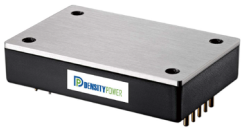
Technical Specification

DQB100W24/48 Series

4:1 Input 1/4th Brick Isolated 100Watts DC/DC Converters

FEATURES

- 4:1Wide input range: 9-36/18-75VDC
- 100W isolated outputs
- Efficiency up to 87.5%
- Fixed outputs from 3.3 to 48VDC
- Adjustable Vout (-10% to +10%)
- Fixed switching frequency, predicted EMI
- Stable @ no-load operation
- Remote On/Off control
- 1500VDC I/O isolation
- Industry standard 1/4th brick footprint (2.28" × 1.45" × 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



PRODUCT OVERVIEW

The DQB100W24/48 series are highly reliable, and efficient isolated DC/DC converter. Standard input range of 9-36V (24V nominal) /18-75V (48V nominal) is ideal for automation, power grid, railway, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

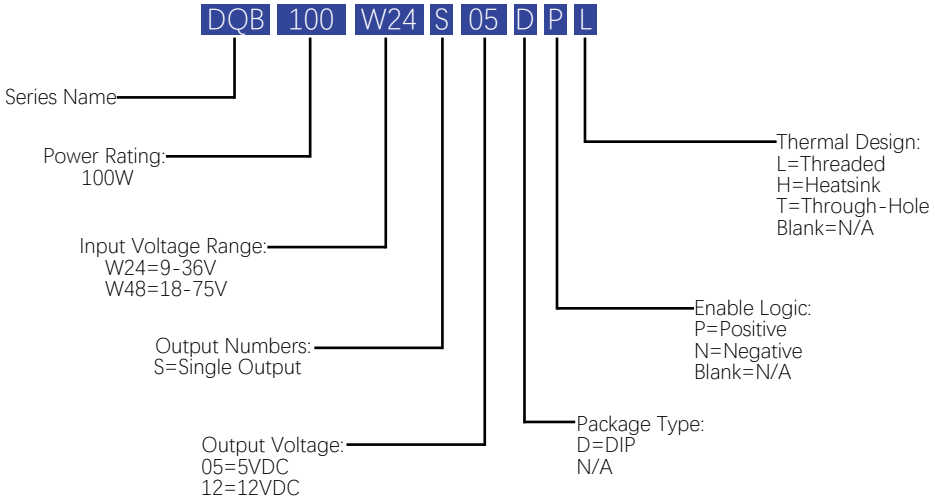
A wealth of self-protection features included input undervoltage lockout, over temperature shutdown, over current protection with "hiccup" autorestart technique, provides indefinite short-circuit protection, along with output OVP. Threaded or through holes are provided to allow easy mount or the addition 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 DQB100W24/48 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]
DQB100W24S03	24	9-36	3.3	30	85.5	10000	2.28"×1.45"×0.50" DIP
DQB100W24S05	24	9-36	5	20	87	6800	
DQB100W24S09	24	9-36	9	11.1	87.5	3000	
DQB100W24S12	24	9-36	12	8.3	86.5	2400	
DQB100W24S15	24	9-36	15	6.67	86.5	2000	
DQB100W24S24	24	9-36	24	4.17	87	1500	
DQB100W24S28	24	9-36	28	3.57	87	1000	
DQB100W24S36	24	9-36	36	2.78	86.5	820	
DQB100W24S48	24	9-36	48	2.09	87	470	
DQB100W48S12	48	18-75	12	8.3	86	2400	
DQB100W48S24	48	18-75	24	4.17	87	1500	

Model Numbering



Absolute Maximum Ratings

Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous	24V Input type	-0.7		36	VDC
	48V Input type	-0.7		75	VDC
Input Voltage Transient(< 100ms)	24V Input type			50	VDC
	48V Input type			100	VDC
On/Off Remote Control Voltage	Referred to -Vin	0		75	VDC
On/Off Remote Control Current		0	0.25	1	mA
Operating Baseplate Temperature		-40		100	°C
Operating Environment Temperature		-40		85	°C
Storage Temperature Range		-55		125	°C
Soldering Temperature	Wave Soldering < 10s			260	°C

Safety and EMC Compliance

Conducted Emission	EN55032	Class A (With external filter)
Radiated Emission	EN55032	Class A (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

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
Isolation Resistance (Viso=500VDC)	Input to output	100			MΩ
	Input to case	100			MΩ
	Output to case	100			MΩ
Isolation Capacitance	Input to output		1000		pF
Isolation Safety Rating	Basic insulation				
Switching Frequency			250		KHz
Start-up Delay	From start-up threshold recover to 10% Vout		50	150	mS
Rise Time	From 10% Vout to 90% Vout capacitive load		30	50	mS
Remote On/Off Control	Positive Logic, ON state	3.0		75	VDC
	Positive Logic, OFF state	0		1.2	VDC
	Negative Logic, ON state	0		1.2	VDC
	Negative Logic, OFF state	3.0		75	VDC
Remote Control Current		0	0.25	1.0	mA
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	9	24	36	VDC
	48V Input type	18	48	75	VDC
Start-up Threshold	24V Input type	8.0		9.0	VDC
	48V Input type	16		18	VDC
Under Voltage Shutdown	24V Input type	7.5		8.5	VDC
	48V Input type	15		17	VDC
Input Current @ No Load	24V Input type			200	mA
	48V Input type			120	mA
Input Current @ Min. Line (Vin=min.line, Iout=full load)	24V Input type			14	A
	48V Input type			7.0	A
Input Current @ Shutdown Mode				15	mA
Reflect Ripple Current (Peak-Peak)	Measured at input pin with 4.7μH inductor and 330μF capacitance		100	150	mA
Recommended Input Fuse	24V Input type		25		A
	48V Input type		15		A
Recommended External Input Capacitance			330		μF

Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Power				100	W
Vout Accuracy	50% Load, Vin nom	-1.5		+1.5	%
Adjustable Range	Trim up/ Trim down	-10		+10	%
Line Regulation	Vin from min. line to max. line, 50% load	-0.2		+0.2	%
Load Regulation	From min. load to full load, Vin=nom.line	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	% of Vout /°C
Total Regulation		-2		+2	%
Thermal Shutdown		105	110	115	°C
Thermal Shutdown Recover		85	95	100	°C
Over Voltage Protection	Hiccup, Auto-recover	115		140	%
Over Current Protection	Hiccup, Auto-recover	110		160	%
Short Circuit Protection	Hiccup, Auto-recover				
Remote Sense Voltage				10	%
Minimum Load	No minimum load required				

