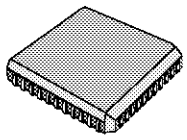
SGS-THOMSON MICROELECTRONICS

L3913

MONOCHIP TELEPHONE

ADVANCE DATA

- ADJUSTABLE SLOPE OF DC CHARACTERISTIC
- ADJUSTABLE AUTOMATIC LINE LENGHT RECEIVING AND SENDING GAIN CONTROL (NOT USED IN DTMF), WITH POSSIBILITY OF FIXED GAIN (PABX).
- ADJUSTABLE AUTOMATIC LINE LENGHT TRACKING ANTISIDETONE SYSTEM
- ADJUSTABLE DYNAMIC IMPEDANCE
- STABILIZED POWER SUPPLY FOR PERIPHERALS
- CONFIDENCE LEVEL DURING PULSE AND DTMF DIALLING
- RECEIVING AMPLIFIER FOR DYNAMIC OR PIEZO-ELECTRIC EARPIECES
- HIGH IMPEDANCE MICROPHONE INPUTS (80KΩ MIN. IN SYMMETRICAL AND 40KΩ MIN. IN ASYMMETRICAL) SUITABLE FOR DYNAMIC, MAGNETIC, PIEZO-ELECTRIC OR ELECTRET MICROPHONE
- DYNAMIC LIMITING IN SENDING (ANTICLIPPING) PREVENTS DISTORTION OF LINE SIGNAL AND SIDETONE
- ANTISQUELCH SYSTEM IN SENDING PREVENTS "ROOM NOISE" TO BE TRANSMITTED, AND IMPROVES THE ANTI-LARSEN EFFICIENCY
- LOUDHEARING PROGRAMMABLE GAIN IN 8 STEPS OF 3 dB USING THE SERIAL BUS, OR LINEARLY USING A POTENTIOMETER
- ANTILARSEN SYSTEM WHICH DOESN'T CUT THE RECEIVING VOICE
- ANTIDISTORTION SYSTEM BY AUTOMATIC GAIN CONTROL VERSUS AVAILABLE LOUDHEARING CURRENT
- RINGING BALANCED OUTPUT IN DMOS FOR HIGHER POWER CAPABILITY
- 4 RINGING TONES ADJUSTABLE WITHOUT EXTERNAL COMPONENTS
- INTERNAL SPEED UP CIRCUIT PERMITS A FASTER CHARGE OF V_{CC} AND V_{RAM} CAPACITORS
- LOGIC BOUNCE ELIMINATION
- PULSE DIALLING 66/33 OR 60/40 OR DTMF DIALLING SELECTABLE BY PROGRAMMING PIN
- ADJUSTABLE FLASHING DURATION (90ms or 265ms)



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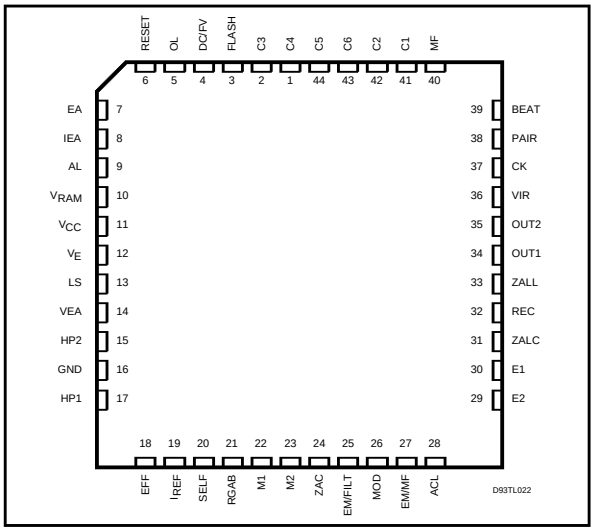
PIN CONNECTION (top view)

