ELECTRICAL · CHEAT SHEET

SMD resistor *codes*.

Decoder for surface-mount resistor markings — **3-digit** (E24, 5%), **4-digit** (E96, 1%), and **EIA-96** (1% precision). Per IEC 60062.

How the three systems work

SYSTEM	FORMAT	DECODING	TYPICAL TOLERANCE	EXAMPLE
3-digit	`ABC`	AB × 10^{C} Ω	±5% (E24 series)	`472` = 47 × 10^{2} = 4.7 kΩ
4-digit	`ABCD`	ABC × 10^{D} Ω	±1% (E96 series)	`4992` = 499 × 10^{2} = 49.9 kΩ
EIA-96	`NNX`	(base from table for NN) × (multiplier from table for X)	±1% (E96 series)	`01C` = 100 × 100 = 10 kΩ
"R" notation	e.g. `4R7`, `R47`, `0R10`	R = decimal point	varies (read marking direction carefully)	`4R7` = 4.7 Ω; `R47` = 0.47 Ω; `0R10` = 0.10 Ω
Zero-ohm jumper	`0`, `00`, `000`, `0000`	Not a resistor — a wire bridge	—	Used to route traces without a via

> **Quick rule of thumb:** count digits and check for letters. Three numbers = general purpose (5%); four numbers = precision (1%); two numbers + letter = EIA-96 (1%, compact).

Reading 3-digit codes

The first two digits are the significant figures; the third is the multiplier (power of 10).

MARKING	CALCULATION	VALUE
`100`	10 × 10^{0}	10 Ω
`220`	22 × 10^{0}	22 Ω
`470`	47 × 10^{0}	47 Ω
`101`	10 × 10^{1}	100 Ω
`221`	22 × 10^{1}	220 Ω
`472`	47 × 10^{2}	4.7 kΩ

MARKING	CALCULATION	VALUE
`103`	10×10^{3}	10 kΩ
`104`	10×10^{4}	100 kΩ
`105`	10×10^{5}	1 MΩ
`106`	10×10^{6}	10 MΩ

> **Watch out:** `100` means 10 Ω (10×10^{0}), *not* 100 Ω. The trailing zero is the multiplier, not the third significant digit.

Reading 4-digit codes (precision)

First three digits are significant figures; fourth is the multiplier. Used for ±1% E96 series.

MARKING	CALCULATION	VALUE
`1000`	100×10^{0}	100 Ω
`4700`	470×10^{0}	470 Ω
`1001`	100×10^{1}	1 kΩ
`4991`	499×10^{1}	4.99 kΩ
`1002`	100×10^{2}	10 kΩ
`4992`	499×10^{2}	49.9 kΩ
`1003`	100×10^{3}	100 kΩ
`1004`	100×10^{4}	1 MΩ

EIA-96 multiplier letters

The third character of an EIA-96 code is a letter giving the multiplier:

LETTER	MULTIPLIER	LETTER	MULTIPLIER
Z	×0.001	**D**	×1000

LETTER	MULTIPLIER	LETTER	MULTIPLIER
Y or R	×0.01	E	×10000
X or S	×0.1	F	×100000
A	×1	–	–
B or H	×10	–	–
C	×100	–	–

> In practice, **A, B, C, X** cover 99% of what you'll see. The duplicates (Y/R, X/S, B/H) come from harmonizing different national standards.

EIA-96 base value table (codes 01–96)

The first two digits of an EIA-96 marking look up a base value in this table (E96 series, ±1% standard values):

CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE
01	100	25	178	49	316	73	562
02	102	26	182	50	324	74	576
03	105	27	187	51	332	75	590
04	107	28	191	52	340	76	604
05	110	29	196	53	348	77	619
06	113	30	200	54	357	78	634
07	115	31	205	55	365	79	649
08	118	32	210	56	374	80	665
09	121	33	215	57	383	81	681
10	124	34	221	58	392	82	698
11	127	35	226	59	402	83	715
12	130	36	232	60	412	84	732
13	133	37	237	61	422	85	750

CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE
14	137	38	243	62	432	86	768
15	140	39	249	63	442	87	787
16	143	40	255	64	453	88	806
17	147	41	261	65	464	89	825
18	150	42	267	66	475	90	845
19	154	43	274	67	487	91	866
20	158	44	280	68	499	92	887
21	162	45	287	69	511	93	909
22	165	46	294	70	523	94	931
23	169	47	301	71	536	95	953
24	174	48	309	72	549	96	976

Worked EIA-96 examples

MARKING	BASE (FROM TABLE)	MULTIPLIER (FROM LETTER)	VALUE
`01A`	01 → 100	A → ×1	100 Ω
`01B`	01 → 100	B → ×10	1 kΩ
`01C`	01 → 100	C → ×100	10 kΩ
`29B`	29 → 196	B → ×10	1.96 kΩ
`38C`	38 → 243	C → ×100	24.3 kΩ
`39D`	39 → 249	D → ×1000	249 kΩ
`68X`	68 → 499	X → ×0.1	49.9 Ω
`92Z`	92 → 887	Z → ×0.001	0.887 Ω

