NOVATEK

NOVATEK

NT93403-05x

PRELIMINARY

Multi-Feature Phone LSI With LCD Driver

Features

4-bit CMOS

- The NT93403-05X is a multi-feature tone/pulse dialer based on a CMOS 4-bit single chip microcomputer with 5120 X 10 bit ROM and 1204 X 4 bit RAM capacity
- Built-in LCD driver and direct interface with 16-digit LCD display

Dialing

- Dialing parameters are set by external diodes and the SELECT pin
- Built-in high-precision dual-tone multi-frequency (DTMF) generator and on-chip pulse dialer
- Switchable tone/pulse dialing
- Dialing speeds of 10 or 20 pps and Make/Break Ratio of 40/60 or 33/67
- Normal or Sweden/Denmark modes for number of pulses selectable
- Minimum DTMFsignal duration/separation guaranteed
- Chain dialing
- Manual dialing will execute as many digits as entered
- Redial function (up to 48 digits)

Long distance control

- Three long distance control functions are available:
  (1) Key Lock: The chip will detect the key lock status
  (2) Pass Code: The chip will check pass code. (pass code replaces key)
  (3) Key and pass code
- With the diode setting, three defaults can be chosen: 0,168
- Three-digit restriction codes are user-programmable
- For restriction dialing, "0" and "168" can be restricted simultaneously
- Complete and strict restriction dialing function. For example, "pause" key + "0" key will not dial out for "0" restriction dialing
- "SOS" key is provided for forgotten pass codes, which when depressed, automatically resets to 000

Memory

- 13 24-digit memory locations: 3 direct and 20 indirect memories
- 3 single button dialing memories
- One-touch auto-dialing and abbreviated dialing
- "MEM"key used for abbreviated dialing
- "EM1", "EM2" and "EM3" memory locations are provided

Pause, Flash, Hold, Mute, P/T

- Pause time programmable from 1 to 5 seconds (1 second resolution) by key entry
- Flash time programmable from 90, 100 msec to 900 msec (100 msec resolution) by key entry
- Manual HOLD key controls HOLDOUT signal. Hold mode can be released by $\overline{\text{HOLDIN}}$ input pin
- HOLD LCD indicator (blinking) and HOLDOUT for music during hold
- Manual MUTE key controls $\overline{\text{XMUTE}}$ signal
- Pulse to tone key function

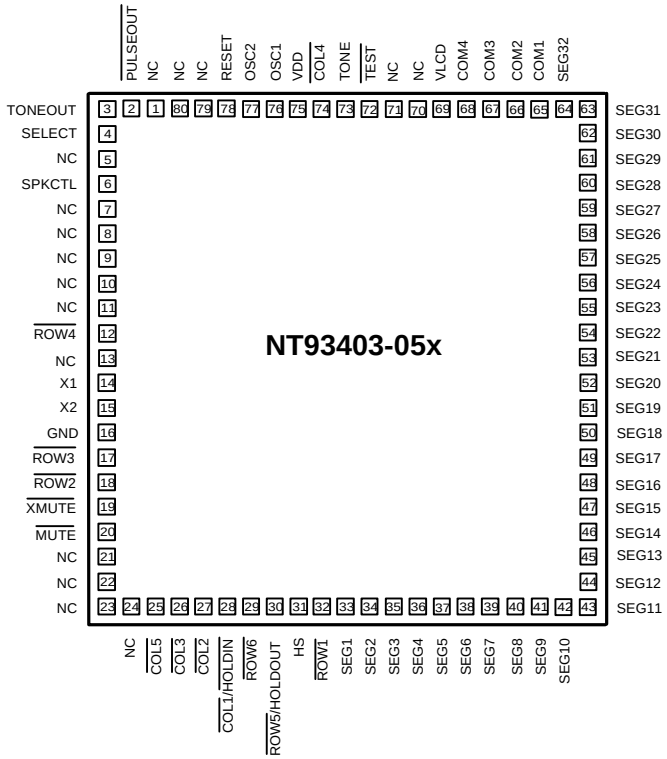
Other Features

- 5 sets of the last dialed phone numbers (up to 24 digits) and dialing time (mm-ss)
- LCD self testing function
- Calendar and real time clock display with 12-hour format and AM/PM indicator
- Key-in tone output for valid key data
- Error display and error beep sounds when sequence is entered incorrectly
- Speaker phone control output and LED control pin are provided
- Reset pin provided
- 5 X 7 matrix keypad interface
- Operating Voltage Range: 2.5V - 5.5V

General Description

NT93403-05X is a CMOS, silicon integrated circuit designed for multi-feature phones. This LSI provides the following functions: one-touch/abbreviated dialing, message function, redial, programmable flash, pause, lock, password, key-in tone, hold, and mute. The device also includes a DTMF generator, on-chip pulse dialer, LCD drive/controller and a 32 kHz watch oscillator circuit.

Pad Configuration



Keyboard Configuration

$\overline{COL1}$	$\overline{COL2}$	$\overline{COL3}$	$\overline{COL4}$	$\overline{COL5}$	
1	2	3	EM1	CLOCK	$\overline{ROW1}$
4	5	6	EM2	TIMER	$\overline{ROW2}$
7	8	9	EM3	NOT USED	$\overline{ROW3}$
*/TONE/AM	0	#/LOCK/PM	NOT USED	UP	$\overline{ROW4}$
MEM	PAUSE	FLASH	NOT USED	DOWN	$\overline{ROW5}$
REDIAL	HOLD	STORE	LD	NOT USED	$\overline{ROW6}$
PASSWORD	MUTE	SPEAKER	TONE	NOT USED	GND

Key Description

Key Name	Description
0 - 9	Number key
*/TONE/AM	✳ key, Pulse → Tone change key,and AM key
#/LOCK/PM	# key, Lock number setting key,and PM key
MEM	Abbreviated memory location key
PAUSE	Pause key
FLASH	Flash key
REDIAL	Redial and one-key redial key
HOLD	Hold key
STORE	Store key
PASSWORD	Password setting key
MUTE	Mute control key
SPEAKER	HANDS-FREE mode key
EM1, EM2, EM3	One-touch emergency recall key
LD	Line disconnect key
CLOCK	CLOCK KEY
TIMER	Stopwatch Start/stop Key
UP	Up searching key for 5 last sets of dialed numbers and time
DOWN	Down searching key for 5 last sets of dialed numbers and time
TONE	Pulse → Tone change key

Pin Description

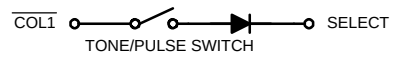
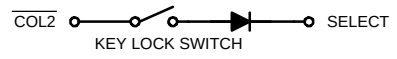
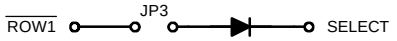
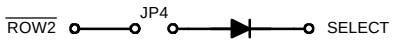
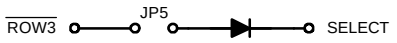
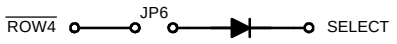
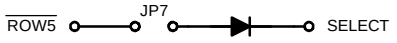
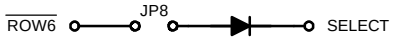
Pin No.	Symbol	I/O	Description
1	NC		No Connection
2	$\overline{\text{PULSEOUT}}$	O	Dial pulse output
3	TONEOUT	O	Key-in tone, error beep and confirmation beep output. Key-in tone is 875Hz and sends output for about 60 msec
4	SELECT	O	TONE/PULSE dialing, FREE/LOCK, 10 pps/20 pps, Make/Break ratio, Flash time, Message Function enable/disable select pin
5	NC		No Connection
6	SPKCTL	O	Hook switch control. Normal low When message function is active, this pin will go high to connect line Speaker phone on: high Speaker phone off: low HS pin high $\rightarrow$ low: low
7 - 10	NC		No Connection
11	NC		No Connection
12	$\overline{\text{ROW4}}$	O	Keyboard interface
13	NC		No Connection
14,15	X1, X2		Watch oscillator input . A 32768Hz crystal is used
16	GND		Ground
17	$\overline{\text{ROW3}}$	O	Keyboard interface and LED driver
18	$\overline{\text{ROW2}}$	O	Keyboard interface pin
19	$\overline{\text{XMUTE}}$	O	XMute Output. Controls microphone circuits of voice network
20	$\overline{\text{MUTE}}$	O	Mute Output. Controls UM5110 AUD. (See Interface Circuits) Active low during tone or pulse dialing
21 - 24	NC		No Connection

Pin Description (continued)

Pin No.	Symbol	I/O	Description
25	$\overline{\text{COL5}}$	I	Keyboard interface
26	$\overline{\text{COL3}}$	I	Keyboard interface
27	$\overline{\text{COL2}}$	I	Keyboard interface
28	$\overline{\text{COL1}}$/ $\overline{\text{HOLDIN}}$	I	Keyboard interface and hold release input
29	$\overline{\text{ROW6}}$	O	Keyboard interface
30	$\overline{\text{ROW5}}$ /HOLDOUT	O	Keyboard interface and hold control output
31	HS	I	Hook switch input Low: off hook High: on hook
32	$\overline{\text{ROW1}}$	O	Keyboard interface
33 - 64	SEG1-32	O	LCD interface
65 - 68	COM1-4	O	LCD interface
69	VLCD	I	Power supply for LCD driver. Should be floating
70, 71	NC		No Connection
72	$\overline{\text{TEST}}$	I	Connect to VDD in normal operation
73	TONE	O	DTMF signal output
74	$\overline{\text{COL4}}$	I	Keyboard interface
75	VDD		Power supply (2.5 V - 5.5 V)
76 77	OSC1 OSC2		System Clock Oscillator input A 3.5795 MHz crystal is used
78	RESET	I	Resets the LSI. High active
79	NC		No Connection
80	NC		No Connection

■ Parameter Selection

Parameter selection is accomplished using the SELECT pin, by connecting the SELECT pin through a diode to the column pins ($\overline{COL1}$ - $\overline{COL5}$) and row pins ($\overline{ROW1}$ - $\overline{ROW6}$). Parameters may be selected. The following table shows the parameter selection.

