Technical Specification

DFB600D24/48 Series

2:1 Input Full Brick 600Watts DC/DC Converters

FEATURES

- Standard input range: 18-36/36-75VDC
- 600W isolated outputs
- Effciency up to 92%
- Fixed outputs from 12 to 48VDC
- Adjustable Vout (±10%)
- Fixed switching frequency, predicted EMI
- Stable @ no-load operation
- Remote On/Off control
- 1500VDC I/O isolation
- Industry standard full brick footprint (4.20" × 2.40" × 0.50")
- Extensive self-protection, UVLO, OVP, OTP,OCP and short protection
- Operating temperature range: -40°C to +100°C
- Fully encapsulated, high reliability
- Flexible extra heat-sink mount type
- Accurate current sharing, N+1 redundant parallel

PRODUCT OVERVIEW

The DFB600D24/48 series are highly reliable, and efficient isolated DC/DC converter. Input range of 18-36V(24V nominal) and 36-75V(48V nominal) are ideal for automation, power grid, railway, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

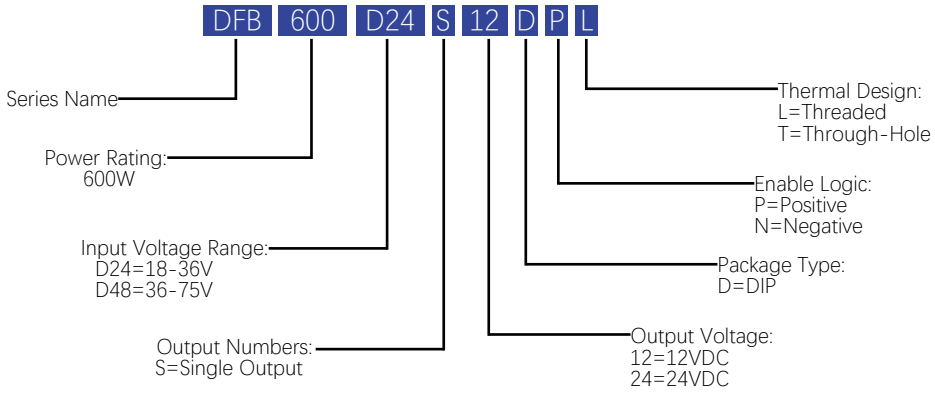
A wealth of self-protection features included input undervoltage lockout, over temperature shutdown, over current protection with "hiccup" autorestart technique, provides indefinite short-circuit protection, along with output OVP. Threaded or through holes are provided to allow easy mount or the addition of a heat sink for extended temperature operation. The operation temperature is -40°C to 100°C, the module delivers full output power @ 100°C baseplate temperature. The DFB600D24/48 series have current share function, which also support N+1 redundant parallel operation.

The DFB600D24/48 series are designed to safety standards IEC/EN 62368-1.

Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency typ. [%]	Capacitive Load Max [μF]	Package [inch]
DFB600D24S12	24	18-36	12	50	89	10000	4.60"×2.40"×0.50" DIP
DFB600D24S24	24	18-36	24	25	90	6800	
DFB600D24S28	24	18-36	28	21.4	91	5600	
DFB600D24S32	24	18-36	32	18.75	90	5000	
DFB600D24S48	24	18-36	48	12.5	91.5	4000	
DFB600D48S24	48	36-75	24	25	92	6800	
DFB600D48S48	48	36-75	48	12.5	92	4000	

Model Numbering



Absolute Maximum Ratings

Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous	24V Input type	-0.7		40	VDC
	48V Input type	-0.7		80	VDC
Input Voltage Transient	< 100ms 24V Input type			50	VDC
	< 100ms 48V Input type			100	VDC
On/Off Remote Control	Referred to -on/off			10	VDC
On/Off Remote Control Current		0		1	mA
Operating Case Temperature		-40		100	°C
Operating Environment Temperature		-40		85	°C
Storage Temperature Range		-55		125	°C
Humidity		10		95	%
Soldering Temperature	Wave Soldering < 10s			260	°C

Safety and EMC Compliance

Conducted Emission	EN55032	Class B (With external filter)
Radiated Emission	EN55032	Class B (With external filter)
Conducted Susceptibility	IEC/EN61000-4-6	10Vrms Criteria A
Radiated Susceptibility	IEC/EN61000-4-3	10V/m Criteria A
EFT	IEC/EN61000-4-4	±2KV Criteria A (With external filter)
Surge	IEC/EN61000-4-5	±2KV Criteria A (With external filter)
ESD	IEC/EN61000-4-2	±6KV Contact ±8KV Air Criteria A
Isolation Safety Rating	Basic insulation	

General Specifications

Parameters	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	Input to output		1500		VDC
	Input to case		1500		VDC
	Output to case		1500		VDC

General Specifications

Parameters	Conditions	Min.	Typ.	Max.	Units
Isolation Resistance (Viso=500VDC)	Input to output		100		MΩ
	Input to case		100		MΩ
	Output to case		100		MΩ
Isolation Capacitance	Input to output		2000		pF
Switching Frequency			300		KHz
Start-up Delay			100	150	mS
Rise Time			30	50	mS
Remote On/Off Control	Positive Logic, ON state	Open or 3 ≤ Vr ≤ 10			VDC
	Positive Logic, OFF state	Short or 0 ≤ Vr ≤ 0.8			VDC
	Negative Logic, ON state	Short or 0 ≤ Vr ≤ 0.8			VDC
	Negative Logic, OFF state	Open or 3 ≤ Vr ≤ 10			VDC
Thermal Shutdown	Case temperature	100	110	115	°C
Thermal Shutdown Recover	Case temperature	85	90	95	°C
MTBF	MIL-HDBK-217F		500		KHrs
Vibration	IEC 60068-2-64, Environmental testing - Part 2				
Shock	IEC 60068-2-27, Environmental Testing- Part 2.27				

Input Specifications

Parameters	Conditions	Min.	Typ.	Max.	Units
Operating Voltage Range	24V Input type	18	24	36	VDC
	48V Input type	36	48	75	VDC
Start-up Threshold	24V Input type	16	17	18	VDC
	48V Input type	32	34	36	VDC
Under Voltage Shutdown	24V Input type	15	16	17	VDC
	48V Input type	30	32	34	VDC
Input Over Voltage Shutdown	24V Input type	38	41	44	VDC
	48V Input type	79	82	85	VDC
Input Over voltage Recovery	24V Input type	37	40	43	VDC
	48V Input type	76	79	82	VDC
Input Current @ No Load	24V Input type		150	250	mA
	48V Input type		75	200	mA
Input Current @ Min. Line	24V Input type			40	A
	48V Input type			20	A
Input Current @ Shutdown Mode	24V & 48V Input type		25	50	mA
Reflect Ripple Current (Peak-Peak) ①	24V Input type		60	100	mA
	48V Input type		60	100	mA
Recommended Input Fuse	24V Input type		80		A
	48V Input type		40		A
Recommended External Input Capacitance	24V Input type	470	820		μF
	48V Input type	220	470		μF

Note: ① Reflected ripple current is tested with certain filter parameters, please see reflected ripple current in technical notes on page 21 for more details.

Performance Data (DFB600D24S12)

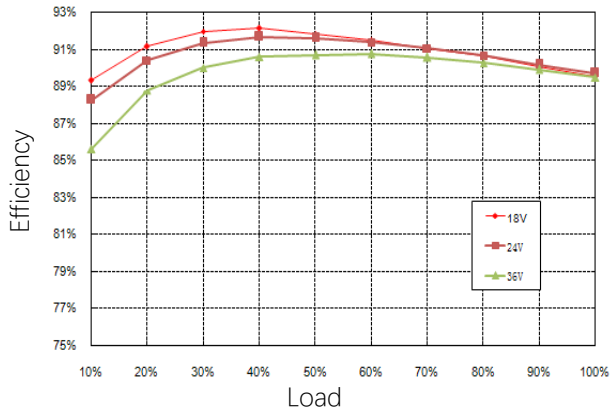
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		11.82	12.00	12.18	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			100	120	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			400	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		10000	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 5 for details.

