



MA6G Series

WinkEE

6W, Encapsulated DIP1"X1" Package DC/DC Converters for Railway Applications

Features

- ▶ Rated power: 6W Max
- ▶ Input voltage 40...160VDC
- ▶ Regulated output
- ▶ High efficiency up to 86%
- ▶ Isolation voltage 2250VDC
- ▶ Low ripple and noise
- ▶ Operating temperature range: -40 ~ +85°C ambient
- ▶ RoHS compliant
- ▶ Standard 1"x1" package
- ▶ Under voltage, over voltage, over current, and short circuit protection
- ▶ Meet IEC/EN 62368-1, EN50155 standards
- ▶ Designed for railway apps
- ▶ 5 year warranty



Model Numbers

Model Number	Input Voltage [VDC]			V _{OUT} [VDC]	Output Current [mA]		Efficiency [%] Typ.	Capacitive Load [uF] Max.
	Nom.	Range	*Max.		Max.	Min.		
MA6G-050	110	40-160	170	5.0	1200	0	80	1000
MA6G-120	110	40-160	170	12	500	0	84	470
MA6G-150	110	40-160	170	15	400	0	85	220
MA6G-240	110	40-160	170	24	250	0	86	100
MA6G-050D	110	40-160	170	±5	±600	0	80	470
MA6G-120D	110	40-160	170	±12	±250	0	84	100
MA6G-150D	110	40-160	170	±15	±200	0	85	100

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

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

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	-	68	-	mA	
Input current	No load		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	-	10	-	μs	
Input under voltage shutdown		28	33	-	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 -	- - 3	12 1.2 8	VDC VDC mA	Positive Logic
Output voltage accuracy	$I_{\text{OUT}}=5\%$ to 100%	-	± 1	± 3	%	
Line regulation Full load, $V_{\text{IN}}=V_{\text{IN, Min}}$ to $V_{\text{IN, Max}}$		-	± 0.5	± 1.0	%	
Load regulation $I_{\text{OUT}}=5\%$ to 100% of $I_{\text{OUT, rated}}$	Main output Others	-	± 0.5 ± 0.5	± 1.0 ± 1.5	%	
Cross regulation $+I_{\text{OUT}}=50\%$, $-I_{\text{OUT}}=25\%$ to 100%	Dual output models	-	-	± 10	%	
Output ripple and noise	20MHz bandwidth	-	50	100	mVp-p	
Temperature coefficient	Full load	-	-	0.03	%/ $^\circ\text{C}$	
Dynamic load response $I_{\text{OUT}}=25\% \sim 50\% \sim 75\%$ of $I_{\text{OUT, rated}}$	Peak deviation* Peak deviation Recovery time	-	± 3 ± 3 300	± 8 ± 5 500	% V_{OUT} % V_{OUT} μs	* $V_{\text{OUT}}=5\text{V, } \pm 5\text{V}$
Output over voltage protection		110	-	160	% V_{OUT}	
Output over current protection		120	-	210	% 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 I/P & O/P to Case	2250 1600	-	-	VDC	
Isolation resistance Tested at 500VDC	I/P to O/P	1000	-	-	M ohm	
Isolation capacitance 100KHz, 0.1V	I/P to O/P	-	1000	-	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	
Cooling method		Free air convection				
Case material		Aluminum alloy				
Vibration		IEC/EN61373 – Category 1, Grade B				
MTBF	MIL-HDBK-217F	>1,000,000 Hours, T _A =25°C				
Design based on standards		IEC/EN 62368-1, EN50155				
Safety certifications		IEC/EN 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		25.4 x 25.4 x 12 mm, 21g				

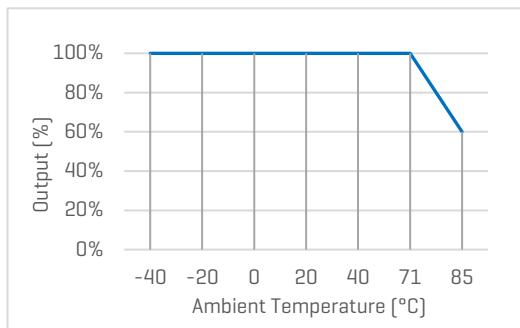
* Switching frequency is measured at full load. The converter reduces the switching frequency at low load [less than 50% load] for better efficiency.

