

Features

- Supply Voltage: 4.5V to 36V
- Offset Voltage: $\pm 50\mu\text{V}$ 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/ $\sqrt{\text{Hz}}$ 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

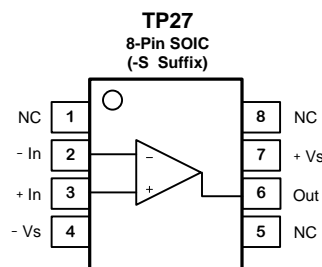


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Revision History

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 $V_S = 30V$, $T_A = 25^\circ C$, $R_L = 10k\Omega$, 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
			$-40^\circ C$ to $125^\circ C$			1.8	mA
		$V_S = 5V$			1.2	1.5	mA
			$-40^\circ C$ to $125^\circ C$			1.7	mA
PSRR	Power Supply Rejection Ratio	$V_S = 4.5V$ to $36V$		125	140		dB
			$-40^\circ C$ to $125^\circ C$	120			dB
Input Characteristics							
V_{OS}	Input Offset Voltage	$V_S = 30V$, $V_{CM} = 15V$		-50		50	μV
			$-40^\circ C$ to $125^\circ C$	-70		70	μV
		$V_S = 5V$, $V_{CM} = 2.5V$		-50		50	μV
			$-40^\circ C$ to $125^\circ C$	-70		70	μV
$V_{OS\ TC}$	Input Offset Voltage Drift		$-40^\circ C$ to $125^\circ C$		0.01	0.2	$\mu V/^\circ C$
I_B	Input Bias Current				100		pA
		$-40^\circ C$ to $125^\circ C$			100		pA
I_{OS}	Input Offset Current				100		pA
I_{IN}	Differential Input Current	$V_S = 36V$, $V_{ID} = 36V$			10	100	μA
			$-40^\circ C$ to $125^\circ C$			120	μA
C_{IN}	Input Capacitance	Differential Mode			5		pF
		Common Mode			2.5		pF
A_v	Open-loop Voltage Gain	$R_{LOAD} = 10k\Omega$, $V_{OUT} = 0.5V$ to $29.5V$		130	140		dB
			$-40^\circ C$ to $125^\circ C$	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
			$-40^\circ C$ to $125^\circ C$	120			dB

Output Characteristics							
	Output Swing from Positive Rail	$R_{LOAD} = 100k\Omega$ to $V_{S/2}$			10	15	mV
			-40°C to 125°C			30	
		$R_{LOAD} = 10k\Omega$ to $V_{S/2}$			75	100	mV
			-40°C to 125°C			180	mV
		$R_{LOAD} = 2k\Omega$ to $V_{S/2}$			400	500	mV
			-40°C to 125°C			750	mV
	Output Swing from Negative Rail	$R_{LOAD} = 100k\Omega$ to $V_{S/2}$			3	5	mV
			-40°C to 125°C			10	mV
		$R_{LOAD} = 10k\Omega$ to $V_{S/2}$			25	35	mV
			-40°C to 125°C			60	mV
		$R_{LOAD} = 2k\Omega$ 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/ μ s
			-40°C to 125°C	2.2			V/ μ s
t_{OR}	Overload Recovery				500		ns
t_S	Settling Time, 0.1%	$G = 1, 10V$ step			7		μ s
	Settling Time, 0.01%				12		μ s
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		μ V _{PP}
e_N	Input Voltage Noise Density	$f = 0.1Hz$			8		nV/ \sqrt{Hz}
		$f = 1kHz$			8		nV/ \sqrt{Hz}
		$f = 10kHz$			10		nV/ \sqrt{Hz}
		$f = 100kHz$			20		nV/ \sqrt{Hz}
i_N	Input Current Noise	$f = 10kHz$			200		fA/ \sqrt{Hz}
THD+N	Total Harmonic Distortion and Noise	$f = 1kHz, G = 1, R_L = 10k\Omega, V_{OUT} = 6V_{RMS}$			0.0005		%

