QBVS021A0B41-VZ DC-DC Power Module

50 to 57V_{DC} input; 11.8V_{DC} output; 21.5A output current

RoHS Compliant

The QBVS021A0B41-VZ dc-dc converter is a new generation of fully regulated DC/DC power modules designed to support 11.8Vdc intermediate bus applications where requiring a tightly regulated output voltage. The QBVS021A0B41-VZ series operate from an input voltage range of 50 to 57Vdc and provide up to 250W output power with a fully regulated output voltage of 11.8Vdc. The converter incorporates a fully regulated control topology, and innovative packaging techniques to achieve full load efficiency exceeding 95% at 11.8Vdc output. This leads to lower power dissipations such that for many applications a heat sink is not required. Standard features include on/off control, output overcurrent and over temperature protection, input under and over voltage lockout.

Applications

- Distributed power architectures
- Intermediate bus voltage applications
- Networking equipment
- Servers and storage applications
- Supercomputers
- Automatic Test Equipment

Features

- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863
- Compliant to REACH Directive (EC) No 1907/2006
- High and flat efficiency with peak efficiency 95%
- Input voltage range: 50-57Vdc
- Delivers up to 250W output power
- Fully regulated 11.8V output at all Vin
- Low output ripple and noise
- Module Size: 66.3mm x 32.0mm x 15.4 mm(2.61in x 1.26in x 0.606in)
- Constant switching frequency
- Remote On/Off control
- Output over current protection
- Over temperature protection
- Wide operating temperature range: -5°C to 85°C, continuous
- ANSI/UL# 62368-1 and CAN/CSA† C22.2 No. 62368-1 Recognized, DIN VDE‡ 0868-1/A11:2017 (EN62368-1:2014/A11:2017)
- ISO** 9001 and ISO 14001 certified manufacturing facilities

† ‡ ** See footnotes on page x

QBVS021A0B41-VZ Technical Specifications

Table 1. Input Requirements

Voltage					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Operating Range Normal Transient up to 200msec		 50 47		 57 60	 V V
Turn-On Voltage	1	45	-	47.2	V
Turn-Off Voltage	1, 2	42.8	-	45	V
1. Power supply shall have the minimum 2.0 V hysteresis between Turn-On and Turn-Off. 2. Power supply must work in fully regulated mode.					

Current					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Maximum Input Current (VIN=50, POUT=250W)		-	-	5.9	A
Inrush Current Peak Current	1	-	-	50	A
Inrush Current Transient Rating				0.1	A^2s
Input Reflected Ripple Current	2	-	-	2	mA_{rms}/W
1. Refer to 4.1.3. The external input capacitance shall be the maximum and the minimum capacitances. 2. Refer to 4.1.3. The external input capacitance shall be the maximum capacitance.					

Table 2. Output Requirements

Power / Voltage					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Output Power			-	250	W
Output Current		0	21.5		A
Output Voltage VIN = 53.5 Vdc, Io = 10.5A	1		11.8		V
Output Set Point Accuracy VIN = 53.5 Vdc, Io = 10.5A	1			± 1	%
Load Regulation Output voltage variation overload change from 0% to 100% at VIN = 53.5V	1		-	± 1	%
Line Regulation Output voltage variation over Input voltage change from 50V to 57V at Io = 10.5A.	1		-	± 1	%
1.It includes temperature coefficient effect, and aging, and is measured at output terminals. It is valid only for the normal input voltage range from 50V to 57V: The output is out of regulation, except for the normal input voltage range. Refer to 4.2.2.					
Transient Response					
Peak Output Voltage Deviation under a fixed input voltage	1, 2			± 360	mV
Output Voltage Settling Time	3	-	-	300	ms
1.Load step: 50% ® 100% ® 50% of Io=21.5A under 0.25A/μsec of the slew rate. It is measured at the output pins with 0.1μF and 1μF of ceramic capacitors and 150μF of the minimum system output capacitance: 20MHz BW limited. Also, it is measured over all normal input voltage range and over full operating temperature range. 2.Voltage deviation is measured between the starting voltage and the peak voltage deviation during the transient. 3.It shall be measured from when the step load is applied to when the output voltage reaches within ±1% of the final voltage.					
Output Voltage Ripple and Noise					
Peak-to-Peak Normal operating range, Io = no load to 21.5A	1	-	-	150	mV
1. It is to be measured at output pins with 0.1μF and 1μF ceramic capacitors, and the 150μF of the minimum system output capacitance: Refer to 'External Capacitance' for details. 20MHz BW limited.					

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Table 3. Feature Characteristics

Efficiency

Parameter	Notes	Min	Nom	Max	Units
TA = 25 °C, 100 LFM airflow across long axis	1, 2				
80% of Irated ≤ Iout ≤ 100% of Irated		93.3	95		%
50% of Irated ≤ Iout ≤ 80% of Irated		93	95		%
30% of Irated ≤ Iout ≤ 50% of Irated		90	93.5		%
20% of Irated ≤ Iout ≤ 30% of Irated		87	91		%
TA = 70 °C, 200 LFM airflow across long axis,	1,2				
80% of Irated ≤ Iout ≤ 100% of Irated		93	95		%
50% of Irated ≤ Iout ≤ 80% of Irated		93	95		%
30% of Irated ≤ Iout ≤ 50% of Irated		90	93		%
20% of Irated ≤ Iout ≤ 30% of Irated		87	91		%

1. It shall be measured over all normal operating input voltage range after unit temperature is stabilized.
2. The input and the output voltages shall be measured on the module.

