

# SN7103/P



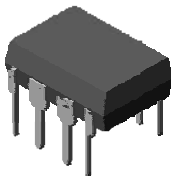
Semiconductor

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Dual Operational Amplifier and  
Voltage Reference



SOP-8



DIP-8

## Description

The SN7103 is a monolithic IC that includes one independent op-amp and another op-amp for which the non inverting input is wired to a 2.5V fixed Voltage Reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

### OPERATIONAL AMPLIFIER

LOW INPUT OFFSET VOLTAGE : 1.0mV

LOW SUPPLY CURRENT : 350uA/op.(@ V<sub>CC</sub> = 5V)

MEDIUM BANDWIDTH (unity gain) : 0.9MHz

LARGE OUTPUT VOLTAGE SWING : 0V to (V<sub>CC</sub> - 1.5V)

INPUT COMMON MODE VOLTAGE RANGE INCLUDES GROUND

WIDE POWER SUPPLY RANGE : 3 to 32V or ( $\pm 1.5$  to  $\pm 16$ V)

### VOLTAGE REFERENCE

FIXED OUTPUT VOLTAGE REFERENCE 2.5V

0.4% AND 1% VOLTAGE PRECISION

SINK CURRENT CAPABILITY : 1 to 100mA

TYPICAL OUTPUT IMPEDANCE : 0.2 $\Omega$

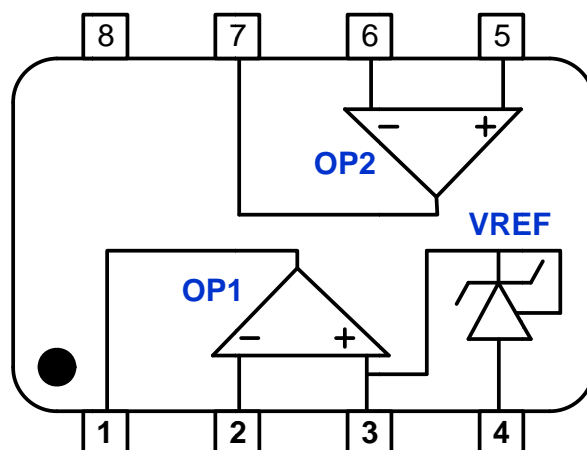
## ORDERING INFORMATION

Product	Marking	Package
SN7103	SN7103	SOP-8
SN7103P	SN7103	DIP-8

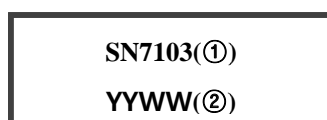
## Application

- ◆ Battery chargers
- ◆ AC to DC Power Supply

## Block Diagram



### ▲ Marking Detail Information



- ① Device Code
- ② Week Code

## ◆ Pin connection



## ◆ Pin Configuration

No.	Name	Function
1	Output 1	OP-AMP 1 Output
2	Input 1 (-)	OP-AMP 1 Inverting Input
3	Input 1 (+)	OP-AMP 1 Non-Inverting Input
4	$V_{EE}$	GND or Negative Supply Voltage Input
5	Input 2 (+)	OP-AMP 2 Non-Inverting Input
6	Input 2 (-)	OP-AMP 2 Inverting Input
7	Output 2	OP-AMP 2 Output.
8	$V_{CC}$	Supply Voltage Input

◆ Absolute Maximum Ratings (  $T_a = 25^\circ\text{C}$  )

Parameter	Symbol	Limits	Unit
DC Supply Voltage	$V_{CC}$	36	V
Differential Input Voltage	$V_{id}$	36	V
Input Voltage	$V_i$	-0.3 to +36	V
Maximum Junction Temperature	$T_j$	150	$^\circ\text{C}$
Operating Junction Temperature Range	$T_{opr}$	-40 ~ +85	$^\circ\text{C}$
Thermal Resistance	$R_{thja}$	175	$^\circ\text{C}/\text{W}$
Storage Temperature Range	$T_{stg}$	-55 ~ +150	$^\circ\text{C}$

