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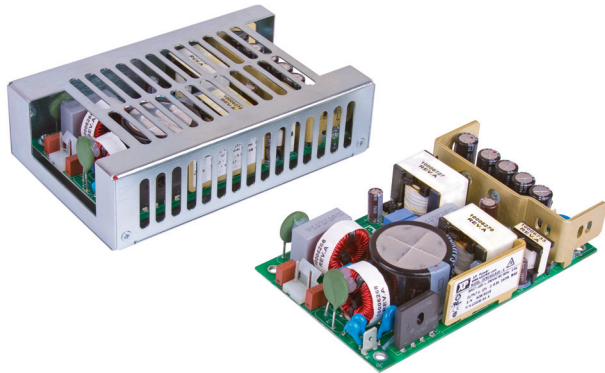
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# ECM140 Series



- High Efficiency Resonant Topology
- High Power Density 7.2 W/in<sup>3</sup>
- Convection & Force-cooled Ratings
- Class I & Class II Installations
- Industry Standard 3.0" x 5.0" x 1.30" Format
- 12 V Fan Output as Standard
- 5 V Standby Option
- Remote Sense as Standard
- IT, Industrial & Medical Safety Approvals
- Remote On/Off & Power Good Signals Option

Approved for Class I and Class II applications, the ECM140 range of single output AC-DC, 148 W power supplies feature high power density in an industry standard 3 x 5" (76.2 mm x 127.0 mm) footprint. The 1.30" (33.0 mm) high, 1U compatible high-density power supplies meet EN55022 Level B conducted emissions with leakage currents of 100  $\mu$ A at 115 VAC or 215  $\mu$ A at 230 VAC. Making these switchers ideal for industrial, IT and medical applications.

The ECM140 series has single output versions from 12 V to 48 VDC, adjustable by  $\pm 5\%$ . All models include an additional +12V / 0.5 A fan output. They are dual-fused for compliance with IEC60601-1 and efficiency is 88% typical, so minimal excess heat is generated. The ECM140 require only 10 CFM of cooling to deliver a full 148 W of power up to +60 °C and operates at up to +70 °C with derating. The units also supply 120 W when convection-cooled up to +50 °C with operation to +70 °C with derating.

Comprehensive overvoltage, overload and short circuit protection is built in. Optional -A units offer a +5 V / 0.5 A standby rail, an open collector Power OK signal and Remote On/Off function.



## Models and Ratings - Convection-cooled

Output Power <sup>(1)</sup>	Output Voltage V1	Max Output Current V1	Fan Output V2	Standby Supply V3 (optional)	Model Number <sup>(2,3)</sup>
120 W	12.0 VDC	10.0 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US12
120 W	15.0 VDC	8.0 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US15
120 W	18.0 VDC	6.6 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US18
120 W	24.0 VDC	5.0 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US24
120 W	28.0 VDC	4.2 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US28
120 W	48.0 VDC	2.5 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US48

**Notes:**

1. Convection-cooled, max output power must not exceed 120 W for combined V1, V2, & V3
2. For V3 5 V standby, Power OK & Inhibit, add suffix '-A' to model number.
3. For covered versions, add suffix '-C' to model number or order part no. ECM140 COVER KIT for standalone cover. Not suitable for use in class II installations.

## Models and Ratings - Forced-cooled

Output Power <sup>(1)</sup>	Output Voltage V1	Max Output Current V1	Fan Output V2	Standby Supply V3 (optional)	Model Number <sup>(2)</sup>
148 W	12.0 VDC	11.7 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US12
148 W	15.0 VDC	9.3 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US15
148 W	18.0 VDC	7.7 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US18
148 W	24.0 VDC	5.8 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US24
148 W	28.0 VDC	5.0 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US28
148 W	48.0 VDC	2.9 A	12.0 V/0.5 A	5.0 V/0.5 A	ECM140US48

**Notes:**

1. 10 CFM airflow.
2. For V3 5 V standby, Power OK & Inhibit, add suffix '-A' to model number.
3. For cover with Top Fan assembly add '-TF' to model number, e.g. ECM140US12-TF or ECM140US12-ATF.

## Input Characteristics

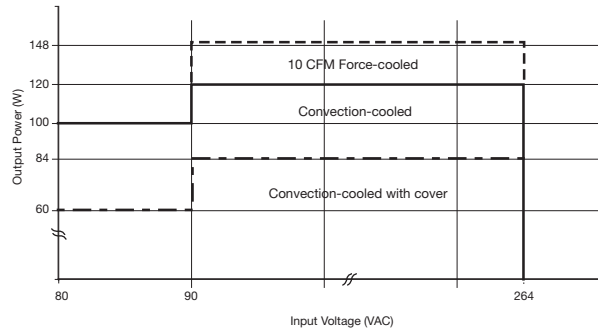
Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Input Voltage - Operating	80	115/230	264	VAC	Derate output power < 90 VAC. See fig. 1. Power OK signal cannot be used <90 VAC.
Input Frequency	47	50/60	400	Hz	Agency approval 47-63 Hz
Power Factor		>0.5			230 VAC, 100% load EN61000-3-2 class A compliant
Input Current - No Load		0.25/0.2		A	115/230 VAC
Input Current - Full Load		2.5/1.3		A	115/230 VAC
Inrush Current			40	A	230 VAC cold start, 25 $\mu$ C
Earth Leakage Current		100/215	265	$\mu$ A	115/230 VAC/50 Hz (Typ.), 264 VAC/60 Hz (Max.)
		0.5/1.1		mA	115/230 VAC/400 Hz
Input Protection	T5.0A/250 V internal fuse in both line and neutral				

