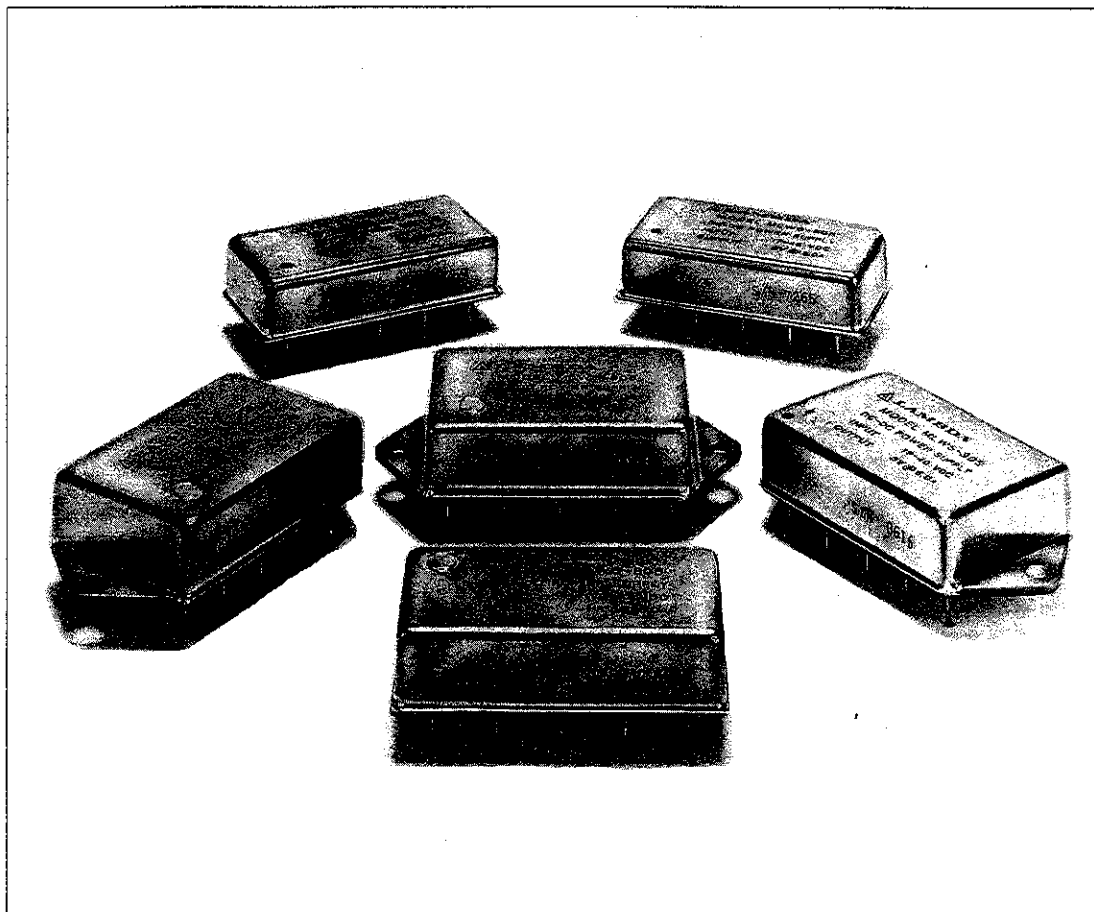


LAMBDA'S MLW SERIES



High Density, High Reliability Converters for MIL-Environments

Lambda's MLW Series isolated DC-to-DC converters and filters provide an ideal solution for the unique requirements of military and civilian aerospace applications. Acceleration, shock, vibration and rapid temperature variation are common attributes of airborne equipment. The "ES" option screens units specifically for these rigorous conditions. All models feature inputs centered around 28VDC in compliance with MIL-STD-704D requirements. By using thick film hybrid technology, Lambda has achieved high density, high reliability and superior regulation without requiring external components. The MLW Series is available with single and dual outputs up to 70W, and triple outputs up to 60W.

