LMTM78_0.5 series

Wide input, non-isolated & regulated, single output

Switching Regulator

- Efficiency up to 92%
- Short circuit protection (SCP)
- Ultra-small, ultra-thin DFN package (9.00 x 7.00 x 3.10mm)
- Operating temperature range: -40°C to +105°C
- No-load input current as low as 0.1mA
- Meets AEC -Q100 (under testing)
- EN62368 approved

The LMTM78_0.5 series are high efficiency switching regulators. The converters feature high efficiency, low loss and short-circuit protection in a compact DFN package.

These products are widely used in applications such as industrial control, instrumentation and electric power.

Common specifications	
Cooling:	Free air convection
Short circuit protection mode:	Hiccup mode
Short circuit protection:	Continuous, automatic recovery
Operating temperature range:	-40°C ~ +105°C
Storage temperature range:	-55°C ~ +125°C
Lead temperature:	300°C MAX, 1.5mm from case for 10 sec
Operating case temperature:	100°C MAX
Reflow Soldering Temperature:	Peak temp. ≤ 245°C,maximum duration time ≤ 60s at 217°C. For actual application, please refer to IPC/JEDEC J-STD-020D.1
Storage humidity range:	< 95%
Case material:	Plastic [UL94-V0]
MTBF (MIL-HDBK-217F,+25°C):	> 9152 Khours
Weight:	0.58g
Dimensions:	9.00 ×7.00 × 3.10mm

Input specifications					
Item	Test conditions	Min	Typ	Max	Units
No load input current			0.1		mA
Reverse polarity input	Avoid/not protected				
Input filter	Capacitor				
Remote ON/OFF*	• Module switch on	Ctrl pin open or pulled high (TTL 2.5~5VDC)			
	• Module switch off	Ctrl pin pulled low to GND (-Vo) (0~0.6VDC)			
	• Input current when switched off		240		μA

* The positive output ctrl pin voltage is referenced to input GND; Negative output ctrl pin voltage is referenced to -Vo.

Example:
LMTM78_05-0.5
LM = Series; T = SMT case; M = Micro size; 05 = 5Vout; 0.5 = 0.5A

Output specifications					
Item	Test conditions	Min	Typ	Max	Units
Voltage accuracy	Input voltage range at full load				
	• 3.3VDC		±2	±4	%
	• Others		±2	±3	%
Line regulation	Input voltage range at full load		±0.2		%
Load regulation	Nominal input, 10% to 100% load		±0.4		%
Ripple + Noise*	20MHz bandwidth		20	45	mVp-p
Temperature coefficient	- 40°C to + 105°C ambient		±0.02		%/°C
Transient response deviation	Nominal input voltage, 25% load step change		50	120	mV
Transient recovery time	Nominal input voltage, 25% load step change		0.2	0.8	ms
Vadj	input voltage range		±10		%Vo
Switching frequency	Full load, nominal input voltage		2.0		MHz

* Ripple and noise tested with "parallel cable" method.

EMC specifications				
EMI	CE	CISPR32/EN55032 (see EMC recommended circuit, ②)	CLASS B	
EMI	RE	CISPR32/EN55032 (see EMC recommended circuit, ②)	CLASS B	
EMS	ESD*	IEC/EN61000-4-2	Contact ±6KV	perf. Criteria B
EMS	RS	IEC/EN61000-4-3	10V/m	perf. Criteria A
EMS	EFT	IEC/EN61000-4-4 (see EMC recommended circuit, ①)	±1KV	perf. Criteria B
EMS	Surge	IEC/EN61000-4-5 (see EMC recommended circuit, ①)	±1KV	perf. Criteria B
EMS	CS	IEC/EN61000-4-6	3 Vr.m.s	perf. Criteria A

* The static level of the Ctrl & Trim pin is ±2KV when they are not connected to external devices; It is suggested to connect an external capacitor (105K/50V) from Ctrl to GND/-Vo to meet ESD (±6KV) of the Ctrl pin, and to connect a varistor (22V/30A) from Trim to GND/-Vo to meet ESD(±6KV) of the Trim pin.

Note:
1. All specifications measured at Ta = 25°C, humidity <75%, nominal input voltage and rated output load unless otherwise specified.
2. In this datasheet, all the test methods of indications are based on corporate standards.

