

FAN5032

8-Bit Programmable 2 to 4 Phase Synchronous Buck Controller

Features

- Selectable 2, 3, or 4 phase operation at up to 1MHz per phase
- $\pm 7.7\text{mV}$ worst-case differential sensing error over temperature
- Active current balancing between the output phases
- Power good and crowbar blanking supports on-the-fly VID code changes
- 0.5V to 1.6V output
- Fully compliant to Intel® VR10 and VR11 specifications
- Selectable VR10 extended (7 bit) and VR11 (8 bit) VID tables
- Programmable soft-start ramp
- Programmable short-circuit protection and latch-off delay

Special Features

- 300mV OVP and crowbar threshold

Applications

- Desktop PC/server processor power supplies for existing and next-generation Intel processors
- VRM modules

Description

The FAN5032 is a controller for a multi-phase buck switching regulator optimized to convert a 12V input supply to the processor core voltage required by high-performance Intel processors. It has an internal 8-bit digital to analog converter (DAC) that converts a digital voltage identification (VID) code, sent from the processor to set the output voltage between 0.5V and 1.6V in 6.25mV steps. It outputs a pulse-width modulated (PWM) signal to external MOSFET drivers that, in turn, drive the switching power MOSFETs. The switching frequency of the design is programmable by a single resistor value and the number of phases can be programmed to support 2, 3, or 4 phase applications.

The FAN5032 also includes programmable no-load offset and droop functions to adjust the output voltage as a function of the load current, as required by the Intel specifications. The FAN5032 also provides an accurate and reliable short-circuit protection function with an adjustable over-current set point.

The FAN5032 is specified over the commercial temperature range of 0°C to 85°C and is available in a 40-lead MLP package.

Ordering Information

Product Number	Package Type	Pb-Free	Operating Temperature Range	Packing Method	Quantity per Reel
FAN5032MPX	MLP-40	Yes	0°C to 85°C	Tape and Reel	3,000

