

1 General description

The FS26 is a power system basis chip (Power SBC) designed for low and mid-end micro controllers units. It features advance power managment conversion to support battery voltage from 3.2 V up to 40 V.

System level power is provided with a high efficiency buck controller, two programmable LDOs, a high precision voltage reference and two voltage tracker with high voltage protection to support loads off-module.

The FS26 features fully indepenent and configurable functional safety state machine with up to two fail-safe outputs and system level monitoring mechanism to reach a high integrity safety level targeting system up to ASIL-D. Electrical characteristics are maintained in the FS26 data sheet

2 Features and benefits

- High voltage boost converted supporting front-end or independent operation
- One high voltage buck pre-regulator with low power mode support
- One high efficiency buck regulator for MCU core voltage support
- Two linear regulators with low power mode support
- High precission 1% accurate voltage reference
- Two Voltage tracking regulator with high voltage protection for off-module load support
- Fully independent safety state machine with monitoring mechanism targeting ASIL-B applications
- Long duration timer, counting up to 6 months with 1.0 s resolution
- Selectable wake-up sources to bring the system back from low power modes
- Two configurable GPIO pins
- 10 MHz SPI communication interface

3 Applications

- Automotive motor control / gate driver systems
- 48 V battery systems
- Hybrid battery systems
- Electric vehicle battery systems
- Body controller systems



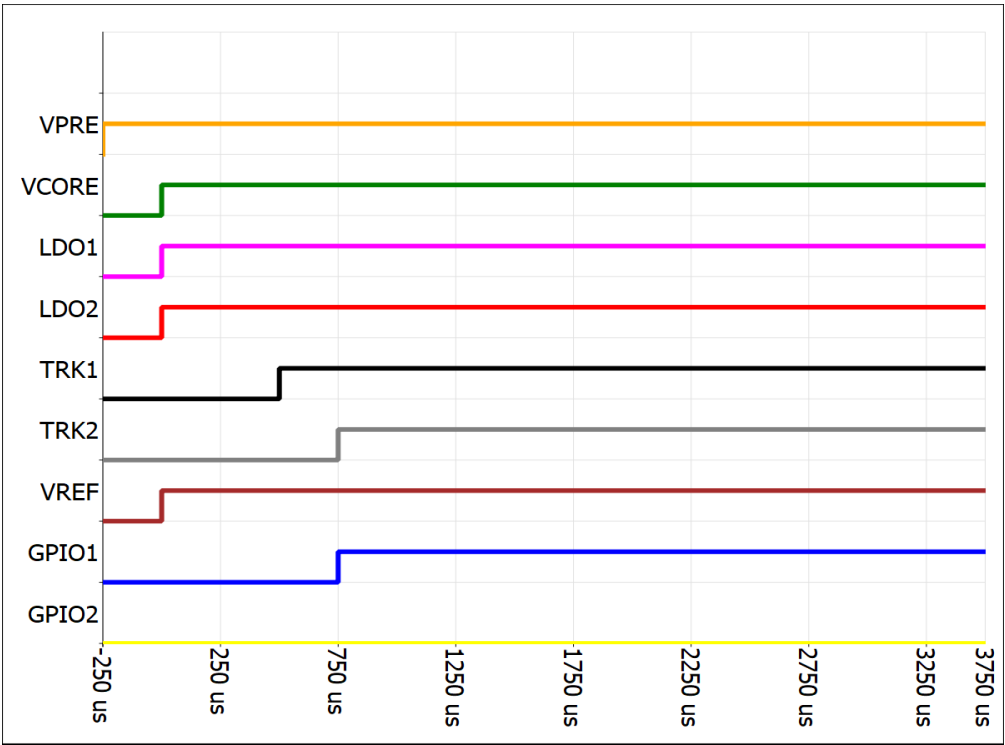
4 Ordering information

Table 1. Ordering information

| Type number ^[1] | Package | | |
|----------------------------|-----------|---|-----------|
| | Name | Description | Version |
| SFS2633AMDEPAD | LQFP48 AE | HLQFP48-EP plastic thermally enhanced low profile quad flat package. 48 terminals; 0.5mm pitch; 7 mm x 7 mm x 1.4 mm body | SOT1571-1 |

