Size: 4.6in x 2.4in x 0.55in
(116.8mm x 61mm x 13.9mm)

FEATURES

- Wide Input Voltage Range
- Industry Standard Full Brick Package
- High Reliability & High Efficiency, & High Power Density
- Designed to Meet RoHS5
- Active Current Share
- Low Ripple & Noise
- Over Current, Short Circuit, Over Voltage, and Over Temperature Protection
- Input Over Voltage & Under Voltage Protection
- Designed to meet UL/IEC/EN60950/GB49943

APPLICATIONS

- Radar
- Electronic Warfare
- Industrial Control
- Vehicles

DESCRIPTION

The DCEV1000 series of DC/DC converters offers up to 1000 watts of output power in a 4.6” x 2.4” x 0.55” industry standard full brick package. This series consists of a single output models with wide input voltage range and active current share. Each model in this series features high reliability, high efficiency, high power density, low ripple and noise, as well as protection against over current, short circuit, over voltage, over temperature, and input over voltage and under voltage conditions. This series is designed to meet RoHS5 and UL/IEC/EN60950/GB49943 standards.

MODEL SELECTION TABLE

Model Number	Input Voltage Range	Output Voltage	Output Current		Typ. Ripple & Noise	Min. Efficiency		Typ. Efficiency		Rated Output Power
			Min Load	Max Load		50% Load	100% Load	50% Load	100% Load	
DCEV1000-500S12	500VDC (380~650VDC)	12VDC	0A	70A	100mV	90.8%	91.0%	92.8%	93.0%	840W
DCEV1000-500S28		28VDC	0A	35.7A	200mV	91.5%	91.5%	93.5%	93.5%	1000W
DCEV1000-500S36		36VDC	0A	27.8A	200mV	92.5%	92.5%	94.5%	94.5%	1000W
DCEV1000-500S48		48VDC	0A	20.83A	300mV	92.0%	92.5%	94.0%	94.5%	1000W

SPECIFICATIONS

All specifications are based on Tc=25°C, Rated Input Voltage, Rated Output Voltage, and Full Load unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS		Min	Typ	Max	Unit
INPUT SPECIFICATIONS						
Input Voltage Range			380	500	650	VDC
	Absolute Maximum Operating Input Voltage, Continuous				650	VDC
	Absolute Maximum Non-Operating Input Voltage Range, Continuous	12VDC Output			700	VDC
		Others	-0.3		700	
Input Current	Vin=380VDC, Po=840W	12VDC Output Models			2.8	A
	Vin=380VDC, Po=1000W	Others			3	
No-Load Input Current	Vin=500VDC, Io=0A			40	60	mA
Input Current Transient	Vin=500VDC, External High-Frequency, low ESR 22μF electrolytic capacitor 12μH inductance				3	A^2s
Input Terminal Ripple Current	Vin=500VDC, Full Load, see fig. 3 for test method			200	400	mA
Input Capacitor	High-Frequency, low ESR aluminum electrolytic capacitor, withstand voltage ≥800VDC (low temperature <-25ºC, in parallel with a 2.2μF, 1000VCBB capacitor at the input)		22	47		μF
Input Under-Voltage Protection	12VDC Output: Io=35A 28VDC Output: Io=17.85A 36VDC Output: Io=13.9A 48VDC Output: Io=10.42A	Turn-Off Threshold	345	355	365	VDC
		Turn-On Threshold	355	365	375	
		Hysteresis		10		
Input Over-Voltage Protection	12VDC Output: Io=35A 28VDC Output: Io=17.85A 36VDC Output: Io=13.9A 48VDC Output: Io=10.42A	Turn-Off Threshold	675	685	700	VDC
		Turn-On Threshold	650	665	680	
		Hysteresis		20		
OUTPUT SPECIFICATIONS						
Output Voltage Set Point	12VDC Output: Vin=500VDC, Io=35A		11.88	12	12.12	VDC
	28VDC Output: Vin=500VDC, Io=17.85A		27.2	28	28.28	
	36VDC Output: Vin=500VDC, Io=13.9A		35.64	36	36.36	
	48VDC Output: Vin=500VDC, Io=10.42A		47.52	48	48.48	
Output Voltage Range	12VDC Output: Vin=380-350VDC, Io=0-70A, Tc=-40~100ºC		11.64		12.36	VDC
	28VDC Output: Vin=380-650VDC, Io=0-35.7A, Tc=-40~80ºC		27.16	28	28.84	
	36VDC Output: Vin=380-650VDC, Io=0-27.8A, Tc=-40~90ºC		24.92		37.08	
	48VDC Output: Vin=380-650VDc, Io=0-20.83A, Tc=-40~90ºC		46.56		49.44	

SPECIFICATIONS

All specifications are based on Tc=25°C, Rated Input Voltage, Rated Output Voltage, and Full Load unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS			Min	Typ	Max	Unit
OUTPUT SPECIFICATION (Cont.)							
Setting Accuracy	Vin=380-650VDC, Io=0-Max Load					±1	%
Line Regulation	Vin=380-650VDC, Io=Max Load					±0.20	%
Load Regulation	Vin=500VDC, Io=0-Max Load					±0.50	%
Voltage Trim Range(1)				-10		+10	%
Total Output Power(1)	Iomax			See Table			
Output Current Range(1)	Pomax=840W			0		70	A
Output Busbar Voltage of Current Sharing	Vout=12VDC, Iomax			4.75	5.00	5.25	VDC
Current Sharing Sensitivity (Ii/Ie-ΣI/nIe)	12VDC Output: Io=35-70A, 28VDC Output: Io=17.85-35.7A, 36VDC Output: Io=13.9-27.8A, 48VDC: Io=10.42-20.83A				±5	±10	%
Auxiliary Power Output Voltage	Output Current 0-20mA			9.0	11.0	13.0	VDC
Auxiliary Power Output Current						20	mA
Ripple and Noise (Peak to Peak)	Test method see fig. 4	12VDC Output			100	200	mV
		28VDC Output			200	400	
		36VDC Output			200	360	
		48VDC Output			300	600	
Output Capacitor(2)	12VDC Output			4000	6200		µF
	28VDC & 36VDC Output			1000	1500		
	48VDC Output			560	670		
Output Capacitance	Full Resistive Load	12VDC Output				15000	F
		28VDC Output				1	
		36VDC Output				3000	
		48VDC Output				1500	
Turn-On Rise Time	10% Vout to 90% Vout (rated output capacitance)				20	40	ms
Start Up Time	Input voltage at under-voltage recovery point to 10% Vout	12VDC, 36VDC, & 48VDC Outputs				2000	ms
		28VDC Output			500	1000	
Transient Response	12VDC Output: 25%-50%-25%, 50%-75%-50% Iout (max), di/dt=2.5A/µs(3)		Overshoot		300	600	mV
			Settling Time		700	2000	µs
	28VDC Output: 25%-50%-25%, 50%-75%-50% Iout (max), di/dt=2.5A/µs, external output capacitance 1000µF (solid capacitor or polymer capacitor)		Overshoot		500	1000	mV
			Settling Time		300	500	µs
	36VDC Output: 25%-50%-25%, 50%-75%-50% Iout (max), di/dt=2.5Aµs, external output capacitance 1000µF		Overshoot		1200	1800	mV
			Settling Time		2000	4000	µs
	48VDC Output: 25%-50%-25%, 50%-75%-50% Iout (max), di/dt=2.5A/µs, external output capacitance 560µF		Overshoot		1200	2000	mV
			Settling Time		2000	4000	µs
Output Voltage Overshoot						5	%Vout
Operating Transient Protection	Absolute Maximum Rating, ≤1s					675	VDC
Temperature Coefficient	12VDC Output: Tc=-40~100ºC, 28VDC Output: Tc=-40~80ºC, 36VDC & 48VDC Outputs: Tc=-40~90ºC					±0.02	%/ºC
REMOTE ON/OFF CONTROL							
Off-State Voltage				2.4		18.0	VDC
On-State Voltage				-1.0		0.8	VDC
Control Current						6	mA
Remote Turn-On Rise Time	ON/OFF startup. 10% Vout to 90% Vout (rated output capacitance)				20	40	ms
Remote Start-Up Time	ON/OFF startup to 10% Vout	12VDC, 36VDC, & 48VDC Outputs			400	1000	ms
		28VDC Output			200	400	
Voltage Between ON/OFF (+) and ON/OFF (-)	Absolute Maximum Rating, Continuous (ripple noise is less than 200mVp-p)			-2		18	VDC
PROTECTION							
Short Circuit Protection				See App Notes			
Over Current Protection	Vin=500VDC, Hiccup Mode	12VDC Output		76	84	92	A
	Vin=500VDC, first constant current mode, then hiccup, then auto recovery	28VDC Output		40	42	44	
		48VDC Output		23	25	27	
	Vin=500VDC, hiccup mode	36VDC Output		30.5	33.4	36.1	
Over Voltage Protection	Vin=500VDC, protection mode lockup. Entering a power outage or dog CNT remote ca reboot.	12VDC Output, Io=35A		14.0	15.0	16.0	VDC
		28VDC Output, Io=17.85A		37	39	41	
		36VDC Output, Io=13.9A		42	46	50	
		48VDC Output, Io=10.42A		57	62	67	

