Features

- Supply Voltage: 3V to 36V
- Low Supply Current: Maximum 1000μA per channel
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Input Rail to –V_S, Rail to Rail Output
- Fast Response: 3.5 MHz Bandwidth, 15V/μs Slew Rate, 100ns Overload Recovery
- Low Offset Voltage:
  - ±2mV Maximum at 25°C,
  - ±2.5mV Maximum at -40°C to 85°C
  - ±3mV Maximum at -40°C to 125°C
- Very Low THD+N: 0.0005% at Gain = 1, 1kHz
- Excellent EMIRR: 60dB at 900MHz
- 2KV HBM, 1KV CDM, 150mA Latch Up
- –40°C to 125°C Operation Temperature Range

Description

The TP226X series amplifiers are newest high supply voltage amplifiers with low offset, low power and stable high frequency response. They incorporate 3PEAK's proprietary and patented design techniques to achieve very good AC performance with 3.5MHz bandwidth, 15V/μs slew rate and low distortion while drawing only typical 700μA of quiescent current per amplifier. The input common-mode voltage range extends to V–, and the outputs swing rail-to-rail. The TP226X family can be used as plug-in replacements for many commercially available op-amps to reduce power and improve input/output range and performance.

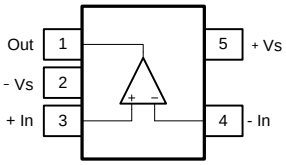
The combination of features makes the TP226X ideal choices for industrial control, motor control and portable audio amplification, sound ports, and other consumer audio.

Applications

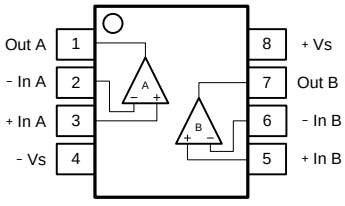
- Sensor Interface
- Motor Control
- Industrial Control
- Audio

Pin Configuration

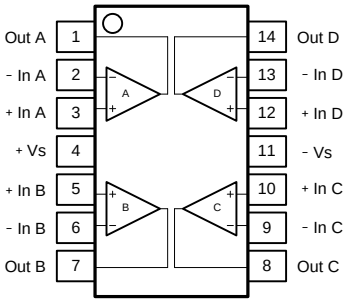
TP2261
5-Pin SOT23
-T Suffixes



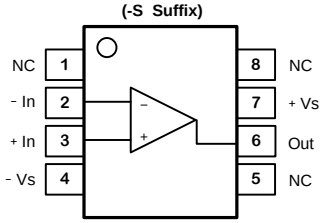
TP2262
8-Pin SOIC/TSSOP/MSOP
-S, -TS and -V Suffixes



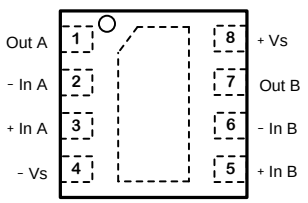
TP2264
14-Pin SOIC/TSSOP
-S and -T Suffixes



TP2261
8-Pin SOIC
(-S Suffix)



TP2262
8-Pin DFN 3*3
(-F2 Suffix)



The thermal pad of DFN package is recommended to be left float or connected to -Vs

Table of Contents

Revision History

Date	Revision	Notes
2017/12/21	Rev.Pre	Pre-Release Version
2018/9/9	Rev.0	Initial Version
2018/12/21	Rev.0.01	Add New Part Number: TP2262L1-TSR, TP2261L1-TR. Update mark information: Add “TP” before “226” on 8-Pin SOIC and 14-Pin SOIC Package.
2019/2/15	Rev.0.02	Add New Part Number: TP2262-F2R. Update Package Outline Dimensions.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TP2261-SR	-40 to 125°C	8-Pin SOIC	2261 AAYW Note 1	3	Tape and Reel, 4000
TP2261-TR	-40 to 125°C	5-Pin SOT23	226YW Note 1	3	Tape and Reel, 3000
TP2261L1-TR	-40 to 125°C	5-Pin SOT23	226YW Note 1	1	Tape and Reel, 3000
TP2262-SR	-40 to 125°C	8-Pin SOIC	TP2262 AAYW Note 1	3	Tape and Reel, 4000
TP2262-F2R	-40 to 125°C	8-Pin DFN 3*3	2262 AAYW Note 1	3	Tape and Reel, 4000
TP2262L1-SR	-40 to 125°C	8-Pin SOIC	TP2262 AAYWL Note 1	1	Tape and Reel, 4000
TP2262-TSR	-40 to 125°C	8-Pin TSSOP	2262 AAYW Note 1	3	Tape and Reel, 3000
TP2262L1-TSR	-40 to 125°C	8-Pin TSSOP	2262 AAYWL Note 1	3	Tape and Reel, 3000
TP2262-VR	-40 to 125°C	8-Pin MSOP	2262 AAYW Note 1	3	Tape and Reel, 3000
TP2264-SR	-40 to 125°C	14-Pin SOIC	TP2264 AAYW Note 1	3	Tape and Reel, 2500
TP2264L1-SR	-40 to 125°C	14-Pin SOIC	TP2264 AAYWL Note 1	1	Tape and Reel, 2500
TP2264-TR	-40 to 125°C	14-Pin TSSOP	2264 AAYW Note 1	3	Tape and Reel, 3000

Note 1: “AA” identify the manufacture site. “YW” is the date code means manufacture year and week as following, “L” means MSL1 product.

The calendar year and the workweek coding scheme is as follows:

Year	Code	Year	Code
2010	A	2023	N
2011	B	2024	O
2012	C	2025	P
2013	D	2026	Q
2014	E	2027	R
2015	F	2028	S
2016	G	2029	T
2017	H	2030	U
2018	I	2031	V
2019	J	2032	W
2020	K	2033	X
2021	L	2034	Y
2022	M	2035	Z

Workweek	Code	Workweek	Code	Workweek	Code	Workweek	Code	Workweek	Code
1	1	14	E	27	R	40	e	53	r
2	2	15	F	28	S	41	f		
3	3	16	G	29	T	42	g		
4	4	17	H	30	U	43	h		
5	5	18	I	31	V	44	i		
6	6	19	J	32	W	45	j		
7	7	20	K	33	X	46	k		
8	8	21	L	34	Y	47	l		
9	9	22	M	35	Z	48	m		
10	A	23	N	36	a	49	n		
11	B	24	O	37	b	50	o		
12	C	25	P	38	c	51	p		
13	D	26	Q	39	d	52	q		

Absolute Maximum Ratings Note 1

Parameters	Rating
Supply Voltage, $(+V_S)$– $(-V_S)$	40 V
Input Voltage	$(-V_S)$ – 0.3 to $(+V_S)$ + 0.3
Differential Input Voltage	$(+V_S)$ - $(-V_S)$
Input Current: +IN, –IN Note 2	±10mA
Output Short-Circuit Duration Note 3	Infinite
Maximum Junction Temperature	150°C
Operating Temperature Range	–40 to 125°C
Storage Temperature Range	–65 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 300mV 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.

