

## TONE / PULSE DIALER WITH REDIAL FUNCTION

### DESCRIPTION

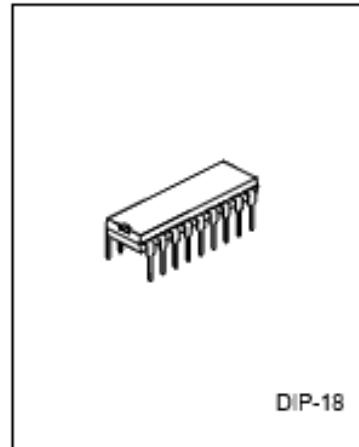
The SC9102C/D are Tone/Pulse switchable dialer which are fabricated in COMS technology with wide operating voltage for both tone and pulse mode, and consumes very low memory retention current in on hook state.

### FEATURES

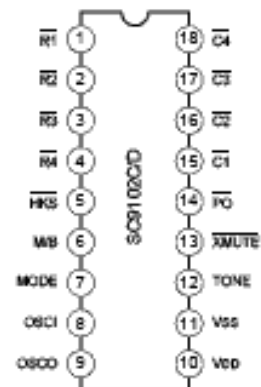
- \*Tone/Pulse switchable dialer
- \*One 32-digit last number redial memory
- \*Pulse-to-tone (P→T) is provided for PBX operation
- \*Flash key is available
- \*Minimum tone duration is 100ms
- \*Minimum intertone pause is 106ms
- \*Uses 3.579549MHz crystal or ceramic resonator
- \*Redial Pause time (0ms)
- \*Mixed dialing
- \*Power on reset circuit is provided
- \*Many options can be selected
- Mode (10PPS; 20PPS; Tone)
- MB 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

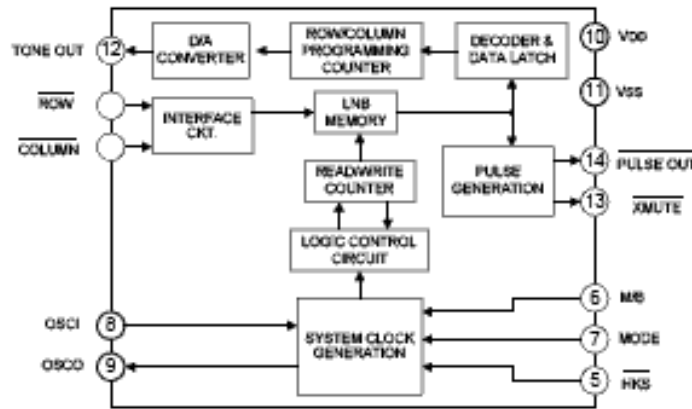
SC9102C	DIP-18 Packaged
SC9102D	DIP-18 Packaged



### PIN CONFIGURATIONS



**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**

MB	Pulse Rate	MB Ratio	Flash Time	
			SC9102D	SC9102C
VSS	10PPS	40:60	600ms	100ms
VDD	10PPS	33:66	100ms	600ms
Open	20PPS	33:66	600ms	600ms

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Rev. 2.0 2001-11-02

**ABSOLUTE MAXIMUM RATINGS**

(Tamb=25°C, All voltage referenced to Vss, unless otherwise specified)

Characteristic	Symbol	Value	Unit
Power Supply Voltage	VDD	6.0	V
Input Voltage	VIN	-0.3~VDD+0.3	V
Power Dissipation	PD	500	mW
Operating Temperature	Topr	-25~+70	°C
Storage Temperature	Tstg	-55~+150	°C

