

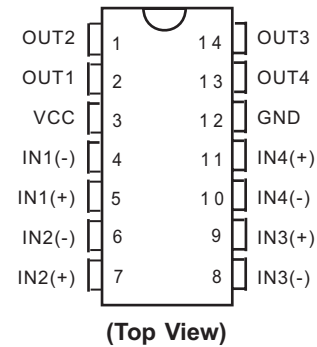
Quad Differential Comparators

DESCRIPTION

The LM339 consists of four independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for four comparators which were designed specifically to operate from a single power supply over a wide range of voltages.

These comparators are designed for use in level detection, low-level sensing and memory applications in consumer, automotive and industrial electronic applications.

PIN CONFIGURATION



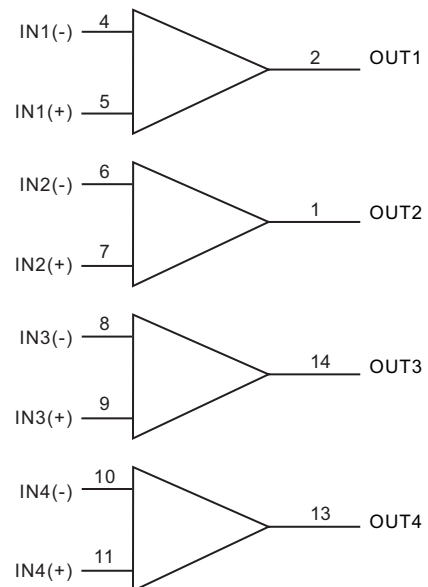
FEATURES

- Single or Split Supply Operation
- Low Input Bias Current
- Low Input Offset Current
- Input Common Mode Voltage Range to GND
- Low Output Saturation Voltage
- TTL and CMOS Compatible

APPLICATIONS

- Limit Comparators
- Simple A/D Converters
- Pulse/Square wave/Time delay Generators
- Wide Range VCO
- MOS Clock Generator
- High Voltage Digital Logic Gate
- Multi-vibrators

LOGIC SYMBOL



ORDERING INFORMATION

Temperature Range	Package		Orderable Device	Package Qty
-40°C to +85°C	DIP14L	Pb-Free	LM339N	25Units/Tube
	SOP14L		LM339DR	3000Units/R&T
			LM339D	50Units/Tube



SCHEMATIC DIAGRAM (one comparator)

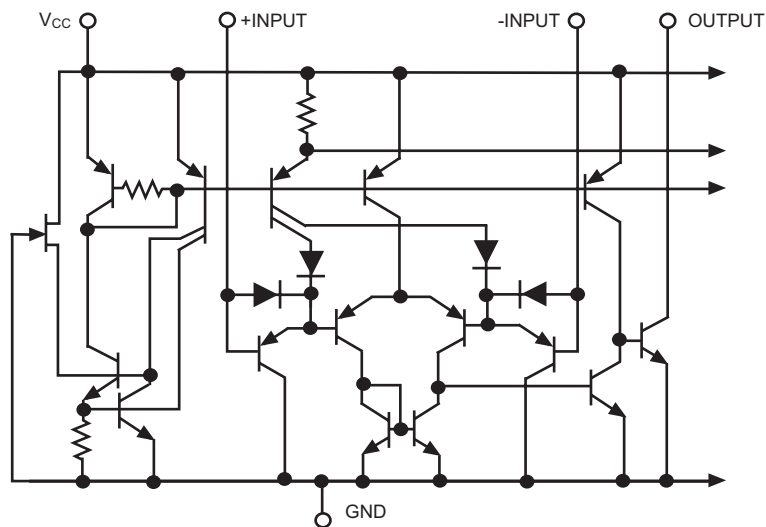


Figure 1. Schematic

ABSOLUTE MAXIMUM RATINGS

(Maximum Ratings are those values beyond which damage to the device may occur.)