SPECIFICATIONS

All specifications are based on Tc=25°C, Rated Input Voltage, Rated Output Voltage, and Full Load unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS			Min	Typ	Max	Unit
PROTECTON (CONT.)							
Over Temperature Protection	PCB (near the thermistor) temperature	12VDC Output	Trip Point	100	110	120	ºC
			Restart	90	100	110	
			Hysteresis		10		
		28VDC Output	Trip Point	80	90	100	
			Restart	70	80	90	
			Hysteresis		10		
		36VDC & 48VDC Outputs	Trip Point	90	100	110	
			Restart	80	90	100	
			Hysteresis		10		
ENVIRONMENTAL SPECIFICATIONS							
Operating Temperature	Case Temperature, Absolute Maximum Rating	12VDC Output		-40		+100	ºC
		28VDC Output		-40		+80	
		36VDC & 48VDC Output		-40		+90	
Storage Temperature	Ambient Temperature, Absolute Maximum Rating			-55		+125	ºC
Operating Relative Humidity	Non-Condensing			5		95	%
Storage Relative Humidity	Non-Condensing			5		95	%
Solderability	Wave Soldering, Less than 10s					260	ºC
	Manual Welding, Less than 5s					425	
Cooling				Heatsink/Air Cooling/Water Cooling			
MTBF	Vin=500VDC, Full Load Output, Tc=25ºC			$2x10^6$			H
GENERAL SPECIFICATIONS							
Efficiency	Vin=500VDC, Tc=25ºC			See Table			
Switching Frequency					300		KHz
Isolation Voltage	Condition: 10mA/60s, rise rate 500VDC/s, no breakdown, no arc	Input to Output		4250VDC			
		Input to Case		3535VDC			
		Output to Case		1500VDC			
Isolation Resistance	90% relative humidity, standard atmospheric pressure, 500VDC				≥100		MΩ
PHYSICAL SPECIFICATIONS							
Weight				7.94oz (225g)			
Dimensions (L x W x H)				4.6in x 2.4in x 0.55in (116.8mm x 61mm x 13.9mm)			
Baseplate Material				Aluminum Baseplate + Plastic Case			
SAFETY CHARACTERISTICS							
Safety Approvals	Related certification according to customer's demand	UL[8]		UL 60950-1; C22.2 No. 60950-1			
		CE		EN 60950-1			
		CB		IEC 60950-1			
		TUV		EN 60950-1			
		CQC/CCC		GB 4943			
		CSA		C22.2 No. 60950-1			
EMC	Tested together with customer system, pass	EMI	Conducted Emission	MIL-STD-461			
		EMS	Spike Signal	MIL-STD-461			
RoHS5	RoHS compliant materials, lead						
Reference Standards and Specifications	MIL-STD-810F			Environmental Engineering considerations and laboratory tests			
	MIL-STD-461E			Requirement for the control of electromagnetic interference characteristics of subsystems and equipment			
	MIL-STD-202			Test methods for electronic and electrical component parts			
	MIL-HBDK-217F			Reliability prediction of electronic equipment			
	MIL-M-28787			Modules, standard electronic general specification			

NOTES

1. See Application Notes: Output Trim
2. See Application Notes: Typical application circuit
3. Minimum external output capacitance required (solid capacitor or polymer capacitor)
4. Under conditions of the above configuration, testing in accordance with specified level, without any problems, the test can be directly judged through (PASS).
5. Under conditions of the above configuration, testing in accordance with specified level, if there is an output shutdown because of occurring power module OVP or LVP or power module failure because of device damage, the test is not passed (FAIL).
6. Under conditions of the above configuration, testing in accordance with specified level, a temporary output voltage fluctuation occurred. If the output voltage of the power module does not exceed the regulation accuracy, return to normal immediately when test stops, and there was no module reset, device damage, the test results can be judged through (PASS).
7. Under conditions of the above configuration, testing in accordance with specified level, a temporary output voltage fluctuation occurred. If output voltage fluctuation is out of regulation accuracy, it cannot directly determine whether it is OK in this case. We need further verification on application products.
8. This product is Listed to applicable standards and requirements by UL

**Due to advances in technology, specifications subject to change without notice.*

ADDITIONAL TESTS

ENVIRONMENTAL TESTS

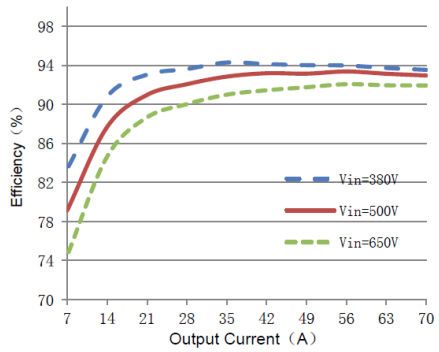
TESTS		CONDITIONS	METHODS
High Temperature	Storage	125ºC, 24H	MIL-STD-810 High Temperature
	Operating	65ºC, 24H; input low voltage, standard voltage, high voltage of each for 8H	
Low Temperature	Storage	-55ºC, 24H	MIL-STD-810 Low Temperature
	Operating	-40ºC, 24H; input low voltage, standard voltage, high voltage of each for 8H	
Temperature Shock	Storage	-55ºC~125ºC; Hold Time: 30 min; Cycles: 25 times; high and low temperature switching time less than 1min.	MIL-STD-810 Temperature Shock, Program I
	Operating	-40ºC~65ºC; Hold Time: 30 min; Cycles: 25 times; high and low temperature switching time less than 1 min.	
HTOL		Rated input voltage, maximum operating temperature, 1000h	MIL-STD-202 Life (at elevated ambient temperature)
Humidity (steady state)		40ºC, 95%, 96H	MIL-STD-202 Humidity (steady state)
Humidity (alternating)		25ºC~65ºC; 95%; 24h/cycle; cycles: 10 times	MIL-STD-202 Moisture Resistance
Salt Fog		NaCl: 5±1%; PH:6.5~7.2 (35±2ºC); 96H	MIL-STD-202 Salt Spray, Test Conditions A
Fungus		Under the provisions of MIL-STD-810 mold environment, module appearance impact assessment was no more than level 2 after 28d	Meets MIL-STD-810 Test Conditions
Low Air Pressure		58.53kPa, 16H	MIL-STD-202 Barometric Pressure (reduced) Test Conditions F
Sinusoidal Vibration		10-55Hz, 0.75mm, 2H/each axial	MIL-STD-202 Vibration
Random Vibration		50-2000Hz, (2 m/s^2) ^{2}/Hz; 50-100Hz, +6dB/OTC; 1000-2000Hz, -6dB/OTC; 30min/each axial	MIL-STD-202 Random Vibration, Test Conditions I-A
Shock		500m/s^2, 11ms; 3 shocks for three mutually perpendicular 6 directions of each	MIL-STD-202 Shock (specified pulse); Test Conditions A

