

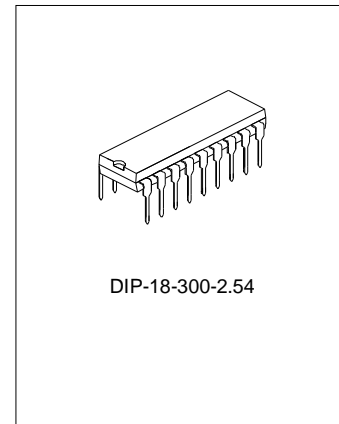
T/P SWITCHABLE DIALER WITH REDIA FUNCTION

DESCRIPTION

The SC9102C/D are Tone/Pulse switchable dialer which are fabricated in COMS technology with wide operating voltage for both tone and pulse mode, and consumes very low memory retention current in on hook state.

FEATURES

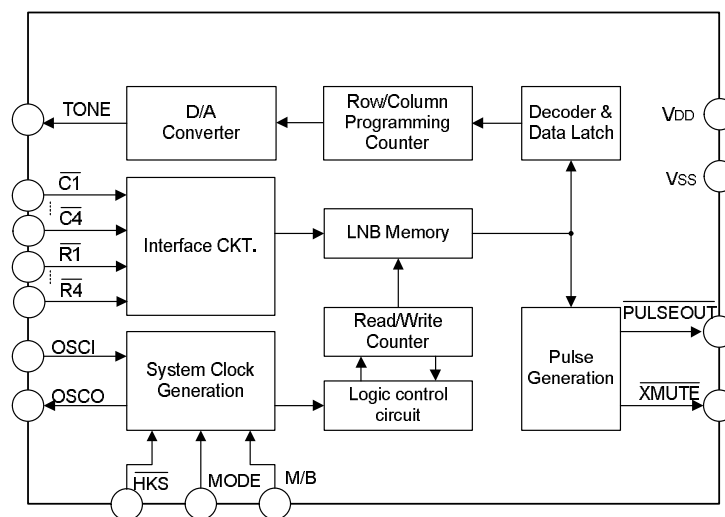
- * Tone/Pulse switchable dialer
- * One 32-digit last number redial memory
- * Pulse-to-tone (P→T) is provided for PBX operation
- * Flash key is available
- * Minimum tone duration is 100ms
- * Minimum intertone pause is 106ms
- * Uses 3.579549MHz crystal or ceramic resonator
- * Redial Pause time (0ms)
- * Mixed dialing
- * Power on reset circuit is provided
- * Many options can be selected
- Mode (10PPS; 20PPS; Tone)
- M/B ratio (40:60;33:66)
- Pause time (3.6ms)
- * Flash function (RESET)
- (P→T) pause time (3.6ms)
- Flash time (600/100ms)
- Flash pause time (0ms)
- * Packaged in 18-pin plastic DIP



ORDERING INFORMATION

Part	Package
SC9102C	DIP-18-300-2.54
SC9102D	DIP-18-300-2.54

BLOCK DIAGRAM



KEYBOARD ASSIGNMENT

	$\overline{C1}$	$\overline{C2}$	$\overline{C3}$	$\overline{C4}$
$\overline{R1}$	1	2	3	P→T
$\overline{R2}$	4	5	6	F
$\overline{R3}$	7	8	9	P
$\overline{R4}$	*/P	0	#/RD	RD

Note: 1) P→T: Execute P→T function.

2) P: Pause key.

3) F: Flash key

4) RD: Redial key

5) */P: In Tone mode, execute * function; In pulse mode, execute pause function

6) #/RD: In Tone mode, execute # function; In pulse mode, execute redial function

DIALING SIGNAL OPTION

M/B	Pulse Rate	M/B Ratio	Flash Time	
			SC9102D	SC9102C
V _{SS}	10PPS	40:60	600ms	100ms
V _{DD}	10PPS	33:66	100ms	600ms
Open	20PPS	33:66	600ms	600ms

ABSOLUTE MAXIMUM RATING(T_{amb}=25°C, All voltage referenced to V_{SS}, unless otherwise specified)

Characteristics	Symbol	Ratings	Unit
Power Supply Voltage	V _{DD}	6.0	V
Input Voltage	V _{IN}	-0.3~V _{DD} +0.3	V
Power Dissipation	P _D	500	mW
Operating Temperature	T _{opr}	-25~+70	°C
Storage Temperature	T _{stg}	-55~+150	°C

ELECTRICAL CHARACTERISTICS(T_{amb}=25°C, V_{DD}=2.5V, f_{OSC}=3.579545MHz, unless otherwise specified).

