# ADJUSTABLE PRECISION ZENER SHUNT REGULATOR
BL431

DESCRIPTION

The BL431 is a three-terminal adjustable regulator with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 2.5V) and 36V with two external resistors. This device has typical dynamic output impedance of $0.2\,\Omega$. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

Outline Drawing

TO-92

SOT23
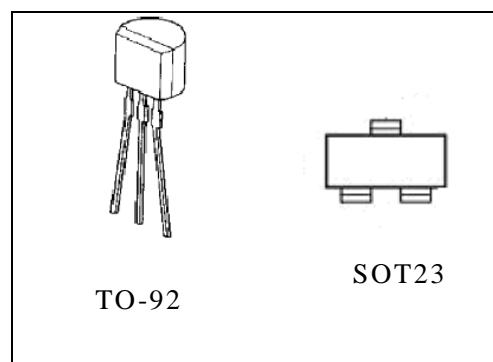
FEATURE

- Programmable output voltage to 36V
- Low dynamic output impedance $0.2\,\Omega$ typical
- Sink current capability of 1.0mA to 100mA
- Equivalent full-range temperature coefficient of 50ppm/℃ typical
- Temperature compensated for operation over full rated
- operating temperature range
- Low output noise voltage
- Fast turn on response

BLOCK DIAGRAM
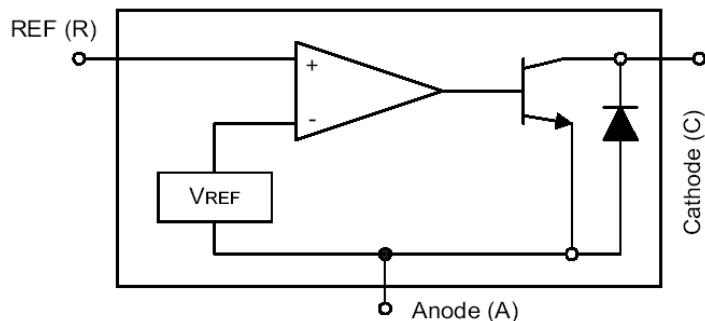
PIN CONNECTION

Order Number	Pin Configuration (Top View)
BL431 (TO-92)	3 Cathode 2 Anode 1 Ref
BL431 (SOT23)	Anode 3 2 Cathode 1 Ref
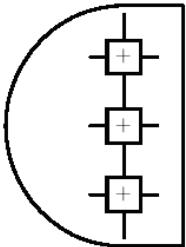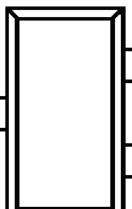
ABSOLUTE MAXIMUM RATINGS

Operating temperature range applies unless otherwise specified.)

Characteristic	Symbol		Value	Unit
Cathode Voltage	Vka		37	V
Cathode Current Range (continuous)	Ika		-10~+150	mA
Reference Input Current Range	I_{REF}		10	mA
Power Dissipation	P_D	TO-92	770	mW
		SOT23-3	230	
Operating Temperature Range	Topr		0~+70	℃
Store temperature Range	Tstg		-65~+150	℃

ELECTRICAL CHARACTERISTICS (Ta=25℃ unless otherwise specified)

| Parameter	Conditions		Symbol	Min	Typ	Max	Unit
		TO92					
Reference Voltage	Vz=V$_{REF}$ Ii=10mA	+/-0.5%	V$_{REF}$	2.487	2.500	2.513	V
		+/-1.0%		2.475		2.525	
		+/-2.0%		2.440		2.55	
		SOT23					
		+/-0.5%	V$_{REF}$	2.482	2.495	2.508	V
		+/-1.0%		2.470		2.520	
		+/-2.0%		2.440		2.55	
Deviation of Reference Input Voltage Over Temperature	Vz=V$_{REF}$, Ii=10mA		Vdev	-	8.0	17	mV
Ratio of the Change in Reference Voltage to the Change in Cathode Voltage	Iz=10mA	Vz=V$_{REF}$~10V	Δ V$_{REF}$/ Δ Vz	-	-1.0	-2.7	mV/V
		Vz=10~36V		-	-0.5	-2.0	
Reference Input Current	R1=10kΩ,R2=∞ I1=10mA		I$_{REF}$	-	2.0	4.0	μA
Deviation of Reference Input Current Over Temperature	R1=10kΩ,R2=∞ I1=10mA		∝ I$_{REF}$	-	0.4	1.2	μA
Minimum Cathode Current for Regulation	Vz=V$_{REF}$		Iz(min)	-	0.4	1.0	mA
Off-State Current	Vz=36V,V$_{REF}$=0V		Iz(off)	-	0.05	1.0	μA
Dynamic Output Impedance	Vz=V$_{REF}$, Iz=1 to 100mA,f<1.0kHz		Rz	-	-	0.50	Ω

