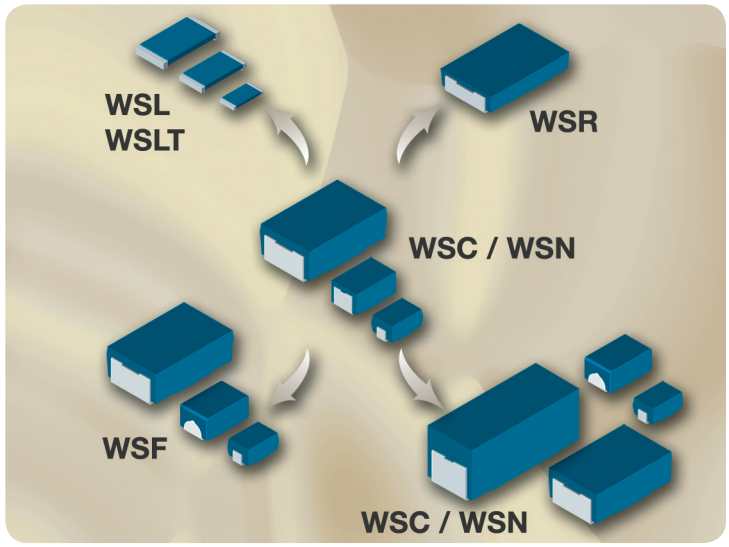
WSC/WSN CONVERSION GUIDE

Vishay Dale

WSC/WSN Wirewound Surface-Mount Resistors



Time to Make the Switch!

RESOURCES

- For technical questions contact ww2aresistors@vishay.com

A WORLD OF SOLUTIONS

WSC/WSN CONVERSION GUIDE

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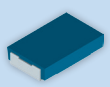
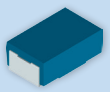
Introduction

Vishay offers many technologies that cover broad resistance ranges and wattages. There have been many advancements since the release of the original wirewound WSC and the following tables show the overlapping products that are available (grouped by wattage rating).

Global Model	Power Rating	Resistance Range	RTC (ppm/°C)	Tolerance	Dimensions	Applications
WSL1206...18 	0.5 W	0.007 Ω to 0.2 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.126 in [3.20 mm] W = 0.063 in [1.60 mm] H = 0.025 in [0.64 mm]	• Disc drive motor controls • DC/DC converters • Li-Ion battery management • VRMs in notebook PCs
WSL2010 	0.5 W	0.007 Ω to 0.5 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.200 in [5.08 mm] W = 0.100 in [2.54 mm] H = 0.025 in [0.64 mm]	
WSC01/2 WSN01/2** 	0.5 W	0.1 Ω to 0.99 Ω 1.0 Ω to 4.99 Ω	± 90 ± 50	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.200 in [5.08 mm] W = 0.125 in [3.18 mm] H = 0.096 in [2.44 mm]	• Instrumentation • DC/DC converters
WSF2012 	0.5 W	5.0 Ω to 1.43 kΩ	± 100 ± 50 ± 25	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.200 in [5.08 mm] W = 0.125 in [3.18 mm] H = 0.096 in [2.44 mm]	• Automotive controls (body electronics and powertrain) • Networking/line cards
WSLT2010...18 	1.0 W	0.01 Ω to 0.50 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.200 in [5.08 mm] W = 0.100 in [2.54 mm] H = 0.025 in [0.64 mm]	• Li-Ion battery management • DC/DC converters • VRMs in notebook PCs • Disc drive motor controls • Automotive controls (body electronics and powertrain)
WSLT2512 	1.0 W	0.01 Ω to 0.50 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.250 in [6.35 mm] W = 0.125 in [3.18 mm] H = 0.025 in [0.64 mm]	
WSC0001 WSN0001** 	1.0 W	0.1 Ω to 0.99 Ω 1.0 Ω to 26.50 Ω 26.51 Ω to 2.77 kΩ	± 90 ± 50 ± 20	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.250 in [6.35 mm] W = 0.150 in [3.81 mm] H = 0.110 in [2.79 mm]	• Automotive controls (engine control modules) • Instrumentation • Voltage divider circuits
WSC2515 WSN2515** 	1.0 W	0.1 Ω to 0.99 Ω 1.0 Ω to 26.50 Ω 26.51 Ω to 2.5 kΩ	± 90 ± 50 ± 20	± 0.1 %, ± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.250 in [6.35 mm] W = 0.150 in [3.81 mm] H = 0.110 in [2.79 mm]	
WSF2515 	1.0 W	10 Ω to 10 kΩ	± 100 ± 50 ± 25	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.250 in [6.35 mm] W = 0.150 in [3.81 mm] H = 0.110 in [2.79 mm]	• Automotive controls (body electronics and powertrain) • Networking/line cards
WSR2 	2.0 W	0.01 Ω to 1.0 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.455 in [11.56 mm] W = 0.275 in [6.98 mm] H = 0.095 in [2.41 mm]	• DC/DC converter in switching power supplies • VRMs in notebook PCs • Instrumentation • Automotive controls (body electronics and powertrain)
WSC0002 WSN0002** 	2.0 W	0.1 Ω to 0.99 Ω 1.0 Ω to 9.99 Ω 10 Ω to 4.92 kΩ	± 90 ± 50 ± 20	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.445 in [11.30 mm] W = 0.275 in [6.98 mm] H = 0.167 in [4.24 mm]	• Automotive controls (engine control modules) • Instrumentation • Voltage divider circuits • Networking/line cards

