General Description

The EC95810 series are highly accurate, ultra-low current consumption voltage detectors, developed using CMOS process. A delay circuit is built-in for microprocessor supervisory circuits in MCU and digital systems. Two output forms N-channel open-drain and CMOS output are available. The device is ideal for battery powered portable devices which require low current consumption.

The EC95810 consists of a comparator, a voltage reference unit, a resistor divider, an output driver, a hysteresis circuit, and a delay circuit. The detection voltage is fixed internally with ±2.0% accuracy by advanced trimming technology.

The devices are available in SOT-23, SC-82 and SC-70 packages.

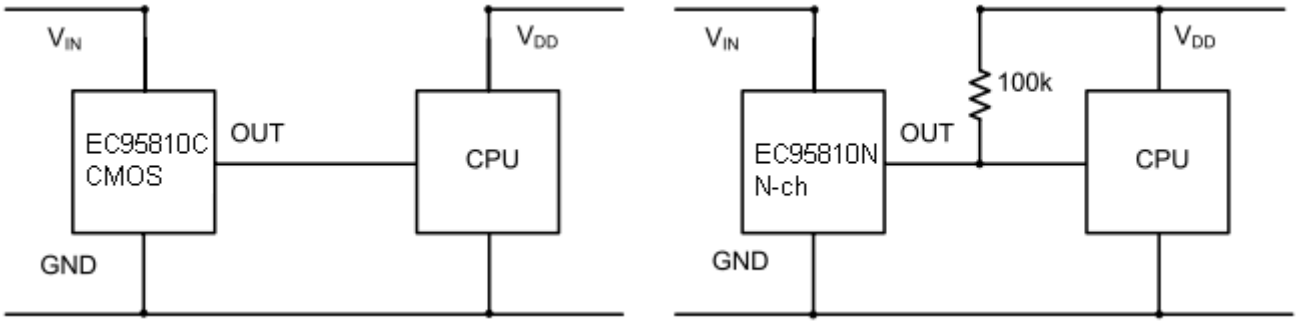
Features

- Ultra-Low Quiescent Current：1.2 μA (Typ.)
- High Accuracy of Detection Voltage：±2%
- Hysteresis Width 5% VDET (Typ.)
- Detection Voltage：1.6V to 6.0V (0.1V Step)
- Built-in Delay Circuit：200ms (Typ.)
- Operating Voltage Range：1.0V to 6.0V
- N-ch Open Drain and CMOS Output
- SOT-23, SC-82 and SC-70 Packages
- RoHS Compliant and 100% Lead (Pb)-Free and Green (Halogen Free with Commercial Standard)

Applications

- Microprocessor Reset Circuitry
- Memory Battery Back-up Circuits
- Power-on Reset Circuits
- Power Failure Detection
- System Battery Life and Charge Voltage Monitors
- Delay Circuitry

Typical Application Circuit



Ordering Information

EC95810 X XX XX X R

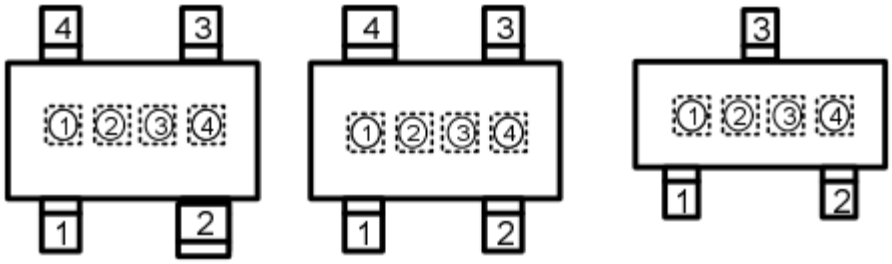
- Circuit Type
- Vout type: N=N-ch Open drain, C=CMOS
- Detection Voltage Code(Exam.): 16=1.6V, 17=1.7V, 18=1.8V, ：
- Package Type：B1=SOT23-3L, C1=SC70-3L, C7=SC82-4L
- Pin Type: SC82-4L: I/S, N：Normal
- R:Tape & Reel

Marking Information

1. SOT23-3L

Package	Part Number	Marking	Marking Information
SOT23-3L	EC95810NXXB1R	95810 NXXYW	XX：Detection Voltage(16=1.6V;17=1.7V 18=1.8V…) Y：Year code(D=2013;E=2014;F=2015…) W：Week Code(The big character of A~Z is for the week of 1~26, and small a~z is for the week of 27~52.
SOT23-3L	EC95810CXXB1R	95810 CXXYW	

2. SC70-3L & SC82-4L



SC82-4L(Pin Type I) SC82-4L(Pin Type S) SC70-3L

① Represents Products Series(See Note1)

② Represents decimal number of detect voltage(See Note 2)

③ Represents week Code of Production Date Code

The big character of A~Z is for the week of 1~26, and small a~z is for the week of 27~52.

④ Represents Pin Type of Product

N is Normal; I is for SC82-4L Pin Type I; S is for SC82-4L Pin Type S

Note：Starting with underlined second digit, a bar is for production year 2012. The next bar is mark on top of 3rd digit is for year 2013. The next bar is mark on bottom of 3rd is for year 2014.The next bar is mark on top of 4th digit is year for 2015. The naming pattern continues with consecutive characters for later years.

