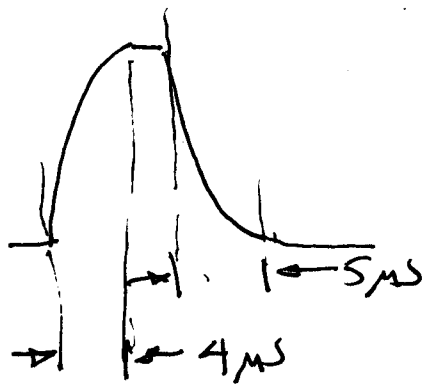
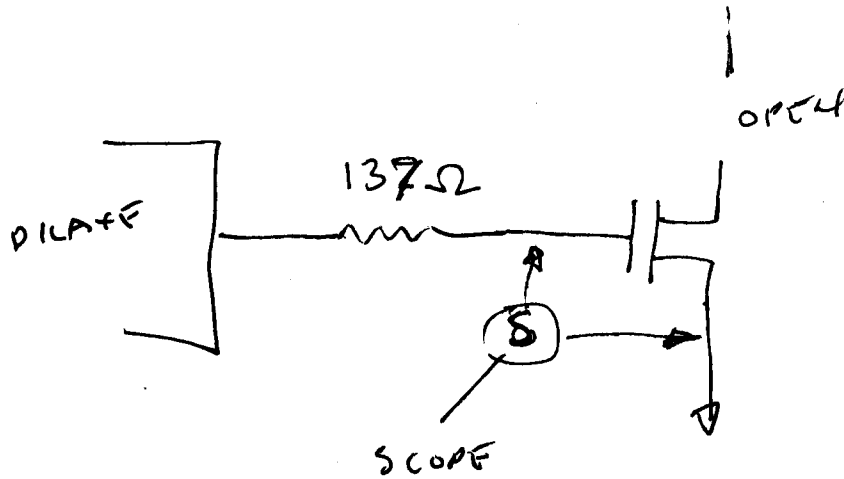


18 AUG 2013

Roderick.

GOT A HANTEK 6022BF PC OSCILLOSCOPE,  
FINALLY, NO LONGER BLIND.

LEFT DRAIN UNSOLDERED FROM PREVIOUS TEST CIRCUIT,  
FOUND TRANSISTOR STILL GOOD, EVEN AFTER GETTING SO HOT,  
IT UNSOLDERED ITSELF.



32MHz CLOCK

PERIOD = 255

→ 1024 32MHz CLOCKS,

PERIOD = 32μs

PULSE = 150 ±

150 32MHz CLOCKS.

~ 5μs

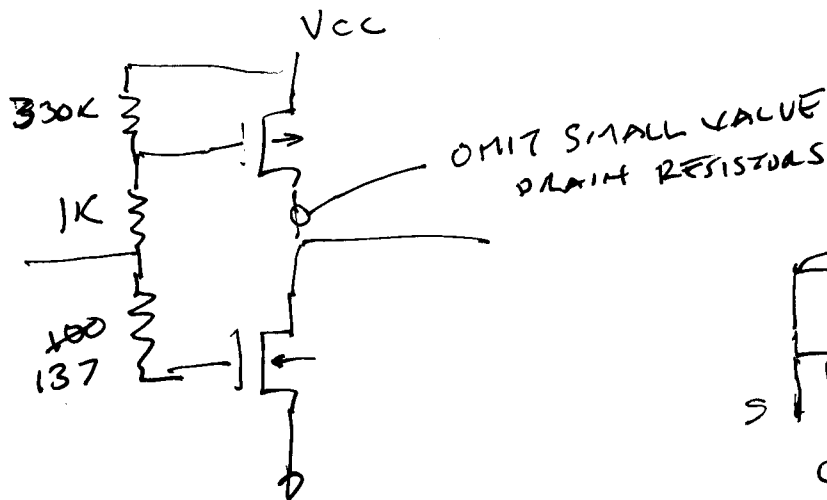
CAN SEE HOW ALL OF OUTPUT POWER IS  
BURIED IN TURN OFF TRANSITION.

