TDK·Lambda

i1C Series DC/DC Power Modules

200W Step-up/Step-down Converter
9-36V or 18-75V Input range
1” x 1” Footprint

The i1C series power modules perform both step-up and step-down voltage conversions from 12V, 24V or 48V buses. The i1C series utilizes a non-isolated power topology offering a low component count and resulting in a low-cost structure and a superior level of performance. The compact, shielded design features a low profile and weight that allow for extremely flexible and robust manufacturing processes. The ultra-high efficiency enables the i1C series to offer a much higher power density in an industry standard package.

Features

- Size – 26.42mm x 26.42 mm x 10.2 mm (1.04 in. x 1.04 in. x 0.4 in.)
- Maximum weight 30g (1.06 oz.)
- Through-hole pins 3.68mm (0.145”)
- Industry standard package
- Up to 200W of output power with minimal power de-rating
- Wide output voltage adjustment range
- Negative logic On/Off
- 5-sided metal case and spread spectrum technology for superior noise characteristics
- Full, auto-recovery protection
  - Input under voltage
  - Short circuit
- ISO Certified manufacturing facilities

Optional Features

- Positive logic On/Off
- No Output Voltage Adjustment Pin
- No On/Off Pin
- Long 5.59mm (0.220”) pin length

Ordering Information:

Product Identifier	Package Size	Platform	Input Voltage	Output Current	Units	Main Output Voltage	# of Outputs		Feature Set		RoHS indicator
i	**1**	**C**	**2W**	**010**	**A**	**050**	**V**	**-**	**001**	**-**	**R**
TDK Lambda	1in x 1in	i1C	2W - 9V to 36V 4W - 18V to 75V 48 – 40V to 65V	010 – 10A	Amps	050 - 5V 120 – 12V	Single		See option table		R=RoHS Compliant

Option Table:

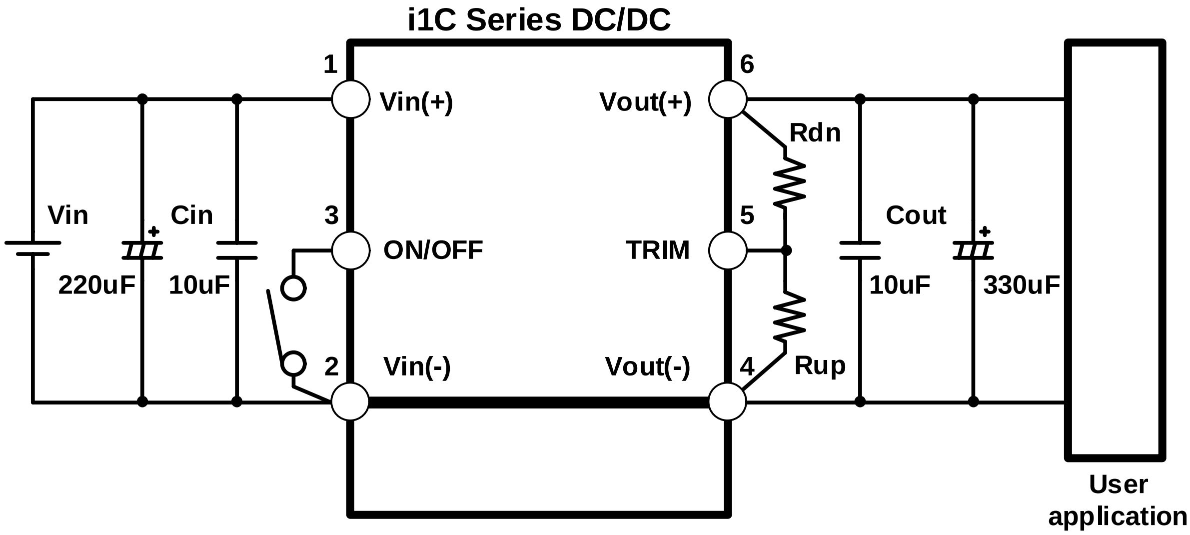
Feature Set	Positive Logic On/Off	Negative Logic On/Off	Output Voltage Trim Pin	0.145" Pin Length (Default)	0.220" Pin Length
-000	YES	-	YES	YES	-
-001	-	YES	YES	YES	-
-004	YES	-	YES	-	YES
-005	-	YES	YES	-	YES

Product Offering:

Product Code	Input Voltage (V)	Output Voltage (V)	Output Current (A)	Maximum Output Power (W)	Efficiency
i1C2W010A120V	9 - 36	9.6 - 28	10	200	98%
i1C4W010A120V	18 - 75	9.6 - 28	10	200	97%

TDK·Lambda

Typical Application Circuit:

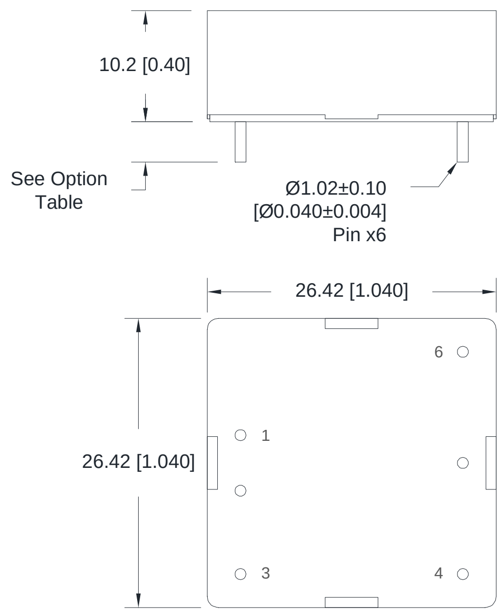


Recommendation

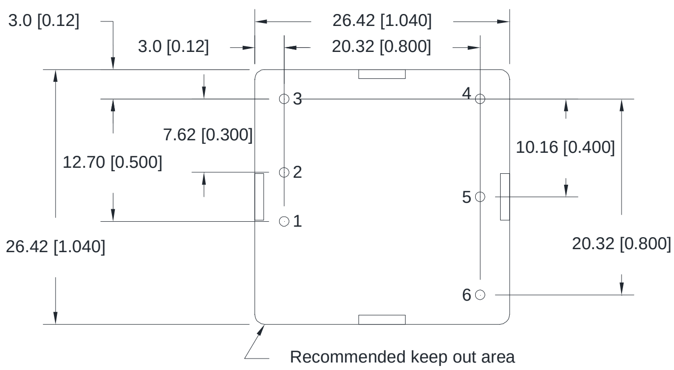
1. Cin and Cout MLCC should be connected to the i1C module as close as possible to reject high frequency noise.
2. Connect Vin(-) and Vout(-) to copper ground plane underneath the i1C module.
3. TRIM resistors Rup or Rdn should be connected to the i1C module as close as possible.

Mechanical Specification: (–00x-R product options)

Dimensions are in mm [in]. Unless otherwise specified, tolerances are:
x.x ± 0.5 [0.02] / x.xx ± 0.25 [0.010]



Recommended Hole Pattern:



Recommended hole pattern (top view)

Pin Assignment:

PIN	Function	PIN	Function
1	Vin (+)	4	Vout (-) / GND
2	Vin (-) / GND	5	TRIM (if populated)
3	On/Off (if populated)	6	Vout (+)

Pin base material is brass or copper with tin over nickel plating.

Maximum Weight: 30g (1.06 oz.)

Absolute Maximum Ratings:

Stresses in excess of Absolute Maximum Ratings may cause permanent damage to the device.

Characteristic	Min	Max	Unit	Notes & Conditions
Continuous Input Voltage	-0.25	80	Vdc	i1C4W
	-0.25	40		i1C2W
Isolation Voltage	---	---	Vdc	NOT APPLICABLE
Storage Temperature	-55	125	˚C	
Operating Temperature Range (Tcase)	-40	120*	˚C	Measured at the location specified in the thermal measurement figure; absolute maximum temperature varies with operating condition – see curves in the thermal performance section of the data sheet.

*Engineering estimate

Input Characteristics:

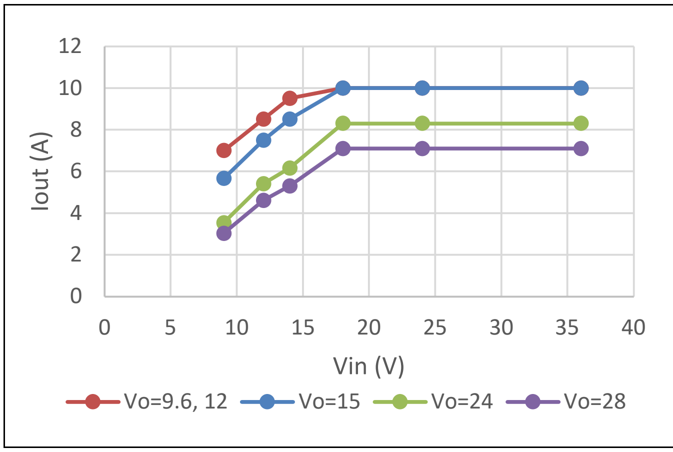
Unless otherwise specified, specifications apply over all rated Input Voltage, Resistive Load and Temperature Conditions.

Characteristic	Min	Typ	Max	Unit	Notes & Conditions
Operating Input Voltage	9	---	36	Vdc	i1C2W
	18	---	75		i1C4W
Maximum Input Current	---	---	15	A	i1C4W Vin = Vin,min to Vin,max; Po = Po,max
	---	---	20		i1C2W Vin = Vin,min to Vin,max; Po = Po,max
Stand-by Input current	---	2	---	mA	Vin = Vin,nom, On/Off = Off
No load Input current	---	40	---	mA	I1C2W: Vin = 24V; Vo = 12V; Io = No load
	---	27	---	mA	I1C4W: Vin = 24V; Vo = 12V; Io = No load
Startup Delay Time from application of input voltage	---	4	---	ms	Vo = 0% to 10% of Vo,set; On/Off = On, Io = Io,max, Tc = 25˚C
Startup Delay Time from On/Off	---	4	---	ms	Vo = 0% to 10% of Vo,set; Vin = Vi,nom, Io = Io,max,Tc = 25˚C
Output Voltage Rise Time	---	3	---	ms	Vo = 10% to 90% of Vo,set; Io = Io,max, Tc = 25˚C,
Turn on input voltage	---	8.2	---	V	i1C2W
	---	15.5	---		i1C4W
Turn off input voltage	---	7.7	---	V	i1C2W
	---	14.7	---		i1C4W

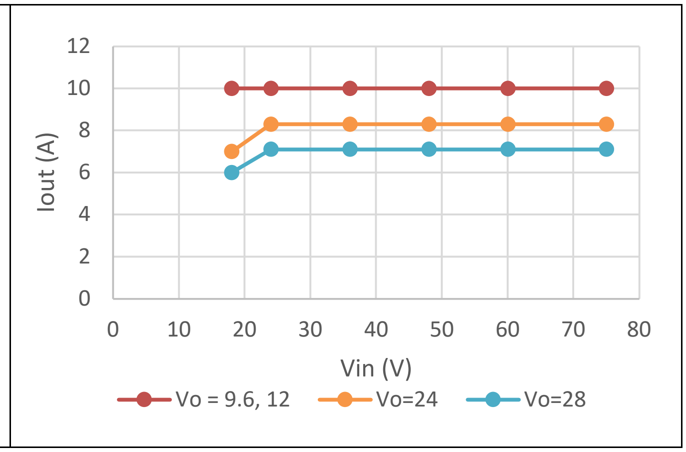
Caution: The power modules are not internally fused. An external input line normal blow fuse with a maximum value of 25A is required; see the Safety Considerations section of the data sheet.

Operating Range:

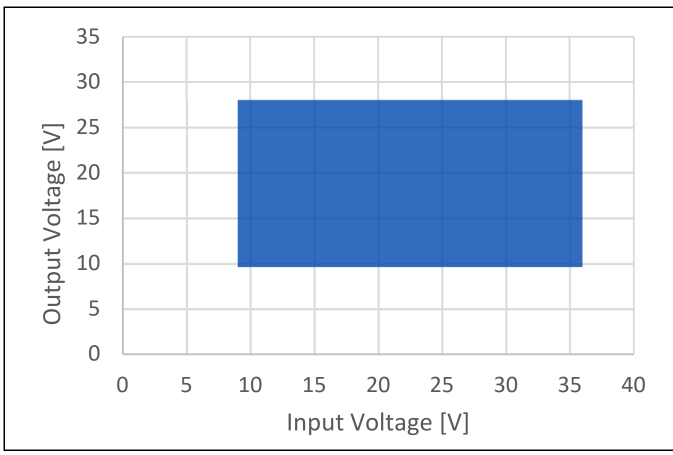
Allowable output current is limited by a combination of Vin and Vout during Step-up mode. The output voltage may start to decrease if the allowable output current is exceeded.