TEST CIRCUIT
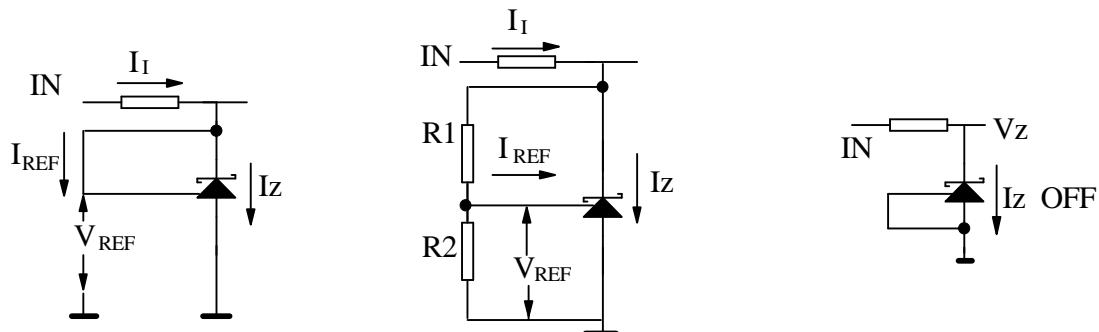
Note: Vz=V$_{REF}$(1+R1/R2)+I$_{REF}$*R1

1.Test circuit for Vz=V$_{REF}$ 2.Test circuit for Vz>V$_{REF}$ 3.Test circuit for off-state current

APPLICATION CIRCUIT

$$Vo = (1+R1/R2) V_{REF}$$

1. Shunt Regulator

$$Vo = (1+R1/R2) V_{REF}$$
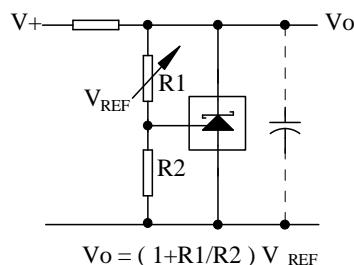
2. Series Regulator
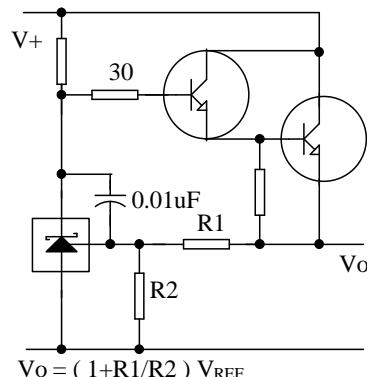
$$Vo = (1+R1/R2) V_{REF}$$
$$Vo_{MIN} = V_{REF} + 5 V$$
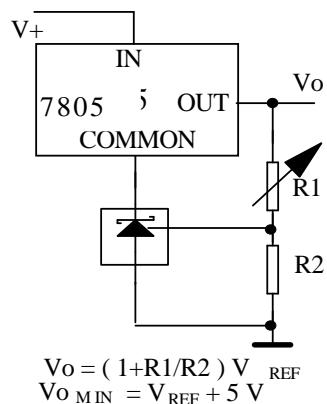
3. Output Control of a Three

Terminal Fixed Regulator
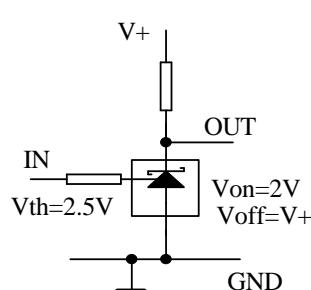
4. Single Supply Comparator with

