CLASS D AUDIO DRIVER

Features

- Hi-side and Lo-side independent floating PWM input
- Programmable bidirectional over-current detection with self-reset function
- Over current sensing output
- Shoot-through prevention logic
- High noise immunity
- ±100 V ratings deliver up to 500 W in output power
- 3.3 V / 5 V logic compatible input
- Operates up to 800 kHz

Product Summary

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{OFFSET}$ (max)</td>
<td>±100 V</td>
</tr>
<tr>
<td>Gate driver</td>
<td></td>
</tr>
<tr>
<td>$I_{o+}$</td>
<td>2.0 A</td>
</tr>
<tr>
<td>$I_{o-}$</td>
<td>2.0 A</td>
</tr>
<tr>
<td>Propagation delay</td>
<td>120 ns</td>
</tr>
<tr>
<td>OC protection delay (max)</td>
<td>500 ns</td>
</tr>
<tr>
<td>Shutdown delay (max)</td>
<td>250 ns</td>
</tr>
</tbody>
</table>

Typical Applications

- Class D audio amplifier
- Half bridge converter with digital controller

Package Options

- 16-Lead SOIC

Typical Connection Diagram

(Please refer to Lead Assignments for correct pin configuration. This diagram shows electrical connections only.)
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</tr>
</tbody>
</table>
Description

The IRS20965S is a high voltage, high speed MOSFET driver with floating PWM inputs designed for Class D audio amplifier applications.

Bi-directional current sensing using $R_{DS(ON)}$ of the MOSFETs detects over current conditions during positive and negative load currents without any external shunt resistors. An over current flag output provides over current status without shutting down, enabling full external control over OCP protection sequences.

Independent HIN and LIN inputs offers independent control on HO and LO. Internal shoot-thru prevention logic provides safe operation by eliminating simultaneous ON state in the output MOSFET.
Qualification Information†

<table>
<thead>
<tr>
<th>Qualification Level</th>
<th>Industrial††</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments: This family of ICs has passed JEDEC’s Industrial qualification. IR’s Consumer qualification level is granted by extension of the higher Industrial level.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Moisture Sensitivity Level</th>
<th>SOIC16N</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSL2†† 260°C (per IPC/JEDEC J-STD-020)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESD</th>
<th>Machine Model</th>
<th>Class B (per JEDEC standard EIA/JESD22-A115)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Human Body Model</td>
<td>Class 2 (per EIA/JEDEC standard JESD22-A114)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>IC Latch-Up Test</th>
<th>Class I, Level A (per JESD78D)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>RoHS Compliant</th>
<th>Yes</th>
</tr>
</thead>
</table>

† Qualification standards can be found at International Rectifier’s web site [http://www.irf.com/](http://www.irf.com/)

