

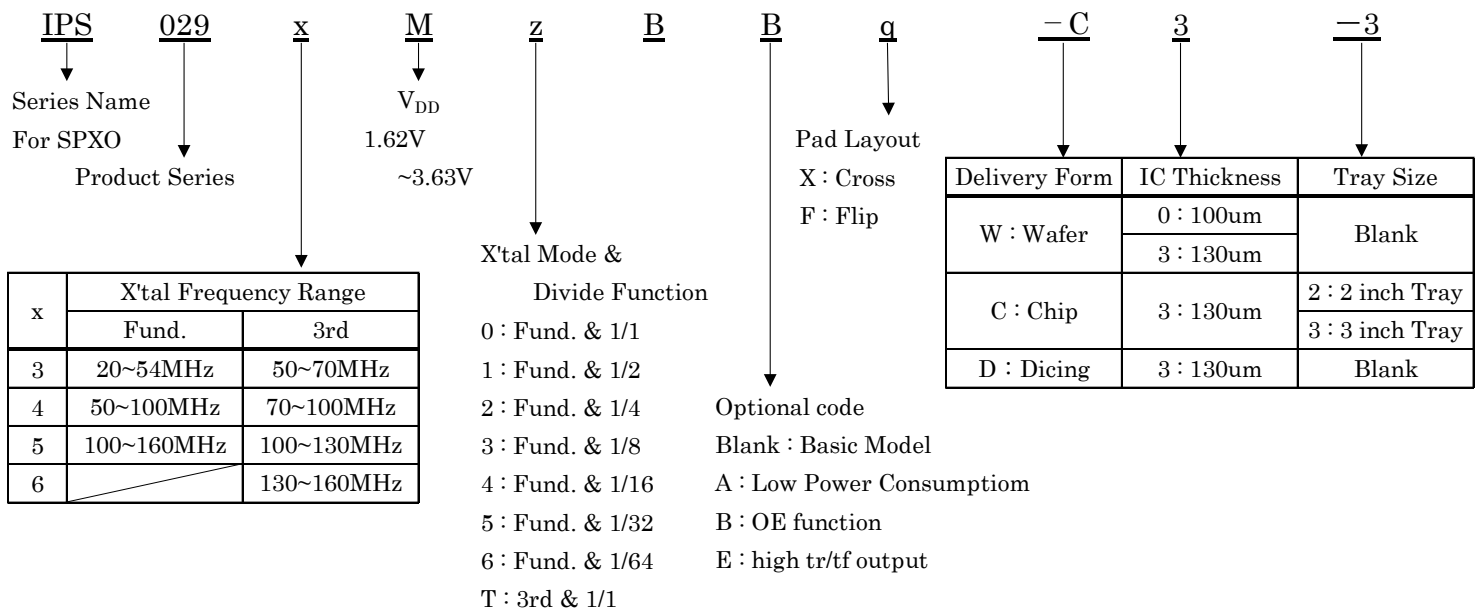
## ■ Description

IPS029\*B series is the successor IC of IPS009BM series and IPS029xM series, for SPXO corresponding to the fundamental or 3rd overtone crystal from 20MHz to 160MHz. Chip size of this IC is small enough for 2016 size SMD. IPS029B series is the basic series, IPS029BA series features low power consumption, IPS029BB series includes OE functionality, and IPS029BE series offers high-speed tr/tf.

## ■ Features

- Operation temperature : -40°C~125°C
- Power supply voltage : 1.62V~3.63V
- Standby function : Oscillation stop / Output disable
- Frequency range : 20MHz~160MHz
- Output : CMOS
- Crystal mode : Fundamental & 3rd overtone
- Small chip size : 0.56mm × 0.56mm
- Divider function : 1/2, 1/4, 1/8, 1/16, 1/32 and 1/64

### 1. Part number rule



## 2. Series

### 2-1 IPS029xMyBz Basic Series

| Part Number      | Crystal Frequency<br>f (MHz) |        | Crystal<br>Mode | Divide | Output Frequency<br>F0 (MHz) |        | Remarks                      |
|------------------|------------------------------|--------|-----------------|--------|------------------------------|--------|------------------------------|
|                  | Min.                         | Max.   |                 |        | Min.                         | Max.   |                              |
| IPS029 3 M 0 B X | 20.00                        | 54.00  | Fund            | 1/1    | 20.00                        | 54.00  | Basic series<br>Fundamental  |
| IPS029 3 M 0 B F |                              |        |                 | 1/2    | 10.00                        | 27.00  |                              |
| IPS029 3 M 1 B X |                              |        |                 |        |                              |        |                              |
| IPS029 3 M 1 B F |                              |        |                 | 1/4    | 5.00                         | 13.50  |                              |
| IPS029 3 M 2 B X |                              |        |                 |        |                              |        |                              |
| IPS029 3 M 2 B F |                              |        |                 | 1/8    | 2.50                         | 6.75   |                              |
| IPS029 3 M 3 B X |                              |        |                 |        |                              |        |                              |
| IPS029 3 M 3 B F |                              |        |                 | 1/16   | 1.25                         | 3.38   |                              |
| IPS029 3 M 4 B X |                              |        |                 |        |                              |        |                              |
| IPS029 3 M 4 B F |                              |        |                 |        |                              |        |                              |
| IPS029 4 M 0 B X | 50.00                        | 100.00 | 3rd             | 1/1    | 50.00                        | 100.00 | Basic series<br>3rd Overtone |
| IPS029 4 M 0 B F |                              |        |                 | 1/1    | 100.00                       | 160.00 |                              |
| IPS029 5 M 0 B X | 100.00                       | 160.00 |                 |        |                              |        |                              |
| IPS029 5 M 0 B F |                              |        |                 | 1/1    | 50.00                        | 70.00  |                              |
| IPS029 3 M T B X | 50.00                        | 70.00  |                 |        |                              |        |                              |
| IPS029 3 M T B F |                              |        |                 | 70.00  | 100.00                       | 1/1    |                              |
| IPS029 4 M T B X | 100.00                       | 130.00 |                 |        |                              |        |                              |
| IPS029 4 M T B F |                              |        |                 | 130.00 | 160.00                       | 1/1    |                              |
| IPS029 5 M T B X | 100.00                       | 130.00 |                 |        |                              |        |                              |
| IPS029 5 M T B F |                              |        |                 | 130.00 | 160.00                       | 1/1    |                              |
| IPS029 6 M T B X | 130.00                       | 160.00 |                 |        |                              |        |                              |
| IPS029 6 M T B F |                              |        |                 | 130.00 | 160.00                       | 1/1    |                              |

Please contact us for gray color models.