Characteristics	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating Voltage	V _{DD}	Tone/Pulse	2.0		5.5	V
		Memory retention	1.0		5.5	
Operating Current	I _{OP}	Tone		0.6	2	mA
		Pulse, OFF-HOOK, Keypad entry, no load		0.2	0.6	
Standby Current	I _S	ON-HOOK, No keypad entry, no load V _{DD} =1.0V		0.1	5	μA

(To be continued)

(Continued)

Characteristics		Symbol	Conditions	Min.	Typ.	Max.	Unit
Memory Retention Current		I _{mr}			0.1	0.1	μA
Control Pin Input Low Voltage		V _{il}		V _{SS}		0.3V _{DD}	V
Control Pin Input High Voltage		V _{ih}		0.7V _{DD}		V _{DD}	
X _{MUTE} Pin Leakage Current		I _{mth}	V _{X_{MUTE}} =12.0V			1	μA
X _{MUTE} Pin Sink Current		I _{mtl}	V _{X_{MUTE}} =0.5V	1			mA
H _{KS} Pin Input Current		I _{hks}	V _{hks} =2.5V			0.1	μA
Keyboard Scanning Pin	Drive Current	I _{kbd}	V _n =0V (note1)	4	10	30	μA
	Sink Current	I _{kbs}	V _n =2.5 (note1)	200	400		
Key-in Debounce Time		t _{DB}			20		ms
Pulse Mode							
Pulse Output Pin Leakage Current		I _{poh}	V _{po} =12V	--	--	1.0	μA
Pulse Output Pin Sink Current		I _{pol}	V _{po} =0.5V	1.0	3.0	--	mA
Pulse Rate		f _{pr}		--	10	--	pps
				--	20	--	
Make/Break Ratio		t _M : t _B		--	40:60	--	%
				--	33:66	--	
Pre-digit Pause (Pulse rate=10pps)		t _{PDP}	M/B ratio=40:60	--	40	--	ms
			M/B ratio=33:66	--	33	--	
Pre-digit Pause (Pulse rate=20pps)		t _{PDP}	M/B ratio=40:60	--	20	--	ms
			M/B ratio =33:66	--	16.5	--	
Inter-digit Pause		t _{IDP}	Pulse rate=10pps	--	800	--	ms
			Pulse rate=20pps	--	600	--	
Tone Mode							
Tone	DC Level	V _{dc}	V _{DD} =2.0V~5.5V	0.45V _{DD}	0.55V _{DD}	0.7V _{DD}	V
	Sink Current	I _{tl}	V _{dtmf} =0.5V	0.15	--	--	mA
Output Pin	AC level	V _{dtmf}	Row group, R _L =10KΩ	120	150	180	mV _{rms}
	Load Resistor	R ₁	Dist.<=23dB	10	--	--	KΩ
DTMF Signal	Pre-emphasis	t _{wist}	V _{DD} =2.0~5.5 V	1	2	3	dB
	Distortion(note 2)	Dist.	R _L =10KΩ	--	-30	-23	dB
Minimum tone duration Time		t _{TD}	Auto redial	--	100	--	ms
Minimum Intertone Pause Time		t _{TTP}	Auto redial	--	106	--	ms

Note: 1. V_n: Input voltage of any keyboard scanning pin (Row group, Column group)

2. Distortion (dB) = 20log{[V₁²+V₂²+V₃²+...+V_n²]^{1/2}}/[(V_L²+V_H²)^{1/2}]}

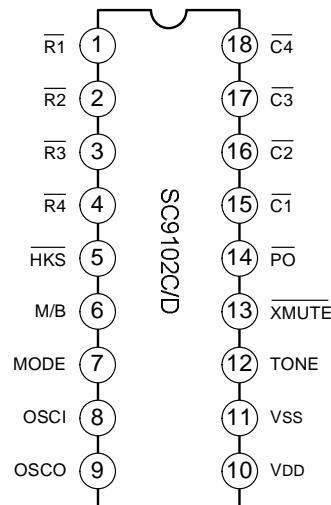
V_L, V_H: Row group and Column group signal

V₁, V₂, ..., V_n: Harmonic signal (BW = 300Hz~3500Hz)

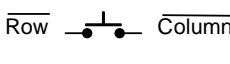
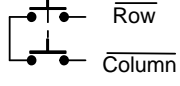
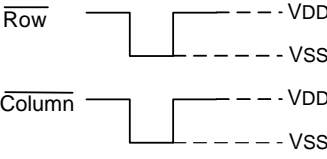
ACTUAL FREQUENCY OUTPUT (f_{osc}=3.579545MHz)

