

1.Description

The FL431 series ICs are three-terminal adjustable shunt regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger and other adjustable regulators.

The output voltage of these ICs can be set to any value between VREF (2.5V) and the maximum cathode voltage (36V).

The FL431 precision reference is offered in four voltage tolerances: $\pm 0.3\%$, $\pm 0.4\%$, $-0.3\%-0\%$ and $0\%-0.3\%$.

These ICs are available in 3 packages: SOT-23, SOT-89-3L, TO-92.

2.Features

- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 2.0mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C

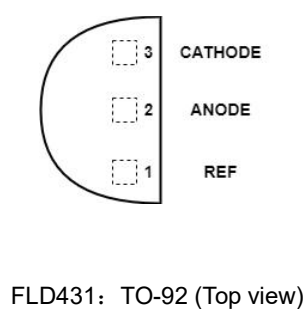
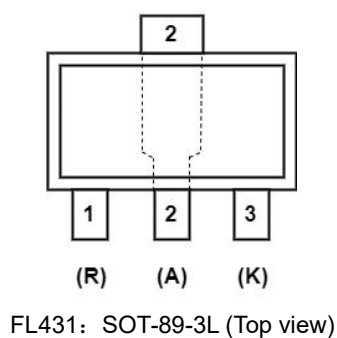
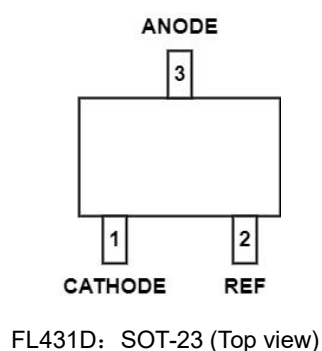
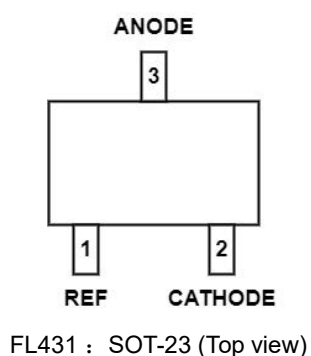
3.Applications

- Charger
- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference

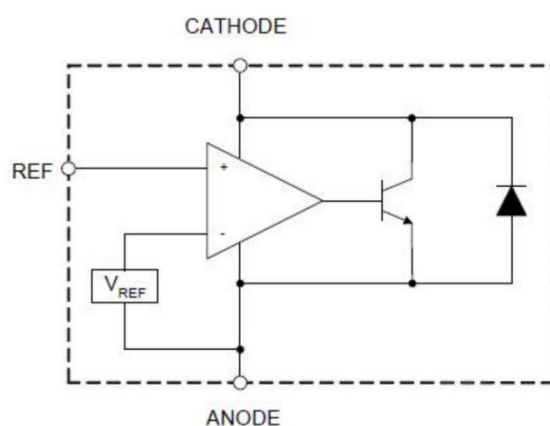
4.Order information

Mode	Package	Voltage Tolerances	Ordering Number	Packing Option
FL431	SOT-23	$\pm 0.4\%$	FL431TYSOT23G/TR	Tape and Reel,3000
	SOT-89-3L		FL431TYSOT893G/TR	Tape and Reel,1000
	TO-92		FL431TYTO92G/TX	Box,2000
	SOT-23	$\pm 0.3\%$	FL431XYSOT23G/TR	Tape and Reel,3000
	SOT-89-3L		FL431XYSOT893G/TR	Tape and Reel,1000
	TO-92		FL431XYTO92G/TX	Box,2000,
	SOT-23	$-0.3\%-0\%$	FL431RYSOT23G/TR	Tape and Reel,3000
	SOT-89-3L		FL431RYSOT893G/TR	Tape and Reel,1000
	TO-92		FL431RYTO92G/TX	Box,2000
	SOT-23	$0\%-0.3\%$	FL431SYSOT23G/TR	Tape and Reel,3000
	SOT-89-3L		FL431SYSOT893G/TR	Tape and Reel,1000
	TO-92		FL431SYTO92G/TX	Box,2000
FL431D	SOT-23	$\pm 0.4\%$	FL431DYSOT23G/TR	Tape and Reel,3000