**2-2 IPS029xMyBAz Low Power Consumption Series**

| Part Number        | Crystal Frequency<br>f (MHz) |        | Crystal<br>Mode | Divide | Output Frequency<br>F0 (MHz) |        | Remarks                  |
|--------------------|------------------------------|--------|-----------------|--------|------------------------------|--------|--------------------------|
|                    | Min.                         | Max.   |                 |        | Min.                         | Max.   |                          |
| IPS029 3 M 0 B A X | 20.00                        | 54.00  | Fund            | 1/1    | 20.00                        | 54.00  | Low Power<br>Consumption |
| IPS029 3 M 0 B A F |                              |        |                 | 1/2    | 10.00                        | 27.00  |                          |
| IPS029 3 M 1 B A X |                              |        |                 | 1/4    | 5.00                         | 13.50  |                          |
| IPS029 3 M 1 B A F |                              |        |                 | 1/8    | 2.50                         | 6.75   |                          |
| IPS029 3 M 2 B A X |                              |        |                 | 1/16   | 1.25                         | 3.38   |                          |
| IPS029 3 M 2 B A F |                              |        |                 | 1/32   | 0.62                         | 1.69   |                          |
| IPS029 3 M 3 B A X |                              |        |                 | 1/64   | 0.31                         | 0.84   |                          |
| IPS029 3 M 3 B A F |                              |        |                 | 1/1    | 100.00                       | 150.00 |                          |
| IPS029 3 M 4 B A X |                              |        |                 | 1/2    | 50.00                        | 75.00  |                          |
| IPS029 3 M 4 B A F |                              |        |                 | 1/4    | 25.00                        | 37.50  |                          |
| IPS029 3 M 5 B A X |                              |        |                 | 1/8    | 12.50                        | 18.75  |                          |
| IPS029 3 M 5 B A F |                              |        |                 | 1/1    | 50.00                        | 70.00  |                          |
| IPS029 3 M 6 B A X |                              |        |                 | 1/1    | 70.00                        | 100.00 |                          |
| IPS029 3 M 6 B A F |                              |        |                 | 1/1    | 100.00                       | 130.00 |                          |
| IPS029 5 M 0 B A X | 100.00                       | 150.00 | Fund            | 1/1    | 100.00                       | 150.00 |                          |
| IPS029 5 M 0 B A F |                              |        |                 | 1/2    | 50.00                        | 75.00  |                          |
| IPS029 5 M 1 B A F |                              |        |                 | 1/4    | 25.00                        | 37.50  |                          |
| IPS029 5 M 2 B A F |                              |        |                 | 1/8    | 12.50                        | 18.75  |                          |
| IPS029 5 M 3 B A F |                              |        |                 | 1/1    | 100.00                       | 130.00 |                          |
| IPS029 3 M T B A F | 50.00                        | 70.00  | 3rd             | 1/1    | 50.00                        | 70.00  |                          |
| IPS029 4 M T B A F | 70.00                        | 100.00 |                 | 1/1    | 70.00                        | 100.00 |                          |
| IPS029 5 M T B A F | 100.00                       | 130.00 |                 | 1/1    | 100.00                       | 130.00 |                          |
| IPS029 6 M T B A F | 130.00                       | 160.00 |                 | 1/1    | 130.00                       | 160.00 |                          |

Please contact us for gray color models.

**2-3 IPS029xMyBBz OE Series**

| Part Number        | Crystal Frequency<br>f (MHz) |        | Crystal<br>Mode | Divide | Output Frequency<br>F0 (MHz) |        | Remarks     |
|--------------------|------------------------------|--------|-----------------|--------|------------------------------|--------|-------------|
|                    | Min.                         | Max.   |                 |        | Min.                         | Max.   |             |
| IPS029 3 M 0 B B X | 20.00                        | 54.00  | Fund            | 1/1    | 20.00                        | 54.00  | OE function |
| IPS029 3 M 0 B B F |                              |        |                 |        |                              |        |             |
| IPS029 3 M 1 B B X |                              |        |                 | 1/2    | 10.00                        | 27.00  |             |
| IPS029 3 M 1 B B F |                              |        |                 |        |                              |        |             |
| IPS029 3 M 2 B B X |                              |        |                 | 1/4    | 5.00                         | 13.50  |             |
| IPS029 3 M 2 B B F |                              |        |                 |        |                              |        |             |
| IPS029 4 M 0 B B X | 50.00                        | 100.00 |                 | 1/1    | 50.00                        | 100.00 |             |
| IPS029 4 M 0 B B F |                              |        |                 |        |                              |        |             |
| IPS029 4 M 1 B B X |                              |        |                 | 1/2    | 25                           | 50     |             |
| IPS029 4 M 1 B B F |                              |        |                 |        |                              |        |             |
| IPS029 4 M 2 B B X |                              |        |                 | 1/4    | 12.5                         | 25     |             |
| IPS029 4 M 2 B B F |                              |        |                 |        |                              |        |             |
| IPS029 5 M 0 B B X | 100.00                       | 160.00 |                 | 1/1    | 100.00                       | 160.00 |             |
| IPS029 5 M 0 B B F |                              |        |                 |        |                              |        |             |

Please contact us for gray color models.

