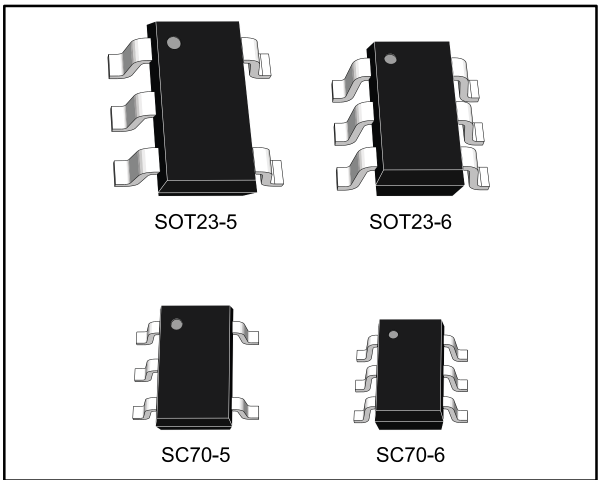
TSV6290, TSV6290A, TSV6291, TSV6291A

Micropower with high merit factor CMOS operational amplifiers

Datasheet - production data



Features

- Low supply voltage: 1.5 V – 5.5 V
- Rail-to-rail input and output
- Low input offset voltage: 800 µV max (A version)
- Low power consumption: 29 µA typical
- Gain bandwidth product: 1.3 MHz typical
- Stable when used in gain configuration
- Micropackages: SOT23-5/6, SC70-5/6
- Low input bias current: 1 pA typical
- Extended temperature range: -40 to 125 °C
- 4 kV human body model

Applications

- Battery-powered applications
- Portable devices
- Signal conditioning
- Active filtering
- Medical instrumentation

Description

The TSV6290 and the TSV6291 are single operational amplifiers with a high bandwidth which consume only 29 µA. They must be used in a gain configuration (G < -3, G > 4).

With a very low input bias current and low offset voltage (800 µV maximum for the A version), the TSV629x family of devices is ideal for applications requiring precision. The devices can operate at a power supply ranging from 1.5 to 5.5 V, and therefore suit battery-powered devices, extending battery life.

The TSV6290 comes with a shutdown function.

The TSV6290 and TSV6291 present a high tolerance to ESD, sustaining 4 kV for the human body model.

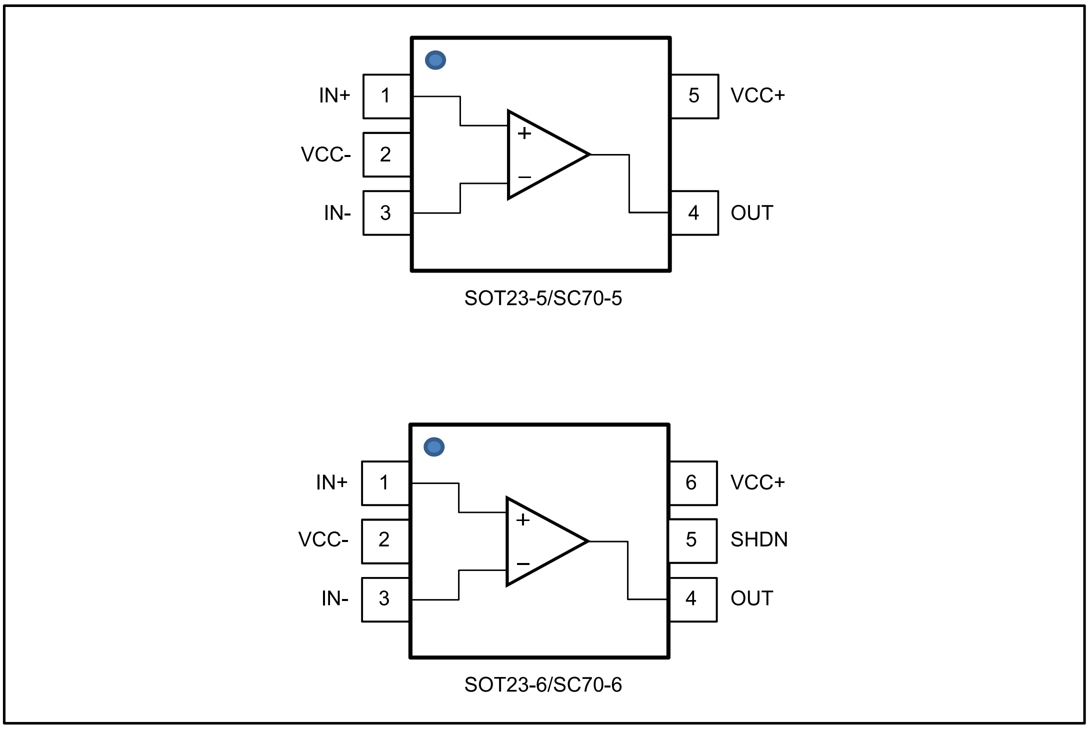
The TSV6290 and TSV6291 are offered in SOT23-5/6 and SC70-5/6 micropackages, with extended temperature ranges from -40 °C to 125 °C.

All these features make the TSV629x ideal for sensor interfaces, battery-supplied and portable applications, as well as active filtering.

Contents

1 Package pin connections

Figure 1: Package pin connections (top view)



2 Absolute maximum ratings and operating conditions

Table 1: Absolute maximum ratings (AMR)

Symbol	Parameter		Value	Unit
V_{CC}	Supply voltage (1)		6	V
V_{id}	Differential input voltage (2)		$\pm V_{CC}$	
V_{in}	Input voltage (3)		(V_{CC-}) - 0.2 to (V_{CC+}) + 0.2	
I_{in}	Input current (4)		10	mA
$\overline{SHDN}$	Shutdown voltage (3)		(V_{CC-}) - 0.2 to (V_{CC+}) + 0.2	V
T_{stg}	Storage temperature		-65 to 150	°C
T_j	Maximum junction temperature		150	
R_{thja}	Thermal resistance junction-to-ambient (5)(6)	SOT23-5	250	°C/W
		SOT23-6	240	
		SC70-5	205	
		SC70-6	232	
ESD	HBM: human body model (7)		4	kV
	MM: machine model (8)		300	V
	CDM: charged device model (9)		1.5	kV
	Latch-up immunity		200	mA

Notes:

(1)All voltage values, except differential voltage, are with respect to network ground terminal.

(2)Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.

(3)V_{cc} - V_{in} must not exceed 6 V, V_{in} must not exceed 6 V.

(4)Input current must be limited by a resistor in series with the inputs.

(5)R_{th} are typical values.

(6)Short-circuits can cause excessive heating and destructive dissipation.

(7)Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.

(8)Machine mode: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.

