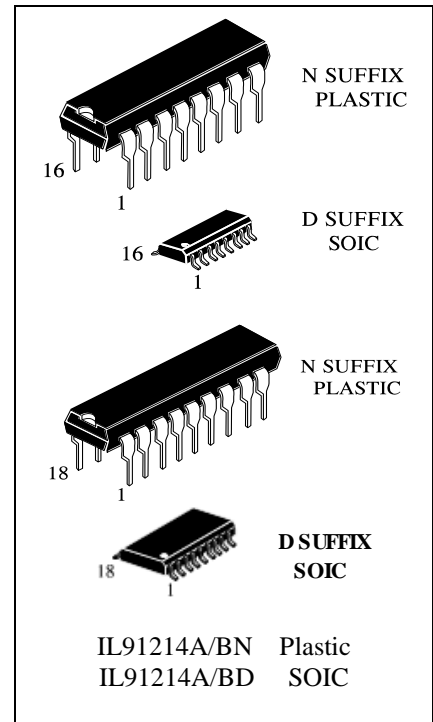# TONE / PULSE DIALER WITH FLASH FUNCTION

IL91214A/B

IL91214A and IL91214B are tone/pulse dialers designed for providing standard DTMF or pulse signals. The ICs enable to:
- generate standard DTMF or pulse signals of dialing as well as "flash" pulses;
- store and redial last number;
- generate pause in the transmitted package of dial signals;

ICs are designed to be used in telephone sets.

N SUFFIX
PLASTIC

D SUFFIX
SOIC

N SUFFIX
PLASTIC

**D SUFFIX
SOIC**

IL91214A/BN   Plastic
IL91214A/BD   SOIC

ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing
IL91214AN		DIP16	Tube
IL91214AD		SOP16	Tube
IL91214ADT	T_A = -20° to 70° C	SOP16	Tape & Reel
IL91214BN		DIP18	Tube
IL91214BD		SOP18	Tube
IL91214BDT		SOP18	Tape & Reel
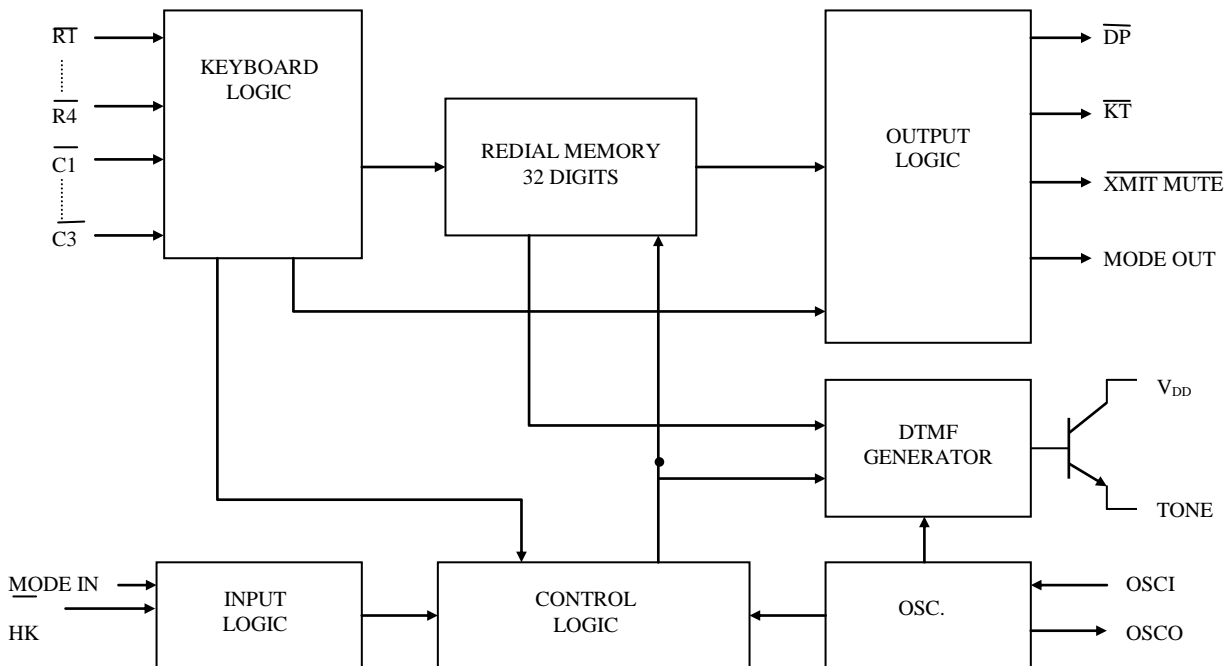
Figure. **BLOCK DIAGRAM**

IK Semicon
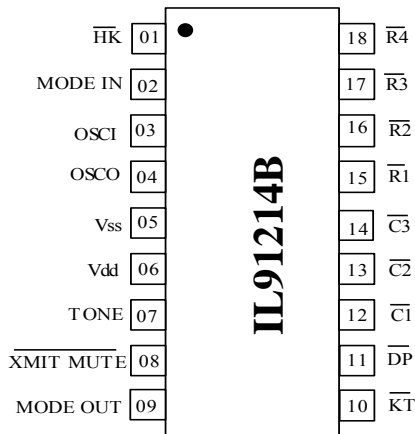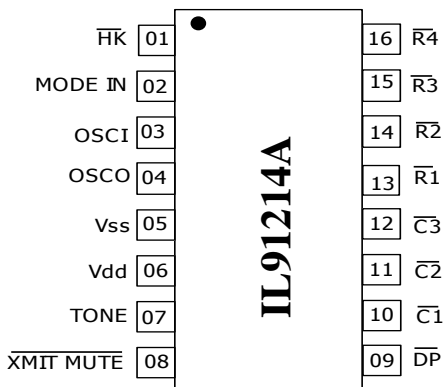
PIN DESCRIPTION

