DATASHEET

2 × 12A Analog Dual Output MicroDLynx™: Non-Isolated DC-DC Power Modules

4.5V$_{dc}$ –14.4V$_{dc}$ input; 0.6V$_{dc}$ to 5.5V$_{dc}$ output; 2x12A Output Current

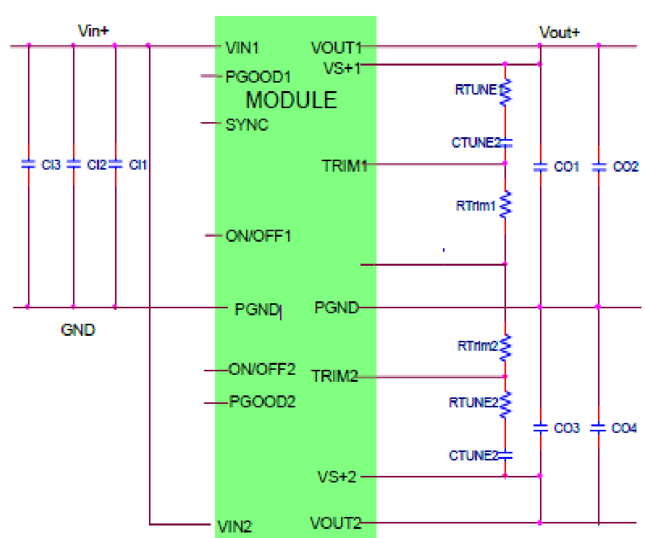
RoHS Compliant

Description

The 2 × 12A Analog Dual MicroDlynx™ power modules are non-isolated dc-dc converters that can deliver up to 2 × 12A of output current. These modules operate over a wide range of input voltage (V_{IN} = 4.5V$_{dc}$-14.4V$_{dc}$) and provide precisely regulated output voltages from 0.6V$_{dc}$ to 5.5V$_{dc}$. 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



Features

- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863
- Compatible in a Pb-free or SnPb reflow environment
- Compliant to REACH Directive (EC) No 1907/2006
- Compliant to IPC-9592 (September 2008), Category 2, Class II
- Wide Input voltage range ($4.5V_{dc}$-$14.4V_{dc}$)
- Each Output voltage programmable from 0.6_{Vdc} to $5.5V_{dc}$ via external resistor.
- Small size: 20.32 mm x 11.43 mm x 8.5 mm (0.8 in x 0.45 in x 0.335 in)
- Wide operating temperature range -40°C to 85°C
- Tunable Loop™ to optimize dynamic output voltage response
- Power Good signal for each output
- Fixed switching frequency with capability of external synchronization
- 180° Out-of-phase to reduce input ripple
- Output overcurrent protection (non-latching)
- Output Overvoltage protection
- Over temperature protection
- Remote On/Off
- Ability to sink and source current
- Start up into Pre-biased output
- Cost efficient open frame design
- 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_{IN1} and V_{IN2}	-0.3	15	V
VS+1, VS+2,	All		-0.3	7	V
Operating Ambient Temperature (see Thermal Considerations section)	All	T_A	-40	85	°C
Storage Temperature	All	T_{stg}	-55	125	°C

Electrical Specifications

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

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN1} and V_{IN2}	4.5	—	14.4	V_{dc}
Maximum Input Current (V_{IN}=4.5V to 14.4V, I_O=$I_{O,\,max}$)	All	$I_{IN1,max}$ & $I_{IN2,max}$			23	Adc
Input No Load Current (V_{IN} = 12V_{dc}, I_O = 0, module enabled)	$V_{O,set}$ = 0.6V_{dc}	$I_{IN1,No\ load}$ & $I_{IN2,No\ load}$		72		mA
	$V_{O,set}$ = 5.5V_{dc}	$I_{IN1,No\ load}$ & $I_{IN2,No\ load}$		210		mA
Input Stand-by Current (V_{IN} = 12V_{dc}, module disabled)	All	$I_{IN1,stand\text{-}by}$ & $I_{IN2,stand\text{-}by}$		14		mA
Inrush Transient	All	I^2t & I_2^{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	Both Inputs		25		mAp-p
Input Ripple Rejection (120Hz)	All	Both Inputs		-68		dB
Output Voltage Set-point (with 0.1% tolerance for external resistor used to set output voltage)	All	$V_{O1,Set}$ & $V_{O2,Set}$	-1.0		+1.0	%$V_{o\ set}$
Output Voltage (Over all operating input voltage, resistive load, and temperature conditions until end of life)	All	$V_{O1,Set}$ & $V_{O2,Set}$	-3.0	—	+3.0	%$V_{o\ set}$
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_{O1} & V_{O2}	0.6		5.5	V_{dc}
Remote Sense Range	All	Both Outputs			0.5	V_{dc}
Output Regulation (for $V_O \geq 2.5V_{dc}$)		Both Outputs				
Line (V_{IN}=$V_{IN,\ min}$ to $V_{IN,\ max}$)	All	Both Outputs		—	+0.4	%$V_{o\ set}$
Load (I_O=$I_{O,\ min}$ to $I_{O,\ max}$)	All	Both Outputs		—	10	mV
Output Regulation (for $V_O < 2.5V_{dc}$)						
Line (V_{IN}=$V_{IN,\ min}$ to $V_{IN,\ max}$)	All	Both Outputs		—	5	mV
Load (I_O=$I_{O,\ min}$ to $I_{O,\ max}$)	All	Both Outputs		—	10	mV
Temperature (Tref=TA, min to TA, max)	All	Both Outputs		—	0.4	%$V_{o\ set}$

Technical Specifications (continued)

Electrical Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Ripple and Noise on nominal output at 25°C						
(V_{IN}=$V_{IN, nom}$ and I_O=$I_{O, min}$ to $I_{O, max}$ C_o = 2x0.1+2X4.7nF+2x47µF per output)						
Peak-to-Peak (5Hz to 20MHz bandwidth)	All		—	50	100	mV_{pk-pk}
RMS (5Hz to 20MHz bandwidth)	All			20	38	mV_{rms}
External Capacitance[1]						
Without the Tunable Loop™						
ESR ≥ 1 mΩ	All	$C_{O, max}$	2x47	—	2x47	µF
With the Tunable Loop™						
ESR ≥ 0.15 mΩ	All	$C_{O, max}$		—	1000	µF
ESR ≥ 10 mΩ	All	$C_{O, max}$		—	5000	µF
Output Current (in either sink or source mode)	All	I_o	0		12X2	A_{dc}
Output Current Limit Inception (Hiccup Mode) (current limit does not operate in sink mode)	All	$I_{O, lim}$		150		% $I_{o,max}$
Output Short-Circuit Current (VO≤250mV) (Hiccup Mode)	All	$I_{O1, s/c}$,$I_{O1, s/c}$		6		A_{rms}
Efficiency	$V_{O,set}$ = 0.6V_{dc}	η_1, η_2		79		%
V_{IN}= 12V_{dc}, T_A=25°C	$V_{O,set}$ = 1.2V_{dc}	η_1, η_2		88		%
I_O=$I_{O, max}$, V_O= $V_{O,set}$	$V_{O,set}$ = 1.8V_{dc}	η_1, η_2		91		%
	$V_{O,set}$ = 2.5V_{dc}	η_1, η_2		93		%
	$V_{O,set}$ = 3.3V_{dc}	η_1, η_2		94		%
	$V_{O,set}$ = 5.0V_{dc}	η_1, η_2		95		%
Switching Frequency	All	f_{sw}		500		kHz
Frequency Synchronization	All					
Synch Frequency (2 x f_{switch})				1000		kHz
Synchronization Frequency Range	All		-5%		+5%	kHz
High-Level Input Voltage	All	V_{IH}	2.0			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

[1] 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.

General Specifications

Parameter	Device	Min	Typ	Max	Unit
Calculated MTBF (IO=0.8IO, max, TA=40°C) Telecordia Issue 3 Method 1 Case 3	All		75,767,425		Hours
Weight		—	4.5 (0.16)	—	g (oz.)

Technical Specifications (continued)

Feature Specifications

Unless otherwise indicated, specifications apply over all 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 (VIN=VIN, min to VIN, max ; open collector or equivalent Signal referenced to GND)						
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 Input High Voltage Logic Low (Module ON) Input low Current Input Low Voltage	 All All All All	 I_{IH1}, I_{IH2} V_{IH1}, V_{IH2} I_{IL1}, I_{IL2} V_{IL1}, V_{IL2}	 — 2 — -0.2	 — — — —	 1 $V_{IN,max}$ 20 0.6	 mA V_{dc} μA 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	T_{delay1}, T_{delay2}	—	2	—	msec
Case 2: Input power is applied for at least one second and then the On/Off input is enabled (delay from instant at which Von/Off is enabled until V_o = 10% of $V_{o, set}$)	All	T_{delay1}, T_{delay2}	—	800	—	μsec
Output voltage Rise time (time for Vo to rise from 10% of $V_{o, set}$ to 90% of $V_{o, set}$)	All	T_{rise1}, T_{rise2},	—	6	—	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		Both Outputs			3.0	$\%V_{o\ set}$
Over Temperature Protection (See Thermal Considerations section)	All	T_{ref}		135		°C
Input Undervoltage Lockout Turn-on Threshold Turn-off Threshold Hysteresis	 All All All	 Both Inputs Both Inputs Both Inputs	 0.15	 0.2	 4.5 4.25 	 V_{dc} V_{dc} V_{dc}
PGOOD (Power Good) Signal Interface Open Drain, $V_{supply} \leq$ 5VDC Overvoltage threshold for PGOOD ON Overvoltage threshold for PGOOD OFF Undervoltage threshold for PGOOD ON Undervoltage threshold for PGOOD OFF Pulldown resistance of PGOOD pin Sink current capability into PGOOD pin	 All All All All All All	 Both Outputs Both Outputs Both Outputs Both Outputs Both Outputs Both Outputs		 108.33 112.5 91.67 87.5 40 	 70 5	 $\%V_{O, set}$ $\%V_{O, set}$ $\%V_{O, set}$ $\%V_{O, set}$ Ω mA

Technical Specifications (continued)

Characteristic Curves

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII™ at 0.6V_o and 25°C.

