

HIGH POWER THICK FILM CHIP RESISTORS

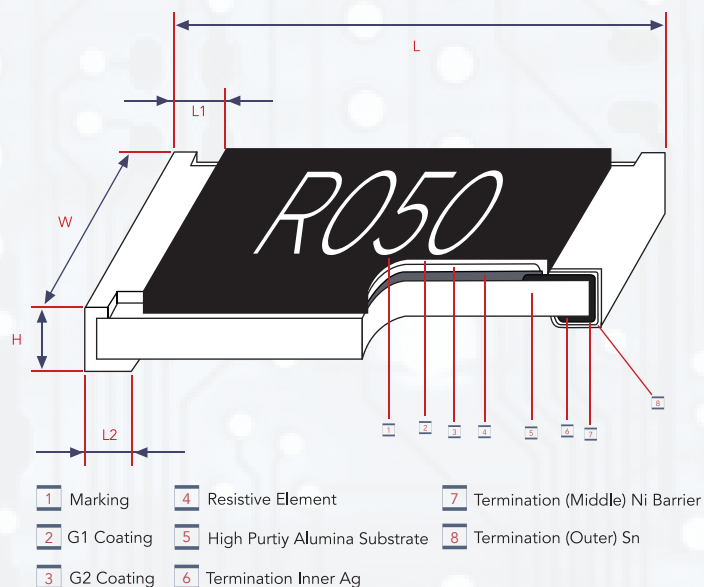
- HPR SERIES -



SCOPE

- This specification for approval relates to High Power Thick Film Chip Resistors manufactured by CalChip Electronics Inc.'s specifications.

CONSTRUCTION & DIMENSIONS



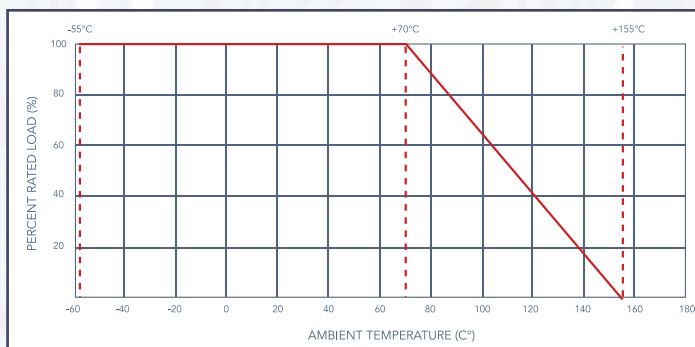
TYPE	SIZE (INCH)	L	W	H	L1	L2
HPR04	0402	1.00 ± 0.10	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.10
HPR06	0603	1.60 ± 0.10	0.80 + 0.15 -0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
HPR10	0805	2.00 ± 0.15	1.25 + 0.15 -0.10	0.55 ± 0.10	0.40 ± 0.20	0.40 ± 0.20
HPR12	1206	3.10 ± 0.15	1.55 + 0.15 -0.10		0.45 ± 0.20	0.45 ± 0.20
HPR14	1210	3.10 ± 0.10	2.60 ± 0.20		0.50 ± 0.25	0.50 ± 0.20
HPR20	2010	5.00 ± 0.10	2.50 ± 0.20		0.60 ± 0.25	
HPR18	1812	4.50 ± 0.20	3.20 ± 0.20	0.55 ± 0.20	0.50 ± 0.20	
HPR25	2512	6.35 ± 0.10	3.20 ± 0.20	0.55 ± 0.10	0.60 ± 0.25	

TYPE DESIGNATION

- The type designation shall be in the following form:

TYPE	POWER RATING	RESISTANCE TOLERANCE	NOMINAL RESISTANCE
HPR12	1/2W (0.5W)	F, J	75Ω

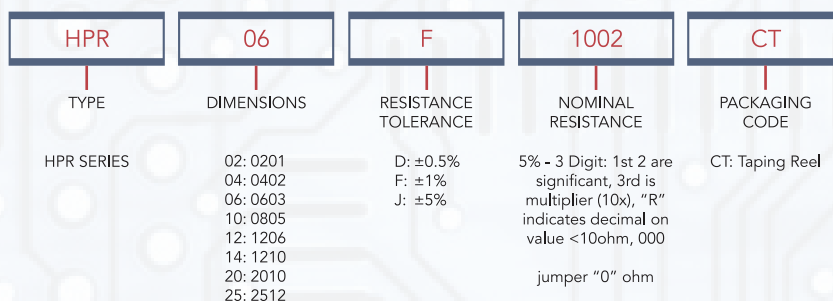
POWER RATING



- Resistors shall have a power rating based on continuous load operation at an ambient temperature of 70°C . For temperature in excess of 70°C.

