Eclipse Series

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Voting/ Glide Tone Encoder

This manual is produced by RF Technology Pty Ltd
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General System Description

The Voting Tone Encoder module is for use in mobile systems employing base station signal strength voting. It provides the audio interface and signal strength encoding for the RF Technology Eclipse series receivers. The encoder is compatible with the voting equipment supplied by Mobicom Ltd.

The system encodes the received signal strength information as an audio tone. The tone is varied over the range 2703 Hz to 2976 Hz according to the strength of the received signal. The lowest frequency corresponds to no signal. The tone frequency increases with increasing signal strength until the maximum of 2976 Hz is reached.

The dynamic range of the system, the difference between the weakest and strongest received signals, is approximately 20 dB. This is much less than the total range of usable signal levels in a system, but it is sufficient to cover the range where voting is useful. The minimum usable signal is generally accepted to be 12 dB SINAD and above 30 dB SINAD there is negligible improvement in intelligibility. The voting equipment is optimized for the 12-30 dB SINAD range.

Installation and Operation

The VTE module plugs into the Eclipse series sub-rack. All connections are via the DB-25 pin connector on the rear of the module. The unit is aligned at the factory and should not require realignment. The only adjustments required are the signal strength threshold and the line output level. These can be set from the front panel.

An indication of the received signal strength is provided on the front panel by eight yellow LEDs. When no signal is present all of the LEDs are OFF. The lowest LED (1) comes ON when the signal level rises above the receiver squelch threshold. As the signal increases the lowest LED will turn OFF and the next higher LED will come ON. At some points, particularly on weak signals, the indication will flicker between adjacent LEDs. This is normal and is a consequence of the random nature of noise on radio signals.

Module Connections

The module requires audio, discriminator and COS signals from the Eclipse receiver and 12 Volt dc power. The necessary connections are shown in the table below.

Rx Signal	Rx Pin	VTE pin
DIR AUDIO	17	17
DISC AUDIO	18	18
AUDIO GND	5	5
COS+	3	3
COS-	16	16

Power	VTE pin
+12 Vdc	1,14
GND	13,25

Tone +Voice Output	VTE pin
Line [+]	6
Line [-]	20

COS

The receiver COS output must be changed from the factory standard "dc loop" configuration and jumpered for "free switch" output. This is accomplished by removing JP7, JP8 and JP9.

System Calibration

The following procedure may be used to calibrate the encoder and set the audio output level.

1 Apply a -60 dBm on channel signal to the receiver with standard modulation. (60% at 1 KHz).

2. Using an audio level meter, verify that the receiver DISC AUDIO (pin 18) and DIR AUDIO (pin 17) output are between 0.45 Vrms and 0.55 Vrms. If the audio levels are not within the specified range, the receiver discriminator and line output should be reset according to the receiver maintenance manual.

3. Using a noise and distortion or SINAD meter to monitor the receiver DIR AUDIO output. Reduce the signal generator output until the SINAD drops to 20 dB.

Note, the receiver DIR AUDIO is also connected to the test connector on the receiver front panel. The SINAD and DIR AUDIO level can be measured between pins 6 and 1.

4. With the generator level set to obtain 20 dB SINAD, turn the Voting THRESHOLD adjustment (VTH) on the front panel fully clockwise until the lowest signal strength LED (1) is ON. Then slowly turn the adjustment counter-clockwise until the second (2) signal strength LED comes ON and remains ON continuously.

5. Connect an audio level meter across the module 600 Ohm line output on pins 6 and 20. Set the Line adjustment on the front panel to obtain the desired output.

Circuit Description

The following descriptions should be read as an aid to understanding the block and circuit diagrams in this manual.

Noise Signal Processing -

The discriminator output from the receiver contains both audio signals and noise. The audio level remains constant as the strength of the received signal changes. The level of noise varies inversely with the strength of the received signal and therefore can be used to determine the signal to noise ratio of the received signal.

The discriminator audio is connected to the input of a unity gain amplifier U1A. A balanced bridge circuit is used to reduce noise which may be introduced through the ground loop.

