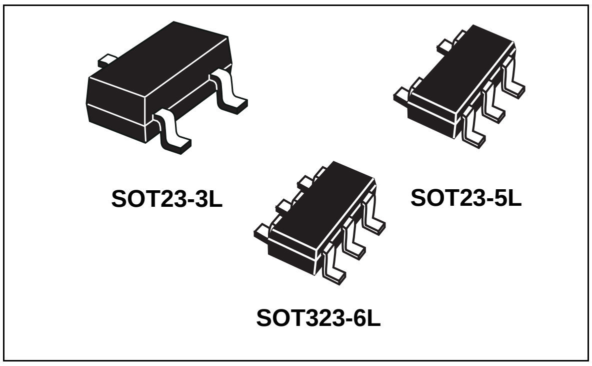
TLVH431

Programmable shunt voltage reference

Datasheet - production data



Features

- Adjustable output voltage: 1.24 V to 18 V
- Low operating current: 100 µA at 25 °C
- 0.25%, 0.5% and 1.5% voltage precision
- Sink current capability up to 60 mA
- -40 to +125 °C temperature range
- 100 ppm/°C maximum temperature coefficient
- Available in SOT23-3L, SOT23-5L and SOT323-6L packages

Applications

- Computers
- Battery chargers
- Switch mode power supplies
- Battery operated equipment
- Data acquisition systems
- Energy management

Description

The TLVH431 is a low power programmable shunt voltage reference, with guaranteed temperature stability over the entire operating temperature range.

The output voltage may be set to any value between 1.24 V and 18 V by means of an external resistor divider.

The TLVH431 operates with a wide current range from 100 µA to 60 mA with a typical dynamic impedance of 0.22 Ω.

Available in SOT23-3L, SOT23-5L and SOT323-6L surface mounted packages, it can be designed in applications where space saving is a critical issue.

The low operating current is a key advantage for power restricted designs.

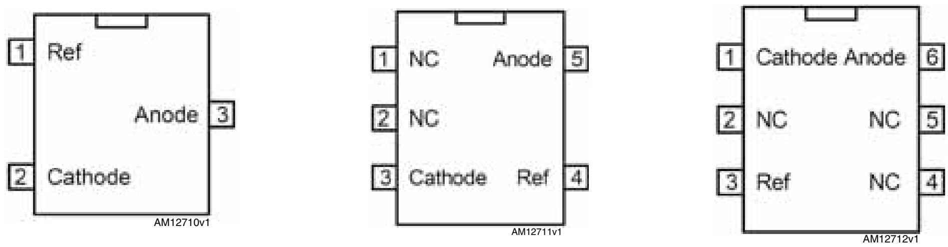
Table 1. Device summary

Part number	Precision	Package	Temperature range
TLVH431AIL3T	0.5%	SOT23-3L	-40 to +125°C
TLVH431BIL3T	0.25%		
TLVH431LIL3T	1.5%		
TLVH431AIL5T	0.5%	SOT23-5L	
TLVH431BIL5T	0.25%		
TLVH431LIL5T	1.5%		
TLVH431AICT	0.5%	SOT323-6L	
TLVH431BICT	0.25%		
TLVH431LICT	1.5%		

Contents

1 Pin configuration

Figure 1. Pin configuration (top view)



SOT23-3L SOT23-5L SOT323-6L

2 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{KA}	Cathode to anode voltage	22	V
I_K	Continuous cathode current range	- 100 to +100	mA
I_{REF}	Reference input current range	- 0.05 to +3	mA
T_{STG}	Storage temperature	- 65 to +150	°C
ESD	Human body model (HBM)	2	kV
	Machine model (MM)	200	V
	Charged device model	1500	V
T_{LEAD}	Lead temperature (soldering) 10 sec	260	°C
T_J	Max. junction temperature	+150	°C

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

Table 3. Thermal data

Symbol	Parameter	SOT323-6L	SOT23-3L	SOT23-5L	Unit
R_{thJA}	Thermal resistance junction-ambient	221	248	157	°C/W
R_{thJC}	Thermal resistance junction-case	110	136	67	°C/W

Table 4. Operating conditions

Symbol	Parameter	Value	Unit
V_{KA}	Cathode to anode voltage	V_{ref} to 18	V
I_{kmin}	Minimum operating current	100	µA
I_{kmax}	Maximum operating current	60	mA
T_{oper}	Operating free air temperature range	-40 to +125	°C

3 Electrical characteristics

I_k = 10 mA, T_{amb} = 25 °C (unless otherwise specified).

