MI4000BRU

40W, Miniature 1"x 1" Case, Ultrawide 4:1 Input Range DC/DC Converters

Key Features:

- 40W Output Power
- Miniature 1"x1" Case
- Ultrawide 4:1 Input Range
- -40°C to +105°C Temp
- 1500 VDC Isolation
- Efficiency to 92%
- Short Circuit Protection
- Over Voltage Protection
- Over Current Protection
- Industry Standard Pin-Out

CE

RoHS

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, See Note 3	24 VDC Input	9	24	36	VDC
	48 VDC Input	18	48	75	
Input Start Voltage	24 VDC Input			9	VDC
	48 VDC Input			18	
Input Under Voltage Protection	24 VDC Input	5.5	7.5		VDC
	48 VDC Input	12	15.5		
Reflected Ripple Current	Rated Input Voltage		60		mA
Input Filter			PI Filter		

Output

Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage Accuracy	5% - 100% Load		±1.0	±3.0	%
Line Regulation	Vin = Min. to Max. @ Full Load		±0.2	±0.5	
Load Regulation	5%-100% Load		±0.5	±1.0	%
Ripple & Noise, See Note 2	20 MHz bandwidth, 5%-100% load		100	200	mVp-p
Transient Recovery Time	25% Load step change		300	500	µs
Transient Response Deviation			±5	±8	%
Temperature Coefficient	Full load		±0.01	±0.02	%/°C
Over Load Protection		110	140		%Io
Output Short Circuit	Continuous, self-recovery				
Over Voltage Protection		110	140		%VOUT

General

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	60 seconds, leakage current < 1 mA	1500			VDC
Isolation Resistance	500 VDC	1000			MΩ
Isolation Capacitance	100 KHz / 0.1V		2000		pF
Switching Frequency	Full load, nominal Vin		330		kHz

Environmental

Parameter	Conditions	Min.	Typ	Max.	Units
Operating Temperature Range	See Fig 1 & 2	-40		+105	°C
Storage Temperature Range		-50		+125	°C
Cooling	Free Air Convection				
Humidity, See Note 7	Non condensing			95	%RH

Physical

Case Size	1.0 x 1.0 x 0.4724 in (See mechanical diagrams on page 5)
Case Material	Aluminum alloy
Weight	0.74Oz (21.0g)

Reliability Specifications

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL-HDBK-217F@25°C	1.0			MHours
Lead Temperature	1.5mm from case for 10 seconds			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			Full Load Efficiency (%, Typ)	Reflected Ripple Current (mA, Typ)	Capacitive Load (µF, Max) (See Note 2&6)	Fuse Rating Slow-Blow (mA) (See Note 1)
	Voltage (VDC)		Current (mA)		Voltage (VDC)	Current (mA, Max)	Current (mA, Min)				
	Nominal	Range	Full-Load (Typ)	No-Load							
MI4024S-03BRU	24	9 - 36	1894	60	3.3	10000	0	89	60	10000	10000
MI4024S-05BRU	24	9 - 36	1852	60	5	8000	0	91	60	10000	10000
MI4024S-12BRU	24	9 - 36	1852	12	12	3333	0	91	60	2700	10000
MI4024S-15BRU	24	9 - 36	1852	12	15	2667	0	92	60	1680	10000
MI4024S-24BRU	24	9 - 36	1852	12	24	1667	0	91	60	680	10000
MI4048S-03BRU	48	18 - 75	958	60	3.3	8000	0	89	60	10000	5000
MI4048S-05BRU	48	18 - 75	926	60	5	8000	0	91	60	10000	5000
MI4048S-12BRU	48	18 - 75	926	12	12	3333	0	92	60	2700	5000
MI4048S-15BRU	48	18 - 75	926	12	15	2667	0	92	60	1680	5000
MI4048S-24BRU	48	18 - 75	926	12	24	1667	0	91	60	680	5000
MI4048S-28BRU	48	18 - 75	926	12	28	1428	0	91	60	680	5000

