DATASHEET

7A Analog PicoDLynxII™: Non-Isolated DC-DC Power Modules

4.5V_{dc} –14.4V_{dc} input; 0.6V_{dc} to 5.5V_{dc} output; 7A Output Current

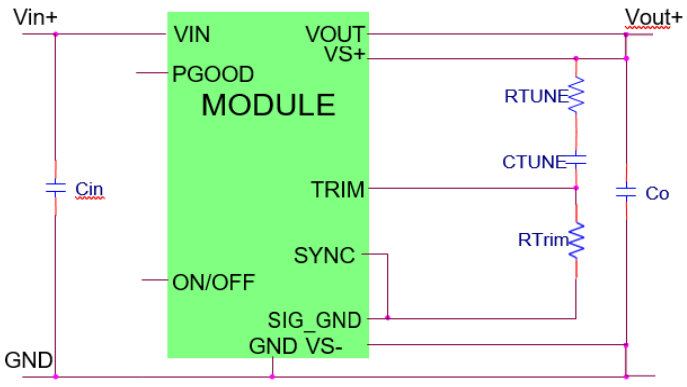
RoHS Compliant

Description

The 7A Analog PicoDLynxII™ power modules are non-isolated dc-dc converters that can deliver up to 7A of output current. These modules operate over a wide range of input voltage (V_{IN} = 4.5V_{dc}-14.4V_{dc}) and provide a precisely regulated output voltage from 0.6V_{dc} to 5.5V_{dc}, programmable via an external resistor. Features include remote On/Off, adjustable output voltage, over current and over temperature protection. The module also includes the Tunable Loop™ feature that allows the user to optimize the dynamic response of the converter to match the load with reduced amount of output capacitance leading to savings on cost and PWB area.

Applications

- Distributed power architectures
- Intermediate bus voltage applications
- Telecommunications equipment
- Servers and storage applications
- Networking equipment
- Industrial equipment



See footnotes on page 2

Features

- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863
- Compliant to REACH Directive (EC) No 1907/2006
- Compatible in a Pb-free or SnPb reflow environment (Z-versions)
- Compliant to IPC-9592 (September 2008), Category 2, Class II
- Compliant to REACH Directive (EC) No 1907/2006
- DOSA based
- Wide Input voltage range (4.5Vdc-14Vdc)
- Output voltage programmable from 0.6Vdc to 5.5Vdc via external resistor PMBus™#
- Tunable Loop™ to optimize dynamic output voltage response
- Flexible output voltage sequencing EZ-SEQUENCE
- Power Good signal
- Fixed switching frequency with capability of external synchronization
- Output over current protection (non-latching)
- Over temperature protection
- Remote On/Off
- Ability to sink and source current
- Cost efficient open frame design
- Small size: 12.2 mm x 12.2 mm x 7.5 mm (0.48 in x 0.48 in x 0.295 in)
- Wide operating temperature range [-40°C to 85°C: Std; -40°C to 105°C: Ruggedized]
- 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

FOOTNOTES

* UL is a registered trademark of Underwriters Laboratories, Inc.

† 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

Technical Specifications

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Device	Symbol	Min	Max	Unit
Input Voltage Continuous	All	V_{IN}	-0.3	15	V
VS	All		-0.3	7	V
SYNC	All			3.6	V
Operating Ambient Temperature (see Thermal Considerations section)	All	T_A STANDARD RUGGEDIZED	-40 -40	85 105	°C
Storage Temperature	All	T_{stg}	-55	125	°C

Electrical Specifications

Unless otherwise indicated, specifications apply overall operating input voltage, resistive load, and temperature conditions.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN}	4.5		14.4	V_{dc}
Maximum Input Current (V_{IN}=4.5V to 14V, I_O=$I_{O,\ max}$)	All	$I_{IN,\ max}$			7	A_{dc}
Input No Load Current (V_{IN} = 12V_{dc}, I_O = 0, module enabled)	$V_{O,\ set}$ = 0.6 V_{dc}	$I_{IN,\ No\ load}$		29		mA
	$V_{O,\ set}$ = 5.5V_{dc}	$I_{IN,\ No\ load}$		60		mA
Input Stand-by Current (V_{IN} = 12V_{dc}, module disabled)	All	$I_{IN,\ stand\text{-}by}$		16		mA
Inrush Transient	All	I^2t			1	A^2s
Input Reflected Ripple Current, peak-to-peak (5Hz to 20MHz, 1µH source impedance; V_{IN} =4.5 to 14V, I_O=I_{Omax}; See Test Configurations)	All			20		mAp-p
Input Ripple Rejection (120Hz)	All			-76		dB
Output Voltage Set-point accuracy over entire output range						
0 to 85°C, Vo=over entire range	All	$V_{O,\ set}$	-0.5		+0.5	% VO, set
-40 to 85°C, Vo=over entire range	All	$V_{O,\ set}$	-1		+1	% VO, set
Voltage Regulation[1]						
Line Regulation	(V_{IN}=$V_{IN,\ min}$ to $V_{IN,\ max}$)			5		mV
	(12V_{IN}±20%)			2		mV
Load (I_O=$I_{O,\ min}$ to $I_{O,\ max}$) Regulation	All			6		mV
	≤1.2V_{out}			1		mV

[1]Worst case Line and load regulation data, all temperatures, from design verification testing as per IPC9592.

Technical Specifications (continued)

Electrical Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Adjustment Range (selected by an external resistor) (Some output voltages may not be possible depending on the input voltage – see Feature Descriptions Section)	All	V_O	0.6		5.5	V_{dc}
Remote Sense Range	All				0.5	V_{dc}
Output Ripple and Noise on nominal output (V_{IN}=$V_{IN,\ nom}$ and I_O=$I_{O,\ min}$ to $I_{O,\ max}$ Co = 0.1µF // 3x22 µF ceramic capacitors)						
Peak-to-Peak (5Hz to 20MHz bandwidth)	All		—	17		mVpk-pk
RMS (5Hz to 20MHz bandwidth)	All			5		mVrms
External Capacitance[2]						
Without the Tunable Loop™						
ESR ≥ 1 mΩ	All	$C_{O,\ max}$	3x22	—	7x22	µF
With the Tunable Loop™				—		
ESR ≥ 0.15 mΩ	All	$C_{O,\ max}$	3x22	—	1000	µF
ESR ≥ 10 mΩ	All	$C_{O,\ max}$	3x22	—	5000	µF
Output Current (in either sink or source mode)	All	I_o	0		7	A_{dc}
Output Current Limit Inception (Hiccup Mode) (current limit does not operate in sink mode)	All	$I_{O,\ lim}$		125		% $I_{o,\ max}$
Output Short-Circuit Current (VO≤250mV) (Hiccup Mode)	All	$I_{O,\ s/c}$		3.9		Arms
Efficiency	VO,set = 0.6Vdc	η		78.6%		%
V_{IN}= 12V_{dc}, T_A=25°C	VO, set = 1.2Vdc	η		87.7%		%
I_O=$I_{O,\ max}$, V_O= $V_{O,set}$	VO,set = 1.8Vdc	η		91.2%		%
	VO,set = 2.5Vdc	η		93.2%		%
	VO,set = 3.3Vdc	η		94.6%		%
	VO,set = 5.0Vdc	η		96%		%
Switching Frequency	All	f_{sw}		500		kHz
Frequency Synchronization	All					
Synchronization Frequency Range (2 x f_{switch})	All		950	1000	1050	kHz
High-Level Input Voltage	All	V_{IH}	2			V
Low-Level Input Voltage	All	V_{IL}			0.4	V
Minimum Pulse Width, SYNC	All	t_{SYNC}	100			ns
Maximum SYNC rise time	All	t_{SYNC_SH}	100			ns

[2]External capacitors may require using the new Tunable Loop™ feature to ensure that the module is stable as well as getting the best transient response. See the Tunable Loop™ section for details.

Technical Specifications (continued)

General Specifications

Parameter	Device	Min	Typ	Max	Unit
Calculated MTBF (I_O=0.8$I_{O,max}$, T_A=40°C) Telecordia Issue 3 Method 1 Case 3	All		81,291,063		Hours
Weight			2.2 (0.078)		g (oz.)

Feature Specifications

Unless otherwise indicated, specifications apply overall operating input voltage, resistive load, and temperature conditions. See Feature Descriptions for additional information.

Parameter	Device	Symbol	Min	Typ	Max	Unit
On/Off Signal Interface (V_{IN}=$VI_{N,min}$ to $V_{IN,max}$; open collector or equivalent, Signal referenced to GND) Device code with suffix "4" – Positive Logic (See Ordering Information) Logic High (Module ON)						
Input High Current	All	I_{IH}		—	17	µA
Input High Voltage	All	V_{IH}	2.1	—	7	V
Logic Low (Module OFF)						
Input Low Current	All	I_{IL}	—	—	2	µA
Input Low Voltage	All	V_{IL}	-0.2	—	0.8	V
Device Code with no suffix – Negative Logic (See Ordering Information) (On/OFF pin is open collector/drain logic input with external pull-up resistor; signal referenced to GND) Logic High (Module OFF)						
Input High Current	All	I_{IH}	—	—	3	mA
Input High Voltage	All	V_{IH}	2.1	—	7	V_{dc}
Logic Low (Module ON)						
Input low Current	All	I_{IL}	—	—	0.3	mA
Input Low Voltage	All	V_{IL}	-0.2	—	0.8	V_{dc}
Turn-On Delay and Rise Times						
(V_{IN}=$V_{IN,nom}$, I_O=$I_{O,max}$, V_O to within ±1% of steady state)						
Case 1: On/Off input is enabled and then input power is applied (delay from instant at which V_{IN} = $V_{IN,min}$ until V_o =10% of $V_{o,set}$)	All	Tdelay		0.6		msec
Case 2: Input power is applied for at least one second andthen the On/Off input is enabled (delay from instant at which Von/Off is enabled until V_o = 10% of $V_{o,set}$)	All	Tdelay		0.4		msec
Output voltage Rise time (time for Vo to rise from 10% of $V_{o,set}$t to 90% of $V_{o,set}$)	All	Trise		2.8		msec
Output voltage overshoot (T_A = 25°C V_{IN}= $V_{IN,min}$ to $V_{IN,max}$,I_O = I_O, min to $I_{O,max}$) With or without maximum external capacitance					3.0	% $V_{O,set}$
Over Temperature Protection (See Thermal Considerations section)	All	T_{ref-}		135		°C

Technical Specifications (continued)

Feature Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Units
Input Undervoltage Lockout ($V_{out} \leq 3.3V_o$)						
Turn-on Threshold	All			4.25		V_{dc}
Turn-off Threshold	All			4.05		V_{dc}
Hysteresis	All			0.2		V_{dc}
PGOOD (Power Good)						
Signal Interface Open Drain, $V_{supply} \leq 5VDC$						
Overvoltage threshold for PGOOD ON	All			108.33		$\%V_{O, set}$
Overvoltage threshold for PGOOD OFF	All			112.5		$\%V_{O, set}$
Undervoltage threshold for PGOOD ON	All			91.67		$\%V_{O, set}$
Undervoltage threshold for PGOOD OFF	All			87.5		$\%V_{O, set}$
Pulldown resistance of PGOOD pin	All			40	70	Ω
Sink current capability into PGOOD pin	All				5	mA

* Over temperature Warning – Warning may not activate before alarm and unit may shutdown before warning