Parameter	Symbol	Value	Unit
Power Supply Voltages	V_{CC}	36	V
		± 18	
Input Differential Voltage Range	V_{IDR}	36	V
Input Common Mode Voltage Range (Note1)	V_{ICR}	-0.3 to V_{CC}	V
Output Short Circuit to Ground	I_{SC}	Continuous	
Input Current, per pin (Note2)	I_{IN}	50	mA
Junction Temperature	T_J	150	$^{\circ}C$
Storage Temperature	T_{STG}	-65 to +150	$^{\circ}C$
Lead Temperature, 1mm from Case for 10 Seconds	T_L	260	$^{\circ}C$
Power Dissipation @ $T_A=25^{\circ}C$	P_D	1.0	W
Derate above $25^{\circ}C$		8.0	mW/ $^{\circ}C$

Note 1: Split Power Supplies.

Note 2: $V_{IN} < -0.3V$. This input current will only exist when voltage at any of the input leads is driven negative.

RECOMMENDED OPERATING CONDITIONS

Parameter		Symbol	Min	Max	Unit
DC Supply Voltage	Single Supply	V_{CC}	5.0	30	V
	Split Supplies		± 2.5	± 15	
Operating Temperature, All Package Types		T_A	-40	+85	$^{\circ}\text{C}$

Note: This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range $\text{GND} \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

ELECTRICAL CHARACTERISTICS ($T_A = -40$ to $+85^{\circ}\text{C}$)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$V_O = 1.4\text{V}$, $V_{CC} = 5.0 \sim 30\text{V}$; $R_S \leq 100\Omega$, $V_{ICR} = 0 \sim (V_{CC} - 1.5)\text{V}$			9.0 5.0*	mV
Input Bias Current	I_{IB}	$V_O = 1.4\text{V}$, $V_{CC} = 5.0 \sim 30\text{V}$ $V_{ICR} = 0 \sim (V_{CC} - 1.5)\text{V}$			400	nA
Input Offset Current	I_{IO}	$V_O = 1.4\text{V}$, $V_{CC} = 5.0 \sim 30\text{V}$, $V_{ICR} = 0 \sim (V_{CC} - 1.5)\text{V}$			± 150 $\pm 50^*$	nA
Input Common Mode Voltage Range	V_{ICR}	$V_{CC} = 5.0 \sim 30\text{V}$	0		$V_{CC} - 2.0\text{V}$	V
Supply Current	I_{CC}	$R_L = \infty$, $V_{CC} = 5.0\text{V}$			2.0*	mA
		$R_L = \infty$, $V_{CC} = 30\text{V}$			2.5*	
Voltage Gain	A_{VOL}	$V_{CC} = 15\text{V}$, $R_L = 15\text{k}\Omega$		200*		V/mV
Large Signal Response Time	t_1	$V_{IN} = \text{TTL Logic Swing}$, $V_{ref} = 1.4\text{V}$, $V_{CC} = 5.0\text{V}$, $R_L = 5.1\text{k}\Omega$, $V_{RL} = 5.0\text{V}$		300*		ns
Response Time	t_2	$V_{CC} = 5.0\text{V}$, $R_L = 5.1\text{k}\Omega$, $V_{RL} = 5.0\text{V}$		1.3*		μs
Output Sink Current	I_{SINK}	$V_I(-) = 1.0\text{V}$, $V_I(+) = 0\text{V}$, $V_O \leq 1.5\text{V}$, $V_{CC} = 5.0\text{V}$	6.0*			mA
Saturation Voltage	V_{SAT}	$V_I(-) = 1.0\text{V}$, $V_I(+) = 0\text{V}$, $I_{SINK} \leq 4.0\text{mA}$, $V_{CC} = 5.0\text{V}$			700	mV
Output Leakage Current	I_{OL}	$V_I(+) = 1.0\text{V}$, $V_I(-) = 0\text{V}$	$V_O = 5.0\text{V}$		0.1*	nA
			$V_O = 30\text{V}$		1000	



ELECTRICAL CHARACTERISTICS(CONTINUED)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Differential Input Voltage Range	V_{IDR}	All $V_{IN} \geq GND$ or V-Supply (if used)			V_{CC}^*	V

* at $T_A = 25^\circ C$

TYPICAL PERFORMANCE CHARACTERISTICS

($V_{CC} = 15V$, $T_A = +25^\circ C$, (each comparator))