Pin #		Designation	Description
A	**B**		
1	1	$\overline{HK}$	Hook switch input
2	2	MODE IN	MODE IN = V_{DD}: pulse mode, 10 Hz, M/B = 1/2, MODE IN = V_{SS}: tone mode, MODE IN = floating mode, 20 Hz, M/B = 1/2
3	3	OSCI	Oscillator input
4	4	OSCO	Oscillator output
5	5	V_{SS}	Ground
6	6	V_{DD}	Supply output
7	7	TONE	Tone dialing output
8	8	$\overline{XMIT}$ $\overline{MUTE}$	Dialing transmission mute output
	9	MODE OUT	Mode output pin
	10	$\overline{KT}$	Key-in tone output
9	11	$\overline{DP}$	Dialing pulse output
10	12	$\overline{C1}$	Keyboard column input
11	13	$\overline{C2}$	Keyboard column input
12	14	$\overline{C3}$	Keyboard column input
13	15	$\overline{R1}$	Keyboard row input
14	16	$\overline{R2}$	Keyboard row input
15	17	$\overline{R3}$	Keyboard row input
16	18	$\overline{R4}$	Keyboard row input

KEYBOARD ASSIGNMENT
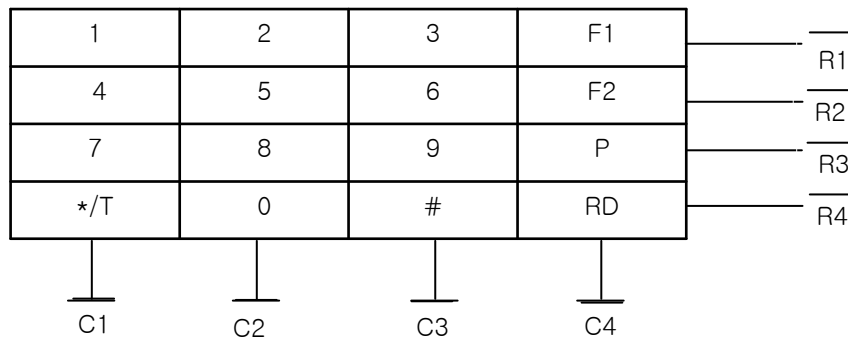
1. */T – At Pulse mode this key works as Pulse -> DTMF key (T key), at DTMF mode the key works as *key. */T key
   will occupy one memory digit in either use.
2. F1 – Flash key. The break time is 297ms
3. F2 – Flash key for break time 640ms
4. P – Pause key (2.2 seconds)
5. RD – One key redial key
6. # - At pulse mode this key input is neglected, at DTMF mode this key works as # key.

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DESCRIPTION OF IC PINS FUNCTION

$\overline{\text{HK}}$ pin (01) – hook switch input. This inverter input detects the condition of the phone set hook switch contact. "Off Hook" means connecting to GND, "On Hook" - connecting to V_{DD}.

MODE IN pin (02) - The mode selection pin for three states. The mode selection pin is checked for tone / pulse dialing the number at each entering with numeric key. In pulse mode, the dialing speed is checked with M /B ratio when entering with the first key.

OSCI, OSCO pins (03, 04) – input and output pins of the generator between which the 3.58 MHz quartz resonator is connected.

GND, V_{DD} pins (05, 06) – power supply pins.

TONE pin (07) – tone dialing signal output. When the actual keystroke is detected in DTMF mode, appropriate low and high band frequencies are generated that are the output dual tone signal. TONE output is in "Off" state (switched off) in pulsed mode.

$\overline{\text{XMIT}}\ \overline{\text{MUTE}}$ pin (08) – dial transmission output in silent mode. This is N-channel open drain output. Normally the pin is set to "Off". During DTMF dialing this output is set to "Enable" state.

MODE OUT pin (09) – Only IC IL91214VN pin. Output mode pin. This is N-channel open drain output. The pin is set to "On" for the tone output signal and to "Off" for the pulse output signal.

$\overline{\text{KT}}$ pin (10) – Only IC IL91214BN pin. Tone output of key input. This pin with N-channel open drain forms the signal for every keystroke in pulse mode by pressing the function keys (RD, T, F1, F2, P). The output frequency is 437 Hz, the tone duration is 23 ms.

$\overline{\text{DP}}$ pin (09 for IL91214AN, 11 for IL91214BN) – pulse dialling output. This is N-channel open drain output. The output signal will be switched on during bond braking and switched off during bond formation in pulse dialling mode.

$\overline{\text{R1}} - \overline{\text{R4}}$, $\overline{\text{C1}} - \overline{\text{C3}}$ pins (10 – 16 for IL91214AN, 12 – 18 for IL91214BN) – Keyboard pins. These pins serve as the interface to XY matrix keyboard. On the matrix keyboard 4 x 4 the input from the fourth bump $\overline{\text{C4}}$ should be connected to GND.

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OPERATING PROCEDURE

Description of symbols:
In the description below, the signals are defined in relation to the push buttons or keys that are active.

Off Hook – means that the receiver is off the hook switch.

On Hook – means that the receiver is on the hook switch.

D1 – represents the first digit dialed in the chain of digits.

Dn – represents the last digit dialed in the chain of digits.

D_{n+1} – represents the beginning of a new chain of digits.

Dn+m – represents the last digit of a new chain of digits.

HFI↓ – represents a switch that activates the mode of dialing the number without lifting the handset switching to the logic zero condition.

*/T – is the key of transition from pulse dialing to DTMF- dialing

RD – redial key.

O – zero key (ZERO).

P – pause key.

F –"Flash" key.

