

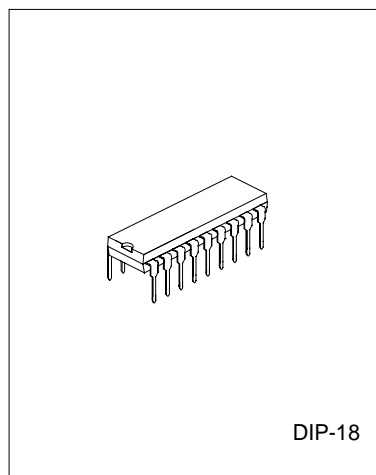
## TONE / PULSE DIALER WITH REDIAL FUNCTION

### DESCRIPTION

The SC91310 series are monolithic ICs that provide the necessary signals for either pulse or tone dialing. The SC91310 series feature a redial memory.

### FEATURES

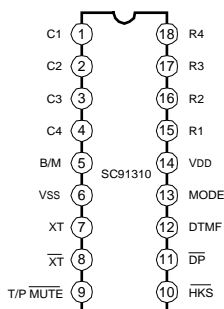
- \*DTMF / Pulse switchable dialer
- \*32 digits for redial memory
- \*pulse-to-tone (P→T) keypad for long distance call operation
- \*Break / Make ratio is selectable by pin option
- \*Uses 4x4 keyboard
- \*Easy operation with redial, flash, pause, and P→T keypads
- \*Flash, pause, P→T (pulse-to tone) can be stored as a digit in memory
- \*Minimum tone output duration:100ms
- \*minimum intertone pause: 100ms
- \*On-chip power-on reset
- \*Uses 3.579545 MHz crystal or ceramic resonator
- \*Packaged in 18-pin plastic DIP



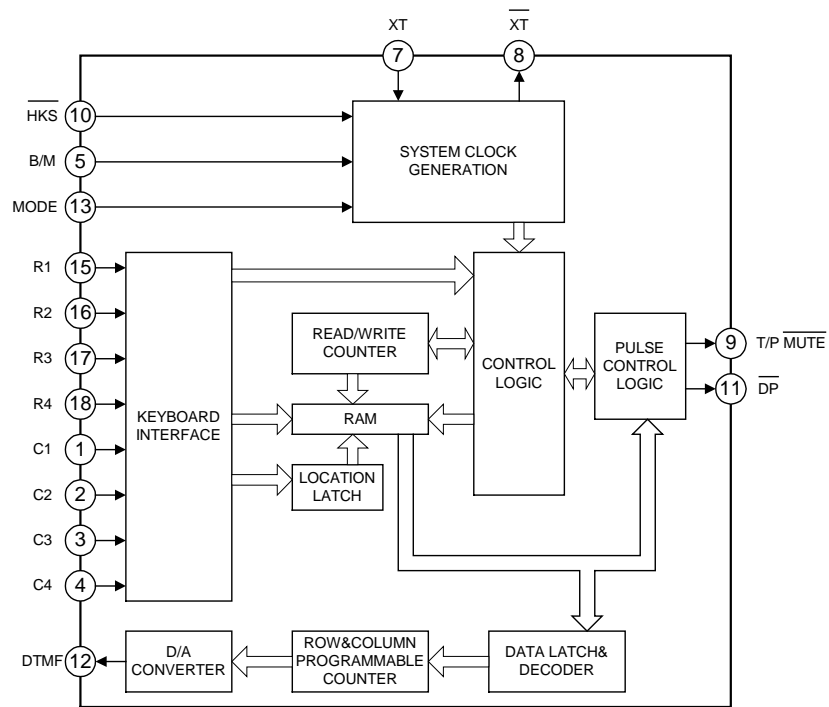
### ORDERING INFORMATION (The different dialers in the SC91310 series are shown in the following table)

