

OVERVIEW

The FPM48 battery charger provides ultimate flexibility in charge control for a wide range of energy storage systems for commercial, military and aerospace applications. This module is also capable of operating in constant-voltage mode with programmable output voltage and current limit. The FPM48 is compliant to MIL-STD-461F/DO-160 emissions and susceptibility, MIL-STD-810G vibration/shock, and designed to withstand MIL-STD-1275E voltage surge/spike requirements. No external filters and circuitry required.

The FPM48 has up to 10A charge capability and could be paralleled for higher power applications, providing a total charge current of n*10A. Battery voltage and charge current setpoints are user-controlled with a simple 0-2.5VDC linear external reference (DC or PWM), which allows for custom charge profiles on a wide range of battery technologies. Output current will automatically adjust and regulate output voltage once voltage setpoint is reached. Optional MPPT function with Blue Harmonics PVS Controller. Internal NTC allows for temperature feedback and automatic power limiting.

Features and Benefits

- MIL-STD-461F and DO-160 compliance to conducted emissions and susceptibility
- MIL-STD-810G Vibration and Shock
- Wide input voltage range 8-72VDC (MIL-STD-1275E surge/spike compliance)
- FCC Class A (Conducted Emissions)
- User-controlled voltage and current setpoints for flexible charge control
- Ability to operate in constant-voltage mode (see Note 1) with user-programmable output voltage and current-limit
- No external filter required
- Reverse input protection
- Battery in-rush current limiting (see Note 4)
- Temperature feedback for user-controlled power limiting
- Internal overload protection
- One-wire interconnect for parallel operation
- Optional MPPT control input (user-controlled or with external smart module)



Module Specifications



Input Voltage, V_i	8-72VDC
Output Voltage, V_o	2-45VDC (see Note 2)
Output Current	10A maximum (see Note 3)
Output Power	450W (see Note 3)
EXTVCC Power	1.5W @ 12VDC
Peak Efficiency	98%
Current Regulation	±1%
Charge Current Set Point	0-10A (external 0-2.5V reference)
Output Voltage Regulation	±1%
Switching Frequency	200kHz (±5kHz)
Protection	Over-current with output foldback
Operating Temperature, T_b (baseplate)	-40°C to 70°C or NTC1/2=900Ω (±100Ω)
Operating Temperature (ambient)	-40°C to 75°C
Storage Temperature	-55°C to 125°C
MTBF (MIL-HDBK-217F)	1.4x10 ⁶ HRS, Ground Benign, 40°C T_b

Note 1 Minimum 150mA pre-load required and may vary based on V_i - V_o operating range.

Note 2 Converter operation in step-down mode only. Input must be >2VDC above output voltage for guaranteed full output voltage and current range

Note 3 Subject to temperature-power derating

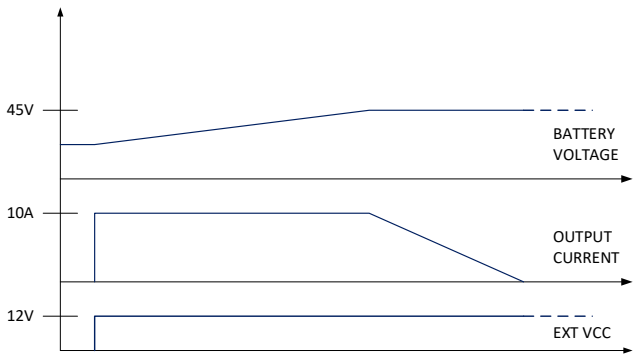
Note 4 Requires battery connection before EXTVCC is enabled

Absolute Maximum Ratings

IN+ TO PGND	80VDC
OUT+ TO PGND	48VDC
EXT VCC	12.8VDC
I-REF, V-REF, PV-REF	5.5VDC
Mounting Torque	6 in-lbs