Output Specifications												
Parameters		24V Input Type									48V Input Type	
		S03	S05	S09	S12	S15	S24	S28	S36	S48	S12	S24
Output Voltage Normal(VDC)		3.3	5.0	9.0	12	15	24	28	36	48	12	24
Ripple & Noise Max. (mV pk-pk) ①		100	100	120	120	150	240	280	360	480	120	240
Dynamic Load Peak Deviation (%Vout) ②		±8	±5	±5	±5	±5	±5	±5	±5	±5	±5	±5
Dynamic Load Response (μS)		500	500	500	500	500	500	500	500	500	500	500
Capacitive Load (μF)	Min.	330	0	0	470	0	0	0	0	100	100	0
	Max.	10000	6800	3000	2400	2000	1500	1000	820	470	2400	1500

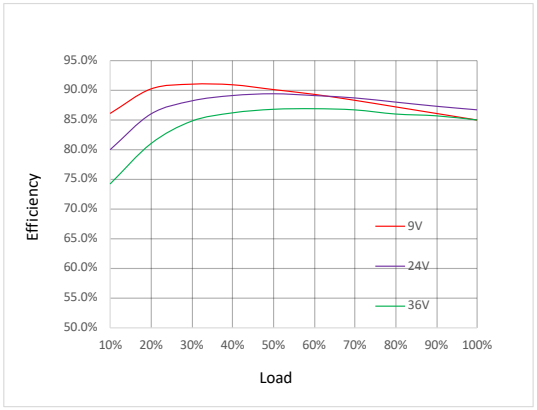
Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 15 for more details.
② The load is set from 50%-75%-50% of Imax, di/dt=1A/μS, please refer to dynamic waveforms in performance data on page 10-12 for details.

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

Performance Data

EFFICIENCY VS LOAD

DQB100W24S03



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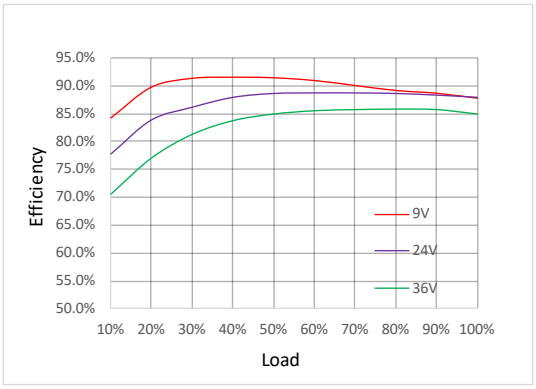

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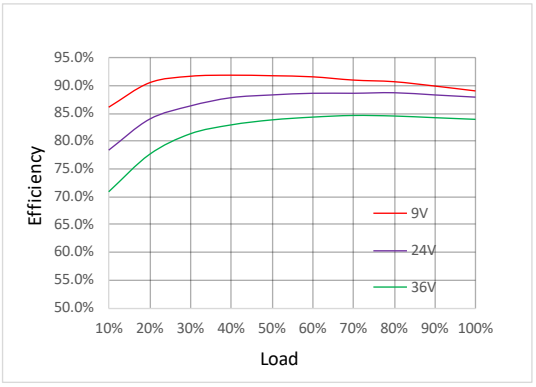

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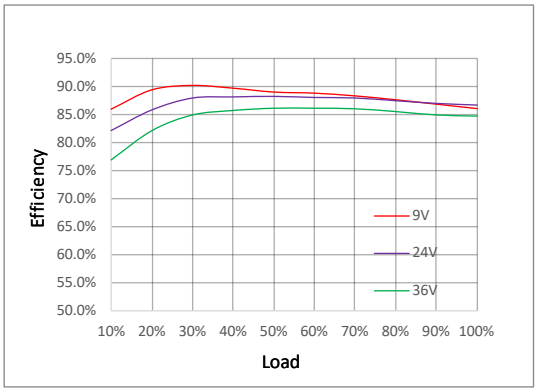

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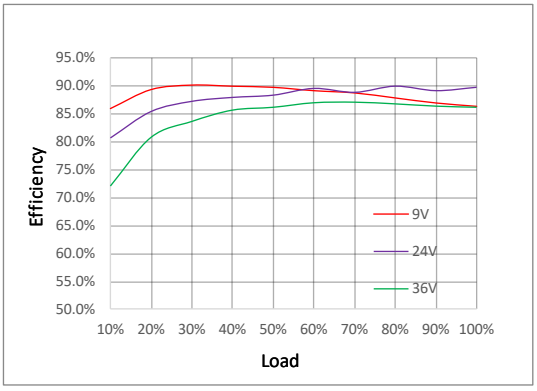

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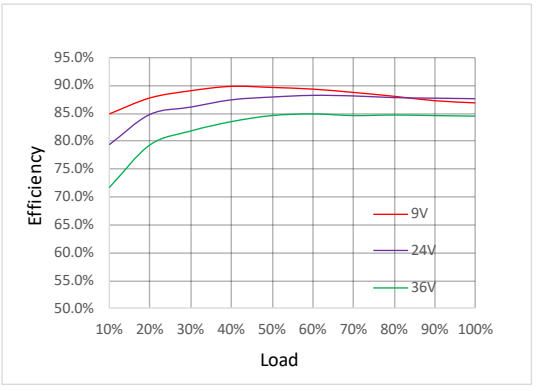
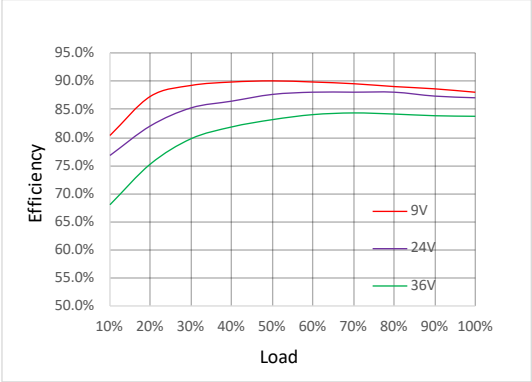


Performance Data

EFFICIENCY VS LOAD

DQB100W24S28



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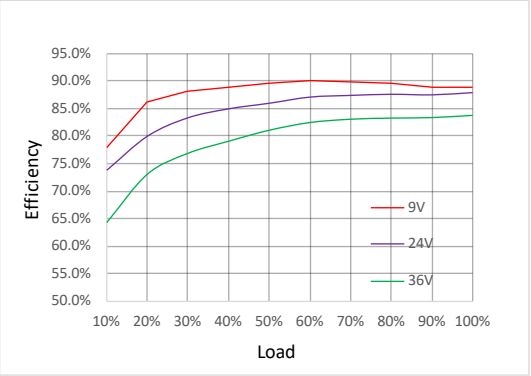

