

PRELIMINARY - January 17, 2000

TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

## DESCRIPTION

The SC1545 was designed for instantly available motherboard applications. As part of the Semtech family of SmartLDO's it provides additional control functions not available in a standard LDO.

The device provides the capability to control three separate supplies. There is an on-board 500mA, 2.5V LDO with current limit protection, and drive pins for an N-channel MOSFET and a P-channel MOSFET. Internal logic circuitry ensures that the system starts up in a controlled manner, and that the correct outputs are enabled during specific sequences of BF\_CUT and SLP.

The LDO draws its power from the 5V standby supply, and the N-channel MOSFET drive is derived from the 12V supply.

The SC1545 is available in the surface mount SO-8 package.

## FEATURES

- 500mA LDO with Over Current Protection (OCP)
- $\pm 2.5\%$  LDO regulation over line, load and temperature
- Power sequencing for three supplies

## APPLICATIONS

- Instantly available motherboards
- Embedded systems
- Desktop computers

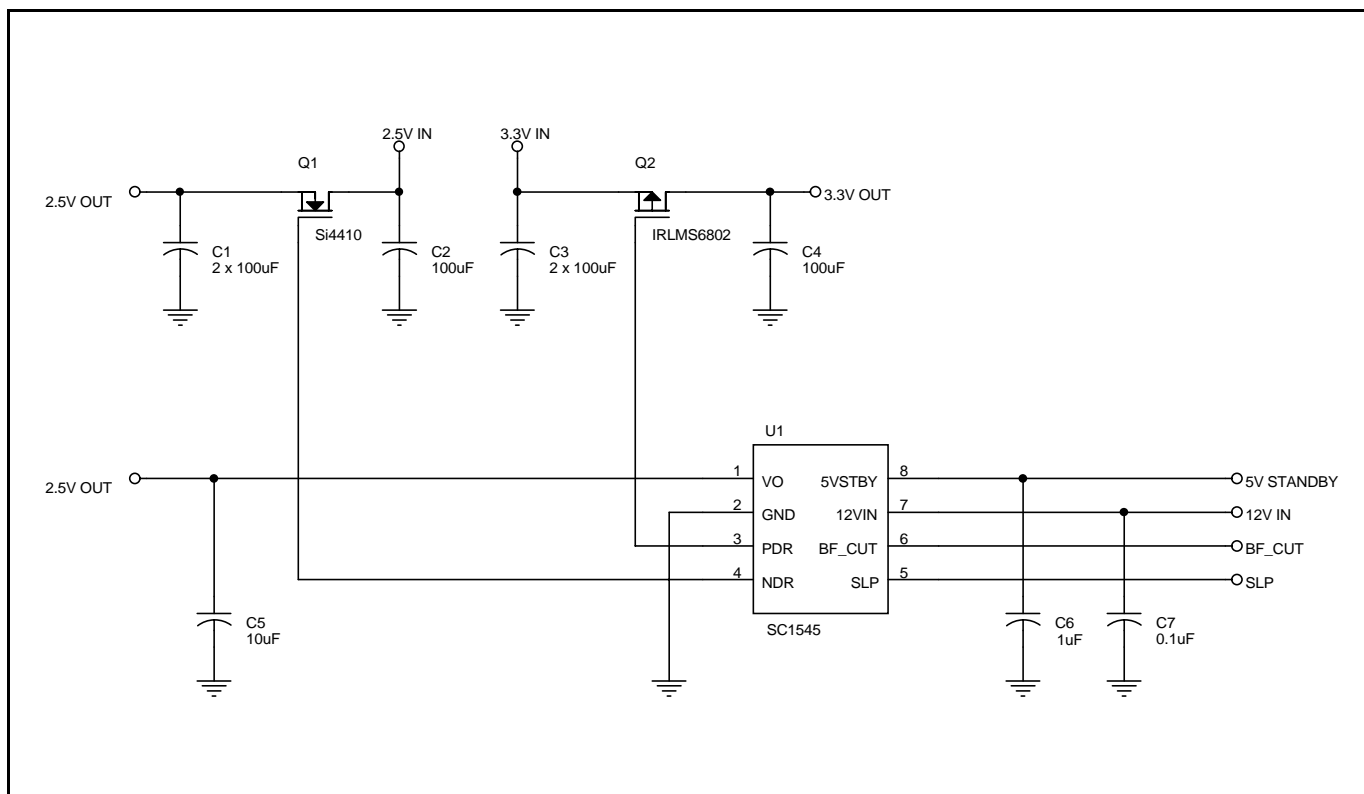
## ORDERING INFORMATION

| Part Number <sup>(1)</sup> | Package |
|----------------------------|---------|
| SC1545CS                   | SO-8    |

Note:

(1) Add suffix 'TR' for tape and reel packaging.