* For full resistance value ranges, reference appropriate data sheet.

** WSN max resistance values are half of the WSC equivalent.

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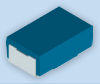
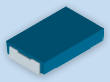
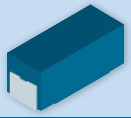
Global Model	Power Rating	Resistance Range	RTC (ppm/ °C)	Tolerance	Dimensions	Applications
WSC4527 WSN4527** 	2.0 W	0.1 Ω to 0.30 Ω 0.31 Ω to 0.99 Ω 1.0 Ω to 9.99 Ω 10 Ω to 4.92 kΩ	± 150 ± 90 ± 50 ± 20	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.455 in [11.56 mm] W = 0.275 in [6.98 mm] H = 0.167 in [4.24 mm]	• Automotive controls (engine control modules) • Instrumentation • Voltage divider circuits • Networking/line cards
WSF4527 	2.0 W	10 Ω to 100 kΩ	± 100 ± 50 ± 25	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.455 in [11.56 mm] W = 0.275 in [6.98 mm] H = 0.167 in [4.24 mm]	
WSR3 	3.0 W	0.01 Ω to 0.2 Ω*	± 75	± 0.5 %, ± 1.0 %	L = 0.455 in [11.56 mm] W = 0.275 in [6.98 mm] H = 0.095 in [2.41 mm]	• DC/DC converter in switching power supplies • VRMs in notebook PCs • Automotive controls (body electronics and powertrain)
WSC6927 WSN6927** 	3.0 W	0.1 Ω to 0.30 Ω 0.31 Ω to 0.99 Ω 1.0 Ω to 9.99 Ω 10 Ω to 8 kΩ	± 150 ± 90 ± 50 ± 20	± 0.5 %, ± 1.0 %, ± 5.0 %	L = 0.690 in [17.53 mm] W = 0.275 in [6.98 mm] H = 0.280 in [7.11 mm]	• Automotive controls (engine control modules) • Instrumentation • Voltage divider circuits • Satellite receivers

* For full resistance value ranges, reference appropriate data sheet.

** WSN max resistance values are half of the WSC equivalent.

Performance Characteristics

Test	Conditions of Test	Test Limits				
		WSL/WSLT	WSR2	WSR3	WSC/WSN	WSF
Thermal Shock	-55 °C to +150 °C, 1000 cycles	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR	± (1.0 % +0.05 Ω) ΔR
Short-Time Overload	5 x rated power for 5 s (4 x for WSR3)	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (2.0 % +0.0005 Ω) ΔR	± (0.2 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
Low-Temp. Storage	-65 °C for 24 h	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.2 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
High-Temp. Exposure	1000 h at +275 °C (+175 °C for WSC01/2 and WSF, and +170 °C for WSL)	± (1.0 % +0.0005 Ω) ΔR (2.0 % for WLT2010…18)	± (1.0 % +0.0005 Ω) ΔR	± (1.0 % +0.0005 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR	± (1.0 % +0.05 Ω) ΔR
Bias Humidity	+85 °C, 85 % RH, 10 % bias, 1000 h	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.2 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
Mechanical Shock	100 g for 11 m, 5 pulses	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.1 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
Vibration	10 Hz to 500 Hz in one min, 3 directions, 9 h	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.1 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
Load Life	1000 h at rated power, +70 °C, 1.5 h “ON,” 0.5 h “OFF”	± (1.0 % +0.0005 Ω) ΔR	± (1.0 % +0.0005 Ω) ΔR	± (2.0 % +0.0005 Ω) ΔR	± (1.0 % +0.05 Ω) ΔR	± (1.0 % +0.05 Ω) ΔR
Resistance to Solder Heat	+ 260 °C solder, 10 s - 12 s dwell, 25 mm/s emergence	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR
Moisture Resistance	MIL-STD-202, method 106, 0 % power	± (0.5 % +0.0005 Ω) ΔR (1.0 % for WSLT)	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.0005 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR	± (0.5 % +0.05 Ω) ΔR

