

MU6D Series

6W, Wide 4:1 Input Range, 1.5KV Isolation, DIP24 Package DC/DC Converters

Features

- ▶ Input voltage range 9~36Vdc, or 18~75Vdc
- ▶ Regulated single or dual output
- ▶ High efficiency up to 88%
- ▶ Standby power 0.12W only
- ▶ Isolation voltage 1.5KVdc
- ▶ Operating temperature range: -40 ~ +85°C ambient
- ▶ No external components required for operating
- ▶ RoHS compliant
- ▶ Six side metal shielding
- ▶ Industrial standard DIP24 package
- ▶ Full SMT structure inside
- ▶ Under voltage, over voltage, over current, and short circuit protection
- ▶ Certified to UL60950-1, IEC/EN60950-1
- ▶ 3 year warranty



Overview

The MU6D series are 1.5KV isolated 6Watt DC/DC converters with standard DIP24 footprint. Designed with high efficiency, they operate in a wide temperature range from -40°C to +85°C. Other features include wide 4:1 input voltage range, under voltage, over voltage, over current, and short circuit protections. These converters are ideally suitable for battery operated equipment, measurement equipment, telecom, wireless network, industrial control system, where isolated, tightly regulated voltages are desired.

Model Numbers

Model Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
			Min.	Max.		
MU6D-S2403	9~36	3.3	0	1500	79	1800
MU6D-S2405	9~36	5	0	1200	83	1000
MU6D-S2409	9~36	9	0	667	84	680
MU6D-S2412	9~36	12	0	500	87	470
MU6D-S2415	9~36	15	0	400	88	220
MU6D-S2424	9~36	24	0	250	87	100
MU6D-S4803	18~75	3.3	0	1500	80	1800
MU6D-S4805	18~75	5	0	1200	84	1000
MU6D-S4809	18~75	9	0	667	85	680
MU6D-S4812	18~75	12	0	500	87	470
MU6D-S4815	18~75	15	0	400	88	220
MU6D-S4824	18~75	24	0	250	87	100
MU6D-D2405	9~36	±5	0	±600	83	680
MU6D-D2409	9~36	±9	0	±333	86	220
MU6D-D2412	9~36	±12	0	±250	87	330

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Model Numbers (continued)

Model Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [μ F] Max.
			Min.	Max.		
MU6D-D2415	9~36	\pm 15	0	\pm 200	88	220
MU6D-D2424	9~36	\pm 24	0	\pm 125	87	100
MU6D-D4805	18~75	\pm 5	0	\pm 600	83	680
MU6D-D4812	18~75	\pm 12	0	\pm 250	87	330
MU6D-D4815	18~75	\pm 15	0	\pm 200	88	220

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

* Standard models in MU6D series are 1.5KV isolation single and dual outputs. See MU6D-K3 series for 3KV isolation models, and MU6D-K6 for 6KV isolation models.

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 voltage range	$V_{IN, Nom} = 24V$ $V_{IN, Nom} = 48V$	9 18	24 48	36 75	Vdc	
Input current No load	$V_{IN, Nom} = 24V$ $V_{IN, Nom} = 48V$	-	5 4	12 8	mA	
Input current Full load	$V_{IN, Nom} = 24V$ $V_{IN, Nom} = 48V$	-	301 148	309 154	mA	
Input reflected ripple current		-	20	-	mA	
Input voltage surge 1 second max	$V_{IN, Nom} = 24V$ $V_{IN, Nom} = 48V$	-0.7 -0.7	-	50 100	Vdc	
Startup input voltage	$V_{IN, Nom} = 24V$ $V_{IN, Nom} = 48V$	-	-	9 18	Vdc	
Output voltage accuracy		-	\pm 1	\pm 3	%	
Output voltage balance Dual output with balanced load		-	\pm 0.5	\pm 1.5	%	
Line regulation Full load, $V_{IN} = V_{IN, Min}$ to $V_{IN, Max}$	Main output Other output	-	\pm 0.2 \pm 0.5	\pm 0.5 \pm 1.0	%	
Load regulation $I_{OUT}=5\%$ to 100% of $I_{OUT, rated}$	Main output Other output	-	\pm 0.5 \pm 0.5	\pm 1.0 \pm 1.5	%	
Temperature coefficient	Full load	-	-	0.03	%/ $^\circ\text{C}$	
Output ripple and noise 20MHz bandwidth, peak to peak		-	60	85	mV	
Cross regulation Dual output, $I_{OUT, main}=50\%$ of $I_{OUT, rated}$, $I_{OUT, other}=10\%$ to 100% of $I_{OUT, rated}$		-	-	\pm 5	%	

