Features

- Supply Voltage: 4.5V to 36V
- Offset Voltage: ±300μV Maximum
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Input Rail to $-V_S$, Rail to Rail Output
- Bandwidth: 1 MHz
- Slew Rate: 0.7V/μs
- Excellent EMI Suppress Performance: 80dB at 1GHz
- Offset Voltage Temperature Drift: 2 μV/°C
- Low Noise: 30 nV/√Hz at 1kHz
- 2KV HBM, 1KV CDM
- –40°C to 125°C Operation Temperature Range

Applications

- Instrumentation
- Active Filters, ASIC Input or Output Amplifier
- Sensor Interface
- Industrial Control

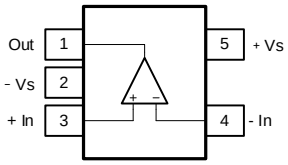
Description

The TP124X 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 1MHz bandwidth, 0.7V/μs slew rate and low distortion while drawing only 150μA of quiescent current per amplifier. The input common-mode voltage range extends to V–, and the outputs swing rail-to-rail. The TP124X 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 TP124X ideal choices for industrial control, instrumentation.

Pin Configuration

TP1241L1
5-Pin SOT23
-T Suffixes



TP1242L1
8-Pin SOIC/MSOP
-S, and -V Suffixes

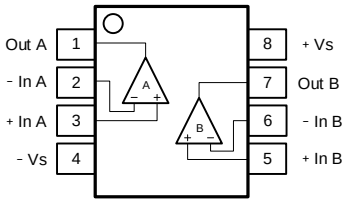


Table of Contents

Revision History

Date	Revision	Notes
2020/12/10	Rev.A.0	Initial Version
2021/1/16	Rev.A.1	Update Overload Recovery Time: 100ns to 2us
2021/4/15	Rev.A.2	Update Iq of TP1241, add TP1242L1-VR

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TP1241L1-TR	-40 to 125°C	5-Pin SOT23	124	1	Tape and Reel, 3000
TP1242L1-SR	-40 to 125°C	8-Pin SOIC	TP1242	1	Tape and Reel, 4000
TP1242L1-VR	-40 to 125°C	8-Pin MSOP	TP1242	1	Tape and Reel, 3000

Note 1: The sample will be ready in one month.

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 MSOP	210	45	°C/W

Electrical Characteristics

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

Symbol	Parameter	Conditions	T_A	Min	Typ	Max	Unit
Power Supply							
V_S	Supply Voltage Range			4.5		36	V
I_Q	Quiescent Current per Amplifier,	V_S = 30V, TP1241L1			250	500	μA
			-40°C to 125°C			700	μA
		V_S = 30V, TP1242L1			150	350	μA
			-40°C to 125°C			500	μA
PSRR	Power Supply Rejection Ratio	V_S = 4.5V to 36V		100	120		dB
			-40°C to 125°C	95			dB
Input Characteristics							
V_{OS}	Input Offset Voltage	V_S = 30V, V_{CM} = 15V		-300	50	300	μV
			-40°C to 125°C	-800		800	μV
		V_S = 5V, V_{CM} = 2.5V		-300	50	300	μV
			-40°C to 125°C	-800		800	μV
		V_S = 5V, V_{CM} = 0V		-500	100	500	μV
			-40°C to 85°C	-1000		1000	μV
			-40°C to 125°C	-3000		3000	μV
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	200	nA
			-40°C to 125°C			300	nA
C_{IN}	Input Capacitance	Differential Mode			5		pF
		Common Mode			2.5		pF
Av	Open-loop Voltage Gain	V_S = 30V, V_{OUT} = 0.5V to 29.5V		110	130		dB
			-40°C to 125°C	90			dB
V_{CMR}	Common-mode Input Voltage Range			(V-)		(V+) – 1.5	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0.5V to 28.5V		100	120		dB
			-40°C to 125°C	95			dB

