# Data Sheet
# *FlatPAC*™
# 50 to 600 Watts Autoranging AC-DC Switchers

## Features

- RoHS compliant (VE versions)
- Microcontroller architecture
- Inputs: 115/230 Vac autoranging
- Meets FCC Part 15, EN55022, Class B conducted emissions
- 80 – 90% efficiency
- Any output: 1 to 95 Vdc
- Module enable/disable (except LU series)
- UL, TÜV, CE marked
- Remote sense and current limit
- BUS OK and AC OK (except LU series)
- 40 ms ride-through time
- OVP and thermal shutdown
- 1 output; up to 200 W
- 1 or 2 outputs; up to 400 W
- 1, 2, or 3 outputs; up to 600 W

## Product Highlights

If you're looking for the convenience of a complete, low profile, agency-approved switching power supply, look no further. The FlatPAC combines Vicor's workhorse VI-200 family of DC-DC converters with a modular package and front-end subassembly to provide from 50 to 600 W of output power from one to three outputs.

A flat plate heat sink for use in conduction cooled applications may be specified as an alternate to the standard finned version by adding "CC" to the end of the model number.

Vicor's FlatPAC is also available with a current controlled output using BatMod converter modules of 12, 24, or 48 Vdc outputs. This option is specified by appending "BM" or "BC" (for conduction cooled versions) to the end of the FlatPAC model number.

**Mixing VI-200 and BatMods in a single FlatPAC is not permissible.**

The FlatPAC's contemporary design allows us to configure your order quickly and provide rapid turnaround on standard models. It is truly a complete power solution, enabling you to spend more time designing your system and less time worrying about how to power it.

## Configuration Chart

**Typical Model: VI-RU** [0][1][1]-[E][U][U][U]-[⁝⁝][⁝⁝]

| Input | Output | Input Characteristics |
|---|---|---|
| 115/230 Vac | **1:** 5 Vdc at 200 W<br>**2:** 12 Vdc at 200 W<br>**3:** 12 Vdc at 200 W | **90–132/180–264 Vac**<br>**U** = Autoranging |

Substitute VE– for VI– for RoHS compliant versions

| Configuration | Total Power | # of Converters | Dimensions |
|---|---|---|---|
| **Single Output** | | | |
| VI-LU [•]-[.•][•.] | 50 – 200 W | 1 | 9.25" x 2.5" x 1.37" (234,8 x 124,5 x 34,8 mm) |
| VI-MU [•]-[.•][⁝⁝] | 200 – 400 W | 2 | 9.25" x 4.9" x 1.37" (234,8 x 124,5 x 34,8 mm) |
| VI-NU [•]-[.•][⁝.] | 300 – 600 W | 3 | 9.25" x 7.3" x 1.37" (234,8 x 185,4 x 34,8 mm) |
| **Dual Output** | | | |
| VI-PU [•][•]-[.•][•.][•.] | 100 – 400 W | 2 | 9.25" x 4.9" x 1.37" (234,8 x 124,5 x 34,8 mm) |
| VI-QU [•][•]-[.•][⁝⁝][•.] | 150 – 600 W | 3 | 9.25" x 7.3" x 1.37" (234,8 x 185,4 x 34,8 mm) |
| **Triple Output** | | | |
| VI-RU [•][•][•]-[.•][•.][•.][•.] | 150 – 600 W | 3 | 9.25" x 7.3" 1.37" (234,8 x 185,4 x 34,8 mm) |

### [•] Output Voltage

| | | | | | |
|---|---|---|---|---|---|
| **Z** = 2 V | **W** = 5.5 V | **M** = 10 V | **N** = 18.5 V | **K** = 40 V | **D** = 85 V |
| **Y** = 3.3 V | **V** = 5.8 V | **1** = 12 V | **3** = 24 V | **4** = 48 V | **B** = 95 V |
| **0** = 5 V | **T** = 6.5 V | **P** = 13.8 V | **L** = 28 V | **H** = 52 V | |
| **X** = 5.2 V | **R** = 7.5 V | **2** = 15 V | **J** = 36 V | **F** = 72 V | |

### [.•] Product Grade Temps. °C

| Grade | Operating | Storage |
|---|---|---|
| **E** = | 0 to +85 | –20 to +100 |
| **C** = | 0 to +85 | –20 to +100 |
| **I** = | –30 to +85 | –55 to +100 |

Temperatures apply to product case.