Table 5. Electrical characteristics for TLVH431

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{ref}	Reference voltage	$V_{KA} = V_{ref}$ TLVH431A 0.5% TLVH431B 0.25% TLVH431L 1.5%	 1.234 1.237 1.222	1.24	 1.246 1.243 1.258	V
ΔV_{ref}	Reference voltage variation overtemperature range (1)	- 40 °C < T_{amb} < +125 °C TLVH431A 0.5% TLVH431B 0.25% TLVH431L 1.5%	 -26.7 -23.5 -39		 +26.7 +23.5 +39	mV
$\Delta V_{KA}/\Delta T$	Average temperature coefficient	$V_{KA} = V_{ref,}$ - 40 °C < T_{amb} < +125 °C		±30	±100	ppm/°C
I_{kmin}	Minimum cathode current for regulation	$V_{KA} = V_{ref}$		60	100	µA
		$V_{KA} = V_{KAmax}$		160	200	
ΔI_{kmin}	Minimum cathode current variation overtemperature range	$V_{KA} = V_{ref}$, - 40 °C < T_{amb} < +125 °C		70	100	µA
		$V_{KA} = V_{KAmax,}$ - 40 °C < T_{amb} < +125°C		100	200	
I_{ref}	Reference input current	R_1 = 10 kΩ, $R_2 = \infty$		1.5	2.5	µA
ΔI_{ref}	Reference current variation overtemperature range	R_1 = 10 kΩ, $R_2 = \infty$ - 40 °C < T_{amb} < + 125 °C		2.5	3.5	µA
$\frac{\Delta Vref}{\Delta Vka}$	Ratio of change in reference input voltage to change in cathode to anode voltage	ΔV_{KA} = 18 V to V_{ref}			-2	mV/V
		ΔV_{KA} = 18 V to V_{ref} - 40 °C < T_{amb} < +125 °C			-2.5	
I_{off}	Off-state cathode current	$V_{KA} = V_{KAmax,} V_{ref}$ = GND		10	80	nA
ΔI_{off}	Off-state cathode current overtemperature range	$V_{KA} = V_{KAmax,} V_{ref}$ = GND - 40 °C < T_{amb} < +125 °C		1000	2000	nA
$\lvert R_{KA} \rvert$	Static impedance	$V_{KA} = V_{ref,}$ ΔI_K = 100 µA to 60 mA		0.14	0.62	W
$\lvert Z_{KA} \rvert$	Dynamic impedance (2)	$V_{KA} = V_{ref,}$ ΔI_K = 10 mA to 60 mA, f ≤ 1 kHz		0.22	0.85	W
e_n	Wide band noise	I_K = 10 mA; 10 Hz < f < 100 kHz		30		mV_{RMS}
T_{ON}	Turn-on setting time	$V_{KA} = V_{ref,}$ ΔI_K = 10 mA		40	70	µsec

1. The overtemperature tolerance values are calculated as: $\pm Vk_{25°C}$ x {$tolerance_{25°C}$+[(ppm_{max} /°C) x (ΔT)]}. Example: TLVH431A $\Delta V_{k = \pm 1.24 \text{ x } (0.5\% + 100 \text{ ppm/}}$°C x 165 °C) = ±1.24 x (0.5%+1.65%)= ±1.24 x 2.15% = ± 26.7 mV.
2. The dynamic impedance is defined as $\lvert Z_{KA} \rvert = \Delta V_{KA}/\Delta I_{K.}$

Note: Limits are 100% production tested at 25 °C. Limits over the temperature range are guaranteed through correlation and by design.

4 Typical performance characteristics

The following plots are referred to the typical application circuit and, unless otherwise noted, at T_A = 25 °C.

