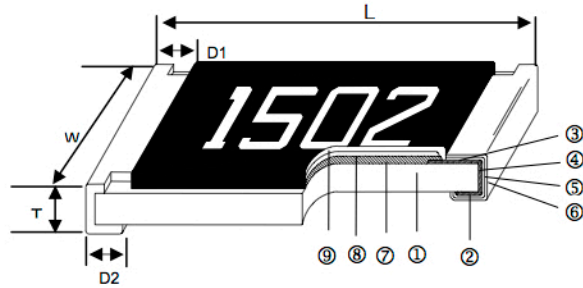


# Automotive Grade Chip Resistor – CAR Series



## Construction



① Alumina Substrate	④ Edge Electrode (NiCr)	⑦ Resistor Layer (RuO <sub>2</sub> /Ag)
② Bottom Electrode (Ag)	⑤ Barrier Layer (Ni)	⑧ Primary Overcoat (Glass)
③ Top Electrode (Ag-Pd)	⑥ External Electrode (Sn)	⑨ Secondary Overcoat (Epoxy)

## Features

- AEC-Q200 Compliance
- Highly reliable multilayer electrode construction
- Compatible with all soldering process

## Applications

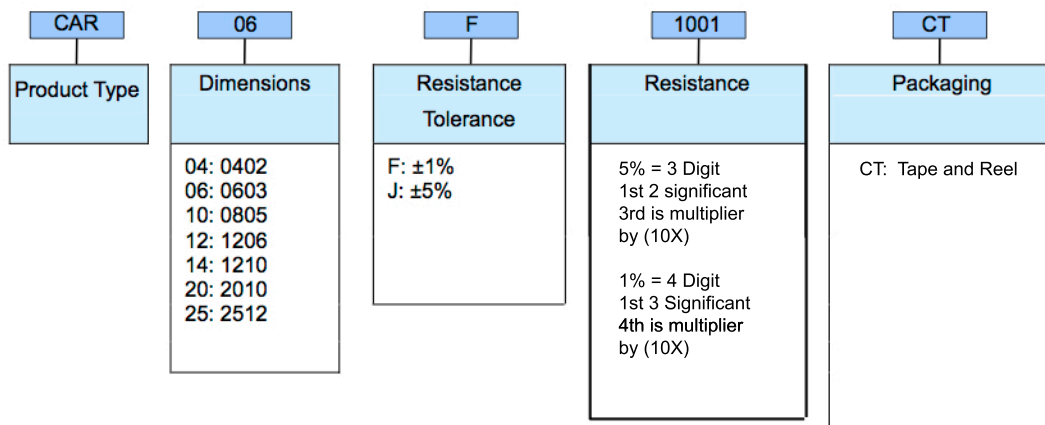
- Automotive Industry
- Telecommunication Equipments
- Radio and Tape Recorders, TV Tuners
- Digital Cameras, Watches, Pocket Calculators
- Computers, Instruments

## Dimensions

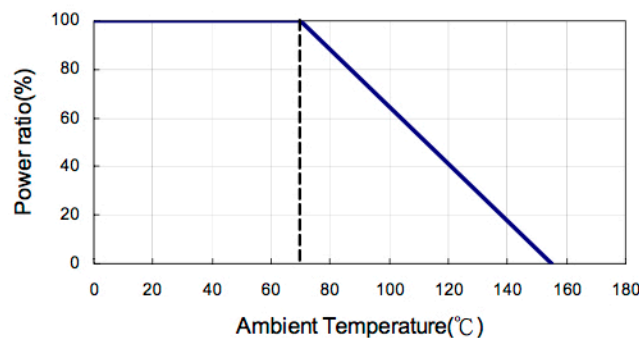
Unit: mm

Type	Size (Inch)	L	W	T	D1	D2	Weight (g) (1000pcs)
CAR04	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.620
CAR06	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
CAR10	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
CAR12	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
CAR14	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
CAR20	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
CAR25	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448

## Part Numbering



## Derating Curve



## Standard Electrical Specifications

Item Type	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range		TCR (PPM/°C)
					±1%	±5%	
CAR04 (0402)	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
<b>Jumper</b>	1A				0Ω (<50mΩ)		-
CAR06 (0603)	1/10W	-55 ~ +155°C	75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
<b>Jumper</b>	1A				0Ω (<50mΩ)		-
CAR10 (0805)	1/8W	-55 ~ +155°C	150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
CAR12 (1206)	1/4W		200V	400V			
<b>Jumper</b>	2A		0Ω (<50mΩ)				
CAR14 (1210)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
<b>Jumper</b>	2.5A				0Ω (<50mΩ)		-
CAR20 (2010)	3/4W	-55 ~ +155°C	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
<b>Jumper</b>	3.5A				0Ω (<50mΩ)		-
CAR25 (2512)	1W	-55 ~ +155°C	250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
<b>Jumper</b>	4A				0Ω (<50mΩ)		-

Operating Voltage= $\sqrt{P \cdot R}$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. overload voltage listed above, whichever is lower.

■ Cal-Chip is capable of manufacturing the optional spec based on customer's requirement.

