Thin Film Technology Corp.

Product Guide

Sulfur Resistant Technology

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Sulfur Resistant Products

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2-Terminal CSR	High Power & Small Size, High Heat Dissipation	MPA	1206	2512								
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	General Purpose Current Sensing, Wrapped Electrodes	WEL	0603	0805	1206	2010	2512	4320	4527			
	General Purpose Current Sensing, Wrapped Electrodes, High Power & Small Size	WEL Long-Side	0508	0612	0815	1020	1225	0830	1530	1836	2043	
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	Non-Wrapped Electrodes	WKL Long-Side	0508	0612	0815	1020	1225	0830	1530	1836	2043	
Jumper	High Current	LPC	01005	0201	0402	0603	0805	1206				
Thin Film	Low TCR and Tolerance	KN	0201	0402	0603	0805	1206	1210	2010	2512		
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	High-Grade Anti-Sulfur	KS	0402	0603	0805	1206	1210	2010	2512			
Thick Film	High-Grade Anti-Sulfur	TFAS	0402	0603	0805	1206	1210	2010	2512			
	High-Grade Anti-Sulfur	KGAS Short-Side	0402	0603	0805	1206	1210	1812	2010	2512		
	High-Grade Anti-Sulfur	KGAS Long-Side	1218									

English case sizes shown.

Sulfur Resistant Applications

- AI Servers
- Telecommunication
- MPU Systems
- Industrial Systems
- Offshore Installations
- Oil and Gas

Purpose of Sulfur Resistant Products

Welcome to our comprehensive guide on anti-sulfur resistors, where we explore the intricate dynamics of silver-sulfur interactions, potential risks they pose, and the innovative solutions that bolster our resistors against challenging environments.

When silver (Ag) encounters sulfur, a chemical reaction ensues, leading to the formation of silver sulfide (Ag2S), also known as “flowers of sulfur.” These interactions can significantly compromise resistor functionality, causing performance deterioration and eventual failure.

In the realm of resistors, two primary types tackle the challenges presented by silver-sulfur reactions:

Inherently Anti-Sulfur Resistors:
• Engineered with materials inherently resistant to sulfur corrosion.
• Offers a robust solution without the need for additional protective layers.

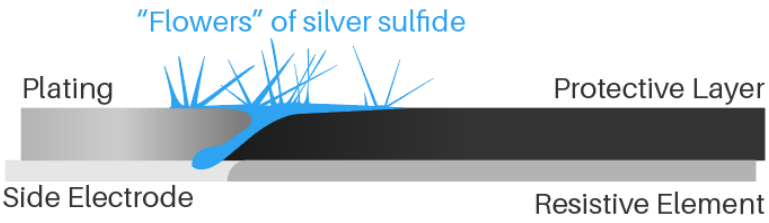
Thick Film Resistors with Additional Protection:
• Capitalizes on the cost efficiency of thick film resistors.
• Implements specific strategies to neutralize the impact of silver-sulfur interactions.

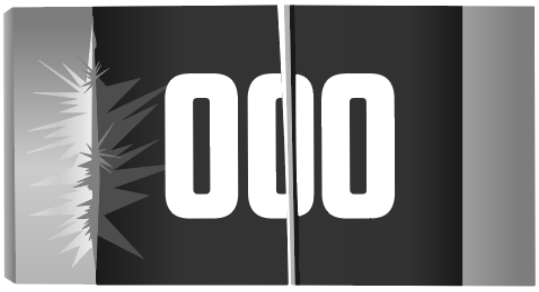
Thick film resistors, known for their cost-effectiveness, typically contain silver in the electrode. To mitigate sulfur’s impact, manufacturers employ innovative solutions:

Mixed Materials in Electrodes:
• Introduces materials like palladium to counteract sulfur-induced corrosion.

Additional Layers in Manufacturing:
• Integrates multiple overcoat layers during production.
• Offers various levels tailored to specific needs and trade-offs.

Ensuring the reliability of anti-sulfur resistors demands stringent testing. The EIA-977 standard, a rigorous testing method, evaluates resistor resilience in sulfur-rich environments.





WRL-L4

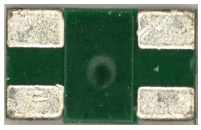
4-Terminal Current Sense

Construction

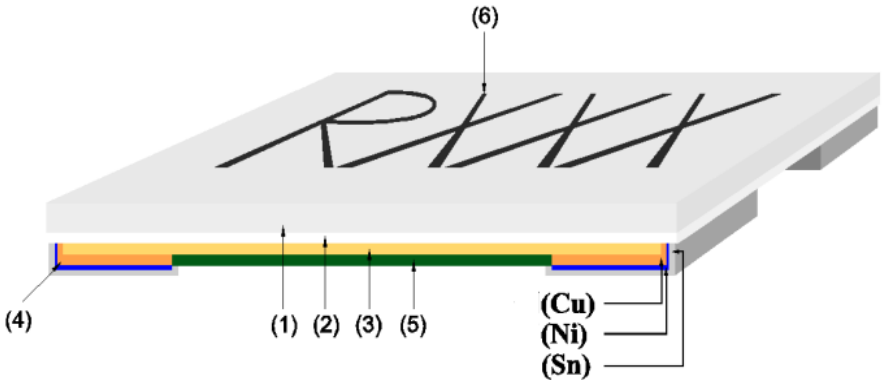
- High purity alumina ceramic
- MnCu resistive element
- Epoxy-resin overcoat
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

