# Silan Semiconductors

SC91310 Series

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

DIP-18
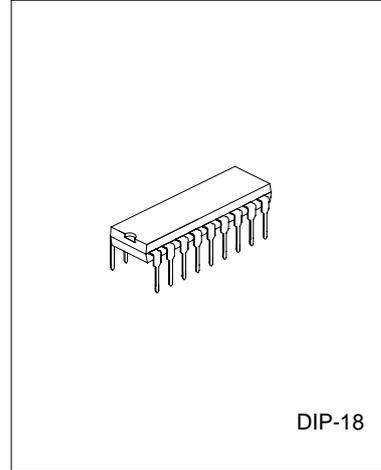
ORDERING INFORMATION (The different dialers in the SC91310 series are shown in the following table)

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

C1 (1)   (18) R4
C2 (2)   (17) R3
C3 (3)   (16) R2
C4 (4)   (15) R1
B/M (5)   SC91310   (14) VDD
VSS (6)   (13) MODE
XT (7)   (12) DTMF
$\overline{XT}$ (8)   (11) $\overline{DP}$
T/P $\overline{MUTE}$ (9)   (10) $\overline{HKS}$

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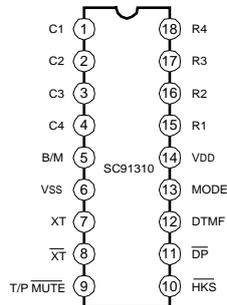
BLOCK DIAGRAM
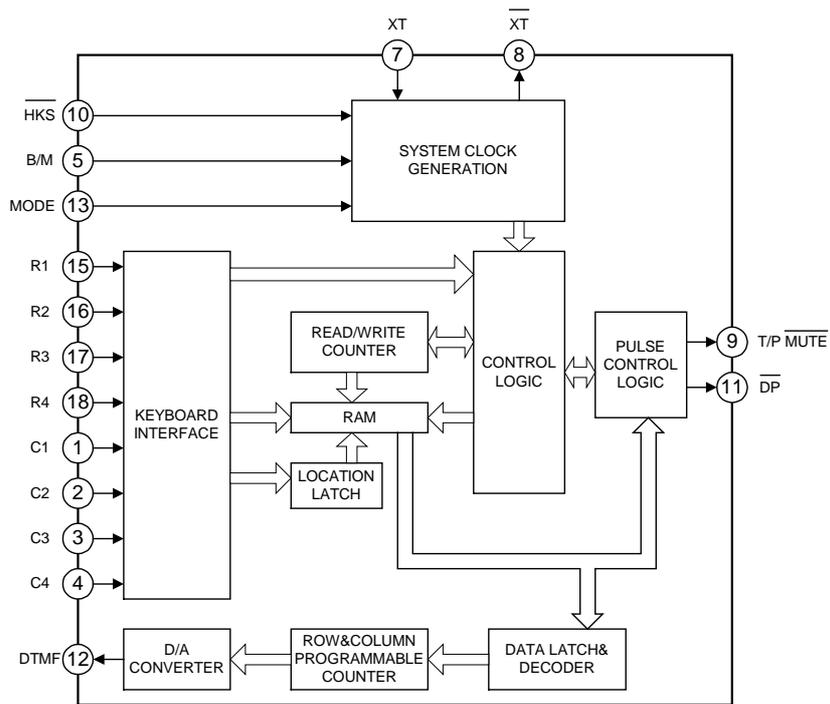
ABSOLUTE MAXIMUM RATINGS

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.

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DC ELECTRICAL CHARACTERISTICS

