NCLH Series

AEC-Q200 Metall Alloy Current Sensing Resistors

AEC-Q200 QUALIFIED

ROHS/REACH COMPLIANT HALOGEN FREE

COMPONENTS
Performance Passives By Design

FEATURES

- WIDE RANGE OF RESISTANCE VALUES
- 0.2mΩ ~ 500mΩ RESISTANCE RANGE & JUMPER
- RESISTOR TOLERANCES DOWN TO ±0.5%
- LOW TCR OPTIONS DOWN TO ≤±50 PPM/°C
- HIGH POWER CAPABILITY UP TO 5 WATT
- OPERATING TEMPERATURE UP TO 170°C
- OPTIONAL AEC-Q200 QUALIFIED FOR AUTOMOTIVE APPLICATIONS (SEE PART NUMBER SYSTEM FOR DETAILS)

SPECIFICATIONS

Type	EIA Size	Power Rating & Code At 70°C	TCR (PPM/°C)	Max.*1 Current Rating	Max.*2 Overload Current	Resistance Range 1% (F) 2% (G), 5% (J)	Temperature Range
NCLH1206	1206	0.5W	≤±50ppm	22.36	50.00	1.0mΩ ~ 75mΩ	-55 °C ~ +170°C
		0.75W (M)		27.38	61.23	1.0mΩ ~ 75mΩ	
		1.0W (H)		31.62	70.71	1.0mΩ ~ 50mΩ	
		1.5W (U)		38.72	86.60	1.0mΩ ~ 10mΩ	
NCLH2512	2512	1.0W	≤±75ppm	44.72	100	0.5mΩ ~ 0.8mΩ	
		1.0W	≤±50ppm	31.62	70.71	1.0mΩ ~ 500mΩ	
		2.0W (M)	≤±75ppm	63.24	141.42	0.5mΩ ~ 0.8mΩ	
		2.0W (M)	≤±50ppm	44.72	100	1.0mΩ ~ 450mΩ	
		3.0W (H)	≤±75ppm	77.45	173.20	0.5mΩ ~ 0.8mΩ	
		3.0W (H)	≤±50ppm	54.77	122.47	1.0mΩ ~ 100mΩ	
NCLH2725	2725	4.0W	≤±100ppm	141.42	282.84	0.2mΩ	
			≤±50ppm	126.49	252.98	0.25mΩ ~ 3mΩ	
NCLH2728	2728	4.0W	≤±50ppm	31.62	63.24	4.0mΩ ~ 450mΩ	
NCLH4527	4527	2.0W	≤±75ppm	63.24	141.42	0.5mΩ	
		2.0W	≤±50ppm	44.72	100.00	1.0mΩ ~ 100mΩ	
		3.0W (M)	≤±75ppm	77.45	173.20	0.5mΩ	
		3.0W (M)	≤±50ppm	54.77	122.47	1.0mΩ ~ 60mΩ	
		5.0W (H)	≤±75ppm	100.00	173.20	0.5mΩ	
		5.0W (H)	≤±50ppm	70.71	122.47	1.0mΩ ~ 500mΩ	

ZERO OHM JUMPER PART NUMBERS AND SPECIFICATIONS

Type	EIA Size	Part Number	Power Rating & Code At 70°C	Max. Current Rating	Resistance	Temperature Range
NCLH1206	1206	NCLH1206ZOTRF	1.0W	70.7A	≤0.2mΩ	-55 °C ~ +170°C
NCLH2512	2512	NCLH2512ZOTRF	2.0W	100A		
		NCLH2512MZOTRF	3.0W (M)	122A		

PART NUMBER SYSTEM

NCLH 4527 H G 0M75 TR Q Y F

- F — RoHS compliant
- Y — OPTIONAL: "Y" denotes suitable for automotive equipment, sourced to special production and inspection at IATF-16949 certified production site
- Q — AEC-Q200 Qualified (OPTIONAL)
- TR — Tape & Reel Packaging: TR = Standard Tape & Reel
- 0M75 — Resistance Code: Four characters. The letter "M" indicates milli-ohms for 0M50 = 0.5mΩ and 0M75 = 0.75mΩ , R001 = 1mΩ, R002 = 2mΩ, etc.
- G — Tolerance Code: D = 0.5%, F = 1.0%, G = ±2%, J = ±5%
- H — Power Rating: Blank = Standard, M = Medium, H = High, U = Ultra High (see table above)
- 4527 — Size Code
- NCLH — Series

