Datasheet

System Lens Drivers

μ-step System Lens Driver for Digital Still Cameras

BU24020GU

General Description

BU24020GU is a system Lens Driver which is capable of μ-step driving and possible to configure a high precision and low noise lens driver system. This device performs μ-step driving control internally and can reduce a load of CPU.

Features

- Built-in 4 Channel Drivers
  1ch to 4ch: Voltage Control Type H-Bridge
  (for 2 STM Systems)
- Built-in 2 Channel PI Driver Circuits
- Built-in PLL Circuit

Applications

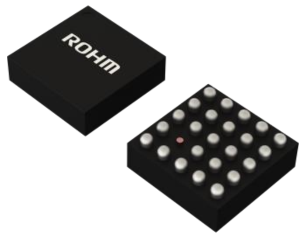
- Digital Still Camera

Key Specifications

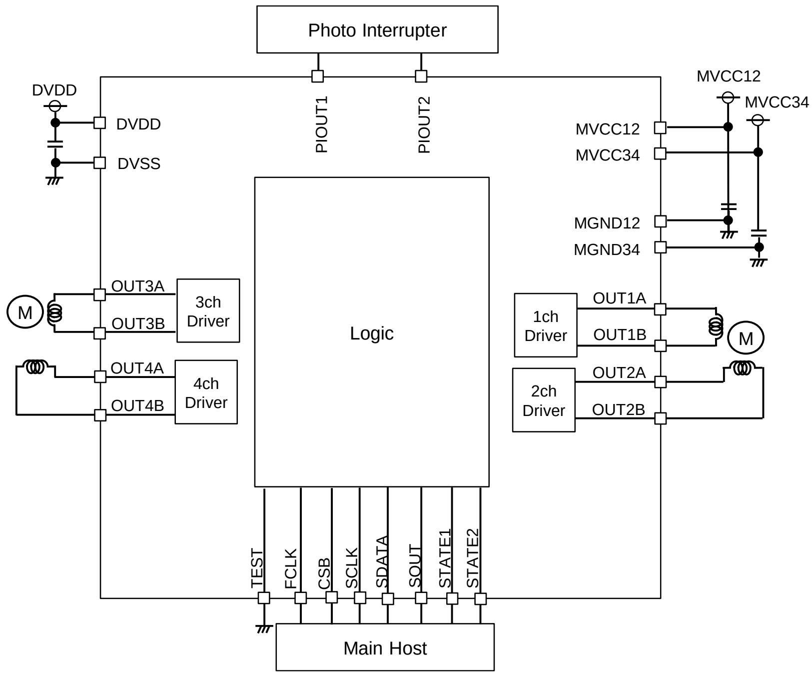
- Digital Power Supply Voltage: 2.7 V to 3.6 V
- Driver Power Supply Voltage: 2.7 V to 5.5 V
- Input/Output Current (1ch to 4ch): 500 mA (Max)
- Clock Operating Frequency: 1 MHz to 28 MHz
- ON-Resistance (1ch to 4ch): 1.5 Ω (Typ)
- Operating Temperature Range: -20 °C to +85 °C

Package

Package	W (Typ) x D (Typ) x H (Max)
VCSP85H2 (24 pin)	2.60 mm x 2.60 mm x 1.00 mm



Typical Application Circuit



○Product structure : Silicon integrated circuit ○This product has no designed protection against radioactive rays

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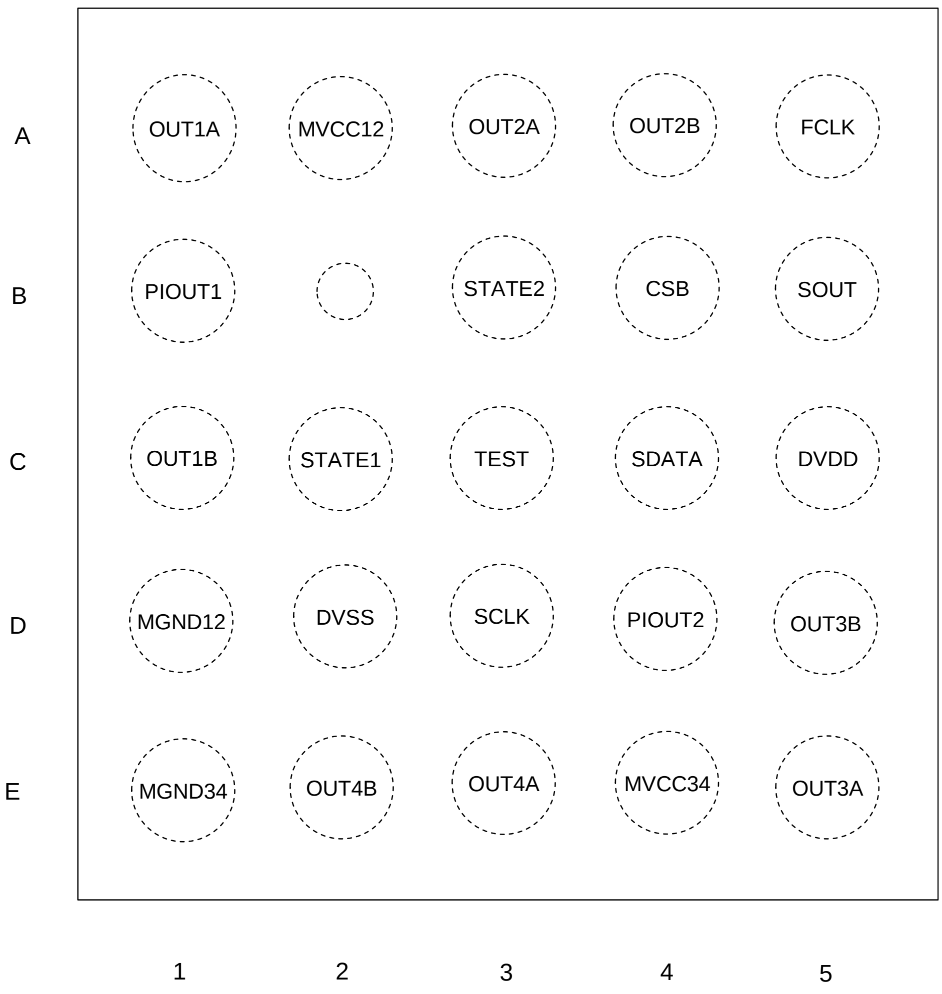
Pin Configuration

