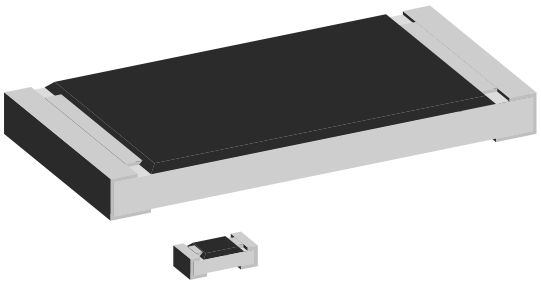
# Standard Thick Film Chip Resistors



## FEATURES

- Stability at different environmental conditions $\Delta R/R \leq 1$ % (1000 h rated power at 70 °C)
- 2 mm pitch packaging option for 0603 size
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

HALOGEN FREE

## APPLICATIONS

- Automotive
- Industrial
- Telecommunication

## LINKS TO ADDITIONAL RESOURCES

3D Models

D/CRCW e3 standard thick film chip resistors are the perfect choice for most fields of modern electronics where high reliability and stability are of major concern. Typical applications include automotive, telecommunications, and industrial.

## TECHNICAL SPECIFICATIONS

| DESCRIPTION | D10/ CRCW0402 e3 | D11/ CRCW0603 e3 | D12/ CRCW0805 e3 | D25/ CRCW1206 e3 | CRCW1210 e3 | CRCW1218 e3 | CRCW2010 e3 | CRCW2512 e3 |
|---|---|---|---|---|---|---|---|---|
| Imperial size | 0402 | 0603 | 0805 | 1206 | 1210 | 1218 | 2010 | 2512 |
| Metric size code | RR1005M | RR1608M | RR2012M | RR3216M | RR3225M | RR3246M | RR5025M | RR6332M |
| Resistance range | 1 Ω to 10 MΩ; jumper (0 Ω) | | | | | 1 Ω to 2.2 MΩ; jumper (0 Ω) | 1 Ω to 10 MΩ; jumper (0 Ω) | |
| Resistance tolerance | ± 5 %; ± 1 % | | | | | | | |
| Temperature coefficient | ± 200 ppm/K; ± 100 ppm/K | | | | | | | |
| Rated dissipation, $P_{70}$ (1)(2) | 0.10 W | 0.125 W | 0.25 W | 0.25 W | 0.5 W | 1.0 W | 0.75 W | 1.0 W |
| Operating voltage, $U_{max.}$ $AC_{RMS}$/DC (2) | 75 V | 75 V | 150 V | 200 V | 200 V | 200 V | 400 V | 500 V |
| Permissible film temperature, $\vartheta_{F\ max.}$ (1) | 155 °C | | | | | | | |
| Operating temperature range | -55 °C to +155 °C | | | | | | | |
| Permissible voltage against ambient (insulation): 1 min, $U_{ins}$ | 100 V | 100 V | 200 V | 300 V | 300 V | 300 V | 300 V | 300 V |
| Failure rate: $FIT_{observed}$ | ≤ 0.1 x $10^{-9}$/h | | | | | | | |

**Notes**

(1) Please refer to “Application Information” below

(2) Please refer to “Maximum Resistance Change at Rated Dissipation and Operating Voltage” table, see below

## APPLICATION INFORMATION

When the resistor dissipates power, a temperature rise above the ambient temperature occurs, dependent on the thermal resistance of the assembled resistor together with the printed circuit board. The rated dissipation applies only if the permitted film temperature is not exceeded.

These resistors do not feature a limited lifetime when operated within the permissible limits. However, resistance value drift increasing over operating time may result in exceeding a limit acceptable to the specific application, thereby establishing a functional lifetime.



For technical questions, contact: thickfilmchip@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| MAXIMUM RESISTANCE CHANGE AT RATED DISSIPATION AND OPERATING VOLTAGE | | | |
|---|---|---|---|
| **OPERATION MODE** | | **STANDARD** | **EXTENDED** |
| Rated dissipation, $P_{70}$ | **D10/CRCW0402 e3** | 0.063 W | 0.10 W |
| | **D11/CRCW0603 e3** | 0.10 W | 0.125 W |
| | **D12/CRCW0805 e3** | 0.125 W | 0.25 W |
| Operating voltage, $U_{max.}$ $AC_{RMS}$/DC | **D10/CRCW0402 e3** | 50 V | 75 V |
| | **D11/CRCW0603 e3** | 75 V | 75 V |
| | **D12/CRCW0805 e3** | 150 V | 150 V |
| Resistance change | | 1 Ω to 10 MΩ | |
| Max. resistance change at $P_{70}$/$U_{max.}$ $AC_{RMS}$/DC for resistance change, $I\Delta R/RI$ after [1]: | 1000 h | ≤ 1 % | ≤ 2 % |
| | 8000 h | ≤ 2 % | - |

