Tel: 886-2-66296288
Fax: 886-2-29174598
URL: http://www.princeton.com.tw

Infrared Remote Control Transmitter **PT2212**

DESCRIPTION

PT2212 is a remote control transmitter utilizing CMOS Technology specially designed for infrared remote control applications. PT2212 can support up to 256 command codes and is functionally compatible with TC9012. Pin assignments and application circuit are optimized for easy PCB Layout and low cost advantage.

FEATURES

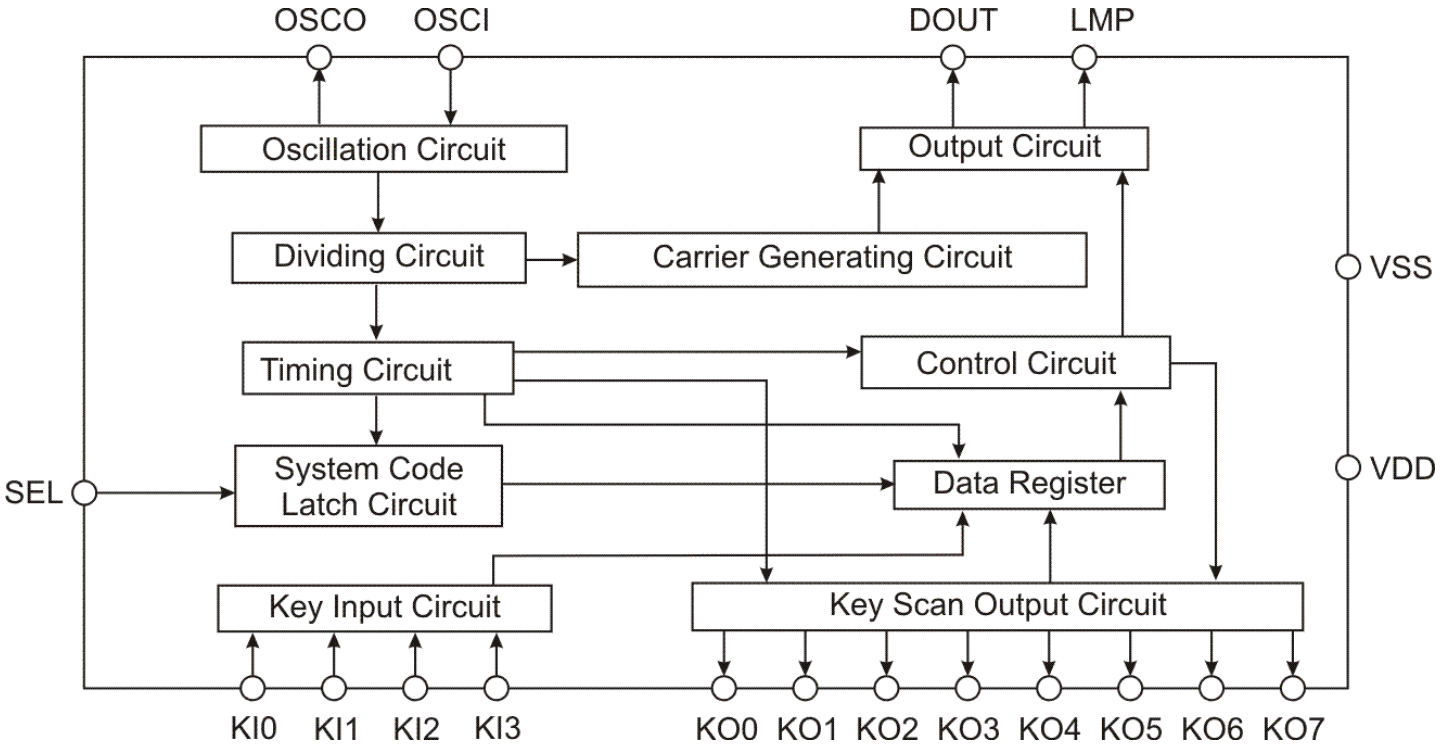
- CMOS technology
- Low power consumption
- Least external components
- Low voltage operation
- Double key operation
- Up to 32 function keys provided
- Up to 8 system codes
- Up to 256 command codes
- High efficiency transmission
- Transmission indication output pin provided