WMW3DHG3214112 014467 00070007 01

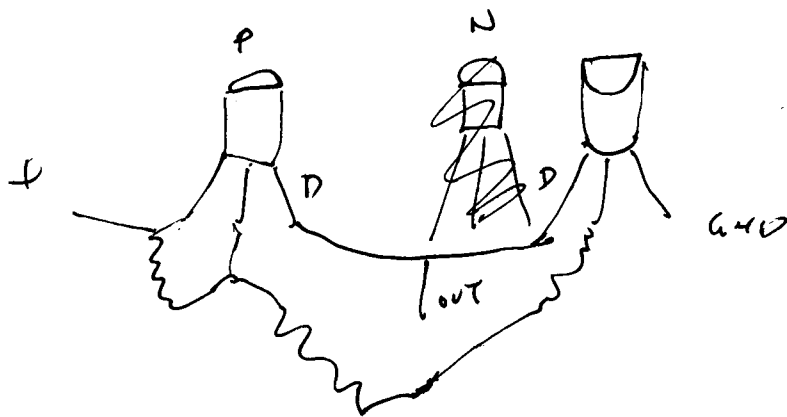


19 AUG 2013

ONLY HAVE 2 N-CH LEADTO MOSFETS, SO MUST DO  
DRIVER EXPERIMENT FIRST, IF EXPERIMENT DESTROYS  
TRANSISTOR, I'D RATHER LEARN ABOUT MOS DRIVER THAN  
FLASHER, ALREADY HAVE SOLUTION FOR FLASHER USING  
DARLINGTONS.



TP2104 P-CH  
TN2106 N-CH



~~Capital One 360~~

~~Normal credit qualifications and other terms and conditions apply. This does not represent an offer to enter into a loan agreement. Products, rates, and terms subject to change without notice. Not all loan products or terms are available in all states. Refinancing to pay off existing debt may extend the term of the debt, possibly resulting in higher overall costs and increasing the total amount paid when compared to your current situation. No prepayment penalties apply. Normal credit qualifications and other terms and conditions apply. This does not represent an offer to enter into a loan agreement. Loans subject to credit approval. Products, rates, and terms subject to change without notice. This offer is non-transferable and cannot be combined with any other offer. Products and services offered by Capital One, N.A., NMLS ID 453156, Member FDIC and Equal Housing Lender. ©2013 Capital One. All rights reserved.~~