**Note**

[1] Applies to components with stability class 1

| TEMPERATURE COEFFICIENT AND RESISTANCE RANGE | | | | |
|---|---|---|---|---|
| **TYPE / SIZE** | **TCR** | **TOLERANCE** | **RESISTANCE** | **E-SERIES** |
| **D10/CRCW0402 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 1.5 A | ≤ 20 mΩ | 0 Ω | - |
| **D11/CRCW0603 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 2.0 A | ≤ 20 mΩ | 0 Ω | - |
| **D12/CRCW0805 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 2.5 A | ≤ 20 mΩ | 0 Ω | - |
| **D25/CRCW1206 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 3.5 A | ≤ 20 mΩ | 0 Ω | - |
| **CRCW1210 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 5.0 A | ≤ 20 mΩ | 0 Ω | - |
| **CRCW1218 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 2.2 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 2.2 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 7.0 A | ≤ 20 mΩ | 0 Ω | - |
| **CRCW2010 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 6.0 A | ≤ 20 mΩ | 0 Ω | - |
| **CRCW2512 e3** | ± 200 ppm/K | ± 5 % | 1 Ω to 10 MΩ | E24 |
| | ± 200 ppm/K | ± 1 % | 1 Ω to 9.76 Ω | E24; E96 |
| | ± 100 ppm/K | ± 1 % | 1 Ω to 10 MΩ | E24; E96 |
| | Jumper, $I_{max.}$ = 7.0 A | ≤ 20 mΩ | 0 Ω | - |

**Note**

- The temperature coefficient of resistance (TCR) is not specified for 0 Ω jumpers


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## PACKAGING

| TYPE / SIZE | CODE | QUANTITY | PACKAGING STYLE | WIDTH | PITCH | PACKAGING DIMENSIONS |
|---|---|---|---|---|---|---|
| **D10/CRCW0402 e3** | ED = ET7 | 10 000 | Paper tape acc. to IEC 60286-3, Type 1a | 8 mm | 2 mm | Ø 180 mm / 7" |
| | EE = EF4 | 50 000 | | | | Ø 330 mm / 13" |
| **D11/CRCW0603 e3** | EI = ET2 | 5000 | | | | Ø 180 mm / 7" |
| | ED = ET3 | 10 000 | | | | Ø 180 mm / 7" |
| | EE = ET8 | 50 000 | | | | Ø 330 mm / 13" |
| | EA = ET1 | 5000 | | | 4 mm | Ø 180 mm / 7" |
| | EC = ET6 | 20 000 | | | | Ø 330 mm / 13" |
| **D12/CRCW0805 e3** | EA = ET1 | 5000 | | | | Ø 180 mm / 7" |
| | EC = ET6 | 20 000 | | | | Ø 330 mm / 13" |
| **D25/CRCW1206 e3** | EA = ET1 | 5000 | | | | Ø 180 mm / 7" |
| | EC = ET6 | 20 000 | | | | Ø 330 mm / 13" |
| **CRCW1210 e3** | EA = ET1 | 5000 | | | | Ø 180 mm / 7" |
| | EC = ET6 | 20 000 | | | | Ø 330 mm / 13" |
| **CRCW1218 e3** | EK = ET9 | 4000 | Blister tape acc. to IEC 60286-3, Type 2a | 12 mm | 4 mm | Ø 180 mm / 7" |
| **CRCW2010 e3** | EF = E02 | 4000 | | | | Ø 180 mm / 7" |
| **CRCW2512 e3** | EG = E67 | 2000 | | | 8 mm | Ø 180 mm / 7" |
| | EH = E82 | 4000 | | | 4 mm | |

## PART NUMBER AND PRODUCT DESCRIPTION

**Part Number: CRCW0603562RFKEA**
**Part Number: CRCW06030000Z0EA**

| C | R | C | W | 0 | 6 | 0 | 3 | 5 | 6 | 2 | R | F | K | E | A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| TYPE / SIZE | RESISTANCE | TOLERANCE | TCR | PACKAGING |
|---|---|---|---|---|
| **CRCW0402**<br>**CRCW0603**<br>**CRCW0805**<br>**CRCW1206**<br>**CRCW1210**<br>**CRCW1218**<br>**CRCW2010**<br>**CRCW2512** | **R** = decimal<br>**K** = thousand<br>**M** = million<br>**0000** = jumper | **F** = ± 1 %<br>**J** = ± 5 %<br>**Z** = jumper | **K** = ± 100 ppm/K<br>**N** = ± 200 ppm/K<br>**0** = jumper | **EA, EC, ED, EE,**<br>**EF, EG, EH, EI, EK**<br>(E.. = lead (Pb)-free) |

**Product Description: D11/CRCW0603 100 562R 1 % ET1 e3**
**Product Description: D11/CRCW0603 0R0 ET1 e3**

| D11/CRCW0603 | 100 | 562R | 1 % | ET1 | e3 |
|---|---|---|---|---|---|
| TYPE / SIZE | TCR | RESISTANCE | TOLERANCE | PACKAGING | LEAD (Pb)-FREE |
| **D10/CRCW0402**<br>**D11/CRCW0603**<br>**D12/CRCW0805**<br>**D25/CRCW1206**<br>**CRCW1210**<br>**CRCW1218**<br>**CRCW2010**<br>**CRCW2512** | ± **100** ppm/K<br>± **200** ppm/K | **10R** = 10 Ω<br>**562R** = 562 Ω<br>**1M** = 1 MΩ<br>**0R0** = jumper | ± **1 %**<br>± **5 %** | **ET1, ET2, ET3,**<br>**ET6, ET7, ET8,**<br>**ET9, EF4, E02,**<br>**E67, E82**<br>(E.. = lead (Pb)-free) | **e3** = pure tin<br>termination finish |


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## DESCRIPTION

Production is strictly controlled and follows an extensive set of instructions established for reproducibility. A cermet film layer and a glass-over are deposited on a high grade ($Al_2O_3$) ceramic substrate with its prepared inner contacts. A special laser is used to achieve the target value by smoothly fine trimming the resistive layer without damaging the ceramics. The resistor elements are covered by a protective coating designed for electrical, mechanical and climatic protection. The terminations receive a final pure matte tin on nickel plating.

