

Version:  
June 26, 2017



**(TCPWCH)**  
**Common Mode Chokes**  
**For USB, IEEE 394,**  
**Lan Interface**

**Token Electronics Industry Co., Ltd.**

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## ▶ Product Introduction

### Token Extends Low-Profile Common Mode Choke Enhance Space Savings.

#### Features :

- Recommended solder profile: reflow.
- Low profile and very small size SMD Design.
- Wound Chip constructure with standard 0805 to 1812 size.
- Best EMI suppression effect but least impact to data signal wave form.

#### Applications :

- Preventive measure against high speed signal radiation emissions such as USB, IEEE 1394 (Firewire) or LAN interface.
- Best for NB, DSC, mobile device design.

Common mode chokes (TCPWCH) are used in order to filter common mode electromagnetic interference (EMI) currents without de-rating under high currents and without causing signal degradation. Common mode chokes are applied to supply and return pairs of conductors and are ideal for EMI filtering of signal lines.

Token Electronics offers SMD Common Mode Inductors & EMI Filters (TCPWCH) in standard 0805, 1206, 1810, and 1812 size, with a maximum height of 1.2 mm, 2.0 mm, 2.2 mm, and 2.8 mm making them low profile common mode chokes available.

They provide high differential mode cutoff frequency and common mode noise attenuation across a wide frequency range, suiting them as ideal for noise suppression in super-high-speed signal lines such as DisplayPort, DVI, USB 3.x, and HDMI 2.0. The chokes are also suited for high-speed differential signal lines such as USB, IEEE1394, and LVDS, and are compatible with USB Type-C specification.

All (TCPWCH) series comes a wide variety of options to meet your needs with halogen free and feature RoHS Directive. Token is able to customize and manufacture your request. Please contact our sales or link to Token official website "[SMD Balun Transformers](http://www.token.com.tw)" for more information.

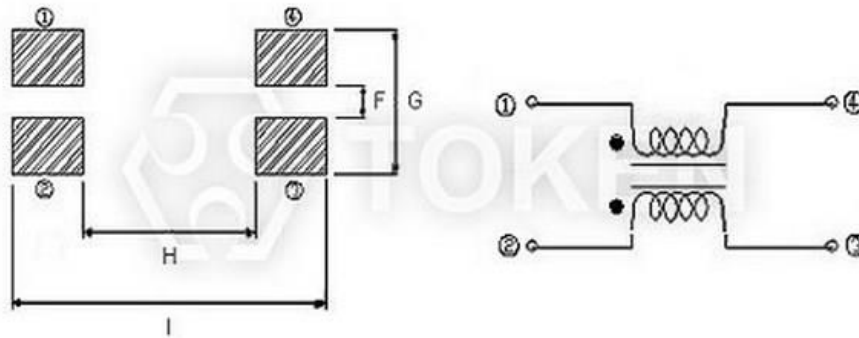
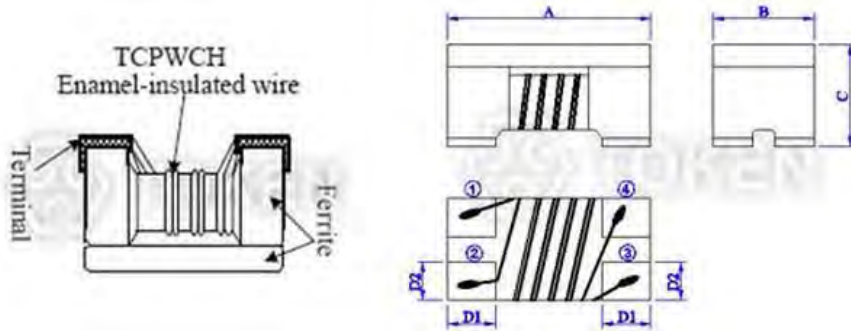


## Config. & Dim.

### Configurations & Dimensions (TCPWCH-2012/3216/4525/4532/453226/453228)

UNIT: mm (inch)

