GAPTEC®
GREEN TECHNOLOGY

LMS78_1.0 Series

Wide Input Non-Isolated & Regulated, Single Positive/Negative Output

Switching Regulator

- **Efficiency up to 97%**
- **Operating temperature: -40°C ~ +85°C**
- **Pin-out compatible with LM78XX Linear**
- **Short circuit protection (SCP), thermal shutdown**
- **Low ripple and noise**
- **Micro miniature SIP package**
- **No heatsink required**
- **Industry standard pinout**
- **MTBF>2,000,000 hours**
- **Can be used to convert a positive voltage into a negative voltage**
- **Only two extra capacitors are required**
- **Input voltage range can be lower than the output voltage for higher output voltages in negative application**

The LMS78_1.0 series high efficiency switching regulators are ideally suited to replace 78xx linear regulators and are pin compatible.
The efficiency of up to 97% means that very little energy is wasted as heat so there is no need for any heatsinks with their additional space and mounting costs.

Model selection:
LMS78_yy-pp
LM=Series; **S=**case; **##=**Vout; **pp=**output current
Example:
LMS78_05-1.0
LM=Series; S=SIP Case; ##= 5Vout; pp=1.0A

RoHS

Output specifications					
Item	Test conditions	Min	Typ	Max	Units
Output voltage accuracy	100% load		±2	±3	%
Line regulation	Vin= min. to max. at full load		±0.2	±0.4	%
Load regulation	10% to 100% load		±0.4	±0.6	%
Ripple + Noise*	20MHz Bandwidth		25	35	mVp-p
Short circuit input power			0.5	1.8	W
Short circuit protection		Continuous, automatic recovery			
Switching frequency	100% full load	280	330	450	KHz
Quiescent current	Positive output Negative output		5 7	8 13	mA mA
Thermal shutdown	Internal IC junction		150		°C
Temperature coefficient	-40 °C to +85 °C ambient			±0.02	%/°C
Max capacitance load				1000	µF

*Test ripple and noise by “parallel cable” method.

Common specifications	
Temperature rise at full load:	25°C MAX, 15°C TYP
Cooling:	Free air convection
Operating temperature range:	-40°C~+85°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
Storage humidity range:	< 95%
Package material:	Plastic [UL94-V0]
MTBF:	>2,000,000 hours
Package weight:	3.7g

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.

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency [Vin. min]	Efficiency [Vin. max]
LMS78_03-1.0	4.75-28 4.75-25	3.3 -3.3	1000 -600	90 80	83 82
LMS78_05-1.0	6.5-32 7.0-27	5.0 -5.0	1000 -600	93 85	88 87
LMS78_6.5-1.0	9.0-32 7.0-25	6.5 -6.5	1000 -400	94 88	90 90
LMS78_09-1.0	12-32 7.0-23	9.0 -9.0	1000 -400	95 89	92 91
LMS78_12-1.0	16-32 7.0-20	12 -12	1000 -300	96 89	94 91
LMS78_15-1.0	20-32 7-17	15 -15	1000 -300	97 87	94 92

Add suffix “L” for 90° bend pins, for example: LMS78_05-1.0L.

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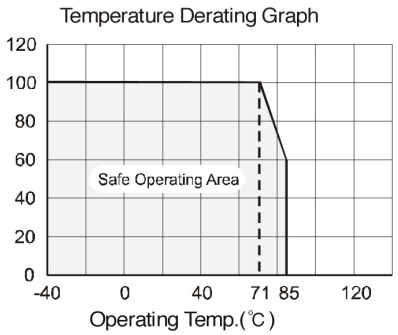
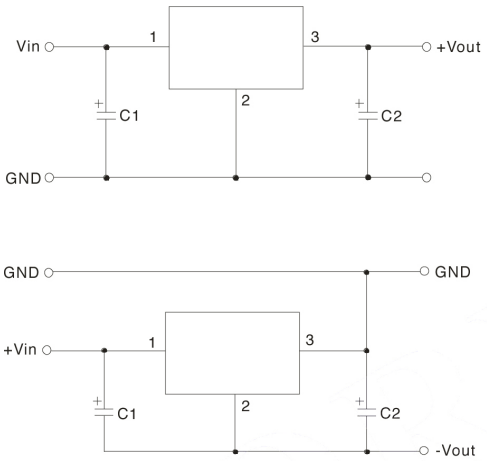
Typical characteristics



