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AK60A **Economy** *Series*



**50-100W Output Power
DC-DC Converter Module
Technical Reference Manual**

Series Highlights

- High Efficiency - up to 88%
- 100W Output Power
- Excellent transient response
- 85°C baseplate/case operating temperature
- Low output ripple and noise
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- Designed to meet Telecom specification
- Fixed switching frequency

Contents

Introduction	2
Special Features	2
Ordering Information	3
Safety	3

Electrical Specifications 4

Absolute Maximum Ratings – all models	4
Pin Connections - all models	5
Electrical Specifications for 24V Input Models (AK60A-024L-xxxFyy)	6
Insulation - all models	6
Electrical Specifications for 48V Input Models (AK60A-048L-xxxFyy)	8

Functional Description 10

Remote Sense (+SENSE, -SENSE)	10
Enable Control (ENABLE)	10
PRI AUX	10
CLK IN	11
Output Voltage Adjustment (V ADJ)	12
Signal Common (S COM)	12

Design Considerations 13

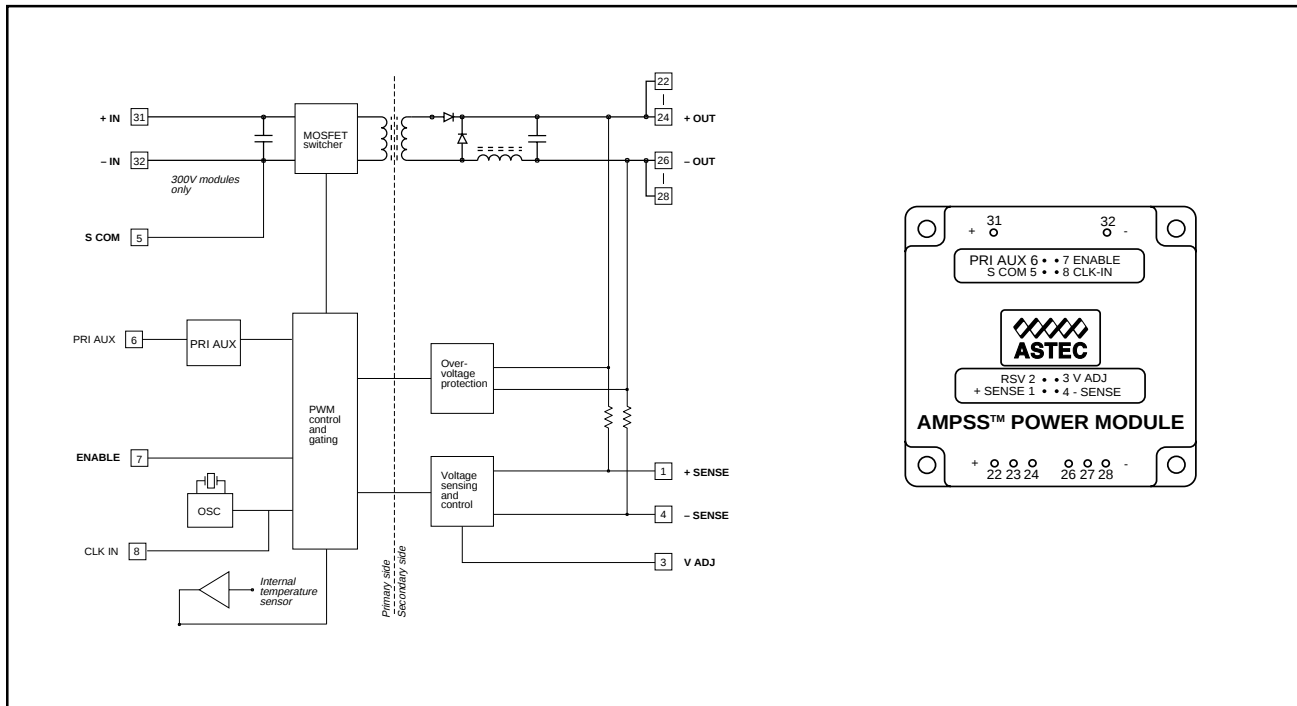
Input Bulk Capacitors	13
Remote Loads	13
Input Undervoltage Protection	13
Conducted EMI	13
Output Ripple and Noise	13
Input Fusing	13
Break Regulation	14
Overtemperature Protection	14
MTBF	14
Thermal Data	14

Application Example 15

Mechanical Information 16

Dimensions	16
Recommended PCB Layout	17
Heatsink Mounting Information	18

AK60A Economy Series DC-DC Converters



Introduction

The AK60A is an isolated, single output DC to DC converter module, providing up to 100W output. The AK60A features primary side control, remote enable, remote sensing and a baseplate operating temperature of up to 85°C.

Special Features

- High Efficiency - up to 88%
- 500 KHz fixed frequency switching
- 85°C baseplate/case operating temperature (with no derating)
- Low output ripple and noise
- Excellent transient response
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- TTL compatible enable control
- Adjustable output voltage
- Overtemperature and short circuit protection

Ordering Information

Model Number	Input Voltage	Output Voltage	Output Current	Output Power
AK60A-048L-050F10	48V	5V	10A	50W
AK60A-048L-050F15	48V	5V	15A	75W
AK60A-048L-050F20	48V	5V	20A	100W
AK60A-048L-120F04	48V	12V	4.2A	50W
AK60A-048L-120F06	48V	12V	6.3A	75W
AK60A-048L-120F08	48V	12V	8.3A	100W
AK60A-048L-150F03	48V	15V	3.3A	50W
AK60A-048L-150F05	48V	15V	5.0A	75W
AK60A-048L-150F07	48V	15V	6.7A	100W
AK60A-024L-050F10	24V	5V	10A	50W
AK60A-024L-050F15	24V	5V	15A	75W
AK60A-024L-050F20	24V	5V	20A	100W
AK60A-024L-120F04	24V	12V	4.2A	50W
AK60A-024L-120F06	24V	12V	6.3A	75W
AK60A-024L-120F08	24V	12V	8.3A	100W
AK60A-024L-150F03	24V	15V	3.3A	50W
AK60A-024L-150F05	24V	15V	5.0A	75W
AK60A-024L-150F07	24V	15V	6.7A	100W
AK60A-024L-240F02	24V	24V	2.1A	50W
AK60A-024L-240F03	24V	24V	3.1A	75W
AK60A-024L-240F04	24V	24V	4.2A	100W