Technical Specifications (continued)

Characteristic Curves

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 0.6V$_o$ and 25°C

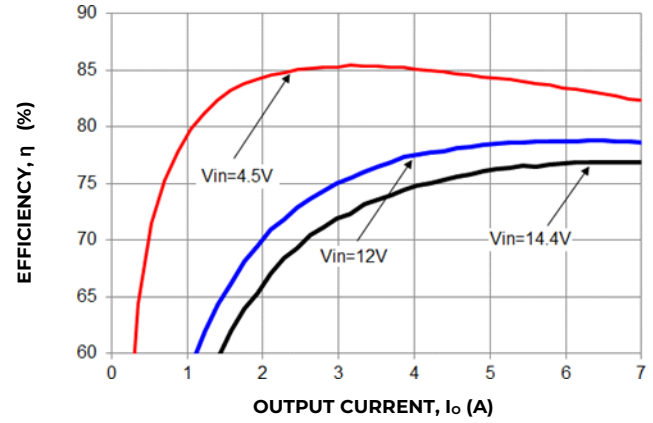


Figure 1. Converter Efficiency verses output current

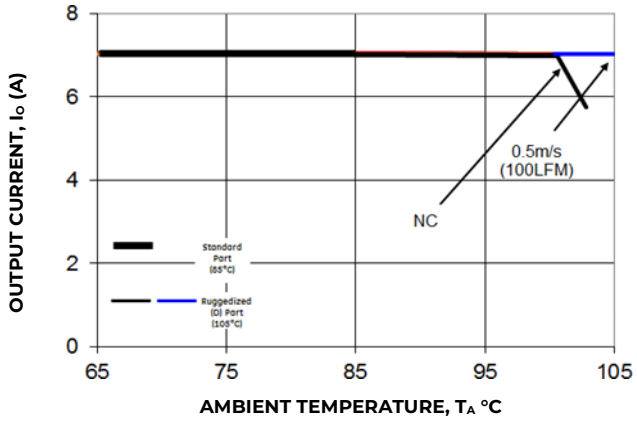


Figure 2. Derating Output Current verses Ambient Temperature and Airflow.

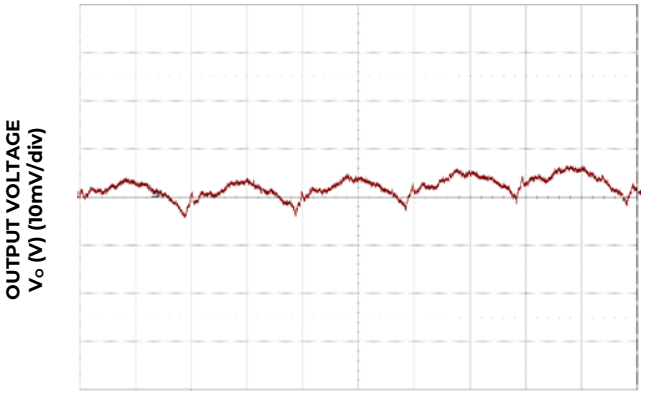


Figure 3. Typical output ripple (C_O=3+-x22µF ceramic, V_{IN} = 12V, $I_o = I_{o,max,}$).

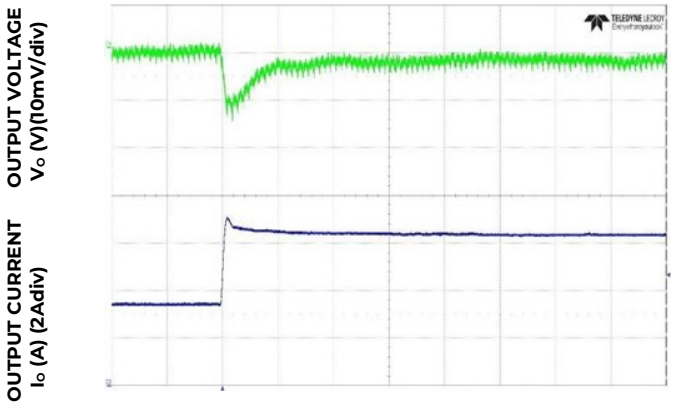


Figure 4. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C$_{out}$= 6x47uF + 4x330uF, CTune=22nF, RTune=237Ω

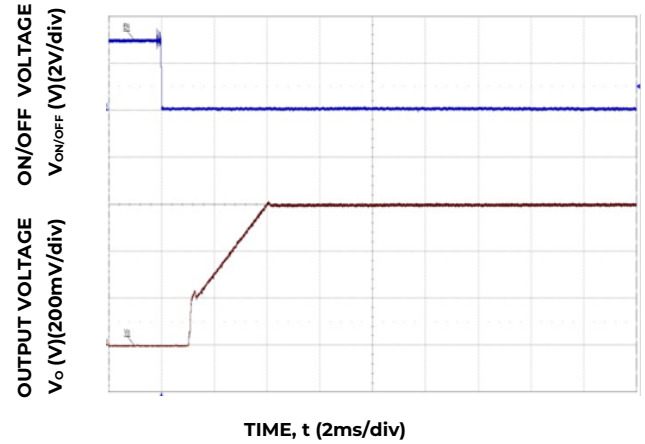


Figure 5. Typical Start-up Using On/Off Voltage ($I_o = I_{o,max}$).

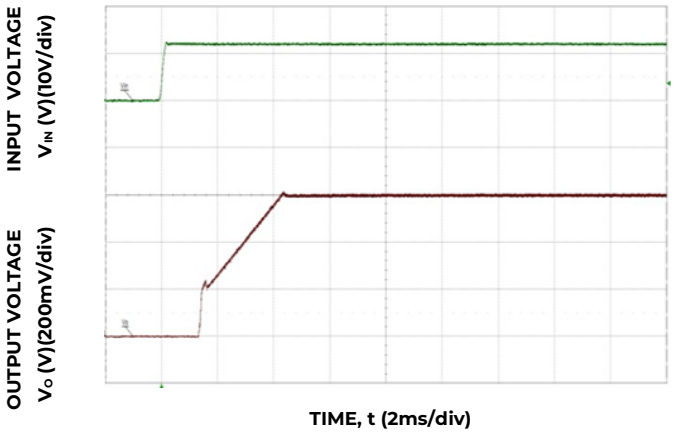


Figure 6. Typical Start-up Using Input Voltage (V_{IN} = 12V, $I_o = I_{o,max}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 1.2V$_o$ and 25°C

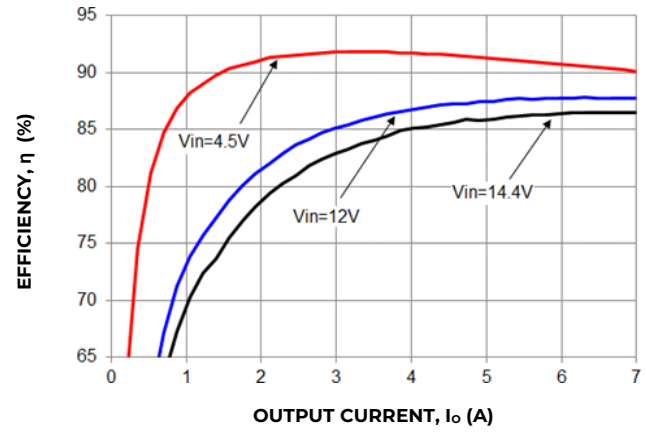


Figure 7. Converter Efficiency verses output current

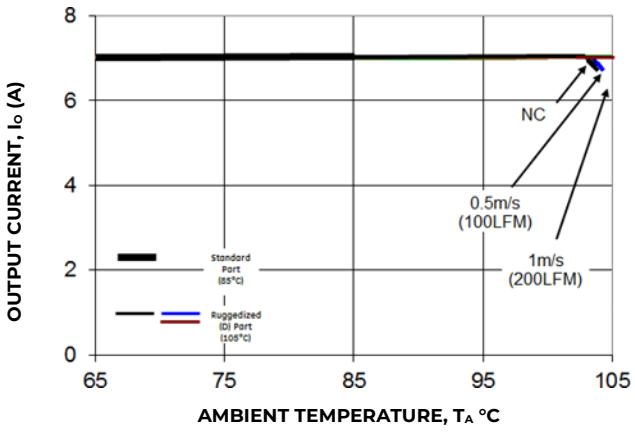


Figure 8. Derating Output Current verses Ambient Temperature and Airflow.

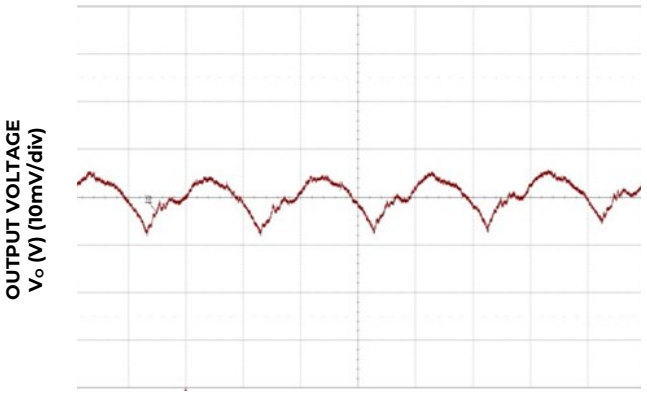


Figure 9. Typical output ripple (C_O=3x22 µF ceramic, V_{IN} = 12V, $I_o = I_{o,max,}$).

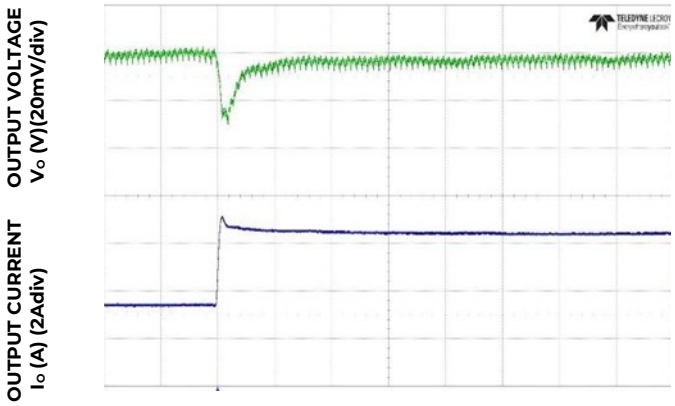


Figure 10. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C_{out}= 6x47uF + 1x330 uF, CTune=12 nF, RTune=300 Ω

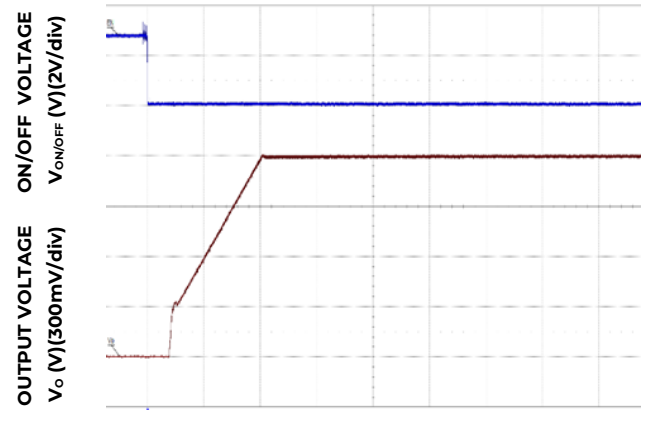


Figure 11. Typical Start-up Using On/Off Voltage ($I_o = I_{o,max}$).