### [⁝⁝] Output Power/Current

| VOUT ≥5 V | VOUT < 5 V |
|---|---|
| **W** = 100 W | **W** = 20 A |
| **V** = 150 W | **V** = 30 A |
| **U** = 200 W | **U** = 40 A |
| **S** = 300 W | **S** = 60 A |
| **Q** = 400 W | **Q** = 80 A |

### [•.] Output Power/Current

| VOUT ≥5 V | VOUT < 5 V |
|---|---|
| **Y** = 50 W | **Y** = 10 A |
| **X** = 75 W | **X** = 15 A |
| **W** = 100 W | **W** = 20 A |
| **V** = 150 W | **V** = 30 A |
| **U** = 200 W | **U** = 40 A |

### [⁝.] Output Power/Current

| VOUT ≥5 V | VOUT < 5 V |
|---|---|
| **S** = 300 W | **S** = 60 A |
| **P** = 450 W | **P** = 90 A |
| **M** = 600 W | **M** = 120 A |

### [⁝⁝] Options

| | | |
|---|---|---|
| **BC** = BatMod/Conduction Cooled | **BM** = BatMod | **CC** = Conduction Cooled |



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## SPECIFICATIONS

(typical at 25°C, nominal line and 75% load, unless otherwise specified)

### ■ INPUT SPECIFICATIONS

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| AC line input | | | | | |
| Autoranging | | 90 – 132/180 – 264 | | Vac | |
| Line frequency | | 47 – 63 | | Hz | (C-Grade and E-Grade) |
| | | 47 – 440 | | Hz | (I-Grade) |
| Inrush current: 115 Vac operation: | | | | | |
| 1 converter | | 16 | | A | @ peak line |
| 2 converters | | 23 | | A | @ peak line |
| 3 converters | | 39 | | A | @ peak line |
| Inrush current: 230 Vac operation | | | | | |
| 1 converter | | 32 | | A | @ peak line |
| 2 converters | | 47 | | A | @ peak line |
| 3 converters | | 78 | | A | @ peak line |
| Ride-through time (full load) | | | | | |
| 90/180 Vac low line | | 5 | | ms | minimum |
| 115/230 Vac nominal line | | 40 | | ms | minimum |
| AC fail warning time | | 5 | | ms | minimum (low line, full load) |
| AC and BUS OK (2 and 3 converter models only) | | | | | |
| Off state – Vce | | | 70 | V | |
| On state – Vcesat | | | 0.4 | V | @ 1 mA (1.5 mA max.) |
| Module disable (2 and 3 converter models only, optically isolated LED input) | | | | | |
| Continuous forward current | | 1 – 30 | | mA | |
| Forward voltage | | | 1.65 | V | @ 30 mA |
| Dielectric withstand | | | | | |
| Primary to chassis GND | | 2,121 | | Vdc | |
| Primary to secondary | | 4,242 | | Vdc | |
| Secondary to chassis GND | | 707 | | Vdc | |

### ■ OUTPUT SPECIFICATIONS

| | E-Grade | | | C-, I-Grade | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** | **Notes** |
| Set point accuracy | | 1% | 2% | | 0.5% | 1% | VNOM | |
| Load/line regulation | | | 0.5% | | 0.05% | 0.2% | VNOM | LL to HL, 10% to Full Load |
| | | | 1% | | 0.2% | 0.5% | VNOM | LL to HL, No Load to full load |
| Output temperature drift | | 0.02 | | | 0.01 | 0.02 | %/°C | Over rated temperature |
| Long term drift | | 0.02 | | | 0.02 | | %/1 k hours | |
| Output ripple | | | | | | | | |
| 2 V | | | 150 mV | | 60 mV | 100 mV | p-p | 20 MHz bandwidth |
| 5 V | | | 5% | | 2% | 3% | p-p | 20 MHz bandwidth |
| 10 – 48 V | | | 3% | | 0.75% | 1.5% | p-p | 20 MHz bandwidth |
| Output voltage trimming[1] | 50% | | 110% | 50% | | 110% | | |
| Total remote sense compensation | 0.5 | | | 0.5 | | | Volts | 0.25 V max. neg. leg |
| OVP set point | | 125% | | 115% | 125% | 135% | VNOM | Recycle power |
| Current limit | 105% | | 135% | 105% | | 125% | INOM | Automatic restart |
| Short circuit current[2] | 20% | | 140% | 20% | | 130% | INOM | |



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## SPECIFICATIONS (CONT.)

