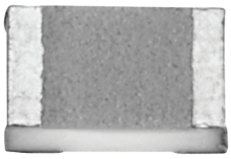
Thin Film Microwave Resistors



FEATURES

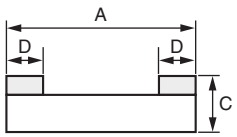
- Small size, down to 20 by 16 mils
- Edged trimmed block resistors
- Pure alumina substrate (99.5 %)
- Various terminations:
  - Pre-tinned over nickel barrier (wraparound or flip chip) for solder reflow
  - Gold pad for wire (or ribbon) bonding (one face only)
- Ohmic range: 10R to 500R
- Small internal reactance (LC down to 1×10^{-24})
- Tolerance 1 %, 2 %, 5 %, 10 %
- TCR: 100 ppm/°C in (- 55 °C, + 155 °C) temperature range

Pb-free

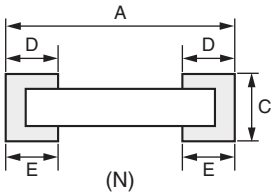
RoHS
COMPLIANT

Those miniaturized components are designed in such a way that their internal reactance is very small. When correctly mounted and utilized, they function as almost pure resistors on a very large range of frequency, up to 20 GHz.

DIMENSIONS in millimeters [inches]



(F) and (P)



(N)

CASE SIZE MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	DIMENSIONS				POWER RATING Pn mW	LIMITING ELEMENT VOLTAGE V
	A	B	C	D/E		
	MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	MAX. TOL. + 0.127 [+ 0.005] MIN. TOL. - 0.127 [- 0.005]	MAX. TOL. + 0.13 [+ 0.005] MIN. TOL. - 0.13 [- 0.005]		
02016	0.5 [0.020]	0.4 (0.016)	0.5 (0.02)	0.15 [0.006]	30	30
0402	1.00 [0.040]	0.6 (0.023)	0.5 (0.02)	0.38 [0.015]	50	37
0505	1.27 [0.050]	1.27 (0.050)	0.5 (0.02)	0.38 [0.015]	125	50
0603	1.52 [0.060]	0.75 (0.030)	0.5 (0.02)	0.38 [0.015]	125	50
0705/0805	1.91 [0.075]	1.27 (0.050)	0.5 (0.02)	0.38 [0.015]	200	50
1005	2.54 [0.100]	1.27 (0.050)	0.5 (0.02)	0.38 [0.015]	250	75
1206	3.00 [0.126]	1.60 (0.063)	0.5 (0.02)	0.38 [0.015]	330	75

TOLERANCE VERSUS OHMIC VALUES			
OHMIC RANGE	10 Ω ≤ R < 50 Ω	50 Ω ≤ R < 100 Ω	100 Ω ≤ R ≤ 500 Ω
TOLERANCE	5 %, 10 %	2 %, 5 %, 10 %	1 %, 2 %, 5 %, 10 %

GLOBAL PART NUMBER INFORMATION

New Global Part Numbering: CH0402-50RJP (1) (preferred part number format)

C	H	0	4	0	2	-	5	0	R	J	P

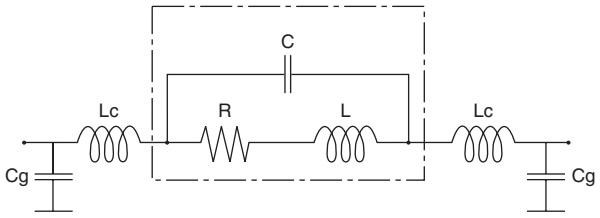
GLOBAL MODEL	SIZE	OHMIC VALUE	TOLERANCE	TERMINATION
CH	**02016** **0402** **0505** **0603** **0805** **1005** **1206**	10R to 500R	**F** = 1 % **G** = 2 % **J** = 5 % **K** = 10 %	**F** (Flip Chip): SnAg over nickel barrier **N** (W/A): SnAg over nickel barrier (except 02016) **P** (one face): Gold Bonding Pads

Historical Part Number example: CH 0402 50R 5 % P e2 (will continue to be accepted)

CH	0402	50R	5 %	P	e2
HISTORICAL MODEL	SIZE	OHMIC VALUE	TOLERANCE	TERMINATION	LEAD (Pb)-FREE VERSION e2: tin/silver e4: gold

Note:
(1) 02016 Not available with N termination - Tape option: Except P termination