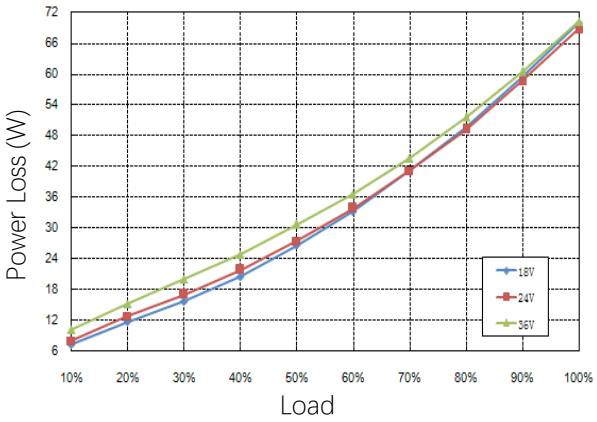
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D24S12)

EFFICIENCY VS LOAD

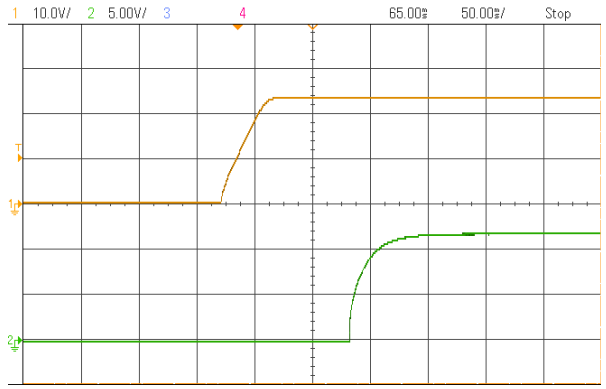


POWER DISSIPATION VS LOAD



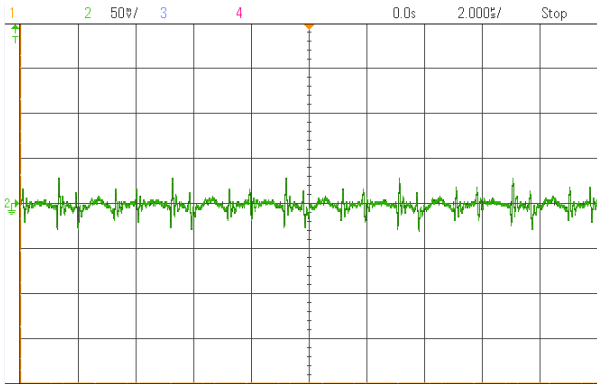
START UP

Ch1:Vin Ch2:Vout



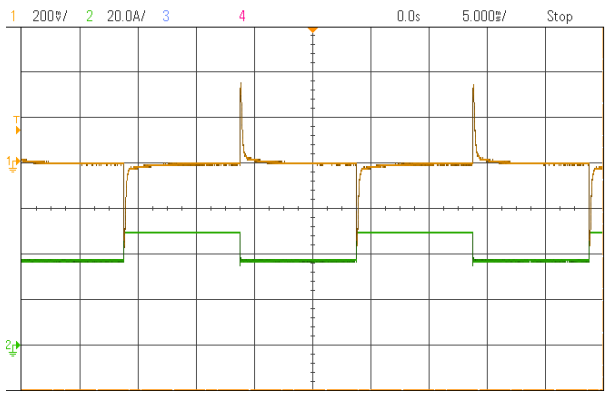
RIPPLE & NOISE BANDWIDTH 20MHz

Ch2:Vout

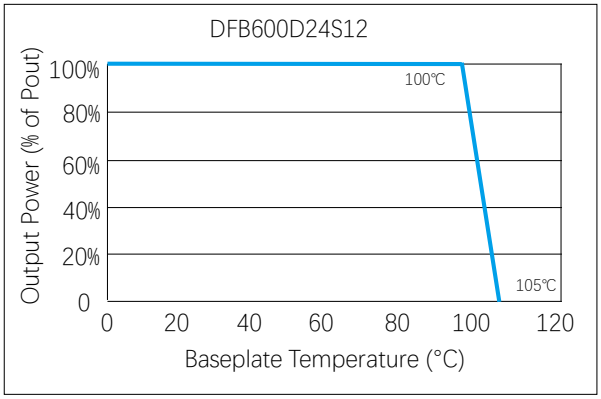


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

Ch1:Vout Ch2:Iout



THERMAL DREATING CURVE



Performance Data (DFB600D24S24)

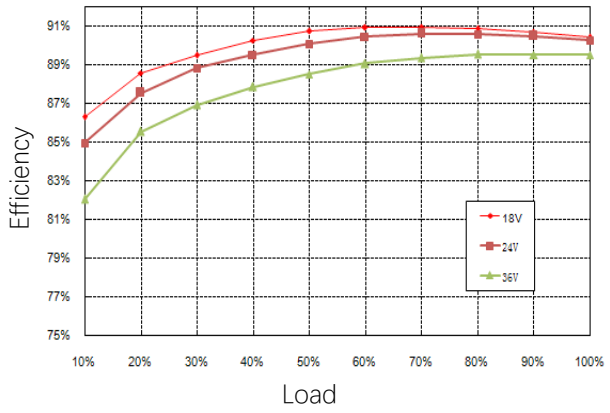
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		23.64	24.00	24.36	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			180	240	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			400	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		6800	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 7 for details.

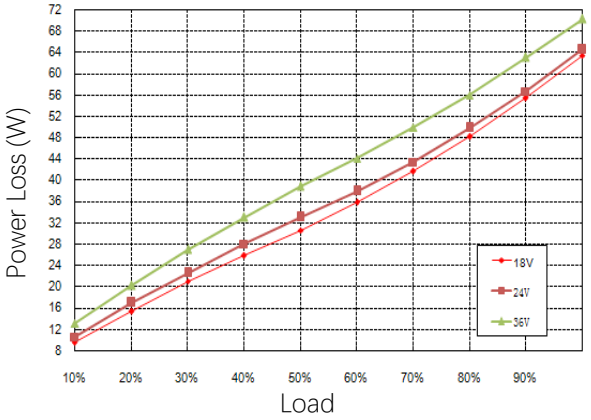
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D24S24)

EFFICIENCY VS LOAD

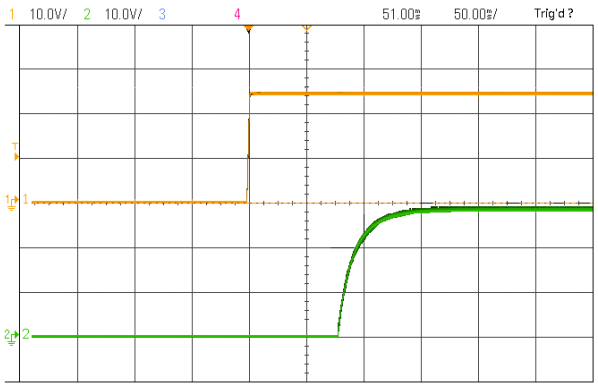


POWER DISSIPATION VS LOAD



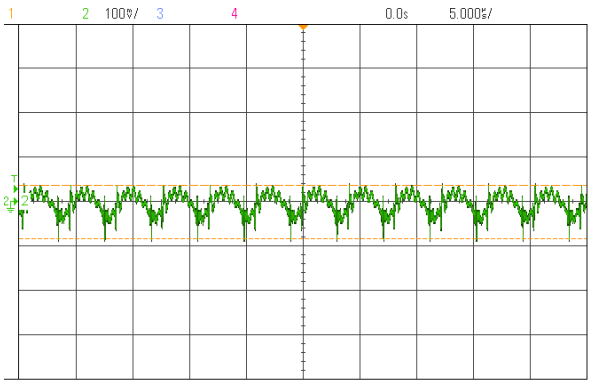
START UP

Ch1:Vin Ch2:Vout



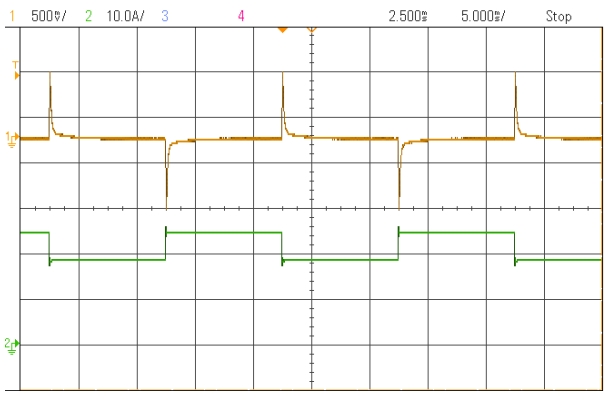
RIPPLE & NOISE BANDWIDTH 20MHz

Ch2:Vout

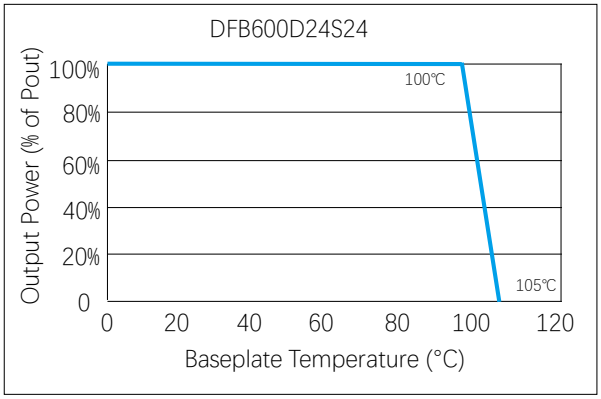


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

Ch1:Vout Ch2:Iout



THERMAL DREATING CURVE



Performance Data (DFB600D24S28)

