



SP6089

Synchronous Rectifier Driver

DESCRIPTION

The SP6089 is a low-drop diode emulator IC, which when it combined with an external switch replaces Schottky diodes in high-efficiency flyback converters.

The SP6089 generates its own supply voltage and does not need auxiliary winding for either high-side or low-side applications. Programmable ringing detection circuitry prevents the SP6089 from false turning on at V_{DS} oscillations during discontinuous conduction mode (DCM) and quasi-resonant (QR) operation.

SP6089 is available in space saving SOT-23-6L package.

APPLICATIONS

- Industrial Power Systems
- Distributed Power Systems
- Battery Powered Systems
- Flyback Converters
- USB PD Quick Chargers

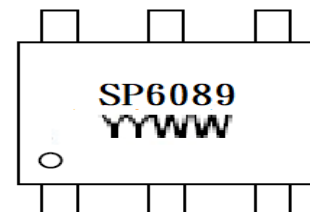
FEATURES

- Does not need auxiliary winding for either high-side or low-side applications
- Fast turn-on and turn-off delay
- Ringing detection prevents false turn-on during DCM and QR operations
- Less than 100mW standby power
- <400uA quiescent current at light load mode
- Supports CCM, DCM and QR operation
- Support both high-side and low-side rectification
- Available in space saving SOT-23-6L package

PINCONFIGURATION (SOT-23-6L)



PART MARKING



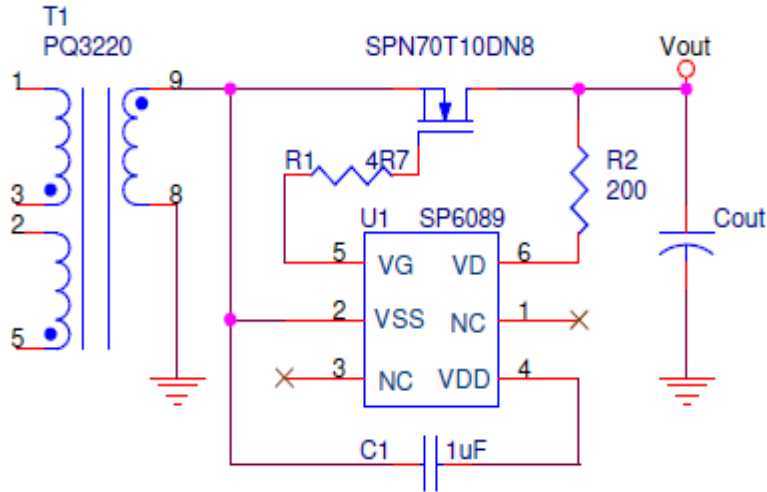
Y : Year Code
W : Week Code



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TYPICAL APPLICATION CIRCUIT



PIN DESCRIPTION

| Pin | Symbol | Description |
|-----|-----------------|--|
| 1 | NC | |
| 2 | V _{SS} | Ground, also used as reference for V _D |
| 3 | NC | |
| 4 | V _{DD} | Linear regulator output. Supply voltage for internal circuits |
| 5 | V _G | Gate driver output |
| 6 | V _D | External FET drain voltage sensing and input of linear regulator |

ORDERING INFORMATION

| Part Number | Package | Part Marking |
|--------------|-----------|--------------|
| SP6089S26RGB | SOT-23-6L | SP6089 |

