NOVATEK

NT91315XL Series

PRELIMINARY

Microcontroller for Monitor

Features

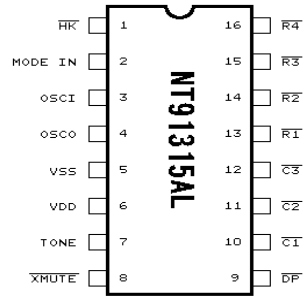
- Tone/Pulse switchable
- 32-digit redial memory
- 32-digit save memory (DL version)
- 3 emergency memory banks (16 digits each)
- 10 indirect memory banks (16 digits each)
- Flash, Pause, P→T can be saved as a digit in memory
- Chain dialing allowed
- None or (0) or (0, 9) or (0, 168) or all digits dialing inhibition (diode option) for PABX system or long distance dialing lock out
- Pause time 2.2/3.6 sec selectable (diode option)
- 3 pulse dialing number systems N/N+1/10-N (diode option)
- Dialing rate 10pps, M/B ratio 2/3 & 1/2 selectable/dialing rate 10pps & 20pps selectable, M/B ratio 1/2 (diode option)
- Hands-Free control function with debouncing (BL, CL & DL version)
- Hold function with debouncing (CL & DL version)
- Key-tone output for dialing access (DL version)
- One-key redial (DL version)
- Flash time 600ms, 300ms, 100ms (DL version)
- Power-up reset circuit provided
- Key release debouncing
- 32-step synthetic tone output for low DTMF output harmonic distortion
- 16/18/20/22-pin packages

General Description

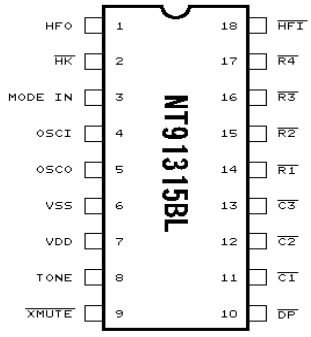
The NT91315XL series are single-chip silicon gate CMOS integrated circuits with on-chip oscillators to be used with a 3.58 MHz crystal or ceramic resonator. They provide dialing pulse (DP) or dual tone multi-frequency (DTMF) dialing. A 24-key (5x5-1) matrix keyboard is used for either DP or DTMF mode. In on-chip RAM, up to 32 digits can be saved for both redial and save functions, and up to 16 digits can be saved for 3 direct emergency and 10 indirect dialing memory banks. In DTMF mode, a small minimum tone duration and minimum inter-tone pause allows for rapid dialing. Maximum tone duration depends on the key depression time in manual dialing.

Pin Configurations

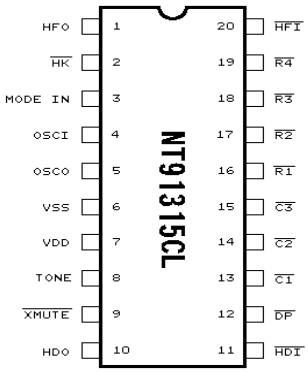
a. NT91315AL



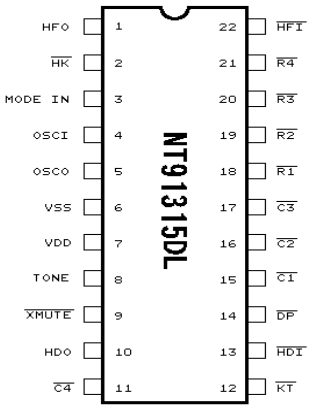
b. NT91315BL



c. NT91315CL



d. NT91315DL

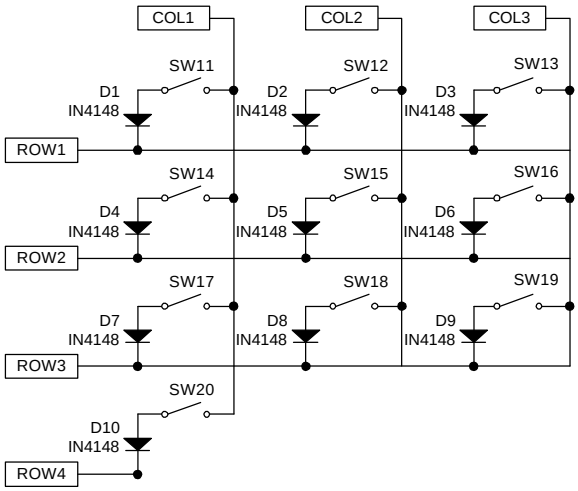


Keyboard Assignments

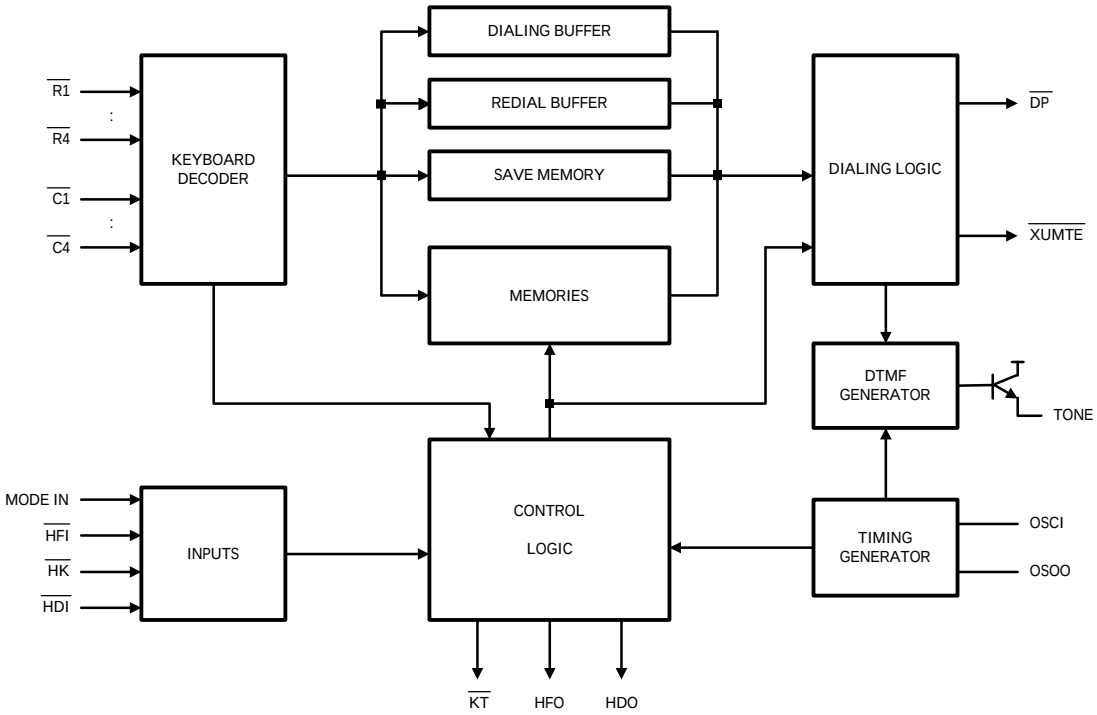
	$\overline{C1}$	$\overline{C2}$	$\overline{C3}$	GND	$\overline{C4}$
$\overline{R1}$	1	2	3	ST	RD
$\overline{R2}$	4	5	6	A/L	P
$\overline{R3}$	7	8	9	F1	F2
$\overline{R4}$	*/T	0	#	RD/P	F3
	M1	M2	M3		SAVE