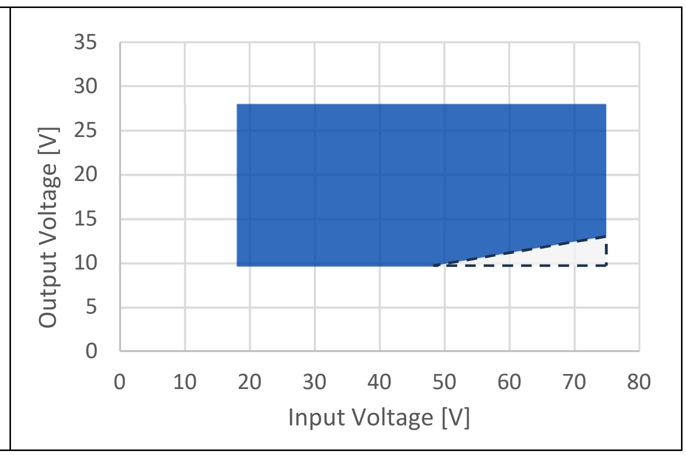
i1C2W010A120V Input Voltage vs. Output Current operating range.



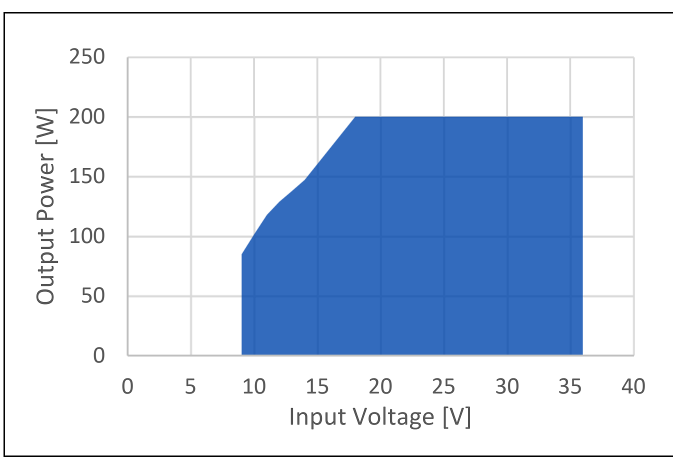
i1C4W010A120V Input Voltage vs. Output Current operating range.



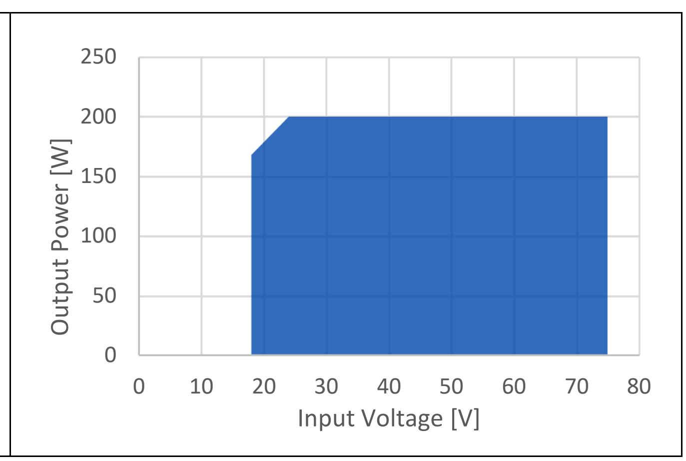
i1C2W010A120V Input Voltage vs. Output Voltage operating range.



i1C4W010A120V Input Voltage vs. Output Voltage operating range. Operating the unit in the unspecified region bounded by the dashed lines should not damage the unit, though at light loads can lead to increased output ripple and/or poor regulation.



i1C2W010A120V Input Voltage vs. Output Power operating range.



i1C4W010A120V Input Voltage vs. Output Power operating range.

Electrical Characteristics:

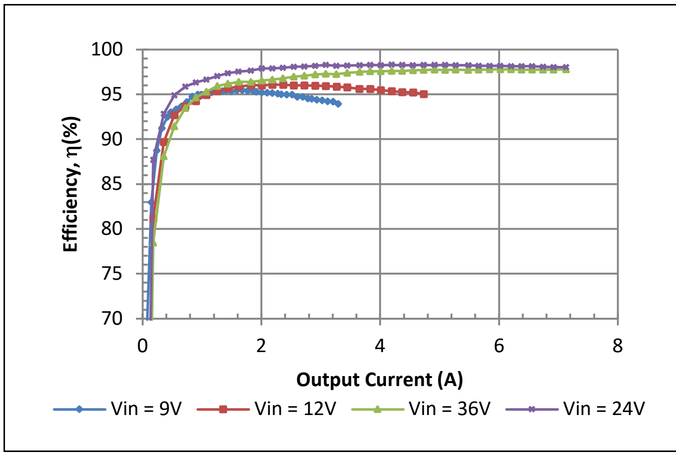
i1C2W010A120V-xxx-R

Characteristic	Min	Typ	Max	Unit	Notes & Conditions
Output Voltage Initial Set point	11.76	12	12.24	V	Vin=Vin,nom; Io=Io,min; Tc = 25˚C
Output Voltage Tolerance	-4.0	-	+4.0	%	Overall rated input voltage, load, and temperature conditions to end of life
Efficiency Vo = 12V Vo = 24V	--- ---	95 95	--- ---	% %	Vin=12V; Io=Io,max; Tc = 25˚C
Efficiency Vo = 12V Vo = 24V	--- ---	95 97	--- ---	% %	Vin=24V; Io=Io,max; Tc = 25˚C
Line Regulation	---	0.2	---	%	Vin=Vin,min to Vin,max
Load Regulation	---	0.5	---	%	Io=Io,min to Io,max
Output Current	0	---	10	A	Observe maximum power limit. Allowable output current varies with input voltage, please refer to chart.
Output Current Limiting Threshold	---	14	---	A	Vo = 0.9 • Vo,nom; Tc<Tc,max
Short Circuit Current	---	12	---	A	Vo = 0.25V, Tc = 25˚C
Output Ripple and Noise Voltage Step down : 24Vin, 12Vo, 10A Step up : 12Vin, 24Vo, 4.6A	 --- ---	 150 240	 --- ---	 mVpp mVpp	Measured across one 330 µF electrolytic capacitor and one 22 µF ceramic capacitor – see input/output ripple measurement figure; BW = 20MHz.
Output Voltage Adjustment Range	9.6	---	28	V	
Dynamic Response: Recovery Time Transient Voltage	 --- ---	 1 700	 --- ---	 ms mV	di/dt =1A/us, Vin=Vin,nom; Vo=24V, load step from 25% to 75% of Io,max
Switching Frequency	---	250	---	kHz	modulates to spread noise spectrum
External Load Capacitance	100	---	3000*	µF	
Vref	---	1	---	V	Required for trim calculation
Vo,nom	---	12	---	V	Required for trim calculation. This is the nominal output voltage of the unit if the trim resistor is not populated.
F	---	30100	---	Ω	Required for trim calculation
G	---	1620	---	Ω	Required for trim calculation

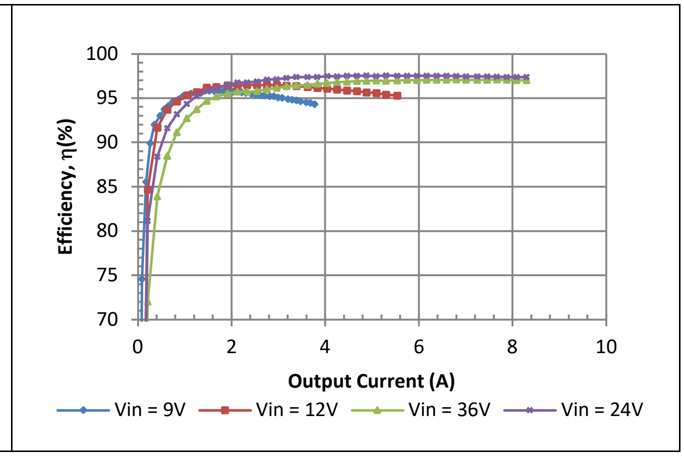
*Due to the extremely wide range of input and output conditions, i1C performance such as output ripple and transient voltage behavior can vary significantly from application to application. Please confirm performance in actual use case. TDK-Lambda can assist with selection of external components. Please contact technical support, especially if very low ESR capacitor banks beyond the listed range are required.

Typical Efficiency vs. Input Voltage:

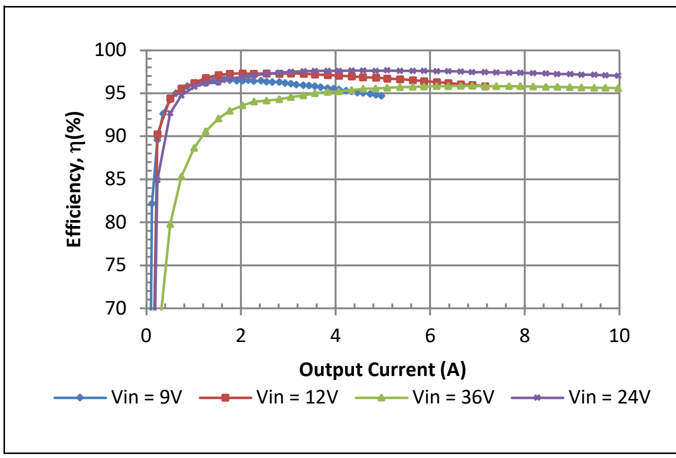
i1C2W010A120V-xxx-R



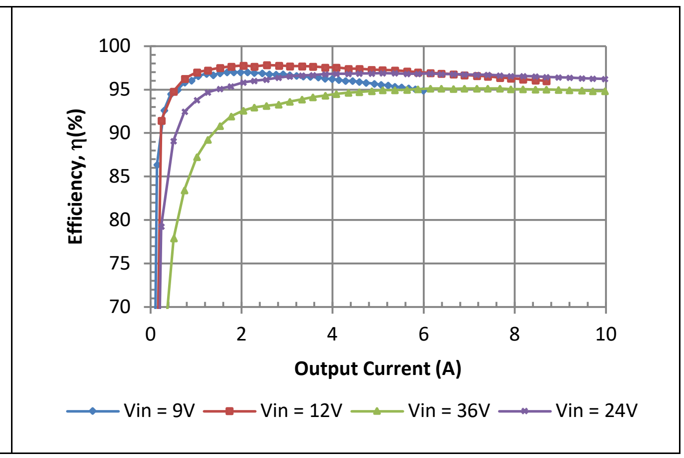
Vo = 28V



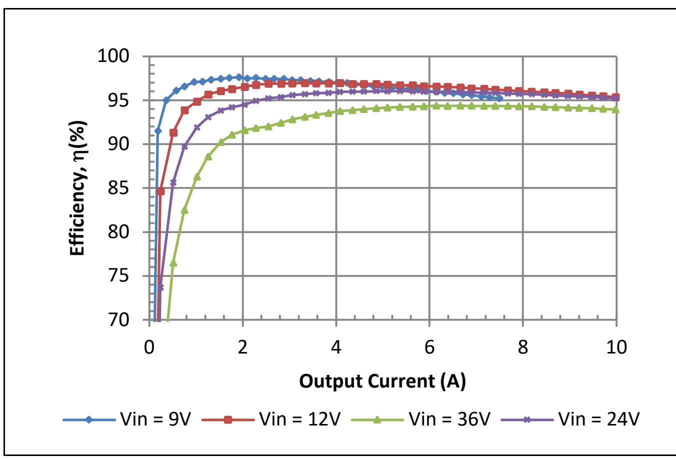
Vo = 24V



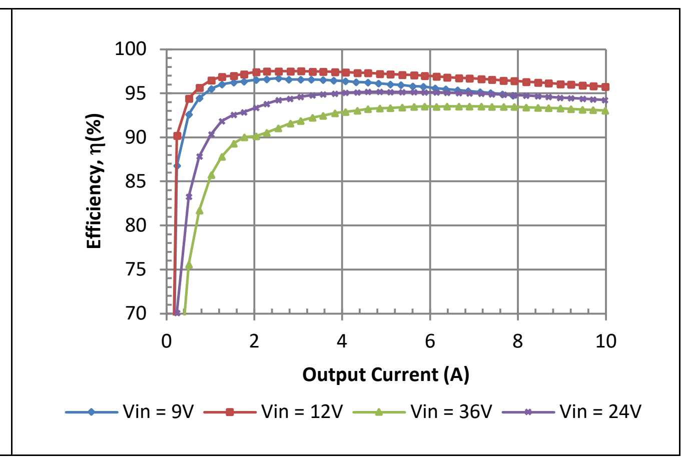
Vo = 18V



Vo = 15V



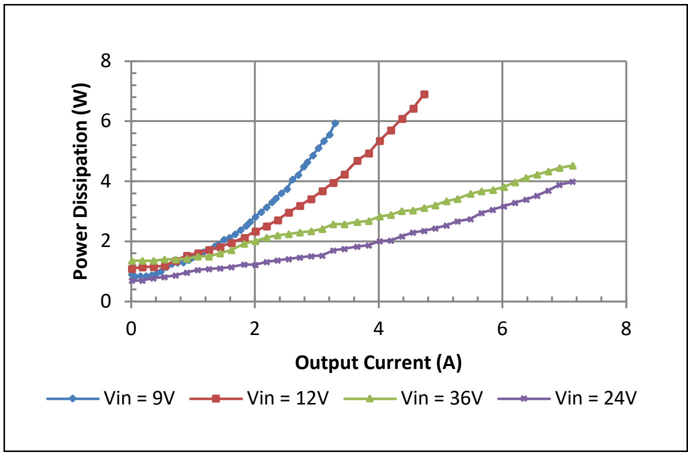
Vo = 12V



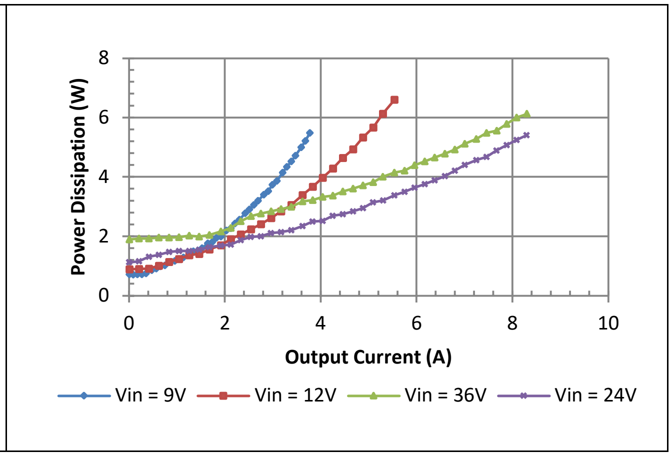
Vo = 9.6V

Typical Power Dissipation vs. Input Voltage:

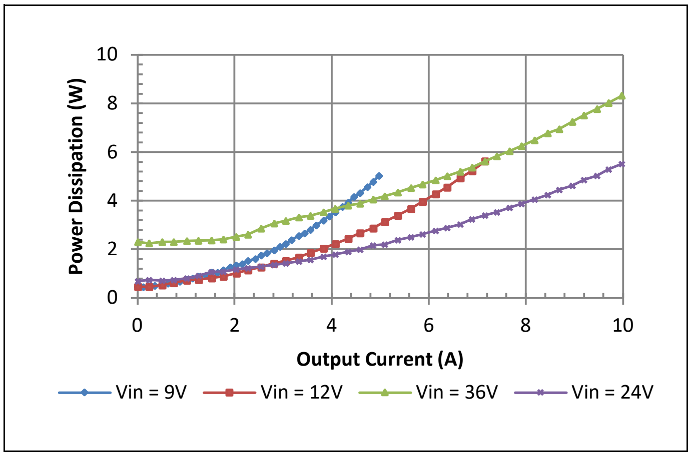
i1C2W010A120V-xxx-R



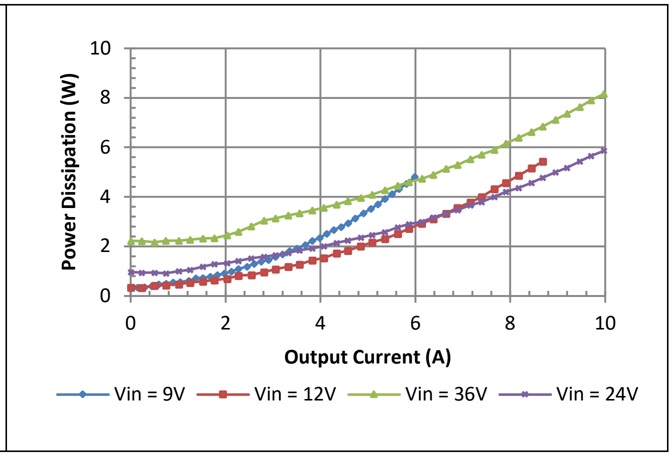
Vo = 28V



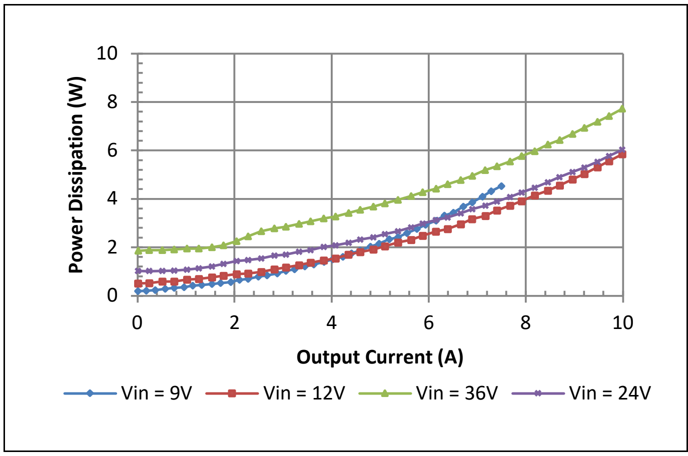
Vo = 24V



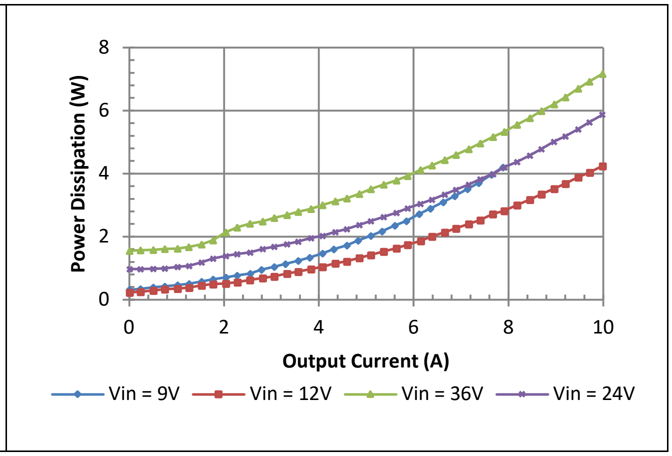
Vo = 18V



Vo = 15V



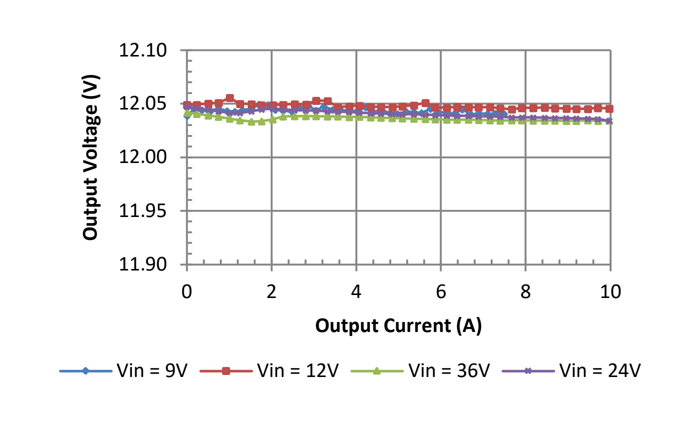
Vo = 12V



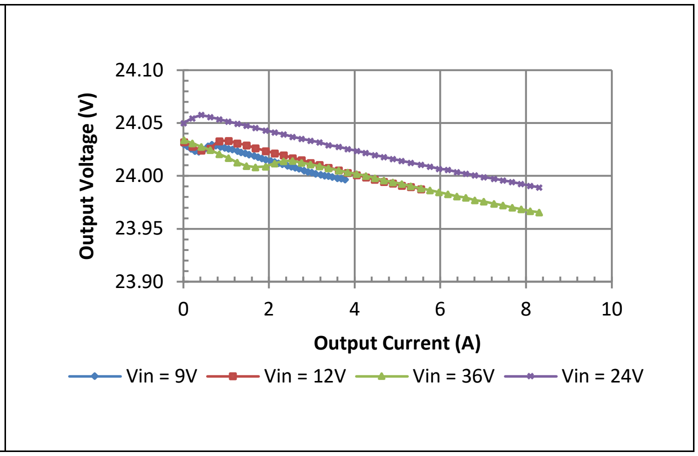
Vo = 9.6V

Static Characteristic:

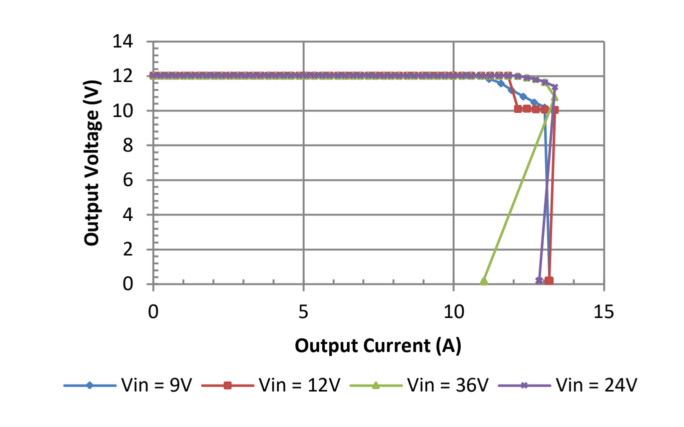
i1C2W010A120V-xxx-R



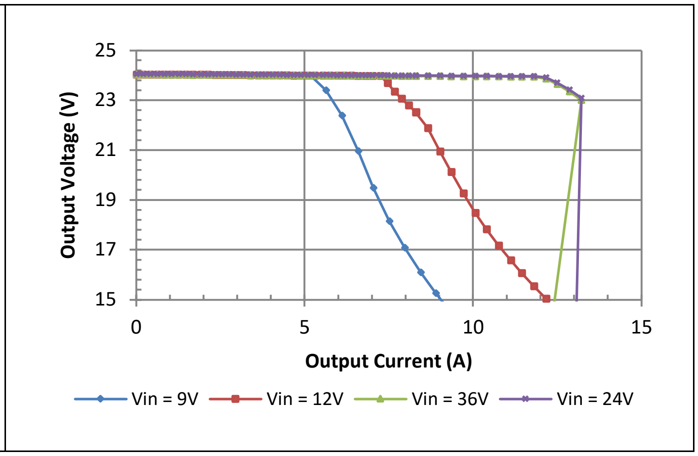
Typical Load regulation with Vo = 12V.



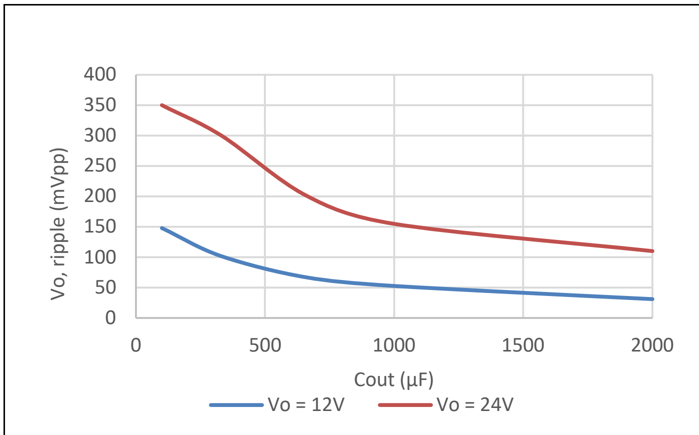
Typical Load regulation with Vo = 24V.



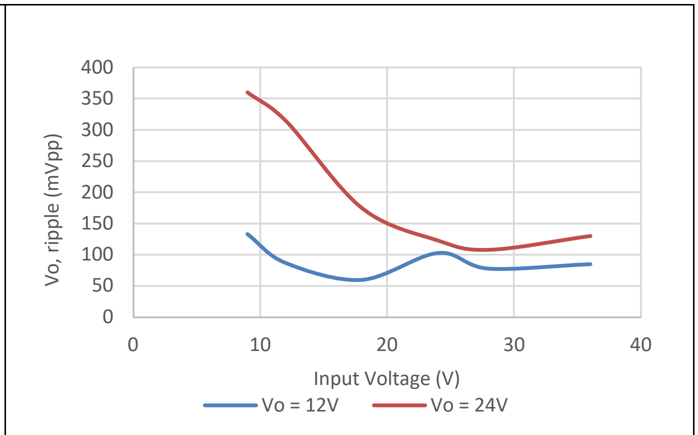
Typical Overload Characteristics with Vo = 12V.



Typical Overload Characteristics with Vo = 24V.



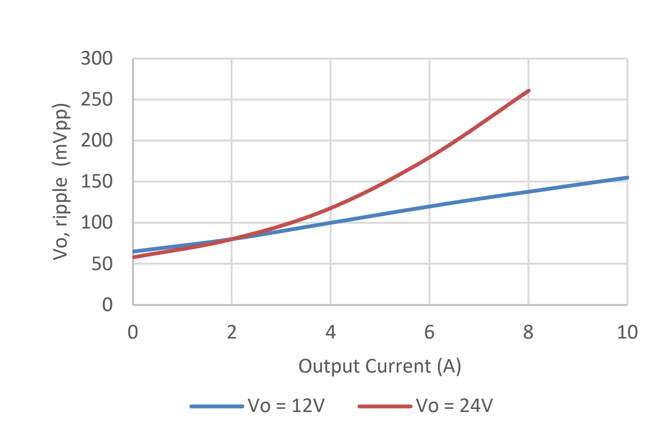
Typical output ripple magnitude versus external capacitor value at 50% load.



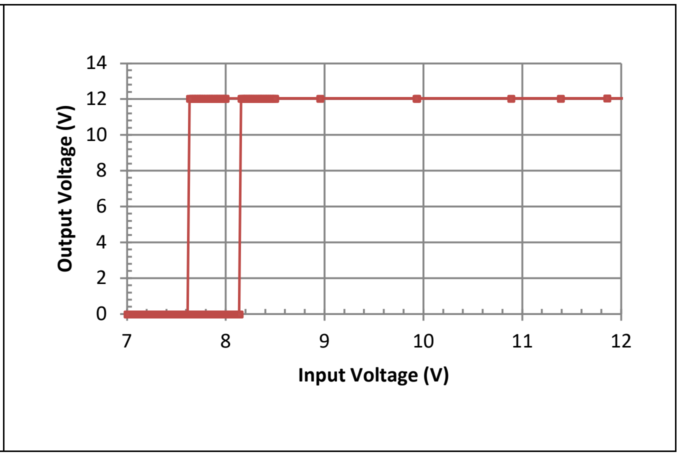
Typical output ripple magnitude versus line voltage at 50% load w/ Cout = 330µF.

