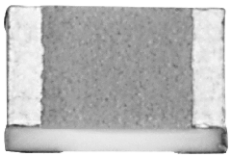
50 GHz Thin Film Microwave Resistors



FEATURES

- SMD wraparound or flip chip resistor
- 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
- Design kits available
- 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
- Compliant to RoHS directive 2002/95/EC

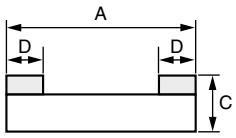
Pb-free

RoHS COMPLIANT

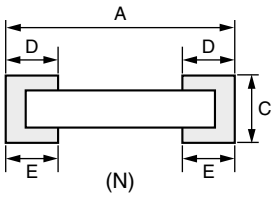
GREEN (5-2008)**

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 50 GHz.

DIMENSIONS in millimeters [inches]



(F) and (P)



(N)

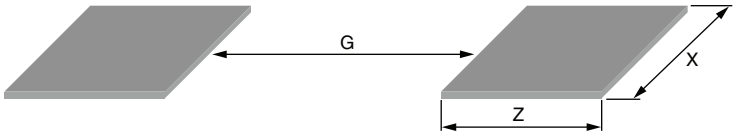
CASE SIZE MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	DIMENSIONS					POWER RATING Pn mW	LIMITING ELEMENT VOLTAGE V
	A	B	C	D/E			
	MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	MAX. TOL. + 0.1 [+ 0.004] MIN. TOL. - 0.1 [- 0.004]	MAX. TOL. + 0.127 [+ 0.005] MIN. TOL. - 0.127 [- 0.005]	MIN.	MAX.		
02016 preferred	0.50 [0.020]	0.39 [0.016]	0.42 [0.02] (1)	0.1 [0.004]	0.2 [0.008]	30	30
0402 preferred	1.00 [0.040]	0.6 [0.023]	0.5 [0.02]	0.15 [0.006]	0.35 [0.014]	50	37
0505	1.27 [0.050]	1.27 [0.050]	0.5 [0.02]	0.25 [0.010]	0.51 [0.020]	125	50
0603 preferred	1.52 [0.060]	0.75 [0.030]	0.5 [0.02]			125	50
0705/0805	1.91 [0.075]	1.27 [0.050]	0.5 [0.02]			200	50
1005	2.54 [0.100]	1.27 [0.050]	0.5 [0.02]			250	75
1206	3.06 [0.120]	1.60 [0.063]	0.5 [0.02]	0.27 [0.011]	0.53 [0.021]	330	75

Note

(1) + or - 0.07 mm

** Please see document “Vishay Green and Halogen-Free Definitions (5-2008)”: www.vishay.com/doc?99902

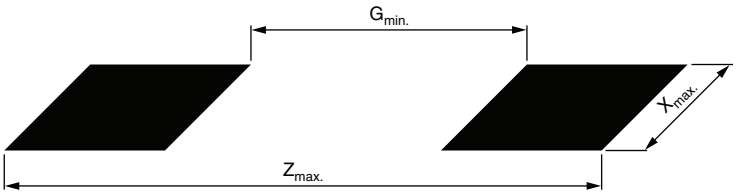
LAND PATTERN FLIP CHIP TERMINATIONS in millimeters



CHIP SIZE	Z	X	G
02016	0.3	0.5	0.2
0402	0.5	0.650	0.4
0505	0.6	1.320	0.510
0603	0.6	0.9	0.760
0705/0805	0.7	1.3	1.14
1005	0.7	1.3	1.780
1206	0.9	1.7	2.1

Note
- Suggested land pattern: According to IPC-7351

WRAPAROUND TERMINATIONS in millimeters



CHIP SIZE	$Z_{max.}$	$G_{min.}$	$X_{max.}$
0402	1.55	0.15	0.73
0505	1.82	0.10	1.40
0603	2.37	0.35	0.98
0705/0805	2.76	0.74	1.40
1005	3.39	1.37	1.40
1206	3.91	1.85	1.73

TOLERANCE VS. OHMIC VALUES			
OHMIC RANGE	10 Ω ≤ R < 50 Ω	50 Ω ≤ R < 100 Ω	100 Ω ≤ R ≤ 500 Ω (1)
TOLERANCE	5 %, 10 %	2 %, 5 %, 10 %	1 %, 2 %, 5 %, 10 %

Note
(1) Best tolerance for 100 Ω to 500 Ω in 02016 is 2 %

PREFERRED MODELS AND VALUES

Vishay/Sfernice highly recommend to use the smallest sizes and flip chip version to get the best performances.

