ADJUSTABLE PRECISION SHUNT REGULATORS

概述General Description

The FL431-A is a three-terminal adjustable shunt regulator with guaranteed thermal stability over a full operation range. It features sharp turn-on characteristics,low temperature coefficient and low output impedance，which make it ideal substitute for Zenner diode in applications such as switching power supply ，charger and other adjustable regulators.

The output voltage of FL431-A can be set to any value between Vref(2.5V) and the corresponding maximum cathode voltage(36V).

The FL431-A is offered in two grade initial voltage tolerance at 25°C，0.4% and 0.8%.

This IC is available in 3 packages:TO-92, SOT-89 and SOT-23.

FL431-A是三端可調的，全溫度範圍穩定的並聯調整器。具有快速啟動、低溫漂和低輸出阻抗的特性，在開關電源、充電和其他可調調整器應用中是齊納二極體的理想替代器件。

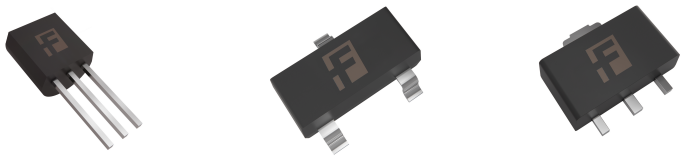
輸出電壓範圍為Vref(2.5V)到最大陰極電壓36V。0.4%和0.8%兩種精度(25 ° C) 。

封裝:TO-92,SOT89和SOT-23。

特點Features

- 可編程精確的輸出電壓:2.5V-36V
  Programmable Precise Output Voltage from2.5V to 36V
- 容性負載下高度穩定
  High Stability Under Capacitve Load
- 低陰極電流，典型值400μ A
  Low Minimum Cathode Current for Regulation : 400u A(Typ.)
- 低溫漂，典型值4.5mV
  Low Temperature Deviation: 4.5mv Typical
- 電流能力: 1mA-100mA
  Sink Current Capacity from 1mA to 100mA
- 寬工作溫度範圍:-40 ° C~125 ° C
  Wide Operating Range : -40 ° C to 125 ° C

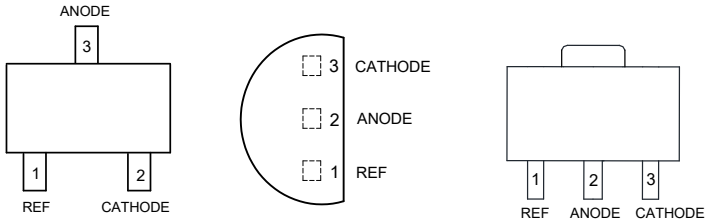
引腳排列Pin Configuration



TO-92(Bulk Packing) SOT-23 SOT-89

Figure 1. Package Type of FL431-A

N Package (SOT-23) Z Package (TO-92 (Bulk Package))



SOT23 **TO92 (Bulk Packing)** **SOT89**

Figure 2. Pin Configuration of FL431-A(Top View)

應用領域 Applications

- 充電器Charger
- 電壓適配器Voltage Adapter
- 開關電源Switching Power Supply
- 圖形卡Graphic Card
- 精確電壓基準Precision Voltage Reference