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	1500VDC	1500VDC
Isolation, Input to Baseplate	1500VDC	1500VDC
Isolation, Output to Baseplate	500VDC	500VDC
Operating Temperature (Baseplate) / Case	-20 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	

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

Note : V_o = module output voltage

Note: Relative to -OUTPUT

Primary Control Pins	
ENABLE	-0.5 to 20 VDC
PRI AUX	-0.5 to 14VDC
CLK-IN	-10 to 10 VDC

Note: Relative to - INPUT/ S COM

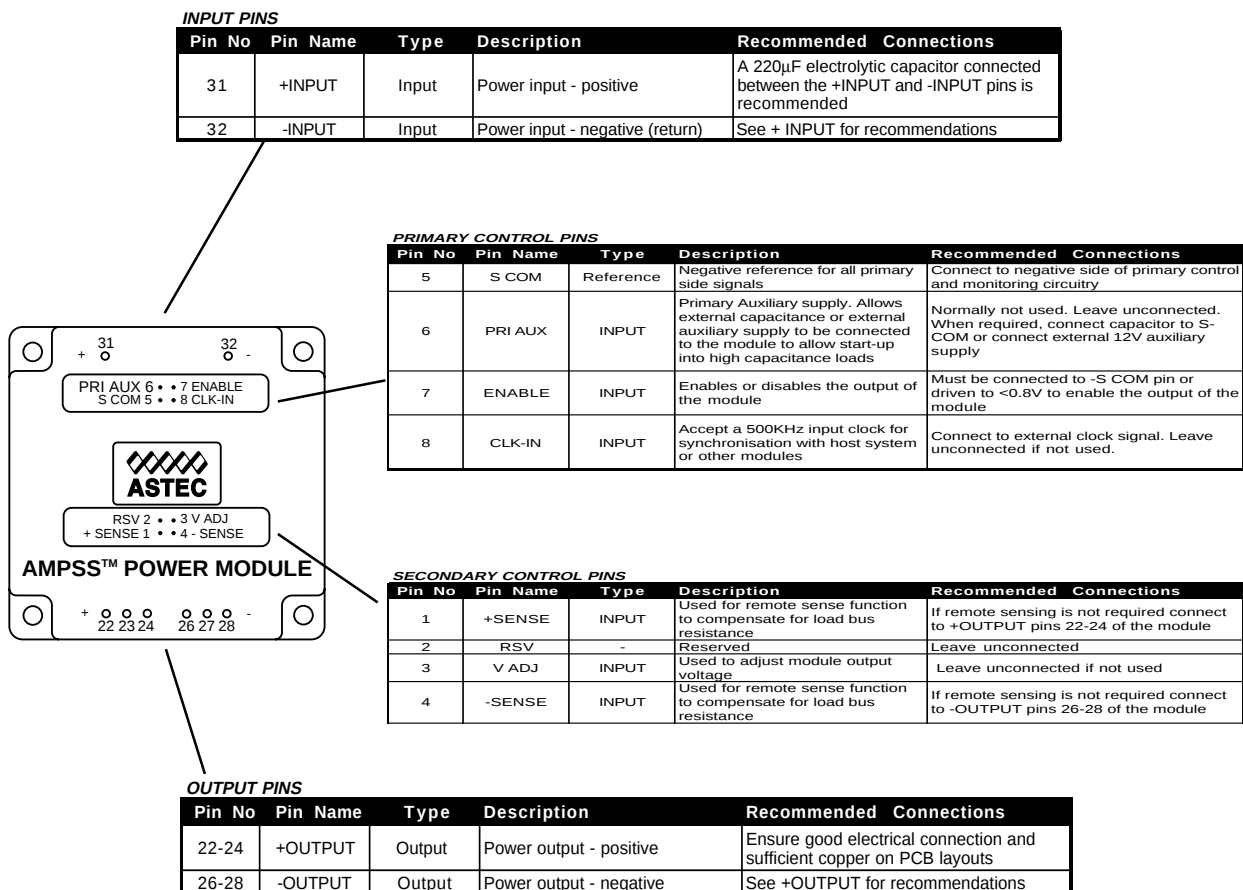
Specifications

Electrical characteristics are guaranteed over the full baseplate/Case temperature range (-20 to 85°C) and for the full range of input voltage (V_i) and for the full load range (I_{omin} 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

**CONTROL SIGNALS**

Control Function	Conditions	Parameter	Min	Typ	Max	Units
V ADJ - voltage adjust	5V output: Connect 2.4K Ω from Vadj to +SENSE	V _O		90		%V _{Onom}
	12V output: Connect 27K Ω from Vadj to +SENSE	V _O		90		%V _{Onom}
	15V output: Connect 39K Ω from Vadj to +SENSE	V _O		90		%V _{Onom}
	24V output: Connect 82K Ω from Vadj to +SENSE	V _O		90		%V _{Onom}
	Connect to -SENSE	V _O		110		%V _{Onom}
ENABLE - module enable	Module enabled	V _{ENABLE}	0		0.8	V
	Module disabled	V _{ENABLE}	2		10	V
	V _{ENABLE} = 0.8V	ENABLE current source			300	μ A
PRI AUX	External Capacitor	External Capacitance	0		2200	μ F
		Capacitor voltage rating	25			V
	External Aux	V _{CC}	11.8	12.0	14	V
CLK-IN	available at Rev2 or above module	I _{aux} current drawn from external supply		100	200	mA
		V _{CLK IN}	4.4	5.0	5.5	V _{P-P}
		Clock Frequency		500		KHz
		Duty Cycle	49	50	51	%

Electrical Specifications for 24V Input Models (AK60A-024L-xxxFyy)

Insulation - all models

INSULATION

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

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	15.6		17.8	V
Input low line power off voltage	Module shutdown	8		13	V
Input capacitance				9	μF
Input current	Low line, nom V_O , max I_O AK60A-024L-050F10 AK60A-024L-050F15 AK60A-024L-050F20 AK60A-024L-120F04 AK60A-024L-120F06 AK60A-024L-120F08 AK60A-024L-150F03 AK60A-024L-150F05 AK60A-024L-150F07 AK60A-024L-240F02 AK60A-024L-240F03 AK60A-024L-240F04		3.5 5.4 7.5 3.5 5.2 7.2 3.5 5.2 7.0 3.5 5.1 6.9		A A A A A A A A A A A A