APPLICATIONS

- Television
- VCR
- Video disc
- CD player
- AV controller
- Audio equipment

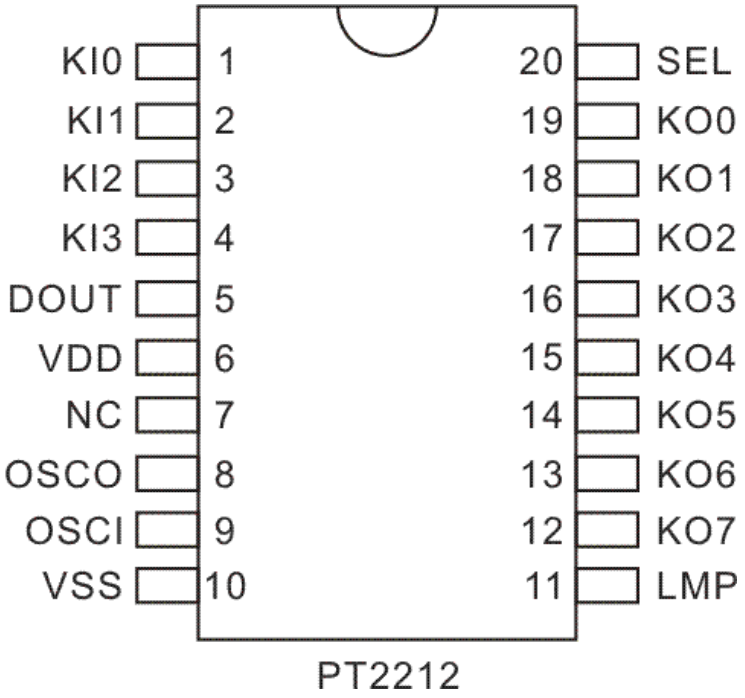
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BLOCK DIAGRAM



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PIN CONFIGURATION



PIN DESCRIPTION

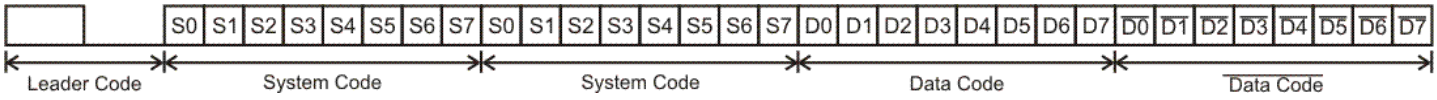
Symbol	I/O	Description	Pin No.
KI0 ~ KI3	I	Key Matrix Input Pins Built-in Pull-down Resistance	1 ~ 4
DOUT	O	Remote Output Pin The transmission pulse row modulated with carrier (38KHz duty 1/3) is outputted. Large output current may be obtained for operating infrared LED by means of driving base of NPN-Tr	5
VDD	-	Positive Power Supply	6
NC	-	No Connection	7
OSCO	O	Oscillator Output Pin.	8
OSCI	I	Oscillator Input Pin	9
VSS	-	Negative Power Supply	10
LMP	O	Transmission Indication Output Pin. This pin connects the transmission Indicator LED.	11
KO0 ~ KO7	O	Key Matrix Output Pins	19 ~12
SEL	I	System Code Selection Pin	20

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FUNCTION DESCRIPTION

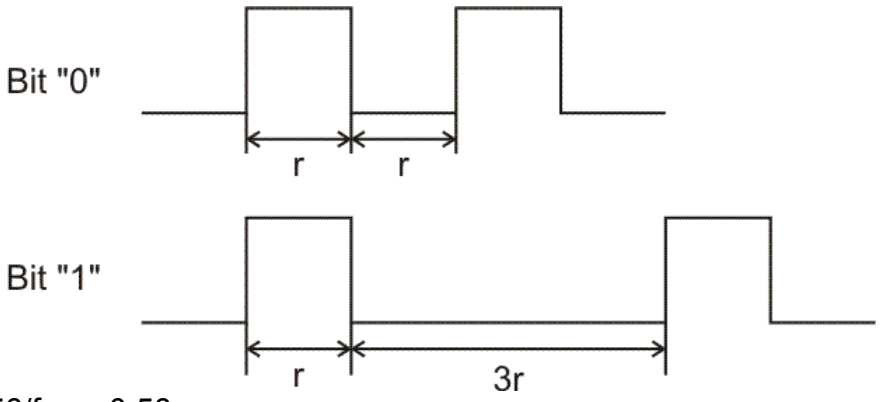
TRANSMISSION CODE FORMAT

The PT2212 transmission code is composed a leader code, system code, and the data code. There are 8-bit of system code (S0 to S7) and this 8-bit system code is outputted twice. Likewise, there are 8-bit of data code (D0 to D7), and the inversion data code is also transmitted. Please refer to the diagram below for details.



The leader code is composed of a 4.5ms “High” and 4.5ms “Low”. The system code and the data code are transmitted via a P.P.M. (Pulse Position Modulation) Method. With the system codes transmitted twice and the data code sent with its inversion code, simultaneously, highly efficient operations can be constructed.

