

C - M A C M I C R O C I R C U I T S

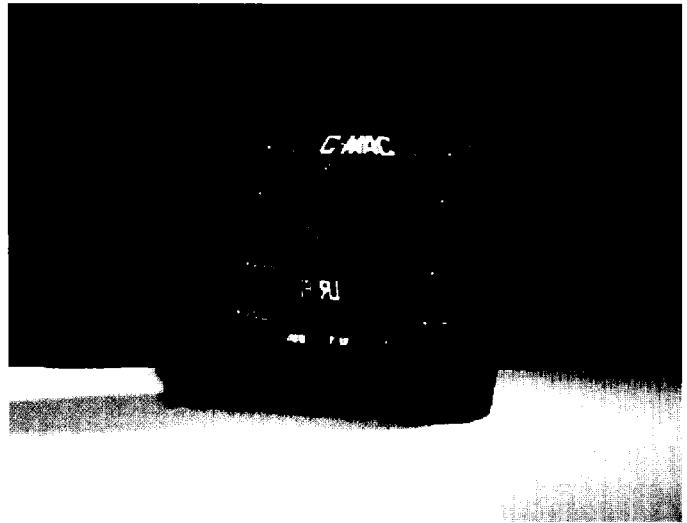
High Density 50-150W DC-DC Power Modules

CMH Series

36-75Vdc Input, 50W/in³, 76-87% Efficiency
Single Outputs 2.2V/3.3V/5V/12V/15V

The **CMH Series** uses innovative circuit design and packaging techniques to produce up to 150 Watts output at 100°C base-plate in half of the footprint of other commercially available power modules, while providing more control functions.

The **CMH Series** comprises a core product in C-MAC's offering of **Real Solutions for Distributed Power Architectures** - a range of power conversion solutions that are specifically designed to meet the needs of the system designer.



APPLICATIONS

- ◆ Distributed Power Systems
- ◆ Data Processing Systems
- ◆ Telecommunications Systems
- ◆ Industrial Process Control Systems
- ◆ High Power Density
- ◆ Low design-in cost
- ◆ Standard Module Type

CONTROL FUNCTIONS

- ◆ Primary & Secondary referenced Enable
- ◆ Pin-programmable output voltage:
2.2V→1.5V, 3.3V→2.2V, 5V→3.3V, 12V→9V, 15V→12V
- ◆ Remote-sense allows applications in N+1 redundant configurations
- ◆ Adjustable current limit
- ◆ Module OK signal
- ◆ Adjustable Over Voltage Protection Limit
- ◆ Output voltage trim
- ◆ Optional Enable Logic

GENERAL FEATURES

- ◆ Full 150 Watts (30A) at 5 Volts, 100°C
- ◆ Meets UL, CSA, VDE, BAPT requirements
- ◆ Fixed-frequency operation
- ◆ Accurate current-sharing with fail-safe feature
- ◆ Internal Differential & Common-mode filtering
- ◆ MTBF: 1 million hours (MIL-STD-217)
- ◆ Fast transient response

PROTECTION FEATURES

- ◆ Latching over-voltage protection
- ◆ Current limiting with automatic recovery
- ◆ Over-temperature protection at 100°C base-plate temperature
- ◆ Output short circuit protected



APPLICATIONS INFORMATION

Over Current Protection (OCP Adj)

(Featured Option Only)

The default current-limit threshold is 33A for the 5V module and 14A for the 12V module. To enable the use of the modules at different power levels, the current-limit may be set by an external programming resistor from OCP Adj to -SENSE, with values outlined below:

Module	Resistor	I Limit	P _o
5V	Short	20A	75W
	1.75K	24A	100W
	5K	29A	125W
12V	Short	8A	75W
	1.75K	10A	100W
	5K	12A	125W

Thermal Characteristics

An over-temperature protection circuit shuts the module off if the base-plate temperature exceeds 110°C. Proper thermal management is required to ensure reliable operation. A standard extruded heatsink may be mounted to the converter using the 4 threaded M3 holes in the base-plate.

Temperature Warning (TMP-WRN)

(Featured Option Only)

This is an open drain signal that is asserted low whenever the module temperature rises to within approximately 2°C of its thermal shutdown threshold. When asserted low, the pin will sink up to 5mA. An LED indicator may be directly connected between this pin and a pull-up voltage source (not to exceed 15V). A current limiting resistor is not necessary.

Preset Output Trim

The TRIM pin allows adjustment of the output voltage to preset levels by connecting this pin to the -SENSE pin. The characteristics of this function are as follows:

15V module:

Connecting the TRIM pin to the -SENSE pin changes the output to 12V.

12V module:

Connecting the TRIM pin to the -SENSE pin changes the output to 9V.

5V module:

Connecting the TRIM pin to the -SENSE pin changes the output to 3.3V.