Typical Waveform:

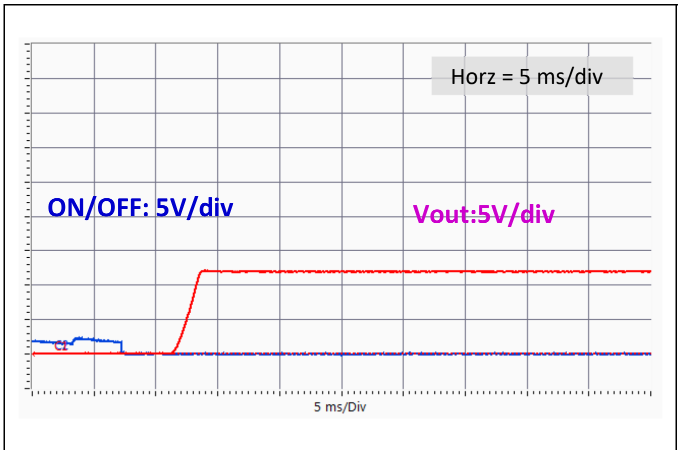
i1C2W010A120V-xxx-R



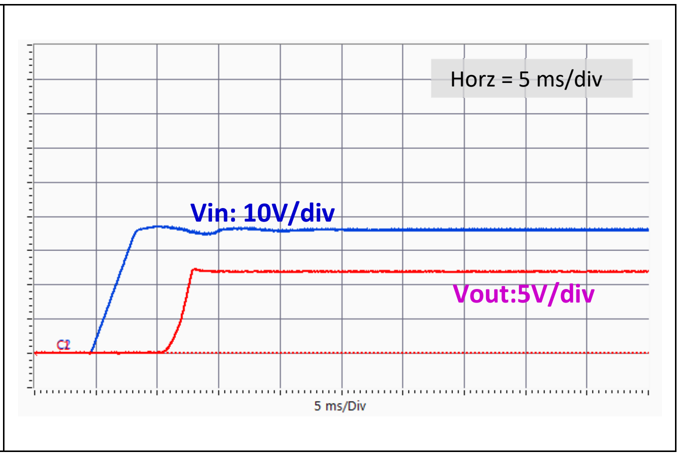
Typical output ripple magnitude versus load current with 330µF external capacitor and Vin = 24V.



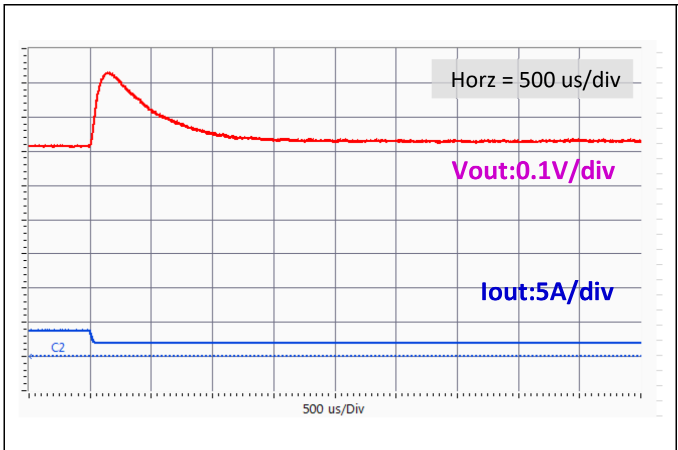
Typical turn on and turn off threshold with Vout = 12V.



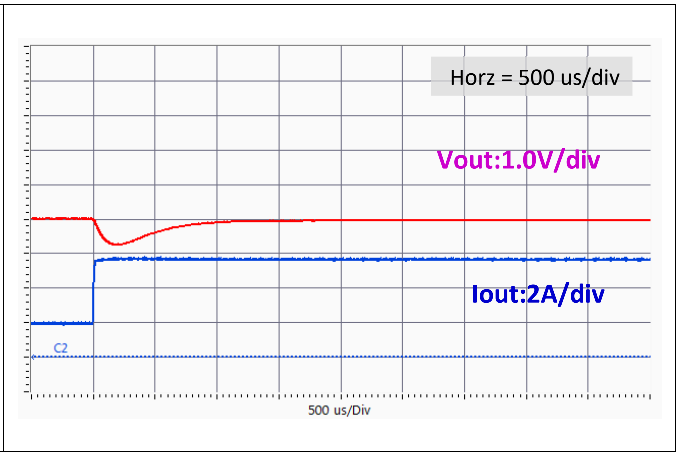
Typical startup characteristic from On/Off at full load; Vin=24V, Vo=12V, Io=10A, Cext=450µF.



Typical startup characteristic from Vin at full load; Vin=36V, Vo=12V, Cext=450µF.



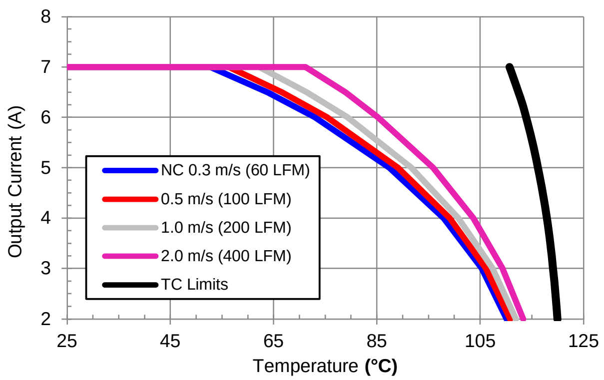
Typical Load transient response with step-up mode; Load Step from 50% (5A) and 25% (2.5A) with Slew rate of 0.1A/µs; Vin=12V, Vo=12V Cext = 450µF.



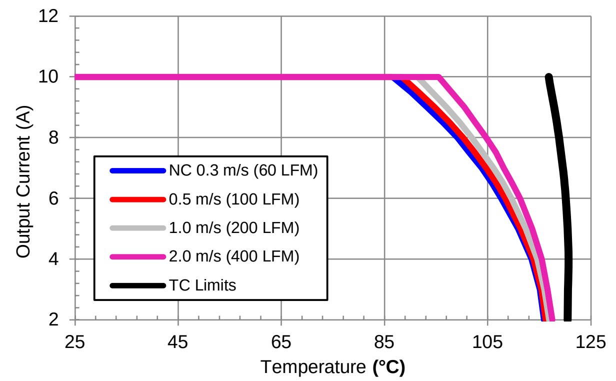
Typical Load transient response with step-up mode; Load Step from 25% (2.1A) and 75% (6.3A) with Slew rate of 1.0A/µs; Vin=36V, Vo=24V Cext = 450µF.

TDK·Lambda

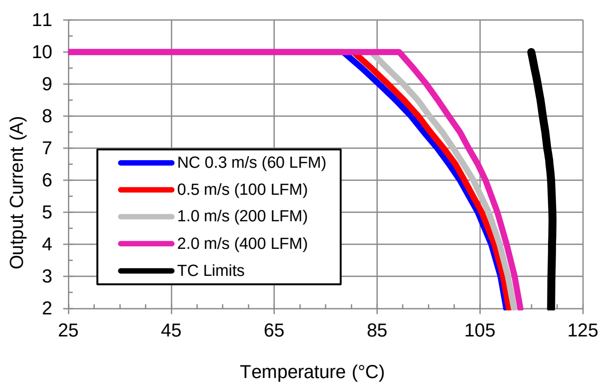
Thermal Performance: i1C2W010A120V-xxx-R



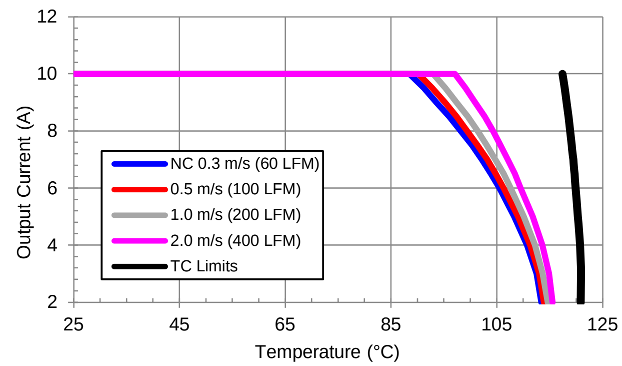
Vin=12V, Vo=24V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 6 to pin 4.



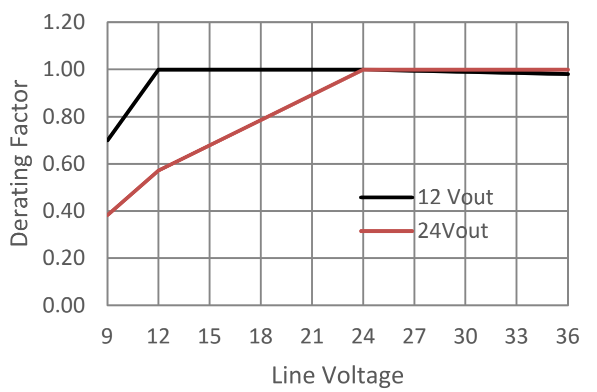
Vin=12V, Vo=12V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 6 to pin 4.



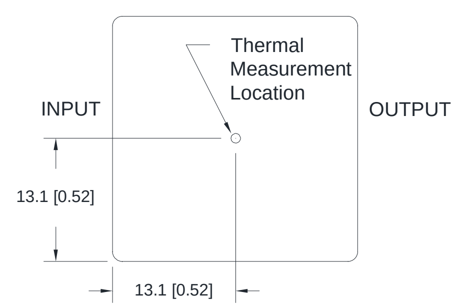
Vin=24V, Vo=24V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 6 to pin 4.



Vin=24V, Vo=12V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 6 to pin 4.



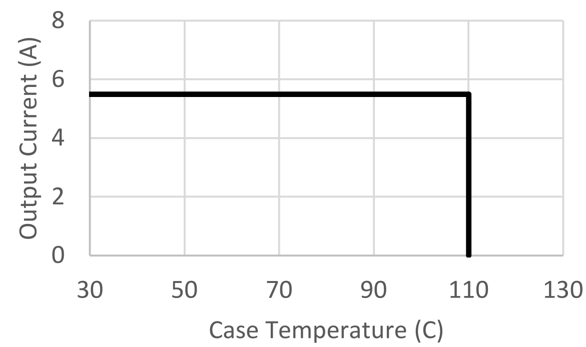
Typical output current derating versus line voltage in 85 °C ambient with airflow 1m/s (200 LFM).



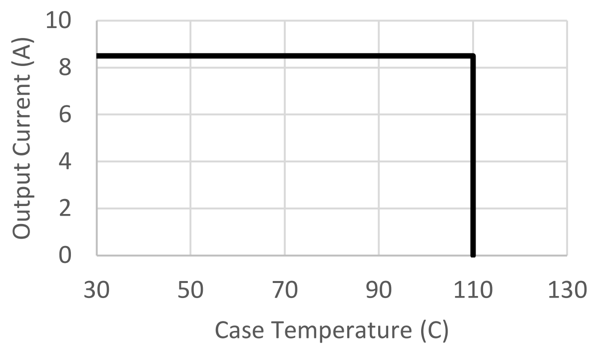
The thermal curves provided are based on measurements made in TDK Lambda's test setup that is described in the Thermal Management section. Due to the large number of variables in system design and the extremely wide operating range of the module. TDK Lambda recommends that the user verify the module's thermal performance in the end application. The critical component should be thermocoupled, monitored and should not exceed the temperature limit specified in the derating curve above. It is critical that the thermocouple be mounted in a manner that gives direct thermal contact or significant measurement errors may result. TDK Lambda can provide modules with a thermocouple pre-mounted to the critical component for system verification tests.

Thermal Performance:

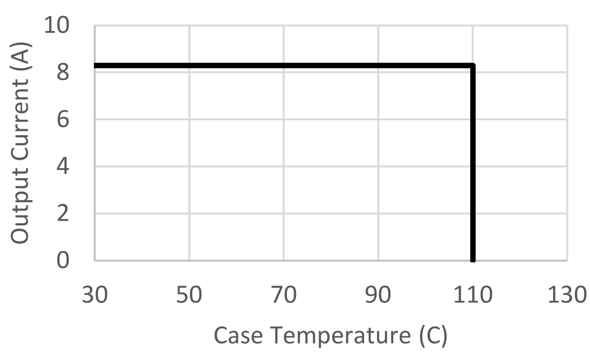
i1C2W010A120V-xxx-R



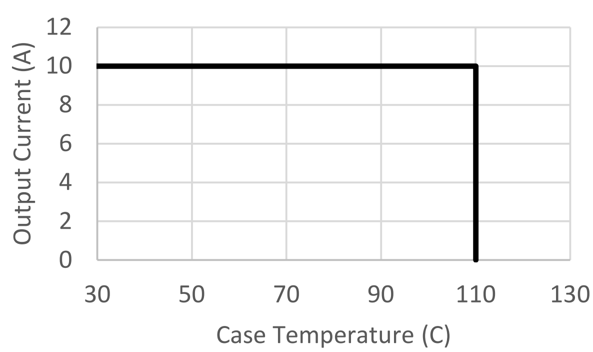
Vin=12V, Vo=24V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=12V, Vo=12V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=24V, Vo=24V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=24V, Vo=12V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.