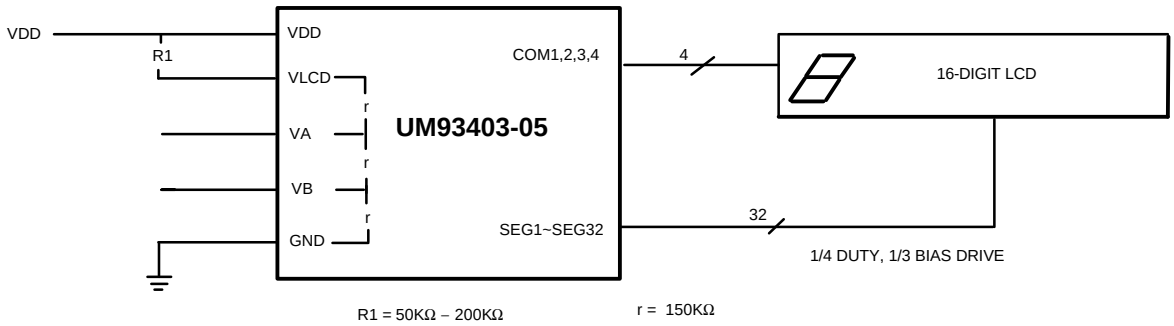
	OPENED : Tone Dialing CLOSED : Pulse Dialing
	OPENED : Free Dialing CLOSED : Key Locked (Restriction dialing)
	OPENED : PASSWORD SETTING DISABLE CLOSED : SET PASSWORD TO 000
	OPENED : Restriction no. "168" off CLOSED : Restriction no. "168" on
	OPENED : 40/60 MBR CLOSED : 33/67 MBR
	OPENED : 10 PPS CLOSED : 20 PPS
	OPENED : 600 ms CLOSED : 100 ms
	OPENED : N PULSES CLOSED : N + 1 PULSES
	OPENED : PAUSE TIME = 2 SEC CLOSED : PAUSE TIME = 4 SEC

Note: If user wants to change the setting values of $\overline{ROW1}$ - $\overline{ROW6}$, NT93403-05X must be reset again.

LCD Connection and Format

■ LCD connection

The LCD should be operated on 1/4 duty and 1/3 bias. Examples of LCD connection are given as follows:



Since large LCD panels need a large driving current, it is possible the internal dividing resistor circuit cannot provide the correct bias voltage. In this external resistors can solve this problem.

However, small external resistors result in more power dissipation. Hence external resistors must be experimentally determined. Also, R1 should be experimentally determined.

$$\text{VLCD = driving voltage of LCD} = \frac{r + r + r}{R1 + r + r + r} \times V_{DD}$$

NT93403-05X LCD Format

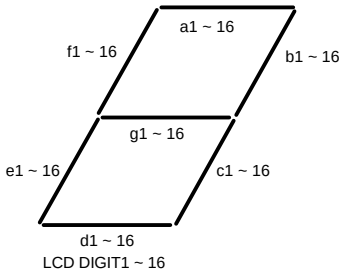
If the HOLD indicator is not provided on the LCD, HOLDOUT pin can be used to drive LED as HOLD indicator.

LCD Display Dot Format

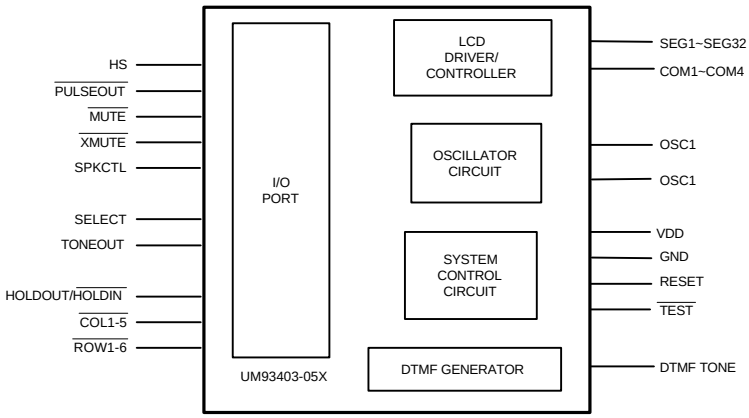
LCD	SEG1	SEG2	SEG3	SEG4	SEG5	SEG6	SEG7	SEG8	SEG9	SEG10	SEG11	SEG12
COM1	f1	a1	f2	a2	f3	a3	f4	a4	f5	a5	f6	a6
COM2	g1	b1	g2	b2	g3	b3	g4	b4	g5	b5	g6	b6
COM3	e1	c1	e2	c2	e3	c3	e4	c4	e5	c5	e6	c6
COM4	d1	-	d2	AM	d3	-	d4	PM	d5	-	d6	STORE

LCD	SEG13	SEG14	SEG15	SEG16	SEG17	SEG18	SEG19	SEG20	SEG21	SEG22
COM1	f7	a7	f8	a8	f9	a9	f10	a10	f11	a11
COM2	g7	b7	g8	b8	g9	b9	g10	b10	g11	b11
COM3	e7	c7	e8	c8	e9	c9	e10	c10	e11	c11
COM4	d7	-	d8	MTE	d9	-	d10	-	d11	-

LCD	SEG23	SEG24	SEG25	SEG26	SEG27	SEG28	SEG29	SEG30	SEG31	SEG32
COM1	f12	a12	f13	a13	f14	a14	f15	a15	f16	a16
COM2	g12	b12	g13	b13	g14	b14	g15	b15	g16	b16
COM3	e12	c12	e13	c13	e14	c14	e15	c15	e16	c16
COM4	d12	-	d13	HOLD	d14	SPK	d15	-	d16	-



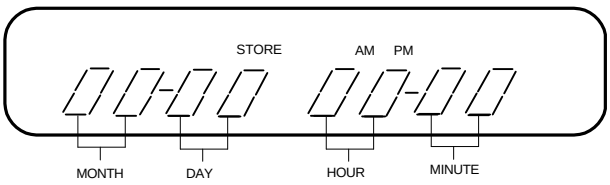
Block Diagram



Functional Description

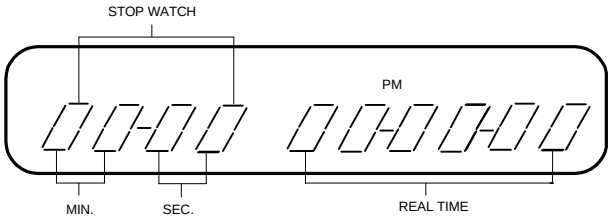
Real Time Clock

- After power-on reset, the LCD will display all the segments for one second and then return to NORMAL CLOCK mode.
- During normal conditions, the display shows month, date, hour, minute, and second. (phone number is displayed upon digit entry or corresponding set mode information is displayed).
- Real time can be displayed whenever "CLOCK" key is depressed.
- Real time clock setting procedure
  1. Press "STORE" key.
  2. Press "CLOCK" key.
  3. Enter month, date, AM/PM, hour, minute. (Use */# for AM/PM and 01:00~12:59 for hour & minute).
  4. Press "STR" key once again. (Seconds start from 00)
  5. Blinking cursor on the position for digit entry is provided.
  6. Key entry must be 2 digits. (ie: 03 for March).
  7. If setting is interrupted half way, previous time will be displayed.
  8. If any key is incorrectly entered, the key is ignored.
  9. If real time clock is not set after power-on reset, clock display will blink. (Pressing "CLOCK" key can stop this blinking).



Stopwatch

- Stopwatch timer is provided up to 59 minutes and 59 seconds.
- Display shows minutes and seconds at month/date display location.
- Timer will stop by either going on-hook or by depressing "TIMER" key once.
- Timer start/stop procedure
  1. Press "TIMER" key to start. The real time will change to 00-00 and start counting.
  2. Real time will be displayed at this time, but only month and date will be replaced by timer.
  3. Press "TIMER" key once again to stop timer. (display stays approx. 10 seconds after stop and returns to month and date automatically).
  4. Timer display can be forced to return to date and month by touching "CLOCK" key once.
- Auto Start-watch
  1. Lift the phone off the hook, or press the SPEAKER key.
  2. Enter desired number from the keypad if necessary.
  3. After 6 seconds, the timer will start counting from 00-00.
  4. Hang up the telephone by handset or SPEAKER key to stop the timer counting. The display will hold TIMER mode about 10 seconds and return to CLOCK mode automatically.



Normal Dialing & Receiving

- Take phone off hook, or press the SPEAKER key.
- Enter desired number from the keyboard, including pause, flash and tone keys. The FLASH key disconnects line and initializes dial buffer.
- The display shows *,#,pause,flash and tone with different symbols.
- As many digits as necessary may be entered without restriction.
- The number will be dialed out in TONE or PULSE, depending on the SELECT pin (TONE/PULSE switch key). DIALING may be changed from PULSE to TONE by pressing the */TONE key.
  1) Tone dialing rate: real time dialing (minimum tone duration is 98 msec).
  2) Pulse dialing rate: 10 or 20 pps. M/B ratio is 33/67 or 40/60. The number of pulses depends on the SELECT and $\overline{\text{ROW5}}$ pins.
- "*" and "#" are not dialed out in PULSE mode.
- DTMF tone output duration depends on how long the key is depressed. Minimum tone duration and inter-digit pause times are 98 msec.

Dialing

1. Lift the handset, or press the [SPEAKER] key.
2. Enter desired phone number [9] [3] [4] . . . [0] .
3. When call is finished, hang up the handset, or press the [SPEAKER] key.

Receiving

1. When the telephone rings, lift the handset, or press the [SPEAKER] key.
2. When call is finished, hang up the handset, or press the [SPEAKER] key.

Redialing

- Lift the handset, press the SPEAKER key, or press the FLASH key after dialing a number.
- Press the REDIAL key once. The number stored in the redial buffer will be dialed, including pause, tone, one touch dialing and abbreviated auto dialing.
- No redial function is executed if more than 48 digits (including memory dialing) are entered during dialing. An error beep sounds and "FULL" will be displayed on the LCD if number dialed exceeds 48 digits.