(9)Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

Table 2: Operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	1.5 to 5.5	V
V_{icm}	Common mode input voltage range	(V_{CC-}) - 0.1 to (V_{CC+}) + 0.1	
T_{oper}	Operating free air temperature range	-40 to 125	°C

3 Electrical characteristics

Table 3: Electrical characteristics at (VCC+) = 1.8 V with (VCC-) = 0 V, Vicm = VCC/2, Tamb = 25 °C, and RL connected to VCC/2 (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV6290, TSV6291			4	mV
		TSV6290A, TSV6291A			0.8	
		$T_{min} < T_{op} < T_{max}$, TSV6290, TSV6291			6	
		$T_{min} < T_{op} < T_{max}$, TSV6290A, TSV6291A			2	
DV_{io}	Input offset voltage drift			2		μV/°C
I_{io}	Input offset current, $V_{out} = V_{CC}/2$ (1)			1	10	pA
		$T_{min} < T_{op} < T_{max}$		1	100	
I_{ib}	Input bias current, $V_{out} = V_{CC}/2$ (1)			1	10	
		$T_{min} < T_{op} < T_{max}$		1	100	
CMR	Common mode rejection ratio, 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 1.8 V, V_{out} = 0.9 V	53	74		dB
		$T_{min} < T_{op} < T_{max}$	51			
A_{vd}	Large signal voltage gain	R_L = 10 kΩ, V_{out} = 0.5 V to 1.3 V	78	95		
		$T_{min} < T_{op} < T_{max}$	73			
V_{OH}	High-level output voltage, $V_{OH} = V_{CC} - V_{out}$	R_L = 10 kΩ		5	35	mV
		$T_{min} < T_{op} < T_{max}$			50	
V_{OL}	Low-level output voltage	R_L = 10 kΩ		4	35	
		$T_{min} < T_{op} < T_{max}$			50	
I_{out}	Isink	V_{out} = 1.8 V	6	12		mA
		$T_{min} < T_{op} < T_{max}$	4			
	Isource	V_{out} = 0 V	6	10		
		$T_{min} < T_{op} < T_{max}$	4			
I_{CC}	Supply current (per operator)	No load, $V_{out} = V_{CC}/2$		25	31	μA
		$T_{min} < T_{op} < T_{max}$			33	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF		1.1		MHz
Gain	Minimum gain for stability	Phase margin = 60 °, R_f = 10 kΩ, R_L = 10 kΩ, C_L = 20 pF		4		V/V
				-3		
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, Vout = 0.5 V to 1.3 V		0.33		V/μs

Notes:

(1)Guaranteed by design.

Table 4: Shutdown characteristics VCC = 1.8 V (TSV6290)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
I_{CC}	Supply current in shutdown mode (all operators)	$\overline{SHDN}$ = (V_{CC-})		2.5	50	nA
		T_{min} < T_{op} < 85 °C			200	nA
		T_{min} < T_{op} < 125 °C			1.5	µA
t_{on}	Amplifier turn-on time	R_L = 5 kΩ, V_{out} = (V_{CC-}) to (V_{CC-}) + 0.2 V		300		ns
t_{off}	Amplifier turn-off time	R_L = 5 kΩ, V_{out} = (V_{CC+}) - 0.5 to (V_{CC+}) - 0.7 V		30		ns
V_{IH}	$\overline{SHDN}$ logic high		1.3			V
V_{IL}	$\overline{SHDN}$ logic low				0.5	V
I_{IH}	$\overline{SHDN}$ current high	$\overline{SHDN}$ = (V_{CC+})		10		pA
I_{IL}	$\overline{SHDN}$ current low	$\overline{SHDN}$ = (V_{CC-})		10		pA
I_{OLeak}	Output leakage in shutdown mode	$\overline{SHDN}$ = (V_{CC-})		50		pA
		T_{min} < T_{op} < T_{max}		1		nA

Table 5: (VCC+) = 3.3 V, (VCC-) = 0 V, Vicm = VCC/2, Tamb = 25 °C, RL connected to VCC/2 (unless otherwise specified)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV6290, TSV6291			4	mV
		TSV6290A, TSV6291A			0.8	
		$T_{min} < T_{op} < T_{max}$, TSV6290, TSV6291			6	
		$T_{min} < T_{op} < T_{max}$, TSV6290A, TSV6291A			2	
DV_{io}	Input offset voltage drift			2		μV/°C
I_{io}	Input offset current (1)			1	10	pA
		$T_{min} < T_{op} < T_{max}$		1	100	
I_{ib}	Input bias current (1)			1	10	
		$T_{min} < T_{op} < T_{max}$		1	100	
CMR	Common mode rejection ratio, 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 3.3 V, V_{out} = 1.65 V	57	79		dB
		$T_{min} < T_{op} < T_{max}$	53			
A_{vd}	Large signal voltage gain	R_L= 10 kΩ, V_{out} = 0.5 V to 2.8 V	81	98		
		$T_{min} < T_{op} < T_{max}$	76			
V_{OH}	High-level output voltage, $V_{OH} = V_{CC} - V_{out}$	R_L = 10 kΩ		5	35	mV
		$T_{min} < T_{op} < T_{max}$			50	
V_{OL}	Low-level output voltage	R_L = 10 kΩ		4	35	
		$T_{min} < T_{op} < T_{max}$			50	
I_{out}	Isink	V_{out} = 5 V	23	45		mA
		$T_{min} < T_{op} < T_{max}$	20			
	Isource	V_{out} = 0 V	23	38		
		$T_{min} < T_{op} < T_{max}$	20			
I_{CC}	Supply current (per operator)	No load, V_{out} = 2.5 V		26	33	μA
		$T_{min} < T_{op} < T_{max}$			35	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF		1.2		MHz
Gain	Minimum gain for stability	Phase margin = 60 °, R_f = 10 kΩ, R_L = 10 kΩ, C_L = 20 pF		4		V/V
				-3		
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, V_{out} = 0.5 V to 2.8 V		0.4		V/μs

Notes:

(1)Guaranteed by design.