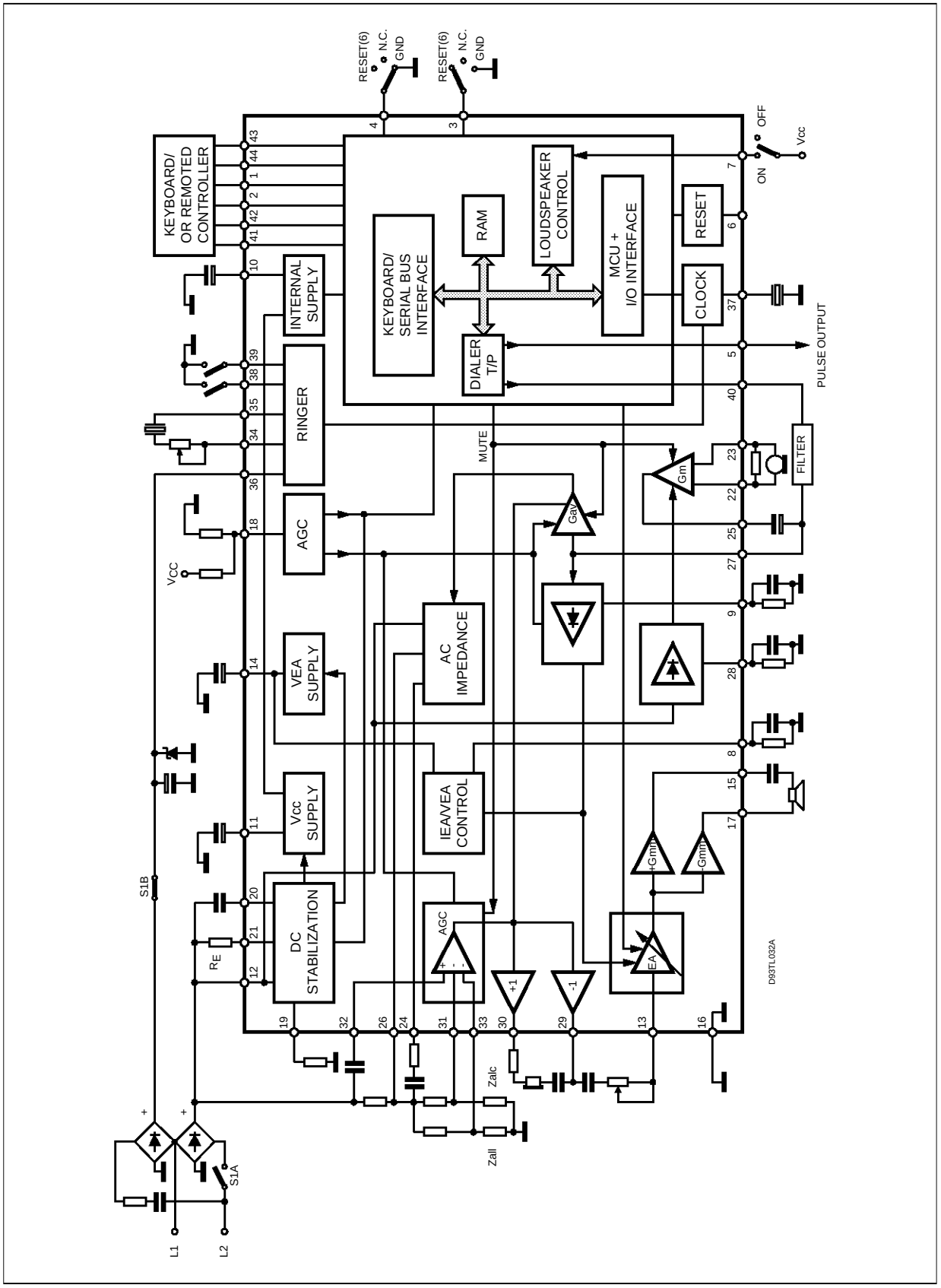


- INTERDIGITAL PAUSE
- CONFIDENCE TONE (440Hz)
- LAST NUMBER RADIAL UP TO 23 DIGITS
- STANDARD LOW COST CERAMIC 455KHz
- BINARY DATA INPUT IN SERIAL MODE
- TEST MODE CAPABILITY

DESCRIPTION

The L3913 monochip is a BIPOLAR CMOS-DMOS (BCD) integrated circuit that performs all the speech and line interface functions required in an electronic telephone set, the ringing function with 4 melodies, the pulse and DTMF dialling with redial, the loudhearing with antilarsen and antidistortion systems, a keyboard interface with the possilbility to interface with an external microcontroller using the internal serial bus, and a power supply for peripheral.

BLOCK DIAGRAM



PIN FUNCTIONS

N°	Name	Description
1	C4	Keyboards inputs
2	C3	Keyboard inputs
3	FLASH	Flashing selection (80 or 265ms)
4	DC/FV	Dialling selection (33/66 pulse, 40/60 pulse or DTMF)
5	OL	Open line output
6	RESET	Output reset in normal case, input reset in test mode
7	EA	Loudhearing ON/OFF
8	IEA	Antidistortion time constant adjustment in loudhearing
9	AL	Antilarsen time constant adjustment in loudhearing
10	V_{RAM}	RAM and internal logic supply
11	V_{CC}	Power supply for peripherals
12	V_E	Line voltage
13	LS	Loudhearing input
14	VEA	Loudhearing supply
15	HP2	Loudspeaker output
16	GND	Ground
17	HP1	Loudspeaker output
18	EFF	line lenght AGC adjustment
19	I_{REF}	Bias adjustment
20	SELF	Electronic self input
21	RGAB	DC characteristic slope adjustment
22	M1	Microphone input
23	M2	Microphone input
24	ZAC	Dynamic impedance adjustment
25	EM/FILT	First sending stage output
26	MOD	Modulator output
27	EM/MF	NSecond sending stage input and DTMF input
28	ACL	Anticlipping time constant adjustment
29	E2	Receiver output
30	E1	Receiver output
31	ZALC	Short line sidetone network
32	REC	Receiver input
33	ZALL	Long line sidetone network
34	OUT1	Buzzer output
35	OUT2	Buzzer output
36	VIR	Ringing supply
37	CK	Ceramic input (455KHz)
38	PAIR	Ajustment between 2 pairs of ringing frequencies
39	BEAT	Beat ajustment of each pair
40	MF	DTMF output
41	C1	Keyboard inputs
42	C2	Keyboard Inputs
43	C6	Keyboard inputs
44	C5	Keyboard inputs

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C; f = 1kHz; R_E = 20kΩ; all resistance are specified at 1%, all capacitance at 2%)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	Fig.
DC CHARACTERISTICS							
V_L	Line Voltage	I_L = 15mA I_L = 25mA I_L = 60mA	- 5.75 12.75	4.4 6.15 13.15	4.9 6.55 13.55	V V V	1 1 1
V_{CC}	Stabilized Voltage Supply	ICC = 0.6mA I_L = 8.3mA	2	2.5	-	V	1
		I_{CC} = 2.1mA I_L = 25mA	3.15	3.4	3.65	V	1
I_{RAM}	Operative	VRAM = 3.5V	-	-	500	µA	
I_{RAM}	STAND-BY	VRAM = 3.5V	-	-	300	nA	
RECEPTION							
GR1	Receiving Gain	I_L = 25mA V_L = 0.3Vrms	10	11	12	dB	2
GR2	Receiving Gain	I_L = 60mA (see AGCR)	2.5	4	5.5	dB	2
AGCR	Delta Gain Receive	I_L = 60mA (to be applied only if GR2 is not respected)	6.3	7	7.7	dB	2
R_X	Distortion	I_L = 30mA; V_{out} = 5Vpp	-	0.6	3	%	2
		I_L = 60mA; V_{out} = 5Vpp	-	0.6	3	%	2
Z_{out}	Receiver	I_L = 25mA; V_{out} = 50mVrms	45	65	85	Ω	2
R_X	Offset	I_L = 25mA / 60mA	-500	-	500	mV	2
	Sidetone	I_L = 25mA V_{MI} = 2mVrms I_L = 60mA	- -	30 16	- -	dB dB	1 1
TRANSMISSION							
GS1	Sending GAIN	I_L = 25mA V_{mic} = 2mVrms	47.5	48.5	49.5	dB	1
GS2	Sending GAIN	I_L = 60mA (see SGCS)	40.4	41.9	43.4	dB	1
AGCS	Delta GAIN sending	I_L = 60mA (to be applied only if GS2 is not respected)	5.9	6.6	7.3	dB	1
CMRR	Common Mode Rejection	I_L = 25mA; V_{cm} = 50mVrms	-	75	-	dB	1
T_x	Distortion	I_L = 36mA V_{mi} = 5mVrms V_{mi} = 5mVrms + 10dB V_{mi} = 5mVrms + 20dB	- - -	- - -	3 5 7	% % %	1 1 1
AS	GAIN Attenuation	I_L = 25mA V_{mi} = 2mVrms	65	-	-	dB	1
Z_{in}	Microphone Impedance	I_L = 30mA	85	120	-	KΩ	1
T_x	Offset Pin 25 (DTMF - T_x)	I_L = 25mA / 60mA	- 100		+ 100	mV	1
$T_{x\ swing}$	Tx Output Voltage Swing	I_L = 36mA V_{mi} c= 5mVrms+10dB	3.2	3.8	4.4	Vpp	1
$T_{x\ squelch}$	Dynamic Range	IL = 25mA V_{mic} = 1mVrms/0.15mVrms	7.5	9	10.5	dB	1
Z_{LINE}	Matching	I_L = 25mA I_L = 60mA	580	630	680	Ω	2
NOISE							
T_x	Noise	I_L = 25mA (psophometric)	-	- 78	-	dBmp	1
R_x	Noise	I_L = 25mA (psophometric)	-	200	-	µVp	2

