

ET6934 - Constant Current LED Controller/driver

General Description

ET6934 is a constant Current LED Controller driver. 8CH constant current segment output lines, 16CH grid output lines. It integrates MCU digital interface, data latch and LED high voltage driver. ET6934 product adopts CMOS technology and is mainly used in small LED display driver.

Features

- CMOS technology
- Support 1-16 scan application, the maximum application matrix is 8 × 16 (8 SEG × 16 GRID)
- Seg constant current drive
- Global gray scale adjustable (constant current 16steps adjust)
- I²C interface
- Build-in RC oscillation
- Built-in power-on reset and low-voltage reset
- Package: SOP28(ET6934M28), SOP32(ET6934M32), EQSOP28(ET6934S)

Device Information

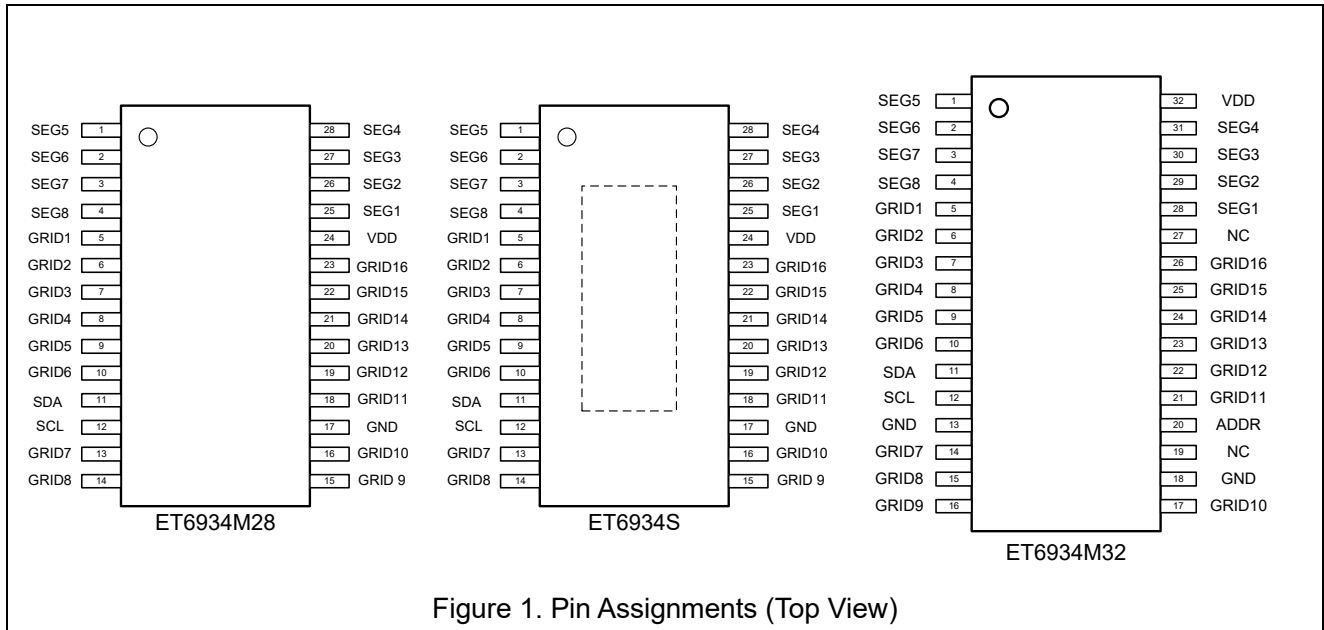
Part No.	Package	Size
ET6934M28	SOP28	10.35mm × 18mm
ET6934M32	SOP32	10mm × 21mm
ET6934S	EQSOP28	9.8mm × 3.8mm

Application

- Household appliances, Toy display
- Smart portable devices, Smart audio

ET6934

Pin Configurations



Pin Description

Symbol	Pin number		Description
	SOP28/EQSOP28	SOP32	
SEG1~SEG8	25~28, 1~4	28~31, 1~4	Segment output, connected to LED anode
GRID1~GRID16	5~10, 13~16, 18~23	5~10, 14~17, 21~26	Grid output, connected to LED cathode
SDA	11	11	I ² C Serial data input
SCL	12	12	I ² C Serial clock input
GND	17	13, 18	GND
ADDR	-	20	Chip address input
VDD	24	32	Power supply
NC	-	19, 27	

ET6934

Functional Description

ET6934 is a constant current driver chip based on I²C communication protocol for LED display panel. It supports up to 8 × 16 bits of output, and can adjust the number of scanning bits (GRID port) through register configuration, so as to obtain larger single-point driving current.