- The load shall be derate as shown in in Power rating chart above.

PART NUMBERING




RATINGS

TYPE	POWER RATING AT 70°C	MAX WORKING CURRENT	MAX OVERLOAD CURRENT	MAX WORKING VOLTAGE	MAX OVERLOAD VOLTAGE	DIELECTRIC WITHSTANDING VOLTAGE	TEMP. RANGE	AMBIENT TEMP.	RESISTANCE RANGE
HPR04	1/10W	3A	6A	50V	100V	100V	-55°C ~+155°C	70°C	1Ω~10MΩ 0Ω (≤10mΩ)
HPR06	1/5W	5A	10A	75V	150V	300V			0.1Ω~10MΩ 0Ω (≤8mΩ)
HPR10	1/3W	6A	12A	150V	300V	500V			10mΩ~10MΩ 0Ω (≤5mΩ)
HPR12	1/2W	10A	20A	200V	400V	500V			0.1Ω~10MΩ 0Ω (≤4mΩ)
HPR14	3/4W	12A	24A	200V	500V	500V			10mΩ~10MΩ 0Ω (≤5mΩ)
HPR20	1W	12A	24A	200V	500V	500V			0.1Ω~10MΩ 0Ω (≤5mΩ)
HPR18	1.25W	12A	24A	200V	500V	500V			10mΩ~10MΩ 0Ω (≤5mΩ)
HPR25	2W	16A	32A	300V	500V	500V			

NOMINAL RESISTANCE

Effective figures of nominal resistance shall be in accordance:

E-24 values – these are preferred and will have standard MOQ

E-96 values – are available on case by case basis and availability and MOQ need to be confirmed with factory first

VOLTAGE RATING

Resistors shall have a rated direct-current (DC) continuous working voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

Note: Max. Working Voltage or $\sqrt{P \times R}$ whichever is lesser | Max. Overload Voltage or $2.5 \sqrt{P \times R}$ whichever is lesser

Where: RCWV = Rated DC or RMS AC continuous working voltage at commercial-line frequency and waveform (volt)

P = Power Rating (watt)

R = Nominal Resistance (ohm)

POWER RATING RESISTANCE RANGE AND T.C.R.

TYPE	POWER RATING AT 70°C	TOLERANCE %	RESISTANCE RANGE	TCR PPM/°C	STANDARD SERIES
HPR04 (0402)	1/10W	Jumper	0Ω (≤10mΩ)		E-96, E-24
		±1, ±5	1Ω < R < 10Ω	±400	
			10Ω < R < 100Ω	±200	
			100Ω < R < 10MΩ	±100	
HPR06 (0603)	1/5W	Jumper	0Ω (≤8mΩ)		E-96, E-24
		±1, ±5	0.1Ω ≤ R ≤ 0.2Ω	±200	
			0.2Ω < R ≤ 10MΩ	±100	
HPR10 (0805)	1/3W	Jumper	0Ω (≤5mΩ)		E-96, E-24
		±1, ±5	0.01Ω ≤ R ≤ 0.015Ω	±800	
			0.015Ω < R ≤ 0.025Ω	±600	
			0.025Ω < R ≤ 0.05Ω	±400	
			0.05Ω < R ≤ 0.1Ω	±200	
			0.1Ω < R ≤ 10MΩ	±100	
HPR12 (1206)	1/2W	Jumper	0Ω (≤5mΩ)		E-96, E-24
		±1, ±5	0.01Ω ≤ R ≤ 0.015Ω	±700	
			0.015Ω < R < 0.03Ω	±400	
			0.03Ω < R < 0.05Ω	±300	
			0.05Ω ≤ R < 0.1Ω	±150	
			0.1Ω < R ≤ 10MΩ	±100	
HPR14 (1210)	3/4W	Jumper	0Ω (≤4mΩ)		E-96, E-24
		±1, ±5	0.1Ω ≤ R ≤ 10MΩ	±100	
HPR20 (2010)	1W	Jumper	0Ω (≤5mΩ)		E-96, E-24
		±1, ±5	0.01Ω ≤ R < 0.015Ω	±800	
			0.015Ω < R < 0.05Ω	±600	
			0.05Ω < R ≤ 10MΩ	±100	
HPR18 (1812)	1.25W	Jumper	0Ω (≤5mΩ)		E-96, E-24
		±1, ±5	0.1Ω ≤ R ≤ 10MΩ	±100	
HPR25 (2512)	2W	Jumper	0Ω (≤5mΩ)	500V	E-96, E-24
		±1, ±5	0.01Ω ≤ R < 0.02Ω	±800	
			0.020Ω < R ≤ 0.05Ω	±400	
			0.05Ω < R ≤ 10MΩ	±100	



