

MOS DIGITAL INTEGRATED CIRCUIT

μ PD6102G

MULTI-PURPOSE REMOTE CONTROL TRANSMITTER IC CMOS LSI

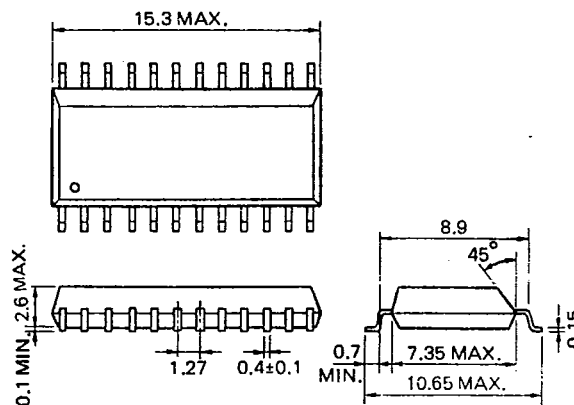
DESCRIPTION

The μ PD6102G is a versatile remote control infrared transmitter (TX) integrated circuit for TV, VCR, stereo, air conditioner and many other applications. The maximum of 34304 commands are available with the custom code selection by external diodes. This enables effective control of various apparatus without interference. The transmitting code consisting of 16 bits can be directly decoded by a 4-bit MPU, thus giving a wide application. The package is a 24-Pin MINI FLAT that is the best suited for miniaturization of apparatus.

