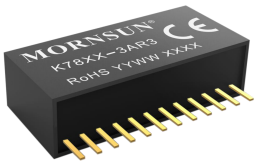
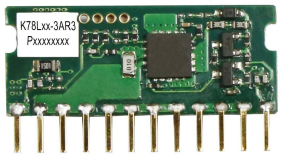
DC/DC Converter

K78(L)xx-3AR3 Series

MORNSUN®

Wide input voltage non-isolated and regulated single output





3 years Warranty

CE Report EN 62368-1 UKCA Report BS EN 62368-1 RoHS

FEATURES

- High efficiency up to 97%
- No-load input current as low as 2mA
- Operating ambient temperature range: -40℃ to +85℃
- Output short-circuit protection

K78(L)xx-3AR3 series are high efficiency switching regulators. The converters feature high efficiency, low loss, short circuit protection, and there is no need for a heat sink. These products are widely used in applications such as industrial control, instrumentation and electric power.

Selection Guide

Certification	Part No.	Input Voltage (VDC)*	Output		Full Load Efficiency (%) Typ.	Capacitive Load (μF)
		Nominal (Range)	Voltage (VDC)	Current (mA) Max.	Vin Min. / Vin Max.	Max.
EN/BS EN	K78(L)03-3AR3	24 (8-36)	3.3	3000	90/83	1000
	K78(L)05-3AR3	24 (8-36)	5	3000	93/89	680
	K78(L)X6-3AR3	24 (10-36)	6.5	3000	94/90	330
	K78(L)09-3AR3	24 (13-36)	9	3000	95/91	330
	K78(L)12-3AR3	24 (16-36)	12	3000	97/93	330
	K78(L)15-3AR3	24 (19-36)	15	3000	97/94	330

Note: * For input voltages exceeding 30 VDC, an input capacitor of 22μF/50V is required.

Input Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
No-load Input Current		--	2	4	mA
Reverse Polarity at Input		Avoid / Not protected			
Input Filter		Capacitance filter			
Ctrl*	Module on	Ctrl pin open or pulled high (TTL 4.5-14VDC)			
	Module off	Ctrl pin pulled low to GND (0-0.8VDC)			
	Input current when off	--	--	4	mA

Note: * The Ctrl pin voltage is referenced to input GND.

Output Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	0%-100% load, input voltage range	--	±2	±3	%
Linear Regulation	Full load, input voltage range	--	±0.5	±1	
Load Regulation	Nominal input voltage, 10% -100% load	--	±0.5	±1	

Ripple & Noise*	20MHz bandwidth, nominal input voltage, 100% load	3.3V/5V/6.5V/9V output	--	40	70	mVp-p
		12V/15V output	--	50	100	
Temperature Coefficient	Operating ambient temperature -40℃ to +85℃		--	--	±0.03	%/℃
Transient Response Deviation	Nominal input voltage, 50% load step change	3.3V output	--	--	5	%Vo
		5V/6.5V output	--	--	4	
		9V/12V output	--	--	3	
		15V output	--	--	2	
Transient Recovery Time	Nominal input voltage, 50% load step change		--	0.1	0.2	ms
Short-circuit Protection	Nominal input voltage		Continuous, self-recovery			
Note: * The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;						

General Specifications

Item	Operating Conditions	Min.	Typ.	Max.	Unit
Operating Temperature	See Fig. 1	-40	--	+85	℃
Storage Temperature		-55	--	+125	
Pin Soldering Resistance Temperature	Soldering time: 10s (Max)	--	--	+260	
Storage Humidity	Non-condensing	5	--	95	%RH
Switching Frequency*	PWM mode	100	250	400	kHz
MTBF	MIL-HDBK-217F@25℃	2000	--	--	k hours
Note: * Different switching frequencies of different output voltages.					

