

AEO40x48 / ALO40x48 Single Output 8th Brick: Baseplate or Open-Frame Module

The AEO40x48 / ALO40x48 series is Astec's High Current 8th Brick industry standard offering. Operating from an input voltage range of 36V to 75V, the series provides 7 configured outputs starting from 1.2V all the way up to 12V. It delivers up to 40A max current for 1.8V and lower at impressive levels of efficiency. It provides tight regulation and exhibits clean and monotonic output start up characteristics. The AEO_ALO series comes with industry standard features such as Input UVLO; non-latching OCP, OVP and OTP; Output Trim; Differential Remote Sense pins. Both baseplate (AEO) and open frame (ALO) construction are available as well as TH or SMT termination. With its wide operating temperature range of -40°C to 85°C ambient, the converters are deployable into almost any environment.



Special Features

- Industry Standard 8th Brick Footprint
- Baseplate or Open frame construction
- Low Ripple and Noise
- Regulation to zero load
- High Capacitive Load Start-up
- Fixed Switching Frequency
- Industry standard features: Input UVLO; Enable; non-latching OVP, OCP and OTP; Output Trim, Differential Remote Sense
- Meets Basic Insulation

Environmental Specifications

- -40°C to 85°C Operating Temperature
- -40°C to 125°C Storage Temperature
- MTBF > 1 million hours

Electrical Parameters

Input

| | |
|-------------|--------------|
| Input Range | 36-75 VDC |
| Input Surge | 100V / 100ms |

Control

| | |
|---|----------------|
| Enable | TTL compatible |
| (Positive or Negative Logic Enable Options) | |

Output

| | |
|-----------------------------|-------------------------------------|
| Load Current | Up to 40A max ($V_O \leq 1.8V$) |
| Line/Load Regulation | < 1% V_O |
| Ripple and Noise | 15mV _{P-P} typical at 1.8V |
| Output Voltage | |
| Adjust Range | ±10% V_O |
| Transient Response | 2% Typical deviation |
| | 50% to 75% Load Change |
| | 20ms settling time (Typ) |
| Remote Sense | +10% V_O |
| Over Current Protection | 120% max |
| Over Voltage Protection | 130% max |
| Over Temperature Protection | 110 °C |

Safety

UL + cUL 60950, Recognized
 EN60950 through TUV-PS



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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 | Typical | Max | Unit |
|--|--|--|---------------------------------|---------------------------------|--|------|
| Input Voltage Continuous Transient (100ms) | All | V _{in} V _{in trans} | -0.3 - | - - | 75 100 | Vdc |
| I/O Isolation Input-to-Output | All | - | 1500 | - | - | Vdc |
| Operating Temperature ¹ | All | T _A | -40 | - | 85 | °C |
| Storage Temperature | All | T _{STG} | -55 | - | 125 | °C |
| Operating Humidity | All | - | 10 | - | 85 | % |
| Max Voltage at Enable Pin | All | - | -0.6 | - | 25 | Vdc |
| Max Output Power | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | P _{O,MAX} | - - - - - - - | - - - - - - - | 120.0 100.0 99.0 88.0 72.0 60.0 48.0 | W |

INPUT SPECIFICATION

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|--|---------------------|---------------------------------|---------------------------------|---|-------|
| Operating Input Voltage Range | All | V _{IN} | 36 | 48 | 75 | Vdc |
| Input Under-Voltage Lock-out T_ON Threshold T_OFF Threshold | All | | 33 31 | 34 32 | 36 34 | Vdc |
| Max Input Current ² | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | I _{in max} | - - - - - - - | - - - - - - - | TBA 3.5 3.5 3.3 TBA TBA TBA | A |
| Standing Loss | All | | - | - | 4 | W |
| Input Ripple Current ³ | All | I _{II} | - | 10 | 30 | mAp-p |



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Electrical Specifications (continued)

OUTPUT SPECIFICATIONS

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|--|---------------------------------|---|---|---|-----------------------------------|
| Output Voltage Set point $V_{IN} = V_{IN,MIN}$ to $V_{IN,MAX}$ $I_O = I_{O,MAX}$ | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | $V_{O,SET}$ | 11.80 4.90 3.25 2.45 1.76 1.47 1.17 | 12.00 5.00 3.30 2.50 1.80 1.50 1.20 | 12.20 5.10 3.35 2.55 1.84 1.53 1.23 | Vdc |
| Output Regulation Line $V_{IN} = V_{IN,MIN}$ to $V_{IN,MAX}$ Load $V_{IN} = V_{IN,NOM}$ $I_O = I_{O,MIN}$ to $I_{O,MAX}$ Temp $V_{IN} = V_{IN,NOM}; I_O = I_{O,MAX}^4$ | All | - - - | - - - | 0.1 0.1 0.5 | 0.2 0.5 1.0 | % |
| Output Ripple and Noise ⁵ Peak-to-Peak $I_O = I_{O,MAX}; V_{IN} = V_{IN,NOM};$ BWL = 20 MHz; $T_A = 25^\circ C$ | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | - - - - - - - | - - - - - - - | 50 40 40 20 15 15 15 | 120 90 75 75 50 50 50 | mVp-p |
| Output Current ⁶ | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | I_O | 0 0 0 0 0 0 0 | - - - - - - - | 10 20 30 35 40 40 40 | A |
| Output Current-limit Inception $V_O = 90\% V_{O,NOM}; T_A = 25^\circ C$ $V_{IN} = V_{IN,NOM}$ Non-latching / auto-recovery | B (12V0) A (5V0) F (3V3) G (2V5) Y (1V8) M (1V5) K (1V2) | $I_{O,OCF}$ | 11.5 24.0 33.0 42.0 46.0 46.0 46.0 | - - - - - - - | 17.0 32.0 41.5 47.0 60.0 60.0 60.0 | A |
| External Load Capacitance $I_O = I_{O,MAX}$, resistive load ESR | All B (12V0) A (5V0) F (3V3) | C_{EXT} | - - - 4 | - - - - | 20,000 2000 10,000 10,000 - | μF m Ω |



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Electrical Specifications *(continued)*

OUTPUT SPECIFICATIONS

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|----------|-------------|------|---------|------|------------------|
| Efficiency $V_{IN} = V_{IN,NOM}; I_O = I_{O,MAX}$ $T_A = 25\text{ }^\circ\text{C};$ | B (12V) | η | 91 | 92 | 93 | % |
| | A (5.0V) | η | 92 | 93 | 94 | |
| | F (3.3V) | η | 90 | 91 | 93 | |
| | G (2.5V) | η | 89 | 90 | 92 | |
| | Y (1.8V) | η | 87 | 88 | 89 | |
| | M (1.5V) | η | 85 | 86 | 87 | |
| | K (1.2V) | η | 84 | 85 | 86 | |
| Output Over Voltage Protection Non-latching / autorecovery | B (12V) | $V_{O,OVp}$ | 13.8 | 14.4 | 15.0 | v |
| | A (5.0V) | | 5.8 | 6.0 | 6.2 | |
| | F (3.3V) | | 3.8 | 4.0 | 4.3 | |
| | G (2.5V) | | 2.9 | 3.0 | 3.2 | |
| | Y (1.8V) | | 2.1 | 2.2 | 2.4 | |
| | M (1.5V) | | 1.8 | 1.9 | 2.0 | |
| Over Temperature Protection Autorecovery | AEO | | 110 | - | 120 | $^\circ\text{C}$ |
| | ALO | | 110 | - | 120 | |
| Input to Output Turn-On Delay $V_{IN} = V_{IN,NOM}, I_O = I_{O,MAX}$ | All | - | - | - | 17 | ms |
| | 5V, 12V | | - | - | 20 | |
| Enable to Output Turn-On Delay $V_{IN} = V_{IN,NOM}, I_O = I_{O,MAX}$ | All | - | - | - | 17 | ms |
| | 5V, 12V | | - | - | 20 | |
| Output Voltage Rise Time 10% to 90% of $V_{O,NOM}$ $V_{IN} = V_{IN,NOM}, I_O = I_{O,MAX}$ | All | - | - | 3.0 | 9.0 | ms |
| | 5V | | - | 4.0 | 11.0 | |
| | 12V | | - | 9.0 | 16.0 | |
| Switching Frequency | All | F_{SW} | 380 | 450 | 520 | kHz |
| Output Voltage Remote Sensing | All | - | - | - | 10 | % V_O |
| Output Voltage Trim Range ⁷ | All | | 90 | | 110 | % V_O |
| Output Voltage Overshoot | All | - | - | 0 | 3 | % V_O |
| Dynamic Response $di/dt = 0.1\text{ A}/\mu\text{s}$ | All | - | - | 2 | 5 | % |
| | | | | | | |
| Peak Deviation $\Delta I_O = 50\% \text{ to } 75\% \text{ of } I_{O,max}$ | All | - | - | 20 | 100 | μs |
| Settling Time $V_{ref} = V_{O,nom}$ | All | - | - | 2 | 5 | % |
| Peak Deviation $\Delta I_O = 50\% \text{ to } 25\% \text{ of } I_{O,max}$ | All | - | - | 20 | 100 | μs |
| Settling Time $V_{ref} = V_{O,nom}$ | | | | | | |