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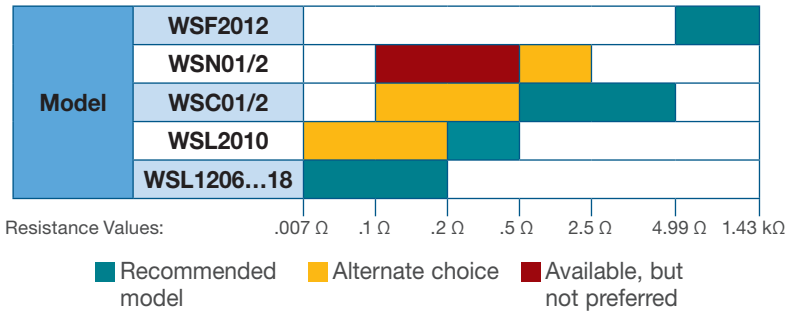
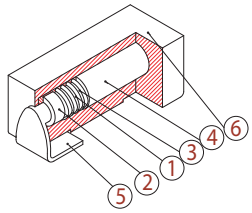
Surface-Mount Resistors: 0.5 W

- The WSC01/2 and WSN01/2 are the original 0.5 W wirewound SMD resistors
- It is recommended to convert to the latest technologies, as highlighted on this page

WSL = low value, Power Metal Strip®
WSC = mid value, wirewound
WSN = mid value, wirewound, non-inductive
WSF = high value, metal film

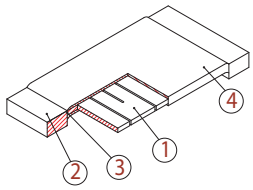


WSC01/2 WSN01/2



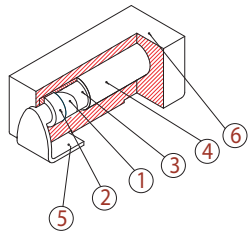
1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Plated terminal
6) Epoxy mold with ink print

WSL1206...18 WSL2010



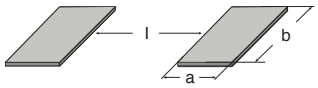
1) Resistive element
2) Plated terminal
3) Terminal/element weld
4) Silicone coating with ink print

WSF2012



1) Ceramic core
2) Resistor end cap
3) Resistance element
4) Subassembly coating
5) Plated terminal
6) Epoxy mold with ink print

Solder Pad Layout



Model	Solder Pad Dimensions in Inches [Millimeters]			Technology Selection Criteria					
	a	b	l	Smallest Footprint	Lowest Inductance	Pulse Handling	RTC	Lead Time	Cost
WSC01/2	0.085 [2.16]	0.070 [1.78]	0.080 [2.03]	Good	Good	Best	Better	Better	Good
WSN01/2	0.085 [2.16]	0.070 [1.78]	0.080 [2.03]	Good	Better	Better	Better	Good	Good
WSL1206...18	0.062 [1.57]	0.070 [1.78]	0.030 [0.76]	Best	Best	Better	Best	Best	Better
WSL2010	0.055 [1.40]	0.120 [3.05]	0.130 [3.30]	Better	Best	Best	Best	Best	Best
WSF2012	0.085 [2.16]	0.070 [1.78]	0.080 [2.03]	Good	Better	Good	Good	Better	Better

