

Innovative Service Around the Globe

Current Sensing Chip Resistors

YAGEO Phícomp

About Yageo



Founded in 1977, the Yageo Corporation has become a world-class provider of passive component services with capabilities on a global scale, including production and sales facilities in Asia, Europe and the Americas. The corporation provides one-stop-shopping, offering its complete product portfolio of resistors, capacitors and wireless components in both commodity and specialty versions to meet the diverse requirements of customers.

Yageo currently ranks as the world No.1 in chipresistors, No. 3 in MLCCs and No. 4 in ferrite products, with a strong global presence: 21 sales offices in 15 countries, 9 production sites, 8 JIT logistic hubs, and 2 R&D centers worldwide.

We support our customers with extensive literature including datasheets, brochures and application notes, which are also available electronically on our website at: www.yageo.com

Introduction

Low Resistance, High Power for Current Sensing Applications

Reliable current measurement is critical for the protection, control, and monitoring to keep circuits safe during operation in power and instrumentation systems. Engineers in power supply and battery circuit designs need to consider a give-and-take strategy between low resistance values to minimize power losses and sufficient voltage supplies to avoid noises generated from the environments or particularly in switch mode power supplies.

Yageo's current-sensing chip resistors are also fully compatible with today's high volume pick-and-place assembly systems. As such, they offer attractive, cost-effective solutions to designers of low voltage power supplies and battery management systems. Featuring a comprehensive resistance range of 0.5 milli-ohms to I ohm (low-ohmic), and available from 0.05 to 10 watts, they are not only applicable to battery packs, power supplies and converters, but also suitable for use in diverse power control circuits of tablets, notebook computers and hard disks.

Yageo now offers three types of surface-mount (SMT) currentsensing chip resistors based on thick film, metal foil, and metal plate technologies, with scalable product portfolios to meet the various demands of customers and their applications.

Key Features of Yageo's Current Sensing Chip Resistors

- Low resistance value from $0.2m\Omega$ to 20 $m\Omega$ for minimizing power losses
- High power rating from 0.05 to 10 watts
- Tight tolerance within 2% to exhibit actual current via voltage reading
- Low TCR to avoid measurement distortions.TCR ranges from 50 to 100ppm/°C for metal and 100 to 1500ppm/°C for thick film current sensors
- Scalable off-the-shelf products in standard case sizes
- Wide termination and 4-termination are also available
- · Compatibility with surface-mount assembly process
- RoHS/REACH-compliant & Halogen-free

The low temperature coefficient of resistance (TCR) of Yageo's current sensing chip resistors minimizes the resistance change caused by self-heating and high temperature environments.

Thermal electromotive force (EMF) is also an important consideration. Thermal EMF is an important parameter of the metal foil series of battery management circuits, and of current sensing resistors. Thermal electromotive force (EMF) of an Mn-Cu alloy is especially optimal with low EMF below μ 0.03 uV/°C.

Product Portfolio

Thick Film Current Sensing Chip Resistors (RL & PT Series)

Based on thick film technology, these products exhibit far low parasitic inductance than wirewound and leaded counter parts. Yageo's thick film RL/PT low-ohmic current sensing chip resistors is low cost, capable of providing low TCR down to ± 75 ppm/°C, resistance value down to 50m Ω with power up to 2 watts of power dissipation.

Metal Foil Current Sensing Chip Resistors (PE Series)

Metal foil current-sensing resistors made of Mn-Cu alloy are developed with substrates to provide a better thermal dissipation and with a wider resistance range up to $300m\Omega$. In the metal foil type, TCR ranges from 50 to $100ppm/^{\circ}C$, power rates up to 2W, and resistance value is available as low as $5m\Omega$.

Metal Plate Current Sensing Chip Resistors (PA Series)

A relatively simple construction without multiple cuts, metal plate current sensing resistors provide low TCR down to ± 100 ppm/°C, high power rating up to 3W, high frequency performance and low resistance down to $Im\Omega$.

Wide Termination Current Sensing Chip Resistors (PE wide Series)

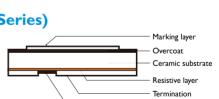
Using the wider side as connection in the mounting plate, wide termination current sensing chip resistors strengthen solder joints, holding reliably to achieve higher power rating needs. With an ideal structure to suppress heat generation, wide termination type current sensors save space, and reduce resistor numbers in highdensity circuit board designs.