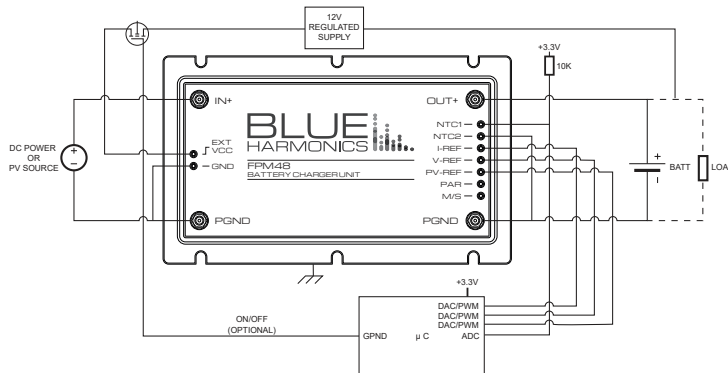
Pin Functions

NTC1/ NTC2	Internal 10K NTC ($\pm 5\%$). Refer to R-T chart and use for device temperature monitor and over-temperature protection. Recommended operating limit is 900Ω ($\pm 100\Omega$).
I-REF	External current reference with 0-2.5VDC range (0-10ADC full scale). Compatible with DC voltage or $>5\text{kHz}$ PWM signal. Internally clamped to 2.5VDC. In parallel operation, leave pin floating for Slave modules.
V-REF	External voltage reference with 0-2.5VDC range (0-45VDC full scale). Compatible with DC voltage or $>5\text{kHz}$ PWM signal. Internally clamped to 2.5VDC.
PV-REF	Optional MPPT control. Connect to GND when not used.
EXT VCC	External +12VDC power input. Apply +12VDC ($\pm 5\%$), 150mA source. If enable function is required, use appropriate switch circuit to connect/disconnect +12VDC source.
GND	Control ground. Connect to PGND.
M/S	Master/Slave mode select. Leave pin floating for single-module operation. In parallel mode, float pin for Master and connect to GND for all Slave modules.
PAR	In parallel mode, connect all PAR pins for each module together. Leave pin floating for single-module operation.
PGND	Power ground connections. Internally tied to chassis.
IN+	Input power connection
OUT+	Output power connection

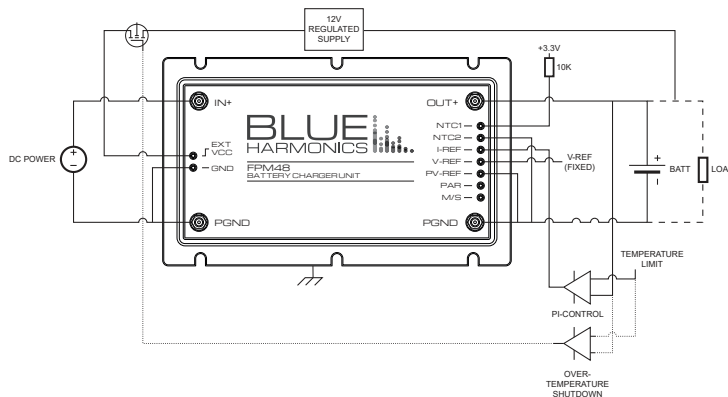


BATTERY CHARGING PROFILE WITH FIXED I-V SETPOINTS (I-REF, V-REF = 2.5V)