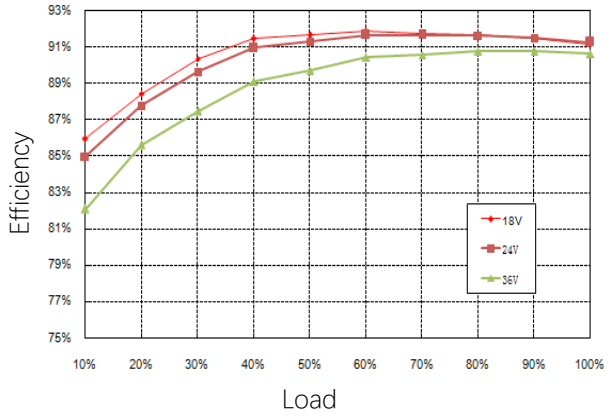
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		27.58	28.00	28.42	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			200	280	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			400	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		5600	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 9 for details.

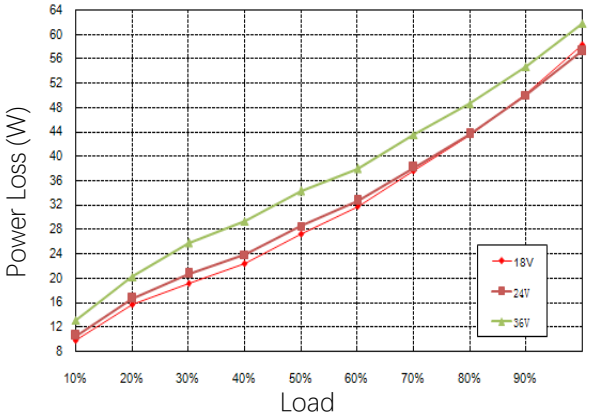
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D24S28)

EFFICIENCY VS LOAD

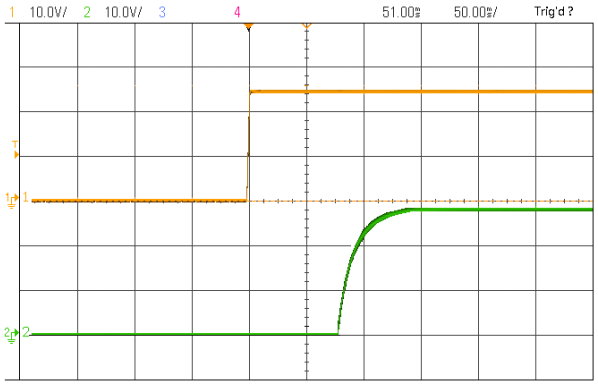


POWER DISSIPATION VS LOAD



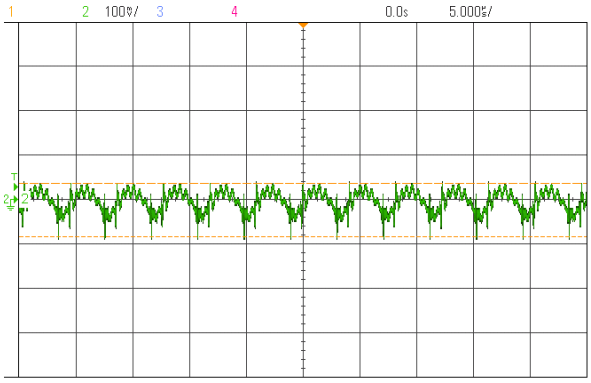
START UP

Ch1:Vin Ch2:Vout



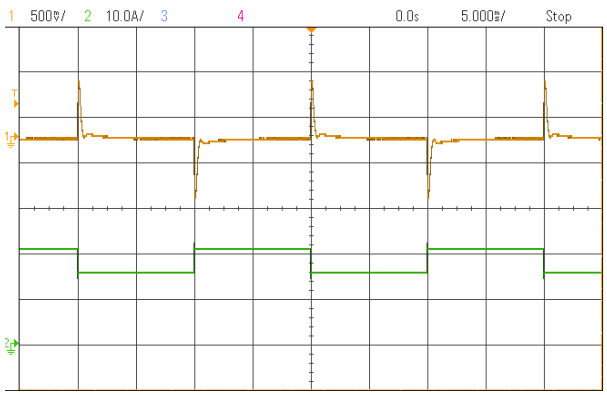
RIPPLE & NOISE BANDWIDTH 20MHz

Ch2:Vout

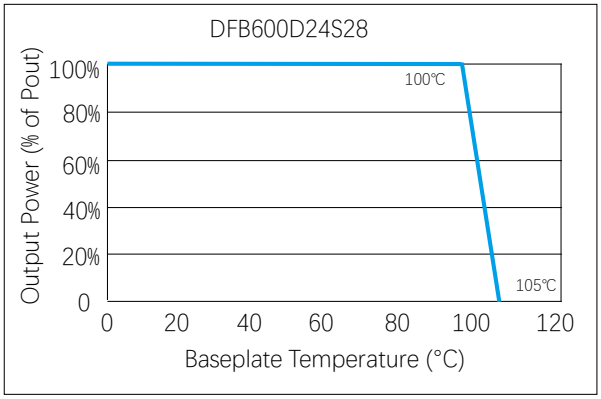


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

Ch1:Vout Ch2:Iout



THERMAL DREATING CURVE



Performance Data (DFB600D24S32)

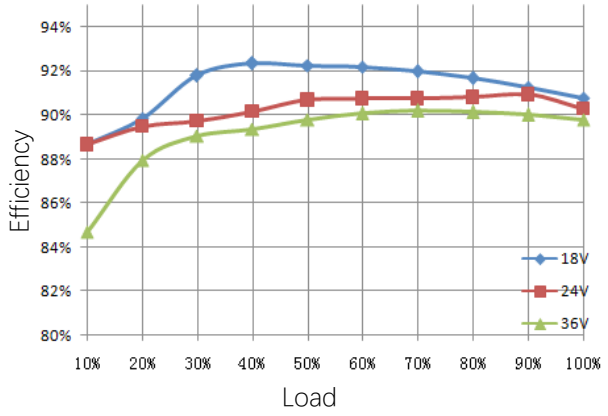
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		31.52	32.00	32.48	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			150	320	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			300	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		5000	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 11 for details.

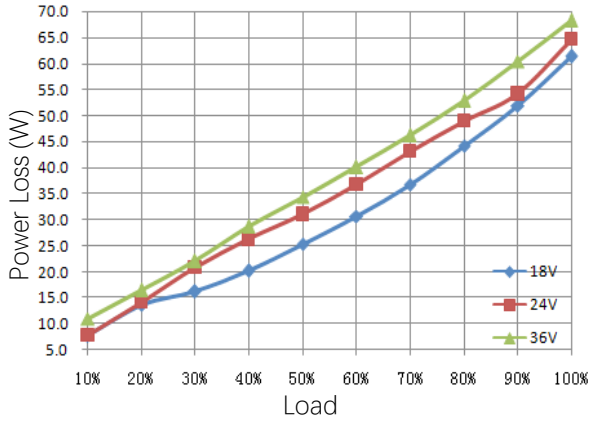
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D24S32)

