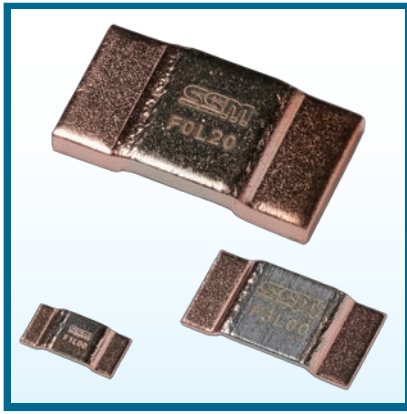




High-Precision Low-TCR Alloy Current Sensing Resistors

■MSR series

AEC-Q200 Compliant

Features

- The MSR series is based on precision resistance alloy and welded with vacuum electron beam welding equipment to ensure its characteristics and reliability.
- Precision machining and uniform welding provide a minimum tolerance of $\pm 0.5\%$ without trimming.
- The TCR achieves a minimum of 25ppm/°C over a wide temperature range of -55°C to 170°C.
- The "trim-free" technology avoids current loss and is free of hot spots.
- The thermoelectric power is extremely low and thermal fluctuations are minimized.

Applications

- Automotive Electronic
- Precision Power Supply
- Instrumentation
- Medical Equipment



◆Part numbering system

MSRSF 2512 P - 5L00 - D 4P0

Series code

Size: 2512, 3920, 5930

Temperature Coefficient of Resistance

Nominal resistance value

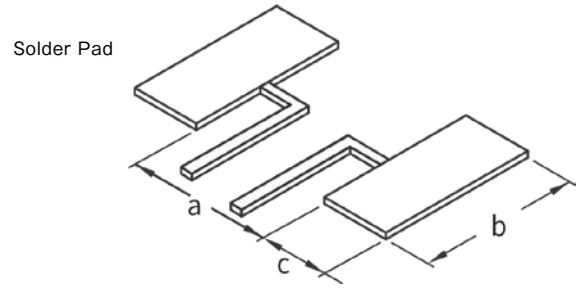
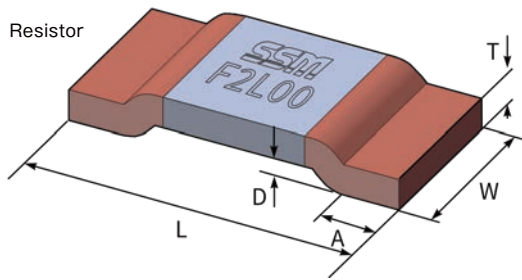
Packaging: 4P0 (4,000)