External Capacitance

Parameter	Notes	Min	Nom	Max	Units
Input Capacitance	1,2,3	300	-	1500	μF
Output Capacitance	1,2,3	150	-	1750	μF

1. Module starts up with any external capacitance in the specified range.
2. Input capacitor could be the combination of electrolytic and ceramic capacitors whereas output capacitor is all the ceramic capacitors. Then, the capacitance is defined under the zero DC bias condition.
3. Input capacitor: ESR £ 90 mΩ , Output capacitor: ESR £ 2 mΩ

Turn-On/Turn-Off

Parameter	Notes	Min	Nom	Max	Units
Turn-On Delay	1	-	-	30	ms
Output Voltage Rise Time	2	1	-	15	ms
Pre-Biased Voltage	3	-	-	Vout	V
Turn-On Overshoot	4	-	-	360	mV
Turn-Off Undershoot	5	-	-	180	mV

1. a) Period between Vin connection and Vout rising to 10% of final value when Enable signal is existing, or
   b) Period between Enable signal connection and Vout rising to 10% of final value when Vin is existing.
   The turn-on delay shall be measured under the 2A load condition.
2. Elapsed time when output voltage is raised from 10% of final value to 90% of final value under 2A load condition.
3. The specification shall be met when the power supply works without another power source in parallel. The power supply will start up normally and without any damage under a pre-biased output voltage.
4. It shall be tested under no load and 2A load condition.
5. It shall be tested under no load and full load condition.

Output Enable

Parameter	Notes	Min	Nom	Max	Units
Enable ON State Voltage (at Pin)	1,2	2		5	V
Enable OFF State Voltage (at Pin)	1,2	-	-	0.8	V
ON/OFF Current	1,2,3	-	-	0.5	mA

1. Output Enable signal is referenced to Vin(-). The enable pin is connected to an external 5V via a 10kΩ and ground via a 20kΩ.
2. Active High, It shall be remarked that the power supply shall be turned off and remain in OFF state when the Enable pin is floating.
3. The current is specified for both going into and going out of the Enable pin.

Power Good Signal Characteristics

Parameter	Notes	Min	Nom	Max	Units
Output Voltage for PGOOD triggering		10.2		11	V
Power Good High State Voltage	1,2	-	-	5	V
Power Good High State Current (into Pin)	1,2	-	-	10	μA
Power Good Low State Voltage	1,2	-	-	1.2	V
Power Good Low State Current (into Pin)	1,2	-	-	2.5	mA

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Table 3. Feature Characteristics (continued)

1. PGOOD is referenced to Vin(-). An external logic level voltage is connected to the pin via a resistance of 2.5kΩ to 10kΩ. A high signal
shown in the pin represents the good status of the output voltage.
2. It shall be tested under full operating temperature and input voltage ranges.

Protection					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Input Voltage Slew Rate	1	0.1	-	1	V/µs
Input Over-Voltage	2	62	-	65	V
Over-current Protection	3	28	-	33	A
Over-temperature	4				

1. Input voltage step will not cause an OCP trip under Pout=250W with maximum external output capacitance.
2. Input OVP will latch the power supply off. The power supply shall be reset by input power recycling.
3. Output current shall be limited under any combination of input and output voltages. Under over-current condition, hiccup mode
operation shall be implemented. The restart shall follow the initial power-up manner. Refer to paragraph 4.5.2.
4. See paragraph 4.5.5.

Table 4. General

Pinout				
Pin #	**Square**	**Length**	**Name**	**Function**
1	0.025 in	0.115 in	n/c	Not connected
2	0.025 in	0.115 in	n/c	Not connected
3	0.025 in	0.115 in	n/c	Not connected
4	0.025 in	0.115 in	PGOOD	Power good signal
5	0.025 in	0.115 in	ENABLE	Remote output enable signal
6	0.025 in	0.115 in	VIN(-)	Negative input voltage
7	0.025 in	0.115 in	VIN(-)	Negative input voltage
8	0.025 in	0.115 in	VIN(+)	Positive input voltage
9	0.025 in	0.115 in	VIN(+)	Positive input voltage
10	0.025 in	0.115 in	VOUT(-)	Negative output voltage
11	0.025 in	0.115 in	VOUT(+)	Positive output voltage
12	0.025 in	0.115 in	VOUT(-)	Negative output voltage
13	0.025 in	0.115 in	VOUT(+)	Positive output voltage
14	0.025 in	0.115 in	VOUT(-)	Negative output voltage
15	0.025 in	0.115 in	VOUT(+)	Positive output voltage
16	0.025 in	0.115 in	VOUT(-)	Negative output voltage
17	0.025 in	0.115 in	VOUT(+)	Positive output voltage
18	0.025 in	0.115 in	VOUT(-)	Negative output voltage
19	0.025 in	0.115 in	VOUT(+)	Positive output voltage
20			Support	Mechanical support
21			Support	Mechanical support

Environmental					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Temperature, Operating,	1	-5	-	85	°C
Temperature, Storage		-40	-	125	°C
Input-Output Isolation	2	2250	-	-	Vdc
Altitude, Operating	1	-500	-	10,000	feet
Relative Humidity, Operating, Non-Condensing Non-Operating, Non-Condensing		 10 10	 -	 90 95	 %

1. Operating temperature range is already extended to accommodate altitude requirement.
2. The 2250V is to be applied **for 60sec** based on IEEE 802.3, **33.4.1 Isolation**

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Table 4. General (continued)

Reliability and Safety Specification					
Parameter	**Notes**	**Min**	**Nom**	**Max**	**Units**
Calculated MTBF at 25°C		-	12.7	-	Mhrs
Service Life at 60°C ambient temperature and 200		-	384.5	-	years
ESD Human Body Model (HBM) Charged Device Model (CDM) Machine Model (MM)		± 2000 V ± 500 V ± 200 V			
EMI	1	FCC Class B and EN55022 Class B Radiated			
Safety		UL/cUL 60950-1 Recognized. Board and plastic material (including headers/connectors) shall meet UL flammability specifications per 94 V-0.			
1. Power supply is not tested alone under the standards. Instead, system including power supply shall meet the					

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† CSA is a registered trademark of Canadian Standards Association.