Keyboard Scanning Pin		Standard(Hz)	Output	Deviation(%)
R1	f1	697	699	+0.28
R2	f2	770	766	-0.52
R3	f3	852	848	-0.47
R4	f4	941	948	+0.74
C1	f5	1209	1216	+0.57
C2	f6	1336	1332	-0.30
C3	f7	1477	1472	-0.34

PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Pin Name	Description
15	$\overline{C1}$	*Provides keyboard scanning. * \overline{HKS} pin is LOW, the column group stays in "HIGH" and row group stays in "LOW" state.
16	$\overline{C2}$	*The keypad is compatible with the standard dual contact matrix keyboard (as figure1b), the inexpensive single contact keyboard (as figure 1a), and electronic input (as figure 1c).
17	$\overline{C3}$	*When \overline{HKS} is "LOW", a valid key entry is defined by related Row & Column connection or by electronic input.
18	$\overline{C4}$	*Activation of two or more keys will result in no response, except for single key. *To avoid keyboard-bouncing error, this chip provides built-in debounce circuit. (The debounce time = 20ms)
1	$\overline{R1}$	  Figure 1a: Single contact form keyboard configuration Figure 1b: Dual contact form keyboard configuration
2	$\overline{R2}$	
3	$\overline{R3}$	
4	$\overline{R4}$	
		 Figure 1c: Electronic signal input keyboard configuration
8	OSCI	*Oscillator input & output pins. *The 3.579545MHz oscillator is formed by a built-in inverter inside of this chip and by connecting a 3.579545MHz crystal or a ceramic resonator across the OSCI and OSCO pins. (built-in feedback resistor and capacitor)
9	OSCO	*When \overline{HKS} is "LOW", a valid key-in may turn on this oscillator and generates a 3.579545 MHz clock.
13	\overline{XMUTE}	*Mute output pins. *NMOS open drain output structure. *The output is in "LOW" state during dialing sequence (both Pulse and Tone mode) otherwise this pin is "high-impedance". *Long (continue) Mute.
11	VSS	*Negative power supply pin.
10	VDD	*Positive power supply pin.
5	\overline{HKS}	*Hook switch input pin. *When the handset is in ON-HOOK state, this pin must be pulled "high" in order to disable the dialing operation and decrease the power consumption. *When in OFF-HOOK state, the \overline{HKS} pin must be pulled "low" state for all function operation.

(To be continued)

(Continued)

Pin No.	Pin Name	Description	
14	\overline{PO}	*Pulse output signal pin. *NMOS open drain output structure. *The output is "LOW" during pulse dialing and Flash operation, otherwise this output is "floating".	
12	TONE	*Dual Tone Multi-frequency output pin. *In TONE mode, when an entry of digit key (include *, # key), this pin will send out a corresponding DTMF signal. *The TONE pin provides minimum tone duration and minimum intertone pause time to support rapid key-in. If key-in time is less than 100ms, DTMF signal will last for 100ms; otherwise the tone duration will last as long as the key is pressed.	
7	MODE	*Mode selection pin.	MODE
		*Three-state input structure.	VDD
		*This pin can select the three modes shown on the right.	VSS
			Dialing mode
			Pulse mode
			Pulse mode
			Tone mode
6	M/B	*M/B ration selection pin. (The function seeing the Dialing signal option table)	

KEYBOARD OPERATION

Symbol definitions:

- a) \uparrow : OFF-HOOK or enable Hand Free function.
- b) \downarrow : ON-HOOK or disable Hand Free function.
- c) \uparrow : Input level from low to high.
- d) \downarrow : Input level from high to low.
- e) D1~Dn : Digit key: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #, (C1~Cn is same as D1~Dn).
- f) Dp1~Dpn : Pulse digit: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #, (Cp1~Cpn is same as Dp1~Dpn).
- g) Dt1~Dtn : Tone digit: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, *, #, (Ct1~Ctn is same as Dt1~Dtn).
- h) t_F : Flash time.
- i) t_P : Pause time.
- j) t_{PT} : Pulse to Tone wait time.
- k) t_{FP} : Pause time for flash.
- l) t_{RP} : Pause time for redial.
- m) LNB : Last number redial buffer.