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.
Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to \( V_{SS} \); all currents are defined positive into any lead. The Thermal Resistance and Power Dissipation ratings are measured under board mounted and still air conditions.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_B )</td>
<td>High side floating supply voltage</td>
<td>-0.3</td>
<td>215</td>
<td>V</td>
</tr>
<tr>
<td>( V_S )</td>
<td>High side floating supply voltage ( \dagger )</td>
<td>( V_B - 20 )</td>
<td>( V_B + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{HO} )</td>
<td>High side floating output voltage</td>
<td>Vs - 0.3</td>
<td>Vs + 0.3</td>
<td></td>
</tr>
<tr>
<td>( V_{CSH} )</td>
<td>CSH pin input voltage</td>
<td>Vs - 0.3</td>
<td>Vs + 0.3</td>
<td></td>
</tr>
<tr>
<td>( V_{CC} )</td>
<td>Low side fixed supply voltage ( \dagger )</td>
<td>-0.3</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>( V_{LO} )</td>
<td>Low side output voltage</td>
<td>-0.3</td>
<td>( V_{CC} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{DD} )</td>
<td>Floating input supply voltage</td>
<td>-0.3</td>
<td>210</td>
<td></td>
</tr>
<tr>
<td>( V_{SS} )</td>
<td>Floating input supply voltage ( \dagger )</td>
<td>(See ( I_{DDZ} ))</td>
<td>( V_{DD} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{HIN} )</td>
<td>PWM input voltage</td>
<td>( V_{SS} - 0.3 )</td>
<td>( V_{DD} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{LIN} )</td>
<td>PWM input voltage</td>
<td>( V_{SS} - 0.3 )</td>
<td>( V_{DD} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{CSD} )</td>
<td>CSD pin input voltage</td>
<td>( V_{SS} - 0.3 )</td>
<td>( V_{DD} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{OC} )</td>
<td>OC pin input voltage</td>
<td>( V_{SS} - 0.3 )</td>
<td>( V_{DD} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{OCSET} )</td>
<td>OCSET pin input voltage</td>
<td>-0.3</td>
<td>( V_{CC} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( V_{REF} )</td>
<td>VREF pin voltage</td>
<td>-0.3</td>
<td>( V_{CC} + 0.3 )</td>
<td></td>
</tr>
<tr>
<td>( I_{DDZ} )</td>
<td>Floating input supply zener clamp current ( \dagger )</td>
<td>-</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>( I_{CCZ} )</td>
<td>Low side supply zener clamp current ( \dagger )</td>
<td>-</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>( I_{BSZ} )</td>
<td>Floating supply zener clamp current ( \dagger )</td>
<td>-</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>( I_{OREF} )</td>
<td>Reference output current</td>
<td>-</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>( dV_S/dt )</td>
<td>Allowable ( V_S ) voltage slew rate</td>
<td>-</td>
<td>50</td>
<td>V/ns</td>
</tr>
<tr>
<td>( dV_{SS}/dt )</td>
<td>Allowable ( V_{SS} ) voltage slew rate ( \dagger )</td>
<td>-</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>( dV_{SS}/dt )</td>
<td>Allowable ( V_{SS} ) voltage slew rate upon power-up ( \dagger )</td>
<td>-</td>
<td>50</td>
<td>V/ms</td>
</tr>
<tr>
<td>( P_d )</td>
<td>Maximum power dissipation</td>
<td>-</td>
<td>1.0</td>
<td>W</td>
</tr>
<tr>
<td>( R_{thJA} )</td>
<td>Thermal resistance, Junction to ambient</td>
<td>-</td>
<td>115</td>
<td>°C/W</td>
</tr>
<tr>
<td>( T_J )</td>
<td>Junction Temperature</td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>( T_S )</td>
<td>Storage Temperature</td>
<td>-55</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>( T_L )</td>
<td>Lead temperature (Soldering, 10 seconds)</td>
<td>-</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

\( \dagger \) \( V_{DD} - V_{SS}, V_{CC} - \text{COM}, \) and \( V_B - V_S \) contain internal shunt zener diodes. Please note that the voltage ratings of these can be limited by the clamping current.

\( \dagger \) For the rising and falling edges of step signal of 10V. \( V_{SS} = 15 \text{V} \) to 200V.

\( \dagger \) \( V_{SS} \) ramps up from 0V to 200V.
### Recommended Operating Conditions

For proper operation, the device should be used within the recommended conditions below. The $V_s$ and COM offset ratings are tested with supplies biased at $I_{DD} = 3\,mA$, $V_{CC} = 12\,V$ and $V_B - V_s = 12\,V$.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_B$</td>
<td>High side floating supply absolute voltage</td>
<td>$V_s + 10$</td>
<td>$V_s + 14$</td>
<td>V</td>
</tr>
<tr>
<td>$V_s$</td>
<td>High side floating supply offset voltage</td>
<td>†</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>$I_{DDZ}$</td>
<td>Floating input supply zener clamp current</td>
<td>1</td>
<td>5</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{OC}$</td>
<td>OC pin input voltage</td>
<td>$V_{SS}$</td>
<td>$V_{DD}$</td>
<td></td>
</tr>
<tr>
<td>$V_{SS}$</td>
<td>Floating input supply absolute voltage</td>
<td>0</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>$V_{HO}$</td>
<td>High side floating output voltage</td>
<td>$V_s$</td>
<td>$V_B$</td>
<td></td>
</tr>
<tr>
<td>$V_{CC}$</td>
<td>Low side fixed supply voltage</td>
<td>10</td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>$V_{LO}$</td>
<td>Low side output voltage</td>
<td>0</td>
<td>$V_{CC}$</td>
<td></td>
</tr>
<tr>
<td>$V_{HIN}$</td>
<td>HIN PWM input voltage</td>
<td>$V_{SS}$</td>
<td>$V_{DD}$</td>
<td></td>
</tr>
<tr>
<td>$V_{LIN}$</td>
<td>LIN PWM input voltage</td>
<td>$V_{SS}$</td>
<td>$V_{DD}$</td>
<td></td>
</tr>
<tr>
<td>$V_{CSD}$</td>
<td>CSD pin input voltage</td>
<td>$V_{SS}$</td>
<td>$V_{DD}$</td>
<td></td>
</tr>
<tr>
<td>$I_{OREF}$</td>
<td>Reference output current to COM ††</td>
<td>0.3</td>
<td>0.8</td>
<td>mA</td>
</tr>
<tr>
<td>$V_{OCSET}$</td>
<td>OCSET pin input voltage</td>
<td>0.5</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>$T_A$</td>
<td>Ambient Temperature</td>
<td>-40</td>
<td>125</td>
<td>°C</td>
</tr>
</tbody>
</table>

