Purpose:

This demo illustrates the various models of the MOSFET, namely the S, SR, and SCS models. The models are displayed on the scope by plotting the current $i_D$ (taken as a voltage across a load resistor) versus the voltage $v_{DS}$, with a sinusoidal drive on $V_S$ to display a line rather than simply a point. The S and SR models are shown by switching $v_{GS}$ between voltages above (ON state) and below (OFF state) the MOSFET threshold voltage. The SCS model is shown in a similar manner, by incrementally increasing $v_{GS}$ from just below $v_T$ to some amount above it. This shows the saturation (current source) region of the MOSFET not visible when larger values of $v_{GS}$ are used.

Steps:

1. To show the switch model, $v_{IN}$ is set to a large value, and switched on and off. The i-v characteristic as seen from the drain to the source is shown on the scope. The curve looks like an open circuit (horizontal line) and a short circuit (vertical line) accordingly.

2. To show the switch-resistor model, $v_{IN}$ is set to a slightly smaller value, and switched on and off. The i-v characteristic as seen from the drain to the source is shown on the scope. The curve looks like an open circuit (horizontal line) and a resistor (sloped line) accordingly.

3. To show the switch-current source model, $v_{IN}$ is set just below $v_T$ and increased incrementally, to show a family of curves.

Description: MOSFET Switch (S); switch resistor (SR); Switch Current Source (SCS); models

1) Set FG2 @ High Z mode, frequency @ 500 HZ Sine, Amp @ 3 v p-p, Offset @ 1.5 v p-p

2) Set FG1 @ High Z mode (DC offset only) press DC offset button and hold it until you hear the click!

   a) To show S model, set FG1 dc offset to 5 v, (NOT MORE THAN 5 V IT WILL DAMAGE THE FET) turn the switch (S1) on the pc board to FG1 to show $V_{GS}>V_T$ and off to show $V_{GS}<V_T$. See Fg1 pictorial graph!

   b) To show SR model, set FG1 dc offset to 2.6 v, turn the switch on the pc board to FG1 to show $V_{GS}>V_T$ and off to show $V_{GS}<V_T$. See Fg1 pictorial graph!

   c) To show SCS model, making various curves, do the following: The switch on the pc board should be set on FG1 ON, roll FG1 dc offset voltage between 2 & 2.4 v by tenths (i.e. 2.0, 2.1, ....2.4). See Fg1 pictorial graph!

*Note: See below the sequence of button to change from 50 Ohm termination to High Z mode!
Oscilloscope Setup

<table>
<thead>
<tr>
<th>CH</th>
<th>V/DIV</th>
<th>OFFSET</th>
<th>MODE</th>
<th>FUNC</th>
<th>MATH</th>
<th>VERTICAL</th>
<th>HORIZONTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>off</td>
<td>1</td>
<td>0</td>
<td>DC</td>
<td>off</td>
<td>CH1−CH2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>off</td>
<td>1</td>
<td>0</td>
<td>DC</td>
<td>off</td>
<td>F1 + 500 m</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>off</td>
<td>1</td>
<td>-1.0</td>
<td>DC</td>
<td>on</td>
<td>F2 vs CH2</td>
<td>1  2  500mv 999 mv</td>
</tr>
<tr>
<td>4</td>
<td>off</td>
<td>2</td>
<td>6.0</td>
<td>DC</td>
<td>off</td>
<td>CH2-CH3</td>
<td></td>
</tr>
</tbody>
</table>

Horizontal: 2 m Acquisition: AUTO AUTO 4 Trigger: CH1

Waveform Generator Setup

<table>
<thead>
<tr>
<th>UNIT</th>
<th>WAVE</th>
<th>AMP</th>
<th>OFFSET</th>
<th>FREQ</th>
<th>+6</th>
<th>+25</th>
<th>-25</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>FG1</td>
<td>DCV</td>
<td>0</td>
<td>2 &amp; 5 V</td>
<td>1 k</td>
<td>Hi Z</td>
<td></td>
<td></td>
<td>OFF</td>
</tr>
<tr>
<td>FG2</td>
<td>SIN</td>
<td>3</td>
<td>1.5</td>
<td>500 HZ</td>
<td>Hi Z</td>
<td></td>
<td></td>
<td>Trigger: INT, INT</td>
</tr>
</tbody>
</table>

- See the sequence of buttons to be pressed
  - >
  - >0
  - >
  - 0.4v
  - v
  - < High
  - > 50 Ohm
**S/SR/SCS MODELS**

- 100 Ohm
- 2N7000
- CH2
- (14)*
- (2)
- FG1
- VGS > VT
- ID
- VGS < VT
- VDS
- (17)*
- (2)*
- S1
- (2)*
- (2)*
- FG2
- 14
- ID
- VGS > VT
- VGS < VT
- VDS
- ( ) Pins

*Note # of pins on the PC board and BNC connectors

○ BNC

( ) Pins