(Tamb=25~70°C, V_{DD}~V_{SS}=2.5V, fosc=3.58MHz, all outputs unloaded)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	V_{DD}		2.0	--	5.5	V
Operating Current	I_{OP}	Tone	--	0.3	0.5	mA
		Pulse	--	0.15	0.3	mA
Standby Current	I_{SB}	$\overline{HKS}$ =0, No load, & No key entry	--	--	15	μA
Memory Retention Current	I_{MR}	$\overline{HKS}$ =1, V_{DD}=1.0V	--	--	0.2	μA
DTMF Output Voltage	V_{TO}	Row group, R_L=5kΩ	130	150	170	mVrms
Pre-emphasis		Col/Row, V_{DD}=2.0~5.5V	1	2	3	dB
DTMF Distortion	T_{HD}	R_L=5kΩ, V_{DD}=2.0~5.5V	--	-30	-23	dB
DTMF OUTPUT DC Level	V_{TDC}	R_L=5kΩ, V_{DD}=2.0~5.5V	1.0	--	3.0	V
TMF Output Sink Current	I_{TL}	V_{TO}=0.5V	0.2	--	--	mA
$\overline{DP}$ Output Sink Current	I_{PL}	V_{PO}=0.5V	0.5	--	--	mA
T/P $\overline{MUTE}$ Output Sink Current	I_{ML}	V_{MO}=0.5V	0.5	--	--	mA
$\overline{HKS}$ I/P Pull-high Resistor	R_{KH}		--	300	--	kΩ
Keypad Input Drive Current	I_{KD}	V_I=0V	30	--	--	μA
Keypad Input Sink Current	I_{KS}	V_I=2.5V	200	400	--	μA
Keypad Resistance			--	--	5.0	kΩ

AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Keypad Active in Debounce	T_{KID}		--	20	--	mS
Key Release Debounce	T_{KRD}		--	20	--	mS
Pre-digit Pause[1]	T_{PDP1}	B/M=1	--	40	--	mS
	10pps	B/M=0	--	33.3	--	
Pre-digit Pause[2]	T_{PDP2}	B/M=1	--	20	--	mS
	20pps	B/M=0	--	16.7	--	
Interdigit Pause (Auto dialing)	T_{IDP}	10pps	--	800	--	mS
		20pps	--	500	--	
Make / Break Ratio	M/B	B/M=1	--	40:60	--	%
		B/M=0	--	33:67	--	
DTMF Output Duration	T_{TD}	Auto Dialing	--	100	--	mS
Intertone Pause	T_{ITP}	Auto Dialing	--	100	--	mS
Flash Break Time	T_{FB}	SC91314	--	73	--	mS
		SC91314A	--	100	--	
		SC91312A	--	300	--	
		SC91312 / SC91316	--	600	--	
Flash Pause Time	T_{FP}	SC91314A	--	100	--	mS
		SC91314	--	140	--	
		SC91312A	--	300	--	
		SC91312 / SC91316	--	600	--	
Pause Time	T_P	SC91312	--	2.0	--	S
		SC91314A / SC91316	--	3.6	--	

Note: 1. Crystal parameters suggested for proper operation are Rs<100Ω, Lm=96mH, Cm=0.02pF, Cn=5pF,

Ci=18pF, Fosc.=3.579545MHz±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 μC can also be used. A valid key entry is defined as a single row being connected to a single column.
7,8	XT, $\overline{XT}$	I,O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonator.
9	T/P $\overline{MUTE}$	O	The T/P $\overline{MUTE}$ 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 V_{DD} places the dialer in pulse mode (10 pps). Leaving mode pin floating places the dialer in pulse mode (20 pps).
10	$\overline{HKS}$	O	Hook switch input. $\overline{HKS}$ = 1: On-hook state. Chip in sleeping mode, no operation. $\overline{HKS}$ = 0: Off-hook state. Chip enabled for normal operation. The $\overline{HKS}$ pin is pulled to V_{DD} by an internal resistor.
11	$\overline{DP}$	O	N-channel drain dialing pulse output (Figure 1). Flash key will cause $\overline{DP}$ 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

Pin No.	Pin Name	I/O	Description
14,6	V_{DD}, 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)

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2) If the mode switch is set to tone mode, then the output signal will be:

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

(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

OFF HOOK , 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

NORMAL DIALING
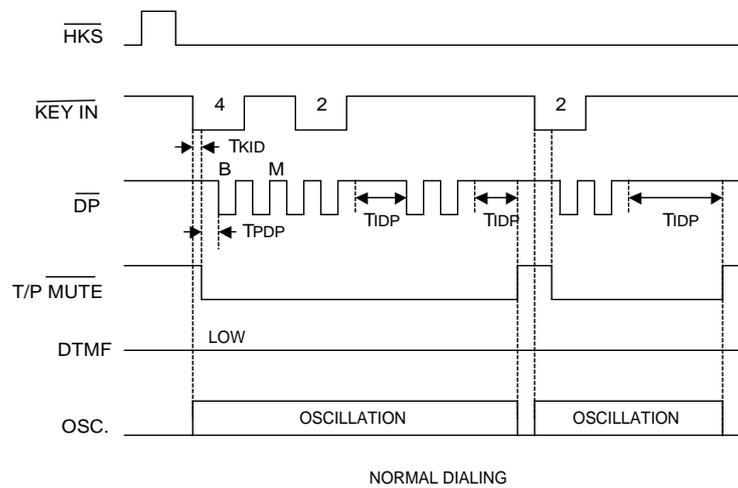
Figure 1(a). Pulse Mode Timing Diagram

