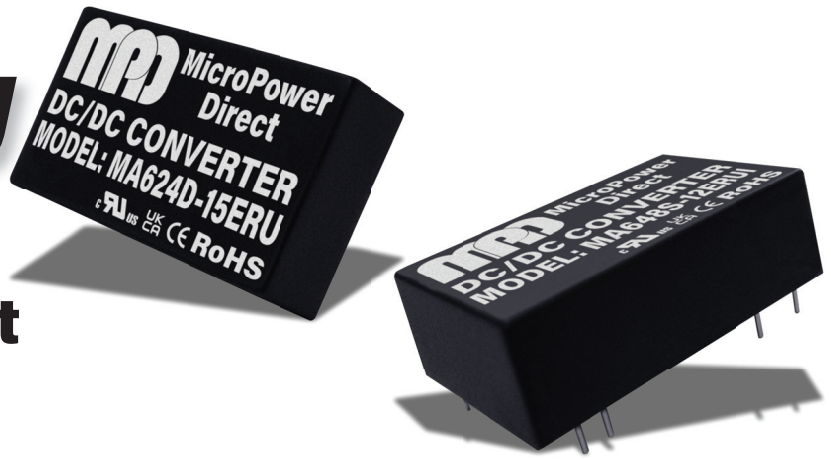


MA600ERU

4:1 Input, 6W DIP, Single & Dual Output DC/DC Converters



Key Features:

- 6W Output Power
- 4:1 Input Voltage Range
- EN 60950 Approved
- 1,500 VDC Isolation
- 17 Standard Models
- Efficiency to 88%
- Input Under Volt Protection
- Compact DIP Case
- Meets EN 55032
- Over Current Protection
- -40°C to +85°C Operation
- Industry Standard Pin-Out



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



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	24 VDC Input	9.0	24.0	36.0	VDC
	48 VDC Input	18.0	48.0	75.0	
Input Start Voltage	24 VDC Input			9.0	VDC
	48 VDC Input			18.0	
Under Voltage Shutdown	24 VDC Input	5.5	6.5		VDC
	48 VDC Input	12.0	15.5		
Input Filter	π (Pi) Filter				

Output Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	I _{OUT} = 5% to 100%		±1.0	±3.0	%
Output Voltage Balance	Dual Outputs, Balanced Loads		±0.5	±1.5	%
Line Regulation, See Note 2	+V _{OUT}		±0.2	±0.5	%
	-V _{OUT}		±0.5	±1.0	
Load Regulation, See Note 3	+V _{OUT}		±0.5	±1.0	%
	-V _{OUT}		±0.5	±1.5	
Cross Regulation	See Note 4			±5.0	%
Ripple & Noise (20 MHz)	See Note 5		85	120	mV P - P
Transient Recovery Time, See Note 6			300	500	μSec
Transient Response Deviation, See Note 6			±3.0	±5.0	%
Temperature Coefficient				±0.03	%/°C
Output Over Voltage Protection		110		160	%V _{OUT}
Output Over Current Protection	24 V _{OUT} Models	110	220	290	%I _{OUT}
	All Other Models	110	140	190	
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/0.1V		1,000		pF
Switching Frequency			300		kHz

Environmental Parameter	Conditions	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient	-40	+25	+85	°C
Storage Temperature Range		-55		+125	°C
Cooling	Free Air Convection				
Humidity	RH, Non-condensing			95	%

Physical Parameter	Conditions	Min.	Typ.	Max.	Units
Case Size	See Mechanical Diagram (Page 4)				
Case Material	Aluminum Alloy				
Weight	0.49 Oz (14g)				

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL HDBK 217F, 25°C, Gnd Benign	1.0			MHours
Safety Standards	UL/cUL 62368-1 recognition (UL certificate)				
Vibration	10-55 Hz, 10G, 30 Min along x,Y,Z Axis				