- 1206 & 2512 English case sizes
- Power up to 1W
- Resistance from 0.5mΩ, 1mΩ~100mΩ
- TCR down to ±30ppm/°C
- Tolerance down to ±0.3%
- AEC-Q200 Qualified
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification		
Case Size	1206	2512
Power Rating	1/2W	1/3W, 1/2W, 1W
Resistance Range	0.5mΩ and 1mΩ~100mΩ (1mΩ increments)	
TCR (±ppm/°C)	±30, ±50, ±75, ±100	
Operating Temp. Range	-55°C~+155°C	



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

CPA

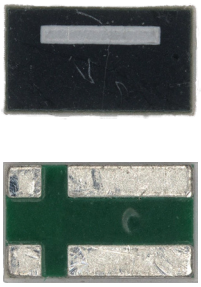
4-Terminal Current Sense

Construction

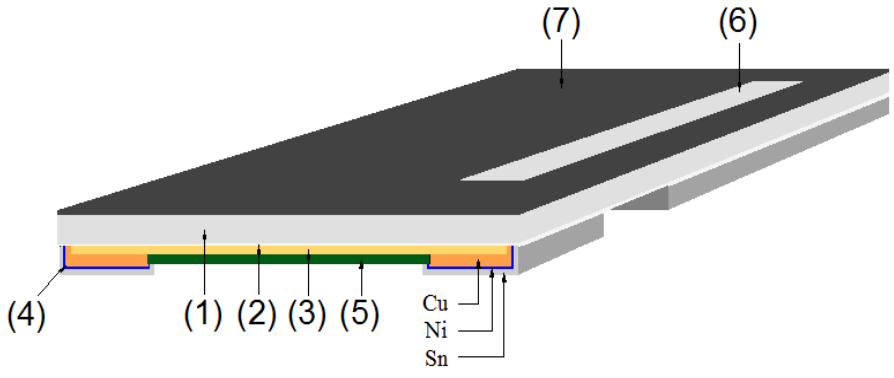
- High purity alumina ceramic
- Ni alloy resistive element
- Epoxy-resin overcoat
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

- 0612 English case sizes
- Power of 1W
- Resistance from 0.5mΩ~25mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification			
Case Size	0612		
Power Rating	1W		
Resistance Range	0.5mΩ, 0.75mΩ	1mΩ~4mΩ	5mΩ~25mΩ
TCR (±ppm/°C)	±150, ±200	±100	±50
Operating Temp. Range	-55°C~+155°C		



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (white)
7. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

FCP

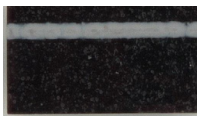
4-Terminal Current Sense

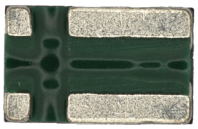
Construction

- Glass epoxy substrate
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

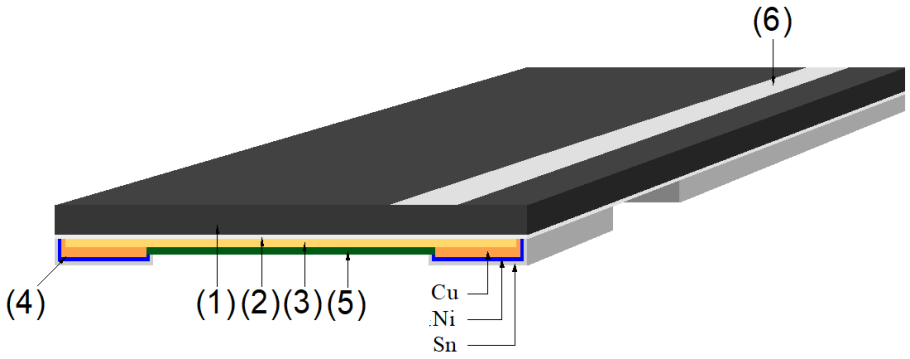
Features

- 0306, 0508, 0612 English case sizes
- Power up to 1W
- Resistance from 0.5mΩ~5mΩ
- TCR's down to ±75ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1





Electrical Specification				
Case Size	0306	0508	0612	
Power Rating	1/2W	1/2W	1W	
Resistance Range	1mΩ~5mΩ	1mΩ~2mΩ	0.5mΩ~0.75mΩ	1mΩ~5mΩ
TCR ±ppm/°C	±100	±100	±100	±75
Operating Temp. Range	-55°C~+155°C			



1. Substrate: Epoxy
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (white)

CPC

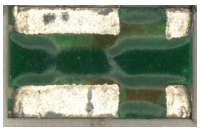
4-Terminal Current Sense

Construction

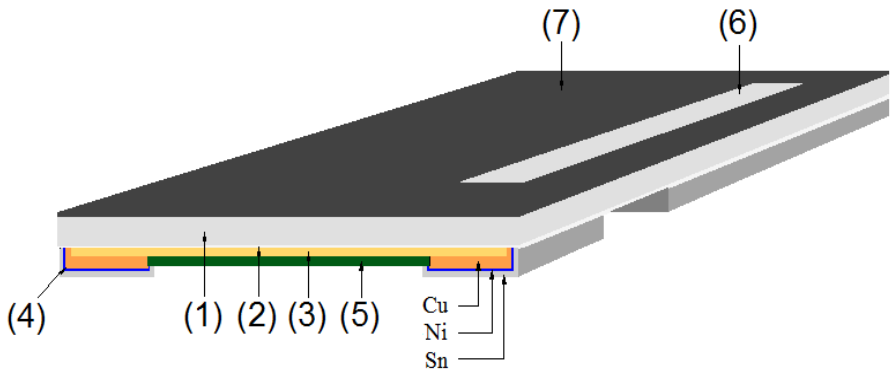
- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