Four-Termination, Current Sensing Chip Resistors (PS Series)

Design of accurate measurement circuitry, lower power consumption, higher accuracy, and smaller space requirements are important features for electronic control units. Four termination, current sensing resistors separating current-carry from voltagesensing termination are able to improve voltage and current measurement accuracy from the ideal Kelvin configuration. They also improve interference and thermoelectric effects at higher applied power.

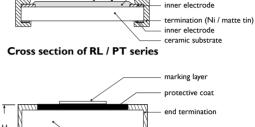
Shunt, Current Sensing Chip Resistors (PU Series)

This series are used for current sensing under the high current circuit, and provide ultra low resistance value down to $0.2m\Omega$. Its open air structure has better heat dissipation for high power resistor rating up to 10W.



Overcoat

Cross section of 4-termination series





marking layer

protective coat

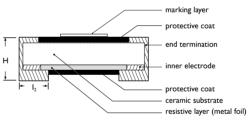
resistive layer

resistive layer (metal foil)





Cross section of PA series



Cross section of wide termination series

Marking Shunt structure

Cu

Product Selection Tables

Electrical characteristics

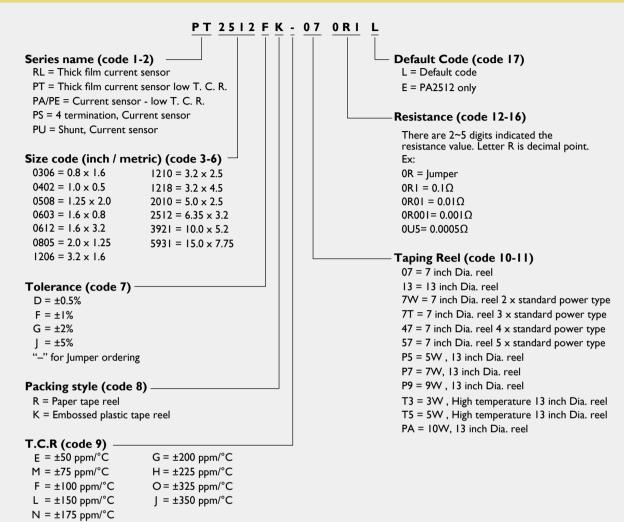
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PT2010xK-7WxxxxL 2010 IW 100 \leq K < 1Ω 100 mΩ < R < 1Ω ±75 ppr	/°C	$100m\Omega < R < 1\Omega \pm 75 \text{ ppm/}^{\circ}$		100 2 K < 122			IW	2010		PT2010xK-7WxxxxL		
		100mΩ ±100 ppm		100 ≤ R < 1Ω				IW	2512		PT2512xK-07xxxxL	
PT2512xK-7WxxxxL 2512 2W 100 ± 1 < 1Ω 100 ± 1 < 1Ω I00mΩ < R < IΩ ±75 ppr	/°C	$100m\Omega < R < 1\Omega \pm 75 \text{ ppm/}^{\circ}$		100 = 1 < 122			2W	2312		PT2512xK-7WxxxxL		
		$50m\Omega \le R \le 70m\Omega \pm 350 \text{ ppm}$			50 <r<200< td=""><td></td><td></td><td>1/20W</td><td>0201</td><td></td><td>PE0201xRx07xxxxxL</td></r<200<>			1/20W	0201		PE0201xRx07xxxxxL	
$\frac{\text{PE0201xRx7WxxxxxL}}{1/10W} \qquad \qquad \frac{300 \text{ m}\Omega < \text{R} \le 200 \text{m}\Omega \pm 100 \text{ pr}}{100 \text{ pr}}$	pm/°C	$70m\Omega < R \le 200m\Omega \pm 100 \text{ ppm}$	_	50 =11=200			1/10W	0201		PE0201xRx7WxxxxxL		
PE0402xRx07xxxxxL 1/16W -55°C to 125°C					-55°C to 125°C		1/16W			PE0402xRx07xxxxxL		
PE0402xRx7WxxxxxL /8W		+100ppm/°C		10 < R < 910	10 < R < 910	10 ≤ R ≤ 910	55 6 10 125 6		1/8W	0402		PE0402xRx7WxxxxxL
PE0402xRx/TxxxxL 1/6W				10 - 11 - 710				0102				
PE0402xRx47xxxxL I/4W			-									
PE0603xRx07xxxxxL I/10W												
PE0603xRx7WxxxxL I/5W												
PE0603xRx7TxxxxxL 0603 I/3W 5,10, 20 ≤ R ≤ 910				5,10, 20 ≤ R ≤ 910				0603				
PE0603xRx47xxxxL 2/5W ±0.5%			±0.5%									
PE0603xRx57xxxxxL PE 1/2W (>50mΩ)			(>50mΩ)			(PxR)^1/2	1/2W		PE	PE0603xRx57xxxxxL		
PE0805xRx0/xxxxxL 1/8W ±75 ppm/°C						(1,1,1) 1/2	1/8W			PE0805xRx07xxxxL		
PE0805xRx7WxxxxxL ±100 ppm/°C 0805 1/4W 5,10, 20 ≤ R ≤910 ±100 ppm/°C		±100 ppm/°C	T2 /0	5.10.20 < R <910			I/4W	0805		PE0805xRx7WxxxxxL		
PE0805×R×7T×xxxxL 1/3W -55°C to 170°C				5,10, 20 = 1(= 710	-55°C to 170°C		1/3W	0005		PE0805xRx7TxxxxL		
PE0805xRx47xxxxL I/2W						-55 C to 170 C		1/2W			PE0805xRx47xxxxL	
PE1206xRx07xxxxxL I/4W							I/4W			PE1206xRx07xxxxxL		
PE1206xRx7WxxxxxL I206 I/2W 5 ≤ R ≤ 910				910	$5 \le R \le 910$			1/2W	1206		PE1206xRx7WxxxxxL	
PE1206xRx47xxxxxL IW							IW			PE1206xRx47xxxxL		
PE2010xKx07xxxxxL 2010 1/2W 5 ≤ R ≤ 100 +50 ppm/°C				5 < R < 100			1/2W	2010		PE2010xKx07xxxxxL		
PE2010xKx7WxxxxL Z010 IW 5 ≤ R ≤ 100 ±50 ppm/°C ±75 ppm/°C ±75 ppm/°C ±75 ppm/°C ±75 ppm/°C		±50 ppm/°C +75 ppm/°C		5 - 1 - 100			IW	2010		PE2010xKx7WxxxxxL		
PE2512xKx0/xxxxxL 2512 100 ±100 ppm/°C				6 < R < 100			IW	2512				
PE2512xKx7WxxxxxL 2312 2W 83 K 3 100				0 - 1 - 100			2W	2312		PE2512xKx7WxxxxxL		