Compared with the traditional LED display panel driver chip, when the number of LED lights changes, the current of a single LED will change, which will affect the brightness of the display; while the constant current design of ET6934 is adopted, when the display mode is configured, the current of each LED will remain constant, and will not fluctuate due to the number of LED lights.

Serial Port Interface (I²C)

Bus Interface

MCU can transmit data with ET6934 each other through SDA and SCL port. SDA and SCL composite bus interface, and a pull-up resistor to the power supply should be connected.

Data Validity

When the SCL signal is HIGH, the data of SDA port is valid and stable. Only when the SCL signal is low, the level on the SDA port can be changed.

Start (Re-start) and Stop Working Conditions

When the SCL signal is high, SDA signal from high to low represents start or re-start working conditions, while the SCL signal is high, SDA signal from low to high represents stop working conditions.

Byte format

Each byte of data line contains 8 bits, which contains an acknowledge bit. The first data is transmitted MSB.

Acknowledge

During the writing mode, ET6934 will send a low level response signal with one period width to the SDA port. During the reading mode, ET6934 will not send response signal and the host will send a high response signal one period width to the SDA.

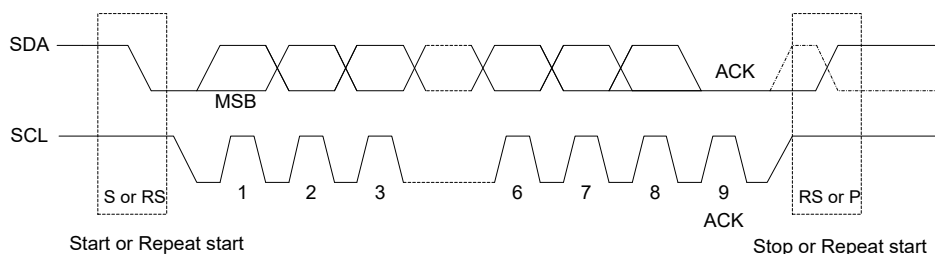


Figure 2. I²C write mode

- ACK=Acknowledge
- MSB=Most Significant Bit
- S=Start Conditions RS=Restart Conditions P=Stop Conditions
- Fastest Transmission Speed =400KBITS/S
- Restart: SDA-level turnover as expressed by the dashed line waveform

ET6934

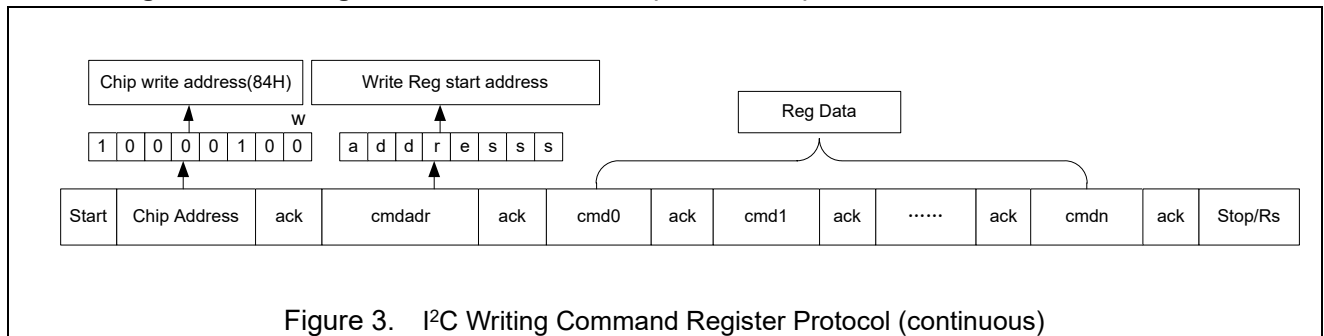
Chip-Address

ET6934 has 2 chip-address(Only to ET6934M32):

