KOA Europe GmbH

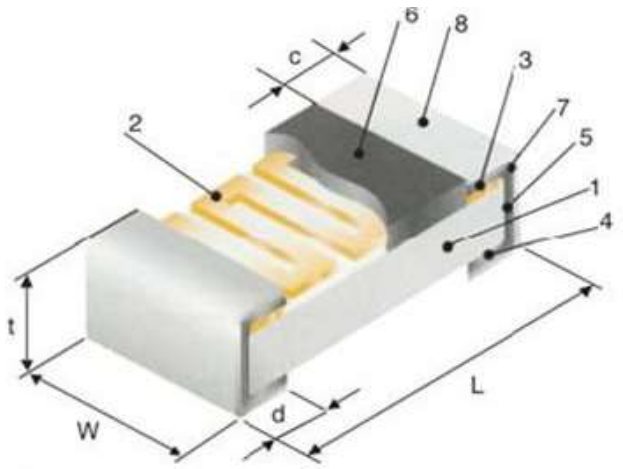
THIN FILM

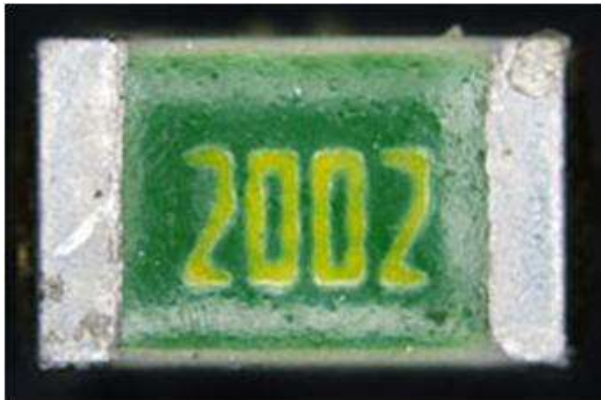
RN73 - RN73R - RN73H

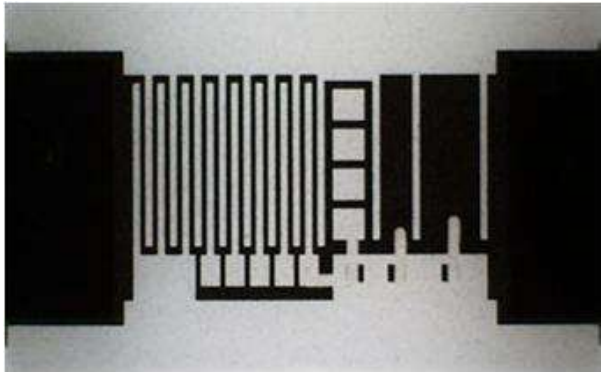
2021-02-17

Thin Film Series Comparison

Thin Film Flat Chip Construction







Laser Trimming

Structure

1	Ceramic substrate	
2	NiCr Metal fil	~ 0,2 µm
3	Top termination (CrNiCu)	
4	Bottom termination (CrNiCu)	
5	End termination (NiCr)	
6	Protective coat	
7	Ni Barrier	
8	Sn plating	

What are the Main Advantages of Thin Film?

Advantages of Thin Film Technology

- High precision initial tolerances down to ±0.05 %
- Extremely low T.C.R. down to ±5 ppm/K
- Higher stability over lifetime than thick film resistors
- Low drift of resistance value
- Low current noise, excellent linearity
- More stable in higher frequencies
- Better short time overload
- Better resistance to soldering heat
- No sulfuration of terminations
- Operating temperature performance up to +155 ºC

Thin Film Series Comparison

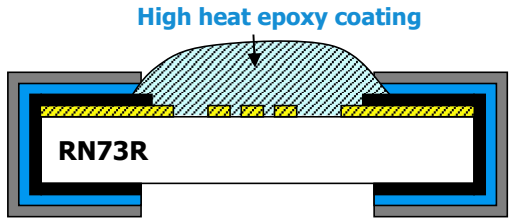
Automotive

RN73R & RN73H Features

RN73R

Features

- Improved resistance to electric corrosion and stability compared to RN73
- Excellent heat resistance
  - ✓ Operating temperature range: -55 ºC ~ +155 ºC
  - ✓ High power rating at rated ambient temperature +85 ºC
- Improved moisture resistance of 0.25 % (+85 ºC ambient, 85 %, 1000 hrs)
- AEC-Q200 qualified, Sulfur resistance verified according to ASTM B 809-95

