

## CAR0424FP front-end

**Input: 90V<sub>ac</sub> to 264V<sub>ac</sub>; Output: 24V<sub>dc</sub> @ 400W; 5V<sub>dc</sub> @ 1A Standby**

RoHS Compliant



### Applications

- 24V<sub>dc</sub> distributed power architectures

### Features

- Efficiency: exceeds 80plus “Gold” criteria
- Universal input with PFC
- No power de-rating at low range input
- ON/OFF control of the 24V<sub>dc</sub> output
- Remote sense on the 24V<sub>dc</sub> output
- No minimum load requirements
- 5V<sub>dc</sub> @ 1A Standby
- Auto recoverable OC & OT protection
- Operating temperature: 0 - 70°C (de-rated above 50°C)
- Provisions for securing the power supply from either side or the bottom

### Description

The CAR0424FP Front-End provides highly efficient isolated power from worldwide input mains in a compact form factor. This power supply is ideal for applications where mid to light load efficiency is of key importance in order to reduce system power consumption during ‘typical’ operational conditions.

- Routers/ VoIP/Soft and other Telecom Switches
- Mid to high-end Servers, ATE Equipment
- Forced air cooling
- EN62368-1 2006 +A1,2011
- UL62368-1, 2007
- IEC62368-1, 2005 +A1:2009 +A2:2013
- CE mark<sup>§</sup>
- CB certificate available
- Meets FCC part 15, EN55032 Class B standards
- Meets EN61000 immunity and transient standards
- Shock & vibration: Meets IPC 9592 Class II standards
- Compliant to RoHS Directive 2011/65/EU and amended Directive (EU) 2015/863.
- Compliant to REACH Directive (EC) No 1907/2006

#### 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.

§ Intended for integration into end-user equipment. All the required procedures for CE marking of end-user equipment should be followed. (The CE mark is placed on selected products.)

\*\* 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	Symbol	Min	Max	Unit
Input Voltage: Continuous	$V_{IN}$	0	264	$V_{AC}$
Operating Ambient Temperature	$T_A$	0	70 <sup>1</sup>	°C
Storage Temperature	$T_{stg}$	-40	85	°C
I/O Isolation voltage to Frame (100% factory Hi-Pot tested)			2121	$V_{DC}$

<sup>1</sup> See accompanying power derating table

### Electrical Specifications

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

INPUT					
Parameter	Symbol	Min	Typ	Max	Unit
Operational Range	$V_{IN}$	90	115/230	264	$V_{AC}$
Frequency Range (ETSI 300-132-1 recommendation)	$F_{IN}$	47	50/60	63	Hz
Main Output Turn OFF	$V_{IN}$	70		80	$V_{AC}$
Main Output Turn ON		75		85	
Hysteresis between turn OFF and turn ON		5			
Maximum Input Current ( $V_O = V_{O, set}$ , $I_O = I_{O, max}$ )	$I_{IN}$			4.6	$A_{AC}$
$V_{IN} = 100V_{AC}$				2.2	
$V_{IN} = 208V_{AC}$					
Cold Start Inrush Current (Excluding x-caps, 25°C, <10ms, per ETSI 300-132)	$I_{IN}$			37	$A_{PEAK}$
Efficiency ( $T_{amb} = 25^\circ C$ , $V_O = 24V$ )	$V_{IN}$		115V / 230V		%
100% load		$\eta$		88 / 91	
Holdup time ( $V_{OUT} \geq 23.52V_{DC}$ , $T_{AMB} 25^\circ C$ , $I_O = I_{O, max}$ )	$T$		20		ms
$V_{in} = 230V_{AC}$					
Leakage Current ( $V_{IN} = 250V_{AC}$ , $F_{IN} = 60Hz$ )	$I_{IN}$			3.5	$mA_{RMS}$
Isolation Input/Output		3000			$V_{AC}$
Input/Frame		2121			$V_{DC}$
Output/Frame		100			$V_{DC}$

