

Description

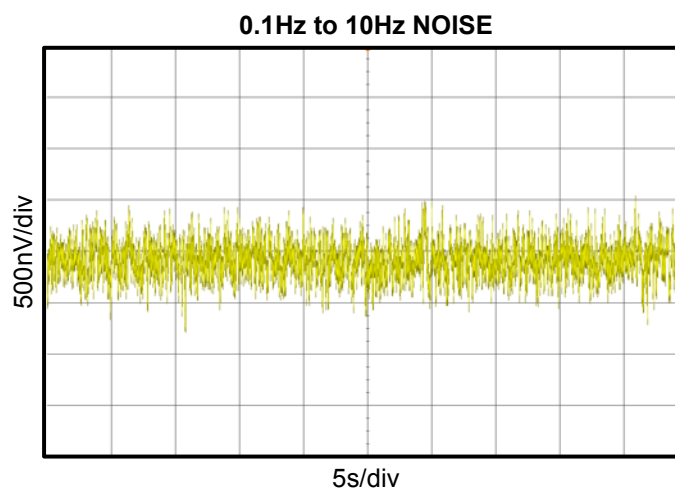
The TP5531/2 low-power chopper stabilized operational amplifiers provide input offset voltage correction for very low offset and offset drift over time and temperature. The devices operate with a single supply voltage as low as 1.8V, while drawing 34 μ A per amplifier of quiescent current with a gain 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.

Applications

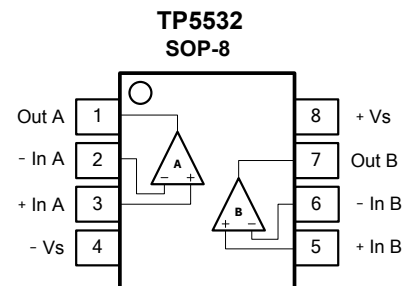
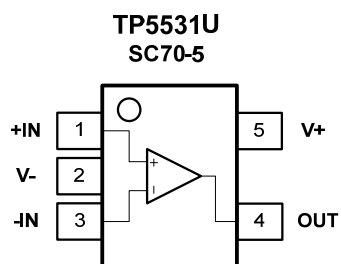
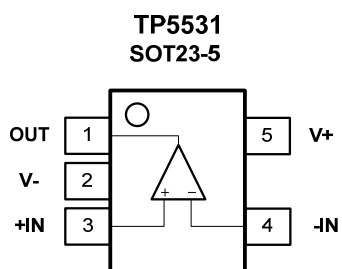
- Transducer Amplifier
- Bidirectional Current Sense
- DC Offset Correction
- Temperature Measurement
- Remote Located Sensors
- Battery-Powered Instruments
- Electronic Weigh Scales

Features

- LOW OFFSET VOLTAGE: 10 μ V (Max)
- ZERO DRIFT: 0.008 μ V/ $^{\circ}$ C
- 0.1Hz to 10Hz Noise: 1.1 μ V_{PP}
- Low Supply Current: 34 μ A per Amplifier
- Bandwidth: 350 kHz
- Slew Rate: 0.16 V/ μ s
- High Gain, 130 dB High CMRR and PSRR
- Rail-to-rail Input and Output Swing
- -40 $^{\circ}$ C to 125 $^{\circ}$ C Operation Range



Pin Configuration (Top View)