TYPICAL HIGH FREQUENCY PERFORMANCE ELECTRICAL MODEL



C: Internal shunt capacitance
L: Internal inductance
R: Resistance
Lc: External connection inductance
Cg: External capacitance to ground

The complex impedance of the chip resistor is given by the following equations:

$$Z = R \frac{1 + j\, X_L/R}{1 + j\, R/X_C}$$ with $X_L = 2\pi fL$: Reactance of the internal inductance

$$\theta = \text{Arc tg} \frac{X_L (X_C + X_L) + R^2}{R\, X_C}$$ with Xc= I/2πfC: Reactance of the internal capacitance

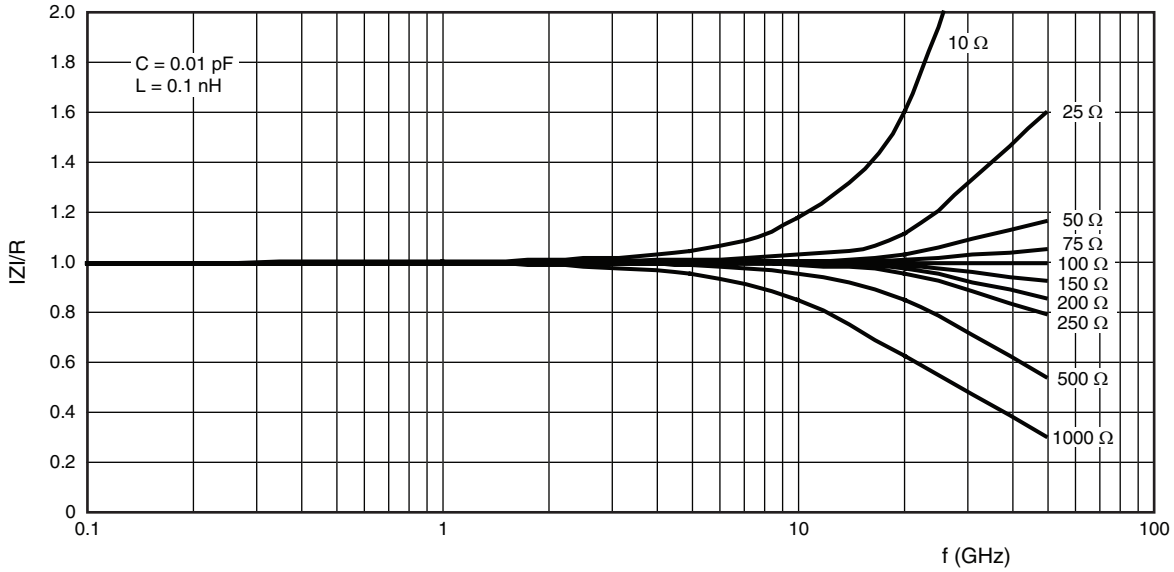
$$[Z] = R \left[\frac{1 + (X_L/R)^2}{1 + (R/X_C)^2}\right]^{1/2}$$ f = frequency

The resistor is purely resistive when $R = (L/C)^{1/2} = Z_o$. The smaller the LC product the greater the frequency range over which the resistor looks approximately resistive.

This can be seen on the graphs relevant to 02016 (R = 100 Ω, LC = 1 x 10^{-24}), 0402 (R = 129 Ω, LC = 15 x 10^{-24}) and 1206 (R = 200 Ω, LC = 100 x 10^{-24}).