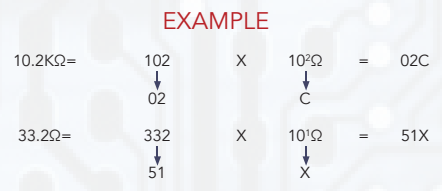
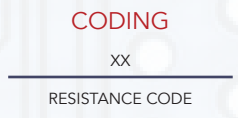
MARKING

- RESISTORS

- A. Chip Resistors type HPR04 No marking
- B. ± 1% Tolerance HPR06 E-96 series use below decoding method

- MULTIPLIER CODE

VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE										
100	01	162	21	261	41	422	61	681	81										
102	02	165	22	267	42	432	62	698	82										
105	03	169	23	274	43	442	63	715	83										
107	04	174	24	280	44	453	64	732	84										
110	05	178	25	287	45	464	65	750	85										
113	06	182	26	294	46	475	66	768	86										
115	07	187	27	301	47	487	67	787	87										
118	08	191	28	309	48	499	68	806	88										
121	09	196	29	316	49	511	69	825	89										
124	10	200	30	324	50	523	70	845	90										
127	11	205	31	332	51	536	71	866	91										
130	12	210	32	340	52	549	72	887	92										
133	13	215	33	348	53	562	73	909	93										
137	14	221	34	357	54	576	74	931	94										
140	15	226	35	365	55	590	75	953	95										
143	16	232	36	374	56	604	76	976	96										
147	17	237	37	383	57	619	77												
150	18	243	38	392	58	634	78												
154	19	249	39	402	59	649	79												
158	20	255	40	412	60	665	80												
CODE	A	B	C	D	E	F	G	H	X	Y	Z								
MULTIPLIER	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³								



- Marking for HPR06 E-24, E-96 series 1% tolerance, the value that no have multiplier code indicate marking follow this: The first two digits are significant figures of resistance and the third one denoted number of zeros and under line the marking letters
- Example



- ± 5% Tolerance HPR06, HPR10, HPR12, HPR14, HPR18, HPR20, HPR25: the first two digits are significant figures of resistance and the third onedenoted number of zeros.
- For ohmic values below 10 Ω



MARKING

- For E-96 series [$\pm 1\%$ (F) tolerance] in HPR06 size 3 digit system (due to space restrictions) please refer to page 4 for coding formula

- $\pm 1\%$ Tolerance HPR10, HPR12, HPR14, HPR20, HPR18, HPR25 : 4 Digits, the first three digits are significant figures of resistance and the fourth digit denoted number of zeros. Letter "R" is for decimal point.



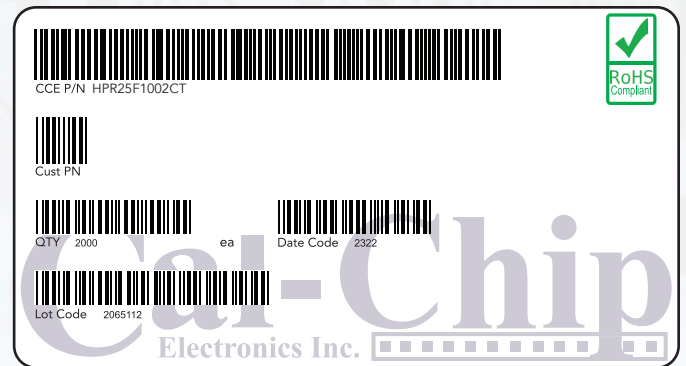
- Marking for $\pm 1\%$, $\pm 5\%$ Tolerance HPR10, HPR12, HPR14, HPR20, HPR18, HPR25 (Only for $0.01\Omega \sim 0.099\Omega$) : 4 Digits



LABELS

Label shall be marked with the following item :

- A: Cal-Chip Part Number
- B: Customer P/N Where Applicable
- C: Quantity
- D: Date Code
- E: Lot No.



