Features

- Supply Voltage: 4.5 V to 36 V
- Offset Voltage: ±50 μV Maximum
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Input Rail to −VS, Rail to Rail Output
- Bandwidth: 12 MHz
- Slew Rate: 10 V/μs
- Excellent EMI Suppress Performance: 45 dB at 1 GHz
- Over-Temperature Protection
- Low Noise: 10 nV/√Hz at 1 kHz
- AEC-Q100 Qualification

Applications

- On Board Charger
- Motor Control
- Precision Signal Condition

Description

The TPA1882Q-VR-S is the newest high supply-voltage amplifier with 50 μV low-offset voltage, low noise and stable high-frequency response. It incorporates proprietary and patented design techniques to achieve excellent AC performance with 12 MHz bandwidth, 10 V/μs slew rate and low distortion while drawing 2 mA quiescent current per amplifier. The input common-mode voltage extends to V–, and the output swings rail-to-rail. The amplifier can be used as a plug-in replacement for many commercially available op-amps to improve performance.

The amplifier has the over-temperature protection feature to guarantee the chip safe. The output of the amplifier will enter high impedance state when junction temperature reaches around 170°C, and the device will be recovered when the junction temperature drops to around 150°C.

Pin Configuration

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

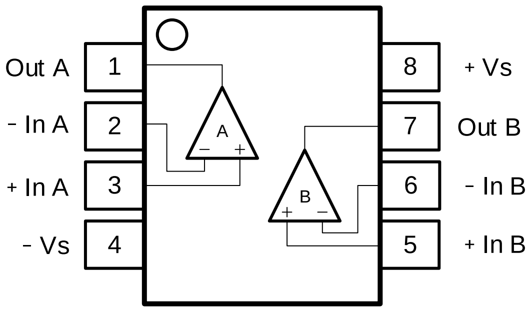


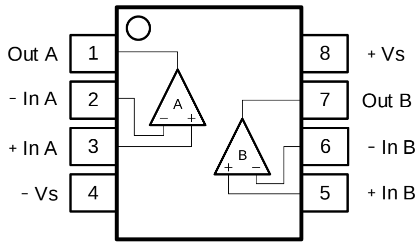
Table of Contents

Revision History

Date	Revision	Notes
	Rev.A.0	Initial version

Pin Configuration and Functions

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



Pin Functions

Pin		I/O	Description
No.	Name		
1	Out A	Output	Output of channel A
2	−In A	Input	Inverting input of channel A
3	+In A	Input	Noninverting input of channel A
4	$-V_S$	Power Supply	Negative power supply (1)
5	+In B	Input	Noninverting input of channel B
6	−In B	Input	Inverting input of channel B
7	Out B	Output	Output of channel B
8	$+V_S$	Power Supply	Positive power supply (1)

Note: (1) In this document, $(+V_S) - (-V_S)$ is referred to as V_S.

Specifications

Absolute Maximum Ratings

Parameter	Min	Max	Unit
Supply Voltage, $(+V_S) - (-V_S)$		40	V
Input Voltage	$(-V_S) - 0.3$	40	V
Differential Input Voltage	$(-V_S) - (+V_S)$	$(+V_S) - (-V_S)$	V
Input Current: +IN, −IN (1)	−10	+10	mA
Output Short-Circuit Duration (2)		Infinite	
Maximum Junction Temperature		150	°C
Operating Temperature Range	−40	125	°C
Storage Temperature Range	−65	150	°C
Lead Temperature (Soldering, 10 sec)		260	°C

Note: 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.

(1) The inputs are protected by ESD protection diodes to negative power supply. If the input extends more than 300 mV beyond the negative power supply, the input current should be limited to less than 10 mA.

