REV	Description	Date	Approved
A	Initial Release	2/4/00	

TECHNICAL REFERENCE NOTES (TRN)

AA05E SERIES

DC-DC CONVERTER

ASTEC POWER

ANDOVER, MA

1. General Description and Scope

This specification covers the requirements for AA05E-048L-XXXS switching DC-DC converter. This module operates off a 36 – 75V DC bus and provides both a single and dual isolated output. Six output options are available in the family as shown below.

Table 1. Device Part Numbers

Model Designation	Part Number
033S	AA05E-048L-033S
050S	AA05E-048L-050S
120S	AA05E-048L-120S
150S	AA05E-048L-150S
120D	AA05E-048L-120D
150D	AA05E-048L-150D

2. Electrical Specifications

2.1 Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device in not implied at these or any other conditions in excess of those given in the operational sections of the TRN. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input Voltage:						
Continuous:	All	V_I	0	-	-	Vdc
Transient (100ms)	All	$V_{I, trans}$	0	-	25	Vdc
Operating Case Temperature	All	Tc	-40	-	100	ºC
Storage Temperature	All	Tstg	-55	-	125	ºC
Operating Humidity	All	-	-	-	95	%
I/O Isolation	All	-	-	-	1500	Vdc

2.2 Input Specifications

Table 2. Input Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_I	36	48	75	Vdc
Maximum Input Current (V_I = 0 to $V_{I,max}$: Io = Io,max)	033S	$I_{I,max}$	-	-	0.130	A
	050S	$I_{I,max}$	-	-	0.185	A
	120S	$I_{I,max}$	-	-	0.180	A
	150S	$I_{I,max}$	-	-	0.180	A
	120D	$I_{I,max}$	-	-	0.175	A
	150D	$I_{I,max}$	-	-	0.175	A
Input Reflected-ripple Current (5Hz to 20MHz: 12uH source impedance: T_A = 25 ºC.) See Figure 1.	All	I_I	-	-	10	mAp-p
No Load Input Power (V_I = $V_{I,nom}$)	All	-	-	-	0.75	W
Maximum Input Capacitance	All	-	-	-	3.0	uF

CAUTION: This power module is not internally fused. An input line fuse must always be used.

2.3 Output Specifications

Table 3. Output Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Setpoint (V_I = $V_{I,min}$ to $V_{I,max}$: Io = Io,max; T_A = 25 ºC)	033S	Vo,set	3.267	3.3	3.333	Vdc
	050S	Vo,set	4.95	5.0	5.05	Vdc
	120S	Vo,set	11.88	12.0	12.12	Vdc
	150S	Vo,set	14.85	15.0	15.15	Vdc
	120D	Vo,set	±11.88	±12.0	±12.12	Vdc
	150D	Vo,set	±14.85	±15.0	±15.15	Vdc
Output Regulation:						
Line (V_I = $V_{I,min}$ to $V_{I,max}$)	All	-	-	-	0.5	%
Load(Io = Io,min to Io,max)		-	-	-	1.0	%
Temperature (Tc = -40 ºC to +100 ºC)		-	-	0.5	2.0	%Vo
Output Ripple and Noise (Across 0.10 uF ceramic capacitors) See Figure 2.	All	-	-	25	50	mVp-p
External Load Capacitance	All	-	-	-	1000	uF
Output Current	033S	Io	0.1	-	1.0	A
	050S	Io	0.1	-	1.0	A
	120S	Io	0.04	-	0.41	A
	150S	Io	0.03	-	0.33	A
	120D	Io	±0.02	-	±0.20	A
	150D	Io	±0.02	-	±0.16	A
Output Current-limit Inception (Vo = 97% Vo,set)	033S	Io	-	-	1.70	A
	050S	Io	-	-	1.70	A
	120S	Io	-	-	0.70	A
	150S	Io	-	-	0.56	A
	120D	Io	-	-	±0.35	A
	150D	Io	-	-	±0.27	A
Output Short-circuit Current (Vo = 250mV)	All	-	-	-	190	%Io,max

Table 3. Output Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Efficiency ($V_I = V_{I,nom}$; Io = Io,max; T_A = 25 ºC)	033S 050S 120S 150S 120D 150D	Io Io Io Io Io Io	71 74 75 75 77 77	73 76 77 77 79 79	- - - - - -	% % % % % %
Dynamic Response: (ΔIo/Δt = 1A/10us; $V_I = V_{I,nom}$; T_A = 25 ºC) Load Change from Io = 50% to 75% of Io, max: Peak Deviation Settling Time Load Change from Io = 50% to 25% of Io, max: Peak Deviation Settling Time	 All All	 - - - -	 - - - -	 - - - -	 2 1000 2 1000	 %Vo usec %Vo usec
Turn-on Time (Io = Io,max; Vo within 1%)	All	-	-	150	200	msec
Output Voltage Overshoot (Io = Io,max; T_A = 25 ºC)	All	-	-	-	5	%Vo

