36V, 8MHz Rail-to-Rail Output CMOS Operational Amplifier

1 FEATURES

- **High Gain Bandwidth: 8MHz**
- **Input Offset Voltage: ±0.5mV (Typical)**
- **Quiescent Current: 3mA/Amp**
- **Rail to Rail Output**
- **Supply Range: +5V to +36V**
- **Specified Up to +125°C**
- **Micro Size Packages: SOP8, MSOP8**

2 APPLICATIONS

- **Sensors**
- **Photodiode Amplification**
- **Active Filters**
- **Test Equipment**
- **Driving A/D Converters**

3 DESCRIPTIONS

The RS8452 families of products offer high voltage (36V) operation and rail-to-rail output, as well as excellent speed/power consumption ratio, providing an excellent bandwidth (8MHz) and slew rate of 5V/μs. The op-amps are unity gain stable and feature an ultra-low input bias current.

The input can operate normally within the negative power rail to 2V below of the positive power rail. The RS8452 families of operational amplifiers are specified at the full temperature range of −40°C to +125°C under single power supplies of 5V to 36V or dual power supplies of ±2.5V to ±18V.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE(NOM)
RS8452	SOP8	4.90mm x 3.90mm
	MSOP8	3.00mm x 3.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

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4 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

VERSION	Change Date	Change Item
A.1	2020/12/2	Initial version completed
A.2	2021/6/21	1. Fix TSSOP-14 Package mistake in Page 12 in A.1 Version 2. Added the value of Input Voltage Noise Density 3. Added the information of package size
A.3	2022/03/16	Increase the minimum junction temperature
A.4	2024/01/24	1. Added MSL on Page 7 in RevA.3 2. Update ELECTRICAL CHARACTERISTICS 3. Delete SOT23-5 Package
A.4.1	2024/03/01	Modify packaging naming
A.5	2024/12/24	1. Delete RS8454XP/RS8454XQ Orderable Device 2. Delete content related to RS8454 3. Change the product name to: RS8452

5 PACKAGE/ORDERING INFORMATION (1)

Orderable Device	Package Type	Pin	Channel	Op Temp(°C)	Device Marking (2)	MSL (3)	Package Qty
RS8452XK	SOP8	8	2	-40°C ~125°C	RS8452	MSL3	Tape and Reel,4000
RS8452XM	MSOP8	8	2	-40°C ~125°C	RS8452	MSL3	Tape and Reel,4000

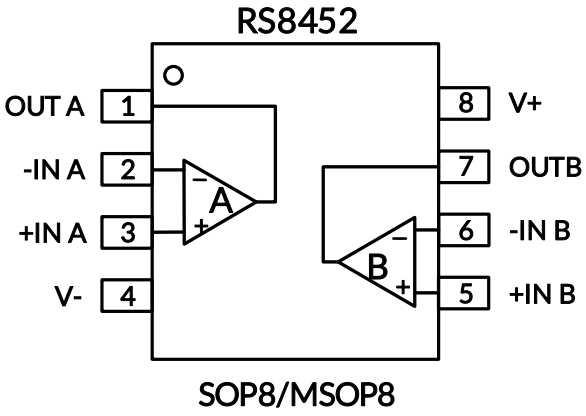
NOTE:

(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

6 PIN CONFIGURATION AND FUNCTIONS



Pin Description

NAME	PIN	I/O (1)	DESCRIPTION
	SOP8/MSOP8		
-INA	2	I	Inverting input, channel A
+INA	3	I	Noninverting input, channel A
-INB	6	I	Inverting input, channel B
+INB	5	I	Noninverting input, channel B
OUTA	1	O	Output, channel A
OUTB	7	O	Output, channel B
V-	4	-	Negative (lowest) power supply or ground (for single supply operation)
V+	8	-	Positive (highest) power supply

