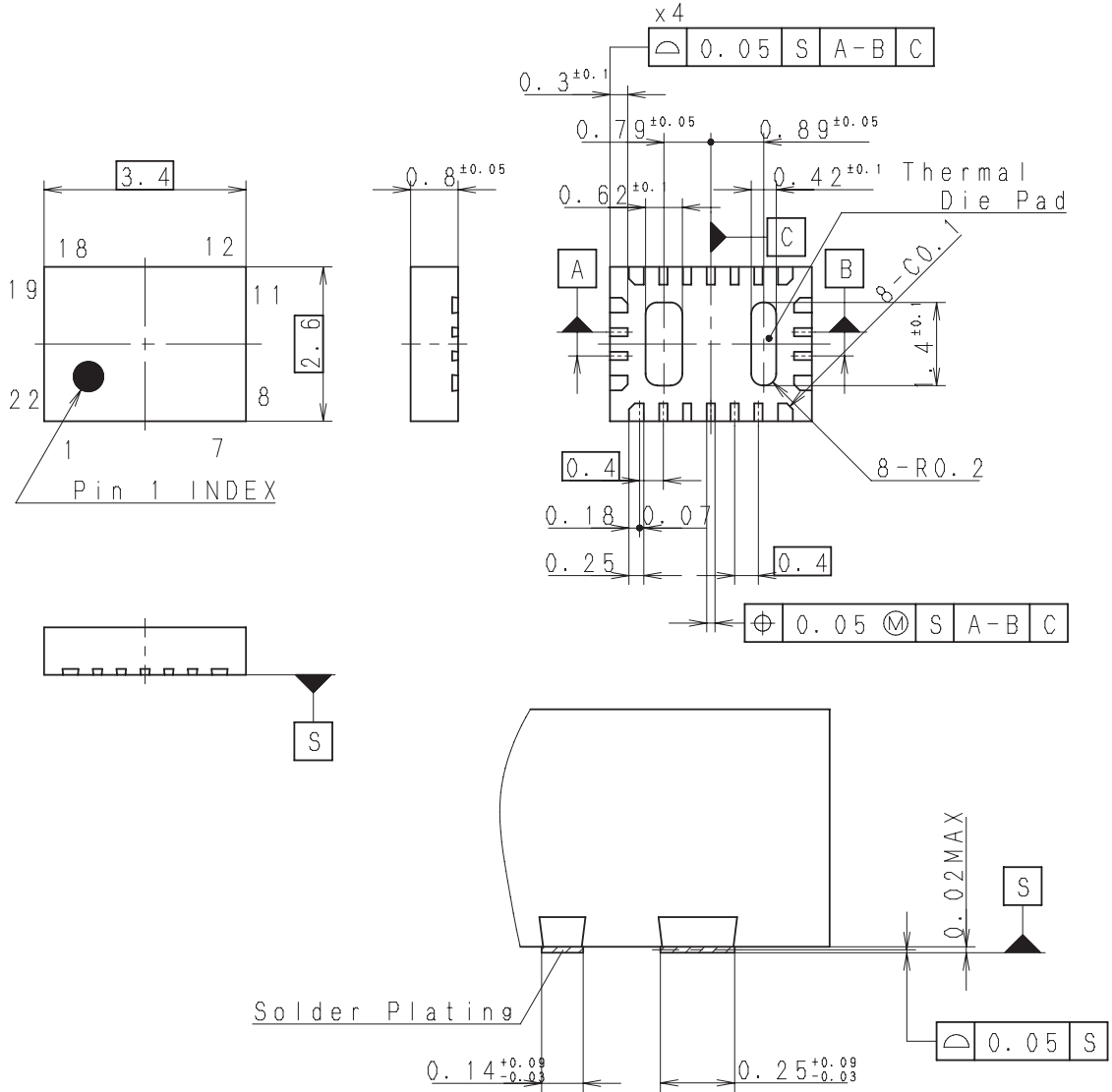
Recommended PCB Design



Package Outline

(Unit: mm)

22PIN VQFN (PLASTIC)



Note:Cutting burr of lead are 0.05mm MAX.

TERMINAL SECTION  
PACKAGE STRUCTURE

|            |             |
|------------|-------------|
| SONY CODE  | VQFN-22P-01 |
| JEITA CODE | —           |
| JEDEC CODE | —           |

|                    |                |
|--------------------|----------------|
| PACKAGE MATERIAL   | EPOXY RESIN    |
| TERMINAL TREATMENT | SOLDER PLATING |
| TERMINAL MATERIAL  | COPPER ALLOY   |
| PACKAGE MASS       | 0.02g          |

AP-4000-22007S Rev. 0

LEAD PLATING SPECIFICATIONS

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