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time	$V_I = 0$ to V_{Inom}			1	sec
Transient response (25% to 75% load change @ 0.1A/μS, recovery to 1% V_O)	Step-load excursion			10	% V_O
	Step-load response			500	μS

Electrical Specifications for 24V Input Models (Cont'd)

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Nominal (factory set) output voltage	AK60A-024L-050F10 AK60A-024L-050F15 AK60A-024L-050F20 AK60A-024L-120F04 AK60A-024L-120F06 AK60A-024L-120F08 AK60A-024L-150F03 AK60A-024L-150F05 AK60A-024L-150F07 AK60A-024L-240F02 AK60A-024L-240F03 AK60A-024L-240F04		5.0 5.0 5.0 12.0 12.0 12.0 15.0 15.0 15.0 24.0 24.0 24.0		V V V V V V V V V V V V
Output voltage set point accuracy	$T_C = +25^{\circ}\text{C}$, $V_I = V_{\text{Inom}}$, $I_O = I_{\text{Orated}}$	-1		1	% V_{Onom}
Remote sense compensation	$V_I = V_{\text{Imin}}$			0.5	V
Output voltage adjust		90		110	% V_{Onom}
Nominal (factory set) output overvoltage protection trip point		120		140	% V_{Onom}
Line regulation	V_{Imin} to V_{Imax}			0.2	% V_{Onom}
Load regulation ¹	10% of I_{Omax} to I_{Omax}			0.5	% V_{Onom}
Noise and ripple	20MHz bandwidth			3	% V_O
Output current	AK60A-024L-050F10 AK60A-024L-050F15 AK60A-024L-050F20 AK60A-024L-120F04 AK60A-024L-120F06 AK60A-024L-120F08 AK60A-024L-150F03 AK60A-024L-150F05 AK60A-024L-150F07 AK60A-024L-240F02 AK60A-024L-240F03 AK60A-024L-240F04	1.00 1.50 2.00 0.42 0.63 0.83 0.33 0.50 0.67 0.21 0.31 0.42		10.00 15.00 20.00 4.20 6.30 8.30 3.30 5.00 6.70 2.10 3.10 4.20	A A A A A A A A A A A A
Output current limit	V_O dropped to 90% of V_{Onom}	105		125	% I_{Orated}
Temperature coefficient	Per $^{\circ}\text{C}$ Baseplate temperature			0.02	% $V_O/^{\circ}\text{C}$
Maximum Load Capacitance (PRI AUX left open)	RESISTIVE LOAD START UP AK60A-024L-050F10 AK60A-024L-050F15 AK60A-024L-050F20 AK60A-024L-120F04 AK60A-024L-120F06 AK60A-024L-120F08 AK60A-024L-150F03 AK60A-024L-150F05 AK60A-024L-150F07 AK60A-024L-240F02 AK60A-024L-240F03 AK60A-024L-240F04		TBD TBD TBD TBD TBD TBD 40 200 500 TBD TBD TBD		μF μF μF μF μF μF μF μF μF μF μF μF
Overtemperature shutdown	Baseplate temperature	88	95	100	$^{\circ}\text{C}$
Efficiency	$V_I = V_{\text{Inom}}$, $V_O = V_{\text{Onom}}$, $I_O = I_{\text{Orated}}$ AK60A-024L-050F10 AK60A-024L-050F15 AK60A-024L-050F20 AK60A-024L-120F04 AK60A-024L-120F06 AK60A-024L-120F08 AK60A-024L-150F03 AK60A-024L-150F05 AK60A-024L-150F07 AK60A-024L-240F02 AK60A-024L-240F03 AK60A-024L-240F04	81 79 78 83 84 84 84 84 84 83 84 85 84	82 80 80 87 86 86 86 86 86 84 86 86 86		% % % % % % % % % % % % %

Notes :

1. If Pri Aux option is not implemented then minimum load of 10% is required to establish stable converter operation

Electrical Specifications for 48V Input Models (AK60A-048L-xxxFyy)

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	22.0		32.5	V
Input low line power off voltage	Module shutdown	20.0		28.0	V
Input capacitance				2.5	μ F
Input current	Low line, nom V_O , max I_O				
	AK60A-048L-050F10		1.9		A
	AK60A-048L-050F15		2.8		A
	AK60A-048L-050F20		3.6		A
	AK60A-048L-120F04		1.8		A
	AK60A-048L-120F06		2.6		A
	AK60A-048L-120F08		3.4		A
	AK60A-048L-150F03		1.9		A
	AK60A-048L-150F05		2.7		A
	AK60A-048L-150F07		3.5		A

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time	$V_I = 0$ to V_{Inom}			1	sec
Transient response (25% to 75% load change @ 0.1A/ μ S, recovery to 1% V_O)	Step-load excursion			10	% V_O
	Step-load response			500	μ S

Electrical Specifications for 48V Input Models (Cont'd)

OUTPUT CHARACTERISTICS					
Parameter	Conditions	Min	Typ	Max	Units
Nominal (factory set) output voltage	AK60A-048L-050F10		5.0		V
	AK60A-048L-050F15		5.0		V
	AK60A-048L-050F20		5.0		V
	AK60A-048L-120F04		12.0		V
	AK60A-048L-120F06		12.0		V
	AK60A-048L-120F08		12.0		V
	AK60A-048L-150F03		15.0		V
	AK60A-048L-150F05		15.0		V
	AK60A-048L-150F07		15.0		V
Output voltage set point accuracy	$T_c = +25^\circ\text{C}$, $V_i = V_{inom}$, $I_o = I_{Orated}$	-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		120		140	% V_{Onom}
Line regulation	V_{imin} to V_{imax}			0.2	% V_{Onom}
Load regulation ¹	10% of I_{Omax} to I_{Omax}			0.5	% V_{Onom}
Noise and ripple	20MHz bandwidth			3	% V_o
Output current	AK60A-048L-050F10	1.00		10.00	A
	AK60A-048L-050F15	1.50		15.00	A
	AK60A-048L-050F20	2.00		20.00	A
	AK60A-048L-120F04	0.42		4.20	A
	AK60A-048L-120F06	0.63		6.30	A
	AK60A-048L-120F08	0.83		8.30	A
	AK60A-048L-150F03	0.33		3.30	A
	AK60A-048L-150F05	0.50		5.00	A
	AK60A-048L-150F07	0.67		6.70	A
Output current limit	V_o dropped to 90% of V_{Onom}	105		125	% I_{Orated}
Maximum Load Capacitance (PRI AUX left open)	RESISTIVE LOAD STARTUP				
	AK60A-048L-050F10		5200		μF
	AK60A-048L-050F15		5200		μF
	AK60A-048L-050F20		16000		μF
	AK60A-048L-120F04		350		μF
	AK60A-048L-120F06		600		μF
	AK60A-048L-120F08		1800		μF
	AK60A-048L-150F03		180		μF
	AK60A-048L-150F05		400		μF
	AK60A-048L-150F07		440		μF
Temperature coefficient	Per $^\circ\text{C}$ Baseplate temperature			0.02	% $V_o/^\circ\text{C}$
Overtemperature shutdown	Baseplate temperature	88	95	100	$^\circ\text{C}$
Efficiency	$V_o = V_{Onom}$, $V_i = V_{inom}$, $I_o = I_{Orated}$				
	AK60A-048L-050F10	80	82		%
	AK60A-048L-050F15	80	82		%
	AK60A-048L-050F20	81	82		%
	AK60A-048L-120F04	84	87		%
	AK60A-048L-120F06	86	88		%
	AK60A-048L-120F08	86	88		%
	AK60A-048L-150F03	80	83		%
	AK60A-048L-150F05	82	84		%
	AK60A-048L-150F07	83	85		%

