

FEATURES

- ▶ SIP-Package 11.5x7.55x10.2 mm
- ▶ Pin-out compatible with LM78xx Linear Regulators
- ▶ Very high Efficiency up to 97%
- ▶ Excellent Line/Loads Regulation
- ▶ Low Ripple and Noise
- ▶ Short Circuit Protection
- ▶ Operating Temp. Range -40°C to +90°C
- ▶ Thermal Shutdown
- ▶ Low Stand-by Current
- ▶ 3 Years Product Warranty



PRODUCT OVERVIEW

The MINMAX M78A series is a new range of switching regulators designed as a drop-in replacement for old LM78xx linear regulators with low efficiency. The very high efficiency of these step-down converters allow an operating temperature up to 80°C at full-load without need of any heatsink. The regulators come in a package which fits in the standard TO-220 footprint of linear regulators. The high efficiency and low stand-by power consumption of these switching regulators offer the designer a new, cost-efficient solution for many applications.

Model Selection Guide

Model Number	Input Voltage (Range) Note 8 VDC	Output Voltage VDC	Output Current	Max. capacitive Load μF	Efficiency (typ.)	Efficiency (typ.)
			Max. mA		@Min. Vin %	@Max. Vin %
M78AR015-0.5	4.75 ~ 32	1.5	500	220	73	63
M78AR018-0.5		1.8	500	220	82	71
M78AR025-0.5		2.5	500	220	87	77
M78AR033-0.5		3.3	500	220	91	81
M78AR05-0.5	6.5 ~ 32	5	500	220	94	86
M78AR065-0.5	8 ~ 32	6.5	500	220	95	88
M78AR09-0.5	11 ~ 32	9	500	220	96	92
M78AR12-0.5	15 ~ 32	12	500	220	97	94
M78AR15-0.5	18 ~ 32	15	500	220	97	95

Input Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Input Surge Voltage (1 sec. max.)		-0.3	---	34	VDC
Internal Filter Type		Capacitor			
Internal Power Dissipation		---	---	0.4	W
Short Circuit Input Power		---	---	1.5	W
Input Current	@No Load	---	5	---	mA

Output Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit	
Output Voltage Setting Accuracy		---	±2.0	±3.0	%Vnom.	
Line Regulation	Vin=Min. to Max.	1.5V to 6.5V	---	±0.2	±0.4	%
		9V to 15V	---	±0.1	±0.2	%
Load Regulation	Io=10% to 100%	1.5V to 6.5V	---	±0.4	±0.6	%
		9V to 15V	---	±0.25	±0.4	%
Min. Load	No minimum Load Requirement					
Ripple & Noise	0-20MHz Bandwidth	1.5V to 6.5V	---	---	30	mV _{P-P}
		9V to 15V	---	---	40	mV _{P-P}
Transient Recovery Time	50% Load Step Change	---	100	---	μsec	
Transient Response Deviation		---	±2	---	%	
Temperature Coefficient		---	---	±0.015	%/°C	
Output Current Limit		---	---	1	A	
Short Circuit Protection	Continuous					

General Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
I/O Isolation Voltage	None				
Switching Frequency		280	330	380	KHz
MTBF(calculated)	MIL-HDBK-217F@25°C, Ground Benign	2,000,000	---	---	Hours

Input Fuse (recommended)

1.5V,1.8V Output Models	2.5V Output Models	3.3V Output Models	5V,6.5V,9V,12V,15V Output Models
500mA Slow-Blow Type	600mA Slow-Blow Type	700mA Slow-Blow Type	1000mA Slow-Blow Type