The Bit “0” and “1” waveforms are given below:



Note: r=Tm, Tm=256/fosc=0.56ms

The leader code and the first bit of the inverted system code (S0) are transmitted when the key is continuously pressed, thus reduction of the reception treating time and the power dissipation of the infrared LED is possible. At this point, the leader code become very dominant that the average current flow towards the infrared LED is reduced to 1.8% of the peak value leading to a highly efficient transmission.

KEY INPUT OPERATION

A Key Input Operation may be considered legal or illegal depending on the key pressed. For key interconnection, please refer to the application circuit diagram in the APPLICATION CIRCUIT SECTION.

A pull-down resistor is already connected in the VSS Terminals of the Key Input Pins. A 4x8 Key Matrix which may be constructed by connecting Key Inputs – KI0 to KI3 and Key Scan Outputs – KO0 to KO7. When more than two keys are pressed simultaneously, the transmission is terminated by the multi-depression preventive circuit function. For conditions regarding the double key operation, please refer to the DOUBLE KEY OPERATION SECTION.

If a key has been continuously pressed for a period of 36ms, the system code and the data code are read and transmitted once. For ON Chattering prevention, the data reading is NOT performed when the key is pressed during the first 9ms.

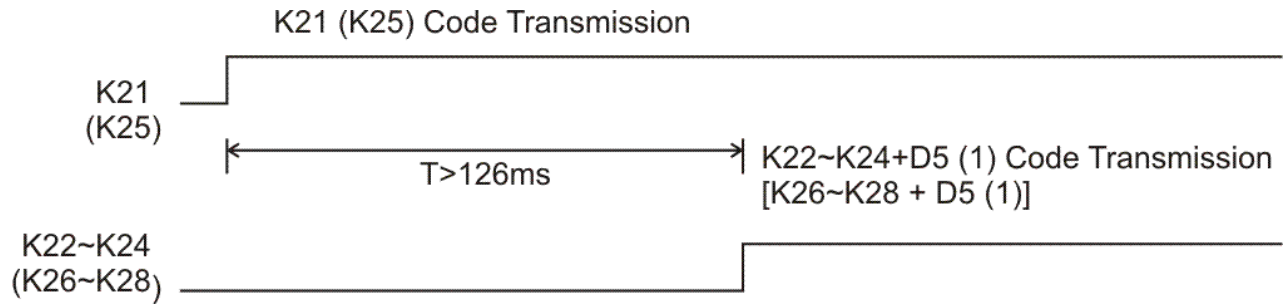
DOUBLE KEY OPERATION

As stated earlier, double key operation is possible for the following key combinations:

K21 and K22
K21 and K23
K21 and K24
K25 and K26
K25 and K27
K25 and K28

If other key combinations are pressed other than those stated above, then it is considered illegal because of the PT2212's multiple depression preventive circuitry. However, it is possible to inhibit this multiple depression preventive circuitry so that a double key operation may be performed, thereby a transmission can occur. This condition is possible if the D5 of the Data Code is set to "1". Because of the order of priority, a transmission can only be made possible in this mode by pressing K22~K24 (K26~K28) 126ms after pressing K21 (K25). Please refer to the diagrams below.

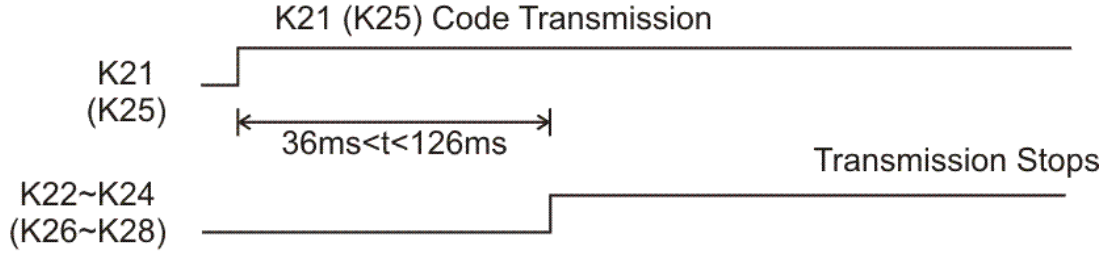
DOUBLE KEY TRANSMISSION TIMING



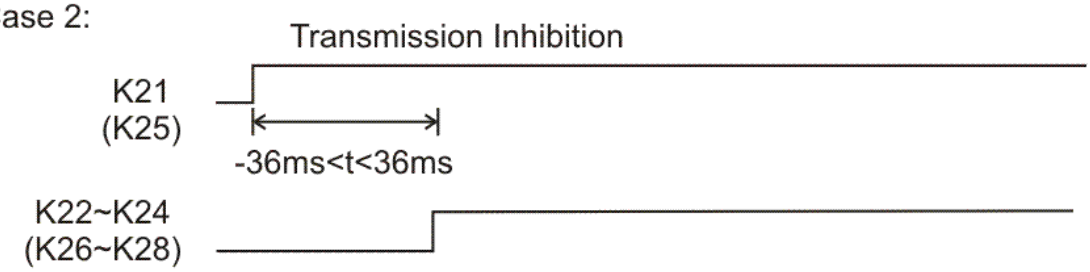
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DOUBLE KEY TRANSMISSION INHIBITION