Notes :

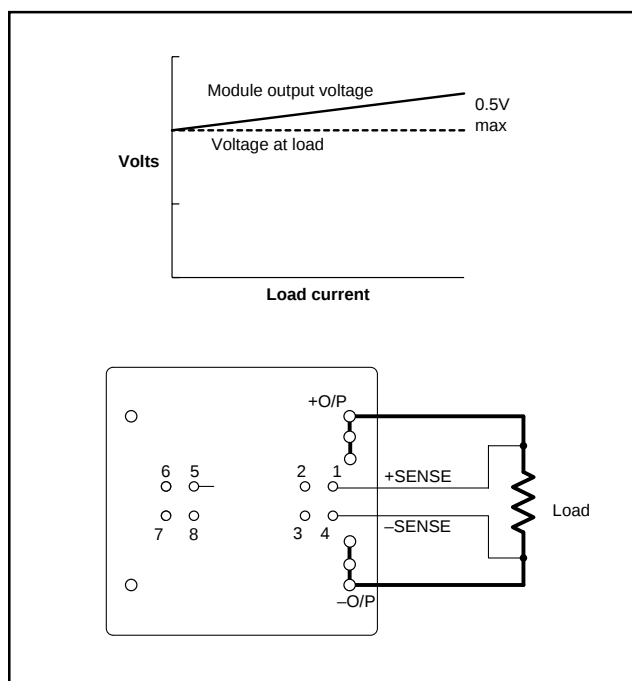
1. If Pri Aux option is not implemented then minimum load of 10% is required to establish stable converter operation

Functional Description

This section explains how to implement the functions found on the AK60A 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.

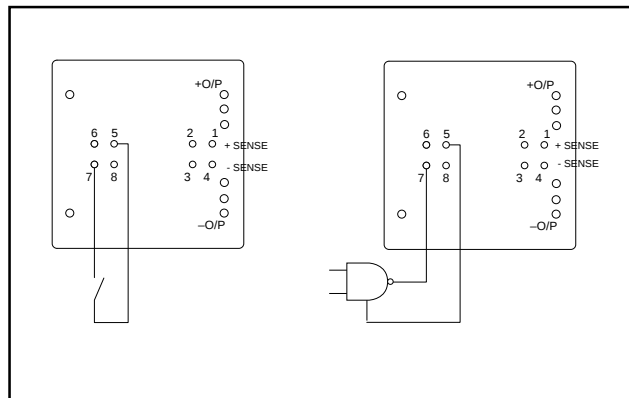


Note: If the sense leads fail open circuit, the module will revert to local sense at the output pins. Incorrect connection of sense leads may damage the module

Enable Control (ENABLE)

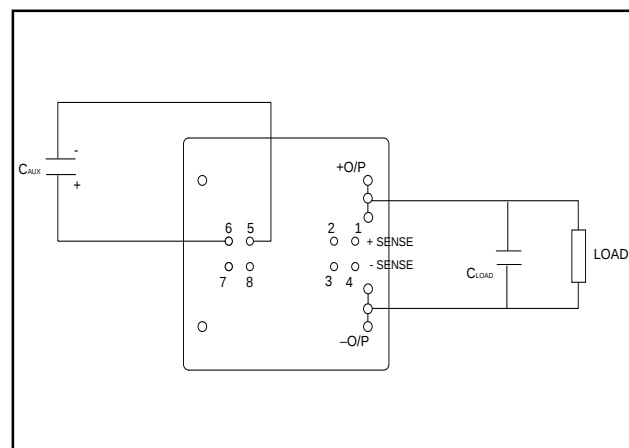
The enable pin is a TTL compatible input used to turn the output of the module on or off. The module output is enabled when the ENABLE pin is connected to S COM or driven to a logic low of $<0.8V$ (but not negative).

The output is disabled when the ENABLE pin is open or driven to a logic high $>2V$.



PRI AUX

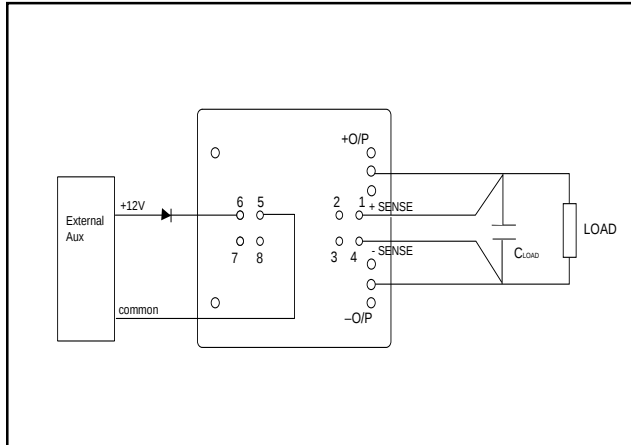
The ability of the AK60 to start highly capacitive loads can be extended by adding an external capacitor or adding an external auxiliary supply.