ADJUSTABLE PRECISION SHUNT REGULATORS

電路功能框圖Functional Block Diagram

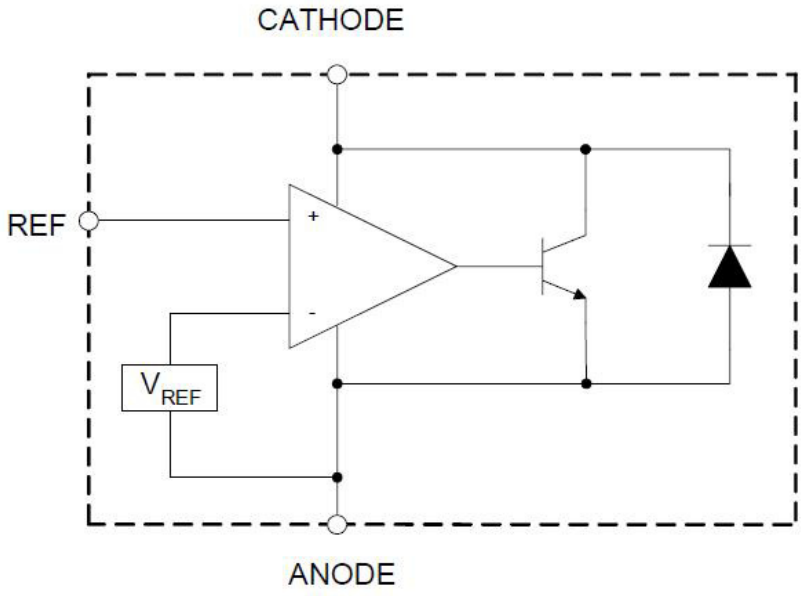


Figure 3. Functional Block Diagram of FL431A

絕對最大額定值Absolute Maximum Rating(Note 1)

Symbol 符號	Parameter 參數說明		Value數值範圍	Unit單位
V_{KA}	Cathode Voltage 陰極電壓		40	V
I_{KA}	Cathode Current Range (Continuous) 陰極電流範圍		-100 to 150	mA
I_{REF}	Reference Input Current Range 參考輸入電流範圍		0.05-10	mA
P_D	Power Dissipation 耗散功率		Z, R Package: 700	mW
			N Package: 200	
θ_{JA}	Thermal Resistance (Junction to Ambient) 熱阻	SOT23	380	°C/W
		TO92	165	
		SOT89	165	
T_J	Junction Temperature 結溫		+150	°C
T_{STG}	Storage Temperature Range 存儲溫度		-65 to +150	°C
ESD	ESD (Human Body Model) 人體模型		2000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

備註1：超過“絕對最大額定值”的應力可能會造成器件永久損壞。這些僅是應力額定值，器件工作在上述條件以及超出“建議工作條件”的情況是不可取的。長期處於“絕對最大額定值“可能影響器件的可靠性。

推薦工作條件Recommended Operating Conditions

Symbol 符號	Parameter 參數	Min 最小值	Max 最大值	Unit 單位
V_{KA}	Cathode Voltage 陰極電壓	V_{REF}	37	V
I_{KA}	Cathode Current 陰極電流	0.3	100	mA
T_A	Operating Ambient Temperature Range 工作環境溫度	-40	+125	°C

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電特性表Electrical Characteristics

Operating Conditions:TA=25 °C, unless otherwise specified
工作條件：除非特指，環境溫度為25℃

Symbol 符號	Test Circuit 測試電路	Parameter 參數	Conditions 測試條件		Min 最小值	Typ 典型值	Max 最大值	Unit 單位
V_{REF}	4	Reference Voltage 參考電壓	$V_{KA} = V_{REF}$, I_{KA} = 10mA		2.483	2.495	2.507	V
ΔV_{REF}	4	Deviation of Reference Voltage Over Full Temperature Range 基準電壓溫漂	$T_{min} \le Ta \le T_{max}$		—	3	17	mV
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	5	Ratio of Change in Reference Voltage to the Change in Cathode Voltage 基準電壓的線性調整率	I_{KA} = 10mA	ΔV_{KA} = 10V to V_{REF}	—	0.6	2.7	mV/V
				ΔV_{KA} = 36V to 10V	—	0.4	2.0	
I_{REF}	5	Reference Current 基準電流	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞		—	0.2	4	μA
ΔI_{REF}	5	Deviation of Reference Current Over Full Temperature Range 基準電流溫漂	I_{KA} = 10mA, R1 = 10kΩ R2 = ∞, T_A = -40 to +125°C		—	0.4	1.2	μA
I_{KA} (Min)	4	Minimum Cathode Current for Regulation 最小陰極電流	$V_{KA} = V_{REF}$		—	—	0.5	mA
I_{KA} (Off)	6	Off-state Cathode Current 夾斷陰極電流	V_{KA} = 40V, V_{REF} = 0		—	0.01	0.9	μA
Z_{KA}	4	Dynamic Impedance 動態阻抗	$V_{KA} = V_{REF}$, I_{KA} = 1 to 100mA, f ≤ 1.0kHz		—	0.27	0.5	Ω
θ_{JC}	—	Thermal Resistance 熱阻	SOT23		—	135.48	—	°C/W
	—		TO92		—	81.63	—	
	—		SOT89		—	29.80	—	

電特性表(續) Electrical Characteristics(cont.)