Figure 2. Test circuit for V_{KA} = V_{ref}

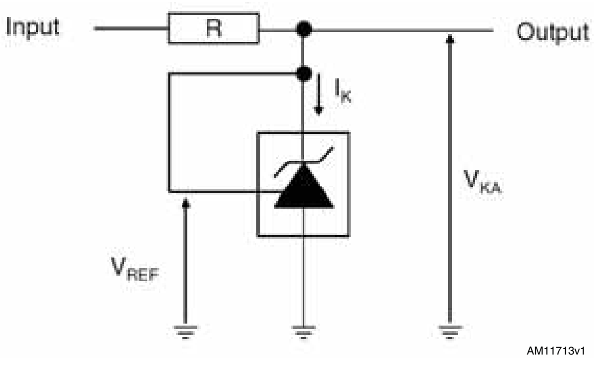


Figure 3. Test circuit for V_{KA} > V_{ref}

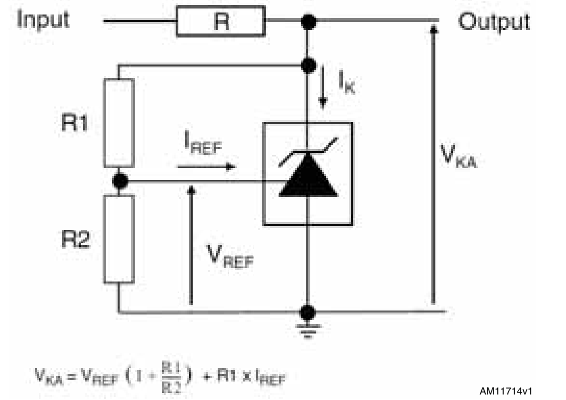


Figure 4. Reference voltage vs. temperature

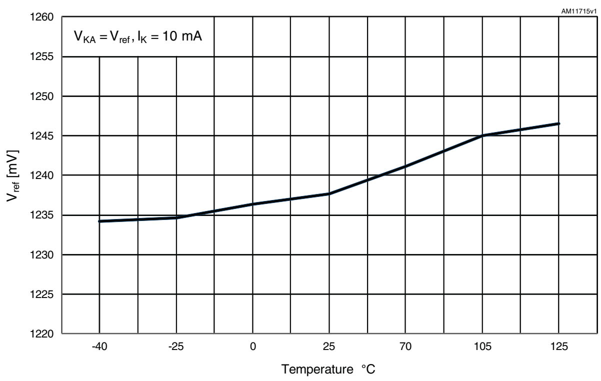


Figure 5. Minimum cathode current for regulation vs. temperature

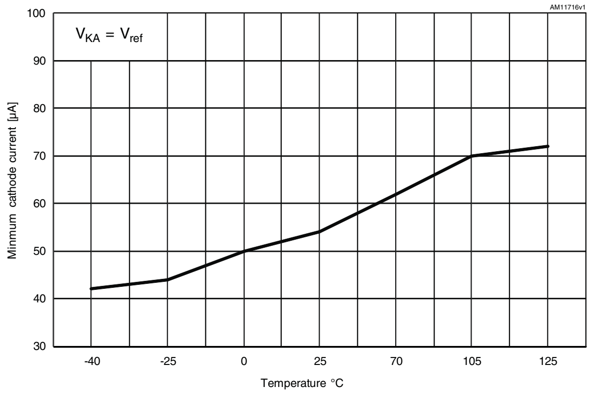


Figure 6. Off-state cathode current vs. temperature

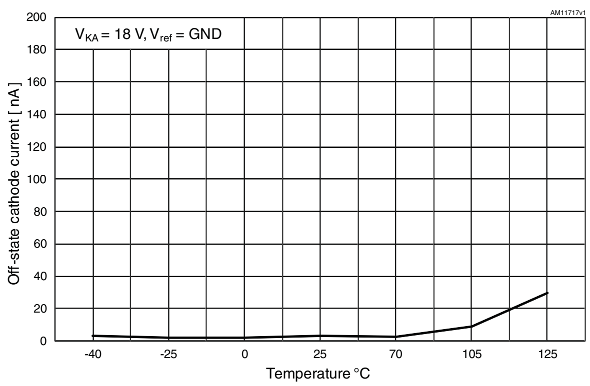


Figure 7. Reference input current vs. temperature

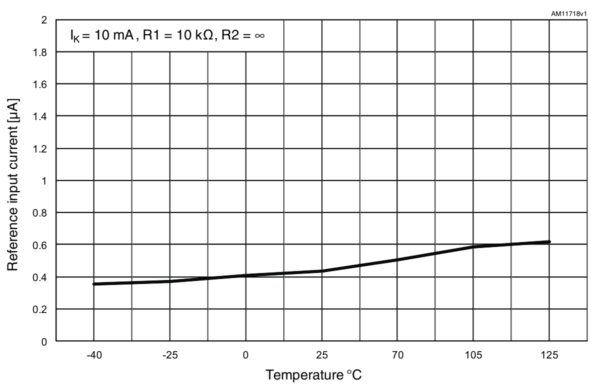