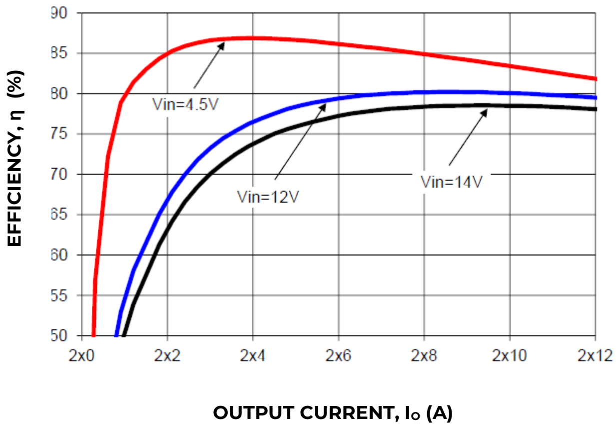


Figure 1. Converter Efficiency versus Output Current.

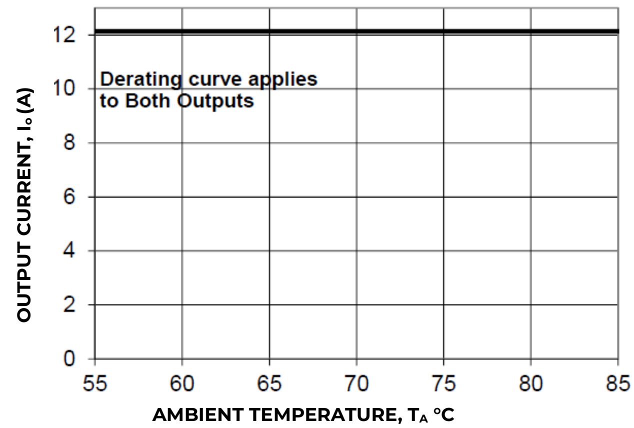


Figure 2. Derating Output Current versus Ambient Temperature and Airflow.

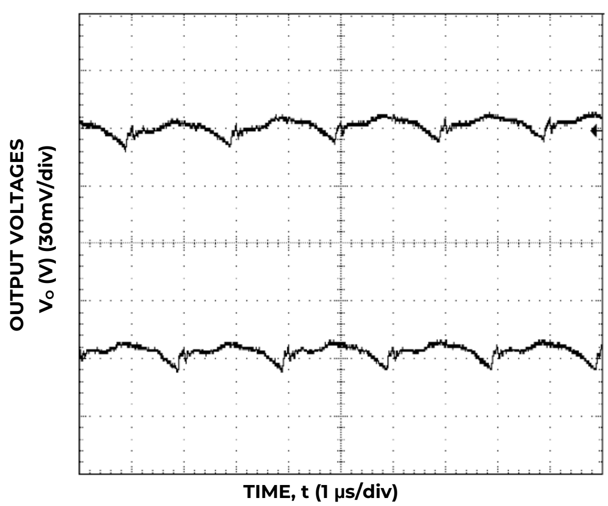


Figure 3. Typical output ripple and noise (C_O= 2×0.1uF+2×47uF ceramic, V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

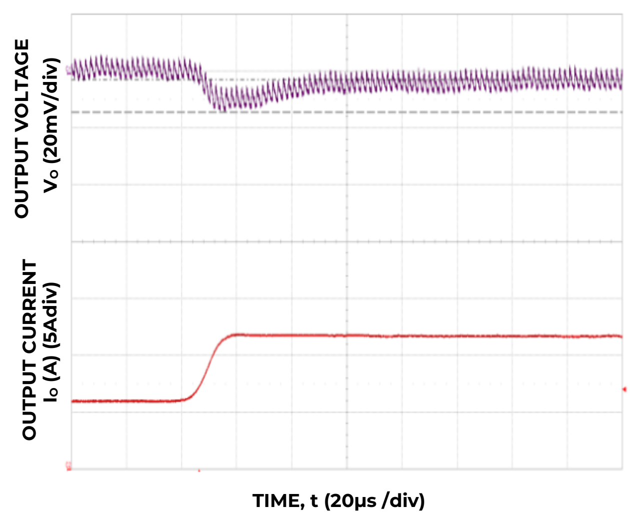


Figure 4. Transient Response to Dynamic Load Change from 50% to 100% on one output at 12V_{in}, C_{out}=2x47uF+7x330uF, C_{Tune}=12nF. R_{Tune}=300Ω

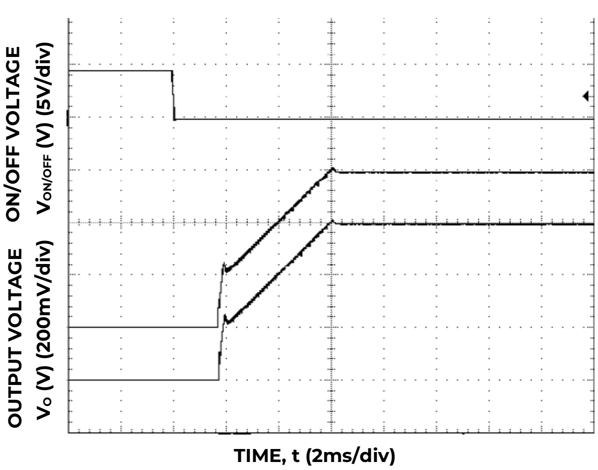


Figure 5. Typical Start-up Using On/Off Voltage (Vin=12V, Io = $I_{o1,max}$, $I_{o2,max}$).

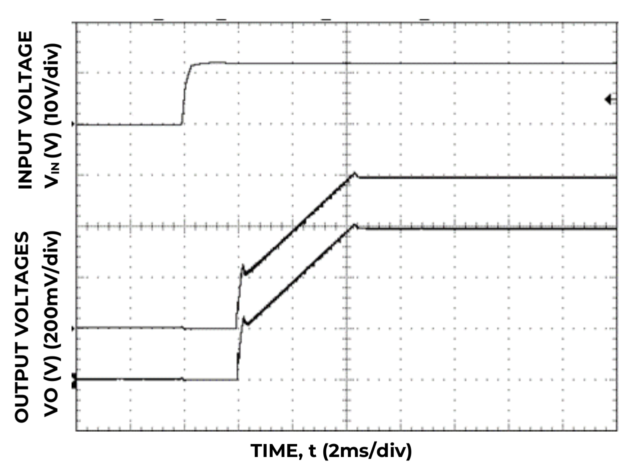


Figure 6. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max,}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII™ at 1.2V$_o$ and 25°C

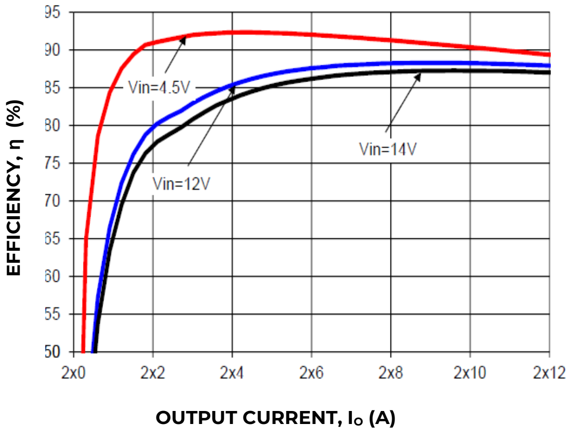


Figure 7. Converter Efficiency versus Output Current.

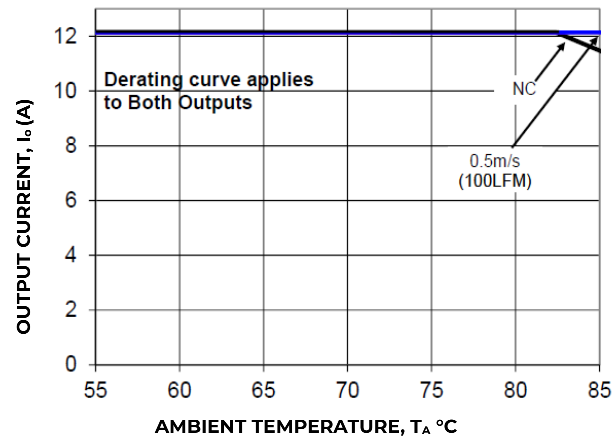


Figure 8. Derating Output Current versus Ambient Temperature and Airflow.

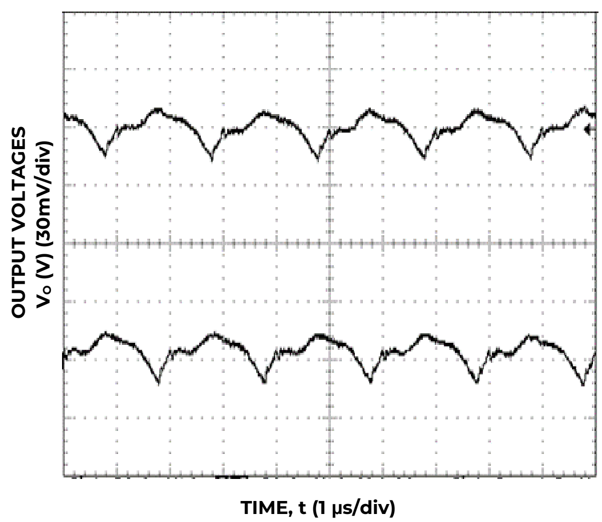


Figure 9. Typical output rippvle and noise (C_O= 2×0.1uF+2×47uF ceramic, V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

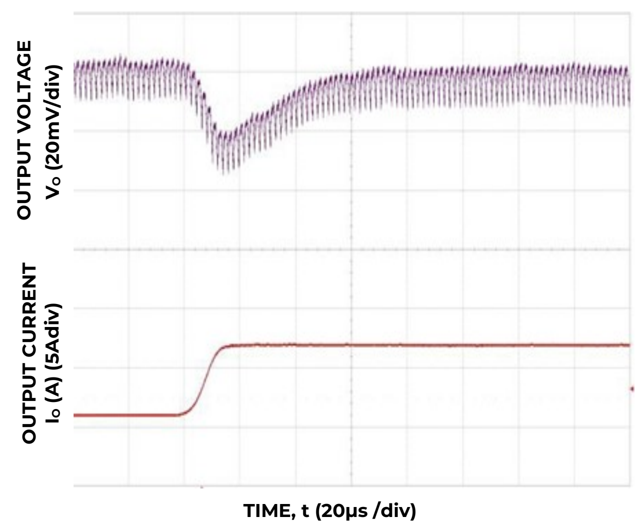


Figure 10. Transient Response to Dynamic Load Change from 50% to 100% on one output at 12V$_{in}$, C_{out}=3x47uF+3x330uF, C_{Tune}=2700pF & R_{Tune}=300Ω