RECOMMENDED OPERATIONS:

1 Pulse mode operation
a) Off Hook _ D1 … Dn
The pulse mode is defined as the initial mode, when the first entry from the keyboard is not * / T key accompanying Off Hook condition, and the mode selection pin is floating (MODE IN = VDD or floating).
b) On Hook _ HFI↓_ D1 … Dn
The pulse mode is defined as the initial mode, when entering with D1 key is not * / T, while MODE IN mode selection pin is either VDD or floating. The device will hold pause for 824 ms, then Off Hook condition is automatically detected, or HFI↓ key is pressed. This occurs with pulse or DTMF dialling, if you press any key.
The dial speed, or the bond formation / bond braking ratio is determined by entering with the first key, checking MODE IN status, and will not change. MODE IN status can switch over to dialling only from pulse to DTMF after entering with the first key.

2 Operation in DTMF mode
a) Off Hook _ D1 … Dn or
On Hook _ HFI↓_ D1 … Dn,
DTMF mode is determined as the initial mode, as MODE IN mode pin is connected to GND.

b) Off Hook _ */T _ D1 … Dn or

Off Hook _ HFI↓ _ D1 … Dn

The initial mode is pulse when the mode selection pin MODE IN = V_{DD} or is floating. * / T key can switch over the dial mode to tone mode. In contrast to the normal mode switch, entering with * / T key as the first key pressed, will not give any pause time. There are only 31 digits for redial memory available in the buffer to be used for operations (a) and (b) because * / T mode switch key will take one digit of the space.

3 Manual dialing with automatic access pause

Off Hook _ O _ P _ D1 … Dn

Entering with the pause key can be accepted and stored in the redial memory. Each one is stored as a digit. Each key entering will result in 2.2 second pause.

4 Redial

a) Off Hook _ RD or

On Hook _ HFI↓_ RD

Up to 32 digits (pulse mode) or 31 digits (in tone mode) can be dialed using RD key. RD key is prohibited when pulse or tone signals are transmitted. Redial is prohibited, if the number exceeds 32 digits, as the redial memory can hold up to 32 digits.

b) Off Hook _ RD _ D1 … Dn or

On Hook _ HFI↓_ RD_ D1 … Dn

After pressing RD key, we can add digits to the number in the redial memory. At the end of the dial the redial memory will contain the original digits plus the digits dialed after pressing RD key. Every time you press the redial key the saved number is dialed exactly as it was dialed before, regardless of the status of MODE IN pin.

5 Tone / pulse switch operation

a) Off Hook _ D1 … Dn _ /MODE IN pin switches to GND/_ D_{n+1} … Dn+m

            /——— Pulse mode——————/

Mode selection pin is always checked on entering with the tone or pulse mode key. Dialling can be switched from pulse to tone mode, but not vice versa. Switching MODE IN pin to GND will cause the chip to save the discharge * / T before the first tone digit in the redial memory, and will automatically insert 2.2 second pause before tonal dialed digits. After switching the mode, the mode selection pin status will no longer be checked. So it will be not possible to switch from dial to pulse mode.

b) Off Hook _ D1 … Dn _ */T   _ D_{n+1} … Dn+m

         / Pulse mode / / DTMF mode /

Pulse mode is initially determined by MODE IN pin = V_{DD} or floating. At that time the mode can be set to DTMF mode by pressing * / T key.

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DTMF mode will begin as soon as the last pulse is transmitted. In this mode the signal from D_{n+1} D_{n+m} is sent through TONE pin as DTMF signal. If the sequence of digits before or after entering * / T key contains P key pin, or if MODE IN switch is pressed, a 2.2 second pause will be added to automatically inserted pause time, which also makes 3.57 seconds. Both of the above described switch modes can store up to 31 digits in the redial memory.

6 One key redial

Off Hook _ D1 … Dn _ RD or

On Hook _ HFI↓ _ D1 … Dn _ RD

If the dialing from **D1** to **Dn** is finished, pressing **RD** will make force pulse dialing pin to go to a low state at 1.67 from the breaking moment, and 824 ms pause will be added automatically.

If the pulses with the dialed number from **D1** to **Dn** are not over, pressing the redial key will be ignored.

7 Flash key dial

Off Hook _ F _ D1 … Dn _ RD or

On Hook _ HFI↓ _ F _ D1 … Dn _ RD

F keys imitate the fast operations of hook off/ hook on. Pressing the flashing keys F1 or F2 will cause 96 ms or 640 ms pause (or 297 ms, or 640 ms, depending on the model) at $\overline{\text{DP}}$ output. Then a 824 ms pause is made and dialing the digits from **D1** to **Dn** continues. Then these digits are stored in the redial memory.

Each time when you press **F,** the memory of the re dialed number will be cleaned to save the new entry. Moreover, **MODE IN** pin status will be checked again to set tone / pulse dialing mode.

Similarly, to ensure that IC is operating properly, entering of new **F** keys will be ignored as long as the dialed digits end.

ABSOLUTE MAXIMUM RATINGS*

Parameter	Symbol	Absolute maximum value
Supply voltage	V_{DD}	$\leq 6.0V$
Input voltage	V_{IN}	$V_{SS}-0.3V \sim V_{DD}+0.3V$
Output voltage	V_{OUT}	$V_{SS}-0.3V \sim V_{DD}+0.3V$
Output voltage ($\overline{DP}$, $\overline{XMIT\ MUTE}$).	V_{OUT}	$\leq 1.2V$
Tone output current	I_{TONE}	≤ 50 mA
Power dissipation	P_D	≤ 500 mW
Storage temperature	T_{STG}	$-40^{O}C \sim +125^{O}C$

* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device.