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	
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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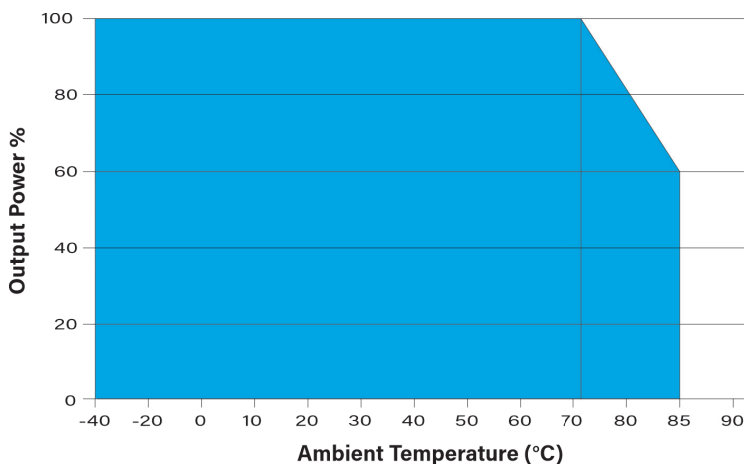
Model Selection Guide

Model Number	Input				Output			Efficiency (% Typ)	Reflected Ripple Current (mA Typ)	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							
MA624S-03ERU	24	9.0 - 36.0	316	7	3.3	1,500	0.0	79	20.0	1,800	1,600
MA624S-05ERU	24	9.0 - 36.0	301	7	5.0	1,200	0.0	83	20.0	1,000	1,600
MA624S-09ERU	24	9.0 - 36.0	297	7	9.0	667	0.0	84	20.0	1,000	1,600
MA624S-12ERU	24	9.0 - 36.0	287	7	12.0	500	0.0	87	20.0	470	1,600
MA624S-15ERU	24	9.0 - 36.0	284	7	15.0	400	0.0	88	20.0	220	1,600
MA624S-24ERU	24	9.0 - 36.0	287	7	24.0	250	0.0	87	20.0	100	1,600
MA624D-05ERU	24	9.0 - 36.0	301	7	±5.0	±600	± 0.0	83	20.0	680	1,600
MA624D-09ERU	24	9.0 - 36.0	291	7	±9.0	±333	± 0.0	86	20.0	220	1,600
MA624D-12ERU	24	9.0 - 36.0	287	7	±12.0	±250	± 0.0	87	20.0	330	1,600
MA624D-15ERU	24	9.0 - 36.0	287	7	±15.0	±200	± 0.0	88	20.0	220	1,600
MA624D-24ERU	24	9.0 - 36.0	287	7	±24.0	±125	± 0.0	87	20.0	100	1,600
MA648S-03ERU	48	18.0 - 75.0	156	3	3.3	1,500	0.0	80	20.0	1,800	800
MA648S-05ERU	48	18.0 - 75.0	149	3	5.0	1,200	0.0	84	20.0	1,000	800
MA648S-09ERU	48	18.0 - 75.0	148	3	9.0	667	0.0	85	20.0	680	800
MA648S-12ERU	48	18.0 - 75.0	144	3	12.0	500	0.0	87	20.0	470	800
MA648S-15ERU	48	18.0 - 75.0	142	3	15.0	400	0.0	88	20.0	220	800
MA648S-24ERU	48	18.0 - 75.0	144	3	24.0	250	0.0	87	20.0	100	800
MA648D-05ERU	48	18.0 - 75.0	150	3	±5.0	±600	0.0	83	20.0	680	800
MA648D-12ERU	48	18.0 - 75.0	144	3	±12.0	±250	0.0	88	20.0	330	800
MA648D-15ERU	48	18.0 - 75.0	144	3	±15.0	±200	0.0	87	20.0	220	800