(2) A heat sink may be required to keep the junction temperature below the absolute maximum rating. This depends on the power dissipation of the application. Thermal resistance varies with the amount of PC board metal connected to the package.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	AEC Q100-002	2	kV
CDM	Charged Device Model ESD	AEC Q100-011	1	kV

Recommended Operating Conditions

Parameter		Min	Typ	Max	Unit
V_S	Supply Voltage, $(+V_S) - (-V_S)$	4.5		36	V

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
8-Pin MSOP	210	45	°C/W

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Power Supply						
V_S	Supply Voltage Range		4.5		36	V
I_Q	Quiescent Current per Amplifier	V_S = 30 V		2	2.5	mA
		V_S = 30 V, T_A = −40°C to 125°C			3	mA
		V_S = 5 V		1.9	2.4	mA
		V_S = 5 V, T_A = −40°C to 125°C			2.9	mA
PSRR	Power Supply Rejection Ratio	V_S = 4.5 V to 36 V	125	155		dB
		V_S = 4.5 V to 36 V, T_A = −40°C to 125°C	120			dB
Input Characteristics						
V_{OS}	Input Offset Voltage	V_S = 30 V, V_{CM} = 15 V	−35		35	μV
		V_S = 30 V, V_{CM} = 15 V, T_A = −40°C to 125°C	−50		50	μV
		V_S = 5 V, V_{CM} = 2.5 V	−35		35	μV
		V_S = 5 V, V_{CM} = 2.5 V, T_A = −40°C to 125°C	−50		50	μV
V_{OS} TC	Input Offset Voltage Drift	T_A = −40°C to 125°C		0.01		μV/°C
I_B	Input Bias Current			100		pA
		T_A = −40°C to 125°C		800		pA
I_{OS}	Input Offset Current			100		pA
I_{IN}	Different Input Current	V_S = 36 V, V_{ID} = 36 V			100	μA
		V_S = 36 V, V_{ID} = 36 V, T_A = −40°C to 125°C			150	μA
C_{IN}	Input Capacitance	Differential Mode		5		pF
		Common Mode		2.5		pF
Av	Open-loop Voltage Gain	R_{LOAD} = 10 kΩ, V_{OUT} = 0.5 V to 29.5 V	125	155		dB
		R_{LOAD} = 10 kΩ, V_{OUT} = 0.5 V to 29.5 V, T_A = −40°C to 125°C	120			dB
V_{CMR}	Common-mode Input Voltage Range		(V-)		(V+) – 2	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0 V to 28.5 V	125	155		dB
		V_{CM} = 0 V to 28.5 V, T_A = −40°C to 125°C	120			dB

Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Output Characteristics						
	Output Swing from Positive Rail	R_{LOAD} = 100 kΩ to V_S/2		12	25	mV
		R_{LOAD} = 100 kΩ to V_S/2, T_A = −40°C to 125°C			40	mV
		R_{LOAD} = 10 kΩ to V_S/2		80	120	mV
		R_{LOAD} = 10 kΩ to V_S/2, T_A = −40°C to 125°C			200	mV
		R_{LOAD} = 2 kΩ to V_S/2		370	500	mV
		R_{LOAD} = 2 kΩ to V_S/2, T_A = −40°C to 125°C			750	mV
	Output Swing from Negative Rail	R_{LOAD} = 100 kΩ to V_S/2		5	25	mV
		R_{LOAD} = 100 kΩ to V_S/2, T_A = −40°C to 125°C			30	mV
		R_{LOAD} = 10 kΩ to V_S/2		30	80	mV
		R_{LOAD} = 10 kΩ to V_S/2, T_A = −40°C to 125°C			200	mV
		R_{LOAD} = 2 kΩ to V_S/2		140	300	mV
		R_{LOAD} = 2 kΩ to V_S/2, T_A = −40°C to 125°C			500	mV
I_{SC}	Output Short-Circuit Current	Source	70	95		mA
		Source, T_A = −40°C to 125°C	50			mA
		Sink	130	150		mA
		Sink, T_A = −40°C to 125°C	85			mA
AC Specifications						
GBW	Gain-Bandwidth Product			12		MHz
SR	Slew Rate	G = 1, 10 V step	8	12		V/μs
		G = 1, 10 V step, T_A = −40°C to 125°C	7			V/μs
t_{OR}	Overload Recovery			500		ns
t_S	Settling Time, 0.1%	G = 1, 10 V step		2		μs
	Settling Time, 0.01%	G = 1, 10 V step		13		μs
PM	Phase Margin	R_L = 10 kΩ, C_L = 50 pF		60		°
GM	Gain Margin	R_L = 10 kΩ, C_L = 50 pF		10		dB
	Crosstalk	f = 100 Hz		120		dB
		f = 100 kHz		120		dB