Figure 12. Typical Start-up Using Input Voltage (V_{IN} = 12V, $I_o = I_{o,max}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 1.8V$_o$ and 25°C

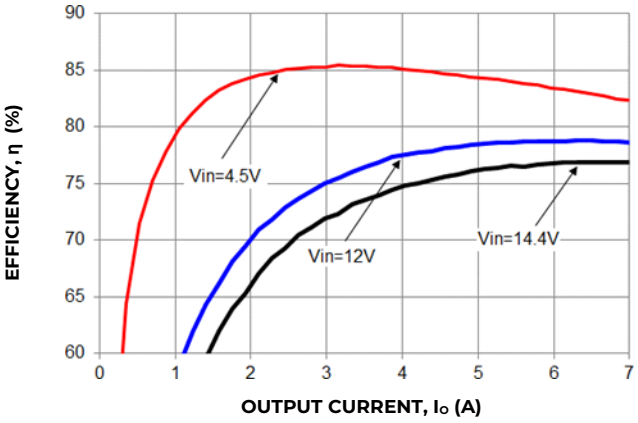


Figure 13. Converter Efficiency verses output current

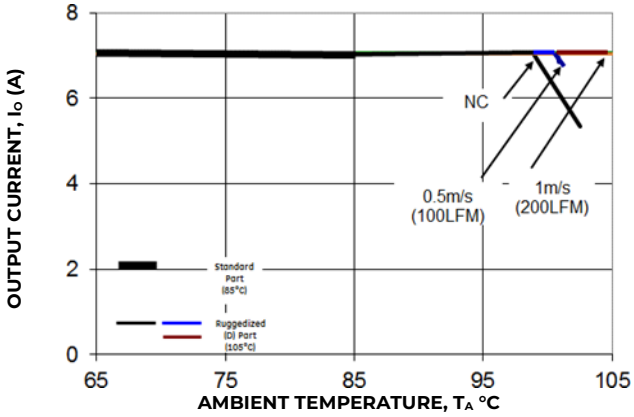


Figure 14. Derating Output Current verses Ambient Temperature and Airflow.

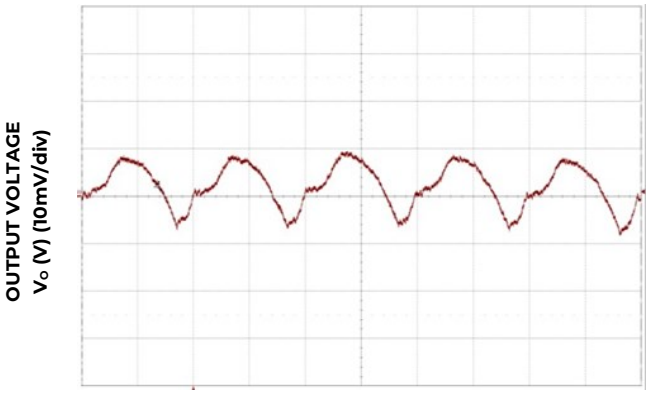


Figure 15. Typical output ripple and noise (C_O=3x22µF ceramic, V_{IN} = 12V, I_o = $I_{o,max,}$).

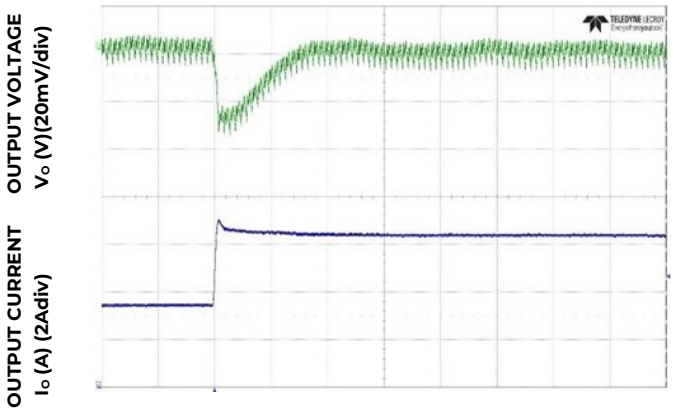


Figure 16. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C$_{out}$= 3x47uF + 1x330uF, CTune=3.9nF, RTune=300Ω

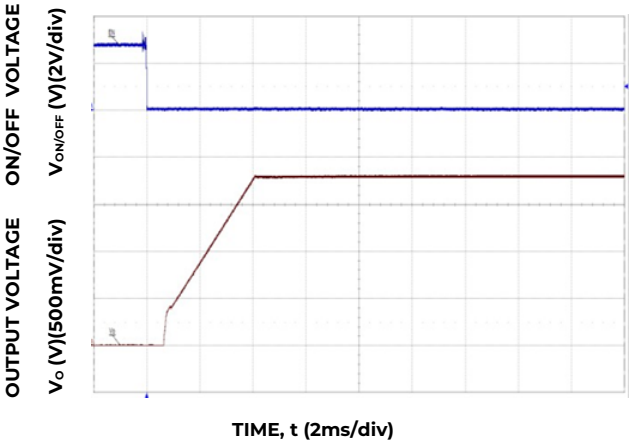


Figure 17. Typical Start-up Using On/Off Voltage (I_o = $I_{o,max}$).

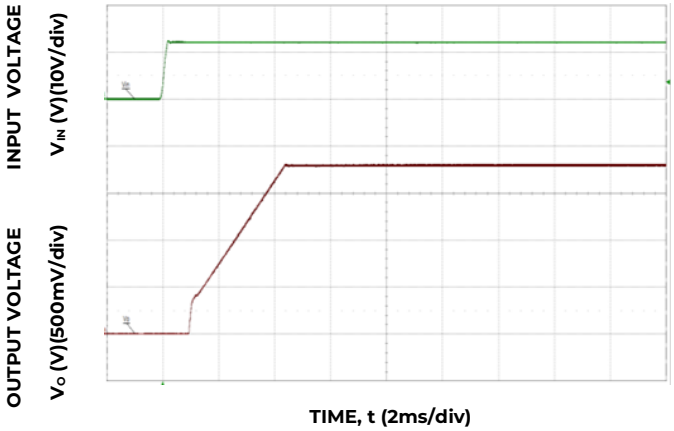


Figure 18. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o,max}$).

Characteristic Curves (continued)

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 2.5V$_o$ and 25°C

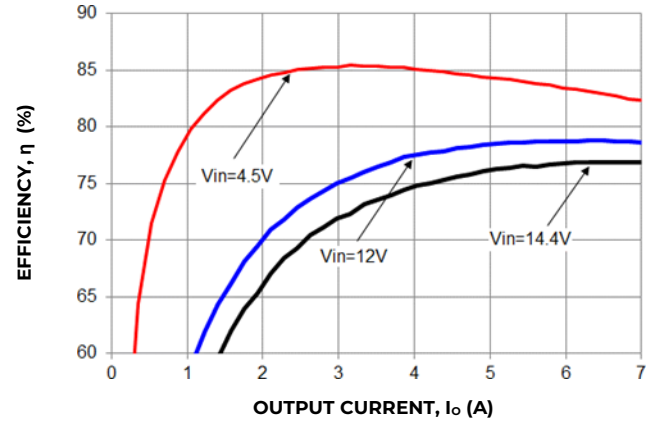


Figure 19. Converter Efficiency verses output current

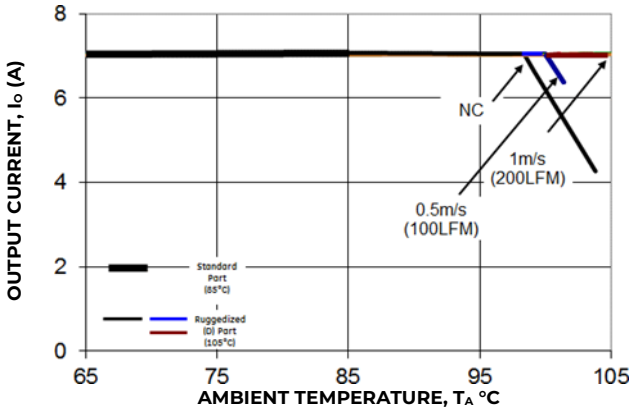


Figure 20. Derating Output Current verses Ambient Temperature and Airflow.

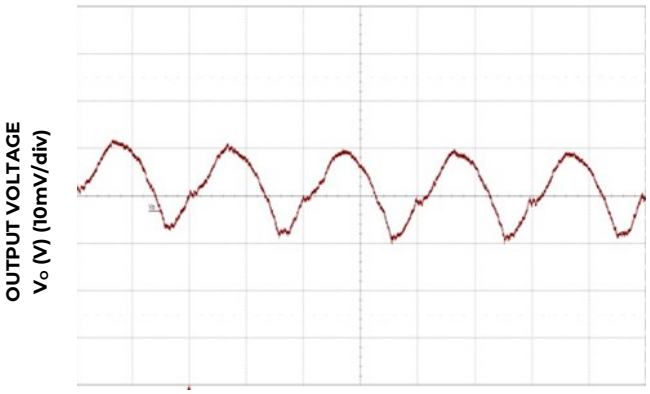


Figure 21. Typical output ripple and noise (C_O=3x22µF ceramic, V_{IN} = 12V, I_o = $I_{o,max,}$).

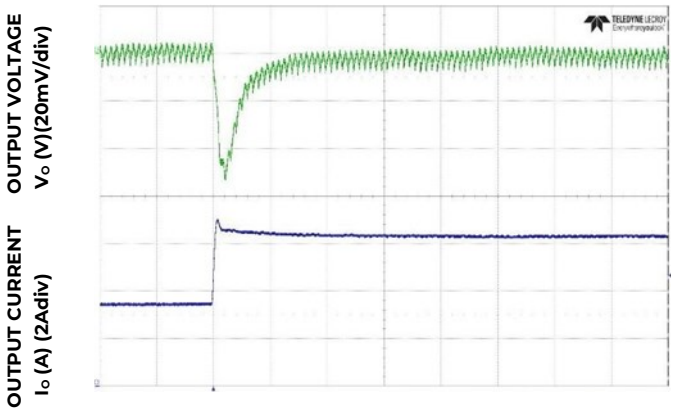


Figure 22. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C$_{out}$= 6x47uF, CTune=3.9nF, RTune=300Ω

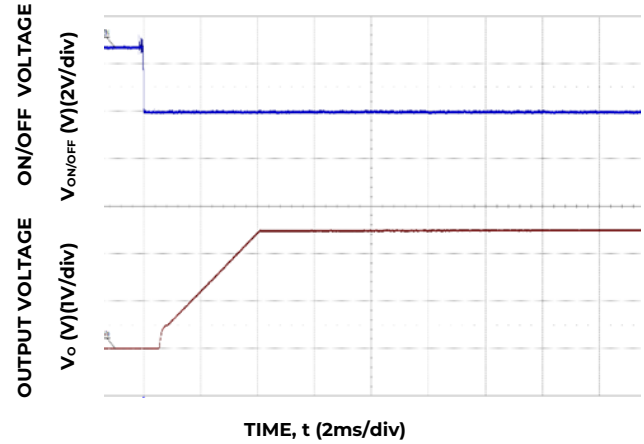


Figure 23. Typical Start-up Using On/Off Voltage (I_o = $I_{o,max}$).