Mechanical Specifications

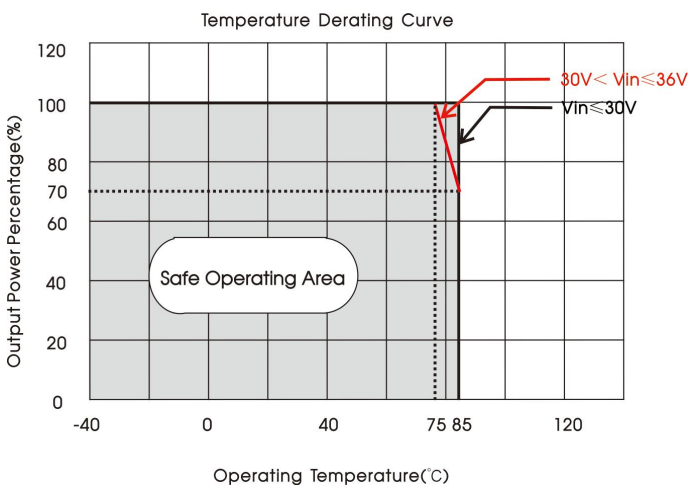
Case Material	K78xx-3AR3 Series	Black plastic; flame-retardant and heat-resistant (UL94V-0)
	K78Lxx-3AR3 Series	Open frame
Dimensions	K78xx-3AR3 Series	32.15 x 14.85 x 9.05 mm
	K78Lxx-3AR3 Series	30.60 x 12.50 x 5.80mm
Weight	K78xx-3AR3 Series	9.3g(Typ.)
	K78Lxx-3AR3 Series	4.0g(Typ.)
Cooling Method	Free air convection	

Electromagnetic Compatibility (EMC)

Emissions	CE	CISPR32/EN55032	CLASS B (see Fig. 3 for recommended circuit)	
	RE	CISPR32/EN55032	CLASS B (see Fig. 3 for recommended circuit)	
Immunity	ESD	IEC/EN 61000-4-2	Contact ±6kV	perf. Criteria B
	RS	IEC/EN 61000-4-3	10V/m	perf. Criteria A
	EFT	IEC/EN 61000-4-4	±1kV (see Fig. 3 for recommended circuit)	perf. Criteria B
	Surge	IEC/EN 61000-4-5	line to line ±1kV (see Fig. 3 for recommended circuit)	perf. Criteria B
	CS	IEC/EN 61000-4-6	3Vr.m.s	perf. Criteria A

Typical Characteristic Curves

3.3V/5V/6.5V output



9V/12V/15V output

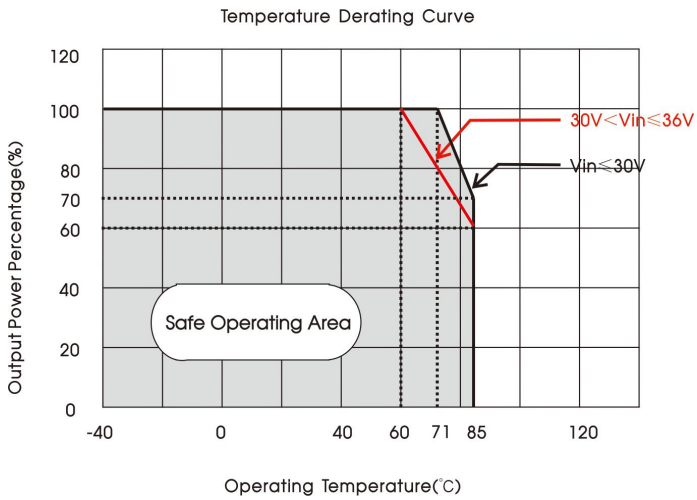


Fig. 1

Design Reference

1. Typical application

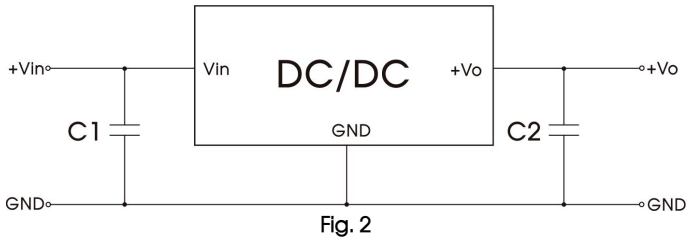


Fig. 2

Table 1

Part No.	C1 (ceramic capacitor)	C2 (ceramic capacitor)
K78(L)03-3AR3	10μF/50V	22μF/10V
K78(L)05-3AR3		22μF/10V
K78(L)X6-3AR3		22μF/10V
K78(L)09-3AR3		22μF/16V
K78(L)12-3AR3		22μF/25V
K78(L)15-3AR3		22μF/25V

