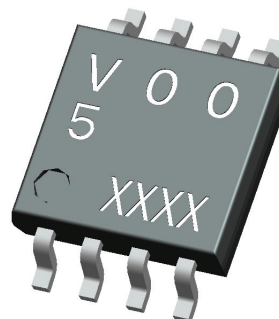


# Constant Current IC

# W2RV005RM

## Most Suitable Constant Current IC for Driving Full Color LED

- Built-in 3 lines required to drive full color LED.
- Easy thermal design due to large power dissipation.
- Contained in the 2.9 x 2.8-mm small package.
- Can be used as a stand-alone IC or can be driven by Omron's W2RF004RM and W2RF002RF LED Control IC's.
- RoHS Compliant



## Ordering Information

| Description         | Model     |
|---------------------|-----------|
| Constant Current IC | W2RV005RM |

## Specifications

### Absolute Maximum Ratings (Ta = 25°C)

| Item                      | Symbol     | Rating                              |
|---------------------------|------------|-------------------------------------|
| Supply Voltage            | $V_{CC}$   | 36 V                                |
| Output Voltage            | $V_{OUT}$  | 36 V                                |
| Output Current / terminal | $I_{OUT}$  | 50 mA (see note 1)                  |
| Input Voltage             | $V_{IN}$   | -0.3 to 6 V                         |
| Power Dissipation         | $P_d$      | IC alone: 387 mW                    |
|                           |            | Standard Board: 587 mW (see note 2) |
| Operating Temperature     | $T_{OPR}$  | -20 to 85 °C                        |
| Storage Temperature       | $T_{STG}$  | -40 to 150 °C                       |
| Junction Temperature      | $T_{JMAX}$ | 150 °C                              |

### Recommended Operating Conditions

| Item                      | Symbol    | Rating       |
|---------------------------|-----------|--------------|
| Supply Voltage            | $V_{CC}$  | 4.5 to 20 V  |
| Output Voltage            | $V_{OUT}$ | 2.0 to 20 V  |
| Output Current / terminal | $I_{OUT}$ | 3.0 to 30 mA |

**Note:** 1. Take the power consumption and power dissipation into consideration.  
 2. When implemented on a standard board (70 x 70 x 1.6 mm, Cu 3%, Single-sided glass epoxy board). The value reduces at a rate of about 4.7 mW/°C when the IC is used at Ta = 25°C or higher.

### Electrical Characteristics (Ta = 25°C, $V_{CC}$ = 12V)

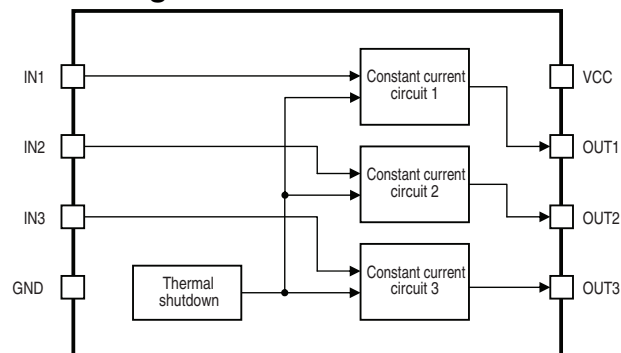
| Item                               | Symbol           | Condition                                                                                                     | Spec. |      |      | Unit          | Applicable terminal   |
|------------------------------------|------------------|---------------------------------------------------------------------------------------------------------------|-------|------|------|---------------|-----------------------|
|                                    |                  |                                                                                                               | Min.  | Typ. | Max. |               |                       |
| Standby current consumption        | $I_{CC1}$        | IN1 to 3: OPEN                                                                                                | ---   | 0.7  | 1.4  | mA            | $V_{CC}$              |
| Operating current consumption      | $I_{CC2}$        | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$ , All CH: ON                                       | ---   | 5.5  | 7.6  | mA            | $V_{CC}$              |
| Output current 1                   | $I_{OUT1}$       | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$ , All CH: ON                                       | 19.5  | 20.8 | 22.1 | mA            | OUT1 to 3             |
| Output current 2                   | $I_{OUT2}$       | $R_{IN} = 13 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$ , All CH: ON                                        | 10.5  | 11.2 | 11.9 | mA            | OUT1 to 3             |
| Current error between channels     | $\Delta I_{OUT}$ | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$                                                    | -3.0  | ---  | 3.0  | %             | OUT1 to 3             |
| Output current voltage fluctuation | $\Delta IV$      | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 7.0 \pm 4.0 \text{ V}$                                            | -3.0  | ---  | 3.0  | %             | OUT1 to 3             |
| Inverting input current for OFF    | $I_{OFF}$        | ---                                                                                                           | ---   | ---  | 17.0 | $\mu\text{A}$ | IN1 to 3              |
| Inverting input current for ON     | $I_{ON}$         | ---                                                                                                           | 42.0  | ---  | ---  | $\mu\text{A}$ | IN1 to 3              |
| ON output propagation time         | $t_{ON}$         | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$ , Output current $I_{OUT} \times 0.9$ arrival time | ---   | 1.0  | ---  | $\mu\text{s}$ | IN1 to 3<br>OUT1 to 3 |
| OFF output propagation time        | $t_{OFF}$        | $R_{IN} = 6.8 \text{ k}\Omega$ , $V_{OUT} = 4.0 \text{ V}$ , Output current $I_{OUT} \times 0.1$ arrival time | ---   | 0.4  | ---  | $\mu\text{s}$ | IN1 to 3<br>OUT1 to 3 |

