



Preliminary

CONTENT

1. GENERAL DESCRIPTION	2
2. FEATURES.....	2
3. APPLICATIONS	3
4. PIN CONFIGURATIONS.....	3
FUNCTION BLOCK DIAGRAM.....	3
6. PIN DESCRIPTIONS	4
7. FUNCTION DESCRIPTIONS.....	5
8. ABSOLUTE MAXIMUM RATINGS	9
9. DC ELECTRICAL CHARACTERISTICS	10
10. AC ELECTRICAL CHARACTERISTIC	11
11. TIMING DIAGRAM	12
12. APPLICATION CIRCUIT	15
13.PAD DIAGRAM	18



Preliminary

1. GENERAL DESCRIPTION

The EM92P203 is a multi-purpose dialer that is composed of Pocket dialer and Single tone / Dual tone dialer.

In pocket dialer mode it provides 3 sets of 32-digit programmable OTP MEMORY with key input pins (K1, K2, K3) for dialing. The DTMF pin can drive buzzer (Resonant Frequency at 1.1 KHz) directly. 3 sets of 32-digit phone number can be programmed through the R/W, CLK and SDIO pins to OTP memory.

In Single tone /Dual tone dialer mode it provides ST pin for select either single tone output or dual tone output. And provides CLK & SDIO pins for series data input from microprocessor. After received 4 bits data, when the TOE pin input high, the data is latched into DTMF generator. The tone will be output from DTMF pin.

2. FEATURES

(1) POCKET DIALER MODE :

- Wide operating voltage from 2.0V to 5.5V.
- Clock Source : 3.579545MHz Crystal (or ceramic resonator)
- OTP memory capacity : 3*32 nibbles.
- DTMF tone output.
- Low power consumption.

(2) TONE DIALER MODE :

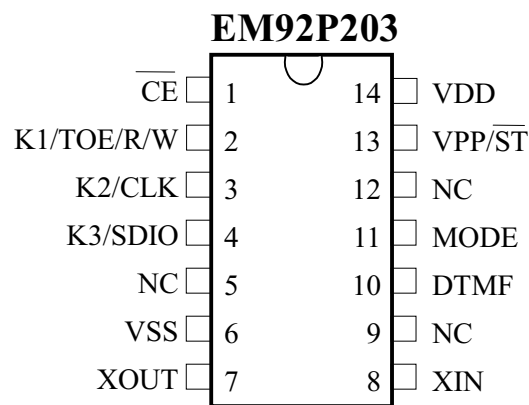
- Wide operating voltage from 2.0V to 5.5V.
- Clock Source : 3.579545MHz crystal (or ceramic resonator) or external clock from microprocessor with 3.579545 MHz crystal.
- Direct interface with microprocessor.
- Single tone / Dual tone output switchable.

Preliminary

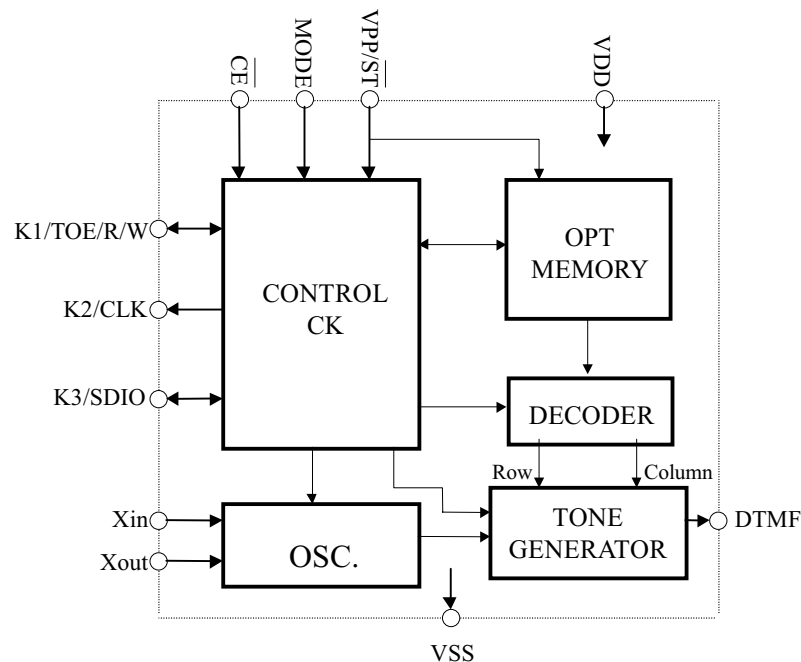
3. APPLICATIONS

Pocket dialer and Tone dialer.

