

MU20G Series

20W, Wide 4:1 Input, 1.5KV Isolation, DIP1"x1" DC/DC Converters



Features

- Rated power: 20W Max
- Input voltage range 4:1
- Regulated single output
- High efficiency up to 91%
- Isolation voltage 1.5KVDC
- Remote On/Off control
- Output trimming $\pm 10\%$
- Operating temperature range: $-40 \sim +85^{\circ}\text{C}$ ambient
- RoHS compliant
- Compact 1"x1" package
- Under voltage, over voltage, over current, and short circuit protection
- Designed to meet UL/EN/IEC 62368-1
- 3 year warranty



Overview

The MU20G series are 1.5KV isolated 20Watt DC/DC converters with standard DIP1"x1" footprint. Designed with high efficiency, they operate in a wide temperature range from -40°C to $+85^{\circ}\text{C}$. Other features include wide 4:1 input voltage range, remote on/off control, output trimming, 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.

Model Numbers

Model Number	Input Voltage [VDC]			V _{OUT} [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
	Nom.	*Range	*Max.		Max.	Min.		
MU20G-2403	24	9-36	40	3.3	5000	0	88	10000
MU20G-2405	24	9-36	40	5	4000	0	90	10000
MU20G-2406	24	9-36	40	6	3333	0	89	10000
MU20G-2412	24	9-36	40	12	1667	0	90	1600
MU20G-2415	24	9-36	40	15	1333	0	91	1000
MU20G-2424	24	9-36	40	24	833	0	91	500
MU20G-2405D	24	9-36	40	± 5	± 2000	0	87	2000
MU20G-2412D	24	9-36	40	± 12	± 833	0	90	800
MU20G-2415D	24	9-36	40	± 15	± 667	0	90	600
MU20G-2424D	24	9-36	40	± 24	± 417	0	89	300
MU20G-4803	48	18-75	80	3.3	5000	0	88	10000
MU20G-4805	48	18-75	80	5	4000	0	90	10000
MU20G-4812	48	18-75	80	12	1667	0	91	1600
MU20G-4815	48	18-75	80	15	1333	0	91	1000
MU20G-4824	48	18-75	80	24	833	0	91	500

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Model Numbers [continued]

Model Number	Input Voltage [VDC]			V _{OUT} [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
	Nom.	*Range	*Max.		Max.	Min.		
MU20G-4805D	48	18-75	80	±5	±2000	0	86	2000
MU20G-4812D	48	18-75	80	±12	±833	0	90	800
MU20G-4815D	48	18-75	80	±15	±667	0	90	600
MU20G-4824D	48	18-75	80	±24	±417	0	90	300

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

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

* Add suffix "A" to the model numbers for "Ctrl" pin removed before delivery. E.g. MU20G-2405A

Electrical Specifications

Unless otherwise indicated, specifications are measured at T_A=25°C, nominal input voltage, full load after warm up.

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
Input current Full load	V _{IN, Nom} = 24V	-	920	-	mA	
	V _{IN, Nom} = 48V	-	460	-	mA	
Input current No load	V _{IN, Nom} = 24V	-	35	-	mA	
	V _{IN, Nom} = 48V	-	20	-	mA	
Reflected ripple current		-	30	-	mA	
Input voltage surge 1 second max	V _{IN, Nom} = 24V	-0.7	-	50	Vdc	
	V _{IN, Nom} = 48V	-0.7	-	100	Vdc	
Startup input voltage	V _{IN, Nom} = 24V	-	-	9	VDC	
	V _{IN, Nom} = 48V	-	-	18	VDC	
Input under voltage shutdown	V _{IN, Nom} = 24V	5.5	6.5	-	VDC	
	V _{IN, Nom} = 48V	12	15.5	-	VDC	
Startup time		-	10	-	mS	
Remote On/Off control "Ctrl" pin open or logic high [ON] "Ctrl" pin grounded or logic low [OFF]	Logic high	3.5	-	12	VDC	Positive Logic
	Logic low	0	-	1.2	VDC	
	Ctrl pin current	-	2	7	mA	
Output voltage accuracy	I _{OUT} =0 to 100%	-	±1	±3	%	
Line regulation Full load, V _{IN} = V _{IN, Min} to V _{IN, Max}	Main output	-	±0.2	±0.5	%	
	Other output	-	±0.5	±1.0	%	
Load regulation I _{OUT} =5% to 100% of I _{OUT, rated}		-	±0.5	±1.0	%	
Output ripple and noise 20MHz bandwidth	Single Out	-	50	100	mVp-p	
	Dual Out	-	100	200	mVp-p	
Cross regulation I _{OUT, main} =50% of I _{OUT, rated} , I _{OUT, other} =10% to 100% of I _{OUT, rated}	Dual output	-	-	±5	%	
Temperature coefficient	Full load	-	-	±0.03	%/°C	