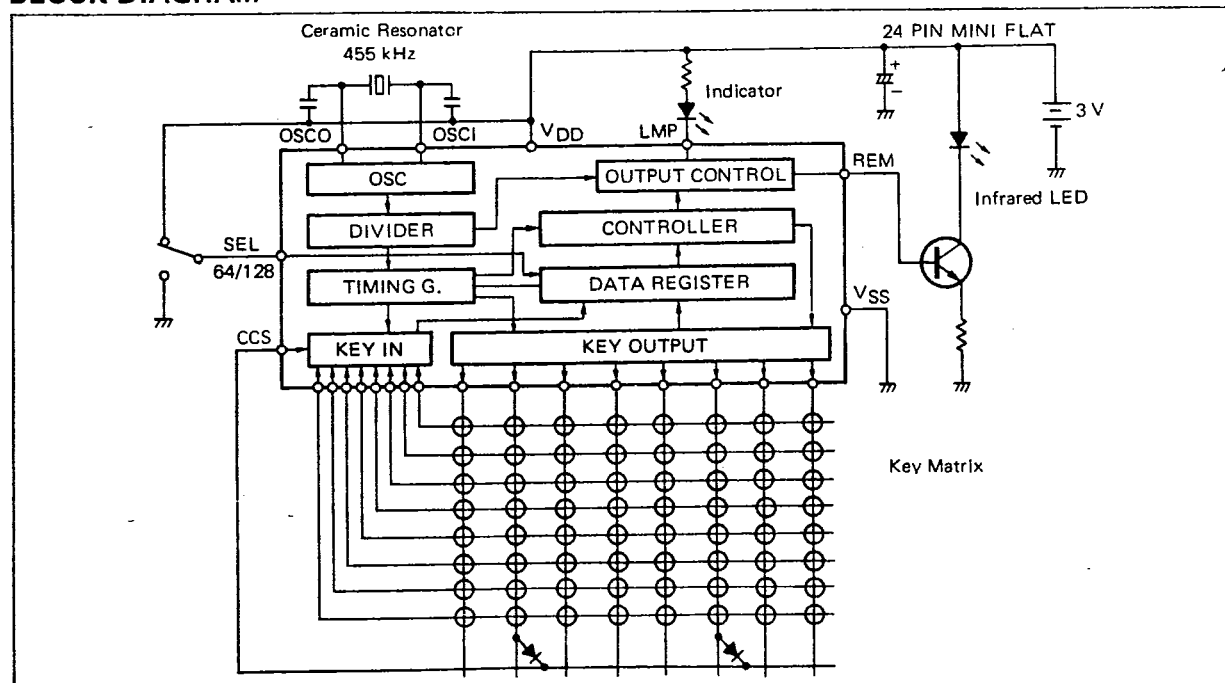
FEATURES

- Low Voltage Operation $V_{DD} = 2.0$ to 3.3 V
- Low Power Consumption . . . $I_{DD} < 1 \mu A$ at Standby Mode
- 64 Function KEYS and 3 dual Action KEY
- 256 Custom Codes selected by External Diode
- 16 bit Pulse Position Modulated code
- High Transmission Efficiency . . IR LED ON Duty 3 %
- Indicator Output
- Package . . . 24 Pin MINI FLAT
- Transmit 128 Data Code
- μ PD1913C (20 key) } Code Compatible
- μ PD1943G (32 key) }

PACKAGE DIMENSIONS (in millimeters)



BLOCK DIAGRAM



μPD6102G

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T-77-11

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Supply Voltage	V _{DD} - V _{SS}	4.0	V
Input Voltage	V _{IN} - V _{SS}	-0.3 to V _{DD}	V
Output Current	I _{OH} (REM, LMP)	-15.0	mA
Power Dissipation	P _d	250	mW
Operating Temperature Range	T _{opt}	-20 to +75	°C
Storage Temperature Range	T _{stg}	-40 to +125	°C

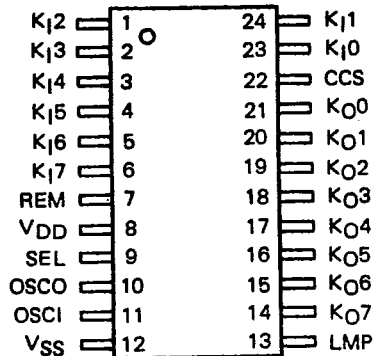
RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V _{DD}	2.0	3.0	3.3	V
Oscillation Frequency	f _{osc}	400	455	500	kHz
Lamp Output Current	I _{OL} (LMP)		1		mA

ELECTRICAL CHARACTERISTICS (T_a = 25 °C, V_{DD} = 3.0 V)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Supply Current	I _{DD} (OP)		0.1	1.0	mA	f _{OSC} = 455 kHz
Supply Current	I _{DD} (ST)			1	μA	f _{OSC} = STOP
Input High Voltage	V _{IH} (KI)	0.7 V _{DD}		V _{DD}	V	
Input Low Voltage	V _{IL} (KI)	0		0.3 V _{DD}	V	
Input Pull Down Resistor	R(KI)	150	300	600	kΩ	
Output Current	I _{OH} (REM)	-5	-13		mA	V _{OH} (REM) = 1.5 V
Output Low Voltage	V _{OL} (LMP)		0.17	0.3	V	I _{OL} = 1.0 mA

Connection Diagram (Top View)



Terminal

1	K12	Key Input 2
2	K13	Key Input 3
3	K14	Key Input 4
4	K15	Key Input 5
5	K16	Key Input 6
6	K17	Key Input 7
7	REM	Remote Output
8	VDD	3 V
9	SEL	64/128 Data Select
10	OSCO	Oscillator Output
11	OSCI	Oscillator Input
12	VSS	
13	LMP	Lamp Output
14	K07	Key Output 7
15	K06	Key Output 6
16	K05	Key Output 5
17	K04	Key Output 4
18	K03	Key Output 3
19	K02	Key Output 2
20	K01	Key Output 1
21	K00	Key Output 0
22	CCS	Custom Code Select Input
23	K10	Key Input 0
24	K11	Key Input 1

μPD6102G

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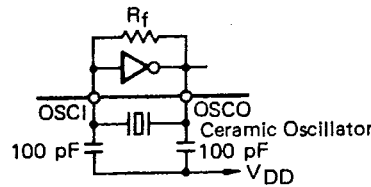
1. Key In & Out Pins K_I0 ~ K_I7, K_O0 ~ K_O7

Pull down resistors are connected between key input pins and V_{SS}. Simultaneous pressing of several keys activates the multiple input inhibiting circuit, thus making no transmission. Two key inputs with the interval of less than 36 ms is regarded as simultaneous. Priority of two inputs separating more than 36 ms is given on the first-pressed-first-served or longer-pressed-first-served basis.