4. PIN CONFIGURATIONS



5. FUNCTION BLOCK DIAGRAM



6. PIN DESCRIPTIONS

Symbol	I/O	Active	Function	
V_{DD}, V_{SS}	---	---	Power supply pins.	
$V_{PP}(ST)$	---	---	Write OTP Mode	12V Write voltage supply
	I(P.D)	---	Pocket Dialer Mode	X Pocket dialer
			Tone dialer Mode	L Dual tone output
				H Single tone output
Mode	I	---	L	Pocket dialer mode.
			H	Tone dialer mode.
/CE	I	L	H	Power down and OSC STOP.
			L	Chip enable.
K1 (TOE/R/W)	I(P.U.)	---	Stay high impedance when chip not enable (/CE=high).	
			Pocket Dialer Mode	Key 1 input pin. With pull up resistor.
			Tone dialer Mode	Tone enables pin (TOE).
			Write OTP Mode	Read/Write input pin (R/W).
K2 (CLK)	I(P.U)	---	Stay high impedance when chip not enable (/CE=high).	
			Pocket Dialer Mode	Key 2 input pin. With pull up resistor.
			Tone dialer Mode	Series data in clock pin (CLK).
			Write OTP Mode	Series data in clock pin (CLK). With pull up resistor.
K3 (SDI / SDIO)	I(P.U.)/O	---	Stay high impedance when chip not enable (/CE=high).	
			Pocket Dialer Mode	Key 3 input pin. With pull up resistor.
			Tone dialer Mode	Series data input pin (SDI).
			Write OTP Mode	Series data input/output pin (SDIO) K3 pin is output pin when R/W pin connects to high level. And K3 pin is input pin when R/W pin connects to low level.
Xin	---	---	Crystal input terminal or external clock input pin.	
Xout	---	---	Crystal output terminal or connects to Ground.	
DTMF	O	---	The DTMF (Dual Tone Multi-Frequency) signal output pin.	

Note: I/O : Input / Output
P.U.: Pull Up
L : Low

I : Input
P.D.: Pull Down
X : Don't Care

O : Output
H : High

Preliminary

7. FUNCTION DESCRIPTIONS

The mode transition is controlled by MODE,/CE and Vpp pin.

Function	Mode	/CE	VPP	K1	K2	K3	Notes
Dual Tone Mode	1	0	0	Tone Duration	Series data-in clock	0 0 0 0	DTMF tone : D
						0 0 0 1	DTMF tone : 1
						0 0 1 0	DTMF tone : 2
						0 0 1 1	DTMF tone : 3
						0 1 0 0	DTMF tone : 4
						0 1 0 1	DTMF tone : 5
						0 1 1 0	DTMF tone : 6
						0 1 1 1	DTMF tone : 7
						1 0 0 0	DTMF tone : 8
						1 0 0 1	DTMF tone : 9
						1 0 1 0	DTMF tone : 0
						1 0 1 1	DTMF tone : *
						1 1 0 0	DTMF tone : #
						1 1 0 1	DTMF tone : A
						1 1 1 0	DTMF tone : B
						1 1 1 1	DTMF tone : C
Single Tone Mode	1	0	1	Tone Duration	Series data-in clock	0 0 X X	Inhibit
						0 1 0 0	R1 tone
						0 1 0 1	R2 tone
						0 1 1 0	R3 tone
						0 1 1 1	R4 tone
						1 0 0 0	C1 tone
						1 0 0 1	C2 tone
						1 0 1 0	C3 tone
						1 0 1 1	C4 tone
						1 1 X X	Inhibit
Idle Mode	X	1	X	HiZ	HiZ	HiZ	OSC STOP and Power down
Pocket Dialer Mode	0	0	0	K1	K2	K3	OSC ENABLE when Key in, stop when Address counter bit 4 carry or stop code.
Write OTP Mode	0	0	1	R/W	Series data-in clock	Series data input / output	Latch K2 and K3 pin as mode select when Vpp raise to 12V

Note: H.V. : Vpp connect to 12V. X : Don't care. HiZ : High Impedance.

Preliminary

(1) POCKET DIALER :

Set Mode pin to low, /CE to low and Vpp to low will enter Pocket Dialer mode.

K1, K2 & K3 internal pull up. When Key falling edge was detected, other key input were disable. And the internal pull up resistor of 3 keys will be switched to high impedance resistor to avoid power consumption.

After Key input detected, the CONTROL CIRCUIT will turn on all circuit, and enable OTP memory data output. The sequential phone number of pressed key stored in the OTP memory will send to decoder and makes the TONE generator output DTMF signal.

If 32 nibbles was full filled with phone number, after the 32th nibble finished dialing, the CONTROL CIRCUIT will turn off all circuit and stop OSC. If not full filled, when encountered the STOP CODE (1110 or 1111), the CONTROL CIRCUIT will turn off all circuit and stop OSC.

The table of DECODER at pocket dialer mode is as follow :

Data	Tone output	Description
0000	(X)	Don't care
0001	1	DTMF " 1 "
0010	2	DTMF " 2 "
0011	3	DTMF " 3 "
0100	4	DTMF " 4 "
0101	5	DTMF " 5 "
0110	6	DTMF " 6 "
0111	7	DTMF " 7 "
1000	8	DTMF " 8 "
1001	9	DTMF " 9 "
1010	0	DTMF " 0 "
1011	*	DTMF " * "
1100	#	DTMF " # "
1101	(PAUSE)	Pause 3.6 sec
1110	(STOP)	Stop dialing and OSC stop
1111	(STOP)	Stop dialing and OSC stop

Preliminary

(2) WRITE OTP MODE :

Set Mode pin to low, /CE pin to low and Vpp to high will enter Write OTP mode.

The K1 pin is called R/W, K2 pin is CLK and K3 pin is SDIO in this mode.

a. Write to OTP MEMORY:

When R/W pin input low, the SDIO pin changes to series input port for write OTP MEMORY.

