Technical Specification

DQB150D24 Series

2:1 Input 1/4th Brick Isolated 150Watts DC/DC Converters

FEATURES

- Standard input range: 18-36VDC
- 150W isolated outputs
- Effciency up to 91%
- Fixed outputs from 5, 12, 24, 28, 36 and 48VDC
- Adjustable Vout (±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 DQB150D24 series are highly reliable, and efficient isolated DC/DC converter. Standard input range of 18-36V(24V nominal) is ideal for automation, power grid, railway, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

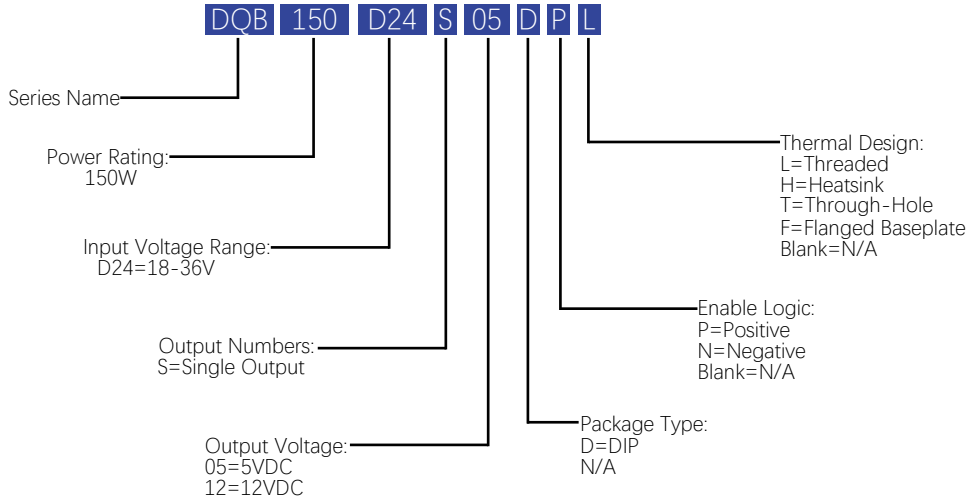
A wealth of self-protection features included input undervoltage lockout, over temperature shutdown, over current protection with "hiccup" autorestart technique, provides indefinite short-circuit protection, along with output OVP. Threaded or through holes are provided to allow easy mount or the addition 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 DQB150D24 series are designed to safety standards IEC/EN 60950, 2nd edition.

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]
DQB150D24S05	24	18-36	5	30	89	9000	2.28×1.45×0.50 DIP
DQB150D24S12	24	18-36	12	12.5	89	4000	
DQB150D24S24	24	18-36	24	6.25	90	2000	
DQB150D24S28	24	18-36	28	5.36	91	1500	
DQB150D24S36	24	18-36	36	4.17	89	1000	
DQB150D24S48	24	18-36	48	3.13	89	820	

Model Numbering



Absolute Maximum Ratings

Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous		-0.7		40	VDC
Input Voltage Transient	< 100ms			50	VDC
On/Off Remote Control Voltage	Referred to -Vin	0		40	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	EN55022	Class B (With external filter)
Radiated Emission	EN55022	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

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	120	mS
Rise Time	From 10% Vout to 90% Vout capacitive load		30	50	mS
Remote On/Off Control					
"P" suffix					
Positive Logic, ON state		3.0		40	VDC
Positive Logic, OFF state		0		1.2	VDC
"N" suffix					
Negative Logic, ON state		0		1.2	VDC
Negative Logic, OFF state		3.0		40	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		18	24	36	VDC
Start-up Threshold		16	17	18	VDC
Under Voltage Shutdown		15	16	17	VDC
Input Current @ No Load			150	250	mA
Input Current @ Min. Line	Vin=min.line, Iout=full load			10	A
Input Current @ Shutdown Mode			10	20	mA
Reflect Ripple Current (Peak-Peak)	Measured at input pin with 4.7μH inductor and 220μF capacitance		80	120	mA
Recommended Input Fuse			15		A
Recommended External Input Capacitance		220	330		μF

