CB CE UL

Size: 4.60in x 2.40in x 0.5in
(116.8mm x 61mm x 12.7mm)

FEATURES

- Operating Input Voltage Range of 90~290VAC or 130~400VDC
- Digital Control, Built-In PFC
- Built-In Soft Start Circuit
- PMBus 1.2 Communication Protocol
- Full Brick Size with Base Plate
- Current Sharing (N≤6)
- Over Current, Short Circuit, Over Voltage and Over Temperature Protection
- Negative Logic
- Remote ON/OFF and SENSE
- Module can be Paralleled
- RoHS6 Compliant
- CB, CE, UL Approvals

APPLICATIONS

- Servers/Storage Equipment
- Routers/Switches
- Telecommunications Equipment
- Enterprise Networks

DESCRIPTION

The PSB500 series of AC/DC power modules offers up to 500 watts of output power in a 4.60” x 2.40” x 0.5” full brick package. This series consists of single outputs models with an operating input voltage range of 90~290VAC or 130~400VDC. Each model in this series has digital control, built-in PFC, and remote ON/OFF and SENSE. Each model has over current, short circuit, over voltage, and over temperature protection, is RoHS compliant, and has CB, CE, and UL approvals. Please contact factory for order details.

MODEL SELECTION TABLE

Model Number	Input Voltage Range	Output Voltage	Output Current	Efficiency	Output Power	Ripple & Noise
PSB12S-500	90~290VAC (130~400VDC)	12VDC	0~42A	91% Max.	500W	<1%Vo
PSB28S-500		28VDC	0~18A	92% Max.		
PSB48S-500		48VDC	0~10.5A	92.8% Max.		

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current 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	AC			90		290	VAC
	DC			130		400	VDC
Rated Input Voltage				100	110/220	240	VAC
Absolute Maximum Input Voltage						315	VAC
Frequency				47	50/60	63	Hz
Input Current	Vin=90VAC, 100% Load					8	A
Inrush Current	@110VAC					20	A
	@220VAC					40	
Power Factor	Vin=110/220VAC, 25ºC, 100% Load			0.95			
THD	Vin=110/220VAC, 25ºC, Pout=500W					10	%
Input Undervoltage Protection	Protection Threshold			74		85	VAC
	Recovery Threshold					90	
	Hysteresis			5			
Input Overvoltage Protection	Protection Threshold			295		310	VAC
	Recovery Threshold			290			
	Hysteresis			5			
Input Voltage Precision	25ºC, Vin=90~290VAC			-10		10	VAC
PROTECTION							
Short Circuit Protection	Module is not damaged even with long-term short circuits			Self-Recovery			
Over Current Protection	Self-Recovery			105		150	%
Over Voltage Protection	Latch		12VDC Model		15.5		V
			28VDC Model		37		
			48VDC Model		59.5		
Over Temperature Protection(6)	Self-Recovery	12VDC & 48VDC Models	Baseplate	90			ºC
			Hysteresis	5			
		28VDC Models	Baseplate	95			
			Hysteresis	5			
REMOTE ON/OFF CONTROL							
Negative Logic	Low Level			0		0.8	V
	High Level			2.4		3.5	

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

SPECIFICATION	TEST CONDITIONS	Min	Typ	Max	Unit
OUTPUT SPECIFICATIONS					
Output Voltage		See Table			
Voltage Initial Setting	PSB12S-500	11.88		12.12	V
	PSB28S-500	27.72		28.28	V
	PSB48S-500	47.52		48.48	V
Line Regulation	Vin=90-290VAC, Max. Output Power		±0.3		%Vo
Load Regulation	Vin=220VAC, 0-Max. Output Power		±0.8		%Vo
External Load Capacitance	12VDC Model: Output capacitor: low ESR aluminum capacitor (recommended product model: APXE160ARA221MHA0G NCC)	220 x 6		10000	µF
	12VDC Model: Boost voltage bulk capacitor: long life aluminum capacitor (recommended product model: ELXS451VSN391MR50S NCC)	390		390 x 2	µF
	24VDC & 48VDC Models: Output Capacitor: low ESR aluminum capacitor (recommended product model: EKY-630ELL471MK25S NCC)	470 x 3		470 x 11	µF
	24VDC & 48VDC Models: Boost volta+ge bulk capacitor: long life aluminum capacitor (recommended product model: ELXS451VSN391MR50S NCC)	390		390 x 2	µF
Voltage Adjustment Range (Trim)(1)	PSB12S-500	9.6		13.2	V
	PSB28S-500	20		32	V
	PSB48S-500	36		55	V
Regulated Voltage Precision	Full Range of V_{IN} V_{OUT} and T_A	-3		+3	%
Output Power		See Table			
No Load Power	110VAC, 25ºC			10	W
	220VAC, 25ºC			12	W
Output Current(2)		See Table			
Ripple & Noise (Pk-Pk, 20MHZ BW)	12VDC Model: Ambient Temp: ≥-5ºC		100	240	mV
	12VDC Model: Ambient Temp: -40 ~ -5ºC			240	mV
	28VDC Model: Ambient Temp: -5 ~ 85ºC			320	mV
	28VDC Model: Ambient Temp: -25 ~ -5ºC			640	mV
	28VDC Model: Ambient Temp: -40 ~ -25ºC			640	mV
	48VDC Model: Ambient Temp: -5 ~ 85ºC			550	mV
	48VDC Model: Ambient Temp: -25 ~ 5ºC			800	mV
	48VDC Model: Ambient Temp: -40 ~ -25ºC			800	mV
Standby Power	110/220VAC, 25ºC			5	W
Hold-Up Time(3)	Bulk Capacitor: 390µF, Ambient Temp: 25ºC, 100% Load from input power outage to 90% Vout	10			mS
Output Voltage Delay Time	From V_{IN} connection to 10% V_{OUT}			8	S
Output Voltage Rise Time	From 10% V_{OUT} to 90% V_{OUT}, Ambient Temp: 25ºC			100	mS
	From 10% V_{OUT} to 90% V_{OUT}, Ambient Temp: -40 ~ -25ºC(4)			400	mS
Output Voltage Overshoot	Full Range of V_{IN} I_{OUT} and Ambient Temp			5	%Vnom
Overshoot Amplitude Recovery Time	V_{IN}=110/2230VAC; Current Change Rate: 0.1A/µS Load: 25%-50%-25%; 50%-75%-50%			5	%
				250	µS
Current Sharing Accuracy(5)		-10		+10	%
Remote Sense	+S			5	%Vout
	-S			0.5	V
CB	Current sharing pin that needs to be connected to –S	0		3.3	V
TRIM(6)	28VDC & 48VDC	0		2.5	V
Absolute Maximum Voltage to SCL/SDA/ADDR/CB				3.6	V
Temperature Coefficient	Full Range of V_{IN} I_{OUT} and T_A	-0.02		0.02	%/ºC
PROTECTION					
Short Circuit Protection	Module is not damaged even with long-term short circuits	Self-Recovery			
Over Current Protection	Self-Recovery	105		150	%
Over Voltage Protection	Latch: 12VDC Model		15.5		V
	Latch: 28VDC Model		37		V
	Latch: 48VDC Model		59.5		V
Over Temperature Protection(7)	Self-Recovery: 12VDC & 48VDC Models: Baseplate	90			ºC
	Self-Recovery: 12VDC & 48VDC Models: Hysteresis	5			ºC
	Self-Recovery: 28VDC Models: Baseplate	95			ºC
	Self-Recovery: 28VDC Models: Hysteresis	5			ºC

SPECIFICATIONS

All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted.
We reserve the right to change specifications based on technological advances.

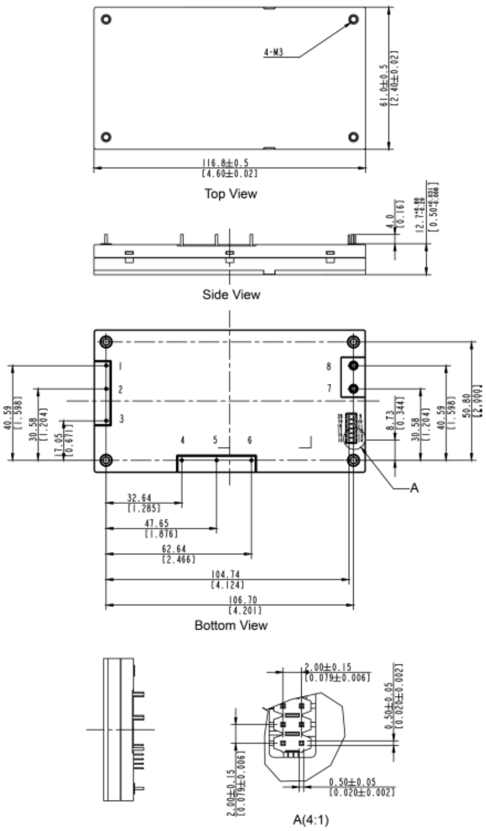
SPECIFICATION	TEST CONDITIONS			Min	Typ	Max	Unit
ENVIRONMENTAL SPECIFICATIONS							
Operating Temperature				-40		85	ºC
Storage Temperature				-55		125	ºC
Altitude[8]				0		5000	m
Baseplate Temperature	Conduction Cooled			-40		90	ºC
Operating and Storage Humidity	Non-Condensing			10		95	%RH
MTBF	Telcordia SR332 Method 1 Case 3, Normal Input/Rated Output, 80% Load, Baseplate Temp: 25ºC				1,200,000		Hours
GENERAL SPECIFICATIONS							
Efficiency	12VDC Model	100% Load	@110VAC, 42A, 25ºC	87	88		%
			@220VAC, 42A, 25ºC	89.5	91		
		50% Load	@110VAC, 21A, 25ºC	87	88		
			@220VAC, 21A, 25ºC	89	91		
	28VDC Model	100% Load	@110VAC, 18A, 25ºC	88	89		
			@220VAC, 18A, 25ºC	91	92		
		50% Load	@110VAC, 9A, 25ºC	88	89		
			@220VAC, 9A, 25ºC	90	92		
	48VDC Model	100% Load	@110VAC, 10.5A, 25ºC	87	90.2		
			@220VAC, 10.5A, 25ºC	90	92.8		
		50% Load	@110VAC, 5.25A, 25ºC	87	9.1		
			@220VAC, 5.25A, 25ºC	90	92.1		
AUX	Auxiliary power output. Its output current is less than 20mA			10		14	V
Impulse Current				DM/CM:5kA			
Insulation Characteristics	Reinforced Insulation	Input to Output Insulation Voltage				4242	VDC
		Input to Baseplate Insulation Voltage				3535	
		Output to Baseplate Insulation Voltage				707	
	Insulation Resistance	Input to Output Resistance		10			MΩ
		Input to Baseplate Resistance		10			
		Output to Baseplate Resistance		10			
PMBus Communication				Input Voltage/Power; Input Fault Alarm; Output Voltage; Output OVP/OCP Alarm; Module Information Base Plate Temperature; Software Switch Module; OTP Alarm			
Absolute Maximum Number of Models for Parallel Operation						2	PCS
PHYSICAL SPECIFICATIONS							
Weight				6.70oz (190g)			
Dimensions (L x W x H)				4.60in x 2.40in x 0.5in (116.8mm x 61mm x 12.7mm)			
SAFETY CHARACTERISTICS							
Safety Approvals	All Models	UL60950-1, EN6950-1, IEC 60950-1 TUV, CE, & UL					
	28VDC & 48VDC Models	C22.2 No. 60950-1					
Surge	DC/CM: 6kV						

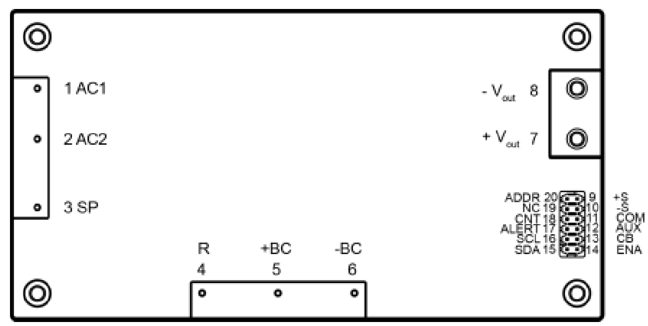
NOTES

1. The output voltage can be adjusted by 12C or the Trim pin. Preferentially use the Trim pin for output voltage adjustment.
2. Oscilloscope Bandwidth: 20MHz; Ripple and Noise depends on the environment temperature and external filter circuit. Reference technical manual.
3. Output Capacitor of 12VDC Models: 220µF x 6
   Output Capacitor of 28VDC & 48VDC Models: 470µF x 3
4. When the temperature is below -25ºC, there is no requirement on the output voltage rise waveform.
5. The output power of each module must be greater than 200W. The voltage difference between modules connected in parallel should be less than 5%
6. Needs to be connected to -S if output voltage adjustment is required.
7. The over temperature protection threshold is obtained by measuring the temperature of the middle of the baseplate.
8. Certified to 4000m

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

MECHANICAL DRAWINGS





NOTES:
1. All dimensions: in mm [in].
Tolerances: x.x±0.5mm [x.xx±0.02in], x.xx±0.25mm [x.xxx±0.010in] unless otherwise specified.
2. Pin 1-6: 1.00±0.05mm [0.039±0.001in.]
3. Pin 7-8: 2.00±0.05mm [0.079±0.001in]

