ENHANCED FLOATING HOT DECK LVPS WITH ISOLATED DIGITAL AND ANALOG I/O

PRELIMINARY DATA SHEET

- Precision analog control
- Isolated up to 15kV
- DC leakage current of <10nA
- AC leakage capacitance of <40pF
- 4 regulated floating LV power outputs
- Isolated digital I/O to and from floating hot deck
- Isolated analog I/O to and from floating hot deck

GENERAL INFORMATION:

The "EFL" Series of floating-hot-deck, low-voltage power supplies offers an integrated solution for systems requiring LV power & controls with high-voltage isolation. Combining a highly isolated, DC-to-DC, multi-output low-voltage power supply (LVPS) with an advanced isolated digital & analog I/O topology, the "EFL" sub-system provides both power and controls to floating-hot-deck circuitry. This solution, when combined with one or more UV HVPS or other circuitry, can provide high-performance solutions for applications such as:

Floating/Stacked Ion- or E-Beam Biases	Floating Filament Bias
Floating Pulsers & Gated Grids	Floating Capacitance Meters
Floating High Side Current Monitors	Floating Leakage Testers

Please contact UltraVolt's customer service department for an analysis of your requirements.

DESIGN METHODOLOGY:

The "EFL" Series utilizes a dual-ended forward converter topology with a nominal switching frequency of <100 kHz. Once input voltage stabilizes, under-voltage lockout is released. When the LVPS enable is raised above a TTL 1, the converter begins to switch. The soft-start circuit brings the converter to full power over a 1mS period, reducing surges on the source supply. A constant-frequency PWM regulation system with optically isolated feed back controls the MOSFET push-pull power stage, driving a highly isolated transformer. This isolated power ultimately provides 4 separate LV floating outputs. The power stage is protected from intermittent output-current overloads or short circuits via a primary current limit circuit. The isolated digital I/O channel(s) are optically transmitted directly to the floating hot deck with a schmitt trigger buffer providing glitch-free output on the floating hot deck. The isolated analog I/O channel(s) are converted to digital data and optically transmitted directly to the floating hot deck for conversion back to analog.

COMPATIBILITY:

The "EFL" Series works directly with any UltraVolt "A" or "C" Series DC-to-DC HVPS from 0 to 62V through 0 to 40kV @ 0 to 4 watts through 0 to 20 watts. By providing isolated power, TTL enable/disable, and voltage programming, UV HVPS can be floated or stacked on one another.

ISOLATED POWER OUTPUTS:

The "15EFL12-12W" provides floating +12VDC @ 1 Amp, ±15VDC @ 50 mA, and +5.1VDC @ 500mA from a single ground side +12VDC input. The "15EFL24-24W" provides floating +24VDC @ 1 Amp, ±15VDC @ 50 mA, and +5.1VDC @ 500 mA from a single ground side +24VDC input. The main output is typically used to drive a floating HVPS, or filament switching regulator, etc. The ±15VDC provides bias to floated Op-Amps, DACs & ADCs. The +5.1VDC can run floating micro-controllers or watchdog reset circuits.

ISOLATED CONTROLS: DIGITAL CHANNELS

The "-I/O" option provides one isolated digital I/O channel from the grounded system side to the floating hot deck and one from the hot deck to the ground deck. The TTL bit is inverted. The output, a schmitt trigger TTL buffer, sources up to 0.8mA and sinks up to 3mA. This bit is typically used to enable/disable a floated UV HVPS.

ISOLATED CONTROLS: ANALOG CHANNELS

The "-I/O" option provides isolated analog I/O channel(s) from the grounded system side to the floating hot deck. The analog signal is converted to digital and translated back to analog at the floating hot deck. The output is buffered. This signal is typically used to remote program a floated UV HVPS or a floating filament regulator with precision characteristics.

STANDBY MODE:

All "EFL" models feature an LVPS enable/disable function. When the enable is TTL 0 (<+0.7 VDC +/-0.2 I_{sink}=1mA), the floating LVPS is in standby mode. All isolated outputs go to 0VDC; input current drops to < 150 mA; and all functions are shut down except the +5 Volt reference, which is always operational. If the LVPS enable pin is left unconnected, TTL 1 or at greater voltages up to +5VDC the converter operates normally.

