



## NT3758 Series

### Tri-State Programmable Encoder/Decoder

#### Features

- Single-chip CMOS construction
- Single-chip Encoder/Decoder selected by jump wire
- Wide Operating Voltage Range:  $V_{DD} = 3$  to 12 Volts
- Built-in RC oscillator (can use 5% resistor)
- Easy interface with RF, Infrared (IR) and Ultrasonic transmission media
- Tri-state (0, 1, open) address codes, some of address codes used as data codes or as internal addresses by mask option
- Internal address code is 18-bit, ie  $3^{18} = 387,420,489$  different codes at most
- Decoder has 8-bit latch data
- Series IC for various applications
- NT3758-120A pin out compatible with NT3750

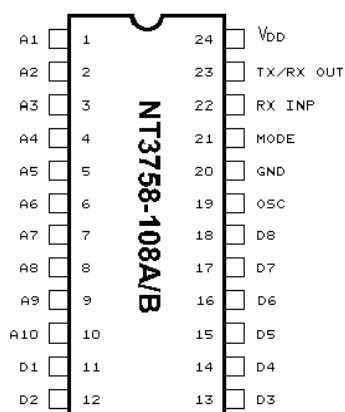
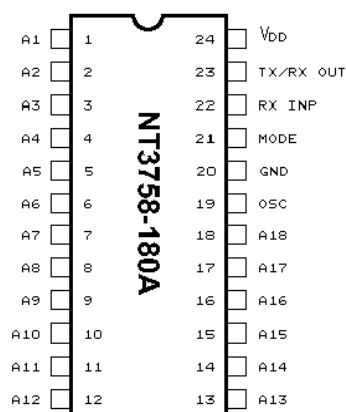
#### General Description

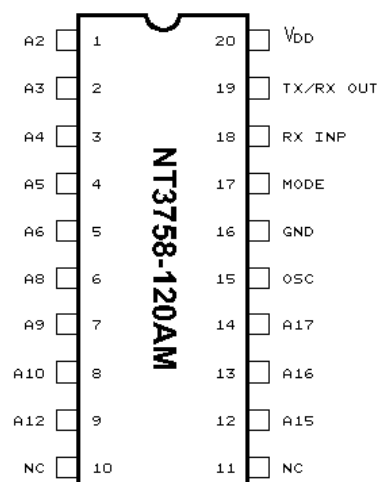
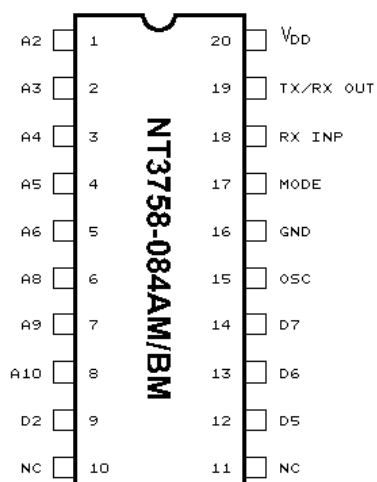
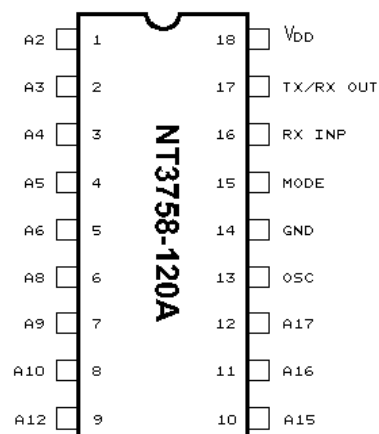
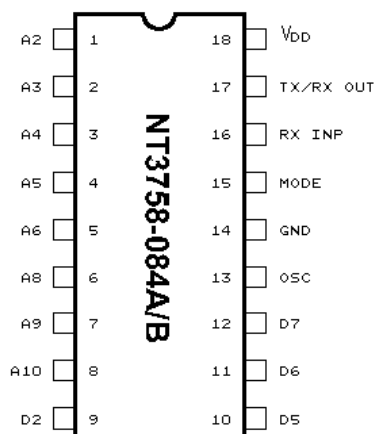
The NT3758 Series are single-chip programmable encoder/decoder ICs, fabricated in CMOS structure for low power consumption. They are enhanced for new stage encoder/decoder ICs to provide many more combinations for higher security.

Most combinations are achieved by NT3758-180A, providing  $3^{18} = 387,420,489$  combinations. Some ICs of this series provide 4 to 8 data bits for controlling.

According to the following information, the internal address bits, 18 bits/24-pin and 12 bits/18-pin package, can be assigned by customer in advance for much higher security and confidentiality. Whenever the address codes of transmitter transmits, the receiver can check the address codes with his own and the successive two matched address codes will generate a low pulse. If there are any data bits, the receiver can latch these data bits at the corresponding pins for controlling.

#### Pin Configurations



**Pin Configurations (continued)**


**Pin Descriptions**
**1. NT3758-180A/AM, NT3758-120A and NT3758-120AM**

Pin Number			Designation	Description
NT3758-180A/AM	NT3758-120A	NT3758-120AM		
1	-	-	A1	Address select line 1 is tri-state indicated as 0, 1 and open
2	1	1	A2	Address select line 2 is tri-state indicated as 0, 1 and open
3	2	2	A3	Address select line 3 is tri-state indicated as 0, 1 and open
4	3	3	A4	Address select line 4 is tri-state indicated as 0, 1 and open
5	4	4	A5	Address select line 5 is tri-state indicated as 0, 1 and open
6	5	5	A6	Address select line 6 is tri-state indicated as 0, 1 and open
7	-	-	A7	Address select line 7 is tri-state indicated as 0, 1 and open
8	6	6	A8	Address select line 8 is tri-state indicated as 0, 1 and open
9	7	7	A9	Address select line 9 is tri-state indicated as 0, 1 and open
10	8	8	A10	Address select line 10 is tri-state indicated as 0, 1 and open
11	-	-	A11	Address select line 11 is tri-state indicated as 0, 1 and open
12	9	9	A12	Address select line 12 is tri-state indicated as 0, 1 and open