Two I ² C Chip-Address		Description
ADDR Connect PIN	Chip address	W/R mode
VDD	86H	Writing mode
GND	84H	Writing mode

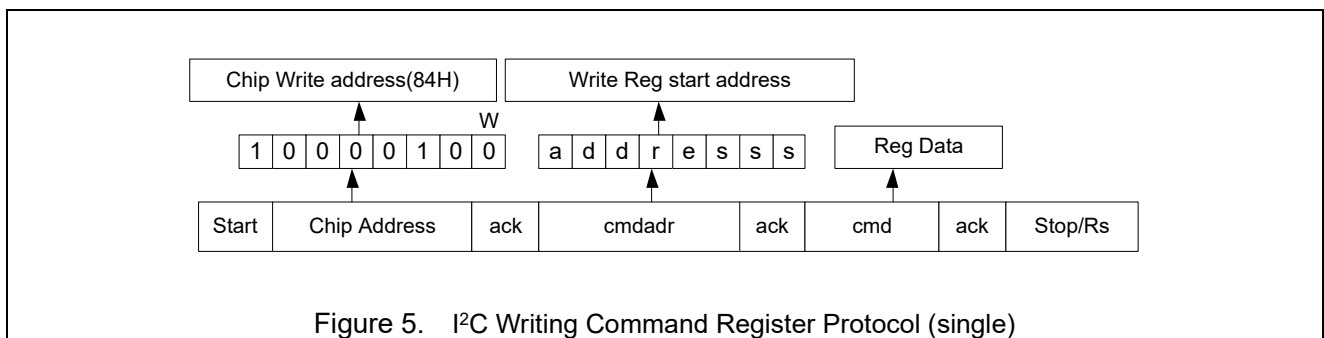
Note: ET6924M28 and ET6934S chip-address is fixed 84H

I²C Writing Command Register Interface Protocol (continuous):



- Start = Start Conditions
- Chip Address = Write register address = 10000100
- ack = Acknowledge from ET6934
- Write Reg start address byte = cmdadr (REG's 8bit address)
- ack = Acknowledge from ET6934
- Command Reg data 0=cmd0(Command data)
- ack = Acknowledge from ET6934
-
- Command Reg data n=cmdn(Command data)
- ack = Acknowledge from ET6934
- Stop/Rs=Stop Condition/Restart Condition

I²C Writing Command Register Interface Protocol (single):



- Start =Start Conditions
- Chip Address = Write register address = 0110010+0(w)b

ET6934

- ack = Acknowledge from ET6934
- Write Reg start address byte = cmdadr(REG's 8bit address)
- ack = Acknowledge from ET6934
- Command Reg data =cmd(Command data)
- ack = Acknowledge from ET6934
- Stop/Rs=Stop Condition/Restart Condition

Register Map

Addr	Description
00H~0FH	Display Data Register
10H~11H	Display Mode Register
12H	Status Control Register

Display Data Register

The registers store display data of ET6934, and its address is 16 byte units from 00H - 0FH.

It corresponds to the LED lamp connected by the chip SEG and GRID pins.

