## Silan Microelectronics

SC50560

INFRARED REMOTE CONTROL TRANSMITTER OF 50560 CODE FORMAT

DESCRIPTION

The SC50560 is a remote control transmitter utilizing CMOS technology housed in a 20-pin DIP or SOP package. A 4x8 key matrix and extension bit inputs allow the transmission of up to 256 instructions. The transmission code consists of 16 bits code (8 bits custom code and 8 bits data code) and a leader code.

Pin assignments and application circuit of SC50560 are optimized for easy PCB layout and cost saving advantage for remote control applications.
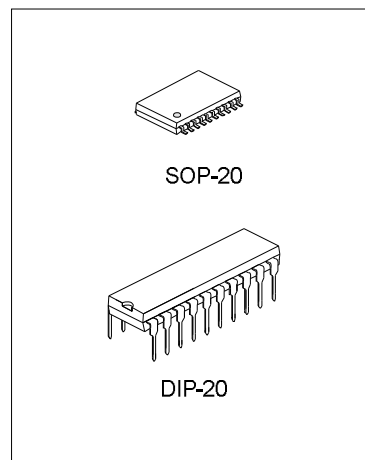
FEATURES

* CMOS technology
* Low power consumption
* Least external components
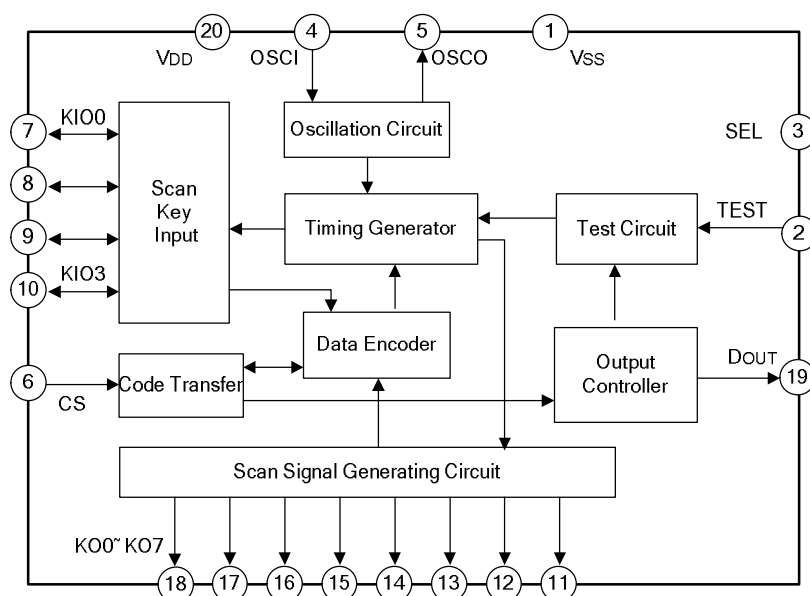* LED power dissipation is less during the transmission of Instructions

APPLICATIONS

* Audio Equipment
* Television
* Video Cassette Recorder
* Air Condition

SOP-20

DIP-20

ORDERING INFORMATION

Device	Package
SC50560	DIP-20-300-2.54
SC50560S	SOP-20-375-1.27

BLOCK DIAGRAM

ABSOLUTE MAXIMUM RATINGS (Tamb=25°C)

Characteristics	Symbol	Ratings	Unit
Supply Voltage	V_{CC}	-0.3 ~ 5.5	V
Input Voltage	V_{IN}	V_{SS}-0.3V ~ V_{DD}+0.3V	V
Output Voltage	V_{OUT}	$V_{SS} \leq V_O \leq V_{DD}$	V
Operating Temperature	T_{opr}	-20 ~ 70	°C
Storage Temperature	T_{stg}	-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS (Tamb=25°C, V_{DD} =3.0V,V_{SS}=0,Unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}	f_{OSC}=455KHz	2.0	3.0	4.0	V
Operating Current	I_{OP}	f_{OSC} =455KHz		0.12	0.3	mA
Stand-by Current	I_{SB}	OSCO =V_{DD} K_{IO0}~K_{IO3}= V_{DD} TEST = V_{SS} SEL = V_{SS}		0.1	1	μA
High level Output Current (Dout)	I_{OH}	V_{OH}=2V	-1.0	-13		mA
Low Level Output Current (Dout, KO0~KO7)	I_{OL}	V_{OL}=0.9V	0.5	1.2		mA
	$I_{KO0~KO7}$		4.5	5.3		
High Level Input Voltage (CS) (KIO0~KIO3)	V_{IH}	V_{DD}=3.0V	0.7 V_{DD}		V_{DD}	V
Low Level Input Voltage (CS) (KIO0~KIO3)	V_{IL}	V_{DD}=3.0V	0		0.3V_{DD}	V
Input Pull-High Resistance (KIO0~KIO3)	R_{IN}	V_{DD}=3.0V	55	70	85	kΩ