Maximum Load Capacitance

Model	C_{ALX}				
	None	100 μ F	470 μ F	1000 μ F	2200 μ F
AK60A-024L-050F10	TBD	TBD	TBD	TBD	TBD
AK60A-024L-050F15	TBD	TBD	TBD	TBD	TBD
AK60A-024L-050F20	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F04	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F06	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F08	TBD	TBD	TBD	TBD	TBD
AK60A-024L-150F03	40	940	1200	12250	26000
AK60A-024L-150F05	200	1440	6300	13500	21800
AK60A-024L-150F07	500	2500	8000	20000	35000
AK60A-024L-240F02	TBD	TBD	TBD	TBD	TBD
AK60A-024L-240F03	TBD	TBD	TBD	TBD	TBD
AK60A-024L-240F04	TBD	TBD	TBD	TBD	TBD
AK60A-048L-050F10	5200	28000	35000	>200000	>200000
AK60A-048L-050F15	5200	28000	35000	>200000	>200000
AK60A-048L-050F20	16000	45000	50000	>200000	>200000
AK60A-048L-120F04	350	1250	8800	15700	21500
AK60A-048L-120F06	600	2200	8800	15700	21500
AK60A-048L-120F08	1800	6400	22800	49200	99000
AK60A-048L-150F03	180	1100	5500	11000	28550
AK60A-048L-150F05	400	1330	7700	15700	35100
AK60A-048L-150F07	440	2200	15700	31800	49200

Alternatively an external auxiliary supply can be used.



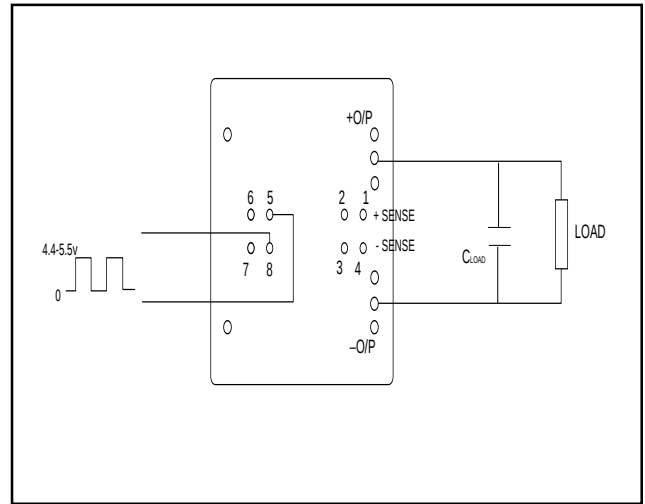
With an external auxiliary supply, the AK60A can be used with any value of Load capacitance.

CLK IN

The CLK IN function is available at Rev2 or above module

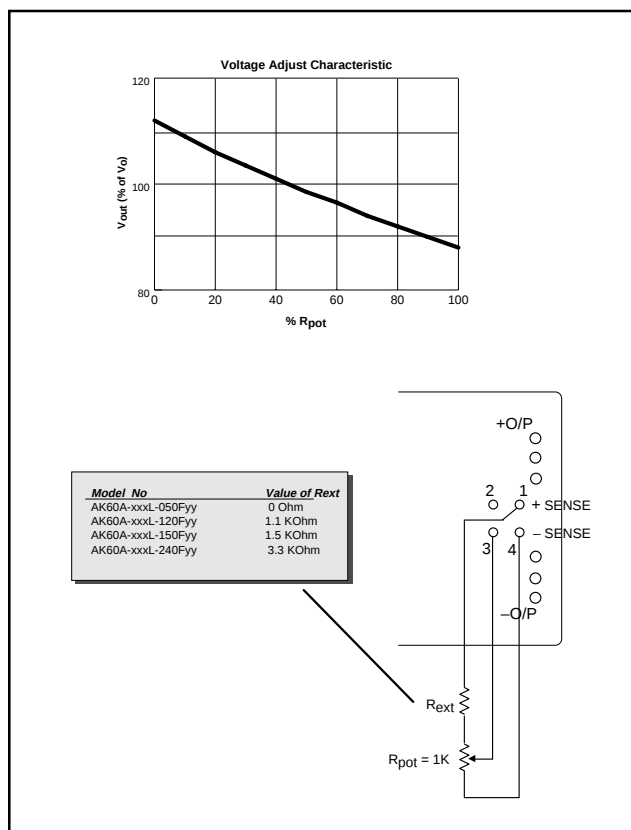
The CLK IN pin allows the AK60 to be synchronised to an external clock signal.

The clock signal is a 50% duty cycle square wave.



Output Voltage Adjustment (V ADJ)

The output voltage of the module may be accurately adjusted by up to $\pm 10\%$ of the nominal factory set output. Adjustment is carried out using a 1K Ohm trimming potentiometer connected as indicated.

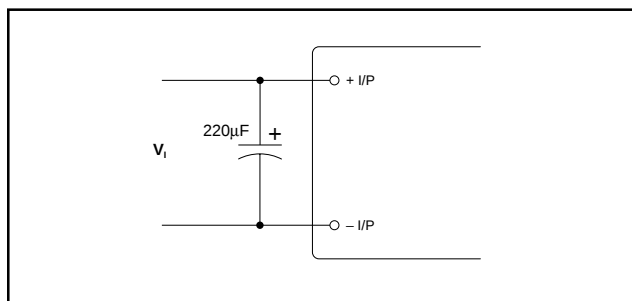


Signal Common (S COM)

The S COM pin is the common signal return for all primary side controls.

Design Considerations

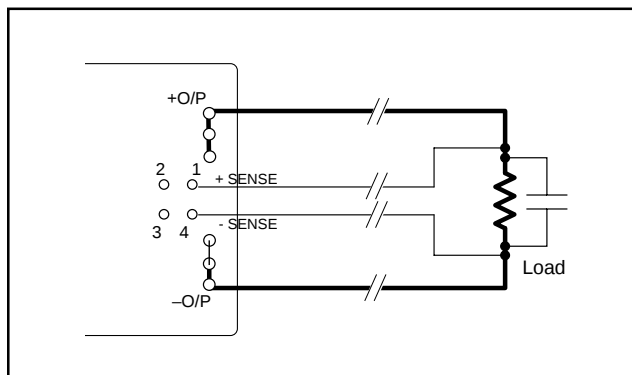
Input Bulk Capacitors



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 AK60A Economy Series module typical values are 220µF/50V for 24V modules, 220µF/100V for 48V 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 buss 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.