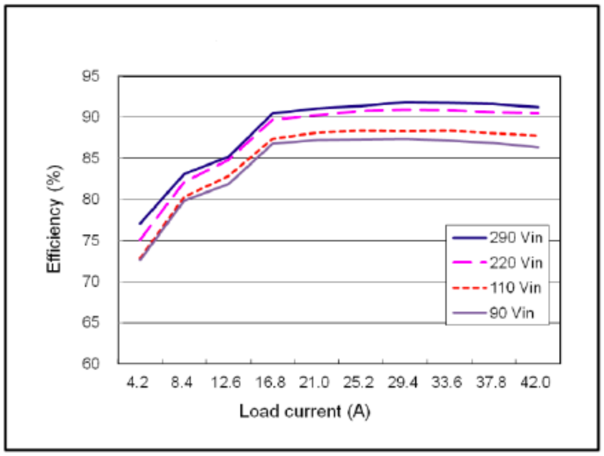
PIN DEFINITION

Pin Number	Name		Function
1	AC1		AC Input
2	AC2		
3	SP		Surge Protection
4	R		External Resistor for Inrush Current Protection
5	+BC		Boost Output Voltage (+)
6	-BC		Boost Output Voltage (-)
7	+VOUT		+DC Output
8	-VOUT		-DC Output
9	+S		Remote Sense (+)
10	-S		Remote Sense (-)
11	COM		Common Ground
12	AUX		Auxiliary Power Supply (12V0.2A, to the *COM*)
13	CB		Current Balance for Parallel Operation
14	ENA		Enable signal or AC loss signal (OC), Function reuse: 1. Output voltage OK indicating pin, when output voltage exceeds a threshold, the pin is in the state of low resistance 2. AC input OK indicating pin, when the AC Vin is powered off, the pin is in a high impedance state
15	SDA		PMBus Serial Data Line
16	SCL		PMBus Serial Clock Line
17	ALERT		PMBus Alert
18	CNT		ON/OFF Control (Output Side) (Negative Logic)
19	12VDC	NC	-
	28VDC & 48VDC	TRIM	Adjustment of Output Voltage
20	ADDR		Module Address (An External Resistor to the *COM*)

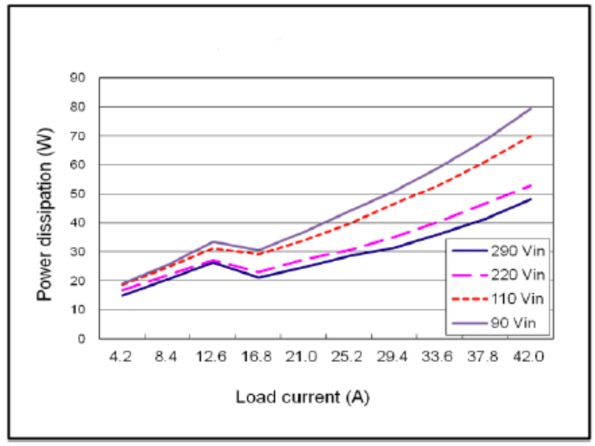
CHARACTERISTIC CURVES

Conditions: Ambient Temp: 25ºC unless otherwise specified

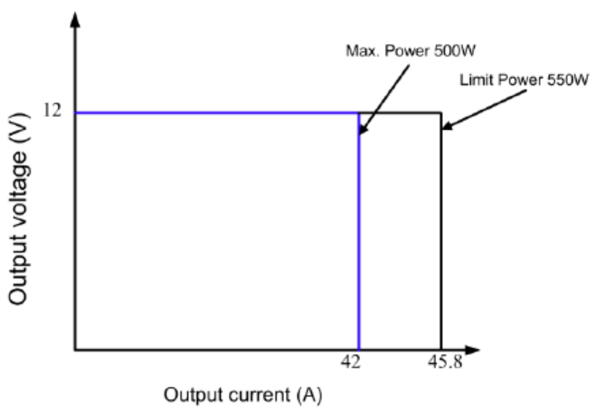
12VDC Model Efficiency



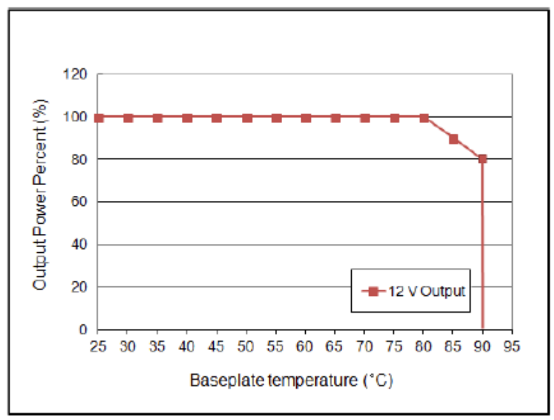
12VDC Model Power Dissipation



12VDC Model Output Voltage vs. Output Current

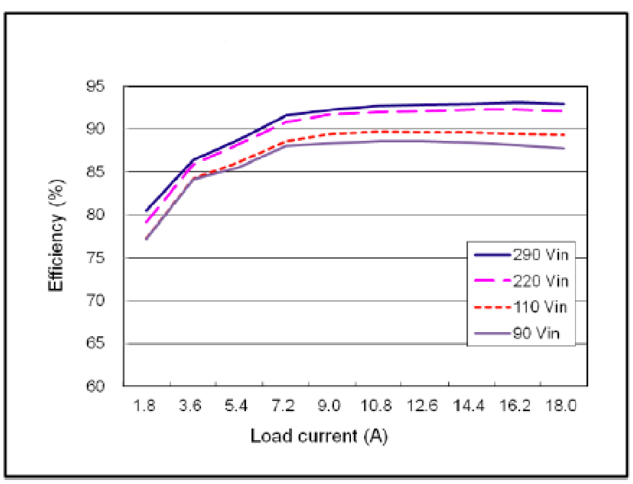


12VDC Model Thermal Derating Curve

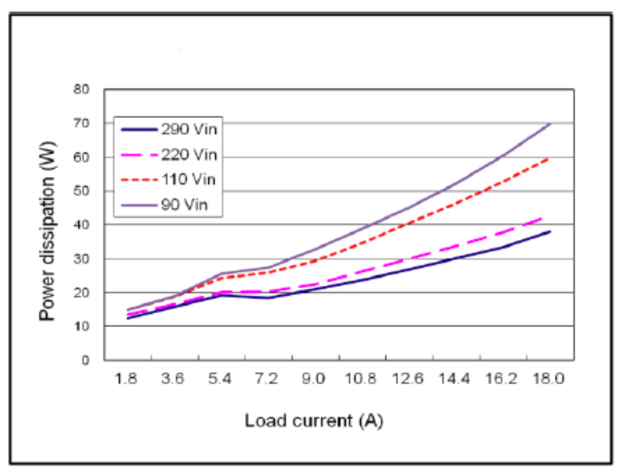


Vin=110/220V, Ambient Temperature=85ºC

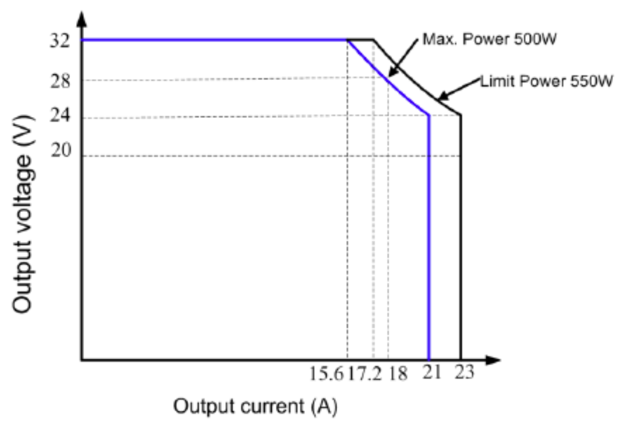
28VDC Model Efficiency



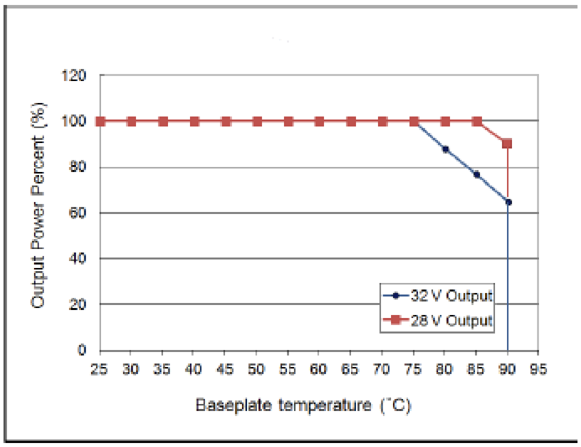
28VDC Model Power Dissipation



28VDC Model Output Voltage vs. Output Current

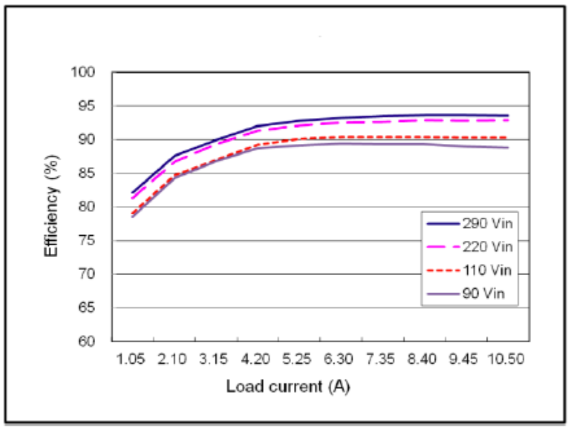


28VDC Model Thermal Derating Curve

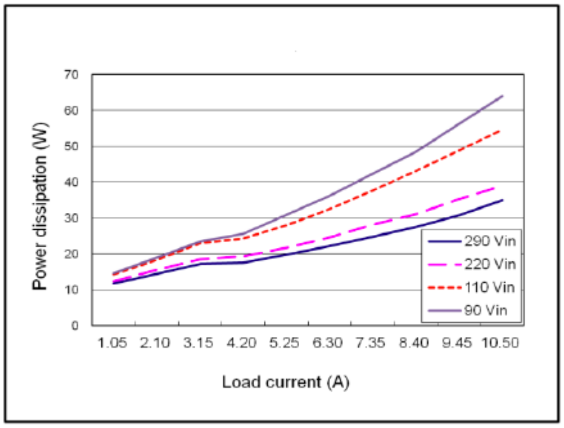


Vin=110/220V, Ambient Temperature=85ºC

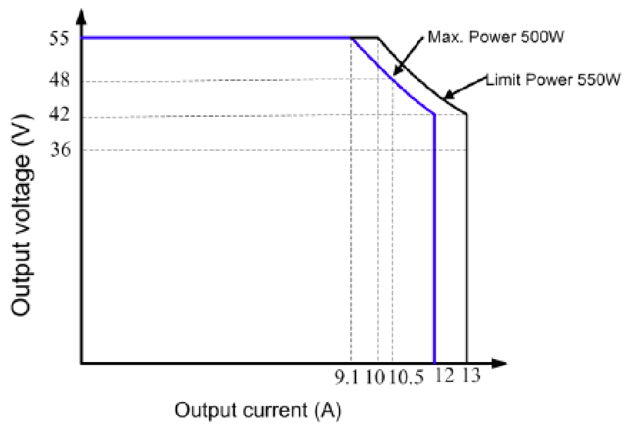
48VDC Model Efficiency



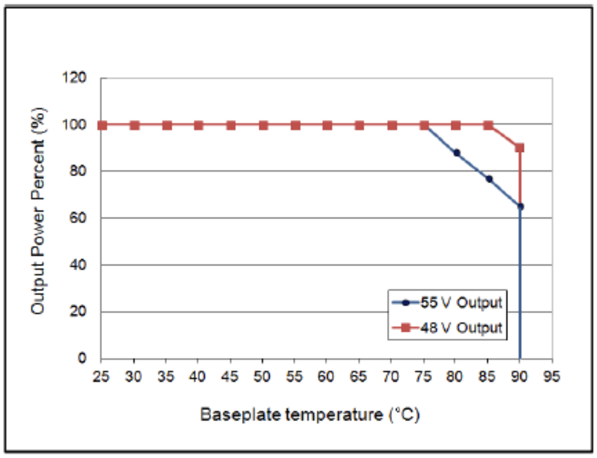
48VDC Model Power Dissipation



48VDC Model Output Voltage vs. Output Current



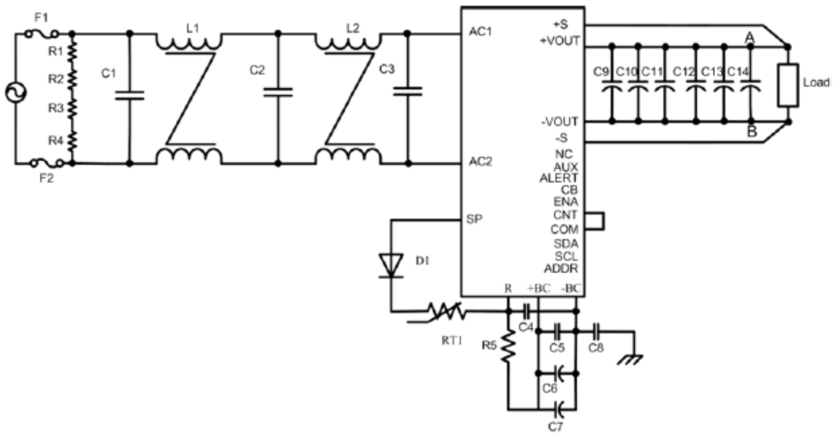
48VDC Model Thermal Derating Curve



Vin=110/220V, Ambient Temperature=85ºC

TYPICAL WAVEFORMS

12VDC Models

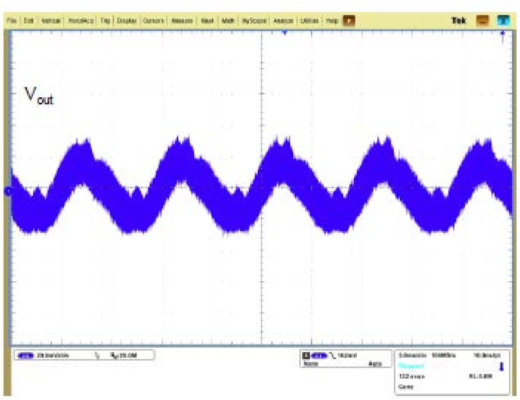


Test Setup Diagram

F1, F2: 15A, 250VAC
C1, C3: The 1µF/275VAC film capacitor is recommended
C2: The 0.68µF/275VAC film capacitor is recommended
C4, C5: The 1.5µF/450V film capacitor is recommended
C6, C7: The 390µF/450V long life aluminum electrolytic capacitor is recommended.
C8: The 2200pF capacitor is recommended
C9, C10, C11, C12, C13, C14: The 220µF/16V low ESR aluminum electrolytic capacitor is recommended
L1, L2: 6mH
R1, R2, R3, R4: 100kΩ/0.25 W resistor
R5: Cement resistor 75Ω/5W
RT1: Negative temperature coefficient (NTC) resistor 1Ω
D1: 1kV/3A

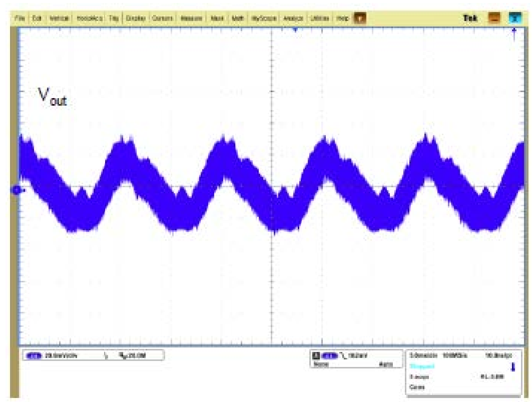
NOTE: Points A and B, which are used for testing the output voltage ripple, must be 25mm (0.98in) away from the Vout (+) pin and the Vout (-) pin, respectively.

