UMW TP5531/5532

1.8V, 34μA, RRIO, Zero Drift Op-amps

1.Description

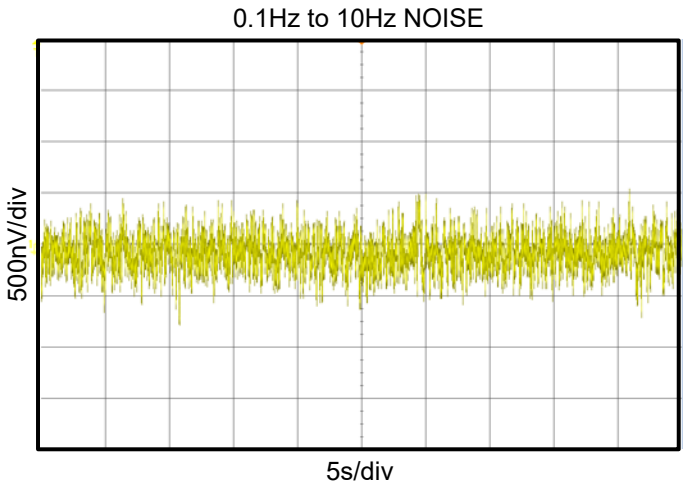
The TP5531/5532 low-power chopper stabilized operational amplifiers provide input offset voltage correction for very low offset and offset drift over time and temperature. The devices operate with a single supply voltage as low as 1.8V, while drawing 34μA per amplifier of quiescent current with a gain bandwidth product of 350kHz. They are unity gain stable, have no 1/f noise, have good Power Supply Rejection Ratio (PSRR) and Common Mode Rejection Ratio (CMRR), and feature rail-to-rail input and output swing.

2.Features

- Low Offset Voltage: 10μV (Max)
- Zero Drift: 0.008μV/°C
- 0.1Hz to 10Hz Noise: 1.1μV_{PP}
- Low Supply Current: 34μA per Amplifier
- Bandwidth: 350kHz
- Slew Rate: 0.16V/μs
- High Gain, 130dB High CMRR and PSRR
- Rail-to-rail Input and Output Swing
- -40°C to 125°C Operation Range

3.Applications

- Transducer Amplifier
- Bidirectional Current Sense
- DC Offset Correction
- Temperature Measurement
- Remote Located Sensors
- Battery-Powered Instruments
- Electronic Weigh Scales



4.Absolute Maximum Ratings T_A= 25°C

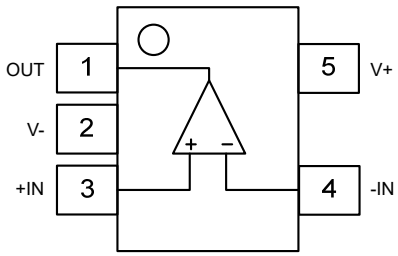
Parameter	Value
Supply Voltage	6V
Input Voltage	V^-–0.2 to V^+ + 0.2
Input Current: +IN, –IN Note 2	±20mA
Output Current: OUT	±60mA
Output Short-Circuit Duration Note 3	Indefinite
Current at Supply Pins	±50mA
Operating Temperature Range	-40°C to 125°C
Maximum Junction Temperature	150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	260°C

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

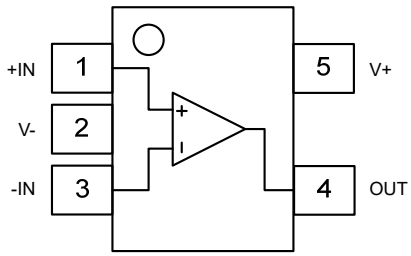
Note 2: The inputs are protected by ESD protection diodes to each power supply. If the input extends more than 500mV beyond the power supply, the input current should be limited to less than 10mA.

Note 3: A heat sink may be required to keep the junction temperature below the absolute maximum. This depends on the power supply voltage and how many amplifiers are shorted. Thermal resistance varies with the amount of PC board metal connected to the package. The specified values are for short traces connected to the leads.