## TYPICAL APPLICATION CIRCUIT



PRELIMINARY - January 17, 2000

**ABSOLUTE MAXIMUM RATINGS**

| Parameter  | Symbol            | Maximum        | Units |
|--|-------------------|----------------|-------|
| 12V Input Voltage Range                              | 12VIN             | -0.3 to +15    | V     |
| 5V Input Voltage Range                               | 5VSTBY            | -0.3 to +7     | V     |
| P-channel MOSFET Gate Drive                          | PDR               | -0.3 to 5VSTBY | V     |
| N-channel MOSFET Gate Drive                          | NDR               | -0.3 to 12VIN  | V     |
| Input Pins   |                   | -0.3 to +7     | V     |
| Operating Ambient Temperature Range                  | T <sub>A</sub>    | 0 to +70       | °C    |
| Operating Junction Temperature Range                 | T <sub>J</sub>    | 0 to +125      | °C    |
| Storage Temperature Range                            | T <sub>STG</sub>  | -65 to +150    | °C    |
| Lead Temperature (Soldering) 10 Sec                  | T <sub>LEAD</sub> | 300            | °C    |
| Thermal Impedance Junction to Case                   | θ <sub>JC</sub>   | 47             | °C/W  |
| Thermal Impedance Junction to Ambient <sup>(1)</sup> | θ <sub>JA</sub>   | 65             | °C/W  |
| ESD Rating   | ESD               | 2              | kV    |

Note:

(1) 2 inch square of 1/16" FR-4, double sided, 1 oz. minimum copper weight.

**ELECTRICAL CHARACTERISTICS**

 Unless specified, 12VIN = 12V, 5VSTBY = 5V, C<sub>O</sub> = 100µF min., T<sub>A</sub> = 25°C. Values in **bold** apply over full operating temperature range.

| Parameter                        | Symbol           | Test Conditions | MIN          | TYP   | MAX          | Units |
|----------------------------------|------------------|-----------------|--------------|-------|--------------|-------|
| <b>12VIN</b>                     |                  |                 |              |       |              |       |
| Supply Voltage                   | 12VIN            |                 | <b>11.28</b> | 12.00 | <b>12.72</b> | V     |
| Quiescent Current                | I <sub>Q12</sub> |                 |              | 800   | 1000         | µA    |
|                                  |                  |                 |              |       | <b>1200</b>  |       |
| <b>5VSTBY</b>                    |                  |                 |              |       |              |       |
| Supply Voltage                   | 5VSTBY           |                 | <b>4.7</b>   | 5.0   | <b>5.3</b>   | V     |
| Quiescent Current                | I <sub>Q5</sub>  | LDO ON          |              | 9.5   | 11           | mA    |
|                                  |                  | LDO OFF         |              | 3.0   | 4.0          |       |
|                                  |                  |                 |              |       | <b>5.0</b>   |       |
| <b>Undervoltage Lockout (5V)</b> |                  |                 |              |       |              |       |
| UVLO Threshold                   | UVLO             | 5VSTBY rising   | <b>4.1</b>   | 4.3   | <b>4.5</b>   | V     |
|                                  |                  | 5VSTBY falling  | <b>3.9</b>   | 4.1   | <b>4.3</b>   | V     |
| Hysteresis                       | HYST             |                 |              | 200   |              | mV    |
| Logic Reset Threshold            | RST              |                 | <b>1.5</b>   | 2.0   | <b>2.5</b>   | V     |

PRELIMINARY - January 17, 2000

**ELECTRICAL CHARACTERISTICS (Cont.)**

 Unless specified, 12VIN = 12V, 5VSTBY = 5V, C<sub>O</sub> = 100μF min., T<sub>A</sub> = 25°C. Values in **bold** apply over full operating temperature range.