## Output Characteristics

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Output Voltage - V1	12		48	VDC	See Models and Ratings table
Initial Set Accuracy			$\pm 1^{(V1)}$ , $\pm 5^{(V2)}$ & $\pm 3^{(V3)}$	%	50% load, 115/230 VAC
Output Voltage Adjustment	$\pm 5$			%	V1 only via potentiometer. See mech. details (P13).
Minimum Load	$0^{(V1 \& V3)}$ & $0.1^{(V2)}$			A	V2 min load for regulation only when used
Start Up Delay		1.5		s	230 VAC full load (see fig.2)
Hold Up Time	16	20		ms	115 VAC full load (see fig.3 & 4)
Drift			$\pm 0.2$	%	After 20 min warm up
Line Regulation			$\pm 0.5$	%	90-264 VAC
Load Regulation			$\pm 1^{(V1)}$ , $\pm 5^{(V2 \& V3)}$	%	0-100% load. V2 0.1-0.5 A load
Transient Response - V1			4	%	Recovery within 1% in less than 500 $\mu$ s for a 50-75% and 75-50% load step
Over/Undershoot - V1		5		%	See fig.5
Ripple & Noise			$1^{(V1)}$ & $2^{(V2 \& V3)}$	% pk-pk	20 MHz bandwidth (see fig.6 & 7)
Overvoltage Protection	115		140	%	Vnom DC. Output 1 only, recycle input to reset
Overload Protection	110		150	% I nom	Output 1 only, auto reset (see fig.8)
Short Circuit Protection					Continuous, trip & restart (hiccup mode) all outputs
Temperature Coefficient			0.05	%/°C	
Overtemperature Protection				°C	Not fitted

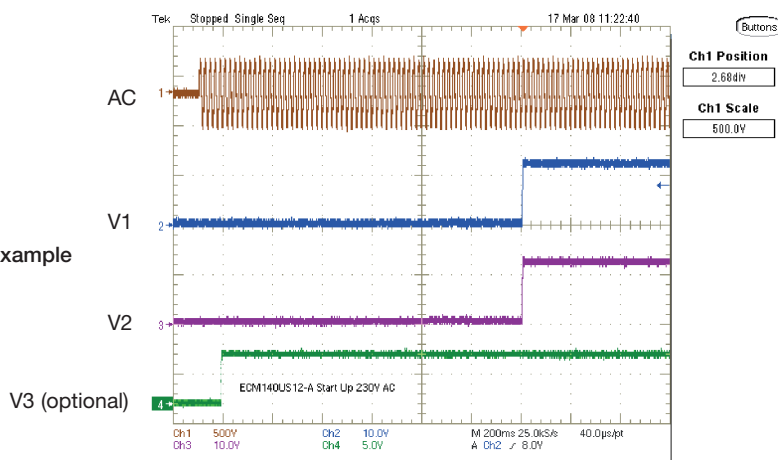
## Input Voltage Derating

Figure 1



## Start Up Delay From AC Turn On

Figure 2  
V1, V2 & V3 start up example  
from AC turn on



## Hold Up Time From Loss of AC

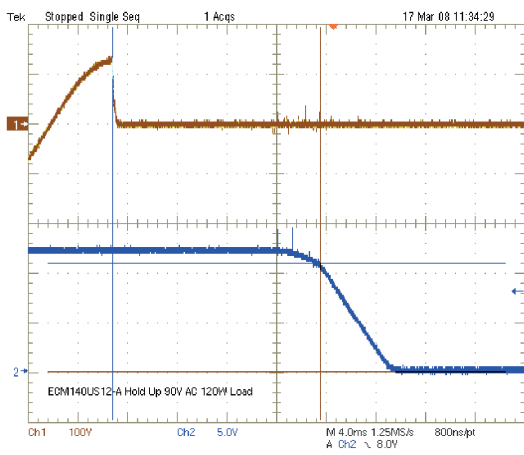


Figure 3  
V1 hold up example at 120 W load  
with 90 VAC input (16.7 ms)

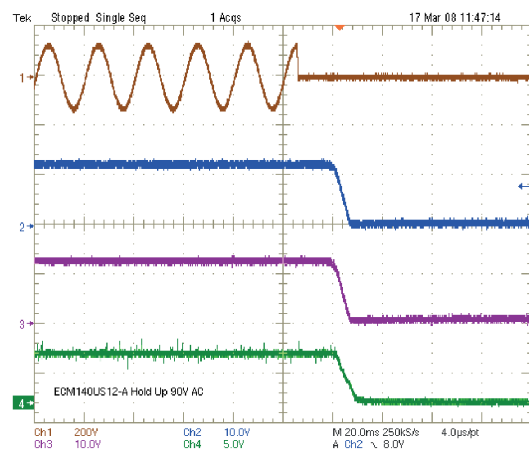
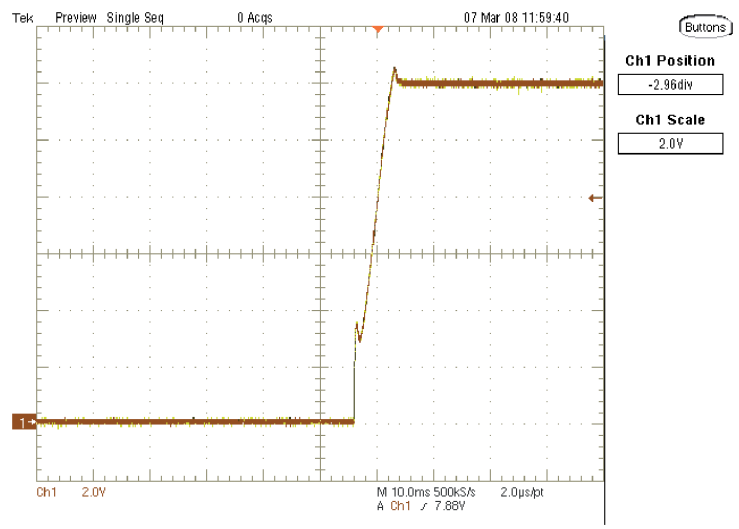