The wide band discriminator signal level is adjusted by RV1 which serves to set the threshold of the encoder.

Noise Filter -

Operational amplifiers U1A and U1B are used in active high pass filter circuits to separate the noise from the voice frequency audio. These filters effectively remove all audio frequencies below 8 KHz leaving only the noise and distortion components. The noise and distortion are amplified by operational amplifier U2B.

Noise Detector -

The amplified signal is then fed to the noise detector. The noise detector consists of U2A, U3B, D2 and associated passive components.

The noise detector, a precision full wave rectifier circuit, converts the ac noise signal to a dc voltage. This dc voltage is smoothed by a low pass filter consisting of U4A and associated components. U4B amplifies the smoothed signal to provide 0-5 Volts for the microcontroller A/D input.

Micro-controller -

A single chip micro-controller IC U11 is used to generate the voting tones. It also provides an indication of the signal strength by means of eight LEDs.

The conditioned dc noise level voltage is connected to the analogue to digital converter input of U11. U11 then uses the digital noise value and the state of the COS input to determine the required tone frequency.

The micro-controller timer is programmed to produce a square wave output at frequencies between 2.7 and 3.0 KHz. The square wave is level shifted by U10B before being fed to a low pass filter U10A. The low pass filter reduces the harmonic content of the square wave to less than 2%.

Receiver Voice Frequency Processing -

The audio from the receiver direct audio output is connected to a bridge amplifier built around U5A. The bridge configuration is used to reduce possibility of noise being introduced through the ground loop.

Two notch filters are used to remove audio frequency components which may be present between 2.7 and 3.0 KHz. If the voice components were not removed, they would interfere operation of the voting system. The two filters consist of U5B,U6,U7,U8A and associated passive components. They are tuned by RV3 to 2731 Hz and by RV4 to 2818 Hz.

Audio Summing and Output -

The voting tone and voice signals are combined by summing amplifier U8B. The relative level of the voice and tone are set by RV2 and RV6 respectively. RV5 on the output of U8B is used to set output level of the combined signal.

The combined signal is then fed to U9. U9 is used to provide the drive for 600 Ohm balanced lines through transformer T1.