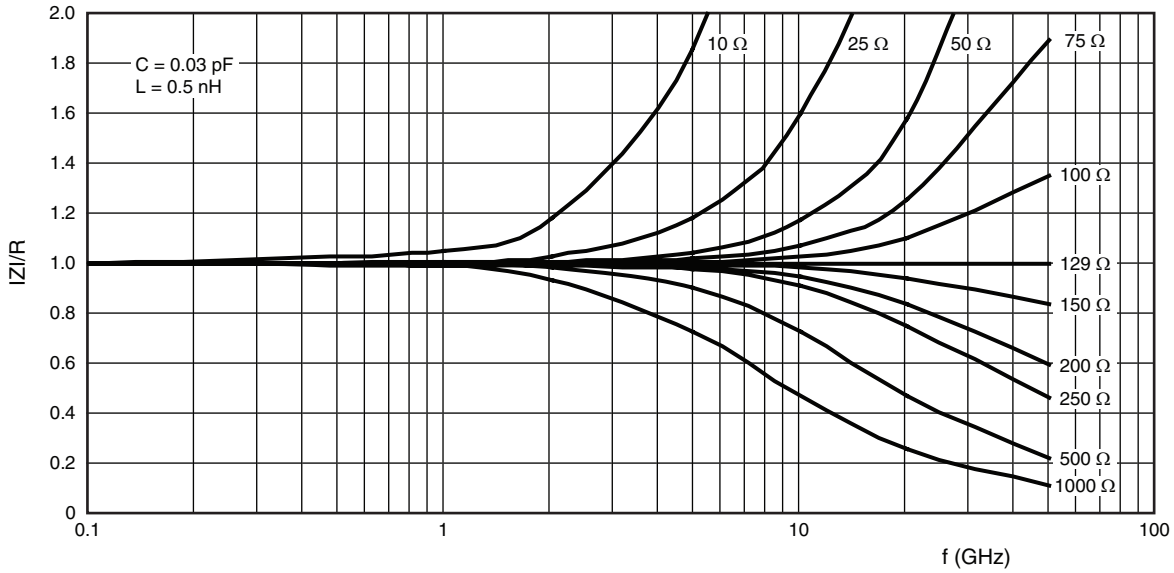
Note:
The external reactance (Lc and Cg) depends on the PCB material, the layout and assembly technology. It does affect the HF performance and needs to be estimated. The external reactance can be utilized to compensate the internal one.