These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{DD} = 3.5 V, V_{SS} = 0 V, F_{OSC} = 3.579 MHz, T = 25°C, unless otherwise specified)

Parameter	Symbol	Min.	Typ	Max.	Condition	
Supply voltage, V	V_{DD}	2.0		5.5	Pulse mode	
		2.0		5.5	Tone mode	
Memory retention voltage, V	V_{MR}	1				
Memory retention current, uA	* I_{MR}		0.05	0.4	V_{DD} = 1.0 V $\overline{HK}$ = V_{DD}	All outputs unloaded
Operation current, mA	I_{DDP}		0.32	1.0	Pulse	
	I_{DDT}		0.6	2.0	Tone	
Standby current, uA	* I_{SO}		0.03	0.05	$\overline{HK}=V_{DD}$	All outputs unloaded. No key selected. $V_{DD}=1.5V$
			0.5	10	$\overline{HK}=V_{SS}$	
Input voltage, V	V_{IH}	0.8 V_{DD}		V_{DD}	V_{DD} = 3.5 V	
	V_{IL}	0		0.2 V_{DD}		
Input current R1-R4, uA	I_R		115			
Tone out voltage, mV	V_{OC}	584	730	876	Column	$V_{DD}=3.5V$ $R_L=5K$
	V_{OR}	456	570	684	Row	
Sink current XMUTE, mA	I_{OL1}	0.9	5.3		$V_{DD}=3.5V$, $V_{OL}=0.4V$	
Sink current DP, mA	I_{OL2}	1.1	5.3		$V_{DD}=3.5V$, $V_{OL}=0.4V$	
Distortion, %	DIS %		1	5		

* - in this mode IC functioning is not guaranteed.

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AC CHARACTERISTICS

(V_{DD} = 3.5 V, V_{SS} = 0 V, F_{OSC} = 3.579 MHz, T = 25°C, unless otherwise specified)

Parameter	Symbol	Min.	Typ	Max.	Condition	
					Dialing speed, pps	
Make time, ms	T_M		33.3		10	M/B=1/2
			16.7		20	M/B=1/2
Break time, ms	T_B		66.6		10	M/B=1/2
			33.3		20	M/B=1/2
Inter-digit pause time, ms	T_{IDP}		824		10 pps	
			458		20 pps	
Pause time, s	T_{PAU}		2.2			
Auto-redial break time, s	T_{AOBK}		2.2			
Delay time key valid to signal out, ms	T_D		0			
Key-in debounce, ms	T_{KD}		21			
Key-in tone duration, ms	T_{KTD}		23			
Key-in tone frequency, Hz	F_{KT}		437			
Minimal tone duration time, ms	T_{MFD}		94			
Minimum tone inter-digit pause, ms	T_{TIDP}		96			
Redial tone duration, мs	T_{MFDR}		94			
Redial tone inter-digit duration, ms	T_{TIDPR}		96			

VALUES OF GENERATED FREQUENCIES

R/C	Frequency	Error, %	Unit	Conditions
$\overline{R}1$	697	+ 0.31	Hz	
$\overline{R}2$	770	+ 0.19	Hz	
$\overline{R}3$	852	+ 0.03	Hz	
$\overline{R}4$	941	+ 0.10	Hz	FOSC = 3.579 MHz
$\overline{C}1$	1.209	+ 0.57	Hz	
$\overline{C}2$	1.336	- 0.32	Hz	
$\overline{C}3$	1.477	- 0.35	Hz	

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1. Pulse dialing mode.
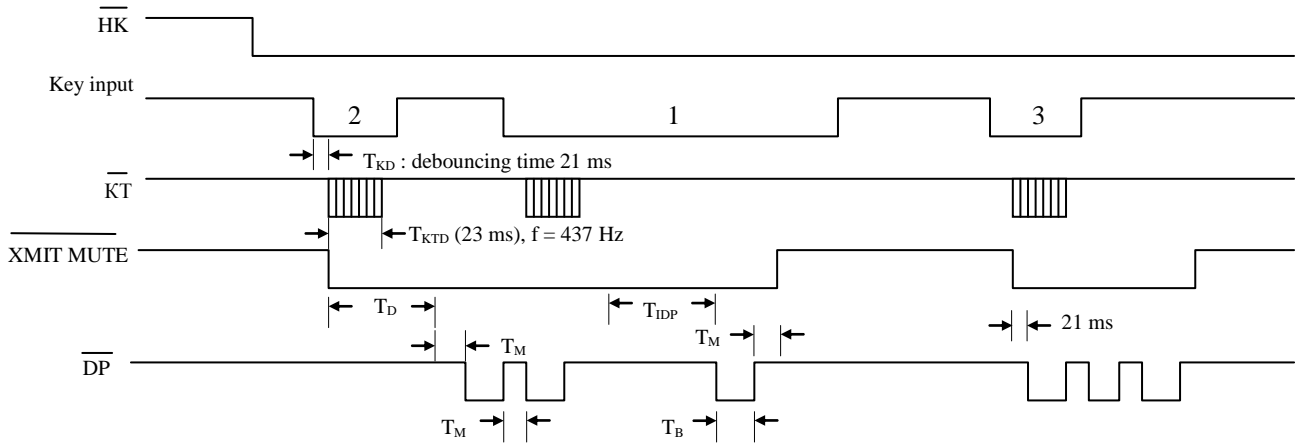
2. Tone dialing mode.