Notes:

1. It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection Guide.
2. All DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 7. Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values Cin and Cout and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.
3. The input voltage should not exceed the specified range value, otherwise it may cause permanent and irreparable damage.
4. It is recommended to use at a load of over 5%. If the load is below 5%, the ripple index of the product may exceed the specifications, but it does not affect the reliability of the product.
5. The maximum capacitive load is tested within the input voltage range and under full load conditions.
6. Unless otherwise specified, all indicators in this manual are measured at Ta=25 °C, humidity<75% RH, nominal input voltage, and output rated load.
7. Product specifications are subject to change without prior notice.

Temperature Derating 24VIN, 3.3/5 VOUT

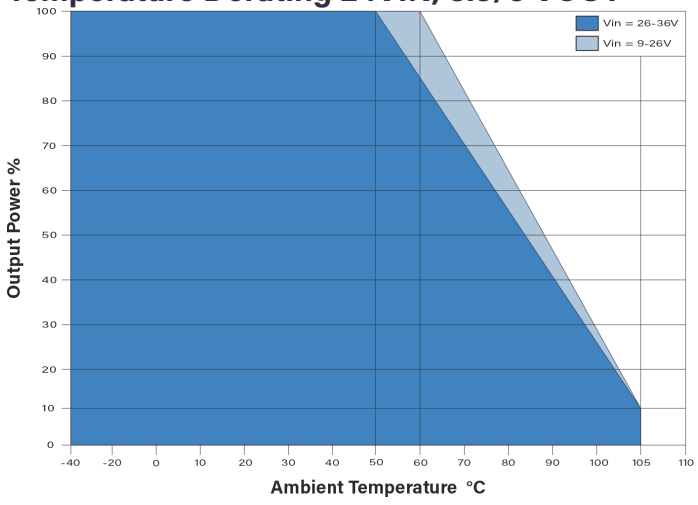


Fig. 1

Temperature Derating 24VIN, 12/24 VOUT

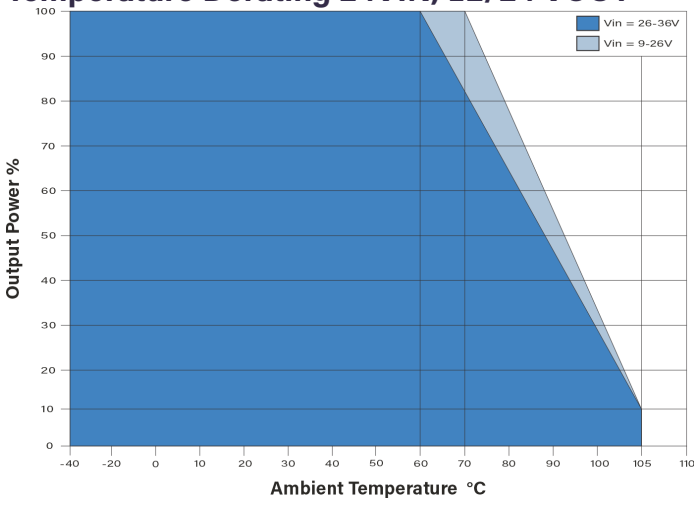


Fig. 2

Temperature Derating 48VIN, 3.3/5 VOUT

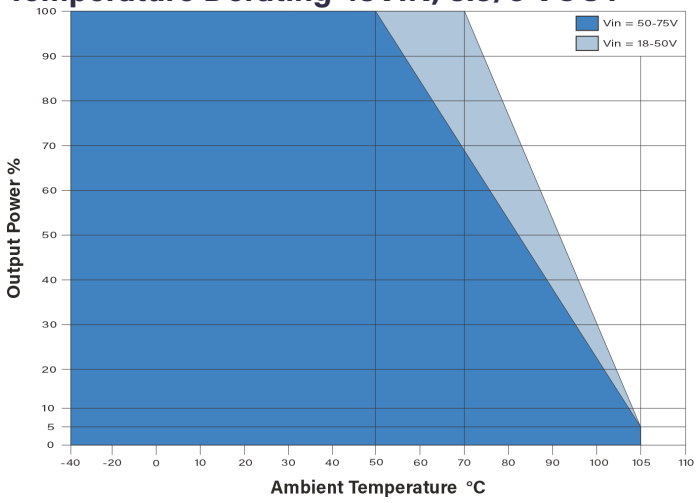


Fig. 3

Temperature Derating 48VIN, 12/15 VOUT

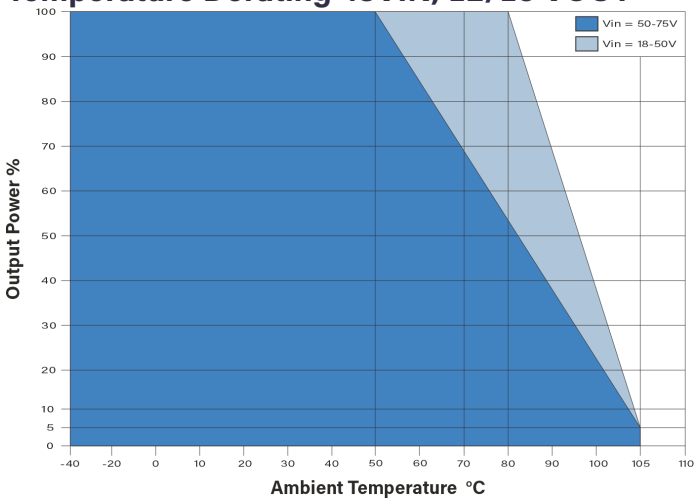


Fig. 4

Load vs VIN: 24VIN Models

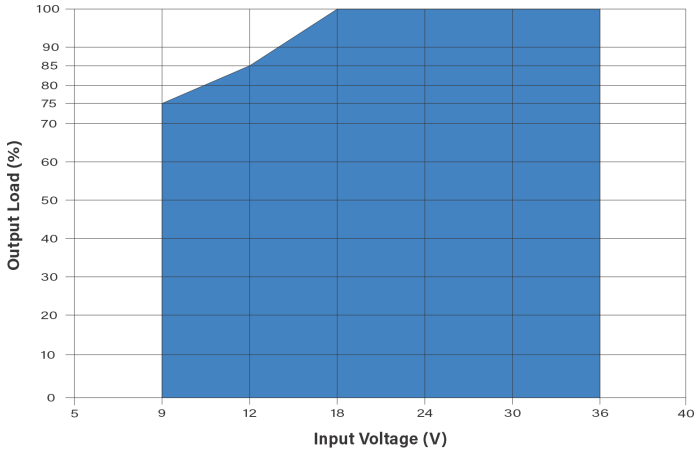


Fig. 5

Load vs VIN: 48VIN Models

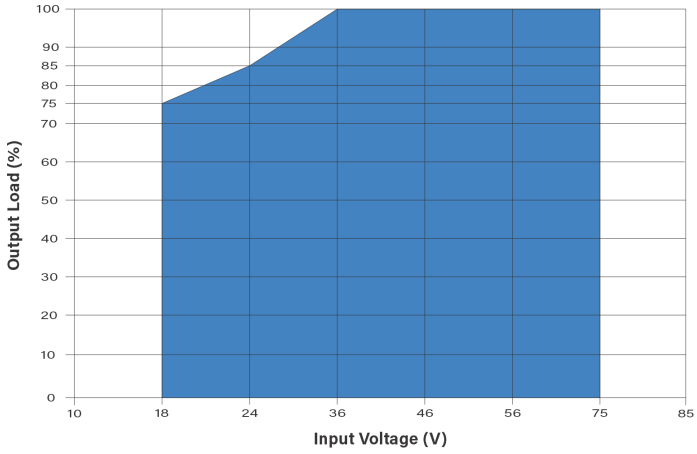


Fig. 6

Application Circuits

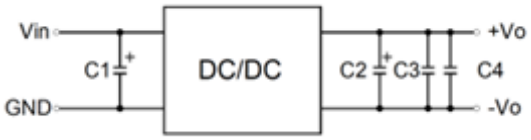


Fig. 7

Recommended Component Parameters				
Vin(VDC)	C1 (uF)	C2 (uF)	C3 (uF)	C4 (uF)
24	100	470	10	0.1
48			22	10

