

# GS431

## Adjustable Precision Shunt Regulators

### Product Description

The GS431 is a three-terminal adjustable shunt regulator with specified thermal stability.

The output voltage may be set to any value between  $V_{REF}$  (approximately 2.5V) and 36V with two external resistors.

This device has a typical output impedance of  $0.2\Omega$ . Active output circuitry provides very sharp turn-on characteristics, making this device excellent replacement for Zener diodes in many applications.

GS431 is available in TO-92, SO-8, SOT-89 and SOT-23 packages

### Features

- Equivalent Full Range Temperature Coefficient 30ppm/°C
- Temperature-Compensated for Operation over Full Rated Operating Temperature Range.
- Sink Current Capability 1mA to 100mA
- Adjustable Output Voltage
- Low ( $0.2\Omega$  Typ.) Dynamic Output Impedance
- Low Output Noise
- Fast Turn-on Response
- RoHS Compliant, 100%Pb & Halogen Free

### Applications

- Battery Operated Computer
- Switching Power Supplies
- Adjustable Power Supplies
- Linear Regulators
- Instrumentation
- Computer Disk Drivers

### Block Diagram & Symbol

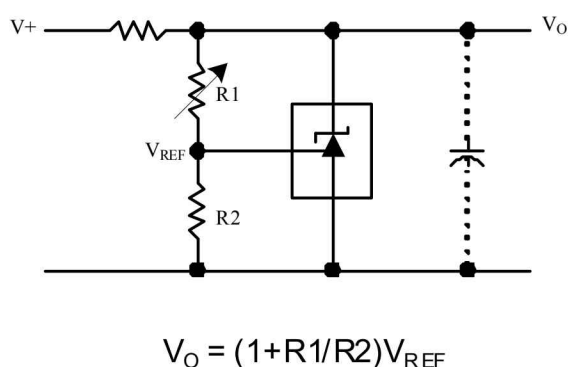


Figure 1. Shunt Regulator

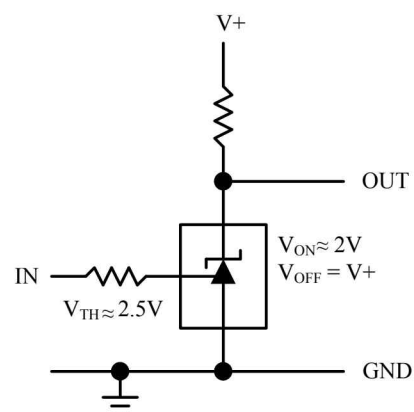
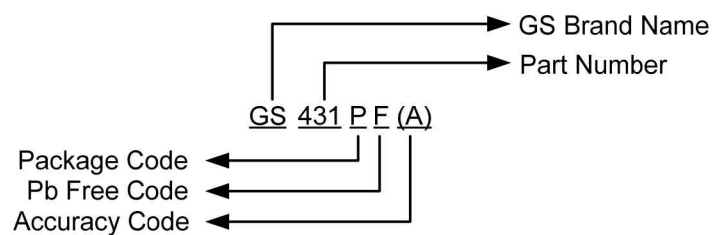


Figure 2. Single Supply Comparator with Temperature Compensated Threshold

## Packages & Pin Assignments

GS431JZ (SOT-23)		GS431JW (SOT-23)		GS431Z (SOT-23-3L)		GS431W (SOT-23-3L)		
1	REF	1	CATHODE	1	REF	1	CATHODE	
2	CATHODE	2	REF	2	CATHODE	2	REF	
3	ANODE	3	ANODE	3	ANODE	3	ANODE	
GS431Y (SOT-89)		GS431N (TO-92)		GS431S (SO-8)				
1	REF	1	REF	1	CATHODE	5	NC	
2	ANODE	2	ANODE	2	ANODE	6	ANODE	
3	CATHODE	3	CATHODE	3	ANODE	7	ANODE	
				4	NC	8	REF	