ESD Rating

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001	2	kV
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002	1	kV

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
5-Pin SOT23	250	81	°C/W
8-Pin SOIC	158	43	°C/W
8-Pin TSSOP	191	44	°C/W
8-Pin DFN 3*3	120	50	°C/W
8-Pin MSOP	210	45	°C/W
14-Pin SOIC	120	36	°C/W
14-Pin TSSOP	180	35	°C/W

Electrical Characteristics

All test condition is V_S = 30V, T_A = 25°C, R_L = 10kΩ to V_S/2, unless otherwise noted.

Symbol	Parameter	Conditions	T_A	Min	Typ	Max	Unit
Power Supply							
V_S	Supply Voltage Range			3		36	V
I_Q	Quiescent Current per Amplifier	V_S = 30V, TP2261			1000	1500	μA
			-40°C to 125°C			1700	μA
		V_S = 5V, TP2261			850	1300	μA
			-40°C to 125°C			1500	μA
		V_S = 30V, TP2262/TP2264			700	1000	μA
			-40°C to 125°C			1200	uA
		V_S = 5V, TP2262/TP2264			600	850	μA
			-40°C to 125°C			1000	μA
PSRR	Power Supply Rejection Ratio	V_S = 3V to 36V		95	120		dB
			-40°C to 125°C	90			dB
Input Characteristics							
V_{OS}	Input Offset Voltage	V_S = 30V, V_{CM} = 0V to 28V		-2	0.1	2	mV
			-40°C to 85°C	-2.5		2.5	mV
			-40°C to 125°C	-3		3	mV
		V_S = 30V, V_{CM} = 28.5V		-3		3	mV
			-40°C to 125°C	-4		4	mV
		V_S = 5V, V_{CM} = 2.5V		-2	0.1	2	mV
			-40°C to 125°C	-3		3	mV
V_{OS} TC	Input Offset Voltage Drift		-40°C to 125°C		2		μV/°C
I_B	Input Bias Current				25		pA
			-40°C to 85°C		80		pA
			-40°C to 125°C		1000		pA
I_{OS}	Input Offset Current				25		pA
I_{IN}	Different Input Current	V_S = 36V, V_{ID} = 36V			10		nA
			-40°C to 125°C		100		nA
C_{IN}	Input Capacitance	Differential Mode			5		pF
		Common Mode			2.5		pF
Av	Open-loop Voltage Gain			105	120		dB
			-40°C to 125°C	100			dB
V_{CMR}	Common-mode Input Voltage Range			(V-)		(V+) – 1.5	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0V to 28V		105	130		dB
			-40°C to 125°C	100			dB

Output Characteristics							
V_{OH}	Output Swing from Positive Rail	R_{LOAD} = 10kΩ to V_S/2			200	300	mV
			-40°C to 125°C			450	mV
		R_{LOAD} = 2kΩ to V_S/2			1.1	1.4	V
			-40°C to 125°C			2	V
V_{OL}	Output Swing from Negative Rail	R_{LOAD} = 10kΩ to V_S/2			200	300	mV
			-40°C to 125°C			450	mV
		R_{LOAD} = 2kΩ to V_S/2			0.8	1	V
			-40°C to 125°C			1.6	V
I_{SC}	Output Short-Circuit Current			25	32		mA
			-40°C to 85°C	20			mA
			-40°C to 125°C	15			mA
AC Specifications							
GBW	Gain-Bandwidth Product				3.5		MHz
SR	Slew Rate	G = 1, 10V step			15		V/μs
		Open Loop		9	15		V/μs
			-40°C to 85°C	7			V/μs
			-40°C to 125°C	6			V/μs
t_{OR}	Overload Recovery				100		ns
t_S	Settling Time, 0.1%	G = -1, 10V step			0.8		μs
	Settling Time, 0.01%				1		μs
PM	Phase Margin	V_S = 36V, R_L=10K, C_L=100pF			60		°
GM	Gain Margin	V_S = 36V, R_L=10K, C_L=100pF			15		dB
Noise Performance							
E_N	Input Voltage Noise	f = 0.1Hz to 10Hz			1.7		μV_{RMS}
e_N	Input Voltage Noise Density	f = 1kHz			30		nV/ √Hz
i_N	Input Current Noise	f = 1kHz			2		fA/√Hz
THD+N	Total Harmonic Distortion and Noise	f = 1kHz, G =1, R_L = 10kΩ, V_{OUT} = $6V_{RMS}$			0.0005		%

Typical Performance Characteristics

V_S = ±15V, V_{CM} = 0V, R_L = 10kΩ, unless otherwise specified.