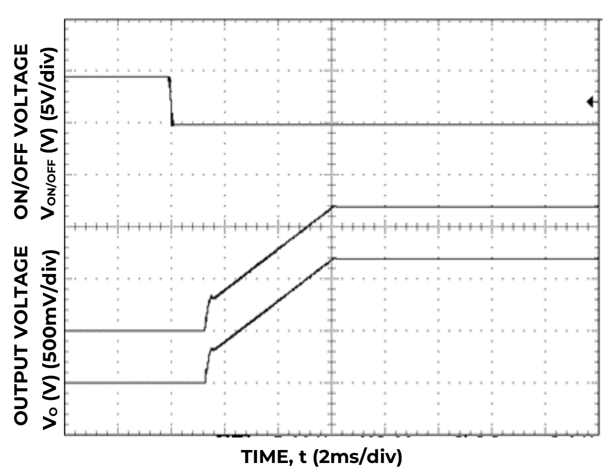


Figure 11. Typical Start-up Using On/Off Voltage (V_{IN}=12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

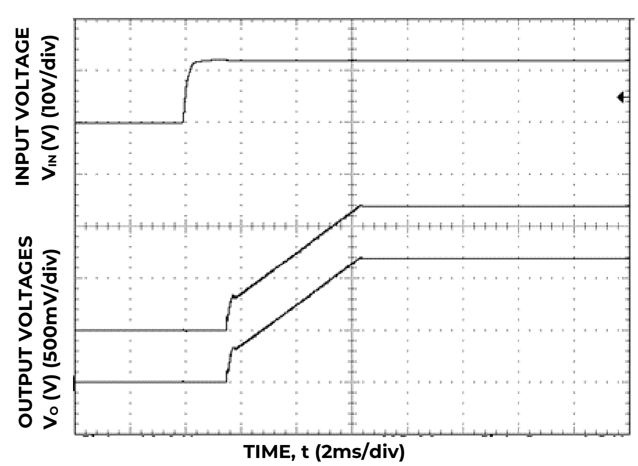


Figure 12. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII™ at 1.8V$_o$ and 25°C.

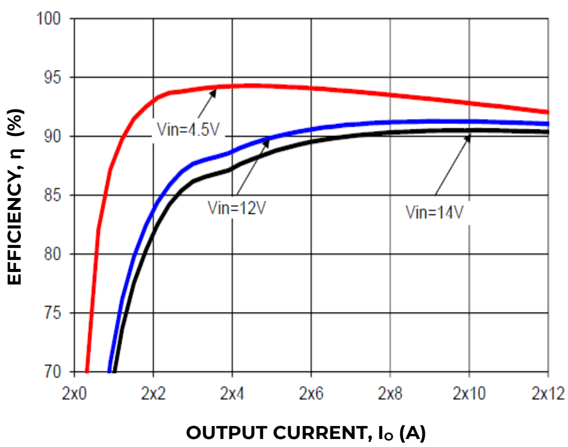


Figure 13. Converter Efficiency versus Output Current.

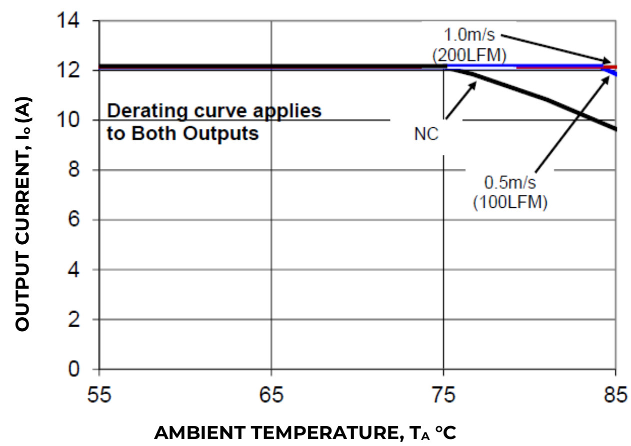


Figure 14. Derating Output Current versus Ambient Temperature and Airflow.

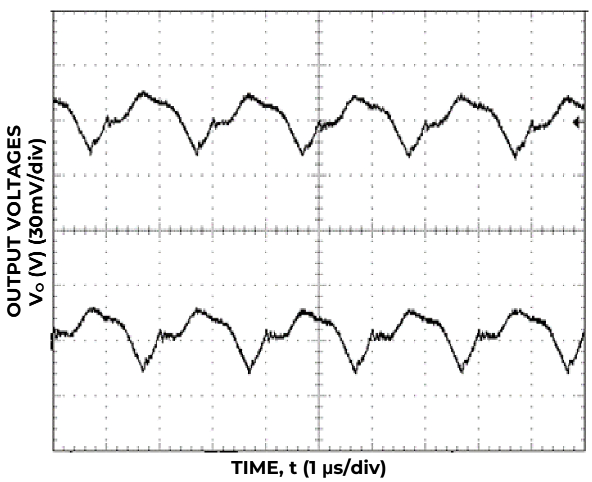


Figure 15. Typical output ripple and noise (C_O= 2×0.1uF+2×47uF ceramic, V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

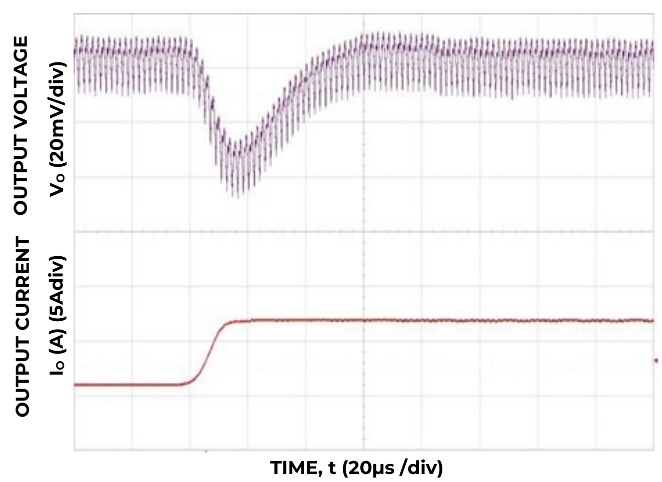


Figure 16. Transient Response to Dynamic Load Change from 50% to 100% on one output at 12V$_{in}$, C_{out}=3x47uF+3x330uF, C_{Tune}=1800pF & R_{Tune}=300Ω

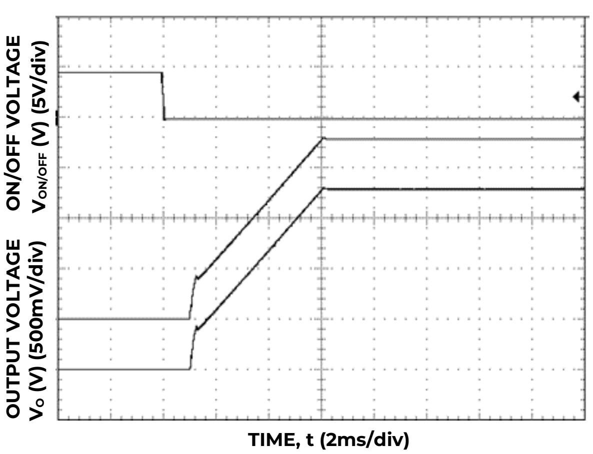


Figure 17. Typical Start-up Using On/Off Voltage (V_{IN}=12V, I_o = $I_{o1,max}$, $I_{o2,max,}$).

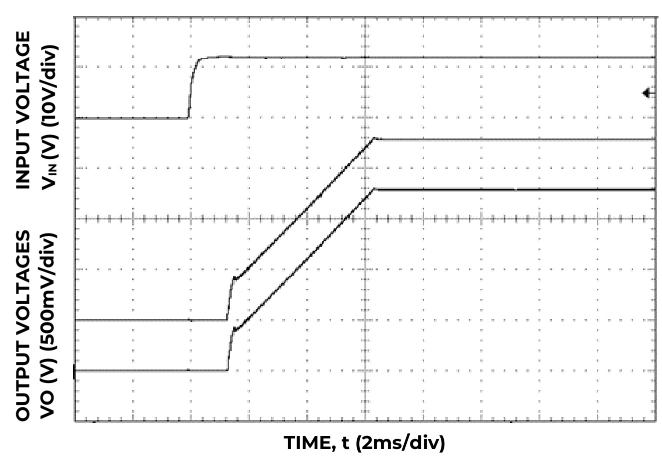


Figure 18. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max,}$).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII™ at 2.5V$_o$ and 25°C.

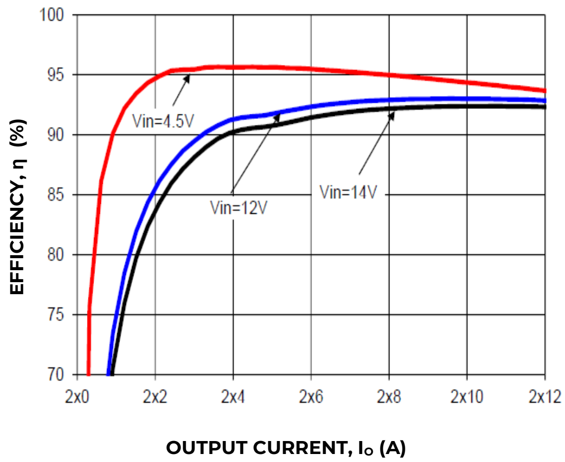


Figure 19. Converter Efficiency versus Output Current.