Resistance tolerance

◆Electrical Specification

Series	Size inch. (mm)	Resistance Value	Power	Max. Current	Operating Temperature	TCR (20°C/R _{sef})	Tolerance	Thermal Resistance	PKG.	
MSRSF	2512 (6432)	3 mΩ	4 W	36 A	-55~170 °C	±25 ppm/°C	± 0.5 % ±1 % ±5 %	19.7 °C/W	4,000 pcs.	
		5 mΩ	2.5 W	22 A				31.1 °C/W		
	3920 (10052)	1 mΩ	8 W	89 A				2,000 pcs.	7.8 °C/W	
		2 mΩ	6 W	55 A					15.4 °C/W	
		3 mΩ	5 W	41 A					23 °C/W	
		4 mΩ	6 W	32 A					31.1 °C/W	
		5 mΩ	5 W	25 A					38.4 °C/W	
		5930 (15078)	1 mΩ	10 W					100 A	6.4 °C/W
	2 mΩ		10 W	63 A					12.6 °C/W	
	3 mΩ		10 W	45 A					19.1 °C/W	
	MSRPF		2512 (6432)	1.5 mΩ					5 W	57 A
2 mΩ		5 W		50 A	13.4 °C/W					
3 mΩ		4 W		36 A	19.8 °C/W					
4 mΩ		3 W		27 A	26.9 °C/W					
5 mΩ		2.5 W		22 A	33.6 °C/W					
MSREK	2512 (6432)	2 mΩ	5 W	50 A	-55~170 °C	±100 ppm/°C	± 0.5 % ±1 % ±5 %	13.2 °C/W	4,000 pcs.	
		3 mΩ	4 W	36 A				19.8 °C/W		
		4 mΩ	3 W	27 A				24.3 °C/W		
		5 mΩ	2.5 W	22 A				31.1 °C/W		
MSREM	2512 (6432)	0.3 mΩ	6 W	140 A	-55~170 °C	±200 ppm/°C	± 0.5 % ±1 % ±5 %	4.1 °C/W	4,000 pcs.	
		0.5 mΩ	6 W	109 A				5.1 °C/W		
		1 mΩ	6 W	77 A				11.1 °C/W		
MSRPK	3920 (10052)	1 mΩ	8 W	89 A	-55~170 °C	±50 pm/°C	± 0.5 % ±1 % ±5 %	7.6 °C/W	2,000 pcs.	
		2 mΩ	6 W	54 A				15.4 °C/W		
		3 mΩ	5 W	40 A				23.1 °C/W		
		4 mΩ	4 W	30 A				28.9 °C/W		
		5 mΩ	3 W	24 A				36.5 °C/W		
MSRPM	3920 (10052)	0.2 mΩ	12 W	244 A	-55~170 °C	±150 ppm/°C	± 0.5 % ±1 % ±5 %	3.6 °C/W	1,000 pcs.	
		0.3 mΩ	10 W	182 A		3.8 °C/W		2,000 pcs.		
		0.5 mΩ	9 W	134 A		6.3 °C/W				
		1 mΩ	8 W	89 A		12.6 °C/W				
	5930 (15078)	0.1 mΩ	15 W	387 A		1.9 °C/W				
		0.2 mΩ	15 W	273 A		2.6 °C/W				
		0.3 mΩ	10 W	182 A		3.3 °C/W				
		0.5 mΩ	10 W	142 A		6.5 °C/W				
		0.8 mΩ	9 W	105 A		9.3 °C/W				
1 mΩ	9 W	94 A	11.4 °C/W							

◆ Dimensions



Not following the recommended solder pad design can seriously affect the temperature coefficient measurement results and current sensing accuracy!

◆ Electrical Specification

Series	Size inch. (mm)	Resistance Value	Unit:mm							
			L	W	A	T	D	a	b	c
MSRSF	2512 (6432)	3 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.45±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		5 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.27±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
	3920 (10052)	1 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	1.3±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		2 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.65±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		3 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.45±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		4 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.33±0.15	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		5 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.27±0.15	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
	5930 (15078)	1 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	1.05±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.2
		2 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	0.53±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.2
		3 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	0.35±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.2
MSRPF	2512 (6432)	1.5 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.90±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		2 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.65±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		3 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.45±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		4 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.33±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		5 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.27±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
MSREK	2512 (6432)	2 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.6±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		3 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.4±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		4 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.33±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		5 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.25±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
MSREM	2512 (6432)	0.3 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	1.0±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		0.5 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.9±0.2	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
		1 mΩ	6.3±0.3	3.0±0.3	1.3±0.3	0.4±0.15	0.35±0.2	3.9±0.2	3.4±0.25	1.8±0.25
MSRPF	3920 (10052)	1 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	1.3±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		2 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.6±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		3 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.4±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		4 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.33±0.15	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		5 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.25±0.15	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
MSRPM	3920 (10052)	0.2 mΩ	10.0±0.3	5.2±0.3	1.8±0.3	1.4±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		0.3 mΩ	10.0±0.3	5.2±0.3	1.8±0.3	1.3±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		0.5 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.8±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
		1 mΩ	10.0±0.3	5.2±0.3	2.0±0.3	0.4±0.2	0.5±0.2	5.6±0.1	6.2±0.2	2.7±0.2
	5930 (15078)	0.1 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	2.0±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1
		0.2 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	1.6±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1
		0.3 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	1.1±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1
		0.5 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	0.65±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1
		0.8 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	0.47±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1
		1 mΩ	15.0±0.3	7.75±0.3	3.8±0.3	0.38±0.2	0.5±0.2	5.6±0.1	8.75±0.2	5.2±0.1