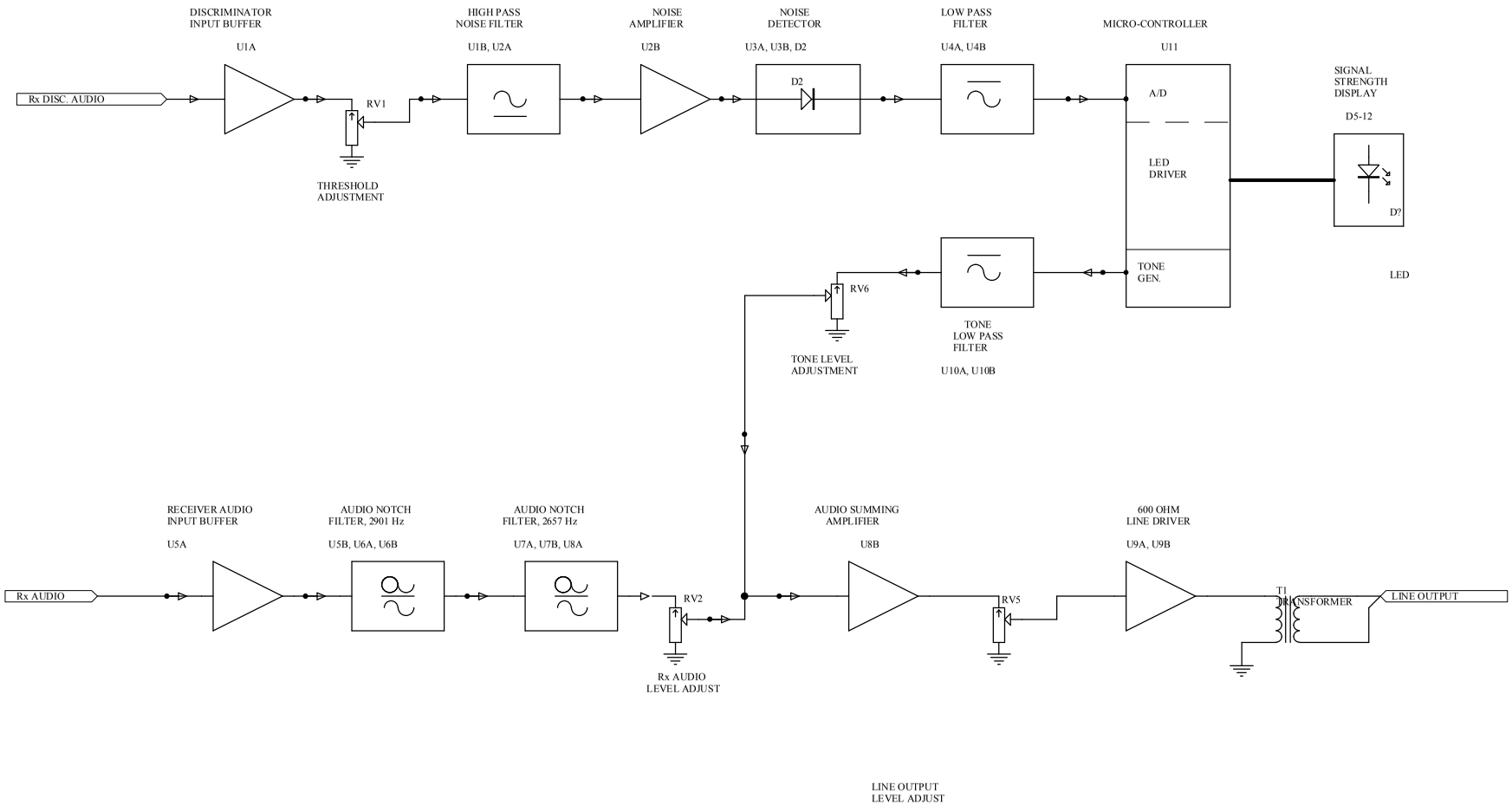
APPENDIX A - Voting Tone Encoder Parts List

RF Technology Pty. Ltd. 05/9139 R13 Iss.1

Ref.	Description	Part Number
C1	CAP 10U 35V RAD ELECTRO	41/2001/010U
C10	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C11	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C12	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C13	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C14	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C15	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C16	CAP 27P 2% 100V NPO RAD.1	45/2680/027P
C17	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C18	CAP 47P 2% 100V NPO RAD.1	45/2680/047P
C19	CAP 47P 2% 100V NPO RAD.1	45/2680/047P
C2	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C20	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C21	CAP 15N 5% 400V MKT RAD.2	47/2040/015N
C22	CAP 2N2 5% 400V MKT RAD.2	47/2040/02N2
C23	CAP 6N8 10% 400V MKT RD.2	47/2040/06N8
C24	CAP 33N 5% 400V MKT RAD.2	47/2040/033N
C25	CAP 470U 25V RB ELECTRO	41/2001/470U
C26	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C27	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C28	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C29	CAP 10N 10% 400V MKT RD.2	47/2040/010N
C3	CAP 10U 35V RAD ELECTRO	41/2001/010U
C30	CAP 4N7 10% COG RAD.2	46/2000/04N7
C31	CAP 4N7 10% COG RAD.2	46/2000/04N7
C32	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C33	CAP 10N 10% 400V MKT RD.2	47/2040/010N
C34	CAP 4N7 10% COG RAD.2	46/2000/04N7
C35	CAP 4N7 10% COG RAD.2	46/2000/04N7
C36	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C37	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C38	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C39	CAP 10N 10% 50V X7R RAD.2	46/2001/010N
C4	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C40	CAP 4N7 10% COG RAD.2	46/2000/04N7
C41	CAP 470U 25V RB ELECTRO	41/2001/470U
C42	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C43	CAP 47U 25V RB ELECTRO	41/2001/047U
C44	CAP 1UO 10% 50V MKT	47/2007/01U0
C45	CAP 1UO 10% 50V MKT	47/2007/01U0
C46	CAP 1UO 10% 50V MKT	47/2007/01U0
C47	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C48	CAP 22N 5% 63V MKT RAD.2	47/2010/022N
C49	CAP 100N 5% 50V MKT RD.2	47/2007/100N
C5	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C50	CAP 1N2 5% NPO RAD.2	46/2000/01N2
C51	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C52	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C53	CAP 10U 35V RAD ELECTRO	41/2001/010U
C54	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C55	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C56	CAP 27P 2% 100V NPO RAD.1	45/2680/027P
C57	CAP 27P 2% 100V NPO RAD.1	45/2680/027P
C58	CAP 10U 35V RAD ELECTRO	41/2001/010U
C59	CAP 10U 35V RAD ELECTRO	41/2001/010U