‡ VDE is a trademark of Verband Deutscher Elektrotechniker e.V.

** ISO is a registered trademark of the International Organization of Standards # The PMBus name and logo are registered trademarks of the System Management Interface Forum (SMIF

4.1 Input Requirements

4.1.1 Input Voltage and Current

The power supply shall start and operate within the range of the minimum and maximum voltages and currents as specified in the Table 1.

4.1.2 Input Voltage Slew Rate

The input voltage rise time (measured from 10% to 90% of the final voltage value) shall meet the requirement shown in Table 3.

4.1.3 Inrush Current

The maximum inrush current is specified in Table 1. The inrush current shall decay to its normal operating current in less than 30msec. The inrush current shall not exceed the I2t rating in Table 1. The inrush current shall not damage the unit.

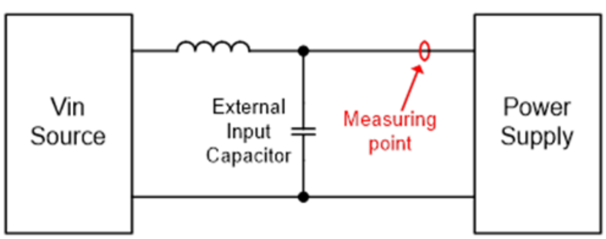

Figure 1. Measurement of inrush current

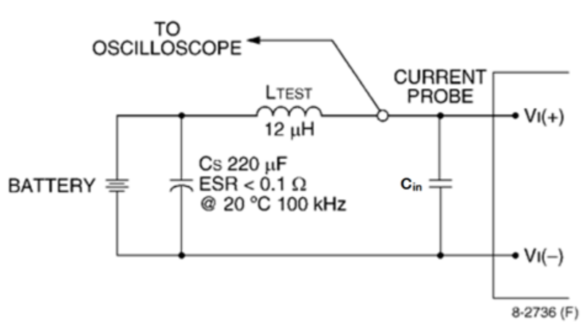

Figure 2. Measurement of input reflected ripple current

4.1.4 Input Capacitance Requirement

Input capacitance is required at the input of the power supply between VIN+ and VIN- for the purpose of noise reduction and stability. External capacitors may be placed next to the power supply and its capacitance range is defined in Table 3.

In addition, ceramic capacitors may be located externally or internally and its dielectric shall be X5R or X7R.

4.1.5 Input Protection

The power input will be protected with an external fast blow fuse or electronic current limiter with a maximum value of current required by safety agencies, which sustains all inrush and operating currents, but which will open on catastrophic failure of the power supply and disengages the power supply from the bus.

4.1.6 Load Transient Effects on Input Current

When the power supply is providing an output current step to the load, the slew rate of the input current of the power supply shall not exceed 0.1A/µsec. The power supply is to be tested with minimum external input and output capacitances under the load slew rate shown in Table 2. The input current shall be measured between the external input capacitor and the power supply.

4.1.7 Brown Out

The power supply shall not be damaged if the input voltage drops below the minimum input value. Also, the power supply shall not be damaged (including not blowing a fuse) if the input voltage drops below the minimum normal value in any rate of ramp or decay. Brown-out shall be tested using 100% loading condition.

4.2 Outputs Requirements

4.2.1 Output Voltage and Current

The output voltage shall remain within the tolerances as specified in Table 2, under all combinations of input voltage variation, load variation, and environmental conditions. The total output power is specified in Table 3.

The power supply must work in fully regulated mode down to input turn off voltage in Table 1.

4.2.2 Regulation

The output voltage shall stay within the tolerance band as measured at the output terminals under all the combination of the following:

- Input Operating Range
- Specified Load Range
- Thermal Drift and Aging Drift

Load Regulation @ 53.5V = (Vo @ 0A – Vo @ 21A) /(Vo @ 10.5A)

Line Regulation @ 10.5A = (Vo @ 57V – Vo @ 50V) / (Vo @ 53.5V)

4.2.3 Output Capacitance Requirement

The power supply will always be operated with external capacitance connected across its output. These external capacitors will be electrolytic and/or ceramic capacitors of varying electrical size and varying values of ESR. The ceramic capacitors are to be X5R or X7R and their size shall not be larger than 1210.

The power supply must meet all operating requirements with external capacitances and ESR anywhere in the ranges shown in the table.

4.2.4 Output Voltage Ripple and Noise

Ripple and noise shall not exceed the limit specified in Table 2. Also, there shall not be larger line frequency ripple than the limit. The measurements are made at the power supply output terminal under the minimum and maximum load conditions with the 20 MHz of the bandwidth.

The test method, i.e. test circuit, used to measure the ripple and noise shall be specified. For the measurement, it is recommended that a 50Ω coaxial cable shall be terminated to an oscilloscope with a 50Ω resistor from the positive line to the negative line, or a 50Ω resistor shall be connected in series with the positive line between the test board and 50Ω coaxial cable.

The 0.1uF and the 1μF ceramic capacitors can be placed in parallel at the measurement point.

4.2.5 Overshoot and Undershoot

The turn-on overshoot due to the application of the input voltage and enable signal shall not be larger than the specified value in Table 3. The power supply shall incorporate soft-start which shall reset upon any loss of input voltage. The output voltage shall have no reverse polarity (undershooting) at the turn-off.

