UMW TSV6291

Micropower with high merit factor cmos operational amplifiers

1.Description

The UMW TSV6291 are single operational amplifiers with a high bandwidth which consume only 29μA. 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 UMW TSV629 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

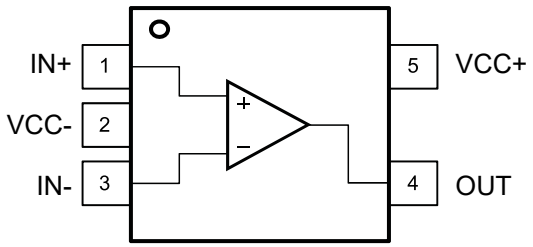
2.Features

- Low supply voltage: 1.5 V - 5.5 V
- Rail-to-rail input and output
- Low input offset voltage: 800μV 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, SC70-5
- Low input bias current: 1 pA typical
- Extended temperature range: -40 to 125°C
- 4 kV human body model

3.Applications

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

4.Pinning information



SOT23-5/SC70-5

5.Absolute Maximum Ratings

Parameter		Symbol	Value	Units
Supply voltage (1)		V_{CC}	7	V
Differential input voltage (2)		V_{id}	$\pm V_{CC}$	V
Input voltage (3)		V_{in}	(V_{CC-})-0.2 to (V_{CC+})+0.2	V
Input current (4)		I_{in}	10	mA
Shutdown voltage (3)		SHDN	(V_{CC-})-0.2 to (V_{CC+})+0.2	V
Storage temperature		T_{STG}	-65 to 150	°C
Maximum junction temperature		T_J	150	°C
Thermal resistance junction-to-ambient (5)(6)	SOT23-5	R_{thja}	250	°C/W
	SC70-5		205	°C/W

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) Rth 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.

6.Operating conditions

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

7.1 Electrical Characteristics

(V_{CC+})=1.8V with (V_{CC-})=0V, V_{icm}=V_{CC}/2, T_{amb}=25°C, and R_L connected to V_{CC}/2 (unless otherwise specified)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Minimum gain for stability	Gain	Phase margin=60 °, R_f=10kΩ		4		V/V
		R_L=10kΩ, C_L=20pF		-3		V/V
Slew rate	SR	R_L=10kΩ, C_L=100pF V_{out}=0.5V to 1.3V		0.33		V/μs

7.2 Electrical Characteristics

(V_{CC+})=3.3V with (V_{CC-})=0V, V_{icm}=V_{CC}/2, T_{amb}=25°C, and R_L connected to V_{CC}/2 (unless otherwise specified)

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

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Minimum gain for stability	Gain	Phase margin=60 °, R_f=10kΩ		4		V/V
		R_L=10kΩ, C_L=20pF		-3		V/V
Slew rate	SR	R_L=10kΩ, C_L=100pF V_{out}=0.5V to 2.8V		0.4		V/μs

7.3 Electrical Characteristics

(V_{CC+})=5V with (V_{CC-})=0V, V_{icm}=V_{CC}/2, T_{amb}=25°C, and R_L connected to V_{CC}/2 (unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Offset voltage	V_{io}	UMW TSV6291			4	mV
		UMW TSV6291A			0.8	mV
		T_{min}<T_{op}<T_{max}, UMW TSV6291			6	mV
		T_{min}<T_{op}<T_{max}, UMW TSV6291A			2	mV
Input offset voltage drift	DV_{io}			2		μV/°C
Input offset current (1)	I_{io}	T_{min}<T_{op}<T_{max}		1	10	pA
				1	100	pA
Input bias current (1)	I_{ib}	T_{min}<T_{op}<T_{max}		1	10	pA
				1	100	pA
Common mode rejection ratio, 20 log ($\Delta V_{ic}/\Delta V_{io}$)	CMR	0V to 5V, V_{out}=2.5V	60	80		dB
		T_{min}<T_{op}<T_{max}	55			dB
Supply voltage rejection ratio, 20 log ($\Delta V_{CC}/\Delta V_{io}$)	SVR	V_{CC}=1.8 to 5V	75	102		dB
		T_{min}<T_{op}<T_{max}	73			dB
Large signal voltage gain	A_{vd}	R_L=10kΩ, V_{out}=0.5V to 4.5V	85	98		dB
		T_{min}<T_{op}<T_{max}	80			dB
High-level output voltage, V_{OH}=V_{CC}-V_{out}	V_{OH}	R_L=10kΩ		7	35	mV
		T_{min}<T_{op}<T_{max}			50	mV
Low-level output voltage	V_{OL}	R_L=10kΩ		6	35	mV
		T_{min}<T_{op}<T_{max}			50	mV
Isink	I_{OUT}	V_{out}=5V	40	69		mA
		T_{min}<T_{op}<T_{max}	35			mA
Isource		V_{out}=0V	40	74		mA
		T_{min}<T_{op}<T_{max}	35			mA
Supply current (per operator)	I_{CC}	No load, V_{out}=2.5V		30	36	μA
		T_{min}<T_{op}<T_{max}			38	μA
Gain bandwidth product	GBP	R_L=10kΩ, C_L=100pF		1.3		MHz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Minimum gain for stability	Gain	Phase margin=60 °, R_f=10kΩ		4		V/V
		R_L=10kΩ, C_L=20pF		-3		V/V
Slew rate	SR	R_L=10kΩ, C_L=100pF V_{out}=0.5V to 4.5V		0.5		V/μs
Equivalent input noise voltage	e_n	f=1kHz		70		nV/√Hz
Total harmonic distortion	THD	A_V=-10, f_{in}=1kHz, R_L=100kΩ, V_{icm}=V_{CC}/2, V_{in}=40mV_{pp}		0.15		%