COMPONENT DIMENSIONS (mm)

Type	EIA Size	Power Rating @ 70°C	Resistance Range	L	W	H	T1	T2
NCLH1206	1206	0.5W 0.75W(M)	1mΩ	3.200±0.254	1.650±0.254	0.820±0.254	0.508±0.254	0.508±0.254
			2mΩ			0.700±0.254		
			3mΩ			0.600±0.254		
			4~20mΩ			0.550±0.254		
			21~50mΩ			0.470±0.254		
			51~75mΩ			0.400±0.254		
		1.0W(H)	1mΩ			0.820±0.254		
			2mΩ			0.700±0.254		
			3mΩ			0.600±0.254		
			4~20mΩ			0.550±0.254		
			21~50mΩ			0.470±0.254		
		1.5W(U)	1mΩ			0.820±0.254		
			2mΩ			0.700±0.254		
			3mΩ			0.600±0.254		
			4~10mΩ			0.550±0.254		
NCLH2512	2512	1.0W	451~500mΩ	6.350±0.254	3.050±0.254	0.350±0.254	0.750±0.254	0.850±0.254
		1.0W 2.0W (M)	0.5mΩ			0.820±0.254	1.980±0.254	2.00±0.254
			0.6mΩ			0.700±0.254		2.100±0.254
			0.75mΩ				1.150±0.254	1.980±0.254
			0.8mΩ					1.860±0.254
			1mΩ			0.720±0.254		2.200±0.254
			1.1mΩ					1.900±0.254
			1.5mΩ					1.400±0.254
			2~5mΩ					1.150±0.254
			6mΩ			0.550±0.254		1.100±0.254
			7~10mΩ			0.600±0.254		
			11~75mΩ			0.600±0.254	1.050±0.254	
			76~100mΩ			0.550±0.254	0.750±0.254	
			101~135mΩ			0.470±0.254		
			136~200mΩ			0.400±0.254		
			201~450mΩ					0.850±0.254

Continue on next page

NCLH Series

AEC-Q200 Metall Alloy Current Sensing Resistors

AEC-Q200 QUALIFIED

ROHS/REACH COMPLIANT HALOGEN FREE

COMPONENTS
Performance Passives By Design

COMPONENT DIMENSIONS (mm)

Type	EIA Size	Power Rating @ 70°C	Resistance Range	L	W	H	T1	T2
NCLH2512	2512	3.0W (H)	0.50mΩ	6.350±0.254	3.050±0.254	0.820±0.254	1.980±0.254	2.000±0.254
			0.60mΩ			0.700±0.254		2.100±0.254
			0.75mΩ				1.150±0.254	1.980±0.254
			0.8mΩ					1.860±0.254
			1mΩ			0.720±0.254		2.200±0.254
			1.1mΩ					1.900±0.254
			1.5mΩ					1.400±0.254
			2~5mΩ					1.150±0.254
			6mΩ			0.550±0.254	0.75±0.254	1.100±0.254
			7~10mΩ			0.600±0.254	1.150±0.254	
			11~75mΩ				0.75±0.254	
			76~100mΩ			0.550±0.254		
NCLH2725	2725	4.0W	0.2mΩ	6.900±0.254	6.350±0.254	1.100±0.254	1.20±0.254	2.150±0.254
			0.25mΩ			0.950±0.254		2.287±0.254
			0.3mΩ					1.975±0.254
			0.35mΩ					1.710±0.254
			0.4mΩ					1.440±0.254
			0.5mΩ			0.850±0.254		2.080±0.254
			0.6mΩ					1.780±0.254
			0.8mΩ					1.300±0.254
			1mΩ	6.800±0.254		0.650±0.254	1.15±0.254	1.800±0.254
			1.5~1.6mΩ					1.500±0.254
			2~3mΩ			0.550±0.254		
NCLH2728	2728	4.0W	4~450mΩ	6.600±0.254	6.700±0.254	0.580±0.254	0.400±0.254	1.050±0.254
NCLH4527	4527	2.0W	0.5mΩ	11.300±0.500	6.600±0.500	0.770±0.254	0.900±0.254	3.000±0.254
			1mΩ			0.650±0.254		
			1.5~20mΩ					2.000±0.254
			21~100mΩ			0.550±0.254		
		3.0W (M)	0.5mΩ			0.770±0.254	0.900±0.254	3.000±0.254
			1mΩ			0.650±0.254		
			1.5~20mΩ					2.000±0.254
			21~60mΩ			0.550±0.254		
		5.0W (H)	0.5mΩ			0.800±0.254	0.650±0.254	3.000±0.254
			1mΩ			0.680±0.254		
			1.5~20mΩ					2.000±0.254
			21~500mΩ			0.580±0.254		