◆ Part Number information

M	S	R	S	F	2	5	1	2	P	-	5	L	0	0	-	F	4	P	0
Series (5 digits)					Size (4 digits)				TCR (1 digits)		Resistance (4 digits)				Tolerance (1 digits)		Quantity (3 digits)		
MSRSF MSRPF MSREK MSREM MSRPF MSRPM					2512 3920 5930				P:±25 ppm/°C Q:±50 ppm/°C R:±100 ppm/°C E:±150 ppm/°C S:±200 ppm/°C		5L00 = 5 mΩ 0L50 = 0.5 mΩ				D:±0.5 % F:±1 % J:±5 %		2P0 = 2,000 pcs. 4P0 = 4,000 pcs.		

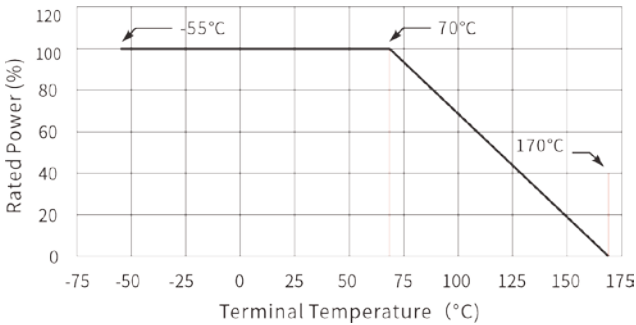
High-Precision Low-TCR Alloy Current Sensing Resistors