Redialing

1. Lift the handset, press the [SPEAKER] key, or press the [FLASH] key after dialing a number.
2. Press the [REDIAL] key.
3. Numbers stored in the redial buffer will automatically be dialed out.

Chain Dialing

- Take phone off the hook, or press the SPEAKER key.
- Any combination of dialing methods can be used.
- Press the one-touch dial key or abbreviated auto dialing key in sequence to initiate continuous dialing.

Chain Dialing

1. Lift the handset, or press the [SPEAKER] key.
2. Press the [M01] [M02] [M03] keys.
3. The telephone numbers stored in M01 + M02 + M03 will automatically be dialed out.

Memory Storage

Memory Storage Operation:

1) Press the Store key once.
2) Enter desired location key:
   One-touch auto-dial (DIRECT mode): EM1, EM2, or EM3

   Abbreviated auto dial (INDIRECT mode): Enter the desired memory location in the "2-Digit Code" form. (from 01 to 10)
3) Enter desired phone number.
4) Press the Store key once again.

Example:

Key Sequence	Memory Contents
STORE + EM1 + 1 + 2 + 3 + STORE	EM1 = 123
STORE + EM2 + 3 + 6 + 9 + STORE	EM2 = 369
STORE + 1 + 0 + 1 + 4 + 7 + STORE	M10 = 147
STORE + 0 + 4 + 2 + 5 + 8 + STORE	M04 = 258

- To exit the memory storage sequence without modifying the contents of memory, skip step 4 or press the CLOCK key.
- If more than 24 digits are antered, an error beep will sound, and "FULL" will be dispalyed.
- If an invalid key is entered, repeat entire sequence.
- Total memory size is: 13 memory locations x 24 digits.

Storing Memory Phone Number 1

1. Press the [STORE] key.
2. Press the [EM2] station number.
3. Enter desired phone number [9] [3] [4] . . . [0] .
4. Press the [STORE] key (EM2 = 934 . . . 0).

Storing Memory Phone Number 2:

1. Press the STORE key.
2. Enter two digit station number (for 01 - 20).
3. Enter desired phone number 9 3 4 . . . 0 .
4. Press the STORE key (M05 = 934 . . . 0).

Memory Dialing

One-touch auto-dialing:

- Lift the handset, or press the SPEAKER key.
- Press desired one-touch auto-dial key.
- The number stored in memory will be dialed out.
  Abbreviated auto-dialing
- Two-touch auto-dialing:
  - Take the phone off the hook, or press the SPEAKER key.
  - Press the MEM key.
  - Enter desired memory location number (from 01 - 10).
  - The number stored in memory will be dialed out.

One-touch auto-dialing

1. Lift the handset, or press the SPEAKER key.
2. Press the EM1 station number.
3. The contents of EM1 will be dialed out.

Abbreviated Dialing

Two-touch auto-dialing:

1. Lift the handset, or press the SPEAKER key.
2. Press the MEM Key.
3. Enter 0 4 station number.
4. The contents of M04 will be dialed out.

Setting FLASH & FLASH Time

- FLASH code cannot be stored in the redial buffer if this key is pressed.
- During the execution of the FLASH code, $\overline{\text{PULSEOUT}}$, $\overline{\text{MUTE}}$ and $\overline{\text{XMUTE}}$ are pulled low for 90 - 900 msec, followed by a pause for 0.8 seconds before the next digit is executed.
- During normal dialing, the flash disconnects the line and initializes the dial buffer. The FLASH key can be used to cancel the REDIAL mode and memory dialing.
- Pressing the FLASH key causes the phone to first go off-line, then return on-line.

Using FLASH to Correct an Incorrect Number Entry

1. Lift handset, or press the SPEAKER key.
2. Press desired phone number. For example: 9 3 4 0 .
3. Press FLASH key.
4. Press desired phone number. For example: 9 3 4 1 .
5. The phone number 9341 will be dialed out.

Using FLASH as a Redial Key When Line is Busy

1. Lift handset, or press the SPEAKER key.
2. Enter desired phone number. For example: 9 3 4 0 .
3. Press the FLASH key.
4. Press the REDIAL key.
5. The phone number 9340 will be dialed out.

Using FLASH as a PABX Switch

1. Lift handset, or press the SPEAKER key.
2. Press the FLASH key.
3. Press a switching number. For example: 7 7 0 .
4. The phone number will switch to 770.

PROGRAMMABLE FLASH:

- Initial flash timing is 100 or 600 msec, determined by Select pin.
- Flash time can be programmed from key entry if necessary.
- Flash time can be set from 90 or 100 msec to 900 msec, with a resolution of 100 msec.
- Flash time setting procedure:
  1) Press the STORE key once.
  2) Press the FLASH key.
  3) Press desired number 0, 1 - 9 (corresponding to 90, 100 - 900 msec).
  4) Press the STORE key once again to confirm setting.
- To exit the above sequence without modifying the original data, skip step 4, or press the CLOCK key.
- If any incorrect key is entered, repeat entire sequence.

Flash Time Setting

1. Press the STORE key.
2. Press the FLASH key.
3. Press 8 for 800 ms flash time.
4. Press the STORE key.

Setting and Using Pause

PROGRAMMABLE PAUSE:

- Initial pause timing is 2 or 4 seconds for each press of the pause button.
- Pause timing can be programmed from key entry .
- Pause time can be set from 1 to 5 seconds, with 1 second resolution.
- Pause time setting procedure:
  1) Press the STORE key once.
  2) Press the PAUSE key.
  3) Enter desired pause time (from 1 to 5 seconds).
  4) Press the STORE key once again to confirm the setting.
- To exit the above sequence without modifying the original data, skip step 4, or press the CLOCK key.
- If any incorrect key is entered, repeat entire sequence .

Setting Pause Time

1. Press the STORE key.
2. Press the PAUSE key.
3. Press 4 for 4 sec pause time.
4. Press the STORE key.

Check Last Dialed Numbers Function

- If user ever dialed out phone numbers, user can use UP or DOWN key to check last dialing time and last dialed numbers.
- The LCD display will show: mm-ss xxxxx... (up to 24 digits of phone number).

***/TONE/Key Function**

- During PULSE DIALING, a DTMF signal will be produced if the */TONE key is pressed.
- The tone data can be stored in memory for memory dialing and redialing.

Hold Control

Hold and Hold Release

1. During phone call, press the HOLD key.
2. Listener will hear a melody and the HOLD LCD symbol will blink.
3. Hang up the handset.
4. When handset is lifted or SPEAKER key is pressed, HOLD mode will be released.
5. The HOLD mode can also be released by another phone set.

   The $\overline{\text{HOLDIN}}$ is used as the Hold Release pin.

Mute Control

Using Mute

1. During the phone call, press the MUTE key.
2. Listener will be unable to hear speaker's voice, and the SPEAKER LCD symbol blink.
3. Press the MUTE key again to release MUTE.

PASSWORD Function

- When $\overline{\text{COL2}}$ is not connected to the SELECT pin with a diode (the Key Lock Switch is opened), the device is in FREE mode (i.e., no restricted dialing). The PASSWORD function can be used to set this device to LOCK mode (i.e., restricted dialing), as follows:
  1) Press the PASSWORD key.
  2) Press the #/LOCK key. A confirming beep will sound.
- Resetting this device to FREE from PASSWORD LOCK:
  1) Press the PASSWORD key.
  2) Enter the password. If the password is correct, a confirming beep will sound; otherwise, an error beep will sound.
- After resetting the device to FREE mode, the

password can be changed. If no key is pressed within 20 seconds or if the phone is off-line, the password cannot be changed.

- Changing the password:
  1) Press the STORE key once.
  2) Press PASSWORD.
  3) Enter desired password (from 000 to 999).
  4) Press the Store key once again to confirm the setting.
- To exit the above sequence without modifying the original data, skip step 4, or press the CLOCK key.
- If any incorrect key is entered, repeat entire sequence. If the password is forgotten, press SOS. The NT93403-05X will change the password to a default value of 000.

Password Lock Setting:

(Available only when $\overline{\text{COL2}}$ is not connected to the SELECT pin by a diode, i.e., Key Lock Switch is opened)

1. Press the [PASSWORD] key.
2. Press the [#/LOCK] key.

Changing the setting to FREE mode from PASSWORD LOCK mode:

1. Press the [PASSWORD] key.
2. Enter the password [#] [#] [#] .

(Note: # could be only number from 0,1,2,.....to 9)

Setting the Password:

1. Press the [STORE] key.
2. Press the [PASSWORD] key.
3. Enter the new password [#] [#] [#] .
4. Press the [STORE] key.

Lock Control

Dial Restriction

- When $\overline{COL2}$ is connected to the SELECT pin with a diode (Key Lock Switch is closed), the function becomes active.
- A restriction code can be as many as 3 digits. Either one, two, or three numbers may be defined.
- If the first 3 digits dialed are identical to the restriction codes, an error "beep" will sound and no numbers can be dialed out.
- Procedure for defining the restriction code:
  1) Set this device to FREE mode with the SELECT pin.
  2) Press the STORE key once.
  3) Press the #/LOCK key.
  4) Enter restriction code (up to 3 digits).

Note: Restriction codes may be in the following forms:

X : one set of numbers: if the first digit of the number dialed matches X, dialing is restricted

XY : one set of numbers: if the first two digits of the number dialed match XY, dialing is restricted

XYZ : one set of numbers: if the first three digits of the number dialed match XYZ, dialing is restricted

*X-Y : two sets of numbers: if the first digit of the number dialed matches X or Y, dialing is restricted

*X-YZ or XY-Z: two sets of numbers: one set defined by the first digit and the other by first two digits

Note: When restriction codes are defined, the first digit of each must be different. To define two different restriction codes, enter the first restriction code, press the #/LOCK and then enter the second code.

5) After entering the new restriction code, press the STORE to confirm .

- Clearing procedure for restriction codes:
  1) Set the device to FREE mode with SELECT.
  2) Press the STORE key once.
  3) Press the #/LOCK key twice.
  4) Press the STORE key once again to complete the clear operation.
- To exit any of the above sequences without modifying the original data, skip step 5, or press the CLOCK key.
- If any invalid key is entered, repeat entire sequence.
- Only numbers 0 - 9 can be restricted.

