AA60A-036L-050D033H SERIES

This specification covers the requirement for a wide input voltage range (18V to 60V) half brick - baseplate design, 60W power - dual output high efficiency DC/DC converter.

MODEL NAME	V_{IN} nominal	V_{OUT} / I_{OUT}
AA60A-036L-050D033H	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033HN	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-6	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033HN-6	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-8	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033HN-8	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-6M3	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-8M3	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-6M4	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-8M4	36V	5V, 12A / 3.3V, 15A
AA60A-036L-050D033H-6M9	36V	5V, 12A / 3.3V, 15A

OPTIONS:

	SUFFIX
Negative Enable:	"N"
Positive Enable:	No suffix “N”
3.7mm (nom) Pin Length:	"-6"
2.8mm (nom) Pin Length:	"-8"
0.45"H - Transverse Heatsink	M3
0.45"H - Longitudinal Heatsink	M4
Non-threaded baseplate stand-off	M9

Electrical Specifications

STANDARD TEST CONDITION on a single module unless otherwise specified.

TA:		25ºC (Ambient Air)
- V_{IN}:	PIN 1	Return Pin for +VIN
Case:	PIN 2	Case Ground - OPEN
Enable:	PIN 3	Dependent on model series [1]
+ V_{IN}:	PIN 4	48 VDC
+V_{OUT2}:	PIN 5	3.3V Load
-V_{OUT2}:	PIN 6	3.3V Load Return
Trim2:	PIN 7	3.3V Trim - Open
+V_{OUT1}:	PIN 8	5V Load
- V_{OUT1}:	PIN 9	5V Load Return
Trim1:	PIN 10	5V trim - Open

Note: 1. For Negative Enable series ("N" suffix), Enable pin should be connected to -Vin to allow module to turn-on. For Positive Enable series (no "N" suffix), Enable pin should be connected to + Vin.

ABSOLUTE MAXIMUM RATINGS

Stresses in excess of the absolute maximum ratings can cause permanent damage to the converter. Functional operation of the device is converter is not implied at these or any other conditions in excess of those given in the operational section of the specs. Exposure to absolute maximum ratings for extended period can adversely affect device reliability.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input Voltage:						
Continuous	All	V_{IN}	0	-	60	Vdc
Transient(100ms) :		$V_{IN, trans}$	0	-	100	Vdc
Operating Ambient Temperature		T_A	-40	-	70[2]	ºC
Operating Baseplate Temp erature		TB		-	100	ºC
Storage Temperature		T_{STG}	-55	-	125	ºC
Operating Humidity		-	-	-	85	%
I/O Isolation						
Input to Output		-	1500	-	-	Vdc
Input to Case			707	-	-	Vdc
Output to Case			1500	-	-	Vdc

Note: 2. Power Derating applies

Electrical Specifications (*continued)*

INPUT SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage After start-up with max 60W	All	V_{IN}	19 18	36	60 60	VDC VDC
Startup Voltage	All		19		20	VDC
Shutdown Voltage			17	17.8	18	VDC
Maximum Input Current[3] Conditions: $V_{IN} = V_{IN,min}$ $I_O = I_{O,max}$; $T_A = 25$ °C	All	$I_{IN,max}$	-	-	6.5	A
Input Reflected Ripple Current[4] Conditions: $P_{O1} = P_{O2} = 30W$; $T_A = 25$ °C	All	I_{I1}/ I_{I2}	-	-	100	mA_{PK-PK}
Standing Loss Condition: $V_{IN} = V_{IN,nom}$; $T_A = 25$ °C	All	-	-	3	-	W

NOTE: 3. This power module is not internally fused. An input line is recommended.
4. See Figure 1 for Input Reflected Ripple Current Test Setup.

