TONE/PULSE DIALER WITH RTC AND LCD DISPLAY FUNCTIONS

GENERAL DESCRIPTION

The W91510DN series ICs are Si-gate CMOS IC that provide the signals needed for either pulse or tone dialing. They feature a 12/16-digit LCD driver for displaying telephone numbers and calling time. A real time clock is included to display the time of day. The W91510DN series is fabricated using CMOS technology and thus provide good performance in low voltage, low power applications.

FEATURES

- One by 32 digits for redial
- Uses 5 × 6 keyboard
- Pause, pulse-to-tone (*/T) can be stored as a digit in memory
- Flash can be stored as a digit in memory when in store mode
- Minimum tone output duration: 87 mS
- Minimum intertone pause: 87 mS
- Tone/pulse mode pin selectable
- Make/break ratio pin selectable
- Dialing rate: 10 ppS
- Pause time: 3.6 Sec.
- Flash break time (73 mS, 100 mS, 300 mS or 600 mS) selectable by keypad
- Built-in 12 or 16-digit LCD driver (1/4 duty, 1/3 bias) selectable by mask option
- Built-in calling timer from [00:00] to [59:59]
- On-chip power-on reset and clear LCD
- Uses 3.579545 MHz TV quartz crystal or ceramic resonator
- Uses 32768 Hz crystal as RTC frequency base
- Packaged in 64-pin plastic QFP with RTC
- Switchable 24-hour clock or 12-hour clock with p.m. mode by keypad
- 0 or 9 dialing inhibition pin for PABX systems or long distance dialing lock out
- On hook debounce: 150 mS in normal mode and 20 mS in lock mode
- Off-hook delay 300 mS in lock mode ($\overline{DP}$ will keep low for 300 mS while off hook except the first off hook after power on reset that $\overline{DP}$ will keep high for 100 mS then go low for 200 mS)
- First key-in delay: 300 mS in lock mode
- Mixed dialing allowed

- The functions of the different dialers in the W91560DN series are shown in following table:

TYPE NO.	LCD DIGITS	LOCK	HOLD	PAUSE TIME
W91510DNF	16	–	Yes	3.6 Sec.
W91511DLNF	16	Yes	–	
W91512DNF	12	–	Yes	
W91513DLNF	12	Yes	–	
W91510DNH*	16	Yes	Yes	3.6 Sec.
W91512DNH*	12	Yes	Yes	

* Chip form package.

PIN CONFIGURATION

PIN DESCRIPTION

SYMBOL	PIN NO.	I/O	FUNCTION
Row, Column Inputs	18–21, 13–17	I	The keyboard inputs may be used with either the standard 5 × 6 keyboard, an inexpensive single contact (form A) keyboard or electronic input. A valid key entry is defined by a single row being connected to a single column.
XT1, $\overline{XT1}$	22, 23	I, O	A built-in inverter provides oscillation with an inexpensive 3.579545 MHz crystal or ceramic resonater. The oscillator ceases when a keypad input is not sensed after chip enable and dialing finished. The crystal frequency deviation is ±0.02%.
T/P $\overline{MUTE}$	8	O	The T/P $\overline{MUTE}$ is a conventional CMOS N-channel open drain output. The output transistor is switched on low level during dialing sequence (both pulse and tone mode), one-key redial break and flash break. Otherwise, it is switched off.
H/P MUTE	9 (W91510DNF, W91512DNF, only)	O	The H/P MUTE is a conventional CMOS inverter output, During pulse dialing, one-key redial break, flash break and hold functions, this pin will output an active high. It remains in a low state at all other times.
LOCK	9 (W91511DLNF, W91513DLNF only)	I	The LOCK pin is used to prevent "0" or "9" dialing under PABX system long distance call control. When the first key input after reset is "0" or "9", all the key inputs, including "0" or "9" key, become invalid, and the chip generates no output. The telephone is reinitialized by a reset. The following table describes the functions of the LOCK pin:
$\overline{HKS}$	24	I	Hook switch input. $\overline{HKS}$ = V_{DD} or floating: On-hook state. Chip in sleeping mode, no operation. $\overline{HKS}$ = V_{SS}: Off-hook state. Chip enable for normal operation. $\overline{HKS}$ pin is pulled to V_{DD} by internal resistor.

LOCK PIN	FUNCTION
V_{DD}	"0", "9" dialing inhibited
Floating	Normal dialing
V_{SS}	"0" dialing inhibited

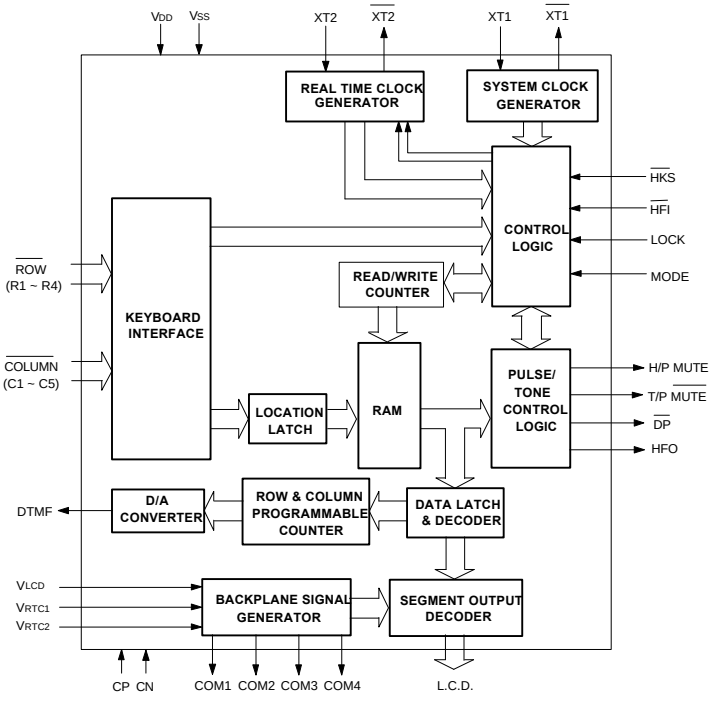
Pin Description, continued

<table>
<tr><th>SYMBOL</th><th>PIN NO.</th><th>I/O</th><th>FUNCTION</th></tr>
<tr><td>$\overline{HFI}$, HFO</td><td>25, 10</td><td>I, O</td><td>Handfree control pins. A low pulse on the $\overline{HFI}$ input pin toggles the handfree control state.
Status of the handfree control is listed in the following table:
<table>
<tr><th colspan="2">CURRENT STATE</th><th colspan="3">NEXT STATE</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>$\overline{HFI}$ ↓</td><td>High</td><td>Yes</td></tr>
<tr><td>On Hook</td><td>High</td><td>$\overline{HFI}$ ↓</td><td>Low</td><td>No</td></tr>
<tr><td>Off Hook</td><td>High</td><td>$\overline{HFI}$ ↓</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>
$\overline{HFI}$ pin is pulled to V_{DD} by internal resistor.
Detailed timing diagrams are shown in Figure 4(a), 4(b).</td></tr>
<tr><td>$\overline{DP}$ / $\overline{C6}$</td><td>11</td><td>O</td><td>This pin is a CMOS N-channel open drain output. Flash key will cause $\overline{DP}$ to go active in either pulse mode or tone mode. In lock mode, the $\overline{DP}$ keeps low for 300 mS during off-hook delay time. The timing diagram is shown as Figure 1(a), 1(b), 1(c), 1(d).</td></tr>
<tr><td>DTMF</td><td>6</td><td>O</td><td>In pulse mode, this pin remains in low state at all time.
In tone mode, it will output a dual or single tone. Detailed timing diagram for tone mode is shown in Figure 2(a), 2(b), 2(c), 2(d).
<table>
<tr><th colspan="4">OUTPUT FREQUENCY</th></tr>
<tr><th></th><th>Specified</th><th>Actual</th><th>Error %</th></tr>
<tr><td>R1</td><td>697</td><td>699</td><td>+0.28</td></tr>
<tr><td>R2</td><td>770</td><td>766</td><td>- 0.52</td></tr>
<tr><td>R3</td><td>852</td><td>848</td><td>- 0.47</td></tr>
<tr><td>R4</td><td>941</td><td>948</td><td>+0.74</td></tr>
<tr><td>C1</td><td>1209</td><td>1216</td><td>+0.57</td></tr>
<tr><td>C2</td><td>1336</td><td>1332</td><td>- 0.30</td></tr>
<tr><td>C3</td><td>1477</td><td>1472</td><td>- 0.34</td></tr>
</table></td></tr>
<tr><td>VLCD</td><td>29</td><td>O</td><td>Power supply pin for LCD driver.
A 0.1 µF capacitor is connected between VLCD and V_{SS}.</td></tr>
<tr><td>CP, CN</td><td>31, 32</td><td>I</td><td>CP is the voltage control capacitor positive pin.
CN is the voltage control capacitor negative pin.
A 0.1 µF capacitor is connected between these two pins.</td></tr>
</table>

Pin Description, continued

SYMBOL	PIN NO.	I/O	FUNCTION
COM1 to COM4	33–36	O	COM1 to COM4 are the common signal output terminal for the 1/4 duty LCD.
SEG1 to SEG32	37–64, 1–4	O	SEG1 to SEG32 are the 16-digit segment signal outputs.
XT2, $\overline{XT2}$	26, 27	I, O	A quartz crystal oscillator provides an RTC frequency time base of 32.768 KHz.
VRTC1, VRTC2	28, 30	I	Either VRTC1 should be connected to a 1.5V battery, and VRTC2 should be connected a capacitor 0.1 μF to ground.
VDD, VSS	5, 7	I	Power input pins.
MODE	12	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, M/B = 1/2). Leaving mode pin floating places the dialer in pulse mode (10 ppS, M/B = 2/3).

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

Keyboard Operation

C1	C2	C3	C4	C5	$\overline{DP}$ / $\overline{C6}$	
1	2	3			HOLD1	R1
4	5	6	F4		HOLD2	R2
7	8	9	CHK		APSET	R3
*/T	0	#	R/P	RTC/HOUR	SET	R4
F1	F2	F3	OKR	TIM/MIN		Vx

- */T: * in tone mode and P→T in pulse mode
- F1, F2, F3, F4: Flash keys
- R/P: Redial and pause function key
- OKR: One-key redial function
- RTC: Real time clock toggle key
- TIM: a. Display last calling time
  b. Start and/or stop counting up calling time
- HOUR and MIN: Adjusting time setting keys
- HOLD1, HOLD2: Hold function keys
- APSET: Toggle to set RTC display mode
- SET: Toggle the RTC set function on/off.
- CHK: a. Check dialing number
  b. Check dialing time

Note: D1, ..., Dn, D1', ..., Dn': 0, ..., 9, ∗/T, #

Normal Dialing

OFF HOOK (or ON HOOK & $\overline{HFI}$), 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 in normal dialing.