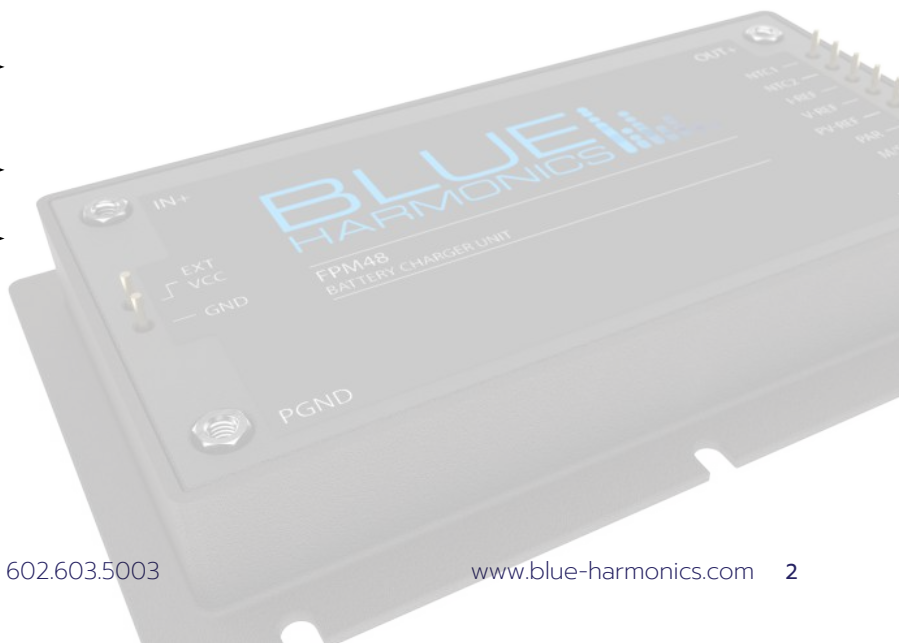
TYPICAL APPLICATIONS



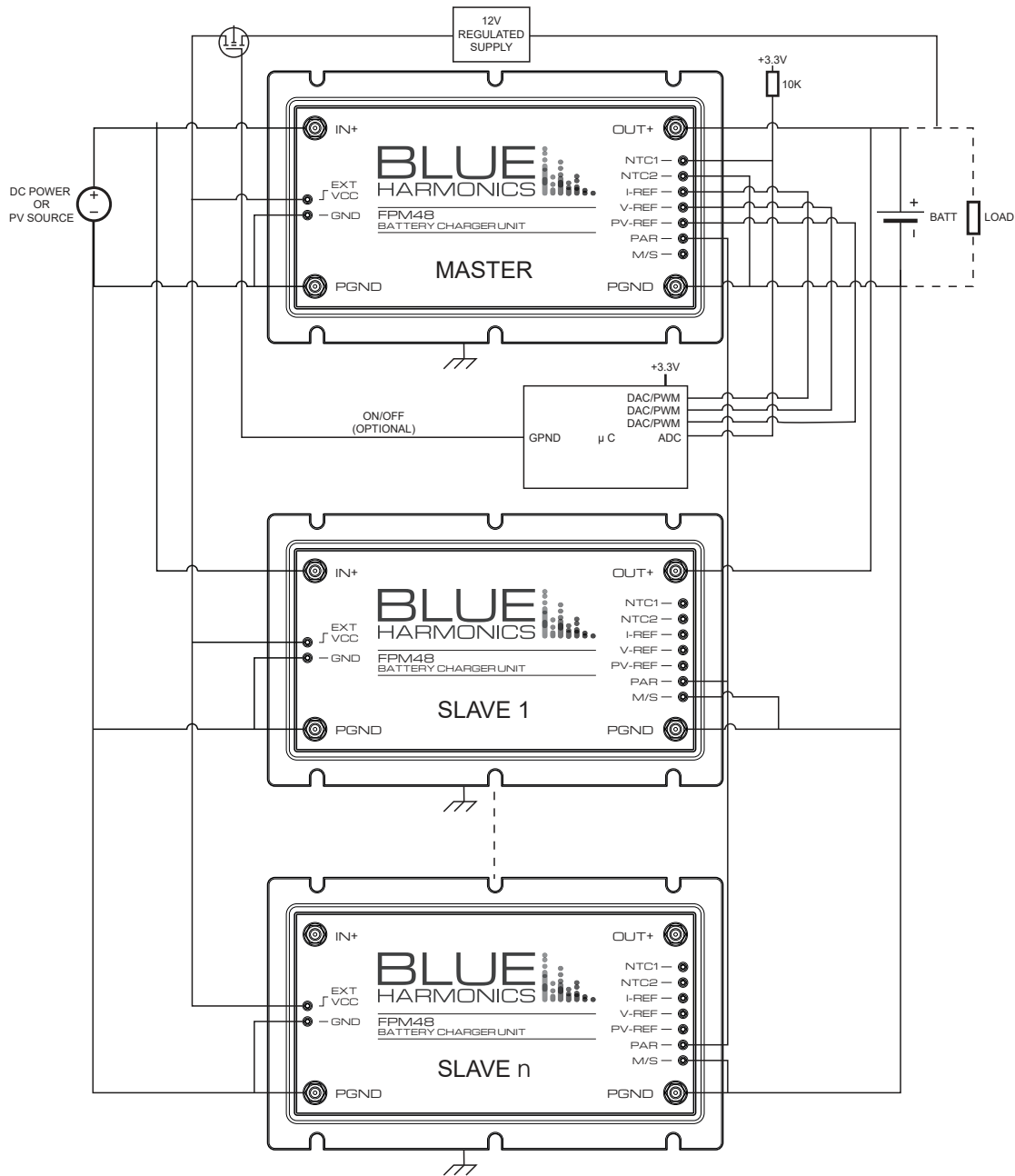
MICROCONTROLLER-BASED BATTERY CHARGER OR ADJUSTABLE POWER SUPPLY WITH MPPT CONTROL (PV SOURCE)



SIMPLE CHARGER WITH FIXED EXTERNAL VOLTAGE AND CURRENT SETPOINTS. TEMPERATURE FEEDBACK OPTION FOR AUTOMATIC POWER LIMITING OR OVER-TEMPERATURE SHUTDOWN



TYPICAL APPLICATIONS CONT'D



PARALLEL OPERATION UP TO N-MODULES WITH 10A MAXIMUM OUTPUT CURRENT PER MODULE

The FPM48 may be used as a standalone battery charger or externally controlled with an external microcontroller for dynamic adjustments during charge operation. I-REF, V-REF and PV-REF scales linearly (0-2.5V) with the corresponding specifications for output current (0-10A), output voltage (0-45V) and input voltage (0-72V) respectively. In battery charging applications, it is required for EXT VCC to be disabled (<0.8VDC) when battery is connected to the output (OUT+). [CAUTION: Connecting a battery with the FPM48 enabled (EXTVCC=12V) may result in internal component degradation or failure]

