

# MU40H Series

40W, Wide 4:1 Input, 1.5KV Isolation, DIP2"x1" DC/DC Converters



## Features

- Rated power: 40W Max
- Input voltage range 4:1
- Regulated output with 10% trimming range
- High efficiency up to 93%
- Isolation voltage 1.5KVDC
- Remote On/Off control
- Operating temperature range: -40 ~ +80°C ambient
- RoHS compliant
- Standard 2"x1" package
- Six-sided metal shielding package
- Under voltage, over voltage, over current, and short circuit protection
- Meet UL/EN/IEC 62368-1
- 3 year warranty



## Overview

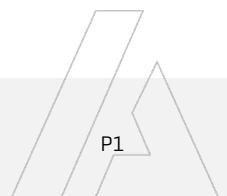
The MU40H series are 1.5KV isolated 40Watt DC/DC converters with standard DIP2"x1" footprint. Designed with high efficiency, they operate in a wide temperature range from -40°C to +80°C. Other features include wide 4:1 input voltage range, remote on/off control, under voltage, over voltage, over current, and short circuit protections. These converters are ideally suitable for industrial control system, measurement equipment, telecom, wireless network.

## Model Numbers

Model Number	Input Voltage [VDC]			V <sub>OUT</sub> [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
	Nom.	Range	*Max.		Max.	Min.		
MU40H-2405	24	9~36	40	5	8000	0	91	15000
MU40H-2409	24	9~36	40	9	4444	0	91	4700
MU40H-2412	24	9~36	40	12	3333	0	92	3000
MU40H-2415	24	9~36	40	15	2666	0	93	2200
MU40H-2424	24	9~36	40	24	1666	0	92	1300
MU40H-2412D	24	9~36	40	±12	±1666	0	87	1000
MU40H-2415D	24	9~36	40	±15	±1333	0	87	680
MU40H-2424D	24	9~36	40	±24	±833	0	87	470
MU40H-4805	48	18~75	80	5	8000	0	91	15000
MU40H-4812	48	18~75	80	12	3333	0	92	3000
MU40H-4815	48	18~75	80	15	2666	0	93	2200
MU40H-4824	48	18~75	80	24	1666	0	92	1300
MU40H-4812D	48	18~75	80	±12	±1666	0	87	1000
MU40H-4815D	48	18~75	80	±15	±1333	0	87	680
MU40H-4824D	48	18~75	80	±24	±833	0	87	470

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

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



# MU40H Series

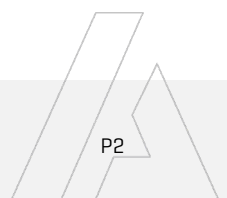
40W, Wide 4:1 Input, 1.5KV Isolation, DIP2"X1" DC/DC Converters