Output Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Output Power				150	W
Vout Accuracy	50% Load, Vin nom	-1.5		+1.5	% of V
Adjustable Range	Trim up/ Trim down (DIP Type)	-10		+10	% of Vout
Line Regulation	Vin=18-36VDC, half load	-0.2		+0.2	%
Load Regulation	Vin=24VDC, load=0%-100% or 100%-0% of full load	-0.5		+0.5	%
Temperature Coefficient		-0.02		+0.02	% of Vout /°C
Total Regulation		-2		+2	%
Thermal Shutdown		105	105	115	°C
Thermal Shutdown Recover		85	95	100	°C
Over Voltage Protection	Hiccup	115		140	%Vout
Over Current Protection	Hiccup	110		160	%Iout
Short Circuit Protection	Hiccup				
Remote Sense Voltage				10	%
Minimum Load	No minimum load required				

Output Specifications							
Parameters		Modules					
		S05	S12	S24	S28	S36	S48
Output Voltage Normal(VDC)		5.0	12	15	24	36	48
Ripple & Noise Max. (mV pk-pk) ①		100	120	150	240	360	480
Dynamic Load Peak Deviation (%Vout) ②		±5	±5	±5	±5	±5	±5
Dynamic Load Response (μS)		500	500	500	500	500	500
Capacitive Load (μF)	Min	0	0	0	100	0	100
	Max	9000	4000	2000	1500	1000	820

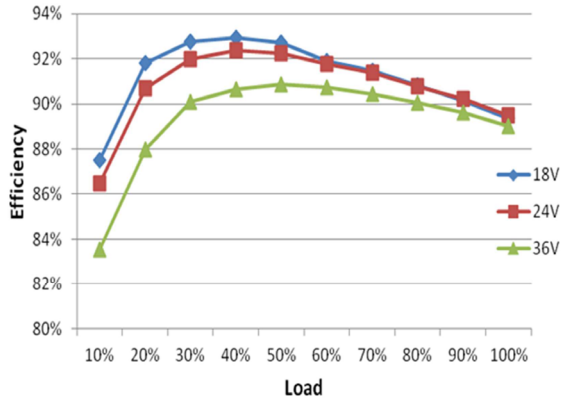
Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise in technical notes on page 12 for more details.
② The load is set from 50%-75%-50% of Imax, di/dt=1A/μS, please refer to dynamic waveforms in performance data on page 8 for details.

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

Performance Data

EFFICIENCY VS LOAD

DQB150D24S05



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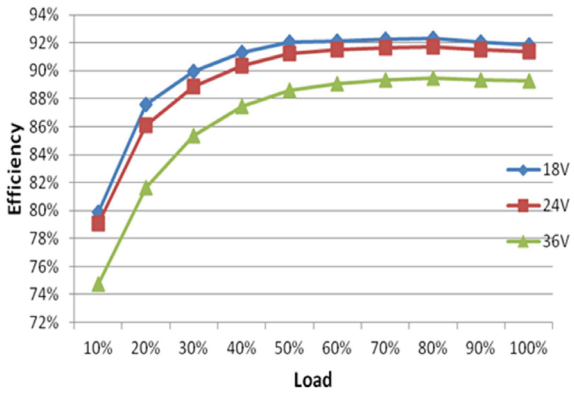

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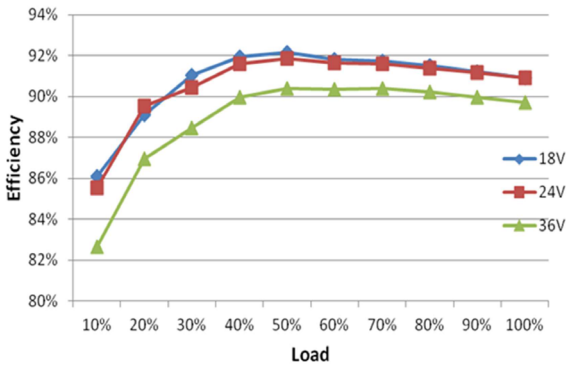

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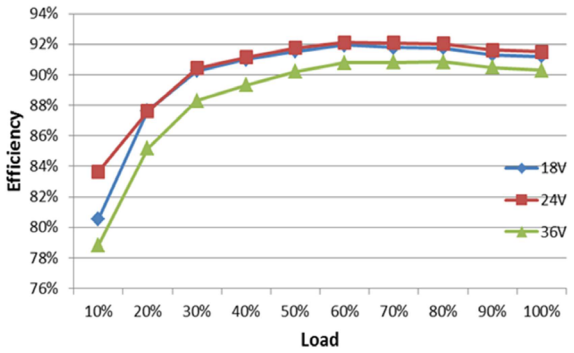