Electrical Characteristics:

i1C4W010A120V-xxx-R

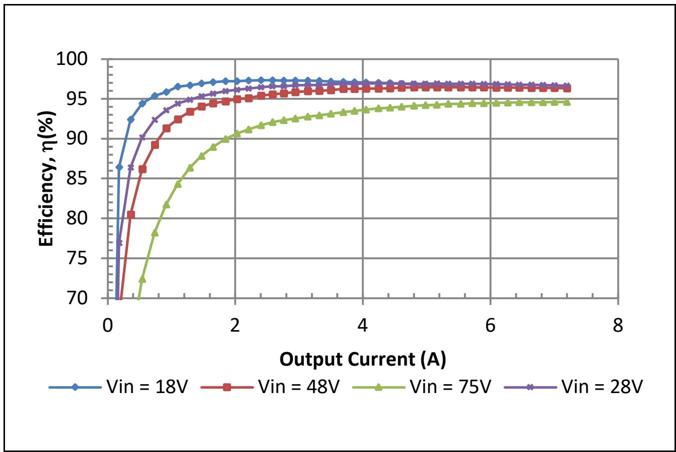
Characteristic	Min	Typ	Max	Unit	Notes & Conditions
Output Voltage Initial Set point	11.76	12	12.24	V	Vin=Vin,nom; Io=Io,min; Tc = 25˚C
Output Voltage Tolerance	-4.0	---	+4.0	%	Over all rated input voltage, load, and temperature conditions to end of life
Efficiency Vo = 12V Vo = 24V	--- ---	93 97	--- ---	% %	Vin=24V; Io=Io,max; Tc = 25˚C
Efficiency Vo = 12V Vo = 24V	--- ---	92 95.5	--- ---	% %	Vin=48V; Io=Io,max; Tc = 25˚C
Line Regulation	---	0.2	---	%	Vin=Vin,min to Vin,max
Load Regulation	---	0.5	---	%	Io=Io,min to Io,max
Output Current	0	---	10	A	Observe maximum power limit. Allowable output current varies with input voltage, please refer to chart.
Output Current Limiting Threshold	---	14	---	A	Vo = 0.9 • Vo,nom; Tc<Tc,max
Short Circuit Current	---	14	---	A	Vo = 0.25V, Tc = 25˚C
Output Ripple and Noise Voltage Step down : 24Vin, 12Vo, 10A Step up : 18Vin, 24Vo, 4.6A	 --- ---	 50 160	 --- ---	 mVpp mVpp	Measured across one 330 µF electrolytic capacitor and one 22 µF ceramic capacitor – see input/output ripple measurement figure; BW = 20MHz.
Output Voltage Adjustment Range	9.6	---	28	V	
Dynamic Response: Recovery Time Transient Voltage	 --- ---	 1 800	 --- ---	 ms mV	di/dt =1A/us, Vin=Vin,nom; Vo=24V, load step from 25% to 75% of Io,max
Switching Frequency	---	250	---	kHz	modulates to spread noise spectrum
External Load Capacitance	100	---	3000*	µF	
Vref	---	1	---	V	Required for trim calculation
Vo,nom	---	12	---	V	Required for trim calculation. This is the nominal output voltage of the unit if the trim resistor is not populated.
F	---	30100	---	Ω	Required for trim calculation
G	---	1620	---	Ω	Required for trim calculation

* Due to the extremely wide range of input and output conditions, I1C performance such as output ripple and transient voltage behavior can vary significantly from application to application. Please confirm performance in actual use case. TDK-Lambda can assist with selection of external components. Please contact technical support, especially if very low ESR capacitor banks beyond the listed range are required.

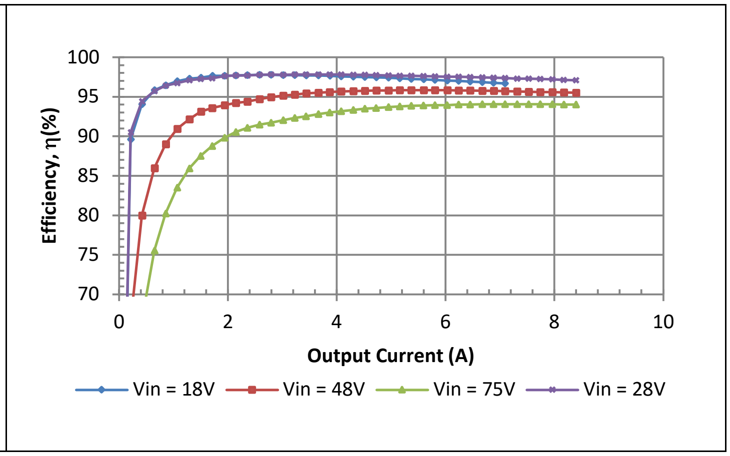
TDK·Lambda

Typical Efficiency vs. Input Voltage:

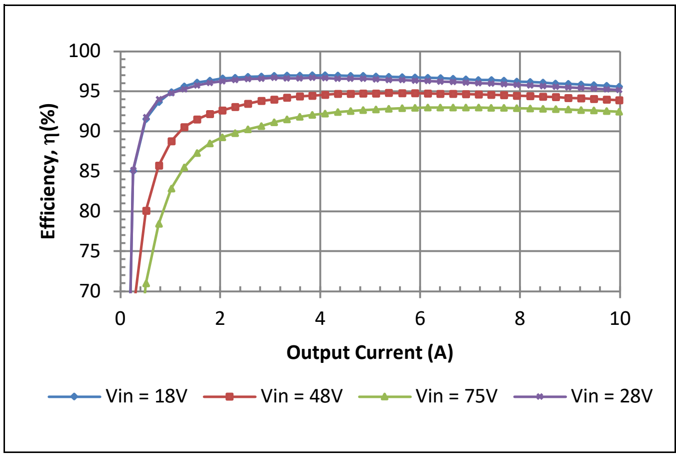
i1C4W010A120V-xxx-R



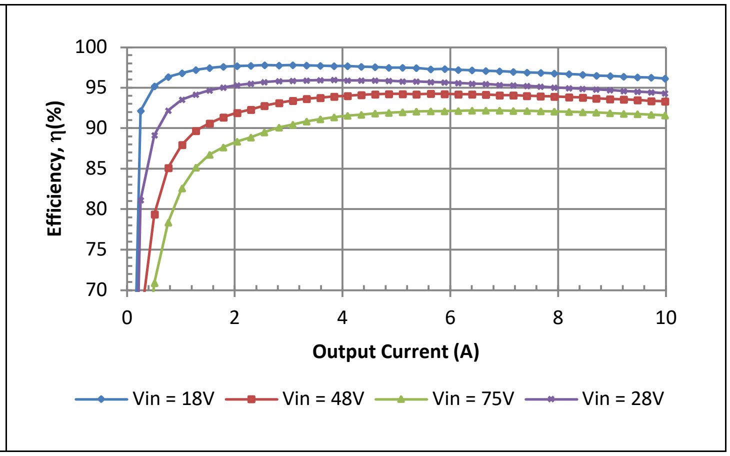
Vo = 28V



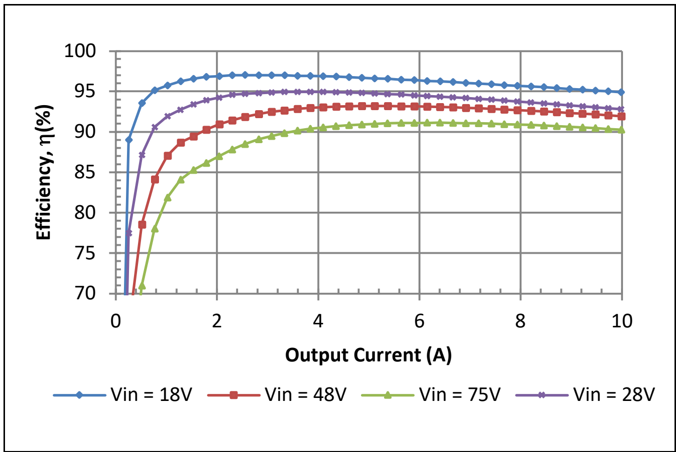
Vo = 24V



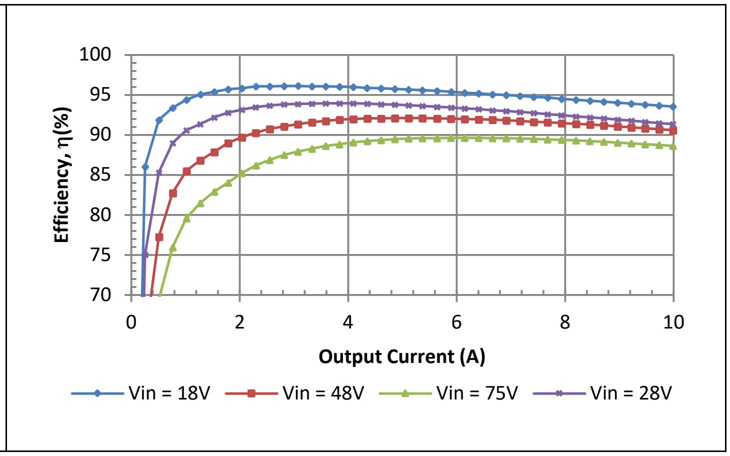
Vo = 18V



Vo = 15V



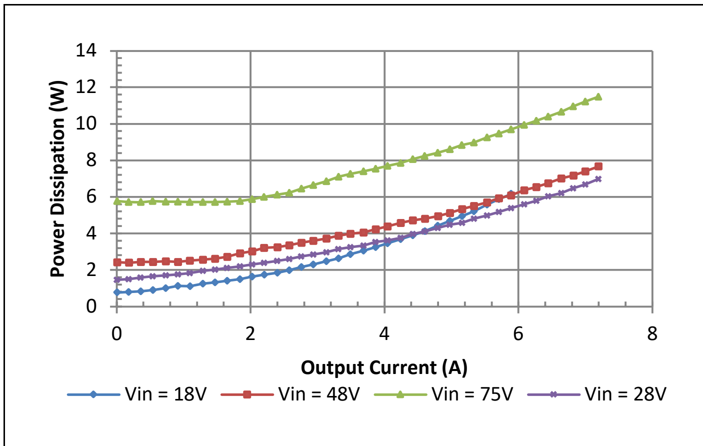
Vo = 12V



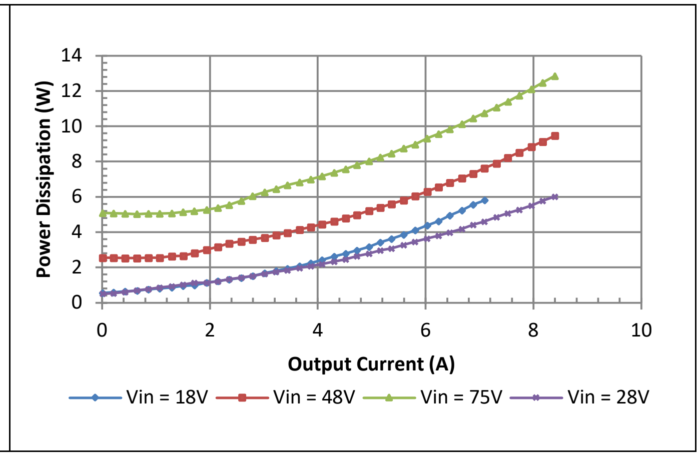
Vo = 9.6V

Typical Power Dissipation vs. Input Voltage:

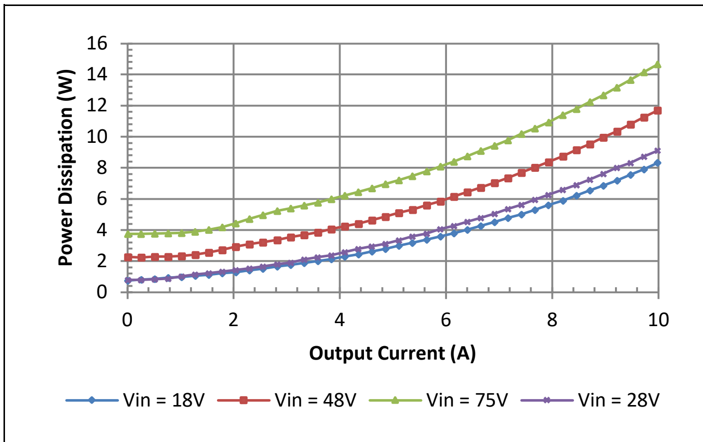
i1C4W010A120V-xxx-R



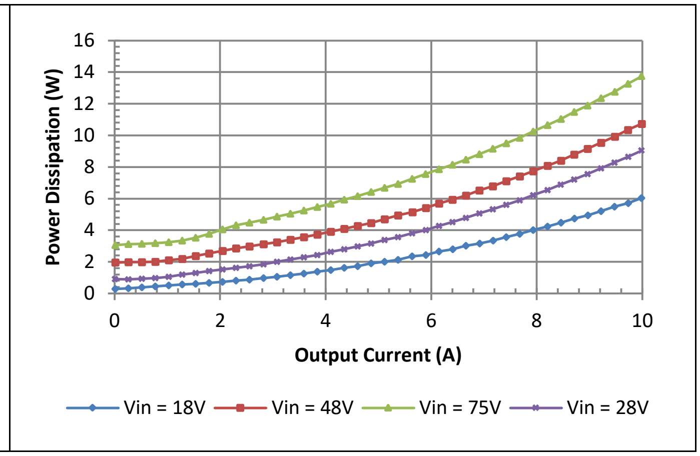
Vo = 28V



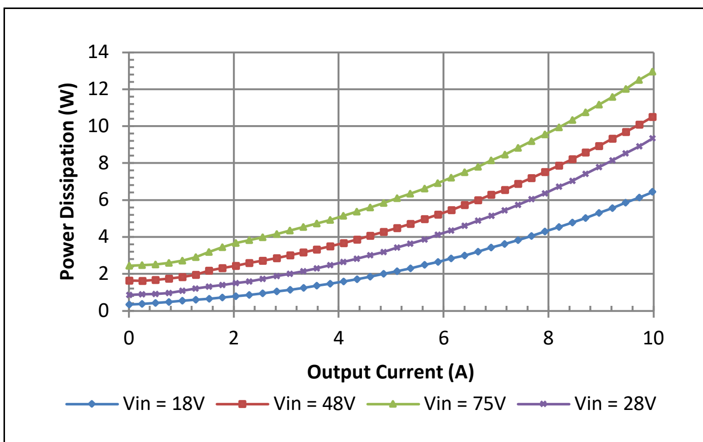
Vo = 24V



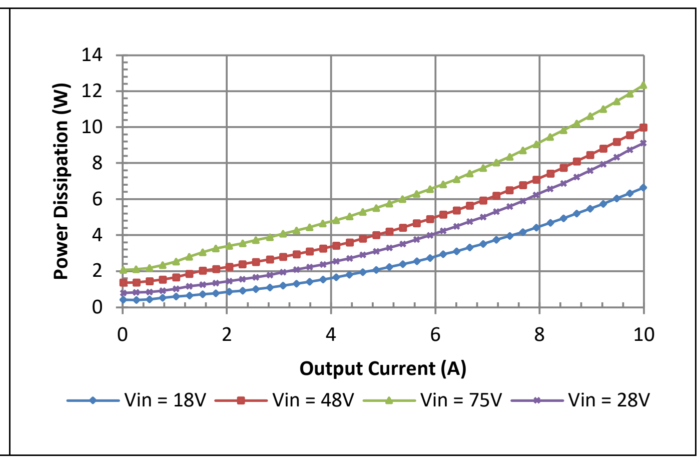
Vo = 18V



Vo = 15V



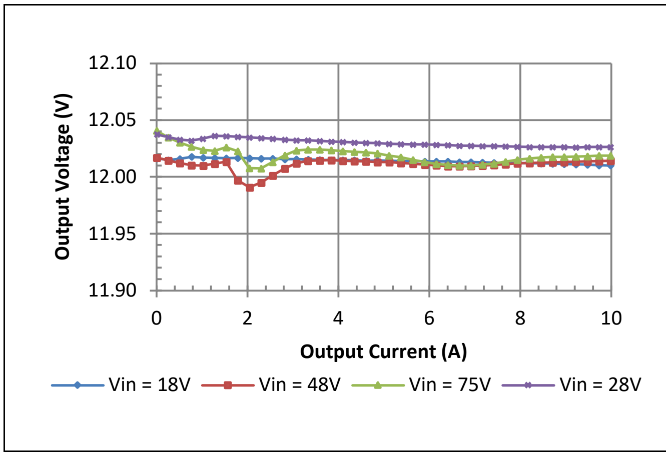
Vo = 12V



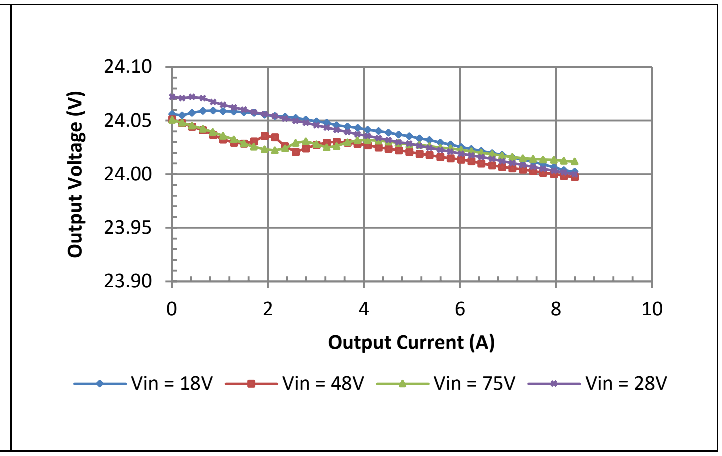
Vo = 9.6V

Static Characteristic:

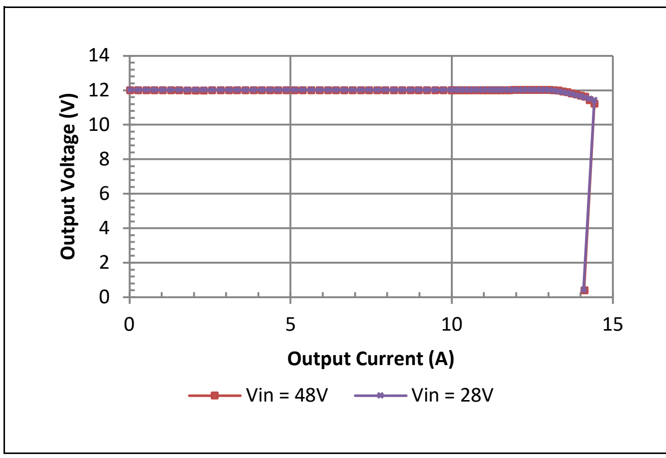
i1C4W010A120V-xxx-R



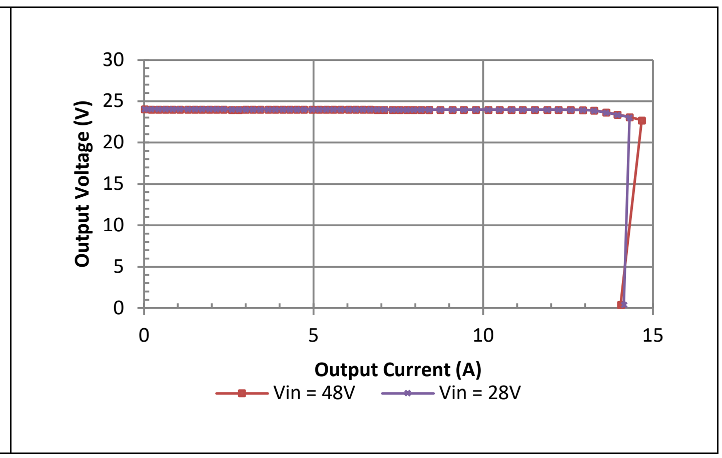
Typical Load regulation with Vo = 12V.



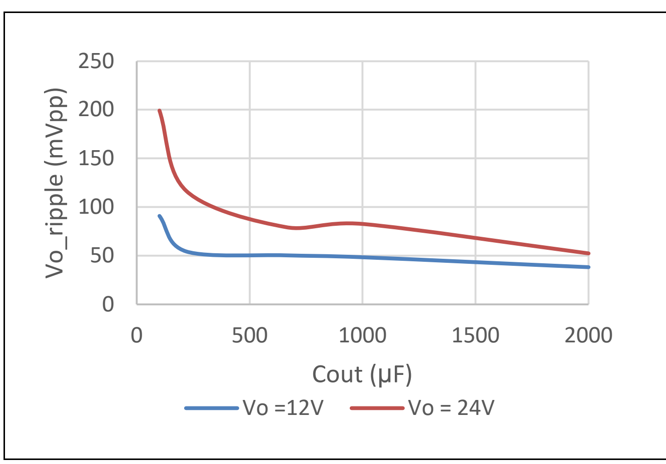
Typical Load regulation with Vo = 24V.



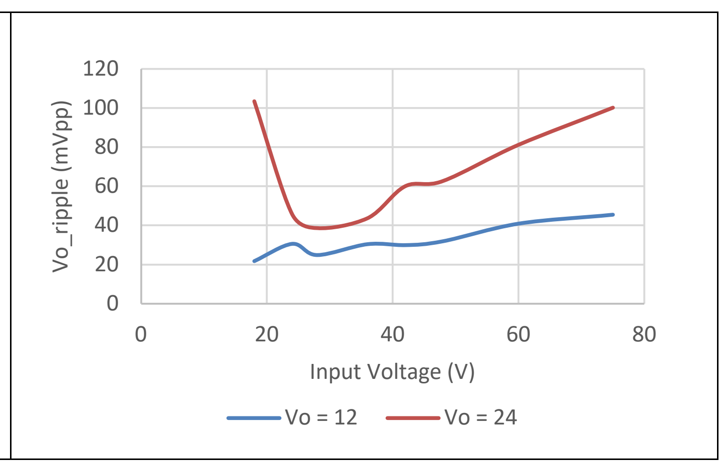
Typical Overload Characteristics with Vo = 12V.



Typical Overload Characteristics with Vo = 24V.



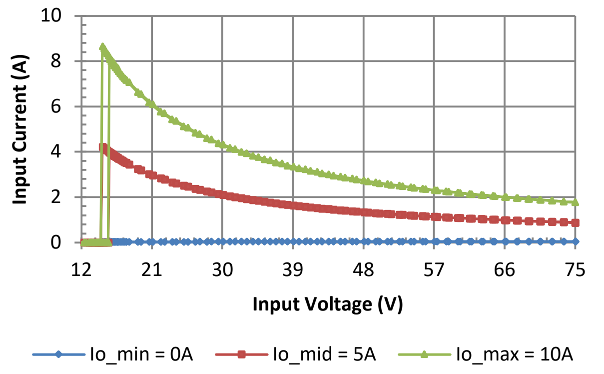
Typical output ripple magnitude versus external capacitor value at 50% load with Vin = 48V.



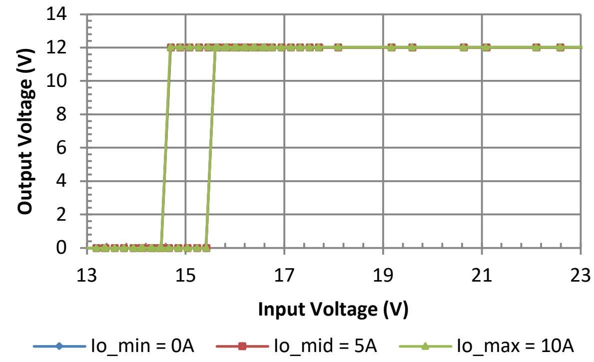
Typical output ripple magnitude versus line voltage at 50% load w/ Cout = 1000µF.

Typical Waveform:

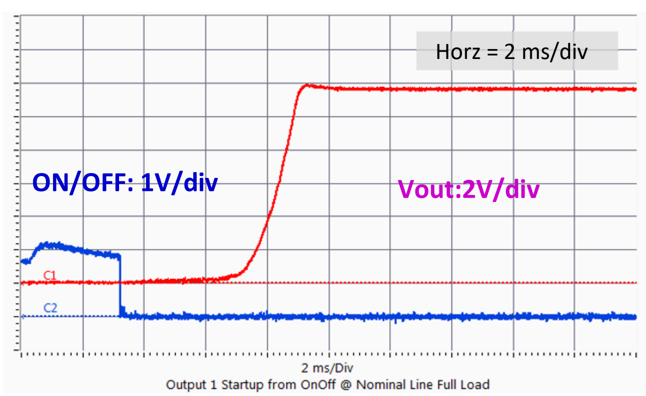
i1C4W010A120V-xxx-R



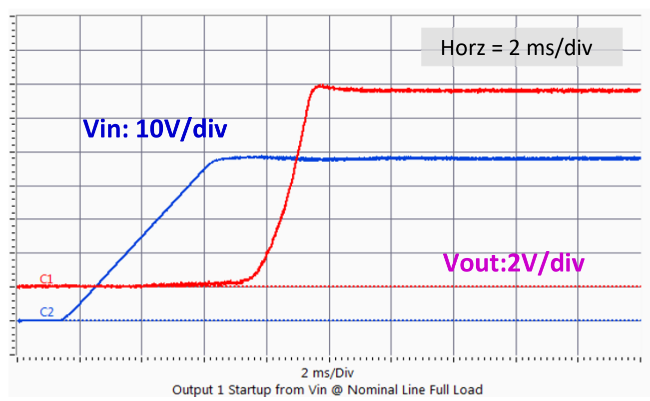
Typical Input Current versus Input voltage with Vout = 12V.



