

MR12, MR10, MR08, MR06, MR04

±1%, ±5%

Thick film General Purpose Chip Resistors Size 1206, 1210, 0805, 0603, 0402 Automotive & Military Compliant

*Contents in this sheet are subject to change without prior notice.



FEATURE

- 1. High reliability and stability $\pm 1\%$
- 2. Sulfuration resistant ASTM B-809 60'C 500 hrs
- 3. Automotive AEC Q-200 & Military MIL-STD Compliant
- 4. 100% CCD inspection
- 5. RoHS 2 compliant and Halogen free products

APPLICATION

- Automotive application
- Consumer electrical equipment
- EDP, Computer application
- Telecom application

DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to within tolerance by laser cutting of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (lead free) alloy.

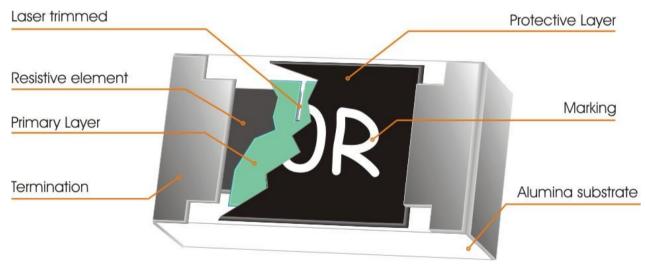


Fig 1. Construction of a Chip-R

QUICK REFERENCE DATA

ltem		General Specification								
Series No.	MR	10	MF	R12	MR	808	MF	MR06		204
Size code	1210(3225)	1206(3216)	0805(2012)	0603(0603(1608) 0402(1005)
Resistance				1Ω ~ 10	MΩ (±5% t	olerance),	Jumper			
Range				1Ω	2~10MΩ (±	1% toleran	ce)			
Resistance	±1%	±5%	±1%	±5%	±1%	±5%	±1%	±5%	±1%	±5%
Tolerance	E96/E24	E24	E96/E24	E24	E96/E24	E24	E96/E24	E24	E96/E24	E24
TCR (ppm/°C)										
R > 1MΩ	\leq ± 200		\leq ± 200		\leq ± 200		$\leq \pm 200$		\leq \pm 200	
10Ω < R \leq 1M Ω	$\leq \pm$	100	\leq ± 100		$\leq \pm 100$		\leq \pm 100		\leq \pm 100	
$R \leq 10 \Omega$	-200~	+400	-200~+400		-200~+400		-200~+400		-200~+400	
Max. dissipation @ T _{amb} =70°C	1/2	W	1/4 W		1/4 W		1/8 W		1/10 W	
Max. Operation Voltage (DC or RMS)	20	0V	200V		150V		75V		50V	
Max. Overload Voltage (DC or RMS)	400V 400V		0V	30	0V	15	0V	10	0V	
Climatic category (IEC 60068)					55/1	55/56				

Note :

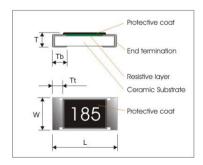
- 1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
- 2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

 $RCWV = \sqrt{RatedPower \times Resistance Value}$ or Max. RCWV listed above, whichever is lower.

3. The resistance of Jumper is defined $< 0.05\Omega$.

DIMENSIONS (unit : mm)

	MR10	MR12	MR08	MR06	MR04
L	$\textbf{3.10}\pm\textbf{0.10}$	$\textbf{3.10}\pm\textbf{0.10}$	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
w	$\textbf{2.60} \pm \textbf{0.10}$	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
т	$\textbf{0.55}\pm\textbf{0.10}$	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tb	0.50 ± 0.20	$\textbf{0.45}\pm\textbf{0.20}$	$\textbf{0.40}\pm\textbf{0.20}$	0.30 ± 0.15	0.25 ± 0.10
Tt	0.50 ± 0.20	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	$\textbf{0.20}\pm\textbf{0.10}$



MARKING

Size \ Nr. Of digit of code\tolerance	±5%	±1%
1210/1206/0805	3-digits marking	4-digits marking
0603 (1608)	3-digits marking	3-digits marking
0402(1005)	N0 MA	RKING

3-digits marking (±5% : 1206, 1210, 0805 & 0603)

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value.