Recommended sizes:
CH02016/CH0402/CH0603

Recommended terminations:
F

Recommended Values:
10R/18R/25R/50R/75R/100R/150R/180R/200R/250R/330R/500R
Those values are available with a MOQ of 100 pieces.
Other values can be ordered upon request, but higher MOQ will apply: 1000 pieces for CH02016, 500 pieces for CH0402, 250 pieces for CH0505/CH0603/CH0705/CH0805/CH1005 and 100 pieces for CH1206.

Design kits are available Ex Stock in CH02016 and CH0402 sizes. There are 20 pieces per recommended value. F termination. 5 % tolerance.
Those kits are packaged in pieces of tape and delivered in ESD bags.

PACKAGING

Standard packaging is waffle pack for sizes as of 0402 and paper tape for size 02016.
Plastic tape and reel is available for other sizes (low conductivity) or paper tape under request.

GLOBAL PART NUMBER INFORMATION

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

C	H	0	4	0	2	-	5	0	R	J	F	T

GLOBAL MODEL	SIZE	OHMIC VALUE	TOLERANCE	TERMINATION (1)	PACKAGING (2)
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): (3) Gold bonding pads	**T** = Tape and reel **PT** = Paper tape Leave blank for waffle pack

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

Global Part Number Ordering design kits:
CHKIT-02016
CHKIT-0402

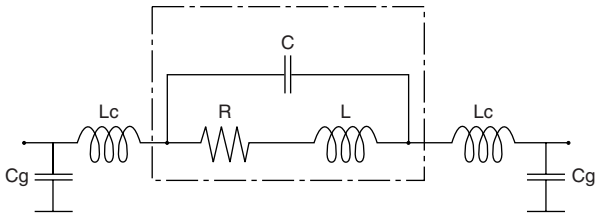
Notes

(1) 02016 Not available with N termination

(2) 02016 Paper tape only available

(3) Gold termination for application in hermetic package

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

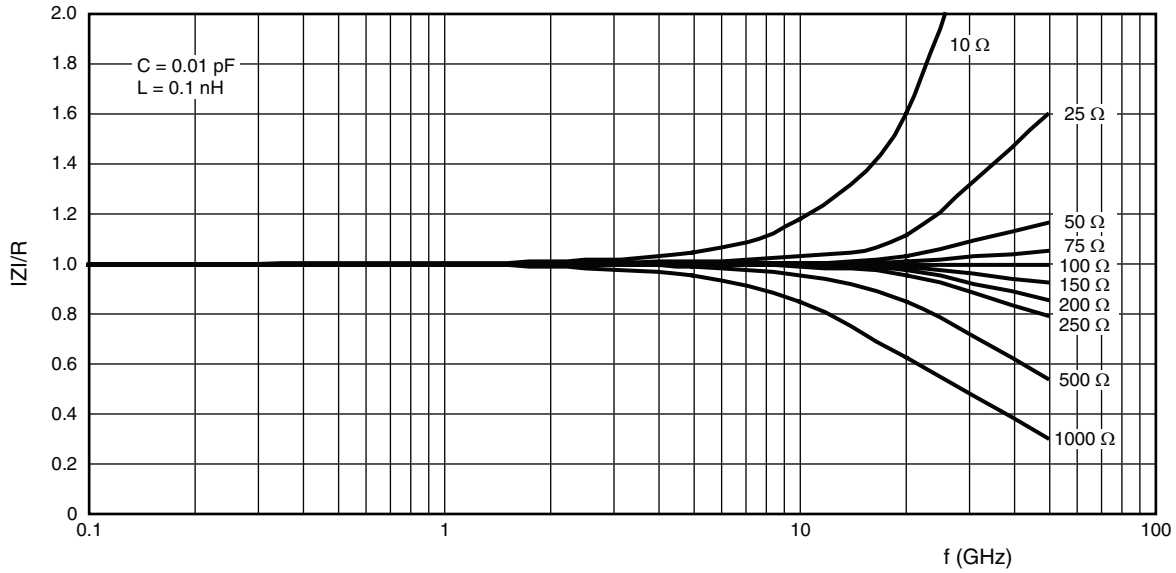
The resistor is purely resistive when $R = (L/C)^{1/2} = Z_o$. The smaller the LC product the greater the frequency range over which the resistor looks approximately resistive.