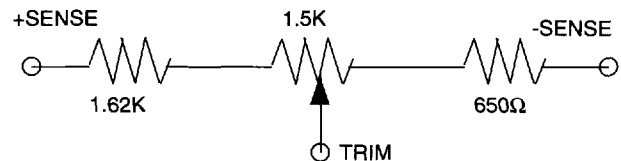
3.3V module:

Connecting the TRIM pin to the -SENSE pin changes the output to 2.2V.

2.2V module:

Connecting the TRIM pin to the -SENSE pin changes the output to 1.5V.

Variable Output Trim (±10% Adjust)



Typical Example for a 5V module

ORDERING INFORMATION

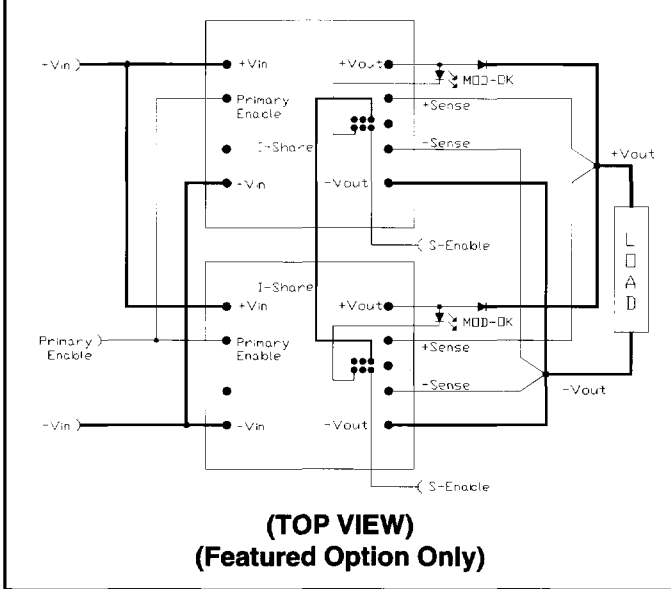
Part Number	Power	Output Voltage	Output Current	Efficiency
CMHW50-2	66W	2.2V	30A	76%
CMHW75-3	83W	3.3V	25A	83%
CMHW100-3	100W	3.3V	30.3A	81.5%
CMHW100-5	125W	5.0V	25A	86.5%
CMHW150-5	150W	5.0V	30A	86%
CMHW150-12	150W	12.0V	12.5A	85.5%
CMHW150-15	150W	15.0V	10A	86.5%

NOTE: Add Suffix 'F' to part number to denote Featured version
Add Suffix 'L' to part number to denote Negative Enable Logic

Example Part Numbers: **CMHW100-3F** 100W, 3.3V Output, Featured Version
CMHW150-2L 150W, 12V Output, Negative Enable Logic
CMHW100-5FL 125W, 5V Output, Featured Version, Negative Enable Logic

APPLICATIONS INFORMATION

N+1 Redundancy with Current Sharing



The I-Share pins on paralleled converters must be connected together to force the converters to share current. Protection circuitry will disconnect the internal share line from the bus when the unit is not enabled or shut down due to a fault condition. This allows the remaining units to share equally the added load in N+1 redundant applications.

Primary & Secondary Enable (P-ENBL & S-ENBL)

(S-ENBL Featured Option Only)

The CMH Series modules have both a secondary-side and primary-side Enable referenced to the appropriate return. The module output may be enabled/disabled by the Primary and Secondary inputs. These inputs have internal pull-up resistors and can be driven by open collector signals. Positive Enable Logic is standard, Negative Enable Logic is available by specifying 'L' Option in the part number. The S-ENBL input is TTL input compatible.

P-ENBL	S-ENBL	V_o	'L' Option V_o
Low	Low	OFF	ON
Low	Open/High	OFF	OFF
Open/High	Low	ON	OFF
Open/High	Open/High	OFF	OFF

NOTE: P-ENBL referenced to $-V_{IN}$, S-ENBL referenced to $-SENSE$

MOD-OK Signal (MOD-OK)

(Featured Option Only)

This is an open collector signal that indicates that the converter is powered up and switching. The MOD-OK signal is asserted low when the converter is switching and will sink a maximum of 5mA in this state. If the converter is disabled or drops out of regulation, the internal MOD-OK transistor will open and be pulled up to the appropriate source voltage provided by the user, not to exceed 15V. An LED directly connected between V_o (must not exceed 15V) and this pin provides a visual MOD-OK.

Over Voltage Protection Adjust (OVP Adj)

(Featured Option Only)

This function allows the system designer to change the OVP threshold to facilitate different V_o settings.

