

SINGLE POWER SUPPLY SYNCHRONOUS PWM CONTROLLER

PRELIMINARY DATA SHEET

Pb Free Product

DESCRIPTION

The NX2150 controller IC is a single power supply synchronous Buck controller IC designed for step down DC to DC converter applications. NX2150 is optimized to convert bus voltages from 5V to 24V to outputs as low as 0.8V voltage. An internal regulator converts bus voltage to 5V, which provides voltage supply to internal logic and driver circuit. The NX2150 has programmable frequency feature and operates at 300kHz when Rt pin is open. The NX2150 employs fixed loss-less current limiting by sensing the Rdson of synchronous MOSFET followed by hiccup feature. Feedback under voltage triggers Hiccup.

Other features of the device are: Over voltage protection, thermal shutdown, 5V gate drive, Adaptive deadband control, Internal digital soft start, Vcc undervoltage lock out and shutdown capability via the comp pin.

- Single voltage supply from 5V to 24V
- Programmable frequency
- Internal Digital Soft Start Function
- Prebias Startup
- Less than 50 nS adaptive deadband
- Current limit triggers hiccup by sensing Rdson of Synchronous MOSFET
- No negative spike at Vout during startup and shutdown
- Over Voltage triggers latch out
- Power Good indicator available
- Pb-free and RoHS compliant

FEATURES

APPLICATIONS

- LCD TV
- Graphic Card on board converters
- Memory Vddq Supply in mother board applications
- On board DC to DC such as 12V to 3.3V, 2.5V or 1.8V
- Hard Disk Drive
- Set Top Box

TYPICAL APPLICATION

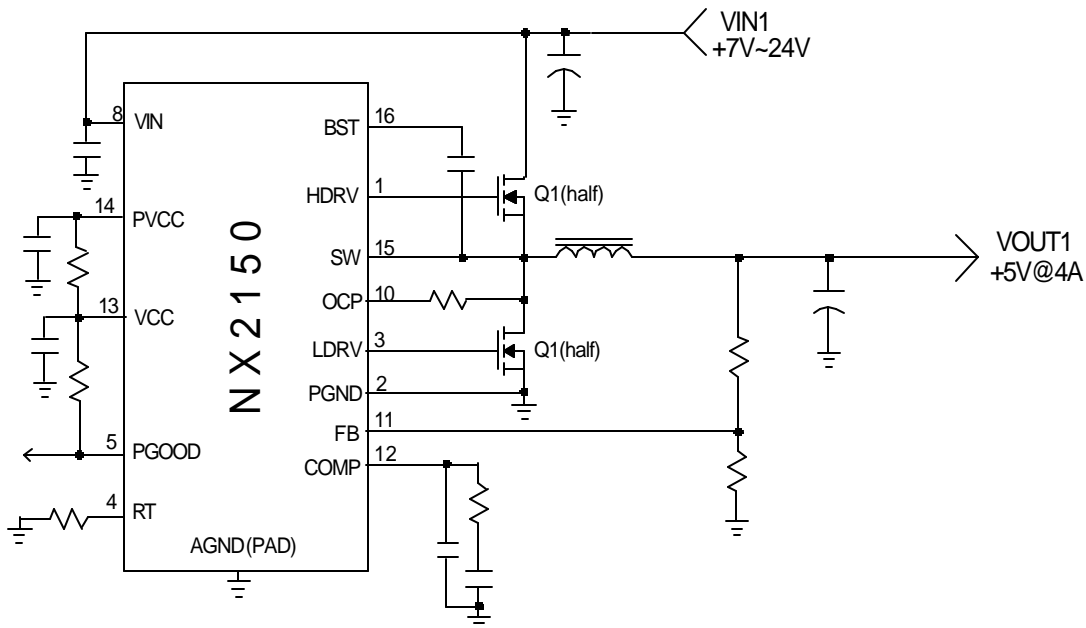


Figure1 - Typical application of 2150

ORDERING INFORMATION

| Device | Temperature | Package | Frequency | Pb-Free |
|------------|-------------|-----------|----------------|---------|
| NX2150CMTR | 0 to 70°C | MLPQ -16L | 300kHz to 1MHz | Yes |

