



**THE DATASHEET OF
LCD20-48D12W**





P-DUKE POWER

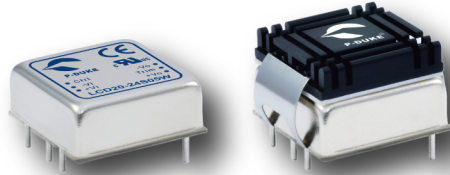
LCD20W Series

DC-DC Converter
Up to 20 Watts

3
YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway

UL US CB CE

1600
VDC
Isolation
Voltage

4 : 1
Wide
Input
Range

6
sided
Shielding

Internal
EN55032
Class
Filter **A**

LOW
Standby
Power

NO
Min. Load
Required

REMOTE
ON
OFF

OCP

OVP

SCP

UVP

PART NUMBER STRUCTURE

| LCD20 | - 48 | S | 05 | W | V | - | M3 | A | HC |
|-------------|---------------------|------------------------|--|-------------|--|---|---|---|-------------------------------------|
| Series Name | Input Voltage (VDC) | Output Quantity | Output Voltage (VDC) | Input Range | -10% ~ +20% Vout Adjustability | | Operating Temp. Options | Remote ON/OFF & Trim Options | Assembly Options |
| | 24:9~36 48:18~75 | S:Single D:Dual | 3P3:3.3 05:5 12:12 15:15 24:24 12:±12 15:±15 24:±24 | 4:1 | □: None V: -10~+20% (Only for 5Vout) | | □: Standard -40~+101°C With derating M3: M3 Version -55~+101°C With derating | □: Negative logic A: Positive logic B: Without Ctrl pin C: Negative logic without Trim pin D: Without Ctrl & Trim pin E: Positive logic without Trim pin | □: None HC: Heat-sink with Clamp |

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 |
| LCD20-24S3P3W | 9 ~ 36 | 3.3 | 4500 | 10 | 89 | 7000 |
| LCD20-24S05W | 9 ~ 36 | 5 | 4000 | 10 | 89 | 5000 |
| LCD20-24S05WV | 9 ~ 36 | 5 | 4000 | 10 | 88 | 5000 |
| LCD20-24S12W | 9 ~ 36 | 12 | 1670 | 6 | 89 | 850 |
| LCD20-24S15W | 9 ~ 36 | 15 | 1330 | 6 | 89 | 700 |
| LCD20-24S24W | 9 ~ 36 | 24 | 833 | 10 | 91 | 220 |
| LCD20-24D12W | 9 ~ 36 | ±12 | ±833 | 6 | 89 | ±500 |
| LCD20-24D15W | 9 ~ 36 | ±15 | ±667 | 6 | 90 | ±350 |
| LCD20-24D24W | 9 ~ 36 | ±24 | ±417 | 12 | 91 | ±100 |
| LCD20-48S3P3W | 18 ~ 75 | 3.3 | 4500 | 10 | 90 | 7000 |
| LCD20-48S05W | 18 ~ 75 | 5 | 4000 | 10 | 90 | 5000 |
| LCD20-48S05WV | 18 ~ 75 | 5 | 4000 | 10 | 89 | 5000 |
| LCD20-48S12W | 18 ~ 75 | 12 | 1670 | 4 | 89 | 850 |
| LCD20-48S15W | 18 ~ 75 | 15 | 1330 | 4 | 90 | 700 |
| LCD20-48S24W | 18 ~ 75 | 24 | 833 | 8 | 91 | 220 |
| LCD20-48D12W | 18 ~ 75 | ±12 | ±833 | 4 | 89 | ±500 |
| LCD20-48D15W | 18 ~ 75 | ±15 | ±667 | 4 | 90 | ±350 |
| LCD20-48D24W | 18 ~ 75 | ±24 | ±417 | 10 | 91 | ±100 |