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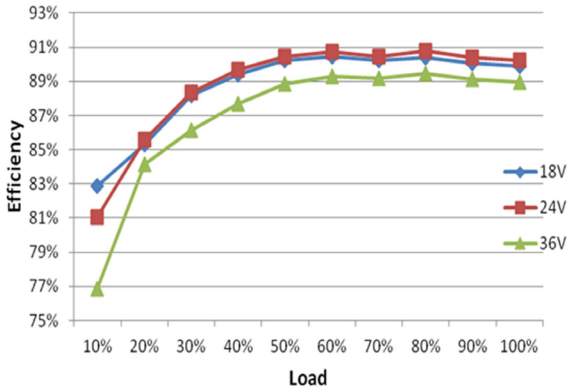

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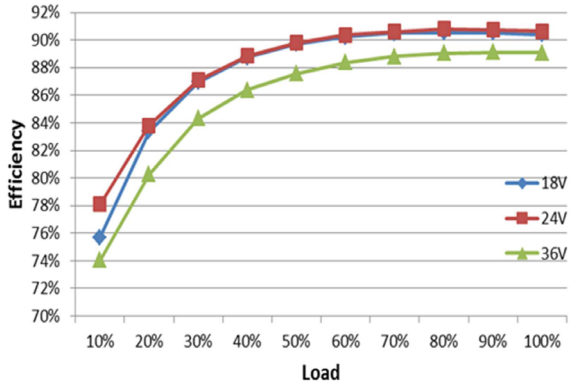
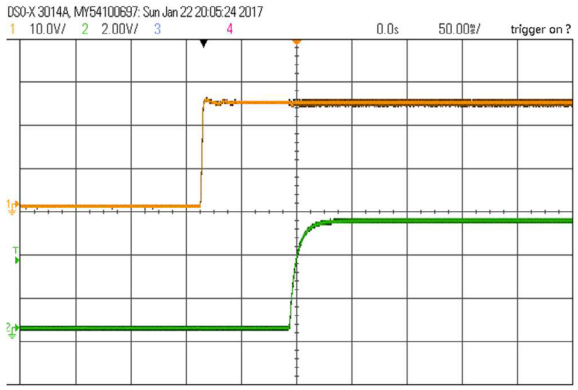


Performance Data

START UP

Ch1: Vin Ch2: Vout

DQB150D24S05



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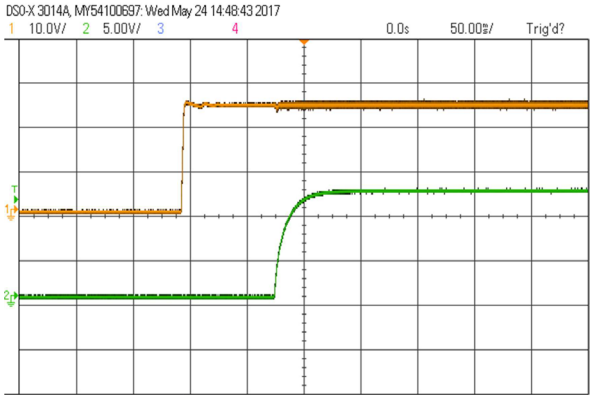

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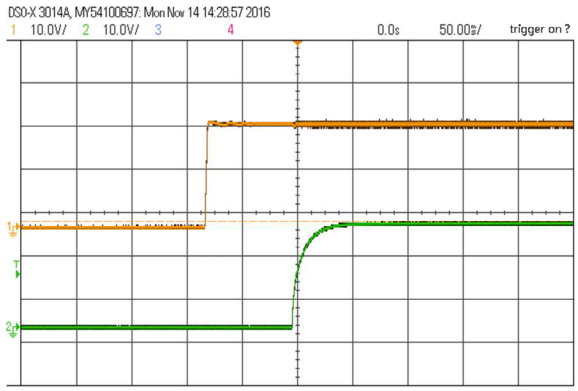