Figure 4  
V1, V2 & V3 hold up example at  
120 W load 90 VAC input

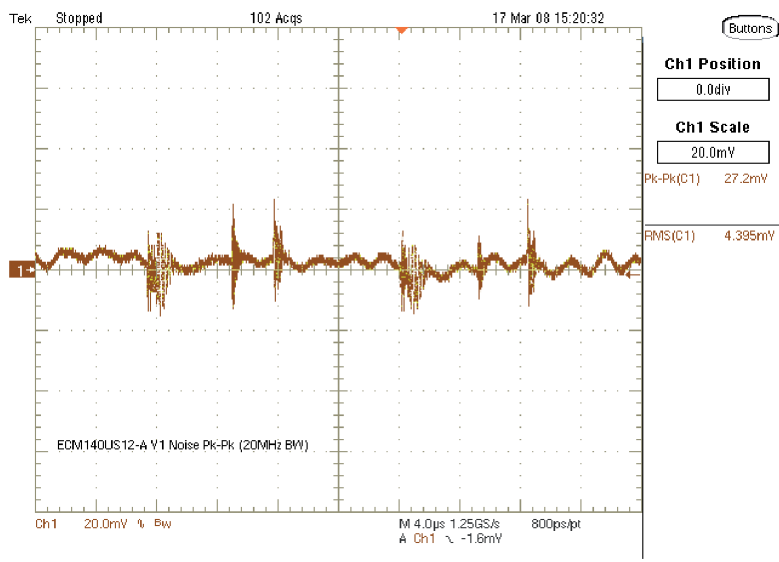
## Output Overshoot

Figure 5  
Typical Output Overshoot  
(ECM140US12 shown)



## Output Ripple & Noise

Figure 6  
V1 ECM140US12 (full load)  
27 mV pk-pk ripple. 20 MHz BW



## Output Ripple & Noise cont.

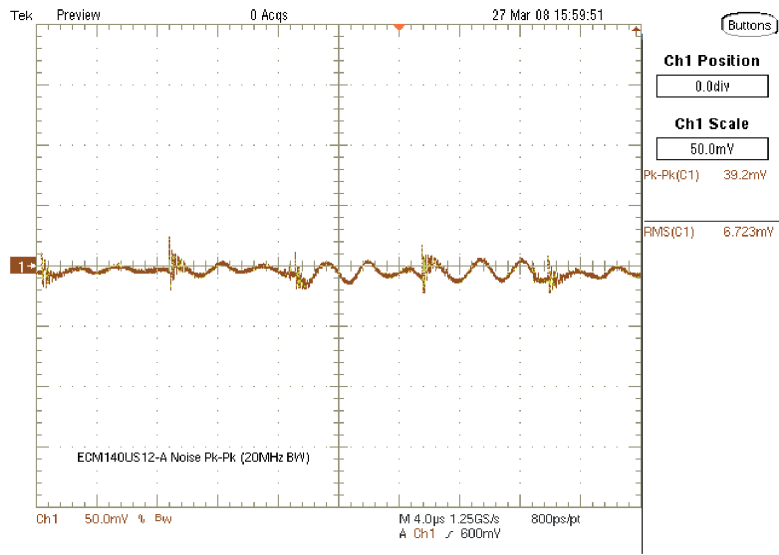


Figure 7  
V1 ECM140US12 (full load)  
39 mV pk-pk ripple. 20 MHz BW

## Output Overload Characteristic

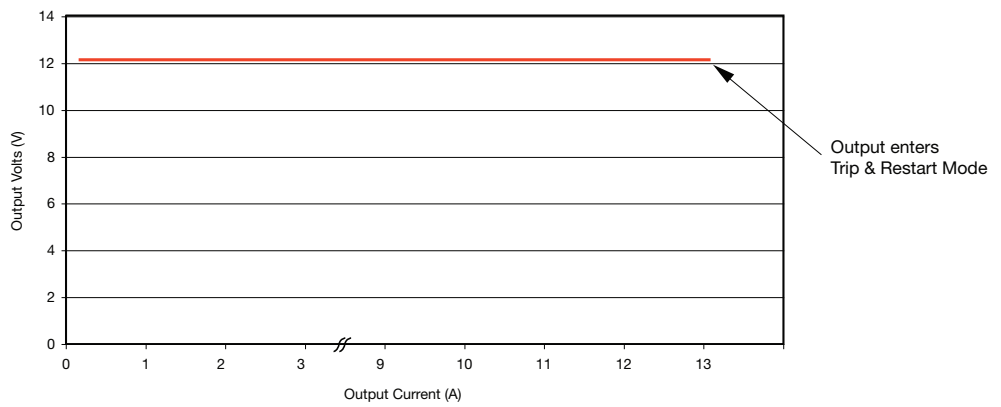


Figure 8  
Typical V1 Overload  
Characteristic  
(ECM140US12 shown)

## General Specifications

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Efficiency		88		%	Full load (see fig.9 & 10)
Isolation: Input to Output Input to Ground Output to Ground	4000			VAC	
	1500			VAC	
	500			VAC	
Switching Frequency		70		kHz	
Power Density			7.2	W/in <sup>3</sup>	
Mean Time Between Failure		220		kHrs	MIL-HDBK-217F, Notice 2 +25 °C GB
Weight			0.7 (320)	lb (g)	