12VDC Model Output Voltage Ripple



For points A and B in the test set-up diagram.
Vin=110VAC, Vout=12V, Iout=42A

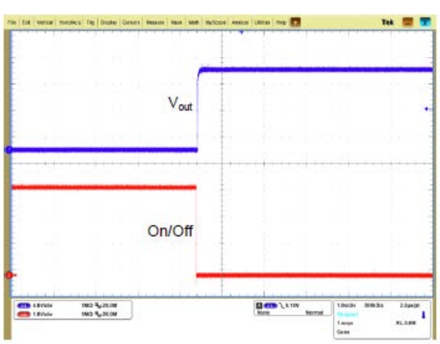
12VDC Output Voltage Ripple



For points A and B in the test set-up diagram
Vin=220VAC, Vout=12V, Iout=42A

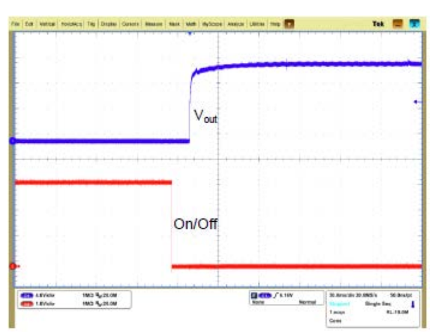
Conditions: Ambient Temp.=25ºC unless otherwise specified

12VDC Model Startup from On/Off



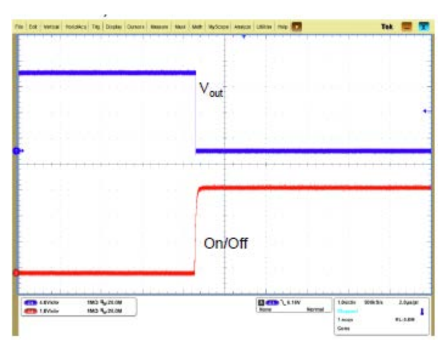
Vin=110VAC, 100% load

12VDC Model Startup from On/Off



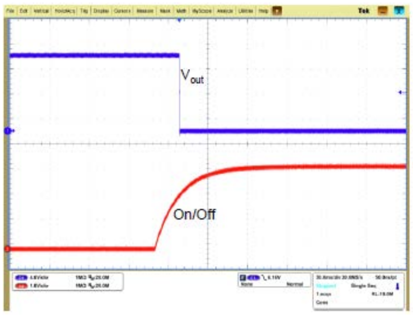
Vin=110VAC, 100% load

12VDC Model Shutdown from On/Off



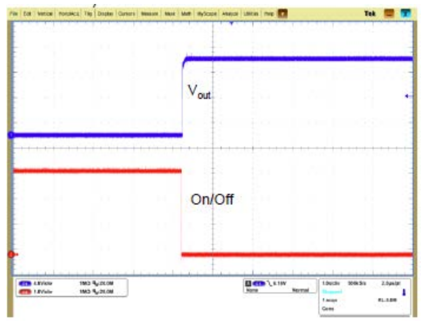
Vin=110VAC, 100% Load

12VDC Model Shutdown from On/Off



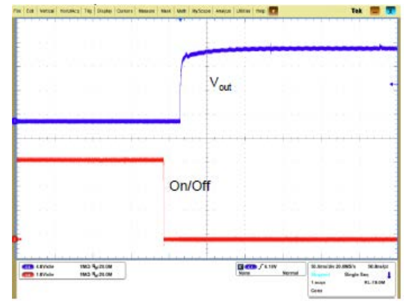
Vin=110VAC, 100% Load

12VDC Model Startup from On/Off



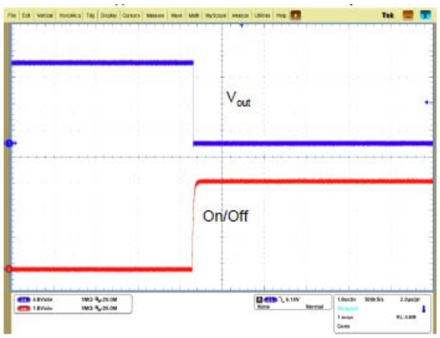
Vin=220VAC, 100% Load

12VDC Model Startup from On/Off



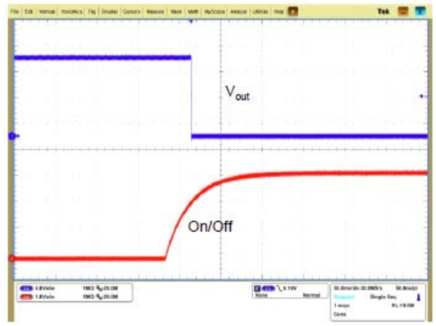
Vin=220VAC, 100% Load

12VDC Model Shutdown from On/Off



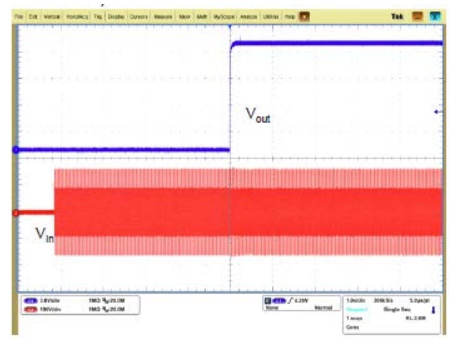
Vin=220VAC, 100% Load

12VDC Model Shutdown from On/Off



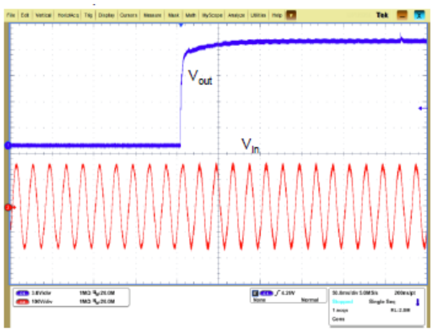
Vin=220VAC, 100% Load

12VDC Model Startup by Power-On



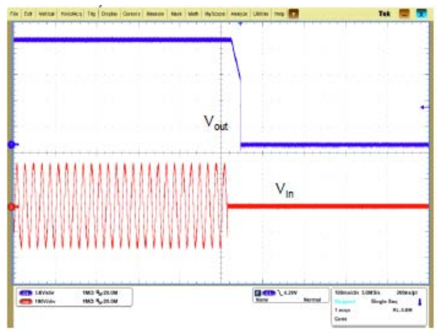
Vin=110VAC, 100% Load

12VDC Model Startup by Power-On



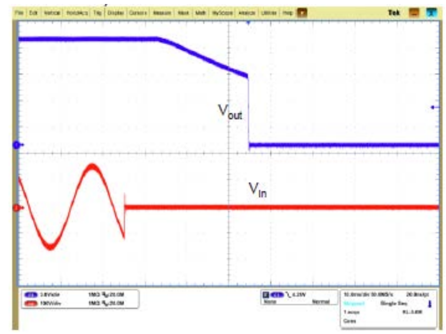
Vin=110VAC, 100% Load

12VDC Model Shutdown by Power-Off



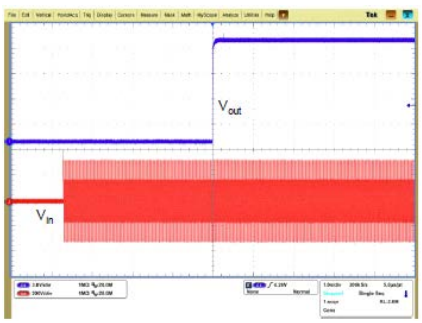
Vin=110VAC, 100% Load

12VDC Model Shutdown by Power-Off



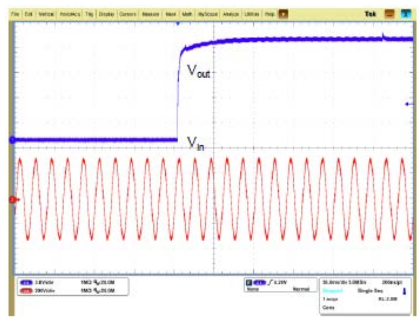
Vin=110VAC, 100% Load

12VDC Model Startup by Power-On



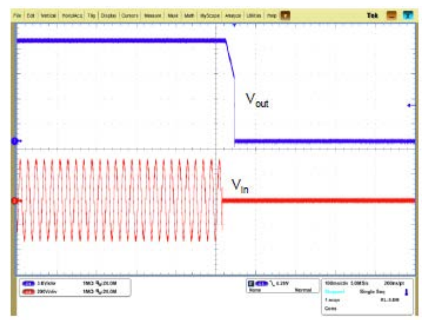
Vin=220VAC, 100%

12VDC Model Startup by Power-On



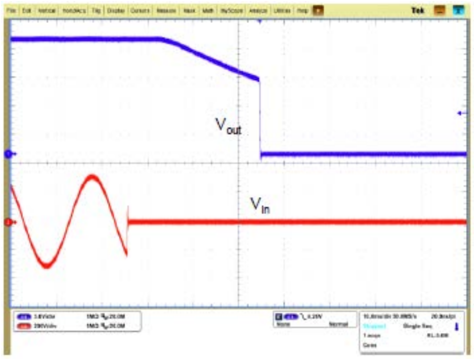
Vin= 220VAC, 100% Load

12VDC Model Shutdown by Power Off



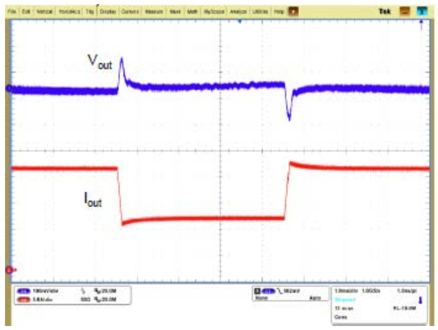
Vin=220VAC, 100% Load

12VDC Model Shutdown by Power-Off



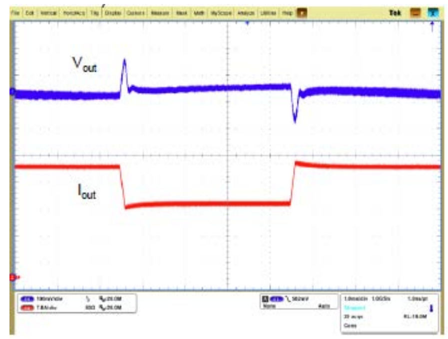
Vin=220VAC, 100% Load

12VDC Model Output Voltage Dynamic Response



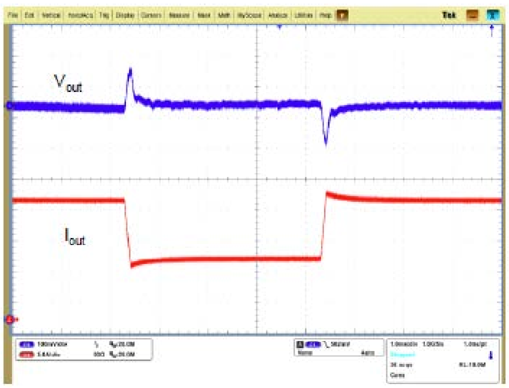
Vin=110VAC, load: 50%-25%-50% di/dt=0.1A/µs

12VDC Model Output Voltage Dynamic Response



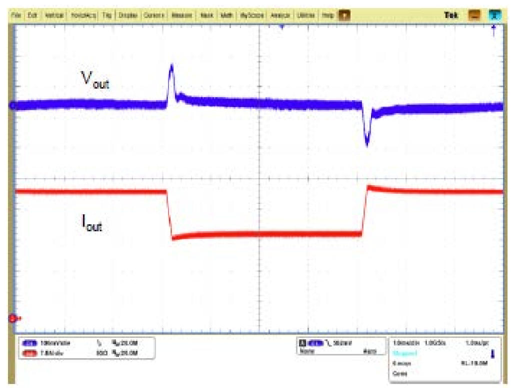
Vin=110VAC, load: 75%-50%-75% di/dt=0.1A/µs

