20 REN Ring Generator
HV441DB2

Introduction

The Supertex HV441 is a power-efficient, switch-mode ring generator IC requiring minimal external components.

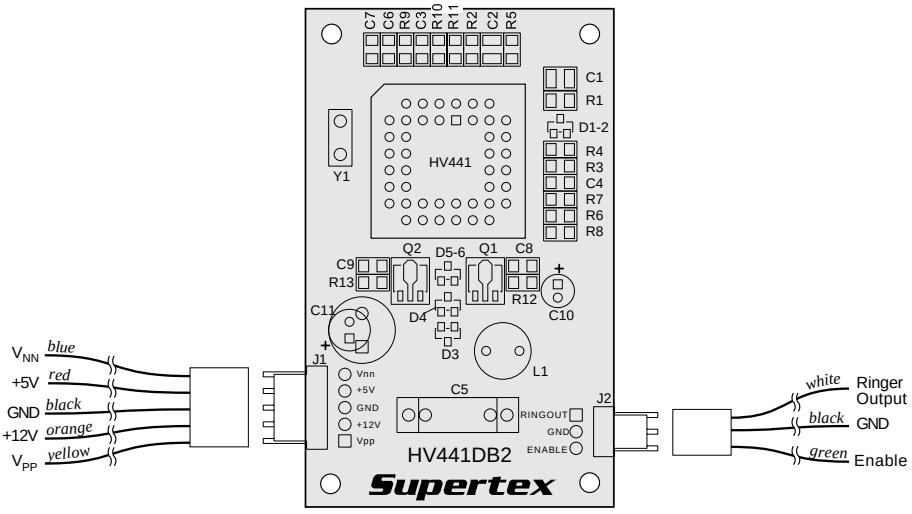
The HV441DB2 demo board contains all the circuitry necessary to drive a 20 REN (North American) ringer load. Simply connect power supplies, ringer load, and enable input as shown below.

For a more detailed description on using the HV441, please refer to Application Note AN-H35.

Specifications

Ringing Frequency	20Hz ±2Hz
Ringing Amplitude	$58V_{RMS}$ ±5%
Ringer THD	<10%
Output Offset	$-48V_{DC}$ ±3V *(using a 12V ±2.5% supply)*
Max Ringer Load	20 REN *(North American)*

Board Layout and Connections



V_{NN} and V_{PP} Supplies

V_{PP} is +56.5V ±5%. V_{NN} is -153V ±5%. The voltage difference between these two supplies must not exceed 220 volts. Current draw from each supply is less than 80mA. Output filter capacitance of these supplies must be at least 200µF.

The +5V and +12V supplies must always be powered up before the V_{NN} and V_{PP} supplies. See the section on supply sequencing, next page.

+12 Volt Supply

Required tolerance is ±2.5%. Current draw is less than 5mA.

Ringer output offset is referenced to the 12 volt supply and varies 4 volts for every 1 volt change in the supply.

+5 Volt Supply

Required tolerance is ±10%. Current draw is less than 5mA.

Enable

This input enables/disables the ringer output. A logic high (5V) turns the output ON, while a low (0V) turns the output OFF. The enable pin must not be left floating. When OFF, the output is in a high impedance state. Both turn-on and turn-off are synchronized to occur when the ringing signal crosses -48 volts.

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

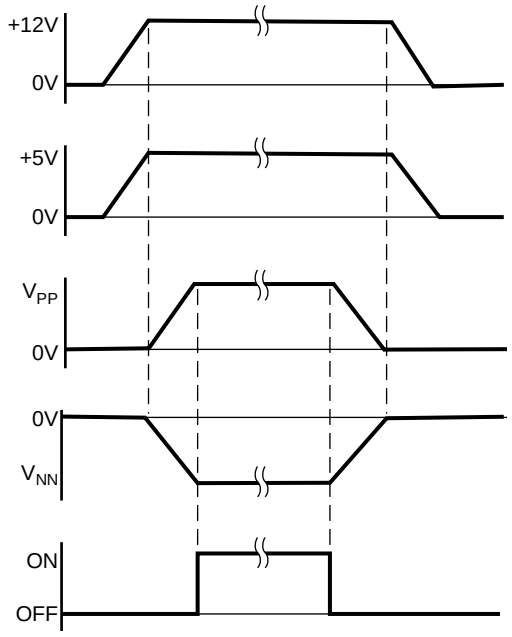
Ringer Output

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

12/11/97

Supply Sequencing

The +5V and +12V supplies must always be powered up before the V_{NN} and V_{PP} 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

Supertex has available a demo board designed to drive 5 RENs (HV441DB1) without the need for discrete transistors and using smaller components. The supplied board (HV441DB2) is certainly capable of driving 5 RENs, but may be modified for 5 REN applications, as outlined below. Refer to the board layout and connection diagram at the beginning of this note for component locations.