Table 6: (VCC+) = 5 V, (VCC-) = 0 V, Vicm = VCC/2, Tamb = 25 °C, RL connected to VCC/2 (unless otherwise specified)

Symbol	Parameter		Min.	Typ.	Max.	Unit
DC performance						
V_{io}	Offset voltage	TSV6290, TSV6291			4	mV
		TSV6290A, TSV6291A			0.8	
		$T_{min} < T_{op} < T_{max}$, TSV6290, TSV6291			6	
		$T_{min} < T_{op} < T_{max}$, TSV6290A, TSV6291A			2	
DV_{io}	Input offset voltage drift			2		µV/°C
I_{io}	Input offset current (1)			1	10	pA
		$T_{min} < T_{op} < T_{max}$		1	100	
I_{ib}	Input bias current (1)			1	10	
		$T_{min} < T_{op} < T_{max}$		1	100	
CMR	Common mode rejection ratio, 20 log ($\Delta V_{ic}/\Delta V_{io}$)	0 V to 5 V, V_{out} = 2.5 V	60	80		dB
		$T_{min} < T_{op} < T_{max}$	55			
SVR	Supply voltage rejection ratio, 20 log ($\Delta V_{CC}/\Delta V_{io}$)	V_{CC} = 1.8 to 5 V	75	102		
		$T_{min} < T_{op} < T_{max}$	73			
A_{vd}	Large signal voltage gain	R_L = 10 kΩ, V_{out} = 0.5 V to 4.5 V	85	98		
		$T_{min} < T_{op} < T_{max}$	80			
V_{OH}	High-level output voltage, $V_{OH} = V_{CC} - V_{out}$	R_L = 10 kΩ		7	35	mV
		$T_{min} < T_{op} < T_{max}$			50	
V_{OL}	Low-level output voltage	R_L = 10 kΩ		6	35	
		$T_{min} < T_{op} < T_{max}$			50	
I_{out}	I_{sink}	V_{out} = 5 V	40	69		mA
		$T_{min} < T_{op} < T_{max}$	35			
	I_{source}	V_{out} = 0 V	40	74		
		$T_{min} < T_{op} < T_{max}$	35			
I_{CC}	Supply current (per operator)	No load, V_{out} = 2.5 V		30	36	µA
		$T_{min} < T_{op} < T_{max}$			38	
AC performance						
GBP	Gain bandwidth product	R_L = 10 kΩ, C_L = 100 pF		1.3		MHz
Gain	Minimum gain for stability	Phase margin = 60 °, R_f = 10 kΩ, R_L = 10 kΩ, C_L = 20 pF		4		V/V
				-3		
SR	Slew rate	R_L = 10 kΩ, C_L = 100 pF, V_{out} = 0.5 V to 4.5 V		0.5		V/µs
e_n	Equivalent input noise voltage	f = 1 kHz		70		nV/√Hz
THD	Total harmonic distortion	Av = -10, f_{in} = 1 kHz, R_L= 100 kΩ, V_{icm} = Vcc/2, V_{in} = 40 mVpp		0.15		%

Notes:

(1)Guaranteed by design.

Table 7: Shutdown characteristics VCC = 5 V (TSV6290)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DC performance						
I_{CC}	Supply current in shutdown mode (all operators)	$\overline{SHDN} = V_{IL}$		5	50	nA
		$T_{min} < T_{op} < 85$ °C			200	nA
		$T_{min} < T_{op} < 125$ °C			1.5	µA
t_{on}	Amplifier turn-on time	R_L = 5 kΩ , $V_{out} = (V_{CC-})$ to $(V_{CC-}) + 0.2$ V		300		ns
t_{off}	Amplifier turn-off time	R_L = 5 kΩ, $V_{out} = (V_{CC+}) - 0.5$ V to $(V_{CC+}) - 0.7$ V		30		ns
V_{IH}	$\overline{SHDN}$ logic high		4.5			V
V_{IL}	$\overline{SHDN}$ logic low				0.5	V
I_{IH}	$\overline{SHDN}$ current high	$\overline{SHDN} = (V_{CC+})$		10		pA
I_{IL}	$\overline{SHDN}$ current low	$\overline{SHDN} = (V_{CC-})$		10		pA
I_{OLeak}	Output leakage in shutdown mode	$\overline{SHDN} = (V_{CC-})$		50		pA
		$T_{min} < T_{op} < T_{max}$		1		nA