◆ Electrical Characteristics (  $T_a = 25^\circ\text{C}$  )

Parameter	Symbol	Min	Typ	Max	Unit
Total Supply Current, excluding current in the voltage reference $V_{CC} = 5\text{V}$ , no load $T_{min} < T_{amb} < T_{max}$ $V_{CC} = 30\text{V}$ , no load $T_{min} < T_{amb} < T_{max}$	$I_{CC}$	-	0.7	1.2	mA
		-	-	2.0	

◆ **Electrical characteristics**

[ **Independent OP-AMP 2** ]

(  $V_{CC}=+5V$ ,  $V_{EE}=\text{Ground}$ ,  $V_O=1.4V$ ,  $T_A=25^\circ\text{C}$  ; unless otherwise specified )

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input Offset Voltage	$V_{io}$	$T_a = 25^\circ\text{C}$	-	1.0	4.0	mV
		$T_{min.} < T_a < T_{max}$	-	-	5.0	
Input Offset Voltage Drift	$DV_{io}$		-	7.0	-	$\mu\text{V}/^\circ\text{C}$
Input Offset Current	$I_{io}$	$T_a = 25^\circ\text{C}$	-	2.0	30	nA
		$T_{min.} < T_a < T_{max}$	-	-	50	
Input Bias Current	$I_{ib}$	$T_a = 25^\circ\text{C}$	-	20	150	nA
		$T_{min.} < T_a < T_{max}$	-	-	200	
Large Signal Voltage Gain	$A_{vd}$	$V_{cc}=15V$ , $R_L=2K$ , $V_o=1.4V$ to $11.4V$	50	100	-	V/mV
		$T_{min.} < T_a < T_{max}$	25	-	-	
Supply Voltage Rejection Ratio	SVR	$V_{cc}=5V$ to $30V$	65	100	-	dB
Input Common Mode Voltage Range	$V_{icm}$	$V_{cc}=30V$ [Note 1]	0	-	$V_{cc}-1.5$	V
		$T_{min.} < T_a < T_{max}$	0	-	$V_{cc}-2.0$	
Common Mode Rejection Ratio	CMR	$T_a = 25^\circ\text{C}$	70	85	-	dB
		$T_{min.} < T_a < T_{max}$	60	-	-	
Output Source Current	$I_{source}$	$V_{cc}=15V$ , $V_o=2V$ , $V_{id}=1V$	20	40	-	mA
Short Circuit to Ground	$I_O$	$V_{cc}=15V$	-	40	60	mA
Output Sink Current	$I_{sink}$	$V_{cc}=15V$ , $V_o=2V$ , $V_{id}=-1V$	10	20	-	mA
High Level Output Voltage	$V_{OH}$	$V_{cc}=30V$ , $R_L=10K$	27	28	-	V
		$T_{min.} < T_a < T_{max}$	27	-	-	
Low Level Output Voltage	$V_{OL}$	$R_L=10K$	-	5	20	mV
		$T_{min.} < T_a < T_{max}$	-	-	20	
Slew Rate at Unity Gain	SR	$V_i=0.5V$ to $3V$ , $V_{cc}=15V$ $R_L=2K$ , $C_L=100pF$	0.2	0.4	-	V/ $\mu\text{s}$
Gain Bandwidth Product	GBP	$V_{cc}=30V$ , $R_L=2k$ , $C_L=100pF$ , $f=100kHz$ , $V_{in}=10mV$	0.5	0.9	-	MHz
Total Harmonic Distortion	THD	$F=1kHz$ , $A_v=20dB$ , $R_L=2k$ , $V_{cc}=30V$ , $C_L=100pF$ , $V_o=2V_{pp}$	-	0.02	-	%

Note 1 : The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V_{CC} - 1.5V$  But either of both inputs can go to  $+36V$  without damage.