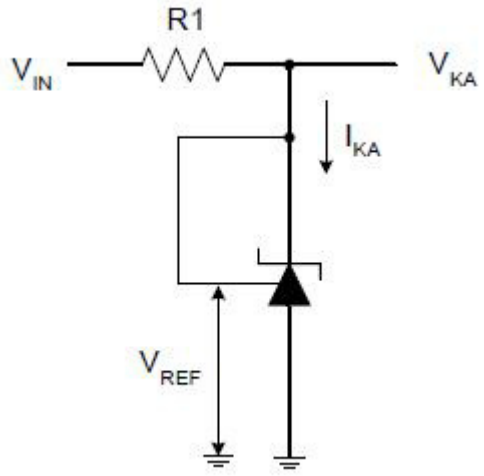


Figure 4. Test Circuit 4 for $V_{KA}=V_{REF}$

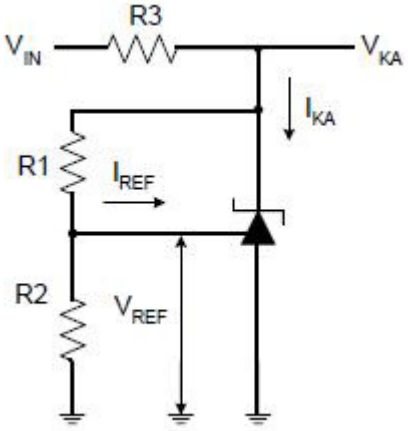


Figure 5. Test Circuit 5 for $V_{KA}=V_{REF}$ $(1+R_1/R_2)+I_{REF}*R_1$

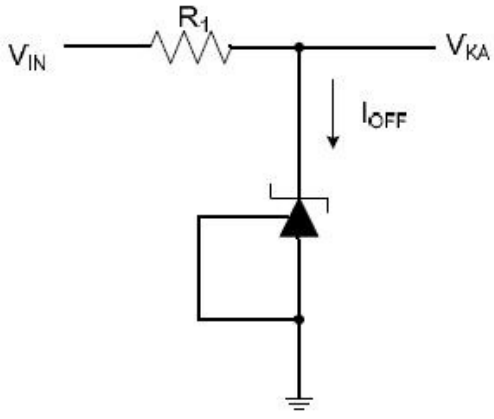
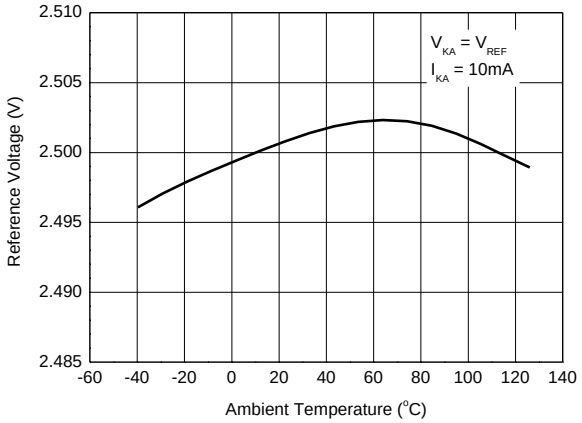