## Efficiency Versus Load

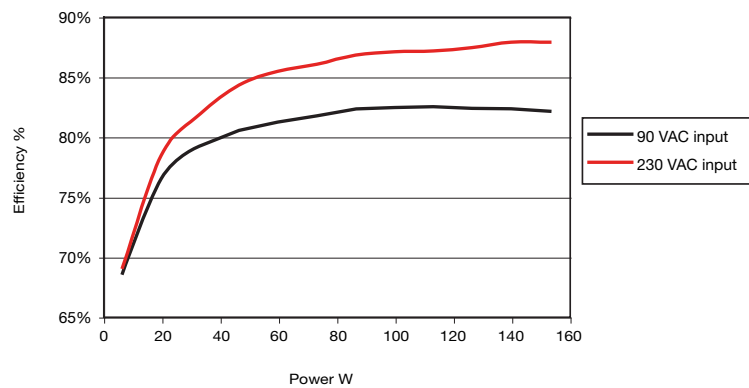


Figure 9  
ECM140US12 at 90 & 230 VAC

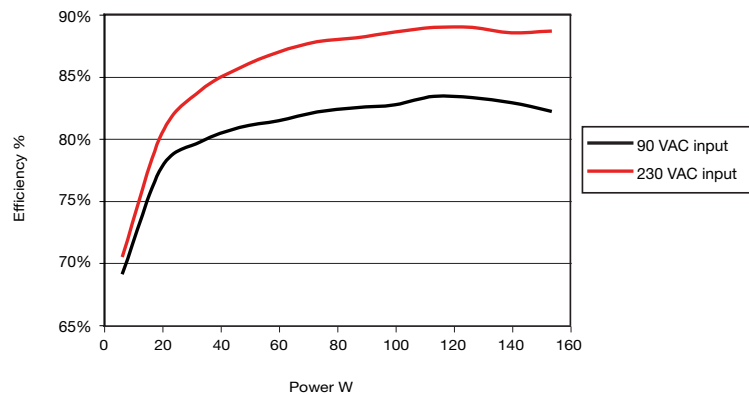


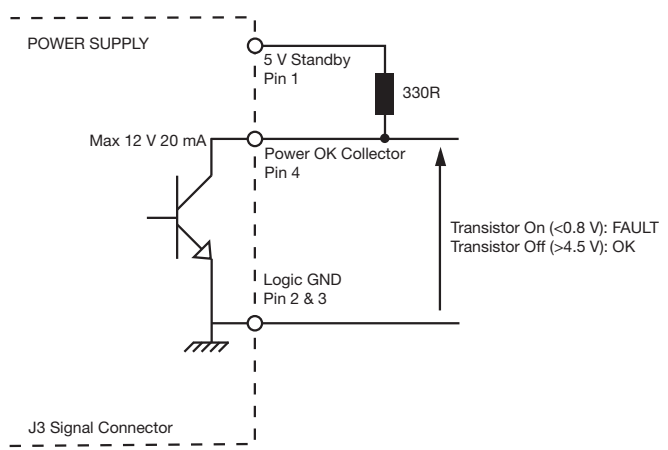
Figure 10  
ECM140US24 at 90 & 230 VAC

Characteristic	Notes & Conditions
<b>Signals (standard)</b>	
Remote Sense	Compensates for 0.5 V total voltage drop
<b>Signals (option -A)</b>	
Power OK (combined AC OK & DC OK)	Open collector referenced to logic ground & output 0V, transistor normally off when AC is good (see fig.11 - 15) AC OK: Provides ≥ 3 ms warning of loss of output from AC failure
Remote On/Off (Inhibit/Enable)	Uncommitted isolated optocoupler diode, powered diode inhibits the supply (see fig.16-21)
Standby Supply V3	5V/0.5 A supply, always present when AC supplied, referenced to logic ground and output 0V

# Signals

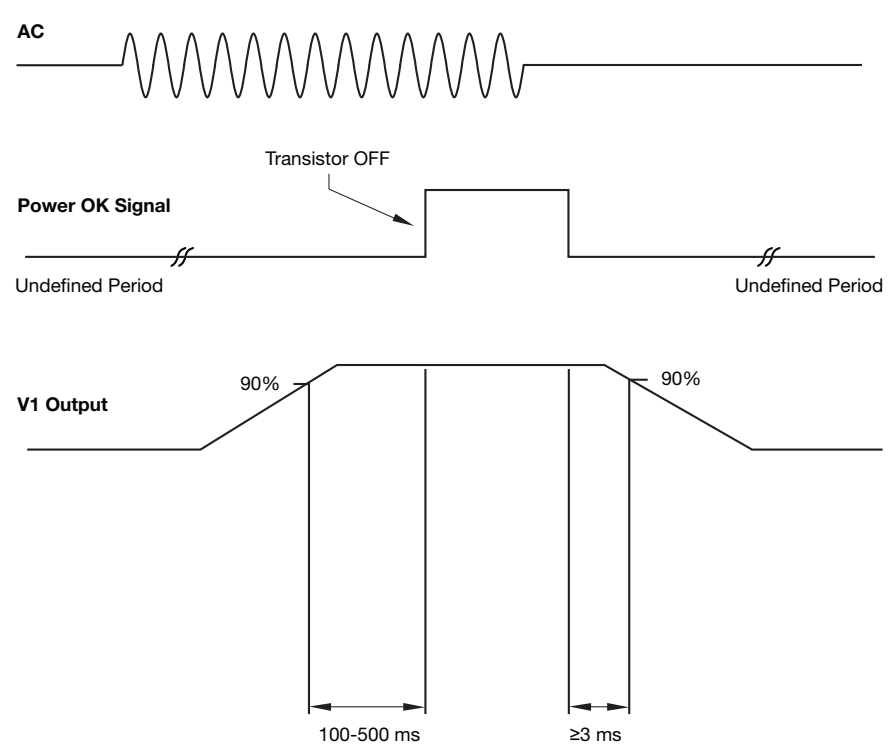
## Power OK (Optional -A)