**Pin Descriptions (continued)**

Pin Number			Designation	Description
NT3758-180A/AM	NT3758-120A	NT3758-120AM		
-	-	10	NC	No Connection
-	-	11	NC	No Connection
13	-	-	A13	Address select line 13 is tri-state indicated as 0, 1 and open
14	-	-	A14	Address select line 14 is tri-state indicated as 0, 1 and open
15	10	12	A15	Address select line 15 is tri-state indicated as 0, 1 and open
16	11	13	A16	Address select line 16 is tri-state indicated as 0, 1 and open
17	12	14	A17	Address select line 17 is tri-state indicated as 0, 1 and open
18	-	-	A18	Address select line 18 is tri-state indicated as 0, 1 and open
19	13	15	OSC	R.C. input pin for single pin oscillator. A resistor is connected from this pin to $V_{DD}$ and a capacitor to GND.
20	14	16	GND	Ground pin
21	15	17	MODE	This pin is used to select TRANSMIT or RECEIVE modes.  MODE — $V_{DD}$ : Encoder mode  MODE — GND: Decoder mode
22	16	18	RX INP	Receiver input pin. Receives waveform from the detected circuit.
23	17	19	TX/RX OUT	In ENCODER mode, this pin will transmit waveform; in DECODER mode, this pin will switch to LOW if comparison is OK.
24	18	20	$V_{DD}$	Positive power supply

**2. NT3758-180A/B/AM/BM, NT3758-084A/B and NT3758-084AM/BM**

Pin Number			Designation	Description
NT3758-180A/B/AM/BM	NT3758-084A/B	NT3758-084AM/BM		
1	-	-	A1	Address select line 1 is tri-state indicated as 0, 1 and open
2	1	1	A2	Address select line 2 is tri-state indicated as 0, 1 and open
3	2	2	A3	Address select line 3 is tri-state indicated as 0, 1 and open
4	3	3	A4	Address select line 4 is tri-state indicated as 0, 1 and open
5	4	4	A5	Address select line 5 is tri-state indicated as 0, 1 and open
6	5	5	A6	Address select line 6 is tri-state indicated as 0, 1 and open
7	-	-	A7	Address select line 7 is tri-state indicated as 0, 1 and open
8	6	6	A8	Address select line 8 is tri-state indicated as 0, 1 and open
9	7	7	A9	Address select line 9 is tri-state indicated as 0, 1 and open
10	8	8	A10	Address select line 10 is tri-state indicated as 0, 1 and open
11	-	-	D1	Data output pin 1, states are either HIGH (1 or open) or LOW (0)
12	9	9	D2	Data output pin 2, states are either HIGH (1 or open) or LOW (0)

**Pin Descriptions (continued)**

Pin Number			Designation	Description
NT3758-180A/B/AM/BM	NT3758-084A/B	NT3758-084AM/BM		
-	-	10	NC	No connection
-	-	11	NC	No connection
13	-	-	D3	Data output pin 3, states are either HIGH (1 or open) or LOW (0)
14	-	-	D4	Data output pin 4, states are either HIGH (1 or open) or LOW (0)
15	10	12	D5	Data output pin 5, states are either HIGH (1 or open) or LOW (0)
16	11	13	D6	Data output pin 6, states are either HIGH (1 or open) or LOW (0)
17	12	14	D7	Data output pin 7, states are either HIGH (1 or open) or LOW (0)
18	-	-	D8	Data output pin 8, states are either HIGH (1 or open) or LOW (0)
19	13	15	OSC	R.C. input pin for single pin oscillator. A resistor is connected from this pin to $V_{DD}$ and a capacitor to GND
20	14	16	GND	Ground pin
21	15	17	MODE	This pin is used to select TRANSMIT or RECEIVE modes.  MODE — $V_{DD}$ : Encoder mode  MODE — GND: Decoder mode
22	16	18	RX INP	Receiver input pin. Receives waveform from the detected circuit.
23	17	19	TX/RX OUT	In ENCODER mode, this pin will transmit waveform; in DECODER mode, this pin will switch to LOW if comparison is OK.
24	18	20	$V_{DD}$	Positive power supply

## Functional Description

### General

The operating mode of the NT3758 series is controlled by the "MODE" pin. When the "MODE" pin is connected to  $V_{DD}$  the circuit will automatically switch to ENCODER mode, then "TX/RX OUT" pin acts as data out pin and "RX INP" pin acts as an idle pin. When "MODE" pin is connected to GND the circuit will switch to decoder mode, then "TX/RX OUT" pin will switch to LOW if comparison is OK, otherwise this pin will remain HIGH, and "RX/INP" receives waveform from detected circuit.

### Encoder Mode

The encoder mode is selected by connecting "MODE" pin to  $V_{DD}$ .

The transmit sequence is initiated by the power connection and continuously transmits until power-down. Each transmitted address bit is encoded into address pulses (see Figure 1). A logic zero is encoded as two consecutive

long pulses, a logic one as two consecutive short pulses and an open as a long pulse followed by a short pulse. Each transmitted data bit is encoded into logic zero or one and the data pulse is the same as the address pulse (see Figure 1), i.e., the state of data pin is either one or zero. The data is one when connected to  $V_{DD}$  or open and zero when connected to GND.

The NT3758-180A samples the 18 bit tri-state address and encodes this parallel address data for transmitting. These 18 address pins may be in either of three states (0, 1, open) allowing  $3^{18} = 387,420,489$  possible combinations. The NT3758-120A provides 12-bit address and allows  $3^{12} = 531,441$  possible combinations.

The NT3758-108A/B and NT3758-084A/B provide address bits and data bits, as described in Table 1.

Part Number	Address Bits	Address Combinations	Data Bits	Data Combinations
NT3758-108A/B/AM/BM	10	59,049	8	256
NT3758-084A/B/AM/BM	8	6,561	4	16

**Table 1**

### Decoder Mode

The decoder mode is selected by connecting "MODE" pin to GND.

The decoder receives the serial data from the detected circuit and outputs the comparison result or data, if it is valid. The received data may include two types — without data and with data.

For decoders without data ICs, such as NT3758-180A and NT3758-120A, the address word is examined bit by bit as received; if two successive address words match the address bits of decoder, the "TX/RX OUT" pin will switch to LOW and two successive unmatched address words will cause "TX/RX OUT" pin to return to HIGH (see Figure. 3-1).