Figure 8. Cathode current vs. cathode voltage

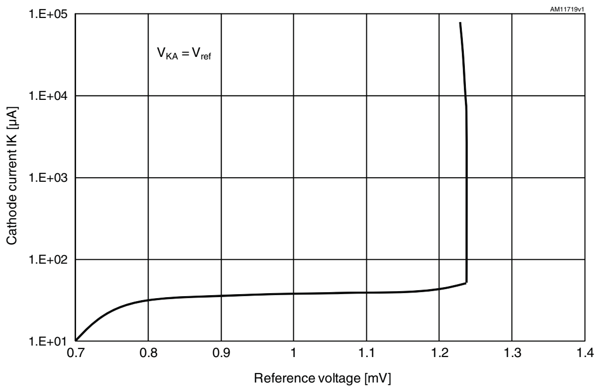


Figure 9. ΔV_{ref} vs. ΔV_{KA}

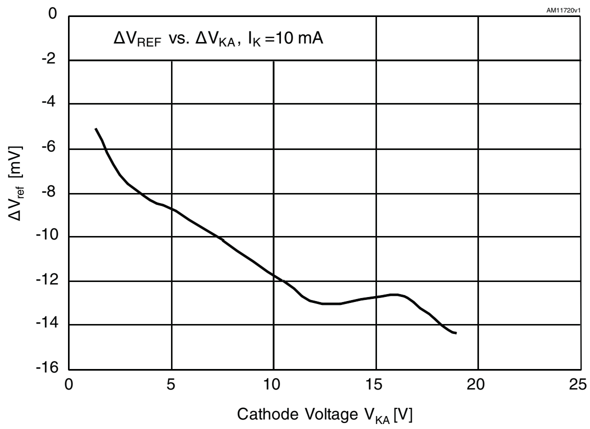


Figure 10. Wideband noise

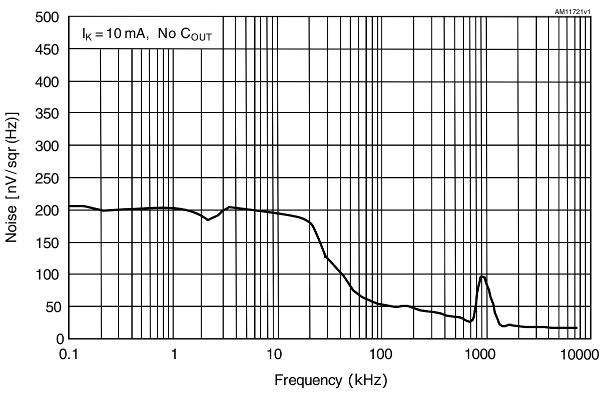


Figure 11. Gain and phase vs. frequency

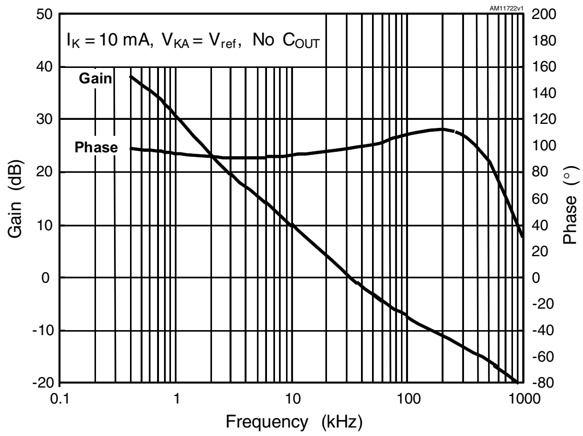
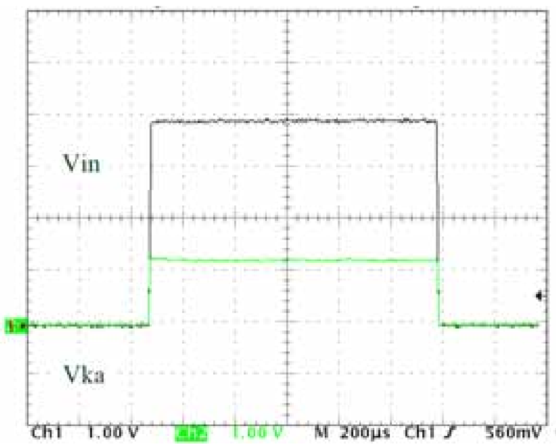
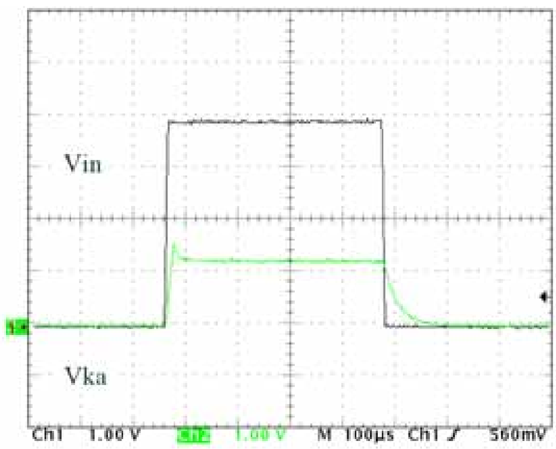


Figure 12. Turn-on (no C_{LOAD})



V_{IN} from 0 to 4 V, I_K = 1 mA, no C_{LOAD}

Figure 13. Turn-on (C_{LOAD} = 10 nF)