PIN CONFIGURATION


```
Vss    1        20  VDD
TEST   2        19  DOUT
SEL    3        18  KO0
OSCI   4        17  KO1
OSCO   5   SC50560  16  KO2
CS     6        15  KO3
KIO0   7        14  KO4
KIO1   8        13  KO5
KIO2   9        12  KO6
KIO3   10       11  KO7
```
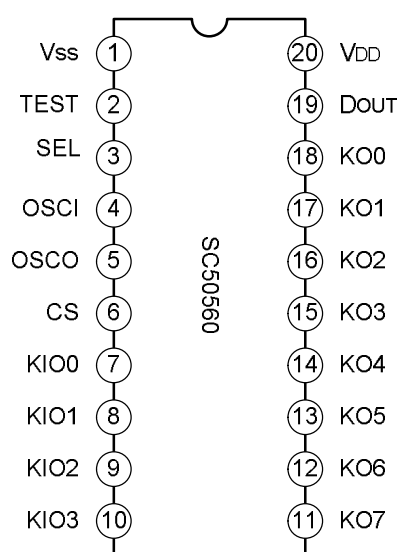
PIN DESCRIPTION

Pin No.	Pin Name	Description
1	Vss	Negative Power Supply
2	TEST	Test Pin. This pin is normally connected to VSS.
3	SEL	Select Pin for SC50560-001/003.
4	OSCI	Oscillation Input Pin
5	OSCO	Oscillation Output Pin
6	CS	Code Select Pin
7~10	KIO0~KIO3	Input/Output Pins
18~11	KO0~KO7	Scan Output Pins
19	Dout	Output Pin
20	VDD	Positive Power Supply

FUNCTIONAL DESCRIPTION

SC50560 is capable of transmitting up to 256 different instructions and 8 bits custom codes using a 16-bit PCM Code with a leader code. Furthermore, oscillation is normally stopped when there is no operating, thereby, lower power dissipation.

1. TRANSMISSION CODE

SC50560 transmission code consists of a leader code, 8 bits custom code (C0 to C7) followed by a sync. bit and 8 bits data code (D0 to D7) followed another sync. bit. The custom and the data codes are separated by a separator. Please refer to the diagram below:
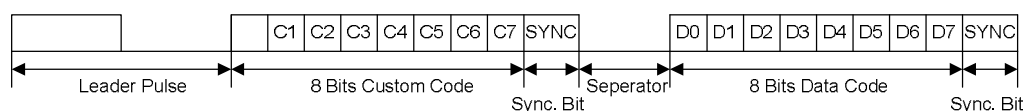

Figure 1. SC50560 Transmission Code Format

One transmission Code Word consists of a 19-bit pulse (that is the leader pulse plus the 16 bits code) and the separator. It is transferred in a 63.4ms for as long as the key is depressed. Please refer to the diagram below:
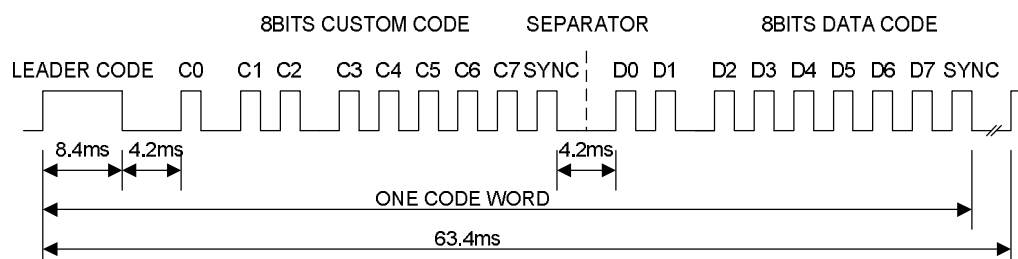

Figure 2. SC50560 Detailed Code Word Format

LEADER CODE

The leader code is located at the beginning of the transmission code and is made up of 8.4ms HIGH & 4.2ms LOW pulse and is modulated in 38KHz providing easy identification of the reception code head bit at the receiver.

CUSTOM CODE

Custom Code may be selected by connection CS Input with Scan Output (KO0 to KO4). An example of a custom code selection is shown in the diagram below.
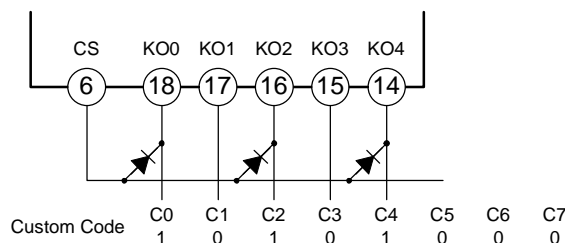

Figure 3. custom Code Selection Example

DATA CODE

D0 to D7 of the transmission code are the data code bits. When CS Input and the Scan Output (KO5 to KO7) are connected, data bits—D5 to D7 becomes the system extended code bits. An example of the Extended code Bits Selection is given in the diagram below:
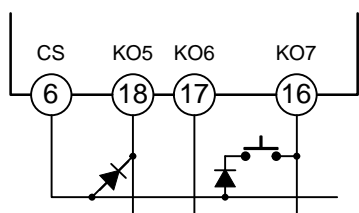

Data Code	D5	D6	D7
SW = OFF	1	0	0
SW = ON	1	0	1

Figure 4. Extended Code Selection

2. SEPARATOR

The separator demarcates the custom code and the data code. It consists of a 4.2ms LOW pulse interval and can be determined at the receiver so theat any interference with other remote control system may be avoided. Please refer to Figure 2.