Addr	Parameter	Description	Defalt Value
00H	GRID1 Data	Grid1data<7:0> Corresponding control SEG8~SEG1	00H
01H	GRID2 Data	Grid2data<7:0> Corresponding control SEG8~SEG1	00H
02H	GRID3 Data	Grid3data<7:0> Corresponding control SEG8~SEG1	00H
03H	GRID4 Data	Grid4data<7:0> Corresponding control SEG8~SEG1	00H
04H	GRID5 Data	Grid5data<7:0> Corresponding control SEG8~SEG1	00H
05H	GRID6 Data	Grid6data<7:0> Corresponding control SEG8~SEG1	00H
06H	GRID7 Data	Grid7data<7:0> Corresponding control SEG8~SEG1	00H
07H	GRID8 Data	Grid8data<7:0> Corresponding control SEG8~SEG1	00H
08H	GRID9 Data	Grid9data<7:0> Corresponding control SEG8~SEG1	00H
09H	GRID10 Data	Grid10data<7:0> Corresponding control SEG8~SEG1	00H
0AH	GRID11 Data	Grid11data<7:0> Corresponding control SEG8~SEG1	00H
0BH	GRID12 Data	Grid12data<7:0> Corresponding control SEG8~SEG1	00H
0CH	GRID13 Data	Grid13data<7:0> Corresponding control SEG8~SEG1	00H
0DH	GRID14 Data	Grid14data<7:0> Corresponding control SEG8~SEG1	00H
0EH	GRID15 Data	Grid15data<7:0> Corresponding control SEG8~SEG1	00H
0FH	GRID16 Data	Grid16data<7:0> Corresponding control SEG8~SEG1	00H

ET6934

Display Mode Register

Addr: 10h			Reset Register			
Addr	Bit	Bit Name	Default	Access	Description	
10H	7:4	-	0000	-	-	
	3:0	Brightness	1111	W	SEG port output constant current	
					1111	70mA（Default）
					1110	65.6mA
					1101	61.3mA
						
0000	4.37mA					
Addr: 11h			Reset Register			
Addr	Bit	Bit Name	Default	Access	Description	
11H	7:4	-	0000	-	-	
	3:0	Scan rows	1111	W	Number of valid GRID scan rows	
					1111	16rows（default）
					1110	15rows
					1101	14rows
						
0000	1row					

Status Control Register

Addr: 12h			Reset Register		
Addr	Bit	Bit Name	Default	Access	Description
12H	0	Shutdown	0	W	0 Shutdown
					1 Operating mode
	1	Status control	0	W	0 Display off
					1 Display on
	7:2	-	000000	-	- Set to 0 please

Display cycle

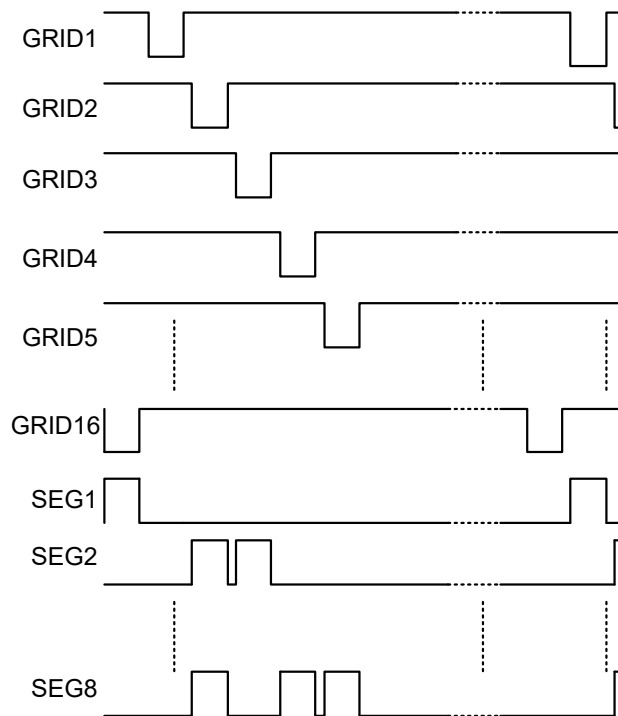


Figure 6. Display Cycle

Command Order

For the first power-on, it is necessary to configure the Status Control Register (12H) to 01H (that is, the circuit is in working state).

Register writing order: Status Control Register→Display Data Register→Display Mode Register→Status Control Register.

Note: Once the D0 of the Status Control Register is configured to 0 and the data is rewritten, it is necessary to configure the Status Control Register to 01H before performing other operations.

