Low Voltage Adjustable Precision Shunt Regulator

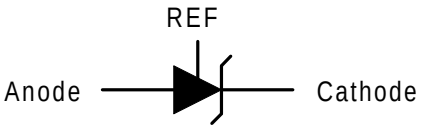
Features

- Precise Reference Voltage to 1.24V
- Guaranteed 0.5% or 1% Reference Voltage Tolerance
- Sink Current Capability , 60mA to 100mA
- Quick Turn-on
- Adjustable Output Voltage , $V_O = V_{REF}$ to 20V
- Low Operational Cathode Current , 60mA Typical
- 0.1Ω Typical Output Impedance
- SOT-23-5 Packages

Applications

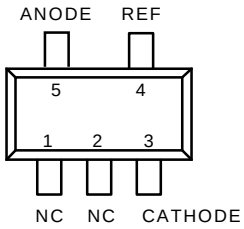
- Linear Regulators
- Adjustable Power Supply
- Switching Power Supply

Symbol

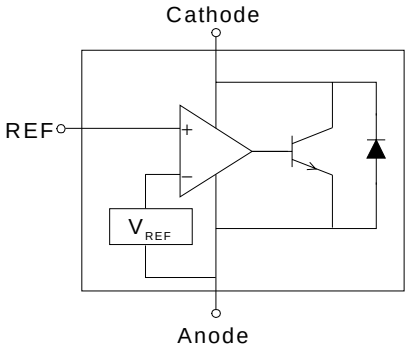


General Description

The APL1431L is a 3-terminal low voltage adjustable precision reference with specified thermal stability over applicable commercial temperature ranges . Output voltage may be set to any value between V_{REF} (1.24 V) and 20 V with two external resistors (see Figure 2) . When used with an photocoupler , the APL1431L is an ideal voltage reference in isolated feedback circuits for 1.24V to 12V switching-mode power supplies . This device has a typical output impedance of 0.1Ω . Active output circuitry provides a very sharp turn-on characteristic , making the APL1431L excellent replacements for zener diodes in many applications , including on-board regulation and adjustable power supplies .



Functional Diagram



Ordering and Marking Information

APL1431L □□□-□□□

- Lead Free Code
- Handling Code
- Temp. Range
- Package Code
- Elec. Grade

Elec. Grade
A : 0.5% Reference Voltage Tolerance
B : 1% Reference Voltage Tolerance
Package Code
B : SOT- 23 - 5
Temp. Range
C : 0 to 70 °C I : -40 to 85 °C
Handling Code
PB : Plastic Bag TB : Tape & Box
TR : Tape & Reel
Lead Free Code
L : Lead Free Device Blank : Original Device

APL1431L B : 1431L

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{KA}	Cathode Voltage	20	V
I_K	Continuous Cathode Current	100	mA
I_{REF}	Reference Current	3	mA
θ_{JA}	Thermal Resistance from Junction to Ambient in Free Air SOT-23-5	357	°C/W
T_J	Operating Junction Temperature Range	-40 to 150	°C
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_{SOL}	Lead Temperature Range, T_s (Soldering, 10sec)	260	°C

Electrical Characteristics

T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Test Conditions		APL1431L Min.	APL1431L Typ.	APL1431L Max.	Unit
V_{REF}	Reference Voltage	$V_{KA}=V_{REF}$, I_K=10mA, T_A= 25°C, (Fig. 1)	APL1431LA	1.234	1.240	1.246	V
			APL1431LB	1.228	1.240	1.252	
		T_A= full range (see Note 1), (Fig. 1)	APL1431LA	1.222	1.240	1.258	
			APL1431LB	1.215	1.240	1.265	
V_{DEV}	V_{DEF} Temp Deviation	T_A= full range(see Note 1), $V_{KA}=V_{REF}$, I_K=10mA, (Fig. 1)			5	15	mV
ΔV_{REF} /ΔV_{KA}	Ratio of Change in V_{REF} to Change in Cathode Voltage	I_K=10mA, ΔV_{KA} =16V to V_{REF} (Fig. 2)			-0.2	-1.0	mV/V
I_{REF}	Reference Input Current	I_K=10mA, R_1=10kΩ, R_2=∞ (Fig. 2)			0.15	0.5	µA

