AMPSS™
Astec Modular Power Supply System

AK80A Economy Series

132 - 240W Output Power DC-DC Converter Module Technical Reference Manual

Series Highlights

- High Efficiency - up to 87%
- 85°C baseplate/case operating temperature
- Low output ripple and noise
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- Excellent Transient Response
- Fixed Switching Frequency
- Designed to meet Telecom specification

ASTEC

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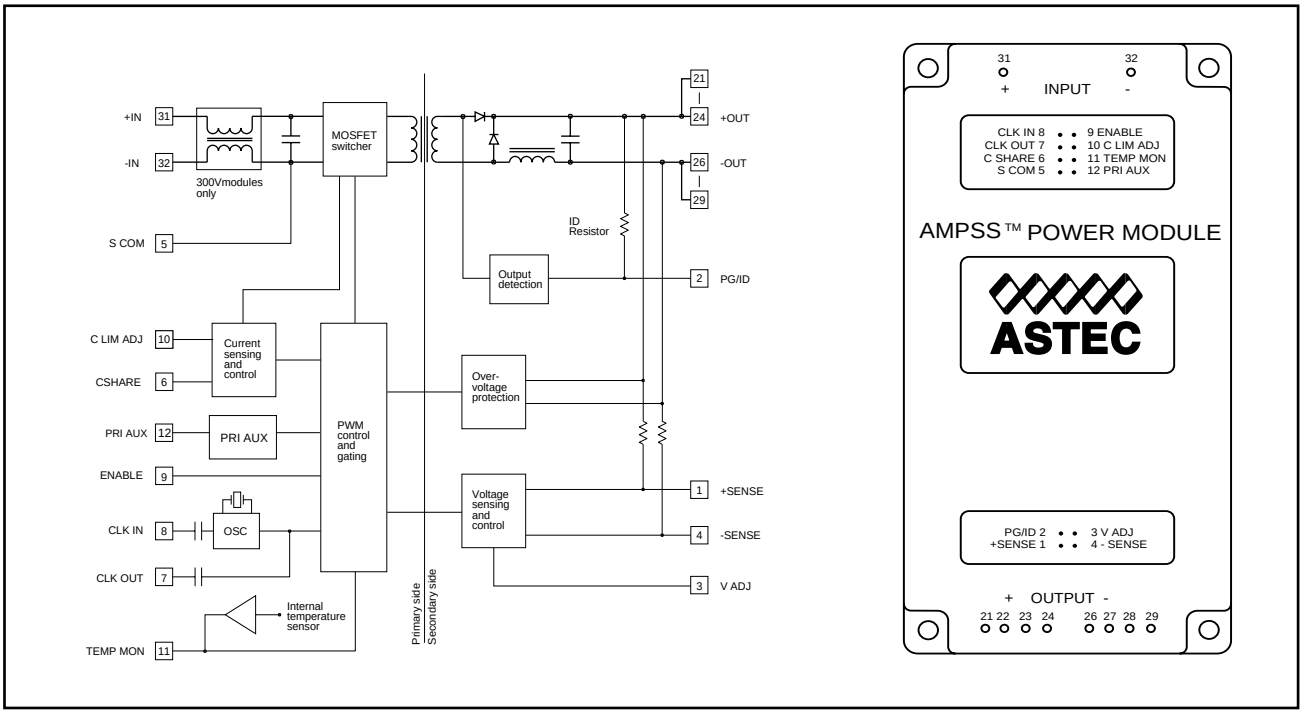
AK80A Economy Series DC-DC Converters



Introduction

The AK80A is an isolated, single output DC to DC converter module, providing up to 240W output with a maximum baseplate operating temperature of 85°C with no derating. The AK80A features adjustable output voltage, current limit adjust and temp monitor.

Special Features

- High Efficiency - up to 87%
- 500KHz fixed switching frequency
- 85°C baseplate/ case operating temperature - no derating
- Low output ripple and noise
- Excellent transient response
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- Parallelable with current share
- Temperature monitoring output
- Overtemperature and short circuit protection
- Adjustable output voltage and current limit

Ordering Information

Model Number	Input Voltage	Output Voltage	Output Current	Output Power
AK80A-048L-033F50	48V	3.3V	50A	165W
AK80A-048L-050F40	48V	5V	40A	200W
AK80A-048L-120F18	48V	12V	18A	216W
AK80A-048L-150F16	48V	15V	16A	240W
AK80A-048L-240F10	48V	24V	10A	240W
AK80A-024L-033F40	24V	3.3V	40A	132W
AK80A-024L-050F30	24V	5V	30A	150W
AK80A-024L-120F14	24V	12V	14A	168W
AK80A-024L-150F12	24V	15V	12A	180W
AK80A-024L-240F08	24V	24V	8A	192W

Please contact Astec for information on other output voltages, power ranges and configurations.

Safety

UL:	UL1950
CSA:	CSA C22.2 No.950
VDE:	VDE 0805 (48Vin only)
	EN60950 (48Vin only)
CE:	CE Mark (48Vin only)

Please contact Astec for information on specific module approvals.
Note: *Ensure all modules are used according to the Installation Instructions provided with each module.*

All modules are designed to meet the following specifications:

ETS300-132-2
ETS300-386-1[(1)]
EN55022-A[(1)]
EN55022-B[(1)]
EN41003
IEC6100-44[(1)]
IEC6100-45[(1)]
IEC950
VDE0871-A[(1)]
VDE0878-A[(1)]
BTNR2511(5)[(1)]

[(1)] Require additional external circuitry for full compliance. Please refer to application section of this manual or contact technical support office for further information.

Electrical Specifications

Absolute Maximum Ratings – all models

Exceeding the specified absolute maximum ratings may severely damage the module. These ratings are intended as guidelines for absolute worst case operating conditions and are not to be interpreted as recommended operating condition

General	48V Input	24V Input
Continuous Input Voltage	72V	36V
Input Surge Voltage (1 sec)	75V (continuous)	38V
Isolation, Input to Output*	2100VDC	1500VDC
Isolation Input to Baseplate*	2100VDC	1500VDC
Isolation, Output to Baseplate*	500VDC	500VDC
Operating Temperature (Baseplate)/ Case	0 to 85°C	
Storage Temperature	-40 to 105°C	
Operating Relative Humidity (non-condensing)	10% to 95%	
Storage Relative Humidity (non-condensing)	95% Max	
Altitude (Operating)	< 3000m	
Altitude (Storage)	< 9000m	
Lead Temperature (soldering 5 Seconds)	235°C	

Primary Control Pins	
TEMP MON	-0.5 to 7 VDC
C SHARE	-0.5 to 7 VDC
CLK OUT	-10 to 10 VDC
CLK IN	-10 to 10 VDC
CLIM ADJ	-0.5 to 7 VDC
PRI AUX	-0.5 to 14VDC
ENABLE	-0.5 to 20 VDC

Note: Relative to -INPUT/ S COM

Secondary Control Pins	
+SENSE	V_o - 0.5 to V_o + 0.5 VDC
-SENSE	-0.5 to 0.5 VDC
V ADJ	-0.5 to 7 VDC
PG/ID	-0.5 to V_o + 0.5VDC

Note : V_o = module output voltage
Note: Relative to -OUTPUT

Specifications

Electrical characteristics are guaranteed over the full baseplate/ Case temperature range (0 to 85°C) and for the full range of input voltage (V_I) and for the full load range (0 to I_O rated). Except where indicated , +SENSE and -SENSE are connected to the output terminals at the point of measurement, ENABLE is connected to S COM. All other pins are left floating.

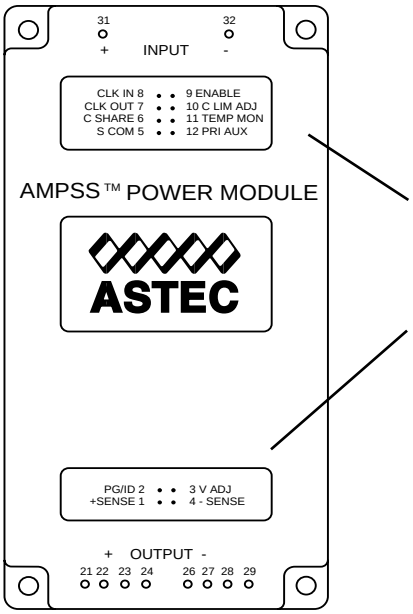
Definitions

V_I, V_O and I_O are actual operating conditions, V_{Inom}, V_{Onom} and I_{Orated} are nominal ratings.

