TP27

36V, 6MHz, 50μV Vos Op Amps

Features

- Supply Voltage: 4.5V to 36V
- Offset Voltage: ±50μV Maximum
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Input Rail to $–V_S$, Rail to Rail Output
- Drive any capacitive load
- Bandwidth: 6MHz, Slew Rate: 5V/μs
- Excellent EMI Suppress Performance: 85dB at 1GHz
- Over-Temperature Protection
- Low Noise: 8 nV/√Hz at 1kHz
- 2KV HBM, 1KV CDM, 500mA Latch Up
- –40°C to 125°C Operation Temperature Range

Applications

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

Description

The TP27 is newest high supply voltage amplifiers with low offset, low power and stable high frequency response. It incorporates 3PEAK's proprietary and patented design techniques to achieve very good AC performance with 6MHz bandwidth, 5V/μs slew rate and low distortion. The input common-mode voltage range extends to V–, and the outputs swing rail-to-rail. The TP27 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 TP27 ideal choices for industrial control, instrumentation.

	TP07A	**TP17**	**TP27**
Vos 25°C, μV	±150	±100	±50
Vos -40 to 85°C, μV	±500	±400	±70
GBW, MHz	1	6	6
Iq, mA	1.5	2	1.6

Pin Configuration

TP27
8-Pin SOIC
(-S Suffix)

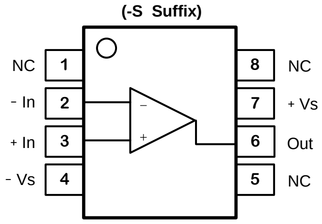


Table of Contents

Revision History

Date	Revision	Notes
2018/12/21	Rev.Pre	Pre-Release Version
2019/9/11	Rev.0	Initial Version
2020/8/1	Rev.A	Correct typo in the header: 5MHz -> 6MHz, Add Test Figure
2021/7/7	Rev.A.1	Update maximum rating: Input voltage: $(-V_S)$ – 0.3 to $(+V_S)$ + 0.3 -> $(-V_S)$ – 0.3 to 40 V Differential Input Voltage : $(+V_S)$ - $(-V_S)$ -> $(-V_S)$ - $(+V_S)$ to $(+V_S)$ - $(-V_S)$

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity
TP27-SR	-40 to 125°C	8-Pin SOIC	TP27	3	Tape and Reel, 4000

Absolute Maximum Ratings Note 1

Parameters	Rating
Supply Voltage, $(+V_S)–(-V_S)$	40 V
Input Voltage	$(-V_S)$ – 0.3 to 40 V
Differential Input Voltage	$(-V_S)$ - $(+V_S)$ to $(+V_S)$ - $(-V_S)$
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 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
LU	Latch Up	JESD 78, 25°C	500	mA
		JESD 78, 125°C	250	mA

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
8-Pin SOIC	158	43	°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			1.4	1.6	mA
			-40°C to 125°C			1.8	mA
		V_S = 5V			1.2	1.5	mA
			-40°C to 125°C			1.7	mA
PSRR	Power Supply Rejection Ratio	V_S = 4.5V to 36V		125	140		dB
			-40°C to 125°C	120			dB
Input Characteristics							
V_{OS}	Input Offset Voltage	V_S = 30V, V_{CM} = 15V		-50		50	μV
			-40°C to 125°C	-70		70	μV
		V_S = 5V, V_{CM} = 2.5V		-50		50	μV
			-40°C to 125°C	-70		70	μV
V_{OS} TC	Input Offset Voltage Drift		-40°C to 125°C		0.01	0.2	μV/°C
I_B	Input Bias Current				100		pA
			-40°C to 125°C		100		pA
I_{OS}	Input Offset Current				100		pA
I_{IN}	Different Input Current	V_S = 36V, V_{ID} = 36V			10	100	μA
			-40°C to 125°C			120	μA
C_{IN}	Input Capacitance	Differential Mode			5		pF
		Common Mode			2.5		pF
Av	Open-loop Voltage Gain	R_{LOAD} = 10kΩ, VOUT = 0.5 V to 29.5 V		130	140		dB
			-40°C to 125°C	125			dB
V_{CMR}	Common-mode Input Voltage Range			(V-)		(V+) – 1.5	V
CMRR	Common Mode Rejection Ratio	V_{CM} = 0V to 28.5V		125	140		dB
			-40°C to 125°C	120			dB

