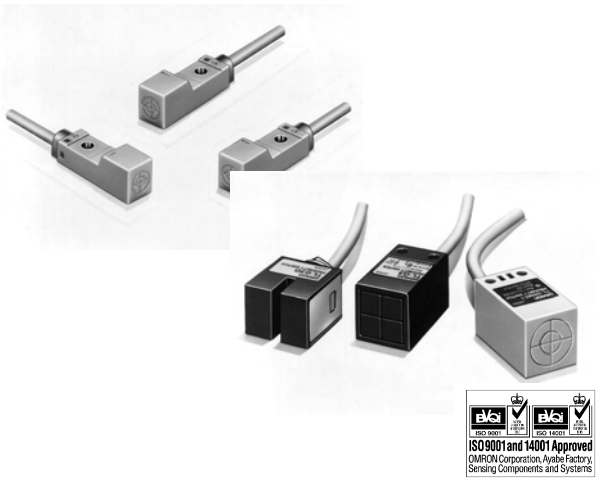
OMRON

# Inductive Proximity Sensor

**TL-Q/TL-G**

## Subminiature Sensor Ideal for Narrow Mounting Space

- Grooved TL-G3D is ideal for high-speed pulse generator and high-speed revolution control.
- TL-Q2 and TL-Q5 save mounting space and are convenient for incorporation into miniature controllers, office equipment, etc.



ISO9001 and 14001 Approved
OMRON Corporation, Ayabe Factory, Sensing Components and Systems

## Ordering Information

| Shape | Sensing distance | Output | | Model | Approval |
|---|---|---|---|---|---|
| Rectangular | 2 mm | DC 3-wire | NO | TL-Q2MC1 (see note 1) | CE |
| | 5 mm | DC 2-wire | NO | TL-Q5MD1 (see note 1) | CE |
| | | | NC | TL-Q5MD2 (see note 1) | CE |
| | | DC 3-wire | NO | TL-Q5MC1 (see note 2) | CE |
| | | | NC | TL-Q5MC2 (see note 2) | CE |
| Grooved | 7.5 mm | | NO | TL-G3D-3 | --- |

**Note:** 1. Models different in response frequency are available. These model numbers take the form of TL-Q□M□□5 (e.g., TL-Q5MD15).
2. The model with a robot cord has a model number ending with the suffix R (e.g., TL-Q5MC1-R).

