

High-performance Clock Generator Series

# Compact 1ch Clock Generators for Digital Cameras



BU7344HFV, BU7345HFV, BU7346GUL

No.11005EAT06

## ●Description

These Clock Generators incorporate compact package compared to oscillators, which provides the generation of high-frequency CCD clocks necessary for digital still cameras and digital video cameras.

## ●Features

- 1) SEL pin allowing for the selection of frequencies
- 2) Selection of OE (PDB) pin enabling Power-down function
- 3) Crystal-oscillator-level clock precision with high C/N characteristics and low jitter
- 4) Micro miniature Package incorporated
- 5) Single power supply of 3.3 V

## ●Applications

Digital Still Camera, Digital Video Camera, and others

## ●Line up matrix

| Parameter                   | BU7344HFV   | BU7345HFV   | BU7346GUL               |
|-----------------------------|-------------|-------------|-------------------------|
| Supply voltage              | 2.7V~3.6V   | 2.7V~3.6V   | 2.7V~3.6V               |
| Operating temperature range | -5 °C~75 °C | -5 °C~75 °C | -5 °C~75 °C             |
| Reference input clock       | 27.0000MHz  | 27.0000MHz  | 27.0000MHz              |
| Output clock                | 40.5000MHz  | 38.0000MHz  | 38.0000MHz              |
|                             | 36.0000MHz  | 36.0000MHz  | 36.0000MHz              |
| Standby current(MAX.)       | 1.0μA       | 1.0μA       | 1.0μA                   |
| Operating current (TYP)     | 4.0mA       | 3.5mA       | 3.5mA                   |
| Package                     | HVSOF6      | HVSOF6      | VCSP50L1<br>1.5mm×1.0mm |

● Absolute maximum ratings (Ta=25 °C)

| Parameter                 | Symbol | Ratings                                 | Unit |
|---------------------------|--------|---|------|
| Supply voltage            | VDD    | -0.3 ~ 4.0                              | V    |
| Input voltage             | VIN    | -0.3 ~ VDD+0.3                          | V    |
| Storage temperature range | Tstg   | -55 ~ 125                               | °C   |
| Power dissipation         | Pd     | 410(BU7344HFV, BU7345HFV) <sup>*1</sup> | mW   |
|                           |        | 460(BU7346GUL) <sup>*2</sup>            |      |

\*1 Mounted on 70mm \* 70mm \* 1.6mm Glass-epoxy PCB. Derating: 4.1mW / °C at Ta > 25°C

\*2 Mounted on 50mm \* 58mm \* 1.75mm Glass-epoxy PCB. Derating: 4.6mW / °C at Ta > 25°C

\* Operating is not guaranteed.

\* The radiation-resistance design is not carried out.

● Operating conditions

| Parameter             | Symbol | Ratings      | Unit |
|-----------------------|--------|--------------|------|
| Supply voltage        | VDD    | 2.7 ~ 3.6    | V    |
| Input H voltage       | VINH   | 0.8VDD ~ VDD | V    |
| Input L voltage       | VINL   | 0.0 ~ 0.2VDD | V    |
| Operating temperature | Topr   | -5 ~ 75      | °C   |
| Output load           | CL     | 15(MAX.)     | pF   |

● Electrical characteristics

OBU7344HFV (Ta=25 °C, VDD=3.3V, Crystal frequency=27.0000MHz, unless otherwise specified.)

| Parameter             | Symbol  | Limits  |      |      | Unit | Conditions                      |
|-----------------------|---------|---------|------|------|------|---------------------------------|
|                       |         | Min.    | Typ. | Max. |      |                                 |
| Output H voltage      | VOH     | 2.8     | -    | VDD  | V    | IOH = -3.0mA                    |
| Output L voltage      | VOL     | 0.0     | -    | 0.5  | V    | IOL = 3.0mA                     |
| Standby current       | IDDst   | -       | -    | 1.0  | μA   | OE = L                          |
| Consumption current 1 | IDD1    | -       | 4.0  | 5.2  | mA   | 40.5000MHz output<br>SEL = L    |
| Consumption current 2 | IDD2    | -       | 3.5  | 4.6  | mA   | 36.0000MHz output<br>SEL = H    |
| Pull-down load        | Rpd     | 50      | 100  | 200  | kΩ   | input PIN, pull-down load value |
| Output frequency      |         |         |      |      |      |                                 |
| OUT1                  | CLK40.5 | 40.5000 |      |      | MHz  | IN*12/4/2, SEL = L              |
| OUT2                  | CLK36   | 36.0000 |      |      | MHz  | IN*8/3/2, SEL = H               |

\* The output frequency is determined by the arithmetic (frequency division) expression of a frequency input to IN.  
If the input frequency is set to 27.0000MHz, the output frequency will be as listed above.

OBU7345HFV (Ta=25 °C, VDD=3.3V, Crystal frequency=27.0000MHz, unless otherwise specified.)

| Parameter             | Symbol | Limits  |      |      | Unit | Conditions                      |
|-----------------------|--------|---------|------|------|------|---------------------------------|
|                       |        | Min.    | Typ. | Max. |      |                                 |
| Output H voltage      | VOH    | 2.8     | -    | VDD  | V    | IOH = -3.0mA                    |
| Output L voltage      | VOL    | 0.0     | -    | 0.5  | V    | IOL = 3.0mA                     |
| Standby current       | IDDst  | -       | -    | 1.0  | μA   | OE = L                          |
| Consumption current 1 | IDD1   | -       | 3.5  | 4.6  | mA   | 38.0000MHz output<br>SEL = L    |
| Consumption current 2 | IDD2   | -       | 3.5  | 4.6  | mA   | 36.0000MHz output<br>SEL = H    |
| Pull-down load        | Rpd    | 50      | 100  | 200  | kΩ   | input PIN, pull-down load value |
| Output frequency      |        |         |      |      |      |                                 |
| OUT1                  | CLK38  | 38.0000 |      |      | MHz  | IN*76/27/2, SEL = L             |
| OUT2                  | CLK36  | 36.0000 |      |      | MHz  | IN*8/3/2, SEL = H               |

\* The output frequency is determined by the arithmetic (frequency division) expression of a frequency input to IN.  
If the input frequency is set to 27.0000MHz, the output frequency will be as listed above.

