

DC-DC CONVERTERS

SINGLE AND DUAL OUTPUT, 2:1 INPUT RANGE, UP TO 6 WATTS

MEDICAL AND INDUSTRIAL APPLICATIONS
MCWA6 SERIES



FEATURES

- 2XMOPP 8mm Clearance and Creepage
- No Minimum Load Required
- 5,000Vac Input to Output Isolation
- 2:1 Input Range
- Internal EN55032 Class A Filter
- Low Leakage Current
- Low Standby Power
- Operating Altitude 5,000 meters
- Over Current Protection
- Over Voltage Protection
- Short Circuit Protection
- Under Voltage Protection
- Safety Meets:
IEC/ EN/ ANSI/AAMI ES 60601-1 and
IEC/ EN/ UL 62368-1
- RoHS and REACH Compliant

SELECTION GUIDE All specifications are typical at nominal input, full load and 25°C, unless otherwise noted.

| Input Voltage Range Vdc | Output Voltage Vdc | Output Current @ Full Load mA | Input Current @ No Load mA | Efficiency % | Maximum Capacitor Load µF | Model Number |
|----------------------------|-----------------------|-------------------------------------|----------------------------------|-----------------|---------------------------------|--------------|
| 9 ~ 18 | 5 | 1200 | 10 | 84 | 1500 | MCWA6-12S5 |
| 9 ~ 18 | 12 | 500 | 10 | 87 | 260 | MCWA6-12S12 |
| 9 ~ 18 | 15 | 400 | 10 | 86 | 210 | MCWA6-12S15 |
| 18 ~ 36 | 5 | 1200 | 6 | 84 | 1500 | MCWA6-24S5 |
| 18 ~ 36 | 12 | 500 | 6 | 87 | 260 | MCWA6-24S12 |
| 18 ~ 36 | 15 | 400 | 6 | 87 | 210 | MCWA6-24S15 |
| 36 ~ 75 | 5 | 1200 | 4 | 84 | 1500 | MCWA6-48S5 |
| 36 ~ 75 | 12 | 500 | 4 | 87 | 260 | MCWA6-48S12 |
| 36 ~ 75 | 15 | 400 | 4 | 86 | 210 | MCWA6-48S15 |
| 9 ~ 18 | ±5 | ±600 | 15 | 83 | ± 860 | MCWA6-12-5 |
| 9 ~ 18 | ±12 | ±250 | 10 | 87 | ± 150 | MCWA6-12-12 |
| 9 ~ 18 | ±15 | ±200 | 14 | 86 | ± 110 | MCWA6-12-15 |
| 18 ~ 36 | ±5 | ±600 | 8 | 84 | ± 860 | MCWA6-24-5 |
| 18 ~ 36 | ±12 | ±250 | 6 | 86 | ± 150 | MCWA6-24-12 |
| 18 ~ 36 | ±15 | ±200 | 8 | 86 | ± 110 | MCWA6-24-15 |
| 36 ~ 75 | ±5 | ±600 | 4 | 83 | ± 860 | MCWA6-48-5 |
| 36 ~ 75 | ±12 | ±250 | 4 | 87 | ± 150 | MCWA6-48-12 |
| 36 ~ 75 | ±15 | ±200 | 4 | 85 | ± 110 | MCWA6-48-15 |

PIN CONNECTIONS:

- **Type A:** Standard-No Suffix
- **Type B:** Use Suffix "B"

TRIM:

- **No Trim:** Standard-No Suffix
- **Trim:** Use Suffix "T"
- (Type "B" Only)