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Voltage Setpoint Conditions: $V_I = V_{IN,nom}$; $T_A = 25$ °C; $T_C = 50$°C; V_{O1}: $I_{O1} = I_{O,max}$; V_{O2}: $I_{O2} = I_{O,min}$;	All	V_{O1}/ V_{O2}	4.92 / 3.25	5.0 / 3.30	5.08 / 3.35	Vdc
Load Current	All	I_{O1}/I_{O2}	0.5 / 0.5	-	12.0 / 15.0	A
Output Capacitive Load	All				10,000	?F
Line Regulation	All		-	0.01	1.0	%Vo
Load Regualtion[5]	All		-	0.05	1.0	%Vo
Temperature Coefficient of Voltage Conditions: T_C = -40?C to 100?C $V_{IN} = V_{IN,nom}$; $I_O = I_{O,max}$;	All		-	-	2.0	%Vo

Electrical Specifications (*continued)*

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Ripple and Noise:						
Peak-to-Peak[6]	All		-	50	100	mV_{PK-PK}
Conditions: $I_O = I_{O,max}$; $V_{IN} = V_{IN,nom}$; BW = 20 MHz; T_A = 25 °C			-	20	40	mV_{RMS}
Over Current Limit Inception		I_{O1}	16.5	-	22	A
		I_{O2}	18.0	-	25	A
Efficiency	5V	?1	80	83		%
Conditions: $V_{IN} = V_{IN,nom}$; T_A = 25 °C; T_C = 50 °C max	3.3V	?2	73	75		%
?1: $I_{O1} = I_{O1,max}$, $I_{O2} = I_{O2,min}$						
?2: $I_{O1} = I_{O1,min}$, $I_{O2} = I_{O2,max}$						
Dynamic Response						
Conditions: ?I_O/?t = 1A/10?s ; $V_{IN} = V_{IN,nom}$; T_A = 25?C; T_C = 50?C max						
Peak Voltage Deviation	3.3V	-	-	52	120	mV
Load Change: I_O = 50% to 75% $I_{O,max}$	5V		-	27	300	mV
Other output at min load						
Transient Settling Time						
Up to 1% of Vo	3.3V	-	-	40	300	?sec
	5V	-	-	-	300	msec
Turn-On Time	All	-	-	5	100	msec
Conditions: $V_{IN} = V_{IN,min}$; $I_{O1} = I_{O,max}$, $I_{O2} = I_{O,min}$; T_A = 25?C						
Output Voltage Overshoot	All	-	-	120	200	$\%V_O$
Conditions: IO = $I_{O,max}$; T_A = 25?C;						

NOTE: 5. Channel under test shall follow the specified conditions while the other channel is set to min load.
6. Channel under test shall be set to full load with the other channel set to $I_{O,min}$ - See Fig 2 for the recommended ripple and noise test setup.

Electrical Specifications (*continued)*

FEATURE SPECIFICATION

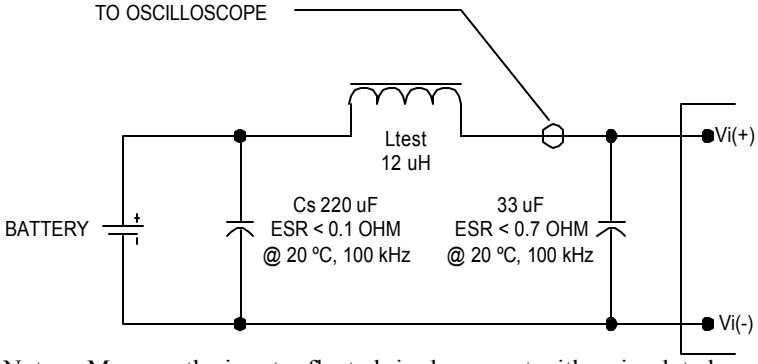
Parameter	Device	Symbol	Min	Typ	Max	Unit
Enable Pin Voltage						
Logic Low:	ALL	V_{ENABLE}	0	-	0.7	V
Logic High:		V_{ENABLE}	1.5	-	12.0	V
Enable Pin Current						
Logic Low	All	I_{ENABLE}	-	0.4	1.0	mA
Logic High: (I_{LKG} at V_{ENABLE} = 5V)	All	I_{ENABLE}	-	-	50	?A
Output Over Voltage Clamp	All	$V_{O,CLAMP}$	120	-	140	%V_O
Output Voltage Adjustment Range	5V	V_{01}	4.3	-	5.25	V
V_{O1}: V_{IN}=$V_{IN,nom}$; I_{O1} = $I_{O,MAX}$; I_{O2} = $I_{O,MIN}$	3.3V	V_{02}	2.5	-	3.46	V
V_{O2}: V_{IN}=$V_{IN,nom}$; I_{O2} = $I_{O,MAX}$; I_{O1} = $I_{O,MIN}$						