4 Electrical characteristic curves

Figure 2: Supply current vs. supply voltage at Vicm = VCC/2

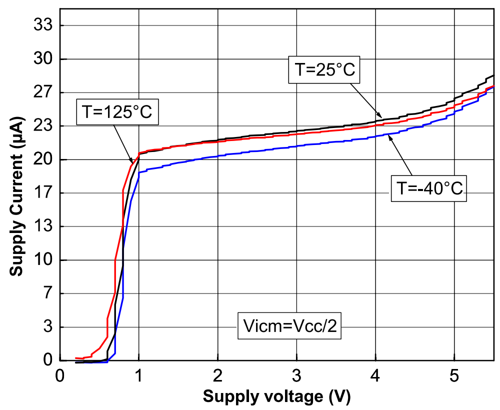


Figure 3: Output current vs. output voltage at VCC = 1.5 V

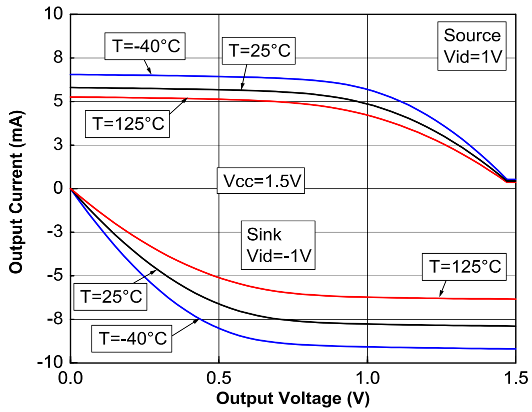


Figure 4: Output current vs. output voltage at VCC = 5 V

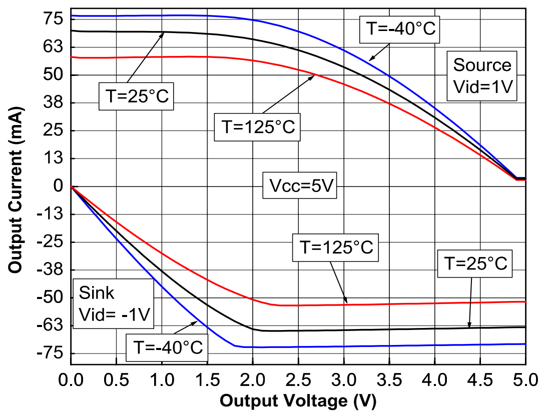


Figure 5: Peaking at closed loop gain = -10 at VCC = 1.5 V and VCC = 5 V

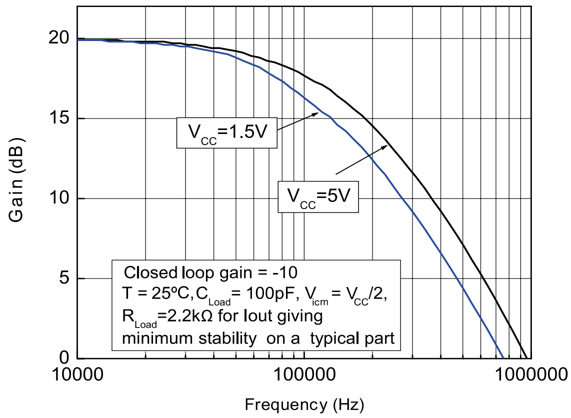


Figure 6: Peaking at closed loop gain = -3, VCC = 1.5 V

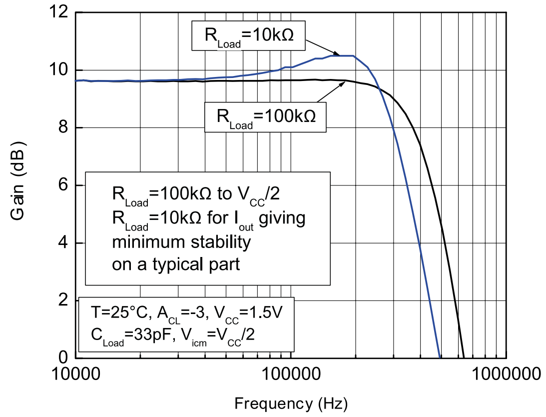


Figure 7: Peaking at closed loop gain = -3, VCC = 5 V

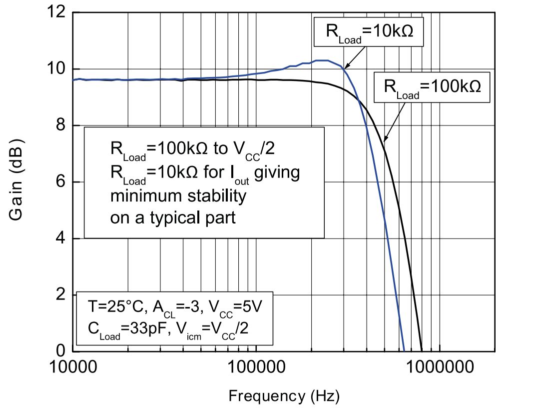


Figure 8: Positive slew rate vs. supply voltage in closed loop

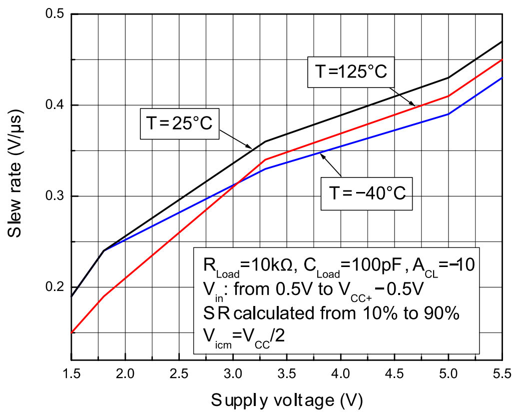


Figure 9: Negative slew rate vs. supply voltage in closed loop

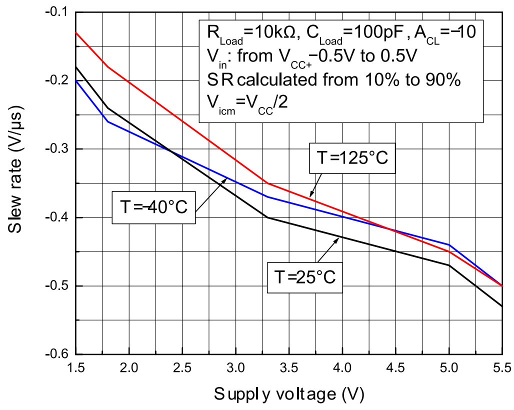


Figure 10: Slew rate vs. supply voltage in open loop

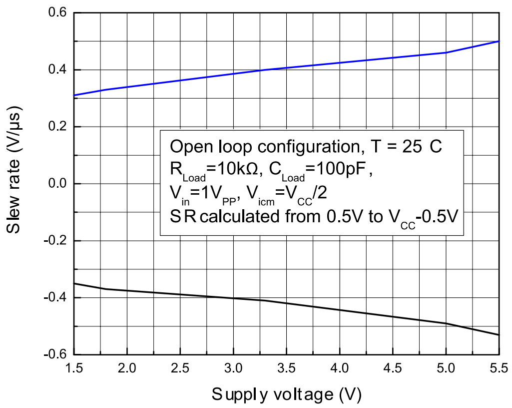


Figure 11: Slew rate timing in open loop

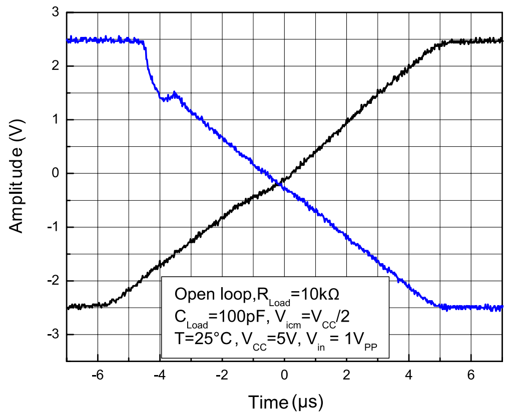


Figure 12: Slew rate timing in closed loop

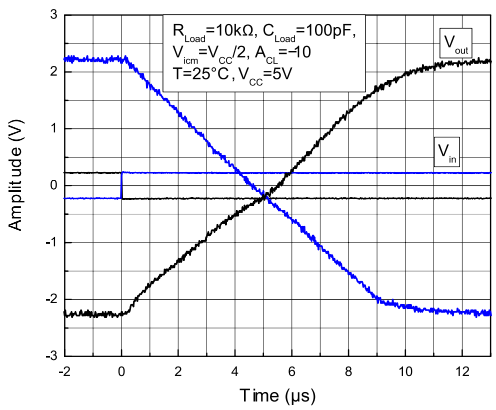


Figure 13: Noise at VCC = 5 V

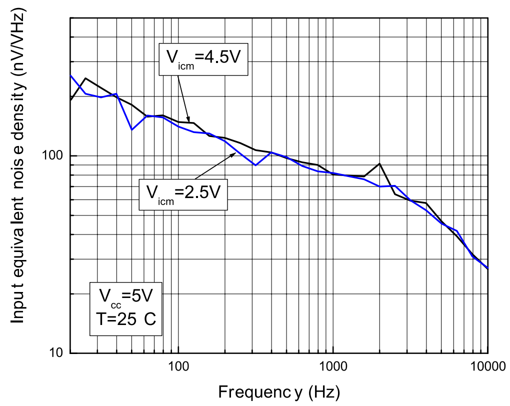


Figure 14: Distortion + noise vs. output voltage at VCC = 1.8 V

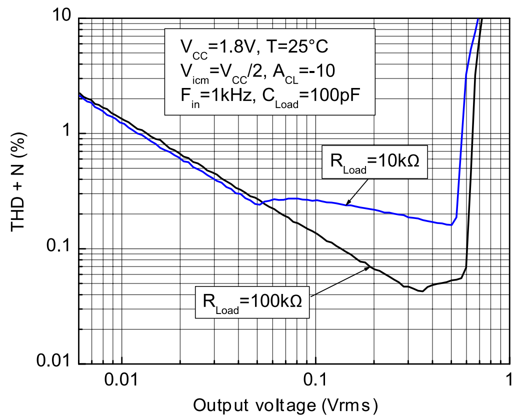


Figure 15: Distortion + noise vs. output voltage at VCC = 5 V

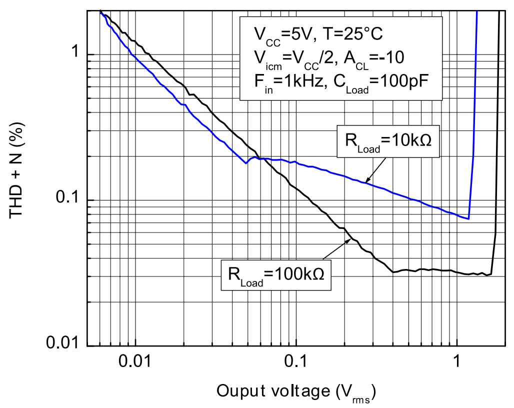


Figure 16: Distortion + noise vs. frequency at VCC = 1.8 V

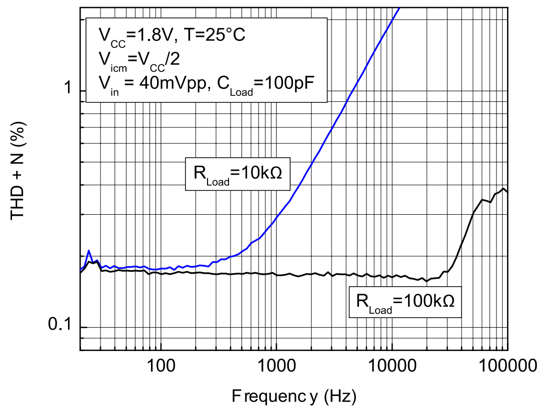
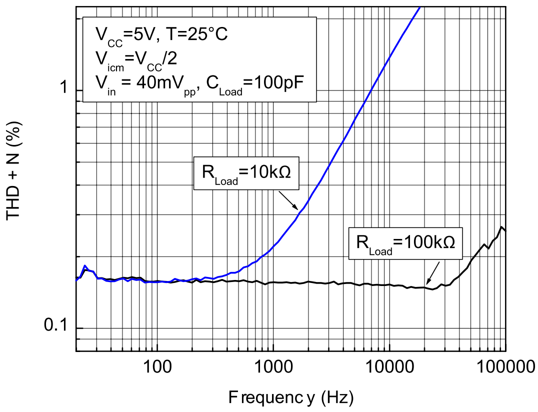


Figure 17: Distortion + noise vs. frequency at VCC = 5 V



5 Application information

5.1 Operating voltages