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Electrical Specifications [continued]

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Dynamic load response $I_{OUT}=25\% \sim 50\% \sim 75\%$ of $I_{OUT, rated}$	Peak deviation**		± 5	± 8	% V_{OUT}	** $V_{OUT}=3.3V, 5V, \pm 5V$
	Peak deviation	-	± 3	± 5	% V_{OUT}	
	Recovery time		300	500	μS	
Input under voltage shutdown	$V_{IN, Nom} = 24V$	5.5	6.5	-	Vdc	
	$V_{IN, Nom} = 48V$	14.0	15.5	-	Vdc	
Output over voltage protection		100	-	160	% V_{OUT}	
Output over current protection		110	140	190	% I_{OUT}	
Output short circuit protection		Continuous, automatic recovery, hiccup				

* 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.	Input to output	1500	-	-	VDC	
Isolation resistance Tested at 500VDC, input to output		1000	-	-	M ohm	
Isolation capacitance 100KHz, 0.1V, input to output		-	1000	-	pF	
Switching frequency	Full load	-	300	-	KHz	PWM mode
Operating temperature	See "Derating Curve"	-40	-	+85	$^{\circ}C$	
Storage temperature		-55	-	+125	$^{\circ}C$	
Storage humidity	None condensing	5	-	95	%RH	
Case material		Aluminum alloy				
Soldering temperature	Wave soldering	300 $^{\circ}C$, 10 seconds				
Vibration		10Hz to 55Hz, 10G, 30 minutes along X, Y and Z axis				
MTBF	MIL-HDBK-217F	>1,000,000 Hours, $T_A=25^{\circ}C$				
Design based on standards		RoHS5 compliant, all materials meet UL94V-0, product designed to meet UL60950-1, IEC/EN60950-1, FCC, EN55022				
Safety certifications		UL60950-1, IEC/EN60950-1				
EMC		CISPR22, EN55022 Class B with external circuit, see "Figure 2" in Recommended External Circuit section [Class A, without external circuit]. IEC/EN61000-4-2, 3, 4, 5, 6, 29				
Size, and Weight		32.0 x 20.0 x 10.8 mm, 14g				

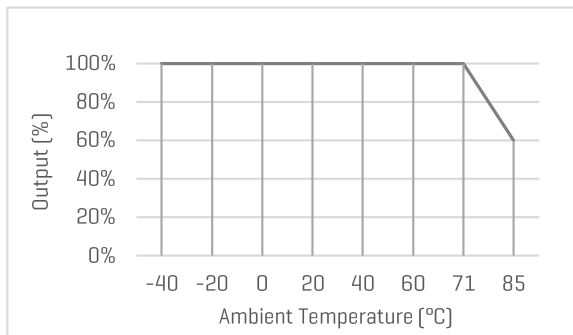
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Characteristic Curves