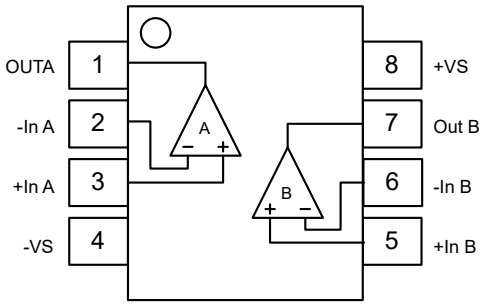
5.Pinning Information



TP5531
SOT23-5



TP5531U
SC70-5



TP5532
SOP-8

6.ESD, Electrostatic Discharge Protection

Parameter	Symbol	Condition	Min	Units
Human Body Model ESD	HBM	MIL-STD-883H Method 3015.8	7	kV
Charged Device Model ESD	CDM	JEDEC-EIA/JESD22-C101E	2	kV

7.Electrical Characteristics

The boldface denotes the specifications which apply over the full operating temperature range T_A=-40°C to +125°C. At T_A=27°C, V_{DD}=5V, R_L=10kΩ, V_{CM}=V_{DD}/2, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Supply Voltage Range	V_{DD}		1.8		5.5	V
Quiescent current per amplifier	I_Q	I_O=0		34	40	μA
Over temperature					55	μA
Input Offset Voltage	V_{OS}	Input grounded, unity gain		2	10	μV
vs temperature	dV_{OS}/dT			0.008	0.05	μV/°C
vs power supply	PSRR	V_S=+1.8V to +5.5V		0.5		μV/V
input voltage noise, f=0.01Hz to 1Hz	V_n			0.4		$μV_{pp}$
input voltage noise, f=0.1Hz to 10Hz				1.1		$μV_{pp}$
Input voltage noise density, f=1kHz	en			55		nV/√Hz
Input capacitor, Differential	C_{IN}			3		pF
Input capacitor, Common-Mode				2		pF
Input Bias Current	I_B			±50	±200	pA
Over temperature					800	pA
Input offset current	I_{OS}			±100	±400	pA
Common-mode voltage range	V_{CM}		(V-)-0.1		(V+)+0.1	V
Common-mode rejection ratio	CMRR		110	130		dB
Output Voltage Swing from rail	V_O	R_L=10kΩ		5	10	mV
Over temperature		R_L=10kΩ			10	mV
Short-circuit curent	I_{SC}				±60	mA
Maximum Capacitive Load	C_L			1000		pF
Unity Gain Bandwidth	GBWP	C_L=100pF		350		kHz
Slew rate	SR	G=+1, C_L=100pF		0.16		V/μs
Overoad recovery time	t_{OR}	G=-10		60		μs
Settling time to 0.01%	t_S	C_L=100pF		40		μs

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Open-Loop Voltage Gain	A_{VOL}	(V-)+100mV<V_O<(V+)-100mV R_L=100kΩ	100	120		dB
Thermal Resistance Junction to Ambient	θ_{JA}	SC70-5 (SOT3530)		250		°C/W
		SOT23-5		200		°C/W
		SOP-8		158		°C/W