Type No.	Pulse(pps)	Flash(ms)	Flash pause(ms)	Pause(s)
SC91312/A	10/20	600/300	600/300	2.0
SC91314/A	10/20	73/100	140/100	3.6
SC91316	10/20	600	600	3.6

### PIN CONFIGURATIONS



**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	Value	Unit
DC Supply Voltage	VDD-VSS	-0.3~7.0	V
Input / Output Voltage	VIL	VSS-0.3	V
	VIH	VDD+0.3	V
	VOL	VSS-0.3	V
	VOH	VDD+0.3	V
Power Dissipation	PD	120	mW
Operating Temperature	Topr	-20~+70	°C
Storage Temperature	Tstg	-55~+125	°C

Note: Exposure to conditions beyond those listed under Absolute Maximum Ratings may adversely affect the life and reliability of the device.

## DC ELECTRICAL CHARACTERISTICS

(Tamb=25~70°C, VDD-VSS=2.5V, fosc=3.58MHz, all outputs unloaded)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	VDD		2.0	--	5.5	V
Operating Current	IOP	Tone	--	0.3	0.5	mA
		Pulse	--	0.15	0.3	mA
Standby Current	ISB	$\overline{\text{HKS}}=0$ , No load, & No key entry	--	--	15	$\mu\text{A}$
Memory Retention Current	IMR	$\overline{\text{HKS}}=1$ , VDD=1.0V	--	--	0.2	$\mu\text{A}$
DTMF Output Voltage	VTO	Row group, RL=5k $\Omega$	130	150	170	mVrms
Pre-emphasis		Col/Row, VDD=2.0~5.5V	1	2	3	dB
DTMF Distortion	THD	RL=5k $\Omega$ , VDD=2.0~5.5V	--	-30	-23	dB
DTMF OUTPUT DC Level	VTDC	RL=5k $\Omega$ , VDD=2.0~5.5V	1.0	--	3.0	V
TMF Output Sink Current	ITL	VTO=0.5V	0.2	--	--	mA
$\overline{\text{DP}}$ Output Sink Current	IPL	VPO=0.5V	0.5	--	--	mA
T/P MUTE Output Sink Current	IML	VMO=0.5V	0.5	--	--	mA
$\overline{\text{HKS}}$ I/P Pull-high Resistor	RKH		--	300	--	k $\Omega$
Keypad Input Drive Current	IKD	VI=0V	30	--	--	$\mu\text{A}$
Keypad Input Sink Current	IKS	VI=2.5V	200	400	--	$\mu\text{A}$
Keypad Resistance			--	--	5.0	k $\Omega$

## AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Keypad Active in Debounce	TKID		--	20	--	mS
Key Release Debounce	TKRD		--	20	--	mS
Pre-digit Pause <sup>1</sup>	TPDP1 10pps	B/M=1	--	40	--	mS
		B/M=0	--	33.3	--	
Pre-digit Pause <sup>2</sup>	TPDP2 20pps	B/M=1	--	20	--	mS
		B/M=0	--	16.7	--	
Interdigit Pause (Auto dialing)	TIDP	10pps	--	800	--	mS
		20pps	--	500	--	
Make / Break Ratio	M/B	B/M=1	--	40:60	--	%
		B/M=0	--	33:67	--	
DTMF Output Duration	TTD	Auto Dialing	--	100	--	mS
Intertone Pause	TITP	Auto Dialing	--	100	--	mS
Flash Break Time	TFB	SC91314	--	73	--	mS
		SC91314A	--	100	--	
		SC91312A	--	300	--	
		SC91312 / SC91316	--	600	--	
Flash Pause Time	TFP	SC91314A	--	100	--	mS
		SC91314	--	140	--	
		SC91312A	--	300	--	
		SC91312 / SC91316	--	600	--	
Pause Time	TP	SC91312	--	2.0	--	S
		SC91314A / SC91316	--	3.6	--	

Note: 1. Crystal parameters suggested for proper operation are  $R_s < 100\Omega$ ,  $L_m = 96\text{mH}$ ,  $C_m = 0.02\text{pF}$ ,  $C_n = 5\text{pF}$ ,  
 $C_i = 18\text{pF}$ ,  $F_{osc} = 3.579545\text{MHz} \pm 0.02\%$ .