- 0306 English case size
- Power of 1/3W
- Resistance from 1mΩ~50mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification			
Case Size	0306		
Power Rating	1/3W		
Resistance Range	1mΩ~4mΩ	5mΩ~9mΩ	10mΩ~50mΩ
TCR (±ppm/°C)	±100	±50, ±100, ±150	±50, ±100, ±150
Operating Temp. Range	-55°C~+155°C		



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (white)
7. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

MPA

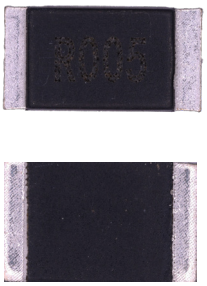
2-Terminal Current Sense

Construction

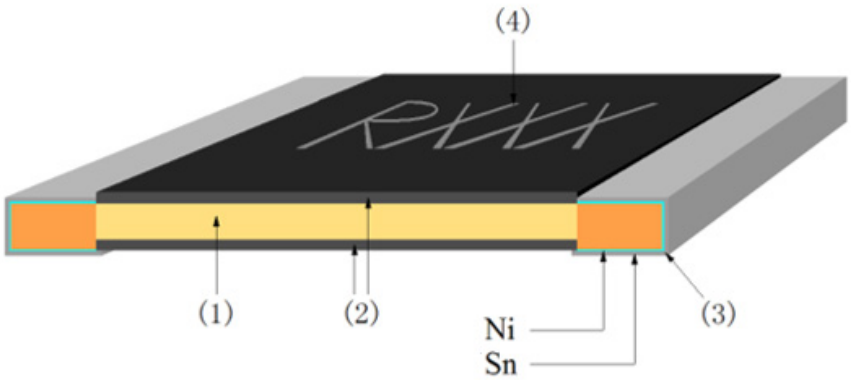
- Complex alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

- 1206 & 2512 English case sizes
- Power up to 3W
- Resistance from 0.5mΩ~56mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification									
Case Size	1206		2512						
Power Rating	1W		2W			3W			
Resistance Range	1mΩ~ 3mΩ	4mΩ~ 15mΩ	0.50mΩ, 0.75mΩ	1mΩ, 1.5mΩ	2mΩ~ 56mΩ	0.50mΩ, 0.75mΩ	1mΩ	2mΩ~ 4mΩ	5mΩ~ 56mΩ
TCR ±ppm/°C	±150	±75	±150	±100	±50	±150	±100	±50	
Operating Temp. Range	-55°C~+170°C								



1. Resistive Element:Cu- Alloy
2. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)
3. Plating Electrode Sn, Ni
4. Marking: Laser Marking

MPC

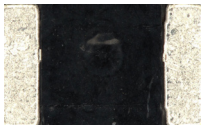
2-Terminal Current Sense

Construction

- Cu alloy resistive element
- Epoxy-resin overcoat
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

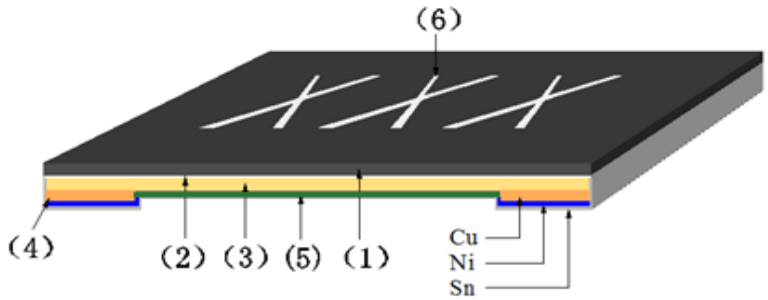
Features

- 0201, 0402, 0603, 0805, 1206 English case sizes
- Power up to 1W
- Resistance from 1mΩ~50mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification								
Case Size	0201		0402			0603		
Power Rating	1/4W		1/3W		1/4W	1/3W		
Resistance Range	10mΩ	20mΩ	2.5mΩ~3mΩ	5mΩ~25mΩ	40mΩ~50mΩ	2mΩ	2.5mΩ~5mΩ	6mΩ~20mΩ
TCR ±ppm/°C			±150	±100			±100	±75
Operating Temp. Range	-55°C~+155°C							

Electrical Specification						
Case Size	0805				1206	
Power Rating	1/2W				1W	
Resistance Range	1mΩ	1.5mΩ	2mΩ~5mΩ	6mΩ~20mΩ	1mΩ~4mΩ	5mΩ~20mΩ
TCR ±ppm/°C	±150	±100	±75	±50	±75	±50
Operating Temp. Range	-55°C~+155°C					