For decoders with data IC, such as NT3758-108A/B and NT3758-084A/B, the address word with data word are examined bit by bit as received. The first 10 bits

(ex. NT3758-108A/B) are assumed to be address bits. If the address bits match the address bits from detect circuit, the next eight data bits are stored and matched to the last valid data stored. When the second word with data is received, the address bits must match again, and if they do, the data bits are checked against the previous stored data bits. If the two words (eight bits data each) of data match, the data is transferred to the output data pins (D1, D2 to D8). If the decoder is momentary type, the data pins will latch the data till the "TX/RX OUT" pin switches to HIGH; for latch decoder, the data pins will latch the data till the next valid data appears (see Figure. 3-2). Although the address bits are tristate (0, 1, open), the data information must be either one or zero. An open state will be decoded as a logic one. The above table (Table 1) also describes these (decoder with data).

**Absolute Maximum Ratings\***

Power Supply Voltage . . . . . -0.3V to 11V  
 Operating Temperature . . . . . 40°C to 85°C  
 Storage Temperature (Tstg) . . . . . -55°C to 150°C  
 Applied Voltage on any Pin . . . . .  
 . . . . . GND - 0.3 < VIN < VDD + 0.3

**\*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 absolute maximum rating conditions for extended periods may affect device reliability.

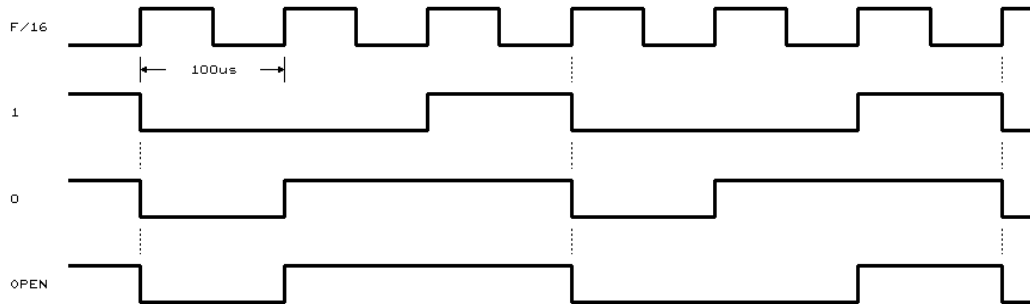
**DC Electrical Characteristics (TA = 25°C, VDD = 9V, GND = 0V, unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Conditions
VDD	Operating Voltage	3.0	-	12	V	
IOP	Operating Current	-	-	1.2	mA	
Vsh Vsl	Schmitt Trigger Input Level	- -	6 2	- -	V V	HIGH LOW
Vih Vil	Other Pins Input Level	8.5 -	- -	- 0.5	V V	HIGH LOW
Voh Vol	Output Pin Logic Level	8.5 -	- -	- 1	V V	Isource = 5μA Isink = 2mA
Iohd Iold	DATA Output Current HIGH Level LOW Level	9 9	- -	- -	mA mA	VDD = 12V Voh = 6V Vol = 6V
IohT IolT	TX/RX Output Current HIGH Level LOW Level	35 15	- -	- -	mA mA	VDD = 12V Voh = 6V Vol = 6V
F	Operating Frequency	-	160	-	KHz	+15% exclusive of external part



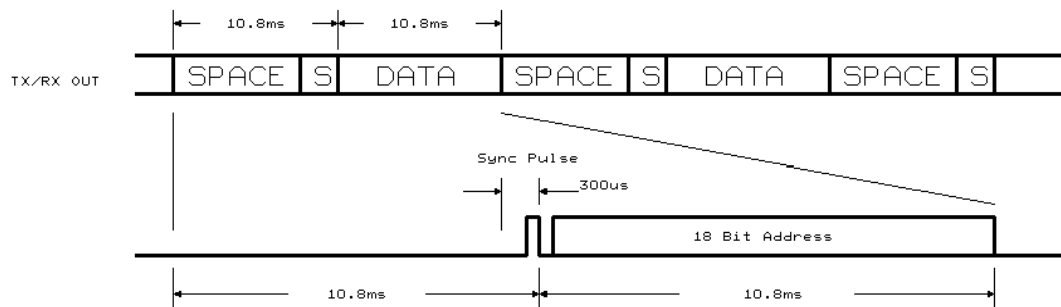
## Timing Waveforms

### Tri-State Encoded Pulses



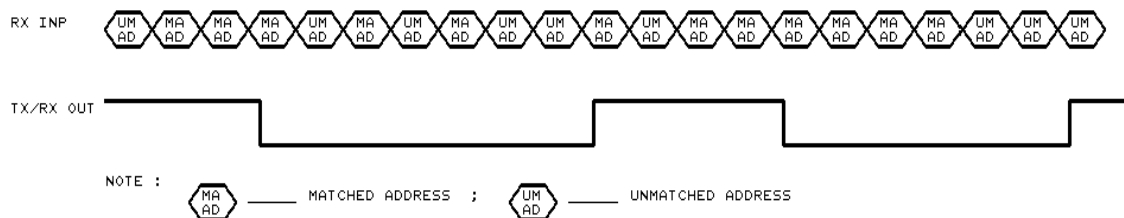
**Figure 1**

### ENCODER Mode



**Figure 2**

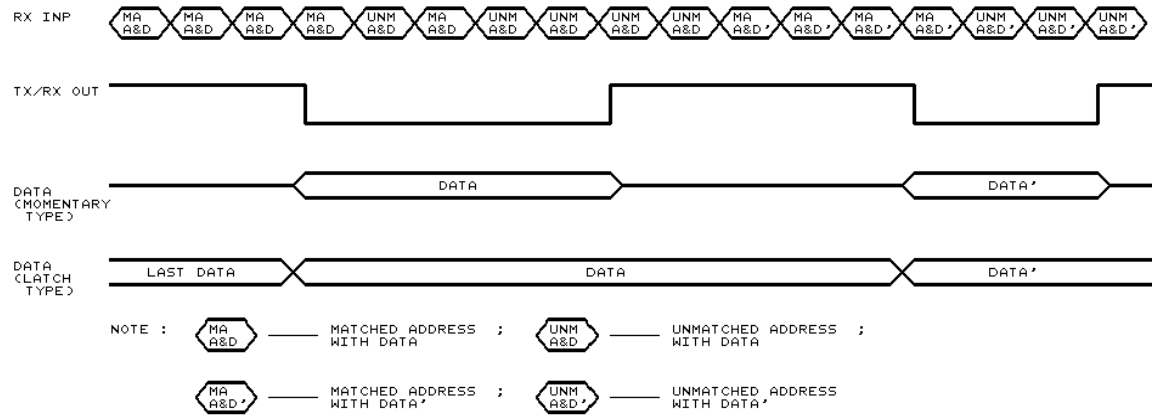
### DECODER Mode (without data):