ISOLATION SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	All	-	-	2000	-	pF
Isolation Resistance	All	-	10	-	-	M?

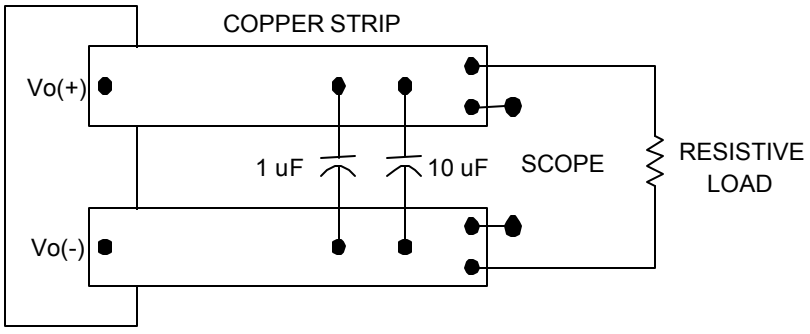
SAFETY APPROVAL

The AA60A-036L series have been certified through:
?? UL 1950, Third Edition - Recognized
?? CSA C22.2 No 950-95 - Recognized
?? EN60950 through TUV-PS



Note: Measure the input reflected ripple current with a simulated source inductance (Ltest) of 12uH. Capacitor Cs offsets possible battery/ source impedance. Measure current as shown above.

Figure 1. Input Reflected Ripple Current Measurement Setup.



Note: Use a 1?F 50V X7R ceramic capacitor and a 10?F 25V tantalum cap. Scope measurement should be made using a BNC probe socket positioned about 76mm (3 in.) away from the module's output terminals. The ext. capacitors should be placed between the BNC socket and the module's output terminals, with a minimum distance of 51mm (2in.) from the latter.

Figure 2. Peak to Peak Output Noise Measurement Setup.

Basic Operation and Features

INPUT STARTUP / SHUTDOWN VOLTAGE

To prevent any instability to the converter that may affect and consequently damage the end system, the AA60A series have been designed to turn-on once V_{IN} is in the voltage range of 19 - 20VDC. Likewise, it has also been programmed to turn-off when V_{IN} drops down to 17 - 18VDC.

OUTPUT VOLTAGE ADJUST/TRIM

Each channel/ output comes with a Trim pin (Pin 10 for V_{O1} and Pin 7 for V_{O2}). This can be used to used to adjust the outputs up and down per the given trim range in the previous section. This is achieved by connecting an external resistor as described below.

Output voltage adjustment is accomplished by connecting an external resistor between the Trim Pin and either the $+V_O$ or $-V_O$ Pins. With an external resistor, R_{TRIM} between the Trim Pin and $+V_O$ Pin the output voltage increases. With R_{TRIM} connected between the Trim Pin and $-V_O$ Pin the output voltage decreases. See Figure 3.