OBU7346GUL (Ta=25 °C, VDD=3.3V, Crystal frequency=27.0000MHz, unless otherwise specified.)

| Parameter             | Symbol | Limits  |      |      | Unit | Conditions                      |
|-----------------------|--------|---------|------|------|------|---------------------------------|
|                       |        | Min.    | Typ. | Max. |      |                                 |
| Output H voltage      | VOH    | 2.8     | -    | VDD  | V    | IOH = -3.0mA                    |
| Output L voltage      | VOL    | 0.0     | -    | 0.5  | V    | IOL = 3.0mA                     |
| Standby current       | IDDst  | -       | -    | 1.0  | μA   | PDB = L                         |
| Consumption current 1 | IDD1   | -       | 3.5  | 4.6  | mA   | 38.0000MHz output<br>SEL = L    |
| Consumption current 2 | IDD2   | -       | 3.5  | 4.6  | mA   | 36.0000MHz output<br>SEL = H    |
| Pull-down load        | Rpd    | 50      | 100  | 200  | kΩ   | input PIN, pull-down load value |
| Output frequency      |        |         |      |      |      |                                 |
| OUT1                  | CLK38  | 38.0000 |      |      | MHz  | XIN*76/27/2, SEL = L            |
| OUT2                  | CLK36  | 36.0000 |      |      | MHz  | XIN*8/3/2, SEL = H              |

\* The output frequency is determined by the arithmetic (frequency division) expression of a frequency input to XIN.  
If the input frequency is set to 27.0000MHz, the output frequency will be as listed above.

●Reference data (BU7344HFV basic data)

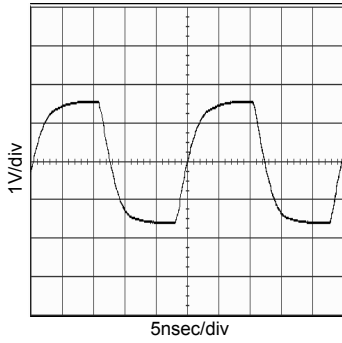


Fig.1 40.5MHz output waveform  
(CL=15pF, Ta=25 °C)

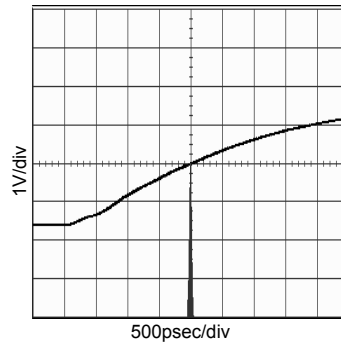


Fig.2 40.5MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

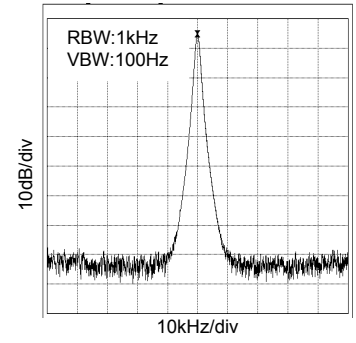


Fig.3 40.5MHz spectrum  
(CL=15pF, Ta=25 °C)

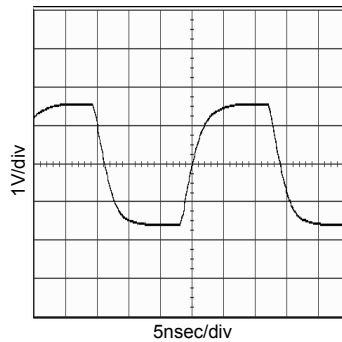


Fig.4 36MHz output waveform  
(CL=15pF, Ta=25 °C)

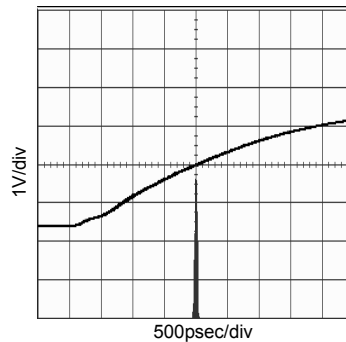


Fig.5 36MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

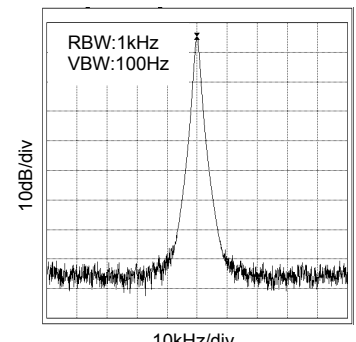


Fig.6 36MHz spectrum  
(CL=15pF, Ta=25 °C)

●Reference data (BU7345HFV basic data)

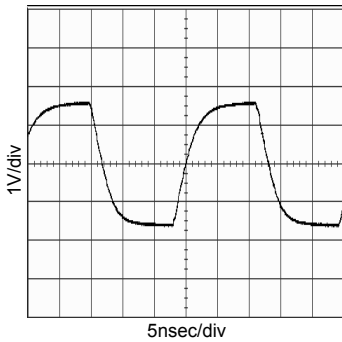


Fig.7 38MHz output waveform  
(CL=15pF, Ta=25 °C)