Pin Connections - all models

INPUT PINS

Pin No	Pin Name	Type	Description	Recommended Connections
31	+INPUT	Input	Power input - positive	A 220µF electrolytic capacitor connected between the +INPUT and -INPUT pins is recommended
32	-INPUT	Input	Power input - negative (return)	See + INPUT for recommendations



CONTROL PINS

Pin No	Pin Name	Type	Description	Recommended Connections
1	+SENSE	Input	Used for remote sense function to compensate for load bus resistance	If remote sensing is not required connect to +OUTPUT pins 21-24 of the module
2	PG/ID	Output	High level output ($V_{PG/ID} = V_O$) indicates module converter is running. Can also be used to identify the nominal output voltage of the module by measuring resistance between PG/ID and +SENSE	ID Resistance = [$V_{O(nom)}$]KW. Leave unconnected if not used
3	V ADJ	Input	Used to adjust module output voltage	Leave unconnected if not used
4	-SENSE	Input	Used for remote sense function to compensate for load bus resistance	If remote sensing is not required connect to -OUTPUT pins 26-29 of the module
5	S COM	Reference	Negative reference for all primary side signals	Connect to negative side of primary control and monitoring circuitry
6	C SHARE	Input/Output	Allows modules connected in parallel to accurately share current	Connect to C SHARE pins of other modules. Leave unconnected if not used
7	CLK OUT	Output	Provides a 1MHz clock output for synchronization with other modules	Capacitor coupled output. Leave unconnected if not used
8	CLK IN	Input	Accepts a 1MHz clock input for synchronization with other modules	Capacitor coupled input. Leave unconnected if not used
9	ENABLE	Input	Enables or disables the output of the module	Must be connected to S COM pin or driven to <0.8V to enable the output of the module
10	C LIM ADJ	Input	Used to adjust the current limit set point	Leave unconnected if not used
11	TEMP MON	Output	Provides a voltage signal proportional to the internal absolute temperature of the module	Leave unconnected if not used
12	PRI AUX	INPUT	Primary Auxiliary supply. Allows external capacitance or external auxiliary supply to be connected to the module to allow start-up into high capacitance loads	Normal unused. Leave unconnected. When required, connect capacitor to S-COM or connect external 12V auxiliary supply

OUTPUT PINS

Pin No	Pin Name	Type	Description	Recommended Connections
21-24	+OUTPUT	Output	Power output - positive	Ensure good electrical connection and sufficient copper on PCB layouts
26-29	-OUTPUT	Output	Power output - negative	See +OUTPUT for recommendations

CONTROL SIGNALS

Control Function	Conditions	Parameter	Min	Typ	Max	Units
PG/ID power good / Identification function	Converter running : $I_{Orated} > I_O > 1A$	$V_{PG/ID}$		100		$\%V_O$
	Converter not running	$V_{PG/ID}$			1.0	V
	3.3 V output	Resistance, PG/ID to +OUTPUT	3.23	3.3	3.37	KW
	5V output		5.00	5.1	5.20	KW
	12V output		11.76	12	12.24	KW
	15V output		14.70	15	15.30	KW
	24V output		23.52	24	24.48	KW
V ADJ - voltage adjust	A resistor of R connected between V ADJ and +SENSE where : AK80A-xxxL-033Fyy R=1.2KW AK80A-xxxL-050Fyy R=2.4KW AK80A-xxxL-120Fyy R=27KW AK80A-xxxL-150Fyy R=39KW AK80A-xxxL-240Fyy R=82KW	V_O		90		$\%V_{Onom}$
	V ADJ connected to -SENSE	V_O		110		$\%V_{Onom}$
C SHARE - current share function*	C SHARE pins of modules in parallel connected	C SHARE accuracy		±5	±15	$\%I_{O\ rated}$
		Max no. of units			5	
CLK OUT - clock output		$V_{CLK\ OUT}$	4.4		5	Vp-p
	CLK IN open	Clock freq.	0.98	1	1.02	MHz
		Max fan out			2	
CLK IN - clock input		$V_{CLK\ IN}$	4.4		5.5	Vp-p
		Clock freq	0.9	1	1.1	MHz
PRI AUX	External Capacitor	External Capacitiance	0		TBD	µF
		Capacitor voltage rating	25			V
	External Aux	Vcc	10	12.0	14	V
		I_{aux} current drawn from external supply		0.2	0.3	A
ENABLE - module enable	Module enabled	V_{ENABLE}	0		0.8	V
	Module disabled	V_{ENABLE}	2		10	V
C LIM ADJ - Current Limit Adjust	C LIM ADJ connected to S COM	C LIM set point		20		$\%I_{Orated}$
	C LIM ADJ open	C LIM set point		115		$\%I_{Orated}$
TEMP MON - temperature monitor signal		V_{TMON} sensitivity	9.8	10	10.2	mV/°C
		Source impedence		1		KW

Notes :
Each module must supply min 5% of rated current to ensure the module and the C-share signal are in operation when operating in parallel.

Insulation - all models

INSULATION

Parameter	Conditions	Min	Typ	Max	Units
Input-output insulation resistance	500VDC	10			M W
Input-baseplate insulation resistance	500VDC	10			M W
Output-baseplate insulation resistance	500VDC	10			M W

Electrical Specifications for 24V Input Models

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Input voltage		18	24	36	V
Input surge voltage	(1 second)			38	V
Input low line power on voltage	Module power on	15		17.5	V
Input low line power off voltage	Module shutdown	50		80	% V_{Ion}
No load input power	$V_I = V_{Inom}$			15	W
Input capacitance				12	µF

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time			100	1000	msec
Transient response	(25% to 75% load change @ 0.1A/µS, recovery to 1% V_O)				
	Step-load excursion			10	% V_O
	Step-load response			300	µS

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Nominal (factory set) output voltage					
	AK80A-024L-033F40		3.3		V
	AK80A-024L-050F30		5.0		V
	AK80A-024L-120F14		12.0		V
	AK80A-024L-150F12		15.0		V
	AK80A-024L-240F08		24.0		V
Output voltage set point accuracy	T_C = +25°C, $V_I = V_{Inom}$, $I_O = I_{Orated}$	-1		1	% V_{Onom}
Remote sense compensation *	$V_I = V_{Imin}$			0.5	V
Output voltage adjust		90		110	% V_{Onom}
Nominal (factory set) output overvoltage protection trip point	All models :	120	130	140	% V_{Onom}
	except AK80A-024L-033F40	130	145	160	% V_{Onom}
Line regulation	V_{Imin} to V_{Imax}			0.2	% V_{Onom}
Load regulation	0 to I_{Omax}				
	All models			0.5	% V_{Onom}
	except				
	AK80A-024L-033F40			150	mV
Noise and ripple	20MHz bandwidth			3	% V_{Onom}
Output current					
	AK80A-024L-033F40	0		40	A
	AK80A-024L-050F30	0		30	A
	AK80A-024L-120F14	0		14	A
	AK80A-024L-150F12	0		12	A
	AK80A-024L-240F08	0		8	A
Output current limit	V_O dropped to 90% of V_{Onom}	105	115	125	% I_{Orated}
Short circuit current (average current)				85	% I_{Orated}
Maximum Load capacitance (PRI AUX left open)	RESISTIVE LOAD START UP				
	AK80A-024L-033F40			200000	µF
	AK80A-024L-050F30			150000	µF
	AK80A-024L-120F14			85000	µF
	AK80A-024L-150F12			80000	µF
	AK80A-024L-240F08			9000	µF
Temperature coefficient	Per °C Baseplate temperature			0.02	% V_O/°C
Overtemperature shutdown	Baseplate temperature	87		110	°C
Efficiency	$V_O = V_{Onom}$, $V_i = V_{inom}$, $I_O = I_{Orated}$				
	AK80A-024L-033F40	73	74		%
	AK80A-024L-050F30	80	81		%
	AK80A-024L-120F14	85	86		%
	AK80A-024L-150F12	85	86		%
	AK80A-024L-240F08	85	86		%