1. Substrate: Glass Epoxy
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WEL

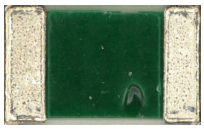
2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

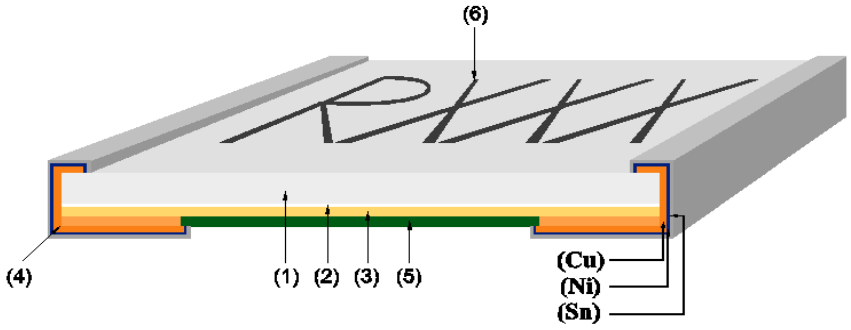
- 0603, 0805, 1206, 2010, 2512, 4320, 4527 English case sizes
- Power up to 4W
- Resistance from 2mΩ~700mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification						
Case Size	0603		0805		1206	
Power Rating	1/2W		3/4W		1W	
Resistance Range	5mΩ~9mΩ	10mΩ~100mΩ	3mΩ	4mΩ~500mΩ	3mΩ	4mΩ~700mΩ
TCR ±ppm/°C	±75	±50	±75	±50	±75	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	2010		2512		4320	
Power Rating	1 1/2W		2W		3W	
Resistance Range	2mΩ~9mΩ	10mΩ~700mΩ	2mΩ~3mΩ	4mΩ~700mΩ	2mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±75	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification		
Case Size	4527	
Power Rating	4W	
Resistance Range	2mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50
Operating Temp. Range	-55°C~+155°C	



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WEL: Long-Side

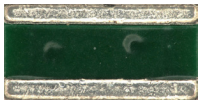
2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

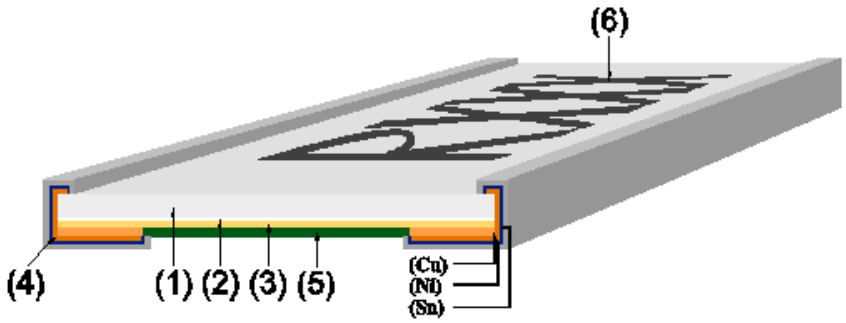
- 0508, 0612, 0815, 1020, 1225, 0830, 1530, 1836, 2043 English case sizes
- Power up to 5W
- Resistance from 1mΩ~100mΩ
- TCR's down to ±50ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification						
Case Size	0508		0612		0815	
Power Rating	1W		1 1/2W		2W	
Resistance Range	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification							
Case Size	1020			1225		0830	
Power Rating	2W			3W		3W	
Resistance Range	0.5mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±150	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C						

Electrical Specification						
Case Size	1530		1836		2043	
Power Rating	4W		4W		5W	
Resistance Range	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WEL Auto

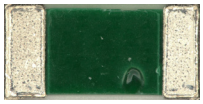
2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

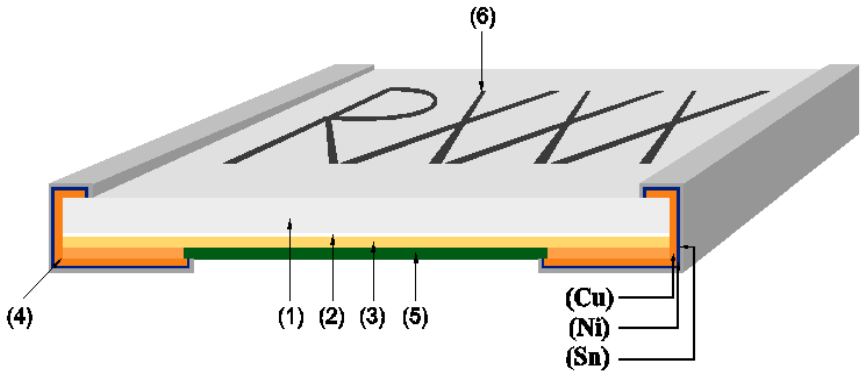
Features

- 0603, 0805, 1206, 2010, 2512, 4320, 4520 English case sizes
- Power up to 2W
- Resistance from 3mΩ~570mΩ
- TCR down to ±50ppm/°C
- Tolerance down to ±0.5%
- AEC-Q200 Qualified
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification						
Case Size	0603		0805		1206	
Power Rating	1/2W		3/4W		1W	
Resistance Range	5mΩ~9mΩ	10mΩ~20mΩ	5mΩ~9mΩ	10mΩ~200mΩ	3mΩ~9mΩ	10mΩ~570mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification			
Case Size	2010		2512
Power Rating	1 1/2W		2W
Resistance Range	5mΩ~9mΩ	10mΩ~300mΩ	50mΩ~350mΩ
TCR ±ppm/°C	±100	±50	±50
Operating Temp. Range	-55°C~+155°C		



