Features

- Supply Voltage: 3V to 36V
- Offset Voltage: ±2mV Maximum
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Bandwidth: 1.5MHz, Slew Rate: 0.5V/μs
- Input Rail to $-V_S$, No Internal ESD Diode to $+V_S$
- Low 1/f Noise: 50 nV/√Hz at 10Hz
- High PSRR+: 60dB at 100KHz
- No significant output glitch when power on and off
- –40°C to 125°C Operation Temperature Range

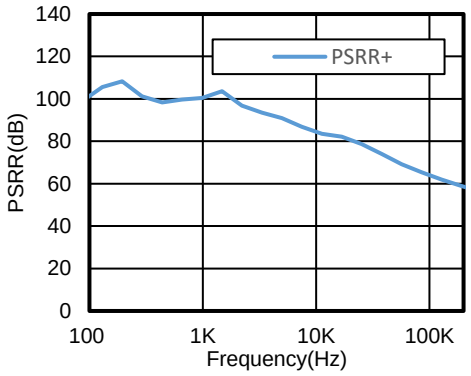
Applications

- Instrumentation
- Sensor Interface
- Motor Control
- Industrial Control

Description

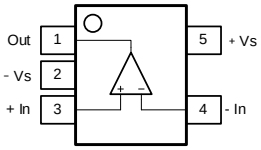
The TPA264X series amplifiers are newest high supply voltage amplifiers with 2mV offset, low noise and immunity to high frequency noise from power supply. They incorporate 3PEAK's proprietary and patented design techniques to achieve very good AC performance with 1.5MHz bandwidth, 0.5V/μs slew rate and low distortion while drawing only 550μA of quiescent current per amplifier.

The input common-mode voltage range extends to $-V_S$, and no internal ESD diode between input and $+V_S$, This feature can block the current path from input to $+V_S$ when power down but the signal still in input pin, it's usual in battery related application.

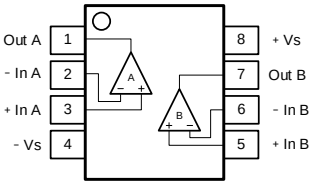


Pin Configuration

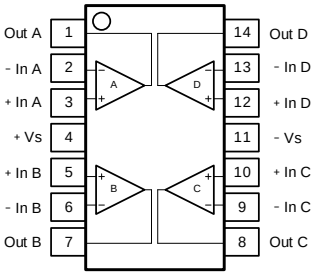
TPA2641
5-Pin SOT23



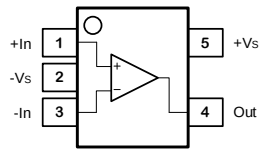
TPA2642
8-Pin SOIC/TSSOP/MSOP



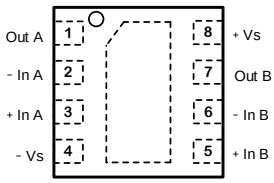
TPA2644
14-Pin SOIC/TSSOP



TPA2641U
5-Pin SOT23



TPA2642
8-Pin DFN



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

Table of Contents

Revision History

Date	Revision	Notes
2020/4/26	Rev.A.0	Initial version

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPA2641-S5TR	-40 to 125°C	5-Pin SOT23	641	3	Tape and Reel, 3000
TPA2641U-S5TR Note 1	-40 to 125°C	5-Pin SOT23	64U	3	Tape and Reel, 3000
TPA2642-SO1R	-40 to 125°C	8-Pin SOIC	A2642	3	Tape and Reel, 4000
TPA2642-DF4R Note 1	-40 to 125°C	8-Pin DFN 2*2	642	3	Tape and Reel, 3000
TPA2642-TS1R Note 1	-40 to 125°C	8-Pin TSSOP	A2642	3	Tape and Reel, 3000
TPA2642-VS1R	-40 to 125°C	8-Pin MSOP	A2642	3	Tape and Reel, 3000
TPA2644-SO2R	-40 to 125°C	14-Pin SOIC	A2644	3	Tape and Reel, 2500
TPA2644-TS2R Note 1	-40 to 125°C	14-Pin TSSOP	A2644	3	Tape and Reel, 3000

Note 1: Sample will be ready in two months after manufacture start.

