



# CRCW-HP

PULSE PROOF, HIGH POWER THICK  
FILM CHIP RESISTOR  
PRODUCT OVERVIEW

## DRALORIC BEYSCHLAG RESISTORS

A **WORLD OF**  
**SOLUTIONS**





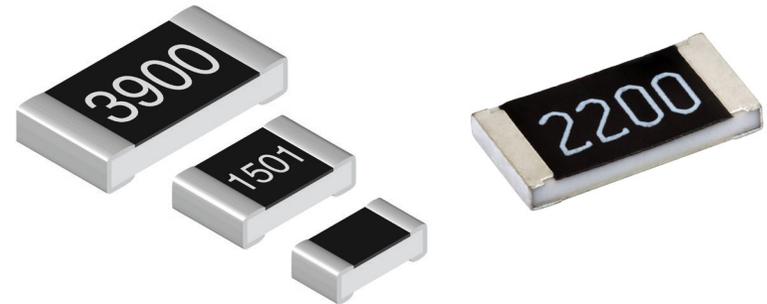
# INTRODUCTION

## Purpose

- Introduction of the Vishay CRCW-HP Pulse Proof, High Power Thick Film Chip Resistors

## Objectives

- Present an overview of this product's special performance properties
- Discuss product design and features
- Discuss product advantages
- Present possible applications



Welcome to the Vishay CRCW-HP Pulse Proof, High Power Thick Film Chip Resistors product overview. This tutorial will provide an overview of the CRCW-HP resistor family. The key functional performance parameters of the CRCW-HP series will be discussed as well as design, features, and benefits when compared to standard chip resistors of same case size. A selection of potential applications from typical market segments will be presented.



# FUNCTIONAL PERFORMANCE OF THE CRCW-HP

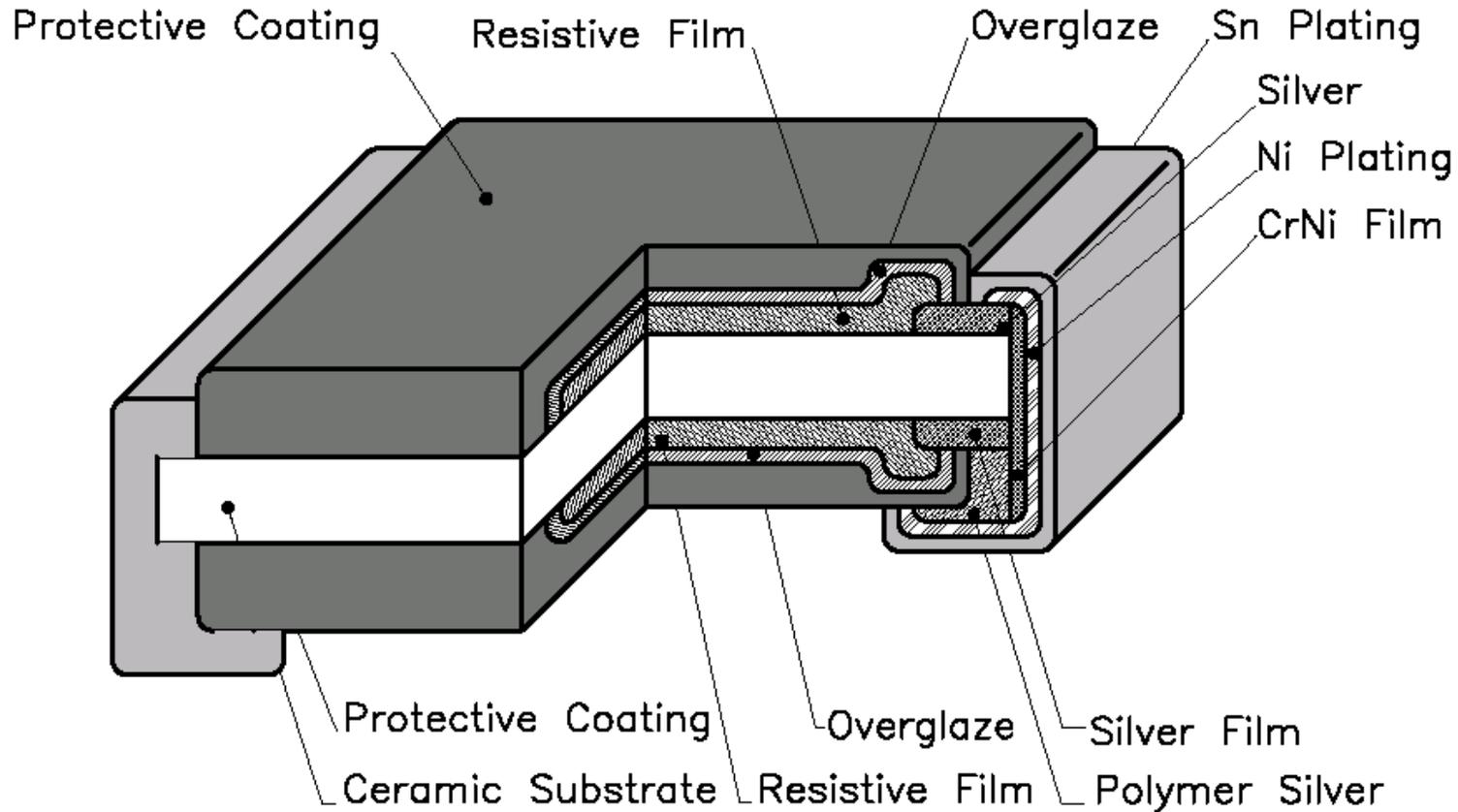
- High Power Pulse Proof thick film resistor technology
- Tolerances of 0.5%, 1% or 5% and TCR of 100 ppm/°C or 200 ppm/°C
- Double side printed resistor element
- Resistance range from 1  $\Omega$  to 1 M $\Omega$  as well as 0R0 jumper
- AEC-Q200 qualified
- RoHS Compliant and Halogen free
- Available case sizes from 0402 up to 2512