2.4 Isolation Specifications

Table 4. Isolation Specifications

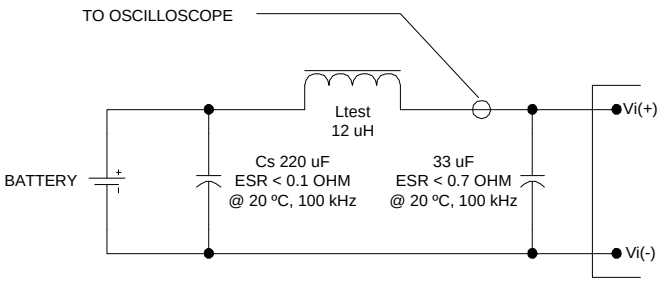
Parameter	Device	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	All	-	-	260	-	pF
Isolation Resistance	All	-	-	10	-	Mohm

2.5 General Specifications

Table 5. General Specifications

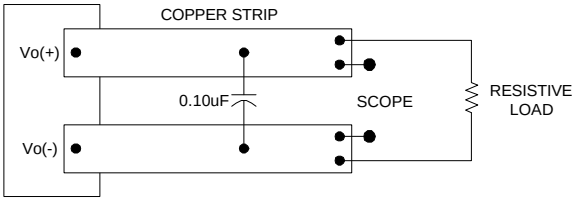
Parameter	Device	Symbol	Min	Typ	Max	Unit
Calculated MTBF (Io = Io,max; Tc = 25 ºC)	All	-	-	1,000,000	-	hours
Weight	All	-	-	-	15(0.50)	g (oz.)

2.6 Test Configurations



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

Figure 1. Input Reflected-ripple Test Setup.



Note: Use a 0.10 uF ceramic capacitors. Scope measurement should be made using a BNC socket. Position the load between 51 mm and 76 mm (2 in. and 3 in.) from module.

Figure 2. Peak-to-Peak Output Noise Measurement Test Setup.

3.0 Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat-dissipating components inside the unit are thermally coupled to the case. Heat is removed by conduction, convection, and radiation to the surrounding environment.

Increasing airflow over the module enhances the heat transfer via convection. Figure 3 shows the maximum power that can be dissipated by the module without exceeding the maximum case temperature versus local ambient temperature (Ta) for natural convection through 3.0 m/s (600 ft/min).

Systems in which these power modules are used typically generate natural convection airflow rates of 0.25 m/s (50 ft/min) due to other heat dissipating components in the system. Therefore, the natural convection condition represents airflow rates of approximately 0.25 m/s (50 ft/min). Use of Figure 3 is shown in the following example:

Thermal Considerations (continued)

Example

What is the minimum airflow necessary for a 050S operating at 48V, an output current of 1.0 A, and a maximum ambient temperature of 90 ºC?

Solution:

Given: Vi = 12V, Io = 1.0 A, Ta = 90 ºC.
Determine Pd from Figure 5: Pd = 1.6 W.
Determine Airflow from Figure 3: v = 2.0 m/s (400 ft/min).

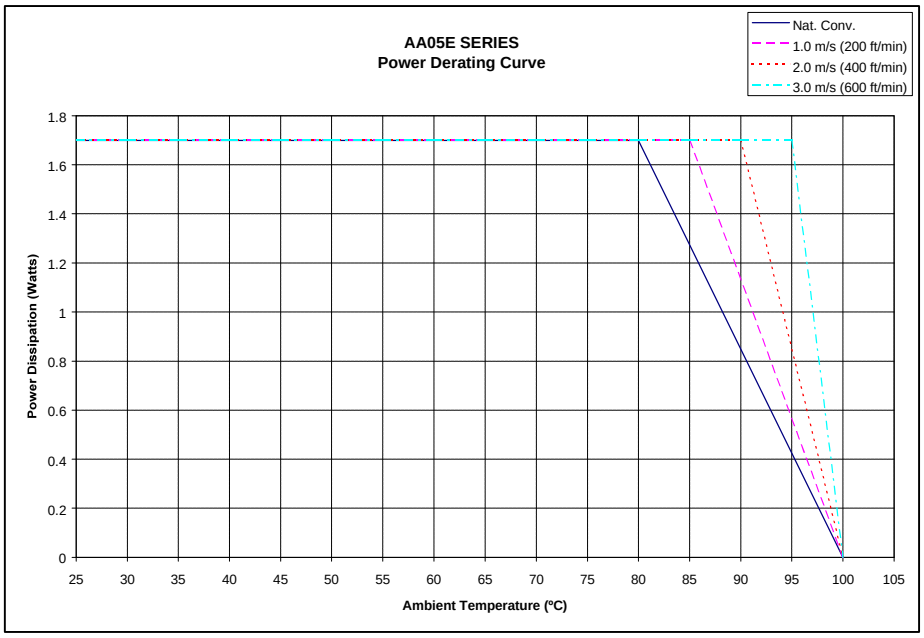


Figure 3. Forced Convection Power Derating.