Output Characteristics							
V_{OH}	Output Swing from Positive Rail	R_{LOAD} = 100kΩ to V_S/2			15	30	mV
			-40°C to 125°C			50	mV
		R_{LOAD} = 10kΩ to V_S/2			60	90	mV
			-40°C to 125°C			140	mV
V_{OL}	Output Swing from Negative Rail	R_{LOAD} = 100kΩ to V_S/2			10	20	mV
			-40°C to 125°C			30	mV
		R_{LOAD} = 10kΩ to V_S/2			35	50	mV
			-40°C to 125°C			90	mV
		No Load to V-			5	10	mV
			-40°C to 125°C			15	mV
I_{SC}	Output Short-Circuit Current	Source			70		mA
		Sink			120		
AC Specifications							
GBW	Gain-Bandwidth Product				1		MHz
SR	Slew Rate	G = 1		0.3	0.7		V/μs
			-40°C to 125°C	0.1			V/μs
t_{OR}	Overload Recovery				2		μs
t_S	Settling Time, 0.1%	G = -1, 10V step			15		μs
	Settling Time, 0.01%				20		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			10		dB
Noise Performance							
E_N	Input Voltage Noise	f = 0.1Hz to 10Hz			2		μV_{RMS}
e_N	Input Voltage Noise Density	f = 1kHz			30		$nV/\sqrt{Hz}$
i_N	Input Current Noise	f = 1kHz			2		$fA/\sqrt{Hz}$