3. CARRIER

The carrier of the transmission signal is 38KHz and one pulse width is 0.52ms. Therefor, with the exception of the leader code, there are twenty 38KHz clock in one pulse width. Please refer to the diagram below.
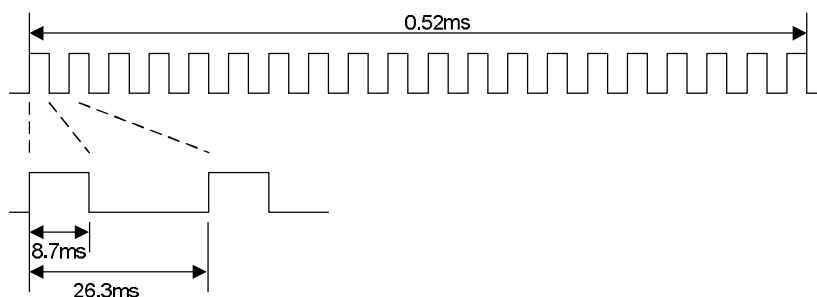

Figure 5. Transmission Signal Carrier Diagram

4. KEY INPUT

By connecting the input pins – KI0 to KI3 and scan output pins –KO0 to KO7 (also known as the Standard Keys), a 4x8 key matrix may be formed. Likewise, a maximum of 256 instructions may be provided by connecting the input CS with the scan output –KO0 to KO7 (also known as the Extended Keys). When two or more standard keys are pressed, the transmission output Dout is kept at LOW and no transmission code is outputted. Please refer to the tables below.

Data Key Input	D0	D1
KI0	0	0
KI1	1	0
KI2	0	1
KI3	1	1

Data Scan Output	D2	D3	D4
KO0	0	0	0
KO1	1	0	0
KO2	0	1	0
KO3	1	1	0
KO4	0	0	1
KO5	1	0	1
KO6	0	1	1
KO7	1	1	1

Data CS Input	D5	D6	D7
KO5	1	--	--
KO6	--	1	--
KO7	--	--	1

5. Oscillation Circuit

The oscillation circuit may be constructed by connected a ceramic resonator between the OSCI and OSCO. Please refer to the diagram right. When the references signal is set to 455KHz the carrier can be set at 38KHz. When no key input is pressed, the oscillation circuit is normally stopped, thereby, lower power dissipation.
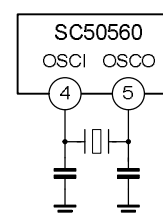

Figure 6. Oscillation Circuit

6. CODE FORMAT MODES

SC50560 code format comes in three modes: 001, 002 and 003. Please refer to the diagram below:

SC50560 Version	Description	Minimum Number of Words Transmitted
SC50560-001	Mode A Code Format:Custom Code Bit 5--C5=0, SEL is connected to VDD	1 word
SC50560-002	Mode A & B Code Formats	3 words
SC50560-003	Mode A Code Format:Custom Code Bit 5--C5=1, When SEL is connected to Vss	-----

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Both SC50560-001 and SC50560-002 make use of the same operation when the input from terminal CS and the scan output (KO0 to KO4) are connected to make the custom code selection with the exception of the number of word transmitted. Please refer to the table above:

MODE A

The diagram below gives us the transmission code format for Mode A. One Code Word consists of the Leader Code, 8 bits Custom Code followed by a sync. bit, Separator and 8 bits Data Code followed by another sync. bit. Please refer to the diagram below.
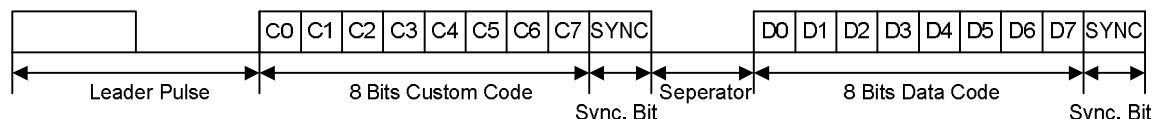
	C0	C1	C2	C3	C4	C5	C6	C7	SYNC		D0	D1	D2	D3	D4	D5	D6	D7	SYNC

Leader Pulse   8 Bits Custom Code   Sync. Bit   Seperator   8 Bits Data Code   Sync. Bit

Figure 7.   Mode A Code Format

Each Code Bit may either be "0" or "1". Please refer to the diagram below.