Temperature Compensated Threshold

5. Higher Current Shunt Regulator
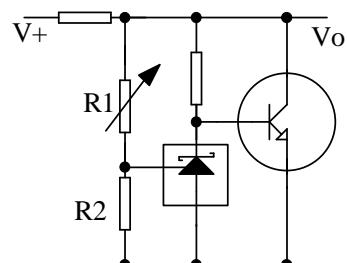
6. Crow Bar
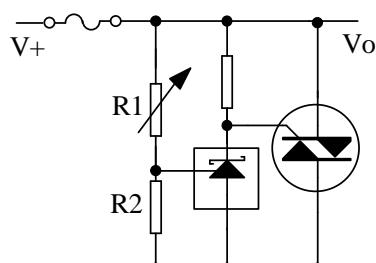
$$Vo=(1+R1/R2)*V_{REF} \qquad Vlimit=(1+R1/R2)*V_{REF}$$

CHARACTERISTIC CURVES

Vref - Ta

Iref - Ta

$I_{KA} - V_{KA}$

$I_{KA} - V_{KA}$

$\Delta Vref/\Delta V_{KA} - Ta$

Ioff - Ta

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1.4

Vn − f
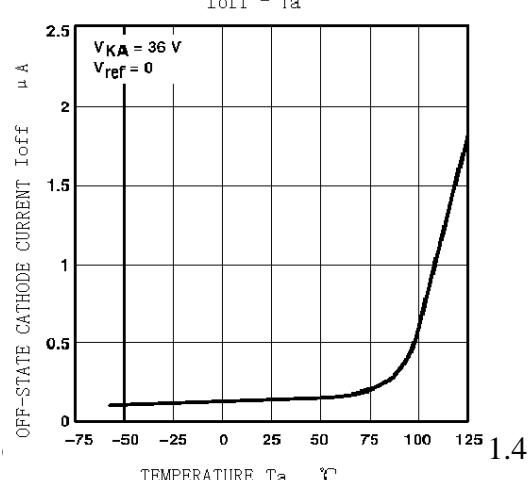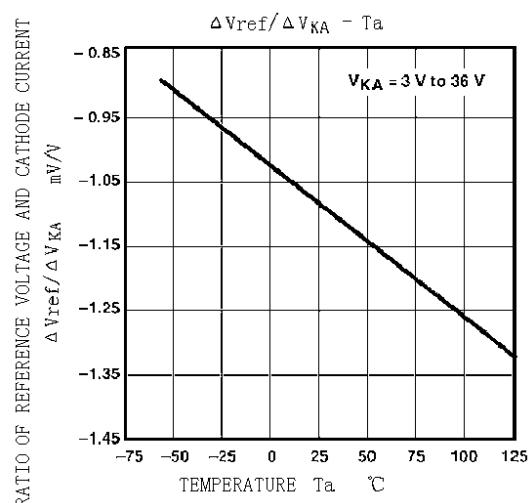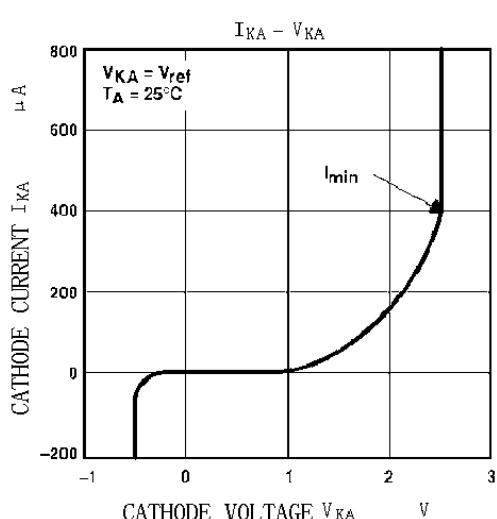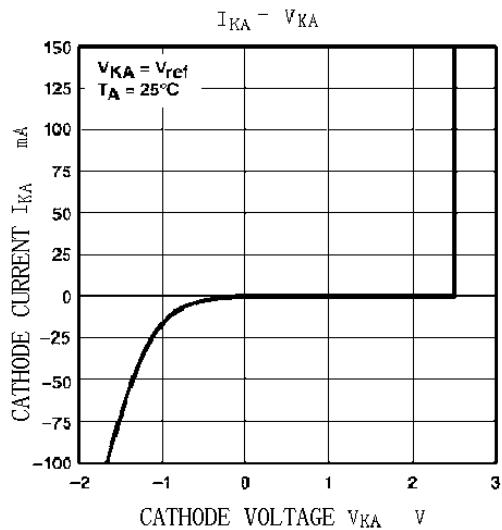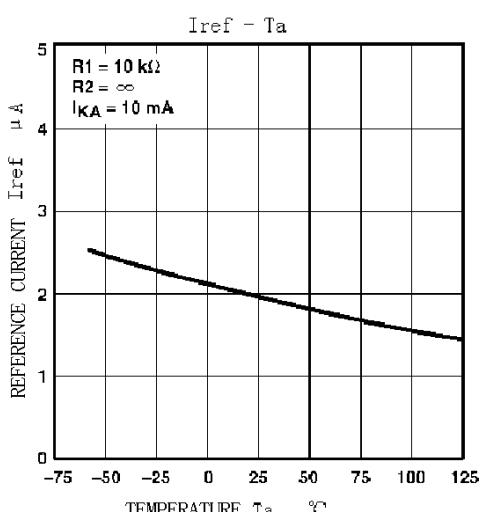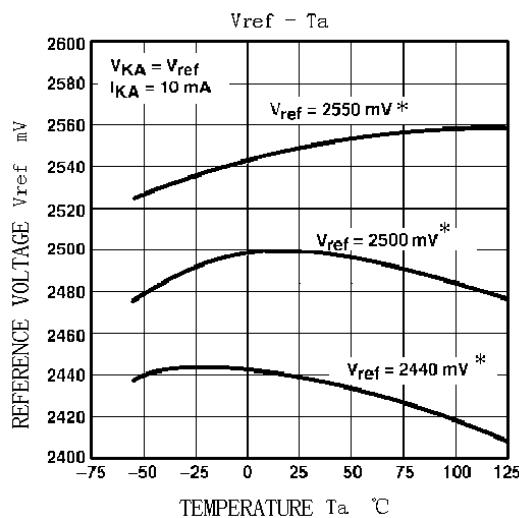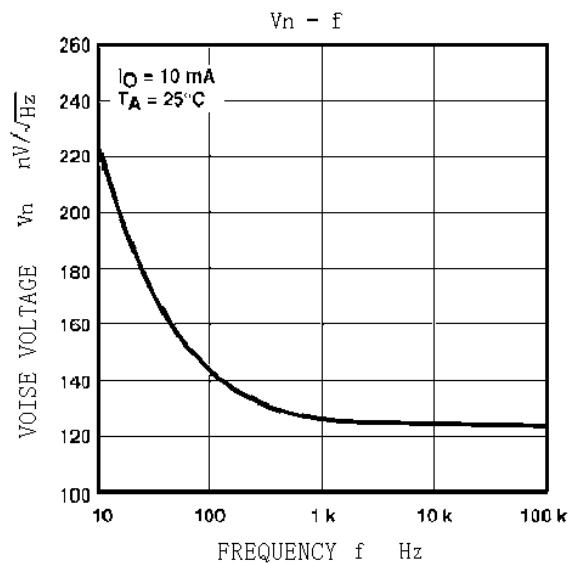
STABILITY BOUNDARY CONDITIONS:

Load Capacitance (F)

Test Circuit for Stability Boundary:
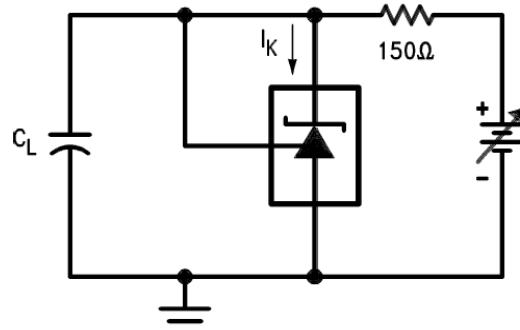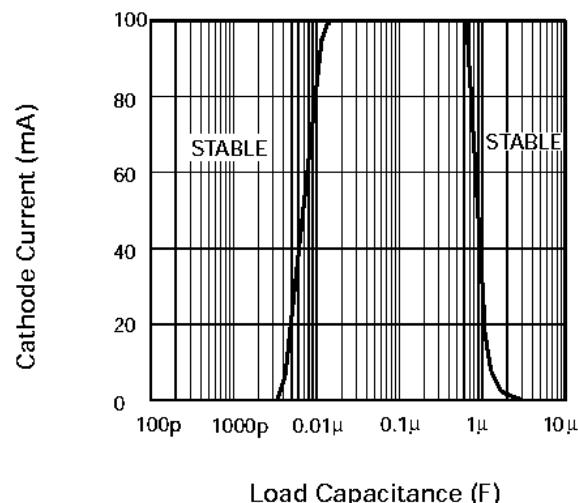
Appendix：