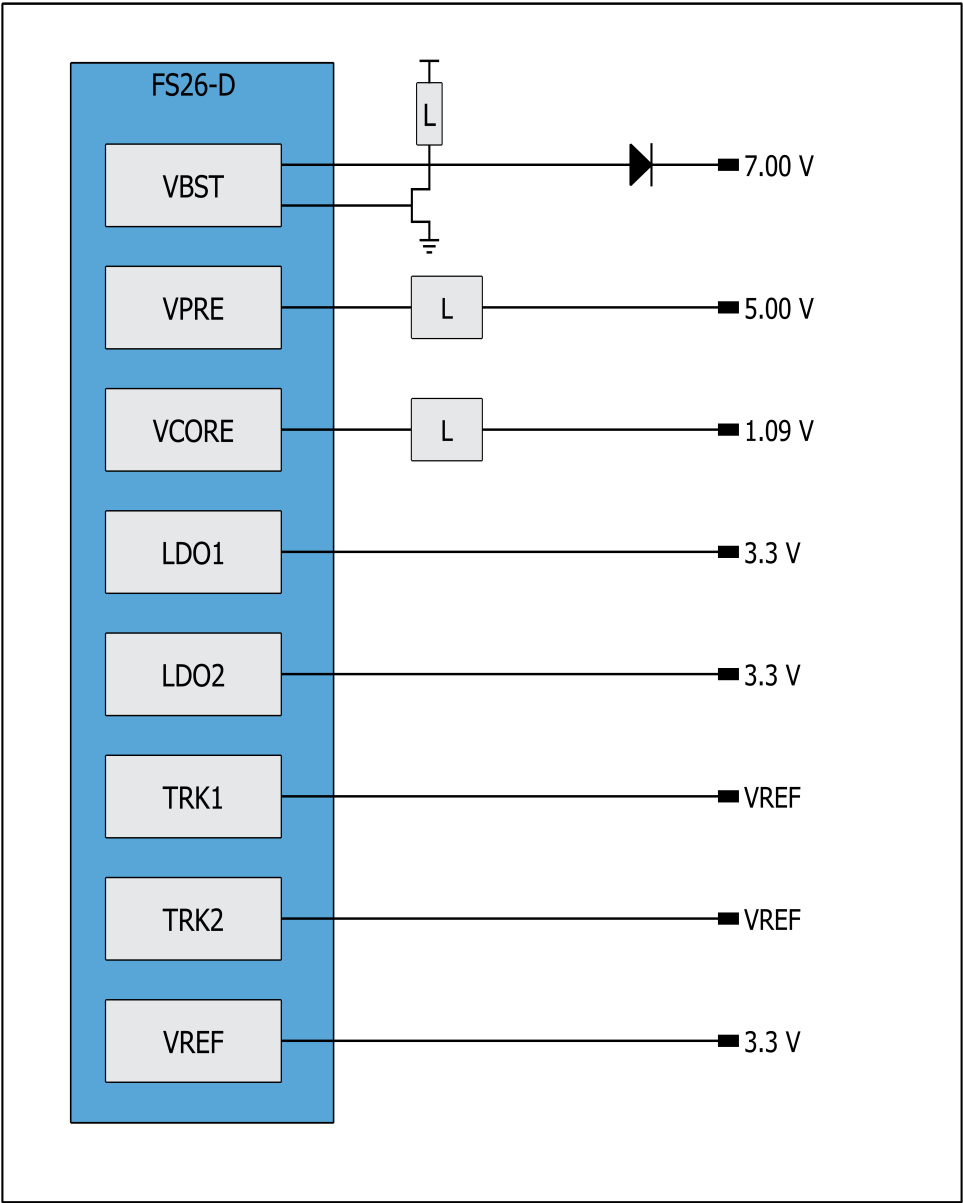
[1] To order parts in tape and reel, add the R2 suffix to the part number.