Figure 11



## Power OK - Timing Diagram

Figure 12





## Signals (cont.)

### Power OK (Optional -A)

Figure 13  
Power OK signal example  
at AC switch on

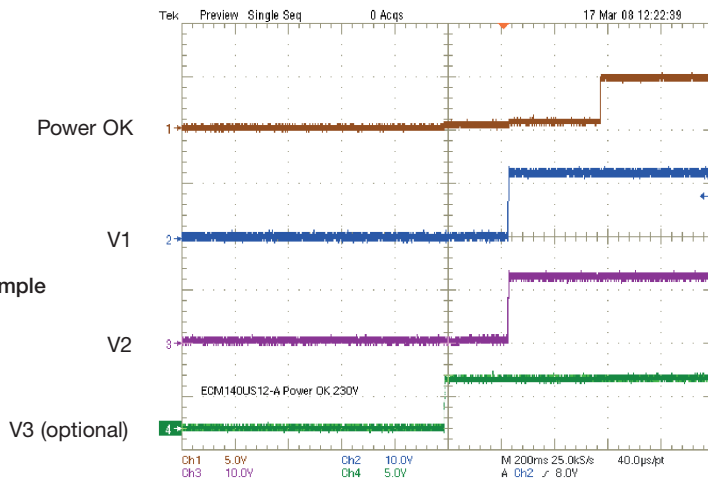


Figure 14  
Power OK signal example  
at AC switch off

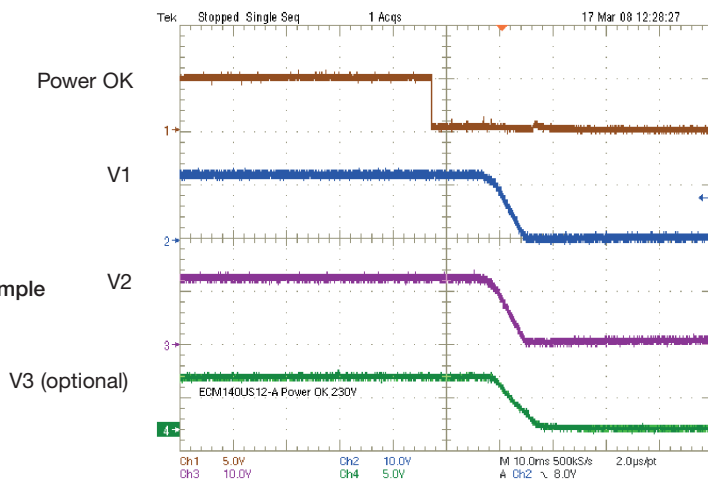
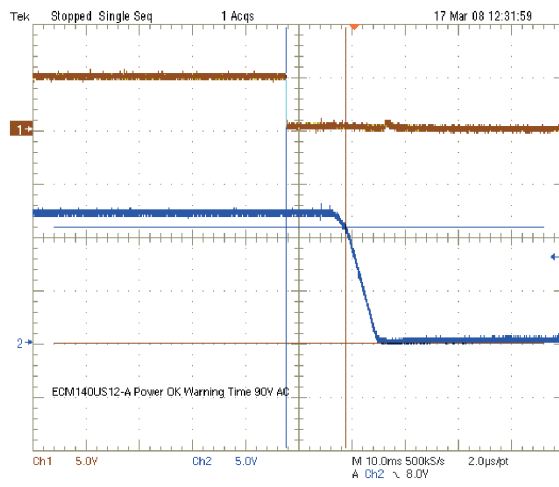


Figure 15  
V1 warning time example at  
Power OK signal 90 VAC  
120 W load (11.2 ms)



## Signals (cont.)

### Remote On/Off (Inhibit/Enable) (Optional -A)

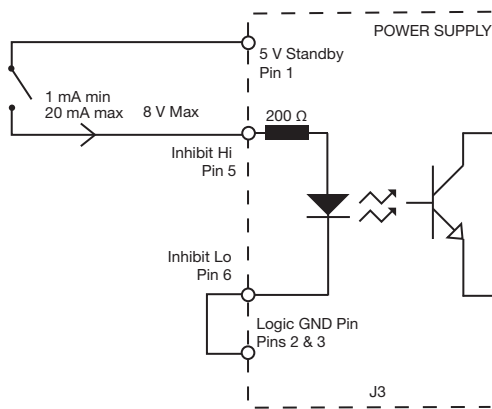


Figure 16  
Inhibit (Hi)

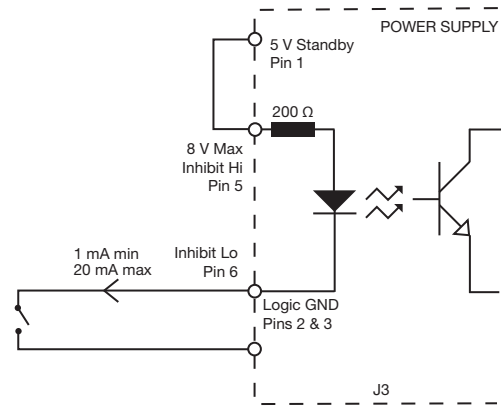


Figure 17  
Inhibit (Lo)

Figure 18  
Example of outputs switching off when Inhibit (Lo) configuration used & switch closed

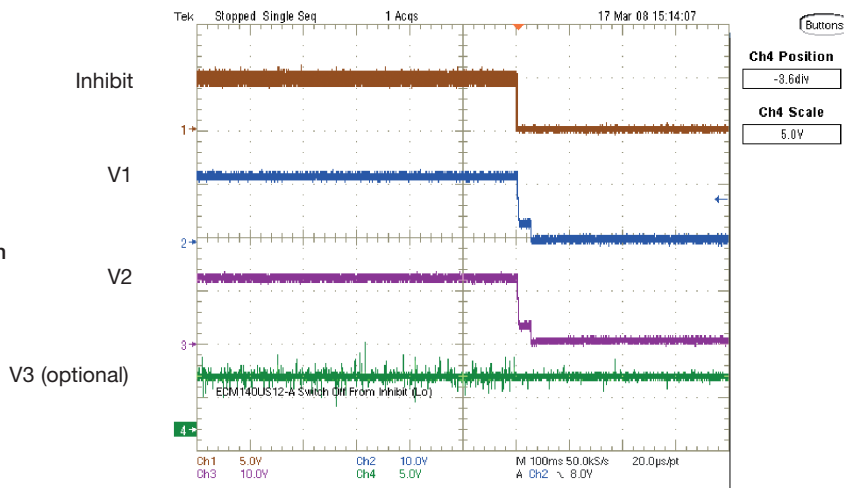
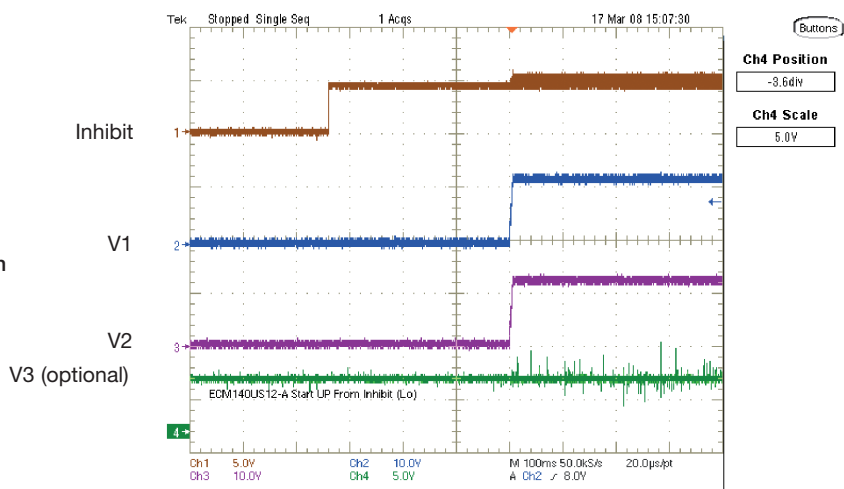