MECHANICAL:

"EFL" Series units are in PCB-mountable plastic cases requiring a footprint of 8.5 in^2 and only 10 in^3 of volume. Mounting plates and brackets are available for chassis mounting. See Application Note 6 for thermal considerations and for mounting configurations.

ENVIRONMENTAL:

The "EFL" Series provides full power operation at case temperatures from -20 to +55°C. All units receive a 24-hour burn-in prior to final testing. Extended temperature range is available along with other enhanced capabilities. Please contact the factory.

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Typical Characteristics:

Parameter	Conditions	Models			Units
Input Power:		**12W Models**	**24W Models**	**36W Models**	
Voltage Range	Full Power	+12 ± 5%	+24 ± 10%	+24 ± 10%	VDC
Current	Standby (Disabled)	< 150	< 100	< 100	mA
Current	No Load	< 0.25	< 0.35	< 0.35	A
Current	Max Load	< 2.50	< 1.90	< 2.80	A
AC Ripple Current	Nominal Input, Full Load	< 50	< 50	< 50	mA p-p
Local Controls: Reference		**All Types**			
Output Voltage	T = +25°C, Initial value	+ 5.00 ± 2 %			VDC
Output Impedance	T = +25°C	464 ± 1%			Ω
Stability	Over full temperature range	See Figure A			Graph
Local Controls: LVPS Enable / Disable		**All Types**			
Power supply on	Open, or a voltage above TTL high	+2.4 to 5			VDC
Power supply off	Grounded, or a voltage below TTL low	0 to + 0.7 ± 0.2 (Isink 1mA minimum)			VDC
Input / Output Isolation:		**All Types**			
Isolation Voltage	Continuous	15			kV
Leakage Current	All inputs to all outputs	< 10			nA
Leakage Capacitance	All inputs to all outputs	< 40 std, < 50 "-E"			pF
Isolated Power Outputs:		**15EFL12-12W**	**15EFL24-24W**	**15EFL24-36W**	
Output #1 Power	Nominal input, max Iout	12	24	36	W
Output #1 Voltage	Nominal input voltage range	+12 ± 1%	+24 ± 1%	+24 ± 1%	VDC
Output #1 Current	Minimum to Maximum	0 to 1	0 to 1	0 to 1.5	A
Output #1 Line Regulation	Nominal input range, full load	< 0.1 %	< 0.1 %	< 0.1 %	VDC
Output #1 Load Regulation	No load to full load	< 0.1 %	< 0.25 %	< 0.25 %	VDC
Output #1 Ripple	Full load	< 2.5 %	< 1.5%	< 1.5%	V p-p
Output #2 & #4 Voltage	Nominal input voltage range	±15 ± 2%	±15 ± 2%	±15 ± 2%	VDC
Output #2 & #4 Current	Minimum to Maximum	0 to 50	0 to 50	0 to 50	mA
Output #2 & #4 Line Regulation	Nominal input range, full load	< 0.1 %	< 0.3 %	< 0.3 %	VDC
Output #2 & #4 Load Regulation	No load to full load	< 5 %	< 1 %	< 1 %	VDC
Output #2 & #4 Ripple	Full load	< 2.5 %	< 2.5 %	< 2.5 %	V p-p
Output #3 Voltage	Nominal input voltage range	+5.1 ± 1%	+5.1 ± 1%	+5.1 ± 1%	VDC
Output #3 Current	Minimum to Maximum	500	500	500	mA
Output #3 Line Regulation	Nominal input range, full load	< 1 %	< 1 %	< 1 %	VDC
Output #3 Load Regulation	No load to full load	< 1 %	< 1 %	< 1 %	VDC
Output #3 Ripple	Full load	< 4 %	< 4 %	< 4 %	V p-p
Isolated Controls: TTL Channel "UP"		**All Types1**			
Local input	Source voltage, sink current	0 ≤ 0.5 (Isink 3mA minimum) 1 ≥ 2.4 (300uA or open collector)			VDC
Isolated output	Inverted & buffered TTL	1 ≥ 2.4, 0 ≤ 0.4 ± (Sources 0.8 mA, Sinks 3 mA)			VDC
Baud Rate	Duty cycle	< 15			ms
Isolated Controls: Analog Channel "UP"		**12V Models**	**24V Models**		
Local input voltage	Range	0 to + 5	0 to + 10		VDC
Isolated output voltage	Range	0 to + 5	0 to + 10		VDC
Local input impedance		20.0 K			Ω
Initial offset error		< ± 2			mV
Gain error	Full scale	< ± 0.2 %			VDC
Linearity error	Full scale	< ± 0.05 %			VDC
Stability	30 min. warm-up, per 8 hrs/day	< 0.02%			VDC
Temperature Coefficient	0 to +55 °C	< ± 10			ppm/°C
Bandwidth	Symmetric or asymmetric signal	DC to 4			Hz

