



P-DUKE POWER

MPM20 · MPM20W Series

DC-DC Converter
Up to 20 Watts

5
YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Medical



PV



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Railway

UL US CB CE FC

| | | | | | | | | | | | |
|----------------|---|---------------------------------|-------------------------|---|---------------------------|-------------------------|-----------------------------|---|---------------------|-----|-----|
| 2 x MOPP | 5000 VAC Reinforced Insulation | 4 : 1 Wide Input Range | 2 : 1 Input Range | Internal EN55032 Class Filter A | LOW Leakage Current | LOW Standby Power | NO Min. Load Required | Operating Altitude 5000 meter | REMOTE ON OFF | OCP | OTP |
| OVP | SCP | UVP | | | | | | | | | |

PART NUMBER STRUCTURE

| Series Name | Input Voltage (VDC) | Output Quantity | Output Voltage (VDC) | Input Range | Remote On/Off Option |
|-----------------------|---------------------|-----------------|----------------------|-------------|--|
| MPM20 - 48 S 05 W - P | 12:9~18 | S:Single | 05:5 | □: 2:1 | □:No pin P:Positive logic N:Negative logic |
| | 24:18~36 | | 12:12 | | |
| | 48:36~75 | 15:15 | | | |
| | | 24:24 | | | |
| | | D: Dual | 05:±5 | | |
| | | | 12:±12 | | |
| | | | 15:±15 | | |
| MPM20 - 24 S 05 W - P | 24:9~36 | S:Single | 05:5 | W: 4:1 | □:No pin P:Positive logic N:Negative logic |
| | 48:18~75 | | 12:12 | | |
| | | 15:15 | | | |
| | | 24:24 | | | |
| | | D: Dual | 05:±5 | | |
| | | | 12:±12 | | |
| | | | 15:±15 | | |

TECHNICAL SPECIFICATION All specifications are typical at nominal input, full load and 25°C unless otherwise noted

| Model Number | Input Range | Output Voltage | Output Current @Full Load | Input Current @ No Load | Efficiency | Maximum Capacitor Load |
|--------------|-------------|----------------|---------------------------|-------------------------|------------|------------------------|
| | VDC | VDC | mA | mA | % | μF |
| MPM20-12S05 | 9 ~ 18 | 5 | 4000 | 8 | 88.5 | 5000 |
| MPM20-12S12 | 9 ~ 18 | 12 | 1670 | 12 | 88.5 | 850 |
| MPM20-12S15 | 9 ~ 18 | 15 | 1330 | 13 | 89 | 700 |
| MPM20-12S24 | 9 ~ 18 | 24 | 833 | 11 | 89 | 220 |
| MPM20-12D05 | 9 ~ 18 | ±5 | ±2000 | 11 | 86 | ±2500 |
| MPM20-12D12 | 9 ~ 18 | ±12 | ±833 | 11 | 89 | ±500 |
| MPM20-12D15 | 9 ~ 18 | ±15 | ±667 | 14 | 89 | ±350 |
| MPM20-24S05 | 18 ~ 36 | 5 | 4000 | 8 | 90 | 5000 |
| MPM20-24S12 | 18 ~ 36 | 12 | 1670 | 9 | 90 | 850 |
| MPM20-24S15 | 18 ~ 36 | 15 | 1330 | 9 | 90 | 700 |
| MPM20-24S24 | 18 ~ 36 | 24 | 833 | 9 | 90 | 220 |
| MPM20-24D05 | 18 ~ 36 | ±5 | ±2000 | 11 | 86 | ±2500 |
| MPM20-24D12 | 18 ~ 36 | ±12 | ±833 | 9 | 90 | ±500 |
| MPM20-24D15 | 18 ~ 36 | ±15 | ±667 | 11 | 90 | ±350 |
| MPM20-48S05 | 36 ~ 75 | 5 | 4000 | 9 | 89.5 | 5000 |
| MPM20-48S12 | 36 ~ 75 | 12 | 1670 | 9 | 88.5 | 850 |
| MPM20-48S15 | 36 ~ 75 | 15 | 1330 | 9 | 89 | 700 |
| MPM20-48S24 | 36 ~ 75 | 24 | 833 | 9 | 88.5 | 220 |
| MPM20-48D05 | 36 ~ 75 | ±5 | ±2000 | 9 | 86 | ±2500 |
| MPM20-48D12 | 36 ~ 75 | ±12 | ±833 | 9 | 88.5 | ±500 |
| MPM20-48D15 | 36 ~ 75 | ±15 | ±667 | 9 | 89 | ±350 |
| MPM20-24S05W | 9 ~ 36 | 5 | 4000 | 8 | 88.5 | 5000 |
| MPM20-24S12W | 9 ~ 36 | 12 | 1670 | 11 | 88.5 | 850 |
| MPM20-24S15W | 9 ~ 36 | 15 | 1330 | 10 | 89 | 700 |
| MPM20-24S24W | 9 ~ 36 | 24 | 833 | 10 | 88.5 | 220 |
| MPM20-24D05W | 9 ~ 36 | ±5 | ±2000 | 9 | 86 | ±2500 |
| MPM20-24D12W | 9 ~ 36 | ±12 | ±833 | 10 | 88.5 | ±500 |
| MPM20-24D15W | 9 ~ 36 | ±15 | ±667 | 11 | 89 | ±350 |
| MPM20-48S05W | 18 ~ 75 | 5 | 4000 | 9 | 89.5 | 5000 |
| MPM20-48S12W | 18 ~ 75 | 12 | 1670 | 9 | 88.5 | 850 |
| MPM20-48S15W | 18 ~ 75 | 15 | 1330 | 9 | 89 | 700 |
| MPM20-48S24W | 18 ~ 75 | 24 | 833 | 9 | 88.5 | 220 |
| MPM20-48D05W | 18 ~ 75 | ±5 | ±2000 | 9 | 86 | ±2500 |
| MPM20-48D12W | 18 ~ 75 | ±12 | ±833 | 9 | 88.5 | ±500 |
| MPM20-48D15W | 18 ~ 75 | ±15 | ±667 | 9 | 89 | ±350 |