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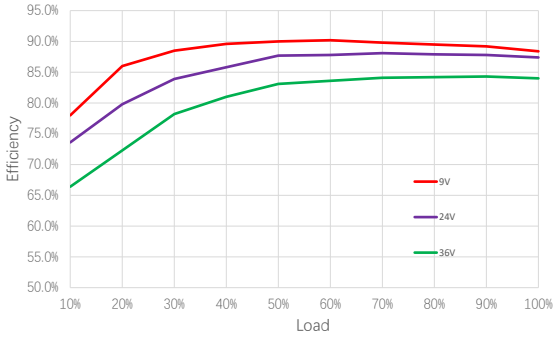

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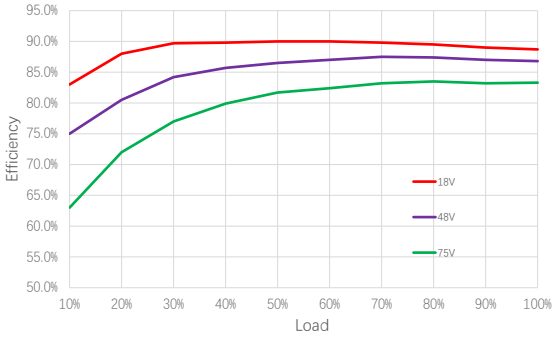

EFFICIENCY VS LOAD

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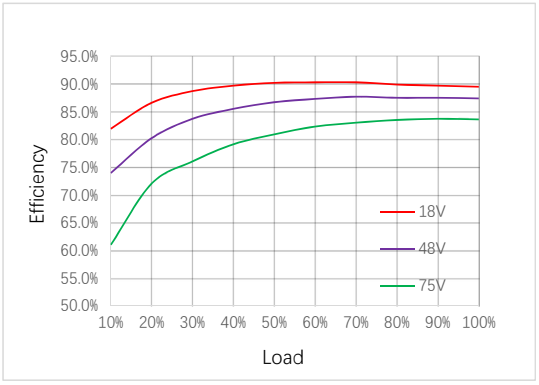
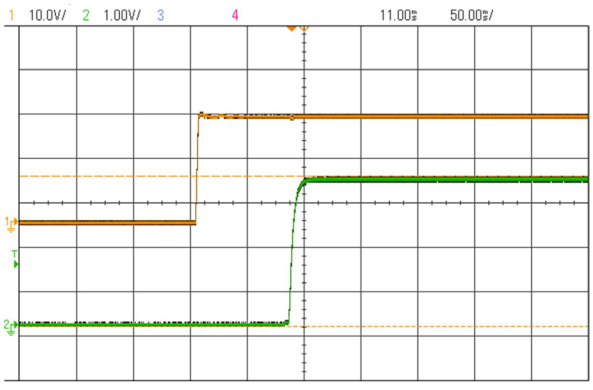


START UP Ch1: Vin Ch2: Vout

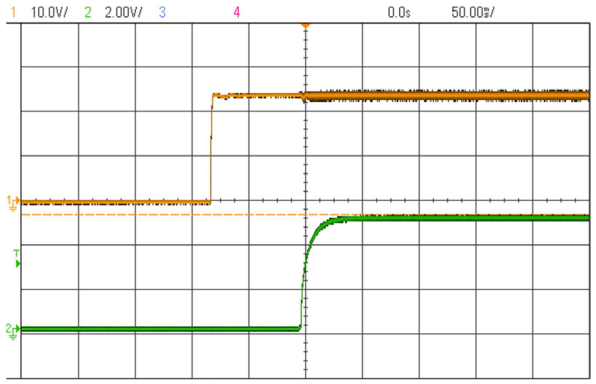
DQB100W24S03



Performance Data

START UP Ch1: Vin Ch2: Vout

DQB100W24S05



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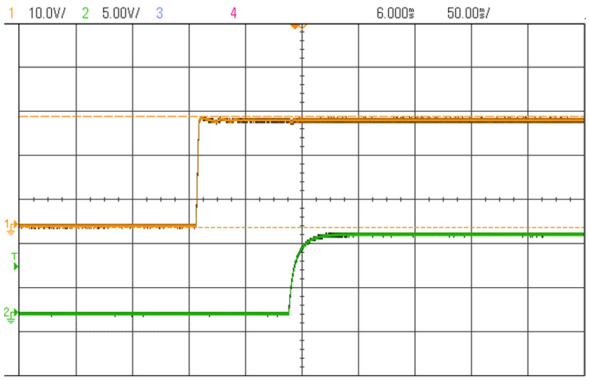

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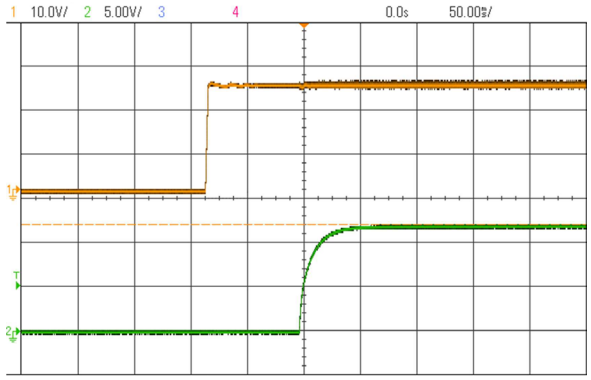

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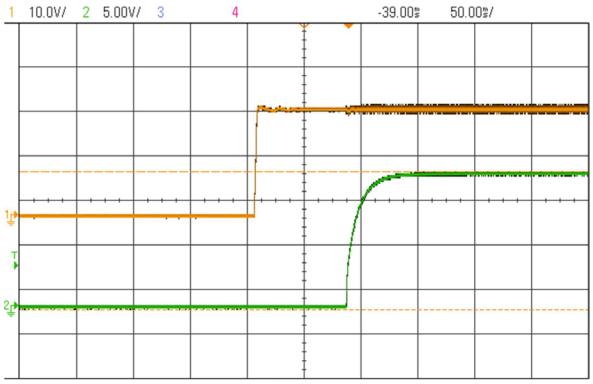