Figure 6. Test Circuit 6 for I_{OFF}

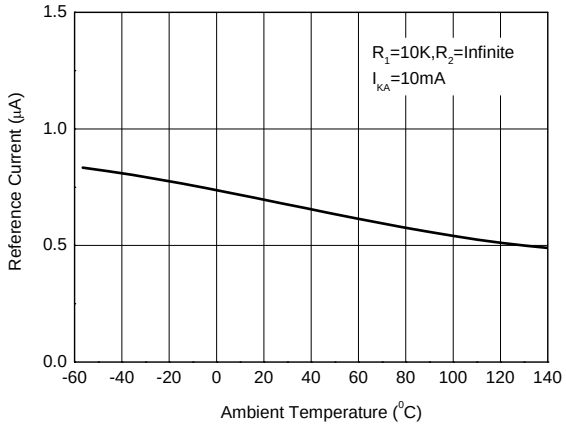
ADJUSTABLE PRECISION SHUNT REGULATORS

典型性能Typical Performance Characteristics

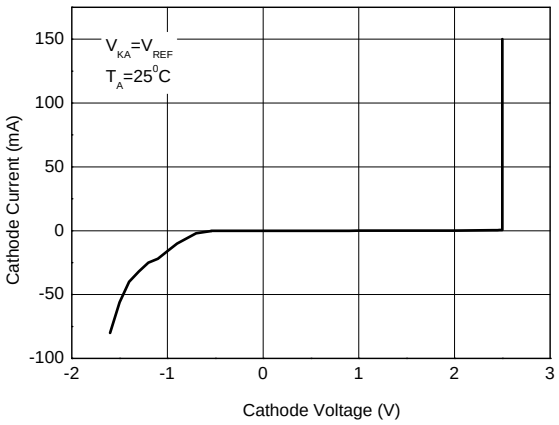
Reference Voltage vs. Ambient Temperature



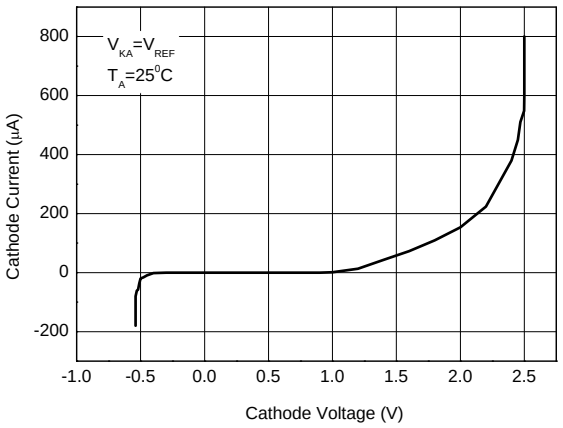
Reference Current vs. Ambient Temperature