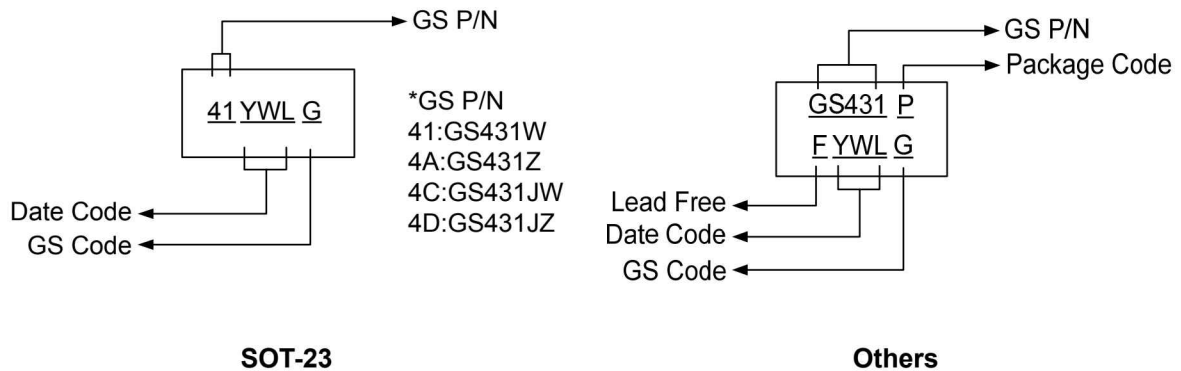
## Ordering Information



Device	Package
GS431JWF	SOT-23
GS431JZF	SOT-23
GS431WF	SOT-23-3L
GS431ZF	SOT-23-3L
GS431NF	TO-92
GS431SF	SOP-8
GS431YF	SOT-89

- GS TO-92 package type have already used "Lead Free" process in 2000, so GS product without marked "F" to different.
- Accuracy Range : (A) means 0.5% accuracy, (B) means 1% accuracy.

## Marking Information



## Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Rating	Unit
$V_{KA}$	Cathode Voltage ( <b>Note 1</b> )	36	V
$I_K$	Continuous Cathode Current Range	1 to +100	mA
$I_{REF}$	Reference Current Range	-50 $\mu$ A to 10mA	mA
$\theta_{JA}$	Thermal Resistance Junction To Ambient	SOT-23 833 SOP-8 192 SOT-89 250 TO-92 250	$^{\circ}$ C/W
$P_D$	Power Dissipation	SOT-23 0.15 SOP-8 0.625 SOT-89 0.5 TO-92 0.5	W
$T_{OPR}$	Operating Temperature Range	-40 to 85	$^{\circ}$ C
$T_J$	Junction Temperature Range	0 to 125	$^{\circ}$ C
$T_{STG}$	Storage Temperature Range	-65 to 150	$^{\circ}$ C
$T_{LEAD}$	Lead Temperature Range(Soldering, 10sec)	260	$^{\circ}$ C

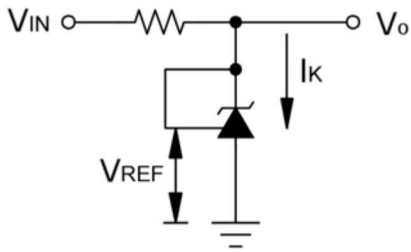
**Note 1:** Voltage values are with respect to the anode terminal unless otherwise noted.

## Electrical Characteristics

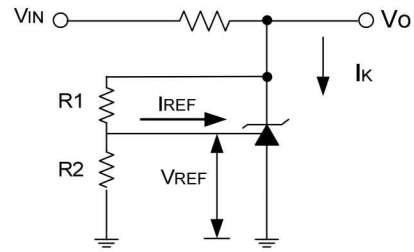
Electrical Characteristics at 25°C free-air temperature (unless otherwise noted).