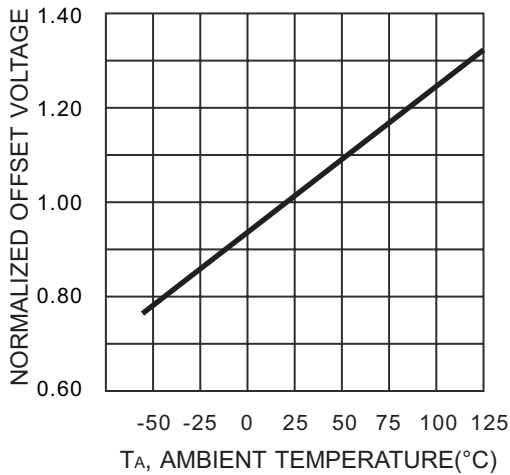


Figure 2. Normalized Input Offset Voltage

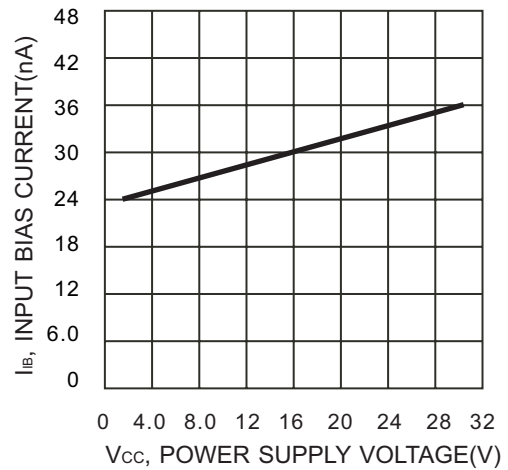


Figure 3. Input Bias Current

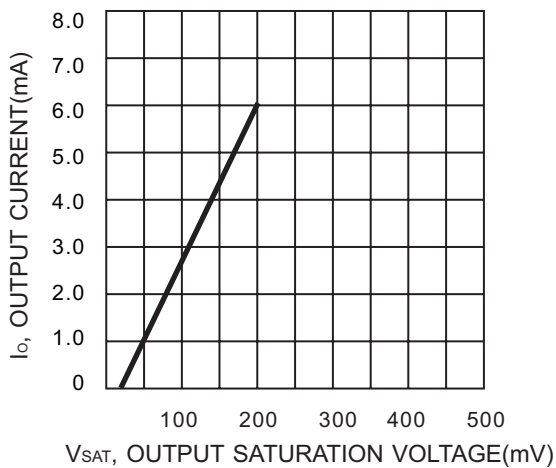


Figure 4. Output Sink Current versus Output Saturation Voltage



TYPICAL APPLICATION

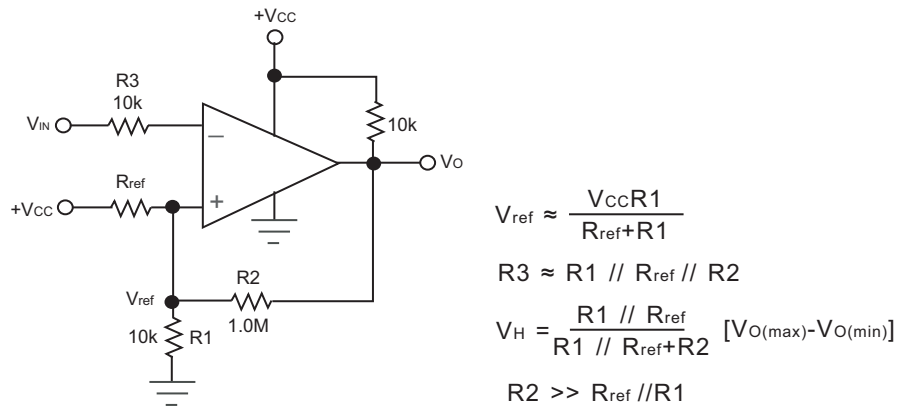


Figure 5. Inverting Comparator with Hysteresis

