

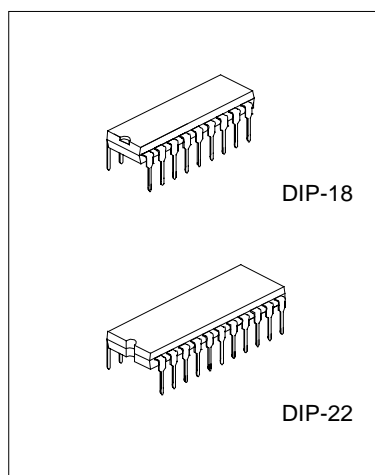
13 MEMORY TONE / PULSE DIALER WITH REDIAL SAVE HANDFREE & HOLD FUNCTION

DESCRIPTION

The SC91650A/B, SC91651A/B, SC91652A/B are 13-memory Tone/Pulse switchable dialer with Last Number Redial(LNB) and HOLD function, 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

- *13-memory Tone/Pulse switchable dialer
- *Three 16-digit one touch memory and ten 16-digit two touch memory
 - One 32-digit last number redial memory
 - One 32-digit SAVE function for storing phone number in off hook status
- Note: only 15-digit/31-digit for Tone mode, 1-digit use to identify tone mode
- *Pulse-to-tone (P→T) is provided for PBX operation
- *Flash key is available
- *Minimum tone duration is 100ms for SC91650, SC91651 or 91ms for SC91652
- *Minimum intertone pause is 106ms for SC91650, SC91651 or 91ms for SC91652
- *Uses 3.579545MHz crystal or ceramic resonator
- *Many options can be selected
 - Mode (10PPS; 20PPS; Tone)
 - M/B ratio (40:60;33:66)
 - Pause time (3.6s;2.0s)
 - Pulse number (n;n+1;10-n)
 - Flash function (RESET;digit)
 - (P→T) pause time (3.6s;1.0s)
 - Flash time (80ms; 93ms; 100ms; 200ms; 300ms; 600ms)
 - Flash pause time (200ms; 1000ms)
- * Redial pause time (1ms)
- * Mixed dialing and cascade dialing is provided
- * Handfree function is provided for speaker phone application

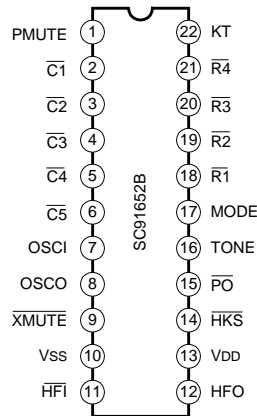
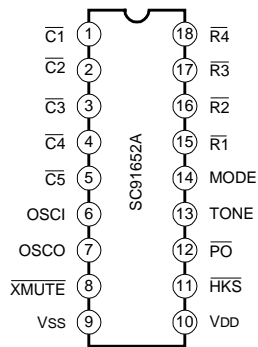
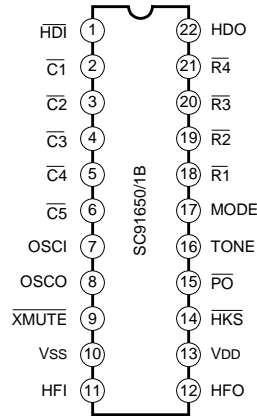
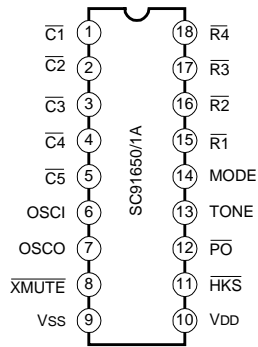


- *Power on reset circuit is provided
- *Hold function is provided
- * Keytone is provided
- *Packaged in 18-DIP or 22-DIP






ORDERING INFORMATION

SC91650A	DIP-18 Package
SC91650B	DIP-22 Package
SC91651A	DIP-18 Package
SC91651B	DIP-22 Package
SC91652A	DIP-18 Package
SC91652B	DIP-22 Package

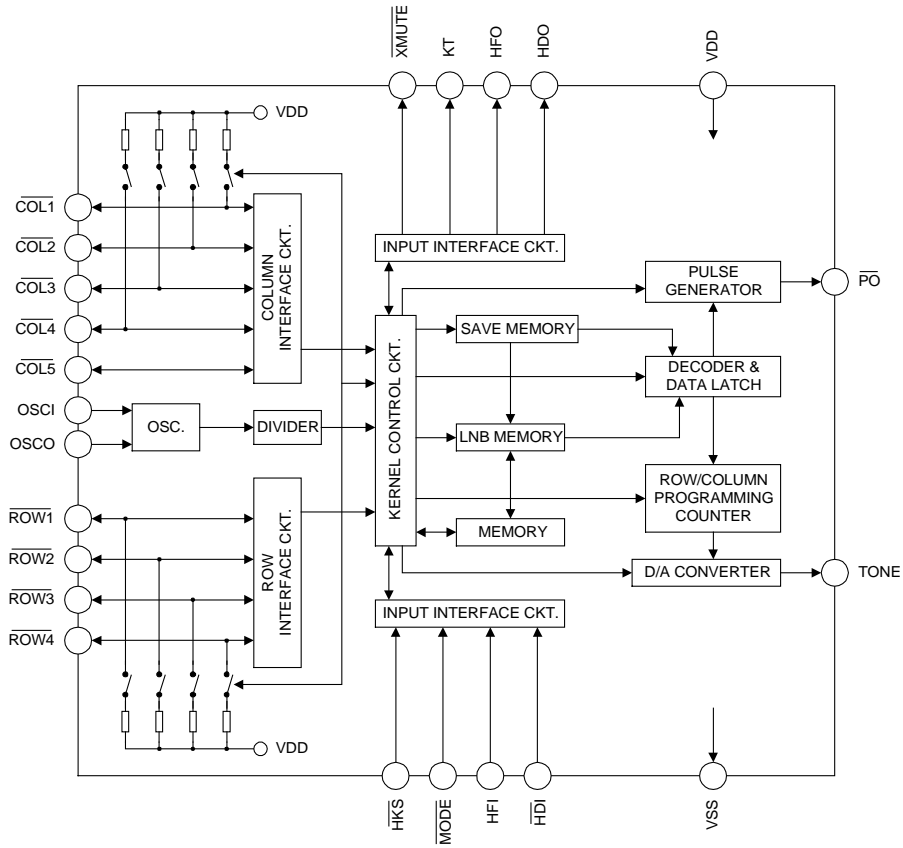
PIN CONFIGURATIONS



SELECTION GUIDE

	HDI	HFI	PO	PMUTE	KT	Tone Duration
SC91650A	N	N	Inverter	N	N	100mS
SC91650B			Inverter	N	N	100mS
SC91651A	N	N	Open drain	N	N	100mS
SC91651B			Open drain	N	N	100mS
SC91652A	N	N	Open drain	N	N	91mS
SC91652B	N		Open drain	Y	Y	91mS

