AVO75 Series

30-75 Watts

Eighth-brick Converter

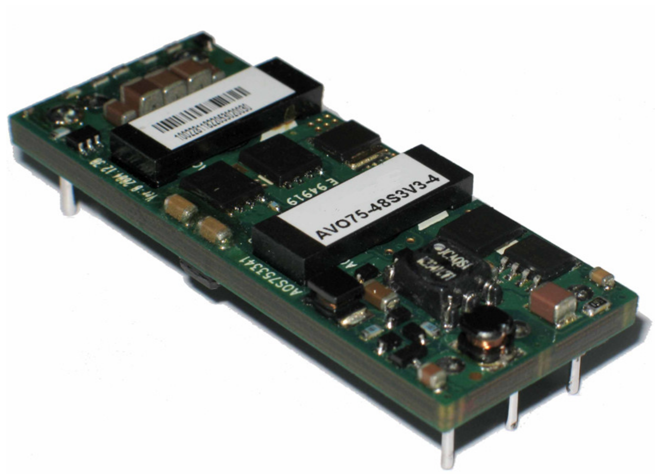
Total Power: 30-75Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Single

Special Features

- Delivering up to 25A output
- Ultra-high efficiency 92% typ. at full load
- 2:1 Wide input range: 36V ~ 75V
- Improved thermal performance
- Basic isolation
- High power density
- Low output noise
- RoHS 6 compliant
- Remote control function (negative logic)
- Remote sense
- CNT function
- Trim function: 80% ~ 110%
- Input under voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection
- Industry standard eighth-brick pin-out outline

Safety

UL 60950-1
UL1950
EN60950-1
IEC 60950-1/VDE 0805
CAN/CSA-22.2 No. 60950-1-03



Product Descriptions

The AVO75 series is a single output DC/DC converter with standard eighth-brick form factor and pin configuration. It delivers up to 25A output current. Ultra-high 92% efficiency and excellent thermal performance makes it an ideal choice for use in small space, high current and low voltage applications and can operate over an ambient temperature range of -40 ^{O}C ~ +85 ^{O}C.

Applications

Telecom/ Datacom

ARTESYN™
EMBEDDED TECHNOLOGIES

Model Numbers

Standard	Output Voltage	Output current	Efficiency (Typ.)	Structure
AVO75-48S1V2	1.2Vdc	25A	87%	Open-frame
AVO75-48S1V5	1.5Vdc	25A	88%	Open-frame
AVO75-48S1V8	1.8Vdc	25A	89%	Open-frame
AVO75-48S2V5	2.5Vdc	25A	90%	Open-frame
AVO75-48S3V3	3.3Vdc	20A	91%	Open-frame
AVO75-48S05	5.0Vdc	15A	92%	Open-frame
AVO75-48S12	12.0Vdc	6.3A	91%	Open-frame

Ordering information

AVO75	-	48	S	1V5	P	-	6
①		②	③	④	⑤		⑥

①	Model series	AVO: high efficiency eighth brick series name
②	Input voltage	48: 36V ~ 75V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	1V2-1.2V, 1V5-1.5V, 1V8-1.8V, 2V5-2.5V, 3V3-3.3V, 05-5V, 12-12V
⑤	CNT logic	Default: negative logic; P: positive logic
⑥	Pin length	4: 4.8mm, 6: 3.8mm

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the “Absolute Maximum Ratings” may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply’s reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage Operating -Continuous Non-operating -100mS	 All All	$V_{IN,DC}$	 - -	 - -	 75 100	 Vdc Vdc
Maximum Output Power	AVO75-48S1V2 AVO75-48S1V5 AVO75-48S1V8 AVO75-482V5 AVO75-48S3V3 AVO75-48S05 AVO75-48S12	$P_{O,max}$	- - - - - - -	- - - - - - -	30 37.5 45 62.5 66 75 75	W
Isolation Voltage[1] Input to outputs	 All		 -	 -	 2000	 Vdc
Isolation capacitance	All		-	1000	-	PF
Isolation resistance	All		10	-	-	MΩ
Ambient Operating Temperature	All	T_A	-40	-	+85	^{O}C
Operating Board Temperature	All	Tc	-	-	+100	^{O}C
Storage Temperature	All	T_{STG}	-55	-	+125	^{O}C
Humidity Operating	 All		 -	 -	 85	 %

Note 1 - 1mA for 60s, slew rate of 2000V/10s

Input Specifications

Table 2. Input Specifications:

Parameter		Conditions[1]	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC		All	$V_{IN,DC}$	36	48	75	Vdc
Turn-on Voltage Threshold	AVO75-48S12	$I_O = I_{O,max}$	$V_{IN,ON}$	34.8	37	38	Vdc
	Other models			31	34	36	
Turn-off Voltage Threshold	AVO75-48S12	$I_O = I_{O,max}$	$V_{IN,OFF}$	33.8	35.5	37	Vdc
	Other models			30	33	35	
Maximum Input Current ($I_O = I_{O,max}$)		$V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	-	2.5	A
Recommended Input Fuse[2]		Fast blow external fuse recommended		-	-	5	A
Input Reflected Ripple Current		5Hz to 20MHz, 12µH source impedance, TA = 25 ^{O}C		-	-	20	mA
Supply Voltage Rejection			-	50	60	-	dB
Operating Efficiency	AVO75-48S1V2	T_A=25 ^{O}C, $I_O = I_{O,max}$	η	-	88	-	%
	AVO75-48S1V5			-	87	-	%
	AVO75-48S1V8			-	89	-	%
	AVO75-48S2V5			-	90.5	-	%
	AVO75-48S3V3			-	91	-	%
	AVO75-48S05			-	92	-	%
	AVO75-48S12			-	91	-	%
	AVO75-48S1V2	T_A=25 ^{O}C, I_O = 50% $I_{O,max}$		-	87	-	%
	AVO75-48S1V5			-	88	-	%
	AVO75-48S1V8			-	88.5	-	%
	AVO75-48S2V5			-	89.5	-	%
	AVO75-48S3V3			-	91	-	%
	AVO75-48S05			-	91	-	%
	AVO75-48S12			-	90	-	%

Note 1 - Ta = 25 ^{O}C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.
Note 2 - This power module is not internally fused. An input line fuse must always be used. To meet international safety requirements, a 250 Volt rated fuse should be used. If one of the input lines is connected to chassis ground, then the fuse must be placed in the other input line. Standard safety agency regulations require input fusing. Recommended fuse ratings is 5A for the AVO75 Series.

Output Specifications

Table 3. Output Specifications:

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
Set Voltage	AVO75-48S1V2	$V_{IN,DC,min}$ to $V_{IN,DC,max}$ $I_O=I_{O,max}$	V_O	1.18	1.2	1.22	Vdc
	AVO75-48S1V5			1.48	1.5	1.52	
	AVO75-48S1V8			1.77	1.8	1.83	
	AVO75-48S2V5			2.46	2.5	2.54	
	AVO75-48S3V3			3.25	3.3	3.35	
	AVO75-48S05			4.95	5	5.05	
	AVO75-48S12			11.85	12	12.15	
Output Voltage Trim Range	AVO75-48S1V2		V_O	0.96	-	1.32	V
	AVO75-48S1V5			1.20	-	1.65	
	AVO75-48S1V8			1.44	-	1.98	
	AVO75-48S2V5			2.00	-	2.75	
	AVO75-48S3V3			2.64	-	3.63	
	AVO75-48S05			4.00	-	5.50	
	AVO75-48S12			9.60	-	13.20	
Output Voltage Line Regulation	AVO75-48S1V2	$V_{IN,DC,min}$ to $V_{IN,DC,max}$		-	1	-	mV
	AVO75-48S1V5			-	1	-	
	AVO75-48S1V8			-	1	-	
	AVO75-48S2V5			-	1	-	
	AVO75-48S3V3			-	1	-	
	AVO75-48S05			-	4	-	
	AVO75-48S12			-	9	-	
Output Voltage Load Regulation	AVO75-48S1V2	$I_{o,min}$ to $I_{o,max}$		-	1	-	mV
	AVO75-48S1V5			-	1	-	
	AVO75-48S1V8			-	1	-	
	AVO75-48S2V5			-	1	-	
	AVO75-48S3V3			-	1	-	
	AVO75-48S05			-	5	-	
	AVO75-48S12			-	5	-	
Output Voltage Temperature Regulation		Tc=-40 ^{O}C to +100 ^{O}C	$\%V_O$	-	-	0.02	%Vo/^{O}C
Output Ripple, pk-pk	AVO75-48S1V2	Measure with a 1uF ceramic capacitor in parallel with a 470uF aluminum capacitor, 5 to 20MHz bandwidth	V_O	-	50	-	mV_{PK-PK}
	AVO75-48S1V5			-	55	-	
	AVO75-48S1V8			-	45	-	
	AVO75-48S2V5			-	50	-	
	AVO75-48S3V3			-	50	-	
	AVO75-48S05			-	55	-	
	AVO75-48S12			-	55	-	
Output Current	AVO75-48S1V2	-	I_O	0	-	25	A
	AVO75-48S1V5			0	-	25	
	AVO75-48S1V8			0	-	25	
	AVO75-48S2V5			0	-	25	
	AVO75-48S3V3			0	-	20	
	AVO75-48S05			0	-	15	
	AVO75-48S12			0	-	6.3	

Note 1 - Ta = 25 ^{O}C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
Output DC current-limit inception[2]	AVO75-48S1V2	-	I_O	28	-	35	A
	AVO75-48S1V5			28	-	35	
	AVO75-48S1V8			28	-	35	
	AVO75-48S2V5			28	-	35	
	AVO75-48S3V3			22	-	28	
	AVO75-48S05			16.5	-	21	
	AVO75-48S12			6.9	-	10	
V_O Load Capacitance[3]	AVO75-48S1V2	-	C_O	220	470	10,000	uF
	AVO75-48S1V5			220	470	10,000	
	AVO75-48S1V8			220	470	10,000	
	AVO75-48S2V5			220	470	10,000	
	AVO75-48S3V3			220	470	10,000	
	AVO75-48S05			220	470	5000	
	AVO75-48S12			220	470	1000	
V_O Dynamic Response Peak Deviation	AVO75-48S1V2	50%~75%~50% 25% load change slew rate = 0.1A/us	$\pm V_O$	-	60	-	mV
	AVO75-48S1V5			-	50	-	
	AVO75-48S1V8			-	50	-	
	AVO75-48S2V5			-	60	-	
	AVO75-48S3V3			-	85	-	
	AVO75-48S05			-	110	-	
	AVO75-48S12			-	150	-	
V_O Dynamic Response Settling Time	AVO75-48S1V2	50%~75%~50% 25% load change slew rate = 0.1A/us	T_s	-	300	-	uSec
	AVO75-48S1V5			-	115	-	
	AVO75-48S1V8			-	125	-	
	AVO75-48S2V5			-	70	-	
	AVO75-48S3V3			-	70	-	
	AVO75-48S05			-	120	-	
	AVO75-48S12			-	120	-	
V_O Dynamic Response Peak Deviation	AVO75-48S1V2	50%~75%~50% 25% load change slew rate = 1A/us	$\pm V_O$	-	130	-	mV
	AVO75-48S1V5			-	130	-	
	AVO75-48S1V8			-	120	-	
	AVO75-48S2V5			-	170	-	
	AVO75-48S3V3			-	130	-	
	AVO75-48S05			-	130	-	
	AVO75-48S12			-	120	-	
V_O Dynamic Response Settling Time	AVO75-48S1V2	50%~75%~50% 25% load change slew rate = 1A/us	T_s	-	300	-	uSec
	AVO75-48S1V5			-	100	-	
	AVO75-48S1V8			-	115	-	
	AVO75-48S2V5			-	150	-	
	AVO75-48S3V3			-	80	-	
	AVO75-48S05			-	130	-	
	AVO75-48S12			-	320	-	

Note 2 - Hiccup: auto-restart when over-current condition is removed.

