AEQ75Y48 Single Output: Baseplate DC-DC Converter Module
Industry Standard ¼ Brick: 36V-75V Input / 1.8V @ 75A Output Current

The AEQ75Y48 series is the latest addition to Astec's quarter brick size offerings. At 1.8V, it delivers 75A maximum output current at 89% Efficiency. It provides tight regulation and exhibits clean and monotonic output start up characteristics. The new modules come with industry standard features such as Input UVLO, OCP, OVP, OTP, Output Trim, differential output Sense pins. It also comes standard with 2 pairs of output power pins (add suffix "-3" for single pair output pin option) and offers baseplate construction for optimum user flexibility.

Special Features

- **Industry Standard ¼ Brick Footprint**
- **Redundant output power pins (with single pair option)**
- **Positive and Negative Enable Options**
- **Regulation to Zero Load**
- **High Capacitive Load Start-up**
- **Output Trim**
- **Input Under-Voltage Lockout**
- **Low profile**

Environmental Specifications

- **-40ºC to 105ºC Operating Temperature**
- **-55ºC to 125ºC Storage Temperature**
- **MTBF > 1 million hours**

Electrical Parameters

Input

Input Range	**36-75 VDC**
Input Surge	**100V / 100ms**
Efficiency	**1.8V @ 89% (Typ)**

Control

Enable	**TTL compatible**
(Positive and Negative Enable Options)	

Output

Load Current	**1.8V @ 75A max**
Line/Load Regulation	**< 1% V_O**
Ripple and Noise	**100mV_{PK-PK} max**
Output Voltage Adjust Range	**±10% V_O**
Transient Response	**< 100mV deviation (Typ) 50% to 75% Load Change 100μsec settling time (Typ)**
Remote Sense	**+10%V_O**
Over Current Protection	**120% $I_{O,MAX}$**

Safety

UL + cUL 60950, Recognized
EN60950 through TUV-PS

Electrical Specifications

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[1]						
Continuous	All	V_{IN}	0	-	75	Vdc
Transient (100ms)	All	$V_{IN, trans}$	0	-	100	Vdc
Isolation Voltage Input to Output Input to Baseplate Output to Baseplate	All		1500	-	-	Vdc
Operating Ambient Temperature	All	T_A	-40	-	105	ºC
Storage Temperature	All	T_{STG}	-55	-	125	ºC
Operating Humidity	All	-	10	-	85	%
Maximum Enable Voltage	All				25	Vdc
Max Output Power		P_O	-	-	135	W

STANDARD TEST CONDITION on a single module unless otherwise specified.

T_A		25°C (Ambient Air)
Airflow		400LFM
$+V_{IN}$	PIN 1	+48Vdc input supply
Enable	PIN 2	Dependent on model series
$-V_{IN}$	PIN 3	Return pin for $+V_{IN}$
$-V_{OUT}$	PIN 4	Connected to Load Return [Optional Pin]
$-V_{OUT}$	PIN 5	Connected to Load Return
-Sense	PIN 6	Connected to $-V_{OUT}$
Trim	PIN 7	Open
+Sense	PIN 8	Connected to $+V_{OUT}$
+Vout	PIN 9	Connected to +Load
+Vout	PIN 10	Connected to +Load [Optional Pin]

Electrical Specifications (*continued)*

INPUT SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All T1	V_{IN}	36 36	48 48	75 62	V_{DC}
Input Under-Voltage Lock-out T_ON Threshold T_OFF Threshold	All		 34 32	 34.8 33.5	 35.5 34.5	Vdc
Maximum Input Current[1] Conditions: V_{IN} =$V_{IN,min}$ I_O = $I_{O,max}$; T_A = 25 ºC	All	$I_{IN,max}$	-	-	4.5	A
Max P_{DISS} @ I_O = 0A (V_{IN} = $V_{IN,NOM}$) @ 25 ºC	All		-	3	4	W
Input Reflected Ripple Current[2] Conditions: P_O = $P_{O,max}$; T_A = 25 ºC BW: 5Hz to 20MHz	All	I_{I1}	-	10	20	mA_{PK-PK}