## Timing Characteristics (Ta = 25°C, VCC = 12V)

| Item                        | Symbol    | Condition                                                                                                   | Spec. |      |      | Unit          | Applicable terminal   |
|-----------------------------|-----------|-------------------------------------------------------------------------------------------------------------|-------|------|------|---------------|-----------------------|
|                             |           |                                                                                                             | Min.  | Typ. | Max. |               |                       |
| ON output propagation time  | $t_{ON}$  | $R_{IN} = 6.8\text{ k}\Omega$ , $V_{OUT} = 4.0\text{V}$ , Output current $I_{OUT} \times 0.9$ arrival time. | ---   | 1.0  | ---  | $\mu\text{S}$ | IN1 to 3<br>OUT1 to 3 |
| OFF output propagation time | $t_{OFF}$ | $R_{IN} = 6.8\text{ k}\Omega$ , $V_{OUT} = 4.0\text{V}$ , Output current $I_{OUT} \times 0.1$ arrival time. | ---   | 0.4  | ---  | $\mu\text{S}$ |                       |

## Engineering Data

### Block Diagram

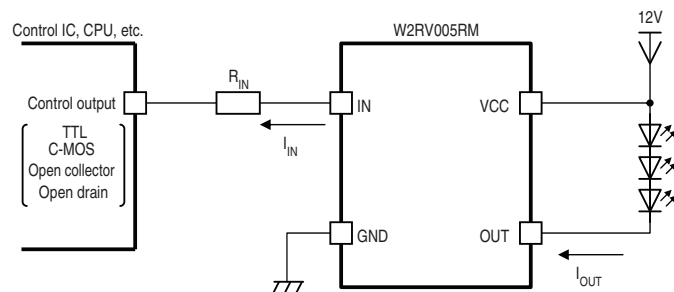


### Terminal Designation

| Terminal Number | Terminal Name   | Description  |
|-----------------|-----------------|--------------|
| 1               | IN1             | Input pin 1  |
| 2               | IN2             | Input pin 2  |
| 3               | IN3             | Input pin 3  |
| 4               | GND             | Ground       |
| 5               | OUT3            | Output pin 3 |
| 6               | OUT2            | Output pin 2 |
| 7               | OUT1            | Output pin 1 |
| 8               | V <sub>CC</sub> | Power Supply |