INTERNAL IMPEDANCE CURVE FOR 02016 SIZE

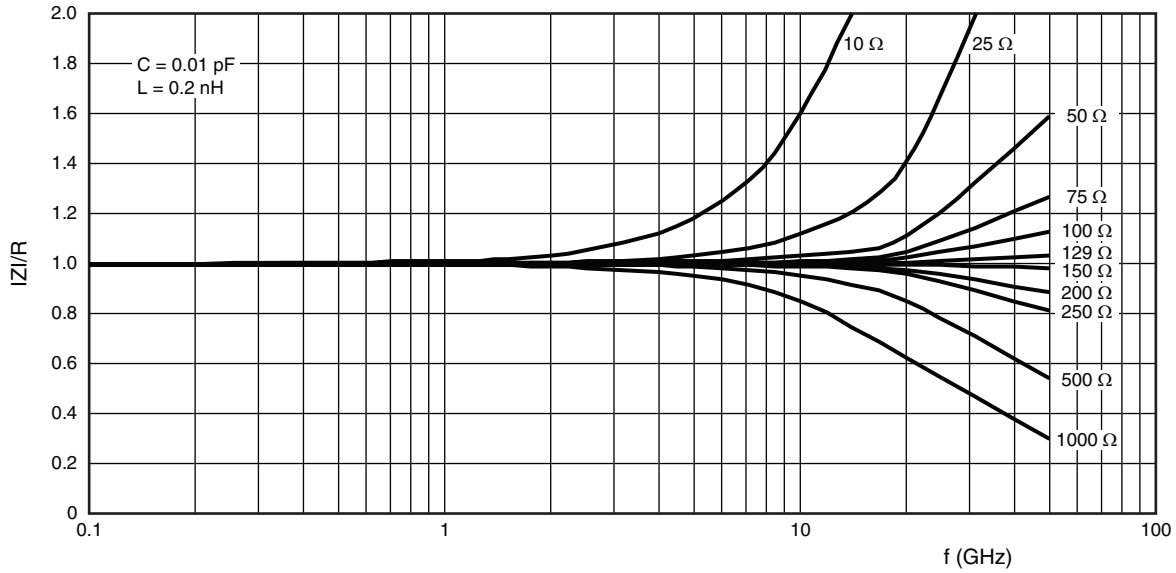


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0402 SIZE

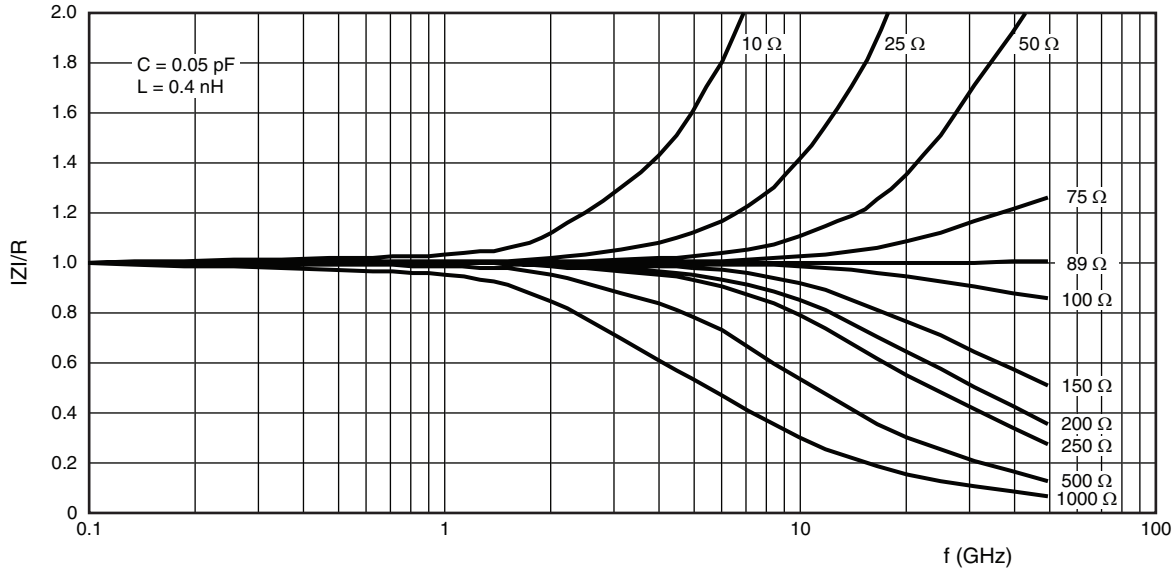


Impedance as a function of frequency for a chip resistor N termination (wraparound)