**2-4 IPS0293MTBEX high tr/tf Series**

| Part Number        | Crystal Frequency<br>f (MHz) |       | Crystal<br>Mode | Divide | Output Frequency<br>F0 (MHz) |       | Remarks           |
|--------------------|------------------------------|-------|-----------------|--------|------------------------------|-------|-------------------|
|                    | Min.                         | Max.  |                 |        | Min.                         | Max.  |                   |
| IPS029 3 M T B E X | 50.00                        | 70.00 | 3rd             | 1/1    | 50.00                        | 70.00 | high tr/tf output |

### 3. Absolute Maximum Ratings

 $V_{SS}=0V, T_a=25^{\circ}C \pm 2^{\circ}C$ 

| Parameter            | Symbol    | Condition     | Ratings      |              |             |
|----------------------|-----------|---------------|--------------|--------------|-------------|
|                      |           |               | Min          | Max          | Unit        |
| Supply Voltage       | $V_{DD}$  |               | $V_{SS}-0.5$ | 5.0          | V           |
| Input Voltage        | $V_{IN}$  | All Input Pin | $V_{SS}-0.5$ | $V_{DD}+0.5$ | V           |
| Output Voltage       | $V_{OUT}$ |               | $V_{SS}-0.5$ | $V_{DD}+0.5$ | V           |
| Output Current       | $I_{OUT}$ |               |              | 25           | mA          |
| Junction Temperature | $T_j$     |               | -55          | 150          | $^{\circ}C$ |
| Storage Temperature  | $T_{stg}$ |               | -55          | 125          | $^{\circ}C$ |

### 4. Recommended Operating Condition

 $V_{SS}=0V, T_a=-40^{\circ}C \sim 125^{\circ}C$ 

| Parameter               | Symbol    | Condition | Min                 | Typ | Max                 | Unit        | Note     |
|-------------------------|-----------|-----------|---------------------|-----|---------------------|-------------|----------|
| Supply Voltage          | $V_{DD}$  |           | 1.62                |     | 3.63                | V           | $V_{DD}$ |
| “H” Input Voltage       | $V_{IH}$  |           | $V_{DD} \times 0.8$ |     |                     | V           | CE(OE)   |
| “L” Input Voltage       | $V_{IL}$  |           |                     |     | $V_{DD} \times 0.2$ | V           | CE(OE)   |
| Input Voltage           | $V_{IN}$  |           | $V_{SS}$            |     | $V_{DD}$            | V           | CE(OE)   |
| Output Load Capacitance | CL        | CMOS      |                     |     | 15                  | pF          | OUT      |
| Ambient Temperature     | $T_{opt}$ |           | -40                 |     | 125                 | $^{\circ}C$ |          |

This IC has enough immunity against ESD and Latch-up, but handle with care.

## 5. Electrical Specification

### 5-1 IPS029xM0By / IPS029xM0BAy

Unless otherwise stated, CL=15pF, V<sub>DD</sub>=1.62V~3.63V, V<sub>SS</sub>=0V, Ta=-40°C~125°C

| Parameter                                                  | Symbol             | Condition                                                                                          |                             | Specification      |     |                    | Unit |
|------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------|-----------------------------|--------------------|-----|--------------------|------|
|                                                            |                    |                                                                                                    |                             | Min                | Typ | Max                |      |
| Output leak current                                        | I <sub>Z</sub>     | CE=0V, X1=V <sub>DD</sub> or V <sub>SS</sub><br>V <sub>out</sub> =V <sub>SS</sub> ~V <sub>DD</sub> |                             |                    |     | 10                 | μA   |
| “H” output voltage                                         | V <sub>OH</sub>    | I <sub>OH</sub> =-1.0mA                                                                            |                             | 0.9V <sub>DD</sub> |     |                    | V    |
| “L” output voltage                                         | V <sub>OL</sub>    | I <sub>OL</sub> =1.0mA                                                                             |                             |                    |     | 0.1V <sub>DD</sub> | V    |
| Output Disable Time                                        | T <sub>plz</sub>   |                                                                                                    |                             |                    |     | 100                | ns   |
| Output Enable Time                                         | T <sub>pzl</sub>   |                                                                                                    |                             |                    |     | 2.0                | ms   |
| Oscillation start up time                                  | T <sub>start</sub> | V <sub>DD</sub> ≥ 1.62V                                                                            |                             |                    |     | 2.0                | ms   |
| Current consumption<br>* CL=15pF<br>i=2,3,4<br>j=2,3,4,5,6 | I <sub>DD</sub>    | IPS0293M0B, f=27MHz, V <sub>DD</sub> =1.8V                                                         |                             |                    |     | 2.3                | mA   |
|                                                            |                    | IPS0293M0B, f=27MHz, V <sub>DD</sub> =3.3V                                                         |                             |                    |     | 4.2                |      |
|                                                            |                    | IPS0293M0BA, f=27MHz, V <sub>DD</sub> =1.8V                                                        |                             |                    |     | 2.0                |      |
|                                                            |                    | IPS0293M0BA, f=27MHz, V <sub>DD</sub> =3.3V                                                        |                             |                    |     | 3.5                |      |
|                                                            |                    | IPS0293M1B, f=27MHz, V <sub>DD</sub> =1.8V                                                         |                             |                    |     | 2.0                |      |
|                                                            |                    | IPS0293M1B, f=27MHz, V <sub>DD</sub> =3.3V                                                         |                             |                    |     | 3.5                |      |
|                                                            |                    | IPS0293M1BA, f=27MHz, V <sub>DD</sub> =1.8V                                                        |                             |                    |     | 1.5                |      |
|                                                            |                    | IPS0293M1BA, f=27MHz, V <sub>DD</sub> =3.3V                                                        |                             |                    |     | 2.5                |      |
|                                                            |                    | IPS0293MiB, f=27MHz, V <sub>DD</sub> =1.8V                                                         |                             |                    |     | 1.5                |      |
|                                                            |                    | IPS0293MiB, f=27MHz, V <sub>DD</sub> =3.3V                                                         |                             |                    |     | 3.0                |      |
|                                                            |                    | IPS0293MjBA, f=27MHz, V <sub>DD</sub> =1.8V                                                        |                             |                    |     | 1.0                |      |
|                                                            |                    | IPS0293MjBA, f=27MHz, V <sub>DD</sub> =3.3V                                                        |                             |                    |     | 1.5                |      |
|                                                            |                    | IPS0294M0B, f=100MHz, V <sub>DD</sub> =1.8V                                                        |                             |                    |     | 6.0                |      |
|                                                            |                    | IPS0294M0B, f=100MHz, V <sub>DD</sub> =3.3V                                                        |                             |                    |     | 12.0               |      |
|                                                            |                    | IPS0295M0B, f=150MHz, V <sub>DD</sub> =1.8V                                                        |                             |                    |     | 14.0               |      |
|                                                            |                    | IPS0295M0B, f=150MHz, V <sub>DD</sub> =3.3V                                                        |                             |                    |     | 20.0               |      |
|                                                            |                    | IPS0295M0BA, f=150MHz, V <sub>DD</sub> =1.8V                                                       |                             |                    |     | 12.0               |      |
|                                                            |                    | IPS0295M0BA, f=150MHz, V <sub>DD</sub> =3.3V                                                       |                             |                    |     | 17.0               |      |
| Current consumption at oscillation stop                    | I <sub>DDD</sub>   | V <sub>DD</sub> =3.3V, CE ≤ 0.3V                                                                   |                             |                    |     | 5.0                | uA   |
| Freq. V <sub>DD</sub> deviation                            | F <sub>vst</sub>   | V <sub>DD</sub> =1.8V±10%                                                                          | IPS0293MyB(A)<br>IPS0294M0B |                    |     | ±1.0               | ppm  |
|                                                            |                    |                                                                                                    | IPS0295M0B(A)               |                    |     | ±3.0               |      |
|                                                            |                    | V <sub>DD</sub> =3.3V±10%                                                                          | IPS0293MyB(A)<br>IPS0294M0B |                    |     | ±1.0               |      |
|                                                            |                    |                                                                                                    | IPS0295M0B(A)               |                    |     | ±2.0               |      |