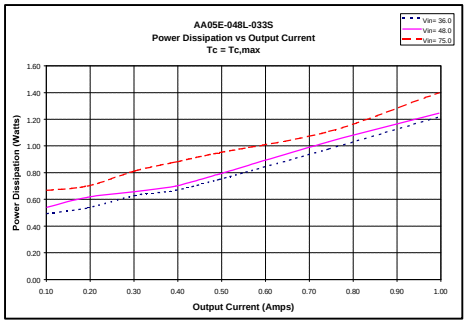


Figure 4. 033S Power Dissipation

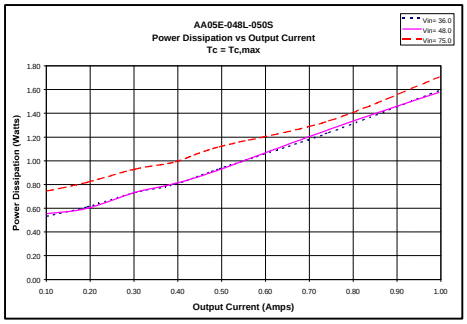


Figure 5. 050S Power Dissipation

Thermal Considerations (continued)

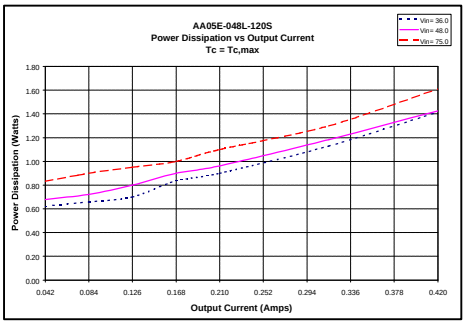


Figure 6. 120S Power Dissipation

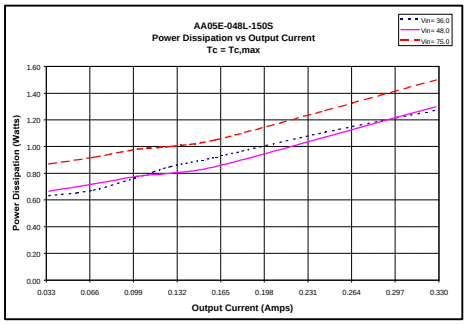


Figure 7. 150S Power Dissipation

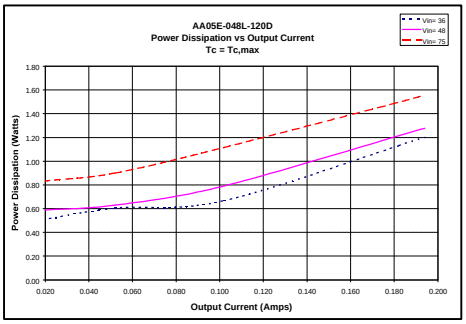


Figure 8. 120D Power Dissipation

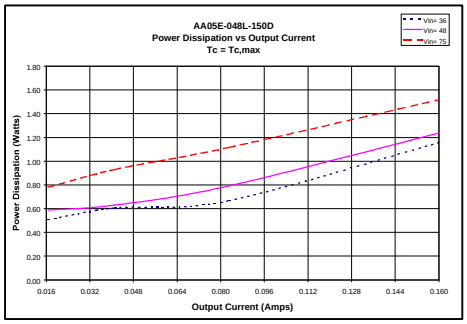


Figure 9. 150D Power Dissipation

4.0 Input Fusing Considerations

An input fuse is recommended to protect the module, as well as external circuitry, in case of an input reverse voltage fault condition or other fault conditions where excess amounts of input current could be present. Generally the fuse should be rated at 1.5 times the maximum operating input current.

5.0 Outline Diagram

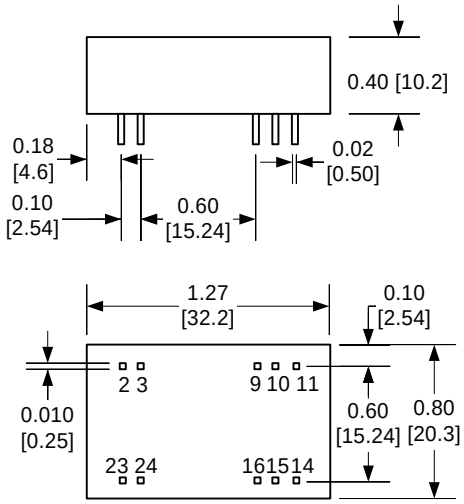


Figure 10 . AA05E Unit Outline – Pin View

Pin Assignment

Single Output

Pins 2 & 3: -Vin
Pins 22 & 23: +Vin
Pin 14: +Vout
Pin 16: Com
Remaining pins NC

Dual Output

Pins 2 & 3: -Vin
Pins 22 & 23: +Vin
Pin 14: +Vout
Pins 9 & 16: Com
Pin 11: -Vout
Remaining pins NC