12VDC Model Output Voltage Dynamic Response



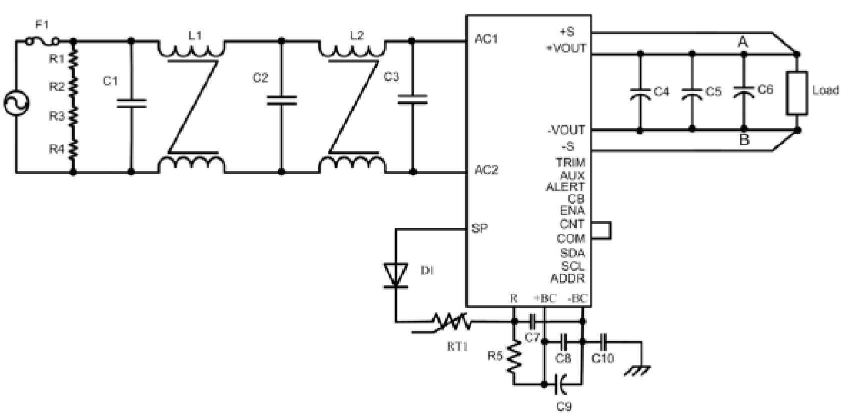
Vin=220VAC, load: 50%-25%-50% di/dt=0.1A/µs

12VDC Output Voltage Dynamic Response



Vin=220VAC, load: 75%-50%-75% di/dt=0.1A/µs

28VDC Model

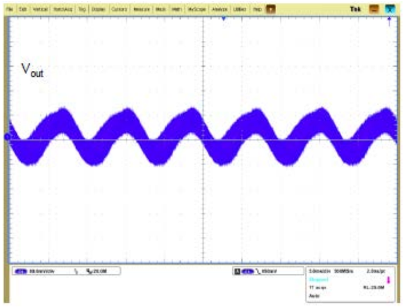


Test Setup Diagram

F1: 15A, 250VAC
C1, C3: The 1µF/275VAC film capacitor is recommended
C2: The 0.68µF/275VAC film capacitor is recommended
C4, C5, C6: The 470µF/63V low ESR aluminum electrolytic capacitor is recommended
C7, C8: The 1.5µF/56V film capacitor is recommended.
C8: The 2200pF capacitor is recommended
C9: The 390µF/450V long life (5000h) aluminum electrolytic capacitor is recommended
C10: The 2200pF capacitor is recommended
L1, L2: 3.5 mH
R1, R2, R3, R4: 100kΩ/0.25 W resistor
R5: Cement resistor 75Ω/5W
RT1: Negative temperature coefficient (NTC) resistor 1Ω
D1: 1kV/3A

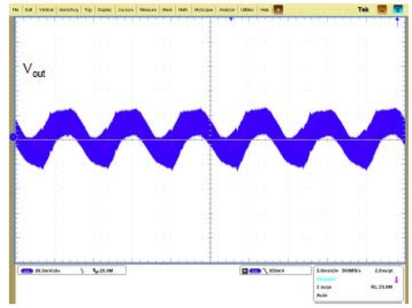
NOTE: Points A and B, which are used for testing the output voltage ripple, must be 25mm (0.98in) away from the Vout (+) pin and the Vout (-) pin, respectively.

28VDC Model Output Voltage Ripple



For points A and B in the test set-up diagram.
Vin=110VAC, Vout=28V, Iout=18A

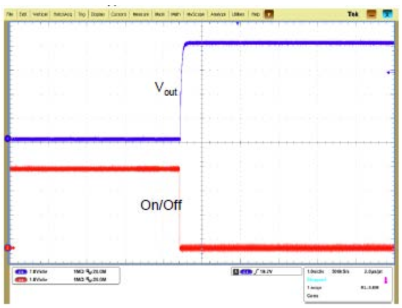
28VDC Output Voltage Ripple



For points A and B in the test set-up diagram
Vin=220VAC, Vout=28V, Iout=18A

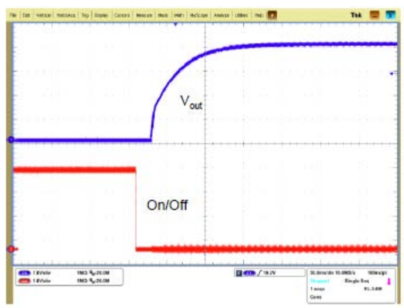
Conditions: Ambient Temp.=25ºC unless otherwise specified

28VDC Model Startup from On/Off



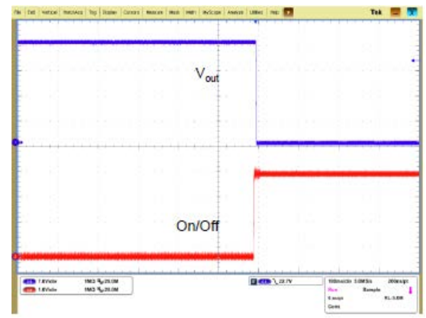
Vin=110VAC, 100% load

28VDC Model Startup from On/Off



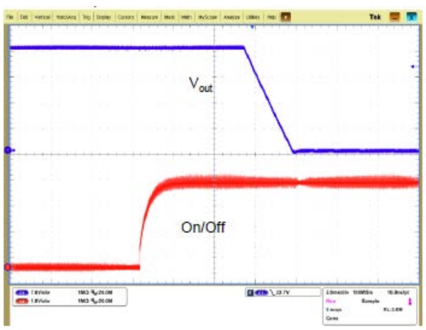
Vin=110VAC, 100% load

28VDC Model Shutdown from On/Off



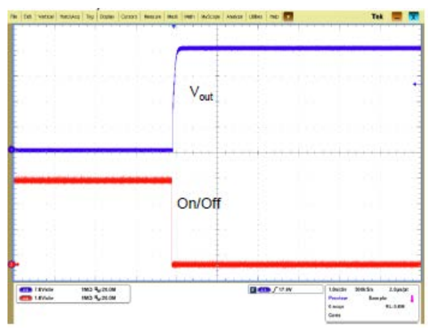
Vin=110VAC, 100% Load

28VDC Model Shutdown from On/Off



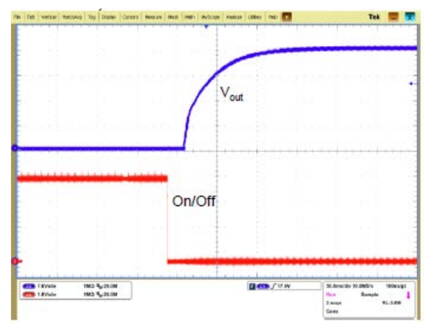
Vin=110VAC, 100% Load

28VDC Model Startup from On/Off



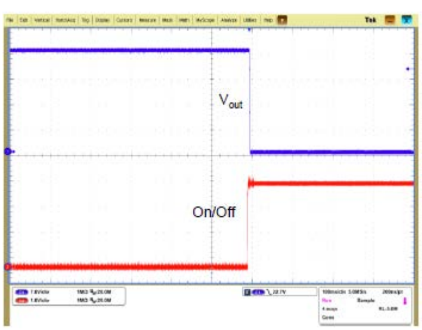
Vin=220VAC, 100% Load

28VDC Model Startup from On/Off



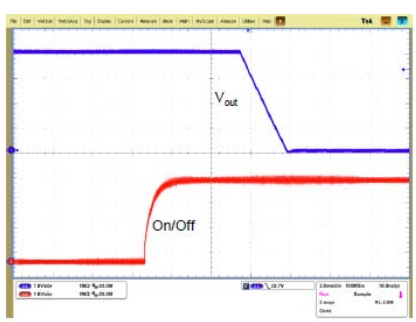
Vin=220VAC, 100% Load

28VDC Model Shutdown from On/Off



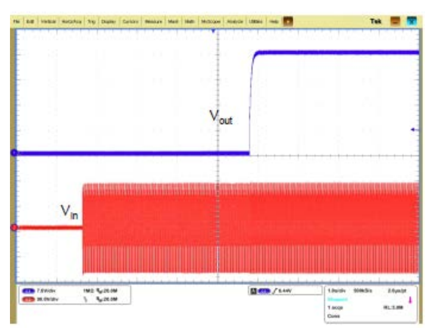
Vin=220VAC, 100% Load

28VDC Model Shutdown from On/Off



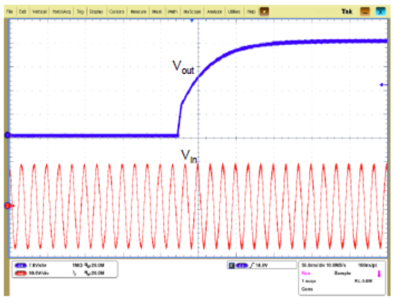
Vin=220VAC, 100% Load

28VDC Model Startup by Power-On



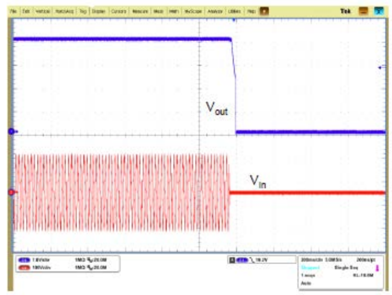
Vin=110VAC, 100% Load

28VDC Model Startup by Power-On



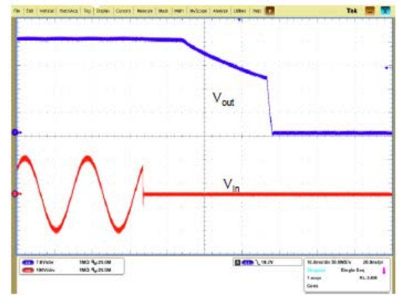
Vin=110VAC, 100% Load

28VDC Model Shutdown by Power-Off



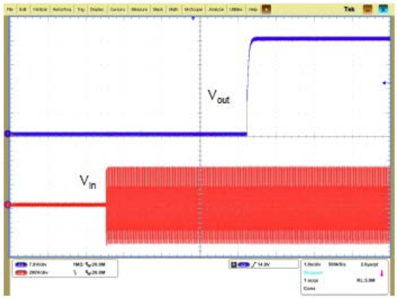
Vin=110VAC, 100% Load

28VDC Model Shutdown by Power-Off



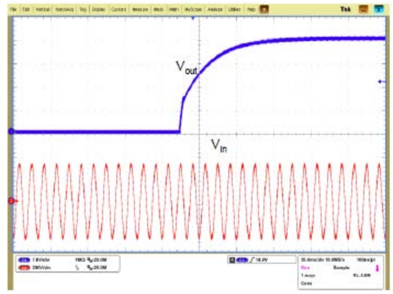
Vin=110VAC, 100% Load

28VDC Model Startup by Power-On



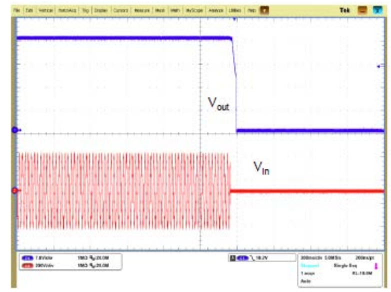
Vin=220VAC, 100%

28VDC Model Startup by Power-On



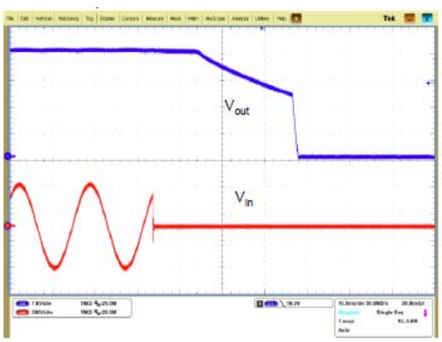
Vin= 220VAC, 100% Load

28VDC Model Shutdown by Power Off



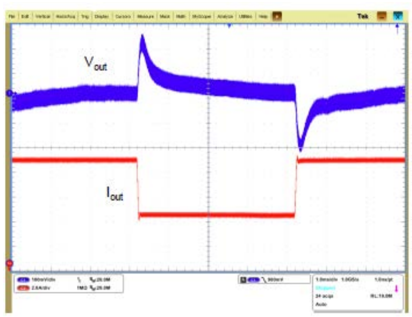
Vin=220VAC, 100% Load

28VDC Model Shutdown by Power-Off



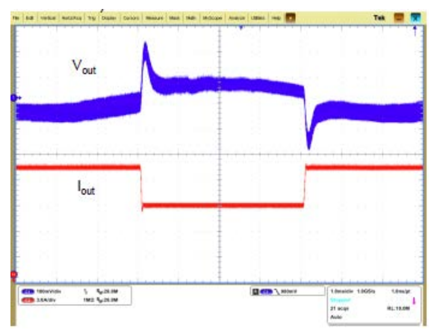
Vin=220VAC, 100% Load

28VDC Model Output Voltage Dynamic Response



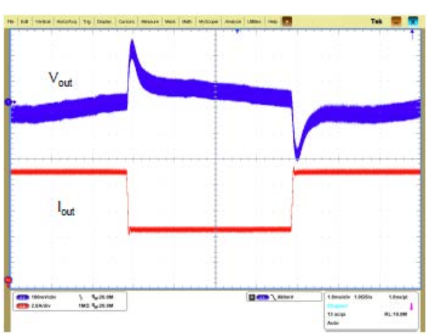
Vin=110VAC, load: 50%-25%-50%
di/dt=0.1A/µs

28VDC Model Output Voltage Dynamic Response



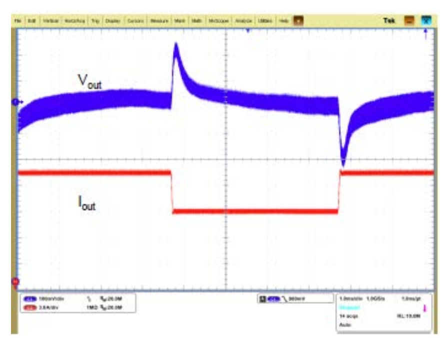
Vin=110VAC, load: 75%-50%-75%
di/dt=0.1A/µs