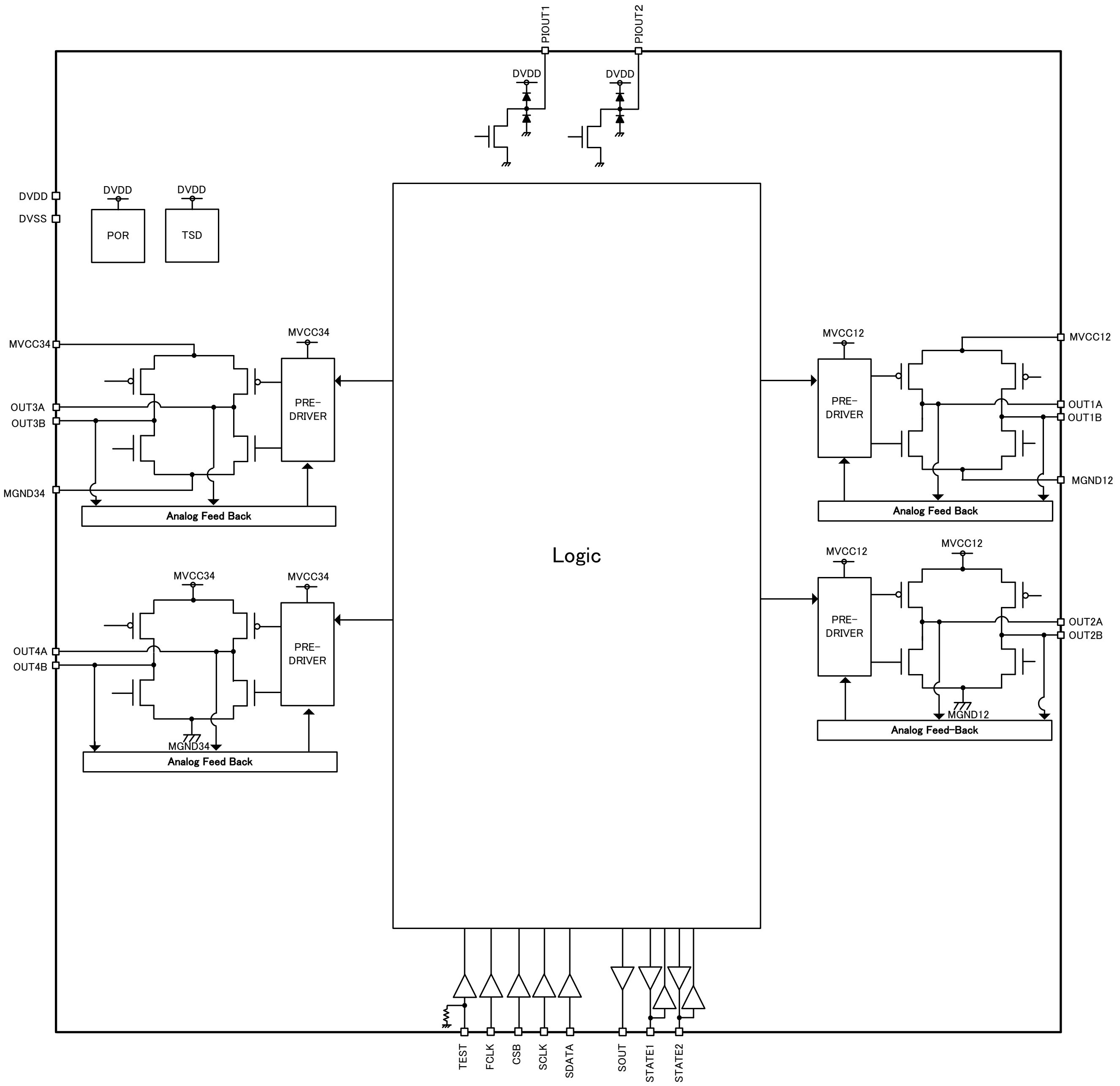
(Top view)



Pin Description

Pin No.	Pin Name	Power Supply	Function	Pin No.	Pin Name	Power Supply	Function
A1	OUT1A	MVCC12	1ch driver A output	C4	SDATA	DVDD	SDATA logic input
A2	MVCC12	-	1ch,2ch driver power supply	C5	DVDD	-	Digital power supply
A3	OUT2A	MVCC12	2ch driver A output	D1	MGND12	-	1ch, 2ch driver ground
A4	OUT2B	MVCC12	2ch driver B output	D2	DVSS	-	Ground
A5	FCLK	DVDD	FCLK logic input	D3	SCLK	DVDD	SCLK logic input
B1	PIOUT1	DVDD	PI driver output 1	D4	PIOUT2	DVDD	PI driver output 2
B3	STATE2	DVDD	STATE2 logic input/output	D5	OUT3B	MVCC34	3ch driver B output
B4	CSB	DVDD	CSB logic input	E1	MGND34	-	3ch, 4ch driver ground
B5	SOUT	DVDD	SOUT logic output	E2	OUT4B	MVCC34	4ch driver B output
C1	OUT1B	MVCC12	1ch driver B output	E3	OUT4A	MVCC34	4ch driver A output
C2	STATE1	DVDD	STATE1 logic input/output	E4	MVCC34	-	3ch, 4ch driver power supply
C3	TEST	DVDD	TEST logic input	E5	OUT3A	MVCC34	3ch driver A output

Block Diagram



Description of Blocks

Stepping Motor Driver (1ch to 4ch Driver)

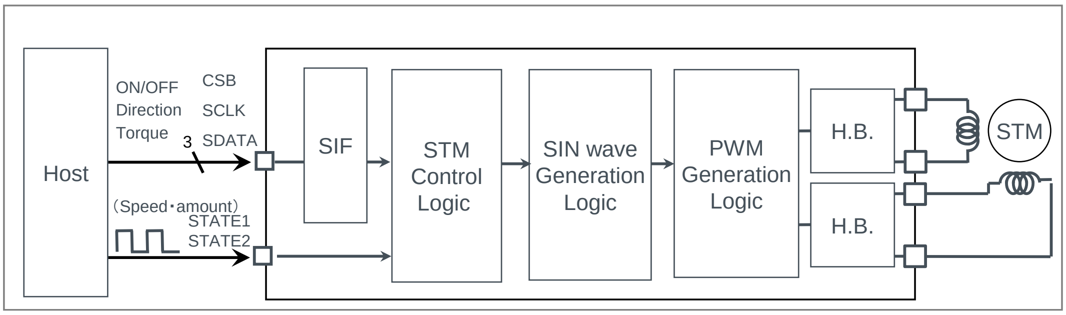
Built-in PWM type stepping motor drivers.
Maximum 2 stepping motors can be driven independently.
Built-in D-class type voltage feedback circuit.
3ch/4ch drivers can also drive DC motor or voice coil motor individually.

(1) Control

Both Clock IN and Autonomous control are possible.

