

Adaptive Digital DC-DC Controller with Current Sharing

Description

The ZL2004-01 is specialized version of the ZL2004 DC-DC controller that has been optimized for high output accuracy within a given set of operating conditions. The ZL2004-01 is otherwise identical to the ZL2004 in features and functionality. The ZL2004-01 has been optimized for use with the ZL1505 MOSFET driver and discrete MOSFETs.

The ZL2004-01 integrates a proprietary Digital-DC communication bus for current sharing and inter device communication. Adaptive algorithms improve light load efficiency. All operating features can be configured by simple pin-strap selection, resistor selection or through the on-board serial port. The PMBus™-compliant ZL2004-01 uses the SMBus™ serial interface for communication with other Digital-DC products or a host controller.

Features

Power Conversion

- Efficient synchronous buck controller
- $\pm 0.2\%$ V_{OUT} set-point accuracy
- 8.0 V to 10.0 V input range
- 0.9 V to 1.1 V output range
- Adaptive performance optimization algorithms
- Fast load transient response
- Active current sharing
- DCR current sensing with digitally adjustable current sense range
- RoHS compliant (5 x 5 mm) QFN package

Power Management

- Digital soft start/stop
- Precision delay and ramp-up
- Power good/enable
- Voltage tracking, sequencing and margining
- Voltage/current/temperature monitoring
- SMBus communication (PMBus compliant)
- Output voltage and current protection
- Internal non-volatile memory (NVM)

Applications

- Servers / storage equipment
- Telecom / datacom equipment
- Power supplies (memory, DSP, ASIC, FPGA)

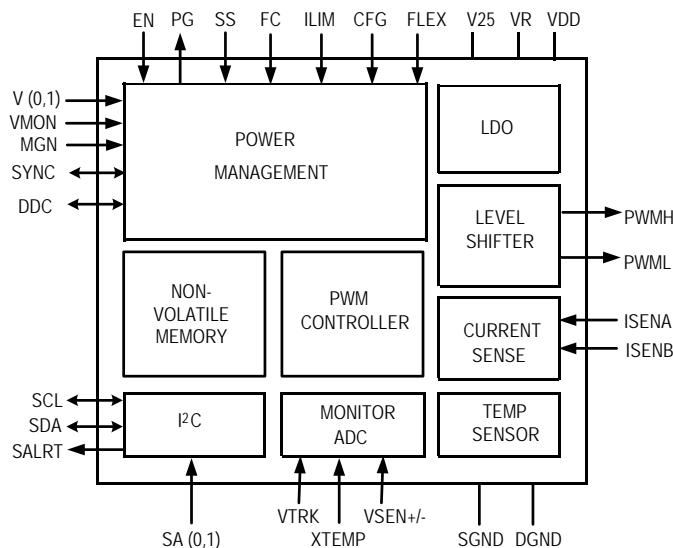


Figure 1. Block Diagram

1. Electrical Characteristics

Table 1. Absolute Maximum Ratings

Operating beyond these limits may cause permanent damage to the device. Functional operation beyond the Recommended Operating Conditions is not implied. Voltage measured with respect to SGND.

| Parameter | Pin(s) | Value | Unit |
|---|---|--------------|------|
| DC supply voltage | VDD | -0.3 to 17 | V |
| Logic I/O voltage | CFG, DDC, EN, FC, FLEX, ILIM, MGN, PG, SA(0,1), SALRT, SCL, SDA, SS, SYNC, VMON, V(0,1) | -0.3 to 6.5 | V |
| Analog input voltages | VSEN+, VSEN-, VTRK, XTEMP | -0.3 to 6.5 | V |
| | ISENA, ISENB | -1.5 to 6.5 | V |
| MOSFET drive reference | VR | -0.3 to 6.5 | V |
| Logic reference | V25 | -0.3 to 3 | V |
| Ground voltage differential ($V_{DGND} - V_{SGND}$) | DGND, SGND | -0.3 to +0.3 | V |
| Junction temperature | – | -55 to 150 | °C |
| Storage temperature range | – | -55 to 150 | °C |
| Lead temperature (soldering, 10 s) | – | 300 | °C |

Table 2. Recommended Operating Conditions and Thermal Information

| Parameter | Symbol | Min | Typ | Max | Unit |
|--|---------------|-----|-----|------|------|
| Input Supply Voltage Range | V_{DD} | 8.0 | – | 10.0 | V |
| Output Voltage Range | V_{OUT} | 0.9 | 1.0 | 1.1 | V |
| Operating Frequency | F_{SW} | – | 400 | – | kHz |
| Operating Ambient Temperature Range | T_A | 0 | – | 65 | °C |
| Junction to Ambient Thermal Impedance ¹ | Θ_{JA} | – | 35 | – | °C/W |
| Junction to Case Thermal Impedance ² | Θ_{JC} | – | 5 | – | °C/W |

Notes:

- Θ_{JA} is measured in free air with the device mounted on a multi-layer FR4 test board and the exposed metal pad soldered to a low impedance ground plane using multiple vias.
- For Θ_{JC} , the “case” temperature is measured at the center of the exposed metal pad

Table 3. Electrical Specifications

$V_{DD} = 8.6\text{ V}$, $V_{OUT} = 1.0\text{ V}$, $T_A = 0^\circ\text{C}$ to 65°C unless otherwise noted. Typical values are at $T_A = 25^\circ\text{C}$.