(1) I = Input, O = Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

			MIN	MAX	UNIT
Voltage	Supply, V_S=(V+) - (V-)		-0.7	36	V
	Signal input pin (2)		(V-)-0.2	(V+) +0.2	
	Signal output pin (3)		(V-)-0.2	(V+) +0.2	
Current	Signal input pin (2)		-10	10	mA
	Signal output pin (3)		-100	100	mA
	Output short-circuits (4)		Continuous		
θ_{JA}	Package thermal impedance (5)	SOP8		110	°C/W
		MSOP8		170	
Temperature	Operating range, T_A		-40	125	°C
	Junction, T_J (6)		-40	150	
	Storage, T_{stg}		-55	150	

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.2V beyond the supply rails should be current-limited to 10mA or less.
(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.2V beyond the supply rails should be current-limited to ±100mA or less.
(4) Short-circuit to ground, one amplifier per package.
(5) The package thermal impedance is calculated in accordance with JESD-51.
(6) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM)	±5000	V
		Machine Model (MM)	±200	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

7.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
Supply voltage, V_S= (V+) - (V-)	Single-supply	5		36	V
	Dual-supply	±2.5		±18	

7.4 Electrical Characteristics

(At T_A = +25°C, V_S=5V to 36V, R_L = 10kΩ connected to V_S/2, and V_{OUT} = V_S/2, V_{CM} = V_S/2, Full [9] = -40°C to 125°C, unless otherwise noted.) [1]

PARAMETER		CONDITIONS	T_J	RS8452			UNITS
				MIN[2]	TYP[3]	MAX[2]	
POWER SUPPLY							
V_S	Operating Voltage Range		25°C	5		36	V
I_Q	Quiescent Current Per Amplifier	V_S=±2.5V, Io=0mA	25°C		3.0	4.75	mA
		V_S=±18V, Io=0mA			3.8	5.75	
PSRR	Power-Supply Rejection Ratio	V_S=5V to 36V	25°C	93	110		dB
INPUT							
Vos	Input Offset Voltage	V_{CM}= V_S/2	25°C	-3	±0.5	3	mV
			Full		±1.3		
Vos Tc	Input Offset Voltage Average Drift		Full		±5		μV/°C
IB	Input Bias Current [4] [5]	V_{CM}=0V	25°C		10	60	pA
			Full		600		
I_{OS}	Input Offset Current [5]	V_{CM}=0V	25°C		10	60	pA
			Full		600		
V_{CM}	Common-Mode Voltage Range	V_S= ±18V	25°C	(V-)		(V+)-2	V
CMRR	Common-Mode Rejection Ratio	V_S= ±2.5V, V_{CM}=(V-) to (V+)-2V	25°C	70	110		dB
		V_S= ±18V, V_{CM}=(V-) to (V+)-2V	25°C	70			
OUTPUT							
A_{OL}	Open-Loop Voltage Gain	R_L=10KΩ, V_O=(V-)+0.6V to (V+)-0.6V	25°C	84	100		dB
			Full	70			
V_{OH}	Output Swing	V_S=±18V, R_L=10KΩ	25°C	17.85			V
V_{OL}						-17.85	V
I_{SC}	Short-circuit current [6] [7]		25°C	±55	±100		mA
C_{LOAD}	Capacitive load drive		25°C		70		pF
FREQUENCY RESPONSE							
SR	Slew Rate [8]	G=+1, C_L=70pF	25°C		5		V/μs
GBW	Gain-Bandwidth Product		25°C		8		MHz
t_S	Settling Time,0.01%	V_S=±2.5V, G=+1, C_L=70pF, Step=2V	25°C		1.0		μs
t_{OR}	Overload Recovery Time	V_{IN}·Gain≥V_S, G=11	25°C		1.0		μs
t_{ON}	Turn On Time		25°C		10		μs
NOISE							
En	Input Voltage Noise	f = 0.1Hz to 10Hz, V_S=±2.5V	25°C		7		μVpp
en	Input Voltage Noise Density	f = 1KHz	25°C		35		nV/$\sqrt{Hz}$

NOTE:
(1) Electrical table values apply only for factory testing conditions at the temperature indicated. Factory testing conditions result in very limited self-heating of the device.
(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.
(4) Positive current corresponds to current flowing into the device.
(5) This parameter is ensured by design and/or characterization and is not tested in production.
(6) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is PD = ($T_{J(MAX)}$ - T_A) / $R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.
(7) Short circuit test is a momentary test.
(8) Number specified is the slower of positive and negative slew rates.
(9) Specified by characterization only.