1. Remove Q1 and Q2
2. Solder a BAV99 in the D5-6 location
3. Change L1 to 1.5mH (150mA rating)*
4. Change C5 to 220nF (200VDC rating)
5. Change C10 and C11 to 2.2µF (100VDC and 200VDC ratings respectively)
6. Change R12 and R13 to 4.3Ω (1/8W rating)
7. Ensure the V_{NN} and V_{PP} supplies are capable of 20mA and have at least 47µF of output capacitance

* *Not all inductors behave similarly, especially at higher frequencies. The recommended inductor is a Toko 187LY-152J.*

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]	R1 & R2	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%

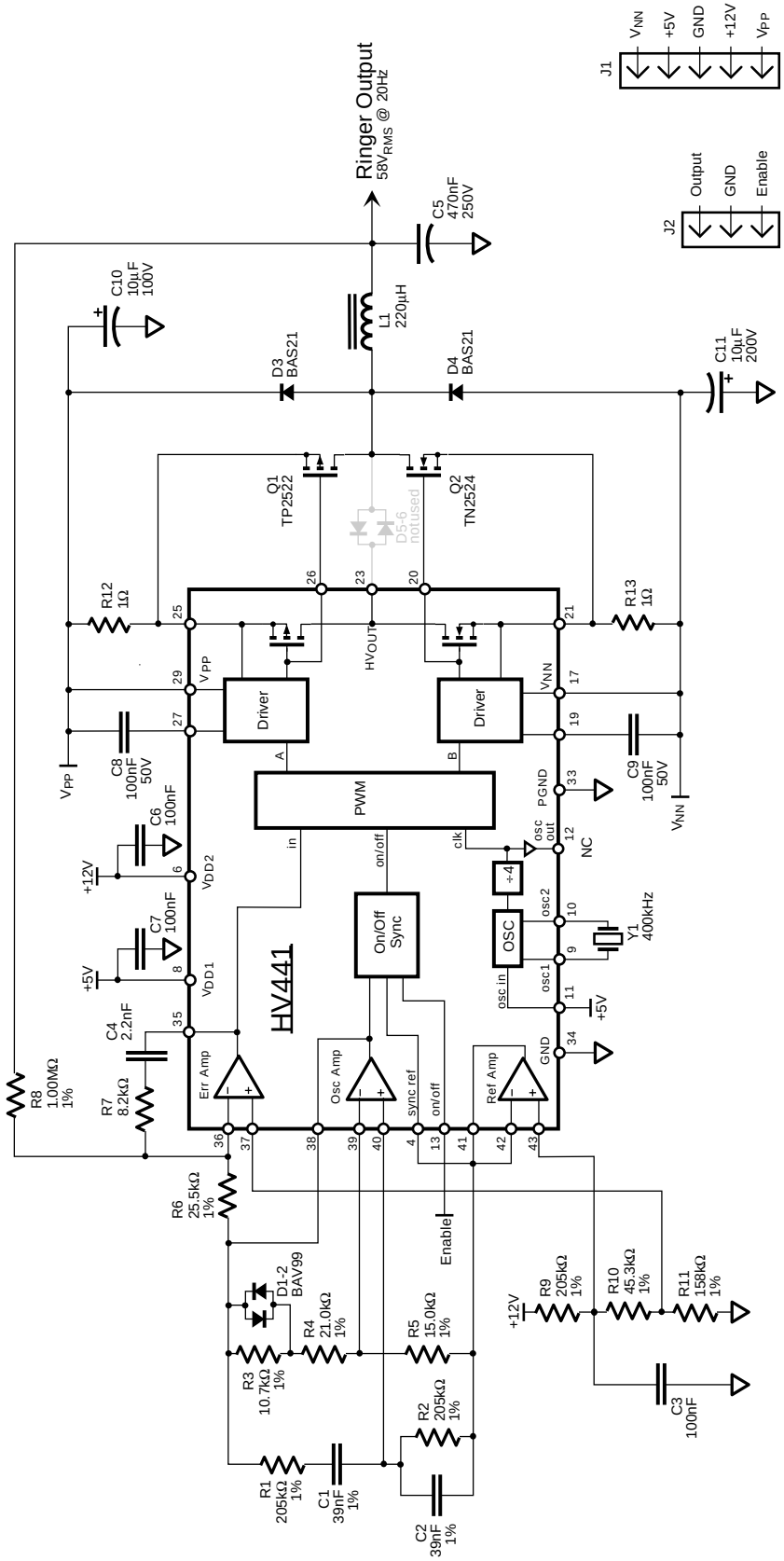
1 Values for other frequencies may be determined from $f_{ring} = (2\pi RC)^{-1}$ *where R=R1=R2 and C=C1=C2.*