8.1 Typical characteristic

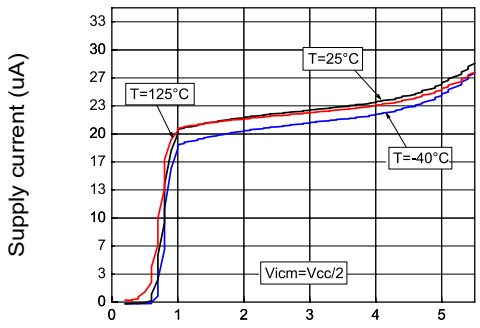


Figure 1: Supply current vs. supply voltage at V_{icm}= V_{CC}/2

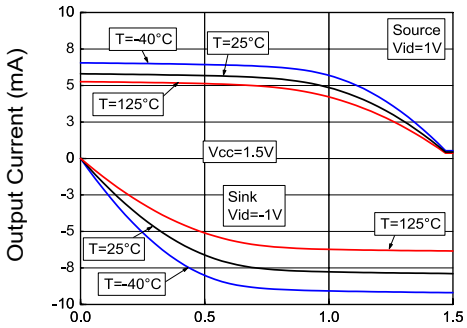


Figure 2: Output current vs. output voltage at V_{CC}=1.5V

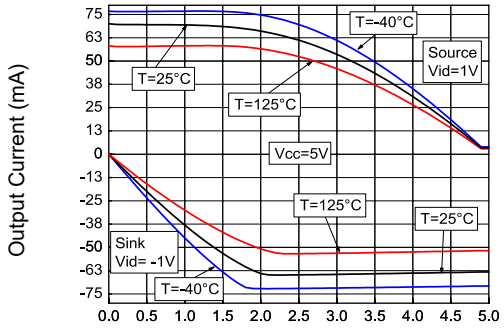


Figure 3: Output current vs. output voltage at V_{CC}=5V

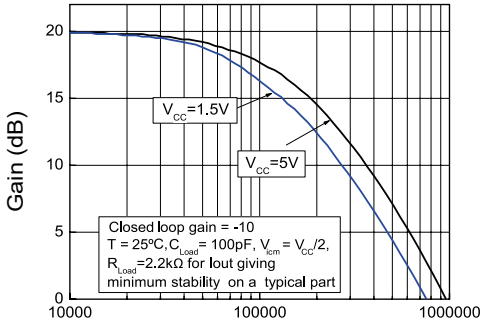


Figure 4: Peaking at closed loop gain = -10 at V_{CC}=1.5V and V_{CC}=5V

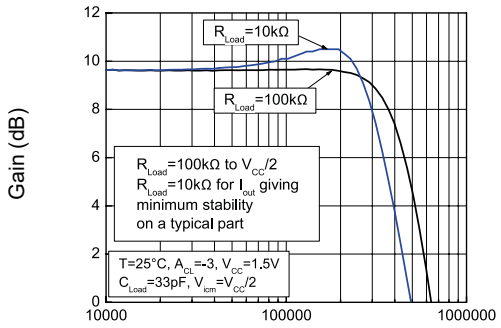


Figure 5: Peaking at closed loop gain =-3, V_{CC}=1.5V

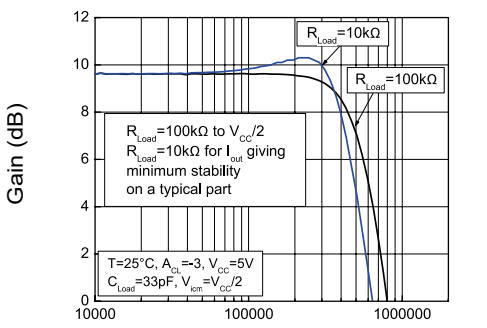