INPUT SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|-------------------------------|-------------------------|---------------------------|-----------|---------------------|------|------|
| Operating input voltage range | 2:1 | 12Vin(nom) | 9 | 12 | 18 | VDC |
| | | 24Vin(nom) | 18 | 24 | 36 | |
| | (W) 4:1 | 48Vin(nom) | 36 | 48 | 75 | VDC |
| | | 24Vin(nom) | 9 | 24 | 36 | |
| Start up voltage | 2:1 | 48Vin(nom) | 18 | 48 | 75 | VDC |
| | | 12Vin(nom) | | | 9 | |
| | (W) 4:1 | 24Vin(nom) | | | 18 | VDC |
| | | 48Vin(nom) | | | 36 | |
| Shutdown voltage | 2:1 | 12Vin(nom) | 7.8 | 8 | 8.6 | VDC |
| | | 24Vin(nom) | 15.8 | 16 | 17.4 | |
| | (W) 4:1 | 48Vin(nom) | 32 | 33 | 34 | VDC |
| | | 24Vin(nom) | 7.8 | 8 | 8.6 | |
| Start up time | Constant resistive load | Power up | | 30 | 60 | ms |
| | | Remote ON/OFF | | 30 | 60 | |
| Input surge voltage | 3 second, max. | 12Vin(nom) | | | 25 | VDC |
| | | 24Vin(nom) | | | 50 | |
| | 3 second, max. | 48Vin(nom) | | | 100 | VDC |
| | | 24Vin(nom) | | | 50 | |
| | | 48Vin(nom) | | | 100 | VDC |
| Input filter | | | | Pi type | | |
| Remote ON/OFF (Option) | Referred to - Vin pin | Positive logic | DC-DC ON | Open or 3.5 ~ 12VDC | | |
| | | | DC-DC OFF | Short or 0 ~ 1.2VDC | | |
| | | Negative logic | DC-DC ON | Short or 0 ~ 1.2VDC | | |
| | | | DC-DC OFF | Open or 3.5 ~ 12VDC | | |
| | | Input current of Ctrl pin | | -0.5 | 1 | mA |
| | | Remote off input current | | 2.5 | | mA |