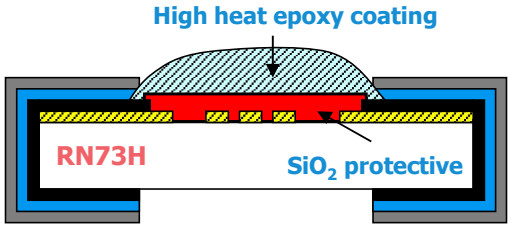


=> Recommendation is RN73R instead of RN73 for new designs (planned EOL for RN73 is 2022)

RN73H

Features

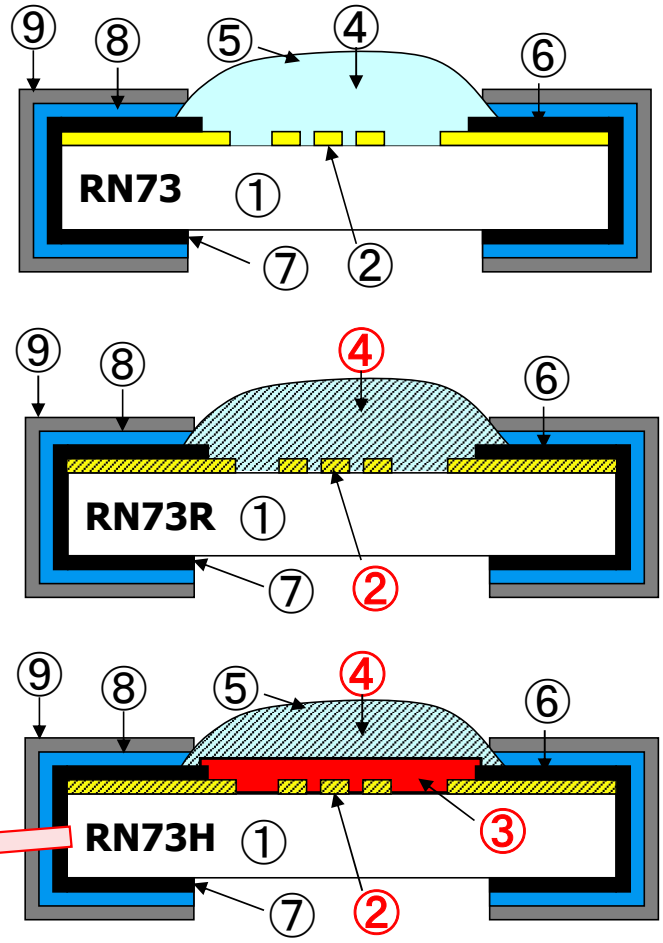
- Recommended for automotive applications
- Excellent moisture resistance and high heat resistance by special resistive film and protective coating
- Additional inorganic passivation
- Improved moisture resistance of 0.1 % (+85 ºC ambient, 85 %, 1000 hrs)
- Load live also specified and tested at +85 ºC ambient, 3000 hrs
- AEC-Q200 qualified, Sulfur resistance verified according to ASTM B 809-95