**Figure 3-1**

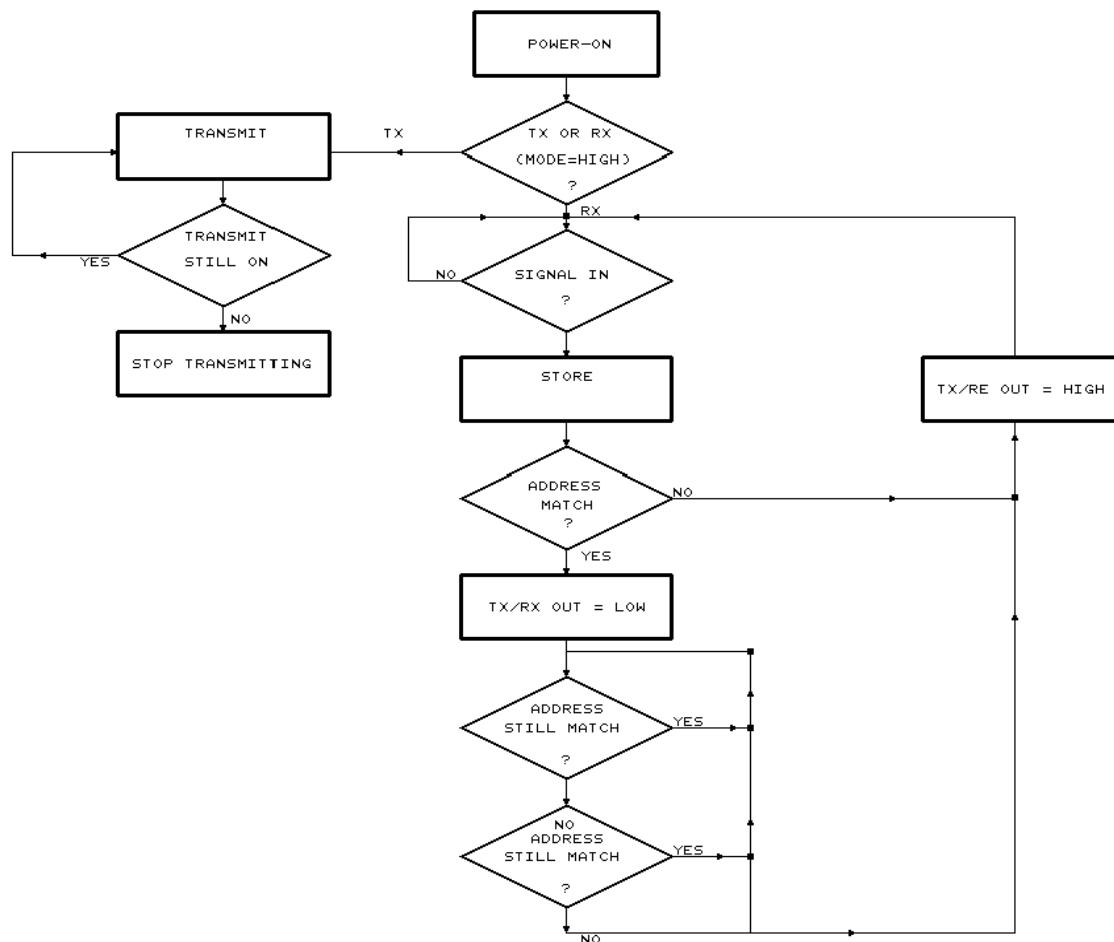
### Timing Waveforms (continued)

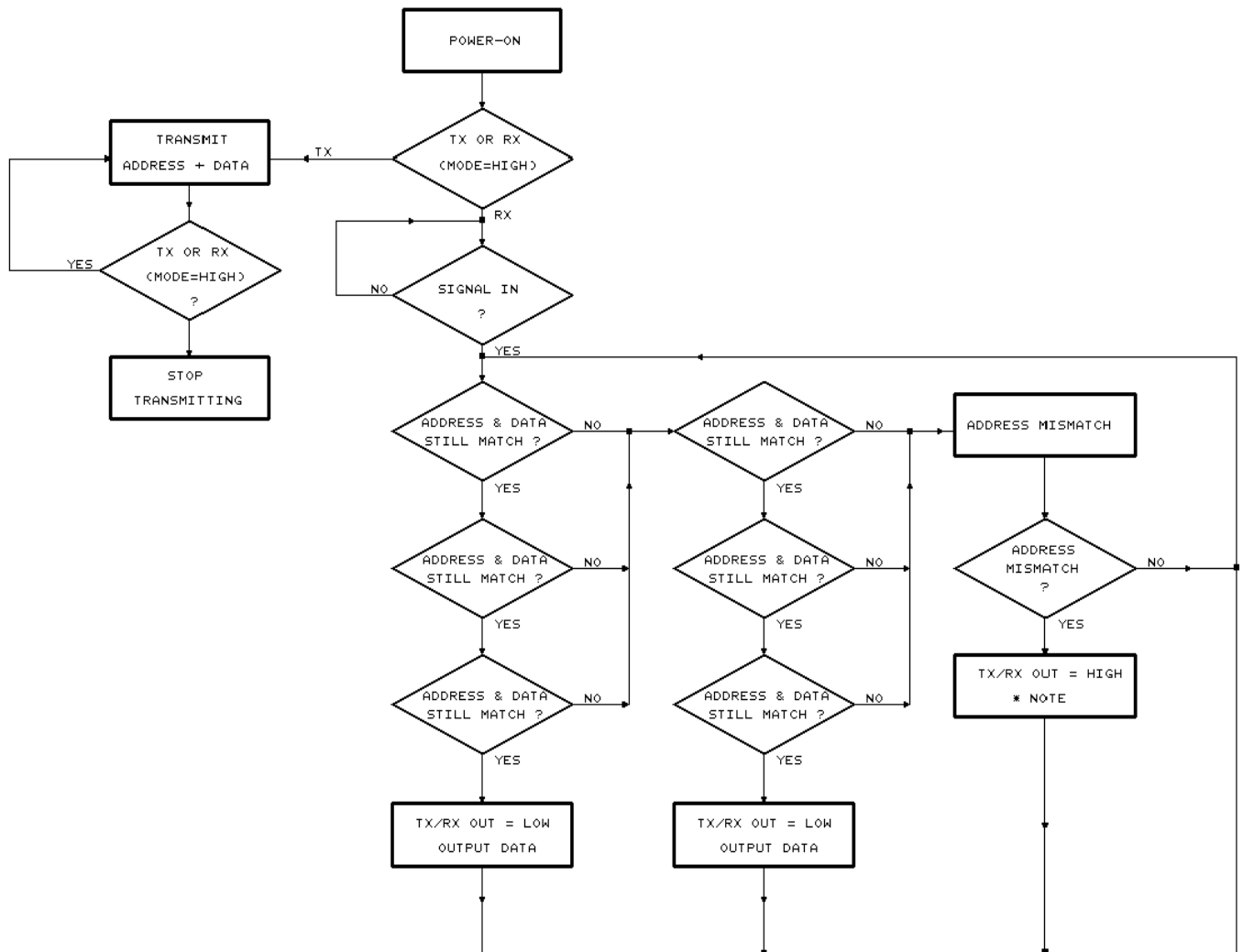
#### Decoder Mode (with data):



