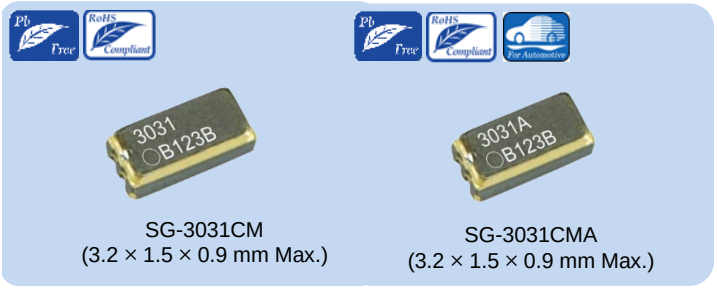
Industry-leading low power, wide temp range and automotive compliant 32.768kHz Crystal Oscillator

SG-3031CM / SG-3031CMA

Features

- Built-in 32.768 kHz crystal unit allows adjustment-free efficient operation.
- Operation temperature -40 °C to +105 °C
- Use of CMOS IC enables reduction of current consumption.
- V_{IO} controls swing amplitude.
- AEC-Q100 compliant (SG-3031CMA)



SG-3031CM
(3.2 × 1.5 × 0.9 mm Max.)

SG-3031CMA
(3.2 × 1.5 × 0.9 mm Max.)

Applications

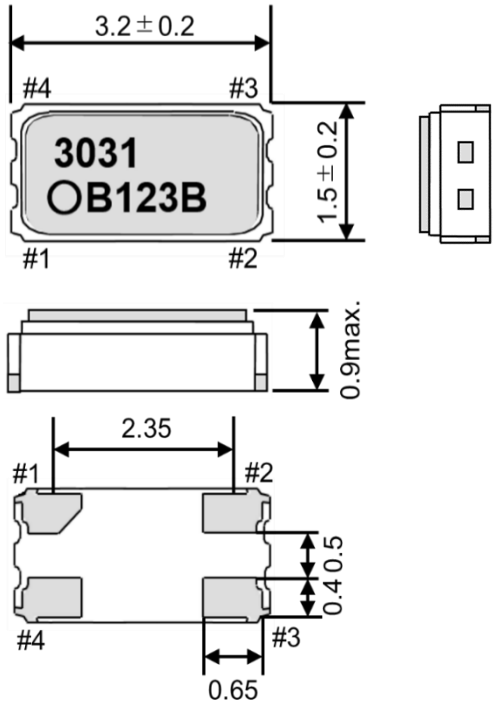
· SG-3031CM
Industrial, Security, Smart Meter,
Clock for Time counting and Sleep function

· SG-3031CMA
Infotainment and communication devices, Body (ECU*)
Clock for Time counting and Sleep function.
*ECU: Electronic control unit

Description

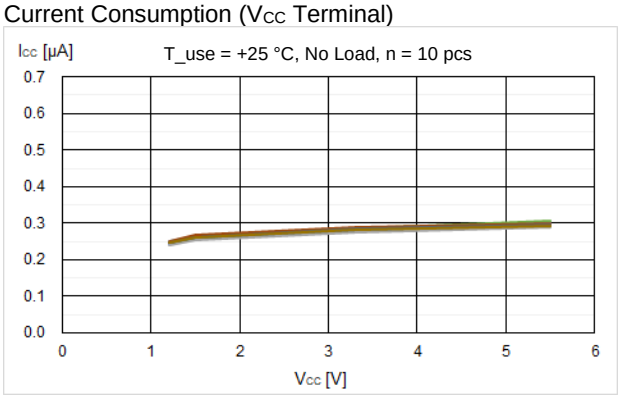
Industry-leading low power, wide temp range and automotive compliant 32.768 kHz Crystal Oscillator, offered in 3.2 x 1.5 mm, 4 pin package.

Outline Drawing

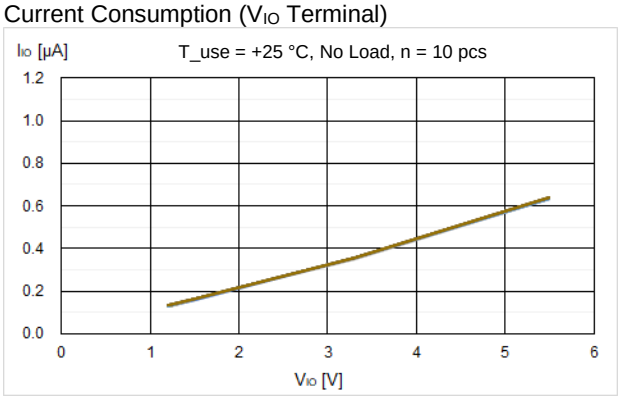


Typical Performance

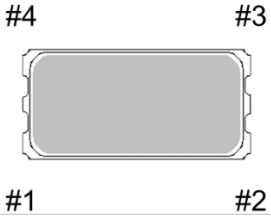
Current Consumption (V_{CC} Terminal)



Current Consumption (V_{IO} Terminal)



Terminal



Pin No.	Connection
#1	V_{IO}
#2	GND
#3	OUT
#4	V_{CC}

1. Product Number / Product Name

1.1 Product Number

SG-3031CM : X 1B00039 1 0001 16
SG-3031CMA : X 1B00040 1 A001 16
(1) (2) (3) (4) (5)