Absolute Maximum Ratings Note 1

Parameters	Rating
Supply Voltage, $(+V_S)$– $(-V_S)$	40 V
Input Voltage	$(-V_S)$ – 0.3 to 40V
Input Current: +IN, –IN Note 2	±10mA
Output Voltage	$(-V_S)$ – 0.3 to $(+V_S)$ + 0.3
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 negative power supply. If the input extends more than 300mV beyond the negative 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 and Latch Up 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
8-Pin TSSOP	191	44	°C/W
8-Pin DFN 2*2	100	60	°C/W
14-Pin SOIC	120	36	°C/W
14-Pin TSSOP	180	35	°C/W

Electrical Characteristics

All test condition is at T_A = 25°C, R_L = 10kΩ, C_L =100pF, 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 = 5V to 36V			350	550	μA
			-40°C to 125°C			650	μA
PSRR	Power Supply Rejection Ratio	V_S = 5V to 36V		100	120		dB
			-40°C to 125°C	95			dB
Input Characteristics							
V_{OS}	Input Offset Voltage	V_S = 36V, V_{CM} = 0V to 28V		-2	0.1	2	mV
			-40°C to 85°C	-3		3	mV
			-40°C to 125°C	-3.5		3.5	mV
		V_S = 5V, V_{CM} = 2.5V		-2	0.1	2	mV
			-40°C to 85°C	-3		3	
			-40°C to 125°C	-3.5		3.5	mV
V_{OS} TC	Input Offset Voltage Drift		-40°C to 125°C		5		μV/°C
I_B	Input Bias Current	V_S = 36V, V_{CM} = 18V			15	30	nA
			-40°C to 125°C			50	nA
I_{OS}	Input Offset Current	V_S = 36V, V_{CM} = 18V			1	10	nA
			-40°C to 125°C			30	nA
I_B	Input Bias Current	V_S = 36V, V_{CM} = 0V			20	50	nA
			-40°C to 125°C			100	nA
I_{OS}	Input Offset Current	V_S = 36V, V_{CM} = 0V			1	30	nA
			-40°C to 125°C			50	nA
I_{IN}	Different Input Current	V_S = 36V, V_{ID} = 36V		-300	50	300	nA
		V_S = 36V, V_{ID} = 36V	-40°C to 125°C	-500		500	nA
C_{IN}	Input Capacitance	Differential Mode			5		pF
		Common Mode			5		pF
Av	Open-loop Voltage Gain			110	130		dB
			-40°C to 125°C	100			dB
V_{CMR}	Common-mode Input Voltage Range		-40°C to 125°C	($-V_S$)		($+V_S$)–2	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0V to 28V		85	110		dB
			-40°C to 125°C	80			dB
Output Characteristics							
	Output Voltage Swing from Positive Rail	I_{LOAD} = 50μA to V_S/2			1.1	1.2	V
			-40°C to 125°C			1.4	V
		I_{LOAD} = 1mA to V_S/2			1.3	1.5	V
			-40°C to 125°C			1.7	V

		I_{LOAD} = 5mA to V_S/2			1.9	2.4	V
			-40°C to 125°C			2.5	V
	Output Voltage Swing from Negative Rail	I_{LOAD} = 50μA to V_S/2			70	100	mV
			-40°C to 125°C			150	mV
		I_{LOAD} = 1mA to V_S/2			0.9	1	V
			-40°C to 125°C			1.1	V
		I_{LOAD} = 5mA to V_S/2			1.2	1.5	V
			-40°C to 125°C			1.6	V
		V_S = 5V, R_{LOAD} = 10kΩ to 0V			5	10	mV
			-40°C to 125°C			15	mV
I_{SC}	Output Short-Circuit Current				50		mA
			-40°C to 125°C		30		mA

AC Specifications							
GBW	Gain-Bandwidth Product				1.5		MHz
SR	Slew Rate	G = 1, 2V step			0.5		V/μs
t_{OR}	Overload Recovery	From positive rail			1.5		μs
		From negative rail			8		μs
t_S	Settling Time, 0.1%	G = 1, 2V step			3		μs
	Settling Time, 0.01%				4		μs
PM	Phase Margin	R_L=10K, C_L=100pF			60		°
GM	Gain Margin	R_L=10K, C_L=100pF			15		dB
	Channel Separation	f = 100 kHz			120		dB
Noise Performance							
E_N	Input Voltage Noise	f = 0.1Hz to 10Hz			1		μV_{RMS}
e_N	Input Voltage Noise Density	f = 1kHz			50		nV/√Hz
i_N	Input Current Noise	f = 1kHz			200		fA/√Hz
THD+N	Total Harmonic Distortion and Noise	f = 1kHz, G =1, R_L = 10kΩ, V_{OUT} = 6V_{RMS}			0.01		%

