

MA40H Series

40W, Encapsulated DIP2"x1" Package DC/DC Converters



Features

- Rated power: 40W Max
- Input voltage 40...160VDC
- Regulated output with 10% trimming range
- High efficiency up to 91%
- Isolation voltage 3KVDC
- Low ripple and noise
- Remote On/Off control
- Operating temperature range: -40 ~ +85°C ambient
- RoHS compliant
- Standard 2"x1" package
- Six-sided metal shielding package
- Under voltage, over voltage, over current, and short circuit protection
- Meet EN/IEC 62368-1, EN50155 standards
- Designed for railway apps
- 3 year warranty



Overview

MA40H series are 2"x1" package DC/DC converters specially designed for railway applications. The series meet EN50155 Europe railway standard and IEC/EN62368 industrial standards. They are input under voltage protected, output over voltage, over current, and short circuit protected, 500Khrs minimum MTBF, highly reliable, and ideally suitable for the railway applications.

Model Numbers

Model Number	Input Voltage [VDC]			V _{OUT} [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
	Nom.	Range	*Max.		Max.	Min.		
MA40H-033	110	40-160	170	3.3	10000	0	87	10000
MA40H-050	110	40-160	170	5	8000	0	88	10000
MA40H-120	110	40-160	170	12	3333	0	91	2700
MA40H-150	110	40-160	170	15	2667	0	91	1680
MA40H-240	110	40-160	170	24	1667	0	89	680
MA40H-480	110	40-160	170	48	833	0	89	470

* Input voltage exceed the Max. value may cause permanent damage.

* Only typical models are listed. Other models may be available upon request.

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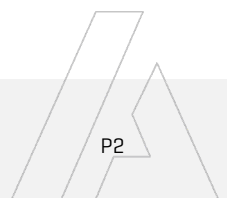


Electrical Specifications

Unless otherwise indicated, specifications are measured at $T_A=25^{\circ}\text{C}$, nominal input voltage, full load after warm up.

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Input current Full load	$V_{OUT}=3.3\text{V}$ Others	-	345 413	-	mA	
Input current No load	$V_{OUT}=3.3\text{V}$ Others		5 3	-	mA	
Reflected ripple current		-	25	-	mA	
Input voltage surge 1 second max		-0.7	-	180	VDC	
Startup input voltage	Full load	-	-	40	VDC	
Startup time	Resistive load	-	20	-	mS	
Input under voltage shutdown		28	32	-	VDC	
Remote On/Off control "Ctrl" pin open or logic high [ON] "Ctrl" pin grounded or logic low [OFF]	Logic high Logic low Ctrl pin current	3.5 0 -	- - 2	12 1.2 10	VDC VDC mA	Positive Logic
Output voltage accuracy	$I_{OUT}=5\%$ to 100%	-	± 1	± 3	%	
Line regulation Full load, $V_{IN}=V_{IN, Min}$ to $V_{IN, Max}$		-	± 0.4	± 1.0	%	
Load regulation $I_{OUT}=5\%$ to 100% of $I_{OUT, rated}$		-	± 0.5	± 1.0	%	
Output ripple and noise 20MHz bandwidth, peak to peak		-	150	200	mVp-p	
Temperature efficiency	Full load	-	-	0.03	%/ $^{\circ}\text{C}$	
Dynamic load response $I_{OUT}=25\%\sim 50\%\sim 75\%$ of $I_{OUT, rated}$	Peak deviation* Peak deviation Recovery time	-	± 5 ± 3 300	± 8 ± 5 500	% V_{OUT} % V_{OUT} μS	* $V_{OUT}=3.3, 5\text{V}$
Output voltage trim	Trim range	-	-	± 10	% V_{OUT}	
Output over voltage protection		110	-	160	% V_{OUT}	
Output over current protection		110	140	190	% I_{OUT}	
Output short circuit protection		Continuous, automatic recovery				
Input filter		PI filter				
Hot plug		None				

* Operating with less than 5% of rated load will not cause damage to the converters, but the performances data may not fall into the specifications, and stable operating is not assured.



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General Specifications

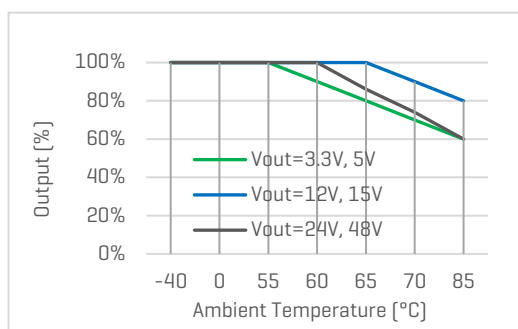
Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Isolation voltage 1 minute, leakage current 1mA max.	I/P to O/P	3000	-	-	VDC	
Isolation resistance Tested at 500VDC	I/P to O/P	1000	-	-	M ohm	
Isolation capacitance 100KHz, 0.1V	I/P to O/P	-	2200	3000	pF	
Switching frequency*	Full load	-	220	-	KHz	PWM mode
Operating temperature	See "Derating Curve"	-40	-	85	°C	
Storage temperature		-55	-	125	°C	
Storage humidity	None condensing	5	-	95	%RH	
Pin soldering resistance 1.5mm away from case for 10 sec		-	-	300	°C	
Vibration		IEC/EN61373 – Category 1, Grade B				
Cooling method		Free air convection				
Case material		Aluminum alloy				
MTBF	MIL-HDBK-217F	>500,000 Hours, T _A =25°C				
Design based on standards		EN/IEC 62368-1, EN50155				
Safety certifications		EN/IEC 62368-1				
EMC		CISPR32, EN55032 Class B, IEC/EN61000-4-2, 3, 4, 5, 6 EN50155, IEC/EN50121-3-2, EN55016-2-1				
Size, and Weight		50.8 x 25.4 x 12 mm, 41g				

* Switching frequency is measured at full load. The converter reduces the switching frequency at low load [less than 50% load] for better efficiency.