† Logic operational for $V_s$ equal to -5V to +200V. Logic state held for $V_s$ equal to -5V to $V_{BS}$.

†† Nominal voltage for $V_{REF}$ is 5V. $I_{OREF}$ of 0.3 – 0.8 mA dictates total external resistor value on $V_{REF}$ to be 6.3k to 16.7kΩ.
Electrical Characteristics

V<sub>CC</sub>, V<sub>BS</sub>= 12 V, I<sub>DD</sub>=3mA, V<sub>SS</sub>=20V, C<sub>L</sub>=1nF, STP=VCC and T<sub>A</sub>=25°C unless otherwise specified.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
<th>Test Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Side Supply</td>
<td>Vcc supply UVLO positive threshold</td>
<td>8.4</td>
<td>8.9</td>
<td>9.4</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>UV&lt;sub&gt;CC&lt;/sub&gt;-</td>
<td>Vcc supply UVLO negative threshold</td>
<td>8.2</td>
<td>8.7</td>
<td>9.2</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;QCC&lt;/sub&gt;</td>
<td>Low side quiescent current</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>mA</td>
<td>V&lt;sub&gt;DT&lt;/sub&gt;=Vcc</td>
</tr>
<tr>
<td>V&lt;sub&gt;CLAMPL&lt;/sub&gt;</td>
<td>Low side zener diode clamp voltage</td>
<td>19.6</td>
<td>20.4</td>
<td>21.6</td>
<td>V</td>
<td>I&lt;sub&gt;CC&lt;/sub&gt;=5mA</td>
</tr>
<tr>
<td>High Side Floating Supply</td>
<td>High side well UVLO positive threshold</td>
<td>8.0</td>
<td>8.5</td>
<td>9.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>UV&lt;sub&gt;BS&lt;/sub&gt;</td>
<td>High side well UVLO negative threshold</td>
<td>7.8</td>
<td>8.3</td>
<td>8.8</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;QBS&lt;/sub&gt;</td>
<td>High side quiescent current</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;LKH&lt;/sub&gt;</td>
<td>High to Low side leakage current</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>µA</td>
<td>V&lt;sub&gt;B&lt;/sub&gt;=V&lt;sub&gt;S&lt;/sub&gt;=200V</td>
</tr>
<tr>
<td>V&lt;sub&gt;CLAMPH&lt;/sub&gt;</td>
<td>High side zener diode clamp voltage</td>
<td>14.7</td>
<td>15.3</td>
<td>16.2</td>
<td>V</td>
<td>I&lt;sub&gt;BS&lt;/sub&gt;=5mA</td>
</tr>
<tr>
<td>Floating Input Supply</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt;, V&lt;sub&gt;SS&lt;/sub&gt; floating supply UVLO positive threshold</td>
<td>8.2</td>
<td>8.7</td>
<td>9.2</td>
<td>V</td>
<td>V&lt;sub&gt;SS&lt;/sub&gt;=0V</td>
</tr>
<tr>
<td>UV&lt;sub&gt;DD&lt;/sub&gt;-</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt;, V&lt;sub&gt;SS&lt;/sub&gt; floating supply UVLO negative threshold</td>
<td>7.7</td>
<td>8.2</td>
<td>8.7</td>
<td>V</td>
<td>V&lt;sub&gt;SS&lt;/sub&gt;=0V</td>
</tr>
<tr>
<td>I&lt;sub&gt;QDD&lt;/sub&gt;</td>
<td>Floating Input quiescent current</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>mA</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt;=9.5V +V&lt;sub&gt;SS&lt;/sub&gt;</td>
</tr>
<tr>
<td>V&lt;sub&gt;CLAMPM&lt;/sub&gt;</td>
<td>Floating Input zener diode clamp voltage</td>
<td>9.8</td>
<td>10.2</td>
<td>10.8</td>
<td>V</td>
<td>I&lt;sub&gt;DD&lt;/sub&gt;=5mA</td>
</tr>
<tr>
<td>I&lt;sub&gt;LKM&lt;/sub&gt;</td>
<td>Floating input side to Low side leakage current</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>µA</td>
<td>V&lt;sub&gt;DD&lt;/sub&gt;=V&lt;sub&gt;SS&lt;/sub&gt;=200V</td>
</tr>
<tr>
<td>Floating PWM Input</td>
<td>Logic “1” input threshold voltage</td>
<td>2.3</td>
<td>1.9</td>
<td>-</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>Logic “0” input threshold voltage</td>
<td>-</td>
<td>1.9</td>
<td>1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>I&lt;sub&gt;IN&lt;/sub&gt;-</td>
<td>Logic “1” input bias current</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>µA</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=3.3V</td>
</tr>
<tr>
<td>I&lt;sub&gt;IN&lt;/sub&gt;-</td>
<td>Logic “0” input bias current</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>µA</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;=V&lt;sub&gt;SS&lt;/sub&gt;</td>
</tr>
</tbody>
</table>
**Electrical Characteristics (cont’d)**