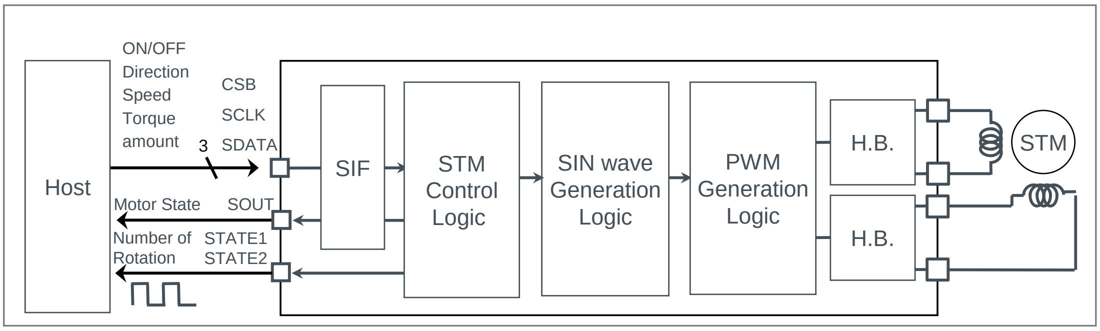
(a)Clock IN Control

Set the registers for the stepping motor control.
Stepping motor rotates in synchronization with clock input to the STATE1 pin and/or the STATE2 pin.
Mode of stepping motor control is selectable from μ-step, 1-2 phase excitation and 2 phase excitation. And the number of edge for electrical angle cycle is selectable from 4, 8, 32, 64, 128, 256, 512 or 1024.



(b)Autonomous Control

Stepping motor rotates by setting the registers to drive the stepping motor.
It is possible to output from serial output (the SOUT pin) the status information which are operation command status (excecution:1, stop: 0), cache register status and motor position, and to output signal (MO output) from the STATE1 pin and the STATE2 pin in synchronization with motor operation.
Mode of stepping motor control is selectable from μ-step (1024 portion), 1-2 phase excitation and 2 phase excitation.
Built-in Cache register enables to set next operation commands during motor operation, and continuous operation is possible.



Absolute Maximum Ratings (Ta=25 °C)

Parameter	Symbol	Rating	Unit	Remark
Supply Voltage	DVDD	-0.3 to +4.5	V	
	MVCC	-0.3 to +7.0	V	MVCC12, MVCC34,
Input Voltage	V_{IN}	-0.3 to supply voltage+0.3	V	
Input / Output Current *(Note 1)*	I_{IN}	500	mA	MVCC12, MVCC34
		50	mA	PIOUT1, PIOUT2
Maximum Junction Temperature	Tjmax	125	°C	
Storage Temperature Range	Tstg	-55 to +125	°C	
Power Dissipation *(Note 2)*	Pd	0.80	W	

Caution 1: *Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.*

Caution 2: *Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, design a PCB with power dissipation taken into consideration by increasing board size and copper area so as not to exceed the maximum junction temperature rating.*

(Note 1) Must not exceed Pd.
(Note 2) When use at Ta=25 °C or more, derate 8 mW per 1 °C
(At mounting 50 mm x 58 mm x 1.75 mm glass epoxy board.)

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Digital Power Supply Voltage	DVDD	2.7	3.0	3.6	V	DVDD≤MVCC
Driver Power Supply Voltage	MVCC	2.7	5.0	5.5	V	MVCC12, MVCC34
Clock Operating Frequency	f_{FCLK}	1	-	28	MHz	Reference clock
Operating Temperature	Topr	-20	+25	+85	°C	

Electrical Characteristics

(Unless otherwise specified Ta=25 °C, DVDD=3.0 V, MVCC12=MVCC34=5.0 V)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
<Current Consumption>						
Quiescent Current	I_{SSD}	-	50	95	µA	DVDD power supply CMD_RS = 0
	I_{SSM}	-	0	10	µA	MVCC power supply CMD_RS = 0
Operational Current	I_{DDD}	-	5	10	mA	DVDD power supply CMD_RS = 1 f_{FCLK} = 24 MHz CLK_DIV setting: 0h No load
<Logic Block>						
Low-Level Input Voltage	V_{IL}	DVSS	-	0.3 x DVDD	V	
High-Level Input Voltage	V_{IH}	0.7 x DVDD	-	DVDD	V	
Low-Level Input Current	I_{IL}	0	-	10	µA	V_{IL} = DVSS
High-Level Input Current	I_{IH}	0	-	10	µA	V_{IH} = DVDD
Low-Level Output Voltage	V_{OL}	DVSS	-	0.2 x DVDD	V	I_{OL} = 1.0 mA
High-Level Output Voltage	V_{OH}	0.8 x DVDD	-	DVDD	V	I_{OH} = 1.0 mA
<PI Driver Circuit>						
Output Voltage	V_{PIO}	-	0.15	0.5	V	I_{IH} = 30 mA
<Voltage Driver Block 1ch to 4ch>						
ON-Resistance	R_{ON}	-	1.5	2.0	Ω	I_O = ±100 mA (sum of high and low sides)
OFF-Leak Current	I_{OZ}	-10	0	+10	µA	Output Hiz setting
Accuracy of Average Voltage between Output Pins	V_{DIFF}	-5	-	+5	%	different_output_voltage setting: 2Bh

Typical Performance Curves

(Unless otherwise specified Ta=25 °C, DVDD=3.0 V, MVCC12=MVCC34=5.0 V)