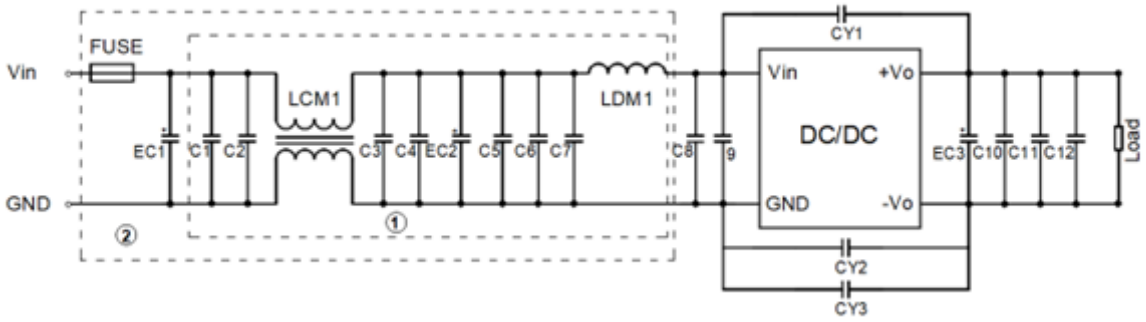
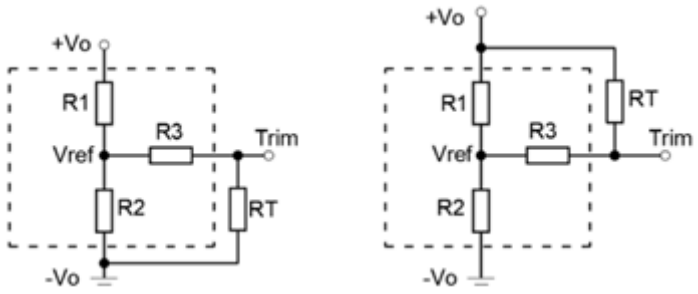


Fig. 8

EMI Recommended Component Parameters												
Vin(VDC)	**FUSE**	**CEC1 (uF)**	**EC2 (uF)**	**C1, C2, C3, C4, C5 (uF)**	**LCM1 (mH)**	**LDM1 (uH)**	**C8, C9 (uF)**	**CY2 (pF)**	**CY1, CY3 (pF)**	**EC3 (uF)**	**C10 (uF)**	**C11, C12 (uF)**
24V	Select for Application	1000	220	4.7	0.32	2.2	-	222	2200	470	10	1
48V		680	100	4.7	10	6.8	4.7	102	2200	470	22	10



Trim Up **Trim Down**

Trim resistor connections (dashed line shows internal resistor network)

Fig. 9

Trim Recommended component parameters				
Vout(V)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	10	6.064	13.622	1.24
5	2.4	2.344	13.622	2.5
12	8.2	2.153	17.346	2.5
15	12	2.388	21.016	2.5
24	10	1.158	10.714	2.5
28	10	0.979	13.04	2.5

