

**6.002 Demo# 06 ( Load set up Demo#06.set)**  
**S/SR/SCS models**  
**Lecture 6 (and 8)**

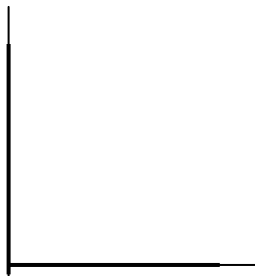
**Agarwal Fall 00**

Purpose:

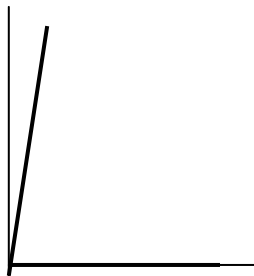
This demo illustrates the various models of the MOSFET, namely the S, SR, and SCS models. The models are displayed on the scope by plotting the current  $i_D$  (taken as a voltage across a load resistor) versus the voltage  $v_{DS}$ , with a sinusoidal drive on  $V_S$  to display a line rather than simply 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:

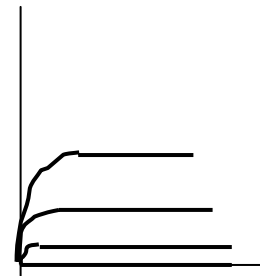
1. To show the switch model,  $v_{IN}$  is set to a large value, and switched on and off. The  $i$ - $v$  characteristic as seen from the drain to the source is shown on the scope. The curve looks like an open circuit (horizontal line) and a short circuit (vertical line) accordingly.
2. To show the switch-resistor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



**S model**



**SR model**



**SCS model**

**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

CH	V/DIV	OFFSET	MODE	FUNC	MATH	VERTICAL		HORIZONTAL	
1 off	1	0	DC	off	CH1– CH2				
2 off	1	0	DC	off	F1 ÷ 500 m				
3 off	1	-1.0	DC	on	F2 vs CH2	1	2	500mv	999 mv
4 off	2	6.0	DC	off	CH2-CH3				
Horizontal: 2 m		Acquisition: AUTO		AUTO	4			Trigger: CH1	

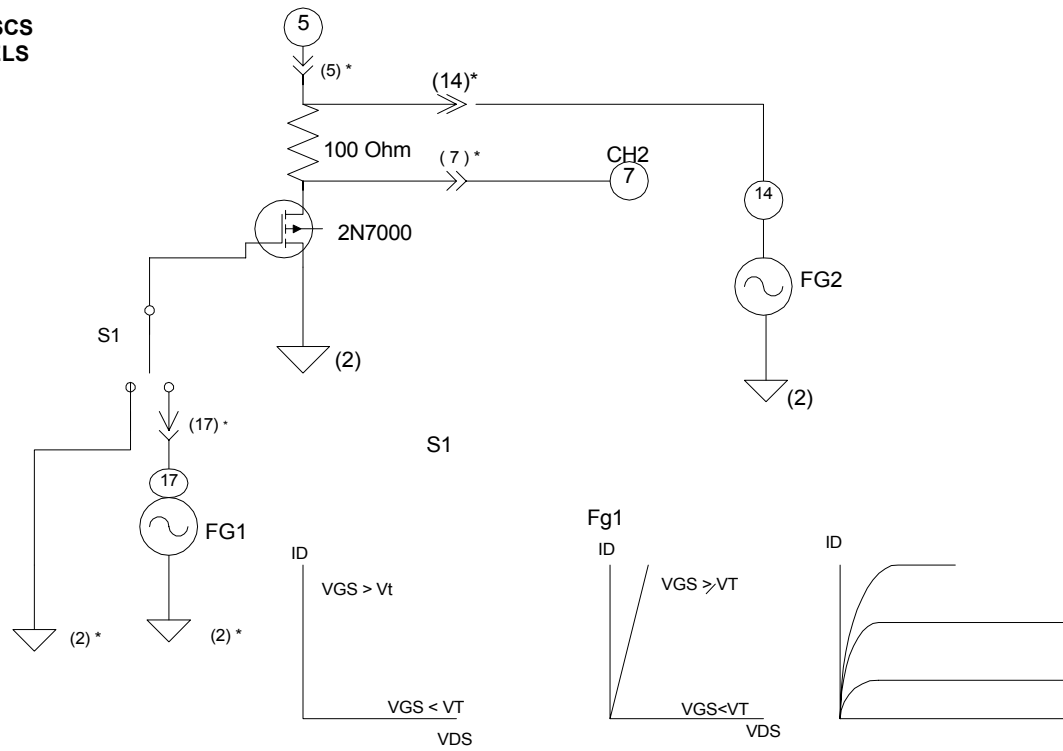
### Waveform Generator Setup

### Power Supply Setup

UNIT	WAVE	AMP	OFFSET	FREQ	+6	+25	-25	OUTPUT
FG1	DCV	0	2 & 5 V	1 k	Hi Z			OFF
FG2	SIN	3	1.5	500 HZ	Hi Z	Trigger: INT, INT		

- See the sequence of buttons to be pressed
- >
- >0
- >
- 0.4v
- v
- < High
- > 50 Ohm

**S/SR/SCS  
MODELS**



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

○ BNC

( ) Pins