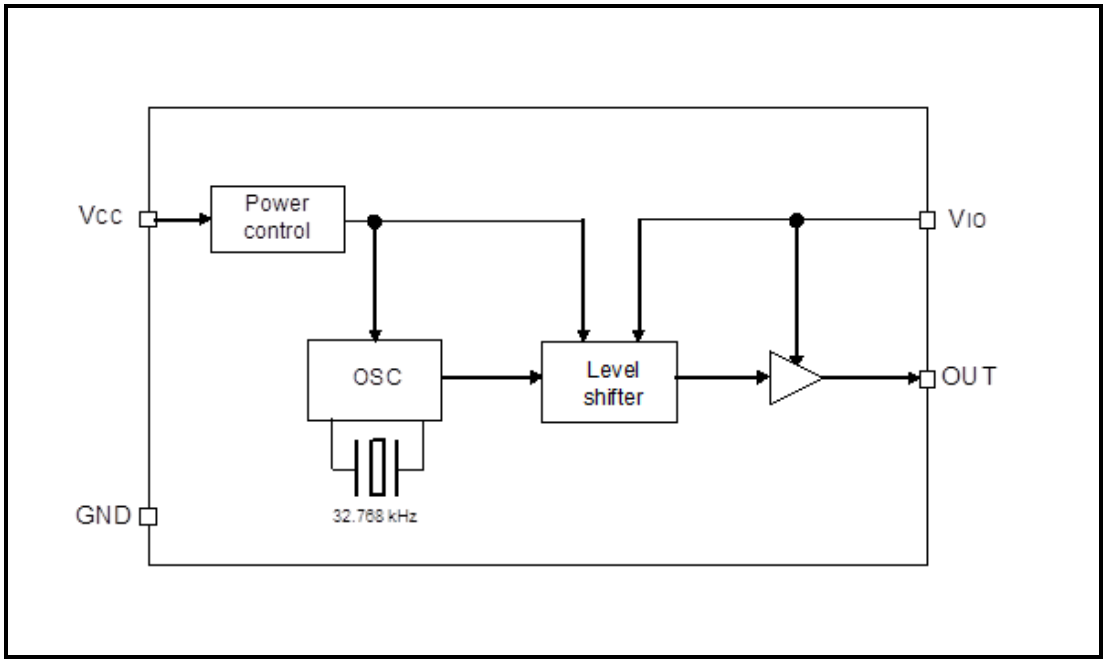
(1) Crystal devices
(2) Model
(3) Pb free code (1 : EU RoHS compliant / Pb free)
(4) Detail specifications
(5) Packing (16 : 3 000 pcs/reel)

1.2 Product Name (Standard Form)

SG-3031 CM 32.768000 kHz
SG-3031 CM A 32.768000 kHz
(a) (b) (d) (c)

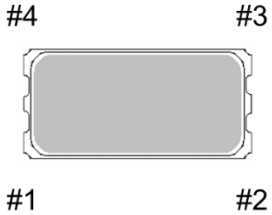
(a) Model
(b) Package type (CM : 3.2 x 1.5 x 0.9 mm size)
(c) Output Frequency
(d) For Automotive

2. Block diagram



3. Terminal Description

3.1. Terminal Arrangement



Pin No.	Connection
#1	V_{IO}
#2	GND
#3	OUT
#4	V_{CC}

3.2. Terminal Function

Pin No.	Pin Name	Function	Comment
#1	V_{IO}	OUT power supply	Power supply terminal for output buffer. The H level output from the OUT terminal is the voltage input to this terminal. This terminal can also be used as an Output Enable terminal. When setting Disable, V_{IO} = 0 V.
#2	GND	GND	Connect to the negative terminal (ground) of the power supply.
#3	OUT	CLK Output	This is a CMOS 32.768 kHz output pin. By changing the input level of the V_{IO} terminal, the voltage at the H level output can be varied.
#4	V_{CC}	Oscillator power supply	Power supply pin for driving the 32.768 kHz oscillation circuit.

4. External Connection Example

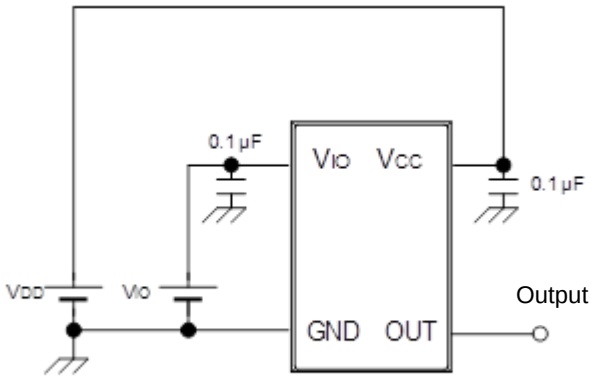


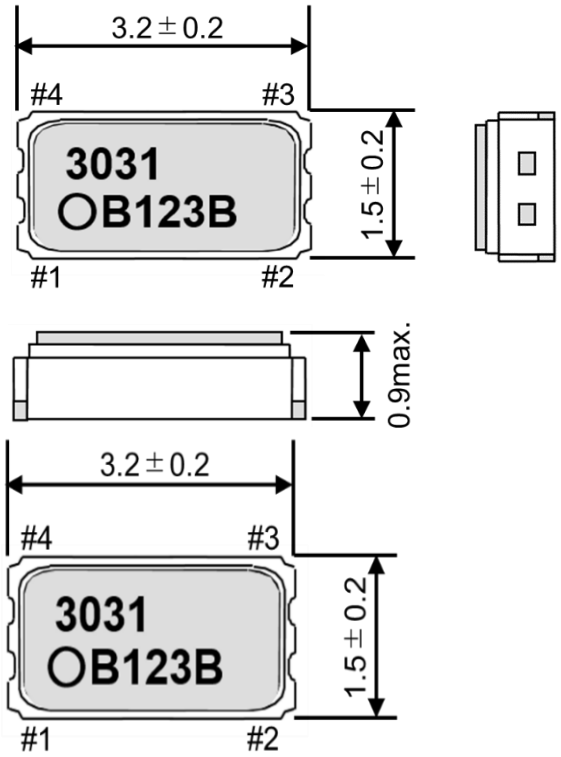
Figure 1 connection example

1) For stable operation, it is recommended that the bypass capacitor (0.01 µF to 0.1 µF) between the V_{CC} and GND and between the V_{IO} and GND.
2) When not using the V_{IO} function, connect the V_{IO} to V_{CC}.
3) Set $V_{IO} = V_{CC}$ when using 1.2 V ≤ V_{CC} < 1.5 V.