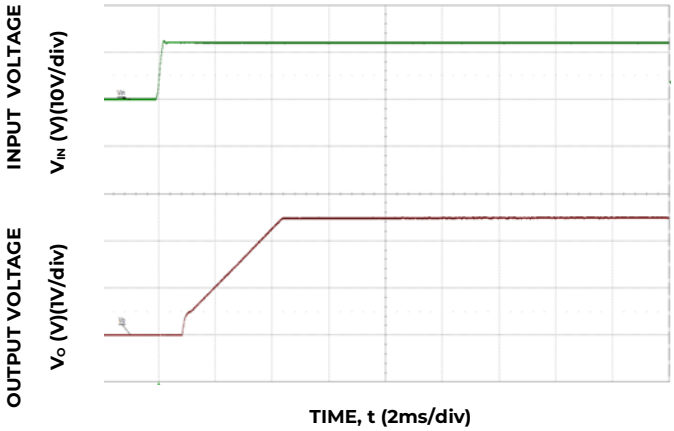


Figure 24. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o,max}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 3.3V$_o$ and 25°C

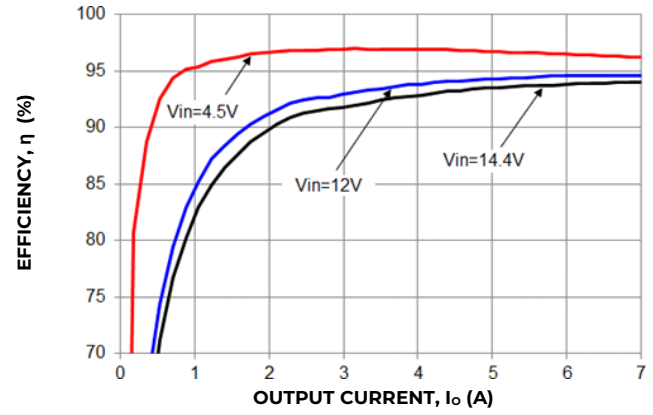


Figure 25. Converter Efficiency verses output current

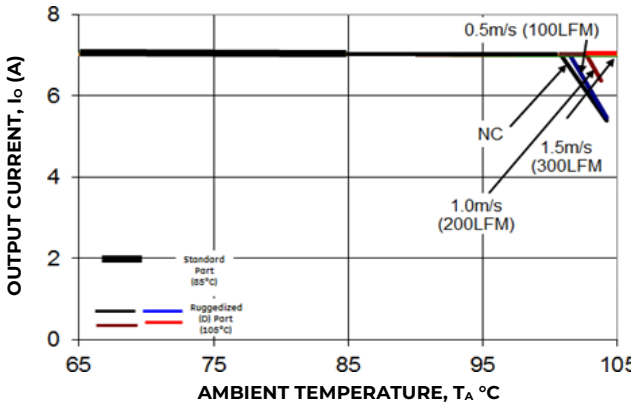


Figure 26. Derating Output Current verses Ambient Temperature and Airflow.

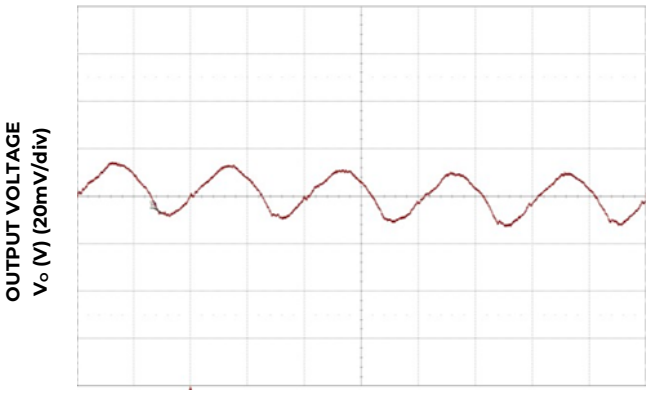


Figure 27. Typical output ripple and noise (C_O=3x22µF ceramic, V_{IN} = 12V, I_o = $I_{o,max,}$).

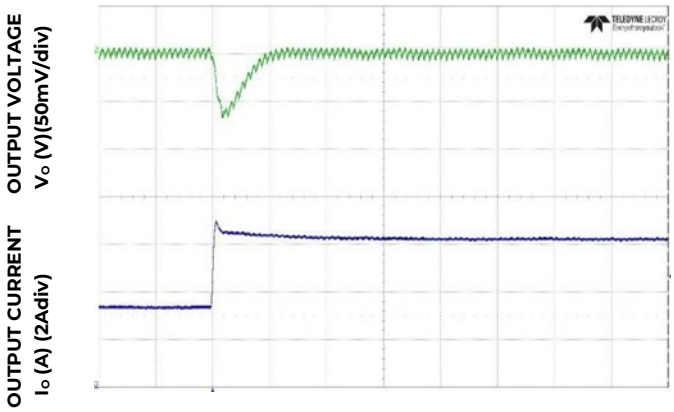


Figure 28. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C$_{out}$= 5x47uF, CTune=1.8 nF, RTune=300Ω

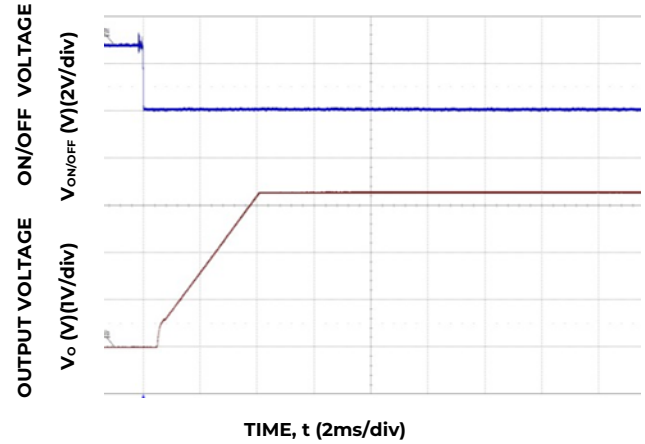


Figure 29. Typical Start-up Using On/Off Voltage (I_o = $I_{o,max}$).

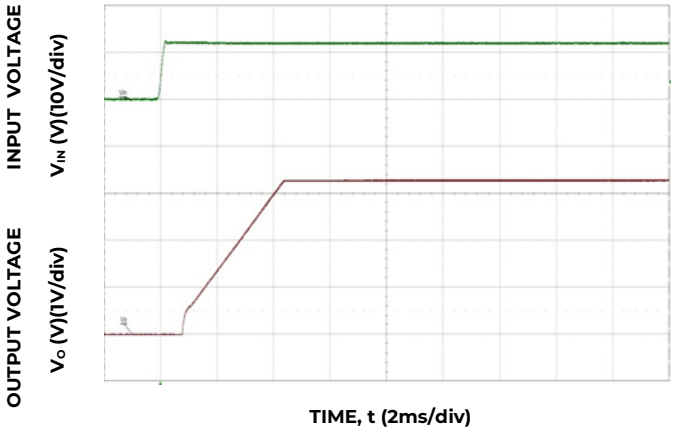


Figure 30. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o,max}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 7A Digital PicoDLynxII™ at 3.3V$_o$ and 25°C

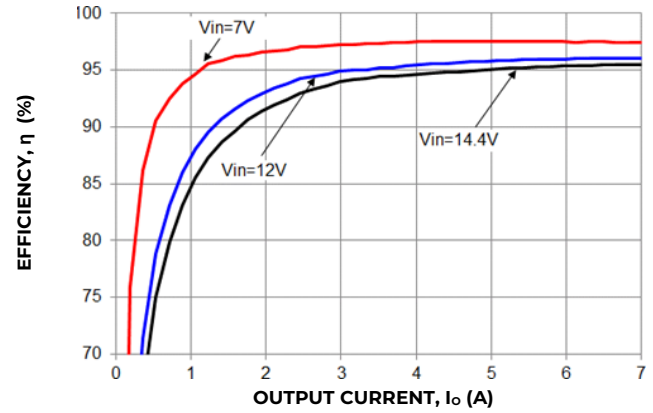


Figure 31. Converter Efficiency verses output current

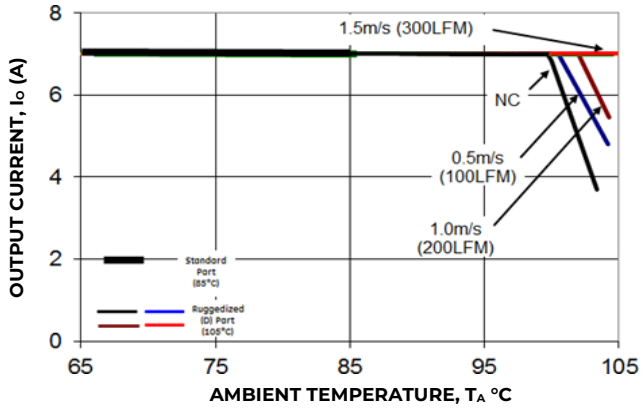


Figure 32. Derating Output Current verses Ambient Temperature and Airflow.

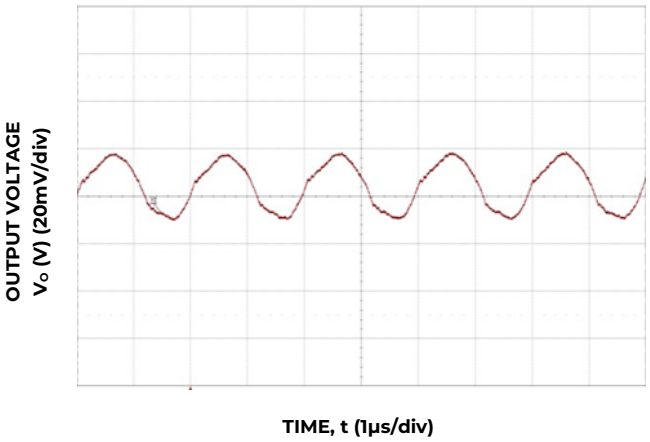


Figure 33. Typical output ripple and noise (C_O=3x22µF ceramic, V_{IN} = 12V, I_o = $I_{o,max,}$).

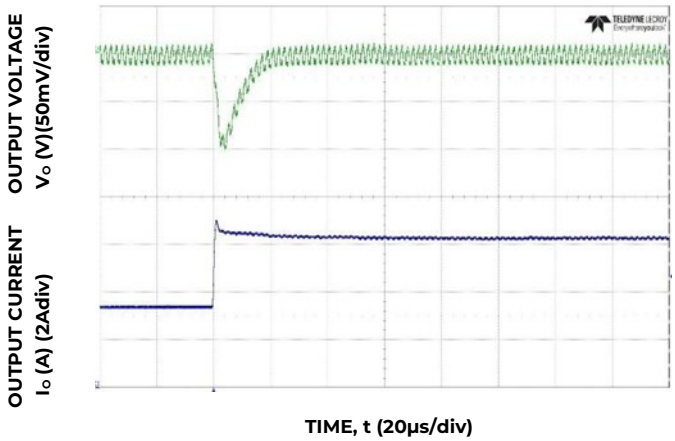


Figure 34. Transient Response to Dynamic Load Change from 50% to 100% at 12V$_{in}$, C$_{out}$= 3x47uF, CTune=1.8 nF, RTune=300Ω

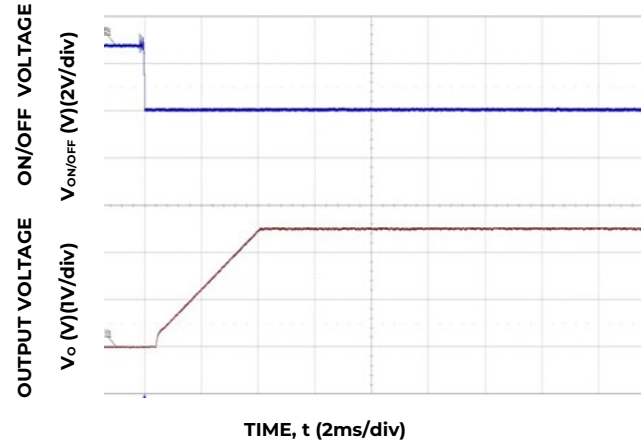


Figure 35. Typical Start-up Using On/Off Voltage (I_o = $I_{o,max}$).