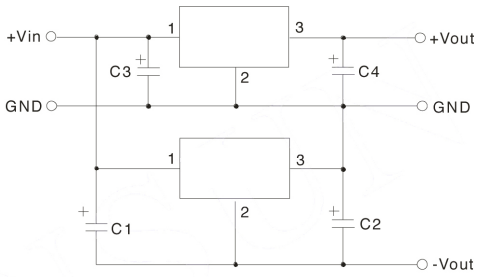
External capacitor table

Part Number	C1,C3 (Ceramic Capacitor)	C2,C4 (Ceramic Capacitor)
LMS78_03-1.0	10μF/50V	22μF/6.3V
LMS78_05-1.0	10μF/50V	22μF/10V
LMS78_6.5-1.0	10μF/50V	10μF/10V
LMS78_09-1.0	10μF/50V	10μF/16V
LMS78_12-1.0	10μF/50V	10μF/25V
LMS78_15-1.0	10μF/50V	10μF/25V

Standard application circuit



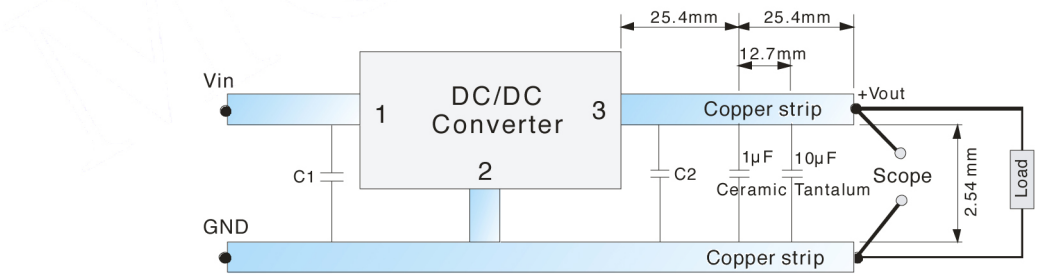
Application example



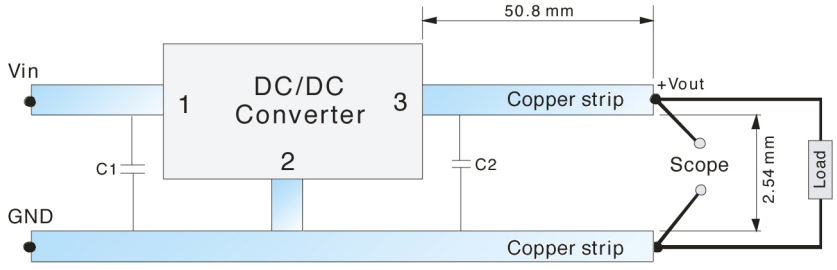
Note:
1. C1 and C2 are required and should be fitted close to the converter pins.
2. The capacitance of C1, C2, C3 and C4 sees external capacitor table, it can be increased properly if required, and tantalum or low ESR electrolytic capacitors may also suffice.
3. No parallel connection or plug and play.

Test configurations (TA=25°C)

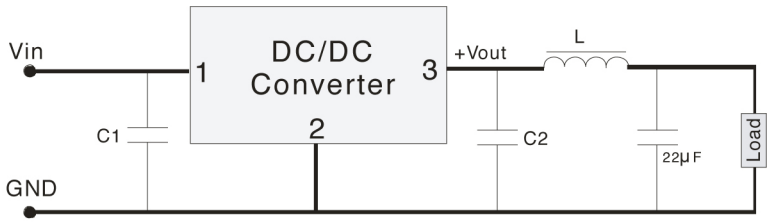
1 Efficiency and output voltage ripple test



2 Start-up and load transient response test



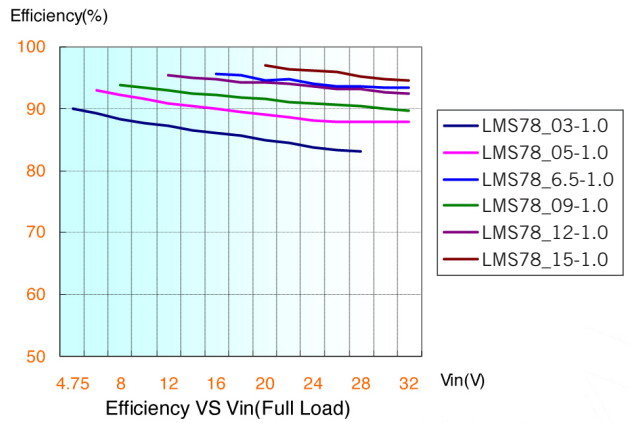
Output ripple reduction



To reduce output ripple, i tis recommended to add a LC filter in output port.
L: Recommended parameter 10μH ~47μH.