26AUG13

Roderick

TAKE PICTURE OF SCOPE TRACE,  $137\Omega$  DIRECT DRIVE  
 $261\Omega$

22AUG13

TRY HOOKING UP 24V BATTERY AGAIN  
- RESOLDER INDUCTOR + LOAD TO MOSFET

GET 24V PROJECTOR LAMP, 250W TYPE EKS  
AS BETTER DUMMY LOAD. \$3.95 @ HALTED

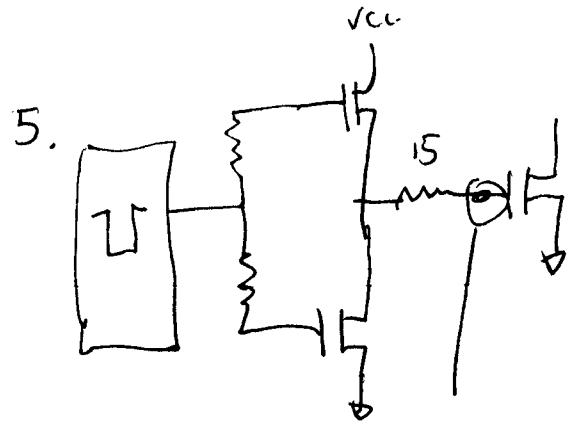
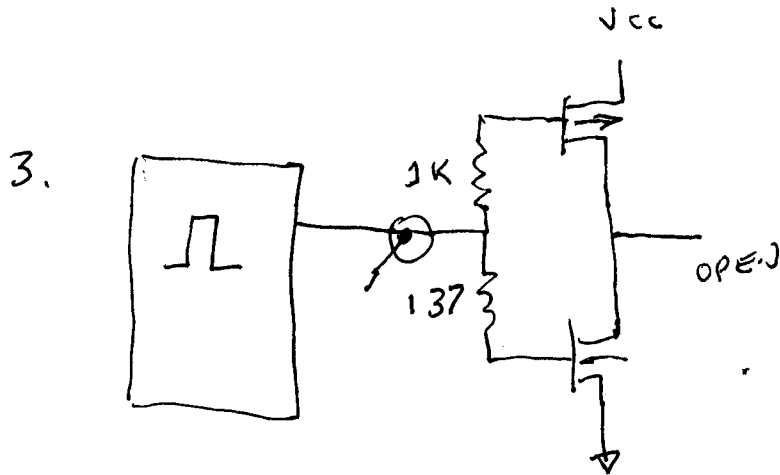
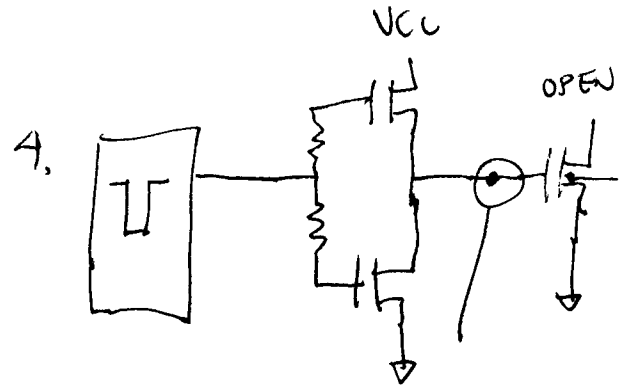
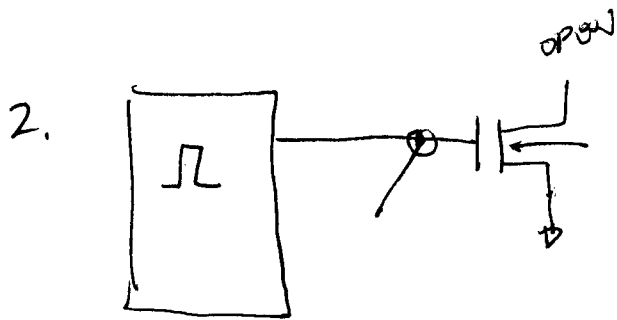
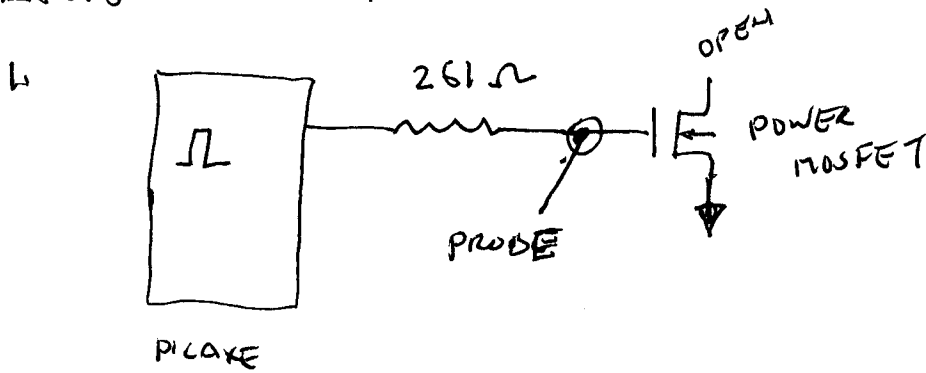
START PROGRAM. GO TO DUTY CYCLE 10/1024.  
WAIT A FEW SECONDS. RESET. CHECK TRANSISTOR  
FOR HEAT. TRY AGAIN, CONTINUOUS AT 10,  
CHECK FOR HEAT. LOOK FOR VOLTAGE ACROSS  
LOAD. RAMP UP DUTY CYCLE, CHECK TEMP., CHECK  
LOAD. BONUS: IS DIODE HEATING?

Q: IS RINGING PRESENT AT DRIVER SIDE?  
→ NO, NOT MUCH.

21 AUG 13; Rodrick.

USB SCOPE IS EXTREMELY INSIGHTFUL. HOW COULD I HAVE DESIGNED WITHOUT IT?