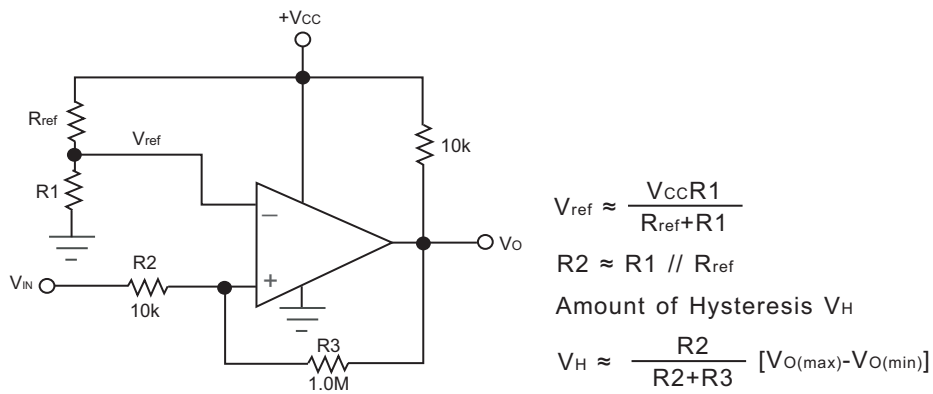
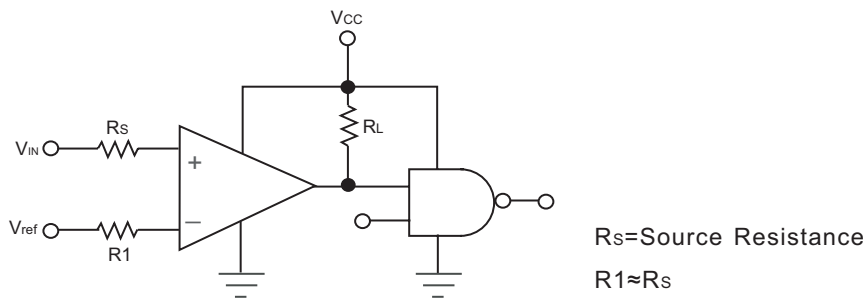


Figure 6. Noninverting Comparator with Hysteresis



Logic	Device	Vcc(V)	RL (kΩ)
CMOS	1/4 MC 14001	+15	100
TTL	1/4 MC 7400	+5.0	10

Figure 7. Driving Logic

TYPICAL APPLICATION(CONTINUED)

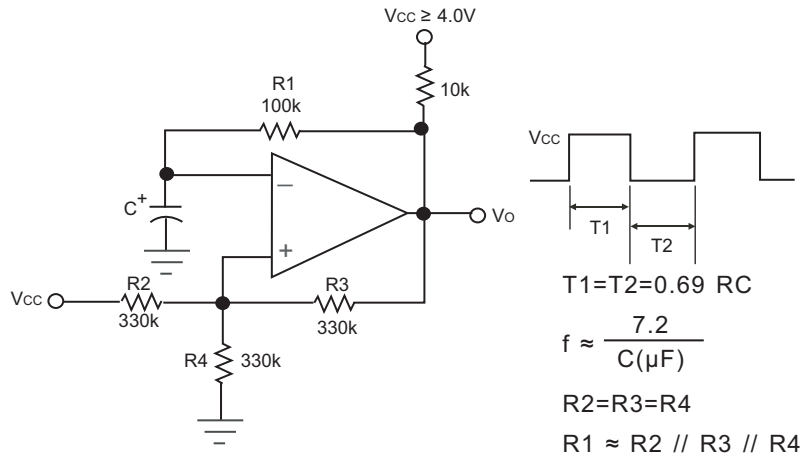
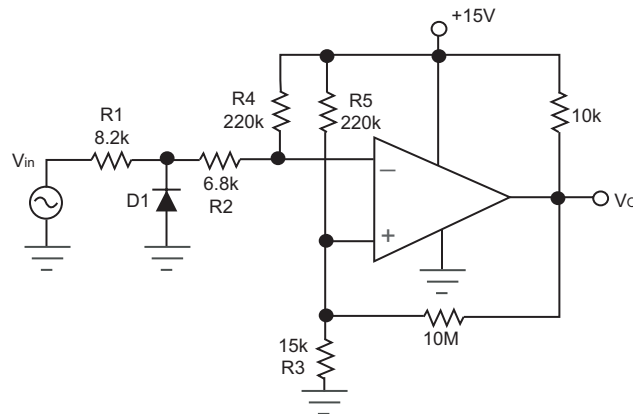
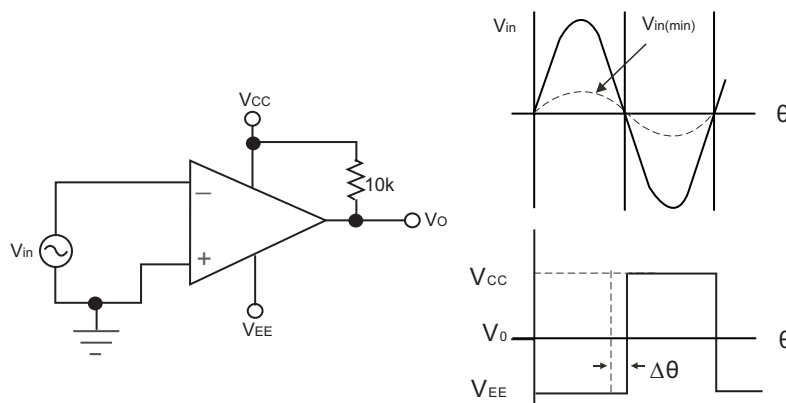