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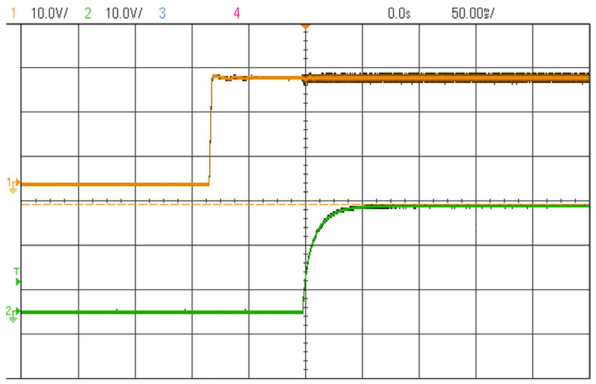

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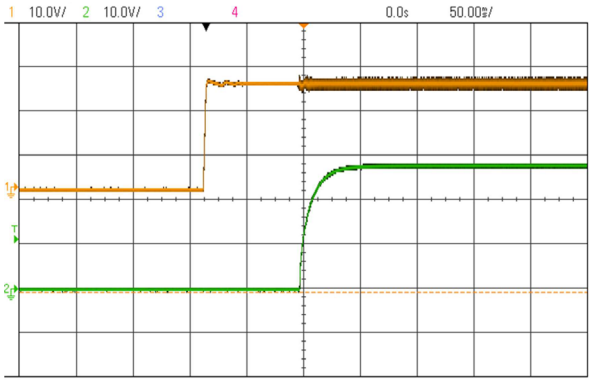

Performance Data

START UP Ch1: Vin Ch2: Vout

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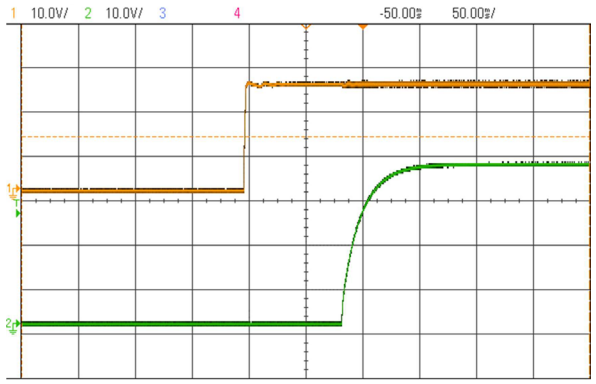

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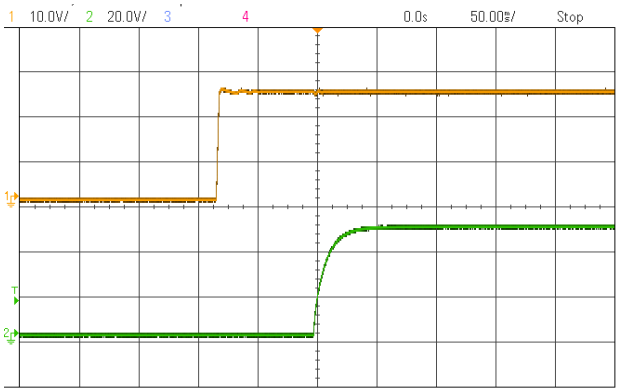

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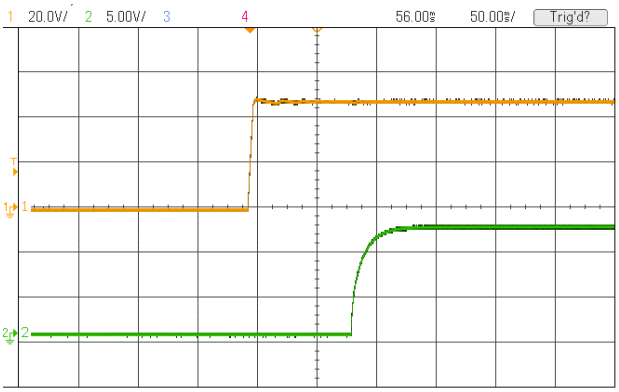

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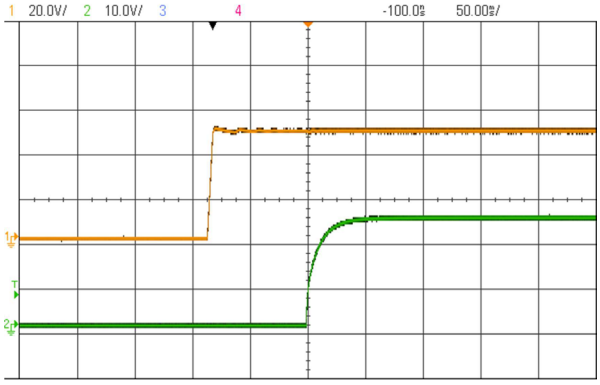

RIPPLE & NOISE 20MHz Bandwidth

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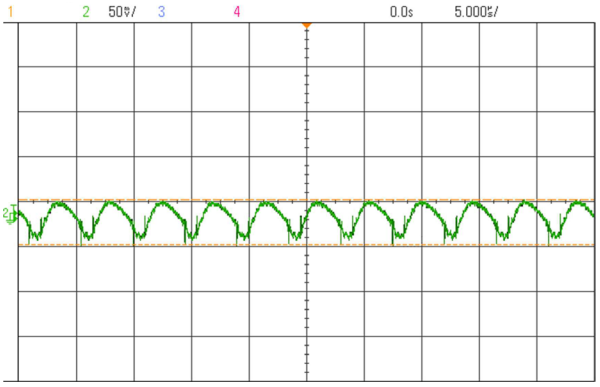

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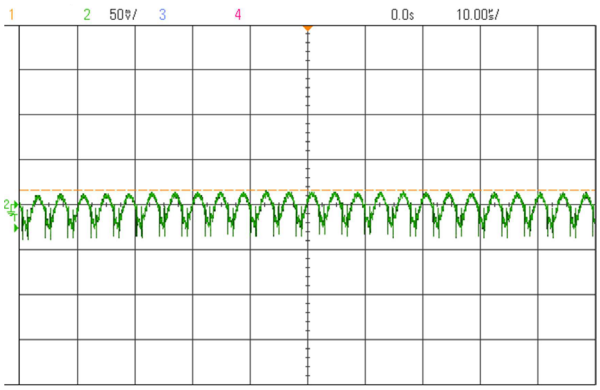