FAN5032 Block Diagram

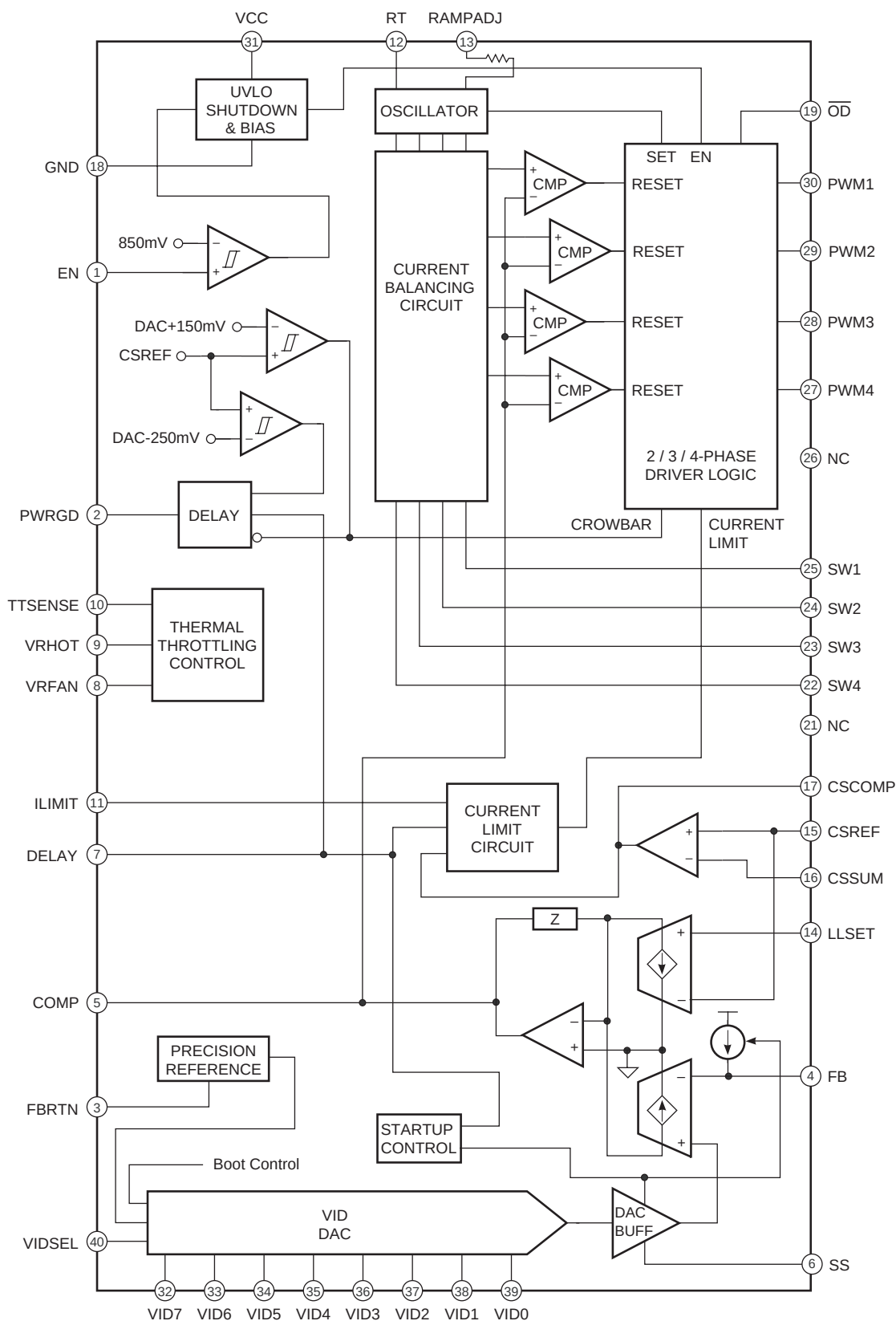


Figure 1. Block Diagram

FAN5032 Pin Assignment

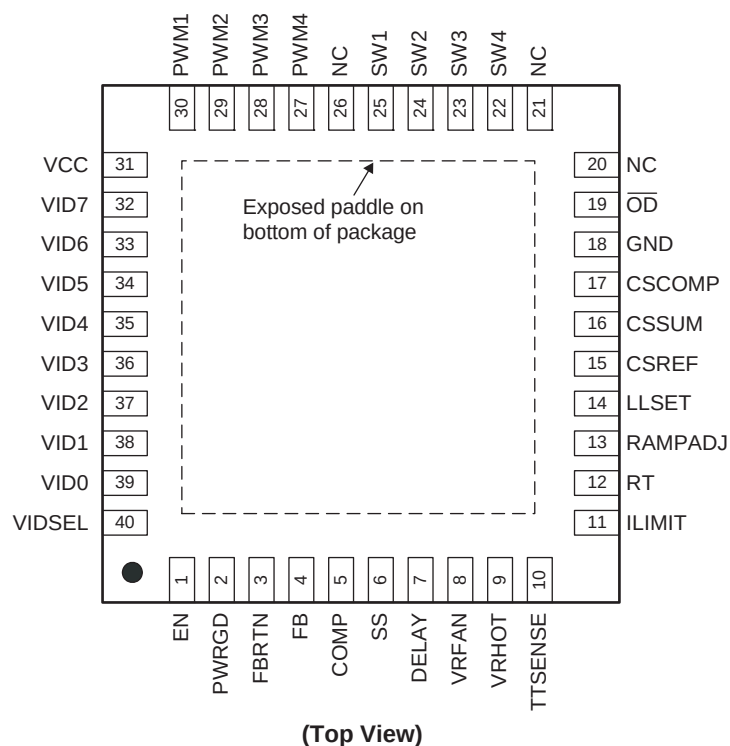


Figure 2. Pin Assignment

Pin Assignments

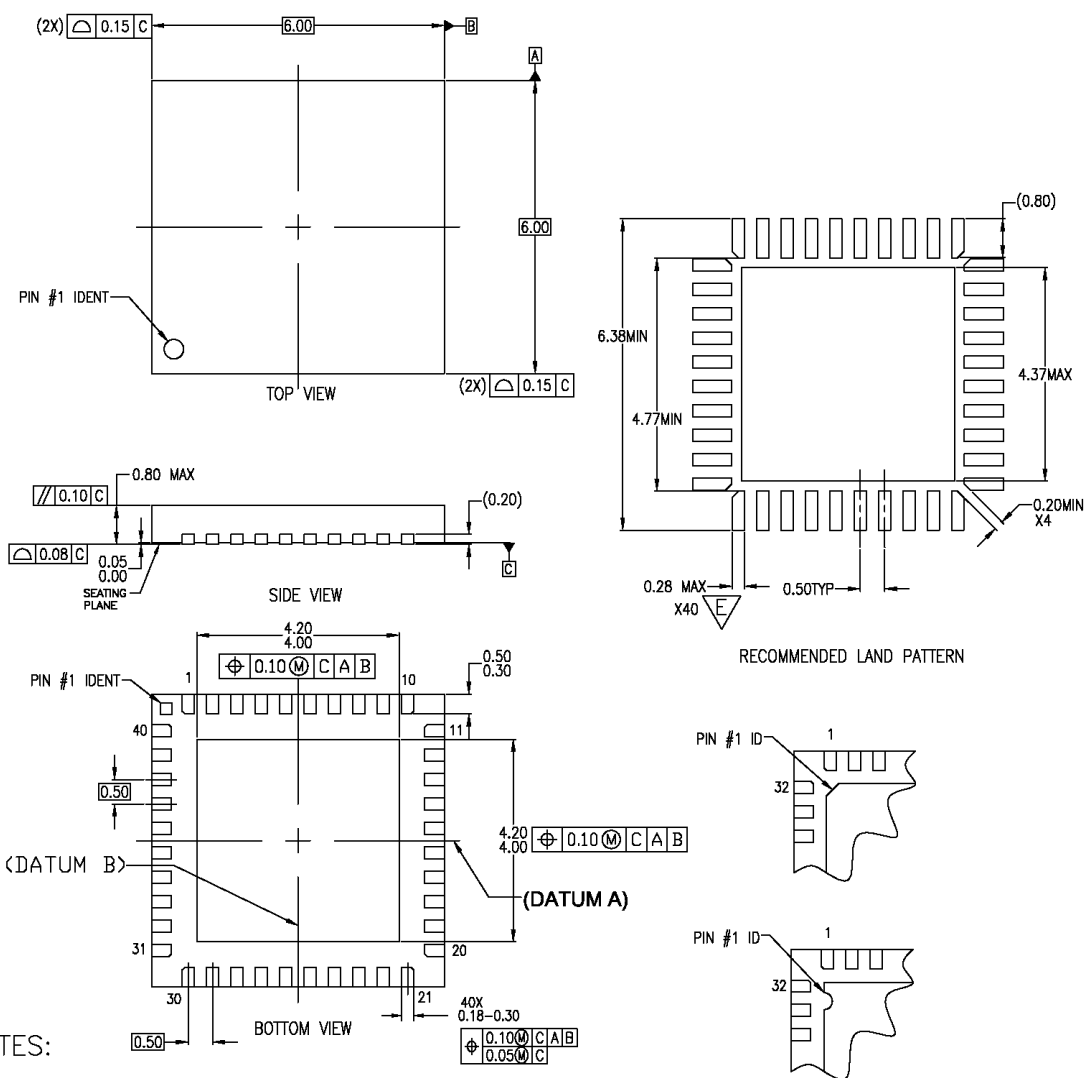
Pin #	Pin Name	Pin Description
1	EN	Power Supply Enable Input. Analog comparator input with hysteresis. If input voltage is higher than the internal threshold, the controller is enabled. If lower, the controller is disabled.
2	PWRGD	Power Good Output. Open drain output that pulls to GND when the output voltage is outside the proper operating range.
3	FBRTN	Feedback Return. VID DAC and error amplifier reference for remote sensing of output voltage.
4	FB	Feedback Input. Error amplifier input for remote sensing of output voltage. A positive internal current source is connected to this pin to allow the output voltage to be offset lower than the DAC voltage.
5	COMP	Error Amplifier Output. For loop compensation.
6	SS	Soft-Start Input. An external capacitor connected between this pin and GND sets the soft-start ramp time.
7	DELAY	Delay Timer Input. An external capacitor connected between this pin and GND sets the over-current latch-off delay time, BOOT voltage hold time, EN delay time, and PWRGD delay time.
8	VRFAN	VR Fan Output. Open drain output that goes high when the TTSENSE voltage goes below the internal VRFAN threshold.