Input Specifications

| | | |
|-------------------------------|-------------------------------|-----------------------------------|
| Operating input voltage range | 9 Min., 12 Typ., 18 Max. | 12Vin (nom) |
| | 18 Min., 24 Typ., 36 Max. | 24Vin (nom) |
| | 36 Min., 48 Typ., 75 Max. | 48Vin (nom) |
| Startup voltage, Vdc | 9 Max. | 12Vin (nom) |
| | 18 Max. | 24Vin (nom) |
| | 36 Max. | 48Vin (nom) |
| Shutdown voltage, Vdc | 7 Min., 8 Typ., 8.8 Max. | 12Vin (nom) |
| | 15 Min., 16 Typ., 17.5 Max. | 24Vin (nom) |
| | 31.5 Min., 33 Typ., 34.5 Max. | 48Vin (nom) |
| Start up time, ms | 35 Typ. | Constant resistive load, Power up |
| Input surge voltage, Vdc | 25 Max. | 12Vin (nom), 3 seconds max. |
| | 50 Max. | 24Vin (nom) |
| | 100 Max. | 48Vin (nom) |
| Input filter | Pi type | |

Output Specifications

| | | |
|--|--------------------------------|--|
| Voltage accuracy, % | -1 Min., 1 Max. | |
| Line regulation, % | | Low line to high line at full load |
| | -0.2 Min., 0.2 Max. | Single |
| | -0.5 Min., 0.5 Max. | Dual |
| Load regulation, % | | No load to full load |
| | -0.2 Min., 0.2 Max. | Single |
| | 1 Min., 1 Max. | Dual |
| Cross regulation, % | -5 Min., 5 Max. | Asymmetrical load 25%/100% FL, Dual |
| Voltage adjustability ⁽¹⁾ , % | -10 Min., 10 Max. | Single output, 5Vout, 12Vout |
| | -10 Min., 20 Max. | Single output, 15Vout |
| | -10 Min., 10 Max. | Dual output, ±5Vout, ±12Vout, ±15Vout |
| Ripple and noise, mVp-p | | Measured by 20MHz bandwidth With a 10µF/25V X7R MLCC |
| | 50 Typ. | 5Vout |
| | 75 Typ. | 12Vout, 15Vout |
| Temperature coefficient, %/°C | -0.02 Min., 0.02 Max. | |
| Transient response recovery time, µs | 250 Typ. | 25% load step change |
| Over voltage protection, Vdc | 5.6 Min., 7 Max. | Single, 5Vout |
| | 13.5 Min., 16 Max. | Single, 12Vout |
| | 18.3 Min., 22 Max. | Single, 15Vout |
| | 5.6 Min., 7 Max. | Dual, 5Vout |
| | 13.5 Min., 18.2 Max. | Dual, 12Vout |
| | 17 Min., 22 Max. | Dual, 15Vout |
| Over load protection, % | 150 Typ. | % of lout rated; Hiccup mode |
| Short circuit protection | Continuous, automatic recovery | |

General Specifications

| | | | | |
|---------------------------|---|------------|----------|----------|
| Isolation voltage, Vac | 1 Minute, Input to Output, Reinforced insulation for 250VAC working voltage | 5,000 Min. | | |
| Isolation resistance, GΩ | 500Vdc | 10 Min. | | |
| Isolation capacitance, pF | | | 15 Typ. | 17 Max. |
| Leakage current, µA | 240VAC, 60Hz | | | 2 Max. |
| Switching frequency, kHz | | 225 Min. | 250 Typ. | 275 Max. |
| Clearance/Creepage, mm | | 8 Min. | | |

| Environmental Specifications | | | |
|-----------------------------------|---------------|--------------|------------|
| Operating ambient temperature, °C | With derating | -40 Min. | +105 Max. |
| Maximum case temperature, °C | | | 105 Max. |
| Storage temperature range, °C | | -55 Min. | +125 Max. |
| Thermal impedance | | | 18 Typ. |
| Operating altitude, m | | | 5,000 Max. |
| Thermal shock | | MIL-STD-810F | |
| Vibration | | MIL-STD-810F | |
| Relative humidity | | 5% to 95% RH | |