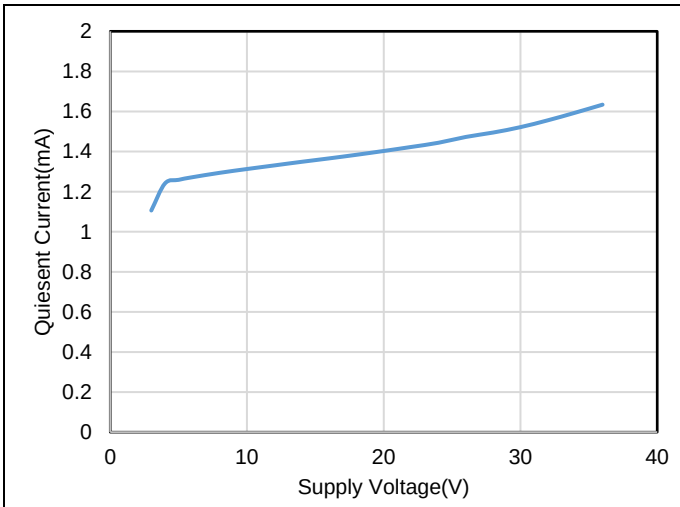


Figure 1. Quiescent Current vs. Supply Voltage, 2ch TP2262

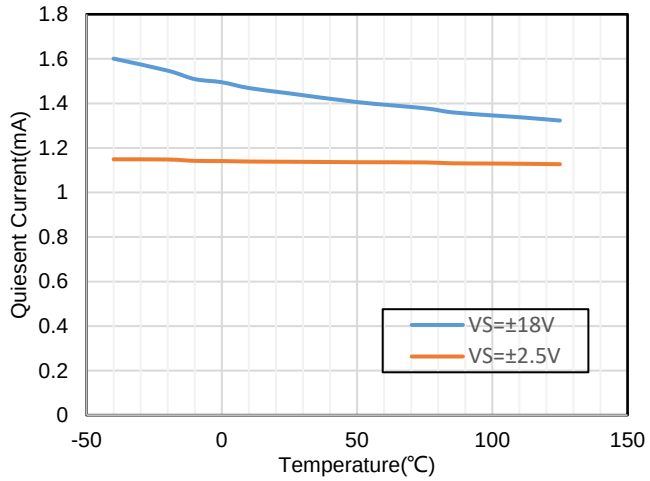


Figure 2. Quiescent Current vs. Temperature, 2ch TP2262

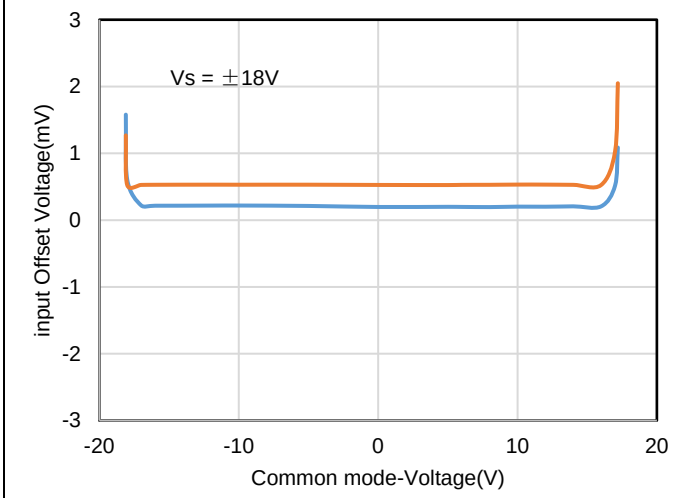


Figure 3. Offset Voltage vs. Common Mode Voltage

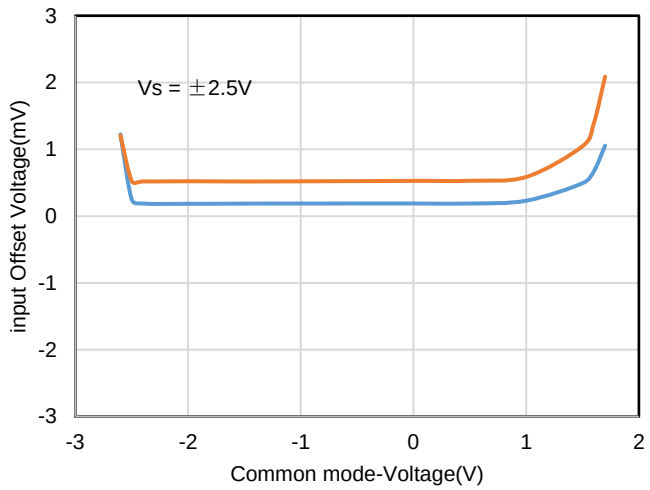


Figure 4. Offset Voltage vs. Common Mode Voltage

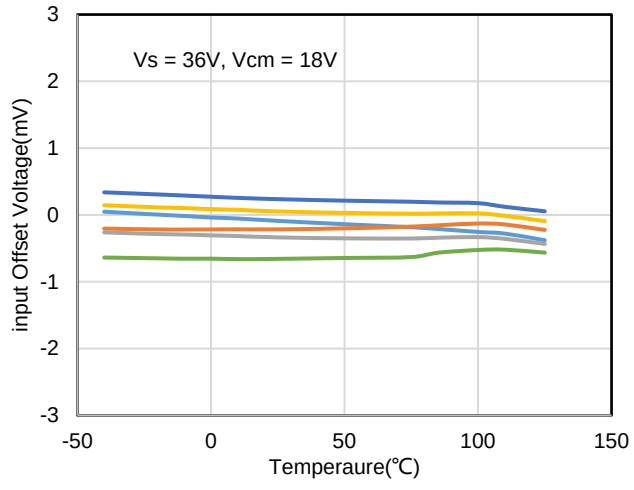


Figure 5. V_{OS} vs. Temperature

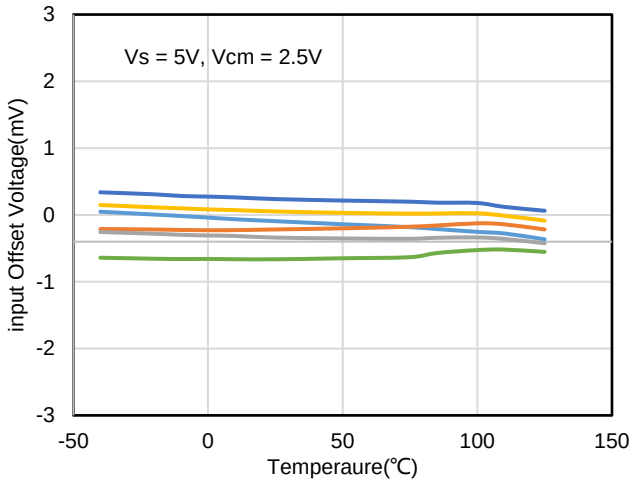


Figure 6. V_{OS} vs. Temperature

V_S = ±15V, V_{CM} = 0V, R_L = 10kΩ, unless otherwise specified.