EFFICIENCY VS LOAD

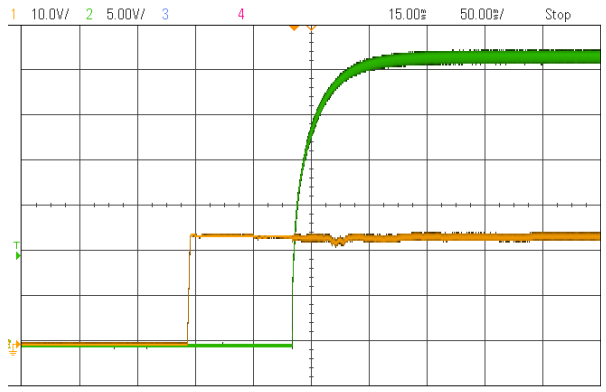


POWER DISSIPATION VS LOAD



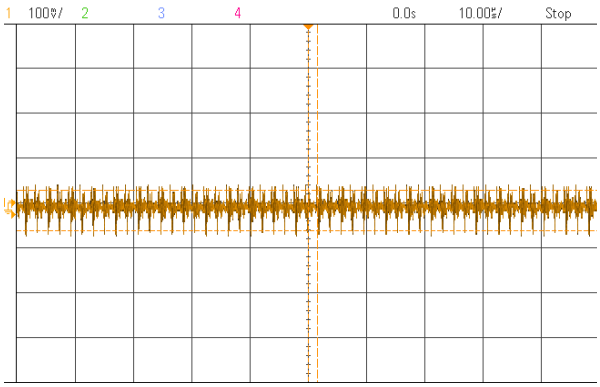
START UP

Ch1:Vin Ch2:Vout



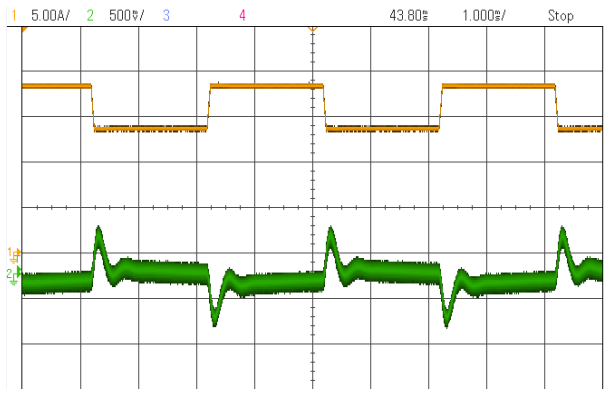
RIPPLE & NOISE BANDWIDTH 20MHz

Ch1:Vout

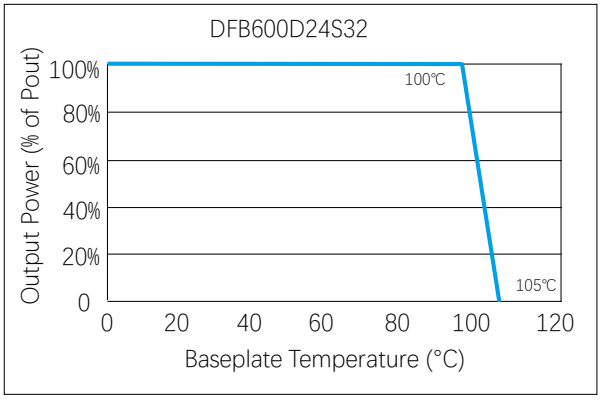


DYNAMIC RESPONSE (75%-100%-75% of $I_{max.}$)

Ch1:Iout Ch2:Vout



THERMAL DREATING CURVE



Performance Data (DFB600D24S48)

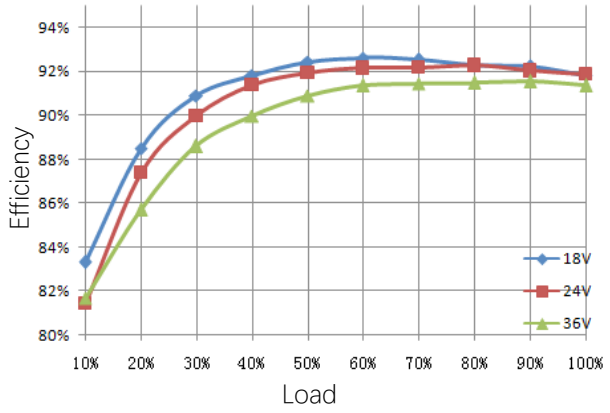
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		47.28	48.00	48.72	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			240	480	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			200	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		220		4000	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=220μF, please refer to dynamic waveforms in performance data on page 13 for details.

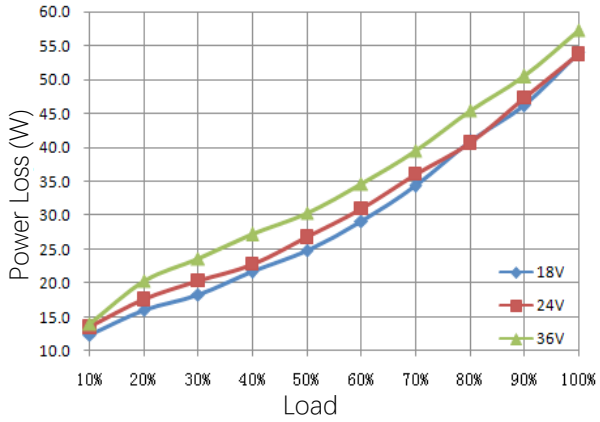
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D24S48)

EFFICIENCY VS LOAD

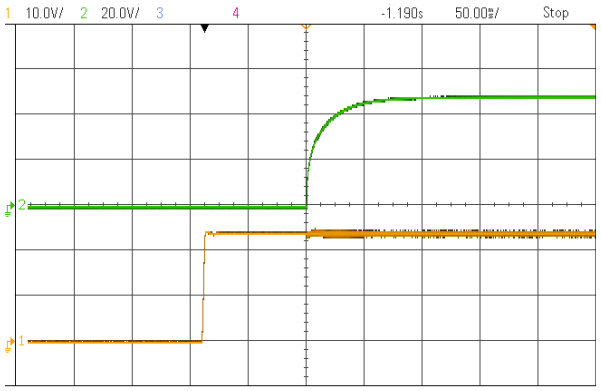


POWER DISSIPATION VS LOAD



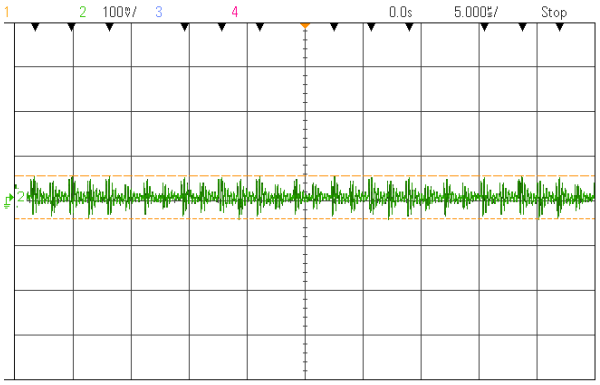
START UP

Ch1:Vin Ch2:Vout



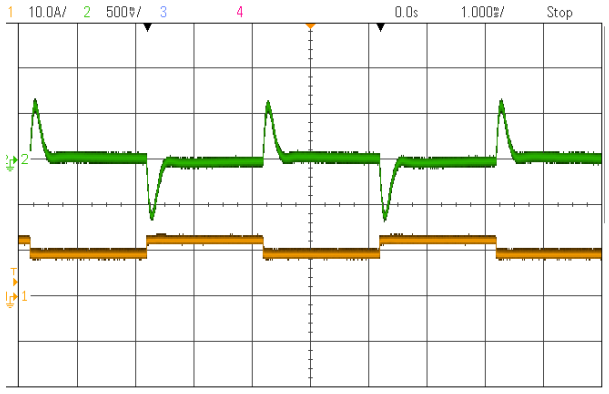
RIPPLE & NOISE BANDWIDTH 20MHz

Ch2:Vout

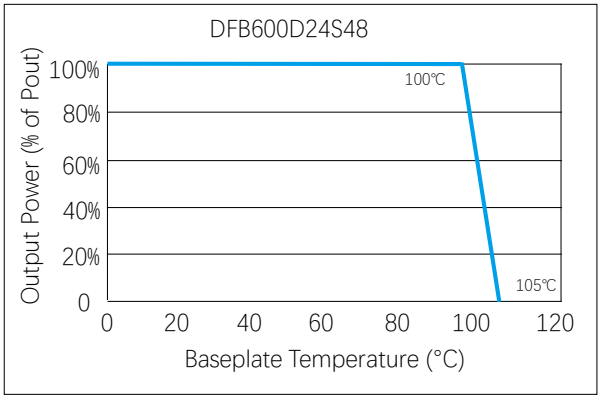


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

Ch1:Iout Ch2:Vout



THERMAL DREATING CURVE



Performance Data (DFB600D48S24)

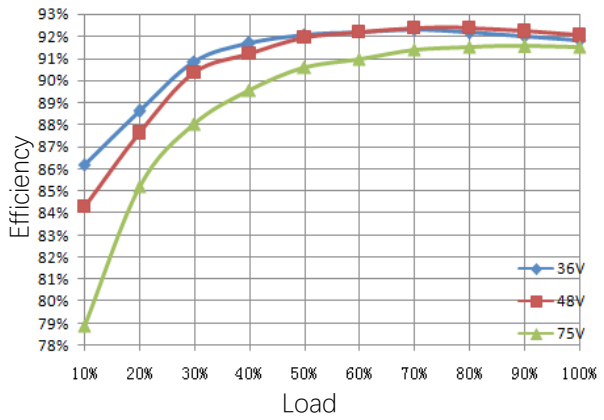
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		23.64	24.00	24.36	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			180	240	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			400	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		6800	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 15 for details.

