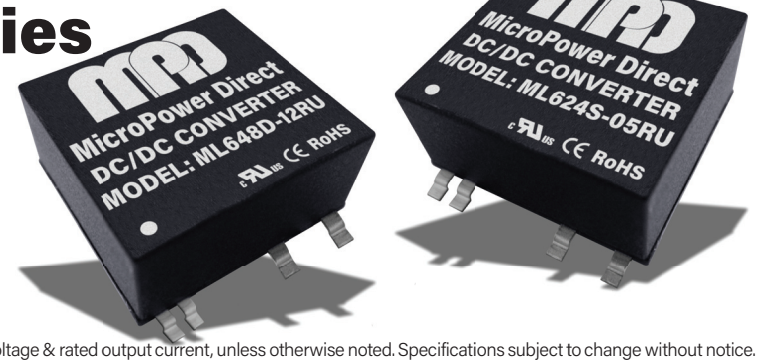
ML600RU Series

Ultra-Compact, 6W Wide 4:1 Input, SMT DC/DC Converters



Key Features:

- 6W Output Power
- Wide 4:1 Input Range
- Ultra-Compact SMT Case
- EN 62368 Approved
- 1,500 VDC Isolation
- Single And Dual Outputs
- Tight Line/Load Regulation
- -40°C to +80°C Operation
- 16 Standard Models
- Remote On/Off
- Available on Tape/Reel

RoHS

Tape & Reel

Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

Input

Parameter	Conditions	Min.	Typ.	Max.	Units
Start Up Voltage	24 VDC Input			9.0	VDC
	48 VDC Input			18.0	
Under Voltage Shutdown	24 VDC Input	8.5			VDC
	48 VDC Input	17.0			
Short Circuit Input Power				3,000	mW
Input Filter	π (Pi) Filter - Meets EN 55022 Class A				

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	At 50% Load		±1.0	±2.0	%
Output Voltage Balance	Dual Output, Balanced Loads		±1.0		
Line Regulation	For VIN = Min to Max		±0.5	±1.0	%
Load Regulation	For IOUT = 15% to 100%		±0.5	±1.2	%
Ripple & Noise (20 MHz)	See Note 3		60	100	mV P - P
Transient Response Time, See Note 4	25% Load Step Change		300	600	μS
Transient Response Deviation			±3		%
Temperature Coefficient			±0.01	±0.02	%/°C
Overload Protection	Foldback Type	110	150		%
Output Short Circuit	Continuous (Autorecovery)				

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 Seconds	1,500			VDC
Isolation Resistance	500 VDC	1,000			MΩ
Isolation Capacitance	100 kHz, 1V		1,200	1,500	pF
Switching Frequency			330		kHz

Remote On/Off (See Note 5)

Parameter	Conditions	Min.	Typ.	Max.	Units
Supply On		2.5		50.0	VDC
Supply Off		-0.7		0.8	VDC
Standby Input Current				10	mA
Control Common	Referenced to Negative Input (pin 2)				

Environmental

Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40		+80	°C
Maximum Case Temperature	Case			+105	°C
Storage Temperature Range		-50		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical

Case Size and Weight	See Mechanical Drawing (Page 4)
Case Material	Non-Conductive Black Plastic (UL94-V0)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	350			kHours
Safety Standards	UL/cUL 62368-1 recognition (UL certificate)				
Moisture Sensitivity Level (MSL)	IPC/JEDEC J-STD-020D.1		Level 2		

Absolute Maximum Ratings

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Surge (1 Sec)	24 VDC Input			50.0	VDC
	48 VDC Input			100.0	
Peak Reflow Temperature	See Page 3			245	°C
Lead Temperature	1.5 mm From Case For 10 Sec.			260	°C

Caution: Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

MicroPower Direct
292 Page Street
Suite D
Stoughton, MA 02072
USA

T: (781) 344-8226
F: (781) 344-8481
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