| INPUT SPECIFICATIONS | | | | | | |
|-------------------------------|-------------------------|---|-------------|----------|---|----------|
| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
| Operating input voltage range | | 24Vin(nom) 48Vin(nom) | 9 18 | 24 48 | 36 75 | VDC |
| Start up voltage | | 24Vin(nom) 48Vin(nom) | | | 9 18 | VDC |
| Shutdown voltage | | 24Vin(nom) 48Vin(nom) | 7.5 15.5 | 8 16 | 8.8 17.5 | VDC |
| Start up time | Constant resistive load | Power up Remote ON/OFF | | | 30 30 | ms |
| Input surge voltage | 1 second, max. | 24Vin(nom) 48Vin(nom) | | | 50 100 | VDC |
| Input filter | | | | | Pi type | |
| Remote ON/OFF | Referred to -Vin pin | Positive logic DC-DC ON (Option) DC-DC OFF Negative logic DC-DC ON (Standard) DC-DC OFF Input current of Ctrl pin Remote off input current | -0.5 | 2.0 | Open or 3 ~ 15VDC Short or 0 ~ 1.2VDC Short or 0 ~ 1.2VDC Open or 3 ~ 15VDC 1.0 | mA 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 Dual | -0.2 -0.5 | | +0.2 +0.5 | % |
| Load regulation | No Load to Full Load | Single Dual | -0.2 -1.0 | | +0.2 +1.0 | % |
| | 10% Load to 90% Load | Single Dual | -0.1 -0.8 | | +0.1 +0.8 | |
| Cross regulation | Asymmetrical load 25%/100% FL | Dual | -5.0 | | +5.0 | % |
| Voltage adjustability | Single output | <input type="checkbox"/> <input type="checkbox"/> S05WV 24Vout Others | -10 -10 -10 | | +20 +20 +10 | % |
| Ripple and noise | Measured by 20MHz bandwidth | | | | | |
| | With a 1 μ F M/C X7R and a 10 μ F T/C | Single 3.3Vout, 5Vout 12Vout, 15Vout | | 75 75 | | mVp-p |
| | With 2 pcs of 6.8 μ F/50V X7R MLCC | 24Vout | | 75 | | |
| | With a 1 μ F M/C X7R and a 10 μ F T/C for each output | Dual 12Vout, 15Vout | | 100 | | |
| | With a 4.7 μ F/50V X7R MLCC for each output | 24Vout | | 100 | | |
| Temperature coefficient | | | -0.02 | | +0.02 | %/°C |
| Transient response recovery time | 25% load step change | | | 250 | | μ s |
| Over voltage protection | | 3.3Vout 5Vout 12Vout 15Vout 24Vout <input type="checkbox"/> <input type="checkbox"/> S05WV | 3.7 5.6 13.5 16.8 29.1 6.3 | | 5.4 7.0 19.6 20.5 32.5 7.4 | VDC |
| Over load protection | % of lout rated; Hiccup mode | | | 150 | | % |
| Short circuit protection | | | | Continuous, automatic recovery | | |

GENERAL SPECIFICATIONS

| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|-----------------------|--------------------------|--|--------------|------------|-----------------------------|------------|
| Isolation voltage | 1 minute | Input to Output Input(Output) to Case | 1600 1000 | | | VDC |
| Isolation resistance | 500VDC | | 1 | | | G Ω |
| Isolation capacitance | | | | | 1500 | pF |
| Switching frequency | | 3.3Vout, 5Vout Others | 248 297 | 275 330 | 303 363 | kHz |
| Safety approvals | IEC /EN /UL 62368-1 | | | | UL:E193009 CB:UL(Demko) | |
| Case material | | | | | Nickel-coated copper | |
| Base material | | | | | FR4 PCB | |
| Potting material | | | | | Silicone (UL94 V-0) | |
| Weight | | | | | 15g (0.53oz) | |
| MTBF | MIL-HDBK-217F, Full load | | | | 1.469 x 10 ⁶ hrs | |

ENVIRONMENTAL SPECIFICATIONS

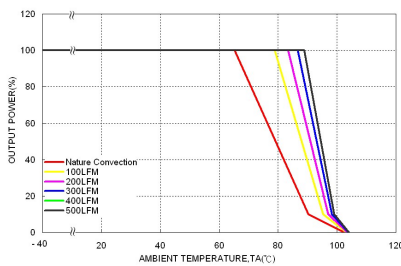
| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|-------------------------------|------------------------|-------------------|------|------|------|--------------|
| Operating ambient temperature | Standard M3 Version | With derating | -40 | | +101 | °C |
| | | With derating | -55 | | +101 | |
| Maximum case temperature | | | | | 105 | °C |
| Storage temperature range | | | -55 | | +125 | °C |
| Thermal impedance | | Without heat-sink | | 17.6 | | °C/W |
| | | With heat-sink | | 14.8 | | |
| Thermal shock | | | | | | MIL-STD-810F |
| Vibration | | | | | | MIL-STD-810F |
| Relative humidity | | | | | | 5% to 95% RH |

EMC SPECIFICATIONS

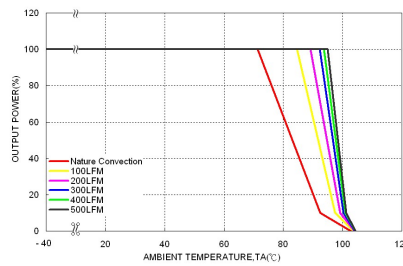
| Parameter | Conditions | | Level |
|--------------------------------|-------------|--|------------------|
| EMI | EN55032 | Without external components | Class A |
| | | With external components | Class B |
| EMS | EN55024 | | |
| ESD | EN61000-4-2 | Air ± 8kV and Contact ± 6kV | Perf. Criteria A |
| Radiated immunity | EN61000-4-3 | 10 V/m | Perf. Criteria A |
| Fast transient | EN61000-4-4 | ± 2kV | Perf. Criteria A |
| Surge | EN61000-4-5 | ± 2kV | Perf. Criteria A |
| | | An external input filter capacitor (Nippon chemi-con KY series, 220µF/100V) | |
| 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.