7.5 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At T_A = +25°C, V_S=±18V, R_L = 10kΩ connected to V_S/2, V_{OUT} = V_S/2, unless otherwise noted.

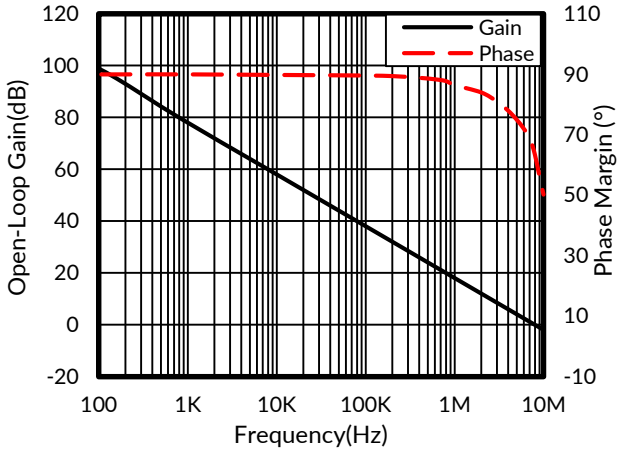


Figure 1. Open-Loop Gain and Phase vs Frequency

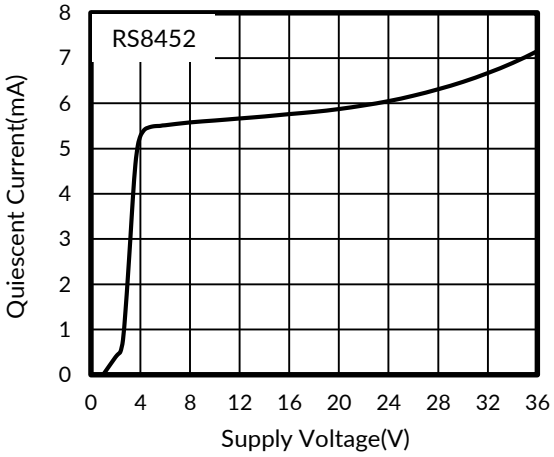


Figure 2. Supply Voltage vs Quiescent Current

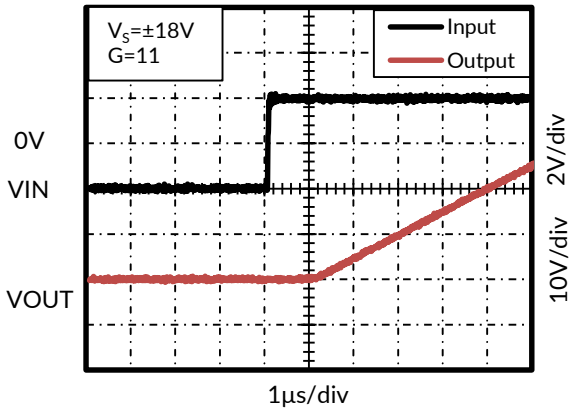


Figure 3. Positive Overvoltage Recovery