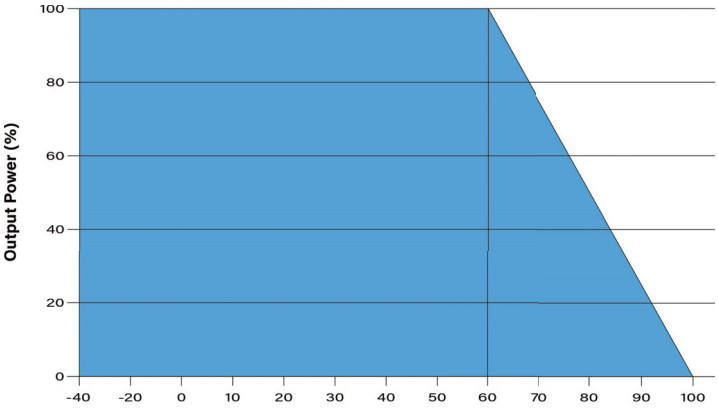
Model Selection Guide

Model Number	Input				Output			Efficiency (%, Typ)	Output Capacitive Load (µF, Max)	Fuse Rating Slow-Blow (mA)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)			
	Nominal	Range	Full-Load	No-Load						
ML624S-03RU(-W)	24	9.0 - 36.0	262	30	3.3	1,450	218	76	330	1,500
ML624S-05RU(-W)	24	9.0 - 36.0	316	30	5.0	1,200	180	79	330	1,500
ML624S-12RU(-W)	24	9.0 - 36.0	301	30	12.0	500	75	83	100	1,500
ML624S-15RU(-W)	24	9.0 - 36.0	301	30	15.0	400	60	83	100	1,500
ML624S-24RU(-W)	24	9.0 - 36.0	301	30	24.0	250	38	83	100	1,500
ML624D-05RU(-W)	24	9.0 - 36.0	301	30	±5.0	±600	±90	82	100	1,500
ML624D-12RU(-W)	24	9.0 - 36.0	301	30	±12.0	±250	±38	83	100	1,500
ML624D-15RU(-W)	24	9.0 - 36.0	301	30	±15.0	±200	±30	83	100	1,500
ML648S-03RU(-W)	48	18.0 - 75.0	131	20	3.3	1,450	218	76	330	750
ML648S-05RU(-W)	48	18.0 - 75.0	158	20	5.0	1,200	180	79	330	750
ML648S-12RU(-W)	48	18.0 - 75.0	151	20	12.0	500	75	83	100	750
ML648S-15RU(-W)	48	18.0 - 75.0	151	20	15.0	400	60	83	100	750
ML648S-24RU(-W)	48	18.0 - 75.0	151	20	24.0	250	38	83	100	750
ML648D-05RU(-W)	48	18.0 - 75.0	151	20	±5.0	±600	±90	82	100	750
ML648D-12RU(-W)	48	18.0 - 75.0	151	20	±12.0	±250	±38	83	100	750
ML648D-15RU(-W)	48	18.0 - 75.0	151	20	±15.0	±200	±30	83	100	750

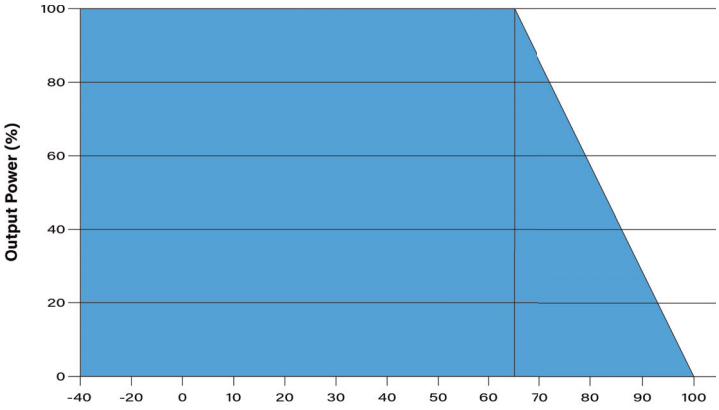
Notes:

1. If the unit is used in an assembly process that includes a wash cycle, the "-W" option should be selected. With this option, the unit is sealed to prevent damage. Contact the factory for more information
2. The specified maximum capacitive load is for each output.
3. When measuring output ripple, it is recommended that an external 0.47 µF ceramic capacitor be placed from +VOUT to -VOUT for single output models or from each output to common for dual output models. For noise sensitive applications, the use of 3.3 µF capacitors will reduce the output ripple.
4. Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
5. The maximum control current at the on/off input (pin 1) during a logic high (+5V) is 500 µA. The maximum control current to the on/off pin at logic low (0V) is -500 µA. If the on/off pin is left open, the unit operates. If grounded, the unit will shut off.
6. Operation at no-load will not damage these units. However, they may not meet all specifications.
7. The converter should be connected to a low ac-impedance source. An input source with a highly inductive impedance may affect the stability of the converter. In applications where the converter output loading is high and input power is supplied over long lines, it may be necessary to use a capacitor on the input to insure start-up.
   In this case, it is recommended that a low ESR (<1.0Ω at 100 kHz) capacitor be mounted close to the converter. For 24V input units a 4.7 µF is recommended and for 48V input models, a 2.2 µF.
8. It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

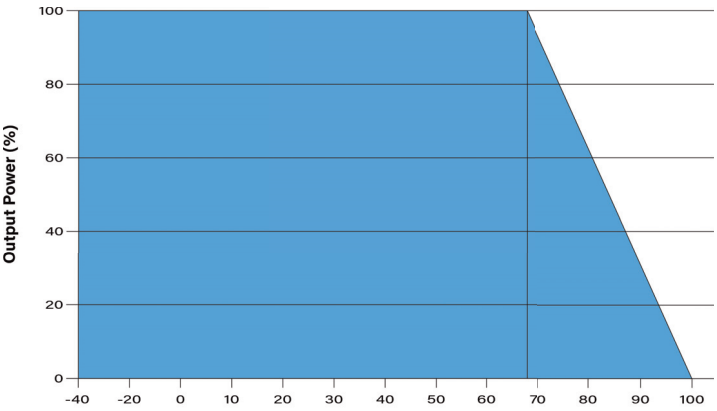
Derating Curve: 50 LFM



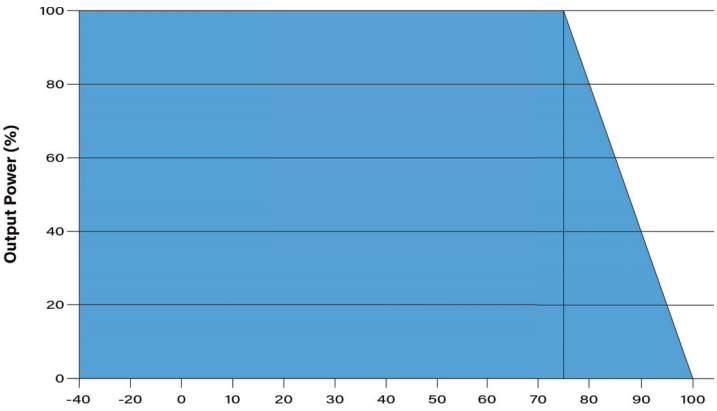
Derating Curve: 100 LFM



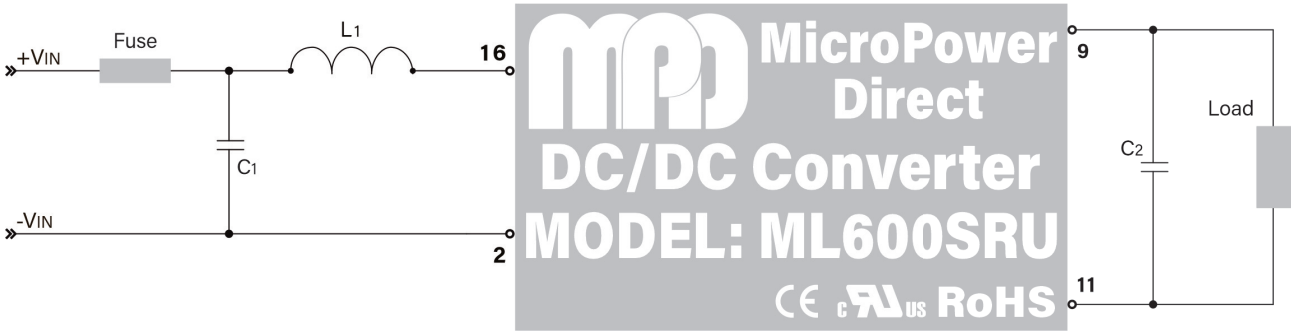
Derating Curve: 200 LFM



Derating Curve: 400 LFM



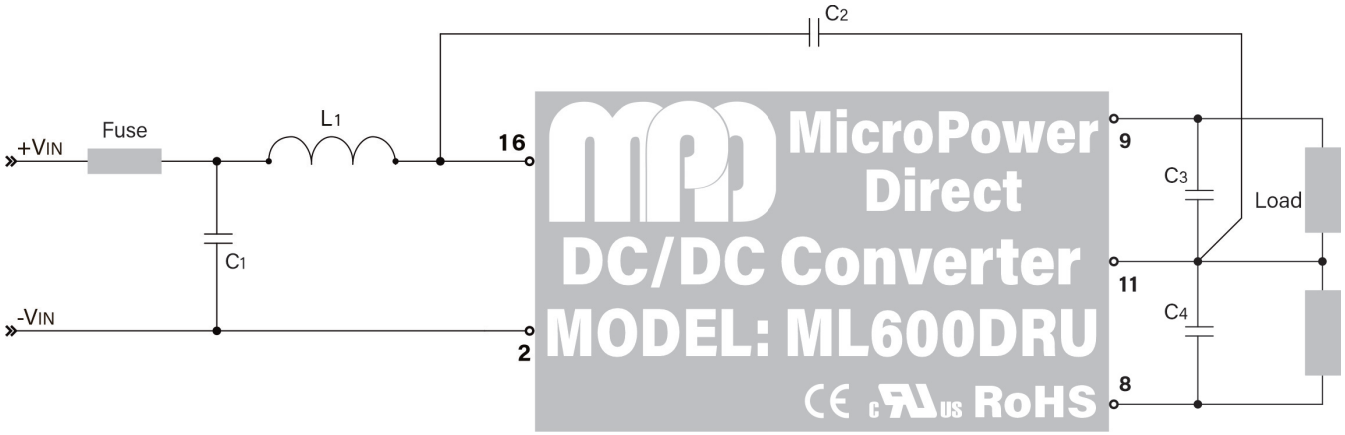
Typical Connection, Single Output



The diagram above illustrates a typical connection of the single output **ML600SRU**. Capacitor C1, and inductor L1 are recommended to help the unit meet the requirements of EN 55022 class B. The capacitor C2 will reduce output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

VIN	C1	L1	C2
24 VDC	4.7 µF/50V 1206 XR7	2.2 µH SCD03021T-2R2M	3.3 µF
48 VDC	4.7 µF/100V 2220 XR7	4.7 µH SCD03021T-4R7M	3.3 µF