Global part number	Series	Size	Power rating	Max. voltage	Operating Temp. range	Resistance range (mΩ)	Tol.	T. C. R.												
PA2512xKF07xxxxE			IW																	
PA2512xKF7WxxxxxE		2512	2W			l≤ R ≤ 50														
PA2512xKF7TxxxxE	PA		3W	(PxR)^1/2	–55°C to 170°C		±1%	±100 ppm/°C												
PA1206xRF07xxxxL			I/4W	(1 × 1() 1/2	-55 C to 170 C		±5%													
PA1206xRF7WxxxxxL		1206	1/2W			l≤ R ≤5														
PA1206xRF47xxxxxL			IW																	
PE0508xRx07xxxxxL	PE	0508	1.2W			5≤R≤100	1.1.9/	±50ppm°C												
PE0612xKx07xxxxxL	(Wide)	0612	IW	(PxR)^1/2	-55°C to 155°C	≤R≤ 00	±1% ±5%	±75ppm/°C												
PE0612xKx7WxxxxxL	(*******)	0012	2W			121/2100	_0/0	±100ppm/°C												
PS0306xRx07xxxxxL			1/8W		-55°C to 125°C		±1%	$5m\Omega \le R \le 100m\Omega \frac{\pm 75 \text{ ppm/°C}}{\pm 100 \text{ ppm/°C}}$												
PS0306xRx7WxxxxxL		0306	I/4W		0.5mΩ ≤ R ≤10mΩ	3≤ R ≤ 100														
PS0306xRx7TxxxxxL	PS		1/2W	(D. D)A1/2				$3m\Omega \le R < 5m\Omega \pm 150 \text{ ppm/}^{\circ}C$												
PS0612xKx07xxxxxL	PS	0612	0612	IW	- (PxR)^1/2	-55°C to I50°C I2mΩ ≤ R ≤ I00mΩ -55°C to I25°C	0.5, 0.75, l≤ R ≤ 100	±5%	$\begin{array}{l} 0.5m\Omega \leq R \leq Im\Omega \pm I50ppm/^{\circ}C \\ I0m\Omega \leq R \leq I3m\Omega \pm 200ppm/^{\circ}C \\ 2m\Omega \leq R \leq 9m\Omega \pm I00ppm/^{\circ}C \\ I4m\Omega \leq R \leq I00m\Omega \pm I00ppm/^{\circ}C \end{array}$											
	392 PU										3W		-65°C to 170°C	0.2/ 0.3/ 0.5/ I/ 2/3/4		0.2mR/ 0.3mR/ 0.5mR ±175ppm/°C ImR~4mR ±75ppm/°C				
PU3921xKxxxxxxL		3921	5		-65°C to 275°C	0.5/1/ 2/3/4		0.5mR ±175pm/°C ImR~4mR ±75ppm/°C												
				5W			2/3/4		0.2mR ±325ppm/°C											
							9W		-65°C to 170°C	0.2/ 0.3/ 0.5/1	±1%	0.3mR/ 0.5mR ±175ppm/°C ImR~4mR ±75ppm/°C								
		PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU	PU		5₩	(PxR)^1/2	-65°C to 170°C	0.2/0.3/ 0.5/1/ 2/3/4	±5%
PU5931xKxxxxxxxL		5931		-	-65°C to 275°C	0.3/0.5/1/2/3/4		0.3mR/ 0.5mR ±175ppm/°C ImR~4mR ±75ppm/°C												
			7W			1/2/3/4		0.2mR ±225ppm/°C												
			10W	10W		-65°C to 170°C	0.2/0.3/ 0.5		0.3mR/ 0.5mR ±175ppm/°C ImR~4mR ±75ppm/°C											