BLOCK DIAGRAM



KEYBOARD ASSIGNMENT

	$\overline{C1}$	$\overline{C2}$	$\overline{C3}$	$\overline{C4}$	$\overline{C5}$
$\overline{R1}$	1	2	3	SAVE	EM1
$\overline{R2}$	4	5	6	F	EM2
$\overline{R3}$	7	8	9	A	EM3
$\overline{R4}$	*T	0	#	RD/P	ST

- 1) *T: In pulse mode, execute P→T function; In TONE mode, execute * key
- 2) SAVE: SAVE key.
- 3) F: Flash key
- 4) RD/P: Redial key/Pause key
- 5) ST: Store key
- 6) EMn: One touch memory key
- 7) A: Auto key for two touch memory

DIALING SIGNAL OPTION

The resistor connection between selected Row (or Column) and Vss may select most country telecom specifications (refer to Row and Column pin description). Those options include M/B ratio, Flash time, pause time, as follows.

a) Make/Break ratio:

Row1	M/B ratio (%)
NR	40:60
R	33:66

b) Pause time & P→T wait time:

Row2	tp(sec)	tpT(sec)
NR	3.6	3.6
R	2.0	1.0

c) Flash Key function:

Column1	Flash key	tFP(sec)
NR	Reset	0.2/0*
R	Digit	1.0

* for flash time = 80ms, 200ms only

d) Flash time:

Row3	Row4	Flash time (ms)
NR	NR	600
NR	R	300
R	NR	93 *100
R	R	200 *80

*for SC91652 only

e) Dialing out Pulse number:

Column3	Column4	Pulse number
NR	NR	n
NR	R	n+1
R	NR	10-n
R	R	reserved

- Note: 1). NR = No resistor connection to Vss.
 2). R = A resistor connection to Vss (820k typically).
 3). N = Pressed digit key.
 4). The following list is the corresponding pulse (break) numbers that are sent out by pressed the number keys.

Digit key	Normal (n)	New Zealand (10-n)	Sweden/Denmark (n+1)
1	1	9	2
2	2	8	3
3	3	7	4
4	4	6	5
5	5	5	6
6	6	4	7
7	7	3	8
8	8	2	9
9	9	1	10
0	10	10	1
*	P→T KEY	P→T KEY	P→T KEY
#	ignored	ignored	ignored

Dialing signal option

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, All voltage referenced to VSS, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
DC Characteristics							
Operating Voltage	VDD	Tone	2.0	--	5.5	V	
		Pulse	2.0	--	5.5		
		Memory retention	1.0	--	5.5		
Operating Current	IOP	Tone	--	0.4	1	mA	
		Pulse	OFF-HOOK, Keypad entry with pull down resistance	--	0.2		0.5
			OFF-HOOK, No Keypad entry		20		80
Standby Current	IS	ON-HOOK, No keypad entry	--	0.1	1.0	μA	
Memory Retention Current	Imr	ON-HOOK, VDD=1.0V	--	0.1	1.0	μA	
Control Pin Input Low Voltage	Vil	--	VSS		0.3VDD	V	
Control Pin Input High Voltage	Vih	--	0.7VDD		VDD		
XMUTE Pin Leakage Current	Imth	VXMUTE=6.0V	--	--	1	μA	
XMUTE Pin Sink Current	Imtl	VXMUTE=0.5V	0.2	--	--	mA	
HKS Pin Input Current	Ihks	Vhks=2.5V	--	--	0.1	μA	
Keyboard Scanning Pin	Drive Current	Ikbd	Vn=0V (note1), No resistors connected to VSS	2	10	50	μA
	Sink Current	Ikbs	Vn=2.5 (note1) No resistors connected to VSS	200	400	800	
Key-in Debounce Time	tDB	--	--	20	--	ms	
HFI pin input resistor	Rhfi	VDD=2.5V	--	200	--	kΩ	
HFO pin drive current	Ihdoh	Vhfo=2.0V	0.2	--	--	mA	
HFO pin sink current	Ihdol	Vhfo=0.5V	0.2	--	--	mA	
HDI pin pull high resistor	Rhdi	VDD=2.5V	--	200	--	kΩ	
HDO pin drive current	Ihdoh	Vhdo=2.0V	0.2	--	--	mA	
HDO pin sink current	Ihdol	Vhdo=0.5V	0.2	--	--	mA	
Pulse Mode							
Pulse Output Pin Leakage Current	Ipoh	Vpo=2.0V(SC91650 only)	0.2	--	--	mA	
Pulse Output Pin Sink Current	Ipol	Vpo=0.5V	0.2	--	--	mA	
Pulse Rate	fpr		--	10	--	pps	
			--	20	--		
Make/Break Ratio	tM: tB		--	40:60	--	%	
			--	33:66	--		

(to be continued)

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(continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Pre-digit Pause	tPDP	M/B ratio=40:60	--	40	--	ms	
		M/B ratio=33:66	--	33	--		
Inter-digit Pause	tIDP	Pulse rate=10pps	--	800	--	ms	
		Pulse rate=20pps	--	500	--		
Tone Mode							
Tone	DC Level	Vdc	VDD=2.0V~5.5V	0.5VDD	--	0.7VDD	V
	Sink Current	I _{tl}	V _{dtmf} =0.5V	0.2	--	--	mA
Output Pin	AC level	V _{dtmf}	Row group, R _L =5KΩ	130	155	180	mV _{rms}
	Load Resistor	R _I	Dist.< -23dB	5	--	--	KΩ
DTMF Signal	Pre-emphasis	twist	VDD=2.0~5.5 V, Column-Row group	1	2	3	dB
	Distortion	Dist.	R _L =5KΩ	--	-30	-23	dB
Minimum tone duration Time (note 3)	t _{TD}	Auto redial	--	100	--	ms	
			--	91	--	ms	
Minimum Intertone Pause Time (note 3)	t _I TP	Auto redial	--	106	--	ms	
			--	91	--	ms	

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

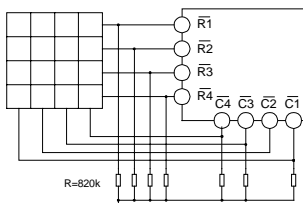
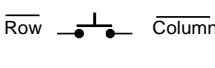
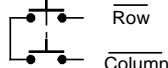
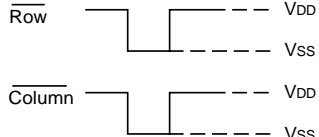
$$2. \text{Distortion (dB)} = 20\log\left\{\frac{[V_1^2+V_2^2+V_3^2+\dots+V_n^2]^{1/2}}{[(V_L^2+V_H^2)^{1/2}]}\right\}$$