Redialing

1. OFF HOOK (or ON HOOK & $\overline{HFI}$), D1 , D2 , Check Memory (or Number Store), D3 , ..., Dn , Busy, Come ON HOOK , OFF HOOK (or ON HOOK & $\overline{HFI}$), R/P

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

b. The redial memory content will be D3, …, Dn.

c. Redial memory can be checked in memory check mode. ([CHK] , [R/P])

d. If redialing length oversteps 32 digits, the redialing function will be inhibited.

2. [OFF HOOK] (or [ON HOOK] & [HFI ïõ]), [D1] , [D2] , ..., [Dn] , Busy, [OKR]

a. If the dialing of [D1] to [Dn] is finished, pressing the [OKR] key will cause the pulse output pin to go low for 2.2 seconds break time and 0.6 seconds pause time will automatically be added.

b. If the pulses of the dialed digits [D1] to [Dn] have not finished, [OKR] will be ignored.

c. The one-key redialing function timing diagram is shown in Figure 3.

Access Pause

[OFF HOOK] (or [ON HOOK] & [HFI ïõ]), [D1] , [D2] , [R/P] , [D3] , ..., [Dn]

, Busy, Come [ON HOOK] , [OFF HOOK] (or [ON HOOK] & [HFI ïõ]), [R/P]

1. The first R/P functions as a pause key and the second as a first key-in redial key.
2. The pause function can be stored in memory.
3. The pause function is executed in normal dialing, redialing, or memory dialing.
4. The pause duration time is 3.6 Sec.
5. The pause function timing diagram is shown in Figure 5

Pulse- to-tone (*/T)

[OFF HOOK] (or [ON HOOK] & [HFI ïõ]), [D1] , [D2] , ..., [Dn] , [*/T] , [D1']

, [D2'] , ..., [Dn']

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

   D1, D2, …, Dn, Pause (3.6 sec), D1', D2', …, Dn'
   (Pulse) (Tone)

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

   D1, D2, …, Dn, *, D1', D2', …, Dn'
   (Tone) (Tone)

3. The dialer remains in tone mode after the digits have been dialed out and can be reset to pulse mode only by going on-hook.
4. The pulse-to-tone function timing diagram is shown in Figure 6(a), 6(b).

Flash (F = F1, F2, F3, F4)

OFF HOOK (or ON HOOK & HFI), F

1. The dialer will execute flash break time of 600 mS(F1), 300 mS(F2), 73 mS(F3) or 100 mS(F4) and pause time of 1S before the next digit (except flash key) is dialed out.
2. The system will return to the initial state after flash break time is finished.
3. Keyboard functions are inhibited during flash break is being executed.
4. The flash timing daigram is shown in Figure 7.

Hold Key

OFF HOOK (or ON HOOK & HFI), HOLD1 (or HOLD2)

1.The hold function is toggled on and off by HOLD1 or HOLD2 key. When the hold function is toggled on, the hold mark (dot of digit_4) will be lit and all key-in (except hold keys and icon keys) will be ignored.

2. The following are examples of hold function toggled on and off:

a. OFF HOOK , HOLD1 (or HOLD2), HOLD1 (or HOLD2)

b. OFF HOOK , HOLD1 (or HOLD2), HFI

c. OFF HOOK , HOLD1 (or HOLD2), ON HOOK , HFI

d. ON HOOK & HFI , HOLD1 (or HOLD2), HFI

3. HOLD1 and HOLD2 have the same function in off-hook state. The difference between HOLD1 and HOLD2 are shown as follows:

a. If OFF HOOK , HOLD1 (or HOLD2), ON HOOK , HOLD1 is entered, then the dialer will be off-line.

If OFF HOOK , HOLD1 (or HOLD2), ON HOOK , HOLD2 is entered, then the dialer will stay at hold function.

b. If ON HOOK & HFI , HOLD1 (or HOLD2), HOLD1 is entered, then the dialer will be off- line.

c. If ON HOOK & HFI , HOLD1 (or HOLD2), and HOLD2 is entered, then the dialer will stay at hold function.

4. The function timing diagram is shown in Figure 8(a), 8(b), 8(c).

Adjusting Time Setting

OFF HOOK (or ON HOOK & HFI), SET , HOUR , MIN , SET

(or ON HOOK)

1. Only HOUR and MIN keys are valid in RTC set mode.
2. Hours and minutes count forward as long as HOUR or MIN key is pressed.
3. The on/off function of SET is tolggled, and the dialer will be initialized after toggle SET key.
4. If the dialing sequence D1, D2, ..., Dn (including flash and pause) has not finished, SET will be ignored.

RTC Display Mode

OFF HOOK (or ON HOOK & HFI), RTC

1.The real time clock display mode can be toggled on and off by RTC key.

2. The icon display will not be changed when enter RTC display mode and set RTC mode.

APSET

1. In the off-hook state, pressing APSET key to toggle the RTC function in 24-hour clock mode or 12-hour clock with p.m. mode.
2. The default mode is 12-hour clock with p.m. mode after power on.

Check Key

OFF HOOK (or ON HOOK & HFI), CHK , R/P

The redial content will be displayed on the LCD when either R/P or OKR is key in.

TIM

OFF HOOK (or ON HOOK & HFI), D1 , D2 , ..., Dn (or Redialing or Repertory dialing), CONVERSATION

1. If no key is pressed after dialing finish, the LCD will display counting time after 6 seconds.
2. If the dialing sequence D1, D2, ..., Dn has not finished, TIM will be ignored.
3. The timer will be initialized by flash and toggle SET key.

ABSOLUTION MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
DC Supply Voltage	V_{DD}–V_{SS}	-0.3 to +7.0	V
Input/Output Voltage	V_{IL}	V_{SS} –0.3	V
	V_{IH}	V_{DD} +0.3	
	V_{OL}	V_{SS} –0.3	
	V_{OH}	V_{DD} +0.3	
Power Dissipation	P_D	120	mW
Operating Temperature	T_{OPR}	-0.5 to +70	°C
Storage Temperature	T_{STG}	-55 to +125	°C

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

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

(V_{DD}–V_{SS} = 2.5V. F_{OSC} = 3.58 MHz, T_A = 25° C, all outputs unloaded.)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Operating Voltage	V_{DD}	-	2.0	-	5.5	V
Operating Current	I_{OP}	Tone, Unloaded	-	0.5	0.7	mA
		Pulse, Unloaded	-	0.4	0.5	
Standby Current	I_{SB}	$\overline{HKS}$ = 0, Unloaded and no key entry	-	-	15	µA
Memory Retention Current	I_{MR}	$\overline{HKS}$ = 1 V_{DD} = 1.0V	-	-	0.5	µA
Tone Output Voltage	V_{TO}	Row group RL = 10 KΩ	130	150	170	mVrms
Pre-emphasis		Col/Row V_{DD} = 2.0 to 5.5V	-	2	3	dB
DTMF Distortion	THD	RL = 10 KΩ V_{DD} = 2.0 to 5.5V	-	-30	-23	dB
DTMF Output DC Level	V_{TDC}	V_{DD} = 2.0 to 5.5V	1.0	-	3.0	V
DTMF 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

DC characteristics, continued

PARAMETER	SYM.	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Common Output Voltage	V_{CH}	-	4.2	4.5	4.8	V
	V_{CL}	-	-	0	0.3	
Common Output Current	I_{CH}	-	-20	-	-	μA
	I_{CL}	-	20	-	-	
Segment Output Voltage	V_{SH}	-	4.2	4.5	4.8	V
	V_{SL}	-	-	0	0.3	
Segment Output Current	I_{SH}	-	-5	-	-	μA
	I_{SL}	-	5	-	-	
RMS Voltage	V_{ON}	-	2.4	2.6	-	Vrms
Across a Segment	V_{OFF}	-	-	1.5	1.7	
Average DC Offset Voltage	V_{DC}	-	-	-	100	mV
$\overline{HFI}$ High Voltage	V_{HFIH}	-	0.8 V_{DD}	-	V_{DD}	V
$\overline{HFI}$ Low Voltage	V_{HFIL}	-	-	-	0.2 V_{DD}	V
T/P $\overline{MUTE}$ Output Sink Current	I_{TML}	V_{TMO} = 0.5V	0.5	-	-	mA
H/P MUTE Output Drive Current	I_{HMH}	V_{HMO} = 2.0V	0.5	-	-	mA
H/P MUTE Output Sink Current	I_{HML}	V_{HMO} = 0.5V	0.5	-	-	mA
Keypad Input Drive Current	I_{KD}	V_I = 0V	4	-	-	μA
Keypad Input Sink Current	I_{KS}	V_I = 2.5V	200	-	-	μA
Keypad Resistance	R_K	-	-	-	5	KΩ
Control Input Pull-up/Down Resistor	R_{IH}	-	100	-	-	KΩ
$\overline{HKS}$ Input Pull-high Resistor	R_{HK}	-	-	500	-	KΩ

AC CHARACTERISTICS

(V_{DD}–V_{SS} = 2.5V, $F_{OSC.}$ = 3.58 MHz, T_A = 25°C, all outputs unloaded.)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Key-in Debounce	T_{KID}	-	-	20	-	mS
Key Release Debounce	T_{KRD}	-	-	20	-	mS
Off-hook Delay Time	T_{OFD}	-	-	300	-	mS
First Key-in Delay Time	T_{FKD}	-	-	300	-	mS
On-hook Debounce Time	T_{OHD}	Unlock	-	150	-	mS
		Lock	-	20	-	
Pulse Mute Delay	T_{MD}	Mode = V_{DD}	-	40	-	mS
		Mode = Floating	-	33.3	-	
Pre-digit-Pause 10 ppS	T_{PDP}	Mode = V_{DD}	-	40	-	mS
		Mode = Floating	-	33.3	-	
Inter-digit Pause (Auto Dialing)	T_{IDP}	10 ppS	-	800	-	mS
Make/Break Ratio	M:B	Mode = V_{DD}	-	40:60	-	%
		Mode = Floating	-	33:67	-	
Tone Output Duration	T_{TD}	-	-	87	-	mS
Inter-tone Pause	T_{ITP}		-	87	-	mS
Flash Break Time	T_{FB}	F1	-	600	-	mS
		F2	-	300	-	
		F3	-	73	-	
		F4	-	100		
Flash Pause Time	T_{FP}	F1, F2, F3,F4	-	1	-	S
Pause Time	T_P	R/P	-	3.6	-	
One Key Redialing Break Time	T_{RB}	-	-	2.2	-	S
One Key Redialing Pause Time	T_{RP}	-	-	0.6	-	S
LCD Frame Frequency	F_{LCD}	-	-	32	-	Hz

RTC DC CHARACTERISTICS

(V_{RTC} = 1.5V, V_{SS} = 0V, $F_{OSC.}$ = 32.768 KHz , T_A = 25° C, all outputs unloaded.)