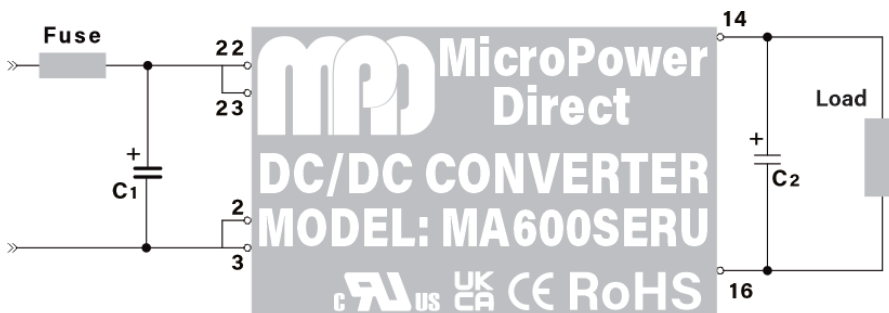
Notes:

1. The specified maximum capacitive load is for each output.
2. Line regulation is specified for $V_{IN} = MIN$ to MAX .
3. Load regulation is specified for $I_{OUT} = 5\%$ to 100% .
4. Cross regulation is measured with the $+V_{OUT}$ (pin 14) set to 50% load and the $-V_{OUT}$ (pin 16) varied from 10% to 100% load. The load on dual output models should not be unbalanced more than 5%. If the load unbalance is greater than 5%, the unit may not meet all specifications.
5. When measuring output ripple & noise, it is recommended that an external capacitor (1 µF to 10 µF) be placed from the $+V_{OUT}$ to the $-V_{OUT}$ pins for single output units and from each output to common for dual output models..
6. Transient recovery is measured to within a 1% error band for a load step change of 25%.
7. These units should not be operated with a load under 5% of full load. Operation at no-load will not damage the unit, but 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



Typical Connection



The diagram at left illustrates a typical connection of the MA600ERU series. Adding capacitors C1 and C2 could improve the stability of the converter over time & temperature and lower output ripple.

The recommended values for the capacitors are as follows:

Model	C1	C2
MA624-xxRU	100 µF	10 µF
MA648-xxRU	10 µF - 47 µF	10 µF

For applications that require filtering to EN 61000, see the EMI connection information on page 3.

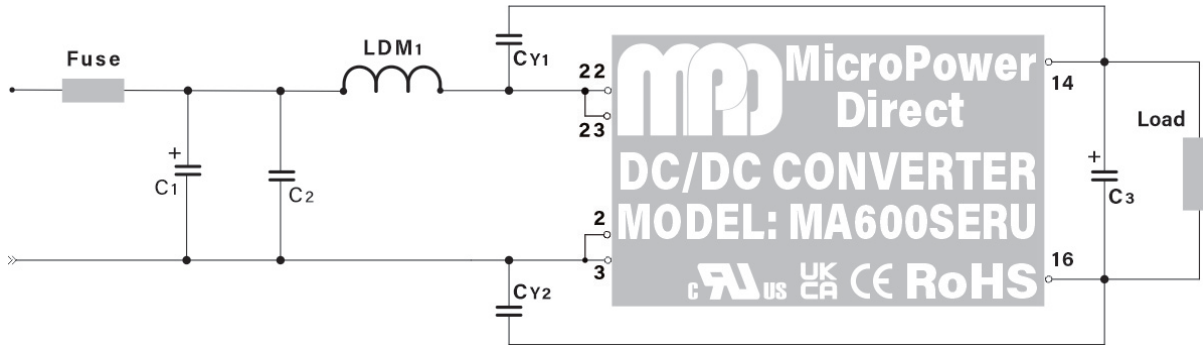
EMC Specifications

Parameter	Standard	Criteria	Level
Radiated Emissions, See Note 1	EN 55022		Class B
Conducted Emissions, See Note 1	EN 55022		Class B
ESD	EN 61000-4-2	B	±4 kV Contact
RS	EN 61000-4-3	A	10V/m
EFT, See Note 2	EN 61000-4-4	B	±2 kV
Surge, See Note 3	EN 61000-4-5	B	±2 kV
CS	EN 61000-4-6	A	3 Vrms
Voltage Dips	EN 61000-4-29	B	0% - 70%

Notes:

1. All units are rated for EN 55022 (CE/RE) Class A without external components. They will meet class B with the addition of a discrete filter circuit as shown in the typical EMI filter connection below. Contact the factory for more information this circuit or one of our filter/surge suppression modules.
2. To meet the requirements of EN 61000-4-4 (±2 kV) external components are needed, as shown in the typical EMI filter connection below. Contact the factory for more information this circuit or one of our filter/surge suppression modules.
3. To meet the requirements of EN 61000-4-5 (±2 kV), external components are needed. This can be done discretely as shown in the typical EMI filter connection below. Contact the factory for more information.