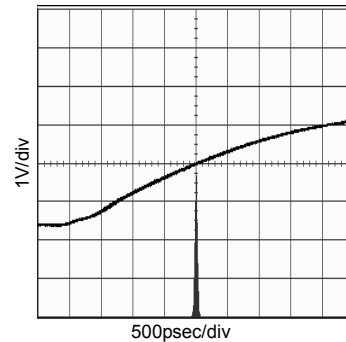


Fig.8 38MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

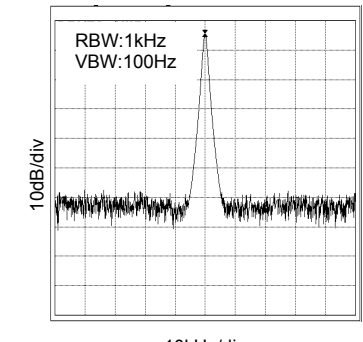


Fig.9 38MHz spectrum  
(CL=15pF, Ta=25 °C)

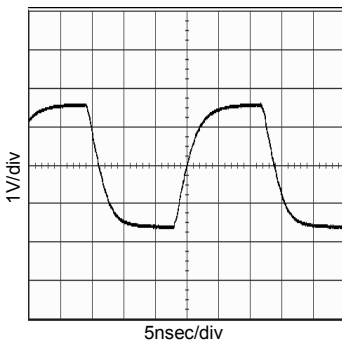


Fig.10 36MHz output waveform  
(CL=15pF, Ta=25 °C)

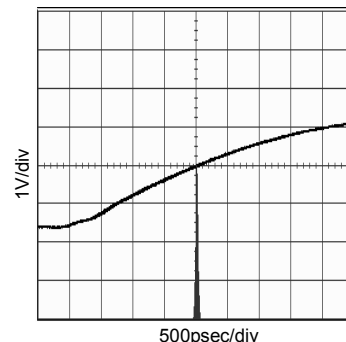


Fig.11 36MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

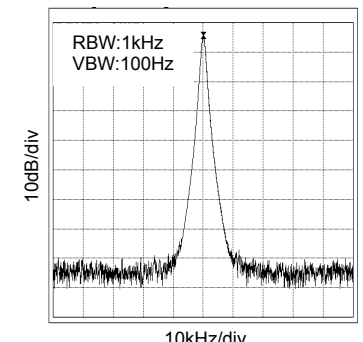


Fig.12 36MHz spectrum  
(CL=15pF, Ta=25 °C)

●Reference data (BU7346GUL basic data)

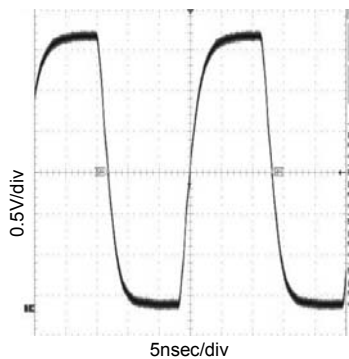


Fig.13 38MHz output waveform  
(CL=15pF, Ta=25 °C)

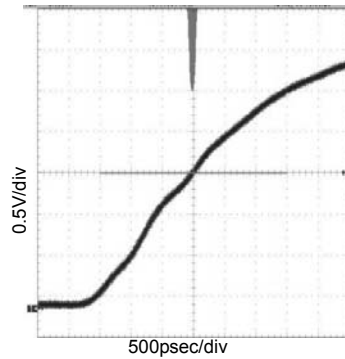


Fig.14 38MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

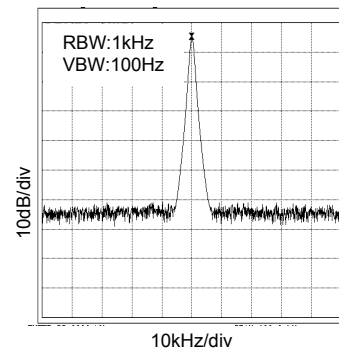


Fig.15 38MHz spectrum  
(CL=15pF, Ta=25 °C)

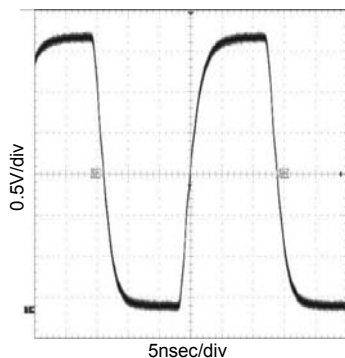


Fig.16 36MHz output waveform  
(CL=15pF, Ta=25 °C)

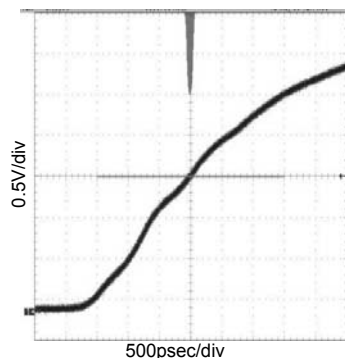


Fig.17 36MHz Period-Jitter  
(CL=15pF, Ta=25 °C)

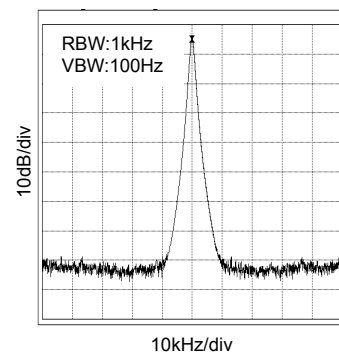


Fig.18 36MHz spectrum  
(CL=15pF, Ta=25 °C)

●Reference data (BU7344HFV Temperature and Supply voltage variations data)