Performance Data

RIPPLE & NOISE 20MHz Bandwidth

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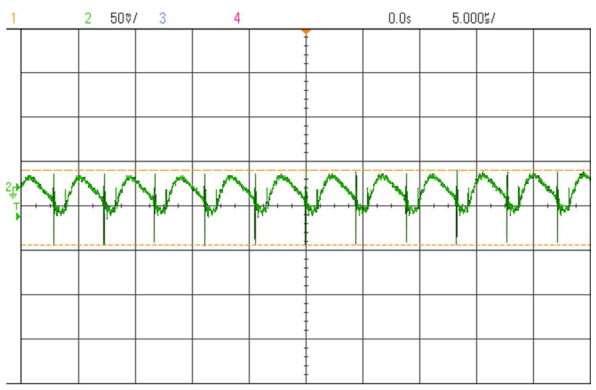

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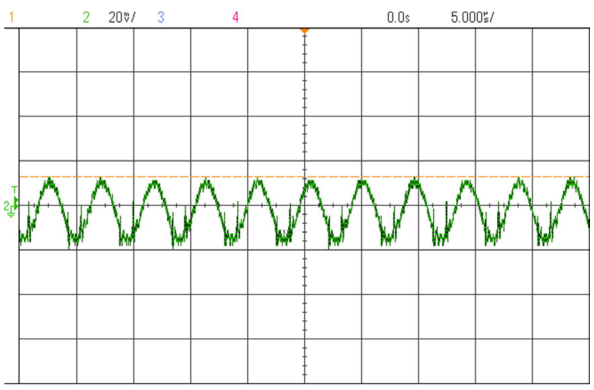

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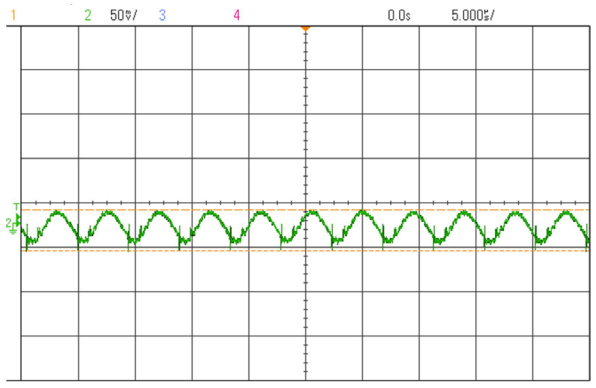

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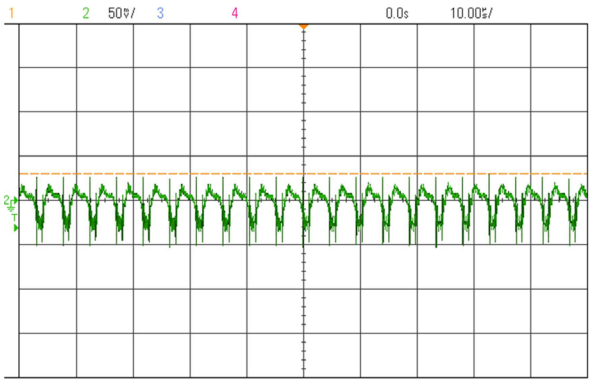

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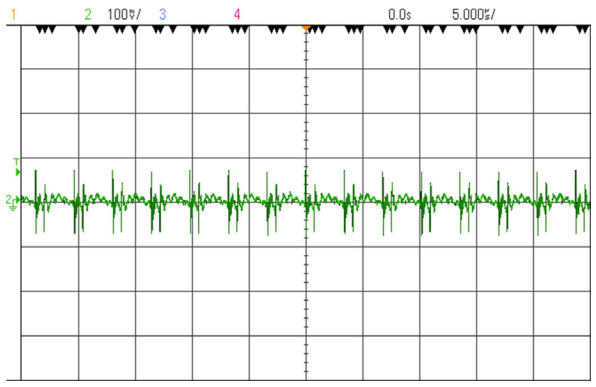

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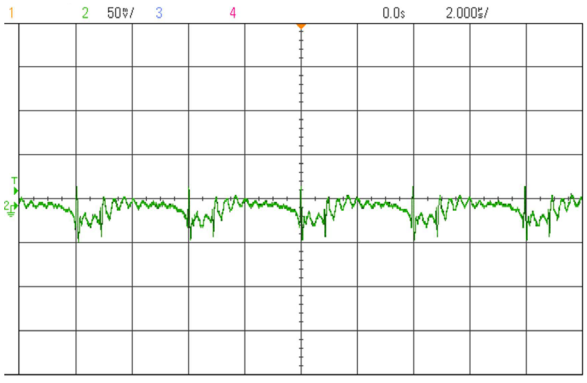
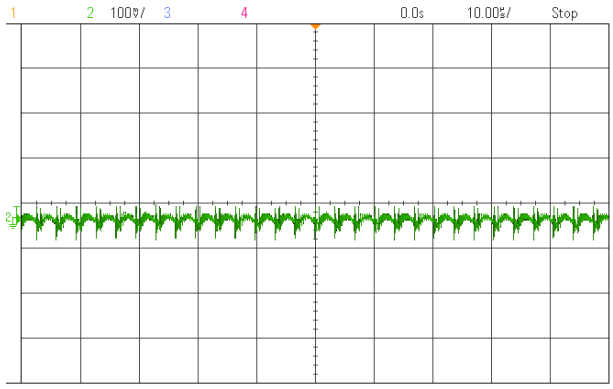


Performance Data

RIPPLE & NOISE 20MHz Bandwidth

DQB100W24S48



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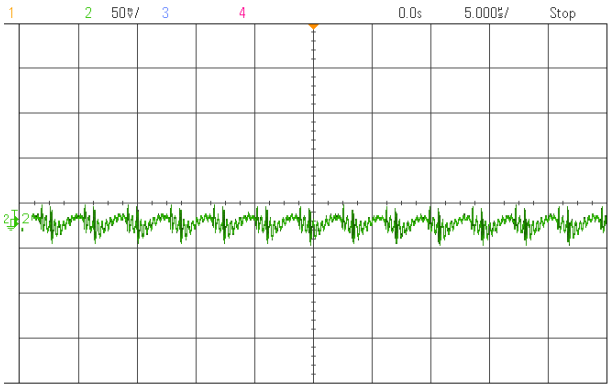
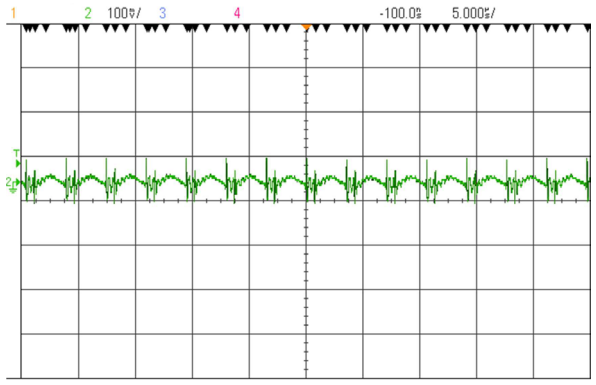


