# APSR Series-Prosemi Shunt Resistors

APSR Series

## Description

- Metal type Low-Resistance shunt resistor.
- Resistance value 0.3 mΩ, 0.5mΩ, 1mΩ, 2mΩ, 3mΩ, 4mΩ.
- Low thermal EMF.
- Low TCR.
- Very low inductance.
- Halogen free, lead free and RoHS compliant.
- AEC-Q200 qualified available.

## Applications

- Power modules.
- Frequency converters.
- Current sensor for power hybrid sources high current for automotive.
- Lithium battery protection board.

## Part number

**APSR 25 S 3 F 0M50**

【1】【2】【3】【4】【5】【6】

【1】Series Name: Prosemi Shunt Resistor for Automotive.

【2】Chip Size: 25: 2512 , 39: 3921

【3】Material: S: CuMnSn, M: CuMn, K: NiCr, C: Ni & Sn plated Copper

【4】Power Rating: 3=3W, 5=5W, J=Jumper.

【5】Resistance Precision: F: ±1%, J: ±5%, 0: Jumper.

【6】Resistance Code: R000: Jumper, R002: 2mΩ, 0M50: 0.5mΩ.

## Electrical Characteristics

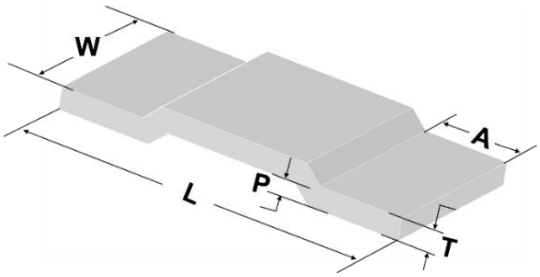
| Size | Power Rating at 70℃(W) | Resistance Range (mΩ)* ±1%;±5% | Element TCR ( ppm/℃) | Operation Temperature Range | Product temperature coefficient (ppm/℃) |
|---|---|---|---|---|---|
| 2512 | 3 | 0.3~2 | ±30 | -55℃~+170℃ | ±250 for 0.3 mΩ and 0.5 mΩ<br>±200 for 1mΩ<br>±75 for 2~4 mΩ |
| | 2 | 3~4 | | | |
| | $I_{max}$=100A | Jumper | - | - | - |
| 3921 | 7 | 0.5~2 | ±30 | -55℃~+170℃ | ±75 for 0.5 mΩ and 1 mΩ<br>±60 for 2~3 mΩ<br>±50 for 4 mΩ |
| | 5 | 3~4 | | | |
| | $I_{max}$=160A | Jumper | - | - | - |

"*" : Other values may be available, contact factory

**Note:**

1) Ir =$(P/R)^{1/2}$ R: Resistance Value Ir: Rating Current P: Rating Power;
2) Product temperature coefficient: Includes the TCR effects of the resistor element and the copper terminal.

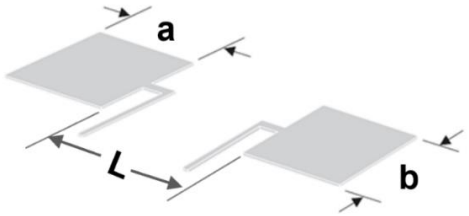
## Physical Dimensions




Unit: mm

| Size | Resistance (mΩ) | L | W | T | A | P | Element Material |
|---|---|---|---|---|---|---|---|
| 3921 | Jumper | 10±0.2 | 5.2±0.2 | - | 1.9±0.2 | 0.5±0.1 | Ni & Sn plated Copper |
| | 0.5 | | | 0.8±0.2 | | | CuMn |
| | 1 | | | 0.4±0.1 | | | CuMn |
| | 2 | | | 0.6±0.1 | | | NiCr |
| | 3 | | | 0.4±0.1 | | | NiCr |
| | 4 | | | 0.3±0.1 | | | NiCr |
| 2512 | Jumper | 6.4±0.2 | 3.2±0.2 | - | 1.53±0.2 | 0.4±0.1 | Ni & Sn plated Copper |
| | 0.3 | | | 0.95±0.1 | | | CuMn |
| | 0.5 | | | 0.4±0.1 | | | CuMnSn |
| | 1 | | | 0.3±0.1 | | | CuMn |
| | 2 | | | 0.5±0.1 | | | NiCr |
| | 3 | | | 0.3±0.1 | | | NiCr |
| | 4 | | | 0.25±0.1 | | | NiCr |