Reading of the custom and key data codes starts at the press of a key, and 36 ms later REM output starts. One transmission is given if the key is kept pressed during this 36 ms. If the key is pressed for more than 108 ms, the leader code is only transmitted continuously. A very fast response is assured as the minimum ON-to-ON interval of 108 ms is discernible.

2. Oscillation Pins OSC_I, OSC_O

The oscillation circuit is only activated by a key input. Adjustment works can be saved if a 400-500 kHz ceramic resonator is used.

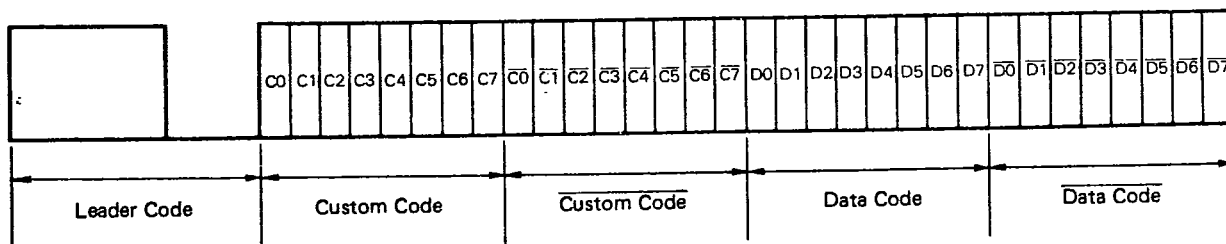


3. Power Supply Pins V_{DD}, V_{SS}

The standard voltage is 3 V or two dry cells. The workable range is 2.0 to 3.3 V. The stand-by current drain is only 1 μA as oscillation is only activated by the press of a key.

4. Remote Output REM

The transmission output consists of the leader code, 8-bit custom code, another 8-bit data code and the complementary codes of custom and data totalling 32 bits as shown below.



The leader code consists of 9 ms carrier and 4.5 ms OFF wave forms and works as the leader of the succeeding codes. This enables effective usage of time relations between reception detection and other processings when the receiver is micro-computerized. The succeeding codes are pulse position modulated (P.P.M.) and the 1 or 0 state depends on the time between pulses. Each code consists of eight bits and their complementary codes are simultaneously transmitted. This assures very low failure rate operation.

The data code has eight bits and D₀ to D₆ except D₅ can be selected by the key matrix K₁ to K₆₄. On double key pressing D₅ is given 1.

When the same key remains pressed the leader code is only transmitted repeatedly for saving of the infrared LED power drain. In this case the leader code transmission duty is predominant and the average power drain of the LED is about 3 % of I (peak). In case of 455 kHz oscillation the signal is modulated by 1/3 duty 38 kHz.

5. DATA 7 Select SEL

D₇ is controlled by the SEL pin enabling the transmission of 128 codes. The SEL pin connected to V_{DD} and V_{SS} gives 0 and 1 to D₇ respectively.

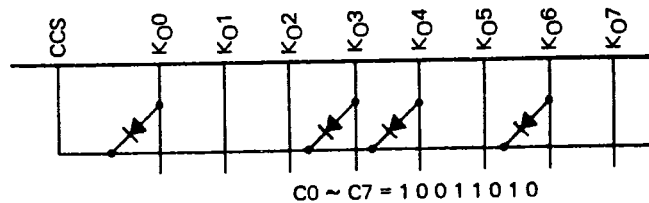
SEL V_{DD} D₇ = 0
 V_{SS} D₇ = 1

6. Custom Code Select CCS

Available at REM output pin are 256 custom codes (C₀ to C₇) depending on external diodes connected between CCS (Custom Code Select) pin and key output pins.

Our customer who likes to use the code other than "00000000" (no diodes connected) may get our suggestion of customer codes for the prevention of interference with other customers' products. Custom codes is common between NEC's IC μPD1913C, μPD1943G and μPD6102G.