OUTPUT SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------------------------|----------------|-------|---------------------------------|-------|-------|
| Voltage accuracy | | | -1.0 | | +1.0 | % |
| Line regulation | Low Line to High Line at Full Load | Single | -0.2 | | +0.2 | % |
| | | Dual | -0.5 | | +0.5 | |
| Load regulation | No Load to Full Load | Single | -0.2 | | +0.2 | % |
| | | Dual | -1.0 | | +1.0 | |
| Cross regulation | Asymmetrical load 25%/100% FL | Dual | -5.0 | | +5.0 | % |
| Voltage adjustability | Single output | 5Vout, 12Vout | -10 | | +10 | % |
| | | 15Vout, 24Vout | -10 | | +20 | |
| Ripple and noise | Measured by 20MHz bandwidth | | | | | mVp-p |
| | With a 10μF/25V X7R MLCC | Single | | | | |
| | | 5Vout | | 50 | | |
| | | 12Vout | | 75 | | |
| | | 15Vout | | 75 | | |
| | With a 4.7μF/50V X7R MLCC | 24Vout | | 100 | | |
| | | Dual | | | | |
| | | ±5Vout | | 50 | | |
| ±12Vout | | | 75 | | | |
| With a 10μF/25V X7R MLCC | ±15Vout | | 75 | | | |
| Temperature coefficient | | | -0.02 | | +0.02 | %/°C |
| Transient response recovery time | 25% load step change | | | 250 | | μs |
| Over voltage protection | Zener diode clamp | 5Vout | | 6.2 | | VDC |
| | | 12Vout | | 15 | | |
| | | 15Vout | | 20 | | |
| | | 24Vout | | 30 | | |
| Over load protection | % of lout rated; Hiccup mode | | | 150 | 185 | % |
| Short circuit protection | | | | Continuous, automatics recovery | | |

GENERAL SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------|--|------|------|------|--|
| Isolation voltage | 1 minute Input to Output Reinforced insulation for 250VAC working voltage | 5000 | | | VAC |
| Isolation capacitance | | | 20 | | pF |
| Leakage current | 240VAC, 60Hz | | 2 | 2.5 | μA |
| Switching frequency | | 225 | 250 | 285 | kHz |
| Clearance / Creepage | | 8 | | | mm |
| Safety approvals | IEC/ EN/ ANSI/AAMI ES 60601-1 IEC/ EN/ UL 60950-1, 62368-1 | | | | UL:E360199 UL:E193009 CB:UL(Demko) |
| Case material | | | | | Non-conductive black plastic |
| Base material | | | | | Non-conductive black plastic |
| Potting material | | | | | Silicone (UL94 V-0) |
| Weight | | | | | 24g (0.85oz) |
| MTBF | MIL-HDBK-217F, Full load | | | | 1.712×10 ⁶ hrs |

ENVIRONMENTAL SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|---------------|------|-------|------|--------------|
| Operating ambient temperature | With derating | -40 | | +105 | °C |
| Maximum case temperature | | | | +105 | °C |
| Over temperature protection | | | 115 | | °C |
| Storage temperature range | | -55 | | +125 | °C |
| Thermal impedance | | | 14.36 | | °C/W |
| Operating altitude | | | | 5000 | m |
| Thermal shock | | | | | MIL-STD-810F |
| Vibration | | | | | MIL-STD-810F |
| Relative humidity | | | | | 5% to 95% RH |

EMC SPECIFICATIONS

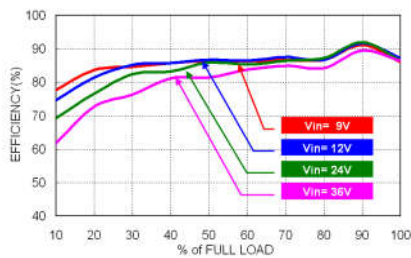
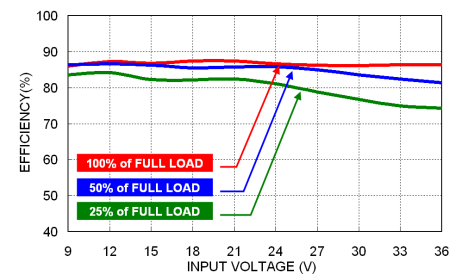
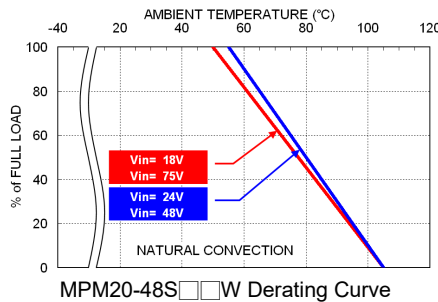
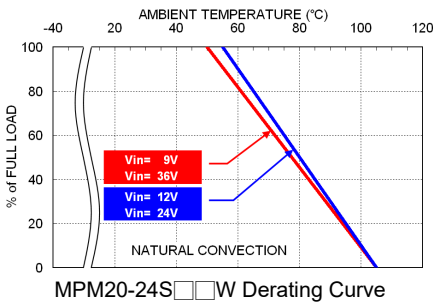
| Parameter | Conditions | Level |
|-------------------|---|--------------------|
| EMI | EN55011, EN55032 and FCC Part 18 Without external components. With external components. | Class A Class B |
| ESD | EN61000-4-2 Air ± 15kV and Contact ± 8kV | Perf. Criteria A |
| Radiated immunity | EN61000-4-3 10 V/m | Perf. Criteria A |
| Fast transient | EN61000-4-4 ± 2kV | Perf. Criteria A |
| | MPM20-12□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel. | |
| | MPM20-24□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel. | |
| | MPM20-48□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ120A, 120V, 3000 Watt peak pulse power) in parallel. | |