EMI Connection



The diagram above illustrates a typical connection of the MA600ERU series for applications that require meeting EMC standards. The units do not require external components to operate as specified. Some notes on this diagram (starting with the input circuit) are:

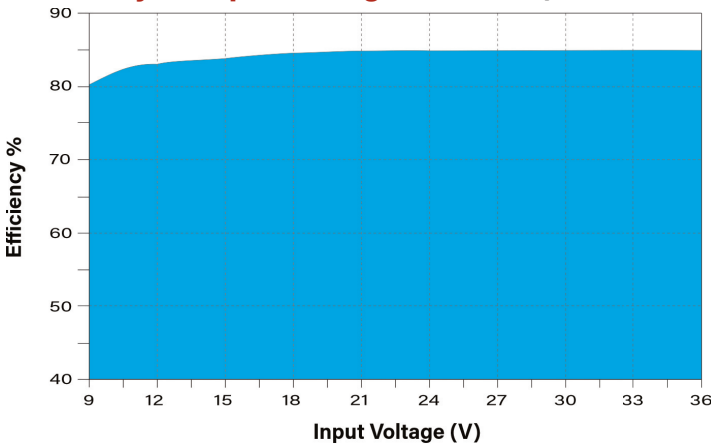
1. It is recommended that an external fuse be used. The recommended fuse is shown in the model chart on page 2.
3. The output filtering capacitor (C3) is a low ESR electrolytic capacitor. Care must be taken in choosing this capacitor not to exceed the capacitive load specification for the unit. Voltage derating of capacitors should be 80% or above.

5. Recommended values for components are:

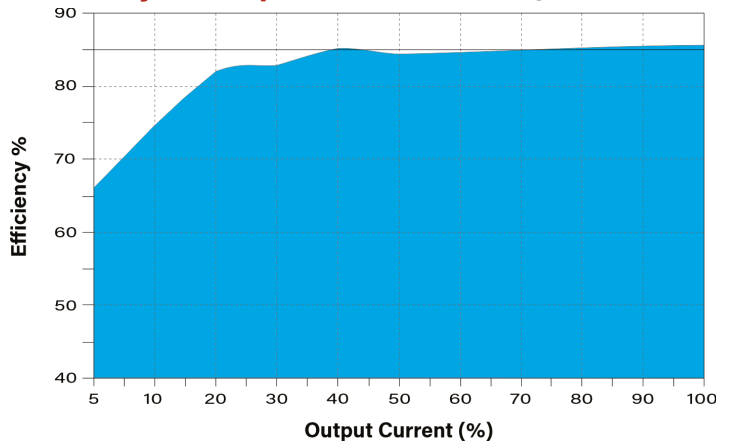
Component	24 V _{IN}	48 V _{IN}
Fuse	1,600 mA	800 mA
C1	330 µF/50V	330 µF/100V
C2	1.0 µF/50V	1.0 µF/100V
LDM1	4.7 µH	4.7 µH
CY1	1 nF/2 kV	1 nF/2 kV
CY2	1 nF/2 kV	1 nF/2 kV
C3	10 µF	10 µF

4. In many applications simply adding input/output capacitors will enhance the input surge protection and reduce output ripple sufficiently. See the Typical application at the bottom of page 2 for more information.