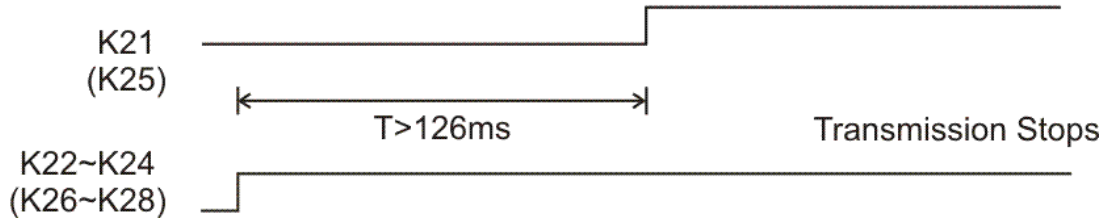
Case 1:



Case 2:



Case 3:



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DATA CODE

Key	Connection					Data Code							
	KI0	KI1	KI2	KI3	KO	D0	D1	D2	D3	D4	D5	D6	D7
K1	*				KO0	0	0	0	0	0	0	0	0
K2		*				1	0	0	0	0	0	0	0
K3			*			0	1	0	0	0	0	0	0
K4				*		1	1	0	0	0	0	0	0
K5	*				KO1	0	0	1	0	0	0	0	0
K6		*				1	0	1	0	0	0	0	0
K7			*			0	1	1	0	0	0	0	0
K8				*		1	1	1	0	0	0	0	0
K9	*				KO2	0	0	0	1	0	0	0	0
K10		*				1	0	0	1	0	0	0	0
K11			*			0	1	0	1	0	0	0	0
K12				*		1	1	0	1	0	0	0	0
K13	*				KO3	0	0	1	1	0	0	0	0
K14		*				1	0	1	1	0	0	0	0
K15			*			0	1	1	1	0	0	0	0
K16				*		1	1	1	1	0	0	0	0
K17	*				KO4	0	0	0	0	1	0	0	0
K18		*				1	0	0	0	1	0	0	0
K19			*			0	1	0	0	1	0	0	0
K20				*		1	1	0	0	1	0	0	0
K21	*				KO5	0	0	1	0	1	0	0	0
K22		*				1	0	1	0	1	0	0	0
K23			*			0	1	1	0	1	0	0	0
K24				*		1	1	1	0	1	0	0	0
K25	*				KO6	0	0	0	1	1	0	0	0
K26		*				1	0	0	1	1	0	0	0
K27			*			0	1	0	1	1	0	0	0
K28				*		1	1	0	1	1	0	0	0
K29	*				KO7	0	0	1	1	1	0	0	0
K30		*				1	0	1	1	1	0	0	0
K31			*			0	1	1	1	1	0	0	0
K32				*		1	1	1	1	1	0	0	0

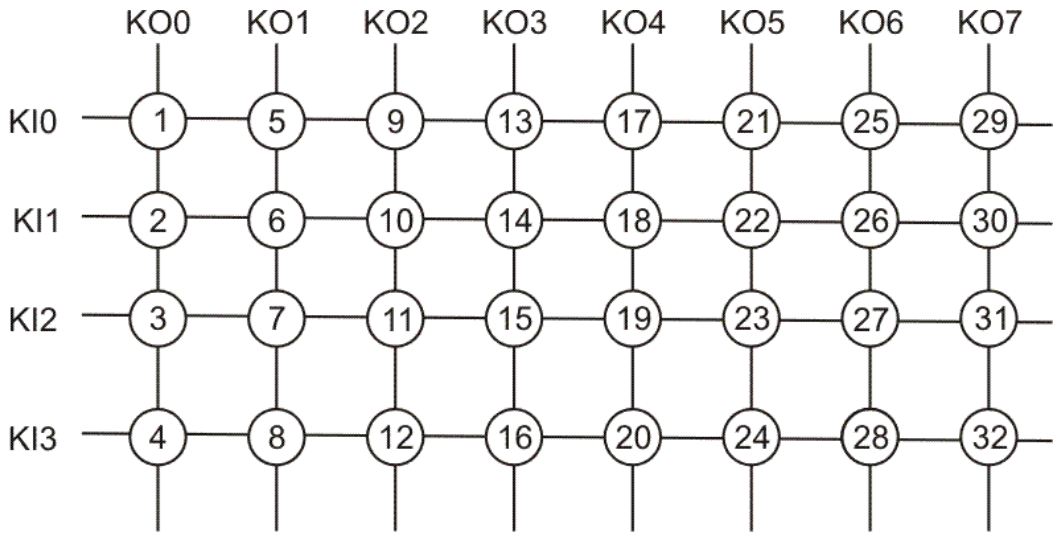
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DATA CODE FOR DOUBLE KEY OPERATION