VDD

Flash time, F1: 600ms(default), F2: 300ms, F3: 100ms
Diode options (switch closed):
D1. Lock 0
D2. Pause time 2.2sec
D3. Flash time 300ms for F1
D4. Lock 0, 9
D5. Pulse dialing 10-N
D6. Pulse dialing N+1
D7. Lock 0, 168
D8. Flash time 100ms for F1
D9. Dialing rate 10pps & 20pps selectable, M/B ratio 1/2
D10. Lock all digits



Block Diagram



Absolute Maximum Ratings*

Supply Voltage (V_{DD}) . . . . . .-0.3V to +6.0V
Input Voltage (V_{IN}) . . . . V_{SS} - 0.3V to V_{DD} + 0.3V
Output Voltage (V_{OUT}) . . . . . .V_{SS} - 0.3V to V_{DD} + 0.3V
Output Voltage (V_{OUT})($\overline{DP}$, $\overline{XMUTE}$) . . . . . .<1.2V
Tone Output Current (I_{TONE}) . . . . . <50 mA
Power Dissipation (P_D) . . . . . <500 mW
Operating Temperature (T_{OP}) . . . . . .-20°C to +70°C
Storage Temperature (Tstg) . . . . . .-40°C to +125°C

* Comments

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the 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 and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Electrical Characteristics (V_{DD} = 2.5V, Vss = 0V, Fosc = 3.579MHz, Top = 25°C, unless otherwise specified.)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Test CKT.
Operating Voltage	V_{DD}	2.0		5.5	V	PULSE mode		A
		2.0		5.5		TONE mode		
Memory Retention Voltage	V_{MR}	0.8			V			-
Memory Retention Current	I_{MR}			0.5	µA	V_{DD} = 1.0V, $\overline{HK}$ = V_{DD} All outputs unloaded		-
Operating Current	I_{DDP}			1.0	mA	PULSE mode	All outputs unloaded	A
	I_{DDT}			2.0		TONE mode		
Standby Current	I_{SC}		0.3	0.5	µA	$\overline{HK}$ =V_{DD}=1.5V	All outputs unloaded No key selected	
				20		$\overline{HK}$ = V_{SS}		
Input Voltage	V_{IH}	0.8		1	V_{DD}	---		
	V_{IL}	0		0.2				
$\overline{R1}$ - $\overline{R4}$ Input Current	IR		16		µA			C
Tone Out Voltage	V_{OC}		720		mVp.p	Column	V_{DD} = 2.5V	D
	V_{OR}		560			Row	RL = 5K	
$\overline{HFI}$ Pull Low Current	I_{HFI}		2.4		µA	V_{DD} = 2.5V (Note 1) $\overline{HFI}$ pin connected to 0V		C

DC Electrical Characteristics (continued)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Test CKT.
HFO, HDO Source Current	I_{OH1}	0.25	0.85		mA	V_{DD} = 2.5V V_{OH} = V_{DD} - 0.4V	B
HFO, HDO, $\overline{KT}$, $\overline{XMUTE}$ Sink Current	I_{OL1}	0.8	2.5		mA	V_{DD} = 2.5V V_{OL} = 0.4V	B
$\overline{DP}$ Sink Current	I_{OL2}	0.8	2.2		mA	V_{OL} = 0.4V	B
Distortion	DIS%		1	5	%	* (See note below)	

*Note:

$$DIS\% = \frac{100 * (V_1^2+V_2^2+ \ldots +Vn^2)^{1/2}}{(V_{IL}^2+ V_{IH}^2)^{1/2}}$$

1. V_1 . . . . Vn are the intermodulation or the harmonic frequencies in the 500 Hz to 3400 Hz band.
2. V_{IL} and V_{IH} are the individual frequency components of the DTMF signal.

AC Characteristics (V_{DD} = 2.5V, Vss = 0V, Fosc = 3.579MHz, Top = 25°C, unless otherwise specified.)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	
Make Time	T_M		33.3		ms	10 pps	M/B = 1/2
			40.0				M/B = 2/3
			16.7			20 pps	M/B = 1/2
			20.0				M/B = 2/3
Break Time	T_B		66.6		ms	10 pps	M/B = 1/2
			60.0				M/B = 2/3
			33.3			20 pps	M/B = 1/2
			30.0				M/B = 2/3
Inter-digit Pause Time	T_{IDP}		824		ms	10 pps	
			458			20 pps	
Pause Time	T_{PAU}		2.2		sec		
			3.6				
Auto-redial Break Time	T_{AOBK}		2.2		sec		
Delay time key valid to signal out	Td		2		ms		
Pick-Up Pause	T_{HK}		824		ms		
Key-in Debounce	Tkd		22		ms		
Key-release Debounce	Trd		24		ms		

AC Characteristics (continued)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Key-in Tone Duration	T_{KTD}		27		ms	
Key-in Tone Frequency	F_{KT}		437		Hz	
Minimum Tone Duration Time	T_{MFD}		94		ms	
Min. Tone inter-digit Pause	T_{IDP}		96		ms	
Redial Tone Duration	T_{RFDR}		94		ms	
Redial Tone inter-digit Duration	T_{TIDPR}		96		ms	
Memory Tone Duration	T_{RFDM}		94		ms	
Memory Tone inter-digit Duration	T_{TIDPM}		96		ms	
Hold-in Debounce	T_{HD}		23		ms	
Hold-release Debounce	T_{HRD}		295		ms	
Hands-Free in Debounce	T_{HFID}		22		ms	
Hands-Free release Debounce	T_{HFRD}		24		ms	

Comparisions of Specified vs. Actual Tone Frequencies

R/C	Spec.	Actual	Error(%)	Unit	Conditions
R1	697	699.2	+0.32	Hz	Fosc = 3.579MHz
R2	770	766.3	-0.48	Hz	
R3	852	847.5	-0.53	Hz	
R4	941	948.1	+0.74	Hz	
C1	1,209	1,216.0	+0.58	Hz	
C2	1,336	1,331.8	-0.31	Hz	
C3	1,477	1,472.0	-0.34	Hz	

