



# **AMD-K6<sup>®</sup> Processor**

# **V<sub>CC2</sub> Voltage Detection**

## *Application Note*

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## Revision History

Date	Rev	Description
Jan 1998	A	Initial release under a non-disclosure agreement.
March 1998	B	Initial published release.
May 1998	C	Added AMD-K6-2 processor Model 8 information to Table 1 and Table 3.
Nov 1998	D	Revised Table 1, "Summary of Volt Detection Signal States for the AMD-K6 <sup>®</sup> Desktop Family," on page 2.
Feb 1999	E	Added AMD-K6-III processor Model 9 information throughout document.
Feb 1999	E	Revised Table 3, "Input States for Auto-Select PAL Solution," on page 5 to correct the VID0 bit entry for 2.2 V products.
Feb 1999	E	Revised Table 1, "Summary of Volt Detection Signal States for the AMD-K6 <sup>®</sup> Desktop Family," on page 2 to reference the AMD-K6 processor family based on nominal core voltage requirements.



## *Application Note*

# **AMD-K6<sup>®</sup> Processor $V_{CC2}$ Voltage Detection**

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Unless otherwise noted, the information in this application note pertains to all processors in the AMD-K6<sup>®</sup> desktop family, which includes the AMD-K6 processor (Models 6 and 7), the AMD-K6-2 processor (Model 8), and the AMD-K6-III processor (Model 9).

## **Why Use Voltage Detection?**

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With the increasing number of different processor types in the market, it becomes increasingly difficult to know which processors require what voltages—5 volt vs. 3 volt? 3.3 volt vs. 3.45 volt vs. 3.54 volt? Single voltage vs. dual voltage? The list goes on and on. Because of this confusion, many processors are often damaged due to electronic over-stress when powered with incorrect voltage settings. By implementing voltage detection, system logic can ensure that safe and appropriate voltage levels are supplied to the processor during system power-up, which helps prevent over-stress damage to processors.

The AMD-K6 processor family is designed to indicate to system logic its specified dual-voltage supply requirements. For those systems that support voltage detection, the implementation by AMD of  $V_{CC2}$  Detect (VCC2DET) and  $V_{CC2}$  High/Low (VCC2H/L#) allows protection against electronic over-stress. This design enhancement is for protection purposes only.

## Signal Descriptions

The AMD-K6 processor Models 7, 8, and 9 support voltage detection through the implementation of VCC2 Detect (VCC2DET) and VCC2 High/Low (VCC2H/L#). These signals are both tied to V<sub>SS</sub> (logic level 0) to indicate to the system logic that it must supply the specified dual-voltage requirements to the V<sub>CC2</sub> and V<sub>CC3</sub> pins. The V<sub>CC2</sub> pins supply voltage to the processor core, independent of the voltage supplied to the I/O buffers on the V<sub>CC3</sub> pins. Upon sampling VCC2DET Low to identify dual-voltage processor requirements, system logic should sample VCC2H/L# to identify the core voltage requirements of 2.9V and 3.2V products (High) and 2.2V and 2.4V products (Low).

The AMD-K6 processor Model 6 (0.35- $\mu$ m process technology) supports voltage detection through the implementation of VCC2DET. VCC2DET is internally tied to V<sub>SS</sub> (logic level 0) to indicate to the system logic that it must supply the specified dual-voltage requirements to the V<sub>CC2</sub> and V<sub>CC3</sub> pins. The VCC2H/L# signal is not implemented in the AMD-K6 processor Model 6, and this pin is designated as an Internal No Connect (INC). To prevent the system logic from misinterpreting this floating INC pin as a Low, system logic that samples VCC2H/L# must incorporate a weak pullup resistor for this signal. Some system implementations may, however, satisfy the need for a weak pullup resistor by design, see “VCC2H/L# Solution” on page 4. Table 1 summarizes the states of the voltage detection signals for the AMD-K6 desktop family.

**Table 1. Summary of Volt Detection Signal States for the AMD-K6<sup>®</sup> Desktop Family**

AMD-K6 <sup>®</sup> Processor Family	VCC2DET	VCC2H/L#	Notes
3.2 V Components	Low	Floating	1, 2
2.9 V Components	Low	Floating	1, 2
2.4 V Components	Low	Low	1
2.2 V Components	Low	Low	1
<b>Notes:</b>			
1 Refer to the AMD-K6, AMD-K6-2, or AMD-K6-III processor data sheets, order# 20695, 21850, and 21918 respectively, for operating specifications as they apply to each product offering.			
2. 2.9V and 3.2V component processors require a weak pullup resistor to provide a High detection of the VCC2H/L# signal.			



## Design Examples

The following design examples illustrate how to utilize the AMD-K6 processor voltage detection signals in system logic to prevent electronic over-stress. However, these examples do not provide a complete voltage supply solution. In fact, most voltage detection designs do not completely calibrate the supply voltage to the specified requirement, in which case additional jumper settings may be required to fine-tune the supplied V<sub>CC2</sub> voltage.

### VCC2DET Solution

The detection of VCC2DET is implemented to ensure the processor powers up in dual-voltage mode. The following logic example can be used for this purpose:

The supplied processor core voltage (V<sub>CC2</sub>) is first compared with a desired reference voltage (3.3V). The result of this comparison is then exclusively ORed with the VCC2DET pin. Finally, the output of this detection logic controls the processor voltage supply source through the shutdown or enable pin of the regulator.

Table 2 shows the solution states for this VCC2DET detection example. Dual voltage is supplied only when V<sub>CC2</sub> is less than or equal to the reference voltage and VCC2DET is Low. Single voltage is supplied only when V<sub>CC2</sub> is higher than the reference voltage and VCC2DET is High. Otherwise, the core voltage regulator is disabled.