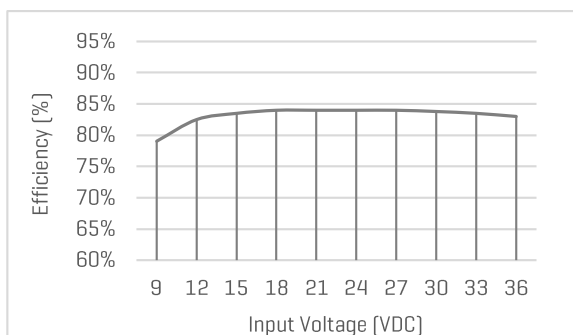
Derating Curve

Output vs Ambient Temperature



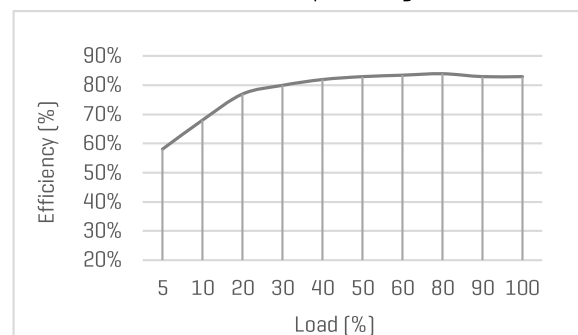
Efficiency vs Input Voltage

MU6D-S2405, with full Load



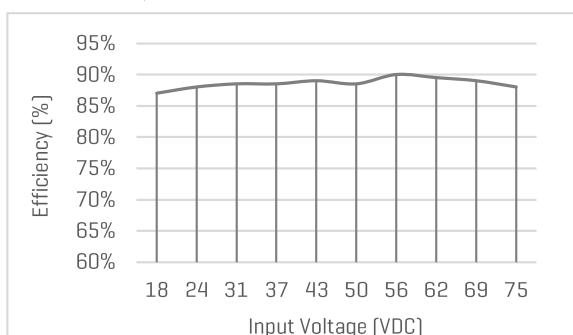
Efficiency vs Load

MU6D-S2405, with nominal input voltage



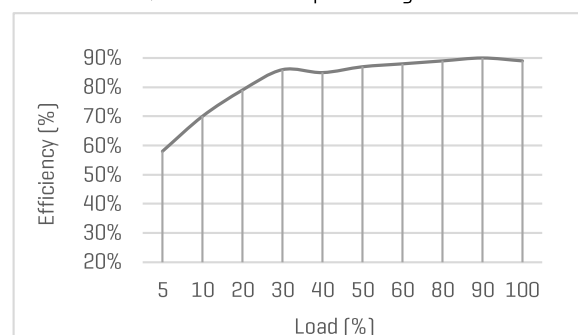
Efficiency vs Input Voltage

MU6D-D4815, with full Load



Efficiency vs Load

MU6D-D4815, with nominal input voltage



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Recommended Application Circuit

Typical External Circuit

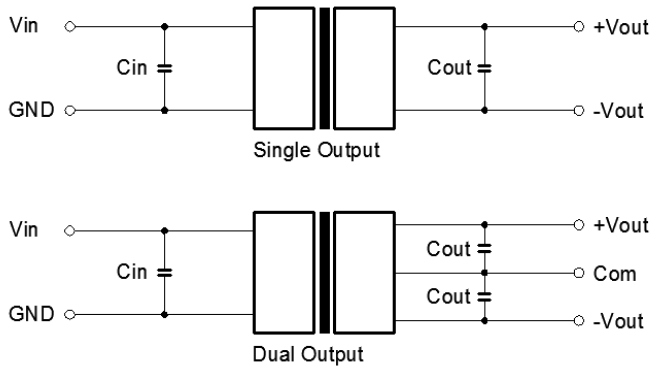


Figure 1. Typical external circuit

* Converters in this series are 100% tested with above circuit before delivery.

Recommended Component Spec

Input Voltage	Cin [μ F]	Cout [μ F]
24V nominal	100	10
48V nominal	10~47	10

Circuit for EMC Enhancement

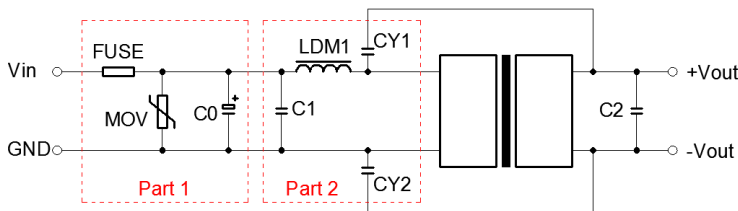


Figure 2. Recommended circuit diagram

Recommended Component Spec

Item	V _{IN} =24V	V _{IN} =48V
LDM1	4.7 μ H	4.7 μ H
MOV	S14K35	S14K60
C0	330 μ F, 50V	330 μ F, 100V
C1	1 μ F, 50V	1 μ F, 100V
CY1, CY2	1nF, 2KV	1nF, 2KV