---

CRCW-HP series resistors are ideally suited for applications where high power and/or enhanced pulse proof features are required. CRCW-HP is available in size 0402 up to 2512 with respective tolerance & TCR combinations of 1%, 100ppm/°C and 5%, 200ppm/°C. The resistance range can be found from 1 $\Omega$  thru 1M $\Omega$  and also 0 $\Omega$  and this product series is automotive AEC-Q200 qualified. Its pure tin plating provides compatibility with lead (Pb)-free and lead containing soldering processes and this resistor is RoHS compliant as well as Halogen free.



# HOW THE CRCW-HP IS CONSTRUCTED



The CRCW-HP resistor is constructed quite similarly to the standard Vishay CRCW thick film resistor. However, the main difference is the double sided design in the HP series where there are two resistive layers connected in parallel. Advantages and benefits of this construction will be discussed in the following slides.



# POWER RATING COMPARISON: STD THICK FILM AND CRCW-HP

## POWER RATING

Size	0402	0603	0805	1206	1210	1218	2010	2512
Standard	0.063W	0.1W	0.125W	0.25W	0.5W	1.0W	0.75W	1W
CRCW-HP	<b>0.20W</b>	<b>0.33W</b>	<b>0.50W</b>	<b>0.75W</b>	0.75W	1.5W	1W	1.5W

-  LATEST POWER RATING UPGRADE
-  EXPECTED TO BE UPGRADED IN 2019

## MAXIMUM CURRENT RATING

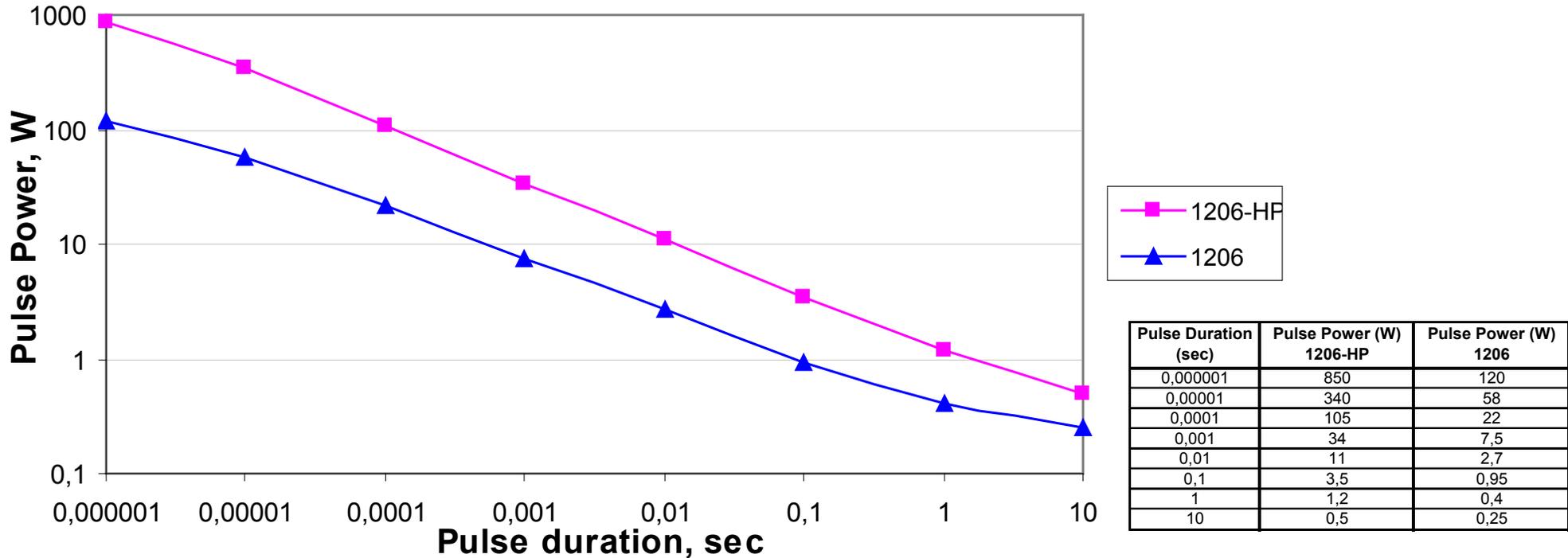
Size	0402	0603	0805	1206	1210	1218	2010	2512
Standard JUMPER 0R	1.5A	2.0A	2.5A	3.5A	5.0A	7.0A	6.0A	7.0A
CRCW-HP JUMPER 0R	3.0A	5.0A	6.0A	10.0A	12.0A	20.0A	12.0A	16.0A