24Vdc MAIN OUTPUT							
Parameter	Symbol	Min	Typ	Max	Unit		
Output Power	W	0	-	400 <sup>2</sup>	W		
fan cooled							
convection cooled				300			
Factory Set default set point (full load, 115 $V_{AC}$ , 25°C)	$V_O$	23.95	24.00	24.05	$V_{DC}$		
Overall regulation (Line, load, temperature)		-2		+2	%		
Ripple and noise <sup>3</sup>					120	$mV_{P-P}$	
Turn-ON overshoot					+3.5	%	
Turn-ON delay					2	sec	
ON/OFF delay time					40	ms	
Turn-ON rise time (10 – 90% of $V_{OUT}$ )					500	ms	

<sup>2</sup>450W for 1 minute, 10% duty cycle max

<sup>3</sup>Measured across a 10 $\mu$ f tantalum and a 0.1 $\mu$ f ceramic capacitors in parallel. 20MHz bandwidth

## Technical Specifications (continued)

### Electrical Specifications (continued)

<b>24V<sub>dc</sub> MAIN OUTPUT (continued)</b>					
Parameter	Symbol	Min	Typ	Max	Unit
Transient response 50% step [10%-60%, 50% - 100%] (dI/dt – 1A/μs, recovery 500μs)	V <sub>o</sub>	-3.5		+3.5	%V <sub>o</sub>
Maximum voltage drop of remote sense				0.25	V <sub>DC</sub>
Overshoot protection, latched (recovery by cycling OFF/ON via hardware)		25.5		27.5	V <sub>DC</sub>
Output current	I <sub>o</sub>	0		16.7	A <sub>DC</sub>
Current limit			19		A <sub>DC</sub>

<b>STANDBY OUTPUT</b>					
Parameter	Symbol	Min	Typ	Max	Unit
Set point	V <sub>o</sub>		5.0		V <sub>DC</sub>
Overall regulation (load, temperature, aging)	V <sub>o</sub>	-5		+5	%
Ripple and noise				50	mV <sub>P-P</sub>
Output current	I <sub>o</sub>	0		1	A <sub>DC</sub>
Overload protection -		110		150	% of FL

### General Specifications

Parameter	Min	Typ	Max	Units	Notes
Calculated Reliability, 25°C Demonstrated Reliability		125,000 250,000		Hrs	Full load, ; MTBF per TR-NWT-000332 method I, case III,
Service Life		10		Yrs	Full load, excluding fans
Weight					

### Feature Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. See Control and Status for additional information. (I<sub>H</sub> < 20μA, I<sub>L</sub> < 4mA).

Parameter	Symbol	Min	Typ	Max	Unit
<b>ON/OFF</b> (pulled up internally to V <sub>stdby</sub> by a 10kΩ resistor)					
Logic High (24V <sub>DC</sub> OFF)	V <sub>IH</sub>	0.7V <sub>DD</sub>	-	V <sub>stdby</sub>	V <sub>DC</sub>
Logic Low (24V <sub>DC</sub> ON)	V <sub>IL</sub>	0	-	0.8	V <sub>DC</sub>
<b>Interlock</b> [short pin controlling presence of the 24V <sub>DC</sub> output] (pulled up internally to V <sub>stdby</sub> by a 10kΩ resistor)					
24V output ON	V <sub>I</sub>	0.7 V <sub>stdby</sub>	-	V <sub>stdby</sub>	V <sub>DC</sub>
24V output OFF	V <sub>I</sub>	0	-	0.4	V <sub>DC</sub>
<b>Power-OK</b> (pulled up internally to V <sub>stdby</sub> by a 10kΩ resistor)					
Logic High (Output voltage is present)	V <sub>OH</sub>	0.7 V <sub>stdby</sub>	-	V <sub>stdby</sub>	V <sub>DC</sub>
Logic Low (Output voltage is not present) (Output transitions LO 4ms before 24V drops below regulation)	V <sub>OL</sub>	0	-	0.4	V <sub>DC</sub>
<b>DC-OK</b> (pulled up internally to V <sub>stdby</sub> by a 10kΩ resistor)					
Logic High (24V <sub>DC</sub> Output is > 92% of nominal)	V <sub>OH</sub>	0.7 V <sub>stdby</sub>	-	V <sub>stdby</sub>	V <sub>DC</sub>
Logic Low (Input out of range)	V <sub>OL</sub>	0	-	0.4	V <sub>DC</sub>