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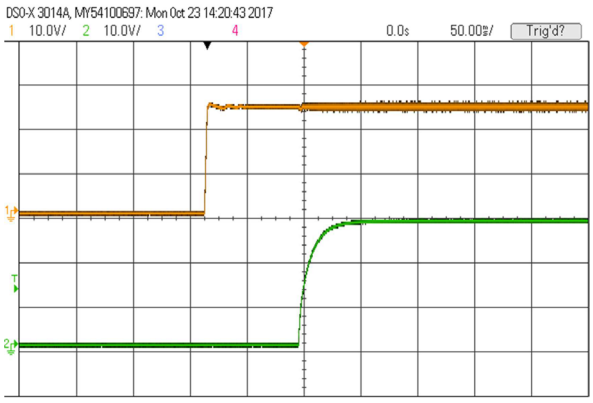

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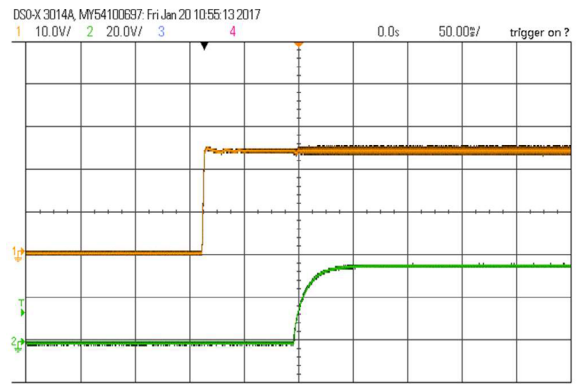

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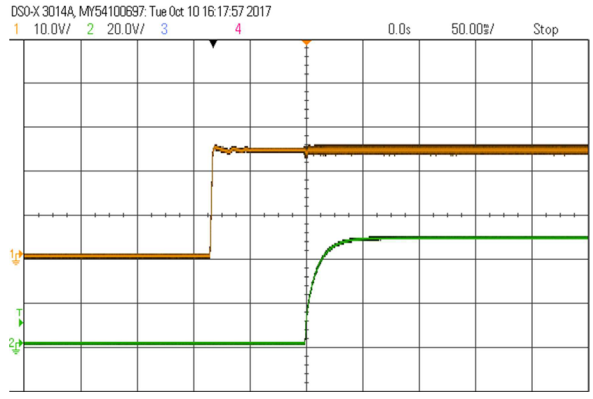
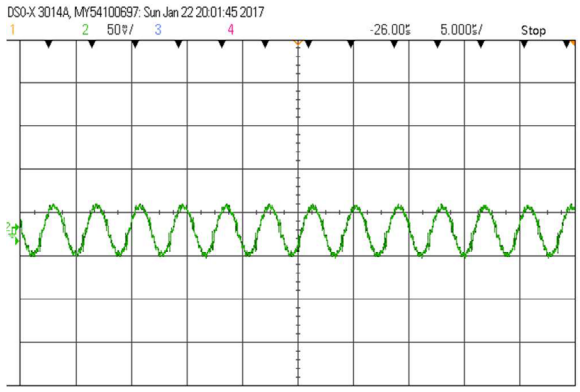


Performance Data

RIPPLE & NOISE 20MHz Bandwidth

DQB150D24S05



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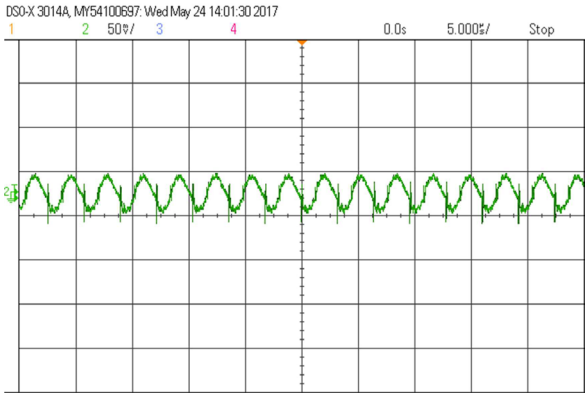

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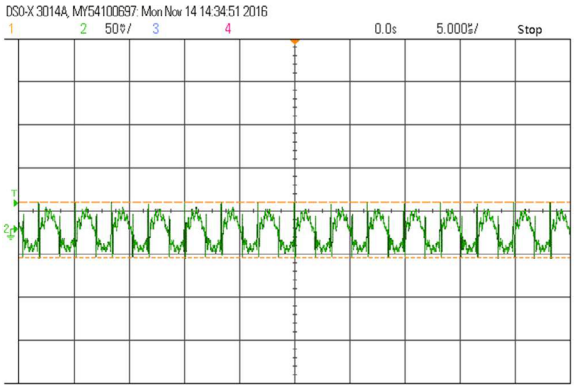