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	Fig.
LOUDHEARING							
V_{ea}	Loudhearing Supply	I_L = 25mA I_L = 60mA	3.5 7.8	3.8 8.2	4.1 8.9	V V	3 3
G_{ea}	Loudhearing Gain	I_L = 30 / 50mA V_{LS} = 20mVrms	19.7	20.7	21.7	dB	3
ΔG_{ea}	8 Steps Programmable Gain Using Serial Bus	IL = 25 / 60mA V_{LS} = 20mVrms	-	3	-	dB	3
Z_{ih}	Input Impedance	I_L = 30mA	24	34	44	KΩ	3
LH	Distortion LOAD = 100Ω	I_L = 50mA V_{ILINE} = 200mVrms V_{ILINE} =350mVrms	- -	1 4.5	3 7	% %	3 3
LH	Offset	I_L = 25mA	-120	-	+120	mV	3
I_{LEAK}	Leakage Pin I_{EA}	I_L = 25mA	-	-	100	nA	3
LH	Offset Pin AL	I_L = 25mA	-	-	150	mV	3
LH	Antilarsen Attenuation	I_L = 30mA Pin 9 to V_{CC}	5.75	6.25	6.75	dB	3
RINGER							
$V_{turn-on}$	Threshold on	Measured at Pin V_{IR}	14	15	17	V	4
$V_{turn-off}$	Threshold off		10.5	12	14	V	4
I_S	Supply Current	V_S = 17V no load	-	1.2	1.6	mA	4
F_{out}	Frequencies	Pin 38 = GND V_{IR} = 32V	1450 1160	1458 1166	1465 1172	Hz Hz	4 4
		Pin 38 = Open V_{IR} = 32V	544 435	547 438	550 441	Hz Hz	4 4
		Pin 39 = GND Pin 39 = Open V_{IR} = 32V	3.9 9	4 9.1	4.1 9.2	Hz Hz	4 4
V_{out}	Output Voltage Swing	V_{IR} = 32V	30	-	-	V	4
I_{IL}	Input Low	V_{IR} = 32V BEAT, PAIR (Pins 38, 39) V_{IL} = 1V	- 12	- 7	- 1.5	µA	4
DTMF GENERATION							
	DTMF Frequency Tolerances	I_L = 25mA	-0.4	-	+0.25	%	1
	DTMF Level	I_L = 25 / 60mA Low group High group Preemphasis	 -10 -8 1	 -8 -6 2	 -6 -4 3	 dBm dBm dB	 1 1 1
	DTMF Distortion	I_L = 25mA BW = 20kHz	see MASK fig. 6				
	DTMF Feedback	I_L = 60mA referred to the line voltage RX LH	 - -	 - 19 - 2.5	 - -	 dB dB	 5 5
	Flash Operating Current		8.3	-	-	mA	1
TMF	Transmission Time		80.1	81.7	83.3	ms	1
T_{IDMF}	Interdigit Time		87.4	89.2	91.5	ms	1
Tm_{MF}	Transmission Mute		167.5	170.9	174.3	ms	1
	Confidence Tone	Only by Serial Bus I_L = 25mA	-	440.9		Hz	1
	Confidence Tone Level		-	- 9	-	dBm	1

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	Fig.
LEAKAGE (V_{RAM} = 3.5V)							
I_{KL}	Input Low (Keyboard current)	C1 % C6 (pins 1, 2, 41 % 44) V_{IL} = 0.5V	1.5	-	5	µA	
I_{il}	Input Low	C1 % C6 (pins 1, 2, 41 % 44) V_{IL} = 0.4V	150	450	1300	µA	
		CK (pin 37) V_{IL} = 0.5V	-	-	1	µA	
I_{ih}	Input High	EA (pin 7) V_{IH} = 3.5V	5	11.5	16	µA	
		DCFV (pin 4), Flash (3) V_{IL} = 0V	- 10	- 6	- 1.5	µA	
		C1 % C6 (pins 1, 2, 41 % 44) V_{IH} = 3.1V	- 1300	- 450	- 150	µA	
		DCFV (pin 4), Flash (3), CK(37) V_{IH} = 3.5V	- -	- -	1 1	µA µA	
I_{ol}	Output Low	Reset (pin 6) V_{OL} = 0.4V OL (pin 5)	0.2 0.7	- -	1.3 3.7	mA mA	
I_{oh}	Output High	Reset (pin 6) VOH = 2.85V OL (pin 5) V_{OH} = 0.7V	- 1.8 - 30	- 0.6 -	- 0.2 - 8	mA µA	
TIMING AND FREQUENCY							
t_r	Reset Time	In mode DTMF In mode 60/40 In mode 66/33	- - -	34.3 30 33	- - -	ms ms ms	7 7 7
t_{on}	Clock Start-up Time		-	5	-	ms	
t_{lb}	Time line Break generating a Reset	In mode 60/40 In mode 66/33 In mode DTMF	290 319 341	- - -	300 330 343	ms ms ms	7 7 7
t_e	Debounce Time	In mode 60/40 In mode 66/33 In mode DTMF	14 15.4 16	24 26.4 27.4	34 37.4 38.9	ms ms ms	
SERIAL BUS							
t_{wl}, t_{wh}	Pulse Width Clock		2	-	-	µs	8
t_{el}, t_{eh}	Pulse Width Enable Signal		2	-	-	µs	8
$t_{set\ up}$	Set-up Time Data to Clock		0	-	-	ns	8
	Hold Time Data Drom Clock		100	-	-	ns	8
t_e	Enable Time		0	-	-	ns	8
t_{RRN}	Time Between two Transmissions		900	-	-	µs	8
PULSE DIALLING (OL)							
	Dialling Pulse Frequency	In mode 60/40 (pin 4 tied to RESET)	-	10	-	Hz	
		In mode 66/33 (pin 4 not Connected)	-	10.11	-	Hz	
T_{OL}	Dialling Pulse Period	pin 4 tied to RESET pin 4 n.c.	- -	100 98.9	- -	ms ms	
t_b	Break Time	pin 4 tied to RESET pin 4 n.c.	- -	60 66	- -	ms ms	
t_m	Make Time	pin 4 tied to RESET pin 4 n.c.	- -	40 33	- -	ms ms	