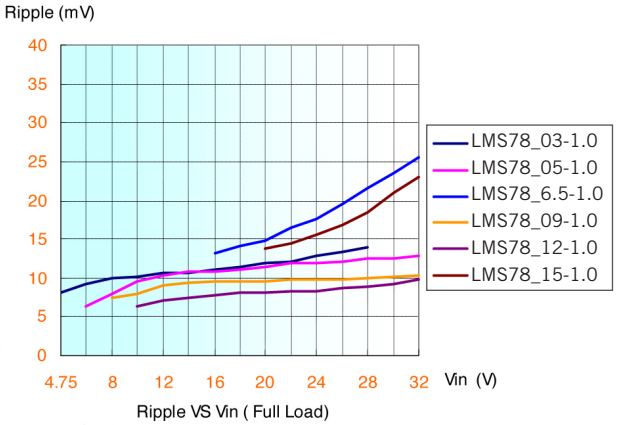
Characteristics (positive voltage output)

Efficiency

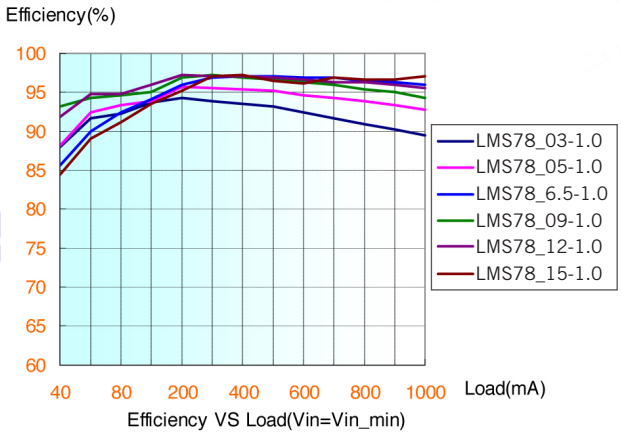


Efficiency VS Vin(Full Load)

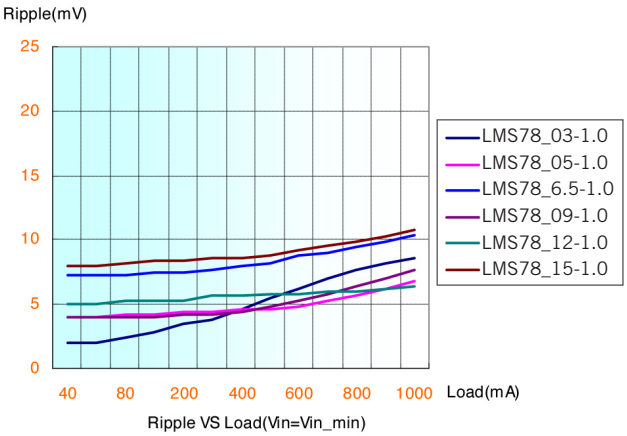
Ripple



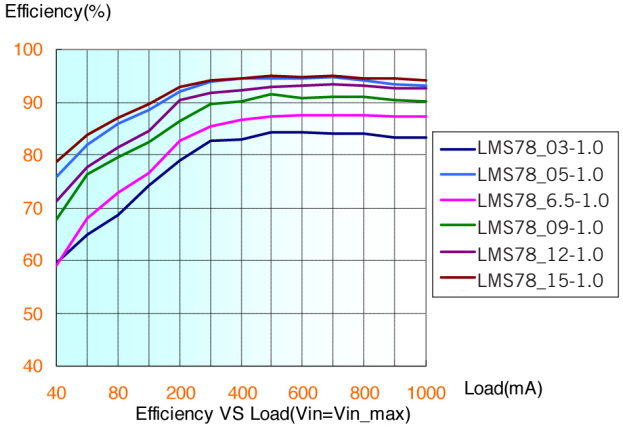
Ripple VS Vin (Full Load)



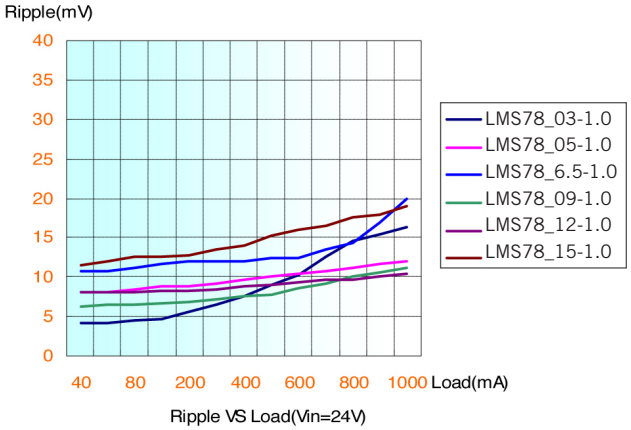
Efficiency VS Load(Vin=Vin_min)



Ripple VS Load(Vin=Vin_min)