TO-92 Package Outline Dimension：

5° 2 PLCS

0.0145-0.0155
[0.368-0.394] BEFORE LEAD FINISH

0.500
[12.70] MIN

SEATING PLANE

0.090
[2.29] MAX
(UNCONTROLLED
LEAD DIA)

0.045-0.055
[1.14-1.40] TYP

0.175-0.185
[4.45-4.70]

EJECTION MARK

Ø 0.065
[1.65]

0.015
[0.38] MAX

0.016-0.021
[0.41-0.53] TYP

0.135-0.145
[3.43-3.68]

0.045-0.055
[1.14-1.40]

R 0.090
[2.29]

10° 2 PLCS

Z03A (REV F)
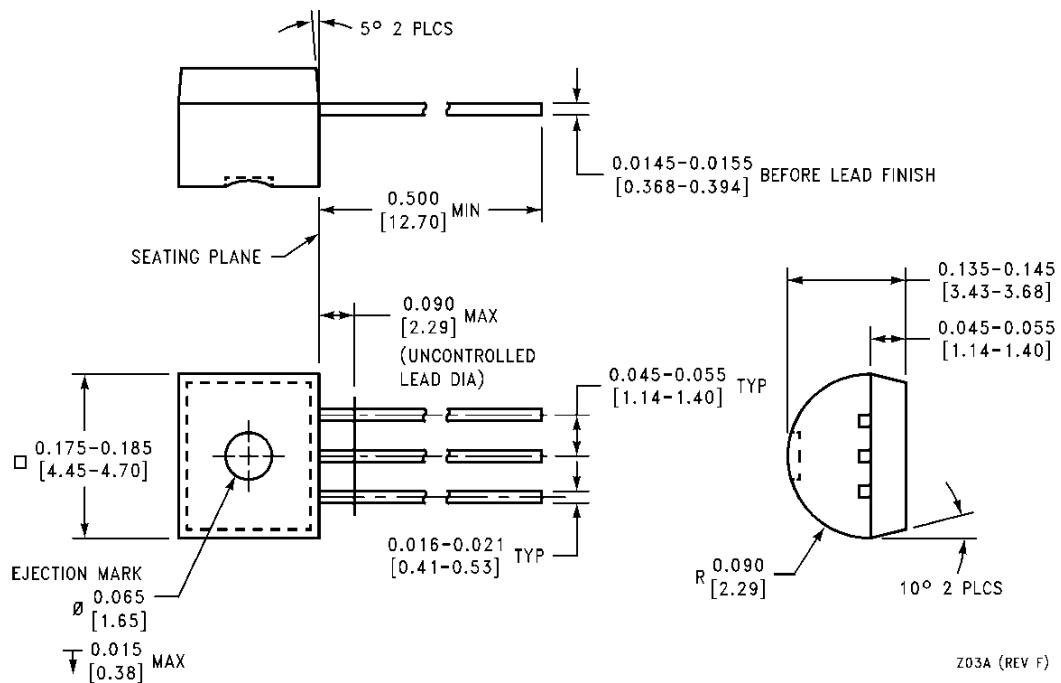
TO-92：
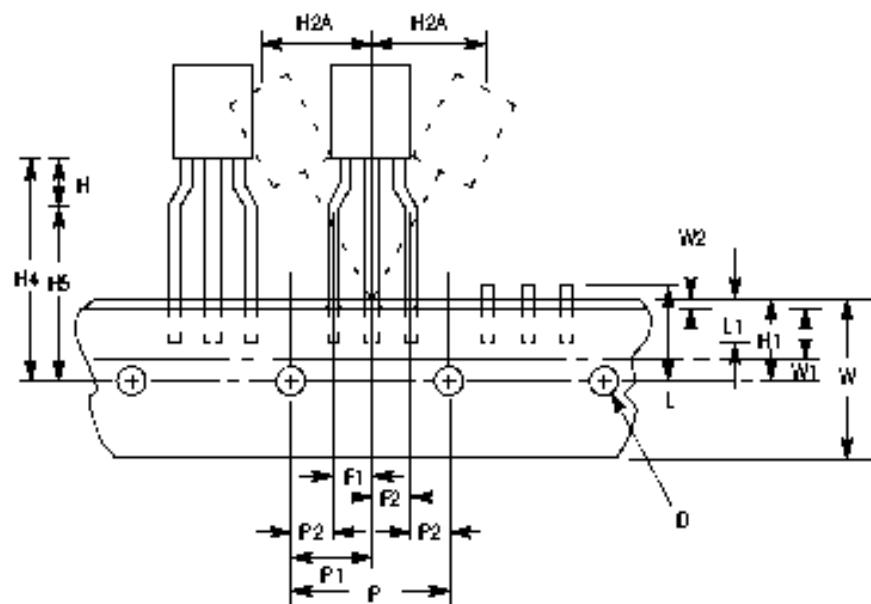
SOT-23-3 Package Outline Dimension：
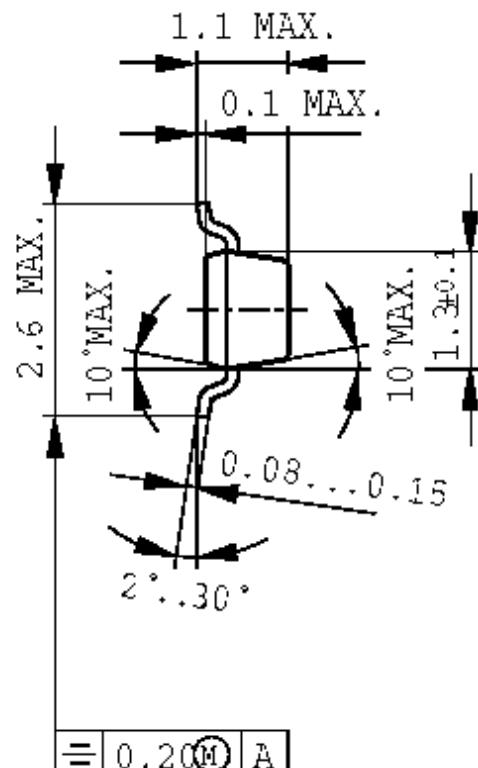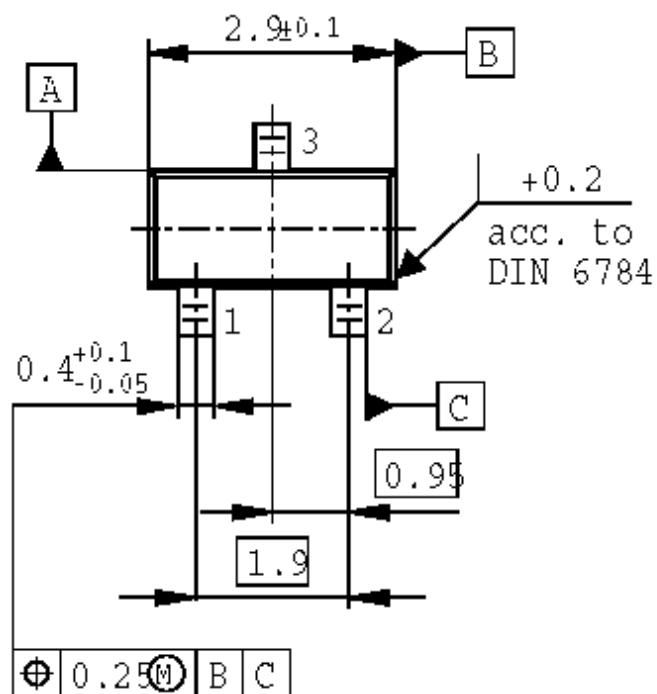
Taping Diagram：

	（mm）
△A	0±1.0
△B	0+1.0
D	4.0±0.2
F1、F2	2.5+0.4 −0.1
H	21.0max
H1	16±0.5
H2	9.0+0.5
P	12.7±0.3
P1	6.35±0.5
T	1.5max
W	18.0+1.0 −0.5
W1	6.0±0.5
W2	1.0max