WSC/WSN CONVERSION GUIDE

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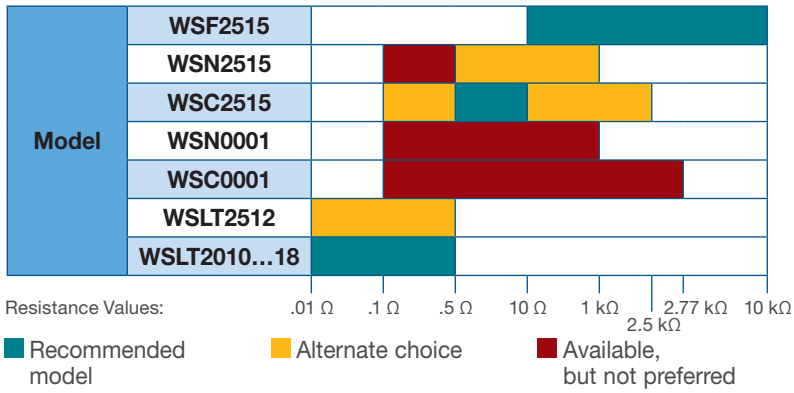
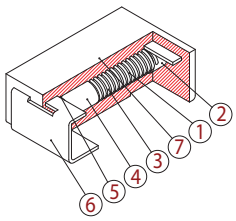
Surface-Mount Resistors: 1 W

- The WSC0001 and WSN0001 are the original 1 W wirewound SMD resistors
- It is recommended to convert to the latest technologies, as highlighted on this page

WSL = low value, Power Metal Strip®
WSC = mid value, wirewound
WSN = mid value, wirewound, non-inductive
WSF = high value, metal film

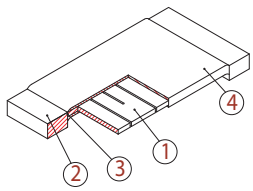


WSC0001 WSN0001



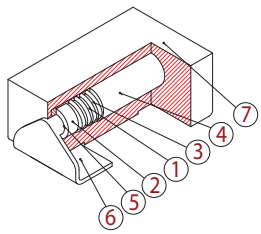
1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Connection - cap to leadframe terminal
6) Plated leadframe terminal
7) LCP mold with laser print

WSLT2010...18 WSLT2512



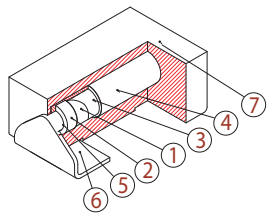
1) Resistive element
2) Plated terminal
3) Terminal/element weld
4) Silicone coating with ink print

WSC2515 WSN2515



1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Connection - cap to terminal
6) Plated terminal
7) LCP mold with laser print

WSF2515



1) Ceramic core
2) Resistor end cap
3) Resistance element
4) Subassembly coating
5) Connection - cap to terminal
6) Plated terminal
7) LCP mold with laser print

Model	Solder Pad Dimensions in Inches [Millimeters]			Technology Selection Criteria					
	a	b	l	Smallest Footprint	Lowest Inductance	Pulse Handling	RTC	Lead Time	Cost
WSC0001	0.090 [2.29]	0.115 [2.92]	0.115 [2.92]	Good	Good	Best	Better	Good	Good
WSN0001	0.090 [2.29]	0.115 [2.92]	0.115 [2.92]	Good	Better	Better	Better	Good	Good
WSC2515	0.090 [2.29]	0.115 [2.92]	0.120 [3.05]	Good	Good	Best	Better	Better	Better
WSN2515	0.090 [2.29]	0.115 [2.92]	0.120 [3.05]	Good	Better	Better	Better	Good	Good
WSLT2010...18	0.055 [1.40]	0.120 [3.05]	0.130 [3.30]	Best	Best	Better	Best	Best	Best
WSLT2512	0.065 [1.65]	0.145 [3.68]	0.160 [4.06]	Better	Best	Best	Best	Best	Best
WSF2515	0.090 [2.29]	0.115 [2.92]	0.120 [3.05]	Good	Better	Good	Good	Better	Better