Typical Performance Characteristics

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

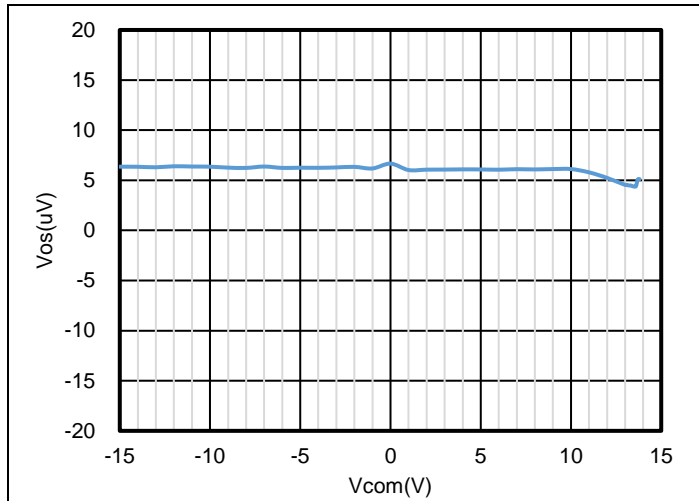


Figure 1. Offset Voltage vs. Common Mode Voltage

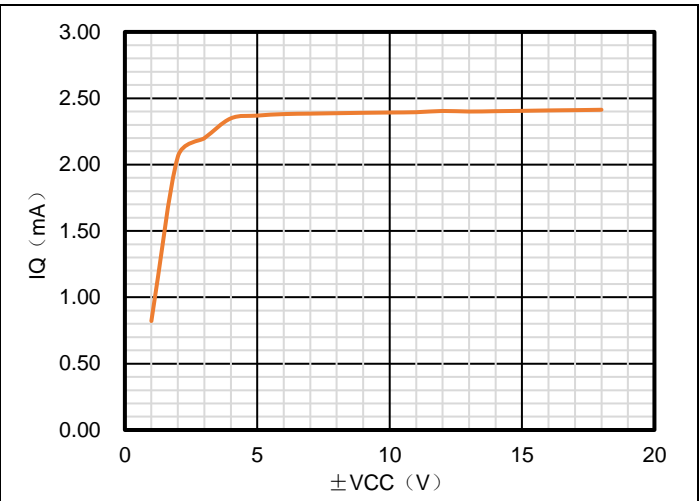


Figure 2. Iq vs. Supply Voltage

