

November 3, 1997

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## DESCRIPTION

The MP60 series of power modules are economical switching DC/DC converters with an integral connector conforming to Intel Corporation's Voltage Regulator Module specification for the Pentium® Pro Processor. The modules have additional monitoring functions for Power Good Signal, Output Enable and Upgrade Present.

The output voltage can be set between 2.1V and 3.5V by means of a four bit voltage identification code, to support current and future versions of the Pentium Pro and OverDrive® processor variants.

To power Pentium II processors (VRM 8.1) use MP60-F or MP60-G.

## FEATURES

- Integral 40-pin header connector
- Programmable output voltage to suit processor (by VID code); adjustable from 2.1 to 3.5V
- Maximum output current 15A
- Efficiency >80% at full load
- Designed to specifications for Intel Pentium® Pro Processor voltage regulator module

## APPLICATIONS

- Intel Pentium® Pro Power Supply
- Deshutes Memory Power Supply (2.5V)

## ORDERING INFORMATION

DEVICE	I <sub>OUT</sub>	V <sub>OUT</sub> (volts)
MP60-E	13A	4 Bit Programmable
MP60-E-HC	15A	4 Bit Programmable

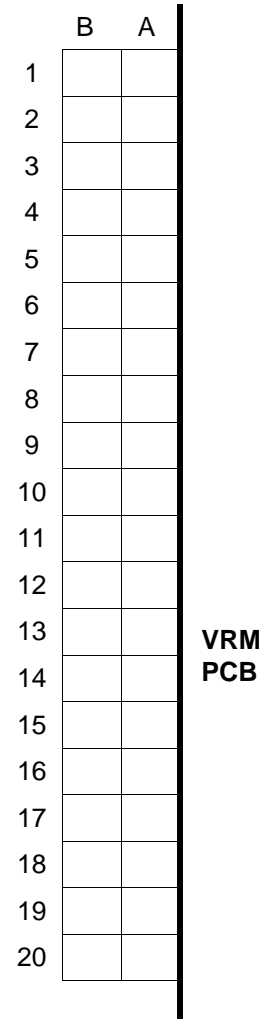
## ELECTRICAL CHARACTERISTICS

Conditions: V<sub>O</sub> = 3.1V, V<sub>IN</sub> = 4.75 - 5.25V, I<sub>O</sub> = 10A, unless otherwise stated.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS
Output Voltage	V <sub>O</sub>	0.95 V <sub>O</sub>		1.05 V <sub>O</sub>	V
Output Current MP60-E	I <sub>O</sub>	0.3		13	A
Output Current MP60-E-HC	I <sub>O</sub>	0.3		15	A
Current Surge Limit MP60-E	I <sub>S</sub>	15			A
Current Surge Limit MP60-E-HC	I <sub>S</sub>	16.5			A
Output over voltage protection		Setpoint + 20%			V
Output slew rate		30			A/μs
Quiescent Current	I <sub>Q</sub>	1			mA
Temperature Coefficient	T <sub>C</sub>		TBD		%/°C
Temperature Stability	T <sub>S</sub>		TBD		%
Operating Efficiency (full load)	η	80			%
Switching Frequency	f <sub>SW</sub>		200		kHz
DC output ripple voltage				48	mV <sub>p-p</sub>
Operating Temperature Range	T <sub>J</sub>	0		60	°C

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INPUT AND OUTPUT CONNECTIONS			
Pin No.	Row A	Row B	Pin No.
1	5V in	5V in	1
2	5V in	5V in	2
3	5V in	5V in	3
4	12V in	12V in	4
5	Reserved	Reserved	5
6	Reserved	OUTEN	6
7	VID0	VID1	7
8	VID2	VID3	8
9	UP#	PWRGD	9
10	V <sub>CCP</sub>	V <sub>SS</sub>	10
11	V <sub>SS</sub>	V <sub>CCP</sub>	11
12	V <sub>CCP</sub>	V <sub>SS</sub>	12
13	V <sub>SS</sub>	V <sub>CCP</sub>	13
14	V <sub>CCP</sub>	V <sub>SS</sub>	14
15	V <sub>SS</sub>	V <sub>CCP</sub>	15
16	V <sub>CCP</sub>	V <sub>SS</sub>	16
17	V <sub>SS</sub>	V <sub>CCP</sub>	17
18	V <sub>CCP</sub>	V <sub>SS</sub>	18
19	V <sub>SS</sub>	V <sub>CCP</sub>	19
20	V <sub>CCP</sub>	V <sub>SS</sub>	20