# Specifications

## ■ Ratings/Characteristics

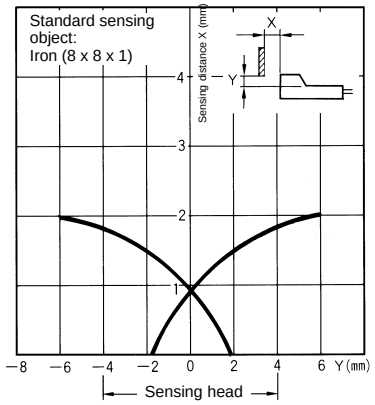
| Item | | TL-Q2MC1 | TL-Q5MD□ | TL-Q5MC□ | TL-G3D-3 |
|---|---|---|---|---|---|
| **Supply voltage (operating voltage range)** | | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max. | 12 to 24 VDC (10 to 30 VDC) | 12 to 24 VDC (10 to 30 VDC), ripple (p-p): 10% max. | 12 to 24 VDC, ripple (p-p): 5% max. |
| **Current consumption** | | 15 mA max. at 24 VDC with no load | --- | 10 mA max. at 24 VDC | 2 mA max. at 24 VDC with no load |
| **Leakage current** | | --- | 0.8 mA max. | --- | --- |
| **Sensing object** | | Ferrous metal (refer to *Engineering Data* for non-ferrous metals) | | | Ferrous metal |
| **Sensing distance** | | 2 mm ±15% | 5 mm ±10% | | 7.5 ±0.5 mm |
| **Sensing distance (standard object)** | | 0 to 1.5 mm (iron, 8 x 8 x 1 mm) | 0 to 4 mm (iron, 18 x 18 x 1 mm) | 0 to 4 mm (iron, 15 x 15 x 1 mm) | 10 mm (iron, 10 x 5 x 0.5 mm) |
| **Differential travel** | | 10% max. of sensing distance | | | |
| **Response time** | | --- | | 2.0 ms max. | 1 ms max. |
| **Response frequency (see note )** | | 0.5 kHz | | | |
| **Operating status (with sensing object approaching)** | | Load ON | D1 models: Load ON<br>D2 models: Load OFF<br>Refer to *Timing Charts*. | C1 models: Load ON<br>C2 models: Load OFF | Load ON |
| **Control output (switching capacity)** | | NPN open collector, 100 mA max. at 30 VDC | 3 to 100 mA DC | NPN open collector, 50 mA max. at 30 VDC | NPN transistor output, 20 mA max. |
| **Circuit protection** | | Reverse connection protection and surge absorber | Load short-circuiting protection and surge absorber | Reverse connection protection and surge absorber | Surge absorber |
| **Indicator** | | Detection indicator | D1 models: Output indicator (red) and setting indicator (green)<br>D2 models: Output indicator (red) | Detection indicator | --- |
| **Ambient temperature** | | Operating: –10°C to 60°C (with no icing) | Operating: –25°C to 70°C (with no icing) | | |
| **Ambient humidity** | | Operating: 35% to 95% | | | |
| **Temperature influence** | | ±10% max. of sensing distance at 23°C in the temperature range of –10°C to 60°C | ±10% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C | ±20% max. of sensing distance at 23°C in the temperature range of –25°C to 70°C | ±10% max. of sensing distance at 23°C in the temperature range of –10°C to 55°C |
| **Voltage influence** | | ±2.5% max. of sensing distance within a range of ±10% of the rated power supply voltage | ±2.5% max. of sensing distance within a range of ±15% of the rated power supply voltage | ±2.5% max. of sensing distance within a range of ±10% of the rated power supply voltage | |
| **Residual voltage** | | 1.0 V max. with a load current of 100 mA and a cord length of 2 m | 3.3 V max. with a load current of 100 mA and a cord length of 2 m | 1.0 V max. with a load current of 50 mA and a cord length of 2 m | --- |
| **Insulation resistance** | | 50 MΩ min. (at 500 VDC) between current carry parts and case | | 5 MΩ min. (at 500 VDC) between current carry parts and case | |
| **Dielectric strength** | | 1,000 VAC, 50/60 Hz for 1 min between current carry parts and case | | 500 VAC, 50/60 Hz for 1 min between current carry parts and case | |
| **Vibration resistance** | | 10 to 55 Hz, 1.5-mm double amplitude for 2 hours each in X, Y, and Z directions | | | |
| **Shock resistance** | | 1,000 $m/s^2$ (approx. 100G) for 10 times each in X, Y, and Z directions | 500 $m/s^2$ (approx. 50G) for 3 times each in X, Y, and Z directions | 200 $m/s^2$ (approx. 20G) for 10 times each in X, Y, and Z directions | |
| **Degree of protection** | | IEC60529 IP67 | | | IEC IP66 |
| **Weight** | | Approx. 30 g (with 2-m cord) | Approx. 45 g (with 2-m cord) | Approx. 60 g (with 2-m cord) | Approx. 30 g (with 1-m cord) |
| **Material** | **Case** | Heat-resistant ABS resin | | | PPO |
| | **Sensing surface** | Heat-resistant ABS resin | | | PPO |

**Note:** The response frequencies of the DC switching components are average values obtained by measuring in sequence a line-up of standard sensing objects. The space between any adjacent sensing objects was twice the width of a single sensing object and the setting distance was half the maximum sensing distance.