## 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
<b>Input current</b> Full load, $V_{IN, Nom}=24\text{V}$	$V_{OUT}=5\text{V}$ Others	-	1894 1852	-	mA	
<b>Input current</b> Full load, $V_{IN, Nom}=48\text{V}$			926	-	mA	
<b>Input current</b> No load			12	-	mA	
<b>Reflected ripple current</b>		-	40	-	mA	
<b>Input voltage surge</b> 1 second max	$V_{IN, Nom}=24\text{V}$ $V_{IN, Nom}=48\text{V}$	-0.7 -0.7	-	50 100	VDC	
<b>Startup input voltage</b>	$V_{IN, Nom}=24\text{V}$ $V_{IN, Nom}=48\text{V}$	-	-	9 18	VDC	
<b>Startup time</b>	Resistive load	-	10	-	mS	
<b>Input under voltage shutdown</b>	$V_{IN, Nom}=24\text{V}$ $V_{IN, Nom}=48\text{V}$	5.5 12	6.5 15.5	-	VDC	
<b>Remote On/Off control</b> "Ctrl" pin open or logic high [ON] "Ctrl" pin grounded or logic low [OFF]	Logic high Logic low Ctrl pin current	3.5 0 -	- - 5	12 1.2 10	VDC VDC mA	Positive Logic
<b>Output voltage accuracy</b>	$I_{OUT}=5\%$ to $100\%$	-	$\pm 1$	$\pm 3$	%	
<b>Line regulation</b> Full load, $V_{IN}=V_{IN, Min}$ to $V_{IN, Max}$		-	$\pm 0.2$	$\pm 0.5$	%	
<b>Load regulation</b> $I_{OUT}=5\%$ to $100\%$ of $I_{OUT, rated}$		-	$\pm 0.5$	$\pm 1.0$	%	
<b>Cross regulation</b> $+I_{OUT}=50\%$ , $-I_{OUT}=10\%$ to $100\%$	Dual output models	-	-	$\pm 5$	%	
<b>Output ripple and noise</b> 20MHz bandwidth, peak to peak		-	100	200	mVp-p	
<b>Temperature coefficient</b>	Full load	-	-	0.03	%/ $^{\circ}\text{C}$	
<b>Dynamic load response</b> $I_{OUT}=25\%\sim 50\%\sim 75\%$ of $I_{OUT, rated}$	Peak deviation Recovery time	-	$\pm 5$ 250	$\pm 8$ 500	% $V_{OUT}$ $\mu\text{S}$	
<b>Output voltage trim</b>	Trim range	-	-	$\pm 10$	% $V_{OUT}$	



# MU40H Series

40W, Wide 4:1 Input, 1.5KV Isolation, DIP2"X1" DC/DC Converters



## Electrical Specifications [continued]

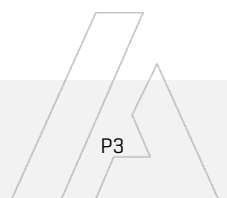
Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Output over voltage protection		110	-	160	% V <sub>OUT</sub>	
Output over current protection		110	140	-	% I <sub>OUT</sub>	
Output short circuit protection		Continuous, automatic recovery				
Input filter		PI filter				
Hot plug		None				

\* 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.

## General Specifications

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Isolation voltage 1 minute, leakage current 1mA max.	I/P to O/P	1500	-	-	VDC	
Isolation resistance Tested at 500VDC	I/P to O/P	1000	-	-	M ohm	
Isolation capacitance 100KHz, 0.1V	I/P to O/P	-	2000	-	pF	
Switching frequency*	Full load	-	330	-	KHz	PWM mode
Operating temperature	See "Derating Curve"	-40	-	80	°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	>1,000,000 Hours, T <sub>A</sub> =25°C				
Design based on standards		UL/EN/IEC 62368-1				
Safety certifications		EN/IEC 62368-1				
EMC		CISPR32, EN55032 Class B with external circuit IEC/EN61000-4-2, 3, 4, 5, 6				
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.