5 Power-up sequence summary



The signals depicted above are enable signals for each regulator. They don't represent the actual ramp voltage.

6 Hardware configuration diagram



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7 OTP configuration

See FS26 datasheet for parametric details. The OTP configuration summary for EP sequence ID is provided in Tables below.

Table 2. Device OTP configuration

| Functional block | Feature | OTP selection |
|----------------------|------------------------------|---------------------------------|
| System configuration | VSUP UV Threshold | 4.8 V/4.3 V |
| | Exit DFS On WAKE1 Event | DFS Exit on Wake1 Event Enabled |
| | Auto-retry Power Up From DFS | Auto-retry Enabled |
| | Auto-retry Mode | Limited retry |
| | Auto-retry Timer Limit | 800 ms |
| | Clock Frequency Selection | 18 MHz |
| | VBOS Input Selection | Auto Transition on VPRE_UVH |
| Power-up Sequence | Power-up Slot Time | 250 us |
| | Power-up Slot Bypass | Bypass Disabled |
| | VCORE Power-up Slot | Slot 0 |
| | LDO1 Power-up Slot | Slot 0 |
| | LDO2 Power-up Slot | Slot 0 |
| | TRK1 Power-up Slot | Slot 2 |
| | TRK2 Power-up Slot | Slot 3 |
| | VREF Power-up Slot | Slot 0 |
| | GPIO1 Power-up Slot | Slot 3 |
| | GPIO2 Power-up Slot | OFF |
| I/O Configuration | GPIO1 Configuration | High Side Driver |
| | GPIO1 Low Side Polarity | GPIO1 LS active high |
| | GPIO1 Pull-up | Pull-Up Disabled |

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| | | |
|--|---------------------------|------------------------------------|
| | GPIO1 Pull-down | Pull-Down Enabled |
| | GPIO1 Detection Threshold | Low voltage threshold |
| | GPIO1 TSD Pull-down | Pull-down enabled in TSD |
| | GPIO2 Configuration | GPIO2 configured as an Input |
| | GPIO2 Low Side Polarity | GPIO2 LS active high |
| | GPIO2 VCORE PGOOD | GPIO2 is not driven by VCORE PGOOD |
| | GPIO2 Pull-up | Pull-Up Disabled |
| | GPIO2 Pull-down | Pull-Down Disabled |
| | GPIO2 Detection Threshold | Low voltage threshold |
| | WAKE1 Detection Threshold | Low voltage threshold |
| | WAKE2 Detection Threshold | Low voltage threshold |
| | WAKE1 Pull-down | Pull-Down Enabled |
| | WAKE2 Pull-down | Pull-Down Enabled |
| | WAKE1 Pull-down Selection | 200 kOhm |
| | WAKE2 Pull-down Selection | 200 kOhm |

Table 3. Switching Regulators

| Functional block | Feature | OTP selection |
|--------------------|------------------------|---------------|
| VPRE Configuration | VPRE In Normal Mode | 5.00 V |
| | VPRE In Standby Mode | 5.00 V |
| | DVS Ramp Rate | 22 mV/us |
| | VPRE Over Current Flag | 2.2 A |
| | Over Current Deglitch | 2000 us |
| | Soft-start Ramp | 2150 us |
| | VPRE Power Down Delay | 100 us |