Electrical Specifications for 48V Input Models

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Input voltage		36	48	72	V
Input surge voltage	continuous			75	V
Input low line power on voltage	Module power on	27		35	V
Input low line power off voltage	Module shutdown	50		80	% V_{Ion}
No load input power	$V_I = V_{Inom}$			10	W
Input capacitance				5.0	µF

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time			100	1000	msec
Transient response	(25% to 75% load change @ 0.1A/µS, recovery to 1% V_O)				
	Step-load excursion			10	% V_O
	Step-load response			300	µS

OUTPUT CHARACTERISTICS

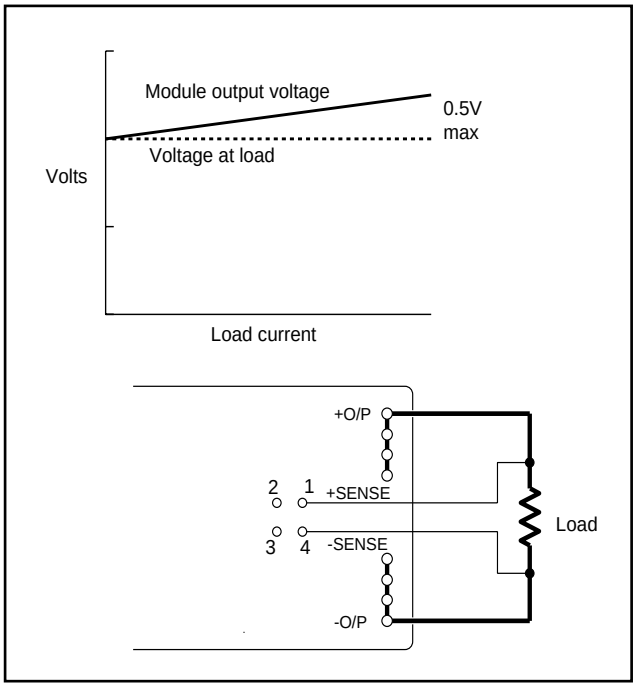
Parameter	Conditions	Min	Typ	Max	Units
Nominal (factory set) output voltage					
	AK80A-048L-033F50		3.3		V
	AK80A-048L-050F40		5.0		V
	AK80A-048L-120F18		12.0		V
	AK80A-048L-150F16		15.0		V
	AK80A-048L-240F10		24.0		V
Output voltage set point accuracy	T_C = +25°C, $V_I = V_{Inom}$, $I_O = I_{Orated}$	-1		1	% V_{Onom}
Remote sense compensation[1]	$V_I = V_{Imin}$			0.5	V
Output voltage adjust		90		110	% V_{Onom}
Nominal (factory set) output overvoltage protection trip point	All models :	120	130	140	% V_{Onom}
	except AK80A-048L-033F50	130	145	160	% V_{Onom}
Line regulation	V_{Imin} to V_{Imax}			0.2	% V_{Onom}
Load regulation	0 to I_{Omax} All modules except AK80A-048L-033F50			0.5 150	% V_{Onom} mV
Noise and ripple	20MHz bandwidth			3	% V_{Onom}
Output current					
	AK80A-048L-033F50	0		50	A
	AK80A-048L-050F40	0		40	A
	AK80A-048L-120F18	0		18	A
	AK80A-048L-150F16	0		16	A
	AK80A-048L-240F10	0		10	A
Output current limit	V_O dropped to 90% of V_{Onom}	105	115	125	% I_{Orated}
Short circuit current (average current)				40	% I_{Orated}
Maximum Load capacitance (PRI AUX left open)	RESISTIVE LOAD START UP				
	AK80A-048L-033F50			6800	µF
	AK80A-048L-050F40			3300	µF
	AK80A-048L-120F18			500	µF
	AK80A-048L-150F16			470	µF
	AK80A-048L-240F10			330	µF
Temperature coefficient	Per °C Baseplate temperature			0.02	% V_O/°C
Overtemperature shutdown	Baseplate temperature	87		110	°C
Efficiency	$V_O = V_{Onom}$, $V_i = V_{inom}$, $I_O = I_{Orated}$				
	AK80A-048L-033F50	71	72		%
	AK80A-048L-050F40	80	82		%
	AK80A-048L-120F18	85	87		%
	AK80A-048L-150F16	84	85		%
	AK80A-048L-240F10	85	86		%

Functional Description

This section explains how to implement the functions found on the AK80A Economy series.

Remote Sense (+SENSE, -SENSE)

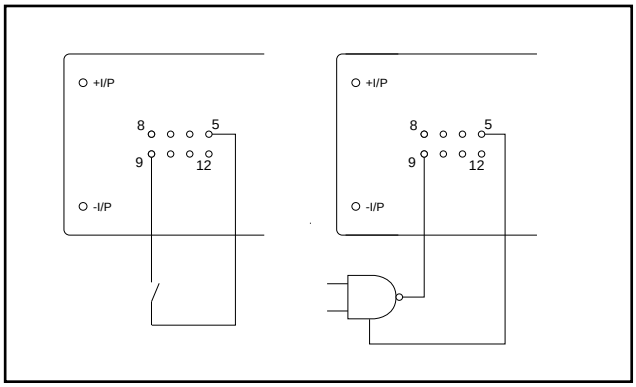
Connect the +SENSE and -SENSE pins directly to the load to allow the module to compensate for the voltage drop across the conductors carrying the load current. If remote sensing is not required (for example if the load is close to the module) the sense pins should be connected directly to the module's output pins to ensure accurate regulation.



Note: *If the sense leads fail open circuit, the module will revert to local sense at the output pins. Incorrect connection of sense leads may damage the module*

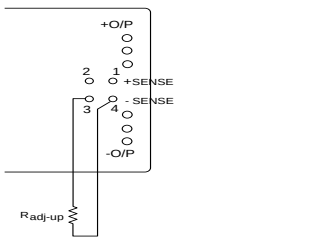
Enable Control (ENABLE)

The enable pin is a TTL compatible input used to turn the output of the module on or off. The module output is enabled when the ENABLE pin is connected to S COM or driven to a logic low of <0.8V (but not negative) with respect to S COM.
The output is disabled when the enable pin is open or driven to a logic high >2V with respect to S COM. If the AK80A is operated in parallel, all ENABLE pins must be connected in parallel to ensure all modules are enabled simultaneously.



Output Voltage Adjustment (V ADJ)

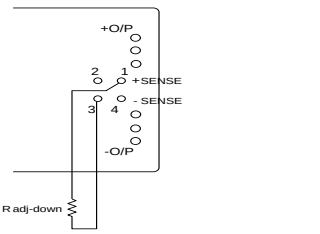
The output voltage of the module may be accurately adjusted by up to ±10% of the nominal factory set output. Adjustment is carried out using a resistor
connected as to control adjust current I_1 and I_2.