# MU40H Series

40W, Wide 4:1 Input, 1.5KV Isolation, DIP2"x1" DC/DC Converters

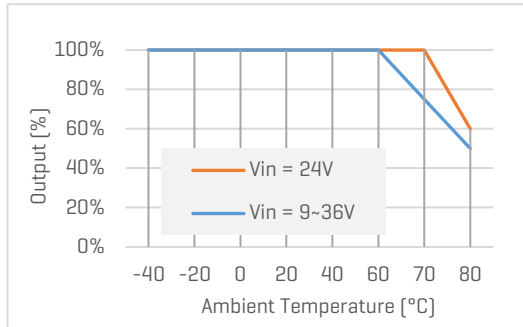


## Characteristic Curves

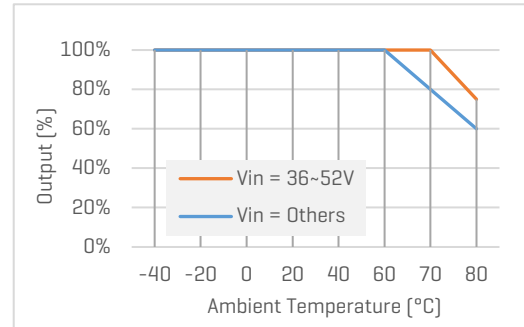
### Derating Curve

#### Output vs Ambient Temperature

MU40H-24xx, No heatsink



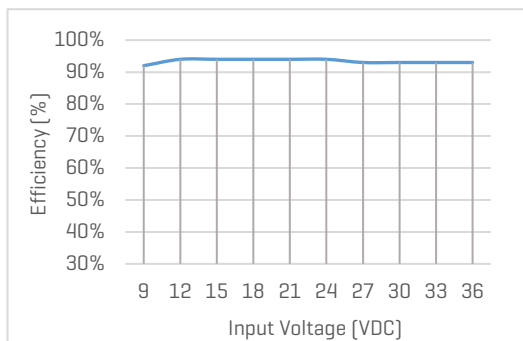
MU40H-48xx, No heatsink



### Efficiency Curve

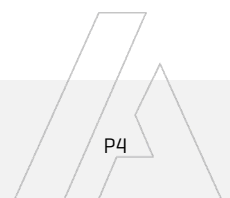
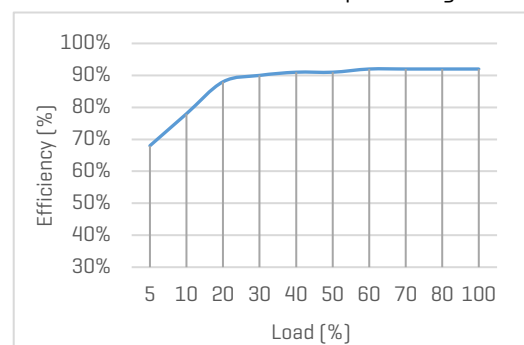
#### Efficiency vs Input Voltage

MU40H-2405, with full Load



#### Efficiency vs Load

MU40H-2405, with nominal input voltage



## Recommended Application Circuit

### Typical External Circuit

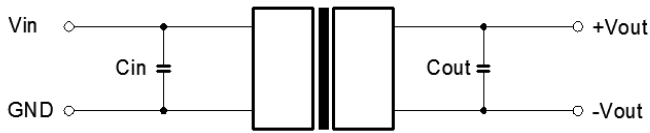


Figure 1. Typical external circuit

#### 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

Input voltage	24V	48V
$C_{IN}$	100uF, 50V	100uF, 100V

[Table 2] Recommended component spec

Output voltage	5 ... 15V	24V
$C_{OUT}$	100uF, 24V	47uF, 50V

### Circuit for EMC Enhancement

\*Use this application circuit to meet Class B EMC performance.

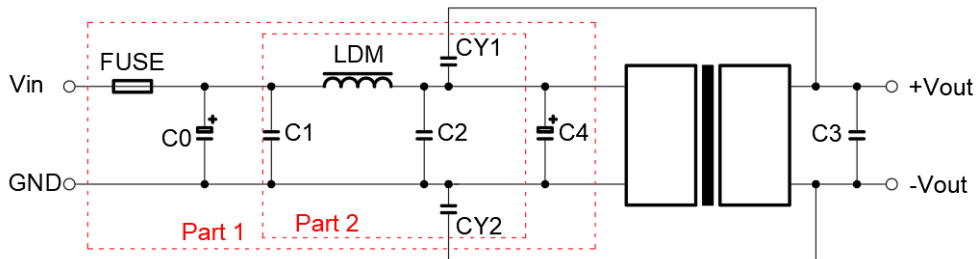


Figure 2. Circuit for EMC enhancement

[Table 3] Recommended component spec

Component	LDM	C0, C4	C1, C2	CY1, CY2
$V_{IN}=24V$	2.2uH, 4A	330uF, 50V	4.7uF, 50V	1nF, 2KV
$V_{IN}=48V$	2.2uH, 2A	330uF, 100V	4.7uF, 100V	1nF, 2KV