=> Recommendation is RN73H for highest reliability

Thin Film Series Comparison

Structural Differences



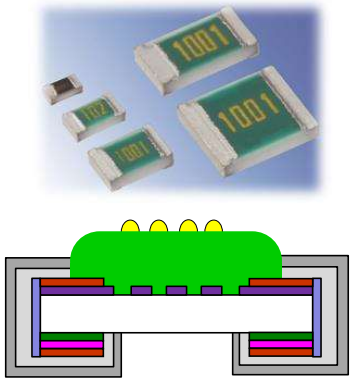
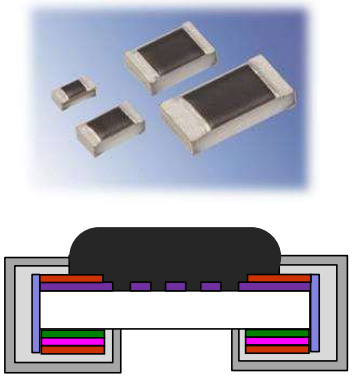
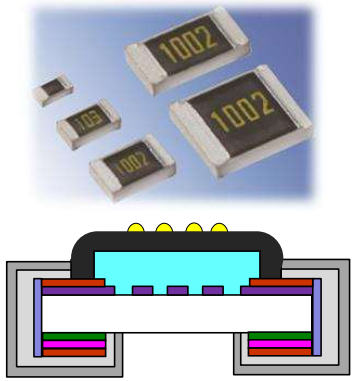
RN73H

Excellent moisture resistance and high heat resistance by special resistive film and special protection

No.	Name	Material
①	Substrate	Alumina ceramic Al_2O_3
	Resistive film	
②	RN73	NiCr metal film
②	RN73R / RN73H	High heat resistant metal film
③	Inner Protective coating RN73H	SiO_2
	Over coating	
④	RN73	High purity epoxy resin
④	RN73R / RN73H	High heat resistant
⑤	Marking	
	RN73R	No marking
	RN73 / RN73H	High purity epoxy resin
⑥	Inner electrode film (Top/Bottom)	CrNiCu Metal film
⑦	Inner electrode edge film	NiCr metal film
⑧	Middle layer Electrode	Ni plating
⑨	Outer layer Electrode	Sn plating

Thin Film Series Comparison

Structural Differences

	RN73	RN73R	RN73H
Structure			
Substrate	□:Al_2O_3	□:Al_2O_3	□:Al_2O_3
Metal Film Resistor	■:Metal-*A*	■:Metal-*B*	■:Metal-*B*
Inner protective coat	—	—	■:Si*X*
Environmental Seal	■:Epoxy Resin	■:Epoxy Resin	■:Epoxy Resin
Marking	■:Epoxy Resin	—	■:Epoxy Resin
Under layer Electrode (Top/Bottom)	■:Cr ■:Ni ■:Cu	■:Cr ■:Ni ■:Cu	■:Cr ■:Ni ■:Cu
Under layer Electrode (Edge)	■:NiCr Alloy	■:NiCr Alloy	■:NiCr Alloy
Middle/Top Electrode	■:Ni Plating ■:Sn Plating	■:Ni Plating ■:Sn Plating	■:Ni Plating ■:Sn Plating

Comparison of Ratings

		RN73		RN73R	RN73H
		General	High Power		
Power Rating	1E (0402)	0.063 W	-	**0.063 W**	
	1J (0603)	0.063 W	0.1 W	**0.1 W**	
	2A (0805)	0.1 W	0.125 W	**0.125 W**	
	2B (1206)	0.125 W	0.25 W	**0.25 W**	
	2E (1210)	0.25 W	-	**0.25 W**	
Max. Working Voltage	1E (0402)	50 V			
	1J (0603)	75 V			
	2A (0805)	150 V			
	2B (1206)	200 V			
	2E (1210)	200 V			
Max. Overload Voltage	1E (0402)	100 V			
	1J (0603)	150 V			
	2A (0805)	300 V			
	2B (1206)	400 V			
	2E (1210)	400 V			
Rated Ambient Temperature		+70 °C		**+85 °C**	
Operating Temperature Range		+55 °C ~ +155 °C			
T.C.R. Condition		+25 °C / -55 °C and +25 °C / +125 °C			