The result of the determined production is verified by an extensive testing procedure on 100 % of the individual chip resistors. Only accepted products are laid directly into the tape in accordance with **IEC 60286-3 Type 1a and Type 2a** [(1)].

## ASSEMBLY

The resistors are suitable for processing on automatic SMD assembly systems. They are suitable for automatic soldering using wave, reflow or vapor phase as shown in **IEC 61760-1** [(1)]. The encapsulation is resistant to all cleaning solvents commonly used in the electronics industry, including alcohols, esters and aqueous solutions. The suitability of conformal coatings, potting compounds and their processes, if applied, shall be qualified by appropriate means to ensure the long-term stability of the whole system.

The resistors are RoHS-compliant, the pure matte tin plating provides compatibility with lead (Pb)-free and lead-containing soldering processes. Solderability is specified for 2 years after production or requalification. The permitted storage time is 20 years. The immunity of the plating against tin whisker growth has been proven under extensive testing.

## MATERIALS

Vishay acknowledges the following systems for the regulation of hazardous substances:

- IEC 62474, Material Declaration for Products of and for the Electrotechnical Industry, with the list of declarable substances given therein [(2)]
- The Global Automotive Declarable Substance List (GADSL) [(3)]
- The REACH regulation (1907/2006/EC) and the related list of substances with very high concern (SVHC) [(4)] for its supply chain

The products do not contain any of the banned substances as per IEC 62474, GADSL, or the SVHC list, see www.vishay.com/how/leadfree.

Hence the products fully comply with the following directives:

- 2000/53/EC End-of-Life Vehicle Directive (ELV) and Annex II (ELV II)
- 2011/65/EU Restriction of the Use of Hazardous Substances Directive (RoHS) with amendment 2015/863/EU
- 2012/19/EU Waste Electrical and Electronic Equipment Directive (WEEE)

Vishay pursues the elimination of conflict minerals from its supply chain, see the Conflict Minerals Policy at www.vishay.com/doc?49037.

## APPROVALS

The resistors are qualified according to AEC-Q200.

Where applicable, the resistors are tested in accordance with **EN 140401-802** which refers to **EN 60115-1**, **EN 60115-8** and the variety of environmental test procedures of the **IEC 60068** [(1)] series.

## RELATED PRODUCTS

For more information about products with better TCR and tighter tolerance please refer to the “Lead (Pb)-Free Thick Film, Rectangular, Semi-Precision Chip Resistors” datasheet (www.vishay.com/doc?20036).

The D/CRCW with SnPb termination plating is designed for applications where lead bearing terminations are mandatory. For ordering D/CRCW with SnPb terminations please refer to latest edition of datasheet D/CRCW (www.vishay.com/doc?20008).

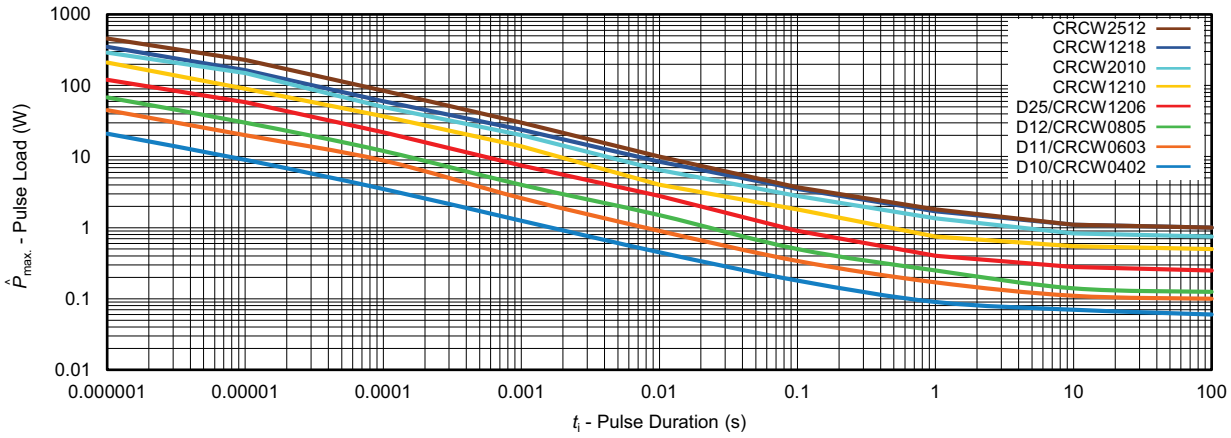
**Notes**

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents
(2) The IEC 62474 list of declarable substances is maintained in a dedicated database, which is available at http://std.iec.ch/iec62474
(3) The Global Automotive Declarable Substance List (GADSL) is maintained by the American Chemistry Council and available at www.gadsl.org
(4) The SVHC list is maintained by the European Chemical Agency (ECHA) and available at http://echa.europa.eu/candidate-list-table


