

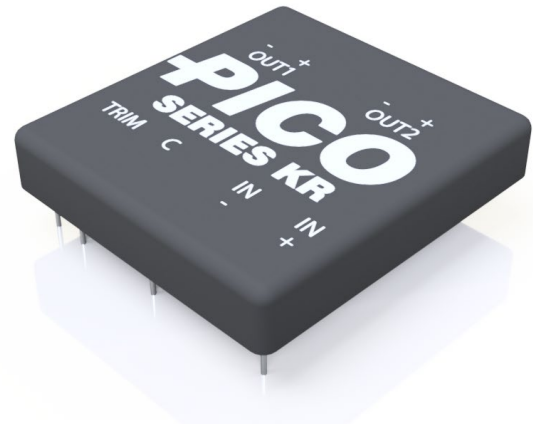
Series KR

20W Isolated Regulated Low Profile DC-DC Converter

PICO
Electronics, Inc.

PRODUCT OVERVIEW

The KR series is an isolated DC-DC converter with wide input range, tight regulation and six-sided shielded case. These modules have trim and control features. Single and dual isolated output models are standard. They can operate up to 20W over the temperature range of -25°C to +70°C without derating, a heat sink or active cooling.



FEATURES

- Up to 20W output at +70°C ambient
- Low profile – 0.500" height
- Up to 3.33:1 input voltage range
- 3.3 to 100V output models
- Six-sided shielded case
- Control feature
- Trimmable output
- Input/output isolation
- Single and dual isolated output
- No external components required
- No heat sink or derating required

Contact Pico for part number of available options:

- Expanded operating temp: -55°C to +85°C
- Select screening per MIL-STD-883:
 - Stabilization Bake
 - Temperature Cycle
 - Burn-In
- Special Input Voltage, Output Voltage, Isolation Voltage or Output Power

| KR | A | 28 | S |
|-------------|---|--|------------------------|
| SERIES NAME | INPUT VOLTAGE RANGE | NOM. OUTPUT VOLTAGE | NUMBER OF OUTPUTS |
| KR | A = 18 to 36V B = 36 to 60V C = 18 to 60V | 3.3 = 3.3V 5 = 5V 5.2 = 5.2V 9 = 9V 12 = 12V 15 = 15V 24 = 24V 28 = 28V 48 = 48V 100 = 100V | S = SINGLE D = DUAL |