4.2.6 Load Step Response

The load step change shall be implemented with the current slew rate specified in Table 2. The dynamic response at the output shall comply with the requirements in Table 2.

A voltage deviation is measured from the initial steady state value. The response time, i.e. the settling time, is measured from the application of the load step to the point where the output voltage is within ±1% of its final steady state value. Refer to Table 2 for the details.

4.2.7 Loop Stability

The vendor shall verify the power supply stability and provide the measured Bode plot: The power supply shall be stable with the minimum output capacitance of 150μF and the maximum output capacitance of 750μF. In addition, the phase margin shall be 45 degrees minimum, and the gain margin shall be 10dB minimum under the range from the minimum to maximum output capacitance, input voltage, output load, and operating temperature.

4.3 Feature Characteristics

4.3.1 Efficiency

The efficiency is to be measured over full load range at low and high lines under the room ambient temperature and the rated high ambient temperature conditions.

4.3.2 Turn-on Delay

It is defined as a period between the time that the input voltage or enable signal is applied and the time that the output voltage reaches 10% of the final value. The time is shown in Table 3.

4.3.3 Output Voltage Rise Time

It is an elapsed time that the output voltage increases from 10% to 90% of the final value. The required time is shown in Table 3.

4.3.4 Monotonic Output Voltage Rising during Turn-On and Turn-Off

The output of the power supply is connected to synchronous buck converters. When the power supply turns on and turns off in the system application, the output voltage waveform shall be monotonic under all line, load, and environmental conditions.

4.3.5 Pre-bias Start-up

With a voltage present at the output side, the power supply shall smoothly power up when the input voltage is applied. The back bias voltage could be as high as the value in Table 3.

4.3.6 Power Good

The power supply shall provide an open-drain/open-collector type circuit representing that the output voltage is within the required voltage band. An external pull-up resistor will be placed between the PGOOD pin and a bias voltage. The signal is referenced to the Vin(-). The signal shall go to the high state when output voltage reaches a typical value (Refer to Table 3), and returns to low state when the output voltage falls below the typical value.

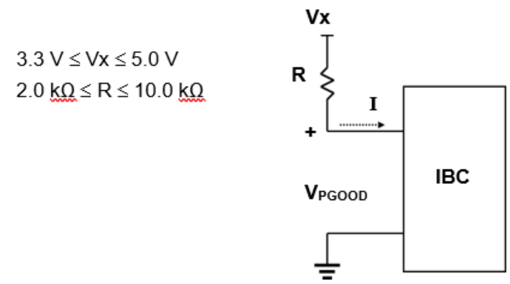

Figure 3. External circuit configuration for PGOOD signal

4.3.7 Output Enable

The power supply shall have output enable input such that its output can be turned on/off by an external LVTTL compatible logic signal. The input shall be active HIGH, such that the power supply shall turn on the output and remains in the ON state. The output shall be disabled and remains in the OFF state when the logic voltage goes LOW. When the input is floating, the power supply shall be turned off and remains in the OFF state. Refer to Table 3 for the details.

4.4 Protection

4.4.1 Shorted Output

An output short circuit is defined as a load impedance which is equal to or less than 100 mΩ. The power supply shall withstand a continuous output short circuit without permanent damage. When the short to ground is removed, the power supply shall restart in the same manner as it starts when input power is first applied.

4.4.2 Over-Current Protection (OCP)

The power supply shall protect itself and a downstream load from damage due to excessive output loading, and shall not activate the over-current protection prior to the minimum output over-current value shown in Table 3.

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The protection shall be implemented to operate in a hiccup mode, allowing the power supply to return to normal operation when the over-loading condition is removed. The restart after an over-current shutdown shall be controlled in the same manner that input power is first applied. In the hiccup operating mode, the ratio of operating time to shut down time shall not exceed 1 to 9.

With proper air flow and all operating conditions within the range of the specification, the power supply shall activate the over-current protection prior to the onset of the over-temperature protection in paragraph 4.4.5.

4.4.3 No Load

The power supply shall not be damaged under no load condition. Also, the output voltage shall stay within the specified voltage tolerance in Table 1.

4.4.4 Input Over-Voltage Protection (OVP)

The power supply shall shut down if the input voltage exceeds the specified ranges in Table 3. The OVP activation shall latch the power supply in the off state; input power shall be removed for greater than 10 milliseconds and then re-applied to resume operation.

4.4.5 Over-temperature Protection (OTP)

The power supply shall incorporate over-temperature protection and shall shutdown in the event that any component reaches a temperature within 20°C of the maximum rated operating temperature of that component. It is the responsibility of the vendor to determine the component or components that will control OTP activation.

After the component temperature has decreased sufficiently, the power supply shall automatically restart; the restart shall be controlled in the same manner that input power is first applied. To prevent rapid on-off cycling of the power supply, there shall be a minimum of 20°C of hysteresis between shutdown and restart.

OTP shall not be activated when the power supply is operated within the ranges of the specified operating temperature, input voltage, and load under the minimum specified cooling air flow.

4.4.6 Input Out of Range Protection

The power supply is allowed to operate outside the normal operating input voltage range during the transient of up to the time specified in Table 1. However, once the input voltage reaches the turn-off threshold, the power supply shall turn itself off, and restart with an input voltage higher than the turn-on threshold in Table 1.

4.4.7 Input-Output Isolation

Refer to Table 4.

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Characteristic Curves

The following figures provide typical characteristics for the QBVS021A0B41-VZ (11.8V, 21.5A) at 25°C. The figures are identical for either positive or negative Remote On/Off logic.