Notes:
1. The required capacitors C1 and C2 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

2. EMC compliance circuit

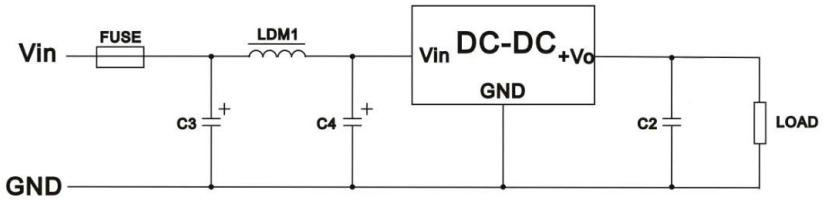
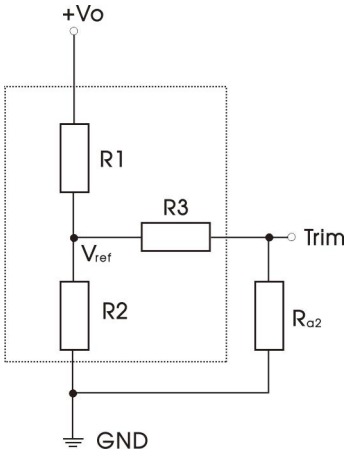


Fig.3 EMC compliance circuit

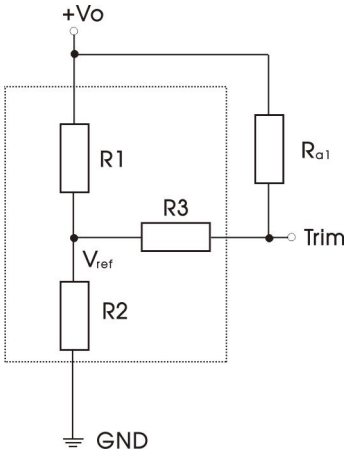
	FUSE	C3	LDM1	C4	C2
Emissions	Select fuse value according to actual input current	100μF /50V	22μH	100μF /50V	Refer to the C2 in Fig. 2
Immunity				680μF /50V	

3. Trim Function for Output Voltage Adjustment (open if unused)

application: connect trim resistor to GND/Vo respectively for adjusting up/down.



output trim up



output trim down

Fig. 4 Circuit diagram of Vtrim up and down (dashed line shows internal part of module)

Calculating Trim resistor values:

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

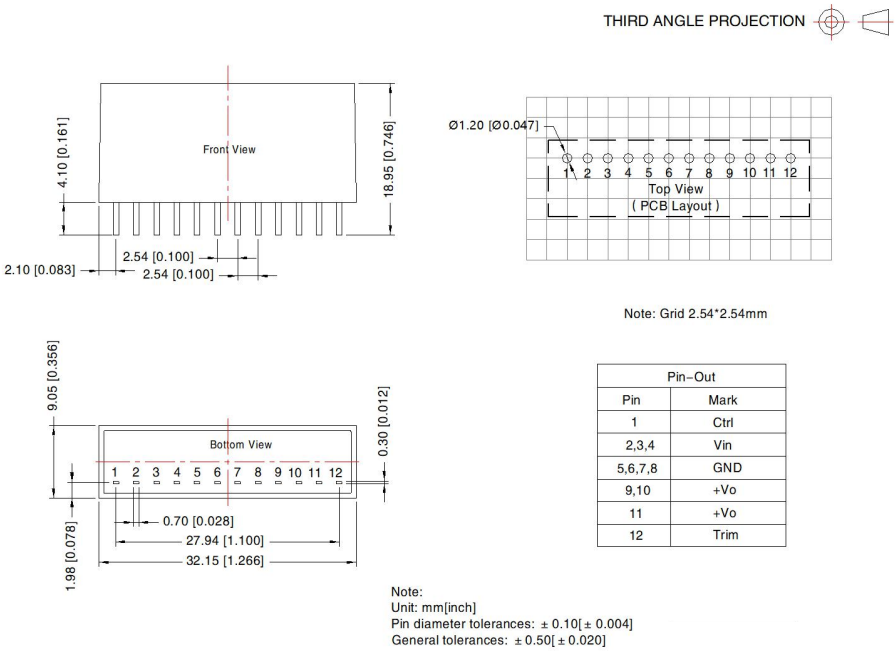
Trim down : $R_{a1}=\frac{aR_1}{R_1-a}-R_3,\quad a=R_1//(R_3+R_{a1})=\frac{V_o'-V_{ref}}{V_{ref}}R_2$