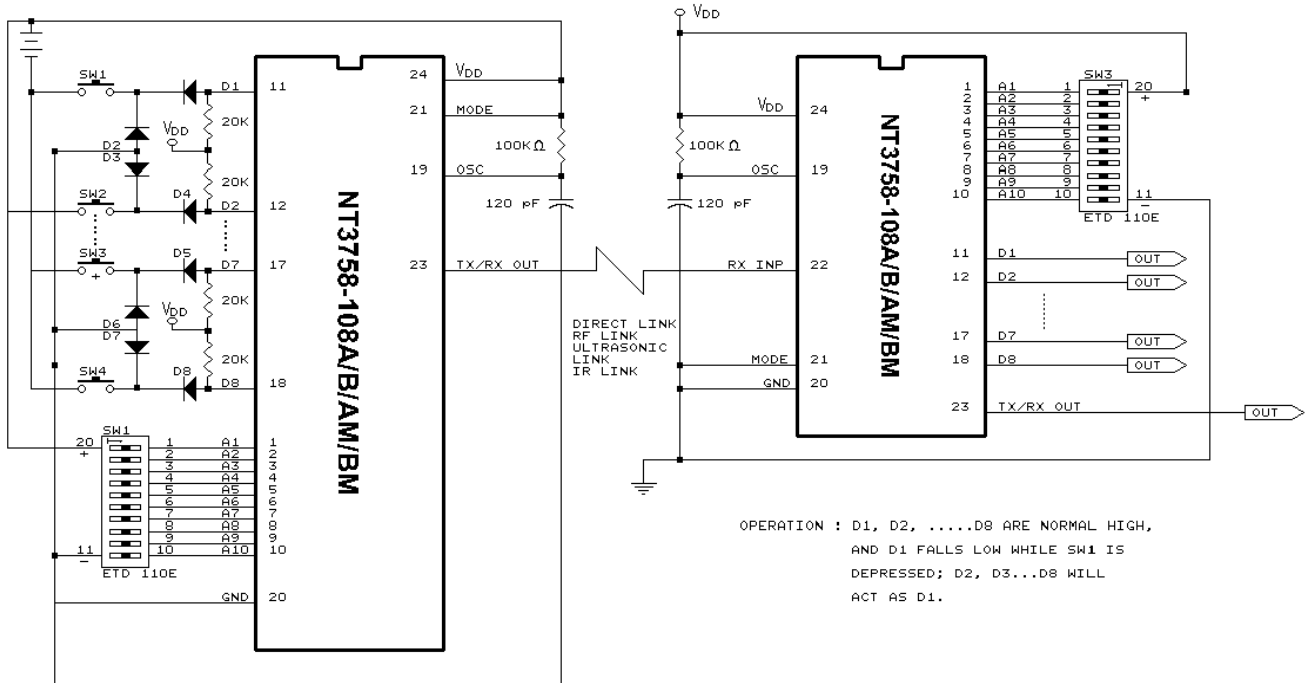
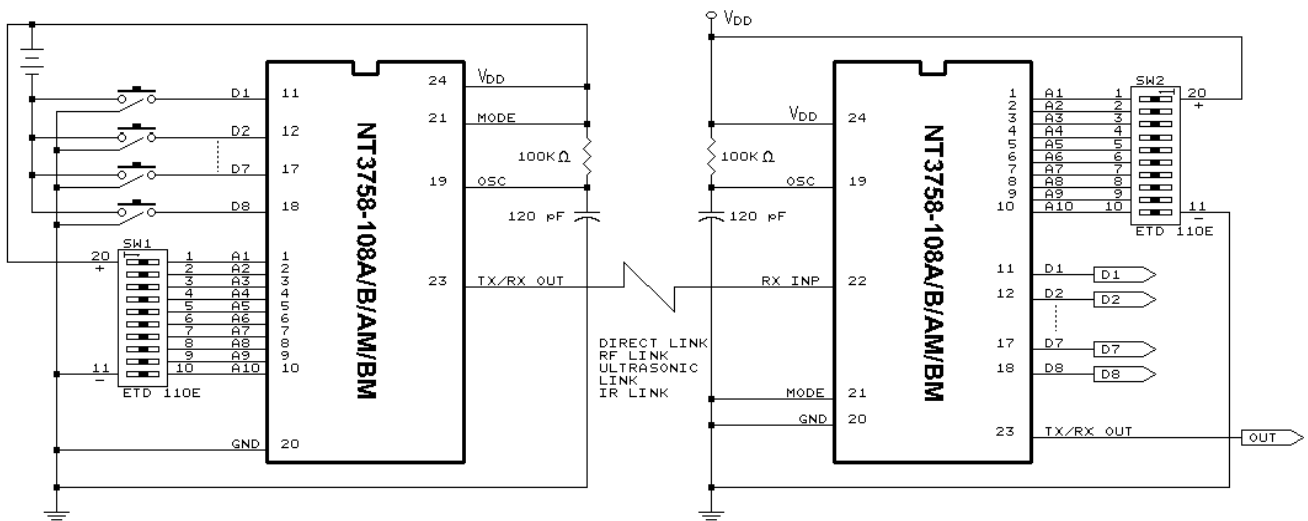
**Figure 3-2**

#### NT3758 Operation Flowchart (without data bit)



**NT3758 Operation Flowchart (with data bit)**


\* Note: For LATCH Type\_\_\_\_\_ Keep current data  
 For MOMENTARY Type\_\_\_\_\_ All Data fall to LOW  
 \* Address MISMATCH INCLUDES "NO SIGNAL IN".