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit	Fig.
PULSE DIALLING (OL) continued.							
t_{IDOL}	Interdigit		830 813	- -	833 816.5	ms ms	
t_{mol}	Transmission Mute n Pulses Dialling	See note below					
t_{FI}	Flash Pulse Duration	Pin 3 to GND, Pin 4 n.c. Pin 3 n.c., Pin 4 n.c. Pin 3 to GND, Pin 4 to Reset Pin 3 to GND, Pin 4 to GND Pin 3 n.c., Pin 4 to Reset Pin 3 n.c., Pin 4 to GND Pin 3 to Reset, Pin 4 to Reset Pin 3 to Reset, Pin 4 to GND Pin 3 to Reset, Pin 4 n.c.	99 264 90 92 240 264 110 115 121	- - - - - - - - -	101.2 266.2 92 94 242.2 266 112.2 117 123.2	ms ms ms ms ms ms ms ms ms	
t_{mfl}	Transmission Mute	In mode 60/40 In mode 66/33 In mode DTMF	830 813 860	- - -	832 815.5 880	ms ms ms	
t_p	Pause Time	In mode 60/40 In mode 66/33 In mode DTMF	3034 2994 3028	- - -	3038 2998 3032	ms ms ms	
	Clock Keyboard: Minimum time to respect, in order to take the pressed pushbutton into account	Pin 4 to pin 6 Pin 4 n.c. Pin 4 to GND	14 15.4 16	24 26.4 27.4	34 37.4 38.9	ms ms ms	
	Clock Keyboard: Minimum time to respect, in order to take the released pushbutton into account	Pin 4 to pin 6 Pin 4 n.c. Pin 4 to GND	24 26.4 27.4	24 26.4 27.4	34 37.4 38.9	ms ms ms	

Note:

Min.	Max.	Unit
n x 100 + 30	n x 100 + 32	ms
n x 98.9 + 22	n x 100 + 24.2	ms

TEST CIRCUITS

Figure 1.

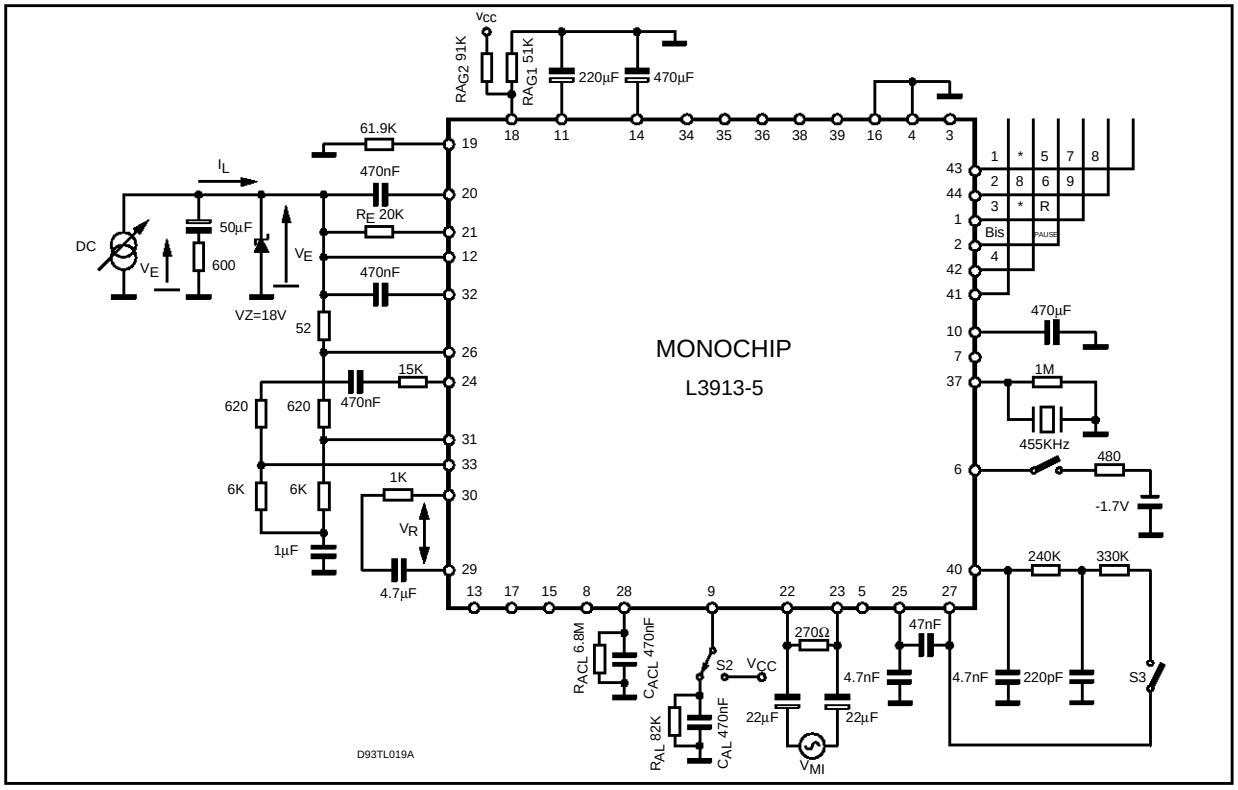


Figure 2.