2. Crystal oscillator accuracy directly affects these times.

**PIN DESCRIPTION**

Pin No.	Pin Name	I/O	Description			
1~4 & 15~18	Column- Row Inputs	I	The keyboard input may be from either the standard 4x4 keyboard or an inexpensive single contact (form A) keyboard. Electronic input from a $\mu\text{C}$ can also be used. A valid key entry is defined as a single row being connected to a single column.			
7,8	XT, $\overline{\text{XT}}$	I,O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.			
9	T/P $\overline{\text{MUTE}}$	O	The T/P $\overline{\text{MUTE}}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on during pulse and tone mode dialing sequence and flash break. Otherwise, it is switched off.			
13	MODE	I	Pulling mode pin to Vss places the dialer in tone mode. Pulling mode pin to VDD places the dialer in pulse mode (10 pps). Leaving mode pin floating places the dialer in pulse mode (20 pps).			
10	$\overline{\text{HKS}}$	O	Hook switch input. $\overline{\text{HKS}} = 1$ : On-hook state. Chip in sleeping mode, no operation. $\overline{\text{HKS}} = 0$ : Off-hook state. Chip enabled for normal operation. The $\overline{\text{HKS}}$ pin is pulled to VDD by an internal resistor.			
11	$\overline{\text{DP}}$	O	N-channel drain dialing pulse output (Figure 1). Flash key will cause $\overline{\text{DP}}$ to go active in both pulse mode and tone mode.			
12	DTMF	O	In pulse mode, remains in low state at all times. In tone mode, outputs a dual or single tone. Detailed timing diagram for tone mode is shown in Figure 2(a, b).			
			Output Frequency(Hz)			
				Specified	Actual	Error %
			R1	697	699	+0.28
			R2	770	766	-0.52
			R3	852	848	-0.47
			R4	941	948	+0.74
			C1	1209	1216	+0.57
			C2	1336	1332	-0.30
C3	1477	1472	-0.34			
14,6	VDD, VSS	I	Power input pins.			
5	B/M	I	The break make ratio is 60:40 if $/M = 1$ and is 66.6:33.3 if $B/M = 0$ . This pin has no function in DTMF mode.			

## FUNCTION DESCRIPTIONS

### 1. KEYBOARD OPERATION

C1	C2	C3	C4	
1	2	3		R1
4	5	6	F	R2
7	8	9	P→T	R3
*	0	#	R/P	R4

\* F: Flash key

\* R/P: Redial and pause function key

\* P→T: Pulse mode to tone mode

### 2. NORMAL DIALING

OFF HOOK , D1 , D2 , ... , Dn

- 1) D1, D2, ..., Dn will be dialed out.
- 2) Dialing length is unlimited, but redial is inhibited if length oversteps 32 digits.

### 3. REDIALING

OFF HOOK , D1 , D2 , ... , Dn BUSY , COME ON HOOK , OFF HOOK , R/P

The R/P key can execute redial function only as the first key-in after off-hook; otherwise, it will execute pause function.

### 4. ACCESS PAUSE

OFF HOOK , D1 , D2 , R/P , D3 , ... , Dn

- 1) The pause function can be stored in memory.
- 2) The pause function is executed in normal dialing or memory dialing.
- 3) The pause function timing diagram is shown in Figure 3.

