FlatPAC™

50 to 600 Watts Autoranging, AC-DC Switchers

Features & Benefits

- 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 95V_{DC}
- Module enable/disable (except LU series)
- UL, TÜV, CE marked
- Remote sense and current limit
- BUS OK and AC OK (except LU series)
- 40ms ride-through time
- OVP and thermal shutdown
- 1 output; up to 200W
- 1 or 2 outputs; up to 400W
- 1, 2, or 3 outputs; up to 600W

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 the Vicor workhorse VI-200 family of DC-DC converters with a modular package and front-end subassembly to provide from 50 to 600W 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.

The Vicor FlatPAC is also available with a current controlled output using BatMod converter modules of 12, 24, or 48V_{DC} 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 V_{DC} at 200W **2:** 12 V_{DC} at 200W **3:** 12 V_{DC} at 200W	**90–132/180–264 Vac** **U** = Autoranging

Substitute VE– for VI– for RoHS compliant versions

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

[•] Output Voltage

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

[•][•] 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

V_{OUT} ≥5V	V_{OUT} < 5V
W = 100W	**W** = 20A
V = 150W	**V** = 30A
U = 200W	**U** = 40A
S = 300W	**S** = 60A
Q = 400W	**Q** = 80A

[ ][•] Output Power/Current

V_{OUT} ≥5V	V_{OUT} < 5V
Y = 50W	**Y** = 10A
X = 75W	**X** = 15A
W = 100W	**W** = 20A
V = 150W	**V** = 30A
U = 200W	**U** = 40A

[ ][ ] Output Power/Current

V_{OUT} ≥5V	V_{OUT} < 5V
S = 300W	**S** = 60A
P = 450W	**P** = 90A
M = 600W	**M** = 120A

[ ][ ] Options

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

Note: Product images may not highlight current product markings.

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	@ 1mA (1.5mA max.)
Module disable (2 and 3 converter models only, optically isolated LED input)					
Continuous forward current		1 – 30		mA	
Forward voltage			1.65	V	@ 30mA
Dielectric withstand					
Primary to chassis GND		2,121		V_{DC}	
Primary to secondary		4,242		V_{DC}	
Secondary to chassis GND		707		V_{DC}	

OUTPUT SPECIFICATIONS

	E-Grade			C-, I-Grade				
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Unit**	**Notes**
Set point accuracy		1%	2%		0.5%	1%	V_{NOM}	
Load/line regulation			0.5%		0.05%	0.2%	V_{NOM}	LL to HL, 10% to Full Load
			1%		0.2%	0.5%	V_{NOM}	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		%/1k hours	
Output ripple								
2V			150mV		60mV	100mV	p-p	20MHz bandwidth
5V			5%		2%	3%	p-p	20MHz bandwidth
10 – 48V			3%		0.75%	1.5%	p-p	20MHz bandwidth
Output voltage trimming[a]	50%		110%	50%		110%		
Total remote sense compensation	0.5			0.5			Volts	0.25V max. neg. leg
OVP set point		125%		115%	125%	135%	V_{NOM}	Recycle power
Current limit	105%		135%	105%		125%	I_{NOM}	Automatic restart
Short circuit current[b]	20%		140%	20%		130%	I_{NOM}	

Specifications (Cont.)

THERMAL CHARACTERISTICS

	E-Grade			C-, I- Grade				
Parameter	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**	**Test Conditions**
Efficiency		78 – 88%			80 – 90%			@ 5V 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 [c]		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

EMI / EMC Characteristics

(Performed on selected samples representative of the U Series FlatPac product family.)

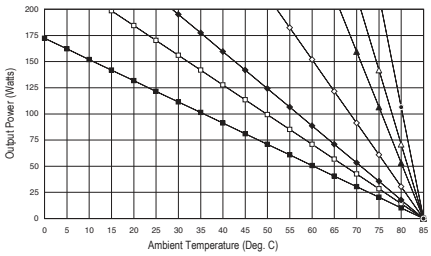
Parameter	Notes
Conducted emissions, LISN	EN 55022 and FCC R&R, Part 15, Subpart B, Class B
Radiated emissions, 10 meters	EN 55022; 1998 and FCC R&R, Part 15, Subpart B, Class A
Electrostatic discharge	IEC 61000-4-2: 1995, Level 4; ±8kV Contact, ± 15kV Air Discharge
RF radiated immunity, E-field	IEC 61000-4-3: 1997; 80MHz to 1.0GHz, 3V/M, CW
Electrical fast transients/burst	EN 61000-4-4: 1995, Level 3; ±2kV,
Surge immunity	EN 61000-4-5: 1996 Class 3; ±2kV Line to Ground, ±1kV Line to Line
RF conducted immunity	IEC 61000-4-6: 1996, class 3, $10V_{RMS}$, 150kHz to 80MHz
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