3-digits marking $(\pm 1\% : 0603)$

Nominal	l resistan	се							Descr	ption					
1.E-24 s	series			As <i>0603</i>	5 0603 WR06X ±5%.										
2.E-96 s	series			The 1st t value :	wo digit o	codes ar	e referrin	g to the	CODE or	the tab	le, the 3r	d code is	s the inde	x of resi	stance
				Y=10 ⁻² ,	X=10 ⁻¹ ,	A=10 ⁰ ,	B=10 ¹ ,	C=10 ² ,	$D=10^{3}$,	E=10 ⁴ ,	F=10 ⁵				
						EX :	17.8 Ω=	25X,17	′8Ω=25A	,1K78	=25B				
							17K8=2	25C,17	′8K=25D	,1M78	=25E				
3. Rema	ark			There is	no marki	ng for th	e items a	ire not ur	nder E-24	and E-	96 series				
CODE	R_value	CODE	R_value	CODE	R_Value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150	30	200	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	34 221 46 294 58 392 70 523 82 698 94							94	931		
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130	24	174	36	232	48	309	60	412	72	549	84	732	96	976

4-digits marking (±1% : 1210/1206/0805)

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value.

Example

RESISTANCE	10Ω	12Ω	100Ω	6800Ω	47000Ω
3-digits marking (1210, 1206, 0805, 0603 $\pm 5\%$)	100	120	101	682	473
4-digits marking	10R0	12R0	1000	6801	4702



FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of \pm 5%, and E24+E96 series for resistors with a tolerance of \pm 1%. The values of the E24/E96 series are in accordance with "IEC publication 60063".

Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2.1

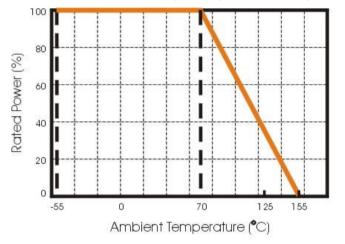


Figure 2.1 Maximum dissipation in percentage of rated power as a function of the ambient temperature

MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.



of

SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

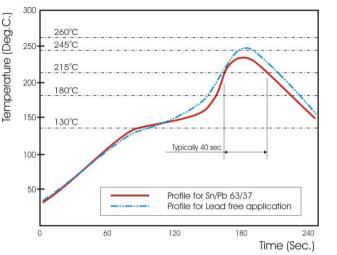


Fig 3. Infrared soldering profile for Chip Resistors

CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

MR12	x	472_	J	т	L
MR12 Automotive code MR10 : 1210 MR12 : 1206 MR08 : 0805 MR06 : 0603 MR06 : 0402	X Type code X : Jumper ±5%, 1Ω ~ 10MΩ ±1%, 10Ω ~ 1MΩ W : ±1%, < 10Ω; >1MΩ	472_ Resistance code ±5%, E24: 2 significant digits followed by no. of zeros and a blank $220\Omega = 221_$ $4K7 = 472_$ $10\Omega = 100_$ $1\Omega = 1R0_$ ("_" means a blank)	J Tolerance F : ±1% J : ±5% P : Jumper	TPackaging codeT: 7" Reeled tapingD: 7" Reel 20K/RL0402 sizeQQ: 10" Reeled tapingG: 13" Reeled tapingB: Bulk	L Termination code L = Sn base (lead free)
		("_" means a blank) Resistance code ±1%, E24+E96: 3 significant digits followed by no. of zeros E96: $37.4K\Omega = 3742$ E24: $220\Omega = 2200$ 4K7 = 4701 $10\Omega = 10R0$ $1\Omega = 1R00$			

* Anti-Sulfuration test conditions: ASTM B-809-95 60'C 500hrs, criteria: +/-1% !

MR10, MR12, MR08, MR06:

1. Reeled tape packaging : 8mm width paper taping 5000pcs per 7" reel, 10kpcs per 10" reel, 20kpcs per 13" reel.

2. Bulk packaging : 5000pcs per poly-bag

MR04:

- 1. Reeled tape packaging : 8mm width paper taping 10,000pcs per reel,
- 2. Bulk packaging : 10,000pcs per poly-bag

TEST AND REQUIREMENTS

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category LCT/UCT/56(rated temperature range : Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, sub-clause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15°C to 35°C.

Relative humidity: 45% to 75%.

Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

All soldering tests are performed with midly activated flux.