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Electrical Specifications (continued)

OUTPUT SPECIFICATIONS

| Parameter | Device | Symbol | Min | Typical | Max | Unit |
|---|--------|--------|-------|---------|------|------|
| Output Enable ON/OFF Open collector TTL compatible | | | | | | |
| Positive Enable: Mod-ON | All | - | 2.95 | - | 20 | V |
| Mod-OFF | All | - | -0.50 | - | 1.20 | V |
| Negative Enable: Mod-ON | All | - | -0.50 | - | 1.20 | V |
| Mod-OFF | All | - | 2.95 | - | 20 | V |

- Note:
1. Derating curves for both openframe and baseplate modules are based on derated component junction temperatures of 120°C or less where applicable.
 2. An input line fuse is recommended for use (e.g. Little Fuse Type 314 - 6A max, 250V min).
 3. External input capacitance required. See Input Ripple Current test measurement setup on Fig 1.
 4. Max output current should meet the appropriate derating curves.
 5. Refer to Fig 2 for output ripple measurement setup.
 6. Appropriate Thermal Derating applies.
 7. Refer to the output trim equations provided (Equation 1 and 2).

SAFETY AGENCY / MATERIAL RATING / ISOLATION

| Parameter | Device | | | | | |
|---------------------------------|--------|--|-----|---------|-----|------|
| Safety Approval ⁸ | All | UL/cUL 60950, 35d Edition – Recognized (PENDING) EN 60950 through TUV (PENDING) | | | | |
| Material Flammability Rating | All | UL94V-0 | | | | |
| Parameter | Device | Symbol | Min | Typical | Max | Unit |
| Input to Output Capacitance | All | | - | 1000 | - | pF |
| Input to output Resistance | All | | - | TBD | - | Ohms |
| Input to Output Insulation Type | All | | - | Basic | - | - |

- Note:
8. Safety approval for 3.3V version is complete.

Electrical Specifications *(continued)*

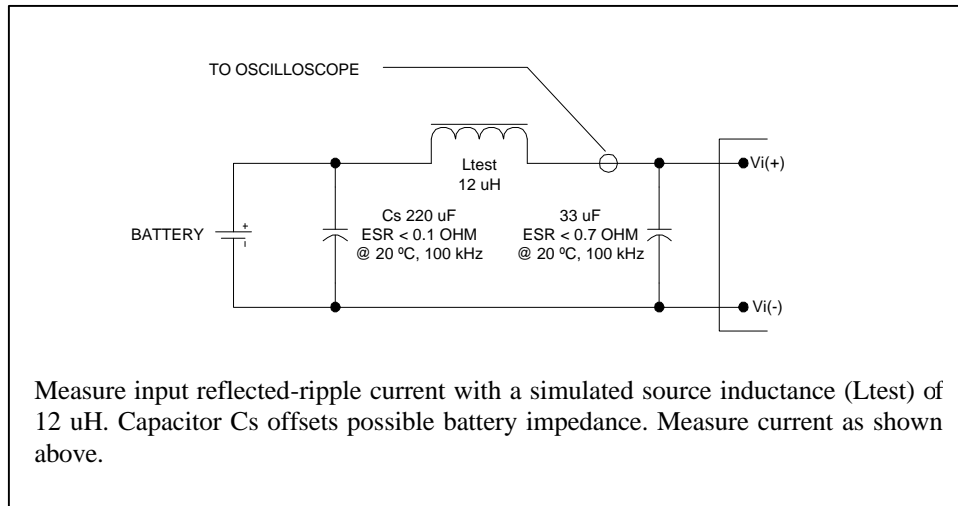


Figure 1. Input Reflected Ripple Current Measurement Setup.

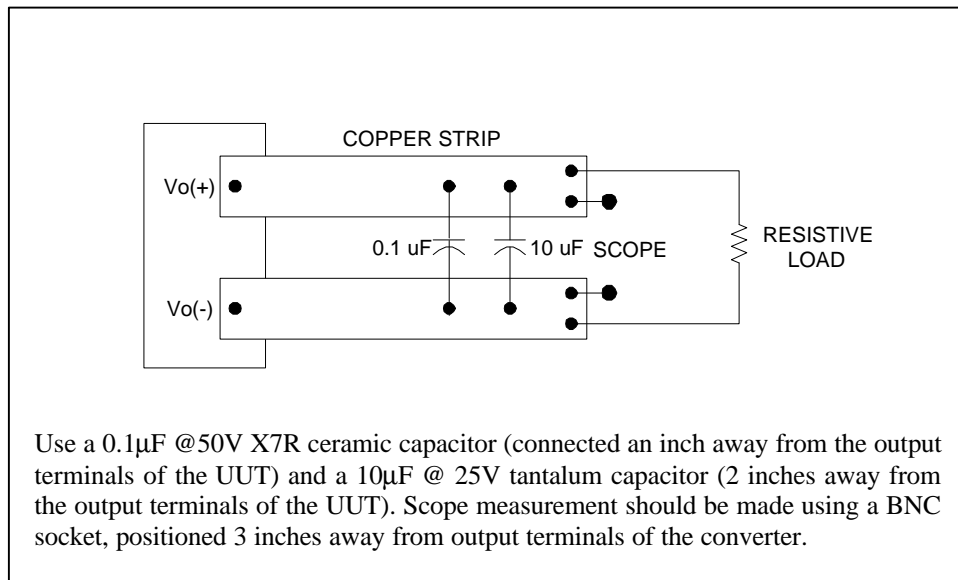


Figure 2. Peak to Peak Output Noise Measurement Setup.

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 33-36 VDC. Likewise, it has also been programmed to turn-off when V_{IN} drops down to 31-34 VDC.

OUTPUT VOLTAGE ADJUST/TRIM

The converter comes with a TRIM pin (PIN 6), 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 (Pin6) and +SENSE PIN (Pin 7). Please refer to Equation (1) for the required external resistance and output adjust relationship.

Equation (1a): 1.5V to 12V

$$R_{adj_up} = \left[\frac{5.1 \times V_{o_set} \times (100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{510}{\Delta\%} - 10.2 \right] \text{ K } \Omega$$

Equation (1b): 1.2V

$$R_{adj_up} = \left[\frac{5.1 \times V_{o_set} \times (100 + \Delta\%)}{0.6 \times \Delta\%} - \frac{510}{\Delta\%} - 10.2 \right] \text{ K } \Omega$$

To **DECREASE** the output, external R_{adj_down} resistor should be connected between TRIM pin (Pin 6) and -SENSE PIN (Pin 5). Please refer to Equation (2) for the required external resistance and output adjust relationship.

