

DESCRIPTION

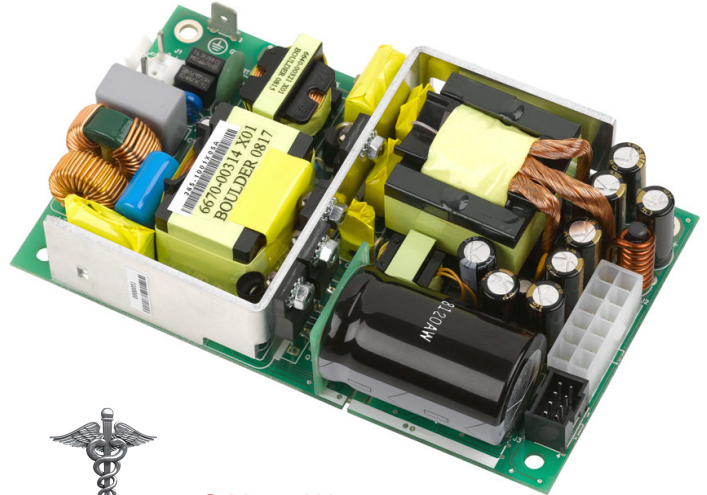
MFA350 is a series of extremely high efficiency, small form factor and single output AC-DC power supplies.

Offering 365 W of regulated DC power from an open frame, industry standard 3" x 5" x 1.28" form factor, the MFA350 series occupies 50% less space in a system. The extremely high power density enable designers to integrate more advanced features into a system without compromising on its size.

By converting energy at >90% efficiency, the MFA350 generates less heat facilitating higher reliability and again space saving designs.

The MFA350 series comply with IEC/EN60601-1 safety and with EN61000-3, EN61000-4 EMC standards.

The series is available in three different high power output voltages at 12V, 24V or 48V and is equipped with an auxiliary low power 12V and 5V stand-by outputs.



2 YEAR WARRANTY

KEY FEATURES

- 365 W active PFC power supply
- Very small form factor (3 x 5 x 1.28) in
- Extremely high efficiency (>90%)
- 12V, 24V and 48V standard output variants
- Universal input voltage range
- Active PFC, EN61000-3-2 compliant
- Low leakage, EN60601-1 compliant
- Over temperature protection
- OV, OC, and short circuit protections
- Stand-by +5 V Output
- Auxiliary fan +12 V output
- Remote enable signal
- DC power good signal
- RoHS-6 compliant (EU directive 2002/95/EC)

TARGET APPLICATIONS

- Medical electronics
- Dental electronics
- Laboratory equipment
- Healthcare diagnostic

MODELS AND OUTPUT SPECIFICATIONS

Model	V1	I1 ¹ Convection	I1 ² Forced air	V1 ³ Ripple	V2	I2 ¹ Convection	I2 ² Forced air	V2 ³ Ripple	5V _{SB}	I5V _{SB} ¹ Convection	I5V _{SB} ² Forced air	5V _{SB} ³ Ripple
MFA350-US12	12 V	16.6 A	30.4 A	120 mV	12 V	0.5 A	1 A	240 mV	5 V	1 A	2 A	50 mV
MFA350-US24	24 V	8.3 A	15.2 A	240 mV	12 V	0.5 A	1 A	240 mV	5 V	1 A	2 A	50 mV
MFA350-US48	48 V	4.16 A	7.6 A	480 mV	12 V	0.5 A	1 A	240 mV	5 V	1 A	2 A	50 mV

¹ The combined output power of V1, V2 and 5V_{SB} must not exceed 200 W for all models when convection cooled.

² The combined output power of V1, V2 and 5V_{SB} must not exceed 365 W for all models at 400 LFM, (the maximum heat sink temperature must remain below +110 °C at +50 °C ambient temperature).

³ Peak-to-Peak measured at 20 MHz Bandwidth.

INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 90 V _{AC} at all load conditions	90	100/240	264	V _{AC}
DC Input Voltage		170	-	370	V _{DC}
Input Frequency		47	-	63	Hz
Input Current	RMS at 180 V _{AC} , maximum load	-	-	2.5	A
	RMS at 90 V _{AC} , maximum load	-	-	5	A
Inrush Current	230 V _{AC} , cold start, no damage	-	-	-	A
Fusing	2X Time Lag 6.3 A, 250 V on L and N	-	-	6.3	A
Efficiency	50% max rated load	90	-	-	%
	20/100% max rated load	88	-	-	%
	Nominal V _{IN} , all versions.	-	-	-	%
+5V_{SB} Consumption	No load, nominal V _{IN}	-	-	1	W
Power Factor	At full rated load, 115 V _{AC} 60 Hz and 230 V _{AC} 50 Hz input voltages	0.9	-	-	
	Complies with EN-61000-3-2				
Harmonic Current	At full rated load, 115 V _{AC} 60 Hz and 230 V _{AC} 50 Hz input voltages				
Leakage Current	120 V _{AC} , 60 Hz, normal condition	-	-	110	μA
	230 V _{AC} , 60 Hz, normal condition	-	-	275	μA

OUTPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V1 Output Voltage	12V	11.4	12	12.6	V
	24V	22.8	24	25.2	V
	48V (1% set point accuracy)	45.6	48	50.4	V
V1 Output Power Rating	All models, convection cooling	-	-	200	W
	All models, forced air cooling (400 LFM)	-	-	365	W
V2 Output Voltage	All models (15% set point accuracy)	10.2	12	13.8	V
V2 Output Current	All models, convection cooling	-	-	0.5	A
	All models, forced air cooling (400 LFM)	-	-	1	A
5V_{SB} Output Voltage	All models (5% set point accuracy)	4.75	5	5.25	V
5V_{SB} Output Current	All models, convection cooling	-	-	1	A
	All models, forced air cooling (400 LFM)	-	-	2	A
V1 Voltage Adjustment Range		±5	-	-	%V1
V1 Load-Line-Cross Regulation	V _{AC} : 90 – 264 V _{RMS} V1 Load: 0 – 30.4 A (12V) 0 – 15.2 A (24V) 0 – 7.6 A (48V) V2 Load: 0 – 1 A 5V _{SB} Load: 0 – 2 A	-	-	±3.0	%V1
V2 Load-Line-Cross Regulation	V _{AC} : 90 – 264 V _{RMS} V1 Load: 0 – 30.4 A (12V) 0 – 15.2 A (24V) 0 – 7.6 A (48V) V2 Load: 0 – 1 A 5V _{SB} Load: 0 – 2 A	-	-	±15	%V2
5V_{SB} Load-Line-Cross regulation	V _{AC} : 90 – 264 V _{RMS} V1 Load: 0 – 30.4 A (12V) 0 – 15.2 A (24V) 0 – 7.6 A (48V) V2 Load: 0 – 1 A 5V _{SB} Load: 0 – 2 A	-	-	±5.1	%5V _{SB}
V1 Line Regulation	V _{AC} : 90 – 264 V _{RMS}	-	-	±0.1	%V1

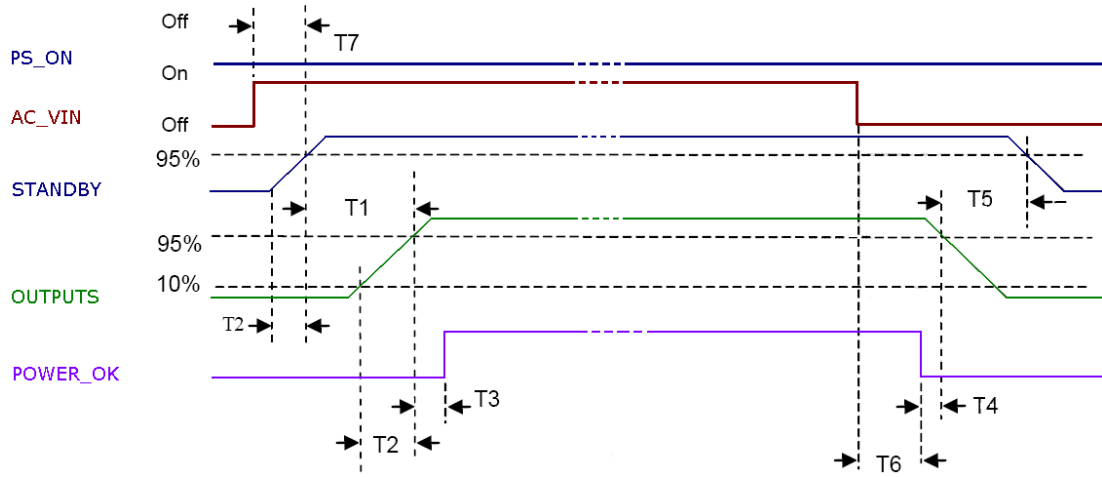
OUTPUT SPECIFICATIONS (CONTINUE)