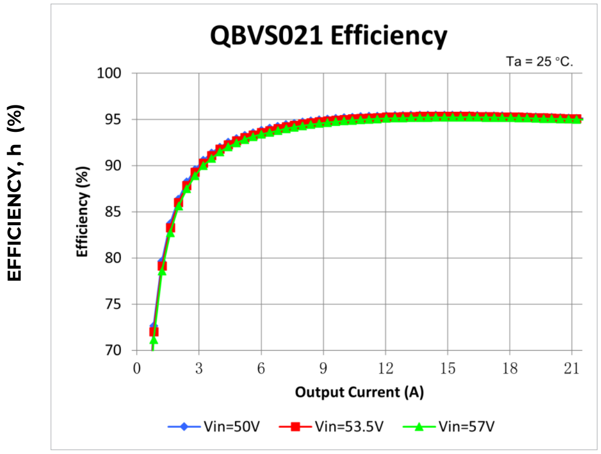


Figure 4. Converter Efficiency versus Output Current.

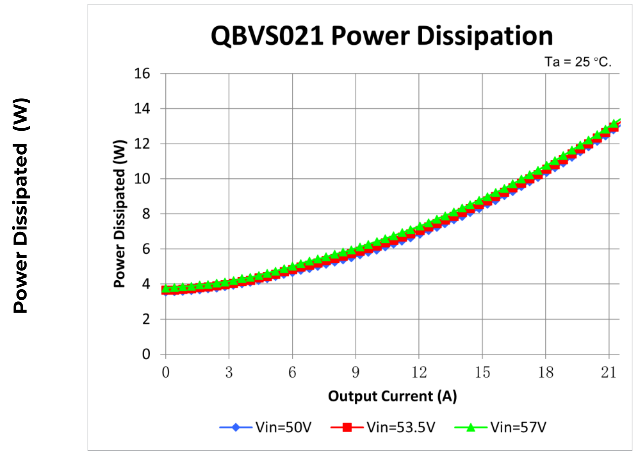


Figure 5. Typical Converter Loss vs. Output Current.

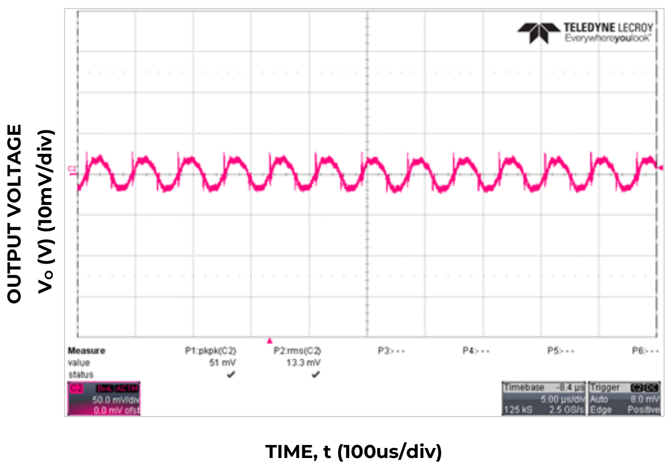


Figure 6. Typical Output Ripple and Noise, $I_o = I_{o,max}$ C_o=150μF.

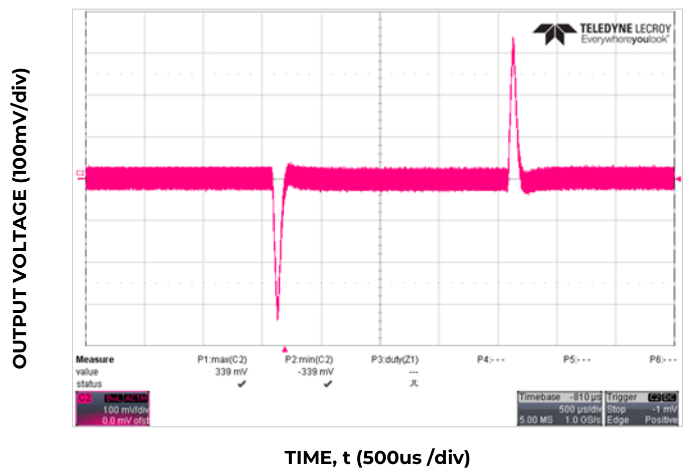


Figure 7. Typical Transient Response to 0.25A/µs Step Change in Load from 50% to 100% to 50% of Full Load, C_o=150µF and 53.5 V_{dc} Input.

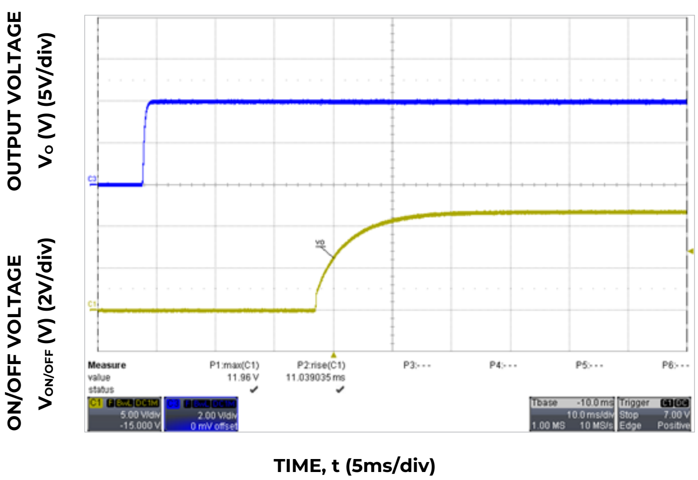


Figure 8. Typical Start-up Using On/Off Voltage ($I_o = I_{o,max}$).