Equation (2):

$$R_{adj_down} = \left(\frac{510}{\Delta\%} - 10.2 \right) \text{ k}\Omega$$

Where: $\Delta\%$ = percent change in output voltage

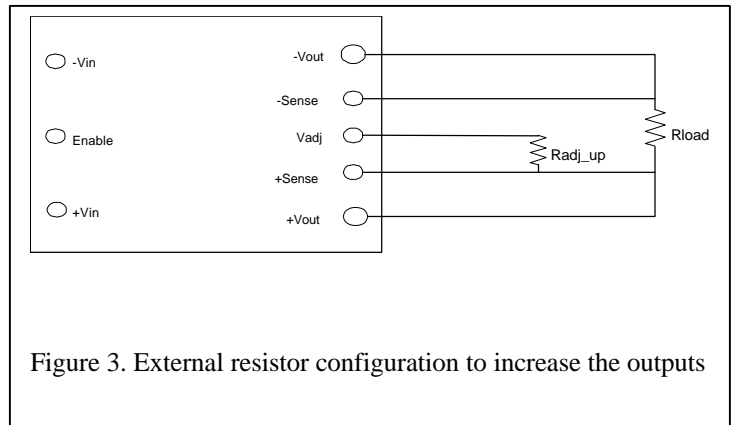


Figure 3. External resistor configuration to increase the outputs

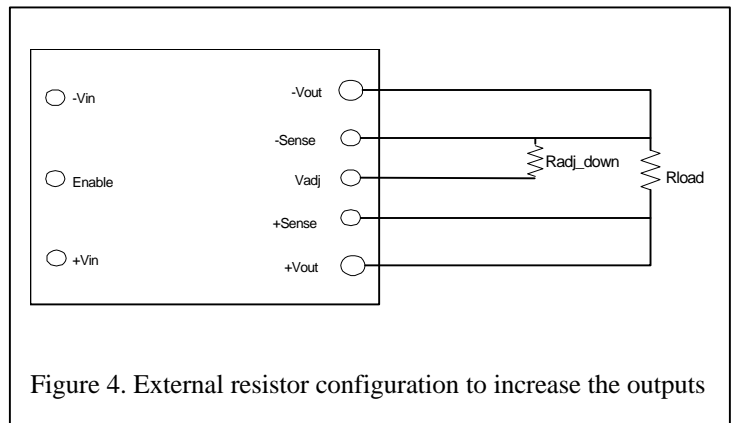


Figure 4. External resistor configuration to decrease the outputs



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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 "N" 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 is non-latching - auto recovery mode. The output of the converter is terminated under an OVP fault condition ($V_o > \text{OVP threshold}$). The converter will attempt to restart until the fault is removed. There is a 100ms lockout period between restart attempts.

OVER CURRENT PROTECTION (OCP)

The Over Current Protection is non-latching - auto recovery mode. The converter shuts down once the output current reaches the OCP range. The converter will attempt to restart until the fault is removed. There is a 100ms lockout period between restart attempts.

OVER TEMPERATURE PROTECTION (OTP)

The Over Temperature Protection circuit will shutdown the converter once the average PCB temperature (See Figure 90B for OTP reference sense point) 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.

REMOTE SENSE

The remote 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 7 (+Sense) and Pin 5 (-Sense) should be connected to Pin 8 (+Vout) and Pin 4 (Return) respectively at the point where regulation is desired. The combination of remote sense and trim adjust cannot exceed 110% of V_o . When output voltage is trimmed up (through remote sensing and/or trim pin), output current must be derated and maximum output power must not be exceeded.



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Performance Curves

3.3V @ 30A

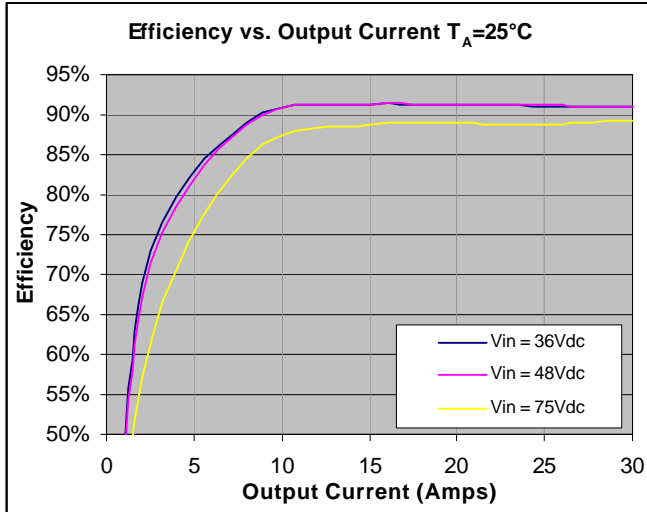


Figure 6. Efficiency vs. Load Current at minimum, nominal and high line, $T_A = 25^\circ\text{C}$.

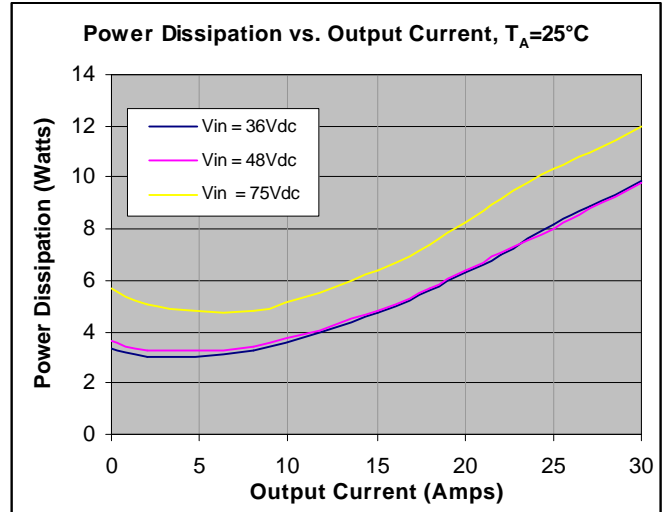


Figure 7. Power Dissipation vs. Load Current at minimum, nominal and high line, $T_A = 25^\circ\text{C}$.

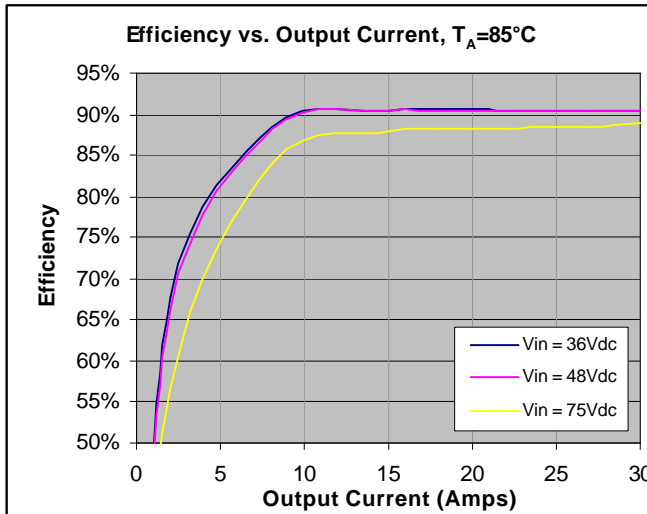


Figure 8. Efficiency vs. Load Current at minimum, nominal and high line, $T_A = 85^\circ\text{C}$.

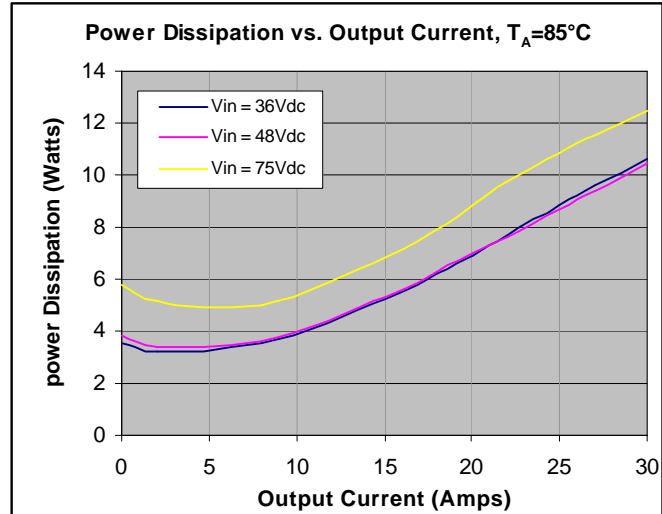


Figure 9. Power Dissipation vs. Load Current at minimum, nominal and high line, $T_A = 85^\circ\text{C}$.



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Performance Curves

3.3V @ 30A (continued)

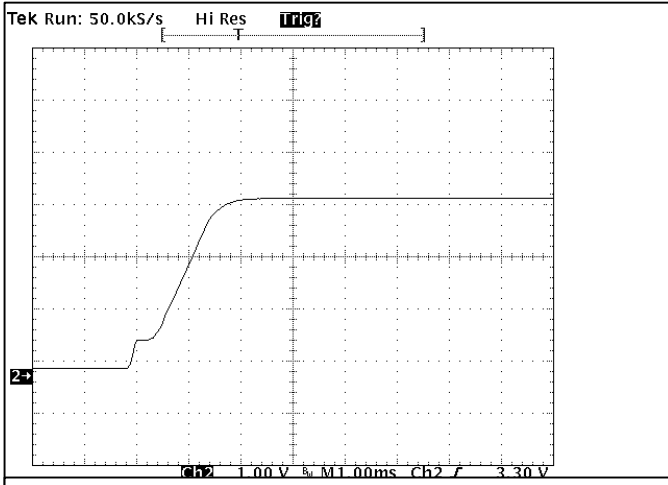


Figure 10. 3.3V output startup characteristic at $V_{IN} = 48Vdc$, $I_O = \text{Full Load}$, $T_A = 25^\circ C$, $C_O = 0$.