ET6934

Absolute Maximum Ratings

(Unless otherwise noted , $T_A = 25^{\circ}\text{C}$, GND = 0V)

Symbol	Parameter name	Condition	Value	Unit
V_{DD}	Supply Voltage		4.5~6.0	V
I_{OS}	SEG output current	$V_{DD}=5V$	-72	mA
I_{OG}	GRID output current	$V_{DD}=5V$	600	mA
P_D	Power Dissipation		830	mW
T_J	Operating Junction Temperature		-40~150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature		-65~150	$^{\circ}\text{C}$

Recommended Operating Range

(Unless otherwise noted , $T_A = 25^{\circ}\text{C}$, GND = 0V)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{DD}	Logic Supply Voltage		5.0		V
V_{IH}	High-Level Input Voltage	$0.7V_{DD}$	-	V_{DD}	V
V_{IL}	Low- Level Input Voltage	0	-	$0.3V_{DD}$	V
T_A	Operating Temperature	-40		85	$^{\circ}\text{C}$

Electrical Characteristics

(Unless otherwise noted, $V_{DD} = 5V$, GND = 0V, $T_A=25^{\circ}\text{C}$)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{SEG}	High-Level Output Current	$V_{DD} = 5V$ $V_O = V_{DD}-1V$, '10H' write 0x0F	-63	-70	-77	mA
I_{OUT}	Low-Level Output Current	$V_O = 0.8V$		560	-	mA
I_{IN}	Input Current	$V_I = V_{DD}$	-	-	± 1	μA
V_{IH}	High-Level Input Voltage	SDA,SCL	$0.7V_{DD}$	-	-	V
V_{IL}	Low-Level Input Voltage	SDA,SCL	-	-	$0.3V_{DD}$	V
V_H	Hysteresis voltage	SDA,SCL	-	0.35	-	V
I_{DD_DYN}	Dynamic Current	No load, Display off	-	-	1	mA
I_{SHUT}	Shutdown current	Shutdown enable			10	μA

ET6934

Switching Character

(Unless otherwise noted, $V_{DD} = 5V$, $GND = 0V$, $T_A = 25^\circ C$)

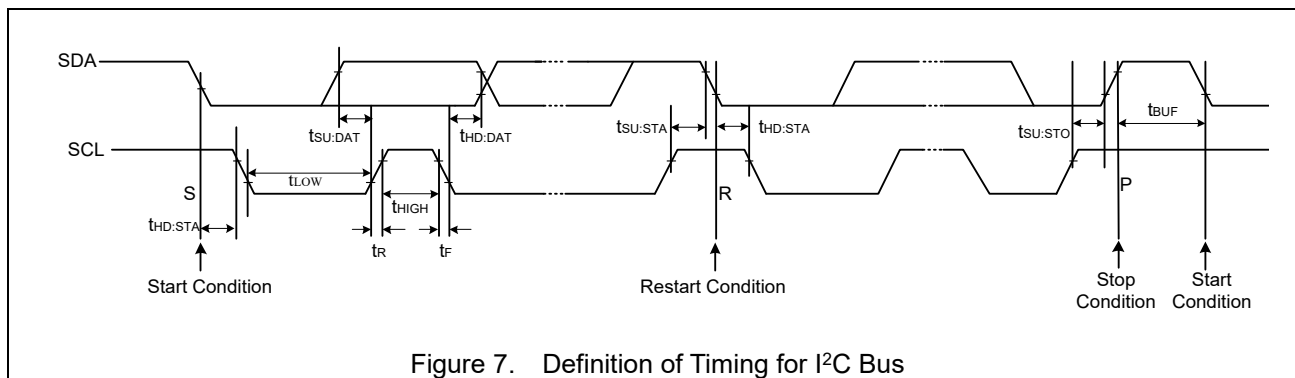
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Rising Time	T_{TZH1}	SEG1~8, $CL=300pF$	-	-	2	us
	T_{TZH2}	GRID1~16, $CL=300pF$	-	-	0.5	us
Falling Time	T_{THZ}	$CL=300pF$, SEGn, GRIDn	-	-	120	us
Input capacitance	C_i	-	-	-	15	pF