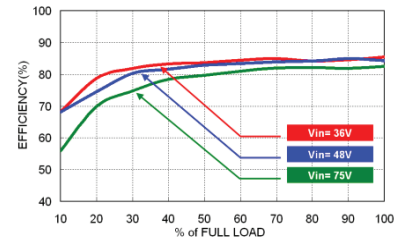
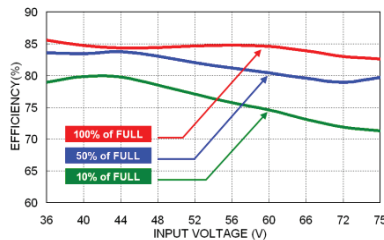
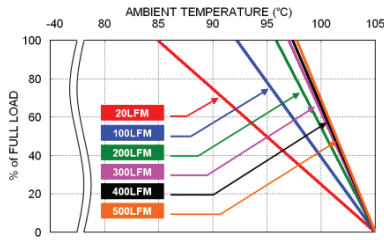
| Physical Specifications | | | EMC Specifications | | |
|-----------------------------|---|----------------|--------------------------------|-------------------------------------|---|
| Design meet safety standard | IEC/ EN/ ANSI/AAMI ES 60601-1 IEC/ EN/ UL 62368-1 | | Specifications | Conditions | Level |
| Dimensions | 1.25 × 0.8 × 0.41 inches (31.8 × 20.3 × 10.5 mm) | A Type, B Type | EMI | EN55011, EN55032, EN60601-1-2 | Without external filter Class A With external filter Class B |
| Case material | Non-conductive black plastic | | EMS | EN55035 and EN60601-1-2 | |
| Base material | Non-conductive black plastic | | ESD | EN61000-4-2 | Air ± 15kV and Contact ± 8kV Perf. Criteria A |
| Potting material | Silicone (UL94 V-0) | | Radiated immunity | EN61000-4-3 | 10 V/m Perf. Criteria A |
| Weight | 13.5g(0.47oz) | A Type, B Type | Fast transient ⁽²⁾ | EN61000-4-4 | ± 2kV Perf. Criteria A |
| MTBF | 3.942 × 10 ⁶ hrs, MIL-HDBK-217F, Full load | | Surge ⁽²⁾ | EN61000-4-5 | Perf. Criteria A |
| | | | Conducted immunity | EN61000-4-6 | 10 Vr.m.s Perf. Criteria A |
| | | | Power frequency magnetic field | EN61000-4-8 | 100A/m continuous; 1000A/m 1 second Perf. Criteria A |

Note:

- Only for B-type Pin connection option.
- 12 input voltage: With an aluminum electrolytic capacitor (Nippon chemi-con KZN series, 3300µF/25V) and a TVS (SMBJ28A, 28V, 600Watt peak pulse power) in parallel.
24 input voltage: With an aluminum electrolytic capacitor (Nippon chemi-con KZN series, 1200µF/50V) and a TVS (SMBJ58A, 58V, 600Watt peak pulse power) in parallel.
48 input voltage: With an aluminum electrolytic capacitor (Nippon chemi-con KZN series, 390µF/100V) and a TVS (SMBJ120A, 120V, 600Watt Watt peak pulse power) in parallel.
- External components may be required for class I application. For further information, please contact Polytron Power Supplies.

CAUTION: This power module is not internally fused. An input line fuse must always be used.