Figure 8. Squarewave Oscillator



D1 prevents input from going negative by more than 0.6V
 $R_1 + R_2 = R_3$
 $R_3 \leq R_5/10$ for small error in zero crossing

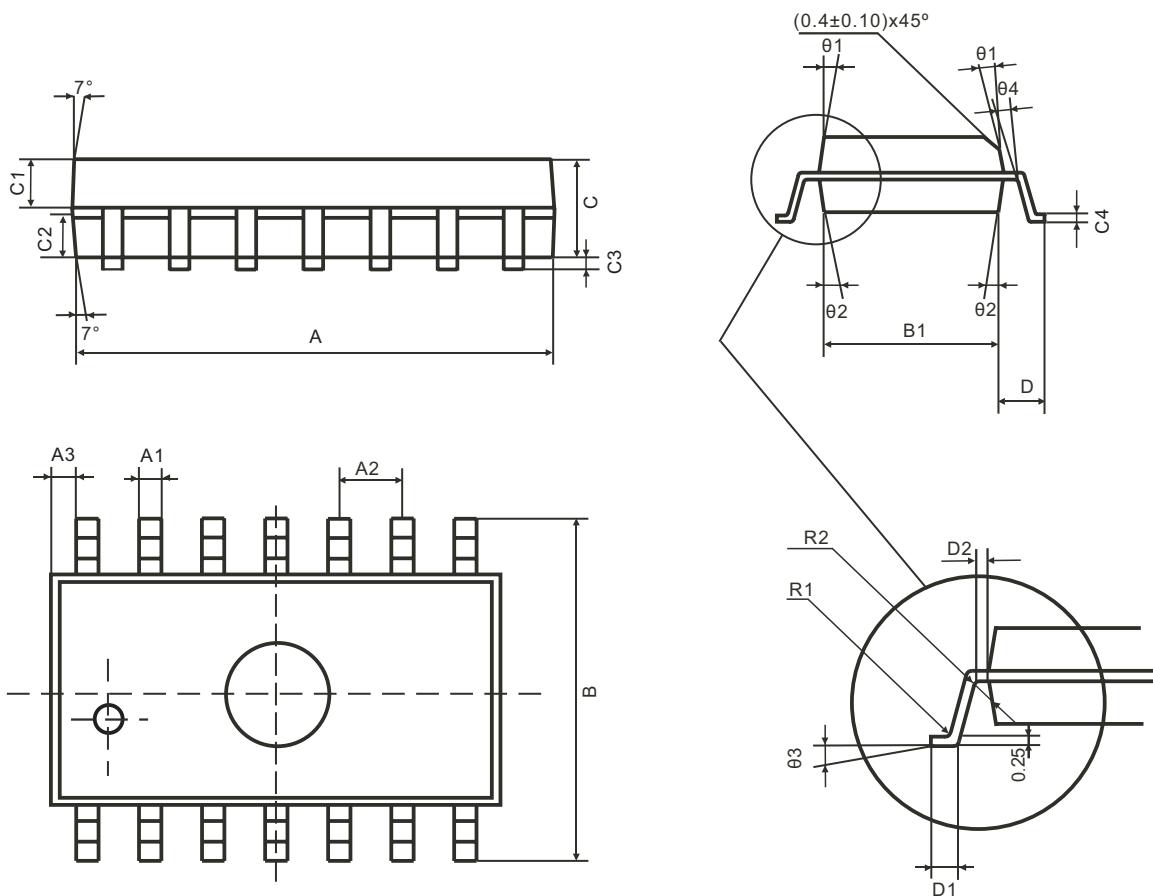
Figure 9. Zero Crossing Detector (Single Supply)