ABSOLUTE MAXIMUM RATINGS(NOTE1)

| | |
|--|----------------|
| VCC,PVCC to GND & BST to SW voltage | 6.5V |
| BST to GND Voltage | 35V |
| VIN to GND Voltage | 30V |
| SW to GND | -2V to 35V |
| All other pins | -0.3V to 6.5V |
| Storage Temperature Range | -65°C to 150°C |
| Operating Junction Temperature Range | -40°C to 125°C |

NOTE1: Stresses above those listed in "ABSOLUTE MAXIMUM RATINGS", may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

PACKAGE INFORMATION

| 16-PIN PLASTIC MLPQ (NX2150) | 10-LEAD PLASTIC MSOP (NX2155) |
|--|---|
| <p>$\theta_{JA} \approx 46^{\circ}\text{C/W}$</p> | <p>$\theta_{JA} \approx 200^{\circ}\text{C/W}$</p> |

ELECTRICAL SPECIFICATIONS

Unless otherwise specified, these specifications apply over $V_{CC} = 5V$, and $T_A = 0$ to 70°C . Typical values refer to $T_A = 25^{\circ}\text{C}$. Low duty cycle pulse testing is used which keeps junction and case temperatures equal to the ambient temperature.

| PARAMETER | SYM | Test Condition | Min | TYP | MAX | Units |
|--|---------------------|--|-----|------|-----|-------|
| Reference Voltage | | | | | | |
| Ref Voltage | V_{REF} | $4.5V < V_{CC} < 5.5V$ | | 0.8 | | V |
| Ref Voltage line regulation | | | | 0.4 | | % |
| Supply Voltage(V_{CC}) | | | | | | |
| V_{CC} Voltage Range | V_{CC} | | 4.5 | 5 | 5.5 | V |
| V_{CC} Supply Current (Static) | I_{CC} (Static) | Outputs not switching | | 3 | | mA |
| V_{CC} Supply Current (Dynamic) | I_{CC} (Dynamic) | $C_{LOAD}=3300\text{pF}$ $F_S=300\text{kHz}$ | | 5 | | mA |
| Supply Voltage(V_{BST}) | | | | | | |
| V_{BST} Supply Current (Static) | I_{BST} (Static) | Outputs not switching | | 0.15 | | mA |
| V_{BST} Supply Current (Dynamic) | I_{BST} (Dynamic) | $C_{LOAD}=3300\text{pF}$ $F_S=300\text{kHz}$ | | 5 | | mA |
| Under Voltage Lockout | | | | | | |
| V_{CC} -Threshold | V_{CC_UVLO} | V_{CC} Rising | | 4.2 | | V |
| V_{CC} -Hysteresis | V_{CC_Hyst} | V_{CC} Falling | | 0.22 | | V |