WSC/WSN CONVERSION GUIDE

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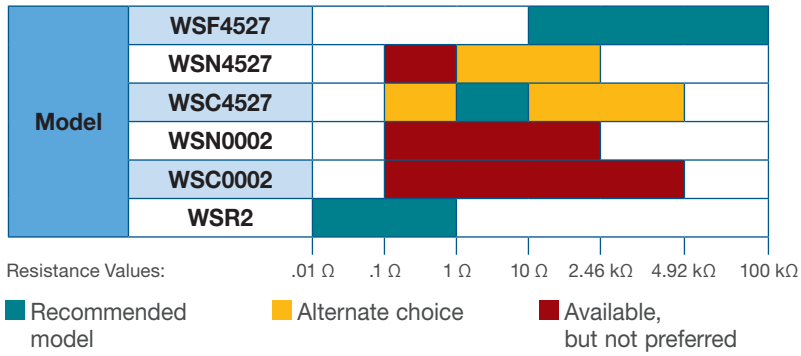
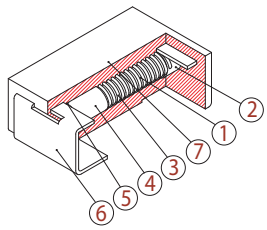
Surface-Mount Resistors: 2 W

- The WSC0002 and WSN0002 are the original 2 W wirewound SMD resistors
- It is recommended to convert to the latest technologies, as highlighted on this page

WSR = low value, Power Metal Strip®
WSC = mid value,wirewound
WSN = mid value, wirewound, non-inductive
WSF = high value, metal film

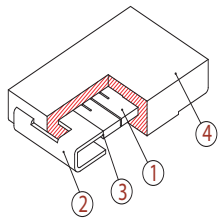


WSC0002 WSN0002



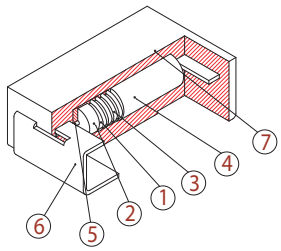
1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Connection - cap to leadframe terminal
6) Plated leadframe terminal
7) LCP mold with laser print

WSR2



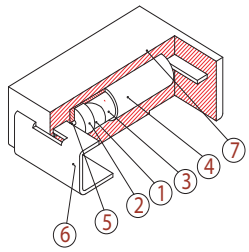
1) Resistive element
2) Plated terminal
3) Terminal/element weld
4) LCP mold with laser print

WSC4527 WSN4527



1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Connection - cap to axial lead, axial lead to leadframe terminal
6) Plated terminal
7) LCP mold with laser print

WSF4527



1) Ceramic core
2) Resistor end cap
3) Resistance element
4) Subassembly coating
5) Connection - cap to axial lead, axial lead to leadframe terminal
6) Plated terminal
7) LCP mold with laser print

Model	Solder Pad Dimensions in Inches [Millimeters]			Technology Selection Criteria					
	a	b	l	Smallest Footprint	Lowest Inductance	Pulse Handling	RTC	Lead Time	Cost
WSC0002	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Good	Good	Best	Better	Good	Good
WSN0002	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Good	Better	Better	Better	Good	Good
WSC4527	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Good	Good	Better	Better	Better	Better
WSN4527	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Good	Better	Better	Better	Good	Good
WSR2	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Best	Best	Best	Best	Best	Best
WSF4527	0.155 [3.94]	0.230 [5.94]	0.205 [5.21]	Good	Better	Good	Good	Better	Better

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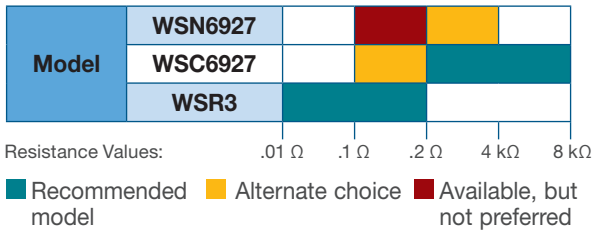
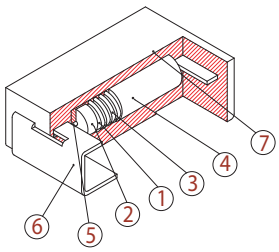
Surface-Mount Resistors: 3 W

- The WSC6927 and WSN6927 are the original 3 W wirewound SMD resistors
- It is recommended to convert to the WSR3 for values of 0.2 Ω and below

WSR = low value, Power Metal Strip®
WSC = mid value, wirewound
WSN = mid value, wirewound, non-inductive