MLW SERIES FEATURES

Available With Environmental Screening	For the most rugged applications, optional screening to MIL-STD-883 is available. Test methods are: • Pre Cap Internal Visual Inspection: Per method 2017 • Stabilization Bake: 24 Hours @ 125°C per method 1008 Condition B • Temperature Cycle: 10 times, – 55°C to 125°C per method 1010 • Constant Acceleration: 500g per method 2001 • Gross Leak: Per method 1014 • Fine Leak: Per method 1014, Condition A • Burn-in: 96 hours @ 70°C ambient • Final Electrical Test (25°C) • Final Visual Inspection: Per method 2009
Wide Voltage Input Range	All input voltage ranges are centered around 28VDC. Minimum input voltage varies from 16VDC to 19VDC (depending on model). Maximum input voltage is 40VDC.
Operating Temperature Range	Most MLW Series models operate from – 55°C to + 135°C ensuring operation in even the most extreme environment. Baseplate temperatures can fluctuate between – 55°C and + 85°C.
Convection Cooled	All models are convection cooled when used with the appropriate heatsink.
Synchronous Operation	The MLW1000 allows for synchronization with system clock.
High Efficiency	78% minimum efficiency on most models.
EMI Protection	MLWF filters are designed to EMI limits per MIL-STD-461B CEO3. Input voltage transient protection is also provided to MIL-STD-704B-D. In addition, the filters protect the MLW Series converters from reverse voltage.

Part II – DC-to-DC Converters

MLW SERIES SPECIFICATIONS

DC Input

28VDC Nominal.

Input Voltage Range

MLWT-952, 955: 16VDC to 36VDC. MLWS-705: 16VDC to 40VDC.
MLWS-605, 612, 805, 812, 815, MLWD-812, 815: 17VDC to 40VDC.
MLWS-912, 915, MLWD-912, 915: 18VDC to 40VDC. MLWS-615, 905, 1003,
1005, 1012, 1015, MLWD-615, 1012, 1015, MLWT-1022, 1055: 19VDC
to 40VDC.

Efficiency

74% minimum on MLWS-605, 1003. 76% minimum on MLWS-615;
MLWD-615, 812, 815; MLWT-952, 955. 78% minimum on all other models.

EMI

All models will meet MIL-STD-461B, CE03 with an appropriate Lambda
MLWF filter.

DC Output

Output voltage range shown in tables.

Regulated Voltage

regulation, line	(low line to high line)
	0.10% on MLWS-605, 815 MLWD-815, 915.
	0.12% on MLWS-812 MLWD-812, 912.
	0.14% on MLWS-1015.
	0.17% on MLWS-1012 MLWD-1015.
	0.20% on MLWS-705, 805, 915 and 5V output of MLWT-952, 955.
	0.21% on MLWD-1012.
	0.25% on MLWS-912.
	0.33% on MLWS-615 MLWD-615.
	0.40% on MLWS-905, 1005; $\pm 12V$ outputs of MLWT-952; $\pm 15V$ outputs of MLWT-955; 5V output of MLWT-1022, 1055.
	0.42% on MLWS-612 MLWD-615.
	1.40% on $\pm 15V$ output of MLWT-1055.
	1.70% on $\pm 12V$ outputs of MLWT-1022.
regulation, load	(50mA preload required on 5V output of all triple output models.)
	0.10% on MLWS-605, 815 MLWD-815.
	0.13% on MLWS-812, 915 MLWD-812, 912.
	0.17% on MLWS-912, 1015.
	0.21% on MLWS-1012.
	0.33% on MLWS-615 MLWD-615
	0.34% on MLWD-915, 1015.
	0.40% on MLWS-705, 805, 905, 1005; MLWT-952, 955; 5V output of MLWT-1022, 1055.
	0.42% on MLWS-612 MLWD-612, 912, 1012.
	0.60% on MLWS-1003.
	3.00% on $\pm 15V$ outputs of MLWT-1055.
	5.00% on $\pm 12V$ outputs of MLWT-1022.
ripple and noise	(2MHz bandwidth, 25°C, 28VDC Input Voltage.)
	30mV pk-pk on MLWS-1003; $\pm 12V$ outputs of MLWT-952; $\pm 15V$ outputs of MLWT-955.
	50mV pk-pk on MLWS-905, 1005, 1012, 1015; MLWD-1012, 1015.
	60mV pk-pk on MLWS-605, 612, 705, 805, 815; MLWD-612, 615.
	65mV pk-pk on MLWS-912, 915.
	80mV pk-pk on MLWS-805; 5V output of MLWT-952, 955.
	85mV pk-pk on MLWT-1022, 1055.

Input Ripple Current

Measured over a 2MHz bandwidth, with 28VDC input at full load.
Maximum 50mA pk-pk reflected input current, on all models.

Input Voltage Transients

50VDC transient for a maximum duration of 50mS on all models. All models will meet the voltage transient specifications for MIL-STD-704(A-D) and MIL-STD-1275 with appropriate MLWF filter.

Short Circuit Protection

Indefinite short circuit protection on all outputs.

Input Reverse Voltage Protection

All models will meet with an appropriate MLWF filter.