Prior Key	Combined Key	D0	D1	D2	D3	D4	D5	D6	D7
K21	K22	1	0	1	0	1	1	0	0
	K23	0	1	1	0	1	1	0	0
	K24	1	1	1	0	1	1	0	0
K25	K26	1	0	0	1	1	1	0	0
	K27	0	1	0	1	1	1	0	0
	K28	1	1	0	1	1	1	0	0

KEY MATRIX

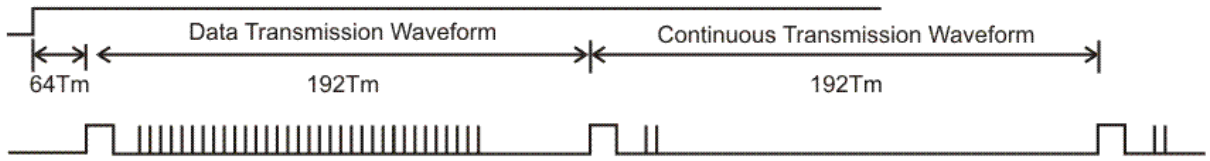
The following diagram illustrated the PT2212 Key Matrix.



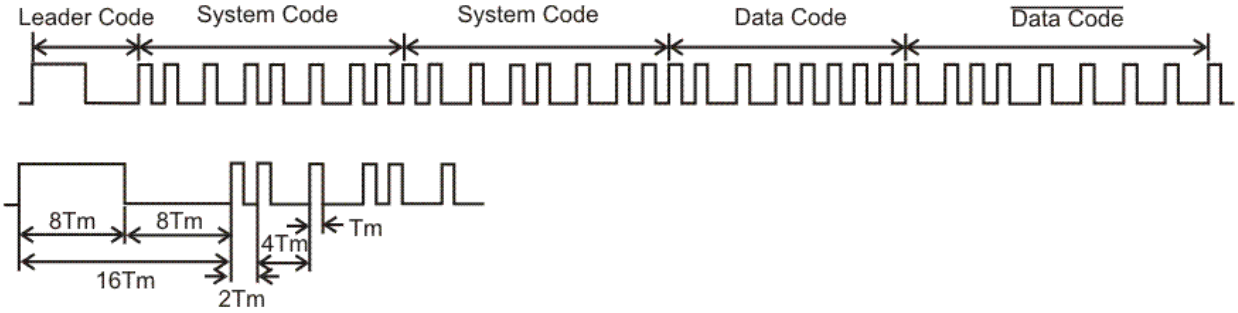
REMOTE OUTPUT WAVEFORM

The transmission signal is outputted after the pulse is modulated with 37.9KHz 1/3 of the 12-divided duty at 455KHz.

Key On

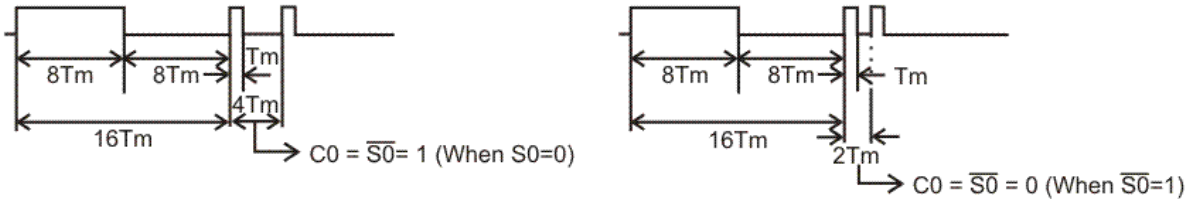


Data Transmission Waveform



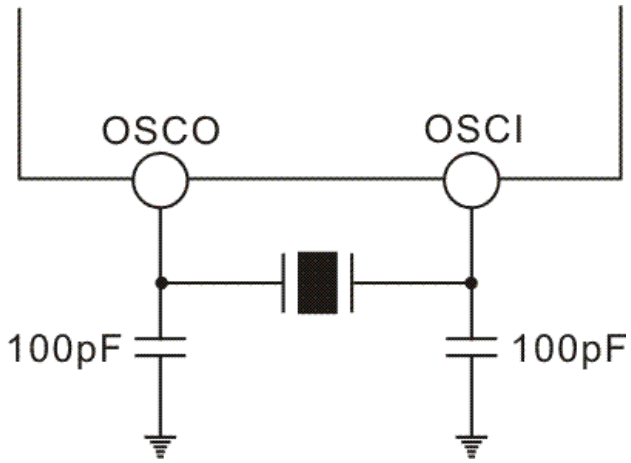
Note: System Clock: Tm = 256/fosc
= 0.56ms (at 455KHz)