◆ **Electrical characteristics**

[ Independent OP-AMP 1 with non-inverting input connected to the internal Vref ]

(  $V_{CC}=+5V$ ,  $V_{EE}=\text{Ground}$ ,  $T_A=25^\circ\text{C}$  ; unless otherwise specified )

Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input Offset Voltage	$V_{io}$	$T_a = 25^\circ\text{C}$	-	1.0	4.0	mV
		$T_{min.} < T_a < T_{max}$	-	-	5.0	
Input Offset Voltage Drift	$DV_{io}$	-	-	7.0	-	$\mu\text{V}/^\circ\text{C}$
Input Bias Current (negative input)	$I_{ib}$	-	-	20	-	nA
Large Signal Voltage Gain	$A_{vd}$	$V_{cc}=15V$ , $R_L=2K$ , $V_{icm}=0V$	-	100	-	V/mV
Supply Voltage Rejection Ratio	SVR	$V_{cc}=5V$ to $30V$ $V_{icm}=0V$	65	100	-	dB
Output Source Current	$I_{source}$	$V_{cc}=15V$ , $V_o=2V$ , $V_{id}=1V$	20	40	-	mA
Short Circuit to Ground	$I_o$	$V_{cc}=15V$	-	40	60	mA
Output Sink Current	$I_{sink}$	$V_{cc}=15V$ , $V_o=2V$ , $V_{id}=-1V$	10	20	-	mA
High Level Output Voltage	$V_{OH}$	$V_{cc}=30V$ , $R_L=10K$	27	28	-	V
		$T_{min.} < T_a < T_{max}$	27	-	-	
Low Level Output Voltage	$V_{OL}$	$R_L=10K$	-	5	20	mV
		$T_{min.} < T_a < T_{max}$	-	-	20	
Slew Rate at Unity Gain	SR	$V_i=0.5V$ to $2V$ , $V_{cc}=15V$ $R_L=2K$ , $C_L=100pF$	0.2	0.4	-	V/us
Gain Bandwidth Product	GBP	$V_{cc}=30V$ , $R_L=2k$ , $C_L=100pF$ , $f=100kHz$ , $V_{in}=10mV$	0.5	0.9	-	MHz
Total Harmonic Distortion	THD	$F=1kHz$ , $A_v=20dB$ , $R_L=2k$ , $V_{cc}=30V$ , $C_L=100pF$ , $V_o=2V_{pp}$	-	0.02	-	%