5.Pin Assignments



6.Functional Block Diagram



7.Absolute Maximum Ratings

Symbol	Parameter		Rating	Unit
V_{KA}	Cathode Voltage		40	V
I_{KA}	Cathode Current Range (Continuous)		-100 to 150	mA
I_{REF}	Reference Input Current Range		10	mA
P_D	Power Dissipation		370	mW
θ_{JA}	Thermal Resistance (Junction to Ambient)	SOT-23	380	°C/W
		TO-92	165	
T_J	Junction Temperature		+150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C
ESD	ESD (Human Body Model)		2500	V

8.Recommended Operating Conditions

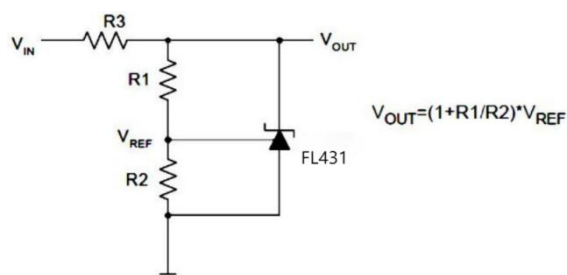
Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	1.0	100	mA
T_A	Operating Ambient Temperature Range	-40	+125	°C

9. Electrical Characteristics

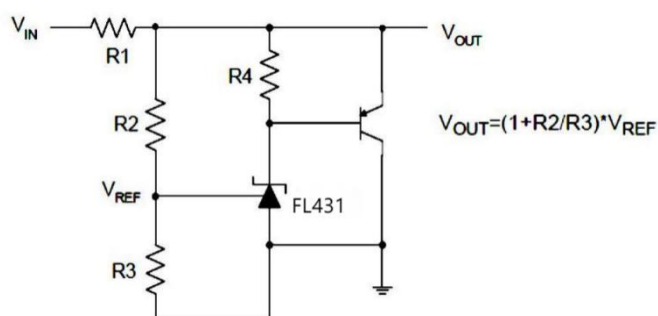
($T_A=+25^{\circ}\text{C}$, unless otherwise specified.)

Symbol	Parameter		Conditions		Min	Typ	Max	Unit
V _{REF}	Reference Voltage	0.3%	V _{KA} =V _{REF} , I _{KA} =10mA		2.4925	2.5	2.5075	V
		0.4%			2.49	2.5	2.51	
ΔV _{REF}	Deviation of Reference Voltage Over Full Temperature Range	V _{KA} =V _{REF} , I _{KA} =10mA	0 to +70℃	—	2	5	mV	
			-40 to +85℃	—	9	15		
			-40 to +125℃	—	9	15		
ΔV _{REF} /ΔV _{KA}	Ratio of Change in Reference Voltage to the Change in Cathode Voltage	I _{KA} =10mA	ΔV _{KA} =10V to V _{REF}	—	-1.1	-2.7	mV/V	
			ΔV _{KA} =36V to 10V	—	-0.5	-2.0		
I _{REF}	Reference Current	I _{KA} =10mA, R1=10KΩ, R2=∞			—	1.1	4	μA
ΔI _{REF}	Deviation of Reference Current Over Full Temperature Range	I _{KA} =10mA, R1=10KΩ, R2=∞, T _A =-40 to +125℃			—	0.32	1.2	μA
I _{KA} (Min)	Minimum Cathode Current for Regulation	V _{KA} =V _{REF}			—	0.4	1.0	mA
I _{KA} (Off)	Off-state Cathode Current	V _{KA} =36V, V _{REF} =0			—	0.05	1.0	μA
Z _{KA}	Dynamic Impedance	V _{KA} =V _{REF} , I _{KA} =1 to 100mA, f≤1.0kHz			—	0.2	0.5	Ω
θ _{JC}	Thermal Resistance	SOT-23			—	140	—	℃/W
		TO-92			—	84	—	