The following equation determines the required external resistor value to obtain an adjusted output voltage:

$$R_{TRIM} = (G - (H * V_{O,Adj})) / (V_{O,Adj} - K)$$

Where: $V_{O, ADJ}$ = is the desired output voltage (e.g. **5.2** V = 5V * +4%)

Trim Output Voltage UP (R_{TRIM} connect to V+)

Model	Output	G	H	K
036H 5/3.3	5	129980.1	10220	5
036H 5/3.3	3.3	12194.5	2000	3.3

Trim Output Voltage DOWN (R_{TRIM} connect to V-)

Model	Output	G	H	K
036H 5/3.3	5	25578.4	10220	5
036H 5/3.3	3.3	3301.2	2000	3.3

OUTPUT OVER VOLTAGE PROTECTION (OVP)

The Over Voltage Protection circuit will shut down the entire converter if any of the two output voltages exceeds the OVP threshold limits. The output will remain latched until the OVP fault is removed and the input voltage is recycled

Basic Operation and Features *(continued)*

OUTPUT ENABLE

The AA60A comes with an Enable pin (PIN 3), which is primarily used to turn ON/OFF the converter. Both a Positive (no part number suffix required) and a Negative (suffix "N" required) Enable Logic option is being offered

For Positive Enable, the converter is turned on when the Enable pin is at logic HIGH or le ft open. The unit turns off when the Enable pin is at logic LOW. On the other hand, the Negative Enable version turns on when the Enable pin is at logic LOW or directly connected to $-V_{IN}$. The unit turns off when the Enable pin is at Logic HIGH.

OVER CURRENT PROTECTION (OCP)

The Over Current Protection circuit will shutdown the converter if any of the load current of either output reaches the OCP threshold limits. The unit will automatically recover once the over current condition is removed.

Performance Curves

EFFICIENCY

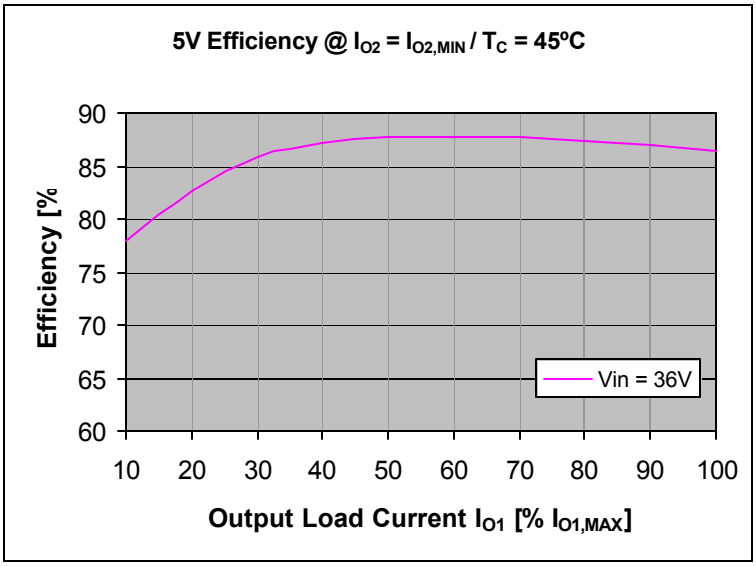


Figure 3. 5V Efficiency curve vs. Output load at 45ºC case temperature, input line voltage of 36VDC nominal.