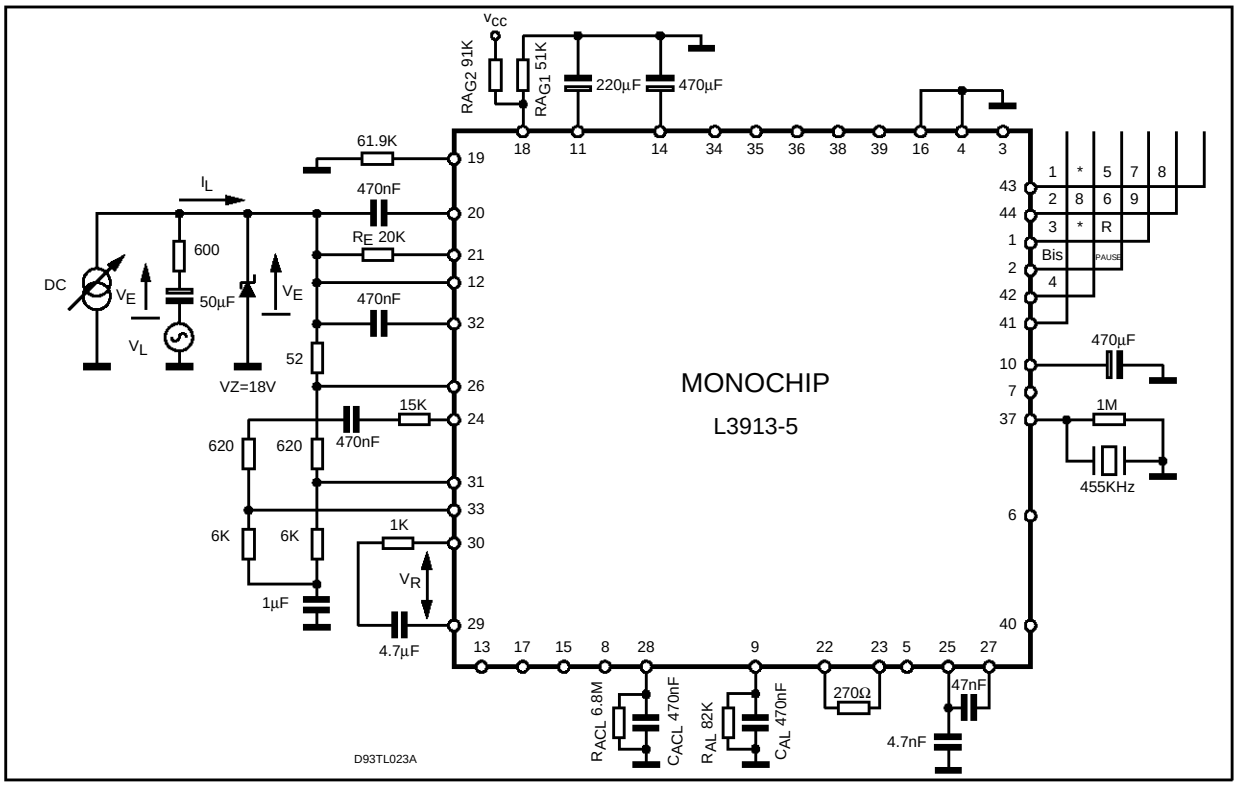


Figure 3.

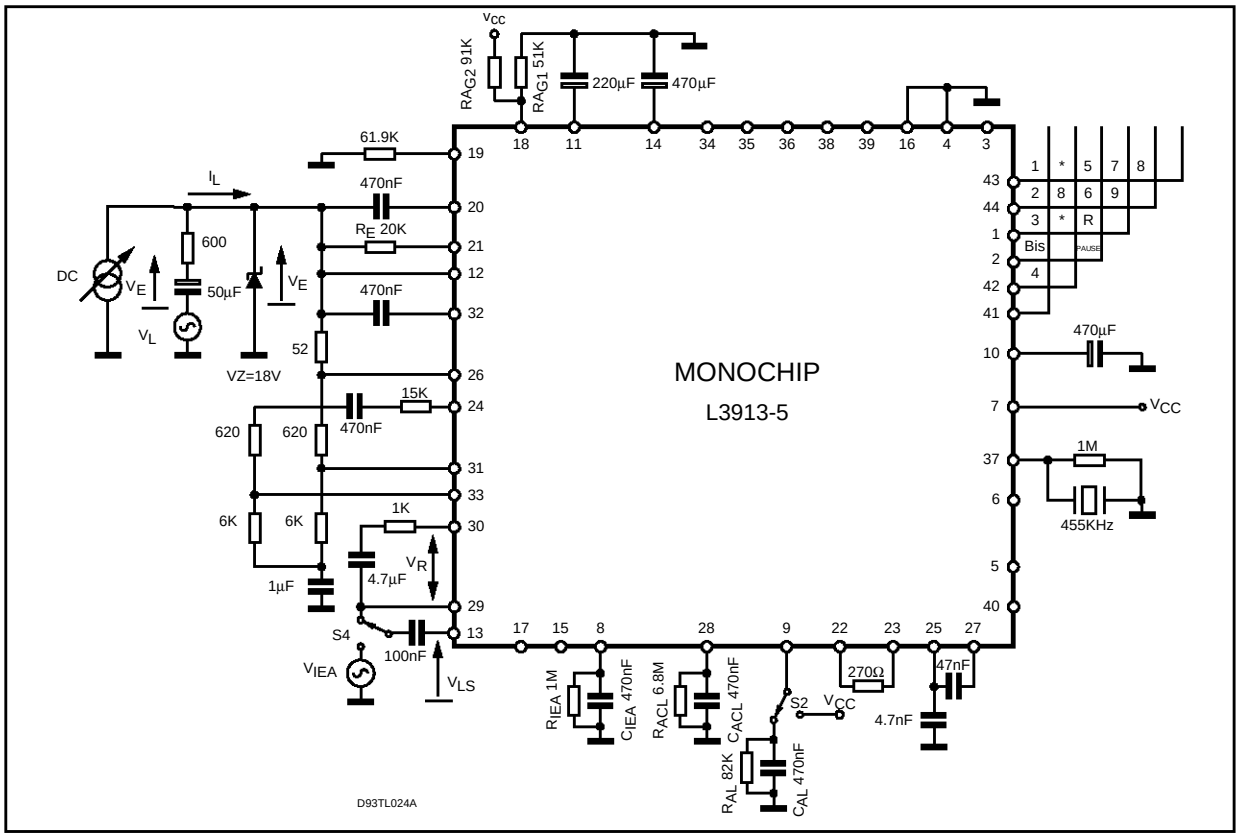
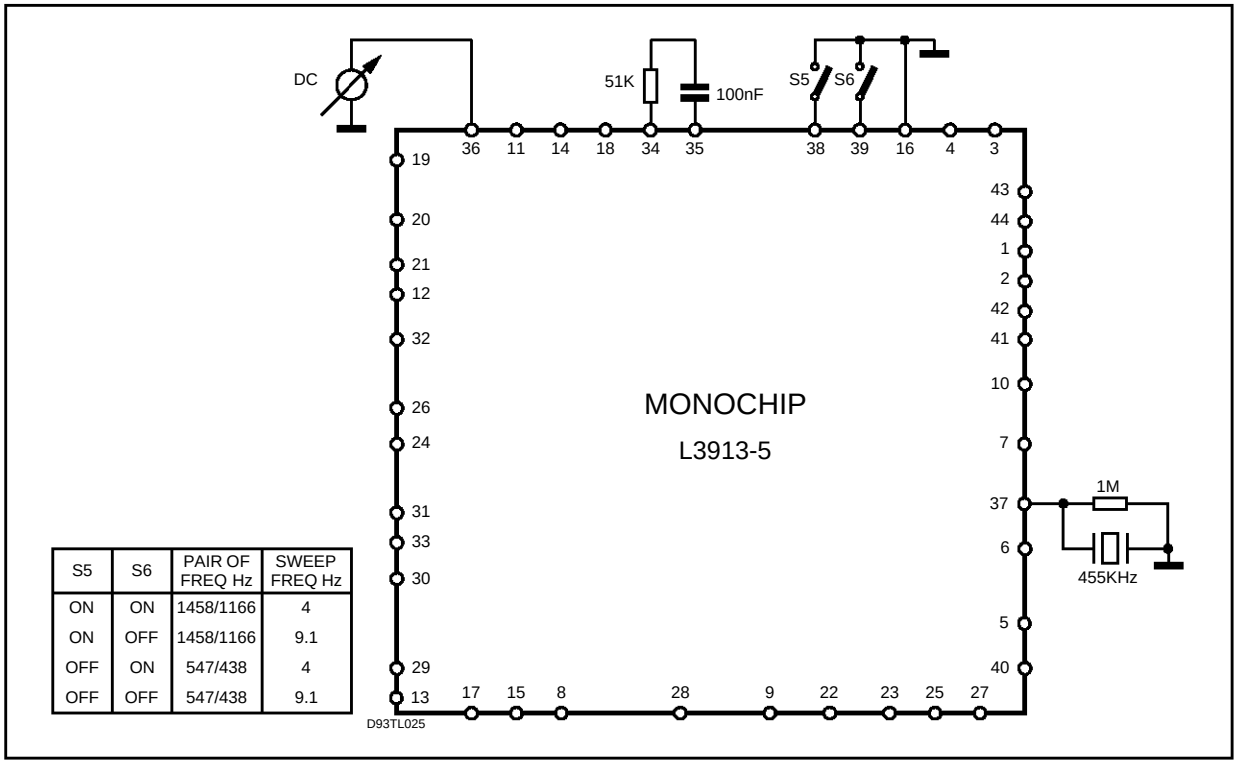