Typical Performance Characteristics

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

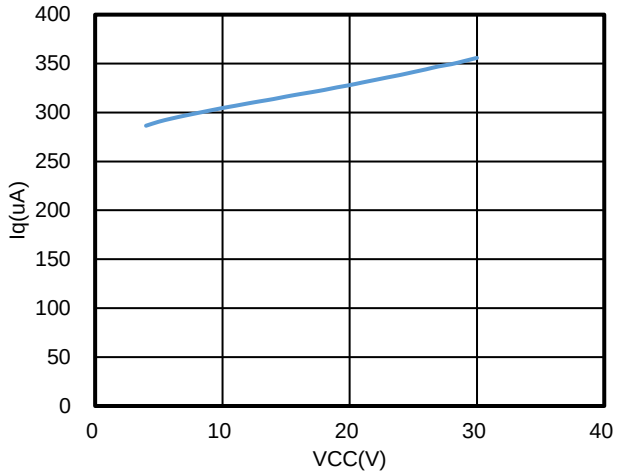


Figure 1. Iq vs. V_{CC}, TP1242L1

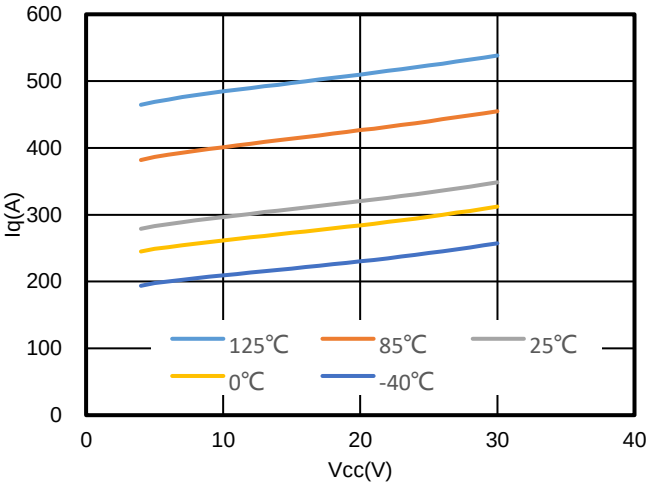


Figure 2. Iq vs. V_{CC} in Different Temperature, TP1242L1

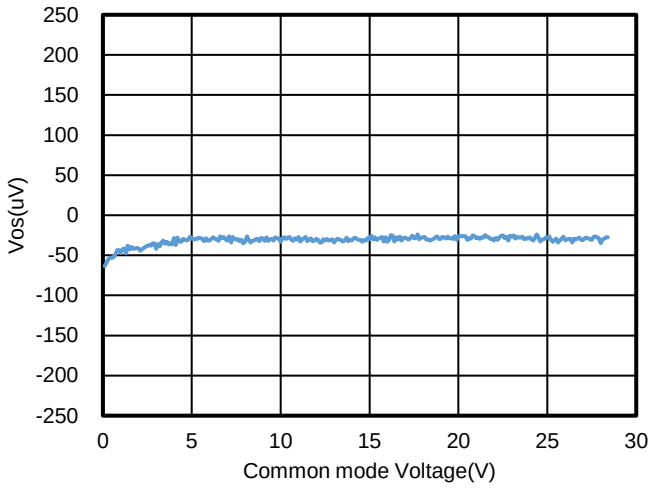


Figure 3. Offset Voltage vs. Common Mode Voltage

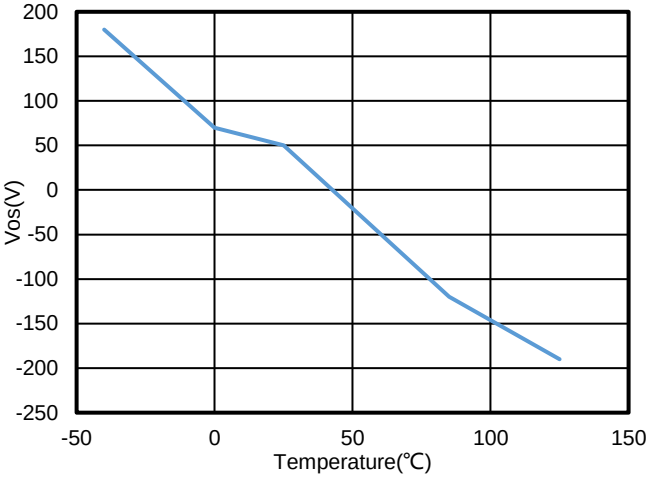


Figure 4. V_{OS} vs. Temperature