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	+0.28
R2	f2	770	-0.52
R3	f3	852	-0.47
R4	f4	941	+0.74
C1	f5	1209	+0.57
C2	f6	1336	-0.30
C3	f7	1477	-0.34

PIN DESCRIPTION

Pin No.						Pin Name	Description
650A/B	651A/B	652A/B	653A/B	654A/B	655A/B		
1	2	1	2	1	2	$\overline{C1}$	*Provides keyboard scanning. a. Dialling option: *The resistor connection between selected Row (or Column) and Vss may select most countries telecom specification.
2	3	2	3	2	3	$\overline{C2}$	
3	4	3	4	3	4	$\overline{C3}$	
4	5	4	5	4	5	$\overline{C4}$	
5	6	5	6	5	6	$\overline{C5}$	
15	18	15	18	15	18	$\overline{R1}$	b. Keyboard scanning: *While \overline{HKS} pin is HIGH, Both column pin and row pin are in floating state. While \overline{HKS} pin is LOW, the column group stays in "HIGH" state and row group stays in "LOW" state. *The keypad is compatible with the standard dual contact matrix keyboard (as figure 1b), the inexpensive single contact keyboard (as figure 1a), and electronic input (as figure 1c).
16	19	16	19	16	19	$\overline{R2}$	*When \overline{HKS} is "LOW", a valid key entry is defined by related Row & Column connection or by electronic input (as shown in figure 1c). *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)
17	20	17	20	17	20	$\overline{R3}$	 
18	21	18	21	18	21	$\overline{R4}$	

(to be continued)

(continued)

Pin No.						Pin Name	Description
650A/B		651A/B		652A/B			
6	7	6	7	6	7	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)
7	8	7	8	7	8	OSCO	*When $\overline{\text{HKS}}$ is "LOW", a valid key-in may turn on this oscillator and generates a 3.579545 MHz clock.
8	9	8	9	8	9	$\overline{\text{XMUTE}}$	*Mute output pins. *NMOS open drain output structure. *The output is in "LOW" state during dialing sequence (both Pulse and Tone mode) and in Hold status otherwise this pin is "high-impedance". *Long (continue) Mute.
9	10	9	10	9	10	VSS	*Negative power supply pin.
10	13	10	13	10	13	VDD	*Positive power supply pin.
11	14	11	14	11	14	$\overline{\text{HKS}}$	*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.
12	15	12	15	12	15	$\overline{\text{PO}}$	*Pulse output signal pin. *Inverter output structure (SC91650). *The output is "LOW" during pulse dialing and Flash operation, otherwise this output is "high". *NMOS open drain output structure.
13	16	13	16	13	16	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 (tTD) and minimum intertone pause time to support rapid key-in. If key-in time is less than tTD (100ms), DTMF signal will last for tTD (100ms); otherwise the tone duration will last as long as the key is pressed.
14	17	14	17	14	17	MODE	*Mode select pin. *Tri-state input structure. *This pin can select following three modes.

(to be continued)

(continued)

Pin No.			Pin Name	Description
650A/B	651A/B	652A/B		
11	11		HFI	*Handfree input control pin. (SC91650, SC91651) *Toggle input structure, rising edge trigger. *It is used to enable and disable Handfree funtion. *With waveshaped by a built-in Schmit trigger, the bounce of input can be eliminated by external R-C debounce circuit. * A built-in pull down resistor is 200kΩ typical.
			$\overline{\text{HFI}}$	* Toggle input structure with pull up resistance 200kΩ, falling edge trigger. (SC91652)
12	12	12	HFO	* Handfree output pin. * Inverter output structure (normally 'low', active 'high'). * When a HFI pin is active, Handfree function will be enabled (HFO=1) or disable (HFO=0). * When the Handfree function is enable (HFO=1), after OFF-HOOK action, it can reset Handfree function and HFO pin return to 'low' state.
1	1		$\overline{\text{HDI}}$	*Hold line input control pin. *Toggle input structure, falling edge trigger. *It is used to enable and disable Hold line function. *With waveshaped by a built-in Schmit trigger, the bounce of input can be eliminated by extenal R.C debounce circuit. *A built-in pull up resistor is 200kΩ typically.
22	22		HDO	*Hold line output pin. *Inverter output structure, falling edge trigger. *When a falling edge signal triggered $\overline{\text{HDI}}$ pin, Hold line function will be enable (HDO=1) or disabled(HDO=0). *When the Hold line function is enable (HDO=1), after OFF-HOOK action or HFO pin is from "low" to "high", it can reset Hold line function and HDO pin return to "low" state.
			KT	*Keytone output pin for ralid key pad input and memory stored (SC91652 only). *CMOS invertor output structure. *It will issue a 1.2kHz, duty cycle 50% signal with duration 30ms. *To prevent signal interference, while DTMF issue, it will disable Keytone output except function key.
			PMUTE	*Pulse mode mute. *CMOS inverter output structure. *The output is high state during dialing sequence (pulse mode only), otherwise this pin is low.

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REV: 1.0 2001.01.15

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 horizontal line) : Input level from low to high.
- d) \downarrow (with horizontal line) : 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.
- n) M1 ... Mm : Memory location; 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

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 (reset function only)
 LNB : Un change (Digit Function only)

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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B) Mixed dialing

Procedure	:	\uparrow D1, D2..., MODE= \downarrow , D9, D10 ..., Dn \downarrow ; or \uparrow D1, D2..., P \rightarrow T, D9, D10 ..., Dn \downarrow
Dial out	:	Dp1, Dp2, ..., t _{PT} , 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 _{RP} , Dt1, Dt2..., Dtn (In Tone mode)
Dial out	:	t _{RP} , 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 _P , Ct1, Ctn (in Tone mode)
Dial out	:	Dp1, Dp2, ... Dpn, t _P , Cp1 ..., Cpn (in Pulse mode)
LNB	:	D1, D2..., Dn, P, C1, C2 ..., Cn

E) Flash Function

1. Reset

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

2 Digit

Procedure	:	\uparrow D1, D2..., Dn, F, C1 ..., Cn \downarrow
Dial out	:	Dt1, Dt2, ..., Dtn, t _F , t _{FP} , Ct1 ..., Ctn (in Tone mode)
Dial out	:	Dp1, Dp2, ..., Dpn, t _F , t _{FP} , Cp1 ..., Cpn (in Pulse mode)
LNB	:	D1, D2 ..., Dn