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

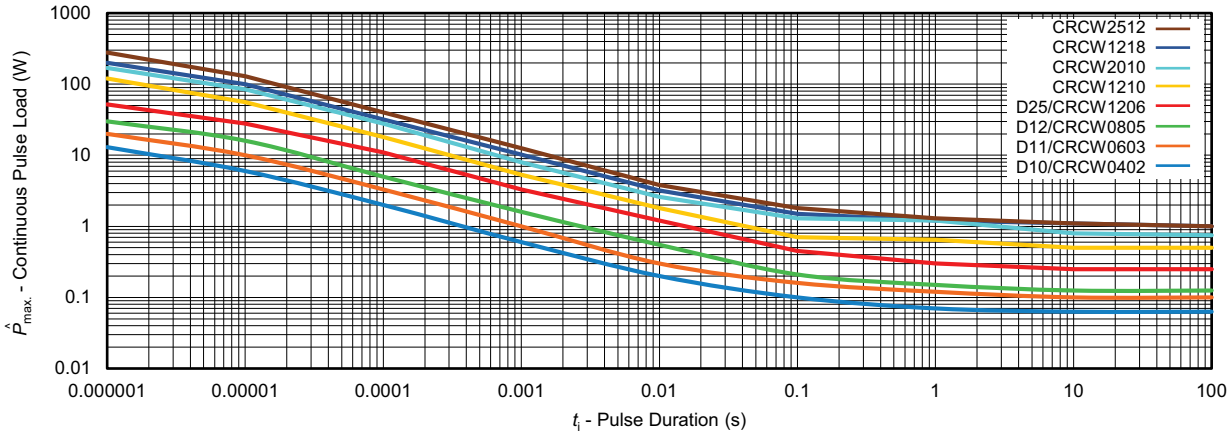
## FUNCTIONAL PERFORMANCE

### Single Pulse



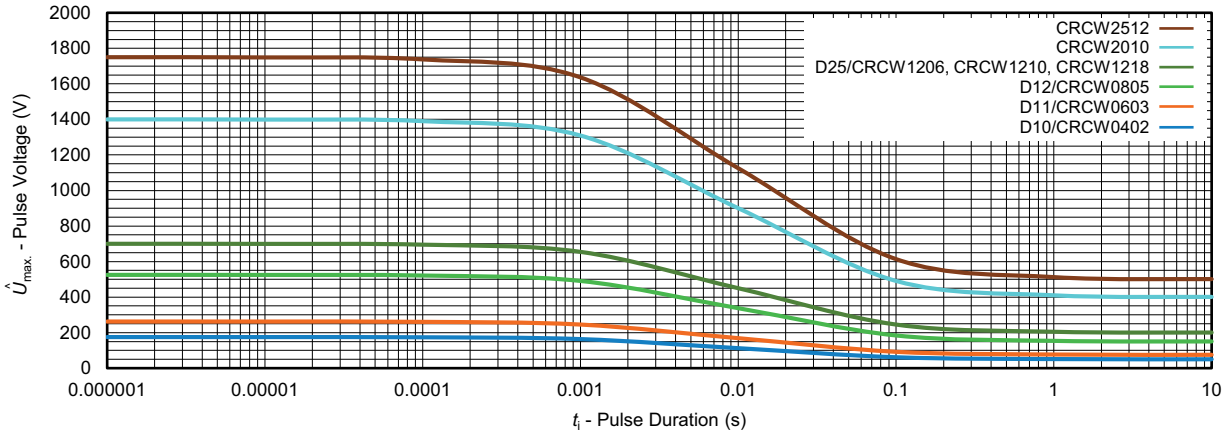

Maximum pulse load, single pulse; applicable if $\overline{P} \rightarrow 0$ and n < 1000 and $\hat{U} = \hat{U}_{max.}$; standard operation mode, for permissible resistance change equivalent to 8000 h operation

### Continuous Pulse




Maximum pulse load, continuous pulses; applicable if $\overline{P} \leq P\,(\vartheta_{amb})$ and $\hat{U} = \hat{U}_{max.}$; standard operation mode, for permissible resistance change equivalent to 8000 h operation