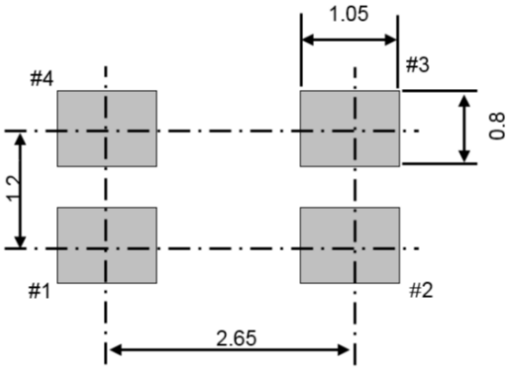
5. Outline Drawing / Marking Layout

5.1. Outline Drawing

SG-3031CM / SG-3031CMA



•Recommended footprint



For stable operation, it is recommended that the bypass capacitor (0.01 µF to 0.1 µF) between the V_{CC} and GND and between the V_{IO} and GND.

5.2. Marking Layout

SG-3031CM / SG-3031CMA

(1) SG-3031CM



(2) SG-3031CMA



∗ The display contents indicate the outline of the seal and display, and do not specify the details of the shape, size and position.

6. Absolute Maximum Ratings

GND = 0 V

Item	Symbol	Specification			Unit	Comments
		Min.	Typ.	Max.		
Supply voltage	V_{CC}, V_{IO}	GND - 0.3		GND + 5.5	V	V_{CC}, V_{IO} Terminal
Storage temperature	T_{STG}	-55		+125	°C	storage as single product

7. Operating Conditions

GND = 0 V

Item	Symbol	Specification			Unit	Comments
		Min.	Typ.	Max.		
Supply voltage	V_{CC}	1.2	3.3	5.5	V	V_{CC} Terminal
Interface voltage	V_{IO}	1.2	3.3	5.5	V	V_{IO} Terminal Set $V_{IO} = V_{CC}$ when using 1.2 V ≤ V_{CC} < 1.5 V.
Operating temperature	T_use	-40		+105	°C	

8. Frequency Characteristics

* Unless otherwise noted, GND = 0 V, T_use = -40 °C to +105 °C
V_{CC} = 1.2 V to 5.5 V, V_{IO} = 1.2 V to 5.5 V

Item	Symbol	Specification			Unit	Comments
		Min.	Typ.	Max.		
Output frequency	fo	32.768			kHz	
Frequency tolerance	f_tol	5 ± 23			× 10^{-6}	T_use = +25 °C V_{CC} = 3.3 V
Frequency / temperature characteristics	fo-Tc	-120		+10	× 10^{-6}	T_use = -20 °C to +70 °C Reference to V_{CC} = 3.3 V, +25 °C
		-240		+10	× 10^{-6}	T_use = -40 °C to +85 °C Reference to V_{CC} = 3.3 V, +25 °C
		-420		+10	× 10^{-6}	T_use = -40 °C to +105 °C Reference to V_{CC} = 3.3 V, +25 °C
Frequency / voltage coefficient	fo-V_{CC}	-1		+1	× 10^{-6} / V	V_{CC} = 1.5 V to 5.5 V reference to V_{CC} = 3.3 V
		-5		+5	× 10^{-6} / V	V_{CC} = 1.2 V to 1.5 V reference to V_{CC} = 3.3 V
Start-up time	t_str		0.15	0.45	s	V_{CC} = 1.5 V to 5.5 V T_use = -40 °C to +105 °C
				1.0	s	V_{CC} = 1.2 V to 1.5 V T_use = -40 °C to +105 °C
Frequency aging *	f_age	-5		+5	× 10^{-6} / year	+25 °C, V_{CC} = 3.3 V, First year

*Aging stability is estimated from environmental reliability tests; expected amount of the frequency variation.
This does not intend to guarantee the product-life cycle.

9. Electrical Characteristics

9.1. DC Electrical Characteristics

* Unless otherwise noted, GND = 0 V, T_use = -40 °C to +105 °C
V_{CC} = 1.2 V to 5.5 V, V_{IO} = 1.2 V to 5.5 V

Item	Symbol	Specification			Unit	Comments
		Min.	Typ.	Max.		
Current consumption (V_{CC} Terminal) *1)	I_{CC}		0.29	0.65	µA	V_{CC} = 1.2 V to 5.5 V
Current consumption (V_{IO} Terminal) *1)	I_{IO}		0.35	0.65	µA	No Load, V_{IO} = 3.3 V ± 0.3 V
			0.6	1.1	µA	No Load, V_{IO} = 5.0 V ± 0.3 V
			2.0	2.7	µA	L_CMOS = 15 pF, V_{IO} = 3.3 V ± 0.3 V
			3.0	4.0	µA	L_CMOS = 15 pF, V_{IO} = 5.0 V ± 0.3 V
Output voltage	V_{OH}	V_{IO} - 0.4			V	V_{IO} = 1.5 V to 5.5 V, I_{OH} = -400 µA
		V_{IO} - 0.2				V_{IO} = 1.2 V to 1.5 V, I_{OH} = -100 µA
	V_{OL}			GND + 0.4	V	V_{IO} = 1.5 V to 5.5 V, I_{OL} = -400 µA
				GND + 0.2		V_{IO} = 1.2 V to 1.5 V, I_{OL} = -100 µA