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LMT78_0.5 series

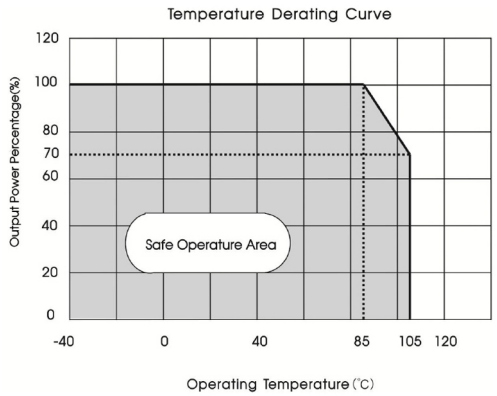
Wide input, non-isolated & regulated, single output

Part Number	Input Voltage [VDC] Nominal	Range	Output Voltage [VDC]	Output Current [mA, Max]	Capacitive load [µF, max]	Efficiency [Vin. min/nom./max]
LMTM78_03-0.5	24 12	4.5-36 7-32	3.3 -3.3	500 -300	680 470	89/79/71 80/82/71
LMTM78_05-0.5	24 12	6.5-36 7-31	5 -5	500 -300	680 470	91/83/78 78/78/71
LMTM78_6.5-0.5	24 12	8-36 7-28	6.5 -6.5	500 -250	680 470	91/85/81 80/79/73
LMTM78_09-0.5	24 12	12-36 8-27	9 -9	500 -200	680 470	92/90/86 82/82/77
LMTM78_12-0.5	24 12	15-36 8-24	12 -12	500 -150	680 470	92/91/86 81/83/79
LMTM78_15-0.5	24 12	18-36 8-21	15 -15	500 -150	680 470	91/91/87 80/81/84

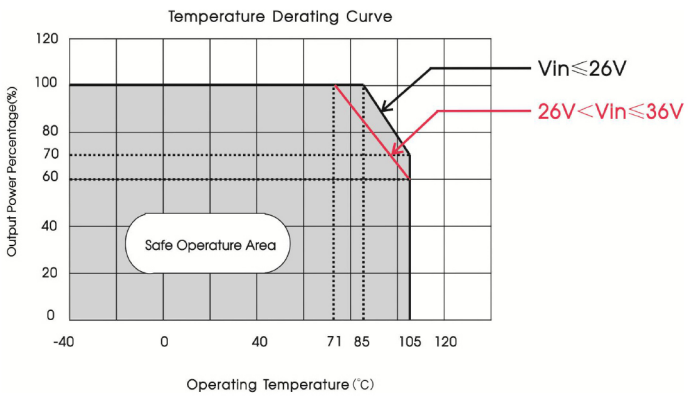
Note: For input voltage higher than 30VDC, a 22uF/50V input capacitor is required.