'-RB' Isolated Controls: TTL Channel "DOWN"			
Parameter	**Conditions**	**All Types**	**Units**
Isolated 'Hot Deck' Input	Source voltage, sink current	0 ≤ 0.5 (Isink 1mA Minimum) 1 ≥ 2.4 (300uA or open collector)	VDC
Local output	Inverted & Buffered TTL	1 > 2.4 (Sources 0.8mA) 0 < 0.4 (Sinks 3mA)	VDC
Propagation Delay	Duty cycle	< 15	ms
Isolated Controls: Analog Channels #1 & #2 "DOWN"			
Parameter	**Conditions**	**All Types**	**Units**
Isolated 'Hot Deck' +Input	Range	0 to +5 for 12V and 0 to +10 for 24V	VDC
Isolated 'Hot Deck' -Input	Range	0 to -5 for 12V and 0 to -10 for 24V	VDC
Isolated 'Hot Deck' + or - Input impedance	Signal source	> 10Meg	Ω
Local output +voltage	Range	0 to +5 for 12V and 0 to +10 for 24V	VDC
Local output -voltage	Range	0 to -5 for 12V and 0 to -10 for 24V	VDC
Initial offset error	Signal source	< ± 2	mVDC
Gain error	Full scale	< ± .2%	VDC
Linearity error	Full scale	< ± .05%	VDC
Stability	30 min. warm-up, per 8 hrs / per day	< 0.01% / < 0.02%	VDC
Temperature Coefficient	-20 °C to +55 °C	< ± 10	ppm/°C
Bandwidth	Symmetric or asymmetric signal	DC to 4	Hz
Temperature:	**Conditions**	**All Types**	
Operating	Full load, case measurement	-20 to +55	°C
Storage	Non-operating, case measurement	-55 to +85	°C
Thermal shock	Mil-Std-810, Method 503-4, Proc. II	-20 to +55	°C
Altitude:		**All Types**	
Operating	All operating conditions	Sea level to Vacuum	
Storage	Non-operating	Sea level to Vacuum	
Shock & Vibration:		**All Types**	
Shock	Mil-Std-810, Method 516.5, Proc IV	20	G's
Vibration	Mil-Std-810, Method 514.5, Fig. 514.5C-3	10	G's
Packaging:		**All Types**	
Material	Outer construction	Plastic (DAP) ASTM-D-5948	
Length	Not including pins or mounting points	5.70" ± 0.050" (144.8)	In (mm)
Width	Not including pins or mounting points	1.50" ± 0.050" (38.1)	In (mm)
Height	Not including pins or mounting points	1.30" ± 0.050" (33.0)	In (mm)
Volume	Not including pins or mounting points	11.1 (182)	In³ (cc)
Weight	Overall	13.3 (377.1)	Oz (g)