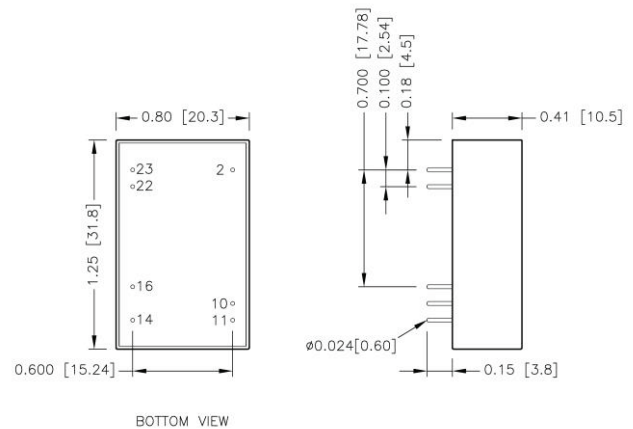
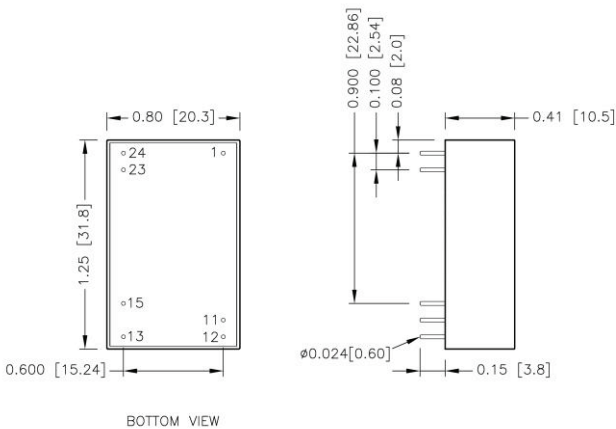
Characteristic Curve



Mechanical Drawing

A Type

B Type



1. All dimensions in inches (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. 3. Pin dimension tolerance ±0.004[0.10]

1. All dimensions in inches (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)
x.xxx±0.01 (x.xx±0.25)
3. 3. Pin dimension tolerance ±0.004[0.10]

PIN CONNECTION

| PIN | SINGLE | DUAL |
|-----|--------|--------|
| 1 | + Vin | + Vin |
| 11 | No Pin | Common |
| 12 | - Vout | No Pin |
| 13 | + Vout | - Vout |
| 15 | No Pin | + Vout |
| 23 | - Vin | - Vin |
| 24 | - Vin | - Vin |

PIN CONNECTION

| PIN | SINGLE | DUAL |
|-----|-------------------------|-------------------------|
| 2 | - Vin | - Vin |
| 10 | Trim (Option) / No pin* | Trim (Option) / No pin* |
| 11 | No pin / NC ** | - Vout |
| 14 | + Vout | + Vout |
| 16 | -Vout | Common |
| 22 | + Vin | + Vin |
| 23 | + Vin | + Vin |

* If don't choose Trim option, there is no pin on the corresponding pin number.

** Pin 11 is "No pin" for Suffix B-T
Pin 11 is "NC" for Suffix B

Fuse Consideration

This power module is not internally fused. An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

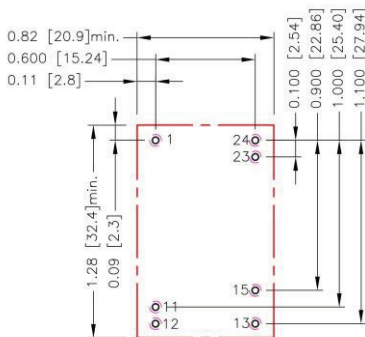
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below:

| Model | Fuse Rating A | Fuse Type |
|--------------------------|------------------|-----------|
| MCWA6-12SXX, MCWA6-12-XX | 1.25 | Slow-Blow |
| MCWA6-24SXX, MCWA6-24-XX | 0.63 | Slow-Blow |
| MCWA6-48SXX, MCWA6-48-XX | 0.315 | Slow-Blow |

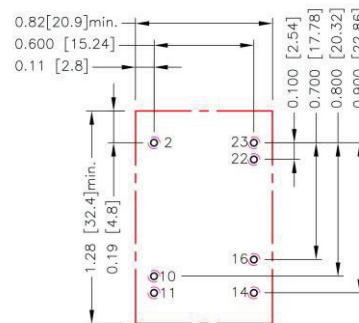
Recommended Pad Layout

A Type



1. All dimensions in inch[mm]
2. Pad size(lead free recommended)
3. Through hole 1.11.12.13.15.23.24: $\Phi 0.035[0.90]$
4. Top view pad 1.11.12.13.15.23.24: $\Phi 0.044[1.13]$
5. Bottom view pad 1.11.12.13.15.23.24: $\Phi 0.071[1.80]$

B Type



1. All dimensions in inch[mm]
2. Pad size(lead free recommended)
3. Through hole 2.10.11.14.16.22.23: $\Phi 0.035[0.90]$
4. Top view pad 2.10.11.14.16.22.23: $\Phi 0.044[1.13]$
5. Bottom view pad 2.10.11.14.16.22.23: $\Phi 0.071[1.80]$

Note:

1. There should be at least 8mm distance between primary and secondary circuit.
2. For further information, please contact Polytron Power Supplies.