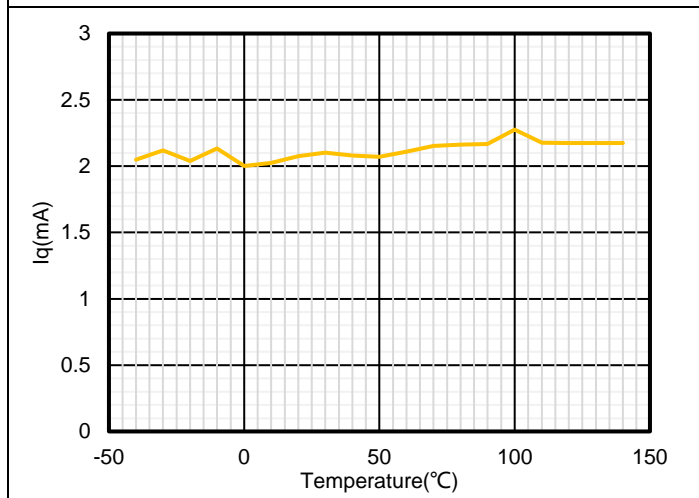


Figure 3. Iq vs. Temperature, +2.5V Supply

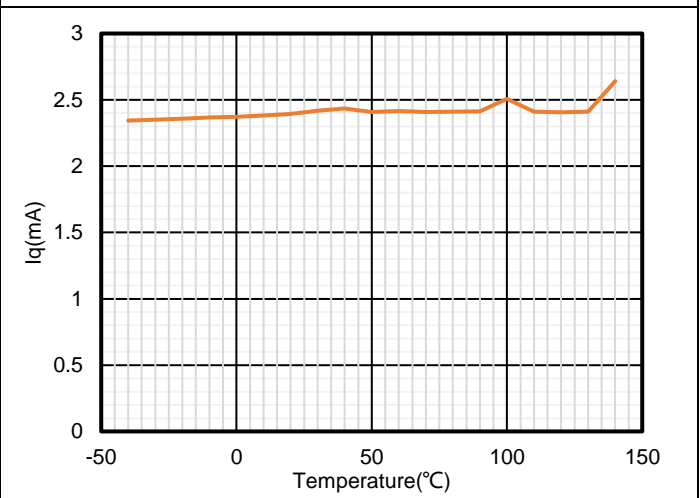


Figure 4. Iq vs. Temperature, ±15V Supply

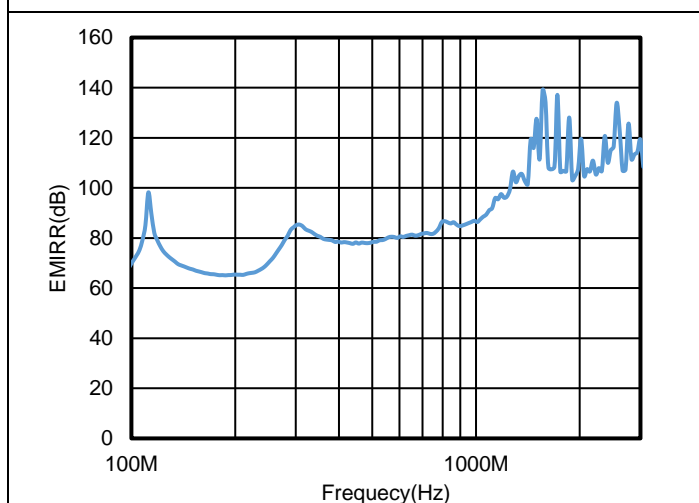


Figure 5. EMIRR vs. Frequency

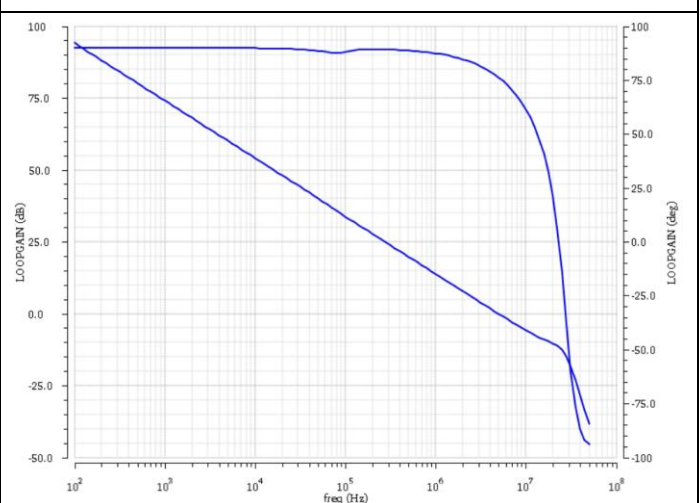