8.1 Typical characteristic

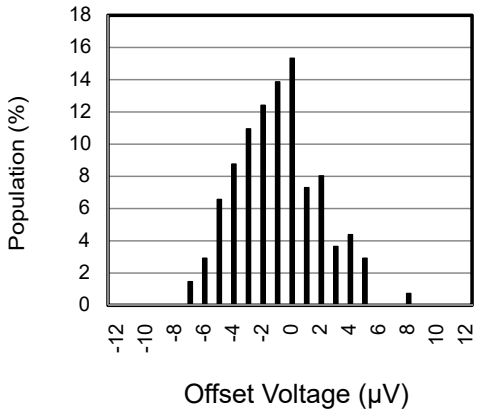


Figure 1: Offset Voltage Distribution

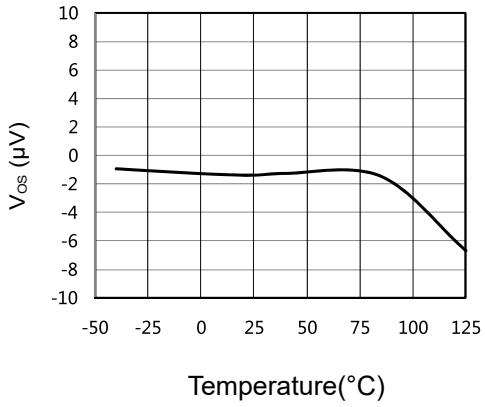


Figure 2: Offset Voltage vs Temperature

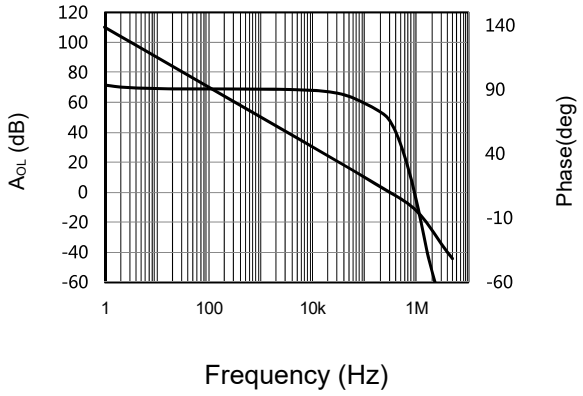


Figure 3: Open-Loop Gain vs Frenquency

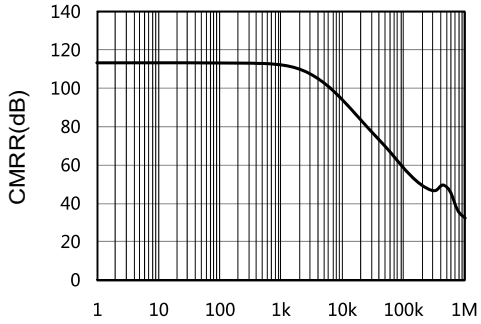


Figure 4: CMRR vs Frequency

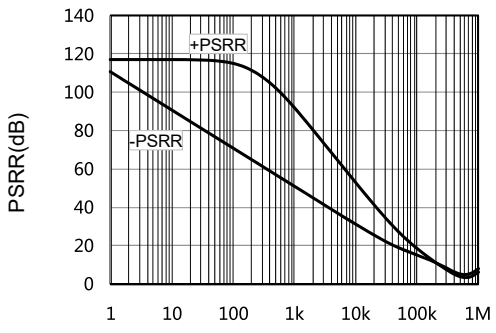


Figure 5: PSRR vs Frequency

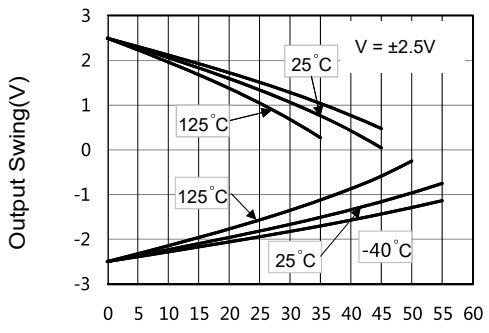


Figure 6: Output Swing vs Load Current