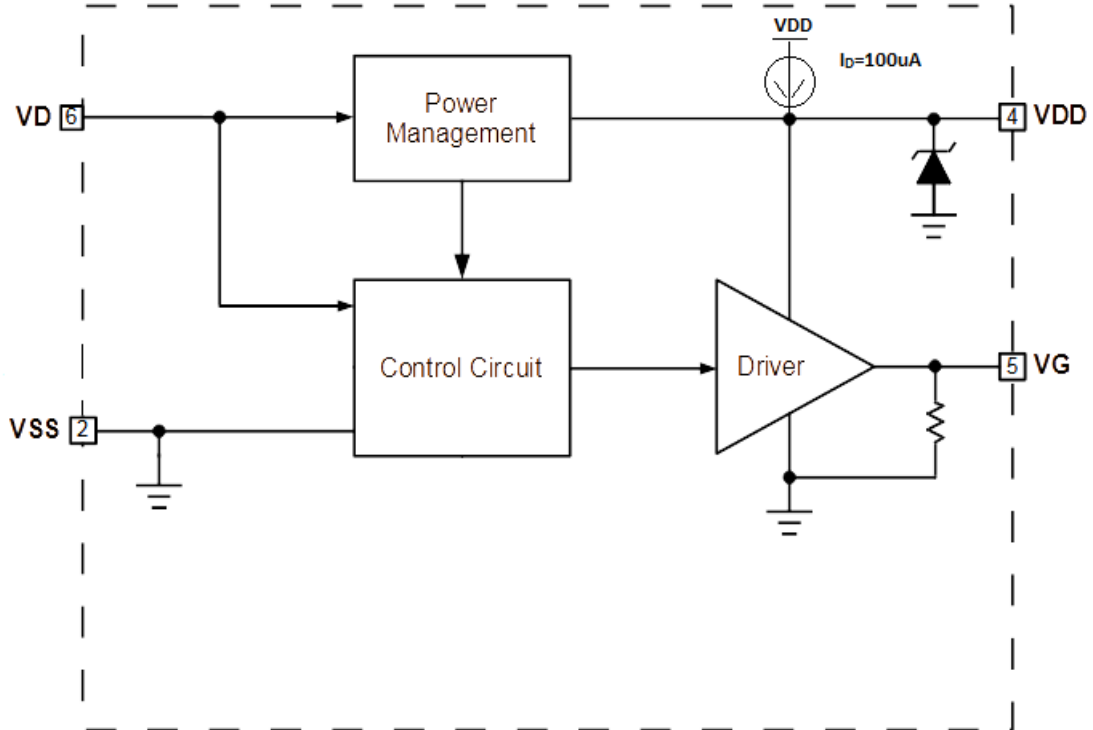
※ SP6089S26RGB : Tape Reel ; Pb – Free ; Halogen - Free



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BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

The following ratings designate persistent limits beyond which damage to the device may occur.

| Symbol | Para | Value | Unit |
|-----------|--|------------|--------------------|
| V_D | V_D pin voltage to V_{SS} | -0.7~200 | V |
| V_{DD} | V_{DD} , and V_G pins voltages to V_{SS} | -0.3~8 | V |
| V_G | Driver Pin | -0.3~8 | V |
| P_D | The power dissipation | 0.30 | W |
| T_J | Operating junction temperature range | -40 to 150 | $^{\circ}\text{C}$ |
| T_{STG} | The storage temperature range | -55 to 150 | $^{\circ}\text{C}$ |

THERMAL RESISTANCE

| Symbol | Para | Value | Unit |
|-----------------|---|-------|-----------------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction –to Ambient | 220 | $^{\circ}\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction –to Case | 110 | $^{\circ}\text{C}/\text{W}$ |