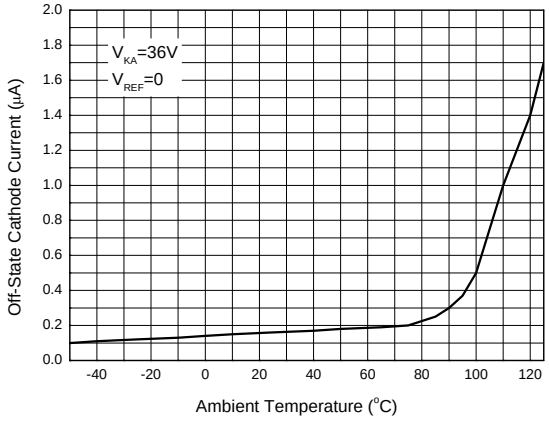
Cathode Current vs. Cathode Voltage



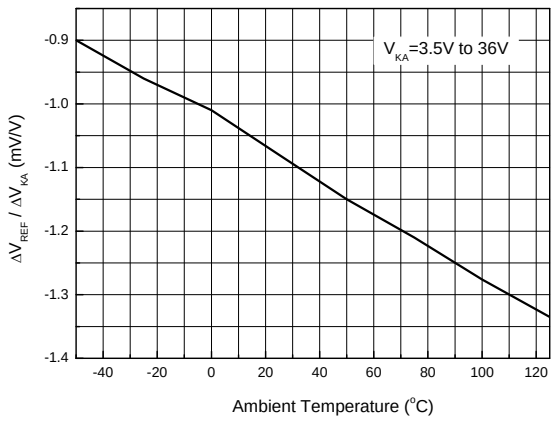
Cathode Current vs. Cathode Voltage



Off-State Cathode Current vs. Ambient Temperature



Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



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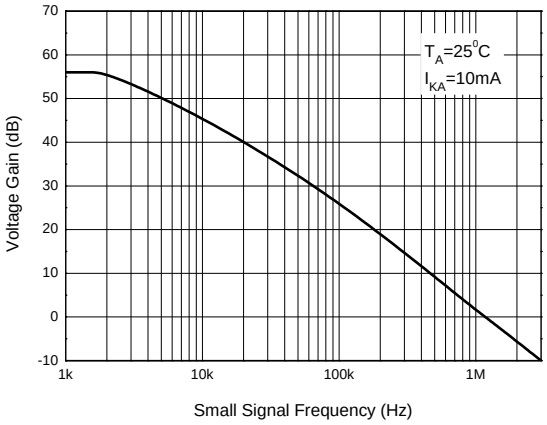
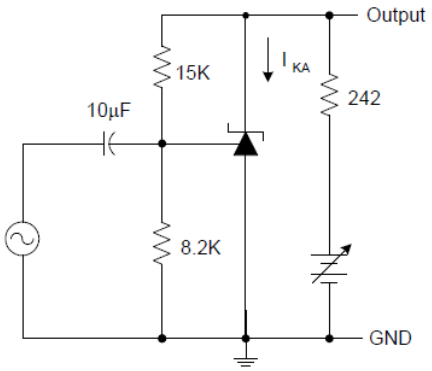
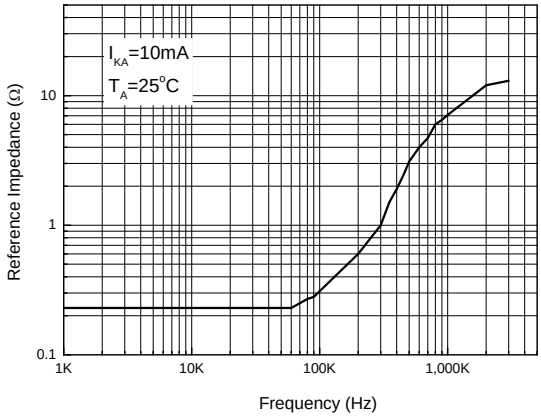
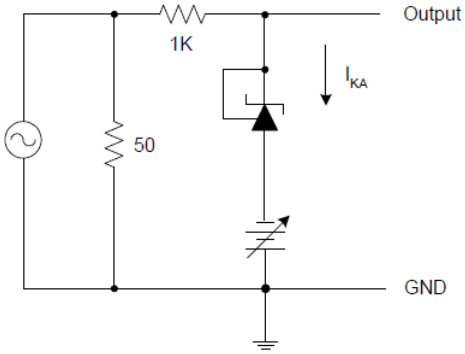
Small Signal Voltage Gain vs. Frequency



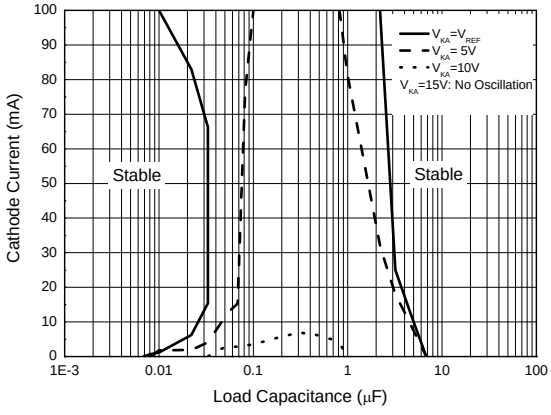


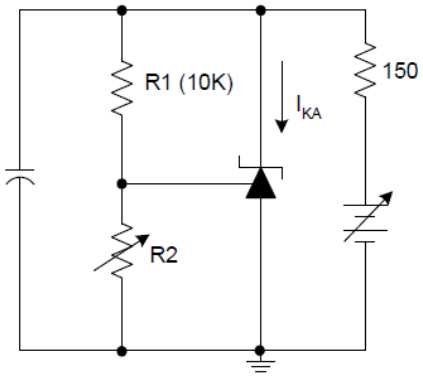
Reference Impedance vs. Frequency



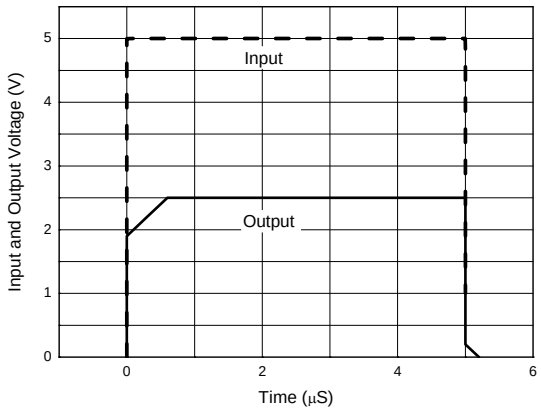


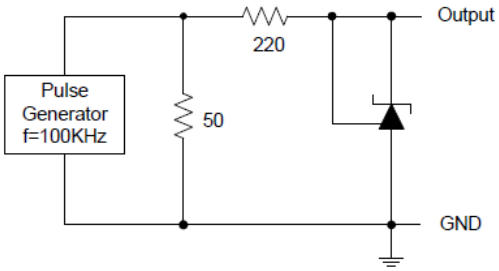
Stability Boundary Conditions vs. Load Capacitance