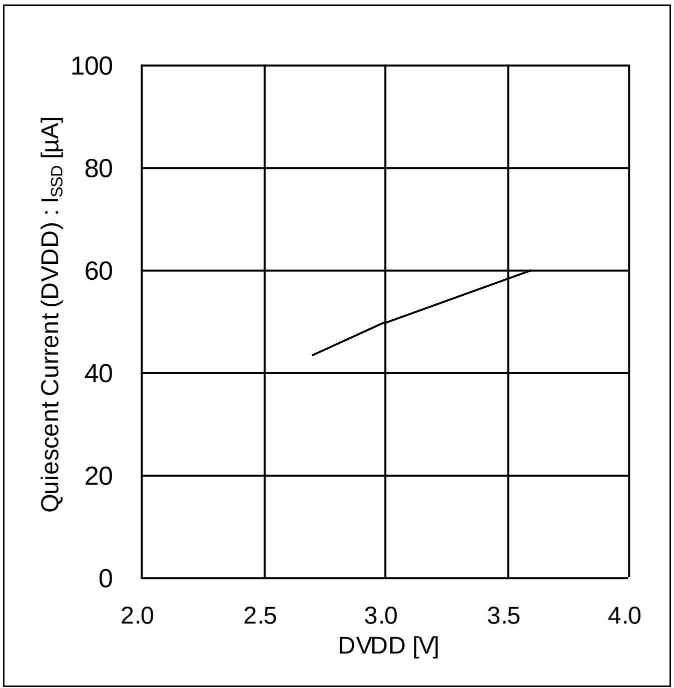


Figure 1. Quiescent Current (DVDD) vs DVDD

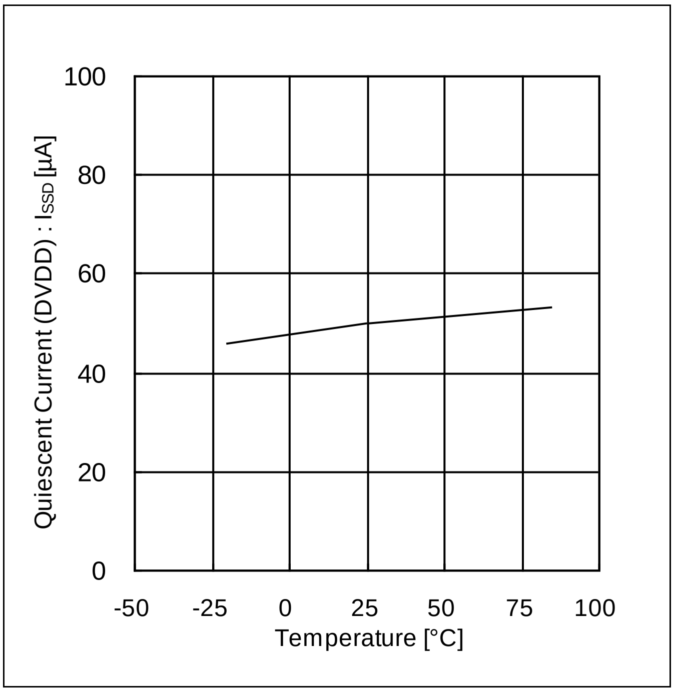


Figure 2. Quiescent Current (DVDD) vs Temperature

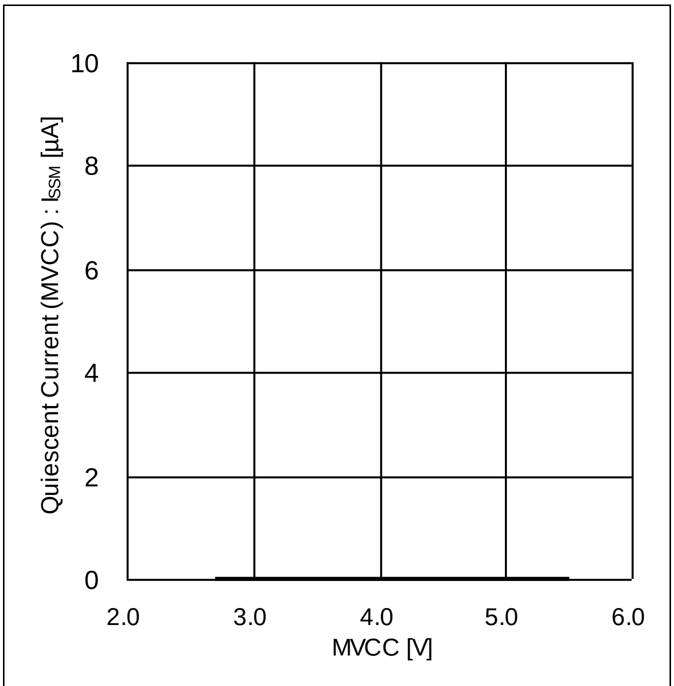


Figure 3. Quiescent Current (MVCC) vs MVCC

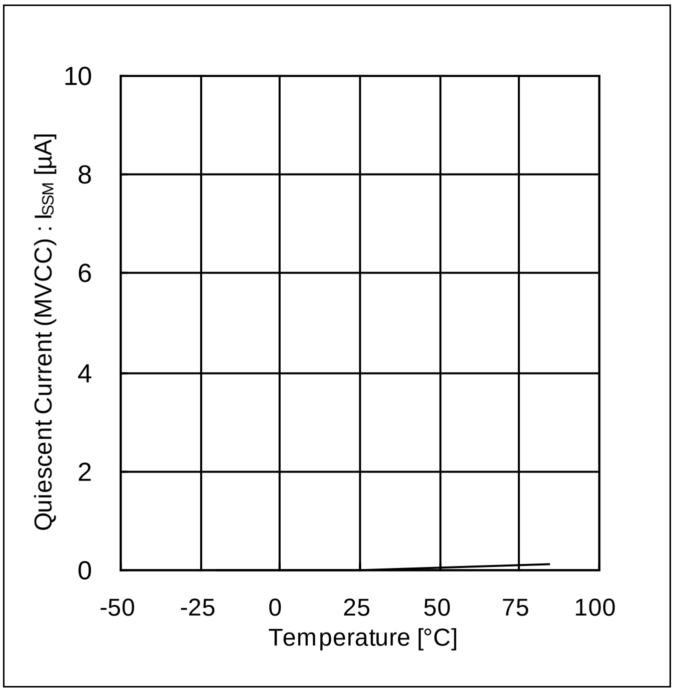


Figure 4. Quiescent Current (MVCC) vs Temperature

Typical Performance Curves – continued

(Unless otherwise specified Ta=25 °C, DVDD=3.0 V, MVCC12=MVCC34=5.0 V)

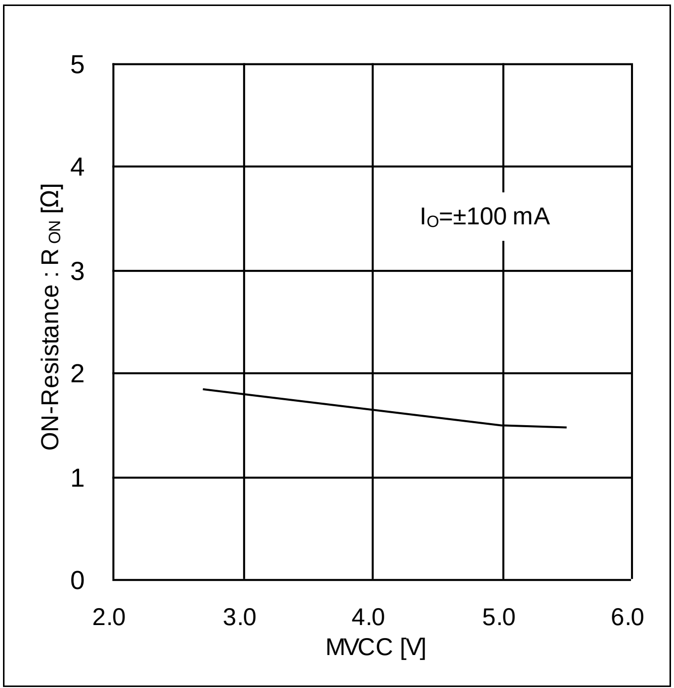


Figure 5. ON-Resistance vs MVCC
(Voltage Driver Block)