| SIZE CODE               | A                          | B                          | C                          | D1<br>TYP       | D2<br>TYP       | F<br>TYP        | G<br>TYP        | H<br>TYP        | I<br>TYP        |
|-------------------------|----------------------------|----------------------------|----------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| TCPWCH-2012<br>(0805)   | 2.00±0.20<br>(0.079±0.008) | 1.20±0.20<br>(0.047±0.008) | 1.20±0.20<br>(0.047±0.008) | 0.45<br>(0.018) | 0.40<br>(0.016) | 0.40<br>(0.016) | 1.20<br>(0.047) | 0.80<br>(0.031) | 2.60<br>(0.102) |
| TCPWCH-3216<br>(1206)   | 3.20±0.20<br>(0.126±0.008) | 1.60±0.20<br>(0.063±0.008) | 2.00±0.20<br>(0.079±0.008) | 0.60<br>(0.024) | 0.60<br>(0.024) | 0.40<br>(0.016) | 1.60<br>(0.063) | 1.60<br>(0.063) | 3.70<br>(0.146) |
| TCPWCH-4525<br>(1810)   | 4.80±0.20<br>(0.189±0.008) | 2.80±0.20<br>(0.110±0.008) | 2.20±0.20<br>(0.087±0.008) | 0.75<br>(0.030) | 0.75<br>(0.030) | 0.70<br>(0.027) | 2.70<br>(0.106) | 3.00<br>(0.118) | 5.50<br>(0.216) |
| TCPWCH-4532<br>(1812)   | 4.50±0.20<br>(0.177±0.008) | 3.20±0.20<br>(0.126±0.008) | 2.80±0.20<br>(0.110±0.008) | 1.00<br>(0.039) | 1.00<br>(0.039) | 0.40<br>(0.016) | 3.60<br>(0.141) | 2.10<br>(0.082) | 4.90<br>(0.192) |
| TCPWCH-453226<br>(1812) | 4.50±0.20<br>(0.177±0.008) | 3.20±0.20<br>(0.126±0.008) | 2.60±0.20<br>(0.102±0.008) | 1.00<br>(0.039) | 1.00<br>(0.039) | 0.40<br>(0.016) | 3.60<br>(0.141) | 2.10<br>(0.082) | 4.90<br>(0.192) |
| TCPWCH-453228<br>(1812) | 4.50±0.20<br>(0.177±0.008) | 3.20±0.20<br>(0.126±0.008) | 2.80±0.20<br>(0.110±0.008) | 1.00<br>(0.039) | 1.00<br>(0.039) | 0.40<br>(0.016) | 3.60<br>(0.141) | 2.10<br>(0.082) | 4.90<br>(0.192) |



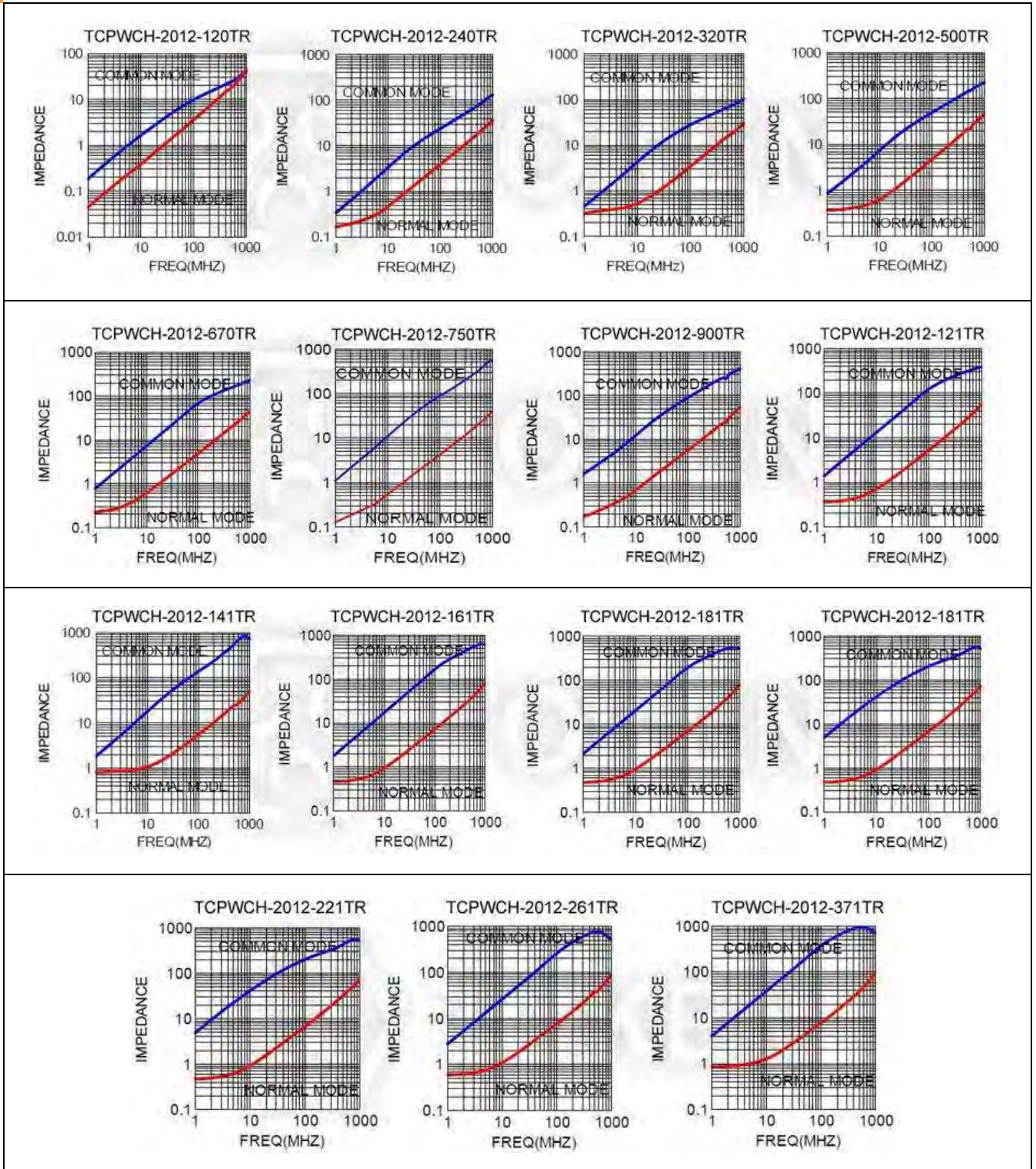
Common mode filter TCPWCH Structure diagram Unit: mm (Inch)