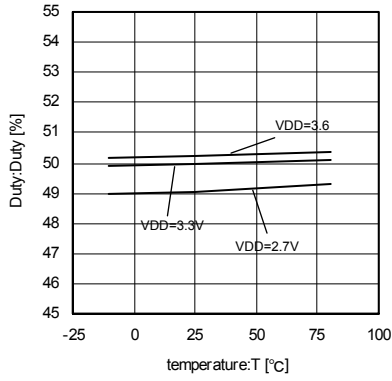


Fig.19 40.5MHz  
Temperature - Duty

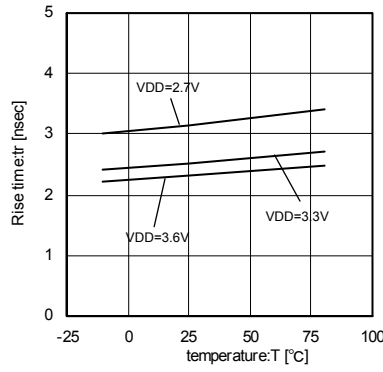


Fig.20 40.5MHz  
Temperature - Rise-time

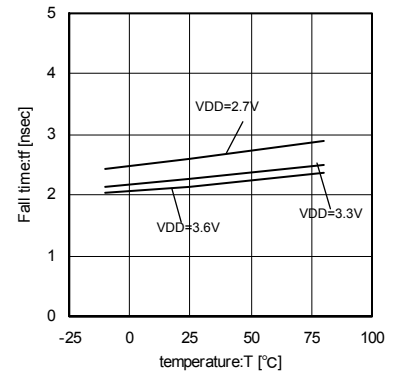


Fig.21 40.5MHz  
Temperature - Fall-time

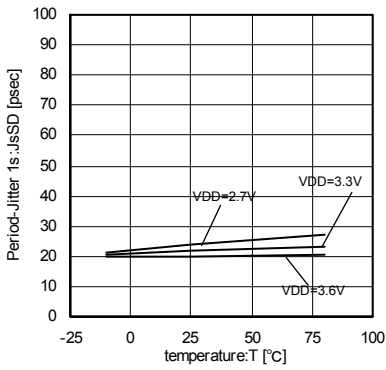


Fig.22 40.5MHz  
Temperature - Period-Jitter 1σ

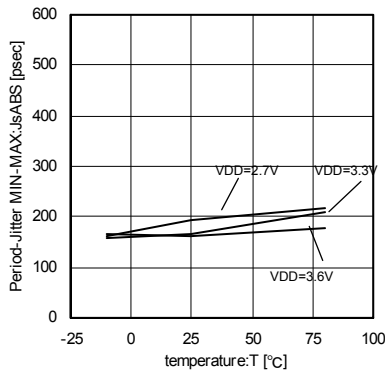


Fig.23 40.5MHz  
Temperature - Period-Jitter MIN-MAX

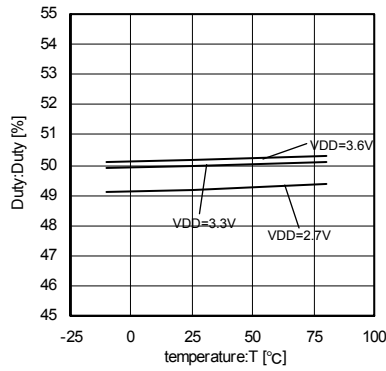


Fig.24 36MHz  
Temperature - Duty

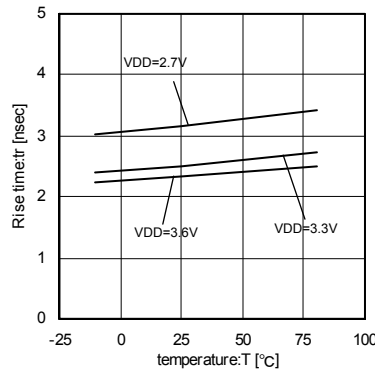


Fig.25 36MHz  
Temperature - Rise-time

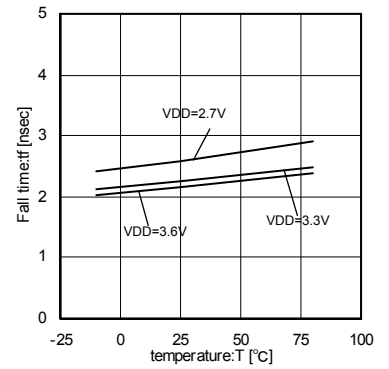


Fig.26 36MHz  
Temperature - Fall-time

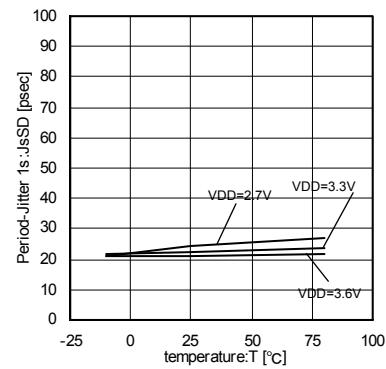


Fig.27 36MHz  
Temperature - Period-Jitter 1σ

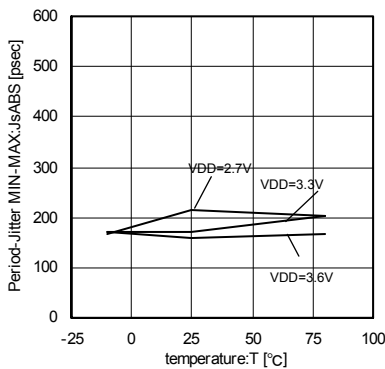


Fig.28 36MHz  
Temperature - Period-Jitter MIN-MAX

●Reference data (BU7345HFV Temperature and Supply voltage variations data)