MODEL LIST**SINGLE OUTPUT**

| Pico Part Number | Output Voltage [VDC] | Output Current | | Efficiency ⁽¹⁾ [%] typ. | Input Current ⁽¹⁾ [%] typ. | Line Regulation [±%] | Load Regulation 25-100% [±%] | Output Ripple @ 1MHz BW [mVp-p] | Output Voltage Tolerance ⁽¹⁾ [±%] |
|------------------|----------------------|----------------|-----------|------------------------------------|---------------------------------------|----------------------|------------------------------|---------------------------------|--|
| | | Min. [mA] | Max. [mA] | | | | | | |
| KRA3.3S | 3.3 | 606.1 | 6061 | 78 | 950 | 2.5 | 3 | 60 | 1 |
| KRA5S | 5 | 400 | 4000 | 78 | 950 | 1.5 | 2.5 | 60 | 0.75 |
| KRA5.2S | 5.2 | 384.6 | 3846 | 78 | 950 | 1.5 | 2.5 | 60 | 0.75 |
| KRA9S | 9 | 222.2 | 2222 | 80 | 925 | 0.75 | 1.25 | 60 | 0.5 |
| KRA12S | 12 | 166.7 | 1667 | 78 | 950 | 0.5 | 1 | 60 | 0.5 |
| KRA15S | 15 | 133.3 | 1333 | 78 | 950 | 0.5 | 1 | 60 | 0.5 |
| KRA24S | 24 | 83.3 | 833 | 81 | 915 | 0.25 | 0.5 | 60 | 0.5 |
| KRA28S | 28 | 71.4 | 714 | 82 | 905 | 0.25 | 0.5 | 60 | 0.5 |
| KRA48S | 48 | 41.7 | 417 | 83 | 890 | 0.25 | 0.5 | 80 | 0.5 |
| KRA100S | 100 | 20 | 200 | 83 | 890 | 0.25 | 0.5 | 100 | 0.5 |
| KRB3.3S | 3.3 | 606.1 | 6061 | 78 | 534 | 2.5 | 3 | 60 | 1 |
| KRB5S | 5 | 400 | 4000 | 78 | 535 | 1 | 2.5 | 60 | 0.75 |
| KRB5.2AS | 5.2 | 384.6 | 3846 | 78 | 535 | 1 | 2.5 | 60 | 0.75 |
| KRB9S | 9 | 222.2 | 2222 | 80 | 520 | 0.5 | 1.25 | 60 | 0.5 |
| KRB12S | 12 | 166.7 | 1667 | 78 | 535 | 0.5 | 1 | 60 | 0.5 |
| KRB15S | 15 | 133.3 | 1333 | 78 | 535 | 0.5 | 1 | 60 | 0.5 |
| KRB24S | 24 | 83.3 | 833 | 81 | 515 | 0.25 | 0.5 | 60 | 0.5 |
| KRB28S | 28 | 71.4 | 714 | 82 | 510 | 0.25 | 0.5 | 60 | 0.5 |
| KRB48S | 48 | 41.7 | 417 | 83 | 500 | 0.25 | 0.5 | 80 | 0.5 |
| KRB100S | 100 | 20 | 200 | 83 | 500 | 0.25 | 0.5 | 100 | 0.5 |
| KRC3.3S | 3.3 | 606.1 | 6061 | 78 | 657 | 2.5 | 3 | 60 | 1 |
| KRC5S | 5 | 400 | 4000 | 78 | 660 | 2 | 2.5 | 60 | 0.75 |
| KRC5.2S | 5.2 | 384.6 | 3846 | 78 | 660 | 2 | 2.5 | 60 | 0.75 |
| KRC9S | 9 | 222.2 | 2222 | 80 | 640 | 1 | 1.25 | 60 | 0.5 |
| KRC12S | 12 | 166.7 | 1667 | 78 | 660 | 0.75 | 1 | 60 | 0.5 |
| KRC15S | 15 | 133.3 | 1333 | 78 | 660 | 0.75 | 1 | 60 | 0.5 |
| KRC24S | 24 | 83.3 | 833 | 81 | 635 | 0.5 | 0.5 | 60 | 0.5 |
| KRC28S | 28 | 71.4 | 714 | 82 | 625 | 0.5 | 0.5 | 60 | 0.5 |
| KRC48S | 48 | 41.7 | 417 | 83 | 615 | 0.5 | 0.5 | 80 | 0.5 |
| KRC100S | 100 | 20 | 200 | 83 | 615 | 0.5 | 0.5 | 100 | 0.5 |