Transient Response (Voltage Deviation) V1, 5V_{SB}	25% load changes at 1 A/ μ s 12V at 2200 μ F Load / I _{OUT} > 0.5 A 24 V at 1000 μ F Load / I _{OUT} > 0.5 A 48V at 560 μ F Load / I _{OUT} > 0.5 A 5V _{SB} at 560 μ F Load / I _{OUT} > 0.1 A	-	-	\pm 5	%V1 %5V _{SB}
V1 Ripple & Noise	All models, Peak-to-peak, 20 MHz BW. 470 pF ceramic and 22 μ F tantalum caps at the load (resistive).	-	-	1	%V1
Rise Time	At 230 V _{AC} , 60% max rated load	0,2	-	20	ms
Start-up Delay	V1 in regulation after PS_ON is asserted	-	-	350	ms
	V1 in regulation after AC is applied	-	-	900	ms
	5V _{SB} in regulation after AC is applied	-	-	700	ms
Turn-on Overshoot	At 500 mA output current, V1 in regulation within 50 ms.	-	10	-	%V1 %V2 %V _{SB}
Hold-up Time	At nominal V _{IN} , full load, for all outputs	20	-	-	ms
Minimum Load	All models; V1, V2 and 5V _{SB}	0	-	-	A
Temperature Drift		-1.2	-	+1.2	mV/°C

SIGNALS/CONTROLS

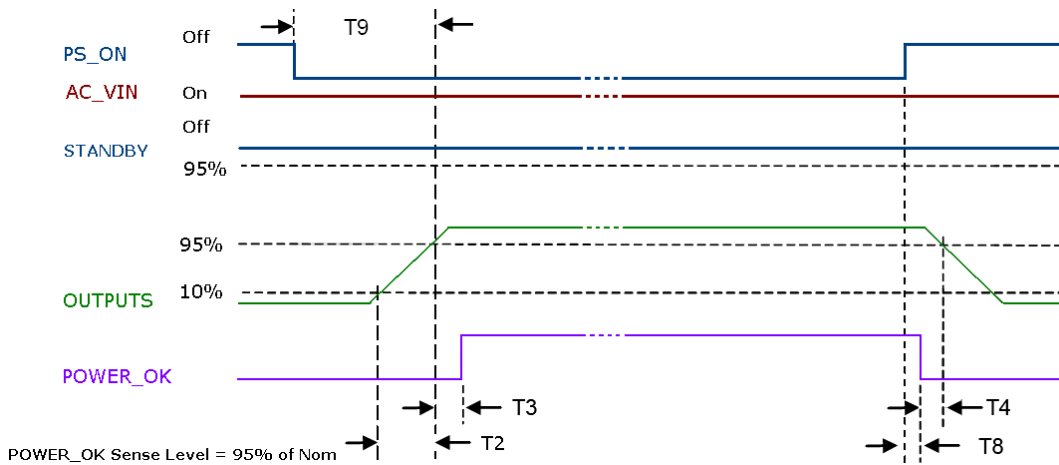
Signal	Notes	Min	Typ	Max	Unit
PS_ON	Active low, +5 V TTL signal compatible. Input low voltage	0	-	2.5	V
	Input high voltage (I _{IN} = 200 μ A)	2.5	-	-	V
	V1 and V2 disabled when PS_ON is open				
	5V _{SB} not affected by PS_ON				
	V1 and V2 enabled with PS_ON connected to RTN				
P_OK	+5 V TTL compatible				
	Logic level low (<10 mA sinking)	-	-	0.4	V
	Logic level high (200 μ A sourcing)	2.4	-	5	V
	Low to high time after V1 in regulation	0.1	-	0.5	s
	Power down warning time	1	-	-	ms
5V_{SB} output	Active and in regulation after a 90<V _{AC} <264 is applied	-	-	700	ms
	5V _{SB} not affected by PS_ON				

SIGNAL TIMINGS



Above waveforms are expected with AC Input ON/OFF:

Standby on - Main outputs on	$1 \text{ ms} \leq T1 \leq 200 \text{ ms}$
Main output Rise Time	$0.2 \text{ ms} \leq T2 \leq 20 \text{ ms}$
Main outputs On - P_OK delay	$100 \text{ ms} \leq T3 \leq 500 \text{ ms}$
Power down warning ¹	$T4 \geq 1 \text{ ms}$ (converter off)
Main Output off - Standby off ²	$T5 \geq 1 \text{ ms}$
Hold-up time (AC off - Main Output off)	$T6 \geq 20 \text{ ms}$ (115/ 230 VAC)
AC_ON - Standby turn on time	$T7 \leq 700 \text{ ms}$



Above waveforms are expected with PS_ON Signal ON/OFF state change:

Main Output Rise Time	$0.2 \text{ ms} \leq T2 \leq 20 \text{ ms}$
Main Outputs on - P_OK delay	$100 \text{ ms} \leq T3 \leq 500 \text{ ms}$
Power down warning ¹	$T4 \leq 1 \text{ ms}$ (converter off)
PS_ON - Main Output (off) Timing	$T8 \leq 60 \text{ ms}$
PS_ON - Main Output (on) Timing	$T9 \leq 350 \text{ ms}$

¹ T4 parameter measurement setup will assume at least 10% of the maximum load on each output.

² T5 parameter measurement setup will assume at least 50% of the maximum load on main output.



PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Under Voltage Lockout	Auto Recovery, Hiccup Mode	60	75	-	V _{AC}
Input Fuse	2X Time Lag 6.3 A, 250 V on L and N	-	-	6.3	A
Over Current	At nominal input voltages, any load, max. 1 minute. Hiccup mode with auto recovery	-	-	150	%I _{1MAX}
Over Voltage	12V 24V 48V 5V _{SB} Maximum voltages under single component failure	13.2 26.4 52 5.5	- - - -	15 30 60 6.8	V
Short Circuit	Hiccup mode with auto recovery				
Over Temperature	Hiccup mode with auto recovery				
Isolation Input-Output		4000	-	-	V _{AC}
Isolation Input-Ground		1500	-	-	V _{AC}
Isolation V1/V2		100	-	-	V _{DC}
Isolation Output/Ground		500	-	-	V _{AC}

ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature Range	No de-rating up to 50°C	-20	-	50	°C
De-rated Operating Temperature Range	Linearly de-rate from full load at 50 °C to half load at 70 °C	-	-	70	°C
Storage Temperature Range		-40	-	85	°C
Humidity	RH, Non-condensing Operating Non-operating	-	-	90 95	% %
Operating Altitude		-	-	3000	m
Shock	Operating: Half-sine 11ms, 2 shock on each axis Non-operating: Half-sine 2ms, 2 shock on each axis	-	-	10 140	g g
Vibration	Operating: 5-500Hz, 3 axis	-	-	2	g
MTBF	75% Full Load, Nominal V _{AC} , 35 °C MIL-HDBK-217-E-1	250000	-	-	Hours
Cooling	Convection Forced air	10 -	- -	- 400	LFM

ELECTROMAGNETIC COMPATIBILITY (EMC) - EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	115 V _{RMS} , 230 V _{RMS} . Maximum load. 4 dB minimum margin	EN 55022	A
Radiated	At 10 m distance	EN 55022	A
Line Voltage Fluctuation and Flicker	At 20%, 50% and 100% maximum load. Nominal input voltages.	EN 61000-3-3	
Harmonic Current Emission	Nominal input voltages. All load conditions.	EN 61000-3-2	A

