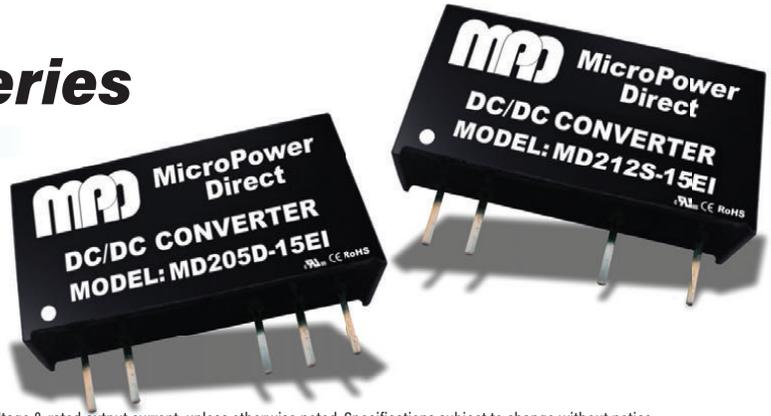


MD200EI Series

Low Cost, 2W High Isolation SIP DC/DC Converters



Key Features:

- 2W Output Power
- Miniature SIP Case
- EN 60950 Approved
- 3,000 VDC Isolation
- Single & Dual Outputs
- >3.5 MHour MTBF
- -40°C to +105°C Operation
- **LOW COST**

**1.5 kV Isolation
Models
Available**



MicroPower Direct

292 Page Street
Suite D
Stoughton, MA 02072
USA

T: (781) 344-8226

F: (781) 344-8481

E: sales@micropowerelectronics.com

W: www.micropowerelectronics.com



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	
Input Voltage Range	5 VDC Input	4.50	5.0	5.50	VDC	
	12 VDC Input	10.80	12.0	13.20		
	15 VDC Input	13.50	15.0	16.50		
	24 VDC Input	21.60	24.0	26.40		
Input Filter	Internal Capacitor					
Output						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Output Voltage Accuracy	See Tolerance Graphs (Page 3)					
Line Regulation	3.3 VDC Output	For V_{IN} Change of 1%			±1.5	%
	All Other Outputs				±1.2	
Load Regulation, See Note 3	See Model Selection Guide					
Ripple & Noise (20 MHz)	See Note 4		75	200	mV P - P	
Temperature Coefficient				±0.03	%/°C	
Output Short Circuit, See Note 5	All 5 V_{IN} Models except 24 V_{OUT}	Continuous (Autorecovery)				
	All Other Models	Momentary (1S)				
General						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Isolation Voltage	60 Seconds	3,000			VDC	
Isolation Resistance	500 VDC	1,000			MΩ	
Isolation Capacitance, See Note 6	100 kHz, 1V		20		pF	
Switching Frequency			100		kHz	
EMI Characteristics						
Parameter	Standard	Criteria		Level		
Radiated Emissions, See Page 3	EN 55032			Class B		
Conducted Emissions, See Page 3	EN 55032			Class B		
ESD, Single Output Models	EN 61000-4-2	B			Contact ±8 kV	
ESD, Dual Output Models	EN 61000-4-2	B			Contact ±6 kV	
Environmental						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Operating Temperature Range	Ambient	-40	+25	+105	°C	
Storage Temperature Range		-55		+125	°C	
Cooling	Free Air Convection					
Humidity	RH, Non-condensing			95	%	
Physical						
Case Size	See Mechanical Dimensions (Page 4)					
Case Material	Non-Conductive Black Plastic (UL-94V0)					
Weight	See Page 4					
Reliability Specifications						
Parameter	Conditions	Min.	Typ.	Max.	Units	
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	3.5			MHours	
Safety Standards	UL/cUL 60950-1 recognition (UL certificate)					
Absolute Maximum Ratings						
Parameter	Conditions	Min.	Typ.	Max.	Units	
Input Voltage Surge (1 Sec)	5 VDC Input			9.0	VDC	
	12 VDC Input			18.0		
	15 VDC Input			21.0		
	24 VDC Input			30.0		
Lead Temperature	1.5 mm From Case For 10 Sec			300	°C	