PERFORMANCE SPECIFICATION

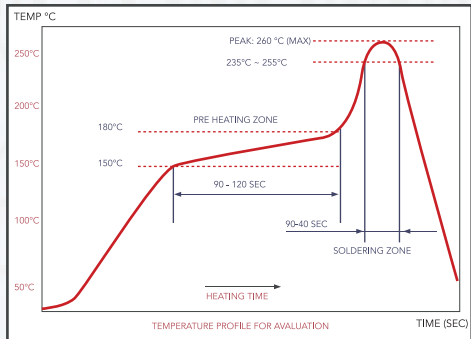
CHARACTERISTICS	LIMITS	TEST METHODS (JIS C 5201-1)
*Insulation Resistance	1,000 M Ω or more	Apply 500V DC between protective coating and termination for 1 min, then measure (Sub-clause 4.6)
*Dielectric Withstanding Voltage	No evidence of flashover mechanical damage, arcing or insulation break down	Apply 100V(0402) 300V(0603) & 500V (0805, 1206, 1210, 2010, 2512) AC between protective coating and termination for 1 minute (Sub-clause 4.7)
Temperature Coefficient	Resistance change rate is $1\Omega \leq R \leq 10\Omega$: $\pm 400\text{PPM}/^\circ\text{C}$ $10\Omega < R \leq 100\Omega$: $\pm 200\text{PPM}/^\circ\text{C}$ $100\Omega < R \leq 10\text{M}\Omega$: $\pm 100\text{PPM}/^\circ\text{C}$	Natural resistance change per temp. degree centigrade. $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6 \text{ (PPM}/^\circ\text{C)}$ R1: Resistance value at room temperature (t1) R2: Resistance value at room temp. plus 100°C (t2) (Sub-clause 4.8)
Short Time Overload	Resistance change rate is $\pm 1\%$: $\pm(1.0\% + 0.1\Omega)\text{Max}$ $\pm 5\%$: $\pm(2.0\% + 0.1\Omega)\text{Max}$	Permanent resistance change after the application of a potential of 2.5 times RCWV for 5 seconds (Sub-clause 4.13)
*Solderability	95 % coverage Min.	Test temperature of solder : $245 \pm 3^\circ\text{C}$ Dipping them solder : 2-3 seconds (Sub-clause 4.17)