Continuous Transmission Waveform



OSCILLATION

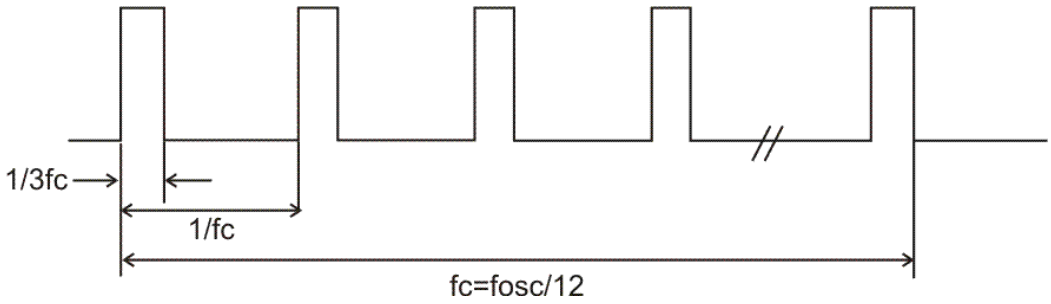
An oscillation circuit may be constructed by connecting a ceramic oscillator to the Oscillator Pins, namely: OSCO and OSCI. The oscillation frequency is 455KHz. When operation is in a stand-by mode, the oscillation is also normally stopped, thus, minimizing power consumption.
When the key switch is pressed, the oscillation starts and the operation begins. When the key is released, the stand-by mode will again be initiated after the completion of the operation. Please refer to the diagram below.



When fosc=455KHz, the oscillation output is divided into 12 parts and the modulation carrier frequency is 37.9 ~ 39.2KHz and 1/3 duty. The 455KHz oscillation is divided into 256 parts and the system fundamental clock is 1.78KHz. The inter-relation between modulation carrier (fc) and the system clock (Tm) with respect to the oscillation frequency (fosc) is given in the equations below.

MODULATION CARRIER, fc = (1/12) fosc (Duty: 1/3)
SYSTEM CLOCK, Tm= 256/fosc

As stated earlier, 455KHz oscillation, the signal is outputted after the pulse is modulated with a 37.9KHz, 1/3 of the duty 12-divided by the carrier generation circuit. Please refer to the carrier waveform diagram below.



It is highly recommended that the following notes must be strictly observed in the preparation of the reception software:

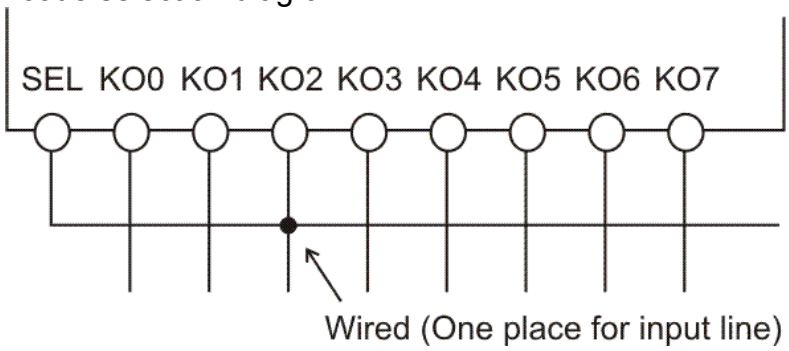
- System Code
  The 8-bit system code is transmitted twice. Therefore, you must decode both codes to be identical.
- Data Code
  The 8-bit data code is transmitted simultaneously with its inversion code. Therefore, you must decode the data code and its inversion code and never fail to check their integrity.

SYSTEM CODE LATCH CIRCUIT

There are 8 kinds of system code that can be selected by wiring the SEL pin to any one of the output pins-KO0 ~ KO7. The fourth bit of the system code (S3) is set to "1", S4 to S7 bits are "0". Please refer to the table and diagram below.

KO connected to SEL	System Code (S2 S1 S0)
KO0	000
KO1	001
KO2	010
KO3	011
KO4	100
KO5	101
KO6	110
KO7	111

Following is the system code selection diagram.