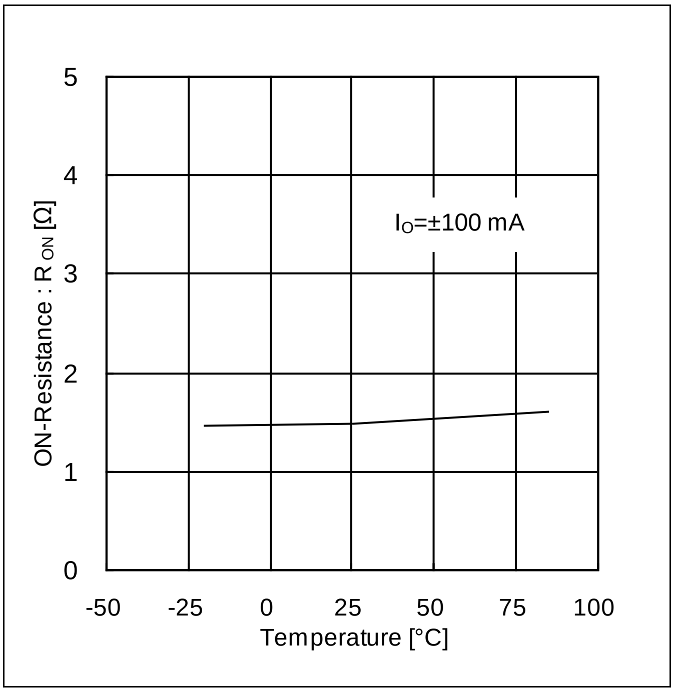


Figure 6. ON-Resistance vs Temperature
(Voltage Driver Block)

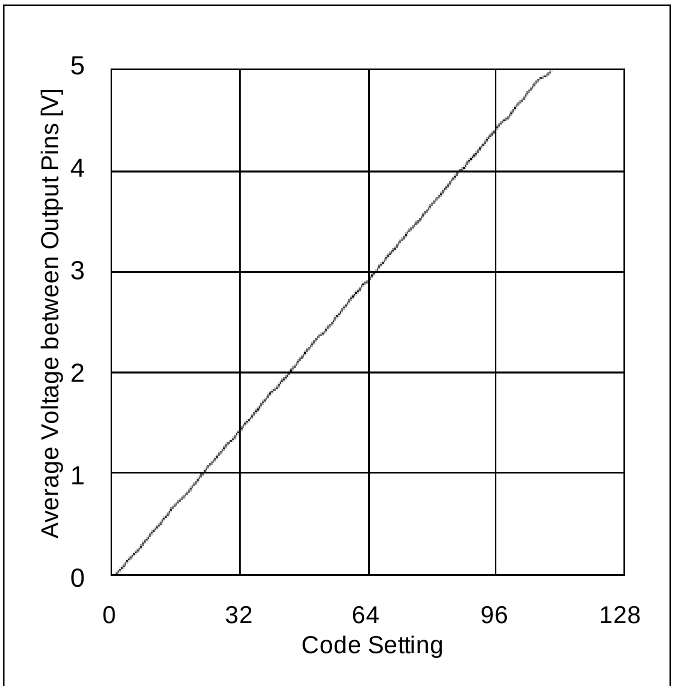


Figure 7. Average Voltage between Output Pins vs Code Setting
(Voltage Driver Block)

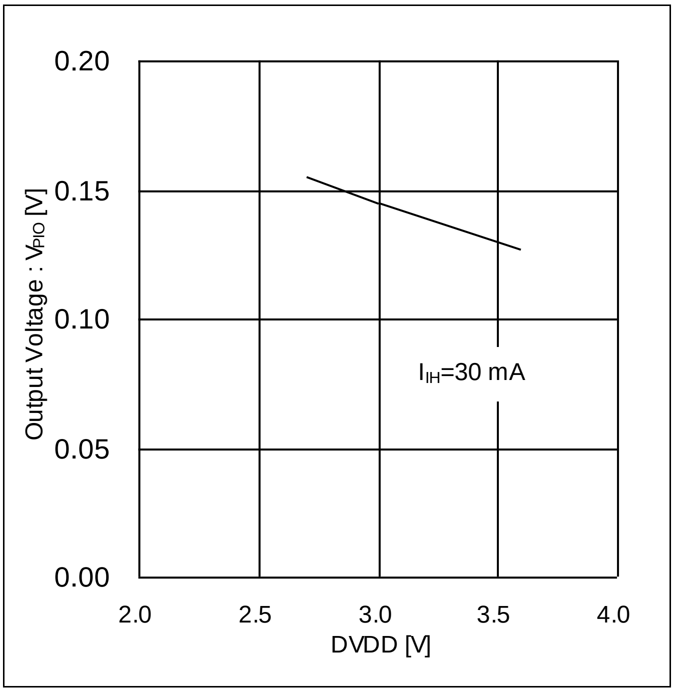
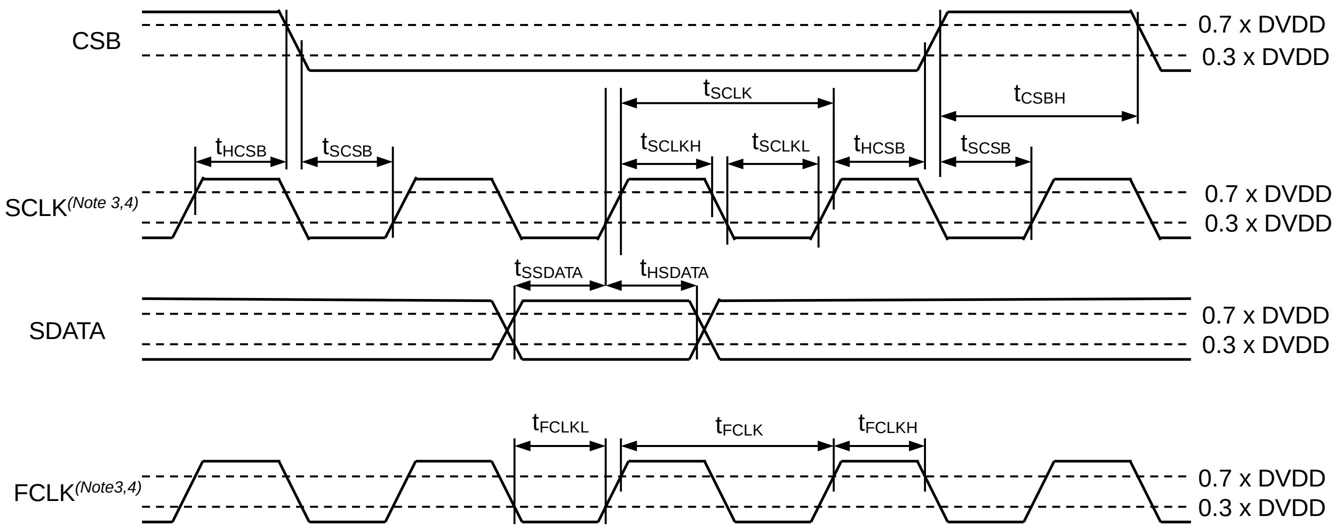