Note 3 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
Turn-on transient	Turn-on delay	$I_O = I_{max}$	$T_{turn-on}$	-	-	20	mS
	Output voltage overshoot	$I_O = 0$	$\%V_O$	-	0	-	%
Switching frequency		All	f_{SW}	-	310	-	KHz
Enable pin voltage	Logic low	All		-0.7	-	1.2	V
	Logic high	All		3.5	-	12	V
Enable pin current (leakage current,@10V)	Logic low	All		-	-	1.0	mA
	Logic high	All		-	-	-	uA
Output over-voltage protection[4]	AVO75-48S1V2 AVO75-48S1V5 AVO75-48S1V8 AVO75-48S2V5 AVO75-48S3V3 AVO75-48S05 AVO75-48S12	-	$\%V_O$	117 120 122 120 118 120 120	- - - - - - -	167 167 167 152 151 150 150	%
Output over-temperature protection[5]		All	T	110	120	135	^{O}C
Output voltage remote sense range		All	%Vo	-	-	10	%
MTBF		Bellcore TR-NWT-000332; full load, 300LFM, 40 ^{O}C T_A		-	2.5	-	10^6 h

Note 4 - Hiccup: auto-restart when over-voltage condition is removed.
Note 5 - Auto recovery.

AVO75-48S1V2 Performance Curves

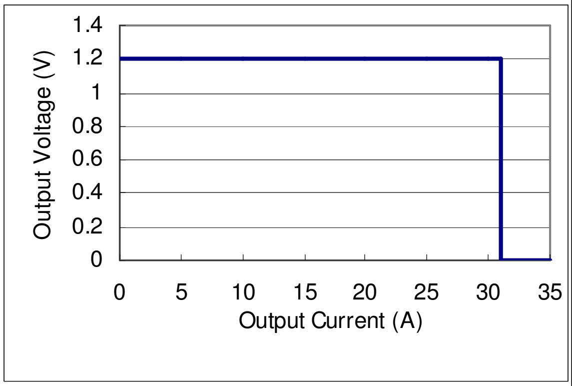


Figure 1: AVO75-48S1V2 Typical over-current

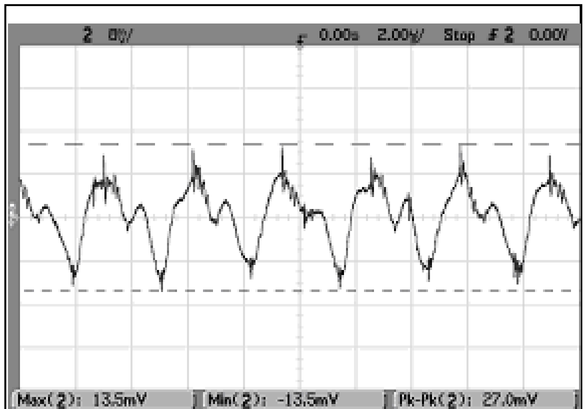


Figure 2: AVO75-48S1V2 Ripple and Noise Measurement

Ch 1: Vo

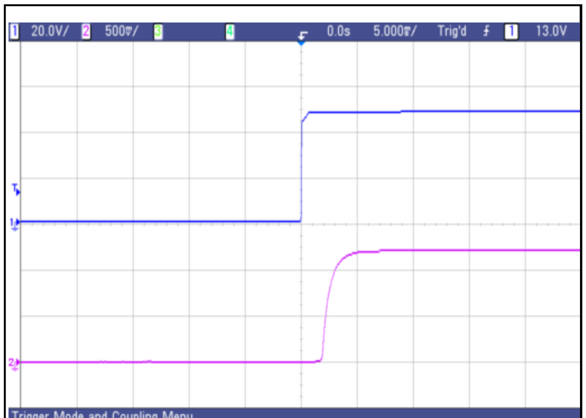


Figure 3: AVO75-48S1V2 typical start-up from power on

Ch 1: Vin   Ch 2: Vo

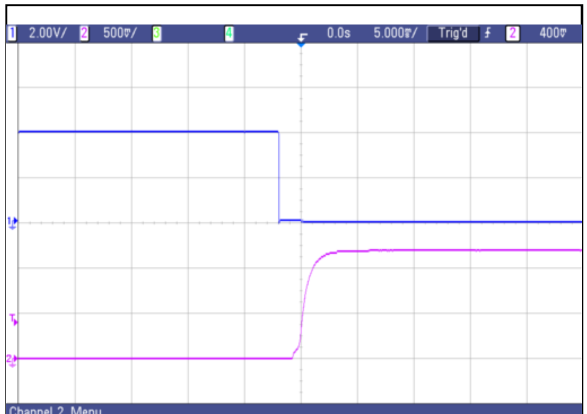


Figure 4: AVO75-48S1V2 typical start-up from CNT on

Ch 1: CNT   Ch 2: Vo

Figure 5: AVO75-48S1V2 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo   Ch 2: Io

Figure 6: AVO75-48S1V2 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo   Ch 2: Io

AVO75-48S1V2 Performance Curves

Figure 7: AVO75-48S1V2 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

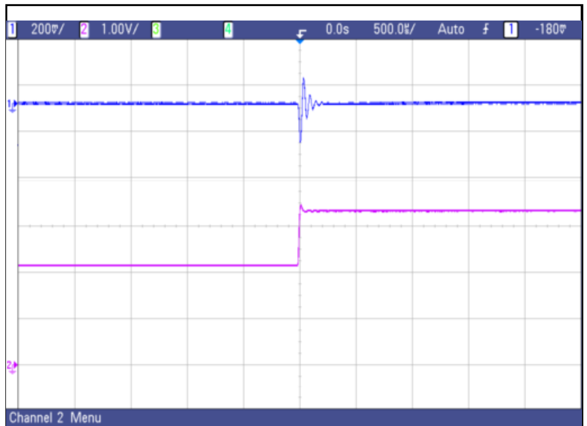


Figure 8: AVO75-48S1V2 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

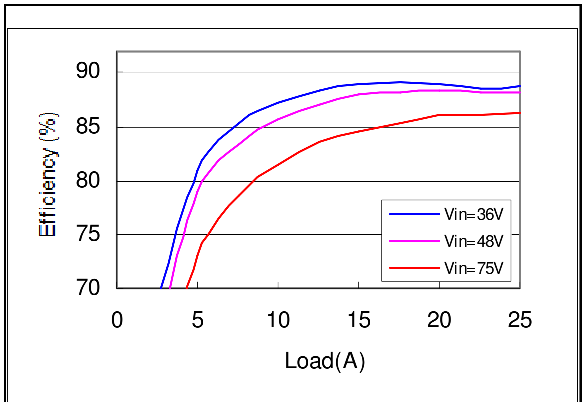


Figure 9: AVO75-48S1V2 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 20A

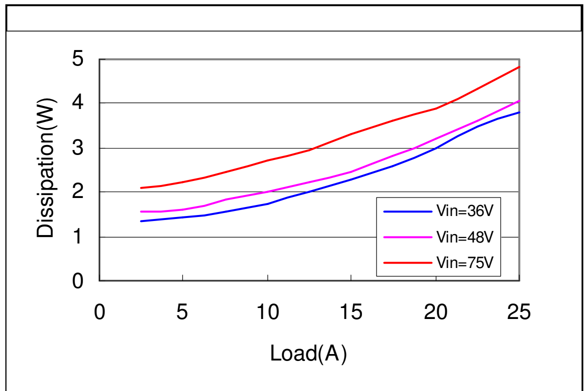


Figure 10: AVO75-48S1V2 Typical power dissipation curve

Loading: Io = 10% increment to 20A

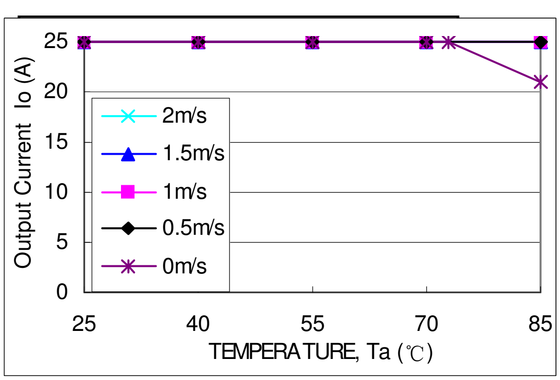


Figure 11 : AVO75-48S1V2 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

AVO75-48S1V5 Performance Curves

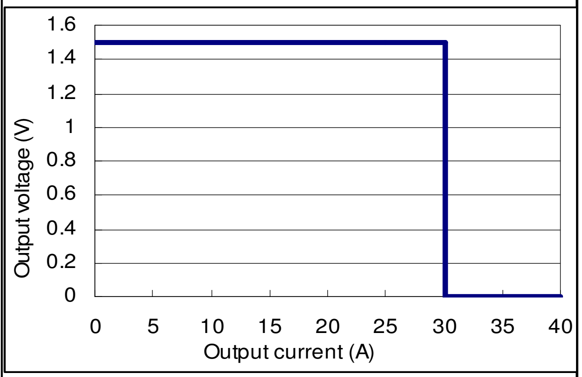


Figure 12: AVO75-48S1V5 Typical over-current

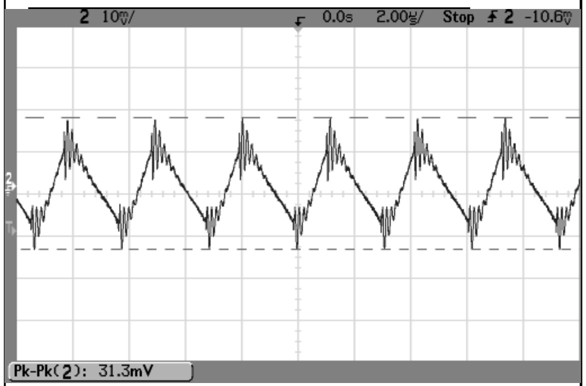


Figure 13: AVO75-48S1V5 Ripple and Noise Measurement

Ch 1: Vo

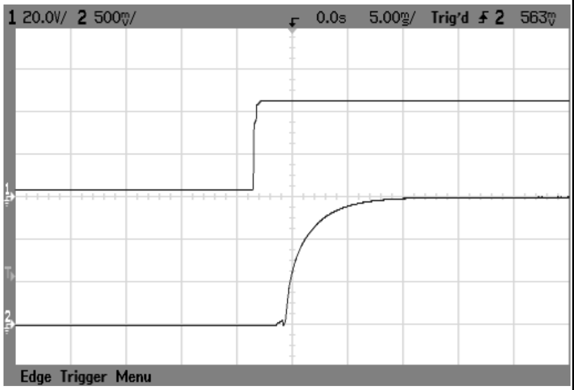


Figure 14: AVO75-48S1V5 typical start-up from power on

Ch 1: Vin Ch 2: Vo

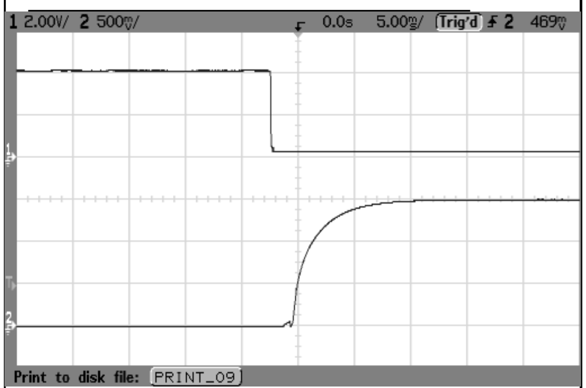


Figure 15: AVO75-48S1V5 typical start-up from CNT on

Ch 1: CNT Ch 2: Vo

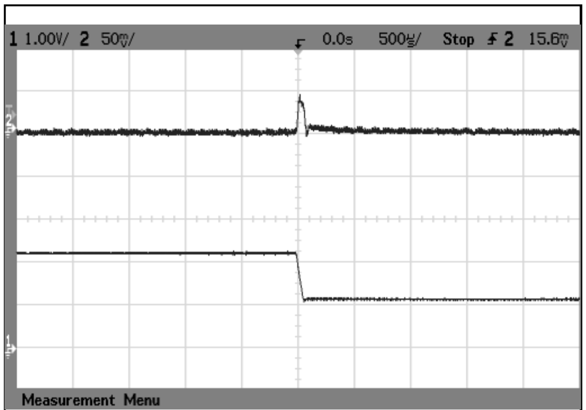


Figure 16: AVO75-48S1V5 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Io Ch 2: Vo