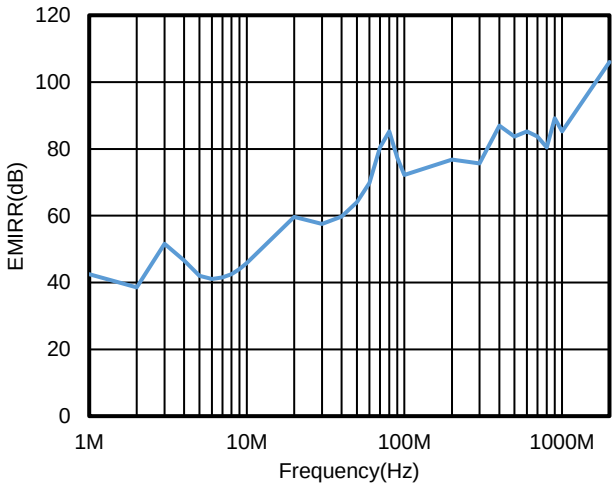


Figure 5. EMIRR vs. Frequency

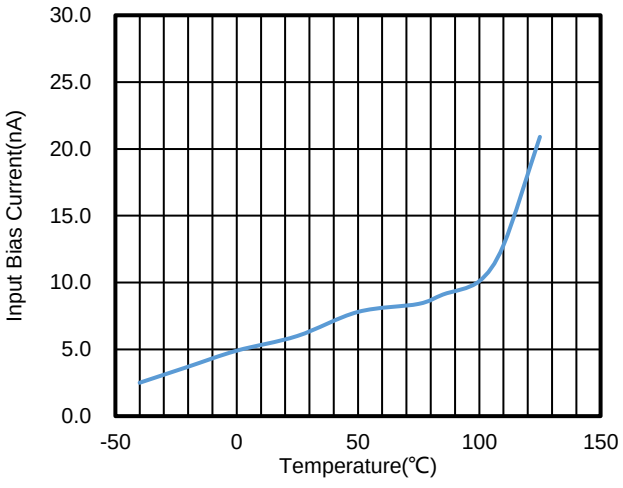


Figure 6. Input Current in Large Vdm vs. Temperature

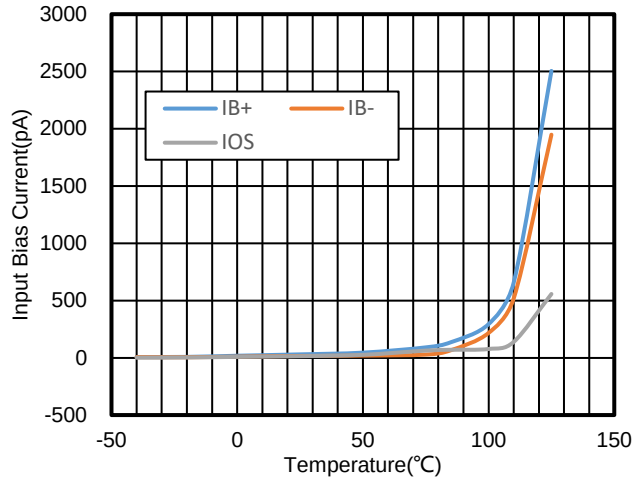


Figure 7. I_B vs. Temperature, -40 to 125°C

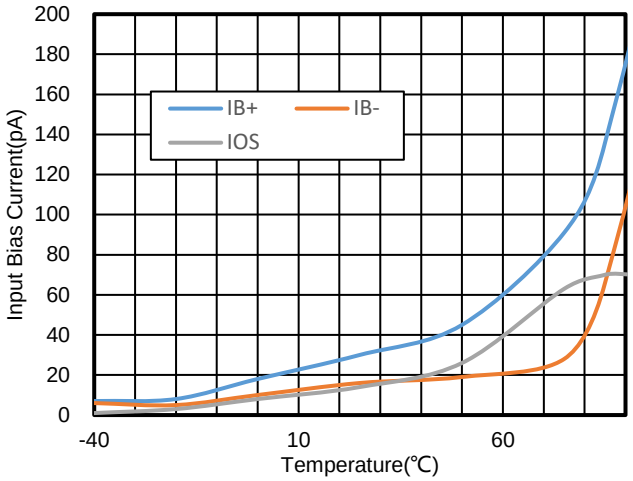


Figure 8. I_B vs. Temperature, -40 to 90°C

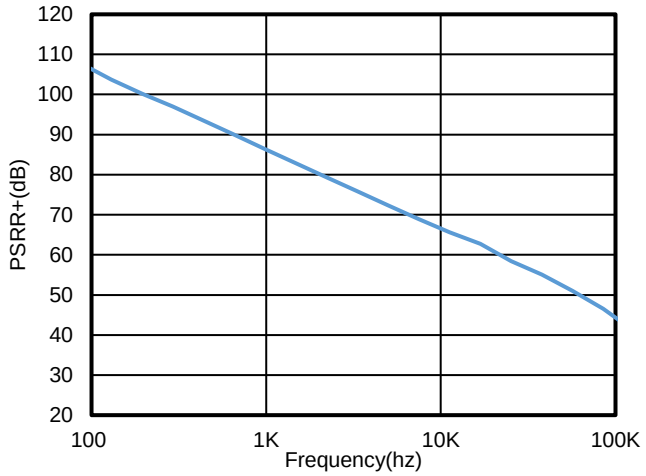


Figure 9. PSRR+ vs. Frequency