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Set point V_{IN} = $V_{IN, min}$ to $V_{IN, max}$; I_O =$I_{O,Max}$	All	$V_{O,SET}$	1.770	1.800	1.830	Vdc
Output Regulation Line: V_{IN} = $V_{IN, Min}$ to $V_{IN, Max}$	All	-	-	0.10	0.30	%Vo
Load: I_O = $I_{O, Min}$ to $I_{O, Max}$	All	-	-	0.05	0.20	%Vo
Temperature: Ta = -40 ºC to +85ºC	All	-	-	15	50	mV
Ripple and Noise[3] RMS (5Hz to 20MHz) Peak-to-Peak: (5Hz to 20MHz)	All	-	-	- 25	30 100	mV_{RMS} mVp-p
Output Current[4]	All	I_O	0	-	75	A
External Load Capacitance Capacitor ESR	All	-	- 4	- -	25,000 -	µF mΩ
Output Current-limit Inception[5] V_{OUT} = 90% $V_{O,SET}$	All	I_O	78	80	90	A
Over Voltage Protection Range[5]	All		2.1	-	2.9	V
Over Temperature Range[6] AEQ (referenced to avg Baseplate temp)	AEQ	T_{BP}	-	110	-	°C

Electrical Specifications (*continued)*

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Efficiency $V_{IN} = V_{IN-NOM}$; T_A=25°C	All	η	88	89	-	%
Turn-On Response Time $V_{IN} = V_{IN-MIN\ to}\ V_{IN-MAX}$	All	-	-	-	15	ms
Switching Frequency	All	-	440	-	520	KHz
Dynamic Response: C_O = 0uF	$\Delta I_O/\Delta t$	-	0.09	0.1	1.1	A/µs
Peak Deviation Load Change from I_O = 50% to 75% of $I_{O, Max}$:	All	Vpk	-	4	8	$\%Vo_{,SET}$
Settling Time to $V_{O, Nom}$		ts	-	100	300	µs
Peak Deviation Load Change from I_O = 50% to 25% of $I_{O, Max}$:	All	Vpk	-	4	8	$\%Vo_{,SET}$
Settling Time to output voltage setpoint tolerance – $Vo_{,SET}$		ts	-	100	300	µs
Output Overshoot at T-on / T-off	All	-	-	-	4	%Vo

Note:
1. An input line fuse is recommended for use.
2. External input capacitance required. See Input Ripple Current test measurement setup on Figure 1.
3. Refer to Figure 2 for output ripple measurement setup.
4. Appropriate Thermal Derating applies. See Figure 6.
5. Over current and over voltage protections are all in auto recovery mode. The converter will shutdown during fault condition then will attempt to auto restart.
6. Output of the module will be terminated once the operating temperature reaches the OTP threshold. Normal operation resumes once the temperature falls below the OTP threshold.

Electrical Specifications (*continued)*

FEATURE SPECIFICATION

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Enable ON/OFF						
Negative Enable ("N" suffix)						
Enable Pin voltage for Module OFF	N	-	2.95	-	20.0	V
Module ON	suffix	-	0	-	0.8	V
Positive Enable (No suffix)						
Enable Pin voltage for Module ON	No	-	0	-	0.8	V
Module OFF	suffix	-	2.95	-	20.0	V
Enable Pin current						
Module at ON State	All	-	-	-	1	mA
Module at OFF State (Leakage)		-	-	-	50	µA
Output Voltage Remote Sensing[7, 9]	All	-	-	-	10	$\%V_O$
Output Voltage Trim Range[8, 9]	All		90		110	$\%V_O$

Note: 7. The sense pins can be used to compensate for any voltage drops (per indicated max limits) that may occur along the connection between the output pins to the load. Pin 8 (+Sense) and Pin 6 (-Sense) should be connected to Pin 9 (+Vout) and Pin 5 (Return) respectively at the point where regulation is desired.
8. Refer to Equation (1) and (2) and Figures 3 and 4 for the Output Trim Adjust configuration.
9. The combination of remote sense and Trim adjust cannot exceed 110% of $V_{O, NOM}$.