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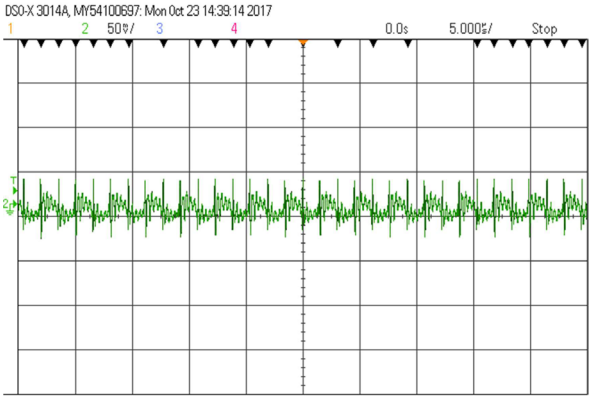

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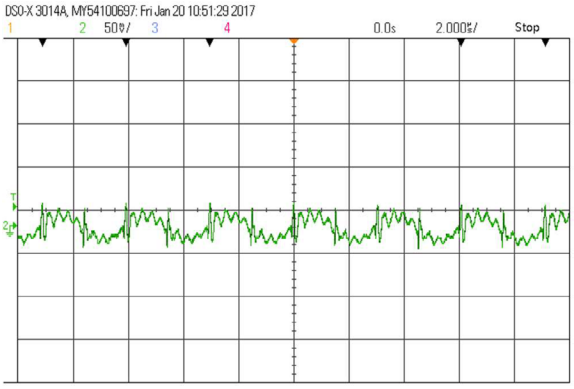

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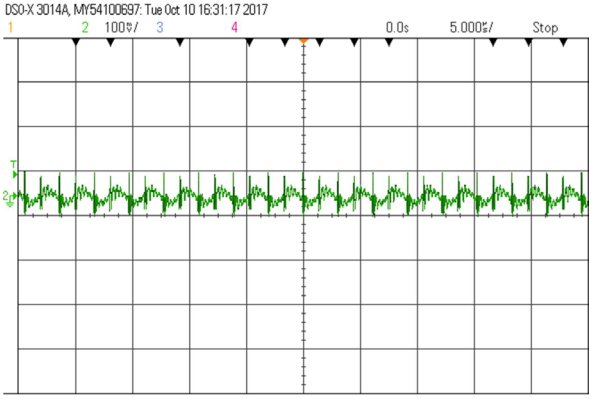
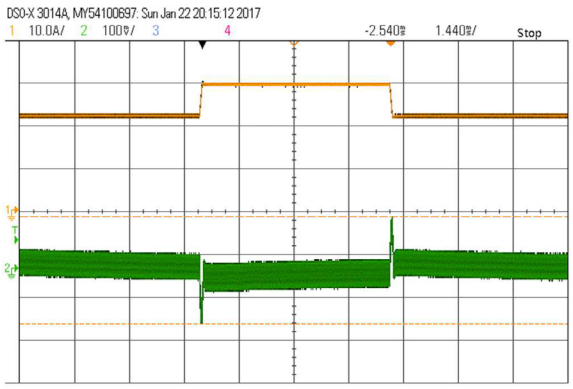


Performance Data

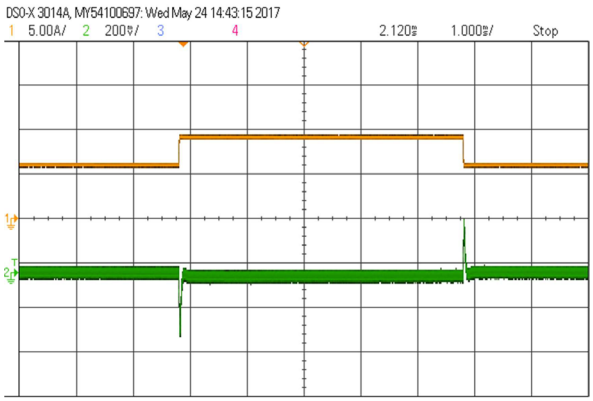
DYNAMIC RESPONSE (50%~75%~50% of I_{max}, di/dt=1A/μs)