Figure 8. Output Voltage vs DVDD
(PI Driver Circuit)

Timing Chart

(Unless otherwise specified Ta=25 °C, DVDD=3.0 V)

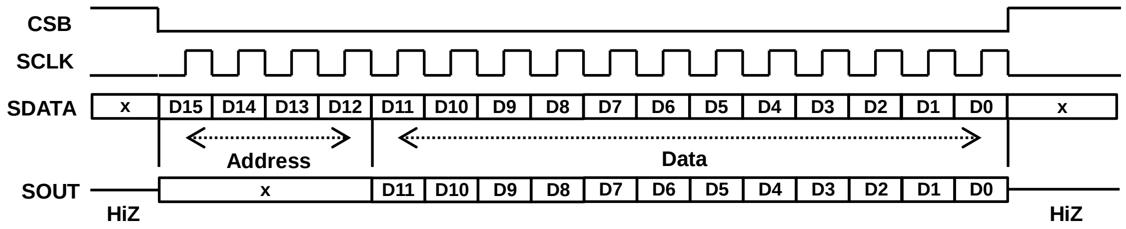
Parameter	Symbol	Design Value
SCLK Input Cycle	t_{SCLK}	100 ns or more
SCLK Low-Level Input Time	t_{SCLKL}	50 ns or more
SCLK High-Level Input Time	t_{SCLKH}	50 ns or more
SDATA Setup Time	t_{SSDATA}	50 ns or more
SDATA Hold Time	t_{HSDATA}	50 ns or more
CSB High-Level Input Time	t_{CSBH}	380 ns or more
CSB Setup Time	t_{SCSB}	50 ns or more
CSB Hold Time	t_{HCSB}	50 ns or more
FCLK Input Cycle	t_{FCLK}	36 ns or more
FCLK Low-Level Input Time	t_{FCLKL}	18 ns or more
FCLK High-Level Input Time	t_{FCLKH}	18 ns or more



(Note 3) FCLK is asynchronous with SCLK.
(Note 4) The duty of FCLK and SCLK is arbitrary after observing the above table.

Serial Interface

Control command is 16-bit serial input (MSB first) and is sent via the CSB, the SCLK, and the SDATA pins.
Higher 4 bits specify addresses and lower 12 bits specify data. Data of each bit is sent via the SDATA pin and taken at a rising edge of SCLK. The Data taken during CSB ‘L’ period is valid and is written in register at a rising edge of CSB.
SOUT output is 12bit data and synchronous with a falling edge of SCLK.

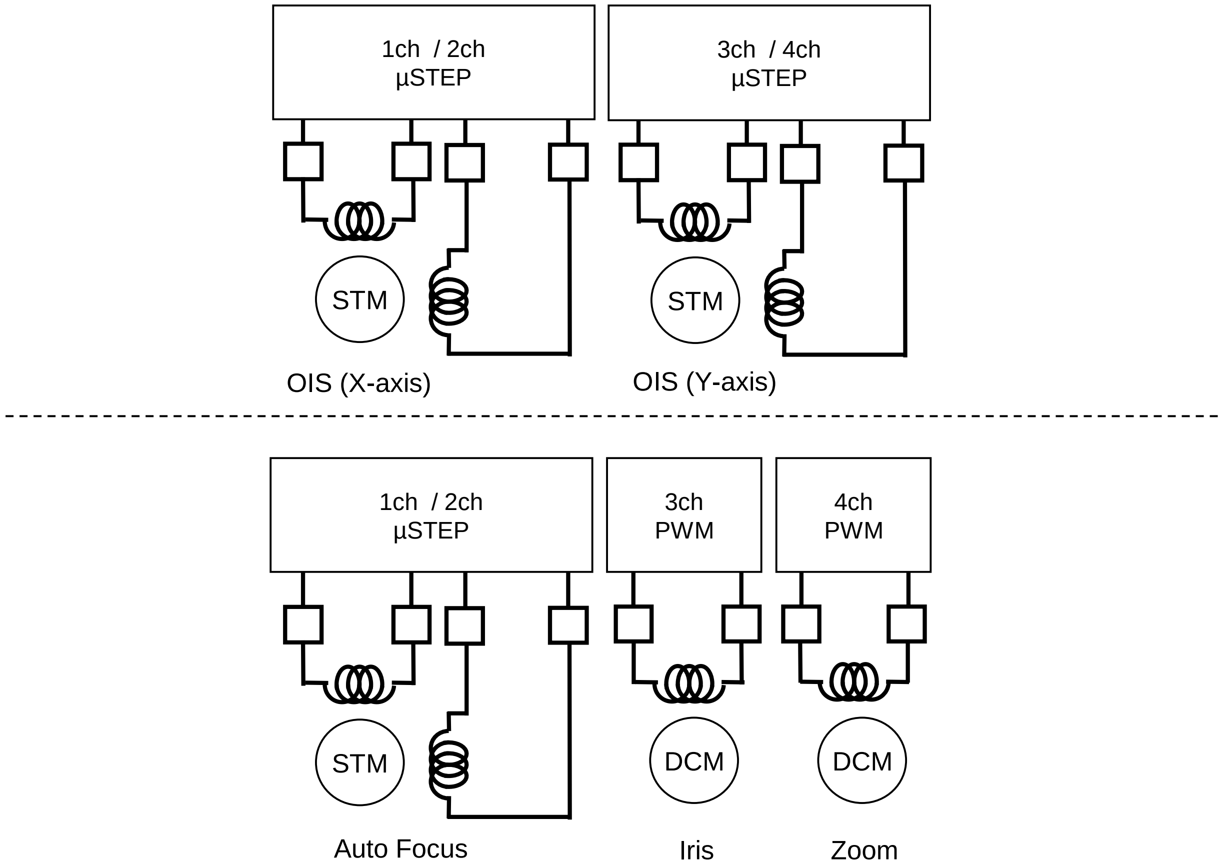


Register Map(Note 5,6,7,8)