V_{IN} from 0 to 4 V, I_K = 1 mA, C_{LOAD} = 10 nF

5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

5.1 SOT23-3L package information

Figure 14. SOT23-3L package outline

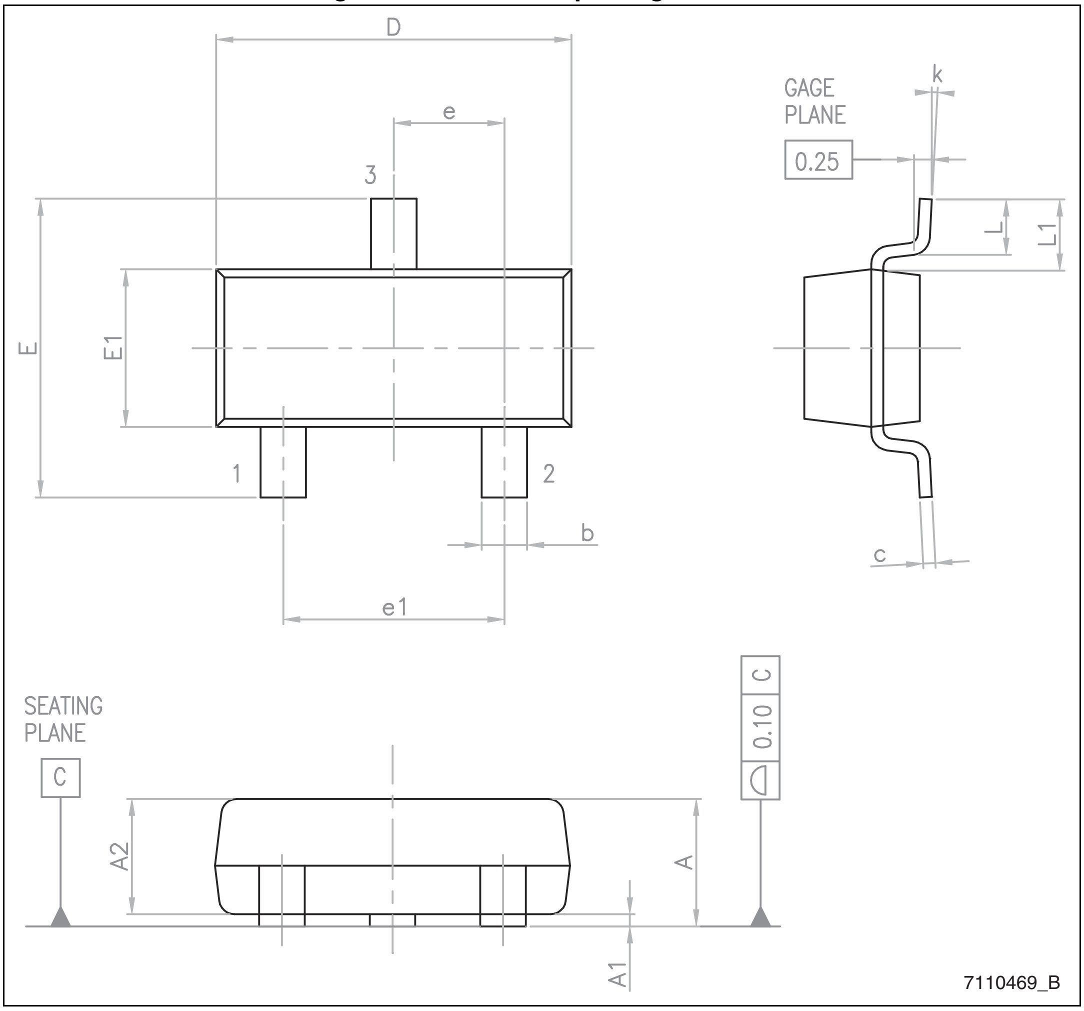


Table 6. SOT23-3L mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	0.89		1.12