Setting a Restriction Code

1. Press the [STORE] key.
2. Press the [#/LOCK] key.
3. Press [0] [#/LOCK] [9] for an example of restriction code 0 and 9.
4. Press the [STORE] key.

Clearing a Restriction Code

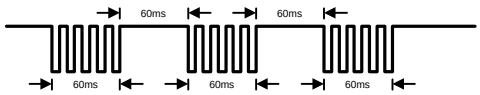
1. Press the [STORE] key.
2. Press the [#/LOCK] [#/LOCK] key twice.
3. Press the [STORE] key.

[LD] key Line Disconnect key
When the phone is on-line status and the user presses the "LD" key. the line condition will break for about 2 seconds before reconnection.

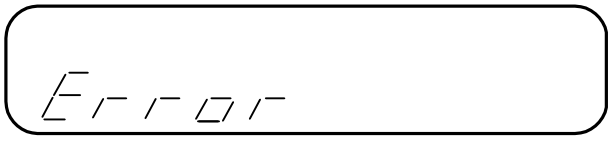
On-line→ "LD" key ===> Line break for 2 sec and pause for 0.8 sec ===> then on-line again

Error Indication

- If a key sequence is invalid, an Error Beep will sound. (3 beeps at 1.75KHz).



- The LCD will show "Error"
- If the message "Error" is shown for more than 10 seconds, the display will automatically return to CLOCK mode.



RESET

- Full Reset: During power-on, or when RESET is high, all registers and temporary areas will be cleared. The phone number in memory will be cleared and all pin selection options will be initialized.
- Partial reset function is provided:
  If user holds down "0" key, the RESET goes high, and the phone number in the memory will not be cleared.

Pulse Dial Option

Pulse dial option

- This function adjusts the number of pulses generated meet the standards of specific countries
- The number of pulses depends on the SELECT pin and the $\overline{\text{ROW5}}$ pin after power-on RESET.

Dialed Number	0	1	2	3	4	5	6	7	8	9
World	10	1	2	3	4	5	6	7	8	9
Sweden/Denmark	1	2	3	4	5	6	7	8	9	10

Hands-Free and Handset Operation

Users may switch between Hands-Free and Handset operation at any time.

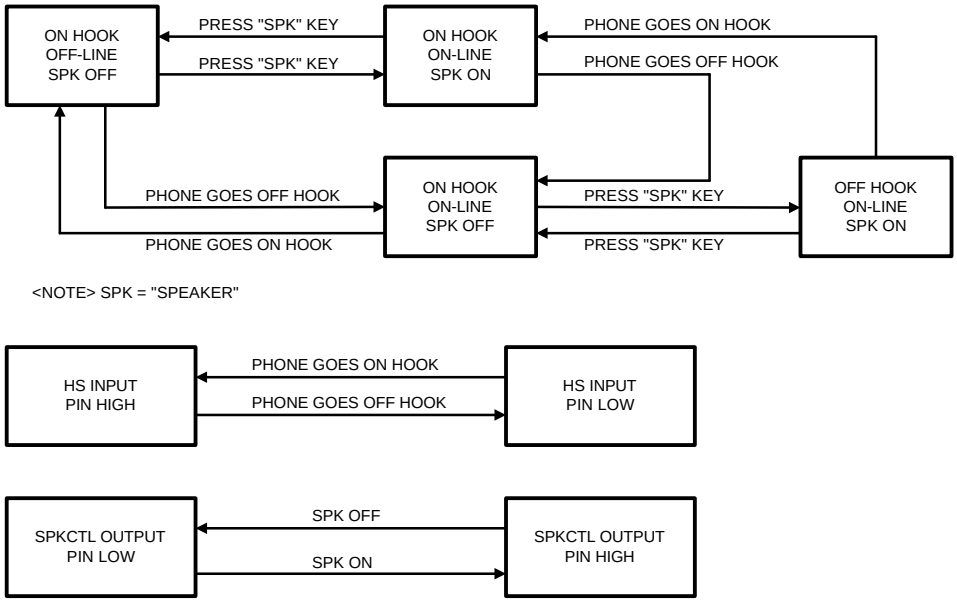
Handset to Hands-Free Operation

1. Press the SPEAKER key.
2. The Hands-free indicator SPKCTL will light.
3. Hang-up the handset and continue the call.

Hands-Free to Handset Operation

1. Lift the handset.
2. The SPEAKER will turn off.

Speaker Mode Diagram

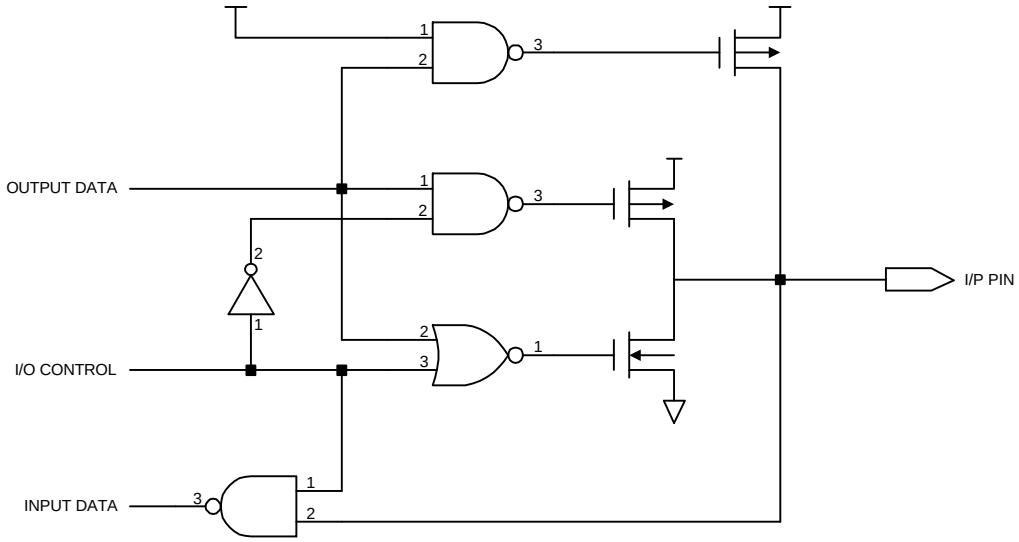


For details, refer to Timing Diagram 11, HS and SPKCTL, on page 37

I/O Pin Type

I/O Pin Type	Designation	Description
Output pins (with pull-up CMOS)	$\overline{\text{PULSEOUT}}$, $\overline{\text{MUTE}}$, $\overline{\text{XMUTE}}$, TONEOUT, $\overline{\text{ROW1}}$ - $\overline{\text{ROW6}}$, SPKCTL, SELECT	During on-hook and no operation, these output low except for TONEOUT and SELECT.
Input pins	$\overline{\text{COL1}}$ - $\overline{\text{COL5}}$, HS,	These pins are internally pulled high except for STOPDET.

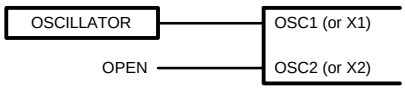
The NT93403-05X I/O pins can be configured as either input or output pins. When configured as output pins, they are pulled high through the MOS. When they are configured as input pins, the pulled-up CMOS can be either enabled or disabled.



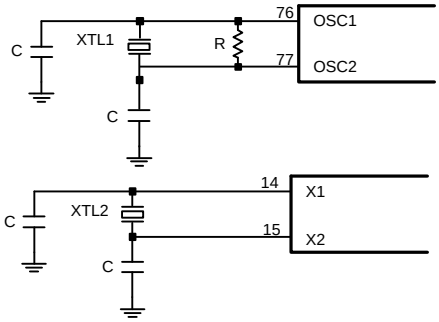
I/O control = high: input port
= low: output port

Oscillator Circuit

■ External Clock Operation

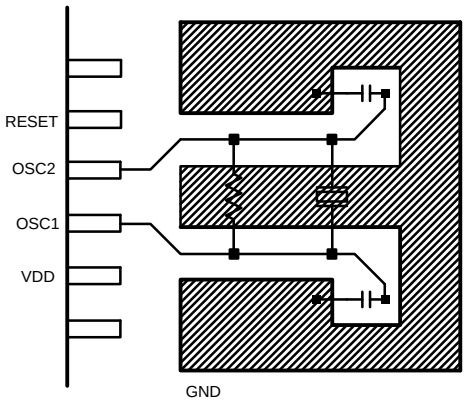


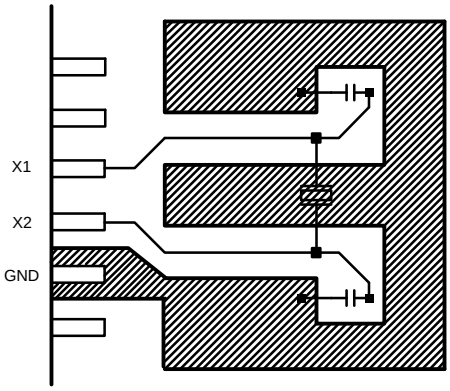
■ Crystal Clock Operation



XTL1 => (3.5795MHz) Crystal Oscillator or Ceramic resonator Oscillator
XTL2 => (32.768KHz) Crystal Oscillator
R => 1M ohm approx.
C => 20pF is recommended

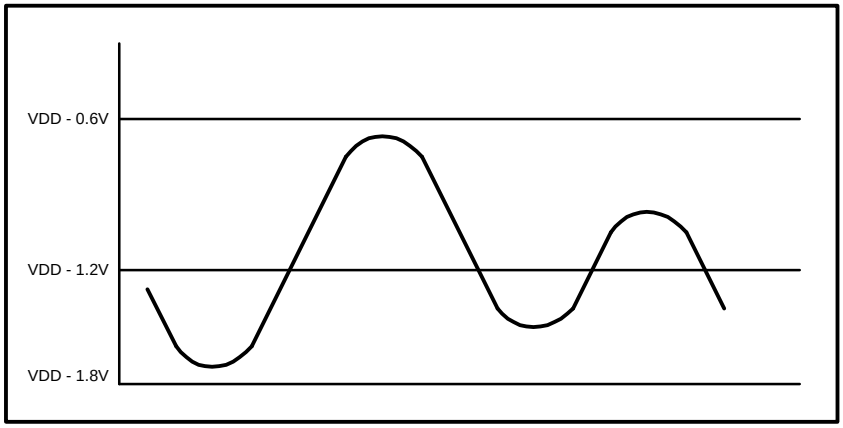
■ Layout of Oscillator Circuit





DTMF Output

The DTMF output signal depends on the reference voltage of VDD - 1.2V.