Electrical Characteristics

T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Test Conditions		APL1431L			Unit
				Min.	Typ.	Max.	
$I_{REF(DEV)}$	I_{REF} Temp Deviation	T_A= full range(see Note 1), R_1=10kΩ, R_2=∞ , I_K=10mA, (Fig. 2)			0.05	0.3	μA
$I_{K(off)}$	Off-state cathode current	V_{REF}=0V, (Fig. 3)	V_K=6V		0.01	0.1	μA
			V_K=16V		0.01	0.5	
Z_{KA}	Dynamic Output Impedance	V_{KA} =V_{REF} , I_K=100μA to 100mA , f<1kHz , (Fig. 1)			0.1	0.3	Ω
$I_{K(MIN)}$	Minimum Operating Current	V_{KA} =V_{REF} , (Fig. 1)			60	80	μA

Note : 1. Full temperature range is 0°C to 70°C for APL1431LXXC, and –40°C to 85°C for APL1431LXXI.

Test Circuits

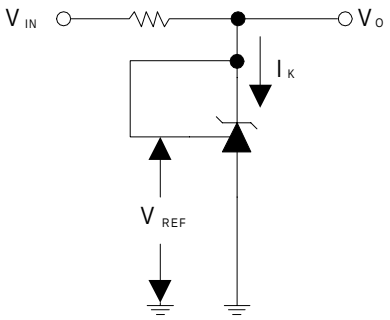


Figure 1. Test Circuit for V_{KA}=V_{REF}, V_O=V_{KA}=V_{REF}

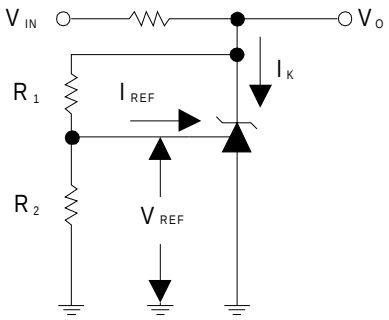


Figure 2. Test Circuit for V_{KA}>V_{REF},
V_O= V_{KA}= V_{REF}× (1+R_1/R_2) + I_{REF}× R_1

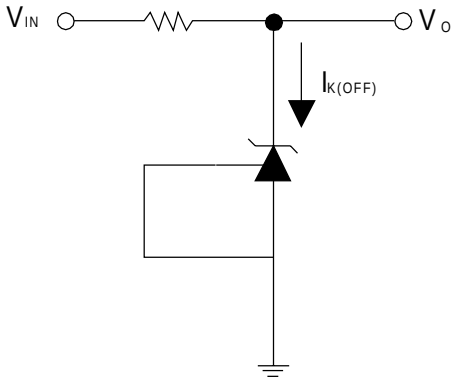
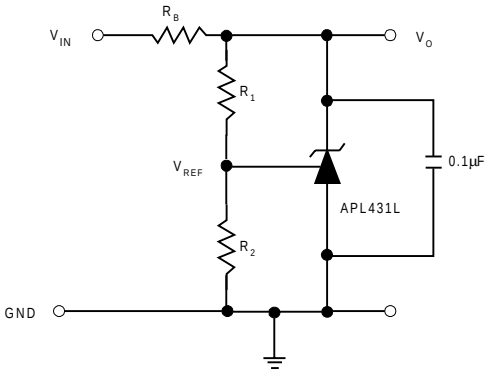
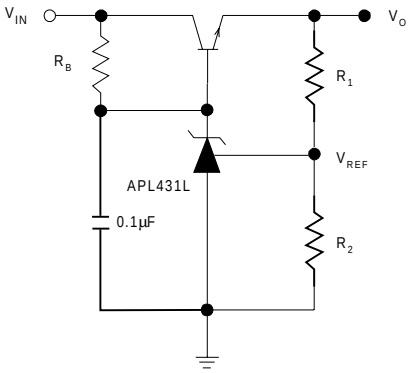