Example of Custom Code



μPD6102G

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Key Data Code

KEY	CONNECTION					DATA CODE								NOTES	
	K ₁₀	K ₁₁	K ₁₂	K ₁₃	K ₀	D0	D1	D2	D3	D4	D5	D6	D7		
K1	*				K00	0	0	0	0	0	0	0	0/1	N/A for μPD1913C	
K2		*				1	0	0	0	0	0	0	0		0/1
K3			*			0	1	0	0	0	0	0	0		0/1
K4				*		1	1	0	0	0	0	0	0		0/1
K5	*				K01	0	0	1	0	0	0	0	0/1		
K6		*				1	0	1	0	0	0	0	0		0/1
K7			*			0	1	1	0	0	0	0	0		0/1
K8				*		1	1	1	0	0	0	0	0		0/1
K9	*				K02	0	0	0	1	0	0	0	0/1		
K10		*				1	0	0	1	0	0	0	0	0/1	
K11			*			0	1	0	1	0	0	0	0	0/1	
K12				*		1	1	0	1	0	0	0	0	0/1	
K13	*				K03	0	0	1	1	0	0	0	0/1		
K14		*				1	0	1	1	0	0	0	0	0/1	
K15			*			0	1	1	1	0	0	0	0	0/1	
K16				*		1	1	1	1	0	0	0	0	0/1	
K17	*				K04	0	0	0	0	1	0	0	0/1		
K18		*				1	0	0	0	1	0	0	0	0/1	
K19			*			0	1	0	0	1	0	0	0	0/1	
K20				*		1	1	0	0	1	0	0	0	0/1	
K21	*				K05	0	0	1	0	1	0	0	0/1		
K22		*				1	0	1	0	1	0	0	0	0/1	
K23			*			0	1	1	0	1	0	0	0	0/1	
K24				*		1	1	1	0	1	0	0	0	0/1	
K25	*				K06	0	0	0	1	1	0	0	0/1		
K26		*				1	0	0	1	1	0	0	0	0/1	
K27			*			0	1	0	1	1	0	0	0	0/1	
K28				*		1	1	0	1	1	0	0	0	0/1	
K29	*				K07	0	0	1	1	1	0	0	0/1		
K30		*				1	0	1	1	1	0	0	0	0/1	
K31			*			0	1	1	1	1	0	0	0	0/1	
K32				*		1	1	1	1	1	0	0	0	0/1	
KEY	COEENCTION					DATA CODE								NOTES	
	K ₁₄	K ₁₅	K ₁₆	K ₁₇	K ₀	D0	D1	D2	D3	D4	D5	D6	D7		
K33	*				K00	0	0	0	0	0	0	1	0/1	N/A for μPD1943G μPD1913C	
K34		*				1	0	0	0	0	0	1	0/1		
K35			*			0	1	0	0	0	0	1	0/1		
K36				*		1	1	0	0	0	0	1	0/1		
K37	*				K01	0	0	1	0	0	0	1	0/1		N/A for μPD1943G μPD1913C
K38		*				1	0	1	0	0	0	1	0/1		
K39			*			0	1	1	0	0	0	1	0/1		
K40				*		1	1	1	0	0	0	1	0/1		
K41	*				K02	0	0	0	1	0	0	1	0/1	N/A for μPD1943G μPD1913C	
K42		*				1	0	0	1	0	0	1	0/1		
K43			*			0	1	0	1	0	0	1	0/1		
K44				*		1	1	0	1	0	0	1	0/1		
K45	*				N03	0	0	1	1	0	0	1	0/1		N/A for μPD1943G μPD1913C
K46		*				1	0	1	1	0	0	1	0/1		
K47			*			0	1	1	1	0	0	1	0/1		
K48				*		1	1	1	1	0	0	1	0/1		
K49	*				K04	0	0	0	0	1	0	1	0/1	N/A for μPD1943G μPD1913C	
K50		*				1	0	0	0	1	0	1	0/1		
K51			*			0	1	0	0	1	0	1	0/1		
K52				*		1	1	0	0	1	0	1	0/1		
K53	*				K05	0	0	1	0	1	0	1	0/1		N/A for μPD1943G μPD1913C
K54		*				1	0	1	0	1	0	1	0/1		
K55			*			0	1	1	0	1	0	1	0/1		
K56				*		1	1	1	0	1	0	1	0/1		
K57	*				K06	0	0	0	1	1	0	1	0/1	N/A for μPD1943G μPD1913C	
K58		*				1	0	0	1	1	0	1	0/1		
K59			*			0	1	0	1	1	0	1	0/1		
K60				*		1	1	0	1	1	0	1	0/1		
K61	*				K07	0	0	1	1	1	0	1	0/1		N/A for μPD1943G μPD1913C
K62		*				1	0	1	1	1	0	1	0/1		
K63			*			0	1	1	1	1	0	1	0/1		
K64				*		1	1	1	1	1	0	1	0/1		