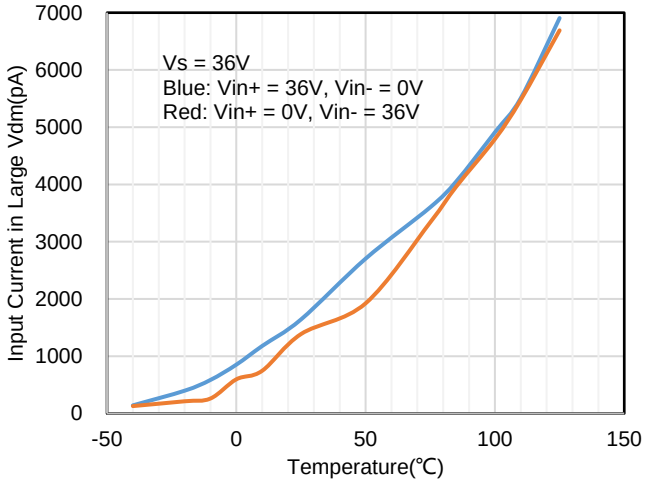


Figure 7. Input Current in Large Vdm vs. Temperature

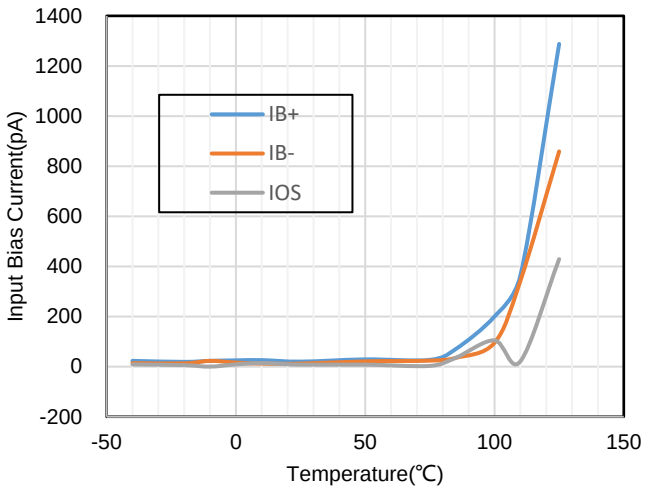


Figure 8. I_B vs. Temperature

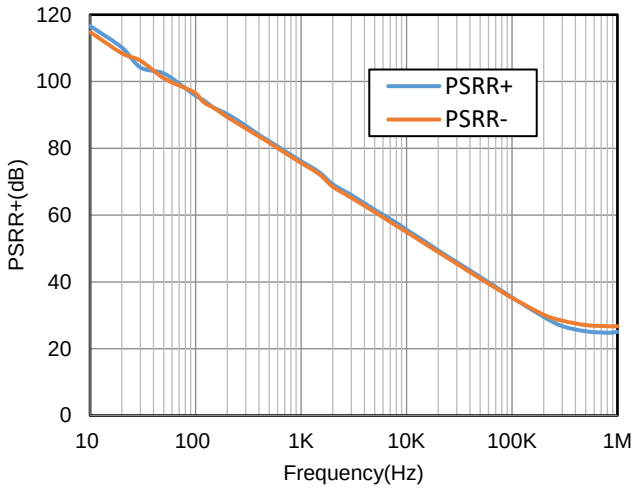


Figure 9. PSRR vs. Frequency

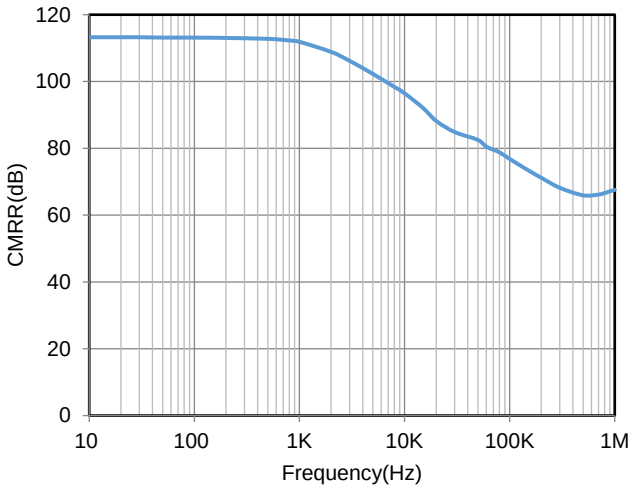


Figure 10. CMRR vs. Frequency

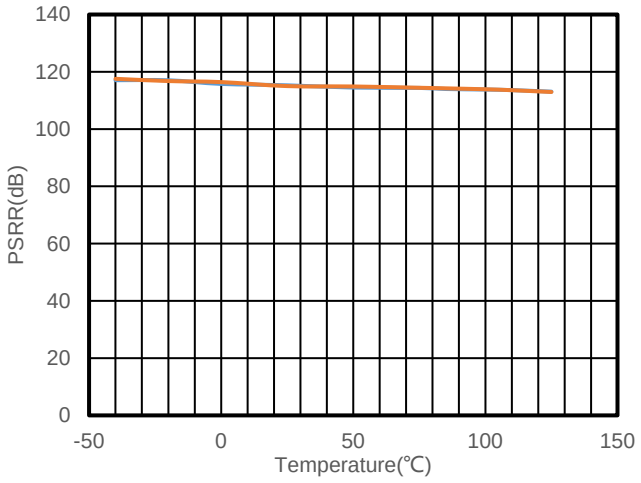


Figure 11. PSRR vs. Temperature

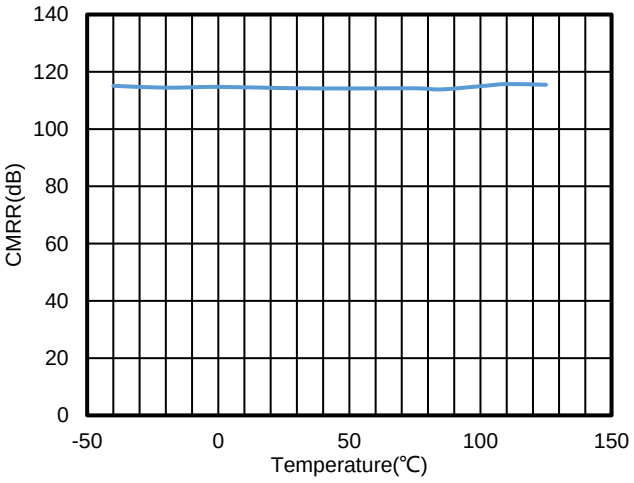


Figure 12. CMRR vs. Temperature

V_S = ±15V, V_{CM} = 0V, R_L = 10kΩ, unless otherwise specified.

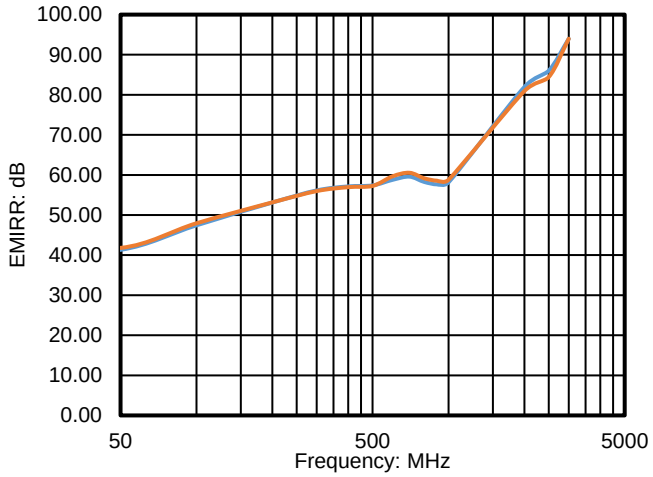


Figure 13. EMIRR+- vs. Frequency

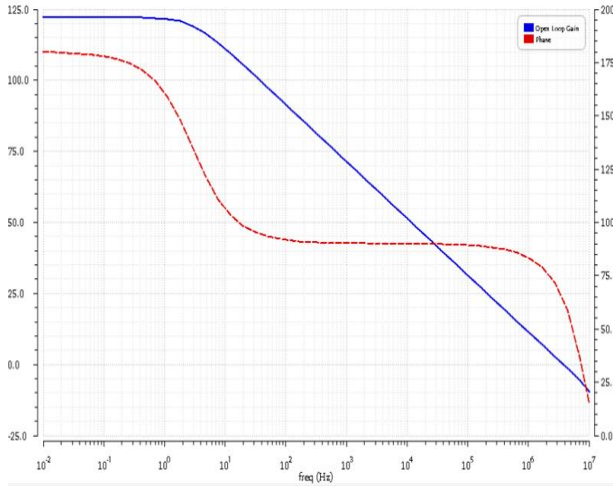


Figure 14. Open Loop Gain and Phase vs. Frequency

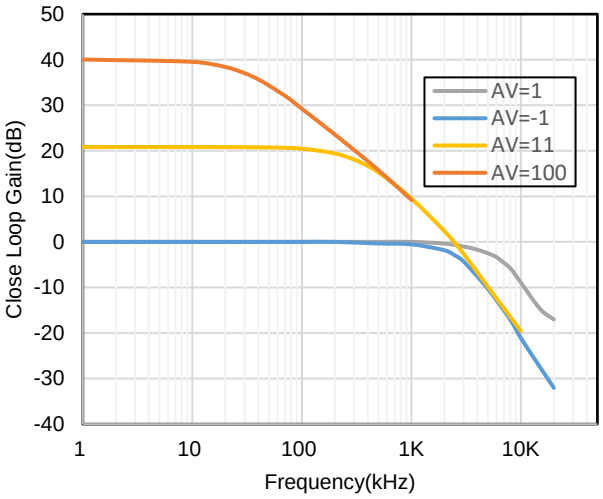
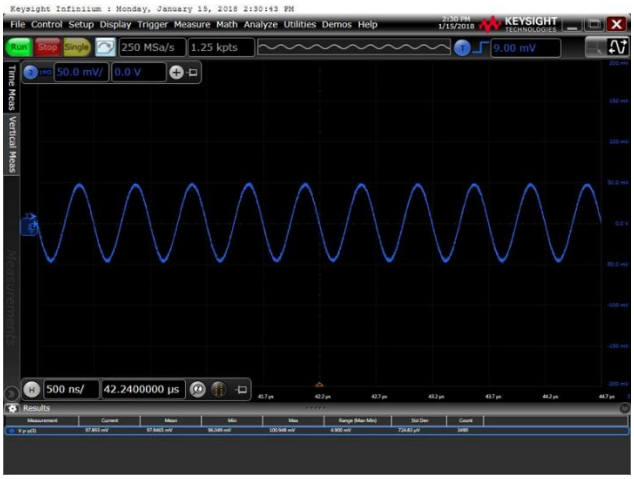