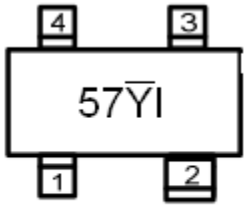
Note 1：Represents Products Series

Mark	Vout Type	Voltage(V)	Mark	Vout Type	Voltage(V)
R	CMOS	0.X	3	N-ch	0.X
T	CMOS	1.X	4	N-ch	1.X
U	CMOS	2.X	5	N-ch	2.X
W	CMOS	3.X	6	N-ch	3.X
0	CMOS	4.X	7	N-ch	4.X
1	CMOS	5.X	8	N-ch	5.X
2	CMOS	6.X	9	N-ch	6.X

Note 2：Represents decimal number of detect voltage

Mark	Voltage(V)	Mark	Voltage(V)
0	X.0	5	X.5
1	X.1	6	X.6
2	X.2	7	X.7
3	X.3	8	X.8
4	X.4	9	X.9

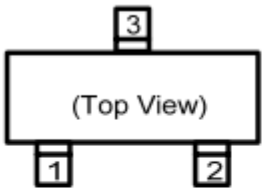
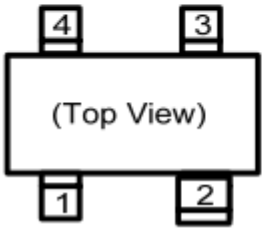
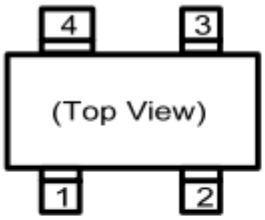
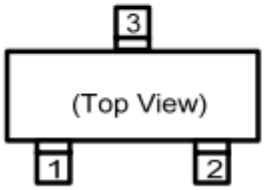
Marking Example：



Part No：EC95810N27C7IR
Date Code：2013 year 24th week

SC82-4L Pin Type I

Pin Description

Part NO.	Part NO.	Pin	Symbol	Pin Description
 SOT-23	EC95810CXXB1NR EC95810NXXB1NR	1	GND	Ground Pin.
		2	V_{OUT}	Regulator Output Pin.
		3	V_{IN}	Regulator Input Pin.
 SC-82	EC95810CXXC7IR EC95810NXXC7IR	1	V_{OUT}	Regulator Output Pin.
		2	V_{IN}	Regulator Input Pin.
		3	NC	No Connect
		4	GND	Ground Pin.
 SC-82	EC95810CXXC7SR EC95810NXXC7SR	1	V_{OUT}	Regulator Output Pin.
		2	V_{IN}	Regulator Input Pin.
		3	NC	No Connect
		4	GND	Ground Pin.
 SC-70	EC95810CXXC1NR EC95810NXXC1NR	1	GND	Ground Pin.
		2	V_{OUT}	Regulator Output Pin.
		3	V_{IN}	Regulator Input Pin.

Absolute Maximum Rating

Parameter		Symbol	Ratings	Units
Input Voltage V_{IN} to GND		V_{IN}	6.0	V
Output Voltage, CMOS		V_{OUT}	GND~V_{IN}+0.3V	V
Output Voltage, N-ch			GND~6V	
Output Current		I_{OUT}	50	mA
Junction Temperature		T_J	+155	°C
Power Dissipation	SOT23-3L	P_D	310	mW
	SC82-4L		250	
	SC70-3L		250	
Operating Ambient Temperature		T_{OPR}	-40 ~ +105	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C
Lead Temperature (soldering, 10sec)			+260	°C

Note：

* The power dissipation values are based on the condition that junction temperature T_J and ambient temperature T_A difference is 100°C.

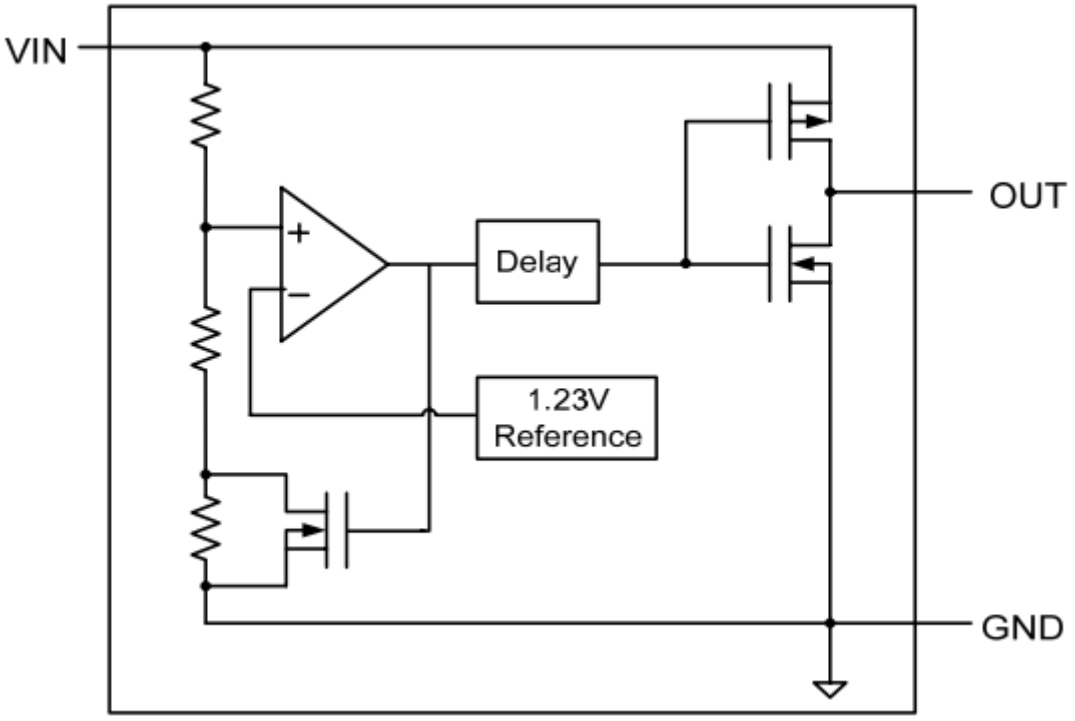
* Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum -rated conditions for extended periods may affect device reliability.