Symbol	Parameter	Conditions	GS431(A)			GS431(B)			Units
			Min	Typ	Max	Min	Typ	Max	
$V_{REF}$	Reference Voltage	$V_{KA}=V_{REF}$ , $I_K=10mA$	2.487	2.500	2.513	2.474	2.500	2.526	V
$V_{DEV}$	Deviation of reference input voltage over full temperature range	$V_{KA}=V_{REF}$ , $I_K=10mA$ , $T_A = \text{Full range}$ (Test circuit 1)		4.0	17		4.0	17	mV
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of change in reference input voltage to the change in cathode voltage	$I_K=10mA$ , $\Delta V_{KA}=10V \text{ to } V_{REF}$ $\Delta V_{KA}=36V \text{ to } 10V$	-2.7 -2	-1.0 -0.4		-2.7 -2	-1.0 -0.4		mV/V
$I_{REF}$	Reference input current	$I_K=10mA$ , $R1=10K\Omega$ , $R2=\infty$ (Test circuit 2)		0.7	4.0		0.7	4.0	$\mu A$
$I_{REF (DEV)}$	Deviation of reference input current over full temperature range	$I_K=10mA$ , $R1=10K\Omega$ , $R2=\infty$ , $T_A = \text{Full range}$ (Test circuit 2)		0.4	1.2		0.4	1.2	$\mu A$
$I_K (\text{min})$	Minimum cathode current for regulation	$V_{KA} = V_{REF}$ (Test circuit 1)		0.4	1.0		0.4	1.0	mA
$I_K (\text{off})$	Off-state cathode current	$V_{KA}=36V$ , $V_{REF}=0$		0.1	1.0		0.1	1.0	$\mu A$
$ Z_{KA} $	Dynamic impedance	$f < 1KHz$ , $V_{KA} = V_{REF}$ $I_K = 1mA \text{ to } 100mA$		0.2	0.5		0.2	0.5	$\Omega$