Typical Connection

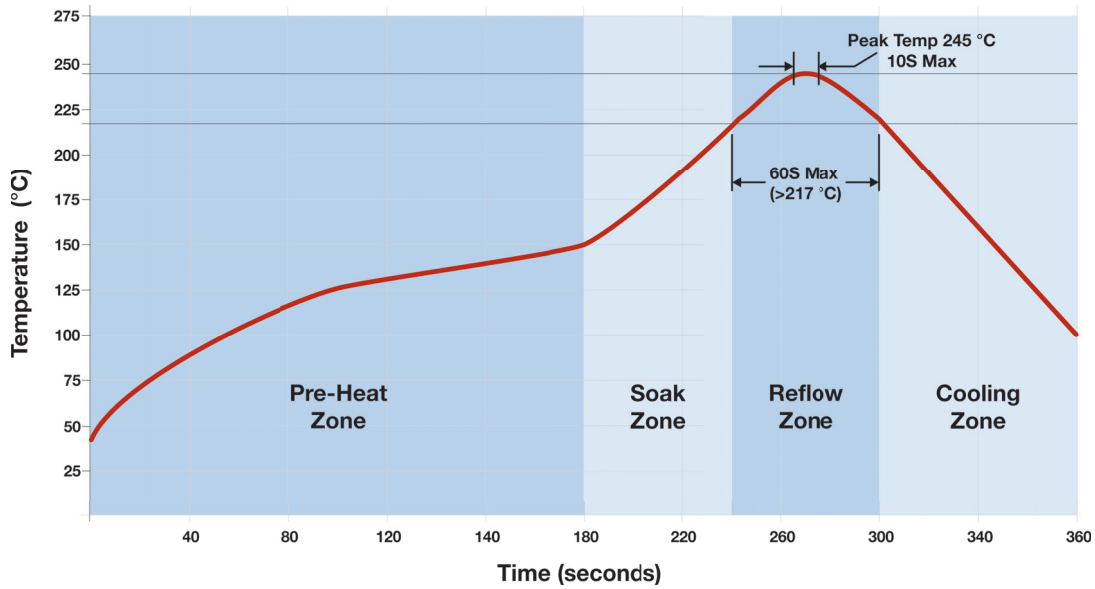


The diagram above illustrates a typical connection of the dual output **ML600DRU**. To help meet conducted emissions requirements (EN 55022 class B), the filter components (L1, C1 & C2) in the diagram above should be used. The capacitors C3 and C4 will reduce output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

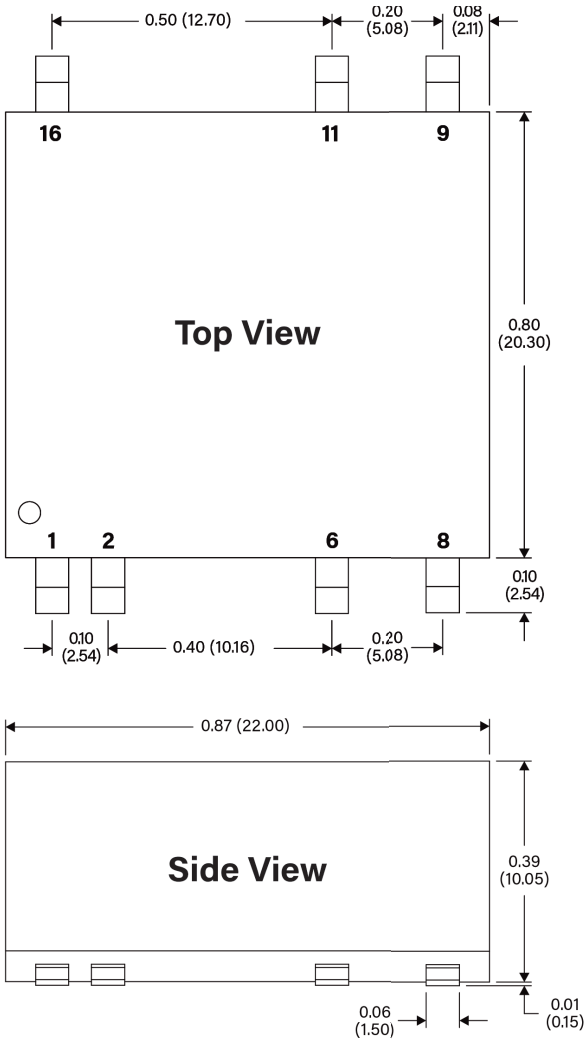
VIN	C1	L1	C2	C3/C4
24 VDC	4.7 µF/50V 1206 XR7	2.2 µH SCD03021T-2R2M		3.3 µF
48 VDC	4.7 µF/100V 2220 XR7	4.7 µH SCD03021T-4R7M	330 pF/2 kV 1808 XR7	3.3 µF