Notes:
1. S0, S1, S2 = 010
2. System Code = 01010000 (S0 to S7)

ABSOLUTE MAXIMUM RATING

(Unless otherwise specified, Ta=25℃)

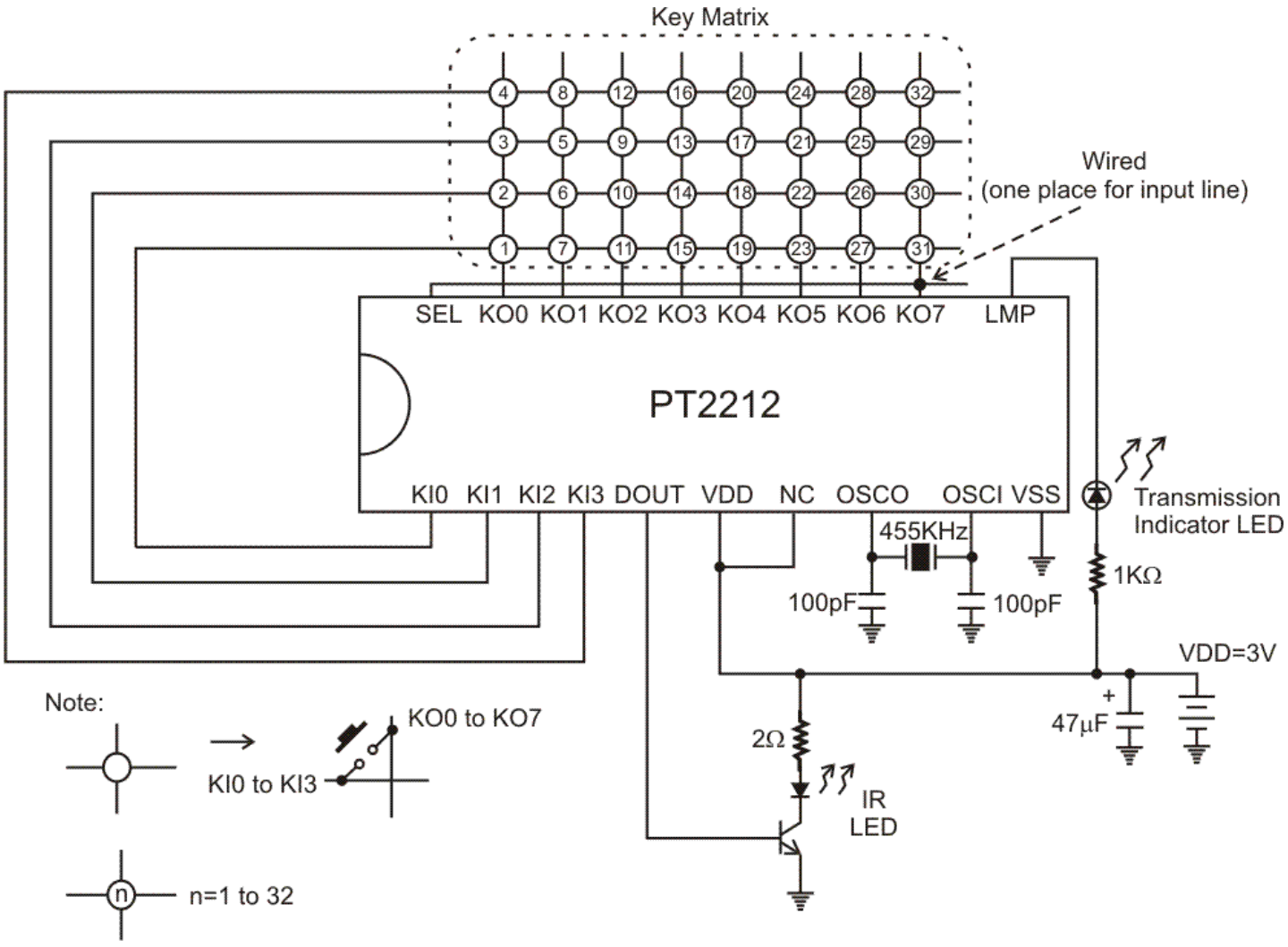
Parameter	Symbol	Rating	Unit
Power supply voltage	VDD	-0.3 ~ 5.0	V
Input voltage	VIN	VSS-0.3 ~ VDD+0.3	V
Operating temperature	Topr	-40 ~ +85	℃
Storage temperature	Tstg	-65 ~ +150	℃

ELECTRICAL CHARACTERISTIC

(Unless otherwise specified, VDD=3.0V, Ta=25℃)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Operating power supply	VDD	All Functions	2.0	-	4.0	V
Oscillation frequency	fosc	VDD=3V C=100pF	400	455	600	KHz
Operating power supply current	IDD	fosc=455KHz VDD=3V	-	-	1	mA
Stand-by current	ISB	VDD=3V fosc=stop	-	-	1	uA
High level input voltage	VIH(KI)	VDD=3V	0.7VDD	-	VDD	V
Low level input voltage	VIL(KI)	VDD=3V	0	-	0.3VDD	V
Pull down resistance	Ron (KI)	VDD=3V	100	300	500	KΩ
High level output current	IOH (DOUT)	VOH=1.5V VDD=3V	-10	-	-	mA
Low level output current	IOL (LMP)	VOL=1.5V VDD=3V	5	-	-	mA