Figure 6. Open Loop Gain and Phase vs. Frequency

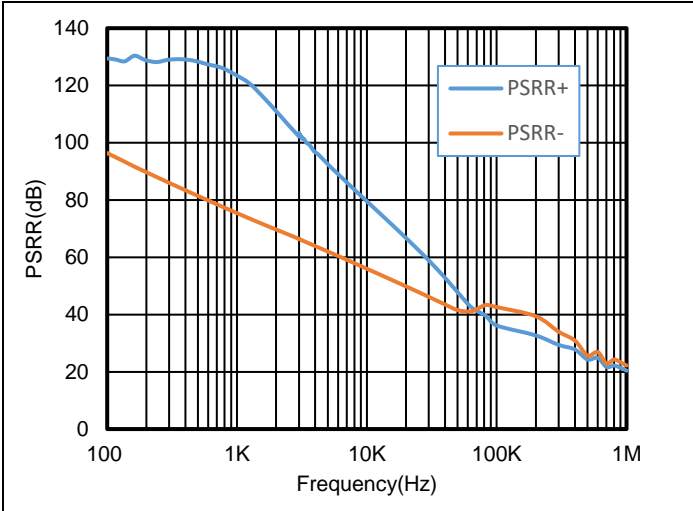


Figure 7. PSRR vs. Frequency

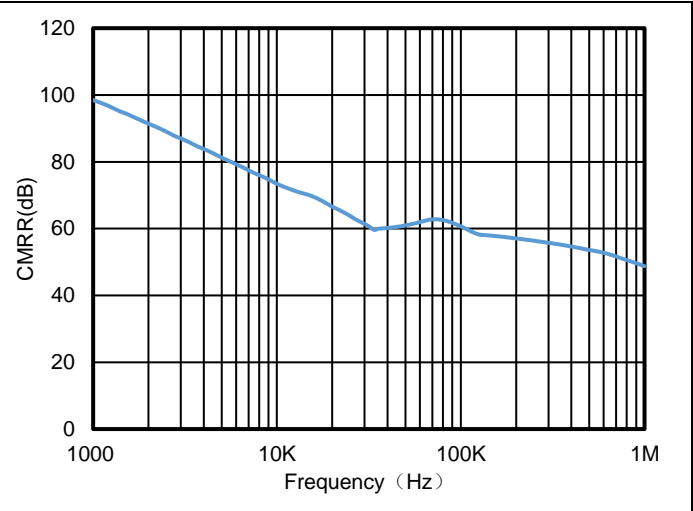
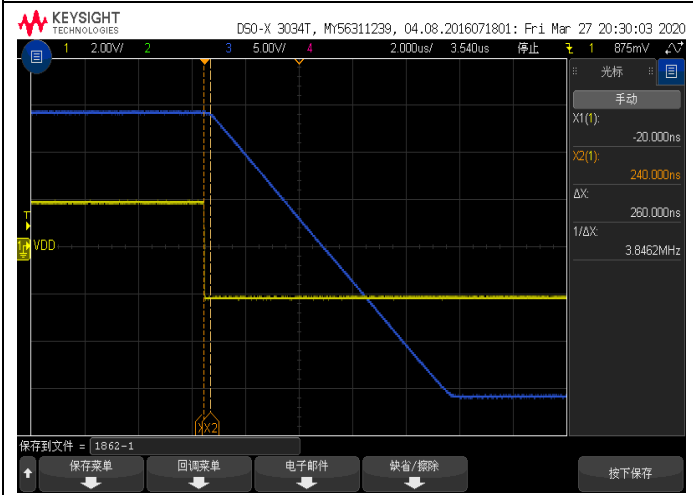
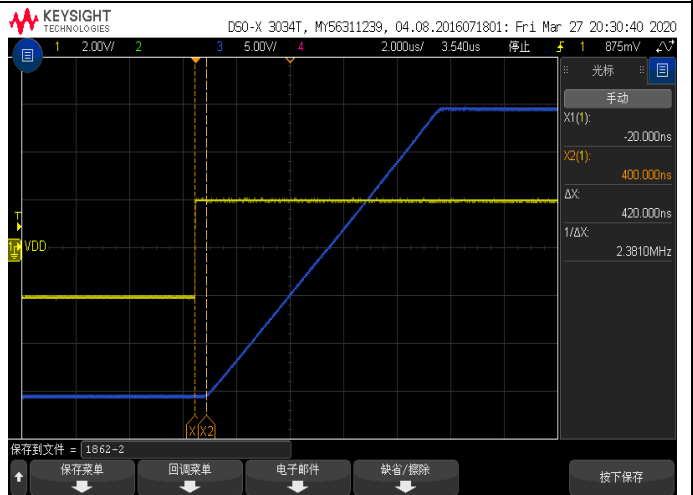