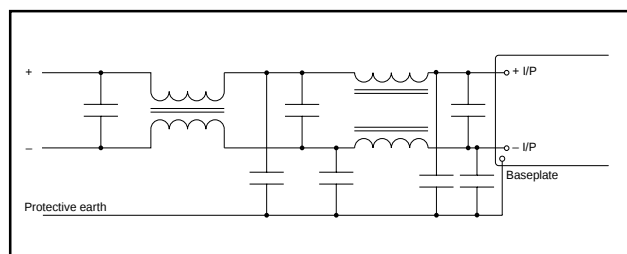
Input Undervoltage Protection

An input undervoltage protection circuit protects the module under low input voltage conditions. Hysteresis is built into the AK60A Enhanced Series module to allow for high levels of ripple on the input supply

voltage without causing the module to cycle on and off. Typically 48V modules will turn on above 31V and turn off below 27V. 24V modules will turn on above 16.5V and turn off below 14V (see Electrical Specifications for exact figures).

Conducted EMI

Although AK60A Economy Series modules contain 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.



AK60A modules have an effective input to ground (baseplate) capacitance of approximately 550pF. This should be accounted for when calculating the maximum EMI 'Y' capacitance to meet ground leakage current specifications.

Output Ripple and Noise

AK60A 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.

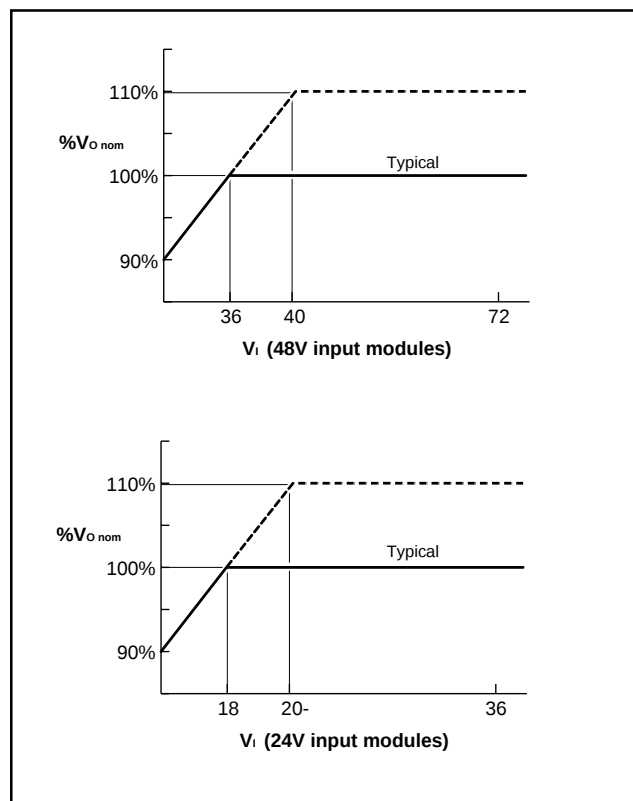
Input Fusing

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.

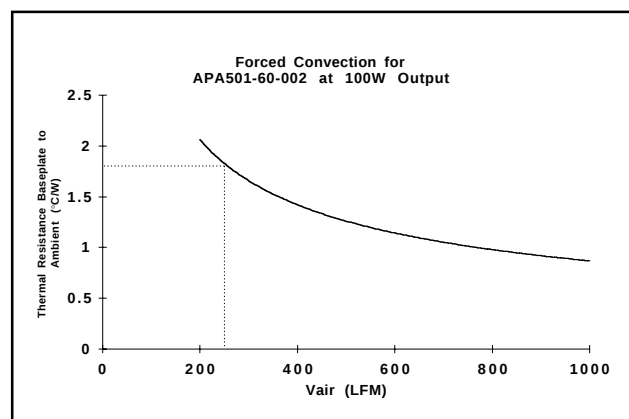
Input	Fuse Rating
24V	15A / 250V
48V	10A / 250V

Break Regulation

AK60A Economy Series modules are designed to deliver full rated output current at up to 0.5V above $V_{O\text{ nom}}$ at the minimum specified input voltage.



Astec (part number APA501-60-002) with 11mm fins and 8mm pitch, will reduce module thermal impedance to 1.8°C/W with a forced air flow of (250 LFM) when mounted with a thermal pad (ASTEC P/N APA502-60-001) between heatsink and module.



Overtemperature Protection

If the module's internal temperature exceeds 85°C, the module will protect itself by cycling on and off until the internal temperature drops below 85°C. By adding an external auxiliary supply to the pri aux pin, the module will latch off and automatically switch on again when the internal temperature has dropped by 5-10°C.