F) One Touch Memory Function

1. Store Memory

Procedure : \uparrow ST, D1, D2..., Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,..... Dn

Procedure : \uparrow ST, D1, D2.....,F, Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,.....,F,Dn

Procedure : \uparrow ST, D1, D2.....,P, Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,.....,P,Dn

Procedure : \uparrow ST, D1, D2.....,P \rightarrow T, Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,....., P \rightarrow T,Dn

2 Quickly Store

Procedure : \uparrow ST, D1, D2, ST, EM1, ST, D3, D4, D5, St, EM2, ST, EMn \downarrow

Dial out : Nothing

EM1 = D1, D2; EM2 = D3, D4, D5, EMn = D3, D4, D5

LNB : D1, D2 ..., Dn

3 Redial

EMn = D1, D2,Dn

Procedure : \uparrow EMn \downarrow

Dial out : Dt1, Dt2, Dtn (in tone mode)

Dial out : Dp1, Dp2, Dpn (in pulse mode)

LNB : D1, D2,.....Dn

G) Two Touch Memory Function

1. Store Memory

Procedure : \uparrow ST, D1, D2..., Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,..... Dn

Procedure : \uparrow ST, D1, D2.....,F, Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,.....,F,Dn

Procedure : \uparrow ST, D1, D2.....,P, Dn, ST, EMn \downarrow

Dial out : Nothing

EMn = D1, D2,.....,P,Dn

Procedure : ↑ ST, D1, D2.....,P→T, Dn, ST, EMn ↓
 Dial out : Nothing
 EMn = D1, D2,....., P→T,Dn

2 Quickly Store

Procedure : ↑ ST, D1, D2, ST, EM1, ST, D3, D4, D5, St, EM2, ST, EMn ↓
 Dial out : Nothing
 EM1 = D1, D2; EM2 = D3, D4, D5, EMn = D3, D4, D5
 LNB : D1, D2 ..., Dn

3 Redial

EMn = D1, D2,Dn
 Procedure : ↑ EMn ↓
 Dial out : Dt1, Dt2, Dtn (in tone mode)
 Dial out : Dp1, Dp2, Dpn (in pulse mode)
 LNB : D1, D2,.....Dn

H) Save Function

1. The Second Redial Memory

Procedure : ↑ D1, D2, Dn, dialing end, SAVE ↓
 Dial out : Dt1, Dt2, Dtn (in tone mode)
 Dial out : Dp1, Dp2, Dpn (in pulse mode)
 LNB : D1, D2, Dn

2 Store Phone Number In Conversation

Procedure : ↑ ST, D1, D2, Dn, conversation, ST, C1, C2, Cn, ST, SAVE ↓
 Dial out : Dt1, Dt2, Dtn (in tone mode)
 Dial out : Dp1, Dp2, Dpn (in pulse mode)
 SAVE : C1, C2, Cn
 LNB : C1, C2, Cn

Note: If key in digit over maximum digit stored in SAVE, then SAVE is ignore.

The data in SAVE is no change, and can dial out after on/off hook.

3 Redial

SAVE : D1, D2, Dn
 Procedure : ↑ SAVE ↓
 Dial out : Dt1, Dt2, Dtn (in tone mode)
 Dial out : Dp1, Dp2, Dpn (in pulse mode)
 LNB : D1, D2,.....Dn(SC91652 only)
 LNB : Un change (SC91650, SC91651)

I) Cascade Dialing

1. Normal Dialing and Memory

Procedure : \uparrow D1, D2, Dn, EM1, EMm ... EMn, A, Mn \downarrow

2. One Touch Memory and Memory

Procedure : \uparrow EMm Emn, A, Mn \downarrow

3. LNB and Memory

Procedure : \uparrow RD, EM1, EMm EMn, A, Mn \downarrow

4. SAVE and Memory for SC91652 only

Procedure : \uparrow SAVE, EM1, EMm EMn, A, Mn \downarrow

Handfree Function operation:

A) To execute Handfree function: When HFO = 'low', HFI pin is active, the Handfree function will be enabled (HFO = 'high')

B) Reset Handfree function:

- a. OFF-HOOK action.
- b. When HFO = 'high', a HFI pin is active again, the Handfree function will be reset (HFO='low').
- c. When HDO pin is from "low" to "high", the Handfree function will be reset (HFO="low").

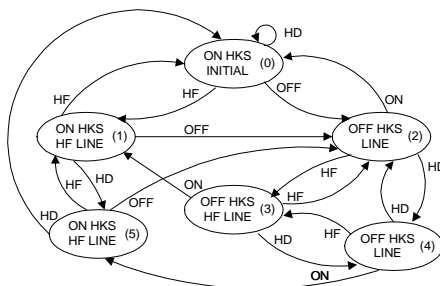
Hold Line Function Operation:

A) To execute Hold Line function: When HFO = 'high' state or HKS is low, HDI pin is active, the Hold line function will be enable (HDO = "high"). The $\overline{\text{XMUTE}}$ pin keep to "low", when HDO stays in "high" state.

B) Reset Hold Line function:

- a. OFF-HOOK action.
- b. HFO pin from "low" to "HIGH level.
- c. When HDO = "high", HDI pin is active, the Hold line function will be disabled (HDO="low").