NCLH Series
AEC-Q200 Metall Alloy Current Sensing Resistors

AEC-Q200 QUALIFIED

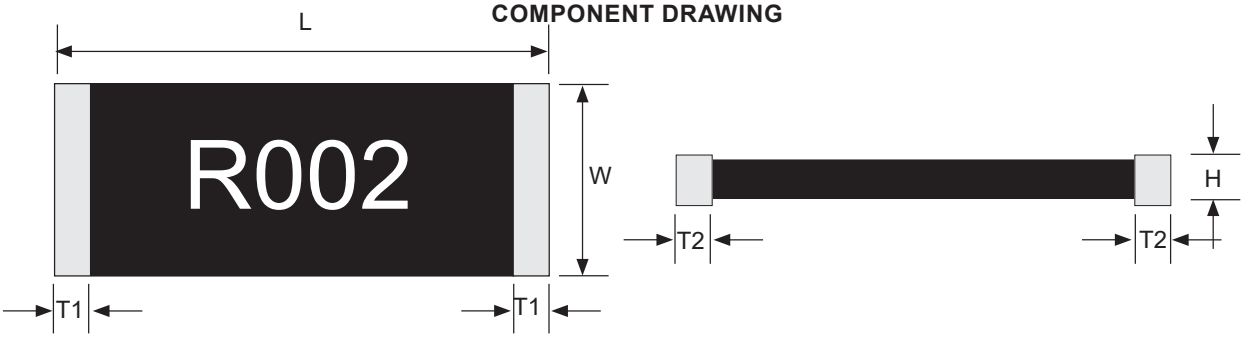
ROHS/REACH COMPLIANT HALOGEN FREE

COMPONENTS
Performance Passives By Design

ZERO OHM JUMPER PART NUMBERS AND SPECIFICATIONS

Type	EIA Size	Power Rating @ 70°C	Resistance Range	L	W	H	T1	T2
NCLH1206	1206	1.0W	≤ 0.2mΩ	3.200±0.254	1.650±0.254	0.650±0.254	0.508±0.254	0.508±0.254
NCLH2512	2512	2.0W	≤ 0.2mΩ	6.350±0.254	3.050±0.254	0.650±0.254	1.15±0.254	1.100±0.254
		3.0W (M)	≤ 0.2mΩ	6.350±0.254	3.050±0.254	0.650±0.254	1.15±0.254	1.100±0.254

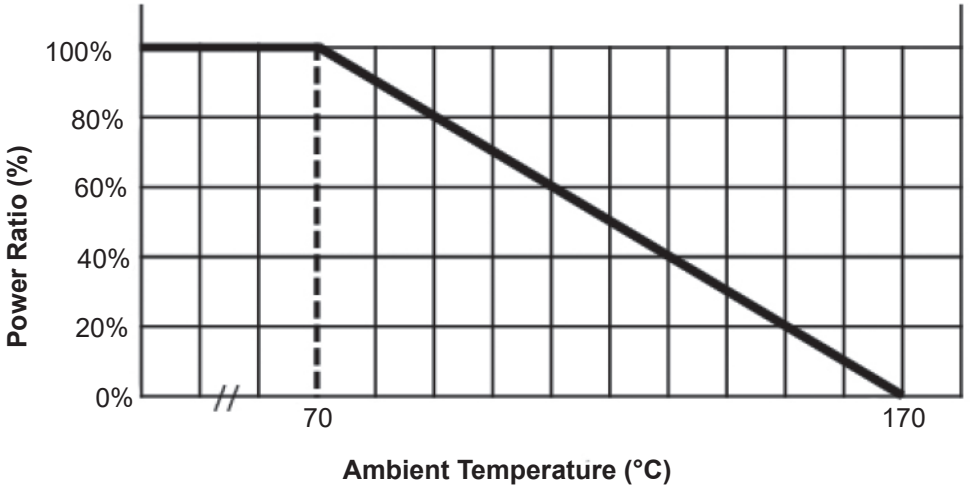
COMPONENT DRAWING



Rated Current: The following equation may be used to determine the DC (Direct Current) or AC (Alternating Current) (RMS, root mean square value) of normal rated power. However, if the result value exceeds the max. current rating, the highest normal rated power is to be used.

$$\text{Rated Current (Amps):} \sqrt{\text{Power rating (Watts) / Resistance (Ohms)}}$$

Power Derating Curve: Operating Temperature Range -55°C ~+170°C)
For operation at ambient temperature in excess of 70°C, the load should be derated in accordance with the power derating curve below.



AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS

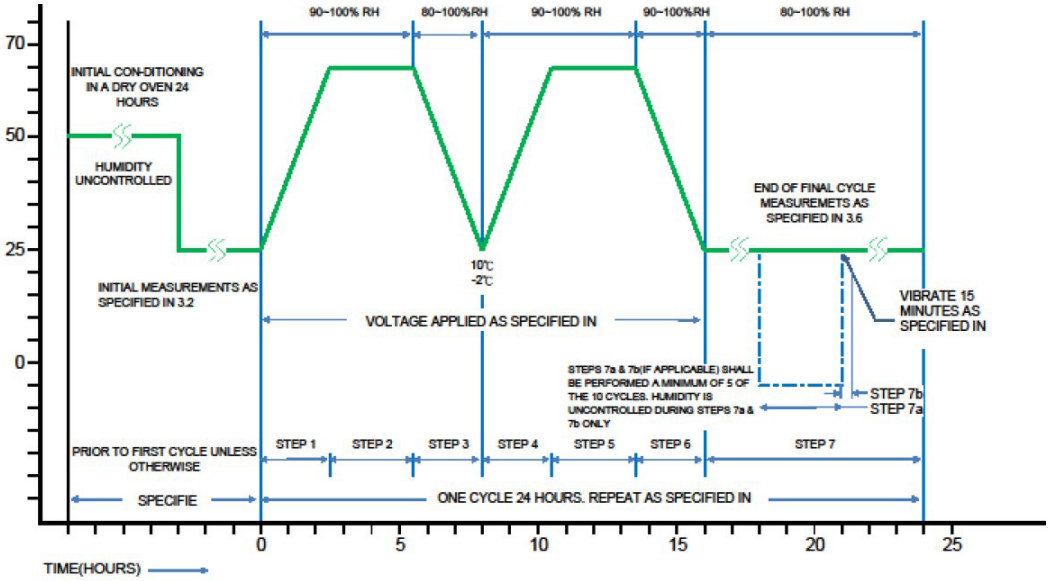
Item	Requirement	Test Method*
Temperature Coefficient of Resistance	As specified	JIS-C-5201-1 4.8, IEC-60115-1 4.8 +25/+150°C +25°C is the reference temperature
Short Time Overload	Size 4527: ΔR/R1 ≤ ± 2% All others: ΔR/R1 ≤ ± 0.5%	JIS-C-5201-1 4.13, IEC-60115-1 4.13 The rated power is as follows: NCLH1206: 0.5W: 5 times rated power NCLH1206M: 0.75W: 5 times rated power NCLH1206H: 1W: 5 times rated power NCLH1206U: 1.5W: 5 times rated power NCLH2512: 1W: 5 times rated power NCLH2512M: 2W: 5 times rated power NCLH2512H: 3W: 5 times rated power*(Note)* NCLH2725U: 4W: 4 times rated power NCLH2728: 4W: 4 times rated power NCLH4527: 2W: 5 times rated power NCLH4527M: 3W: 5 times rated power NCLH4527H: 5W: 3 times rated power For 5 seconds
High Temperature Exposure	Size 4527: ΔR/R1 ≤ ± 2% All others: ΔR/R1 ≤ ± 1%	JIS-C-5201-1 4.25, IEC-60068-2-2 At 170C for 1000 hours.
Resistance to Soldering Heat	ΔR/R1 ≤ ± 0.5%	JIS-C-5201-1 4.18, IEC-60115-1 4.18 260±5°C for 10 seconds.
Resistance to Solvents	ΔR/R1 ≤ ± 0.5% No visual damage	MIL-STD-202 Method 215 The tested resistor be immersed into isopropyl alcohol of 20~25 ºC for 60 secs. The resistor is left in the room for 48 hrs.
Temperature Cycling	ΔR/R1 ≤ ± 0.5%	JESD22 Method JA-104 1000 Cycles (-55°C to +155°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.
Biased Humidity	ΔR/R1 ≤ ± 0.5%	MIL-STD-202 Method 103 1,000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.
Operational Life	For 4527 ΔR/R1 ≤ ±2.0% For all others ΔR/R1≤ ±1.0%	MIL-STD-202, Method 108 70±2°C, RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON"and 0.5 hr "OFF"
Solderability	>95% Coverage. No visual damage	JIS-C-5201-1 4.17, IEC-60115-1 4.17 245±5°C for 3 seconds.
Dielectric Withstanding Voltage	No short or appearance of burning	JIS-C5201-1 4.7 Apply 500VAC for 1 minute.
Vibration	ΔR/R1 ≤ ± 0.5%	MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations. Note: Test from 10-2000 HZ.
Core Body Strength	None broken	JIS-C5201-1 4.15 Central part pressurizing force: 5N,10 seconds
Terminal Strength (SMD)	None broken	AEC Q200-006 Pressurizing force 17.7N for 60 seconds
Board Flexing	ΔR/R1 ≤± 0.5%, None broken	AEC Q200-005 Bending once 2mm for 10 seconds