## Technical Specifications (continued)

### Environmental Specifications

Parameter	Min	Typ	Max	Units	Notes
Ambient Temperature, fan cooled	0		50	°C	
Storage Temperature	-30		60	°C	
Operating Altitude	-152/500		3k/10k	m/ft	
Non-operating Altitude	-152/500		12k/40k	m / ft	
Power Derating with			2.5	%/°C	50°C to 70°C
Power Derating with Altitude			2.0	C/301m C/1k ft	Above 1524 m/5000 ft
Acoustic noise		45		dbA	A distance of 1m @ 30°C, linearly increases to < 50dbA @ 50°C.
Humidity					
Operating	30		95	%	Relative humidity, non-condensing
Storage	10		95		
Shock and Vibration	Meet IPC 9592 Class II, Section 5 requirements				

### EMC Compliance

Parameter	Function	Standard	Level	Criteria	Test
AC input	Conducted	EN55032, FCC part 15,	B		0.15 – 30MHz
	Radiated	EN55032, FCC part 15, CISPR22	B <sup>5</sup>		30 – 10000MHz
	Conducted	EN61000-3-2		Compliant	
	Flicker	EN61000-3-3		Compliant	
AC input immunity	Voltage dips	EN61000-4-11		A	-30%, 10ms
				B	-60%, 100ms
				B	-100%, 5sec
	Voltage surge	EN61000-4-5		A	3.4kV, 1.2/50µs, common mode
			A	2.4kV, 1.2/50µs, differential mode	
Fast transients	EN61000-4-4		B	5/50ns, 2kV (common mode)	
Enclosure immunity	Conducted RF	EN61000-4-6		A	130dBµV, 0.15-80MHz, 80% AM
	Radiated RF fields	EN61000-4-3		A	10V/m, 80-1000MHz, 80% AM
	ESD	EN61000-4-2		B	4kV contact, 8kV air

<sup>4</sup> Radiated emissions compliance is contingent upon the final system configuration.

<sup>5</sup> Schaffner FN9222-15 external filter or equivalent may be used

Criteria	Performance
A	No performance degradation
B	Temporary loss of function or degradation not requiring manual intervention
C	Temporary loss of function or degradation that may require manual intervention
D	Loss of function with possible permanent damage

## Technical Specifications (continued)

### Characteristic Curves

The following figures provide typical characteristics at 25°C.

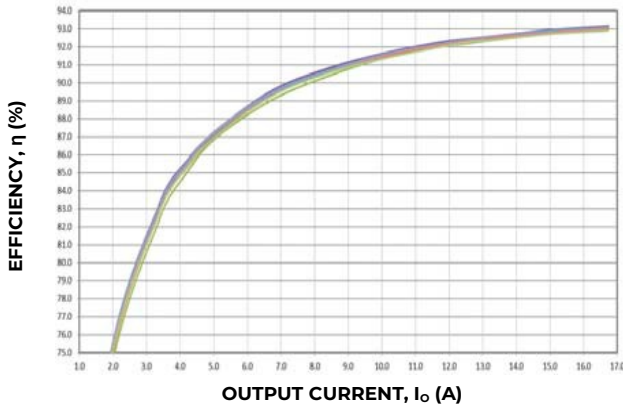


Figure 1. Efficiency  $V_{IN}$ : 230V, Freq: 60Hz.