Output Characteristics							
	Output Swing from Positive Rail	R_{LOAD} = 100kΩ to V_S/2			10	15	mV
			-40°C to 125°C			30	mV
		R_{LOAD} = 10kΩ to V_S/2			75	100	mV
			-40°C to 125°C			180	mV
		R_{LOAD} = 2kΩ to V_S/2			400	500	mV
			-40°C to 125°C			750	mV
	Output Swing from Negative Rail	R_{LOAD} = 100kΩ to V_S/2			3	5	mV
			-40°C to 125°C			10	mV
		R_{LOAD} = 10kΩ to V_S/2			25	35	mV
			-40°C to 125°C			60	mV
		R_{LOAD} = 2kΩ to V_S/2			130	150	mV
			-40°C to 125°C			300	mV
I_{SC}	Output Short-Circuit Current	Source		60	95		mA
			-40°C to 85°C	40			mA
			-40°C to 125°C	35			mA
		Sink		130	150		mA
			-40°C to 85°C	100			mA
			-40°C to 125°C	85			mA
	Capacitive Load Drive				1		nF
AC Specifications							
GBW	Gain-Bandwidth Product				6		MHz
SR	Slew Rate	G = 1, 10V step		3	5		V/μs
			-40°C to 125°C	2.2			V/μs
t_{OR}	Overload Recovery				500		ns
t_S	Settling Time, 0.1%	G = 1, 10V step			7		μs
	Settling Time, 0.01%				12		μs
PM	Phase Margin	R_L=10K, C_L=100pF			70		°
GM	Gain Margin	R_L=10K, C_L=100pF			15		dB
Noise Performance							
E_N	Input Voltage Noise	f = 0.1Hz to 10Hz			0.1		$μV_{PP}$
e_N	Input Voltage Noise Density	f = 0.1Hz			8		nV/√Hz
		f = 1kHz			8		nV/√Hz
		f = 10kHz			10		nV/√Hz
		f = 100kHz			20		nV/√Hz
i_N	Input Current Noise	f = 10kHz			200		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.