Figure 3. Test Circuit for $I_{K(OFF)}$

Application Schematic



Precision Voltage Reference



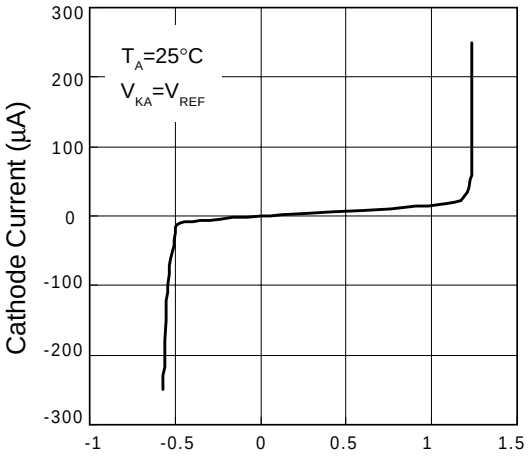
Precision Voltage Regulator

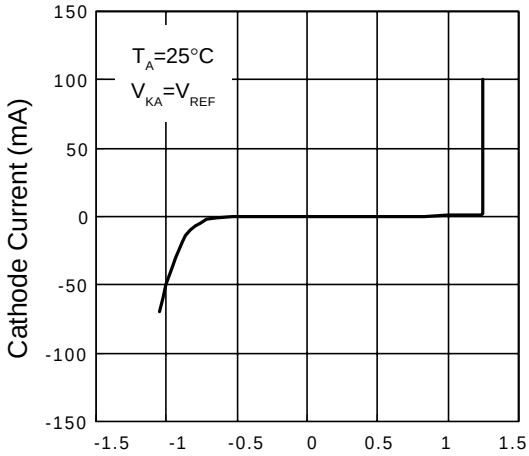
Notes for Application Circuits:

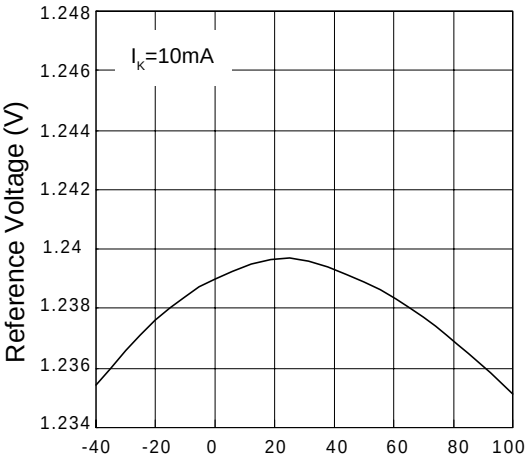
1) To improve the stability of output voltage , a 0.1µF capacitor between cathode and anode of APL431L is strongly recommended.
2) Set V_O according to the following equation:
   $V_O = V_{REF} (1+R1/ R2)+ I_{REF} R1$
3) Choose the value for R_B as follows:

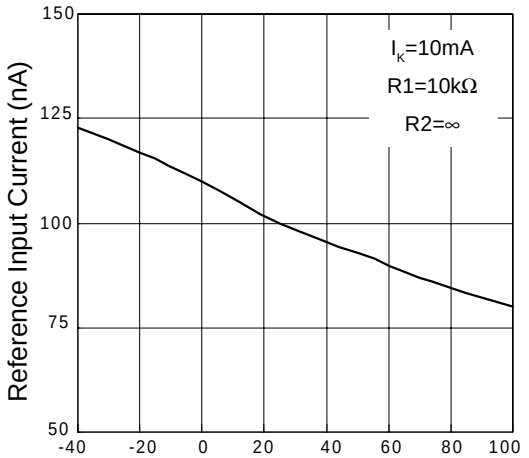
- The maximum limit for R_B should be such that the cathode current(I_K) is greater than the minimum operating current (60µA) at $V_{IN (MIN)}$.
- The minimum limit for R_B should be such that the cathode current (I_K) does not exceed 100mA under all load conditions, and the instantaneous turn-on value for I_K does not exceed 150mA . Both of the following conditions must be met :
  $R_{B,MIN} \geq V_{IN(MAX)} / 150mA$ (to limit instantaneous turn-on I_K)
  $R_{B,MIN} \geq V_{IN(MAX)} - V_O / I_{O (MIN)} + 100mA$ (to limit I_K under normal operating conditions)