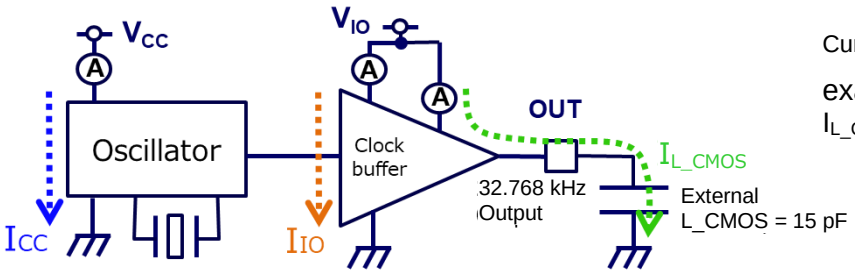
*1) notes)

Current consumed by the product : I_{CC}, I_{IO}, I_{L_CMOS}

I_{CC} : Current that flows through the V_{CC} pin and is consumed by the oscillation circuit.

I_{IO} : Current that flows to the V_{IO} pin and is consumed by the output level control circuit (Clock buffer).

I_{L_CMOS} : The current consumed by the load connected to the output terminal changes.



Current consumption when load is connected

example) For L_CMOS = 15 pF

I_{L_CMOS} = fo × L_CMOS × V_{IO}
= 32.768 [kHz] × 15 [pF] × 3.0 [V]
= 1.475 [µA]

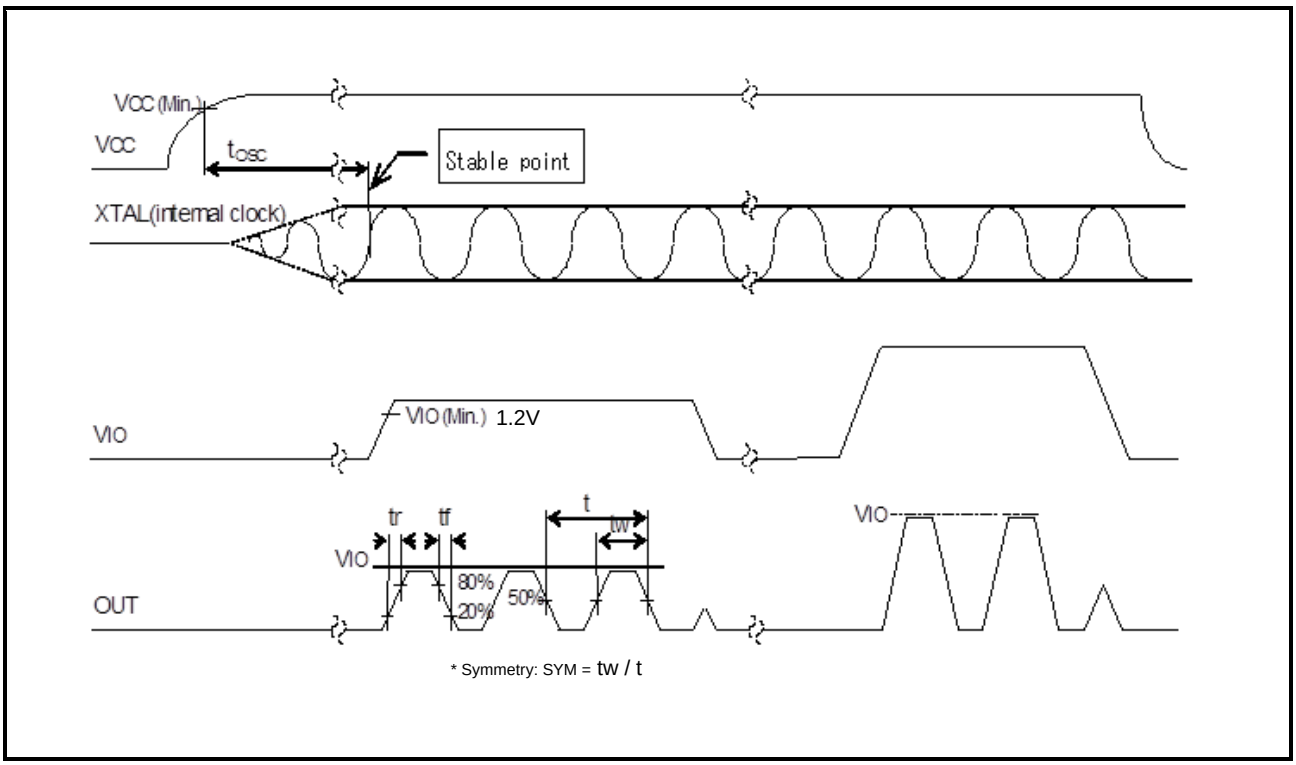
9.2. AC Electrical Characteristics

* Unless otherwise noted, GND = 0 V, T_use = -40 °C to +105 °C
V_{CC} = 1.2 V to 5.5 V, V_{IO} = 1.2 V to 5.5 V

Item	Symbol	Specification			Unit	Comments
		Min.	Typ.	Max.		
CMOS load condition	L_CMOS			15	pF	
Symmetry	SYM	45		55	%	V_{IO} = 1.5 V to 5.5 V, V_{TH} = V_{IO} / 2, L_CMOS = 15pF
		40		60	%	V_{IO} = 1.2 V to 1.5 V, V_{TH} = V_{IO} / 2, L_CMOS = 15pF
Rise time Fall time	tr / tf			200	ns	20 % V_{IO} ↔ 80 % V_{IO}, L_CMOS = 15 pF, V_{IO} = 1.2 V to 5.5 V
				100	ns	20 % V_{IO} ↔ 80 % V_{IO}, L_CMOS = 15 pF, V_{IO} = 1.8 V to 5.5 V