Electrical Characteristics

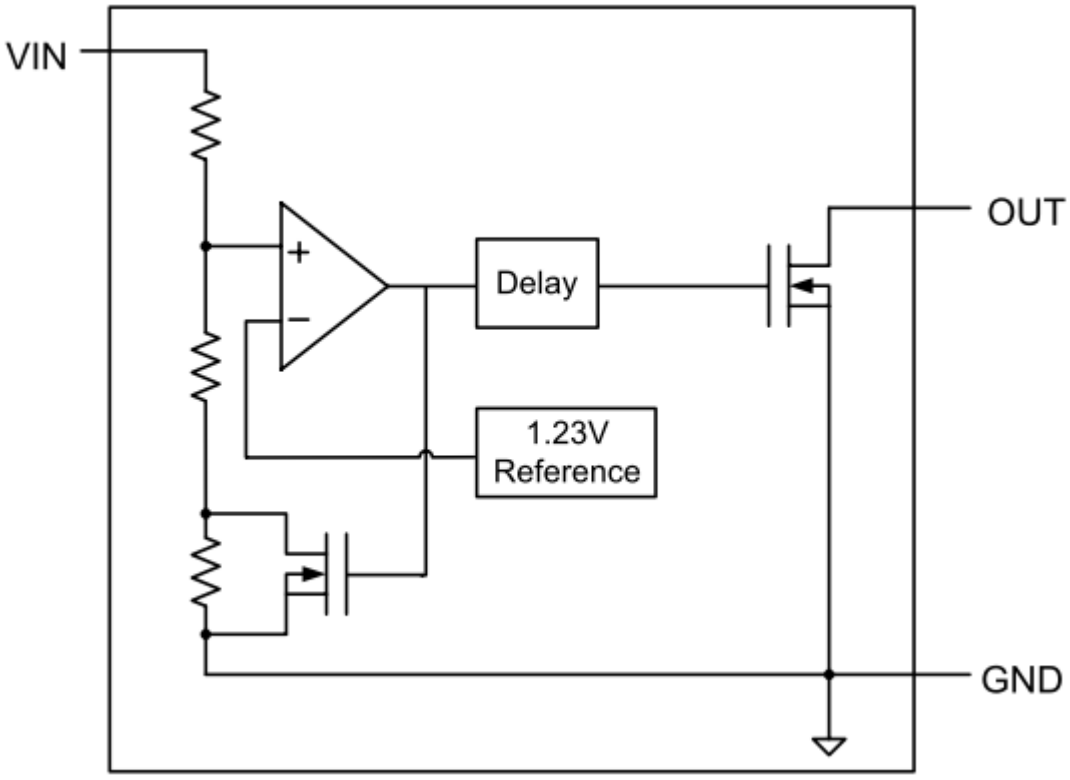
(T_A=25°C, unless otherwise noted.)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Unit
V_{IN}	Operating Voltage			1.0		6.0	V
V_{DET}	Detection Voltage			V_{DET}* 0.98	V_{DET}	V_{DET}* 1.02	V
V_{HYS}	Hysteresis Width			V_{DET}* 0.03	V_{DET}* 0.05	V_{DET}* 0.08	V
I_Q	Quiescent Current	V_{IN}=5V			1.2	3.5	µA
I_{OUT}	Output Current	N-ch Output	V_{IN}=2V	3	7		mA
			V_{IN}=3V	5	10		
			V_{IN}=5V	7	13		
I_{LEAK}	Leakage Current	N-ch, V_{IN}=V_{OUT}=5V				0.1	µA
T_C	Temperature Coefficient	-40°C<T_A< +105°C			100	350	ppm/ °C
T_{DLY}	Transient Delay Time			100	200	400	mS

Function Block Diagram



CMOS Output



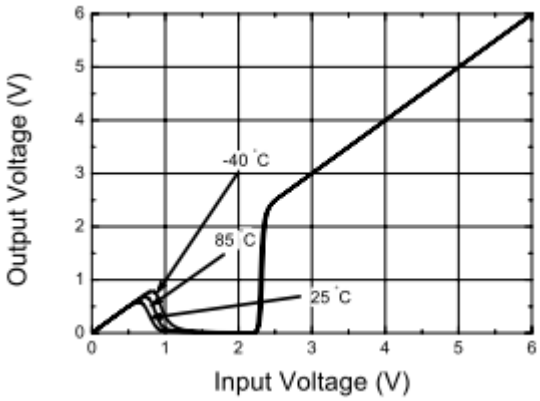
N-ch Open drain Output

Typical Operating Characteristics

(EC95810N22C7IR tested, T_A=+25℃, unless otherwise noted.)

