HV440DB2 Demo Board

by Jimes Lei, Applications Engineering Manager

Introduction

The Supertex HV440 is a power-efficient, switch-mode ring generator IC requiring minimal external components.

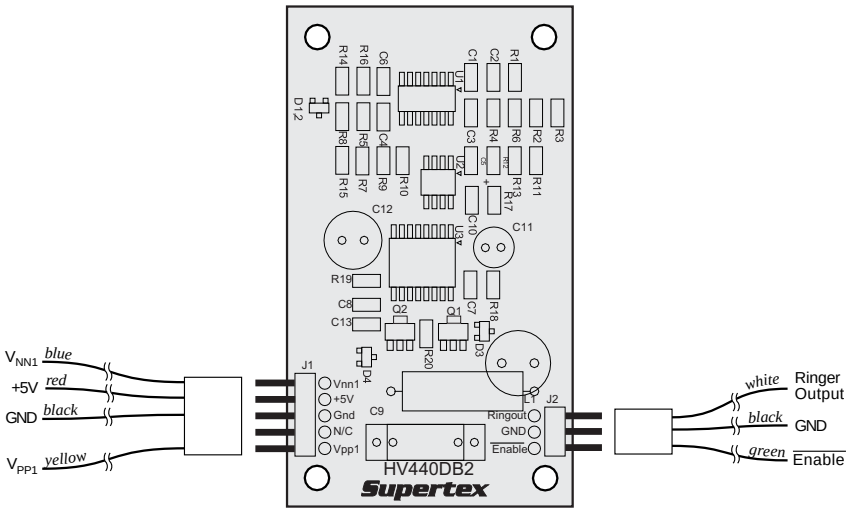
The HV440DB2 demo board contains all the circuitry necessary to drive a 20 REN (North American) ringer load. Simply connect power supplies, ringer load, and enable input as shown below.

For a more detailed description on using the HV440, please refer to Application Note AN-H37.

Specifications

Ringing Frequency	20Hz ±2Hz
Ringing Amplitude	$62V_{RMS}$ ±5%
Ringer THD	<10%
Output Offset	$-48V_{DC}$ ±4V *(using a 5V ±5% supply)*
Max Ringer Load	20 REN *(North American)*

Board Layout and Connections



V_{NN1} and V_{PP1} Supplies

V_{PP1} is +56.5V ±5%. V_{NN1} is -153V ±5%. The voltage difference between these two supplies must not exceed 220 volts. Current draw from each supply is typically 70mA. Output filter capacitance of these supplies must be at least 200µF.

The +5V supply must be powered up before the V_{NN1} and V_{PP1} supplies. See the section on supply sequencing on the next page.

+5 Volt Supply

Required tolerance is ±5%. Current draw is less than 12mA.

Ringer output offset is referenced to the 5 volt supply and varies 9.6 volts for every 1 volt change in the supply.

$\overline{\text{Enable}}$

This input enables/disables the ringer output. A logic low (0V) turns the output ON, while a high (5V) turns the output OFF. The $\overline{\text{enable}}$ pin must not be left floating. When OFF, the output is in a high impedance state.

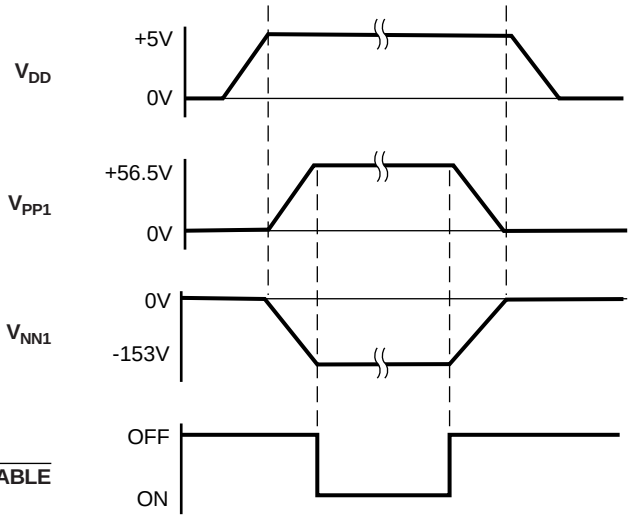
The output must be enabled only after the supplies are stable.

Ringer Output

Connect the ringer load between this output and ground. The load need not be AC coupled, although current draw from the V_{NN1} supply will increase to about 140mA with a DC coupled load, due to the -48VDC output offset.