TRACES TO TAKE:



DUTY CYCLE = 150 / 1024

@ 32 MHz

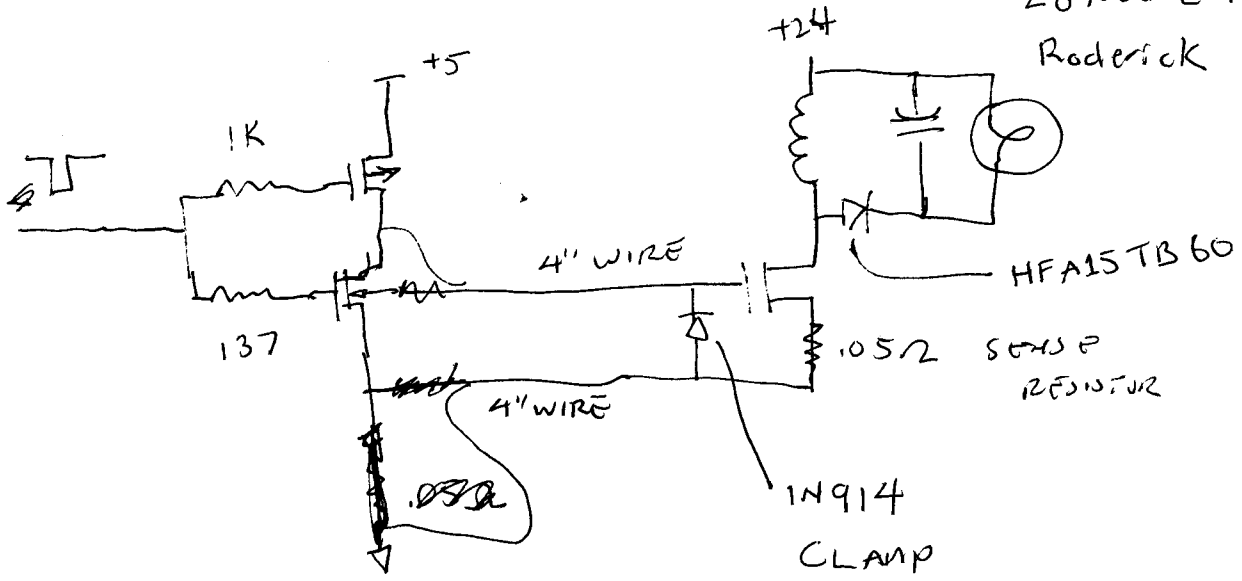
PERIOD = 32  $\mu$ S

PULSE DURATION

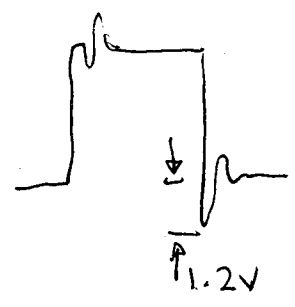
$\approx \frac{150}{1024} \cdot \frac{1}{32 \text{ MHz}} \approx 4.7 \mu\text{S}$

28 AUG 2013

Roderick

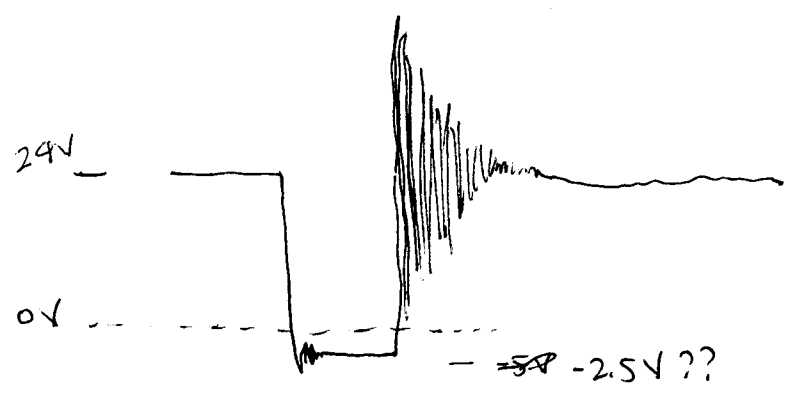


AT MOSFET GATE



RINGING NOT TOO BAD

AT MOSFET DRAIN



SHOULD TRY GETTING RID OF SENSE RESISTOR.