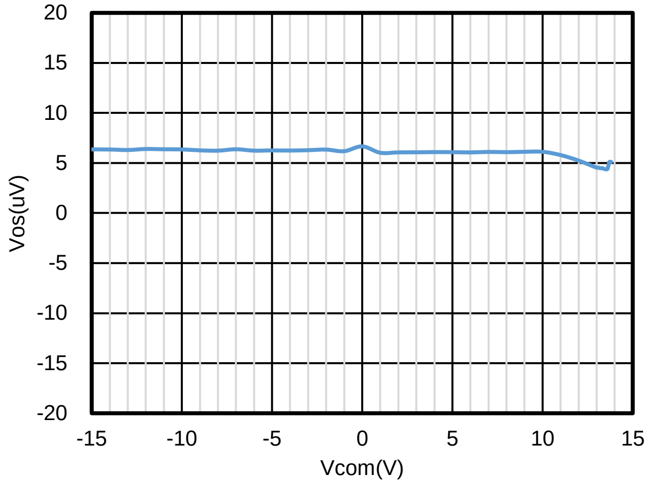


Figure 1. Offset Voltage vs. Common Mode Voltage

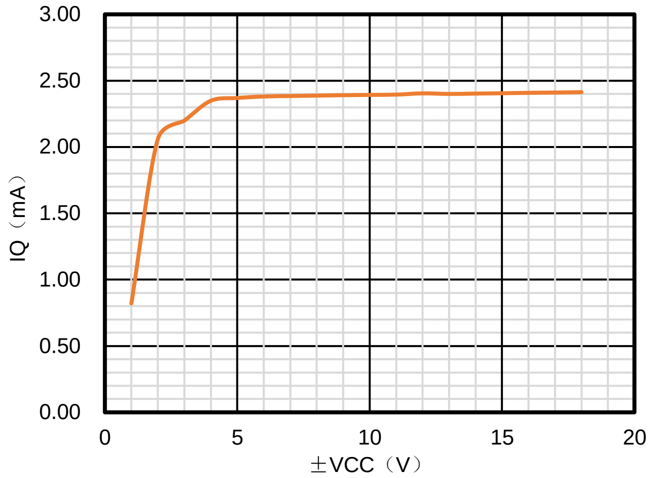


Figure 2. Iq vs. Supply Voltage

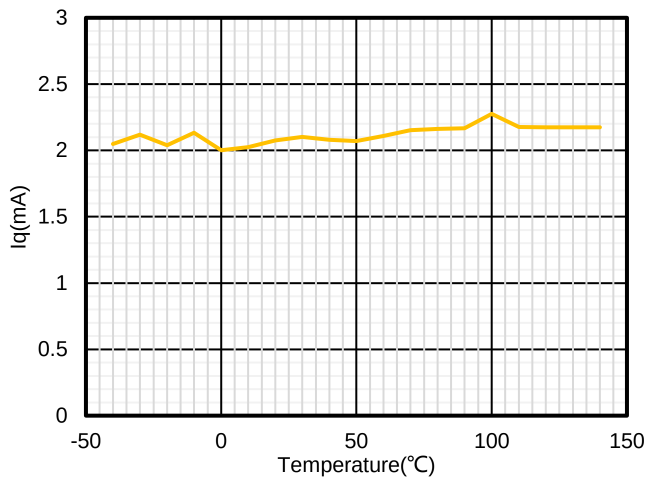


Figure 3. Iq vs. Temperature, +-2.5V Supply

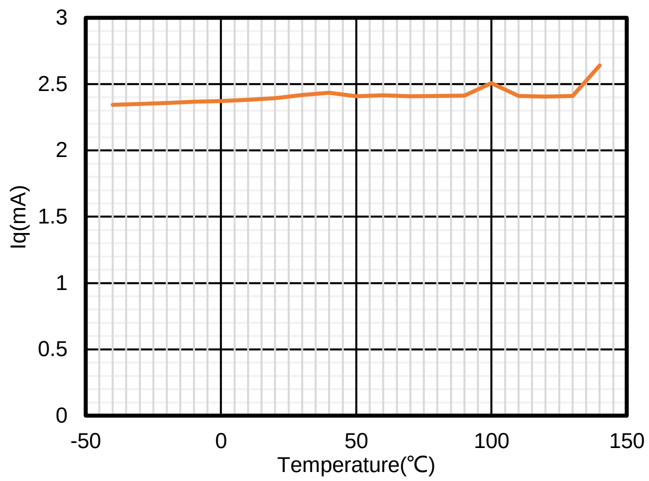


Figure 4. Iq vs. Temperature, +-15V Supply