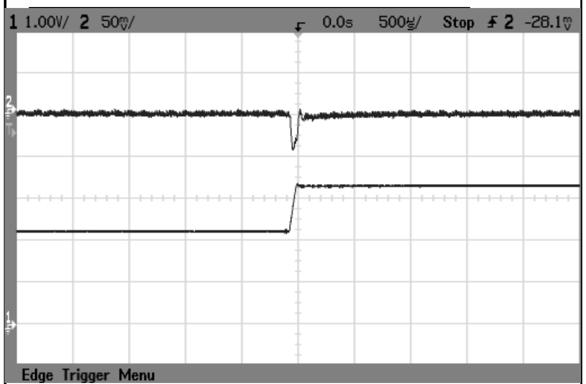


Figure 17: AVO75-48S1V5 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Io Ch 2: Vo

AVO75-48S1V5 Performance Curves

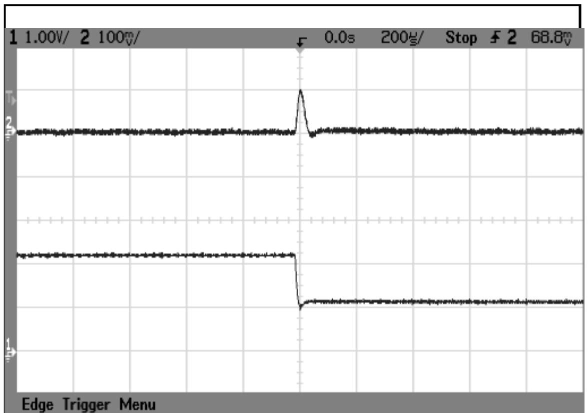


Figure 18: AVO75-48S1V5 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Io Ch 2: Vo

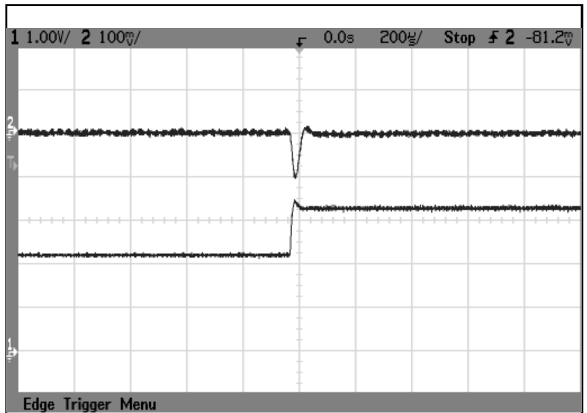


Figure 19: AVO75-48S1V5 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Io Ch 2: Vo

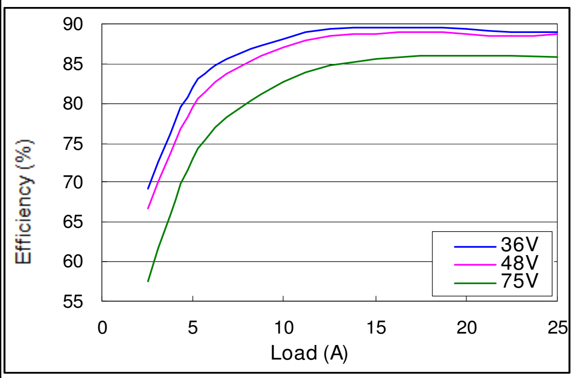


Figure 20: AVO75-48S1V5 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 25A

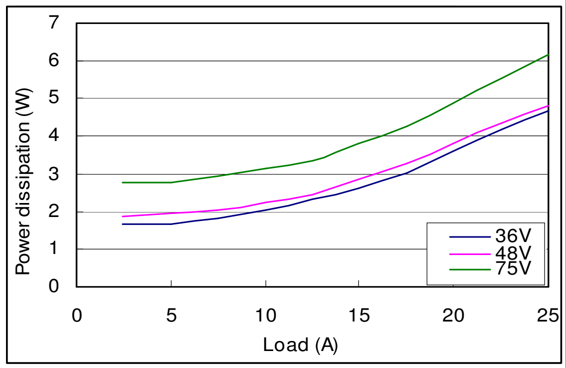


Figure 21: AVO75-48S1V5 Typical power dissipation curve

Loading: Io = 10% increment to 25A

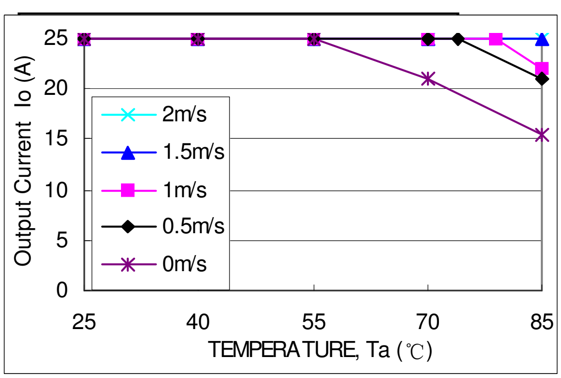


Figure 22: AVO75-48S1V5 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

AVO75-48S1V8 Performance Curves

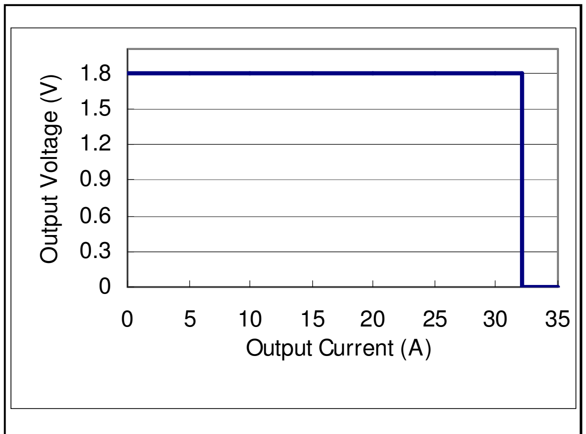


Figure 23: AVO75-48S1V8 Typical over-current

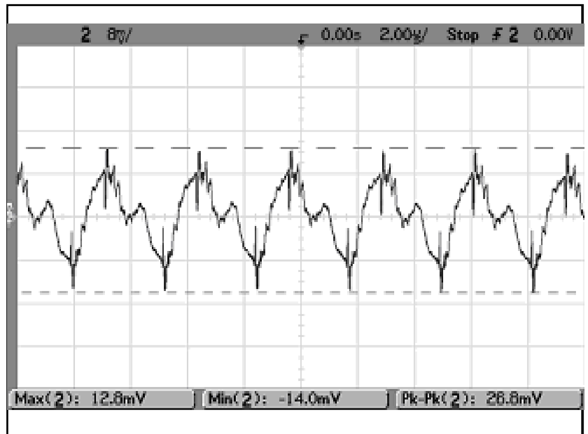


Figure 24: AVO75-48S1V8 Ripple and Noise Measurement

Ch 1: Vo

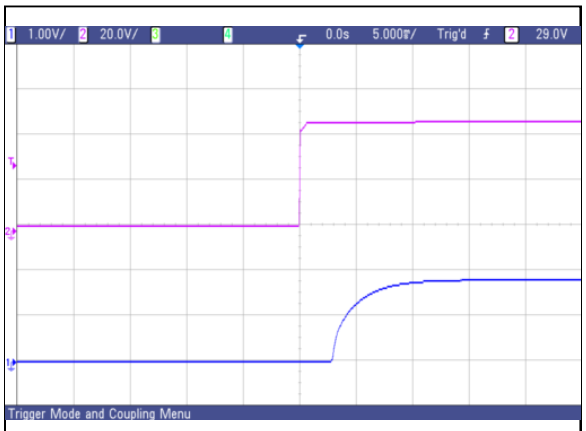


Figure 25: AVO75-48S1V8 typical start-up from power on

Ch 1: Vin Ch 2: Vo

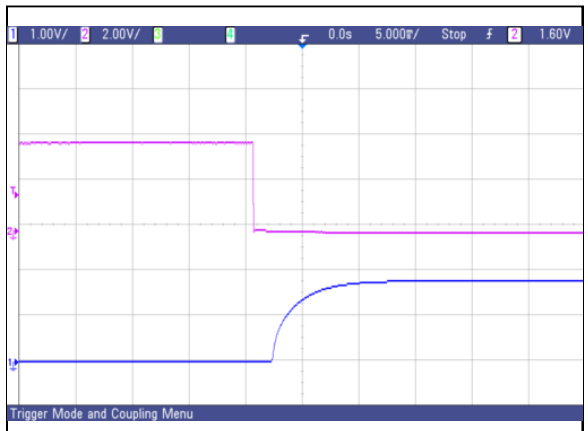


Figure 26: AVO75-48S1V8 typical start-up from CNT on

Ch 1: CNT Ch 2: Vo

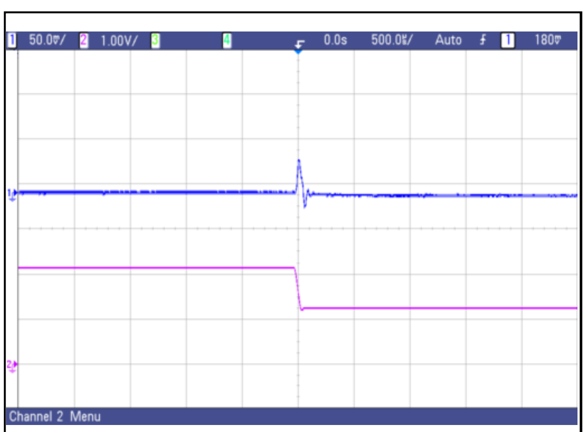


Figure 27: AVO75-48S1V8 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

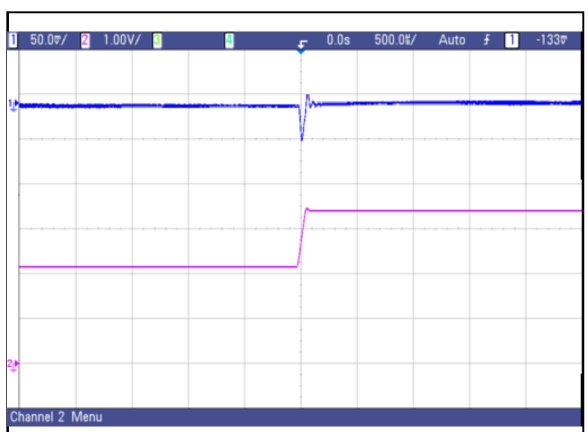


Figure 28: AVO75-48S1V8 Transient Response (500uS/div)
50%~75% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