8.2 Typical characteristic

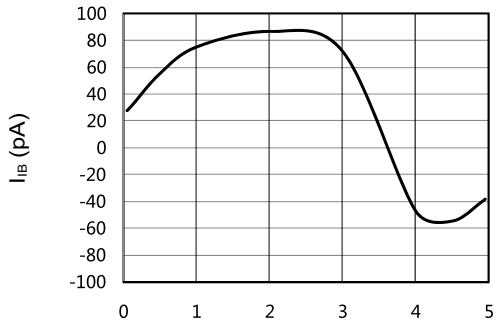


Figure 7: IB vs Common-mode Voltage

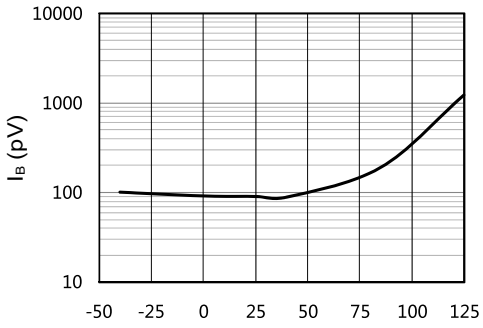


Figure 8: Input Bias vs Temperature

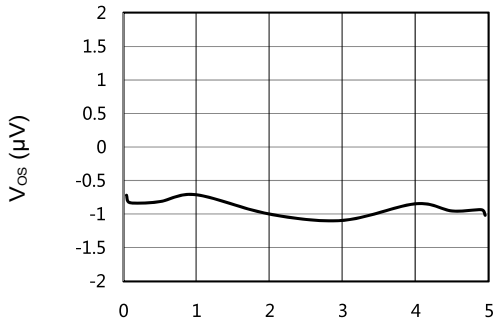


Figure 9: Vosvs Common-mode Voltage

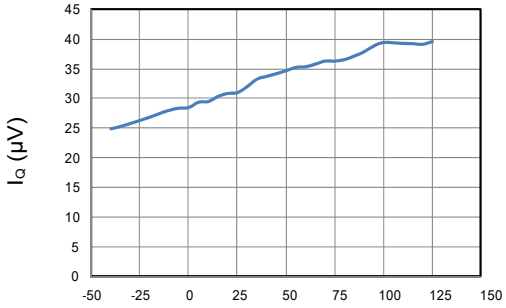


Figure 10: Quiescent Current vs Temperature

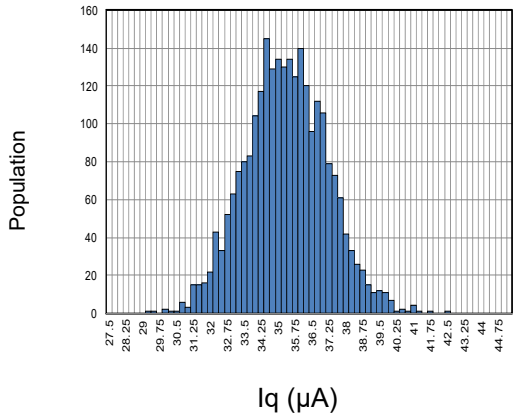


Figure 11: Quiescent Current Distribution

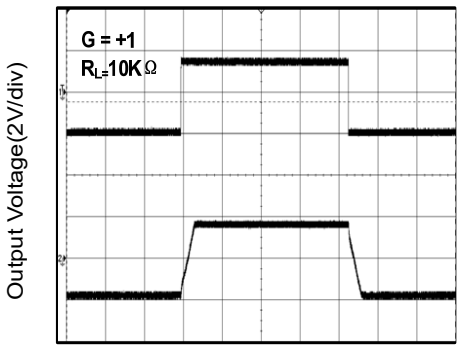