Figure 19  
Example of outputs switching on when Inhibit (Lo) configuration used & switch open



Signals (contd)

Remote On/Off (Inhibit/Enable) (Optional -A)

Figure 20  
Enable (Hi)

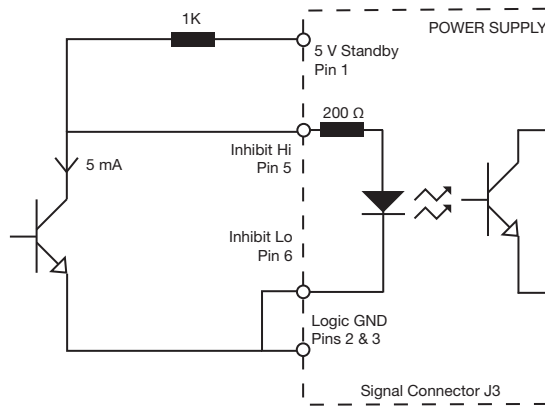
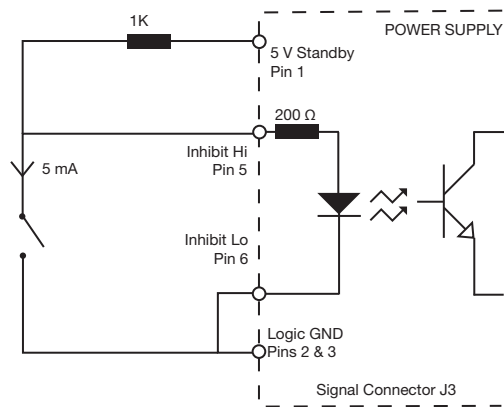


Figure 21  
Enable (Lo)



## Environmental

Characteristic	Minimum	Typical	Maximum	Units	Notes & Conditions
Operating Temperature	0		+70	°C	Derate linearly from +50 °C at 2.5%/°C to 50% at 70 °C when convection-cooled & from +60 °C at 2.5%/°C to 75% at 70 °C when force-cooled. (See fig.21 & Thermal Considerations.
Storage Temperature	-40		+85	°C	
Cooling	10			CFM	>120 W output power. See fig.21 & Thermal Considerations
Humidity	5		95	%RH	Non-condensing
Operating Altitude			3000	m	
Shock					3 x 30 g/11 ms shocks in both +ve & -ve directions along the 3 orthogonal axis, total 18 shocks.
Vibration					Triple axis 5-500 Hz at 2 g x 10 sweeps

## Derating Curve

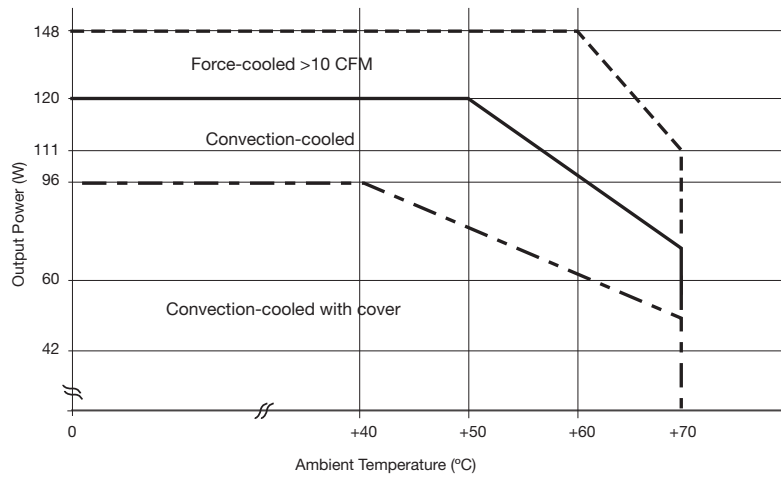


Figure 21

## Electromagnetic Compatibility - Immunity

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Low Voltage PSU EMC	EN61204-3	High severity level	as below	
Harmonic Current	EN61000-3-2	Class A		
Radiated	EN61000-4-3	3	A	
EFT	EN61000-4-4	3	A	
Surges	EN61000-4-5	Installation class 3	A	
Conducted	EN61000-4-6	3	A	
Dips and Interruptions	EN61000-4-11	Dip: 30% 10 ms	A	
		Dip: 60% 100 ms	B	
		Int.: 100% 5000 ms	B	
	EN60601-1-2 (EN61000-4-11)	Dip: 30% 500 ms	A	
		Dip: 60% 100 ms	A	Load derating with 115 VAC input (typically 50% derate dependant on model & load)
		Int.: >95% 5000 ms	B	

## Electromagnetic Compatibility - Emissions

Phenomenon	Standard	Test Level	Criteria	Notes & Conditions
Conducted	EN55022	Class B		See fig. 22
Radiated	EN55022	Class A		
Voltage Fluctuations	EN61000-3-3			