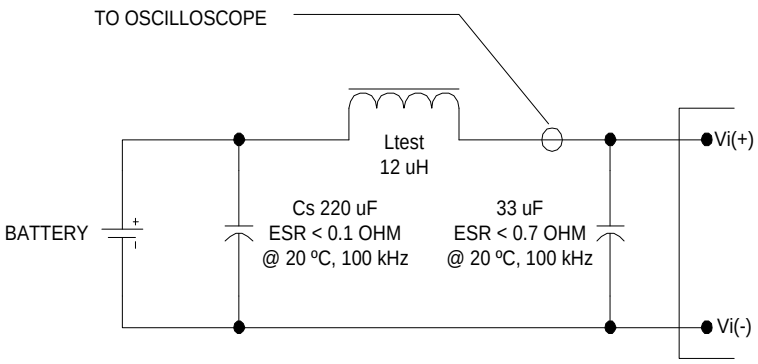
ISOLATION SPECIFICATION

Parameter	Device	Min	Typ	Max	Unit
Isolation Capacitance	All	-	2.70	-	nF
Isolation Resistance	All	10	-	-	MΩ
MTBF Telcordia SR332 (Parts Stress) T_A = 40°C; I_O = 30A; Airflow = 200LFM		1,029,514			Hrs

SAFETY APPROVAL

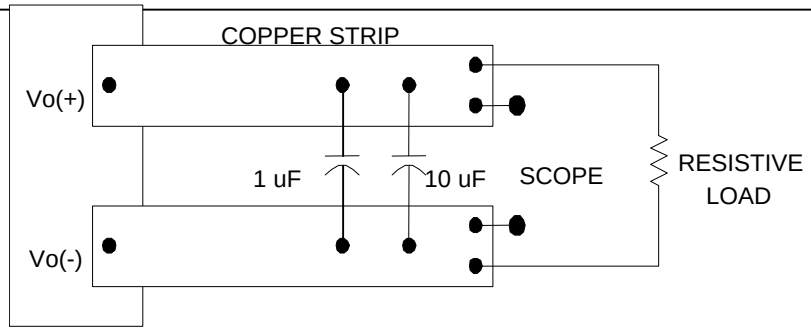
The AEQ75Y48 series have been certified through:
- UL + cUL 60950, Third Edition - Recognized
- EN 60950 through TUV-PS

Electrical Specifications (*continued)*



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 1µF 50V X7R ceramic capacitor and a 10µF 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 UNDER VOLTAGE LOCKOUT

To prevent any instability to the converter, which may affect the end system, the converter have been designed to turn-on once V_{IN} is in the voltage range of 34-35.5VDC. Likewise, it has also been programmed to turn-off when V_{IN} drops down to 32-34.5 VDC.

OUTPUT VOLTAGE ADJUST/TRIM

The converter comes with a TRIM pin (PIN 7), which is used to adjust the output by as much as 90% to 110% of its set point. This is achieved by connecting an external resistor as described below.

To **INCREASE** the output, external R_{adj_up} resistor should be connected between TRIM PIN (Pin7) and +SENSE PIN (Pin 8). Please refer to Equation (1) for the required external resistance and output adjust relationship.

Equation (1):

$$\text{Radj\_up} = \left(\frac{5.1 \cdot Vo(100 + \Delta\%)}{1.225\Delta\%} - \frac{510}{\Delta\%} - 10.2 \right) \cdot k\Omega$$

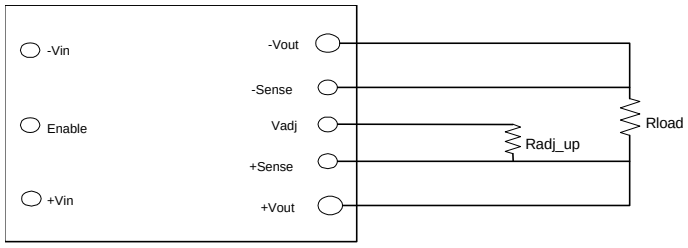


Figure 3. External resistor configuration to increase the outputs

To **DECREASE** the output, external R_{adj_down} resistor should be connected between TRIM PIN (Pin 7) and -SENSE PIN (Pin 6). Please refer to Equation (2) for the required external resistance and output adjust relationship.