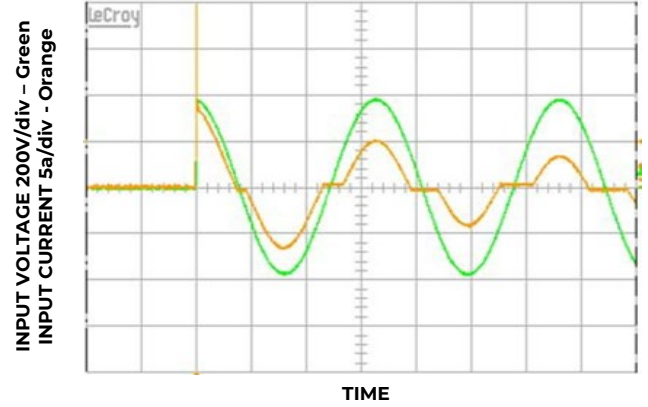


Figure 4. Inrush performance 5ms/div.

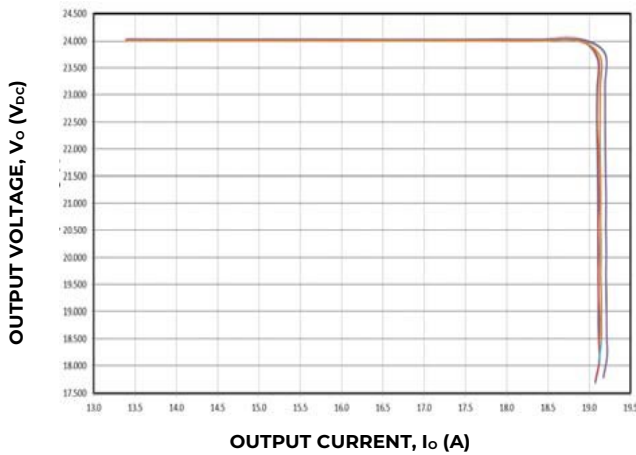


Figure 2. Output current limit profile

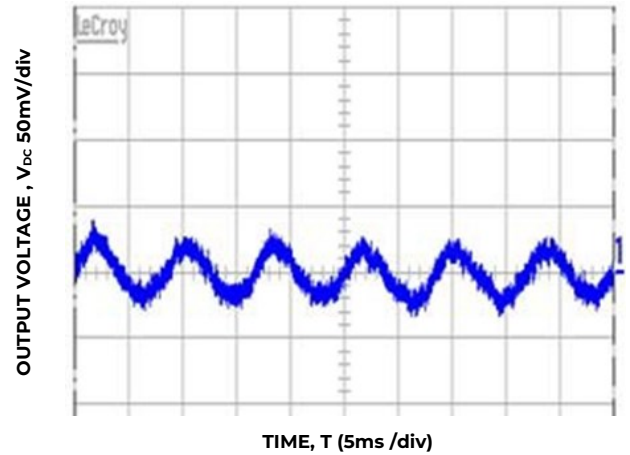


Figure 5. 24V<sub>DC</sub> output PARD, full load,  $V_{IN} = 240V_{AC}$ .