ESD, Electrostatic Discharge Protection

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

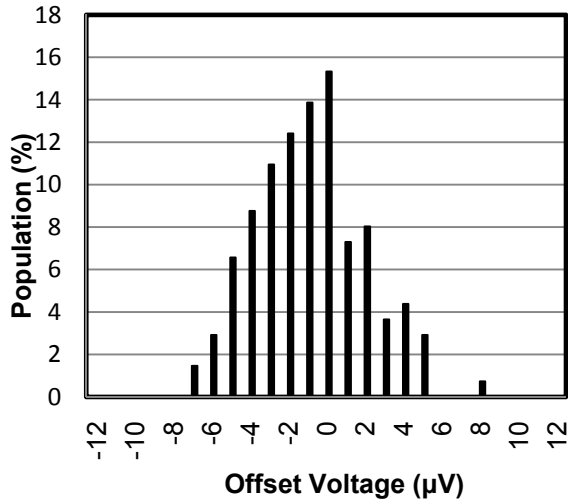
Electrical Characteristics

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

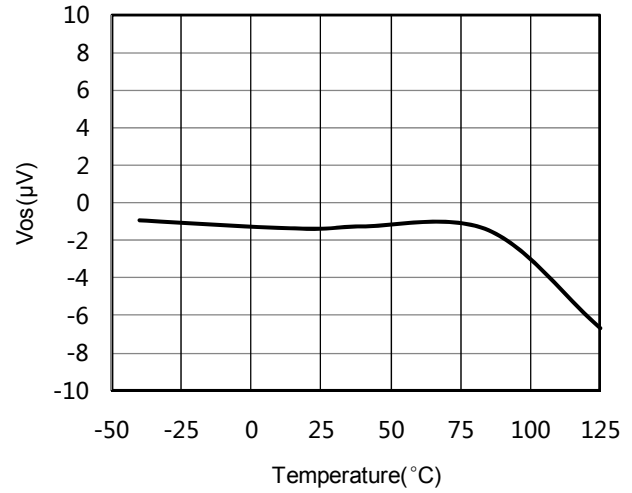
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{DD}	Supply Voltage Range		1.8		5.5	V
I_Q	Quiescent current per amplifier	$I_O = 0$		34	40	μA
	Over temperature				55	μA
V_{OS}	Input Offset Voltage	Input grounded, unity gain.		2	10	μV
dV_{OS}/dT	vs temperature			0.008	0.05	$\mu\text{V}/^{\circ}\text{C}$
PSRR	vs power supply	$V_S = +1.8\text{V}$ to $+5.5\text{V}$		0.5		$\mu\text{V}/\text{V}$
V_n	input voltage noise, $f=0.01\text{Hz}$ to 1Hz			0.4		μV_{pp}
	input voltage noise, $f=0.1\text{Hz}$ to 10Hz			1.1		μV_{pp}
e_n	Input voltage noise density, $f=1\text{kHz}$			55		$\text{nV}/\sqrt{\text{Hz}}$
C_{IN}	Input capacitor, Differential			3		pF
	Input capacitor, Common-Mode			2		pF
I_B	Input Bias Current			± 50	± 200	pA
	Over temperature				800	pA
I_{OS}	Input offset current			± 100	± 400	pA
V_{CM}	Common-mode voltage range		$(V_-) - 0.1$		$(V_+) + 0.1$	V
CMRR	Common-mode rejection ratio		110	130		dB
V_O	Output Voltage Swing from rail	$R_L = 10\text{k}\Omega$		5	10	mV
	Over temperature	$R_L = 10\text{k}\Omega$			10	mV
I_{SC}	Short-circuit current				± 60	mA
C_L	Maximum Capacitive Load			1,000		pF
GBWP	Unity Gain Bandwidth	$C_L = 100\text{pF}$		350		kHz
SR	Slew rate	$G = +1$, $C_L = 100\text{pF}$		0.16		V/ μs
t_{OR}	Overload recovery time	$G = -10$		60		μs
t_s	Settling time to 0.01%	$C_L = 100\text{pF}$		40		μs
A_{VOL}	Open-Loop Voltage Gain	$(V_-) + 100\text{mV} < V_O < (V_+) - 100\text{mV}$, $R_L = 100\text{k}\Omega$	100	120		dB
θ_{JA}	Thermal Resistance Junction to Ambient	SC70-5 (SOT353)		250		$^{\circ}\text{C}/\text{W}$
		SOT23-5		200		
		SOP-8		158		