Typical Performance Characteristics

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

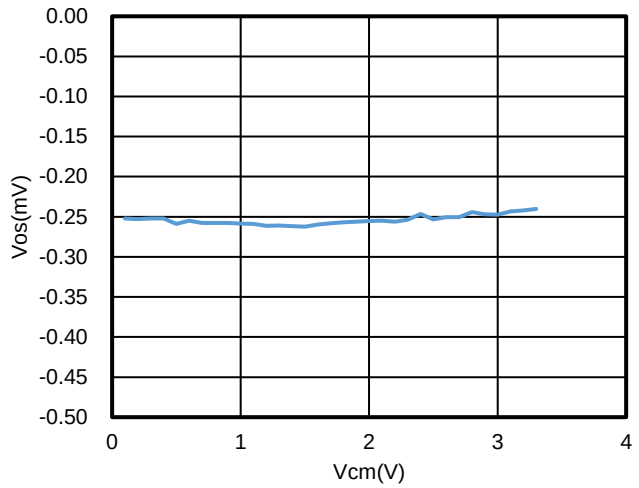


Figure 1. Offset Voltage vs. Common Mode Voltage, V_S = 5V

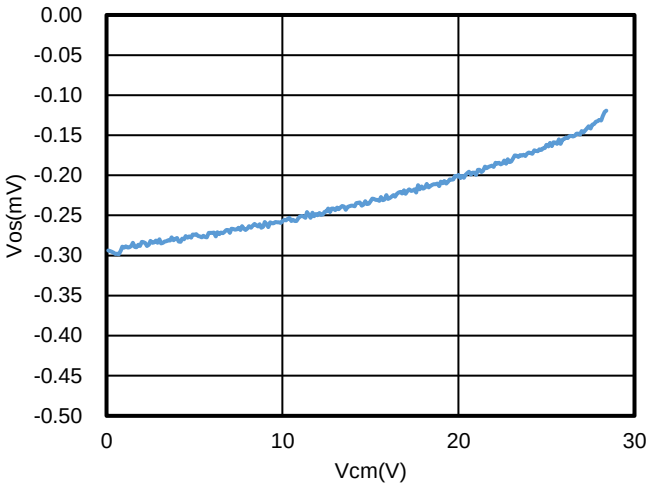


Figure 2. Offset Voltage vs. Common Mode Voltage, V_S = 30V

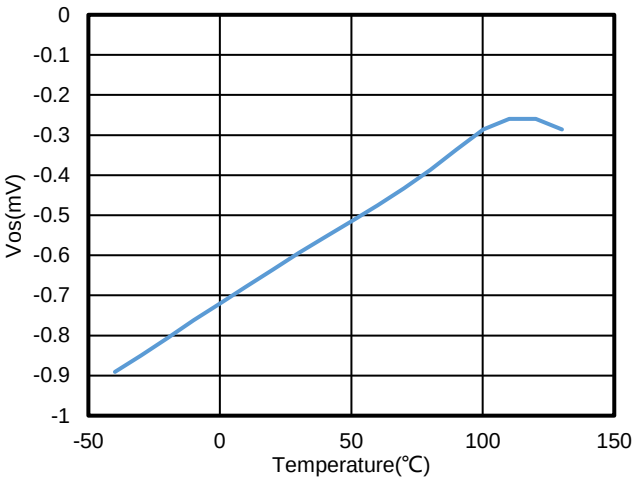


Figure 3. Offset Voltage vs. Temperature, V_S = 30V, V_{CM} = 15V

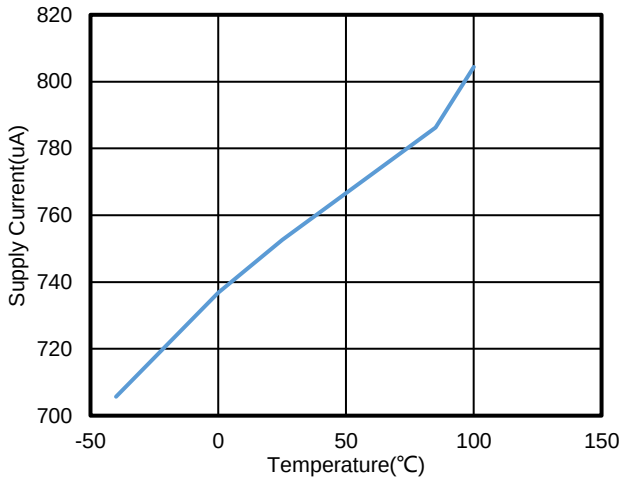


Figure 4. Iq vs. Temperature, +-15V Supply, TPA2642

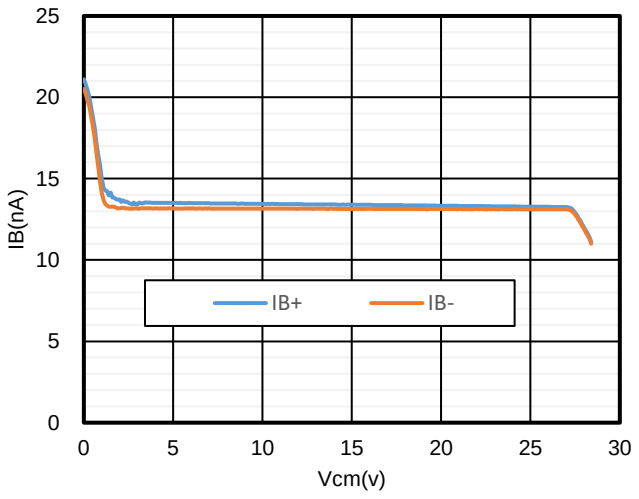