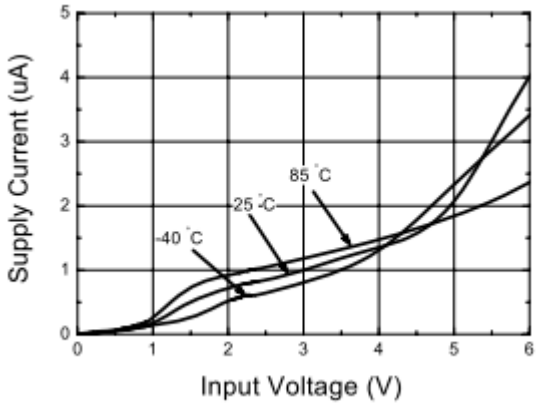
(1) Output Voltage vs. Input Voltage

EC95810N22C7IR



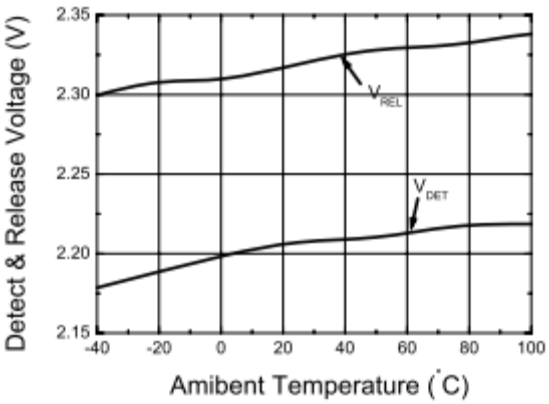
(2) Supply Current v.s Input Voltage

EC95810N22C7IR



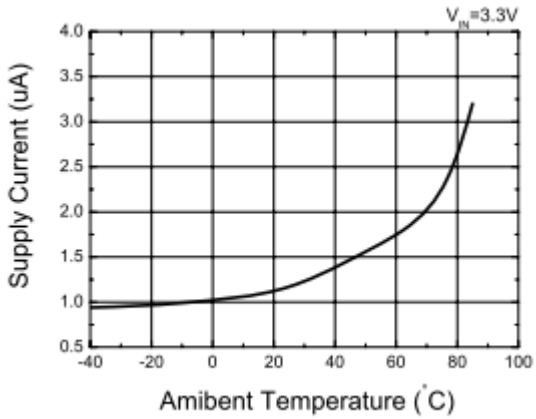
(3) Detect Voltage v.s Amibent Temperature

EC95810N22C7IR

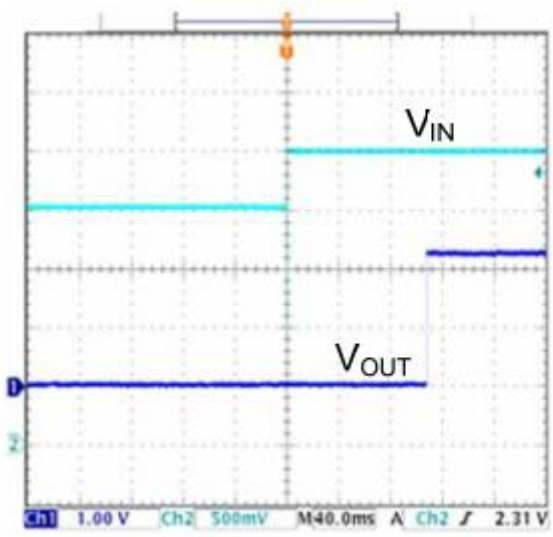


(4) Supply Current v.s Amibent Temperature

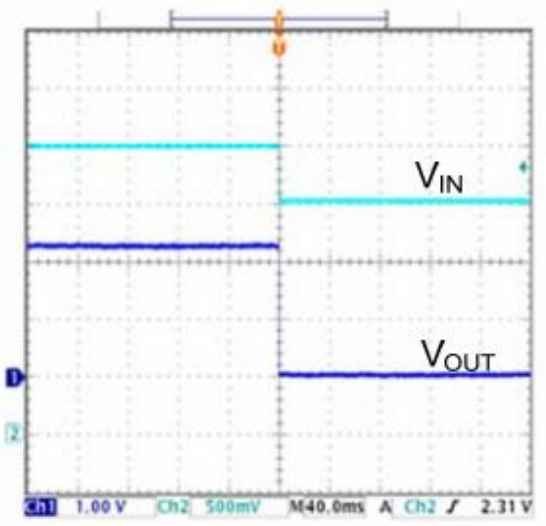
EC95810N22C7IR



(5) Start-up Voltage Waveform



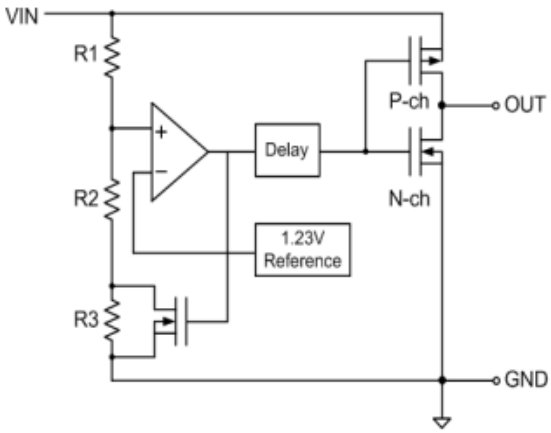
(6) Shutdown Voltage Waveform



Detail Description

Basic Operation

For EC95810C CMOS Active low output:



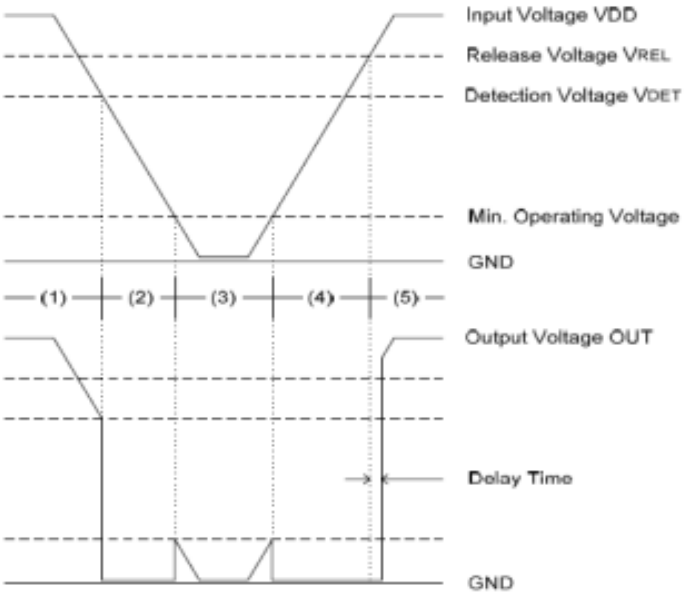
(1) When the input voltage V_{IN} is higher than the release voltage V_{REL} (V_{REL} = V_{DET} + V_{HYS}), the N-ch MOS is OFF and P-ch MOS is ON to provide V_{IN} at the output. Since NMOS is OFF, the comparator input voltage is

