# Secondary-Side Voltage Positioning Controller



## 1 Description

The iW600 is a secondary-side voltage position controller to detect the voltage undershoot. It can be used in Dialog's primary-side control systems to achieve ultra-low no-load power consumption and fast dynamic load response. The iW600 operates in "Normally-OFF" mode with negligible power consumption during power supply normal steady state operation, while monitoring dynamic load change through the voltage on the secondary rectifier. A wake-up signal is transferred through the flyback power transformer to the primary side when a dynamic load change is detected. The iW600 eliminates loop compensation components and the optocoupler on the secondary side to minimize the bill of material cost.

## 2 Features

- Fast system output voltage detection
- Transmits detection signal to the primary side through flyback transformer
- Two-electrical-terminal connection simplifies system PCB layout
- No external components
- Enables <10mW no-load power consumption in typical 5V-output systems
- Available in 3-lead SOT-23 and 2-lead DFN packages

## 3 Applications

- AC/DC adapters/chargers



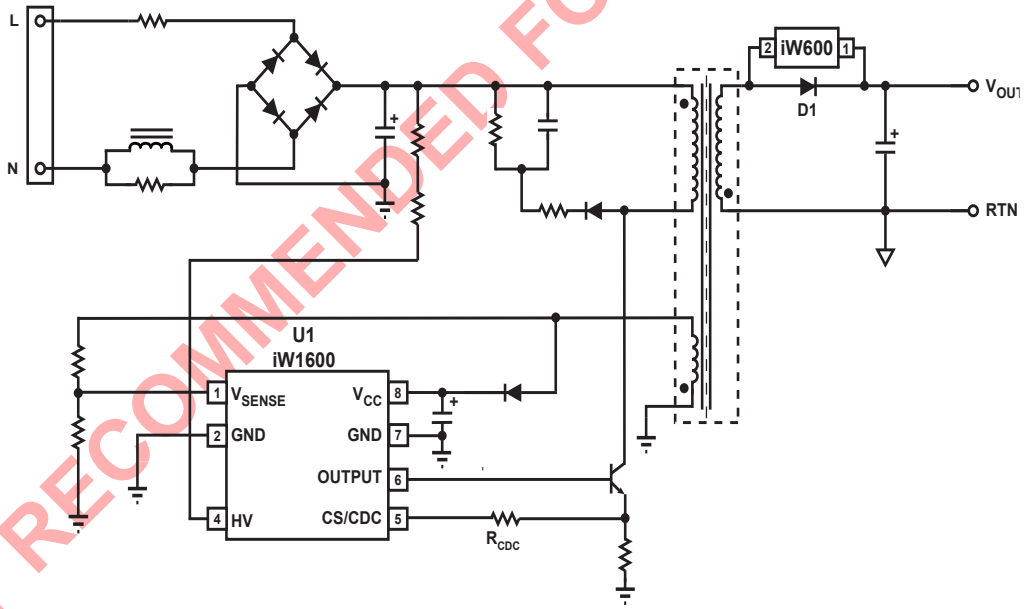



**Figure 3.1: iW600 Typical Application Circuit (Using iW1600 as Primary-Side Controller) (Achieving < 10mW No-load Power Consumption in 5V/2A 10W Adapter with Fast Dynamic Load Response)**

## 4 Pinout Description

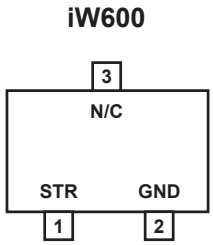



Figure 4.1: 3-Lead SOT-23 Package

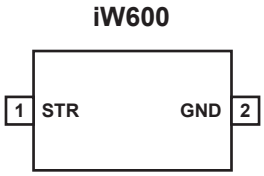



Figure 4.2: 2-Lead DFN Package

| Pin No. | Name | Type | Pin Description |
|---|---|---|---|
| 1 | STR | Power Input/ Analog Input/ Power Output | Stroke pin. Controller Power input and voltage monitoring input. It also builds in a open-drain circuit to drive the flyback power transformer when dynamic load is detected. |
| 2 | GND | Ground | Ground. |
| 3 | N/C | N/C | Not connected. Recommend design a solder pad and solder this pin on the printed circuit board for mechanical stability. |

Note 1: The N/C pin is only available in the 3-lead SOT-23 package.