Vo(V)	R1(kΩ)	R2(kΩ)	R3(kΩ)	Vref(V)
3.3	75	32.68	10	1
5	68	17.01	10	1
6.5	75	13.64	10	1
9	75	9.38	10	1
12	120	10.91	10	1
15	100	7.14	10	1

Vout nom(Vo)	3.3VDC		5.0VDC		6.5VDC		9.0VDC		12VDC		15VDC	
Vout adj(Vo')	R_{a1}	R_{a2}	R_{a1}	R_{a2}	R_{a1}	R_{a2}	R_{a1}	R_{a2}	R_{a1}	R_{a2}	R_{a1}	R_{a2}
3	498.5k											
3.3												
4		96.4k	194.5k									
4.5		52.2k	468.2k									
5												
5.5				125.4k	328.0k							
6				57.8k	742.2k							
6.5												
7						139.6k	215.5k					
8						40.0k	517.2k					
9												
10								64.7k	530.2k			
11								27.4k	1191.1k			
12												
13										109.9k	588.3k	
14										50.0k	1282.8k	
15												
16												90.6k
17												40.1k

4. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

Dimensions and Recommended Layout(K78xx-3AR3 Series)

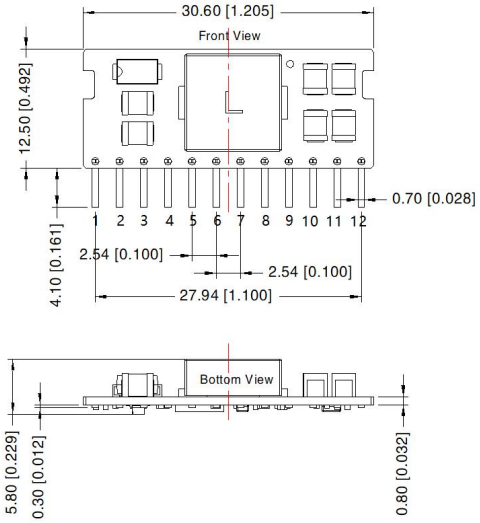


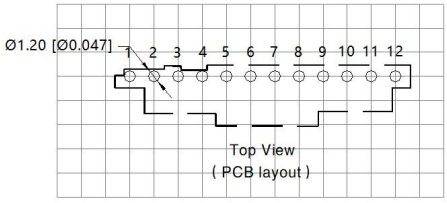
Pin-Out	
Pin	Mark
1	Ctrl
2,3,4	Vin
5,6,7,8	GND
9,10	+Vo
11	+Vo
12	Trim

Note:
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]

Dimensions and Recommended Layout(K78Lxx-3AR3 Series)

THIRD ANGLE PROJECTION





Note: Grid 2.54*2.54mm

Pin-Out	
Pin	Mark
1	Ctrl
2,3,4	Vin
5,6,7,8	GND
9,10	+Vo
11	+Vo
12	Trim

Note:
Unit: mm[inch]
Pin diameter tolerances: ± 0.10[± 0.004]
General tolerances: ± 0.50[± 0.020]

Notes:

1. For additional information on Product Packaging please refer to: www.mornsun-power.com. Packaging bag number: 58210075(K78xx-3AR3), 58210132(K78Lxx-3AR3);
2. The maximum capacitive load offered were tested at input voltage range and full load;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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