Comparison of Performance

(specification values)		RN73	RN73R	RN73H
Rated ambient temperature		+70 ºC	**+85 ºC**	**+ 85ºC**
Short time overload	Rated voltage x 2.5 or Max. overload vol., whichever is less, for 5s	±0.1 %: General ±0.5 %: High Power	**±0.05 %**	**±0.05 %**
Resistance to soldering heat	260ºC±5ºC, 10s±1s	±0.1%	**±0.05 %**[*1]	**±0.05 %**[*1]
Temp Cycling / Rapid change of temperature	−55ºC(30min.) / +125ºC(30min.) 300 cycles	±0.25%	-	**-**
	1E, 1J, 2A: −55ºC(30min.) / +155ºC(30min.) 1000 cycles 2B: −55ºC(30min.) / +155ºC(30min.) 500 cycles	-	**±0.1 %**[*1]	**±0.1 %**[*1]
Moisture Resistance	+40ºC±2ºC, 90%~95%RH, 1000h, 1.5h ON / 0.5h OFF cycle	±0.5 %: General ±0.5 %: High Power	-	**-**
	+85ºC±2ºC, 85%±5%RH, 1000h, 1.5h ON / 0.5h OFF cycle	-	±0.25 %	**±0.1 %**[*1]
Load Life / Endurance at +70 ºC, +85ºC	+70ºC±2ºC, 1000h 1.5h ON / 0.5h OFF cycle	±0.25 %: General ±0.5 %: High Power	-	**-**
	+85ºC±2ºC, 1000h 1.5h ON / 0.5h OFF cycle	-	**±0.1 %** (1000 h)	**±0.1 %** (3000 h)
High temperature Exposure	+155ºC, 1000h	±0.5 %	±0.25 %	**±0.1 %**[*1]

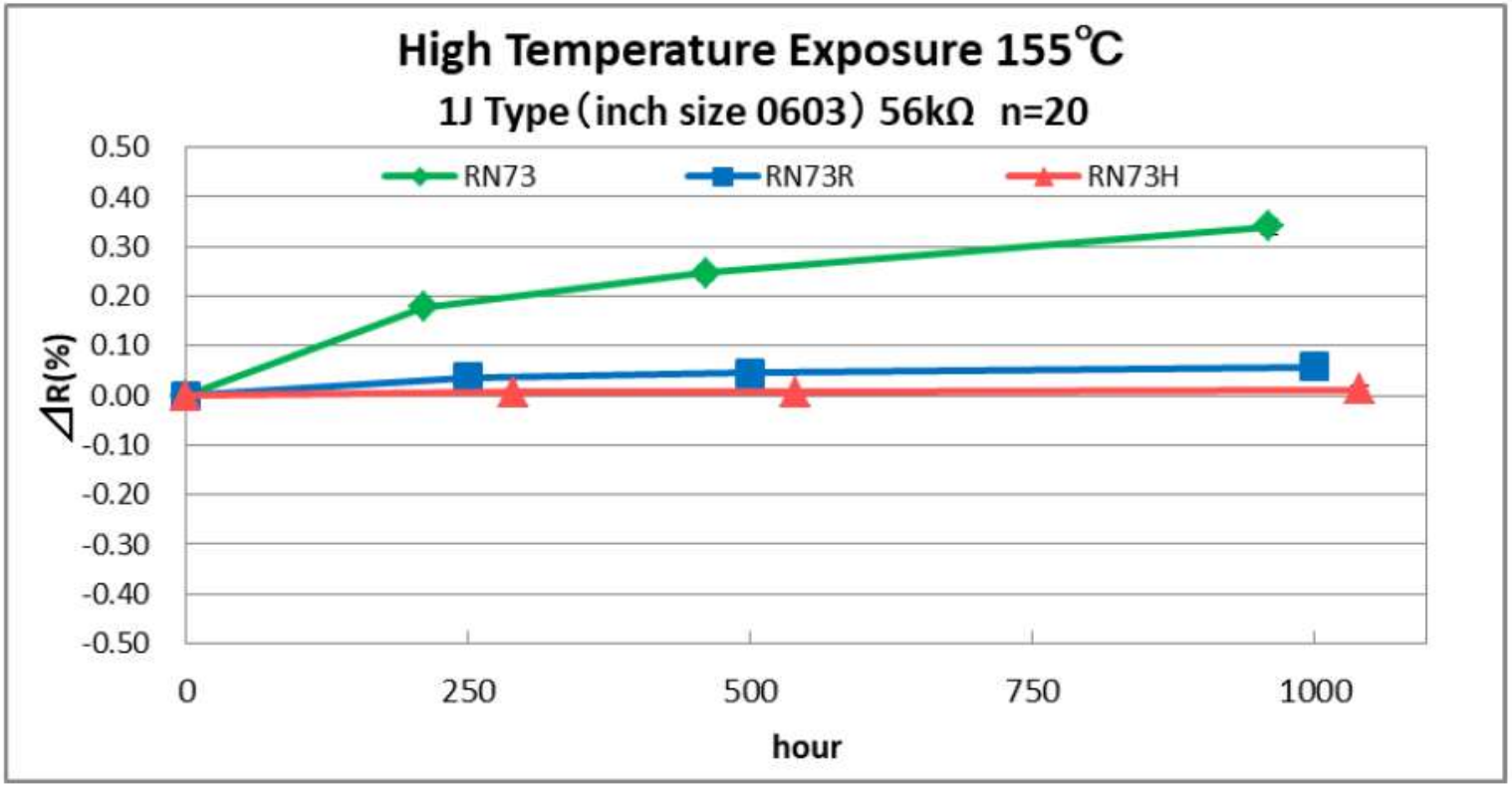
*1 Depends on resistance value.