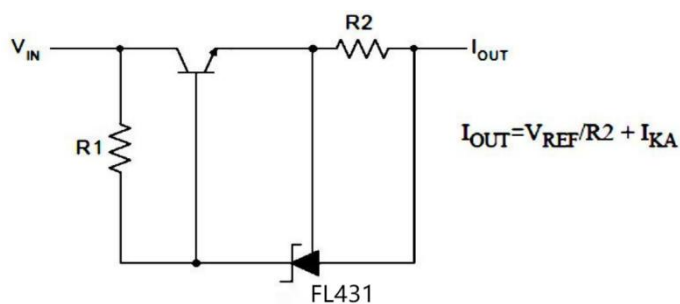
10. Typical Applications Circuit



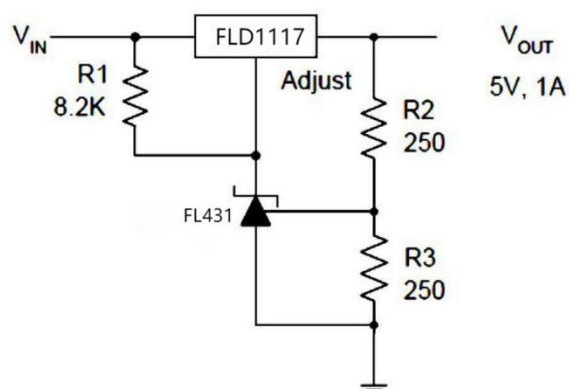
Shunt Regulator



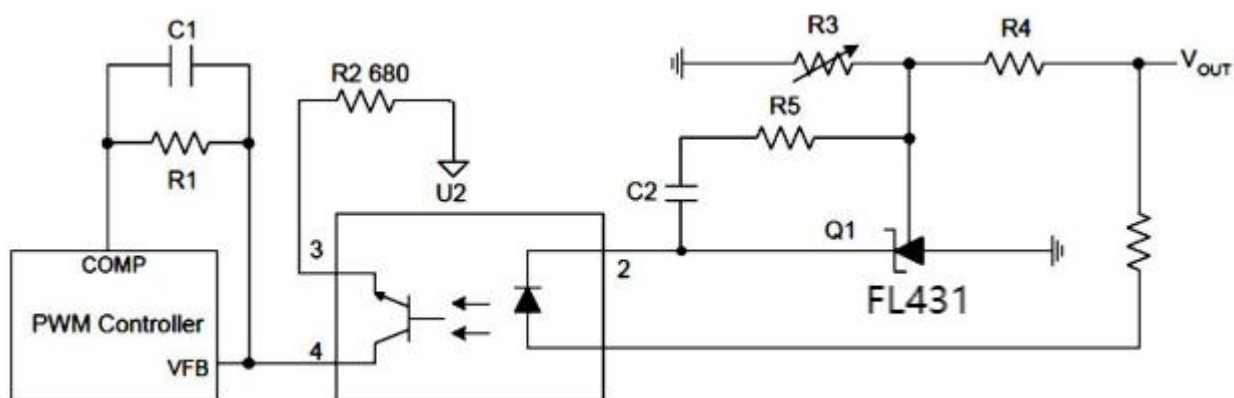
High Current Shunt Regulator



Current Source or Current Limit

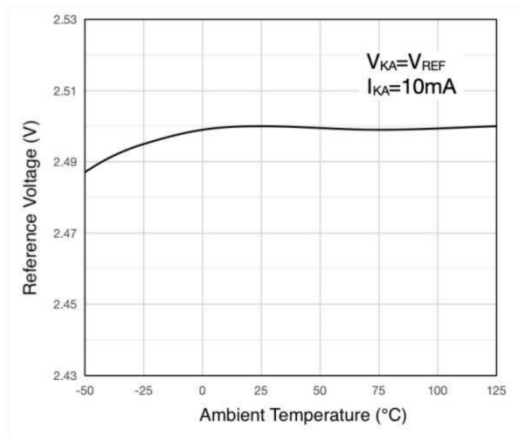


Precision 5V 1A Regulator