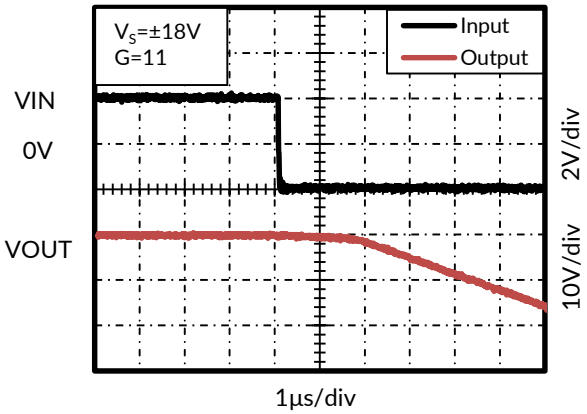


Figure 4. Negative Overvoltage Recovery

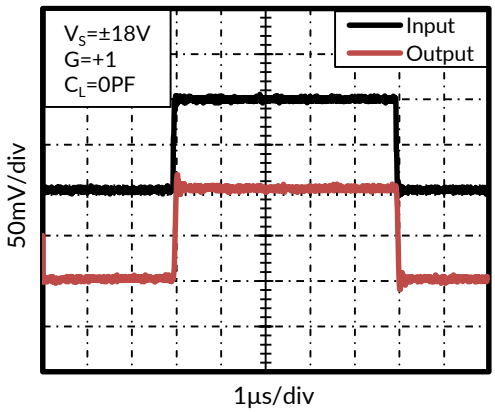


Figure 5. Small Signal Step Response

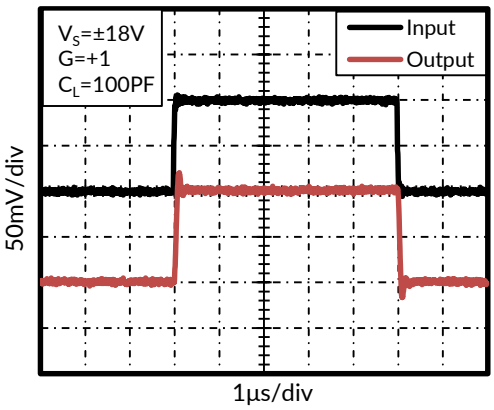


Figure 6. Small Signal Step Response

Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At T_A = +25°C, V_S=±18V, R_L = 10kΩ connected to $V_S/2$, V_{OUT} = $V_S/2$, unless otherwise noted.

