

BL0507
Infrared Remote Control Transmitter IC

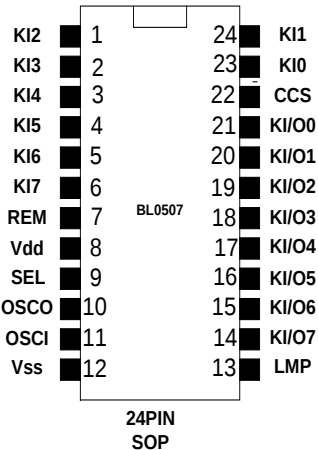
Description

The BL0507 is an infrared remote control transmitter LSI for TV, VCR, stereo components, cassette decks, air conditioners, and other appliances. There are 64 function keys and 3 double action keys, the 128+6 function codes are available by using SELECT terminal. The transmission code consists of “leader pules”, “16bit customer code”, and “16 bit date code”. Using micro-processors for decode, various applications can be realized. (BL0507compatible with NEC standard μ PD 6122-G001)

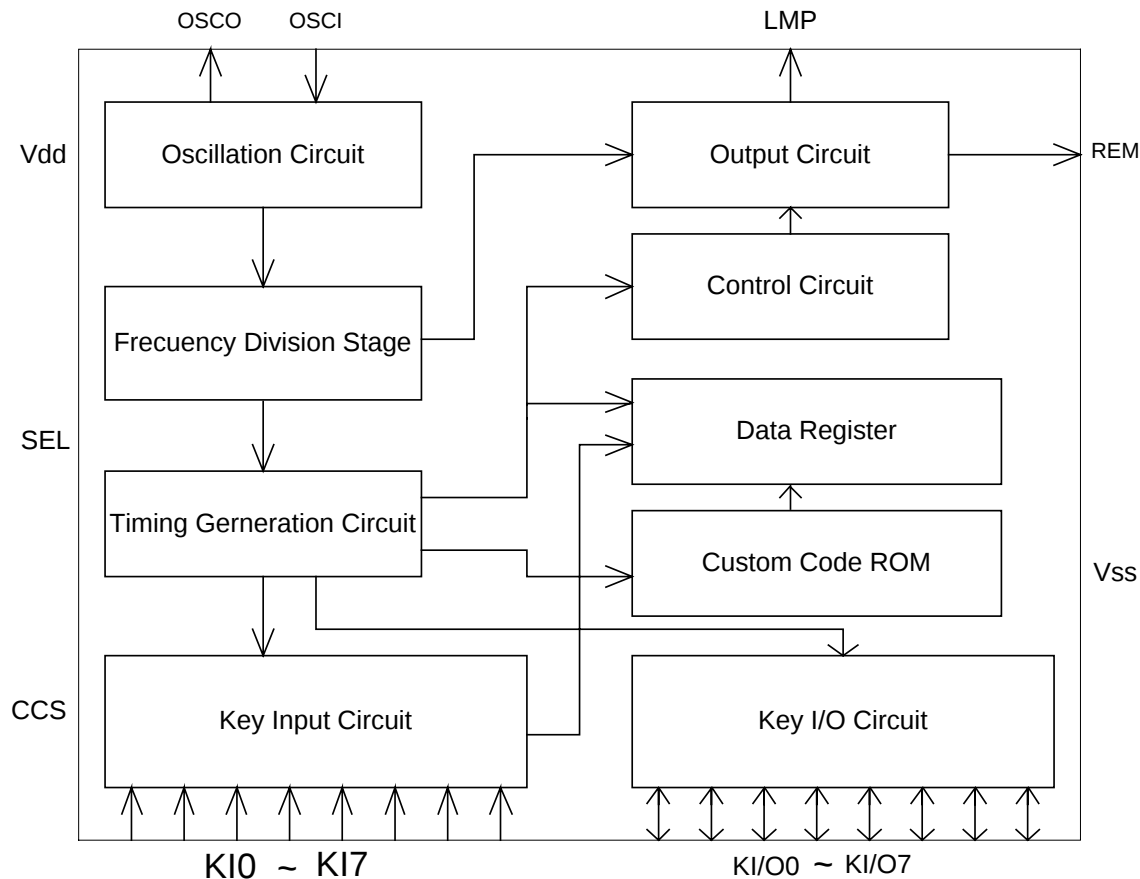
Features

- Low voltage operation: $V_{DD}=2.0\sim3.3V$.
- Low power consumption: $I_{DD}<1\mu A$ at standby mode
- A system with an extremely low error rate.
- A fewer external parts
- Use of ceramic resonator with a 400 to 500 kHz oscillation is designed for non- adjustment operation