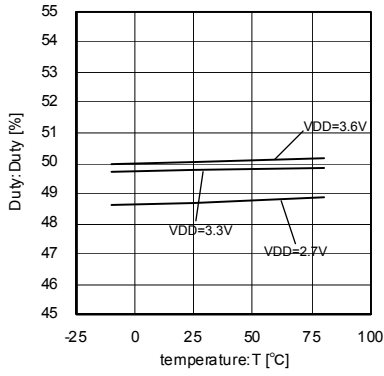


Fig.29 38MHz  
Temperature - Duty

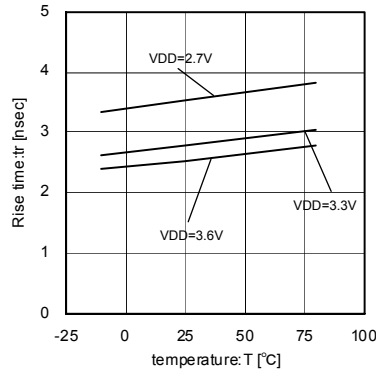


Fig.30 38MHz  
Temperature - Rise-time

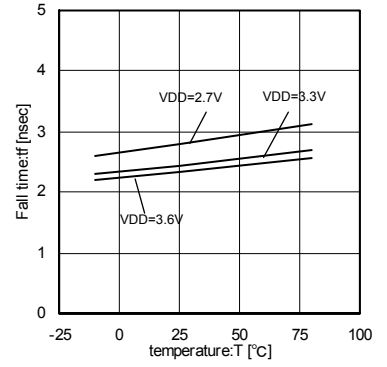


Fig.31 38MHz  
Temperature - Fall-time

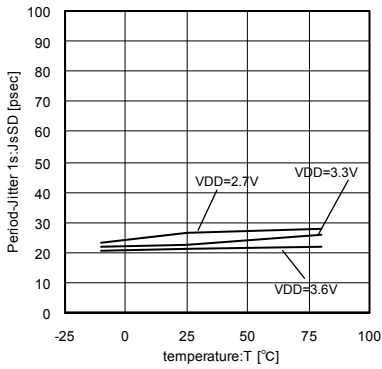


Fig.32 38MHz  
Temperature - Period-Jitter 1σ

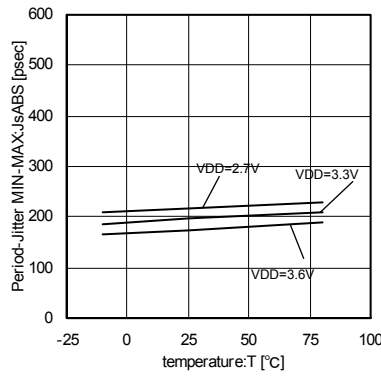


Fig.33 38MHz  
Temperature - Period-Jitter MIN-MAX

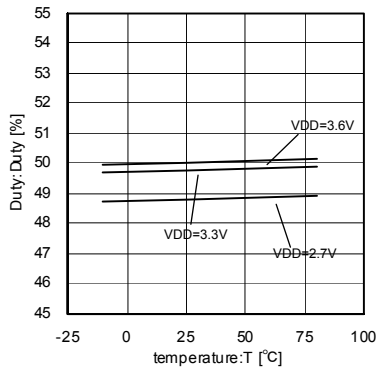


Fig.34 36MHz  
Temperature - Duty

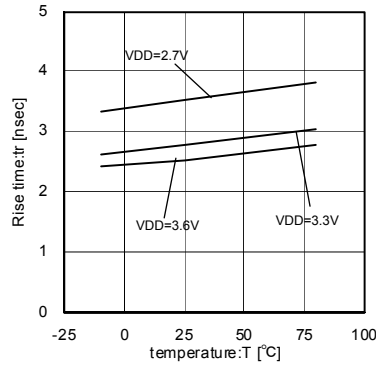


Fig.35 36MHz  
Temperature - Rise-time

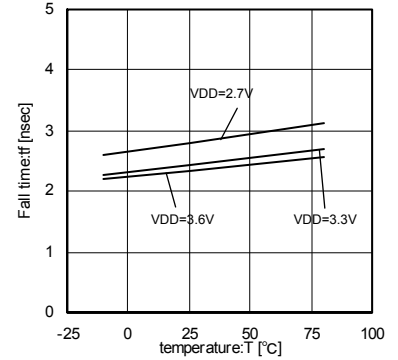


Fig.36 36MHz  
Temperature - Fall-time

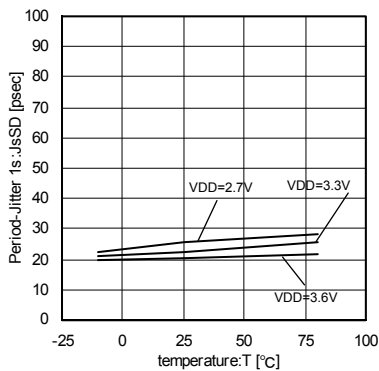


Fig.37 36MHz  
Temperature - Period-Jitter 1σ

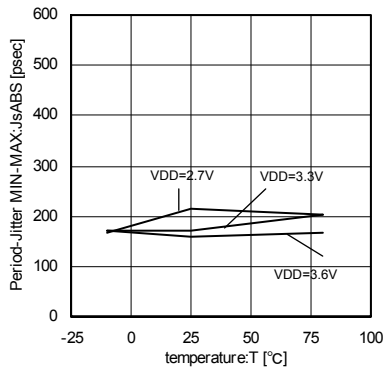


Fig.38 36MHz  
Temperature - Period-Jitter MIN-MAX

●Reference data (BU7346GUL Temperature and Supply voltage variations data)