Continue on next page

AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS

Item	Requirement	Test Method*
Mechanical Shock	ΔR/R1 ≤± 0.5%	MIL-STD 202 Method 213 Electrical test not required. Inspect device construction, marking and workmanship
External Visual	No visual damage	MIL-STD 883 Method 2009 Electrical test not required. Inspect device construction, marking and workmanship.
ESD	ΔR/R1 ≤± 0.5%	AEC-Q200- 002 or ISO/DIS 10605 Human body model 2512 and above: 2KV / 1206 or less:1.5KV

FIGURE 1



AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS FOR ZERO OHM JUMPERS

Item	Requirement	Test Method*
Short Time Overload	≤ 0.2mΩ	JIS-C-5201-1 4.13, IEC-60115-1 4.13 4 times rated power for 5 seconds
Temperature Cycling	≤ 0.2mΩ	JESD22 Method JA-104 1000 Cycles (-55°C to +155°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.
High Temperature Exposure	≤ 0.2mΩ	JIS-C-5201-1 4.25, IEC-60068-2-2 At 170C for 1000 hours.
Biased Humidity	≤ 0.2mΩ	MIL-STD-202 Method 103 1,000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.
Load Life (Endurance)	≤ 0.2mΩ	JIS-C-5201-1 4.25, IEC-60115-1 4.25.1 70±2°C, RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON"and 0.5 hr "OFF"
Solderability	>95% Coverage. No visual damage	JIS-C-5201-1 4.17, IEC-60115-1 4.17 245±5°C for 3 seconds.