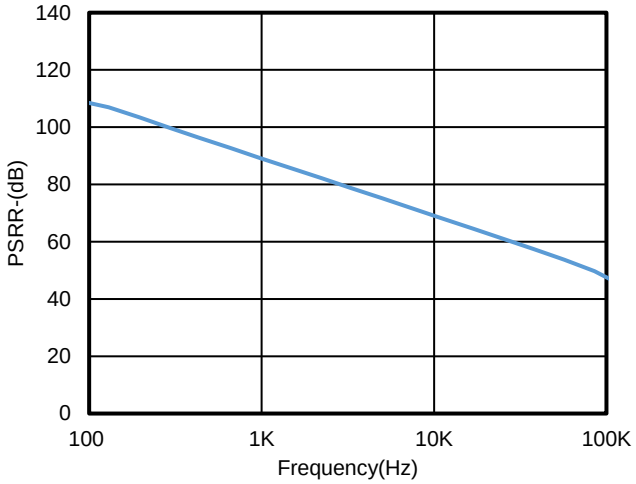


Figure 10. PSRR- vs. Frequency

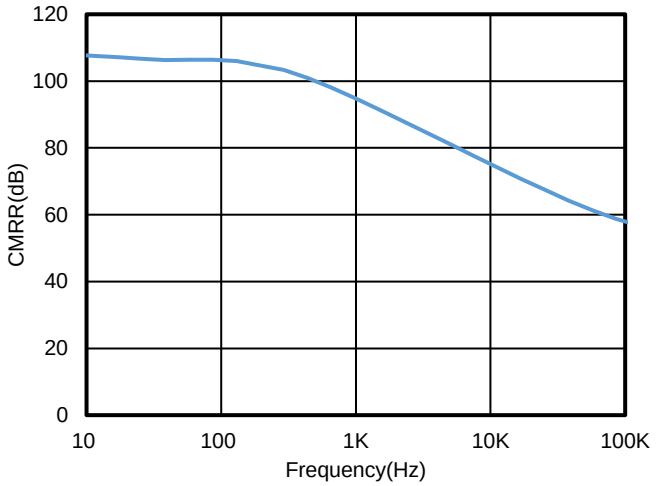


Figure 11. CMRR vs. Frequency

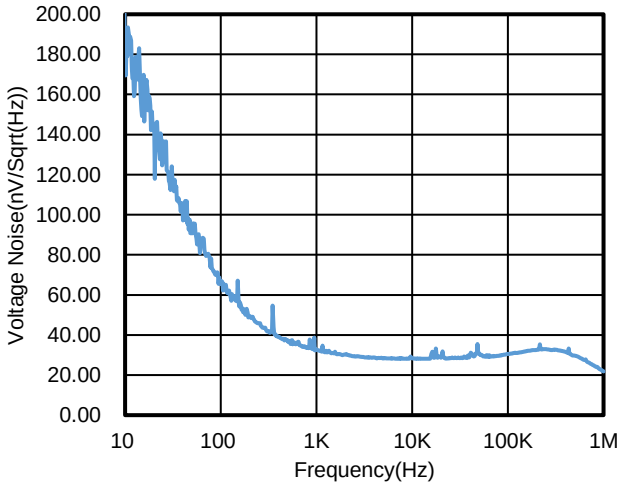


Figure 12. Voltage Noise Spectral Density vs. Frequency

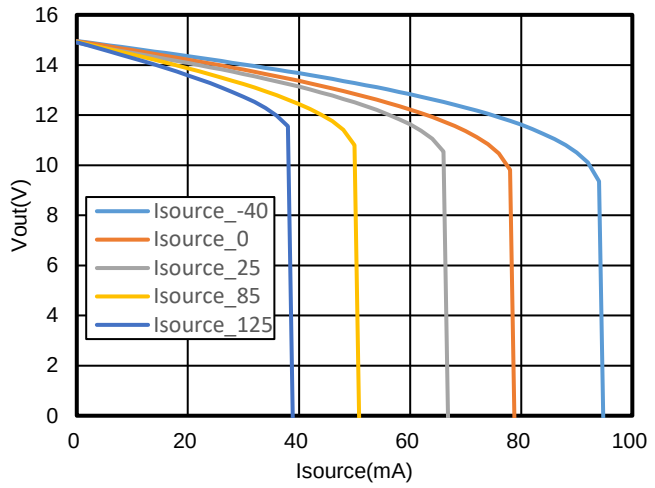


Figure 13. Positive Output Voltage vs. Output Current

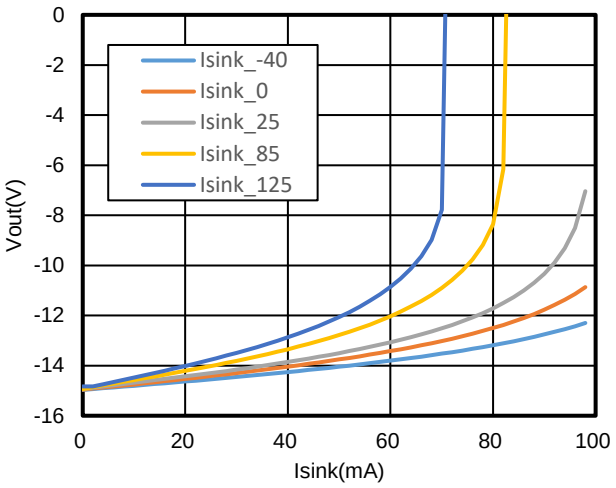


Figure 14. Negative Output Voltage vs. Output Current