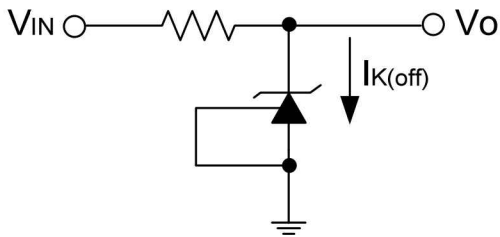
## Test Circuits



**Test Circuit 1.**  
 $V_{KA} = V_{REF}$

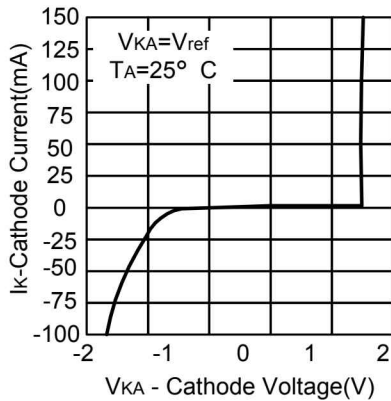


**Test Circuit 2.**  
 $V_{KA} > V_{REF}$

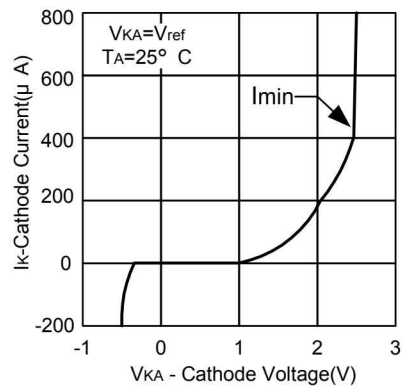


**Test Circuit 3.**  
Off-State Current

## Typical Performance Characteristics

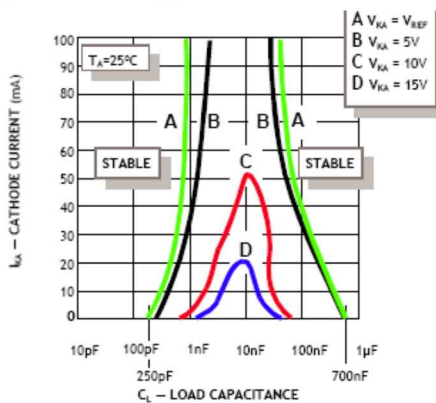


Cathode current vs. cathode voltage



Cathode current vs. cathode voltage

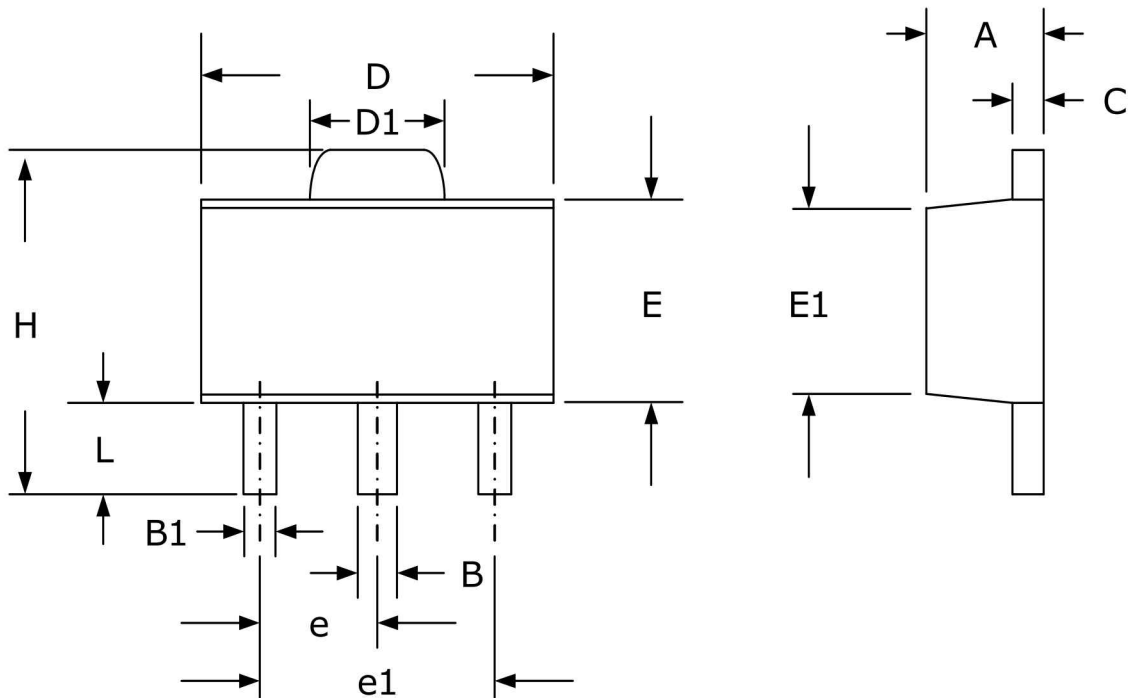