V_{IN} x (R2+R3) / (R1+R2+R3)
When the V_{IN} goes below the V_{REL}, V_{IN} keeps at the output since V_{IN} remains above the detection voltage V_{DET}. The difference between V_{REL} and V_{DET} is the hysteresis range.
(2) When the V_{IN} goes below the V_{DET}, the N-ch MOS is ON and P-ch MOS is OFF to provide GND level at the output. At this time NMOS is ON, the comparator input voltage is

V_{IN} x R2 / (R1+R2)

(3) When the V_{IN} falls below the minimum operating voltage, the output becomes undefined changed to V_{IN} if the output is pulled up to V_{IN}.

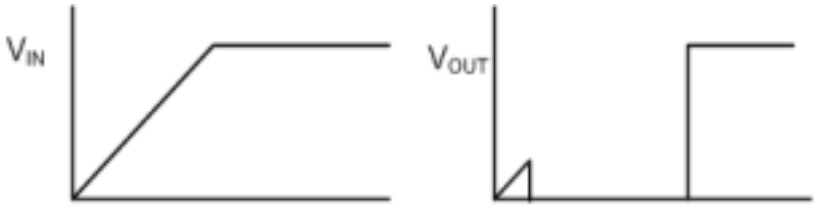
(4) When the V_{IN} rises above the minimum operating voltage, the GND level appears at the output. The GND level keeps at the output even when V_{IN} goes above the detection voltage V_{DET}, as long as it doesn't exceed the release voltage V_{REL}.



(5) When the V_{IN} rises above the release voltage V_{REL}, the N-ch MOS is OFF and P-ch MOS is ON to provide V_{IN} at the output after the delay time counted by the internal delay circuit.

Delay Circuit

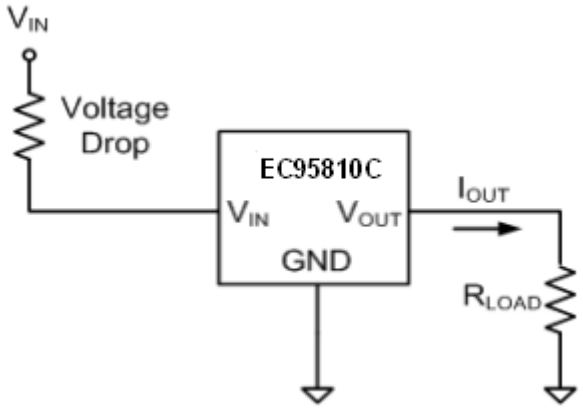
The delay circuit delays the output signal from the time when the power voltage V_{IN} exceeds the release voltage (V_{REL}). The output signal is not delayed when the V_{IN} goes below the detection voltage (V_{DET}). The built-in delay circuit provides benefits of MCU system reliability and low cost by eliminating external components. The output waveform relative to input signal is shown in the figure.



Oscillation Notice

When a resistor is connected between the input voltage and the input pin V_{IN} with CMOS output configuration, oscillation may occur due to voltage drop at R_{IN}. The voltage drop is

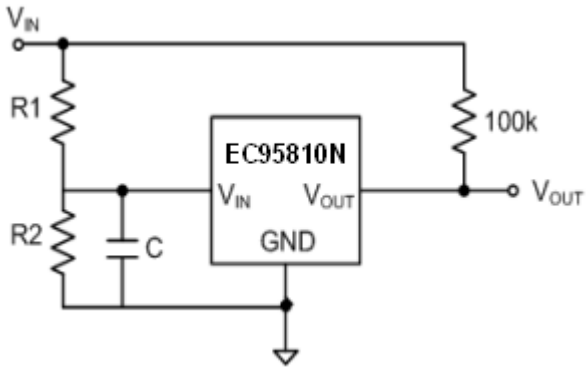
$V_{DROP} = R_{IN} \times I_{OUT}$



When the V_{IN} input voltage rises above the release voltage, the detector output voltage increases and the load current I_{OUT} will flow at R_{LOAD}. A voltage drop is produced at R_{IN}. The voltage drop will also lead to a fall in the input voltage at V_{IN} pin. When the V_{IN} input voltage falls below the detection voltage, output voltage falls to GND and the output current will cease. Then the voltage drop at R_{IN} will disappear, and the V_{IN} input voltage will rise to commence release operation. Oscillation may occur with this release detection-release repetition. It's recommended not to use the CMOS configuration when a resistor R_{IN} is connected between V_{IN} input pin and the powersource. Please use N-channel open drain configuration when R_{IN} is required.

Change of Detection Voltage

For EC95810N N-channel open drain output configuration, the detection voltage can be changed with resistance dividers as shown in the next figure.