AVO75-48S1V8 Performance Curves

Figure 29: AVO75-48S1V8 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

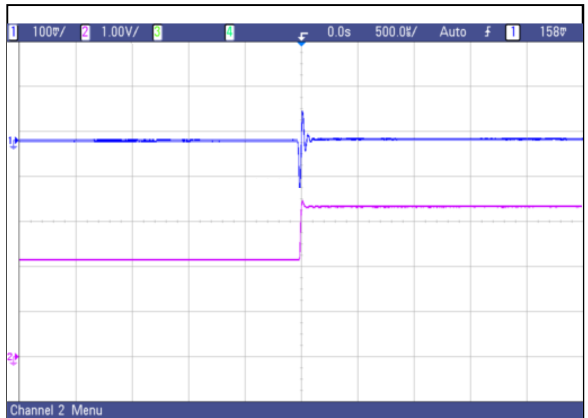


Figure 30: AVO75-48S1V8 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

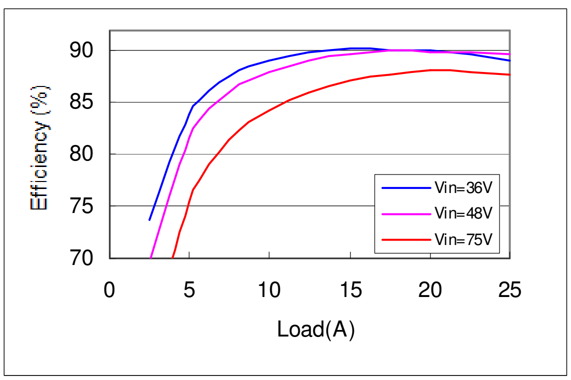


Figure 31: AVO75-48S1V8 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 20A

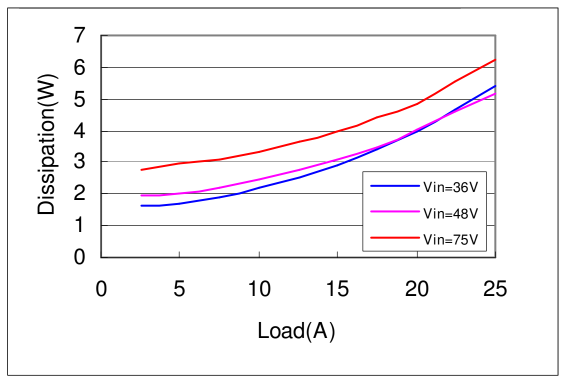


Figure 32: AVO75-48S1V8 Typical power dissipation curve

Loading: Io = 10% increment to 20A

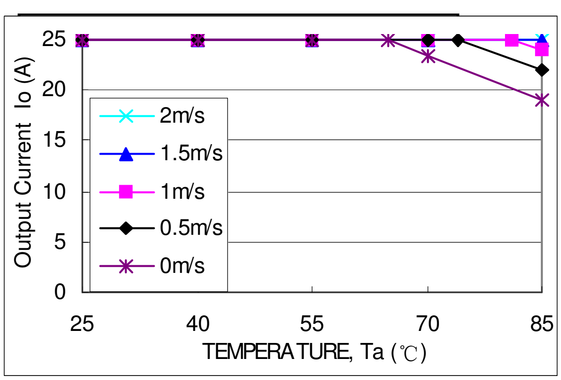


Figure 33: AVO75-48S1V8 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

AVO75-48S2V5 Performance Curves

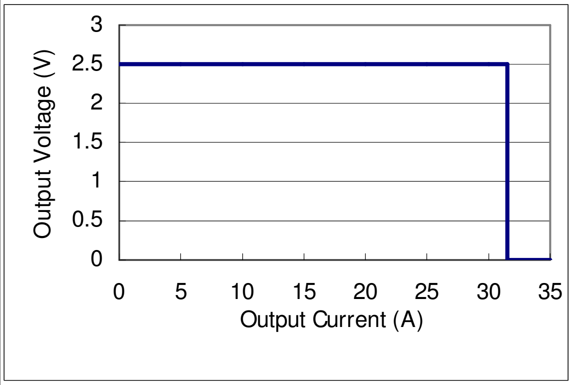


Figure 34: AVO75-48S2V5 Typical over-current

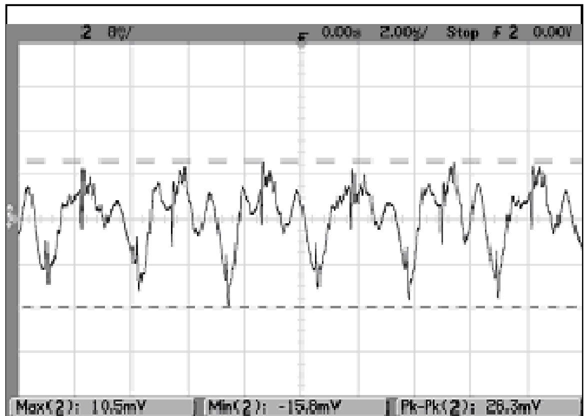


Figure 35: AVO75-48S2V5 Ripple and Noise Measurement

Ch 1: Vo

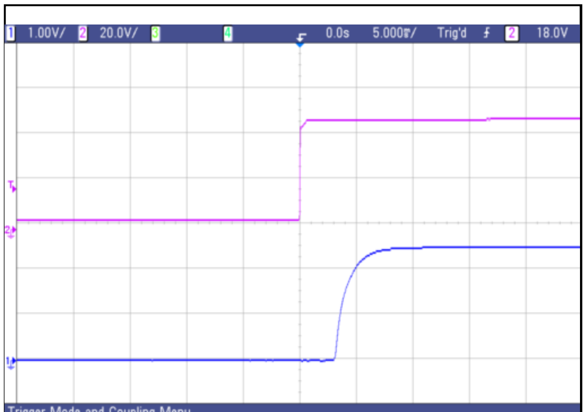


Figure 36: AVO75-48S2V5 typical start-up from power on

Ch 1: Vo Ch 2: Vin

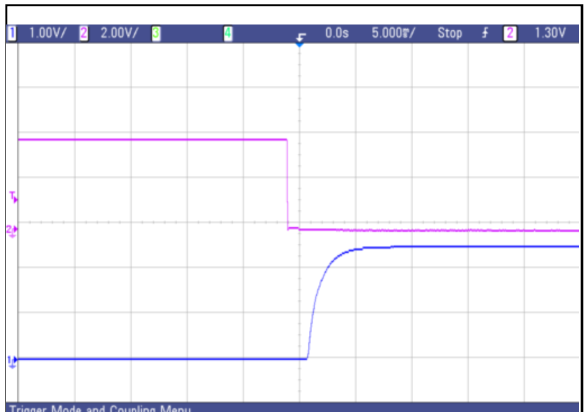


Figure 37: AVO75-48S2V5 typical start-up from CNT on

Ch 1: Vo Ch 2: CNT

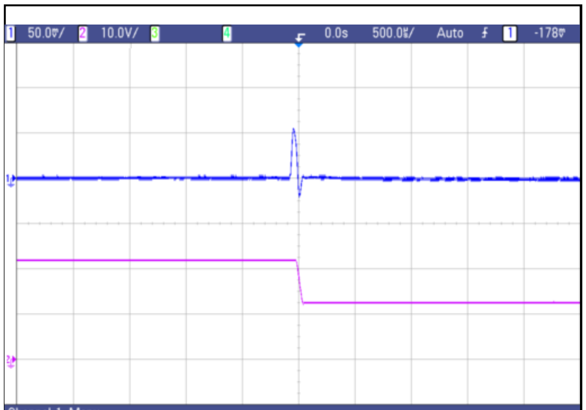


Figure 38: AVO75-48S2V5 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

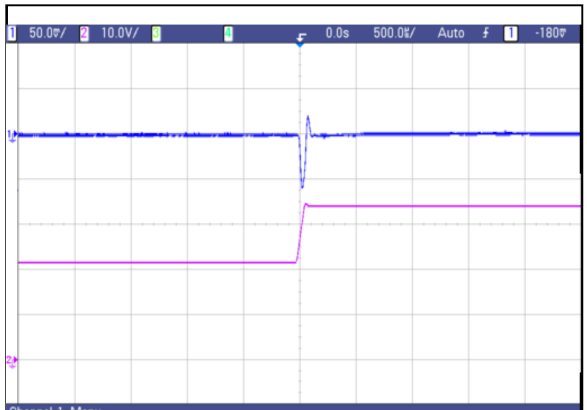


Figure 39: AVO75-48S2V5 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

AVO75-48S2V5 Performance Curves

Figure 40: AVO75-48S2V5 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

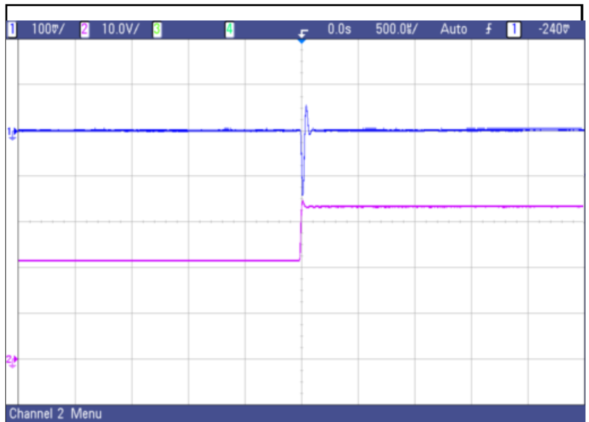


Figure 41: AVO75-48S2V5 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

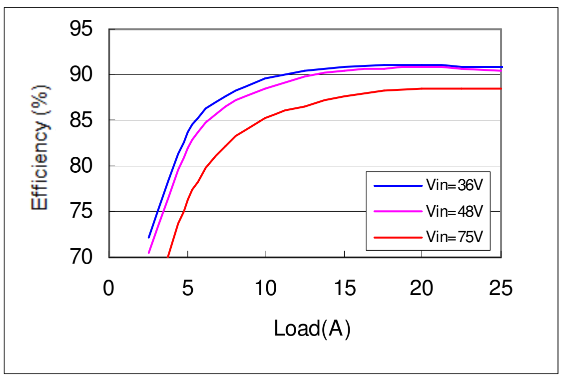


Figure 42: AVO75-48S2V5 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 20A