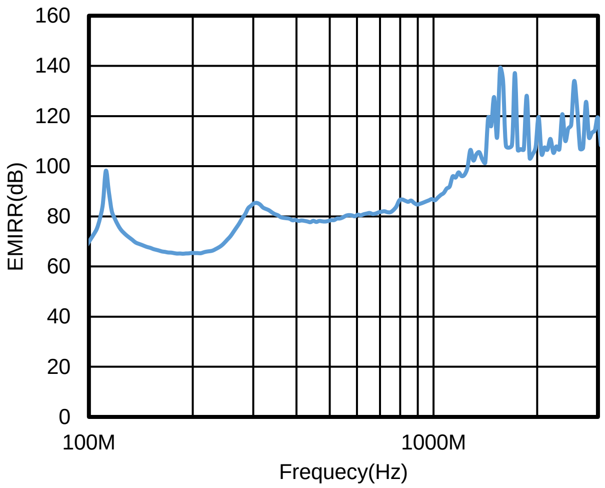


Figure 5. EMIRR vs. Frequency

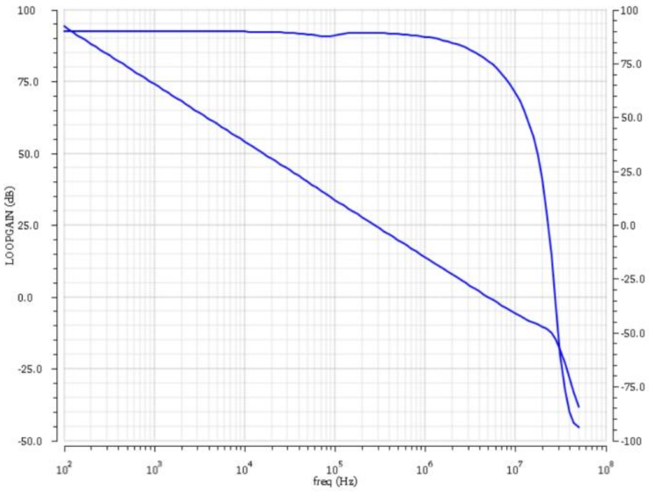


Figure 6. Open Loop Gain and Phase vs. Frequency

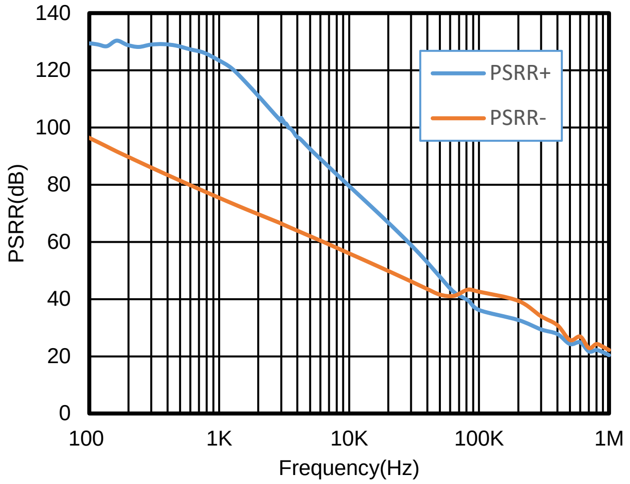


Figure 7. PSRR vs. Frequency

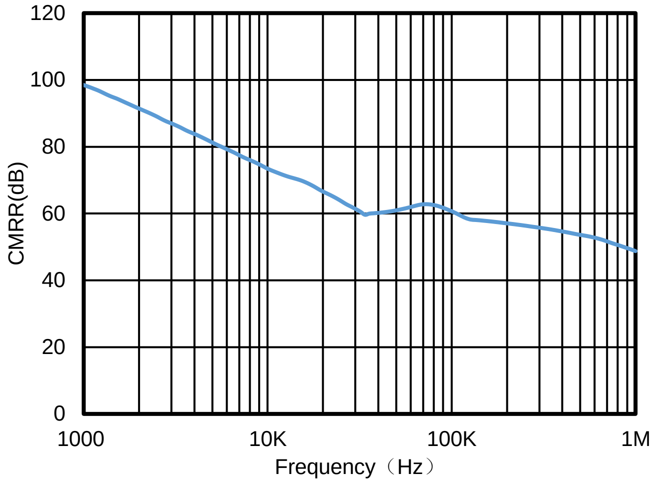
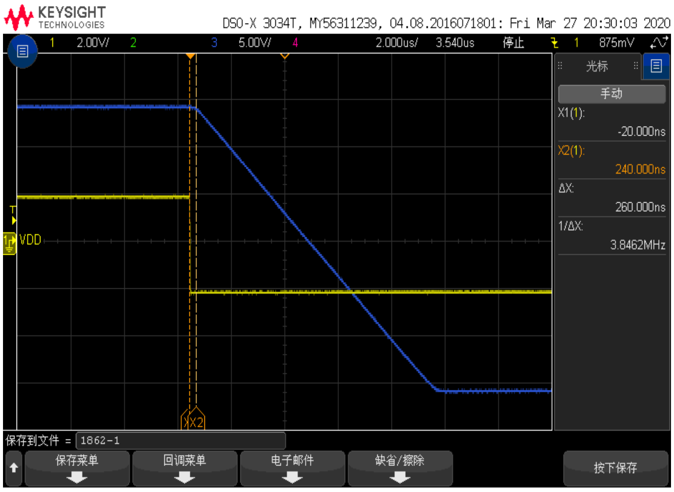


