

The ***Rejistor*** is a precision, electrically-adjustable resistor from Microbridge. The ***Rejistor*** can be adjusted to a precision of **0.1%**, or better. The ***Rejistor*** can be re-adjusted many times bi-directionally within the active range using standard hardware and LabVIEW-based ***Rejst-it*** calibration software.

Low-power ***Rejistors*** are suitable for applications where the total power dissipation (in the pair) does not exceed 1mW.

As a passive device, there is no warm-up period or boot-up time. Each ***Rejistor*** is independently adjustable to any value in the 30% adjustment range while still offering excellent TCR. They are non-volatile, maintaining their adjusted value indefinitely.

Each Low-TCR ***Rejistor*** maintains 0ppm/K TCR across the adjustment range within ± 100 ppm/K. Relative TCR between both ***Rejistors*** is less than ± 50 ppm/K.

PARAMETER	SPECIFICATION
Resistance (as-manufactured)	4.7K Ω
Minimum adjustable resistance	3.3K Ω
Adjustment Precision	0.1% or 0.01% ¹
TCR (per <i>Rejistor</i>)	0 \pm 100ppm/K
Power dissipation (per <i>Rejistor</i>)	0.5mW

BENEFITS

- Precision electrical in-circuit adjustment
- Externally adjust or calibrate parameters on circuits or sensors at final assembly
- Adjustment process isolated from circuit allows true in-circuit calibration
- Single chip solution to calibrate voltages, currents, offsets, gains, etc.
- No mechanical moving parts – suitable for vibration sensitive applications
- Improved reliability; dependability; dust and moisture resistance over mechanical parts
- Dynamic adjustment provides cost and labor savings
- Flexibility reduces rework cost

¹ Adjustment precision is limited by temperature control, accuracy of measurement and adjustment equipment and may increase adjustment time

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ELECTRICALLY ADJUSTABLE 4.7K Ω 1:1 RESISTOR PAIR

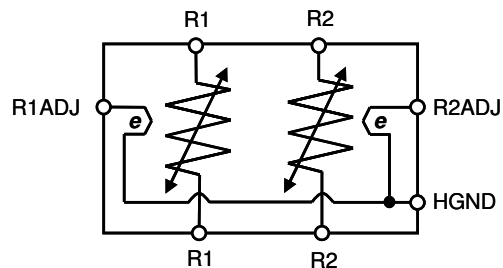


Figure 1: Functional Block Diagram

FEATURES

- Electrically adjustable 4.7K Ω 1:1 dual resistor
- Passive, non-volatile variable resistor
- Adjustment range: 30% down from as-manufactured resistance
- Bi-directional adjustment within active range
- Long term stability 0.5%, see Table 5
- Flexibility: Potential for multiple adjustments
- Stable Temperature Coefficient as resistance is adjusted – TCR: 0 \pm 100ppm/K
- Power Rating up to 1.0mW at 70 $^{\circ}$ C
- Suitable for operation from -40 to +125 $^{\circ}$ C, refer to Table 2
- Passive device, requires no power to operate or maintain adjustment
- Easy to adjust with ***Rejst-it*** software and external DAC/ADC hardware
- Typical adjust times: ~ 1 sec¹.

APPLICATIONS

- Anywhere precision adjustment is required
- Gain and offset adjustment
- Reference voltage or current adjustment
- Precision Voltage Regulator adjustment
- Filter tuning
- RF Amplifier biasing
- Opto-electronics
- Frequency Control devices
- Mechanical or digital potentiometer replacement
- Suitable for high-frequency applications

PIN CONFIGURATION

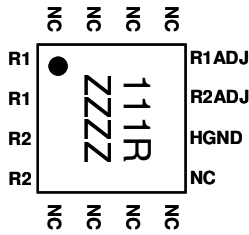


Figure 3: Pin Configuration, 16-pin QFN package (3x3mm)

PIN FUNCTIONAL DESCRIPTION

Table 1: Pin Function Descriptions

Mnemonic	Description	16-Pin QFN Pin No.
R1	Rejistor 1 Terminal	1
R1	Rejistor 1 Terminal	2
R2	Rejistor 2 Terminal	3
R2	Rejistor 2 Terminal	4
HGND	Heater Ground	10
R2ADJ	Rejistor 2 Adjust Input	11
R1ADJ	Rejistor 1 Adjust Input	12
NC	No Connect	5, 6, 7, 8, 9, 13, 14, 15, 16

GENERAL OVERVIEW

The Microbridge Technologies Low TCR dual **Rejistor** family of electrically adjustable micro-resistors can be adjusted and matched to resistance values for precision control of sensors, voltage regulators, amplifiers and other applications. **Rejistors** are passive, non-volatile devices capable of being re-adjusted many times to very-high precision, bi-directionally; using only integrated circuit level electrical signals. Each **Rejistor** is independently adjustable to any ohmic value within a continuous range from the as-manufactured resistance to at least 70% of the as-manufactured value.