Figure 6: Peaking at closed loop gain = -3, V_{CC}=5V

8.2 Typical characteristic

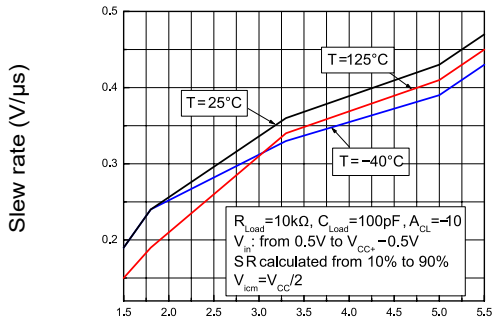


Figure 7: Positive slew rate vs. supply voltage in closed loop

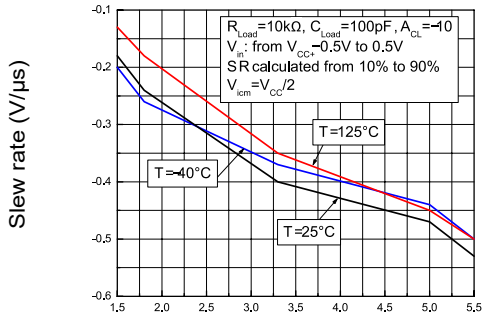


Figure 8: Negative slew rate vs. supply voltage in closed loop

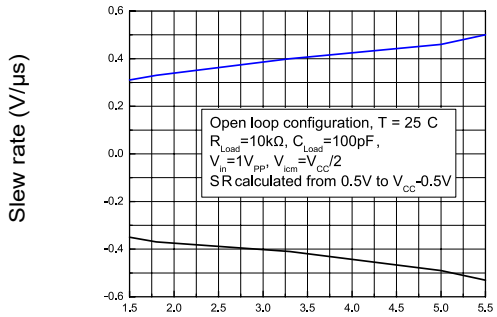


Figure 9: Slew rate vs. supply voltage in open loop

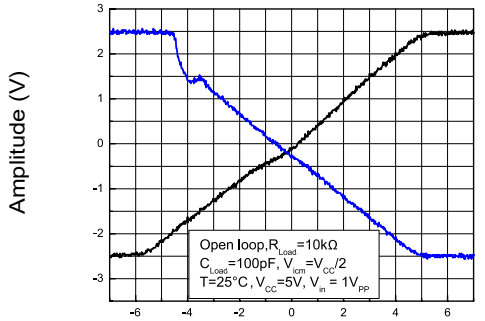


Figure 10: Slew rate timing in open loop

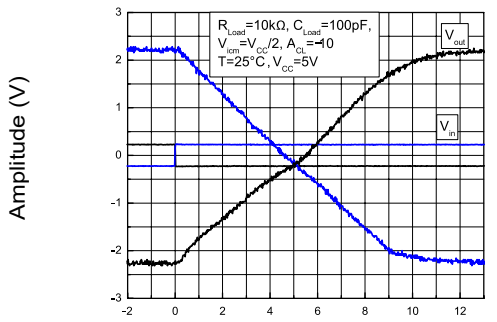


Figure 11: Slew rate timing in closed loop