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{RTC}	-	1.2	1.5	1.8	V
Supply Current	I_{RTC}	No Load	-	2.0	4.0	µA
OSC. Starting Time	T_{OSC}	-	-	-	3	S
OSC. Output Built-in Cap.	C_O	Cl = 12.5 pF	-	25	-	pF
OSC. in Trimmer Cap.	C_{TRIM}	-	5	-	35	pF
Frequency Stability	Δf/f	V_{DD}–V_{SS} = 1.3 to 1.6V	-	-	1	ppM

Notes :

1. Crystal parameters suggested for proper operation are Rs < 100 ohms, Lm = 96 mH , Cm = 0.02 pF , Cn = 5 pF , Cl = 18 pF, and Fosc. = 3.579545 MHz ±0.02%
2. Crystal oscillator accuracy directly affects these times.

TIMING WAVEFORMS

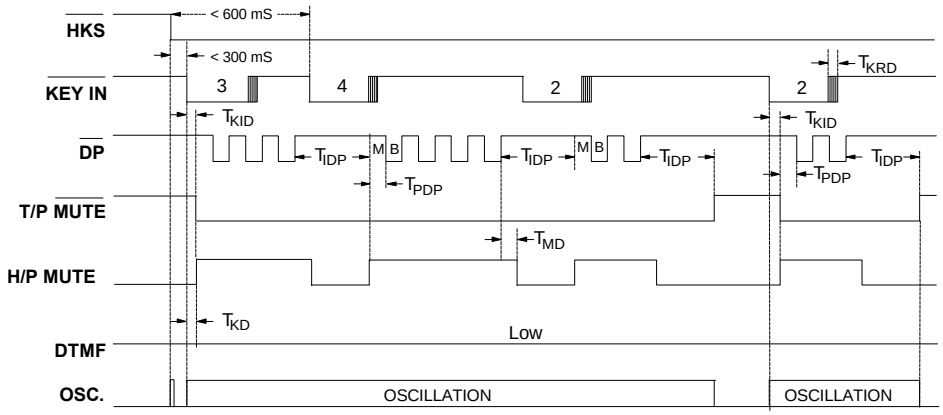


Figure 1(a). Normal Dialing Timing Diagram (Pulse Mode without Lock Function)

Timing Waveforms, continued

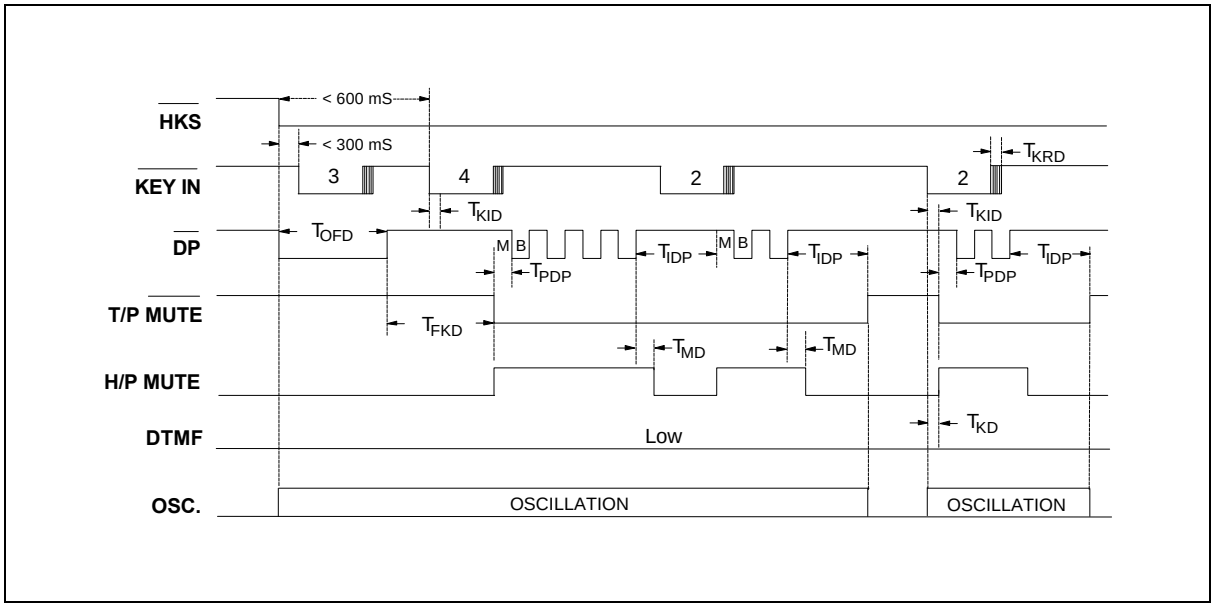


Figure 1(b). Normal Dialing Timing Diagram (Pulse Mode with Lock Function)

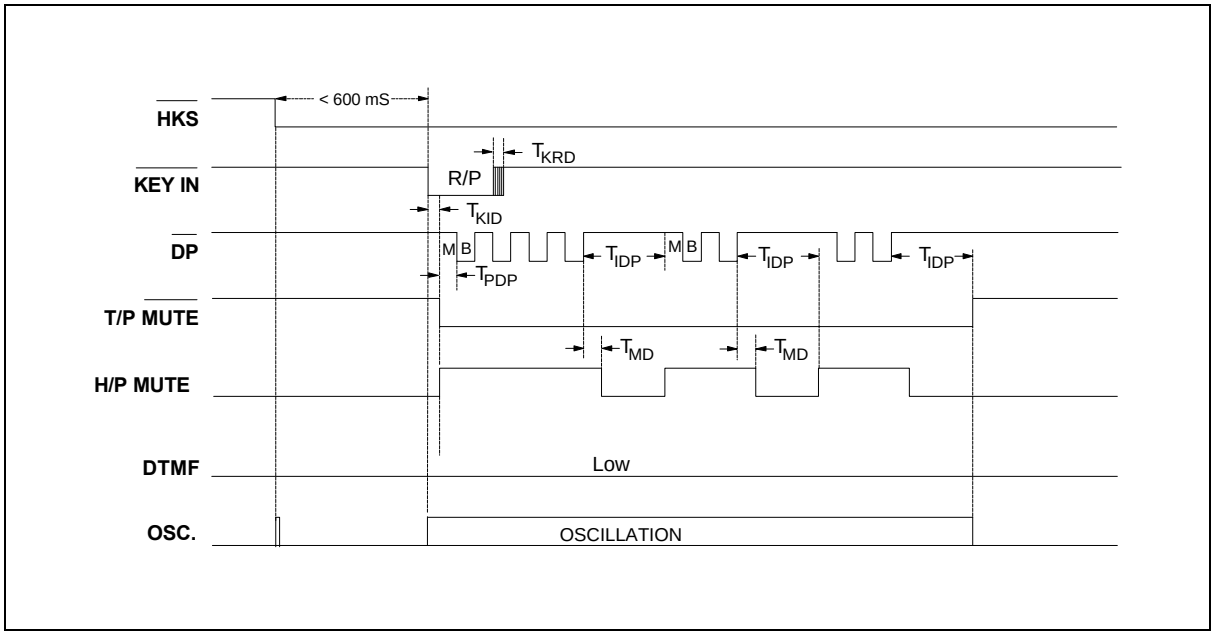


Figure 1(c). Auto Dialing Timing Diagram (Pulse Mode Without Lock Function)

Timing Waveforms, continued

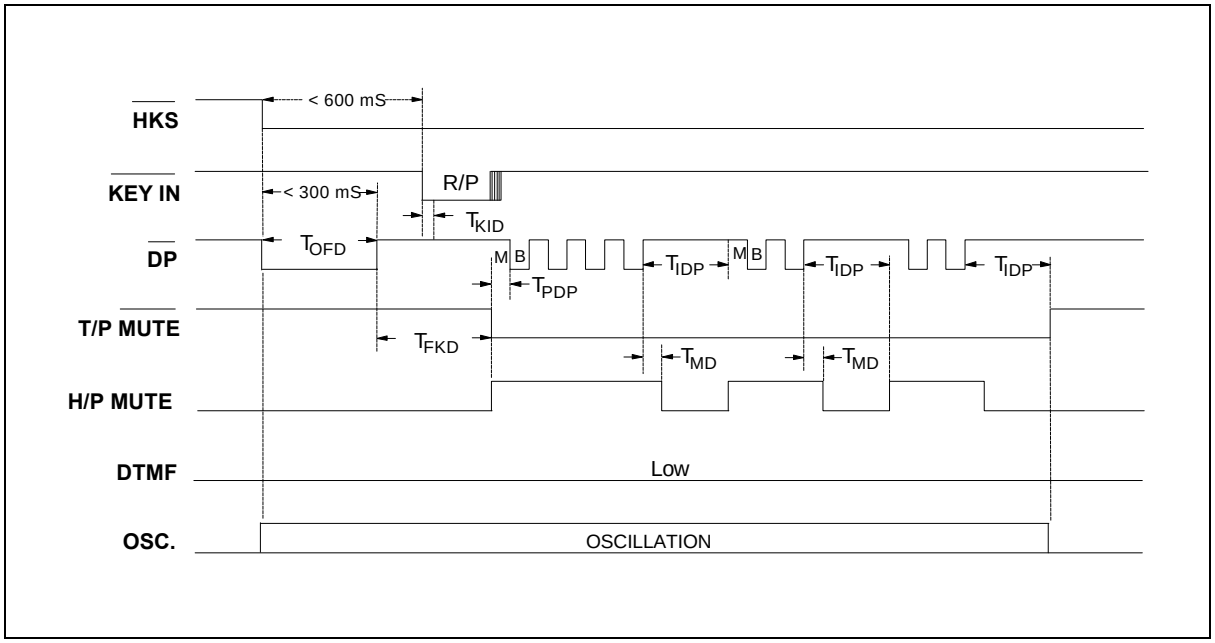


Figure 1(d). Auto Dialing Timing Diagram (Pulse Mode with Lock Function)