| PARAMETER | SYM | Test Condition | Min | TYP | MAX | Units |
|---|----------------------------|---|-----|------|-----|-------|
| Supply Voltage(Vin) | | | | | | |
| V _{in} Voltage Range | V _{in} | | 4.7 | | 25 | V |
| Input Voltage Current | | Vin=24V | | 24 | 40 | uA |
| Vin UVLO | | | | | | |
| V _{in} -Threshold | V _{in_UVLO} | V _{CC} Rising | | 4.5 | | V |
| V _{in} -Hysteresis | V _{in_Hyst} | V _{CC} Falling | | 0.5 | | V |
| SS | | | | | | |
| Soft Start time | T _{ss} | Fsw=300Khz | | 3.4 | | mS |
| Oscillator (Rt) | | | | | | |
| Frequency | F _S | Rt= | | 300 | | KHz |
| Ramp-Amplitude Voltage | V _{RAMP} | | | 1.6 | | V |
| Max Duty Cycle | | | | 84 | | % |
| Min Duty Cycle | | | | | 0 | % |
| Error Amplifiers | | | | | | |
| Transconductance | | | | 2000 | | umho |
| Input Bias Current | I _b | | | 10 | | nA |
| Comp SD Threshold | | | | 0.3 | | V |
| FBUVLO | | | | | | |
| Feedback UVLO threshold | | percent of nominal | 65 | 70 | 75 | % |
| High Side Driver(C_L=2200pF) | | | | | | |
| Output Impedance , Sourcing | R _{source} (Hdrv) | I=200mA | | 1.9 | | ohm |
| Output Impedance , Sinking | R _{sink} (Hdrv) | I=200mA | | 1.7 | | ohm |
| Sourcing Current | I _{source} (Hdrv) | | | 1 | | A |
| Sinking Current | I _{sink} (Hdrv) | | | 1.2 | | A |
| Rise Time | THdrv(Rise) | | | 14 | | ns |
| Fall Time | THdrv(Fall) | | | 17 | | ns |
| Deadband Time | T _{dead} (L to H) | Ldrv going Low to Hdrv going High, 10%-10% | | 30 | | ns |
| Low Side Driver (C_L=2200pF) | | | | | | |
| Output Impedance, Sourcing Current | R _{source} (Ldrv) | I=200mA | | 1.9 | | ohm |
| Output Impedance, Sinking Current | R _{sink} (Ldrv) | I=200mA | | 1 | | ohm |
| Sourcing Current | I _{source} (Ldrv) | | | 1 | | A |
| Sinking Current | I _{sink} (Ldrv) | | | 2 | | A |
| Rise Time | TLdrv(Rise) | | | 13 | | ns |
| Fall Time | TLdrv(Fall) | | | 12 | | ns |
| Deadband Time | T _{dead} (H to L) | SW going Low to Ldrv going High, 10% to 10% | | 10 | | ns |
| OCP | | | | | | |
| OCP current | | | | 32 | | uA |
| Power Good(Pgood) | | | | | | |
| Threshold Voltage as % of Vref | | FB ramping up | | 90 | | % |
| Hysteresis | | | | 5 | | % |

| PARAMETER | SYM | Test Condition | Min | TYP | MAX | Units |
|-------------------------|-----|----------------|-----|-----|-----|-------|
| Over Voltage | | | | | | |
| Over Voltage Trip Point | | | 115 | 120 | | %Vref |
| Hysteresis | | | | 8 | | %Vref |
| Over Voltage Delay | | | | 2 | | cycle |
| Over temperature | | | | | | |
| Threshold | | | | 150 | | °C |
| Hysteresis | | | | 20 | | °C |

PIN DESCRIPTIONS

| PIN # | PIN SYMBOL | PIN DESCRIPTION |
|-------|------------|--|
| 1 | PVCC | An internal 5V regulator provides this supply voltage for the low side fet drivers. A high frequency 1uF ceramic cap must be connected from this pin to the PGND pin as close as possible |
| 2 | VCC | Supply voltage for the internal logic circuit. A 1uF high frequency ceramic capacitor must be connected from this pin to GND pin. |
| 3 | VIN | Voltage supply for the internal 5V regulator. |
| 4 | RT | Oscillator's frequency can be set by using an external resistor from this pin to GND. When RT pin is open, the frequency is 200kHz. |
| 7 | PGOOD | An open drain output that requires a pull up resistor to Vcc or a voltage lower than Vcc. When FB pin reaches 90% of the reference voltage PGOOD transitions from LO to HI state. |
| 9 | FB | This pin is the error amplifier inverting input. This pin is also connected to the output UVLO comparator. When this pin falls below 5.6V, both HDRV and LDRV outputs are in hiccup. |
| 10 | COMP | This pin is the output of the error amplifier and together with FB pin is used to compensate the voltage control feedback loop. This pin is also used as a shut down pin. When this pin is pulled below 0.3V, both drivers are turned off and internal soft start is reset. |
| 11 | BST | This pin supplies voltage to the high side driver. A high frequency ceramic capacitor of 0.1 to 1 uF must be connected from this pin to SW pin. |
| 12 | OCP | This pin is connected to the drain of the external low side MOSFET and is the input of the over current protection(OCP) comparator. An internal current source is flown to the external resistor which sets the OCP voltage across the Rds-on of the low side MOSFET. Current limit point is this voltage divided by the Rds-on. |
| 13 | SW | This pin is connected to the source of the high side MOSFET and provides return path for the high side driver. |
| 14 | HDRV | High side MOSFET gate driver. |
| 15 | PGND | Ground pin. |
| 16 | LDRV | Low side MOSFET gate driver. |
| 5,6,8 | NC | |