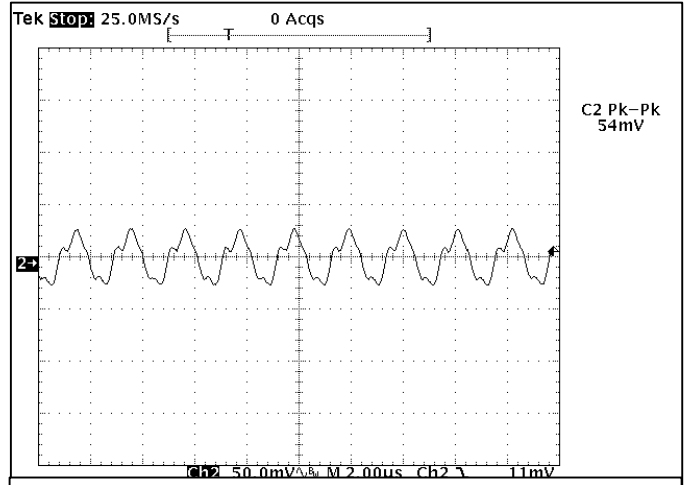


Figure 11. 3.3V output ripple at $V_{IN} = 48Vdc$, $I_O = \text{Full Load}$, $T_A = 25^\circ C$.

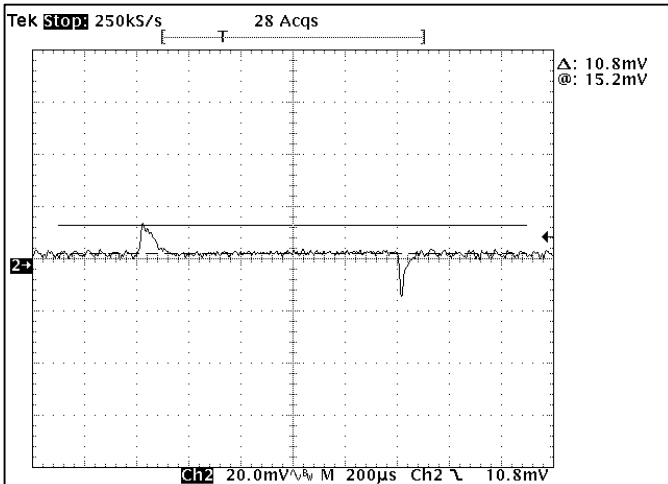


Figure 12. 3.3V output transient response 25% to 50% step change at $V_{IN} = 48Vdc$, $T_A = 25^\circ C$, $C_O = 0$.

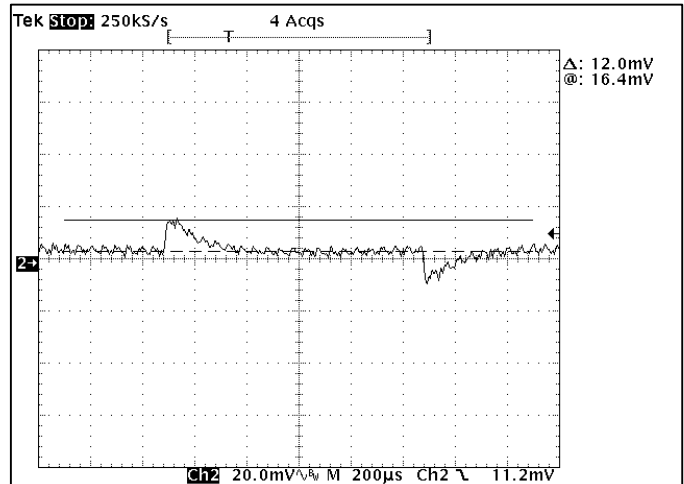


Figure 13. 3.3V output transient response 50% to 75% step change at $V_{IN} = 48Vdc$, $T_A = 25^\circ C$, $C_O = 0$.



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Performance Curves

3.3V @ 30A (continued)

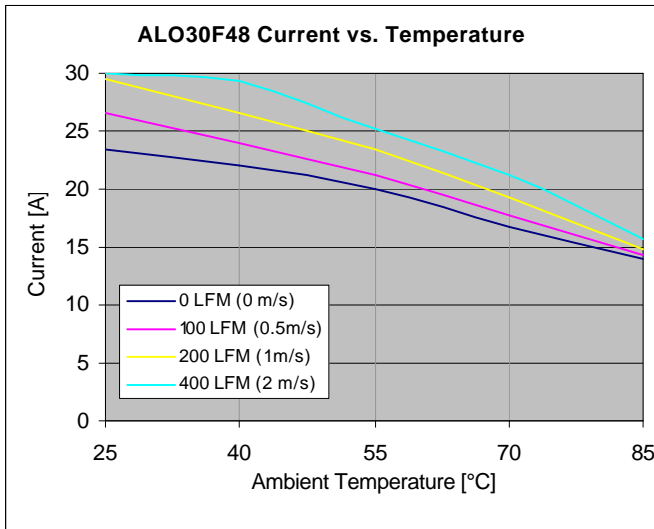


Figure 14. Output Current vs. Temperature for open frame version at $V_{IN} = 48Vdc$ ($T_J \leq 120^\circ C$).

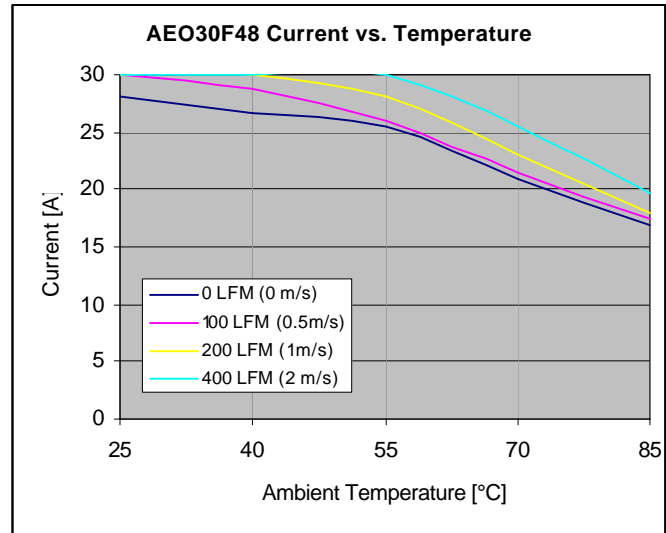


Figure 15. Output Current vs. Temperature for baseplate version at $V_{IN} = 48Vdc$ ($T_J \leq 120^\circ C$).

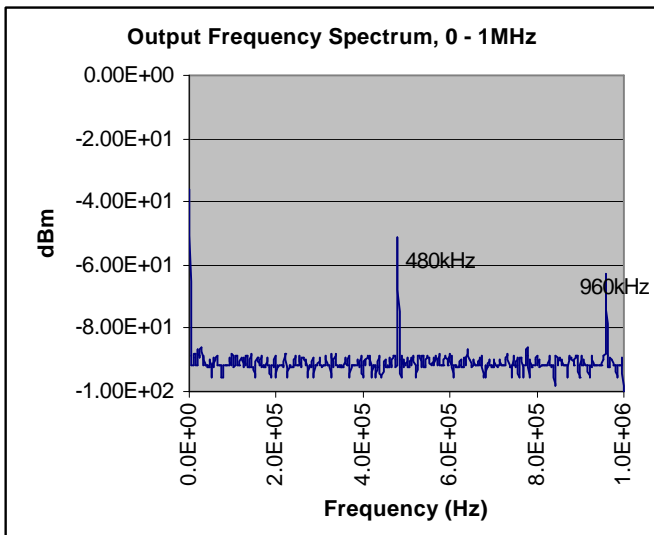


Figure 16. Typical output frequency spectrum at $V_{IN} = 48Vdc$, $I_O = 100\%$ Load, $C_{OUT} = 0$.

