

GENERAL DESCRIPTION

MX1313AS is a secondary side switch IC designed for flyback converter. This IC emulate the behavior of diode rectifier for reduces power dissipation. MX1313AS works in DCM and quasi-resonant operation modes. Ruggedness and noise immunity are accomplished using an advanced blanking scheme and double pulse suppression which allow reliable operation in all operating modes.

MX1313AS senses the internal drain-source voltage, and output ideal drive signal with less external components. It only provides high performance solutions for 5V output voltage application.

MX1313AS is offered in SOP-8 package.

FEATURES

- ◆ Internal 40V 10mΩ trench MOSFET
- ◆ Up to 100kHz operation frequency
- ◆ 80ns turn on propagation delay and 50ns turn off delay
- ◆ Lower quiescent current consumption
- ◆ DCM and Quasi-resonant operation modes compatible
- ◆ VDD under voltage lock out

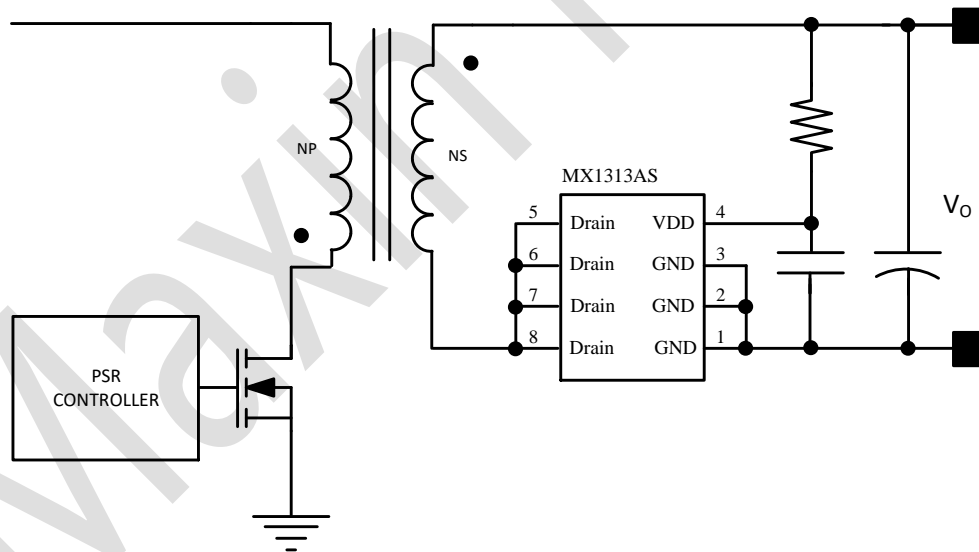
Applications

Cell Phone Charger

Auxiliary Power Adapter

Digital Cameras Charger

Typical Application



General information

Ordering information

| Part Number | Description |
|-------------|--------------------------|
| MX1313AS | SOP8, Halogen-free, RoHS |

Package dissipation rating

| Package | RθJA (°C/W) |
|---------|-------------|
| SOP8 | 90 |

Note: Drain Pin Connected to 200mm² PCB copper clad.

Absolute maximum ratings

| Parameter | Value |
|---|--------------|
| Drain Voltage (off state) | 40 |
| VDD Voltage | -0.3 to 7V |
| Min/Max Operating Junction Temperature T _J | -40 to 150°C |
| Min/Max Storage Temperature T _{STG} | -55 to 150°C |
| ESD(HBM) | ±2kV |
| Lead Temperature (Soldering, 10secs) | 260°C |

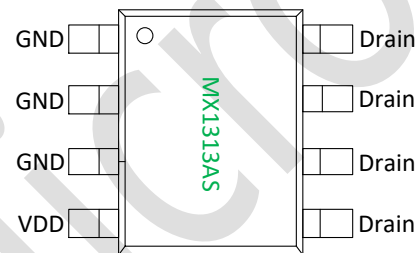
Note: stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Marking information