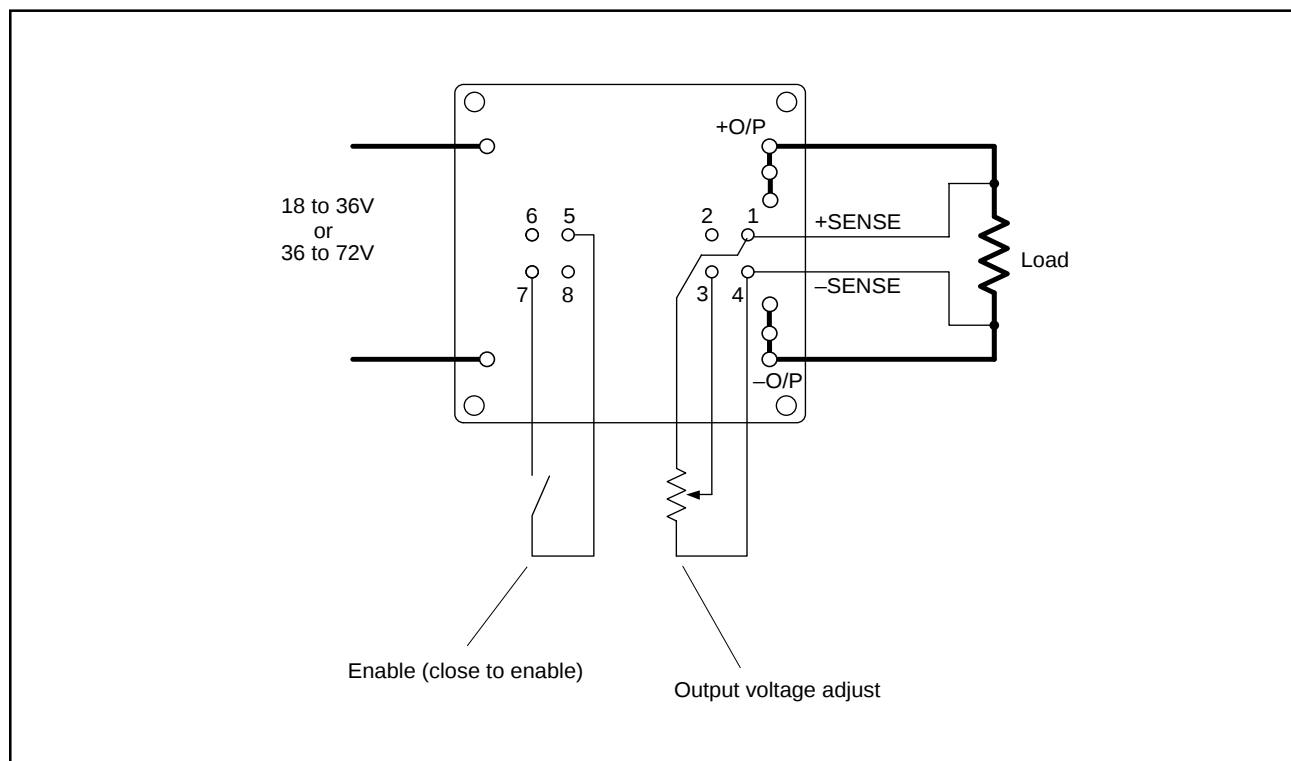
MTBF

Predicted MTBF for the AK60A Economy Series is greater than 1,000,000 hours at maximum rated output and 50°C baseplate temperature.

Thermal Data

Natural convection thermal impedance of the AK60A package is approximately 4.4°C/W. A standard horizontal fin heatsink available from

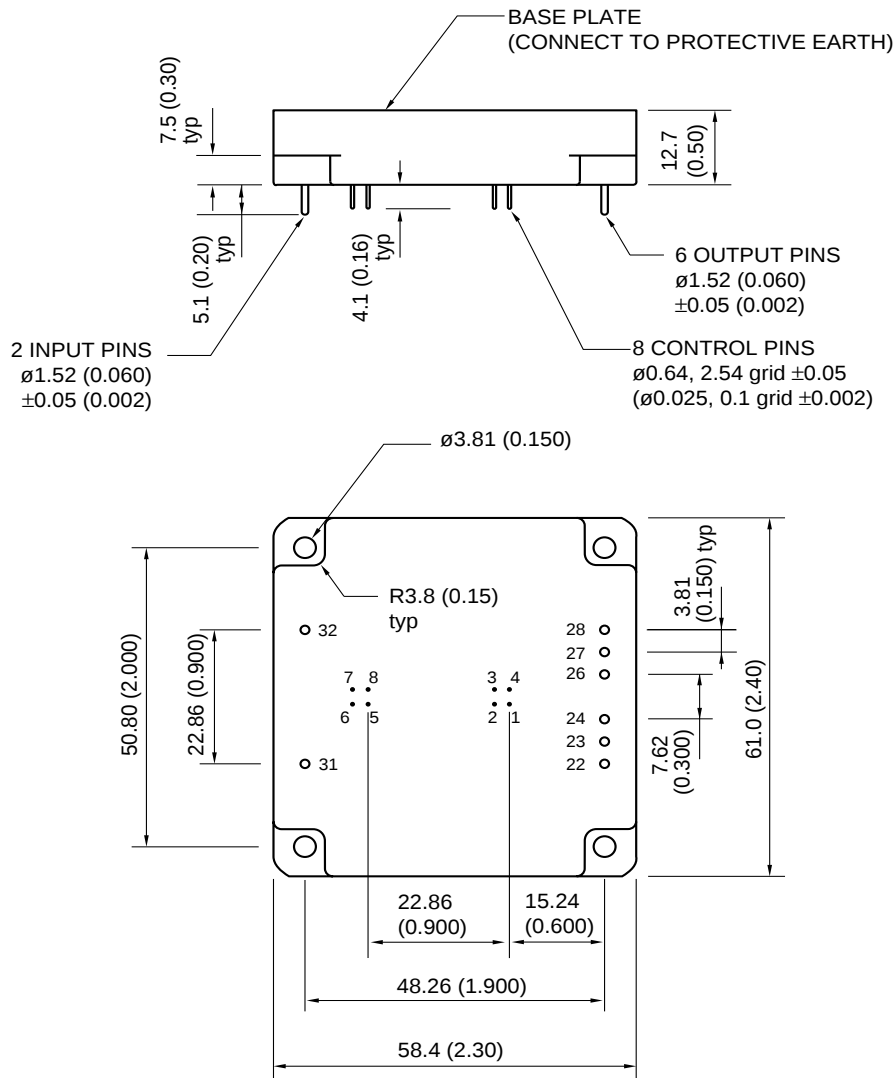
Application Example



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.



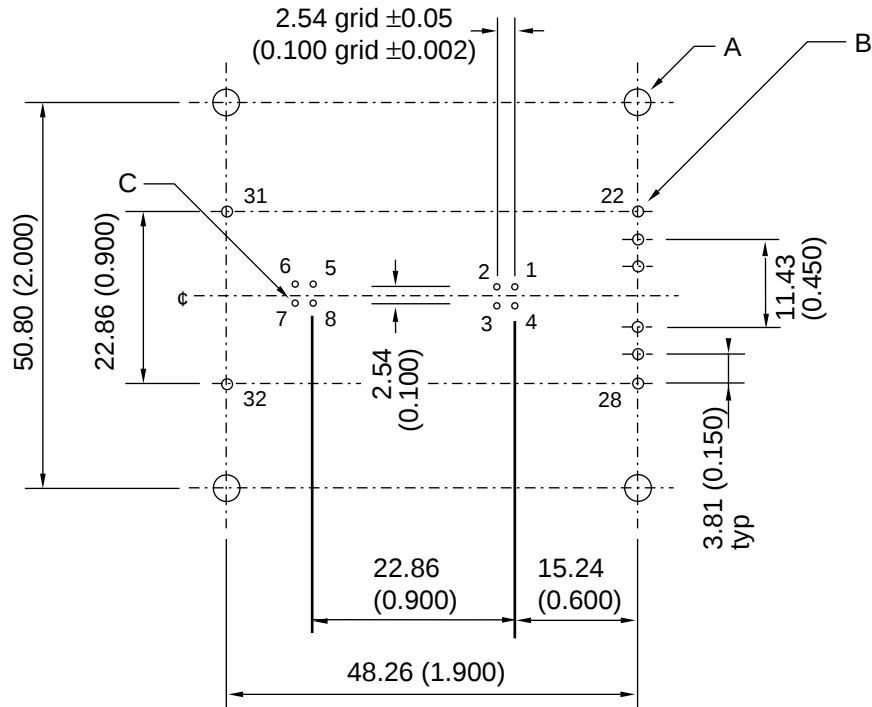
Notes:

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 AK60A 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 $\pm$ 0.1 (0.006).