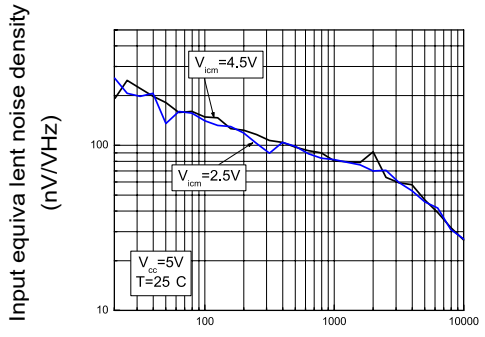


Figure 12: Noise at V_{CC}=5V

8.3 Typical characteristic

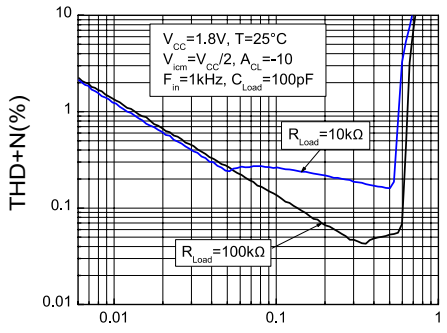


Figure 13: Distortion + noise vs. output voltage at V_{CC}=1.8V

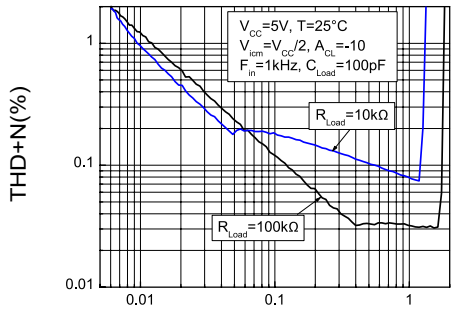


Figure 14: Distortion + noise vs. output voltage at V_{CC}=5V

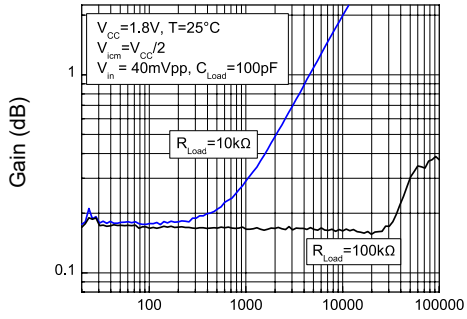


Figure 15: Distortion + noise vs. frequency at V_{CC}=1.8V

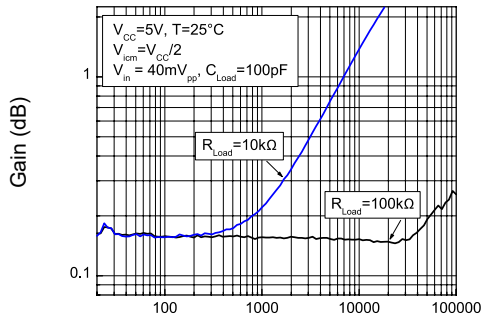


Figure 16: Distortion + noise vs. frequency at V_{CC}=5V

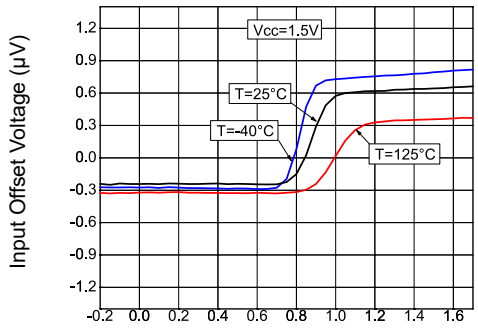