Equation (2)

$$\text{Radj\_down} = \left(\frac{510}{\Delta\%} - 10.2 \right) \cdot k\Omega$$

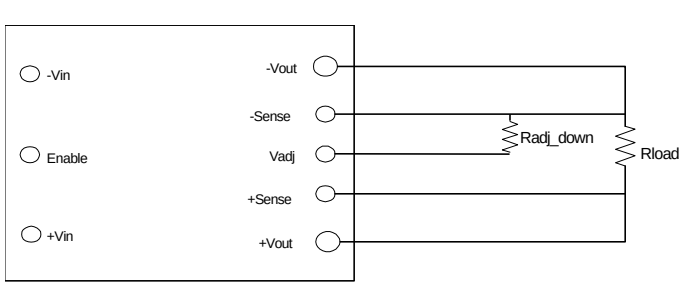


Figure 4. External resistor configuration to increase the outputs

Basic Operation and Features *(continued)*

OUTPUT ENABLE

The converter comes with an Enable pin (PIN 2), 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 options are being offered. Please refer to Table 2 for the Part Numbering Scheme.

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

OUTPUT OVER VOLTAGE PROTECTION (OVP)

The Over Voltage Protection circuit comes in shutdown mode. The output of the converter is terminated under an OVP fault condition (Vo > OVP threshold). The converter will automatically recover once the fault condition is removed.

OVER CURRENT PROTECTION (OCP)

The Over Current Protection circuit comes in shutdown mode. The converter shuts down once the output current reaches the OCP range. The converter will automatically recover once the fault condition is removed.

OVER TEMPERATURE PROTECTION (OTP)

The Over Temperature Protection circuit will shutdown the converter once the average PCB temperature reaches the OTP range. This feature prevents the unit from overheating and consequently going into thermal runaway, which may further damage the converter and the end system. Such overheating may be an effect of operation outside the given power thermal derating conditions. Restart is possible once the temperature of the sensed location drops to less than 110°C.

Performance Curves

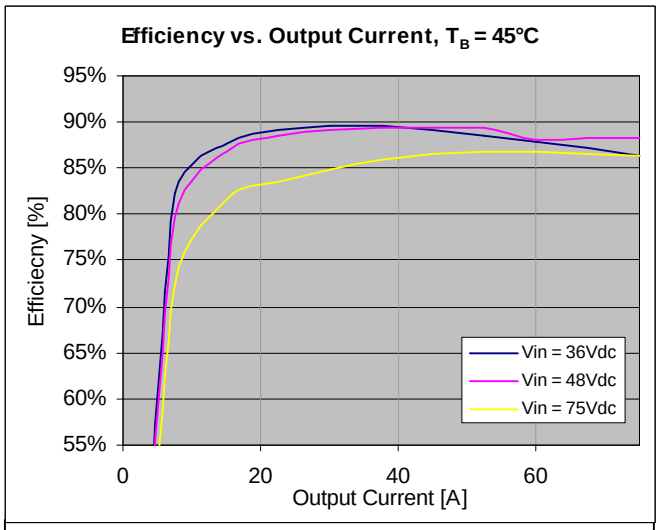


Figure 5. Efficiency vs. Load Current at Baseplate Temperature, T_B = 45ºC.