0.52ms
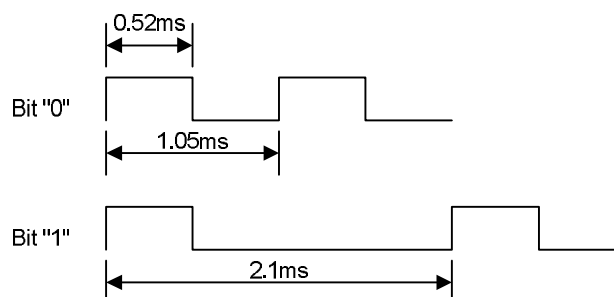
Bit "0"

1.05ms

Bit "1"

2.1ms

Figure 8.   Mode A Bit "0" & "1" Waveform

MODE B

The diagram below gives us the transmission code format for Mode B. Under this mode, the custom codes are not selected, therefore the transmission code only consists of the 6 bits data code followed by a sync. bit. Please refer to the diagram below:
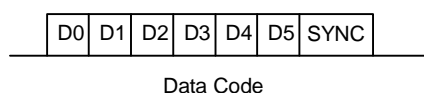
D0	D1	D2	D3	D4	D5	SYNC

Data Code

Figure 9.   Mode B Code Format

A transmission Code Bit may either be "0" or "1". Please refer to the diagram below:
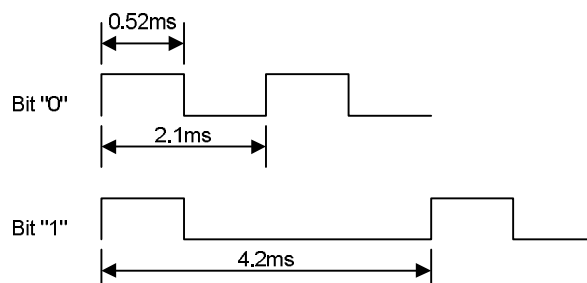
0.52ms

Bit "0"

2.1ms

Bit "1"

4.2ms

Figure 10. Mode B Bit "0" & "1" Waveform Diagram

Under Mode B, a maximum of 32 different instructions may be provided simply by connecting the inputs KI0 to KI3 with the Scan Outputs KO0 to KO7, thereby constructing a 4x8 key matrix. When two or more keys are
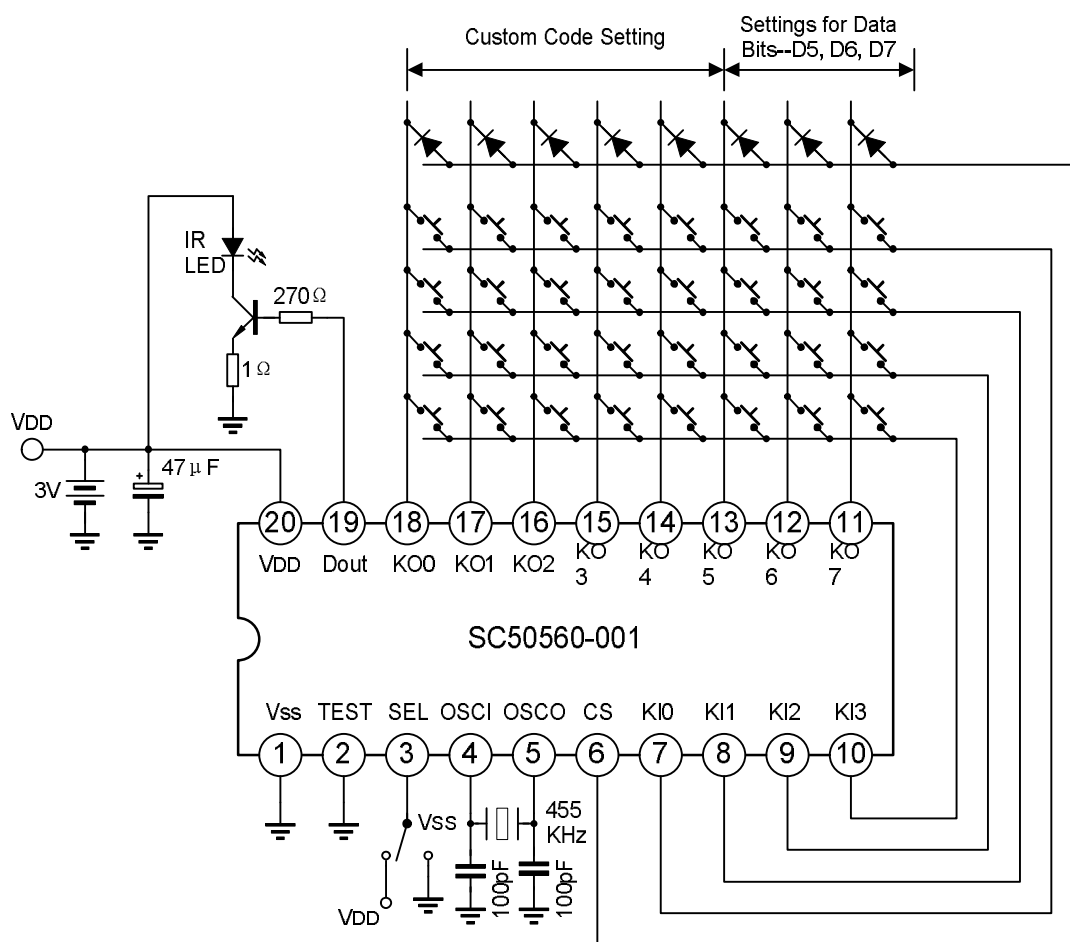
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pressed at the same time, the transmission output Dout is set to and the no transmission occurs. Please refer to the table below.