$V_{CC}, V_{BS}= 12 \text{ V}, I_{DD}=3\text{mA}, V_{SS}=20\text{V}, C_L=1\text{nF}, \text{STP}=V_{CC}$ and $T_A=25^\circ \text{C}$ unless otherwise specified.

### Protection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Voltage (V)</th>
<th>Current (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reference output voltage</td>
<td>$V_{REF}$</td>
<td>4.8 5.1 5.4</td>
<td></td>
</tr>
<tr>
<td>Low side OC threshold in $V_s$</td>
<td>$V_{th_{OCL}}$</td>
<td>1.1 1.2 1.3</td>
<td></td>
</tr>
<tr>
<td>High side OC threshold in $V_{CSH}$</td>
<td>$V_{th_{OCH}}$</td>
<td>1.1+ $V_s$ 1.2+ $V_s$ 1.3+ $V_s$</td>
<td></td>
</tr>
<tr>
<td>CSD pin shutdown release threshold</td>
<td>$V_{th1}$</td>
<td>0.62 x $V_{DD}$ 0.70 x $V_{DD}$ 0.78 x $V_{DD}$</td>
<td>$V_{SS}=0\text{V}$</td>
</tr>
<tr>
<td>CSD pin self reset threshold</td>
<td>$V_{th2}$</td>
<td>0.26 x $V_{DD}$ 0.30 x $V_{DD}$ 0.34 x $V_{DD}$</td>
<td>$V_{SS}=0\text{V}$</td>
</tr>
<tr>
<td>CSD pin charge current</td>
<td>$I_{CSD+}$</td>
<td>70 100 130</td>
<td></td>
</tr>
<tr>
<td>CSD pin discharge current</td>
<td>$I_{CSD-}$</td>
<td>70 100 130</td>
<td></td>
</tr>
<tr>
<td>OC output sink current</td>
<td>$I_{OCC}$</td>
<td>10 - -</td>
<td>mA $V_{OCC}=1\text{V}$</td>
</tr>
<tr>
<td>Propagation delay time from $V_{S}&gt;V_{th_{OCL}}$ to Shutdown</td>
<td>$t_{OCL}$</td>
<td>- - 500</td>
<td>ns</td>
</tr>
<tr>
<td>Propagation delay time from $V_{CSH}&gt;V_{th_{OCH}}$ to Shutdown</td>
<td>$t_{OCH}$</td>
<td>- - 500</td>
<td>ns</td>
</tr>
<tr>
<td>OC output minimum pulse width</td>
<td>$PW_{OC}$</td>
<td>1 - -</td>
<td>µs</td>
</tr>
</tbody>
</table>