Figure 4.



S5	S6	PAIR OF FREQ Hz	SWEEP FREQ Hz
ON	ON	1458/1166	4
ON	OFF	1458/1166	9.1
OFF	ON	547/438	4
OFF	OFF	547/438	9.1

Figure 5.

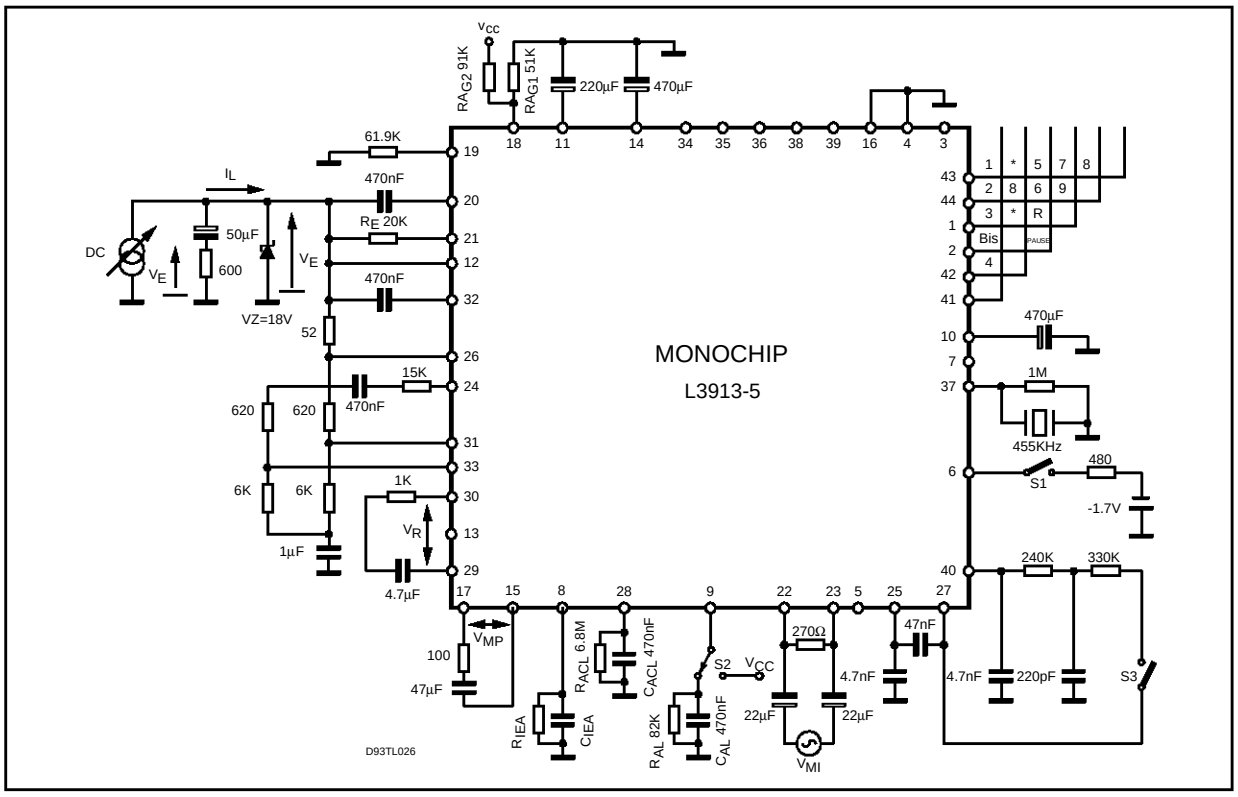
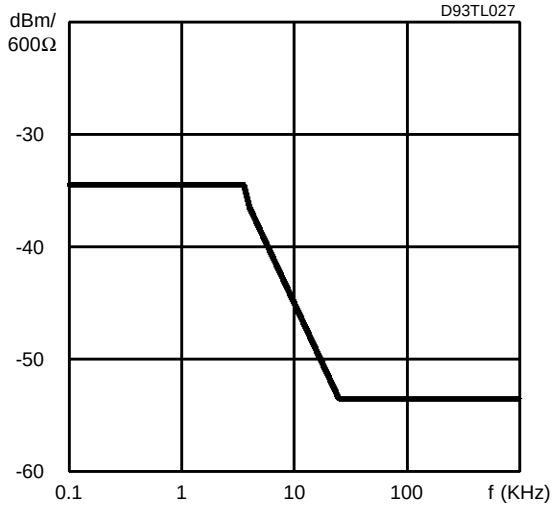