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

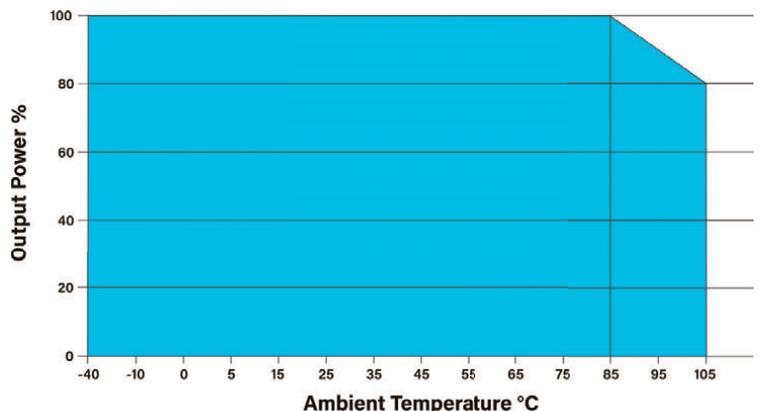
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	Model Number	Input				Output			Load Regulation (% Typ)	Output Capacitive Load (µF Max)	Efficiency (% Typ)	Fuse Rating Slow-Blow (mA)
		Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
		Nominal	Range	Full-Load	No-Load							
UL	MD205S-03EI	5	4.5 - 5.5	334	35	3.3	400	40.0	18.0	220	79	700
UL	MD205S-05EI	5	4.5 - 5.5	488	35	5.0	400	40.0	12.0	220	82	1,000
UL	MD205S-09EI	5	4.5 - 5.5	488	35	9.0	222	22.0	9.0	220	82	1,000
UL	MD205S-12EI	5	4.5 - 5.5	488	35	12.0	167	17.0	8.0	220	82	1,000
UL	MD205S-15EI	5	4.5 - 5.5	482	35	15.0	133	13.0	7.0	220	83	1,000
UL	MD205S-24EI	5	4.5 - 5.5	476	35	24.0	83	8.0	6.0	220	84	1,000
UL	MD205D-03EI	5	4.5 - 5.5	555	35	±3.3	±303	±30.0	18.0	100	72	1,000
UL	MD205D-05EI	5	4.5 - 5.5	500	35	±5.0	±200	±20.0	12.0	100	80	1,000
UL	MD205D-09EI	5	4.5 - 5.5	476	35	±9.0	±111	±11.0	9.0	100	84	1,000
UL	MD205D-12EI	5	4.5 - 5.5	482	35	±12.0	±83	±8.0	8.0	100	83	1,000
UL	MD205D-15EI	5	4.5 - 5.5	488	35	±15.0	±67	±7.0	7.0	100	82	1,000
UL	MD205D-24EI	5	4.5 - 5.5	476	35	±24.0	±42	±4.0	6.0	100	84	1,000
UL	MD212S-05EI	12	10.8 - 13.2	203	20	5.0	400	40.0	12.0	220	82	500
UL	MD212S-09EI	12	10.8 - 13.2	206	20	9.0	222	22.0	9.0	220	81	500
UL	MD212S-12EI	12	10.8 - 13.2	198	20	12.0	167	17.0	8.0	220	84	500
UL	MD212S-15EI	12	10.8 - 13.2	196	20	15.0	133	13.0	7.0	220	85	500
UL	MD212S-24EI	12	10.8 - 13.2	194	20	24.0	83	8.0	6.0	220	86	500
UL	MD212D-03EI	12	10.8 - 13.2	222	20	±3.3	±303	±30.0	18.0	100	75	500
UL	MD212D-05EI	12	10.8 - 13.2	208	20	±5.0	±200	±20.0	12.0	100	80	500
UL	MD212D-09EI	12	10.8 - 13.2	198	20	±9.0	±111	±11.0	9.0	100	84	500
UL	MD212D-12EI	12	10.8 - 13.2	196	20	±12.0	±83	±8.0	8.0	100	84	500
UL	MD212D-15EI	12	10.8 - 13.2	196	20	±15.0	±67	±7.0	7.0	100	84	500
	MD215S-05EI	15	13.5 - 16.5	167	15	5.0	400	40.0	12.0	220	80	400
	MD215S-09EI	15	13.5 - 16.5	167	15	9.0	222	22.0	9.0	220	80	400
	MD215S-12EI	15	13.5 - 16.5	165	15	12.0	167	17.0	8.0	220	81	400
	MD215D-15EI	15	13.5 - 16.5	159	15	±15.0	±67	±7.0	7.0	100	84	400
UL	MD224S-05EI	24	21.6 - 26.4	104	10	5.0	400	40.0	12.0	220	80	200
UL	MD224S-09EI	24	21.6 - 26.4	97	10	9.0	222	22.0	9.0	220	86	200
UL	MD224S-12EI	24	21.6 - 26.4	99	10	12.0	167	17.0	8.0	220	84	200
UL	MD224S-15EI	24	21.6 - 26.4	97	10	15.0	133	13.0	7.0	220	86	200
	MD224S-18EI	24	21.6 - 26.4	97	10	18.0	111	11.0	7.0	220	86	200
UL	MD224S-24EI	24	21.6 - 26.4	97	10	24.0	83	8.0	6.0	220	86	200
UL	MD224D-05EI	24	21.6 - 26.4	104	10	±5.0	±200	±20.0	12.0	100	80	200
UL	MD224D-09EI	24	21.6 - 26.4	99	10	±9.0	±111	±11.0	9.0	100	84	200
UL	MD224D-12EI	24	21.6 - 26.4	99	10	±12.0	±83	±8.0	8.0	100	84	200
UL	MD224D-15EI	24	21.6 - 26.4	99	10	±15.0	±67	±7.0	7.0	100	84	200