Pulse Response of Input and Output Voltage





典型應用 Typical Application

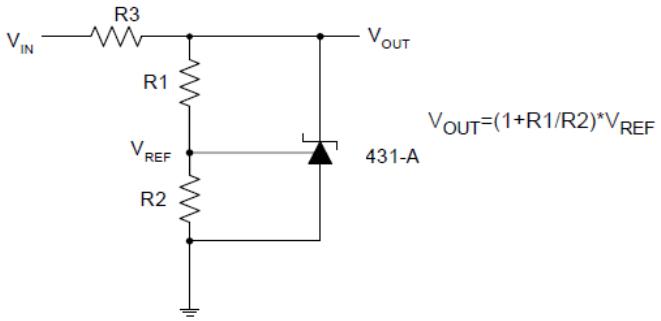


Figure 7. Shunt Regulator

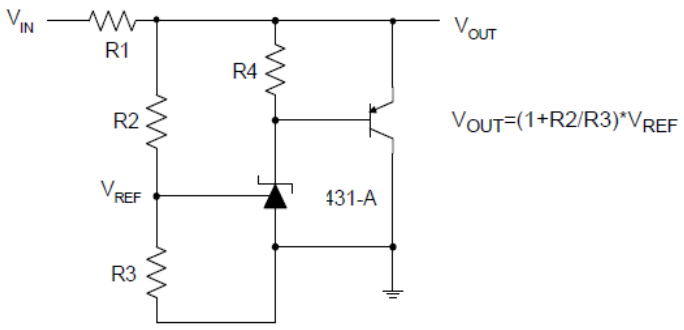


Figure 8. High Current Shunt Regulator

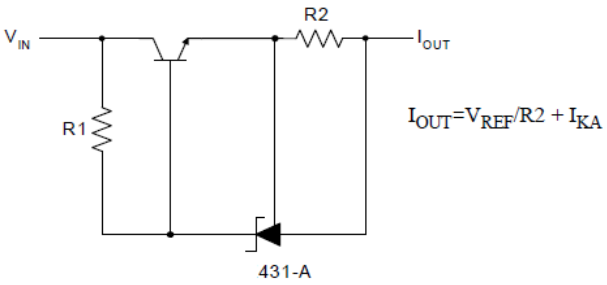


Figure 9. Current Source or Current Limit

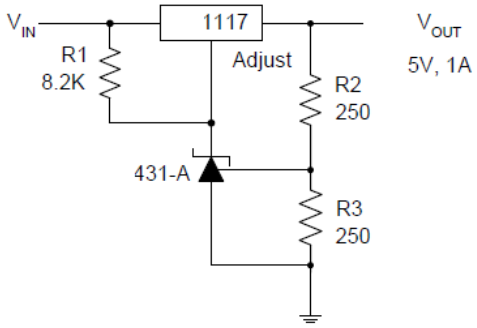


