

RC5042

Programmable DC-DC Converter

Features

- 85% efficiency
- 350 μ A quiescent current in shutdown
- 4 Bit DAC for voltage selection
- On-board Power Good function
- Over-Voltage Protection
- Output voltage range from 2.1V to 3.5V
- Factory trimmed zero TC reference voltage
- Adjustable oscillator frequency to 1MHz
- Drives N-Channel MOSFETs

- 16 pin SOIC package
- Meets Intel VRM specification

Applications

- Programmable power supply for Pentium Pro™ based CPU motherboards
- VRM module for Pentium Pro™ CPU
- Programmable power supply

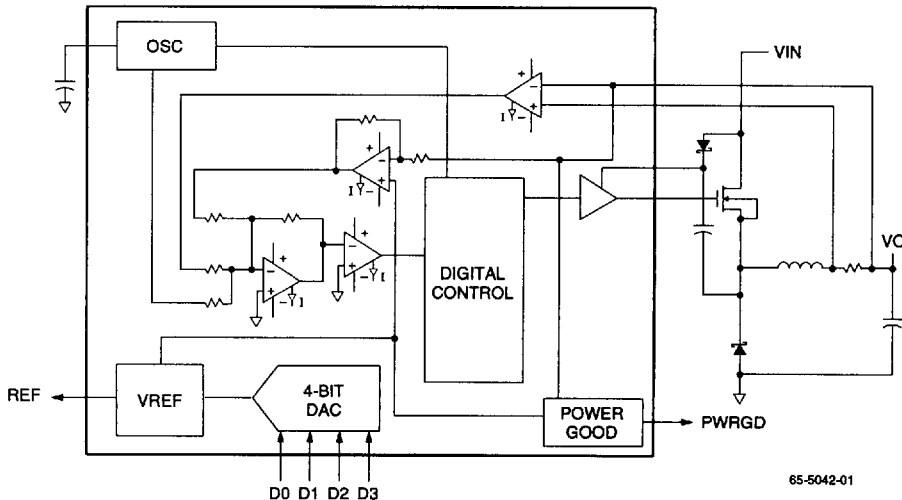
Description

The RC5042 is a non-synchronous DC-DC controller IC dedicated to providing a 5V programmable conversion (2.1V to 3.5V) for Pentium Pro™ CPU power. The RC5042 with the proper applications circuitry can be used to deliver load current greater than 12 Amps. The RC5042 is designed to operate in a standard PWM control mode under heavy load conditions and as a PFM controller in light load conditions. Its highly accurate zero TC reference eliminates the need for precision external components in order to achieve tight tolerance voltage regulation. Through the use of the on-board

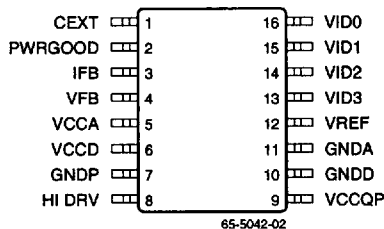
DAC, the RC5042 can generate accurate output voltages from 2.1V up to 3.5V in 0.1V increments. An integrated Power Good function constantly monitors the output voltage and produces a low-going interrupt signal to the Pentium Pro CPU in the event of a out-of-tolerance voltage situation, thereby protecting the CPU. The programmable oscillator can operate from 200KHz to greater than 1MHz to provide for flexibility in choosing external components such as inductors, capacitors, and Power MOSFETs.

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Block Diagram



Pin Assignments



Pin Definitions

Pin Name	Pin Number	Pin Function Description
CEXT	1	External Capacitor for setting oscillator frequency
PWRGOOD	2	An open collector. Logic HIGH indicated power is within limits
IFB	3	Current Feedback Input
VFB	4	Voltage Feedback Input
VCCA	5	Analog VCC
VCCD	6	Digital VCC
GNDP	7	Power ground for high current drivers
HIDRV	8	High side FET driver output
VCCQP	9	VCC for High side FET output driver
GNDD	10	Digital ground
GNDA	11	Analog ground
VREF	12	Reference voltage output
VID3-VID0	13-16	Voltage identification code input

Absolute Maximum Ratings

(beyond which the device may be damaged)¹

Parameter	Conditions	Min	Typ	Max	Units
VIN	Input Voltage			13.2	V
VCCQP	High FET Driver Supply			13.2	V
TJ	Junction Temperature			175	°C
TA	Ambient Operating Temperature	0		70	°C
TS	Storage Temperature	-65		150	°C
TL	Lead Soldering Temperature	10 seconds		300	°C

Notes:

1. Functional operation under any of these conditions is NOT implied.

Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
VCC	Supply Voltage	4.5	5	7	V
VCCQP	Driver Supply Voltage	9	12	13.2	V
VIH	Input Voltage, Logic HIGH	2			V
VIL	Input Voltage, Logic LOW			0.8	V

DC Electrical Characteristics

(VCC = 5V, VCCQP = 12V, fosc = 650 KHz, and TA = +25°C unless otherwise noted. Refer to Figure 1.

Parameter	Conditions	Min	Typ	Max	Units
Output Voltage	See Voltage Identification Code Table, TA = 0–70°C	2.1		3.5	V
Output Current			10		A
Set Point Accuracy	I _{LOAD} = 1A		0.25		%
Output Voltage Tempco			40		ppm/°C
Load Regulation	I _{load} = 0.5 to 10A		1		%Vo
Line Regulation	Input Voltage = 4.75 to 5.25V, I _{load} = 10A (See Figure 1)		0.14		%Vo
Output Voltage Ripple			30		mV
Cumulative Accuracy ¹	TA = 25°C		2	3.5	%
Cumulative Accuracy ¹	TA = 0–70°C		3	5	%
Efficiency	I _{load} = 10A	80	85		%
Power Dissipation			0.1	0.2	W
Output Current Driver		0.5	1.0		A

Notes:

1. Output Voltage Accuracy, Tempco, Load Regulation, Line Regulation, Ripple, & Transient Performance determine the Cumulative Accuracy.