Rejistors are a major improvement over thin-film laser trim and fusible link technologies at the wafer and chip level; as well as manual trim pots, digital potentiometers and thick-film laser trim at the hybrid and board level. **Rejistors** can be adjusted in-circuit to match any desired output condition using standard test equipment. Once adjusted, **Rejistors** maintain their precision indefinitely. Unlike laser trimming, the **Rejistor** can be adjusted up or down within the active adjustment range to facilitate rework or to enhance precision, for example, **Rejistors** can be used to iterate towards a final value.

The **Rejistor** does not require active power. It is electrically isolated from both substrate and heater and can therefore float, electrically.

Operation of the **Rejistor** die has been confirmed well beyond 100MHz. High-frequency performance of a packaged Rejistor is limited by the capacitance and inductance of the package.

Rejistors can be adjusted using the low-cost MBK-408 **Rejistor** Calibration Tool from Microbridge or National Instruments based system or other suitable electronic test equipment. The adjustment process is controlled with **Rejust-it** software, which is based on LabVIEW and available as executable for a standard Windows-based PC.

Available in 16-pin QFN packages, **Rejistors** are RoHS and Pb-free and green compliant.

Table 2: RATINGS – Rejistor R1 and R2 (4.7KΩ) Rejistors 0°C < T_A < +70°C; unless otherwise noted.

Item	Conditions	Typical Specifications
Nominal Resistance R1		4,700Ω
R1 Maximum Power		0.5mW
Nominal Resistance R2		4,700Ω
R2 Maximum Power		0.5mW
Operating Temperature	As specified in this datasheet	0°C to +70°C
	As specified in Application Note “ <i>Rejistor</i> Operating Guidelines for -40 to +125C Operation”	-40 to +125°C
	Beyond -40 to +125°C	Contact Microbridge
Isolation Voltage (between any pins)	Subject to power limits	25V
Total Resistance Tolerance		As-manufactured resistance is ±10% from nominal
Nominal Adjustment range		+0 to -30% from as-manufactured
Nominal Pair Matching	Unadjusted	±2%

Table 3: TCR CHARACTERISTICS – Rejistors

Characteristics	Specification (Worst Case)	Test Method or Conditions
Temperature Coefficient Unadjusted Adjusted	0±100ppm/K 0±100ppm/K	
Change in Temperature Coefficient	± 50ppm/K	TCR change in adjusted device relative to unadjusted device, by analysis
Temperature Coefficient Matching of pairs	± 10ppm/K	Adjusted to match resistance, by analysis
<i>Rejistor</i> Self-heating Coefficient of Resistance	+4800 ppm/mW ±20%	Per <i>Rejistor</i> , unadjusted
Relative Self-heating Coefficient of Resistance	±100 ppm/mW	When both <i>Rejistors</i> carry the same current

Table 4: PACKAGE ELECTRICAL CHARACTERISTICS

Characteristics	Specification (Typical)	Test Method or Conditions
QFN Capacitive Loading	0.7pF	Per package pin, by analysis at 100MHz
QFN Mutual Capacitance	0.1pF	By analysis at 100MHz

Table 5: RELIABILITY DATA

Characteristics	Limit	Test Method or Conditions
Thermal Shock/ Cycling	+ 0.5% ²	JESD22-A104, -65°C to 125°C, 1000 cycles at 2 cycles/hour
Overload	+ 0.5% ²	MIL-R-55342H Par 4.8.6 (Rated Voltage x2.5, 5sec.), Rated voltage based on 1mW maximum power $V = \sqrt{PR}$
High Temperature Exposure (long-term stability)	+ 0.5% ²	JESD22-A103 150°C, 1000hrs
Humidity and Moisture Resistance	+ 0.8% ²	JESD22-A101, 85% RH, 85°C, 1000hrs
Operational Life Test	+ 0.5% ²	JESD22-A108, 125°C, 1000 hrs., static operation at rated power
Shock	± 0.1%	500G, 1ms duration, X,Y,Z axes each 5 shocks
Vibration, High Frequency	± 0.1%	Max acceleration 20G, 20~2000~20Hz, 8 min, X,Y,Z each 4 sweeps

² Where indicated, drift specifications refer to resistance drift in the positive direction. Best performance is achieved at adjustments larger than 10% down from the as-manufactured resistance.