RELIABILITY TESTS

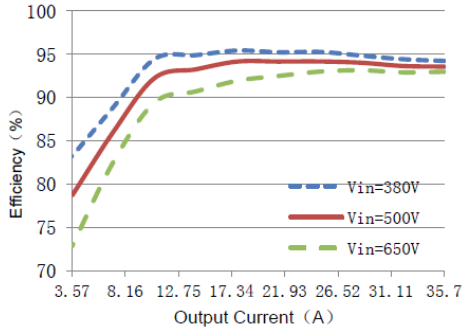
Tests	Official Sample Stage	Small Quantities Stage	Reasons
A. HALT			
High Temperature	√	/	□ The new series of prototype products ■ Important products with high reliability requirements ■ Applications in complex environments □ Customer requirements
Low Temperature	√	/	
Temperature Cycling	/	/	
Vibration	√	/	
Comprehensive Stress Test	√	/	
Operating Temperature	√	/	
B. Accord with Test of Quantitative Requirements Reliability			
Accord with test of reliability quantitative requirements	/	√	□ The new series of prototype products ■ Important products with high reliability requirements ■ Applications need quantitatively MTBF assessment □ Customer Requirements
C. Durability Test			
Temperature Shock	/	√	□ The new series of prototype products ■ Important products with high reliability requirements ■ Applications in complex environments □ Customer Requirements ■ Products required assessment of durability
High temperature/ High Humidity	/	√	
Life Test	/	√	

CHARACTERISTIC CURVES

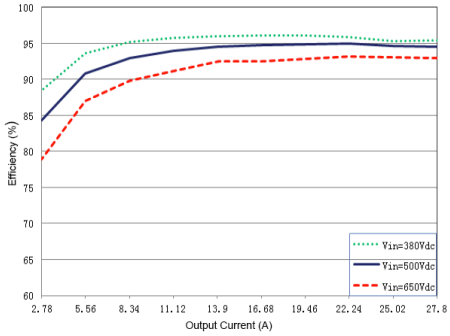
12VDC Output: Efficiency (Tc=25ºC)



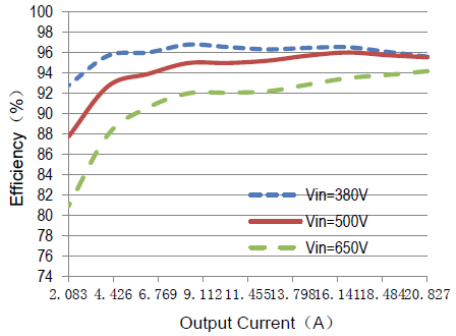
28VDC Output: Efficiency (Tc=25ºC)



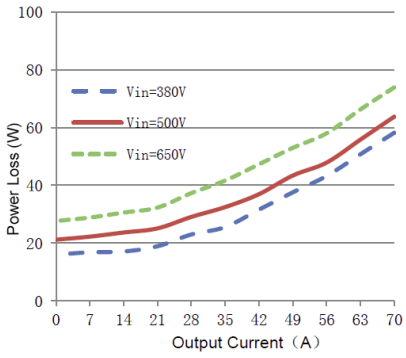
36VDC Output: Efficiency (Tc=25ºC)



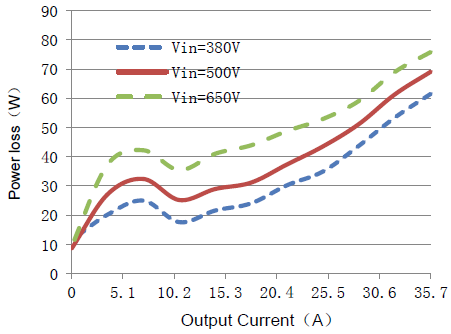
48VDC Output: Efficiency (Tc=25ºC)



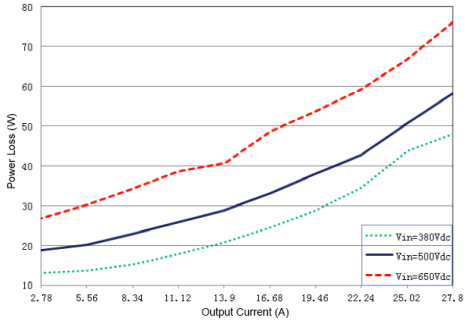
12VDC Output: Power Dissipation (Tc=25ºC)



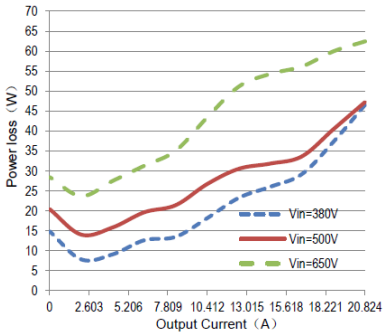
28VDC Output: Power Dissipation (Tc=25ºC)



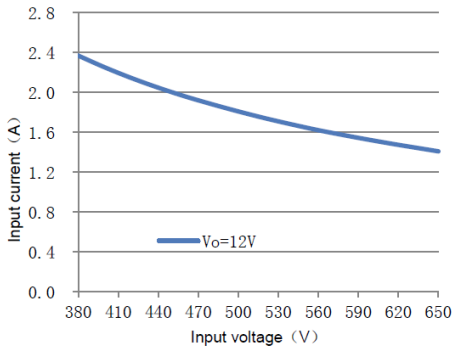
36VDC Output: Power Dissipation (Tc=25ºC)



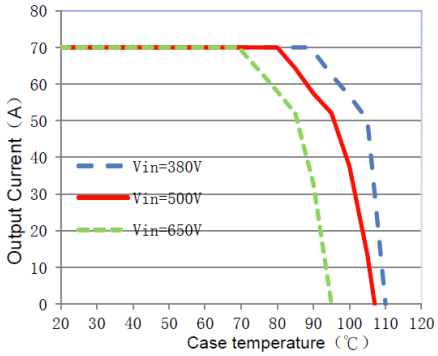
48VDC Output: Power Dissipation (Tc=25ºC)



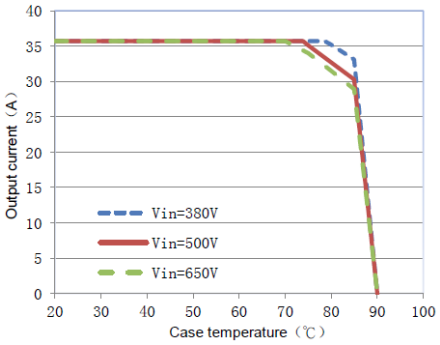
Input Current vs. Input Voltage (Tc=25ºC)