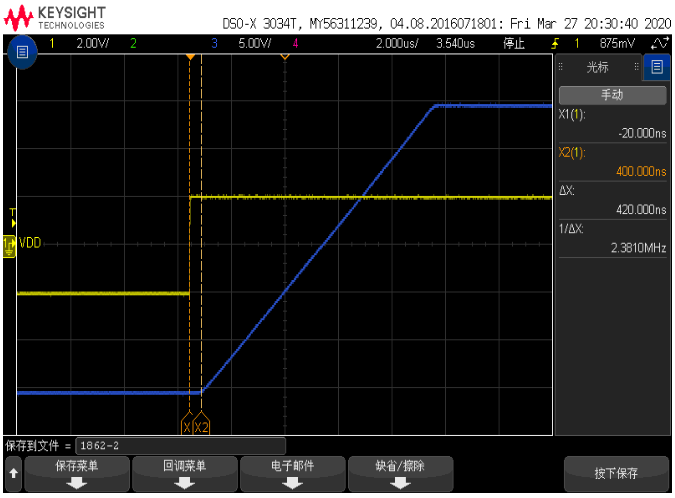
Figure 8. CMRR vs. Frequency



Time: 2us/div, Measure Time: 260ns

R_L=2K, C_L=100pF, G=10

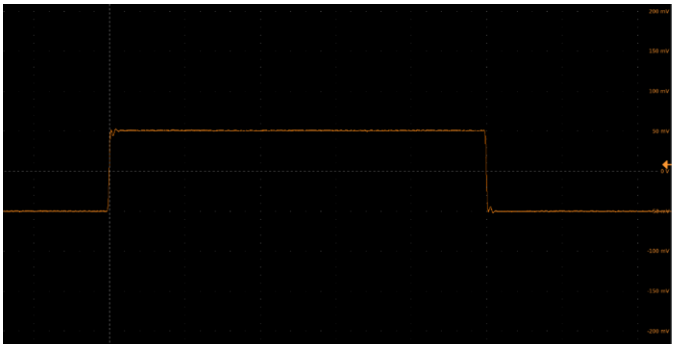
Figure 9. Positive Overload Recovery



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

R_L=2K, C_L=100pF, G=10

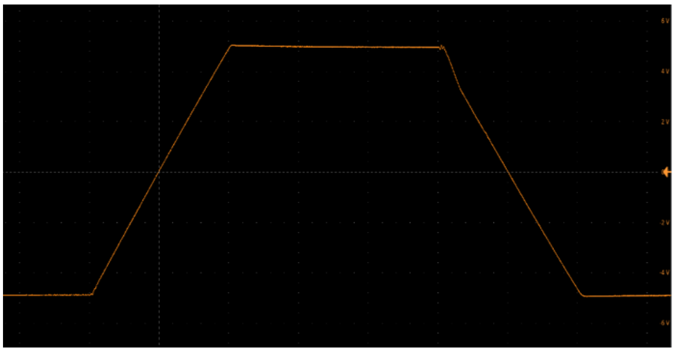