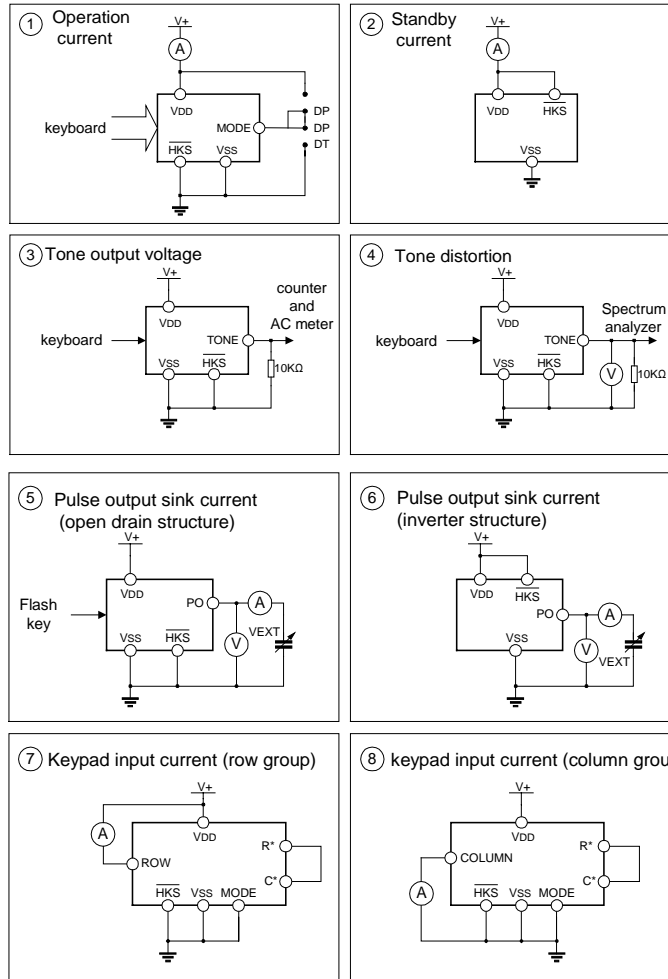
Operating flow chart of Handfree



STATE NO.	\overline{PO}	\overline{XMUTE}	HFO	HDO
(0) INITIAL STATE	0/F	F	0	0
(1) ON HKS HF LINE	1/F	F	1	0
(2) OFF HKS LINE	1/F	F	0	0
(3) OFF HKS HF LINE	1/F	F	1	0
(3) OFF HKS HD LINE	1/F	0	0	1
(3) ON HKS HD LINE	1/F	0	0	1

ON/OFF: ON/OFF HKS
 HF: Depress HF key
 HD: Depress HF key
 F: Floating (Hi-impedance)
 \overline{PO} is floating for SC91651/
 SC91652 open drain
 struc-ture.

TEST CIRCUIT

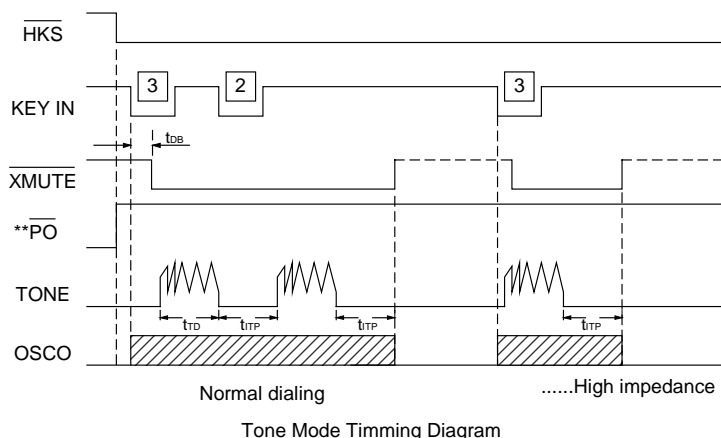


Note: 1. Dist. (dB)=20log{[V₁²+V₂²+V₃²+...V_n²]^{1/2}/[(V_L²+V_H²)^{1/2}]}
 a. V₁...V_n are extraneous frequencies (ie, inter modulation and harmonic), components in the 500Hz to 3400Hz band.
 b. V_L,V_H are the individual frequency components of DTMF signal.
 c. Whether keyboard is pushed refer to the TONE mode time diagram.

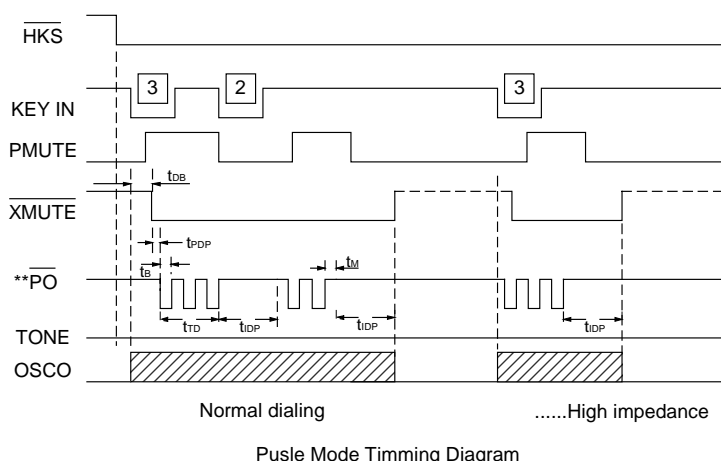
2. Sink current Isink=l/(1-Duty Cycle), l is the net DC current measured from ampere meter.

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

TIMING DIAGRAMS

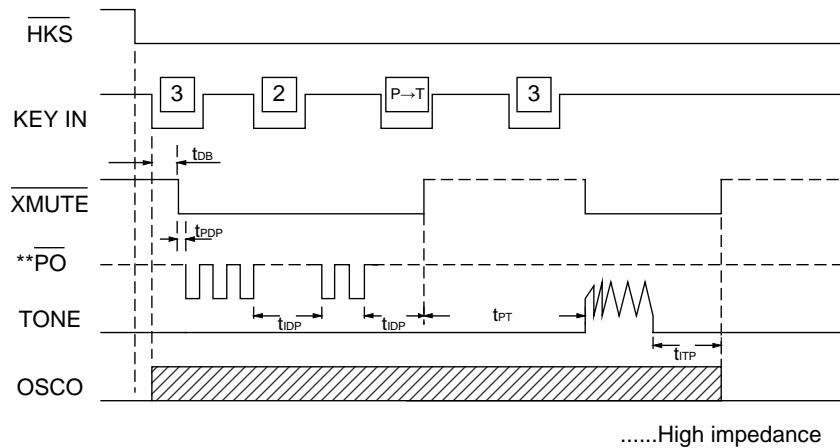


Tone Mode Timing Diagram

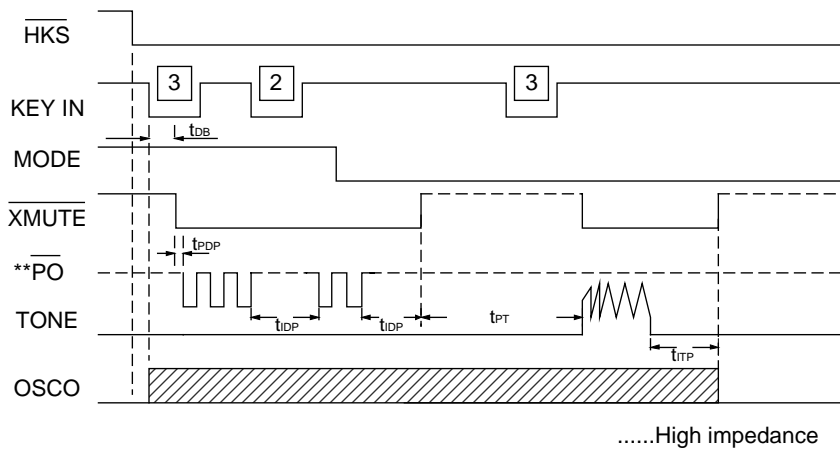


Pulse Mode Timing Diagram

TIMING DIAGRAMS (continued)