Figure 5. I_B vs. Common Mode Voltage, V_S = 30V

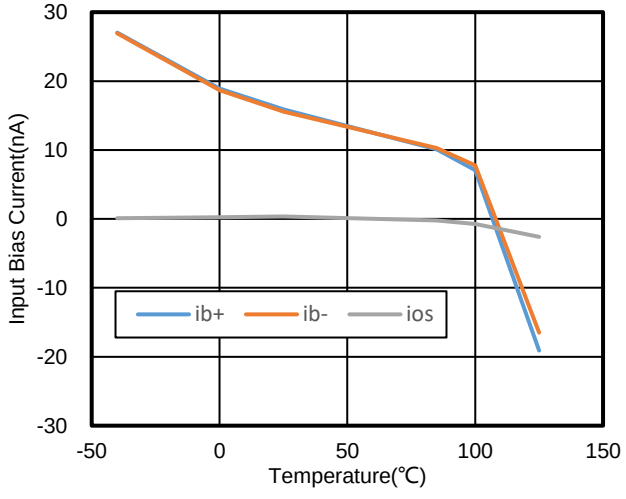


Figure 6. I_B and I_{OS} vs. Temperature, V_S = 30V, V_{CM} = 15V

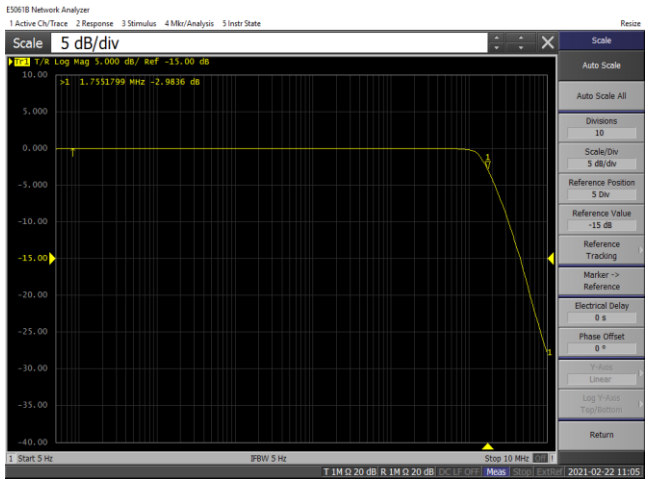


Figure 7. -3dB Bandwidth, G = 1, V_S = 30V

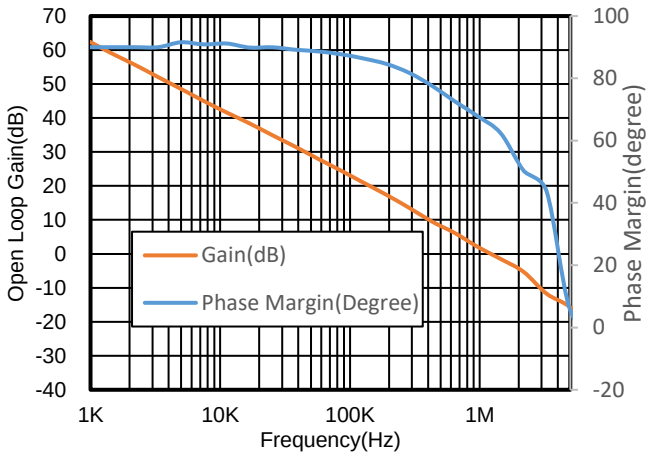


Figure 8. Open Loop Gain and Phase vs. Frequency

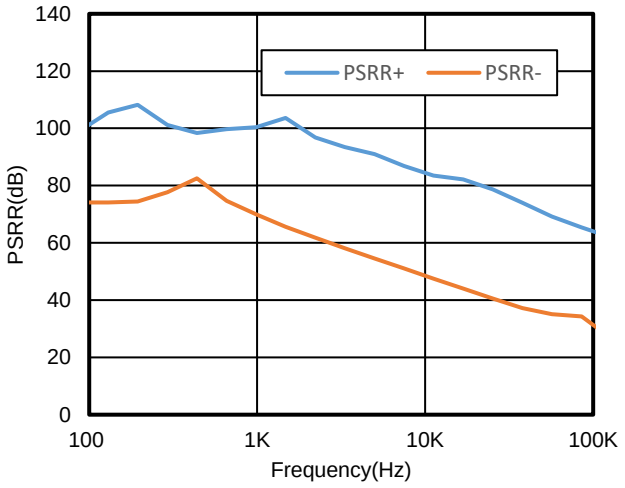


Figure 9. PSRR vs. Frequency

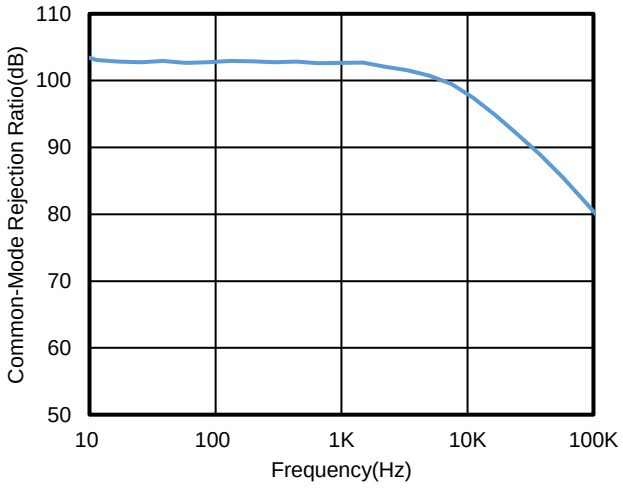


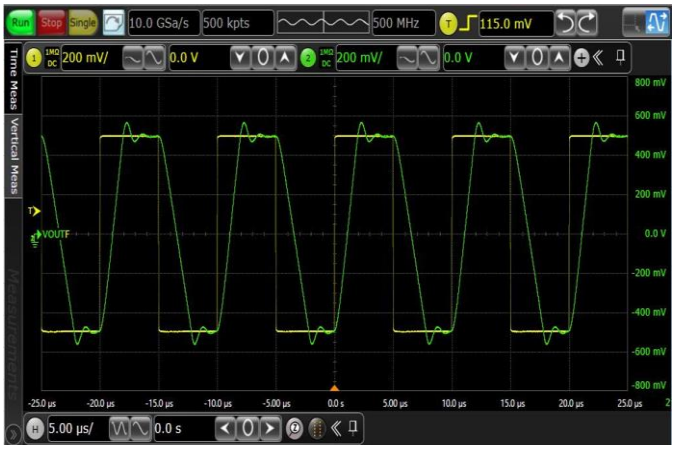
Figure 10. CMRR vs. Frequency