## 2012

### Electrical Characteristics (TCPWCH-2012)

| Part Number       | Impedance ( $\Omega$ ) | Tolerance ( $\pm$ ) % | Test Frequency (MHz) | DC Resistance ( $\Omega$ ) Max. | Rated Current (mA) Max. |
|-------------------|------------------------|-----------------------|----------------------|---------------------------------|-------------------------|
| TCPWCH-2012-120TR | 12                     | 25%                   | 100                  | 0.20                            | 450                     |
| TCPWCH-2012-240TR | 24                     | 25%                   | 100                  | 0.25                            | 420                     |
| TCPWCH-2012-320TR | 32                     | 25%                   | 100                  | 0.25                            | 400                     |
| TCPWCH-2012-500TR | 50                     | 25%                   | 100                  | 0.25                            | 400                     |
| TCPWCH-2012-670TR | 67                     | 25%                   | 100                  | 0.25                            | 400                     |
| TCPWCH-2012-750TR | 75                     | 25%                   | 100                  | 0.70                            | 280                     |
| TCPWCH-2012-900TR | 90                     | 25%                   | 100                  | 0.30                            | 400                     |
| TCPWCH-2012-121TR | 120                    | 25%                   | 100                  | 0.30                            | 370                     |
| TCPWCH-2012-141TR | 140                    | 25%                   | 100                  | 0.32                            | 360                     |
| TCPWCH-2012-161TR | 160                    | 25%                   | 100                  | 0.35                            | 350                     |
| TCPWCH-2012-181TR | 180                    | 25%                   | 100                  | 0.35                            | 330                     |
| TCPWCH-2012-201TR | 200                    | 25%                   | 100                  | 0.40                            | 300                     |
| TCPWCH-2012-221TR | 220                    | 25%                   | 100                  | 0.40                            | 300                     |
| TCPWCH-2012-261TR | 260                    | 25%                   | 100                  | 0.40                            | 300                     |
| TCPWCH-2012-371TR | 370                    | 25%                   | 100                  | 0.45                            | 280                     |