28VDC Model Output Voltage Dynamic Response



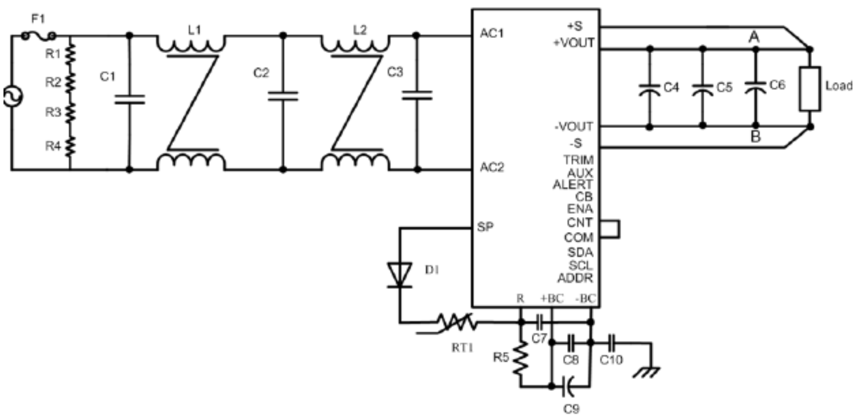
Vin=220VAC, load: 50%-25%-50% di/dt=0.1A/µs

28VDC Output Voltage Dynamic Response



Vin=220VAC, load: 75%-50%-75% di/dt=0.1A/µs

48VDC Model

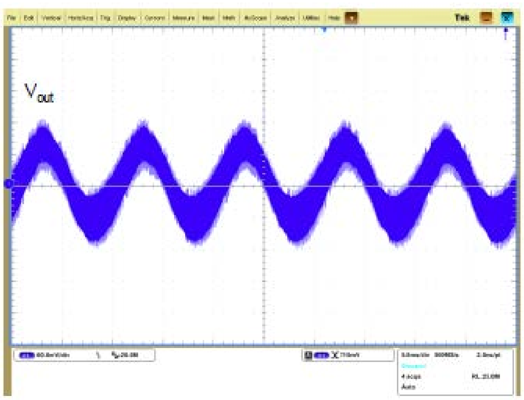


Test Setup Diagram

F1: 15A, 250VAC
C1, C2, C3: The 1µF/275VAC film capacitor is recommended
C4, C5, C6: The 470µF/63V low ESR aluminum electrolytic capacitor is recommended
C7, C8: The 1.5µF/450V film capacitor is recommended.
C8: The 2200pF capacitor is recommended
C9: The 390µF/450V long life (5000h) aluminum electrolytic capacitor is recommended
C10: The 2200pF capacitor is recommended
L1: Common-mode inductor (single phase, 3.5mH)
L2: Common-mode inductor (single phase, 5-12mH)
R1, R2, R3, R4: 100kΩ/0.25 W resistor
R5: Cement resistor 75Ω/5W
RT1: Negative temperature coefficient (NTC) resistor 1Ω
D1: 1kV/3A

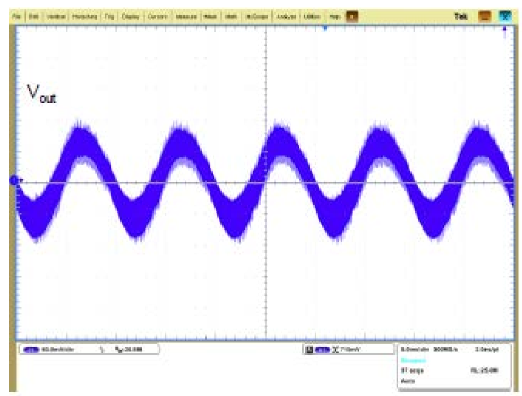
NOTE: Points A and B, which are used for testing the output voltage ripple, must be 25mm (0.98in) away from the Vout (+) pin and the Vout (-) pin, respectively.

48VDC Model Output Voltage Ripple



For points A and B in the test set-up diagram.
Vin=110VAC, Vout=48V, Iout=10.5A

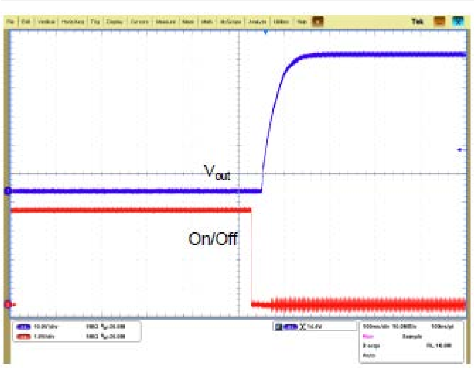
48VDC Output Voltage Ripple



For points A and B in the test set-up diagram
Vin=220VAC, Vout=48V, Iout=10.5A

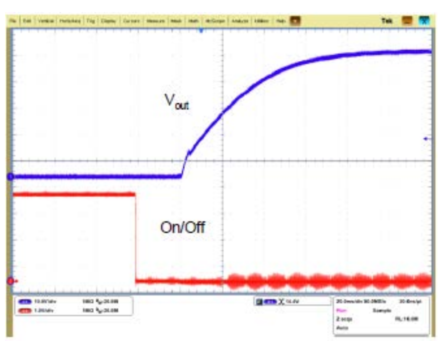
Conditions: Ambient Temp.=25ºC unless otherwise specified

48VDC Model Startup from On/Off



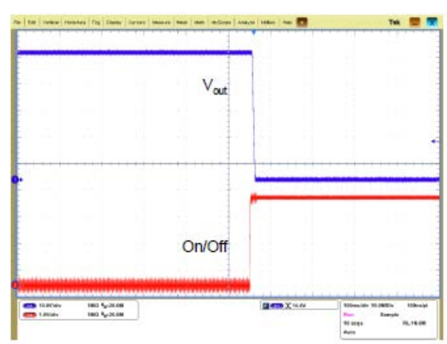
Vin=110VAC, 100% load

48VDC Model Startup from On/Off



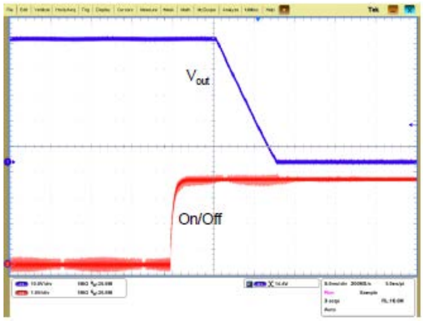
Vin=110VAC, 100% load

48VDC Model Shutdown from On/Off



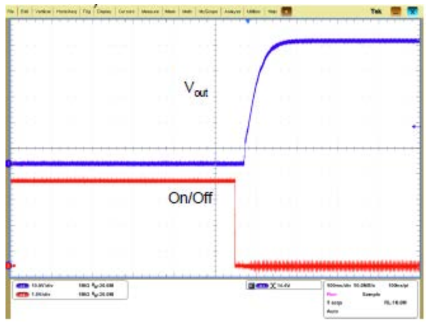
Vin=110VAC, 100% Load

48VDC Model Shutdown from On/Off



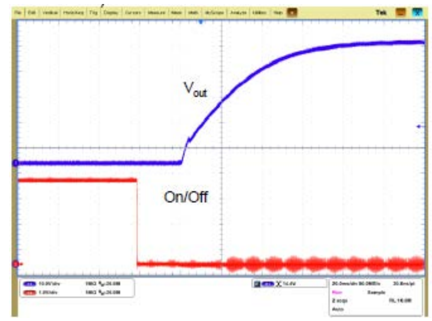
Vin=110VAC, 100% Load

48VDC Model Startup from On/Off



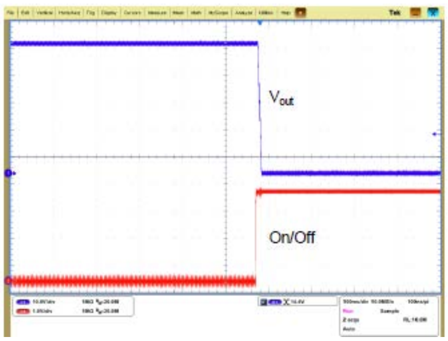
Vin=220VAC, 100% Load

48VDC Model Startup from On/Off



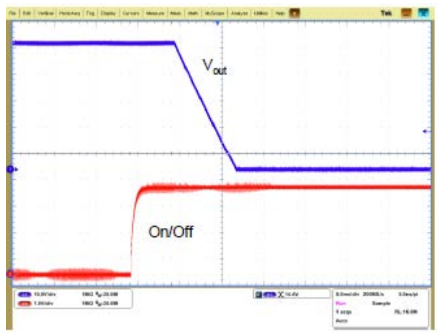
Vin=220VAC, 100% Load

48VDC Model Shutdown from On/Off



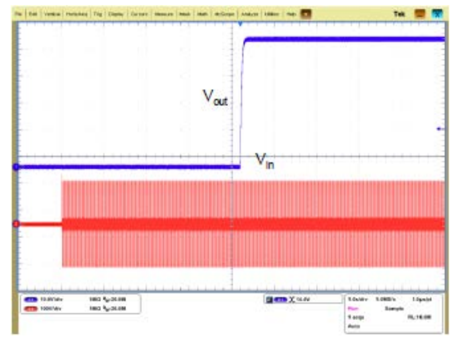
Vin=220VAC, 100% Load

48VDC Model Shutdown from On/Off



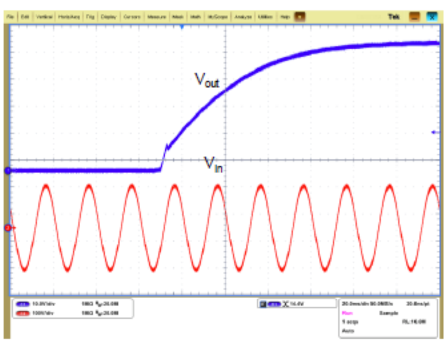
Vin=220VAC, 100% Load

48VDC Model Startup by Power-On



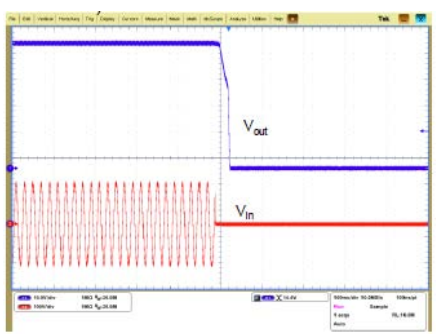
Vin=110VAC, 100% Load

48VDC Model Startup by Power-On



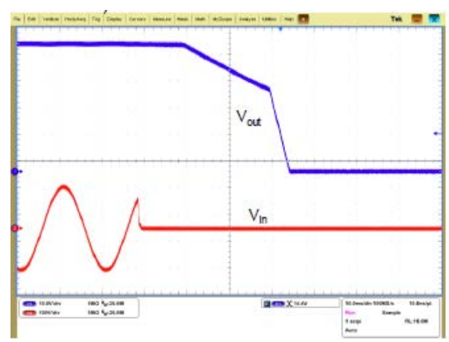
Vin=110VAC, 100% Load

48VDC Model Shutdown by Power-Off



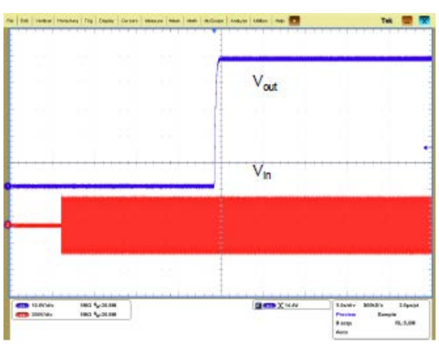
Vin=110VAC, 100% Load

48VDC Model Shutdown by Power-Off



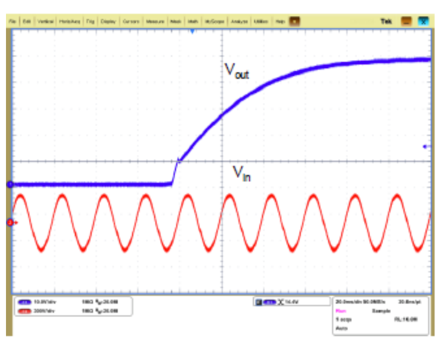
Vin=110VAC, 100% Load

48VDC Model Startup by Power-On



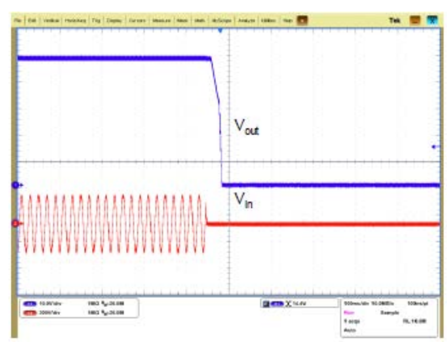
Vin=220VAC, 100%

48VDC Model Startup by Power-On



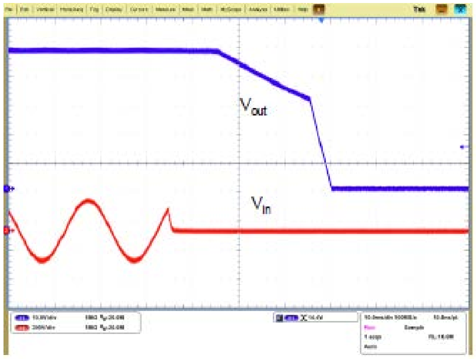
Vin= 220VAC, 100% Load

48VDC Model Shutdown by Power Off



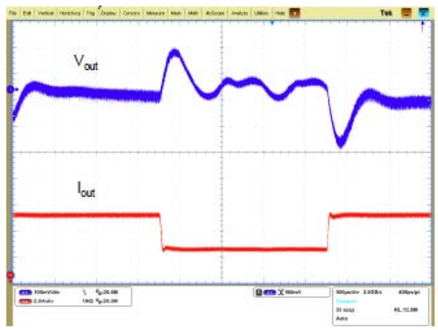
Vin=220VAC, 100% Load

48VDC Model Shutdown by Power-Off



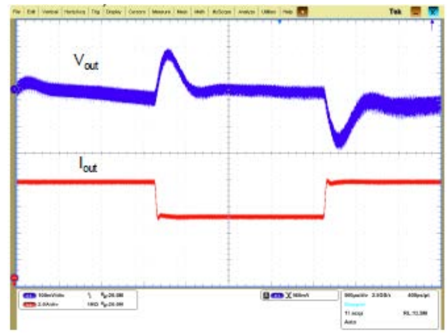
Vin=220VAC, 100% Load

48VDC Model Output Voltage Dynamic Response



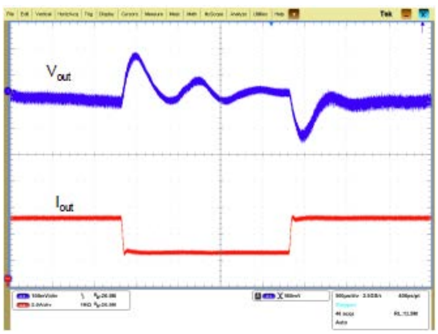
Vin=110VAC, load: 50%-25%-50% di/dt=0.1A/µs