### 5. PULSE-TO-TONE (P→T)

OFF HOOK , D1 , D2 , ... , Dn , P→T , D1' , D2' , ... , Dn'

- 1) If the mode switch is set to pulse mode, then the output signal will be:

D1, D2, ..., Dn, Pause, D1', D2', ..., Dn'

(Pulse) (Tone)

- 2) If the mode switch is set to tone mode, then the output signal will be:  
 $D_1, D_2, \dots, D_n, \boxed{P \rightarrow T}, D_1', D_2', \dots, D_n'$   
 (Tone) (Pause) (Tone)
- 3) The dialer remains in tone mode when the digits have been dialed out and can be reset to pulse mode only by going on-hook.
- 4) The P→T function timing diagram is shown in Figure 4.

**6. FLASH**

$\boxed{\text{OFF HOOK}}, \boxed{F}$

- 1) Flash key can be stored as a digit in memory.
- 2) The system will return to the initial state after the break time is finished.
- 3) The flash function timing diagram is shown in Figure 5.

**TIMING WAVEFORMS**

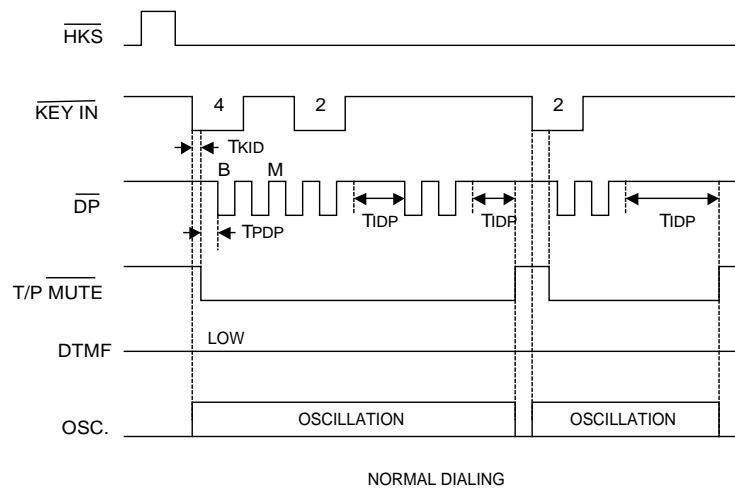


Figure 1(a). Pulse Mode Timing Diagram

**TIMING WAVEFORMS**(continued)

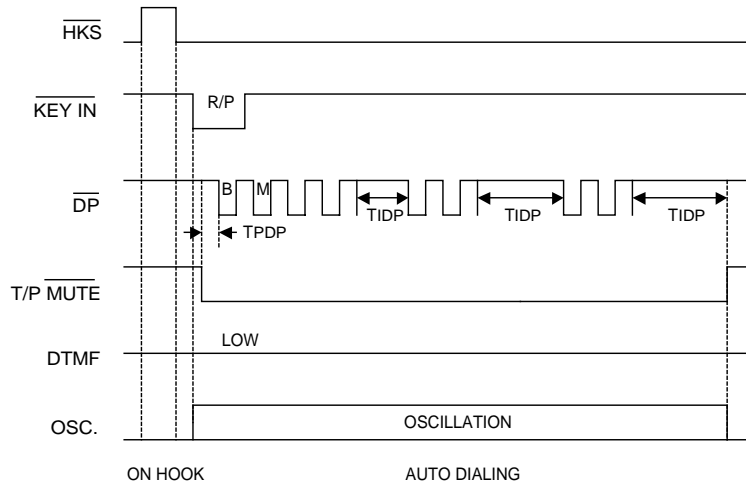


Figure 1(b). Pulse Mode Timing Diagram