Electrical Characteristics (Continued)

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Noise Performance						
E_N	Input Voltage Noise	f = 0.1 Hz to 10 Hz		0.2		μV_{PP}
e_N	Input Voltage Noise Density	f = 0.1 kHz		8		nV/√Hz
		f = 1 kHz		8		nV/√Hz
		f = 10 kHz		8		nV/√Hz
i_N	Input Current Noise	f = 10 kHz		200		fA/√Hz
THD+N	Total Harmonic Distortion and Noise	f = 1 kHz, G = 1, R_L = 10 kΩ, V_{OUT} = 6 V_{RMS}		0.0003		%

Typical Performance Characteristics

All test condition: V_S = 30 V, T_A = +25°C, unless otherwise noted.

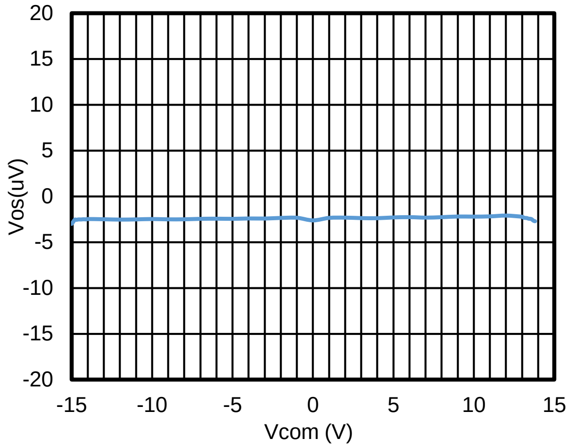


Figure 1. Offset Voltage vs. Common Mode Voltage