Pin Descriptions

<table>
<tr><th colspan="4">Pin No.</th><th rowspan="2">Designation</th><th rowspan="2">I/O</th><th rowspan="2">Description</th></tr>
<tr><th>NT91315AL</th><th>NT91315BL</th><th>NT91315CL</th><th>NT91315DL</th></tr>
<tr><td>1</td><td>2</td><td>2</td><td>2</td><td>$\overline{HK}$</td><td>I</td><td>Hook switch input
This inverter input pin detects the state of the hook switch contact. "Off Hook" is represented by a Vss condition. "On Hook" is represented by a VDD condition</td></tr>
<tr><td>2</td><td>3</td><td>3</td><td>3</td><td>MODE IN</td><td>I, Z</td><td>TRI-STATE mode select pin
The two types the NT91315XL are listed as follows (diode options)
a. Without diode added
<table>
<tr><th>MODE IN</th><th>Tone/ Pulse</th><th>Dial Rate</th><th>M/B Ratio</th></tr>
<tr><td>VDD</td><td>Pulse</td><td>10pps</td><td>2/3</td></tr>
<tr><td>Vss</td><td>Tone</td><td>-</td><td>-</td></tr>
<tr><td>Floating</td><td>Pulse</td><td>10pps</td><td>1/2</td></tr>
</table>
b. With diode added
<table>
<tr><th>MODE IN</th><th>Tone/ Pulse</th><th>Dial Rate</th><th>M/B Ratio</th></tr>
<tr><td>VDD</td><td>Pulse</td><td>10pps</td><td>1/2</td></tr>
<tr><td>Vss</td><td>Tone</td><td>-</td><td>-</td></tr>
<tr><td>Floating</td><td>Pulse</td><td>20pps</td><td>1/2</td></tr>
</table>
The mode selection pin checks for tone/pulse dialing as each digit is entered. In the PULSE mode, the dialing rate is checked, along with the make/break ratio, at the entry of the first key</td></tr>
</table>

Pin Descriptions (continued)

Pin No.				Designation	I/O	Description
NT91315AL	NT91315BL	NT91315CL	NT91315DL			
3 4	4 5	4 5	4 5	OSCI OSCO	I	Oscillator Input and Output pins The time base for the NT91315XL is a crystal controlled on-chip oscillator. It is completed by connecting a 3.58 MHz crystal or ceramic resonator between the OSCI and OSCO pins
5	6	6	6	V_{SS}		Power supply pins These devices are designed to operate from 2.0V to 5.5V
6	7	7	7	V_{DD}		
7	8	8	8	TONE	O	Tone dialing output When a valid keystroke is detected in DTMF mode, appropriate low group and high group frequencies are generated, which hybridize the dual tone output. Tone output is in the OFF state when in PULSE mode
8	9	9	9	$\overline{\text{XMUTE}}$	O	Dialing transmission mute output This is an N-channel open drain output. The $\overline{\text{XMUTE}}$ is normally OFF. During pulse or DTMF dialing, this output is ON
9	10	12	14	$\overline{\text{DP}}$	O	Dialing pulse output This is an N-channel open drain output. The normal output will be ON during break and OFF during make in the PULSE DIALING mode
10	11	13	15	$\overline{\text{C1}}$		
11	12	14	16	$\overline{\text{C2}}$		
12	13	15	17	$\overline{\text{C3}}$		
13	14	16	18	$\overline{\text{R1}}$		
14	15	17	19	$\overline{\text{R2}}$		
15	16	18	20	$\overline{\text{R3}}$		
16	17	19	21	$\overline{\text{R4}}$		
(N.A.)	(N.A.)	(N.A.)	11	$\overline{\text{C4}}$		

Pin Descriptions (continued)

<table>
<tr><th colspan="4">Pin No.</th><th>Designation</th><th>I/O</th><th>Description</th></tr>
<tr><th>NT91315AL</th><th>NT91315BL</th><th>NT91315CL</th><th>NT91315DL</th><th></th><th></th><th></th></tr>
<tr><td>(N.A.)</td><td>(N.A.)</td><td>10</td><td>10</td><td>HDO</td><td>O</td><td>HOLD output pin
This inverter output pin will stay high when HOLD function is active</td></tr>
<tr><td>(N.A.)</td><td>(N.A.)</td><td>11</td><td>13</td><td>$\overline{\text{HDI}}$</td><td>I</td><td>The HOLD function will be toggled when this pin goes from high to low in the OFF HOOK state</td></tr>
<tr><td>(N.A.)</td><td>(N.A)</td><td>(N.A.)</td><td>12</td><td>$\overline{\text{KT}}$</td><td>O</td><td>Key-in tone output
This N-channel open drain pin sends out a "beep" tone for each PULSE mode and each store state key entry, as well as for entries of accepted function keys (ST, F, A/L, R/P, SAVE and memory keys). Tone output frequency is 437 Hz and tone duration is 27 ms</td></tr>
<tr><td rowspan="2">(N.A.)</td><td>1</td><td>1</td><td>1</td><td>HFO</td><td>O</td><td rowspan="2">Hands-Free Control I/O pins These pins enable and disable the Hands-Free Control function. When input pin $\overline{\text{HFI}}$ goes low, the Hands-Free Control state is toggled on. The status of the Hands-Free Control state is listed in the following table:
<table>
<tr><th colspan="2">Current State</th><th colspan="3">Next States</th></tr>
<tr><th>Hook sw.</th><th>HFO</th><th>Input</th><th>HFO</th><th>Dialing?</th></tr>
<tr><td>-</td><td>Low</td><td>$\overline{\text{HFI}}$ ↓</td><td>High</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>High</td><td>$\overline{\text{HFI}}$ ↓</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>$\overline{\text{HFI}}$ ↓</td><td>Low</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>-</td><td>Off Hook</td><td>Low</td><td>Yes</td></tr>
<tr><td>Off Hook</td><td>Low</td><td>On Hook</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>On Hook</td><td>High</td><td>Yes</td></tr>
</table></td></tr>
<tr><td>18</td><td>20</td><td>22</td><td>$\overline{\text{HFI}}$</td><td>I</td></tr>
</table>

Operating Procedures

Symbol Definitions:

In the description below, signals are defined in terms of the key or switch which is activated.

[Off Hook] means the phone is off the hook.

[On Hook] means the phone is on the hook .

[D1] represents the first digit dialed in a string of digits.

[Dn] ([Dk]) represents the last digit dialed in a string of digits.

[Dn+1] ([Dk+1]) represents the beginning of a new string of digits.

[ST] is the Store key.

[A/L] is the Auto/Location key.

[F] is the Flash key.

[RD/P] is the Redial/Pause key.

[RD] is the Redial key.

[P] is the Pause key.

[Mi] is the Emergency key.

[SAVE] is the Save key.

Functional Descriptions:

1. Normal Dialing

   [Off Hook] [D1] . . . [Dn]

   Dial out [D1] . . . [Dn] in either PULSE or TONE mode according to the state of input pin "MODE IN". The redial memory will be [D1] . . . [Dn]. (The number of dialing digits is unlimited, but redial memory is limited to 32 digits.)

2. Flash Dialing

   [Off Hook] [F] [D1] . . . [Dn]

   $\overline{DP}$ will break for 96/297/640ms and pause for an additional 824ms. It will then dial out [D1] . . . [Dn], which will be stored in redial memory.