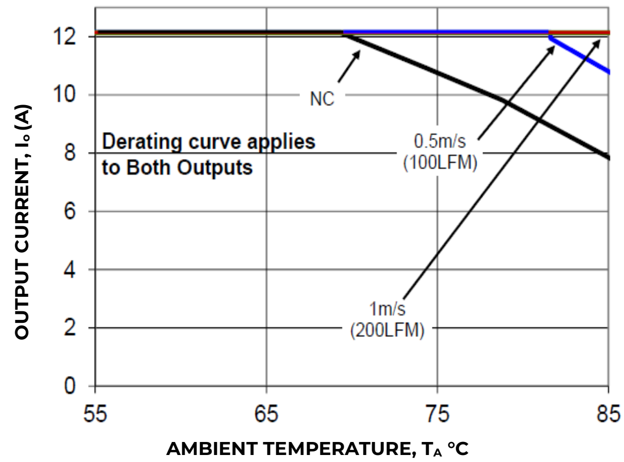


Figure 20. Derating Output Current versus Ambient Temperature and Airflow.

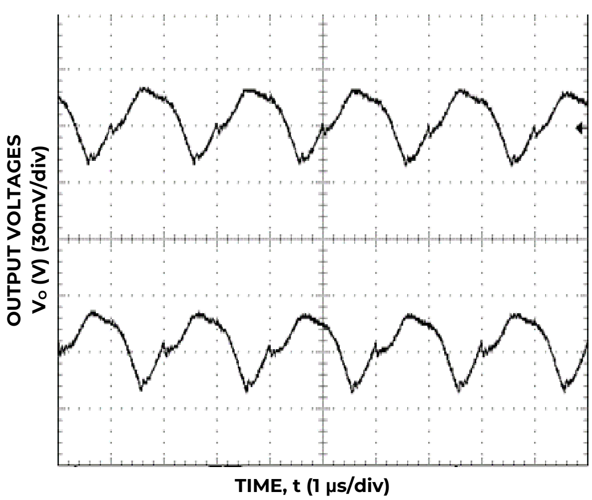


Figure 21. Typical output ripple and noise (C$_O$= 2×0.1uF+2×47uF ceramic, V$_{IN}$ = 12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

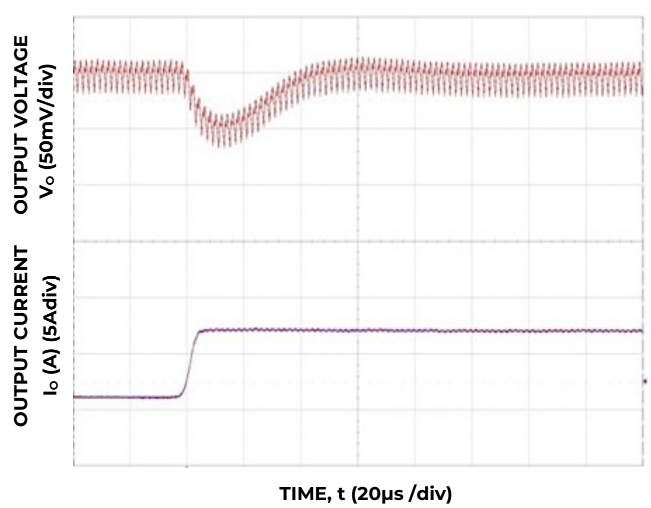


Figure 22. Transient Response to Dynamic Load Change from 50% to 100% on one output at 12V$_{in}$, C$_{out}$=3x47uF+3x330uF, C$_{Tune}$=1500pF & R$_{Tune}$=300Ω

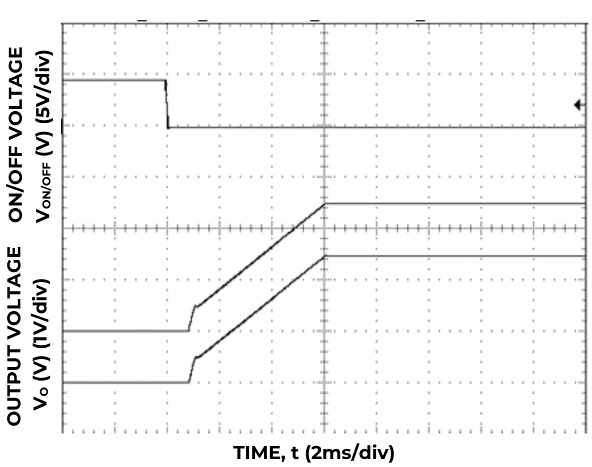


Figure 23. Typical Start-up Using On/Off Voltage (V$_{IN}$=12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

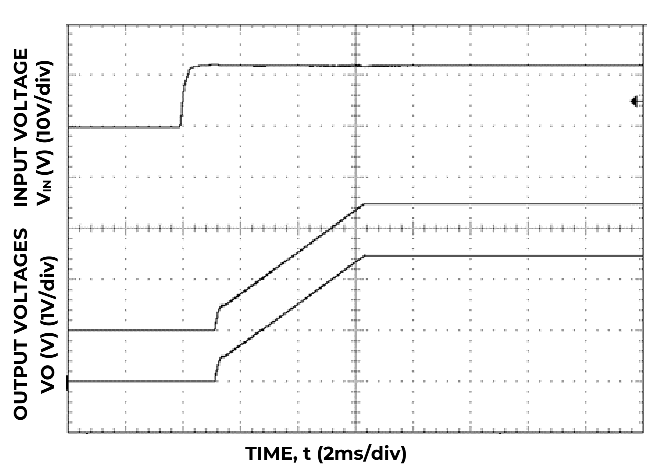


Figure 24. Typical Start-up Using Input Voltage (V$_{IN}$ = 12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII™ at 3.3V$_o$ and 25°C.

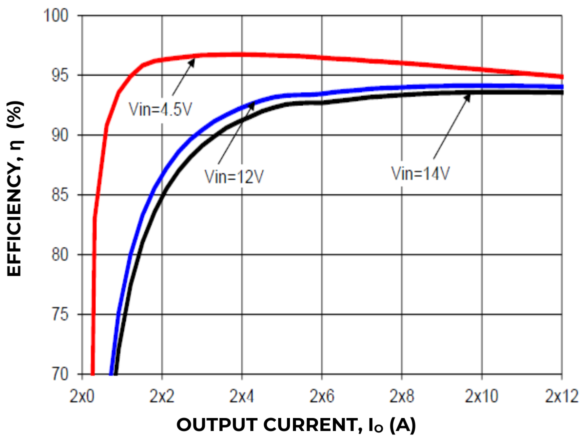


Figure 25. Converter Efficiency versus Output Current.

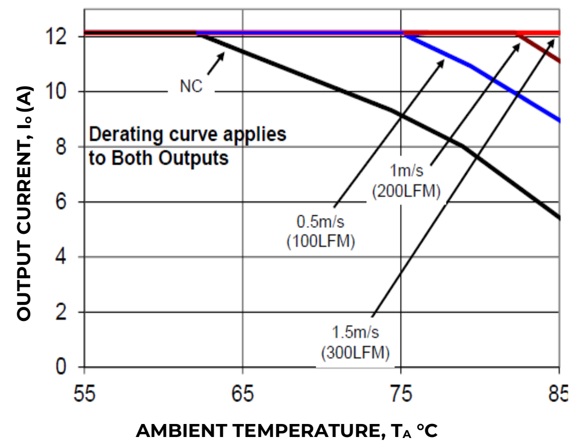


Figure 26. Derating Output Current versus Ambient Temperature and Airflow.

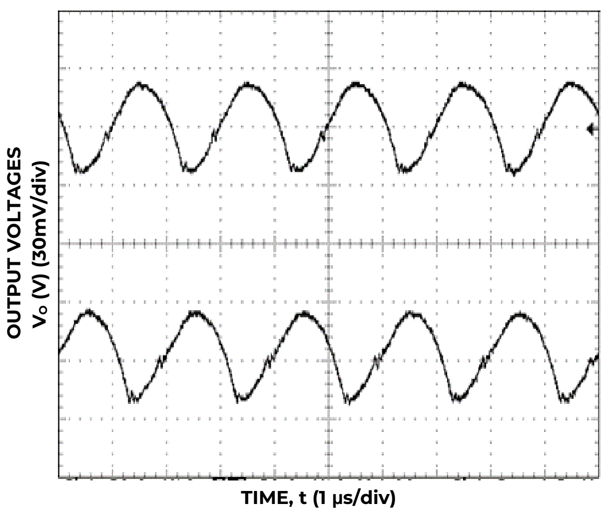


Figure 27. Typical output ripple and noise (C$_O$= 2×0.1uF+2×47uF ceramic, V$_{IN}$ = 12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

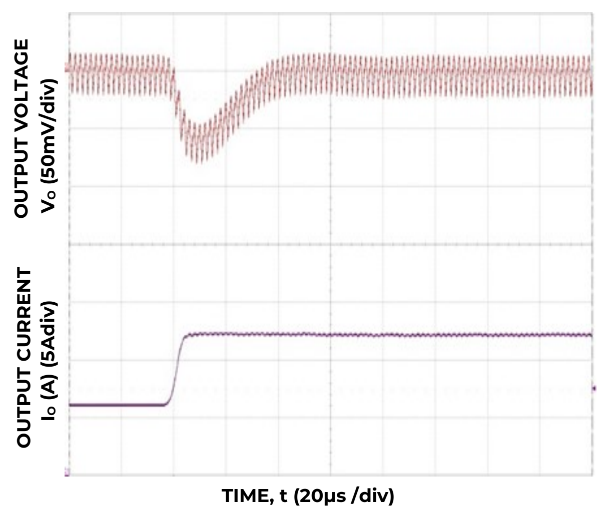


Figure 28 Transient Response to Dynamic Load Change on one output from 50% to 100% at 12Vin, Cout=3x47uF+1x330uF, CTune = 1200pF & RTune = 300Ω

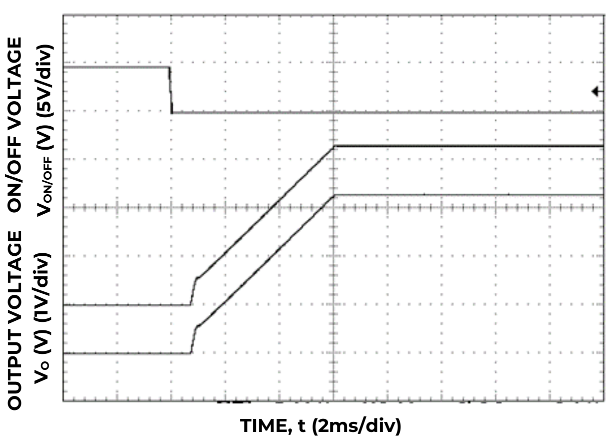


Figure 29. Typical Start-up Using On/Off Voltage (V$_{IN}$=12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

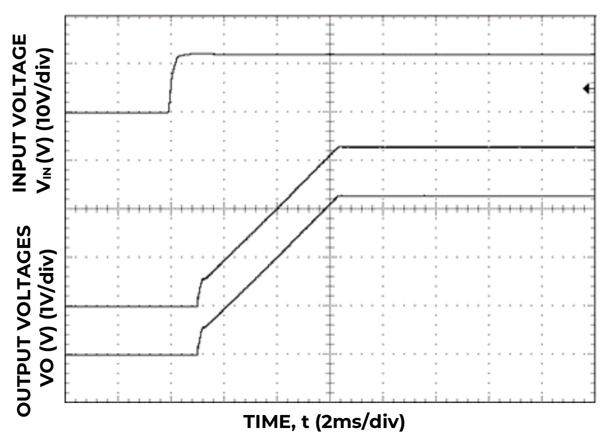


Figure 30. Typical Start-up Using Input Voltage (V$_{IN}$ = 12V, I$_o$ = I$_{o1,max}$, I$_{o2,max}$,).