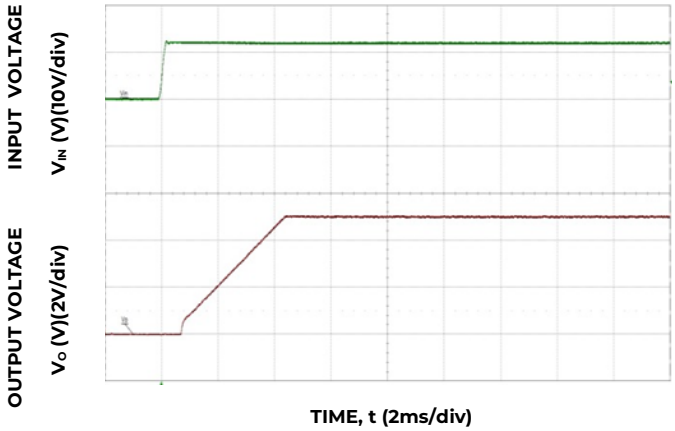


Figure 36. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o,max}$).

Design Considerations

Input Filtering

The 7A Digital PicoDLynxII™ module should be connected to a low ac-impedance source. A highly inductive source can affect the stability of the module. An input capacitance must be placed directly adjacent to the input pin of the module, to minimize input ripple voltage and ensure module stability.

To minimize input voltage ripple, ceramic capacitors are recommended at the input of the module. Figure 31 shows the input ripple voltage for various output voltages at 7A of load current with 2x22 µF or 4x22 µF ceramic capacitors and an input of 12V.

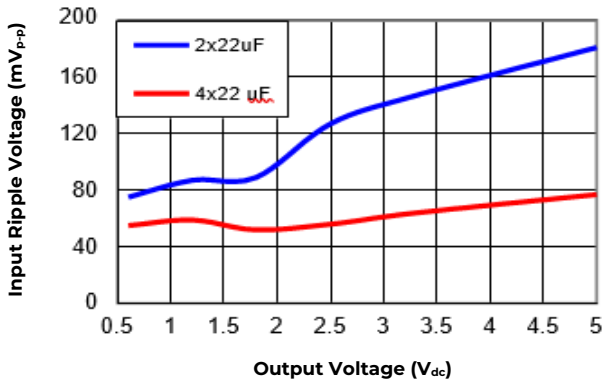


Figure 37. Input ripple voltage for various output voltages with 2x22 µF or 4x22 µF ceramic capacitors at the input (7A load). Input voltage is 12V.

Output Filtering

These modules are designed for low output ripple voltage and will meet the maximum output ripple specification with 0.1 µF ceramic and 3x22 µF ceramic capacitors at the output of the module. However, additional output filtering may be required by the system designer for a number of reasons. First, there may be a need to further reduce the output ripple and noise of the module. Second, the dynamic response characteristics may need to be customized to a particular load step change.

To reduce the output ripple and improve the dynamic response to a step load change, additional capacitance at the output can be used. Low ESR polymer and ceramic capacitors are recommended to improve the dynamic response of the module. Figure 32 provides output ripple information for different external capacitance values at various V_o and a full load current of 7A. For stable operation of the module, limit the capacitance to less than the maximum output capacitance as specified in the electrical specification table. Optimal performance of the module can be achieved by using the Tunable Loop™ feature described later in this data sheet.

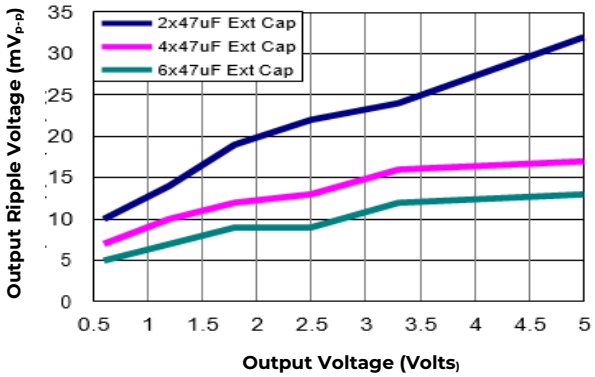


Figure 38. Output ripple voltage for various output voltages with external 2x47 µF, 4x47 µF or 6x47 µF ceramic capacitors at the output (7A load). Input voltage is 12V.

Safety Considerations

For safety agency approval the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards, i.e., UL ANSI/UL* 62368-1 and CAN/CSA+ C22.2 No. 62368-1 Recognized, DIN VDE 0868- 1/ A11:2017 (EN62368-1:2014/A11:2017)

For the converter output to be considered meeting the Requirements of safety extra-low voltage (SELV) or ES1, the input must meet SELV/ES1 requirements. The power module has extra-low voltage (ELV) outputs when all inputs are ELV.

An external 20A Littelfuse 456 series fast-acting fuse or equivalent is recommended on the ungrounded input lead.

Analog Feature Descriptions

Remote On/Off

The 7A Analog PicoDLynxII™ power modules feature an On/Off pin for remote On/Off operation. Two On/Off logic options are available. In the Positive Logic On/Off option, (device code suffix "4" – see Ordering Information), the module turns ON during a logic High on the On/Off pin and turns OFF during a logic Low. With the Negative Logic On/Off option, (no device code suffix, see Ordering Information), the module turns OFF during logic High and ON during logic Low. The On/Off signal should be always referenced to ground. For either On/Off logic option, leaving the On/Off pin disconnected will turn the module ON when input voltage is present.

For positive logic modules, the circuit configuration for using the On/Off pin is shown in Figure 39. When the external transistor Q1 is in the OFF state, the internal PWM #Enable is pulled up internally, thus turning the module ON. When transistor Q1 is turned ON, the On/Off pin is pulled low, and consequently the internal PWM Enable signal is pulled low and the module is OFF.

For negative logic On/Off modules, the circuit configuration is shown in Fig. 40. The On/Off pin should be pulled high with an external pull-up resistor. When transistor Q2 is in the OFF state, the On/Off pin is pulled high, which pulls the internal ENABLE# High and the module is OFF. To turn the module ON, Q2 is turned ON pulling the On/Off pin low resulting in the PWM ENABLE# pin going Low. The typical voltage allowed on the On/Off pin is 7V. If Vin is used as a source, then a suitable external resistor R1 must be used to ensure that the voltage on the On/Off pin does not exceed 7V.

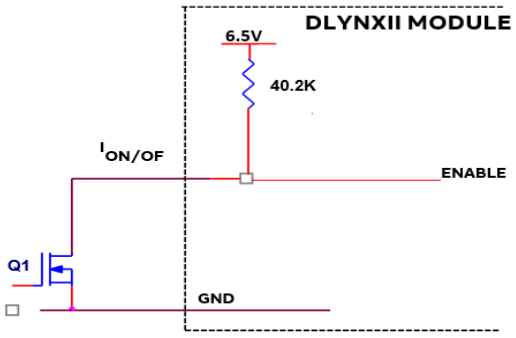


Figure 39. Circuit configuration for using positive On/Off logic.

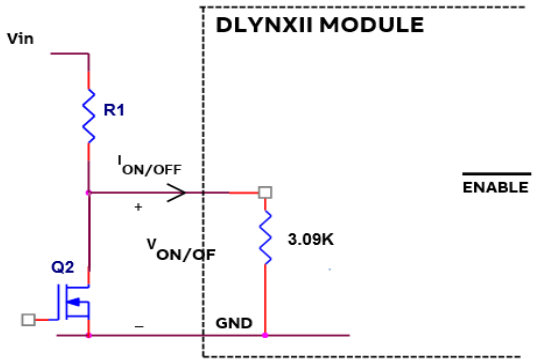


Figure 40. Circuit configuration for using negative On/Offlogic.

Monotonic Start-up and Shutdown

The module has monotonic start-up and shutdown behavior for any combination of rated input voltage, output current and operating temperature range.

Startup into Pre-biased Output

The module can start into a prebiased output as long as the prebias voltage is 0.5V less than the set output voltage.

Analog Output Voltage Programming

The output voltage of the module is programmable to any voltage from 0.6dc to 5.5Vdc by connecting a resistor between resistor between the Trim and SIG_GND pins of the module. Certain restrictions apply on the output voltage set point depending on the input voltage. These are shown in the Output Voltage vs. Input Voltage Set Point Area plot in Fig. 35. The Upper Limit curve shows that for output voltages lower than 1V, the input voltage must be lower than the maximum of 14.4V. The Lower Limit curve shows that for output voltages higher than 3.3V, the input voltage needs to be higher than the

minimum of 4.5V.

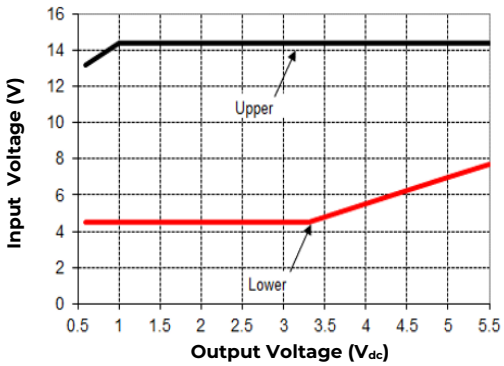


Figure 41. Output Voltage vs. Input Voltage Set Point Area plot showing limits where the output voltage can be set for different input voltages.

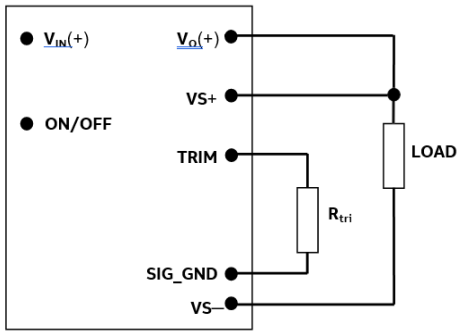


Figure 42. Circuit configuration for programming output voltage using an external resistor.

Caution – Do not connect SIG_GND to GND elsewhere in the layout

Without an external resistor between Trim and SIG_GND pins, the output of the module will be 0.6Vdc. To calculate the value of the trim resistor, R_{trim} for a desired output voltage, should be as per the following equation:

$$R_{trim} = \left[\frac{12}{(V_o - 0.6)} \right] \text{ kΩ}$$

R_{trim} is the external resistor in kΩ

Vo is the desired output voltage.

Table 1 provides R_{trim} values required for some common output voltages.