   [Off Hook] [D1] . . . [Dk] [F] [Dk+1] . . . [Dn]

   The [F] key is unavailable until [D1] . . . [Dk] is dialed out. Dialing [F] [Dk+1] . . . [Dn] uses the same process as the previous case. The redial memory will be [Dk+1] . . . [Dn].

   [Off Hook] [F]

   $\overline{DP}$ will break for 96/297/640ms.
   Redial memory remains unchanged.

3. Memory Dialing

   [Off Hook] ([A/L]) [Mn] (n = 1, 2, 3) or [Off Hook] [A/L] [Dn] ([Dn] = 0 - 9)

   Dials out digits in direct memory [Mn] or indirect memory [Dn] (up to 16 digits). Redial memory remains unchanged.

Notes:

a. In both PULSE and TONE modes, there can be up to 16 digits in a memory location. The tone/pulse attribute is also recorded. In memory dialing, the "MODE IN" pin state does not affect the tone/pulse attribute in memory.

b. The [F] key can be stored only as the first key in memory, not in any other position.

4. Chain Dialing

a. [Off Hook] [D1] . . . [Dk] [Mi] (i = 1, 2, 3) [A/L] [Dm] ([Dm] = 0 - 9) [Dk+1] . . . [Dn].

It first dials out [D1] . . . [Dk], then the digits of [Mi], then the digits of indirect memory [Dm], and finally [Dk+1] . . . [Dn].

b. [Off Hook] [R/P] [R/P] [D1] . . . [Dn] [Mi] (i = 1, 2, 3)

Dials out the digits in redial memory, pauses for 2.2/3.6 sec, then dials [D1] . . . [Dn], and finally the digits in [Mi]. The redial memory is unchanged.

Note:

Memory keys can be accepted at any time during chain dialing, whether or not the dialing process is completed.

5. Mix Dialing

Only PULSE mode to TONE mode is switchable. This is achieved by either changing the MODE IN state, or by depressing the [*/T] key in PULSE mode. TONE mode to PULSE mode switching is not allowed.

6. Memory Storage

a. Direct memory storage

[ST] [D1] . . . [Dn] [Mi] or [ST] [D1] . . . [Dn] [ST] [Mi] or [ST] [D1] . . . [Dn] [A/L] [Mi] or [ST] [D1] . . . [Dn] [ST] [A/L] [Mi] (i = 1, 2, 3).

b. Indirect memory storage

[ST] [D1] . . . [Dn] [ST] [Dj] or [ST] [D1] . . . [Dn] [A/L] [Dj] or [ST] [D1] . . . [Dn] [ST] [A/L] [Dj] ([Dj] = 0 - 9).

c. Quick storage

[ST] [D1] . . . [Dk] ([ST] [A/L]) [Mi] [ST] [Dk+1] . . . [Dm]. [ST] [Dj] [ST] [Dm+1] . . . [Dn] [A/L] [D1]

d. Redial memory storage

[ST] ([RD]) [ST] [Mi] (i = 1, 2, 3) or [ST] ([RD]) [ST] ([A/L]) [Dj] ([Dj] = 0 - 9)

Note: [ST] [RD/P] [ST] [Mi] will take [RD/P] as a pause key.

e. Store after dialing

[D1] . . . [Dn] [ST] [ST] [Mi] (i = 1, 2, 3)

[D1] . . . [Dn] will be dialed out and will be stored in [Mi].

[D1] . . . [Dk] [ST] [Dk+1] . . . [Dn] [ST] [A/L] [Dj] ([Dj] = 0 - 9)

[D1] . . . [Dk] will be dialed out, and [Dk+1] . . . [Dn] will be stored in [A/L] [Dj].

Notes:

a. Storage is processed in Off-Hook state only.

b. In PULSE mode, the key tone is active as valid key input. In TONE mode, [D1] . . . [Dn] [ST] [ST] [Mi], only the last three keys can produce key tones, but [ST] [D1] . . . [Dn] [ST] [A/L] [Dj] has key tones with every key entry whether in PULSE or TONE mode.

c. ("MODE IN" = V_{DD} or floated) [ST] [D1] . . . [Dk] ("MODE IN" = 0) [Dk+1] . . . [Dn] [ST] [Dj]

Store pulse digits [D1] . . . [Dk], [P→T], and tone digits [Dk+1] . . . [Dn] in indirect memory [Dj].

d. In memory storage, the chip will retain the tone/pulse attribute automatically. In memory dialing, the "MODE IN" state is ignored.

e. Memory storage can proceed either before dialing out a number, or after a dialing sequence is completed.

f. During memory storage, $\overline{\text{XMUTE}}$, $\overline{\text{DP}}$ remains in the OFF state, and all outputs remain unchanged except the key tone.

g. Memory storage will not alter the digits in redial memory.

7. Save Operation

a. Save dialing
[Off Hook] [SAVE]
Dials out the digits in [SAVE]. (up to 32 digits)

b. Save storage
[Off Hook] [D1] . . . [Dn] [SAVE]
[D1] . . . [Dn] will be dialed out and stored in [SAVE].

[ST] [D1] . . . [Dn] [SAVE]
[D1] . . . [Dn] will be stored in [SAVE].

[ST] [RD] [SAVE] or [ST] ([RD]) [ST] [SAVE]
The digits in redial will be stored in [SAVE].

c. Save to memory
[ST] [SAVE] ([ST]) [Mi]
Stores the digits in [SAVE] to [Mi].

[ST] [SAVE] ([ST]) [Dj]
Stores the digits in [SAVE] to [A/L] [Dj].

9. One-key Redial

[Off Hook] [D1] . . . [Dn] [RD]
The [RD] key is unavailable until [D1] . . . [Dn] is dialed out. [RD] will break 2.2 sec and pause for 824 ms, then redial [D1] . . . [Dn].

10. Hold Operation

a. When in OFF HOOK state, pressing HOLD key will toggle hold function.