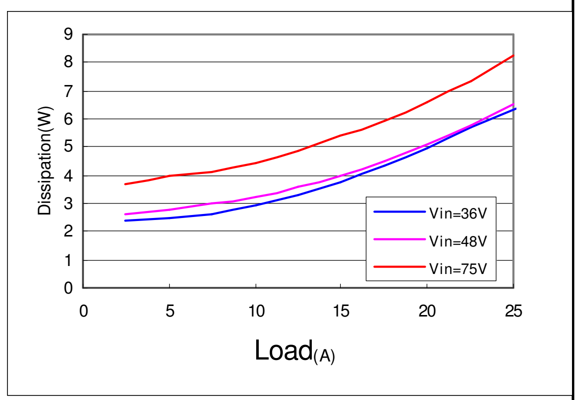


Figure 43: AVO75-48S2V5 Typical power dissipation curve

Loading: Io = 10% increment to 20A

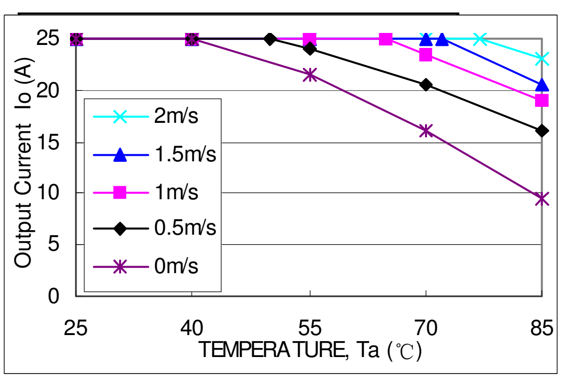


Figure 44: AVO75-48S2V5 output power derating

Airflow direction from –Vin to +Vin; Vin=48V

AVO75-48S3V3 Performance Curves

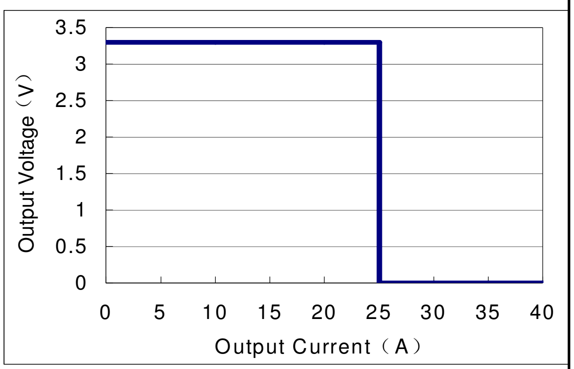


Figure 45: AVO75-48S3V3 Typical over-current

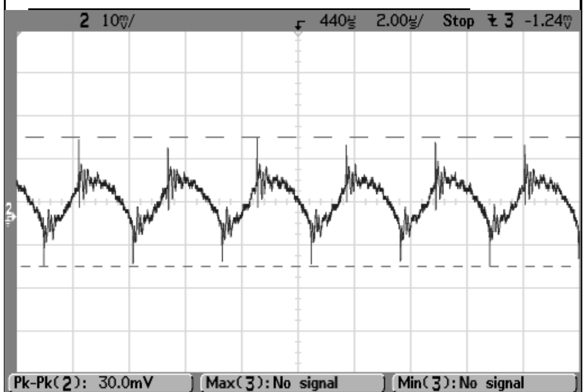


Figure 46: AVO75-48S3V3 Ripple and Noise Measurement

Ch 1: Vo

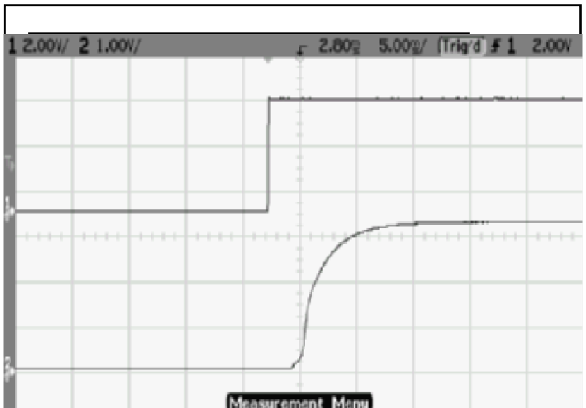


Figure 47: AVO75-48S3V3 typical start-up from power on

Ch 1: Vin Ch 2: Vo

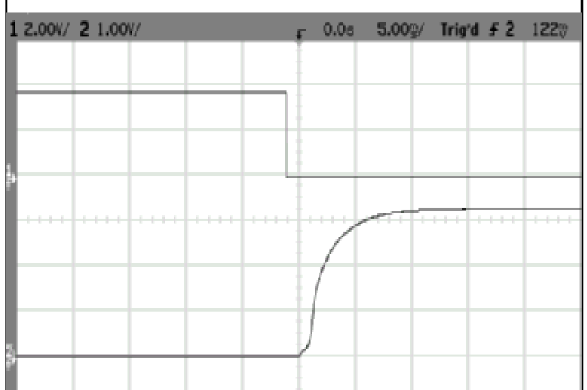


Figure 48: AVO75-48S3V3 typical start-up from CNT on

Ch 1: CNT Ch 2: Vo

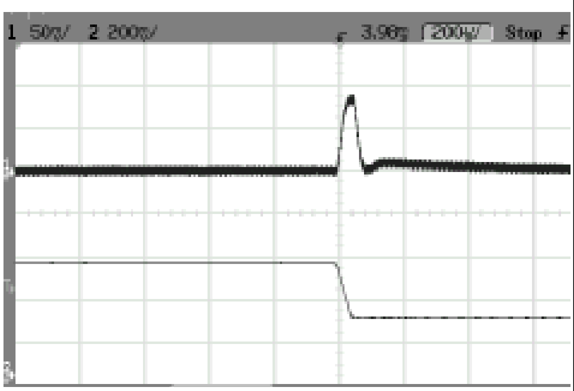


Figure 49: AVO75-48S3V3 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

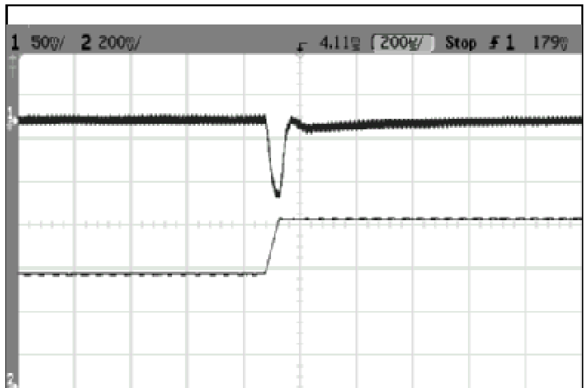


Figure 50: AVO75-48S3V3 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

AVO75-48S3V3 Performance Curves

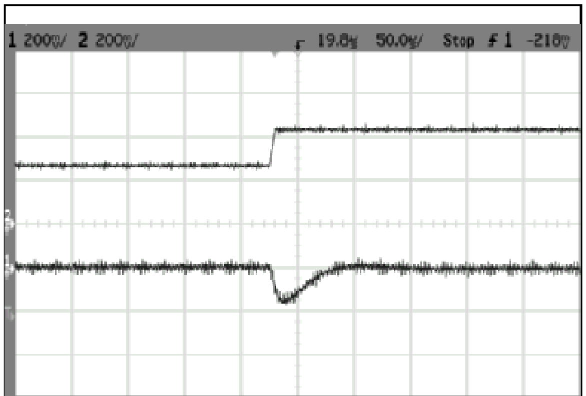


Figure 51: AVO75-48S3V3 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

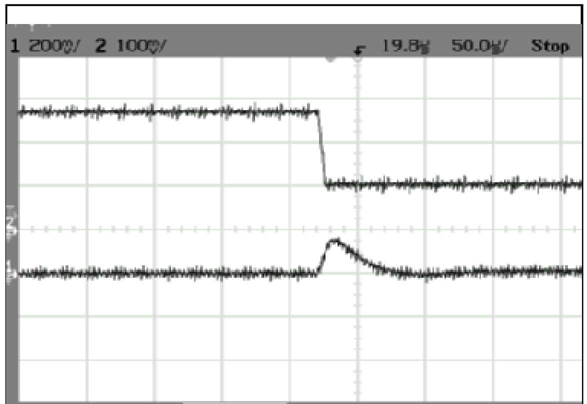


Figure 52: AVO75-48S3V3 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

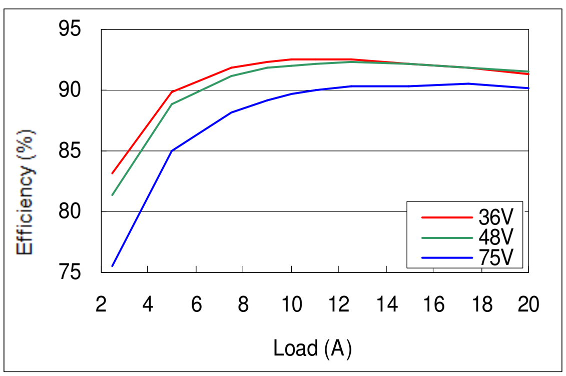


Figure 53: AVO75-48S3V3 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 20A