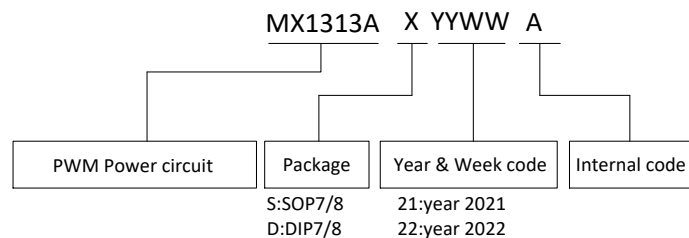
Recommended operating condition

| Symbol | Parameter | Range |
|--------------|----------------------------|----------|
| VDD | VDD supply voltage | 3.5-5.5V |
| PD | Power dissipation @TA=25°C | 1.1W |
| Output power | 5V3.1A typical | 15.5W |

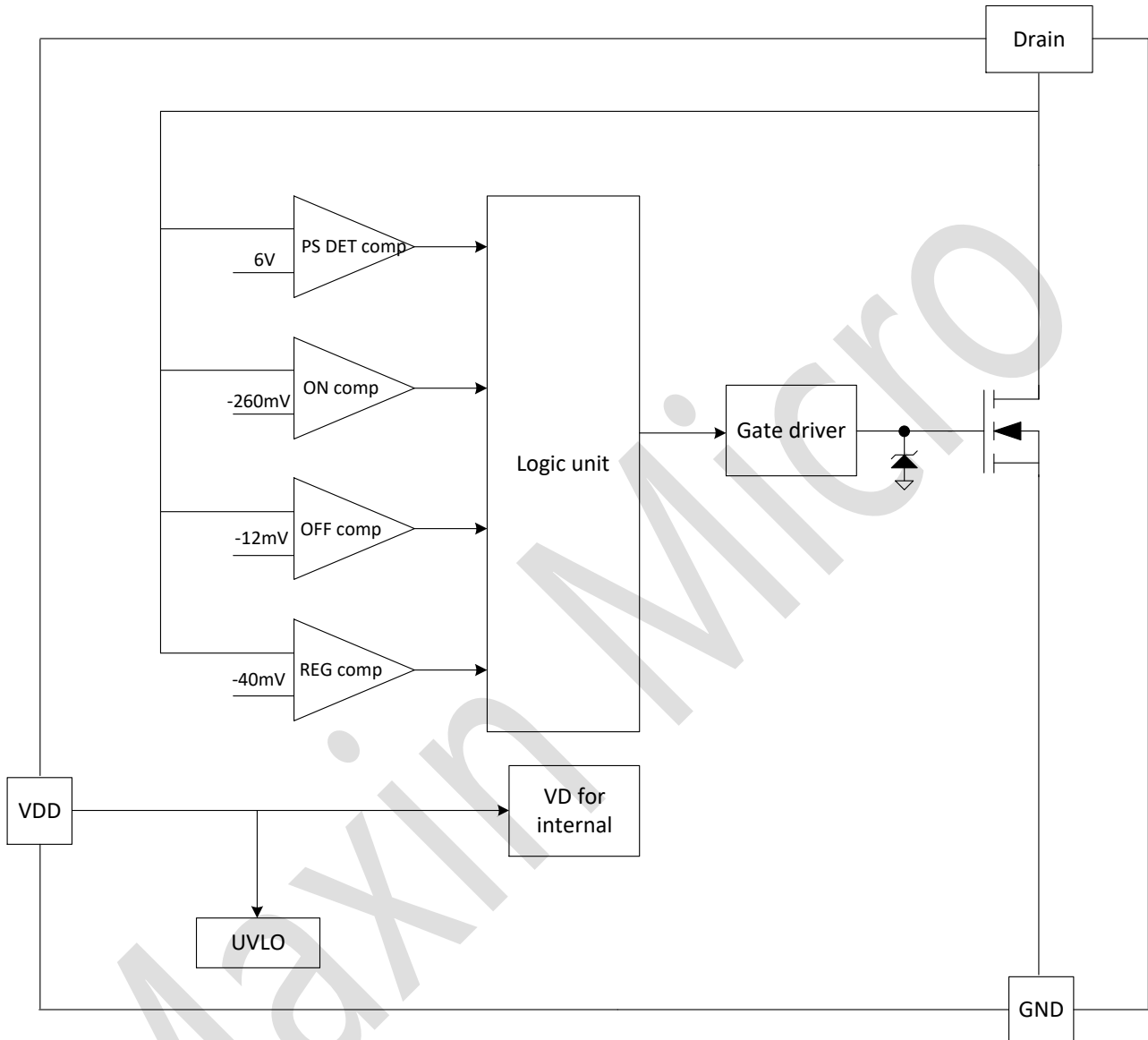
Terminal assignments



| PIN NO. | PIN name | Description |
|---------|----------|--|
| 1/2/3 | GND | Power ground, the source of internal MOSFET. |
| 4 | VDD | Power supply. |
| 5/6/7/8 | Drain | Internal MOSFET drain side. |