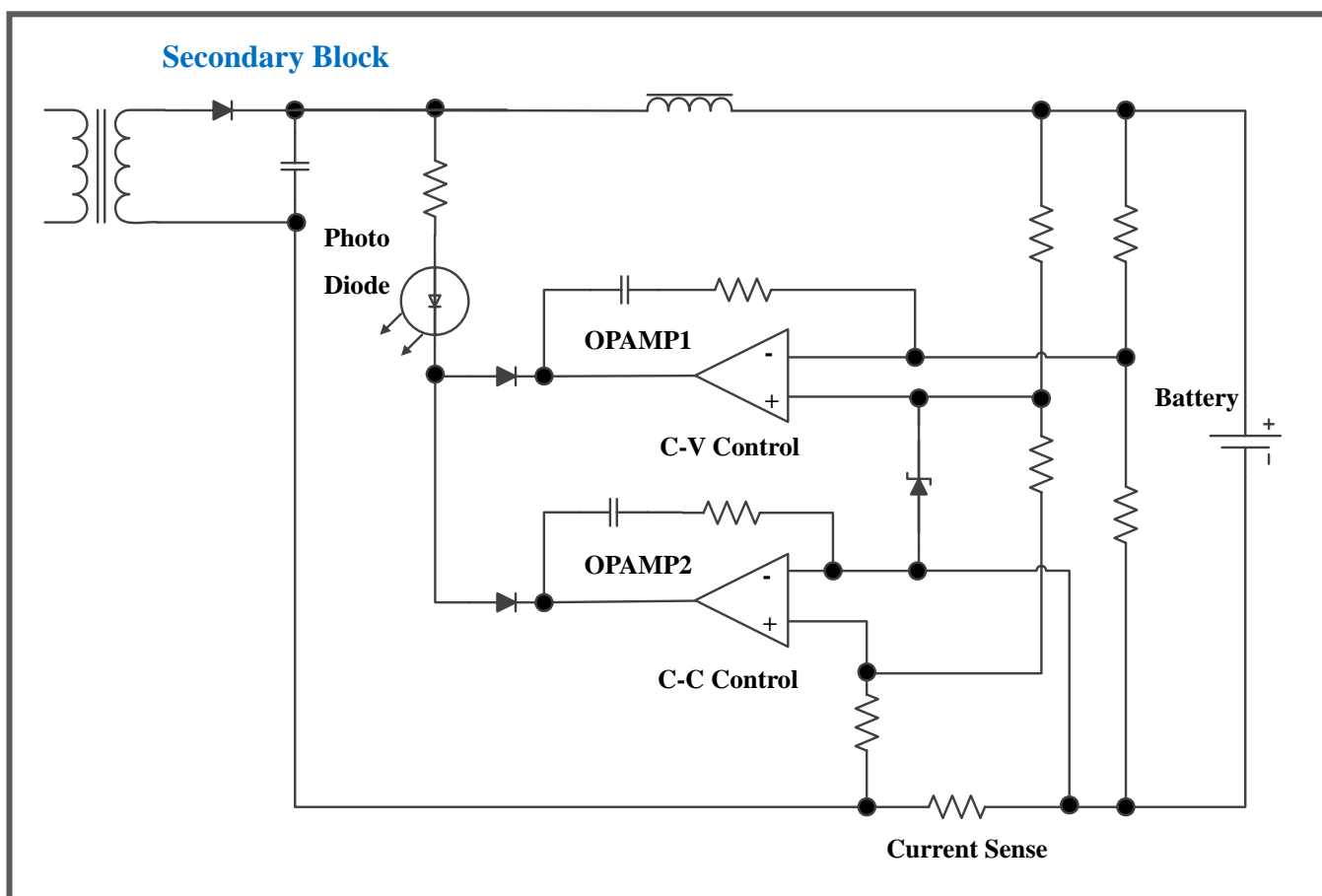
◆ Electrical characteristics

[ Voltage Reference ]

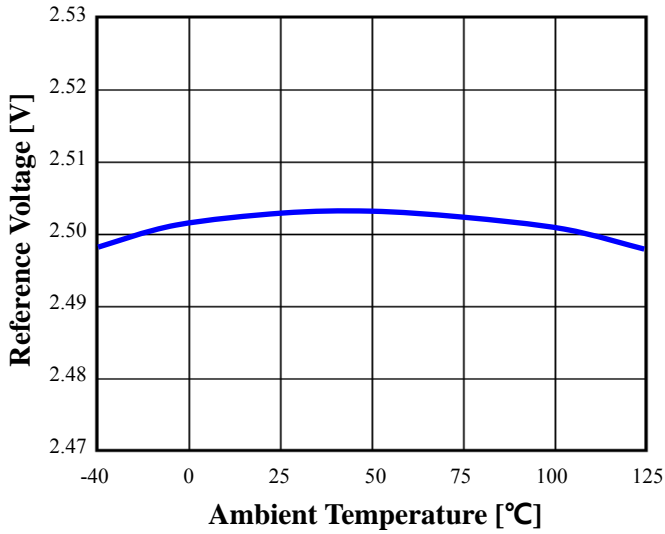
Characteristic	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Cathode Current	$I_K$	-	-	-	100	mA
Reference Input Voltage	$V_{ref}$	$T_a = 25^\circ C$	2.475	2.500	2.525	V
		$T_{min.} < T_a < T_{max}$	2.450	2.500	2.550	
Reference Input Voltage Deviation Over Temperature Range	$\Delta V_{ref}$	$V_{KA} = V_{ref}, I_K = 10mA, T_{min.} < T_a < T_{max}$	-	7	30	mV
Minimum Cathode Current for Regulation	$I_{min}$	$V_{KA} = V_{ref}$	-	0.5	1.0	mA
Dynamic Impedance [note 1]	$ Z_{KA} $	$V_{KA} = V_{ref}, I_K = 1 \text{ to } 100mA, f < 1kHz$	-	0.2	0.5	$\Omega$