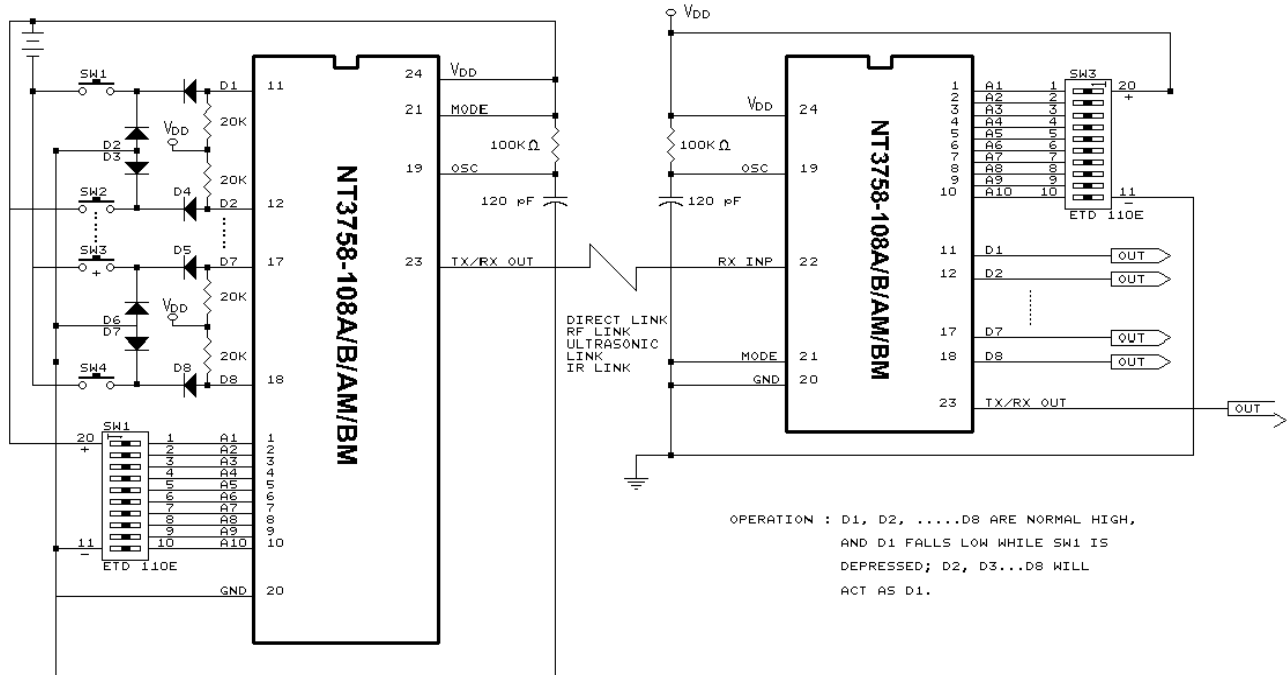
**Application Circuit (without data bit) (for reference only)**

**Application Circuits (with data bit) (for reference only)**
**(A) Use Three-Contact Pushbutton**


Note: ETD 108E — 8-Pin Tri-State DIP switch made by Excel Cell Electronic Co., Ltd.  
ETD 110E — 10-Pin Tri-State DIP switch made by Excel Cell Electronic Co., Ltd.

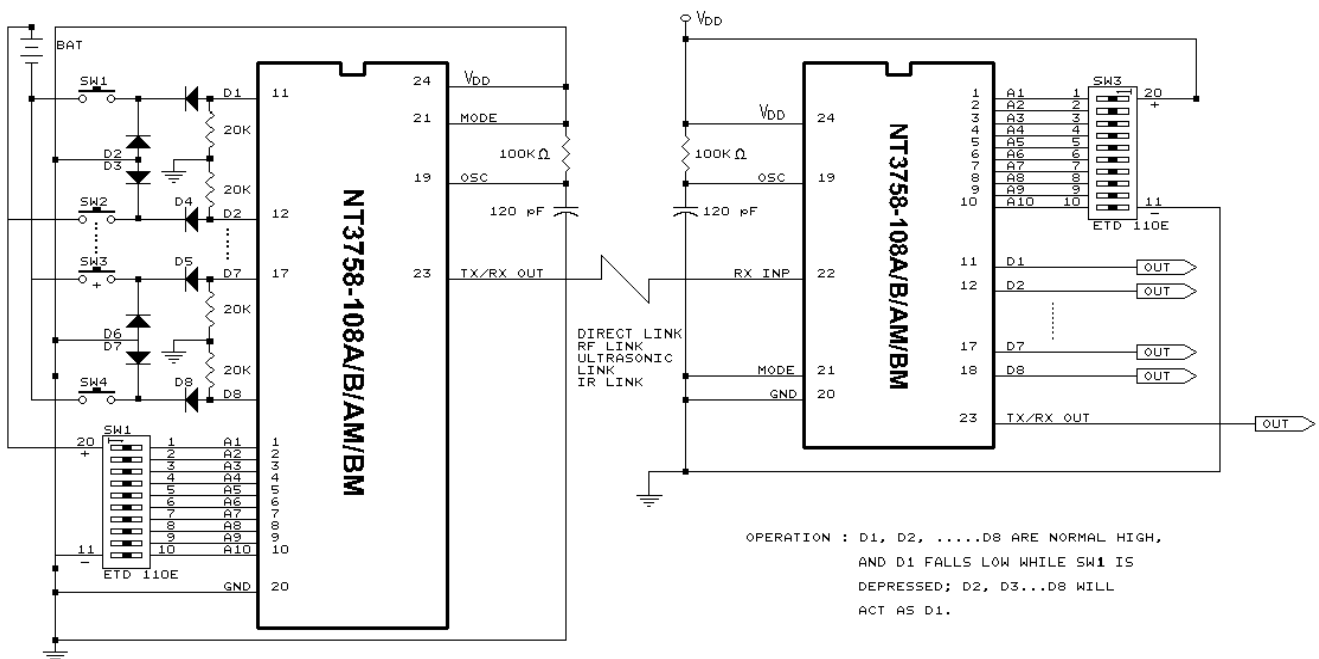
## Application Circuits (continued)