Output Voltage Adjust

All models have a fixed output voltage, $\pm 1\%$ of nominal value, at an input voltage of 28VDC, full load and 25°C ambient temperature. On MLWS-705 and 805 models, the output voltage can be increased by up to 5% by adding an external resistor, per the chart below, between pins 3 and 4.

Nominal Output Voltage Increase	Ohms (Ω)
+0%	Infinity
+1%	390k
+2%	145k
+3%	63k
+4%	22k
+5%	0k

Cooling

All models are conduction cooled and require a suitable heatsink.
Consult factory for heatsink information.

Operating Temperature Range

-55°C to $+85^{\circ}\text{C}$ (baseplate temperature). Operation to 110°C for MLWS-605. Operation to $+130^{\circ}\text{C}$ for MLWS-605. Operation to $+135^{\circ}\text{C}$ for all other models. Consult derating curves for maximum output power available.

Storage Temperature Range

-55°C to $+125^{\circ}\text{C}$ (135°C for MLW-600 Series).

Remote On/Off

Active low.

Mounting

PCB mount. Flanges available on most models for additional structural support and thermal transfer.

Physical Data

Package Model	Oz. Net	Oz. Ship	Size Inches
MLWS-605, 612, 615	1.3	2.3	1.25 x 1.45 x .325
MLWD-612, 615	1.3	2.3	1.25 x 1.45 x .325
MLWS-705	1.9	2.9	1.12 x 2.12 x .405
MLWS-705F	1.9	2.9	1.12 x 2.89 x .405
MLWS-805, 812, 815	1.9	2.9	1.12 x 2.12 x .495
MLWD-812, 815	1.9	2.9	1.12 x 2.12 x .495
MLWS-805F, 812F, 815F	1.9	2.9	1.12 x 2.89 x .495
MLWD-812F, 815F	1.9	2.9	1.12 x 2.89 x .495
MLWT-952, 955	1.9	2.9	1.35 x 1.95 x .500
MLWT-952F, 955F	1.9	2.9	1.35 x 2.70 x .500
MLWD-912, 915	1.9	2.9	1.35 x 2.70 x .500
MLWS-905, 912, 915	1.9	2.9	1.35 x 2.70 x .500
MLWD-1012, 1015	4.9	5.9	2.45 x 3.20 x .595
MLWT-1022, 1055	4.9	5.9	2.45 x 3.20 x .595
MLWS-1003, 1005, 1012, 1015	4.9	5.9	2.45 x 3.20 x .595