**ELECTRICAL CHARACTERISTICS**

(Tamb=25°C, VDD=2.5V, fosc=3.579545MHz, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Operating Voltage	VDD	Tone/Pulse	2.0		5.5	V	
		Memory retention	1.0		5.5		
Operating Current	IOP	Tone		0.6	2	mA	
		Pulse, OFF-HOOK, Keypad entry, no load		0.2	0.6		
Standby Current	IS	ON-HOOK, No keypad entry, no load VDD=1.0V		0.1	5	μA	
Memory Retention Current	Imr			0.1	0.1	μA	
Control Pin Input Low Voltage	Vil		VSS		0.3VDD	V	
Control Pin Input High Voltage	Vih		0.7VDD		VDD		
$\overline{\text{XMUTE}}$ Pin Leakage Current	Imth	V $\overline{\text{XMUTE}}$ =12.0V			1	μA	
$\overline{\text{XMUTE}}$ Pin Sink Current	Imtl	V $\overline{\text{XMUTE}}$ =0.5V	1			mA	
$\overline{\text{HKS}}$ Pin Input Current	Ihks	Vhks=2.5V			0.1	μA	
Keyboard	Drive Current	Ikbd	Vn=0V (note1)	4	10	30	μA
Scanning Pin	Sink Current	Ikbs	Vn=2.5 (note1)	200	400		
Key-in Debounce Time	tDB			20			ms
<b>Pulse Mode</b>							
Pulse Output Pin Leakage Current	IpoH	Vpo=12V	--	--	1.0	μA	
Pulse Output Pin Sink Current	IpoL	Vpo=0.5V	1.0	3.0	--	mA	
Pulse Rate	fpr		--	10	--	pps	
			--	20	--		
Make/Break Ratio	tM: tB		--	40:60	--	%	
			--	33:66	--		

(to be continued)

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Rev: 2.0 2001-11-02

(continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Pre-digit Pause (Pulse rate=10pps)	t <sub>PDP</sub>	M/B ratio=40:60	--	40	--	ms	
		M/B ratio=33:66	--	33	--		
Pre-digit Pause (Pulse rate=20pps)	t <sub>PDP</sub>	M/B ratio=40:60	--	20	--	ms	
		M/B ratio =33:66	--	16.5	--		
Inter-digit Pause	t <sub>IDP</sub>	Pulse rate=10pps	--	800	--	ms	
		Pulse rate=20pps	--	600	--		
<b>Tone Mode</b>							
Tone	DC Level	V <sub>dc</sub>	V <sub>DD</sub> =2.0V~5.5V	0.45V <sub>DD</sub>	0.55V <sub>DD</sub>	0.7V <sub>DD</sub>	V
	Sink Current	I <sub>tl</sub>	V <sub>dtmf</sub> =0.5V	0.15	--	--	mA
Output Pin	AC level	V <sub>dtmf</sub>	Row group, R <sub>L</sub> =10KΩ	120	150	180	mV <sub>rms</sub>
	Load Resistor	R <sub>1</sub>	Dist.<=-23dB	10	--	--	KΩ
DTMF Signal	Pre-emphasis	twist	V <sub>DD</sub> =2.0~5.5 V	1	2	3	dB
	Distortion(note 2)	Dist.	R <sub>L</sub> =10KΩ	--	-30	-23	dB
Minimum tone duration Time	t <sub>TD</sub>	Auto redial	--	100	--	ms	
Minimum Intertone Pause Time	t <sub>TTP</sub>	Auto redial	--	106	--	ms	

 Note: 1. V<sub>n</sub>: Input voltage of any keyboard scanning pin (Row group, Column group)

$$2. \text{Distortion (dB)} = 20\log\{[V_1^2+V_2^2+V_3^2+\dots+V_n^2]^{1/2}/[(V_L^2+V_H^2)^{1/2}]\}$$

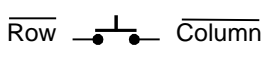
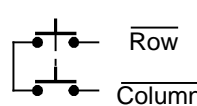
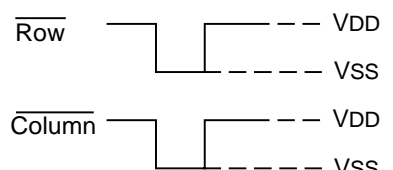
 V<sub>L</sub>,V<sub>H</sub>: Row group and Column group signal

 V<sub>1</sub>, V<sub>2</sub>..., V<sub>n</sub>: Harmonic signal (BW = 300Hz~3500Hz)

**ACTUAL FREQUENCY OUTPUT** (f<sub>osc</sub>=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 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	$\overline{R1}$	  <p>Figure1a: Single contact form keyboard configuration      Figure1b: Dual contact form keyboard configuration</p>  <p>Figure1c: Electronic signal input keyboard configuration</p>
2	$\overline{R2}$	
3	$\overline{R3}$	
4	$\overline{R4}$	
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.