RIPPLE & NOISE 20MHz Bandwidth

DQB100W48S24



DYNAMIC RESPONSE (50%~75%~50% of I_{max}, di/dt=1A/μs)

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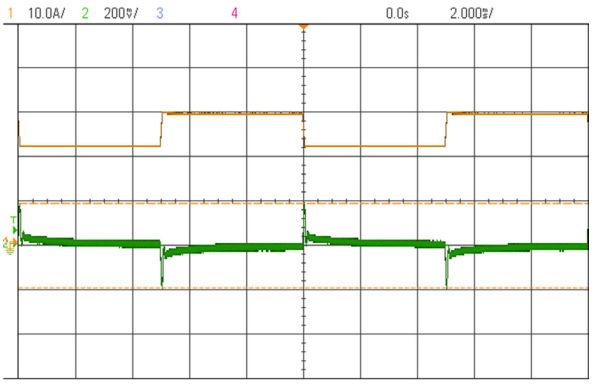
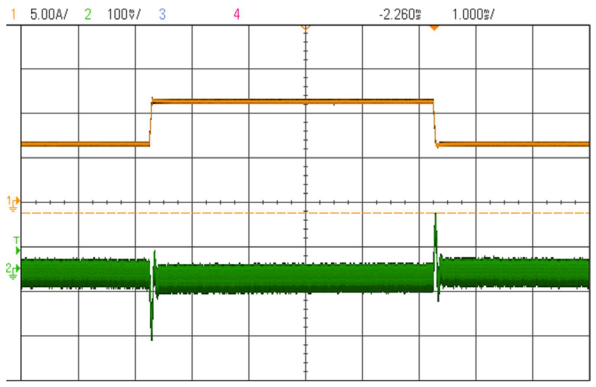


DYNAMIC RESPONSE (50%~75%~50% of I_{max}, di/dt=1A/μs) Ch1: I_{out} Ch2: V_{out}

DQB100W24S05 C_{out}=0μF



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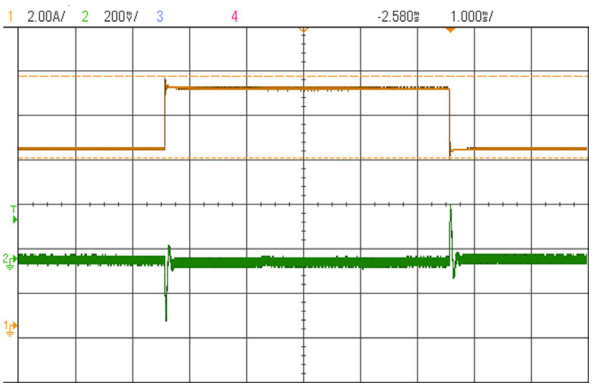
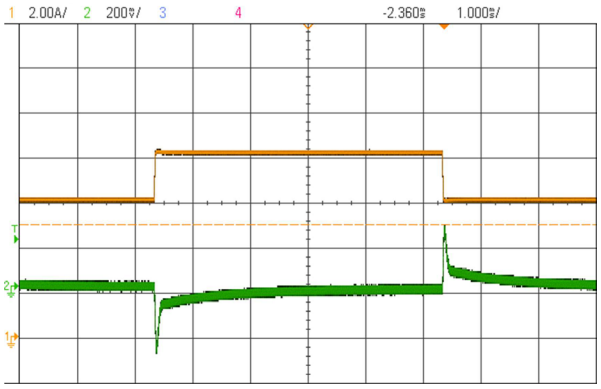


Performance Data

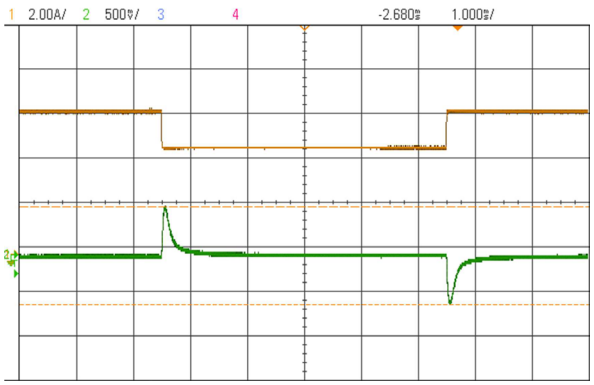
DYNAMIC RESPONSE (50%~75%~50% of I_{max}, di/dt=1A/μs)