Figure 10. Negative Overload Recovery



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

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

Figure 11. 100mV Signal Step Response



Voltage: 2V/div, Time: 2μs/div

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

Figure 12. 10V Signal Step Response

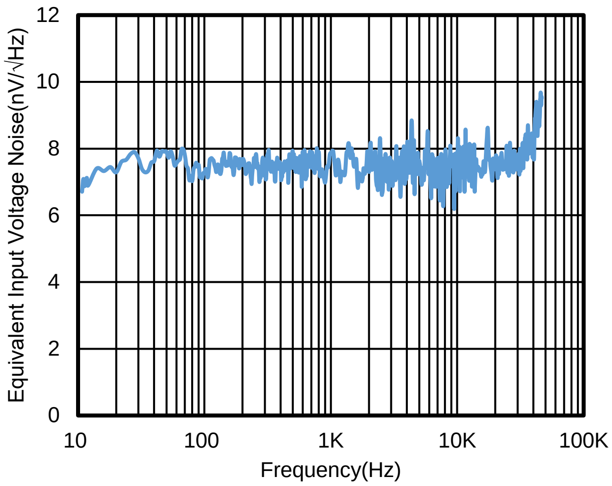


Figure 13. Voltage Noise Density vs. Frequency

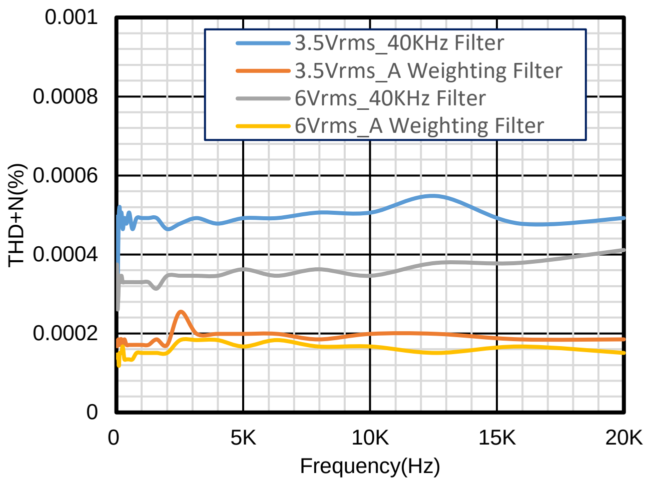


Figure 14. THD vs. Frequency, G = 1

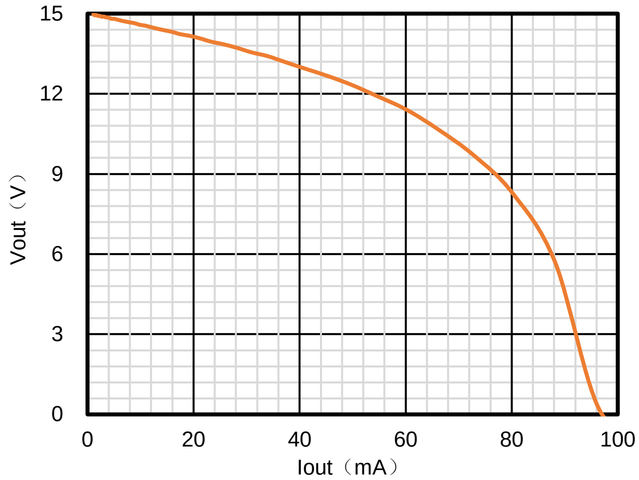


Figure 15. V_{OUT} vs. I_{OUT}, Source

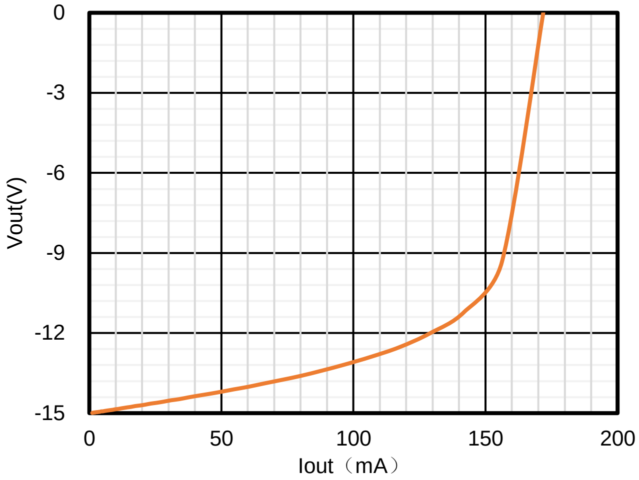
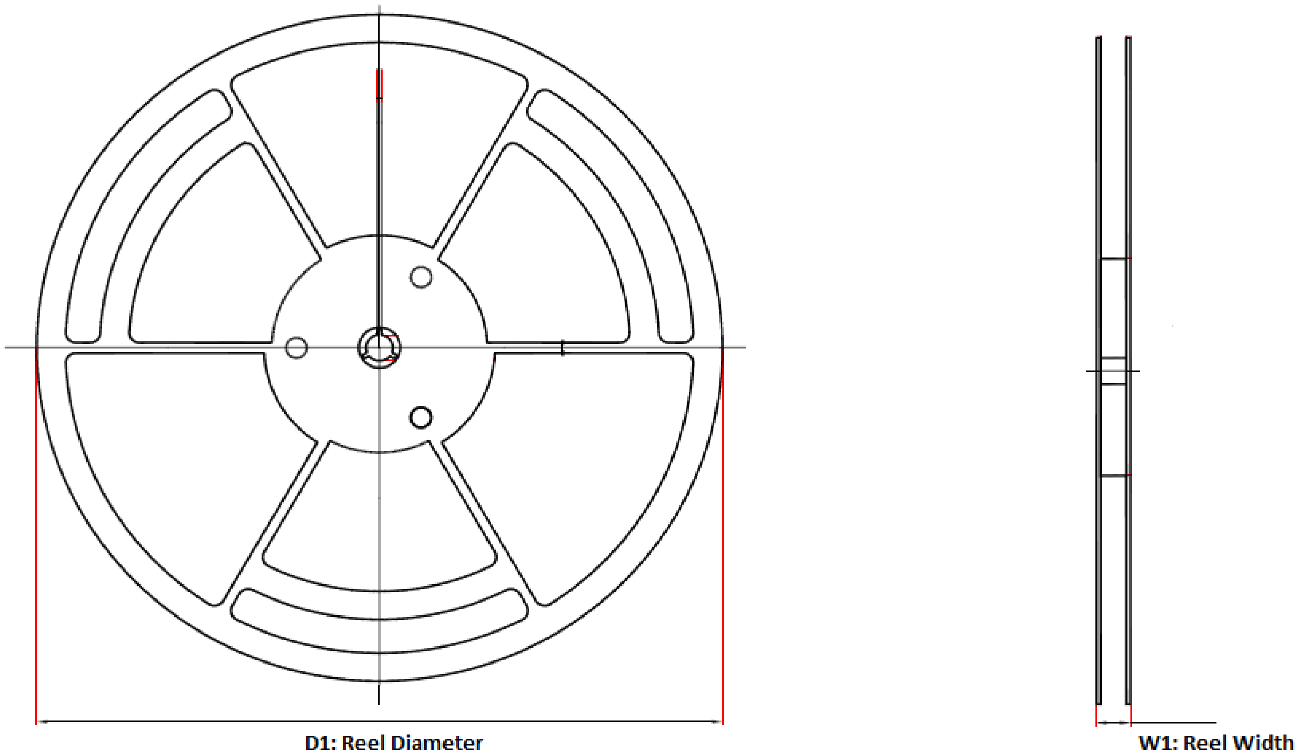
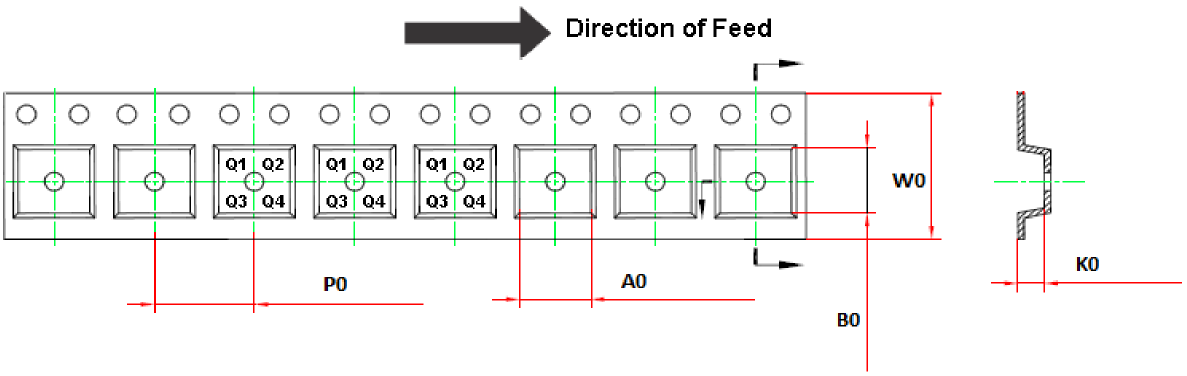