A) Normal Dialing

1. Digit Dialing

- Procedure : \uparrow D1, D2..., Dn \downarrow
- Dial out : Dt1, Dt2..., Dtn (in Tone mode)
- Dial out : Dp1, Dp2..., Dpn (in Pulse mode)
- LNB : D1, D2..., Dn

2. Dialing with flash key

Procedure : $\uparrow F, D1, D2\dots, Dn \downarrow$
 Dial out : $t_F, t_{FP}, Dt1, Dt2\dots, Dtn$ (in Tone mode)
 Dial out : $t_F, t_{FP}, Dp1, Dp2, \dots, Dpn$ (in Pulse mode)
 LNB : $D1, D2\dots, Dn$

3. Dialing with P→T key

Procedure : $\uparrow D1, D2 \dots, P\rightarrow T, \dots, Dn \downarrow$
 Dial out : $Dp1, Dp2, \dots, t_{PT}, \dots, Dpn$ (in Pulse mode)
 LNB : $D1, D2 \dots, P\rightarrow T, \dots, Dn$

Note: If key in digit over maximum digit stored in LNB, then RD is inhibit even after on/off hook.

B) Mixed dialing

Procedure : $\uparrow D1, D2\dots, P\rightarrow T, D9, D10 \dots, Dn \downarrow$
 Dial out : $Dp1, Dp2, \dots, t_{PT}, Dt9, Dt10\dots, Dtn$
 LNB : $D1, D2\dots, P\rightarrow T, D9, D10 \dots, Dn$

C) Redial

LNB : $D1, D2\dots, Dn$
 Procedure : $\uparrow RD \downarrow$
 Dial out : $t_{RP}, Dt1, Dt2\dots, Dtn$ (in Tone mode)
 Dial out : $t_{RP}, Dp1, Dp2,\dots, Dpn$ (in Pulse mode)

Note: If key in digit over maximum digit stored in LNB, then RD is inhibit.