Figure 6: DTMF Distortion French Specification.



LINE BREAK DESCRIPTION

After a line break longer than a Time Line Break (tlb) an internal reset is generated. A short line break < tlb does not affect the reset.

POWER ON RESET TIMINGS (After Line Break)

Figure 7a: $V_{RAM} > V_{Son}$ at t = 0

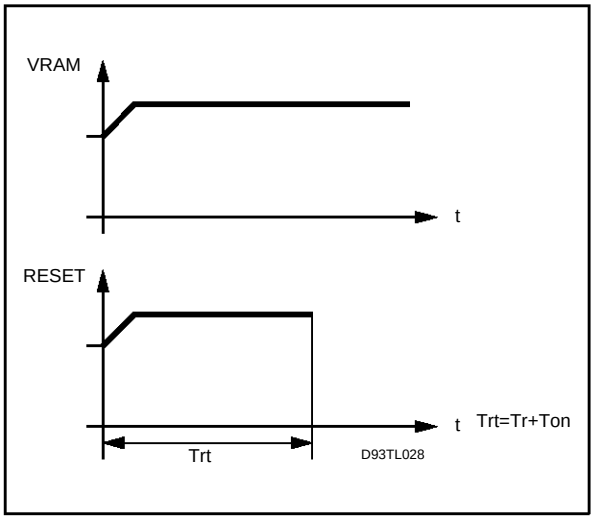
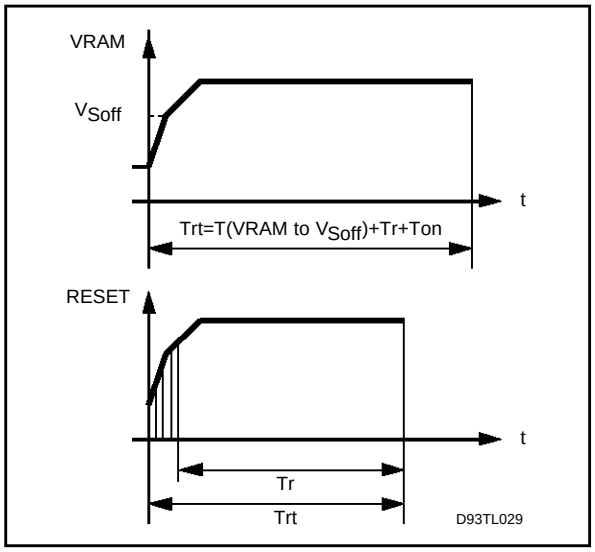


Figure 7b: $V_{RAM} < V_{Son}$ at t = 0



Pin reset: It is the power on reset output.

Figure 8.

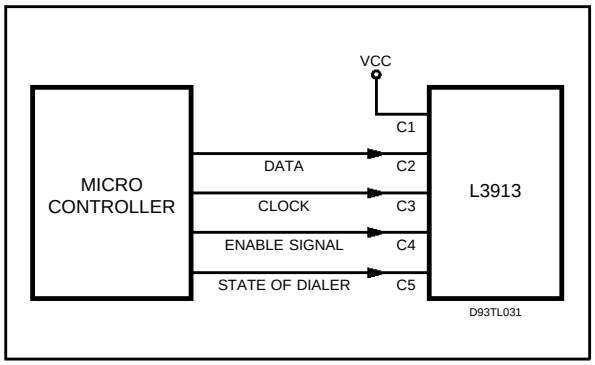
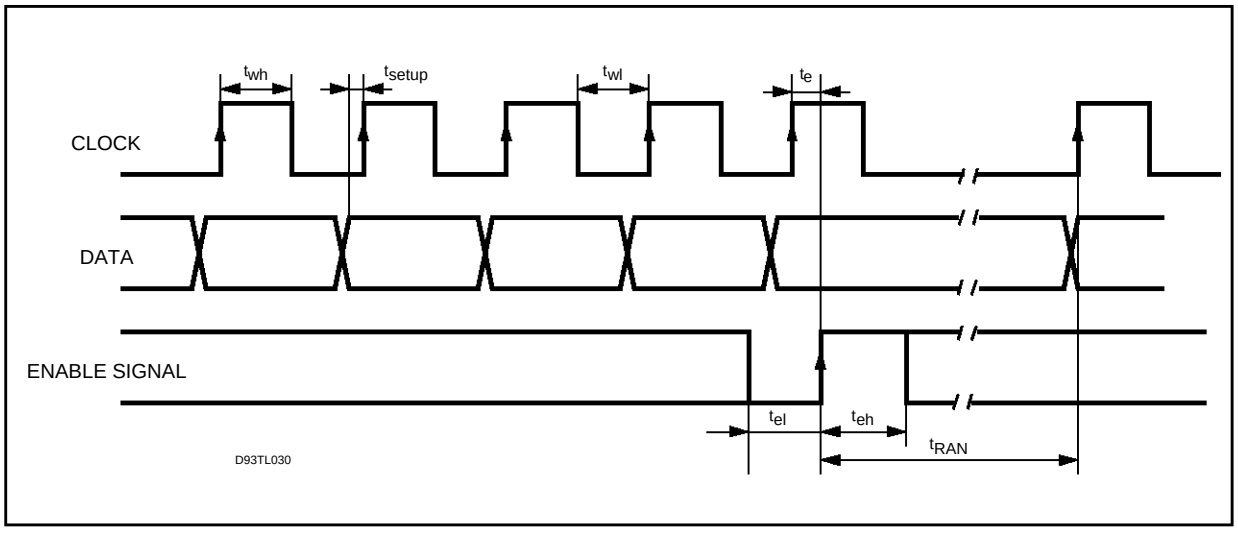


Figure 9: Timing serial bus.