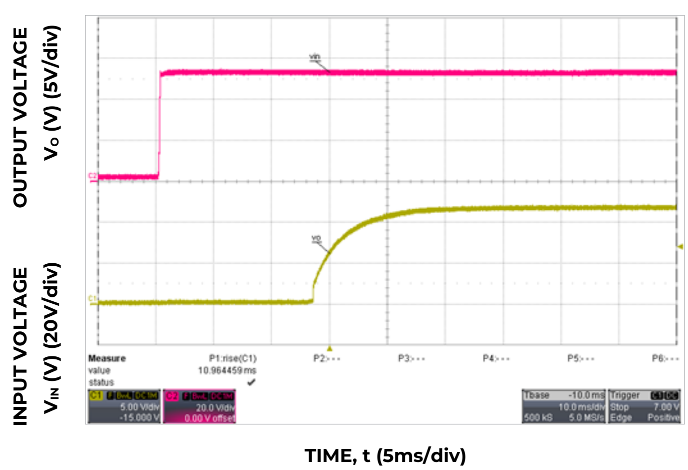
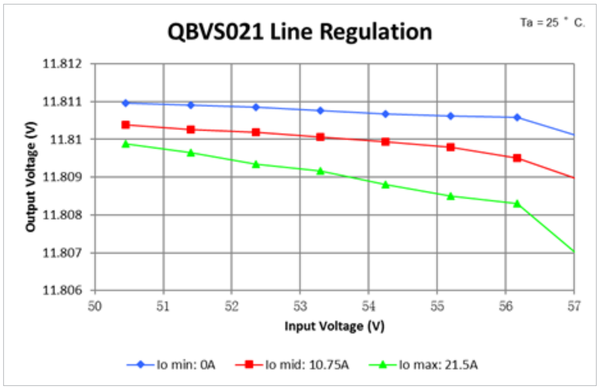


Figure 9. Typical Start-up Using Input Voltage (V_{in} = 53.5V, $I_o = I_{o,max}$).

QBVS021A0B41-VZ Technical Specifications (continued)

The following figures provide typical characteristics for the QBVS021A0B41-VZ (11.8V, 21.5A) at 25°C. The figures are identical for either positive or negative Remote On/Off logic.

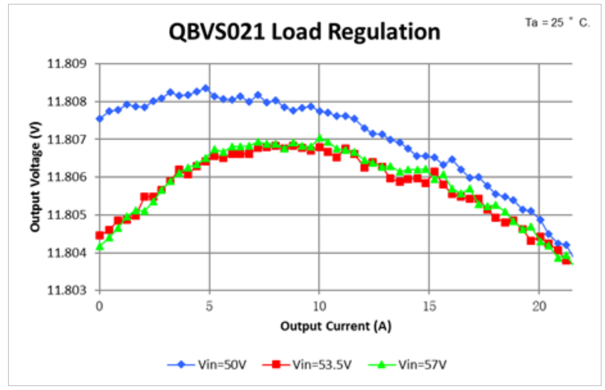
EFFICIENCY, η (%)



Input voltage (V)

Figure 10. Typical Output Voltage Regulation vs. Input Voltage.

Power Dissipated (W)



Output current, t (A)

Figure 11. Typical Output Voltage Regulation vs. Output Current.

Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL60950-1 2nd Ed., CSA C22.2 No. 60950-1 2nd Ed., and VDE0805-1 EN60950-1 2nd Ed.

If the input source is non-SELV (ELV or a hazardous voltage greater than 60 Vdc and less than or equal to 75Vdc), for the module's output to be considered as meeting the requirements for safety extra-low voltage (SELV), all of the following must be true:

- The input source is to be provided with reinforced insulation from any other hazardous voltages, including the ac mains.
- One VIN pin and one VOUT pin are to be grounded, or both the input and output pins are to be kept floating.
- The input pins of the module are not operator accessible.
- Another SELV reliability test is conducted on the whole system (combination of supply source and subject module), as required by the safety agencies, to verify that under a single fault, hazardous voltages do not appear at the module's output.

Note: Do not ground either of the input pins of the module without grounding one of the output pins. This may allow a non-SELV voltage to appear between the output pins and ground.

The power module has safety extra-low voltage (SELV) outputs when all inputs are SELV.

The input to these units is to be provided with a maximum 30A fast-acting (or time-delay) fuse in the ungrounded input lead.

Thermal Considerations

The power modules operate in a variety of thermal environments and sufficient cooling should be provided to help ensure reliable operation. Thermal considerations include ambient temperature, airflow, module power dissipation, and the need for increased reliability. A reduction in the operating temperature of the module will result in an increase in reliability. Heat-dissipating components are mounted on the top side of the module. Heat is removed by conduction, convection and radiation to the surrounding environment. Proper cooling can be verified by measuring the thermal reference temperature (TH1).

QBVS021A0B41-VZ Technical Specifications (continued)

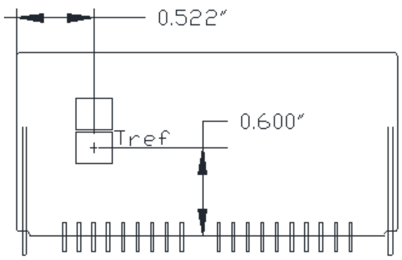


Figure 12. Location of the thermal reference temperature TH1 for base plate module.

Peak temperature occurs at the position indicated in Figure9. For reliable operation, this temperature should not exceed TH1=125°C at any airflow condition. For extremely high reliability you can limit this temperature to a lower value. The output power of the module should not exceed the rated power for the module as listed in the Ordering Information table, or the derated power for the actual operating conditions as indicated in Figs. 14-15.