### ■ THERMAL CHARACTERISTICS

| | E-Grade | | | C-, I- Grade | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Units** | **Test Conditions** |
| Efficiency | | 78 – 88% | | | 80 – 90% | | | @5 V and higher |
| Shut down temp. — case | 90 | 95 | 105 | 90 | 95 | 105 | °C | Cool and recycle power to restart |
| Operating temp. — case | | | 85 | | | 85 | °C | See Thermal Curves |

### ■ MECHANICAL SPECIFICATIONS

| | E-Grade | | | C-, I- Grade | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Units** | **Test Conditions** |
| Weight[3] | | 22.4 (652) | | | 22.4 (652) | | Ounces (Grams) | |

### ■ AGENCY APPROVALS

| Safety Standards | Markings | Notes |
|---|---|---|
| UL1604, UL60950-1 | cURus | |
| UL / CSA / EN / IEC 60950-1 | cTÜVus, CE Mark | Low Voltage Directive (73/23/EEC) |

### ■ EMI / EMC Characteristics (Performed on selected samples representative of the U Series FlatPac product family.)

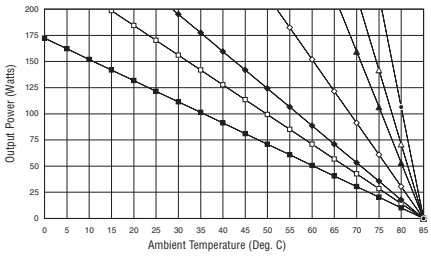
| Parameter | Notes |
|---|---|
| Conducted emissions, LISN | EN 55022 and FCC R&R, Part 15, Subpart B, Class B |
| Radiated emissions, 10 meters | EN 55022; 1998 and FCC R&R, Part 15, Subpart B, Class A |
| Electrostatic discharge | IEC 61000-4-2: 1995, Level 4; ±8 kV Contact, ± 15 kV Air Discharge |
| RF radiated immunity, E-field | IEC 61000-4-3: 1997; 80 MHz to 1.0 GHz, 3 V/M, CW |
| Electrical fast transients/burst | EN 61000-4-4: 1995, Level 3; ±2 kV, |
| Surge immunity | EN 61000-4-5: 1996 Class 3; ±2 kV Line to Ground, ±1 kV Line to Line |
| RF conducted immunity | IEC 61000-4-6: 1996, class 3, 10 Vrms, 150 kHz to 80 MHz |
| Power frequency magnetic field immunity | IEC 61000-4-8: 1994, 30 to 300 A/M, 50Hz |
| Voltage dips and interrupts | IEC 61000-4-11: 1994 |

[1] 10 V, 12 V and 15 V outputs, trim range ± 10%. Consult factory for wider trim range.
[2] Output voltages of 5 V or less incorporate foldback current limiting, outputs greater than 5 V incorporate straight line current limiting.
[3] For MU, PU series, multiply value by 2; for NU, QU, RU series, multiply value by 3.