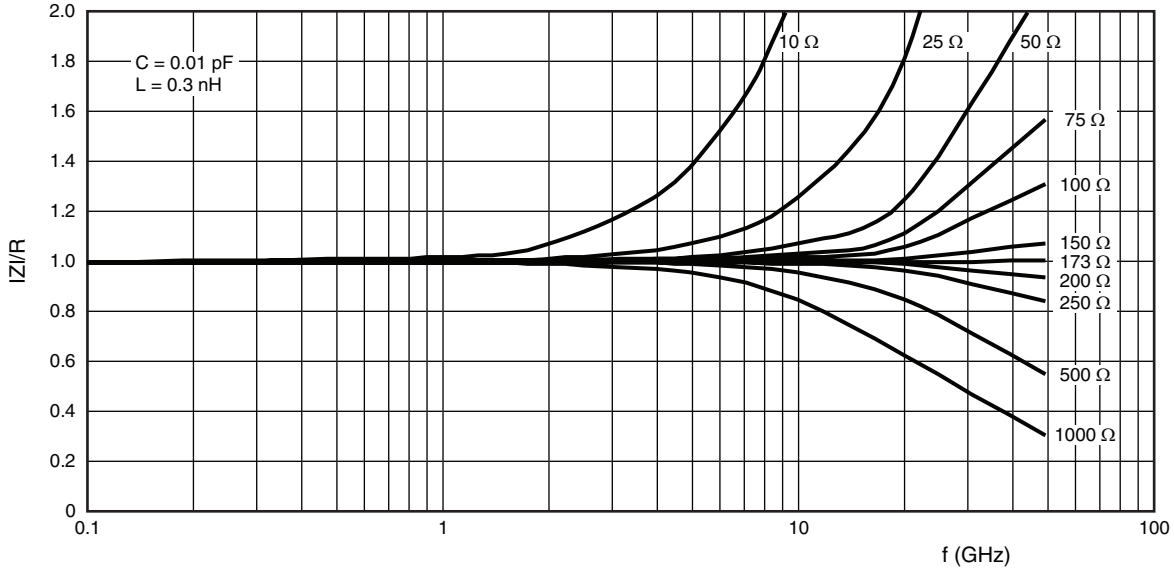


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0603/0505 SIZE

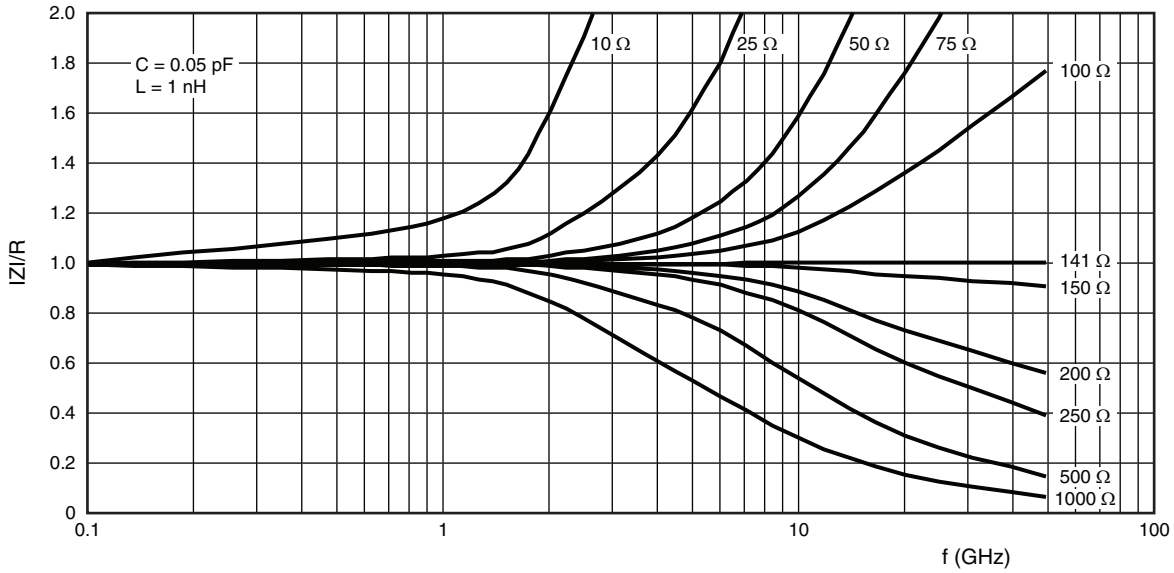


Impedance as a function of frequency for a chip resistor N termination (wraparound)