The SDIO signal will be latched at the falling edge of CLK signal. At the 4th raising edge, series 4 bits data was received (MSB first), then write to OTP MEMORY.

The 3 sets of 32 nibbles OTP memory can be separately programmed and append on the existed set.

b. Read out for data verification:

When R/W pin input high, the SDIO pin changes to series output port for OTP MEMORY data verification.

The CLK falling edge will trigger OTP MEMORY to shift out series 4 bits data sequentially for verification (MSB first).

(3) DUAL TONE MODE :

Set Mode pin to high, /CE to low and Vpp (ST) to low will enter Dual Tone mode.

The K1 pin is called TOE, K2 pin is CLK and K3 pin is SDI in this mode.

The series data input (SDI) will be latched at the falling edge of CLK pin (MSB first).

After series 4 bits data was received, DECODER will decode 4 bits data into Column data and Row data and send to TONE GENERATOR. After set TOE pin to high level, desired DTMF tone will be output from DTMF pin. T_D/T_{ITP} duration is controlled by TOE pin.

Preliminary

The table of DECODER at Dual tone dialer mode is as follow :

Data	Tone output	Description
0000	D	DTMF “ D ”
0001	1	DTMF “ 1 ”
0010	2	DTMF “ 2 ”
0011	3	DTMF “ 3 ”
0100	4	DTMF “ 4 ”
0101	5	DTMF “ 5 ”
0110	6	DTMF “ 6 ”
0111	7	DTMF “ 7 ”
1000	8	DTMF “ 8 ”
1001	9	DTMF “ 9 ”
1010	0	DTMF “ 0 ”
1011	*	DTMF “ * ”
1100	#	DTMF “ # ”
1101	A	DTMF “ A ”
1110	B	DTMF “ B ”
1111	C	DTMF “ C ”

(4) SINGLE TONE MODE :

Set Mode pin to high, /CE to low and Vpp (ST) to high will enter Single Tone mode. The K1 pin is called TOE, K2 pin is CLK and K3 pin is SDI in this mode.

The series data latch method is the same as Dual Tone mode. But DECODER will decode 4 bits data into single tone data and send to TONE GENERATOR.

After set TOE pin to high level, desired single tone will be output from DTMF pin.

T_D/T_{ITP} duration is controlled by TOE pin.

Preliminary

The table of DECODER at Single Tone dialer mode is as follow:

Data	Tone output	Description
0000	(Inhibit)	No Tone output
0001	(Inhibit)	No Tone output
0010	(Inhibit)	No Tone output
0011	(Inhibit)	No Tone output
0100	R1	Output R1 (697Hz) Tone
0101	R2	Output R2 (770Hz) Tone
0110	R3	Output R3 (852Hz) Tone
0111	R4	Output R4 (941Hz) Tone
1000	C1	Output C1 (1209Hz) Tone
1001	C2	Output C2 (1336Hz) Tone
1010	C3	Output C3 (1477Hz) Tone
1011	C4	Output C4 (1633Hz) Tone
1100	(Inhibit)	No Tone output
1101	(Inhibit)	No Tone output
1110	(Inhibit)	No Tone output
1111	(Inhibit)	No Tone output

8. ABSOLUTE MAXIMUM RATINGS

(Ambient temperature is 25°C, all voltages reference to Vss)

Items	Sym.	Rating	Unit
Power supply voltage	V _{DD}	-0.5~6.0 Vdc	V
	V _{PP}	13 Vdc	V
Input voltage range	V _{IN}	V _{SS} -0.5V~V _{DD} +0.5v	V
Operation temperature	T _{OPR}	0~70	°C
Storage temperature	T _{STO}	-40~125	°C
Power consumption	P _D	50	mW
Output voltage range	V _O	-0.5~V _{DD} -0.5	V

Preliminary

9. DC ELECTRICAL CHARACTERISTICS

(Ambient temperature is 25°C , VDD=3.0V unless otherwise noted, all voltages reference to Vss,Fosc=3.579545 MHz)

Parameter	Sym.	Min.	Typ.	Max.	Unit	Condition
Operating voltage	V _{DD}	2.0	--	5.5	V	Unload
Operating current	I _{DD}	--	--	400	uA	At V _{DD} =3V, 3.579545MHz X'Tal, no load.
Programming Voltage	V _{pp}	11.5	12	12.5	V	
Standby current	I _{SB}	--	--	1	uA	/CE=High
K1,K2,K3 Input Pull-up Resistance	R _{I(PULL UP)}	--	470	--	KΩ	Only Pocket Dialer mode with Pull Up resistor
VPP Input Pull-down Resistance	R _{I(PULL Down)}	--	200	--	KΩ	
K1,K2,K3 Schmitt Trigger (input pin)	V _{H-L}	V _{SS}	--	0.3V _{DD}	V	
	V _{L-H}	0.7V _{DD}	--	V _{DD}		
DTMF signal output DC level	V _{DTMF-DC}	0.5V _{DD}	--	0.75V _{DD}	V	V _{DD} =2.0V~5.5V
DTMF signal output AC level	V _{DTMF-AC}	180	205	245	mVrms	Row Group (R _L =5KΩ)
DTMF signal Pre-emphases	Twist	1	2	3	dB	Column-Row
DTMF Sink current	I _{OL}	+0.2	--	--	mA	
DTMF signal Load resistance	R _L	5			KΩ	
DTMF Deviation	Fdev	-1.5		+1.5	%	V _{DD} =2.0V~5.5V
DTMF signal Distortion	THD	--	-30	-23	dB	R _L =5KΩ loaded

Distortion in dB defined as :

$$THD = 20 \log \frac{\sqrt{v_1^2 + v_2^2 + \dots + v_n^2}}{\sqrt{v_l^2 + v_h^2}}$$

Where $v_1, \dots, v_n$ are the unwanted frequency components, v_l is the low frequency tone, v_h is the high frequency tone.