Figure 15. Close Loop Gain and Phase vs. Frequency



V_S =±1.5V, V_{IN}=100mV_{PP}, R_L=10K, C_L=100pF, G=1

Figure 16. Waveform under 3V Supply Voltage

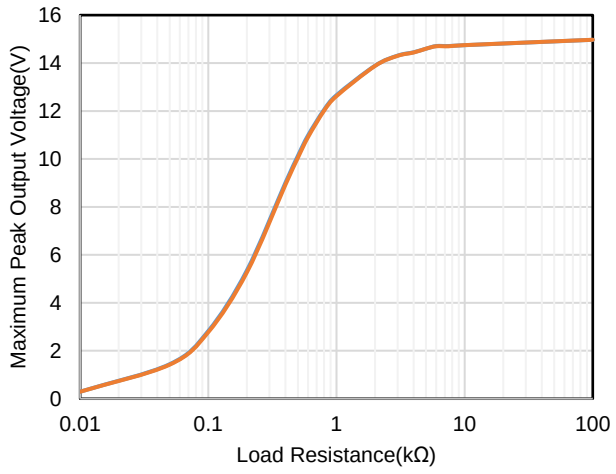


Figure 17. Maximum Peak Output Voltage vs. Load Resistance

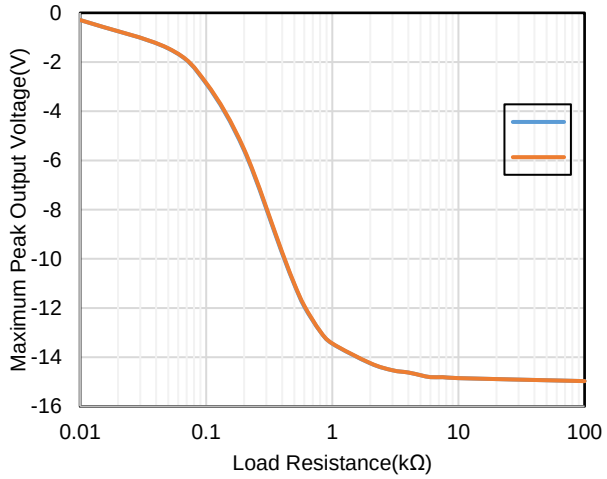


Figure 18. Maximum Peak Output Voltage vs. Load Resistance

V_S = ±15V, V_{CM} = 0V, R_L = 10kΩ, unless otherwise specified.