### Gate Driver

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Symbol Description</th>
<th>Voltage (V)</th>
<th>Current (µA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output high short circuit current (Source)</td>
<td>$I_{O+}$</td>
<td>2.0</td>
<td>-</td>
<td>A $V_{O}=0\text{V}, PW_{\leq10\mu S}$</td>
</tr>
<tr>
<td>Output low short circuit current (Sink)</td>
<td>$I_{O-}$</td>
<td>2.0</td>
<td>-</td>
<td>A $V_{O}=12\text{V}, PW_{\leq10\mu S}$</td>
</tr>
<tr>
<td>Low level output voltage</td>
<td>$V_{OL}$</td>
<td>LO – COM, $HO$ - $VS$</td>
<td>- -</td>
<td>0.1</td>
</tr>
<tr>
<td>High level output voltage</td>
<td>$V_{OH}$</td>
<td>VCC – LO, $VB$ - $HO$</td>
<td>- -</td>
<td>1.4 $I_{O}=0\text{A}$</td>
</tr>
<tr>
<td>Turn-on rise time</td>
<td>$tr$</td>
<td>-</td>
<td>15</td>
<td>ns</td>
</tr>
<tr>
<td>Turn-off fall time</td>
<td>$tf$</td>
<td>-</td>
<td>15</td>
<td>ns</td>
</tr>
<tr>
<td>High and low side turn-on propagation delay, floating inputs</td>
<td>$ton_1$</td>
<td>-</td>
<td>120</td>
<td>ns</td>
</tr>
<tr>
<td>High and low side turn-off propagation delay, floating inputs</td>
<td>$toff_1$</td>
<td>-</td>
<td>120</td>
<td>ns</td>
</tr>
<tr>
<td>High and low side turn-on propagation delay, non-floating inputs</td>
<td>$ton_2$</td>
<td>-</td>
<td>130</td>
<td>ns</td>
</tr>
<tr>
<td>High and low side turn-off propagation delay, non-floating inputs</td>
<td>$toff_2$</td>
<td>-</td>
<td>130</td>
<td>ns</td>
</tr>
<tr>
<td>Intrinsice dead-time: LO turn-off to $HO$ turn-on ($DT_{LO\rightarrow HO}$) &amp; $HO$ turn-off to LO turn-on ($DT_{HO\rightarrow LO}$)</td>
<td>$DT$</td>
<td>0 10 20</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Minimum pulse width for outputs to respond. Positive or Negative.</td>
<td>$PW_{min}$</td>
<td>-</td>
<td>25</td>
<td>ns</td>
</tr>
<tr>
<td>Allowable LO/HO over wrap</td>
<td>$OW_{min}$</td>
<td>10</td>
<td>-</td>
<td>ns</td>
</tr>
</tbody>
</table>

**Note:** $V_S = 100\text{V}, V_{SS} = 100\text{V}$
Waveform Definitions

Figure 1: Timing Diagram

Figure 2: Deadtime Waveform Definitions
Figure 3: CSD to Shutdown Waveform Definitions

Figure 4: $V_S > V_{thOCL}$ to Shutdown Waveform

Figure 5: $V_{CSH} > V_{thOCH}$ to Shutdown Waveform
Input/Output Pin Equivalent Circuit Diagrams:
## Lead Definitions

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VDD</td>
<td>Floating input positive supply</td>
</tr>
<tr>
<td>2</td>
<td>CSD</td>
<td>Shutdown timing capacitor, referenced to VSS</td>
</tr>
<tr>
<td>3</td>
<td>OC</td>
<td>Over current warning output, open drain referenced to VSS</td>
</tr>
<tr>
<td>4</td>
<td>HIN</td>
<td>PWM input, in phase with HO, referenced to VSS</td>
</tr>
<tr>
<td>5</td>
<td>LIN</td>
<td>PWM input, in phase with LO, referenced to VSS</td>
</tr>
<tr>
<td>6</td>
<td>VSS</td>
<td>Floating input supply return</td>
</tr>
<tr>
<td>7</td>
<td>VREF</td>
<td>5V reference output for setting OCSET, reference to COM</td>
</tr>
<tr>
<td>8</td>
<td>OCSET</td>
<td>Low side over current threshold setting, referenced to COM</td>
</tr>
<tr>
<td>9</td>
<td>COM</td>
<td>Low side supply return</td>
</tr>
<tr>
<td>10</td>
<td>LO</td>
<td>Low side output</td>
</tr>
<tr>
<td>11</td>
<td>VCC</td>
<td>Low side logic supply</td>
</tr>
<tr>
<td>12</td>
<td>STP</td>
<td>Shoot-thru prevention logic override (VCC: enabled, COM: disabled)</td>
</tr>
<tr>
<td>13</td>
<td>VS</td>
<td>High side floating supply return</td>
</tr>
<tr>
<td>14</td>
<td>HO</td>
<td>High side output</td>
</tr>
<tr>
<td>15</td>
<td>VB</td>
<td>High side floating supply</td>
</tr>
<tr>
<td>16</td>
<td>CSH</td>
<td>High side over current sensing input, referenced to VS</td>
</tr>
</tbody>
</table>