Note 1 : the dynamic impedance is defined as  $|ZKA| = \Delta V_{KA} / \Delta I_K$

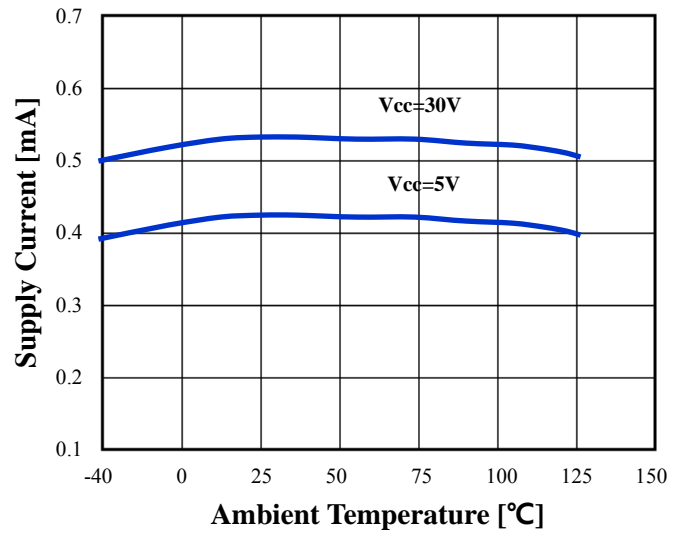
◆ Typical application circuit



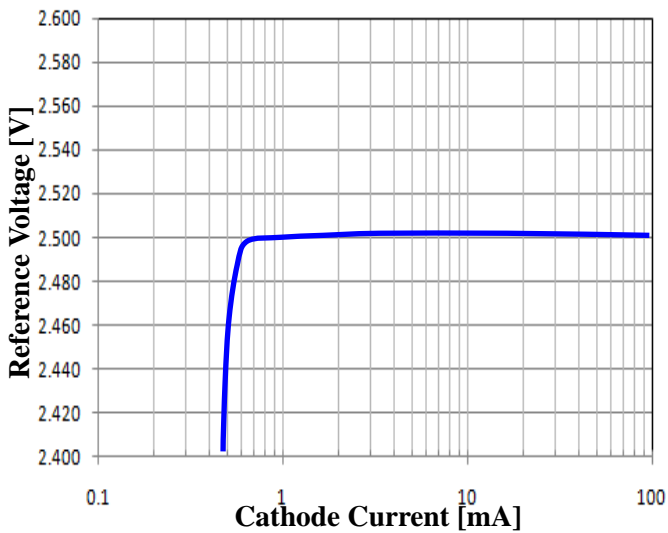
**Fig.1 Reference Voltage vs. Ambient Temp.**



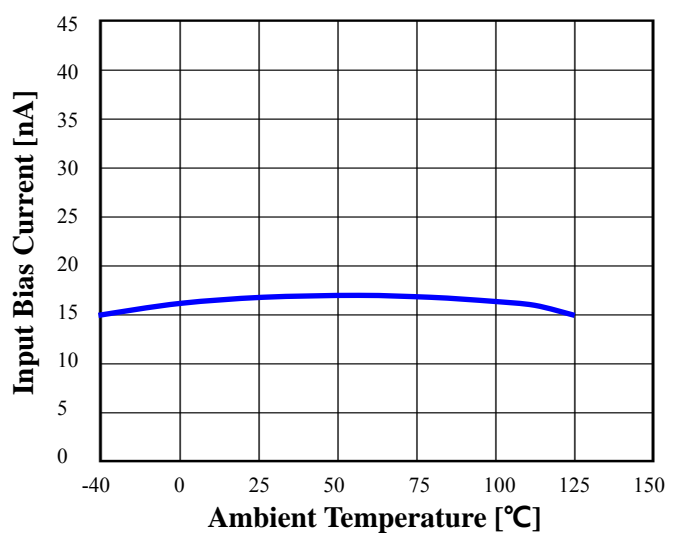
**Fig.2 Supply Current vs. Ambient Temp.**