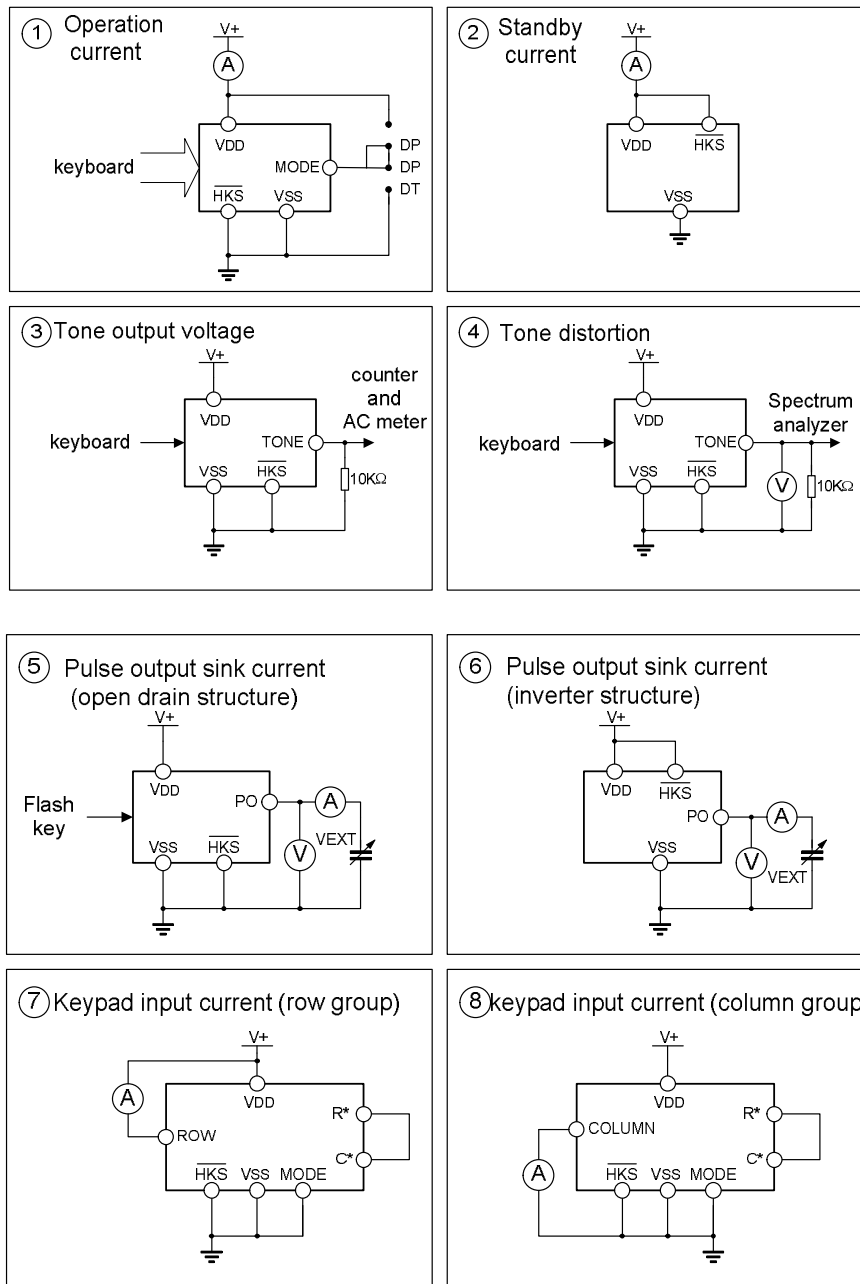
D) Pause Function

Procedure : $\uparrow D1, D2\dots, Dn, P, C1 \dots, Cn \downarrow$
 Dial out : $Dt1, Dt2, \dots, Dtn, t_P, Ct1 \dots, Ctn$ (in Tone mode)
 Dial out : $Dp1, Dp2, \dots, Dpn, t_P, Cp1 \dots, Cpn$ (in Pulse mode)
 LNB : $D1, D2\dots, Dn, P, C1, C2 \dots, Cn$

E) Flash Function

Procedure : $\uparrow D1, D2\dots, Dn, F, C1 \dots, Cn \downarrow$
 Dial out : $Dt1, Dt2,\dots, Dtn, t_F, t_{FP}, Ct1 \dots, Ctn$ (in Tone mode)
 Dial out : $Dp1, Dp2,\dots, Dpn, t_F, t_{FP}, Cp1 \dots, Cpn$ (in Pulse mode)
 LNB : $C1, C2 \dots, Cn$

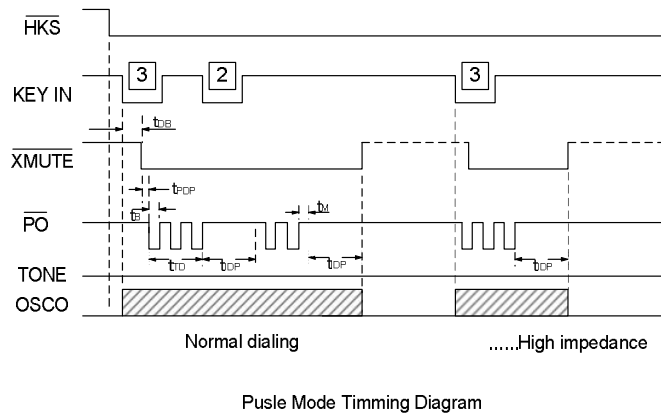
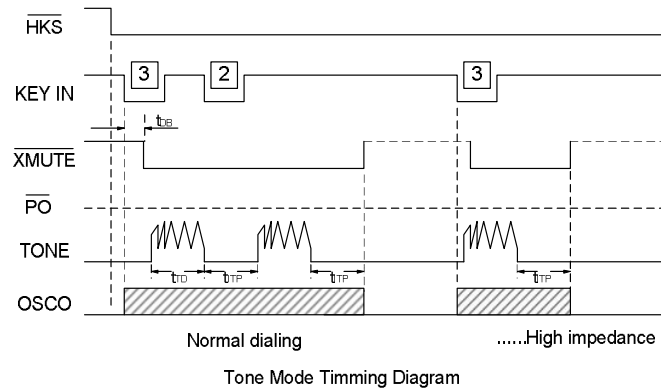
TEST CIRCUIT



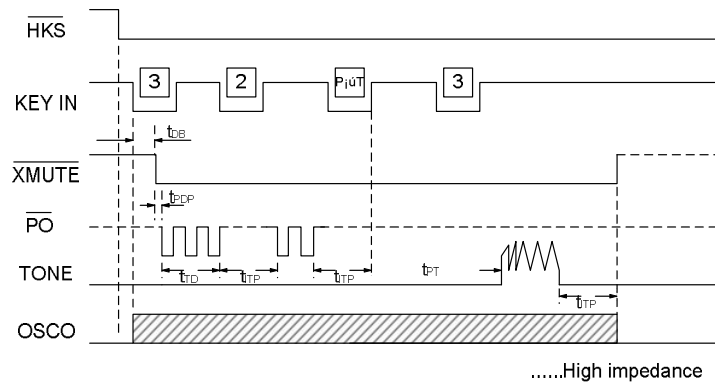
Note: 1. Dist. (dB) = $20 \log \left\{ \frac{[V_1^2 + V_2^2 + V_3^2 + \dots + V_n^2]^{1/2}}{[(V_L^2 + V_H^2)^{1/2}]} \right\}$