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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}	**$V_{OUT}=3.3, 5, 6V$
	Peak deviation	-	± 3	± 5	% V_{OUT}	
	Recovery time		300	500	μS	
Output voltage trim	Trim range	-	-	± 10	% V_{OUT}	
Output over voltage protection		110	-	160	% V_{OUT}	
Output over current protection		110	150	200	% 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.

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	-	300	-	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	>1,000,000 Hours, $T_A=25^{\circ}C$				
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		25.4 x 25.4 x 12 mm, 21g				

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

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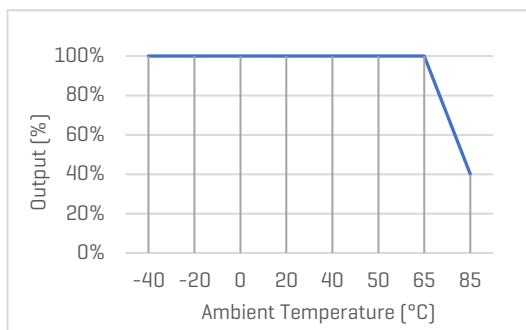


Characteristic Curves

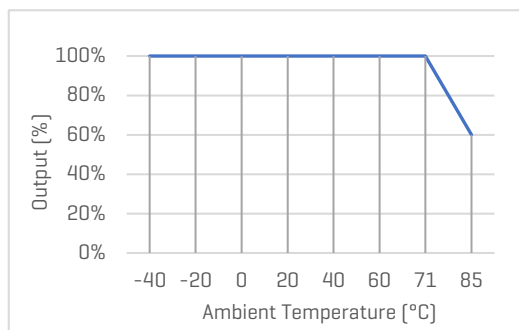
Derating Curve

Output vs Ambient Temperature

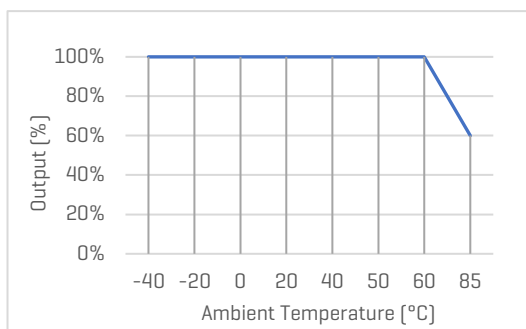
$V_{OUT}=3.3 \dots 6V$, no heatsink



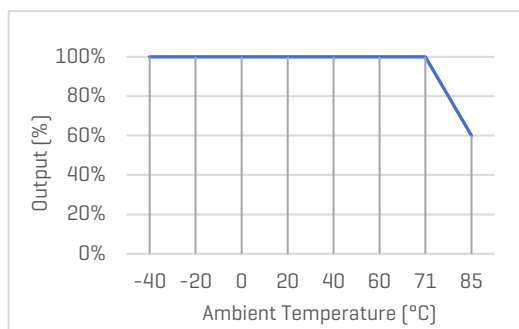
$V_{OUT}=12 \dots 24V$, no heatsink



$V_{OUT}=\pm 5V$, no heatsink



$V_{OUT}=\pm 12, \pm 15, \pm 24V$, no heatsink



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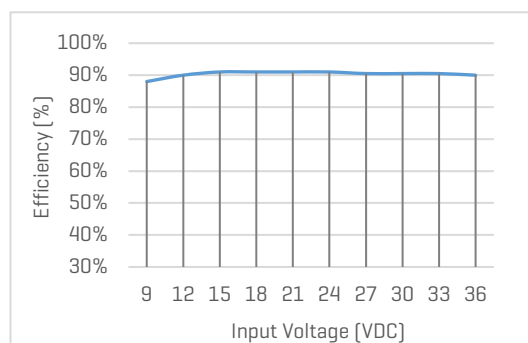