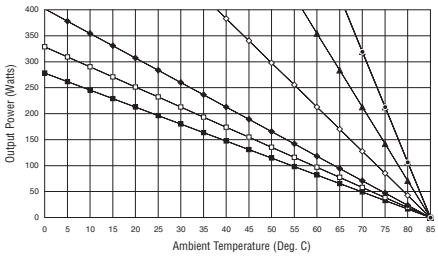
## THERMAL CURVES

FREE AIR — 50 LFM — 100 LFM — 250 LFM — 500 LFM — 750 LFM — 1000 LFM

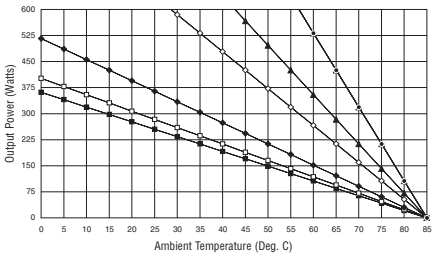
**5 V Output**




**LU Series**

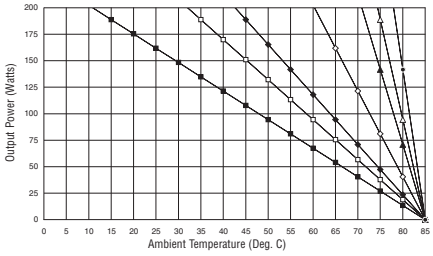



**MU, PU Series**

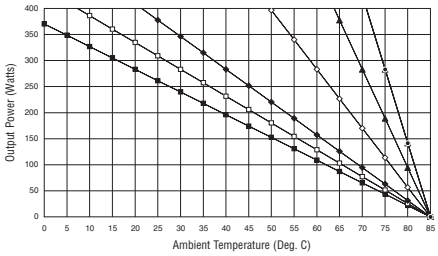



**NU, QU, RU Series**

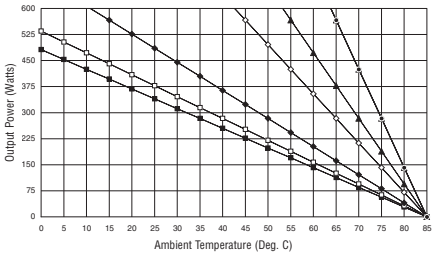
**10 to 48 V Output**




**LU Series**

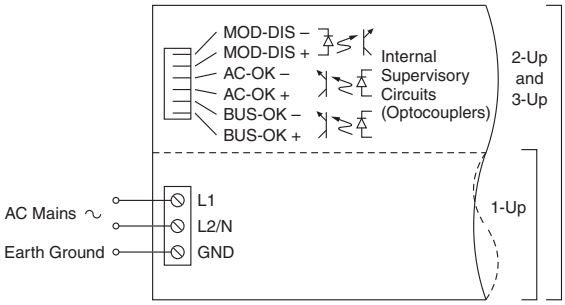



**MU, PU Series**

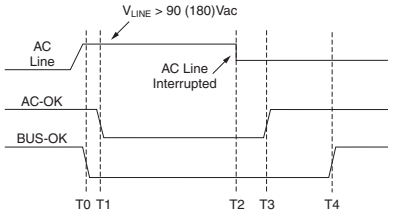



**NU, QU, RU Series**

## APPLICATION CIRCUITS



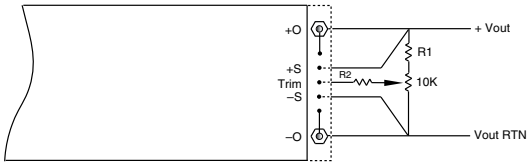

**AC Mains Connections**




**Conditions:** Full Load 90 (180)Vac, AC Line

| Time Interval | Min | Typ | Max | Units | Notes |
|---|---|---|---|---|---|
| T0-T1 | 0 | 0.1 | 1.0 | ms | |
| T2-T3 | 0 | 40 | – | ms | Ride-through time |
| T2-T4 | 5 | – | – | ms | Hold-up time |
| T3-T4 | 5 | – | – | ms | AC fail warning time |

**Power Up and Power Down Sequencing**




**Resistor Values for Trimming Standard Output Voltages**

| Nom. Output Voltage | 5 V | 12 V | 15 V | 24 V | 28 V | 48 V | Trim Range |
|---|---|---|---|---|---|---|---|
| R1(kΩ) | 0.953 | 15.8 | 22.1 | 41.2 | 48.7 | 90.9 | +10%, -10% |
| R2(kΩ) | 90 | 90 | 90 | 90 | 90 | 90 | |

**Output Trimming**



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# MECHANICAL DRAWINGS

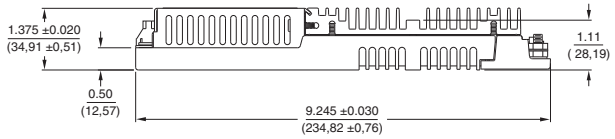
**Inputs**
1 MOD DIS–
2 MOD DIS+
3 AC OK–
4 AC OK+
5 BUS OK–
6 BUS OK+
Input connector, Amp P/N 644488-6; mating connector, MTA-100 IDC Series

7 AC IN L1
8 AC IN L2/N
9 CHASSIS GND
Terminals for #16-12 AWG wire

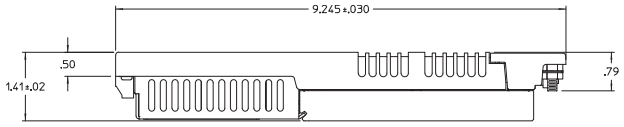
**Outputs**
10 +OUT (#10-32 Stud)
11 +OUT
12 +SENSE ($V_{TRIM}$*)
13 TRIM ($I_{TRIM}$*)
14 –SENSE ($I_{MON}$*)
15 –OUT
16 –OUT (#10-32 Stud)
Output connector, Amp P/N 644486-5; mating connector, MTA-100 IDC Series

*On FlatPACs with BatMODs only.