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

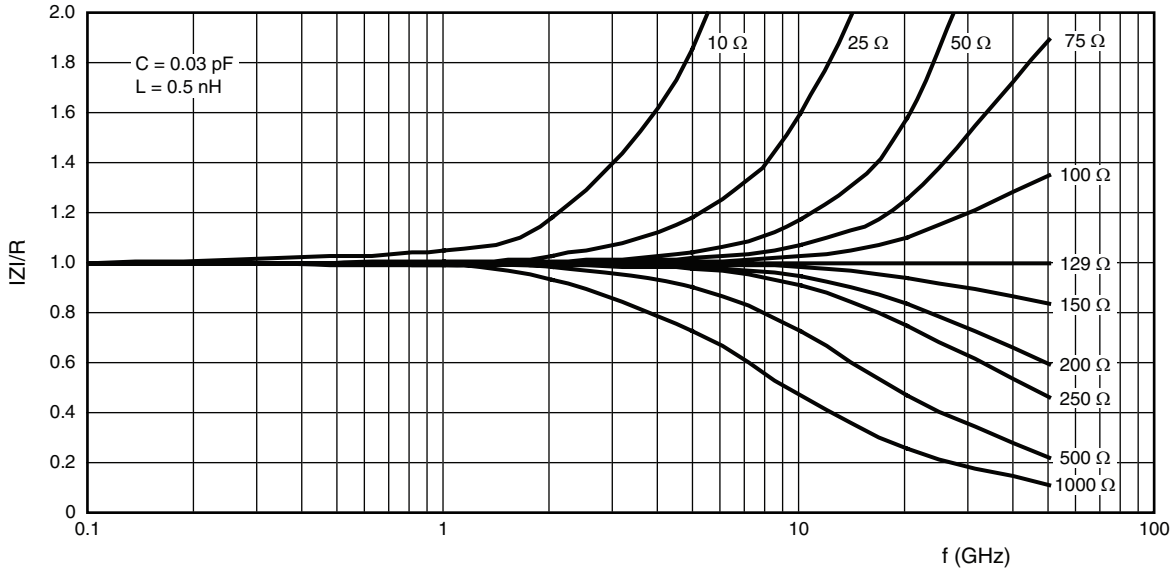
- The external reactance (Lc and Cg) depends on the PCB material, the layout and assembly technology. It does affect the HF performance and needs to be estimated. The external reactance can be utilized to compensate the internal one.