	KO0	KO1	KO2	KO3	KO4	KO5	KO6	KO7
KI0	00	04	08	0C	10*	14*	18*	1C*
KI1	01	05	09*	0D*	11*	15*	19*	1D*
KI2	02	06	0A*	0E*	12*	16*	1A*	1E*
KI3	03	07	0B*	0F*	13*	17*	1B*	1F*

NOTE: * = Output of a five-word transmission code.

APPLICATION CIRCUIT

1. For 01 and 03 Versions

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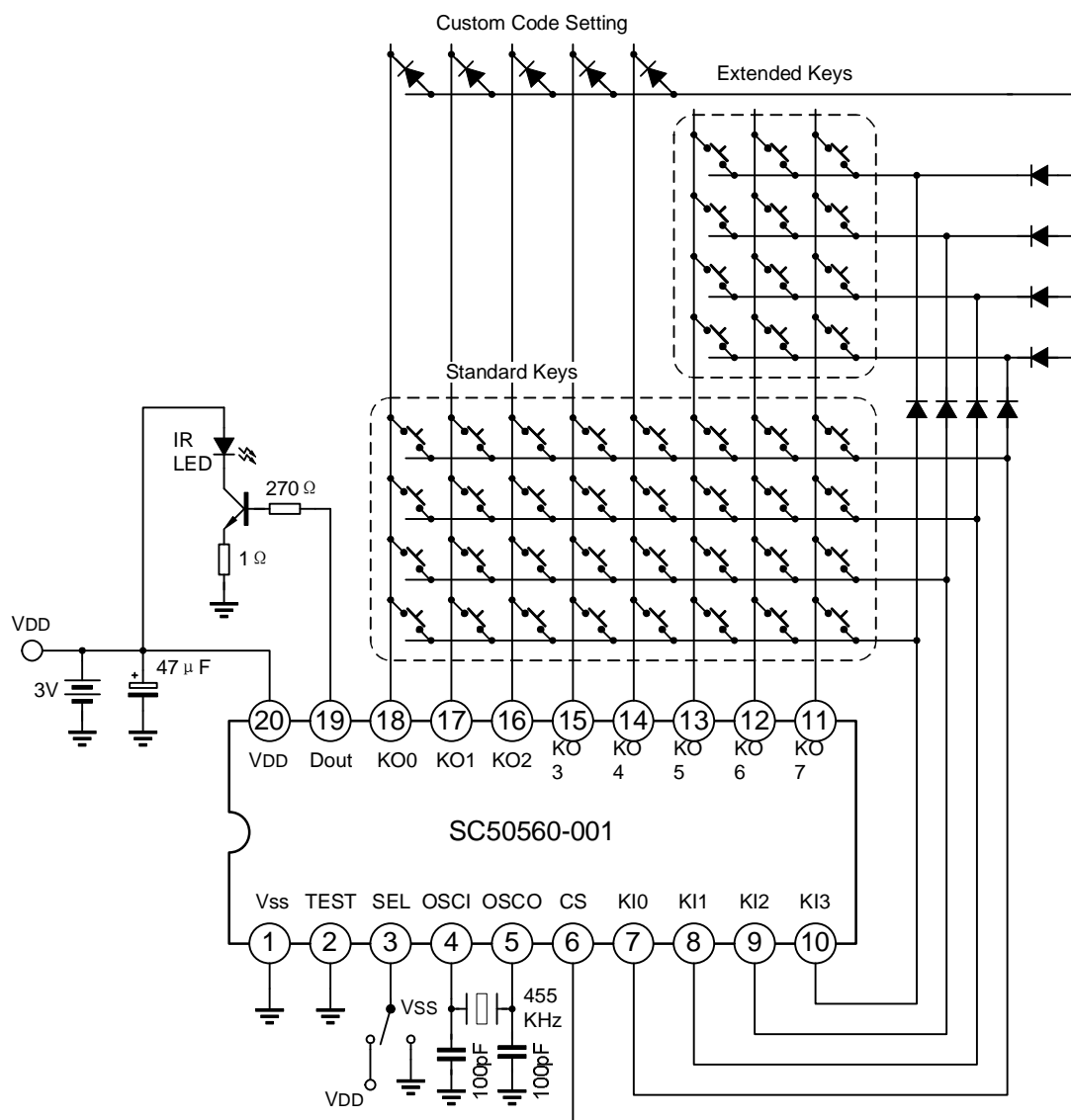
2. Extended Codes