MSR series

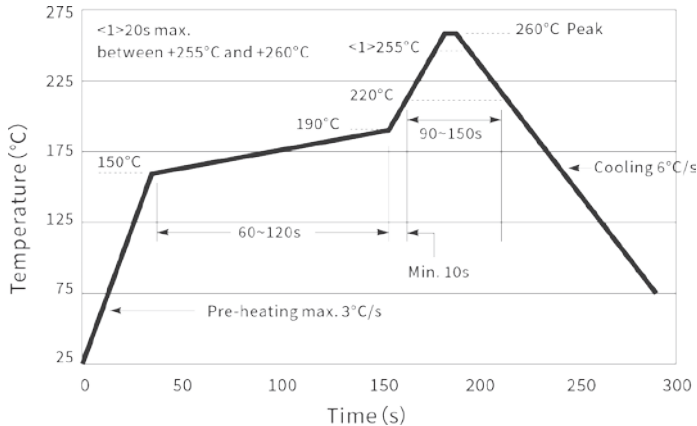
Performance

Test	Test Method	Standards	Typical	Max.
High Temperature Storage	1000h@+170°C, unpowered	AEC-Q200 TEST 3 MIL-STD-202 Method 108	$\Delta R \pm \leq 0.5\%$	$\Delta R \leq \pm 1.0\%$
Thermal Shock	-55°C, 15min~ambient temperature <20s~+155°C, 15min, 1000 cycles	AEC-Q200 TEST 16 MIL-STD-202 Method 107	$\Delta R \leq \pm 0.1\%$	$\Delta R \leq \pm 0.5\%$
Bias Humidity	+85°C, 85%RH, powered no less than 10% rated power for 1000h	AEC-Q200 TEST 7 MIL-STD-202 Method 103	$\Delta R \leq \pm 0.2\%$	$\Delta R \leq \pm 0.5\%$
Load Life	2000h @ +70°C, rated power, 90min on, 30min off +70°C refers to terminal temperature	AEC-Q200 TEST 8 MIL-STD-202 Method 108	$\Delta R \leq \pm 0.5\%$	$\Delta R \leq \pm 1.0\%$
Resistance to Solvent	Immerse in solvent for 3 min and wipe 10 times. Three cycles of three solvents. Dry at ambient temperature after cleaning	AEC-Q200 TEST 12 MIL-STD-202 Method 215	Clear marking. No visible damage	
Mechanical Shock	Half Sine Wave, peak acceleration 100g's, pulse duration 6ms, 3 times in each of six directions, on three different axes	AEC-Q200 TEST 13 MIL-STD-202 Method 213	$\Delta R \leq \pm 0.01\%$	$\Delta R \leq \pm 0.2\%$
Vibration	10-2KHz, 5g's, 20min/cycle, 12 cycles in each directions of X Y Z	AEC-Q200 TEST 14 MIL-STD-202 Method 204	$\Delta R \leq \pm 0.01\%$	$\Delta R \leq \pm 0.2\%$
Resistance to Solder Heat	260°C tin bath for 10s	AEC-Q200 TEST 15 MIL-STD-202 Method 210	$\Delta R \leq \pm 0.2\%$	$\Delta R \leq \pm 0.5\%$
Solderability	245°C tin bath for 3s	AEC-Q200 TEST 18 IEC 60115-1 4.17	No visible damage. 95% minimum coverage	
TCR	55°C and +170°C, +20d Ref.	AEC-Q200 TEST 19 IEC 60115-1 4.8	Within the nominal TCR	$\Delta R \leq \pm 1.0\%$
Substrate Bending	2mm. Duration: 60s.	AEC-Q200 TEST 21 AEC-Q200-005	$\Delta R \leq \pm 0.5\%$	$\Delta R \leq \pm 0.5\%$
Short Time Overload	5x rated voltage, 5s	IEC 60115-1 4.13	$\Delta R \leq \pm 0.5\%$	$\Delta R \leq \pm 0.5\%$
Low Temperature Storage	-55°C for 96h, unpowered	IEC 60068-2-1	$\Delta R \leq \pm 0.5\%$	$\Delta R \leq \pm 0.5\%$
Moisture Resistance	Apply T=24 h/cycle, zero power, method 7a and 7b are not required	MIL-STD-202 Method 106	$\Delta R \leq \pm 0.5\%$	$\Delta R \leq \pm 0.5\%$

Derating Curve

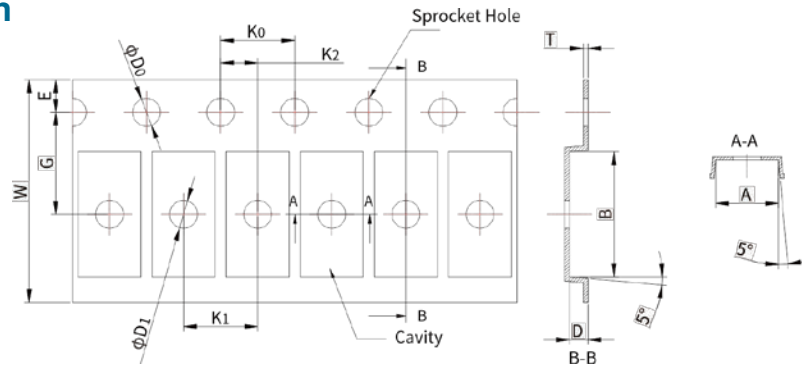


Reflow Soldering Profile



Resistor Surface Temperature:
Pre-Heat: +150°C+190°C,60~120sec.
Reflow: Above +220°C,90~150sec.
Applicable Solder Composition: Sn-Ag-Cu