=> The RN73H-series is especially recommended for automotive applications.

Comparison of Performance

High temperature exposure

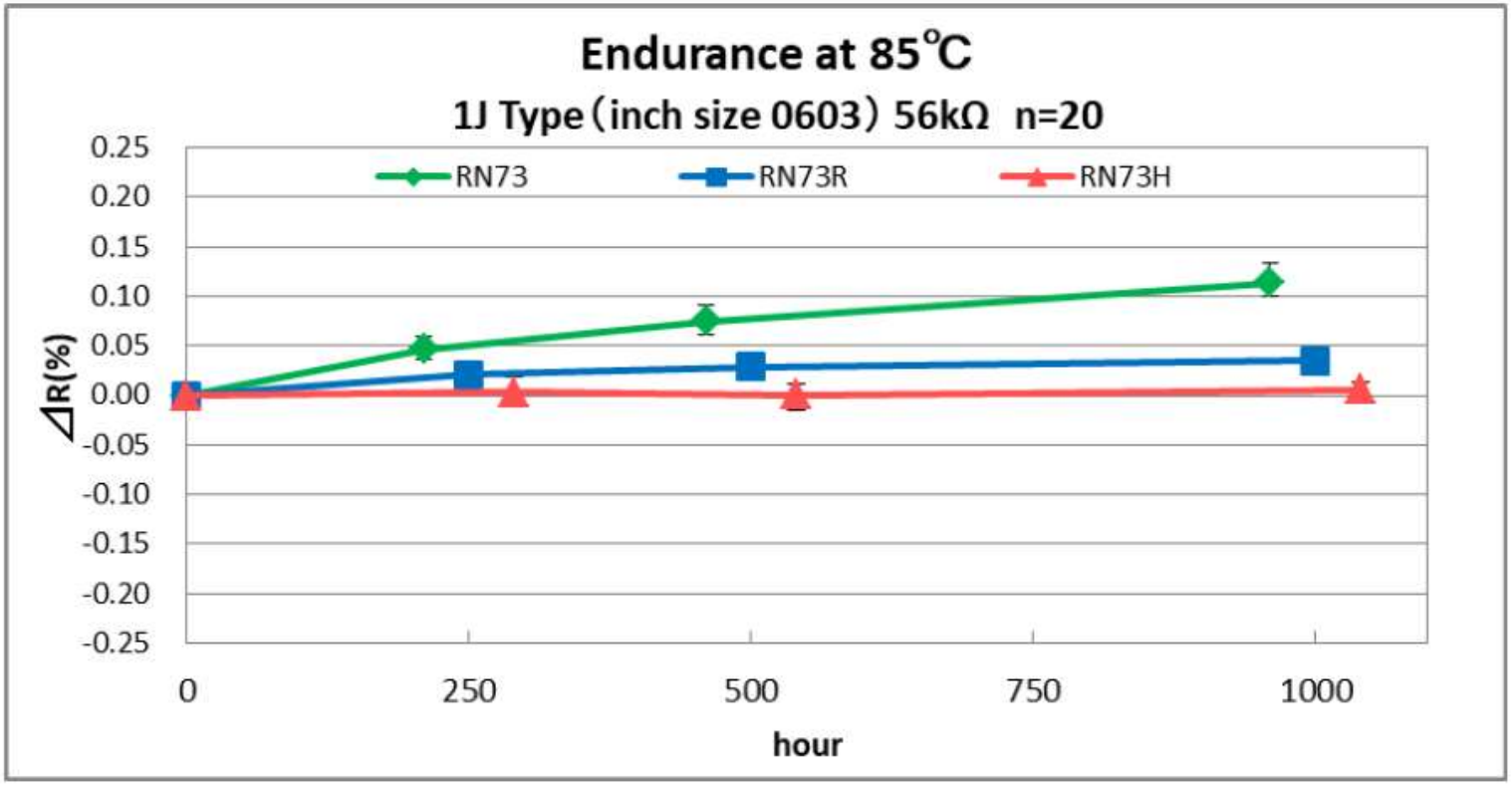
155°C (loaded 0% of rated power)