	Standard Code				Extended Code			
	KI0	**KI1**	**KI2**	**KI3**	**KI0**	**KI1**	**KI2**	**KI3**
KO0	00	01	02	03				
KO1	04	05	06	07				
KO2	08	09	0A	0F		Not Used		
KO3	0C	0D	0E	0B				
KO4	10	11	12	13				
KO5	14	15	16	17	34	35	36	37
KO6	18	19	1A	1B	58	60	5A	5B
KO7	1C	1D	1E	1F	9C	8D	9E	9F

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3. Double Key Operation

4. No Leader Code and Custom Code
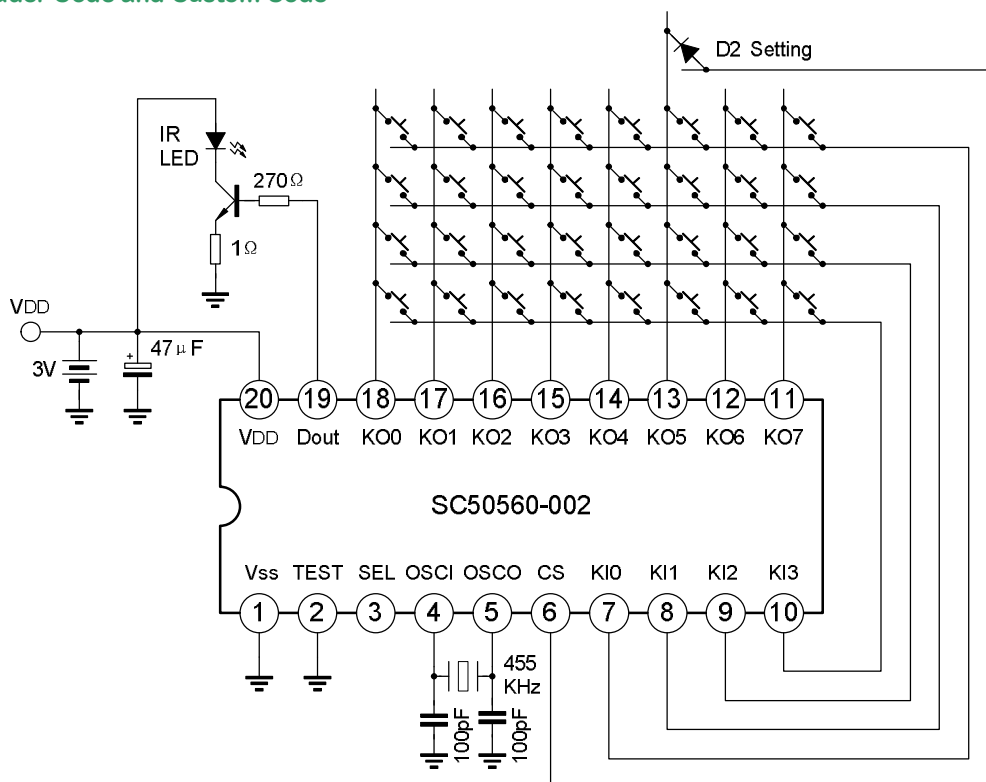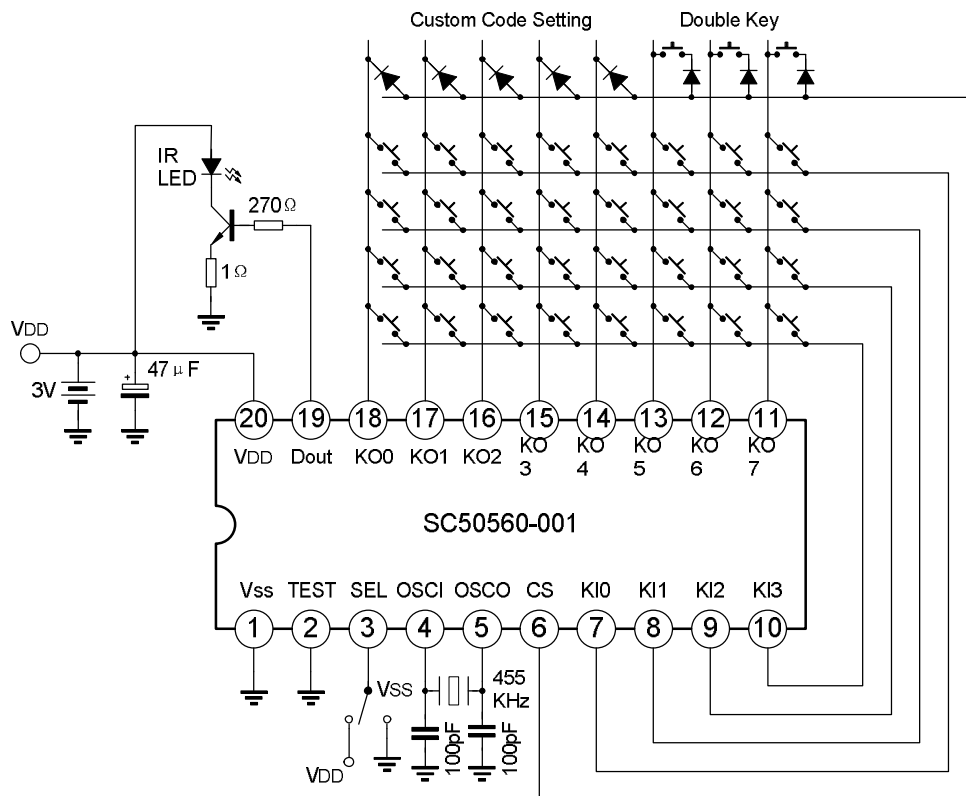
CHIP TOPOGRAPHY