| Output Duty Ratio                 | DUTY    | 1/2V <sub>DD</sub> point                               | 45            | 55  | %  |
|-----------------------------------|---------|--------------------------------------------------------|---------------|-----|----|
| Rise time / Fall time<br>*CL=15pF | Tr / Tf | V <sub>DD</sub> =1.62V~2.25V<br>10%~90%V <sub>DD</sub> | IPS0293MyB(A) | 6.5 | ns |
|                                   |         |                                                        | IPS0294M0B    | 5.0 |    |
|                                   |         |                                                        | IPS0295M0B(A) | 3.5 |    |
|                                   |         | V <sub>DD</sub> =2.25V~3.63V<br>10%~90%V <sub>DD</sub> | IPS0293MyB(A) | 4.0 |    |
|                                   |         |                                                        | IPS0294M0B    | 3.0 |    |
|                                   |         |                                                        | IPS0295M0B(A) | 2.0 |    |

## 5-2 IPS029xMyBB

Unless otherwise stated, CL=15pF, V<sub>DD</sub>=1.62V~3.63V, V<sub>SS</sub>=0V, Ta=-40°C~125°C

| Parameter                               | Symbol             | Condition                                                                                          | Specification              |     |                    | Unit |
|-----------------------------------------|--------------------|----------------------------------------------------------------------------------------------------|----------------------------|-----|--------------------|------|
|                                         |                    |                                                                                                    | Min                        | Typ | Max                |      |
| Output leak current                     | I <sub>Z</sub>     | OE=0V, X1=V <sub>DD</sub> or V <sub>SS</sub><br>V <sub>out</sub> =V <sub>SS</sub> ~V <sub>DD</sub> |                            |     | 10                 | μA   |
| “H” output voltage                      | V <sub>OH</sub>    | I <sub>OH</sub> =-1.0mA                                                                            | 0.9V <sub>DD</sub>         |     |                    | V    |
| “L” output voltage                      | V <sub>OL</sub>    | I <sub>OL</sub> =1.0mA                                                                             |                            |     | 0.1V <sub>DD</sub> | V    |
| Output Disable Time                     | T <sub>plz</sub>   |                                                                                                    |                            |     | 100                | ns   |
| Output Enable Time                      | T <sub>pzl</sub>   |                                                                                                    |                            |     | 200                | ns   |
| Oscillation start up time               | T <sub>start</sub> | V <sub>DD</sub> ≥1.62V                                                                             |                            |     | 2.0                | ms   |
| Current consumption<br>*CL=15pF         | I <sub>DD</sub>    | IPS0293MyBB, f=27MHz, V <sub>DD</sub> =1.8V                                                        |                            |     | 2.3                | mA   |
|                                         |                    | IPS0293MyBB, f=27MHz, V <sub>DD</sub> =3.3V                                                        |                            |     | 4.2                |      |
|                                         |                    | IPS0294MyBB, f=100MHz, V <sub>DD</sub> =1.8V                                                       |                            |     | 6.0                |      |
|                                         |                    | IPS0294MyBB, f=100MHz, V <sub>DD</sub> =3.3V                                                       |                            |     | 12.0               |      |
|                                         |                    | IPS0295M0BB, f=150MHz, V <sub>DD</sub> =1.8V                                                       |                            |     | TBD                |      |
|                                         |                    | IPS0295M0BB, f=150MHz, V <sub>DD</sub> =3.3V                                                       |                            |     | TBD                |      |
| Current consumption at oscillation stop | I <sub>DDD</sub>   | f=54MHz, OE=Low                                                                                    |                            |     | 3.8                | mA   |
|                                         |                    | f=100MHz, OE=Low                                                                                   |                            |     | 5.0                |      |
|                                         |                    | f=150MHz, OE=Low                                                                                   |                            |     | TBD                |      |
| Freq. V <sub>DD</sub> deviation         | F <sub>vst</sub>   | V <sub>DD</sub> =1.8V±10%                                                                          | IPS0293MyBB<br>IPS0294MyBB |     | ±1.0               | ppm  |
|                                         |                    |                                                                                                    | IPS0295M0BB                |     | TBD                |      |
|                                         |                    | V <sub>DD</sub> =3.3V±10%                                                                          | IPS0293MyBB<br>IPS0294MyBB |     | ±1.0               |      |
|                                         |                    |                                                                                                    | IPS0295M0BB                |     | TBD                |      |
| Output Duty Ratio                       | DUTY               | 1/2V <sub>DD</sub> point                                                                           | 45                         |     | 55                 | %    |
| Rise time / Fall time<br>* CL=15pF      | Tr / Tf            | V <sub>DD</sub> =1.62V~2.25V<br>10%~90%V <sub>DD</sub>                                             | IPS0293MyBB                |     | 6.5                | ns   |
|                                         |                    |                                                                                                    | IPS0294MyBB                |     | 5.0                |      |
|                                         |                    |                                                                                                    | IPS0295M0BB                |     | TBD                |      |
|                                         |                    | V <sub>DD</sub> =2.25V~3.63V<br>10%~90%V <sub>DD</sub>                                             | IPS0293MyBB                |     | 4.0                |      |
|                                         |                    |                                                                                                    | IPS0294MyBB                |     | 3.0                |      |
|                                         |                    |                                                                                                    | IPS0295M0BB                |     | TBD                |      |