C6	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C60	CAP 10U 35V RAD ELECTRO	41/2001/010U
C7	CAP 100N 10% 50V X7R RD.2	46/2001/100N
C8	CAP 10N 10% 50V X7R RAD.2	46/2001/010N
C9	CAP 1N2 5% NPO RAD.2	46/2000/01N2
D1	DIODE SIL GP	21/1010/4002
D10	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D11	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D12	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D13	DIODE LED GRN RT ANG MTG	21/1010/LEDG
D2	DIODE SILICON IN4148	21/1010/4148
D3	DIODE SILICON IN4148	21/1010/4148
D4	DIODE SILICON IN4148	21/1010/4148
D5	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D6	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D7	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D8	DIODE LED YEL RT ANG MTG	21/1010/LEDY
D9	DIODE LED YEL RT ANG MTG	21/1010/LEDY
L1	INDUCTOR 10uH AXIAL	37/2021/010U
P1	HEADER, 2x13 STRAIGHT PIN	35/7026/0026
R1	RES 47 5% 0.25W AXIAL	51/1040/0047
R10	RES 6K8 5% 0.25W AXIAL	51/1040/06K8
R11	IC MICRO MC68HC705P9	26/2000/75P9
R11	RES 270K 5% 0.25W AXIAL	51/1040/270K
R12	RES 100 5% 0.25W AXIAL	51/1040/0100
R13	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R14	RES 100K 5% 0.25W AXIAL	51/1040/100K
R15	RES 100K 5% 0.25W AXIAL	51/1040/100K
R16	RES 470K 1% 0.25W AXIAL	51/1010/470K
R17	RES 470K 1% 0.25W AXIAL	51/1010/470K
R18	RES 100 5% 0.25W AXIAL	51/1040/0100
R19	RES 470K 1% 0.25W AXIAL	51/1010/470K
R2	RES 100 5% 0.25W AXIAL	51/1040/0100
R20	RES 27K 5% 0.25W AXIAL	51/1040/027K
R21	RES 470K 1% 0.25W AXIAL	51/1010/470K
R22	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R23	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R24	RES 10K 5% 0.25W AXIAL	51/1040/010K
R25	RES 10K 5% 0.25W AXIAL	51/1040/010K
R26	RES 3K3 5% 0.25W AXIAL	51/1040/03K3
R27	RES 100 5% 0.25W AXIAL	51/1040/0100
R28	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R29	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R3	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R30	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R31	RES 64K9 1% 0.25W AXIAL	51/1010/64K9
R32	RES 15K 5% 0.25W AXIAL	51/1040/015K
R33	RES 10K0 1% 0.25W AXIAL	51/1010/010K
R34	RES 2K7 1% 0.25W AXIAL	51/1010/2K70
R35	RES 33K 1% 0.25W AXIAL	51/1010/33K0
R36	RES 10K0 1% 0.25W AXIAL	51/1010/010K
R37	RES 100 5% 0.25W AXIAL	51/1040/0100
R38	RES 10K0 1% 0.25W AXIAL	51/1010/010K
R39	RES 33K 1% 0.25W AXIAL	51/1010/33K0
R4	RES 1K0 5% 0.25W AXIAL	51/1040/01K0
R40	RES 10K0 1% 0.25W AXIAL	51/1010/010K
R41	RES 100 5% 0.25W AXIAL	51/1040/0100
R42	RES 2K21 1% 0.25W AXIAL	51/1010/2K21
R43	RES 18K 5% 0.25W AXIAL	51/1040/018K
R44	RES 100 5% 0.25W AXIAL	51/1040/0100