## Impedance VS Frequency Graph (TCPWCH-2012)

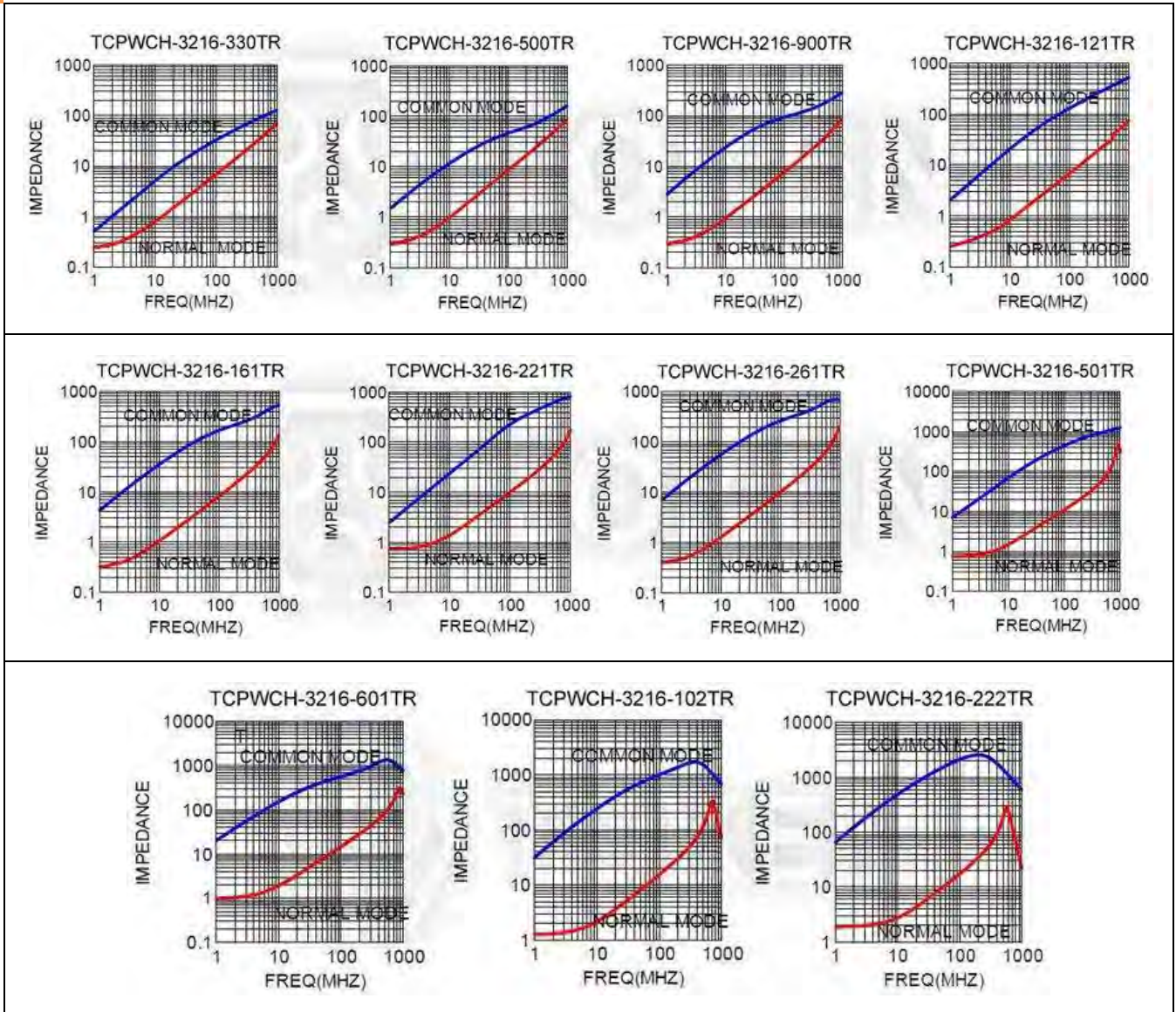


▶ 3216

## Electrical Characteristics (TCPWCH-3216)

| Part Number       | Impedance ( $\Omega$ ) | Tolerance ( $\pm$ ) % | Test Frequency (MHz) | DC Resistance ( $\Omega$ ) Max. | Rated Current (mA) Max. |
|-------------------|------------------------|-----------------------|----------------------|---------------------------------|-------------------------|
| TCPWCH-3216-330TR | 33                     | 25%                   | 100                  | 0.20                            | 400                     |
| TCPWCH-3216-500TR | 50                     | 25%                   | 100                  | 0.25                            | 400                     |
| TCPWCH-3216-900TR | 90                     | 25%                   | 100                  | 0.30                            | 400                     |
| TCPWCH-3216-121TR | 120                    | 25%                   | 100                  | 0.30                            | 400                     |
| TCPWCH-3216-161TR | 160                    | 25%                   | 100                  | 0.40                            | 350                     |
| TCPWCH-3216-221TR | 220                    | 25%                   | 100                  | 0.45                            | 300                     |
| TCPWCH-3216-261TR | 260                    | 25%                   | 100                  | 0.50                            | 310                     |
| TCPWCH-3216-501TR | 500                    | 25%                   | 100                  | 0.80                            | 260                     |
| TCPWCH-3216-601TR | 600                    | 25%                   | 100                  | 0.80                            | 260                     |
| TCPWCH-3216-102TR | 1000                   | 25%                   | 100                  | 1.00                            | 250                     |
| TCPWCH-3216-222TR | 2200                   | 25%                   | 100                  | 1.20                            | 200                     |