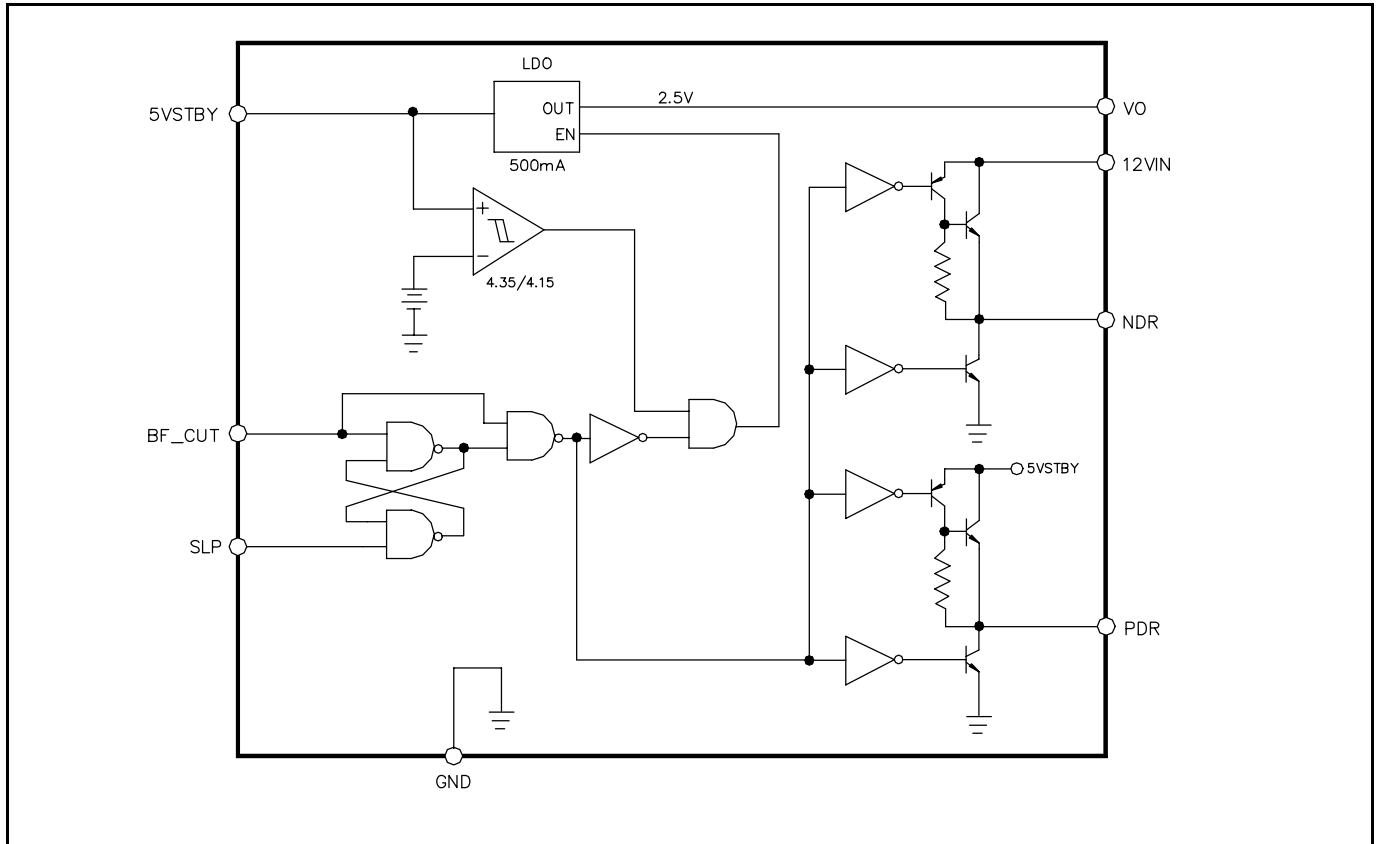
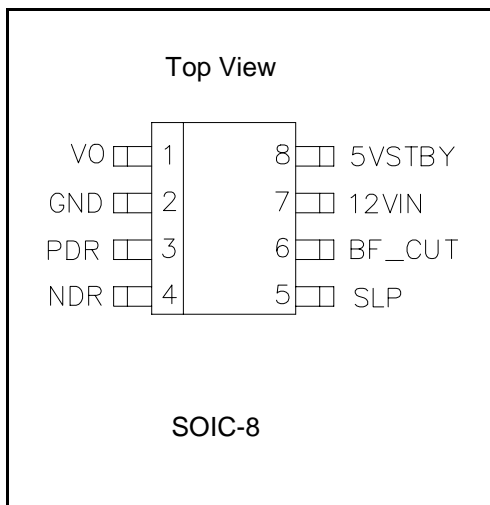
| Parameter  | Symbol               | Test Conditions                                       | MIN          | TYP   | MAX          | Units |
|--|----------------------|---|--------------|-------|--------------|-------|
| <b>VO</b>  |                      |   |              |       |              |       |
| LDO Output Voltage                                       | V <sub>O</sub>       | 4.7V ≤ 5VSTBY ≤ 5.3V,<br>1mA ≤ I <sub>O</sub> ≤ 500mA | -1.5%        | 2.525 | +1.5%        | V     |
|  |                      |   | <b>-2.5%</b> |       | <b>+2.5%</b> |       |
| LDO Output Voltage During Load Transients <sup>(1)</sup> | V <sub>O(T)</sub>    | Load step between 0mA and 500mA at 8A/μs max.         | <b>-3.0%</b> | 2.525 | <b>+3.0%</b> | V     |
| Time To Regulation <sup>(2)</sup>                        | t <sub>REG</sub>     |   |              |       | <b>5</b>     | μs    |
| <b>Inputs (BF_CUT &amp; SLP)</b>                         |                      |   |              |       |              |       |
| Input Resistance   | R <sub>IN</sub>      | BF_CUT = SLP = 5V                                     | <b>1.0</b>   | 10.0  |              | MΩ    |
| High Level Input Voltage                                 | V <sub>IH</sub>      |   | <b>2.0</b>   |       |              | V     |
| Low Level Input Voltage                                  | V <sub>IL</sub>      |   |              |       | <b>0.8</b>   | V     |
| <b>NDR</b>   |                      |   |              |       |              |       |
| Peak Drive Current                                       | I <sub>NDR(PK)</sub> | Sinking: NDR = 0.5V<br>Sourcing: NDR = 10V            | <b>30</b>    |       |              | mA    |
| Output Voltage   | V <sub>NDR</sub>     | Full ON, I <sub>NDR</sub> = 100μA                     | <b>10</b>    | 12    |              | V     |
| Drive Low Delay  | t <sub>DL(N)</sub>   | Measured from BF_CUT threshold to 90% of NDR          |              |       | <b>150</b>   | ns    |
| Fall Time  | t <sub>f(N)</sub>    | Measured from 90% to 10%                              |              |       | <b>1.0</b>   | μs    |
| Drive High Delay   | t <sub>DH(N)</sub>   | Measured from BF_CUT/SLP threshold to 10% of NDR      |              |       | <b>300</b>   | ns    |
| Rise Time  | t <sub>r(N)</sub>    | Measured from 10% to 90%                              |              |       | <b>1.0</b>   | μs    |
| <b>PDR</b>   |                      |   |              |       |              |       |
| Peak Drive Current                                       | I <sub>PDR(PK)</sub> | Sinking: PDR = 0.5V<br>Sourcing: PDR = 3.5V           | <b>30</b>    |       |              | mA    |
| Output Voltage   | V <sub>PDR</sub>     | Full ON, I <sub>PDR</sub> = 100μA                     | <b>3.5</b>   | 5     |              | V     |
| Drive Low Delay  | t <sub>DL(P)</sub>   | Measured from BF_CUT threshold to 90% of PDR          |              |       | <b>150</b>   | ns    |
| Fall Time  | t <sub>f(P)</sub>    | Measured from 90% to 10%                              |              |       | <b>1.0</b>   | μs    |
| Drive High Delay   | t <sub>DH(P)</sub>   | Measured from BF_CUT/SLP threshold to 10% of PDR      |              |       | <b>300</b>   | ns    |
| Rise Time  | t <sub>r(P)</sub>    | Measured from 10% to 90%                              |              |       | <b>1.0</b>   | μs    |
| <b>Overcurrent Protection</b>                            |                      |   |              |       |              |       |
| Current Limit Threshold                                  | I <sub>CL</sub>      | V <sub>O</sub> = 0V                                   | <b>550</b>   |       |              | mA    |