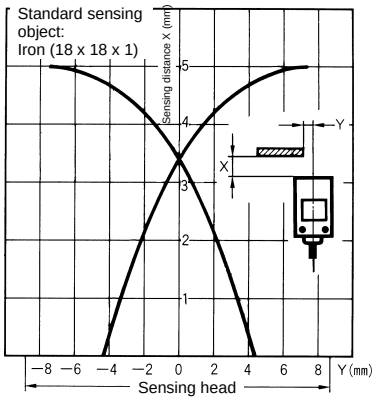
# Engineering Data

## Operating Range (Typical)

**TL-Q2 (Rectangular Model)**

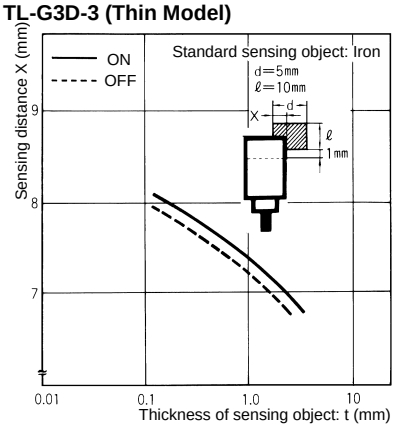



**TL-Q5M□□ (Rectangular Model)**

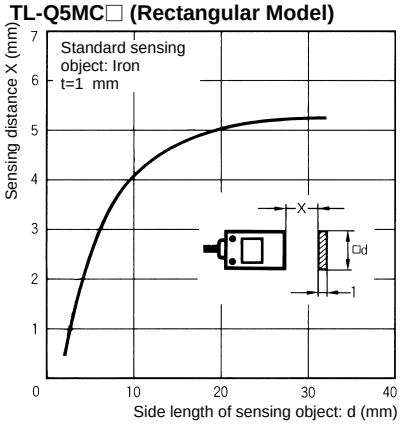



## Sensing Object Thickness and Material vs. Sensing Distance (Typical)

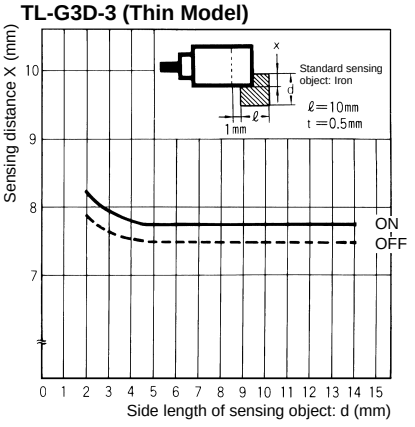
**TL-G3D-3 (Thin Model)**




**TL-Q5MC□ (Rectangular Model)**

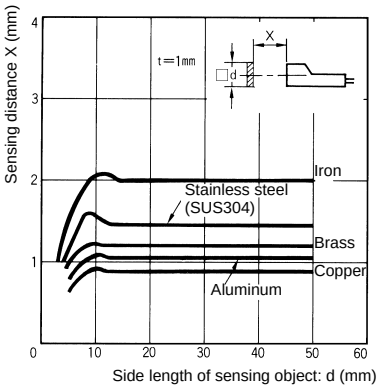



**TL-G3D-3 (Thin Model)**

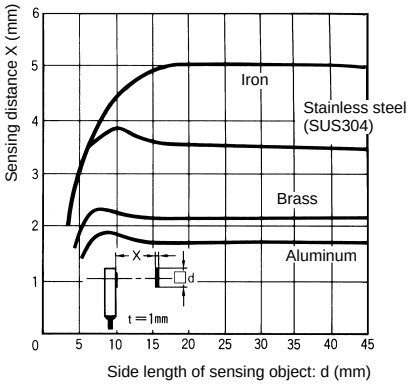



## Sensing Object Size and Material vs. Sensing Distance (Typical)

**TL-Q2**




**TL-Q5**

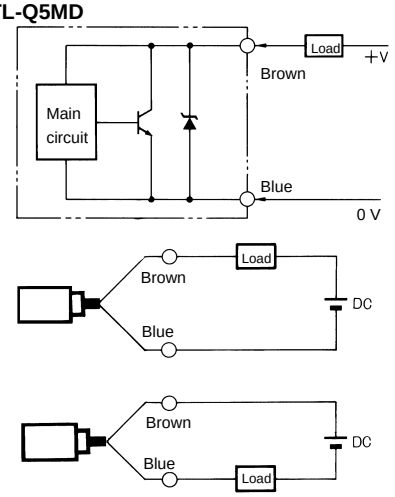


# Operation

## ■ Output Circuits and Timing Charts

### DC 2-wire Model

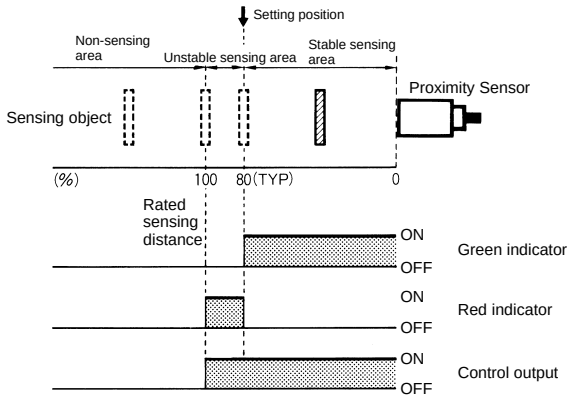
**TL-Q5MD**



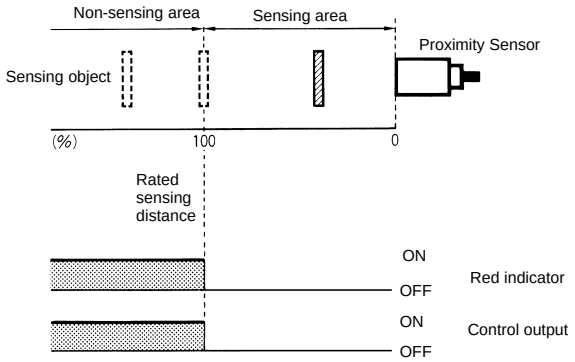

**Note:** The load can be connected in two ways as shown in the above diagrams.

**Timing Charts**

**Normally Open**

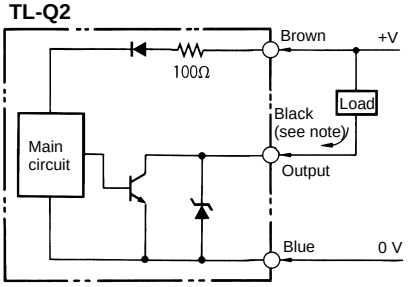



**Normally Closed**



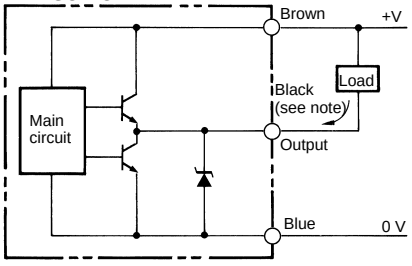