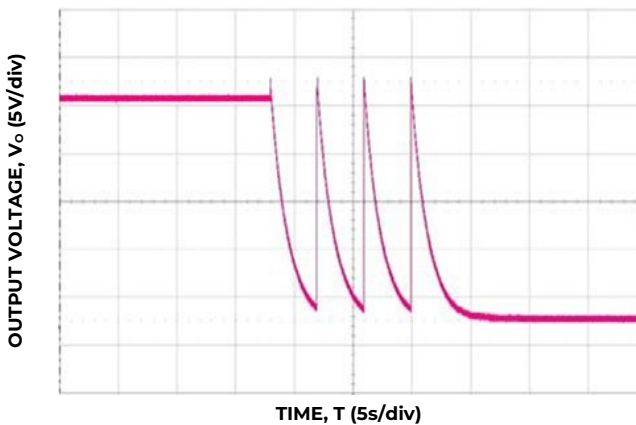


Figure 3. Overvoltage shutdown

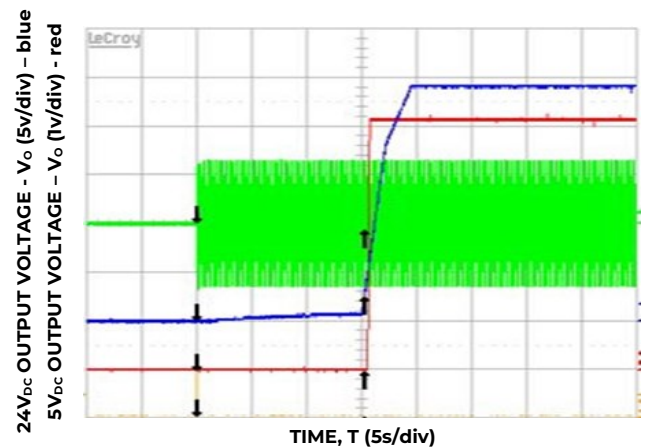


Figure 6. Start up  $V_{IN} 90 V_{AC}$

## Technical Specifications (continued)

### Characteristic Curves

The following figures provide typical characteristics at 25°C.

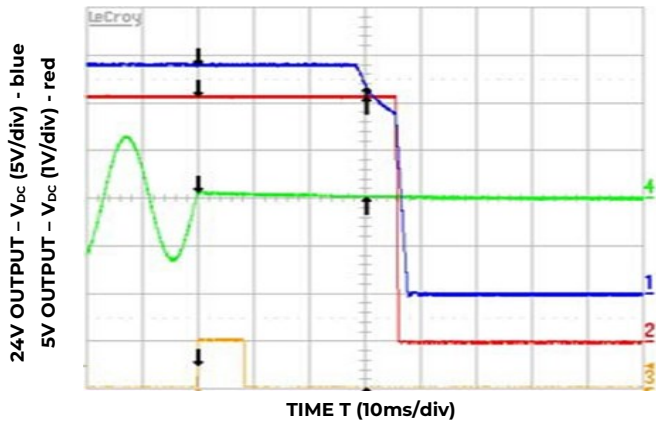


Figure 7. Holdup  $V_{IN} = 90V_{AC}$

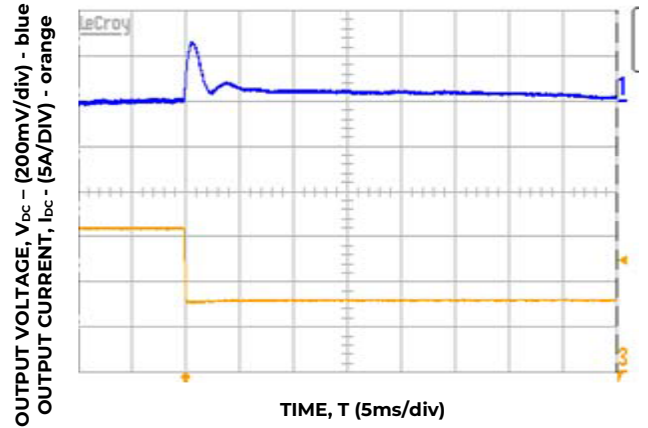


Figure 10. 24V Transient response 50% load step (100 - 50%)