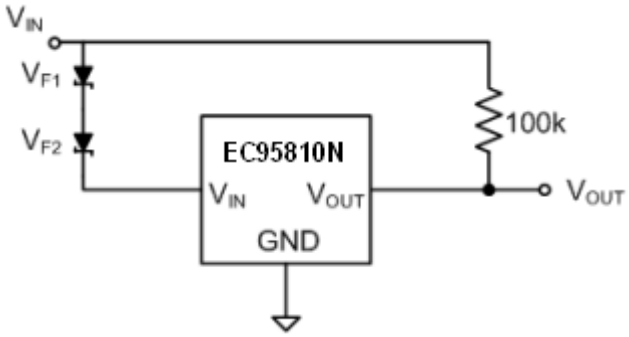


Detection voltage is changed to
V_{DET} x (R1+R2) / R2

Hysteresis width is also changed to

V_{HYS} x (R1+R2) / R2

Resistor R1 should be 75 kΩ or less to avoid oscillation. The detection voltage can also be changed with diodes as shown in the figure.

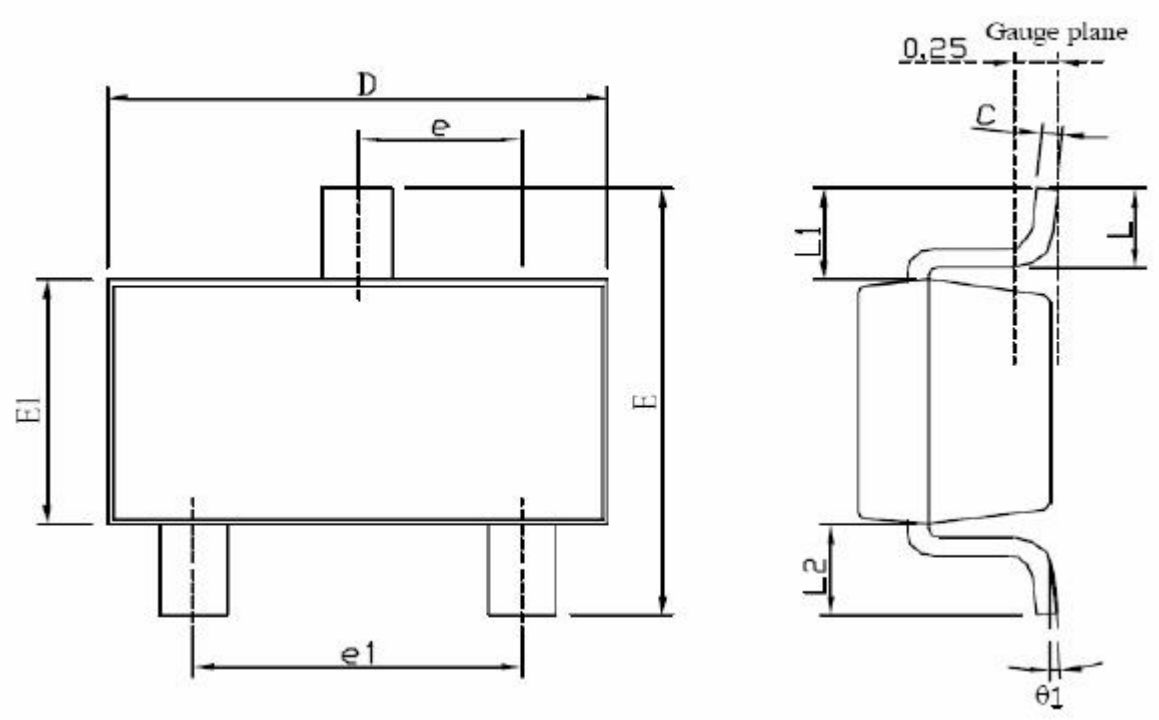


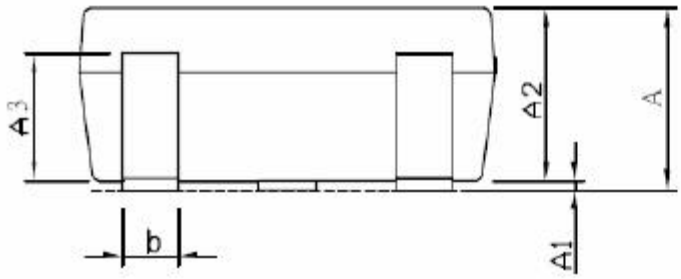
Detection voltage becomes

$V_{F1} + V_{F2} + V_{DET}$

Mechanical Dimensions

OUTLINE DRAWING SOT23-3L

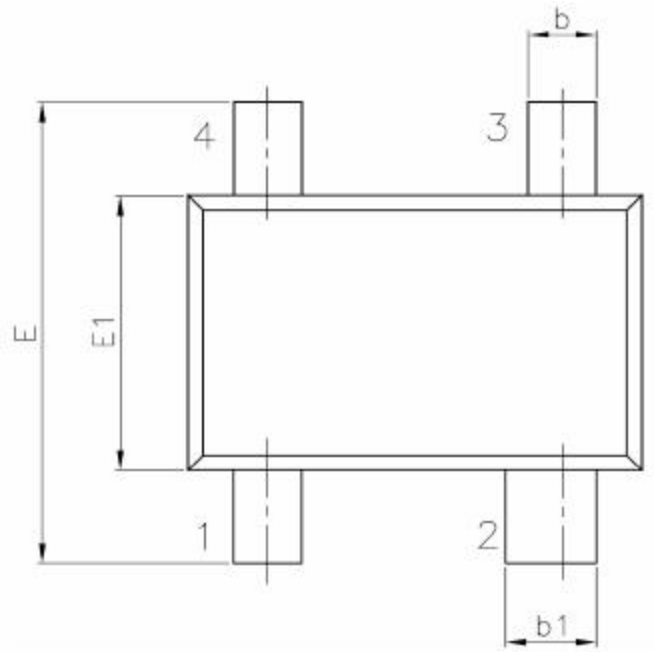


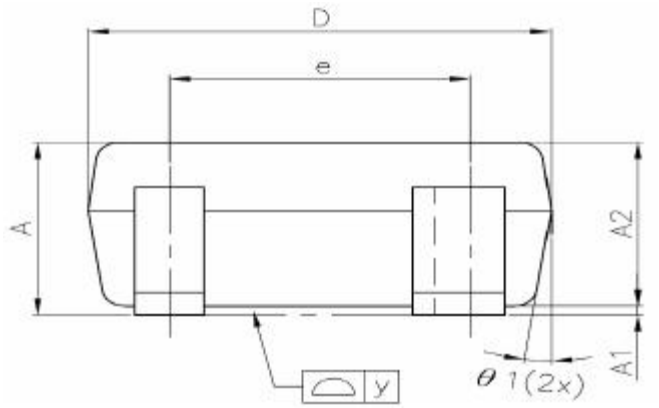


Symbols	Dimensions in Millmeters		
	Min	Nom	Max
A	1.00	1.10	1.40
A1	0.00	0.05	0.10
A2	1.00	1.10	1.30
A3	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.12	0.125	0.225
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	---	0.95(Typ)	---