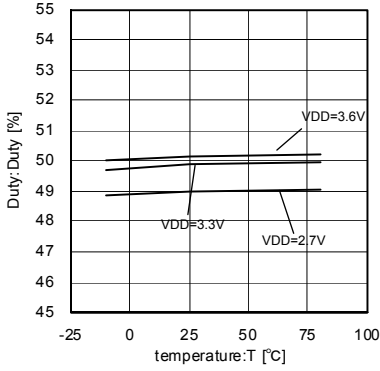


Fig.39 38MHz  
Temperature - Duty

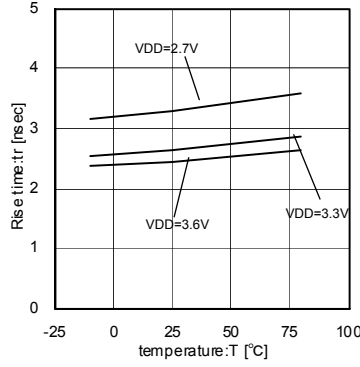


Fig.40 38MHz  
Temperature - Rise-time

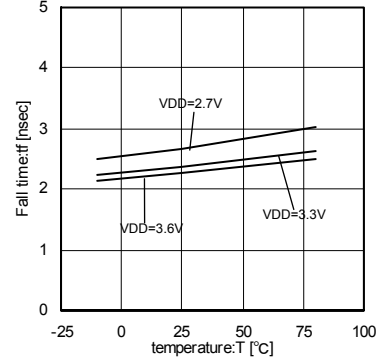


Fig.41 38MHz  
Temperature - Fall-time

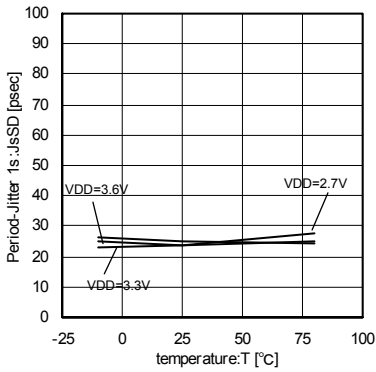


Fig.42 38MHz  
Temperature - Period-Jitter 1σ

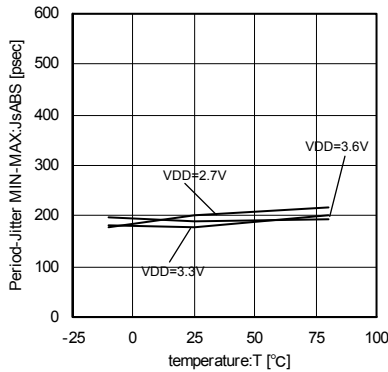


Fig.43 38MHz  
Temperature - Period-Jitter MIN-MAX

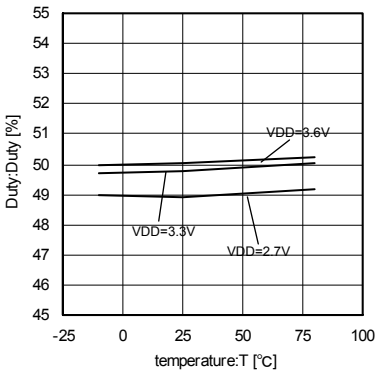


Fig.44 36MHz  
Temperature - Duty

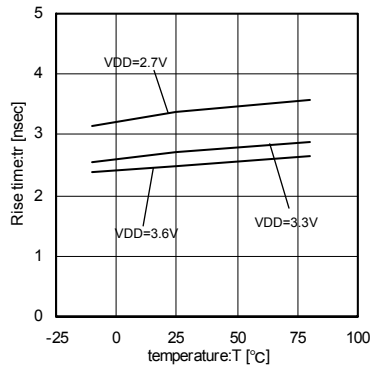


Fig.45 36MHz  
Temperature - Rise-time

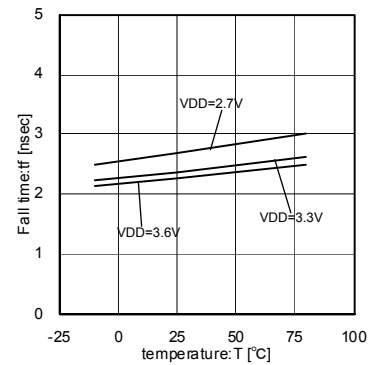


Fig.46 36MHz  
Temperature - Fall-time

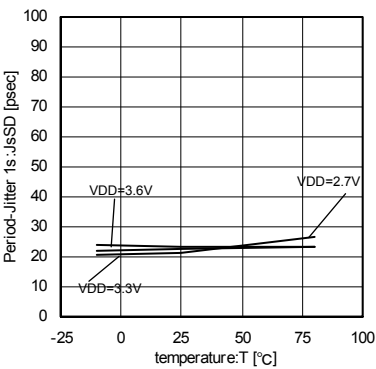


Fig.47 36MHz  
Temperature - Period-Jitter 1σ

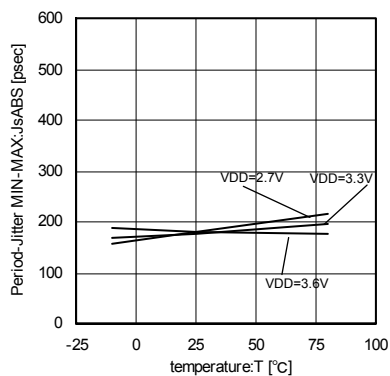


Fig.48 36MHz  
Temperature - Period-Jitter MIN-MAX



●Block diagram, pin assignment/functions

OBU7344HFV

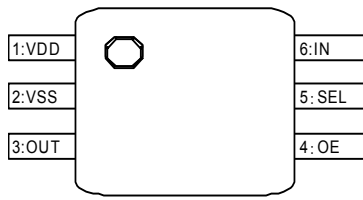


Fig.49 Pin assignment

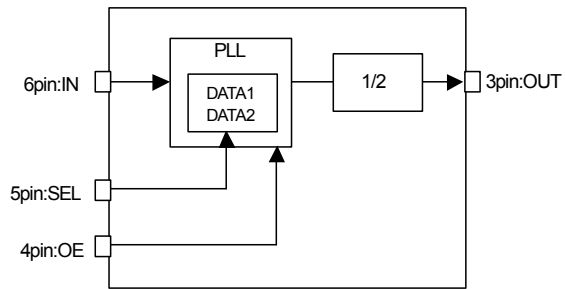


Fig.50 Block diagram

| PIN No. | PIN Name | Function   |
|---------|----------|--|
| 1       | VDD      | Power supply   |
| 2       | VSS      | GND  |
| 3       | OUT      | Clock output terminal (SEL=L:40.5000MHz, SEL=H:36.0000MHz)   |
| 4       | OE       | Power-down pin (L:disable, H:enable), equipped with Pull-down function, output set to L at disable |
| 5       | SEL      | Output selection (L:40.5000MHz, H:36.0000MHz)  |
| 6       | IN       | Clock input pin (27.0000MHz input)   |

OBU7345HFV

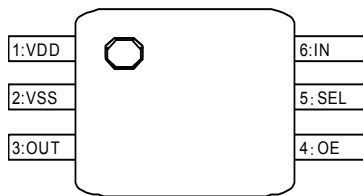


Fig.51 Pin assignment