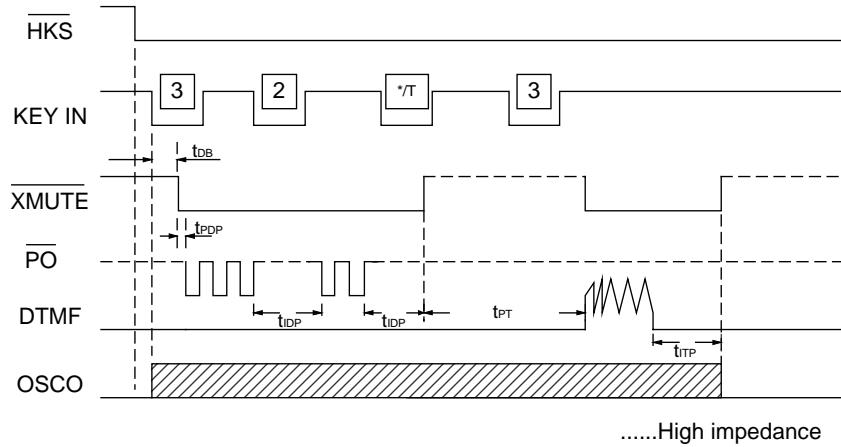


Timing Waveform for mixed dialing Operation (by *T key entry)
for SC91650, SC91651

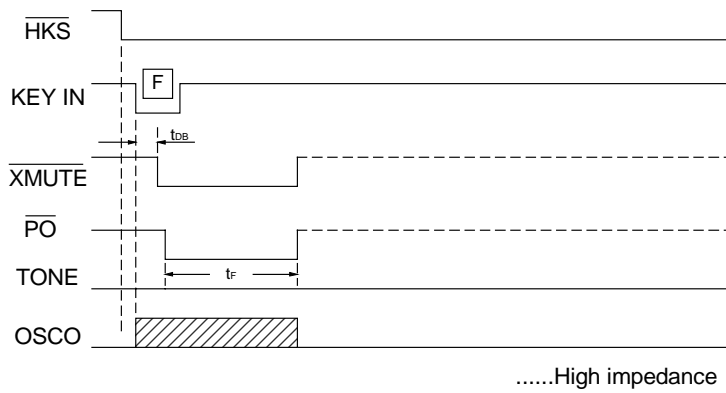


Timing Waveform for mixed dialing Operation (by mode selection pin switches)
for SC91650, SC91651

TIMING DIAGRAMS (continued)

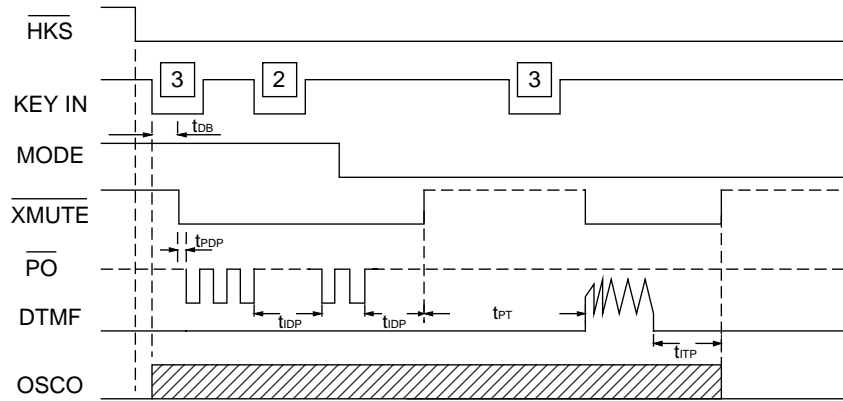


Timing Waveform for mixed dialing Operation (by *T key entry)
for SC91652 only



Flash key operating timing

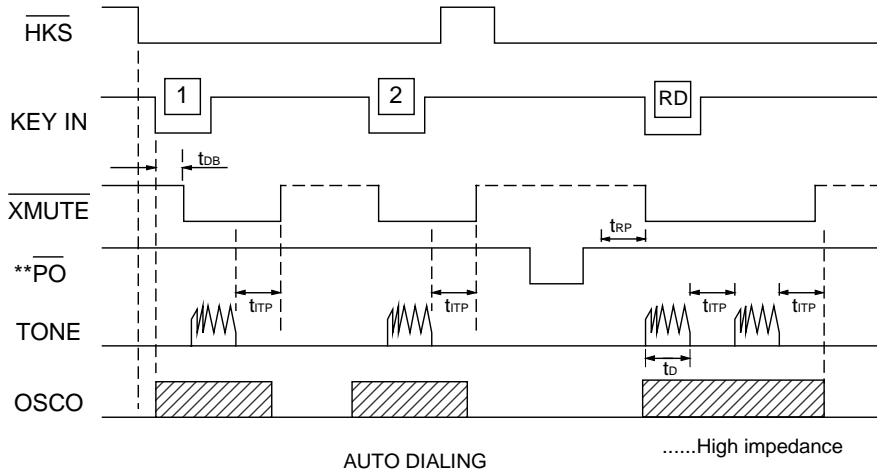
TIMING DIAGRAMS (continued)



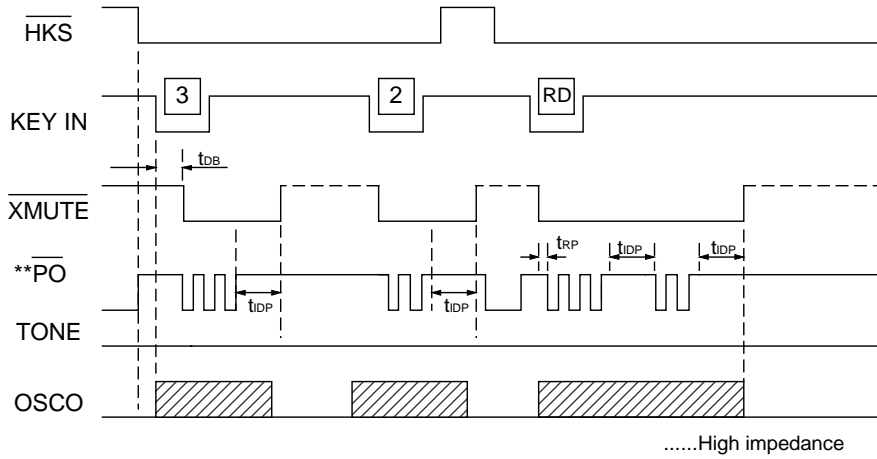
.....High impedance

Timing Waveform for mixed dialing Operation (by mode selection pin switches)
for SC91652 only