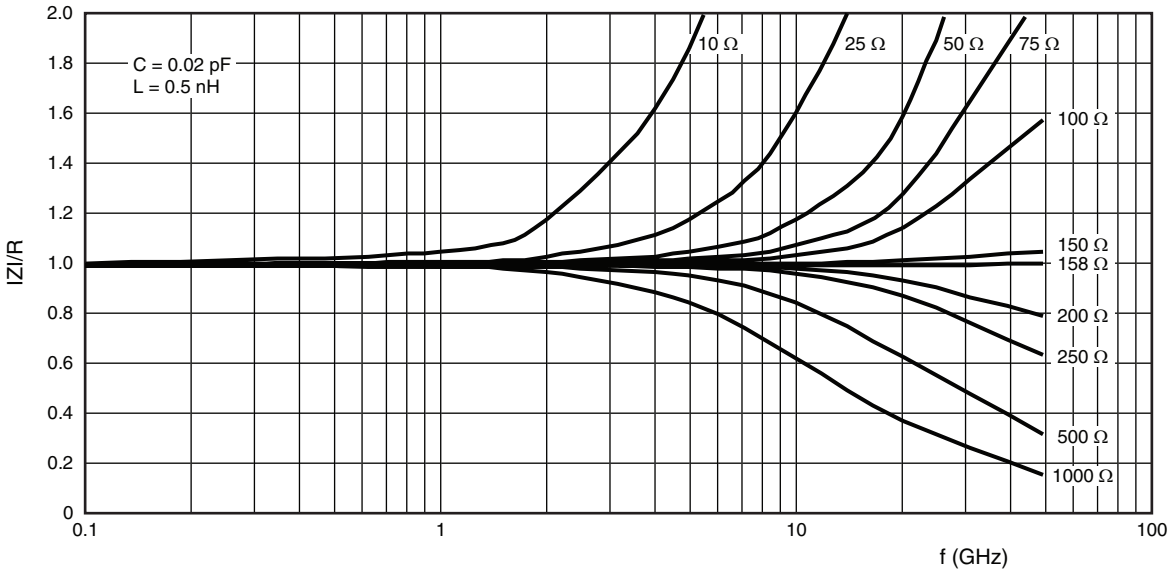


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0805 SIZE

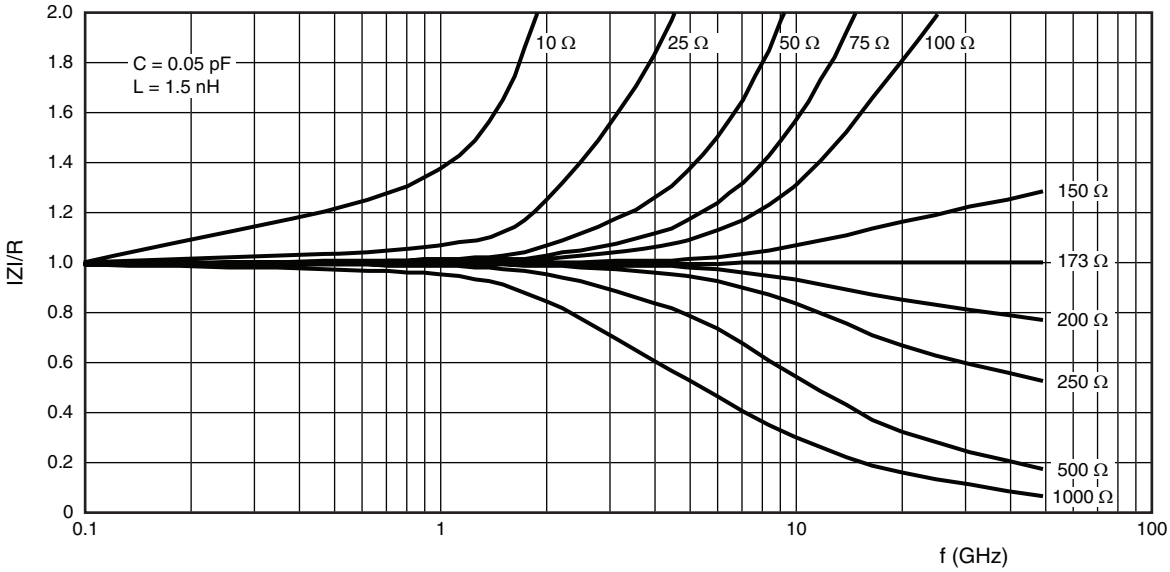


Impedance as a function of frequency for a chip resistor N termination (wraparound)