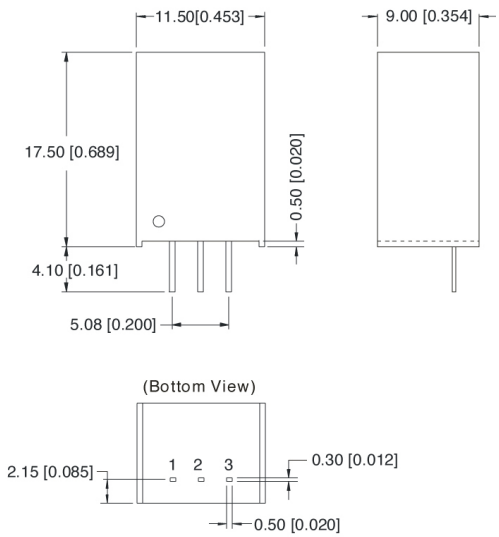
Efficiency VS Load(Vin=Vin_max)



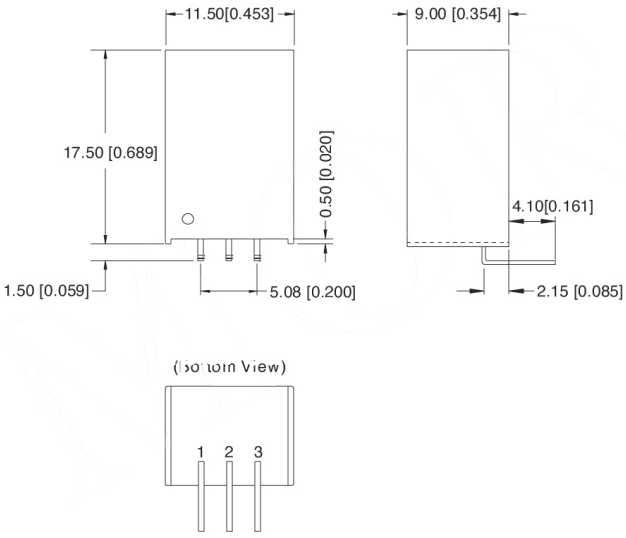
Ripple VS Load(Vin=24V)

Mechanical dimensions

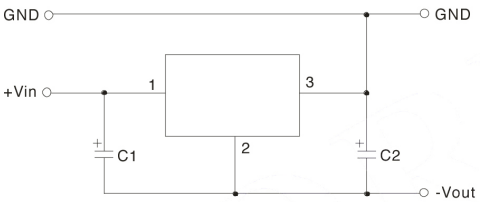
LMS78_xx



LMS78_xxL

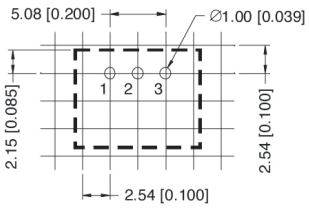


Note:
Unit: mm[inch]
Pin selection tolerances: ±0.10mm [±0.004inch]
General tolerances: ±0.25mm [±0.010inch]

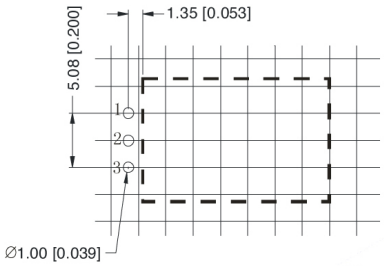


Recommended footprint

LMS78_xx

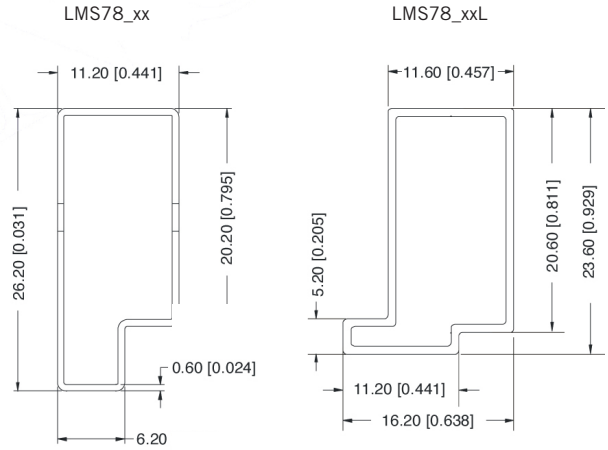


LMS78_xxL



FOOTPRINT DETAILS		
Pin	Positive	Negative
1	+Vin	+Vin
2	GND	-Vout
3	+Vout	GND

Tube outline dimensions



Note:
Unit: mm[inch]
General tolerances: ±0.50mm [±0.020inch]

L=530mm [20.866inch]
Devices per tube quantity: 44pcs

L=220mm [8.661inch]
Devices per tube quantity: 17pcs