48VDC Model Output Voltage Dynamic Response



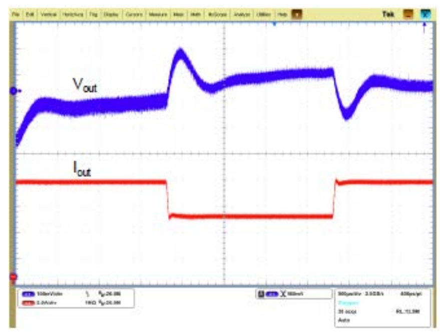
Vin=110VAC, load: 75%-50%-75% di/dt=0.1A/µs

48VDC Model Output Voltage Dynamic Response



Vin=220VAC, load: 50%-25%-50% di/dt=0.1A/µs

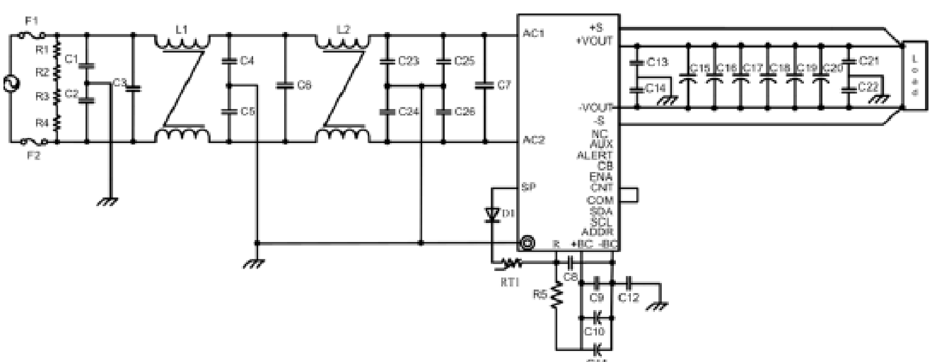
48VDC Output Voltage Dynamic Response



Vin=220VAC, load: 75%-50%-75% di/dt=0.1A/µs

TYPICAL APPLICATION CIRCUIT

12VDC Model



Typcial Application Circuit

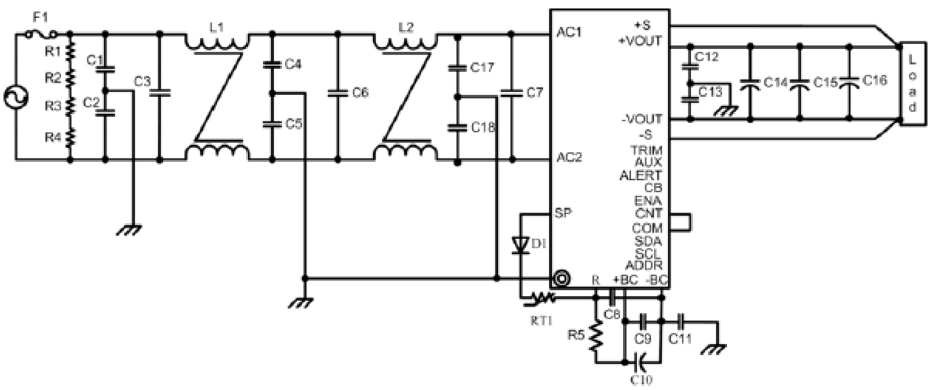
R1, R2, R3, R4: 0.25W, 100kΩ
R5: Cement resistor, 5W, 75Ω
F1, F2: 15A, 250VAC

L1, L2: 6mH
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C7: Film capacitor, 1µF, 275VAC
C4, C5: 2.2nF, 250V
C6: Film capacitor, 0.68µF, 275VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10, C11: Long life (5000h) aluminum electrolytic capacitor, 390µF, 450V (recommended product model: ELXS451VSN391MR50S NCC)
C12: 2200pF
C13, C14: 220nF, 1kV
C15, C16, C17, C18, C19, C20: Low ESR aluminum electrolytic capacitor, 220µF, 16V (recommended product model: APXE160ARA221MHA0G NCC)
C21, C22: 22nF, 1kV
C23, C24: Ceramic capacitor, 4.7nF, 250V
C25, C26: Ceramic capacitor, 1nF, 250V

D1: 1kV, 3A
RT: NTC resistor 1Ω

Notes:
1. C10, C11, C15, C16, C17, C18, C19, C20: When the temperature is lower than -25ºC, recommended capacitance should be doubled.
2. When selecting an output capacitor, consider not only the ripple voltage but aslo the ripple current to prevent risks caused by using a capacitor outside its specificationa. A Γ-shaped filter circuit can be used to reduce the ripple current of an output capacitor.

28VDC Model



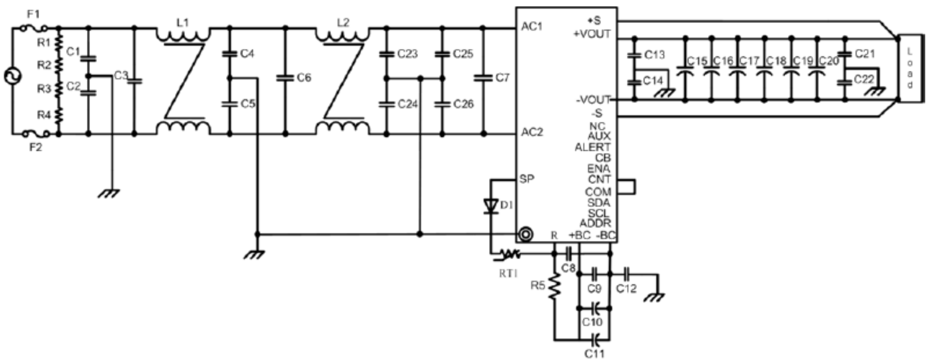
Typcial Application Circuit

Notes:
1. C10, C14, C15, C16: When the temperature is lower than -25ºC, recommended capacitance should be doubled.
2. When selecting an output capacitor, consider not only the ripple voltage but aslo the ripple current to prevent risks caused by using a capacitor outside its specificationa. A Γ-shaped filter circuit can be used to reduce the ripple current of an output capacitor.

R1, R2, R3, R4: 0.25W, 100kΩ
F1: 15A, 250VAC
L1, L2: 3.5mH
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C7: Film capacitor, 1µF, 275VAC
C4, C5: 10nF, 250VAC
C6: Film capacitor, 0.68µF, 275VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10: Long life (5000h) aluminum electrolytic capacitor, 390µF, 450V (recommended product model: ELXS451VSN391MR50S NCC)
C11: 2200pG
C12, C13: 100nF, 1kV
C14, C15, C16: Low ESR aluminum electrolytic capacitor, 470µF, 63V (recommended product model: EKY-630ELL471MK25S NCC)
C17, C18: 1nF, 250V

D1: 1kV, 3A
R5: Cement resistor, 5W, 75Ω
RT1: NTC resistor 1Ω

48VDC Model



Typcial Application Circuit

Notes:
1. C10, C11, C15, C16, C17, C18, C19, C20: When the temperature is lower than -25ºC, the recommended capacitance should be doubled.
2. When selecting an output capacitor, consider not only the ripple voltage but also the ripple current to prevent risks caused by using a capacitor outside its specifications. A Γ-shaped filter circuit can be used to reduce the ripple current on an output capacitor.

R1, R2, R3, R4: 0.25W, 1kΩ
R5: Cement Resistor, 5W, 75Ω
F1, F2: 15A, 250VAC

L1, L2: 6mH
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C7: Film capacitor, 1µF, 275VAC
C4, C5: 2.2nF, 250V
C6: Film capacitor, 0.68µF, 275VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10, C11: Long life (5000h) aluminum electrolytic capacitor, 390µF, 16V (recommended product model: APXE160ARA221MHA0G NCC)
C21, C22: 22nF, 1kV
C23, C24: Ceramic capacitor, 4.7nF, 250V
C25, C26: Ceramic capacitor, 1nF, 250V

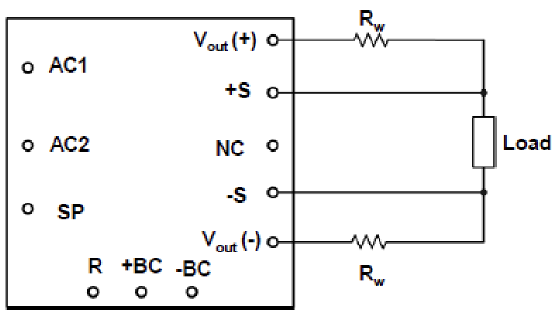
D1: 1kV, 3A
RT1: NTC resistor 1Ω

REMOTE SENSE

This function is used to compensate for voltage drops on R_W, which indicates the line impedance between the output and the load. +S, -S, V_{OUT} (+), and V_{OUT} (-) should meet the following requirements:

$[V_{OUT}(+) – (+S)] \le 5\% \, V_{OUT}$
$[(-S) – V_{OUT}(-)] \le 0.5V$

V_{OUT} is the rated output voltage:
12VDC Model: $11.4V \le [V_{OUT}(+) - V_{OUT}(-)] \le 12.6V$
28VDC Model: $20V \le [V_{OUT}(+) - V_{OUT}(-)] \le 32V$
48VDC Model: $36V \le [V_{OUT}(+) – V_{OUT}(-)] \le 55V$



Configuration Diagram for Remote Sense

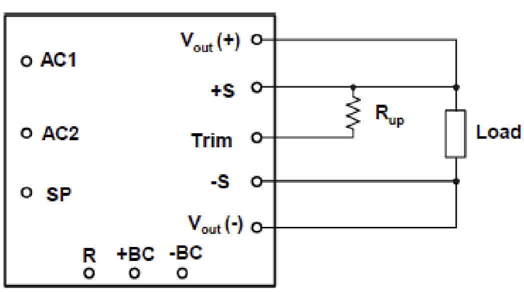
If the remote sense function is not required, +S should be connected to V_{OUT} (+) and -S should be connected to V_{OUT} (-).

OUTPUT VOLTAGE TRIM

28VDC & 48VDC Models

Output voltage can be adjusted within the trim range by using the Trim pin.

Trim Up
The output voltage can be increased by connecting an external resistor between the Trim pin and the +S pin.



Configuration Diagram for Trim Up

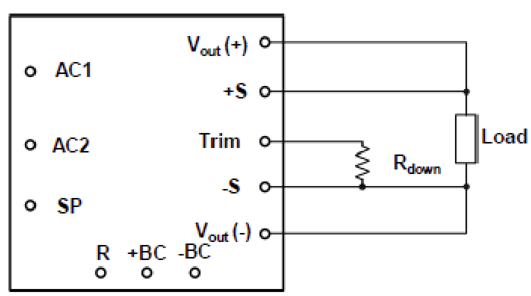
28VDC Model: Relationship between R_{up} and V_{OUT}:

$$R_{up} = \frac{26550 \times V_{OUT}}{V_{OUT} - 28} - 3300(\Omega)$$

48VDC Model: Relationship between R_{up} and V_{OUT}:

$$R_{up} = \frac{46300 \times V_{OUT}}{V_{OUT} - 48} - 3300(\Omega)$$

Trim Down
The output voltage can be decreased by connecting an external resistor between the Trim pin and the -S pin.



Configuration Diagram for Trim Down

28VDC Model: Relationship between R_{down} and V_{OUT}:

$$R_{down} = \frac{2000 \times V_{OUT}}{28 – V_{OUT}} - 3300(\Omega)$$

48VDC Model: Relationship between R_{down} and V_{OUT}:

$$R_{down} = \frac{2000 \times V_{OUT}}{48 - V_{OUT}} - 3300(\Omega)$$

Note:
1. If the Trim pin is not used, it should be left open.
2. When output voltage adjustment is used, ensure that the output voltage is within the required range; otherwise the protection function will be activated.
3. Ensure that the actual output power does not exceed the maximum output power when raising the voltage.

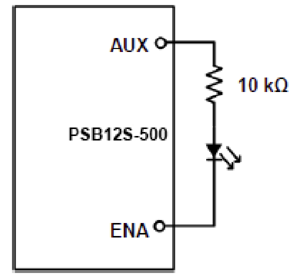
ENABLE (ENA)

12VDC Model

The Enable signal indicates that the output voltage of the module is normal and can supply power to the load (maximum sink current is 10mA and maximum applied voltage is 75V). When the output voltage exceeds 8V at startup, ENA is in low resistance state. When the output voltage drops below 6V or input power fails, ENA is in high resistance state. The logic of Enable is as follows:

Logic Enable	ENA	Output Voltage
Negative Logic	High Resistance	≤6V or input fault, input power failure
	Low Resistance	>8V

The Enable signal is pulled up to the AUX by a 10kΩ external resistor, indicted by an LED.