The TSV6290 and TSV6291 can operate from 1.5 to 5.5 V. Their parameters are fully specified for 1.8, 3.3 and 5 V power supplies. However, the parameters are very stable in the full V_{CC} range and several characterization curves show the TSV629x characteristics at 1.5 V. Additionally, the main specifications are guaranteed in extended temperature ranges from -40 °C to 125 °C.

5.2 Rail-to-rail input

The TSV6290 and TSV6291 are built with two complementary PMOS and NMOS input differential pairs. The devices have a rail-to-rail input, and the input common-mode range is extended from (V_{CC-}) - 0.1 V to (V_{CC+}) + 0.1 V. The transition between the two pairs appears at (V_{CC+}) - 0.7 V. In the transition region, the performance of CMR, SVR, V_{io} and THD is slightly degraded (as shown in *Figure 18* and *Figure 19* for V_{io} vs. V_{icm}).

Figure 18: Input offset voltage vs. input common mode at VCC = 1.5 V

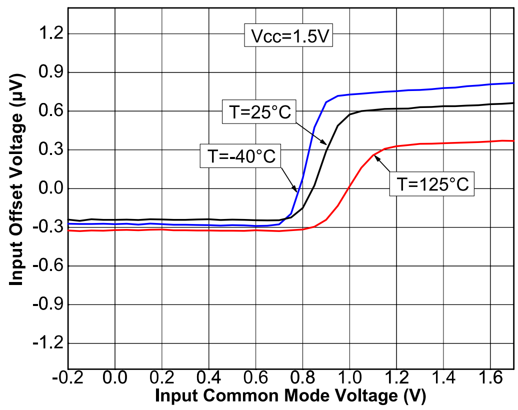
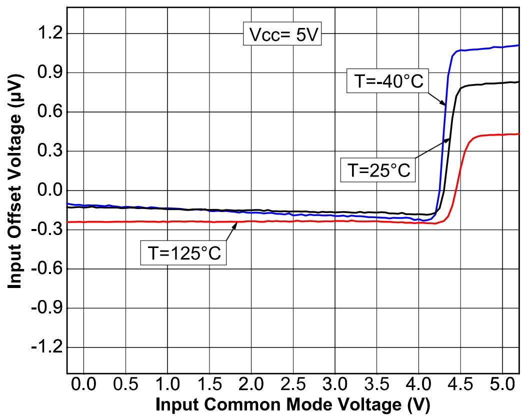


Figure 19: Input offset voltage vs. input common mode at VCC = 5 V



The devices are guaranteed without phase reversal.

5.3 Rail-to-rail output

The operational amplifiers' output levels can go close to the rails: 35 mV maximum above and below the rail when connected to a 10 kΩ resistive load to $V_{CC}/2$.

5.4 Shutdown function (TSV6290)

The operational amplifier is enabled when the $\overline{SHDN}$ pin is pulled high. To disable the amplifier, the $\overline{SHDN}$ must be pulled down to V_{CC-}. When in shutdown mode, the amplifier's output is in a high impedance state. The $\overline{SHDN}$ pin must never be left floating, but tied to (V_{CC+}) or (V_{CC-}).

The turn-on and turn-off times are calculated for an output variation of ±200 mV (*Figure 20* and *Figure 21* show the test configurations).

Figure 20: Test configuration for turn-on time (Vout pulled down)

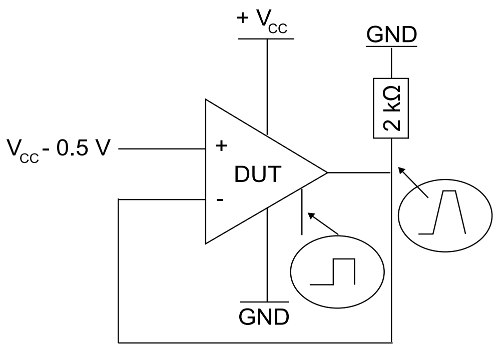


Figure 21: Test configuration for turn-off time (Vout pulled down)