## 5 Absolute Maximum Ratings

Absolute maximum ratings are the parameter values or ranges which can cause permanent damage if exceeded. For maximum safe operating conditions, refer to Electrical Characteristics (Section 6).

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input voltage range | $V_{STR}$ | -1 to 60 | V |
| Continuous DC supply current at $V_{STR}$ pin ($V_{STR}$ = 60V) | $I_{CC\_OP}$ | 1 | mA |
| Open-draining pull-down pulse current ($V_{STR}$ = 40V) | | 400 | mA |
| Maximum junction temperature | $T_{JMAX}$ | 150 | °C |
| Operating junction temperature | $T_{JOPT}$ | -40 to 150 | °C |
| Storage temperature | $T_{STG}$ | -65 to 150 | °C |
| Thermal resistance junction-to-ambient (SOT-23) | $\theta_{JA}$ | 260 | °C/W |
| Thermal resistance junction-to-ambien (DFN) | $\theta_{JA}$ | 680 | °C/W |
| ESD rating per JEDEC JESD22-A114 | | ±2,000 | V |

## 6 Electrical Characteristics

$V_{STR}$ = 5V, -40°C ≤ $T_A$ ≤ 85°C, unless otherwise specified.

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Dynamic load detection comparator threshold | $V_{US\_TH}$ | | | 4.8 | | V |
| $I_{CC}$ (Note 1) | | $V_{STR}$ = 5V | | 100 | | µA |

Note 1: These parameters are not 100% tested. They are guaranteed by design and characterization.

## 7 Typical Performance Characteristics

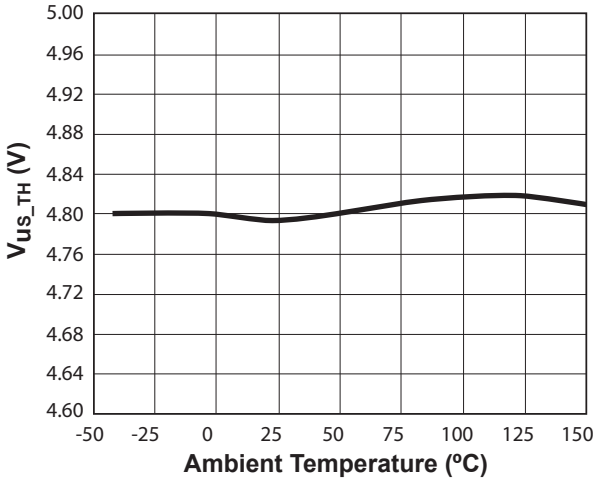



**Figure 7.1 : $V_{US\_TH}$ vs. Temperature**

Note 1: Operating frequency varies based on the load conditions.

