

AUTOMOTIVE GRADE CHIP RESISTOR

- CAR SERIES -

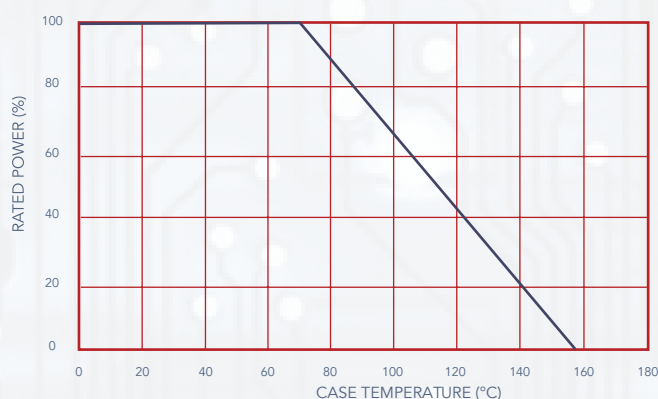
FEATURES

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

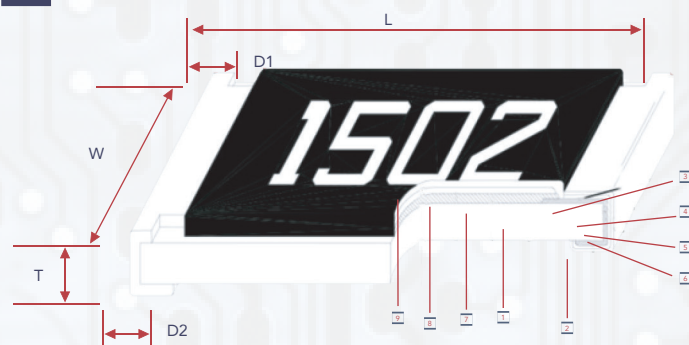
APPLICATIONS

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

DERATING CURVE



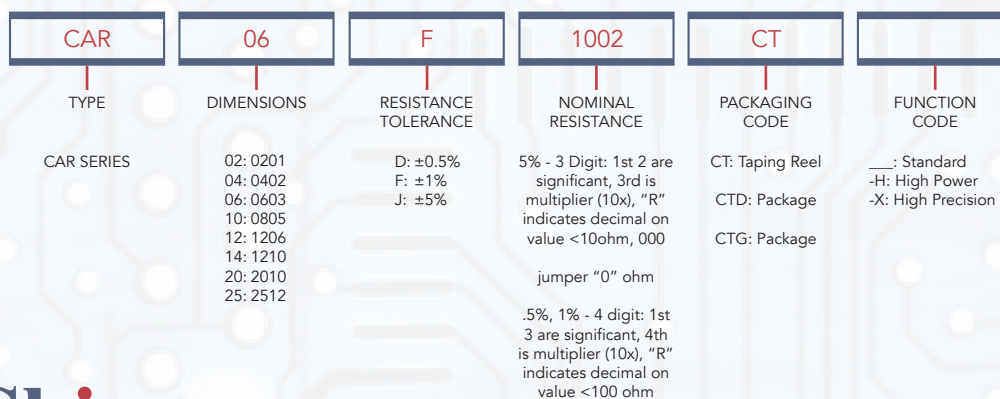
CONSTRUCTION & DIMENSIONS



- | | | |
|-------------------------|---------------------------|------------------------------|
| 1 Alumina Substrate | 4 Edge Electrode (NiCr) | 7 Resistor Layer (Ag/Pd) |
| 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) |

TYPE	SIZE (INCH)	L	W	T	D1	D2	WEIGHT (G) (1000PCS)
CAR02	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
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		15.959		
CAR20	2010	5.00±0.10	2.50±0.15	0.60±0.25			24.241
CAR25	2512	6.35±0.10	3.10±0.15				39.448