Technical Specifications (continued)

Characteristic Curves (continued)

The following figures provide typical characteristics for the 2X12A Analog Dual MicroDLynxII^{TM} at 5V$_o$ and 25°C.

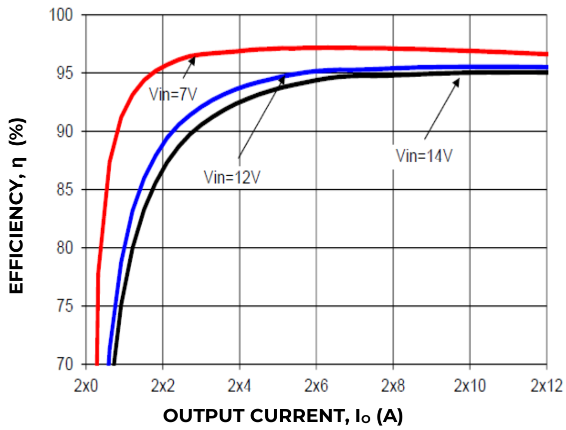


Figure 31. Converter Efficiency versus Output Current.

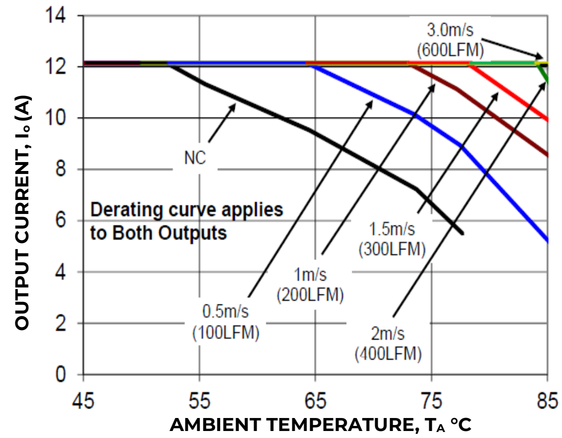


Figure 32. Derating Output Current versus Ambient Temperature and Airflow.

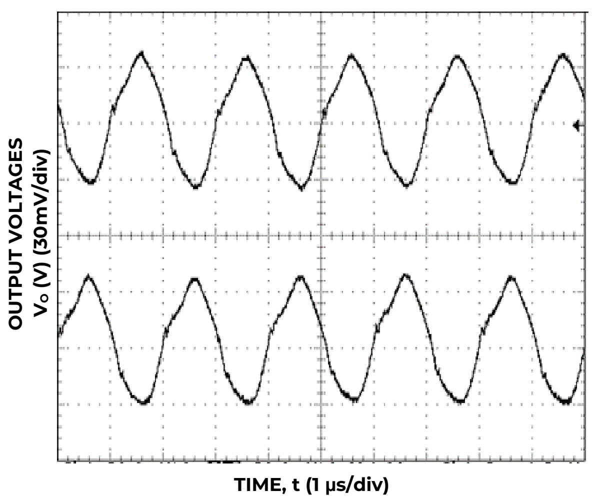


Figure 33. Typical output ripple and noise (C_O= 2×0.1uF+2×47uF ceramic, V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

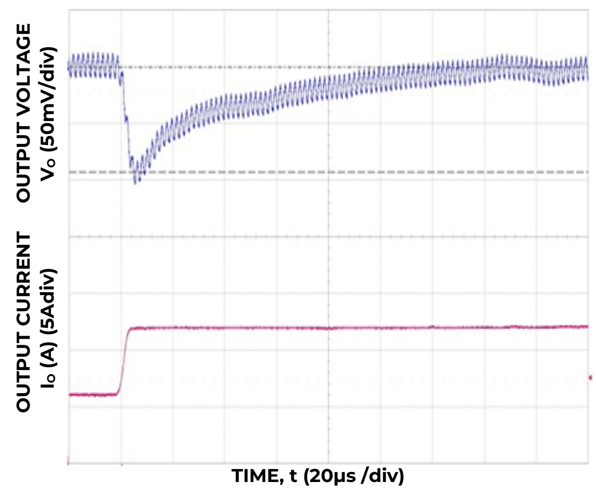


Figure 34. Transient Response to Dynamic Load Change on one output from 50% to 100% at 12Vin, Cout=6x47uF, CTune=470pF & RTune=300Ω

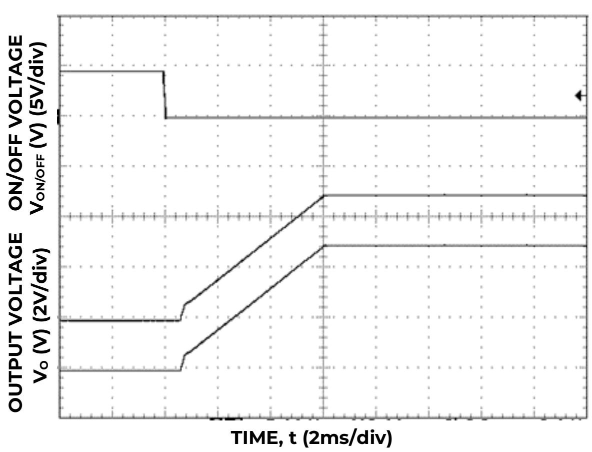


Figure 35. Typical Start-up Using On/Off Voltage (V_{IN}=12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

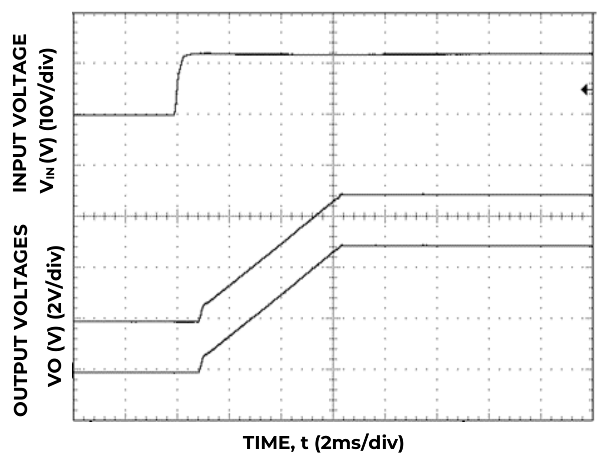


Figure 36. Typical Start-up Using Input Voltage (V_{IN} = 12V, I_o = $I_{o1,max}$, $I_{o2,max}$,).

Technical Specifications (continued)

Design Considerations

Input Filtering

The2 × 12A Analog Dual MicroDlynx™ 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 37 shows the input ripple voltage for various output voltages at2 x 12A of load current with 2x22 μF or 3x22 μF ceramic capacitors and an input of 12V.

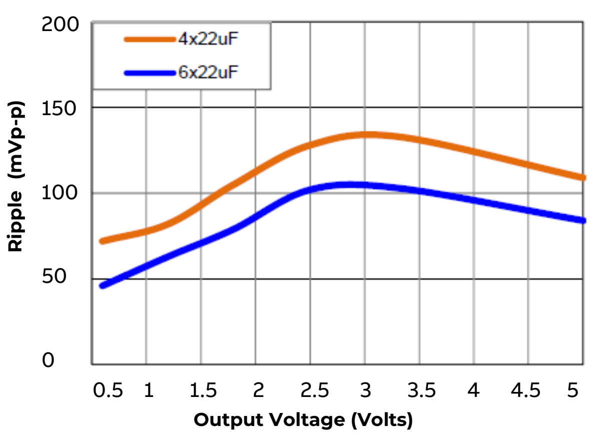


Figure 37. Input ripple voltage for various output voltages with 4x22 μF or 6x22 μF ceramic capacitors at the input (2 x 12A load). Input voltage is 12V

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 22 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 38 provides output ripple information for different external capacitance values at various Vo and a full load current of2 x 12A. 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.

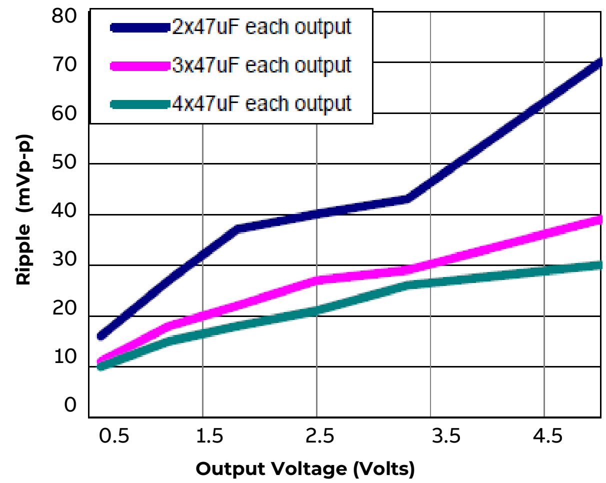


Figure 38. Output ripple voltage for various output voltages with total external 4x47 μF ,6x47 μF or 8x47μF ceramic capacitors at the output (2 x 12A load). Input voltage is 12V.