Quick reference: common values

RESISTANCE	3-DIGIT (5%)	4-DIGIT (1%)	EIA-96 (1%)
10 Ω	100	10R0	01X
100 Ω	101	1000	01A
220 Ω	221	2200	34A
330 Ω	331	3300	51A
470 Ω	471	4700	66A
1 kΩ	102	1001	01B
2.2 kΩ	222	2201	34B
4.7 kΩ	472	4701	66B
10 kΩ	103	1002	01C
22 kΩ	223	2202	34C
47 kΩ	473	4702	66C
100 kΩ	104	1003	01D
1 MΩ	105	1004	01E

Package sizes and what you'll see on each

PACKAGE (IMPERIAL)	SIZE (MM)	POWER (W)	TYPICAL MARKING
2512	6.4 × 3.2	1	3 or 4 digit
2010	5.0 × 2.5	0.75	3 or 4 digit
1206	3.2 × 1.6	0.25	3 or 4 digit
0805	2.0 × 1.25	0.125	3 or 4 digit
0603	1.6 × 0.8	0.1	3 digit or EIA-96
0402	1.0 × 0.5	0.063	Often unmarked or EIA-96
0201	0.6 × 0.3	0.05	Unmarked — refer to BOM
01005	0.4 × 0.2	0.031	Unmarked — refer to BOM

Common pitfalls

- **`100` ≠ 100 Ω.** In the 3-digit system, `100` is 10 × 10⁰ = **10 Ω**. The 3rd digit is the multiplier. For 100 Ω, the marking is `101`.
- **3-digit and 4-digit codes look similar.** A part marked `1001` on an 0805 (4-digit, 1 kΩ) and `101` on an 0603 (3-digit, 100 Ω) can be confused if you don't count digits. When in doubt, measure.
- **Underlined codes are precision E24 in some manufacturer schemes.** A `122` (underlined middle digit) or a single underbar may mean precision (1% or better) at an E24 value not normally in the precision series. Convention varies by maker.
- **Zero-ohm jumper markings vary.** Single `0`, `00`, `000`, or `0000` all indicate a wire bridge, not a 0 Ω calculation. Don't try to decode them.
- **Tolerance and tempco aren't on the marking.** The code gives resistance only. For 1%, 0.1%, 0.01% variants or for low-tempco precision parts, you need the manufacturer's reel label or BOM.
- **Power rating is in the package, not the code.** An 0603 part marked `103` (10 kΩ) is rated about 0.1 W; a 1206 with the same `103` marking is rated 0.25 W. Same value, very different power handling.
- **0402 and smaller usually have no marking.** Below 0603 there's typically no room to print legible characters. The only way to identify the part is from the assembly BOM, the reel label, or a multimeter.
- **"R" on a non-EIA-96 code means decimal point.** `4R7` = 4.7 Ω, `R47` = 0.47 Ω. In EIA-96, R is also one of the multiplier letters (×0.01) — context determines which. If the code is exactly 3 characters with two digits and one letter at the end, it's EIA-96; otherwise R is a decimal point.

Common questions

How do I read an SMD marked '472'?

It's the 3-digit code: first two digits (47) are significant figures, third (2) is the power of 10 multiplier. So 472 = 47 × 10² = 4,700 Ω = 4.7 kΩ. This is one of the most common SMD resistor markings.

What if the resistor has 4 digits like '4701'?

That's the 4-digit precision code (typically ±1% E96 series). First three digits (470) are significant; fourth (1) is the multiplier. So 4701 = 470 × 10¹ = 4,700 Ω = 4.7 kΩ. Same value as '472' in the 3-digit code, but ±1% instead of ±5%.

Why does my SMD resistor say '01C' instead of digits?

It's EIA-96 code, used on tiny precision SMD resistors where there's no room for 4 digits. First two digits (01) look up a base value in the EIA-96 table (01 = 100). The letter (C) is a power of 10 multiplier (C = 100). So 01C = 100 × 100 = 10,000 Ω = 10 kΩ. All EIA-96 resistors are ±1% precision.

Why is my SMD resistor blank — no markings?

Below 0603 (1.6 × 0.8 mm) package size, there's typically no room for legible markings. 0402 and 0201 resistors often ship unmarked. The only way to identify them is from the PCB assembly drawing, manufacturer's reel label, or by measurement with a multimeter.

What does '0' or '000' on an SMD resistor mean?

Zero ohm — it's not a resistor but a jumper/bridge used in PCB layout. They look like resistors so automated assembly machines can place them like any other component, but their function is to connect traces (often for SKU variants or to cross-jump signals). Resistance is typically under 50 mΩ — effectively a wire.

Sources

- **IEC 60062** — Marking codes for resistors and capacitors. The international standard underlying the EIA-96 numeric base values and tolerance letter codes.
- **EIA-RS-279** — The EIA standard for resistor color and marking systems.
- **E-series preferred values** per IEC 60063 — E24, E48, E96, E192 series define which resistance values are standard at each tolerance class.