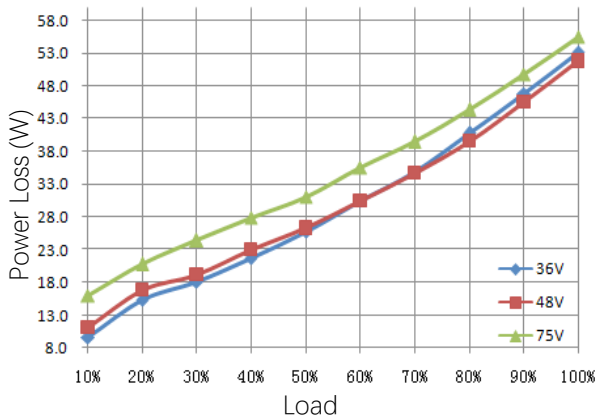
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D48S24)

EFFICIENCY VS LOAD

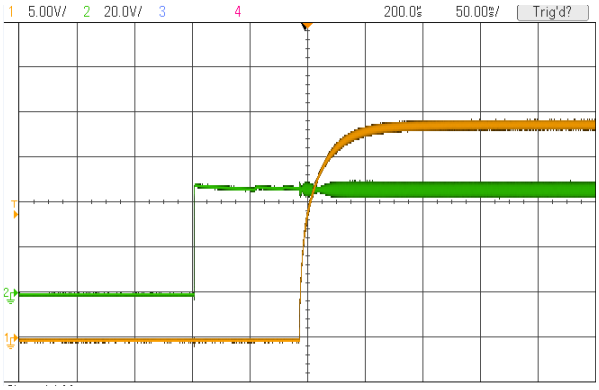


POWER DISSIPATION VS LOAD



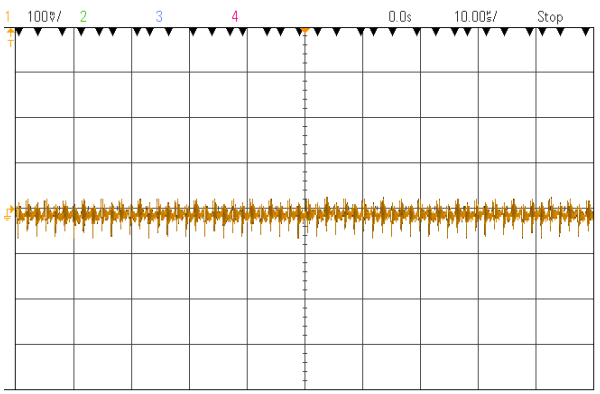
START UP

Ch1:Vout Ch2:Vin



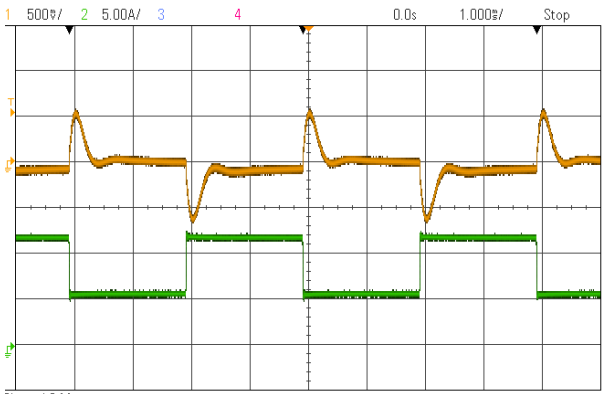
RIPPLE & NOISE BANDWIDTH 20MHz

Ch1:Vout

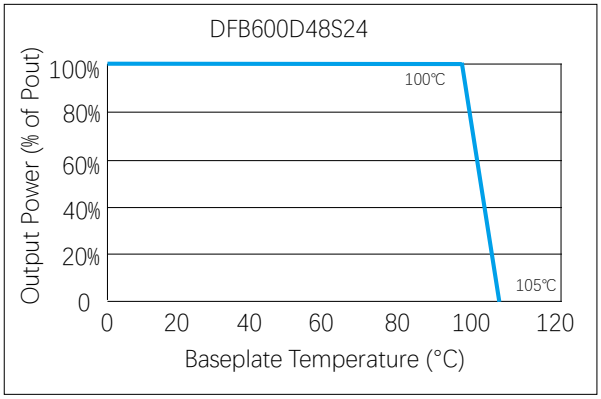


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

Ch1:Vout Ch2:Iout



THERMAL DREATING CURVE



Performance Data (DFB600D48S48)

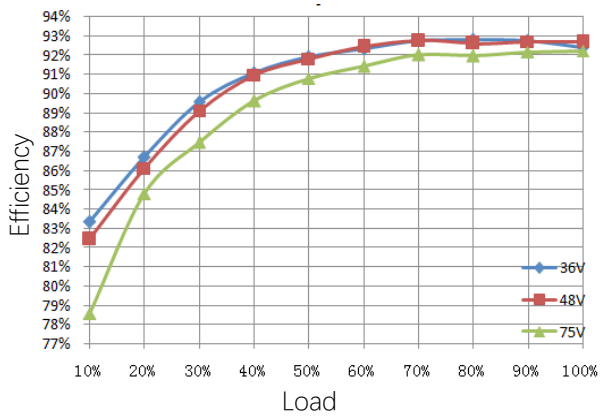
Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Voltage Setpoint		47.28	48.00	48.72	V
Vout Accuracy		-1.5		+1.5	% of Vout
Adjustable Range	Trim up/ Trim down	-20		+10	% of Vout
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=300VDC	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	%of Vout/°C
Total Regulation		-3		+3	%
Ripple & Noise Max. ①			300	480	mV pk-pk
Dynamic Load Peak Deviation ②		-5		+5	%Vout
Dynamic Load Response			200	500	μS
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		150	%
Short Circuit Protection	Hiccup, Auto-recover				
Aux Power Supply Voltage		7		13	VDC
Aux Power Supply Current				20	mA
Remote Sense Voltage				10	%
Current Share Accuracy		-10		+10	%
Capacitive Load		470		4000	μF
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 22 for more details.
② The load is set from 75%-100%-75% of Imax, di/dt=0.1A/μS, Cout=470μF, please refer to dynamic waveforms in performance data on page 17 for details.

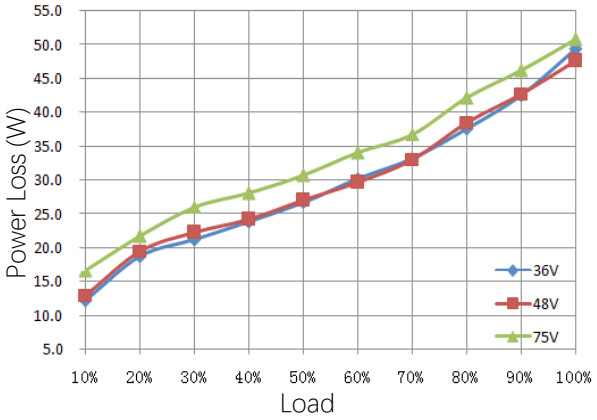
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (DFB600D48S48)

