Selecting Among HIP6004/5, HIP6004A/5A, HIP6004B/5B, and HIP6014/15

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Introduction

All eight part numbers listed above belong to voltage-mode PWM controllers targeted at desktop computer and/or microprocessor applications. These components were designed with emphasis on various Intel and industry requirements, specifically regarding the Pentium II processor and its derivatives.

Background Details

The evolution of these different, yet very similar ICs, was dictated by changes in Intel requirements as well as customer feedback. To ease the system migration to subsequent parts, all the ICs are compatible within their class type. Specifically, all even part numbers (HIP6004/4A/4B/14) represent pin-for-pin compatible synchronous buck controllers, while the odd numbers (HIP6005/5A/5B/15) are pin-for-pin compatible standard buck controllers [1-8]. Among the four pairs (4/5, 4A/5A, 4B/5B, and 14/15), however, there are functional subtleties that differentiate them.

Functional Differences

Reference Voltage DAC

All these converters have a 5-bit DAC-controlled internal voltage reference.

HIP6004 and HIP6005 have an analog DAC, where the VID inputs connect directly to a resistive internal network. Shorting various VID (voltage identification) inputs to ground changes the reference voltage and the converter's output voltage as a result. The drawback of such architecture is that the VID inputs have to be either open or shorted to ground. Pull-up or pull-down resistors on the VID input lines result in erroneous output voltage settings.

HIP6004A/4B/5A/5B/14/15, on the other hand, have fully buffered TTL-compatible VID inputs. Pull-ups to 5V do not affect the output voltage settings (open circuit still regarded as logic 'high'). Table 1 summarizes this difference.

TABLE 1. REFERENCE VOLTAGE DAC TYPE / PULL-UP COMPATIBILITY

5-BIT DAC	6004/5	6004A/5A	6004B/05B	6014/15
TTL-Compatible	No	Yes	Yes	Yes
Pull-up Resistors	Not Allowed	Allowed	Allowed	Allowed

Output Voltage Program

Among the eight part types, there are small differences in the operation of the DAC, as shown in Table 2. While the DAC is, in all cases, programmed to provide the same output voltage for a given VID combination, some controllers have certain voltage settings disabled.

TABLE 2. OUTPUT VOLTAGE PROGRAM AND PGOOD RESPONSE

VID PINS LOGIC STATE	OUTPUT VOLTAGE (HIP60xx)				PGOOD LOGIC STATE (HIP60xx)			
VID 4 3 2 1 0	04 05	04A 05A	04B 05B	14 15	04 05	04A 05A	04B 05B	14 15
0 1 1 1 1	1.30	0	1.30	0	X	0	X	1
0 1 1 1 0	1.35	0	1.35	0	X	0	X	1
0 1 1 0 1	1.40	0	1.40	0	X	0	X	1
0 1 1 0 0	1.45	0	1.45	0	X	0	X	1
0 1 0 1 1	1.50	0	1.50	0	X	0	X	1
0 1 0 1 0	1.55	0	1.55	0	X	0	X	1
0 1 0 0 1	1.60	0	1.60	0	X	0	X	1
0 1 0 0 0	1.65	0	1.65	0	X	0	X	1
0 0 1 1 1	1.70	0	1.70	0	X	0	X	1
0 0 1 1 0	1.75	0	1.75	0	X	0	X	1
0 0 1 0 1	1.80	1.80	1.80	1.80	X	X	X	X
0 0 1 0 0	1.85	1.85	1.85	1.85	X	X	X	X
0 0 0 1 1	1.90	1.90	1.90	1.90	X	X	X	X
0 0 0 1 0	1.95	1.95	1.95	1.95	X	X	X	X
0 0 0 0 1	2.00	2.00	2.00	2.00	X	X	X	X
0 0 0 0 0	2.05	2.05	2.05	2.05	X	X	X	X
1 1 1 1 1	2.00	0	0	0	X	0	1	1
1 1 1 1 0	2.10	2.10	2.10	2.10	X	X	X	X
1 1 1 0 1	2.20	2.20	2.20	2.20	X	X	X	X
1 1 1 0 0	2.30	2.30	2.30	2.30	X	X	X	X
1 1 0 1 1	2.40	2.40	2.40	2.40	X	X	X	X
1 1 0 1 0	2.50	2.50	2.50	2.50	X	X	X	X
1 1 0 0 1	2.60	2.60	2.60	2.60	X	X	X	X
1 1 0 0 0	2.70	2.70	2.70	2.70	X	X	X	X
1 0 1 1 1	2.80	2.80	2.80	2.80	X	X	X	X
1 0 1 1 0	2.90	2.90	2.90	2.90	X	X	X	X
1 0 1 0 1	3.00	3.00	3.00	3.00	X	X	X	X
1 0 1 0 0	3.10	3.10	3.10	3.10	X	X	X	X
1 0 0 1 1	3.20	3.20	3.20	3.20	X	X	X	X
1 0 0 1 0	3.30	3.30	3.30	3.30	X	X	X	X
1 0 0 0 1	3.40	3.40	3.40	3.40	X	X	X	X
1 0 0 0 0	3.50	3.50	3.50	3.50	X	X	X	X

NOTE: 'X' = '0' or '1', depending whether the output voltage is within PGOOD limits

PGOOD Response

During normal converter operation (with the VID combination resulting in an output voltage other than 0V), PGOOD asserts a logic ‘high’ (‘1’) if the output voltage is within 10% (typical) of the DAC setting (reference).

In the case of HIP6004A/5A, for VID settings resulting in converter shutdown (0V output voltage), PGOOD will assert a logic ‘low’ (‘0’), thus indicating the absence of output voltage.

A case that requires special consideration is the dual-processor system. For these systems, designers use one converter for each processor, “wire AND-ing” the open-drain PGOOD signals from both power converters in order to generate a ‘System Power Good’ signal. However, if these systems ship with only one processor populated (second processor offered as an upgrade), the empty processor slot would generate a ‘11111’ VID code, which in turn would disable the corresponding converter. If this converter were to employ a HIP6004A or HIP6005A, the 0V output voltage setting would generate a PGOOD ‘low’, and consequently cause the System Power Good to go ‘low’, disabling the entire computer system. HIP6004B/5B/14/15 handle this situation by generating a PGOOD ‘high’ for all VID settings that result in a 0V converter output.

References

For Intersil documents available on the internet, see web site http://www.intersil.com/

[1] *HIP6004 Data Sheet,* Intersil Corporation, FN4275

[2] *HIP6005 Data Sheet,* Intersil Corporation, FN276

[3] *HIP6004A Data Sheet,* Intersil Corporation, FN4417

[4] *HIP6005A Data Sheet,* Intersil Corporation, FN4418

[5] *HIP6004B Data Sheet,* Intersil Corporation, FN4567

[6] *HIP6005B Data Sheet,* Intersil Corporation, FN4568

[7] *HIP6014 Data Sheet,* Intersil Corporation, FN4420

[8] *HIP6015 Data Sheet,* Intersil Corporation, FN4421

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