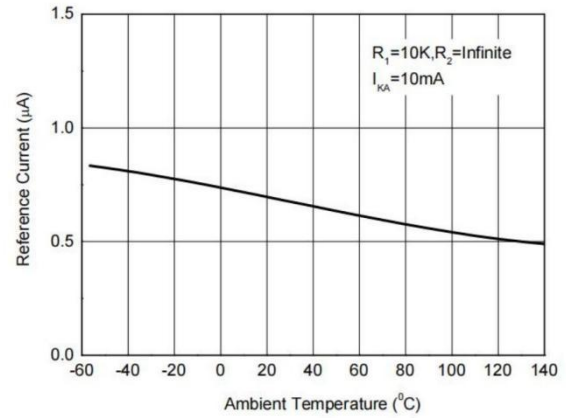


PWM Converter with Reference

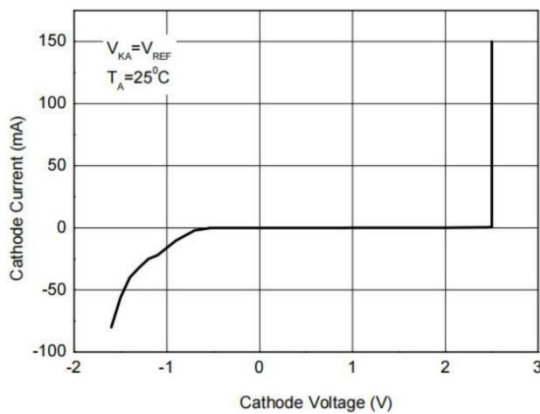
11. Performance Characteristics



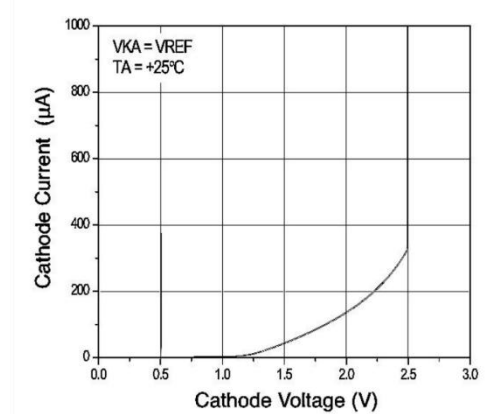
Reference Voltage vs. Ambient Temperature



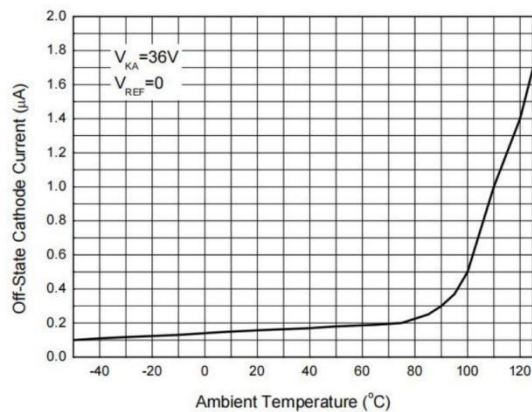
Reference Current vs. Ambient Temperature