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

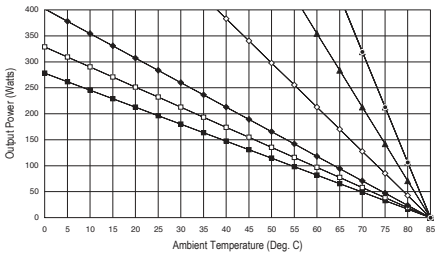
Thermal Curves

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

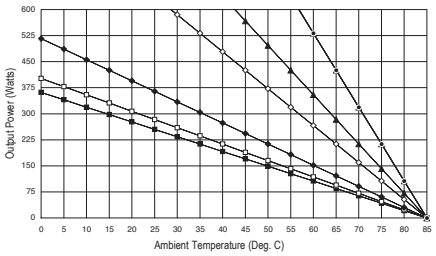
5V Output



LU Series

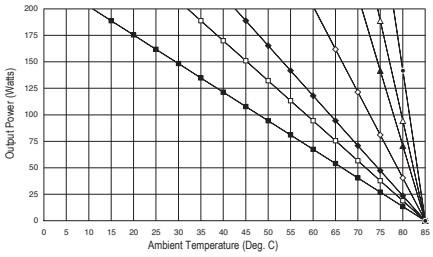


MU, PU Series

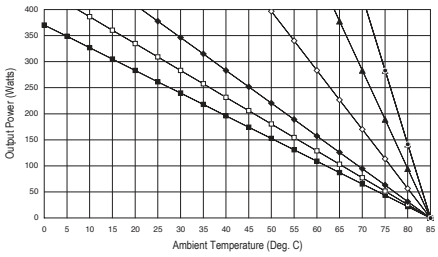


NU, QU, RU Series

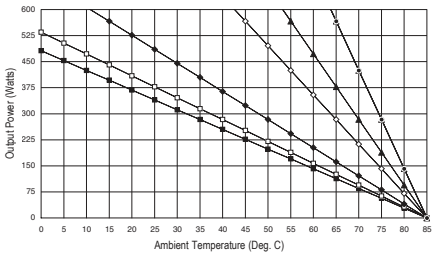
10 to 48V Output



LU Series

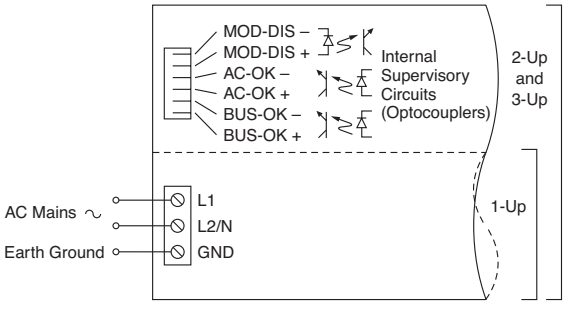


MU, PU Series

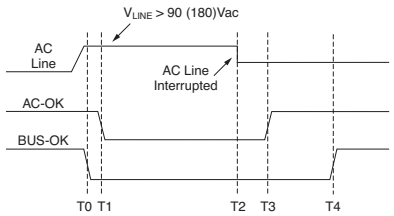


NU, QU, RU Series

Application Circuits



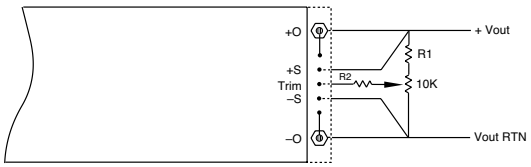
AC Mains Connections



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	5V	12V	15V	24V	28V	48V	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

Mechanical Drawings

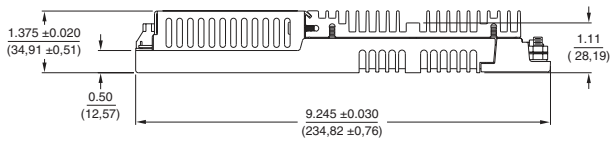
Inputs
1 MOD DIS–
2 MOD DIS+
3 AC OK–
4 AC OK+
5 BUS OK–
6 BUS OK+
Input connector, TE Connectivity P/N 644488-6; mating connector

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

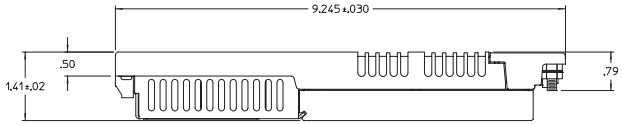
Outputs
10 +OUT (#10-32 Stud)
11 +OUT
12 +SENSE (V_{TRIM}*)
13 TRIM (I_{TRIM}*)
14 –SENSE (I_{MON}*)
15 –OUT
16 –OUT (#10-32 Stud)
Output connector, TE Connectivity P/N 644486-5; mating connector

*On FlatPACs with BatMODs only.