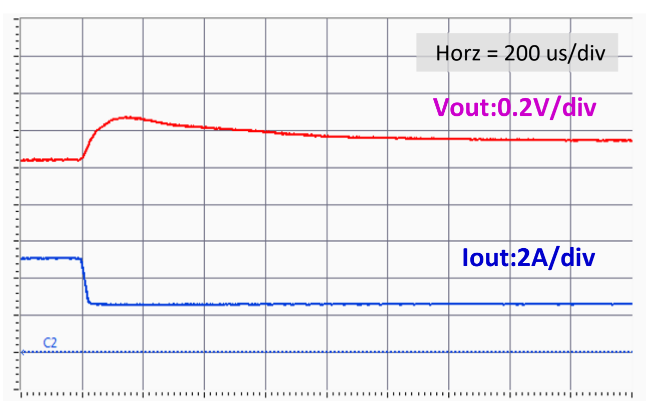
Typical turn on and turn off threshold with Vout = 12V.



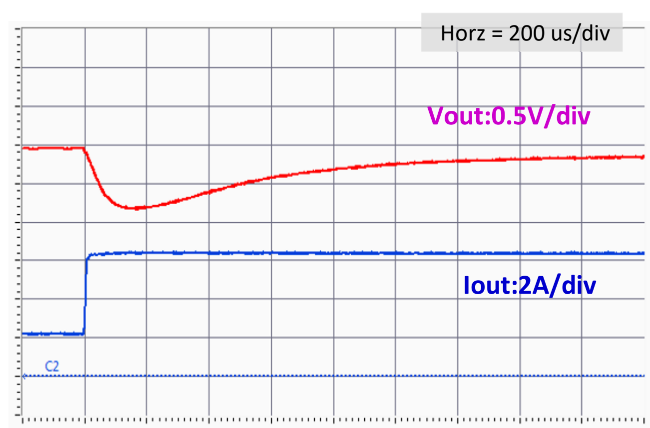
Typical startup characteristic from On/Off at full load; Vin=48V, Vo=12V, Io=10A, Cext=450µF.



Typical startup characteristic from Vin at full load; Vin=48V, Vo=12V, Cext=450µF.

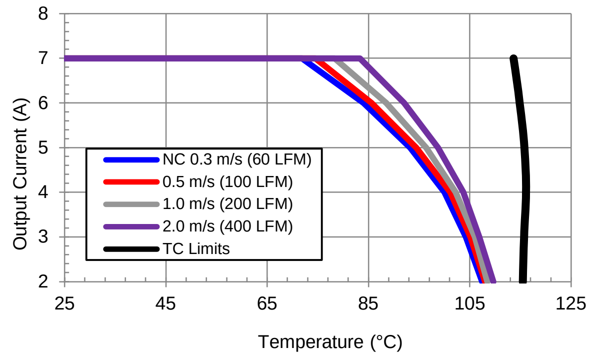


Typical Load transient response with step-up mode; Load Step from 50% (5A) and 25% (2.5A) with Slew rate of 0.1A/µs; Vin=18V, Vo=12V Cext = 450µF.

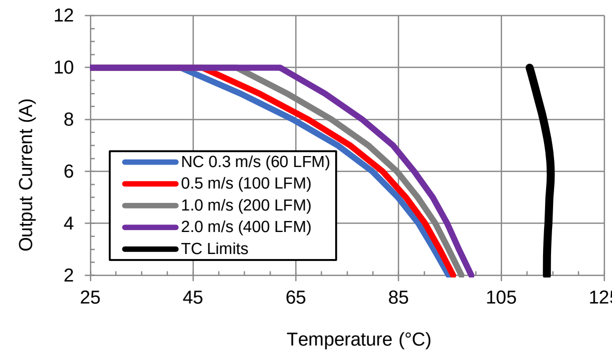


Typical Load transient response with step-up mode; Load Step from 25% (2.1A) and 75% (6.3A) with Slew rate of 1.0A/µs; Vin=48V, Vo=24V Cext = 450µF.

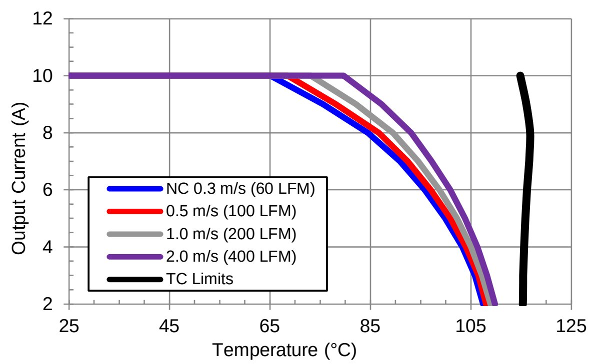
Thermal Performance: i1C4W010A120V-xxx-R



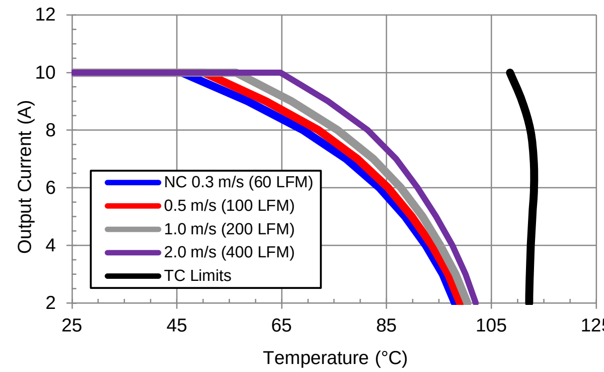
Vin=18V, Vo=24V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 4 to pin 6.



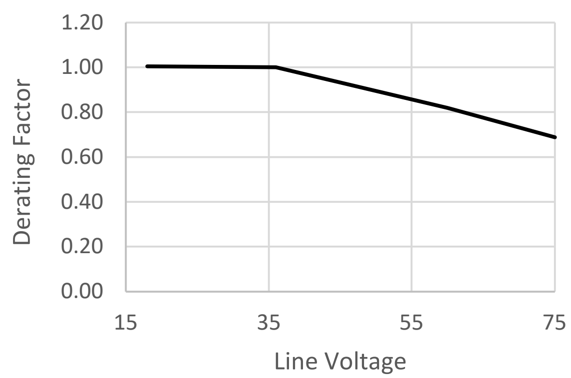
Vin=48V, Vo=24V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 4 to pin 6.



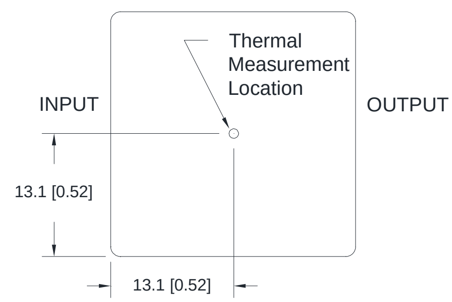
Vin=24V, Vo=12V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 4 to pin 6.



Vin=48V, Vo=12V maximum output current vs. ambient temperature for natural convection (60 LFM) to 2m/s (400 LFM) with airflow from pin 4 to pin 6.



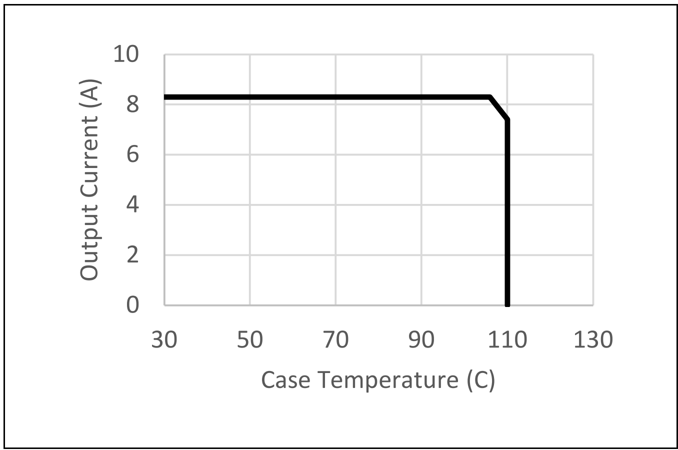
Typical output current derating versus line voltage in 65 °C ambient with airflow 1m/s (200 LFM)



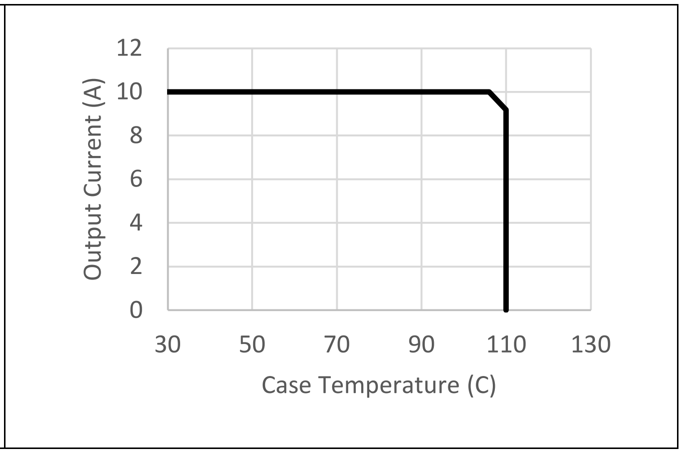
The thermal curves provided are based on measurements made in TDK Lambda's test setup that is described in the Thermal Management section. Due to the large number of variables in system design and the extremely wide operating range of the module. TDK Lambda recommends that the user verify the module's thermal performance in the end application. The critical component should be thermocoupled, monitored and should not exceed the temperature limit specified in the derating curve above. It is critical that the thermocouple be mounted in a manner that gives direct thermal contact or significant measurement errors may result. TDK Lambda can provide modules with a thermocouple pre-mounted to the critical component for system verification tests.

Thermal Performance:

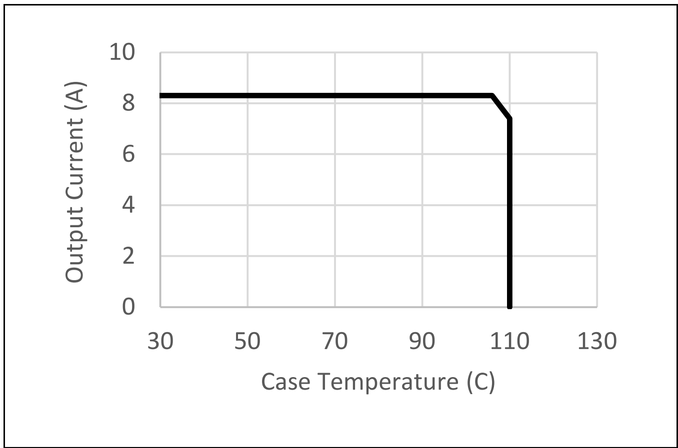
i1C4W010A120V-xxx-R



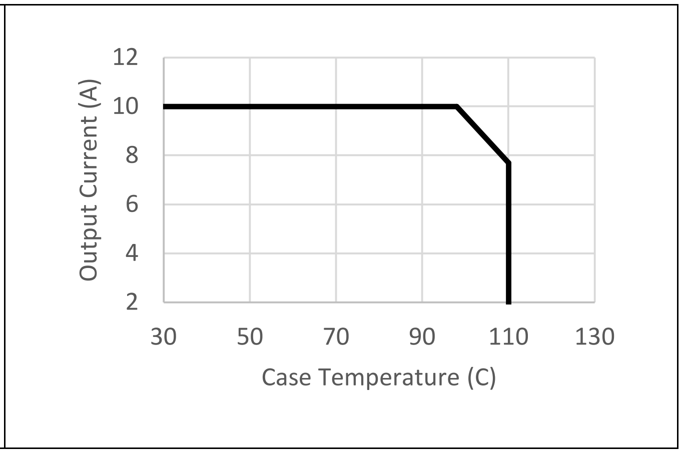
Vin=24V, Vo=24V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=24V, Vo=12V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=48V, Vo=24V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.



Vin=48V, Vo=12V maximum output current vs. baseplate temperature in enclosed environment with Ta = 85 °C.

Thermal Management:

An important part of the overall system design process is thermal management; thermal design must be considered at all levels to ensure good reliability and lifetime of the final system. Superior thermal design and the ability to operate in severe application environments are key elements of a robust, reliable power module.

A finite amount of heat must be dissipated from the power module to the surrounding environment. This heat is transferred by the three modes of heat transfer: convection, conduction and radiation. While all three modes of heat transfer are present in every application, convection is the dominant mode of heat transfer in most applications. However, to ensure adequate cooling and proper operation, all three modes should be considered in a final system configuration.

The open frame design of the power module provides an air path to individual components. This air path improves convection cooling to the surrounding environment, which reduces areas of heat concentration and resulting hot spots.