Absolute Maximum Ratings*

Power Supply Voltage . . . . . 5.5V (VDD)
Applied Voltage on Any Pin . . . . . 0.3V to VDD + 0.3V
Maximum Power Dissipation . . . . . 100 mW
Operating Temperature . . . . . 0°C to 70°C
Storage Temperature . . . . . -55°C to 150°C
Soldering Temp. & Time . . . . . < 260°C, 10sec

*Comments

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to this device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied or intended. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

DC Electrical Characteristics (VDD = 5.0V)

Symbol	Parameter	Pin		Min.	Typ.	Max.	Unit	Conditions
VDD	Power Supply Voltage	VDD		2.5		5.5	V	
I_{OP}	Current in OPERATING Mode	VDD			1.1	1.5	mA	Without DTMF load
I_{SP}	Current in STOP Mode	VDD	VDD = 5V		30	40	µA	With LCD load (See Notes)
V_{IH}	Input High Voltage	RESET HS		0.9VDD		VDD +0.3	V	
		OSC1		VDD -0.3		VDD +0.3	V	
		Other pins		0.8VDD		VDD +0.3	V	
V_{IL}	Input Low Voltage	RESET HS		-0.3		0.1VDD	V	
		OSC1		-0.3		0.3	V	
		Other pins		-0.3		0.2VDD	V	

DC Electrical Characteristics (continued)

Symbol	Parameter	Pin	Min.	Typ.	Max.	Unit	Conditions
V_{OH}	Output High Voltage	All output pins	VDD -1.0			V	I_{OH} = 0.5mA
V_{OL}	Output Low Voltage	All output pins			0.6	V	I_{OL} = 1.6mA
V_{RET}	RAM Data Retention Voltage	VDD	1.5			V	STOP mode
P_{TONE}	Tone Output Voltage Ratio	TONE		2.5		dB	(col/row)
Voc	Single Column Output Amplitude	TONE		810		mVp-p	Rload = 10KΩ
Vor	Single Row Output Amplitude	TONE		630		mVp-p	Rload = 10KΩ
Dtone	Tone Output Distortion	TONE		3		%	
Rtone	Tone Output Resistance	TONE			1K	Ω	
Rpull	Pull-up Resistance	HS, $\overline{COL1}$- $\overline{COL5}$		200K		Ω	

Note: STOP mode = Off-line state with no operation.

Frequency Tolerance of Output Tones for DTMF Signaling

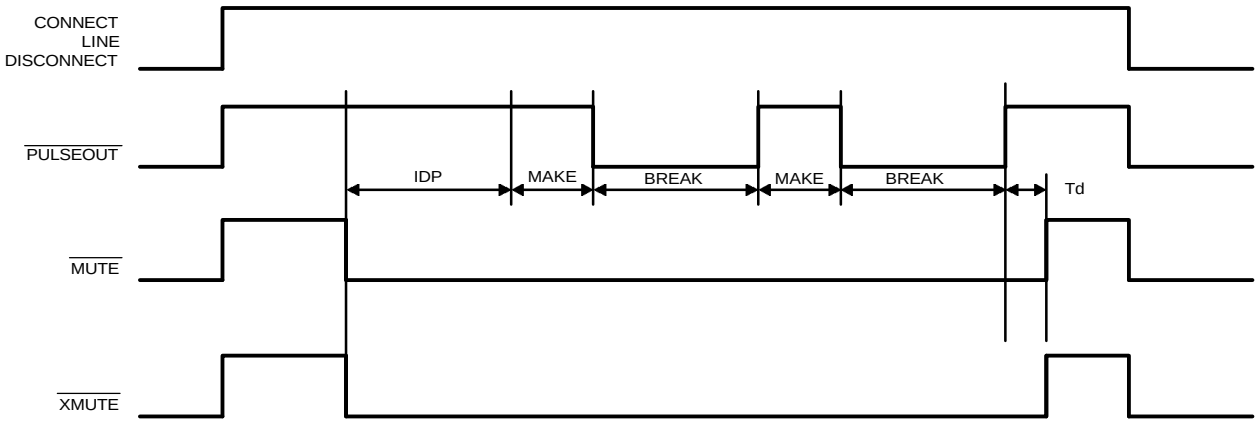
Row/Column	Standard Frequency (Hz)	NT93403-05X (Hz)	Deviation (%)
Row_1	697	696.9	-0.01
Row_2	770	768.8	-0.15
Row_3	852	850.6	-0.15
Row_4	941	940.0	-0.10
Col_1	1209	1209.3	+0.03
Col_2	1336	1339.6	+0.27
Col_3	1477	1481.6	+0.31
Col_4	1633	1632.9	-0.01

AC Characteristics

Symbol	Parameter	Pin	Min.	Typ.	Max.	Unit	Conditions
fosc	Oscillation Frequency	OSC1, 2		3.579545		MHz	
		X1,X2		32.768		KHz	
trsth	Reset High Level Width	RESET	3			msec	
trstf	Reset Falling Time	RESET			20	msec	
twch	Clock High Pulse Width	OSC1	120			msec	External Clock
twcl	Clock Low Pulse Width	OSC1	120			msec	External Clock

Timing Waveforms

1. Pulse Dialing Timing



(1) 10 PPS (40/60)

Symbol	Min.	Typ.	Max.	Unit
IDP	-	800	-	msec
MAKE	-	40	-	msec
BREAK	-	60	-	msec
Td	-	30	-	µsec

(2) 10 PPS (33/67)

Symbol	Min.	Typ.	Max.	Unit
IDP	-	800	-	msec
MAKE	-	33	-	msec
BREAK	-	67	-	msec
Td	-	30	-	µsec

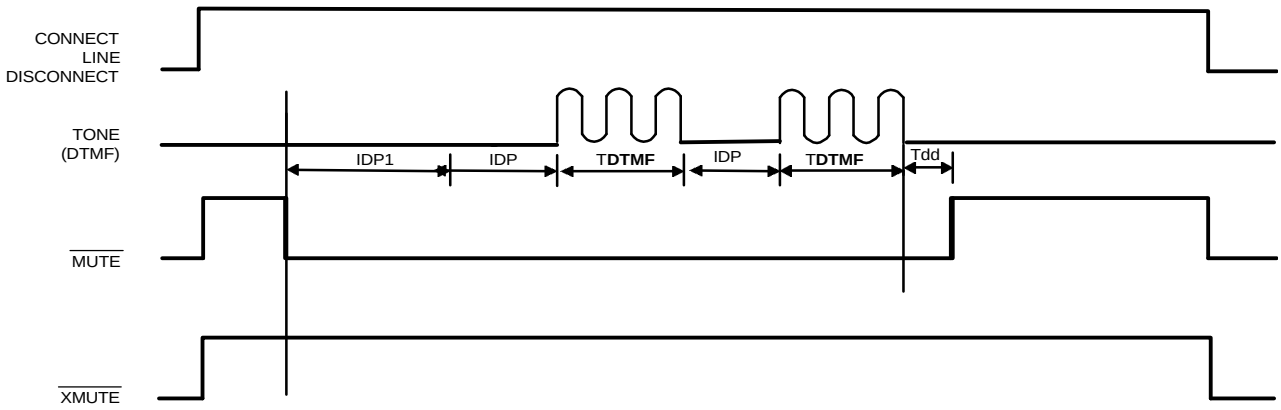
(3) 20 PPS (40/60)

Symbol	Min.	Typ.	Max.	Unit
IDP	-	500	-	msec
MAKE	-	20	-	msec
BREAK	-	30	-	msec
Td	-	30	-	µsec

(4) 20 PPS (33/67)

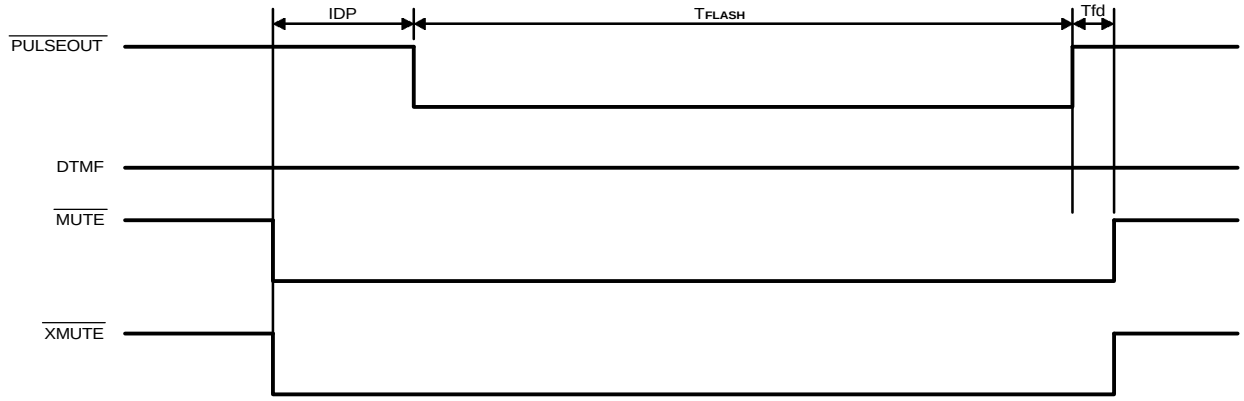
Symbol	Min.	Typ.	Max.	Unit
IDP	-	500	-	msec
MAKE	-	17	-	msec
BREAK	-	33	-	msec
Td	-	30	-	µsec