INTERNAL IMPEDANCE CURVE FOR 02016 SIZE

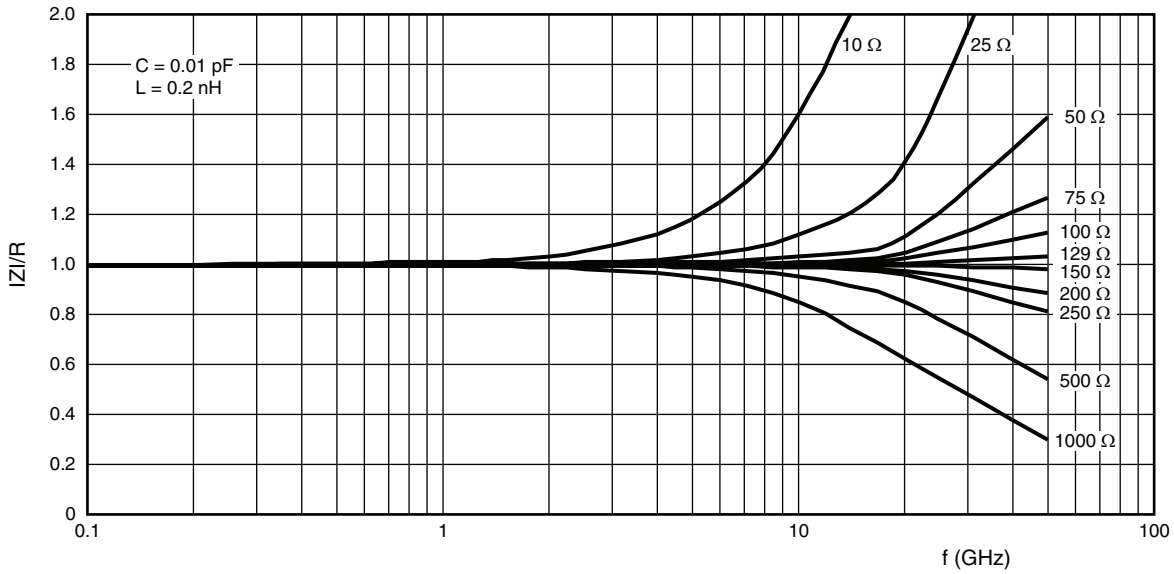


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0402 SIZE

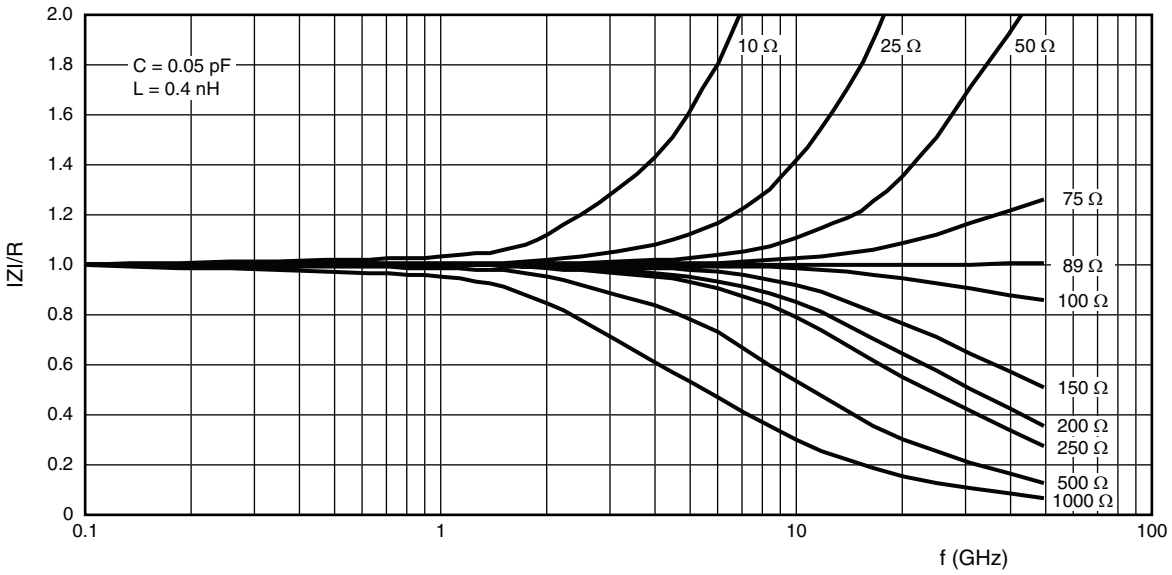


Impedance as a function of frequency for a chip resistor N termination (wraparound)