TIMING WAVEFORMS(continued)
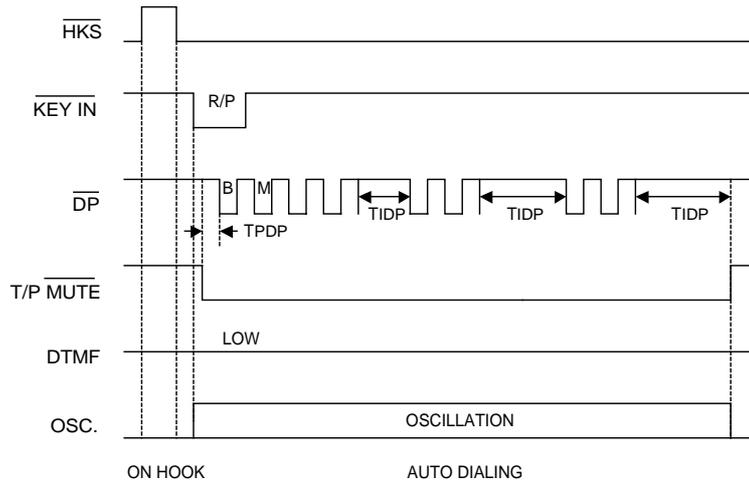
Figure 1(b). Pulse Mode Timing Diagram
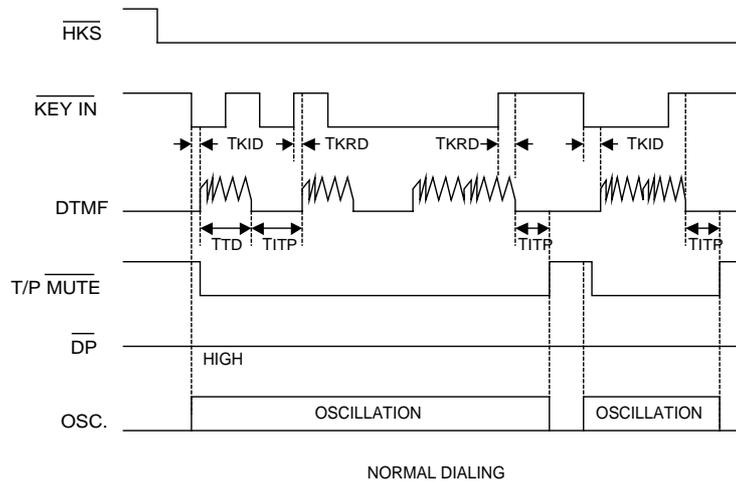
Figure 2(a). Tone Mode Timing Diagram