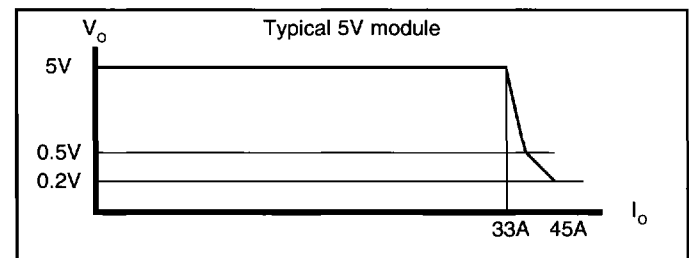
Connection	OVP Threshold ($\pm 10\%$)
2.2 V / 3.3 V / 5 V Modules	
Open	6.3 V typ
Connect to V_o	4.0 V typ
1.2 V / 1.5 V modules	
Open	14.4 V typ
Connect to V_o	12.0 V typ

Remote Sense (+SENSE, -SENSE)

The remote sense pins allow system designers to compensate for voltage drops in the power busses and in ORing diodes used in redundant systems. The remote sense will compensate for voltage drops up to 0.5V. Both pins should be connected for proper operation. If a sense lead fails open-circuit or if the leads are left unconnected, the module will revert to local sense at the module V_o terminals. The remote sense pins should be connected to the Cathode of the ORing diode or beyond to compensate for the diode forward drop and trace losses in the power bus.

Current Limit

An innovative circuit provides current limit on the module. The figure below depicts the typical current limit for a 5V module. Thresholds differ with V_o .



INPUT SPECIFICATIONS (@ 25°C unless otherwise noted)

Parameter	Symbol	Min	Typ	Max	Units
Operating Input Voltage (-40 °C to 100°C)	V_I	36	48	75	Vdc
Inrush Current				8	A pk
Inrush Transient	i^2t			4	A ² s
Input Ripple Rejection (100Hz, 120Hz)			60		dB
No-Load Input Power			1	1.5	W
Primary Enable Low	V_{LE}, I_{IL}			0.8V, 1mA	
Primary Enable High	V_{HE}, I_{IH}	3.5V		400uA	
P-ENABLE Open Pin Voltage (@ $V_I = 75V$)	V_{PIOH}		12	15	V
Secondary Enable Low (Featured option only)	V_{LE}, I_{IL}			0.8V, 300uA	
Secondary Enable High (Featured option only)	V_{HE}, I_{IH}	3.5V		100uA	
S-ENABLE Open Pin Voltage (Featured option only)	V_{SIOH}			5.5	V

OUTPUT SPECIFICATIONS (@ 25°C unless otherwise noted)

Parameter	Symbol	Min	Typ	Max	Units
Voltage Options	V_o nom		2.2/3.3/5.0 12.0/15.0		V
Total Regulation (load, line, initial, drift, temp)				2.5	% V_o nom
Output Voltage Set Point ($V_I = 48V, I_o = \text{full load}$)	V_o set	99	100	101	% V_o nom
Output Regulation Line ($V_I = 36V$ to $75V$) Load ($I_o = 0A$ to I_o max) Temp (-40 °C to 100 °C)			0.1 0.1 0.56	0.2 0.2 1.12	% % %
Output Ripple & Noise Voltage (see note below) RMS Peak to Peak (5Hz to 20MHz)				<u>2.2 3.3 5 12 15</u> 30 35 35 50 65 75 100 100 150 150	V mV RMS mV pk-pk
V_o Margin Range ($V_o = V_o$ nom, $I_o = I_o$ max)	V_M		-35, +20		% V_o nom
Remote Sense Compensation				0.5	V
Output Current				<u>50 75 100 125 150</u> 30 20 25 30 10 15 20 25 30 4 6 8 10 12.5 3 5 7 9 10	W A A A A A
Dynamic Response ($V_I = 48V$) Load change: 25% -75% I_{max} ($di/dt = 0.1A/us$) Peak deviation Settling time (to 1% V_o)			2.2- 12 & <u>5.0 15</u> 100 240 200	<u>2.2 3.3 5 12 15</u> 150 150 150 450 450 250	V mV usec
Current-sharing, module to module @ 90% I_o max (Featured option only)			3	10	% I_{avg}

NOTE: Scope measurement should be made using a BNC socket. Position a resistive load 50-75mm from module connected across + V_o and - V_o with copper strips shunted by a 1.0uF capacitor near the module and a 47uF tantalum capacitor near the load.