## Lead Assignments

![Lead Assignments Diagram](image-url)
NOTES:
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AC.
5. DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.
6. DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS SHALL NOT EXCEED 0.15 [.006].
Tape and Reel Details: SOIC16N

LOAD TAPE FEED DIRECTION

NOTE: CONTROLLING DIMENSION IN MM

CARRIER TAPE DIMENSION FOR 16SOICN

<table>
<thead>
<tr>
<th>Code</th>
<th>Metric Min</th>
<th>Metric Max</th>
<th>Imperial Min</th>
<th>Imperial Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7.90</td>
<td>8.10</td>
<td>0.311</td>
<td>0.318</td>
</tr>
<tr>
<td>B</td>
<td>3.90</td>
<td>4.10</td>
<td>0.153</td>
<td>0.161</td>
</tr>
<tr>
<td>C</td>
<td>15.70</td>
<td>16.30</td>
<td>0.618</td>
<td>0.641</td>
</tr>
<tr>
<td>D</td>
<td>7.40</td>
<td>7.60</td>
<td>0.291</td>
<td>0.299</td>
</tr>
<tr>
<td>E</td>
<td>6.40</td>
<td>6.60</td>
<td>0.252</td>
<td>0.260</td>
</tr>
<tr>
<td>F</td>
<td>10.20</td>
<td>10.40</td>
<td>0.402</td>
<td>0.409</td>
</tr>
<tr>
<td>G</td>
<td>1.50</td>
<td>n/a</td>
<td>0.059</td>
<td>n/a</td>
</tr>
<tr>
<td>H</td>
<td>1.50</td>
<td>1.60</td>
<td>0.059</td>
<td>0.062</td>
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</table>

REEL DIMENSIONS FOR 16SOICN

<table>
<thead>
<tr>
<th>Code</th>
<th>Metric Min</th>
<th>Metric Max</th>
<th>Imperial Min</th>
<th>Imperial Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>329.60</td>
<td>330.25</td>
<td>12.976</td>
<td>13.001</td>
</tr>
<tr>
<td>B</td>
<td>20.95</td>
<td>21.45</td>
<td>0.824</td>
<td>0.844</td>
</tr>
<tr>
<td>C</td>
<td>12.80</td>
<td>13.20</td>
<td>0.503</td>
<td>0.519</td>
</tr>
<tr>
<td>D</td>
<td>1.95</td>
<td>2.45</td>
<td>0.077</td>
<td>0.098</td>
</tr>
<tr>
<td>E</td>
<td>98.00</td>
<td>102.00</td>
<td>3.858</td>
<td>4.015</td>
</tr>
<tr>
<td>F</td>
<td>n/a</td>
<td>22.40</td>
<td>n/a</td>
<td>0.881</td>
</tr>
<tr>
<td>G</td>
<td>18.50</td>
<td>21.10</td>
<td>0.728</td>
<td>0.830</td>
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<tr>
<td>H</td>
<td>16.40</td>
<td>18.40</td>
<td>0.645</td>
<td>0.724</td>
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</table>
Part Marking Information

- **Part number**: IRS20965S
- **Date code**: YWW
- **Pin 1 Identifier**: ?
- **Lot Code** (Prod mode – 4 digit SPN code): ? XXXX
- **Assembly site code** Per SCOP 200-002
- **MARKING CODE**: P
- **Lead Free Released**
- **Non-Lead Free Released**

Ordering Information

<table>
<thead>
<tr>
<th>Base Part Number</th>
<th>Package Type</th>
<th>Standard Pack</th>
<th>Complete Part Number</th>
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<tbody>
<tr>
<td>IRS20965SPBF</td>
<td>SO16N</td>
<td>Tube/Bulk, 45</td>
<td>IRS20965SPBF</td>
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<tr>
<td></td>
<td></td>
<td>Tape and Reel, 2500</td>
<td>IRS20965STRPBF</td>
</tr>
</tbody>
</table>

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