## Environmental Characteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			-55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	RCWV*2.5 or Max. Overload voltage for 5 seconds, 2 seconds for high power series
Insulation Resistance	≥10G			Max. Overload voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	70±2°C, Max. Working voltage for 1000 hrs with 1.5 hrs "ON" and 0.5 hrs "OFF"
Biased Humidity	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Bending once for 5 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Thermal Shock	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	-55C/+155°C. Note: Number of cycles required-300, Maximum transfer time-20 seconds, Dwell time-15minutes. Air-Air.
Solderability	95% min. coverage			245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			1.42 times RCWV (RMS) for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%			260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	-55°C to +125°C, 1000 cycles
Moisture Resistance	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	24 hrs/cycle
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(1%+0.05Ω)			Human body, 2KV
Flame Retardance	Not flame			Temperature sensing at 500°C, voltage power subjected to 32VDC current clamped up to 500ADC and decreased in 1.0VDC/hour.
Resistance to solvents	Marking Unsmearred			Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal strength	Not Broken			Force of 1.8kg for 60 seconds.

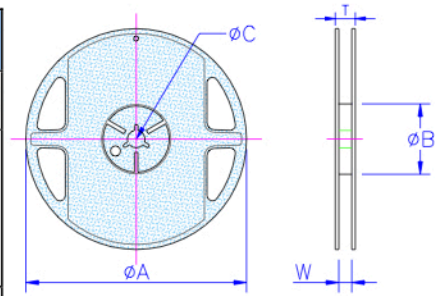


## Packaging

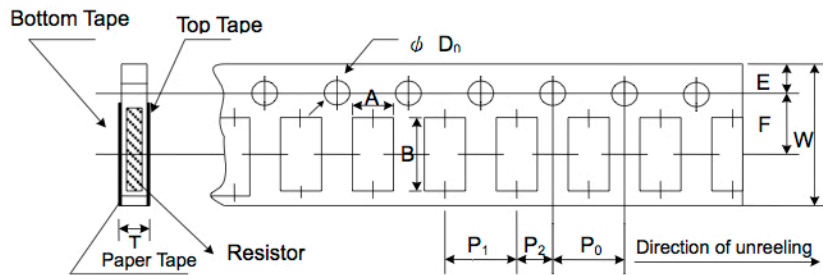
Reel Specifications & Packaging Quantity

Unit: mm

Type	Packaging Quantity	Tape Width	Reel Diameter	$\Phi A$	$\Phi B$	$\Phi C$	W	T	
CAR04	Paper	10K	8mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	13.0±0.2	9.0±0.5	12.5±0.5
CAR06 CAR10 CAR12 CAR14	Paper	5K	8mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	13.0±0.2	9.0±0.5	12.5±0.5
CAR20 CAR25	Embossed	4K	12mm	7 inch	178.5±1.5	60 <sup>+1/-0</sup>	13.0±0.5	13.0±0.5	15.5±0.5



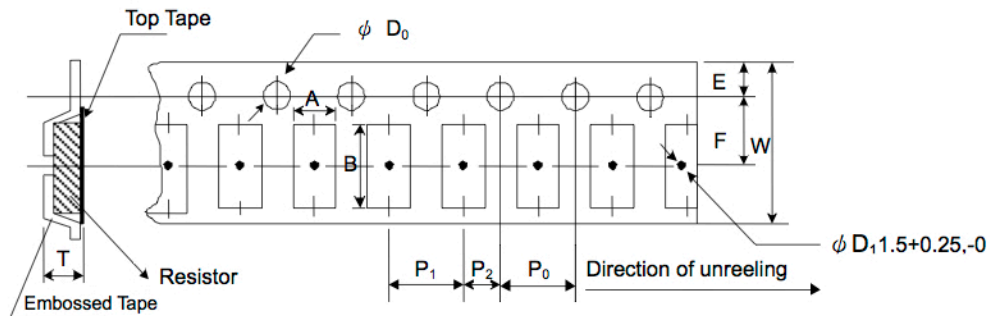
## Paper Tape Specifications



Unit: mm

Type	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	$\Phi D_0$	T
CAR04	0.65±0.10	1.15±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
CAR06	1.10±0.10	1.90±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
CAR10	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CAR12	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
CAR14	2.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

## Embossed Plastic Tape Specifications

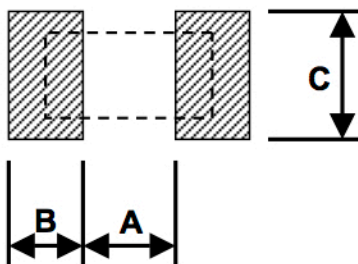


Unit: mm

Type	A	B	W	E	F	P <sub>0</sub>	P <sub>1</sub>	P <sub>2</sub>	$\Phi D_0$	T
CAR20	2.8±0.10	5.5±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 <sup>+0</sup>
CAR25	3.5±0.10	6.7±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 <sup>+0</sup>

## Recommend Land Pattern

Unit: mm



Type	A	B	C
CAR04	0.50	0.45	0.60
CAR06	0.90	0.60	0.90
CAR10	1.20	0.70	1.30
CAR12	2.00	0.90	1.60
CAR14	2.00	0.90	2.80
CAR20	3.80	0.90	2.80
CAR25	3.80	1.60	3.50