R45	RES 100K 5% 0.25W AXIAL	51/1040/100K
R46	RES 470K 1% 0.25W AXIAL	51/1010/470K
R47	RES 10K 5% 0.25W AXIAL	51/1040/010K
R48	RES 270K 5% 0.25W AXIAL	51/1040/270K
R49	RES 10K 5% 0.25W AXIAL	51/1040/010K
R5	RES 6K8 5% 0.25W AXIAL	51/1040/06K8
R50	RES 47 5% 0.25W AXIAL	51/1040/0047
R51	RES 10K 5% 0.25W AXIAL	51/1040/010K
R52	RES 10K 5% 0.25W AXIAL	51/1040/010K
R53	RES 47K 5% 0.25W AXIAL	51/1040/047K
R54	RES 47K 5% 0.25W AXIAL	51/1040/047K
R55	RES 47K 5% 0.25W AXIAL	51/1040/047K
R56	RES 10K 5% 0.25W AXIAL	51/1040/010K
R57	RES 100 5% 0.25W AXIAL	51/1040/0100
R58	RES 100K 5% 0.25W AXIAL	51/1040/100K
R59	RES 220K 5% 0.25W AXIAL	51/1040/220K
R6	RES 270K 5% 0.25W AXIAL	51/1040/270K
R60	RES 4K32 1% 0.25W AXIAL	51/1010/4K32
R61	RES 4K32 1% 0.25W AXIAL	51/1010/4K32
R62	RES 4K32 1% 0.25W AXIAL	51/1010/4K32
R63	RES 330 5% 0.25W AXIAL	51/1040/0330
R64	RES 270 5% 0.25W AXIAL	51/1040/0270
R65	RES 470K 1% 0.25W AXIAL	51/1010/470K
R66	RES 10K 5% 0.25W AXIAL	51/1040/010K
R67	RES 10K 5% 0.25W AXIAL	51/1040/010K
R68	RES 10M 5% 0.25W AXIAL	51/1040/010M
R69	RES 100K 5% 0.25W AXIAL	51/1040/100K
R7	RES 1K0 5% 0.25W AXIAL	51/1040/01K0
R70	RES 10K 5% 0.25W AXIAL	51/1040/010K
R71	RES 1K2 5% 0.25W AXIAL	51/1040/01K2
R72	RES 390 5% 0.25W AXIAL	51/1040/0390
R73	RES 100 5% 0.25W AXIAL	51/1040/0100
R74	RES 1M0 5% 0.25W AXIAL	51/1040/01M0
R75	RES 1M0 5% 0.25W AXIAL	51/1040/01M0
R8	RES 6K8 5% 0.25W AXIAL	51/1040/06K8
R9	RES 100 5% 0.25W AXIAL	51/1040/0100
RV1	TRIMPOT 10K MULTITURN HOR	53/2060/010K
RV2	TRIMPOT 10K MULITURN VERT	53/2061/010K
RV3	TRIMPOT 10K MULITURN VERT	53/2061/010K
RV4	TRIMPOT 10K MULITURN VERT	53/2061/010K
RV5	TRIMPOT 10K MULTITURN HOR	53/2060/010K
RV6	TRIMPOT 10K MULITURN VERT	53/2061/010K
T1	TRANSFORMER LINE 600 OHM	37/2040/5065
U1	IC DUAL FET OP AMP DIP8	25/1050/272C
U10	IC DUAL FET OP AMP DIP8	25/1050/272C
U11	IC MICRO MC68HC705P9	26/2000/75P9
U12	IC VOLT REG 78L08 TO92M	25/2040/78L08
U13	IC VOLT REG 78L05 TO92M	25/2040/78L05
U2	IC DUAL FET OP AMP DIP8	25/1050/272C
U3	IC DUAL CMOS OP AMP DIP8	25/1050/6482
U4	IC DUAL CMOS OP AMP DIP8	25/1050/6482
U5	IC DUAL FET OP AMP DIP8	25/1050/272C
U6	IC DUAL FET OP AMP DIP8	25/1050/272C
U7	IC DUAL FET OP AMP DIP8	25/1050/272C
U8	IC DUAL FET OP AMP DIP8	25/1050/272C
U9	IC DUAL OP AMP MC1458B	25/2050/1458
Y1	CRYSTAL 4.0 MHz	32/2049/04M0