TIMING DIAGRAMS (continued)

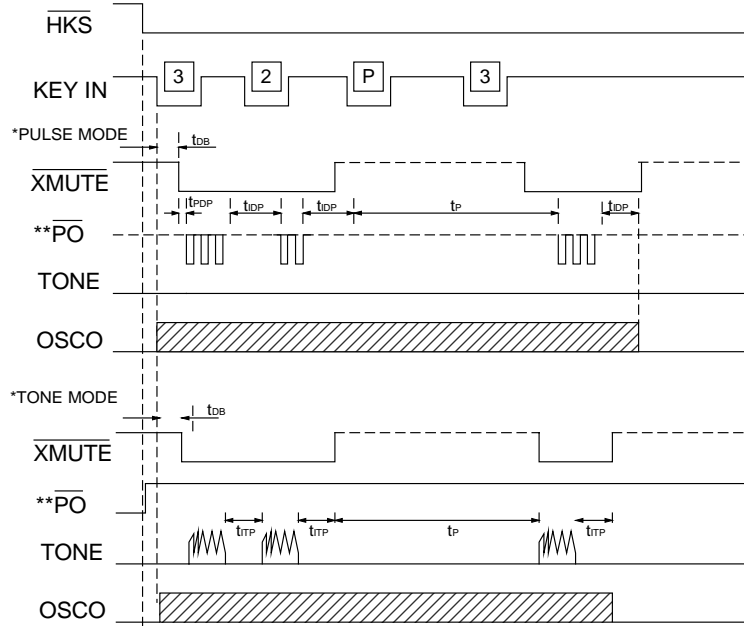


Tone Mode Redial Timing Diagram



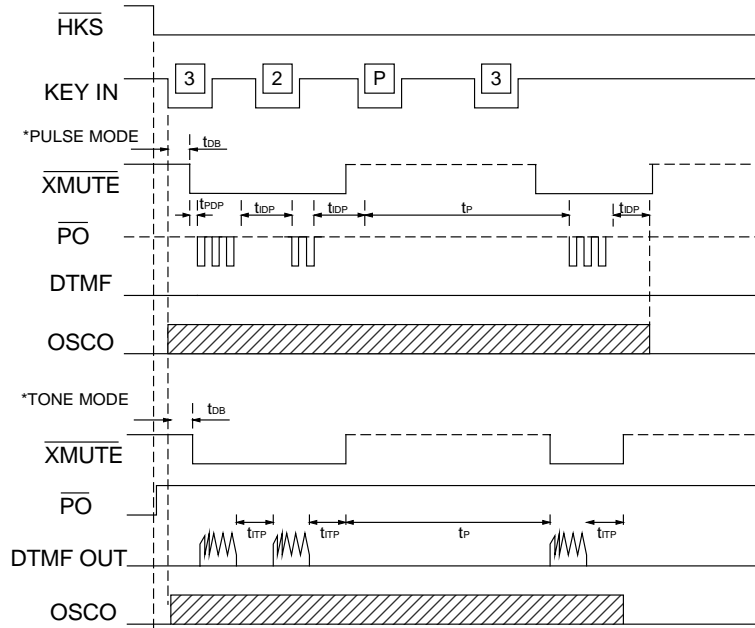
Pulse Mode Redial Timing Diagram

TIMING DIAGRAMS (continued)

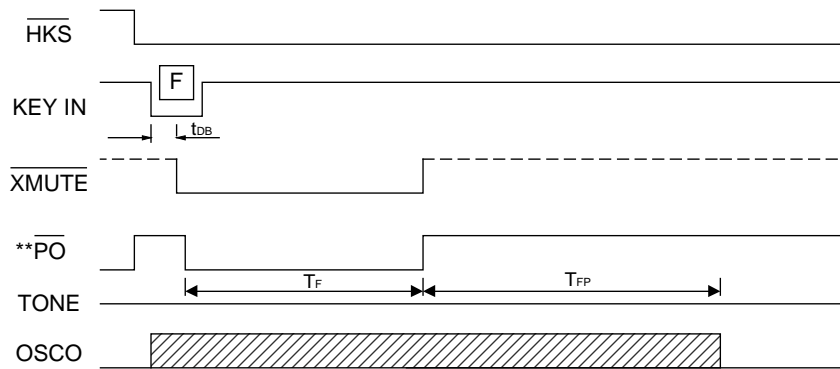


.....High impedance
Pause key operating timing (for SC91650, SC91651)

TIMING DIAGRAMS (continued)



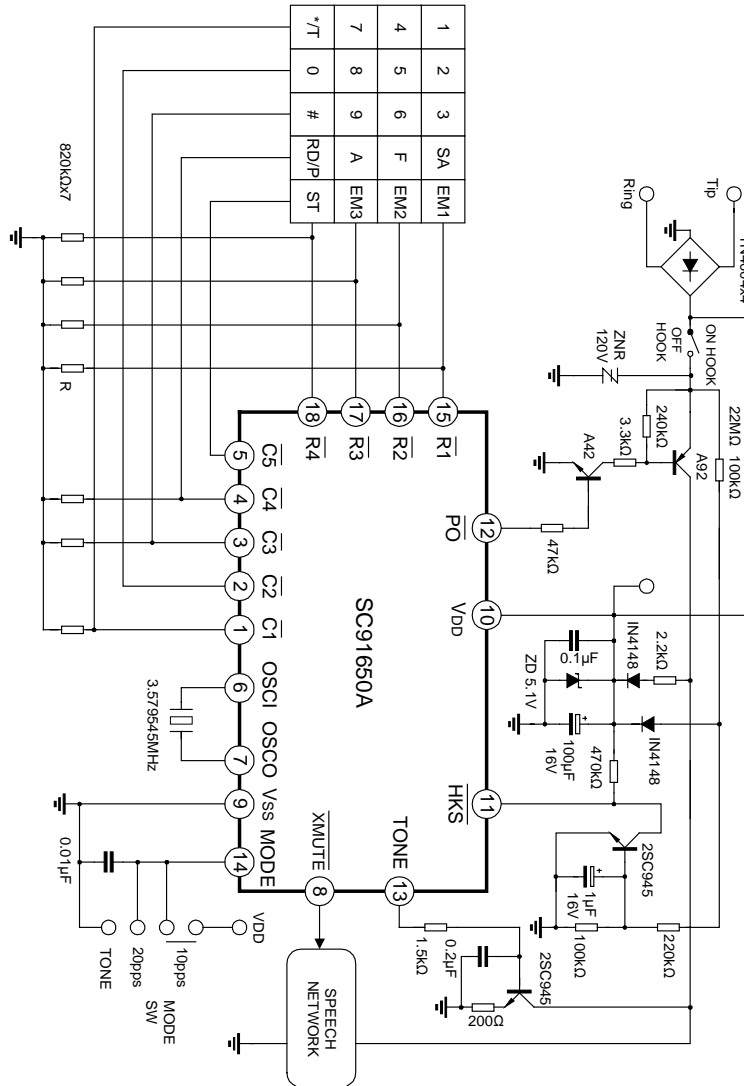
.....High impedance
Pause key operating timing(for SC91652 only)