Pin Assignments (Continued)

Pin #	Pin Name	Pin Description
9	VRHOT	VR Hot Output. Open drain output that goes high when the TTSENSE voltage goes below the internal VRHOT threshold.
10	TTSENSE	Thermal Sense Input. A positive internal current source is connected to this pin. Connecting an external NTC thermistor between this pin and GND produces a positive input voltage that is proportional to temperature.
11	ILIMIT	Current Limit Set. An external resistor from this pin to GND sets the current limit threshold of the converter.
12	RT	Frequency Set Input. An external resistor connected between this pin and GND sets the oscillator frequency of the device.
13	RAMPADJ	PWM Ramp Set Input. An external resistor connected between this pin and the converter input voltage sets the internal PWM ramp.
14	LLSET	Load Line Set Input. This pin can be directly connected to CSCOMP or connected to the center point of a resistor divider between CSCOMP and CSREF. Connecting LLSET to CSREF disables positioning.
15	CSREF	Current Sense Amplifier Positive Input. The voltage on this pin is used as the reference for the current sense amplifier. The power good and crowbar functions are also internally connected to this pin.
16	CSSUM	Current Sense Amplifier Negative Input
17	CSCOMP	Current Sense Amplifier Compensation Output
18	GND	Ground. All internal biasing and logic output signals of the device are referenced to this ground.
19	$\overline{\text{OD}}$	Output Disable. This pin is actively pulled low when the EN input is low or when VCC is below its UVLO threshold, to disable the external MOSFET drivers.
20 to 21	NC	No Connection
22 to 25	SW4 to SW1	Switching Node Current Balance Inputs. Sense the switching side of the inductor and are used to measure the current level in each phase. The SW pins of unused phases should be left open.
26	NC	No Connection
27 to 30	PWM4 to PWM1	PWM Outputs. Each output is connected to the input of an external MOSFET driver, such as the FAN5109. Connecting the PWM3 and/or PWM4 outputs to VCC disables that phase, allowing the FAN5032 to operate as a 2, 3, or 4 phase controller.
31	VCC	Supply Voltage for the Device
32 to 39	VID7 to VID0	Voltage Identification Code Inputs. These digital inputs are connected to the internal DAC and are used to program the output voltage. These pins have 1 μ A internal pull-down; left open, the input state is decoded as logic low.
40	VIDSEL	VID Table Select Input. A logic low selects the extended VR10 DAC table and a logic high selects the VR11 DAC table. This pin has a 1 μ A internal pull-down; left open, the input state is decoded as logic low.
–	Exposed Paddle	Internally connected to die ground. May be connected to ground or left floating. Connect to ground for lowest package thermal resistance.

Mechanical Dimensions

40-Lead MLP



NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-220, VARIATION WJJD-2 WITH EXCEPTION THIS IS A SAWN VERSION
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- LAND PATTERN PER IPC SM-782 FABRICATION AND ASSEMBLY TOLERANCES OF 0.1 MM APPLIED

WIDTH REDUCED TO AVOID SOLDER BRIDGING.

MLP040ArevA

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE ^x TM	FAST [®]	ISOPLANAR TM	PowerSaver TM	SuperSOT TM -6
ActiveArray TM	FAST ^r TM	LittleFET TM	PowerTrench [®]	SuperSOT TM -8
Bottomless TM	FPS TM	MICROCOUPLER TM	QFET [®]	SyncFET TM
Build it Now TM	FRFET TM	MicroFET TM	QS TM	TCM TM
CoolFET TM	GlobalOptoisolator TM	MicroPak TM	QT Optoelectronics TM	TinyLogic [®]
CROSSVOLT TM	GTO TM	MICROWIRE TM	Quiet Series TM	TINYOPTO TM
DOME TM	HiSeC TM	MSX TM	RapidConfigure TM	TruTranslation TM
EcoSPARK TM	I ² C TM	MSXPro TM	RapidConnect TM	UHC TM
E ² CMOS TM	i-Lo TM	OCX TM	μSerDes TM	UltraFET [®]
EnSigna TM	ImpliedDisconnect TM	OCXPro TM	ScalarPump TM	UniFET TM
FACT TM	IntelliMAX TM	OPTOLOGIC [®]	SILENT SWITCHER [®]	VCX TM
FACT Quiet Series TM		OPTOPLANAR TM	SMART START TM	Wire TM
Across the board. Around the world. TM		PACMAN TM	SPM TM	
The Power Franchise [®]		POP TM	Stealth TM	
Programmable Active Droop TM		Power247 TM	SuperFET TM	
		PowerEdge TM	SuperSOT TM -3	

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

Rev. 118