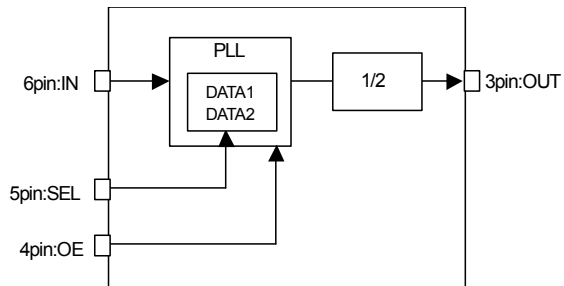
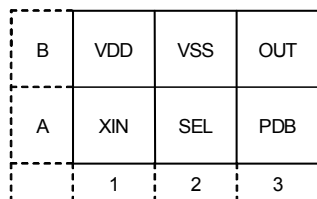


Fig.52 Block diagram

| PIN No. | PIN Name | Function   |
|---------|----------|--|
| 1       | VDD      | Power supply   |
| 2       | VSS      | GND  |
| 3       | OUT      | Clock output terminal (SEL=L:38.0000MHz, SEL=H:36.0000MHz)   |
| 4       | OE       | Power-down pin (L:disable, H:enable), equipped with Pull-down function, output set to L at disable |
| 5       | SEL      | Output selection (L:38.0000MHz, H:36.0000MHz)  |
| 6       | IN       | Clock input pin (27.0000MHz input)   |

OBU7346GUL



Bottom view  
Fig.53 Pin assignment

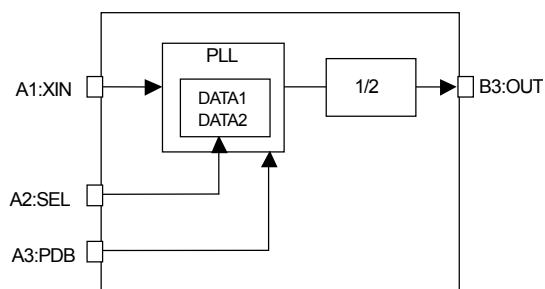


Fig.54 Block diagram

| PIN No. | PIN Name | Function   |
|---------|----------|--|
| A1      | XIN      | Clock input pin (27.0000MHz input)   |
| A2      | SEL      | Output selection (L:38.0000MHz, H:36.0000MHz)  |
| A3      | PDB      | Power-down pin (L:disable, H:enable), equipped with Pull-down function, output set to L at disable |
| B1      | VDD      | Power supply   |
| B2      | VSS      | GND  |
| B3      | OUT      | Clock output terminal (SEL=L:38.0000MHz, SEL=H:36.0000MHz)   |

●Application circuit example

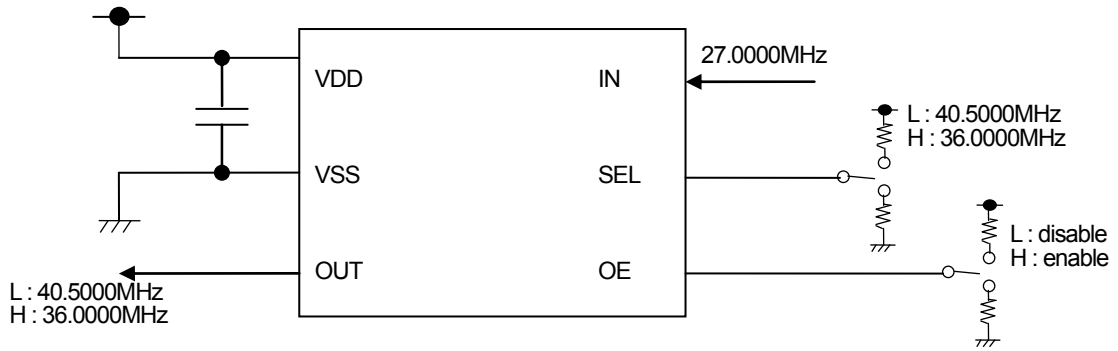


Fig.55 Application circuit example(BU7344HFV)

\* For VDD and VSS, insert a bypass capacitor of approx. 0.1μF as close as possible to the pin. Bypass capacitors with good high-frequency characteristics are recommended. Even though we believe that the typical application circuit is worth of a recommendation, please be sure to thoroughly recheck the characteristics before use.