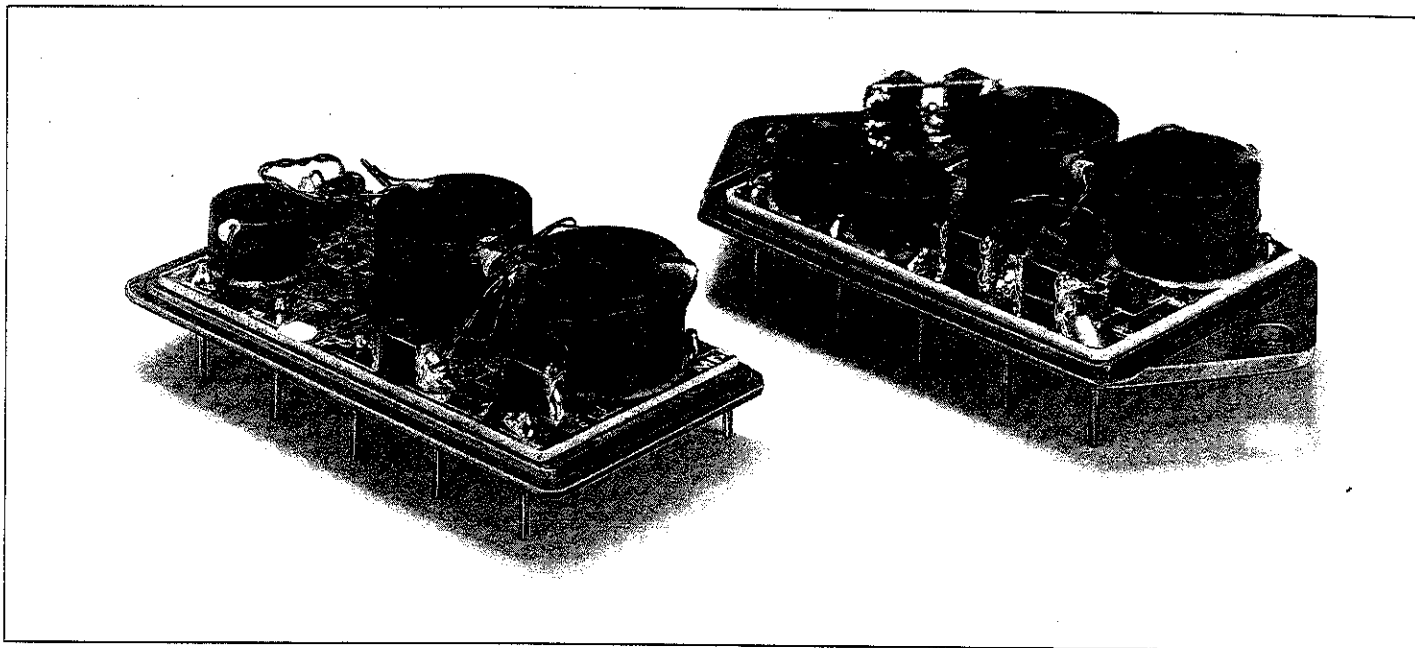
Options

All MLW Series power supplies and MLWF Series filters are available with screening per MIL-STD-883. Consult factory for applicable MIL-STD-883 tests. To order optional screening, add the suffix "ES" to model number and 25% to unit price.

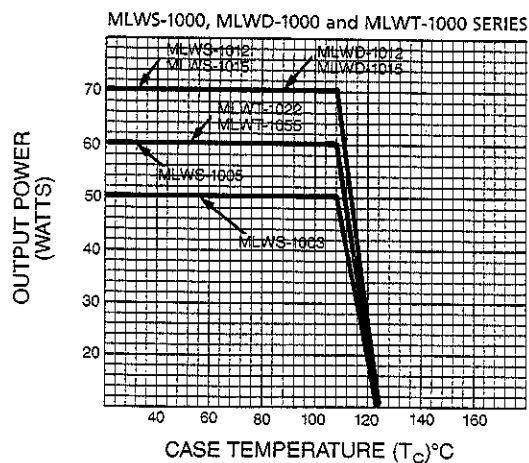
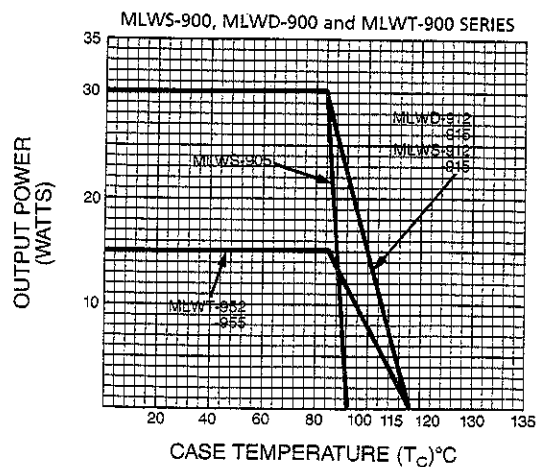
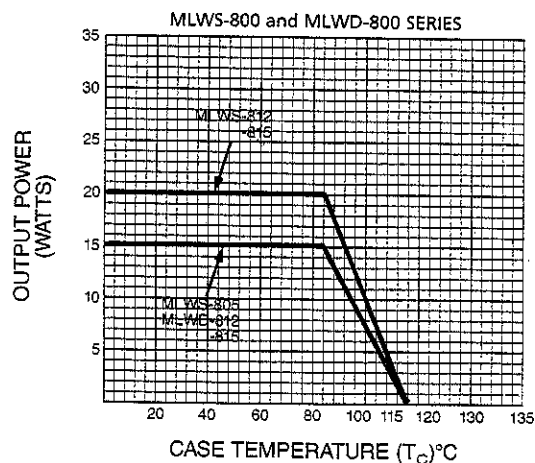
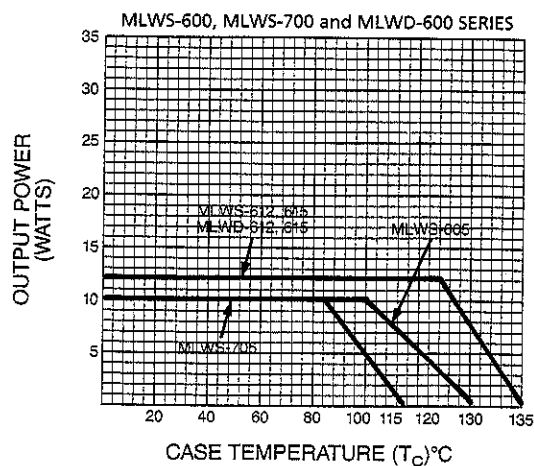
Guarantee

One year guarantee includes labor as well as parts on all MLW Series power supplies and MLWF Series filters.