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), the input must meet SELV requirements. The power module has extra- low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a fast-acting fuse with a maximum rating of 30A (voltage rating 125V_{ac}) in the positive input lead. (Littelfuse 456 Series or equivalent

Analog Feature Descriptions

Remote On/Off

The 2 × 6A Analog Dual MicroDlynx™ 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.

Technical Specifications (continued)

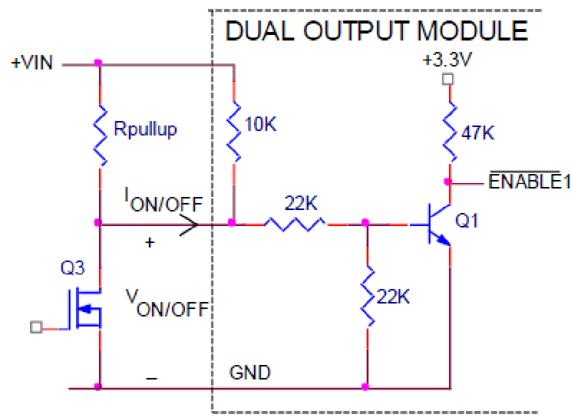
Analog Feature Descriptions (continued)

Remote On/Off (continued)

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. For negative logic On/Off modules, the circuit configuration is shown in Fig. 40.

Output 1



Output 2

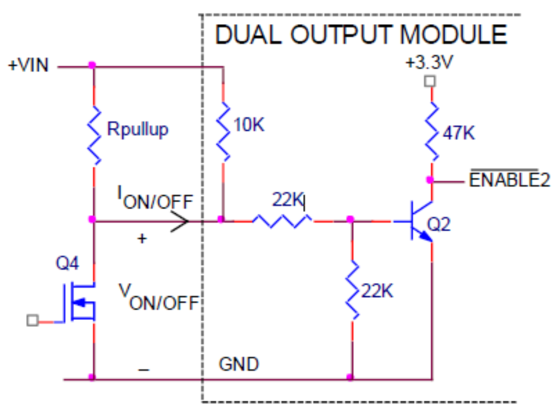
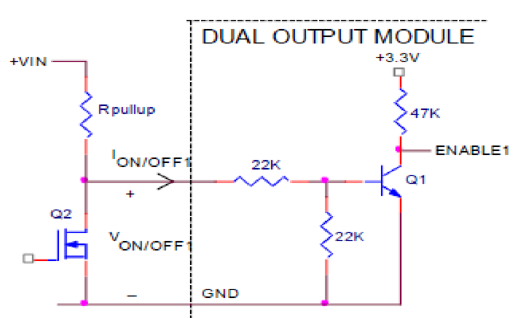


Figure 39. Circuit configuration for using positive On/Off logic.

Output 1



Output 2

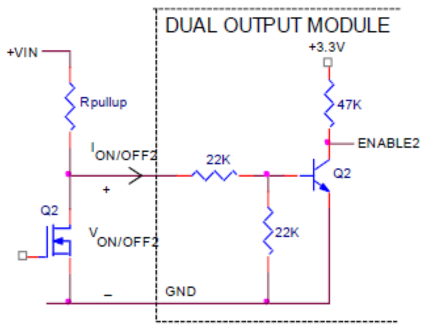


Figure 40. Circuit configuration for using negative On/Off logic.

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 on either or both outputs as long as the prebias voltage is 0.5V less than the set output voltage.

Analog Output Voltage Programming

The output voltage of each output of the module shall be programmable to any voltage from 0.6dc to 5.5Vdc by connecting a resistor between the 2 Trims 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. 1. The Upper Limit curve shows that for output voltages lower than 1V, the input voltage must be lower than the maximum of 14.4V. If the module can operate at 14.4V below 1V then that is preferable over the existing upper curve. The Lower Limit curve shows that for output voltages higher than 0.6V, the input voltage needs to be larger than the minimum of 4.5V

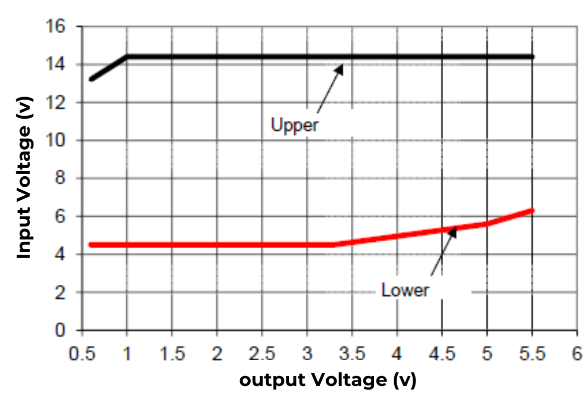
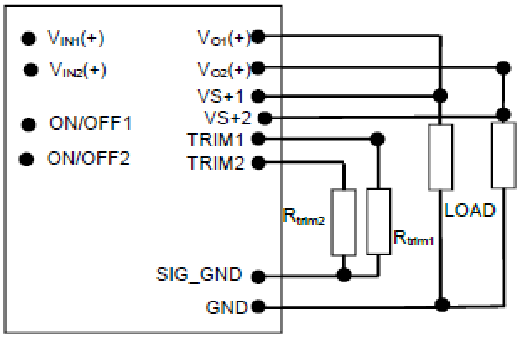


Figure 41. Output Voltage vs. Input Voltage Set Point Area plot showing limits where the output voltage can be set for different input voltages.

Technical Specifications (continued)

Analog Output Voltage Programming (continued)



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

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

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

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

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.

VO, set (V)	Rtrim (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-) for each of the 2 outputs. The voltage drop between the sense pins and the VOUT and GND pins of the module should not exceed 0.5V. If there is an inductor being used on the module output, then the tunable loop feature of the module should be used to ensure module stability with the proposed sense point location. If the simulation tools and loop feature of the module are not being used, then the remote sense should always be connected before the inductor. The sense trace should also be kept away from potentially noisy areas of the board

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 available at **omnionpower.com** in the Embedded power group, 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.

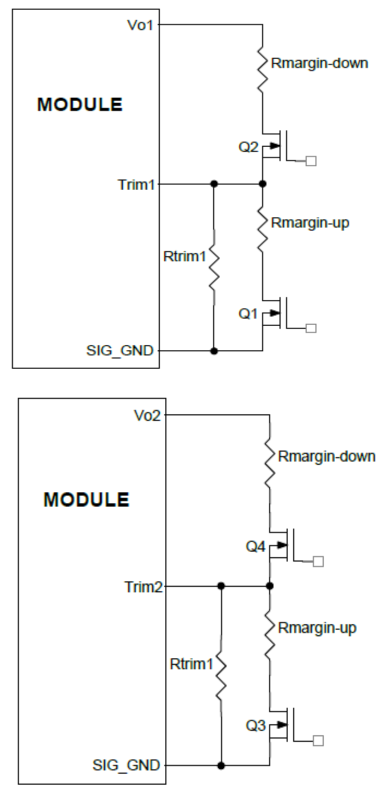


Figure 43. Circuit Configuration for margining Output voltage.

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current-limiting circuitry on both outputs 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.

Technical Specifications (continued)

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 overtemperature threshold of 135°C(typ) is exceeded at the thermal reference point T_{ref} .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 Electrical Specifications table specifies the requirements of the external SYNC signal. If the SYNC pin is not used, the module should free run at the default switching frequency. If synchronization is not being used, connect the SYNC pin to SIG_GND.

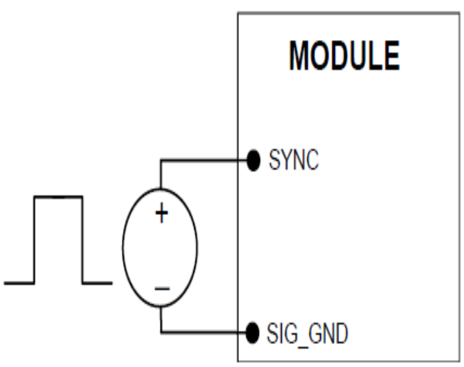


Figure 45. External source connections to synchronize switching frequency of the module.

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. 47. This R-C allows the user to externally adjust the voltage loop feedback compensation of the module.

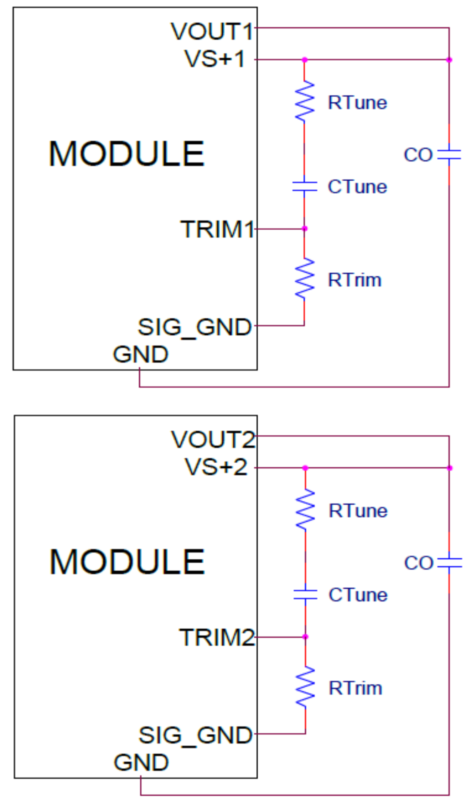


Figure. 47. Circuit diagram showing connection of R_{TUNE} and C_{TUNE} to tune the control loop of the module.

Recommended values of R_{TUNE} and C_{TUNE} for different output capacitor combinations are given in Tables 2. Table 2 shows the recommended values of R_{TUNE} and C_{TUNE} for different values of ceramic output capacitors up to 1000uF that might be needed

Co	3x47µF	4x47µF	6x47µF	10x47µF	20x47µF
R_{TUNE}	300	300	300	300	300
C_{TUNE}	220pF	330pF	1000pF	1800pF	3900pF

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

Technical Specifications (continued)

Tunable Loop™ (continued)

Vo	5V	3.3V	2.5V	1.8V	1.2V	0.6V
Co	6x47µf	3x47µF + 330µF Polymer	3x47µF + 2x330µF Polymer	3x47µF + 2x330µF Polymer	3x47µF + 3x330µF Polymer	2x47µF + 7x330µF Polymer
R_{TUNE}	300	300	300	300	300	300
C_{TUNE}	470pF	1200pF	1500pF	1800pF	2700pF	12nF
ΔV	84mV	39mV	30mV	27mV	20mV	10mV

Table 3. Recommended values of R_{TUNE} and C_{TUNE} to obtain transient deviation of 2% of V_{out} for a 6A step load with V_{in}=12V.