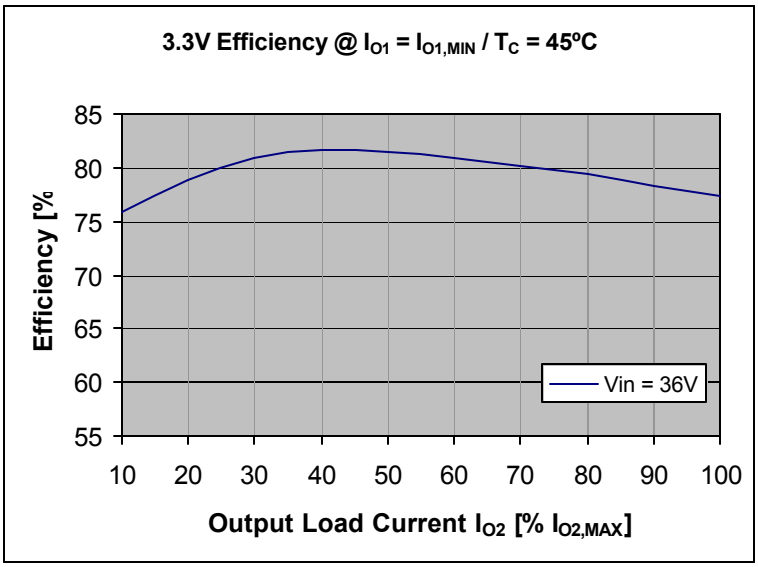


Figure 4. 3.3V Efficiency curve vs. Output load at 45ºC case temperature, input line voltage of 36VDC nominal.

Performance Curves

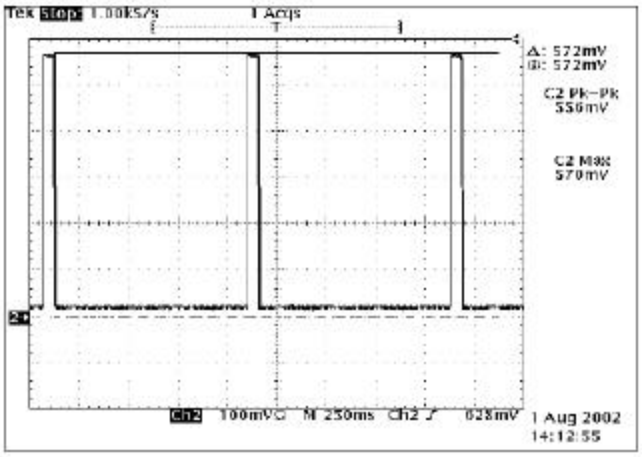


Figure 5. Typical 5V Short circuit waveform at T_A = 25ºC, V_{IN} = 36V nominal.

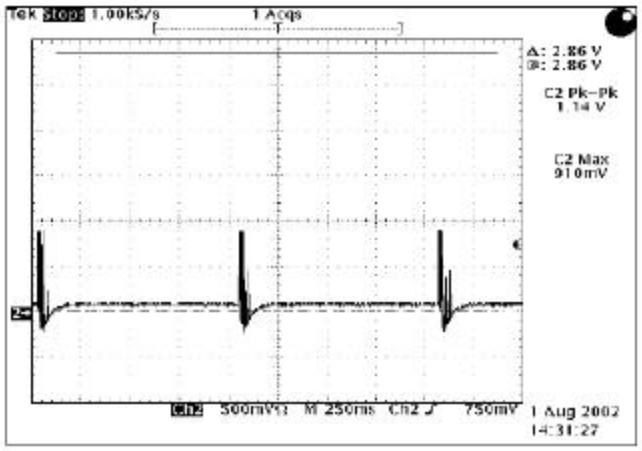


Figure 6. Typical 3.3V Short circuit waveform at T_A = 25ºC, V_{IN} = 36V nominal.