$V_{in(min)} \approx 0.4V$ peak for 1% phase distortion ($\Delta\theta$)

Figure 10. Zero Crossing Detector (Split Supply)

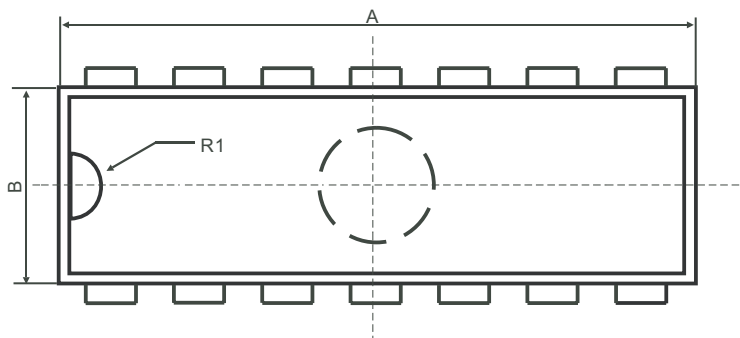
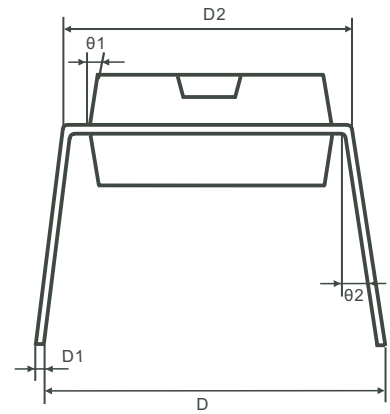
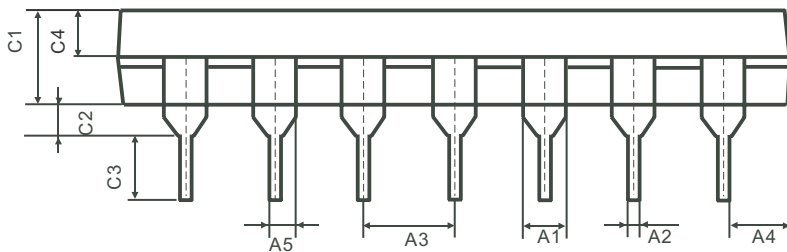
PHYSICAL DIMENSIONS SOP14L



Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	Max		Min	Max
A	8.55	8.75	C4	0.17	0.25
A1	0.330	0.510	D	1.05(TYP)	
A2	1.27(TYP)		D1	0.45	0.65
A3	0.305(TYP)		D2	0.25(TYP)	
B	5.8	6.2	R1	0.2(TYP)	
B1	3.8	4	R2	0.2(TYP)	
C	1.35	1.55	theta1	8°(TYP)	
C1	0.60	0.70	theta2	8°(TYP)	
C2	0.55	0.65	theta3	4°(TYP)	
C3	0.10	0.25	theta4	4°(TYP)	



DIP14L



Symbol	Dimension(mm)		Symbol	Dimension(mm)	
	Min	Max		Min	Max
A	19.00	19.20	C3	3.15	3.45
A1	1.524(TYP)		C4	1.57	1.67
A2	0.39	0.53	D	8.20	8.80
A3	2.54(TYP)		D1	0.20	0.35
A4	1.7(TYP)		D2	7.62	7.87
A5	0.99(TYP)		θ1	8°(TYP)	
B	6.3	6.5	θ2	5°(TYP)	
C1	3.40	3.60	R1	1.0(TYP)	
C2	0.51(TYP)				