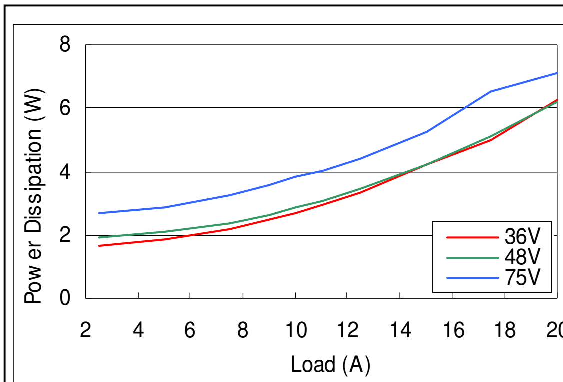


Figure 54: AVO75-48S3V3 Typical power dissipation curve

Loading: Io = 10% increment to 20A

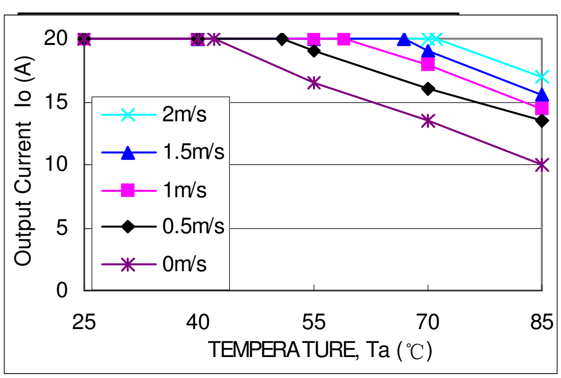


Figure 55: AVO75-48S3V3 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

AVO75-48S05 Performance Curves

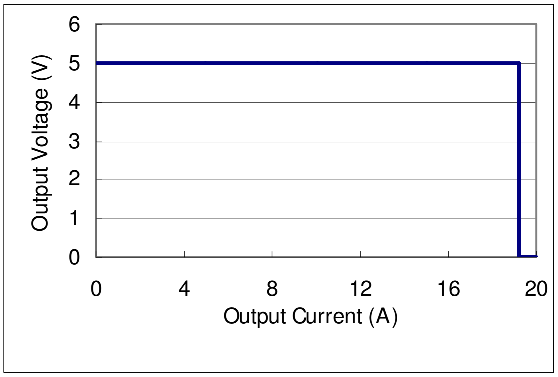


Figure 56: AVO75-48S05 Typical over-current

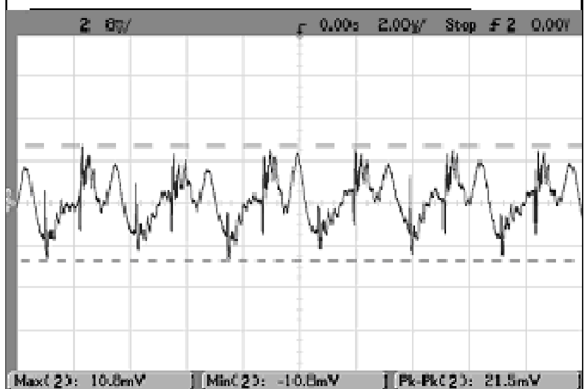


Figure 57: AVO75-48S05 Ripple and Noise Measurement

Ch 1: Vo

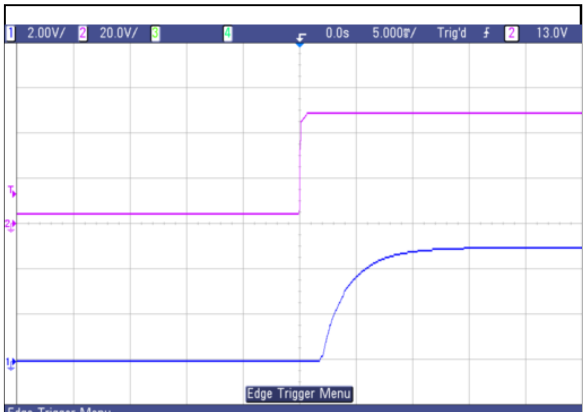


Figure 58: AVO75-48S05 typical start-up from power on

Ch 1: Vo Ch 2: Vin

Figure 59: AVO75-48S05 typical start-up from CNT on

Ch 1: Vo Ch 2: CNT

Figure 60: AVO75-48S05 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

Figure 61: AVO75-48S05 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V

Ch 1: Vo Ch 2: Io

AVO75-48S05 Performance Curves

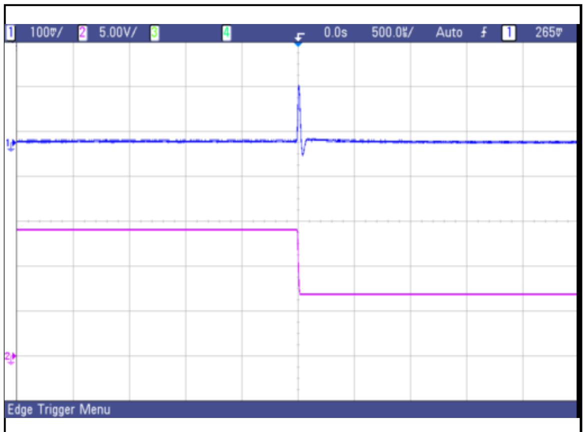


Figure 62: AVO75-48S05 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

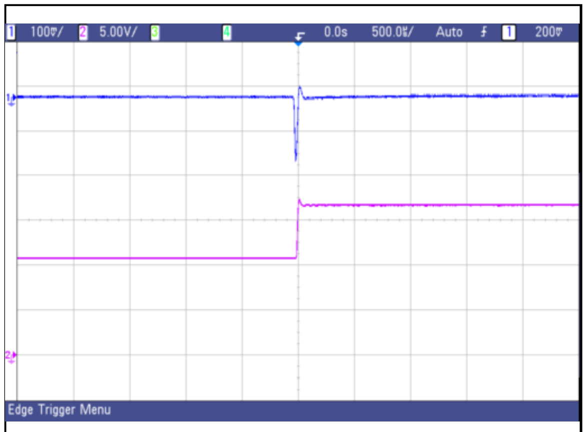


Figure 63: AVO75-48S05 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

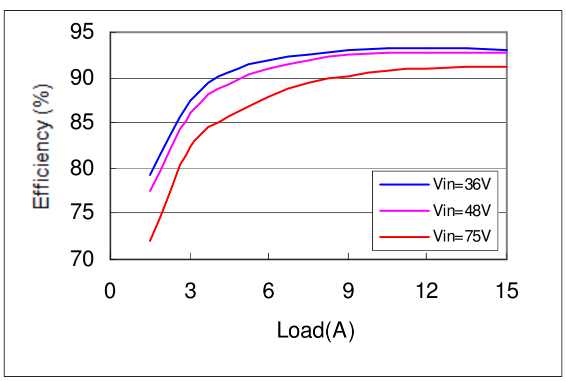


Figure 64: AVO75-48S05 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 10A

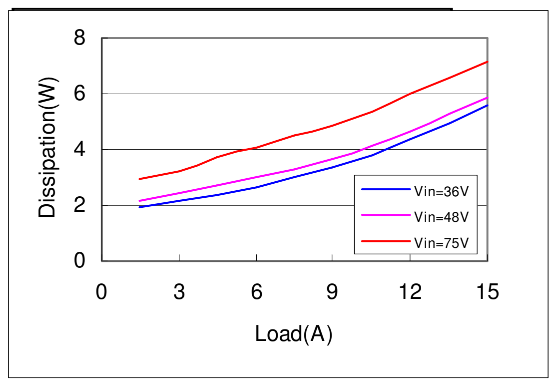


Figure 65: AVO75-48S05 Typical power dissipation curve

Loading: Io = 10% increment to 10A

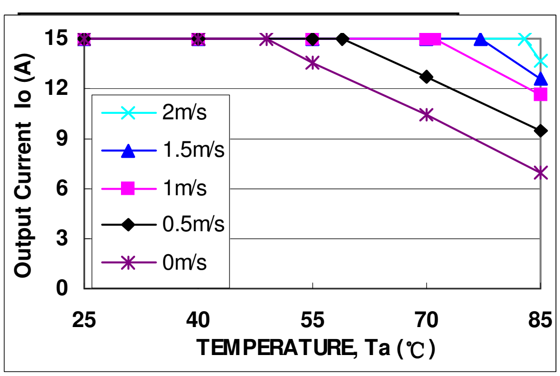


Figure 66: AVO75-48S05 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

AVO75-48S12 Performance Curves

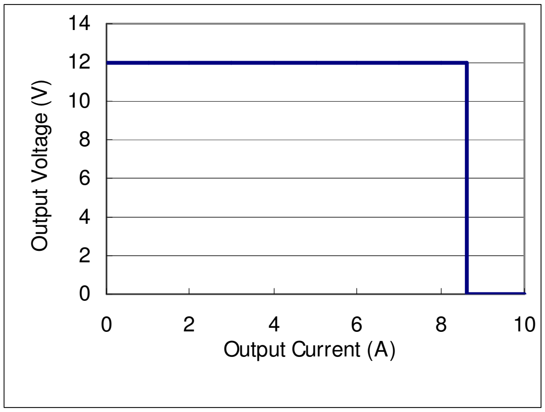


Figure 67: AVO75-48S12 Typical over-current

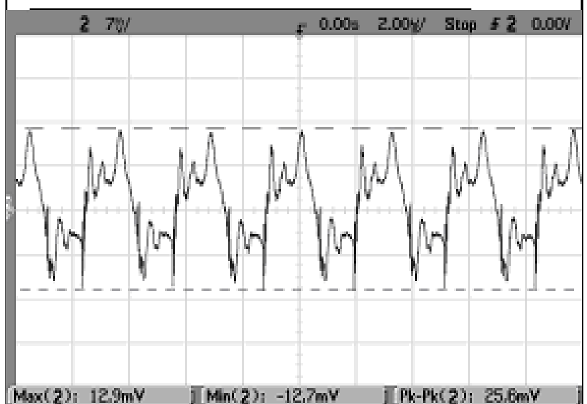


Figure 68: AVO75-48S12 Ripple and Noise Measurement

Ch 1: Vo

Figure 69: AVO75-48S12 typical start-up from power on

Ch 1: Vin Ch 2: Vo

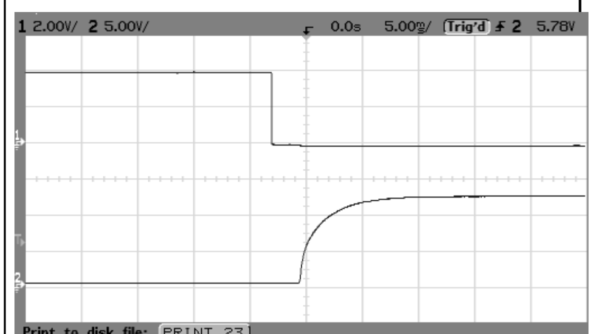


Figure 70: AVO75-48S12 typical start-up from CNT on

Ch 1: CNT Ch 2: Vo

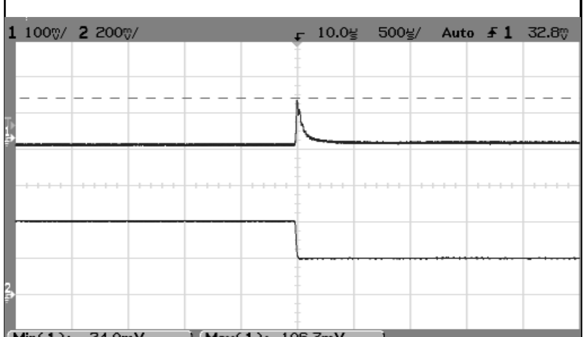


Figure 71: AVO75-48S12 Transient Response
50%~25% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

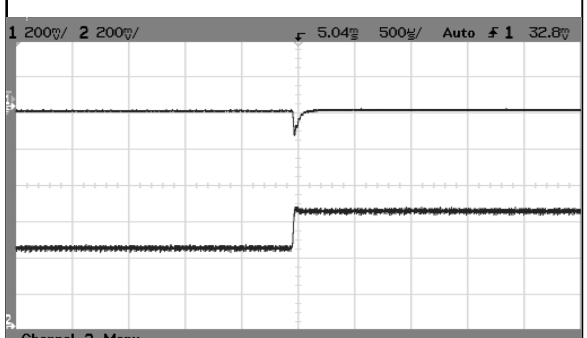


Figure 72: AVO75-48S12 Transient Response
50%~75% load change, 0.1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

AVO75-48S12 Performance Curves

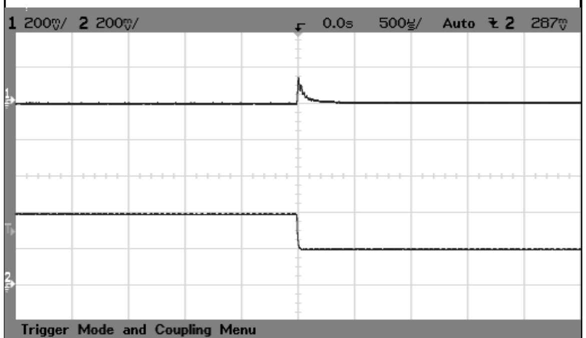


Figure 73: AVO75-48S12 Transient Response
50%~25%load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

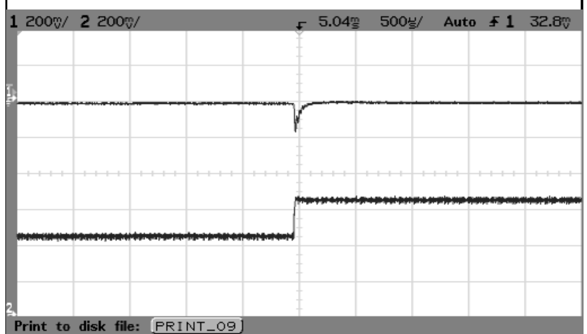


Figure 74: AVO75-48S12 Transient Response
50%~75% load change, 1A/uS slew rate, Vin=48V
Ch 1: Vo Ch 2: Io