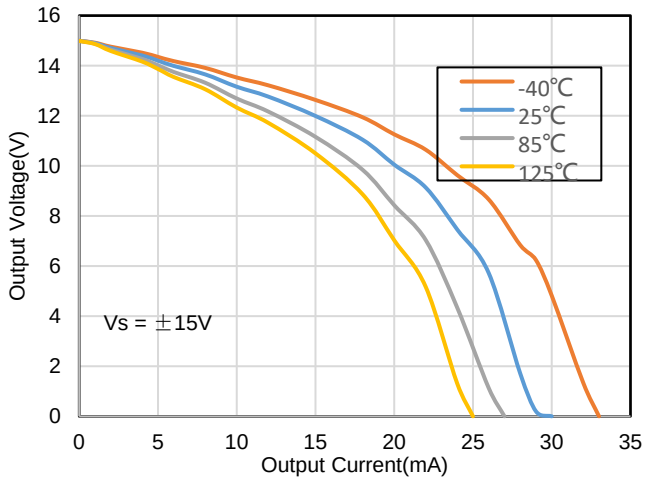


Figure 19. Positive Output Voltage vs. Output Current

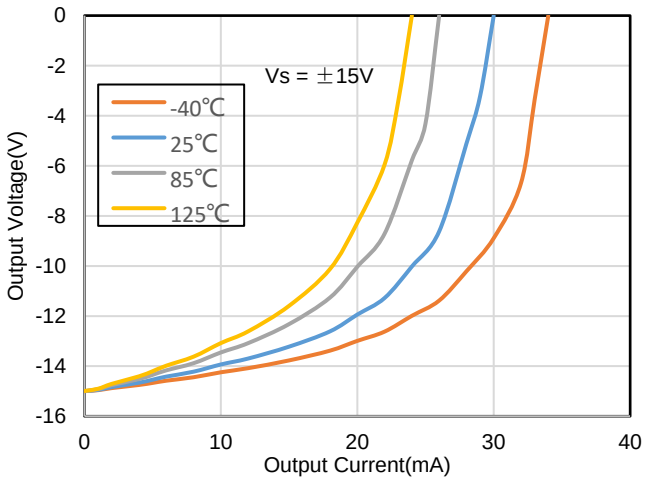


Figure 20. Negative Output Voltage vs. Output Current

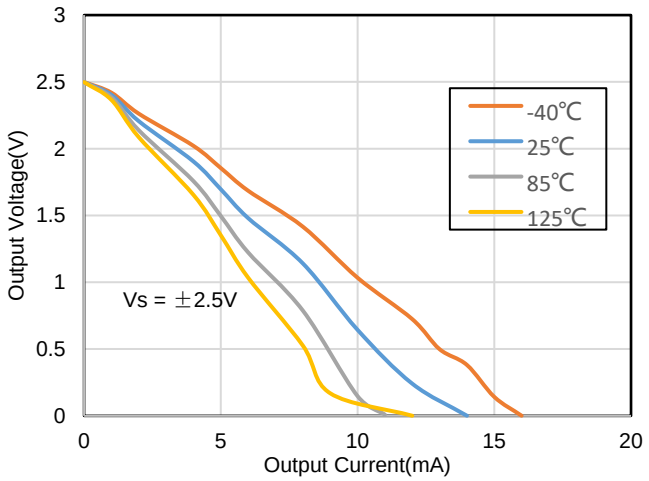


Figure 21. Positive Output Voltage vs. Output Current

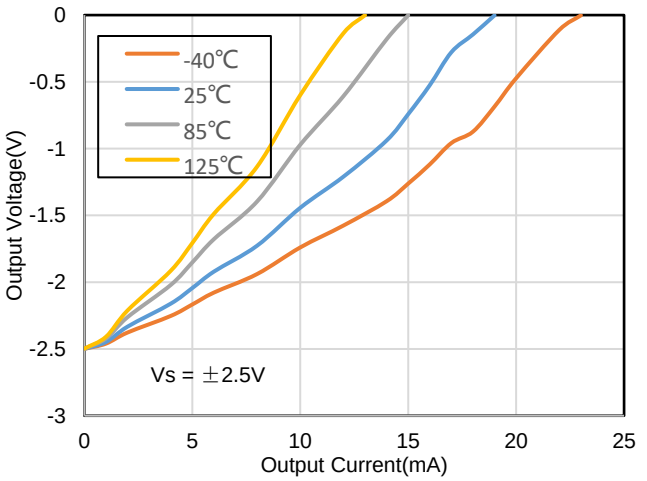


Figure 22. Negative Output Voltage vs. Output Current

Voltage: 1V/div, Time: 200ns/div

V_S =5V, V_{IN} = 2V, R_L=Open, G=3

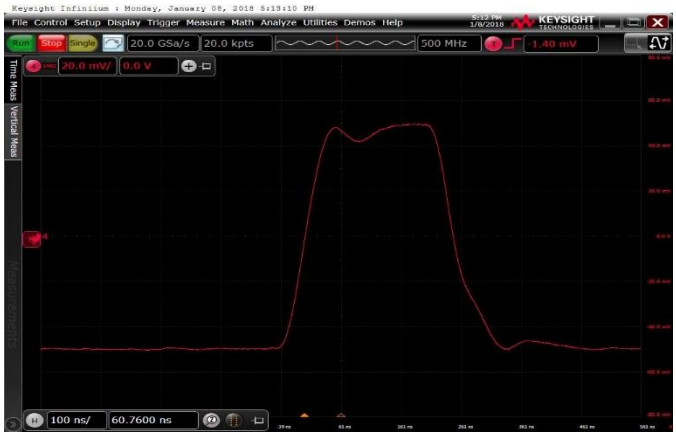
Figure 23. Positive Overload Recovery

Voltage: 1V/div, Time: 200ns/div

V_S =5V, V_{IN} = 2V, R_L=Open, G=3

Figure 24. Negative Overload Recovery

V_S = ±15V, V_{CM} = 0V, R_L = 10kΩ, unless otherwise specified.



Voltage: 20mV/div, Time: 100ns/div

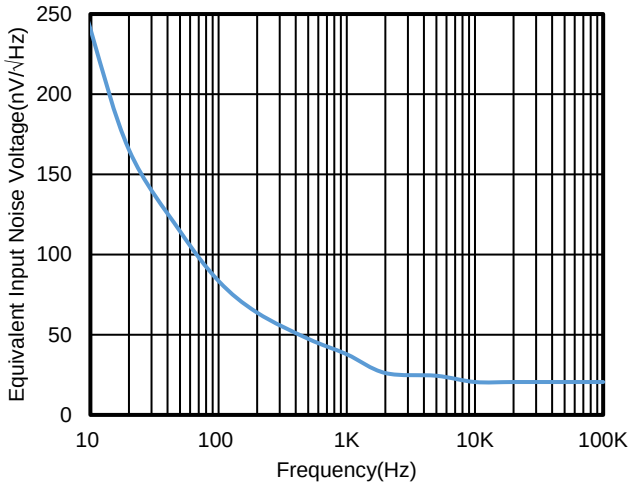
V_S =±15V, R_L=2K, C_L=100pF, G=1

Figure 25. 100mV Signal Step Response

Voltage: 2V/div, Time: 1μs/div

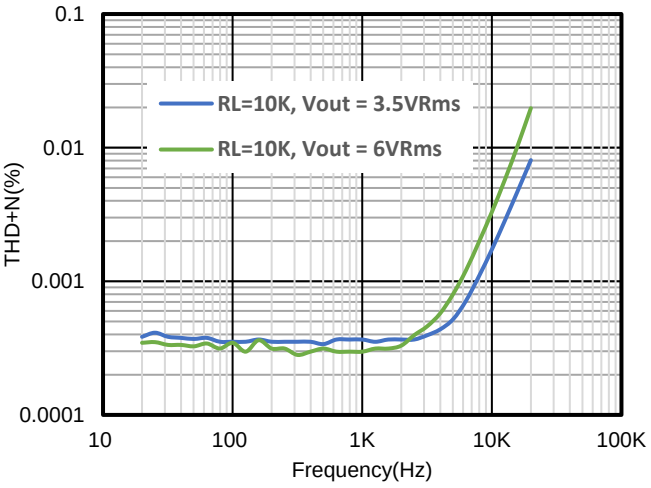
V_S =±15V, R_L=2K, C_L=100pF, G=1

Figure 26. 10V Signal Step Response



V_S =±15V, V_{CM}=0V

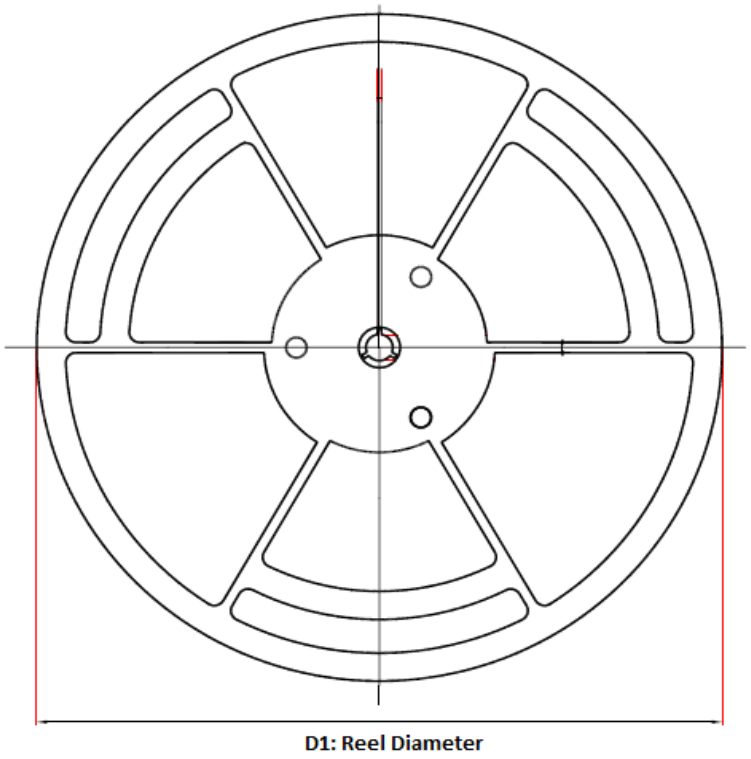
Figure 27. Voltage Noise Spectral Density vs. Frequency



V_S =±15V, V_{CM}=0V, G=1

Figure 28. THD+N vs. Frequency

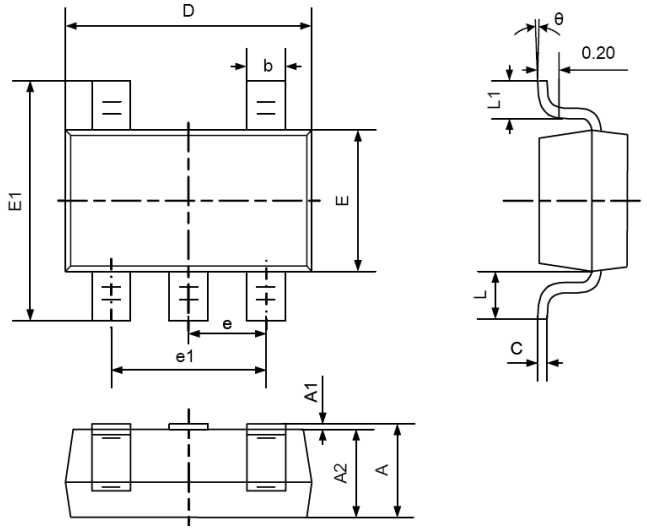
Tape and Reel Information



Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TP2261-TR	5-Pin SOT23	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TP2261-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TP2262-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TP2262L1-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TP2262-VR	8-Pin MSOP	330.0	17.6	5.2	3.3	1.5	8.0	12.0	Q1
TP2262-TSR	8-Pin TSSOP	330.0	17.6	6.8	3.3	1.2	8.0	12.0	Q1
TP2262-F2R	8-Pin DFN3*3	330.0	17.6	3.35	3.35	1.13	8.0	12.0	Q1
TP2264-SR	14-Pin SOIC	330.0	21.6	6.5	9.0	2.1	8.0	16.0	Q1
TP2264L1-SR	14-Pin SOIC	330.0	21.6	6.5	9.0	2.1	8.0	16.0	Q1
TP2264-TR	14-Pin TSSOP	330.0	17.6	6.8	5.4	1.2	8.0	12.0	Q1