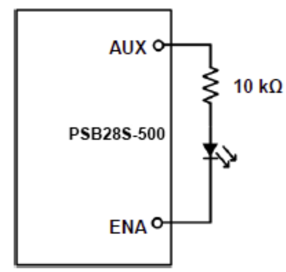
Recommended circuit diagram of Enable

28VDC Model

The Enable signal indicates that the output voltage of the module is normal and can supply power to the load (maximum sink current is 10mA and maximum applied voltage is 75V). When the output voltage exceeds 15V at startup, ENA is in low resistance state. When the output voltage drops bellows 13V or input power fails, ENA is in high resistance state. The logic of Enable is as follows:

Logic Enable	ENA	Output Voltage
Negative Logic	High Resistance	≤13V or input fault, input power failure
	Low Resistance	>15V

The Enable signal is pulled up to the AUX by a 10kΩ external resistor, indicated by an LED.



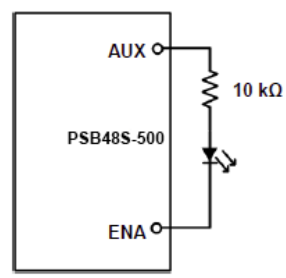
Recommended circuit diagram of Enable

48VDC Model

The Enable signal indicates that the output voltage of the module is normal and can supply power to the load (maximum sink current is 10mA and maximum applied voltage is 75V). When the output voltage exceeds 30V at startup. ENA is in low resistance state. When the output voltage drops below 28V or input power fails, ENA is in high resistance state. The logic of Enable is as follows:

Logic Enable	ENA	Output Voltage
Negative Logic	High Resistance	≤28V or input fault, input power failure
	Low Resistance	>30V

The Enable signal is pulled up to the AUX by a 10kΩ external resistor, indicated by an LED.

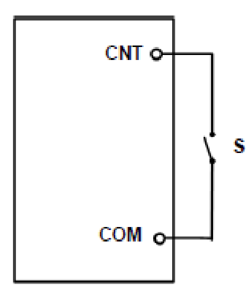


Recommended circuit diagram of Enable

CNT (ON/OFF)

The CNT (On/Off) pin provides the remote control function without turning the input power supply on or off. When the remote control function is not required, short-circuit CNT and COM. The logic of On/Off is as follows:

Logic Enable	On/Off	Output
Negative Logic	Low Level	On
	High Level or Left Open	Off



Configuration diagram of CNT (On/Off) signal

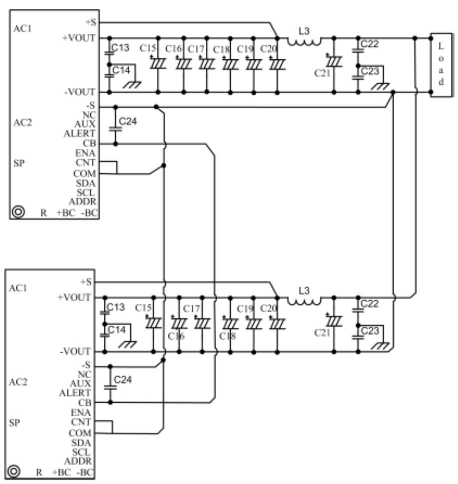
AUXILIARY POWER SUPPLY (AUX)

The AUX pin supplies auxiliary power to an external circuit with a typical output voltage of 12V. Be careful not to short-circuit the pin and other pins on the module; otherwise the module will be damaged. Do not connect the AUX pin if power supply to an external circuit is not required.

PARALLEL OPERATION (CB)

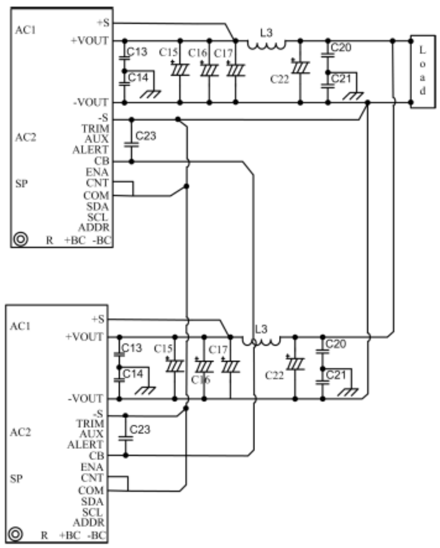
When several modules are used in parallel, an output current can be equally drawn from each module by connecting the CB pins of all modules. A maximum of two modules can be connected in parallel is equal to or less than 90% of the power of two fully loaded modules.

12VDC Model



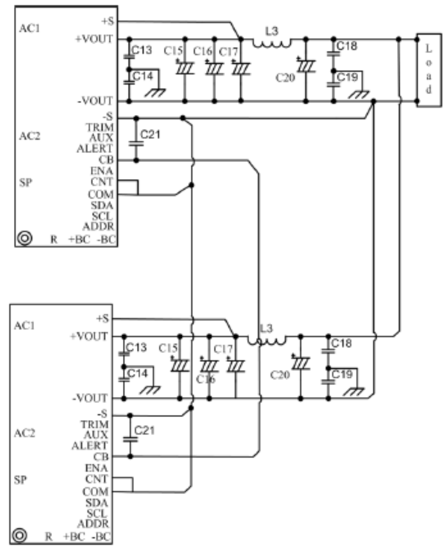
Notes:4
1. L3: High frequency inductor 0.3µH
2. C21: Aluminum electrolytic capacitor 16V, 220µF
3. C24: 1µF, 16V
4. For other capacitor parameters, see EMC

28VDC Mode



Notes:
1. L3: High frequency inductor 0.3µH
2. C22: Aluminum electrolytic capacitor 63V, 470µF
3. C23: 1µF, 16V
4. For other capacitor parameters, see EMC

48VDC Model



Notes:
1. L3: High frequency inductor 0.3µH
2. C20: Aluminum electrolytic capacitor 63V, 470µF
3. C21: 1µF, 16V
4. For other capacitor parameters, see EMC

PMBUS COMMUNICATION

The module communicates with the system over the PMBus. The following table describes the PMBus address:

R (ADDR Pull Down Resistor)	Address
Left Open	Invalid
200kΩ	0x5F
174kΩ	0x5E
150kΩ	0x5D
124kΩ	0x5C
100kΩ	0x5B
75kΩ	0x5A
49.9kΩ	0x59
24.9kΩ	0x58
Ground	Invalid

The address bit is as follows:

Bit	7	6	5	4	3	2	1	0
-	Address							Read/Write

Monitoring and Fault Detection

The module communicates with the system over the PMBus. It provides the monitoring and the fault detection functions.

The module monitors the following:

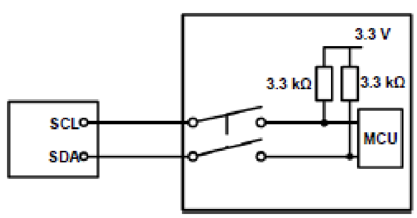
- Module Information
- Input Voltage
- Input Power
- Output Voltage
- Output Power
- Baseplate Temperature
- CNT (On/Off)

The module detects and reports the following:

- Input faults
- Output overvoltage
- Output overcurrent
- Baseplate overtemperature

SCL and SDA

Within the PSU, the SCL and SDA are each connected to a pull-up resistor. Externally, the SCL and SDA are connected to the system through the fault isolation circuit.



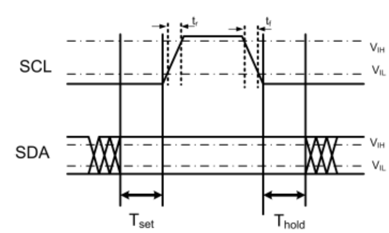
Interconnect diagram of SCL and SDA

PMBus Timing

The module supports both 100kHz (default) and 400kHz clock rates. T_{SET} is the duration for which SDA keeps its value unchanged before SCL increases. T_{hold} is the duration for which SDA keeps its value unchanged after SCL decreases.

Communication will fail if parameter values are consistent with those provided in the following table.

Parameter	Min.	Typ.	Max.	Unit
Logic Input Low (V_{IL})	-	-	1.1	V
Logic Input High (V_{IH})	2.1	-	-	V
Logic Output Low (V_{OL})	-	-	0.25	V
Logic Output High (V_{OH})	2.7	-	-	V
PMBus Setup Time	100	-	-	ns
PMBus Hold-Up Time	0	-	-	ns
Clock/Data Fall Time(t_f)	20+ 0.1Cb	-	300	ns
Clock Data Rise Time (t_r)		-	300	ns
Total Capacitance of One Bus Line (Cb)	-	-	400	pF



PMBus Timing Diagram

PMBus Commands

12VDC Model

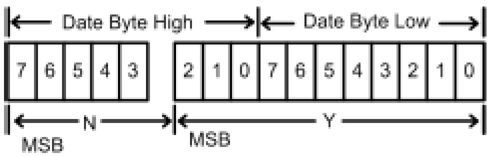
Hex Code	Command Name	Data Type	Data Byte	Data Format
Control Commands				
01h	OPERATION	Read/Write Byte	1	-
03h	CLEAR_FAULTS	Send Byte	0	-
11h	STORE_DEFAULT_ALL	Send Byte	0	-
Output Commands				
20h	VOUT_MODE	Read Byte	1	-
31h	POUT_MAX	Read/Write Word	2	Linear 11
Alarm Command				
51h	OT_WARN_LIMIT	Read/Write Word	2	Linear 11
Status Command				
79h	STATUS_WORD	Read Word	2	-
Monitoring Commands				
88h	READ_VIN	Read Word	2	Linear 11
8Bh	READ_VOUT	Read Word	2	Linear 16
8Ch	READ_IOUT	Read Word	2	Linear 11
8Dh	READ_TEMPERATURE_1	Read Word	2	Linear 11
Monitoring Commands				
96h	READ_POUT	Read Word	2	Linear 11
97h	READ_PIN	Read Word	2	Linear 11
98h	PMBUS_REVISION	Read Byte	1	-
E9h	MFR_STATUS_WORD	Read Word	2	-
ECh	MFR_WRITE_SYSTIME	Write Block	4	Time: S Low byte in the former, the high byte in the post
EFh	MFR_READ_LAST_ACDROP_TIME	Read Block	8	
F6	WRITE_STANDBY	Write Byte	1	0x00: Standby; 0x20: Reset

28VDC & 48VDC Models

Hex Code	Command Name	Data Type	Data Byte	Data Format
Control Commands				
01h	OPERATION	Read/Write Byte	1	-
03h	CLEAR_FAULTS	Send Byte	0	-
11h	STORE_DEFAULT_ALL	Send Byte	0	-
Output Commands				
20h	VOUT_MODE	Read Byte	1	-
21h	VOUT_COMMAND	Read/Write Word	2	Linear 16
Alarm Command				
51h	OT_WARN_LIMIT	Read/Write Word	2	Linear 11
Status Command				
79h	STATUS_WORD	Read Word	2	-
Monitoring Commands				
88h	READ_VIN	Read Word	2	Linear 11
8Bh	READ_VOUT	Read Word	2	Linear 16
8Ch	READ_IOUT	Read Word	2	Linear 11
8Dh	READ_TEMPERATURE_1	Read Word	2	Linear 11
96h	READ_POUT	Read Word	2	Linear 11
Monitoring Commands				
97h	READ_PIN	Read Word	2	Linear 11
98h	PMBUS_REVISION	Read Byte	1	-
E9h	MFR_STATUS_WORD	Read Word	2	-
ECh	MFR_WRITE_SYSTIME	Write Block	4	Time: S Low byte in the former, the high byte in the post
EFh	MFR_READ_LAST_ACDROP_TIME	Read Block	8	
F6	WRITE_STANDBY	Write Byte	1	0x00: Standby; 0x20: Reset

Data Format

- Linear 11 data format
  The linear data format is a two day byte value with an 11-bit binary signed mantissa (two's complement) and a 5-bit binary signed exponent (two's complement) as shown in figure below:

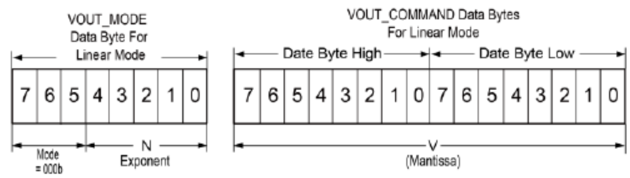


Linear 11 Data Format

The relationship between N, Y, and actual value V is given by the following equation: $X = Y \times 2^N$
12VDC Model: Y is the 11-bit, binary signed mantissa (two's complement)
28VDC & 48VDC Models: Y is the 11-bit two's complement mantissa

12VDC Model: N is the 5-bit, binary signed exponent (two's complement)
28VDC & 48VDC Models: N is the 5-bit, two's complement exponent

- VOUT data format
  Commands related to the output voltage are VOUT_MODE and READ_VOUT for the 12VDC model and VOUT_COMMAND, VOUT_MODE, and READ_VOUT for 28VDC and 48VDC models. The data for these commands is a 16 bit unsigned integer, as shown in figure below.



Vout Data Format

Output Voltage is calculated as follows: $V \times 2^N$
Where:
Voltage is the output voltage value.
V is the 16-bit unsigned integer
N is the 5-bit signed integer (two's complement)

Command Descriptions

OPERATION (01h): By default, the module is turned ON as long as Enable active-low.
The OPERATION command is used to turn the module ON or OFF via the PMBus. It uses the following data bytes.

Function	Data Byte
ON	0x80
RESET	0x00
OFF	0x55

To reset the module after it is turned OFF, wait at least 10 seconds, and then turn it ON. All alarms and shutdowns are cleared during a restart.

CLEAR_FAULTS (03h): Clears the latch fault.

STORE_DEFAULT_ALL (11h): Saves calibrated or modified data. If this command is not sent, calibrated or modified data cannot be saved in the event of a power failure.

VOUT_MOTE (20h): Determines the data type and parameters used by a PMBus command.

12VDC Model: POUT_MAX (31h): Configures the power limiting point (value range: 300W to 550W). The function allows users to change the constant current protection threshold. The constant current can be calculated based on the configured power limiting point and output voltage.
28VDC & 48VDC Models: VOUT_COMMAND (21h): This command is used to change the output voltage of the power supply. The default value for 28VDC models is 28VDC (voltage range 20-32VDC). The default value for 48VDC models is 48VDC (voltage range: 36-55VDC).