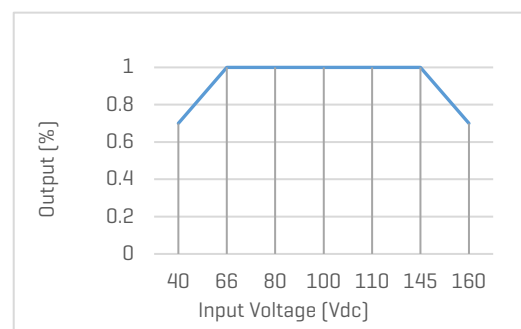
Characteristic Curves

Derating Curve

Output vs Ambient Temperature



Output vs Input Voltage



Recommended Application Circuit

Typical External Circuit

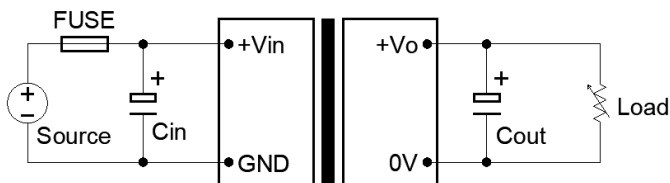


Figure 1. Typical external circuit

Note

*Typical application circuit is to further lower the input and output ripple. It is not required for general use.

*Recommended component specifications are typical values. Excessive external capacitive load may cause startup problem.

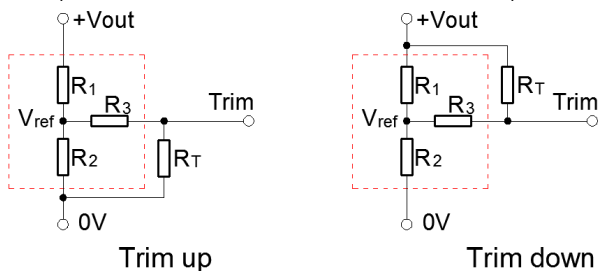
[Table 1] Recommended component spec

V _{OUT}	3.3, 5V	12, 15V	24, 48V
C _{OUT}	470uF, 50V	220uF, 50V	100uF, 100V

*Recommended FUSE to be 2A slow blow, and C_{IN} to be 100uF, 100V

Circuits for Output Trim

* Components within the red block are internal components of the converter.



* The formulas to calculate the desired resistance of Trim resistor "RT".

$$\text{Trim up: } R_T = \frac{a R_2}{R_2 - a} - R_3 \quad a = \frac{V_{ref}}{V_{OUT} - V_{ref}} R_1$$

$$\text{Trim down: } R_T = \frac{a R_1}{R_1 - a} - R_3 \quad a = \frac{V_{OUT} - V_{ref}}{V_{ref}} R_2$$

[Table 3] Internal Component Spec

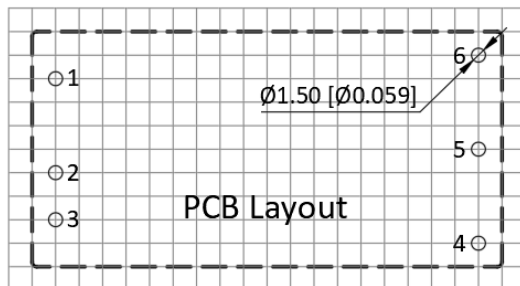
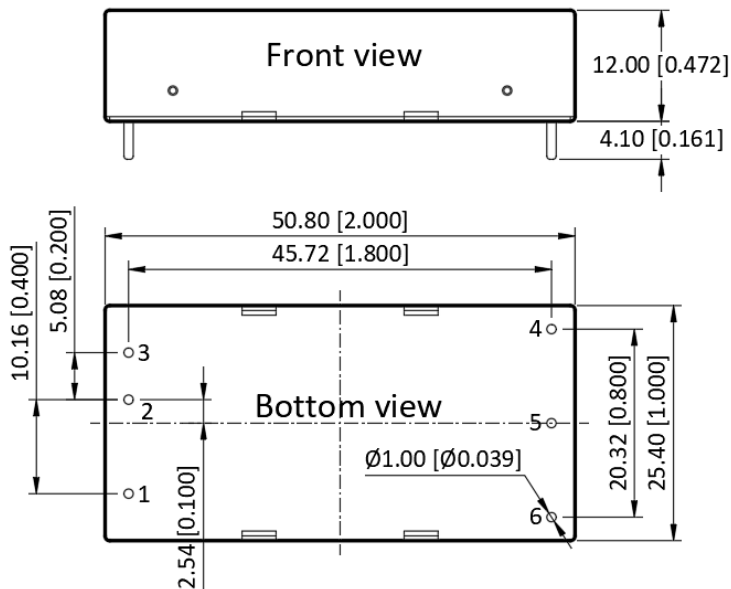
V _{OUT} [V]	R1 [K Ohm]	R2 [K Ohm]	R3 [K Ohm]	V _{ref} [V]
3.3	4.801	2.87	10	1.24
5	2.883	2.87	10	2.5
12	11.000	2.87	15	2.5
15	14.384	2.87	15	2.5
24	24.872	2.87	17.8	2.5
48	55.28	3.0	20	2.5

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Mechanical Specifications



Pin Definition

Pin #	Single Out
1	Ctrl
2	GND
3	V _{IN}
4	+V _{OUT}
5	0V
6	Trim

* Unless otherwise specified unit: mm [inch]

* General tolerance: ± 0.50 [± 0.020]

* Pin thickness: ± 0.10 [± 0.004]

* Footprint grid 2.54 x 2.54 mm