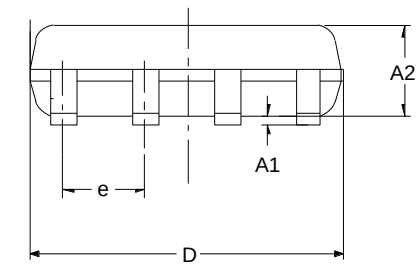
Package Outline Dimensions

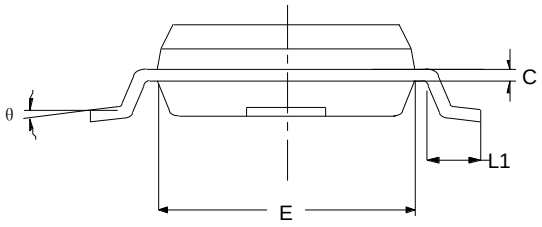
SOT23-5

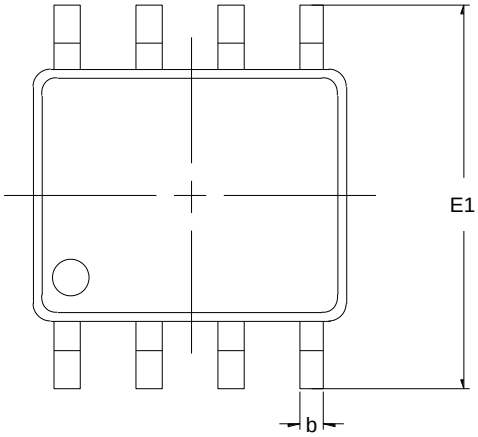


Symbol	Dimensions In Millimeters	
	Min	Max
A	1.050	1.250
A1	0.000	0.100
A2	1.000	1.150
b	0.300	0.500
C	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.600	3.000
e	0.950TYP	
e1	1.800	2.000
L	0.600REF	
L1	0.300	0.600
θ	0°	8°

SOIC-8

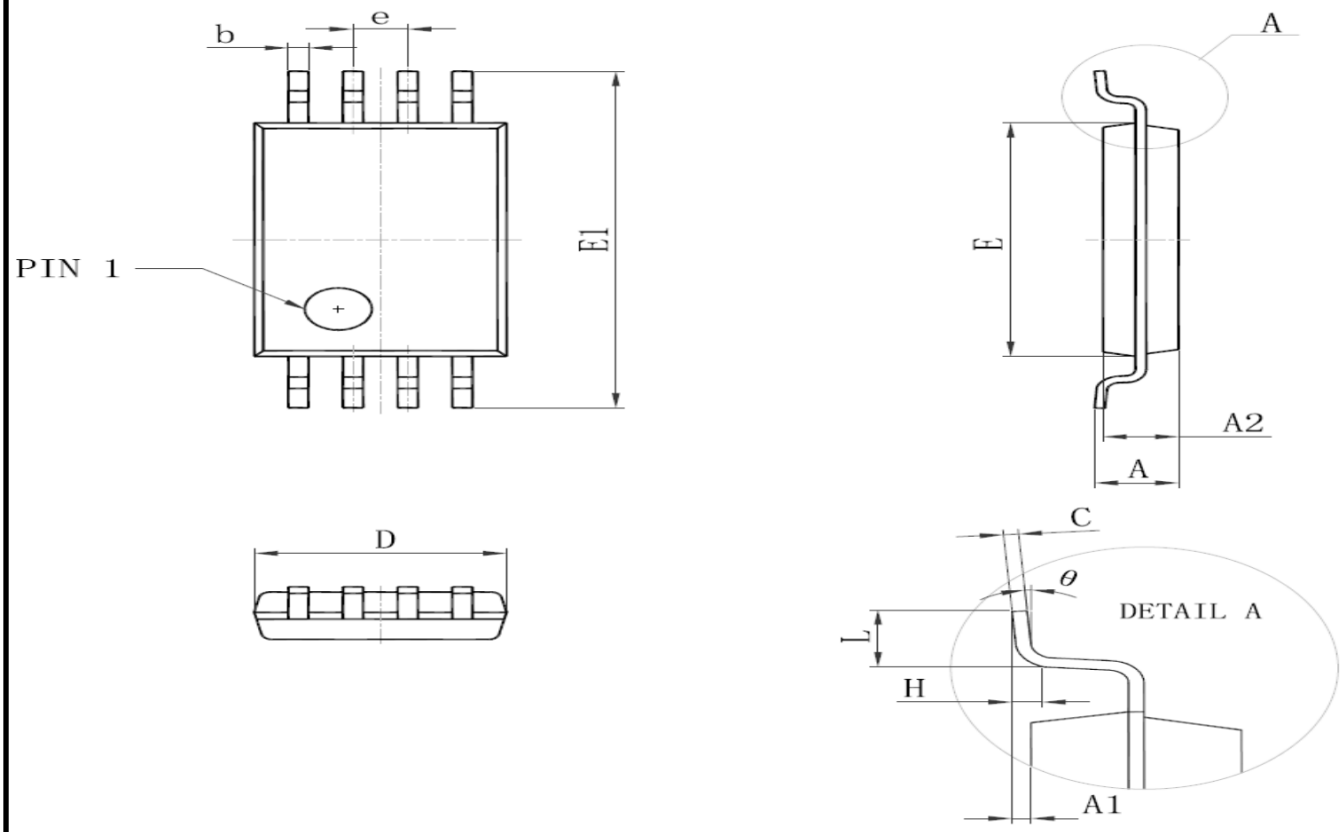






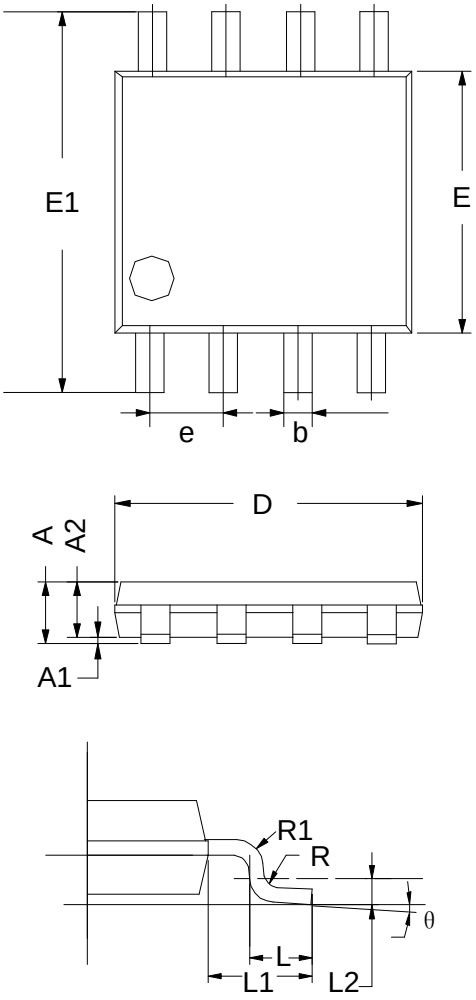
Symbol	Dimensions In Millimeters	
	Min	Max
A1	0.100	0.250
A2	1.300	1.550
b	0.330	0.510
C	0.170	0.250
D	4.700	5.100
E	3.800	4.000
E1	5.800	6.300
e	1.270TYP	
L1	0.400	0.900
θ	0°	8°