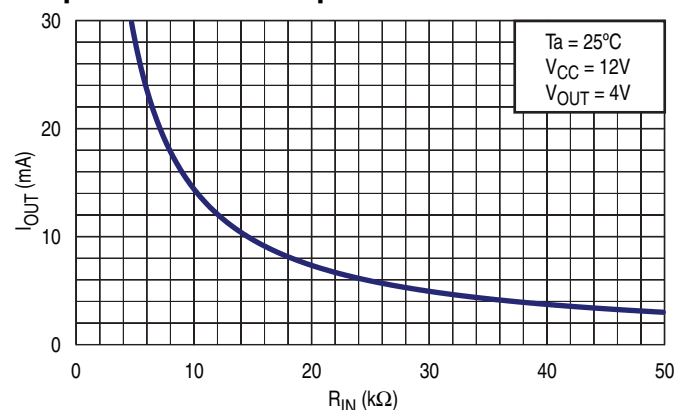
**Note:** Connect unused input pins to a power supply (voltage equal to V<sub>CC</sub> or less) like I/O, and leave unused output pins open.

### Functions



| Control output  | Input current<br>$I_{IN}$ | Output current<br>$I_{OUT}$ |
|-----------------|---------------------------|-----------------------------|
| Logic H or open | OFF                       | OFF                         |
| Logic L         | ON                        | ON                          |

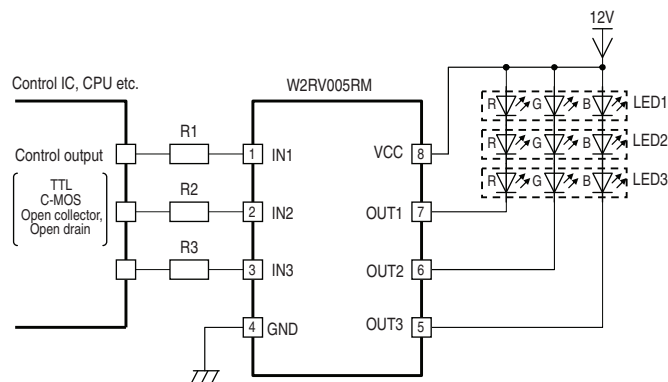
### Output Current vs. Input Resistance



| Output current<br>$I_{OUT}$ (mA) | Input Resistance<br>$R_{IN}$ (kΩ) |
|----------------------------------|-----------------------------------|
| 5                                | 29.6                              |
| 10                               | 14.6                              |
| 15                               | 9.59                              |
| 20                               | 7.12                              |
| 25                               | 5.65                              |
| 30                               | 4.67                              |

**Note:** The figures in the table show theoretical values obtained when one end of  $R_{IN}$  is connected to GND.

## Application Example



## Power Consumption Calculation Example

Conditions:  
 $V_F$  of LED - Red (R): 2.2 V, Green (G): 3.3V, Blue (B): 3.2 V (at 20 mA)  
 OUT1 ~ 3 are all driven at 20 mA

### • Voltage of OUT Terminals

$$\text{OUT1: } 12 - 2.2 \times 3 = 5.4 \text{ V}$$

$$\text{OUT2: } 12 - 3.3 \times 3 = 2.1 \text{ V}$$

$$\text{OUT3: } 12 - 3.2 \times 3 = 2.4 \text{ V}$$

### • Power Consumption

$$\text{OUT1: } 5.4 \text{ V} \times 20 \text{ mA} = 108 \text{ mW}$$

$$\text{OUT2: } 2.1 \text{ V} \times 20 \text{ mA} = 42 \text{ mW}$$

$$\text{OUT3: } 2.4 \text{ V} \times 20 \text{ mA} = 48 \text{ mW}$$

$$\text{VCC: } 12 \text{ V} \times 5.5 \text{ mA} = 66 \text{ mW}$$

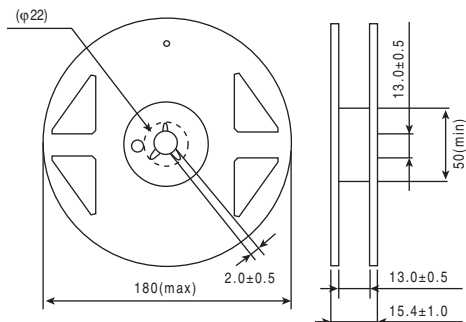
$$\text{Total: } 108 + 42 + 48 + 66 = 264 \text{ mW}$$