PART NUMBERING



STANDARD ELECTRICAL SPECIFICATIONS

TYPE	POWER RATING AT 70°C	OPERATING TEMPERATURE	MAX OPERATING VOLTAGE	MAX OVERLOAD VOLTAGE	RESISTANCE RANGE		TCR (PPM/°C)		
					±1% (E24 - E96)	±5% (E24)			
CAR02 (0201)	1/20W	-55 ~ +125°C	25V	50V	1Ω ≤ R ≤ 10Ω 10Ω - 10MΩ		-100 ~ +350 ±200		
	JUMPER: 1A				0Ω (<50mΩ)				
CAR04 0402	1/16W	-55 ~ +155°C	50V	100V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200		
	JUMPER: 1A				-	0Ω (<50mΩ)			
CAR06 0603	1/10W		75V	150V	1Ω - 9.76Ω 10Ω - 1MΩ 102MΩ - 10MΩ		±200 ±100 ±200		
	JUMPER: 2A				-	0Ω (<50mΩ)			
CAR10 0805	1/8W		150V	300V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200		
	JUMPER: 2A				-	0Ω (<50mΩ)			
CAR12 1206	1/4W		1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ	200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	JUMPER: 2A					-	0Ω (<50mΩ)		
CAR14 1210	1/2W		1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		200V	400V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	JUMPER: 2.5A		-	0Ω (<50mΩ)					
CAR20 2010	3/4		1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200
	JUMPER: 3.5A		-	0Ω (<50mΩ)					
CAR25 2512	1W	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		250V	500V	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±200 ±100 ±200	
	JUMPER: 4A	-	0Ω (<50mΩ)						

Operating Voltage - $\sqrt{P \cdot R}$; or Max. Operating Voltage listed above, whichever is lower.

Operating Current - $2.5 \cdot \sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

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

HIGH PRECISION ELECTRICAL SPECIFICATION

TYPE	POWER RATING AT 70°C	OPERATING TEMPERATURE	MAX OPERATING VOLTAGE	MAX OVERLOAD VOLTAGE	RESISTANCE RANGE	TCR (PPM/°C)
					±0.05%	
CAR04 (0402)	1/16W	-55 ~ +155°C	50V	100V	10Ω - 1MΩ	±100
CAR06 (0603)	1/10W		150V	150V		
CAR10 (0805)	1/8W		150V	300V		
CAR12 (1206)	1/4W		200V	400V		
CAR14 (1210)	1/3W		250V	500V		
CAR20 (2010)	3/4W					
CAR25 (2512)	1W					



■ HIGH POWER RATING ELECTRICAL SPECIFICATIONS

TYPE	POWER RATING AT 70°C	OPERATING TEMPERATURE	MAX OPERATING VOLTAGE	MAX OVERLOAD VOLTAGE	RESISTANCE RANGE			TCR (PPM/°C)
					±0.05% (E24 - E96)	±1% (E24 - E96)	±5% (E24)	
CAR04 (0402)	1/8W	-55 ~ + 155°C	50V	100V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100
CAR06 (0603)	1/4W		75V	150V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100
CAR10 (0805)	1/3W		150V	300V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100
CAR12 (1206)	1/2W		200V	400V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100
CAR20 (2010)	1W		250V	500V	-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100
CAR25 (2512)	2W				-	1Ω - 9.76Ω		±200
						10Ω - 1MΩ		±100

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.

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155°C.

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

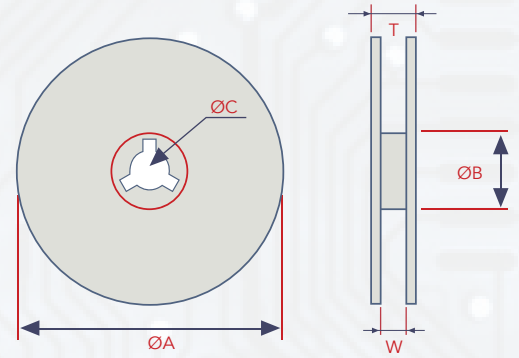
■ ENVIRONMENTAL CHARACTERISTICS

ITEMS	REQUIREMENT			TEST METHODS
	TOL. ≤0.05%	TOL. > 0.05%	JUMPER	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			-55°C ~ +125°C, 25°C is the reference temperature
Short Term 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 1.5hrs "ON" and 0.5hrs "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%+0.100)	<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	5g's for 20 min., 12 cycles each of 3 orientation, 10-2000 Hz
ESD	±(1%+0.05Ω)			Human Body, 2KV
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.