EMC SPECIFICATIONS(CONTINUED)

| Parameter | Conditions | Level |
|--------------------------------|--|------------------|
| Surge | EN61000-4-5 ± 2kV MPM20-12□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ36A, 36V, 3000 Watt peak pulse power) in parallel. MPM20-24□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ58A, 58V, 3000 Watt peak pulse power) in parallel. MPM20-48□□□□ With 2 pcs of aluminum electrolytic capacitor (Nippon chemi-con KY series, 220μF/100V) and a TVS (SMDJ120A, 120V, 3000 Watt peak pulse power) in parallel. | 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 |

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

CHARACTERISTIC CURVE



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.

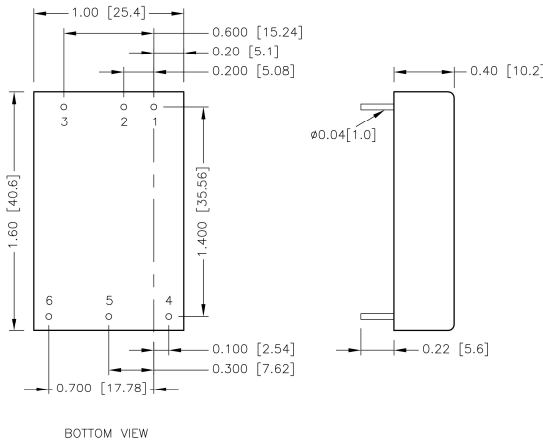
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

| Model | Fuse Rating (A) | Fuse Type |
|----------------------|-----------------|-----------|
| MPM20-12□□□□、24□□□□W | 4 | Slow-Blow |
| MPM20-24□□□□、48□□□□W | 2 | Slow-Blow |
| MPM20-48□□□□ | 1 | Slow-Blow |

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

MECHANICAL DRAWING

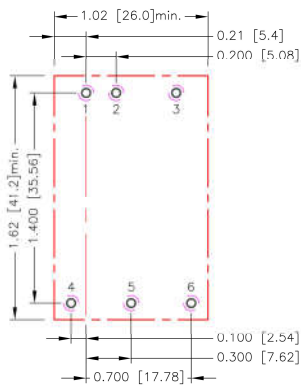


PIN CONNECTION

| PIN | SINGLE | DUAL |
|-----|---------------|---------------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | Ctrl (Option) | Ctrl (Option) |
| 4 | +Vout | +Vout |
| 5 | -Vout | Common |
| 6 | Trim | -Vout |

- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.xx±0.5]
x.xxx±0.01 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

RECOMMENDED PAD LAYOUT



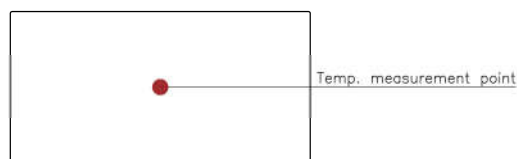
- All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\varnothing 0.051[1.30]$
 Top view pad 1.2.3.4.5.6: $\varnothing 0.064[1.63]$
 Bottom view pad 1.2.3.4.5.6: $\varnothing 0.102[2.60]$

- * There should be at least 8mm distance between primary and secondary circuit.
- ** For further information, please contact P-DUKE.

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).