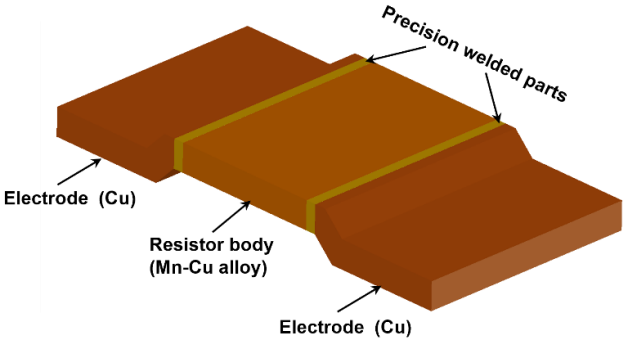
## Recommended Solder Pad Layout




Unit: mm

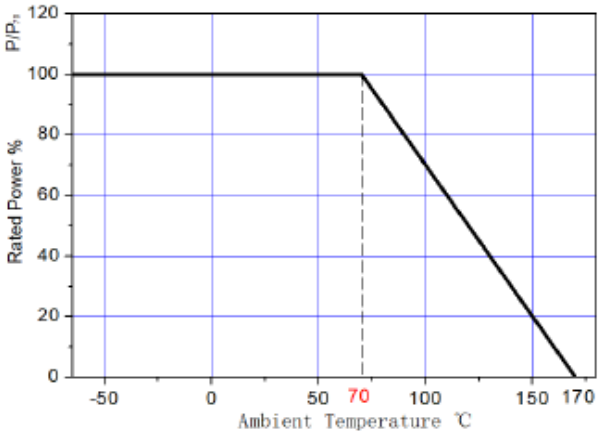
| Type | L | a | b |
|---|---|---|---|
| 2512 | 3.0 | 2.3 | 3.5 |
| 3921 | 5.8 | 2.5 | 6.2 |

## Construction

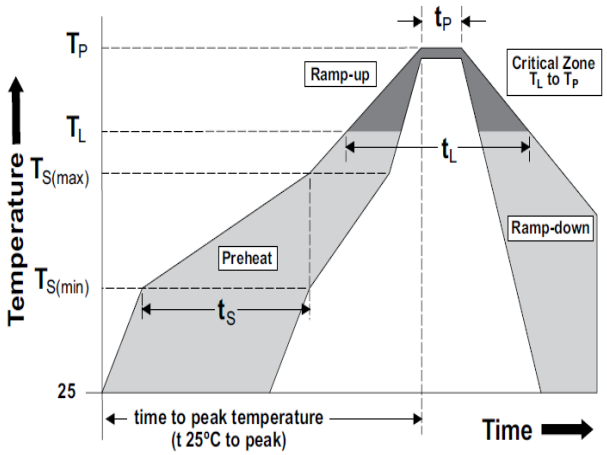



## Power Derating Curve

For resistors operated in ambient temperatures 70°C, power rating shall be derated in according with the curve below:




## Recommended Solder Curve




| Reflow Condition | | Pb – Free assembly |
|---|---|---|
| Pre heat | - Temperature Min ($T_s$(min)) | 150°C |
| | - Temperature Max ($T_s$(max)) | 200°C |
| | - Time (Min to Max) ($t_s$) | 60 – 120 secs |
| Average ramp up rate (Liquidus Temp ($T_L$) to peak | | 5°C/second max |
| $T_S$(max) to $T_L$ - Ramp-up Rate | | 5°C/second max |
| Reflow | - Temperature ($T_L$) (Liquidus) | 217°C |
| | - Time ($t_L$) | 60 – 150 seconds |
| Peak Temperature ($T_P$) | | 260°C |
| Time within 5°C of actual peak Temperature ($t_p$) | | 20 – 40 seconds |
| Ramp-down Rate | | 5°C/second max |
| Time 25°C to peak Temperature ($T_P$) | | 8 minutes Max. |
| Wave Soldering | | Not applicable |
| Hand Soldering | | 350°C, 5 seconds max. |

## Marking Instructions

APSR is marked with three or four digit, We have two different ways of marking:

a. "R" designates the decimal location in ohms,

e. g. For APSR39: 2mΩ: R002; For APSR25: 2mΩ: 002

b. "m" designates the decimal location in milliohms,

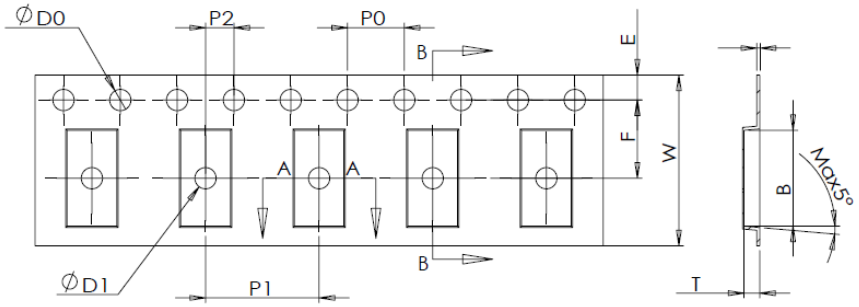
e. g. For APSR39: 0.5mΩ: 0m50; For APSR25: 0.5mΩ: 0m5