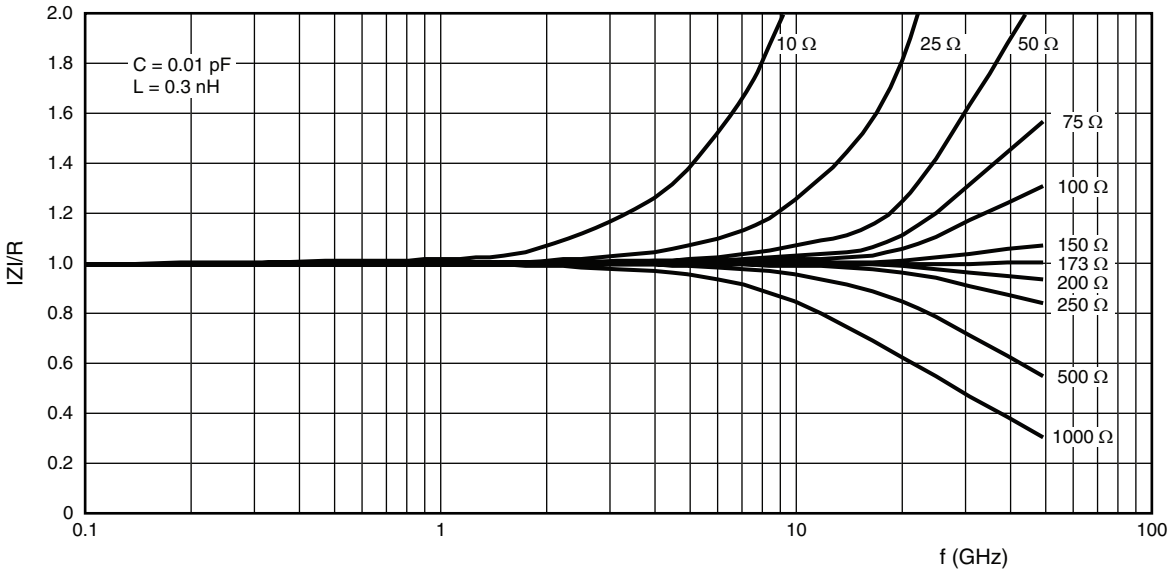


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0603/0505 SIZE

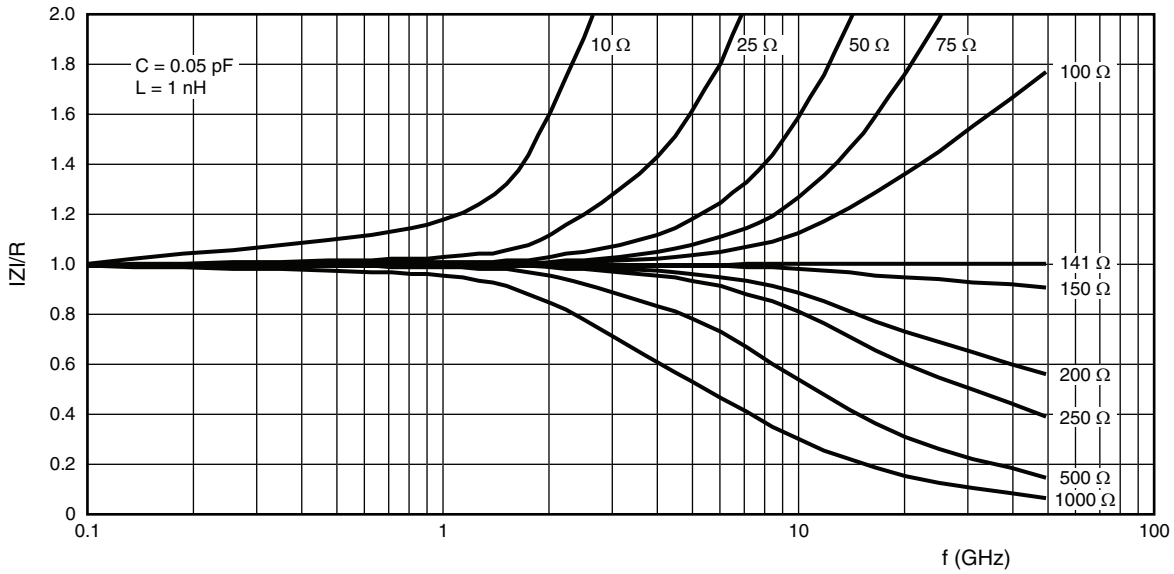


Impedance as a function of frequency for a chip resistor N termination (wraparound)