A1	0.01		0.10
A2	0.88	0.95	1.02
b	0.30		0.50
c	0.08		0.20
D	2.80	2.90	3.04
E	2.10		2.64
E1	1.20	1.30	1.40
e		0.95	
e1		1.90	
L	0.40	0.50	0.60
L1		0.54	
k	0°		8°

5.2 SOT23-5L package information

Figure 15. SOT23-5L package outline

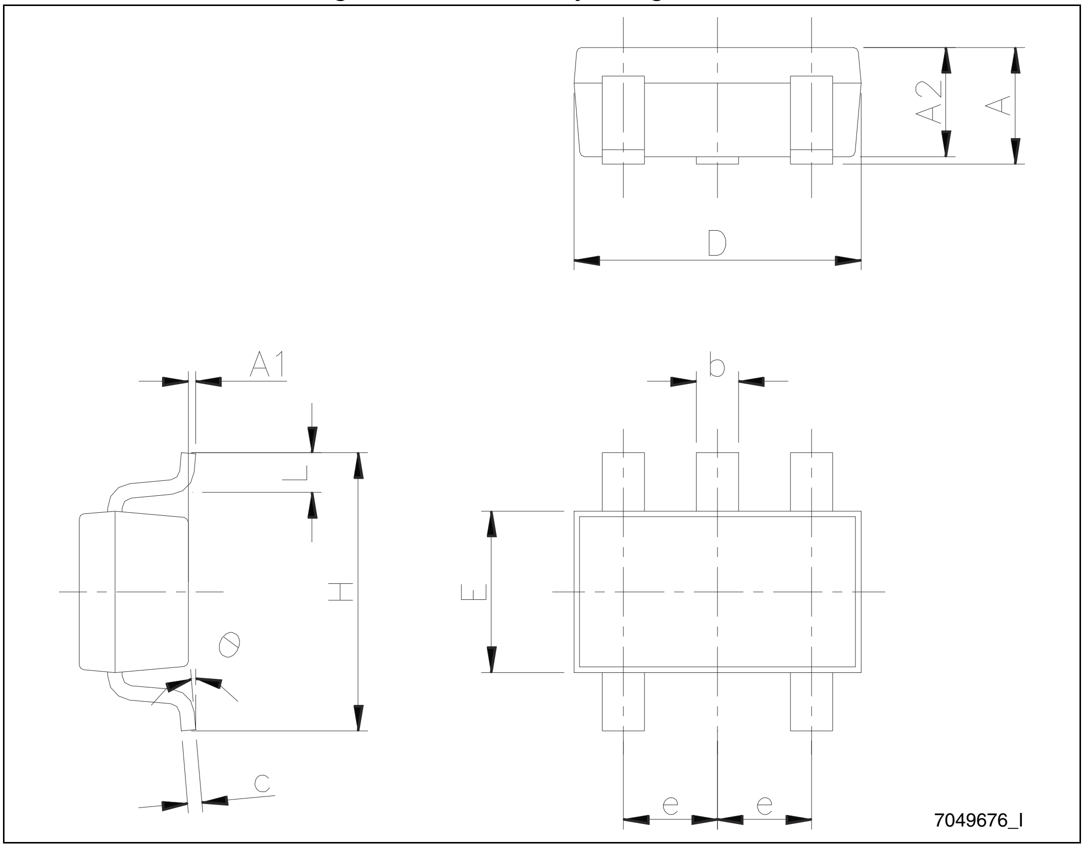
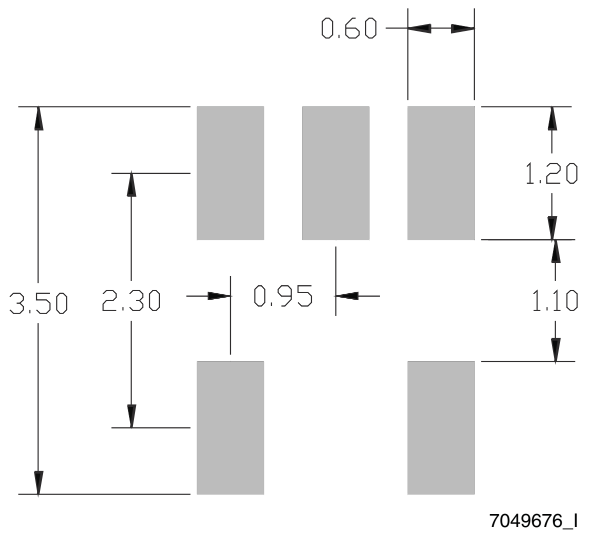