2. DTMF Timing



Symbol	Min.	Typ.	Max.	Unit
IDP1	-	500	-	msec
IDP	-	98	-	msec
T_{DTMF}	-	98	-	msec
Tdd	-	30	-	µsec

3. Flash Timing

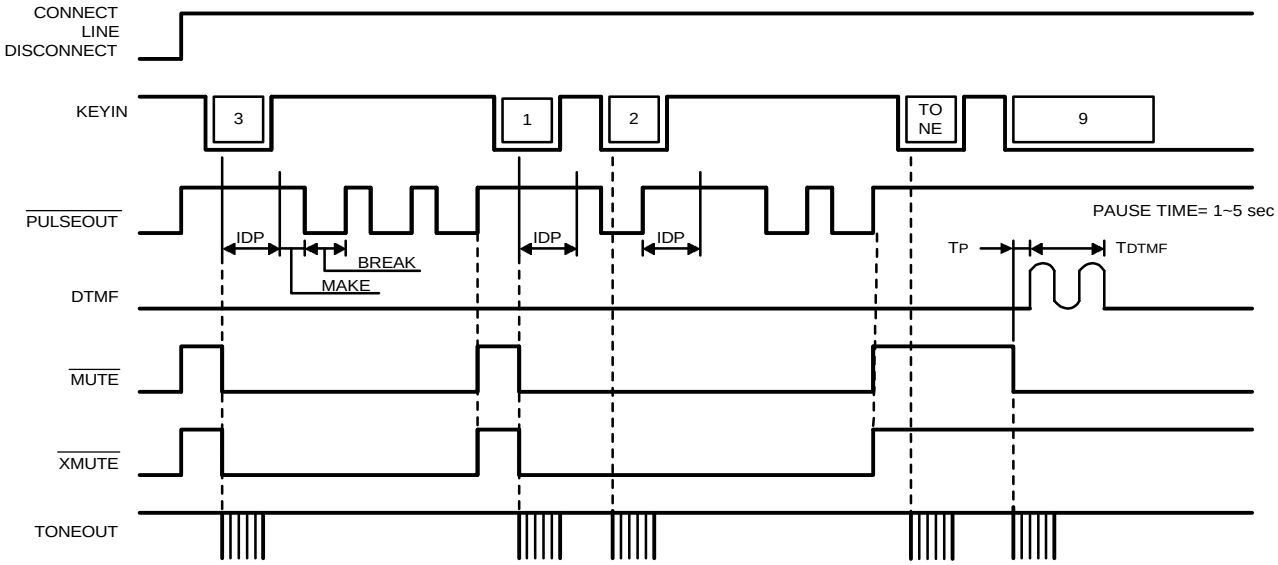


Symbol	Min.	Typ.	Max.	Unit
IDP	-	200	-	msec
TFLASH	-	*	-	msec
Tfd	-	30	-	µsec

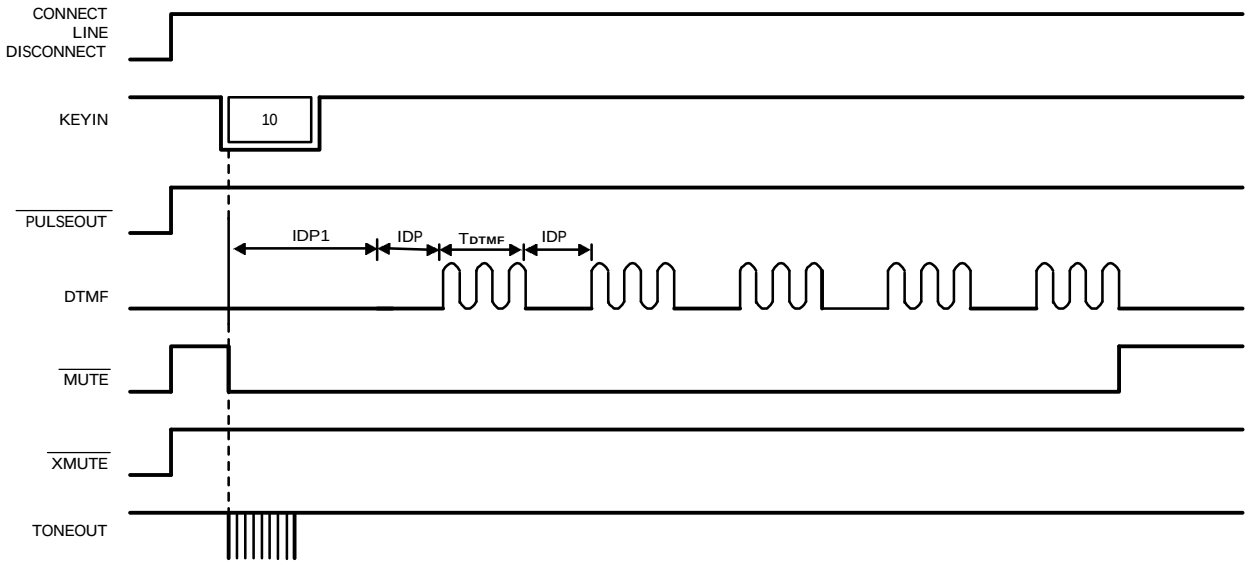
* 90, 100, 200, 300, 400,

* 500, 600, 700, 800, 900

4. Normal Dialing Timing

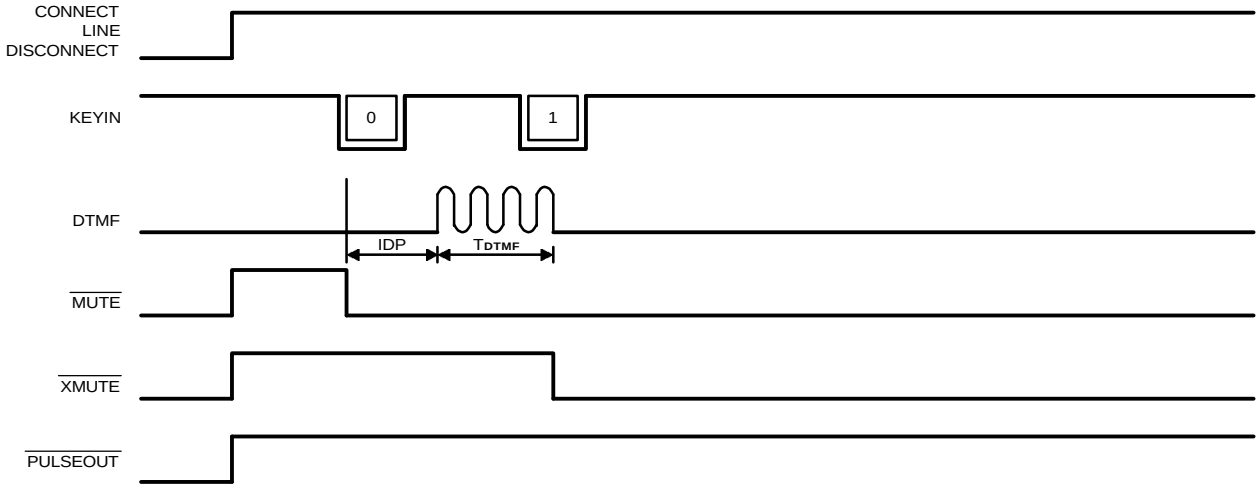


5. One-Touch Dialing (TONE Mode)

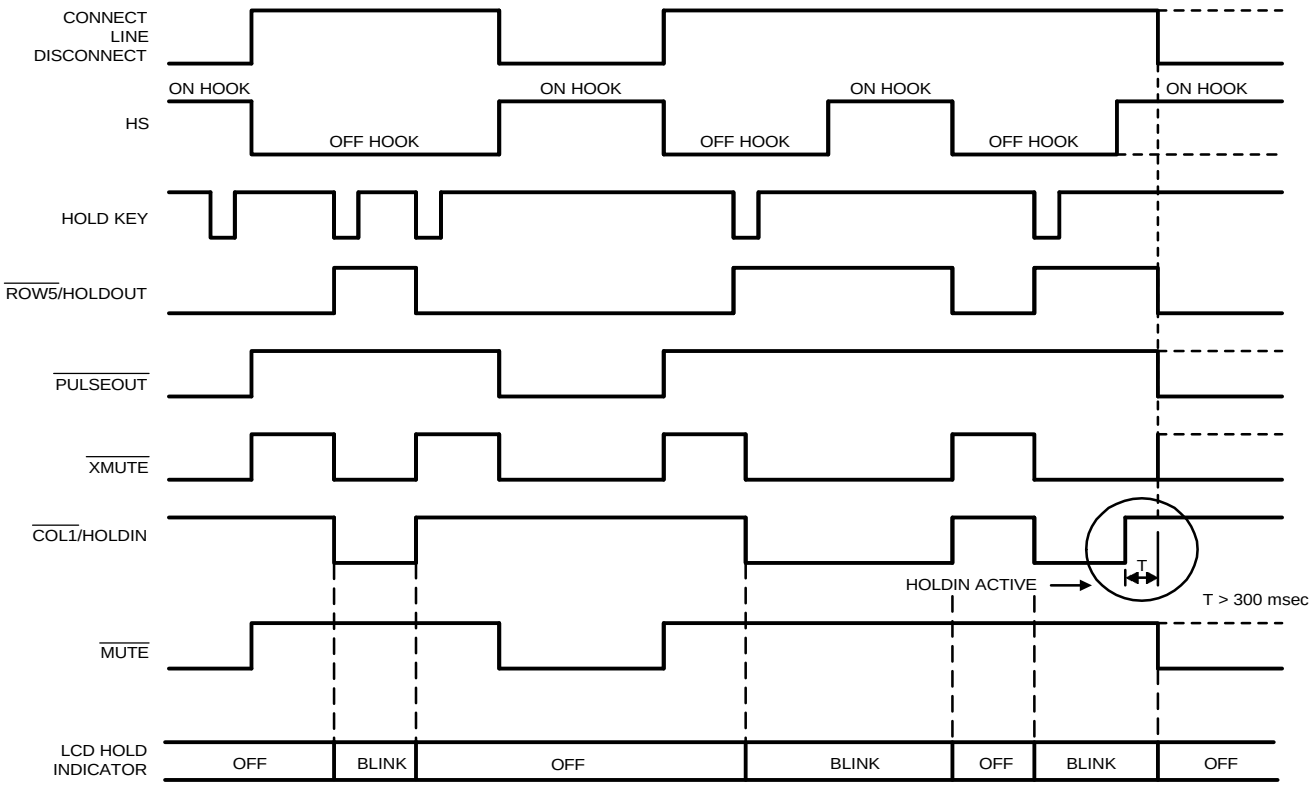


6. Restricted Dialing Timing (DTMF)

(Restricted number: 01)