PROTECTION & MISCELLANEOUS

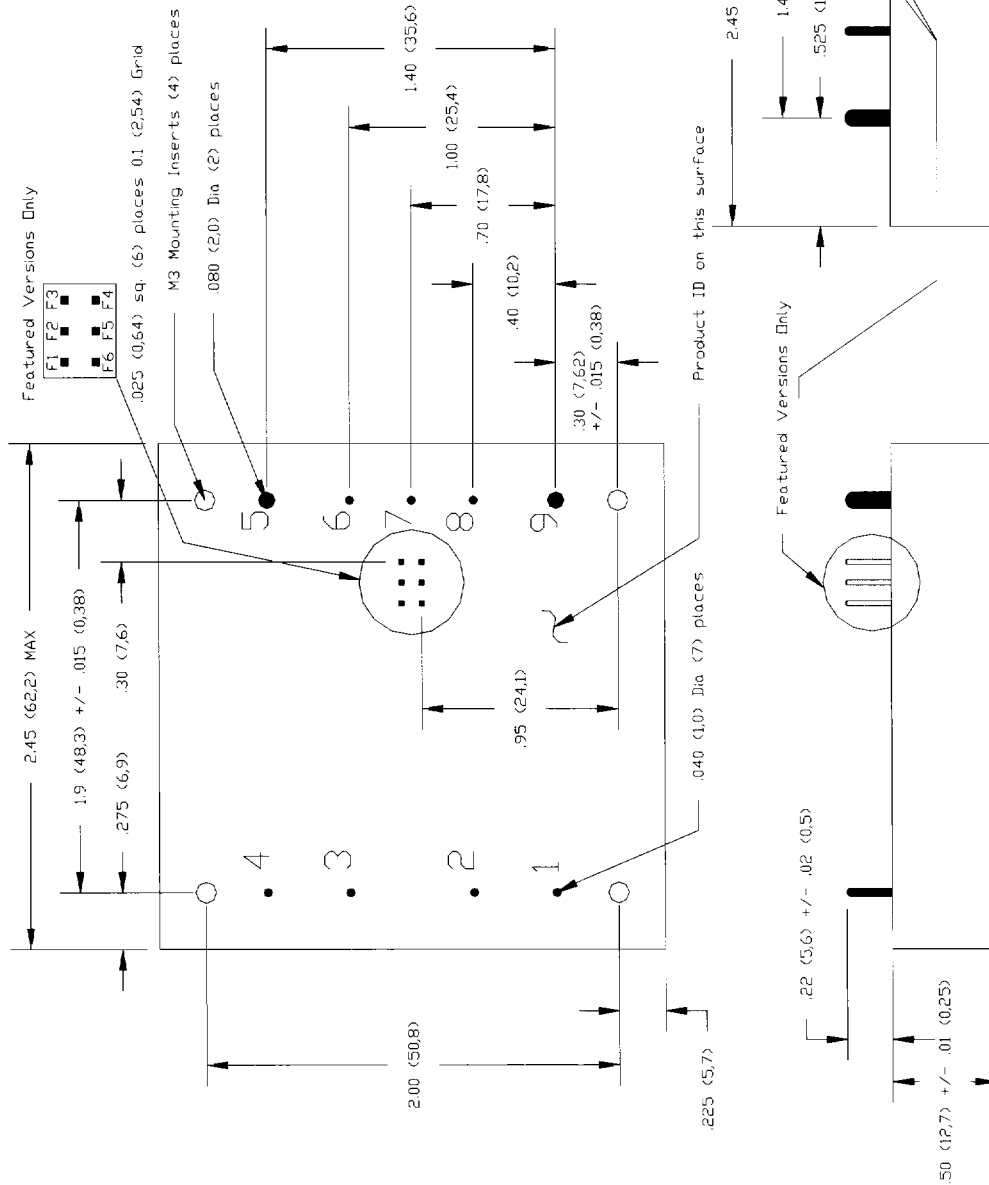
Parameter	Symbol	Min	Typ	Max	Units
Nominal Current Limit ($V_o = 90\% V_o$ nom)		102	110	130	% I_o max
Output Short Circuit Current Limit			130	150	% I_o max
Over Voltage Shutdown	V_{SD}	120	125	130	% V_o max
Over-temperature Shutdown (Tbase-plate)		105	110	120	°C
Turn-on Time from Enable (resistive load) $V_I = 48V, I_o = \text{max}$	t_{ON}		10	15	msec
Isolation Capacitance (1500Vdc)				3,000	pF
Isolation Resistance (1500Vdc)		10			MΩ
Operating Base-plate Temperature		-40		100	°C

MECHANICAL SPECIFICATIONS

OUTLINE DRAWING (BOTTOM VIEW) DIMENSIONS: in. (mm)

PIN FUNCTION	
1	+V _{in}
2	P-ENBL
3	Case
4	-V _{in}
5	-V _{out}
6	-SENSE
7	TRIM
8	+SENSE
9	+V _{out}

Featured Version	
F1	MOD-OK
F2	DCP-Adj
F3	S-ENBL
F4	I-Share
F5	DVP-Adj
F6	TMP-WRN



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