10. Timing Chart

10.1. Timing Chart For Each Terminal



10.2. About V_{IO} Pin Settings

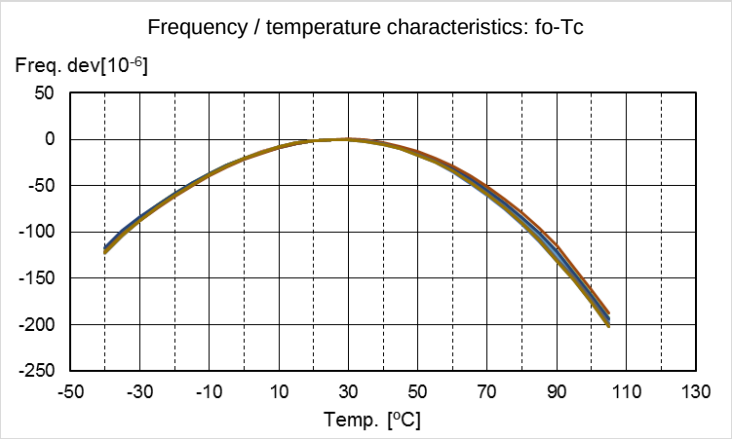
1) In order to output the clock from the oscillator supply voltage should be connected to V_{CC} and V_{IO} pins.
For 1.2 V ≤ V_{CC} < 1.5 V, set V_{IO} = V_{CC}; otherwise, V_{CC} do not need to be equal to V_{IO}

2) As shown in the timing chart above, the output level of the clock output from the OUT pin can be controlled by changing the voltage level applied to the V_{IO} pin.
V_{IO} voltage level = clock output level.

3) V_{IO} pin can also be used as an OE (Output enable) pin.
When V_{IO} = 0 V, the output is disabled.
If V_{CC} is supplied, the internal oscillation circuit will be in operating, and the clock output can be obtained without having to wait for the V_{IO} power to be restored.

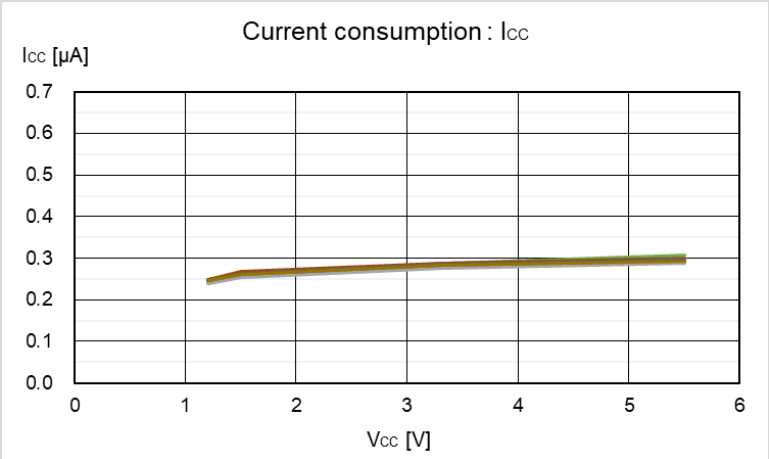
11. Characteristic Data

11.1. Frequency Temperature Coefficient

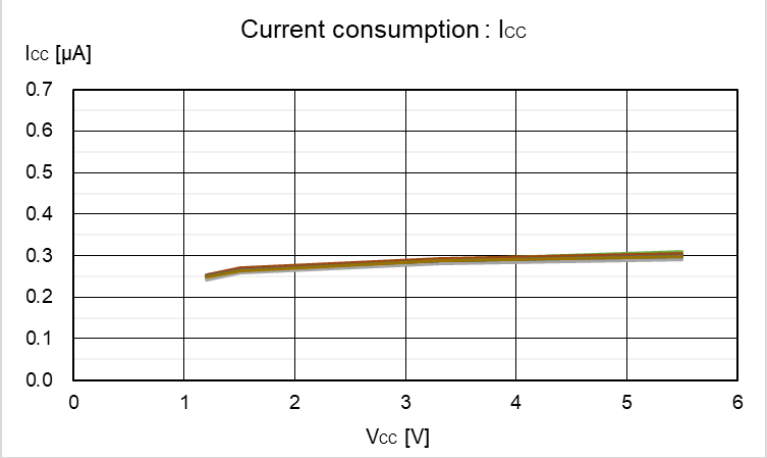


Test Conditions:
No Load, n = 10 pcs.

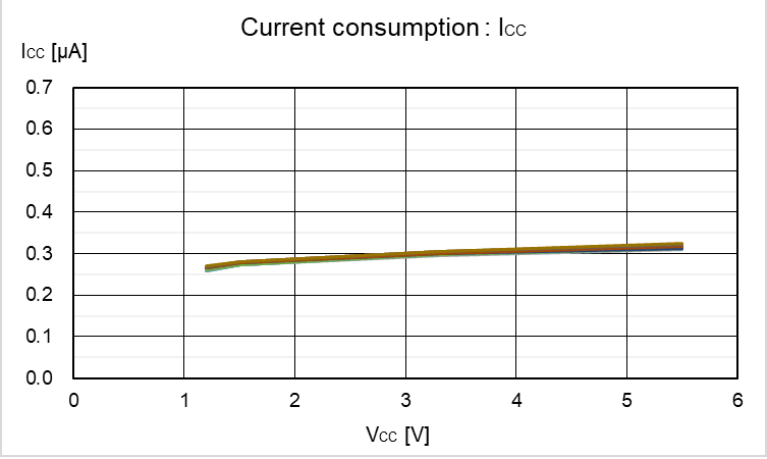
11.2. Current Consumption (V_{CC} Terminal)



Test Conditions:
No Load, T_use = +25 °C, n = 10 pcs.