Block Diagram



Electrical characteristics

($T_A=25^{\circ}\text{C}$, $V_{DD}=5\text{V}$, unless otherwise noted)

| Symbol | Parameter | Test condition | Min | Typ. | Max | Unit |
|----------------------------------|---|----------------|------|------|------|------------------|
| VDD supply voltage | | | | | | |
| I_VDD | Quiescent current | VDD=5.5V | 200 | 300 | 500 | μA |
| UVLO_ON | VDD under voltage lockout enter | VDD rising up | 2.3 | 2.5 | 2.8 | V |
| UVLO_OFF | VDD under voltage lockout exit | | 2.6 | 2.8 | 3.1 | V |
| Control circuitry section | | | | | | |
| V_ON_TH | Turn on threshold ($V_{\text{DRAIN}}-V_{\text{SOURCE}}$) | | -300 | -260 | -200 | mV |
| T_ON_DELAY | Turn on propagation delay | | | 80 | | ns |
| V_OFF_TH | Turn off threshold ($V_{\text{SOURCE}}-V_{\text{DRAIN}}$) | | -20 | -12 | -9 | mV |
| T_OFF_DELAY | Turn off propagation delay | | | 50 | | ns |
| V_REG(DRV) | Drive regulation voltage | | -50 | -40 | -32 | mV |
| T_ON_MIN | Minimum on time | | 500 | 600 | 900 | ns |
| T_OFF_MIN | Minimum off time | | 1.3 | 1.6 | 2.4 | μs |
| V_PS_ON_DET | Primary side on detection voltage | | | 6 | | V |
| T_PS_ON_DET | Primary side on detection blanking time | | | 300 | | ns |
| MOSFET | | | | | | |
| R_DS_ON | Static Drain to Source on resistance | | | 10 | | $\text{m}\Omega$ |
| V_DS | Drain to Source breakdown voltage | | 40 | | | V |

Operation description

MX1313AS detects the drain to source voltage of internal MOSFET. When the secondary winding is on, the current flow the parasitic diode of MOSFET. If the drain voltage is lower than the turn on threshold voltage V_{ON_TH} , the internal drive circuit turn on the MOSFET after a turn on delay time T_{ON_DELAY} . Then the lower conduction loss can be achieved.

UVLO and Power Supply

MX1313AS remains in the UVLO condition until the voltage on the VDD exceeds the voltage UVLO_ON. During the time the gate drive circuit is inactive. The UVLO mode is accessible from any other state of operation whenever MX1313AS supply voltage condition of VDD is smaller than UVLO_OFF occurs.

MX1313AS supply voltage is monitored by the UVLO circuit. It is possible to turn off the circuit by pulling VDD voltage below the turn off threshold voltage. To prevent noise problems, a bypass ceramic capacitor connected to VDD and GND.

Minimum ON time

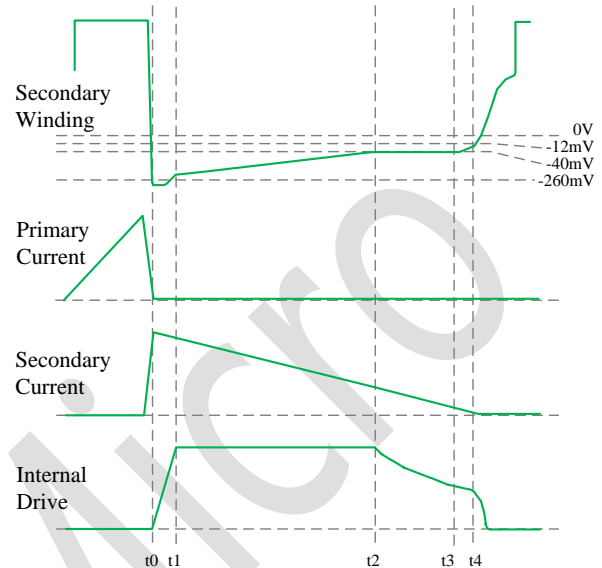
When the internal MOSFET is turned on and some ringing noise may be generated. If that noise falls below the threshold V_{OFF_TH} before minimum on time expires, the internal MOSFET will keep on until the end of the minimum on time.