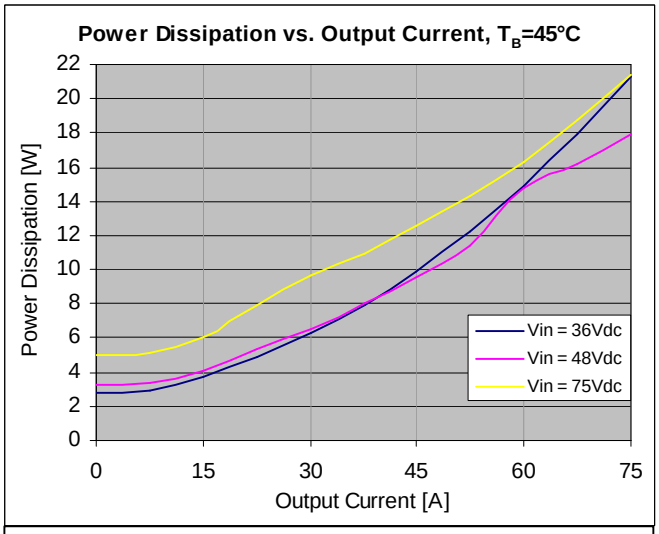


Figure 6. Power Dissipation vs. Load Current at Baseplate Temperature, T_B = 45ºC.

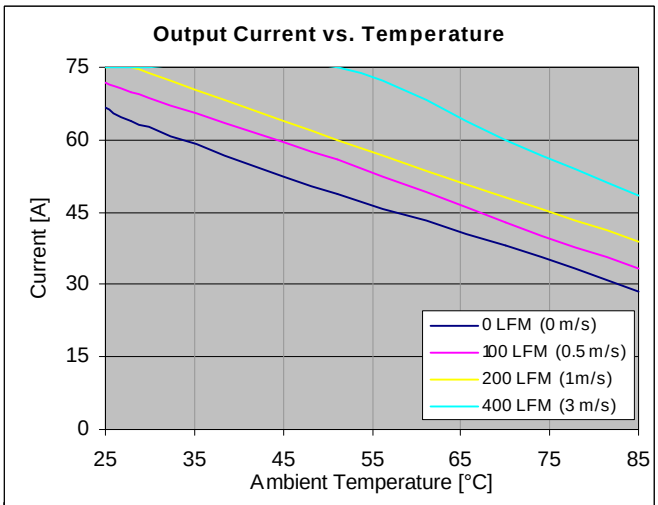


Figure 7. Output Power Derating Curves at V_{IN} = 48Vdc.

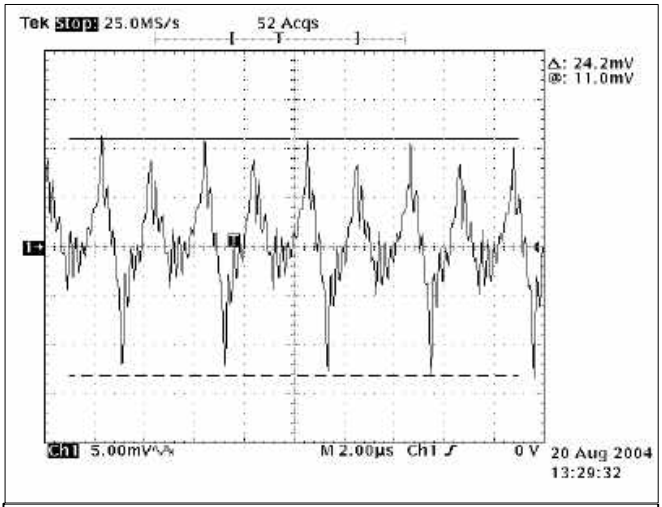


Figure 8. Output Ripple Waveform at V_{IN} = 48Vdc, T_A = 25ºC, I_O = 75A.