TIMING WAVEFORMS(continued)
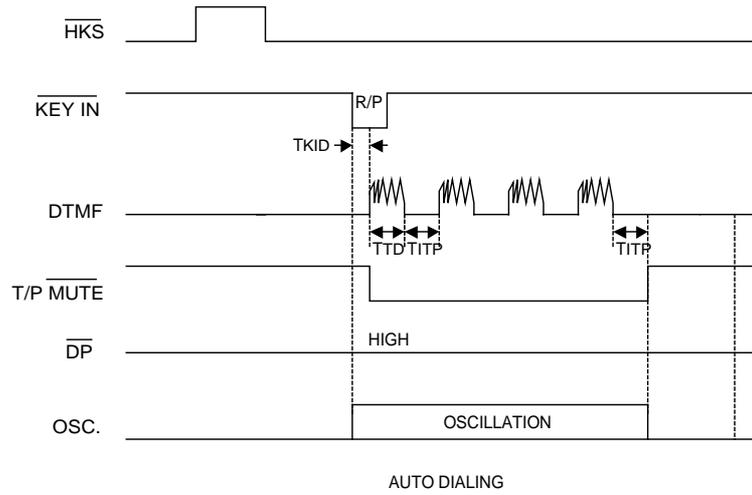

AUTO DIALING

Figure 2(b). Tone Mode Auto Dialing Timing Diagram
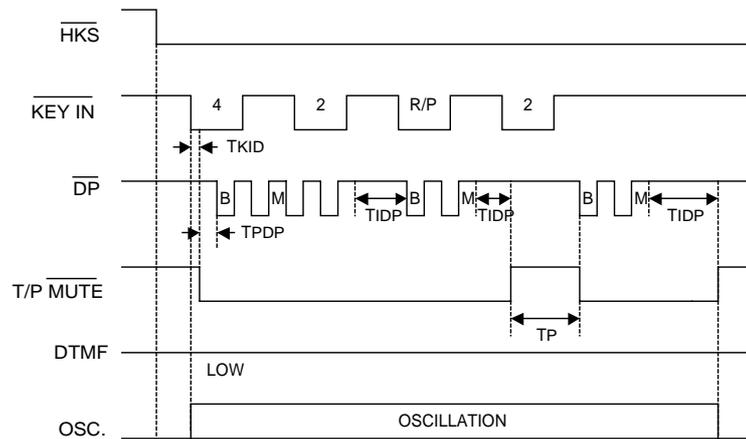
Figure 3. Pause Function Timing Diagram

TIMING WAVEFORMS(continued)
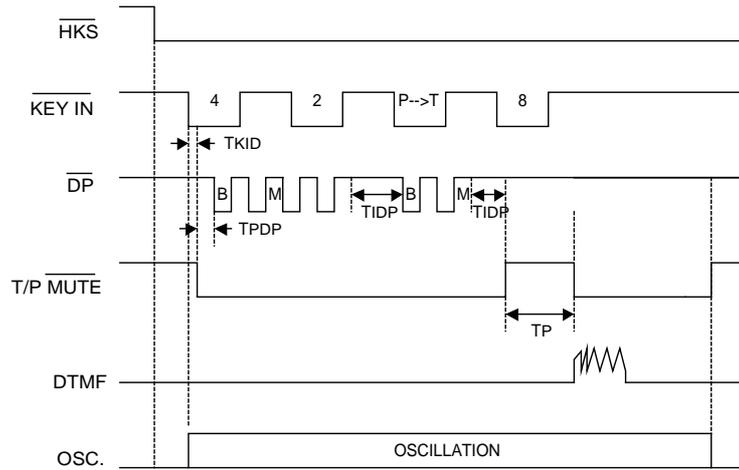

Figure 4. Pulse-to-tone Function Timing Diagram
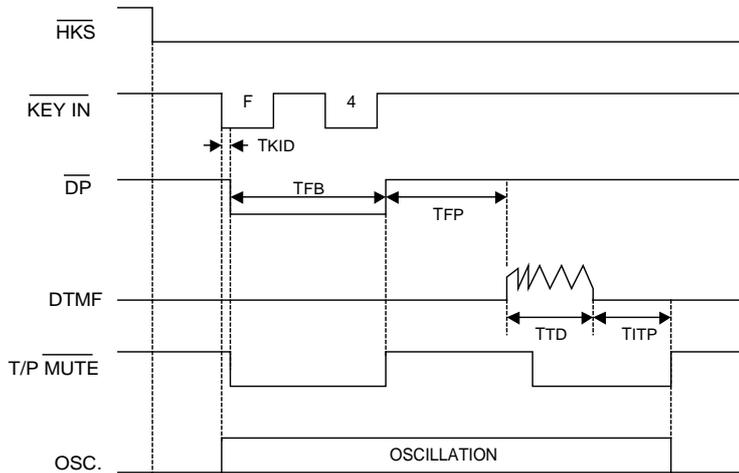
Figure 5. Flash Function Timing Diagram