Characteristic Curves [continued]

Efficiency Curve

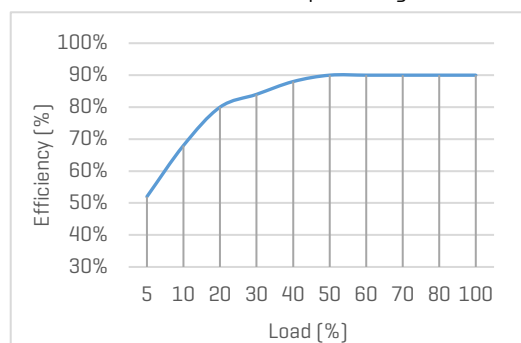
Efficiency vs Input Voltage

MU20G-2405, with full Load

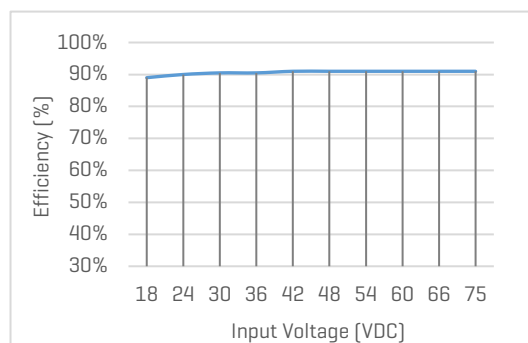


Efficiency vs Load

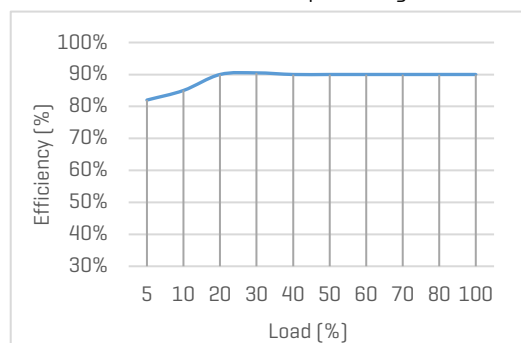
MU20G-2405, with nominal input voltage



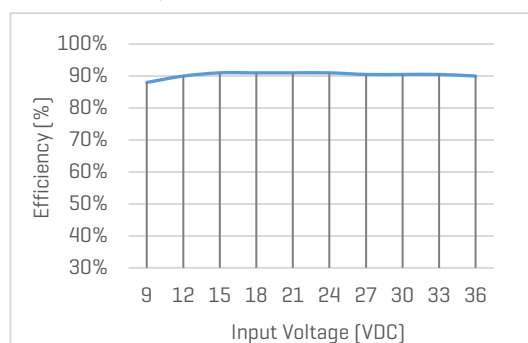
MU20G-4812, with full Load



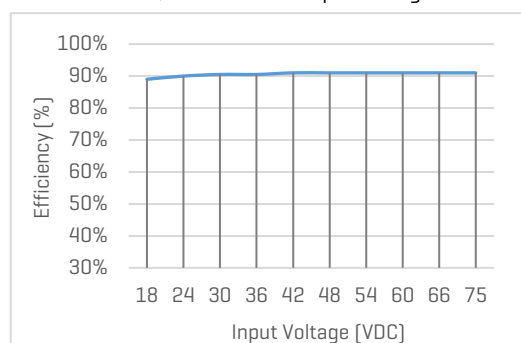
MU20G-4812, with nominal input voltage



MU20G-2405D, with full Load



MU20G-2405D, with nominal input voltage



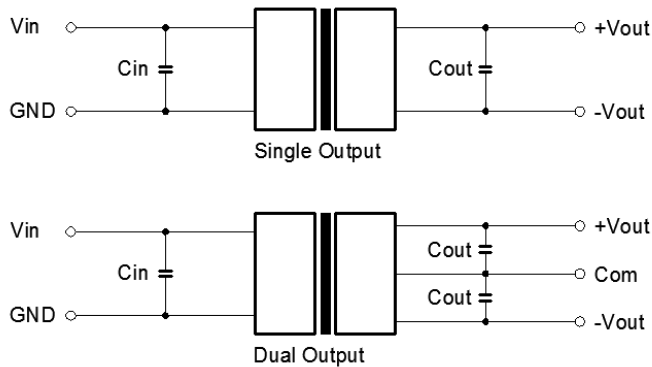
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Recommended Application Circuit

Typical Application 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.