Performance Curves *(continued)*

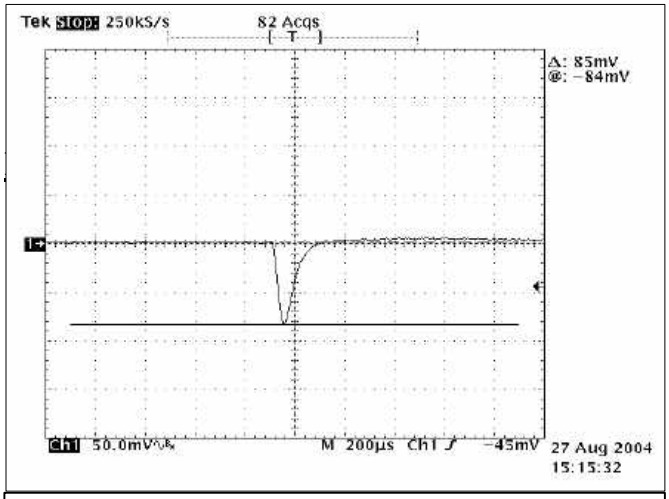


Figure 9. Output Transient Response (50% to 75% Step Change) at V_{IN} = 48Vdc, T_A = 25ºC.

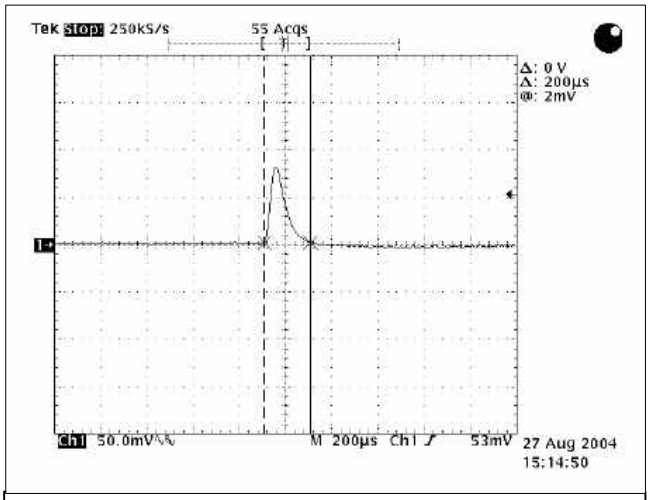


Figure 10. Output Transient Response (25% to 50% Step Change) at V_{IN} = 48Vdc, T_A = 25ºC.

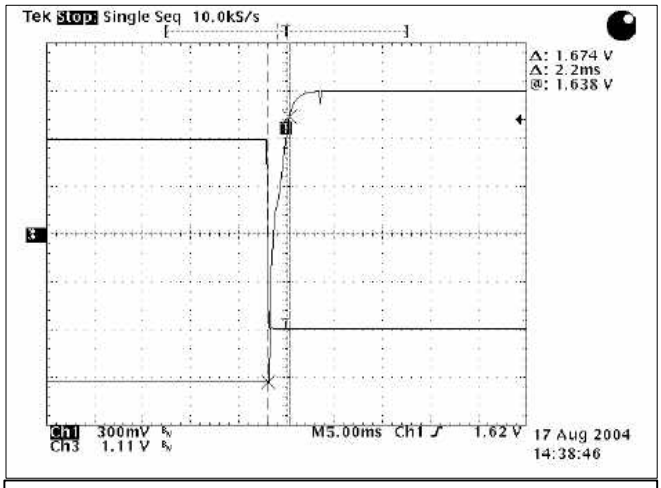


Figure 11. Enable Turn On Characteristic at V_{IN} = 48Vdc, T_A = 25ºC.

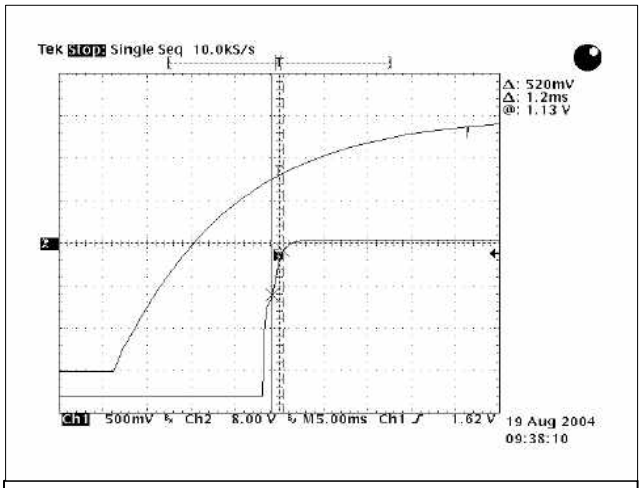


Figure 12. Output Startup Waveform at V_{IN} = 48Vdc, T_A = 25ºC, I_O = 75A.