Reflow Solder Settings

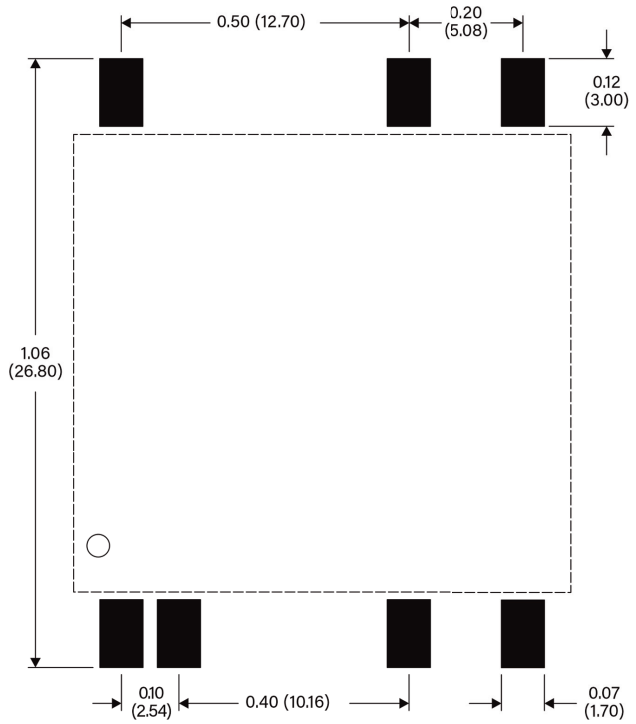
The **ML600RU** series is designed to meet the IPC/JEDEC standard J-STD-020D for reflow soldering. The recommended reflow settings are a peak temperature of 245°C for a maximum period (TPK) of 10S and a time above liquidous (TL) of ≤60 seconds at 217°C, as illustrated above. For more information, please contact the factory.

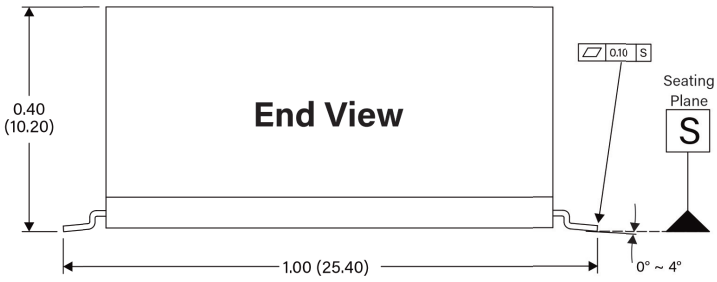


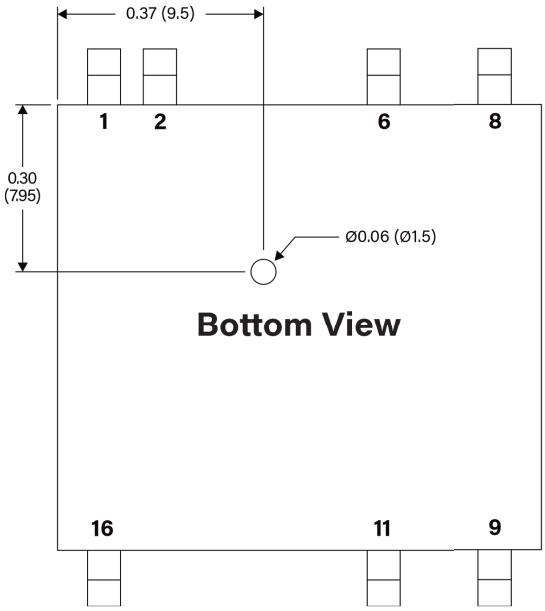
Mechanical Dimensions



Board Layout







Pin Connections

Pin	Single	Pin	Dual
1	Remote On/Off	1	Remote On/Off
2	-VIN	2	-VIN
6	NC	6	Common
8	NC	8	-VOUT
9	+VOUT	9	+VOUT
11	-VOUT	11	Common
16	+VIN	16	+VIN

NC = No connection

Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)
- Pin 1 is marked by a "dot" or indentation on the unit
- The hole in the bottom of the unit is used to discharge steam in the event the unit is baked as part of the assembly process. If a wash cycle is used as part of the assembly process, the "-W" option should be used.
- Weight = 0.27 Oz (7.8g)

MicroPower Direct
We Power Your Success - For Less!
292 Page Street Ste D Stoughton, MA 02072 ▪ TEL: (781) 344-8226 ▪ FAX: (781) 344-8481 ▪ E-Mail: sales@micropowerdirect.com