Figure 16. V_{OUT} vs. I_{OUT}, Sink

Tape and Reel Information

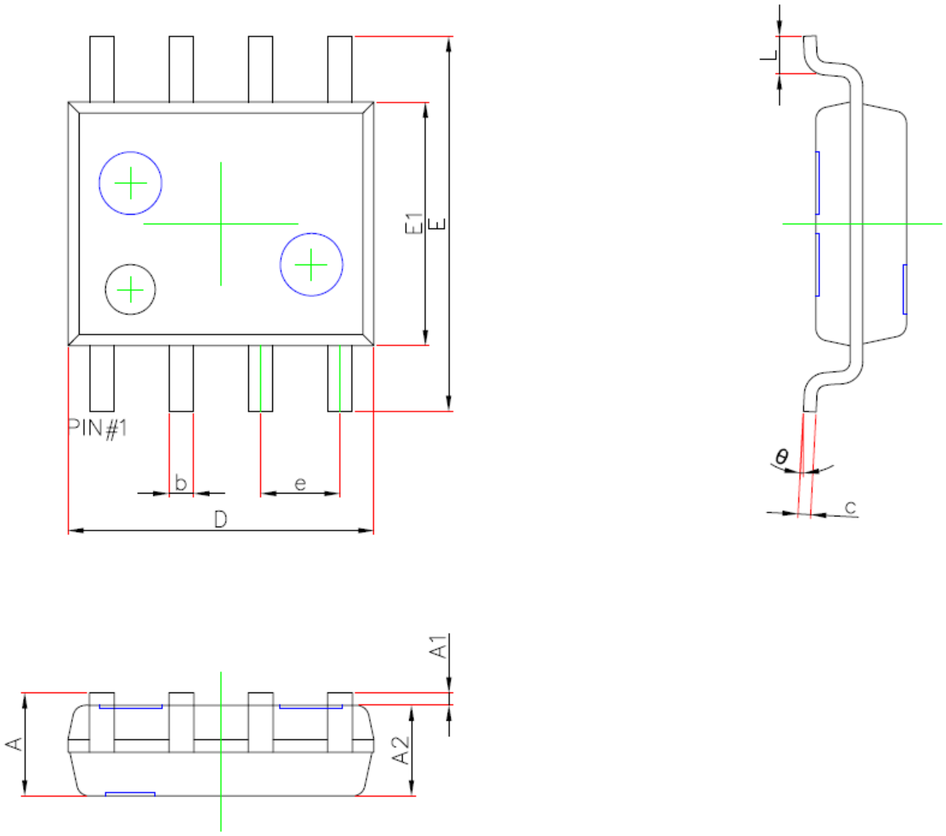




Order Number	Package	D1	W1	A0	B0	K0	P0	W0	Pin1 Quadrant
TP27-SR	8-Pin SOIC	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1

Package Outline Dimensions

SOIC-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	0.007	0.010
D	4.700	5.100	0.185	0.201
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270(BSC)		0.050(BSC)	
L	0.400	0.800	0.016	0.031
θ	0°	8°	0°	8°