e1	---	1.90(Typ)	---
θ1	1°	5°	9°
L	0.37	---	---
L1	---	0.6REF	---
L1-L2	---	---	0.12

Mechanical Dimensions

OUTLINE DRAWING SC82-4L(Pin Type I)

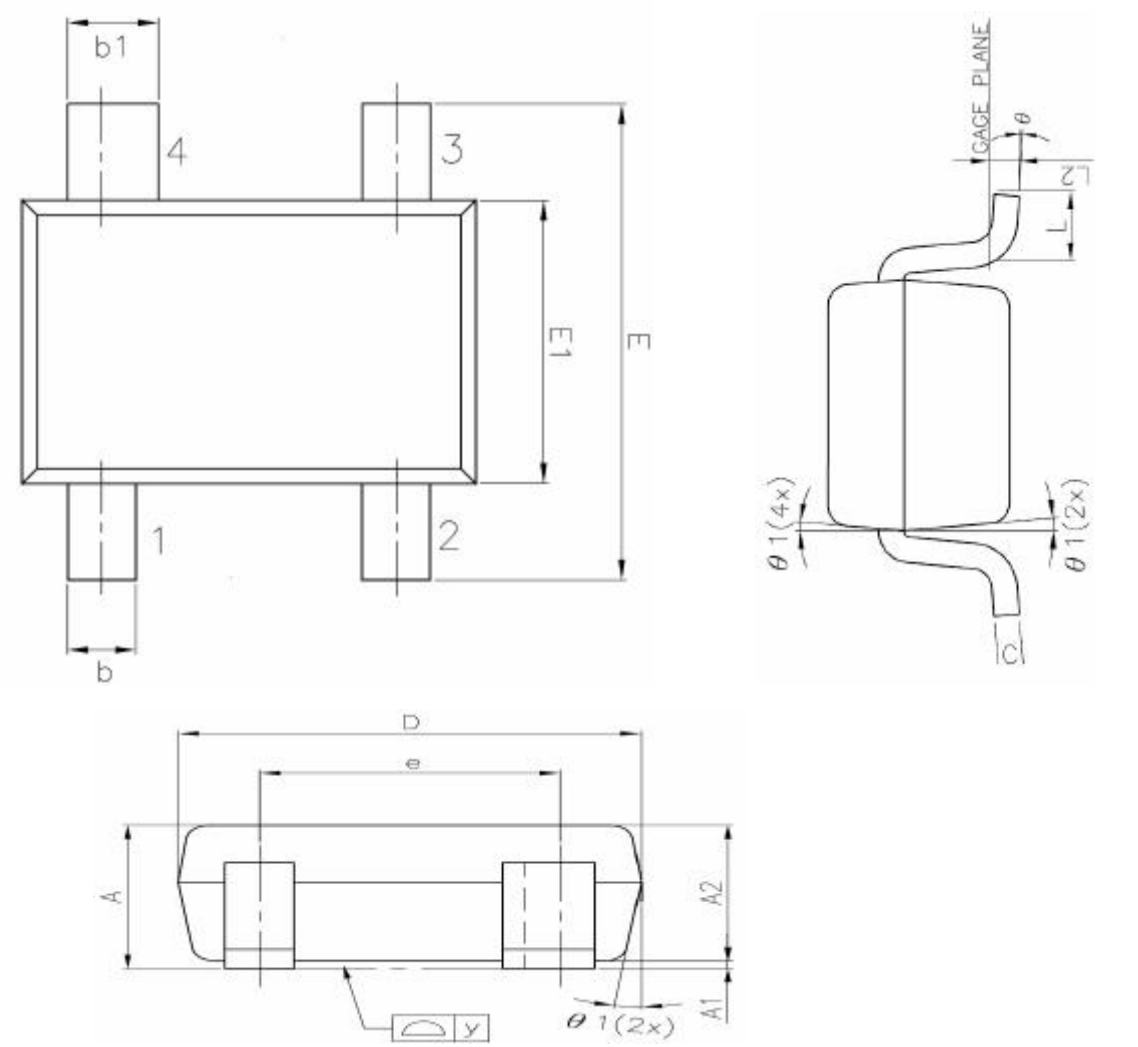




Symbols	Dimension in millimeters			Dimension in inches		
	Min	Nom	Max	Min	Nom	Max
A	0.80	---	1.10	0.031	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.25	0.30	0.40	0.010	0.012	0.016
b1	0.35	0.40	0.50	0.014	0.016	0.020
C	0.10	---	0.26	0.004	---	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E1	1.15	1.25	1.35	0.045	0.049	0.053
E	1.80	2.10	2.40	0.071	0.083	0.094
e	---	1.30	---	---	0.051	---
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	---	0.15	---	---	0.006	---
y	---	---	0.10	---	---	0.004
θ	0°	---	8°	0°	---	8°
θ1	4°	---	12°	4°	---	12°