◆Tape Specification



Series	Size (mm)	Resistance Value	Unit:mm											
			A	B	φDO	φD1	K0	K1	K2	E	G	W	D	T
MSRSF	2512 (6432)	3 mΩ	3.20±0.1	6.60±0.1	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.2	0.90±0.1	0.23±0.05
		5 mΩ	3.20±0.1	6.50±0.1	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.2	0.73±0.1	0.23±0.05
	3920 (10052)	1 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	2.1±0.1	0.3±0.05
		2 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.5±0.1	0.3±0.05
		3 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.5±0.1	0.3±0.05
		4 mΩ	5.65±0.2	10.41±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.14±0.1	0.4±0.05
		5 mΩ	5.65±0.2	10.41±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.14±0.1	0.4±0.05
	5930 (15078)	1 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.0±0.1	4.0±0.1	2.0±0.1	1.75±0.1	11.5±0.05	24.0±0.3	1.9±0.1	0.3±0.05
		2 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.0±0.1	4.0±0.1	2.0±0.1	1.75±0.1	11.5±0.05	24.0±0.3	1.3±0.1	0.3±0.05
		3 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.0±0.1	4.0±0.1	2.0±0.1	1.75±0.1	11.5±0.05	24.0±0.3	1.3±0.1	0.3±0.05
MSRPF	2512 (6432)	1.5 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	1.50±0.1	0.25±0.05
		2 mΩ	3.40±0.2	6.75±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	1.00±0.1	0.23±0.05
		3 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	0.90±0.1	0.23±0.05
		4 mΩ	3.20±0.2	6.50±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	0.73±0.1	0.23±0.05
		5 mΩ	3.20±0.2	6.50±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	0.73±0.1	0.23±0.05
MSREK	2512 (6432)	2 mΩ	3.40±0.2	6.75±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.2	1.00±0.1	0.23±0.05
		3 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.2	0.90±0.1	0.23±0.05
		4 mΩ	3.20±0.2	6.50±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.2	0.73±0.1	0.23±0.05
MSREM	2512 (6432)	0.3 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	1.50±0.1	0.25±0.05
		0.5 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	1.50±0.1	0.25±0.05
		1 mΩ	3.30±0.2	6.60±0.2	1.5±0.1	1.5±0.1	4.00±0.1	4.00±0.1	2.00±0.1	1.75±0.1	5.50±0.05	12.00±0.3	0.9±0.1	0.25±0.05
MSRPF	3920 (10052)	1 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.0±0.1	8.0±0.1	2.00±0.1	1.75±0.1	7.5±0.1	16.0±0.3	2.1±0.1	0.3±0.05
		2 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.0±0.1	8.0±0.1	2.00±0.1	1.75±0.1	7.5±0.1	16.0±0.3	1.5±0.1	0.3±0.05
		3 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.0±0.1	8.0±0.1	2.00±0.1	1.75±0.1	7.5±0.1	16.0±0.3	1.5±0.1	0.3±0.05
		4 mΩ	5.65±0.2	10.41±0.2	1.5±0.1	1.5±0.1	4.0±0.1	8.0±0.1	2.00±0.1	1.75±0.1	7.5±0.1	16.0±0.3	1.14±0.1	0.4±0.05
		5 mΩ	5.65±0.2	10.41±0.2	1.5±0.1	1.5±0.1	4.0±0.1	8.0±0.1	2.00±0.1	1.75±0.1	7.5±0.1	16.0±0.3	1.14±0.1	0.4±0.05
MSRPF	3920 (10052)	0.2 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	2.7±0.1	0.3±0.05
		0.3 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	2.7±0.1	0.3±0.05
		0.5 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.5±0.1	0.3±0.05
		1 mΩ	5.5±0.2	10.5±0.2	1.5±0.1	1.5±0.1	4.00±0.1	8.00±0.1	2.00±0.1	1.75±0.1	7.50±0.1	16.00±0.3	1.5±0.1	0.3±0.05
		0.1 mΩ	8.3±0.2	15.6±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	2.9±0.1	0.4±0.05
	5930 (15078)	0.2 mΩ	8.3±0.2	15.6±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	2.35±0.1	0.4±0.05
		0.3 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	1.9±0.1	0.3±0.05
		0.5 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	1.3±0.1	0.3±0.05
		0.8 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	1.3±0.1	0.3±0.05
		1 mΩ	8.05±0.2	15.3±0.2	1.5±0.1	1.5±0.1	4.00±0.1	12.00±0.1	2.00±0.1	1.75±0.1	11.5±0.1	24.0±0.3	1.3±0.1	0.3±0.05

Series	Unit:mm										
	Size (mm)	A	φB	φC	φD	φE					
MSRSF	2512	1.5 Min.	13.0+0.5/ -0.2	20.2 Min.	330±2	100±2					
MSRPF											
MSREK	3920										
MSREM	5930										
MSRPK											
MSRPM											