Circuit Configuration to Increase Output Voltage

$$I_1 = \frac{Vs}{R1} \qquad I_2 = \frac{Vo - Vs}{R2} \qquad R_{adj\text{-}up} = \frac{1}{\frac{1}{\frac{Vs}{I_1 + I_2} - R3} - \frac{1}{R4}} - R5$$

V0 = (100% - 110%) Vonom



Circuit Configuration to Decrease Output Voltage

$$I_1 = \frac{Vs}{R1} \qquad I_2 = \frac{Vo - Vs}{R2} \qquad R_{adj\text{-}down} = \frac{Vo - Vs + (I_1 + I_2) \times R3}{Vs - (I_1 + I_2) \times (R3 + R4)} \times R4 - R5$$

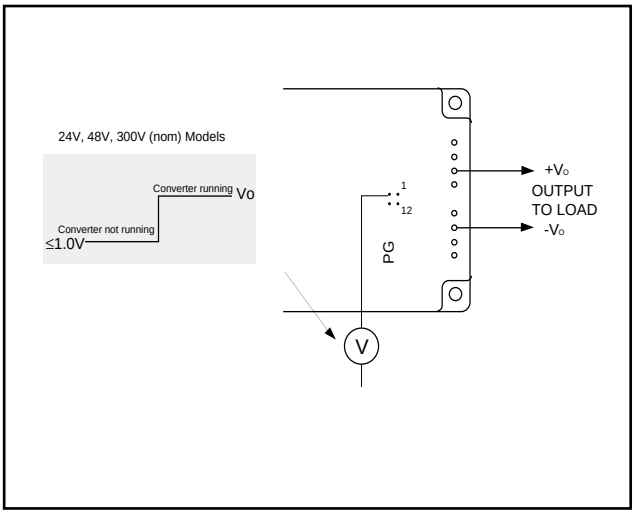
Vo = (90% to 100%) Vonom

MODEL	Vs	R1	R2	R3	R4	R5
3.3V	2.5V	Open	1K8	2K4	3K3	2K4
5.0V	2.5 V	Open	2K7	300	2K4	8K2
12.0V	2.5 V	Open	6K2	0	1K6	10K
15.0V	2.5 V	Open	8K2	0	1K6	11K
24.0V	2.5 V	Open	12K	0	1K5	11K

NOTE: Radj tolerance must be => 1% to achieve a 3% set accuracy

Power Good/Identification (PG/ID)

This pin provides an indication that the module's converter is working, and can also be used to identify the factory set output voltage of the module.
The PG/ID pin goes high to the level of the output voltage (V_O) to indicate that the module is operating and delivering power. The output goes low if the converter stops operating due to a fault such as an overtemperature or overvoltage condition. The PG/ID pin will also go low if the module is disabled via the ENABLE pin.

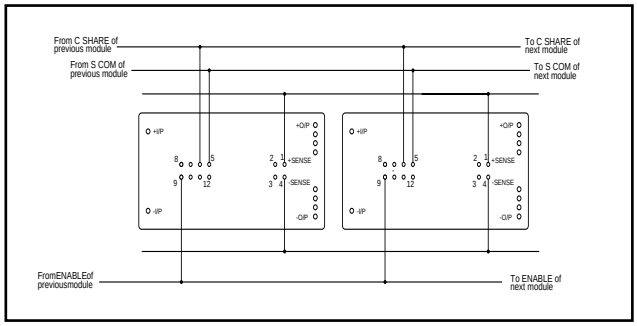


The resistance between the PG/ID pin and the +ve output of the module can be used to determine the output voltage of the module with no power applied according to the table shown:

Output Voltage (V)	Resistance (KΩ)
3.3	3.3
5	5.1
12	12
15	15
24	24

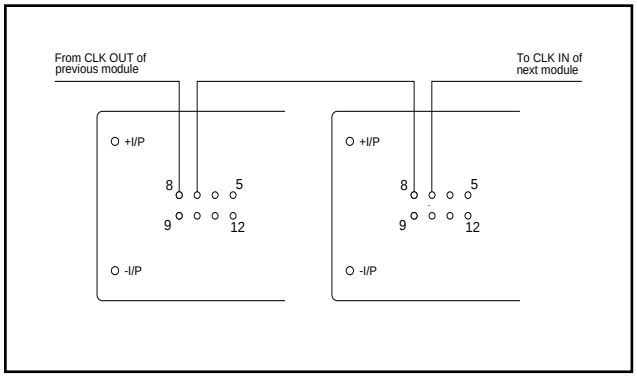
Current Sharing (C SHARE)

To ensure that all modules in a parallel system accurately share current, the C SHARE and S COM pins on each module should be connected together as shown.
The ENABLE pins of each of the modules should be connected either directly to S COM or to a common enable control to ensure that all modules are enabled simultaneously. Only after the module is enabled will C SHARE become active. Only when all C SHARE signals are active will power be delivered to the load.



Clock Signals (CLK IN, CLK OUT)

The module's internal clock is accurate and stable over its full operating range and synchronization is not normally required, but it can reduce noise in paralleled systems.



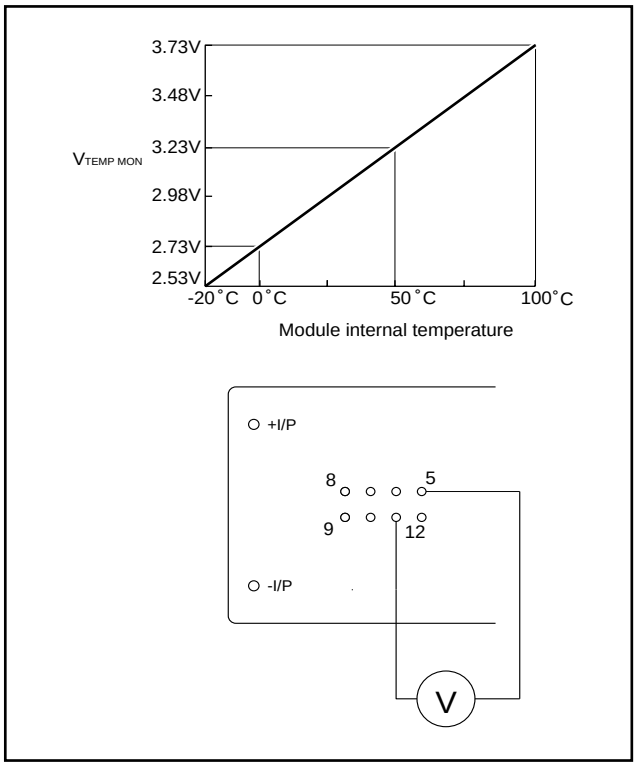
Clock signals can be wired in series (the CLK OUT pin of one module to the CLK IN pin of the next etc) in which case all the modules will be synchronized with the first module in the chain. Alternatively, an external clock signal of 5Vpk-pk at 1MHz±10% can be connected to the CLK IN pins of all the modules.
If the clock input to any module fails, the module will automatically switch back to its internal clock and will continue to operate normally. The CLK IN and CLK OUT signals are AC coupled, so any module can clock another module regardless of polarity.

Temperature Monitoring (TEMP MON)

The TEMP MON pin provides an indication of the module's internal temperature.The voltage at the TEMP MON pin is proportional to the temperature of the module baseplate at 10mV per °C, where:

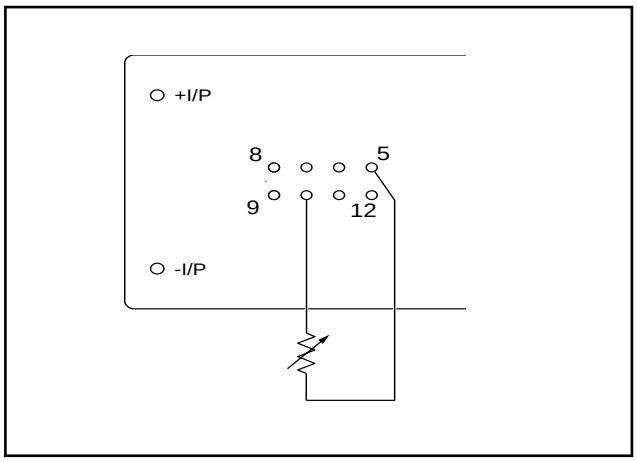
$$\text{Module temperature (°C)} = (V_{\text{TEMP MON}} \times 100) - 273$$

The temperature monitor signal can be used by thermal management systems (e.g. to control a variable speed fan). It can also be used for overtemperature warning circuits and for thermal design verification of prototype power supplies and heatsinks.