Typical Performance Characteristics

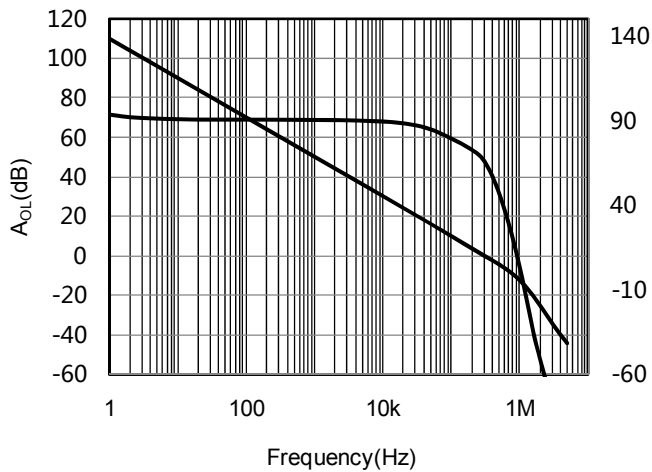
Offset Voltage Distribution



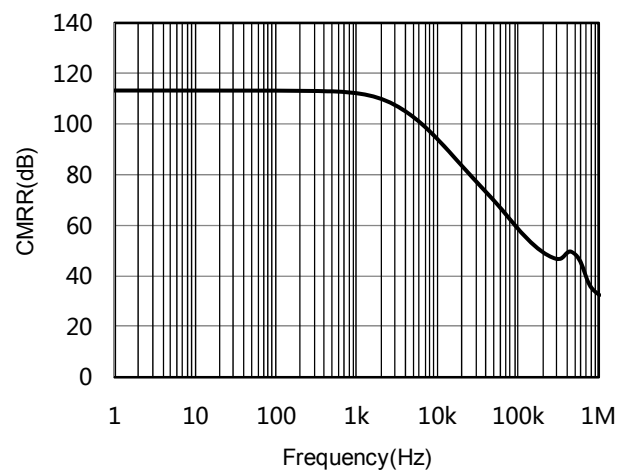
Offset Voltage vs TEMPERATURE



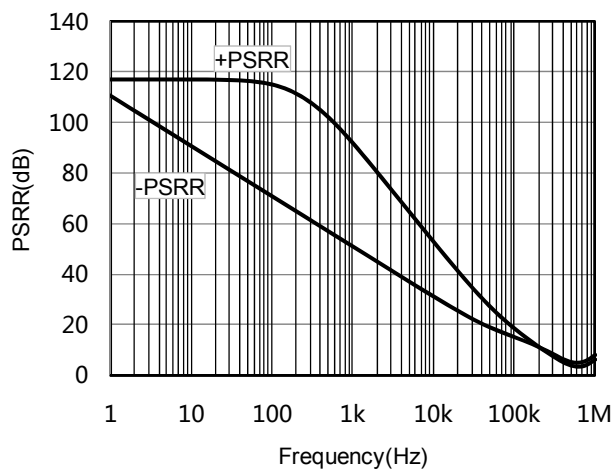
OPEN-LOOP GAIN vs FREQUENCY



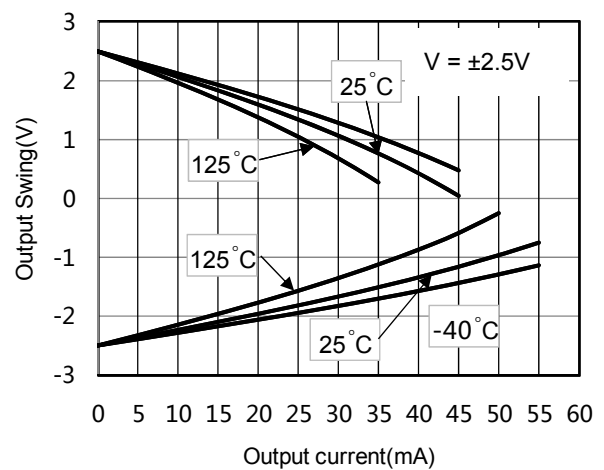
CMRR vs FREQUENCY



PSRR vs FREQUENCY

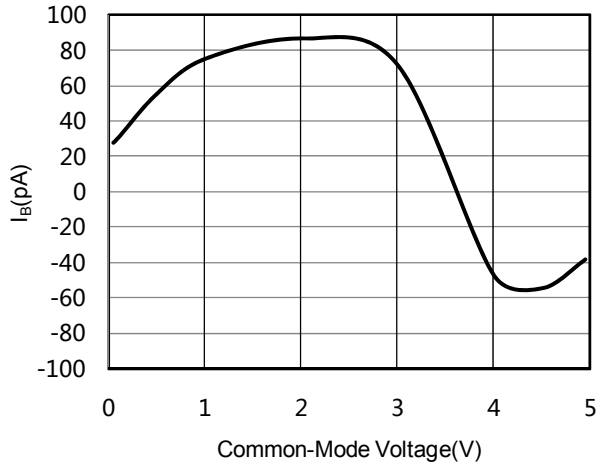


OUTPUT SWING vs LOAD CURRENT

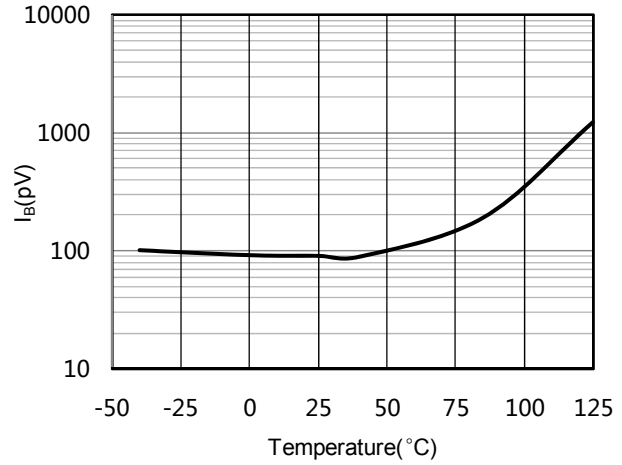