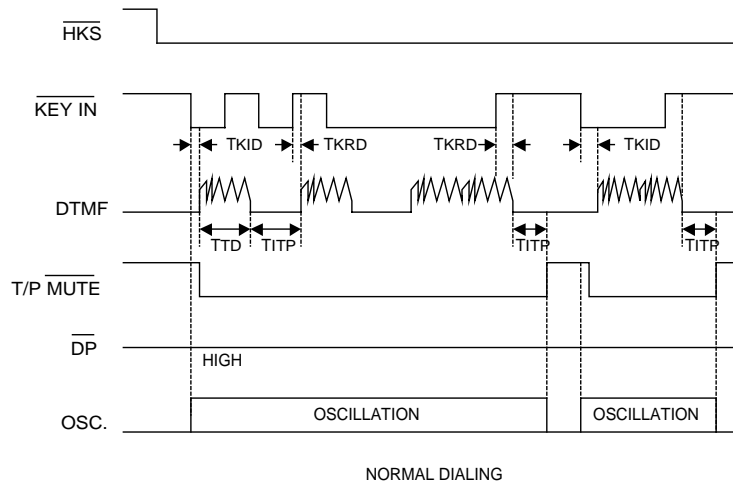


Figure 2(a). Tone Mode Timing Diagram



**TIMING WAVEFORMS**(continued)

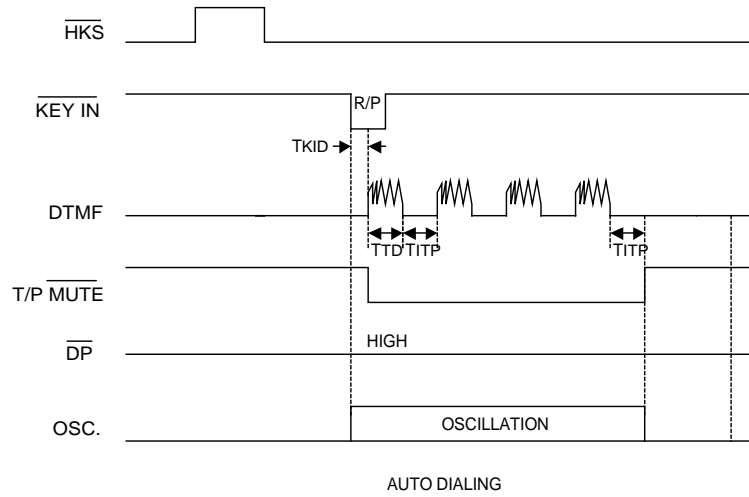


Figure 2(b). Tone Mode Auto Dialing Timing Diagram

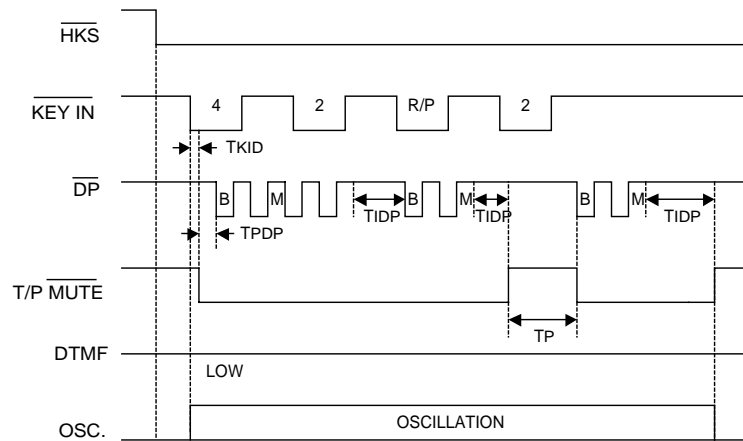


Figure 3. Pause Function Timing Diagram

**TIMING WAVEFORMS**(continued)

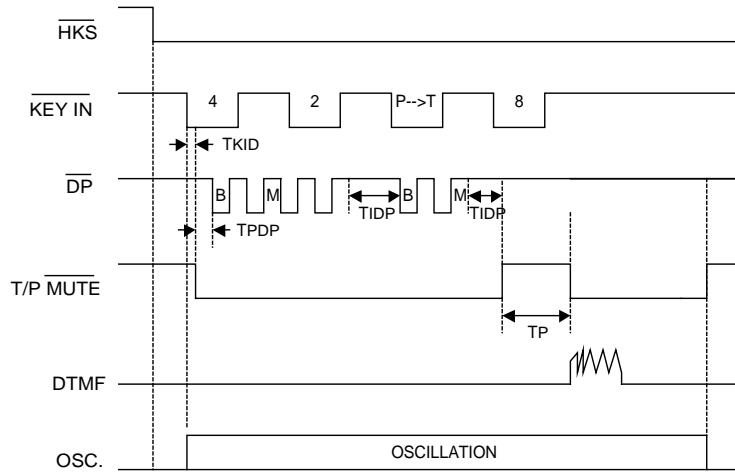


Figure 4. Pulse-to-tone Function Timing Diagram

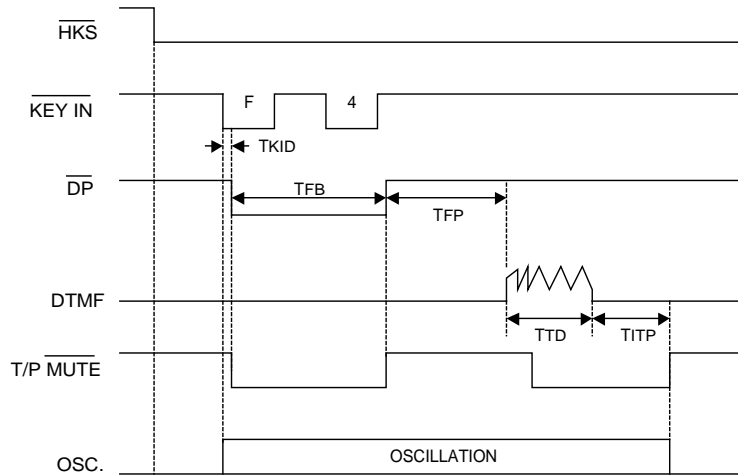
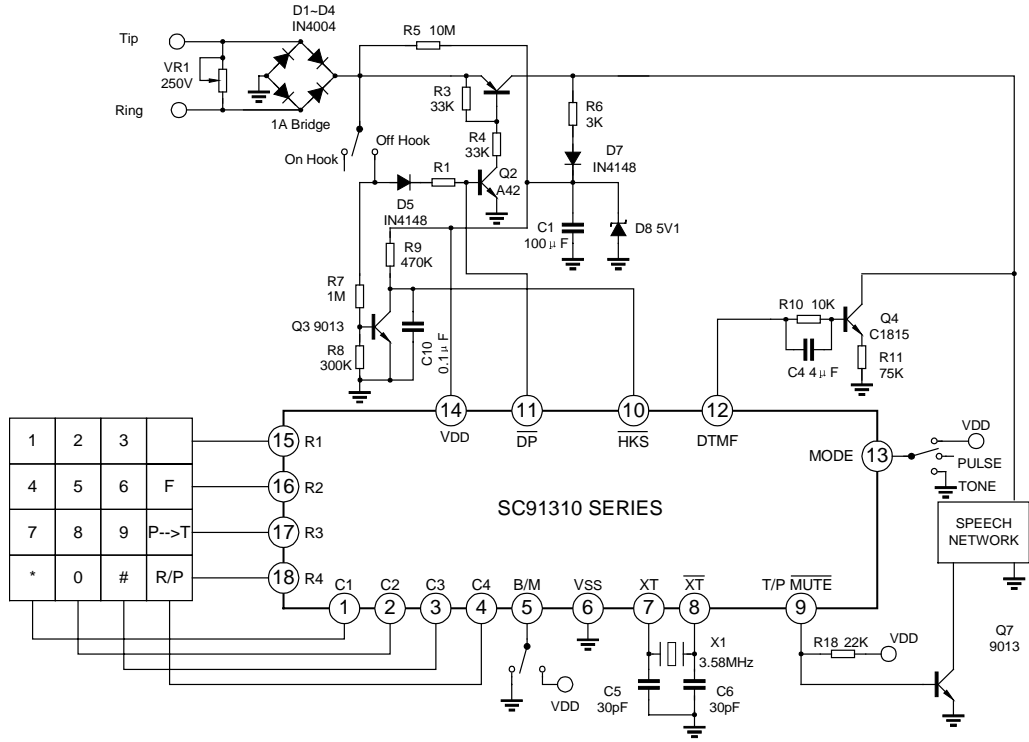