3. Redialing.

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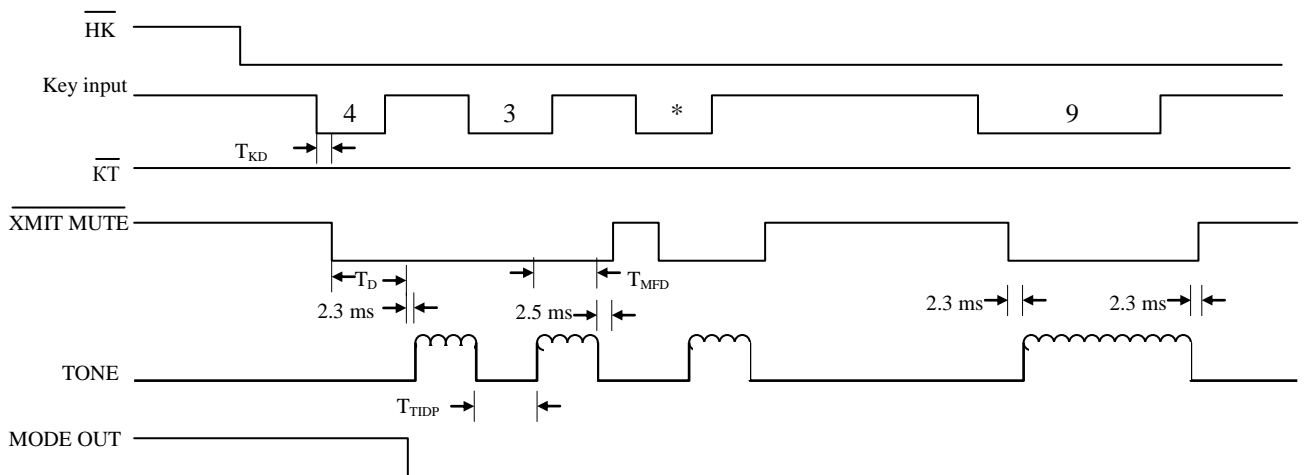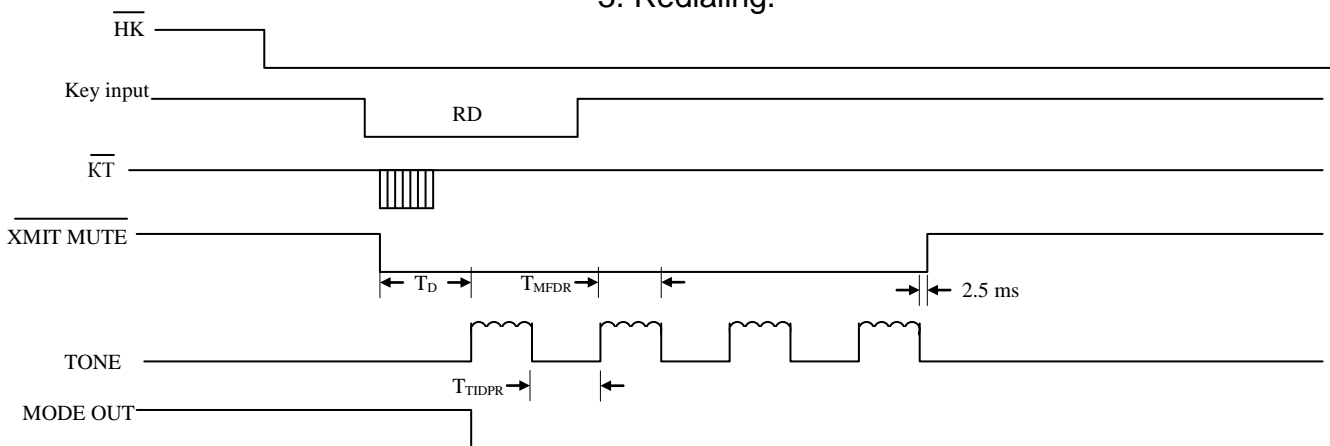