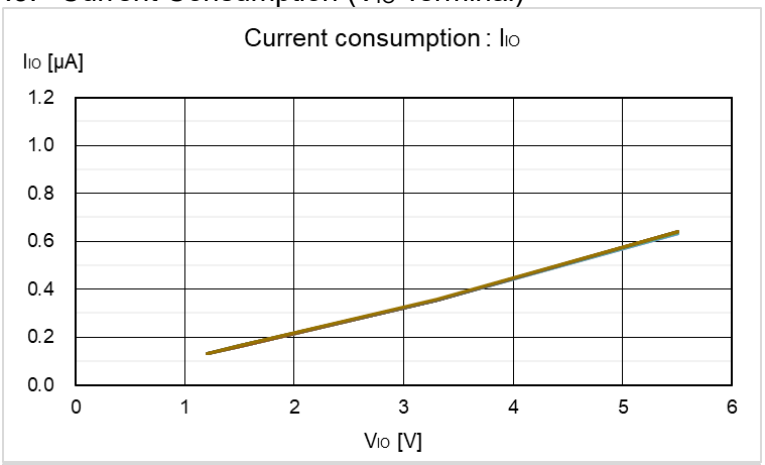


Test Conditions:
No Load, T_use = +85 °C, n = 10 pcs.

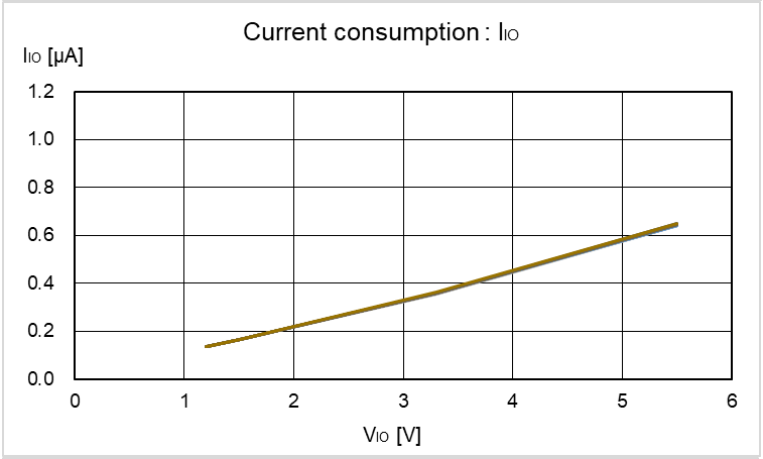


Test Conditions:
No Load, T_use = +105 °C, n = 10 pcs.

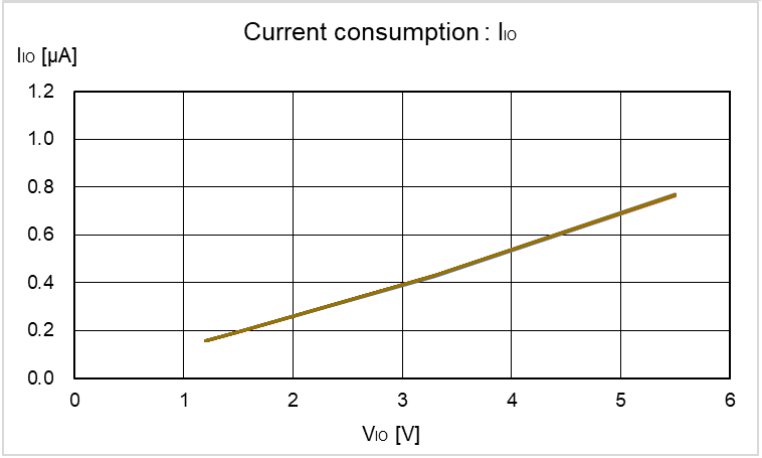
11.3. Current Consumption (V_{IO} Terminal)



Test Conditions:
No Load, T_use = +25 °C, n = 10 pcs.

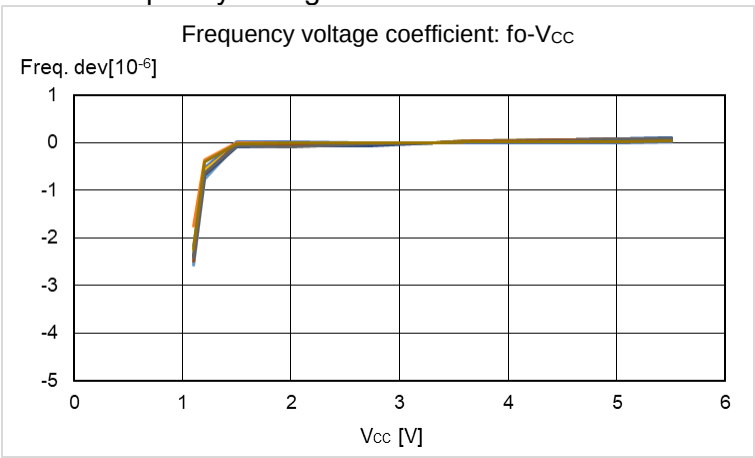


Test Conditions:
No Load, T_use = +85 °C, n = 10 pcs.

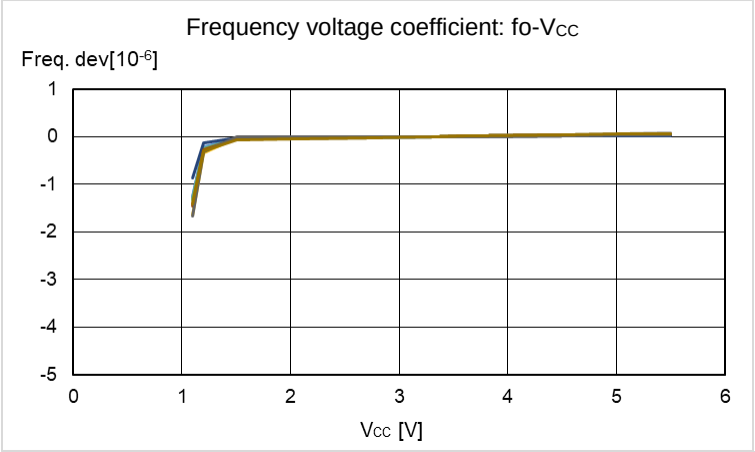


Test Conditions:
No Load, T_use = +105 °C, n = 10 pcs.