Figure 12: Large-Scale Step Response

8.3 Typical characteristic

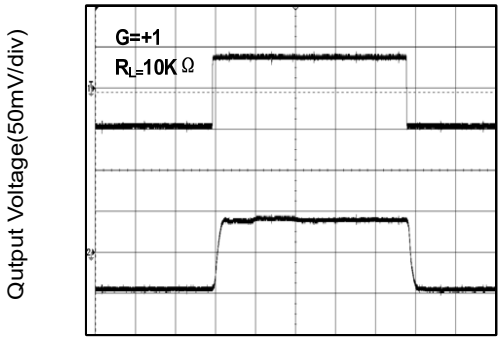


Figure 13: Small-Scale Step Response

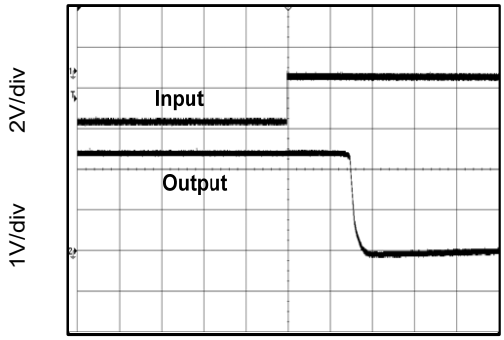


Figure 14: Positive Over-Voltage Recovery

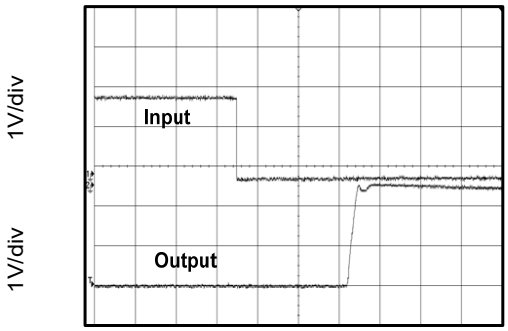


Figure 15: Negative Over-Voltage Recovery

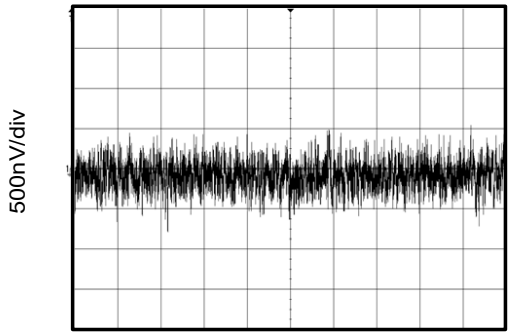


Figure 16: 0.1Hz TO 10Hz Noise

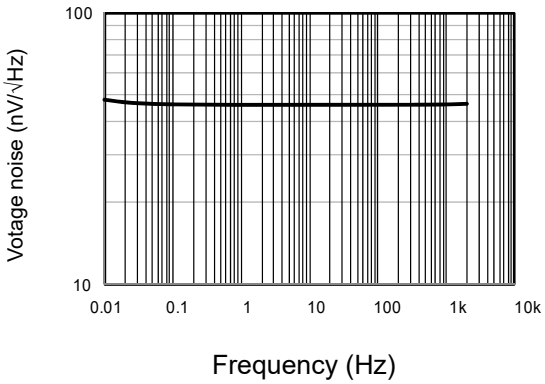
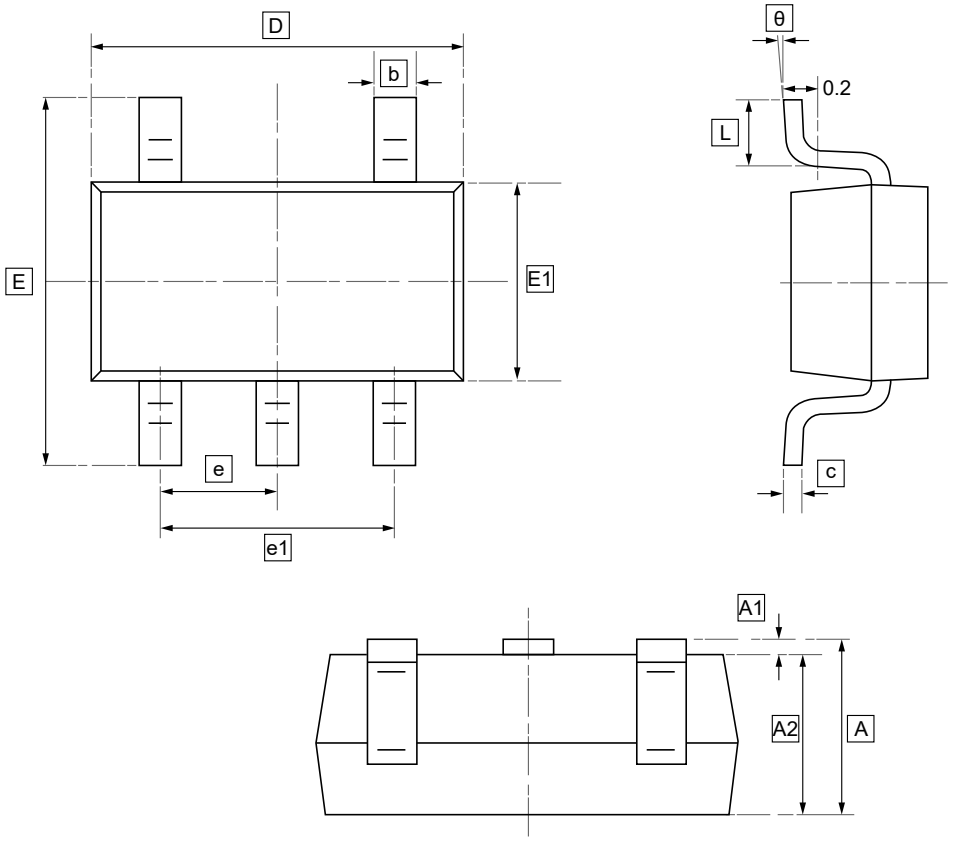