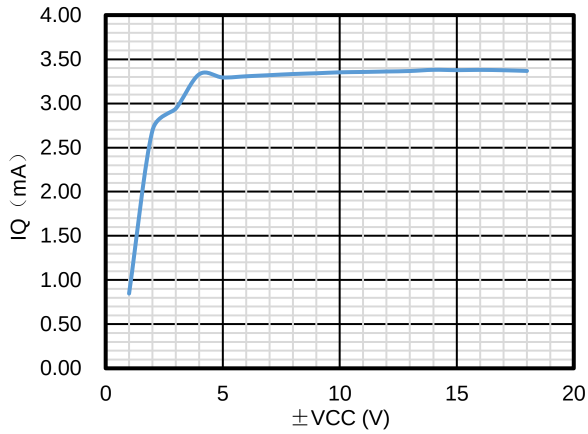


Figure 2. Iq vs. Supply Voltage

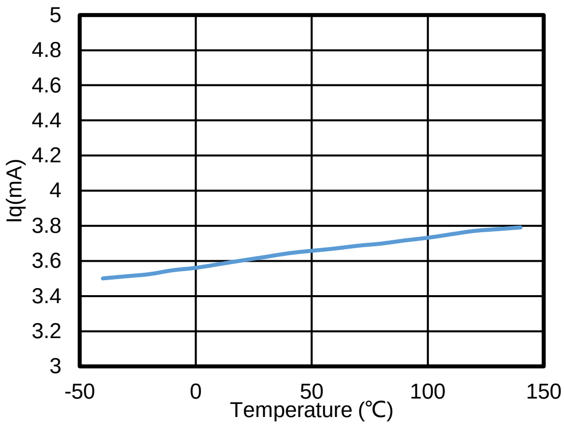


Figure 3. Iq vs. Temperature, 5 V Supply, TPA1882

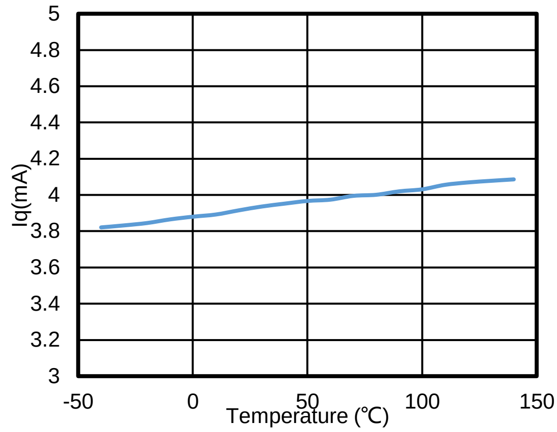


Figure 4. Iq vs. Temperature, 30 V Supply, TPA1882

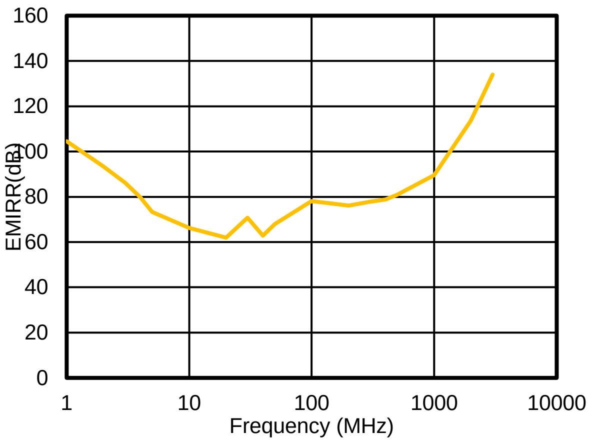


Figure 5. EMIRR vs. Frequency

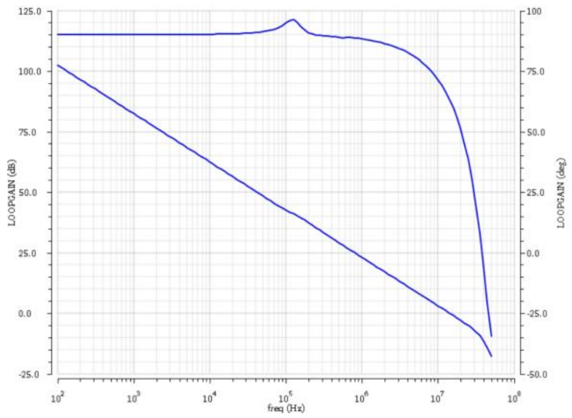


Figure 6. Open Loop Gain and Phase vs. Frequency

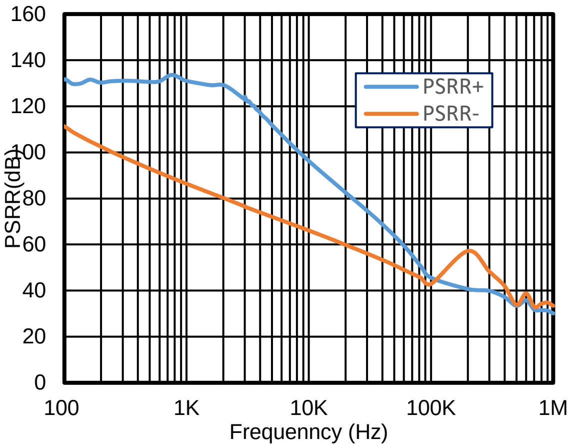


Figure 7. PSRR vs. Frequency

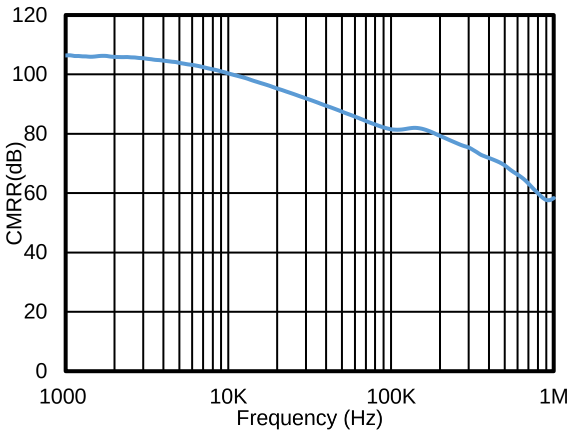
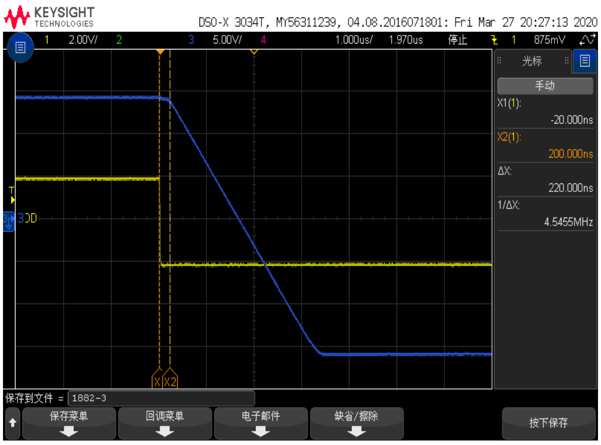