Size: 1.40 x 1.21 mm^2

PAD COORDINATES (Unit: μm)

No.	Symbol	X	Y	No.	Symbol	X	Y
1	P1	-579.10	-35.50	11	P11	579.00	142.30
2	P2	-579.10	-184.50	12	P12	579.00	291.30
3	P3	-579.10	-333.50	13	P13	579.00	440.30
4	P4	-579.10	-482.50	14	P14	270.80	482.50
5	P5	-141.60	-482.50	15	P15	121.80	482.50
6	P6	8.3	-482.50	16	P16	-27.20	482.50
7	P7	421.60	-482.50	17	P17	-176.20	482.50
8	P8	579.00	-304.70	18	P18	-579.10	411.50
9	P9	579.10	-155.70	19	P19	-579.10	262.50
10	P10	579.10	-6.70	20	P20	-579.10	113.50

Note: The original point of the coordinate is the die center.

PCB WIRE LAYOUT SCHEMATIC

Transmitting tube output ground line

The transmitting tube ground line and IC ground line should layout separated or overstriking ground line.
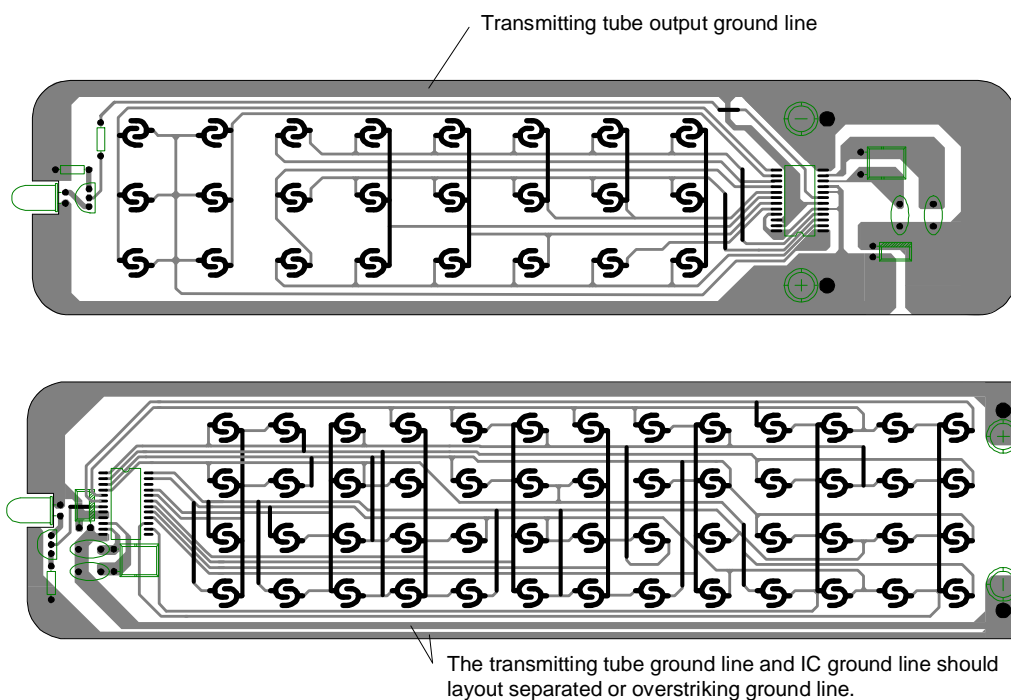
The above IC only use to hint, not to specified.