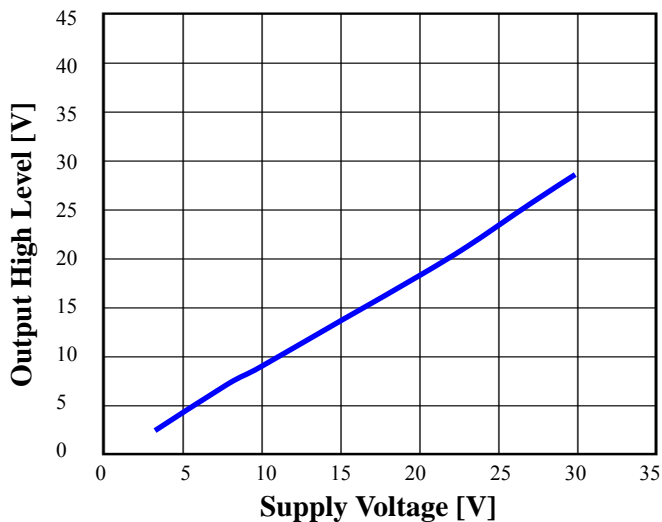
**Fig.3 Reference Voltage vs. Cathode Current**



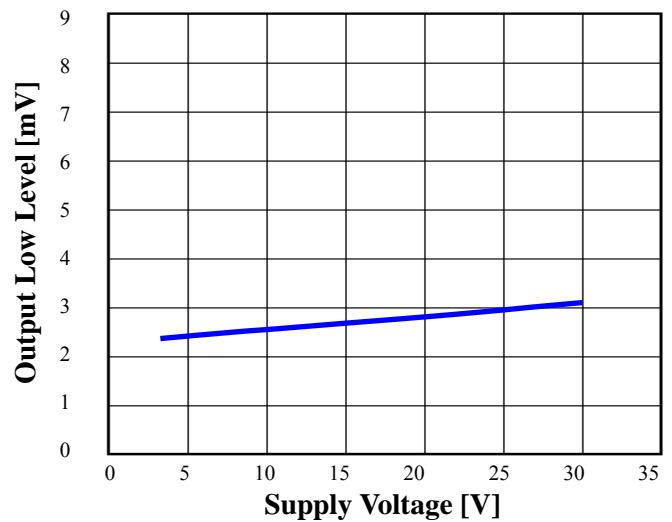
**Fig.4 Input Bias Current vs. Ambient Temp.**