Time: 10µs/div, Measure Time: 1.4µs, G=11

Figure 11. Positive Overload Recovery

Time: 10µs/div, Measure Time: 7.8µs, G=11

Figure 12. Negative Overload Recovery



Voltage: 200mV/div, Time: 5μs/div

R_L=100K, C_L=1nF, G=1

Figure 13. 1V Signal Step Response

Voltage: 2mV/div, Time: 5μs/div

C_L=50pF, G=1

Figure 14. 10mV Signal Step Response

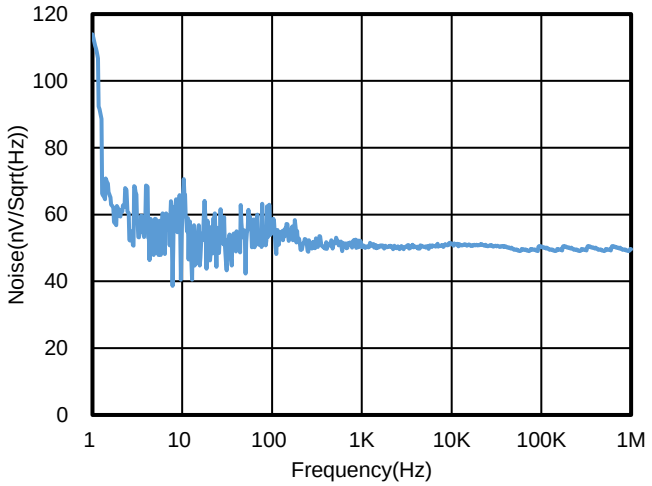


Figure 15. Voltage Noise Density vs. Frequency

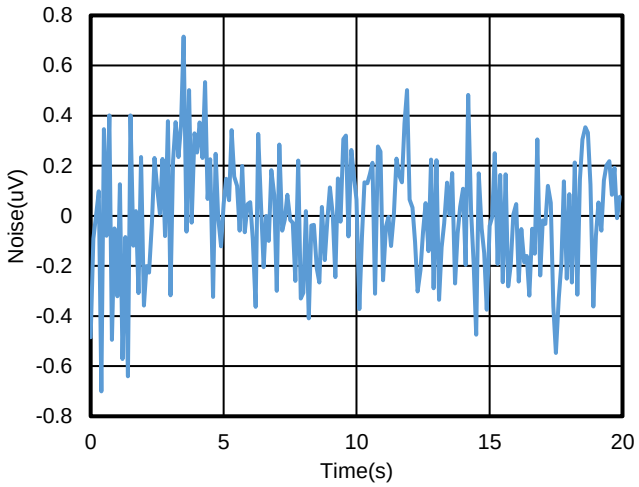


Figure 16. 0.1 to 10Hz Voltage Noise