EFFICIENCY VS LOAD

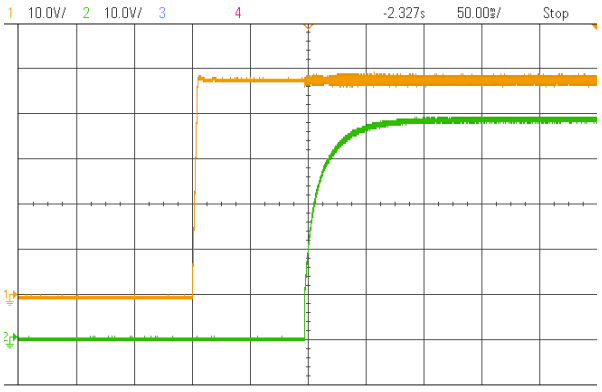


POWER DISSIPATION VS LOAD



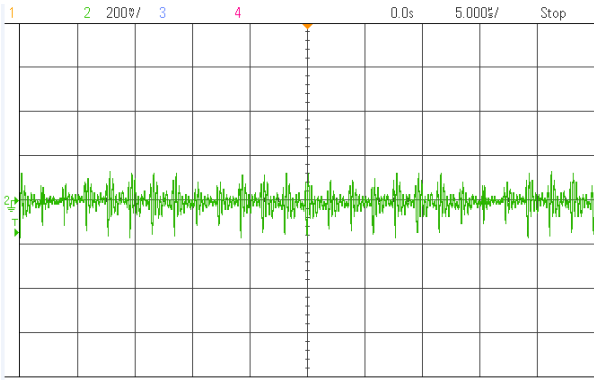
START UP

Ch1:Vin Ch2:Vout



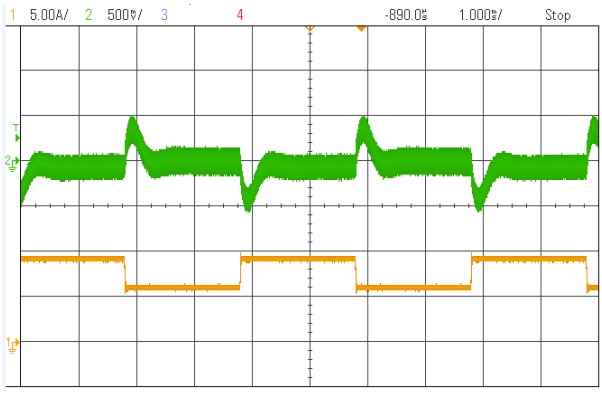
RIPPLE & NOISE BANDWIDTH 20MHz

Ch2:Vout

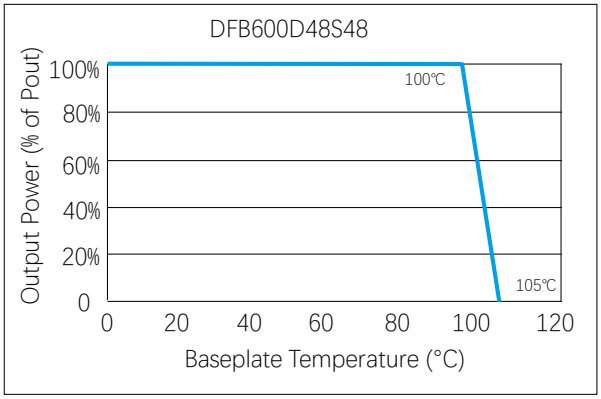


DYNAMIC RESPONSE (75%-100%-75% of $I_{max,}$)

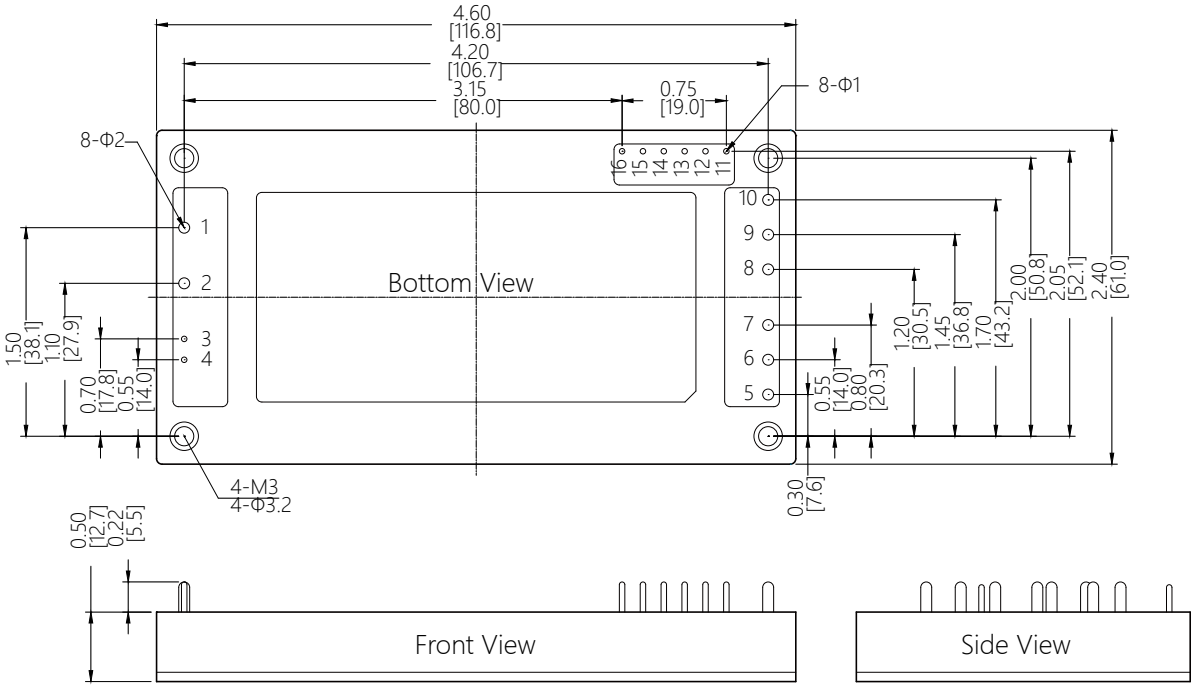
Ch1:Iout Ch2:Vout



THERMAL DREATING CURVE



Mechanical Specifications



PIN:
PIN1, PIN2, PIN5~PIN10: Φ0.078inch
Force: Applied force not exceed 9.8N
PIN3, PIN4, PIN11~PIN16 : Φ0.040inch
Force: Applied force not exceed 4.9N
Material: Copper alloy
Finish: Gold 3 ~ 5μm(min.) over nickel 50μm(Min.)
Baseplate screw locked torque: 0.7N·m Max.

Tolerance:
X.XX=±0.02[0.5]
X.XXX= ±0.010[0.25]

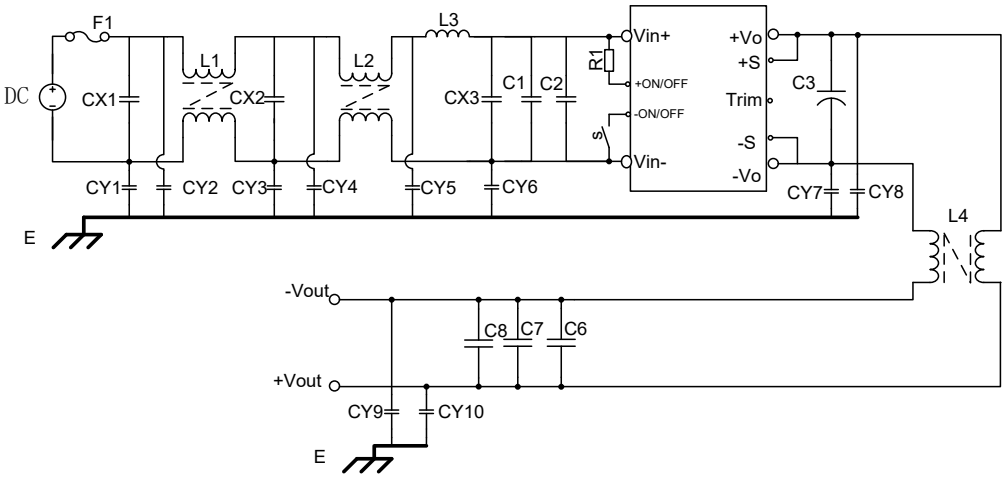
Dimensions are in inches [mm]
Weight: ~230g.

PIN CONNECTIONS	
Pin	Function
1	-Vi (Input Negative)
2	+Vi (Input Positive)
3	-ON/OFF (Remote Control)
4	+ON/OFF (Remote Control)
5, 6, 7	+Vo (Output Positive)
8, 9, 10	-Vo (Output Negative)
11	-S (Output Sense Negative)
12	+S (Output Sense Positive)
13	TRIM (Output Adjustable)
14	PC/NC (Current Share Bus)
15	IOG (Output Fault Signal)①
16	AUX (Auxiliary Power Supply)

Note:
① IOG pin connect with external pull-up resistor 1 kΩ to 5Vdc (Typical).