Heat Transfer via Convection

The thermal data presented here is based on physical measurements taken in a wind tunnel, using automated thermo-couple instrumentation to monitor key component temperatures: FETs, diodes, control ICs, magnetic cores, ceramic capacitors, opto-isolators, and module PWB conductors, while controlling the ambient airflow rate and temperature. For a given airflow and ambient temperature, the module output power is increased, until one (or more) of the components reaches its maximum derated operating temperature, as defined in IPC-9592B. This procedure is then repeated for a different airflow or ambient temperature until a family of module output derating curves is obtained. Please refer to the Application Note "Thermal Characterization Process For Open-Frame Board-Mounted Power Modules" for a detailed discussion of thermal aspects including maximum device temperatures.

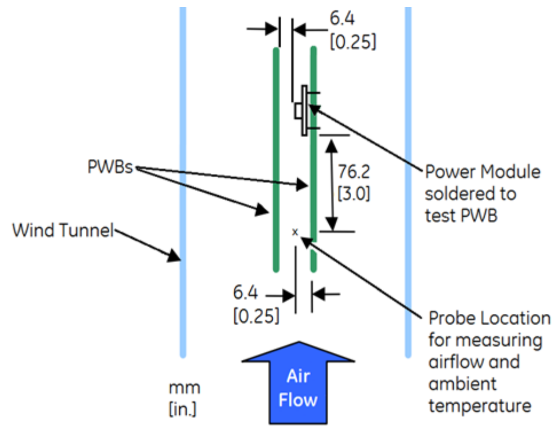


Figure 13. Thermal Test Setup

Increased airflow over the module enhances the heat transfer via convection. The thermal derating of figure 14-15 shows the maximum output current that can be delivered by each module in the indicated orientation without exceeding the maximum TH1 temperature versus local ambient temperature (T_A) for several air flow conditions.

Thermal Considerations (continued)

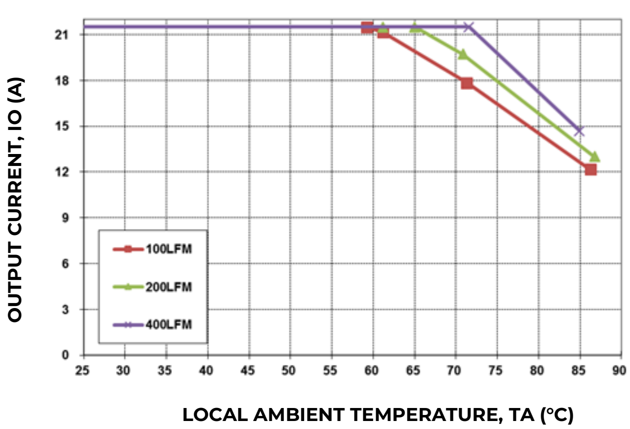


Figure 14. Output Current Derating QBVS021A0Bxx, Airflow Direction for pin1 to pin19; Vin = 53.5V.

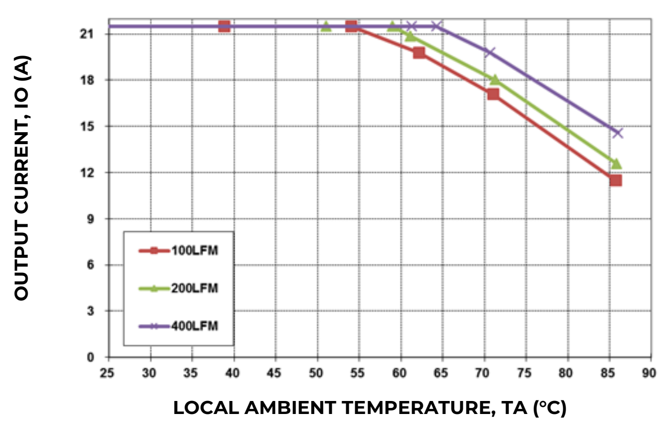


Figure 15. Output Current Derating QBVS021A0Bxx, Airflow Direction for pin19 to pin1; Vin = 53.5V.

Layout Considerations

The QBVS021A0B41-VZ power module series are low profile in order to be used in fine pitch system card architectures. As such, component clearance between the bottom of the power module and the mounting board is limited. Avoid placing copper areas on the outer layer directly underneath the power module. Also avoid placing via interconnects underneath the power module.

For additional layout guidelines, refer to FLT012A0Z Preliminary Data Sheet.

Through-Hole Lead-Free Soldering Information

The RoHS-compliant, Z version, through-hole products use the SAC (Sn/Ag/Cu) Pb-free solder and RoHS-compliant components. The module is designed to be processed through single or dual wave soldering machines. The pins have a RoHS-compliant, pure tin finish that is compatible with both Pb and Pb-free wave soldering processes. A maximum preheat rate of 3°C/s is suggested. The wave preheat process should be such that the temperature of the power module board is kept below 210°C. For Pb solder, the recommended pot temperature is 260°C, while the Pb -free solder pot is 270°C max.

MSL Rating

The QBVS021A0B41-VZ modules have a MSL rating as indicated in the Device Codes table, last page of this document.

Storage and Handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 Rev. A (Handling, Packing, Shipping and Use of Moisture/ Reflow Sensitive Surface Mount Devices). Moisture barrier bags (MBB) with desiccant are required for MSL ratings of 2 or greater. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of £30°C and 60% relative humidity varies according to the MSL rating (see J-STD-060A). The shelf life for dry packed SMT packages will be a minimum of 12 months from the bag seal date, when stored at the following conditions: < 40°C, < 90% relative humidity.