## Stability Boundary Condition



\*GS431 have not oscillation at  $V_{KA}=15V$  and  $V_{KA}=10V$



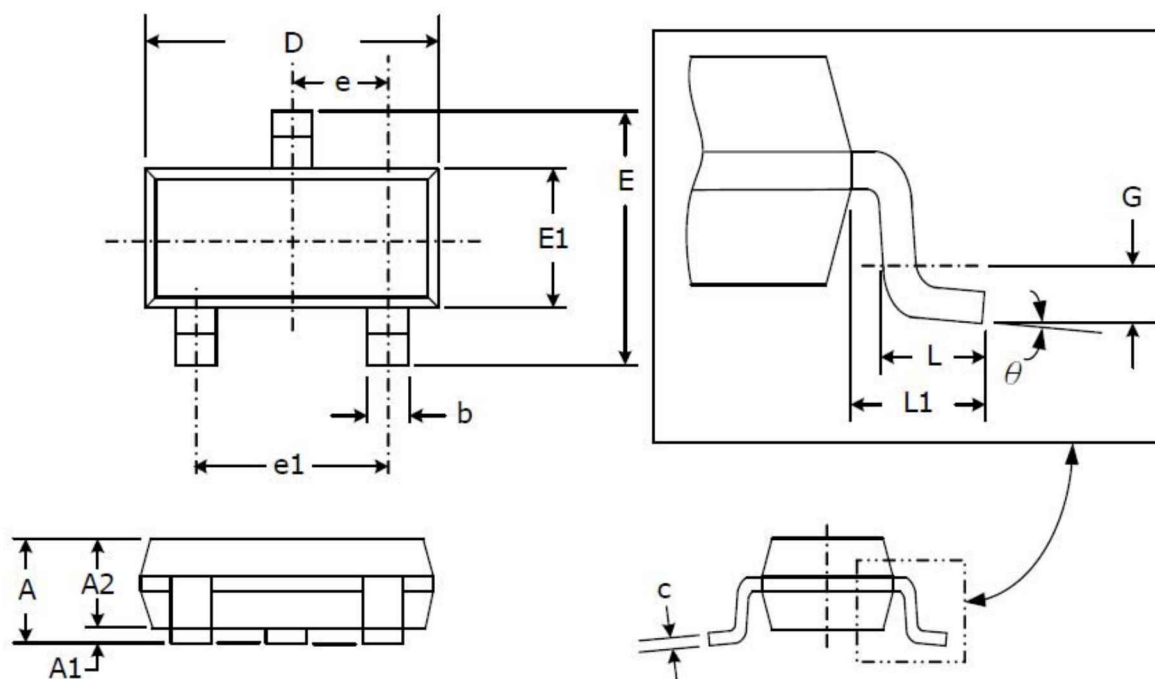
## SOT-89 PLASTIC PACKAGE



### Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	1.40	1.60	.055	.063
B	0.44	0.56	.017	.022
B1	0.36	0.48	.014	.019
C	0.35	0.44	.014	.017
D	4.40	4.60	.173	.181
D1	1.62	1.83	.064	.072
E	2.29	2.60	.090	.102
E1	2.13	2.29	.084	.090
e	1.50 (TYP)		.059 (TYP)	
e1	3.00 (TYP)		.118 (TYP)	
H	3.94	4.25	.155	.167
L	0.89	1.20	.035	.047