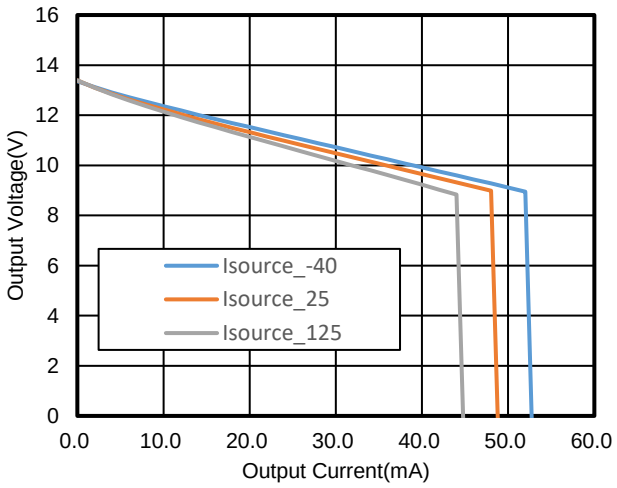


Figure 17. V_{OUT} vs. I_{OUT}, Source

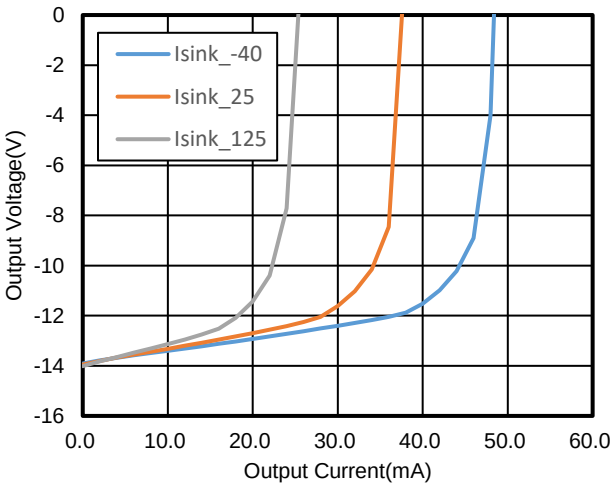


Figure 18. V_{OUT} vs. I_{OUT}, Sink

Power On and Off Behavior, 36V Single Supply, G = 1, Input = V_S / 2, Yellow: V_S, Green: Output

Figure 19. 2ms Power On and Off Time

Figure 20. 10ms Power On and Off Time

Figure 21. 100ms Power On and Off Time

Figure 22. 1s Power On and Off Time

Power On and Off Behavior, +18V and -18V Dual Supply, G = 1, Input = Ground, Green: +V_S, Red: -V_S, Yellow: Output,.