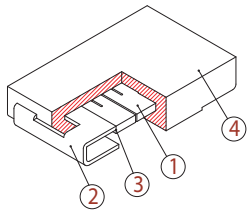


WSC6927 WSN6927



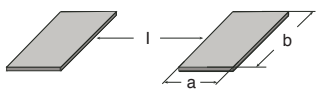
1) Ceramic core
2) Resistor end cap
3) Resistance wire
4) Subassembly coating
5) Connections - cap to axial lead, axial lead to leadframe terminal
6) Plated leadframe terminal
7) LCP mold with ink print

WSR3



1) Resistive element
2) Plated terminal
3) Terminal/element weld
4) LCP mold with laser print

Solder Pad Layout



Model	Solder Pad Dimensions in Inches [Millimeters]			Technology Selection Criteria					
	a	b	l	Smallest Footprint	Lowest Inductance	Pulse Handling	RTC	Lead Time	Cost
WSC6927	0.155 [3.94]	0.235 [5.97]	0.470 [11.94]	Good	Good	Good	Good	Better	Better
WSN6927	0.155 [3.94]	0.235 [5.97]	0.470 [11.94]	Good	Better	Good	Good	Good	Good
WSR3	0.155 [3.94]	0.230 [5.84]	0.205 [5.21]	Best	Best	Best	Best	Best	Best

WSC/WSN CONVERSION GUIDE

Vishay Dale

SEMICONDUCTORS

MOSFETs Segment

MOSFETs
- Low-Voltage TrenchFET® Power MOSFETs
- Medium-Voltage Power MOSFETs
- High-Voltage Planar MOSFETs
- High-Voltage Superjunction MOSFETs
- Automotive-Grade MOSFETs

ICs
- Power Management and Power Control ICs
- Smart Load Switches
- Analog Switches and Multiplexers

Diodes Segment

Rectifiers
- Schottky Rectifiers
- Ultrafast Recovery Rectifiers
- Standard and Fast Recovery Rectifiers
- High-Power Rectifiers/Diodes
- Bridge Rectifiers

Small-Signal Diodes
- Schottky and Switching Diodes
- Zener Diodes
- Tuner/Capacitance Diodes
- Bandswitching Diodes
- RF PIN Diodes

Protection Diodes
- TVS Diodes or TRANSZORB® (unidirectional, bidirectional)
- ESD Protection Diodes (including arrays)

Thyristors/SCRs
- Phase-Control Thyristors
- Fast Thyristors

IGBTs

Power Modules
- Input Modules (diodes and thyristors)
- Output and Switching Modules (contain MOSFETs, IGBTs, and diodes)
- Custom Modules

Optoelectronic Components Segment

Infrared Emitters and Detectors

Optical Sensors

Infrared Remote Control Receivers

Optocouplers
- Phototransistor, Photodarlington
- Linear
- Phototriac
- High-Speed
- IGBT and MOSFET Driver

Solid-State Relays

LEDs and 7-Segment Displays

Infrared Data Transceiver Modules

Custom Products

PASSIVE COMPONENTS

Resistors and Inductors Segment

Film Resistors
- Metal Film Resistors
- Thin Film Resistors
- Thick Film Resistors
- Power Thick Film Resistors
- Metal Oxide Film Resistors
- Carbon Film Resistors

Wirewound Resistors
- Vitreous, Cemented, and Housed Resistors
- Braking and Neutral Grounding Resistors
- Custom Load Banks

Power Metal Strip® Resistors

Battery Management Shunts

Crowbar and Steel Blade Resistors

Thermo Fuses

Chip Fuses

Pyrotechnic Initiators/Igniters

Variable Resistors
- Cermet Variable Resistors
- Wirewound Variable Resistors
- Conductive Plastic Variable Resistors
- Contactless Potentiometers
- Hall Effect Position Sensors
- Precision Magnetic Encoders

Networks/Arrays

Non-Linear Resistors
- NTC Thermistors
- PTC Thermistors
- Varistors

Magnetics
- Inductors
- Wireless Charging Coils
- Transformers

Connectors

Capacitors Segment

Tantalum Capacitors
- Molded Chip Tantalum Capacitors
- Molded Chip Polymer Tantalum Capacitors
- Coated Chip Tantalum Capacitors
- Solid Through-Hole Tantalum Capacitors
- Wet Tantalum Capacitors

Ceramic Capacitors
- Multilayer Chip Capacitors
- Multilayer Chip RF Capacitors
- Disc Capacitors

Film Capacitors

Power Capacitors

Heavy-Current Capacitors

Aluminum Capacitors

ENYCAP™ Energy Storage Capacitors