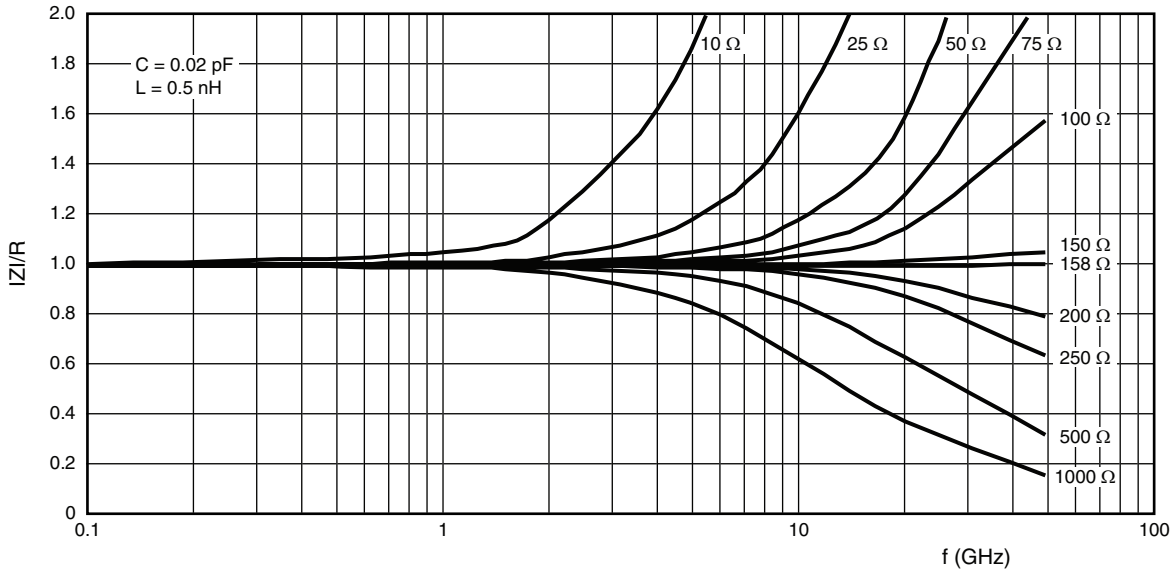


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 0805 SIZE

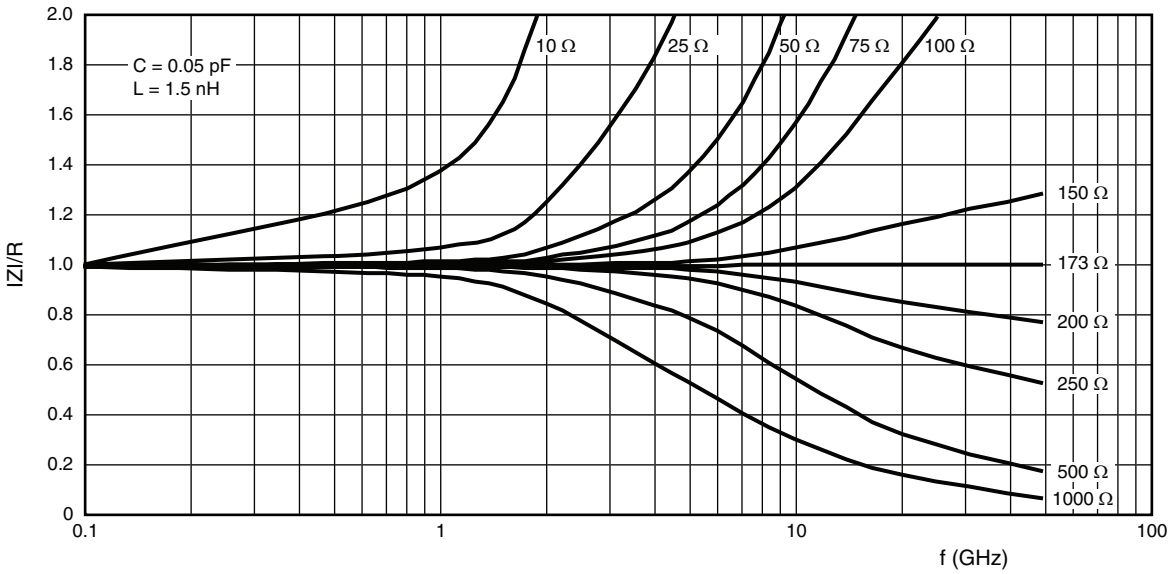


Impedance as a function of