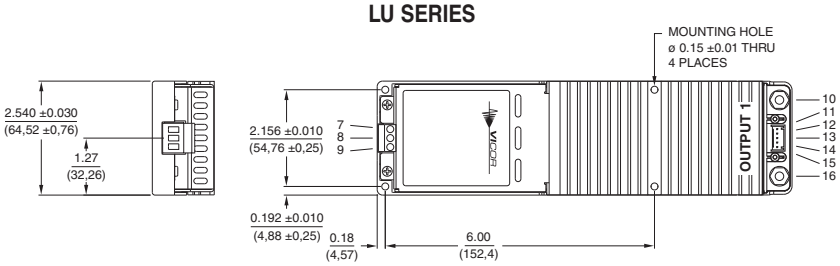
## STANDARD MODELS



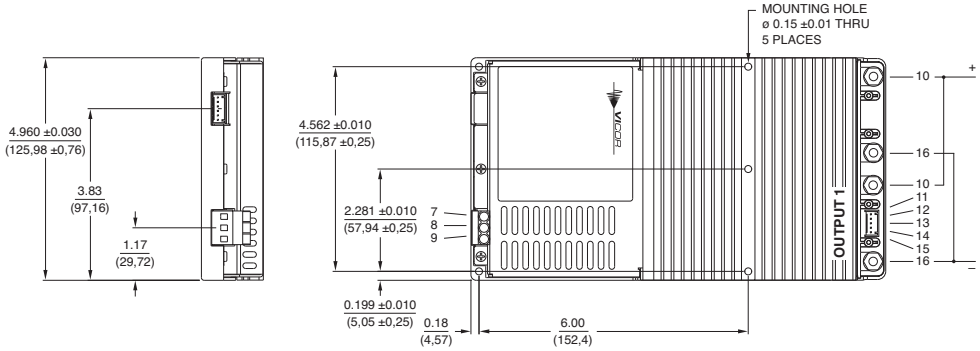

## CONDUCTION COOLED MODELS "–CC"



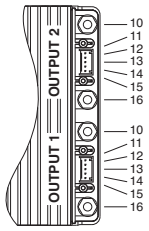

## LU SERIES



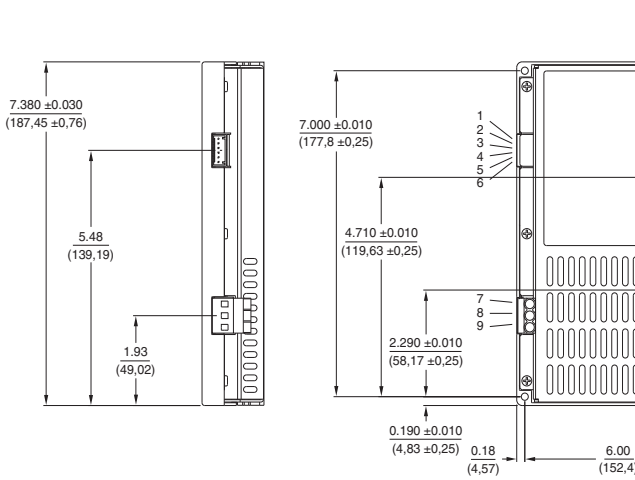

## MU SERIES



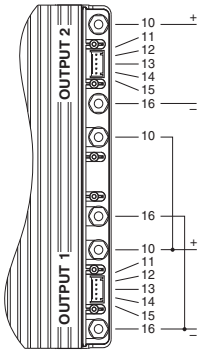

## PU SERIES



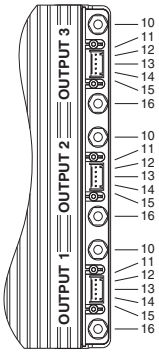

## NU SERIES




## QU SERIES




## RU SERIES



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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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