## Impedance VS Frequency Graph (TCPWC-3216)



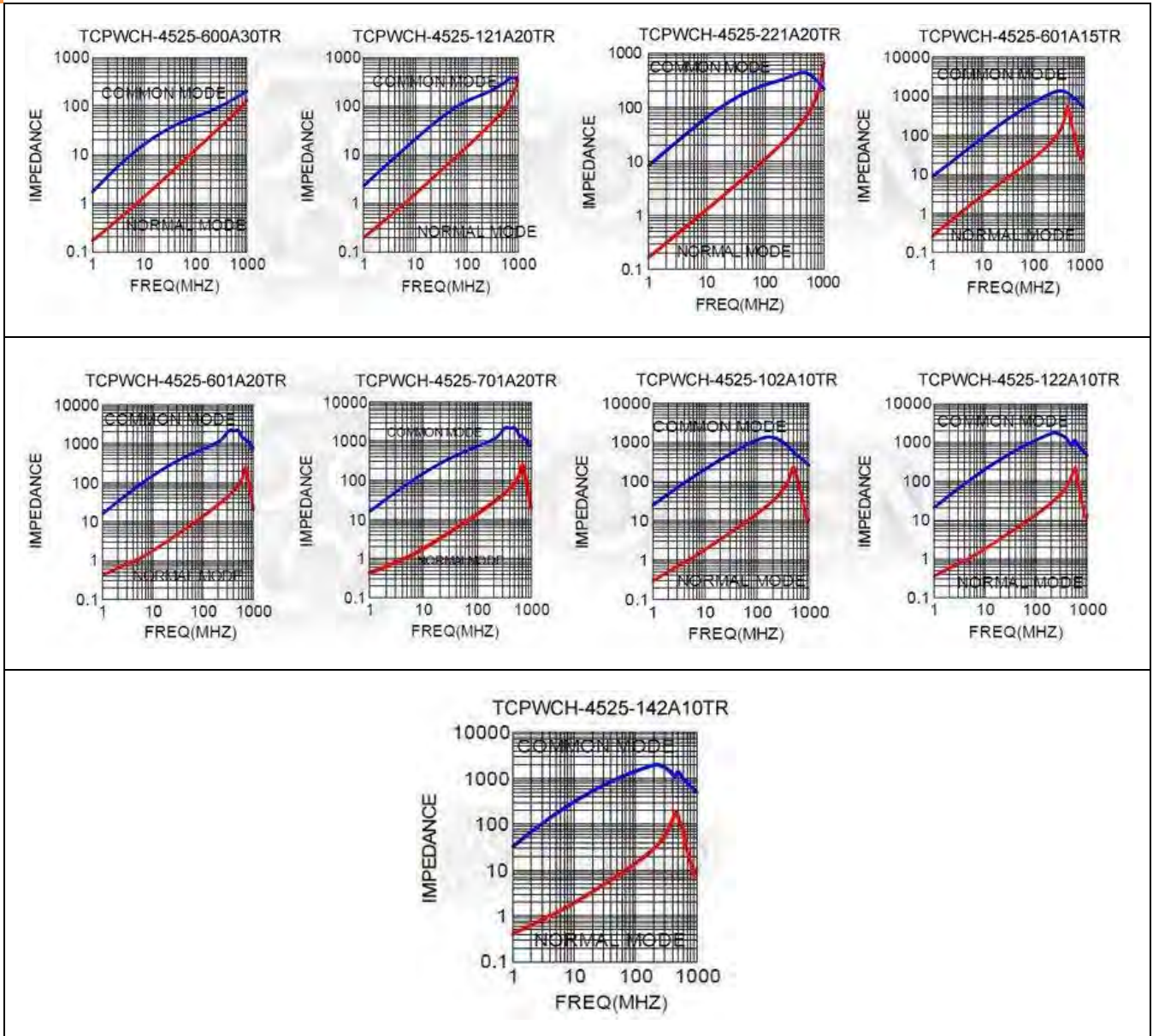
▶ 4525

## Electrical Characteristics (TCPWCH-4525)

| Part Number          | Impedance ( $\Omega$ ) | Tolerance ( $\pm$ ) % | Test Frequency (MHz) | DC Resistance ( $\Omega$ ) Max. | Rated Current (mA) Max. |
|----------------------|------------------------|-----------------------|----------------------|---------------------------------|-------------------------|
| TCPWCH-4525-600A30TR | 60                     | 25%                   | 100                  | 0.10                            | 3000                    |
| TCPWCH-4525-121A20TR | 120                    | 25%                   | 100                  | 0.20                            | 2000                    |
| TCPWCH-4525-221A20TR | 220                    | 25%                   | 100                  | 0.20                            | 2000                    |
| TCPWCH-4525-601A15TR | 600                    | 25%                   | 100                  | 0.30                            | 1500                    |
| TCPWCH-4525-601A20TR | 600                    | 25%                   | 100                  | 0.20                            | 2000                    |
| TCPWCH-4525-701A20TR | 700                    | 25%                   | 100                  | 0.15                            | 2000                    |
| TCPWCH-4525-102A10TR | 1000                   | 25%                   | 100                  | 0.40                            | 1000                    |
| TCPWCH-4525-122A10TR | 1200                   | 25%                   | 100                  | 0.40                            | 1000                    |
| TCPWCH-4525-142A10TR | 1400                   | 25%                   | 100                  | 0.40                            | 1000                    |