MODEL LIST**DUAL OUTPUT**

| Pico Part Number | Output Voltage Per Output [VDC] | Output Current Per Output | | Efficiency ⁽¹⁾ [%] typ. | Input Current ⁽¹⁾ [%] typ. | Line Regulation [±%] | Load Regulation 25-100% [±%] | Output Ripple Per Output @ 1MHz BW [mVp-p] | Output Voltage Tolerance ⁽¹⁾ [±%] |
|------------------|---------------------------------|---------------------------|--------------|---------------------------------------|--|-------------------------|---------------------------------|---|---|
| | | Min. [mA] | Max. [mA] | | | | | | |
| KRA5D | 5 | 200 | 2000 | 78 | 950 | 1.5 | 2.5 | 60 | 0.75 |
| KRA9D | 9 | 111.1 | 1111 | 80 | 925 | 0.75 | 1.25 | 60 | 0.5 |
| KRA12D | 12 | 83.3 | 833 | 78 | 950 | 0.5 | 1 | 60 | 0.5 |
| KRA15D | 15 | 66.7 | 667 | 78 | 950 | 0.5 | 1 | 60 | 0.5 |
| KRA24D | 24 | 41.7 | 417 | 81 | 915 | 0.25 | 0.5 | 60 | 0.5 |
| KRA28D | 28 | 35.7 | 357 | 82 | 905 | 0.25 | 0.5 | 60 | 0.5 |
| KRA48D | 48 | 20.8 | 208 | 83 | 890 | 0.25 | 0.5 | 80 | 0.5 |
| KRB5D | 5 | 200 | 2000 | 78 | 535 | 1 | 2.5 | 60 | 0.75 |
| KRB9D | 9 | 111.1 | 1111 | 80 | 520 | 0.5 | 1.25 | 60 | 0.5 |
| KRB12D | 12 | 83.3 | 833 | 78 | 535 | 0.5 | 1 | 60 | 0.5 |
| KRB15D | 15 | 66.7 | 667 | 78 | 535 | 0.5 | 1 | 60 | 0.5 |
| KRB24D | 24 | 41.7 | 417 | 81 | 515 | 0.25 | 0.5 | 60 | 0.5 |
| KRB28D | 28 | 35.7 | 357 | 82 | 510 | 0.25 | 0.5 | 60 | 0.5 |
| KRB48D | 48 | 20.8 | 208 | 83 | 500 | 0.25 | 0.5 | 80 | 0.5 |
| KRC5D | 5 | 200 | 2000 | 78 | 660 | 2 | 2.5 | 60 | 0.75 |
| KRC9D | 9 | 111.1 | 1111 | 80 | 640 | 1 | 1.25 | 60 | 0.5 |
| KRC12D | 12 | 83.3 | 833 | 78 | 660 | 0.75 | 1 | 60 | 0.5 |
| KRC15D | 15 | 66.7 | 667 | 78 | 660 | 0.75 | 1 | 60 | 0.5 |
| KRC24D | 24 | 41.7 | 417 | 81 | 635 | 0.5 | 0.5 | 60 | 0.5 |
| KRC28D | 28 | 35.7 | 357 | 82 | 625 | 0.5 | 0.5 | 60 | 0.5 |
| KRC48D | 48 | 20.8 | 208 | 83 | 615 | 0.5 | 0.5 | 80 | 0.5 |

Note 1: Tested at nominal input voltage and full output load.

Note 2: Dual output loads must be balanced.

SPECIFICATIONS (Nominal V_{IN} , Full Load, $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)**INPUT**

| Parameter | Condition | Min. | Typ. | Max. | Units |
|---------------------|------------|------|------|------|-------|
| Input Voltage Range | KRA models | 18 | 27 | 36 | VDC |
| | KRB models | 36 | 48 | 60 | |
| | KRC models | 18 | 39 | 60 | |

SPECIFICATIONS (Nominal V_{IN} , Full Load, $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)**OUTPUT**

| Parameter | Condition | Min. | Typ. | Max. | Units |
|--------------|-------------------------------|------|------|------|-------|
| Output Power | Single output models | 2 | - | 20 | W |
| | Dual output models per output | 1 | - | 10 | |

ENVIRONMENTAL

| Parameter | Condition | Min. | Typ. | Max. | Units |
|-----------------------------|--------------------------|------|------|------|------------------|
| Operating Temperature Range | Ambient without derating | -25 | - | +70 | $^\circ\text{C}$ |
| Storage Temperature Range | Ambient | -55 | - | +105 | $^\circ\text{C}$ |
| Temperature Coefficient | | - | - | 0.02 | $\%/\text{C}$ |
| Cooling | Free Air Convection | | | | |

GENERAL

| Parameter | Condition | Min. | Typ. | Max. | Units |
|---------------------------|---|--|------|------|-------------|
| Isolation Voltage | Input to output | 500 | - | - | VDC |
| | OUT1 to OUT2 | 500 | - | - | |
| Switching Frequency | | - | 40 | - | kHz |
| Size (L x W x H) | | 2.8 x 2.6 x 0.5 (71.12 x 66.04 x 12.7) | | | inches (mm) |
| Weight | | - | 165 | - | grams |
| Case | 6-Sided Epoxy Insulated Metal | | | | |
| Potting | Vacuum Impregnated Epoxy | | | | |
| Box Packaging (W x L x H) | 8 x 7.5 x 1.5 (203.2 x 190.5 x 38.1) or 12 x 9 x 1.5 (304.8 x 228.6 x 38.1) | | | | inches (mm) |