I²C Timing Specifications

Symbol	Parameter	Min	Typ	Max	Unit
F_{SCL}	SCL Clock Frequency	0	-	400	KHz
t_{BUF}	Bus Free Time Between STOP and START Condition	1.3	-	-	μs
$t_{HD:STA}$	Hold Time(Repeated) START Condition	0.6	-	-	μs
t_{LOW}	Low Period of SCL Clock	1.3	-	-	μs
t_{HIGH}	HIGH Period of SCL Clock	0.6	-	-	μs
$t_{SU:STA}$	Setup Time for a Repeated START Condition	0.6	-	-	μs
$t_{HD:DAT}$	Data Hold Time	-	-	0.9	μs
$t_{SU:DAT}$	Data Setup Time	100	-	-	ns
t_R	Data Hold Time2	$20+0.1Cb^{(1)}$	-	300	ns
t_F	Data Hold Time2	$20+0.1Cb^{(1)}$	-	300	ns
$t_{SU:STO}$	Setup Time for STOP Condition	0.6	-	-	μs

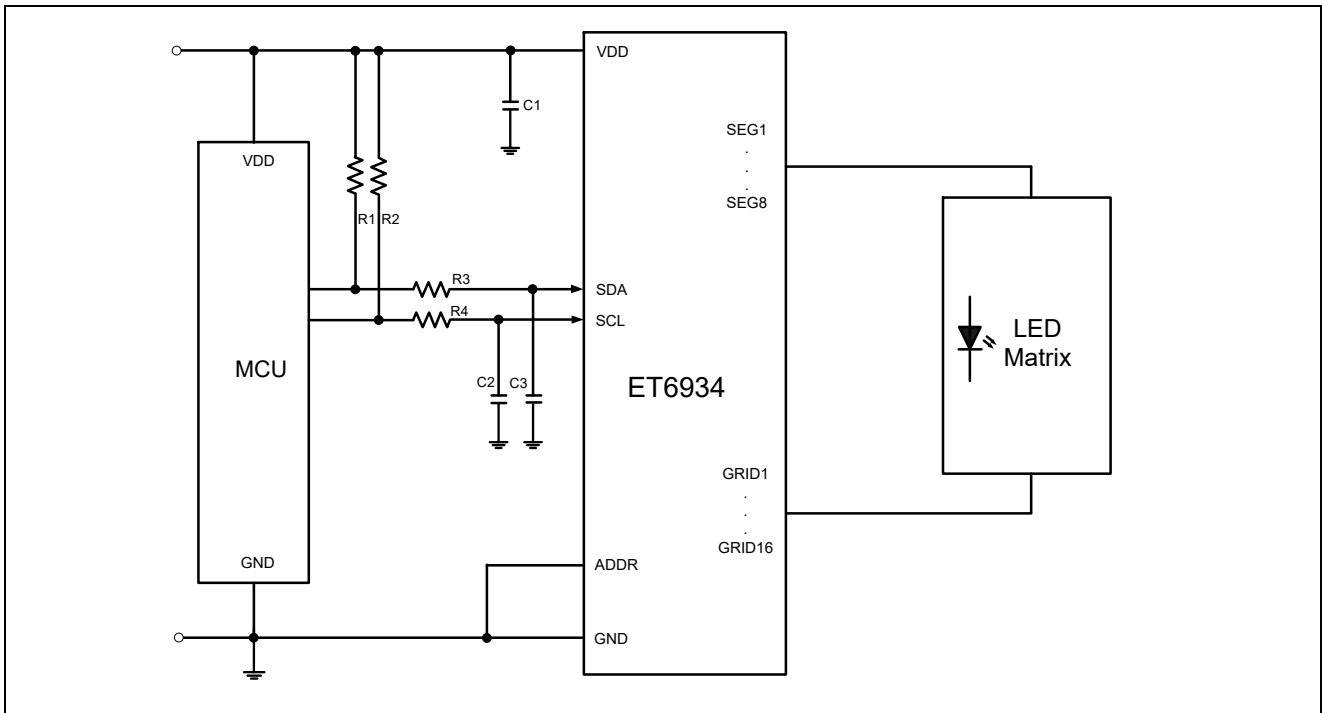
Note 1: C_b =total capacitance of one bus line in PF.