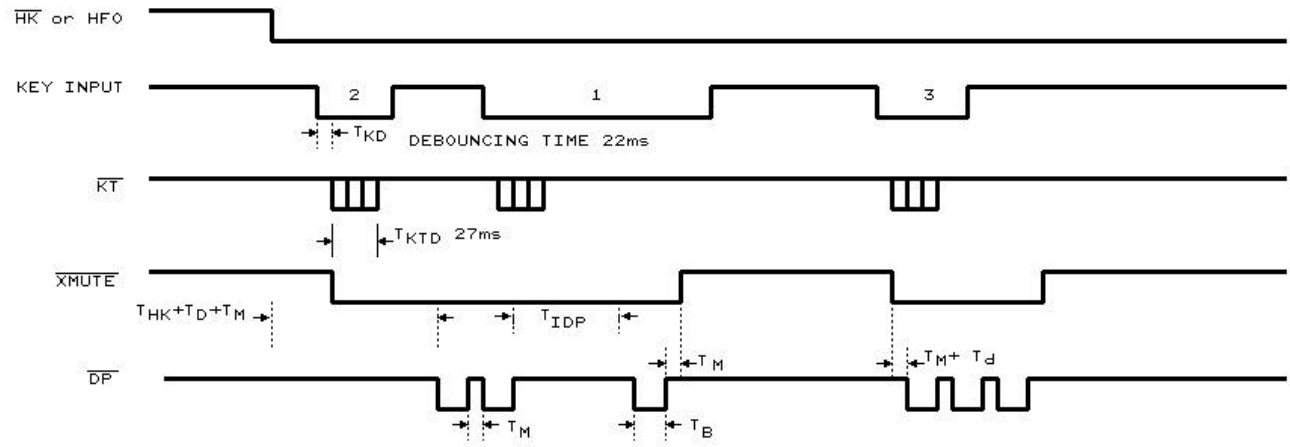
b. When hands-free function is active, pressing HOLD key will activate hold function and release hands-free function.

c. When hold function is active, pressing $\overline{\text{HFI}}$ key will hands-free function activate and release hold function.

d. Picking up receiver will release hold function.

Timing Waveforms

1. Timing Waveforms in PULSE Mode:

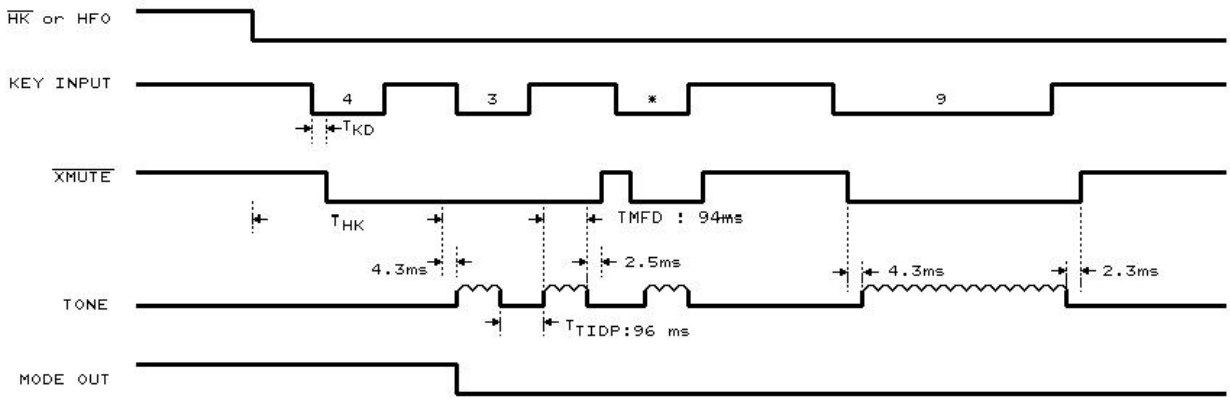


T_{HK}: Pick-Up Pause, 824ms
Td: Delay time or Key valid to dialing signal out, typically 2ms
T_{IDP}: Inter-digit pause time
T_{KTO}: Key-in tone duration
T_{KD}: Debouncing time
Note: "$\overline{HK}$ " or "HFO" indicates that the chip is active when hook switch $\overline{HK}$ goes low or Hands-Free control output HFO goes high.

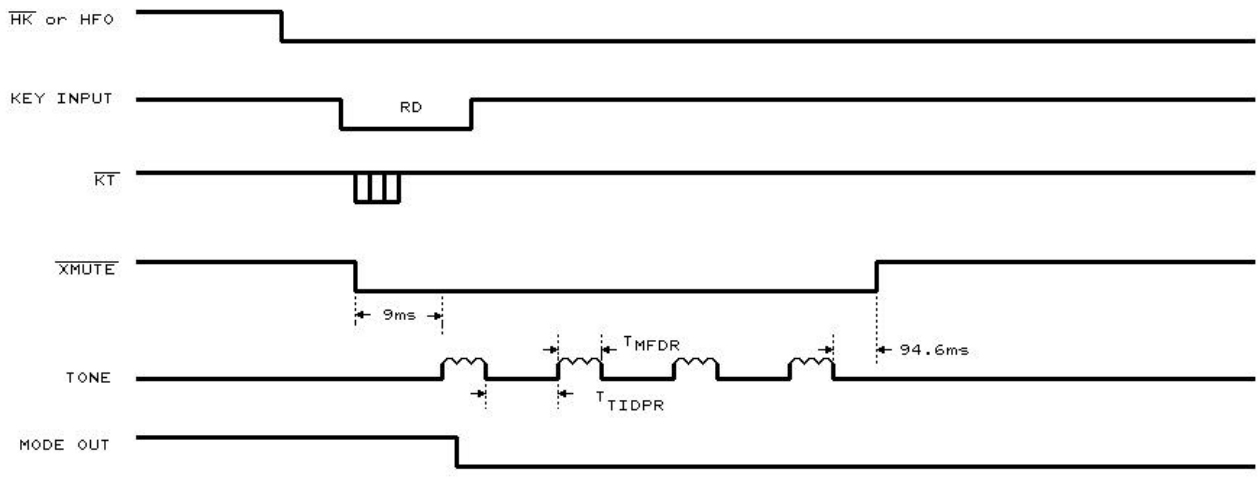
Timing Waveforms (continued)