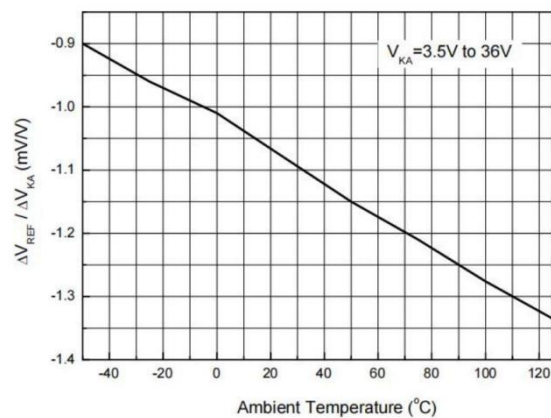
Cathode Current vs. Cathode Voltage



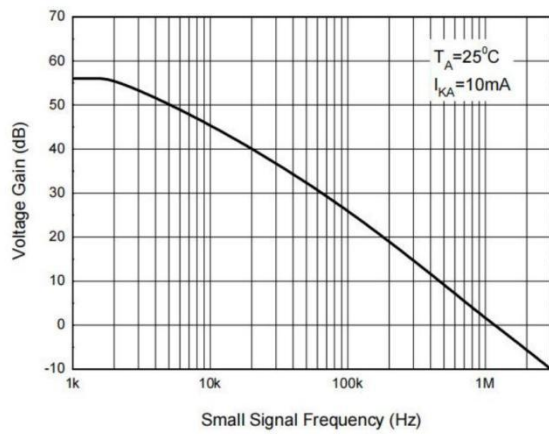
Cathode Current vs. Cathode Voltage



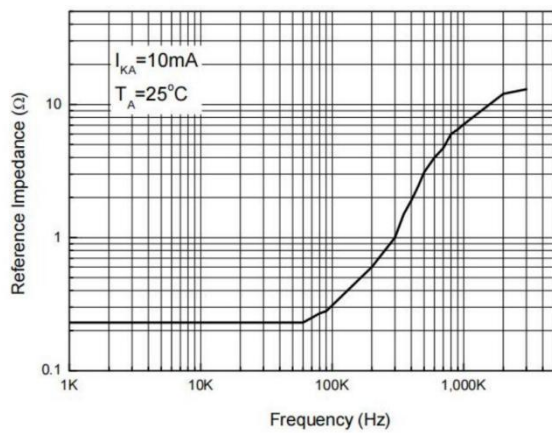
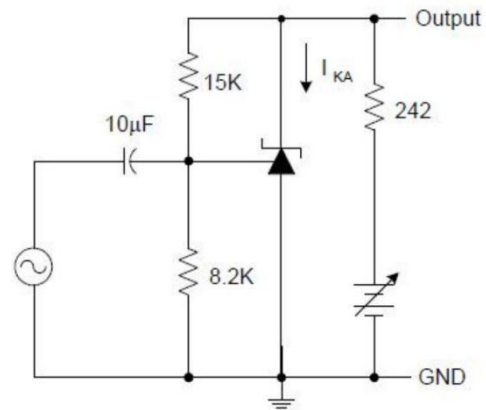
Off-State Cathode Current vs. Ambient Temperature



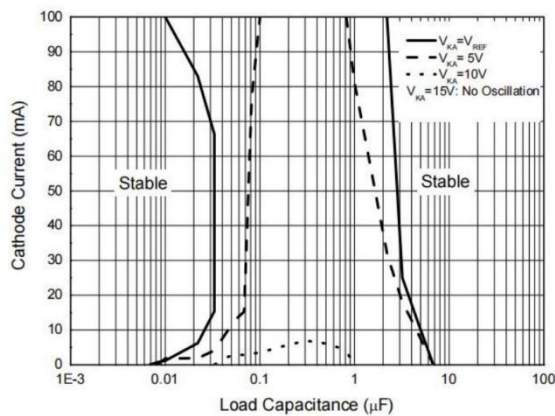
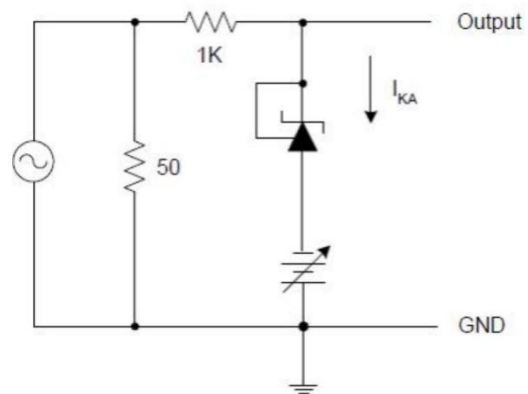
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



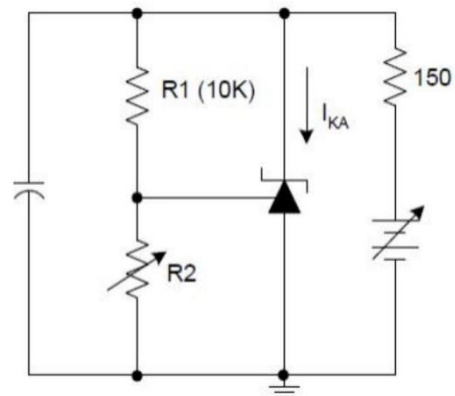
Small Signal Voltage Gain vs. Frequency

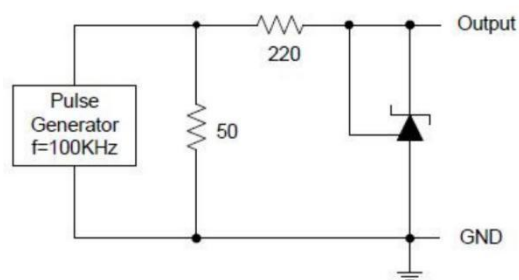
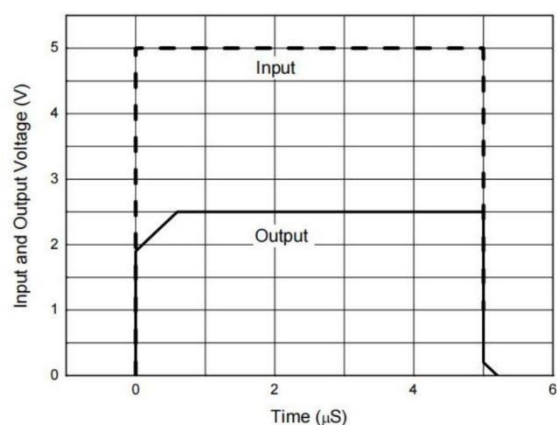