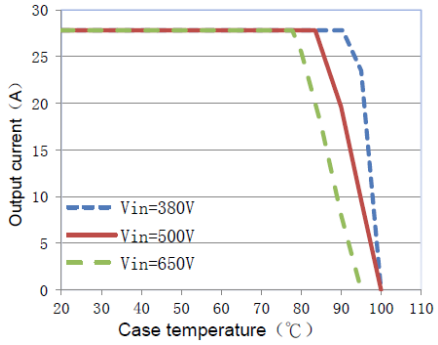
12VDC Output: Derating



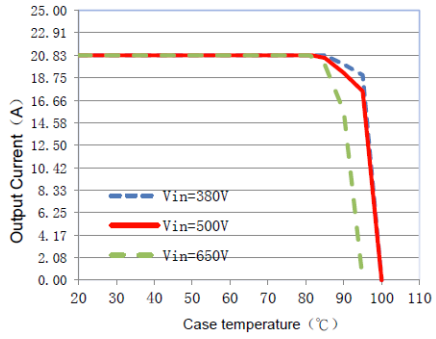
28VDC Output: Derating



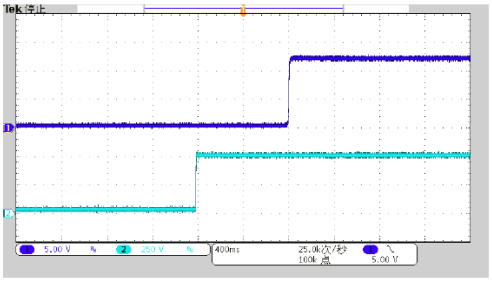
36VDC Output: Derating



48VDC Output: Derating

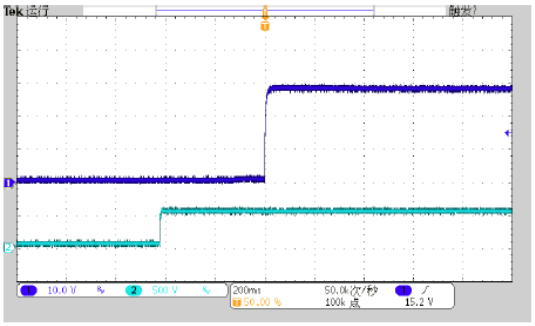


12VDC Output: Startup



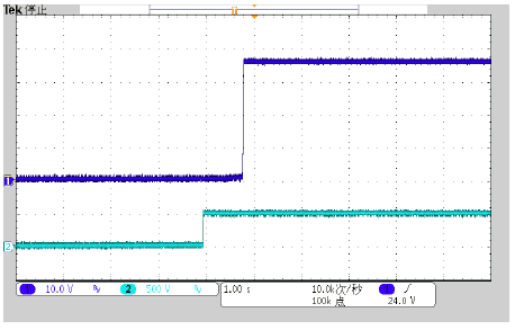
CH1: Output Voltage (5V/div)
CH2: Input Voltage (250V/div)

28VDC Output: Startup



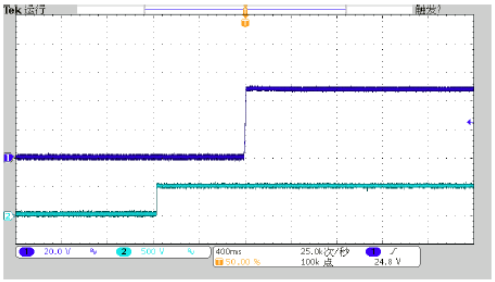
CH1: Output Voltage (10.0V/div)
CH2: Input Voltage (500V/div)

36VDC Output: Startup



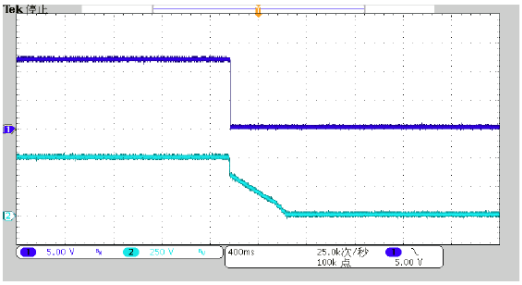
CH1: Output Voltage (10.0V/div)
CH2: Input Voltage (500V/div)

48VDC Output: Startup



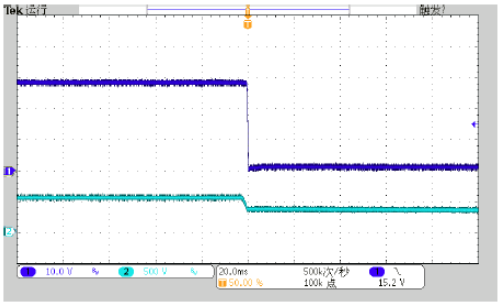
CH1: Output Voltage (20.0V/div)
CH2: Input Voltage (500V/div)

12VDC Output: Shutdown



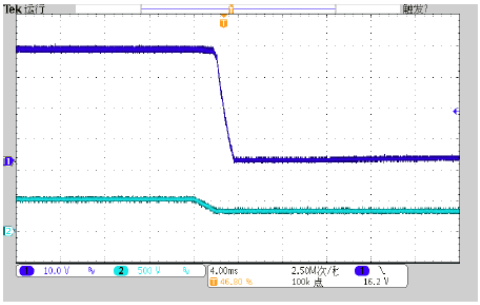
CH1: Output Voltage (5/div)
CH2: Input Voltage (250V/div)

28VDC Output: Shutdown



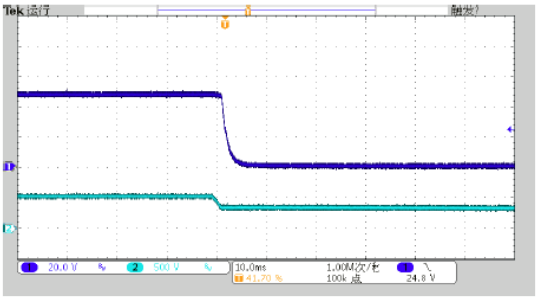
CH1: Output Voltage (10.0V/div)
CH2: Input Voltage (500V/div)

36VDC Output: Shutdown



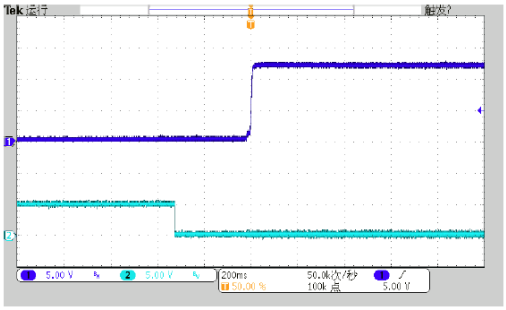
CH1: Output Voltage (10.0V/div)
CH2: Input Voltage (500V/div)

48VDC Output: Shutdown



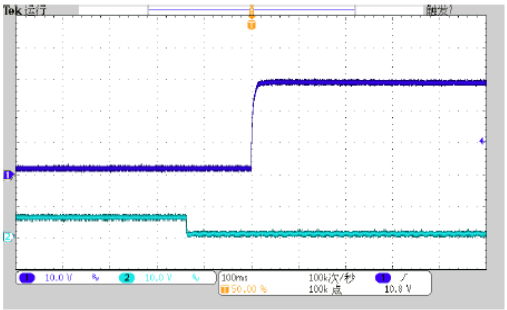
CH1: Output Voltage (20.0V/div)
CH2: Input Voltage (500V/div)

12VDC Output: Turn On by ON/OFF



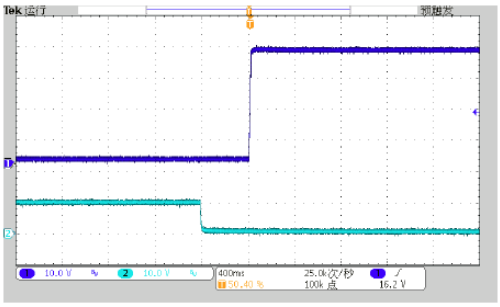
CH1: ON/OFF Voltage (5.0V/div)
CH2: Output Voltage (5.0V/div)

28VDC Output: Turn On by ON/OFF



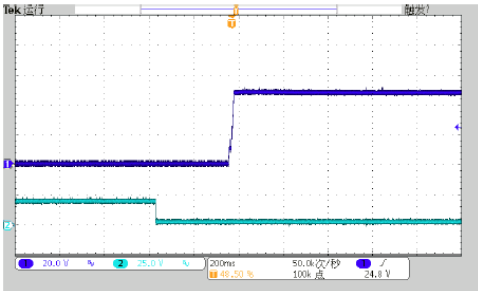
CH1: Output Voltage (10.0V/div)
CH2: ON/OFF Voltage (10.0V/div)

36VDC Output: Turn On by ON/OFF



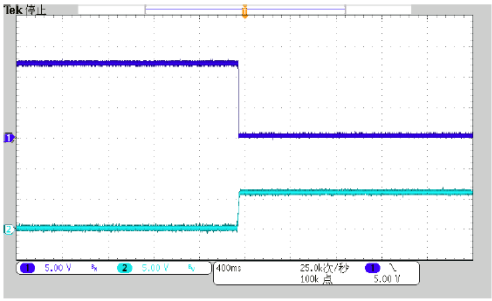
CH1: Output Voltage (10.0V/div)
CH2: ON/OFF Voltage (10.0V/div)