Emissions Performance

Density Power measures its products for conducted emissions against the EN55032 standards. The common mode filter is added at the output of the module, and the maximum output power of the module is 600W. Input voltage is 24VDC, EMI filter is added outside the modules and the conduction limit can meet standards.



Conducted Emissions Test Circuit

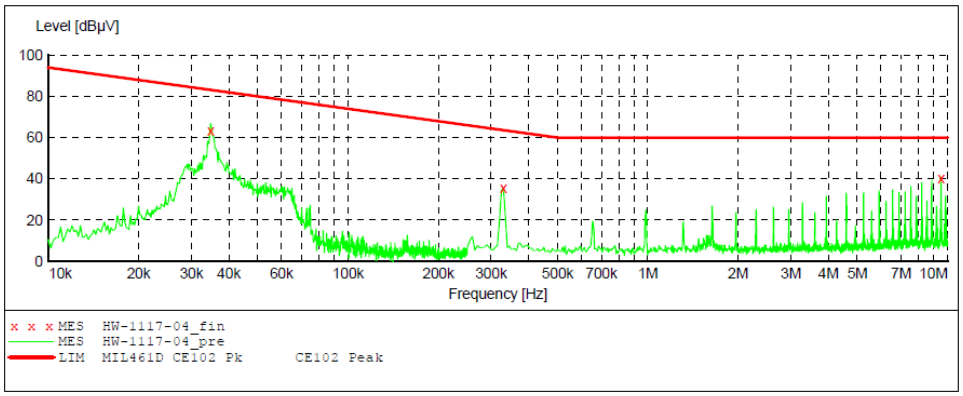
Recommended Filter Parameters

REFERENCE	DESCRIPTION	REFERENCE	DESCRIPTION
F1	FUSE, 80A, 50V	C1/2	330μF/63VDC
CX1/2/3	2.2μF/250VAC	C3	1000μF/63VDC
CY1/2	NC	C6/7/8	100μF/63VDC
CY3/4/5/6	1nF/250VAC	L4	Short
L1	1mH/100KHz/T38, 28*16*13	CY7/8/9/10	33nF/250VAC
L2	2mH/100KHz/T38, 30.5*20*12.5	R1	10KΩ/1206
L3	10uH/CS229060	S	Switch, off (positive logic)

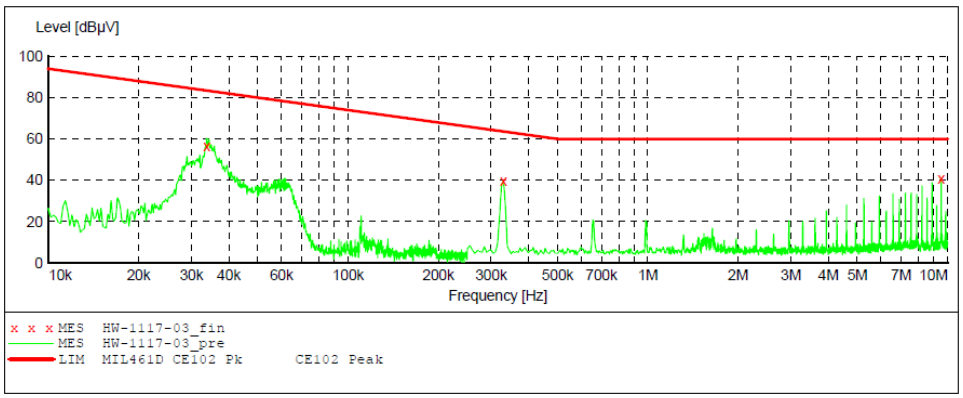
Emissions Performance

Conducted Emission Test Results:

DFB600D24S24 Model (positive line):



DFB600D24S24 Model (negative line):



Technical Notes

TIMING

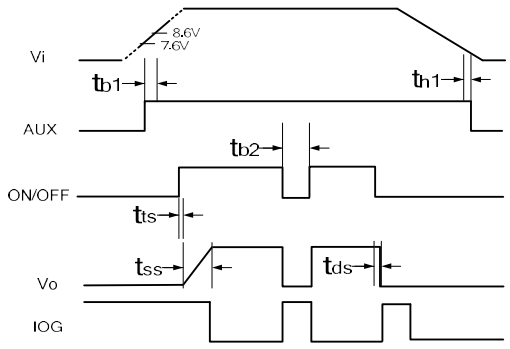


Figure 1· Timing (P Logic)

INPUT FUSING

Certain applications may require fuse at the inputs of power conversion components. Fuses should also be used when there is possibility of sustained input voltage reversal which is not current limited. The DFB600D24/48 modules are not internally fused. We strongly recommend a slow-blown fuse to be used in the ungrounded input supply line.
For safety agency approvals, the installer must install the converter in compliance with the end user safety standard.

TYPICAL APPLICATION CONNECTION

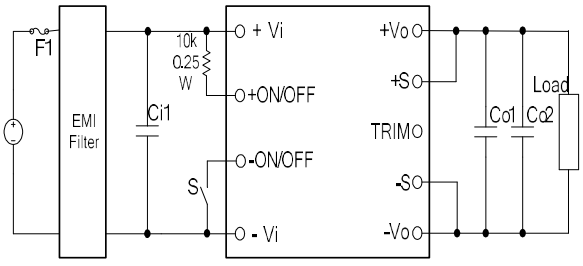


Figure 2·Typical Application Connection

Figure 2 shows the typical use of the module connection. In order to prevent the input line from causing the input oscillation, it is recommended to add the input capacitor close to the input pin of the module. Similarly, the output capacitor is added to the output of the module.Specific recommended parameters: input capacitance Ci1=220μF electrolytic capacitor, Ci2=1μF CBB capacitor. Output Capacitance Co1=10μF tantalum capacitor, Co2 ESR <0.1Ω.

REFLECTED RIPPLE CURRENT

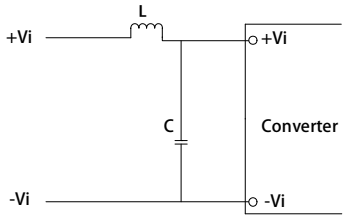


Figure 3· Reflected Ripple Current

Add LC filter at the front of the power module to reduce the interference of reflected ripple current on the DC bus, recommended value of L and C with appropriate current and voltage rating as below: for 24 Vin type, L=10μH, C=820μF; for 48 Vin type, L=10μH, C=470μF.

REMOTE CONTROL FUNCTION

Module Power Remote Control or called ON/OFF pin is for the user to enable or disable the output. Control uses high and low level control, there are two general control logics, positive logic or negative logic control.

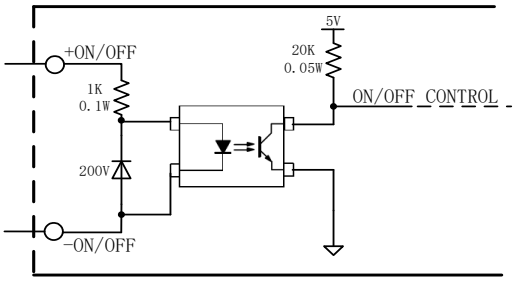


Figure 4· Remote Control

Remote Control Pin can be connected in parallel for multiple converters which with the same Remote Control characters. However, when several converters share the same remote control circuit, the total sink and source current must be taken into consideration, and make sure that the opto-coupler has enough drive capability.

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REMOTE COMPENSATION FUNCTION

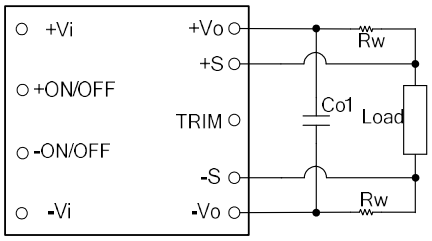


Figure 5· Remote Compensation

The remote compensation function compensates for the voltage drop across the output line. Module compensation function can't exceed 10%, that is:
$[(+Vo) - (-Vo)]-[(+S) -(-S)] \leqslant 10\%V_{onom}$
Remote Sense compensation at nominal Vo only. Incorrect connection of the sense leads may damage the module.
If the remote compensation function is not used, the +Sense and +Vout pin, -Sense and -Vout pins should be connected directly to ensure accurate regulation.