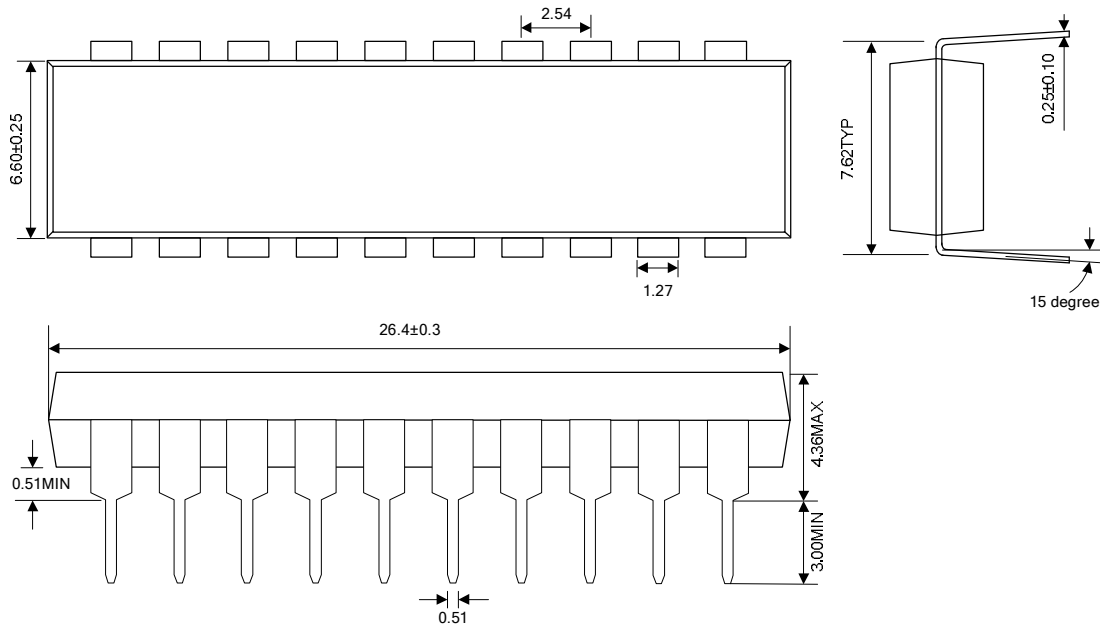**Note:**

* In wire layout, the power filter capacitor should near to IC.
* In wire layout, should avoid power line and ground line too long.
* Recommended infrared transmit unit and IC ground line should layout separated, or overstriking lines.
* The emitter of triode connect 1Ω resistor at least.
* Recommended triode use 9014.

PACKAGE OUTLINE

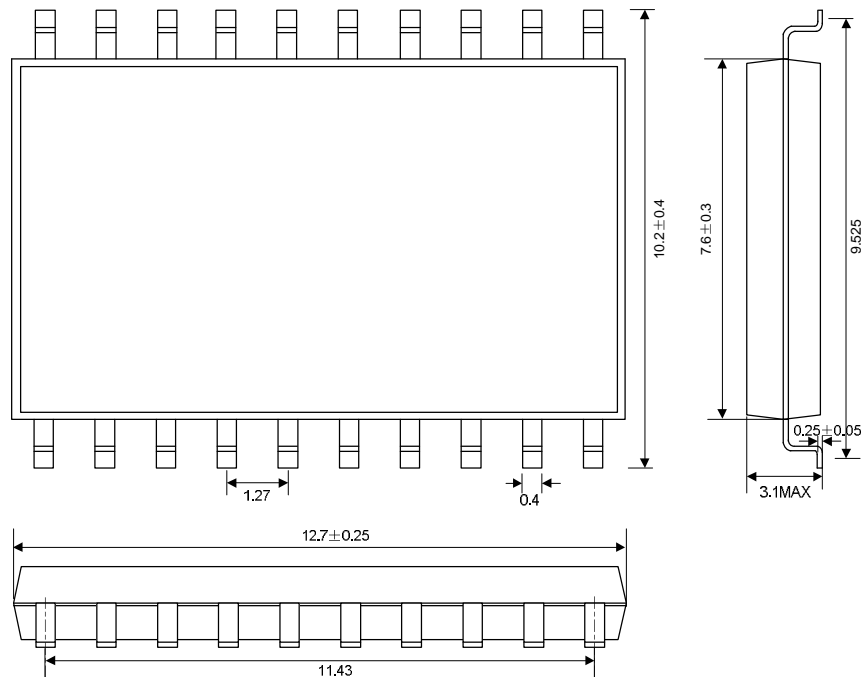### DIP-20-300-2.54   UNIT: mm

2.54

6.60±0.25

7.62TYP

0.25±0.10

1.27

15 degree

26.4±0.3

4.36MAX

0.51MIN

3.00MIN

0.51

SOP-20-375-1.27   UNIT: mm

10.2±0.4

7.6±0.3

9.525

1.27

0.4

0.25±0.05

3.1MAX

12.7±0.25

11.43

CAUTION
ELECTROSTATIC
SENSITIVE DEVICE
DO NOT OPEN OR HANDLE
EXPECT AT A STATIC-FREE
WORKSTATION

HANDLING MOS DEVICES:

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.

ATTACHMENT

Revision History

Data	REV	Description	Page
2000.12.31	2.0	Change name of company in page footer	
2002.01.04	2.1	Delete "or floating " in "6.code format modes"	6
2002.02.28	2.2	Modify the "Pin configuration "	1
		Modify the "Application circuit"	8-11
		Add the "PCB wire layout schematic"	13
		Modify the "Package outline"	14
2002.03.21	2.3	Modify the "figure3" and "figure 4"	4
2004.02.16	2.4	Modify the "FUNCTIONAL DESCRIPTION"	3