Figure 17: Input offset voltage vs. input common mode at V_{CC}=1.5V

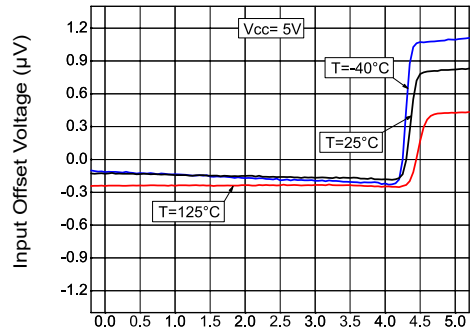


Figure 18: Input offset voltage vs. input common mode at V_{CC}=5V

8.4 Typical characteristic

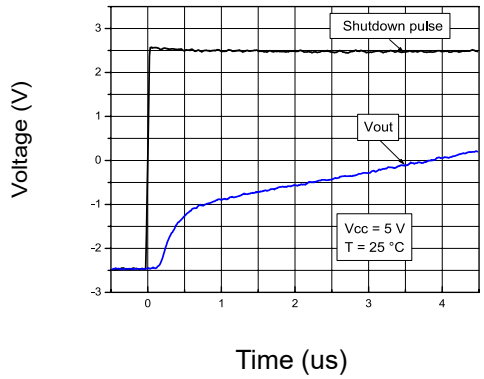


Figure 19: Turn-on time, V_{CC}=5V, Vout pulled down, T=25°C

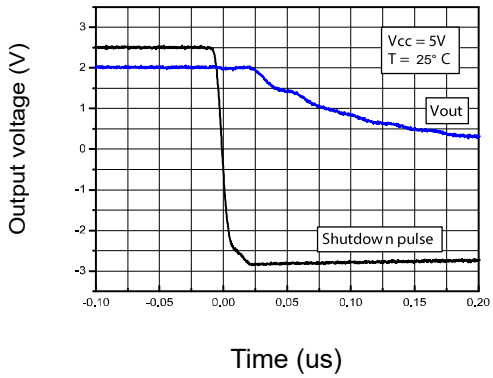


Figure 20: Turn-off time, V_{CC}=5V, Vout pulled down, T=25°C

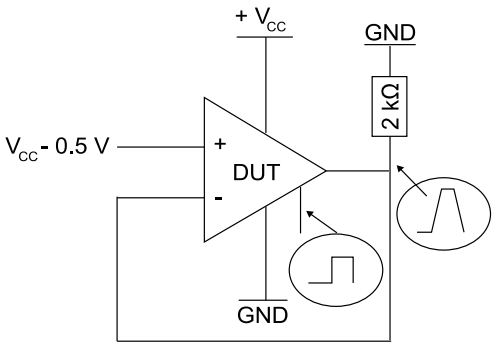


Figure 21: Test configuration for turn-on time (Vout pulled down)

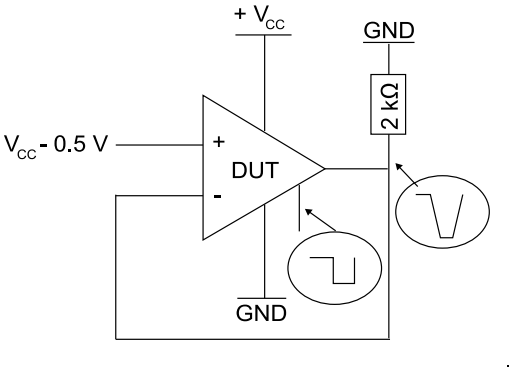
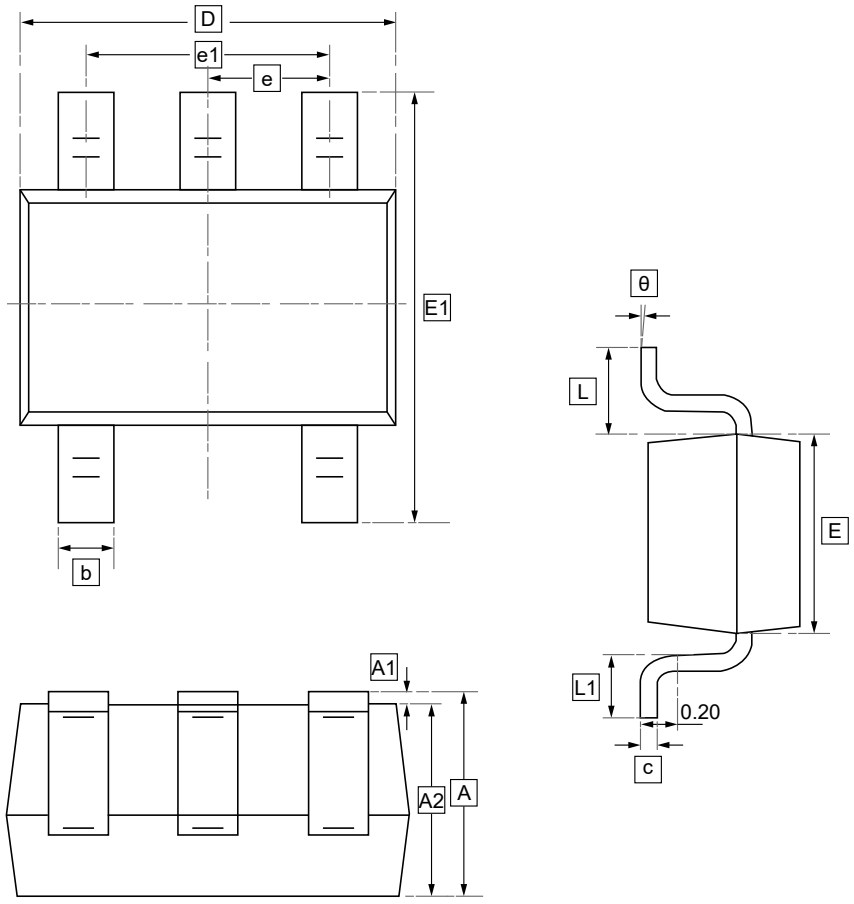