Ch1: I_{out} Ch2: V_{out}

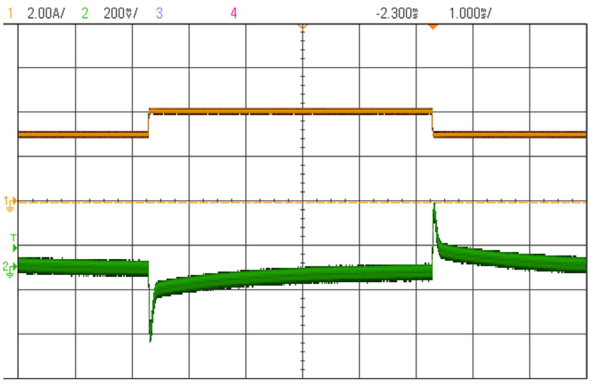
DQB100W24S12 C_{out}=470μF



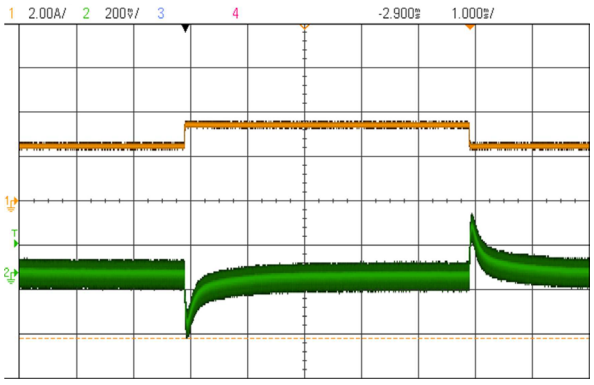
DQB100W24S15 C_{out}=0μF



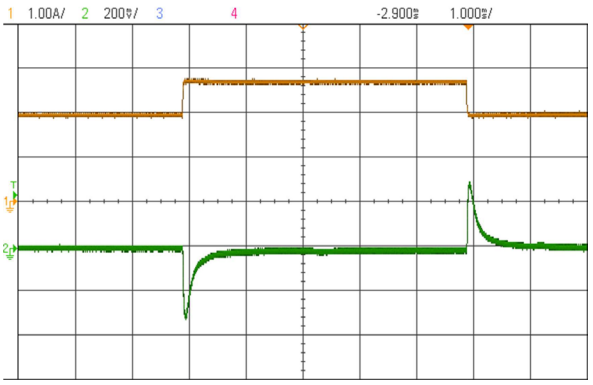
DQB100W24S24 C_{out}=0μF



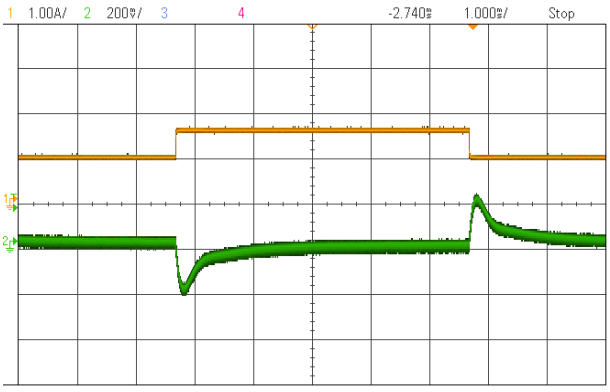
DQB100W24S28 C_{out}=0μF



DQB100W24S36 C_{out}=0μF



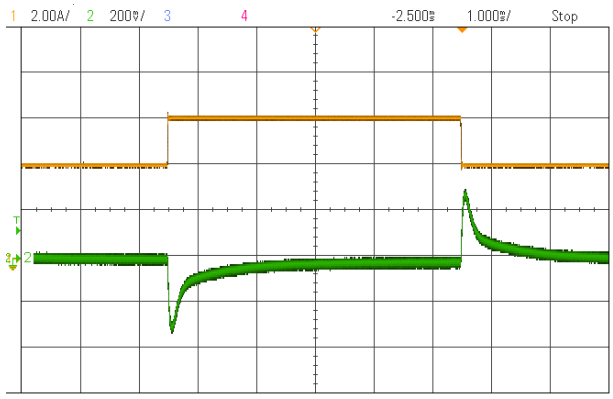
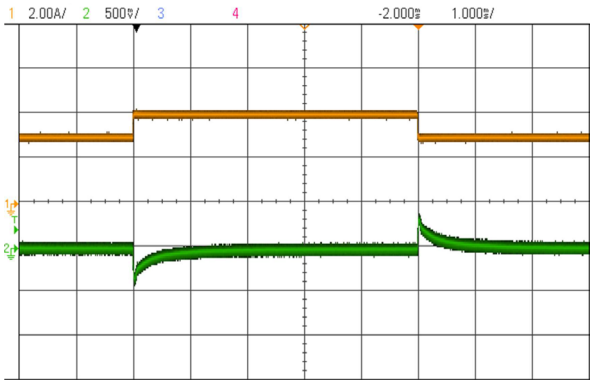
DQB100W24S48 C_{out}=100μF



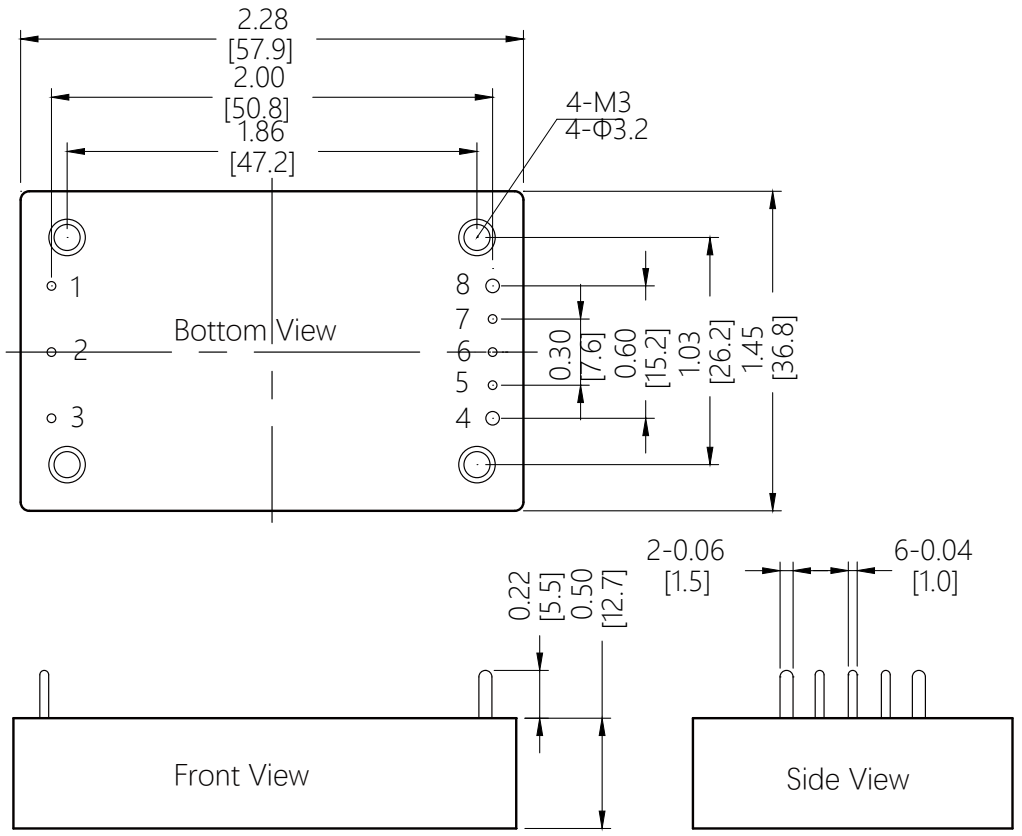
Performance Data

DYNAMIC RESPONSE (50%~75%~50% of I_{max}, di/dt=1A/μs)

Ch1: I_{out} Ch2: V_{out}

DQB100W48S12 C_{out}=100μF	DQB100W48S24 C_{out}=0μF
	

Mechanical Specifications



PIN:
PIN1, PIN2, PIN3, PIN5 PIN6, PIN7: Φ0.040inch
Force: Applied force not exceed 4.9N
PIN4, PIN8 : Φ0.059inch
Force: Applied force not exceed 9.8N
Material: Copper alloy
Finish: Gold 3 ~ 5μm(min.) over nickel 50μm(Min.)
Baseplate screw locked torque: 0.3N·m Max

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

Dimensions are in inches [mm]
Weight: ~66g.