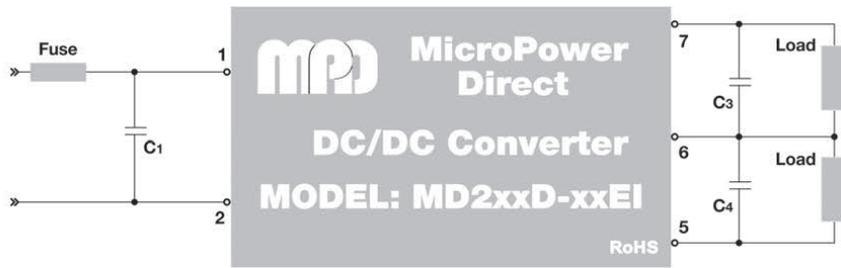
Notes:

1. Units that are marked with the "UL" in the model selection table above are approved to EN 60950.
2. Output capacitive load is specified for each output.
3. Output load regulation is specified for a load change of 10% to 100%.
4. When measuring output ripple, it is recommended that an external 1 µF ceramic capacitor & 10 µF electrolytic capacitor be placed in parallel from the +VOUT pin to the -VOUT pin for single output models, or from each output to common for dual output models.
5. Units with limited short circuit protection must be restarted after a fault.
6. The 24 VIN models have a typical isolation capacitance of 50 pF.
7. Operation at no load will not damage these units, however, they may not meet all specifications.
8. It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