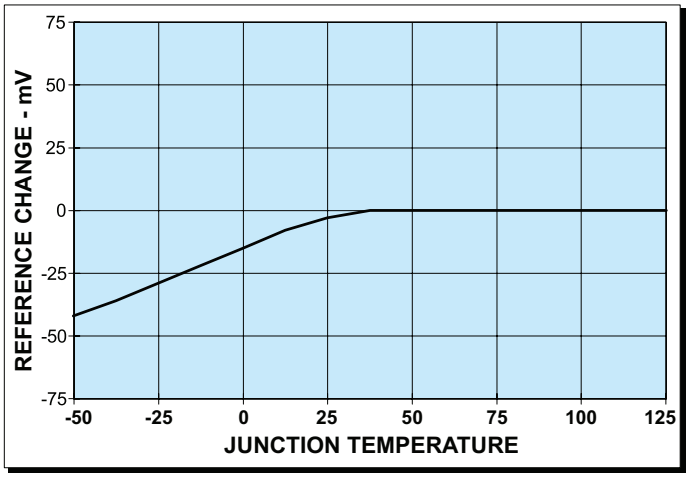

Fig. A
Reference Stability

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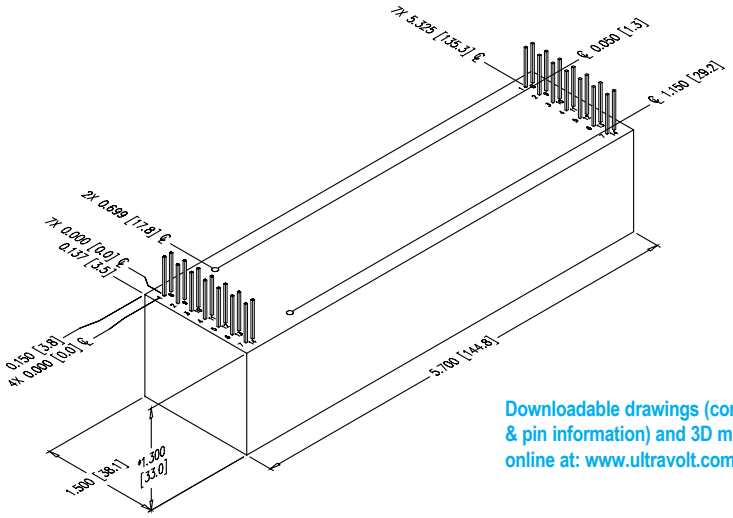

Downloadable drawings (complete with mounting & pin information) and 3D models are available online at: www.ultravolt.com/drawings.htm.

Local Connections

1 - Input Power Ground
2 - Positive Power Input
3 - LVPS Enable/Disable/Sync In
4 - TTL Up
5 - Signal Ground
6 - Analog Up Channel 1
7 - +5V Reference Output
8 - Analog Down Channel 1, +
9 - Analog Down Channel 1, -
10 - Analog Down Channel 2, +
11 - Analog Down Channel 2, -
12 - Analog Up Channel 2
13 - Mode
14 - TTL Output (Inverted Digital Down Channel 1)

Isolated/Floating Connections

1 - Analog Down Channel 1, +
2 - Analog Down Channel 1, -
3 - Analog Down Channel 2, +
4 - Analog Down Channel 2, -
5 - +15VDC Output
6 - Analog Up Channel 2
7 - Floating TTL input (Digital Down Channel 1)
8 - Floating PWR Ground
9 - Floating +12VDC or +24VDC Output
10 - Floating -15VDC Output
11 - Floating TTL Up
12 - Floating Signal Ground
13 - Floating Analog Up Channel 1
14 - Floating +5.1VDC Reference Output

Example: 15EFL12-12W-I/O-R/B

Type — Isolation, Model, Input, Power

PROUDLY MADE IN THE USA

Ordering Information

Type:	15 kV Isolation	**15EFL**
Input Voltage:	12 VDC Nominal	**12**
	24 VDC Nominal	**24**
Power:	Watts Output (12V only)	**-12W**
	Watts Output (24V only)	**-24W**
	Watts Output (24V only)	**-36W**
Standard Features:	(1) Digital Up Channel & (2) Analog Up Channels	**-I/O**
	(1) Digital Down Channel & (2) Analog Down Channel	**-R/B**
Options:	Partial Mu-Metal Shield	**-M**
Case:	Plastic Case - Diallyl Phthalate	**STD**
	"Eared" Chassis Mounting Plate	**-E**