## Impedance VS Frequency Graph (TCPWC-4525)

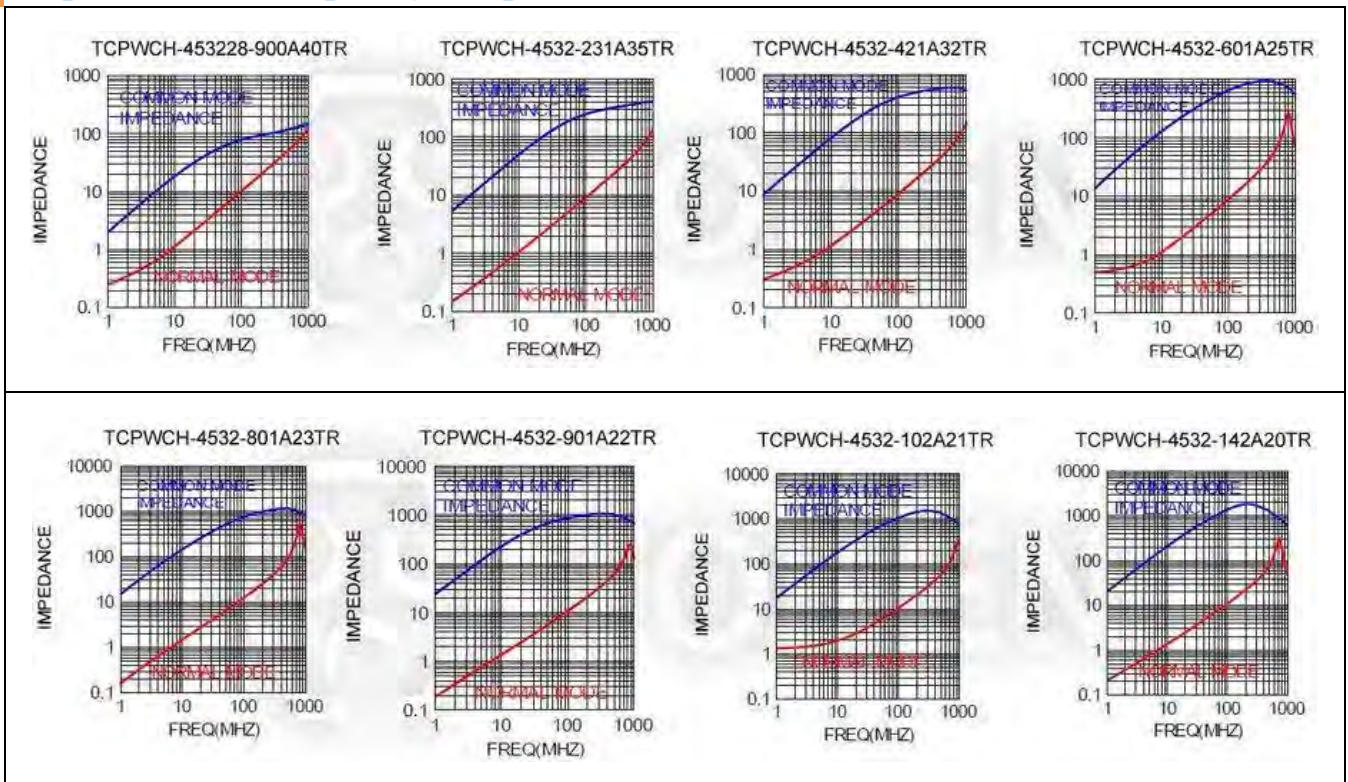


▶ 4532

## Electrical Characteristics (TCPWCH-4532)

| Part Number            | Impedance ( $\Omega$ ) | Tolerance ( $\pm$ ) % | Test Frequency (MHz) | DC Resistance ( $\Omega$ ) Max. | Rated Current (mA) Max. |
|------------------------|------------------------|-----------------------|----------------------|---------------------------------|-------------------------|
| TCPWCH-453228-900A40TR | 90                     | 25%                   | 100                  | 0.050                           | 4000                    |
| TCPWCH-4532-231A35TR   | 230                    | 25%                   | 100                  | 0.051                           | 3500                    |
| TCPWCH-4532-421A32TR   | 420                    | 25%                   | 100                  | 0.052                           | 3200                    |
| TCPWCH-4532-601A25TR   | 600                    | 25%                   | 100                  | 0.065                           | 2500                    |
| TCPWCH-4532-801A23TR   | 800                    | 25%                   | 100                  | 0.100                           | 2300                    |
| TCPWCH-4532-901A22TR   | 900                    | 25%                   | 100                  | 0.100                           | 2200                    |
| TCPWCH-4532-102A21TR   | 1000                   | 25%                   | 100                  | 0.110                           | 2100                    |
| TCPWCH-4532-142A20TR   | 1400                   | 25%                   | 100                  | 0.120                           | 2000                    |