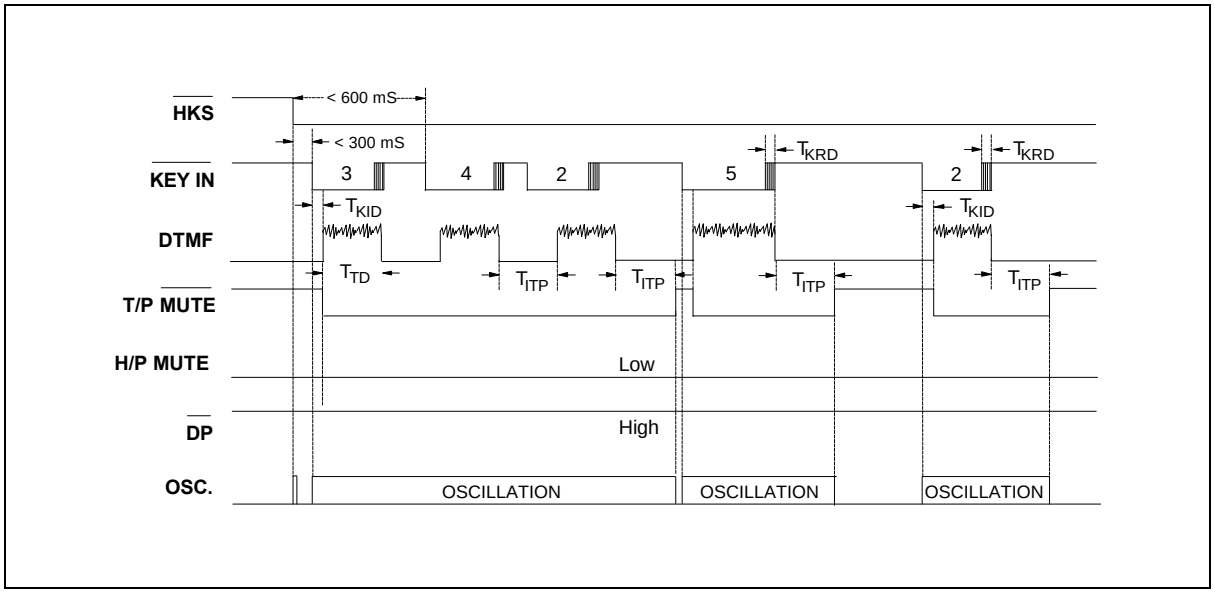


Figure 2(a). Normal Dialing Timing Diagram (Tone Mode Without Lock Function)

Timing Waveforms, continued

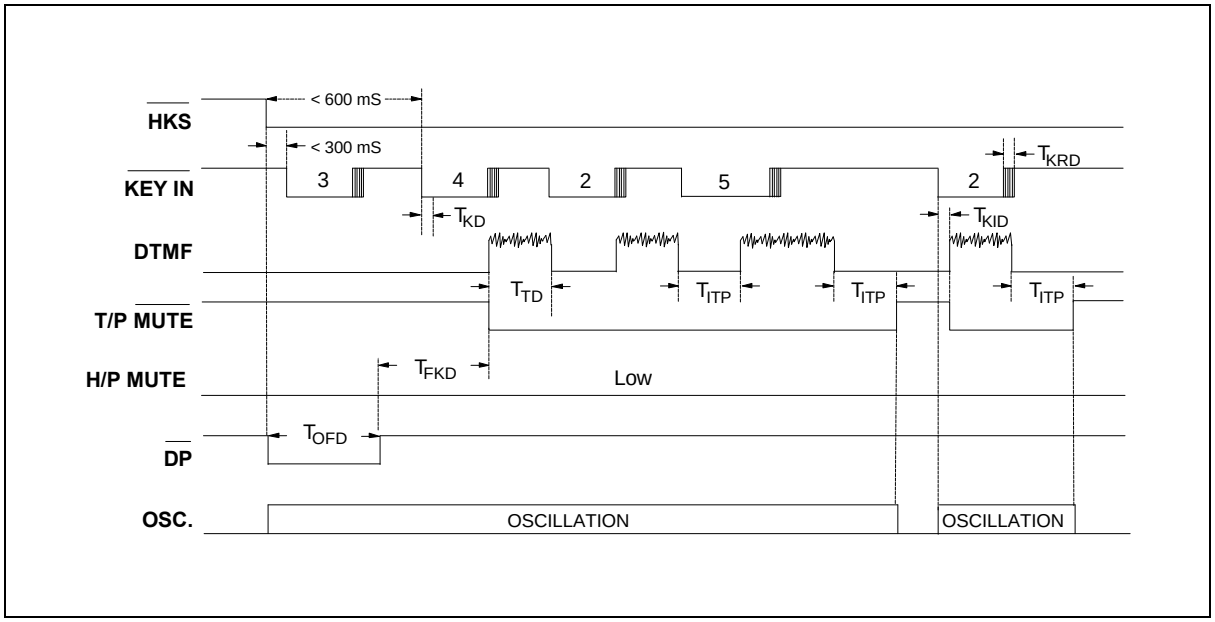


Figure 2(b). Normal Dialing Timing Diagram (Tone Mode with Lock Function)

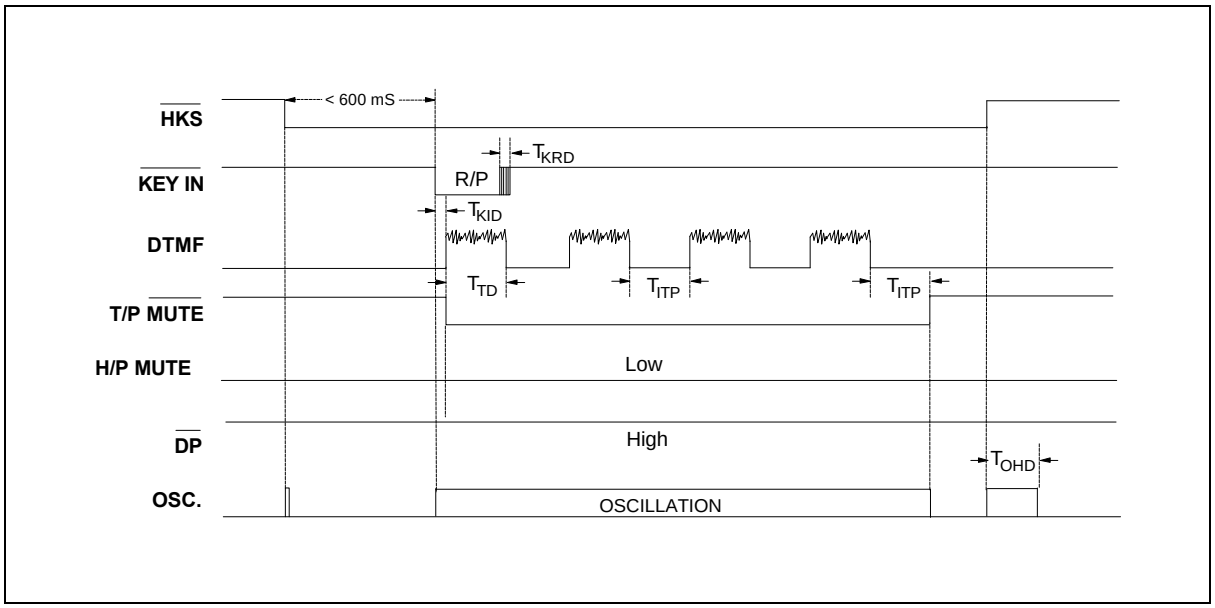


Figure 2(c). Auto Dialing Timing Diagram (Tone Mode Without Lock Function)

Timing Waveforms, continued

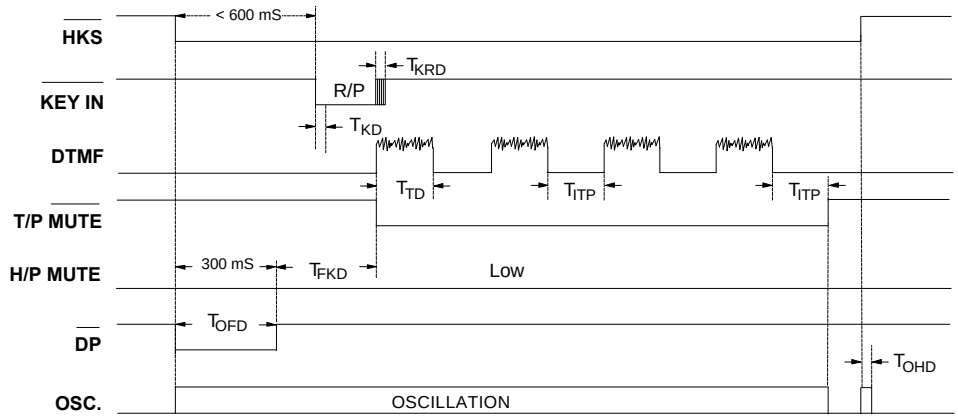


Figure 2(d). Auto Dialing Timing Diagram (Tone Mode with Lock Function)