TSSOP-8



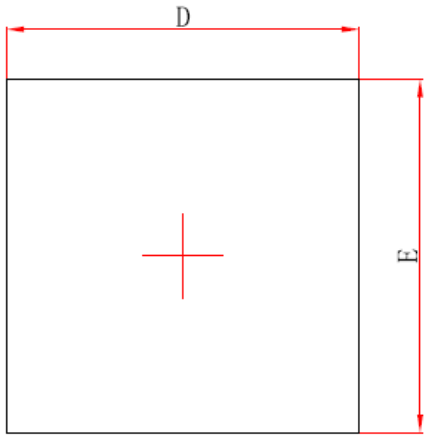
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026（BSC）	
L	0.500	0.700	0.020	0.028
H	0.25(BSC)		0.01（BSC）	
θ	1°	7°	1°	7°

MSOP-8

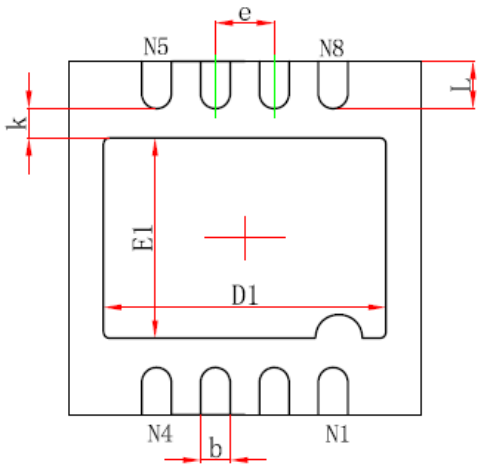


Symbol	Dimensions In Millimeters	
	Min	Max
A	0.800	1.200
A1	0.000	0.200
A2	0.750	0.950
b	0.30 TYP	
C	0.15 TYP	
D	2.900	3.100
e	0.65 TYP	
E	2.900	3.100
E1	4.700	5.100
L	0.400	0.800
L1	0.95 TYP	
L2	0.25 TYP	
θ	0°	6°

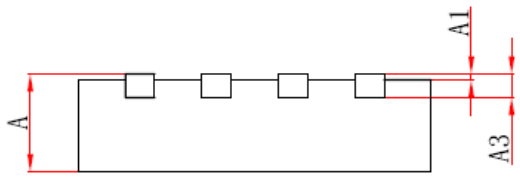
DFN8 3*3



Top View



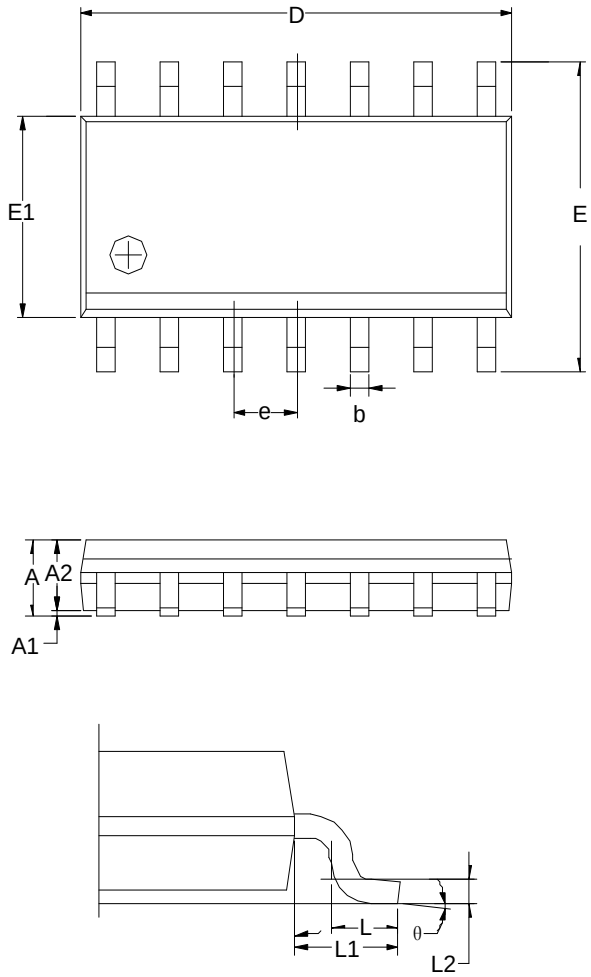
Bottom View



Side View

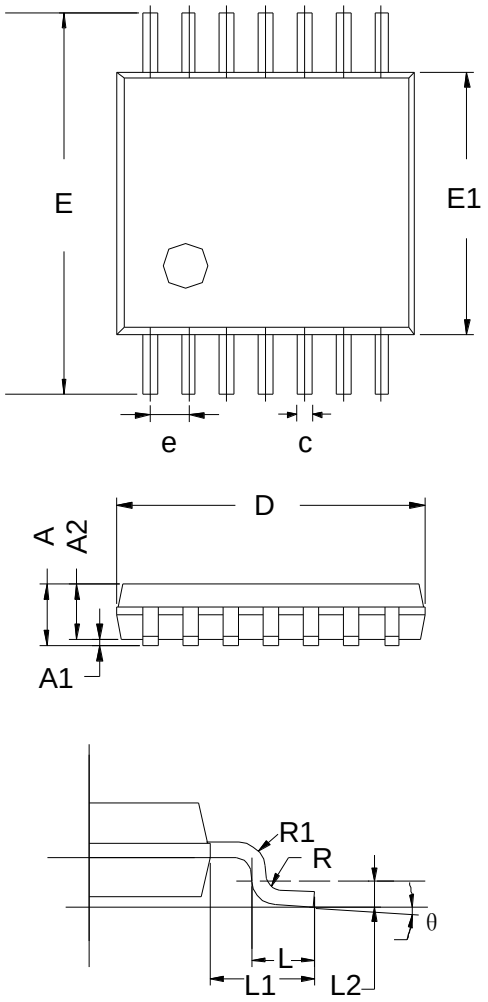
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

SOIC-14



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
b	0.31		0.51
D	8.45	8.63	8.85
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.40	0.60	0.80
L1	1.05 REF		
L2	0.25 BSC		
θ	0°		8°

TSSOP-14



Symbol	Dimensions In Millimeters		
	MIN	TYP	MAX
A	-	-	1.20
A1	0.05	-	0.15
A2	0.80	-	1.05
c	0.19	-	0.30
D	4.86	5.00	5.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	-	-
θ	0°	-	8°