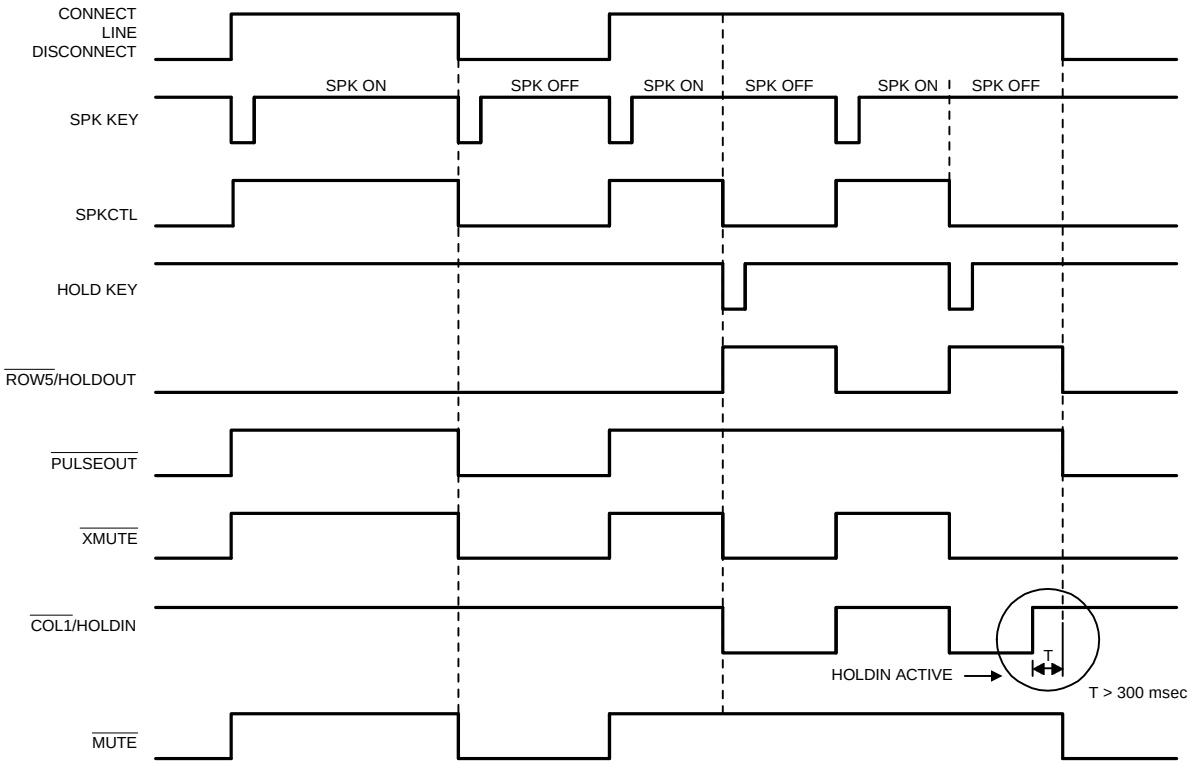


7. Hold Function Timing 1

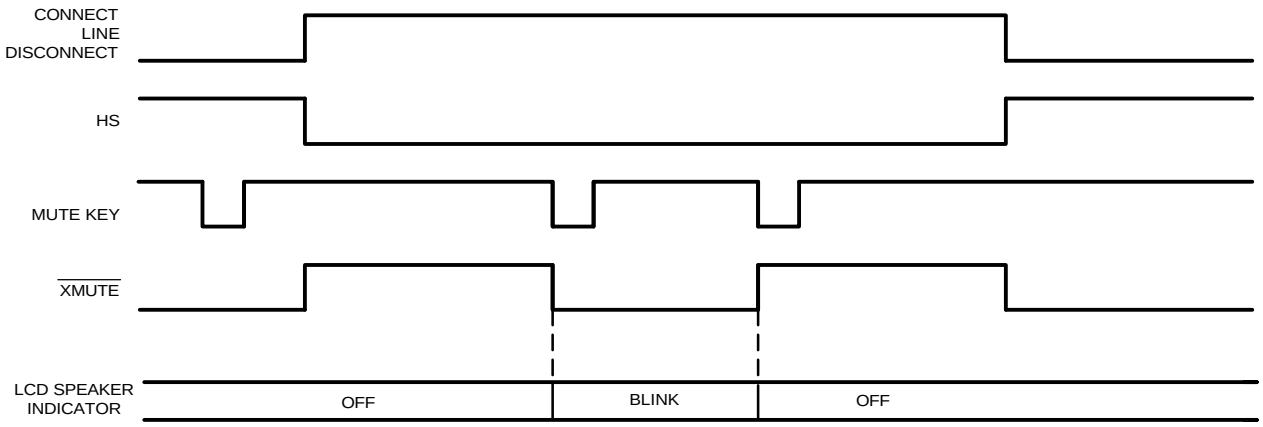


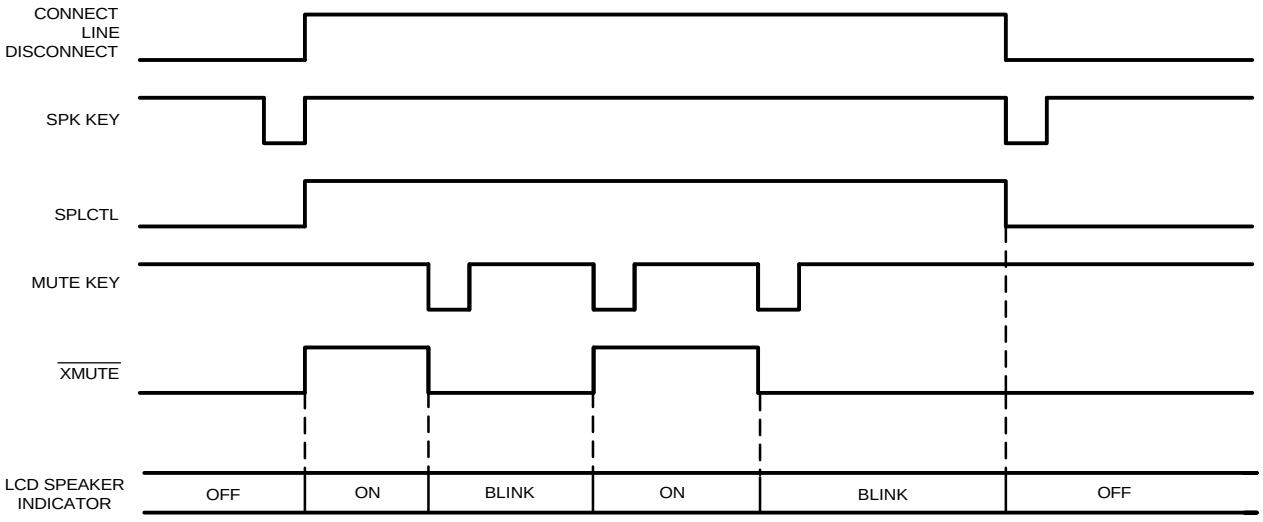
A dashed line occurs when the handset is off-hook during $\overline{\text{HOLDIN}}$ active.