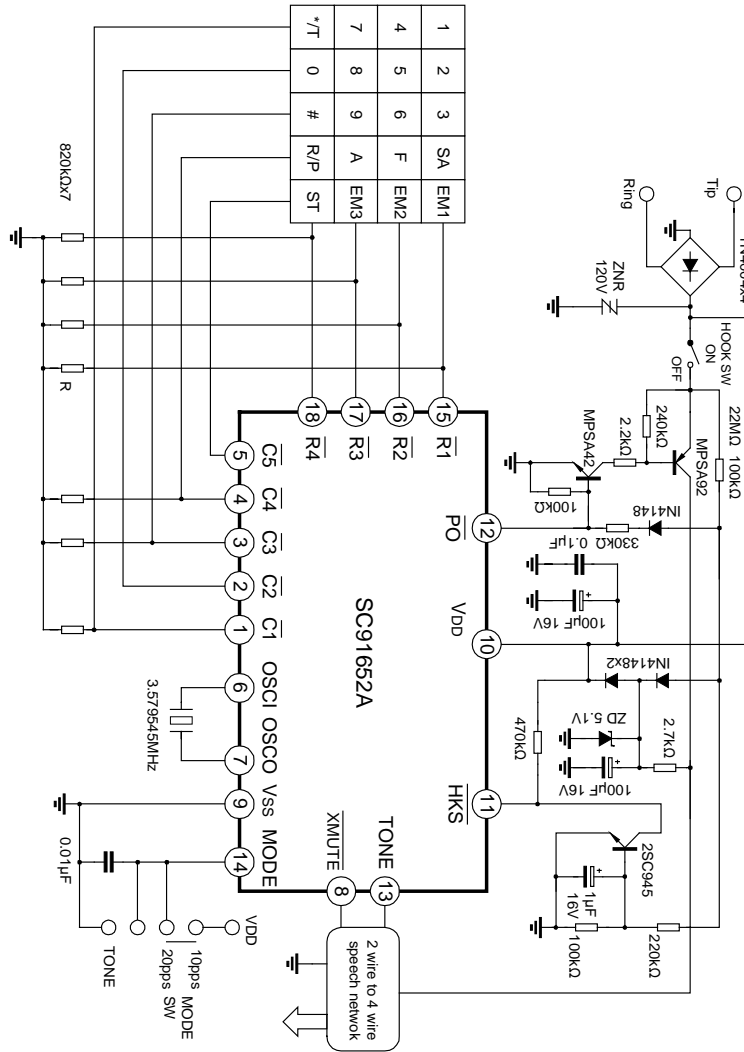
.....High impedance

Flash key operation timing

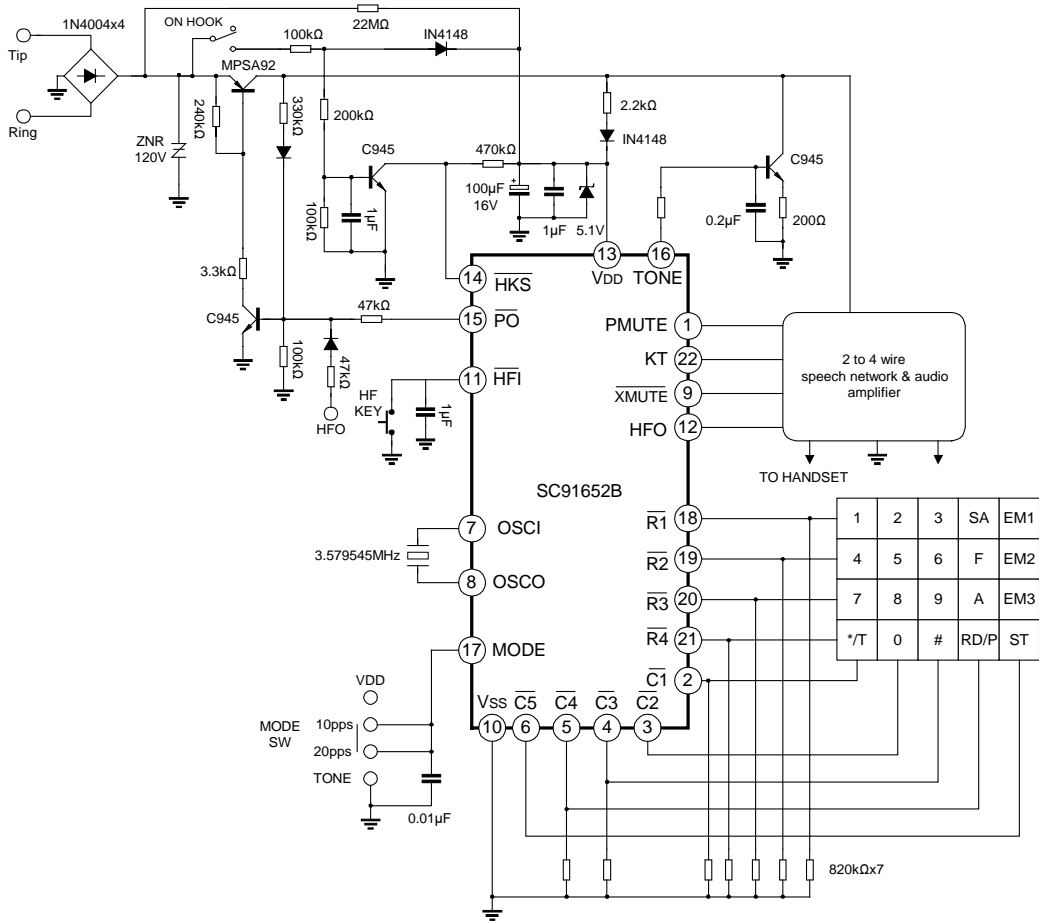
TYPICAL APPLICATION CIRCUIT (for SC91650A)



TYPICAL APPLICATION CIRCUIT (for SC91652A)



TYPICAL APPLICATION CIRCUIT (for SC91652B)



PACKAGE OUTLINE