- a. $V_1 \dots V_n$ are extraneous frequencies (ie, inter modulation and harmonic), components in the 500Hz to 3400Hz band.
- b. V_L, V_H are the individual frequency components of DTMF signal.
- c. Whether keyboard is pushed refer to the TONE mode time diagram.
- 2. Sink current $I_{\text{sink}} = I / (1 - \text{Duty Cycle})$, I is the net DC current measured from ampere meter.
- 3. R^*, C^* mean other column and row.

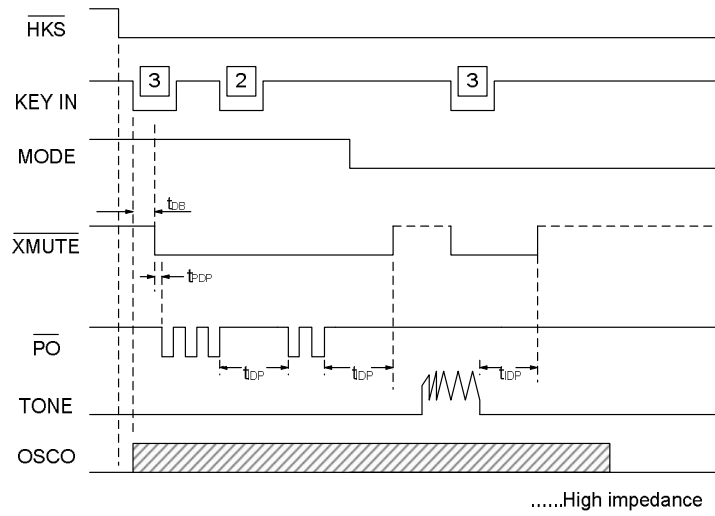
TIMING DIAGRAMS



TIMING DIAGRAMS (continued)

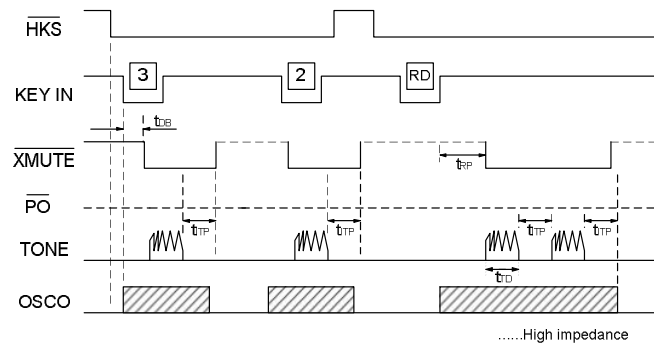


Timing Waveform for mixed dialing Operation
(by *T key entry)

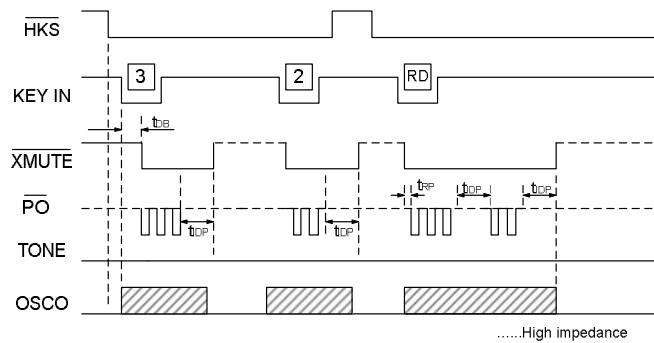


Timing Waveform for mixed dialing Operation
(by MODE pin entry)

TIMING DIAGRAMS (continued)