Thermal Considerations

The power module operates in a variety of thermal environments.

However, sufficient cooling should be provided to help ensure reliable operation of the unit.

Heat is removed by conduction, convection, and radiation to the surrounding environment.

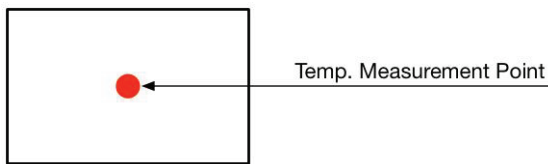
Proper cooling can be verified by measuring the point as the figure below.

The temperature at this location should not exceed "Maximum case temperature".

When operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature".

You can limit this temperature to a lower value for extremely high reliability.

Thermal test condition with vertical direction by natural convection (20LFM).



Output Voltage Adjustment

It allows the user to increase or decrease the output voltage of the module.

This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or -Vout pins.

With an external resistor between the Trim and -Output pin, the output voltage increases.

With an external resistor between the Trim and +Output pin, the output voltage decreases.

The external Trim resistor needs to be at least 1/16W of rated power.

Trim Up Equation

$$R_U = \left[\frac{G \times L}{(V_{o,up} - L - K)} - H \right] \Omega$$

Trim Down Equation

$$R_D = \left[\frac{(V_{o,down} - L) \times G}{(V_o - V_{o,down})} - H \right] \Omega$$

TRIM CONSTANTS

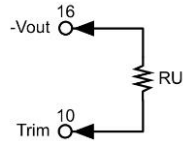
| MODEL | G | H | K | L |
|-----------|--------|--------|------|-----|
| XX-S5B-T | 5,110 | 2,050 | 2.5 | 2.5 |
| XX-S12B-T | 10,000 | 5,110 | 9.5 | 2.5 |
| XX-S15B-T | 10,000 | 5,110 | 12.5 | 2.5 |
| XX--5B-T | 3,000 | 3,000 | 7.5 | 2.5 |
| XX--12B-T | 56,000 | 13,000 | 21.5 | 2.5 |
| XX--15B-T | 30,000 | 13,000 | 27.5 | 2.5 |

Output Voltage Adjustment (Continued)

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below.

Single Output



S5B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 5.050 | 5.100 | 5.150 | 5.200 | 5.250 | 5.300 | 5.350 | 5.400 | 5.450 | 5.500 |
| RU (k Ω) | 253.450 | 125.700 | 83.117 | 61.825 | 49.050 | 40.533 | 34.450 | 29.888 | 26.339 | 23.500 |

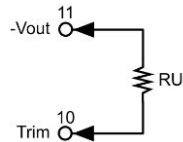
S12B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 12.120 | 12.240 | 12.360 | 12.480 | 12.600 | 12.720 | 12.840 | 12.960 | 13.080 | 13.200 |
| RU (k Ω) | 203.223 | 99.057 | 64.334 | 46.973 | 36.557 | 29.612 | 24.652 | 20.932 | 18.038 | 15.723 |

S15B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 15.150 | 15.300 | 15.450 | 15.600 | 15.750 | 15.900 | 16.050 | 16.200 | 16.350 | 16.500 |
| RU (k Ω) | 161.557 | 78.223 | 50.446 | 36.557 | 28.223 | 22.668 | 18.700 | 15.723 | 13.409 | 11.557 |