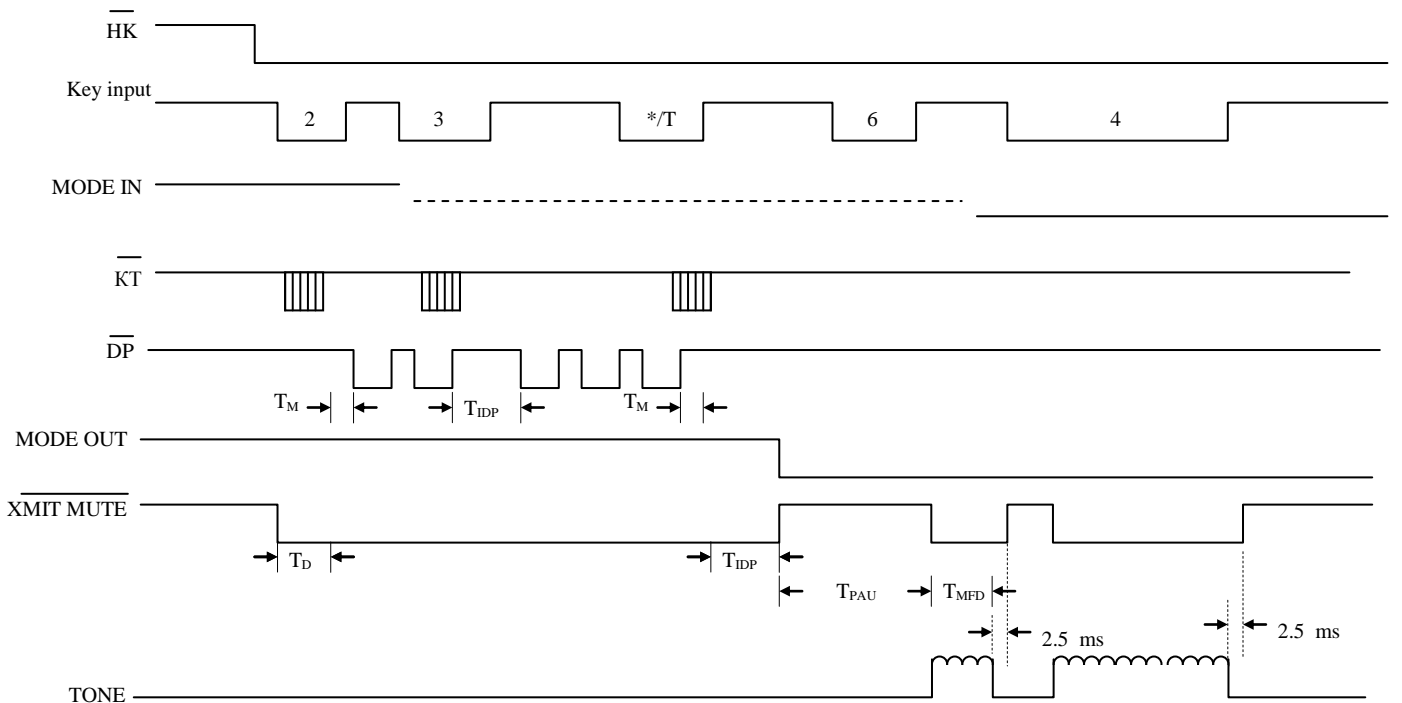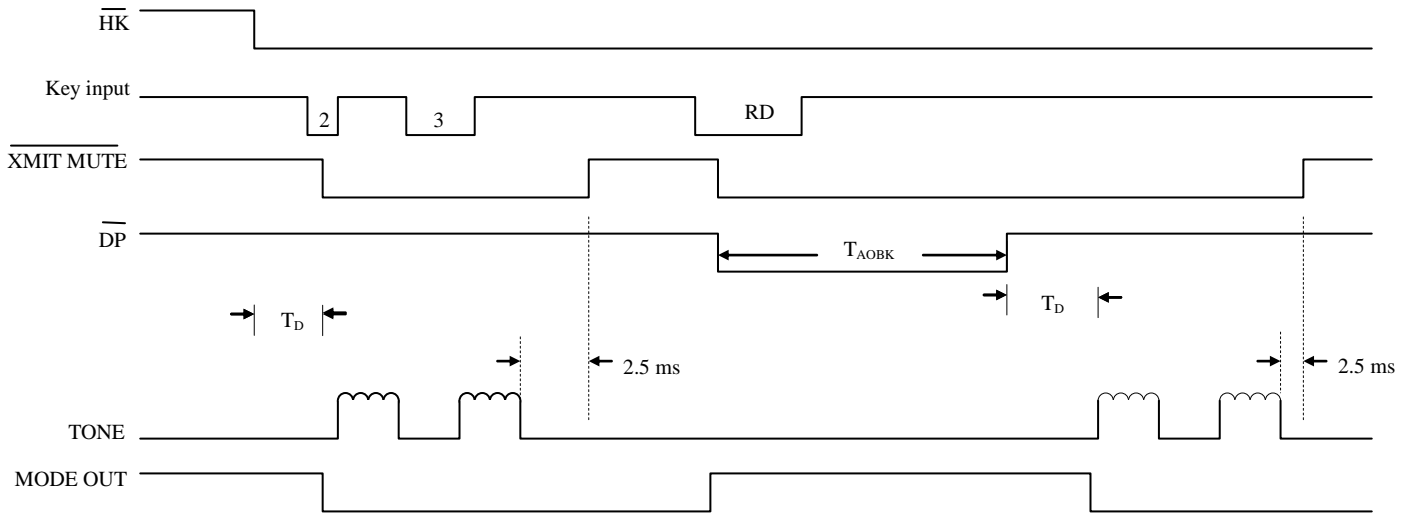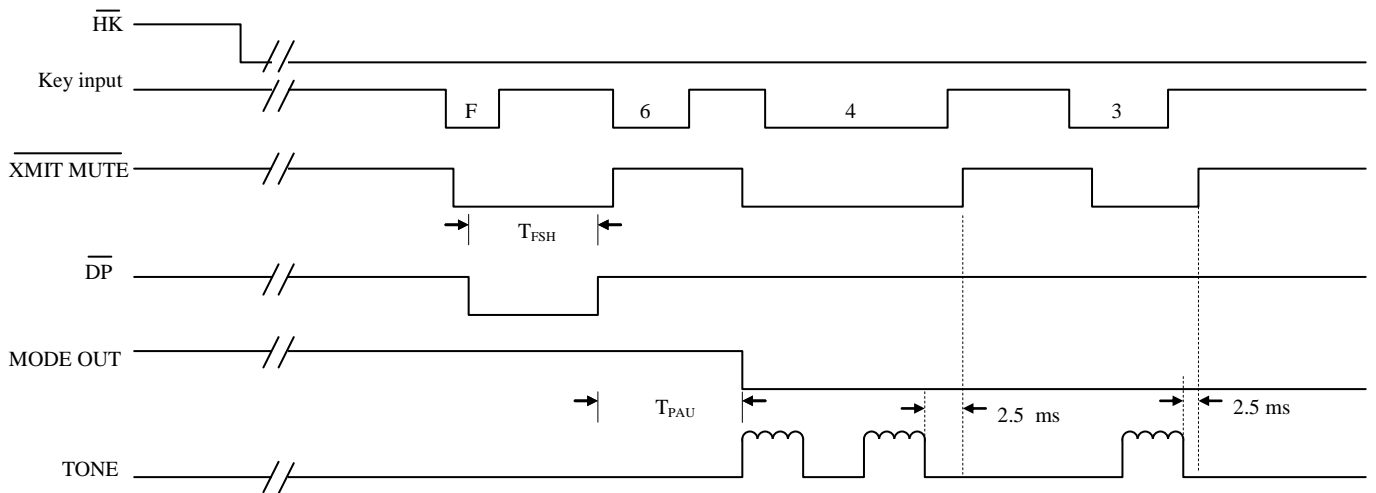## 4. Switching mode operation (MODE IN control).