frequency for a chip resistor N termination (wraparound)

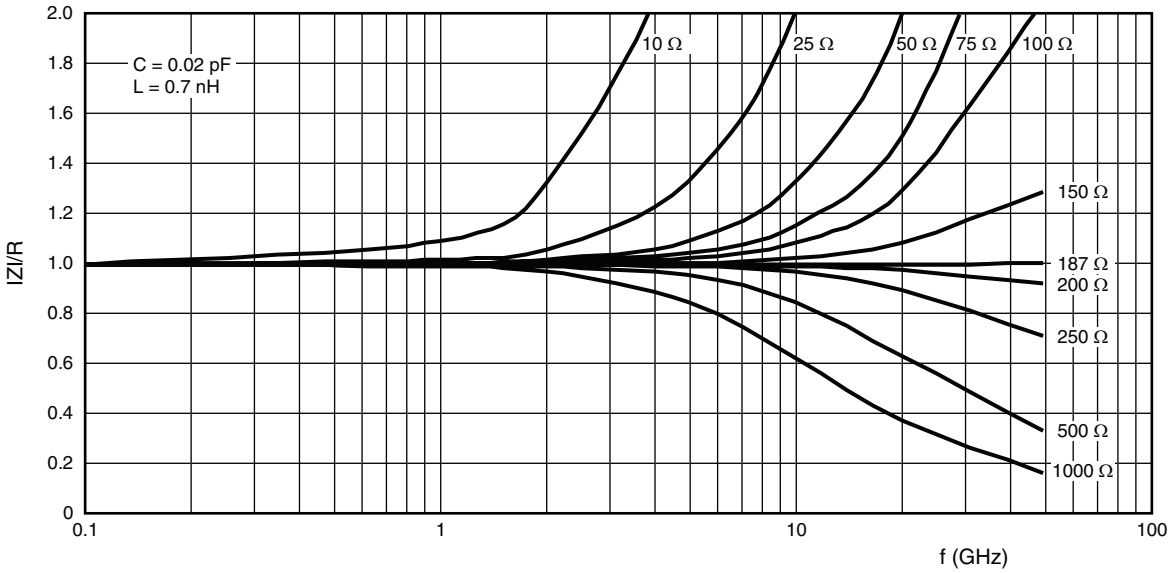


Impedance as a function of frequency for a chip resistor (F and P terminations)