**NOTES:**

 (1) The LDO will bring the output back to within the regular V<sub>O</sub> limits in less than 10μs.

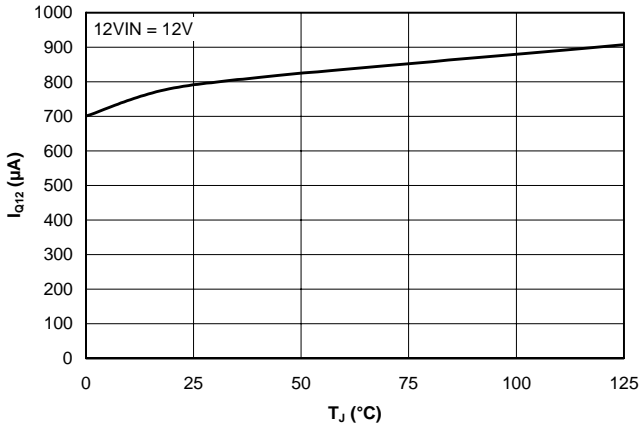
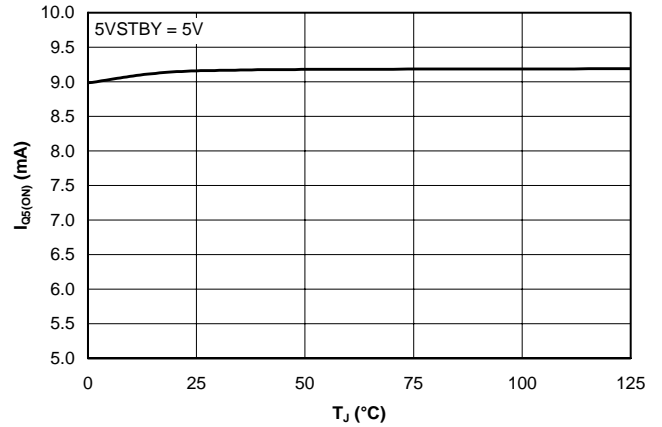
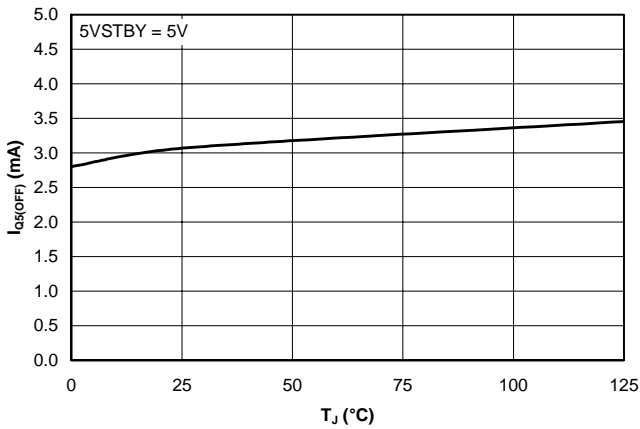
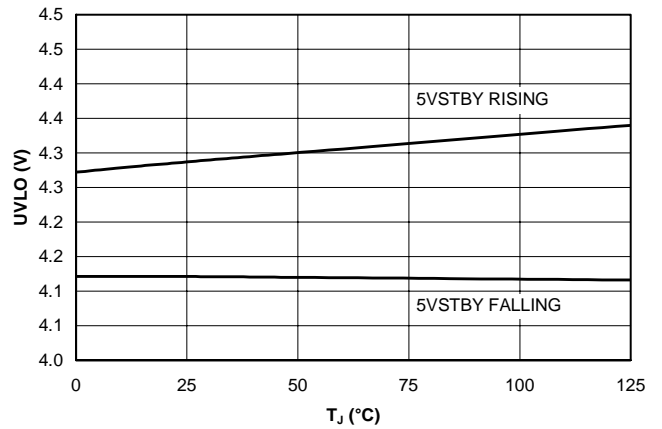
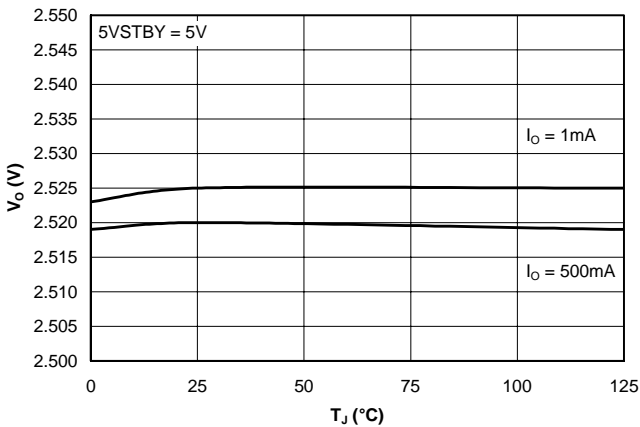
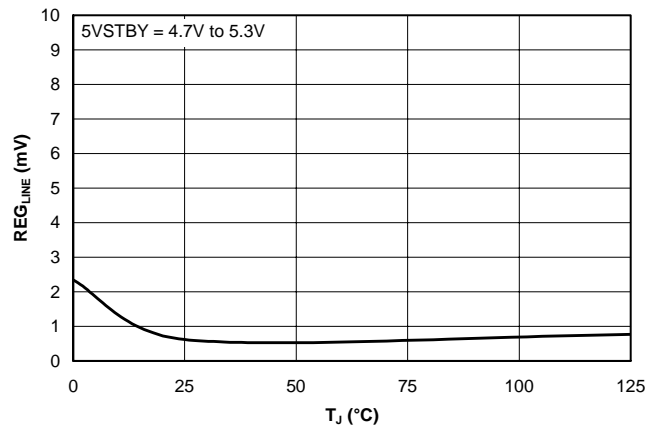
 (2) External 2.5V ± 2.5% applied at output, turning off when NDR goes low. C<sub>O</sub> = 100μF to 400μF, I<sub>O</sub> = 50mA to 200mA.