Mechanical Dimensions

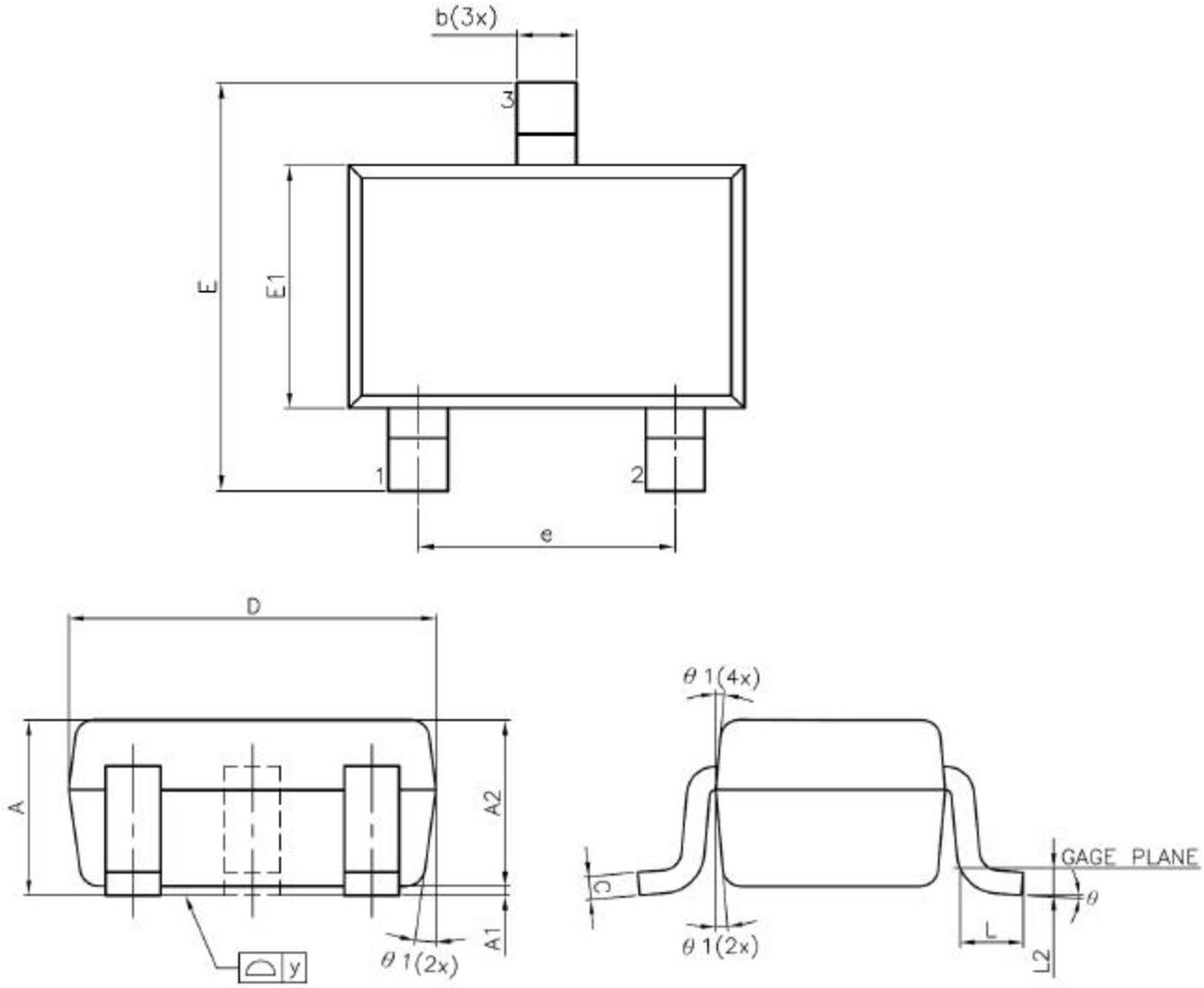
OUTLINE DRAWING SC82-4L(Pin Type S)



Symbols	Dimension in millimeters			Dimension in inches		
	Min	Nom	Max	Min	Nom	Max
A	0.80	---	1.10	0.031	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.25	0.30	0.40	0.010	0.012	0.016
b1	0.35	0.40	0.50	0.014	0.016	0.020
C	0.10	---	0.26	0.004	---	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E1	1.15	1.25	1.35	0.045	0.049	0.053
E	1.80	2.10	2.40	0.071	0.083	0.094
e	---	1.30	---	---	0.051	---
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	---	0.15	---	---	0.006	---
y	---	---	0.10	---	---	0.004
θ	0°	---	8°	0°	---	8°
θ1	4°	---	12°	4°	---	12°

Mechanical Dimensions

OUTLINE DRAWING SC70-3L



Symbols	Dimensions in millmeters			Dimensions in millmeters		
	Min	Nom	Max	Min	Nom	Max
A	0.80	---	1.10	0.031	---	0.043
A1	0.00	---	0.10	0.000	---	0.004
A2	0.70	0.90	1.00	0.028	0.035	0.039
b	0.25	---	0.40	0.010	---	0.016
C	0.08	---	0.22	0.003	---	0.009
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	---	1.30	---	---	0.051	---
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	---	0.15	---	---	0.006	---
y	---	---	0.10	---	---	0.004
θ	0°	4°	8°	0°	4°	8°
θ1	4°	---	12°	4°	---	12°