Preliminary

Actual frequency output (except OSC. deviation) :

Tone	STANDARD (Hz)	OUTPUT (Hz)	Deviation (%)
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
C4	1633	1645	+0.73

10. AC ELECTRICAL CHARACTERISTIC

(Ambient temperature is 25°C , VDD=3.0V unless otherwise noted, all voltages reference to Vss, Fosc=3.579545 MHz)

Parameter	Sym.	Min.	Typ.	Max.	Unit
Tone duration/Inter tone pause Time	T _D /T _{ITP}	90	100	120	ms
Pause Time	T _{pause}	--	3.6	--	Sec
Key debounce time	T _{db}		20		ms
Input Rise and Fall Time	T _r ,T _f			5	us
Data setup time	T _{su}	1	--	--	us
Hold Time, CLK to Data	T _h	1			us
CLK Input Pulse Width	T _w	1			us
Delay Time	T _{dly}	1	--	--	us
Output Rise time	T _{TLH}	200	--	--	ns
Output Fall time	T _{THL}	200	--	--	ns
PGMB program pulse width	T _{PWD}	100	--	--	us

11. TIMING DIAGRAM

(1) SWITCHING WAVEFORMS :

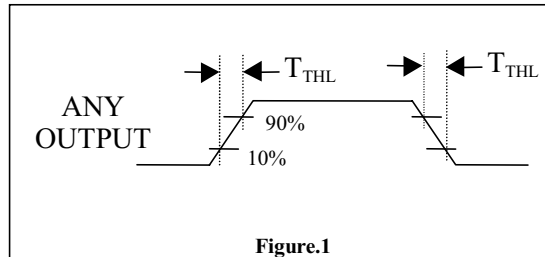


Figure.1

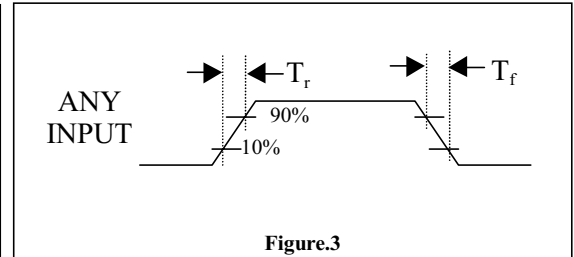


Figure.3

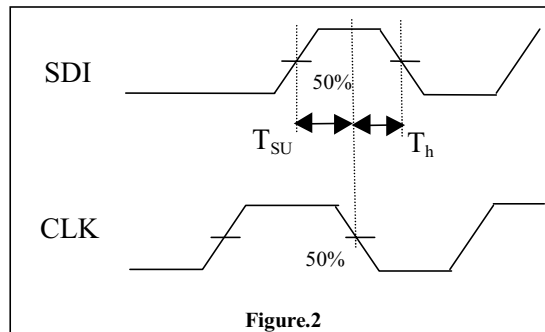


Figure.2

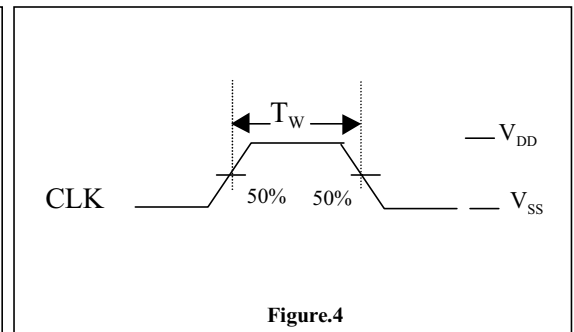
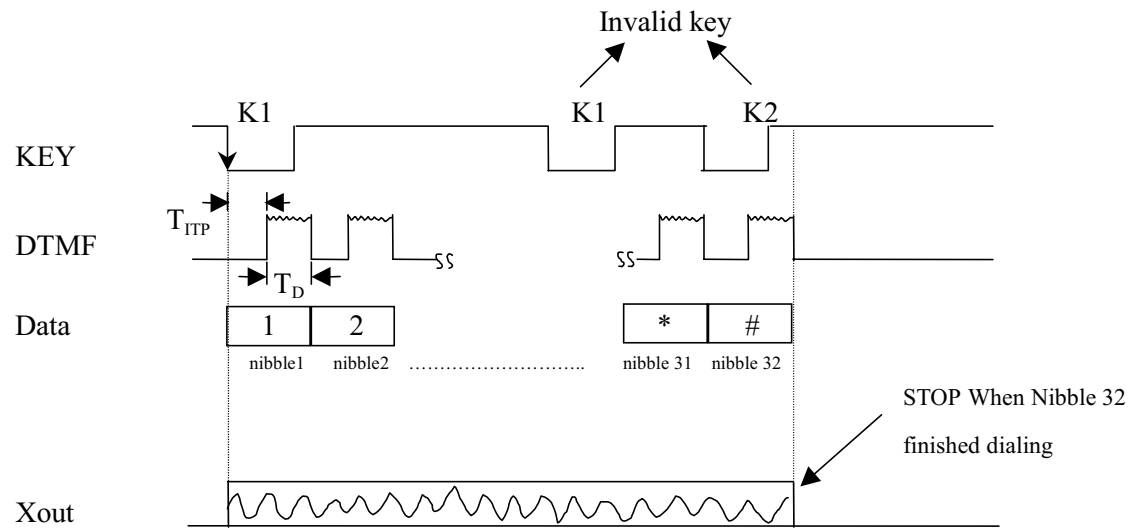