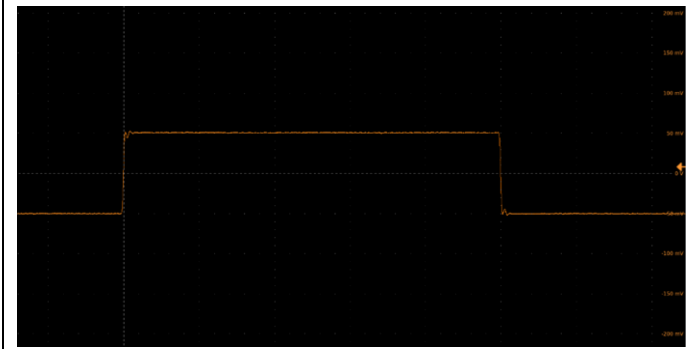
Figure 8. CMRR vs. Frequency



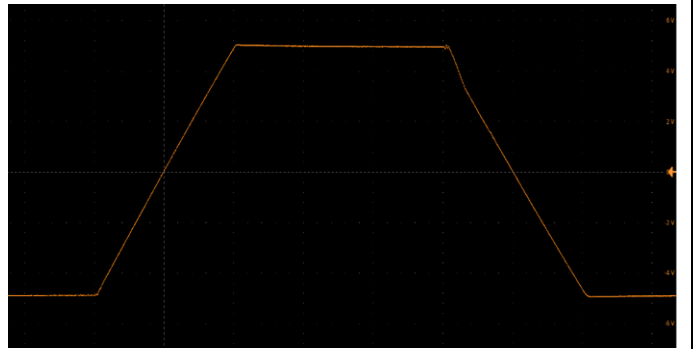
Time: 2us/div, Measure Time: 260ns
RL=2K, CL=100pF, G=10
Figure 9. Positive Overload Recovery



Time: 2us/div, Measure Time: 420ns
RL=2K, CL=100pF, G=10
Figure 10. Negative Overload Recovery



Voltage: 50mV/div, Time: 2us/div
RL=2K, CL=100pF, G=1
Figure 11. 100mV Signal Step Response



Voltage: 2V/div, Time: 2μs/div
RL=2K, CL=100pF, G=1
Figure 12. 10V Signal Step Response