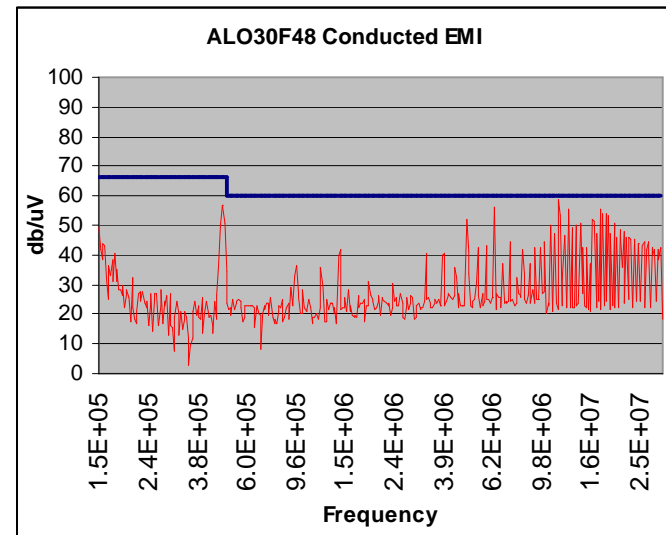


Figure 17. 3.3V Open frame Conducted EMI per Filter defined in Fig 28. $V_{IN} = 48Vdc$, $I_O = 100\%$ Resistive Load, $C_{IN} = 220\mu F$, $C_{OUT} = 4700\mu F$, $T_A = 25^\circ C$.



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Performance Curves

5V @ 20A

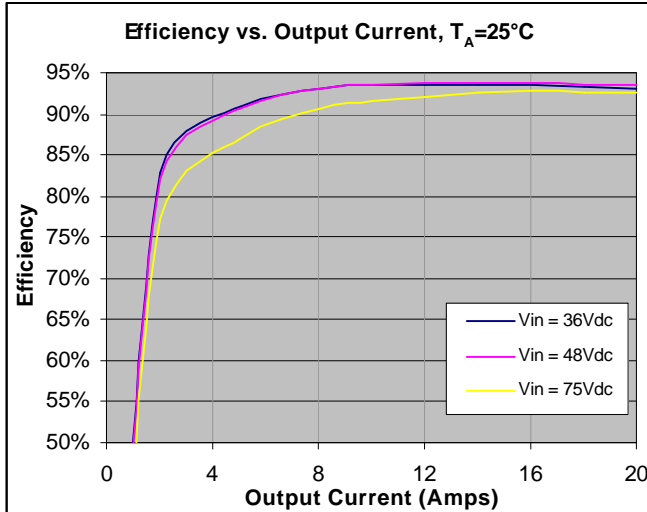


Figure 18. Efficiency vs. Load Current at minimum, nom and high line, $T_A = 25^\circ\text{C}$.

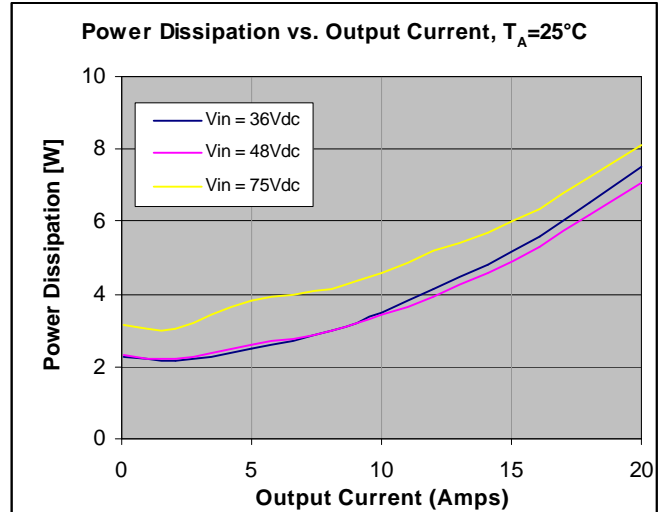


Figure 19. Power Dissipation vs. Load Current at min, nominal and high line, $T_A = 25^\circ\text{C}$.

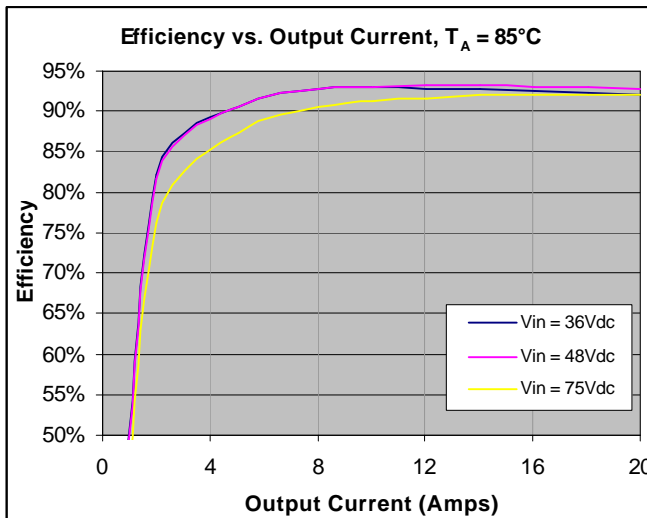


Figure 20. Efficiency vs. Load Current at minimum, nom and high line, $T_A = 85^\circ\text{C}$.

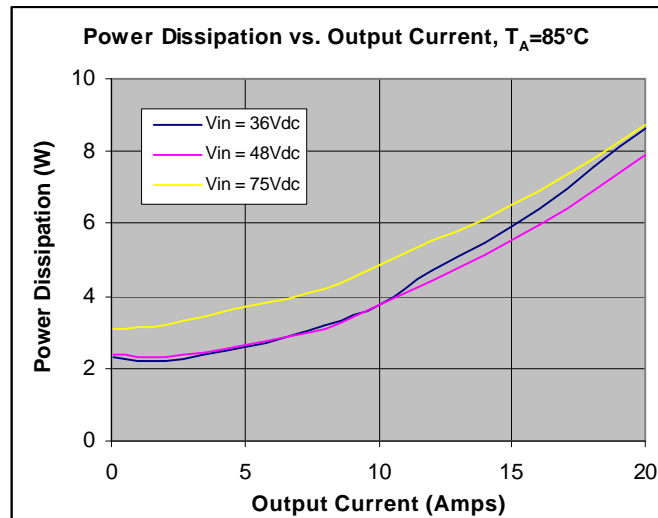


Figure 21. Power Dissipation vs. Load Current at minimum, nominal and high line, $T_A = 85^\circ\text{C}$.

Performance Curves

5V @ 20A (continued)

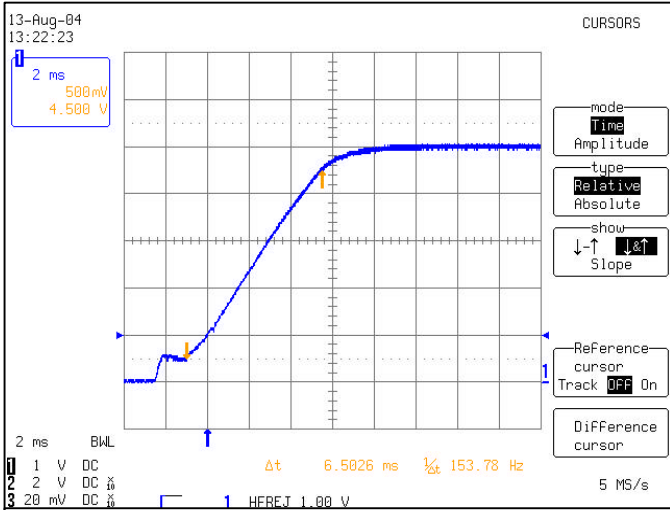


Figure 22. 5V output startup characteristic at $V_{IN} = 48\text{Vdc}$, $I_O = \text{Full Load}$, $T_A = 25\text{ }^\circ\text{C}$, $C_O = 0$.

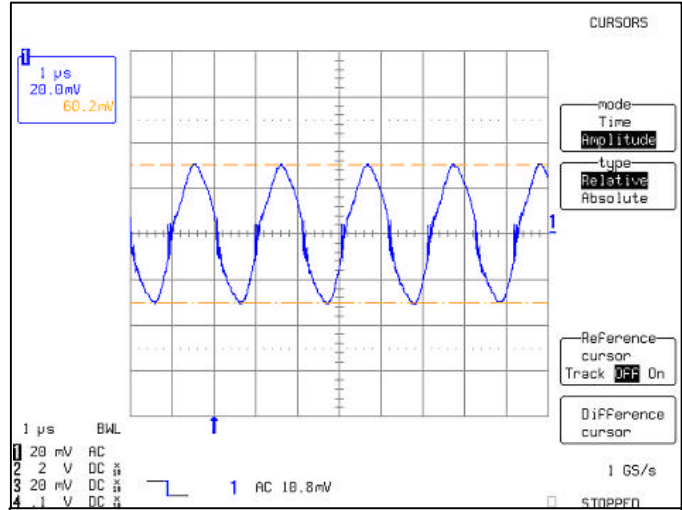


Figure 23. 5V output ripple at $V_{IN} = 48\text{Vdc}$, $I_O = \text{Full Load}$, $T_A = 25\text{ }^\circ\text{C}$.