Figure 1. Typical external circuit

[Table 1] Recommended component spec

Input voltage	24V	48V
C_{IN}	100uF, 50V	10...47uF, 100V
C_{OUT}	10uF	

Circuit for EMC Enhancement

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

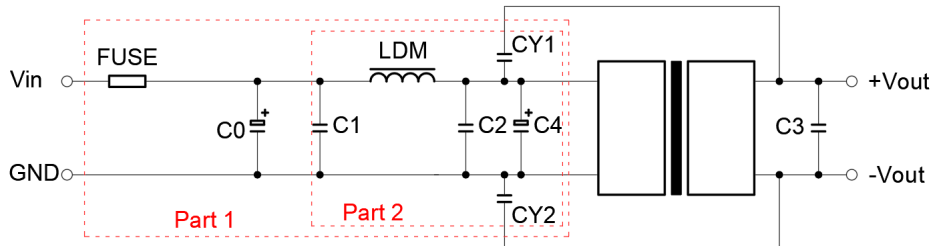


Figure 2. Circuit for EMC enhancement, Single output

[Table 2] Recommended component spec

Component	LDM1	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

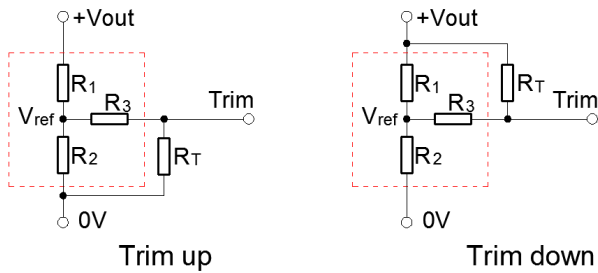
* Fuse to be selected according to application needs.

* C3 refer to C_{OUT} in Table 1

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 _{OUT} [V]	R1 [K Ohm]	R2 [K Ohm]	R3 [K Ohm]	V _{ref} [V]
3.3	10.0	6.064	13.622	1.25
5	2.4	2.344	13.622	2.5
12	8.2	2.153	17.346	2.5
15	12.0	2.388	21.016	2.5
24	10.0	1.158	10.714	2.5

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

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

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

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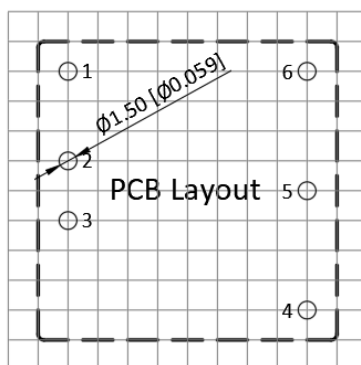
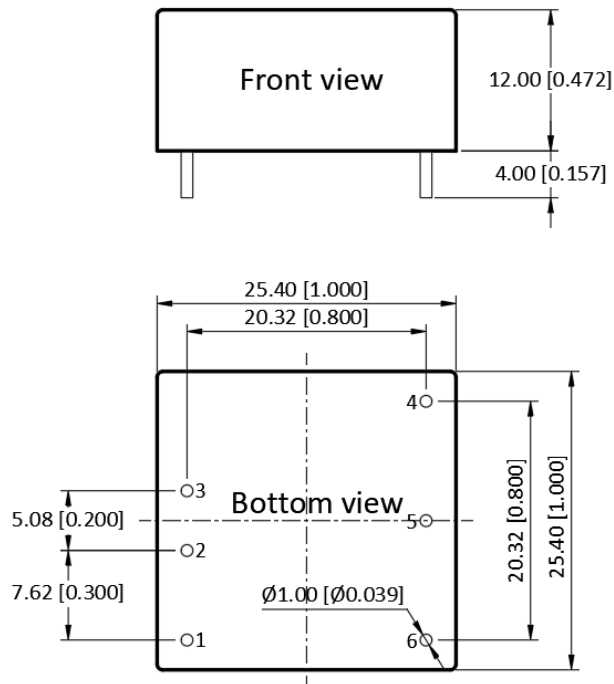
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Mechanical Specifications

No Suffix, Default Package

*Add suffix "A" to the model numbers for "Ctrl" pin removed before delivery. E.g. MU20G-2405A



Pin Definition

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

* 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