NON-AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS

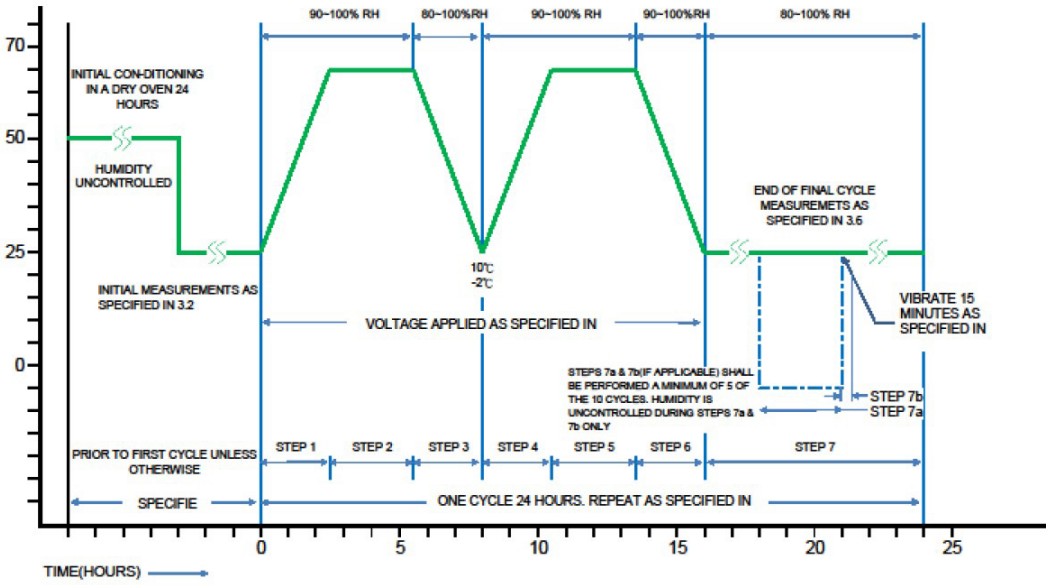
Item	Requirement	Test Method*
Temperature Coefficient of Resistance	As specified	JIS-C-5201-1 4.8 IEC-60115-1 4.8 +25/+150°C +25°C is the reference temperature
Short Time Overload	Size 4527: ΔR/R1 ≤ ± 2% All others: ΔR/R1 ≤ ± 0.5%	JIS-C-5201-1 4.13 IEC-60115-1 4.13 The rated power is as follows: NCLH1206: 0.5W: 5 times rated power NCLH1206M: 0.75W: 5 times rated power NCLH1206H: 1W: 5 times rated power NCLH1206U: 1.5W: 5 times rated power NCLH2512: 1W: 5 times rated power NCLH2512M: 2W: 5 times rated power NCLH2512H: 3W: 5 times rated power*(Note)* NCLH2725U: 4W: 4 times rated power NCLH2728: 4W: 4 times rated power NCLH4527: 2W: 5 times rated power NCLH4527M: 3W: 5 times rated power NCLH4527H: 5W: 3 times rated power For 5 seconds
High Temperature Exposure	Size 4527: ΔR/R1 ≤ ± 2% All others: ΔR/R1 ≤ ± 1%	JIS-C-5201-1 4.25, IEC-60068-2-2 At 170C for 1000 hours.
Resistance to Soldering Heat	ΔR/R1 ≤ ± 0.5%	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260±5°C for 10 seconds.
Temperature Cycling	ΔR/R1 ≤ ± 0.5%	JESD22 Method JA-104 1000 Cycles (-55°C to +155°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.

Continue on next page

NON-AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS

Item	Requirement	Test Method*
Biased Humidity	ΔR/R1 ≤ ± 0.5%	MIL-STD-202 Method 103 1,000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.
Load Life (Endurance)	For 4527 ΔR/R1 ≤ ±2.0% For all others ΔR/R1≤ ±1.0%	JIS-C-5201-1 4.25, IEC-60115-1 4.25.1 70±2°C, RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON"and 0.5 hr "OFF"
Solderability	>95% Coverage. No visual damage	JIS-C-5201-1 4.17, IEC-60115-1 4.17 245±5°C for 3 seconds.
Dielectric Withstanding Voltage	No short or appearance of burning	JIS-C5201-1 4.7 Apply 500VAC for 1 minute.
Core Body Strength	None broken	High Temperatureu ExposureJIS-C5201-1 4.15 Central part pressurizing forcLoad Life (Endurance Solderability e: 5N,10 seconds
Terminal Strength (SMD)	None broken	AEC Q200-006 Pressurizing force 17.7N for 60 seconds
Bending Strength	ΔR/R1 ≤± 0.5%, None broken	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once 2mm for 10 seconds
Moisture Resistance	ΔR/R1 ≤± 0.5%	MIL-STD 202 Method 106 T=24 hours / Cycle ,10Cycles . Steps 7a& 7b not required. Unpowered. (Figure 1)