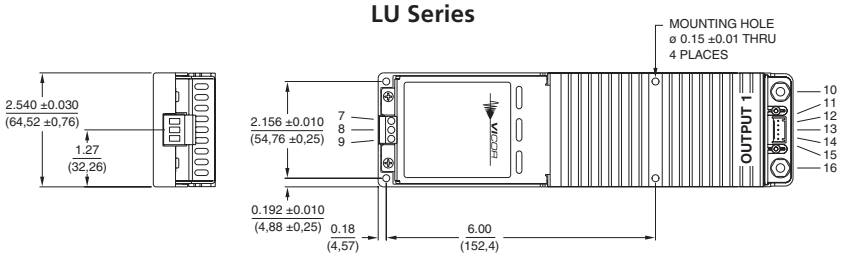
STANDARD Models



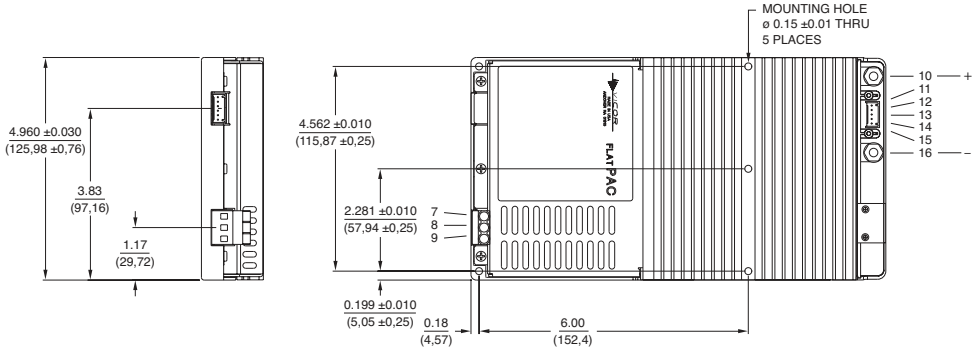
CONDUCTION COOLED Models "–CC"



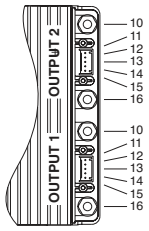
LU Series



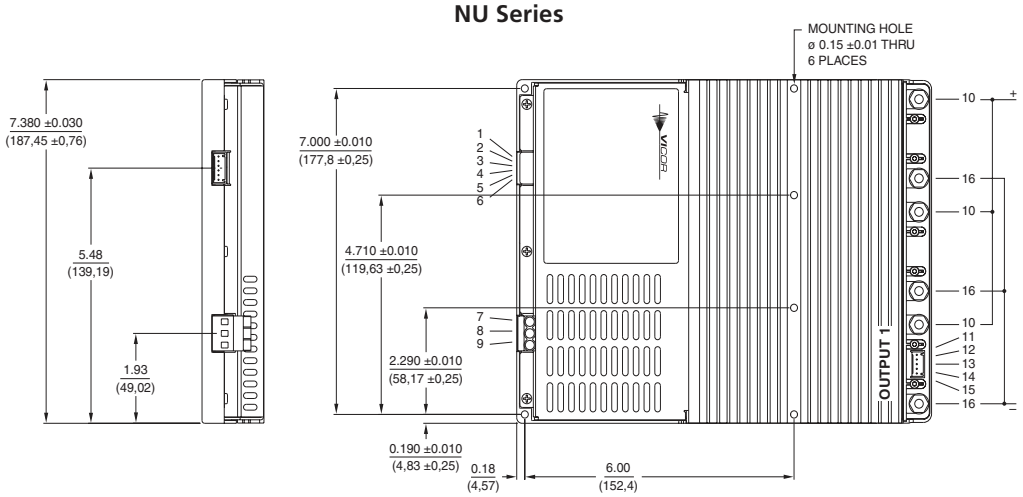
MU Series



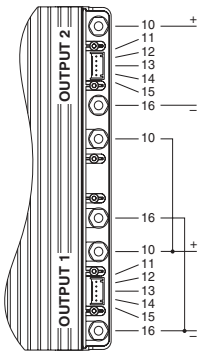
PU Series



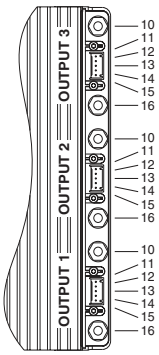
NU Series



QU Series



RU Series



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