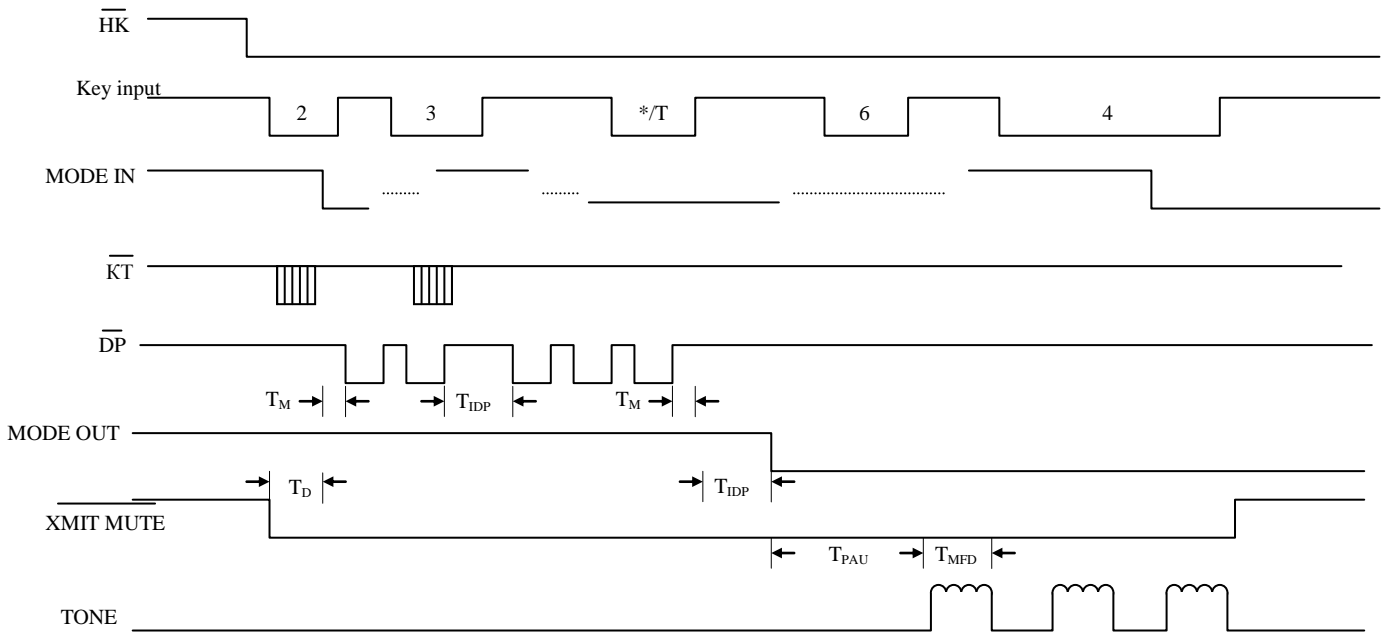
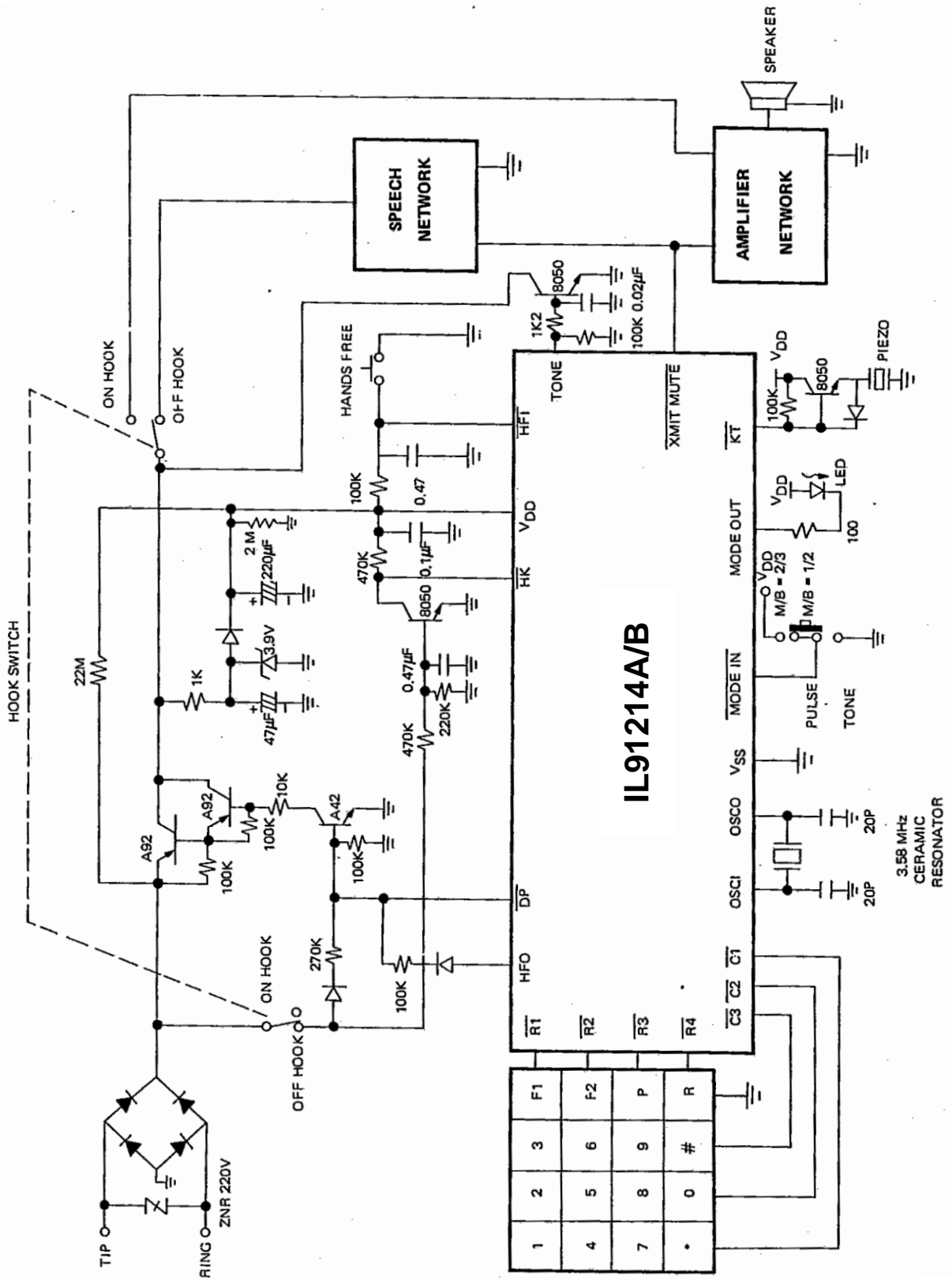## 5. Switching mode operation (*/T key entry).