Typical Performance Characteristics

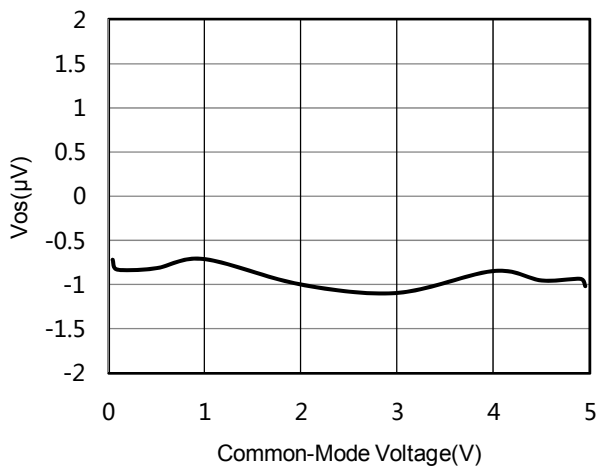
IB vs COMMON-MODE VOLTAGE



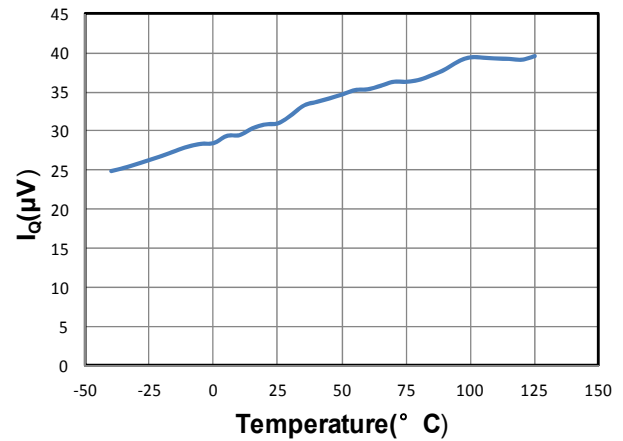
INPUT BIAS vs TEMPERATURE



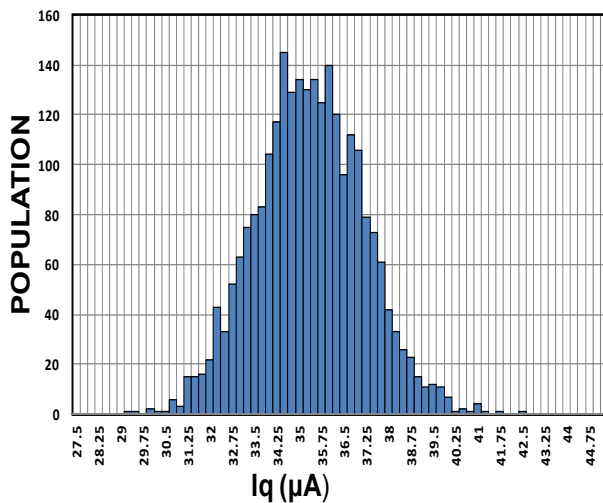
Vos vs COMMON-MODE VOLTAGE



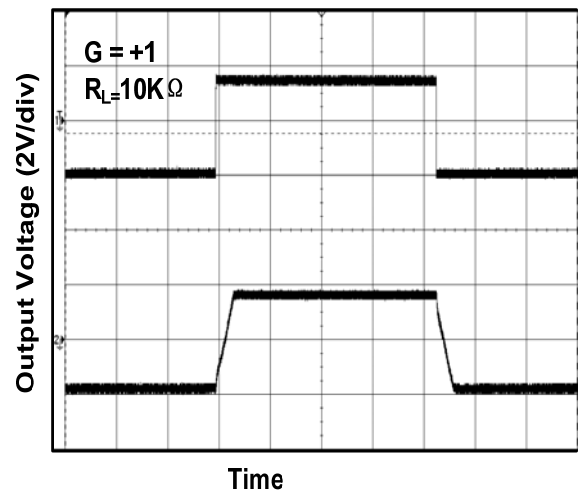
QUIESCENT CURRENT vs TEMPERATURE



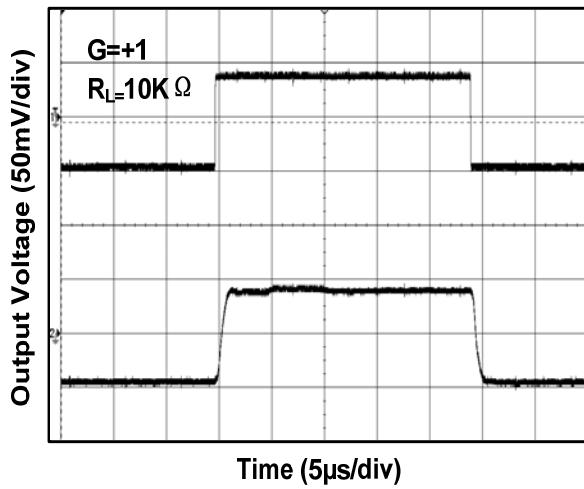
Quiescent Current Distribution



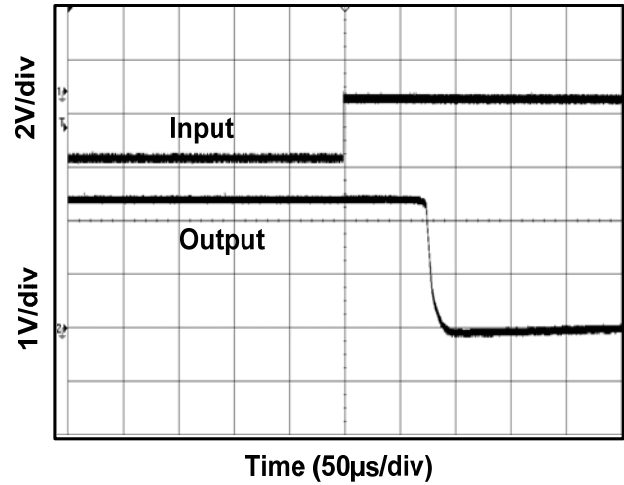