FIGURE 1

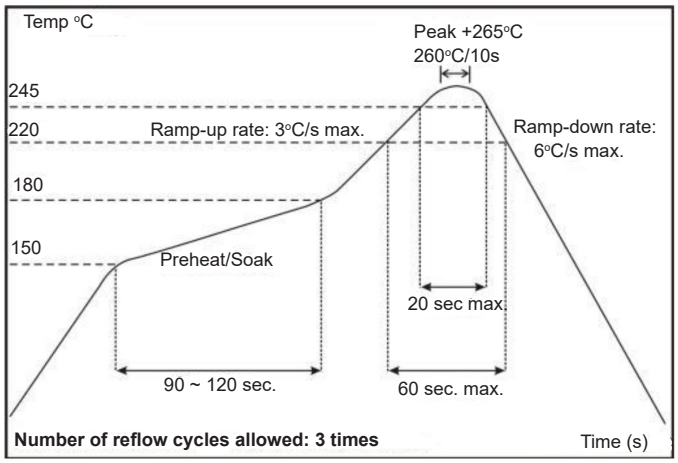


NON-AUTOMOTIVE ENVIRONMENTAL CHARACTERISTICS FOR ZERO OHM JUMPERS

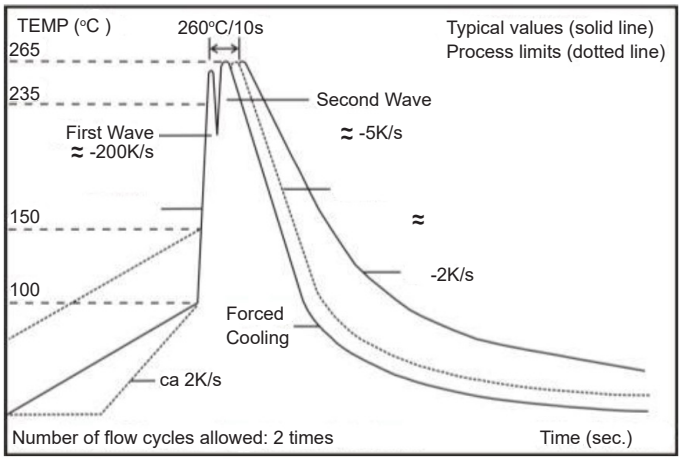
Item	Requirement	Test Method*
Short Time Overload	≤ 0.2mΩ	JIS-C-5201-1 4.13 IEC-60115-1 4.13 4 times rated power for 5 seconds
Temperature Cycling	≤ 0.2mΩ	JESD22 Method JA-104 1000 Cycles (-55°C to +155°C) Measurement at 24±4 hours after test conclusion. 30min maximum dwell time at each temperature extreme.
High Temperature Exposure	≤ 0.2mΩ	JIS-C-5201-1 4.25, IEC-60068-2-2 At 170C for 1000 hours.
Biased Humidity	≤ 0.2mΩ	MIL-STD-202 Method 103 1,000 hours; 85°C/85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.
Load Life (Endurance)	≤ 0.2mΩ	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 70±2°C, RCWV or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON"and 0.5 hr "OFF"
Solderability	>95% Coverage.	JIS-C-5201-1 4.17 IEC-60115-1 4.17 245±5°C for 3 seconds.

RECOMMENDED SOLDERING PROFILES

REFLOW SOLDERING PROFILE

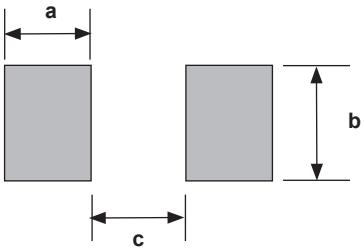


WAVE SOLDERING PROFILE



LAND PATTERN DIMENSIONS

Type	Resistance Range	a	b	c
NCLH1206 All Power Ratings	Jumper: ≤ 0.2mΩ	1.46	2.15	1.68
	1 ~ 75mΩ	1.46	2.15	1.68
NCLH2512 All Power Ratings	Jumper: ≤0.2mΩ	2.30	3.68	3.15
	0.5mΩ~1mΩ	3.24	3.68	1.27
	1.1mΩ/1.5mΩ	3.20	3.68	1.35
	2~5mΩ	2.60	3.68	2.55
	6mΩ~200mΩ	2.30	3.68	3.15
	201mΩ~500mΩ	2.05	3.68	3.65
NCLH2725 All Power Ratings	0.2~0.35mΩ	2.90	6.70	1.28
	0.4~0.8mΩ	3.25	6.85	1.70
	1~3mΩ	2.75	6.85	2.70
NCLH2728	4mΩ~450mΩ	2.05	7.20	3.90
NCLH4527 All Power Ratings	0.5mΩ~1.5mΩ	4.50	8.74	4.50
	2.0mΩ~100mΩ	3.50	8.74	6.50
	101mΩ~500mΩ	3.50	8.74	6.50