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| | | |
|--------------------|-------------------------|-----------------------------|
| | VPRE Transition Voltage | 5.00 V |
| | VPRE Phase Delay | No delay |
| | VPRE LX Slew Rate | Slow mode |
| | Transconductance Amp | 10 uS |
| | Comp Capacitance | 12.0 pF |
| | Comp Resistance | 1300 kOhm |
| | Slope Compensation | 266 mV/us |
| | Minimum On Time In PFM | 1125 ns |
| | Minimum Off Time In PFM | 720 ns |
| | VPRE Clock Selection | FSW/40 |
| | TSD Behavior | Go to DFS |
| | TSD Pull-down | Pull-down enabled in TSD |
| | | |
| VBST Configuration | VBST Voltage | 7.00 V |
| | VBST Configuration | Front-end boost |
| | VBSTFB OV Monitor Mode | Auto-enable mode |
| | Phase Delay | 1 Clock Cycle |
| | Low-side Slew Rate | PU = 1.5 Ohm / PD = 1.0 Ohm |
| | Minimum TON | 200 ns |
| | VBST Soft Start | 425 us |
| | Max Duty-cycle | 87.50 % |
| | Comp Capacitance | 200 pF |
| | Comp Transconductance | 5.1 uS |
| | Comp Resistance | 500 kOhm |
| | Current Limit | 150 mV/RSNS |

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| | | |
|---------------------|----------------------|----------------------------------|
| | Slope Compensation | 127 mV/us |
| VCORE Configuration | VCORE Voltage | 1.09 V |
| | Control Type | Valley mode control |
| | Soft Start | 10 mV/us |
| | VCORE Current Limit | 3.4 A |
| | Phase Delay | 2 Clock Cycles |
| | High-side Slew Rate | Rise = 4.5 V/ns; Fall = 1.2 V/ns |
| | Transconductance Amp | 26 uS |
| | Comp Capacitance | 50 pF |
| | Comp Resistance | 150 kOhm |
| | VCORE Inductor | 1 uH |
| | TSD Behavior | Go to DFS |
| | TSD Pull-down | Pull-down enabled in TSD |

Table 4. Regulators

| Functional block | Feature | OTP selection |
|---------------------|-------------------------|--------------------------|
| LDO1 configurations | LDO1 Voltage In Normal | 3.3 V |
| | LDO1 Voltage In Standby | 3.3 V |
| | LDO1 In Standby Mode | LDO1 Disabled |
| | TSD Behavior | LDO1 disabled only |
| | TSD Pull-down | Pull-down enabled in TSD |
| LDO2 configurations | LDO2 Voltage In Normal | 3.3 V |
| | LDO2 Voltage In Standby | 3.3 V |
| | LDO2 In Standby Mode | LDO2 Enabled |

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| | | |
|---------------------|------------------------|--------------------------|
| | TSD Behavior | LDO2 disabled only |
| | TSD Pull-down | Pull-down enabled in TSD |
| VREF configurations | VREF Voltage | 3.3 V |
| | Internal LDO Reference | 1.2 V |
| TRK1 configurations | TRK1 Input Selection | VREF |
| | TSD Behavior | TRK1 disabled only |
| | TSD Pull-down | Pull-down enabled in TSD |
| TRK2 configurations | TRK2 Input Selection | VREF |
| | TSD Behavior | TRK2 disabled only |
| | TSD Pull-down | Pull-down enabled in TSD |

Table 5. Voltage Monitoring

| Functional block | Feature | OTP selection |
|------------------------|-----------------------------|---------------|
| VMONPRE Configuration | VPRE Monitoring Voltage | 5.00 V |
| | VPRE OV Threshold | 110.5 % |
| | VPRE UV Threshold | 90.0 % |
| | VMONPRE OV Deglitch | 45 us |
| | VMONPRE UV Deglitch | 40 us |
| VMONLDO1 Configuration | LDO1 Monitoring Voltage | 3.3 V |
| | LDO1 OV Threshold | 104.5 % |
| | LDO1 UV Threshold | 95.5 % |
| | LDO1 Degraded UV Monitoring | Normal UV |
| | VMONLDO1 OV Deglitch | 45 us |
| | VMONLDO1 UV Deglitch | 40 us |