Test Setup:

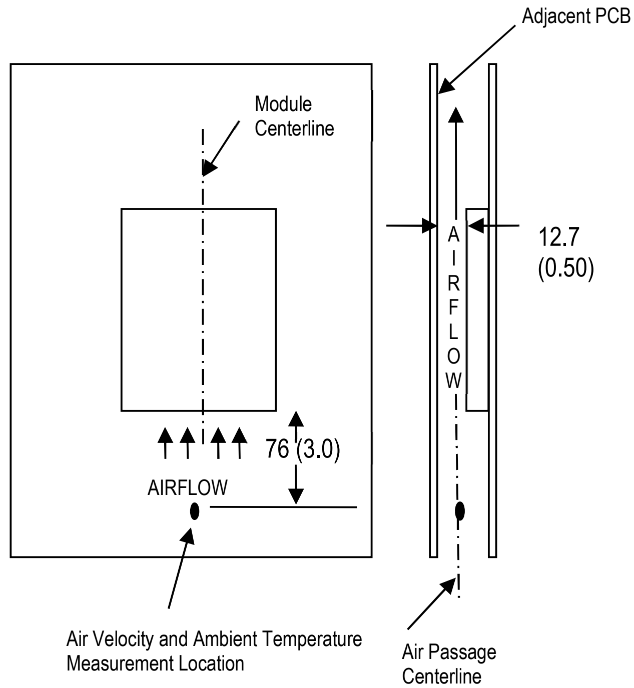
The thermal performance data of the power module is based upon measurements obtained from a wind tunnel test with the setup shown in the wind tunnel figure. This thermal test setup replicates the typical thermal environments encountered in most modern electronic systems with distributed power architectures. The electronic equipment in networking, telecom, wireless, and advanced computer systems operate in similar environments and utilizes vertically mounted PCBs or circuit cards in cabinet racks.

The power module, as shown in the figure, is mounted on a printed circuit board (PCB) and is vertically oriented within the wind tunnel. The cross section of the airflow passage is rectangular. The spacing between the top of the module and a parallel facing PCB is kept at a constant (0.5 in). The power module's orientation with respect to the airflow direction can have a significant impact on the module's thermal performance.

Thermal De-rating:

For proper application of the power module in a given thermal environment, output current de-rating curves are provided as a design guideline on the Thermal Performance section for the power module of interest. The module temperature should be measured in the final system configuration to ensure proper thermal management of the power module. For thermal performance verification, the module temperature should be measured at the component indicated in the thermal measurement location figure on the thermal performance page for the power module of interest.

In all conditions, the power module should be operated below the maximum operating temperature shown on the de-rating curve. For improved design margins and enhanced system reliability, the power module may be operated at temperatures below the maximum rated operating temperature.



Wind Tunnel Test Setup Figure
(Dimensions are in millimeters and (inches)

Heat transfer by convection can be enhanced by increasing the airflow rate that the power module experiences. The maximum output current of the power module is a function of ambient temperature (Ta) and airflow rate as shown in the thermal performance figures on the thermal performance page for the power module of interest. The curves in the figures are shown for natural convection through 2 m/s (400 ft/min). The data for the natural convection condition has been collected at 0.3 m/s (60 ft/min) of airflow, which is the typical airflow generated by other heat dissipating components in many of the systems that these types of modules are used in. In the final system configurations, the airflow rate for the natural convection condition can vary due to temperature gradients from other heat dissipating components.

Operating Information:

Over-Current Protection:

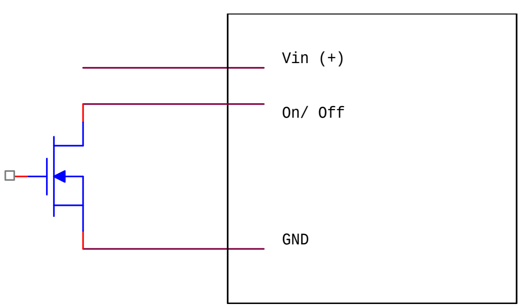
The power modules have output overload protection to protect the module during severe overload conditions. During overload conditions, the power modules may protect themselves by reducing output voltage to limit power or by entering a hiccup current limit mode. The modules will operate normally once the output current returns to the specified operating range. Long term operation outside the rated conditions is not recommended unless measures are taken to ensure the module's thermal limits are being observed.

Remote On/Off:

The power modules have an internal Remote On/Off circuit. The user must supply a compatible switch between the GND pin and the On/Off pin. The maximum voltage generated by the power module at the On/Off terminal is 15V. The maximum allowable leakage current of the switch is 10 μA. The switch must be capable of maintaining a low signal Von/off < 0.25V while sinking 1mA. A voltage source should not be applied to the On/Off terminal.

The standard Remote On/Off is negative logic. In the circuit configuration shown the power module will turn on if the external switch is on and it will be off if the external switch is off. If the negative logic feature is not being used, terminal 3 should be connected to ground.

An optional positive logic On/Off logic is available. In the circuit configuration shown the power module will turn off if the external switch is on and it will be on if the switch is off and the On/Off pin is open. If the positive logic feature is not being used, terminal 3 should be left open.

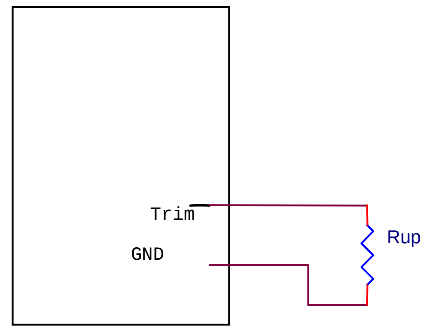


On/Off Circuit for Positive or Negative Logic

Output Voltage Adjustment:

The output voltage of the power module may be adjusted up by using an external resistor connected to the Vout trim terminal.

Care should be taken to avoid injecting noise into the power module's trim pin.



Circuit to Increase Output Voltage

With a resistor between the trim and GND terminals, the output voltage is adjusted up. To adjust the output voltage from Vo,nom to Vo,up the trim resistor should be chosen according to the following equation:

$$\text{Rup} = \left(\frac{\text{F}}{\text{Vo, up} - \text{Vo, nom}}\right) - \text{G}$$

The values of Vo,nom, G, and F are found in the electrical data section for the power module of interest. The maximum power available from the power module is fixed. As the output voltage is trimmed up, the maximum output current must be decreased to maintain the maximum rated power of the module.

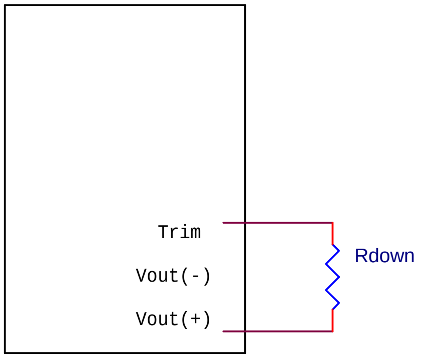
Example : i1C2W010A120V to be trimmed up to 12Vout

Given:

F = 30100
G = 1620
Vo,nom = 12 *(from Electrical Characteristic table)*
Vo,up = 18 *(desired output voltage)*

Then,

$$\text{Rup} = \left(\frac{30100}{18 - 12}\right) - 1620 = 3397\ \Omega$$



Circuit to decrease output voltage

With a resistor between the trim and Vout (+) terminals, the output voltage is adjusted down. To adjust the output voltage from Vo,nom to Vo,down the trim resistor should be chosen according to the following equation:

$$\text{Rdown} = \left(\frac{\text{Vo, down} - \text{Vref}}{\text{Vo, nom} - \text{Vo, down}} \times \text{F}\right) - \text{G}$$

The values of Vref, F, and G are found in the electrical data section for the power module of interest. The current limit set point does not increase as the module is trimmed down, so the available output power is reduced.

Example : i1C2W010A120V to be trimmed down to 9.6Vout

Given:
F = 30100
G = 1620
Vref = 1
Vo,nom = 12 *(from Electrical Characteristic table)*
Vo,down = 9.6 *(desired output voltage)*

Then,

$$\text{Rdown} = \left(\frac{9.6 - 1}{12 - 9.6}\right) * 30100 - 1620 = 106238\,\Omega$$

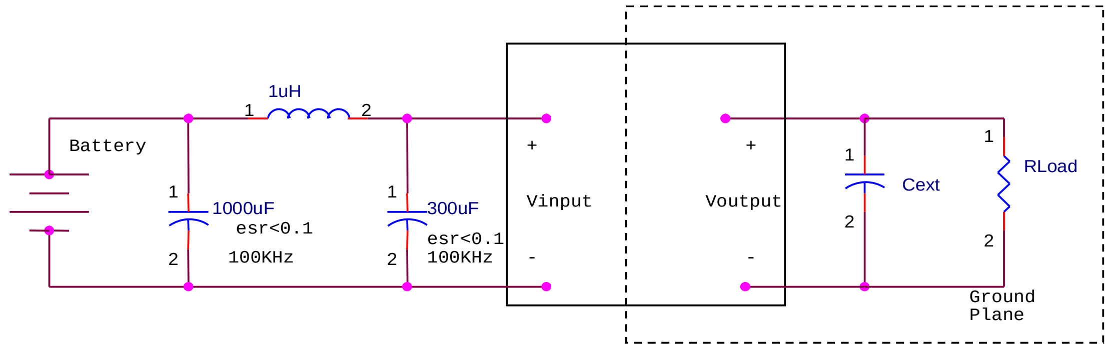
Trim UP Table for i1C (2W and 4W) 010A120V

Vout	Rup (Ohm)
12	OPEN
15	8413
18	3397
24	888
28	261

Trim DOWN Table for i1C (2W and 4W) 010A120V

Vout	Rdown (Ohm)
9.6	107K
10.8	244K
12.0	OPEN

Input / Output Ripple and Noise Measurements:



The input reflected ripple is measured with a current probe and oscilloscope. The ripple current is the current through the 1uH inductor.

The output ripple measurement is made approximately 9 cm (3.5 in.) from the power module using an oscilloscope and BNC socket. The capacitor Cext is located about 5 cm (2 in.) from the power module; its value varies from code to code and is found on the electrical data page for the power module of interest under the ripple & noise voltage specification in the Notes & Conditions column.

EMC Considerations:

TDK-Lambda power modules are designed for use in a wide variety of systems and applications. For assistance with designing for EMC compliance, please contact TDK-Lambda technical support.

Input Impedance:

The source impedance of the power feeding the DC/DC converter module will interact with the DC/DC converter. To minimize the interaction, low-ESR capacitors should be located at the input to the module. It is recommended that a 220µF-330µF input capacitor be placed near the module.

Reliability:

The power modules are designed using TDK Lambda's stringent design guidelines for component derating, product qualification, and design reviews. The MTBF is calculated to be greater than 23 million hours at full output power and Ta = 40˚C using the Telcordia SR-332 calculation method.

Quality:

TDK Lambda's product development process incorporates advanced quality planning tools such as FMEA and Cpk analysis to ensure designs are robust and reliable. All products are assembled at ISO certified assembly plants.

Safety Considerations:

As of the publishing date, certain safety agency approvals may have been received on the i1C series and others may still be pending. Check with TDK-Lambda for the latest status of safety approvals on the i1C product line.

For safety agency approval of the system in which the DC-DC power module is installed, the power module must be installed in compliance with the creepage and clearance requirements of the safety agency.

To preserve maximum flexibility, the power modules are not internally fused. An external input line fast blow fuse with a maximum value of 25A is required. A lower value fuse can be selected based upon the maximum dc input current and maximum inrush energy of the power module.

Warranty:

TDK Lambda's comprehensive line of power solutions includes efficient, high-density DC-DC converters. TDK Lambda offers a three-year limited warranty. Complete warranty information is listed on our web site or is available upon request from TDK-Lambda.

TDK-Lambda France SAS
Tel: +33 1 60 12 71 65
tlf.fr.powersolutions@tdk.com
www.emea.lambda.tdk.com/fr

Italy Sales Office
Tel: +39 02 61 29 38 63
tlf.it.powersolutions@tdk.com
www.emea.lambda.tdk.com/it

Netherlands
tlf.nl.powersolutions@tdk.com
www.emea.lambda.tdk.com/nl

TDK-Lambda Germany GmbH
Tel: +49 7841 666 0
tlg.powersolutions@tdk.com
www.emea.lambda.tdk.com/de

Austria Sales Office
Tel: +43 2256 655 84
tlg.at.powersolutions@tdk.com
www.emea.lambda.tdk.com/at

Switzerland Sales Office
Tel: +41 44 850 53 53
tlg.ch.powersolutions@tdk.com
www.emea.lambda.tdk.com/ch

Nordic Sales Office
Tel: +45 8853 8086
tlg.dk.powersolutions@tdk.com
www.emea.lambda.tdk.com/dk

TDK-Lambda UK Ltd.
Tel: +44 (0) 12 71 85 66 66
tlu.powersolutions@tdk.com
www.emea.lambda.tdk.com/uk

TDK-Lambda Ltd.
Tel: +9 723 902 4333
tli.powersolutions@tdk.com
www.emea.lambda.tdk.com/il-en

TDK-Lambda Americas
Tel: +1 800-LAMBDA-4 or 1-800-526-2324
tla.powersolutions@tdk.com
www.us.lambda.tdk.com

TDK Electronics do Brasil Ltda
Tel: +55 11 3289-9599
sales.br@tdk-electronics.tdk.com
www.tdk-electronics.tdk.com/en

TDK-Lambda Corporation
Tel: +81-3-6778-1113
www.jp.lambda.tdk.com

TDK-Lambda (China) Electronics Co. Ltd.
Tel: +86 21 6485-0777
tlc.powersolutions@tdk.com
www.lambda.tdk.com.cn

TDK-Lambda Singapore Pte Ltd.
Tel: +65 6251 7211
tls.marketing@tdk.com
www.sg.lambda.tdk.com

TDK India Private Limited, Power Supply Division
Tel: +91 80 4039-0660
mathew.philip@tdk.com
www.sg.lambda.tdk.com

For Additional Information, please visit
https://product.tdk.com/en/power/