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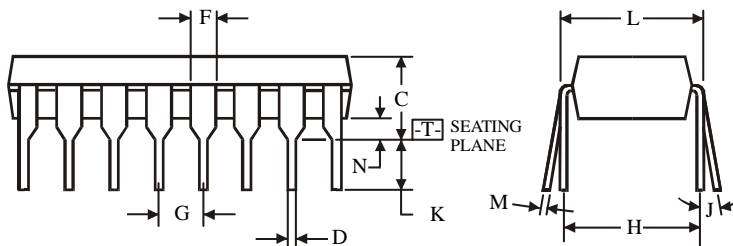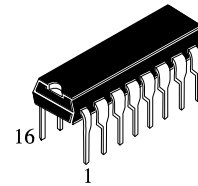6. One key redial using RD key (DTMF mode for example).

7. Flash dialing

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PACKAGE DIMENSION

N SUFFIX PLASTIC DIP
(MS - 001BB)
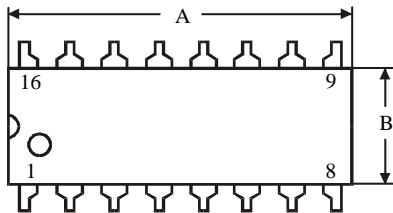
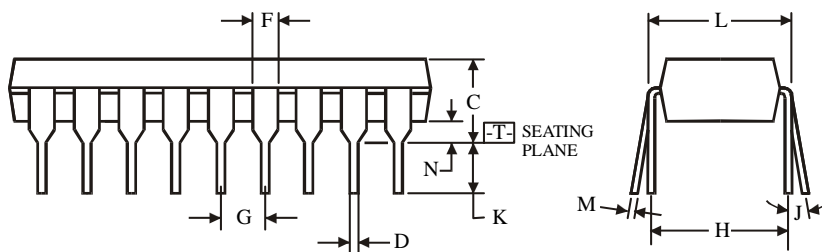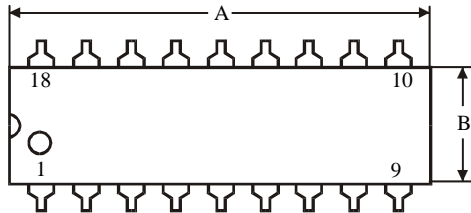|	Dimension, mm	
Symbol	**MIN**	**MAX**
A	18.67	19.69
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

⊕ 0.25 (0.010) Ⓜ T

NOTES:

1. Dimensions "A", "B" do not include mold flash or protrusions.

   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 012AC)
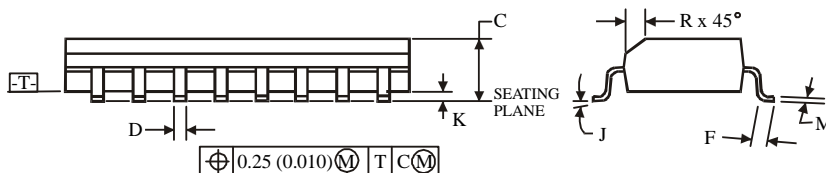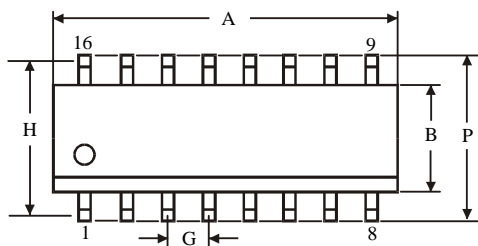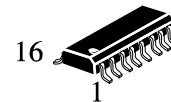
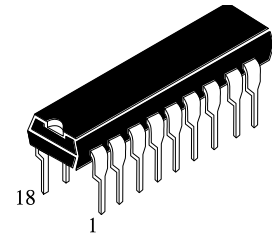|	Dimension, mm	
Symbol	**MIN**	**MAX**
A	9.8	10
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

⊕ 0.25 (0.010) Ⓜ T C Ⓜ

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.

2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.

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N SUFFIX PLASTIC DIP
(MS - 001AC)

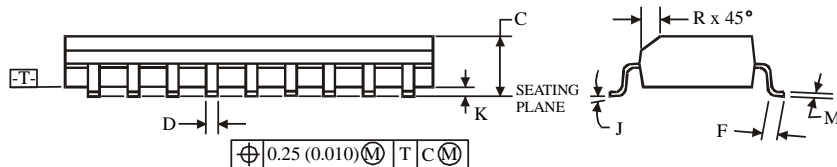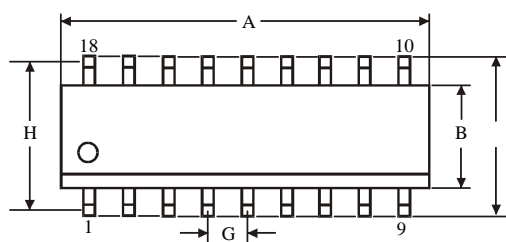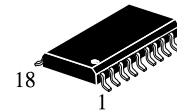|	Dimension, mm	
Symbol	**MIN**	**MAX**
A	22.35	23.37
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

0.25 (0.010) Ⓜ T

NOTES:

1. Dimensions "A", "B" do not include mold flash or protrusions.

   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 013AD)

	Dimension, mm	
Symbol	**MIN**	**MAX**
A	10.1	10.5
B	7.4	7.6
C	2.35	2.65
D	0.33	0.51
F	0.4	1.27
G	1.27	
H		
J	0°	8°
K	0.1	0.3
M	0.23	0.32
P	10	10.65
R	0.25	0.75

0.25 (0.010) Ⓜ T C Ⓜ

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.

2. Maximum mold flash or protrusion 0.15 mm (0.006) per side
   for A; for B – 0.25 mm (0.010) per side.

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