## Product Characteristics

| Item | Test condition/ Methods | Limited | Standard |
|---|---|---|---|
| Resistance | Measuring resistance value at room temperature 25℃±5℃ | Refer to Spec | IEC60115-1 4.5 |
| Temperature coefficient of resistance | TCR =$(R-R_0)/R_0(T_2-T_1)X\ 10^6$<br>$R_0$: resistance of room temperature<br>R: resistance of 125℃<br>$T_1$: Room temperature<br>$T_2$: Temperature at 125℃ | Refer to Spec | MIL-STD-202 Method 304 |
| Short time Overload | 5 times the rated power for 5 seconds | ≤±0.5% | MIL-R-26E |
| Resistance to Soldering Heat | 260℃± 5℃ time：12sec± 0.5sec | ≤±0.5% | MIL-STD-202 Method 210 |
| Temperature Cycling | -55℃ (15min)/+150℃(15min), 1000 cycles | ≤±0.1% | MIL-STD-202 Method107G |
| Low temperature Storage | -55℃ for 24 hours, No power | ≤±0.5% | MIL-STD-26E |
| High Temperature Storage | 170℃ for 1000hours, No power | ≤±1% | IEC6011501-4.25 |
| Bias Humidity | +85℃，85% RH，10%bias, 1000hours | ≤±0.5% | MIL-STD-202 Method103 |
| Mechanical shock | Condition C ,100 g's ,6 msec, 3 mutually perpendicular axes, in 6 directions, three impacts each for a total of 18 times 18 shocks. | ≤±0.5% | MIL-STD-202 Method 213 |
| Vibration | The frequency varies from 10HZ to 55HZ and return to 10HZ, shall be transferred in 1 min. Amplitude : 1.5mm, 3 directions, and 12 hours | ≤±0.5% | MIL-STD-202 Method 201 |
| Operational life | 70℃± 2℃, 1000 hours, at rated power 1.5 hours "ON", 0.5 hours "OFF" | ≤±1% | MIL-STD-202 Method 108 |
| Moisture resistance | MIL-STD-202,method106， No power, 7b not required | ≤±0.5% | MIL-STD-202 Method 106 |

## Packaging

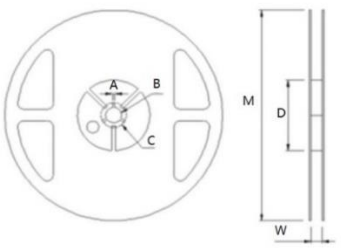
Tape Dimensions



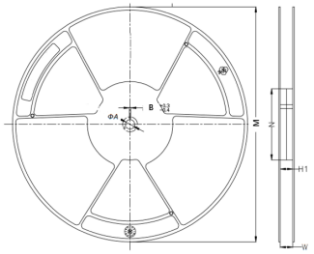

Unit: mm

| Series | Type | A | B | D0 | E | F | φD1 |
|---|---|---|---|---|---|---|---|
| 2512 | 0.3mΩ | 3.60±0.10 | 6.70±0.10 | 1.50+0.10 | 1.75±0.10 | 5.50±0.05 | 1.50±0.10 |
| | 0.5-4mΩ | 3.50±0.10 | 6.74±0.10 | 1.50+0.10 | 1.75±0.10 | 5.50±0.05 | 1.50±0.10 |
| 3921 | 0.5-4mΩ | 5.50±0.10 | 10.50±0.10 | 1.50+0.10/0 | 1.75±0.10 | 7.50±0.1 | 1.50+0.10/0 |
| Series | Type | W | P0 | P1 | P2 | T | |
| 2512 | 0.3mΩ | 12.00±0.30 | 4.00±0.10 | 8.00±0.10 | 2.00±0.05 | 1.60±0.10 | |
| | 0.5-4mΩ | 12.00±0.30 | 4.00±0.10 | 8.00±0.10 | 2.00±0.05 | 1.10±0.10 | |
| 3921 | 0.5-4mΩ | 16.00±0.30 | 4.00±0.10 | 8.00±0.10 | 2.00±0.10 | 1.50±0.10 | |

Reel Dimensions




2512



3921

Unit: mm

| Series | Type | W (mm) | M (mm) | A (mm) | B (mm) | C (mm) | D (mm) |
|---|---|---|---|---|---|---|---|
| 2512 | 7’ reel | 13.8±0.5 | 178.0±2.0 | 2.0±0.5 | 13.5±0.5 | 21.0±0.5 | 80.0±1.0 |
| Series | Type | W (mm) | M (mm) | ΦA (mm) | N (mm) | H1 (mm) | B (mm) |
| 3921 | 13’ reel | 16.4+3.5/-0.2 | 330.0±2.0 | 13.4±0.5 | 100.0±0.2 | 16.4±1.0 | 2.4±0.4 |

Quantity of Package

| Type | Quantity (pcs） |
|---|---|
| 2512 | 0.3mΩ：1000<br>0.5-4mΩ：2000 |
| 3921 | 2500 |

## Storage

1. The temperature condition must be controlled at 25±5℃, The R.H. must be controlled at 60±15% Store in accordance with this requirement, and the validity period is two years after the date of manufacture.
2. Please avoid the mentioned harsh environment below when storing to ensure product performance and its' weldability. Places exposed to sea breeze or other corrosive gas, such as $Cl_2$, $H_2S$, $NH_3$, $SO_2$ and $NO_2$.
3. When the product is moved and stored, please ensure the correct orientation of the box. Do not drop or squeeze the box. Otherwise, the electrode or the body of the product may be damaged.