PRELIMINARY - January 17, 2000

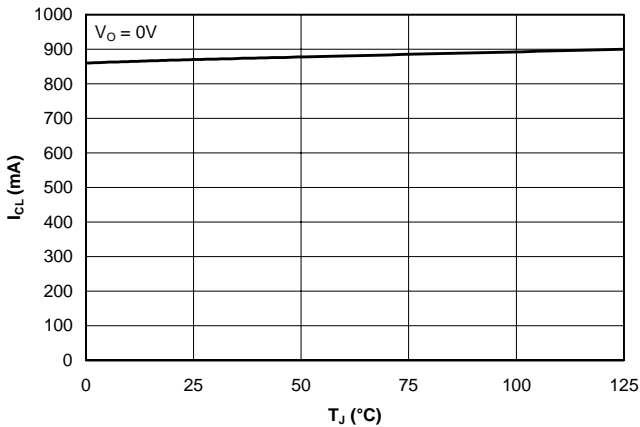
**BLOCK DIAGRAM**

**PIN CONFIGURATION**

**PIN DESCRIPTION**

| Pin | Pin Name | Pin Function                                     |
|-----|----------|--|
| 1   | VO       | LDO 2.5V output.                                 |
| 2   | GND      | Logic and power ground.                          |
| 3   | PDR      | Gate drive signal for P-channel MOSFETs.         |
| 4   | NDR      | Gate drive signal for N-channel MOSFETs.         |
| 5   | SLP      | Control input #1.                                |
| 6   | BF_CUT   | Control input #2.                                |
| 7   | 12VIN    | +12V input supply. Used for generating NDR only. |
| 8   | 5VSTBY   | +5V input supply.                                |