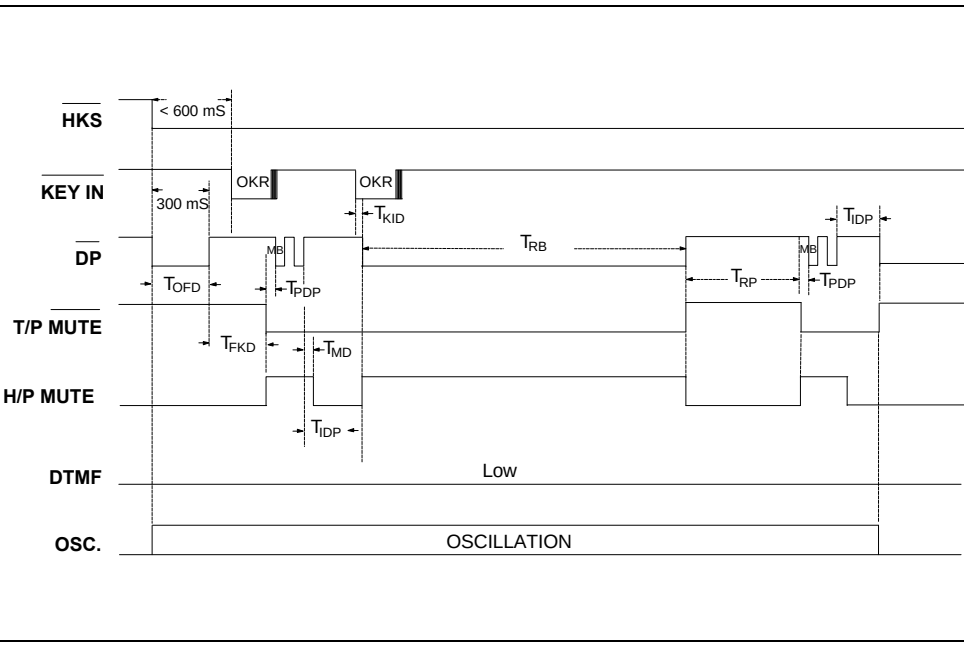


Figure 3. One-key Redial Timing Diagram

Timing Waveforms, continued

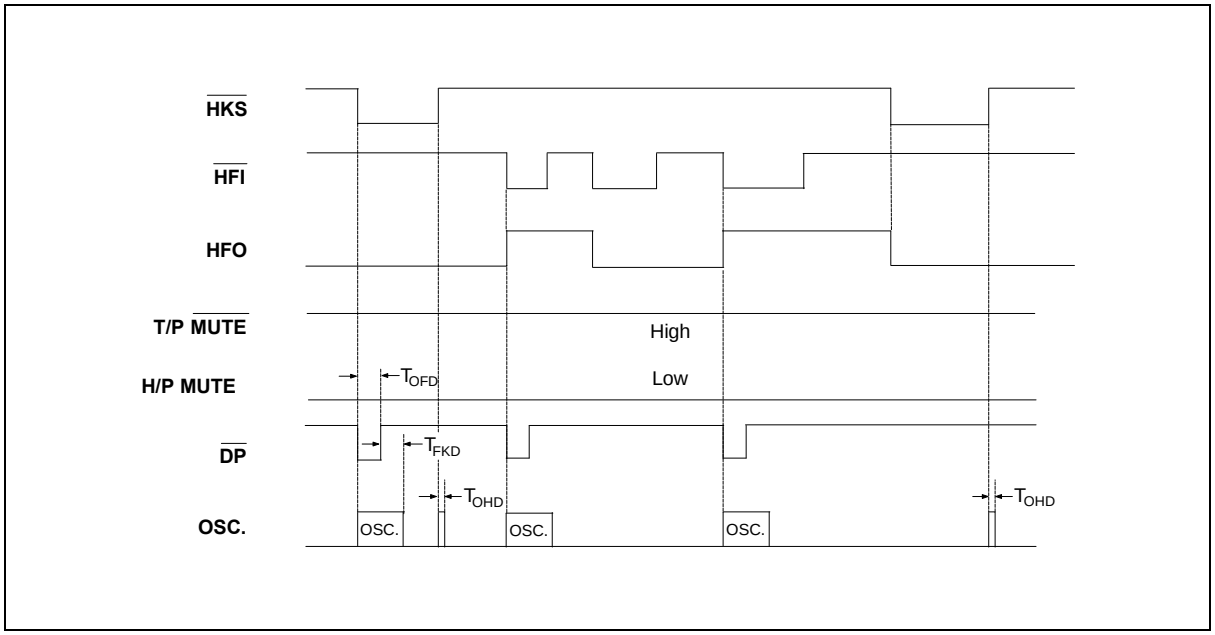


Figure 4(a). Handfree Timing Diagram (with Lock Function)

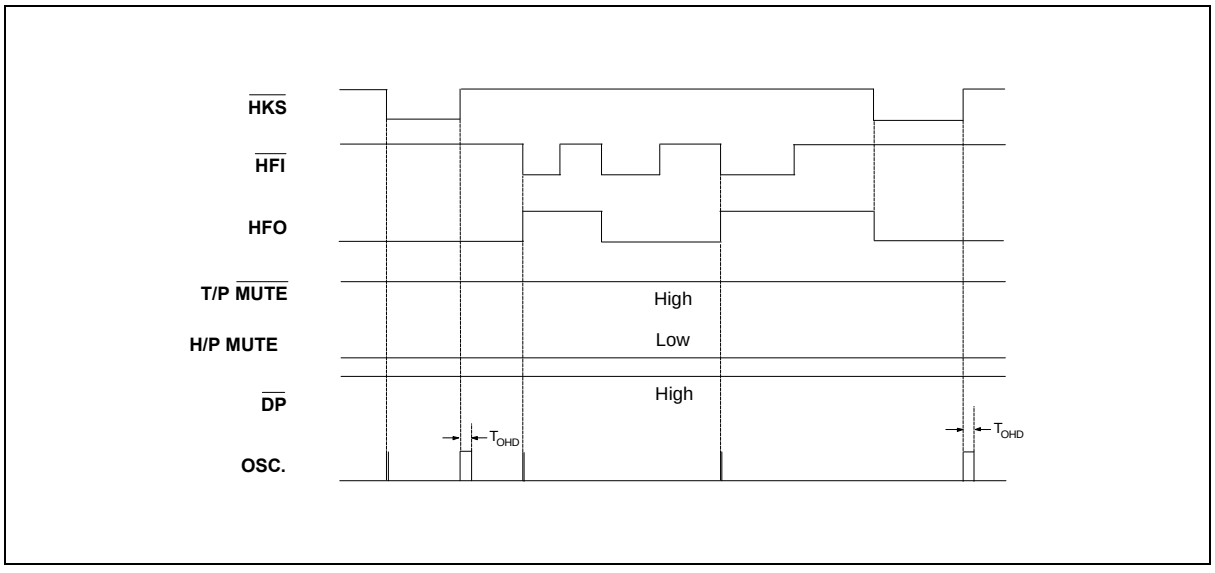


Figure 4(b). Handfree Timing Diagram (Without Lock Function)

Timing Waveforms, continued

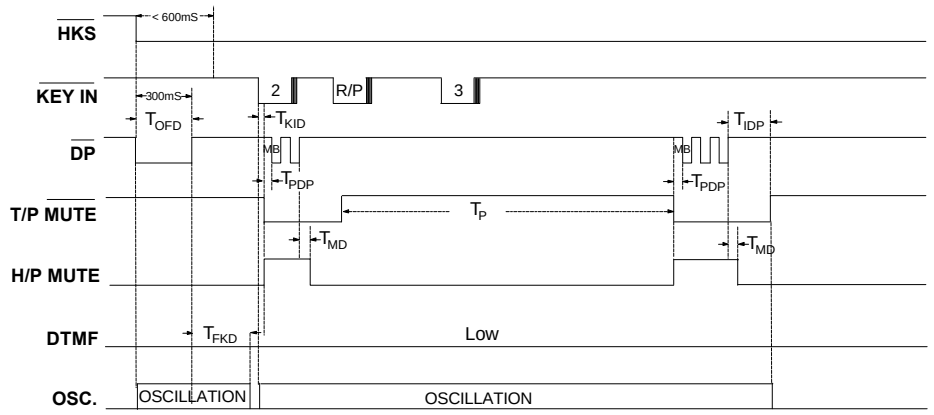


Figure 5. Pause Function Timing Diagram (Pulse Mode)

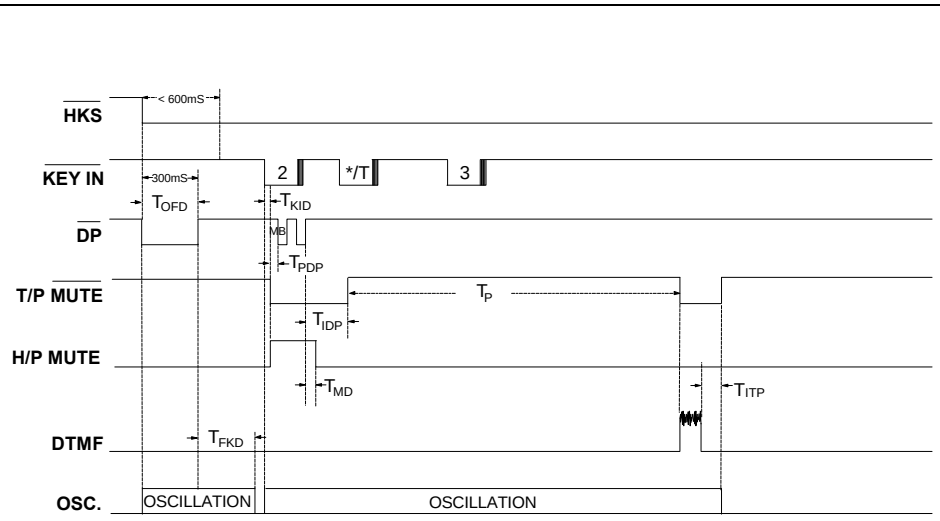


Figure 6(a). Pulse-to-tone Timing Diagram

Timing Waveforms, continued

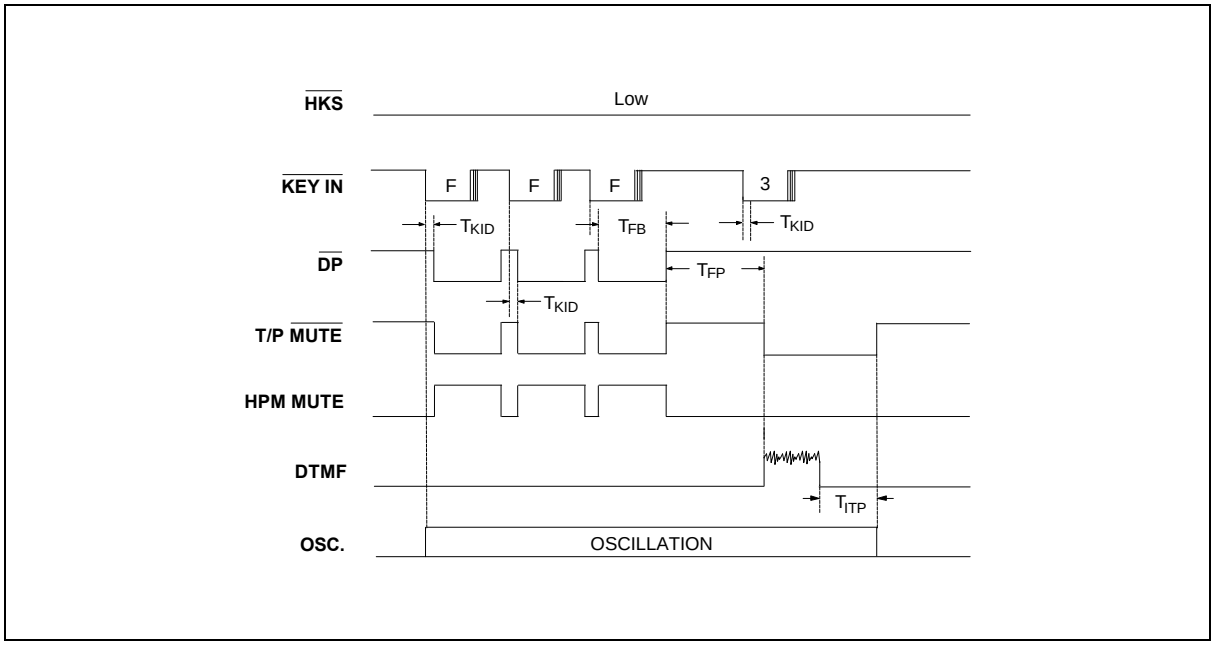


Figure 7. First Priority Flash Timing Diagram

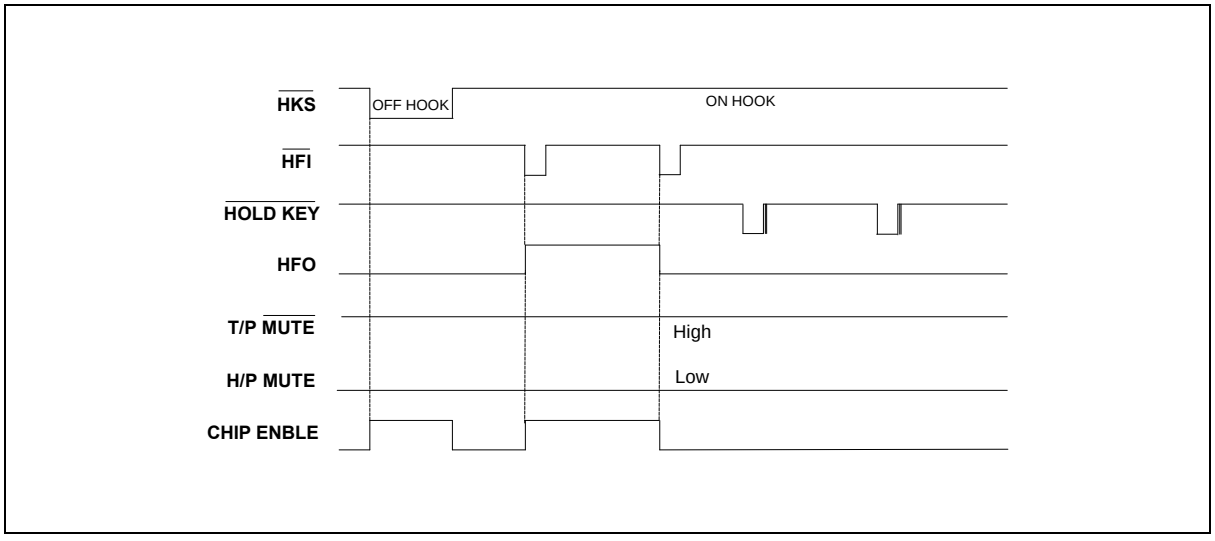


Figure 8(a). Hold and Handfree Timing Diagram

Note: The $\overline{\text{HOLD KEY}}$ cannot be enabled when chip is disabled.