NTC R-T CURVE

T °C	R (ohms)	T °C	R (ohms)	T °C	R (ohms)	T °C	R (ohms)
-55.0	636177.2	0.0	29239.78	55.0	3340.37	110.0	669.19
-54.0	594705.4	1.0	27920.66	56.0	3230.34	111.0	652.42
-53.0	556217.7	2.0	26668.77	57.0	3124.49	112.0	636.14
-52.0	520480.6	3.0	25480.33	58.0	3022.65	113.0	620.35
-51.0	487280.2	4.0	24351.77	59.0	2924.65	114.0	605.02
-50.0	456420.4	5.0	23279.76	60.0	2830.32	115.0	590.14
-49.0	427721.6	6.0	22261.15	61.0	2739.52	116.0	575.69
-48.0	401018.9	7.0	21293.00	62.0	2652.08	117.0	561.66
-47.0	376161.1	8.0	20372.54	63.0	2567.88	118.0	548.03
-46.0	353009.3	9.0	19497.17	64.0	2486.78	119.0	534.80
-45.0	331435.8	10.0	18664.43	65.0	2408.64	120.0	521.94
-44.0	311323.2	11.0	17872.02	66.0	2333.36	121.0	509.45
-43.0	292563.6	12.0	17117.78	67.0	2260.80	122.0	497.31
-42.0	275057.7	13.0	16399.67	68.0	2190.86	123.0	485.52
-41.0	258714.0	14.0	15715.76	69.0	2123.43	124.0	474.06
-40.0	243448.3	15.0	15064.25	70.0	2058.41	125.0	462.92
-39.0	229182.9	16.0	14443.43	71.0	1995.70	126.0	452.09
-38.0	215846.1	17.0	13851.69	72.0	1935.22	127.0	441.56
-37.0	203371.9	18.0	13287.52	73.0	1876.87	128.0	431.32
-36.0	191699.3	19.0	12749.50	74.0	1820.56	129.0	421.37
-35.0	180771.9	20.0	12236.28	75.0	1766.22	130.0	411.68
-34.0	170537.8	21.0	11746.57	76.0	1713.76	131.0	402.27
-33.0	160948.6	22.0	11279.20	77.0	1663.13	132.0	393.10
-32.0	151960.0	23.0	10833.01	78.0	1614.23	133.0	384.19
-31.0	143530.8	24.0	10406.95	79.0	1567.01	134.0	375.52
-30.0	135622.8	25.0	10000.00	80.0	1521.40	135.0	367.08
-29.0	128200.7	26.0	9611.21	81.0	1477.34	136.0	358.87
-28.0	121231.8	27.0	9239.67	82.0	1434.77	137.0	350.87
-27.0	114685.7	28.0	8884.53	83.0	1393.63	138.0	343.09
-26.0	108534.3	29.0	8544.99	84.0	1353.86	139.0	335.51
-25.0	102751.5	30.0	8220.27	85.0	1315.43	140.0	328.14
-24.0	97313.0	31.0	7909.67	86.0	1278.27	141.0	320.96
-23.0	92196.4	32.0	7612.48	87.0	1242.33	142.0	313.96
-22.0	87380.6	33.0	7328.08	88.0	1207.58	143.0	307.15
-21.0	82846.39	34.0	7055.83	89.0	1173.96	144.0	300.51
-20.0	78575.54	35.0	6795.17	90.0	1141.44	145.0	294.05
-19.0	74551.26	36.0	6545.55	91.0	1109.98	146.0	287.75
-18.0	70757.91	37.0	6306.43	92.0	1079.53	147.0	281.61
-17.0	67180.90	38.0	6077.33	93.0	1050.06	148.0	275.63
-16.0	63806.67	39.0	5857.77	94.0	1021.53	149.0	269.80
-15.0	60622.56	40.0	5647.32	95.0	993.91	150.0	264.12
-14.0	57616.77	41.0	5445.54	96.0	967.17		
-13.0	54778.31	42.0	5252.05	97.0	941.28		
-12.0	52096.92	43.0	5066.45	98.0	916.19		
-11.0	49563.03	44.0	4888.39	99.0	891.89		
-10.0	47167.68	45.0	4717.53	100.0	868.35		
-9.0	44902.52	46.0	4553.54	101.0	845.54		
-8.0	42759.76	47.0	4396.10	102.0	823.44		
-7.0	40732.09	48.0	4244.94	103.0	802.01		
-6.0	38812.69	49.0	4099.76	104.0	781.24		
-5.0	36995.19	50.0	3960.30	105.0	761.11		
-4.0	35273.60	51.0	3826.30	106.0	741.58		
-3.0	33642.34	52.0	3697.54	107.0	722.65		