Typical characteristics

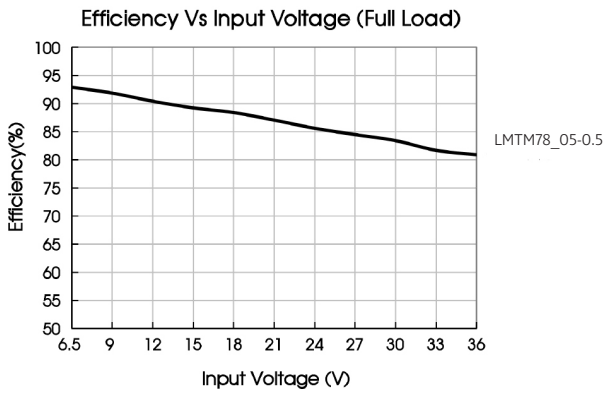
3.3V/5V/6.5V output

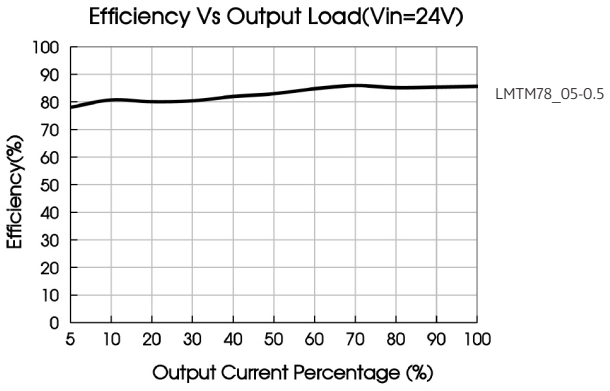


9/12/15V output



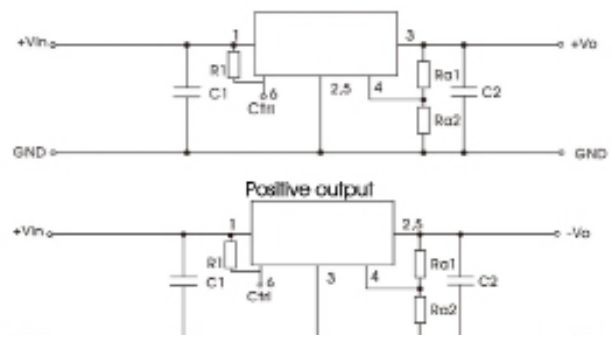
Efficiency





Typical application circuit

1. Typical application

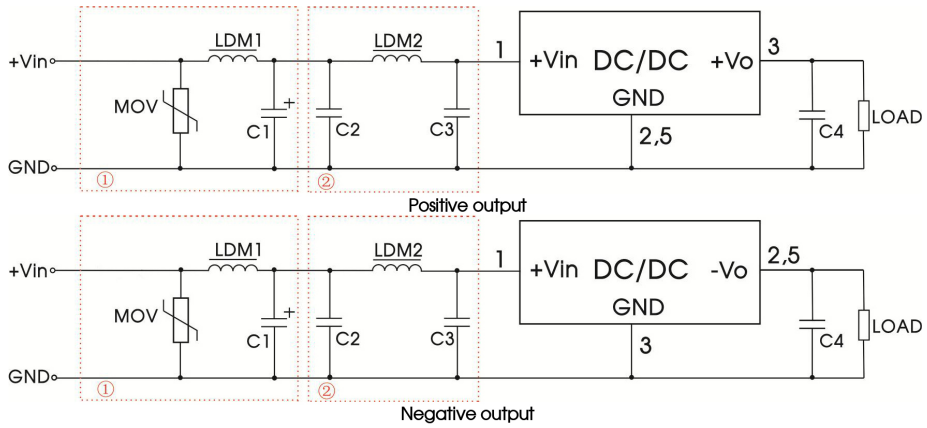


Part number	C1 (ceramic capacitor)	C2 (ceramic capacitor)	R1
LMTM78_03-0.5	10μF/50V	22μF/10V	100kΩ
LMTM78_05-0.5	10μF/50V	22μF/10V	
LMTM78_6.5-0.5	10μF/50V	22μF/16V	
LMTM78_09-0.5	10μF/50V	22μF/16V	
LMTM78_12-0.5	10μF/50V	22μF/25V	
LMTM78_15-0.5	10μF/50V	22μF/25V	

Table 1

Note:
1. The required C1 and C2 capacitors must be connected as close as possible to the terminals of the module;
2. Refer to Table 1 for C1 and C2 capacitor values. For certain applications, increased values and/or tantalum or low ESR electrolytic capacitors may also be used instead;
3. Converter cannot be used for hot swap and with output in parallel;
4. 100k is recommended for R1 when CTRL function is used. If the Ctrl function is not needed, the Ctrl pin can be shorted to the VIN pin without R1.