Timing Waveforms, continued

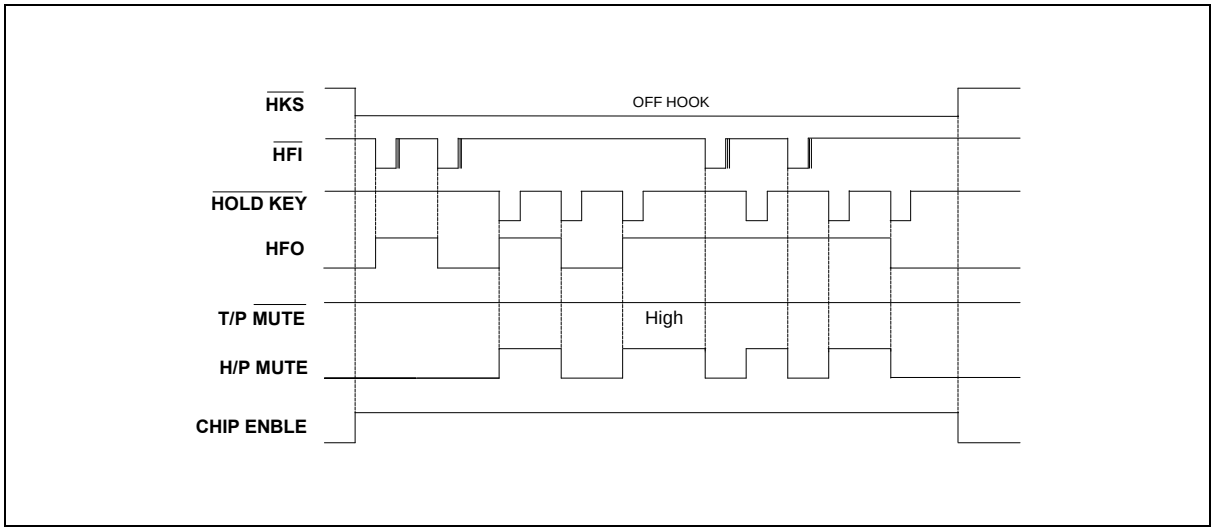


Figure 8(b). Hold and Handfree Timing Diagram

Note: The $\overline{\text{HFI}}$ and $\overline{\text{HOLD KEY}}$ inputs will toggle the HFO signal; as soon as either $\overline{\text{HFI}}$ or $\overline{\text{HOLD KEY}}$ is activated, the HFO signal will go high and previous activate inputs will be ignored.

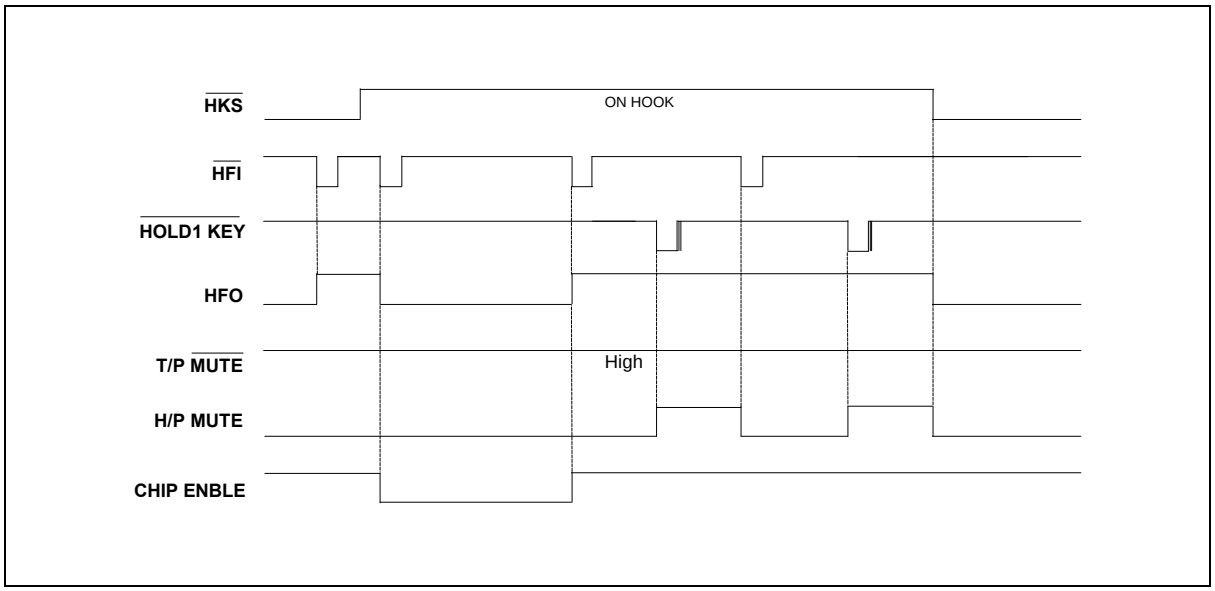
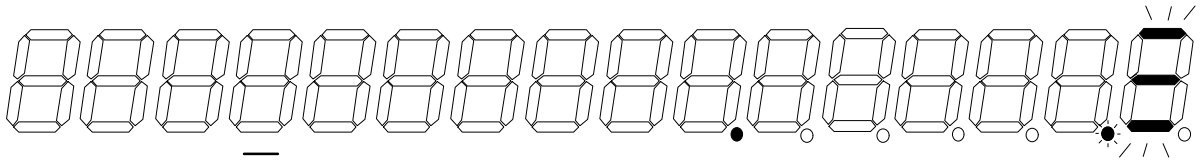


Figure 8(c). Hold and Handfree Timing Diagram

Note: Changing the state of the $\overline{\text{HKS}}$ signal from high to low will initialize the HFO and H/P MUTE signals.

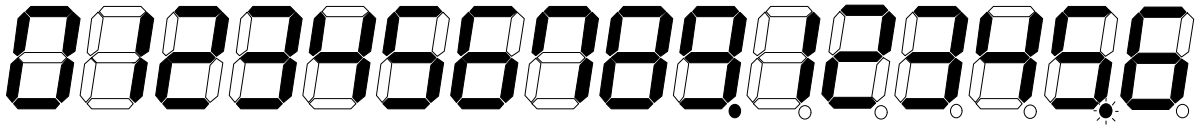
LCD DISPLAY FORMAT

A. Normal Dialing



; Off hook or press "HFI" switch
(Here tone mode was selected).

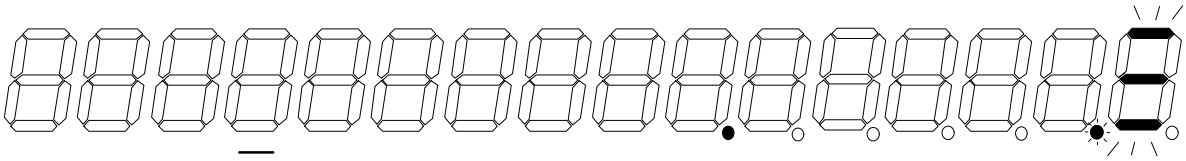
Blinking



; dial" 0123456789123456"

; and "78"

B. Redialing, One touch dialing

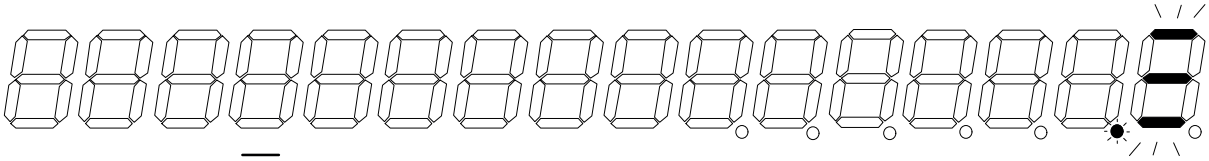


; Off hook or press "HFI" switch
(Here tone mode was selected).

Blinking

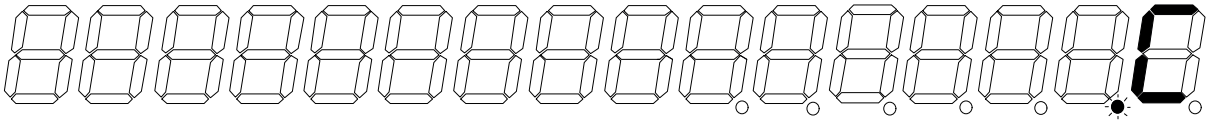
; Press "R/P" or "OKR" key
(Redial = "8123456789")

C. Redial memory Check

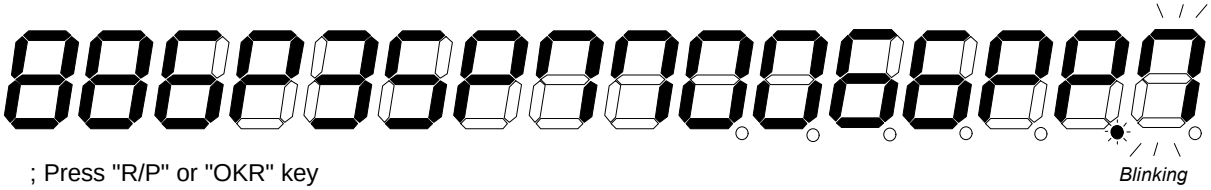


; Off-hook or press "$\overline{\text{HFI}}$" switch

(M1= "886P35P770066PP7126", and here pulse mode was selected)