Pin Assignment



Block Diagram



Pin Description

Pin Number	Symbol	Type (In/Out)	Description
8,12	V _{DD} , Gnd		Power supply, Ground

10,11	OSC O/I		Oscillation pins	Connecting ceramic resonator
23,24, 1~6	KI ₀ ~KI ₇	I	Matrix pins	Key input
14~21	KI/O ₀ ~KI/O ₇	I/O	Matrix pins	Key output, Custom code input
7	REM	O		Outputs the transmission code
22	CCS	I		The custom code can be set by diode connected to the CCS pin and the KI/O pins
13	LMP	O		Outputs "L" while REM pin is outputting a transmission code
9	ESL	I		D ₇ is set to "0" by connecting the SEL to V _{DD} D ₇ is set to "1" by connecting the SEL to V _{SS}

Absolute Maximum Ratings(T_a=25°C)

Characteristic	Symbol	Rating	Unit
Supply Voltage	V _{DD}	6.0	V
Input Voltage	V _{in}	-0.3 to V _{DD}	V
Power Dissipation	P _d	250	mW
Operation Temperature	T _{opt}	-20 to +75	°C
Storage Temperature	T _{stg}	-40 to + 125	°C

Electrical Characteristics (T_a=25°C, V_{DD}=3.0V)

Characteristic	Symbol	Min	Typ	Max	Unit	Condition
Supply Voltage	V _{DD}	2.0	3.0	3.3	V	
Current Consumption 1	I _{DD1}		0.1	1.0	mA	f _{osc} =455kHz
Current Consumption 2	I _{DD2}			1.0	μA	f _{osc} =STOP
REM High Level output Current	I _{OH1}	-5.0	-8.0		mA	V _O =1.5V
REM Low Level output Current	I _{OL2}	15	30		μA	V _O =0.3V
LMP High Level output Current	I _{OH2}	-15	-30		μA	V _O =2.7V
LMP Low Level output Current	I _{OL2}	1	1.5		mA	V _O =0.3V
KI High Level Input Current	I _{ih1}	10		30	μA	V _{in} =3.0V
KI Low Level Input Current	I _{il1}			-0.2	μA	V _{in} =0V
KI High Level Input Voltage	V _{ih1}	0.7V _{DD}				
KI Low Level Input Voltage	V _{il1}	0		0.3V _{DD}		
KI/O High Level Input Voltage	V _{ih2}	1.3		V _{DD}		
KI/O Low Level Input Voltage	V _{il2}	0		0.4		
KI/O High Level Input Current	I _{ih2}	2		7	μA	V _{in} =3.0V
KI/O Low Level Input Current	I _{il2}			-0.2	μA	V _{in} =0V
KI/O High Level Output Current	I _{OH3}	1.0		2.5	mA	V _O =2.5V
KI/O Low Level Output Current	I _{OL3}	35		100	μA	V _O =1.7V
CCS High Level Input Voltage	V _{ih3}	1.1			V	
CCS High Level Input Current	I _{ih3}			0.2	μA	Pull up V _{in} =3.0V
CCS Low Level Input Current	I _{il3}	-3		-3	μA	Pull up V _{in} =0V
CCS High Level Input Current	I _{ih4}	10		30	μA	Pull down V _{in} =3.0V
CCS Low Level Input Current	I _{il4}			-0.2	μA	Pull down V _{in} =0V