Voltage: 5V/div for Output, Time: 10μs/div

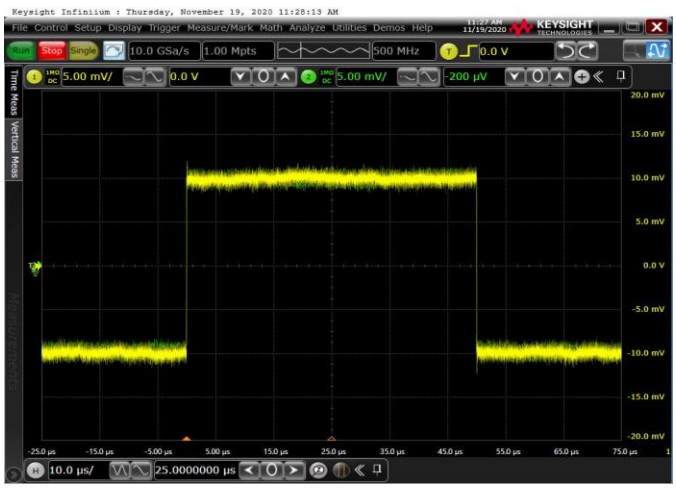
G=10, VREF = GND; VIN=5VPP

Figure 15. Positive Overload Recovery

Voltage: 5V/div for Output, Time: 10μs/div

G=10, VREF = GND; VIN=5VPP

Figure 16. Negative Overload Recovery



Voltage: 5mV/div, Time: 10μs/div

R_L=2K, C_L=100pF, G=1

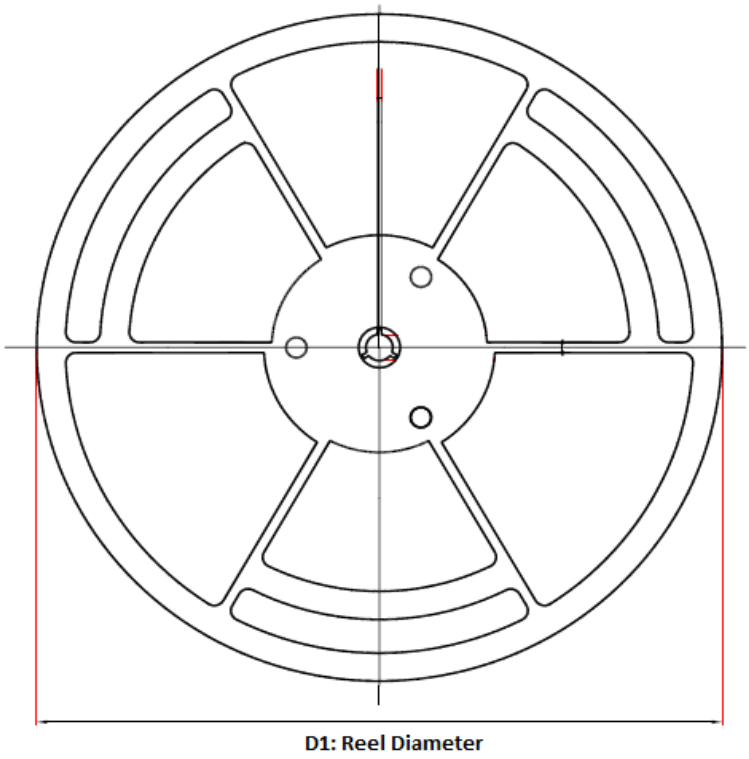
Figure 17. 20mV Signal Step Response

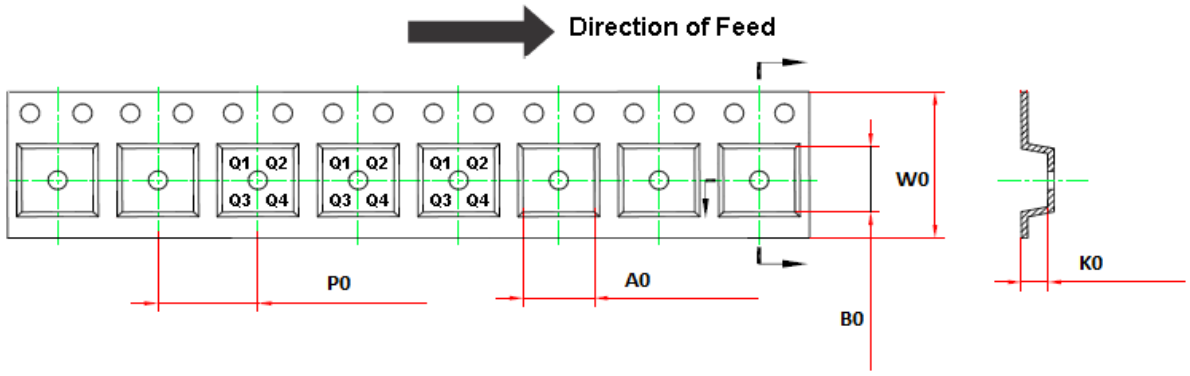