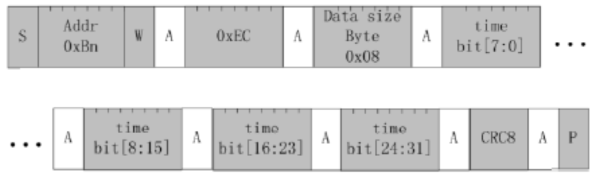
STATUS_WORD (79h): Reports module fault information. The module latches off after a fault occurs.

Bit	Fault Name	Definition
b15-b6	-	-
b5	VOUT_OV	1-Over Voltage, 0-Normal
b4	IOUT_OC	1- Over Current, 0-Normal
b3	-	-
b2	OVER_TEMPERATURE	1-Over Temperature, 0-Normal
b0, b1	-	-

MFR_STATUS_WORD (E9h): Reports the module stat.

Bit	Fault Name	Fault Definition
b15-b1	-	-
b0	REMOTE ON/OFF	1-OFF, 0-ON

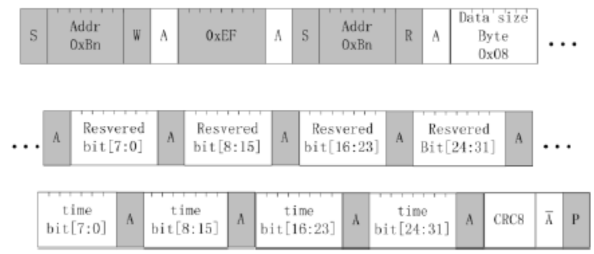
MFR_WRITE_SYSTIME (ECh): As the module does not have a time chip, the system uses the ECh command to deliver the system time to the module. The module then runs based on the delivered system time in unit of seconds. To ensure time accuracy, it is recommended that the system synchronize time to the module every 10 minutes. The MFR_WRITE_SYSTIME command format is shown below.



MFR_WRITE_SYSTIME command format

Note: S: Start Condition, R: Rated bit value of 1, W: Write bit value of 0, A: Acknowledge bit, may be ACK or NACK, P: Stop Condition

MFR_READ_LAST_ACDROP_TIME (EFh): Reads the last disconnection time recorded by the module. The EFh data format is shown in the figure. The time occupies four bytes and the high-order byte takes precedence over the low-order byte during transmission.



MFR_READ_LAST_ACDROP_TIME command format

The module used 8-bit cyclic redundancy check (CRC). The fenerator plynominal is C(x)= x8 + x2 + x1 +1, or 0b100000111 if expressed in binary form. The module complies with the PMBus Protocol Specifiaction rev1.2 requirements.

PROTECTION CHARACTERISTICS

Input Over Voltage Protection

The module will shut down after the input voltage exceeds the input over voltage protection threshold. The module will start to work again after the input voltage reaches the input over voltage recovery threshold. For hysteresis, see protection characteristics.

Input Under Voltage Protection

The module will shut down after the input voltage drops below the under voltage protection threshold. The module will start to work again after the input voltage reaches the input under voltage recovery threshold. For the hysteresis, see protection characteristics.

Output Over Voltage Protection

When the output voltage exceeds the output over voltage protection threshold, the module will enter hiccup mode. If the module experiences five or more times of over voltage due to an internal fault within 20s, the module latches off. You need to restart the module to unlock it. You must power on the module at least 20s after powering it off. The module dynamic over voltage does not exceed 17V for 12VDC model, 39V for 28VDC models, and 69V for 48VDC model.

Output Over Current Protection

When the output current exceeds the output overcurrent protection threshold, the module will enter hiccup mode. When the fault condition is removed, the module will automatically restart.

Over Temperature Protection

A temperature sensor on the module sense the average temperature of the module. It protects the module from being damaged at high temperatures. When the temperature exceeds the over temperature protection threshold, the output will shut down. If the temperature drops below the over temperature protection recovery threshold more than 5 minutes after the module shuts down, the output recovers. Note that the sensor does not sense the temperature within 5 minutes after the output shuts down. Therefore, even if the temperature drops to a very low level within 5 minutes after the output shuts down, there is still no output.

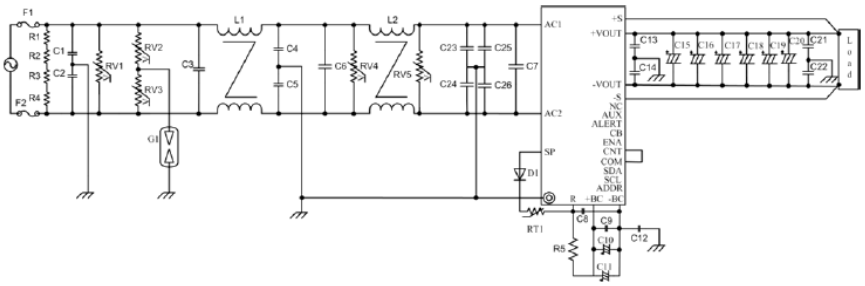
Cooling Characteristics

When the module is running, the temperature of the baseplate must not exceed 90ºC. The module supports natural cooling and fan cooling. Users can select heat sink models depending on the onsite conditions.

EMC

12VDC Model

The figure below shows the EMC test set-up diagram. The acceptance standard must meet the requirements of the conducted emission limits of CISRP22 Class B with 6 dB margin. The level of surge is CM/DM 6kV/6kV 2Ω (1.2/50), and the level of impulse current is CM/DM 5kA/5kA (8/20).



EMC Test set-up diagram

Note: C10, C11, C15, C16, C17, C18m C19, C20: When the temperature is lower than -25ºC, the recommended capacitance should be doubled.

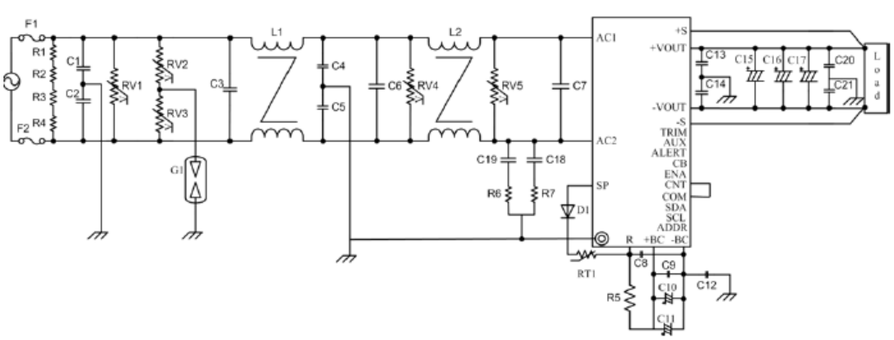
R1, R2, R3, R4: 0.25W, 100kΩ
R5: Cement resistor, 5W, 75Ω
RV1: 620V, 385V, 12kA
RV2, RV3: 750V, 460V, 12kA
RV4: 620V, 385V, 12kA
RV5: 620V, 385V, 4.5A

L1, L2: 6mH
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C7: Film capacitor, 1µF, 275VAC
C4, C5: 2.2µF, 250V
C6: Film capacitor, 0.68µF, 275VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10, C11: Long life (5000h) aluminum electrolytic capacitor, 390µF, 450V (recommended product model: ELXS451VSN391MR50S NCC)
C12: 2200pF
C13, C14: 220nF, 1kV
C15, C16, C17, C18, C19, C20: Low ESR aluminum electrolytic capacitor, 220µF, 16V (recommended product model: APXE160ARA221MHA0G NCC)
C21, C22: 22nF, 1kV
C23, C24: Ceramic capacitor, 4.7nF, 250V
C25, C26: Ceramic capacitor, 1nF, 250V

D1: 1kV, 3A
RT1: NTC Resistor 1Ω
G1: 10kA, 1.5kV
F1, F2: 15A, 250VAC

28VDC Model

The figure below shows the EMC test set-up diagram. The acceptance standard must meet the requirements of the conducted emission limits of CISPR22 Class B with 6 dB margin. The level of surge is CM/DM 6kV/6kV 2Ω (1.2/50), and the level of impulse current is CM/DM 5kA/5kA (8/20).



EMC test set-up diagram

Note: C10, C11, C15, C16, C17: When temperature is lower than -25ºF, the recommended capacitance should be doubled.

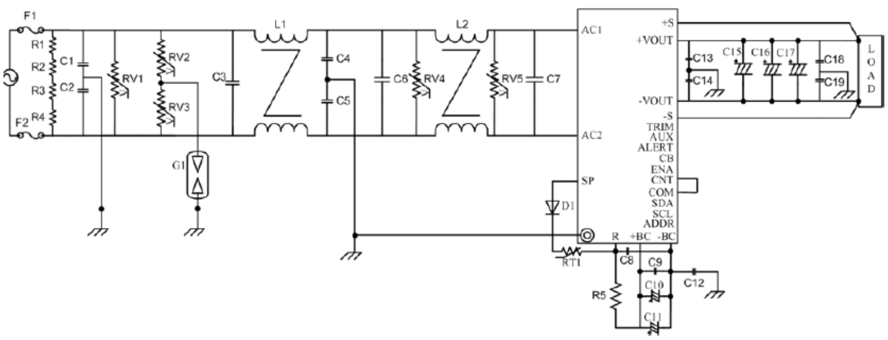
R1, R2, R3, R4: 0.25W, 100kΩ
RV1: 620V, 385V, 12kA
RV2, RV3: 750V, 460V, 12kA
RV4: 620V, 385V, 12kA
RV5: 620V, 385V, 4.5kA

L1, L2: 3.5mH, 220V, 10A
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C7: Film capacitor, 1µF, 275VAC
C4, C5: 0.01µF, 250V
C6: Film capacitor, 0.68µF, 275VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10, C11: Long life (5000h) aluminum electrolytic capacitor, 390µF, 450V (recommended product model: ELXS451VSN391MR50S NCC)
C12: 2200pF
C13, C14: 100nF, 1kV
C15, C16, C17: Low ESR aluminum electrolytic capacitor, 470µF, 63V (recommended product model: EKY-630ELL471MK25S NCC)
C18, C19: 1nF, 250V
C20, C21: 22nF, 1kV

D1: 1kV, 3A
R5: Cement resistor, 5W, 75Ω
R6, R7: 0.25W, 22Ω
RT1: NTC resistor 1Ω
G1: 10kA, 1.5kV
F1, F2: 15A, 250VAC

48VDC Model

The figure below shows the EMC test set-up diagram. The acceptance standard must meet the requirements of the conducted emission limits of CISPR22 Class B with 6 dB margin. The level of surge is CM/DM 6kV/6kV 2Ω (1.2/50), and the level of impulse current is CM/DM 5kA/5kA (8/20).



EMC test set-up diagram

Note: C10, C11, C15, C16, C17: When the temperature is lower than -25ºC, the recommended capacitance should be doubled.

R1, R2, R3, R4: 0.25W, 100kΩ
R5: Cement resistor, 5W, 75Ω
F1, F2: 15A, 250VAC
RV1: 620V, 385, 12kA
RV2, RV3: 750V, 460V, 12kA
RV4: 620V, 385V, 12kA
RV5: 620V, 385V, 4.5kA

L1: 3.5mH, L2: 5-12mH
C1, C2: Ceramic capacitor, 1nF, 250V
C3, C6. C7: Film capacitor, 1µF, 275VAC
C4, C5: 10nF, 250VAC
C8, C9: Film capacitor, 1.5µF, 450V
C10, C11: Long life (5000h) aluminum electrolytic capacitor, 390µF, 450V (recommended product module: ELXS451VSN391MR50S NCC)
C12: 2200pF
C13, C14: 100nF, 1kV
C15, C16, C17: Low ESR aluminum electrolytic capacitor, 470µF, 63V (recommended product model: EKY-630ELL471MK25S NCC)
C18, C19: 22nF, 1kV

D1: 1kV, 3A
RT1: NTC resistor 1Ω
G1: 10kA, 1.5kV

QUALIFICATION TESTING

Parameter	Units	Condition
Highly accelerated life test (HALT)	6	Low temperature limit: -60ºC; high temperature limit: 110ºC; vibration limit: 40G; temperature change rate: 40ºC per minute; vibration frequency range: 10-10000Hz
Temperature Humidity Bias (THB)	12	Maximum input voltage; 85ºC; 85% RH; 1000 operating hours under lowest load power
High Temperature Operation Bias (HTOB)	12	Rated input voltage; airflow rate: 0.5m/s (100LFM) to 5 m/s (1000 LFM); ambient temperature between +45ºC and +55ºC; 1000 operating hours; 50% to 80% load
Power and Temperature Cycling Test (PTC)	12	Rated input voltage; airflow rate: 0.5.m/s (1000 LFM); ambient temperature between -40ºC and +85ºC; 1000 operating hours; 50% load; temperature change rate: 15ºC per minute; dwell time: 22 minutes

THERMAL CONSIDERATION

Thermal Test Point:
Sufficient airflow should be provided to ensure reliable operating of the module. Therefore, thermal components are mounted on the top surface of the module to dissipate heat to the surrounding environment by conduction, convection, and radiation. Proper airflow can be verified by measuring the temperature at the middle of the baseplate.

Thermal Test Point

Power Dissipation
The module power dissipation is calculated based on efficiency. The following formula reflects the relationship between the consumed power (P_d), efficiency (η), and output power (P_o): $P_d = P_o (1-\eta)/\eta$

MECHANICAL CONSIDERATION

Installation
Although the module can be mounted in any direction, free airflow must be available.

Soldering
The module supports standard wave soldering and hand soldering. Reflow soldering is not allowed.
1. For wave soldering, the temperature on the module is specified to a maximum of 260ºC for 7 seconds at most.
2. For hand soldering, the iron temperature should be maintained at 350ºC to 420ºC, and applied to the module pins for less than 10 seconds.
The module can be rinsed using the isopropyl alcohol (IPA) solvent or other suitable solvents.

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 ISO9001-2008 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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