## Impedance VS Frequency Graph (TCPWC-4532)

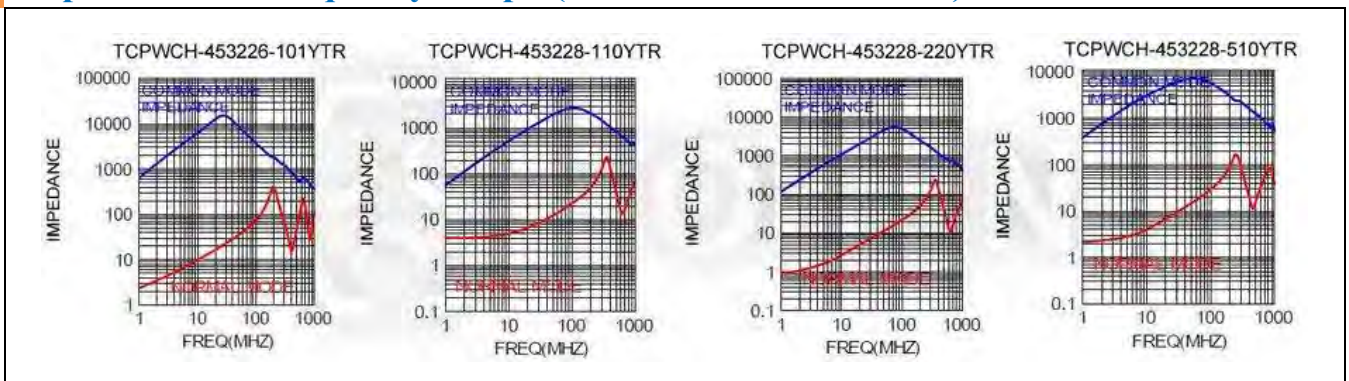


## ▶ 453226/453228

### Electrical Characteristics (TCPWCH-453226/453228)

| Part Number          | Inductance<br>( $\mu\text{H}$ )<br>100KHz/100mV | Impedance<br>( $\Omega$ ) TYP<br>10MHz | DC<br>Resistance<br>( $\Omega$ )<br>Max. | Rated<br>Current<br>Max. | Rated<br>Voltage (V)<br>(DC) | Insulation<br>Resistance<br>( $\text{M}\Omega$ )<br>Min. |
|----------------------|---|--|--|--------------------------|------------------------------|--|
| TCPWCH-453226-101YTR | 100 (+50/-30%)                                  | 5800                                   | 2.0                                      | 250                      | 50                           | 10   |
| TCPWCH-453228-110YTR | 11 (+50/-30%)                                   | 600                                    | 0.6                                      | 250                      | 50                           | 10   |
| TCPWCH-453228-220YTR | 22 (+50/-30%)                                   | 1200                                   | 1.0                                      | 200                      | 50                           | 10   |
| TCPWCH-453228-510YTR | 51 (+50/-30%)                                   | 5800                                   | 1.0                                      | 200                      | 50                           | 10   |

### Impedance VS Frequency Graph (TCPWCH-453226/453228)



## ► Environ. Characteristics

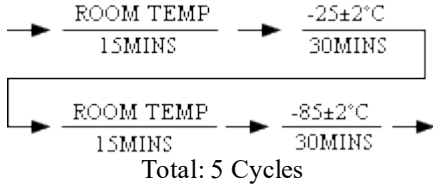
### Electrical Performance Test (TCPWCH)

| Test Items                   | Specifications                                    | Test Conditions / Test Methods  |
|------------------------------|---|---|
| Impedance                    | Refer to standard electrical characteristic spec. | LCR Meter HP 4291B  |
| DC Resistance (RDC)          |   | Micro-Ohm meter (GOM-801G)  |
| Withstand Voltage (VDC)      | Component should not be damaged                   | Test Voltage: 2.5 Times Rated Voltage<br>Testing Time: 60 sec.<br>Charge Current: 0.5mA |
| Rated Voltage (VDC)          |   | Test Voltage: Rated Voltage<br>Testing Time: 1 to 5 sec.<br>Charge Current: 1mA         |
| Insulation Resistance (I.R.) |   | Charge Current: 1 minute<br>10M ohm min   |

### Mechanical Performance Test (TCPWCH)

| Test Items                     | Specifications   | Test Conditions / Test Methods   |
|--------------------------------|--|--|
| Component Adhesion (push Test) | Base: 0805 $\geq$ 2 Lbs<br>Cover: 0805 $\geq$ 1 Lbs<br>Base: 1206 $\geq$ 4 Lbs<br>Cover: 1206 $\geq$ 2 Lbs | The component should be soldered ( $232^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 10 sec.) totinned copper substrate. Applied force gauge to the side of component It must withstand force of 2 or 4 pounds without failure of the component. |
| Drop Test                      | Component should not be damaged  | Dropping chip by each side and corner.<br>Drop 10 times in total<br>Drop height: 100cm<br>Drop weight: 125g  |
| Solderability Test             | The terminal should at least be 90% covered with solder  | The component shall be dipped in a melted solder bath at $235^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 5 seconds.  |
| Vibration Test (Low Frequency) | Component should not be damaged  | 1. Amplitude: 1.5 m/m<br>2. Frequency: 10-55-10 Hz(1min)<br>3. Direction: X, Y, Z<br>4. Duration: 2 Hrs/X, Y, Z  |