The resistors of 0Ω only can do the characteristic noted of *





PERFORMANCE SPECIFICATION

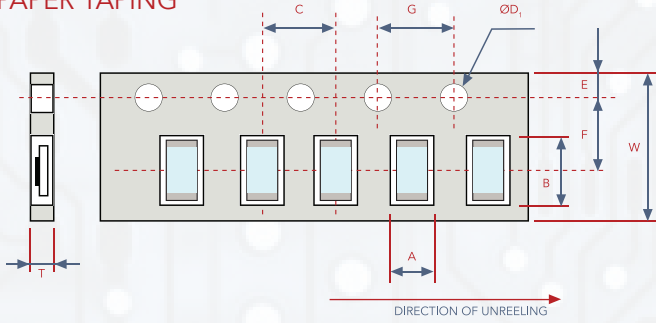
CHARACTERISTICS	LIMITS	TEST METHODS (JIS C 5201-1)															
Soldering Temp. Reference	Electrical characteristics shall be satisfied. Without distinct deformation in appearance. (95 % coverage Min.)	<p>Wave soldering condition: (2 cycles Max.) Pre-heat : 100 ~ 120°C, 30 ± 5 sec. Suggestion solder temp.: 235 ~ 255°C, 10 sec. (Max.) Peak temp.: 260°C</p> <p>Reflow soldering condition: (2 cycles Max.) Pre-heat : 150 ~ 180°C, 90 ~ 120 sec. Suggestion solder temp.: 235 ~ 255°C, 20 ~ 40 sec. Peak temp.: 260°C</p>  <p>Hand soldering condition: The soldering iron tip temperature should be less than 300°C and maximum contact time should be 5 sec.</p>															
Soldering Heat	Resistance change rate is: ±(1%+0.05Ω) Max.	Dip the resistor into a solder bath having a temperature of 260°C±3°C and hold it for 10±1 seconds. (Sub-clause 4.18)															
Temperature Cycling	Resistance change rate is 1%: ± (0.5%+0.1Ω) Max. 5%: ± (1.0%+0.1Ω) Max.	Resistance change after continuous 5 cycles for duty cycle specified below: <table border="1" data-bbox="915 968 1281 1157"> <thead> <tr> <th>STEP</th> <th>TEMPERATURE</th> <th>TIME</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-55°C ± 3°C</td> <td>30 mins</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>10~15 mins</td> </tr> <tr> <td>3</td> <td>+155°C ± 2°C</td> <td>30 mins</td> </tr> <tr> <td>4</td> <td>Room Temp</td> <td>10~15 mins</td> </tr> </tbody> </table> (Sub-clause 4.19)	STEP	TEMPERATURE	TIME	1	-55°C ± 3°C	30 mins	2	Room Temp.	10~15 mins	3	+155°C ± 2°C	30 mins	4	Room Temp	10~15 mins
STEP	TEMPERATURE	TIME															
1	-55°C ± 3°C	30 mins															
2	Room Temp.	10~15 mins															
3	+155°C ± 2°C	30 mins															
4	Room Temp	10~15 mins															
Load Life in Humidity	Resistance change rate is ± 1% (1.0% + 0.1Ω) Max. ± 5% (3.0% + 0.1Ω) Max.	Resistance change after 1,000 hours (1.5 hours "on", 0.5 hour "off") at RCWV in a humidity chamber controlled at 40°C ± 2°C and 90 to 95 % relative humidity (Sub-clause 4.24.2.1)															
Load Life	Resistance change rate is ± 5% (3.0% + 0.1Ω) Max. ± 1% (1.0% + 0.1Ω) Max.	Permanent resistance change after 1,000 hours operating at RCWV, with duty cycle of (1.5 hours"on", 0.5 hour"off") at 70°C± 2°C ambient (Sub-clause 4.25.1)															
Terminal Bending	Resistance change rate is ± (1.0% + 0.05Ω) Max.	Twist of Test Board : Y/X = 5/90 mm for 10 seconds (Sub-clause 4.33)															

The resistors of 0Ω only can do the characteristic noted of *

PACKING SPECIFICATION

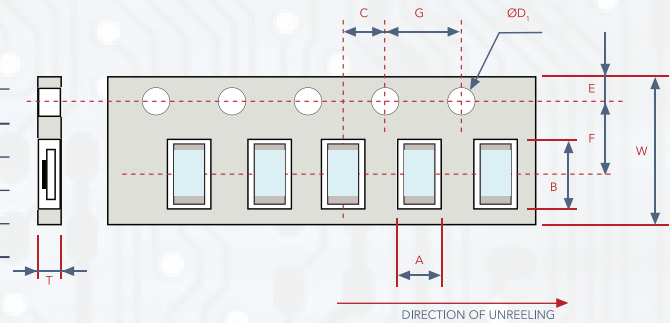
- * Taping Dimension (mm)

PAPER TAPING

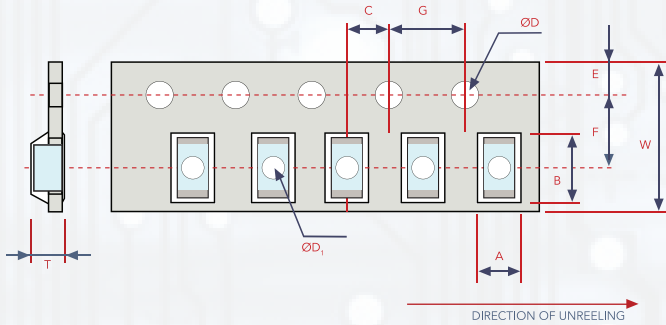


TYPE	A ± 0.1	B ± 0.1	C ± 0.05	øD +0.1-0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.05
HPR04	0.65	1.2	2.0	1.5	1.75	3.5	4.0	8.0	0.42