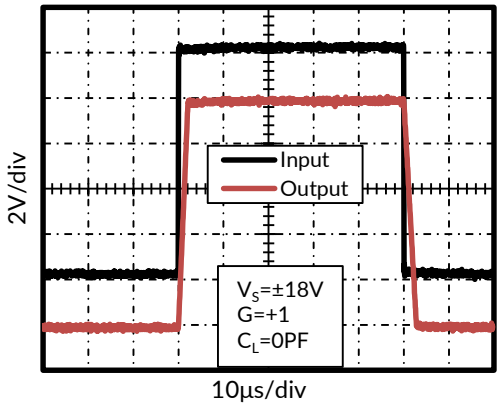


Figure 7. Large Signal Step Response

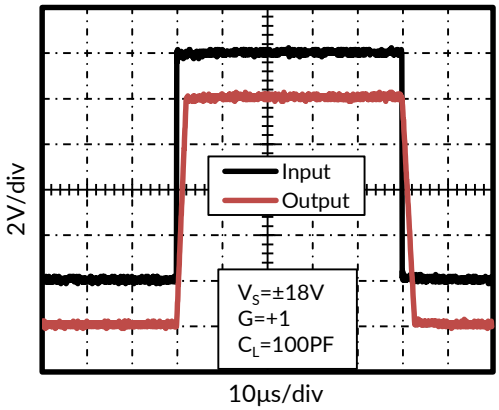


Figure 8. Large Signal Step Response

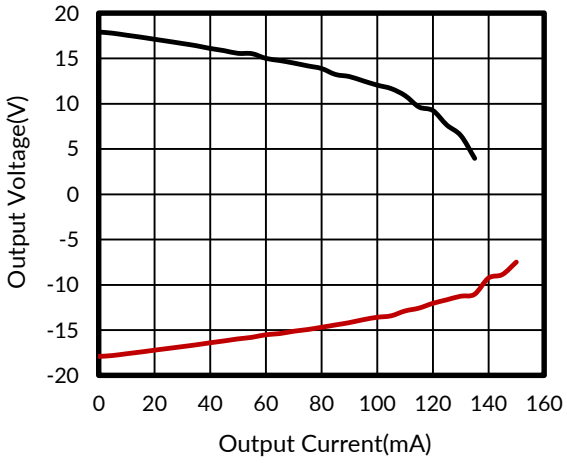


Figure 9. Output Voltage Swing vs Output Current

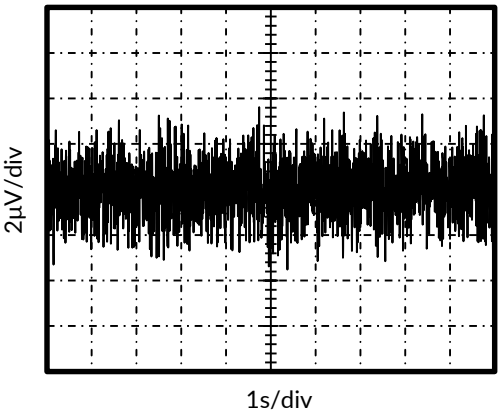
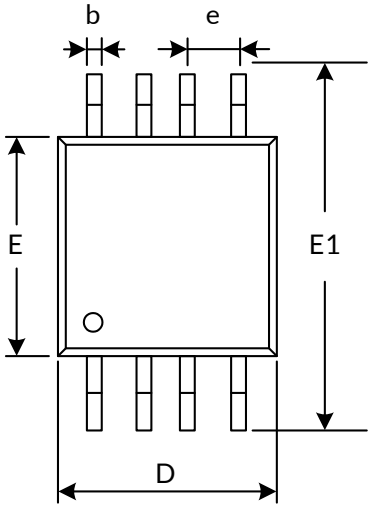
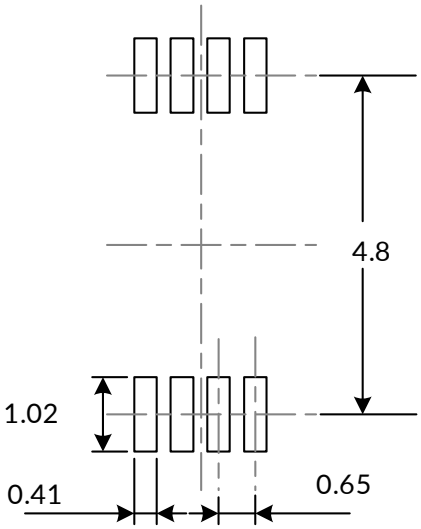


Figure 10. 0.1Hz to 10Hz Noise at Vs=5V

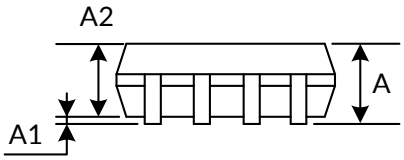
8 PACKAGE OUTLINE DIMENSIONS

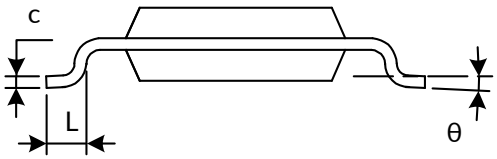
MSOP8 (3)





RECOMMENDED LAND PATTERN (Unit: mm)