PIN CONNECTIONS	
Pin	Function
1	-Vi
2	RC
3	+Vi
4	+Vo
5	+S
6	+TRIM
7	-S
8	-Vo

Technical Notes

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 DQB100W24/48 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

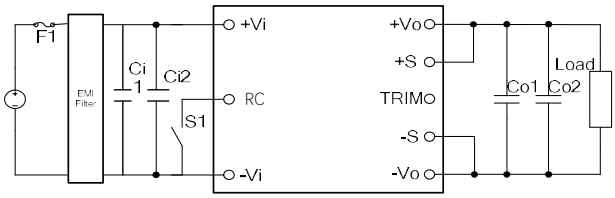


Figure 1·Typical Application Connection

Figure 1 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 = 1uF CBB capacitor. Output Capacitance Co1=10uF tantalum capacitor, Co2 ESR <0.1Ω.

REFLECTED RIPPLE CURRENT

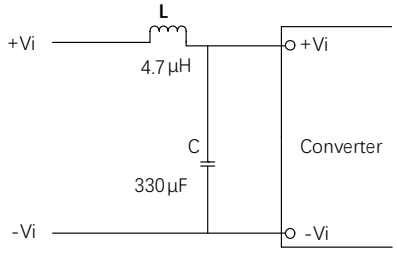


Figure 2· Reflected Ripple Current

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: L=4.7μH; C=330μF.

REMOTE CONTROL FUNCTION

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

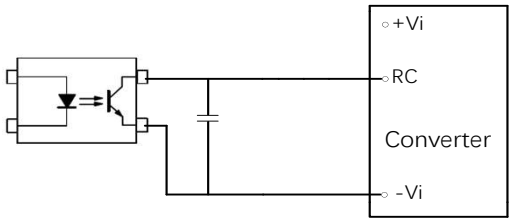


Figure 3· Remote Control

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 circuits, the total sink and source current must be taken into consideration, and make sure that the optocoupler has enough drive capability.
To reduce external PCB trace interference, it is recommended to add high frequency bypass capacitor between RC pin and -Vi, recommended capacitor value is 100-1000pF.

REMOTE COMPENSATION FUNCTION

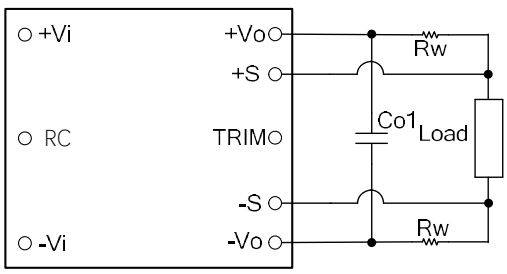


Figure 4· Remote Compensation

Technical Notes

The remote compensation function compensates for the voltage drop across the output line. Module compensation function can't exceed 10%, that is:
$[(+Vo) - (-Vo)]-[(+S) -(-S)] \leqslant 10\%V_{onom}$
If the remote compensation function is not used, the +Sense and +Vout pin, -Sense and -Vout pin need to be shorted directly close to the output.

OUTPUT RIPPLE & NOISE

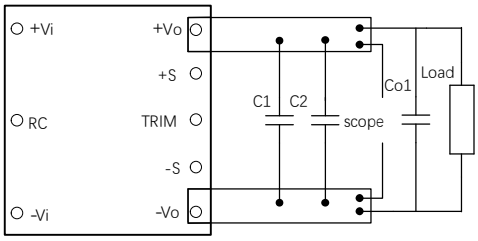


Figure 5· Output Ripple

These DQB100W24/48 modules' output ripple and noise is measured at the rated input voltage and output current, along with 10uF MLCC capacitor 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 START-UP THRESHOLD

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.

CURRENT LIMITING

The maximum current limit remains constant as the output voltage drops. However, once the impedance of the short across the output is small enough to make the output voltage drop below the specified Output Current Limit Shutdown Voltage, 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 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.

Technical Notes

THERMAL SHUTDOWN

These DQB100W24/48 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.

TRIMMING OUTPUT VOLTAGE

DQB100W24/48 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 Trim Pin and Vout+ or Vout-, the output volatge can be increased or decreased depending on its connection. The maximum output voltage adjustment range is -10% to +10%. If the trim function is not used, keep TRIM pin floating.

Trim up:

Add a fixed resistor between in TRIM and +Vo, you can achieve the output voltage up. Do not trim the coverter above maximum trim limit (typically 10%) or the output over voltage protection circuit may be activated.

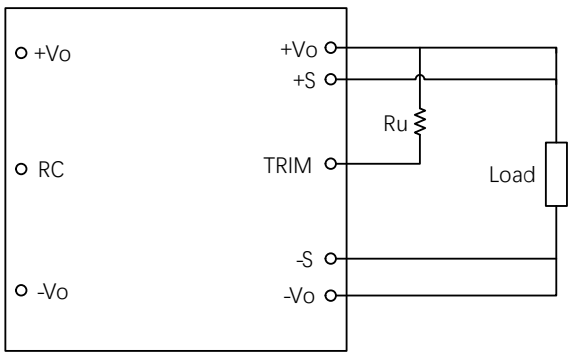


Figure 6· Trim Up Connection

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

$$R_{TRIM-UP} = \left[\frac{5.11\times V_{O,SET}\times(100+\Delta)}{1.24\times\Delta} - \frac{511}{\Delta} - 10.22\right] k\Omega$$

"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:

Add a fixed resistor between in TRIM and -Vo, you can achieve the output voltage down. Do not exceed maximum rated output load.

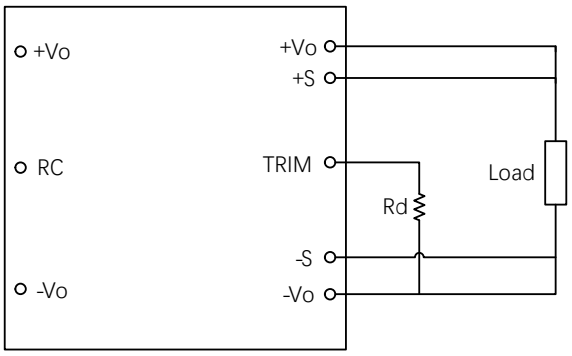


Figure 7· Trim Down Connection

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

$$R_{TRIM-DOWN} = \left[\frac{511}{\Delta} - 10.22\right] k\Omega$$

"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%.

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