Figure.4

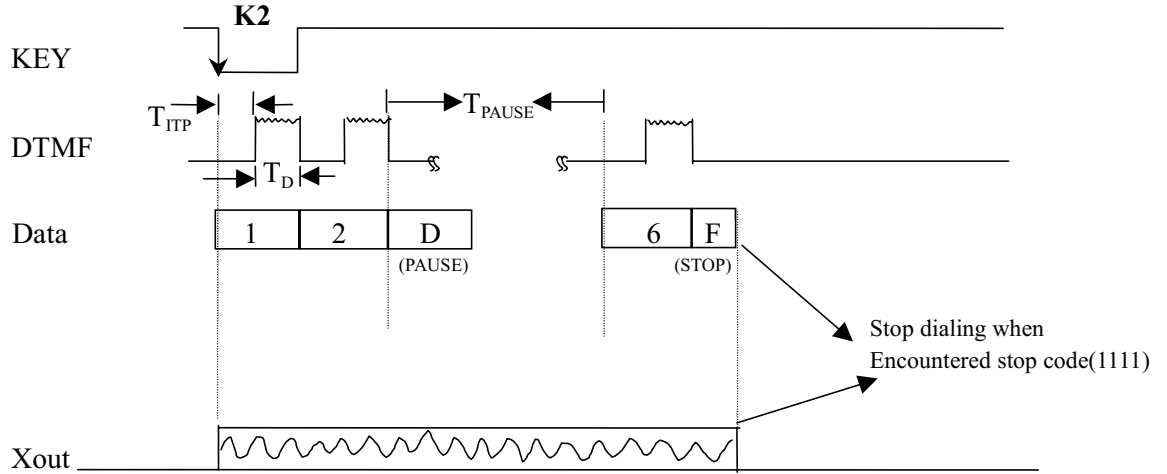
(2) POCKET DIALER MODE :

• Full Filled with 32 nibbles OTP MEMORY :

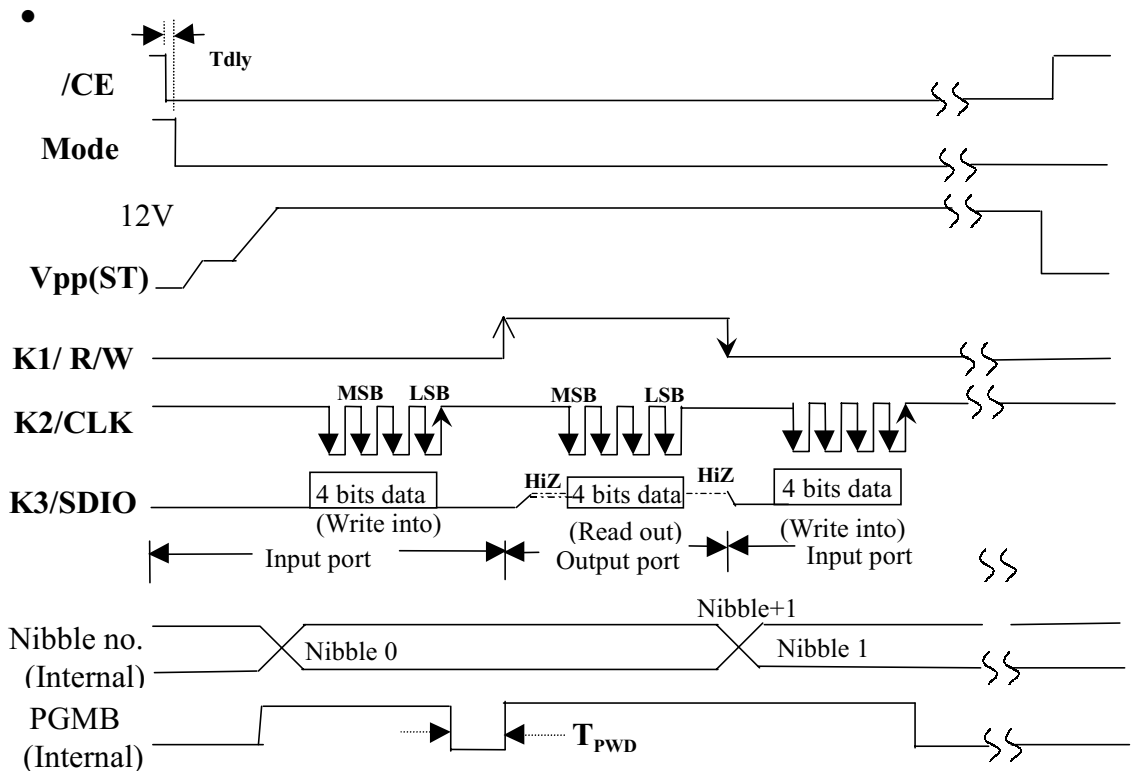


Preliminary

- Not full-filled with 32 nibbles OTP MEMORY :