TYPICAL APPLICATION CIRCUIT
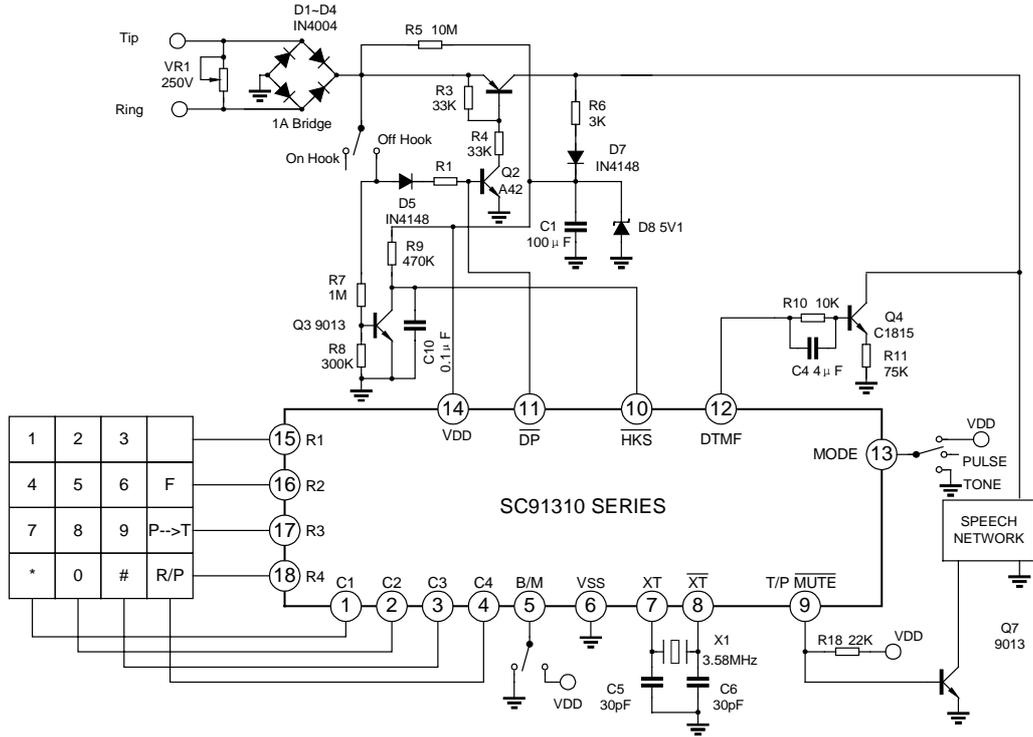
CHIP TOPOGRAPHY

Size: 1.19 x 1.65 mm^2

PAD COORDINATES (Unit: μm)

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

DIP-18-300-2.54	UNIT: mm
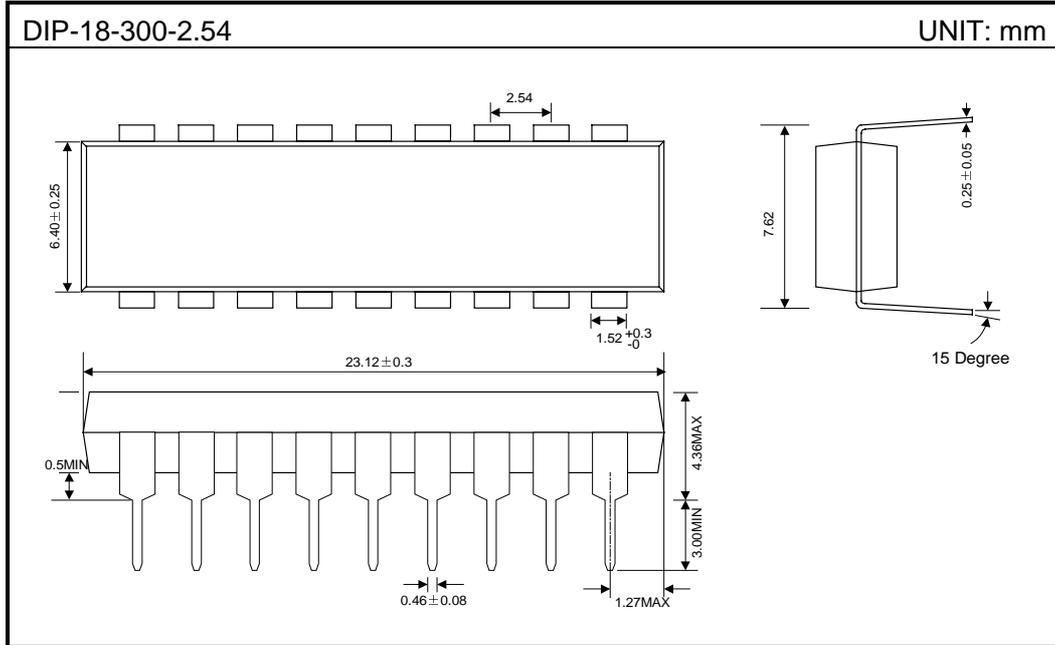
Attach

Revision History

Data	REV	Description	Page
2001.11.13	2.0		
2002.12.03	2.1	Modify the "TYPICAL APPLICATION CIRCUIT"	11