AC Electrical Characteristics¹

(TA = +25°C unless otherwise noted). Refer to Figure 1.

Parameter	Min	Typ	Max	Units
Response Time Sleep-to-Full Load		10		μs
Oscillator Frequency Range	.2		1.2	MHz
Oscillator Frequency Precision		10		%
Maximum Duty Cycle in PWM Mode	90	95		%
Minimum Duty Cycle in PFM Mode			100	ns
Short Circuit Detection Comparator Threshold	80	100		mV
Short Circuit Protection/Coil Saturation Detection, r _{sense} = 5mΩ		20		A
Short Circuit Current Foldback, r _{sense} = 5mΩ		14		A
Response Time to IMAX and Short Circuit Protection		15	30	ns
Soft Start during Power-Up and Power-Down		10		μs

Notes:

1. Guaranteed by characterization, not tested 100%.

Voltage Identification Codes

P6 Pins				VDC	Set Point (\pm mV)	Total Room Temperature Accuracy ¹ (\pm mV)	Total System Accuracy ² (\pm mV)
VID3	VID2	VID1	VID0				
1	1	1	1	No CPU	—	—	—
1	1	1	0	2.1	24	74	105
1	1	0	1	2.2	24	77	110
1	1	0	0	2.3	24	81	115
1	0	1	1	2.4	24	84	120
1	0	1	0	2.5	25	88	125
1	0	0	1	2.6	26	91	130
1	0	0	0	2.7	27	95	135
0	1	1	1	2.8	28	98	140
0	1	1	0	2.9	29	102	145
0	1	0	1	3.0	30	105	150
0	1	0	0	3.1	31	109	155
0	0	1	1	3.2	32	112	160
0	0	1	0	3.3	33	116	165
0	0	0	1	3.4	34	119	170
0	0	0	0	3.5	40	123	175

Notes:

1. Includes set point accuracy + line reg + load reg + transient (\pm mV).
2. Includes temperature effects to total accuracy (\pm mV).

Test Circuits

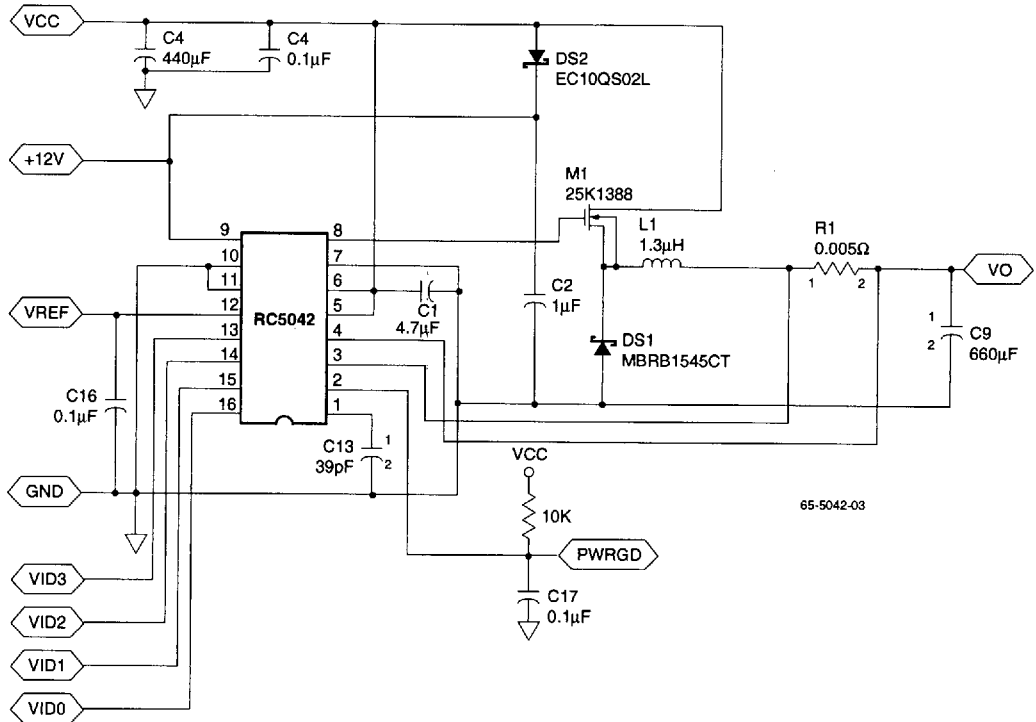


Figure 1. Standard Test or Application Schematic

Table 1. Components for RC5042

RC5042 Standard Application Circuit Bill of Materials			
Ref Designator	Quantity	Part No.	Manufacturer
L1	1	CDRH127-1R3NC 1.3µH	Sumida
M1	2	25K1388	Fuji
DS1	1	MBRB1545CT	Motorola
DS2	1	EC10QS02L	Nihon
R1	1	LRC-2512 .005Ω	IRC
C4	2	OS-CON 10SA220M 220µF	Sanyo
C9	2	OS-CON 10SA330M 330µF	Sanyo
C1	1	1µF	Monolithic ceramic Cap
C13	1	39pF	SMD Cap
C16,C17	2	0.1µF	SMD Cap
R9	1	10K	SMD Resistor

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Ordering Information

Product Number	Package	θJA
RC5042M	16 pin SOIC	80°C/W

Preliminary Information