### DC 3-wire Models

**TL-Q2**



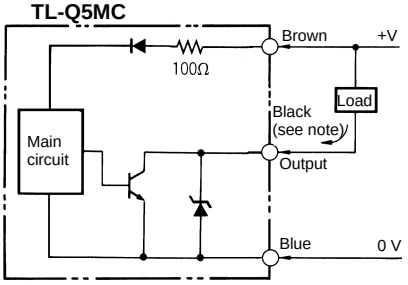

**Note:** Max. load current: 100 mA

**TL-G3D-3**

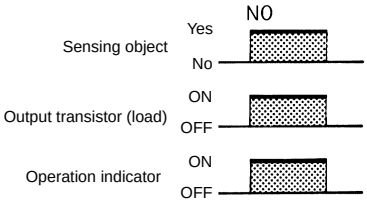


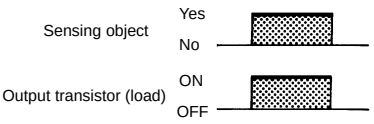

**Note:** Max. load current: 20 mA

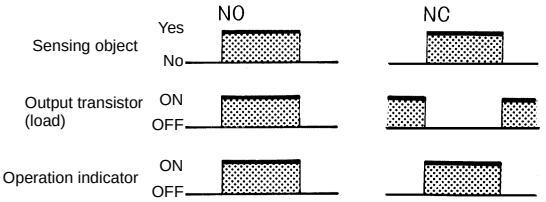
**TL-Q5MC**




**Note:** Max. load current: 50 mA



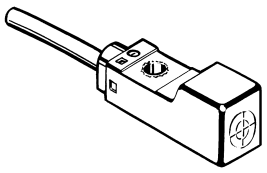



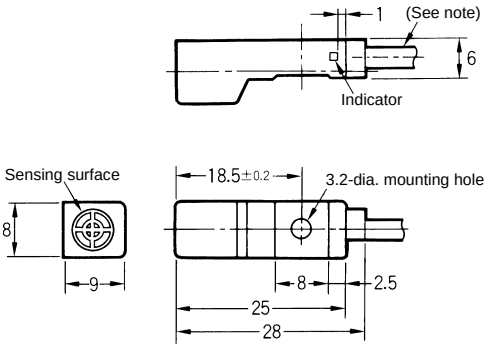

# Dimensions

**Note:** All units are in millimeters unless otherwise indicated.

### TL-Q2

**Rectangular Model**

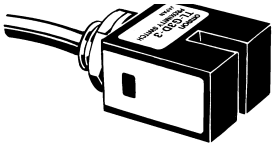


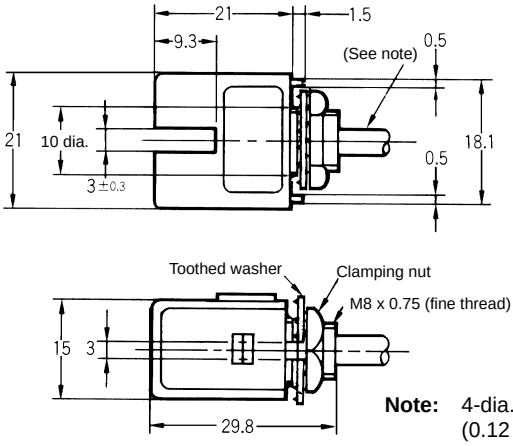



**Note:** 2.9-dia. vinyl-insulated round cord with 3 cores (0.12 dia. x 13); standard length: 2 m

## TL-G3D-3

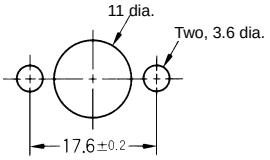
**Thin Model**





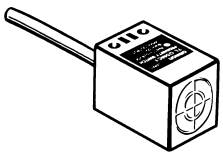

**Note:** 4-dia. vinyl-insulated round cord, 3 cores (0.12 dia. x 18); standard length: 1 m

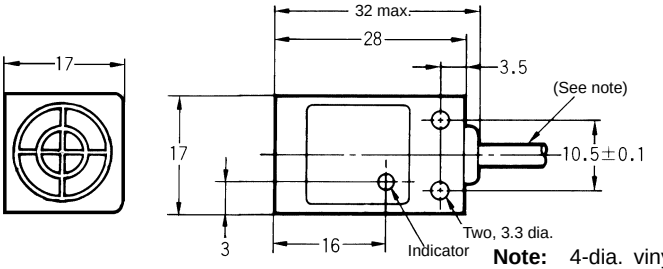
**Mounting Dimensions**




## TL-Q5M

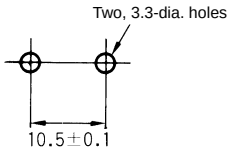