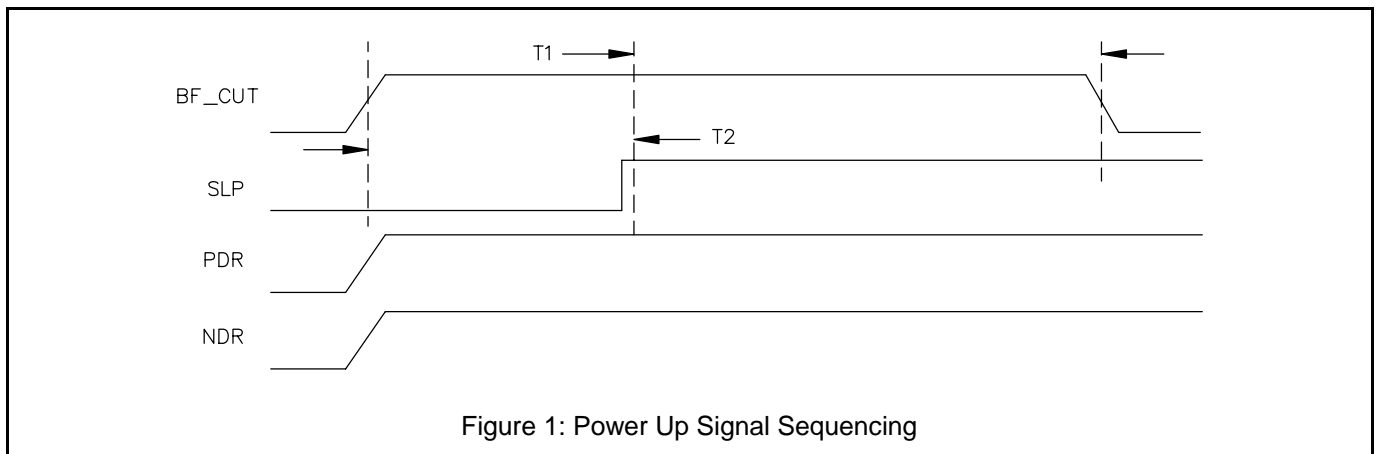
PRELIMINARY - January 17, 2000

**TYPICAL CHARACTERISTICS**
**12VIN Quiescent Current vs.  
Junction Temperature**

**5VSTBY Quiescent Current (ON) vs.  
Junction Temperature**

**5VSTBY Quiescent Current (OFF) vs.  
Junction Temperature**

**5VSTBY Under Voltage Lockout vs.  
Junction Temperature**

**LDO Output Voltage vs.  
Junction Temperature**

**LDO Line Regulation vs.  
Junction Temperature**


PRELIMINARY - January 17, 2000

**TYPICAL CHARACTERISTICS (Cont.)**
**VDO Current Limit vs.  
Junction Temperature**

**TIMING DIAGRAMS**

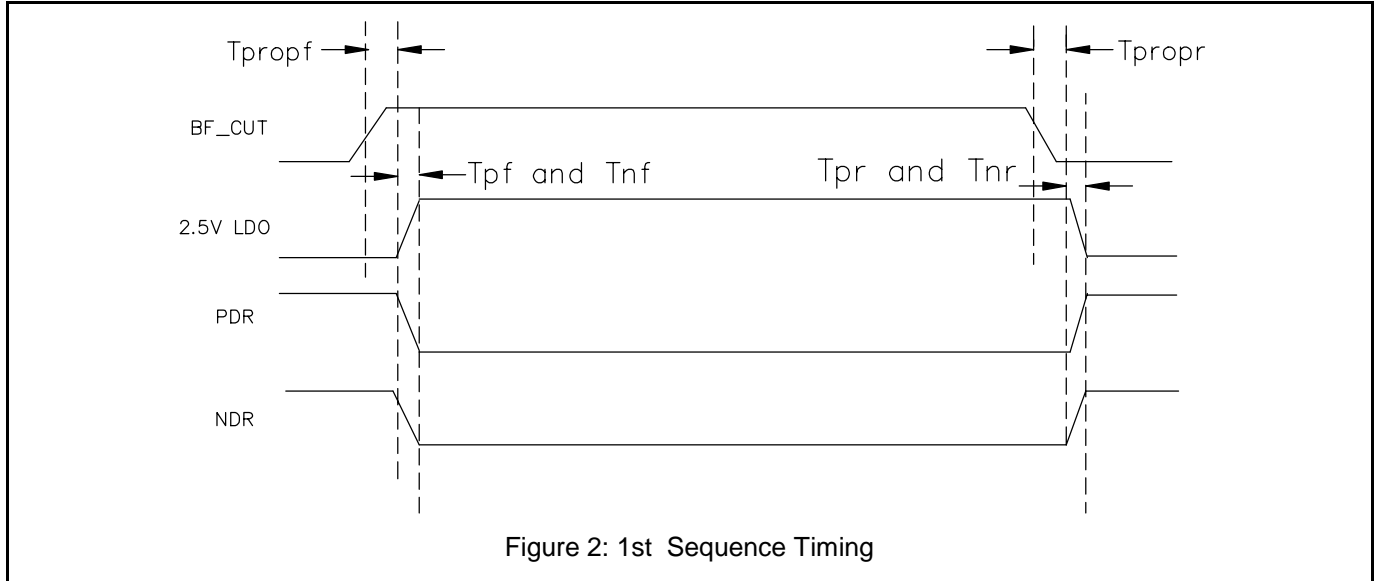
Power up signal sequencing is shown in Figure 1. BF\_CUT, PDR and NDR follow the power rails up to their final values. SLP goes to its high value when the power rails have stabilized, ~25msec after power on. BF\_CUT is pulled low a period T1 after SLP goes high. T1 can be as short as 1msec. Typical measured values are ~200msec. The 2.5V LDO output stays OFF through this sequence.