2. Timing Waveforms in TONE Mode:

(I) Normal Dialing



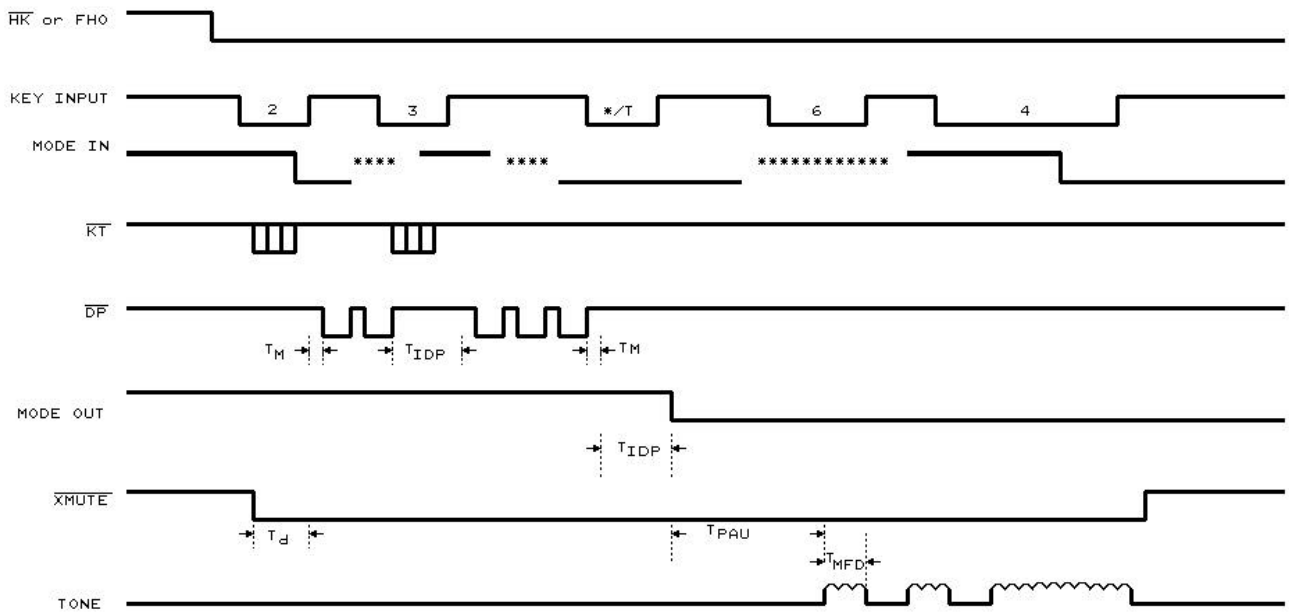
(ii) After (I), Redialing



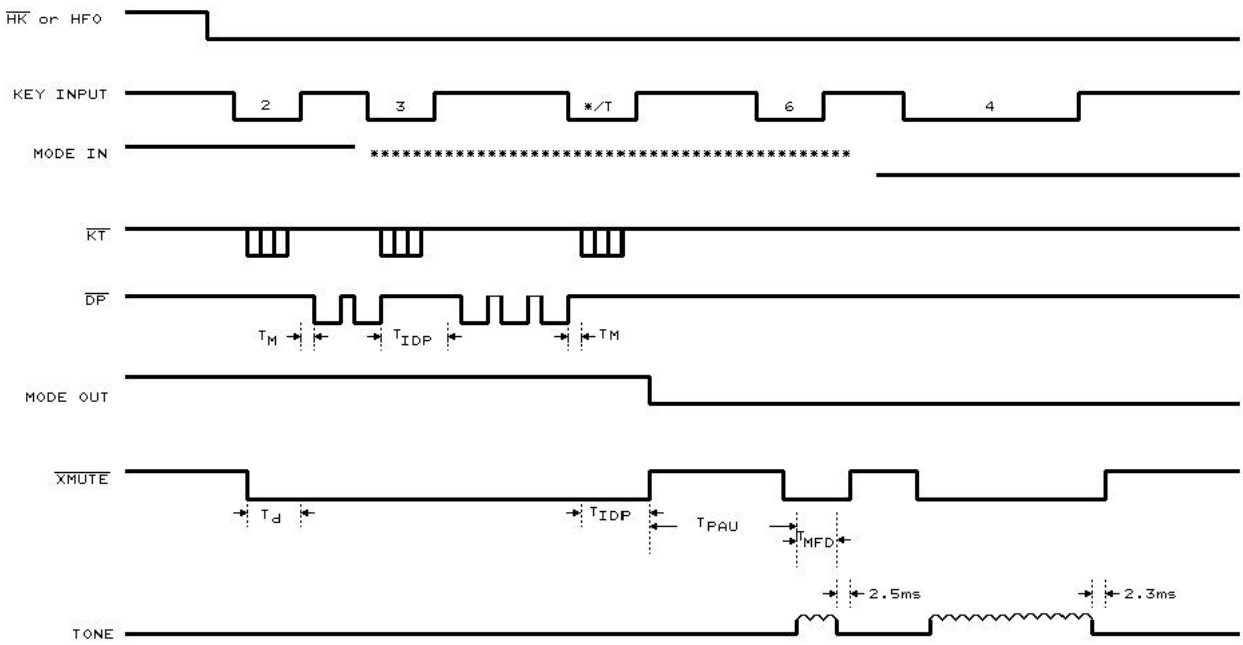
Timing Waveforms (continued)