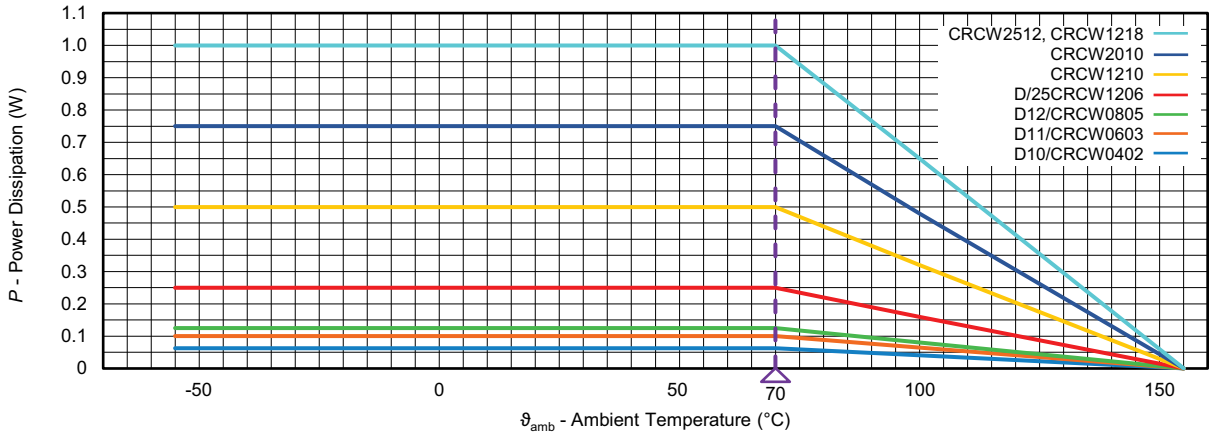
### Pulse Voltage



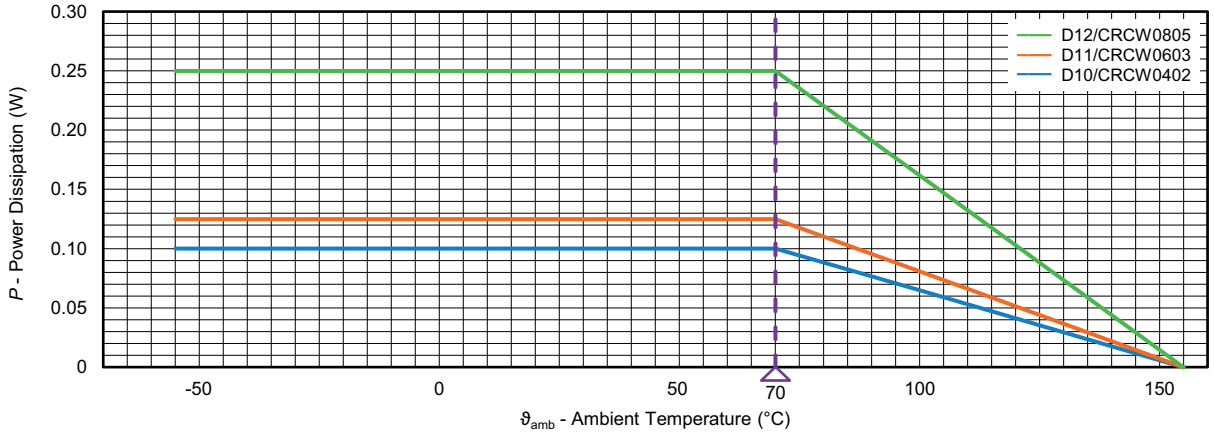

Maximum pulse voltage, single and continuous pulses; applicable if $\hat{P} = \hat{P}_{max.}$; standard operation mode, for permissible resistance change equivalent to 8000 h operation