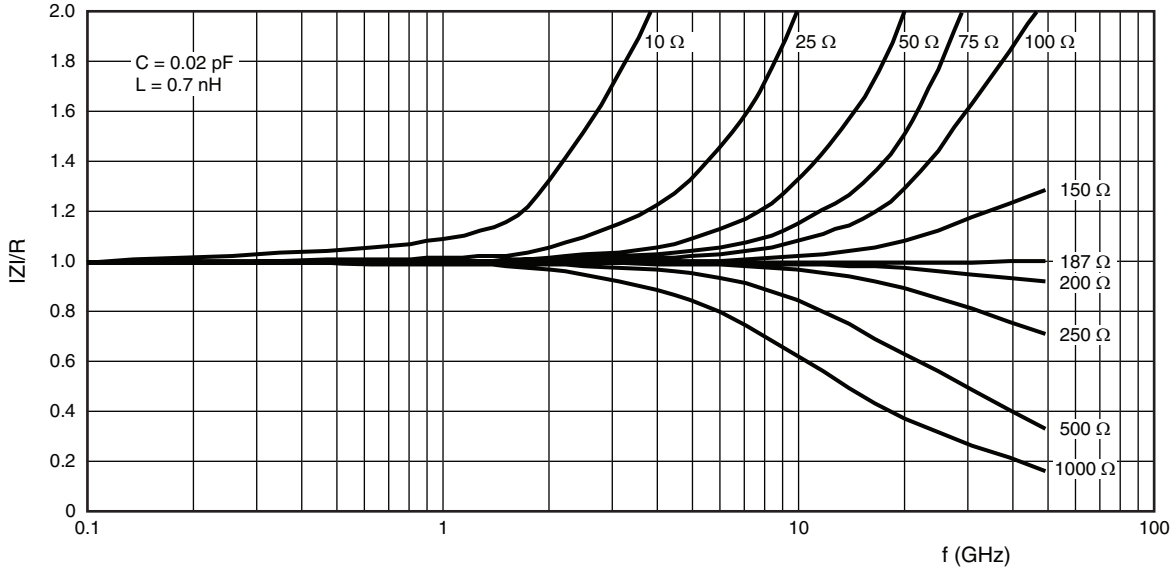


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 1005 SIZE

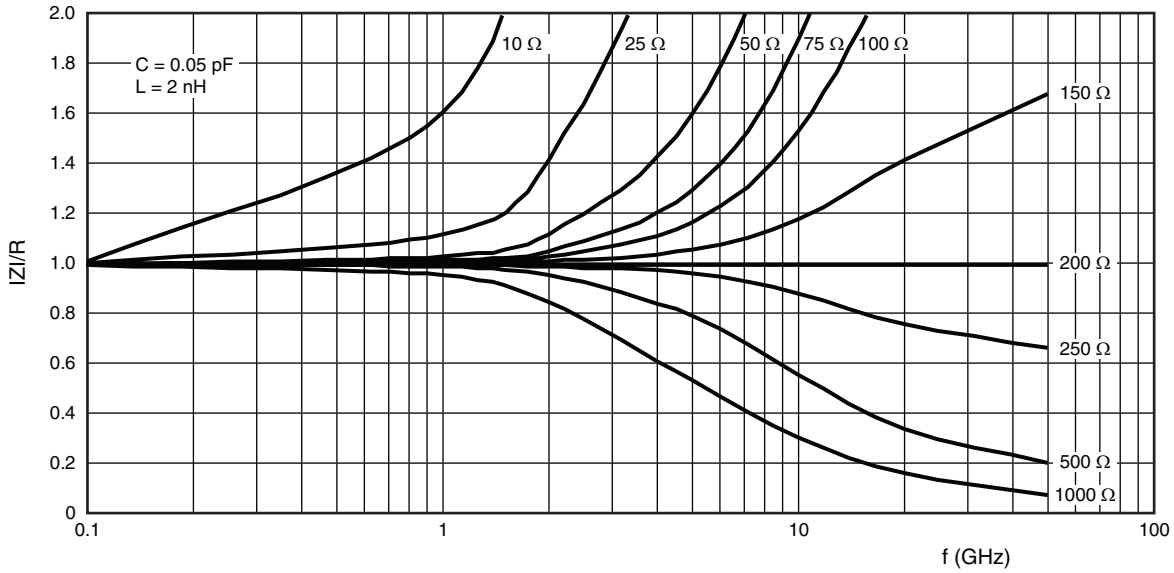


Impedance as a function of frequency for a chip resistor N termination (wraparound)

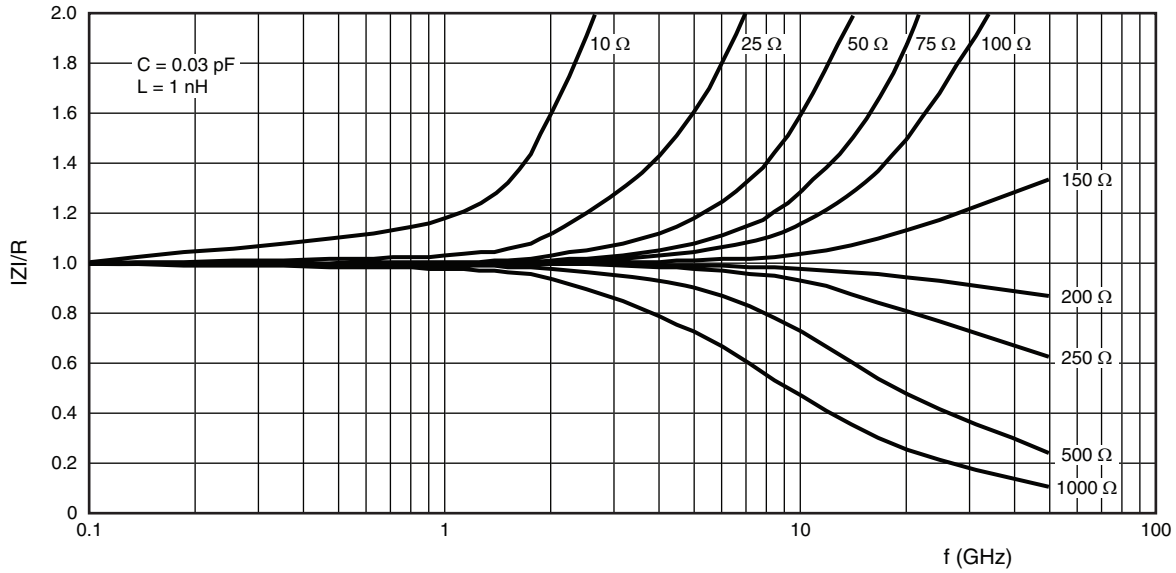


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 1206 SIZE



Impedance as a function of frequency for a chip resistor N termination (wraparound)



Impedance as a function of frequency for a chip resistor (F and P terminations)

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