Turn On and Turn OFF Phase

When second winding is on, current will start flowing through its body diode, generating a negative voltage between drain and source. When the voltage up to the turn on threshold V_{TH_ON} , internal circuit will drive the gate of internal MOSFET on, which will in turn cause the conduction voltage to drop down. The minimum on time will prevent the turn off from some amount of ringing. And the Drain to Source voltage will shrink as the secondary current decreases. Then the Drian to Source voltage will be maintained -40mV by adjusting internal drive voltage.

When the current flowing close to 0A, the -40mV will not be maintained by internal driver. The Drain to Source voltage continue rising which to reach the threshold V_{OFF_TH} (-12mV typical), the internal MOSFET will be turned off after the propagation delay time T_{OFF_DELAY} . After the internal MOSFET is turned off, it is necessary to detect that the Drian to Source voltage reach about 6V or more and after a

continuation time greater than $T_{PS_ON_DET}$ (300ns typical), a valid primary side turn on is confirmed to avoid false turn on caused by quasi-resonant. The following figure shows the timing of turn on and turn off.



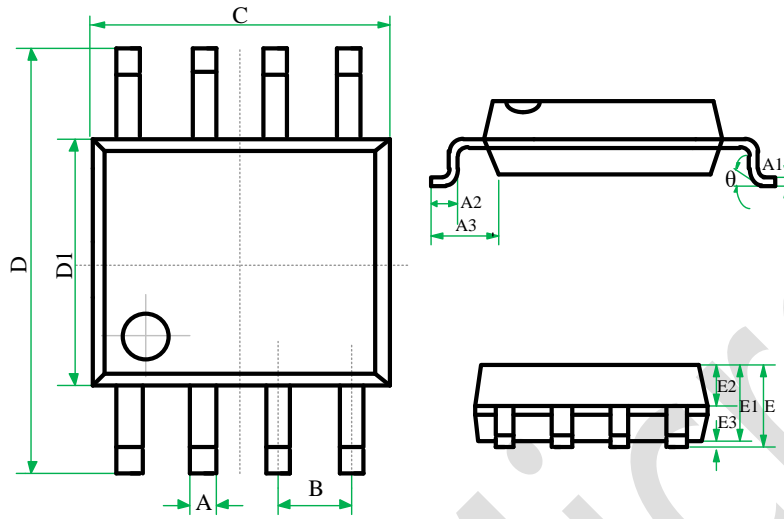
The timing of turn on and turn off

Minimum ON time

The aera of the secondary current loop including the MX1313AS and the output capacitor should be as small as possible to reduce EMI radiation. And the PCB trace must be wide and short for thermal consideration.

The bypass capacitor on VDD should be placed as close as possible to the VDD pin. And the negative node of VDD capacitor should be connected directly to the GND pin.

Package information



| SYMBOL | MILLIMETERS | | | INCHES | | |
|--------|-------------|------|-------|----------|-------|--------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.39 | - | 0.48 | 0.0154 | - | 0.0189 |
| A1 | 0.21 | - | 0.28 | 0.008 | - | 0.011 |
| A2 | 0.50 | - | 0.80 | 0.020 | - | 0.031 |
| A3 | 1.05BSC | | | 0.041BSC | | |
| B | 1.27BSC | | | 0.050BSC | | |
| C | 4.70 | 4.90 | 5.10 | 0.185 | 0.193 | 0.201 |
| D | 5.80 | 6.00 | 6.20 | 0.228 | 0.236 | 0.244 |
| D1 | 3.70 | 3.90 | 4.10 | 0.146 | 0.154 | 0.161 |
| E | - | - | 1.75 | - | - | 0.069 |
| E1 | 1.30 | 1.40 | 1.50 | 0.051 | 0.055 | 0.059 |
| E2 | 0.60 | 0.65 | 0.70 | 0.024 | 0.026 | 0.028 |
| E3 | 0.10 | - | 0.225 | 0.004 | - | 0.009 |
| θ | 0 | - | 8° | 0 | - | 8° |

SOP8 for MX1313AS

Restrictions on Product Use

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