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Size A3	Document Number	REV 2
Date: 19 August 1998	Sheet 1 of 1	

NO.	DATE	DRAWN	APP'D	E.C.O. NO.
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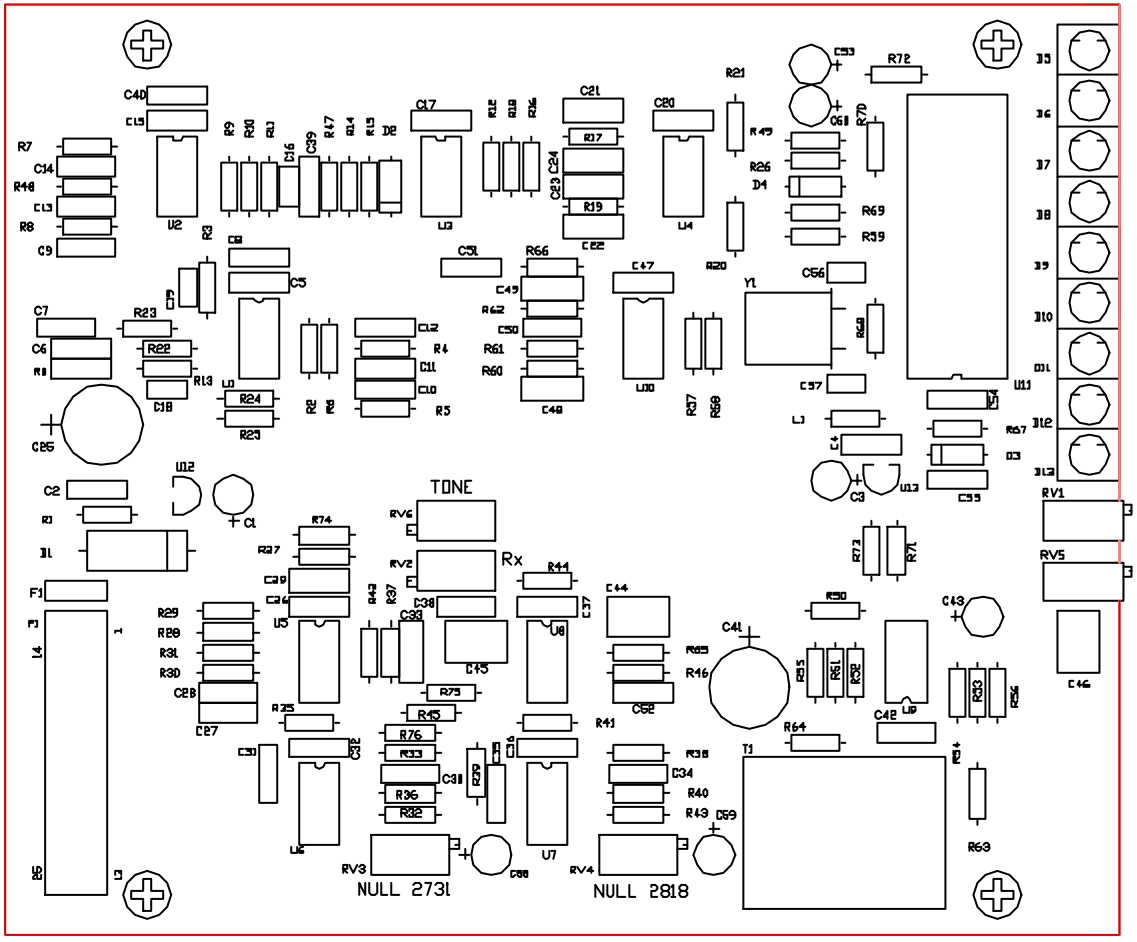