(to be continued)

(continued)

Pin No.	Pin Name	Description		
13	$\overline{\text{XMUTE}}$	*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	$\overline{\text{HKS}}$	*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 $\overline{\text{HKS}}$ pin must be pulled "low" state for all function operation.		
14	$\overline{\text{PO}}$	*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. *Three-state input structure. *This pin can select the three modes shown on the right.	<b>MODE</b>	<b>Dialing mode</b>
			VDD	Pulse mode
			Open	Pulse mode
			VSS	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)  $\uparrow$  (with a horizontal line below the arrow) : Input level from low to high.
- d)  $\downarrow$  (with a horizontal line below the arrow) : 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..., Dn  $\downarrow$
- Dial out :  $t_F$ ,  $t_{FP}$ , Dt1, Dt2..., Dtn (in Tone mode)
- Dial out :  $t_F$ ,  $t_{FP}$ , Dp1, Dp2, ..., Dpn (in Pulse mode)
- LNB : D1, D2..., Dn

#### 3. Dialing with P→T key

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

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

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Rev: 2.0 2001-11-02

B) Mixed dialing

Procedure :  $\uparrow$ D1, D2..., P $\rightarrow$ T, D9, D10 ..., Dn $\downarrow$   
 Dial out : Dp1, Dp2, ..., t<sub>PT</sub>, Dt9, Dt10..., Dtn  
 LNB : D1, D2..., P $\rightarrow$ T, D9, D10 ..., Dn

C) Redial

LNB : D1, D2..., Dn  
 Procedure :  $\uparrow$  RD  $\downarrow$   
 Dial out : t<sub>RP</sub>, Dt1, Dt2..., Dtn (in Tone mode)  
 Dial out : t<sub>RP</sub>, Dp1, Dp2..., Dpn (in Pulse mode)

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

D) Pause Function

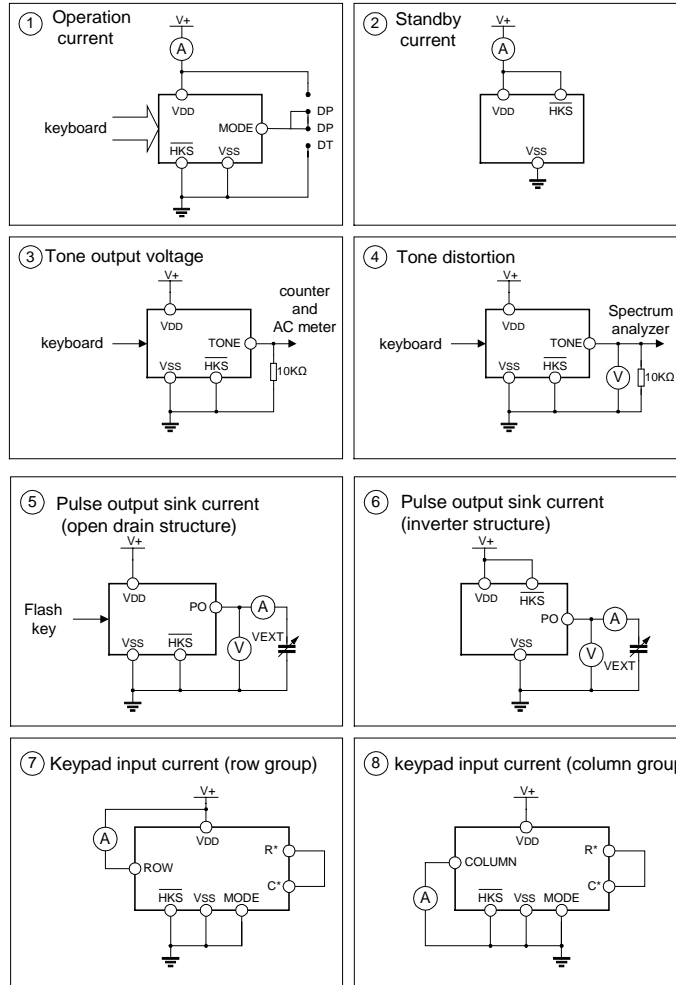
Procedure :  $\uparrow$  D1, D2..., Dn, P, C1 ..., Cn  $\downarrow$   
 Dial out : Dt1, Dt2 ..., Dtn, t<sub>P</sub>, Ct1 ..., Ctn (in Tone mode)  
 Dial out : Dp1, Dp2, ..., Dpn, t<sub>P</sub>, Cp1 ..., Cpn (in Pulse mode)  
 LNB : D1, D2..., Dn, P, C1, C2 ..., Cn