$V_{O,\,set}$ (V)	R_{trim} (KΩ)
0.6	Open
0.9	40
1.0	30
1.2	20
1.5	13.33
1.8	10
2.5	6.316
3.3	4.444
5.0	2.727

Table 1

Remote Sense

The power module has a Remote Sense feature to minimize the effects of distribution losses by regulating the voltage between the sense pins (VS+ and VS-). The voltage drop between the sense pins and the VOUT and GND pins of the module should not exceed 0.5V.

Analog Voltage Margining

Output voltage margining can be implemented in the module by connecting a resistor, $R_{margin\text{-}up}$, from the Trim pin to the ground pin for margining-up the output voltage and by connecting a resistor, $R_{margin\text{-}down}$, from the Trim pin to output pin for margining-down. Figure 43 shows the circuit configuration for output voltage margining. The POL Programming Tool or Power Module Wizard(PMW), available at Go.OmniOn/Industrial under the Downloads section, also calculates the values of $R_{margin\text{-}up}$ and $R_{margin\text{-}down}$ for a specific output voltage and % margin. Please consult your local OmniOn technical representative for additional details.

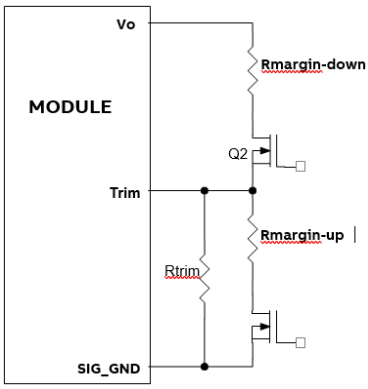


Figure 43. Circuit Configuration for margining Output voltage.

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current-limiting circuitry and can endure current limiting continuously. At the point of current-limit inception, the unit enters hiccup mode. The unit operates normally once the output current is brought back into its specified range.

Overtemperature Protection

To provide protection in a fault condition, the unit is equipped with a thermal shutdown circuit. The unit will shut down if the over-temperature threshold of 120°C (typ) is exceeded at the thermal reference point T_{ref}. Please refer to Electrical characteristic table, over-temperature section on page 5. Once the unit goes into thermal shutdown it will then wait to cool before attempting to restart.

Input Undervoltage Lockout

At input voltages below the input undervoltage lockout limit, the module operation is disabled. The module will begin to operate at an input voltage above the undervoltage lockout turn-on threshold.

Synchronization

The module switching frequency can be synchronized to a signal with an external frequency within a specified range. Synchronization can be done by using the external signal applied to the SYNC pin of the module as shown in Fig. 45, with the converter being synchronized by the rising edge of the external signal. The module switches at half the SYNC frequency. The Electrical Specifications table specifies the requirements of the external SYNC signal. If the SYNC pin is not used, the module will free run at the default switching frequency. If synchronization is not being used, connect the SYNC pin to SIG_GND.

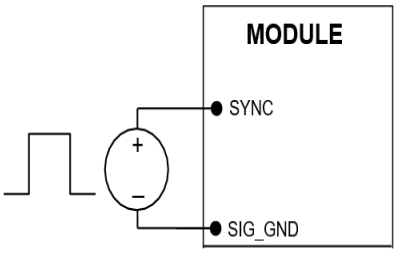


Figure 45. External source connections to synchronize switching frequency of the module.

Dual Layout

Identical dimensions and pin layout of Analog and Digital PicoDLynxII modules permit migration from one to the other without needing to change the layout. In both cases the trim resistor is connected between trim and signal ground. The output of the analog module cannot be trimmed down to 0.51V

Tunable Loop™

The module has a feature that optimizes transient response of the module called Tunable Loop™.

External capacitors are usually added to the output of the module for two reasons: to reduce output ripple and noise (see Figure 38) and to reduce output voltage deviations from the steady-state value in the presence of dynamic load current changes. Adding external capacitance however affects the voltage control loop of the module, typically causing the loop to slow down with sluggish response. Larger values of external capacitance could also cause the module to become unstable.

The Tunable Loop™ allows the user to externally adjust the voltage control loop to match the filter network connected to the output of the module. The Tunable Loop™ is implemented by connecting a series R-C between the VS+ and TRIM pins of the module, as shown in Fig. 46. This R-C allows the user to externally adjust the voltage loop feedback compensation of the module.

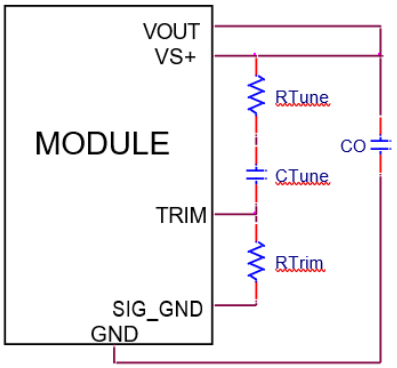


Figure. 46. Circuit diagram showing connection of R_{TUME} and C_{TUNE} to tune the control loop of the module.

Recommended values of R_{TUNE} and C_{TUNE} for different output capacitor combinations are given in Tables 2 and 3. Table 3 shows the recommended values of R_{TUNE} and C_{TUNE} for different values of ceramic output capacitors up to 1000uF that might be needed for an application to meet output ripple and noise requirements. Selecting R_{TUNE} and C_{TUNE} according to Table 3 will ensure stable operation of the module.

In applications with tight output voltage limits in the presence of dynamic current loading, additional output capacitance will be required. Table 3 lists recommended values of R_{TUNE} and C_{TUNE} in order to meet 2% output voltage deviation limits for some common output voltages in the presence of a 3.5A to 7A step change (50% of full load), with an input voltage of 12V.

Please contact your OmniOn technical representative to obtain more details of this feature as well as for guidelines on how to select the right value of external R-C to tune the module for best transient performance and stable operation for other output capacitance values.

Technical Specifications (continued)

C_o	4x47µF	6x47µF	8x47µF	10x47µF	20x47µF
R_{TUNE}	300	300	300	300	300
C_{TUNE}	220p	330p	390p	470p	1.8n

Table 2. General recommended values of of R_{TUNE} and C_{TUNE} for V_{in}=12V and various external ceramic capacitor combinations.

V_o	5V	3.3V	2.5V	1.8V	1.2V	0.6V
C_o	3x47uf	5x47uF	6x47uF	3x47uF + 1x330uF	6x47uF + 1x330uF	6x47uF + 4x330uF
R_{TUNE}	300	300	300	300	300	237
C_{TUNE}	1000pF	1800pF	3900pF	3900pF	12nF	22nF
DV	78mV	52mV	37mV	31mV	20mV	11mV

Table 3. Recommended values of R_{TUNE} and C_{TUNE} to obtain transient deviation of 2% of V_{out} for a 3.5A step load with Vin=12V.

Note: The capacitors used in the Tunable Loop tables are 47 µF/3 mΩ ESR ceramic and 330 µF/9 mΩ ESR polymer capacitors.

Power Module Wizard

OmniOn offers a free web based easy to use tool that helps users simulate the Tunable Loop performance of the PJT007. Go to **omnionpower.com**

and sign up for a free account and use the module selector tool. The tool also offers downloadable Simplis/Simetrix models that can be used to assess transient performance, module stability, etc.

Power Good

The PGOOD terminal can be connected through a pullup resistor (suggested value 100KΩ) to a source of 5VDC or lower. The current through the PGood terminal should be limited to a max value of 5mA

Thermal Considerations

Power modules operate in a variety of thermal environments; however, sufficient cooling should always be provided to help ensure reliable operation.

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. The thermal data presented here is based on physical measurements taken in a wind tunnel. The test set-up is shown in Figure 48. The preferred airflow direction for the module is in Figure 49.

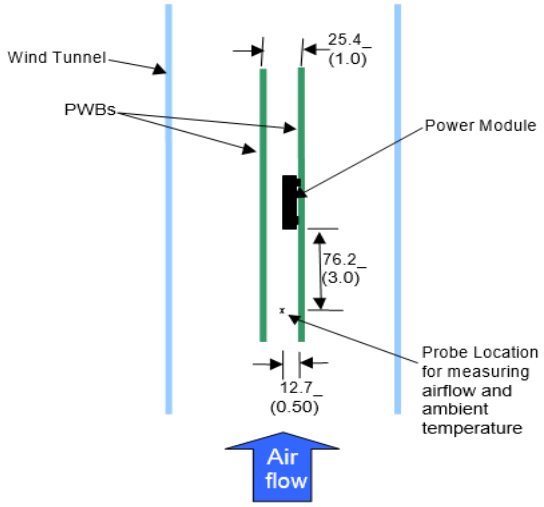


Figure 48. Thermal Test Setup.

The thermal reference points, T_{ref} used in the specifications are also shown in Figure 49. For reliable operation the temperatures at these points should not exceed 120°C. The output power of the module should not exceed the rated power of the module ($V_{o,set}$ x $I_{o,max}$).

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.

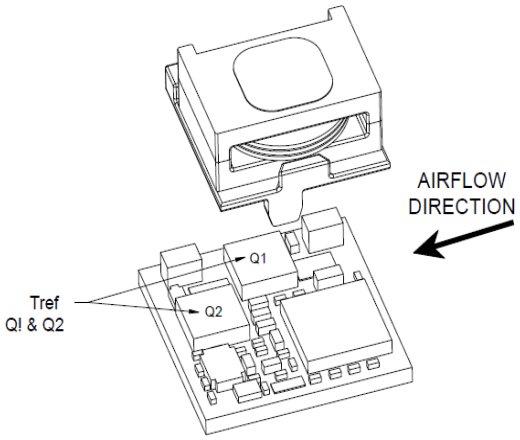


Figure 49. Preferred airflow direction and location of hot- spot of the module (T_{ref}).

Shock and Vibration

The ruggedized (-D version) of the modules are designed to withstand elevated levels of shock and vibration to be able to operate in harsh environments. The ruggedized modules have been successfully tested to the following conditions:

Non operating random vibration:

Random vibration tests conducted at 25C, 10 to 2000Hz, for 30 minutes each level, starting from 30Grms (Z axis) and up to 50Grms (Z axis). The units were then subjected to two more tests of 50Grms at 30 minutes each for a total of 90 minutes.

Operating shock to 40G per Mil Std. 810G, Method 516.4 Procedure I:

The modules were tested in opposing directions along each of three orthogonal axes, with waveform and amplitude of the shock impulse characteristics as follows:

All shocks were half sine pulses, 11 milliseconds (ms) in duration in all 3 axes.

Units were tested to the Functional Shock Test of MIL-STD-810, Method 516.4, Procedure I - Figure 516.4-4. A shock magnitude of 40G was utilized. The operational units were subjected to three shocks in each direction along three axes for a total of eighteen shocks.

Operating vibration per Mil Std 810G, Method 514.5 Procedure I:

The ruggedized (-D version) modules are designed and tested to vibration levels as outlined in MIL-STD-810G, Method 514.5, and Procedure 1, using the Power Spectral Density (PSD) profiles as shown in Table 7 and Table 8 for all axes. Full compliance with performance specifications was required during the performance test. No damage was allowed to the module and full compliance to performance specifications was required when the endurance environment was removed. The module was tested per MIL-STD-810, Method 514.5, Procedure I, for functional (performance) and endurance random vibration using the performance and endurance levels shown in Table 7 and Table 8 for all axes. The performance test has been split, with one half accomplished before the endurance test and one half after the endurance test (in each axis). The duration of the performance test was at least 16 minutes total per axis and at least 120 minutes total per axis for the endurance test. The endurance test period was 2 hours minimum per axis.