48VDC Output: Turn On by ON/OFF



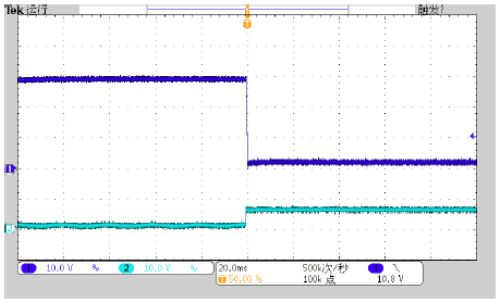
CH1: Output Voltage (20.0V/div)
CH2: ON/OFF Voltage (25.0V/div)

12VDC Output: Turn Off by ON/OFF



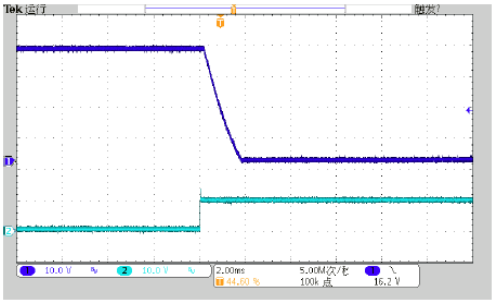
CH1: ON/OFF Voltage (5.0/div)
CH2: Output Voltage (5.0/div)

28VDC Output: Turn Off by ON/OFF



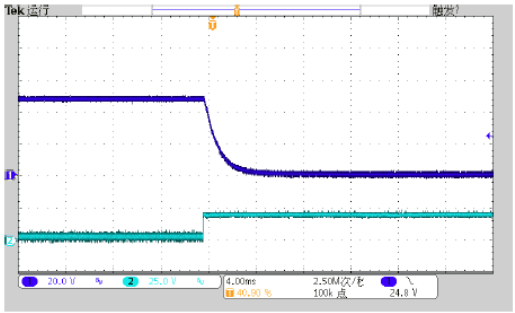
CH1: Output Voltage (10.0V/div)
CH2: ON/OFF Voltage (10.0V/div)

36VDC Output: Turn Off by ON/OFF



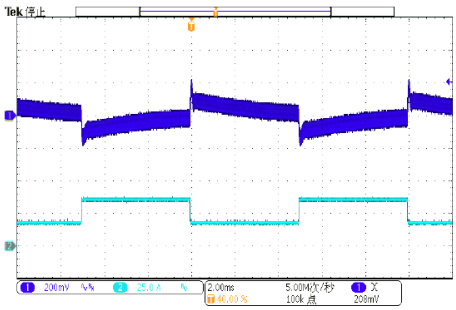
CH1: Output Voltage (10.0V/div)
CH2: ON/OFF (10.0V/div)

48VDC Output: Turn Off by ON/OFF



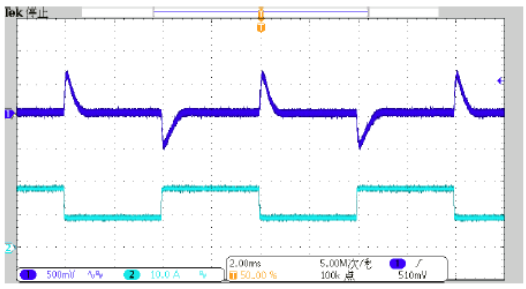
CH1: Output Voltage (20.0V/div)
CH2: ON/OFF Voltage (25.0V/div)

12VDC Output: 25%-50%-25% (2.5A/µs) Dynamic



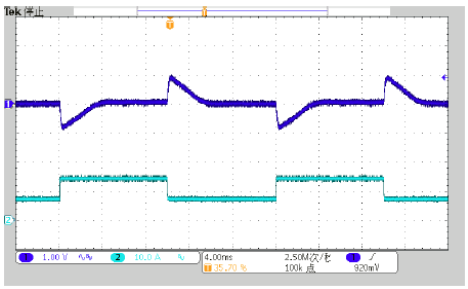
CH1: Output Voltage (200mV/div)
CH2: Output Current (25.0A/div)

28VDC Output: 25%-50%-25% (2.5A/µs) Dynamic



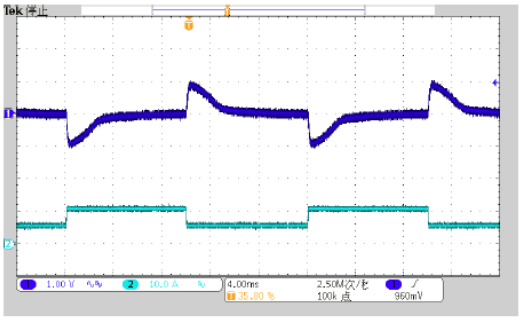
CH1: Output Voltage (500mV/div0
CH2: Output Current (10.0A/diV)

36VDC Output: 25%-50%-25% (2.5A/µs) Dynamic



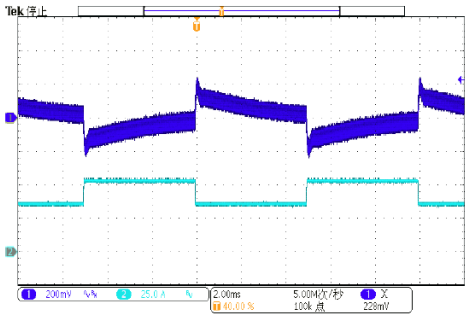
CH1: Output Voltage (1.0V/div)
CH2: Output Current (10.0A/div)

48VDC Output: 25%-50%-25% (2.5A/µs) Dynamic



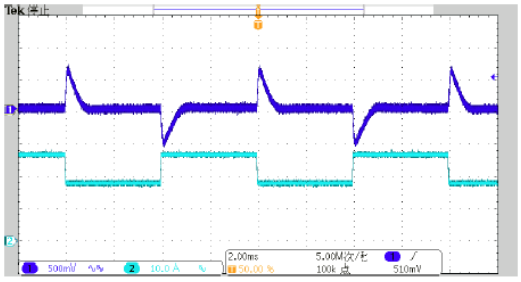
CH1: Output Voltage (1.0V/div)
CH2: Output Current (10.0A/div)

12VDC Output: 50%-75%-50% (2.5A/µs) Dynamic



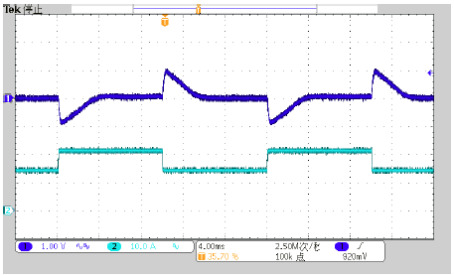
CH1: Output Voltage (200mV/div)
CH2: Output Current (25.0A/div)

28VDC Output: 50%-75%-50% (2.5A/µs) Dynamic



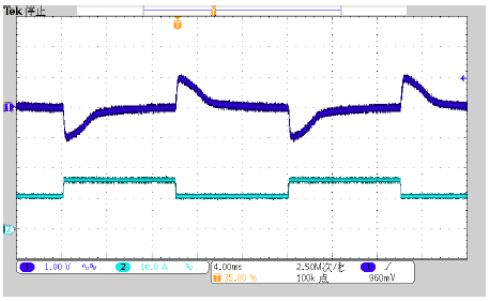
CH1: Output Voltage (500mV/div)
CH2: Output Current (10.0A/div)

36VDC Output: 50%-75%-50% (2.5A/µs) Dynamic



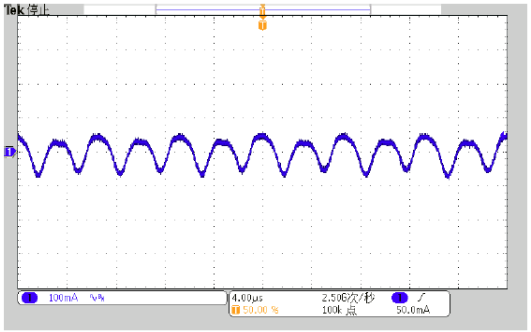
CH1: Output Voltage (1.0V/div)
CH2: Output Current (10.0A/div)