E) Flash Function

Procedure :  $\uparrow$  D1, D2..., Dn, F, C1 ..., Cn  $\downarrow$   
 Dial out : Dt1, Dt2..., Dtn, t<sub>F</sub>, t<sub>FP</sub>, Ct1 ..., Ctn (in Tone mode)  
 Dial out : Dp1, Dp2..., Dpn, t<sub>F</sub>, t<sub>FP</sub>, Cp1 ..., Cpn (in Pulse mode)  
 LNB : C1, C2 ..., Cn



**TEST CIRCUIT**



Note: 1. Dist. (dB)=20log{[V<sub>1</sub><sup>2</sup>+V<sub>2</sub><sup>2</sup>+V<sub>3</sub><sup>2</sup>+...V<sub>n</sub><sup>2</sup>]<sup>1/2</sup>/[(V<sub>L</sub><sup>2</sup>+V<sub>H</sub><sup>2</sup>)<sup>1/2</sup>]}

- a. V<sub>1</sub>...V<sub>n</sub> are extraneous frequencies (ie, inter modulation and harmonic), components in the 500Hz to 3400Hz band.
- b. V<sub>L</sub>,V<sub>H</sub> are the individual frequency components of DTMF signal.
- c. Whether keyboard is pushed refer to the TONE mode time diagram.

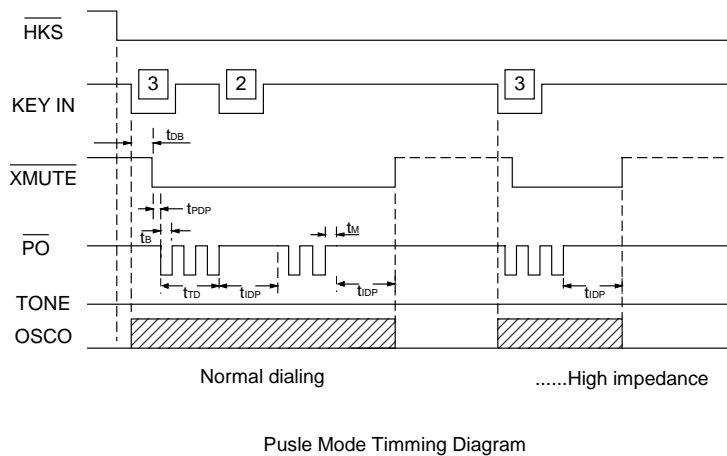
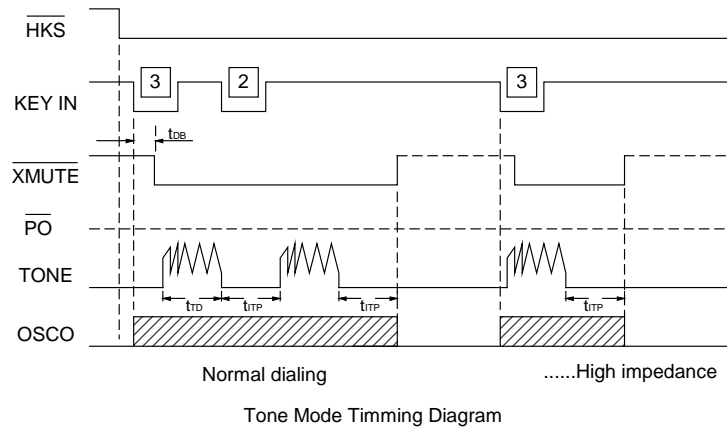
2. Sink current Isink=I/(1-Duty Cycle), I is the net DC current measured from ampere meter.

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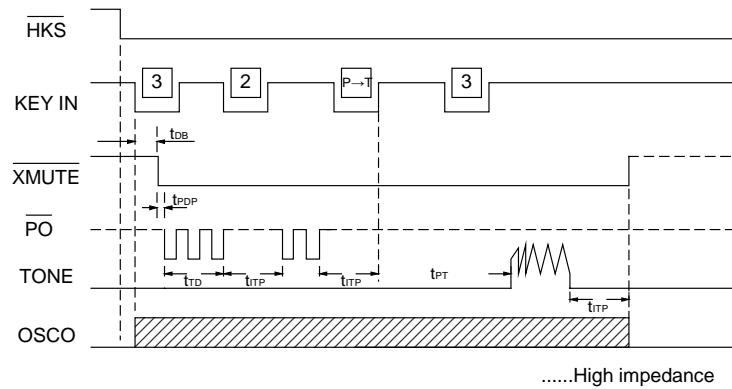
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3. R\*, C\* mean other column and row.