Characteristic Curves

Derating Curve

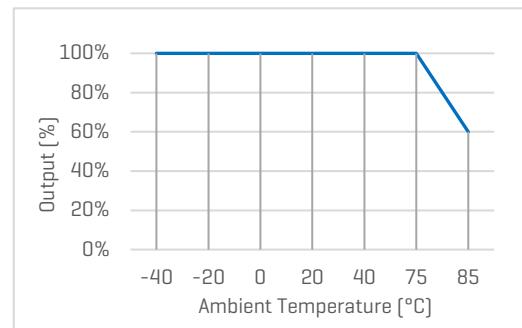
Output vs Ambient Temperature

No heatsink



Output vs Input Voltage

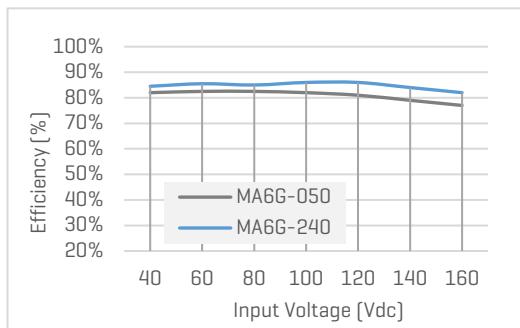
With heatsink



Efficiency Curve

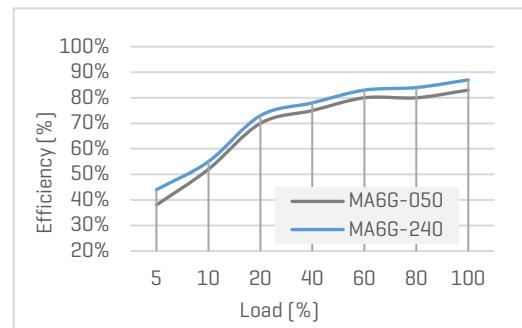
Efficiency vs Input Voltage

Full load



Efficiency vs Load

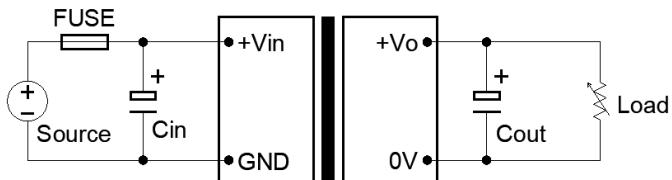
$V_{IN}=110Vdc$





Recommended Application Circuit

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.

Figure 1. Typical external circuit

[Table 1] Recommended component spec

FUSE	2A, slow blow
C _{IN}	10...47uF
C _{OUT}	10uF

Circuit for EMC Enhancement

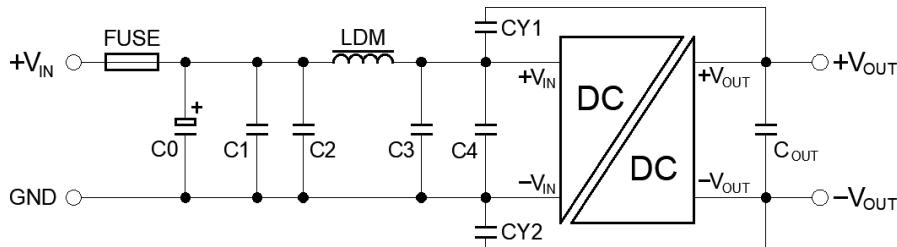


Figure 2: Circuit for EMC Enhancement

[Table 2] Recommended component specifications

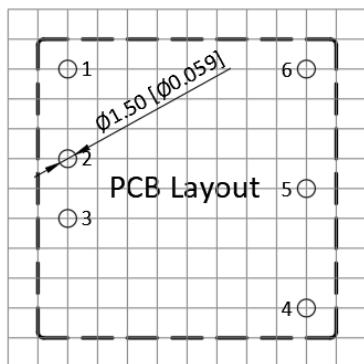
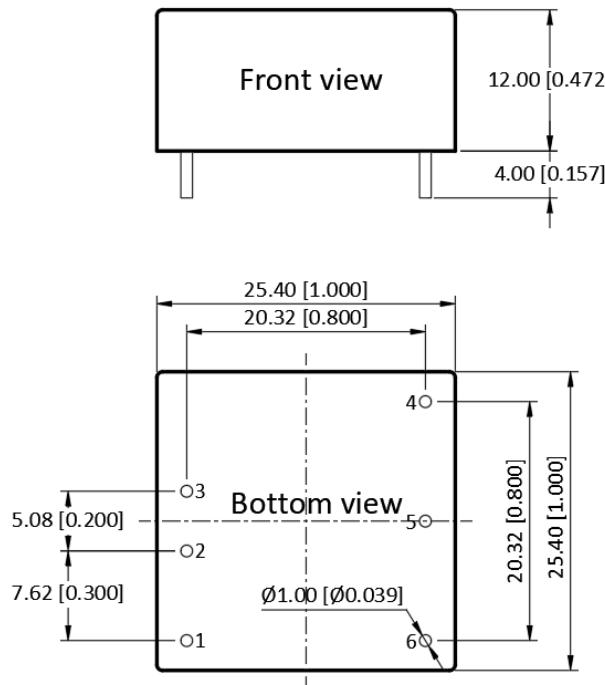
[Table 2] Recommended component spec

Items	LDM	C0	C1 ... C4	CY1, CY2
Spec	68uH	100uF, 200V	0.22uF, 250V	1nF, 3KV

* "Fuse" to be selected according to application needs. "C_{OUT}" refer to the same in Table 1.

* Do not use two converters in parallel to supply higher power.

Mechanical Specifications



Pin Definition

Pin #	Single Out	Dual Out
1	No Pin	Ctrl
2	GND	GND
3	+V _{IN}	+V _{IN}
4	+V _{OUT}	+V _{OUT}
5	No Pin	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