## 8 Functional Block Diagram

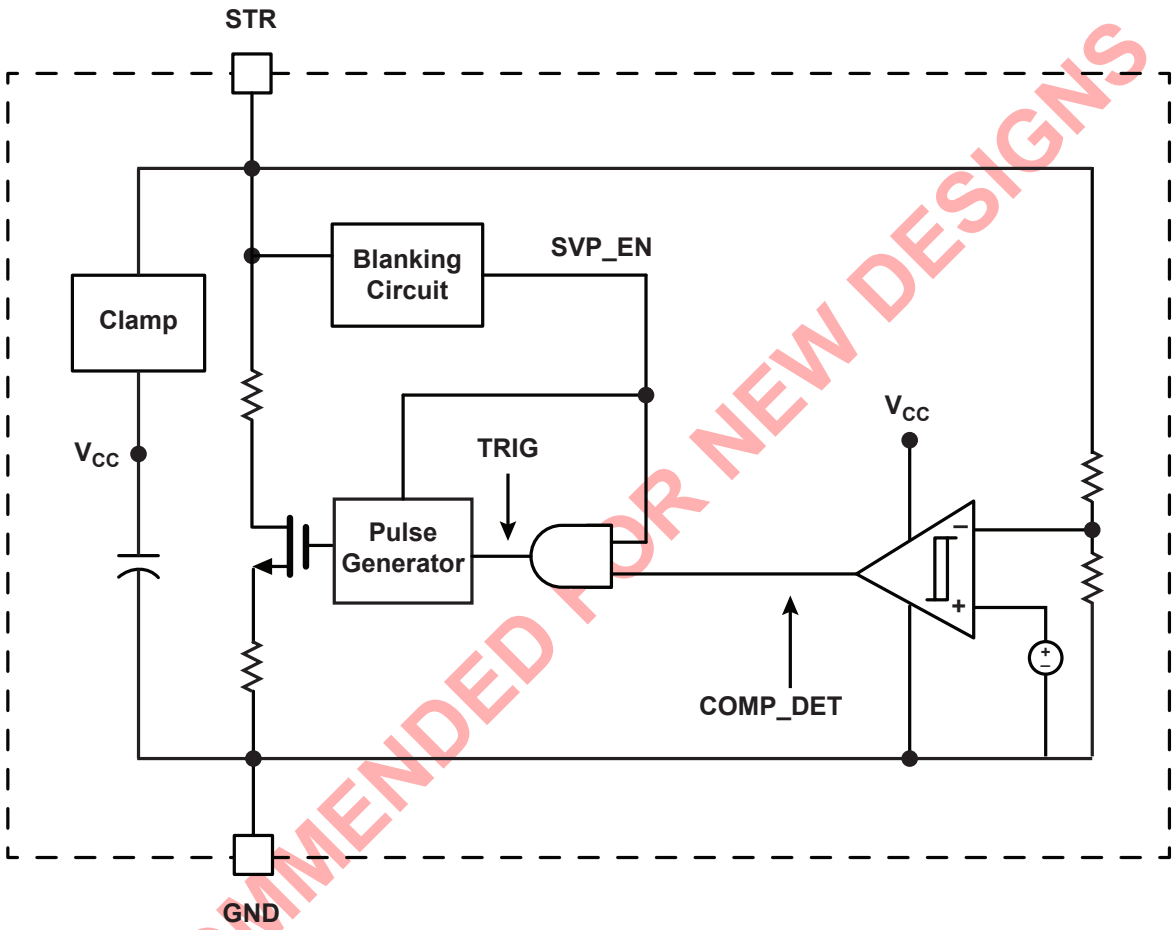



Figure 8.1 : iW600 Functional Block Diagram

## 9 Theory of Operation

The iW600 is a secondary-side voltage position controller that is normally used at the secondary side of a power supply with isolated topology to send output voltage undershoot information to the primary side without the need for an optocoupler. Different from other output voltage detection controllers, the iW600 does not need to monitor the output voltage so that there is no need to have a dedicated pin connected to the system output. Instead it monitors the voltage across the diode rectifier or the synchronous rectifier on the secondary side of the flyback converter to detect the output transient. If the output voltage drops below the predetermined threshold, the iW600 generates a low impedance between the STR and GND pin to change the voltage on the transformer, allowing the primary controller to detect this voltage change through the transformer winding to trigger a load transient event. The iW600 is usually used together with Dialog's primary-side controllers, such as the iW1600 for fast dynamic load response.

Figure 9.1 shows the typical voltage waveform ($V_{STR}$) across the secondary rectifier of the flyback converter in one switching cycle, which is also the STR pin to GND pin input voltage of the iW600. The primary switch is on between $t_0$ and $t_1$, $V_{STR}$ equals to $V_{OUT} + V_{IN\_DC}/N$, where $V_{IN\_DC}$ is the primary voltage after the bridge rectifier and N is the primary-to-secondary turns ratio. After the primary switch turns off at $t_1$, the secondary rectifier is on to conduct the current of the magnetizing inductance of the transformer until the current reaches zero at $t_2$. $V_{STR}$ between $t_1$ and $t_2$ is normally between -1V and 0V. After $t_2$, the parasitic capacitance of the system resonates with the magnetizing inductance of the transformer, causing the $V_{STR}$ to ring between 0V and 2 times of $V_{OUT}$. After the ringing settles at $t_3$, the $V_{STR}$ equals to $V_{OUT}$ until the primary switch turns on again. The iW600 indirectly monitor the $V_{OUT}$ change by measuring the $V_{STR}$ voltage after the ringing settles. If the $V_{STR}$ drops below the predetermined threshold (at $t_{3\_2}$ in Figure. 9.1), it indicates that the $V_{OUT}$ is low due to the load transient. The iW600 accordingly changes its impedance to inject the undershoot signal into the flyback transformer. Once the primary controller such as the iW1600 detects this signal, it turns on the primary switch (at $t_4$ in Figure 9.1) and brings back the $V_{OUT}$ to nominal voltage.