### Typical EMC Plot

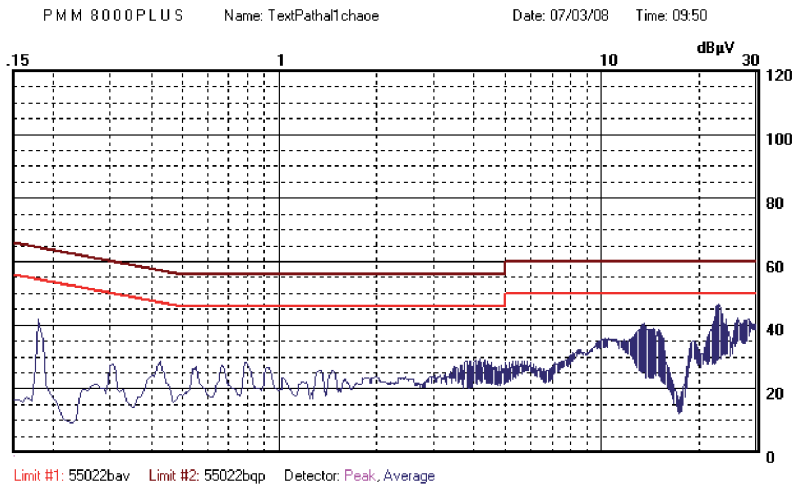


Figure 22  
Typical conducted  
noise plot (Class I)

### Safety Agency Approvals

Safety Agency	Safety Standard	Category
CB Report	CSA CB155548-1978787 IEC60950-1:2005 Ed 2	Information Technology
CSA	CSA certificate #1978793 CSA22.2 No. 60950-1-05	Information Technology
UL	UL File #139109 UL60950-1 (2003)	Information Technology
TUV	TUV Certificate #B08 04 57396 048 EN60950-1:2006	Information Technology
CE	LVD	

Safety Agency	Safety Standard	Category
UL	UL 1604 Class 1 Division II - ECM140US12 Only	Hazardous Locations

Safety Agency	Safety Standard	Category
CB Report	Certificate #US/18300/UL, IEC60601-1 Ed 3 Including Risk Management	Medical
UL	UL File # E146893, ANSI/AAMI ES 60601-1:2005 & CSA C22.2 No. 60601-1:08	Medical
TUV	EN60601-1:2006	Medical

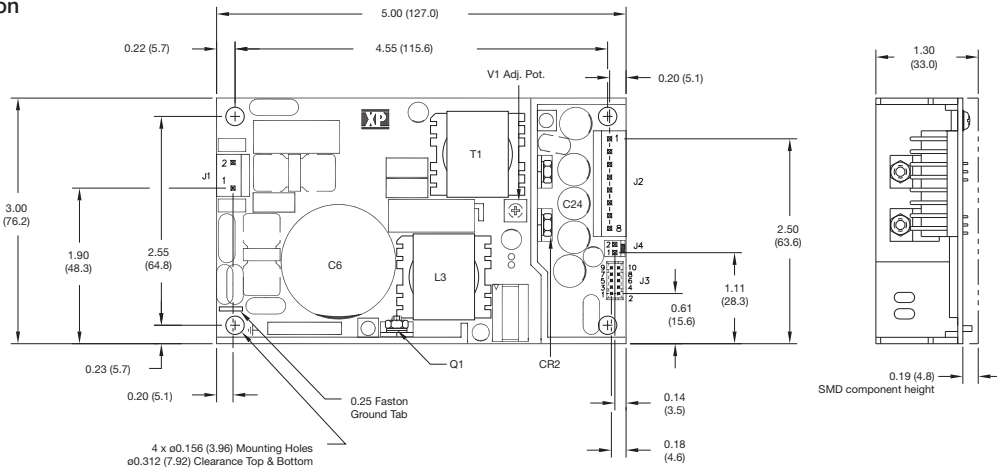
Means of Protection		Category
Primary to Secondary	2 x MOPP (Means of Patient Protection)	IEC60601-1 Ed 3
Primary to Earth	1 x MOPP (Means of Patient Protection)	

Equipment Protection Class	Safety Standard	Notes & Conditions
Class I & Class II	IEC60950-1:2005 Ed 2 & IEC60601-1 Ed 2	See safety agency conditions of acceptability for details

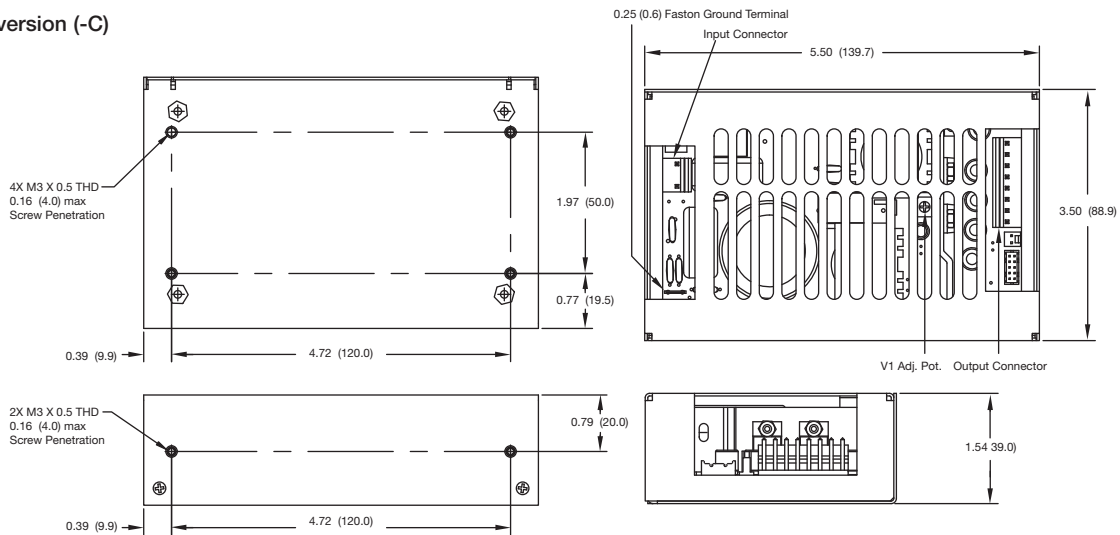


## Mechanical Details

### Open frame version



### Covered version (-C)



Input Connector J1	
Pin 1	Line
Pin 2	Neutral
.25" Faston	
Earth	

J1 mates with Molex housing 09-50-1031 and Molex series 5194 crimp terminals.