2 Not including component tolerances.

Output Ripple Reduction

As supplied, the HV441DB2 has less than $1V_{RMS}$ of output ripple. To obtain even lower ripple, C5 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.

HV441DB2_Schematic



Unless noted otherwise:
All resistors 1/8W, 5%
All capacitors 16V, 10%.

HV441DB2 20 REN Ring Generator Demo Board BOM

Desig	Description	Value	Tol	Rating	Package	Mfg	Mfg PN
J1	Header, 5-pin, right angle, 0.1", tin					Molex	22-05-3051
J2	Header, 3-pin, right angle, 0.1", tin					Molex	22-05-3031
J3	Connector, 5-wire, 24AWG, 0.1"					Molex	22-01-2061
J4	Connector, 3-wire, 24AWG, 0.1"					Molex	22-01-2031
-	Connector terminals, tin QTY 8					Molex	08-50-0114
J5	Socket, 44-pin PLCC					Any	—
R1	Resistor	205k	1%	1/8W	1206	Any	—
R2	Resistor	205k	1%	1/8W	1206	Any	—
R3	Resistor	10.7k	1%	1/8W	1206	Any	—
R4	Resistor	21.0k	1%	1/8W	1206	Any	—
R5	Resistor	15.0k	1%	1/8W	1206	Any	—
R6	Resistor	25.5k	1%	1/8W	1206	Any	—
R7	Resistor	8.2k	5%	1/8W	1206	Any	—
R8	Resistor	1.00M	1%	1/8W	1206	Any	—
R9	Resistor	205k	1%	1/8W	1206	Any	—
R10	Resistor	45.3k	1%	1/8W	1206	Any	—
R11	Resistor	158k	1%	1/8W	1206	Any	—
R12	Resistor	1.0	5%	1/8W	1206	Any	—
R13	Resistor	1.0	5%	1/8W	1206	Any	—
C1	Capacitor, film	39nF	1%	50V	1210	Any	—
C2	Capacitor, film	39nF	1%	50V	1210	Any	—
C3	Capacitor, ceramic X7R	100nF	10%	50V	1206	Any	—
C4	Capacitor, ceramic X7R	2.2nF	10%	50V	1206	Any	—
C5	Capacitor, metallized polyester film	470nF	10%	250V	—	Any	—
C6	Capacitor, ceramic X7R	100nF	10%	50V	1206	Any	—
C7	Capacitor, ceramic X7R	100nF	10%	50V	1206	Any	—
C8	Capacitor, ceramic X7R	100nF	10%	50V	1206	Any	—
C9	Capacitor, ceramic X7R	100nF	10%	50V	1206	Any	—
C10	Capacitor, aluminum electrolytic	10µF	20%	100V	—	Panasonic	ECA-2AM100
C11	Capacitor, aluminum electrolytic	10µF	20%	250V	—	Panasonic	ECA-2EM100
L1	Inductor	220µH	20%	1A	—	J. W. Miller	6000-221K
Y1	Ceramic Resonator	400kHz	0.3%	—	—	Murata	CSB400J
D1-2	Diode, array, general purpose			70V, 100mA	SOT-23	Any	BAV99
D3	Diode, fast recovery			250V, 200mW	SOT-23	Any	BAS21
D4	Diode, fast recovery			250V, 200mW	SOT-23	Any	BAS21
D5-6	(not used)	—	—	—	—	—	—
Q1	MOSFET, P-channel			220V, 0.75A	SOT-89	Supertex	TP2522N8
Q2	MOSFET, N-channel			240V, 1A	SOT-89	Supertex	TP2524N8
IC1	Ring Generator IC				PLCC-44	Suptertex	HV441PJ

Supertex inc.
1235 Bordeaux Drive, Sunnyvale, CA 94089
TEL: (408) 744-0100 • FAX: (408) 745-4800

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Supertex:
HV441DB2