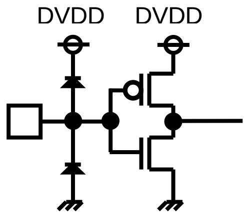
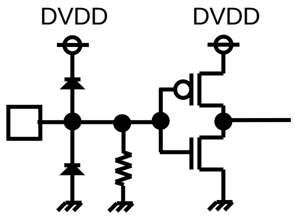
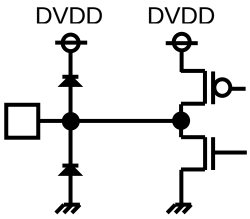
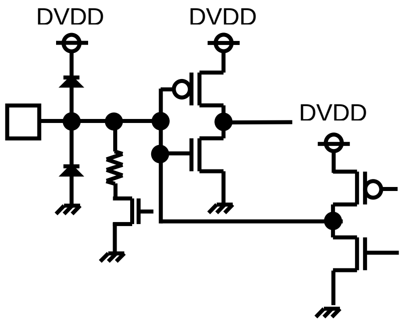
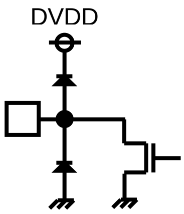
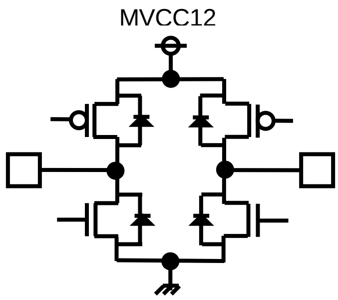
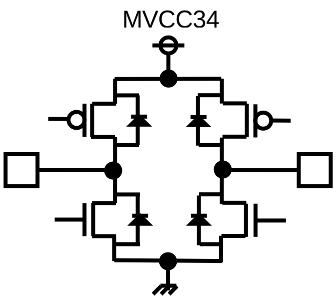
Address[3:0]				Data[11:0]											
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	A_Mode[1:0]		A_SEL[2:0]			A_different_output_voltage[6:0]						
0	0	0	1	0	0	0	0	A_Cycle[5:0]						0	0
				0	0	1	0	A_Cycle[13:6]							
				0	1	1	0	A_BEXC	0	0	A_BSL	A_AEXC	0	0	A_ASL
				1	1	1	0	0	0	A_POS[1:0]		0	0	A_PS	A_Stop
0	0	1	0	A_EN	A_RT	A_Pulse[9:0]									
0	0	1	1	A_ACT	A_BUSY	B_ACT	B_BUSY	L	L	L	L	L	L	L	L
0	1	0	0	B_Mode[1:0]		B_SEL[2:0]			B_different_output_voltage[6:0]						
0	1	0	1	0	0	0	0	B_Cycle[5:0]						0	0
				0	0	1	0	B_Cycle[13:6]							
				0	1	1	0	B_BEXC	0	0	B_BSL	B_AEXC	0	0	B_ASL
				1	0	0	0	0	0	3_CHOP[1:0]		0	0	4_CHOP[1:0]	
				1	0	1	3_State_CTL[1:0]		3_PWM_Duty[6:0]						
				1	1	0	4_State_CTL[1:0]		4_PWM_Duty[6:0]						
				1	1	1	0	0	0	B_POS[1:0]		0	0	B_PS	B_Stop
0	1	1	0	B_EN	B_RT	B_Pulse[9:0]									
0	1	1	1	A_POSITION[9:6]				B_POSITION[9:6]				L	L	L	L
1	0	1	1	0	0	0	0	0	0	Edge	0	0	0	B_CTL	A_CTL
1	1	0	0	0	0	Chopping[1:0]		CacheM	0	0	CLK_EN	CLK_DIV[3:0]			
1	1	0	1	0	0	0	0	0	0	0	0	0	0	PI_CTL2	PI_CTL1
1	1	1	0	1	1	0	0	0	0	0	STB	0	0	STM_RS	CMD_RS
Other than those above				Setting prohibited											

(Note 5) The notations A and B in the register map correspond to Ach and Bch respectively. Ach is defined as 1ch and 2ch driver output, Bch as 3ch and 4ch driver output.
(Note 6) After power on reset, the initial settings are stored in all registers.
(Note 7) The data at register address 4’b0011 and 4’b0111 (ACT, BUSY, A_POSITION[9:6], B_POSITION[9:6]) is internal register value and is output from the SOUT pin. ‘L’ in the above table indicates Low output.
(Note 8) Regarding Mode, different_output_voltage, Cycle, EN, and RT registers, the data written right before the access to the Pulse register is valid and determined at a rising edge of CSB after the access to the Pulse register.
(The Mode, different_output_voltage, Cycle, EN, RT, and Pulse registers have Cache registers. Any registers other than them do not have Cache registers.)

Application Example



I/O Equivalence Circuit

<table>
<tr><th>Pin</th><th>Equivalent Circuit Diagram</th><th>Pin</th><th>Equivalent Circuit Diagram</th></tr>
<tr><td>FCLK
CSB
SCLK
SDATA</td><td></td><td>TEST(Note 9)</td><td></td></tr>
<tr><td>SOUT</td><td></td><td>STATE1
STATE2</td><td></td></tr>
<tr><td>PIOUT1
PIOUT2</td><td></td><td>OUT1A
OUT1B
OUT2A
OUT2B</td><td></td></tr>
<tr><td>OUT3A
OUT3B
OUT4A
OUT4B</td><td></td><td></td><td></td></tr>
</table>

(Note 9) Short the TEST pin to DVSS.

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Recommended Operating Conditions**
   The function and operation of the IC are guaranteed within the range specified by the recommended operating conditions. The characteristic values are guaranteed only under the conditions of each item specified by the electrical characteristics.

6. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

7. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

8. **Inter-pin Short and Mounting Errors**
   Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

9. **Unused Input Pins**
   Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

Operational Notes – continued

10. Regarding the Input Pin of the IC

In the construction of this IC, P-N junctions are inevitably formed creating parasitic diodes or transistors. The operation of these parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions which cause these parasitic elements to operate, such as applying a voltage to an input pin lower than the ground voltage should be avoided. Furthermore, do not apply a voltage to the input pins when no power supply voltage is applied to the IC. Even if the power supply voltage is applied, make sure that the input pins have voltages within the values specified in the electrical characteristics of this IC.

11. Ceramic Capacitor

When using a ceramic capacitor, determine a capacitance value considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

12. Thermal Shutdown Circuit (TSD)

This IC has a built-in thermal shutdown circuit that prevents heat damage to the IC. Normal operation should always be within the IC's maximum junction temperature rating. If however the rating is exceeded for a continued period, the junction temperature (Tj) will rise which will activate the TSD circuit that will turn OFF power output pins. When the Tj falls below the TSD threshold, the circuits are automatically restored to normal operation.