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2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WEL Auto: Long-Side

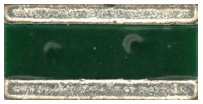
2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

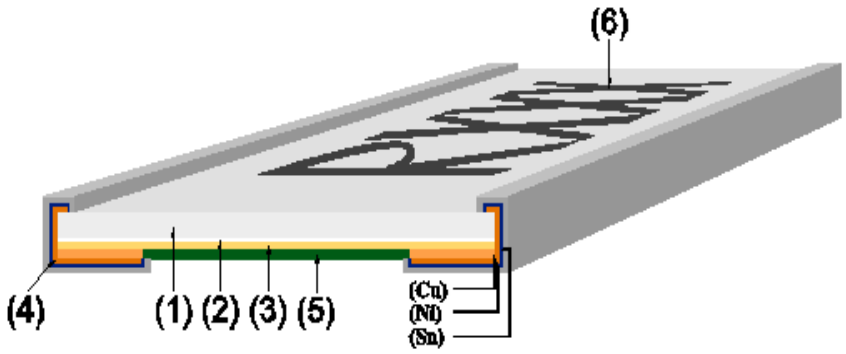
Features

- 0508, 0612, 0815, 1020, 1225, 0830 English case sizes
- Power up to 3W
- Resistance from 1mΩ~100mΩ
- TCR's down to ±50ppm/°C
- Tolerance down to ±0.5%
- AEC-Q200 Qualified
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification				
Case Size	0508		0612	
Power Rating	1W		1 1/2W	
Resistance Range	2mΩ~9mΩ	10mΩ~100mΩ	2mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C			

Electrical Specification						
Case Size	1020		1225		0830	
Power Rating	2W		3W		3W	
Resistance Range	2mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WKL

2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

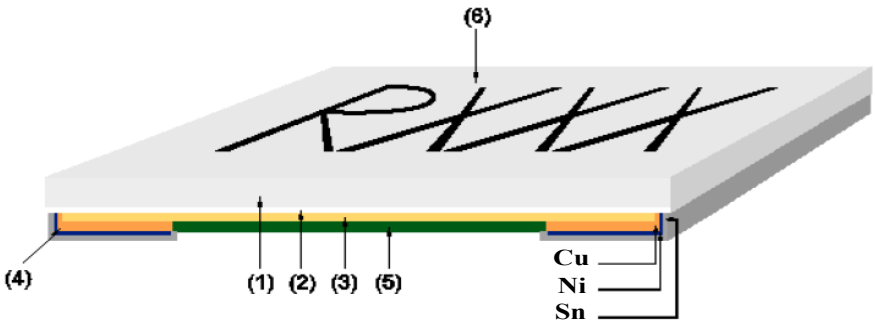
Features

- 0603, 0805, 1206, 2010, 2512, 4320, 4527 English case sizes
- Power up to 4W
- Resistance from 2mΩ~700mΩ
- TCR's down to ±50ppm/°C
- Tolerance down to ±0.5%
- AEC-Q200 qualified
- Moisture Sensitivity Level (MSL) = 1

Electrical Specification						
Case Size	0603		0805		1206	
Power Rating	1/2W		3/4W		1W	
Resistance Range	5mΩ~9mΩ	10mΩ~100mΩ	3mΩ~9mΩ	10mΩ~500mΩ	3mΩ~9mΩ	10mΩ~700mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	2010		2512		4320	
Power Rating	1 1/2W		2W		3W	
Resistance Range	2mΩ~9mΩ	10mΩ~700mΩ	2mΩ~9mΩ	10mΩ~700mΩ	2mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification		
Case Size	4527	
Power Rating	4W	
Resistance Range	2mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50
Operating Temp. Range	-55°C~+155°C	



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

WKL: Long-Side

2-Terminal Current Sense

Construction

- High purity alumina ceramic
- Cu alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

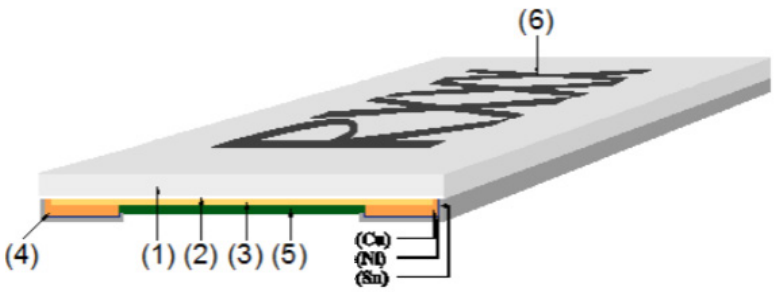
Features

- 0508, 0612, 0815, 1020, 1225, 0830, 1530, 1836, 2043 English case sizes
- Power up to 5W
- Resistance from 1mΩ~100mΩ
- TCR's down to ±50ppm/°C
- Tolerance down to ±0.5%
- AEC-Q200 qualified
- Moisture Sensitivity Level (MSL) = 1