Table 7. SOT23-5L mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.90	1.20	1.45
A1			0.15
A2	0.90	1.05	1.30
b	0.35	0.40	0.50
c	0.09	0.15	0.20
D	2.80	2.90	3.00
e		0.95	
E	1.50	1.60	1.75
H	2.60	2.80	3.00
L	0.10	0.35	0.60
θ	0°		10°

Figure 16. SOT23-5L recommended footprint (dimensions are in mm)



5.3 SOT323-6L package information

Figure 17. SOT323-6L package outline

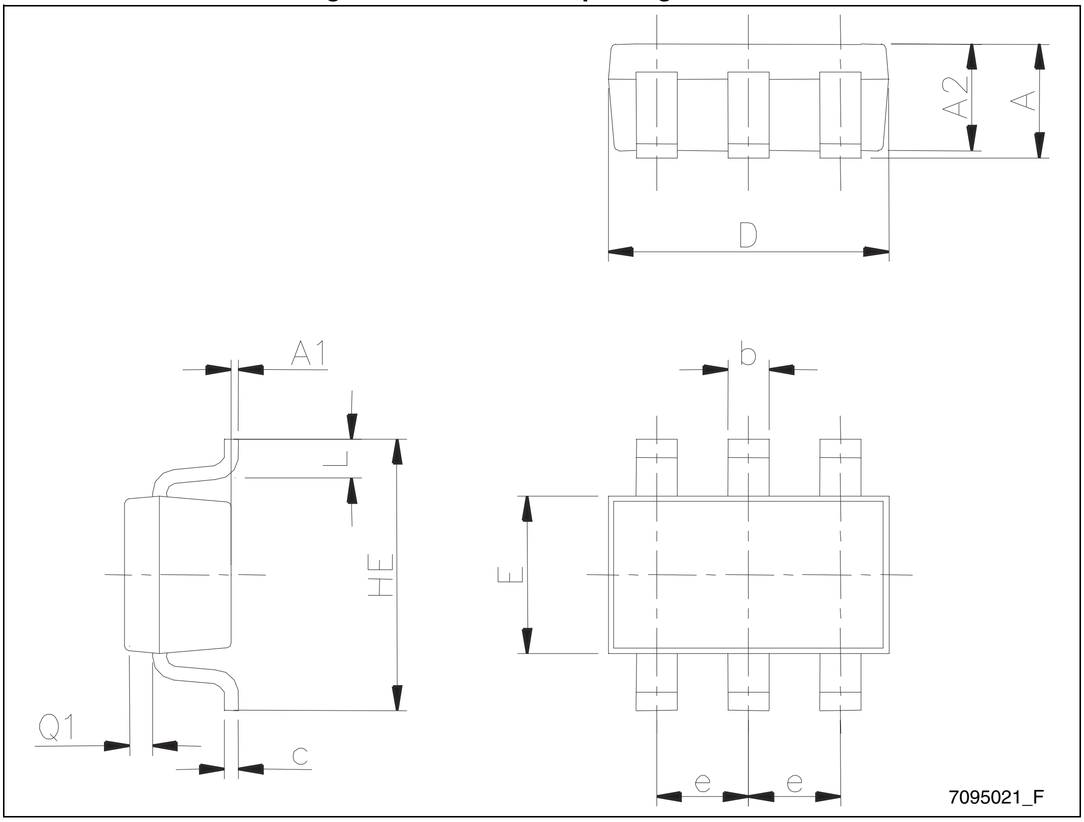
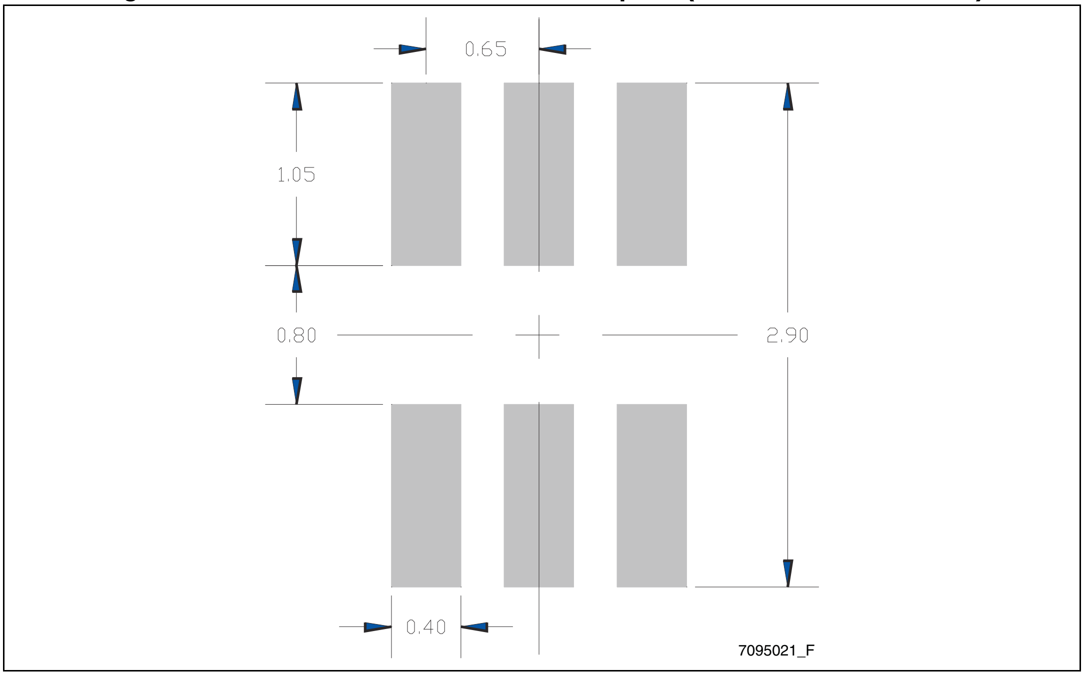


Table 8. SOT323-6L mechanical data

Dim.	mm		
	Min.	**Typ.**	**Max.**
A	0.80		1.10
A1	0		0.10
A2	0.80		1.00
b	0.15		0.30
c	0.10		0.18
D	1.80		2.20
E	1.15		1.35
e		0.65	
HE	1.80		2.40
L	0.10		0.40
Q1	0.10		0.40

Figure 18. SOT323-6L recommended footprint (dimensions are in mm)



6 Revision History

Table 9. Document revision history

Date	Revision	Changes
13-Jun-2012	1	Initial release.
23-Jan-2014	2	Updated the Features in cover page, *Table 1: Device summary* and *Table 5: Electrical characteristics for TLVH431*. Minor text changes.
28-Jan-2014	3	Updated the min. value of V_{ref} in *Table 5: Electrical characteristics for TLVH431*.
24-Mar-2015	4	Updated *Table 7: SOT23-5L mechanical data*. Minor text changes.

Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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- Подбор аналогов;
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- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

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