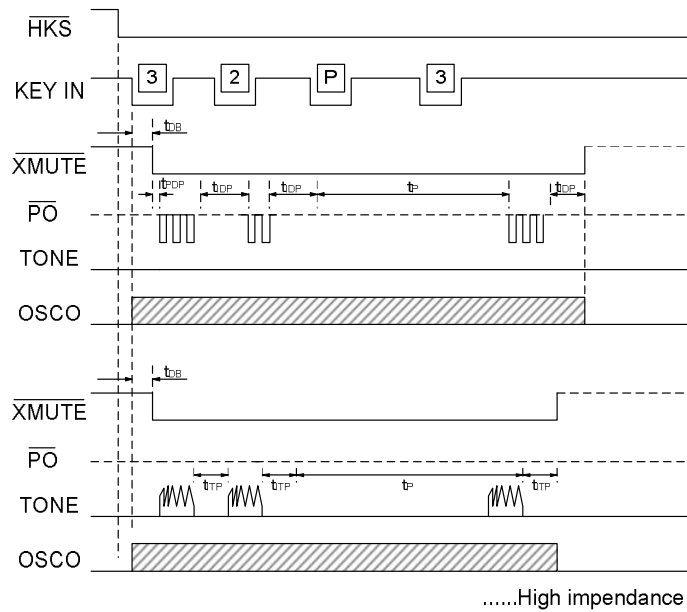


Tone Mode Redial Timing Diagram

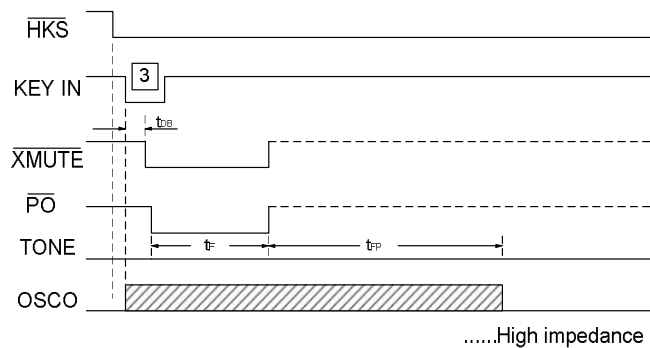


Pulse Mode Redial Timing Diagram

TIMING DIAGRAMS (continued)