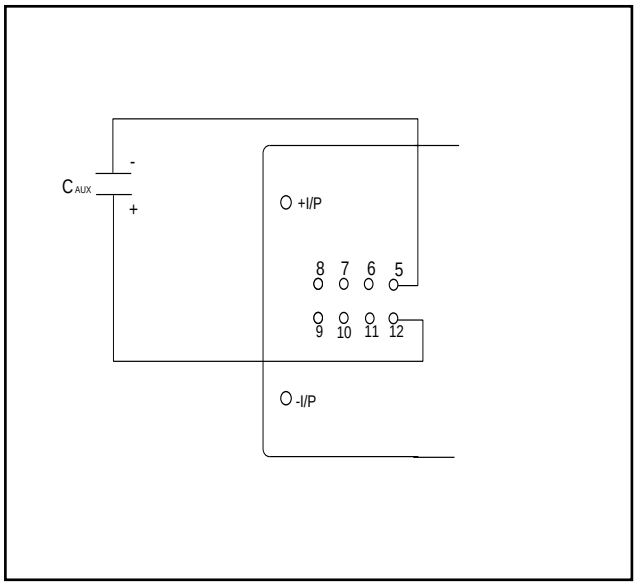
Current Limit Adjustment (C LIM ADJ)

A 'bounce mode' current limiting circuit protects the module under overload or short circuit conditions.
With the C LIM ADJ pin left unconnected the current limit is factory set to 115% of the module's rated output, but may be adjusted across the range from 20% to 100% using a resistor.



PRI AUX

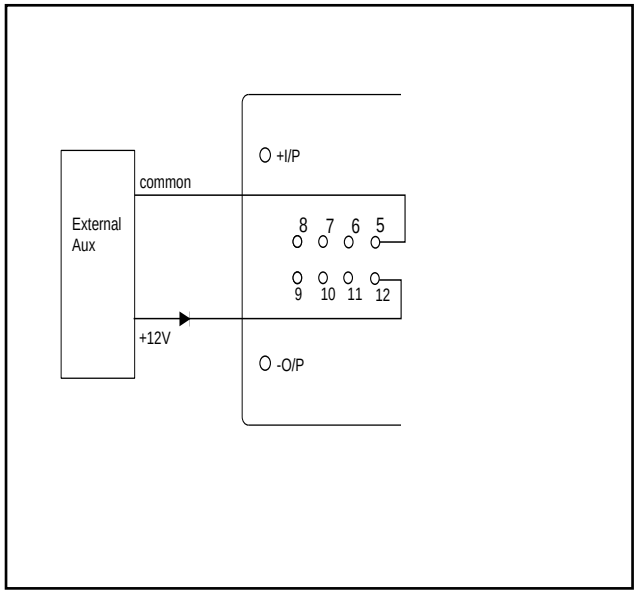
The ability of the AK80 to start highly capacitative loads can be extended by adding an external capacitor or adding an external auxiliary supply.



Maximum Load Capacitance

Model	C_{AUX}				
	None	100µF	470µF	1000µF	2200µF
AK80A-024L-033F40	>200000				
AK80A-024L-050F30	150000				
AK80A-024L-120F14	85000				
AK80A-024L-150F12	80000				
AK80A-024L-240F08	9000				
AK80A-048L-033F50	6800	TBD	TBD	TBD	TBD
AK80A-048L-050F40	3300	TBD	TBD	TBD	TBD
AK80A-048L-120F18	500	TBD	TBD	TBD	TBD
AK80A-048L-150F16	470	TBD	TBD	TBD	TBD
AK80A-048L-240F10	330	TBD	TBD	TBD	TBD

Alternatively an external auxiliary supply can be used.

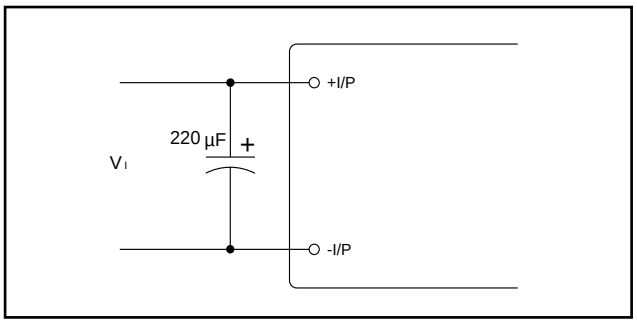


With an external auxiliary supply, the AK80A can be used with any value of Load capacitance

Design Considerations

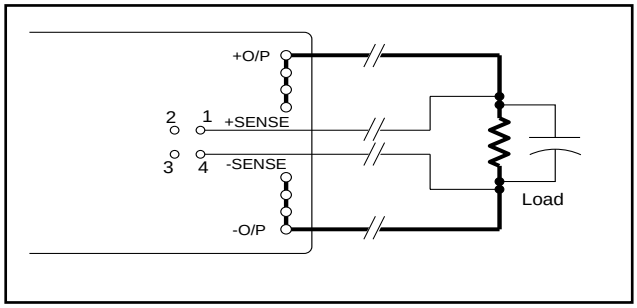
Input Bulk Capacitors

Electrolytic bulk reservoir capacitors placed close to the module input pins are recommended to ensure the module is fed with a low source impedance. For the AK80A Economy Series module typical values are 220µF/100V for 48V modules and 220µF/50V for 24V modules.



Remote Loads

If the sensed load is some distance from the module, the module's output voltage may rise sufficiently to trigger the OVP protection circuit during a step load change due to bus inductance. Fitting a decoupling capacitor at the load can reduce this effect.
It should be noted that a distributed power solution, using AMPSS™ modules placed close to their loads, will optimize transient response.



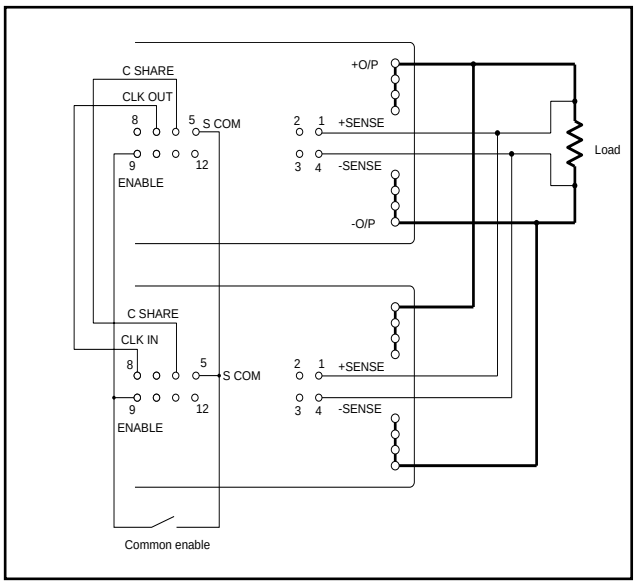
Input Fusing

AMPSS modules do not have an in-line fuse fitted internally. In order to comply with CSA, VDE and UL safety regulations it is recommended that a fuse of the following rating be fitted at the module's input.

Input	Fuse Rating
48V	10A / 250V
24V	15A /250V

Parallel Connection Considerations

A master-slave configuration is not required for AMPSS™ modules. AK80A modules may be connected in parallel using a simple wiring scheme.



Current Sharing

In multi-module paralleled systems, all modules will share current to within ± 5% (typical) of the rated load current per module when the C SHARE pins of each module are connected together. The +SENSE and -SENSE pins of each module should be connected to common points as close as possible to the load.