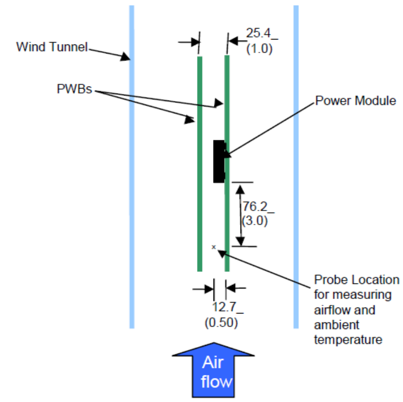


Figure 49. Thermal Test Setup.

Note: The capacitors used in the Tunable Loop tables are 47 µF/2 mΩ ESR ceramic and 330 µF/12 mΩ ESR polymer capacitors.

for an application to meet output ripple and noise requirements. Selecting R_{TUNE} and C_{TUNE} according to Table 2 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 6A to 12A 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.

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 49. The preferred airflow direction for the module is in Figure 50.

The thermal reference points, Tref used in the specifications are also shown in Figure 50. For reliable operation the temperatures at these points should not exceed 135°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.

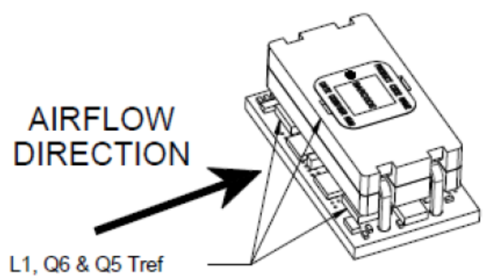
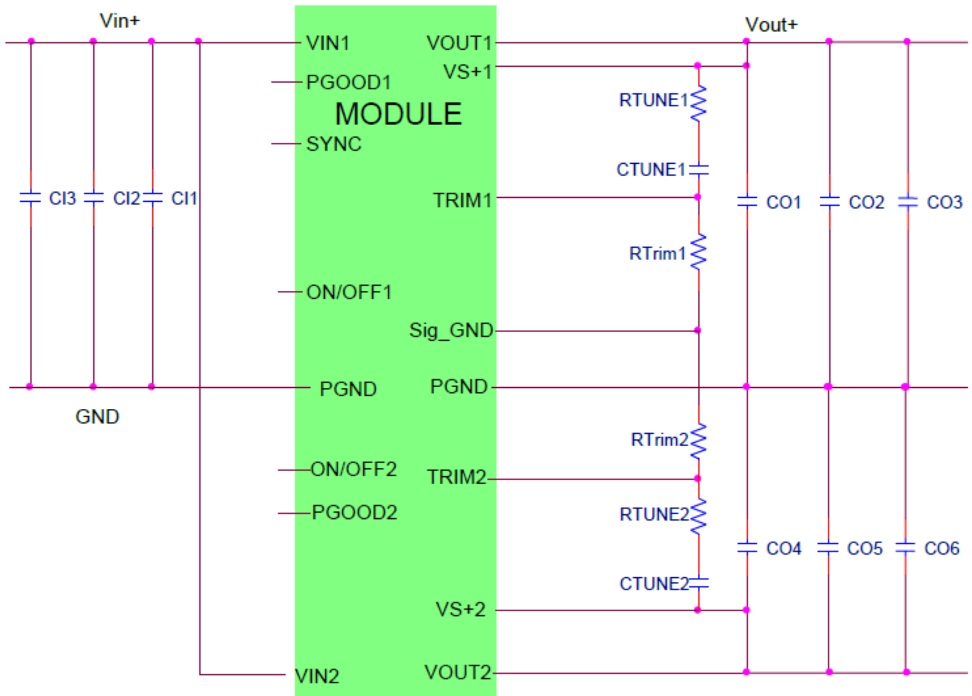


Figure 50. Preferred airflow direction and location of hotspot of the module (T_{ref}).

Example Application Circuit

Requirements:

Vin:	12V
Vout:	1.8V
Iout:	2 × 9A max., worst case load transient is from 6A to 9A
ΔVout:	1.5% of V_{out} (27mV) for worst case load transient
Vin, ripple	1.5% of V_{in} (180mV, p-p)



CI1	Decoupling cap - 4x0.1μF/16V, 0402 size ceramic capacitor
CI2	4x22μF/16V ceramic capacitor (e.g. Murata GRM32ER61C226KE20)
CI3	470μF/16V bulk electrolytic
CO1	Decoupling cap - 2x0.1μF/16V, 0402 size ceramic capacitor
CO2	3 x 47μF/6.3V ceramic capacitor (e.g. Murata GRM31CR60J476ME19)
CO3	1 x 330μF/6.3V Polymer (e.g. Sanyo Poscap)
CO4	Decoupling cap - 2x0.1μF/16V, 0402 size ceramic capacitor
CO5	3 x 47μF/6.3V ceramic capacitor (e.g. Murata GRM31CR60J476ME19)
CO6	1 x 330μF/6.3V Polymer (e.g. Sanyo Poscap)
CTune1	1200pF ceramic capacitor (can be 1206, 0805 or 0603 size)
RTune1	300 ohms SMT resistor (can be 1206, 0805 or 0603 size)
RTrim1	10kΩ SMT resistor (can be 1206, 0805 or 0603 size, recommended tolerance of 0.1%)
CTune2	1200pF ceramic capacitor (can be 1206, 0805 or 0603 size)
RTune2	300 ohms SMT resistor (can be 1206, 0805 or 0603 size)
RTrim2	10kΩ SMT resistor (can be 1206, 0805 or 0603 size, recommended tolerance of 0.1%)

Technical Specifications (continued)

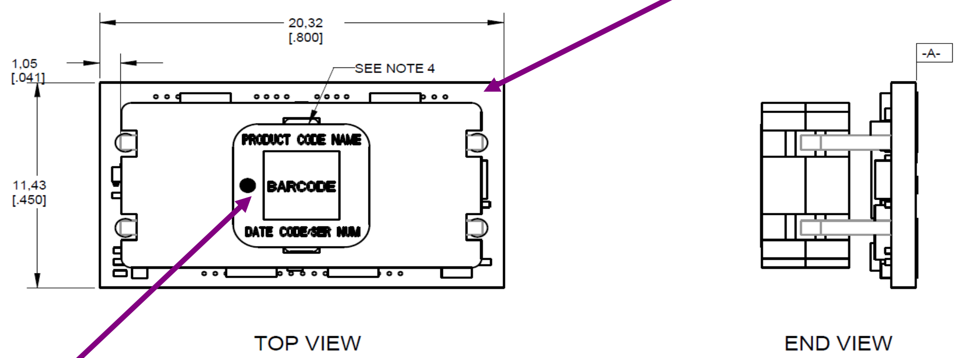
Mechanical Outline

Dimensions are in millimeters and (inches).

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

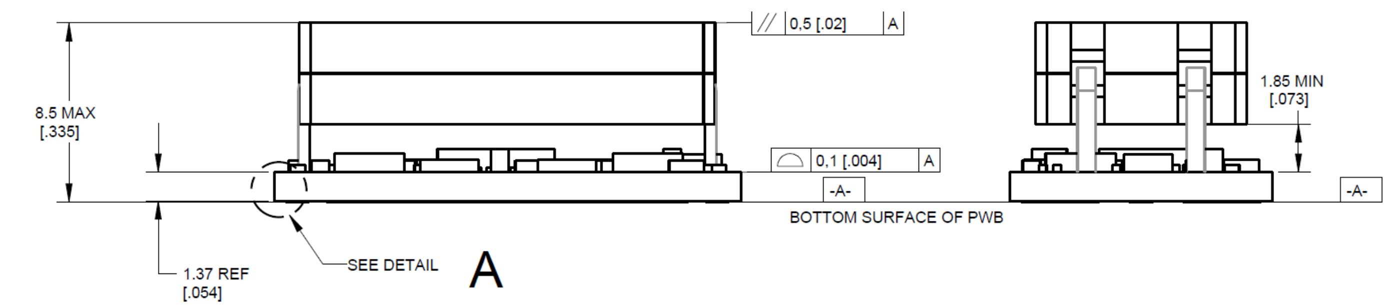
x.xx mm ±0.25 mm (x.xxx in ± 0.010 in.)

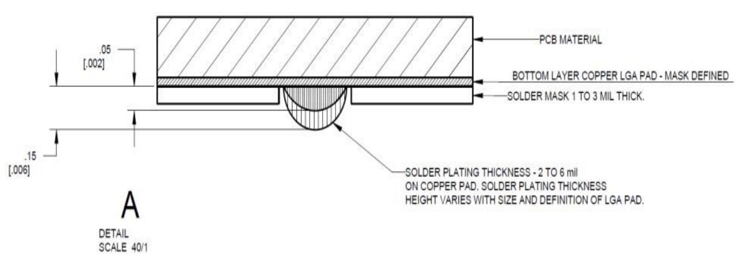
Pin1 (VSNS1) at this corner

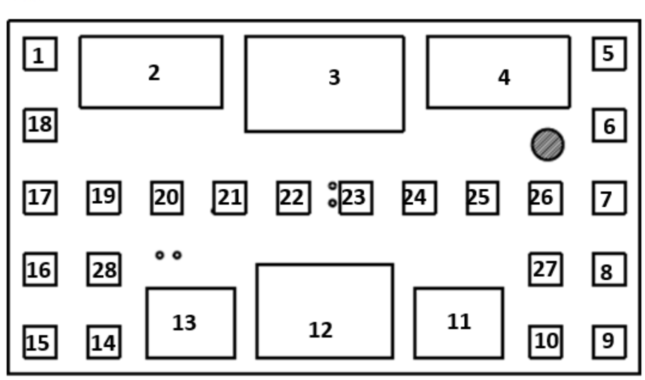


Use this Black Dot for orientation and pin numbering

These figures are for dimension and orientation of the label only. Components location in view will vary due to different models