**Rectangular Model**






**Note:** 4-dia. vinyl-insulated round cord, 0.2 dia. x 3 cores, 0.3 dia. x 2 cores; standard length: 2 m

**Mounting Dimensions**



# Precautions

## Correct Use

### Mounting

Do not tighten any mounting screw with a torque exceeding the maximum tightening torque described in the table to the right.

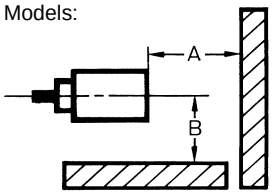
| Model | Tightening torque |
|---|---|
| **TL-Q2M□□** | 6 kgf • cm (0.59 N • m) |
| **TL-Q5M□□** | 6 kgf • cm (0.59 N • m) |
| **TL-G3D-3** | 20 kgf • cm (2 N • m) |

## Effects of Surrounding Metals and Mutual Interference

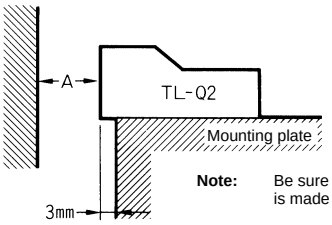
Be sure to keep at least the following distances between the Sensor and the surrounding metal objects.

### Effects of Surrounding Metals

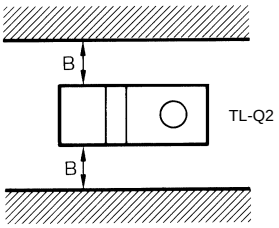
Rectangular Models:




| Model | A (mm) | B (mm) |
|---|---|---|
| **TL-Q5M** | 20 | 20 |

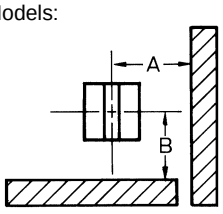



**Note:** Be sure that the mounting plate is made of non-ferrous metal.




| Model | A (mm) | B (mm) |
|---|---|---|
| **TL-Q2** | 12 | 3 |

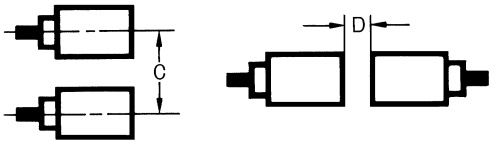
Thin Models:




| Model | A (mm) | B (mm) |
|---|---|---|
| **TL-G3D-3** | 11 | 17 |

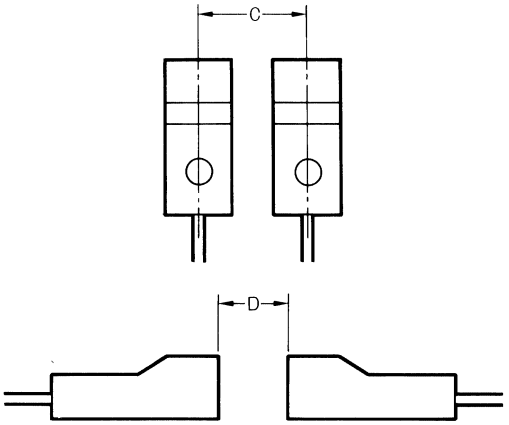
### Parallel or Face-to-face Mounting

Rectangular Models:



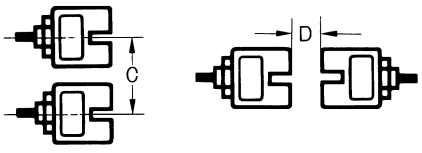

| Model | C (mm) | D (mm) |
|---|---|---|
| **TL-Q5MC** | 60 (17) | 120 (60) |
| **TL-Q5MD** | 60 (30) | 120 (80) |

**Note:** Figures in parentheses will apply if the Sensors in use are different to each other in response frequency.




| Model | C (mm) | D (mm) |
|---|---|---|
| **TL-Q2** | 30 (8) | 90 (45) |

Thin Models:

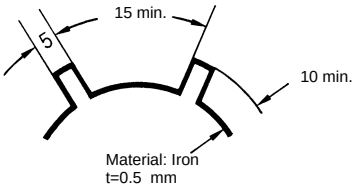



| Model | C (mm) | D (mm) |
|---|---|---|
| **TL-G3D-3** | 31 | 25 |

## Sensing Objects (TL-G3D-3 Thin Model)

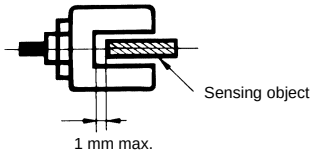
If the TL-G3D-3 is in high-speed response operation with a toothed metal plate, be sure that the sensing object size is as large as or larger than the standard object size and that the sensing objects are separated enough from one another.

The response frequency obtainable when the following toothed metal plate is used will be 1 kHz or higher. If the metal plate is smaller with shorter teeth and narrow adjacent space, the response frequency will decrease.




## Sensing Position (TL-G3D-3 Thin Model)

Be sure that the distance between the bottom of the groove and the sensing object is 1 mm or less.




## Sensing Object Material (TL-Q Rectangular Model)

The sensing distance decreases with non-ferrous metal. Refer to *Sensing Object Size and Material vs. Sensing Distance (Typical)* in *Engineering Data*. If the sensing object is a metal foil that is as thin or thinner than 0.01 mm, there will be little difference in sensing distance between the metal foil and ferrous metal. If the sensing object is, however, extremely thin (e.g., metal-coating film) or not conductive, the sensing object will not be detected.

## TL-Q5 Rectangular Model

Metal Plating Influence (Reference Value):
The following percentage values indicate decreases or increases in sensing distance on the basis of the sensing object with no metal plating as 100%.

| Metal plating type and thickness | Material |
|---|---|
| | Iron |
| No metal plating | 100 |
| Zn5 to 15 μm | 90 to 120 |
| Cd5 to 15 μm | 100 to 110 |
| Ag5 to 15 μm | 60 to 90 |
| Cu10 to 20 μm | 70 to 95 |
| Cu5 to 15 μm | --- |
| Cu (5 to 10 μm) + Ni (10 to 20 μm) | 75 to 95 |
| Cu (5 to 10 μm) + Ni (10 μm) + Cr (0.3 μm) | 75 to 95 |

**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**
To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Cat. No. D003-E1-09 **In the interest of product improvement, specifications are subject to change without notice.**

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