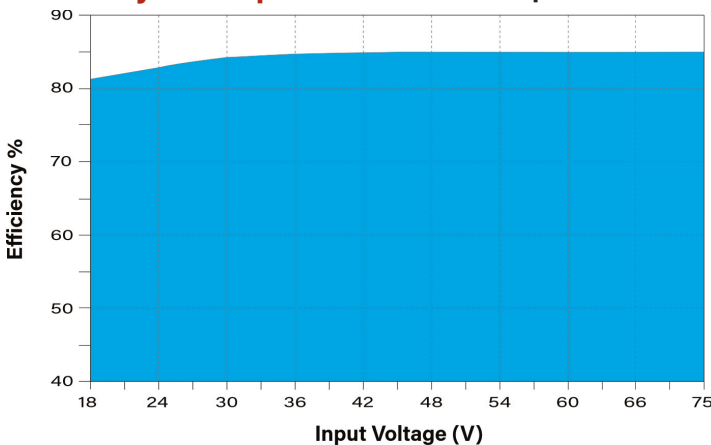
Efficiency vs Input Voltage: 24 VDC Input



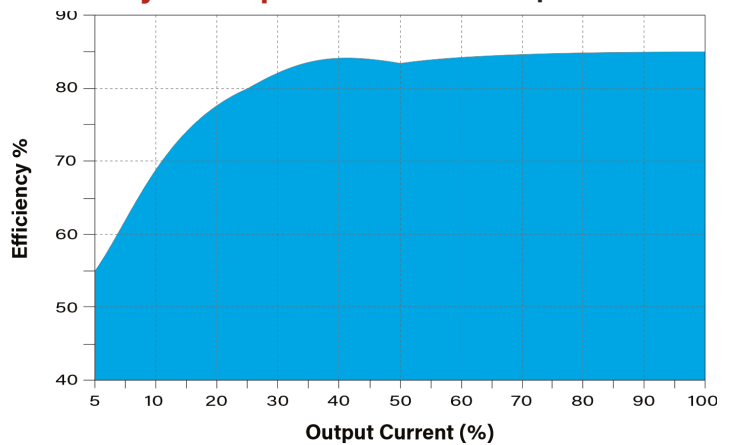
Efficiency vs Output Load: 24 VDC Input



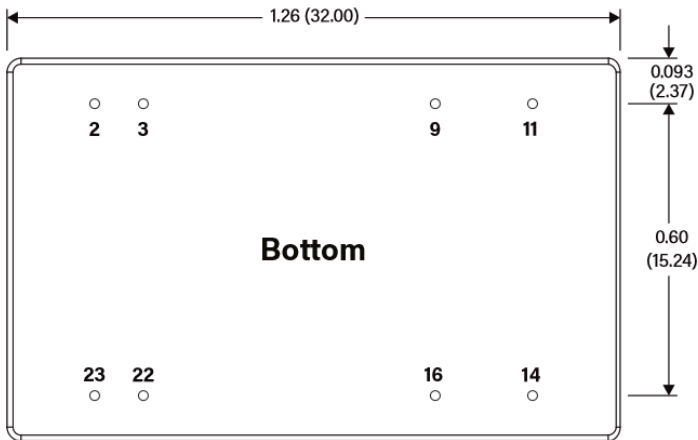
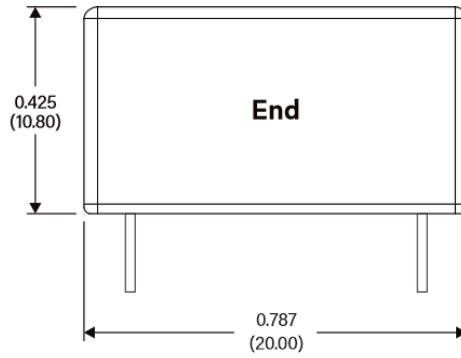
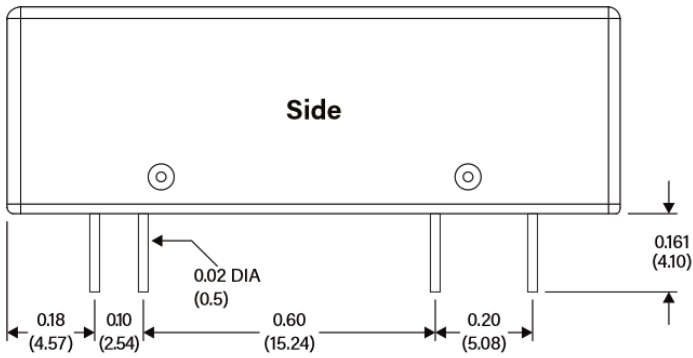
Efficiency vs Output Load: 24 VDC Input