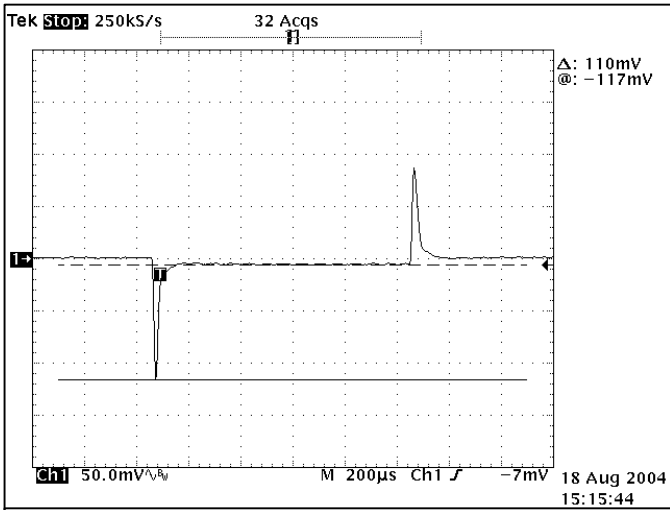


Figure 24. 5V output transient response 25% to 50% step change at $V_{IN} = 48\text{Vdc}$, $T_A = 25\text{ }^\circ\text{C}$, $C_O = 0$.

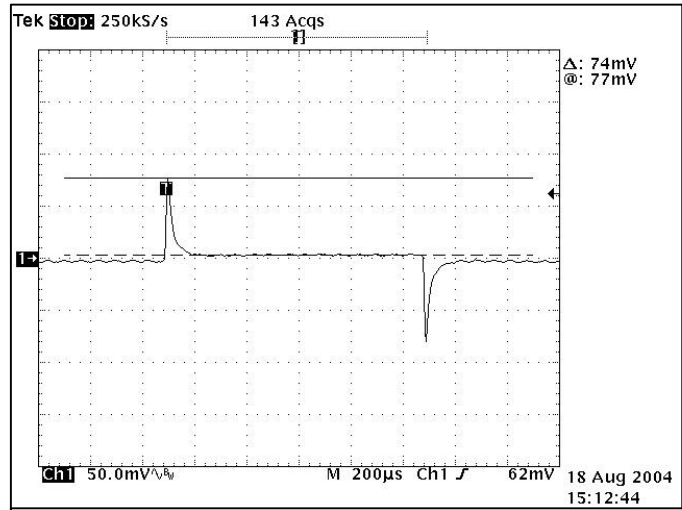


Figure 25. 5V output transient response 50% to 75% step change at $V_{IN} = 48\text{Vdc}$, $T_A = 25\text{ }^\circ\text{C}$, $C_O = 0$.

Performance Curves

5V @ 20A (continued)

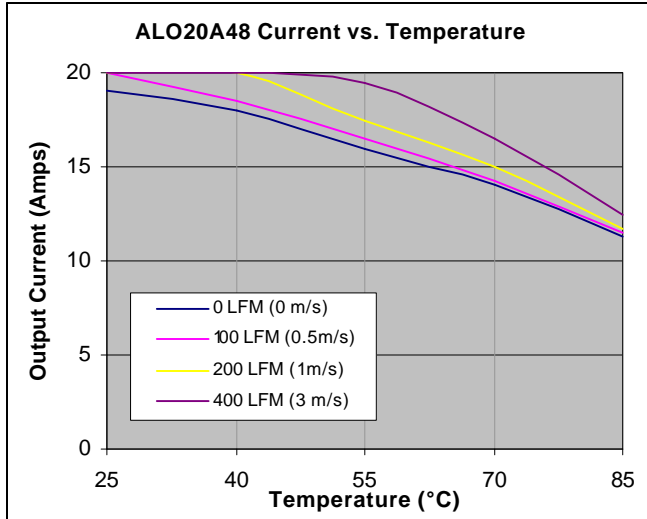


Figure 26. Output Current vs. Temperature for open frame version at $V_{IN} = 48Vdc$ ($T_J \leq 120^\circ C$).

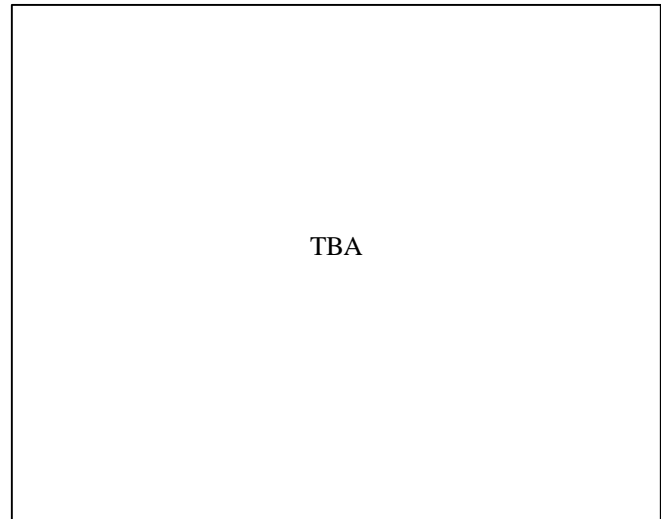


Figure 27. Output Current vs. Temperature for baseplate version at $V_{IN} = 48Vdc$ ($T_J \leq 120^\circ C$).

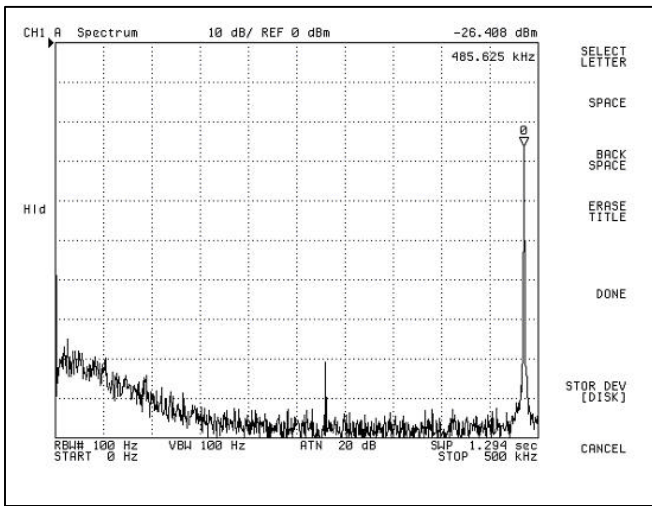


Figure 28. Typical output frequency spectrum (0 – 500kHz) at $V_{IN} = 48Vdc$, $I_O = 50\%$ Load, $C_{OUT} = 0$.

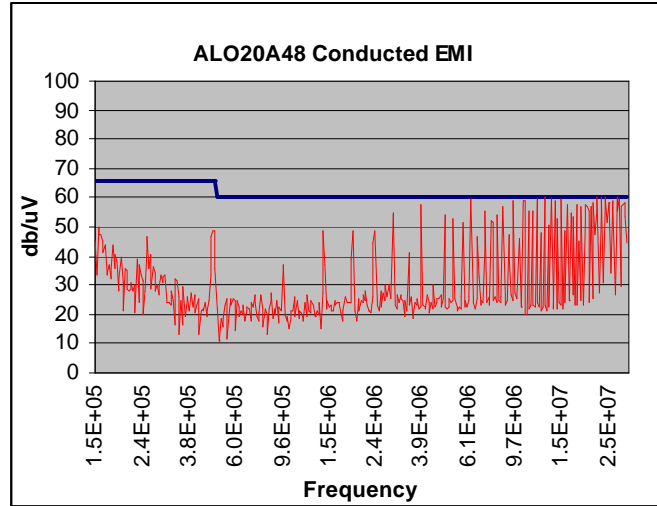


Figure 29. 5V Open frame Conducted EMI per Filter defined in Fig 28. $V_{IN} = 48Vdc$, $I_O = 50\%$ Resistive Load, $T_A = 25^\circ C$.