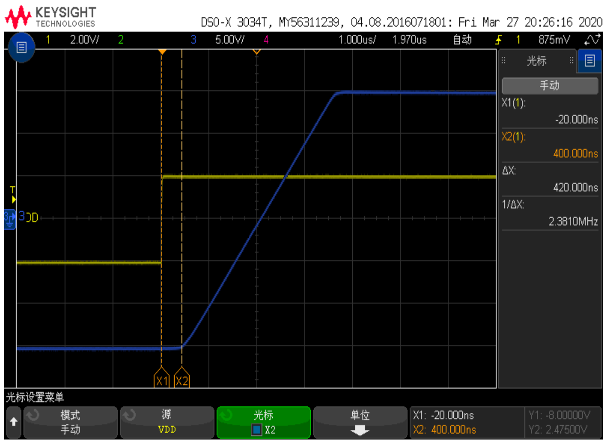
Figure 8. CMRR vs. Frequency



Time: 2 us/div, Measure Time: 220 ns

R_L = 2 kΩ, C_L = 100 pF, G = 10

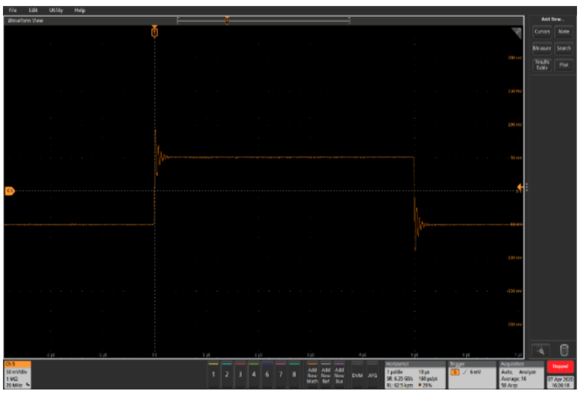
Figure 9. Positive Overload Recovery



Time: 2 us/div, Measure Time: 420 ns

R_L = 2 kΩ, C_L = 100 pF, G = 10

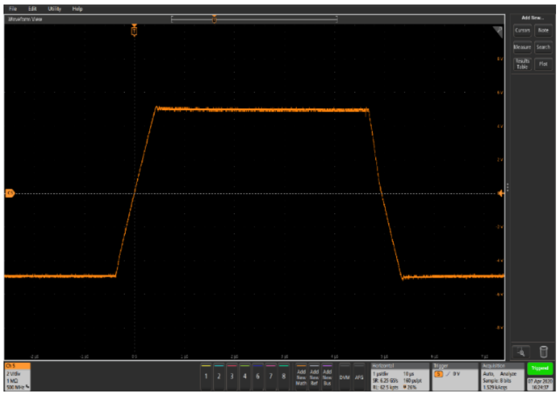