One of the main benefits of the CRCW-HP resistor is the power dissipation which is much higher than power dissipated from standard chip resistor of the same size. For example, a standard 1206 size thick film resistor is rated at 0.25W while CRCW1206-HP is rated at 0.75W (three times more). This is mainly achieved by the double sided printed design. CRCW0805-HP, for instance, is rated at 0.5W, the same power rating as standard 1210 while occupying much less area on the PCB, so there is a significant PCB space that can be saved. This is one of the reasons why the HP series is recommended for densely populated PCBs. The biggest case size of the CRCW-HP series is 2512, rated at 1.5 W. Additionally, CRCW-HP 0R Jumper offers much higher maximum current capability in the same package size as a standard 0R jumper.



# PULSE LOAD CAPABILITY – SINGLE PULSE

## Maximum Safe Pulse Power of Single Pulse, W 1206 Chip Size

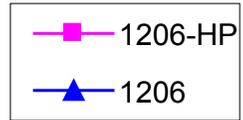
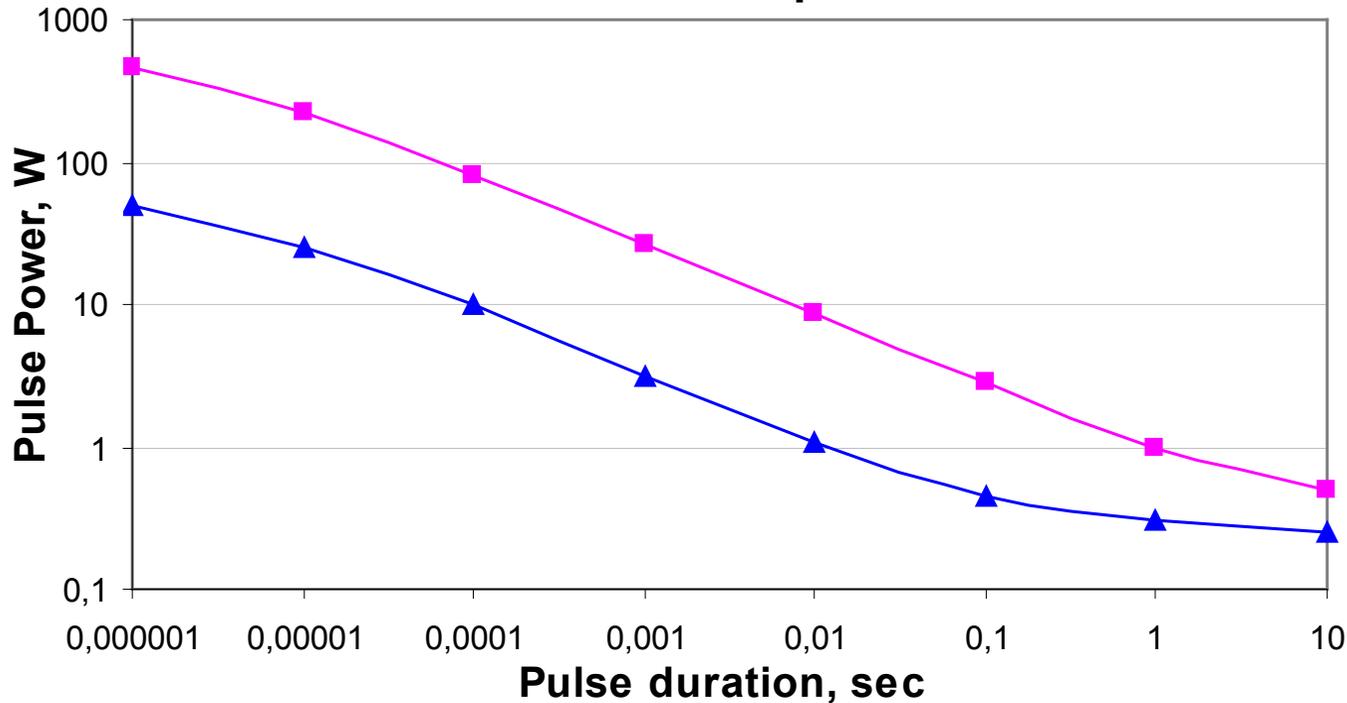