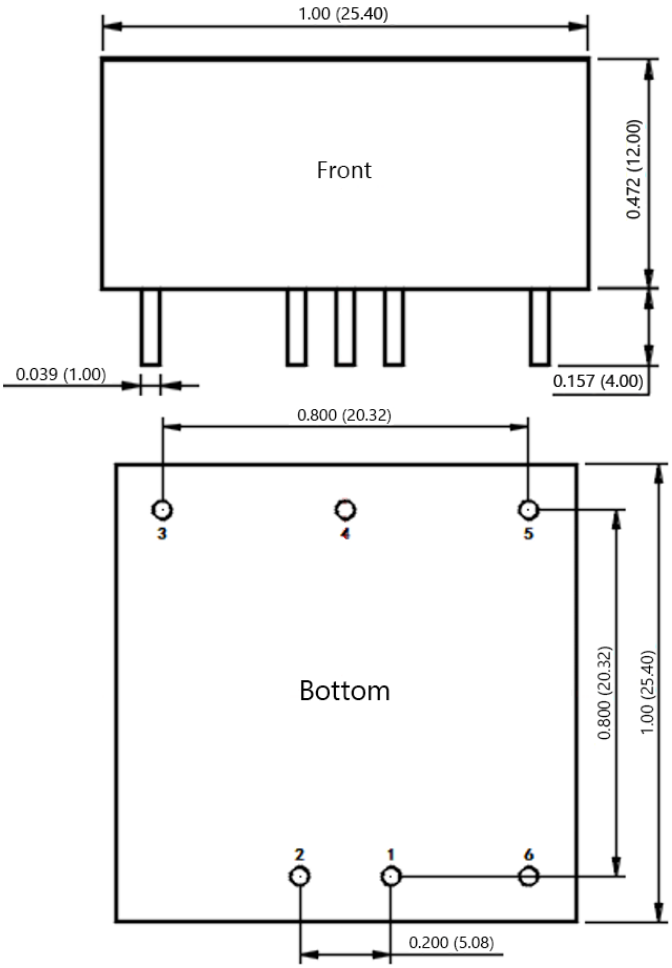
Up: $Rt=\frac{nR2}{R2-n}-R3$ $n=\frac{Vref}{Vo-Vref}*R1$

Up: $Rt=\frac{nR1}{R1-n}-R3$ $n=\frac{Vo-Vref}{Vref}*R2$

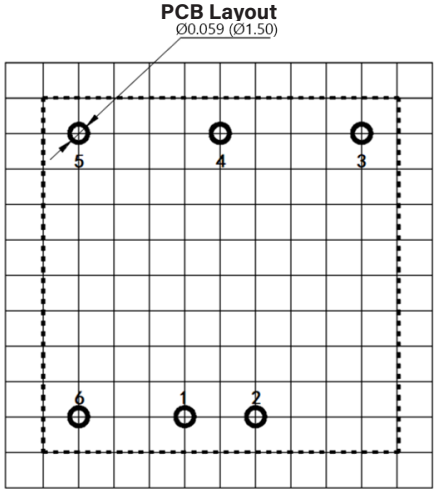
EMI Characteristics

Parameter	Standard	Criteria	Level
Radiated Emissions	CISPR32/EN 55032		Class B
Conducted Emissions	CISPR32/EN 55032		Class B
ESD	IEC/EN 61000-4-2	B	±6 kV Contact, ±8 kV Air
RS	IEC/EN 61000-4-3	A	10V/m
EFT	IEC/EN 61000-4-4	B	±2 kV (Recommended circuit diagram 8)
Input Voltage Surge	IEC/EN61000-4-5	B	±1 kV line to line (Recommended circuit diagram 8)
CS	IEC/EN 61000-4-6	A	3.Vr.m.s

Mechanical Dimensions



PCB Layout



The grid distance is 2.54 x 2.54 mm

Pin Definition Table

Pin	Single
1	GND
2	Vin
3	+Vo
4	Trim
5	-Vo
6	CTRL

Note:
Unit: inches(mm)
Pin section tolerances: ±0.004 (±0.10)
General tolerances: ±0.020 (±0.50)

Control Pin Conditions

Item	Operating Conditions	Min.	Typ.	Max.	Units
Ctrl	Turn off moduel	Connected GND or (0-1.2V)			
	Turn on moduel	Not Connected or (3.5-12V)			
	Input current when off	--	5	8	mA