**5-3 IPS029xMTB / IPS0293MTBE**

 Unless otherwise stated,  $CL=15pF$ ,  $V_{DD}=1.62V\sim 3.63V$ ,  $V_{SS}=0V$ ,  $T_a=-40^{\circ}C\sim 125^{\circ}C$ 

| Parameter                                  | Symbol      | Condition                                                     |                             | Specification |     |             | Unit    |
|--------------------------------------------|-------------|---------------------------------------------------------------|-----------------------------|---------------|-----|-------------|---------|
|                                            |             |                                                               |                             | Min           | Typ | Max         |         |
| Output leak current                        | $I_Z$       | $CE=0V$ , $X1=V_{DD}$ or $V_{SS}$ $V_{out}=V_{SS}\sim V_{DD}$ |                             |               |     | 10          | $\mu A$ |
| “H” output voltage                         | $V_{OH}$    | $I_{OH}=-1.0mA$                                               |                             | $0.9V_{DD}$   |     |             | V       |
| “L” output voltage                         | $V_{OL}$    | $I_{OL}=1.0mA$                                                |                             |               |     | $0.1V_{DD}$ | V       |
| Output Disable Time                        | $T_{plz}$   |                                                               |                             |               |     | 100         | ns      |
| Output Enable Time                         | $T_{pzl}$   |                                                               |                             |               |     | 10.0        | ms      |
| Oscillation start up time                  | $T_{start}$ | $V_{DD}\geq 1.62V$                                            |                             |               |     | 10.0        | ms      |
| Current consumption<br>* $CL=15pF$         | $I_{DD}$    | IPS0293MTB, $f=65MHz$ , $V_{DD}=1.8V$                         |                             |               |     | 13.5        | mA      |
|                                            |             | IPS0293MTB, $f=65MHz$ , $V_{DD}=3.3V$                         |                             |               |     | 30.0        |         |
|                                            |             | IPS0293MTBE, $f=65MHz$ , $V_{DD}=1.8V$                        |                             |               |     | 15.0        |         |
|                                            |             | IPS0293MTBE, $f=65MHz$ , $V_{DD}=3.3V$                        |                             |               |     | 30.0        |         |
|                                            |             | IPS0294MTB, $f=100MHz$ , $V_{DD}=1.8V$                        |                             |               |     | 15.0        |         |
|                                            |             | IPS0294MTB, $f=100MHz$ , $V_{DD}=3.3V$                        |                             |               |     | 32.5        |         |
|                                            |             | IPS0295MTB, $f=130MHz$ , $V_{DD}=1.8V$                        |                             |               |     | 19.0        |         |
|                                            |             | IPS0295MTB, $f=130MHz$ , $V_{DD}=3.3V$                        |                             |               |     | 40.0        |         |
|                                            |             | IPS0296MTB, $f=160MHz$ , $V_{DD}=1.8V$                        |                             |               |     | 24.5        |         |
|                                            |             | IPS0296MTB, $f=160MHz$ , $V_{DD}=3.3V$                        |                             |               |     | 47.0        |         |
| Current consumption<br>at oscillation stop | $I_{DDD}$   | $V_{DD}=3.3V$ , $CE\leq 0.3V$                                 |                             |               |     | 5.0         | $\mu A$ |
| Freq. $V_{DD}$ deviation                   | $F_{vst}$   | $V_{DD}=1.8V\pm 10\%$                                         | IPS0293MTB(E)<br>IPS0294MTB |               |     | $\pm 1.0$   | ppm     |
|                                            |             |                                                               | IPS0295MTB<br>IPS0296MTB    |               |     | $\pm 2.0$   |         |
|                                            |             | $V_{DD}=3.3V\pm 10\%$                                         | All Models                  |               |     | $\pm 1.0$   |         |
| Output Duty Ratio                          | DUTY        | $1/2V_{DD}$ point<br>$-40^{\circ}C\sim 125^{\circ}C$          | IPS0293MTB(E)<br>IPS0294MTB | 45            |     | 55          | %       |
|                                            |             | $1/2V_{DD}$ point<br>$-40^{\circ}C\sim 85^{\circ}C$           | IPS0295MTB<br>IPS0296MTB    | 45            |     | 55          |         |
|                                            |             | $1/2V_{DD}$ point<br>$85^{\circ}C\sim 125^{\circ}C$           | IPS0295MTB<br>IPS0296MTB    | 40            |     | 60          |         |
| Rise time / Fall time<br>* $CL=15pF$       | $T_r / T_f$ | $V_{DD}=1.62V\sim 2.25V$<br>$10\%\sim 90\%V_{DD}$             | IPS0293MTB                  |               |     | 6.5         | ns      |
|                                            |             |                                                               | IPS0293MTBE                 |               |     | 3.5         |         |
|                                            |             |                                                               | IPS0294MTB                  |               |     | 5.0         |         |
|                                            |             |                                                               | IPS0295MTB                  |               |     | 3.5         |         |
|                                            |             |                                                               | IPS0296MTB                  |               |     | 3.5         |         |
|                                            |             | $V_{DD}=2.25V\sim 3.63V$<br>$10\%\sim 90\%V_{DD}$             | IPS0293MTB                  |               |     | 4.0         |         |
|                                            |             |                                                               | IPS0293MTBE                 |               |     | 2.0         |         |
|                                            |             |                                                               | IPS0294MTB                  |               |     | 3.0         |         |
|                                            |             |                                                               | IPS0295MTB                  |               |     | 2.0         |         |
|                                            |             |                                                               | IPS0296MTB                  |               |     | 2.0         |         |