This is the single pulse load capability comparison between standard 1206 and 1206-HP. The X axis is the pulse duration in seconds while the Y axis is the pulse peak power in Watts. For long pulse duration (from 1 to 10 seconds) the HP type can handle 2 - 3 times more power and in very short pulse duration, it can handle up to 7 times more.



# PULSE LOAD CAPABILITY – CONTINUOUS PULSE

## Maximum Safe Pulse Power of Continuous Pulse, W 1206 Chip Size



Pulse Duration (sec)	Pulse Power (W) 1206-HP	Pulse Power (W) 1206
0,000001	450	50
0,00001	220	25
0,0001	80	10
0,001	27	3,2
0,01	8,5	1,1
0,1	2,8	0,45
1	1	0,3
10	0,5	0,25

While the previous slide showed a single pulse load capability comparison, this one shows a continuous pulse of the 1206-HP versus standard 1206. Here it can be observed how superior the HP type is when continuous pulse load is applied. For long pulse duration (from 1 to 10 seconds) the HP type can handle 2 - 3 times more than standard 1206 and in very short pulse duration, it can handle up to 9 times more.



# FEATURES & BENEFITS

- High Power Resistor, same size
- Double sided printed design
- Saves space on PCB
- AEC-Q200 qualified
- Reduced stresses in PCBs caused by temperature changes
- Superior anti-surge and pulse capability
- RoHS compliant
- Halogen Free
- Last minute fix when PCB design is complete and more power is needed

---

Besides its capability to dissipate high power and therefore save space on PCB, the CRCW-HP is becoming more and more popular in the automotive world as it is AEC-Q200 qualified. Another two benefits are the following:

1. Stresses in PCB, caused by temperature changes, are reduced. This is because there are different coefficients of thermal expansion between the resistive layer and the ceramic substrate which causes convex bending of a standard chip resistor. In the HP resistor, due to the double sided printed design, the convex bending caused by the upper resistive layer is compensated by the concave bending caused by the bottom one.
2. The HP chip resistor is well known for its superior anti-surge and pulse capability, again, due to the double sided printed design.



# APPLICATIONS

- High and repetitive surge and pulse loading applications
- Densely populated PCBs requiring high power in small package size

## Alternative Energy

- Solar Inverter
- Power Meters

## AMS (Avionics, Military, Space)

- Handset Radio
- Surveillance System
- Guided Rocket System
- Navigation Antenna / GPS

## Automotive

- Climate Control Module
- LED Driver
- Powertrain
- Transmission controller
- Driver Seat Module
- Coolant Pumps
- Braking System
- Cluster control module

## Computer

- HDD
- AC-DC Adaptor
- Gaming

## Industrial

- DC-DC Converter
- Motor Control
- Electrical Circuit Breaker
- Ignition / switching circuits
- AC main protection

The CRCW-HP is most suitable for applications requiring high surge withstanding ability and superior power dissipation. The HP product is penetrating major markets like Automotive, Industrial, Telecommunication and Computer as well as some others like Medical, Military and Avionics and Alternative Energy. Specific application examples for each market segment are shown above.



# SUMMARY

- CRCW-HP series features up to 1.5 W power rating in case size 2512
- CRCW-HP series features up to 20A maximum current in case size 1218 Jumper
- Double sided printed design
- AEC-Q200 qualified
- Excellent choice for most fields of modern power electronics where increased power dissipation, high pulse capability or space restrictions are of major concern

---

In summary, the Vishay CRCW-HP Pulse Proof, High Power Thick Film Chip resistor series offers a power rating up to 1.5 W in case size 2512 and maximum current up to 20A in case size 1218 OR jumper which allows for a reduction in component counts and replacement of larger case sizes to save board space ultimately lowering costs in power electronics circuits. Important high-reliability applications will benefit from AEC-Q200 qualification as well as from the excellent moisture resistivity. Combining the advantage of high rated dissipation and small case size in one device, the CRCW-HP series is the perfect choice for most fields of today's and tomorrow's emerging high power electronics.