## Tape Packaging

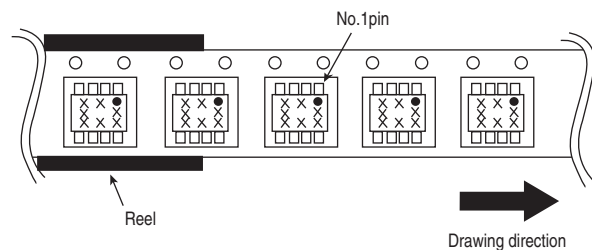
Packaging style: Embossed taping

Packaging quantity: 3,000 pcs/reel

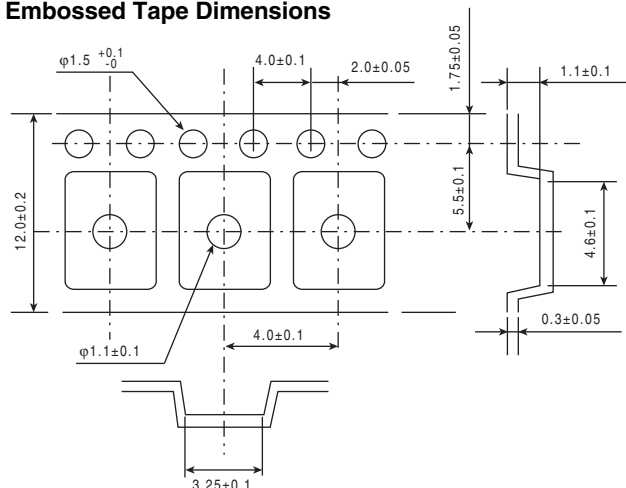
### Reel Dimensions



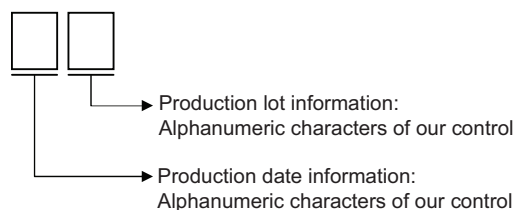
### Direction of Insertion



### Embossed Tape Dimensions



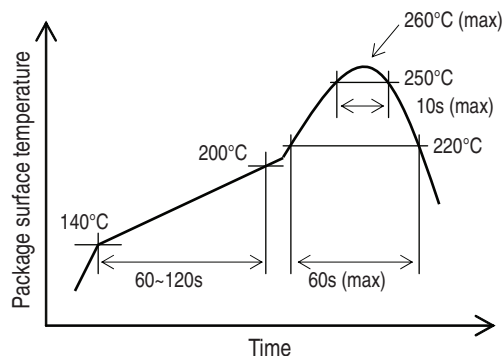
## Lot Code Indication



## Recommended Reflow Conditions

### Allowable Temperature Profile Conditions

Product mounting method should be by Reflow and we recommend the following temperature profile. Reflow no more than two times, maximum.