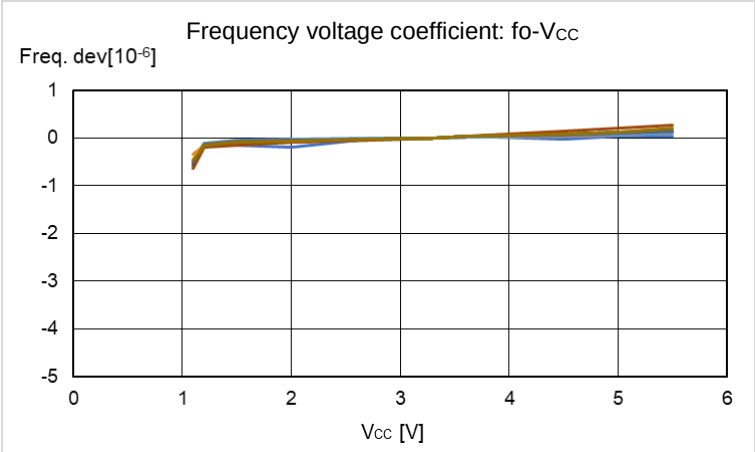
11.4. Frequency Voltage Coefficient



Test Conditions:
No Load, T_use = -40 °C, n = 10 pcs.



Test Conditions:
No Load, T_use = +25 °C, n = 10 pcs.

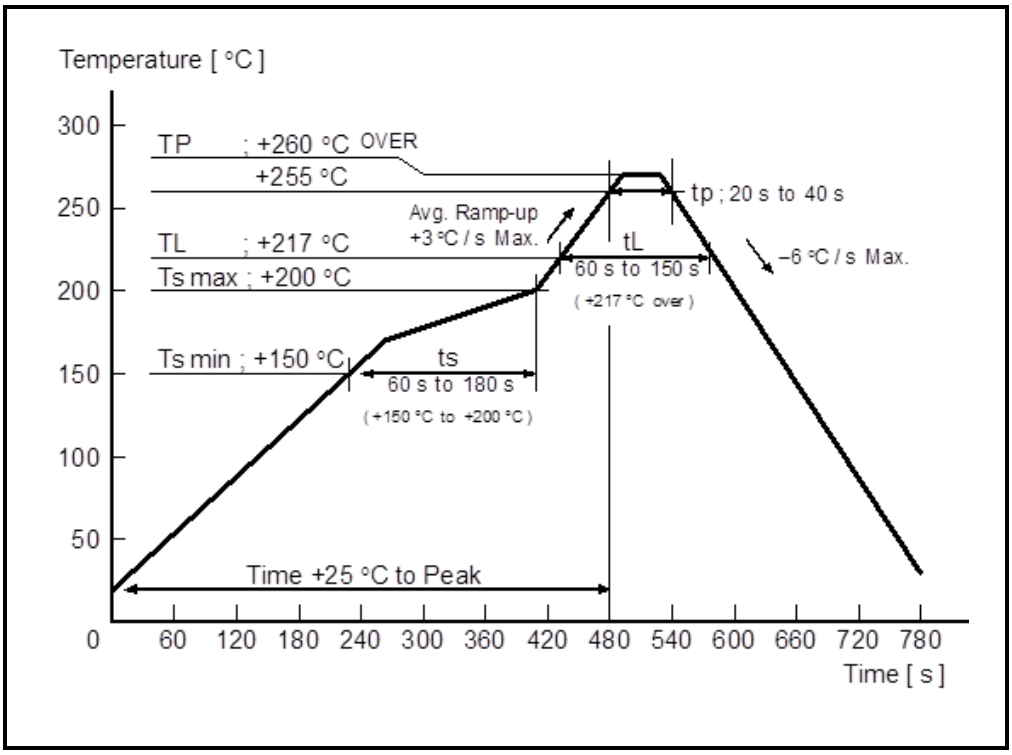


Test Conditions:
No Load, T_use = +105 °C, n = 10 pcs.