### (B) Use Normal Two-Contact Pushbutton

#### (B) - 1 Application Circuit with Data Bit High to Low



#### (B) - 2 Application Circuit with Data Bit Low to High

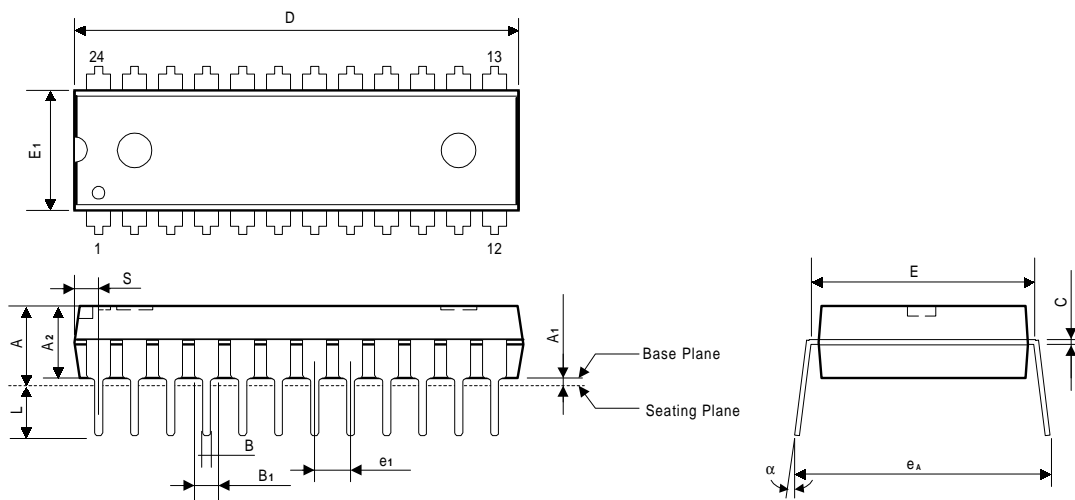


**Ordering Information**

Part No.	Addresses	Data	Data Output Type	Package Type
NT3758-180A	18	0	—	24L DIP
NT3758-180AM	18	0	—	24L SOP
NT3758-108A	10	8	LATCHED	24L DIP
NT3758-108AM	10	8	LATCHED	24L SOP
NT3758-108B	10	8	MOMENTARY	24L DIP
NT3758-108BM	10	8	MOMENTARY	24L SOP
NT3758-120A	12	0	—	18L DIP
NT3758-120AM	12	0	—	20L SOP
NT3758-084A	8	4	LATCHED	18L DIP
NT3758-084AM	8	4	LATCHED	20L SOP
NT3758-084B	8	4	MOMENTARY	18L DIP
NT3758-084BM	8	4	MOMENTARY	20L SOP

**Package Information**
**DIP 24L Outline Dimensions**

unit: inches/mm



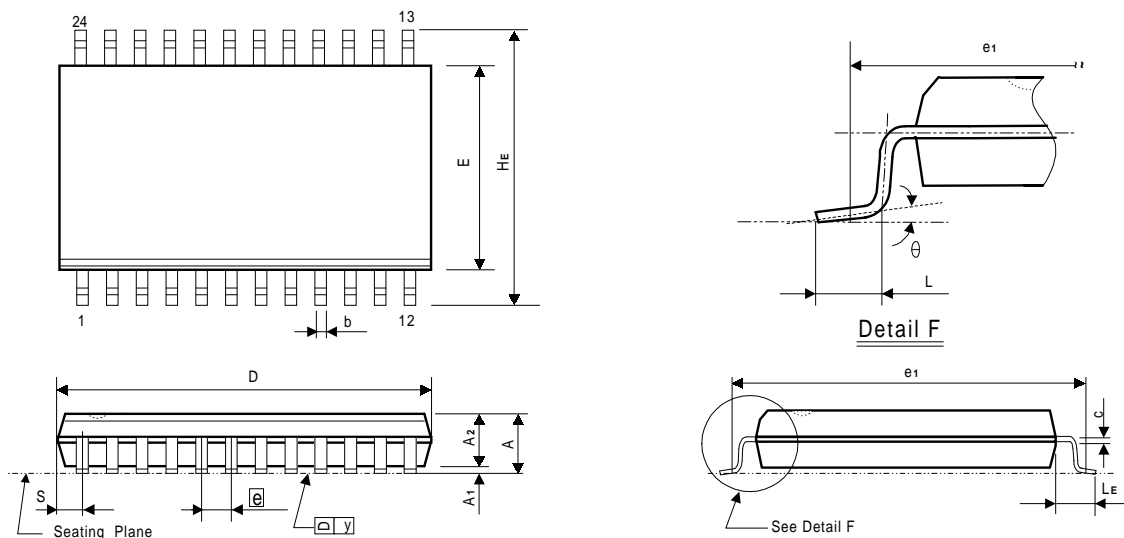
Symbol	Dimensions in inches	Dimensions in mm
A	0.210 Max.	5.33 Max.
A1	0.010 Min.	0.25 Min.
A2	0.155±0.010	3.94±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B1	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	1.250 Typ. (1.270 Max.)	31.75 Typ. (32.26 Max.)
E	0.600±0.010	15.24±0.25
E1	0.550 Typ. (0.562 Max.)	13.97 Typ. (14.27 Max.)
e1	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
eA	0.655±0.035	16.64±0.89
S	0.090 Max.	2.29 Max.

**Notes:**

1. The maximum value of dimension D includes end flash.
2. Dimension E1 does not include resin fins.
3. Dimension S includes end flash.