Figure 10. Negative Overload Recovery



Voltage: 50 mV/div, Time: 2 us/div

R_L = 2 kΩ, C_L = 100 pF, G = 1

Figure 11. 100 mV Signal Step Response



Voltage: 2 V/div, Time: 2 μs/div

R_L = 2 kΩ, C_L = 100 pF, G = 1

Figure 12. 10 V Signal Step Response

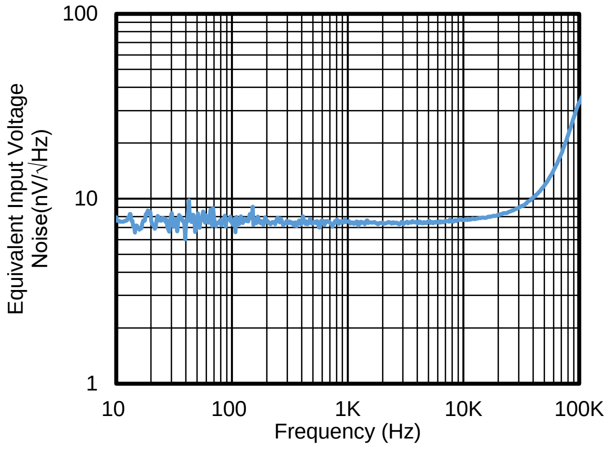


Figure 13. Voltage Noise Spectral Density vs. Frequency