End view of VRM connector  
(viewed from motherboard side)

### VOLTAGE REGULATOR MODULE CONNECTOR PIN REFERENCE

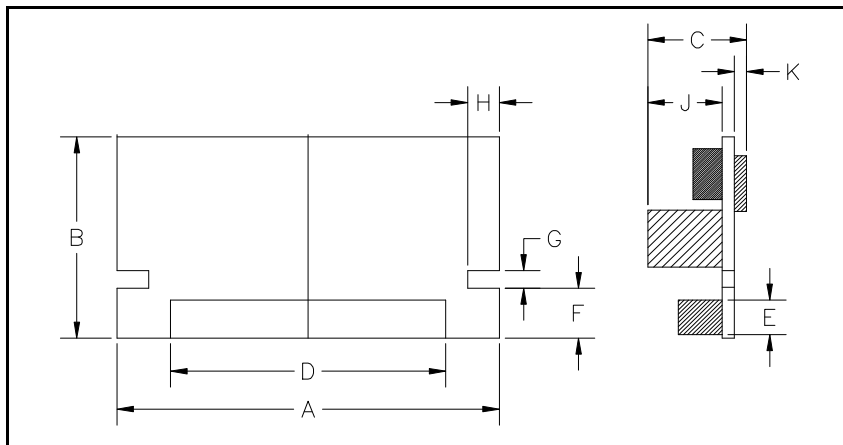
Pin Name	Pin Function
PWRGD	<b>Power Good:</b> When the output voltage is not within specifications (nominal or selected voltage $\pm 7\%$ ) this signal will be in the low state. The PWRGD signal will change to the proper state within 5ms of the output coming into or going out of specification.
OUTEN	<b>Output Enable:</b> A low state disables the output voltage. When disabled, the PWRGD signal shall be in the low state.
UP#	<b>Upgrade Present:</b> Used to indicate the presence of an upgrade processor. Typical state is high (standard processor in system). When in the low or ground state (OverDrive™ processor in system) the output voltage shall be disabled unless the converter can supply to an OverDrive processor's specifications. When disabled, the PWRGD output will be in the low state.
VID(0:3)	<b>Voltage Identification:</b> The module will accept four open collector signals, used to indicate the voltage required by the processor, as defined by Intel
5V in	Main power input for regulation.
12V in	Must also be connected (input for control circuits only)

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VOLTAGE IDENTIFICATION CODE				
Pentium Pro Pins				$V_{CCP}$ (VDC)
VID3	VID2	VID1	VID0	
1	1	1	1	2.0 (no CPU)
1	1	1	0	2.1
1	1	0	1	2.2
1	1	0	0	2.3
1	0	1	1	2.4
1	0	1	0	2.5
1	0	0	1	2.6
1	0	0	0	2.7
0	1	1	1	2.8
0	1	1	0	2.9
0	1	0	1	3.0
0	1	0	0	3.1
0	0	1	1	3.2
0	0	1	0	3.3
0	0	0	1	3.4
0	0	0	0	3.5

0 = processor pin connected to  $V_{SS}$ , 1 = open

### MECHANICAL DIMENSIONS



Component size and location  
for illustration only

Dimension	mm	inch	
A	79.7	3.14	Max
B	43.2	1.70	Max
C	24.4	0.96	Max
D	57.4	2.26	Typ
E	8.13	0.32	Typ
F	10.67 ± 0.13	0.42 ± 0.005	Typ
G	3.81	0.15	Typ
H	6.50	0.26	Min
J	21.6	0.85	Max
K	2.5	0.10	Min

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