The following specifications describe the ZL2004-01 electrical specifications that differ from the ZL2004. Please refer to the ZL2004 data sheet for the full operating specification limits for the remaining functions not described herein.

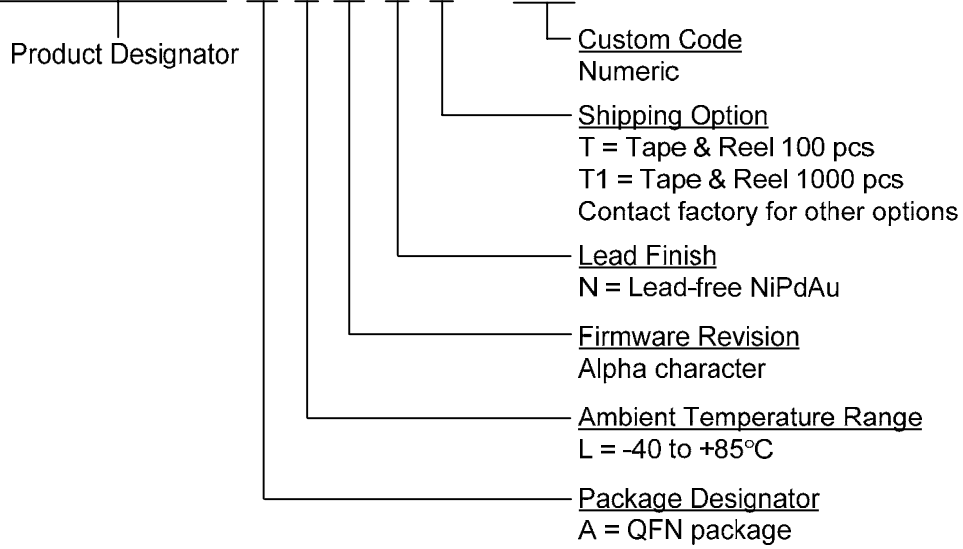
| Parameter | Conditions | Min | Typ | Max | Unit |
|--|--|-------|-----|------|------|
| Input and Supply Characteristics | | | | | |
| I_{DD} supply current at $f_{SW} = 400\text{ kHz}$ | GH no load, GL no load, MISC_CONFIG[7] = 1 | – | 16 | 30 | mA |
| I_{DDS} shutdown current | EN = 0 V No I ² C/SMBus activity | – | 2 | 5 | mA |
| VR reference output voltage | $V_{DD} > 6\text{ V}$, $I_{VR} < 50\text{ mA}$ | 4.5 | 5.2 | 5.5 | V |
| V25 reference output voltage | $V_R > 3\text{ V}$, $I_{V25} < 50\text{ mA}$ | 2.25 | 2.5 | 2.75 | V |
| Output Characteristics | | | | | |
| Output voltage adjustment range | $V_{IN} > V_{OUT}$ | 0.9 | – | 1.1 | V |
| Output voltage setpoint accuracy ¹ | $V_{IN} = 8.6\text{ V}$, $V_{OUT} = 1\text{ V}$ $T_A = 0^\circ\text{C}$ to $+65^\circ\text{C}$, $I_{LOAD} = 0\text{--}40\text{ A}$ | - 0.2 | – | 0.2 | % |
| Oscillator and Switching Characteristics | | | | | |
| Switching frequency ² | SYNC pin floating or NVM configured for 400kHz | – | 400 | – | kHz |
| Switching frequency set-point accuracy | | - 5 | – | 5 | % |
| Fault Protection Characteristics | | | | | |
| UVLO threshold range | Configurable via I ² C/SMBus | 2.85 | – | 16 | V |
| | | | | | |

Notes:

- V_{OUT} set-point measured at the termination of the VSEN+ and VSEN- sense points.
- The ZL2004-01 has been optimized for operation at 400 kHz only. Please consult the factory for requirements at other operating frequencies.

2. Ordering Information

Z L 2 0 0 4 A L N N T - 0 1



3. Revision History

| Rev. # | Description | Date |
|----------|--|---------------|
| 1.0 | Data sheet initial release | March 2008 |
| 1.1 | Updated Ordering Information | May 2008 |
| FN6847.0 | Assigned file number FN6847 to datasheet as this will be the first release with an Intersil file number. Replaced header and footer with Intersil header and footer. Updated disclaimer information to read "Intersil and it's subsidiaries including Zilker Labs, Inc." No changes to datasheet content | February 2009 |



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