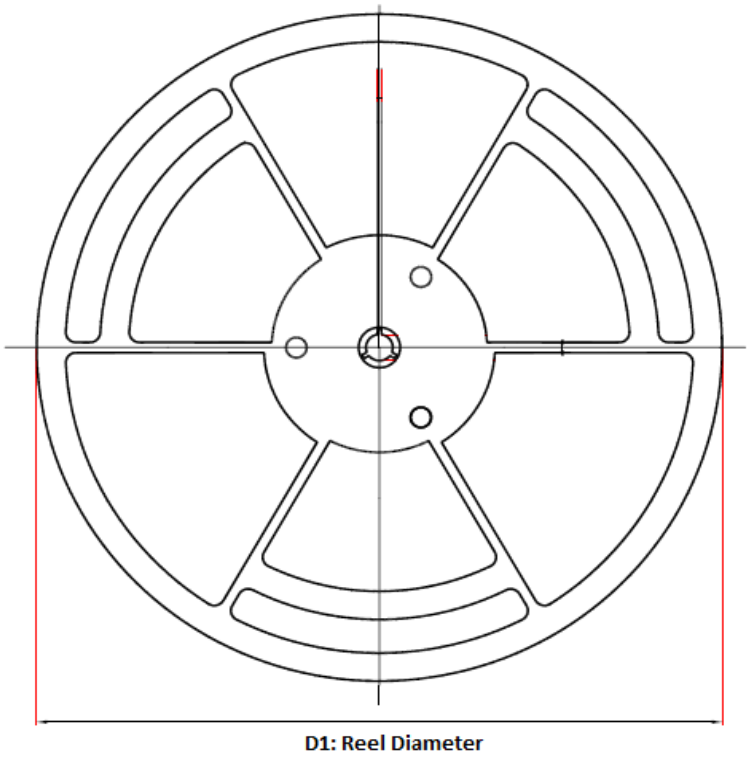
Figure 23. 1ms Power On and Off Time

Figure 24. 10ms Power On and Off Time

Figure 25. 100ms Power On and Off Time

Figure 26. 1s Power On and Off Time

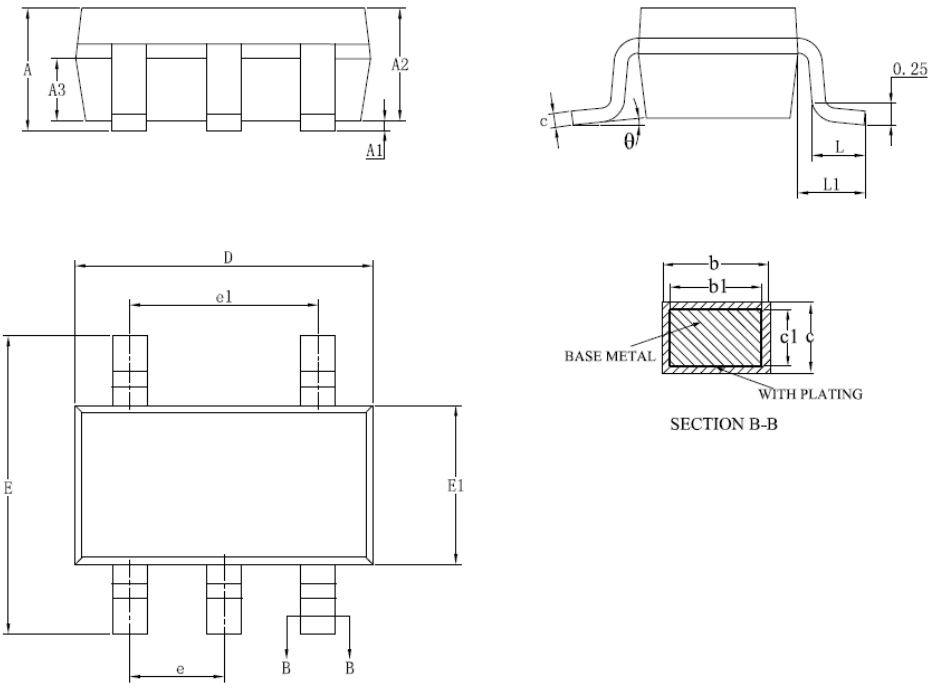
Tape and Reel Information



Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TPA2641-S5TR	5-Pin SOT23	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TPA2641U-S5TR	5-Pin SOT23	180.0	13.1	3.2	3.2	1.4	4.0	8.0	Q3
TPA2642-SO1R	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPA2642-DF4R	8-Pin DFN2*2	180.0	13.1	2.3	2.3	1.1	4.0	8.0	Q1
TPA2642-TS1R	8-Pin TSSOP	330.0	17.6	6.8	3.3	1.2	8.0	12.0	Q1
TPA2642-VS1R	8-Pin MSOP	330.0	17.6	5.2	3.3	1.5	8.0	12.0	Q1
TPA2644-SO2R	14-Pin SOIC	330.0	21.6	6.5	9.0	2.1	8.0	16.0	Q1
TPA2644-TS2R	14-Pin TSSOP	330.0	17.6	6.8	5.4	1.2	8.0	12.0	Q1