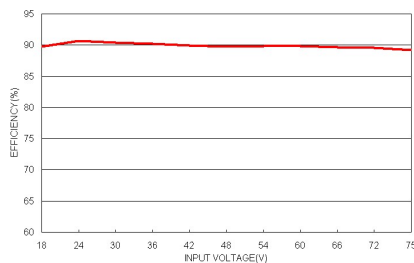
CHARACTERISTIC CURVE



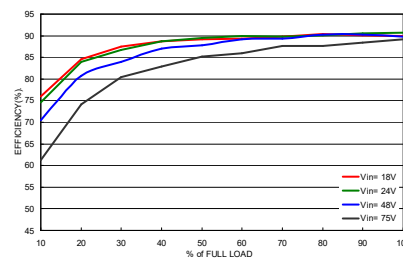
LCD20-48S05W Derating Curve



LCD20-48S05W Derating Curve With Heat-sink



LCD20-48S05W Efficiency vs. Input Voltage



LCD20-48S05W Efficiency vs. Output Load

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.

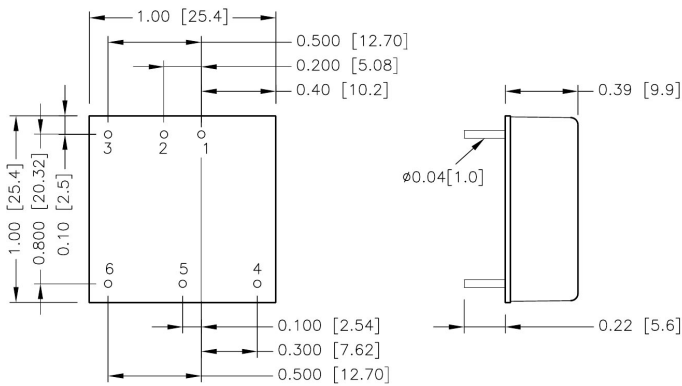
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

| Model | Fuse Rating (A) | Fuse Type |
|---------------------------|-----------------|-----------|
| LCD20-24S□□W、LCD20-24D□□W | 4 | Slow-Blow |
| LCD20-48S□□W、LCD20-48D□□W | 2 | 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



BOTTOM VIEW

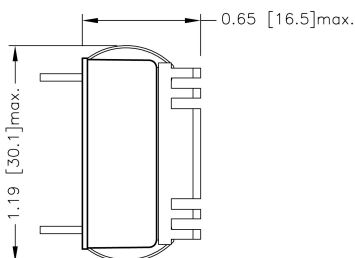
PIN CONNECTION

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

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

HEAT-SINK OPTIONS

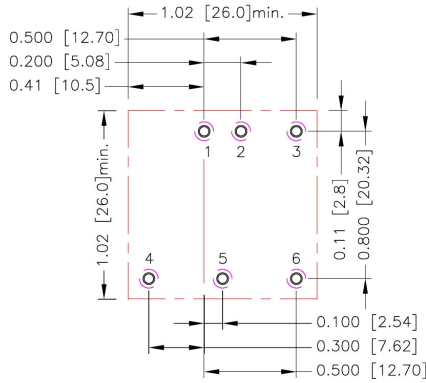
-HC (Heat-sink with clamps)



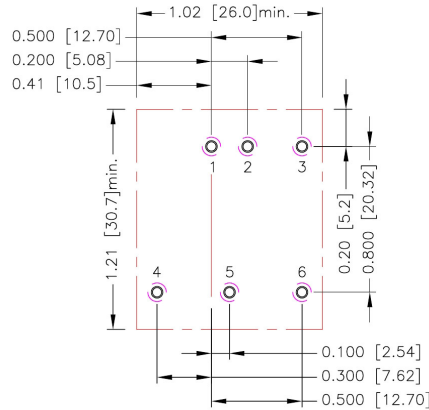
* All dimensions in inch [mm]