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

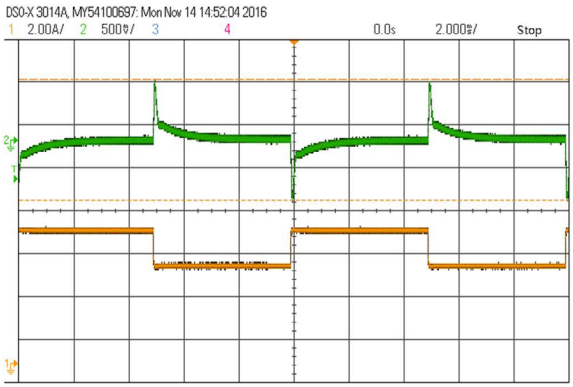
DQB150D24S05 C_{out}=0μF



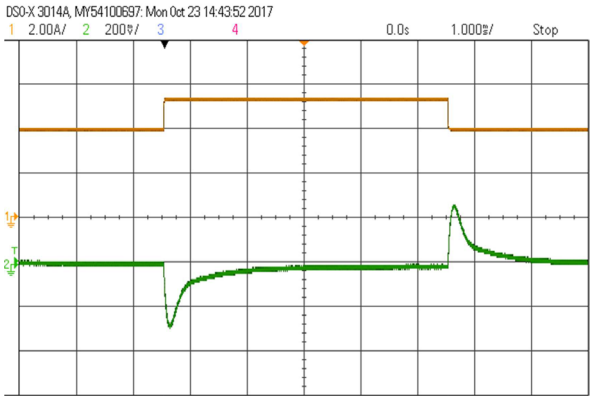
DQB150D24S12 C_{out}=0μF



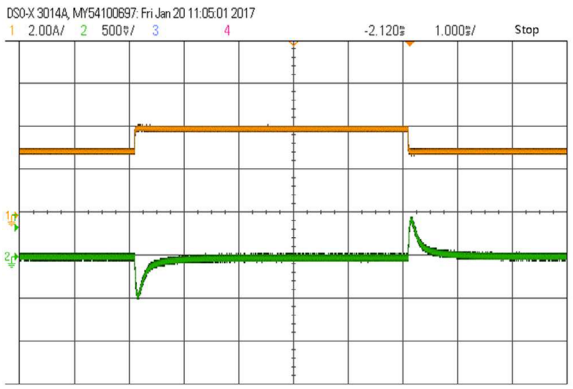
DQB150D24S24 C_{out}=0μF



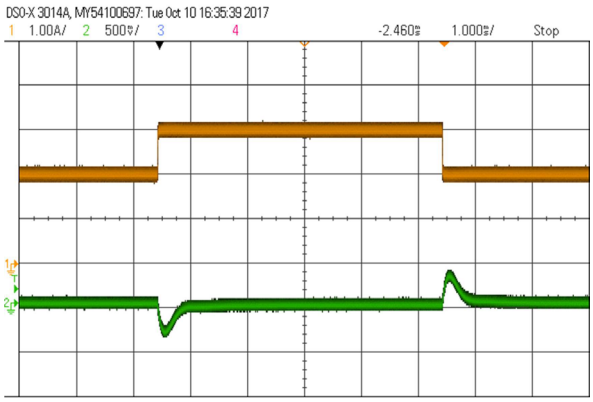
DQB150D24S28 C_{out}=100μF



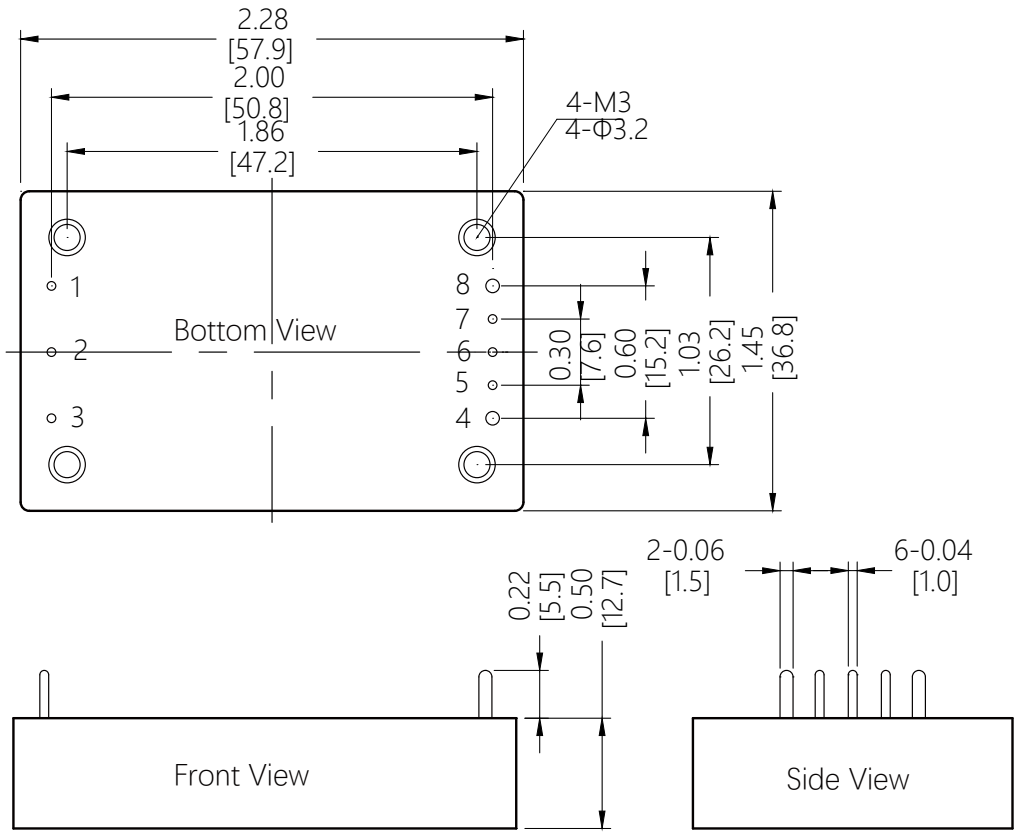
DQB150D24S36 C_{out}=100μF



DQB150D24S48 C_{out}=100μF



Micheanical 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

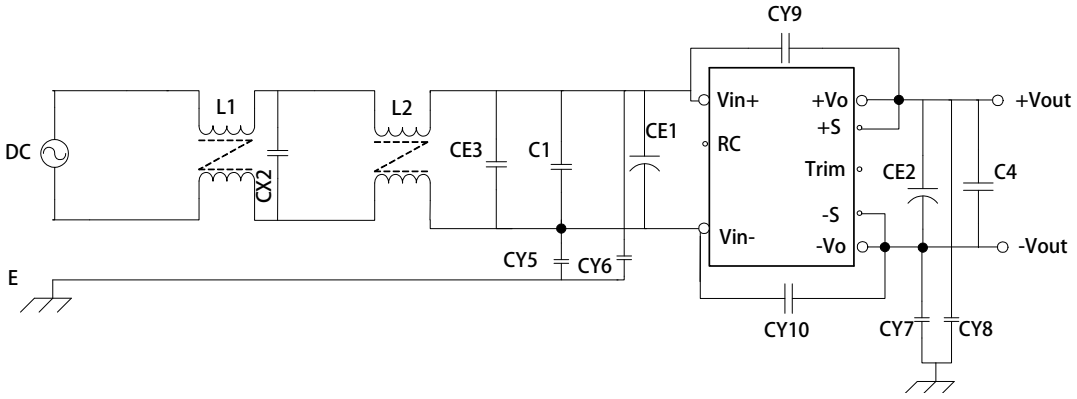
TOLERANCE:
X.XX=±0.02[0.5]
X.XXX= ±0.010[0.25]

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

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

Emissions Performance