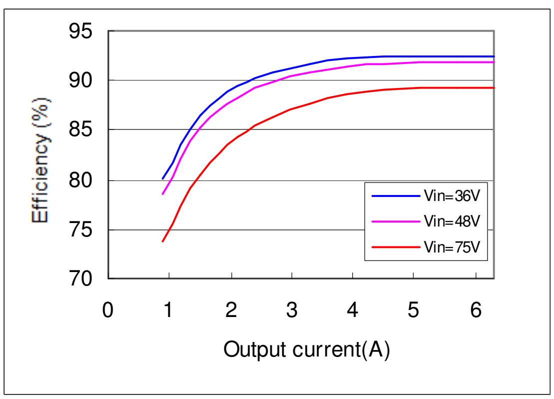


Figure 75: AVO75-48S12 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 4A

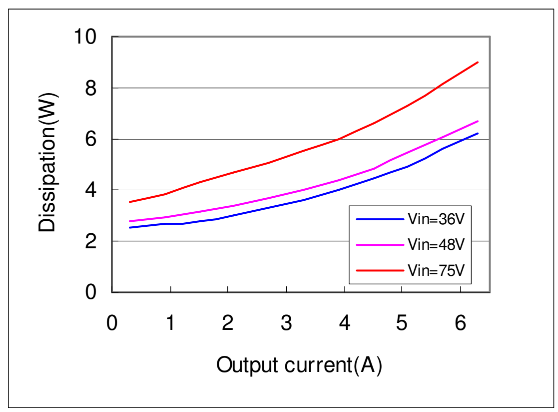


Figure 76: AVO75-48S12 Typical power dissipation curve

Loading: Io = 10% increment to 4A

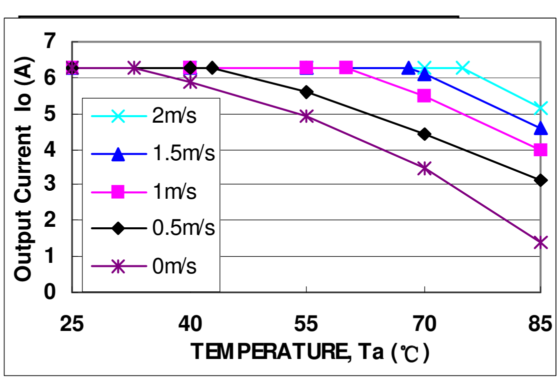
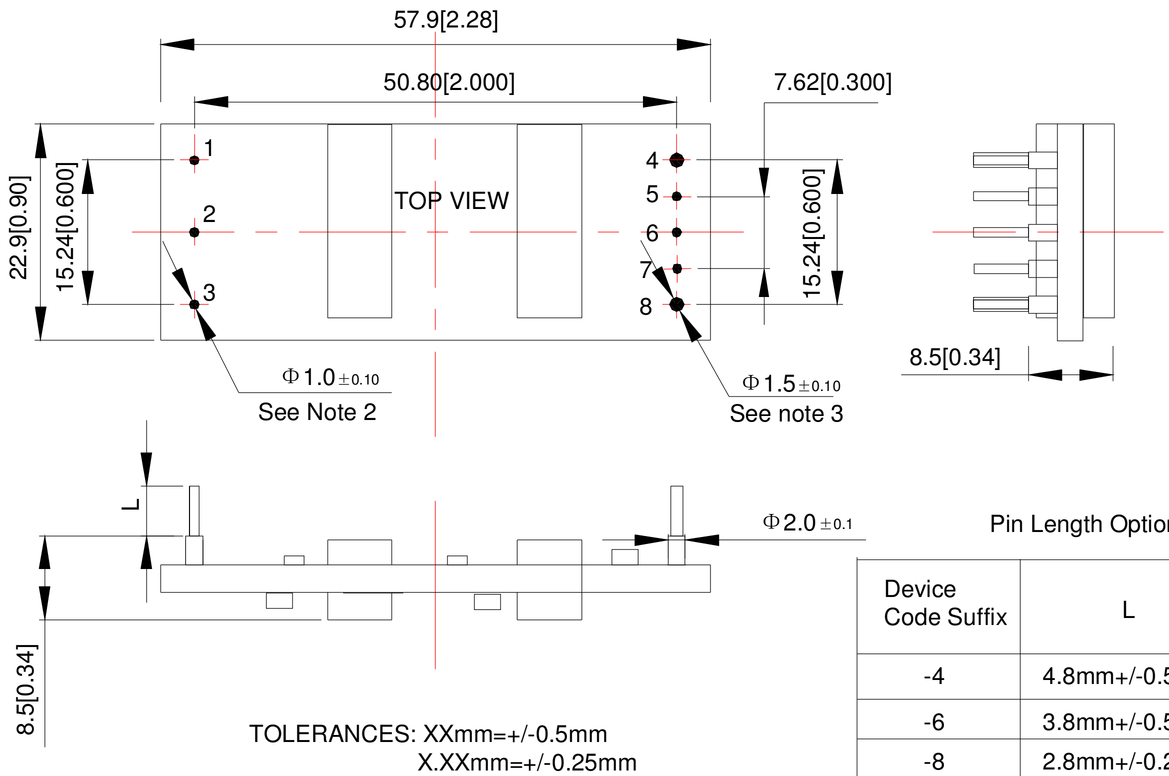


Figure 77: AVO75-48S12 output power derating

Airflow direction from -Vin to +Vin; Vin=48V

Mechanical Specifications

Mechanical Outlines



Pin Length Option

Device Code Suffix	L
-4	4.8mm+/-0.5mm
-6	3.8mm+/-0.5mm
-8	2.8mm+/-0.25mm
NONE	5.8mm+/-0.5mm

Pin Designations

Pin No	Name	**Function**
1	+Vin	Positive input voltage
2	CNT	Remote control, Connected to –Vin for negative logic, open for positive logic
3	-Vin	Negative input voltage
4	+Vo	Positive output voltage
5	+Sense	Positive remote sense
6	Trim	Output voltage trim
7	-Sense	Negative remote sense
8	-Vo	Negative output voltage

Note 1 - Un-dimensioned components are for visual reference only.
Note 2 - Pins 1~3, 5~7 are 1.0mm diameter with 2.0mm diameter standoff shoulders
Note 3 - Pins 4, 8 are 1.5mm diameter with no standoff shoulders

Environmental Specifications

EMI Emissions

The AVO75 series has been designed to comply with the Class A limits of EMI requirements of EN55022 for emissions. For conditions where EMI is a concern, a different input filter can be used. Figure 78 shows the filter designed to reduce EMI effects.

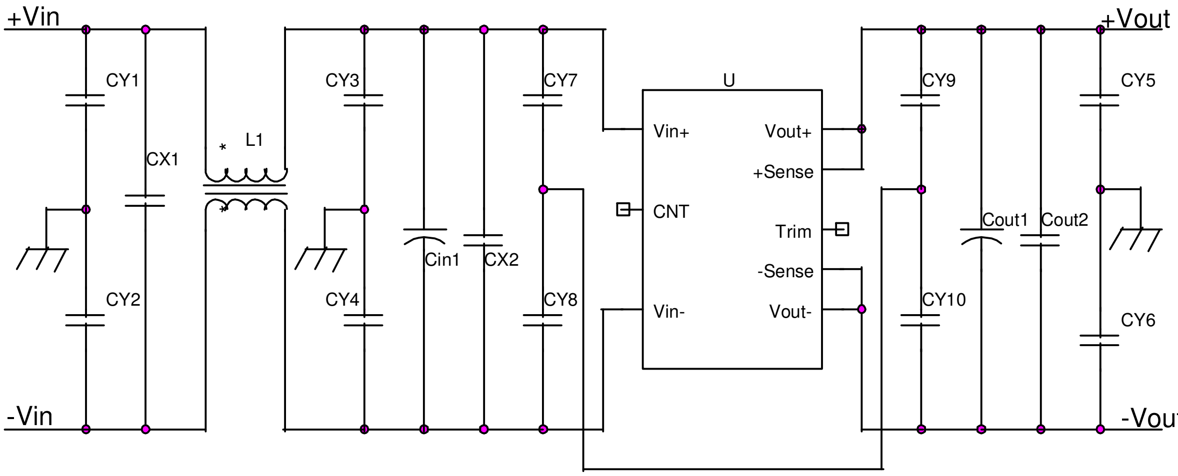


Figure 78: EMI reduction filter

Table 4. Recommended values:

Component	Value/Rating
CY1, CY2, CY5, CY6	4700PF/250VAC
CX1	2.2µ/100V
CY7, CY8, CY9, CY10	1000PF/250VAC
CY3, CY4	0.47µ
Cin1	47µF/100V
CX2	1µF/100V
Cout1	470µF/10V low ESR capacitor
Cout2	1µF/10V
L1	1.8mH

Safety Certifications

The AVO75 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for AVO75 series power supply system

Document	Description
UL 60950-1	US Requirements
UL1950	US Requirements
EN60950-1	European Requirements
IEC 60950-1/VDE 0805	International Requirements
CAN/CSA-22.2 No. 60950-1-03	Canada Requirements

Safety Consideration

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL1950, CSA C22.2 No. 950-95, and EN60950. The AVO75 series input-to-output isolation is a basic insulation. The DC/DC power module should be installed in end-use equipment, in compliance with the requirements of the ultimate application, and is intended to be supplied by an isolated secondary circuit. When the supply to the DC/DC power module meets all the requirements for SELV(<60Vdc), the output is considered to remain within SELV limits (level 3). If connected to a 60Vdc power system, double or reinforced insulation must be provided in the power supply that isolates the input from any hazardous voltages, including the AC mains. One input pin and one output pin are to be grounded or both the input and output pins are to be kept floating. Single fault testing in the power supply must be performed in combination with the DC/DC power module to demonstrate that the output meets the requirement for SELV. The input pins of the module are not operator accessible.

Note: Do not ground either of the input pins of the module, without grounding one of the output pins. This may allow a non-SELV voltage to appear between the output pin and ground.

To comply with the published safety standards, the following must be observed when using this built-in converter.

1. The built-in converter is intended for use as a component part of other equipment. When installing the power supply and marking input and output connections, the relevant safety standards e.g. UL 60950-1; IEC 60950-1/VDE 0805; EN60950-1; CAN/CSA-22.2NO. 60950-1-03 must be complied with, especially the requirements for creepage distances, clearances and distance through insulation between primary and earth or primary and secondary.

2. The output power taken from the built-in converter must not exceed the rating given on the built-in converter.

3. The built-in converter is not intended to be repaired by service personnel in case of failure or component defect (unit can be thrown away).

4. The maximum ambient temperature around the converter must not exceed 55 ^{O}C.

5. An external forced air cooling (CFM: 80.2, Speed: 1m/s, distance from unit: 20cm) shall be used for unit operate with full load and ambient up to 55 ^{O}C.

6. The built-in converter has no in-line fuse. For safety purpose, a fast acting UL listed fuse or UL recognized fuse rated 5A/250V needs to be connected to the input side as external protection.

Operating Temperature

The AVO75 series power supplies will start and operate within stated specifications at an ambient temperature from -40 ^{O}C to 85 ^{O}C under all load conditions. The storage temperature is -55 ^{O}C to 125 ^{O}C.

Thermal Consideration

Thermal management is an important part of the system design. AVO75 series modules have ultra high efficiency at full load, and the module exhibit good performance during pro-longed exposure to high temperatures. However, to ensure proper and reliable operation, sufficient cooling of the power module and power derating is needed over the entire temperature range of the module. Considerations includes ambient temperature, airflow and module power derating.

Measuring the thermal reference point of the module as the method shown in Figure 79 can verify the proper cooling.

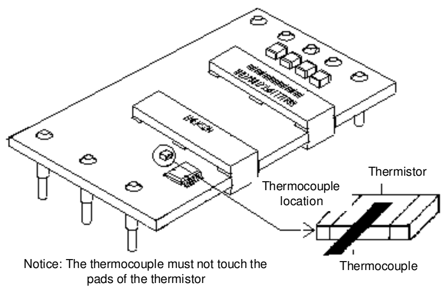


Figure 79 Temperature measurement location

Module Derating

With 48V input, 55 ^{O}C ambient temperature, and 200LFM airflow, AVO75 series are rated for full power. For operation above ambient temperature of 55 ^{O}C, the output power must be derated as shown in derating curves. Meantime, airflow at least 200LFM over the converter must be provided to make the module working properly. It is recommended that the temperature of the thermal reference point be measured using a thermocouple. Temperature on the PCB at the thermocouple location shown in Figure 79 should not exceed 125 ^{O}C in order to operate inside the derating curves.

Application Notes

Typical Application

Below is the typical application of the AVO75 series power supply.

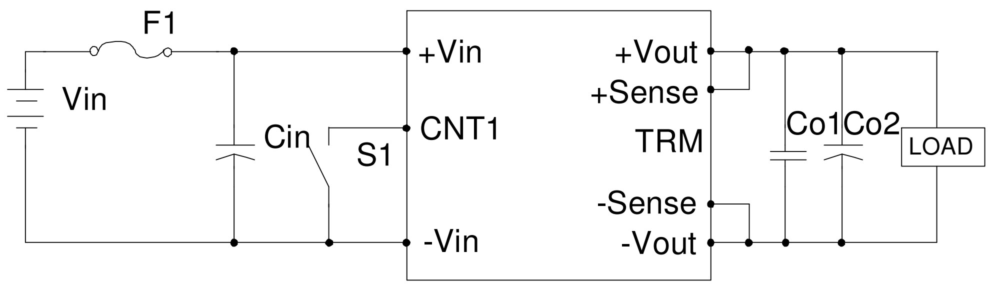


Figure 80 Typical application

C1: F1: Fuse. Use external fuse with a rating of 5A (fast blow type) for each unit

Cin: Recommended input capacitor. Use 47µF/100V high frequency low ESR electrolytic type capacitor

Co1: Recommended 1µF/10V ceramic capacitor

Co2: Recommended output capacitor. Use 470µF/10V high frequency low ESR electrolytic type capacitor.

If Ta< -5 °C, use 220µF tantalum capacitor parallel with a 470µF/10V high frequency low ESR electrolytic capacitor.

Note: The AVO75 modules cannot be used in parallel mode directly.

Remote ON/OFF

The converter is equipped with a primary ON/OFF pin used to remotely turn the converter on or off via a system signal. Two CNT logic options are available. For the positive logic model a system logic low signal will turn the unit off. For the negative logic model a system logic high signal will turn the converter off. For negative logic models where no control signal will be used the ON/OFF pin should be connected directly to -Vin to ensure proper operation. For positive logic models where no control signal will be used the ON/OFF pin should be left unconnected.

The following Figure shows a few simple CNT circuits.