TEQT		REQUIREMENTS		
TEST	PROCEDURE / TEST METHOD	Resistance	0Ω	
Electrical Characteristics	- DC resistance values measurement	Within the specified tolerance		
	- Temperature Coefficient of Resistance (T.C.R)	Refer to "QUICK REFERENC	E DATA"	
JISC5201-1: 1998	Natural resistance change per change in degree centigrade.			
Clause 4.8	$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)} t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$			
	R1 : Resistance at reference temperature			
	R ₂ : Resistance at test temperature			
Resistance to soldering		∆R/R max. ±(0.5%+0.05Ω)		
heat (R.S.H)	SAC solder bath at 270℃±5°C	No visible damage	<50mΩ	
MIL-STD-202 method 210			10011132	
Solderability	a) Bake the sample for 155 ℃ dwell time 4hrs/ solder dipping 235 ℃/ 5sec.	95% coverage min., good tir	ning and	
J-STD-002	b) Steam the sample dwell time 1 hour/ solder dipping	no visible damage	g u.ru	
	260°C / 7sec.			
Temperature cycling	1000 cycles, -55°C ~ +155°C, dwell time 5~10min	∆R/R max. ±(0.5%+0.05Ω)		
JESD22		No visible damage	<50mΩ	
method JA-104				
Moisture Resistance	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	∆R/R max. ±(0.5%+0.05Ω)		
MIL-STD-202		No visible damage	<50mΩ	
method 106		5		
Bias Humidity	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power			
MIL-STD-202		Δ R/R max. ±(1%+0.05 Ω) No visible damage	<50mΩ	
method 103				
Operational Life	1000+48/-0 hours; 35% of operation power, 125±2°C	∆R/R max. ±(1%+0.05Ω)		
MIL-STD-202 method		No visible damage	<50m Ω	
108		INO VISIDIE UAITIAYE		



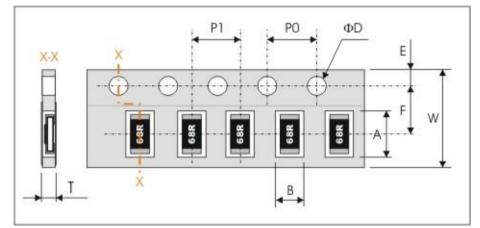
TEOT		REQUIREMENTS	5
TEST	PROCEDURE / TEST METHOD	Resistance ±5%, ±1%	0Ω
High Temperature	1000+48/-0 hours; without load in a temperature chamber	∆R/R max. ±(1%+0.05Ω)	
Exposure	controlled 155±3°C	No visible damage	<50mΩ
MIL-STD-202			<201175
method 108			
Mechanical Shock	1/2 Sine Pulse / 1500g Peak / Velocity 15.4ft/sec	Within the specified	
MIL-STD-202		tolerance	<50mΩ
method 213		No visible damage	
Board Flex	Resistors mounted on a 90mm glass epoxy resin PCB(FR4),	ΔR/R max. ±(1.0%+0.05Ω).	-50m0
AEC-Q200-005	bending once 2mm for 10sec	No visible damage	<50mΩ
Terminal strength	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or re	emoval of
AEC-Q200-006		the	
		terminations	
Vibration	Test 5g's for 20min., 12 cycles each of 3 orientations	ΔR/R max. ±(1.0%+0.05Ω)	
MIL-STD-202		No visible damage	<50mΩ
method 204			
Thermal shock	Test –55 to 155° C / dwell time 15min/ Max transfer time 20sec	∆R/R max. ±(0.5%+0.05Ω)	
MIL-STD-202	300cycles	No visible damage	<50mΩ
method 107			
ESD	Test contact 1.0KV (0.5KV for 0402 only)	∆R/R max. ±(1%+0.05Ω)	- F 0-m C
AEC-Q200-002		No visible damage	<50mΩ

TEST CONDITION FOR JUMPER (0 Ω)

Item	MR10	MR12	MR08	MR06	MR04
Power Rating At 70°C	1/2W	1/4W	1/4W	1/8W	1/10W
Resistance	esistance MAX.50mΩ				
Rated Current	3A	2A	2A	1.5A	1A
Peak Current	7.5A	5A	5A	3.5A	3A
Operating Temperature	-55 ~ +155°C				

PACKAGING

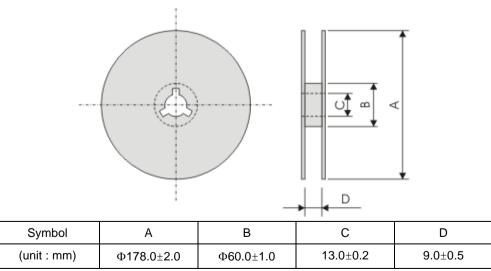
Paper Tape specifications (unit :mm)



Series No.	А	В	W	F	E
MR10	3.60±0.20	3.00±0.20			
MR12	3.60±0.20	2.00±0.20			
MR08	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.20	1.75±0.10
MR06	1.90±0.20	1.10±0.20			
MR04	1.20±0.10	0.70±0.10			

Series No.	P1	P0	ΦD	Т
MR10/12/08	4.00±0.10			Max. 1.0
MR06	4.00±0.10	4.00±0.10	Φ 1.50 ^{+0.1} _{-0.0}	0.65±0.05
MR04	2.00±0.10			0.40±0.05

7" Reel dimensions



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