I²C Timing Waveform



ET6934

Application Circuit



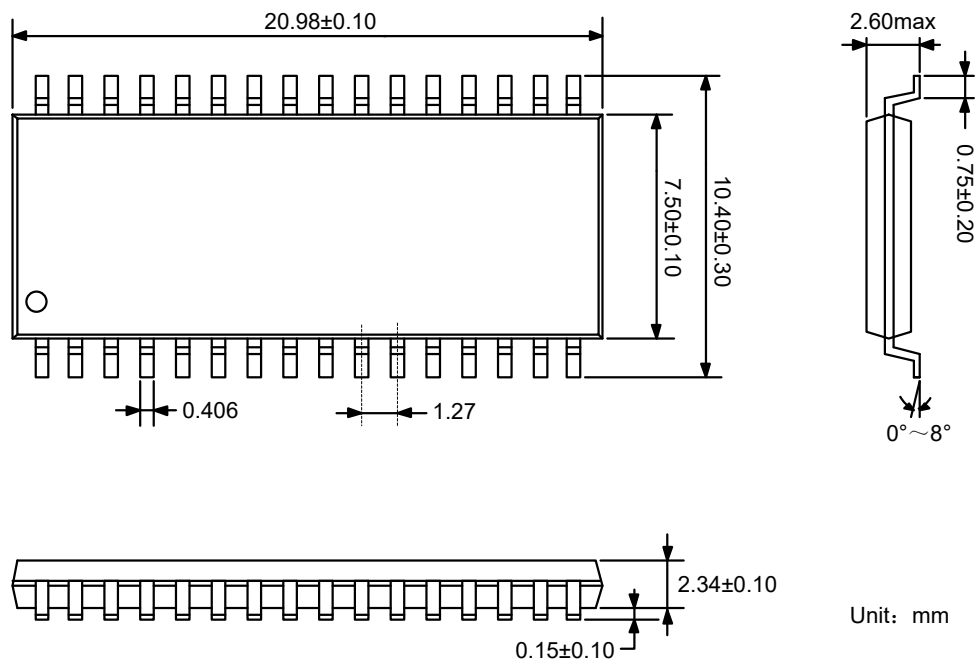
Notes:

1. This application circuit is only for reference.
2. $C1 \geq 1\mu F$ and should be placed as close as possible to the VDD.
3. $R1 \sim R2 = 4.7k\Omega$, $R3 \sim R4 = 100\Omega$, $C2 \sim C3 = 100pF$.
4. The series resistance of the communication port and the capacitor for GND should be placed as close as possible to ET6934, and the resistance value and capacitance value should be adjusted according to the actual anti-interference requirements and verification results.