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ELECTRICAL CHARACTERISTICS

($T_A=25^{\circ}\text{C}$, $V_{dd}=6\text{V}$, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|----------------------------------|---------------------------------|-------------------------------------|-----|-----|-----|---------------|
| Supply Section | | | | | | |
| UVLO | V_{DD} UVLO rising | V_{DD} Rising | 4.0 | 4.4 | 4.7 | V |
| | V_{DD} UVLO Hysteresis | | | 0.4 | | V |
| I_{DD} | Operating current | --- | 280 | 340 | 430 | μA |
| I_{ST} | V_{DD} Startup Current | $V_{DD} = V_{DD_ON} - 0.1\text{V}$ | | | 150 | μA |
| V_{DD} | V_{DD} Operating Voltage | $V_D=40\text{V}$, Other Floating | 5.8 | 6.2 | 6.6 | V |
| V_{DD_clamp} | V_{DD} Clamp Voltage | $I_{DD}=40\text{mA}$ | 6.1 | 6.5 | 6.9 | V |
| Control Circuitry Section | | | | | | |
| V_{LL_DS} | $V_{SS}-V_D$ Turn-on Threshold | | 150 | 200 | 250 | mV |
| V_{FWD} | $V_{SS}-V_D$ Turn-off Threshold | | -25 | -20 | -15 | mV |
| T_{BON} | Turn-on blanking time | $C_{LOAD}=5\text{nF}$ | 1.1 | 1.3 | 1.6 | μS |
| T_{BOFF} | Turn-off blanking time | $C_{LOAD}=5\text{nF}$ | 0.2 | 0.3 | 0.5 | μS |
| T_{DON} | The Turn-on Delay | $C_{LOAD}=5\text{nF}$ | 120 | 150 | 180 | nS |
| T_{DOFF} | Turn-off Delay Time | $C_{LOAD}=5\text{nF}$ | 25 | 30 | 33 | nS |
| Gate Driver Section | | | | | | |
| V_{DRV} | Maximum Drive Voltage | --- | | 6 | | V |
| V_{GSMIN} | Regulated Minimum Drive Voltage | | | 3 | | V |
| I_{SOURCE} | Maximum Source current | $C_{LOAD}=5\text{nF}$ | | 1.5 | | A |
| I_{SINK} | Maximum Sink current | $C_{LOAD}=5\text{nF}$ | | 4 | | A |
| T_{RISE} | Driving Rising Time | $C_{LOAD}=5\text{nF}$ | | | 25 | nS |
| T_{FALL} | Driving Falling Time | $C_{LOAD}=5\text{nF}$ | | | 10 | nS |



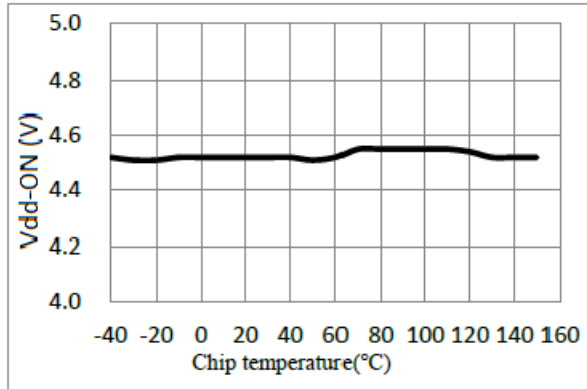
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TYPICAL CHARACTERISTICS