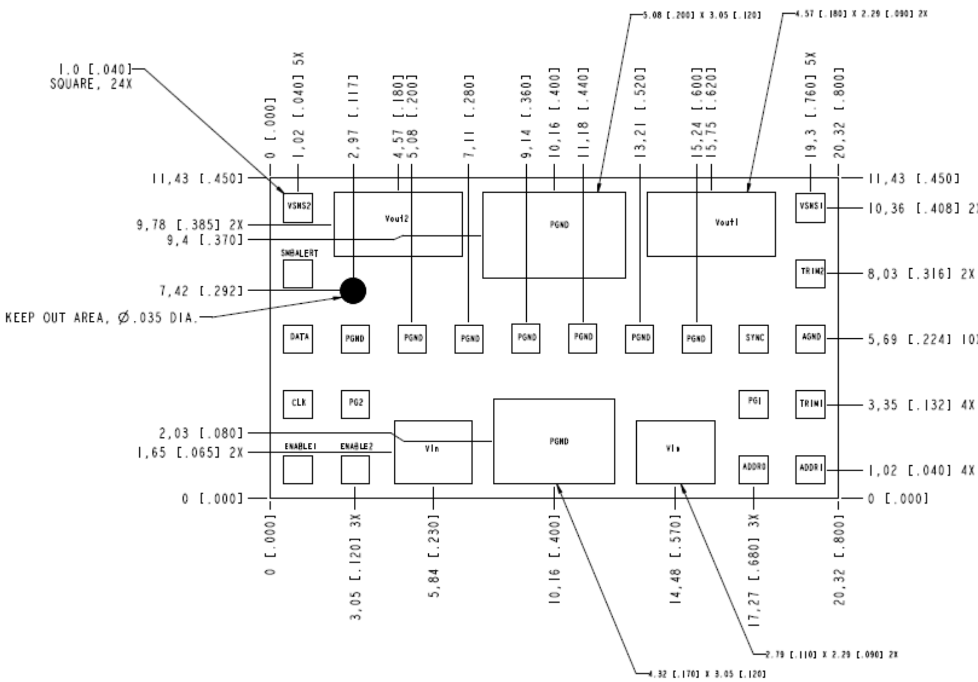


Bottom View

PIN	FUNCTION	PIN	FUNCTION
1	VSNS1	15	NC
2	VOUT1	16	TRIM1
3	PGND	17	SIG_GND
4	VOUT2	18	TRIM2
5	VSNS2	19	SYNC
6	NC	20	PGND
7	NC	21	PGND
8	NC	22	PGND
9	ENABLE1	23	PGND
10	ENABLE2	24	PGND
11	VIN	25	PGND
12	PGND	26	PGND
13	VIN	27	PGOOD2
14	NC	28	PGOOD1

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	VSNS1	15	NC
2	VOUT1	16	TRIM1
3	PGND	17	SIG_GND
4	VOUT2	18	TRIM2
5	VSNS2	19	SYNC
6	NC	20	PGND
7	NC	21	PGND
8	NC	22	PGND
9	ENABLE1	23	PGND
10	ENABLE2	24	PGND
11	VIN	25	PGND
12	PGND	26	PGND
13	VIN	27	PGOOD2
14	NC	28	PGOOD1

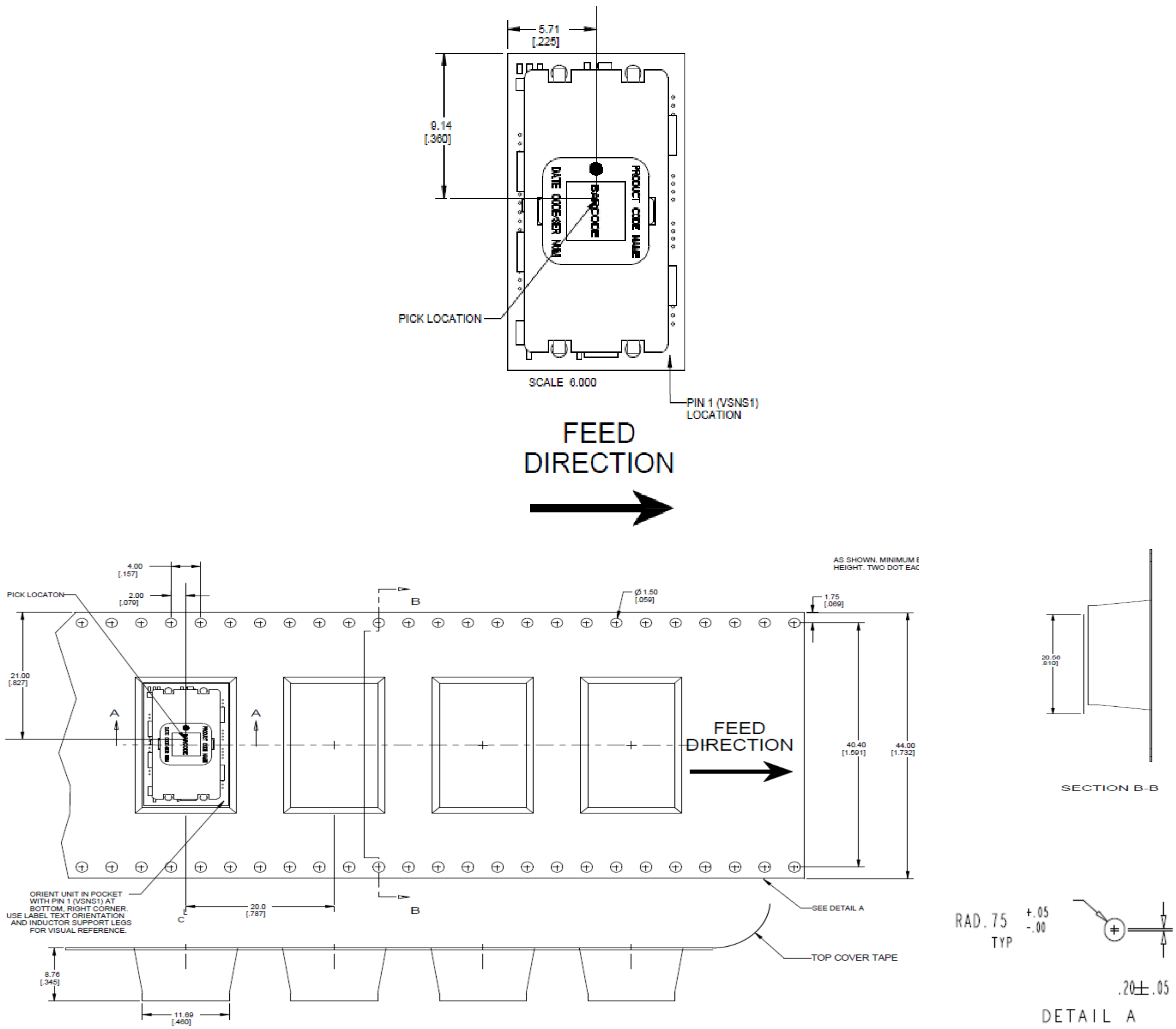
Technical Specifications (continued)

Packaging Details

The 12V Analog Dual MicroDlynx™ 2 × 12A 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).

Black Dot on the label is the orientation marker for locating Pin 1 (bottom right corner)



Reel Dimensions:

Outside Dimensions:	330.2 mm (13.00)
Inside Dimensions:	177.8 mm (7.00”)
Tape Width:	44.00 mm (1.732”)

Technical Specifications (continued)

Surface Mount Information

Pick and Place

The2 × 12A Analog Dual MicroDlynx™ 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

This module is not recommended for assembly on the bottom side of a customer board. If such an assembly is attempted, components may fall off the module during the second reflow process.

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. D (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). The recommended linear reflow profile using Sn/Ag/Cu solder is shown in Fig. 50. Soldering outside of the recommended profile requires testing to verify results and performance.

MSL Rating

The2 x 12A Analog Dual MicroDlynx™ modules have a MSL rating of 3

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.

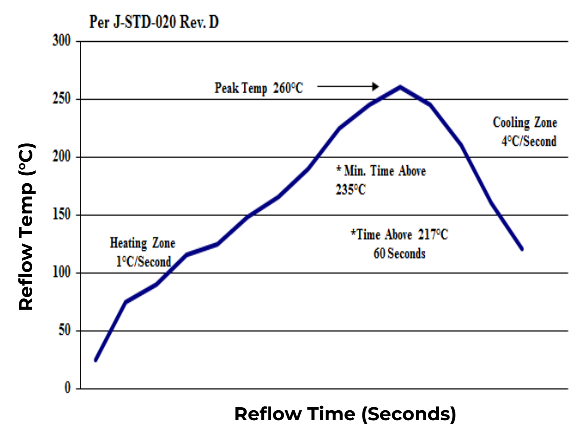


Figure 48. Recommended linear reflow profile using Sn/Ag/Cu solder.

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	OutputVoltage	OutputCurrent	On/OffLogic	Sequencing	Ordering Code
UVXS1212A0X3-SRZ	4.5 – 14.4V_{dc}	0.6 – 5.5 V_{dc}	12A x 2	Negative	No	150038436
UVXS1212A0X43-SRZ	4.5 – 14.4V_{dc}	0.6 – 5.5 V_{dc}	12A x 2	Positive	No	150038437

Table 9. Device Codes

Package Identifier	Family	Sequencing Option	Input Voltage	Output current	Output voltage	On/Off logic	Remote Sense	Options	ROHS Compliance
U	**V**	**X**	**S**	**1212A0**	**X**		**3**	**-SR**	**Z**
P=Pico U=Micro M=Mega G=Giga	D=Dlynx Digital V = DLynx Analog.	T=with EZ Sequence X=without sequencing	Special: 4.5 – 14V	2 × 12A	X = programmable output	4 = positive No entry = negative	3 = Remote Sense	S = Surface Mount R = Tape& Reel	Z = ROHS6

Table 10. Coding Scheme

Contact Us

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Change History (excludes grammar & clarifications)

Revision	Date	Description of the change
12.3	11/13/2021	Updated as per template
12.4	06/22/2023	Correction in value in feature specifications table on page - 5
12.5	10/26/2023	Updated as per OmniOn template

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