Mechanical Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Dimension	All	L W H	- - -	2.30 [58.42] 1.48 [37.59] 0.44 [9.10]	- - -	in [mm] in [mm] in [mm]
Weight	AEQ		-	54 [1.90]	-	g [oz]

PIN ASSIGNMENT			
1	$+V_{IN}$	6	-SENSE
2	ENABLE	7	TRIM
3	$-V_{IN}$	8	+SENSE
4	$-V_O$ [Optional]	9	$+V_O$
5	$-V_O$	10	$+V_O$ [Optional]

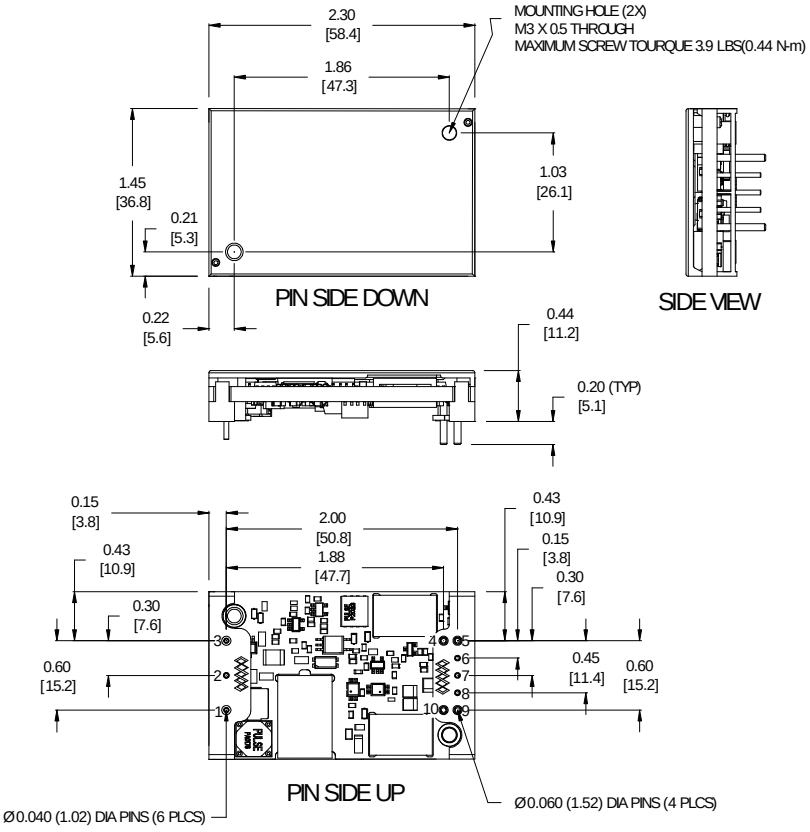


Figure 13. AEQ75Y48 (Baseplate) Mechanical Outline Drawing

Mechanical Specifications

SOLDERING CONSIDERATIONS

The AEQ75Y48 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.

PART NUMBERING SCHEME

Part Number	Construction	Vout / Iout / Enable Logic	Pin Length	Pin Out Option
AEQ75Y48	Baseplate	1.8V / 75A; Positive Enable	5.0 mm	Pins 4 & 10: Present
AEQ75Y48-3	Baseplate	1.8V / 75A; Positive Enable	5.0 mm	Pins 4 & 10: Omitted
AEQ75Y48N	Baseplate	1.8V / 75A; Negative Enable	5.0 mm	Pins 4 & 10: Present
AEQ75Y48N-3	Baseplate	1.8V / 75A; Negative Enable	5.0 mm	Pins 4 & 10: Omitted
AEQ75Y48N-TI[1]	Baseplate	1.8V / 75A; Negative Enable	3.7 mm	Pins 4 & 10: Present

Note: 1 – Tuned version for specific customer application.