* C2 spec refer to Cout in above Figure 1, FUSE to be selected according to application needs

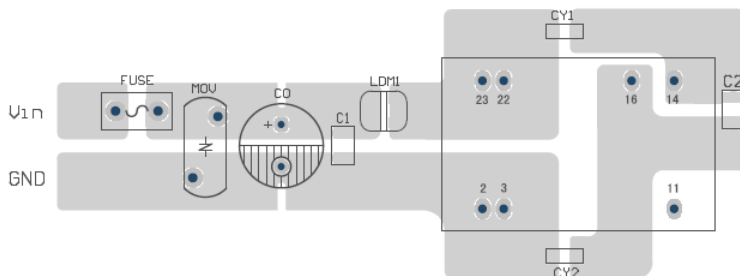


Figure 3. Recommended footprint

* External circuits within block "Part 1" is to improve EMS, and "Part 2" to improve EMI test performance.

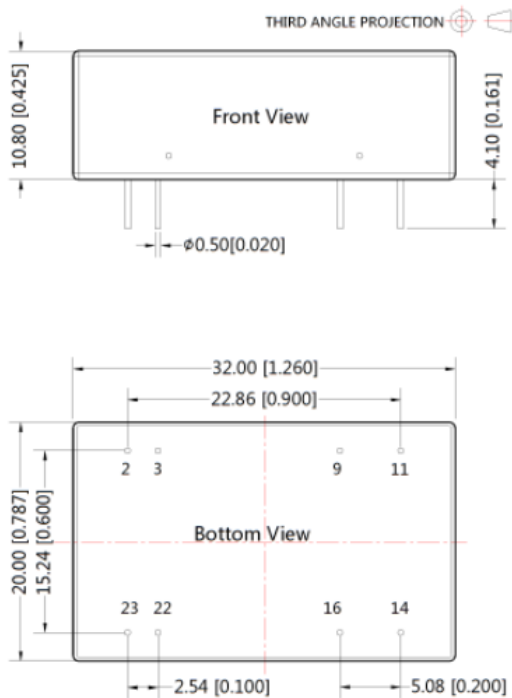
* Minimum clearance between input and output pads at CY1 and CY2 position is no less than 2mm.

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Mechanical Specifications

Default Package



Pin Definition

Pin #	Single Out	Dual Out
2, 3	GND	GND
9	No pin	COM
11	No connection	-V _{OUT}
14	+V _{OUT}	+V _{OUT}
16	OV	COM
22, 23	V _{IN}	V _{IN}

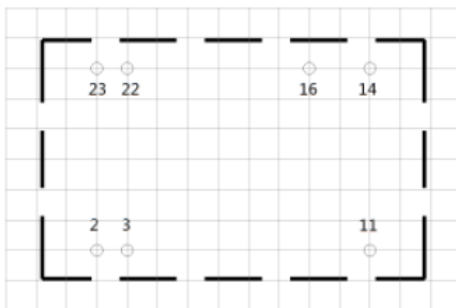
* Unless otherwise specified unit: mm [inch]

* General tolerance: ± 0.50 [± 0.020]

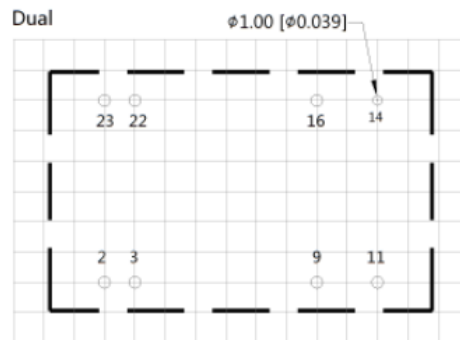
* Pin thickness: ± 0.10 [± 0.004]

* Footprint grid 2.54 x 2.54 mm

Single



Dual



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