TYPE	A ± 0.2	B ± 0.2	C ± 0.05	øD +0.1-0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.1
HPR06	1.10	1.90	2.0	1.5	1.75	3.5	4.0	8.0	0.67
HPR10	1.65	2.40							0.81
HPR12	2.00	3.60							0.81
HPR14	2.80	3.50							0.75



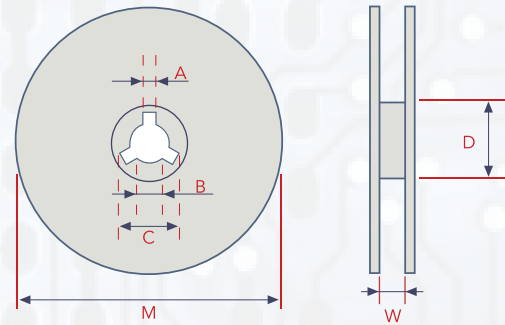
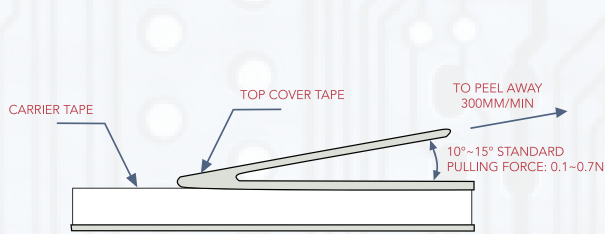
EMBOSSED TAPING



TYPE	A ± 0.2	B ± 0.2	C ± 0.05	øD +0.1-0	øD1 +0.1-0	E ± 0.1	F ± 0.05	G ± 0.1	W ± 0.2	T ± 0.1
HPR20	2.90	5.60	2.0	1.5	1.5	1.75	5.5	4.0	12.0	1.0
HPR18	3.50	4.80								
HPR25	3.50	6.70								

PEELING STRENGTH OF TOP COVER TAPE

- Test Condition: 0.1 to 0.7 N at a peel-off speed of 300 mm / min.



TYPE	PACKAGING	QTY PER REEL	A±0.5	B±0.5	C±0.5	D±1	M±2	W±1
HPR04	Paper	10K	2	13	21	60	178	10
HPR06								
HPR10								
HPR12								
HPR14	Embossed	4K	2	13	21	60	178	13.8
HPR20								
HPR18								
HPR25								



ENVIRONMENT RELATED SUBSTANCE

- This product complies to EU RoHS directive, EU PAHs directive, EU PFOS directive and Halogen free.

- Ozone layer depleting substances.

Ozone depleting substances are not used in our manufacturing process of this product.

This product is not manufactured using Chloro fluorocarbons (CFCs), Hydrochlorofluorocarbons (HCFCs), Hydrobromofluorocarbons (HBFCs) or other ozone depleting substances in any phase of the manufacturing process.

STORAGE CONDITION (MSL1)

- The performance of these products, including the solderability, is guaranteed for a year from the date of arrival at your company, provided that they remain packed as they were when delivered and stored at a temperature of $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and a relative humidity of $60\%RH \pm 10\%RH$, chemical and dust free atmosphere.

- Even within the above guarantee periods, do not store these products in the following conditions. Otherwise, their electrical performance and/or solderability may be deteriorated, and the packaging materials (e.g. taping materials) may be deformed or deteriorated, resulting in mounting failures.

1. In salty air or in air with a high concentration of corrosive gas, such as Cl_2 , H_2S , NH_3 , SO_2 , or NO_2

2. In direct sunlight

- This production is used for automotive electronics, CAL-CHIP ELECTRONICS INC. will not be responsible for any damage, expense or loss caused by the use of this specification in any special environment. This series of product are suitable for automotive electronics applications, as show below, if there are other application, you need to confirm with CAL-CHIP ELECTRONICS INC. whether they are applicable:

a. Control unit for informatiom, entertainment, navigation, audio;

b. Control unit for comfortable doors, windows, seat;

c. Control unit for internal lighting.

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