Voltage: 5V/div, Time: 100μs/div

R_L=2K, C_L=100pF, G=1

Figure 18. 10V Signal Step Response

Tape and Reel Information

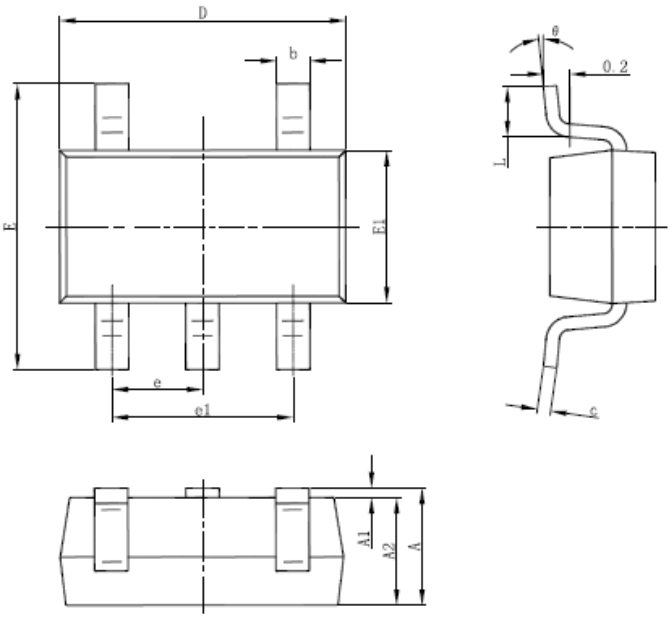




Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TP1241L1-TR	5-Pin SOT23	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TP1242L1-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TP1242L1-VR	8-Pin MSOP	330.0	17.6	5.2	3.3	1.5	8.0	12.0	Q1