Note that the TSD circuit operates in a situation that exceeds the absolute maximum ratings and therefore, under no circumstances, should the TSD circuit be used in a set design or for any purpose other than protecting the IC from heat damage.

13. Disturbance Light

In a device where a portion of silicon is exposed to light such as in a WL-CSP and chip products, IC characteristics may be affected due to photoelectric effect. For this reason, it is recommended to come up with countermeasures that will prevent the chip from being exposed to light.

Ordering Information

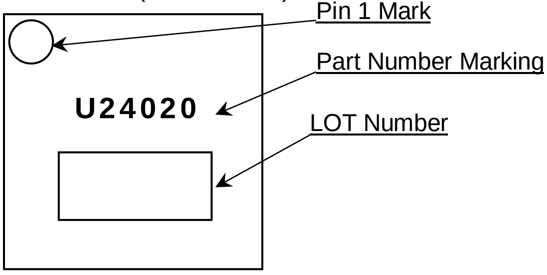
B	U	2	4	0	2	0	G	U	-	E2

Package
GU: VCSP85H2

Packaging and forming specification
E2: Embossed tape and reel

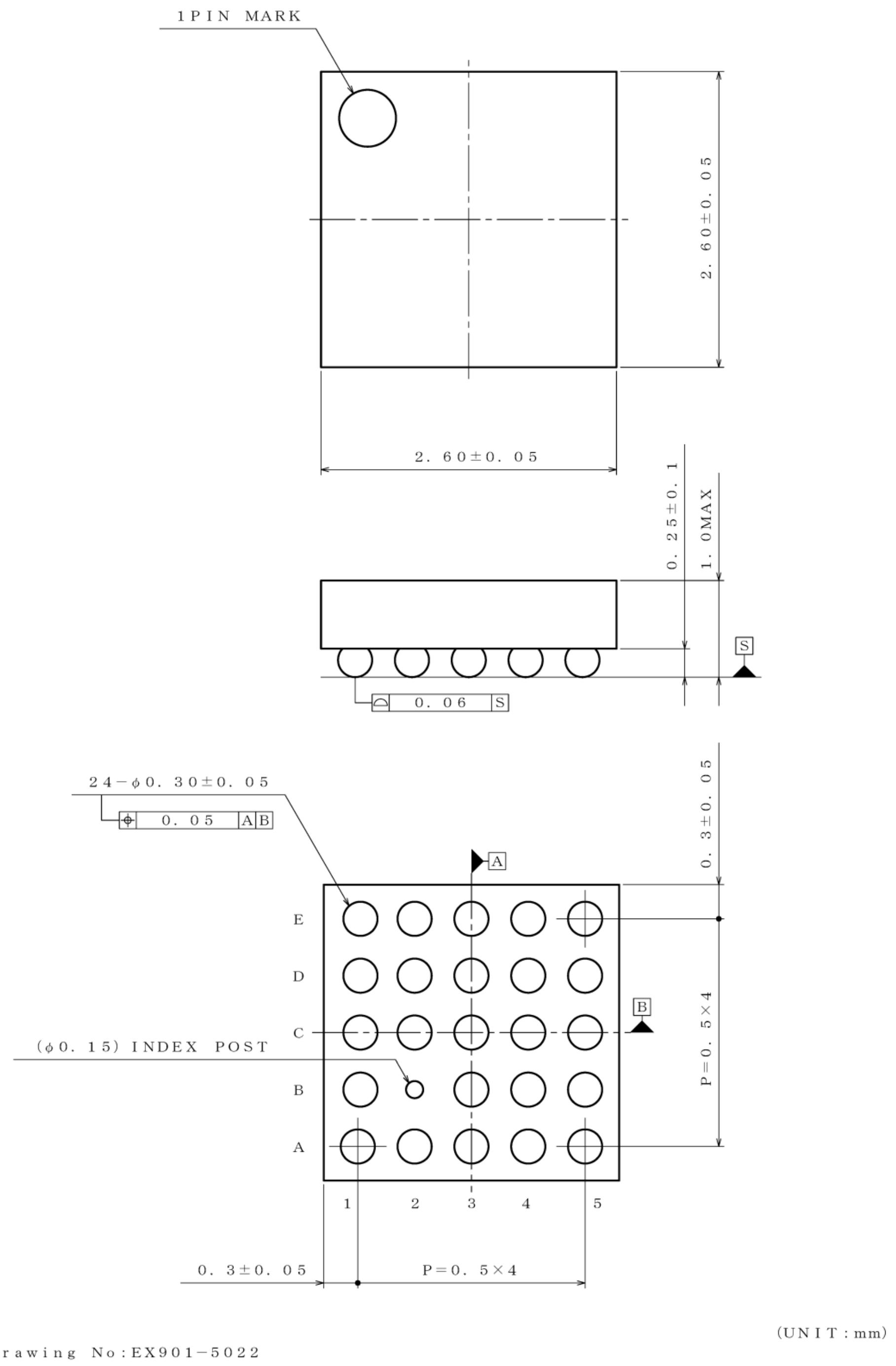
Marking Diagram

TOP VIEW
VCSP85H2 (BU24020GU)



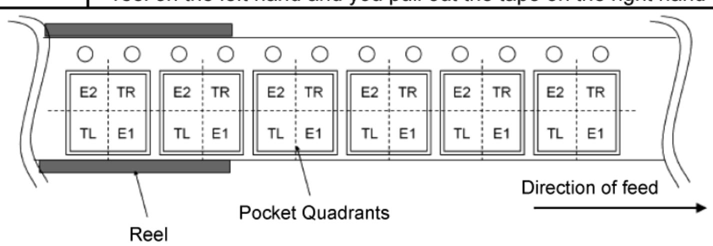
Physical Dimension and Packing Information

Package Name	VCSP85H2 (BU24020GU)



< Tape and Reel Information >

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	E2 The direction is the pin 1 of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand



Revision History

Date	Revision	Changes
15.Mar.2010	001	New Release
18.Apr.2013	002	Update some English words, sentences, descriptions, grammar and format.
12.Mar.2019	003	In the “Typical Application Circuit” names of connected power supply are added. In the “Absolute Maximum Ratings” the “Maximum Junction Temperature” is added. In the “Absolute Maximum Ratings” notes are added. e.g. About when operating the IC over the “Absolute Maximum Ratings”, “Operating Temperature” is moved to “Recommended Operating Conditions” from “Absolute Maximum Ratings”. In the “Typical Performance Curves” package power dissipation graph is removed, because it’s same information as Note 2 in “Absolute Maximum Ratings”. “Operational Notes” are updated. Other formats are updated.

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.) ; or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

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