Figure 17: Voltage Noise Spectral Density vs Frequency

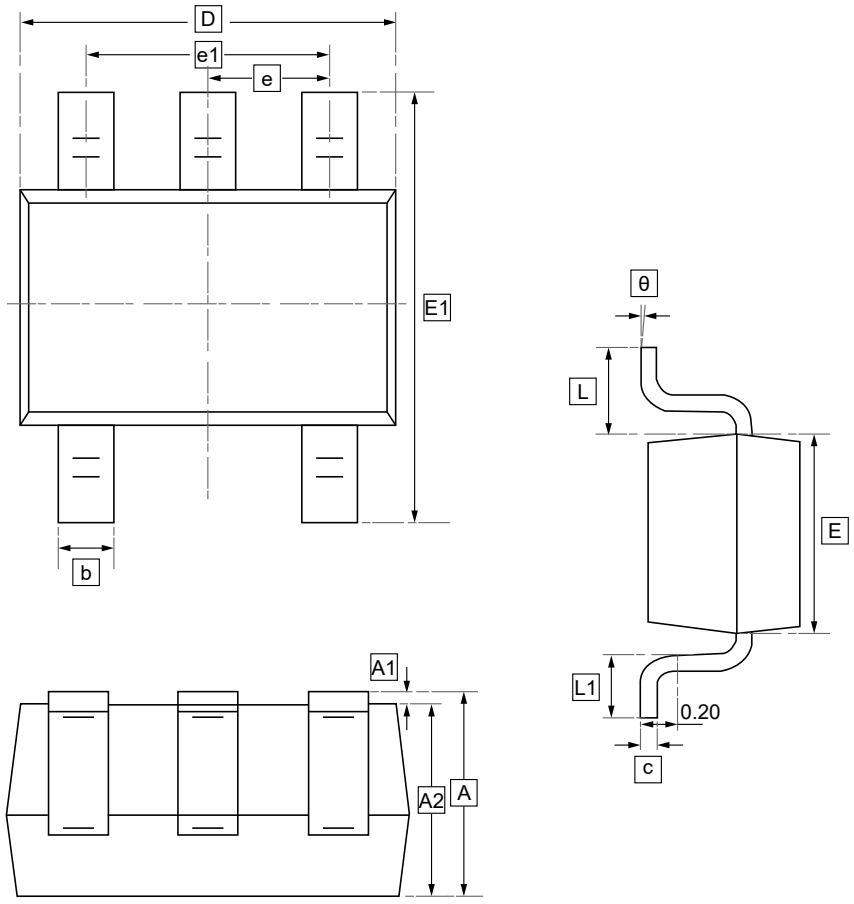
9.1 SOT-23-5 Package Outline Dimensions



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°

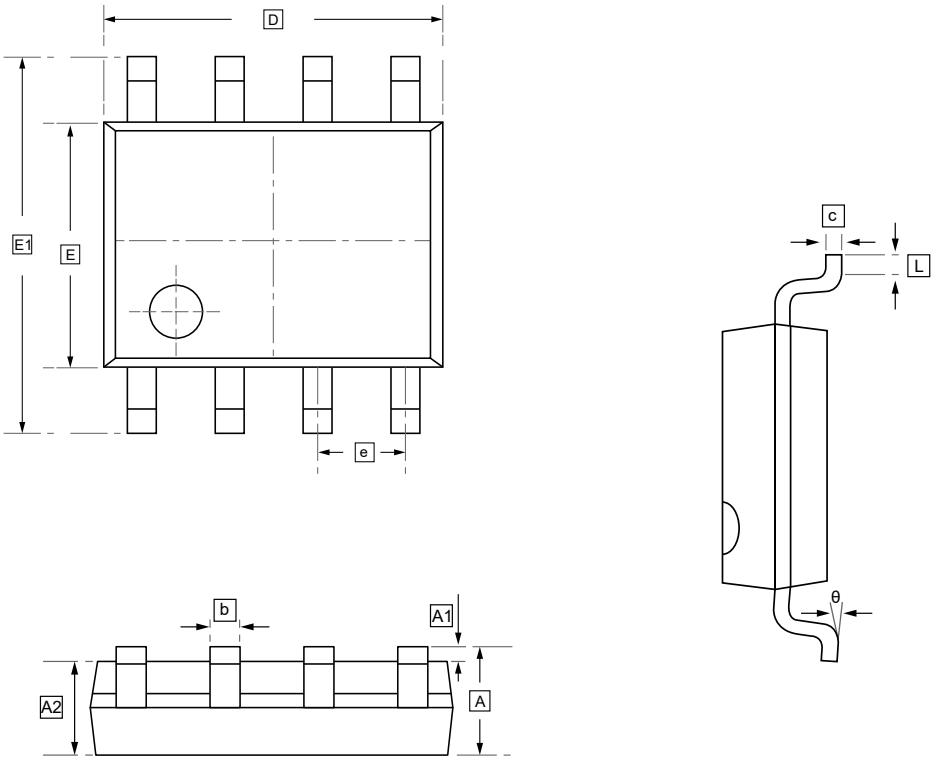
9.2 SC70-5 Package Outline Dimensions



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.

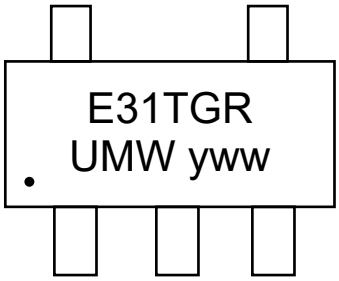
9.3 SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°

10.Ordering Information



yww: Batch Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW TP5531-TR	E31TGR	SOT23-5	3000	Tape and reel
UMW TP5531U-CR	31VG ∩	SC70-5	3000	Tape and reel
UMW TP5532-SR	TP5532	SOP-8	2500	Tape and reel

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