TOP VIEW

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

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

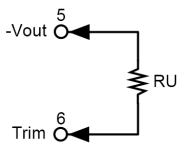
■ Trim Constants

| Module | G | H | K | L |
|--------------------|-------|-------|------|-----|
| MPM20-□□S05、□□S05W | 5110 | 2050 | 2.5 | 2.5 |
| MPM20-□□S12、□□S12W | 10000 | 5110 | 9.5 | 2.5 |
| MPM20-□□S15、□□S15W | 10000 | 5110 | 12.5 | 2.5 |
| MPM20-□□S24、□□S24W | 56000 | 13000 | 21.5 | 2.5 |

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S05、□□S05W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 5.05 | 5.1 | 5.15 | 5.2 | 5.25 | 5.3 | 5.35 | 5.4 | 5.45 | 5.5 |
| RU (kΩ) | 253.450 | 125.700 | 83.117 | 61.825 | 49.050 | 40.533 | 34.450 | 29.888 | 26.339 | 23.500 |

□□S12、□□S12W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 12.12 | 12.24 | 12.36 | 12.48 | 12.6 | 12.72 | 12.84 | 12.96 | 13.08 | 13.2 |
| RU (kΩ) | 203.223 | 99.057 | 64.334 | 46.973 | 36.557 | 29.612 | 24.652 | 20.932 | 18.038 | 15.723 |

□□S15、□□S15W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 15.15 | 15.3 | 15.45 | 15.6 | 15.75 | 15.9 | 16.05 | 16.2 | 16.35 | 16.5 |
| RU (kΩ) | 161.557 | 78.223 | 50.446 | 36.557 | 28.223 | 22.668 | 18.700 | 15.723 | 13.409 | 11.557 |

| ΔV (%) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Vout (V) | 16.65 | 16.8 | 16.95 | 17.1 | 17.25 | 17.4 | 17.55 | 17.7 | 17.85 | 18 |
| RU (kΩ) | 10.042 | 8.779 | 7.711 | 6.795 | 6.001 | 5.307 | 4.694 | 4.149 | 3.662 | 3.223 |

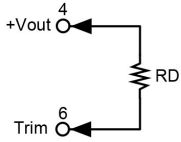
□□S24、□□S24W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|
| Vout (V) | 24.24 | 24.48 | 24.72 | 24.96 | 25.2 | 25.44 | 25.68 | 25.92 | 26.16 | 26.4 |
| RU (kΩ) | 570.333 | 278.667 | 181.444 | 132.833 | 103.667 | 84.222 | 70.333 | 59.917 | 51.815 | 45.333 |

| ΔV (%) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 26.64 | 26.88 | 27.12 | 27.36 | 27.6 | 27.84 | 28.08 | 28.32 | 28.56 | 28.8 |
| RU (kΩ) | 40.030 | 35.611 | 31.872 | 28.667 | 25.889 | 23.458 | 21.314 | 19.407 | 17.702 | 16.167 |

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



| □□S05W | | | | | | | | | | |
|------------------|---------|---------|--------|--------|--------|--------|--------|--------|--------|--------|
| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Vout (V) | 4.95 | 4.9 | 4.85 | 4.8 | 4.75 | 4.7 | 4.65 | 4.6 | 4.55 | 4.5 |
| RD (k Ω) | 248.340 | 120.590 | 78.007 | 56.715 | 43.940 | 35.423 | 29.340 | 24.778 | 21.229 | 18.390 |

| □□S12W | | | | | | | | | | |
|------------------|---------|---------|---------|---------|---------|---------|--------|--------|--------|--------|
| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Vout (V) | 11.88 | 11.76 | 11.64 | 11.52 | 11.4 | 11.28 | 11.16 | 11.04 | 10.92 | 10.8 |
| RD (k Ω) | 776.557 | 380.723 | 248.779 | 182.807 | 143.223 | 116.834 | 97.985 | 83.848 | 72.853 | 64.057 |

| □□S15W | | | | | | | | | | |
|------------------|---------|---------|---------|---------|---------|---------|---------|--------|--------|--------|
| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Vout (V) | 14.85 | 14.7 | 14.55 | 14.4 | 14.25 | 14.1 | 13.95 | 13.8 | 13.65 | 13.5 |
| RD (k Ω) | 818.223 | 401.557 | 262.668 | 193.223 | 151.557 | 123.779 | 103.938 | 89.057 | 77.483 | 68.223 |

| □□S24W | | | | | | | | | | |
|------------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|
| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Vout (V) | 23.76 | 23.52 | 23.28 | 23.04 | 22.8 | 22.56 | 22.32 | 22.08 | 21.84 | 21.6 |
| RD (k Ω) | 4947.667 | 2439.333 | 1603.222 | 1185.167 | 934.333 | 767.111 | 647.667 | 558.083 | 488.407 | 432.667 |