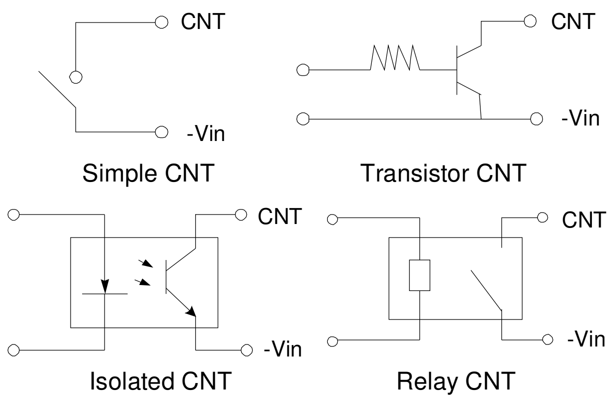


Figure 81 External Remote ON/OFF circuit

Remote Sense

The AVO75 converter can remotely sense both lines of its output which moves the effective output voltage regulation point from the output terminals of the unit to the point of connection of the remote sense pins. This feature automatically adjusts the real output voltage of the AVO75 in order to compensate for voltage drops in distribution and maintain a regulated voltage at the point of load.

When the converter is supporting loads far away, or is used with undersized cabling, significant voltage drop can occur at the load. The best defense against such drops is to locate the load close to the converter and to ensure adequately sized cabling is used. When this is not possible, the converter can compensate for a drop of up to 10%Vo, through use of the sense leads.

When used, the + Sense and - Sense leads should be connected from the converter to the point of load as shown in Figure 82, using twisted pair wire, or parallel pattern to reduce noise effect. The converter will then regulate its output voltage at the point where the leads are connected. Care should be taken not to reverse the sense leads. If reversed, the converter will trigger OVP protection. When not used, the +Sense lead must be connected with +Vo, and -Sense with -Vo.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

Note that at elevated output voltages the maximum power rating of the module remains the same, and the output current capability will decrease correspondingly.

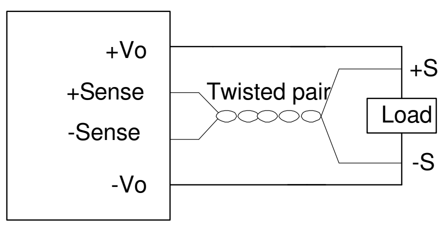


Figure 82 Sense connection

Trim Characteristics

The +Vo output voltage of the AVO75 series can be trimmed with the trim pin provided. Applying a resistor to the trim pin through a voltage divider from the output will cause the +Vo output to increase by up to 10%or decrease by up to 20%. Trimming up by more than 10% of the nominal output may activate the OVP circuit or damage the converter. Trimming down more than 20% can cause the converter to regulate improperly. If the trim pin is not needed, it should be left open.

Trim Up

With an external resistor connected between the TRIM and +SENSE pins, the output voltage set point increases (see Figure 83).

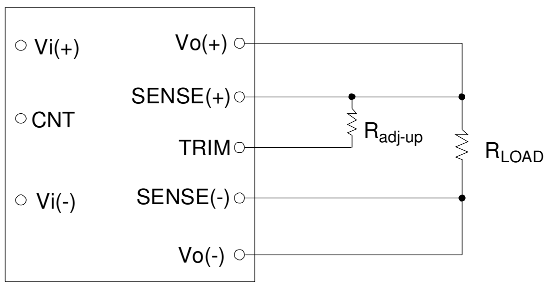


Figure 83 Trim up circuit

The following equation determines the required external-resistor value to obtain a percentage output voltage change of 1%.

For Output Voltage: 1.5V ~ 12V

$$R_{adj-up} = \frac{5.1 \times V_o \times (100 + \Delta\%)}{1.225 \times \Delta\%} - \frac{510}{\Delta\%} - 10.2(k\Omega)$$

For output voltage: 1.2V

$$R_{adj-up} = \frac{5.1 \times V_o \times (100 + \Delta\%)}{0.6 \times \Delta\%} - \frac{510}{\Delta\%} - 10.2(k\Omega)$$

Note: △=(Vnom-Vo)×100/Vnom

Vtrim tolerance: < ±2%,

Radj tolerance: ±1%

For example: trim up the output of AVO75-48S1V8 to 1.98V.

△=(1.98-1.8)×100/1.8=10

$$R_{adj-up} = \frac{5.1 \times 1.8 \times (100 + 10)}{1.225 \times 10} - \frac{510}{10} - 10.2(k\Omega)$$

$$R_{adj-up} = 21.23(k\Omega)$$

Trim Down

With an external resistor between the TRIM and -SENSE pins, the output voltage set point decreases (see Figure 84).

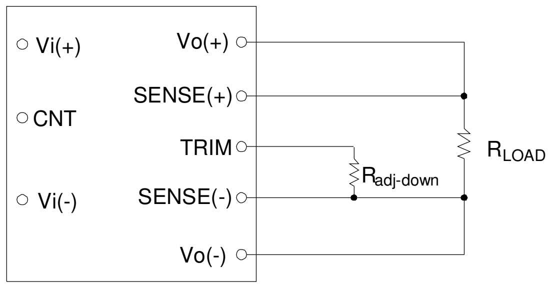


Figure 84 Trim down circuit

The following equation determines the required external-resistor value to obtain a percentage output voltage change of 1%.

For output voltage: 1.2V ~ 12V

$$R_{adj-down} = \frac{510}{\Delta\%} - 10.2(k\Omega)$$

Note: △= (Vnom-Vo) 100/Vnom

Vtrim tolerance: <±2%,

Radj tolerance: ±1%

For example: trim down the output of AVO75-48S1V8 to 1.62V.

△=(1.8-1.62)×100/1.8=10

$$R_{adj-down} = \frac{510}{10} - 10.2(k\Omega)$$

$$R_{adj-down} = 40.8(k\Omega)$$

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

Note that at elevated output voltages the maximum power rating of the module remains the same, and the output current capability will decrease correspondingly.

Output Capacitance

High output current transient rate of change (high di/dt) loads may require high values of output capacitance to supply the instantaneous energy requirement to the load. To minimize the output voltage transient drop during this transient, low ESR (Equivalent Series Resistance) capacitors may be required, since a high ESR will produce a correspondingly higher voltage drop during the current transient.

When the load is sensitive to ripple and noise, an output filter can be added to minimize the effects. A simple output filter to reduce output ripple and noise can be made by connecting a capacitor C1 across the output as shown in Figure 85. The recommended value for the output capacitor C1 is 470µF.

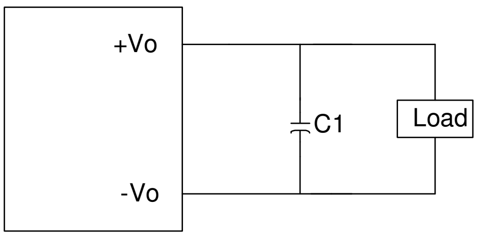


Figure 85 Output ripple filter

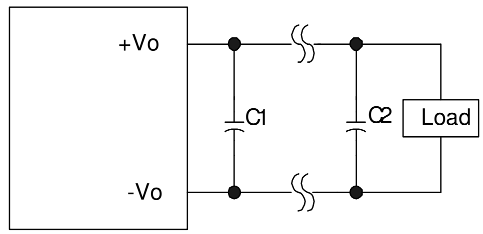


Figure 86 Output ripple filter for a distant load

Extra care should be taken when long leads or traces are used to provide power to the load. Long lead lengths increase the chance for noise to appear on the lines. Under these conditions C1 can be added across the load, with a 1µF ceramic capacitor C2 in parallel generally as shown in Figure 86.

Decoupling

Noise on the power distribution system is not always created by the converter. High speed analog or digital loads with dynamic power demands can cause noise to cross the power inductor back onto the input lines. Noise can be reduced by decoupling the load. In most cases, connecting a 10µF tantalum or ceramic capacitor in parallel with a 1µF ceramic capacitor across the load will decouple it. The capacitors should be connected as close to the load as possible.

Ground Loops

Ground loops occur when different circuits are given multiple paths to common or earth ground, as shown in Figure 87. Multiple ground points have slightly different potential and cause current flow through the circuit from one point to another. This can result in additional noise in all the circuits. To eliminate the problem, circuits should be designed with a single ground connection as shown in Figure 88.

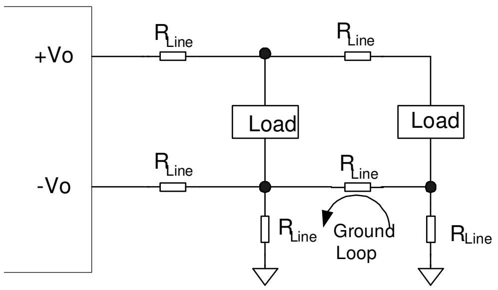


Figure 87 Ground loops

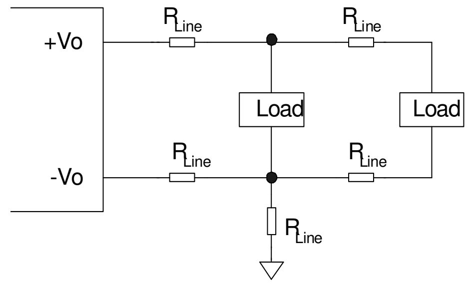


Figure 88 Single point ground

Output Over-Current Protection

AVO75 series DC/DC converters feature fold back current limiting as part of their Over-current Protection (OCP) circuits. When output current exceeds 110% to 140% of rated current, such as during a short circuit condition, the module will work on intermittent mode, also can tolerate short circuit conditions indefinitely. When the over-current condition is removed, the converter will automatically restart.

Output Over-Voltage Protection

The output over-voltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over voltage protection threshold, then the module will work on intermittent mode. When the over-voltage condition is removed, the converter will automatically restart. The protection mechanism is such that the unit can continue in this condition until the fault is cleared.

Over-Temperature Protection

These modules feature an over-temperature protection circuit to safeguard against thermal damage. The module will work on intermittent mode when the maximum device reference temperature is exceeded. When the over-temperature condition is removed, the converter will automatically restart.

Input Reverse Voltage Protection

Under installation and cabling conditions where reverse polarity across the input may occur, reverse polarity protection is recommended. Protection can easily be provided as shown in Figure 89. In both cases the diode used is rated for 10A/100V. Placing the diode across the inputs rather than in-line with the input offers an advantage in that the diode only conducts in a reverse polarity condition, which increases circuit efficiency and thermal performance.

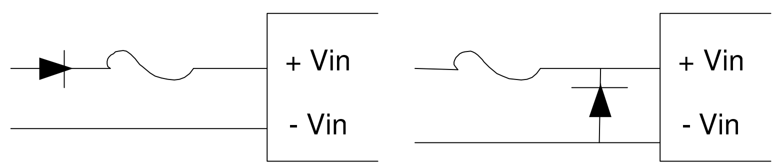


Figure 89 Reverse polarity protection circuit

MTBF

The MTBF, calculated in accordance with Bellcore TR-NWT-000332, is 2,500,000 hours. Obtaining this MTBF in practice is entirely possible. If the board temperature is expected to exceed +25 ^{O}C, then we also advise an oriented for the best possible cooling in the air stream.

Artesyn Embedded Technologies can supply replacements for converters from other manufacturers, or offer custom solutions. Please contact the factory for details.

Soldering

AVO75 series converters are compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20 ~ 30 seconds at 110 ^{O}C, and wave soldered at 260 ^{O}C for less than 10 seconds.

Although AVO75 series converters can be mounted in any orientation, free air-flowing must be taken. Normally power components are always put at the end of the airflow path or have the separate airflow paths. This can keep other system equipment cooler and increase component life spans.

When hand soldering, the iron temperature should be maintained at 425 ^{O}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.

Weight

The AVO75 series weight is 30g maximum.

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Hazardous Substances Announcement (RoHS of China)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AVO75 series	x	x	x	x	x	x

x: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Artesyn Embedded Technologies has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum

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