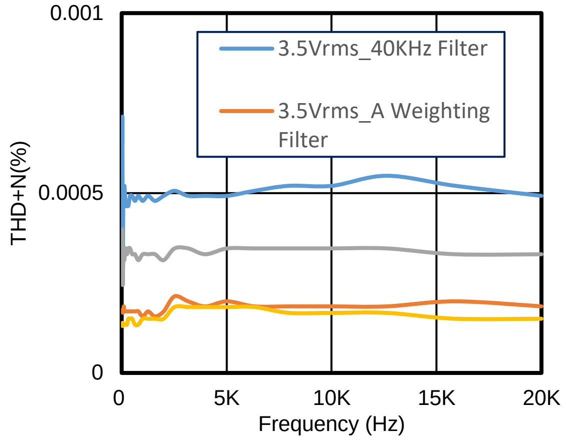


Figure 14. THD+N vs. Frequency

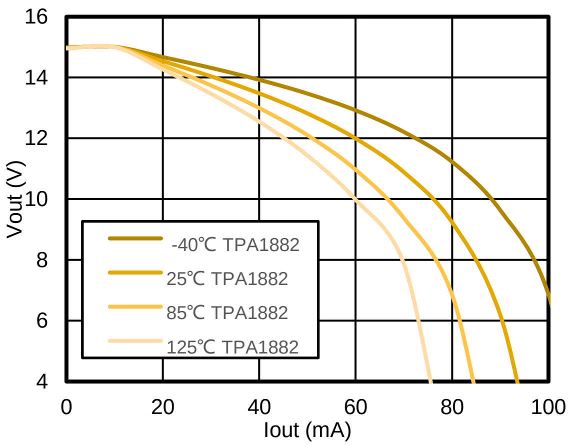


Figure 15. V_{OUT} vs. I_{OUT}, Source

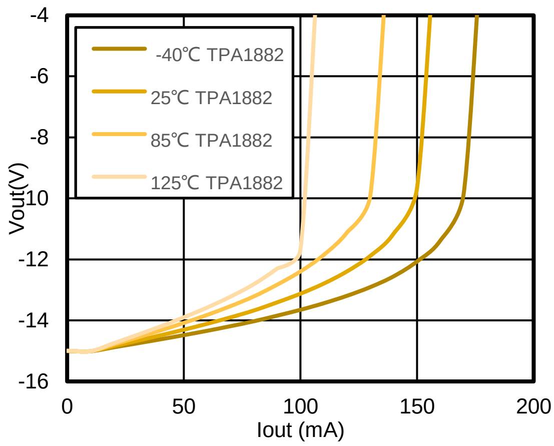
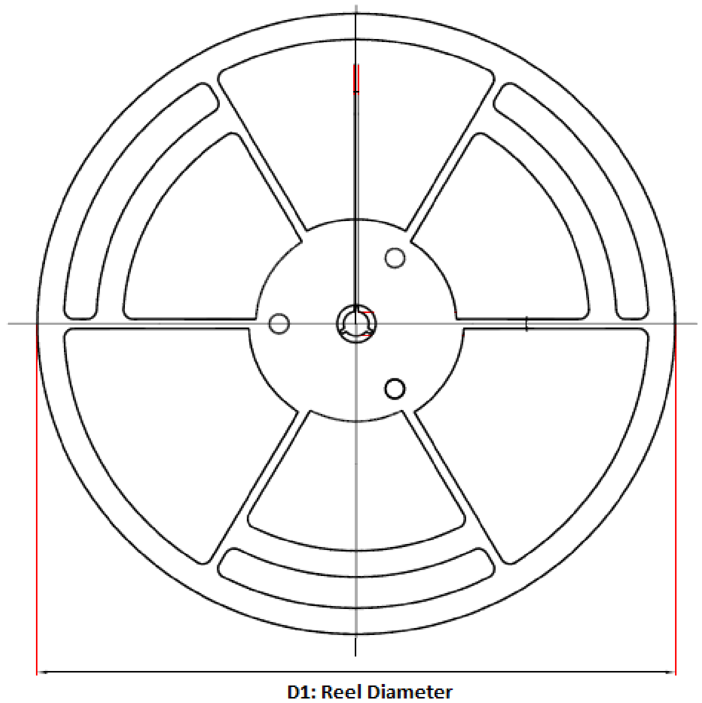
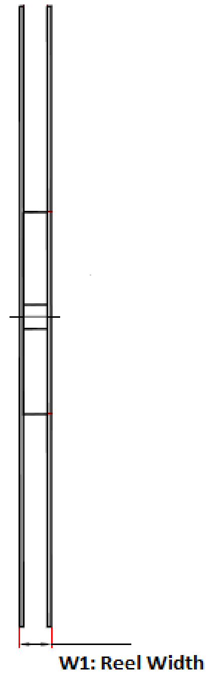
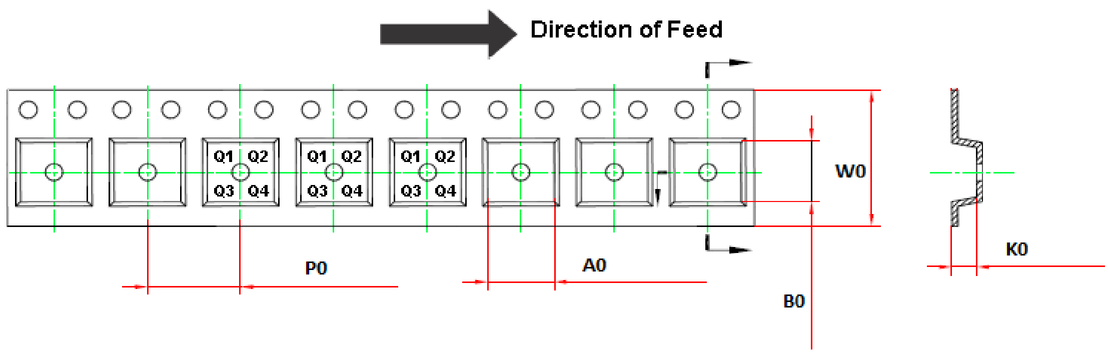