PROTECTION & FEATURES

| Parameter | Condition | Min. | Typ. | Max. | Units |
|----------------------------|--|----------|----------------|------|-------|
| Shortcircuit | Temporary | | | | |
| Shutdown (C) | Non-latched shutdown, Self-recovery | Shutdown | Connect to -IN | | |
| | | Restart | OPEN | | |
| Output Voltage Trim (TRIM) | Trim up only | 0 | - | 5 | % |

DESIGNED TO MEET

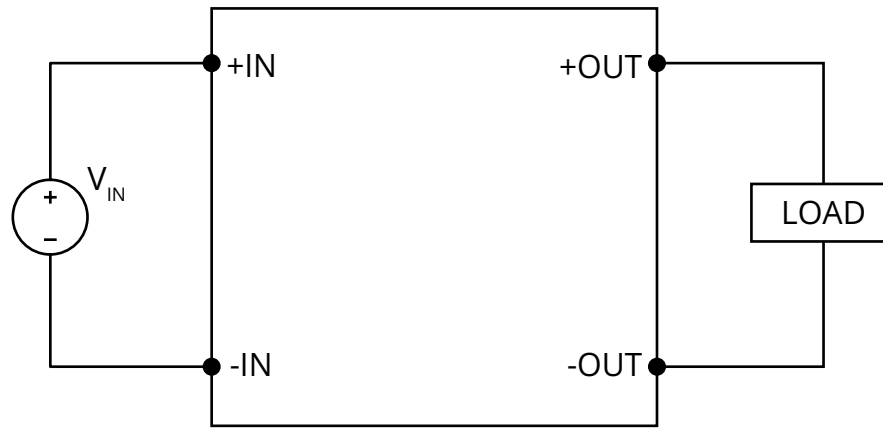
| Test | Referenced Standard | Description |
|-----------|---------------------|--|
| Vibration | MIL-STD-202 | Method 204, Vibration, High Frequency, Condition D |
| Shock | MIL-STD-202 | Method 213, Shock (Specified Pulse), Condition I |
| Humidity | MIL-STD-202 | Method 106, Moisture Resistance |
| Altitude | MIL-STD-202 | Method 105, Barometric Pressure (Reduced), Condition D |

OPTIONS AVAILABLE – CONTACT PICO FOR PART NUMBER

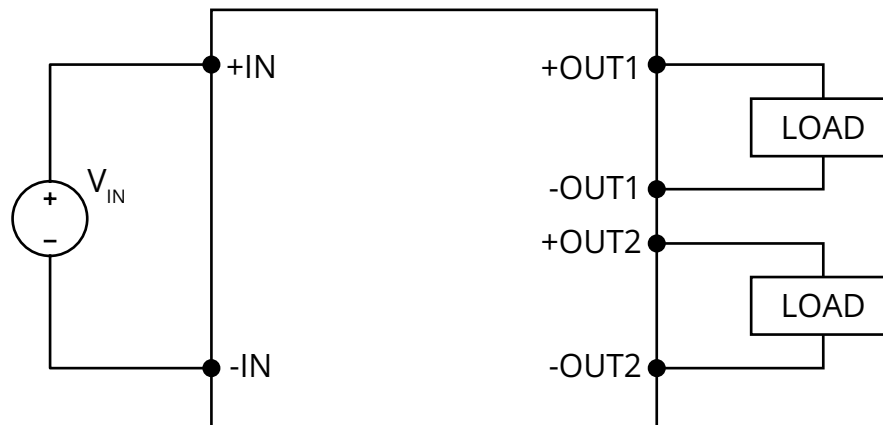
| Parameter | Referenced Standard | Description |
|--|---------------------|--|
| Stabilization Bake | MIL-STD-883 | Referenced Method 1008 Non-operating maximum storage temperature for 24 hours |
| Temperature Cycle | MIL-STD-883 | Referenced Method 1010 Non-operating at temperature extremes, 15 mins/temp, 10 cycles |
| Burn-In | MIL-STD-883 | Referenced Method 1015 Max operating temperature for 160 hours |
| Expanded Ambient Operating Temperature | | -55 $^\circ\text{C}$ to +85 $^\circ\text{C}$ |