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

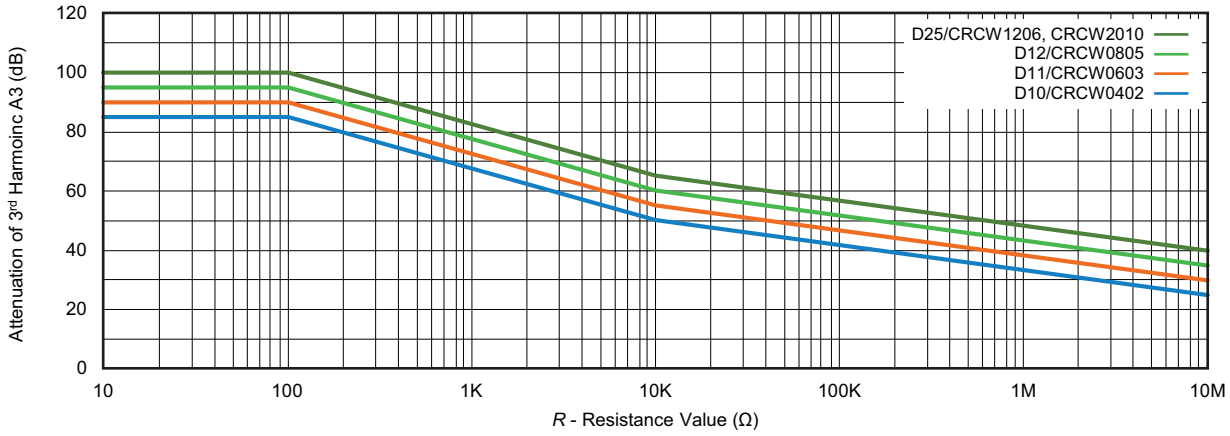
## Derating




## Derating - Extended Operation



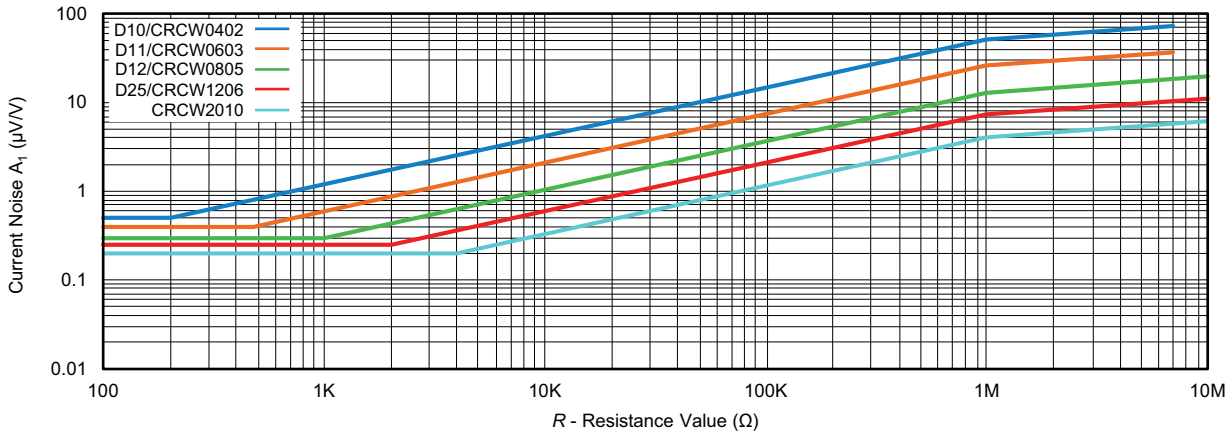

## Non-Linearity





For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

**Current Noise**





For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## TESTS AND REQUIREMENTS

All executed tests are carried out in accordance with the following specifications:

EN 60115-1, generic specification

EN 60115-8, sectional specification

EN 140401-802, detail specification

IEC 60068-2-xx, test methods

The parameters stated in the Test Procedures and Requirements table are based on the required tests and permitted limits of EN 140401-802. The table presents only the most important tests, for the full test schedule refer to the documents listed above. However, some additional tests and a number of improvements against those minimum requirements have been included.

The testing also covers most of the requirements specified by EIA/IS-703 and JIS-C-5201-1.

The tests are carried out under standard atmospheric conditions in accordance with IEC 60068-1, 4.3, whereupon the following values are applied:

Temperature: 15 °C to 35 °C

Relative humidity: 25 % to 75 %

Air pressure: 86 kPa to 106 kPa (860 mbar to 1060 mbar).

A climatic category LCT / UCT / 56 is applied, defined by the lower category temperature (LCT), the upper category temperature (UCT), and the duration of exposure in the damp heat, steady state test (56 days). The components are mounted for testing on boards in accordance with EN 60115-8, 5.2.2 unless otherwise specified.

**TEST PROCEDURES AND REQUIREMENTS**

| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R$) [1] | |
|---|---|---|---|---|---|
| | | | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER |
| | | | Stability for product types: | D10/CRCW0402 e3 to CRCW2512 e3 | |
| | | | D/CRCW e3 | 1 Ω to 10 MΩ | |
| 6.1 | - | Measurements of resistance and tolerance | - | ± 1 % | ± 5 % |
| 6.2 | - | Temperature coefficient of resistance | At (20 / -55 / 20) °C and (20 / 155 / 20) °C | ± 100 ppm/K; ± 200 ppm/K | ± 200 ppm/K |
| 7.1 | - | Endurance at rated temperature 70 °C | $U = \sqrt{P_{70} \times R} \leq U_{max.}$; whichever is the less severe; 1.5 h on; 0.5 h off<br>70 °C; 1000 h<br>70 °C; 8000 h | ± (1 % $R$ + 0.05 Ω)<br>± (2 % $R$ + 0.1 Ω) | ± (2 % $R$ + 0.1 Ω)<br>± (4 % $R$ + 0.1 Ω) |
| | | Endurance at rated temperature 70 °C Extended operation mode | $U = \sqrt{P_{70} \times R} \leq U_{max.}$; whichever is the less severe; 1.5 h on; 0.5 h off 70 °C; 1000 h | ± (2 % $R$ + 0.1 Ω) | |
| 7.3 | - | Endurance at maximum temperature | 155 °C, 1000 h | ± (1 % $R$ + 0.05 Ω) | ± (2 % $R$ + 0.1 Ω) |
| 10.4 | 78 (Cab) | Damp heat, steady state | (40 ± 2) °C; (93 ± 3) % RH; 56 days | ± (1 % $R$ + 0.05 Ω) | |
| 10.5 | 67 (Cy) | Damp heat, steady state, accelerated Extended or standard operation mode depend on case size | (85 ± 2) °C; (85 ± 5) % RH; $U = \sqrt{0.1 \times P_{85} \times R}$ ≤ 100 V; 1000 h | ± (1 % $R$ + 0.05 Ω) | ± (2 % $R$ + 0.1 Ω) |