12. Moisture Sensitivity Level

Item	Class	Test Condition
MSL	LEVEL 1	JEDEC J-STD-020D.1

13. Reflow Profiles (follow to IPC / JEDEC J-STD-020D.1)



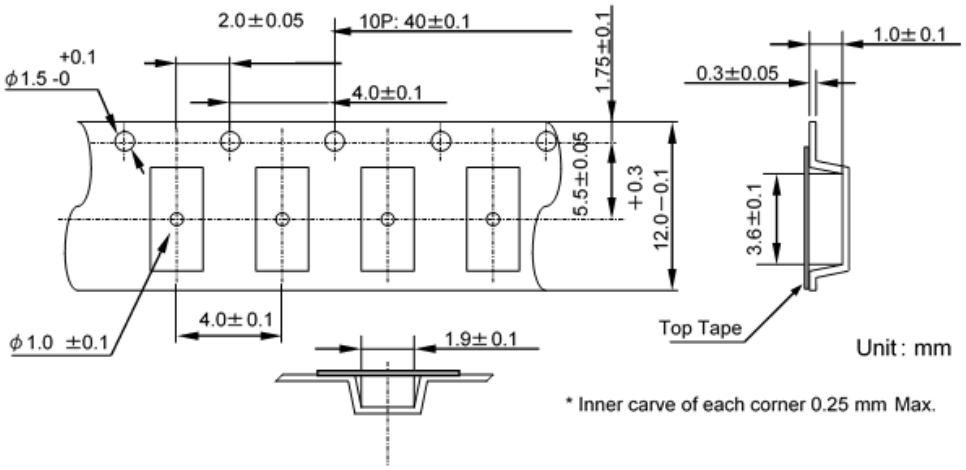
14. Packing Information

14.1. Taping Specification

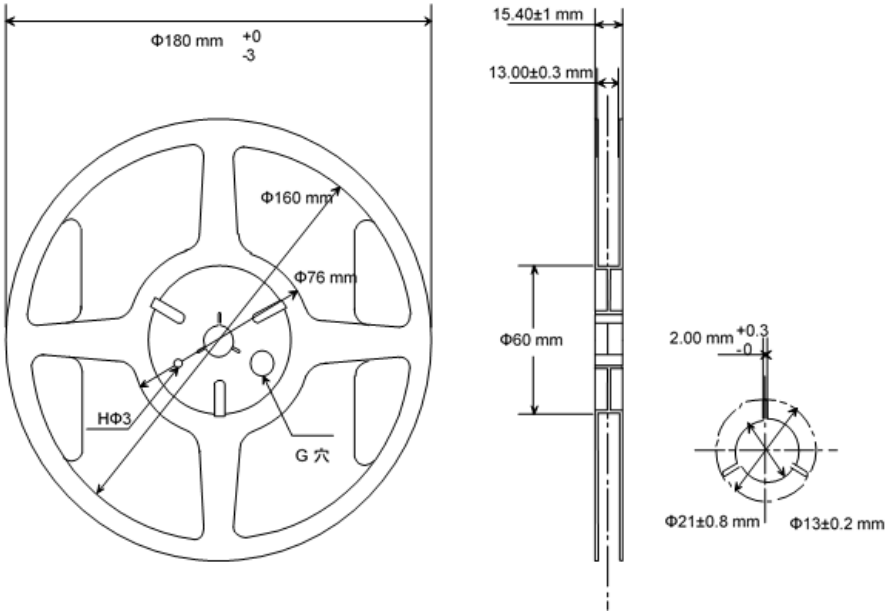
Subject to EIA-481, IEC 60286, JIS C0806.

(1) Tape Dimensions

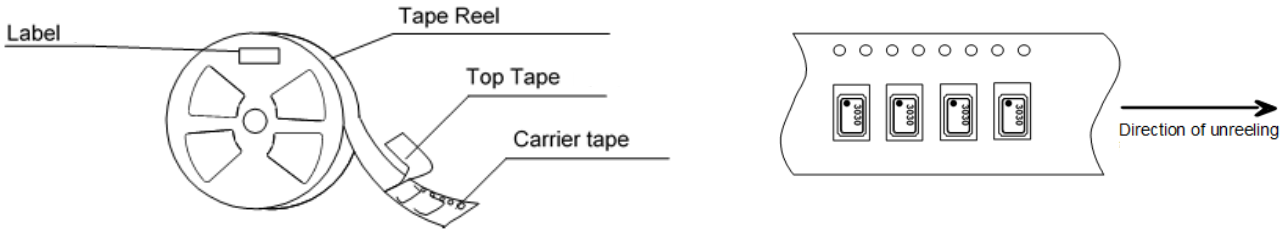
TE1204L
Material of the Carrier Tape: PS (Polystyrene)
Material of the Top Tape: PET (Polyethylene Terephthalate) +PE (Polyethylene)



(2) Reel Dimensions



(3) Storage Form



(4) Storage Quantity

The product number is X1B000391000116 (TG-3031CM), X1B000401A00116 (SG-3031CMA).
Packing quantity is defined by 14th and 15th digit of product number.
The standard is "16", 3 000 pcs/Reel.

15. Handling Precautions

Prior to using this product, please carefully read the section entitled “Precautions” on our Web site (https://www5.epsondevice.com/en/information/#precaution) for instructions on how to handle and use the product properly to ensure optimal performance of the product in your equipment.
Before using the product under any conditions other than those specified therein,
please consult with Epson to verify and confirm that the performance of the product will not be negatively affected by use under such conditions.
In addition to the foregoing precautions, in order to avoid degrading the performance of the product, we strongly recommend that you DO NOT use the product under ANY of the following conditions:

(1) Mounting the product on a board using water-soluble solder flux without completely removing the flux residue from the board. The residue of such flux is soluble in water or water-soluble cleaning agents and the residue, especially the residues which contain active halogens, will negatively affect the performance and reliability of the product.
(2) Using the product in any manner that will result in any shock or impact to the product.
(3) Using the product in places where the product is exposed to water, chemicals, organic solvent, sunlight, dust, corrosive gasses, or other materials.
(4) Using the product in places where it is exposed to static electricity or electromagnetic waves.
(5) Applying ultrasonic cleaning without advance verification and confirmation that the product will not be affected by such a cleaning process which may damage the crystal.
(6) Using the product under any other conditions that may negatively affect the performance and/or reliability of the product.
(7) Using a power supply with ripple may cause of incorrect operation or degradation of phase noise characteristics, so please evaluate before use. It is recommended to keep power ripple below 200mV_{P-P}.
(8) Supply voltage should be increased monotonically.
In addition, please do not power on at midpoint potential since that may cause malfunction or not output.
When changing the V_{CC} voltage during operation, change it more slowly than 1 μs / V.
(9) Frequency aging is calculated from environmental tests results to estimate the amount of frequency variation over time. This does not guarantee the length of the product's life-cycle.

Should any customer use the product in any manner contrary to the precautions and/or advice herein, such use shall be done at the customer’s own risk.

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Tel:150-1290-5940
Email:sales@manduic.com

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	►Designed for automotive general equipment.
	►Designed for automotive applications related to driving and safety.

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