48VDC Output: 50%-75%-50% (2.5A/µs) Dynamic



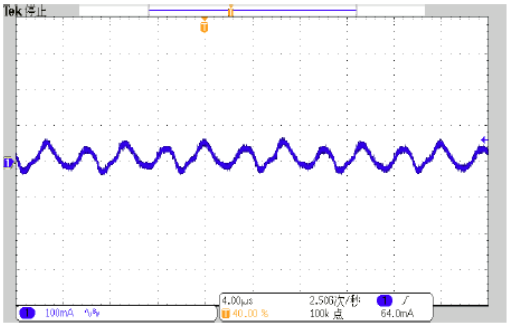
CH1: Output Voltage (1.0V/div)
CH2: Output Current (10.0A/div)

12VDC Output: Input Terminal Ripple Current



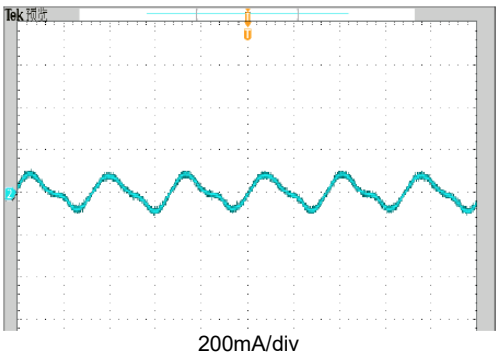
100mA/div

28VDC Output: Input Terminal Ripple Current



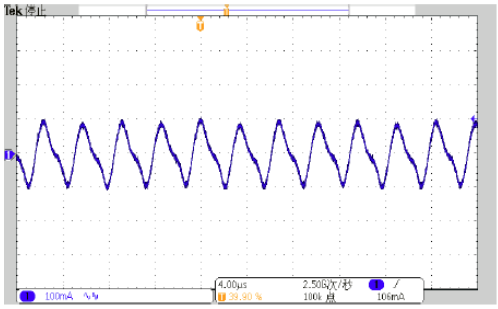
100mA/div

36VDC Output: Input Terminal Ripple Current



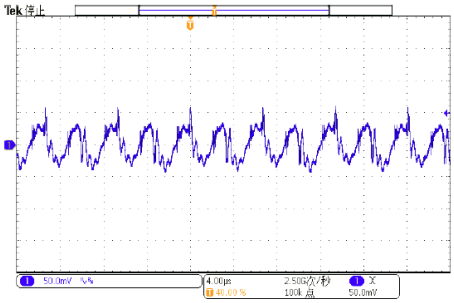
200mA/div

48VDC Output: Input Terminal Ripple Current



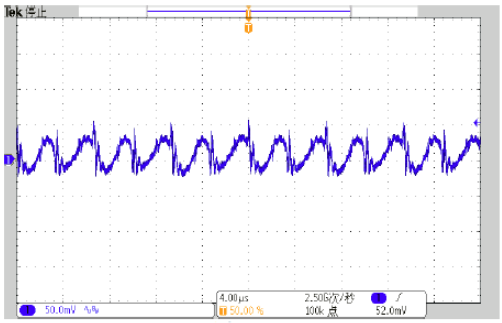
100mA/div

12VDC Output: Output Voltage Ripple



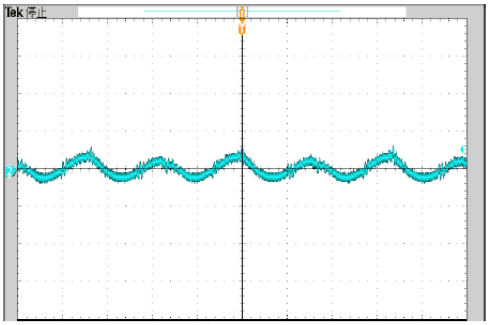
50mV/div

28VDC Output: Output Voltage Ripple



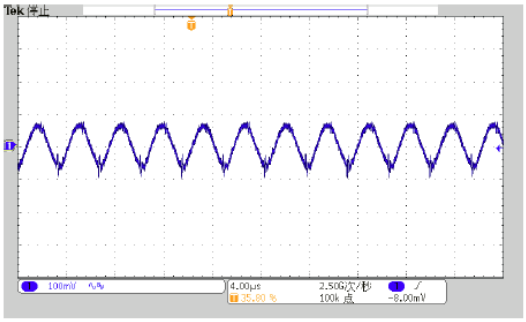
50mV/div

36VDC Output: Output Voltage Ripple



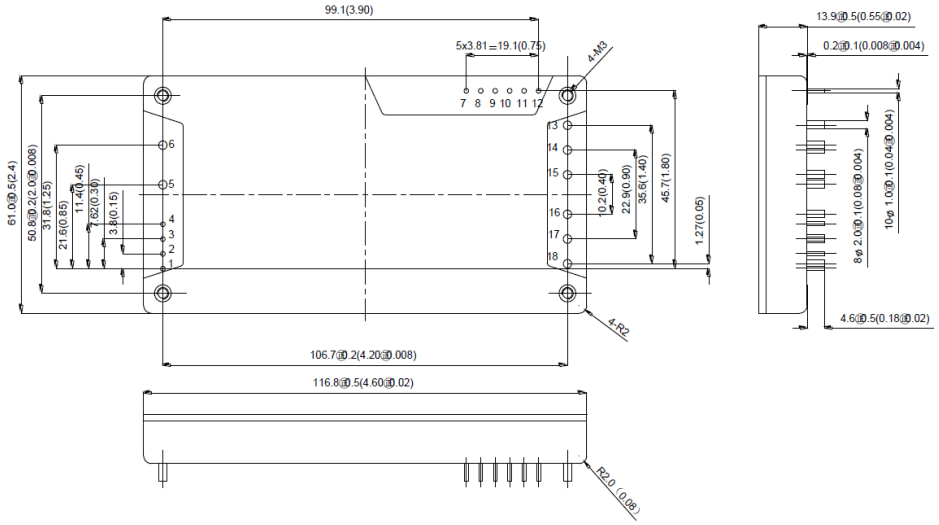
100mV/div

48VDC Output: Output Voltage Ripple



100mV/div

MECHANICAL DRAWINGS



Note:
1. Unit: mm (in)
2. Pins 1-4/7-12 diameters are 1.0mm (0.04in)
3. Other pin diameters are 2.0mm (0.08in)
4. Non-note tolerance: x.x±0.5mm (±0.02in), x.xx±0.25mm (±0.01in)

Pin Assignment

Pin	Symbol	Function
1	NC	No Connection
2	NC	No Connection
3	ON/OFF (+)	Positive Remote Control
4	ON/OFF (-)	Negative Remote Control
5	Vin (+)	Positive Input Voltage
6	Vin (-)	Negative Input Voltage
7	Vaux	Auxiliary Power (Reference to Vout (-))
8	Start_Sync	Startup Synchronization
9	Ishare	Current Share
10	Trim	Output Voltage Trim
11	S (+)	Positive Remote Sense
12	S (-)	Negative Remote Sense
13, 14, 15	Vout (-)	Negative Output Voltage
16, 17, 18	Vout (+)	Positive Output Voltage

PACKAGING, STORAGE & TRANSPORT

Packaging, Storage, & Transport Requirements

Packaging Requirements

- Packaging should be adequately protected during transport, no corrosion, degradation, or mechanical damage.
- Modules should be cleaned and dried
- Packaging and cushion layer materials should not produce electrostatic and should be resistant to corrosion
- Unless there are provisions in the contract, each unit packaging quantity should be determined by supplier.
- Shape and size of the inner package should be uniform and have minimum weight and minimum volume.
- Packaging labeling requirements

Storage Requirements

- Unused products should be placed in the box, the ambient temperature of warehouse should be -10~40ºC; relative humidity is less than 80%, dry, ventilated, non-corrosive gases.
- Crates from the ground should be more than 20cm, from the walls, heat, vent, window of at least 50cm.
- Under the conditions of this provision the storage period is 2 years, more than 2 years after it should be re-tested

Transport Requirements

- Crates should be strong during transport
- Outside of box should comply with relevant provisions of the national standard and there are “Handle with Care” & “Moistureproof” and other signs one boxes.
- Product boxes can be transported by any means of transport. Transportation should avoid direct contact with rain, snow, and mechanical shock.