LINES GOING TO ~~DIODE~~ MAIN RECTIFIER DIODE, CAP, DUMMY LOAD ARE LONG. TRY SHORTENING THEM. DID NOT SEEM TO HELP, BUT

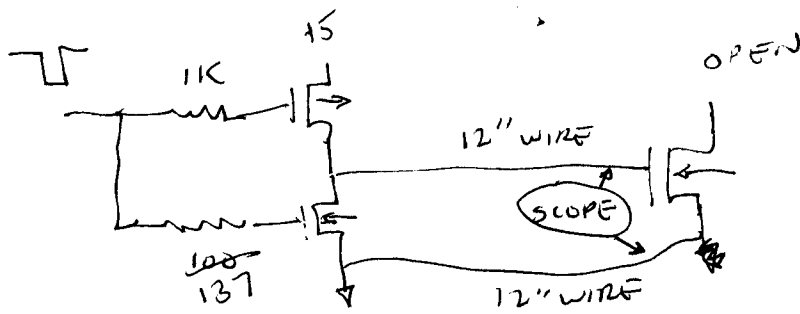
PUTTING IN 15Ω RESISTOR TO GATE SEEMED TO HELP SOMEWHAT.

→ COULD ~~BE~~ MAIN RECTIFIER BE BACKWARDS?

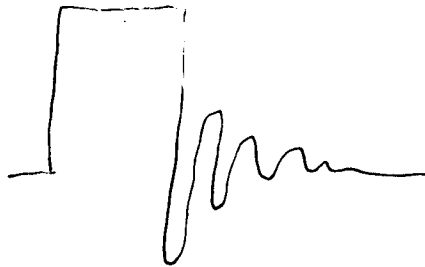
28 AUG 2013

Roderick.

TRIED DRIVING GATE OF POWER MOSFET W/ COMPLEMENTARY PAIR.

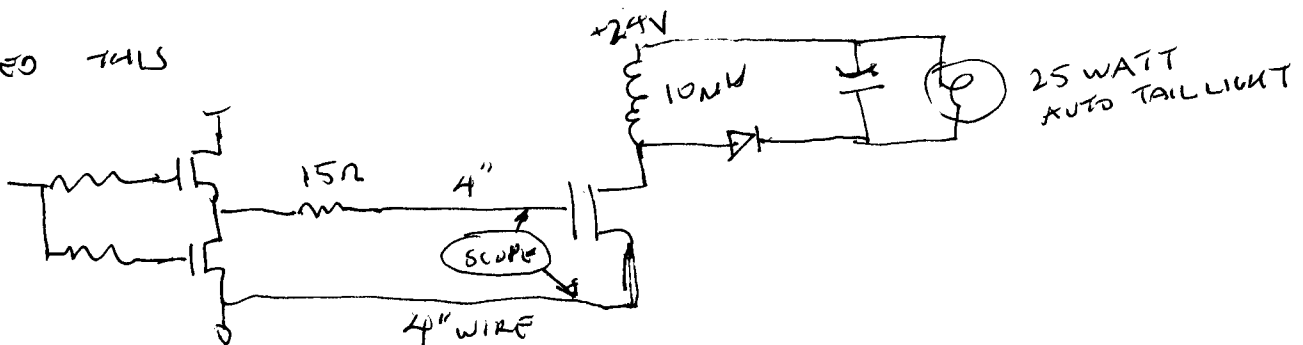


PROBLEM WAS AT GATE OF POWER FET, RINGING ON TRAILING EDGE.

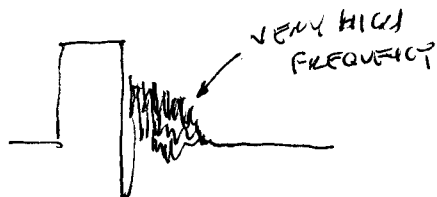


- PUT IN  $15\Omega$  SERIES RESISTOR W/ GATE. RESULT: RINGING GONE, BUT ONLY WHEN NO CURRENT PASSED BY MOSFET.

TRIED THIS



RINGING WAS BACK



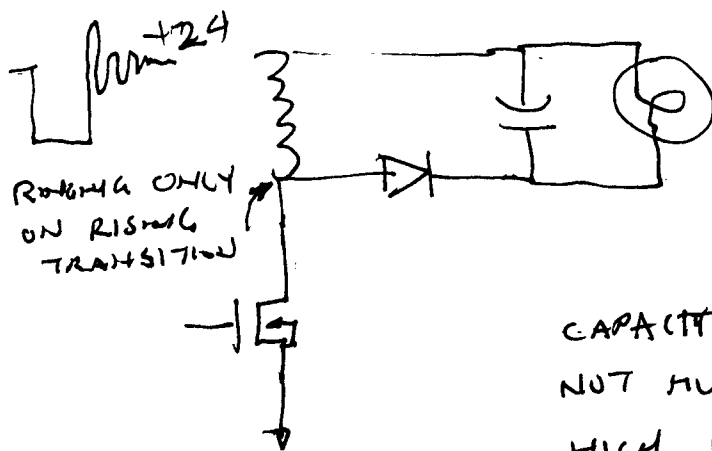
I THINK PROBLEM IS CAUSED BY INDUCTANCE OF LONG WIRES ON GATE AND GROUND RETURN. WILL BUILD PROTO WITH SHORTER LEAD LENGTH. WHEN MEASURED AT COMPLEMENTARY PAIR, RINGING IS MINIMAL. BUT BEFORE MAKING ANOTHER PROTO, WILL TRY A CLAMP DIODE ON MOSFET GATE.