3. Timing Waveforms for Switching Mode Operation:

(i) By mode selection pin switches

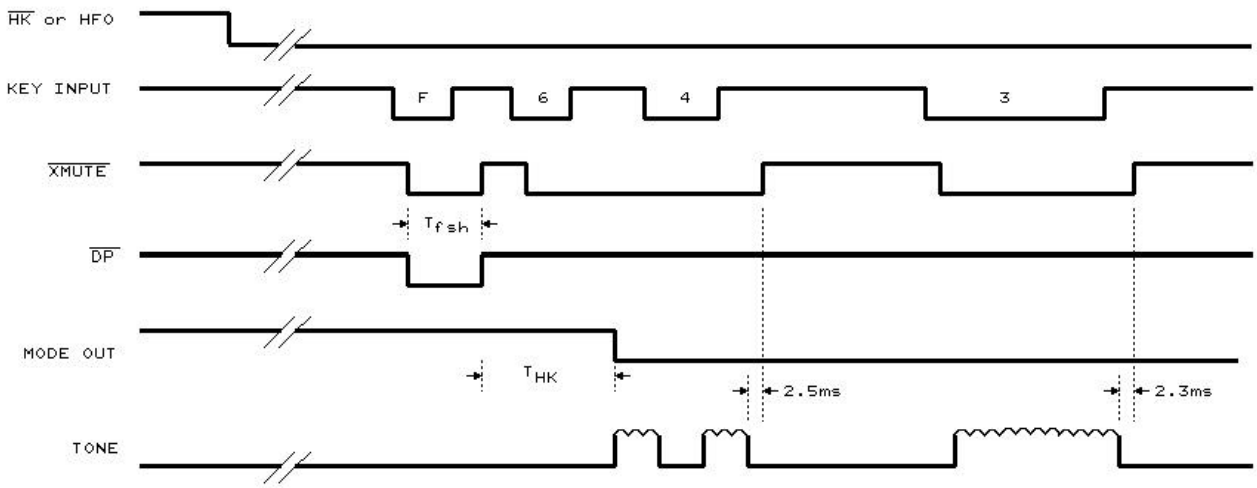


(ii) By */T key entry



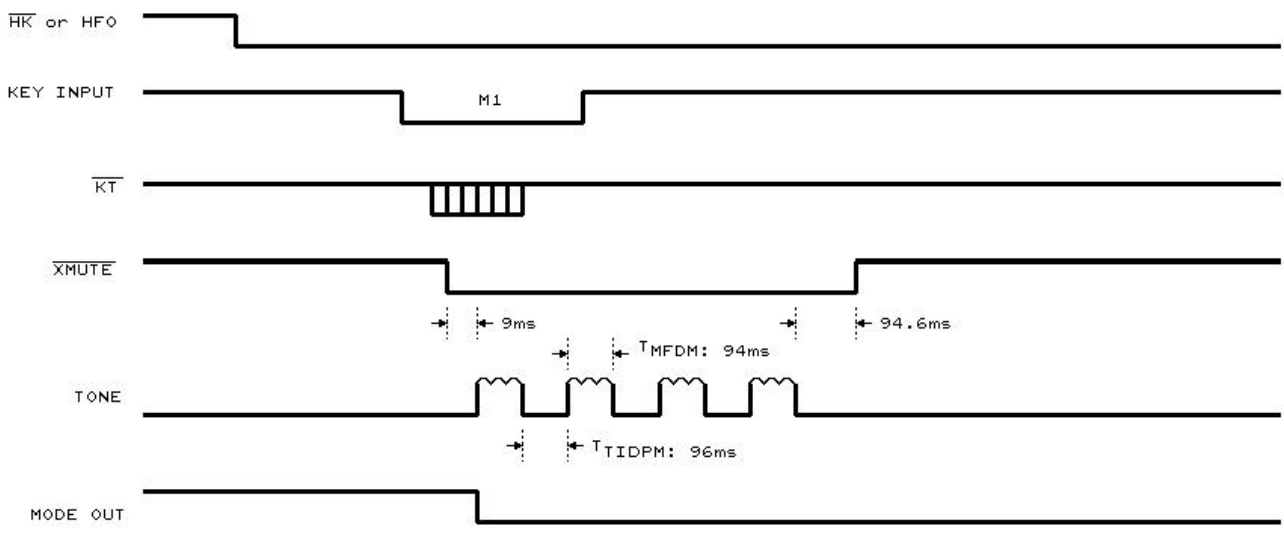
Timing Waveforms (continued)

4. Timing Dialing (DTMF mode used as example):



5. Memory Dial (DTMF mode used as example):

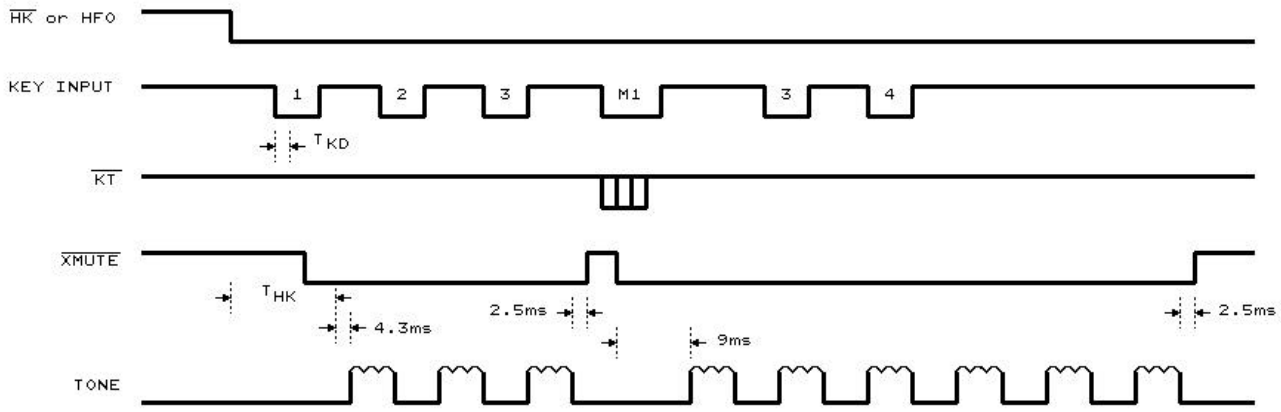
(1, 2, 3, 4 stored in M1)



Timing Waveforms (continued)

6. Chain Dialing (DTMF mode used as example):

(1, 2, 3, 4 stored in M1)



Ordering Information

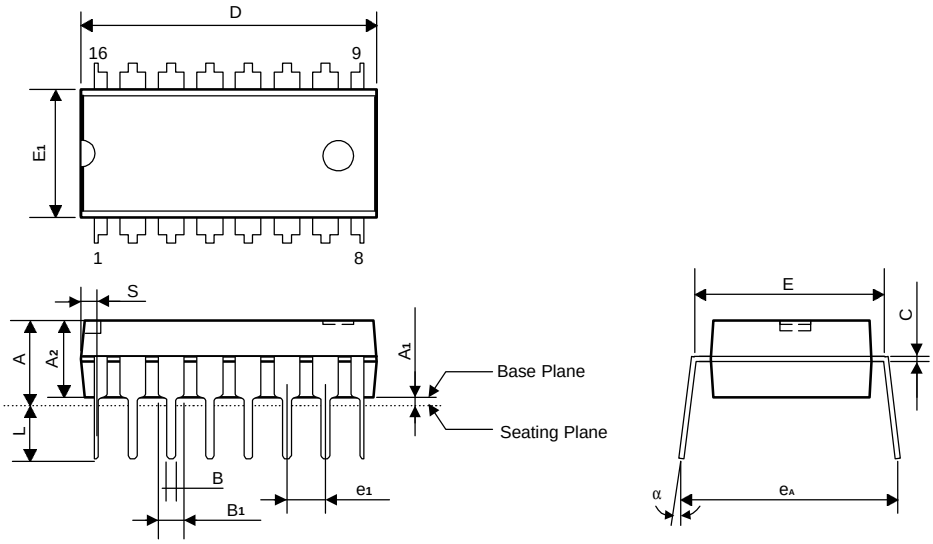
Pin No.	Key Tone	Holds-Free Control	Hold Function	Package
NT91315AL	N.A	N.A	N.A	16L DIP
NT91315BL	N.A	A	N.A	18L DIP
NT91315CL	N.A	A	A	20L DIP
NT91315DL	A	A	A	22L DIP

N.A: Not Available A: Available

Package Inforamtion

DIP 16L Outline Dimensions

unit: inches/mm



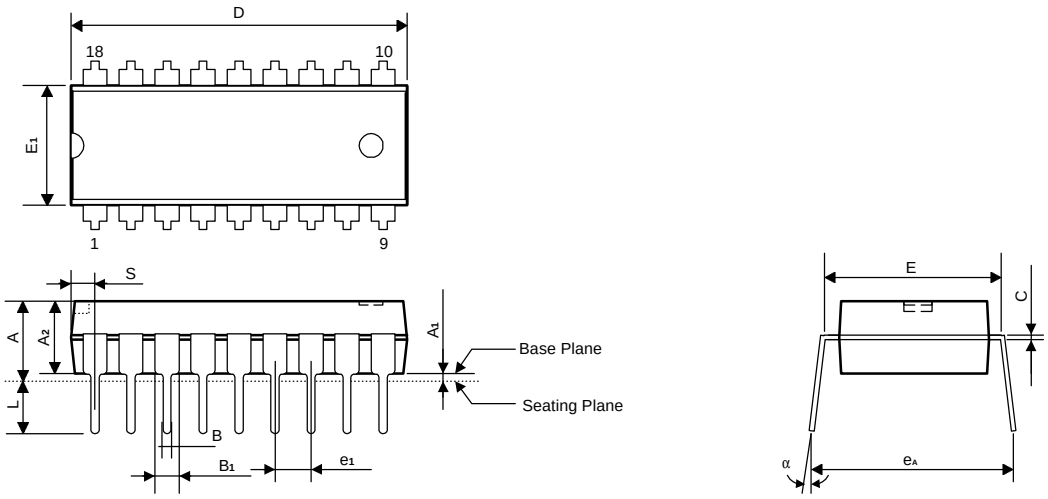
Symbol	Dimensions in inches	Dimensions in mm
A	0.175 Max.	4.45 Max.
A_1	0.010 Min.	0.25 Min.
A_2	0.130±0.010	3.30±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B_1	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	0.750 Typ. (0.770 Max.)	19.05 Typ. (19.56 Max.)
E	0.300±0.010	7.62±0.25
E_1	0.250 Typ. (0.262 Max.)	6.35 Typ. (6.65 Max.)
e_1	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
e_A	0.345±0.035	8.76±0.89
S	0.040 Max.	1.02 Max.