MLW SERIES DERATING CURVES



Power Derating Curves*



*When designing these modules into an application, these power derating curves must be adhered to in order to provide reliable operation.

Part II – DC-to-DC Converters

MIL-Environment MLW Series Input Filters

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
MLWF-300					
Input Voltage ⁶	Steady State	0	28	40	VDC
Input Current ⁶	DC			1.75	Amps
	Ripple				Amps RMS
Input Clamping Voltage	-55°C	40.8	45.1	49.4	VDC
	+25°C	44.7	47.0	49.4	
	+125°C	44.7	49.5	54.2	
Output Voltage ⁶	Steady State	$V_{out} = V_{in} - I_{in}(R_{dc})$			VDC
Output Current ⁶	Steady State			1.75	Amps
DC Resistance (R _{dc})	Steady State			0.25	Ohms
Power Dissipation	Max. Current			1.3	Watts
Noise Reduction	200 kHz-399 kHz		40		dB
	400 kHz-50 MHz		60		
Capacitance	Any Pin to Case			0.032	μF
Isolation	Any Pin to Case 500 VDC	100			MOhm
Operating Temp. ⁶	Case Baseplate	-55		+125	°C
Storage Temp.	Case Baseplate	-65		+150	°C
Weight			46	48	Grams

NOTES: 1: Above 85°C Case Temperature. Derate Current and Voltage. Ratings as Follows:

- Input Voltage: Derate Linearly to 33 VDC at +125°C Case Temp.
- Input Ripple Current: Derate linearly to 270mA on MLWF-200, 400mA on MLWF-400 and 480mA on MLWF-600 at +125°C case temp.
- DC Input & Output Current: Derate linearly to 750mA on MLWF-200 and 1.7 Amp on MLWF-400, 600 at +125°C case temp.
- Typical Applications. Result in V_{out} Within 2% of V_{in}.
- Meets MIL-STD-1275A (AT) 31.31 Surge, and MIL-STD-704A Figs 8 and 9. For these standards derate output linearly from 40 W at 105°C to 20 W at 125°C.
- Meets MIL-STD-461C 10.2 CS06 limits.
- Meets Panavia SP-P-90001, British Standard BS3G100, and Civil Aircraft D0160 Standards.
- Above 125°C case temperature derate as follows:
 - Output Ripple Current: Derate linearly to zero at +135°C case temp.
 - DC Input and Output Current: Derate linearly to zero at 135°C case temp.

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
MLWF-704					
T _{CASE} = -55°C to +125°C, V _{IN} = 28 VDC unless otherwise specified					
Input Voltage	Steady State	0	28	40	VDC
	No Load				
	40 Watt Load	16	28	40	VDC
	Transient			450	VDC
Input Voltage Low Line Lockout		7		15	VDC
Input Current	No Load			5	mA
	Inhibited			2	mA
Inhibit Input Voltage	Open Circuit			5.5	VDC
Inhibit Input Current	V _{inh} = 0 to 0.8V			-0.6	mA
Output Power	V _{in} = 16 to 40 VDC			40	W
Internal Power Dissipation					
	Peak				
	105°C			400	W
	125°C			200	W
Continuous	105°C			30	W
	125°C			15	W
DC Resistance	V _{in} = 16 to 40 VDC 25°C			0.45	ohm
Output Clamp Voltage	40 Watt Load	40		50	VDC
Input Surge Limit	40 W Load, 100V, 0.5 Ohm	0		60	msec
	Imp ³				
	40 W Load, 600V, 50 Ohm	0		20	μsec
Input Spike Limit	Imp ₄				
	40 W Load, 400V, 0.5 Ohm	0		20	μsec
	Imp ₅				
Noise Reduction	200 kHz-50 MHz 100 kHz	50	60 30		dB
Capacitance	Pin to Case		10,000		pF
Isolation	Pin to Case, 500 VDC	100			meg-ohm
Operating Temp. ¹	Baseplate	-55		+125	°C
Storage Temp		-55		+150	°C
Weight			40		Grams

MIL-Environment Converter Ratings Table

MLW SERIES

- Input Voltages Centered Around 28 VDC
- Ideal for Military and Civilian Airborne Applications

MLWF FILTERS

- Designed to EMI Limits per MIL-STD-461B CEO3
- Input Transient Protection per MIL-STD-704B-D