Figure 16. V_{OUT} vs. I_{OUT}, Sink

Tape and Reel Information



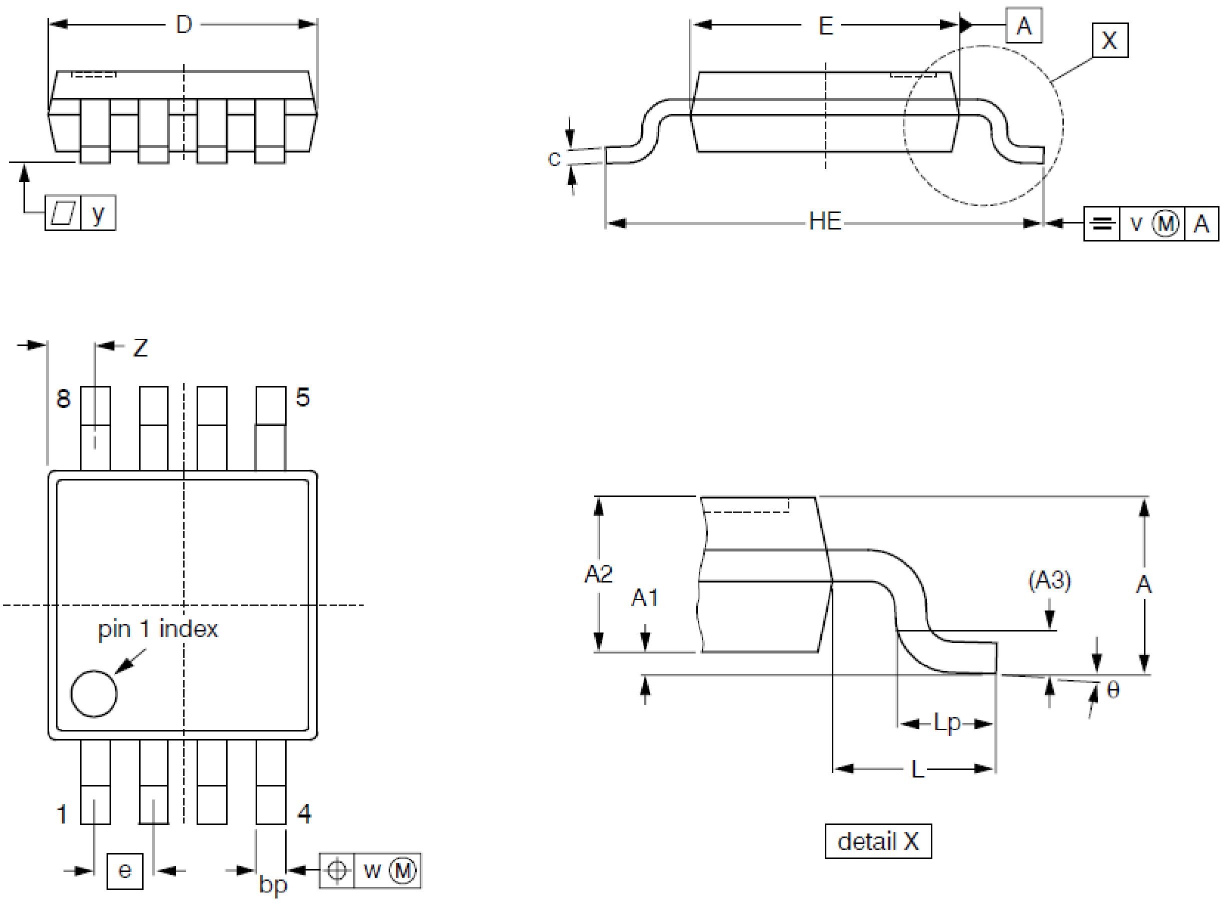




Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPA1882Q-VR-S	8-Pin MSOP	330.0	17.6	5.2	3.3	1.5	8.0	12.0	Q1

Package Outline Dimensions

MSOP-8



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A1	A2	A3	bp	c	D(1)	E(2)	e	HE	L	Lp	v	w	y	Z(1)	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.45 0.25	0.28 0.15	3.1 2.9	3.1 2.9	0.65	5.1 4.7	0.94	0.7 0.4	0.1	0.1	0.1	0.70 0.35	6° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TPA1882Q-VR-S	−40 to 125°C	8-Pin MSOP	1882Q	1	Tape and Reel, 3000