Electrical Specification						
Case Size	0508		0612		0815	
Power Rating	1W		1 1/2W		2W	
Resistance Range	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	1020		1225		0830	
Power Rating	2W		3W		3W	
Resistance Range	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	1530		1836		2043	
Power Rating	4W		4W		5W	
Resistance Range	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ	1mΩ~9mΩ	10mΩ~100mΩ
TCR ±ppm/°C	±100	±50	±100	±50	±100	±50
Operating Temp. Range	-55°C~+155°C					



1. Substrate: Alumina Ceramic
2. Adhesion Layer: Epoxy
3. Resistive Element: Cu-Alloy
4. Terminal Electrode: Sn, Ni, Cu
5. Protective Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (green)
6. Marking Coating: Flame-retardant epoxy, meets UL-94-V0 requirements (black)

LPC

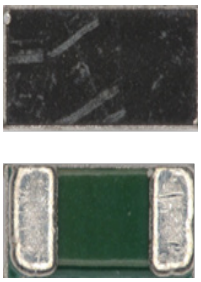
Jumper

Construction

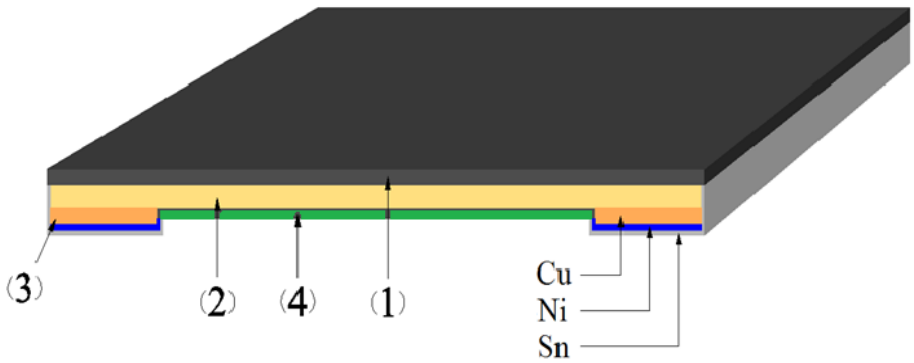
- Cu metal foil resistive element
- Epoxy-resin overcoat
- Non-wrapped terminations
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb Free
- Inherently Anti-Sulfur

Features

- 0201, 0402, 0603, 0805, and 1206 English case sizes
- Max current up to 40 Amps
- Max resistance of up to 1mΩ
- Low profile (0201: 0.21in max.; 0402:0.45in max.; 0603:0.60in max.; 0805-1206:0.60in max.)
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification					
Case Size	0201	0402	0603	0805	1206
Max Current	8.0A	20A	26A	35A	40A
Resistance Range	1mΩ max	0.5mΩ max	0.2mΩ max		
Operating Temp. Range	-55°C~+155°C	-55°C~+170°C			



1. Substrate: Glass Epoxy
2. Resistive Element: Cu-Alloy
3. Terminal Electrode: 100% matte Sn
4. Protection Coating: Epoxy-Resin

KN

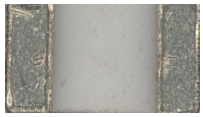
Thin Film

Construction

- High purity alumina ceramic
- Ni alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

Features

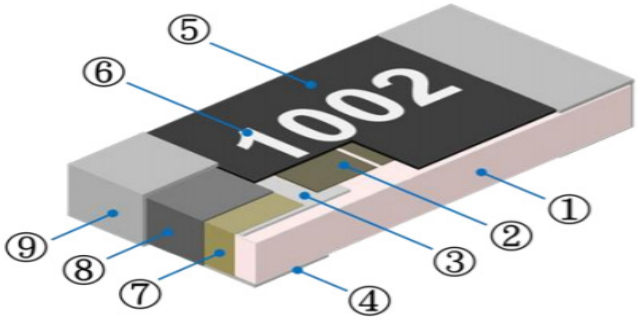
- 0201, 0402, 0603, 0805, 1206, 1210, 2010, and 2512 English case sizes
- Power up to 3/4W
- Resistance from 2.49Ω~1.5MΩ
- TCR down to ±10ppm/°C
- Tolerance down to ±0.1%
- Moisture Sensitivity Level (MSL) = 1



Electrical Specification						
Case Size	0201		0402		0603	
Power Rating	1/20W		1/16W		1/10W	
Resistance Range	22Ω~5KΩ	22Ω~75KΩ	10Ω~68KΩ	2.49Ω~220KΩ	10Ω~332KΩ	2.49Ω~680KΩ
TCR ±ppm/°C	±10, ±15	±25, ±50	±10, ±15	±25, ±50	±10, ±15	±25, ±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	0805		1206		1210	
Power Rating	1/8W		1/4W		1/4W	
Resistance Range	10Ω~680KΩ	2.49Ω~1MΩ	10Ω~1MΩ	2.49Ω~1.5MΩ	10Ω~1MΩ	2.49Ω~1MΩ
TCR ±ppm/°C	±10, ±15	±25, ±50	±10, ±15	±25, ±50	±10, ±15	±25, ±50
Operating Temp. Range	-55°C~+155°C					