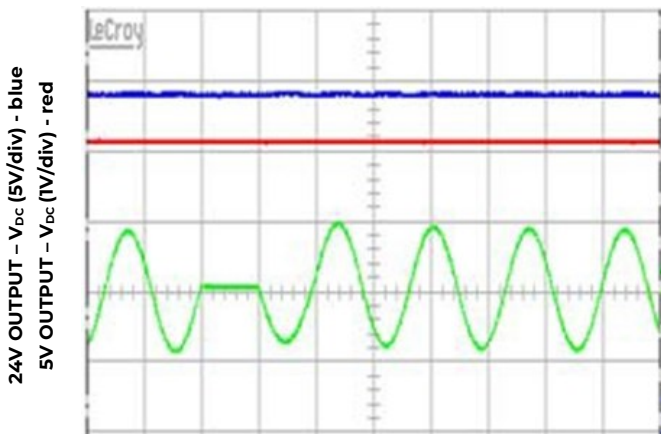


Figure 8.  $\frac{1}{2}$  cycle ride-through  $V_{IN} 140 V_{AC}$

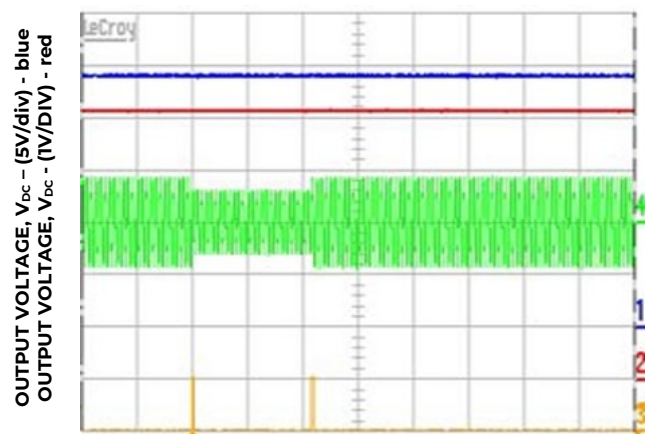


Figure 11. 30% dip ride-through  $V_{IN} 115 V_{AC}$

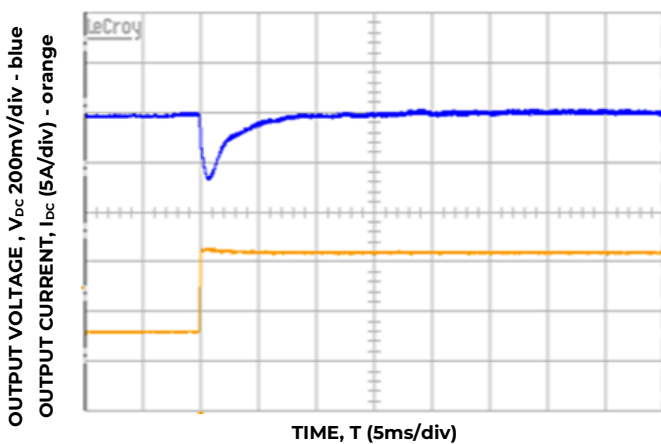


Figure 9. 24V Transient response 50% load step (50 - 100%)