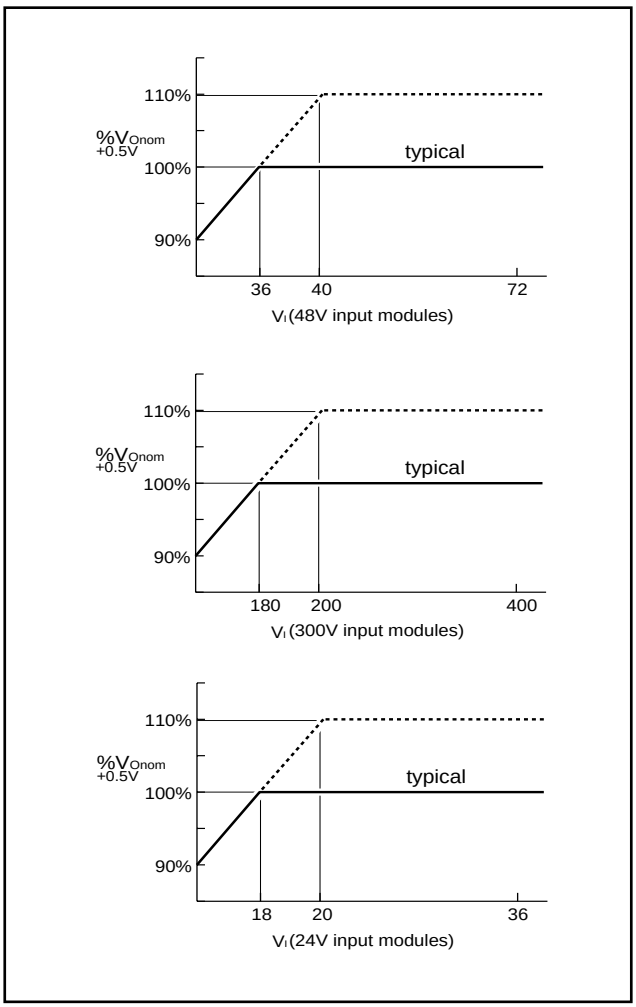
NOTE: After a module is enabled the C SHARE becomes active. Only when all C SHARE signals are active will power be delivered to the load. For this reason the AK80A Series is unsuitable for hot pluggable or redundancy systems.

Synchronization

Modules are synchronized by connecting the CLK OUT pin of one module to the CLK IN pin of the next. Consecutively connected modules operate out of phase with each other, resulting in ripple cancellation at the inputs and outputs of paralleled modules. If the clock input to a module fails, it will automatically revert to its internal clock and continue to operate at full power.

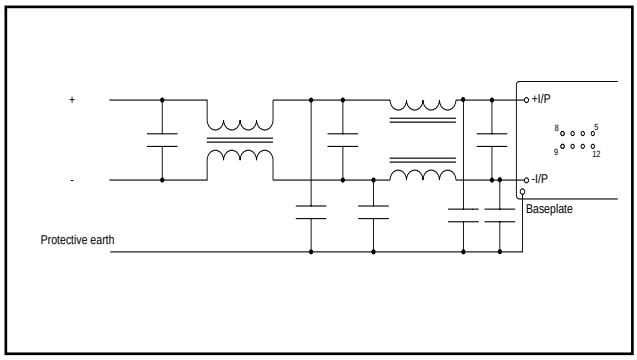
Break Regulation

AK80A Economy Series modules are designed to deliver full rated output current at up to 0.5V above $V_{O\ nom}$ at the minimum specified input voltage.



Conducted EMI

Although AMPSS™ modules contain both common mode and differential mode input EMI filtering, power supply systems using these modules will require additional EMI filtering to enable the system to meet relevant EMI standards.
AK80A modules have an effective input to ground (baseplate) capacitance of 500pF. This should be accounted for when calculating the maximum EMI 'Y' capacitance to meet ground leakage current specifications.

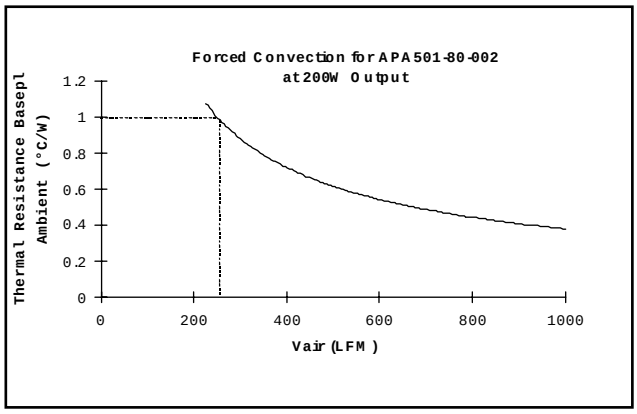


Overtemperature Protection

If the module's internal temperature exceeds 95°C, the module will latch OFF. To reset the module the input supply must be cycled off and then on again, allowing a period of time for the module to cool down.
Overtemperature shutdown can also be programmed to occur at lower temperatures by using the TEMP MON output to control the ENABLE pin.

Thermal Data

Natural convection thermal impedance of the AK80A package without a heatsink is approximately 4°C/W.
A standard horizontal fin heatsink available from Astec (part number APA501-80-002) with 11mm fins and 8mm pitch, will reduce module thermal impedance to 1°C /W with a forced air flow of 250 LFM when mounted with a thermal pad (ASTEC P/N APA502-80-001) between heatsink and module.



MTBF

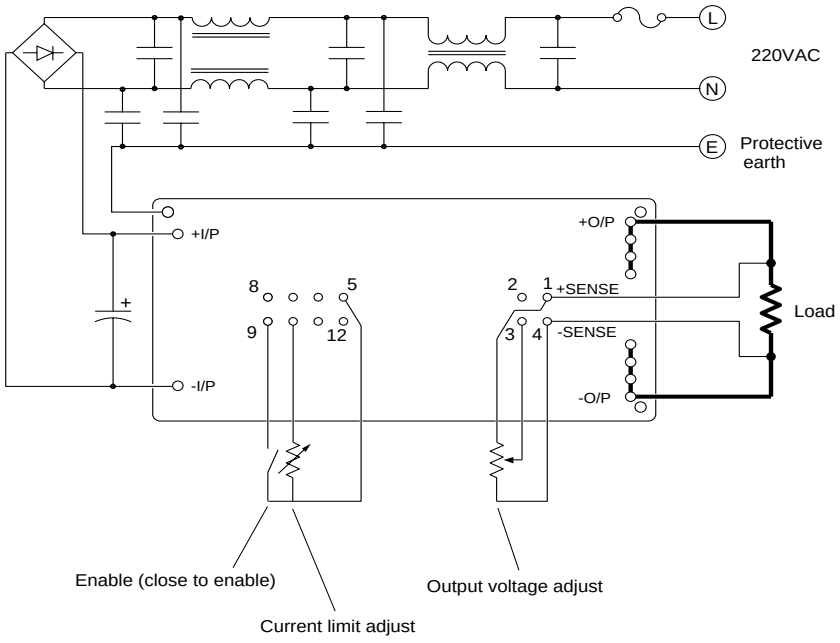
Predicted MTBF for the AK80A Economy Series is greater than 1,000,000 hours at maximum rated output and 50°C baseplate temperature.

Output Ripple and Noise

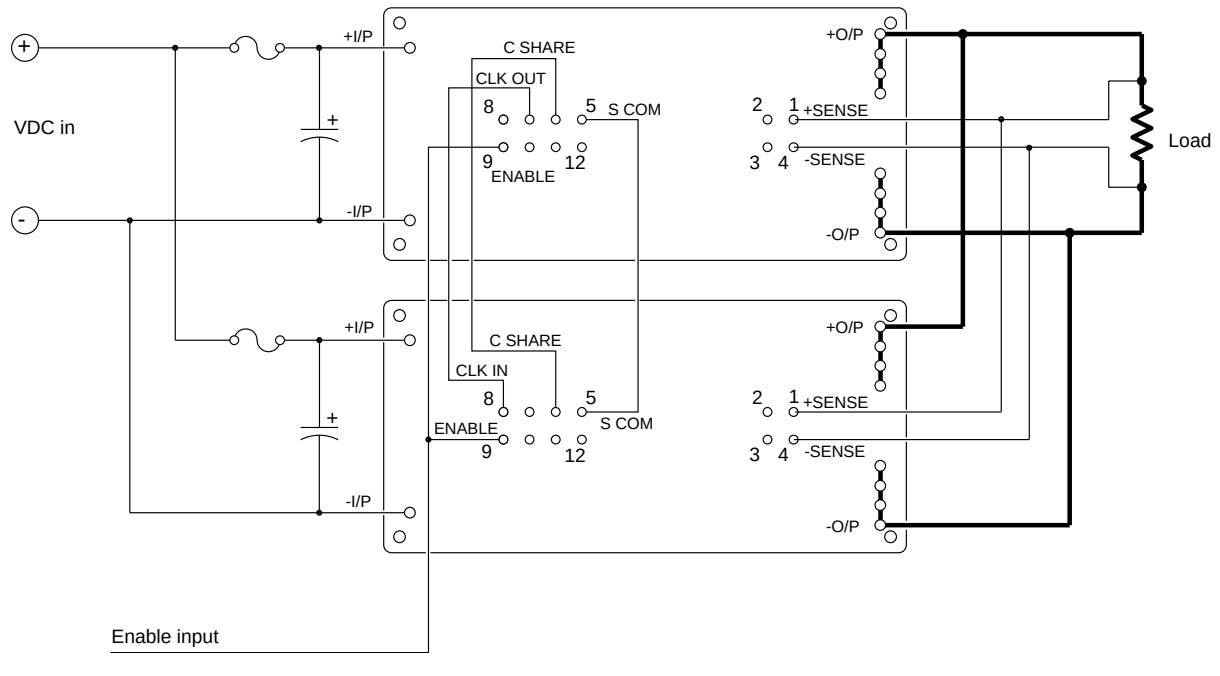
AK80A Economy Series modules are designed to generate very low ripple and noise. When mounted on logic boards, for example, sufficient decoupling is normally provided by the components used to decouple the logic ICs, and no additional decoupling is required.