Electrical Specification				
Case Size	2010		2512	
Power Rating	1/2W		3/4W	
Resistance Range	10Ω~1MΩ	2.49Ω~1MΩ	10Ω~1MΩ	2.49Ω~1MΩ
TCR ±ppm/°C	±10, ±15	±25, ±50	±10, ±15	±25, ±50
Operating Temp. Range	-55°C~+155°C			



1. Alumina substrate
2. Resistive layer
3. Top inner electrode
4. Bottom inner electrode
5. Protective overcoat
6. Marking
7. Side inner electrode
8. Nickel barrier
9. Solder coating (Sn)

KU

Thin Film

Construction

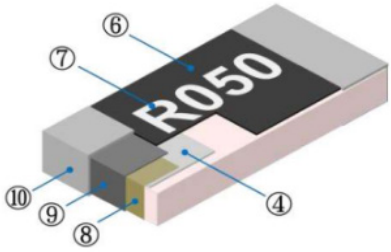
- Metal plate resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- Inherently Anti-Sulfur

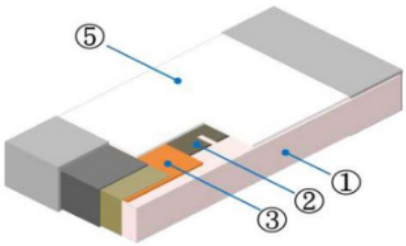
Features

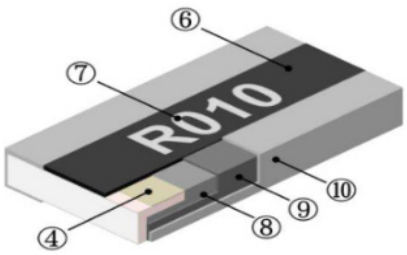
- 0201, 0402, 0603, 0805, 1206, 1210, 2010, 2512 English case sizes
- Power up to 3W
- Resistance from 10mΩ~10Ω
- TCR down to ±50ppm/°C
- Tolerance down to ±0.25%
- Moisture Sensitivity Level (MSL) = 1

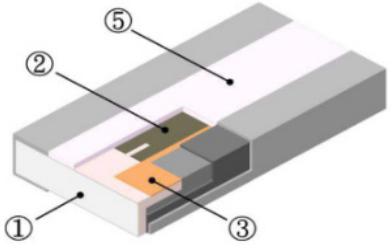
Electrical Specification						
Case Size	0201	0402	0603	0805	1206	1210
Power Rating	1/20W, 1/10W, 1/5W	1/16W, 1/8W, 1/4W	1/10W, 1/5W, 2/5W	1/8W, 1/4W, 1/2W	1/4W, 1/2W, 1W	1/2W, 1W
Resistance Range	50mΩ~10Ω			39mΩ~10Ω		
TCR ±ppm/°C	±50, ±100			±50, ±100, ±150		
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	2010	2512	0508	0612	1020	1225
Power Rating	3/4W, 1 1/2W	1W, 2W, 3W	1W	1W	2W	3W
Resistance Range	100mΩ~10Ω		10mΩ~2Ω			
TCR ±ppm/°C	±50, ±100, ±150		±100, ±150			
Operating Temp. Range	-55°C~+155°C					









1. Alumina substrate
2. Resistive layer
3. Bottom inner electrode (Cu)
4. Top inner electrode
5. Bottom protective overcoat (White: ≥39mΩ | Green: <39mΩ)
6. Top protective overcoat
7. Marking
8. Side inner electrode
9. Barrier layer (Ni)
10. Solder coating (Sn)

KS

Thin Film

Construction

- High purity alumina ceramic
- Ni alloy resistive element
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- High-Grade Anti-Sulfur

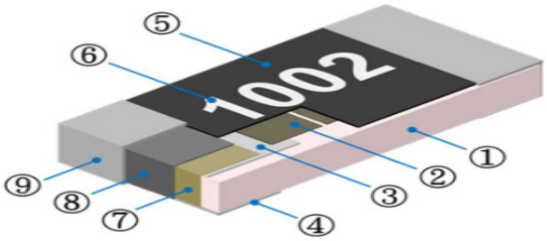
Features

- 0402, 0603, 0805, 1206, 1210, 2010, and 2512 English case sizes
- Power up to 1W
- Resistance from 1Ω~100KΩ
- TCR down to ±10ppm/°C
- Tolerance down to ±0.1%
- Moisture Sensitivity Level (MSL) = 1

Electrical Specification						
Case Size	0402		0603		0805	
Power Rating	1/10W		1/8W		1/4W	
Resistance Range	1Ω~<10Ω	10Ω~10KΩ	1Ω~<10Ω	10Ω~47KΩ	1Ω~<10Ω	10Ω~100KΩ
TCR ±ppm/°C	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100
Operating Temp. Range	-55°C~+155°C					

Electrical Specification						
Case Size	1206		1210		2010	
Power Rating	1/2W		1/2W		3/4W	
Resistance Range	1Ω~<10Ω	10Ω~100KΩ	1Ω~<10Ω	10Ω~100KΩ	1Ω~<10Ω	10Ω~100KΩ
TCR ±ppm/°C	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100
Operating Temp. Range	-55°C~+155°C					