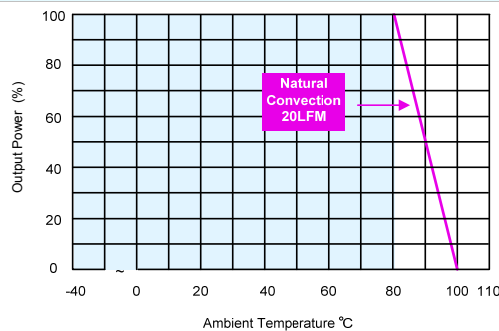
Environmental Specifications

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating Ambient Temperature Range (See Power Derating Curve)	Natural Convection	-40	---	+90	°C
Case Temperature		---	---	+100	°C
Storage Temperature		-55	---	+125	°C
Thermal Shutdown	Internal IC junction	---	160	---	°C
Humidity (non condensing)		---	---	95	% rel. H
Lead Temperature (1.5mm from case for 10Sec.)		---	---	260	°C

EMC Specifications

Parameter	Standards & Level	Performance
Conducted EMI	Compliance to EN55022 and FCC part 15	Class B (See Page 3)
Radiated Emissions	EN55022	Class B
ESD	EN61000-4-2	Class A
Radiated immunity	EN61000-4-3	Class A
Fast transient (4)	EN61000-4-4	Class A
Conducted immunity	EN61000-4-6	Class A
Magnetic Field Immunity	EN61000-4-8	Class A

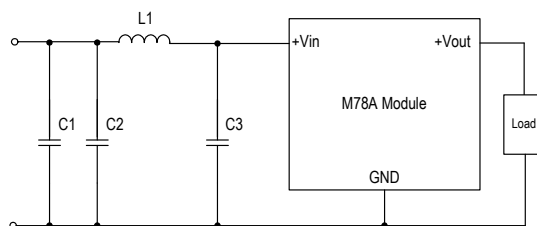
Power Derating Curve



Notes

- Specifications typical at Ta=+25°C, resistive load, nominal input voltage, rated output current unless otherwise noted.
- Other input and output voltage may be available, please contact factory.
- We recommend to protect the converter by a slow blow fuse in the input supply line.
- The M78A series can meet EN61000-4-4 by adding a capacitor across the input pins. Suggested capacitor CHEMI-CON KY 330µF/100V.
- That "natural convection" is about 20LFM but is not equal to still air (0 LFM).
- It needs to increase 1V for Vin(min) under high and low temperature.
- With a input capacitor 22µF/50V for input voltage >28VDC, the input voltage allows 32VDC, max.
- Specifications are subject to change without notice.

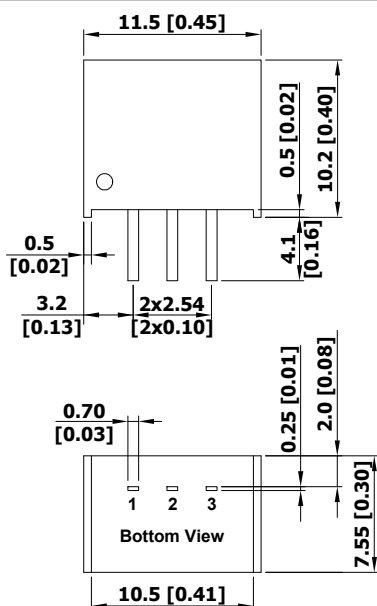
EMI-Filter to meet EN 55022, class A, class B; FCC part 15, level A



Class	Model	C1	C2	C3	L1
Class A	M78A series	---	4.7 μ F/50V 1206 MLCC	4.7 μ F/50V 1206 MLCC	Würth Elektronik NO. 744774033
Class B	M78A series	4.7 μ F/50V 1206 MLCC	4.7 μ F/50V 1206 MLCC	4.7 μ F/50V 1206 MLCC	Würth Elektronik NO. 74477410

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Function
1	+Vin
2	GND
3	+Vout

- ▶ All dimensions in mm (inches)
- ▶ Tolerance: X.X \pm 0.5 (X.XX \pm 0.02)
X.XX \pm 0.25 (X.XXX \pm 0.01)
- ▶ Pins \pm 0.05(\pm 0.002)

Physical Characteristics

Case Size : 11.5x7.55x10.2mm (0.45x0.30x0.40 inches)

Case Material : Non-Conductive Black Plastic (flammability to UL 94V-0 rated)

Pin Material : Alloy 42

Weight : 1.95g