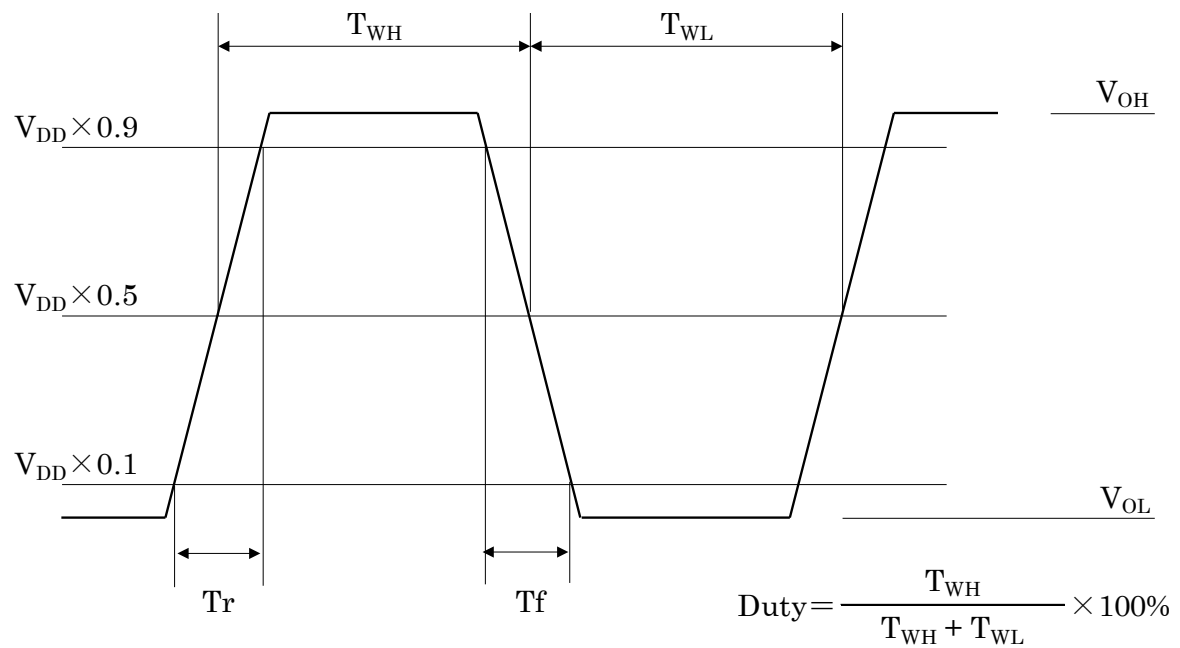
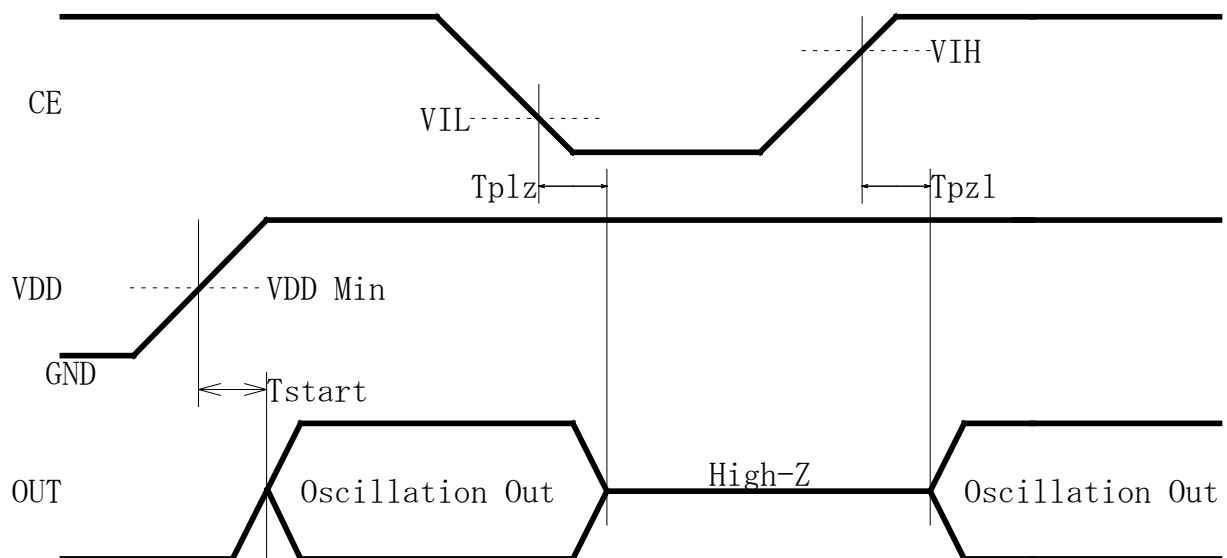


Fig. 5-1 Output Wave Form (Duty,  $T_r$ ,  $T_f$ ,  $V_{OH}$ ,  $V_{OL}$ )



$V_{IH}$  : Threshold voltage for Oscillation Start  
 $V_{IL}$  : Threshold voltage for Oscillation Stop

Fig. 5-2 Input output signal timing

\* IPS029xBBy series are OE pins instead of CE pins.