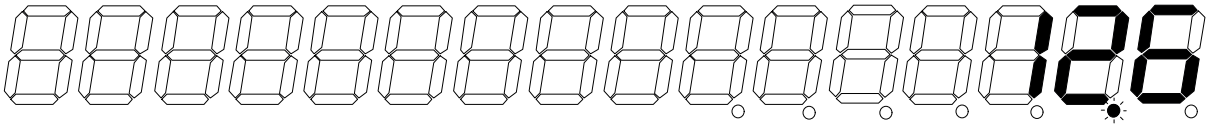


; Press "CHK" key



; Press "R/P" or "OKR" key

(Display 1 to 16 digits)

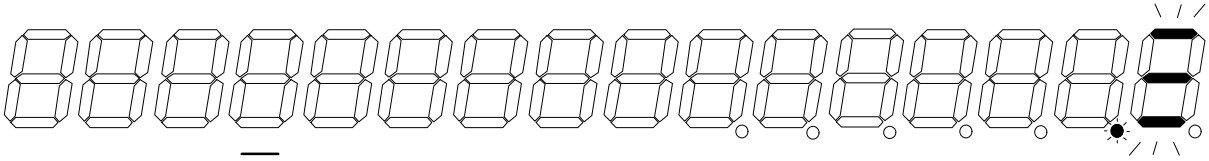


; Press "any key"

(Display 17 to 19 digits)

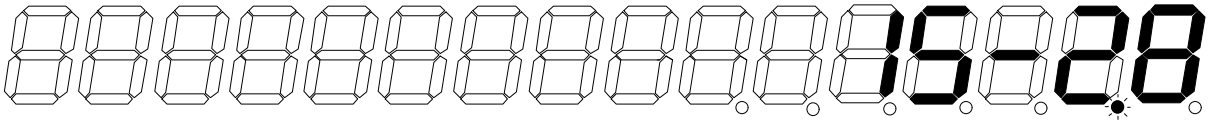
D. Timer Function

a.



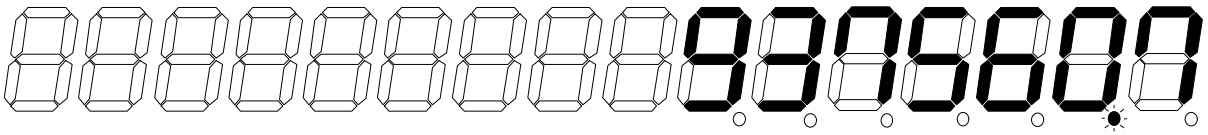
; Off-hook or press "$\overline{\text{HFI}}$" switch

(Here pulse mode was selected)

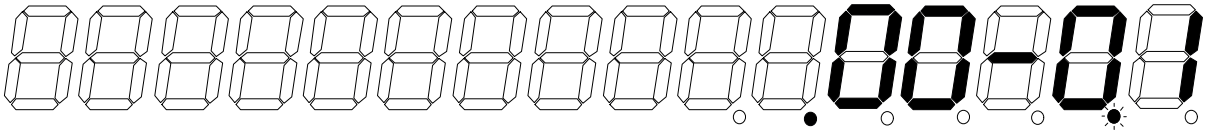


; Press "CHK" key

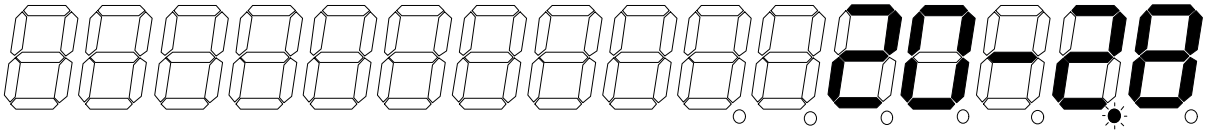
(Display last calling time)



; Dial "9375607"

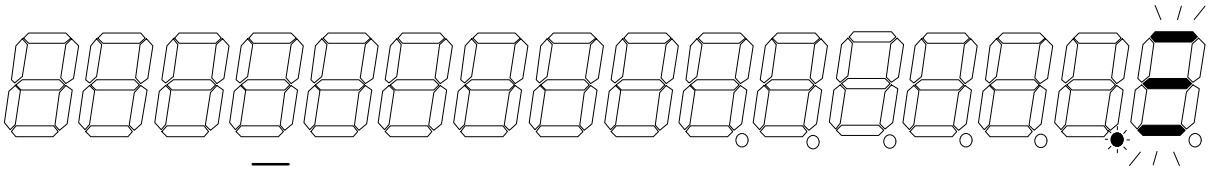


; If "9375607" is dialed comlepted, the system will start timer after 6 seconds
(Timer will start counting up)

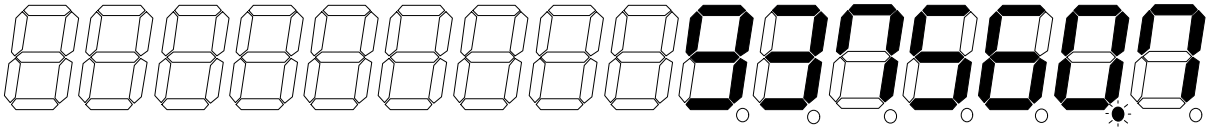


; Press "TIM" key
(Timer will stop)

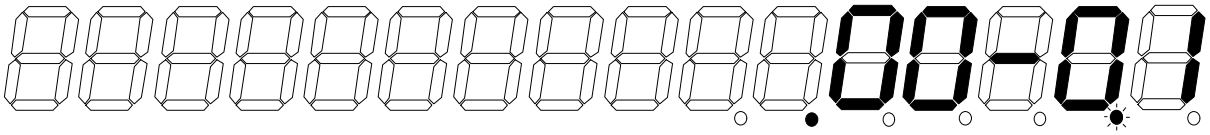
b.



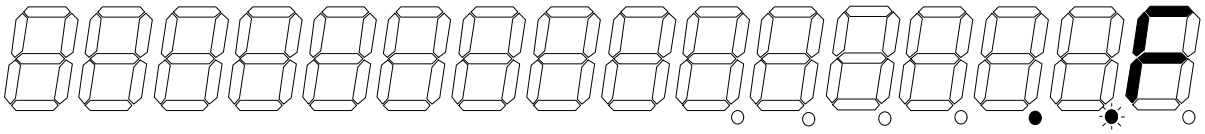
; Off-hook or press "$\overline{\text{HFI}}$" switch
(here pulse mode was selected)



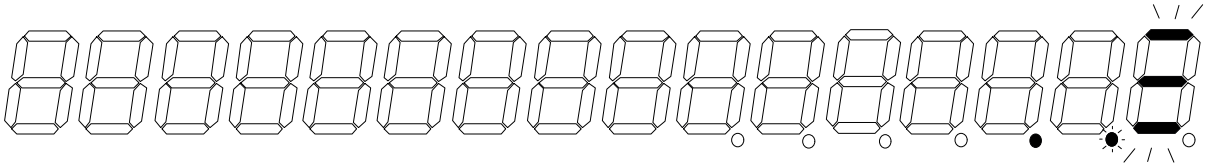
; Dial "9375607"



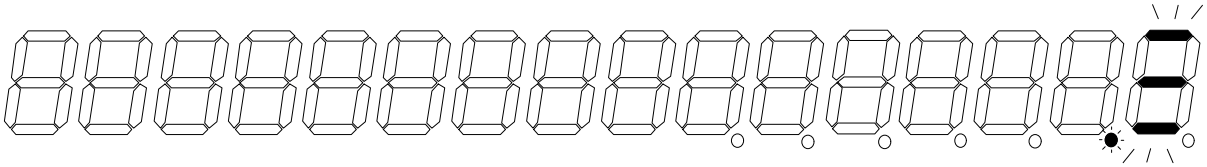
; If "9375607" is dialed completed
press "TIM" key
(Timer will start counting up)



; Press "F1", "F2", "F3" or "F4" key
(The timer will stop and LCD will display a flash mark and flash pattern)

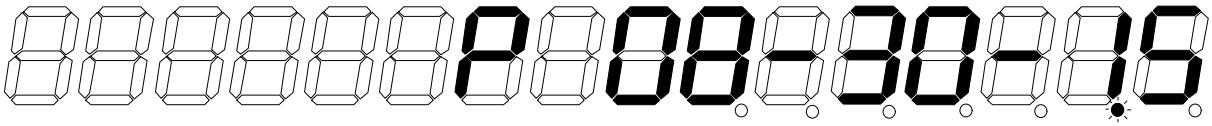


; After flash break is executed

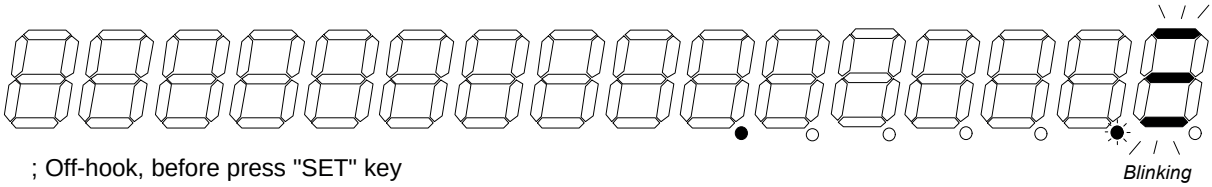


; After flash pause is executed

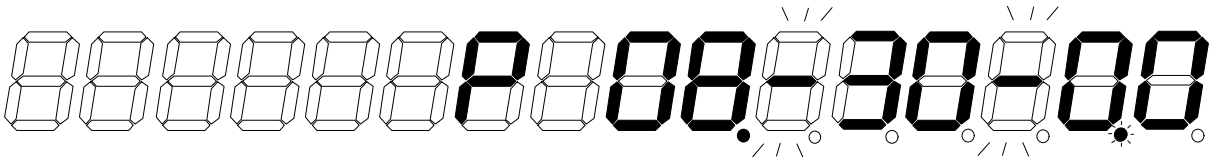
E. RTC Setting Function



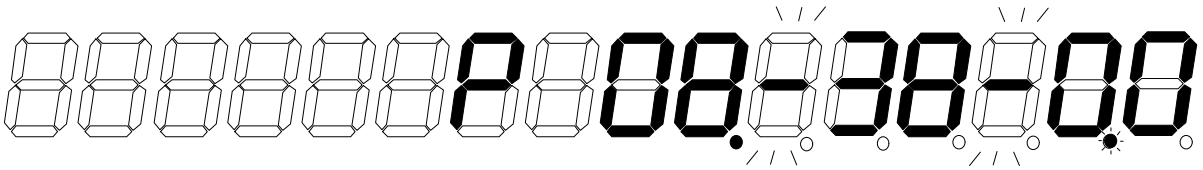
; On-hook
(Display real time)



; Off-hook, before press "SET" key
(Here tone mode was selected)