Density Power measures its products for conducted emissions against the EN55022 standards. EMI filter is added outside the modules and the conduction limit can meet class B.



Conducted Emissions Test Circuit

Recommended Filter Parameters

REFERENCE	DESCRIPTION	REFERENCE	DESCRIPTION
CX2	2.2μF/275V CBB	CE2	100μF/50V
C1	2.2μF/100V	C4	10μF/50V
L1	CM:1.1mH@200KHz Amorphous Core	L2	CM:1.1mH@200KHz Amorphous Core
CE1	220μF/100V	CY7, CY8	4700pF/250V Y2
CY5, CY6	0.1μF/100V CBB	CY9, CY10	4700pF/250V Y2

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 DQB150D24 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

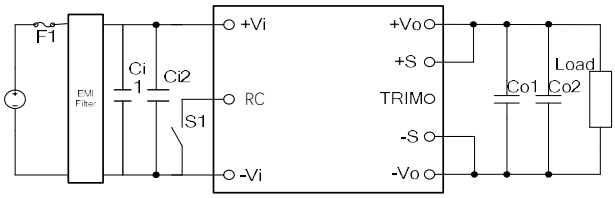


Figure 1·Typical Application Connection

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=22μF electrolytic capacitor, Ci2 = 1uF CBB capacitor. Output Capacitance Co1=10uF tantalum capacitor, Co2 ESR <0.1Ω.