Figure 10. Precision 5V 1A Regulator

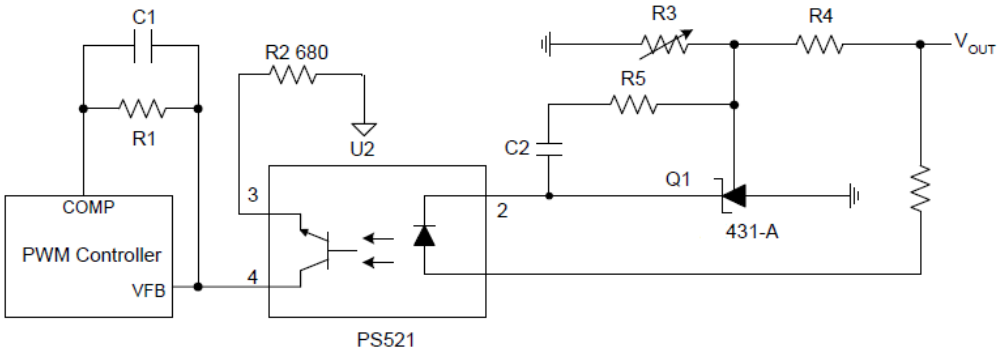
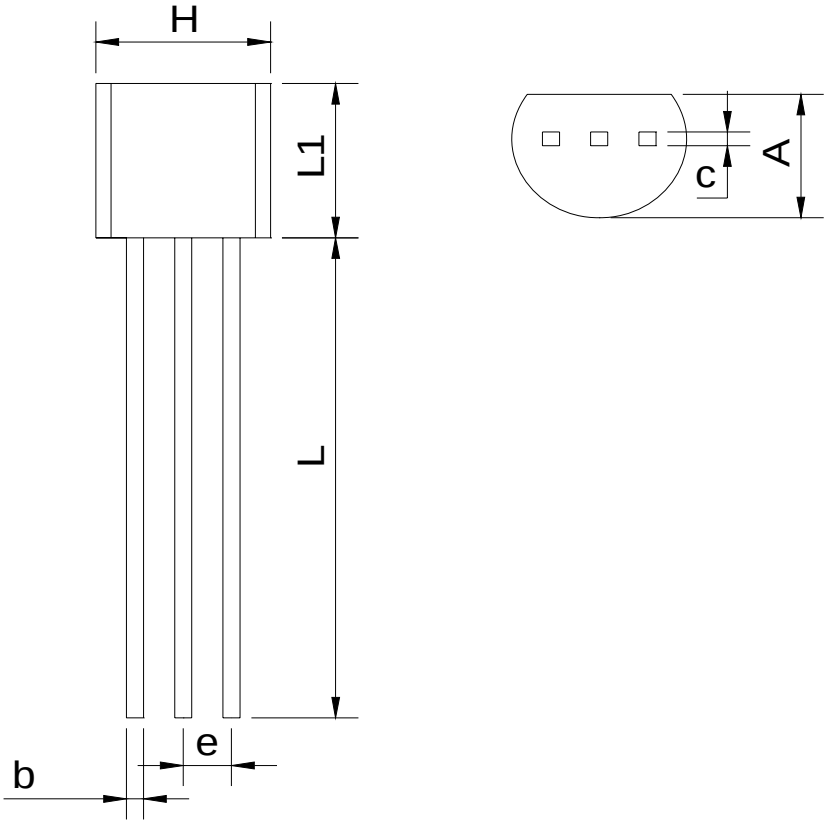


Figure 11. PWM Converter with Reference

封裝外形及尺寸圖

TO92



SYMBOL	mm	
	min	max
A	3.40	3.80
b	0.40	0.50
c	0.35	0.45
e	1.27BSC	
H	4.40	4.80
L	13.00	15.00
L1	4.30	4.70

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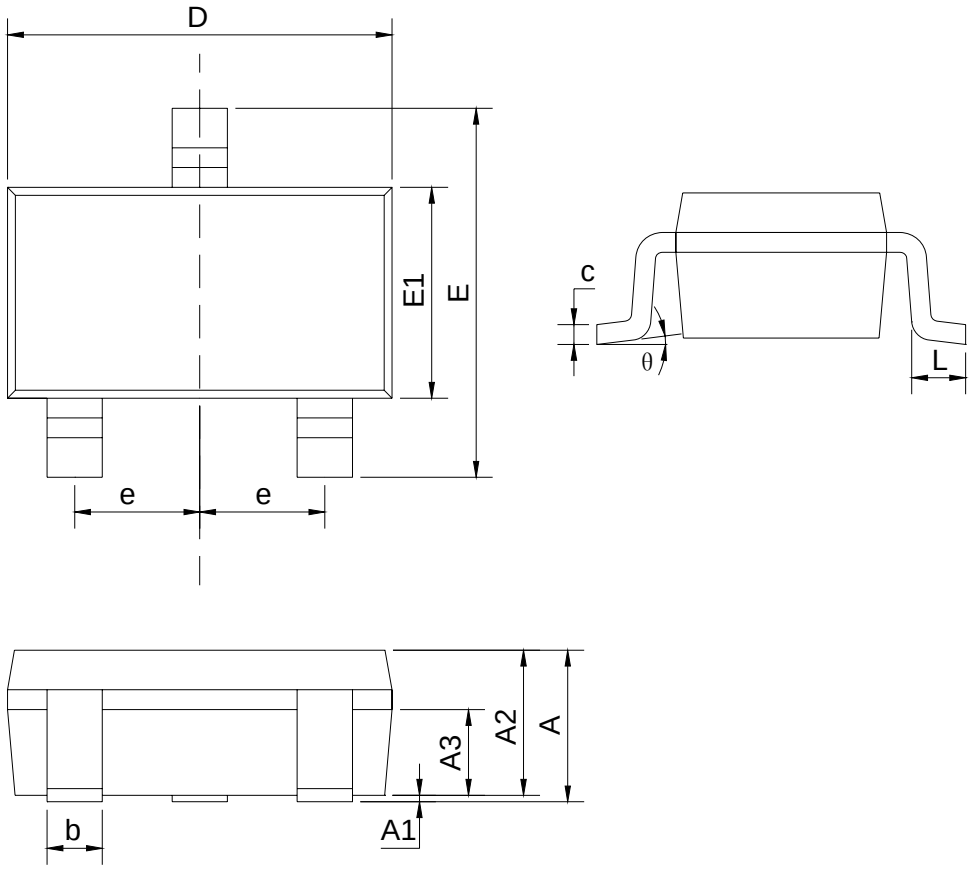
封裝外形及尺寸圖