●Equivalent circuit

| Pin name       | Pin number     | Equivalent circuit |
|----------------|----------------|--------------------|
| OUT            | 3, B3          |                    |
| OE(PDB)<br>SEL | 4, A2<br>5, A3 |                    |
| IN(XIN)        | 6, A1          |                    |

● Appearance of Marker

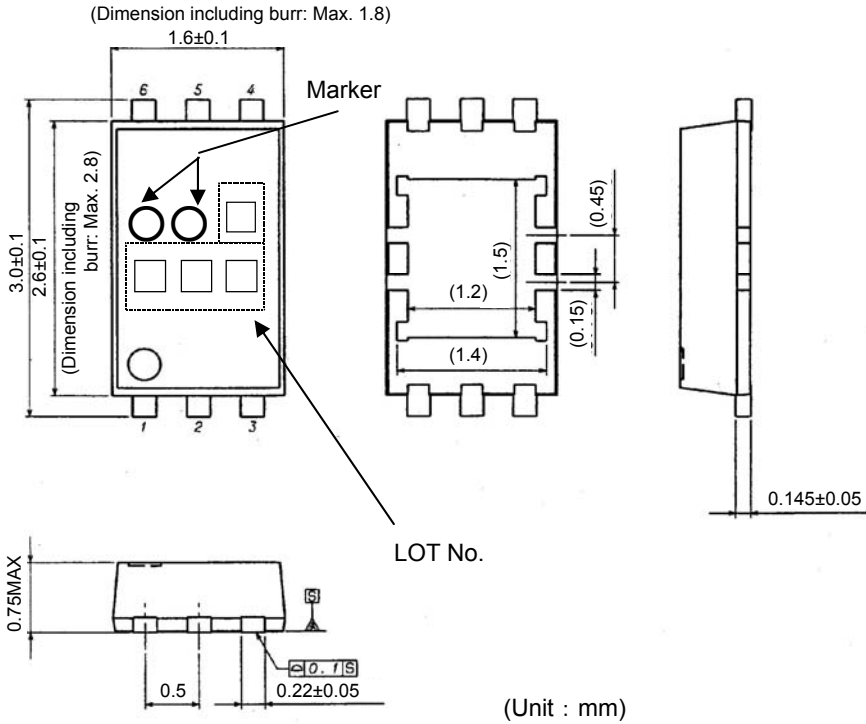


Fig.56 HVSO6 Appearance of Marker

Marker lists

| product name | marker |
|--------------|--------|
| BU7344HFV    | AN     |
| BU7345HFV    | AP     |

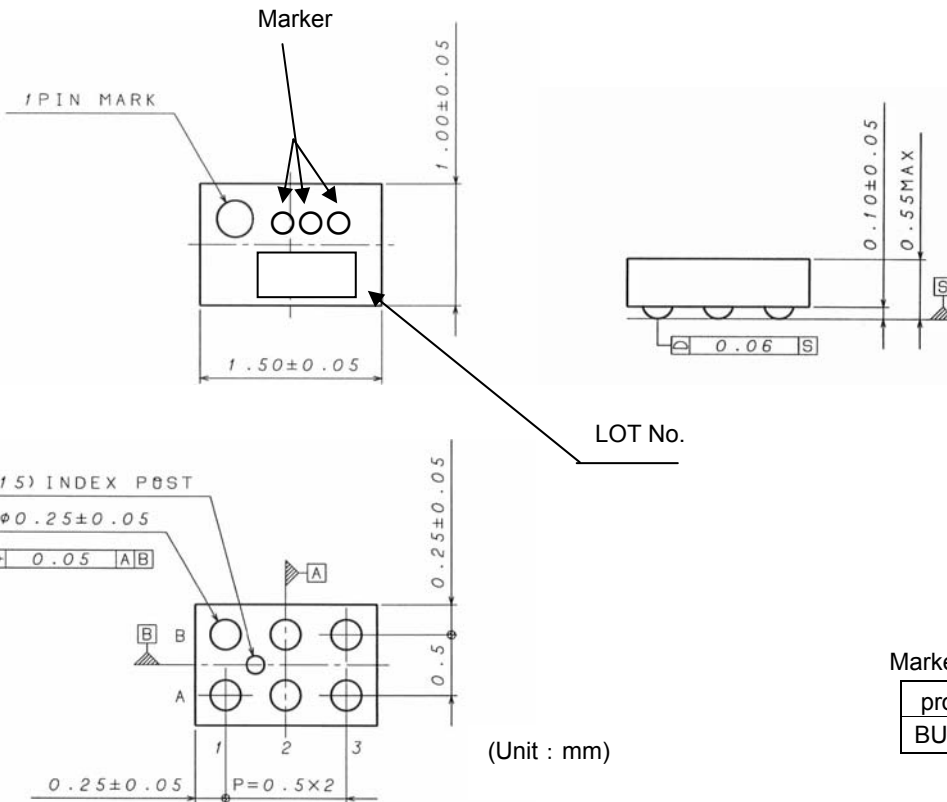


Fig.57 VCSP50L1 Appearance of Marker

Marker lists

| product name | marker |
|--------------|--------|
| BU7346GUL    | AA8    |

**●Notes for use**

- (1) Absolute Maximum Ratings  
An excess in the absolute maximum ratings, such as applied voltage (VDD or VIN), operating temperature range (Topr), etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.
- (2) Recommended operating conditions  
These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.
- (3) Reverse connection of power supply connector  
The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC's power supply terminal.
- (4) Power supply line  
Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines.  
In this regard, for the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner.  
Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.
- (5) GND voltage  
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.
- (6) Short circuit between terminals and erroneous mounting  
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.
- (7) Operation in strong electromagnetic field  
Be noted that using ICs in the strong electromagnetic field can malfunction them.
- (8) Inspection with set PCB  
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.
- (9) Input terminals  
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.
- (10) Ground wiring pattern  
If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.
- (11) External capacitor  
In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.



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