Large-Scale Step Response



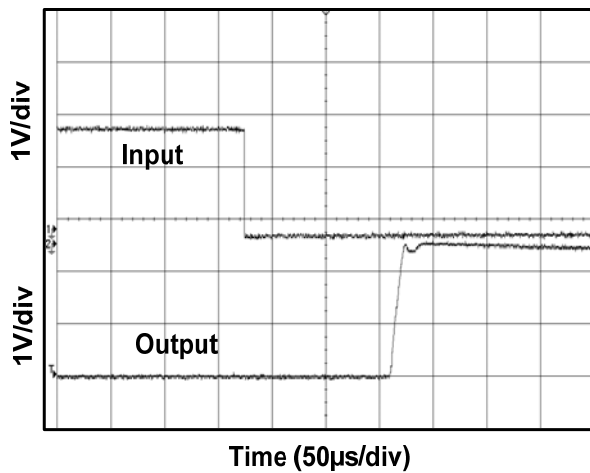
Small-Scale Step Response



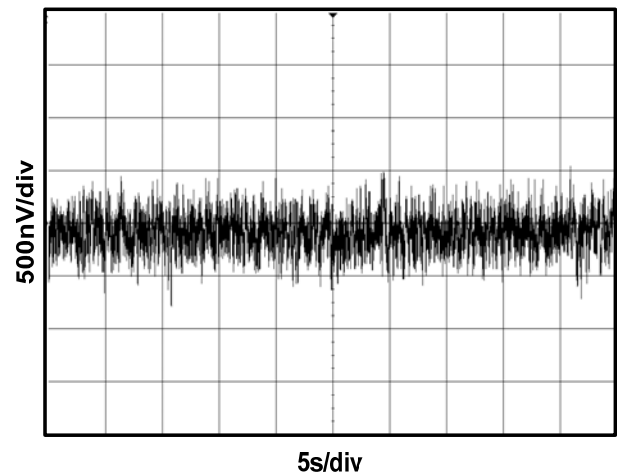
Positive Over-Voltage Recovery



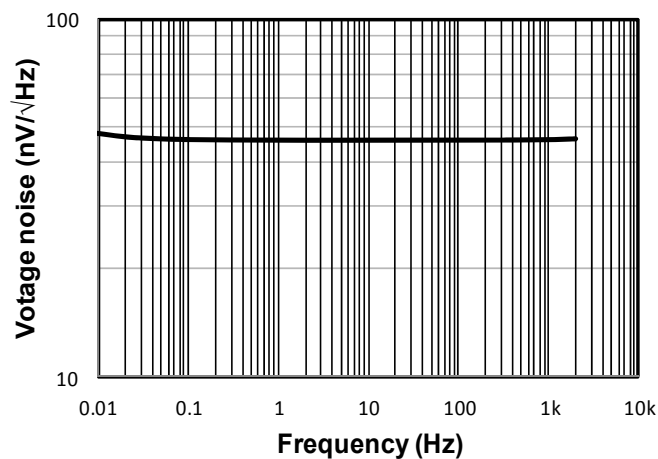
Negative Over-Voltage Recovery



0.1Hz TO 10Hz NOISE

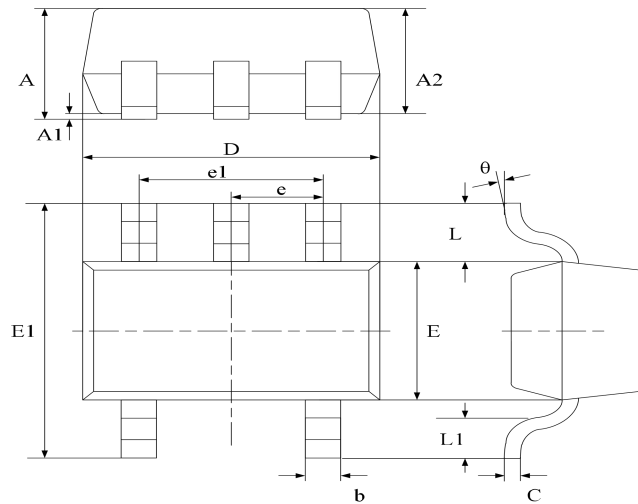


VOLTAGE NOISE SPECTRAL DENSITY vs FREQUENCY



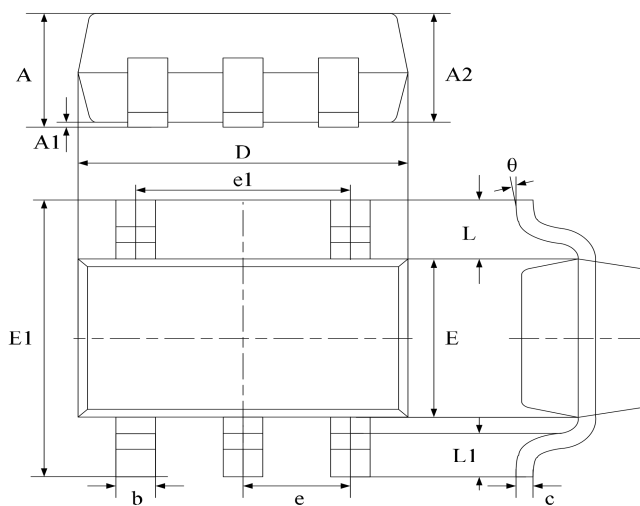
Package Dimension

SC70-5 (SOT353)



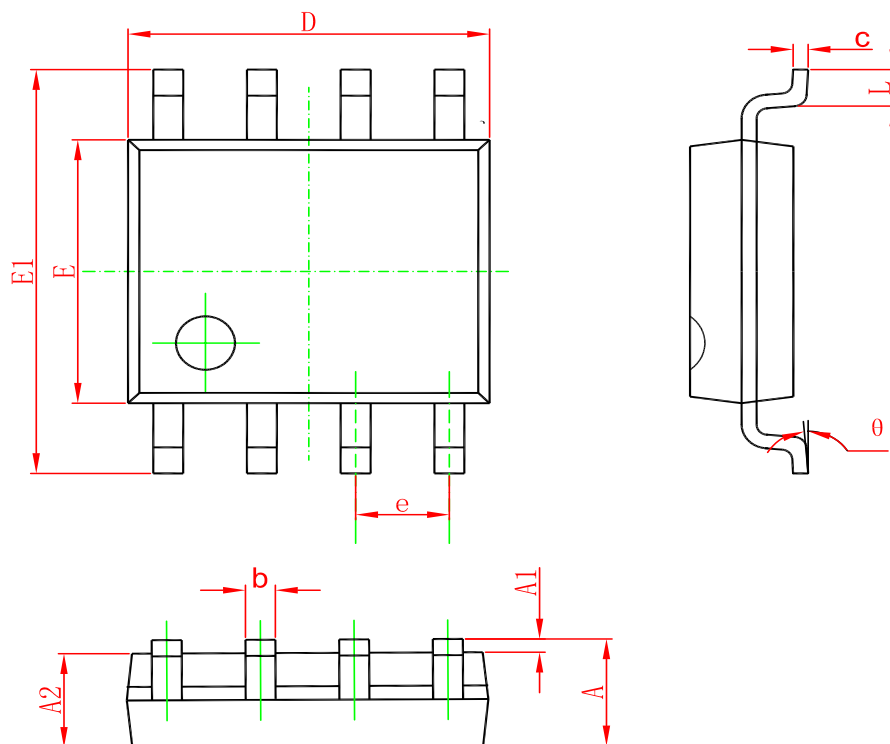
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	0.900	0.035	0.039
b	0.150	0.350	0.006	0.014
C	0.080	0.150	0.003	0.006
D	1.8500	2.150	0.079	0.087
E	1.100	1.400	0.045	0.053
E1	1.950	2.200	0.085	0.096
e	0.850 typ.		0.026 typ.	
e1	1.200	1.400	0.047	0.055
L	0.42 ref.		0.021 ref.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.040	1.350	0.042	0.055
A1	0.040	0.150	0.002	0.006
A2	1.000	1.200	0.041	0.049
b	0.380	0.480	0.015	0.020
c	0.110	0.210	0.004	0.009
D	2.720	3.120	0.111	0.127
E	1.400	1.800	0.057	0.073
E1	2.600	3.000	0.106	0.122
e	0.950 typ.		0.037 typ.	
e1	1.900 typ.		0.078 typ.	
L	0.700 ref.		0.028 ref.	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Ordering information

Order code	Package	Baseqty	Deliverymode	Marking
UMW TP5531-TR	SOT23-5	3000	Tape and reel	E31TGR U
UMW TP5532-SR	SOP-8	2500	Tape and reel	TP5532
UMW TP5531U-CR	SC70-5	3000	Tape and reel	31VG ∩ U