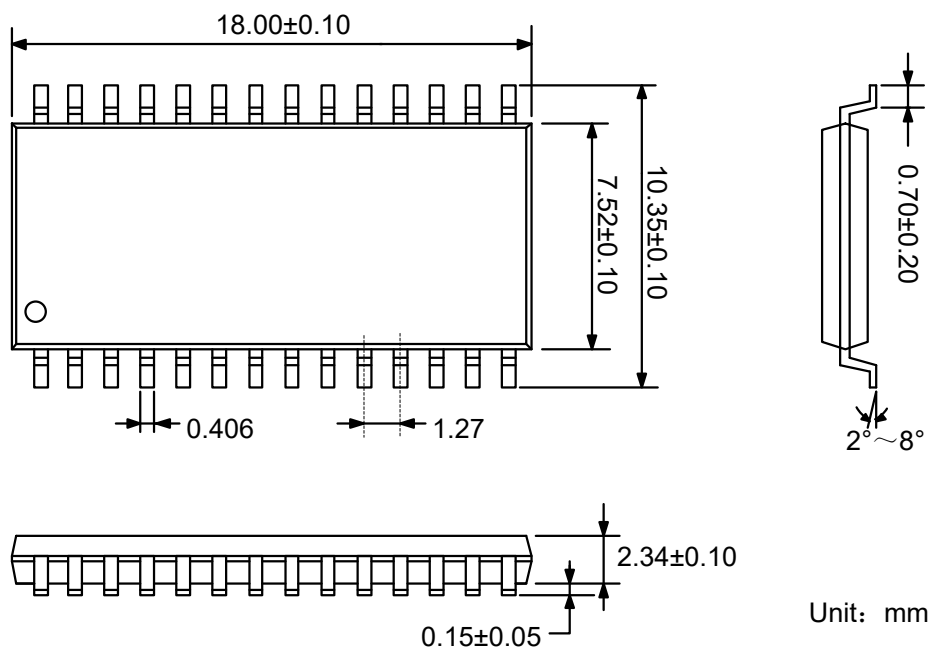
ET6934

Package

SOP32

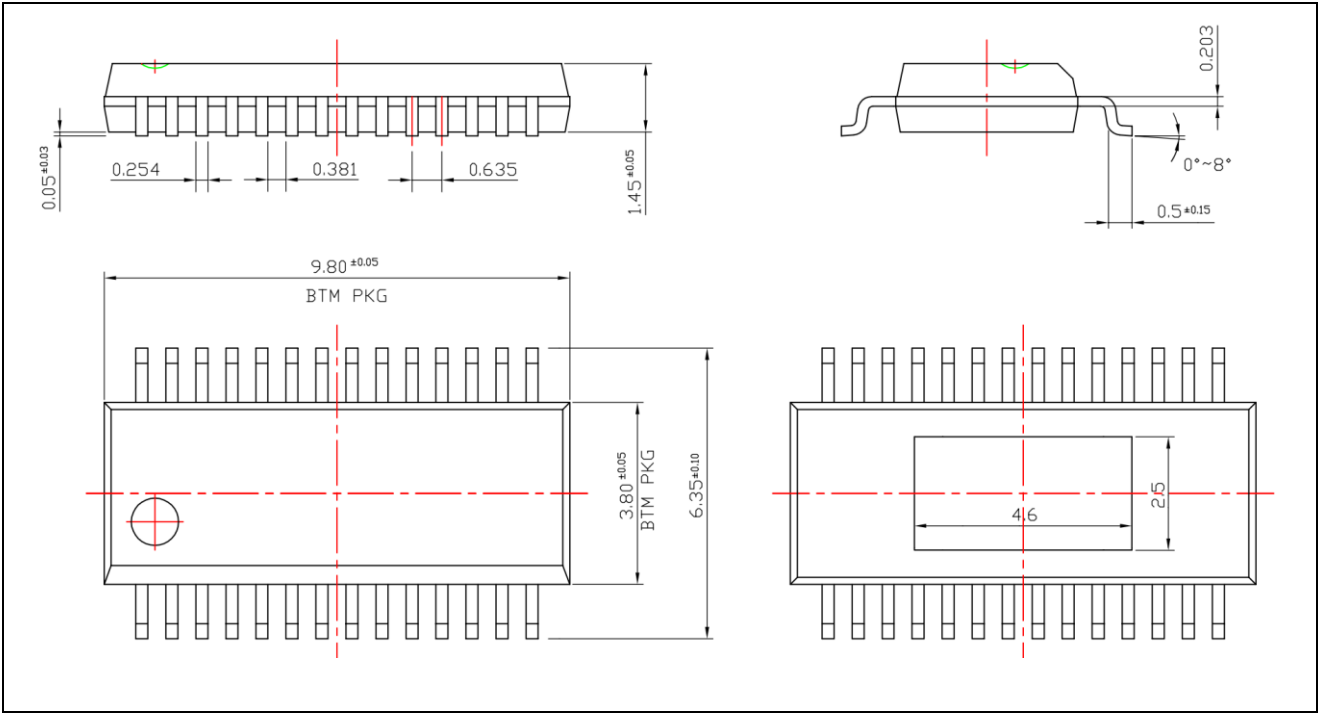


SOP28



ET6934

EQSOP28



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2020-02-24	Original version	Shi Liang Jun	Shi Liang Jun	Zhu Jun Li
1.1	2020-12-01	Updated PD	Shi Liang Jun	Shi Liang Jun	Zhu Jun Li
1.2	2022-06-29	Updated Form	Lvyj Shi Bo	Shi Liang Jun	Zhu Jun Li
1.3	2023-2-29	Add EQSOP28	Shi Bo		LiuJiaYin
1.4	2023-5-11	Change SOP28/SOP32	Shi Bo		LiuJiaYin