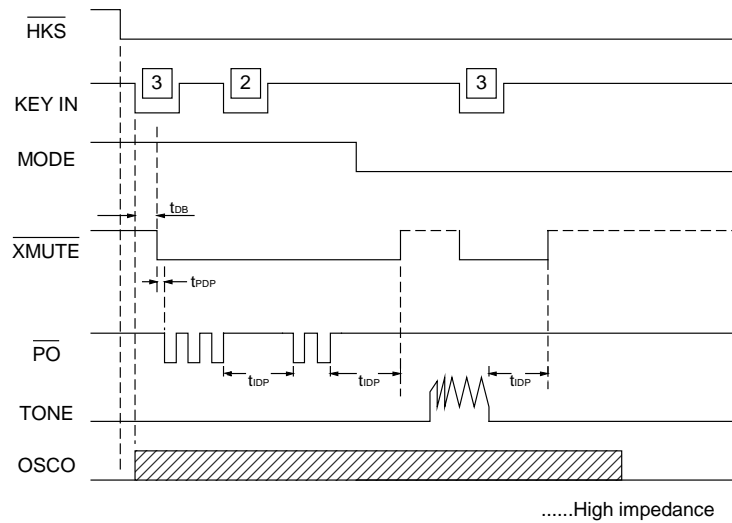
**TIMING DIAGRAMS**



**TIMING DIAGRAMS** (continued)

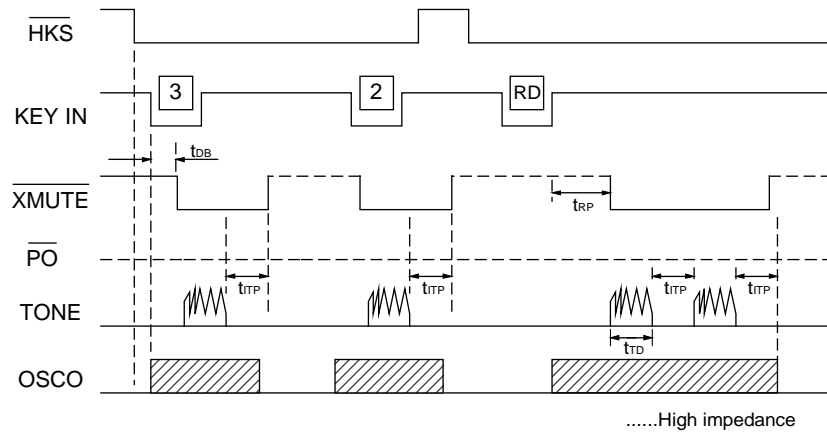


Timing Waveform for mixed dialing Operation  
(by \*T key entry)

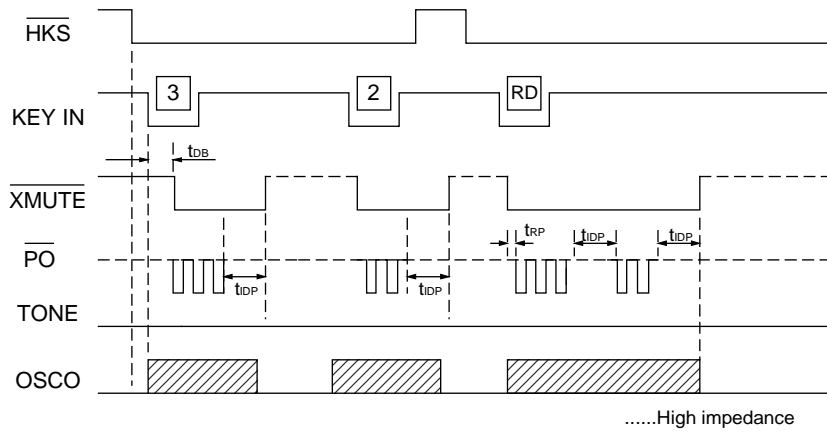


Timing Waveform for mixed dialing Operation  
(by MODE pin entry)