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| | | |
|------------------------|-----------------------------|---------------------------------|
| | LDO1 Pin Lift Detection | LDO1 pin lift detection enabled |
| VMONTRK1 Configuration | TRK1 Monitoring Voltage | 3.3 V |
| | TRK1 OV Threshold | 106.0 % |
| | TRK1 UV Threshold | 94.0 % |
| | VMONTRK1 OV Deglitch | 45 us |
| | VMONTRK1 UV Deglitch | 40 us |
| VMONCORE Configuration | VCORE Monitoring Voltage | 1.09 V |
| | CORE OV Threshold | 104.5 % |
| | CORE UV Threshold | 95.5 % |
| | VMONCORE OV Deglitch | 45 us |
| | VMONCORE UV Deglitch | 40 us |
| VMONLDO2 Configuration | LDO2 Monitoring Voltage | 3.3 V |
| | LDO2 OV Threshold | 108.0 % |
| | LDO2 UV Threshold | 88.0 % |
| | LDO2 Degraded UV Monitoring | Normal UV |
| | VMONLDO2 OV Deglitch | 45 us |
| | VMONLDO2 UV Deglitch | 40 us |
| | LDO2 Pin Lift Detection | LDO2 pin lift detection enabled |

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| | | |
|------------------------|----------------------------|---------------------------------|
| VMONTRK2 Configuration | TRK2 Monitoring Voltage | 3.3 V |
| | TRK2 OV Threshold | 106.0 % |
| | TRK2 UV Threshold | 94.0 % |
| | VMONTRK2 OV Deglitch | 45 us |
| | VMONTRK2 UV Deglitch | 40 us |
| VMONEXT Configuration | External VMON OV Threshold | 108.0 % |
| | External VMON UV Threshold | 92.0 % |
| | VMONEXT OV Deglitch | 45 us |
| | VMONEXT UV Deglitch | 40 us |
| VMONREF Configuration | VREF Monitoring Voltage | 3.3 V |
| | VREF OV Threshold | 104.5 % |
| | VREF UV Threshold | 95.5 % |
| | VMONREF OV Deglitch | 45 us |
| | VMONREF UV Deglitch | 40 us |
| | VREF Pin Lift Detection | VREF pin lift detection enabled |

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Table 6. System Safety Configuration

| Functional block | Feature | OTP selection |
|-----------------------------|---------------------------|----------------------------------|
| ABIST1 Configuration | ABIST1 On VMONPRE | ABIST1 Enabled |
| | ABIST1 On VMONCORE | ABIST1 Enabled |
| | ABIST1 On VMONLDO1 | ABIST1 Enabled |
| | ABIST1 On VMONLDO2 | ABIST1 Enabled |
| | ABIST1 On VMONTRK1 | ABIST1 Enabled |
| | ABIST1 On VMONTRK2 | ABIST1 Enabled |
| | ABIST1 On VMONREF | ABIST1 Enabled |
| | ABIST1 On VMONEXT | ABIST1 Enabled |
| System Safety Configuration | DFS Entry Mode | Go to DFS when FLT_ERR_CNT = max |
| | FS1B Assertion Mode | Delayed Assertion Enabled |
| | RSTB Delay From FS0B | 0 us |
| | RSTB Low Detection Timer | 8 Second Timer Enabled |
| | Watchdog Timer | WD Timer Enable |
| | Bypass LBIST From Standby | Always perform LBIST |
| | Main DFS Availability | Deep Fail Safe Available |

Table 7. OTP ID

| Functional block | Feature | OTP selection |
|--------------------|------------------|----------------------|
| OTP Program ID | Program ID High | E |
| | Program ID Low | P |
| FS Versioning Bits | External Monitor | VMON Enabled |
| | FCCU Function | FCCU available |
| | ERRMON Function | ERRMON not available |

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