INTERNAL IMPEDANCE CURVE FOR 1005 SIZE

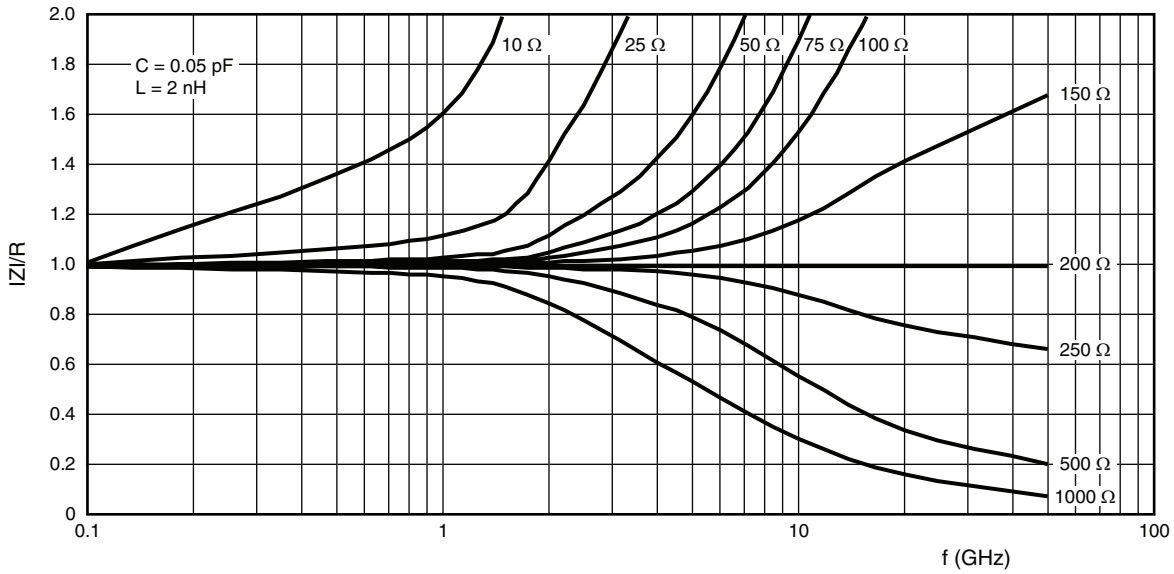


Impedance as a function of frequency for a chip resistor N termination (wraparound)

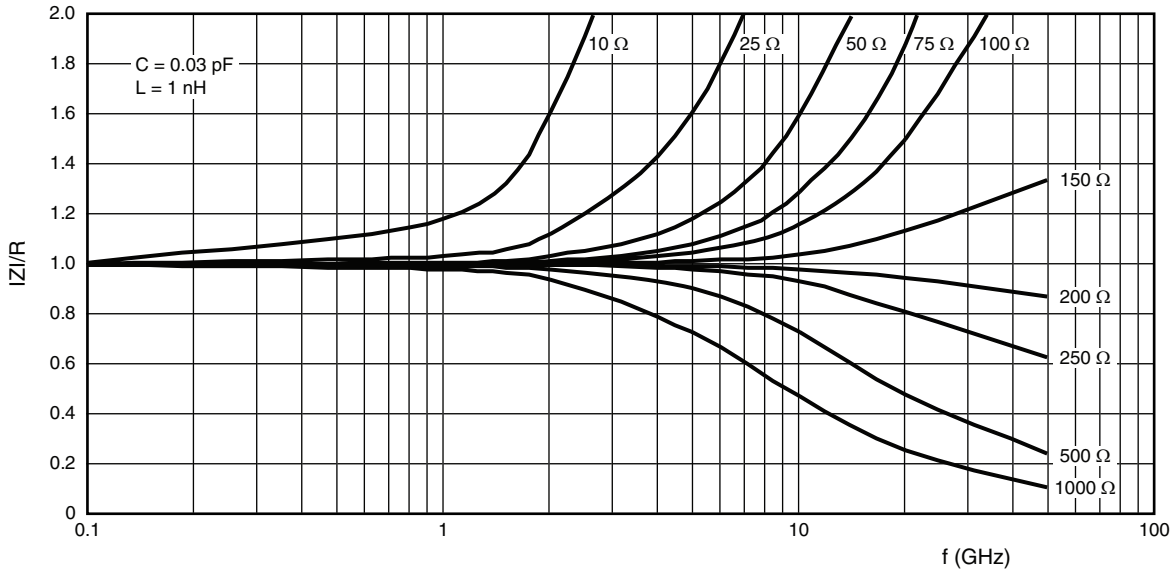


Impedance as a function of frequency for a chip resistor (F and P terminations)

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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