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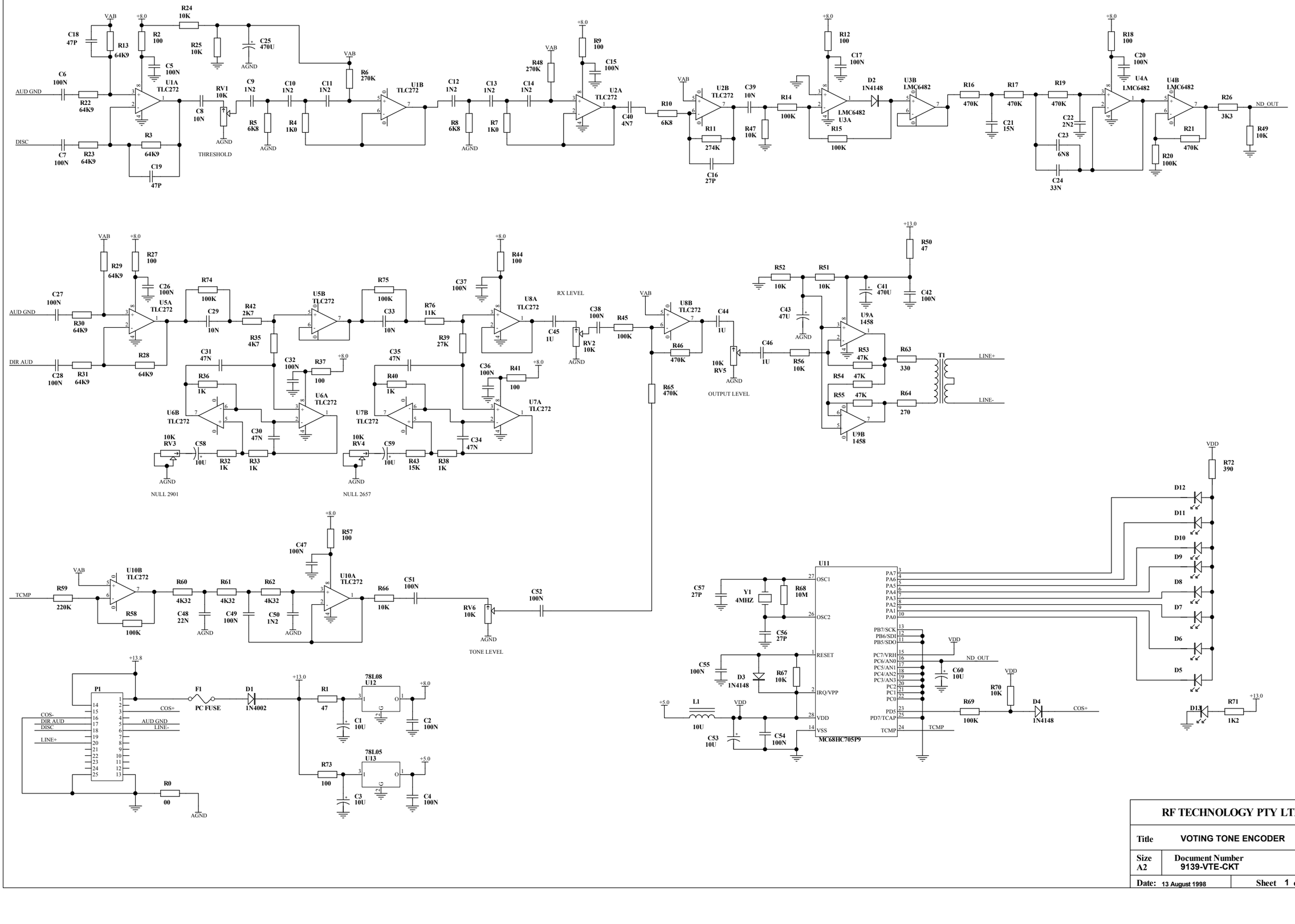