Efficiency vs Output Load: 48 VDC Input



Mechanical Dimensions



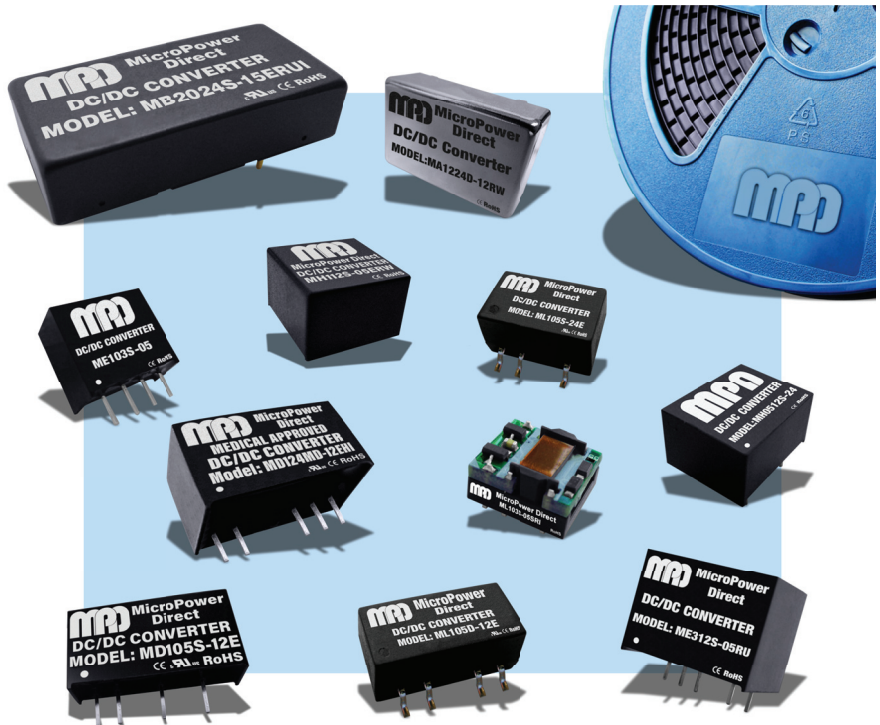
Pin Connections

Pin	Single Output	Pin	Dual Output
2	-VIN	2	-VIN
3	-VIN	3	-VIN
9	No Pin	9	Common
11	No Connection	11	-VOUT
14	+VOUT	14	+VOUT
16	-VOUT	16	Common
22	+VIN	22	+VIN
23	+VIN	23	+VIN

Notes:

- All dimensions are typical in inches (mm)
- Pin 2 is marked by a "dot" or indentation on the unit
- General Tolerance = ± 0.02 (± 0.50)
- Pin Tolerance = ± 0.004 (± 0.10)
- Recommended pin hole size (on the application PC Board) is $\varnothing 0.039$ ($\varnothing 1.00$)
- Weight (Typ) = 0.423 Oz (12.0g)

MPD offers a very wide variety of DC/DC converters. Our standard product line includes SMT, SIP, and DIP potted modules, industry standard 1 x 1" & 1 x 2" modules, as well as new models in an ultra miniature DFN package. Our units are used in applications ranging from high speed gate drive circuits to instrumentation to industrial equipment and medical equipment/instrumentation. Units are available over a power range of 0.25 to 60W. Most models meet international EMC/EMI standards and many are fully approved to EN 62368. Call today, or go to our website to find the right DC/DC power module for your application.



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