Electrical Specification		
Case Size	2512	
Power Rating	1W	
Resistance Range	1Ω~<10Ω	10Ω~100KΩ
TCR ±ppm/°C	±25, ±50, ±100	±10, ±15, ±25, ±50, ±100
Operating Temp. Range	-55°C~+155°C	



1. Alumina substrate
2. Resistive layer
3. Top inner electrode
4. Bottom inner electrode
5. Protective overcoat
6. Marking
7. Side inner electrode
8. Nickel barrier
9. Solder coating (Sn)

TFAS

Thick Film

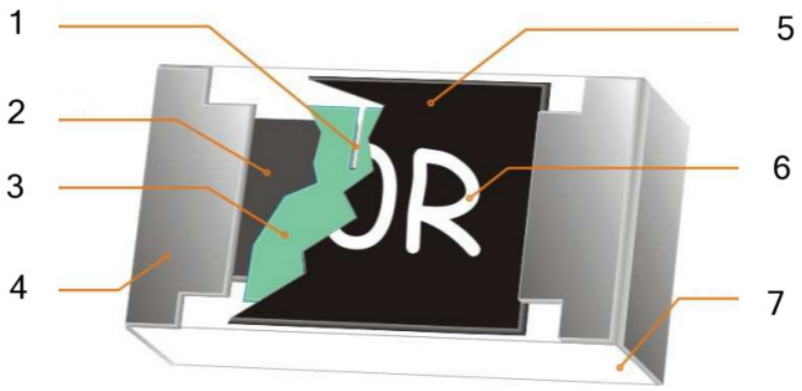
Construction

- High purity alumina ceramic
- Epoxy-resin overcoat
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- High-Grade Anti-Sulfur

Features

- 0402, 0603, 0805, 1206, 1210, 2010, and 2512 English case sizes
- Power up to 1W
- Resistance from 1Ω~10MΩ + Jumper
- TCR down to ±100ppm/°C
- Tolerance down to ±1.0%
- Moisture Sensitivity Level (MSL) = 1

Electrical Specification							
Case Size	0402	0603	0805	1206	1210	2010	2512
Power Rating	1/16W	1/10W	1/8W	1/4W	1/3W	1/2W	1W
Resistance Range (mΩ)	1Ω to 10MΩ+Jumper (0Ω)						
TCR ±ppm/°C	±100, ±200, ±400					±100, ±200	
Operating Temp. Range	-55°C~+155°C						



1. Laser Trimmed
2. Resistive Element
3. Primary Layer
4. Termination
5. Protective Layer
6. Marking
7. Alumina Substrate

KGAS

Thick Film

Construction

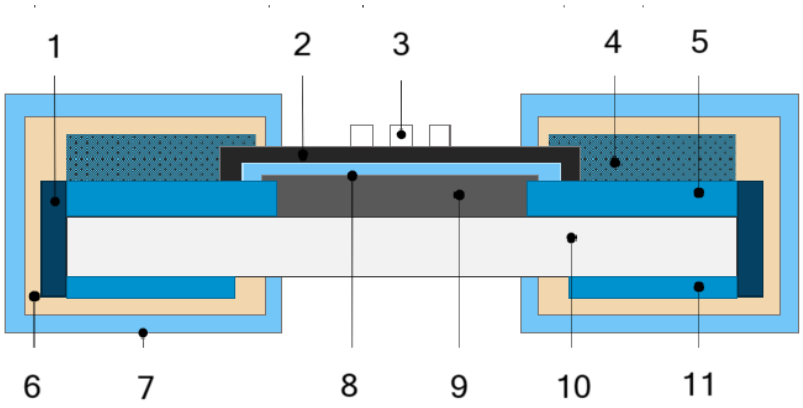
- High purity alumina ceramic
- 100% matte tin over Ni terminations
- Halogen Free
- RoHS compliant and Pb free
- High-Grade Anti-Sulfur

Features

- 0402, 0603, 0805, 1206, 1210, 1218, 1812, 2010, and 2512 English case sizes
- Power up to 1W
- Resistance from 1Ω~10MΩ + Jumper
- TCR down to ±100ppm/°C
- Tolerance down to ±0.5%
- Moisture Sensitivity Level (MSL) = 1

Electrical Specification						
Case Size	0402	0603	0805	1206	1210	1218
Power Rating	1/16W	1/10W	1/8W	1/4W	1/2W	1W
Resistance Range (mΩ)	1Ω to 10MΩ+Jumper (0Ω)					
TCR ±ppm/°C	±100, ±400					
Operating Temp. Range	-55°C~+155°C					

Electrical Specification			
Case Size	1812	2010	2512
Power Rating	3/4W	3/4W	1W
Resistance Range (mΩ)	1Ω to 10MΩ+Jumper (0Ω)		
TCR ±ppm/°C	±100, ±400		
Operating Temp. Range	-55°C~+155°C		



1. Alumina Substrate
2. Back side electrode
3. Top side electrode
4. Secondary top side electrode
5. R-Layer
6. Primary overcoat
7. Secondary overcoat
8. Marking
9. Edge electrode
10. Inner termination
11. Outside termination

QUALITY COMPONENTS WORLDWIDE

Thin Film Technology delivers quality products and services to customers on an ongoing basis. The implementation and maintenance of ISO certified quality management systems helps us to obtain our mission of “Total Customer Satisfaction” with production and operations worldwide.

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