BLOCK DIAGRAM

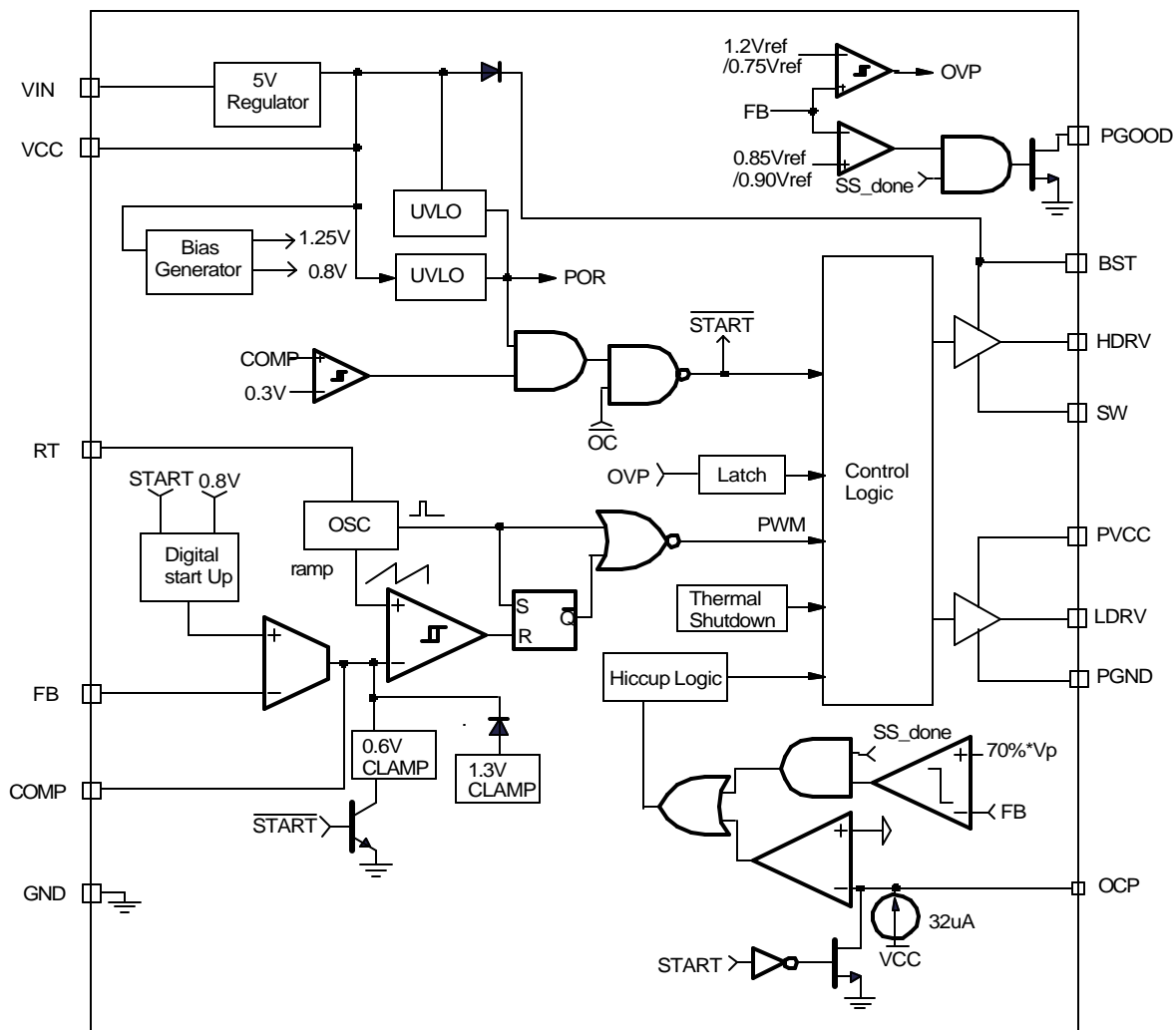


Figure 2 - Simplified block diagram of the NX2150