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## TEST PROCEDURES AND REQUIREMENTS

| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R$) (1) | |
|---|---|---|---|---|---|
| | | | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER |
| | | | Stability for product types: | D10/CRCW0402 e3 to CRCW2512 e3 | |
| | | | D/CRCW e3 | 1 Ω to 10 MΩ | |
| 10.3 | - | Climatic sequence: | - | ± (1 % $R$ + 0.05 Ω) | ± (2 % $R$ + 0.1 Ω) |
| 10.3.4.2 | 2 (Bb) | Dry heat | 125 °C; 16 h | | |
| 10.3.4.3 | 30 (Db) | Damp heat, cyclic | 55 °C; ≥ 90 % RH; 24 h; 1 cycle | | |
| 10.3.4.4 | 1 (Ab) | Cold | -55 °C; 2 h | | |
| 10.3.4.5 | 13 (M) | Low air pressure | 8.5 kPa; 2 h; (25 ± 10) °C; 55 °C; > 90 % RH | | |
| 10.3.4.6 | 30 (Db) | Damp heat, cyclic | 5 days; 5 cycles | | |
| 10.3.4.7 | - | DC load Standard operation mode | $U = \sqrt{P_{70} \times R} \leq U_{max.}$; 1 min | | |
| - | 1 (Ab) | Cold | -55 °C; 2 h | ± (0.25 % $R$ + 0.05 Ω) | ± (0.5 % $R$ + 0.05 Ω) |
| 10.1 | 14 (Na) | Rapid change of temperature | 30 min at -55 °C; and 30 min at 125 °C; 1000 cycles | ± (1 % $R$ + 0.05 Ω) no visible damage | |
| 8.1 | - | Short-term overload | $U = 2.5 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; whichever is the less severe; 5 s | ± (2 % $R$ + 0.05 Ω) | |
| 8.2 | - | Single pulse high voltage overload, 10 µs/700 µs | Severity no. 4: $U = 10 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; whichever is the less severe; 10 pulses 10 µs/700 µs | ± (1 % $R$ + 0.05 Ω) no visible damage | |
| | | Single pulse high voltage overload, 10 µs/700 µs Extended operation mode | Severity no. 4: $U = 10 \times \sqrt{P_{70} \times R} \leq 2 \times U_{max.}$; whichever is the less severe; 10 pulses 10 µs/700 µs | ± (2 % $R$ + 0.1 Ω) no visible damage | |
| 8.4 | - | Periodic electric overload | $U = \sqrt{15 \times P_{70} \times R}$ or ≤ 2 x $U_{max.}$; whichever is the less severe; 0.1 s on; 2.5 s off; 1000 cycles | ± (1 % $R$ + 0.05 Ω) no visible damage | |
| | | Periodic electric overload Extended operation mode | $U = \sqrt{15 \times P_{70} \times R}$ or ≤ 2 x $U_{max.}$; whichever is the less severe; 0.1 s on; 2.5 s off; 1000 cycles | ± (2 % $R$ + 0.1 Ω) no visible damage | |
| 8.5 | - | Electrostatic discharge (human body model) | IEC 61340-3-1 (1); 3 pos. + 3 neg. discharges; ESD voltage acc. to the size: D10/CRCW0402 e3: 400 V D11/CRCW0603 e3: 800 V D12/CRCW0805 e3: 1000 V D25/CRCW1206 e3: 2000 V CRCW1210 e3 to CRCW2512 e3: ≥ 2000 V | ± (1 % $R$ + 0.05 Ω) | |


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

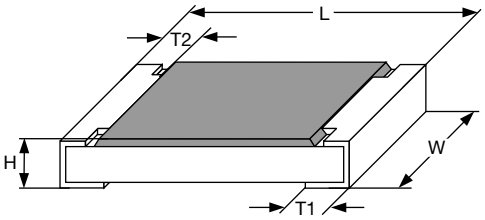
| TEST PROCEDURES AND REQUIREMENTS | | | | | |
|---|---|---|---|---|---|
| EN 60115-1 CLAUSE | IEC 60068-2 TEST METHOD | TEST | PROCEDURE | REQUIREMENTS PERMISSIBLE CHANGE ($\Delta R$) (1) | |
| | | | | STABILITY CLASS 1 OR BETTER | STABILITY CLASS 2 OR BETTER |
| | | | Stability for product types: | D10/CRCW0402 e3 to CRCW2512 e3 | |
| | | | **D/CRCW e3** | 1 Ω to 10 MΩ | |
| 9.11 | 6 (Fc) | Vibration | Endurance by sweeping; 10 Hz to 2000 Hz; no resonance; amplitude ≤ 1.5 mm or ≤ 200 m/s$^2$; 7.5 h | ± (0.25 % $R$ + 0.05 Ω) no visible damage | ± (0.5 % $R$ + 0.05 Ω) no visible damage |
| 11.1 | 58 (Td) | Solderability | Solder bath method; Sn60Pb40 non-activated flux; (235 ± 5) °C (2 ± 0.2) s | Good tinning (≥ 95 % covered); no visible damage | |
| | | | Solder bath method; Sn96.5Ag3Cu0.5 non-activated flux; (245 ± 5) °C (3 ± 0.3) s | | |
| 11.2 | 58 (Td) | Resistance to soldering heat | Solder bath method (260 ± 5) °C; (10 ± 1) s | ± (0.25 % $R$ + 0.05 Ω) | ± (0.5 % $R$ + 0.05 Ω) |
| 11.3 | 45 (XA) | Component solvent resistance | Isopropyl alcohol; 50 °C; method 2 | No visible damage | |
| 9.7 | 21 ($Ue_3$) | Shear (adhesion) | D10/CRCW0402 e3 and D11/CRCW0603 e3: 9 N<br>D12/CRCW0805 e3 to CRCW2512 e3: 45 N | No visible damage | |
| 9.8 | 21 ($Ue_1$) | Substrate bending | Depth 2 mm; 3 times | ± (0.25 % $R$ + 0.05 Ω) no visible damage, no open circuit in bent position | |
| 12.2 | - | Voltage proof | $U$ = 1.4 x $U_{ins}$; 60 s | No flashover or breakdown | |
| 12.4 | - | Flammability, needle flame test | IEC 60695-11-5 (1); 10 s | No burning after 30 s | |