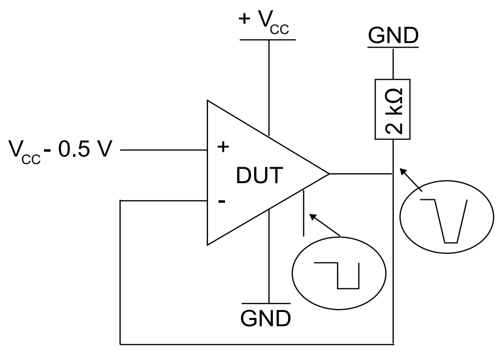


Figure 22: Turn-on time, VCC = 5 V, Vout pulled down, T = 25 °C

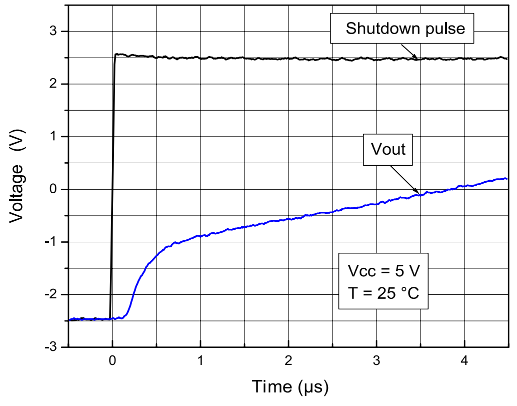
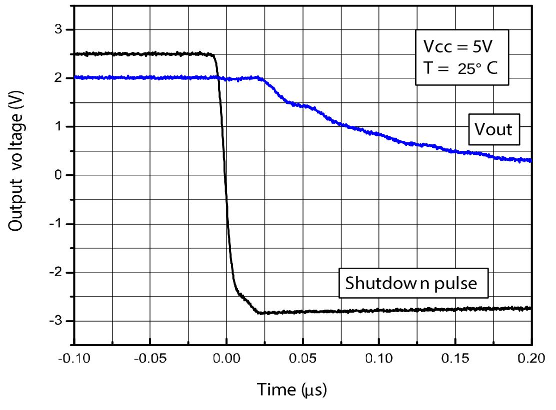


Figure 23: Turn-off time, VCC= 5 V, Vout pulled down, T = 25 °C



5.5 Optimization of DC and AC parameters

These devices use an innovative approach to reduce the spread of the main DC and AC parameters. An internal adjustment achieves a very narrow spread of the current consumption (29 µA typical, min/max at ±17 %). Parameters linked to the current consumption value, such as GBP, SR and A_{vd}, benefit from this narrow dispersion.

5.6 Driving resistive and capacitive loads

These products are micropower, low-voltage operational amplifiers optimized to drive rather large resistive loads, above 5 kΩ. For lower resistive loads, the THD level may significantly increase.

The amplifiers have a relatively low internal compensation capacitor, making them very fast while consuming very little. They are ideal when used in a non-inverting configuration or in an inverting configuration in the following conditions.

- IGainI ≥ 3 in an inverting configuration (C_L = 20 pF, R_L = 100 kΩ) or IgainI ≥ 10 (C_L = 100 pF, R_L = 100 kΩ)
- Gain ≥ 4 in a non-inverting configuration (C_L = 20 pF, R_L = 100 kΩ) or gain ≥ 11 (C_L = 100 pF, R_L= 100 kΩ)

As these operational amplifiers are not unity gain stable, for a low closed-loop gain it is recommended to use the TSV62x (29 µA, 420 kHz) or TSV63x (60 µA, 880 kHz) which are unity gain stable.

Table 8: Related products

Part #	Icc (µA) at 5 V	GBP (MHz)	SR (V/µs)	Minimum gain for stability (C_{Load} = 100 pF)
TSV620-1	29	0.42	0.14	1
TSV6290-1	29	1.3	0.5	11
TSV630-1	60	0.88	0.34	1
TSV6390-1	60	2.4	1.1	11

5.7 PCB layouts

For correct operation, it is advised to add 10 nF decoupling capacitors as close as possible to the power supply pins.

5.8 Macromodel

An accurate macromodel of the TSV6290 and TSV6291 is available on STMicroelectronics' web site at ***www.st.com***. This model is a trade-off between accuracy and complexity (that is, time simulation) of the TSV629x operational amplifiers. It emulates the nominal performances of a typical device within the specified operating conditions mentioned in the datasheet. It helps to validate a design approach and to select the right operational amplifier, *but it does not replace on-board measurements*.

6 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.

6.1 SOT23-5 package information

Figure 24: SOT23-5 package outline

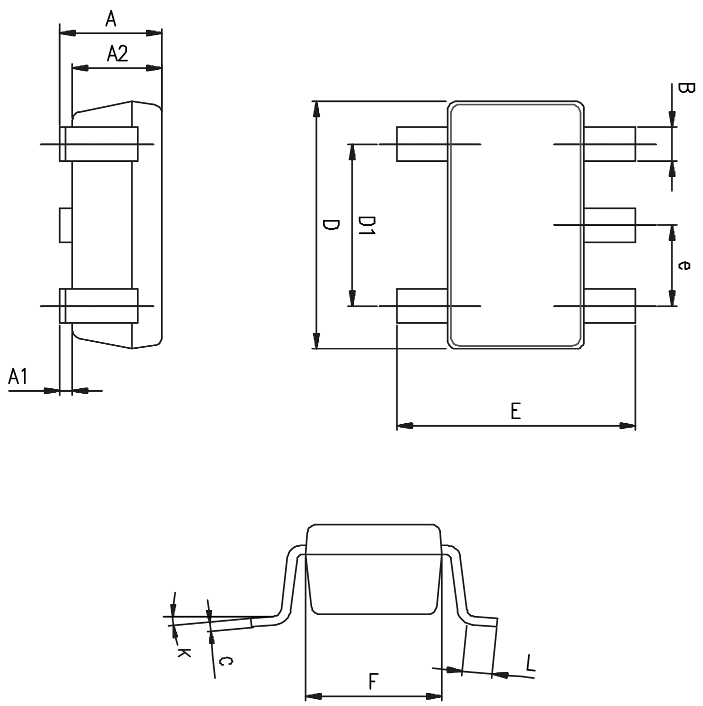


Table 9: SOT23-5 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90	1.20	1.45	0.035	0.047	0.057
A1			0.15			0.006
A2	0.90	1.05	1.30	0.035	0.041	0.051
B	0.35	0.40	0.50	0.014	0.016	0.020
C	0.09	0.15	0.20	0.004	0.006	0.008
D	2.80	2.90	3.00	0.110	0.114	0.118
D1		1.90			0.075	
e		0.95			0.037	
E	2.60	2.80	3.00	0.102	0.110	0.118
F	1.50	1.60	1.75	0.059	0.063	0.069
L	0.10	0.35	0.60	0.004	0.014	0.024
K	0 degrees		10 degrees	0 degrees		10 degrees