**Package Information**
**SOP 24L Outline Dimensions**

unit: inches/mm



Symbol	Dimensions in inches	Dimensions in mm
A	0.110 Max.	2.79 Max.
A <sub>1</sub>	0.004 Min.	0.10 Min.
A <sub>2</sub>	0.091±0.005	2.31±0.13
b	0.016 +0.004 -0.002	0.41 +0.10 -0.05
C	0.006 +0.004 -0.002	0.15 +0.10 -0.05
D	0.606 Typ. (0.620 Max.)	15.39 Typ. (15.75 Max.)
E	0.295±0.010	7.49±0.25
e <sub>1</sub>	0.050 ±0.006	1.27±0.15
e <sub>1</sub>	0.370 NOM.	9.40 NOM.
H <sub>E</sub>	0.406±0.012	10.31±0.31
L	0.036±0.008	0.91±0.20
LE	0.055±0.008	1.40±0.20
S	0.040 Max.	1.02 Max.
y	0.004 Max.	0.10 Max.
θ	0° ~ 10°	0° ~ 10°

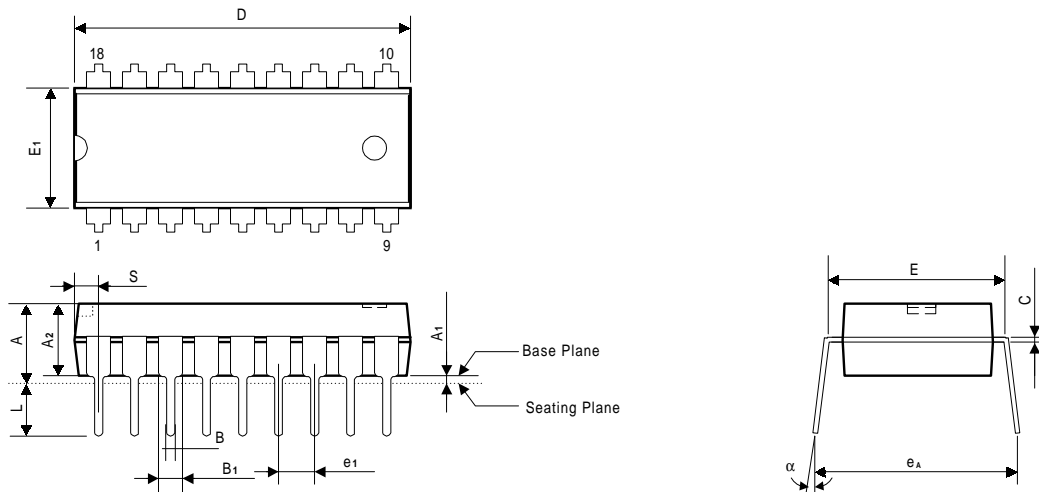
**Notes:**

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension e<sub>1</sub> is for PC Board surface mount pad pitch design reference only.
4. Dimension S includes end flash.



**Package Information**
**DIP 18L Outline Dimensions**

unit: inches/mm



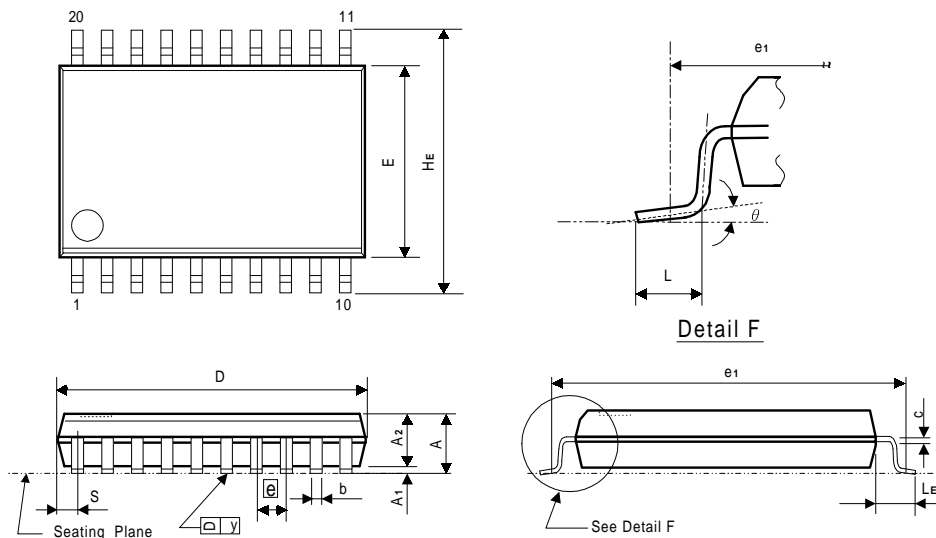
Symbol	Dimensions in inches	Dimension in mm
A	0.175 Max.	4.45 Max.
A <sub>1</sub>	0.010 Min.	0.25 Min.
A <sub>2</sub>	0.130±0.010	3.30±0.25
B	0.018 +0.004 -0.002	0.46 +0.10 -0.05
B <sub>1</sub>	0.060 +0.004 -0.002	1.52 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	0.900 Typ. (0.920 Max.)	22.86 Typ. (23.37 Max.)
E	0.300±0.010	7.62±0.25
E <sub>1</sub>	0.250 Typ. (0.262 Max.)	6.35 Typ. (6.65 Max.)
e <sub>1</sub>	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0° ~ 15°	0° ~ 15°
θ <sub>A</sub>	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<sub>1</sub> does not include resin fins.
3. Dimension S includes end flash.

**Package Information**
**SOP 20L Outline Dimensions**

unit: inches/mm



Symbol	Dimensions in inches	Dimensions in mm
A	0.106 Max.	2.69 Max.
A1	0.004 Min.	0.10 Min.
A2	0.092±0.005	2.33±0.13
b	0.016 +0.004 -0.002	0.41 +0.10 -0.05
C	0.010 +0.004 -0.002	0.25 +0.10 -0.05
D	0.504 Typ. (0.524 Max.)	12.80 Typ. (13.31 Max.)
E	0.295±0.010	7.49±0.25
e	0.050 ±0.006	1.27±0.15
e1	0.376 NOM.	9.50 NOM.
HE	0.406±0.012	10.31±0.31
L	0.032±0.008	0.81±0.20
LE	0.055±0.008	1.40±0.20
S	0.042 Max.	1.07 Max.
y	0.004 Max.	0.10 Max.
θ	0° ~ 10°	0° ~ 10°

**Notes:**

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension e1 is for PC Board surface mount pad pitch design reference only.
4. Dimension S includes end flash.