Derating Curve



Simple Connection

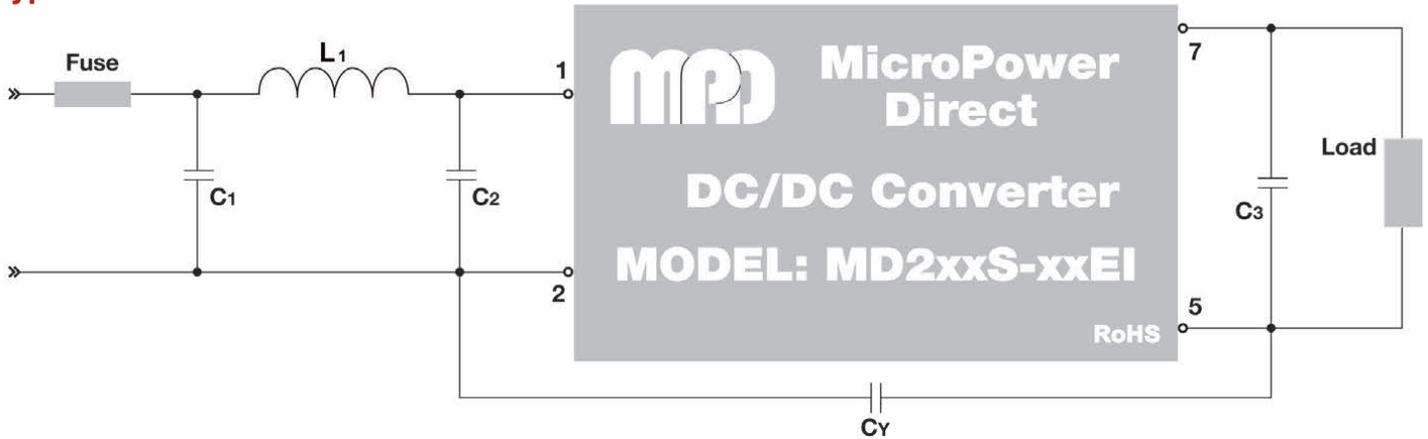


V _{IN}	C ₁
5 VDC	4.7 μF/50V
12 VDC	2.2 μF/50V
15 VDC	2.2 μF/50V
24 VDC	1.0 μF/50V

V _{OUT}	C _{3/C4}
3.3 VDC	10 μF
5 VDC	10 μF
9 VDC	2.2 μF
12 VDC	2.2 μF
15 VDC	1.0 μF
18 VDC	1.0 μF
24 VDC	1.0 μF
±3.3 VDC	4.7 μF
±5 VDC	4.7 μF
±9 VDC	1.0 μF
±12 VDC	1.0 μF
±15 VDC	0.47 μF
±24 VDC	0.47 μF

The diagram above illustrates a simple connection of the MD200xEI series. For applications that do not require the circuit to meet EMI/EMC specifications, the capacitors C1, C3 and C4 will reduce input/output ripple and improve the converter stability over time and temperature. The recommended component values are given in the table at right.

Typical Connection



The diagram above illustrates a typical connection of the MD200xEI series for an application that requires compliance to EMI/EMC standards EN 55032 and EN 61000-4 (as specified on page 1). Some notes on these components are:

1. An external fuse is recommended to protect the unit in the event of a fault on the input line. A recommended value is given in model selection table on page 2.
2. The output filtering capacitor (C3) is a high frequency, low resistance electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage

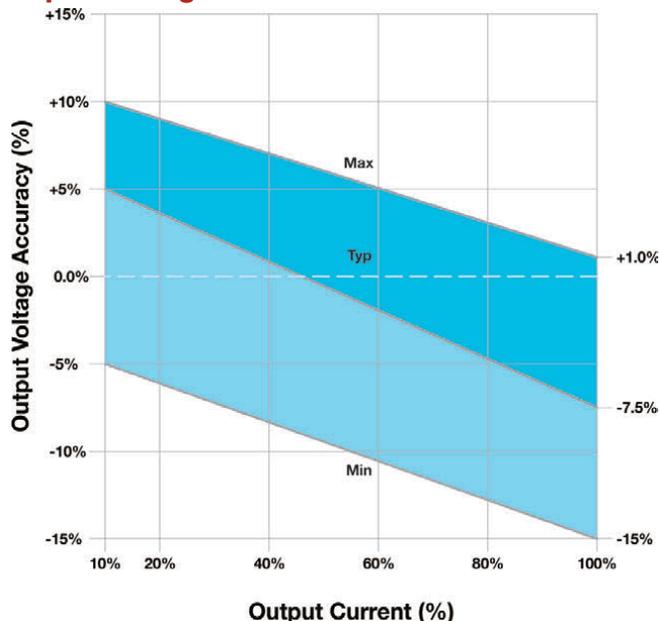
derating of capacitors should be 80% or above.