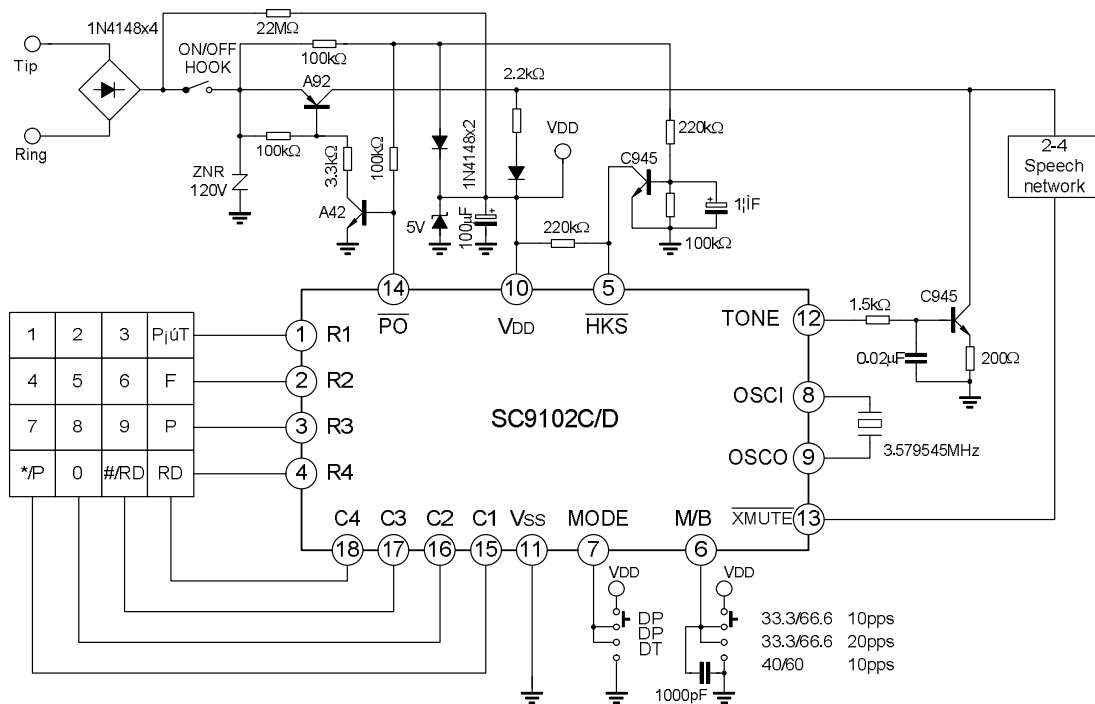


Pause key operating timing

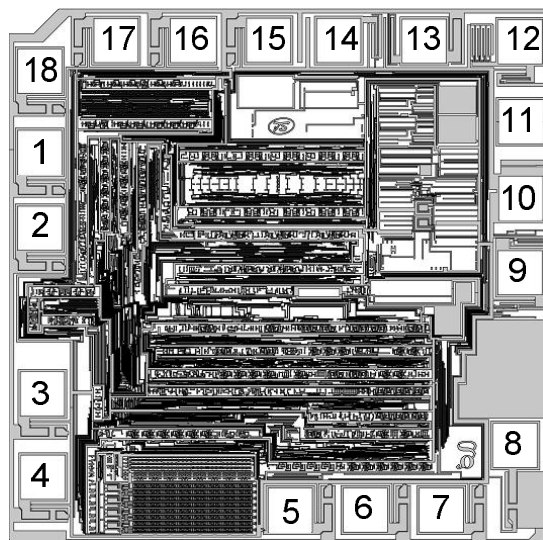


Flash key operating timing

TYPICAL APPLICATION CIRCUIT



CHIP TOPOGRAPHY



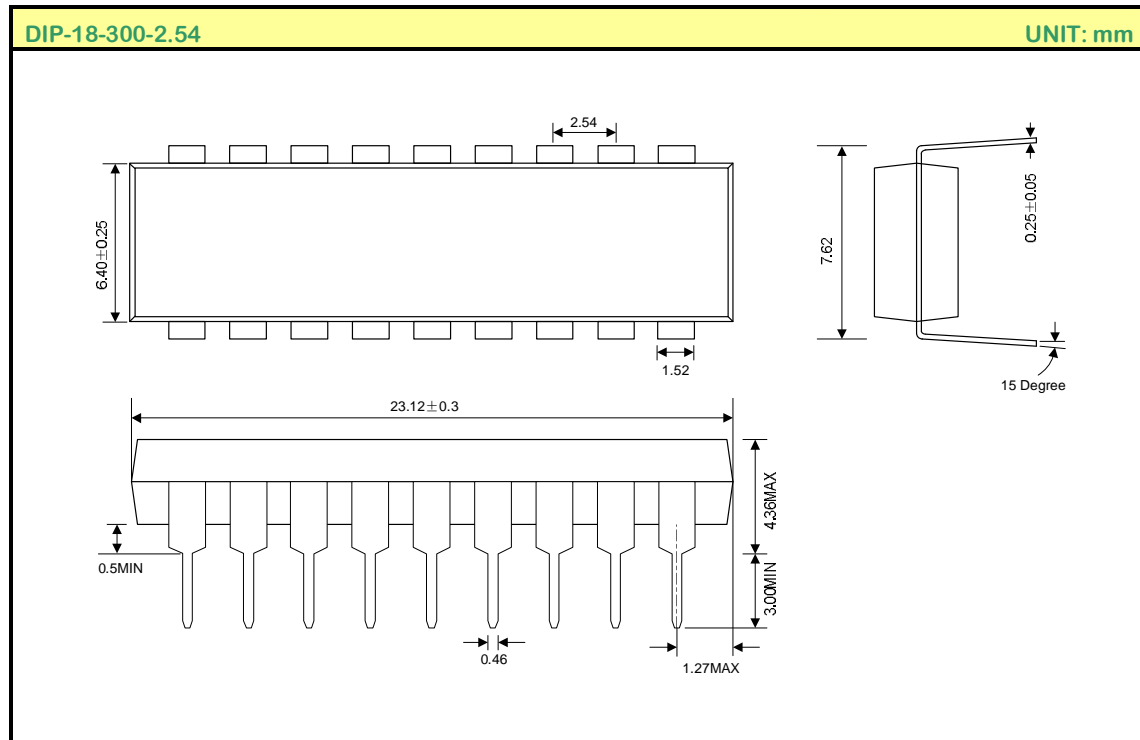
Chip size: 1.35 x 1.33 mm²

PAD COORDINATES (Unit: μm)

Pad No.	Symbol	X	Y	Pad No.	Symbol	X	Y
1	P1	-545.0	276.0	10	P10	542.2	176.4
2	P2	-545.0	109.0	11	P11	541.3	349.5
3	P3	-539.0	-266.0	12	P12	541.0	530.5
4	P4	539.0	-453.5	13	P13	324.3	531.5
5	P5	21.2	-528.0	14	P14	131.0	533.0
6	P6	191.0	-528.0	15	P15	-27.0	531.5
7	P7	362.5	-381.5	16	P16	-199.5	531.5
8	P8	529.5	8.5	17	P17	-373.0	531.5
9	P9	540.5	176.4	18	P18	-545.0	463.5

Note: The original point of the coordinate is the die center.

PACKAGE OUTLINE



HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.