## SOT-23 PLASTIC PACKAGE

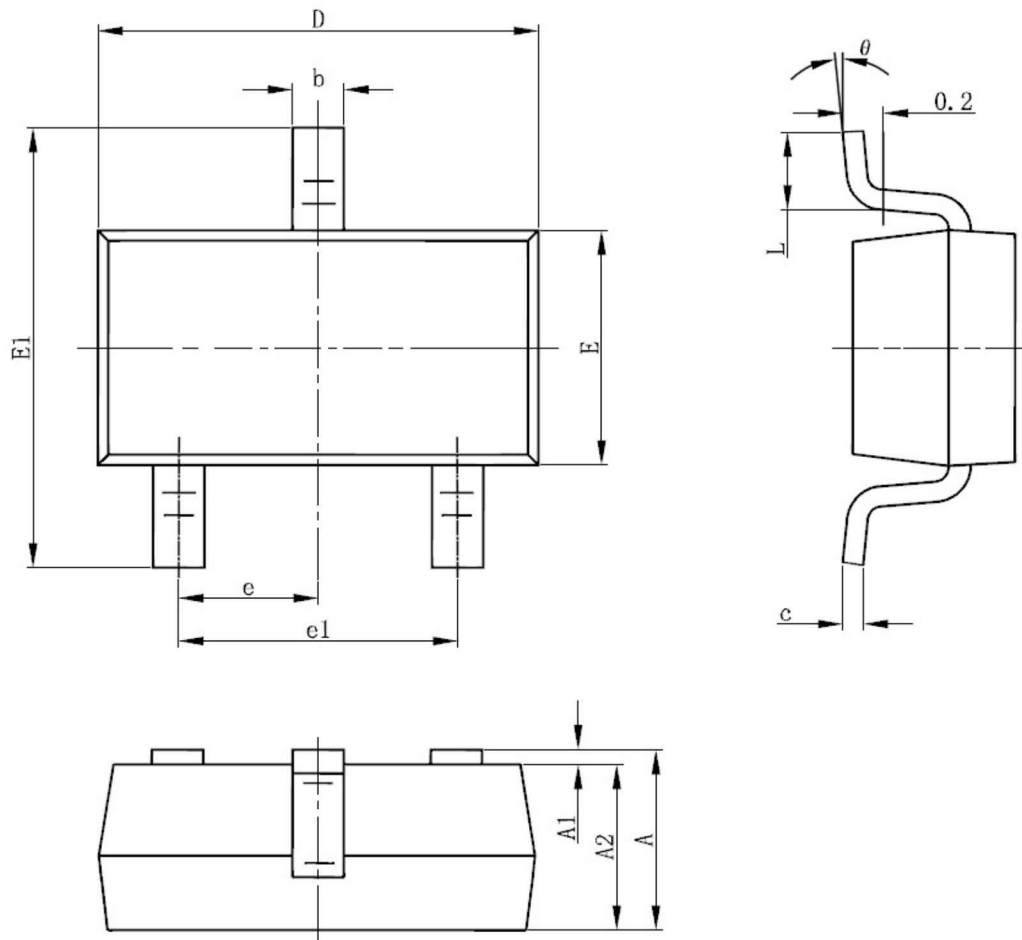


### Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	0.75	1.17	0.030	0.046
A1	0.05	0.15	0.002	0.006
A2	0.70	1.02	0.028	0.040
b	0.30	0.50	0.012	0.020
c	0.08	0.20	0.003	0.008
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E1	1.20	1.40	0.047	0.055
e	0.95 (TYP)		0.037 (TYP)	
e1	1.90 (TYP)		0.075 (TYP)	
L	0.40	0.60	0.016	0.024
L1	0.54 (TYP)		0.021 (TYP)	
G	0.25 (TYP)		0.010 (TYP)	
θ	0°	8°	0°	8°



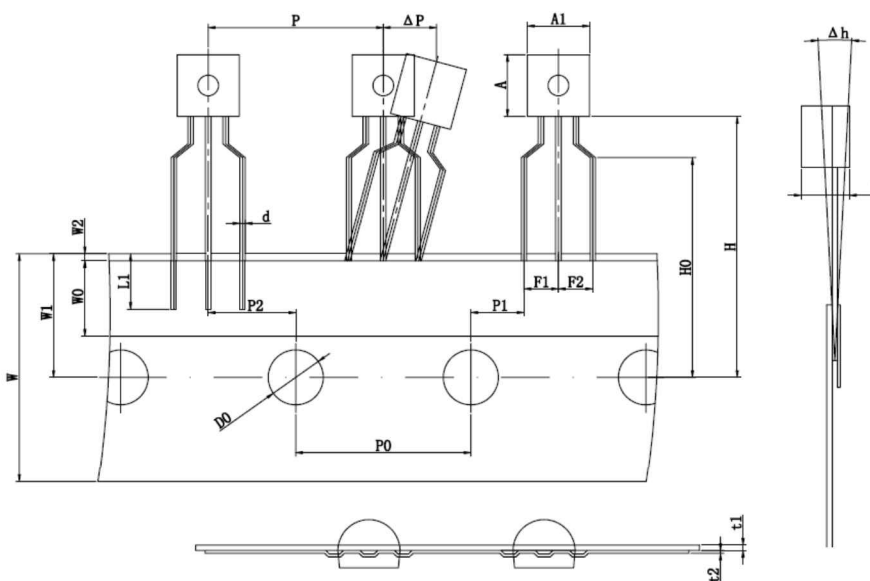
## SOT-23-3L PLASTIC PACKAGE



### Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
<b>A</b>	1.05	1.25	0.041	0.049
<b>A1</b>	0	0.1	0	0.004
<b>A2</b>	1.05	1.15	0.041	0.045
<b>b</b>	0.3	0.5	0.012	0.020
<b>c</b>	0.1	0.2	0.004	0.008
<b>D</b>	2.82	3.02	0.111	0.119
<b>E</b>	1.5	1.7	0.059	0.067
<b>E1</b>	2.65	2.95	0.104	0.116
<b>e</b>	0.950 (TYP)		0.037 (TYP)	
<b>e1</b>	1.8	2	0.071	0.079
<b>L</b>	0.3	0.6	0.012	0.024
<b>Q</b>	0°	8°	0°	8°

## TO-92 PLASTIC PACKAGE







### Dimensions

SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A1	4.4	4.6	.173	.181
A	4.4	4.6	.173	.181
T	3.4	3.6	.133	.142
d	.36	.40	.014	.016
P	12.4	13.0	.487	.512
P0	12.5	12.9	.491	.508
P2	6.05	6.65	.238	.262
F1,F2	2.2	2.8	.086	.110
Δh	-1.0	1.0	-.039	.039
W	17.5	19	.688	.748
W0	5.5	6.5	.216	.256
W1	8.5	9.5	.334	.374
W2	-	1	-	.039
H	19.	21	.747	.827
H0	15.5	16.5	.609	.650
L1	2.5	-	.098	-
D0	3.8	4.2	.149	.165
t1	.35	.45	.014	.018
t2	.15	.25	.006	.010
P1	3.55	4.15	.140	.163
ΔP	-1	1	-.039	.039


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