## 6. Circuit Parameters of Oscillator (Reference Data for Circuit Design)

### 6-1 IPS029xMyB Series

 $T_a=25^{\circ}\text{C}$ 

| Parameter             |                                 | Symbol | Condition         | Min | Typ  | Max | Unit       |
|-----------------------|---------------------------------|--------|-------------------|-----|------|-----|------------|
| Feedback Resistor     | All Models                      | Rf     | Refer to Fig. 6-1 |     | 300  |     | k $\Omega$ |
| Driving Resistor      | IPS0293MyB<br>(y=0, 1, 2, 3, 4) | Rd     | Refer to Fig. 6-1 |     | 1000 |     | $\Omega$   |
|                       | IPS0294M0B                      |        |                   |     | 750  |     |            |
|                       | IPS0295M0B                      |        |                   |     | 250  |     |            |
| Oscillation Capacitor | IPS0293MyB<br>(y=0, 1, 2, 3, 4) | Cg     | Refer to Fig. 6-1 |     | 5.0  |     | pF         |
|                       |                                 | Cd     |                   |     | 12.0 |     |            |
|                       | IPS0294M0B                      | Cg     |                   |     | 3.0  |     |            |
|                       |                                 | Cd     |                   |     | 5.0  |     |            |
|                       | IPS0295M0B                      | Cg     |                   |     | 4.0  |     |            |
|                       |                                 | Cd     |                   |     | 6.0  |     |            |

### 6-2 IPS029xMyBA Series

 $T_a=25^{\circ}\text{C}$ 

| Parameter             |                                  | Symbol | Condition         | Min | Typ  | Max | Unit       |
|-----------------------|----------------------------------|--------|-------------------|-----|------|-----|------------|
| Feedback Resistor     | All Models                       | Rf     | Refer to Fig. 6-1 |     | 200  |     | k $\Omega$ |
| Driving Resistor      | IPS0293MyBA<br>(y=0,1,2,3,4,5,6) | Rd     | Refer to Fig. 6-1 |     | 1000 |     | $\Omega$   |
|                       | IPS0295M0BA                      |        |                   |     | 300  |     |            |
| Oscillation Capacitor | IPS0293MyBA<br>(y=0,1,2,3,4,5,6) | Cg     | Refer to Fig. 6-1 |     | 4.8  |     | pF         |
|                       |                                  | Cd     |                   |     | 12.0 |     |            |
|                       | IPS0295M0BA                      | Cg     |                   |     | 4.8  |     |            |
|                       |                                  | Cd     |                   |     | 4.8  |     |            |

**6-3 IPS029xMyBB Series**

Ta=25°C

| Parameter             |                            | Symbol | Condition         | Min | Typ  | Max | Unit |
|-----------------------|----------------------------|--------|-------------------|-----|------|-----|------|
| Feedback Resistor     | All Models                 | Rf     | Refer to Fig. 6-1 |     | 300  |     | kΩ   |
| Driving Resistor      | IPS0293MyBB<br>(y=0, 1, 2) | Rd     | Refer to Fig. 6-1 |     | 1000 |     | Ω    |
|                       | IPS0294MyBB<br>(y=0, 1, 2) |        |                   |     | 750  |     |      |
|                       | IPS0295M0BB                |        |                   |     | 250  |     |      |
| Oscillation Capacitor | IPS0293MyBB<br>(y=0, 1, 2) | Cg     | Refer to Fig. 6-1 |     | 5.0  |     | pF   |
|                       |                            | Cd     |                   |     | 12.0 |     |      |
|                       | IPS0294MyBB<br>(y=0, 1, 2) | Cg     |                   |     | 3.0  |     |      |
|                       |                            | Cd     |                   |     | 5.0  |     |      |
|                       | IPS0295M0BB                | Cg     |                   |     | 4.0  |     |      |
|                       |                            | Cd     |                   |     | 6.0  |     |      |

**6-4 IPS029xMTB Series / IPS0293MTBE**

Ta=25°C

| Parameter             |             | Symbol | Condition         | Min | Typ  | Max | Unit |
|-----------------------|-------------|--------|-------------------|-----|------|-----|------|
| Feedback Resistor     | IPS0293MTB  | Rf     | Refer to Fig. 6-1 |     | 4.0  |     | kΩ   |
|                       | IPS0293MTBE |        |                   |     | 3.25 |     |      |
|                       | IPS0294MTB  |        |                   |     | 3.0  |     |      |
|                       | IPS0295MTB  |        |                   |     | 2.5  |     |      |
|                       | IPS0296MTB  |        |                   |     | 1.96 |     |      |
| Driving Resistor      | IPS0293MTB  | Rd     | Refer to Fig. 6-1 |     | 500  |     | Ω    |
|                       | IPS0293MTBE |        |                   |     | 500  |     |      |
|                       | IPS0294MTB  |        |                   |     | 250  |     |      |
|                       | IPS0295MTB  |        |                   |     | 250  |     |      |
|                       | IPS0296MTB  |        |                   |     | 125  |     |      |
| Oscillation Capacitor | IPS0293MTB  | Cg     | Refer to Fig. 6-1 |     | 8.0  |     | pF   |
|                       |             | Cd     |                   |     | 10.0 |     |      |
|                       | IPS0293MTBE | Cg     |                   |     | 8.0  |     |      |
|                       |             | Cd     |                   |     | 10.0 |     |      |
|                       | IPS0294MTB  | Cg     |                   |     | 5.0  |     |      |
|                       |             | Cd     |                   |     | 9.0  |     |      |
|                       | IPS0295MTB  | Cg     |                   |     | 4.0  |     |      |
|                       |             | Cd     |                   |     | 8.0  |     |      |
|                       | IPS0296MTB  | Cg     |                   |     | 3.0  |     |      |
|                       |             | Cd     |                   |     | 8.0  |     |      |

\*The above values are the design values and are not guaranteed by test.