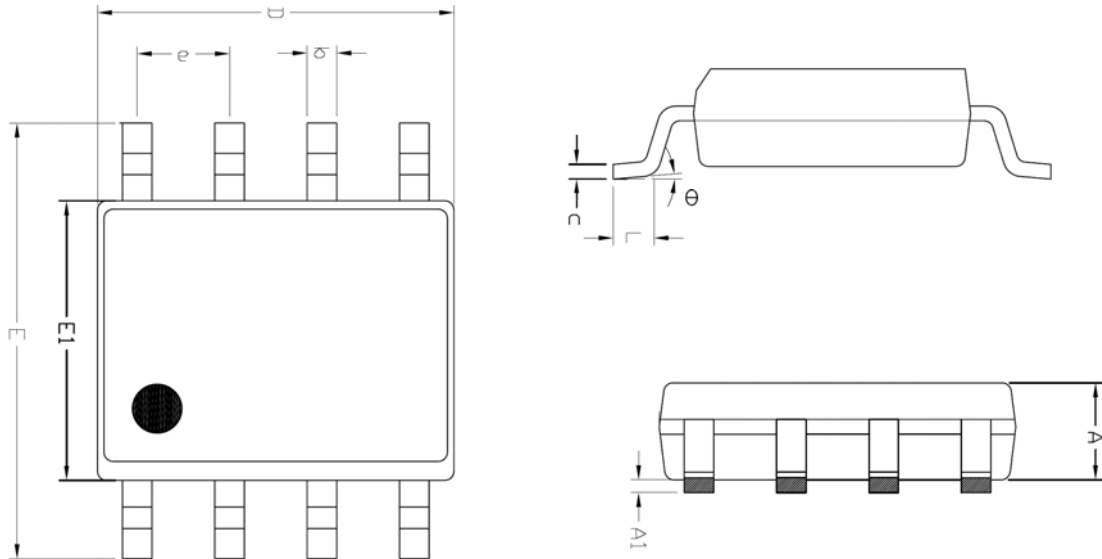
**Fig.5 Output High Level vs. Vcc**



**Fig.6 Output Low Level vs. Vcc**

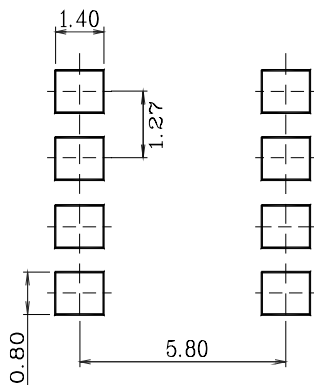


**Outline Dimension (Unit : mm)**

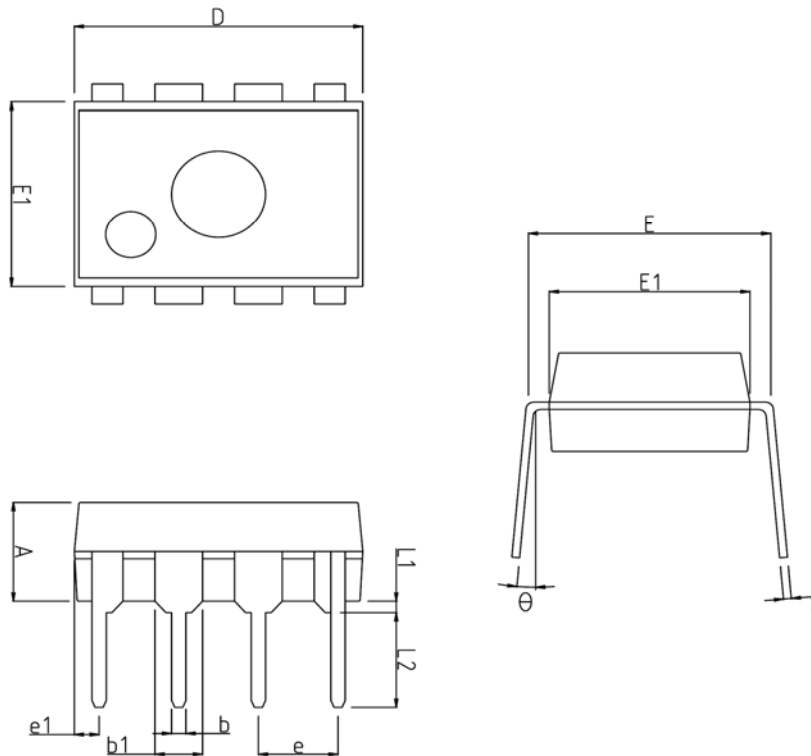


SYMBOL	MILLIMETER(mm)			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	1.245	—	1.445	
A1	0.125	0.175	0.275	
b	0.320	0.420	0.520	
c	0.170	0.220	0.270	
D	4.802	4.902	5.002	
E	5.870	6.020	6.170	
E1	3.761	3.861	3.961	
e	1.270 BSC			
L	0.462	0.562	0.662	
θ	0 °	—	8 °	

**※ Recommend PCB solder land (Unit : mm)**



## Outline Dimension (Unit : mm)



SYMBOL	MILLIMETERS			NOTE
	MINIMUM	NOMINAL	MAXIMUM	
A	3.20	3.40	3.60	
b	0.36	0.46	0.56	
b1	1.42	1.52	1.62	
c	0.20	0.25	0.35	
D	9.00	9.20	9.40	
E	7.37	7.62	7.87	
E1	6.20	6.40	6.60	
e	2.54 TYP			
e1	0.79 TYP			
L1	0.33	—	—	
L2	3.00	3.30	3.60	
θ	0°	—	15°	

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