Notes:
1. The maximum value of dimension D includes end flash.
2. Dimension E_1 does not include resin fins.
3. Dimension S includes end flash.

Pacakge Information

DIP 18L Outline Dimensions

unit: inches/mm



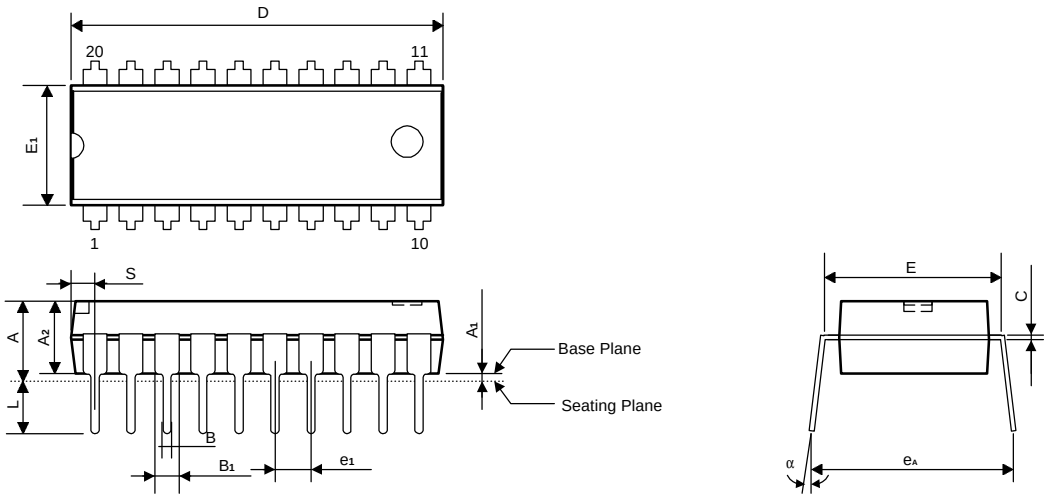
Symbol	Dimensions in inches	Dimension in mm
A	0.175 Max.	4.45 Max.
A_1	0.010 Min.	0.25 Min.
A_2	0.130±0.010	3.30±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B_1	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	0.900 Typ. (0.920 Max.)	22.86 Typ. (23.37 Max.)
E	0.300±0.010	7.62±0.25
E_1	0.250 Typ. (0.262 Max.)	6.35 Typ. (6.65 Max.)
e_1	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
e_A	0.345±0.035	8.76±0.89
S	0.055 Max.	1.40 Max.

Notes:
1. The maximum value of dimension D includes end flash.
2. Dimension E_1 does not include resin fins.
3. Dimension S includes end flash.

Package Information

DIP 20L Outline Dimensions

unit: inches/mm



Symbol	Dimensions in inches	Dimensions in mm
A	0.175 Max.	4.45 Max.
A_1	0.010 Min.	0.25 Min.
A_2	0.130±0.010	3.30±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B_1	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	1.026 Typ. (1.046 Max.)	26.06 Typ. (26.57 Max.)
E	0.300±0.010	7.62±0.25
E_1	0.250 Typ. (0.262 Max.)	6.35 Typ. (6.65 Max.)
e_1	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
e_A	0.345±0.035	8.76±0.89
S	0.078 Max.	1.98 Max.

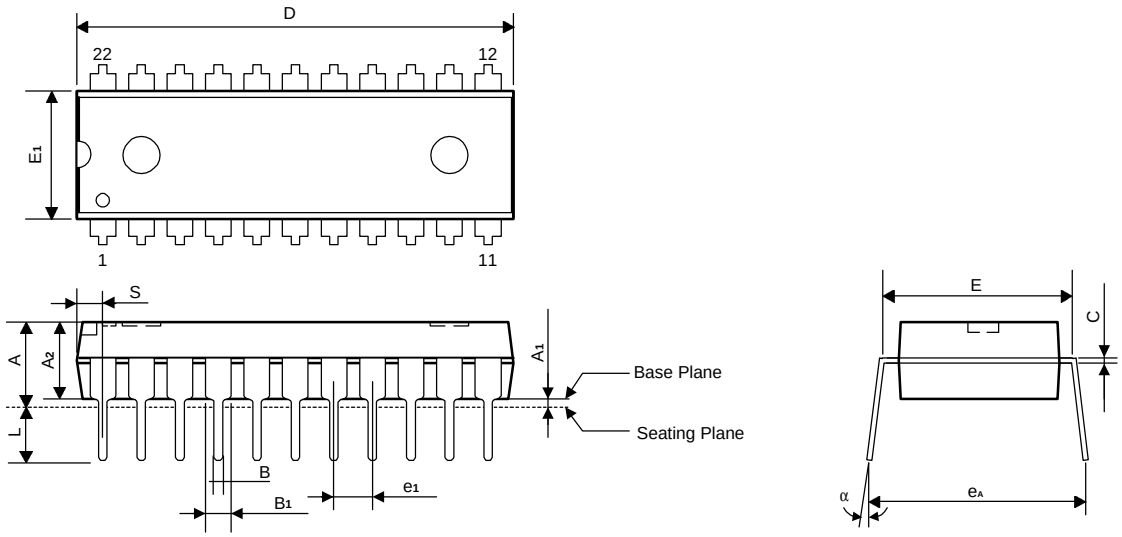
Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E_1 does not include resin fins.
3. Dimension S includes end flash.

Package Information

DIP 22L Outline Dimensions

unit: inches/mm



Symbol	Dimensions in inches	Dimensions in mm
A	0.190 Max.	4.83 Max.
A_1	0.010 Min.	0.25 Min.
A_2	0.130±0.010	3.30±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B_1	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	1.090 Typ. (1.110 Max.)	27.69 Typ. (28.19 Max.)
E	0.400±0.010	10.16±0.25
E_1	0.350 Typ. (0.362 Max.)	8.89 Typ. (9.19 Max.)
e_1	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
e_A	0.445±0.035	11.30±0.89
S	0.060 Max.	1.52 Max.

Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E_1 does not include resin fins.
3. Dimension S includes end flash.