Typical Characteristics

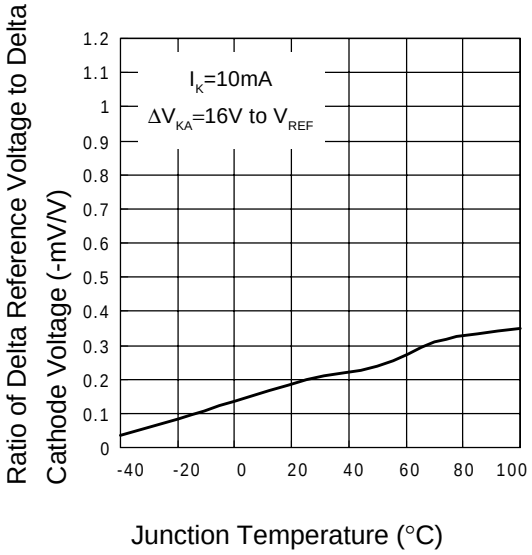


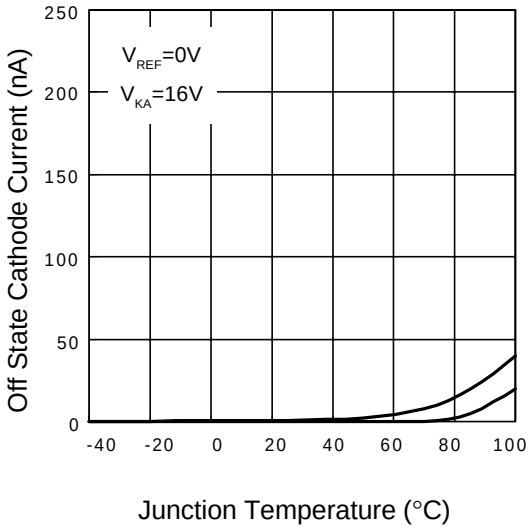






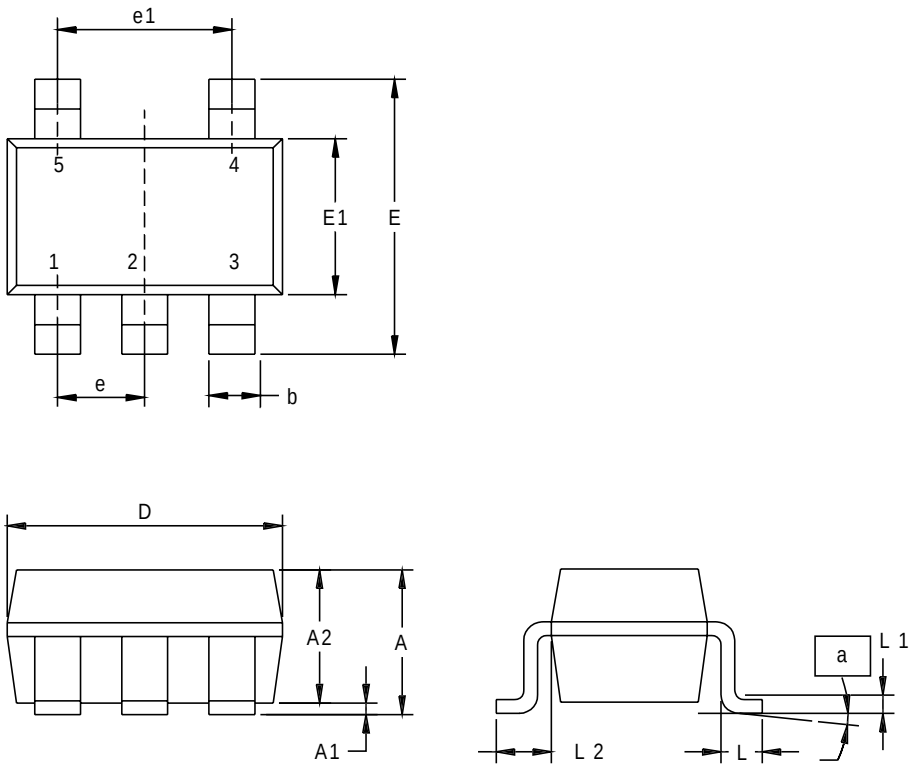
Typical Characteristics (Cont.)