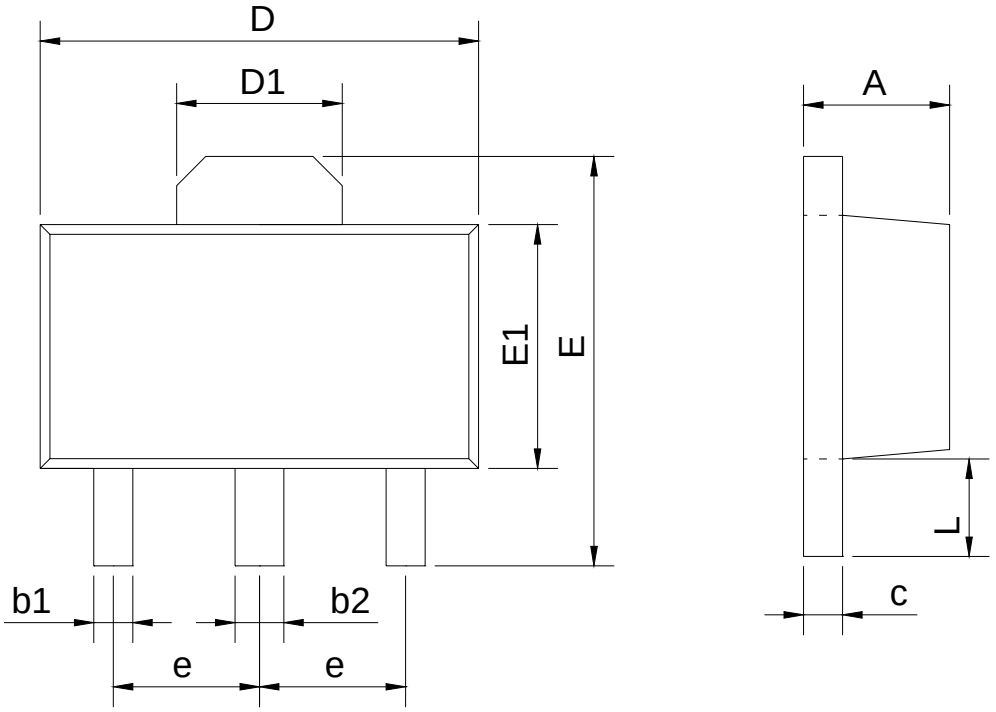
SOT23



SYMBOL	mm	
	min	max
A		1.35
A1	0.04	0.15
A2	1.00	1.20
A3	0.55	0.75
b	0.38	0.48
c	0.10	0.25
D	2.72	3.12
E	2.60	3.00
E1	1.40	1.80
e	0.95BSC	
L	0.30	0.60
θ	0	8°

封裝外形及尺寸圖

SOT89



SYMBOL	mm	
	min	max
A	1.40	1.60
b1	0.35	0.50
b2	0.45	0.60
c	0.36	0.46
D	4.30	4.70
D1	1.40	1.80
E	4.00	4.40
E1	2.30	2.70
e	1.50BSC	
L	0.80	1.20