Application Examples

AC Input Design



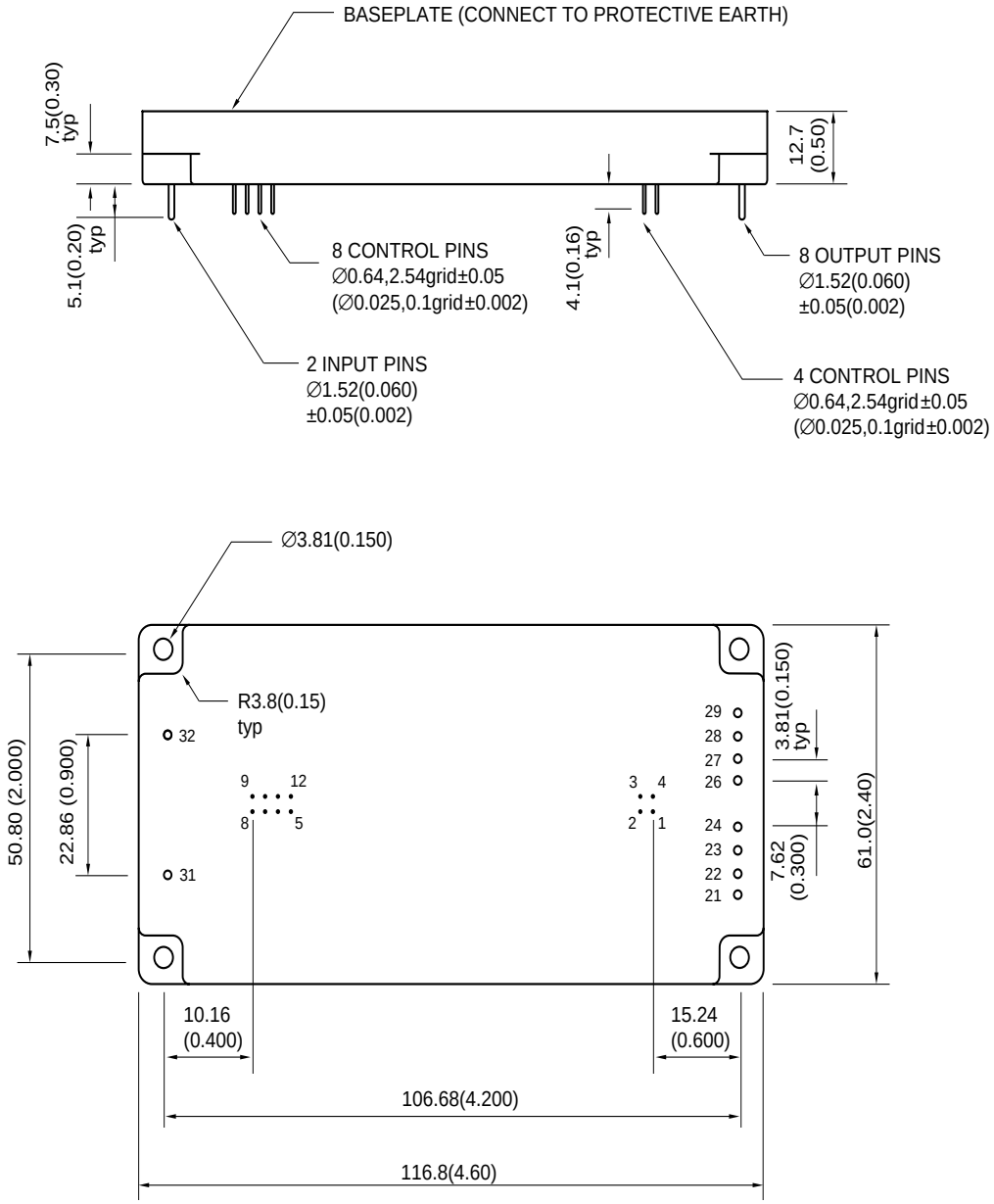
Parallel Connection Design



Mechanical Information

Dimensions

The dimensions are given in mm (inches). Note that the baseplate must be connected to protective earth before power is supplied to the module.

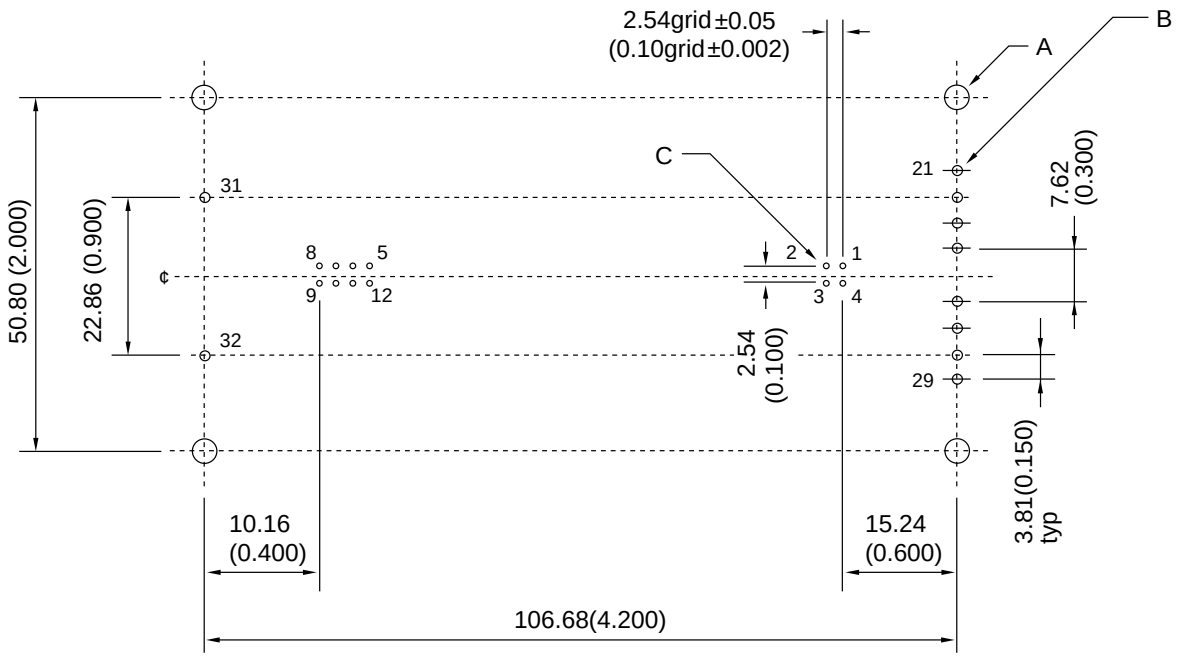


Notes:
1. All dimensions in mm and (inches)
2. Baseplate must be connected to protective earth
3. General tolerance: .X ±0.5(0.02)
   .XX±0.25(0.010)
4. Surface Flatness: Concave 0.12mm max
   Convex 0.38mm max

Recommended PCB Layout

The AK80A Economy Series module may be mounted to a board either by soldering or by using spring sockets.