OUTPUT RIPPLE & NOISE

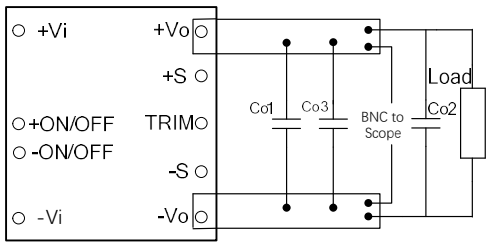


Figure 6· Output Ripple

These DFB600D24/48 modules' output ripple and noise are measured at the rated input voltage and output current, along with 10uF and 0.1uF MLCC used in parallel with appropriate voltage ratings and placed as C1&C2 shown in the figure above. The scope's bandwidth is set to 20MHz.
External output capacitors are required to reduce the ripple & noise. The output capacitors should be low ESR and appropriate frequency response with appropriate voltage ratings, and must be located as close to the converters as possible, also PCB layout must be taken into consideration.

INPUT UNDERVOLTAGE SHUTDOWN AND OVERVOLTAGE PROTECTION

Under normal start-up conditions, module will not begin to regulate until the ramping-up input voltage exceeds the Start-Up Threshold Voltage. Once operating, module will not turn off until the input voltage drops below the Undervoltage Shutdown limit. Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.
When input voltage is over the input overvoltage protection set point, the PWM will be shutdown and the converter will not be turned on until the input voltage drops below input overvoltage threshold.

CURRENT LIMITING

The output voltage remains constant as the output current increases. However, once the output current is over the specified Output DC Current Limit, the converter turns off.
The converter then enters a "hiccup mode" where it repeatedly turns on and off until the short circuit condition is removed. This prevents excessive heating of the converter or the load board.

SHORT CIRCUIT CONDITION

When the converter is in current-limit mode, the output voltage will drop as the output current demand increases and then the converter will be shut down.If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The module is capable of enduring an indefinite short circuit output condition.

OUTPUT OVERVOLTAGE PROTECTION

The output voltages are monitored for an

Technical Notes

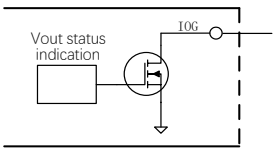
overvoltage condition via magnetic feedback. The signal is coupled to the primary side and if the output voltage rises to a level which could be damaging to the load, the sensing circuitry will power down the PWM controller causing the output voltages to decrease. Following a timeout period the PWM will restart, causing the output voltages to ramp to their appropriate values. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle. This on/off cycling is referred to as "hiccup" mode.

THERMAL SHUTDOWN

These DFB600D24/48 converters are equipped with thermal shutdown circuitry. If environmental conditions cause the internal temperature of the converter to rise above the designed operating temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will auto restart.

IOG OUTPUT STATUS INDICATOR SIGNAL

The IOG pin provides output voltage status indication signal of the module. External pull-up resistance is required to connect with IOG pin. When the output voltage is lower than a certain value, IOG is a high level.



AUX WORKING CONDITION

The AUX pin provides auxiliary power supply function. AUX auxiliary power supply of DFB600D24/48 serves as an independent power supply unit in the module, which is not affected by remote control, over-voltage protection, over-temperature protection, over-current protection and other protective shutdown signals of the module.

TRIMMING OUTPUT VOLTAGE

DFB600D24/48 converters have a trim capability that allows users to adjust the output voltages. Output voltage can be trimmed up or down by a trim pin by connecting a single fixed resistor between +S and +Vo or -S and TRIM, the output volatge can be increased or decreased depending on its connection. The maximum output voltage adjustment range is -20% to +10%. If the trim function is not used, keep TRIM pin floating.

Trim up:

Increase the output voltage by connecting an appropriate value resistor between +S and +Vo Pin. Show as below:

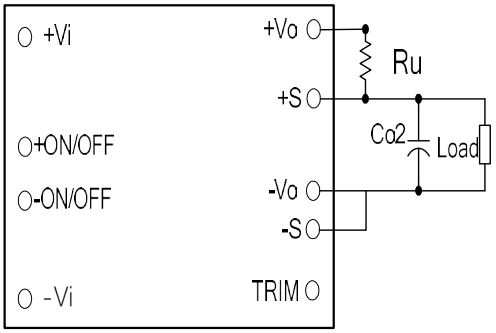


Figure 7· Trim Up Connection

Please follow up the Trim Up formula to calculate the resistor value according to the desired output voltage.

$$R_u = \left(\frac{\Delta}{100} \times Voset\right) K\Omega$$

"Voset" is the output voltage when TRIM is floating, "Δ%" is the change of output voltage. Such as: 12V output is raised to 13.2V,
Δ% = (13.2-12) / 12 * 100% = 10%.

Trim down:

Decrease the output voltage by connecting an

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appropriate value resistor between Trim Pin and -S. Show as below:

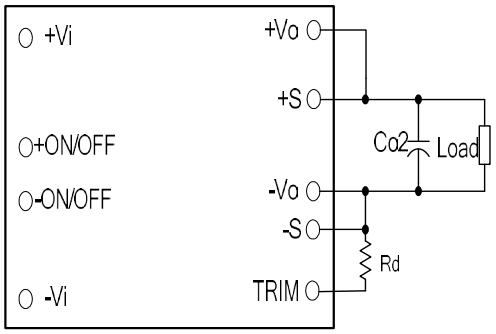

Figure 8· Trim Down Connection

Please follow up the Trim Down formula to calculate the resistor value according to the desired output voltage.

$$R_d = \frac{7.68 \times 33 \times (100 - \Delta)}{(7.68 + 33) \times \Delta + [1.24 \times 33 - (7.68 + 33)] \times 100} K\Omega$$

"Voset" is the output voltage when TRIM is floating, "Δ%" is the amount of change in output voltage. Such as: 12V output is reduced to 10.8V, Δ% = (12-10.8) / 12 * 100% = 10%.

CURRENT SHARE

DFB600D24/48 series are designed for parallel operation. To ensure that all modules in a parallel system accurately share current, the PC/NC pins on each modules should be connected together. In addition, It also supports highly reliable N+1 redundant parallel operation. Typical parallel applications are shown as below:

1.Current share circuits

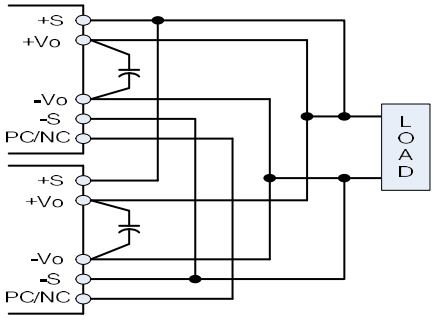

Figure 9· Current share circuits

2. Adjustable output current share circuits

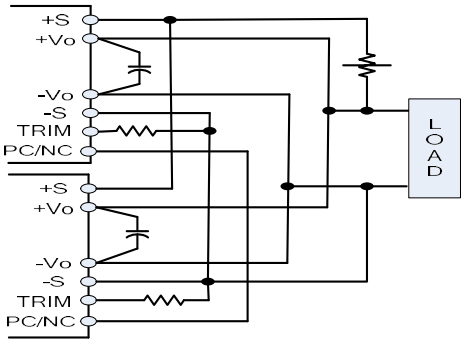

Figure 10· Adjustable output current share circuits

3. N+1 redundant current share circuits

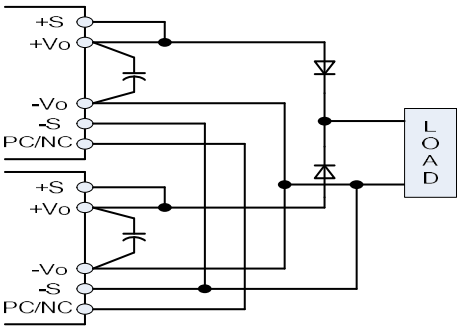

Figure 11· N+1 redundant current share circuits

4. Adjustable N+1 redundant current share circuits

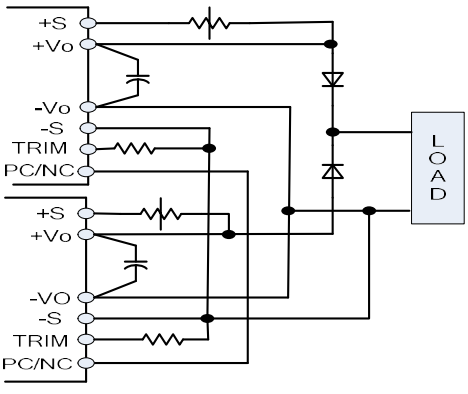

Figure 12· Adjustable output N+1 redundant current share circuits

Technical Notes

This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:
Refer to: http://www.densitypower.com