Comparison of Performance

Endurance at 85°C

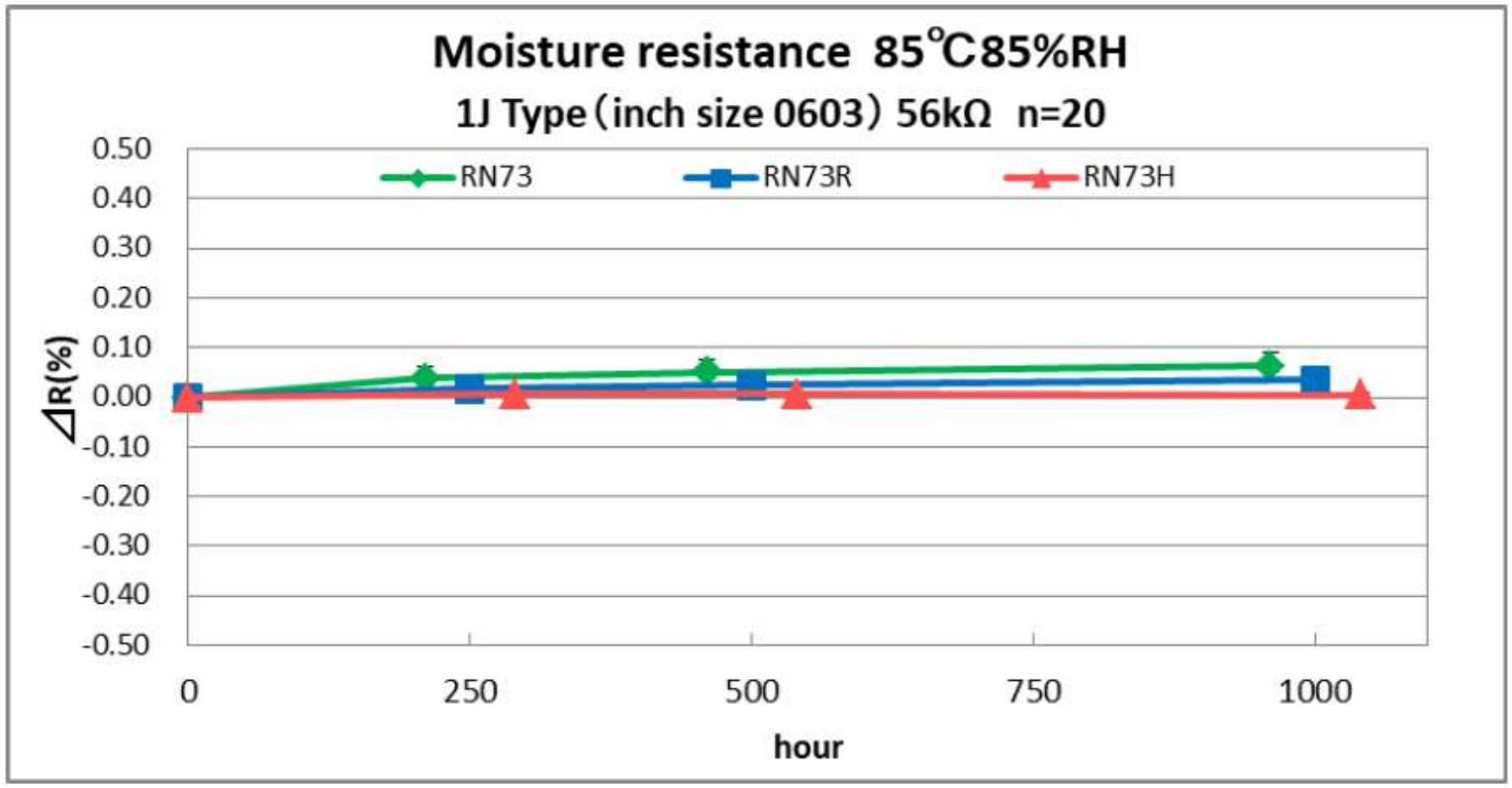
85°C applied voltage



Comparison of Performance

Moisture resistance

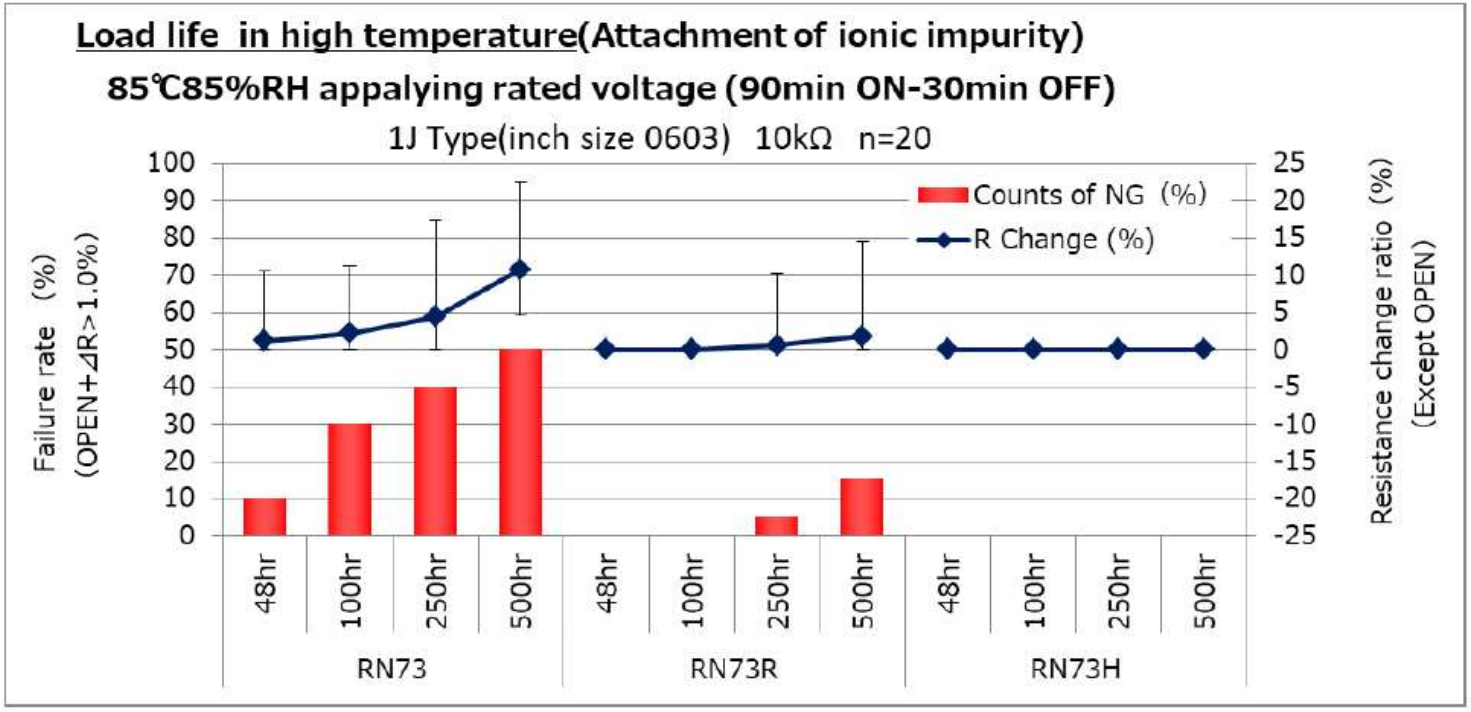
85°C 85%RH applied voltage



Comparison of Performance

Moisture resistance

85°C 85%RH applied voltage (Attachment of ionic impurity)



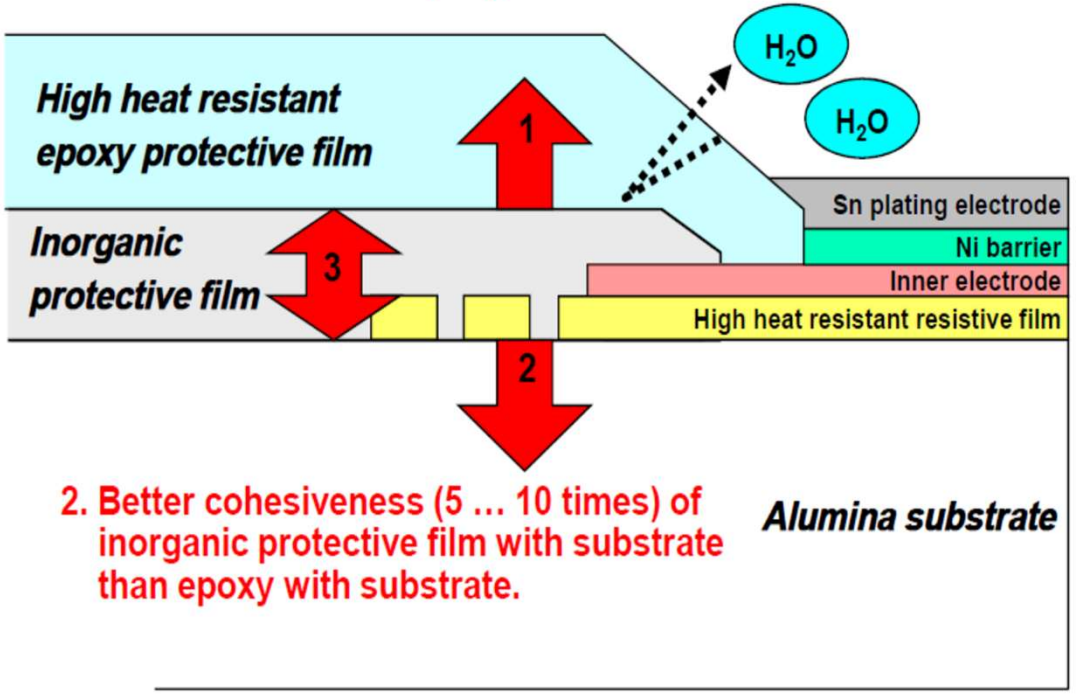
RN73 : Using RN73 series under harsh environment can cause breaking by electric corrosion.
RN73R : Electric corrosion performance is improved compared with RN73 series.
RN73H : RN73H had no electric corrosion. The extra protective coat shut off the moisture

Please note that the possibility of various troubles occurring when the product is excessively contaminated becomes high.

RN73H Internal Structure

Effect of Inorganic Protection

1. Better cohesiveness (1.5 times) of epoxy with inorganic protective film than epoxy with substrate or resistive film



3. Hygroscopicity decreased from 1/10 to 0

2. Better cohesiveness (5 … 10 times) of inorganic protective film with substrate than epoxy with substrate.

Thank you very much for your attention

Newsletter

Subscribe to our newsletter:

https://koaeurope.de/newsletter/