Input Filter for FCC Class B Conducted Noise

A reference design for an input filter that can provide FCC Class B conducted noise levels is shown below (See Figure 89). Two common mode connected inductors are used in the circuit along with balanced bypass capacitors to shunt common mode currents into the ground plane. Shunting noise current back to the converter reduces the amount of energy reaching the input LISN for measurement.

The application circuit shown has an earth ground (frame ground) connected to the converter output (-) terminal. Such a configuration is common practice to accommodate safety agency requirements. Grounding an output terminal results in much higher conducted emissions as measured at the input LISN because a hard path for common mode current back to the LISN is created by the frame ground. “Floating” loads generally result in much lower measured emissions. The electrical equivalent of a floating load, for EMI measurement purposes, can be created by grounding the converter output (load) through a suitably sized inductor(s) while maintaining the necessary safety bonding.

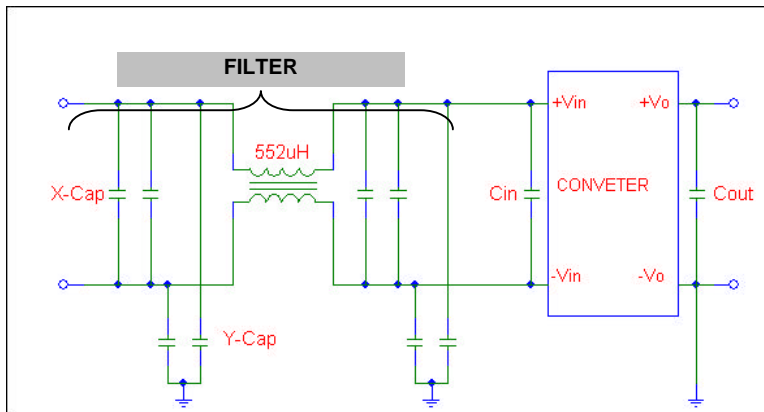


Figure 89: Class B Filter Circuit

PARTS LIST

| CKT CODE | DESCRIPTION |
|----------|---|
| Inductor | CTX01-15091 Cooper Electronic Technologies |
| X-Cap | 0.47 μ F X 4pcs |
| Y-Cap | 22 nF X 4 pcs |



Technical Reference Notes

AEO40x48 / ALO40x48 Series

(Single Output 8th Brick)



Mechanical Specifications

| Parameter | Device | Symbol | Min | Typ | Max | Unit |
|-----------------------|--------|------------------|-----|--------------|-----------------|-----------|
| Dimension | All | L | - | 2.30 [58.42] | - | in [mm] |
| | | W | - | 1.48 [37.59] | - | in [mm] |
| | AEO | H | - | - | 0.40 [10.1] | in [mm] |
| | ALO | H | - | - | 0.32 [8.2] | in [mm] |
| Weight | AEO | | - | 34.02 [1.2] | - | g [oz] |
| | ALO | | - | 22.68 [0.8] | - | g [oz] |
| PIN ASSIGNMENT | | | | | | |
| | 1 | +V _{IN} | | 5 | -SENSE | |
| | 2 | ENABLE | | 6 | TRIM | |
| | 3 | -V _{IN} | | 7 | +SENSE | |
| | 4 | -V _O | | 8 | +V _O | |

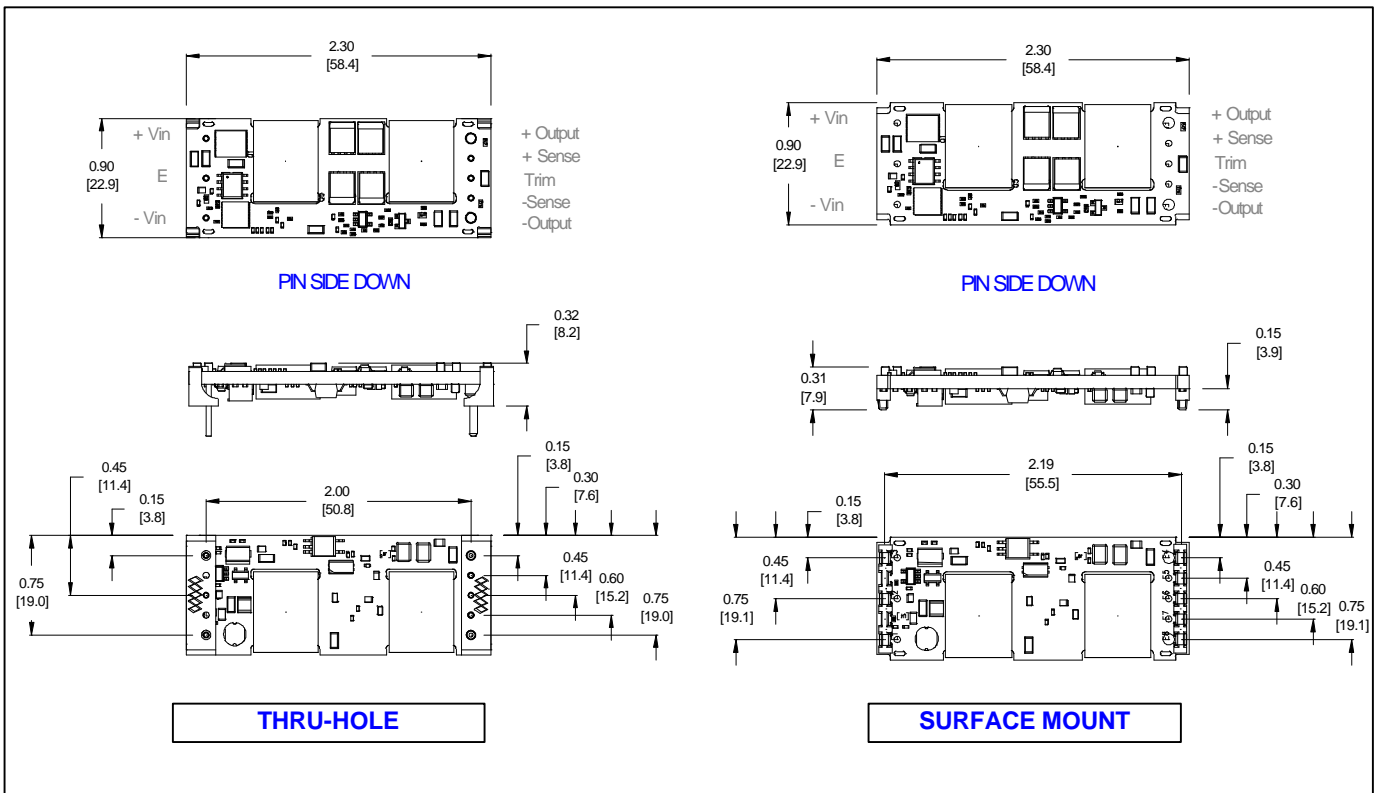


Figure 90A. ALO (Openframe) Mechanical outline.