Figure 21: Test configuration for turn-off time (Vout pulled down)

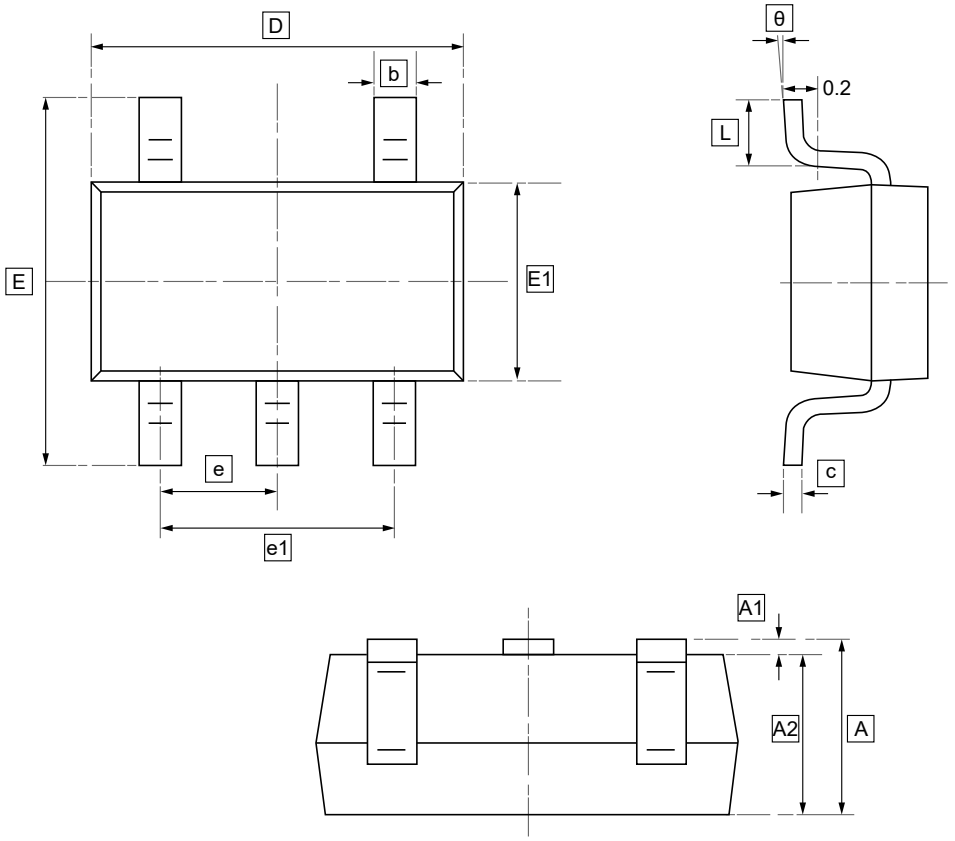
9.1 SC70-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	e1	L	θ
Min	0.90	0.00	0.90	0.15	0.08	1.80	1.15	2.15	0.65	1.20	0.26	7°
Max	1.10	0.10	1.00	0.35	0.15	2.25	1.35	2.45	TYP	1.40	0.46	REF.

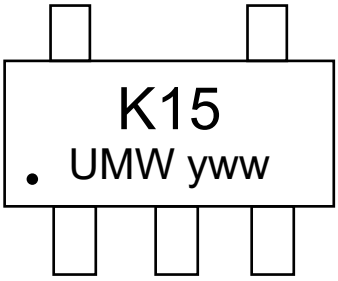
9.2 SOT-23-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

10.Ordering Information



yww: Batch Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW TSV6291AILT	K113	SOT23-5	3000	Tape and reel
UMW TSV6291ILT	K107	SOT23-5	3000	Tape and reel
UMW TSV6291AICT	K15	SC70-5	3000	Tape and reel

11.Disclaimer

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