MAX CURRENT (AMPS) ¹	Vout ADJ. RANGE	MOUNTING	COMPLETE ELEC. SPEC. PG.	UNIT PRICE PER DELIVERED QUANTITY			MODEL
				1	10	25	
SINGLE OUTPUT							
3.5V OUTPUT							
14.30	±1% Fixed	Flange	96	\$ 996	\$ 949	\$917	MLWS-1003
5V OUTPUT							
2.00	±1% Fixed	PC Mount	96	428	406	390	MLWS-605
2.00	5.00-5.25	PC Mount	96	473	449	434	MLWS-705
2.00	5.00-5.25	Flange	96	491	468	453	MLWS-705F
3.00	5.00-5.25	PC Mount	96	473	449	434	MLWS-805
3.00	5.00-5.25	Flange	96	491	468	453	MLWS-805F
6.00	±1% Fixed	Flange	96	704	669	647	MLWS-905
12.00	±1% Fixed	Flange	96	996	949	917	MLWS-1005
12V OUTPUT							
1.00	±1% Fixed	PC Mount	96	428	406	390	MLWS-612
1.67	±1% Fixed	PC Mount	96	512	487	471	MLWS-812
1.67	±1% Fixed	Flange	96	531	506	490	MLWS-812F
2.50	±1% Fixed	Flange	96	704	669	647	MLWS-912
5.83	±1% Fixed	Flange	96	996	949	917	MLWS-1012
15V OUTPUT							
0.80	±1% Fixed	PC Mount	96	428	406	390	MLWS-615
1.33	±1% Fixed	PC Mount	96	512	487	471	MLWS-815
1.33	±1% Fixed	Flange	96	531	506	490	MLWS-815F
2.00	±1% Fixed	Flange	96	704	669	647	MLWS-915
4.67	±1% Fixed	Flange	96	996	949	917	MLWS-1015
DUAL OUTPUT							
± 12V OUTPUT							
0.500	±1% Fixed	PC Mount	96	\$ 467	\$ 444	\$423	MLWD-612
0.625	±1% Fixed	PC Mount	96	515	490	474	MLWD-812
0.625	±1% Fixed	Flange	96	534	510	494	MLWD-812F
1.250	±1% Fixed	Flange	96	761	725	695	MLWD-912 ²
2.920	±1% Fixed	Flange	96	1075	1025	989	MLWD-1012 ³
± 15V OUTPUT							
0.400	±1% Fixed	PC Mount	96	467	444	423	MLWD-615
0.500	±1% Fixed	PC Mount	96	515	490	474	MLWD-815
0.500	±1% Fixed	Flange	96	534	510	494	MLWD-815F
1.000	±1% Fixed	Flange	96	761	725	695	MLWD-915 ²
2.330	±1% Fixed	Flange	96	1075	1025	989	MLWD-1015 ³

NOTES:

¹Baseplate temperature of 85°C

²On MLWD-900 Series, up to 27W are available from either output, providing that the total package power does not exceed 30W.

³On MLWD-1000 Series, up to 66.5W are available from either output, providing that the total package power does not exceed 70W.

MIL-Environment Converter Ratings Table

MLW SERIES

- Input Voltages Centered Around 28 VDC
- Ideal for Military and Civilian Airborne Applications

MLWF FILTERS

- Designed to EMI Limits per MIL-STD-461B CEO3
- Input Transient Protection per MIL-STD-704B-D

Vout (VOLTS)	MAX CURRENT (AMPS) ¹	Vout ADJ. RANGE	MOUNTING	COMPLETE ELEC. SPEC. PG.	UNIT PRICE PER DELIVERED QUANTITY			MODEL
					1	10	25	
TRIPLE OUTPUT								
5V, ± 12V OUTPUT								
5	2.00	± 1% Fixed	PC Mount	96	\$ 685	\$ 651	\$ 629	MLWT-952 ⁵
± 12	0.21	± 1% Fixed		96				
5	2.00	± 1% Fixed	Flange	96	704	670	648	MLWT-952F ⁵
± 12	0.21	± 1% Fixed		96				
5	4.00	± 1% Fixed	Flange	96	1126	1071	1035	MLWT-1022 ^{4,5}
± 12	0.17	± 1% Fixed		96				
5V, ± 15V OUTPUT								
5	2.00	± 1% Fixed	PC Mount	96	\$ 685	\$ 651	\$ 629	MLWT-955 ⁵
± 15	0.17	± 1% Fixed		96				
5	2.00	± 1% Fixed	Flange	96	704	670	648	MLWT-955F ⁵
± 15	0.17	± 1% Fixed		96				
5	4.00	± 1% Fixed	Flange	96	1126	1071	1035	MLWT-1055 ^{4,5}
± 15	0.13	± 1% Fixed		96				

NOTES:

⁴On MLWT-1000 Series, up to 50W are available from any single output, providing that the total package power does not exceed 60W.