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Size A2	**Document Number** 9139-VTE-CKT	**REV** 4
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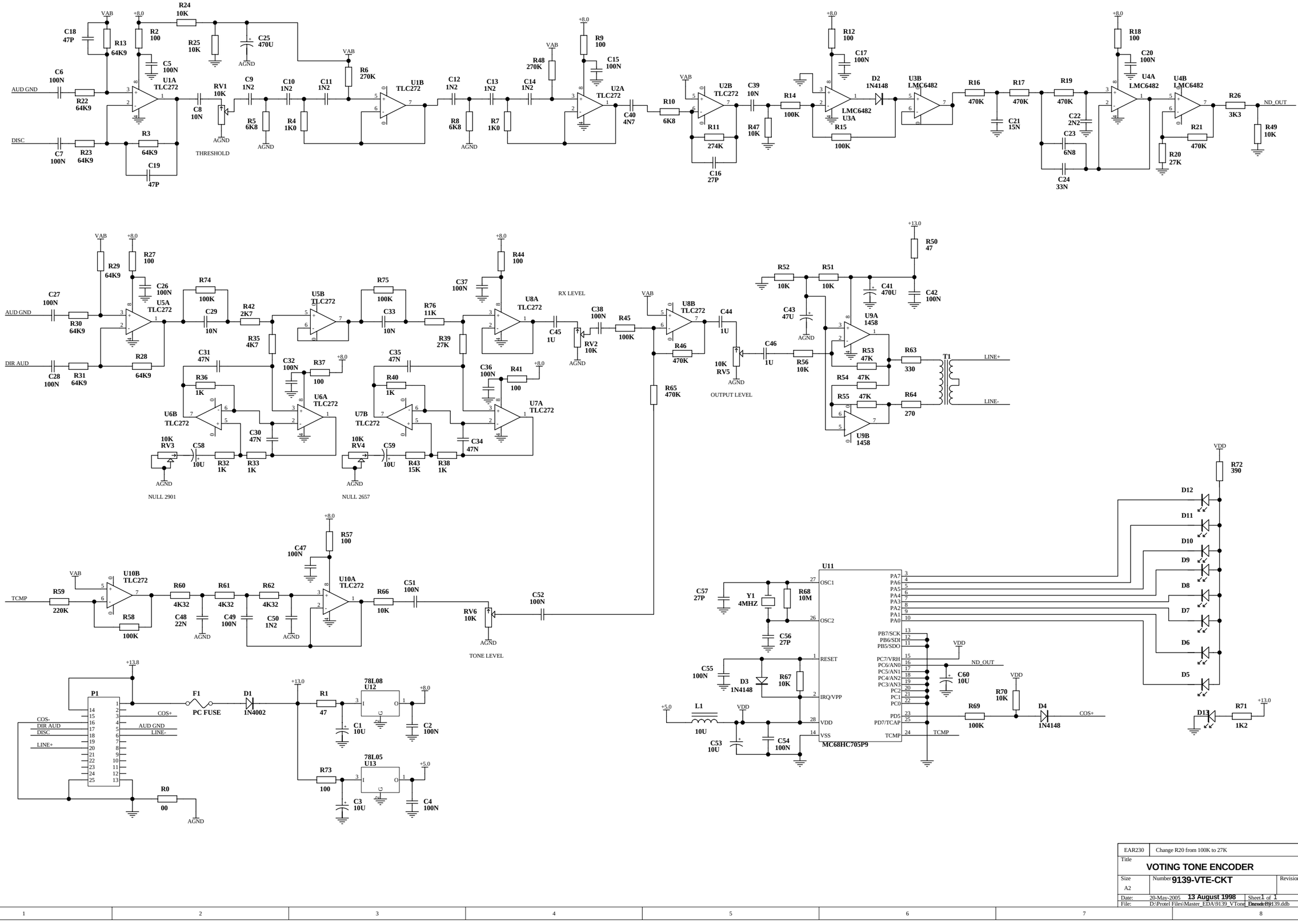

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Size: A2	Number: **9139-VTE-CKT**
Revision: **5**	
Date: 20-May-2005 **13 August 1998**	Sheet 1 of 1
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