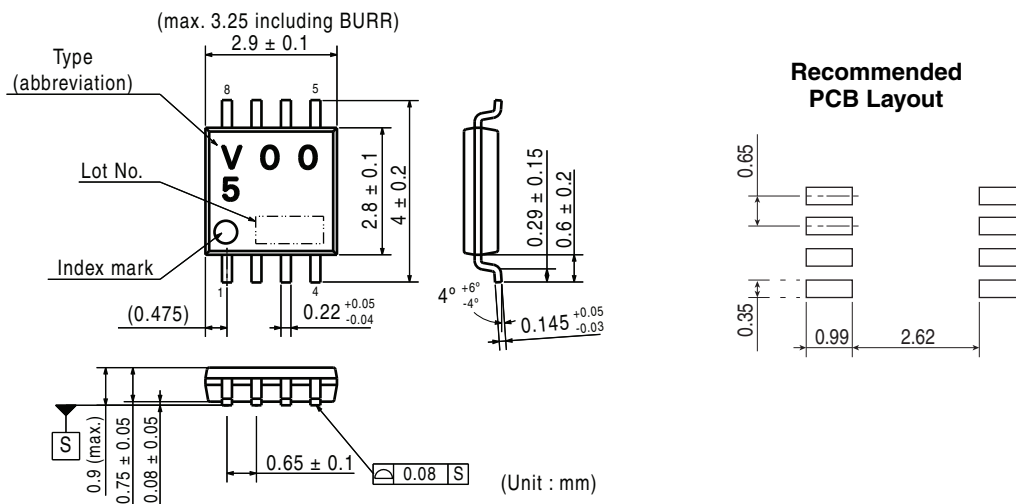


### Storage Conditions before Mounting

Moisture absorption by the plastic package will increase the possibility of faults, such as cracks; therefore, take enough care for storage.

| Storage Conditions     | Period   |
|------------------------|----------|
| 5 to 30°C, 40 to 70%RH | One Year |

# Dimensions



# Precautions for Use

## ■ Correct Use

- The absolute maximum rating is the limit value which should not be exceeded even in a flash. Exceeding this value can cause deterioration of the characteristics or complete failure of the IC.
- Sufficiently take into consideration the static electricity, chattering and voltage of the input to be connected when determining each input terminal. Since unused input terminals may cause an undefined state in the internal circuit, connect them to a power supply (voltage =  $V_{CC}$  or less), like I/O.
- Although the device contains an ESD protection circuit, static electricity that exceeds the function may damage the device. When handling the device, exercise due caution by, for example, grounding the human body.
- Due to the structure of the IC, parasitic elements are formed unavoidably. Exercise due caution not to use the device in a way that activates the parasitic elements. For example, do not apply a voltage lower than GND to the input terminals.
- Taking the power dissipation in actual use into consideration, perform thermal design with a sufficient margin. When a voltage applied to the IC is high, which is due to, for example, a small number of LED's driven in series, IC heat generation can be controlled by inserting a resistance and spreading power consumption evenly.
- This IC incorporates a built-in thermal shutdown circuit. If the chip temperature rises too high, this circuit works and the output terminal becomes an open state. When the chip temperature returns to a normal range, the output terminal also returns to its original state. This circuit is a protective function for use at an emergency, so please do not use it as a regular function.
- Due to potential damage, do not use product that has been dropped or that has come into contact with water.

## ■ RoHS Directive Compliance

Models that are indicated as being RoHS compliant are free of the following six substances.

|                      |                |
|----------------------|----------------|
| Lead:                | 1,000 ppm max. |
| Mercury:             | 1,000 ppm max. |
| Cadmium:             | 100 ppm max.   |
| Hexavalent chromium: | 1,000 ppm max. |
| PBB:                 | 1,000 ppm max. |
| PBDE:                | 1,000 ppm max. |

A large grid of 1000 small squares, each containing a unique combination of symbols (plus, minus, multiplication, division, equals, less than, greater than, and percent) and numbers (0-9). The symbols and numbers are arranged in a way that they are not easily recognizable as a standard mathematical expression, but rather as a random sequence of characters. The grid is organized into 10 rows and 100 columns. Each row contains 10 squares, and each column contains 10 squares. The symbols and numbers are distributed evenly across the grid, with each symbol and number appearing approximately 100 times. The symbols used are: plus (+), minus (-), multiplication (x), division (/), equals (=), less than (<), greater than (>), and percent (%). The numbers used are: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The grid is a visual representation of a large set of random data, where each square is a unique data point. The symbols and numbers are arranged in a way that they are not easily recognizable as a standard mathematical expression, but rather as a random sequence of characters. The grid is organized into 10 rows and 100 columns. Each row contains 10 squares, and each column contains 10 squares. The symbols and numbers are distributed evenly across the grid, with each symbol and number appearing approximately 100 times. The symbols used are: plus (+), minus (-), multiplication (x), division (/), equals (=), less than (<), greater than (>), and percent (%). The numbers used are: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The grid is a visual representation of a large set of random data, where each square is a unique data point.

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**OMRON ELECTRONIC  
COMPONENTS LLC**

55 E. Commerce Drive, Suite B  
Schaumburg, IL 60173

**847-882-2288**

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