## Climatic Test (TCPWCH)

| Test Items                      | Specifications   | Test Conditions / Test Methods  |
|---------------------------------|--|---|
| Low Temperature Storage Test    | Impedance change:<br>Within±20%<br>Without distinct damage in ppearance. | 1. Temp: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2. Time: $1000\pm 48$ Hours<br>3. Component should be tested after 1 hour at room temperature.   |
| Thermal Shock Test              |  |  <p>The diagram shows two cycles of thermal shock. Each cycle starts at ROOM TEMP for 15 MINS, then transitions to <math>-25\pm 2^{\circ}\text{C}</math> for 30 MINS, and returns to ROOM TEMP. The second cycle starts at ROOM TEMP for 15 MINS, then transitions to <math>-85\pm 2^{\circ}\text{C}</math> for 30 MINS, and returns to ROOM TEMP. Total: 5 Cycles.</p> |
| High Temperature Storage Test   |  | 1. Temp: $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2. Time: $1000\pm 48$ Hours<br>3. Component should be tested after 1 hour at room temperature.  |
| Humidity Test                   |  | 1. Temp: $40^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2. R.H.: 90%~95%<br>3. Time: $48\pm 2$ Hours  |
| High Temperature Load Life Test |  | 1. Temp: $85^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2. Time: $96\pm 12$ Hours<br>3. Load: Allowed DC Current  |
| Low Temperature Load Life Test  |  | 1. Temp: $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$<br>2. Time: $96\pm 12$ Hours<br>3. Load: Allowed DC Current   |

● Note: Storage Temperature:  $25^{\circ}\text{C}$ ; Humidity: <80%RH

## Order Codes

### Order Codes (TCPWCH-2012/3216)

| TCPWC       | H              | -         | 2012            |                |         | -             | 120  |         | TR          |  |
|-------------|----------------|-----------|-----------------|----------------|---------|---------------|------|---------|-------------|--|
| Part Number | Shielding Type |           | Dimensions (mm) |                |         | Impedance (Ω) |      | Package |             |  |
| TCPWC       | H              | Shielding | 2012            | 2.00×1.20×1.20 | EIA0805 | 120           | 12Ω  | P       | Bulk        |  |
|             |                |           | 3216            | 3.20×1.60×2.00 | EIA1206 | 121           | 120Ω | TR      | Taping Reel |  |
|             |                |           |                 |                |         |               | 371  | 370Ω    |             |  |

### Order Codes (TCPWCH-4525/4532)

| TCPWC       | H              | -         | 4525            |                |         | -             | 600  |                   | A30    |         | TR          |  |
|-------------|----------------|-----------|-----------------|----------------|---------|---------------|------|-------------------|--------|---------|-------------|--|
| Part Number | Shielding Type |           | Dimensions (mm) |                |         | Impedance (Ω) |      | Stop current (mA) |        | Package |             |  |
| TCPWC       | H              | Shielding | 4525            | 4.80×2.80×2.20 | EIA1810 | 600           | 60Ω  | A30               | 3000mA | P       | Bulk        |  |
|             |                |           | 4532            | 4.50×3.20×2.80 | EIA1812 | 601           | 600Ω | A25               | 2500mA | TR      | Taping Reel |  |
|             |                |           |                 |                |         |               | 102  | 1000Ω             | A10    | 1000mA  |             |  |

### Order Codes (TCPWCH-453226/453228)

| TCPWC       | H              | -         | 453226          |                |         | -               | 101   |               | Y        |         | TR          |  |
|-------------|----------------|-----------|-----------------|----------------|---------|-----------------|-------|---------------|----------|---------|-------------|--|
| Part Number | Shielding Type |           | Dimensions (mm) |                |         | Inductance (μH) |       | Tolerance (%) |          | Package |             |  |
| TCPWC       | H              | Shielding | 453226          | 4.50×3.20×2.60 | EIA1812 | 101             | 100μH | Y             | +50/-30% | P       | Bulk        |  |
|             |                |           | 453228          | 4.50×3.20×2.80 | EIA1812 | 110             | 11μH  |               |          | TR      | Taping Reel |  |
|             |                |           |                 |                |         |                 | 510   |               |          | 51μH    |             |  |

## ► General Information

### Applications of Baluns

In a **RF balun transformer**, one pair of terminals is balanced, that is, the currents are equal in magnitude and opposite in phase. The other pair of terminals is unbalanced; one side is connected to electrical ground and the other carries the signal. Balun transformers can be used between various parts of a wireless or cable communications system. Some common applications denotes as following:

- Television receiver (Balanced) - coaxial cable network or Coaxial antenna system (Unbalanced)
- FM broadcast receiver (Balanced) - Coaxial antenna system (Unbalanced)
- Dipole antenna (Balanced) - Coaxial transmission line (Unbalanced)
- Parallel-wire transmission line (Balanced) - Coaxial transmitter output, or Coaxial receiver input (Unbalanced)

Token's baluns provide impedance transformation in addition to conversion between balanced and unbalanced signal modes. Most television and FM broadcast receivers are designed for 300-ohm balanced systems, while coaxial cables have characteristic impedances of 50 or 75 ohms.

Impedance-transformer baluns with larger ratios are available and used to match high-impedance balanced antennas to low-impedance unbalanced wireless receivers, transmitters, or transceivers.