Supply Sequencing

The +5V supply must always be powered up before the V_{NN1} and V_{PP1} supplies. In addition, the Enable input should be ON only after the supplies have stabilized, and should be OFF before the supplies are powered-down. The following sequencing is recommended.



5 REN Capability

A demo board capable of driving 5 RENs (HV440DB1) is also available from Supertex. However, the supplied board (HV440DB2) can be modified to provide 5 RENs, as outlined below. Refer to the board layout and connection diagram at the beginning of this note for component locations.

1. Add a jumper on the R20 pads
2. Remove Q1 and Q2
3. Change L1 to 10mH (120mA rating)*
4. Change C9 to 220nF (200VDC rating)
5. Change C5 to 680pF
6. Change R18 and R19 to 3.9Ω (1/8W rating)
7. Ensure that the V_{NN1} and V_{PP1} supplies are capable of 30mA and have at least 47µF of output capacitance

* *Not all inductors behave similarly, especially at higher frequencies. The recommended inductor is a Delevan 2474-49L-D.*

Other Ringing Frequencies

By simply changing two resistors, the supplied circuit may be modified to provide ringing frequencies other than 20Hz. The following table lists the resistors to change for some standard ringing frequencies. Please refer to the board layout and connection diagram at the beginning of this note for component locations.

Ringing Frequency[1]	R4, R5	Accuracy[2]
16.7Hz	243kΩ	0.6%
20Hz	205kΩ	-0.5%
25Hz	162kΩ	0.8%
30Hz	137kΩ	-0.7%
33.3Hz	121kΩ	1.3%
40Hz	102kΩ	0.0%
42Hz	97.6kΩ	-0.4%
50Hz	80.6kΩ	1.3%
54Hz	75.0kΩ	0.8%
60Hz	68.1kΩ	-0.1%
66.7Hz	60.4kΩ	1.3%

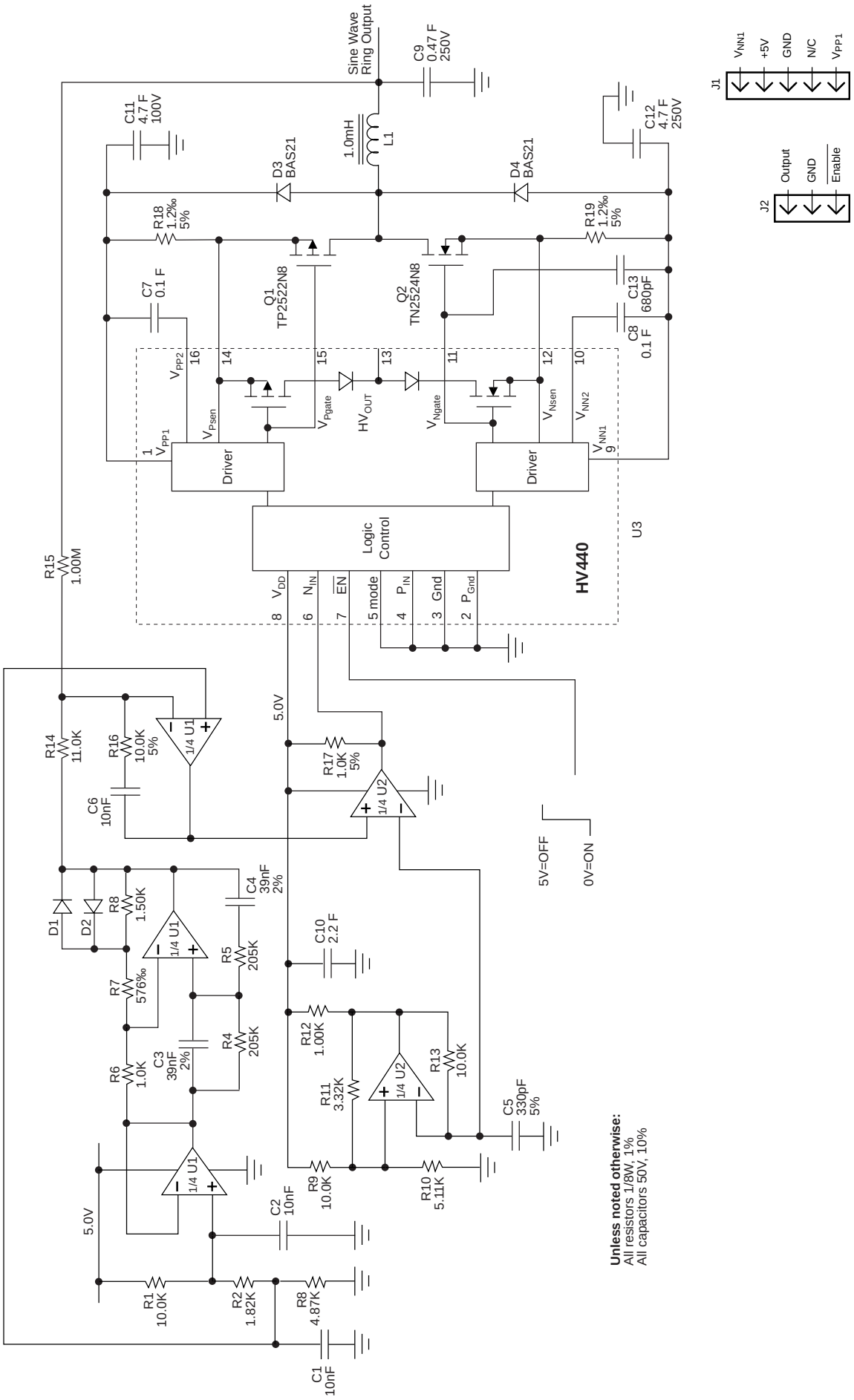
1 *Values for other frequencies may be determined from* $f_{ring} = (2\pi RC)^{-1}$ *where R=R4=R5 and C=C3=C4.*