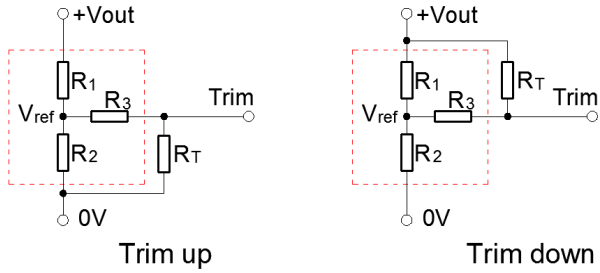
\* Fuse to be selected according to application needs.

\* C3 refer to relative  $C_{OUT}$  values in Table 2.

## Recommended Application Circuit [continued]

### Circuits for Output Trim

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



[Table 3] Internal Component Spec

V <sub>OUT</sub> [V]	R1 [K Ohm]	R2 [K Ohm]	R3 [K Ohm]	V <sub>ref</sub> [V]
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

\* The formulas to calculate the desired resistance of Trim resistor "R<sub>T</sub>".

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

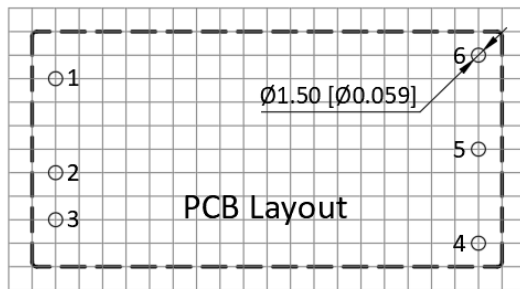
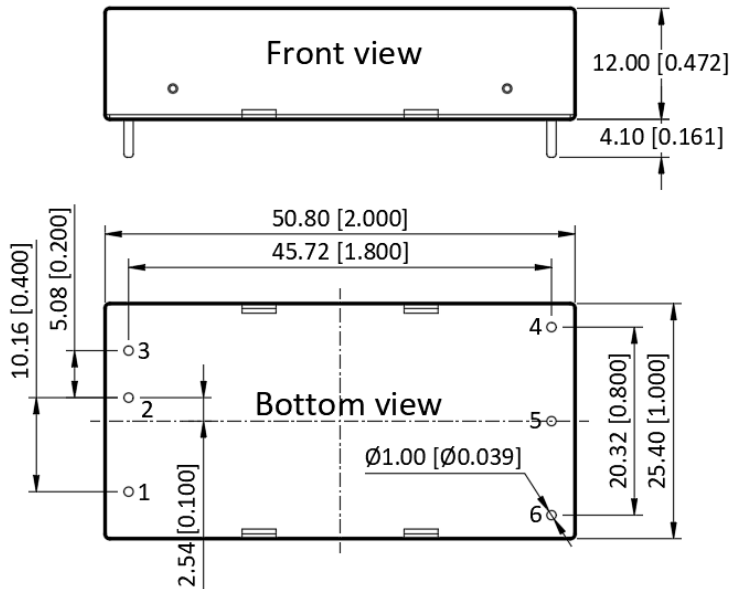
$$\text{Trim down: } R_T = \frac{a R_1}{R_1 - a} - R_3 \quad a = \frac{V_{OUT} - V_{ref}}{V_{ref}} R_2$$

# MU40H Series

40W, Wide 4:1 Input, 1.5KV Isolation, DIP2"X1" DC/DC Converters



## Mechanical Specifications



### Pin Definition

Pin #	Single Out	Dual Out
1	Ctrl	Ctrl
2	GND	GND
3	V <sub>IN</sub>	V <sub>IN</sub>
4	+V <sub>OUT</sub>	+V <sub>OUT</sub>
5	OV	COM
6	Trim	-V <sub>OUT</sub>

\* 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