RECOMMENDED PAD LAYOUT

Standard



-HC

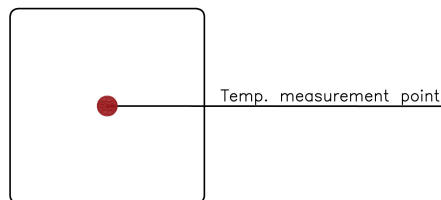


All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6: $\Phi 0.051[1.30]$
 Top view pad 1.2.3.4.5.6: $\Phi 0.064[1.63]$
 Bottom view pad 1.2.3.4.5.6: $\Phi 0.102[2.60]$

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

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins. With an external resistor between the Trim and -Output pin, the output voltage set point increases. With an external resistor between the Trim and +Output pin, the output voltage set point 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

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

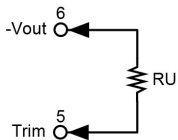
Trim constants

| Module | G | H | K | L |
|---------------|-------|-------|------|-----|
| LCD20-□□S3P3W | 5110 | 2050 | 0.8 | 2.5 |
| LCD20-□□S05W | 5110 | 2050 | 2.5 | 2.5 |
| LCD20-□□S05WV | 5110 | 2050 | 2.5 | 2.5 |
| LCD20-□□S12W | 10000 | 5110 | 9.5 | 2.5 |
| LCD20-□□S15W | 10000 | 5110 | 12.5 | 2.5 |
| LCD20-□□S24W | 56000 | 13000 | 21.5 | 2.5 |

EXTERNAL OUTPUT TRIMMING

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

Trim-up



□□S3P3W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|---------|---------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 3.333 | 3.366 | 3.399 | 3.432 | 3.465 | 3.498 | 3.531 | 3.564 | 3.597 | 3.630 |
| RU (kΩ) | 385.071 | 191.511 | 126.990 | 94.730 | 75.374 | 62.470 | 53.253 | 46.340 | 40.963 | 36.662 |

□□S05W

| 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 (kΩ) | 253.450 | 125.700 | 83.117 | 61.825 | 49.050 | 40.533 | 34.450 | 29.888 | 26.339 | 23.500 |

□□S05WV

| 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 (kΩ) | 253.450 | 125.700 | 83.117 | 61.825 | 49.050 | 40.533 | 34.450 | 29.888 | 26.339 | 23.500 |

| ΔV (%) | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Vout (V) | 5.550 | 5.600 | 5.650 | 5.700 | 5.750 | 5.800 | 5.850 | 5.900 | 5.950 | 6.000 |
| RU (kΩ) | 21.177 | 19.242 | 17.604 | 16.200 | 14.983 | 13.919 | 12.979 | 12.144 | 11.397 | 10.725 |

□□S12W

| 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 (kΩ) | 203.223 | 99.057 | 64.334 | 46.973 | 36.557 | 29.612 | 24.652 | 20.932 | 18.038 | 15.723 |

□□S15W

| 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 (kΩ) | 161.557 | 78.223 | 50.446 | 36.557 | 28.223 | 22.668 | 18.700 | 15.723 | 13.409 | 11.557 |

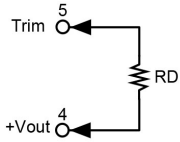
□□S24W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|----------|---------|---------|---------|---------|---------|--------|--------|--------|--------|--------|
| Vout (V) | 24.240 | 24.480 | 24.720 | 24.960 | 25.200 | 25.440 | 25.680 | 25.920 | 26.160 | 26.400 |
| 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) | 26.640 | 26.880 | 27.120 | 27.360 | 27.600 | 27.840 | 28.080 | 28.320 | 28.560 | 28.800 |
| 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



□□S3P3W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|---------|--------|--------|--------|--------|--------|--------|-------|-------|-------|
| Vout (V) | 3.267 | 3.234 | 3.201 | 3.168 | 3.135 | 3.102 | 3.069 | 3.036 | 3.003 | 2.970 |
| RD (k Ω) | 116.719 | 54.779 | 34.133 | 23.810 | 17.616 | 13.486 | 10.537 | 8.325 | 6.604 | 5.228 |

□□S05W

| 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 |

□□S05WV

| 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 |

□□S12W

| 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 |

□□S15W



| 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 |

□□S24W




| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|
| Vout (V) | 23.760 | 23.520 | 23.280 | 23.040 | 22.800 | 22.560 | 22.320 | 22.080 | 21.840 | 21.600 |
| RD (k Ω) | 4947.667 | 2439.333 | 1603.222 | 1185.167 | 934.333 | 767.111 | 647.667 | 558.083 | 488.407 | 432.667 |

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View LCD20-48D12W on WIN SOURCE](#)
-  [P-DUKE Technology, Inc. Information](#)

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-  Shortage Management
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