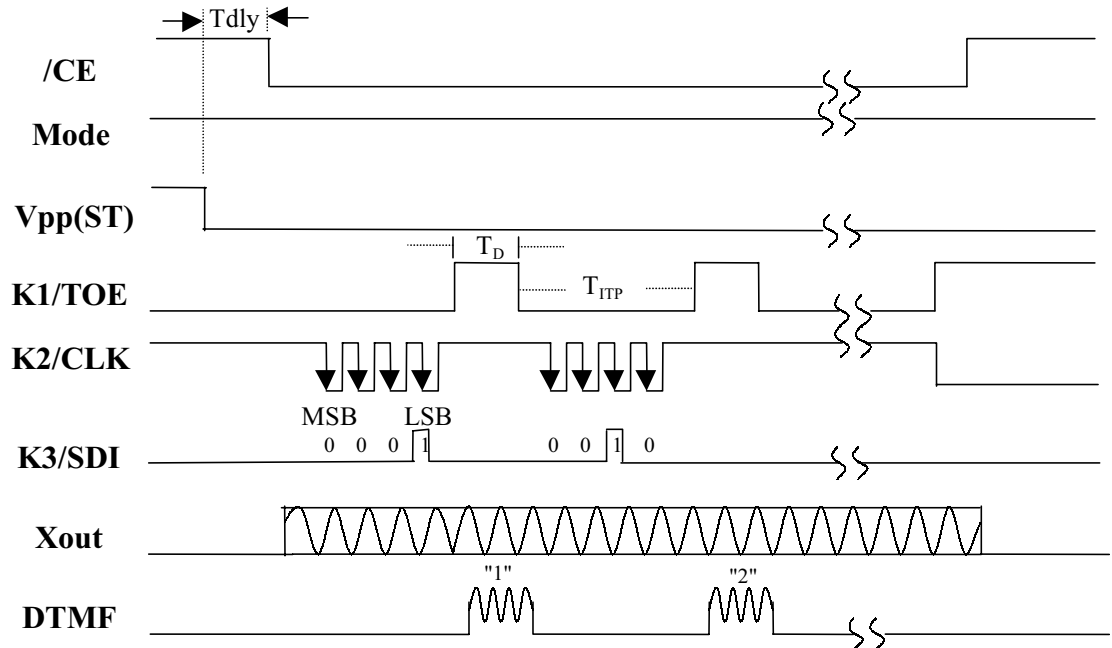
(3) WRITE TO OTP MODE :



Note : HIZ : High Impedance.

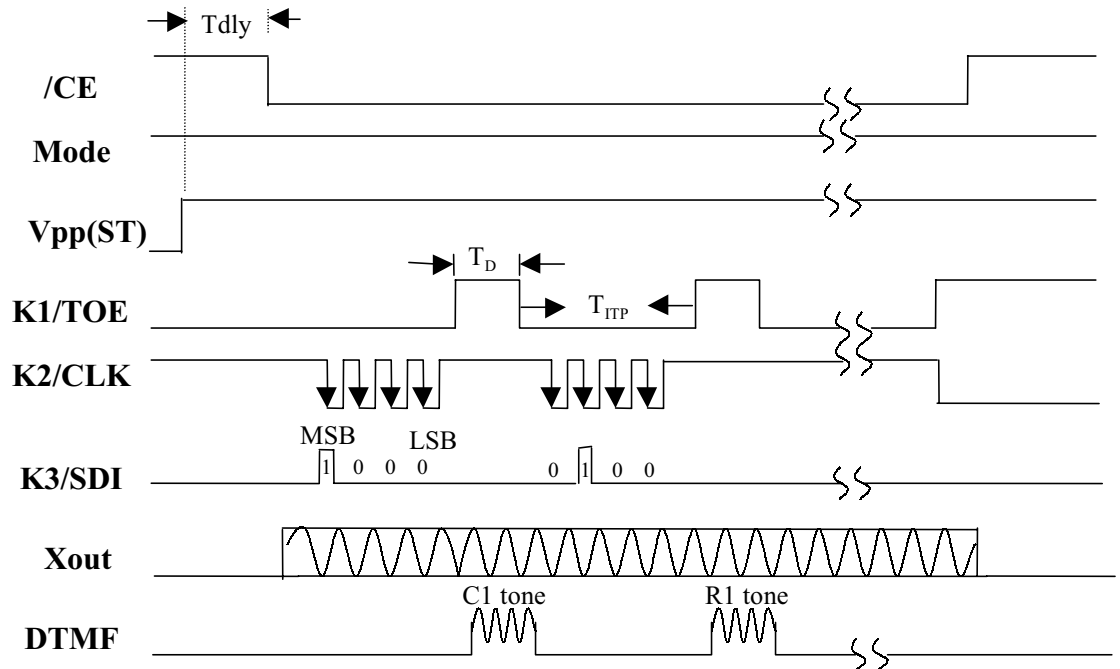
Preliminary

(4) DUAL TONE MODE :