Packaging Information

SOT-23-5

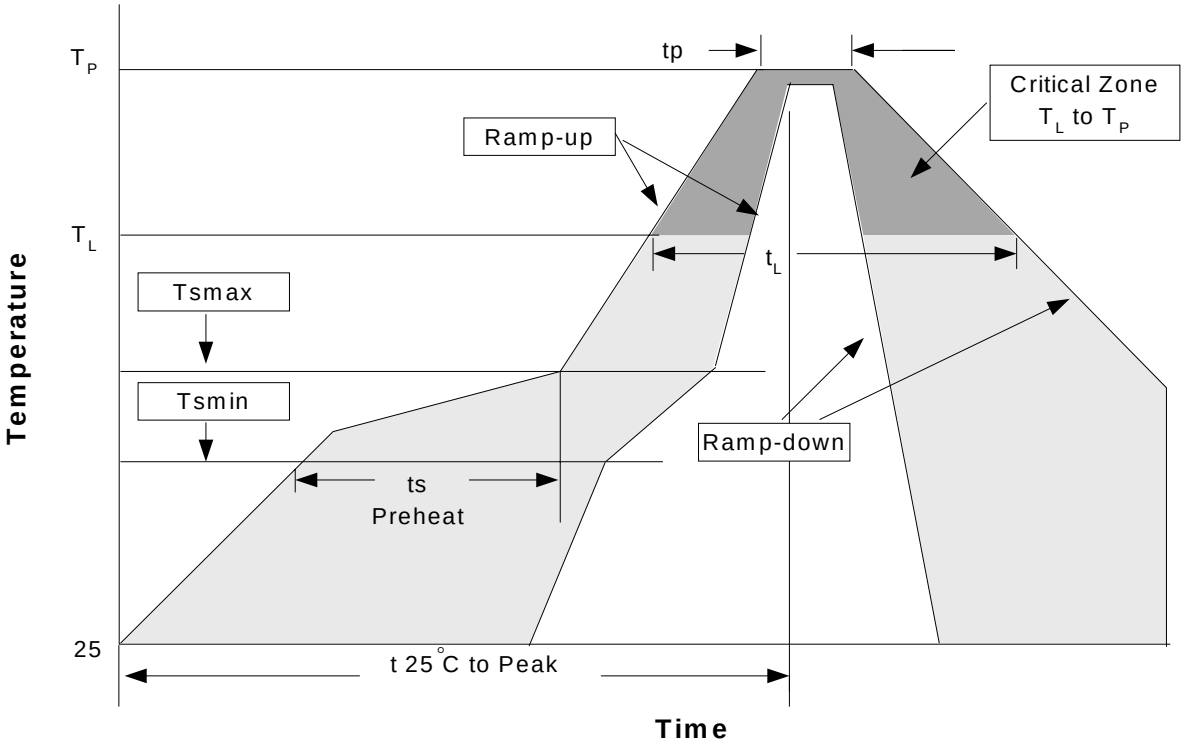


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.95	1.45	0.037	0.057
A1	0.05	0.15	0.002	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.011	0.019
D	2.8	3.00	0.110	0.118
E	2.6	3.00	0.102	0.118
E1	1.5	1.70	0.059	0.067
e	0.95BSC		0.037BSC	
e1	1.90BSC		0.074BSC	
L	0.35	0.55	0.014	0.022
L1	0.20 BSC		0.008 BSC	
L2	0.5	0.7	0.020	0.028
N	5		5	
α	0°	10°	0°	10°

Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

Reflow Condition (IR/Convection or VPR Reflow)



Classificatin Reflow Profiles

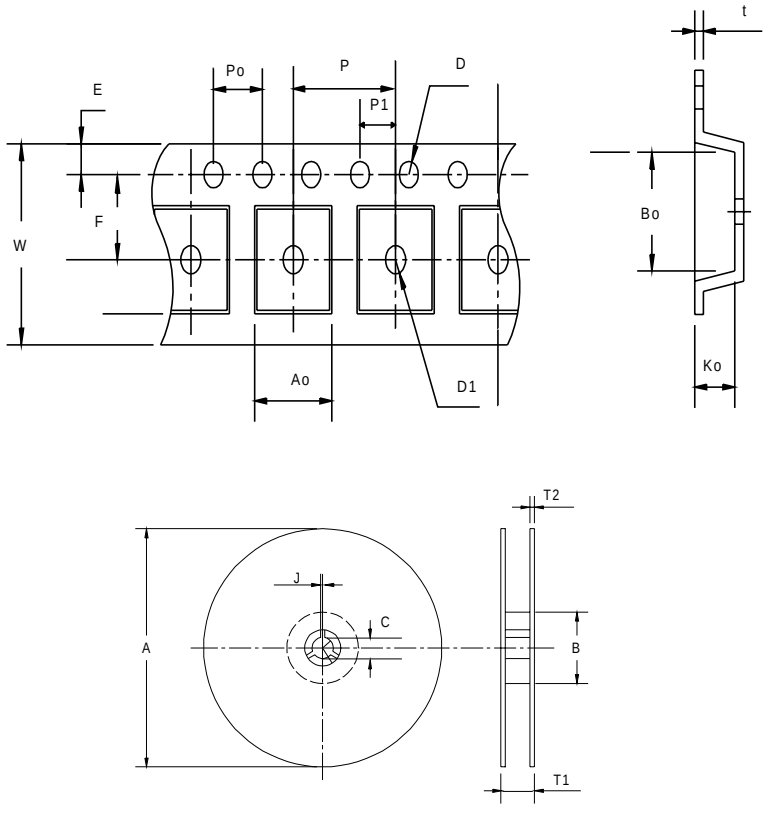
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat - Temperature Min (Tsmin) - Temperature Mix (Tsmax) - Time (min to max)(ts)	100°C 150°C 60-120 seconds		150°C 200°C 60-180 seconds	
Tsmax to T_L - Ramp-up Rate			3°C/second max	
Tsmax to T_L - Temperature(T_L) - Time (t_L)	183°C 60-150 seconds		217°C 60-150 seconds	
Peak Temperature(Tp)	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature(tp)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		6°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

Note: All temperatures refer to topside of the package. Measured on the body surface.

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C, 5 SEC
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @125°C
PCT	JESD-22-B,A102	168 Hrs, 100%RH, 121°C
TST	MIL-STD-883D-1011.9	-65°C~150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms, 1_{tr} > 100mA

Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
SOT-23-5	178 ±1	72 ± 1.0	13.0 + 0.2	2.5 ± 0.15	8.4 ± 2	1.5 ± 0.3	8.0 ± 0.3	4 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	1.5± 0.1	1.5± 0.1	4.0 ± 0.1	2.0 ± 0.1	3.15 ± 0.1	3.2± 0.1	1.4± 0.1	0.2±0.033

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOT- 23-5	8	5.3	3000

Customer Service

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