Table 6: MANUFACTURABILITY DATA

Characteristics	Test Method or Conditions
ESD Discharge	JESD22-A114, human body model weakest pin pair, all lead combinations. Class 1A
Solder ability	JESD22-A113, 235°C, slope 6°C/second

PACKAGING OPTIONS

Table 7: NOMINAL PACKAGE DIMENSIONS

Type	Lead Count	Body Width	Body Length	Lead Pitch	Lead Width	Lead Length	Body Thickness	JEDEC/ EIAJ
QFN	16	3.0mm	3.0mm	0.5mm	0.25mm	0.4mm	0.85mm	MO-220 (VEED)

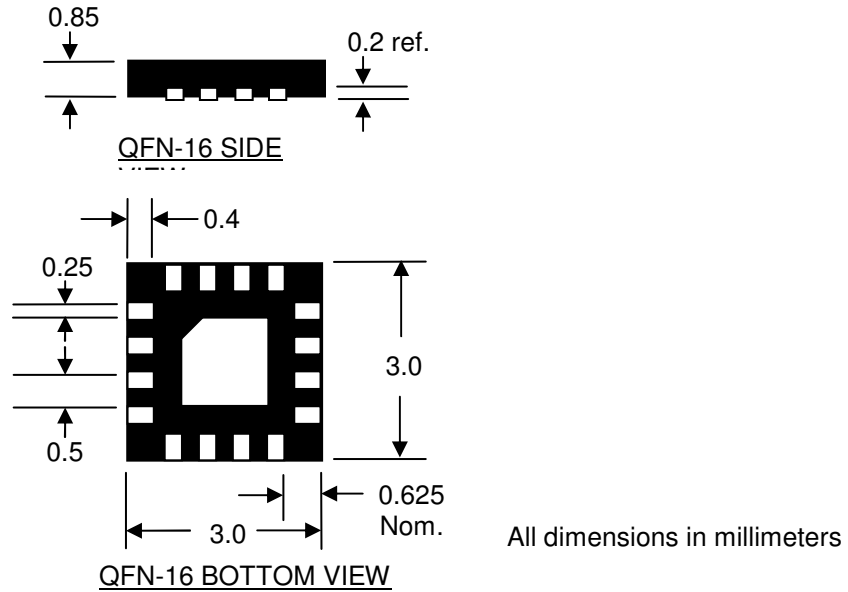


Figure 4: Package Dimensions

TAPE CARRIER PACKAGING

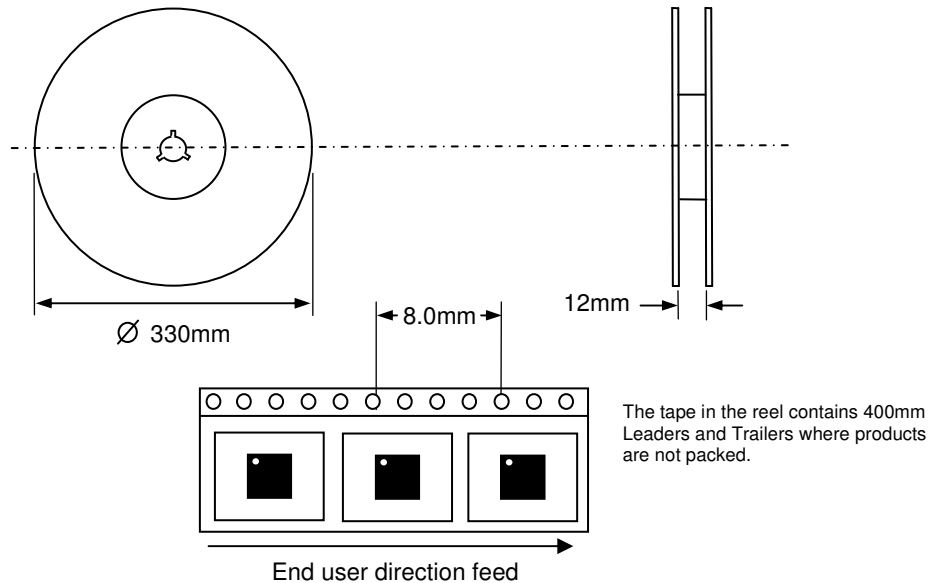


Figure 5: Tape Carrier Dimensions

Table 8: ORDERING INFORMATION

Part Number	Order Code	Package	Part Marking ³	Delivery	Quantity
MBD-472-AL	111R	QFN-16	111R-ZZZZ	Tape and Reel	3000 ⁴

NOMINAL VALUES AVAILABLE

The following additional Micro Power Dual *Rejustors* are available with similar performance specifications. Consult the individual datasheet for more information.

Part Number	Resistance R1 Value (Ω)	Resistance R2 Value (Ω)	Ratio	QFN Order Code
MBD-472-AL	4700	4700	1:1	111R
MBD-472-CL	4700	24,500	1:5	1121
MBD-902-AL	9,000	9,000	1:1	111T
MBD-902-CL	9,000	45,000	1:5	1127
MBD-902-XL	9,000	63,000	1:7	111X
MBD-153-AL	15,000	15,000	1:1	111Y
MBD-153-KL	15,000	45,000	1:3	111U
MBD-333-AL	33,000	33,000	1:1	111Z

Please check with Microbridge Technologies Inc prior to design to ensure you have the latest revision of the datasheet for this part

³ Where ZZZZ represents the 4-digit date code

⁴ Smaller sample quantities available on tape