Frequency (Hz)	PSD Level (G2/Hz)	Frequency (Hz)	PSD Level (G2/Hz)	Frequency (Hz)	PSD Level (G2/Hz)
10	1.14E-03	170	2.54E-03	690	1.03E-03
30	5.96E-03	230	3.70E-03	800	7.29E-03
40	9.53E-04	290	7.99E-04	890	1.00E-03
50	2.08E-03	340	1.12E-02	1070	2.67E-03
90	2.08E-03	370	1.12E-02	1240	1.08E-03
110	7.05E-04	430	8.84E-04	1550	2.54E-03
130	5.00E-03	490	1.54E-03	1780	2.88E-03
140	8.20E-04	560	5.62E-04	2000	5.62E-04

Table 4: Performance Vibration Qualification - All Axes

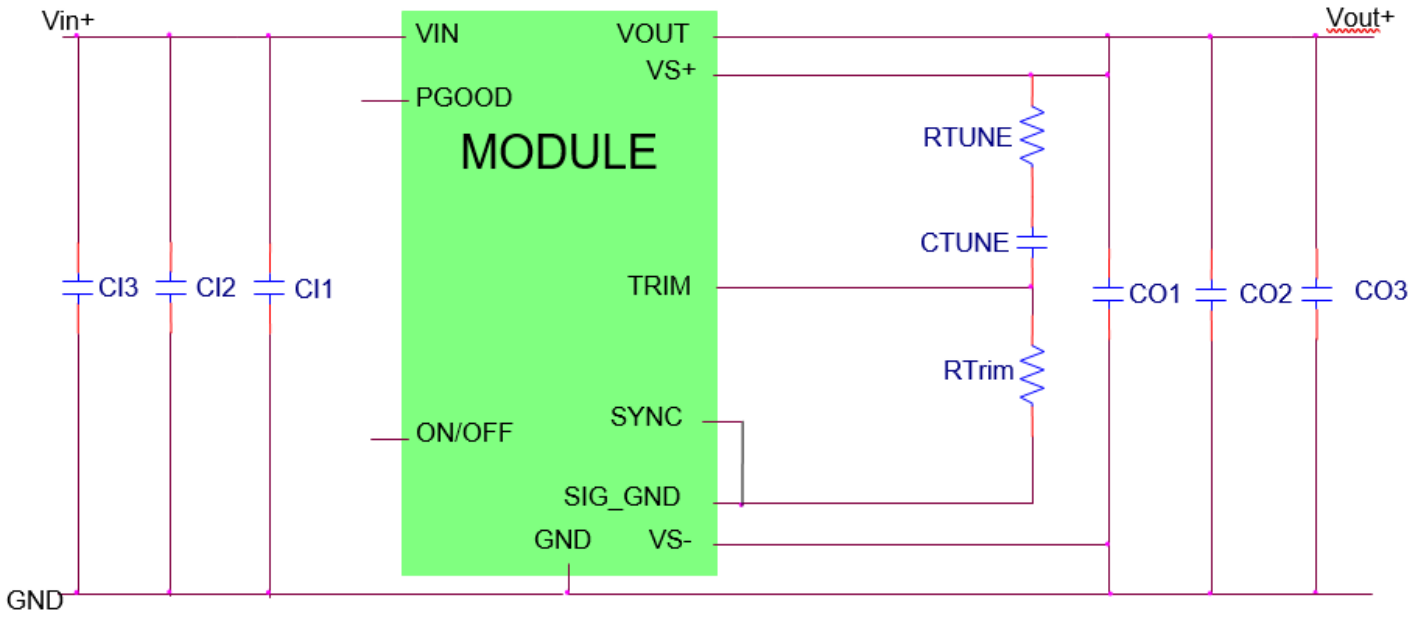
Frequency (Hz)	PSD Level (G2/Hz)	Frequency (Hz)	PSD Level (G2/Hz)	Frequency (Hz)	PSD Level (G2/Hz)
10	0.00803	170	0.01795	690	0.00727
30	0.04216	230	0.02616	800	0.05155
40	0.00674	290	0.00565	890	0.00709
50	0.01468	340	0.07901	1070	0.01887
90	0.01468	370	0.07901	1240	0.00764
110	0.00498	430	0.00625	1550	0.01795
130	0.03536	490	0.01086	1780	0.02035
140	0.0058	560	0.00398	2000	0.00398

Table 5: Endurance Vibration Qualification - All Axes

Example Application Circuit

Requirements:

V_{in}: 12V
V_{out}: 1.8V
I_{out}: 5.25A max., worst case load transient is from 3.5A to 5.25A
DV_{out}: 1.5% of Vout (27mV) for worst case load transient
$V_{in, ripple}$ 1.5% of V_{in} (180mV, p-p)

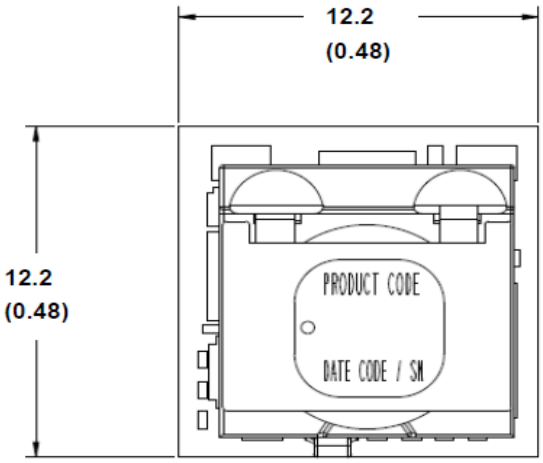


CI1 Decoupling cap - 1x0.047µF/16V ceramic (e.g. Murata LLL185R71C473MA01) + 1x0.1uF/16V 0402 ceramic
CI2 3x22µF/16V ceramic capacitor (e.g. Murata GRM32ER61C226KE20)
CI3 47µF/16V bulk electrolytic
CO1 Decoupling cap - 1x0.047µF/16V ceramic (e.g. Murata LLL185R71C473MA01) + 1x0.1uF/16V 0402 ceramic CO2 5 x 47uF/6.3V 1210 ceramic capacitors
CO3 NA
C_{Tune} 3300 pF ceramic capacitor (can be 1206, 0805 or 0603 size)
R_{Tune} 300Ω SMT resistor (can be 1206, 0805 or 0603 size)
R_{Trim} 10kW SMT resistor (can be 1206, 0805 or 0603 size, recommended tolerance of 0.1%)

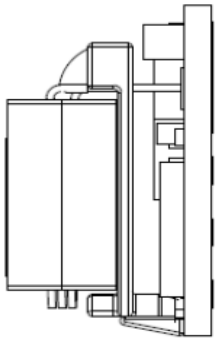
Technical Specifications (continued)

Mechanical Outline

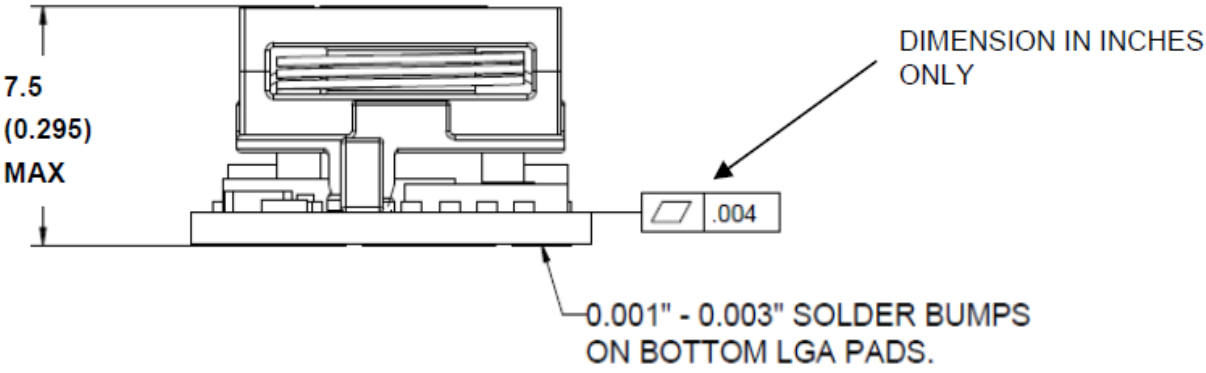
Dimensions are in millimeters and (inches).
Tolerances: x.x mm ±0.5 mm (x.xx in. ± 0.02 in.) [unless otherwise indicated]
x.xx mm ± 0.25 mm (x.xxx in ± 0.010 in.)

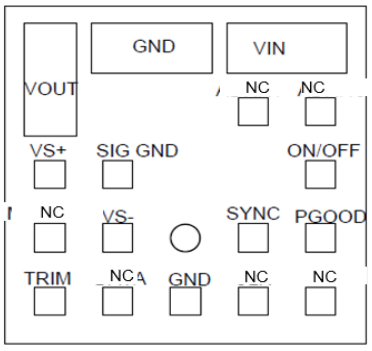


TOP VIEW



SIDE VIEW





BOTTOM VIEW

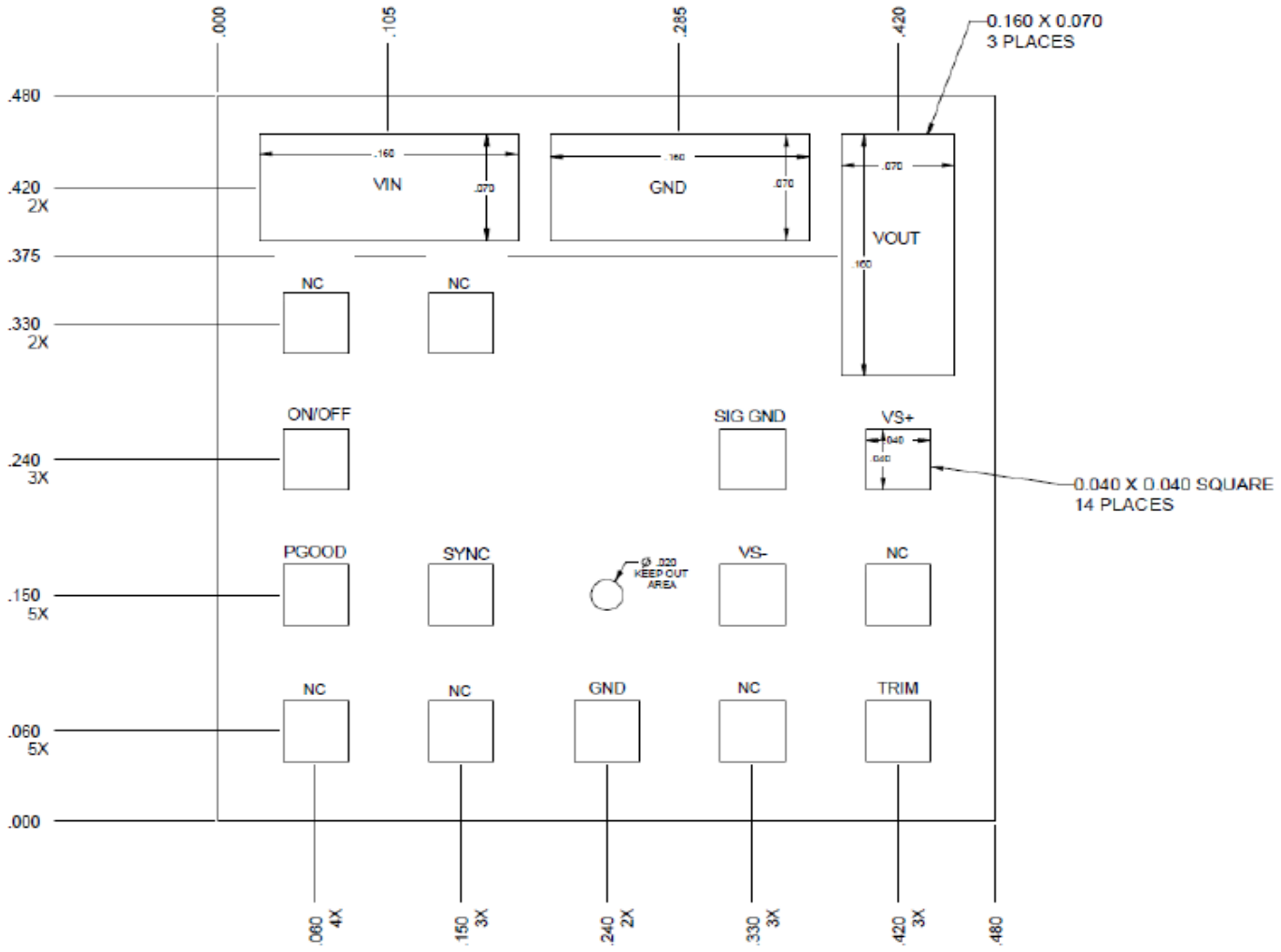
PIN	FUNCTION	PIN	FUNCTION
1	ON/OFF	10	PGOOD
2	VIN	11	SYNC[1]
3	GND	12	VS-
4	VOUT	13	SIG_GND
5	VS+ (SENSE)	14	NC
6	TRIM	15	NC
7	GND	16	NC
8	NC	17	NC
9	NC		