Reference Impedance vs. Frequency



Stability Boundary Conditions vs. Load Capacitance

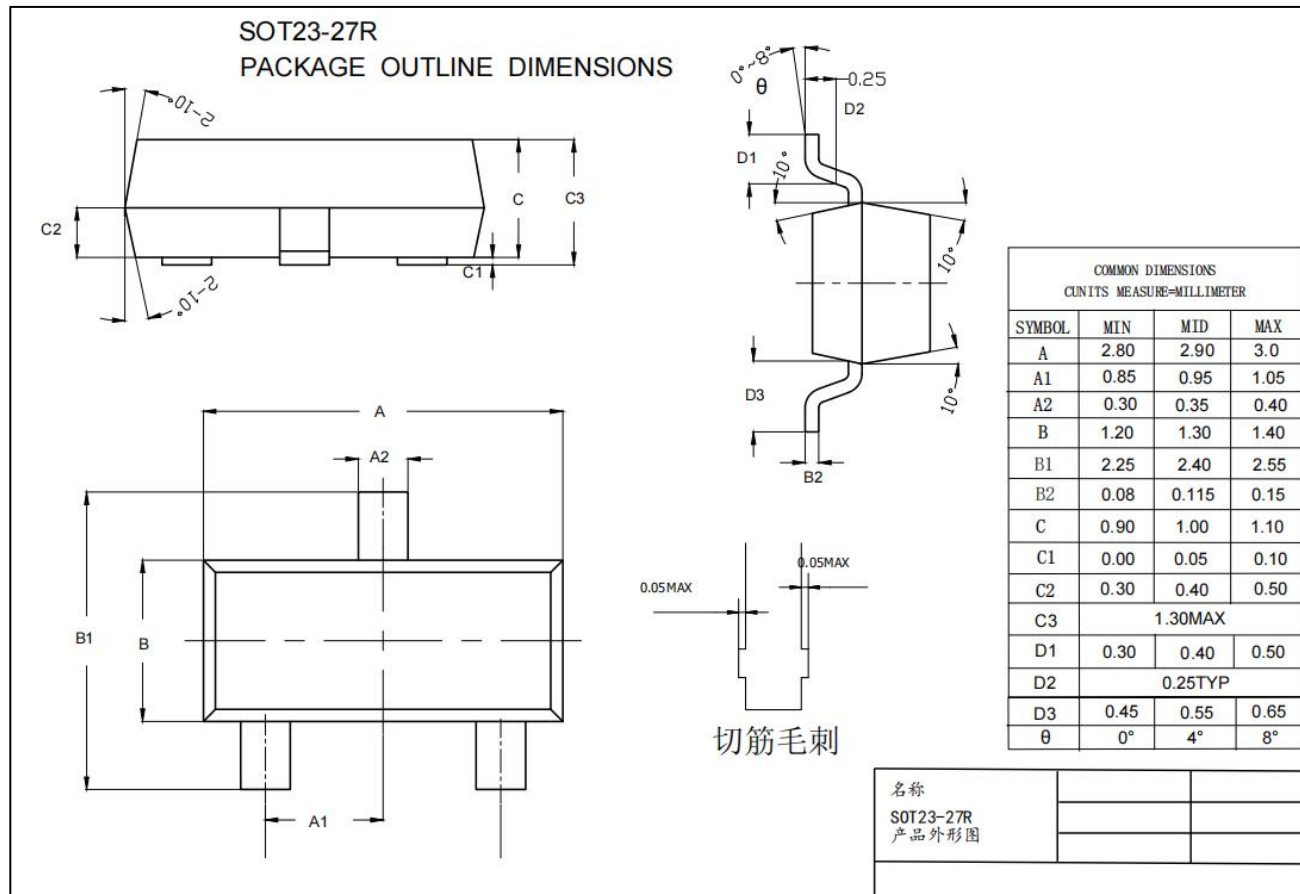




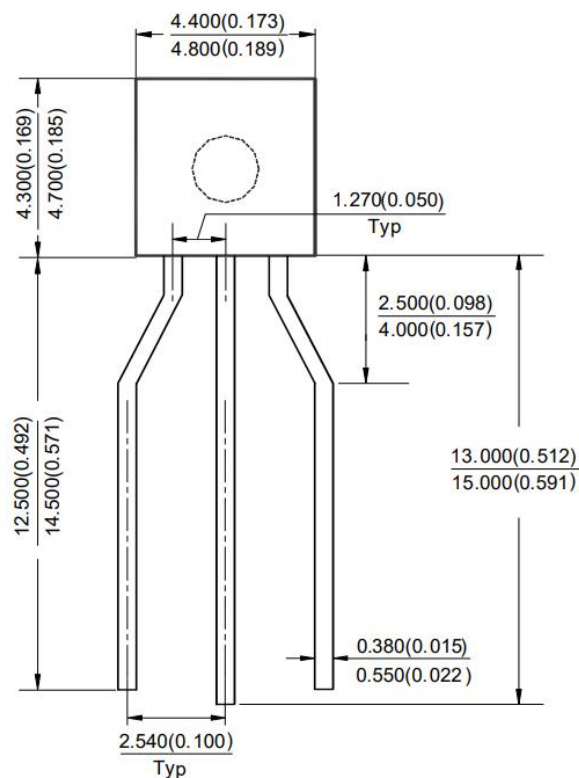
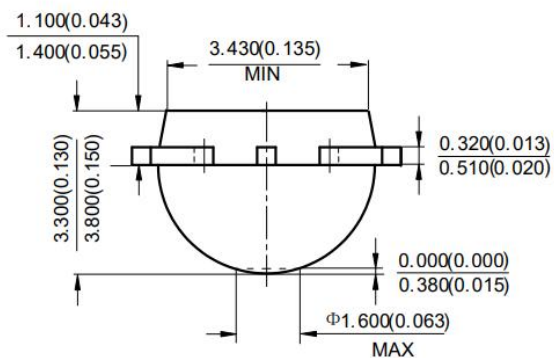
Pulse Response of Input and Output Voltage

12.Package Outline Dimensions

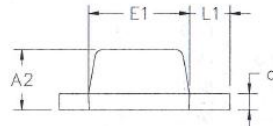
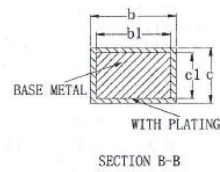
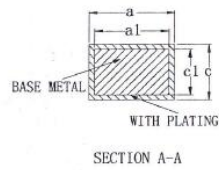
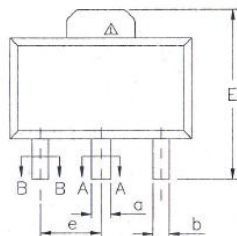
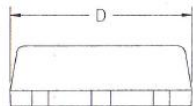
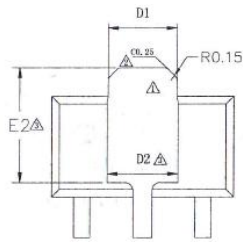
(1) Package Type: SOT-23 (All dimensions in mm.)



(2) Package Type: TO-92(Ammo Packing)



(3) Package Type: SOT-89-3L (All dimensions in mm.)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A2	1.40	1.50	1.60
b	0.38	—	0.46
b1	0.37	0.40	0.43
c	0.38	—	0.42
c1	0.37	0.38	0.39
a	0.46	—	0.56
a1	0.45	0.48	0.51
D	4.40	4.50	4.60
D1	1.62	—	1.83
E	3.95	—	4.25
E1	2.40	2.50	2.60
e	1.50BSC		
L1	0.89	—	1.20

Size (mm)	△ D2	△ E2
66.9*63	1.75REF	2.84REF

13.Important Notice And Disclaimer

- We reserves the right to change the instruction manual without prior notice.
- Any semiconductor product has a certain possibility of failure or malfunction under specific conditions. The buyer is responsible for complying with safety standards and taking safety measures when using our products for system design and overall manufacturing to avoid potential failure risks that may cause personal injury or property damage.
- The improvement of product quality is endless, our company will be dedicated to provide customers with better products.

14.Version Modification Record

Version Number	Revision
First edition	
V0.1	1. Update the Pin Assignments 2. Update the Package Outline Dimensions-Package Type: TO-92(Ammo Packing)