6.2 SOT23-6 package information

Figure 25: SOT23-6 package outline

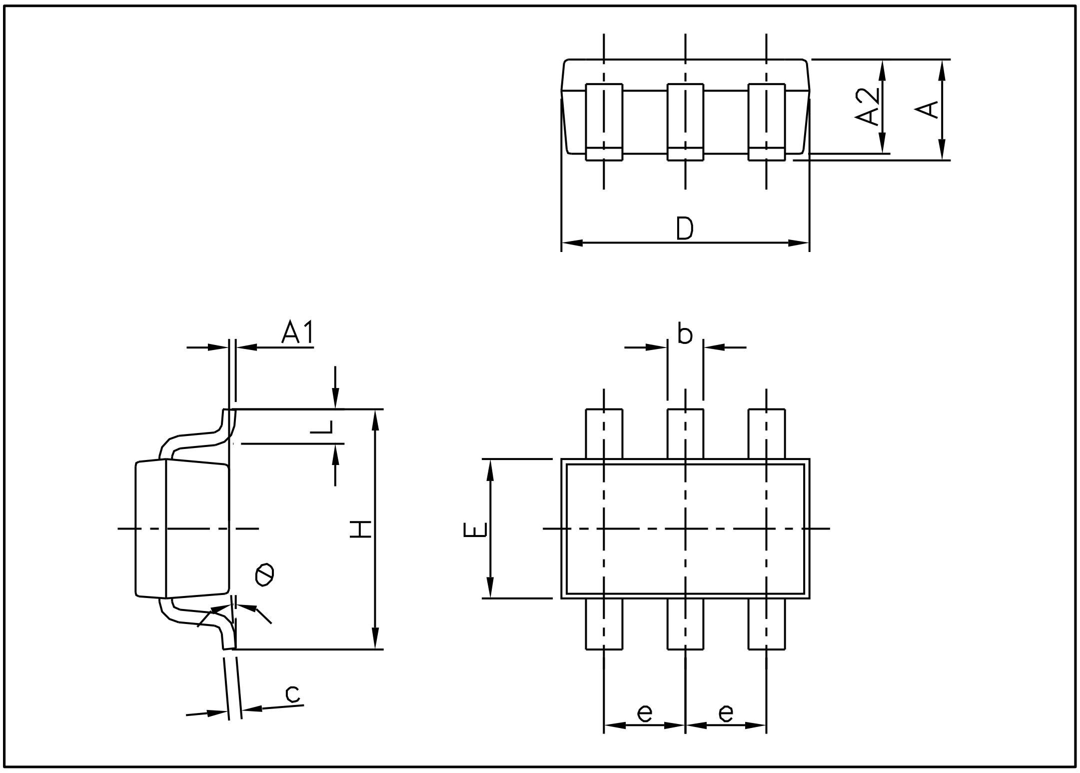


Table 10: SOT23-6 mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.90		1.45	0.035		0.057
A1			0.10			0.004
A2	0.90		1.30	0.035		0.051
b	0.35		0.50	0.013		0.019
c	0.09		0.20	0.003		0.008
D	2.80		3.05	0.110		0.120
E	1.50		1.75	0.060		0.069
e		0.95			0.037	
H	2.60		3.00	0.102		0.118
L	0.10		0.60	0.004		0.024
θ	0 °		10 °	0 °		10 °

6.3 SC70-5 (or SOT323-5) package information

Figure 26: SC70-5 (or SOT323-5) package outline

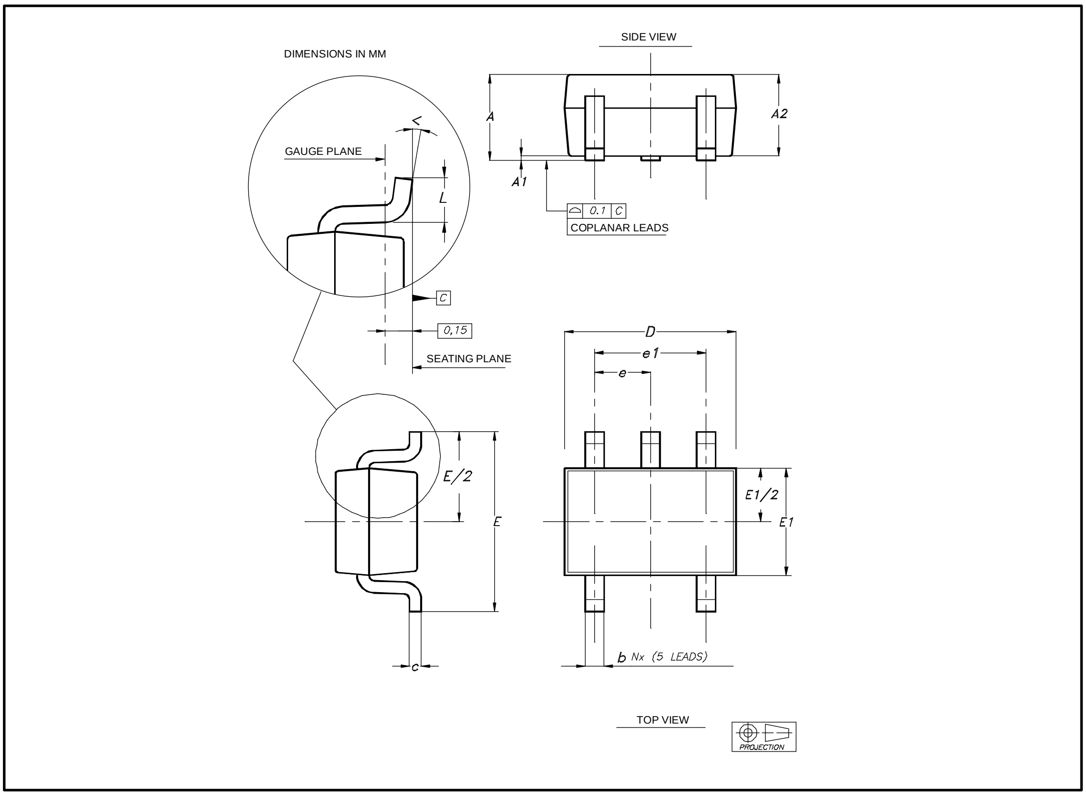


Table 11: SC70-5 (or SOT323-5) mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.10	0.032		0.043
A1			0.10			0.004
A2	0.80	0.90	1.00	0.032	0.035	0.039
b	0.15		0.30	0.006		0.012
c	0.10		0.22	0.004		0.009
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E1	1.15	1.25	1.35	0.045	0.049	0.053
e		0.65			0.025	
e1		1.30			0.051	
L	0.26	0.36	0.46	0.010	0.014	0.018
<	0°		8°	0°		8°