[1] If unused, connect to SIG_GND

Technical Specifications (continued)

Recommended Pad Layout

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.)



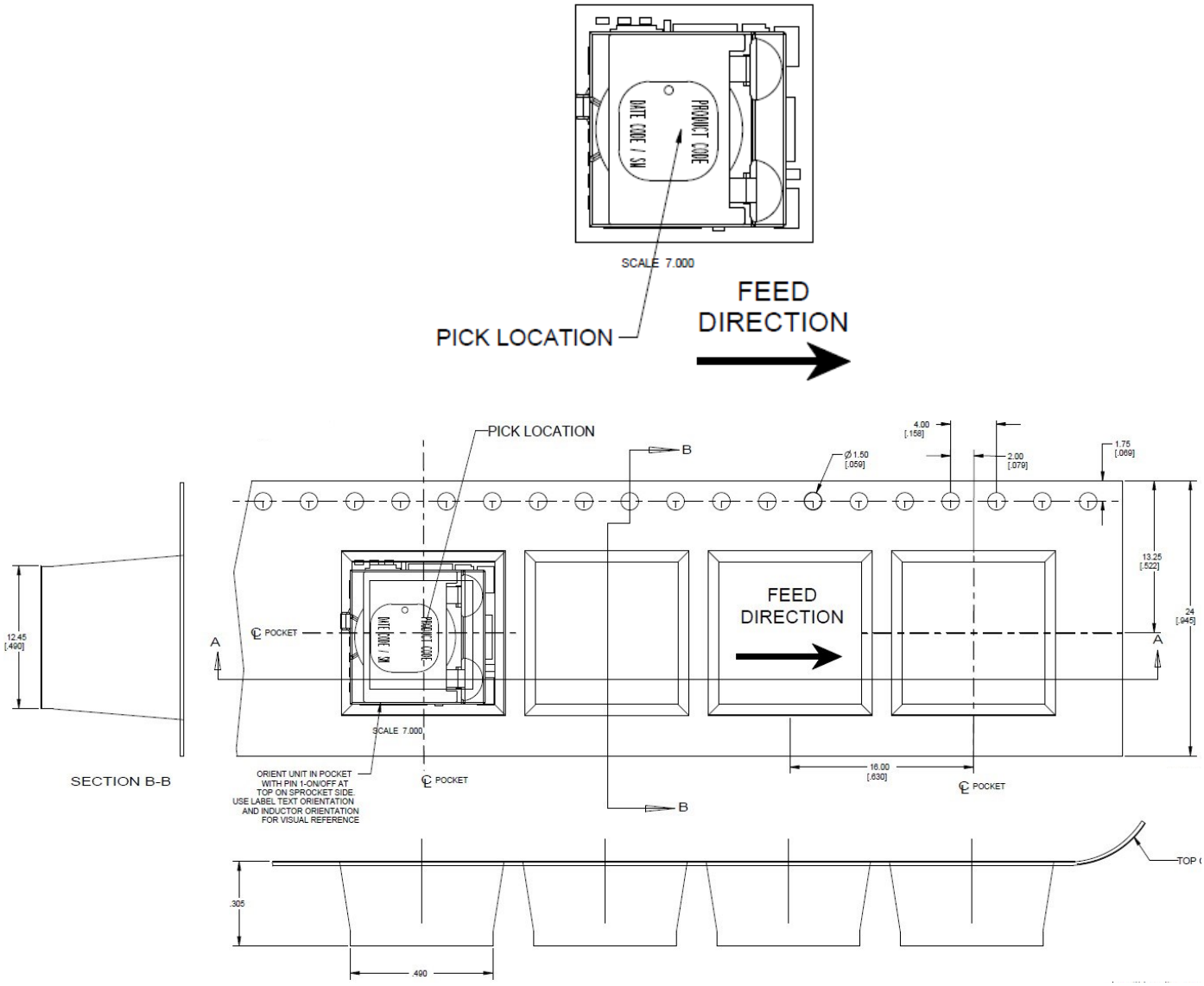
PIN	FUNCTION	PIN	FUNCTION
1	ON/OFF	10	PGOOD
2	VIN	11	SYNC[2]
3	GND	12	VS-
4	VOUT	13	SIG_GND
5	VS+ (SENSE)	14	NC
6	TRIM	15	NC
7	GND	16	NC
8	NC	17	NC
9	NC		

[2]If unused, connect to SIG_GND.

Packaging Details

The 12V Digital PicoDLynxII™ 7A modules are supplied in tape & reel as standard. Modules are shipped in quantities of 200 modules per reel.

All Dimensions are in millimeters and (in inches).



Reel Dimensions:

Outside Dimensions:	330.2 mm (13.00)
Inside Dimensions:	177.8 mm (7.00”)
Tape Width:	24.00 mm (0.945”)

Surface Mount Information

Pick and Place

The 7A Digital PicoDLynxII™ modules use an open frame construction and are designed for a fully automated assembly process. The modules are fitted with a label designed to provide a large surface area for pick and place operations. The label meets all the requirements for surface mount processing, as well as safety standards, and is able to withstand reflow temperatures of up to 300°C. The label also carries product information such as product code, serial number and the location of manufacture.

Nozzle Recommendations

The module weight has been kept to a minimum by using open frame construction. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process. The minimum recommended inside nozzle diameter for reliable operation is 3mm. The maximum nozzle outer diameter, which will safely fit within the allowable component spacing, is 7 mm.

Bottom Side / First Side Assembly

Only the -D version of this module can be placed at the bottom side of the customer board. No additional glue or adhesive is required to hold the module during the top side reflow process. Serial numbers with date codes starting from 19xx21xxxxxx (19 – year, 21 – week) are suitable for bottom side placement.

Lead Free Soldering

The modules are lead-free (Pb-free) and RoHS compliant and fully compatible in a Pb-free soldering process. Failure to observe the instructions below may result in the failure of or cause damage to the modules and can adversely affect long- term reliability.

Pb-free Reflow Profile

Power Systems will comply with J-STD-020 Rev. C (Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices) for both Pb-free solder profiles and MSL classification procedures. This standard provides a recommended forced-air-convection reflow profile based on the volume and thickness of the package (table 4-2). The suggested Pb-free solder paste is Sn/Ag/Cu (SAC). For questions regarding Land grid array(LGA) soldering, solder volume; please contact OmniOn for special manufacturing process instructions. The recommended linear reflow profile using Sn/Ag/Cu solder is shown in Fig. 44. Soldering outside of the recommended profile requires testing to verify results and performance.

MSL Rating

The 7A Digital PicoDLynxII™ modules have a MSL rating of 2A.

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-033A). 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.

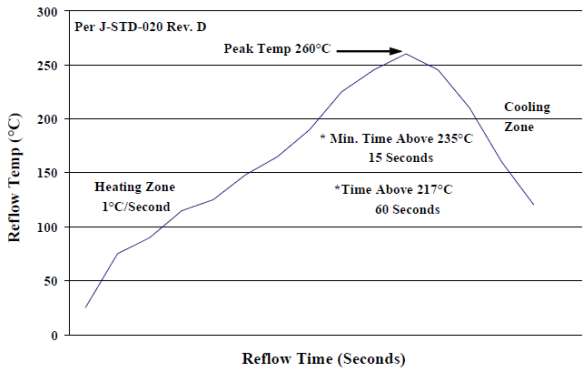


Figure 50. Recommended linear reflow profile using Sn/Ag/Cu solder.

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 Board Mounted Power Modules: Soldering and Cleaning Application Note (AN04-001).

Technical Specifications (continued)

Ordering Information

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

Device Code	Input Voltage Range	Output Voltage	Output Current	On/Off Logic	Sequencing	Ordering Codes
PKX007A0X3-SRZ	4.5 – 14.4V_{dc}	0.6 – 5.5V_{dc}	7A	Negative	Yes	150052943
PKX007A0X43-SRZ	4.5 – 14.4V_{dc}	0.6 – 5.5V_{dc}	7A	Positive	Yes	150052944
PKX007A0X3-SRDZ	4.5 – 14.4V_{dc}	0.6 – 5.5V_{dc}	7A	Negative	Yes	150052976
PKX007A0X43-SRDZ	4.5 – 14.4V_{dc}	0.6 – 5.5V_{dc}	7A	Positive	Yes	150052977

Table 9. Device Codes

-Z refers to RoHS compliant parts

Package Identifier	Family	Sequencing Option	Output current	Output voltage	On/Off logic	Remote Sense	Options		ROHS Compliance
P	**J**	**T**	**007A0**	**X**		**3**	**-SR**		**Z**
P=Pico U=Pico M=Mega G=Giga	J = DLynx II Digital K = DLynxII Analog.	T=with EZ Sequence X = without sequencing	7A	X = programmable output	4 = positive No entry = negative	3 = Remote Sense	S = Surface Mount R = Tape & Reel	D = 105°C operating ambient,40G operating shock as per	Z = ROHS

Table 10 . Coding Scheme

Contact Us

For more information, call us at
+1-877-546-3243 (US)
+1-972-244-9288 (Int'l)

Change History (excludes grammar & clarifications)

Revision	Date	Description of the change
1.8	3/11/2022	Updated as per template , ROHS
1.9	12/06/2023	Updated as per OmniOn template

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PKX007A0X3-SRZ PKX007A0X43-SRZ PKX007A0X3-SRDZ