RECOMMENDED HOLE SIZE TABLE :-

	A	B	C
HOLE SIZE FOR PCB DIRECT SOLDERING	$\varnothing 2.0 + 0.15 / - 0$ ($\varnothing 0.079 + 0.006 / - 0$)	$\varnothing 2.0 + 0.15 / - 0$ ($\varnothing 0.079 + 0.006 / - 0$)	$\varnothing 1.00 + 0.15 / - 0$ ($\varnothing 0.039 + 0.006 / - 0$)
HOLE SIZE FOR SPRING SOCKET MOUNTING*		$\varnothing 2.67 \pm 0.05$ ($\varnothing 0.105 \pm 0.002$)	$\varnothing 1.37 \pm 0.05$ ($\varnothing 0.054 \pm 0.002$)
HOLE SIZE FOR M3.5 MACHINE SCREW	$\varnothing 4.5 + 0.08 / - 0$ ($\varnothing 0.177 + 0.0031 / - 0$) FOR M3.5		

*Spring sockets are available from Astec in packs of 20 control pin sockets and 15 power pin sockets, part no. APA504-00-001. Sockets are not suitable for output current greater than 10A per pin.

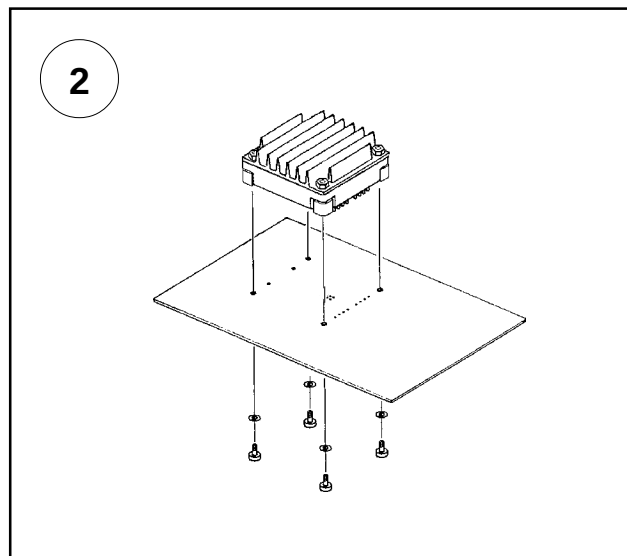
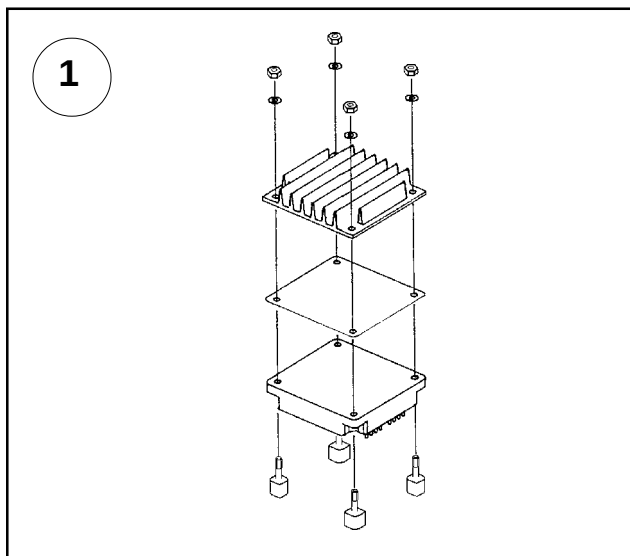
Heatsink Mounting Information

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 AK60A 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: baseplate and heatsink must be connected to protective earth



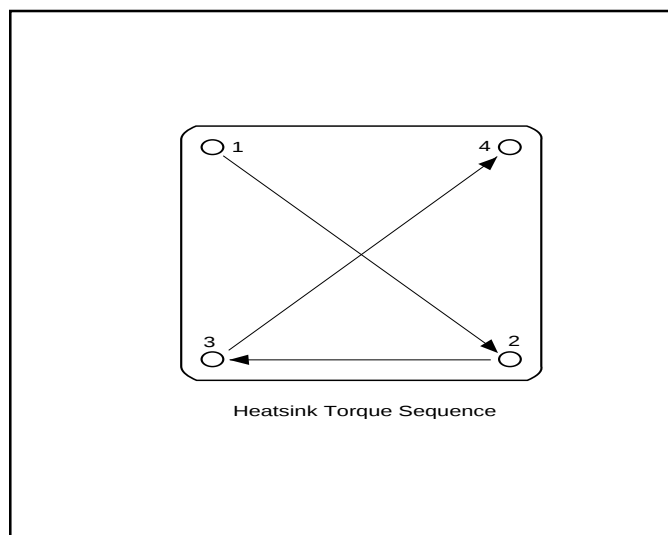
Description	Model Number	Dimensions		Free air thermal resistance
		inches	mm	
Heatsink, "60" size, vertical fin.	APA501-60-001	2.26x2.32x0.6	57.5x59x15	3.8°C/W
Heatsink, "60" size, horizontal fin	APA501-60-002	2.26x2.32x0.6	57.5x59x15	3.9°C/W
Heatsink, "60" size, vertical fin.	APA501-60-003	2.26x2.32x0.9	57.5x59x22.5	3.3°C/W
Heatsink, "60" size, horizontal fin	APA501-60-004	2.26x2.32x0.9	57.5x59x22.5	3.7°C/W
Heatsink, "60" size, vertical fin.	APA501-60-005	2.26x2.32x1.5	57.5x59x37	2.8°C/W
Heatsink, "60" size, horizontal fin	APA501-60-006	2.26x2.32x1.5	57.5x59x37	2.8°C/W
Heatsink, "60" size, low profile	APA501-60-007	2.25x3.50x0.5	57.2x89x12	3.6°C/W
Thermal Pad, "60" size	APA502-60-001			
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:



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.