Recommended Operating Conditions

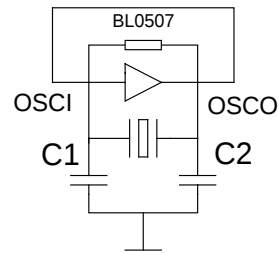
Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{DD}	2.0	3.0	3.3	V
Oscillation Frequency	f _{osc}	400	455	500	kHz
Input Voltage	V _{in}	0		V _{DD}	V

Custom Code select Pull-up Resistance	R_{up}	160	200	240	k Ω
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Function description

• Oscillation Pin:

The BL0507 Oscillation circuit is designed for use of a 400kHz to 500kHz ceramic resonator, but there may be mutual influence between variations in the IC and the ceramic resonator resulting in abnormal oscillation. The following table shows the recommended values of C_1 and C_2 when using the BL0507. The oscillation circuit starts to operate when a key is depressed.



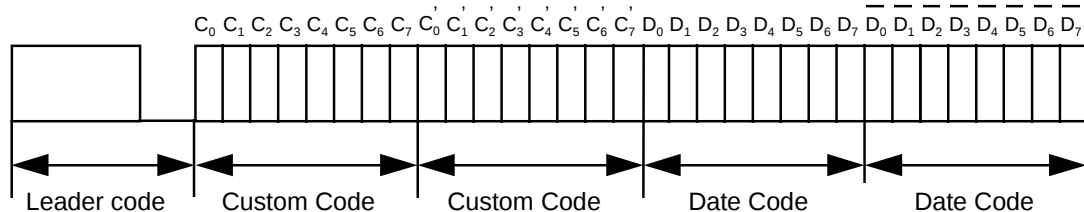
Product	External Capacitance (pF)		Oscillation Voltage Range (V)	
	C_1	C_2	MIN	MAX
CSB455E	220	220	2.0	3.3
CSB480E	220	220	2.0	3.3
P46CRK455M11	120	300	2.0	3.3
KBR-455BTLR	220	220	2.0	3.3

- **REM Pin** Output the transmission code consisting of the leader code ,custom code (16bits) and data code (16bits) .
- **SEL Pin** DATA CODE D_7 can be controlled by this pin, allowing 128 kinds of data to be transmitted. D_7 is set to "0" by connecting the pin to V_{DD} , and to "1" by connecting the SEL pin to V_{SS} . As the input of this pin is high-impedance, it must be connected to either V_{DD} or V_{SS} .
- **CCS Pin** The custom code can be set by the diode connected to the CCS pin and the KI/O pin.
- **LMP Pin** Outputs "L" while the REM pin is outputting a transmission code.

Transmission Code

The transmission code consists of a leader code, 16-bit custom code, and 8-bit data code+8-bit inverse code of the data code, they are also sent simultaneously, giving a total configuration of 32- bits per transmission. The code uses the PPM (pulse position Modulation) method, with "1" and "0" differentiated by the time between pulse. Each code consists of 8-bits, and simultaneous transmission of the inverse code allows configuration of a system with an extremely low error rate.

REM Output Code



The diagram illustrates the timing for the 125KHz protocol. It includes three main signal traces:

- Key Input:** Shows a pulse with a minimum duration of 36ms. An example frequency is given as $f_{osc} = 455\text{kHz}$.
- RF Signal:** Shows the transmitted signal structure. It starts with a **Leader Code** (9ms), followed by four 8-bit segments (each 4.5ms). These are grouped into **Custom Code** (18ms to 36ms) and **Date Code** (27ms) sections. The total duration is 58ms to 76ms. The signal is repeated every 108ms.
- Carrier:** Shows the carrier wave for the first and second pulses. The first pulse has a duration of 9ms, followed by a 4.5ms gap and a 0.56ms pulse. The second pulse has a duration of 9ms, followed by a 2.25ms gap and a 0.56ms pulse. The carrier frequency is $f_c = f_{osc} / 12 = 38\text{kHz}$.