30 AUG 2013

Rohrerick

## DEBUGGING PRINCIPLES

- IF SOMETHING A LITTLE FUNNY, MUST INVESTIGATE
- NEW DESIGN (PROTO) NOT WORKING -  
FIRST, IS IT CONNECTED RIGHT?  
MENTALLY REMOVE COMPONENTS ONE AT A TIME.  
COMPONENT BACKWARDS?
- LOOK AT HIGH FAILURE ITEMS FIRST, LIKE ELECTROLYTICS



LIGHT BULB HAS INDUCTANCE, IS CREATING A TANK CIRCUIT.

CAPACITOR MAY BE DRIED OUT, NOT MUCH OF A CAP ANYMORE, HIGH EQUIVALENT SERIES RESISTANCE. IT WAS SURPLUS...

RECTIFIER COULD BE BACKWARDS, NOT CONNECTED, OR FAULTY.

TRIED SHORTING OUT CAP WITH SHORT WIRE - RINGING STILL THERE.

TRIED REPLACING LOAD CIRCUIT WITH ONLY A HIGH CURRENT SCHOTTKY DIODE. RINGING NOW ON BOTH TRANSITIONS.

DRAIN STILL GOES BELOW GROUND WHEN SWITCHING ON, STAYS AT -2.5V FOR DURATION TRANSISTOR IS ON,

~~BE~~ DISCOUNTING RINGING.

06 SEP 2013  
RODERICK.

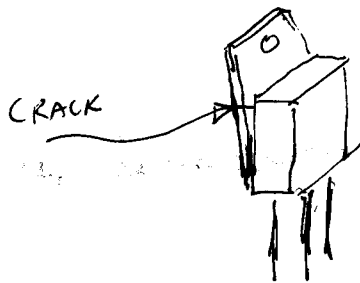
TRIED HARD-WIRED PROTOTYPE OF PTC.

PUT MOSFET DRIVER VERY CLOSE TO ACTUAL MOSFET.

@ DUTY OF 50/1024, SAW ~5V OUTPUT.

I THINK THE LIGHT WAS GLOWING - I SAW SOMETHING OUT OF THE CORNER OF MY EYE WHEN I ~~TURNO~~ RESET TO OFF.

MOSFET OVERHEATED - PLASTIC OF TO-220 CRACKED & IT SMOKED.



MAIN RECTIFIER DID NOT GET WARM.

AFTER IT SMOKED, SAW THE SAME RINGING IN THE DRAIN AGAIN.

13 SEP 13 REBUILT PROTO BOARD WITH IRFB4110 PBF MOSFET. PUT

THICK 1" X 1.5" HEAT SINK ON IT, LOTS OF THERMAL GREASE.

AT DUTY = 30/1024, HEAT SINK ALREADY GETS HOT, NOT TOO HOT TO TOUCH, BUT LIKE OUTSIDE OF A TEACUP. UNHEAT-SINKED TRANSISTOR MUST HAVE BEEN GETTING HOTTER THAN I THOUGHT.

THE GOOD NEWS IS I THINK THE SWITCHING ~~HEAT~~ HEAT IS FIXED AS LONG AS FREQUENCY IS FIXED.



GATE  
DRIVE

MAY NEED TO LOWER FREQUENCY, SHOULD TRY A BIGGER VALUE INDUCTOR.

MAY NEED TO-236 TRANSISTOR IN ACTUAL BOARD, BETTER HEAT XFER.  
247

ALL THE FUNNY ARTIFACTS SEEN MAY HAVE BEEN DUE TO BURNED OUT TRANSISTOR.