3. Suggested component values are:

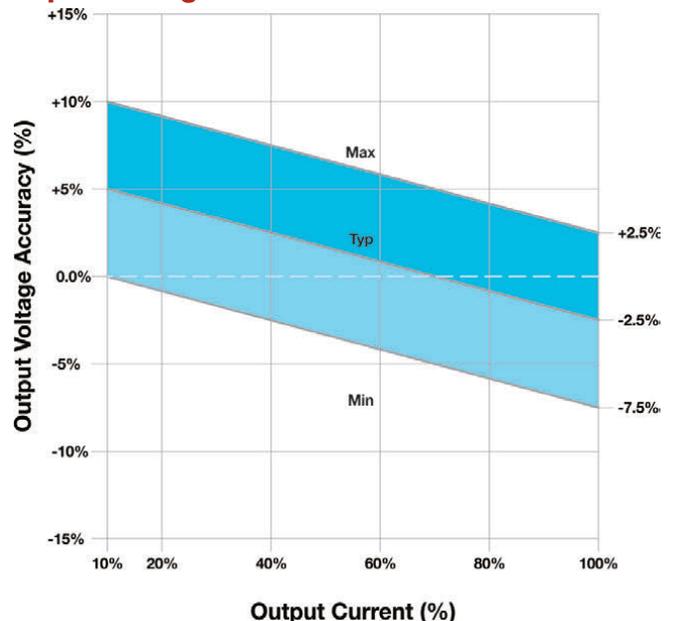
Component	V _{IN} : 5V, 12V, 15V	V _{IN} : 24V
C1	4.7 μF/50V	4.7 μF/50V
C2	4.7 μF/50V	4.7 μF/50V
L1	6.8 μH	6.8 μH
C3	See C3/C4 in Table Above	
CY	---	1 nF/3 kV

4. In many applications, simply adding input/output capacitors will enhance the input surge protection & and reduce output ripple sufficiently. In this case, capacitors C1, C3 and C4 could be connected as shown in the simple connection above, without the other filter components. Recommended capacitor values are given in the table above.

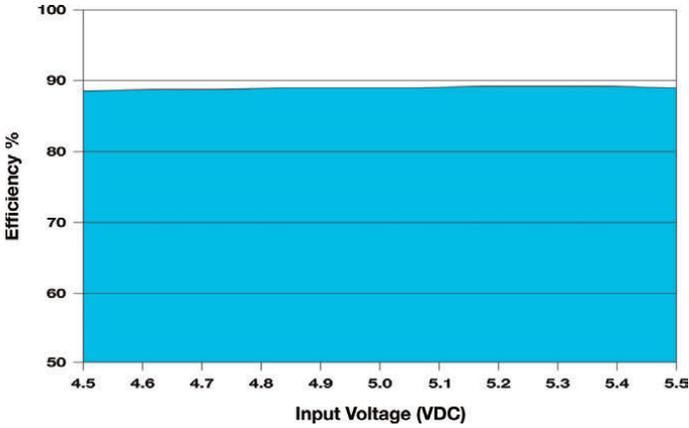
Output Voltage Tolerance: 3.3 V_{OUT} Models



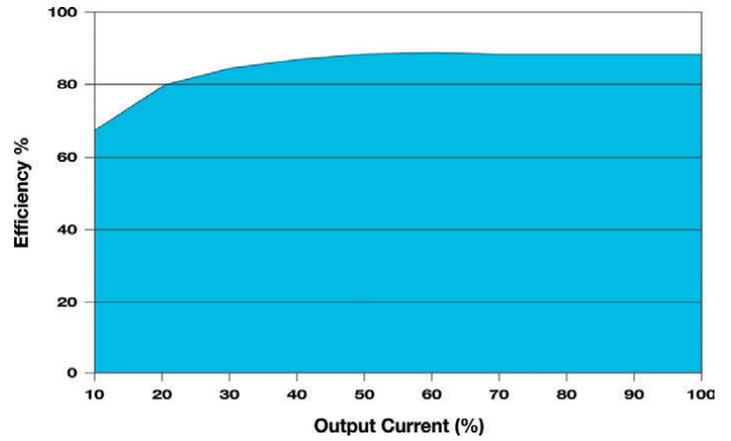
Output Voltage Tolerance: All Other Models



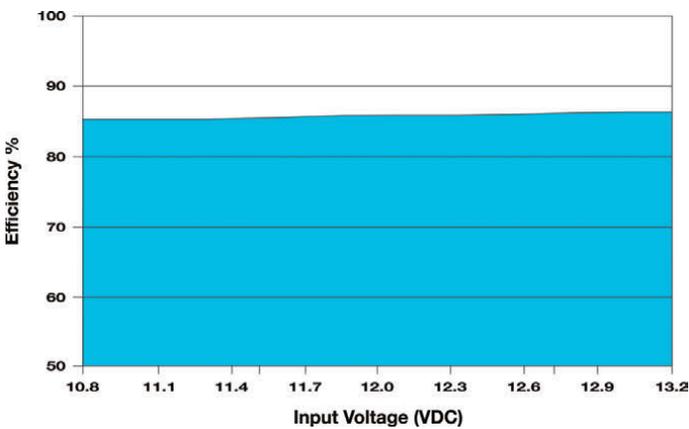
Efficiency vs Input Voltage (5VIN, Full Load)