Key Data Code (Single key)

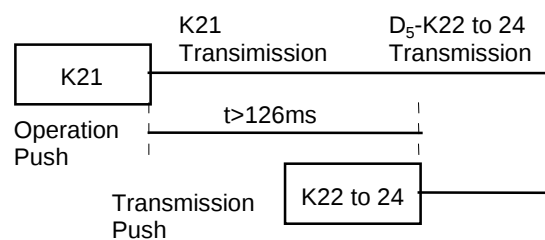
Connect Manner					Key Data Code								
key	kI ₀	kI ₁	kI ₂	kI ₃	KI/O	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
K1	*				KI/O ₀	0	0	0	0	0	0	0	0/1
K2		*				1	0	0	0	0	0	0	0/1
K3			*			0	1	0	0	0	0	0	0/1
K4				*		1	1	0	0	0	0	0	0/1
K5	*				KI/O ₁	0	0	1	0	0	0	0	0/1
K6		*				1	0	1	0	0	0	0	0/1
K7			*			0	1	1	0	0	0	0	0/1
K8				*		1	1	1	0	0	0	0	0/1
K9	*				KI/O ₂	0	0	0	1	0	0	0	0/1
K10		*				1	0	0	1	0	0	0	0/1
K11			*			0	1	0	1	0	0	0	0/1
K12				*		1	1	0	1	0	0	0	0/1
K13	*				KI/O ₃	0	0	1	1	0	0	0	0/1
K14		*				1	0	1	1	0	0	0	0/1
K15			*			0	1	1	1	0	0	0	0/1
K16				*		1	1	1	1	0	0	0	0/1
K17	*				KI/O ₄	0	0	0	0	1	0	0	0/1
K18		*				1	0	0	0	1	0	0	0/1
K19			*			0	1	0	0	1	0	0	0/1
K20				*		1	1	0	0	1	0	0	0/1
K21	*				KI/O ₅	0	0	1	0	1	0	0	0/1
K22		*				1	0	1	0	1	0	0	0/1
K23			*			0	1	1	0	1	0	0	0/1
K24				*		1	1	1	0	1	0	0	0/1
K25	*				KI/O ₆	0	0	0	1	1	0	0	0/1
K26		*				1	0	0	1	1	0	0	0/1
K27			*			0	1	0	1	1	0	0	0/1
K28				*		1	1	0	1	1	0	0	0/1
K29	*				KI/O ₇	0	0	1	1	1	0	0	0/1
K30		*				1	0	1	1	1	0	0	0/1
K3			*			0	1	1	1	1	0	0	0/1

Connect Manner					Key Data Code								
key	kI ₀	kI ₁	kI ₂	kI ₃	KI/O	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
K1	*				KI/O ₀	0	0	0	0	0	0	0	0/1
K2		*				1	0	0	0	0	0	0	0/1
K3			*			0	1	0	0	0	0	0	0/1
K4				*		1	1	0	0	0	0	0	0/1
1													
K3 2				*		1	1	1	1	1	0	0	0/1

Connect Manner					Key Data Code								
key	kI ₄	kI ₅	kI ₆	kI ₇	KI/O	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
K3 3	*				KI/O ₀	0	0	0	0	0	0	1	0/1
K3 4		*				1	0	0	0	0	0	1	0/1
K3 5			*			0	1	0	0	0	0	1	0/1
K3 6				*		1	1	0	0	0	0	1	0/1
K3 7	*				KI/O ₁	0	0	1	0	0	0	1	0/1
K3 8		*				1	0	1	0	0	0	1	0/1
K3 9			*			0	1	1	0	0	0	1	0/1
K4 0				*		1	1	1	0	0	0	1	0/1
K4 1	*				KI/O ₂	0	0	0	1	0	0	1	0/1
K4 2		*				1	0	0	1	0	0	1	0/1
K4 3			*			0	1	0	1	0	0	1	0/1
K4 4				*		1	1	0	1	0	0	1	0/1
K4 5	*				KI/O ₃	0	0	1	1	0	0	1	0/1
K4 6		*				1	0	1	1	0	0	1	0/1
K4 7			*			0	1	1	1	0	0	1	0/1
K4 8				*		1	1	1	1	0	0	1	0/1
K4 9	*				KI/O ₄	0	0	0	0	1	0	1	0/1
K5 0		*				1	0	0	0	1	0	1	0/1
K5 1			*			0	1	0	0	1	0	1	0/1
K5 2				*		1	1	0	0	1	0	1	0/1
K5 3	*					0	0	1	0	1	0	1	0/1