Fig 8.1 shows the block diagram of the iW600. A MOSFET is built in to drive the transformer when the secondary load transient is detected. The resistors at its source and drain are to limit the current going into the path when the MOSFET is turned on. A blanking circuit monitors the $V_{STR}$ to measure when the primary switch or the secondary rectifier is on. The blanking circuit output will be low during these periods ($t_0 - t_2$) to prevent the MOSFET from turning on. A delay timer is also included in the blanking circuit to block the ringing period. A comparator is used to monitor the $V_{STR}$ to detect the load transient. When the $V_{STR}$ falls below $V_{US\_TH}$, the output of the comparator flips.

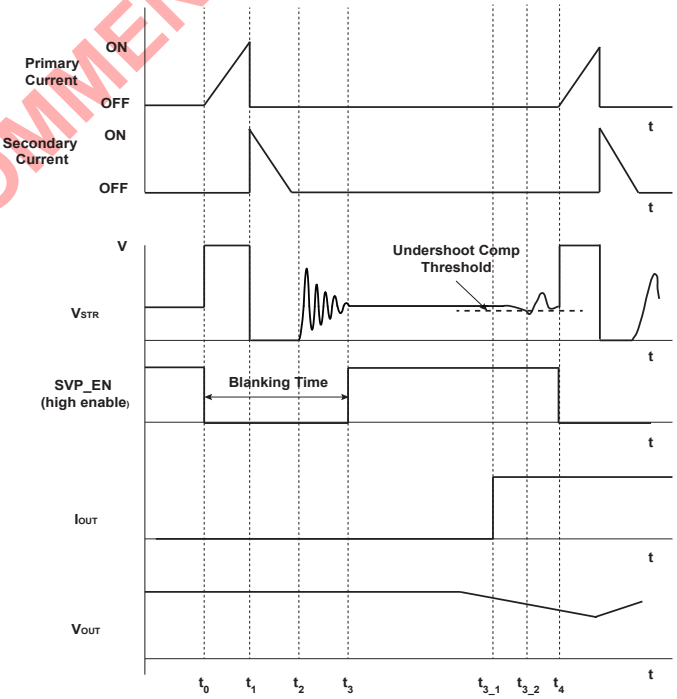



**Figure 9.1 : Dynamic Load Detection and Response Timing Diagram**

## 9.1 Pin Detail

### Pin 1 – STR

Controller power input, voltage monitoring input and open-drain driver to drive the flyback power transformer when dynamic load is detected.

This pin is connected to the secondary rectifier to monitor its voltage.

### Pin 2 – GND

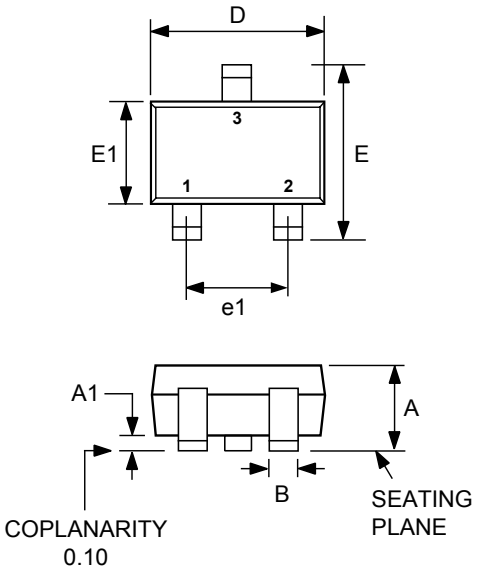
Ground.

### Pin 3 – N/C

The N/C pin is only available in the 3-lead SOT-23 package. Do not connect this pin. It is recommended to design a solder pad and solder this pin on the printed circuit board for mechanical stability.