APPLICATION NOTES

Typical Application Circuit

Power supply modules have internal filter, which can meet general application requirements. If you need a better power system, you can add an external filter network on the input circuit. Typical application circuit is shown in Fig. 1.

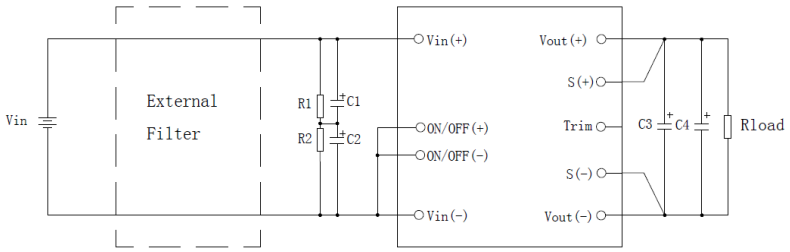


Fig. 1

Device recommended parameter values

No.	Device Specific Description
R1, R2	470KΩ, 1/2W
C1, C2	Electrolytic Capacitors 47μF/450V
C3	12VDC Output Model: Electrolytic capacitor of high frequency, low ESR, good temperature characteristics 2200μFx1/25V
	28VDC Output Model: Solid Capacitor or Polymer Capacitor 1500μF/50V
	36VDC Output Model: Electrolytic capacitor of high frequency, low ESR, good temperature characteristics 1000μFx1/50V
	48VDC Output Model: Electrolytic capacitor of high frequency, low ESR, good temperature characteristics 220μFx1/63V
C4	12VDC Output Model: Solid capacitors 680μFx6/16V
	36VDC Output Model: Solid Capacitors 68μFx8/50V
	48VDC Output Model: Solid Capacitors 56μFx8/63V

Note:

- When ambient temperature is below -25ºC, 4000μF solid capacitors need to be included for 12VDC output models (no more than 6 recommended), 500μF solid capacitors for 36VDC output models, & 450μF for 48VDC output models (no more than 8). When the output requires a larger capacitive load, electrolytic capacitors recommended (solid capacitors have low ESR, which will affect stability & reliability).
- When the ambient temperature is below -25ºC, and the input voltage rises fast (e.g. greater than 10VDC/μs), in order to prevent an input surge voltage that is too high and causes damage to the module, it is recommended to add at least on 2.2μF/1000VDC CBB capacitor and not less than 20μF capacitor (at 10Khz conditions, -55ºC) at the input, or add an additional anti-surge circuits. In practical applications, it is recommended to subject to actual test.
- When an EMI circuit is added, please match the input capacitance to prevent high surge at the input which causes damage to the module.
- There is no fuse inside the module. In order to improve security, please add a series fast-acting fuse at the module's input. Fuse connected to Vin (+) terminal, 10A fast-acting fuse recommended.
- Connect with module terminals in shortest way.
- Please confirm capacitors allowable ripple value.

Remote Switch

Remote control mode: Negative logic

Control Mode	ON/OFF Level		
	Low Level	NC	High Level
Negative Logic	ON	ON	OFF

Below is a simple ON/OFF connection figure

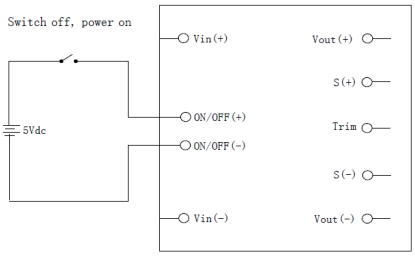


Fig. 2 Control Mode

Input Terminal Ripple Current

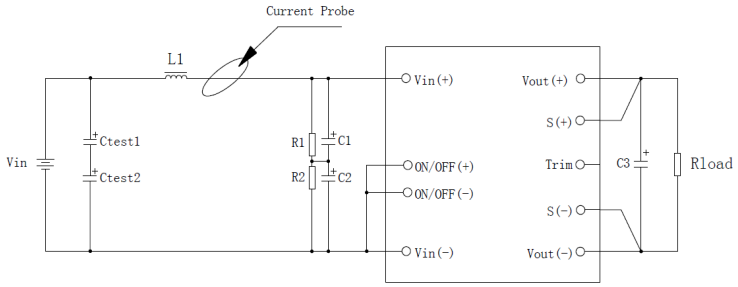


Fig. 3 Input Terminal Current Test

Note:

- 20MHz Bandwidth
- L1: 12μH/100KHz
- Ctest1, Ctest2: 470μF/450V, high-frequency low ESR electrolytic capacitor
- C1, C2: Tc=25ºC, 47μF/450V, high-frequency low ESR electroytic capacitor
- R1, R2 (28VDC Output Model)-470KΩ, 1/2W oxide film resistors
- C3 (28VDC Output Model): 1000μF/50V solid capacitor or polymer capacitor

Output Voltage Ripple and Noise

When the input voltage is rated value, the load is adjusted to full, then the input voltage change in full range. Measure method shown in figure 4.

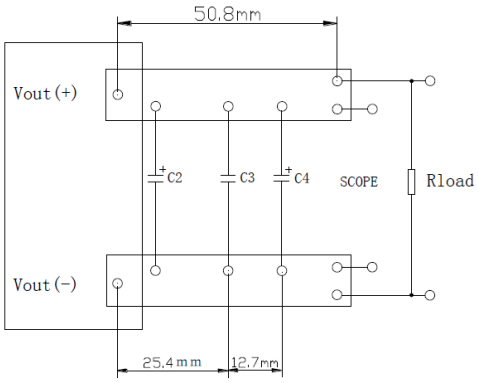


Fig. 4 Output Ripple and Noise Test

Note:

- 20MHz bandwidth
- C3: 12VDC Output Model: 4000μF/16V solid capacitor or polymer capacitor; 28VDC Output Model: 1000μF/50V solid capacitor or polymer capacitor; 36VDC Output Model: 470μFx1/50V(electrolytic capacitor) + 68μF x 50V (solid capacitor), 48VDC Output Model: 450μF/63V solid capacitors or polymer capacitors
- C4: 12VDC, 36VDC, & 48VDC Output Models: 1μF ceramic capacitor; 28VDC Output Model: 1μF/50V ceramic capacitor
- C5: 2VDC, 36VDC, & 48VDC Output Models: 10μF tantalum capacitor; 28VDC Output Model: 10μF/50V tantalum capacitor

Output Trim

Resistance is connected between the Trim and S (+) or the Trim and S (-), then the output voltage can be increased or decreased in the 10.8-13.2VDC range for 12VDC output models, 25.2-30.8VDC range for 28VDC output models, 32.4-39.6VDC range for 36VDC output models, and 43.2-52.8VDC range for 48VDC output models. When resistance is applied between the Trim and S (+), output voltage increases. When resistance is applied between the Trim and S (-), output voltage decreases. In the adjustment process, the resistance should be placed as close as possible to power module terminals; if it doesn't need this feature, trim should not be connected.