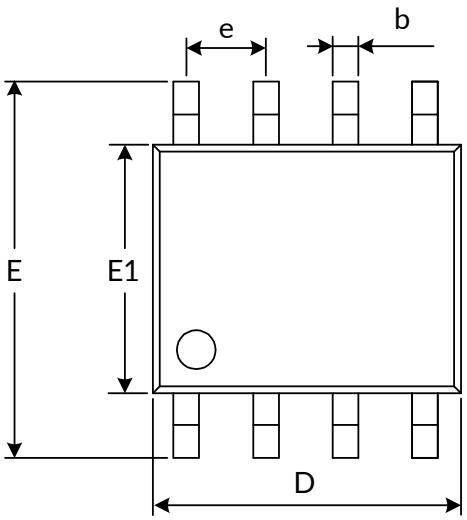


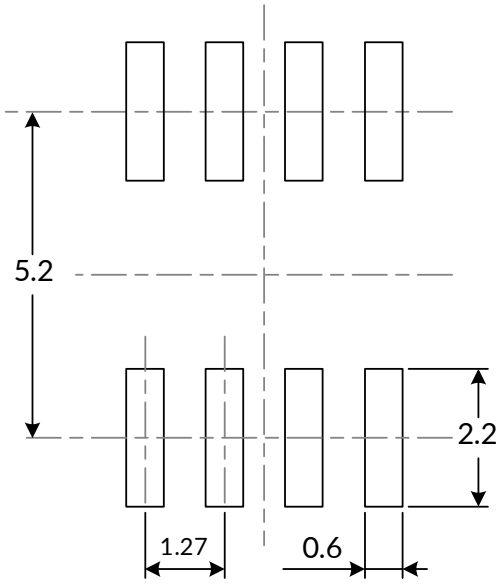
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D (1)	2.900	3.100	0.114	0.122
e	0.650(BSC) (2)		0.026(BSC) (2)	
E (1)	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

NOTE:

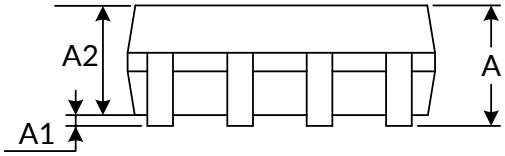
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

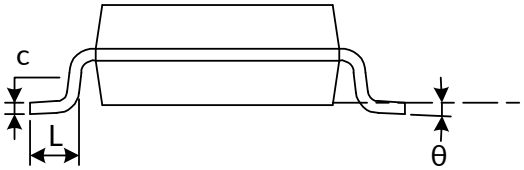
SOP8 (3)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	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 (1)	4.800	5.000	0.189	0.197
e	1.270(BSC) (2)		0.050(BSC) (2)	
E	5.800	6.200	0.228	0.244
E1 (1)	3.800	4.000	0.150	0.157
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

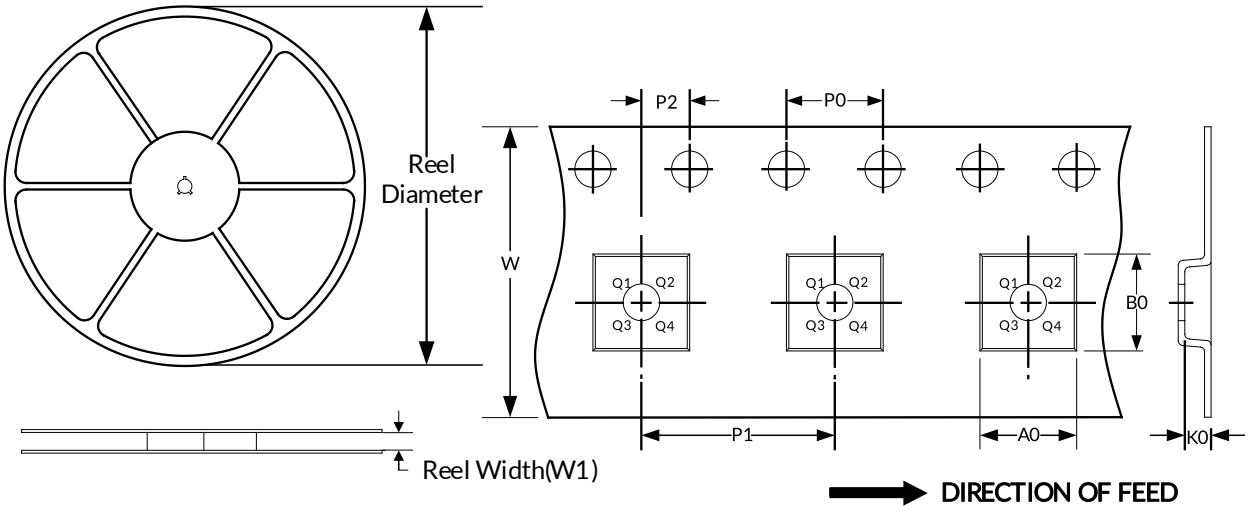
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

9 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOP8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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