** T_D/T_{ITP} duration is controlled by TOE pin.

(5) SINGLE TONE MODE :

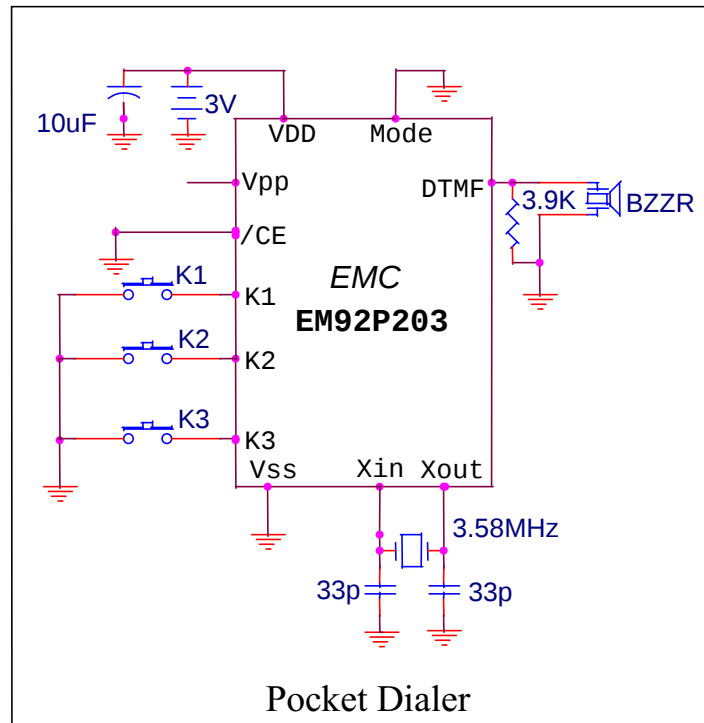


** T_D/T_{ITP} duration is controlled by TOE pin.

12. APPLICATION CIRCUIT

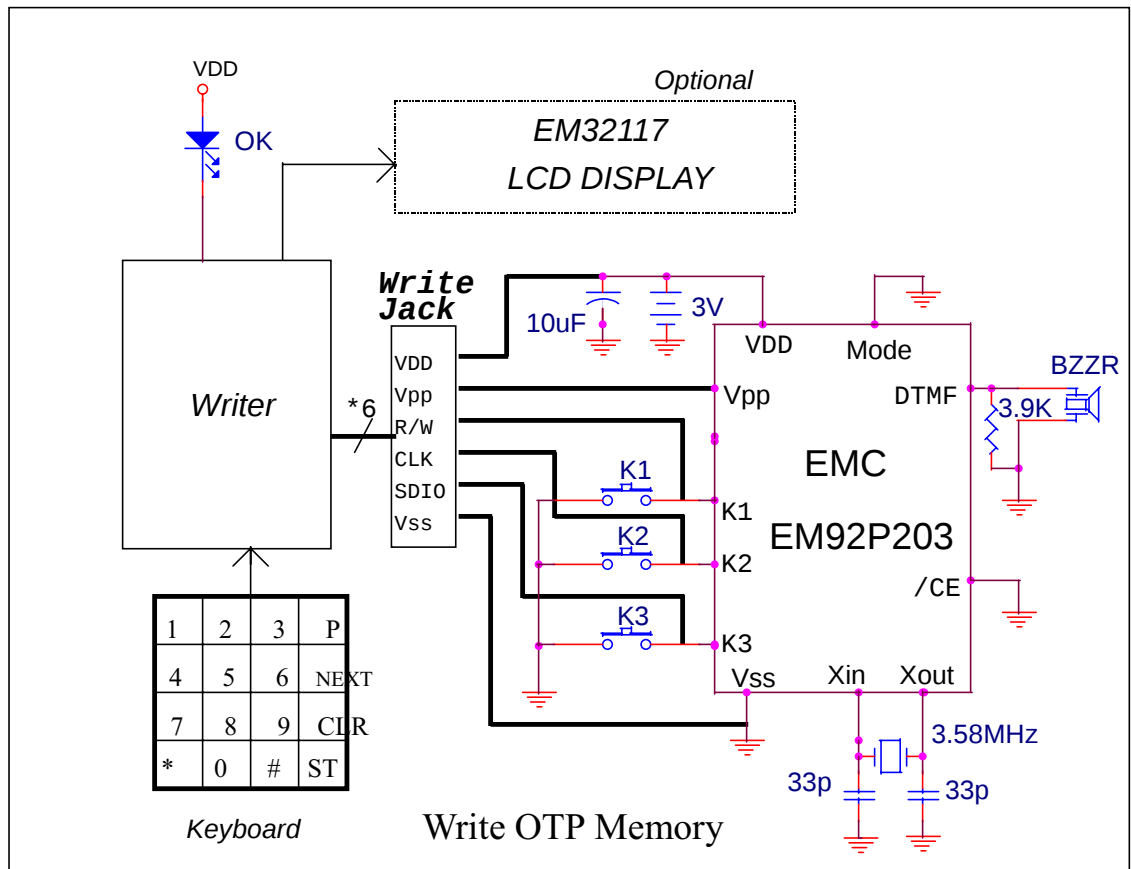
(1) POCKET DIALER :

a. Pocket Dialer Mode :