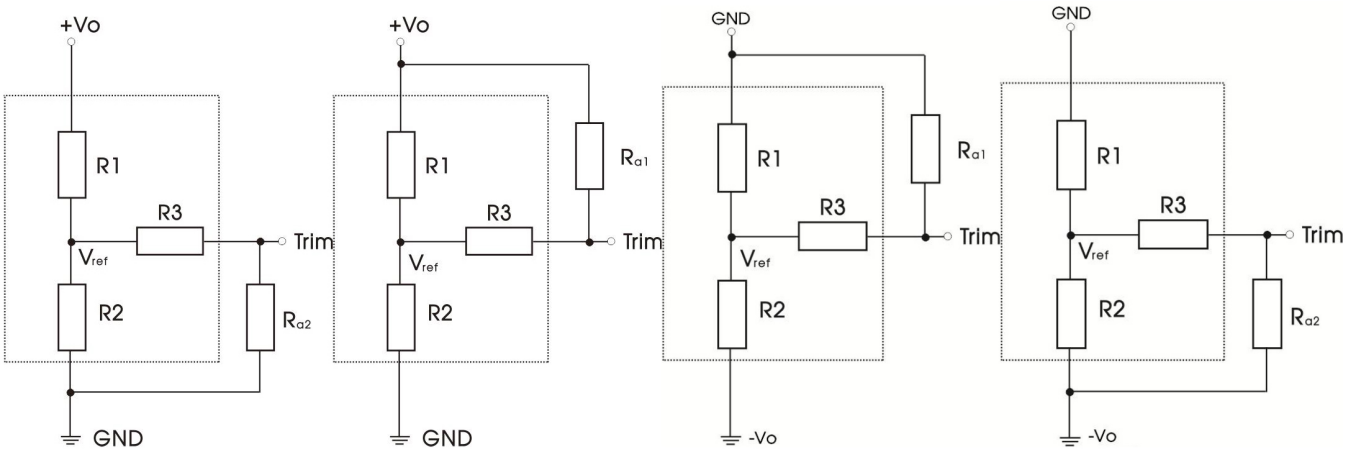
EMC compliance circuit



Note:
For EMC tests we use Part ① for immunity and part ② for emissions test. Selecting based on needs.

Part No.	MOV	LDM1	C1	C2	LDM2	C3	C4
LMTM78_03-0.5 (positive output)	S20K30	82μH	680μF /50V	10μF/50V	10μH	0.47μF/50V	22μF/10V
LMTM78_03-0.5 (negative output)					22μH	/	22μF/10V
LMTM78_05-0.5					10μH	/	22μF/10V
LMTM78_6.5-0.5 / LMTM78_09-0.5					10μH	1μF/50V	22μF/16V
LMTM78_12-0.5 / LMTM78_15-0.5					22μH	0.47μF/50V	22μF/16V

Trim Function for Output Voltage Adjustment (open if unused)



Positive output trim up | Positive output trim down | Negative output trim up | Negative output trim down

Circuit diagram of Vadj up and down (dashed line shows internal part of module)

Calculating Trim resistor values:

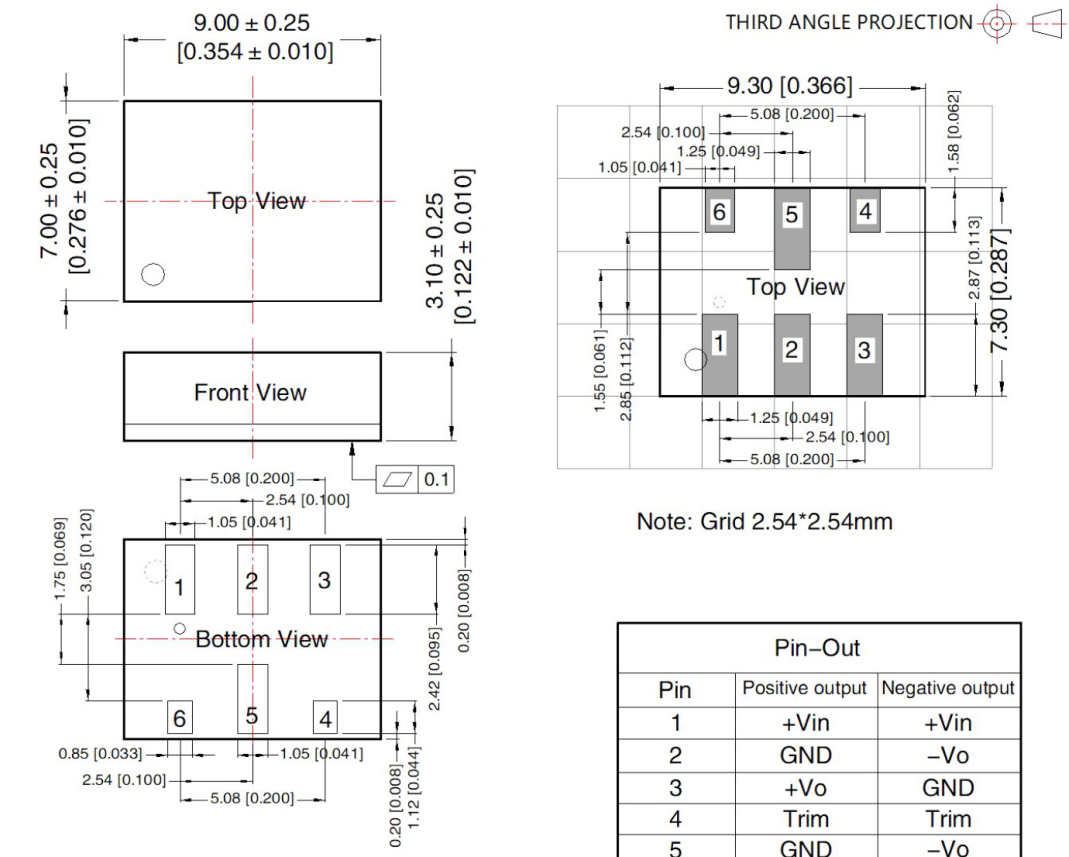
Trim up : $R_{a2}=\frac{aR_2}{R_2-a}-R_3,\quad a=R_2//(R_3+R_{a2})=\frac{V_{ref}}{V_o'-V_{ref}}R_1$