Dual Output



| ΔV (%) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 16.650 | 16.800 | 16.950 | 17.100 | 17.250 | 17.400 | 17.550 | 17.700 | 17.850 | 18.000 |
| RU (k Ω) | 10.042 | 8.779 | 7.711 | 6.795 | 6.001 | 5.307 | 4.694 | 4.149 | 3.662 | 3.223 |

5B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Vout (V) | ± 5.050 | ± 5.100 | ± 5.150 | ± 5.200 | ± 5.250 | ± 5.300 | ± 5.350 | ± 5.400 | ± 5.450 | ± 5.500 |
| RU (k Ω) | 72.000 | 34.500 | 22.000 | 15.750 | 12.000 | 9.500 | 7.714 | 6.375 | 5.333 | 4.500 |

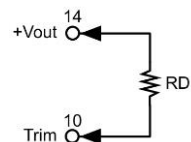
12B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Vout (V) | ± 12.120 | ± 12.240 | ± 12.360 | ± 12.480 | ± 12.600 | ± 12.720 | ± 12.840 | ± 12.960 | ± 13.080 | ± 13.200 |
| RU (k Ω) | 570.333 | 278.667 | 181.444 | 132.833 | 103.667 | 84.222 | 70.333 | 59.917 | 51.815 | 45.333 |

15B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Vout (V) | ± 15.150 | ± 15.300 | ± 15.450 | ± 15.600 | ± 15.750 | ± 15.900 | ± 16.050 | ± 16.200 | ± 16.350 | ± 16.500 |
| RU (k Ω) | 237.000 | 112.000 | 70.333 | 49.500 | 37.000 | 28.667 | 22.714 | 18.250 | 14.778 | 12.000 |

Single & Dual Output



S5B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 4.950 | 4.900 | 4.850 | 4.800 | 4.750 | 4.700 | 4.650 | 4.600 | 4.550 | 4.500 |
| RD (k Ω) | 248.340 | 120.590 | 78.007 | 56.715 | 43.940 | 35.423 | 29.340 | 24.778 | 21.229 | 18.390 |

S12B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|
| Vout (V) | 11.880 | 11.760 | 11.640 | 11.520 | 11.400 | 11.280 | 11.160 | 11.040 | 10.920 | 10.800 |
| RD (k Ω) | 776.557 | 380.723 | 248.779 | 182.807 | 143.223 | 116.834 | 97.985 | 83.848 | 72.853 | 64.057 |

S15B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| Vout (V) | 14.850 | 14.700 | 14.550 | 14.400 | 14.250 | 14.100 | 13.950 | 13.800 | 13.650 | 13.500 |
| RD (k Ω) | 818.223 | 401.557 | 262.668 | 193.223 | 151.557 | 123.779 | 103.938 | 89.057 | 77.483 | 68.223 |

5B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Vout (V) | ± 4.950 | ± 4.900 | ± 4.850 | ± 4.800 | ± 4.750 | ± 4.700 | ± 4.650 | ± 4.600 | ± 4.550 | ± 4.500 |
| RD (k Ω) | 219.000 | 106.500 | 69.000 | 50.250 | 39.000 | 31.500 | 26.143 | 22.125 | 19.000 | 16.500 |

12B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Vout (V) | ± 11.880 | ± 11.760 | ± 11.640 | ± 11.520 | ± 11.400 | ± 11.280 | ± 11.160 | ± 11.040 | ± 10.920 | ± 10.800 |
| RD (k Ω) | 4947.667 | 2439.333 | 1603.222 | 1185.167 | 934.333 | 767.111 | 647.667 | 558.083 | 488.407 | 432.667 |

15B-T

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Vout (V) | ± 14.850 | ± 14.700 | ± 14.550 | ± 14.400 | ± 14.250 | ± 14.100 | ± 13.950 | ± 13.800 | ± 13.650 | ± 13.500 |
| RD (k Ω) | 2707.000 | 1332.000 | 873.667 | 644.500 | 507.000 | 415.333 | 349.857 | 300.750 | 262.556 | 232.000 |