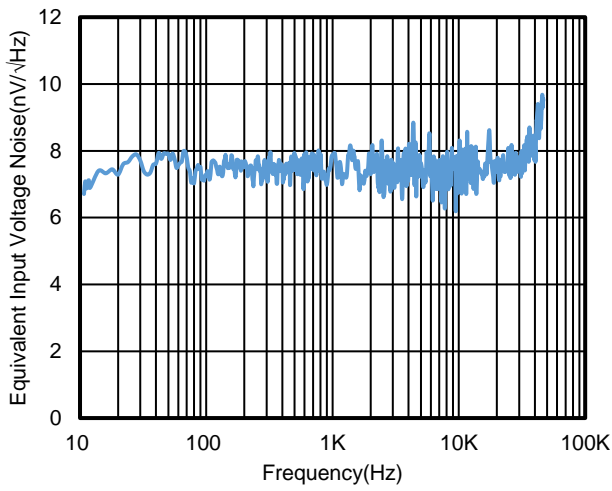


Figure 13. Voltage Noise Density vs. Frequency

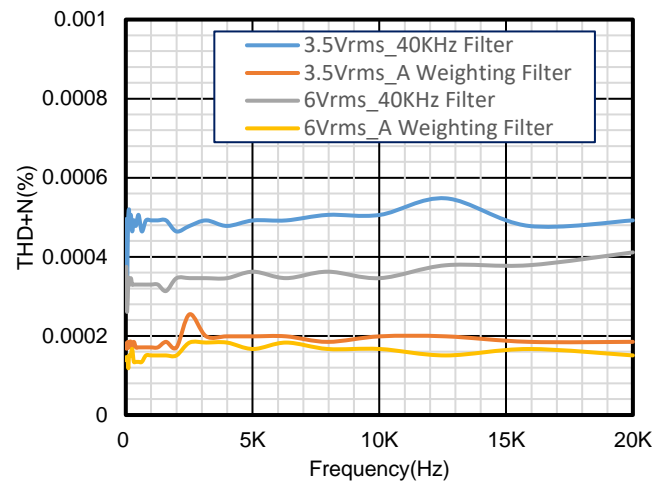


Figure 14. THD vs. Frequency, G = 1

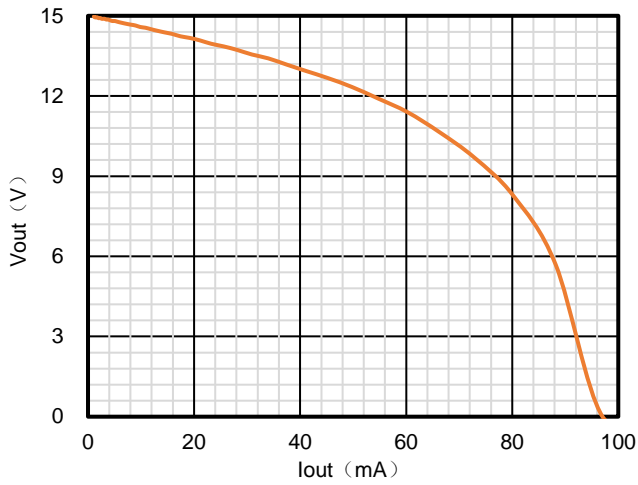


Figure 15. V_{OUT} vs. I_{OUT}, Source

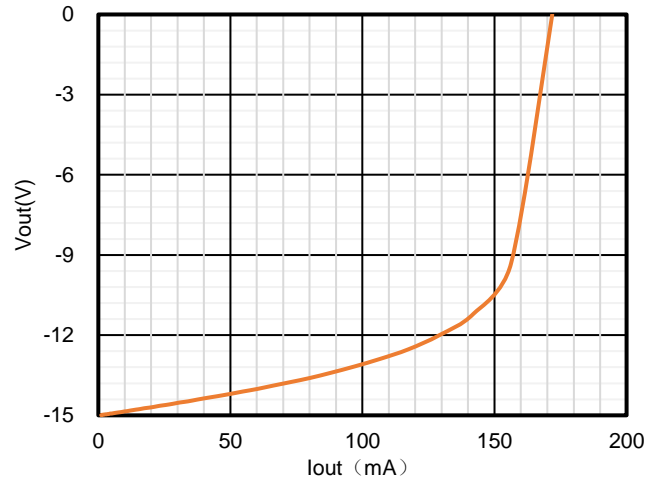
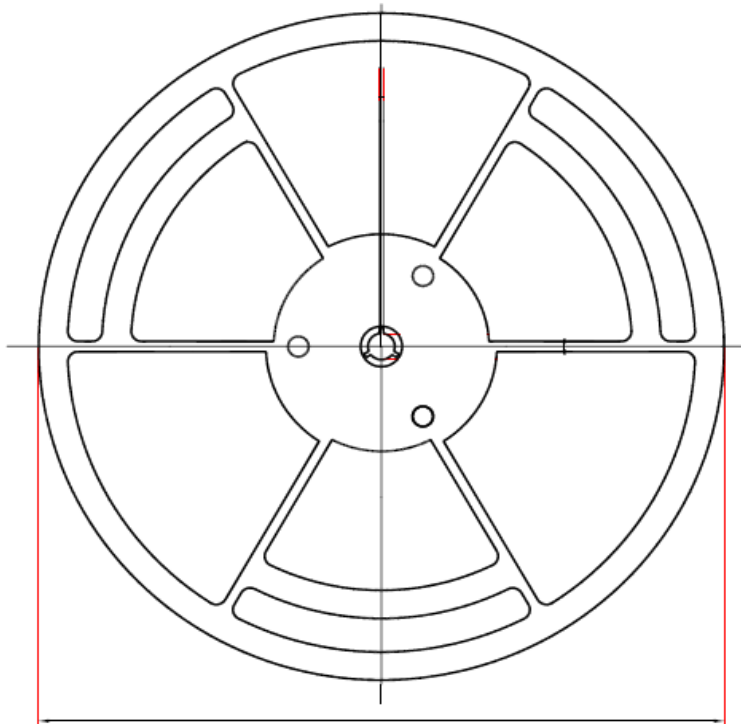
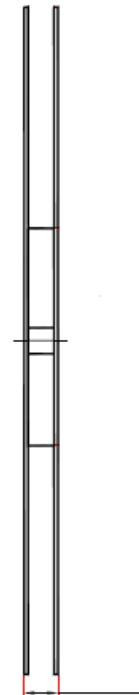