Post Solder Cleaning and Drying Considerations

Post solder cleaning is usually the final circuit board assembly process prior to electrical board testing. The result of inadequate cleaning and drying can affect both the reliability of a power module and the testability of the finished circuit board assembly. For guidance on appropriate soldering, cleaning and drying procedures, refer to GE Board Mounted Power Modules: Soldering and Cleaning Application Note (AN04-001).

If additional information is needed, please consult with your OmniOn Sales representative for more details

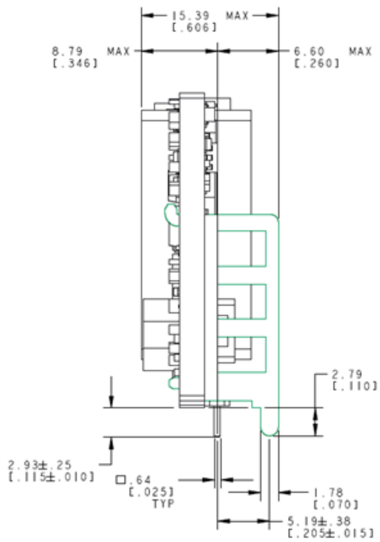
QBVS021A0B41-VZ Mechanical Specifications

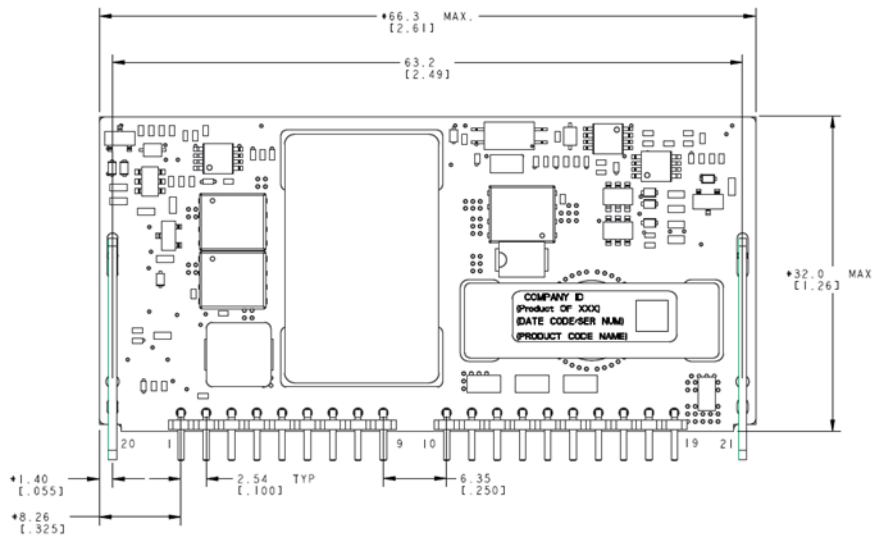
Mechanical Outline for QBVS021A0B41-VZ through-hole Module

Dimensions are in millimeters and [inches].

Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (Unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]





* Exclude routing tap.

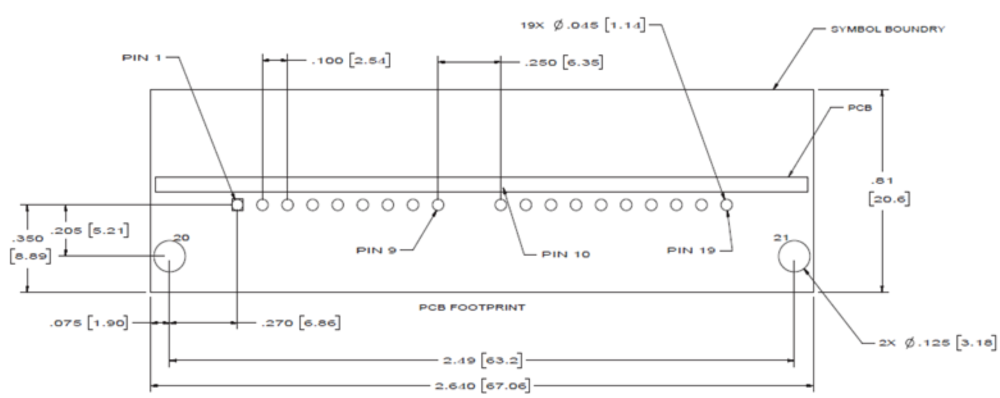
Recommended Pad Layouts

Dimensions are in millimeters and (inches).

Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]

Pin #	Name
1	n/c
2	n/c
3	n/c
4	PGOOD
5	ENABLE
6	VIN(-)
7	VIN(-)
8	VIN(+)
9	VIN(+)
10	VOUT(-)
11	VOUT(+)
12	VOUT(-)
13	VOUT(+)
14	VOUT(-)
15	VOUT(+)
16	VOUT(-)
17	VOUT(+)
18	VOUT(-)
19	VOUT(+)
20	Support
21	Support



QBVS021A0B41-VZ Ordering Information

Packaging Details

All versions of the QBVS021 are supplied as standard in the foam tray. Each foam tray contains a total of 15 power modules.

Each shipping box contains 3 full foam giving a total number of 45 power modules.

Ordering Information

Please contact your OmniOn Sales Representative for pricing, availability and optional features.

Table 5 Device Codes

Product Codes	Input Voltage	Output Voltage	Output Current	Efficiency	Connector	MSL Ra-ting	Comcodes
QBVS021A0B41-VZ	53.5V (40-60Vdc)	11.8V	21.5A	95%	Through hole	2a	1600277067A

QBVS021A0B41-VZ Change History (excludes grammar & clarifications)

Revision	Date	Description of the change
1.1	04/16/2021	Initial Release
1.2	11/30/2023	Updated as per OmniOn template

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