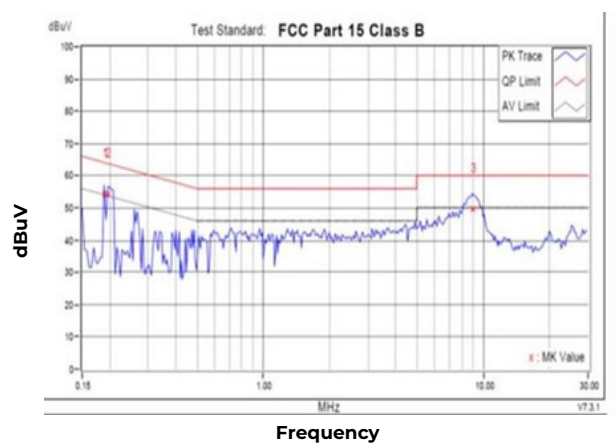
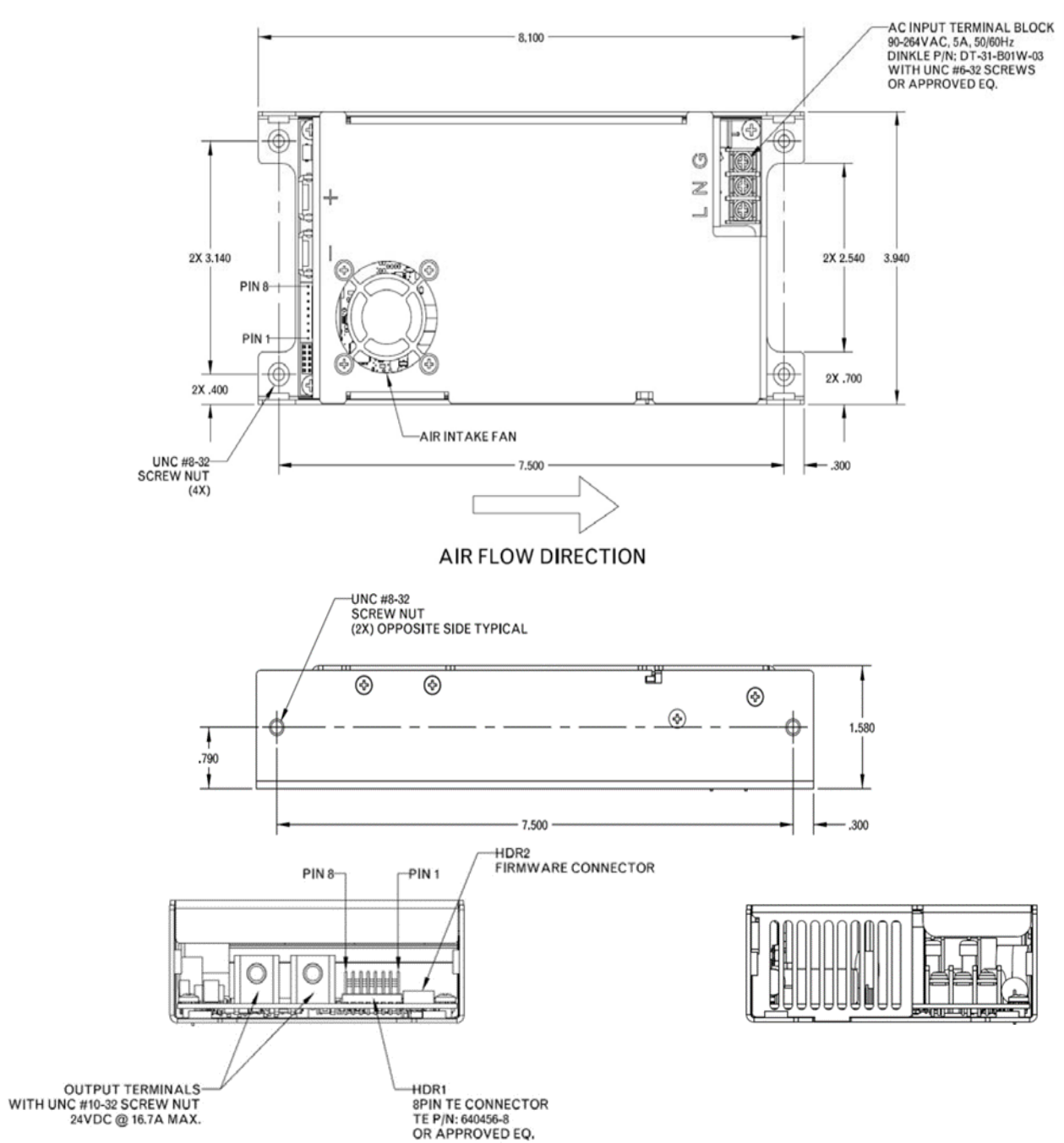


Figure 12. Conducted Emissions

# Technical Specifications (continued)

## Outline Drawing



## Technical Specifications (continued)

### Connector Pin Assignments

<b>Input Connector:</b>	3 position terminal block screw size #6-32
<b>Output Connector:</b>	2 separate bus bars screw size: #10-32
<b>Signal Connector:</b>	8 pin connector TE: 640456-8 Mating connector TE: MTA Series

Pin	Function
1	ON/OFF
2	Inhibit
3	Power- OK
4	DC-OK
5	Signal return
6	+5V <sub>DC</sub>
7	Remote Sense(-)
8	Remote Sense(+)



### Ordering Information

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

PRODUCT	DESCRIPTION
CAR0424FPXXXZ01A	Input: 90V <sub>ac</sub> to 264V <sub>ac</sub> ; Output: 24V <sub>dc</sub> @ 400W; 5V <sub>dc</sub> @ 1A Standby

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## Change History (excludes grammar & clarifications)

Revision	Date	Description of the change
1.2	01/04/2022	Updated as per template and upgraded RoHS standards
1.3	12/18/2023	Updated as per OmniOn template

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