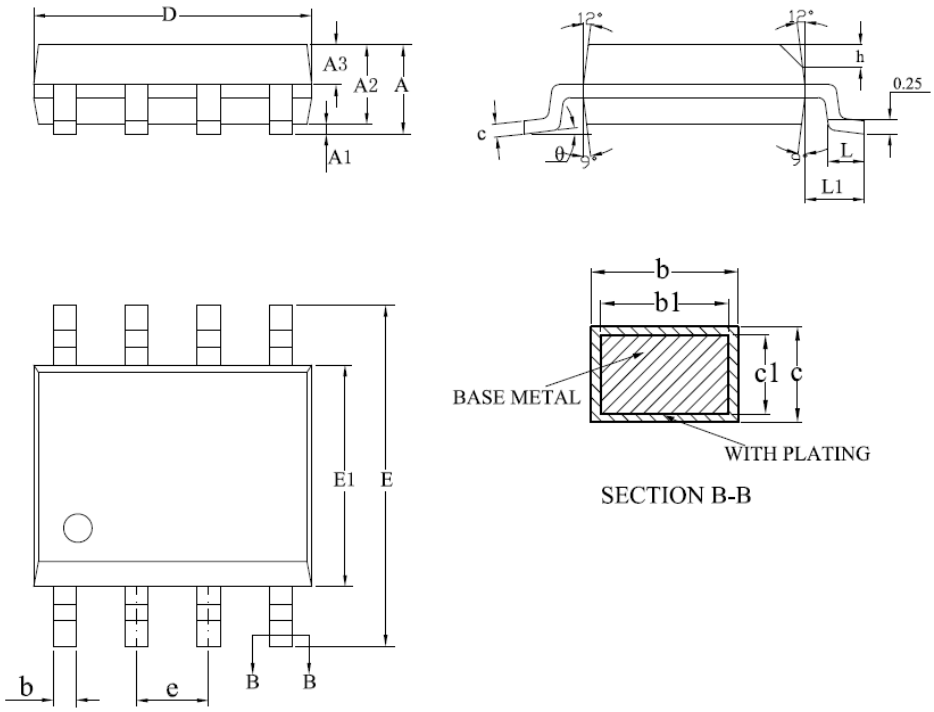
Package Outline Dimensions

SOT23-5



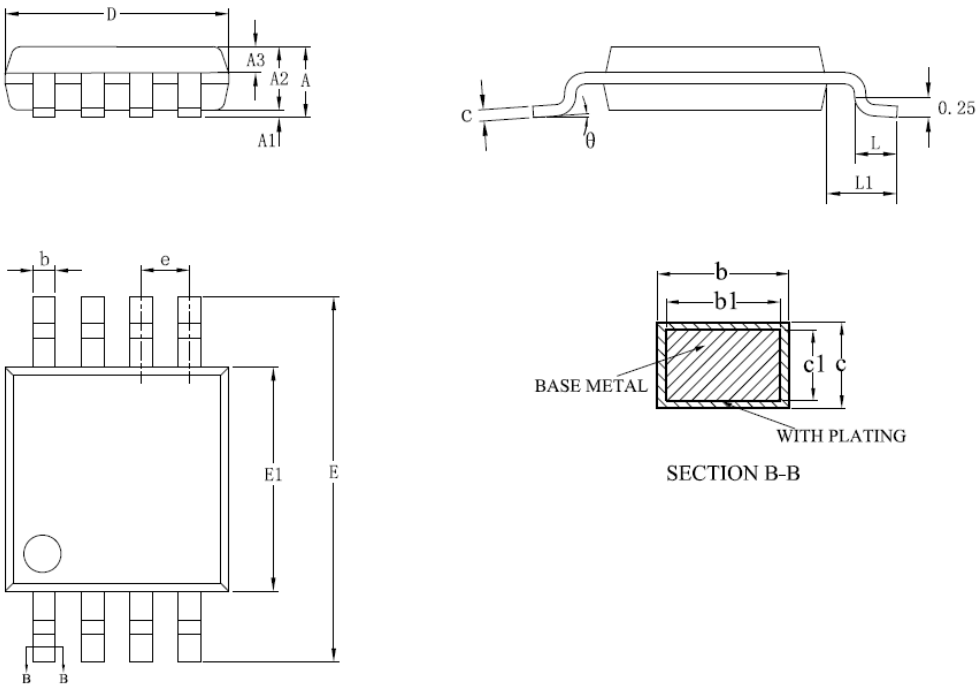
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.25
A1	0.04	—	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	—	0.41
b1	0.32	0.35	0.38
c	0.15	—	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95BSC		
e1	1.90BSC		
L	0.30	—	0.60
L1	0.60REF		
θ	0	—	8°

SOIC-8



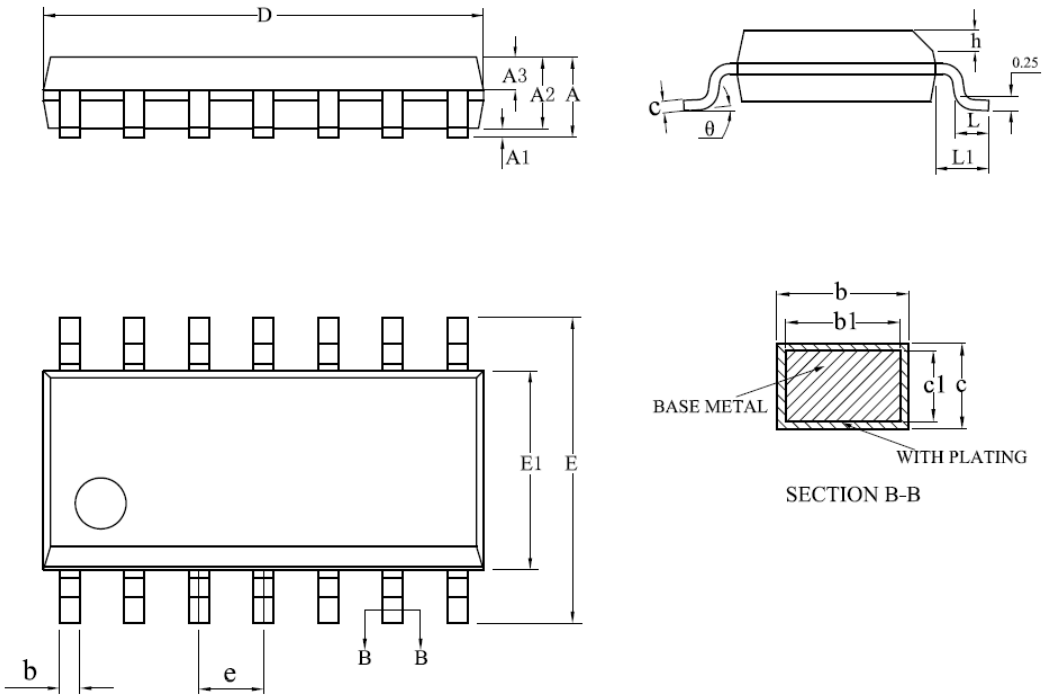
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

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°

SOIC-14



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.05	—	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	8.55	8.65	8.75
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°