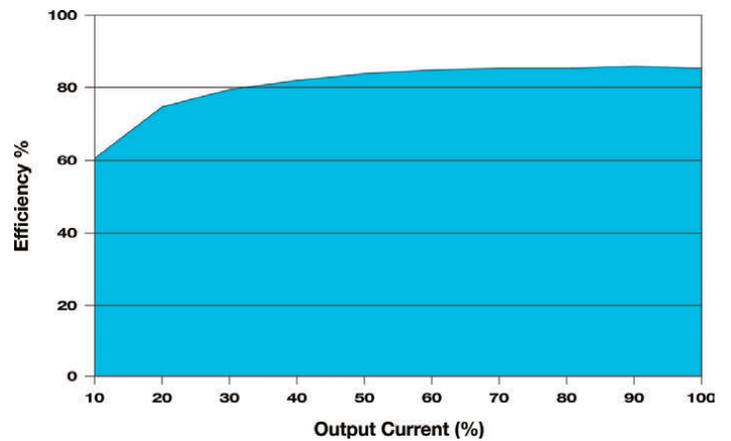
Efficiency vs Output Power (VIN = 5 VDC)



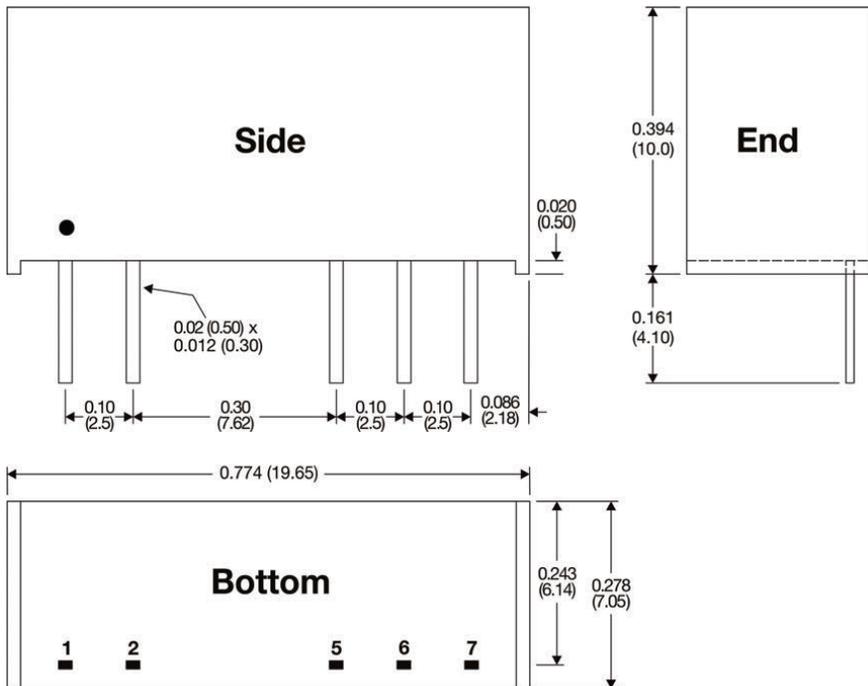
Efficiency vs Input Voltage (12VIN, Full Load)



Efficiency vs Output Power (VIN = 12 VDC)



Mechanical Dimensions



Pin Connections

Pin	Single	Dual
1	+VIN	+VIN
2	-VIN	-VIN
5	-VOUT	-VOUT
6	No Pin	Common
7	+VOUT	+VOUT

Notes:

- All dimensions are typical in inches (mm)
- Pin 1 is marked by a "dot" or indentation on the unit
- General Tolerance = ±0.01 (±0.25)
- Pin Tolerance = ±0.004 (±0.10)
- Recommended pin hole size (on the application PC Board) is Ø 0.039 (Ø1.00)
- Weight (Typ) = 0.08 Oz (2.4g)