Figure 16. V_{OUT} vs. I_{OUT}, Sink

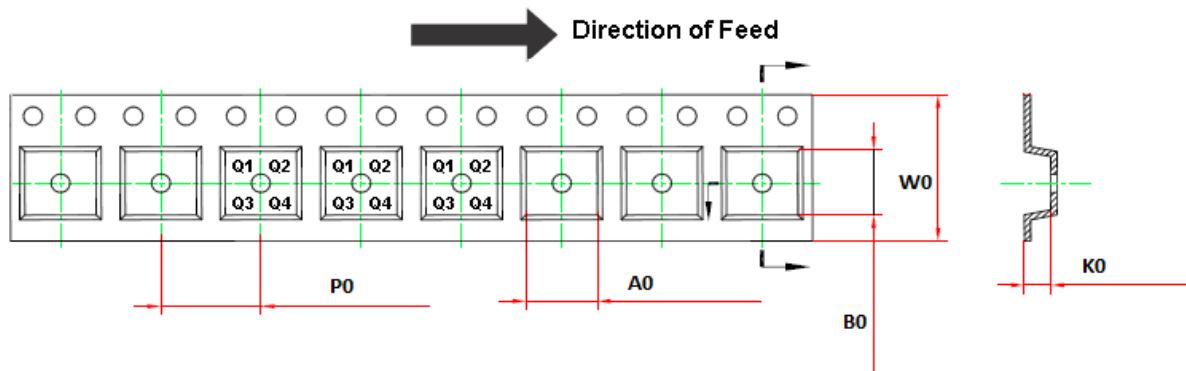
Tape and Reel Information



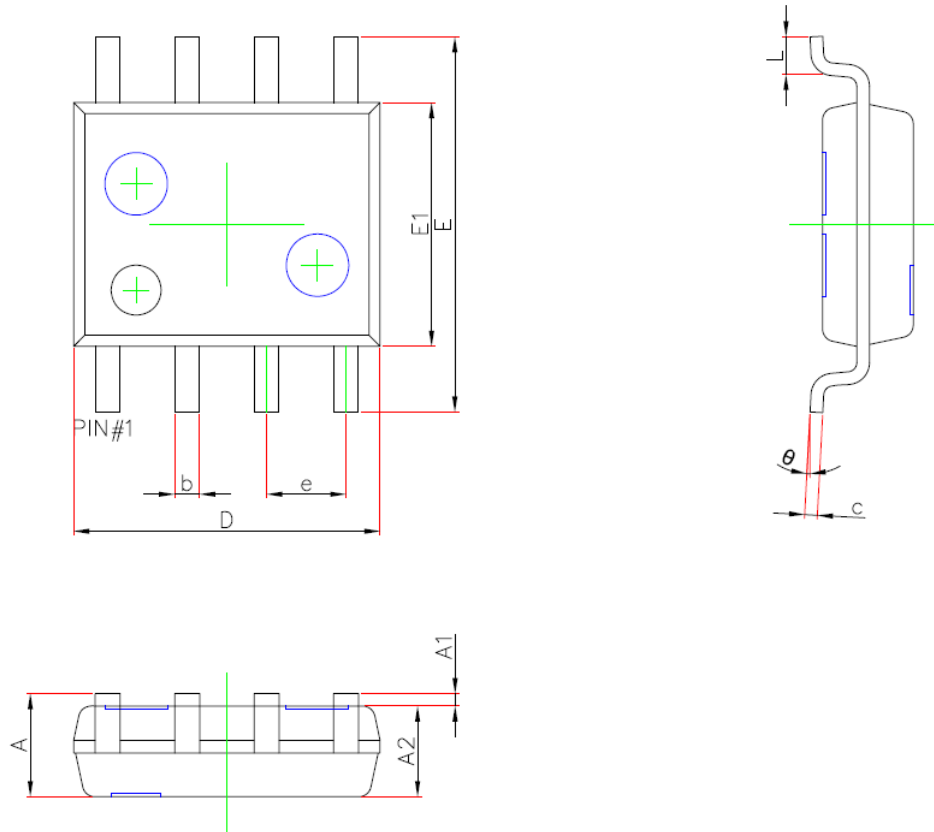
D1: Reel Diameter



W1: Reel Width



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°

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