Jumper							
Global part number	Series	Size	Operating Temp. range	Max. Resistance	Rated Current		
RL0402-R-070RL		0402		20mΩ	I.5A		
RL0603-R-070RL		0603	-55°C to 125°C	20mΩ	2A		
RL0805-R-070RL	RL	0805		20mΩ	2.5A		
RL1206-R-070RL		1206		20mΩ	3.5A		
PT0402-R-070RL		0402		I0mΩ	3A		
PT0603-R-070RL	PT	0603	-55°C to 155°C	8mΩ	5A		
PT0805-R-070RL		0805		5mΩ	6A		
PT1206-R-070RL		1206		5mΩ	10A		



Explanation of ordering code



"-" Based on spec. (- for RL/PT only)

Market Applications

Yageo's current sensing chip resistors are optimized for current sensing control. The current sensor, available from 0.05 to 10 watts, are applicable to battery packs, power supplies and converter,s and are suitable for use in diverse power control circuits of notebook computers or the hard disks of other compact portable devices that have current sensing and over current protection requirements. Featuring a comprehensive resistance range of 0.5 milli-ohms to 1 ohm and superior temperature coefficient (T.C.R.) performance is able to meet various customer demands and applications.

Application	Segment							
Application	Consumer	Automotive	Industrial	Telecom	Medical			
Device & Computing								
Home Appliances	v							
Air Conditioners	v	v						
Diagnostic Equipment					v			
Infotainment System	v		v					
Smart Meters			v					
Smartphones & Tablets	v			v				
Notebooks	v			v				
Wearable Devices	v		v	v	v			
Networking				v				
Batteries								
Battery Chargers	v	v	v	v	v			
Battery Life Indicators	v	v	v	v	v			
Battery Packs	v	v	v	v	v			
Motors								
Motor Controls	v	v	v					
Motor Drives	v	v	v					
Power Supplies			1					
DC/DC Converters	v		v	v	v			
Switch Mode Power Supplies	v	v	v	v	v			
LED Lighting		·		·				
LED Drivers	v	v	v		v			
Ballasts	v	v	v		v			
Storage & Cloud Computing		·	·	·				
Disk Drives (HDD & SSD)	v							
Servers	v							

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