## 10 Physical Dimensions

3-Lead SOT-23 Package




| Symbol | Inches | | Millimeters | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.035 | 0.044 | 0.89 | 1.11 |
| A1 | 0.001 | 0.004 | 0.01 | 0.10 |
| B | 0.015 | 0.020 | 0.37 | 0.50 |
| C | 0.003 | 0.007 | 0.09 | 0.18 |
| D | 0.110 | 0.120 | 2.80 | 3.04 |
| E | 0.083 | 0.104 | 2.10 | 2.64 |
| E1 | 0.047 | 0.081 | 1.20 | 1.40 |
| e1 | 0.070 | 0.020 | 1.78 | 2.04 |

Compliant to JEDEC Standard TO236

Controlling dimensions are in millimeters

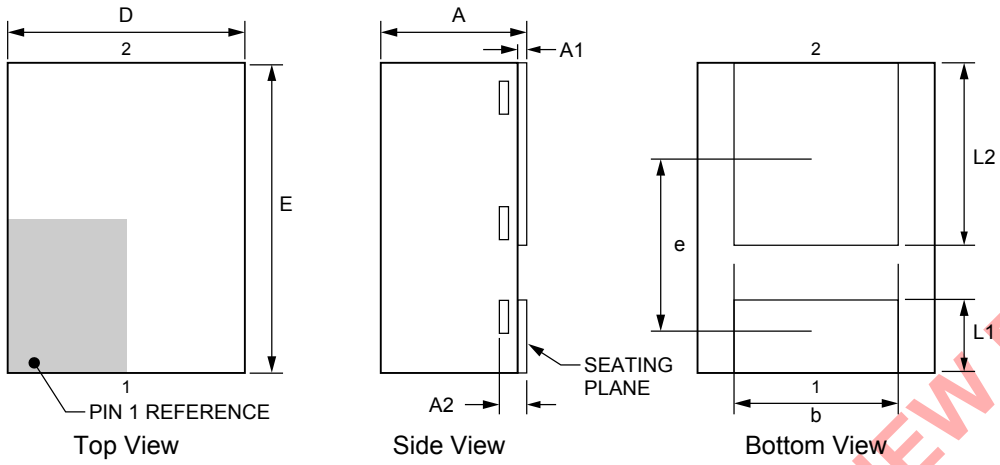
This package is RoHS compliant, and conform to Halide free limits.

Soldering Temperature Resistance:

[a] Package is IPC/JEDEC Std 020D Moisture Sensitivity Level 1
[b] Package exceeds JEDEC Std No. 22-A111 for Solder Immersion resistance; packages can withstand 10 s immersion @ < 260 °C

Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.25 mm per end. Dimension E1 does not include interlead flash or protrusion. Interlead flash or protrusion shall not exceed 0.25 mm per side.

2-Lead DFN Package




| | MILLIMETERS | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | – | 0.05 |
| A2 | | 0.203 REF | |
| b | 0.85 | 0.90 | 0.95 |
| D | 1.25 | 1.30 | 1.35 |
| e | | 1.00 BSC | |
| E | 1.65 | 1.70 | 1.75 |
| L1 | 0.30 | 0.40 | 2.50 |
| L2 | 0.90 | 1.00 | 1.10 |

All dimensions are in millimeters.

Coplanarity applies to the exposed pad as well as the terminals.

Coplanarity shall not exceed 0.05 millimeters.

Warpage shall not exceed 0.05 millimeters.

Soldering Temperature Resistance:

[a] Package is IPC/JEDEC Std 020D Moisture Sensitivity Level 1.
[b] Package exceeds JEDEC Std No. 22-A111 for Solder Immersion Resistance; package can withstand 10 seconds immersion < 260˚C.



## 11 Ordering Information

| Part Number | Options | Package | Description |
|---|---|---|---|
| iW600-00-ST3 | N/A | SOT-23L-3L | Tape & Reel[1] |
| iW600-00-DFN2 | N/A | DFN-1.3m-2L | Tape & Reel[1] |

Note 1: Tape & Reel packing quantity is 3,000/reel. Minimum ordering quantity is 3,000.

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