DIALER FUNCTIONAL DESCRIPTION

The monochip includes a dialling circuit for either pulse dialling or dual tone multifrequency dialling.

The dialler transmits the codes decoded by the logic keyboard on the outputs 0L and DTMF.

DIALING MODE SELECTION

The default dialling mode is selected by the tri-level pin DC/FV (pin 4):

- DC/FV open: pulse dialling in 66/33ms
- DC/FV to pin Reset: pulse dialling in 60/40ms
- DC/FV to pin GND: DTMF dialling calibrated
- mixed mode

When the circuit is in pulse mode, it is possible to change to DTMF dialling with the " * " key. The circuit returns in pulse mode after a reset condition or after a flash pulse.

DIALLING CODES

These are the numeric keys 0 to 9, and the non numeric keys A, B, C, D, *, #. All of them are stored in RAM.

The codes A, B, C, D can be only transmitted by the serial bus, not by standard key board.

In pulse dialling, the code #, B, C, D have no effect on the dialling. The code A (in pulse mode) corresponds to 11 pulses.

SERIAL BUS DESCRIPTION

A microcontroller can be connected to the monochip by 4 pins C2, C3, C4, C5 (see fig. 8)

C1 must be connected to V_{CC} to select the serial mode operation.

C2 sends the data, C3 the clock, C4 the enable

signal, C5 indicates the state of the dialler (if C5 = 0 the dialler is busy, if C5 = 1 the dialler is free).

Data is a 5 bits serial word shifted in a 5 bits register during the positive transition of the clock pulse. The positive transition of the enable signal validates the acquisition of the last 5 bits.

Timings diagram in fig. 9 shows the details of serial bus synchronization.

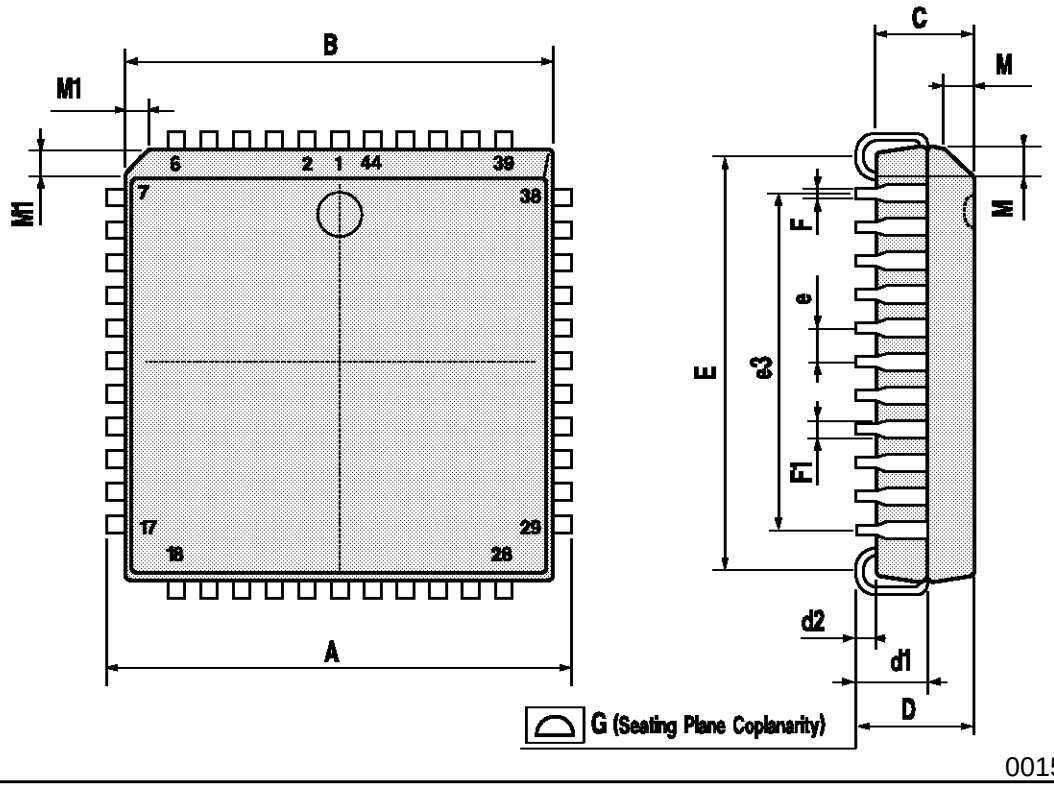
Table 1 explains the "CODE ENTRY" in serial bus mode.

Table 1: Code Enties.

0	0	0	0	0	*
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	0
0	1	0	1	1	A
0	1	1	0	0	B
0	1	1	0	1	C
0	1	1	1	0	D
0	1	1	1	1	*
1	0	0	0	0	RESERVED
1	0	0	0	1	R: FLASH
1	0	0	1	0	REDIAL
1	0	0	1	1	LOUDSPEAKER ON
1	0	1	0	0	CONFIDENCE TONE
1	0	1	0	1	MICROPHONE MUTE
1	0	1	1	0	PAUSE
1	0	1	1	1	RESERVED
1	1	0	0	0	LOUDSPEAKER LEVEL 0dB
1	1	0	0	1	LOUDSPEAKER LEVEL 3dB
1	1	0	1	0	LOUDSPEAKER LEVEL 6dB
1	1	0	1	1	LOUDSPEAKER LEVEL 9dB
1	1	1	0	0	LOUDSPEAKER LEVEL 12dB
1	1	1	0	1	LOUDSPEAKER LEVEL 15dB
1	1	1	1	0	LOUDSPEAKER LEVEL 18dB
1	1	1	1	1	LOUDSPEAKER LEVEL 21dB

PLCC44 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	17.4		17.65	0.685		0.695
B	16.51		16.65	0.650		0.656
C	3.65		3.7	0.144		0.146
D	4.2		4.57	0.165		0.180
d1	2.59		2.74	0.102		0.108
d2		0.68			0.027	
E	14.99		16	0.590		0.630
e		1.27			0.050	
e3		12.7			0.500	
F		0.46			0.018	
F1		0.71			0.028	
G			0.101			0.004
M		1.16			0.046	
M1		1.14			0.045	



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