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N/A = Not Available

7. Double Key Operation

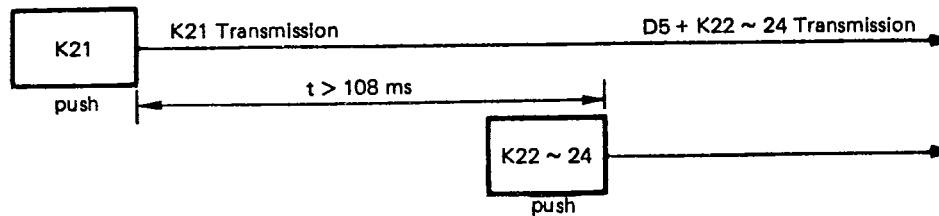
Double key input activates the multiple input inhibiting circuit except K21 to K24.

When a pair of key inputs, K21+K22, K21+K23 or K21+K24, gives 1 to D5. But this function is assured only when one of the key K22 to K24 is pressed 108 ms at the minimum after K21.

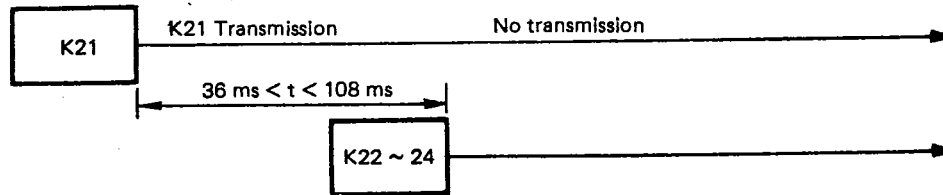
The inhibiting function assures the prevention of malfunction of, say, a tape deck in recording.