REFLECTED RIPPLE CURRENT

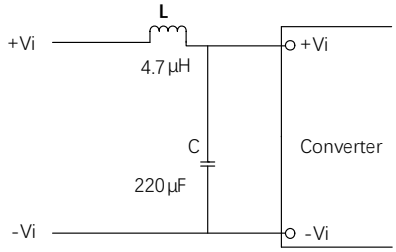


Figure 2· Reflected Ripple Current

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=220μF.

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.

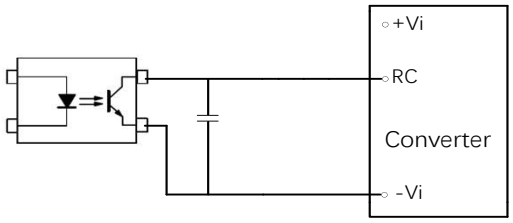


Figure 3· Remote Control

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 circuit, 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

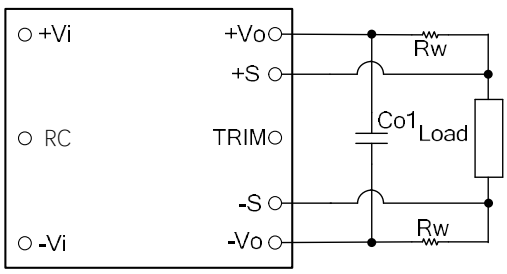


Figure 4· Remote Compensation

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

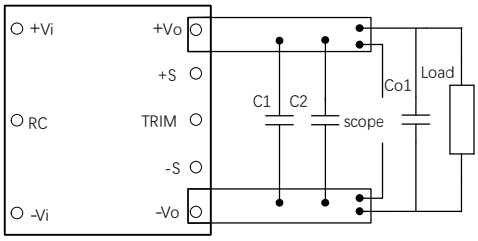


Figure 5· Output Ripple

These DQB150D24 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 DC 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 DQB150D24 converters are equipped withthermal shutdown circuitry. If environmental conditions cause the internal temperature of the DC-DC 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

DQB150WD24 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 converter above maximum trim limit (typically 10%) or the output over voltage protection circuit may be activated.

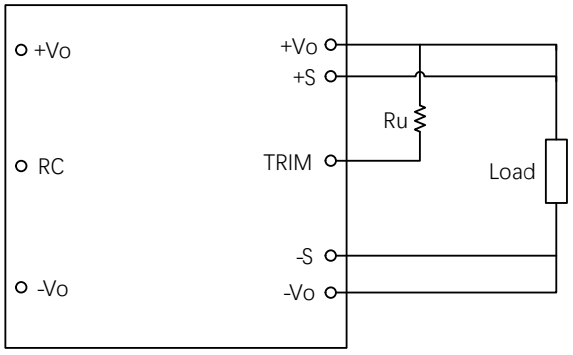


Figure 6· Trim Up Connection

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

$$R_u = \left(\frac{5.11 \times Voset \times (100 + \Delta)}{1.24 \times \Delta} - \frac{511}{\Delta}\right) K\Omega$$

"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.

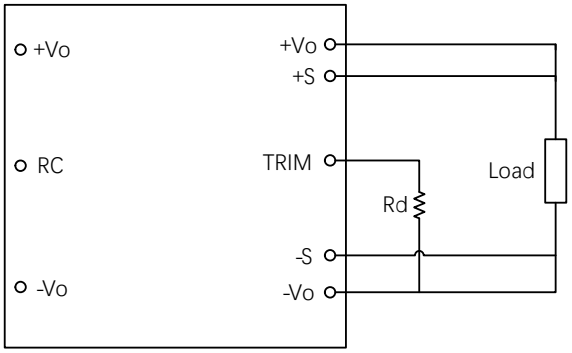


Figure 7· Trim Down Connection

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

$$R_d = \left(\frac{5.11}{\Delta} - 10.22\right) K\Omega$$

"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

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