8. Hold Function Timing 2

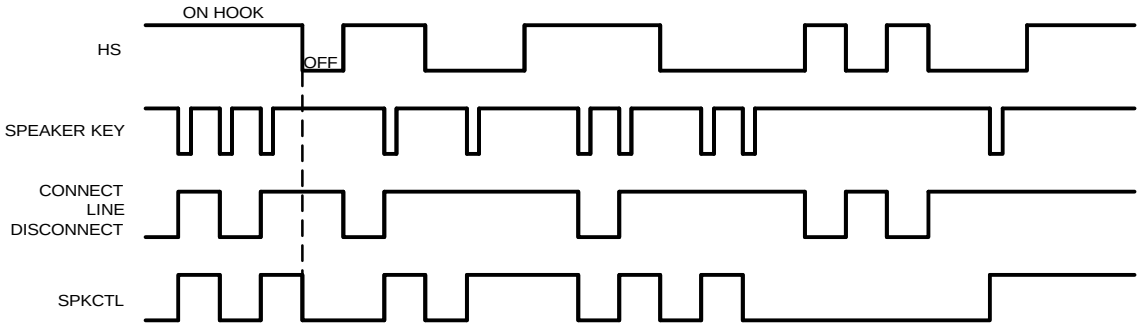


9. Mute Function Timing

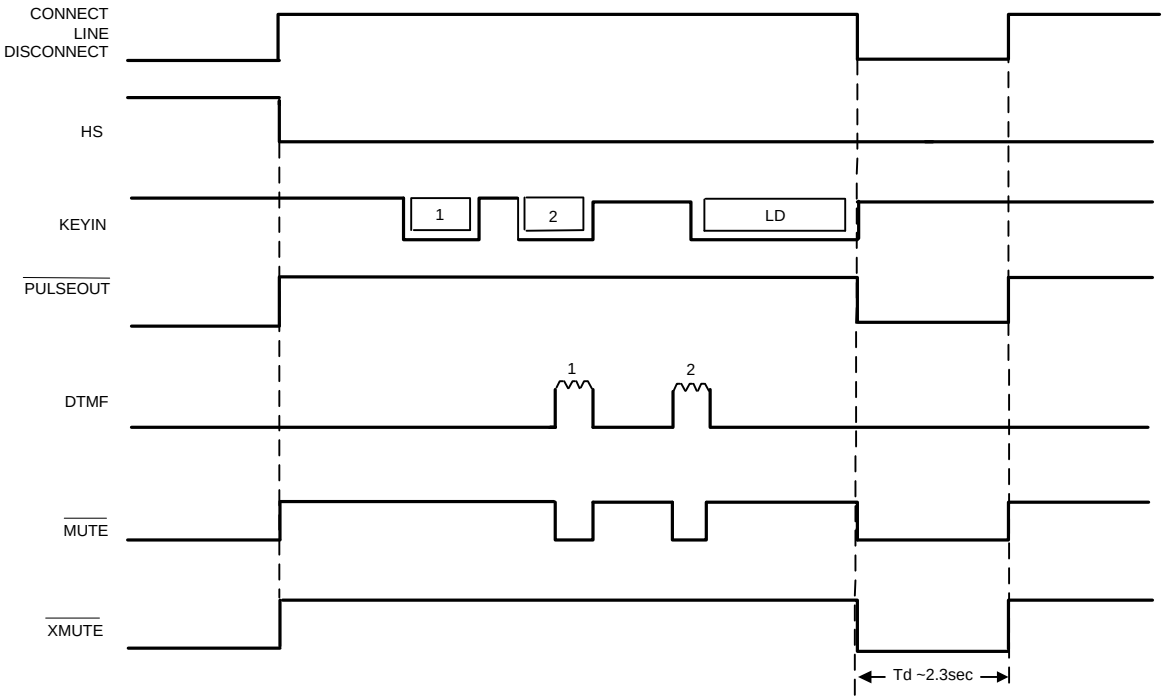




10. HS and SPKCTL Timing



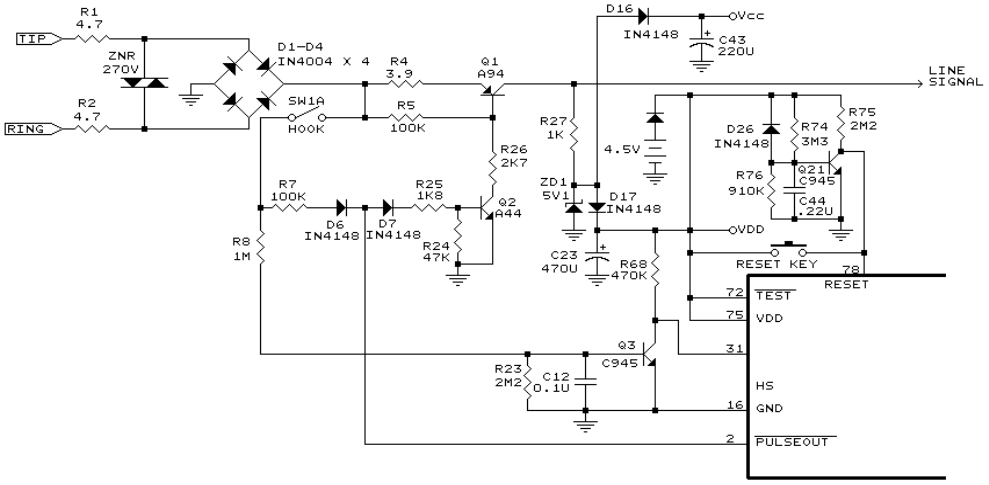
11. Line Key Timing



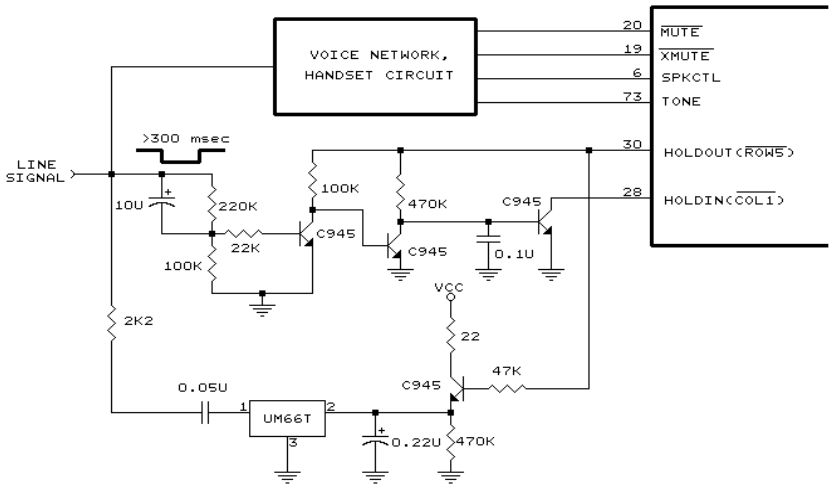
■ NT93403-05X Interface

Application Circuits (for reference only)

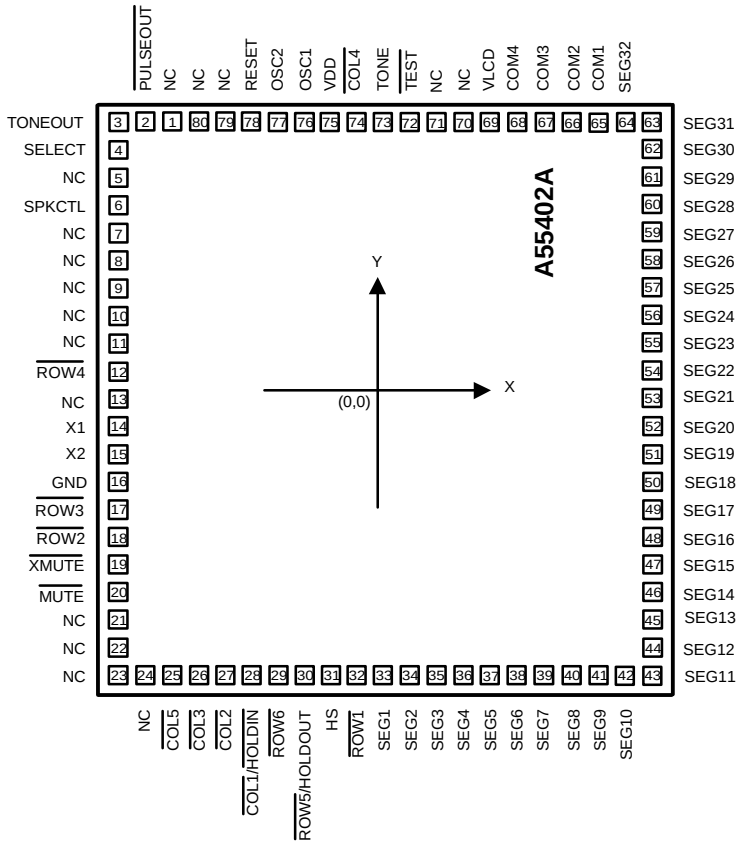
■ Line Control, Power Supply and Reset Circuits



■ Hold Application Circuit



Bonding Diagram



unit: μm

Pad No.	Designation	X	Y	Pad No.	Designation	X	Y
1	NC	-941	1234.8	41	SEG9	941	-1234.8
2	PULSEOUT	-1071	1234.8	42	SEG10	1071	-1234.8
3	TONEOUT	-1194.5	1234.8	43	SEG11	1194.5	-1234.8
4	SELECT	-1212.8	1091	44	SEG12	1212.8	-1091
5	NC	-1212.8	961	45	SEG13	1212.8	-961
6	SPKCTK	-1212.8	831	46	SEG14	1212.8	-831
7	NC	-1212.8	701	47	SEG15	1212.8	-701
8	NC	-1212.8	571	48	SEG16	1212.8	-571
9	NC	-1213.8	450	49	SEG17	1213.8	-450
10	NC	-1213.8	338	50	SEG18	1213.8	-338
11	NC	-1213.8	226	51	SEG19	1213.8	-226
12	ROW4	-1213.8	114	52	SEG20	1213.8	-114
13	NC	-1213.8	1	53	SEG21	1213.8	-2
14	X1	-1213.8	-112	54	SEG22	1213.8	110
15	X2	-1213.8	-226	55	SEG23	1213.8	222
16	GND	-1213.8	-337	56	SEG24	1213.8	334
17	ROW3	-1213.8	-450	57	SEG25	1213.8	446
18	ROW2	-1212.8	-571	58	SEG26	1212.8	571
19	XMUTE	-1212.8	-701	59	SEG27	1212.8	701
20	MUTE	-1212.8	-831	60	SEG28	1212.8	831
21	NC	-1212.8	-961	61	SEG29	1212.8	961
22	NC	-1212.8	-1091	62	SEG30	1212.8	1091
23	NC	-1194.5	-1234.8	63	SEG31	1194.5	1234.8
24	NC	-1071	-1234.8	64	SEG32	1071	1234.8
25	COL5	-941	-1234.8	65	COM1	941	1234.8
26	COL3	-811	-1234.8	66	COM2	811	1234.8
27	COL2	-681	-1234.8	67	COM3	681	1234.8
28	COL1/HOLDIN	-560	-1235.8	68	COM4	560	1235.8
29	ROW6	-448	-1235.8	69	VLCD	448	1235.8
30	ROW5/HOLDOUT	-336	-1235.8	70	NC	336	1235.8
31	HS	-224	-1235.8	71	NC	224	1235.8
32	ROW1	-112	-1235.8	72	TEST	112	1235.8
33	SEG1	0	-1235.8	73	TONE	0	1235.8
34	SEG2	112	-1235.8	74	COL4	-112	1235.8
35	SEG3	224	-1235.8	75	VDD	-224	1235.8
36	SEG4	336	-1235.8	76	OSC1	-336	1235.8
37	SEG5	448	-1235.8	77	OSC2	-450	1235.8
38	SEG6	560	-1235.8	78	RESET	-560	1235.8
39	SEG7	681	-1234.8	79	NC	-681	1234.8
40	SEG8	811	-1234.8	80	NC	-811	1234.8

Ordering Information

Part No.	Package
NT93403F-05X	CHIP