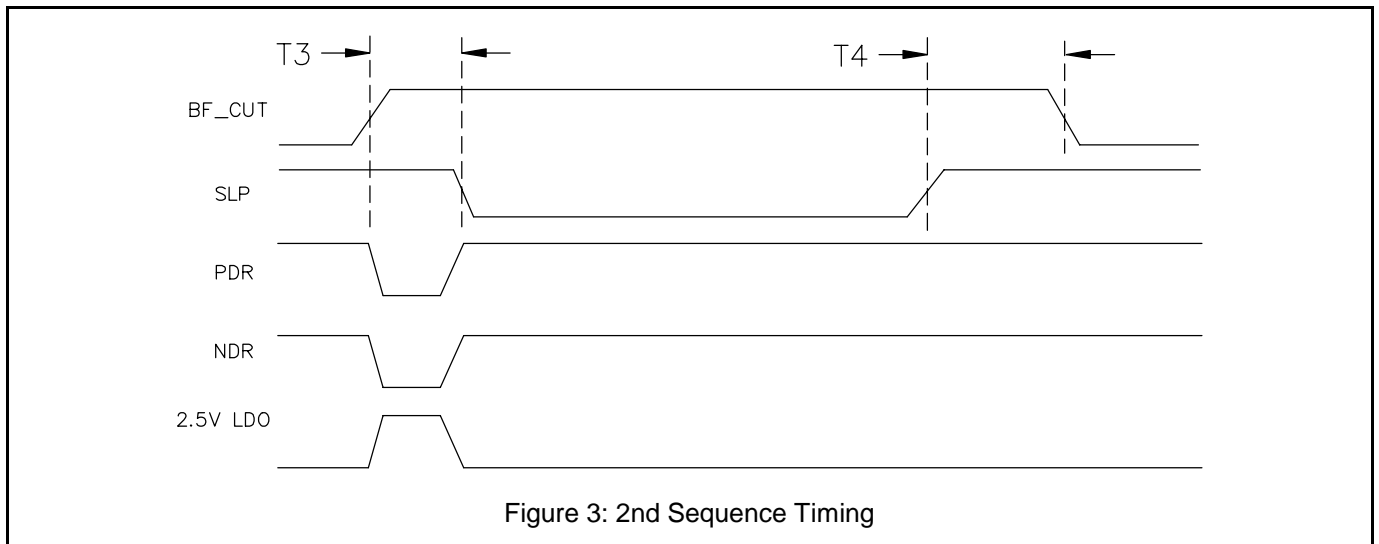
PRELIMINARY - January 17, 2000

**TIMING DIAGRAMS (Cont.)**

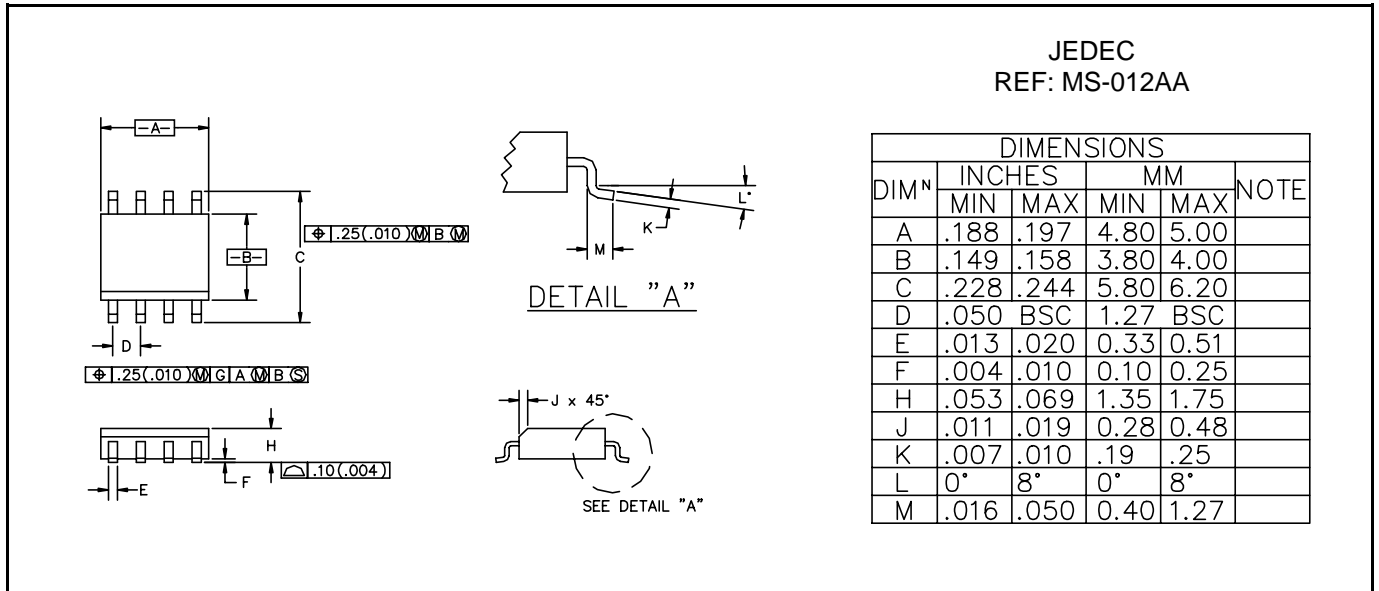
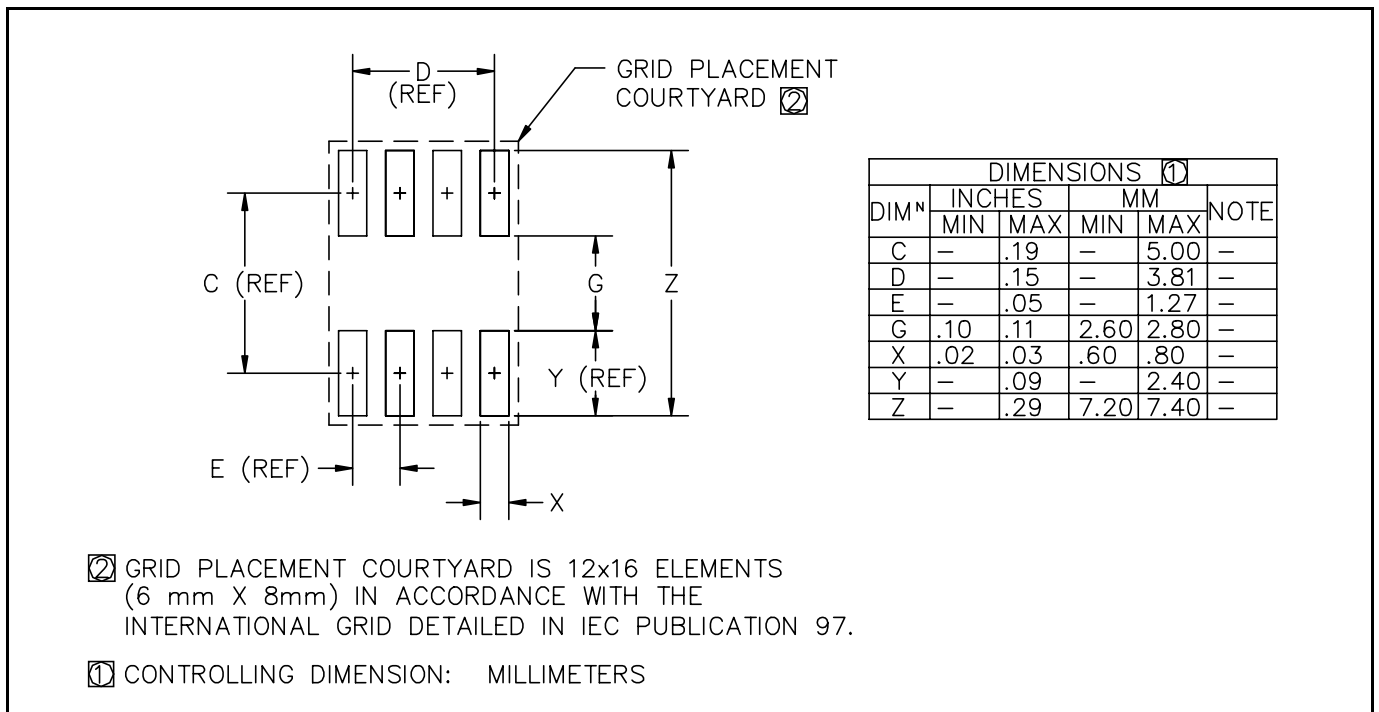
After power up, there are two possible signal sequences that the device will see. The first sequence is with SLP staying HIGH and BF\_CUT transitioning from LOW to HIGH, remaining HIGH for an undetermined period and then going back to LOW. At this point, the system state is back to where it was at the end of the power up sequence. The sequence is shown in Figure 2 (below). During these BF\_CUT transitions, the propagation delays, rise and fall times and going into regulation times for PDR, NDR and VO are described in Electrical Characteristics on page 3. The first sequence can start at any time after the end of the power up sequence.



Signal sequencing for the second possible sequence is shown in Figure 3. BF\_CUT goes from LOW to HIGH and SLP goes from HIGH to LOW, 30μsec to 65μsec (T3) later. When BF\_CUT goes HIGH, PDR and NDR go LOW and the 2.5V LDO turns ON. When SLP goes LOW, PDR and NDR return to HIGH and the 2.5V LDO turns OFF. BF\_CUT will stay HIGH and SLP will stay low for an undetermined time, after which SLP will go HIGH. A minimum of 1msec (T4) later, BF\_CUT will go LOW and the system is back at the end of the power up sequence. Typical measured values of T4 are ~250msec. During all transitions, the propagation delays, rise and fall times, and going into regulation times for PDR, NDR and 2.5V LDO are described in Electrical Characteristics on page 3. The second sequence can start at any time after the end of the power up sequence.



PRELIMINARY - January 17, 2000

**OUTLINE DRAWING**

**MINIMUM LAND PATTERN - SO-8**

 ECN99-694  
 ECN00-831