KEY	D0	D1	D2	D3	D4	D5	D6	D7
K21 + K22	1	0	1	0	1	1	0	0
K21 + K23	0	1	1	0	1	1	0	0
K21 + K24	1	1	1	0	1	1	0	0

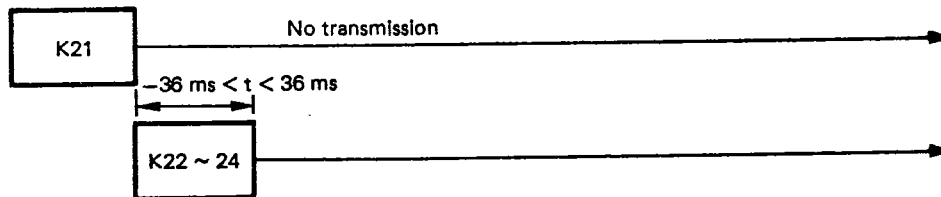
(a) Operation



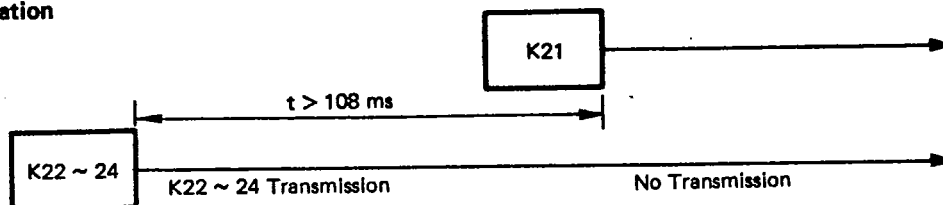
(b) No operation



(c) No operation



(d) No operation



μPD6102G

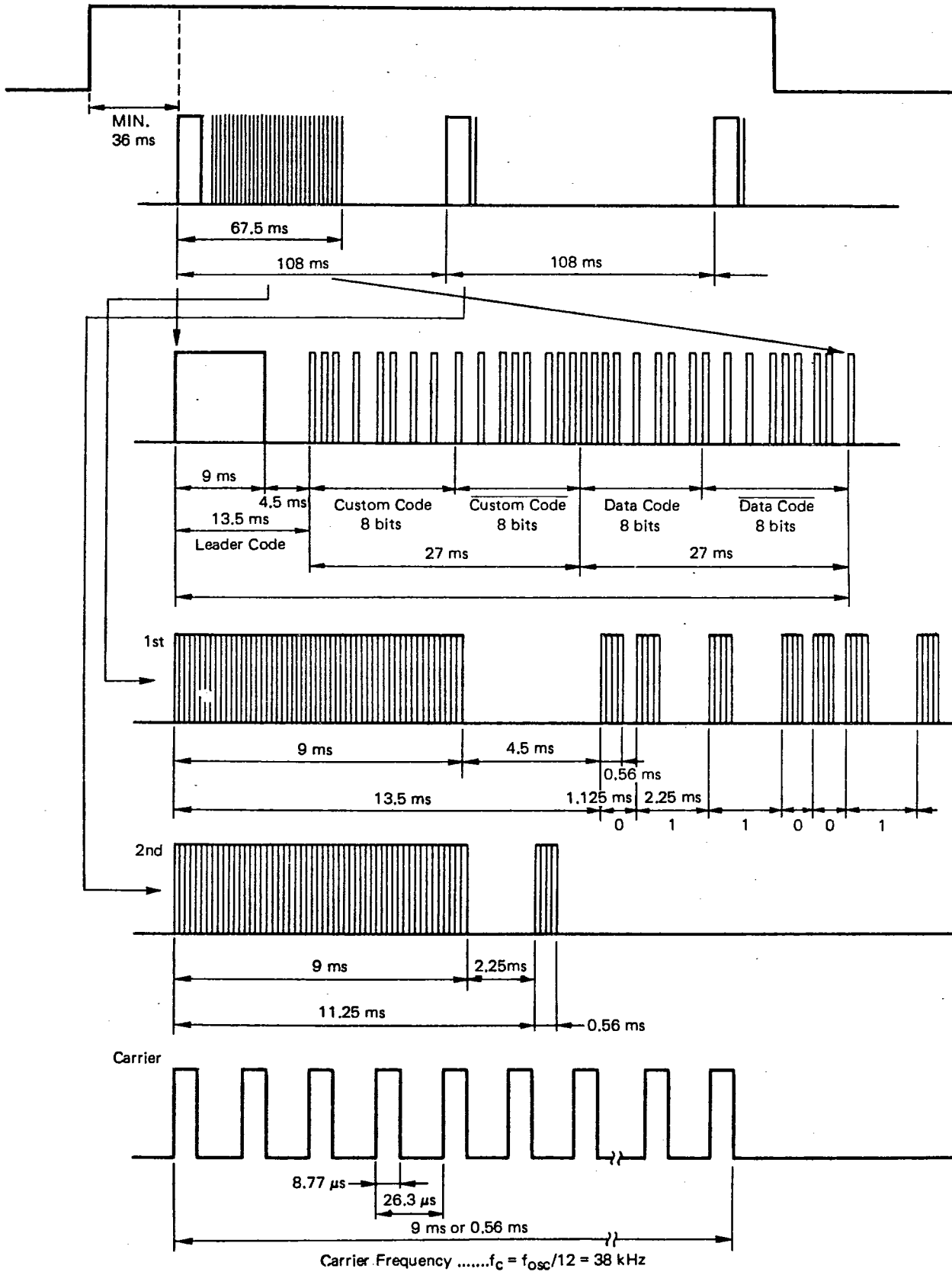
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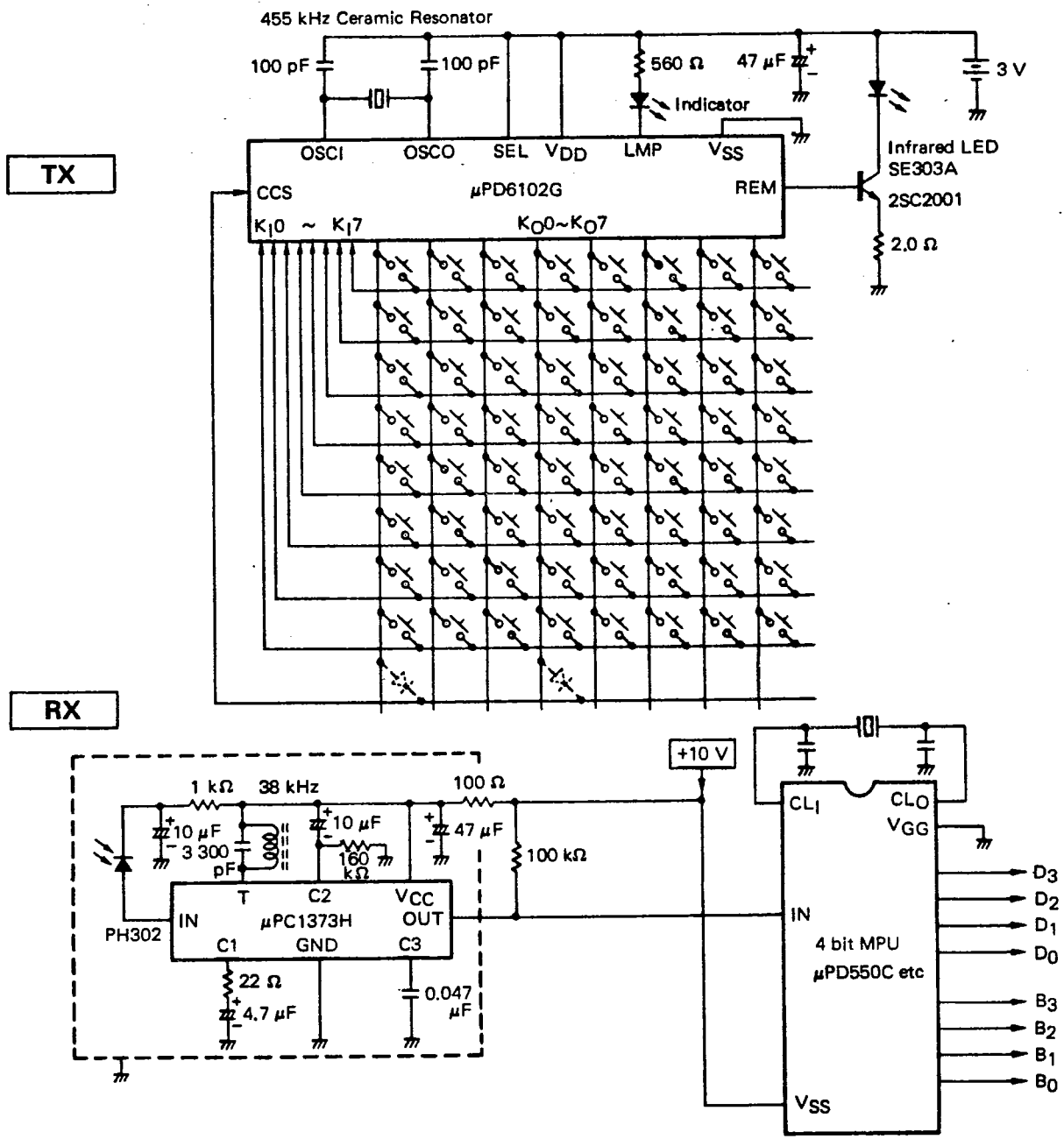
Remote Output Waveforms

KEY Input

Ex. $f_{osc} = 455 \text{ kHz}$



APPLICATION



- SE303A Infrared LED
- PH302 PIN Photo Diode
- μPC1373H Preamplifier for Remote Control
- RX IC TV use
- PLL μPD1700 Series
- VTR, VIDEODISC, STEREO, AIRCONTROL, OTHERS
- 4 bit CPU ... μcom 43 series
- μcom 7500 series
- 8 bit CPU μPD8048, 8049
- μPD7800 series