Materials :
Control pins are tin plated phospher-bronze.
Input and output pins are tin plated copper.



VIEW FROM PCB COMPONENT SIDE

NOTES:
1. PCB COMPONENT SIDE VIEW IS SHOWN.
2. ALL DIMENSIONS IN mm AND (INCHES).
3. GENERAL TOLERANCE: .XX±0.1(0.006).

RECOMMENDED HOLE SIZE TABLE:-

	A	B	C
HOLE SIZE FOR PCB DIRECT SOLDERING	∅2.00+0.15/-0 (∅0.079+0.006/-0)	∅2.00+0.15/-0 (∅0.079+0.006/-0)	∅1.00+0.15/-0 (∅0.039+0.006/-0)
HOLE SIZE FOR SPRING SOCKET MOUNTING*		∅2.67±0.05 (∅0.105±0.002)	∅1.37±0.05 (∅0.054±0.002)
HOLE SIZE FOR M3.5 MACHINE SCREW	∅4.5+0.08/-0 (∅0.177+0.0031/-0) FOR M3.5		

* Spring sockets are available from Astec in packs of 20 control pin sockets and 15 power pin sockets, partno. APA504-00-001. Sockets are not suitable for output current greater than10A per pin.

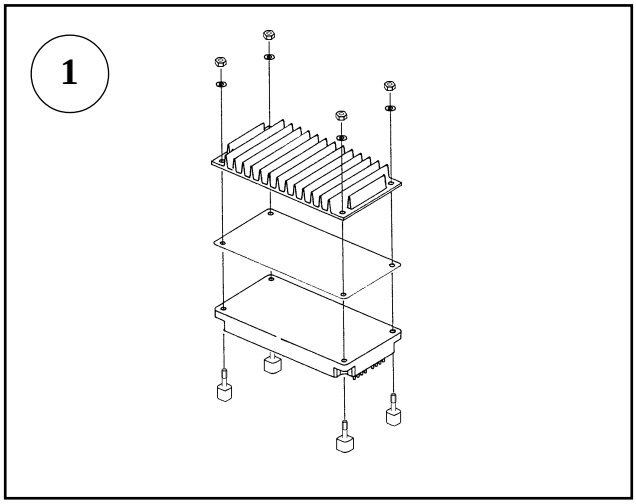
Heatsink Mounting Information

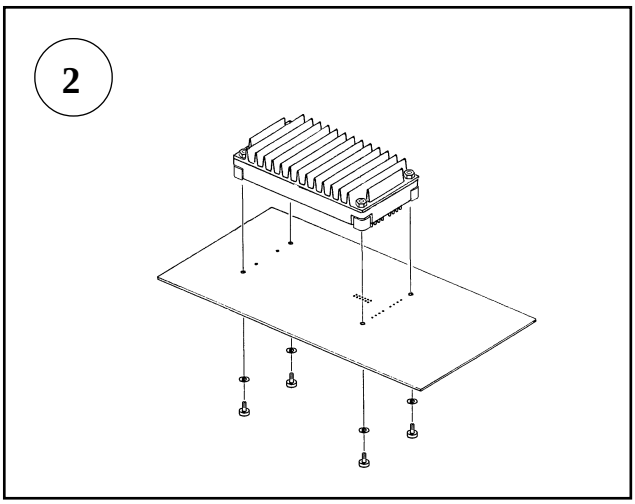
Heatsinks for AMPSS™ modules are available in a variety of sizes and fin orientation. Mounting kits and thermal pads are also available. The table below shows the options available for AK80A Economy Series.
A heatsink mounting kit provides the most convenient way to mount the heatsink to the module and then mount the assembly onto a circuit board

AMPSS™ modules may be retained by their input and output pins only, or may be fixed to the board using bolts screwed into the tapped studs which are provided as part of the mounting kit. In both cases the studs provide clearance between the module and the circuit board to facilitate PCB cleaning operations.

Note: *1). Baseplate and heatsink must be connected to protective earth*

2). Mechanical support must not induce twist in the module baseplate and must incorporate strain relief, e.g. spring washers.





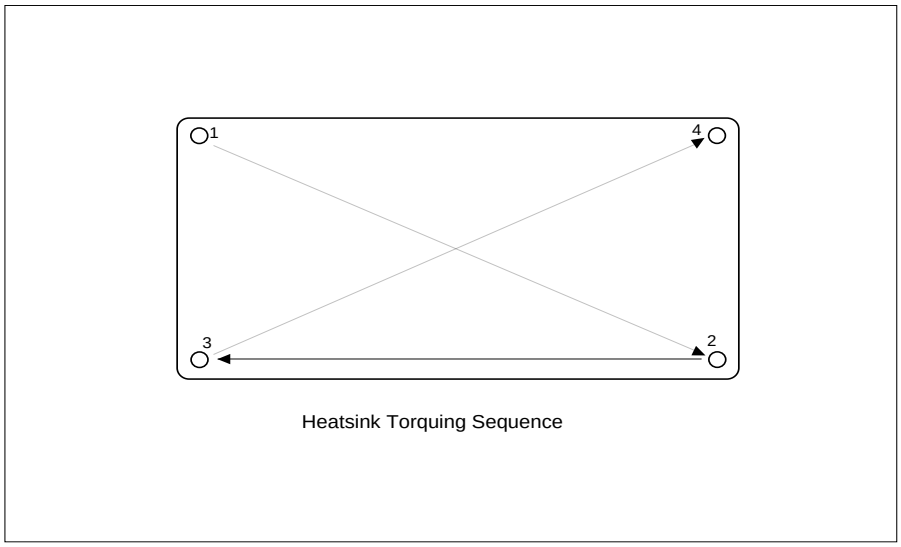
Description	Model Number	Dimensions		Free air thermal resistance
		inches	mm	
Heatsink, "80" size, vertical fin.	APA501-80-001	4.53x2.32x0.6	115x59x15	2.7°C/W
Heatsink, "80" size, horizontal fin	APA501-80-002	4.53x2.32x0.6	115x59x15	2.4°C/W
Heatsink, "80" size, vertical fin.	APA501-80-003	4.53x2.32x0.9	115x59x22.5	2.2°C/W
Heatsink, "80" size, horizontal fin	APA501-80-004	4.53x2.32x0.9	115x59x22.5	2.0°C/W
Heatsink, "80" size, vertical fin.	APA501-80-005	4.53x2.32x1.5	115x59x37	2.0°C/W
Heatsink, "80" size, horizontal fin	APA501-80-006	4.53x2.32x1.5	115x59x37	1.7°C/W
Heatsink, "80" size, low profile	APA501-80-007	4.55x3.50x0.5	115.6x89x12	2.2°C/W
Thermal Pad, "80" size	APA502-80-001			
Mounting Kit, Tapped Studs	APA503-00-001			
Mounting Kit, Solder Studs	APA503-00-002			
Mounting Kit, Tapped Studs for low profile heatsink	APA503-00-007			
Mounting Kit, Solder Studs for low profile heatsink	APA503-00-008			
Spring Sockets (20 cont. 15pwr)	APA504-00-001			

To provide optimal thermal contact between heatsink and module, it is recommended that the mating surface of the heatsink should have a surface flatness of no greater than 0.1mm. The use of a thermal pad or thermal grease is also recommended.

The recommended torque of using AMPSS mounting kit for module/heatsink is:

Screw size	Torque
M3	4-6kg-cm (3.5-5.2 lb-in)
M3.5	6-8kg-cm (5.2-6.9 lb-in)

Torque sequence:



Heatsink Torquing Sequence

It is assumed that all four mounting screws are being torqued to a common surface.

Other thermal management schemes are at customer discretion as long as the maximum thermal rating of the specific module is not exceeded.

For further information contact :

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