TYPICAL CONNECTION CIRCUIT

SINGLE OUTPUT

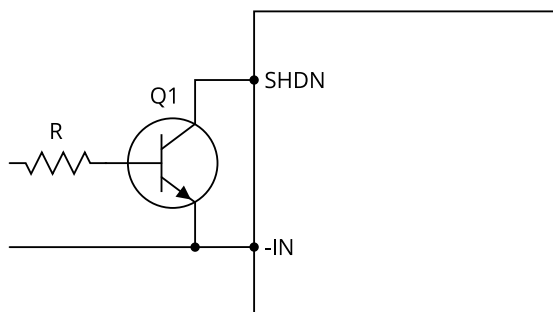


DUAL OUTPUT

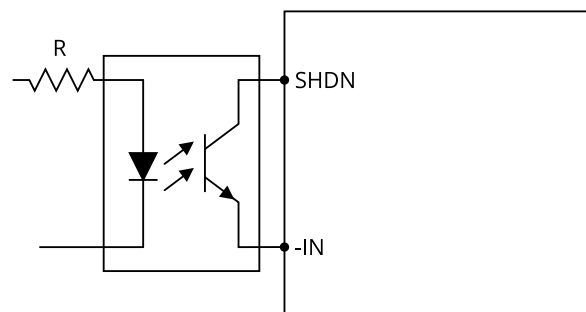


SHUTDOWN

NON-ISOLATED



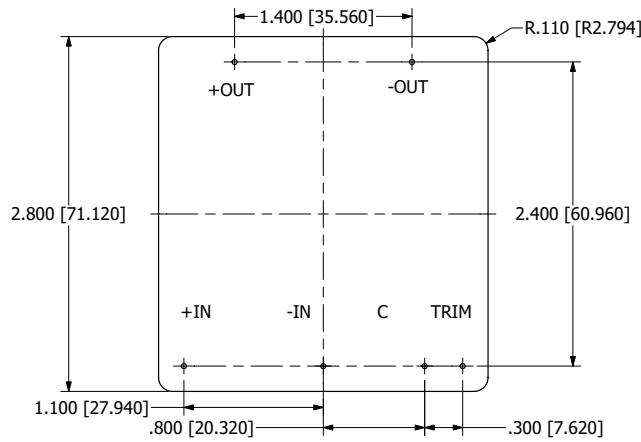
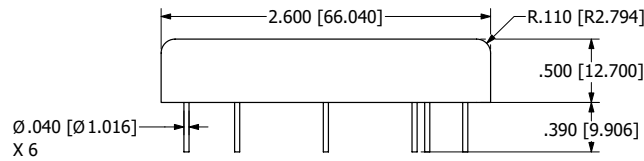
ISOLATED



Please note: During shutdown mode, 475V input and no load condition, the output voltage may increase up to 5% of nominal output voltage. Shutdown is enabled when SHDN pin is pulled low (<1V) relative to -IN. OPEN will automatically restart the module. When floating, the maximum voltage of SHDN is limited to 22VDC.

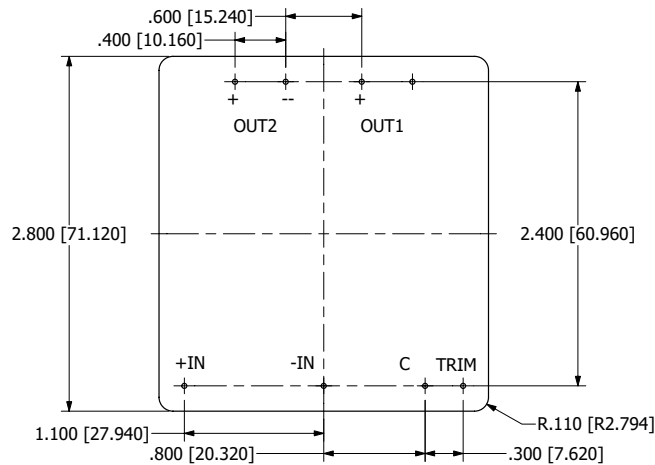
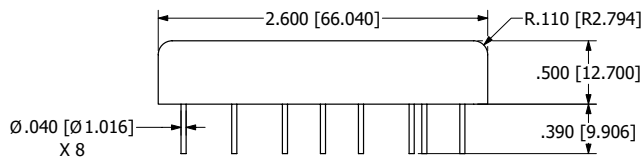
MECHANICAL DRAWINGS