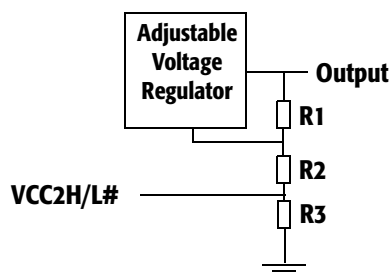
**Table 2. Solution States of the VCC2DET Detection Example**

V <sub>CC2</sub> vs. Reference	VCC2DET Pin	Logic Detection Output	Voltage Supply	Processor Supported
High (V <sub>CC2</sub> < Ref)	Low	High	dual-voltage	AMD-K6 <sup>®</sup> processor
Low (V <sub>CC2</sub> > Ref)	Low	Low	disabled	n/a
High (V <sub>CC2</sub> < Ref)	High	Low	disabled	n/a
Low (V <sub>CC2</sub> > Ref)	High	High	single-voltage	AMD-K5 <sup>™</sup> processor

**VCC2H/L# Solution**

In conjunction with detecting VCC2DET, VCC2H/L# enables the processor to power up at a safe  $V_{CC2}$  voltage level. The following logic example can be used for this purpose:

VCC2H/L# is connected to a voltage-divide resistor circuit to control an adjustable voltage regulator. When VCC2H/L# is Low, resistor R3 is bypassed (shorted to GND) to provide the desired low voltage. If VCC2H/L# is not grounded, the complete resistor circuit is utilized to provide the desired high voltage. In this example, a weak pullup resistor is not required for the VCC2H/L# signal because the resistor circuit serves as the required pullup. Figure 1 illustrates this design example below.



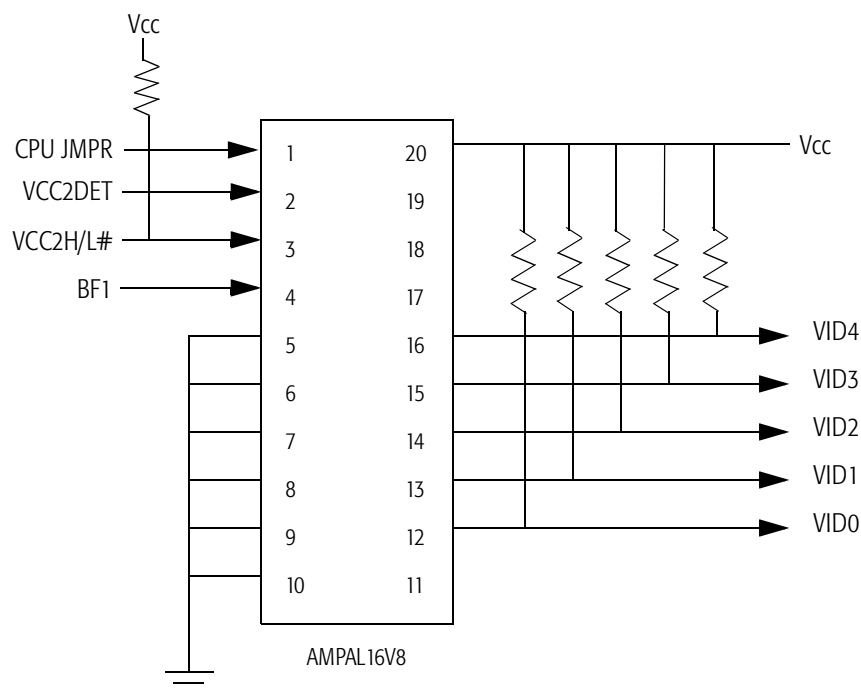
**Figure 1. VCC2H/L# Design Example**

**Auto-Select PLD Solution**

The VCC2DET, VCC2H/L#, and BF1 pins can be used as Programmable Logic Device (PLD) inputs to auto select the proper voltage for a complete range of processors. The outputs of the PLD become inputs to the Voltage ID pins of the switching voltage regulator. An external jumper (or jumpers) can be used to add design flexibility and to differentiate between the AMD-K6 processor and competitor processor configuration requirements.

Figure 2 illustrates the auto-select PLD example using an AMPAL16V8 PLD. Table 3 shows input states for auto selecting the proper voltages for the AMD-K6 processor family.

*Note: This specific example does not support auto detection for 2.4V processors.*


**Figure 2. PLD Auto-Select Design Example**
**Table 3. Input States for Auto-Select PAL Solution**

CPU JPMR Selection	VCC2DET	VCC2H/L#	Core Voltage	Processor	BF1	VID4	VID3	VID2	VID1	VID0
AMD	Low	High (see note)	3.2V	AMD-K6 <sup>®</sup> Model 6 233	High	1	0	0	1	1
AMD	Low	High (see note)	2.9V	AMD-K6 Model 6 200/166	Low	1	0	1	1	0
AMD	Low	Low	2.2V	AMD-K6 Model 7 or AMD-K6-2 Model 8	X	1	1	1	0	1
AMD	High	Low	Not Valid	Not valid	X	X	X	X	X	X
Other	X	X	X	X	X	X	X	X	X	X

**Note:**  
The AMD-K6 processor Model 6 requires a weak pullup resistor to provide the High detection of the VCC2H/L# signal.

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## **What About Motherboards Without Voltage Detection?**

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Voltage detection is recommended but is not required. Unfortunately, many motherboards do not implement voltage detection logic, in which case, there is no protection against incorrect voltage configurations. Motherboards without such logic should be well-marked to identify the correct voltage settings for all AMD-K6 processors. In addition, user manuals should be well-documented to caution users and to stress the importance of configuring correct voltage settings.

For motherboards that do not have volt detection logic, the correct voltage settings for your specific model of AMD-K6 processor should be verified by reviewing the motherboard user's manual before powering up the system.