Preliminary

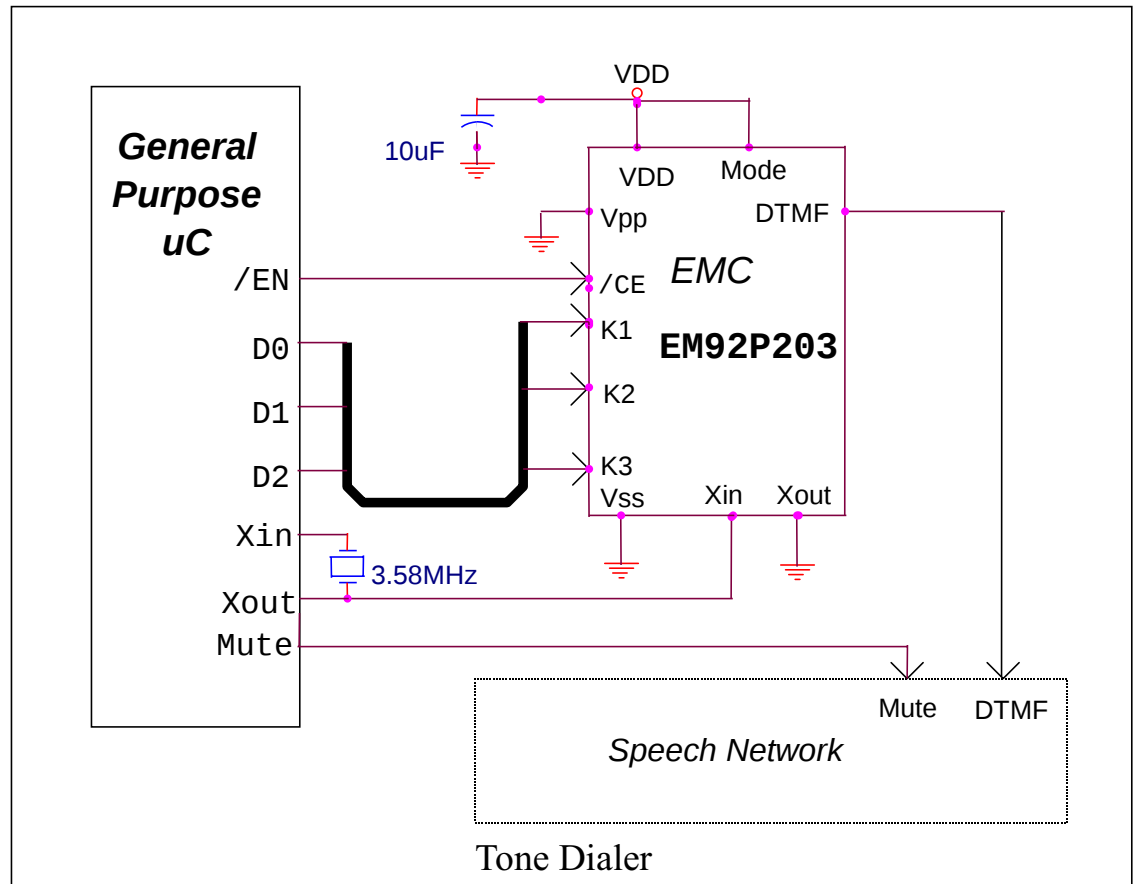
b. Write OTP Memory :



Note: Pocket Dialer Writer has already released, please contact with EMC.

Preliminary

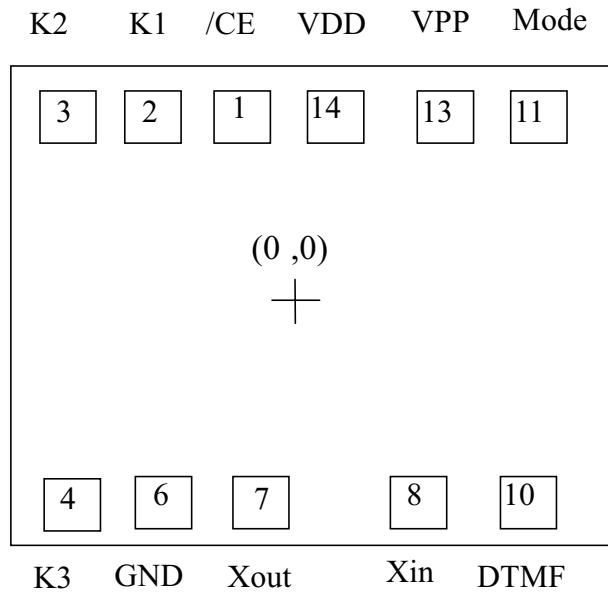
(2) TONE DIALER :



Preliminary

13.PAD DIAGRAM

Pad diagram :



Chip Size : 1190*1060 um

Coordinates :

Pin No	Name	Coordinate (X,Y)
1	CE	-93.1,379.9
2	K1	-265.3,379.9
3	K2	-438.1,379.9
4	K3	-428.3,-380.0
5		
6	GND	-239.4,-380.0
7	Xout	-42.1,-380

Pin No	Name	Coordinate (X,Y)
8	Xin	203.0,-380
9		
10	DTMF	395.7,-380
11	MODE	441.5,379.9
12		
13	VPP	293.6,379.9
14	VDD	78.3,379.9

Unit : um