**TIMING DIAGRAMS**(continued)

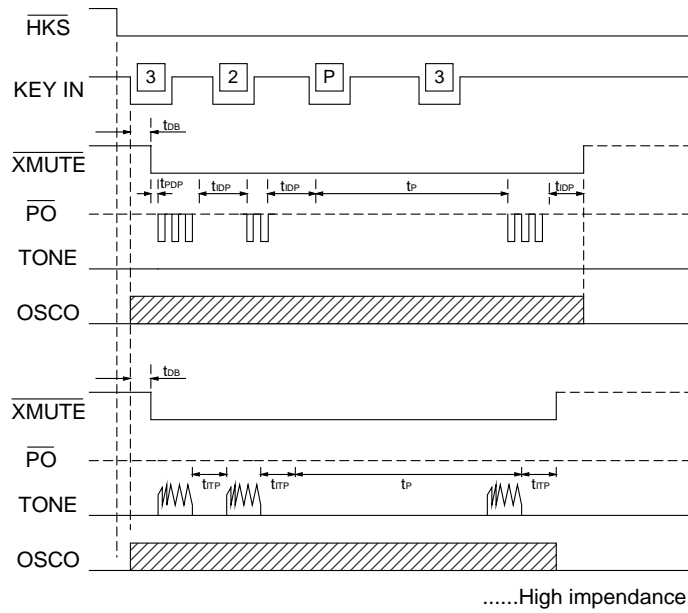


Tone Mode Redial Timing Diagram

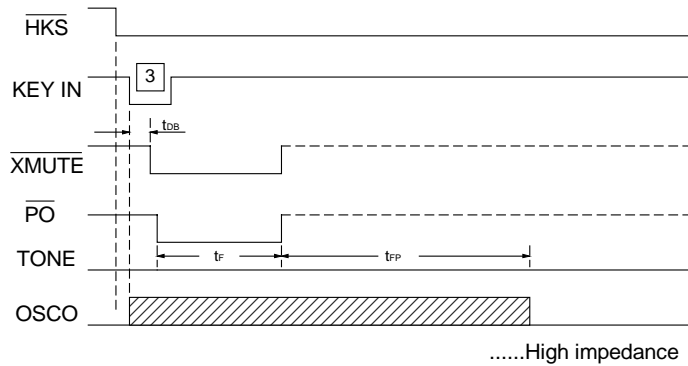


Pulse Mode Redial Timing Diagram

**TIMING DIAGRAMS**(continued)

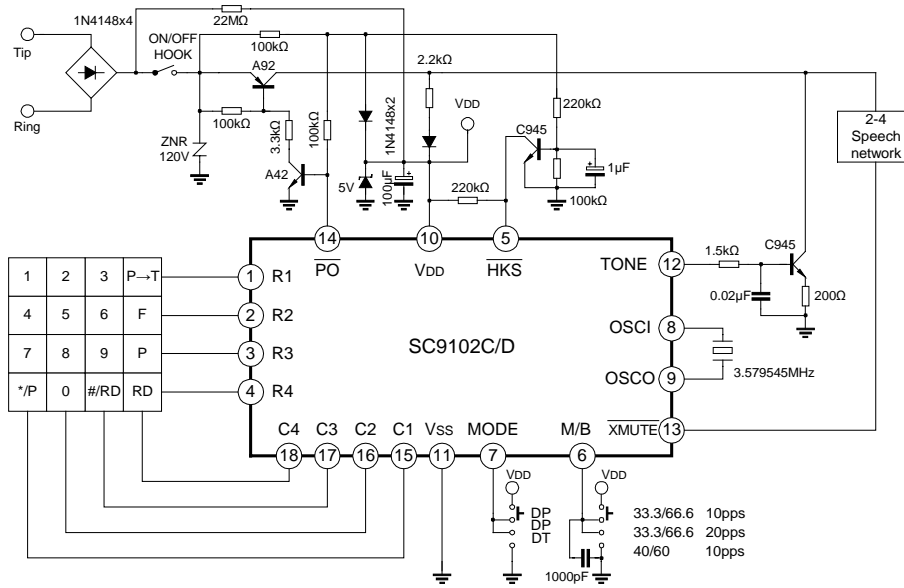


.....High impedance  
Pause key operating timing



.....High impedance  
Flash key operating timing

**TYPICAL APPLICATION CIRCUIT**



**CHIP TOPOGRAPHY**



Chip size: 1.35 x 1.33 mm<sup>2</sup>

**PAD COORDINATES** (Unit:  $\mu\text{m}$ )

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.

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**PACKAGE OUTLINE**