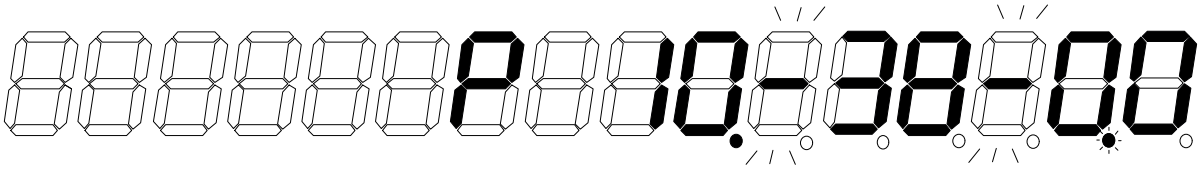


; Entering "Setting Mode" (Press "SET" key)

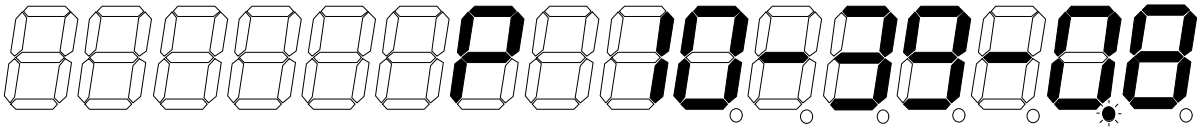


Blinking

; Adjusting "Hour" (Press "HOUR" key)
(Hour counts forward as long as pressing)

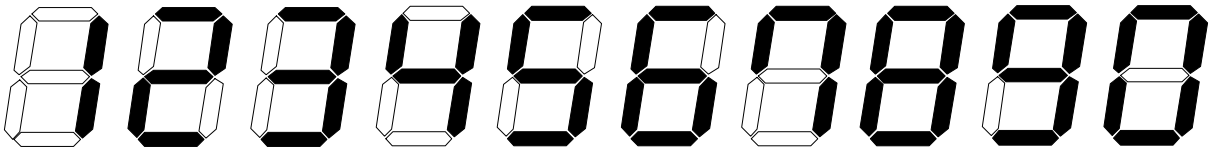


; Adjusting "Minute" (Press "MIN" key)
(Minute counts forward as long as pressing)



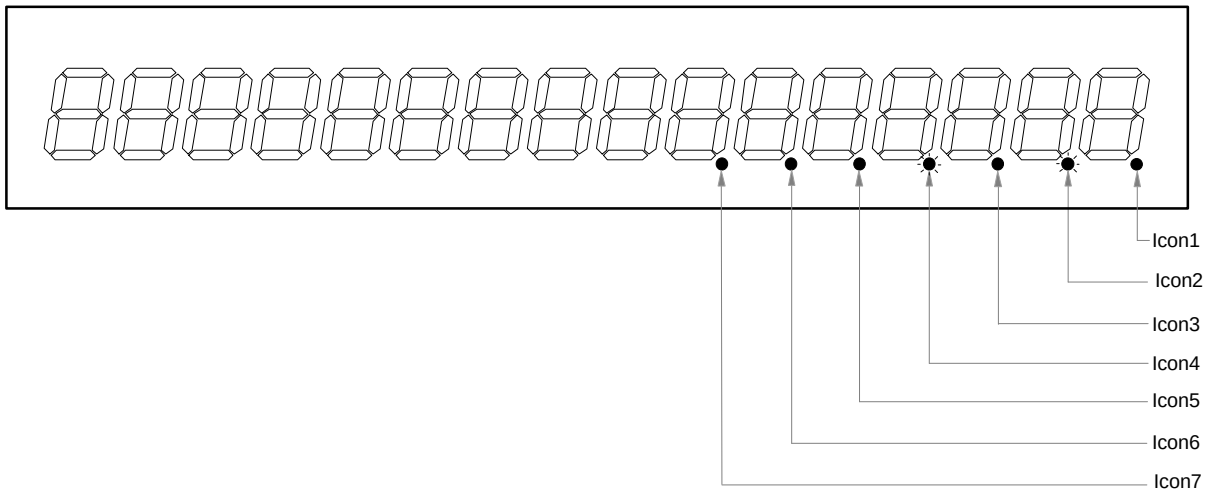
; On-hook or press "SET" key (Toggle)
(Here on-hook was selected)

LCD PATTERN FOR DATA



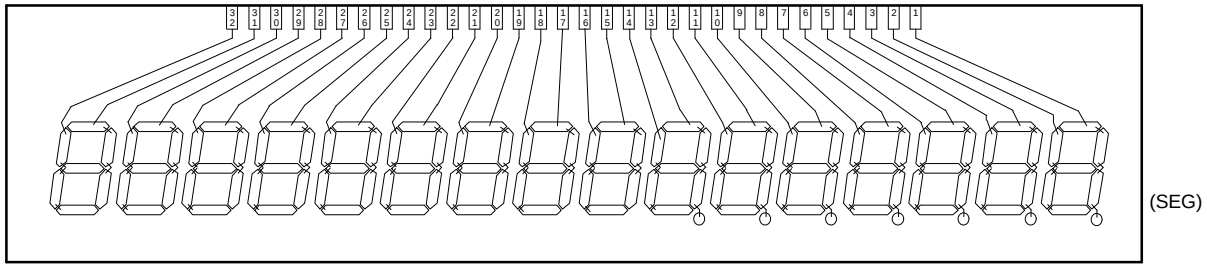
1 2 3 4 5 6 7 8 9 0

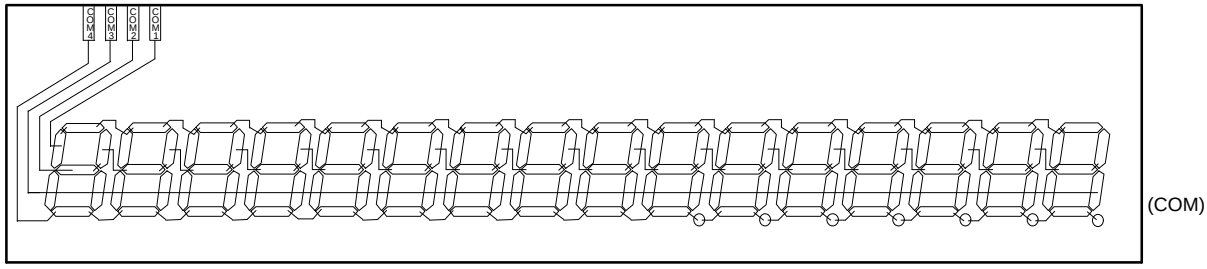
* # P→T P E CHECK F LOCK



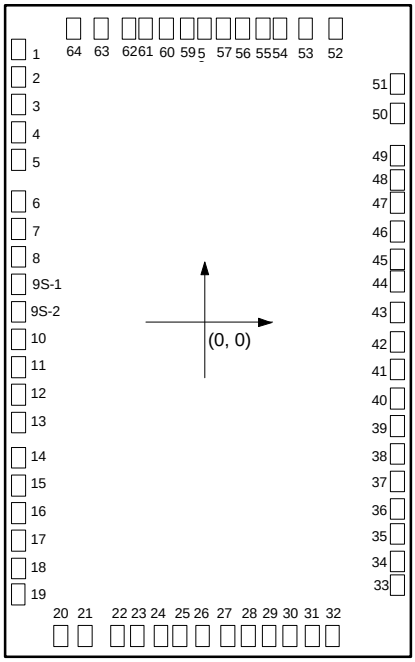
Notes:

Icon1: Pause
Icon2: The icon will be blinking after power on.
Icon3: Flash
Icon4: Hold
Icon5: Handfree
Icon6: Timer
Icon7: Tone





Bonding Pad Diagram



Notes:

1. The substrate must be connected to Vss.

2. The chip size is 2940 × 3630 μm^2

Pad List

PAD NO.	PAD NAME	PIN #	X	Y	PAD NO.	PAD NAME	PIN #	X	Y
1	SEG29	1	-1335.00	1430.70	33	OCM1	33	1335.00	-1307.90
2	SEG30	2	-1335.00	1294.50	34	COM2	34	1335.00	-1166.10
3	SEG31	3	-1335.00	1158.50	35	COM3	35	1335.00	-1024.30
4	SEG32	4	-1335.00	1022.30	36	COM4	36	1335.00	-882.50
5	VDD	5	-1335.00	883.40	37	SEG1	37	1335.00	-746.30
6	DTMF	6	-1335.00	665.20	38	SEG2	38	1335.00	-607.50
7	VSS	7	-1335.00	515.50	39	SEG3	39	1335.00	-471.30
8	T/P $\overline{\text{MUTE}}$	8	-1335.00	373.50	40	SEG4	40	1335.00	-335.30
9S-1	H/P MUTE	9*	-1335.00	229.30	41	SEG5	41	1335.00	-199.10
9S-2	LOCK	9*	-1335.00	88.20	42	SEG6	42	1335.00	-63.00
10	HFO	10	-1335.00	-49.80	43	SEG7	43	1335.00	73.00
11	$\overline{\text{DP}}$/$\overline{\text{C6}}$	11	-1335.00	-191.80	44	SEG8	44	1335.00	209.20
12	MODE	12	-1335.00	-327.80	45	SEG9	45	1335.00	345.20
13	COL1	13	-1335.00	-467.80	46	SEG10	46	1335.00	481.40
14	COL2	14	-1335.00	-627.20	47	SEG11	47	1335.00	617.40
15	COL3	15	-1335.00	-769.20	48	SEG12	48	1335.00	753.60
16	COL4	16	-1335.00	-928.60	49	SEG13	49	1335.00	889.60
17	COL5	17	-1335.00	-1070.60	50	SEG14	50	1335.00	1102.10
18	ROW1	18	-1335.00	-1226.40	51	SEG15	51	1335.00	1270.80
19	ROW2	19	-1335.00	-1368.40	52	SEG16	52	941.30	1657.50
20	ROW3	20	-1080.40	-1679.90	53	SEG17	53	749.00	1657.50
21	ROW4	21	-841.70	-1679.90	54	SEG18	54	534.80	1657.50
22	XT1	22	-598.40	-1679.90	55	SEG19	55	398.60	1657.50
23	$\overline{\text{XT1}}$	23	-453.20	-1679.90	56	SEG20	56	262.60	1657.50
24	HKS	24	-307.90	-1679.90	57	SEG21	57	126.40	1657.50
25	HFI	25	-167.90	-1679.90	58	SEG22	58	-9.60	1657.50
26	XT2	26	24.20	-1679.90	59	SEG23	59	-145.80	1657.50
27	$\overline{\text{XT2}}$	27	188.80	-1679.90	60	SEG24	60	-281.80	1657.50
28	VRTC1	28	326.30	-1679.90	61	SEG25	61	-418.00	1657.50
29	VLCD	29	488.50	-1679.90	62	SEG26	62	-554.00	1657.50
30	VRTC2	30	636.30	-1679.90	63	SEG27	63	-757.70	1657.50
31	CN	31	798.50	-1679.90	64	SEG28	64	-932.00	1657.50
32	CP	32	946.30	-1679.90					

Note: "*" is bonding option.

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