ELECTROMAGNETIC COMPATIBILITY (EMC) - IMMUNITY

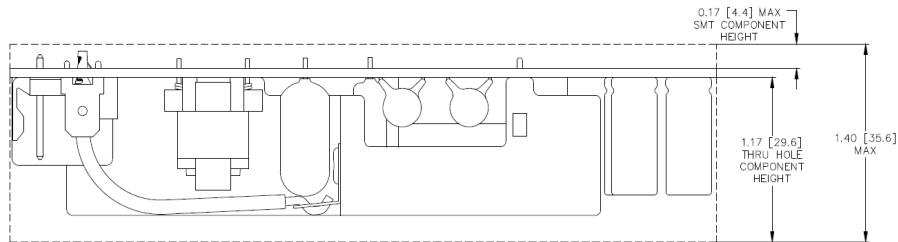
Phenomenon	Conditions / Notes	Standard	Test Level	Performance criteria
ESD	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
Radiated Field	3 V/m, 80-1000 MHz, 1 KHz/2 Hz 80% AM. Dwell time is 3 sec for 2 Hz modulation Dwell time is 1 sec for 1KHz modulation	EN 61000-4-3	3	A
Electric Fast Transient Surge	±2 kV on AC power port for 1 minute; ±1 kV on signal/control lines	EN 61000-4-4	3	A
Surge	± 1 line to line; ± 2 kV line to earth on AC power port; ±0.5 kV for outdoor cables	EN 61000-4-5	3	A
Conducted RF Immunity	3 V _{RMS} , 0,15-80 MHz, 1 KHz/2 Hz 80% AM	EN 61000-4-6	3	A
Dips and Interruptions	Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 5% for 10 ms Interrupts > 95% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11		B B B C

SAFETY AGENCIES APPROVAL

Certification Body	Safety Standards and file numbers	Category
CSA/UL	CSAC22.2 No. 60601-1	MED
IEC IECEE	IEC EN 60601-1	MED
CB Certification	IEC EN 61558-2-16 (12 V _{DC} version only)	SMPS
CE	LVD 73/23/EEC	

MECHANICAL SPECIFICATION

Connector	Manufacturer and Part Number
Input Connector J1	Molex 26-60-4030 or equivalent
J1 Mating Connector	Molex 09-91-0300 (Crimp Terminal Housing) Molex 08-50-0105 (Crimp Terminal, 18-24 AWG)
Ground Connector GND	Molex 19705-4301 or equivalent
Ground Mating Connector	Molex 0190030001 or equivalent
Output Connector J2	Molex 39-28-1123 or equivalent
J2 Mating Connector	Molex 39-01-2120 (Crimp Terminal Housing) Molex 39-00-0039 (Crimp Terminal, 18-24 AWG)
Output Connector J3	Molex 90130-1108 or equivalent
J3 Mating Connector	Molex 90142-0008 (Crimp Terminal Housing) Molex 90119-0109 (Crimp Terminal, 22-24 AWG)



Input Connector J1

Pin	Function
1	AC Live
2	AC Neutral

Input Ground connector GND

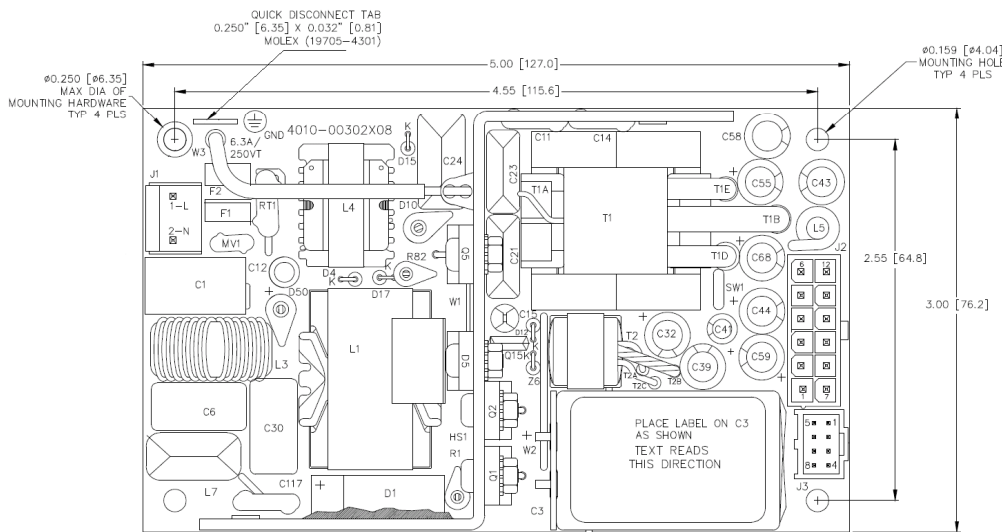
GND	AC Ground
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Output Connector J2

Pin	Function
1	V1
2	V1
3	V1
4	V1
5	V1
6	V1
7	DC Return
8	DC Return
9	DC Return
10	DC Return
11	DC Return
12	DC Return

Output Connector J3

Pin	Function
1	+5V _{SB}
2	-V2
3	RS+
4	+V2
5	POK
6	PS ON
7	RS-
8	-5V _{SB}




Recommended Air Flow Direction

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