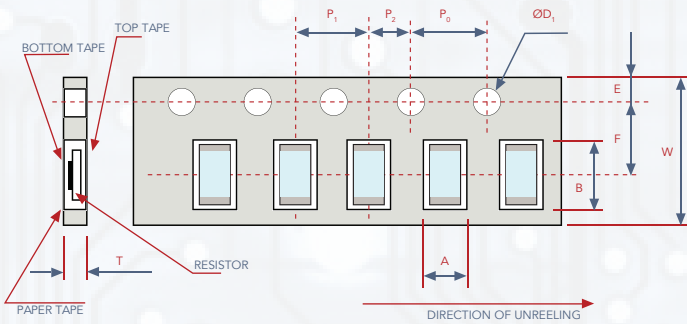
PACKAGING

- Reel Specifications & Packaging Quantity

TYPE	PACKAGING QUANTITY	TAPE WIDTH	REEL DIAMETER	ØA	ØB	ØC	W	T	
CAR04	Paper	10K	7 inch	178.5 ± 1.5	60.0 ^{+1/0}	13.0±0.2	9.0±0.5	12.5±0.5	
CAR06	Paper	5K							8mm
CAR10									
CAR12									
CAR14	Embossed	4K							12mm
CAR20									
CAR25									



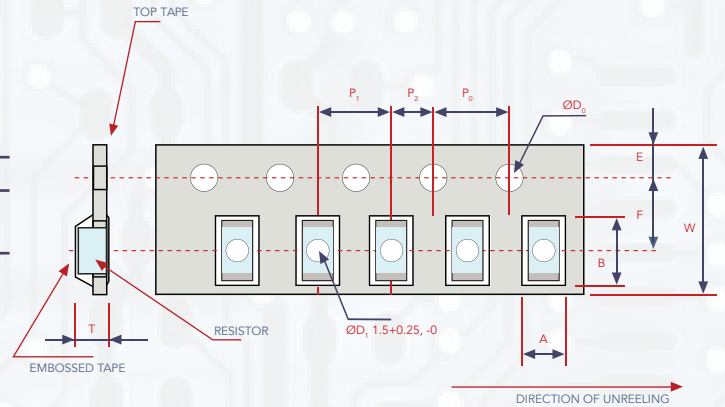
- Paper Tape Specifications



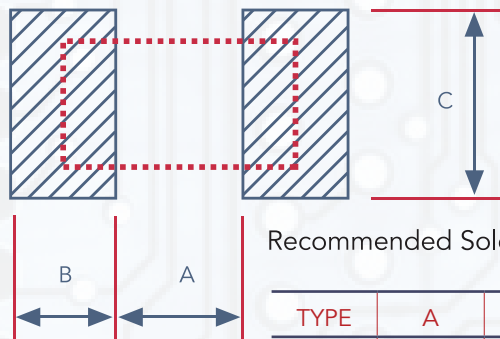
TYPE	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₁	T
CAR04	0.65±0.10	1.15±0.10	8.00±0.20	1.75±0.10	3.5±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.44±0.10
CAR06	1.10±0.10	1.90±0.10								0.70±0.10
CAR10	1.60±0.10	2.40±0.20								0.85±0.10
CAR12	1.90±0.10	3.50±0.20								
CAR14	2.90±0.10									

- Embossed Tape Specifications

TYPE	A	B	W	E	F	P ₀	P ₁	P ₂	ØD ₁	T
CAR20	2.8±0.10	5.5±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.05	4.00±0.10	2.00±0.05	1.50+0.1,-0	1.2 ^{±0}
CAR25	3.5±0.10	6.7±0.10								



RECOMMENDED LAND PATTERN



Recommended Solder Pad

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

- RM PACKAGING DESIGNATORS

TYPE	BLANK	D	G
CAR02	15K		
CAR04	10K		
CAR06	5K		
CAR10	5K	10K	20K
CAR12	5K	10K	20K
CAR14	5K	10K	20K
CAR20	4K		
CAR25	4K		