Mechanical Specifications

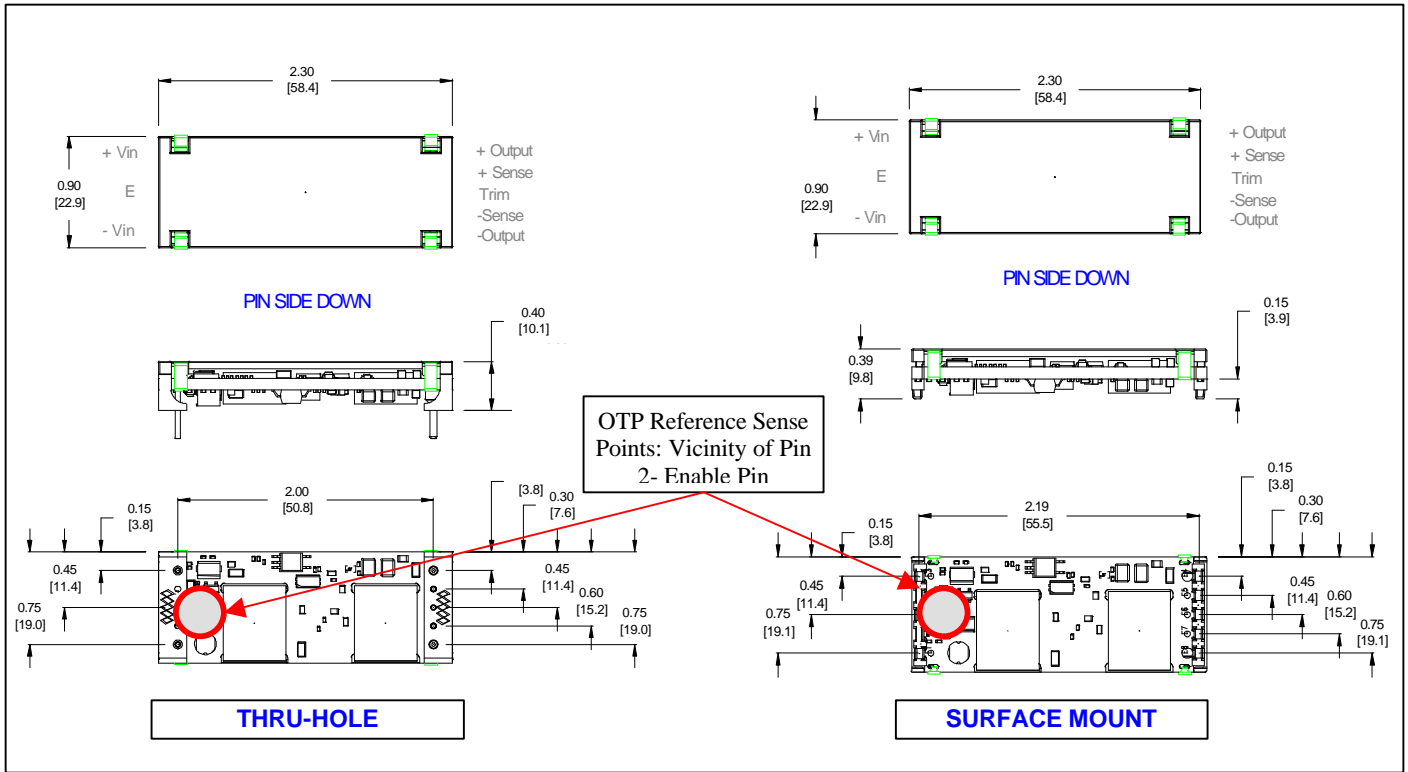


Figure 90B. AEO (Baseplate) Mechanical Outline.

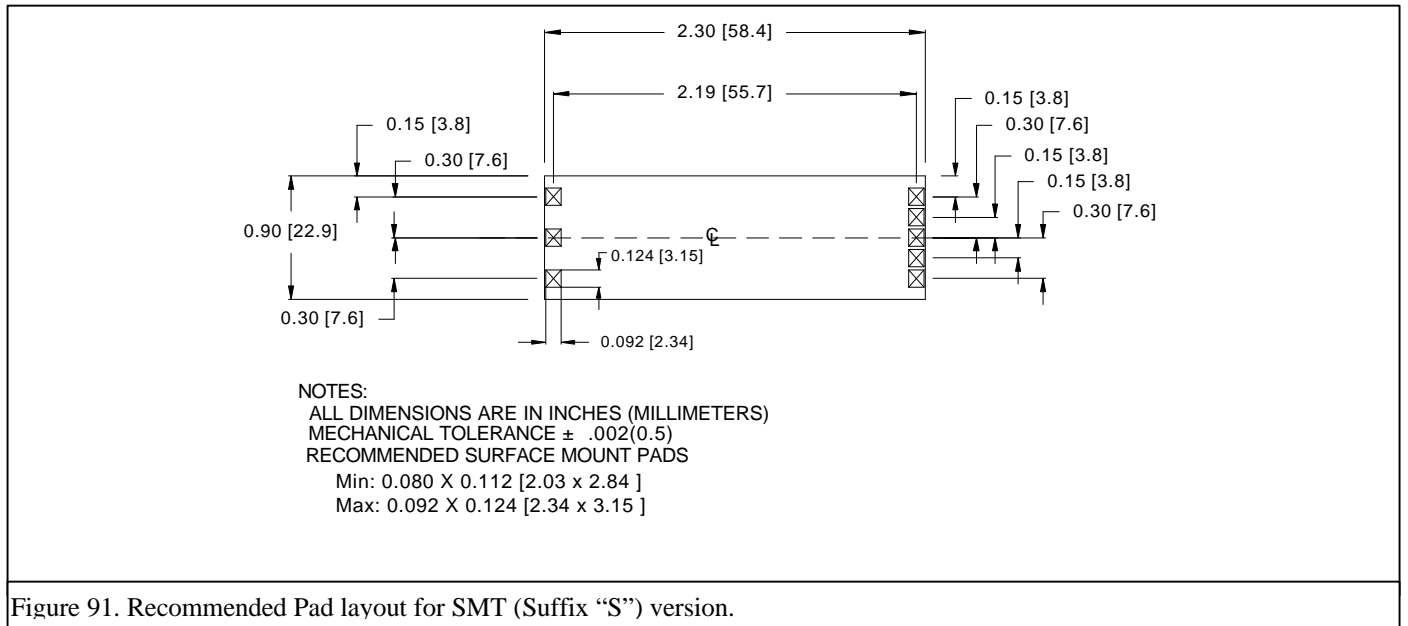


Figure 91. Recommended Pad layout for SMT (Suffix "S") version.



Technical Reference Notes

AEO40x48 / ALO40x48 Series

(Single Output 8th Brick)



SOLDERING CONSIDERATIONS

The AEO (baseplate) series converters are compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20-30 sec at 110°C and wave soldered at 260°C for less than 10 sec.

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.

For SMT terminated modules, refer to Figure 92 for the recommended reflow profile.

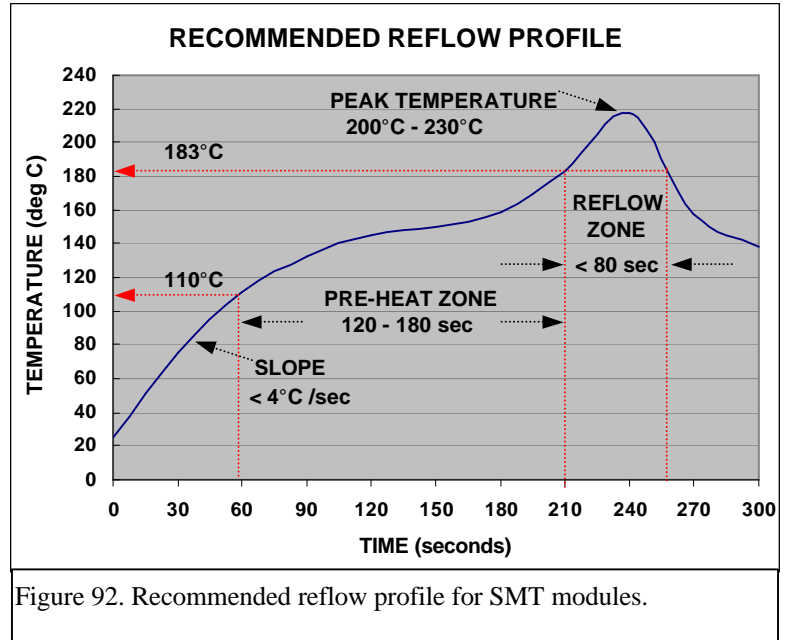


TABLE 2: PART NUMBERING SCHEME

| A | CONSTRUCTION | O | O/P CURRENT | O/P VOLTAGE | Vin | Enable | - | TH PIN LENGTH | TERMINATION |
|---|---------------------------------|---|--|---|-----------|----------------------------------|----------|-------------------------------------|---|
| | W | | xx | y | 48 | N | - | 6 | S |
| | L = Open frame E = Baseplate | | 10 = 10A 20 = 20A 30 = 30A 35 = 35A 40 = 40A 40 = 40A 40 = 40A | B = 12V A = 5.0V F = 3.3V G = 2.5V Y = 1.8V M = 1.5V K = 1.2V | | N = Negative Blank = Positive | | 6 = 3.7mm blank = 5mm default | S = SMT Termination (option exists for 30A and below) Blank = (TH) thru-hole |

Note: 1) For Through Hole termination:

- Std pin length is 5mm nominal (min: 0.189 [4.8]; max: 0.205 [5.2] / in [mm])
- "-6" option is 3.7mm nominal (min: 0.137 [3.5]; max: 0.152 [3.9] / in [mm])
- Pins 4&8 diameter: $\varnothing = 0.062$ [1.57], others: $\varnothing = 0.04$ [1.0] (6X)

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