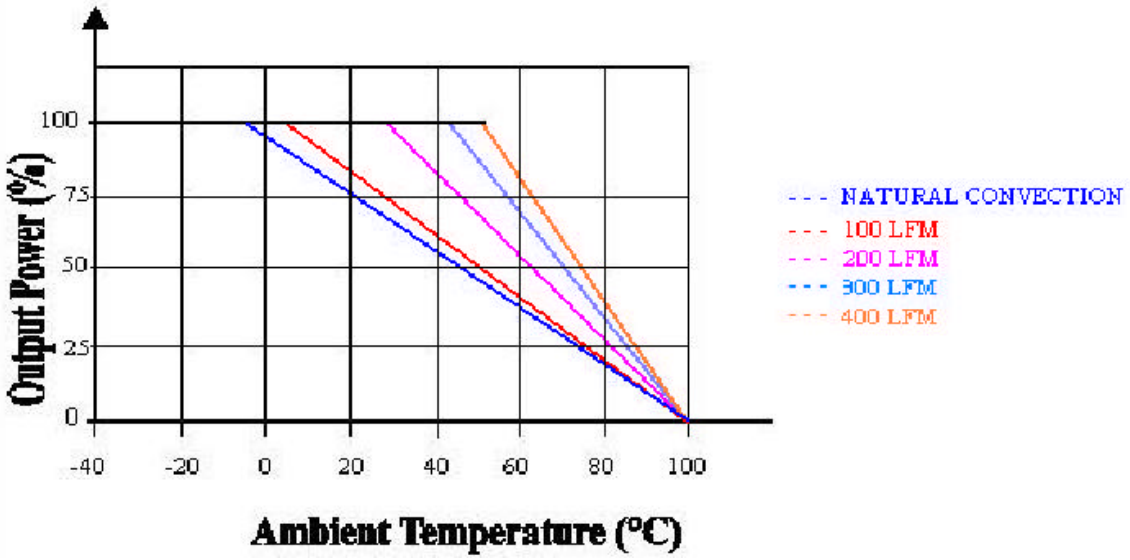


Figure 7. Power Derating at 36V nominal input voltage.

Mechanical Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Dimension	All	L W H	- - -	2.40 [61.0] 2.30 [58.4] 0.50 [12.07]	- - -	in [mm] in [mm] in [mm]
Weight			-	0.0893	0.100	kg
PIN ASSIGNMENT						

1	**$-V_{IN}$**	**6**	**RTN_2**
2	**Case**	**7**	**TRIM_2**
3	**Enable**	**8**	**$+V_{OUT1}$**
4	**$+V_{IN}$**	**9**	**RTN_1**
5	**$+V_{OUT2}$**	**10**	**TRIM_1**

NOTE: Pin diameter at 0.04”

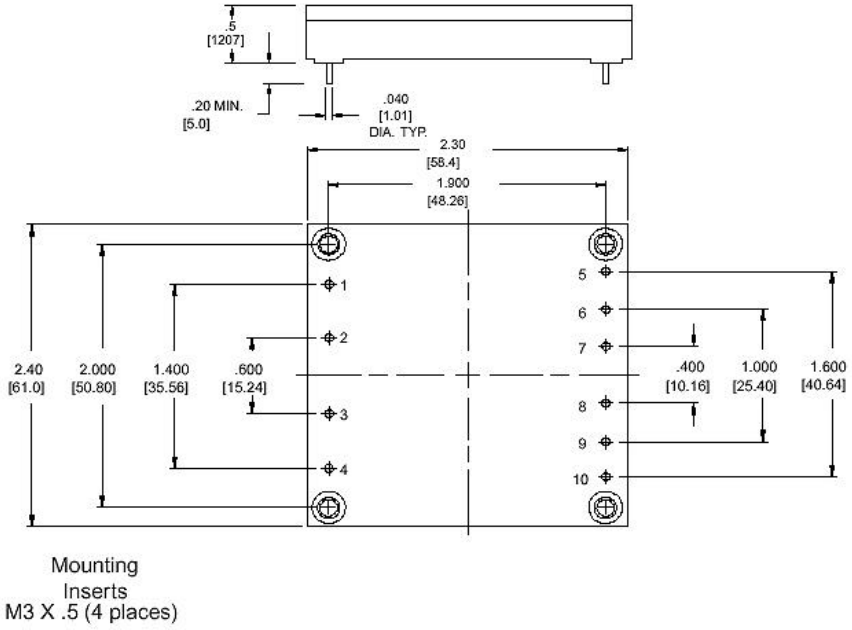


Figure 8. AA60A series mechanical outline (inches [(mm]).

Mechanical Specifications *(continued)*

SOLDERING CONSIDERATIONS

The AA60A series converters are compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20-30 seconds at 110?C and wave soldered at 260?C for less than 10 seconds.

When hand soldering, the iron temperature should be maintained at 425?C and applied to the converter pins for less than 5 seconds. Longer exposure can cause internal damage to the converter. Cleaning can be performed with cleaning solvent IPA or with water.