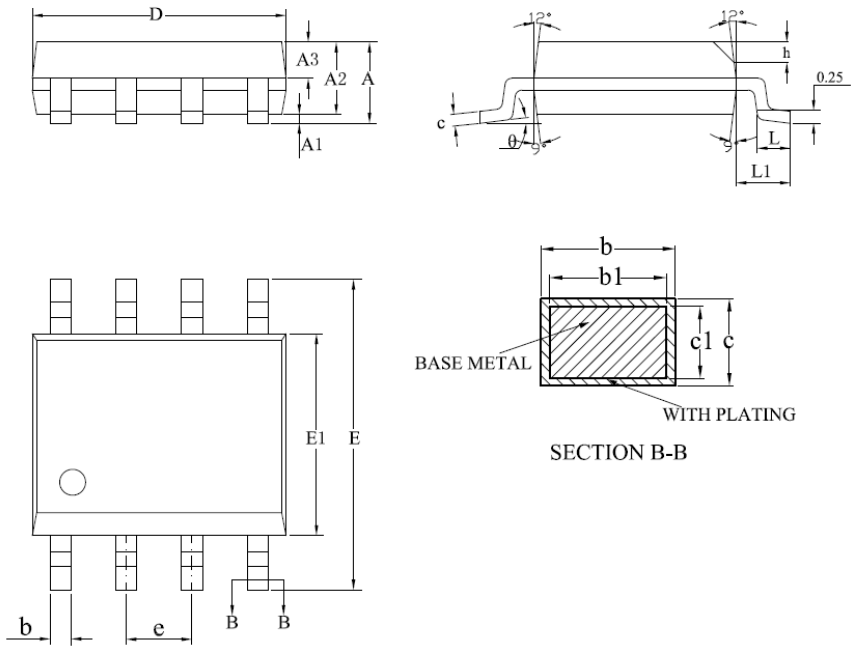
Package Outline Dimensions

SOT23-5



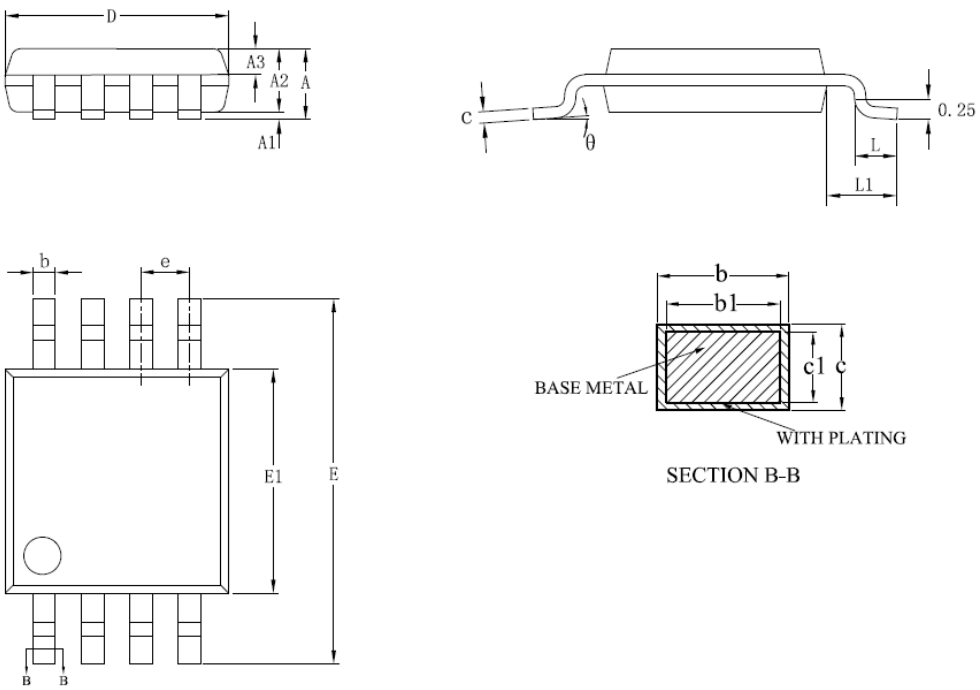
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E1	1.500	1.700	0.059	0.067
E	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOIC-8



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

MSOP-8



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.10
A1	0.05	—	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.28	—	0.36
b1	0.27	0.30	0.33
c	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.90	3.00	3.10
E	4.70	4.90	5.10
E1	2.90	3.00	3.10
e	0.65BSC		
L	0.40	—	0.70
L1	0.95REF		
θ	0	—	8°