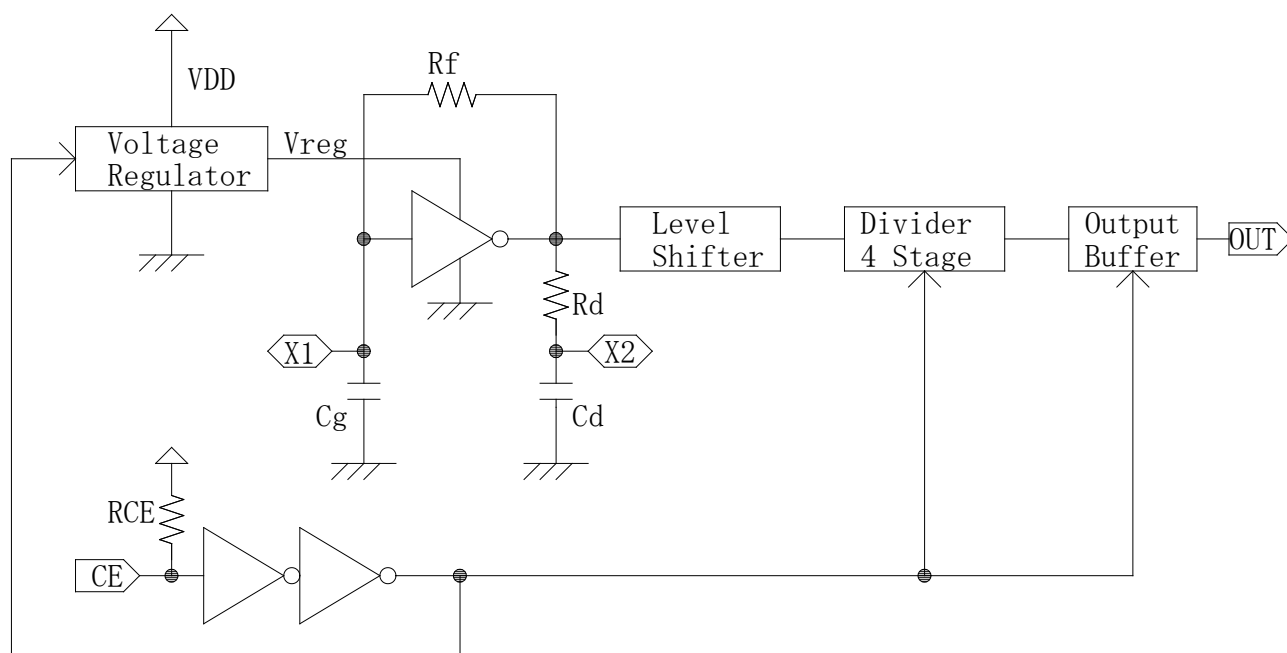
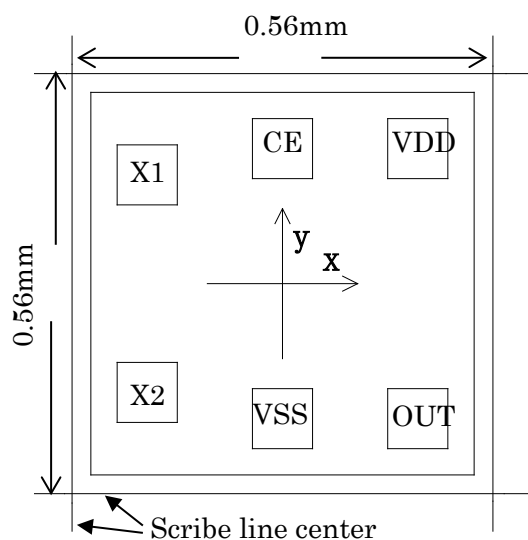


Fig. 6-1 Block Diagram

## 7. Pad Layout

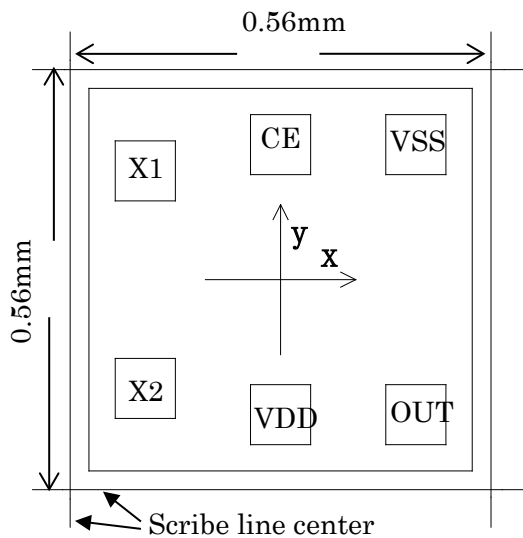
### 7-1 Cross Type



- Die Size: 0.56mm × 0.56mm
- Pad Size: 80um □
- Thickness: 130um ±10um
- IC Backside: Gnd or Open

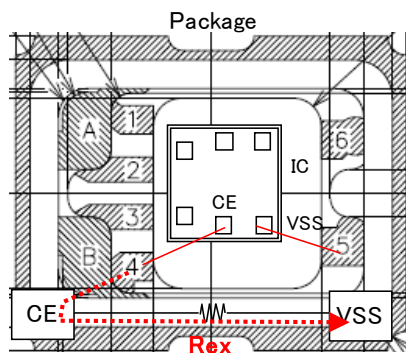
| Pad Name    | Function                                | Location (μm) |         |
|-------------|-----------------------------------------|---------------|---------|
|             |                                         | x             | y       |
| X2          | Crystal Drive                           | -181.00       | -143.15 |
| VSS         | (-) Ground                              | 0.00          | -180.55 |
| OUT(Q)      | Frequency Output                        | 181.00        | -180.55 |
| VDD         | (+) Power Supply                        | 181.00        | 180.55  |
| CE          | Oscillation stop<br>"L": High-Impedance | 0.00          | 180.55  |
| X1          | Crystal Feedback                        | -181.00       | 143.15  |
| Chip Center |                                         | 0             | 0       |

## 7-2 Flip Type



- Die Size: 0.56mm × 0.56mm
- Pad Size: 80um □
- Thickness: 100um or 130um ±10um
- IC Backside: Gnd or Open

| Pad Name    | Function                                | Location (μm) |         |
|-------------|-----------------------------------------|---------------|---------|
|             |                                         | x             | y       |
| X2          | Crystal Drive                           | -181.00       | -143.15 |
| VDD         | (+) Power Supply                        | 0.00          | -180.55 |
| OUT(Q)      | Frequency Output                        | 181.00        | -180.55 |
| VSS         | (-) Ground                              | 181.00        | 180.55  |
| CE          | Oscillation stop<br>"L": High-Impedance | 0.00          | 180.55  |
| X1          | Crystal Feedback                        | -181.00       | 143.15  |
| Chip Center |                                         | 0             | 0       |



### IMPORTANT Notice for CE function

- ※ Oscillation will not be activated when CE=Open after CE=Low if Rex is not large.
- ※ Reference value of Rex is over 10MΩ with CE=Open usage.
- ※ There is no such issue with CE=VDD usage.

Rex : Resistance value between CE and VSS of package

\* IPS029xBBy series are OE pins instead of CE pins.