Connect Manner					Key Data Code								
key	kI ₄	kI ₅	kI ₆	kI ₇	KI/O	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
K3 ₃	*				KI/O ₀	0	0	0	0	0	0	1	0/1
K3 ₄		*				1	0	0	0	0	0	1	0/1
K3 ₅			*			0	1	0	0	0	0	1	0/1
K3 ₆				*		1	1	0	0	0	0	1	0/1
K5 ₄		*			KI/O ₅	1	0	1	0	1	0	1	0/1
K5 ₅			*			0	1	1	0	1	0	1	0/1
K5 ₆				*		1	1	1	0	1	0	1	0/1
K5 ₇	*					0	0	0	1	1	0	1	0/1
K5 ₈		*			KI/O ₆	1	0	0	1	1	0	1	0/1
K5 ₉			*			0	1	0	1	1	0	1	0/1
K6 ₀				*		1	1	0	1	1	0	1	0/1
K6 ₁	*					0	0	1	1	1	0	1	0/1
K6 ₂		*			KI/O ₇	1	0	1	1	1	0	1	0/1
K6 ₃			*			0	1	1	1	1	0	1	0/1
K6 ₄				*		1	1	1	1	1	0	1	0/1

Double Key operation form are following



When more than two keys except K21+K22, K21+K23, K21+K24 are depressed at the same time, the transmission output stops

Key Data Code (Double Key)

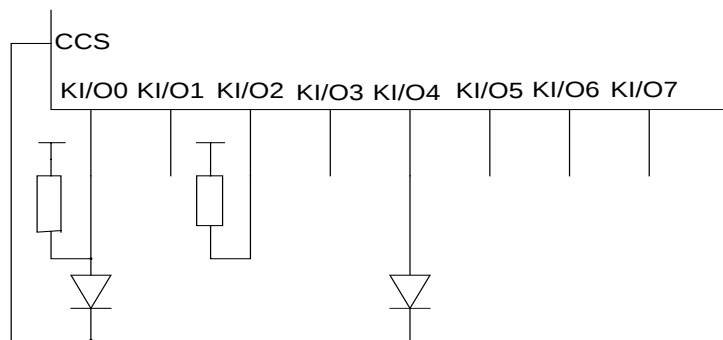
Key	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
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K21+K22	1	0	1	0	1	1	0	0/1
K21+K23	0	1	1	0	1	1	0	0/1
K21+K24	1	1	1	0	1	1	0	0/1

Custom Code Extension

The custom code high-order 8 bit C_n ($n = 0 \sim 7$) are determined by diode attached to the CCS pin and KI/O pins. If KI/Oi are connected to CCS by diode, C_n ($n = 0 \sim 7$) = 1. If KI/Oi are not connected to CCS by diode, C_n ($n = 0 \sim 7$) = 0. The custom code low-order 8 bit C_n' ($n = 0 \sim 7$) are determined by pull-up resistor to the KI/O pins. If pull-up resistors are attached to the KI/O pins, $C_n' = C_n$. If pull-up resistors are not attached to the KI/O PINS, $C_n' = \overline{C_n}$.

Configuration Sample Application



1. Custom code high-order 8 bits

C0	C1	C2	C3	C4	C5	C6	C7
1	0	0	0	1	0	0	0

2. Inverted code of low-order 8 bits

C0'	C1'	C2'	C3'	C4'	C5'	C6'	C7'
1	0	1	0	0	0	0	0

3. Custom code

1	0	0	0	1	0	0	0	1	1	0	1	0	1	1	1
C0	C1	C2	C3	C4	C5	C6	C7	C0'	C1'	C2'	C3'	C4'	C5'	C6'	C7'
								$\overline{C_0}$	$\overline{C_1}$	$\overline{C_2}$	$\overline{C_3}$	$\overline{C_4}$	$\overline{C_5}$	$\overline{C_6}$	$\overline{C_7}$

Sample Application Circuit