Trim down : $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

Vout (V)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vref (V)
3.3	47	15	82	0.8
5	36	6.875	36	0.8
6.5	47	6.596	36	0.8
9	75	7.318	47	0.8
12	120	8.571	51	0.8
15	100	5.634	36	0.8

Vout nom.	±3.3VDC		±5.0VDC		±6.5VDC		±9.0VDC		±12VDC		±15VDC	
Vout adj.	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2	Ra1	Ra2
2.97	221k											
3.63		34k										
4.5			236k									
5.5				20k								
5.85					329k							
7.15						22k						
8.1							562k					
9.9								19k				
10.8									948k			
13.2										29k		
13.5											611k	
16.5												17k

Mechanical dimensions

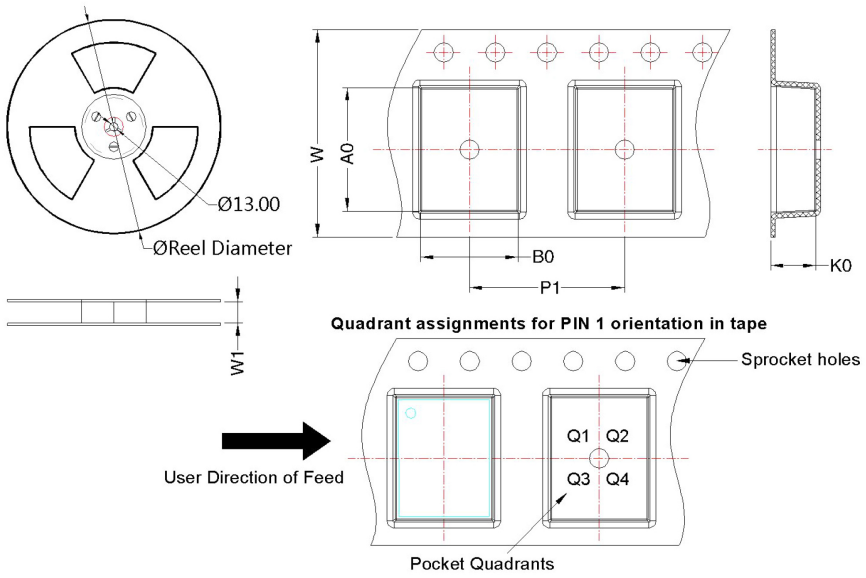


Note: Grid 2.54*2.54mm

Pin–Out		
Pin	Positive output	Negative output
1	+Vin	+Vin
2	GND	–Vo
3	+Vo	GND
4	Trim	Trim
5	GND	–Vo
6	Ctrl	Ctrl

Note:
Unit :mm[inch]
Pin diameter tolerances : ± 0.10[± 0.004]

Tape/Reel packaging



Package Type	Pin	MPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SMD	6	1200	330.0	12.4	9.56	7.56	3.5	12.0	16.0	Q1