NCLH Series

AEC-Q200 Metall Alloy Current Sensing Resistors

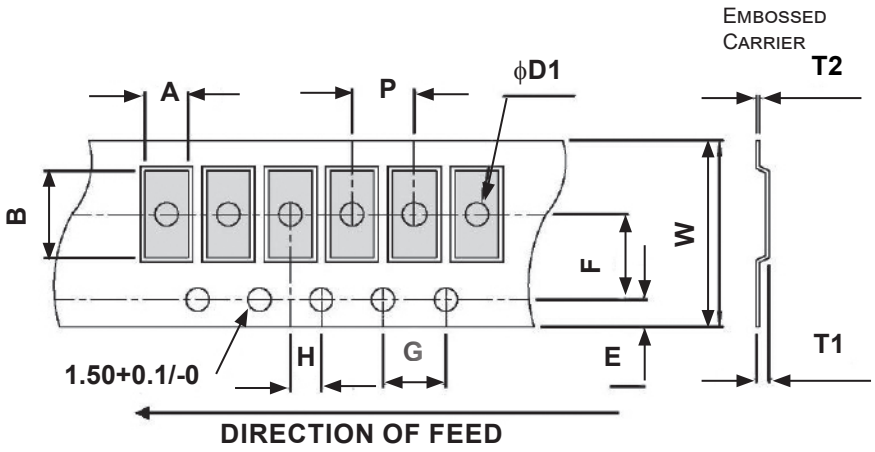
AEC-Q200 QUALIFIED

ROHS/REACH COMPLIANT HALOGEN FREE

COMPONENTS
Performance Passives By Design

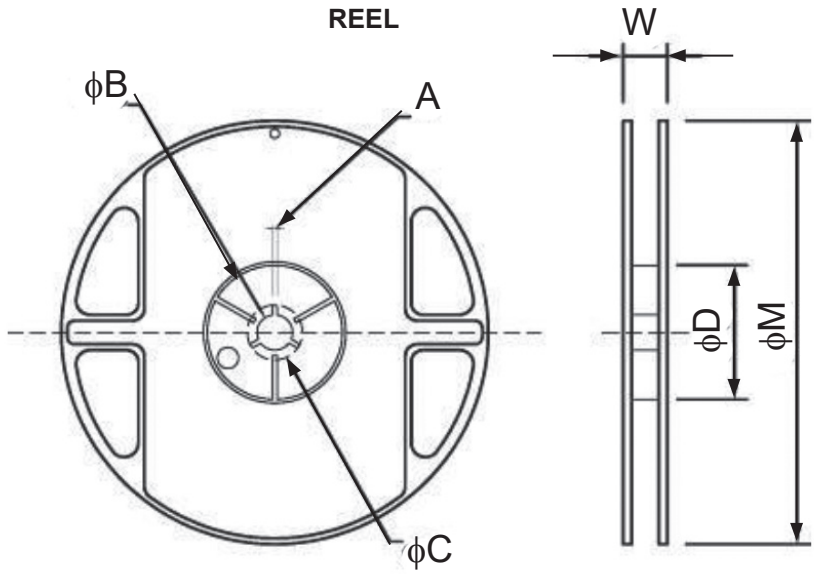
TAPE CARRIER DIMENSION (mm)

Type	Resistance Values	W	P	E	F	ϕD1	G	H	A	B	T1	T2
NCLH1206	1.0mΩ	8.0±0.30	4.0±0.10	1.75±0.10	3.5±0.10	1.0±0.10	4.0±0.10	2.0±0.10	2.03±0.10	3.55±0.10	1.10±0.10	0.20±0.05
	0R/2~75mΩ										0.85±0.10	
NCLH2512	0.5mΩ/ 1.0mΩ	12.0±0.30			5.5±0.10	1.55±0.10			3.50±0.10	6.75±0.10	1.10±0.10	
	0R/0.6~0.8mΩ 1.1~500mΩ										0.90±0.10	
NCLH2725	0.2~0.8mΩ		8.0±0.10						6.81±0.10	7.16±0.10	1.30±0.10	
	1~3mΩ										1.05±0.10	
NCLH2728	4~450mΩ								7.10±0.10	7.05±0.10	0.95±0.10	
NCLH4527	0.5~500mΩ	24.0±0.30	12.0±0.10		11.5±0.10	1.50±0.10			7.38±0.10	12.0±0.10	1.05±0.10	0.30±0.10



REEL DIMENSION (mm)

Tape Width	A	ϕB	ϕC	ϕD	W	ϕM
8mm	2.0±0.5	13.2±0.5	17.7±0.5	60.0±0.5	12.0±0.5	178±1.0
12mm	2.5±0.5	13.5±0.5			16.2±0.5	
24mm	2.0±0.5	13.2±0.5			24.4±2.0	



REEL QUANTITY

Type	Resistance Values	Reel Quantity
NCLH1206	R001	4,000
	All Others	5,000
NCLH2512	All	4,000
NCLH2725	≥1mΩ	2,000
	All Others	1,000
NCLH2728	All Values	2,000
NCLH4527	All Values	1,000