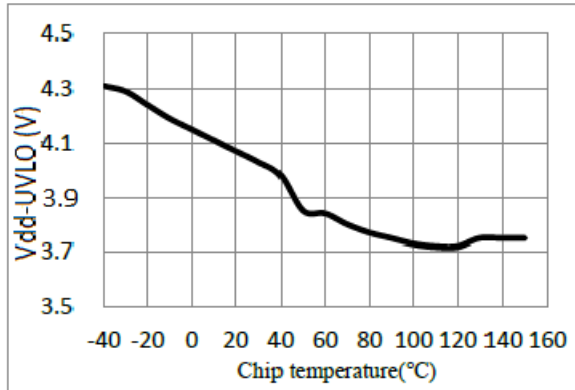
Vdd Start-up Voltage vs Temperature

$C_{Vdd}=1\mu F$, Vdd Rising, Current Suddenly Increases



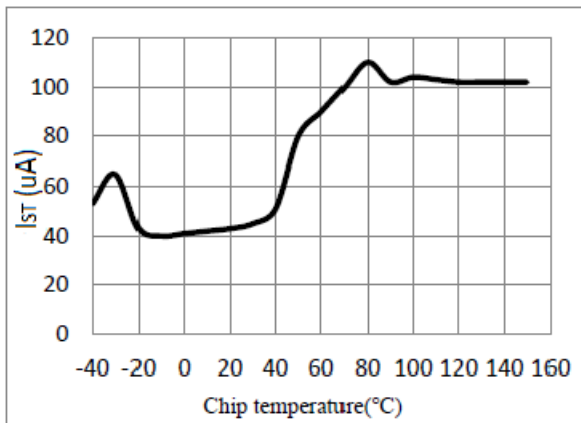
Vdd Turn-off Voltage vs Temperature

$C_{Vdd}=1\mu F$, Vdd Falling, Current Suddenly Drops



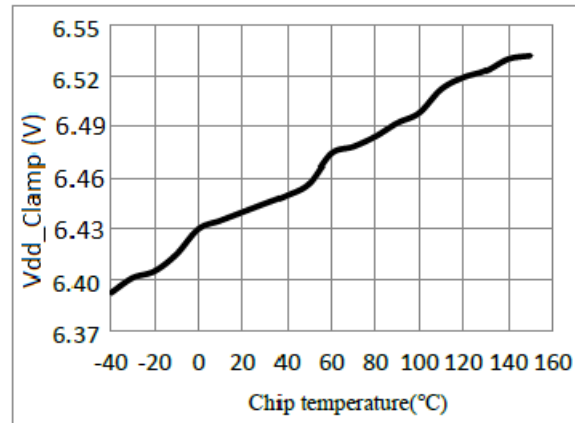
Vdd Start-up Current vs Temperature

$C_{Vdd}=1\mu F$, Vdd-ON- 0.1V



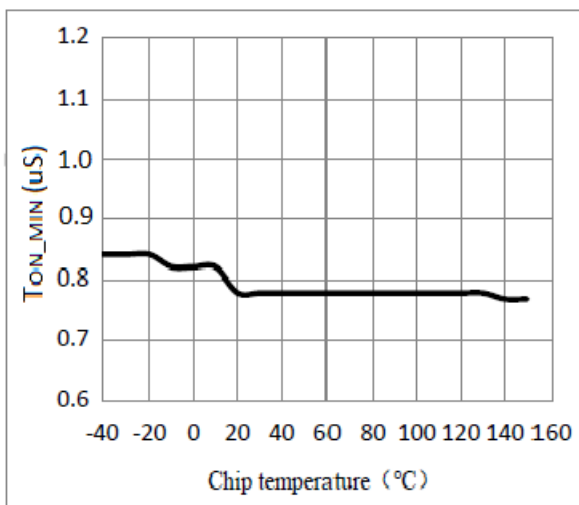
Vdd Clamp Voltage vs Temperature

$C_{Vdd}=1\mu F$, $I_{CC}=20mA$



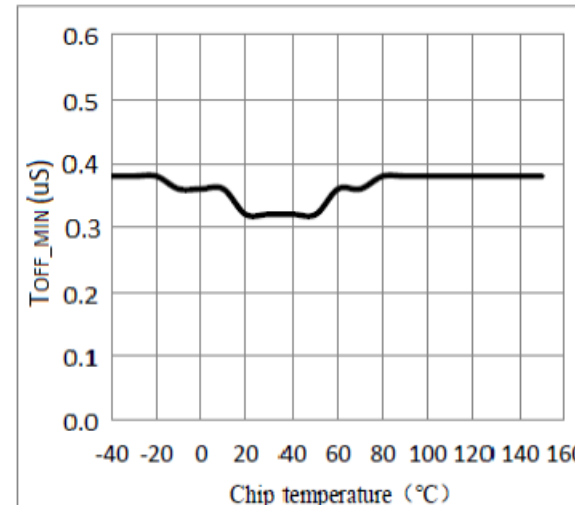
SR Minimum Turn-on Time vs Temperature

Vdd=6V



SR Minimum Turn-off Time vs Temperature

Vdd=6V





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