⁵Minimum preload of 50mA required on 5V output.

DC INPUT FILTERS

MAX CURRENT (AMPS)	MOUNTING	DIFFERENTIAL MODE REJECTION (dB) ¹	COMPLETE ELEC. SPEC. PG.	UNIT PRICE PER DELIVERED QUANTITY			MODEL
				1	10	25	
1.75	PC Mount	40	98	\$159	\$151	\$146	MLWF-200
1.75	Flange	40	98	181	173	168	MLWF-200F
1.75	PC Mount	40	98	368	340	324	MLWF-300
1.75	Flange	40	98	384	357	341	MLWF-300F
3.80	PC Mount	40	98	195	187	181	MLWF-400
3.80	Flange	40	98	214	206	200	MLWF-400F
5.00	PC Mount	40	98	219	210	203	MLWF-600
5.00	Flange	40	98	242	232	225	MLWF-600F
2.50	PC Mount	50	98	605	575	555	MLWF-704
2.50	Flange	50	98	626	596	576	MLWF-704F

NOTES:

¹MLWF-300 and MLWF-300F have 60dB rejection between 400kHz and 50MHz.

Lambda's MLWF Series of high density, high reliability DC input filters provide transient and reverse voltage protection, and EMI filtering for Lambda's MLW Series DC-to-DC converters. With input voltages centered around 28VDC, the MLW and MLWF Series are ideal for worldwide airborne applications. In addition, the MLWF Series provides key MIL-STD-704 (A-D) transient protection and filtering to simplify overall system design. Simply call your local Lambda sales engineer or our factory to discuss your application.

HOW TO SELECT AN INPUT EMI FILTER

Example: For An MLWS-805

1. DETERMINE INPUT AND OUTPUT PARAMETERS:

Efficiency = 76% Minimum
Minimum Input Voltage = 17 VDC
Output Voltage = 5 VDC
Maximum Load Current = 3.0A

2. CALCULATE INPUT CURRENT

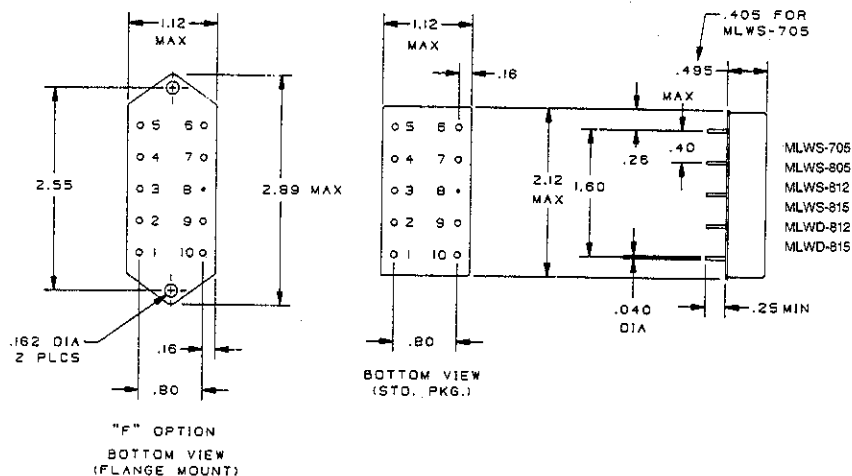
$$I_{\text{INPUT}} = \frac{P_{\text{OUT}}}{\text{Efficiency} \times V_{\text{INPUT}}} = \frac{15W}{(0.76) \times (17)} = 1.16A$$