Output Connector J2	
Pin	Single
1	+V1
2	+V1
3	+V1
4	+V1
5	RTN
6	RTN
7	RTN
8	RTN

J2 mates with Molex housing 09-50-1081 and Molex series 5194 crimp terminals.

Signal Connector J3	
Pin	Single
1	+V3 5V Standby*
2	Logic GND*
3	Logic GND*
4	Power OK*
5	Inhibit HI*
6	Inhibit LO*
7	+Sense
8	-Sense
9	+V1
10	-V1

\*Optional

J3 mates with JST housing PHDR-10VS and JST series SPHD-001T-P0.5 crimp terminals.

Fan Connector J4	
Pin 1	+V2 Fan (12V)
Pin 2	Fan RTN

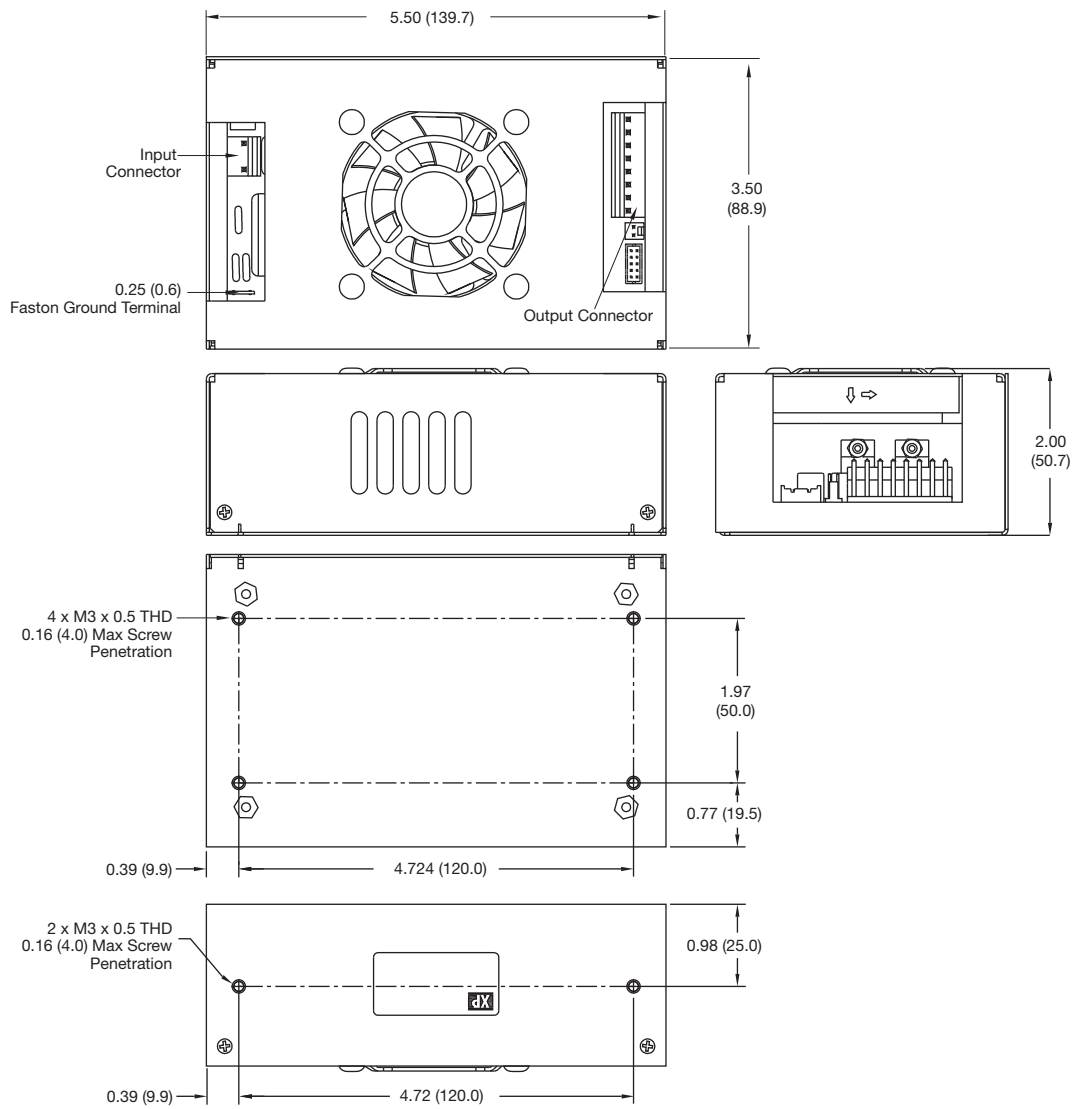
J4 mates with Molex housing 22-01-1024 and Molex series 5103 crimp terminals.

### Notes

1. All dimensions in inches (mm). Tolerance .xx = ±0.02 (0.50); .xxx = ±0.01 (0.25)

## Mechanical Details

### Fan Cover



### Notes

1. All dimensions in inches (mm). Tolerance .xx =  $\pm 0.02$  (0.50); .xxx =  $\pm 0.01$  (0.25)
2. Weight: 0.7 lbs (317g) approx.

## Thermal Considerations

In order to ensure correct and reliable operation of the PSU in the most adverse conditions permitted in the end-use equipment, the temperature of the components listed in the table below must not be exceeded. See drawing on page 13 for component locations. Temperature should be monitored using K type thermocouples placed on the hottest part of the component (out of any direct air flow).

Temperature Measurements (Ambient ≤ 50 °C)	
Component	Max Temperature °C
T1	110 °C
L3	120 °C
Q1	110 °C
CR2	110 °C

## Service Life

The estimated service life of the ECM140 is determined by the cooling arrangements and load conditions experienced in the end application. Due to the uncertain nature of the end application this estimated service life is based on the actual measured temperature of capacitors within the product when installed in the end application.

The graph below expresses the estimated lifetime for a given component temperature and assumes continuous operation at this temperature.

## Estimated Service Life vs Component Temperature