Figure 5. Flash Function Timing Diagram

## TYPICAL APPLICATION CIRCUIT



**CHIP TOPOGRAPHY**



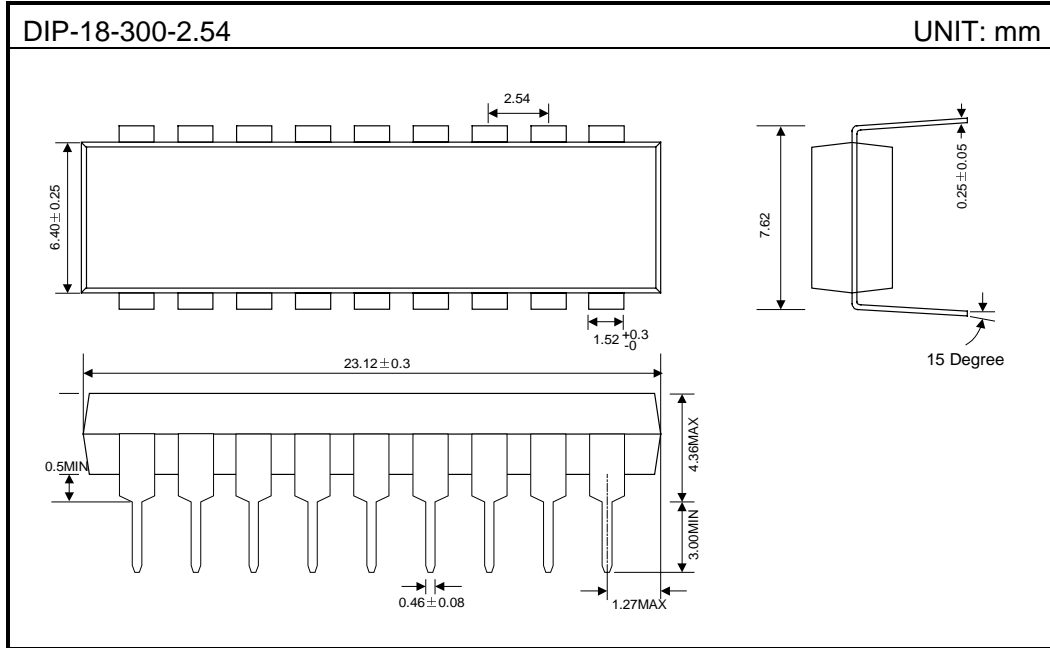
Size: 1.19 x 1.65 mm<sup>2</sup>

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

No.	Symbol	X	Y	No.	Symbol	X	Y
1	P1	-430.1	152.7	10	P10	430.5	101.8
2	P2	-430.9	-334.7	11	P11	430.5	349.8
3	P3	-430.9	-504.7	12	P12	430.5	556.6
4	P4	-382.0	-690.1	13	P13	160.1	655.6
5	P5	-211.4	-688.9	14	P14	-36.8	661.7
6	P6	289.3	-680.1	15	P15	-211.5	611.3
7	P7	430.5	-509.7	16	P16	-430.1	672.7
8	P8	430.5	-238.2	17	P17	-430.1	502.7
9	P9	430.5	-68.2	18	P18	-430.1	327.7

Note: The original point of the coordinate is the die center.

**PACKAGE OUTLINE**



**Attach**

**Revision History**

<b>Data</b>	<b>REV</b>	<b>Description</b>	<b>Page</b>
2001.11.13	2.0		
2002.12.03	2.1	Modify the "TYPICAL APPLICATION CIRCUIT"	11