3. Therefore, the MLWF-200 with an input current of 1.75 Amps is suitable for the application.

4. For multiple converter applications add up all input currents to determine which filter must be used.

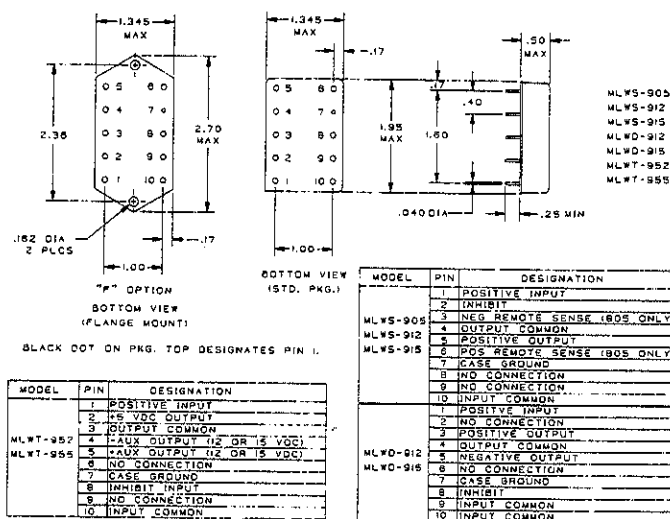
MLW SERIES AND MLWF SERIES FILTERS

MLWS-705
MLWS-805
MLWS-812
MLWS-815



MODEL	PIN	DESIGNATION
MLWS-705 MLWS-805 MLWS-812 MLWS-815 MLWD-812 MLWD-815	1	POSITIVE INPUT
	2	INHIBIT INPUT
	3	OUTPUT ADJUST
	4	OUTPUT COMMON
	5	POSITIVE OUTPUT
	6	NO CONNECTION
	8	CASE GROUND
	9	NO CONNECTION
	10	INPUT COMMON
	10	INPUT COMMON
MLWD-812 MLWD-815	1	POSITIVE INPUT
	2	INHIBIT INPUT
	3	POSITIVE OUTPUT
	4	OUTPUT COMMON
	5	NEGATIVE OUTPUT
	6	NO CONNECTION
	8	CASE GROUND
	9	NO CONNECTION
	10	INPUT COMMON
	10	INPUT COMMON

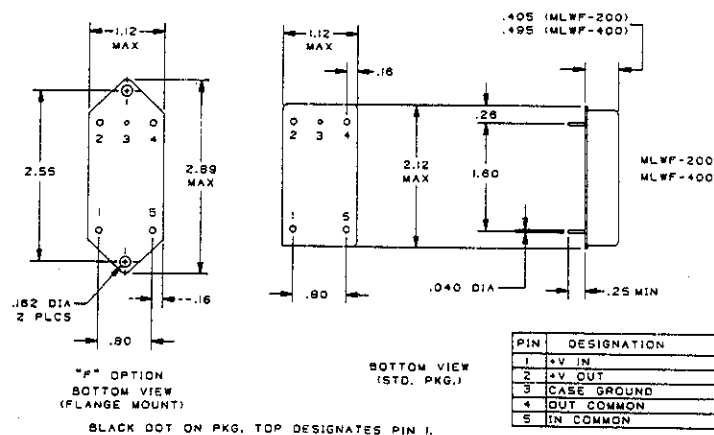
MLWS-905
MLWS-912
MLWS-915
MLWD-812
MLWD-815
MLWD-912
MLWD-915
MLWT-952
MLWT-955



MODEL	PIN	DESIGNATION
MLWS-905 MLWS-912 MLWS-915 MLWD-812 MLWD-815 MLWD-912 MLWD-915 MLWT-952 MLWT-955	1	POSITIVE INPUT
	2	INHIBIT INPUT
	3	NEG REMOTE SENSE (805 ONLY)
	4	OUTPUT COMMON
	5	POSITIVE OUTPUT
	6	POS REMOTE SENSE (805 ONLY)
	7	CASE GROUND
	8	NO CONNECTION
	9	NO CONNECTION
	10	INPUT COMMON
MLWT-952 MLWT-955	1	POSITIVE INPUT
	2	±V VCC OUTPUT
	3	OUTPUT COMMON
	4	±AUX OUTPUT (1/2 OR 1/5 VCC)
	5	±AUX OUTPUT (1/2 OR 1/5 VCC)
	6	NO CONNECTION
	7	CASE GROUND
	8	INHIBIT INPUT
	9	NO CONNECTION
	10	INPUT COMMON

MODEL	PIN	DESIGNATION
MLWS-905 MLWS-912 MLWS-915 MLWD-812 MLWD-815 MLWD-912 MLWD-915 MLWT-952 MLWT-955	1	POSITIVE INPUT
	2	INHIBIT INPUT
	3	NEG REMOTE SENSE (805 ONLY)
	4	OUTPUT COMMON
	5	POSITIVE OUTPUT
	6	POS REMOTE SENSE (805 ONLY)
	7	CASE GROUND
	8	NO CONNECTION
	9	NO CONNECTION
	10	INPUT COMMON
MLWD-812 MLWD-815 MLWD-912 MLWD-915 MLWT-952 MLWT-955	1	POSITIVE INPUT
	2	NO CONNECTION
	3	POSITIVE OUTPUT
	4	OUTPUT COMMON
	5	NEGATIVE OUTPUT
	6	NO CONNECTION
	7	CASE GROUND
	8	INHIBIT INPUT
	9	INPUT COMMON
	10	INPUT COMMON

MLWF-200
MLWF-400



PIN	DESIGNATION
1	±V IN
2	±V OUT
3	CASE GROUND
4	OUT COMMON
5	IN COMMON