APPLICATION CIRCUIT



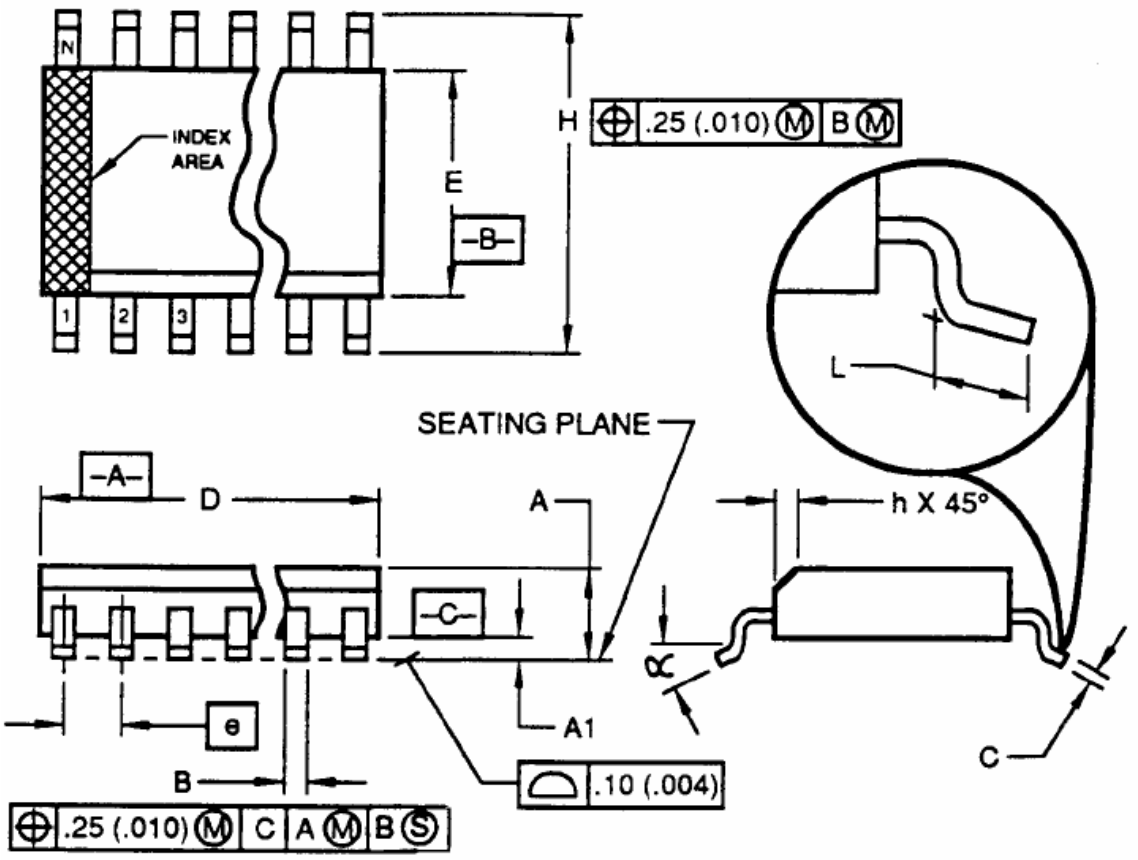
ORDER INFORMATION

Valid Part Number	Package Type	Top Code
PT2212	20 Pins, SOP, 300mil	PT2212

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PACKAGE INFORMATION

20 PINS, SOP, 300MIL



Symbol	Min.	Nom.	Max.
A	2.35	-	2.65
A1	0.10	-	0.30
B	0.33	-	0.51
C	0.23	-	0.32
D	12.60	-	13.00
E	7.40	-	7.60
e	-	1.27 bsc.	-
H	10.00	-	10.65
h	0.25	-	0.75
L	0.40	-	1.27
α	0°	-	8°

Notes:
1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold Flash, protrusion or gate burrs shall not exceed 0.15 mm (0.006 in) per side.
3. Dimension “E” does not include interlead flash or protrusions. Interlead flash or protrusions shall not exceed 0.25 mm (0.010 in) per side.
4. The chamfer on the body is optional. It is not present, a visual index feature must be located within the crosshatched area.
5. “L” is the length of the terminal for soldering to a substrate.
6. N is the number of the terminal positions (N=20)
7. The lead width “B” as measured 0.36 mm (0.014 in) or greater above the seating plane, shall not exceed a maximum value of 0.61 mm (0.24 in).
8. Controlling dimension: MILLIMETER.
9. Refer to JEDEC MS-013, Variation AC.

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