6.4 SC70-6 (or SOT323-6) package information

Figure 27: SC70-6 (or SOT323-6) package outline

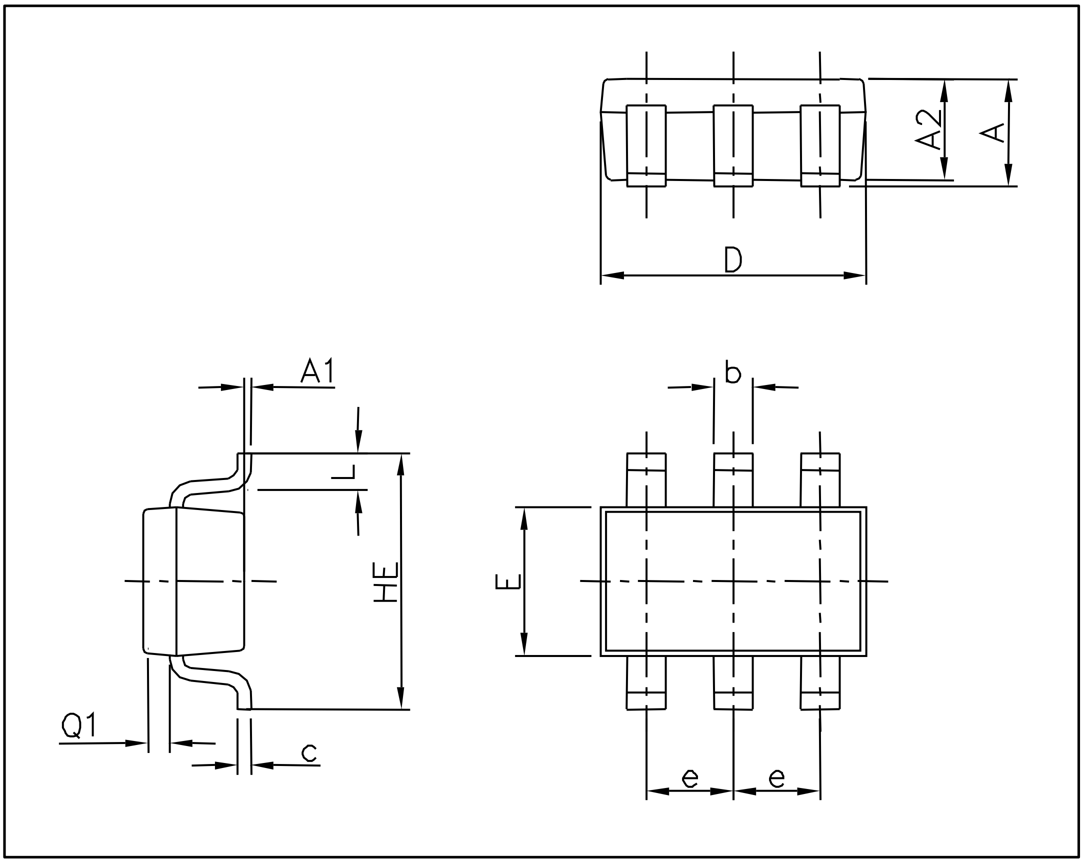
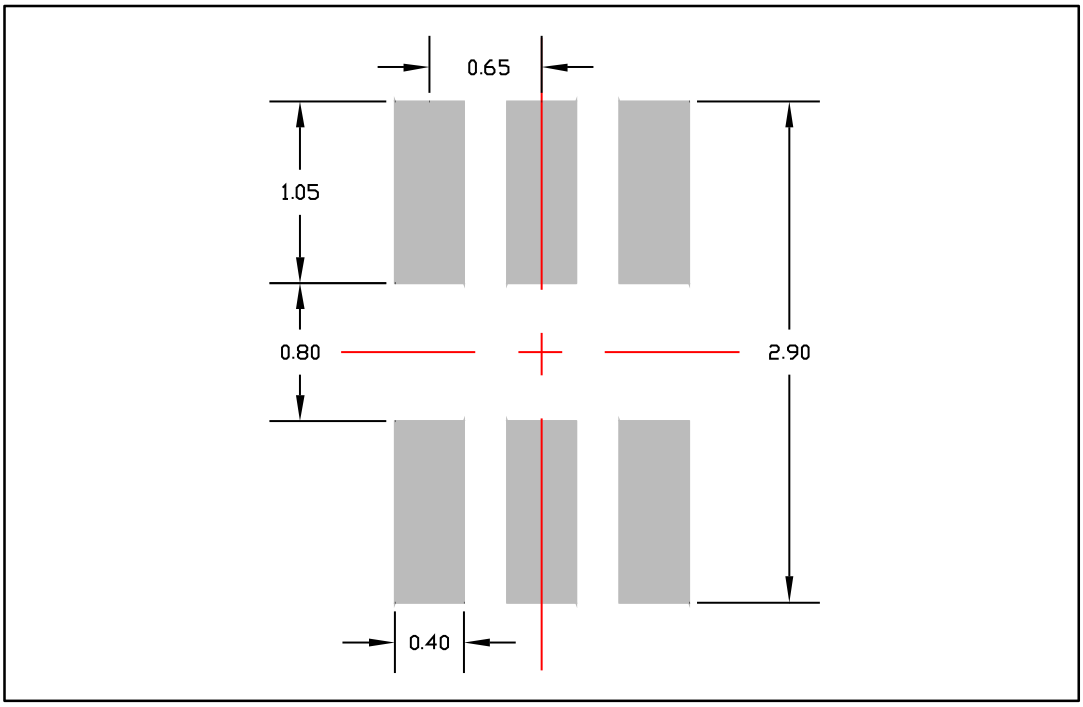


Table 12: SC70-6 (or SOT323-6) mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.80		1.10	0.031		0.043
A1			0.10			0.004
A2	0.80		1.00	0.031		0.039
b	0.15		0.30	0.006		0.012
c	0.10		0.18	0.004		0.007
D	1.80		2.20	0.071		0.086
E	1.15		1.35	0.045		0.053
e		0.65			0.026	
HE	1.80		2.40	0.071		0.094
L	0.10		0.40	0.004		0.016
Q1	0.10		0.40	0.004		0.016

Figure 28: SC70-6 (or SOT323-6) recommended footprint



7 Ordering information

Table 13: Order codes

Part number	Temperature range	Package	Packing	Marking
TSV6290ILT	-40 °C to 125 °C	SOT23-6	Tape and reel	K106
TSV6290ICT		SC70-6		K16
TSV6290AILT		SOT23-6		K139
TSV6290AICT		SC70-6		K39
TSV6291ILT		SOT23-5		K107
TSV6291ICT		SC70-5		K14
TSV6291AILT		SOT23-5		K113
TSV6291AICT		SC70-5		K15

8 Revision history

Table 14: Document revision history

Date	Revision	Changes
04-Mar-2010	1	Initial release.
10-Aug-2016	2	Updated datasheet layout *Table 3*, *Table 5*, and *Table 6*: V_{OH} “min.” values changed to “max.” values. *Figure 8*, *Figure 9*, *Figure 10*: updated Y-axes *Table 11*: updated A and A2 min. values in inches