SINGLE OUTPUT



BOTTOM VIEW

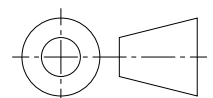
DUAL OUTPUT



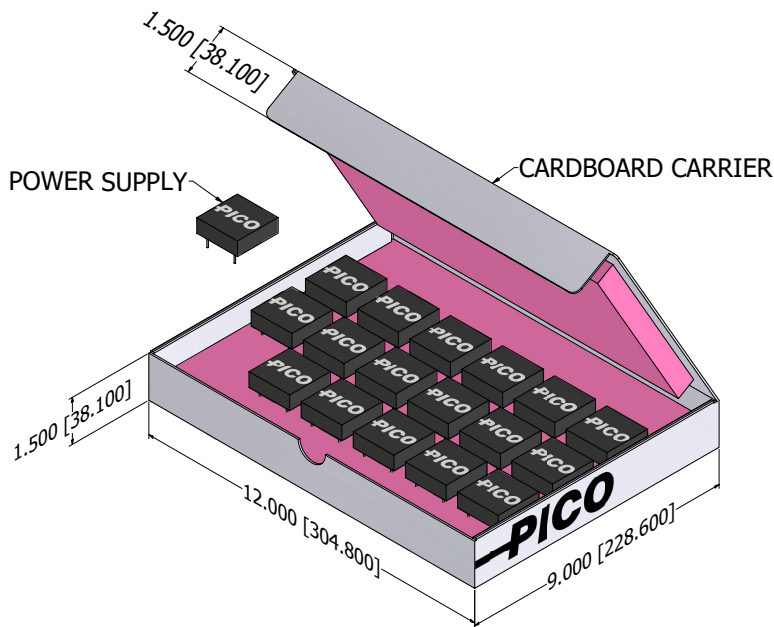
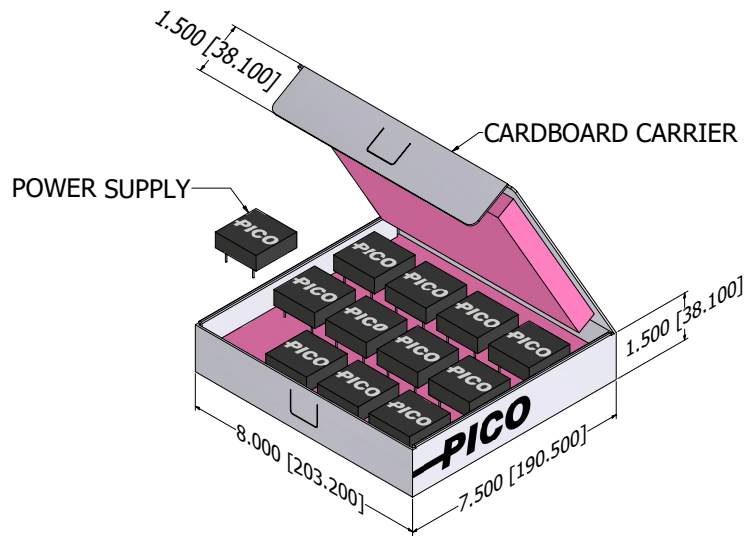
BOTTOM VIEW

NOTES

- a. ALL DIMENSIONS ARE IN INCHES, [] = MM
- b. C IS CONTROL PIN



BOX PACKAGING - BULK



Pico warrants each product manufactured by us and sold by us or an authorized representative, to be free from defects in material and workmanship. If properly used, it will perform within its applicable specifications for a period of one year after original shipment. Pico's obligation under this guarantee is limited to repairing or replacing our product to the original purchaser. This warranty is in lieu of all other warranties, express or implied and constitutes fulfillment of our obligations to the purchaser. We do not guarantee that the products can be used for a particular purpose other than those solely covered by the product's specifications. Pico must be notified if the product must meet particular certifications and/or standards. We assume no liability, in any event, for consequential damages, for anticipated or lost profits, incidental damages or loss of time or other losses incurred by the purchaser or any third party in connection with products covered by this warranty or otherwise. The purchaser will indemnify and hold Pico harmless for any damages, losses, costs, etc. from usage not within the product's specifications. Pico must be consulted before usage of its products in a nuclear, radioactive or space environment.

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