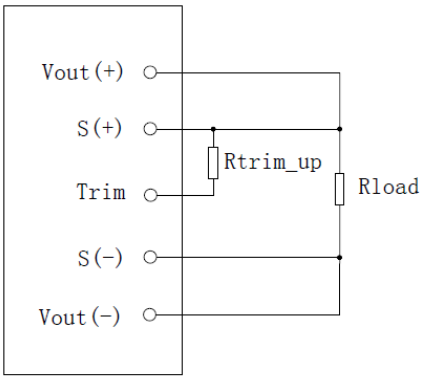


Fig. 5 Output Voltage Up-Regulation

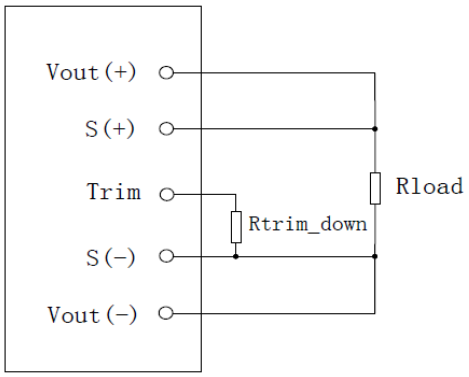


Fig. 6 Output Voltage Down-Regulation

Trim-Up Resistance Formula:

$$Rtrim\_up = \frac{Vout\_norm \times (100 + \Delta)}{1.225 \times \Delta} - \frac{100}{\Delta} - 2$$

Trim-Down Resistance Formula:

$$Rtrim\_down = \frac{100}{\Delta} - 2$$

Note:

- $$\Delta = \left| \frac{Vout - Vout\_norm}{Vout\_norm} \right| \times 100$$
- Vout: the adjusted output voltage
- Vout_norm: rated output voltage.
- The maximum output power cannot exceed the rated power
- The maximum output current cannot exceed the rated current
- This maximum output voltage can't exceed 13.2VDC for 12VDC output model, 30.8VDC for 28VDC output mode, 39.6VDC for 36VDC output model, and 52.8VDC for 48VDC output model; the input voltage should be lower than 450VDC; the recommended increase is only 5%.
- S (+) and S (-) terminal cannot be suspended. If you do not use the S (+) and S (-), shorts the S (+) to the output Vout (+), S (-) to Vout (-).
- Please adjust corresponding resistor slowly in working condition to adjust output voltage; for a quick adjustment, it is recommended after the shutdown.

Output Remote Sense

This power module has output remote sense. It can automatically correct for voltage drop on the output lead. See Fig. 7: the S (+), S (-) respectively connected to the load via twisted-pair. The voltage between those ends is the rated output voltage. If you do not use the S (+) and S (-), shorts the S (+) tc the output Vout (+), S (-) to Vout (-).

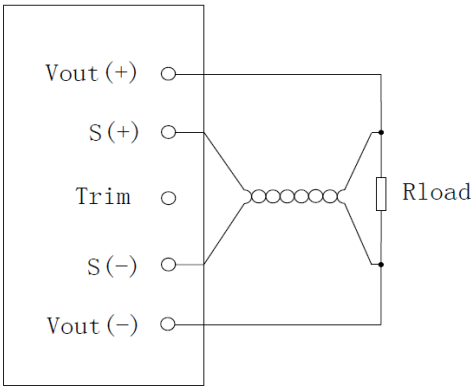


Fig. 7 Output Remote Compensation

Note:

- The maximum output voltage of the power module cannot exceed 110% of rated voltage.
- S (+), S (-) should be consistent with polarity of the output, otherwise the power module will go into protected status.
- Power module's maximum output power stays unchanged. If output voltage increases, output current should reduce accordingly.

Multiple Units in Parallel Feature

12VDC, 36VDC, & 48VDC Output Models

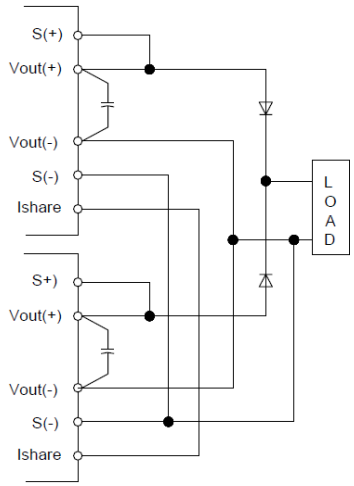


Fig. 8 Multiple Units in Parallel

28VDC Output Model

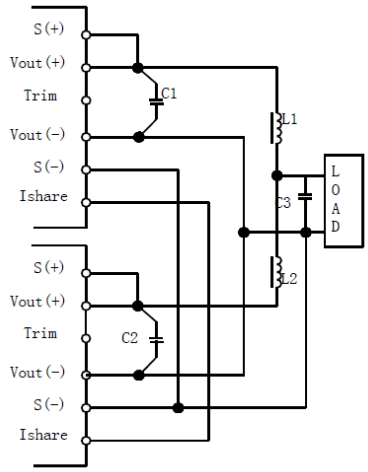


Fig. 9 Multiple Units in Parallel

N + 1 redundant parallel

N module requires N + 1 redundancy. Modules outputs required to be connected in parallel. Ishare pins of multiple units must be connected together, and note to avoid disturbances between cables. Voltage output terminal of each module connected in parallel through the isolation diode. Please note that to meet each module's output impedance symmetry before connecting. Isolated diode must meet current and voltage stress indices. Make sure that each module does not exceed the rated output power and rated output current at parallel application. It can support up to 10 modules in parallel (Fig. 8).

Note: Current Share in Parallel Error Formula Desicription

- n – the number of modules in parallel
- i – modules to calculate the current sharing sensitivity
- I1, I2…Ii….In (2≤n≤10) – Output current of each tested power module
- Ie – rated output current of each tested power module
- ΣI – sum of output current of n tested power modules
- nIe – sum of rated output current of n tested power modules

In parallel: Modules' outputs required to be connected in parallel. I share pins of multiple units must be connected together and note to avoid disturbances between cables. Output voltage terminal of each module are connected in parallel directly, please note that to meet each module output impedance symmetry before parallel connection. It can support up to 10 modules in parallel (Fig. 9).

Note: Current Share in Parallel Error Formula Desicription

- n – the number of modules in parallel
- i – modules to calculate the current sharing sensitivity
- I1, I2…Ii….In (2≤n≤10) – Output current of each tested power module
- Ie – rated output current of each tested power module
- ΣI – sum of output current of n tested power modules
- nIe – sum of rated outptut current of n tested power modules
- C1, C2 – The minimum outptu capacitance.
- L1, L2 ≥0.15uH
- C3 – an additional ceramic/aluminum electrolytic capacitors. If necessary to filter output ripple, C3≥1000uF is recommended

Output Over-Current and Short-Circuit Protection

When output is overload or short-circuited, if the output voltage is higher than the set voltage (approximately 6VDC for 12VDC & 28VDC models, approximately 28VDC for 36VDC output models, and 24VDC for 48VDC output models), power module goes into constant current mode. If the output voltage is lower than the set voltage (approximately 6VDC for 12VDC & 28VDC models, approximately 28VDC for 36VDC output models, and 24VDC for 48VDC output models), the power module will shut down for a certain period of time and then reboot.

Output Over-Voltage Protection

If the voltage across the output exceeds the output over voltage protection threshold, over-voltage protection circuit will run, power module's output will turn off, and enter the protection lock mode. No input or CNT remote can reboot it.

Over Temperature Protection

When aluminum PCB's (near the thermistor) temperature reached near 110ºC (typ) for 12VDC output models, 90ºC (typ) for 28VDC models, and 100ºC (typ) for 36VDC & 48VDC models, over-temperature protection circuit will start working; power module's output is turned off; when temperature returns to 100ºC (typ) for 12VDC models, 80ºC (typ) for 28VDC models, and 90ºC (typ) for 36VDC & 48VDC models, the power will automatically restart.

USER INFORMATION

Please note these warnings and cautions before using, improper operation may cause permanent damage to the power module or cause a fire. Make sure you have read the warnings and cautions before using the product.

Warning:

- When product is energized, keep hands and face away from the product to avoid accidental injury.
- Do not transform or strip product, as this may cause electric shock. If the user processes of transforms it, our company is not responsible for it.
- There are some areas of high temperature and pressure inside the product and you can get an electric shock or burned if touched. Do not touch the internal components.
- When product is energized, do not touch the case to avoid possible burns.

Cautions:

- Confirm the product's input/output connected with signal terminal correct in accordance with product instructions; when wiring it, turn off input.
- Add a 10A quick fuse or other over-current protection devices to the power module input terminals.
- Product diagrams and the parameters are for reference only. Please confirm the circuit and the validity of the parameters before completing circuit design.
- Please use power within scope of technical parameters. If it exceeds the range, it may cause permanent damage.
- Electrical hazards caused by input, output must be considered when using. Make sure the end user will not touch the product. Terminal device manufacturers must design appropriate protection program to ensure that no worker or tools will be in danger from accidentally touching power terminal.
- Our company has final power of interpretation of product description. Without permission, it cannot be copied or reproduced in any way.

COMPANY INFORMATION

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

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