**Note**

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents

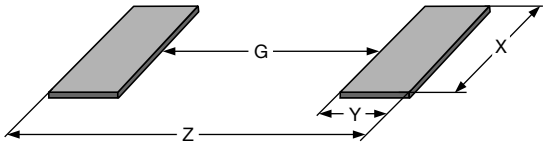

For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

## DIMENSIONS




| DIMENSIONS AND MASS | | | | | | |
|---|---|---|---|---|---|---|
| TYPE / SIZE | L (mm) | W (mm) | H (mm) | T1 (mm) | T2 (mm) | MASS (mg) |
| D10/CRCW0402 e3 | 1.0 ± 0.05 | 0.5 ± 0.05 | 0.35 ± 0.05 | 0.25 ± 0.10 | 0.2 ± 0.10 | 0.65 |
| D11/CRCW0603 e3 | 1.55 + 0.10 / - 0.05 | 0.85 ± 0.10 | 0.45 ± 0.05 | 0.3 ± 0.20 | 0.3 ± 0.20 | 2 |
| D12/CRCW0805 e3 | 2.0 + 0.20 / - 0.10 | 1.25 ± 0.15 | 0.5 ± 0.10 | 0.3 + 0.20 / - 0.10 | 0.3 ± 0.20 | 5.5 |
| D25/CRCW1206 e3 | 3.2 + 0.10 / - 0.20 | 1.6 ± 0.15 | 0.55 ± 0.05 | 0.45 ± 0.20 | 0.4 ± 0.20 | 10 |
| CRCW1210 e3 | 3.2 ± 0.20 | 2.5 ± 0.20 | 0.55 ± 0.05 | 0.45 ± 0.20 | 0.4 ± 0.20 | 16 |
| CRCW1218 e3 | 3.2 + 0.10 / - 0.20 | 4.6 ± 0.15 | 0.55 ± 0.05 | 0.45 ± 0.20 | 0.4 ± 0.20 | 29.5 |
| CRCW2010 e3 | 5.0 ± 0.15 | 2.5 ± 0.15 | 0.6 ± 0.10 | 0.6 ± 0.20 | 0.6 ± 0.20 | 25.5 |
| CRCW2512 e3 | 6.3 ± 0.20 | 3.15 ± 0.15 | 0.6 ± 0.10 | 0.6 ± 0.20 | 0.6 ± 0.20 | 40.5 |

## SOLDER PAD DIMENSIONS




| RECOMMENDED SOLDER PAD DIMENSIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| TYPE / SIZE | WAVE SOLDERING | | | | REFLOW SOLDERING | | | |
| | G (mm) | Y (mm) | X (mm) | Z (mm) | G (mm) | Y (mm) | X (mm) | Z (mm) |
| D10/CRCW0402 e3 | - | - | - | - | 0.45 | 0.6 | 0.6 | 1.65 |
| D11/CRCW0603 e3 | 0.65 | 1.10 | 1.25 | 2.85 | 0.75 | 0.75 | 1.00 | 2.25 |
| D12/CRCW0805 e3 | 0.90 | 1.30 | 1.60 | 3.50 | 1.00 | 0.95 | 1.45 | 2.90 |
| D25/CRCW1206 e3 | 1.40 | 1.40 | 1.95 | 4.20 | 1.50 | 1.05 | 1.80 | 3.60 |
| CRCW1210 e3 | 1.80 | 1.45 | 2.95 | 4.70 | 1.70 | 1.10 | 2.80 | 3.90 |
| CRCW1218 e3 | 1.80 | 1.30 | 5.10 | 4.40 | 1.90 | 1.10 | 4.90 | 4.10 |
| CRCW2010 e3 | 3.40 | 1.65 | 2.85 | 6.70 | 3.50 | 1.45 | 2.80 | 6.40 |
| CRCW2512 e3 | 4.60 | 1.60 | 3.65 | 7.80 | 4.75 | 1.45 | 3.50 | 7.65 |

**Notes**

- The given solder pad dimensions reflect the considerations for board design and assembly as outlined e.g in standards IEC 61188-5-x [(1)] or in publication IPC-7351.
  Still, the given solder pad dimensions will be found adequate for most general applications

(1) The quoted IEC standards are also released as EN standards with the same number and identical contents


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

| REVISION HISTORY | |
|---|---|
| **REVISION DATE** | **DESCRIPTION** |
| **14-Apr-2026** | Page 2, “Temperature Coefficient And Resistance Range” table:<br>- Added TCR ± 200 ppm/K to 1R-9R76, ± 1 % components<br><br>Page 3, “Packaging” table:<br>- Change EG = E67 code quantity to 2000 pcs<br><br>Page 8, “Test Procedures And Requirements” table:<br>- Added TCR ± 200 ppm/K to temperature coefficient of resistance for stability class 1 or better components<br><br>Page 10:<br>- Introduction of “Revision History” table |


For technical questions, contact: thickfilmchip@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

*© 2026 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED*



THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000