2 *Not including component tolerances.*

Output Ripple Reduction

As supplied, the HV440DB2 has less than $1V_{RMS}$ of output ripple. To obtain even lower ripple, C9 may be increased. However, do not exceed 2µF, as distortion of the ringing signal may result. The capacitor should be rated for 200VDC, non-polarized.

HV440DB2 Schematic



HV440DB2 20 REN Ring Generator Demo Board BOM

Desig	Description	Value	Tol	Rating
R1	Thick film chip resistor	10.0K	1%	1/8W
R2	Thick film chip resistor	1.82K	1%	1/8W
R3	Thick film chip resistor	4.87K	1%	1/8W
R4	Thick film chip resistor	205K	1%	1/8W
R5	Thick film chip resistor	205K	1%	1/8W
R6	Thick film chip resistor	1.00K	1%	1/8W
R7	Thick film chip resistor	576	1%	1/8W
R8	Thick film chip resistor	1.50K	1%	1/8W
R9	Thick film chip resistor	10.0K	1%	1/8W
R10	Thick film chip resistor	5.11K	1%	1/8W
R11	Thick film chip resistor	3.32K	1%	1/8W
R12	Thick film chip resistor	1.00K	1%	1/8W
R13	Thick film chip resistor	10.0K	1%	1/8W
R14	Thick film chip resistor	11.0K	1%	1/8W
R15	Thick film chip resistor	1.00M	1%	1/8W
R16	Thick film chip resistor	10K	5%	1/8W
R17	Thick film chip resistor	1K	5%	1/8W
R18	Thick film chip resistor	1.2	5%	1/8W
R19	Thick film chip resistor	1.2	5%	1/8W
C1	X7R ceramic chip capacitor	10nF	10%	50V
C2	X7R ceramic chip capacitor	10nF	10%	50V
C3	Surface mount film capacitor	39nF	2%	50V
C4	Surface mount film capacitor	39nF	2%	50V
C5	NPO ceramic chip capacitor	330pF	5%	50V
C6	X7R ceramic chip capacitor	10nF	10%	50V
C7	X7R ceramic chip capacitor	0.1µF	10%	50V
C8	X7R ceramic chip capacitor	0.1µF	10%	50V
C9	Metallized polyester film capacitor	0.47µF	10%	250V
C10	Tantalum electrolytic chip capacitor	2.2µF	20%	10V
C11	Aluminum electrolytic capacitor	4.7µF	20%	100V
C12	Aluminum electrolytic capacitor	4.7µF	20%	250V
C13	X7R ceramic chip capacitor	680pF	10%	50V
L1	Inductor	1.0mH	10%	510mA
Q1	P-channel MOSFET	TP2522N8	—	220V, 0.75A
Q2	N-channel MOSFET	TN2524N8	—	240V, 1.0A
D1-D2	Diode array, fast recovery	BAV99	—	70V
D3	Diode, fast recovery	BAS21	—	250V
D4	Diode, fast recovery	BAS21	—	250V
U1	Quad operational amplifier IC	LM2902M	—	—
U2	Dual high speed comparator IC	LM2903M	—	—
U3	High Voltage Ring Generator IC	HV440WG	—	—

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