LOW-POWER LOW OFFSET VOLTAGE DUAL COMPARATORS

Description

The AS393/393A consist of two independent precision voltage comparators with a typical offset voltage of 1.0mV and high gain. They are specifically designed to operate from a single power supply over wide range of voltages. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.

The AS393/393A series are compatible with industry standard 393. The AS393A has more stringent input offset voltage than the AS393.

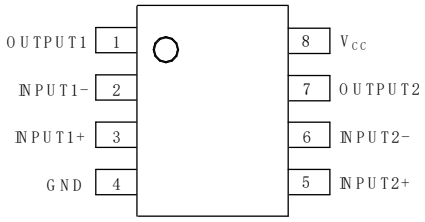
The AS393 is available in standard SO-8 and MSOP-8 packages, the AS393A is available in standard SO-8 package.

Features

- Wide Supply Voltage Range
  - Single Supply: 2V to 36V
  - Dual Supplies: ±1.0V to ±18V
- Low Supply Current Drain: 0.6mA
- Low Input Bias Current: 25nA (typical)
- Low Input Offset Current: ±5.0nA (typical)
- Low Input Offset Voltage: 1.0mV (typical)
- Input Common Mode Voltage Range Includes Ground
- Differential Input Voltage Range Equals to the Power Supply Voltage
- Low Output Saturation Voltage: 200mV at 4mA
- Open Collector Output
- Lead-Free Package: SO-8
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in “Green” Molding Compound: SO-8, MSOP-8
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. “Green” Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

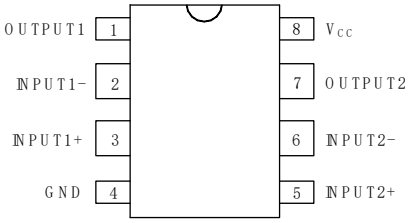
Pin Assignments

(Top View)



SO-8/TSSOP-8 (EOL)/MSOP-8

(Top View)



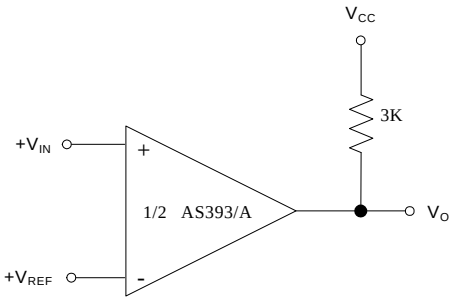
PDIP-8 (EOL)

Applications

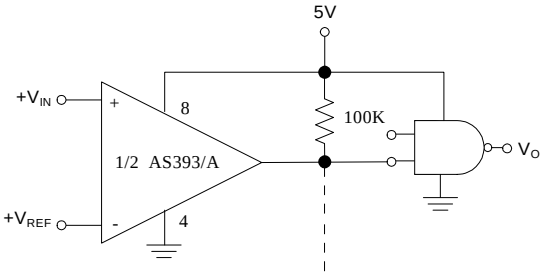
- Battery chargers
- Cordless telephones
- Switching power supplies
- DC-DC modules
- PC motherboards
- Communication equipment

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



Basic Comparator



Driving CMOS

Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating		Unit
V_{CC}	Supply Voltage	40		V
V_{ID}	Differential Input Voltage	40		V
V_{IN}	Input Voltage	-0.3 to 40		V
I_{IN}	Input Current (V_{IN} < -0.3V) (Note 5)	50		mA
—	Output Short-Circuit Current to Ground	Continuous		—
P_D	Power Dissipation (T_A = +25°C)	PDIP-8	780	mW
		SOIC-8	660	
		TSSOP-8	570	
		MSOP-8	450	
T_J	Operating Junction Temperature	+150		°C
T_{STG}	Storage Temperature	-65 to +150		°C
T_{LEAD}	Lead Temperature (Soldering, 10 Seconds)	+260		°C

Notes: 4. Stresses greater than those listed under *"Absolute Maximum Ratings"* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to *"Absolute Maximum Ratings"* for extended periods can affect device reliability.

5. This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3 V_{DC} (at +25°C).

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2	36	V
T_A	Operating Temperature Range	-40	+85	°C

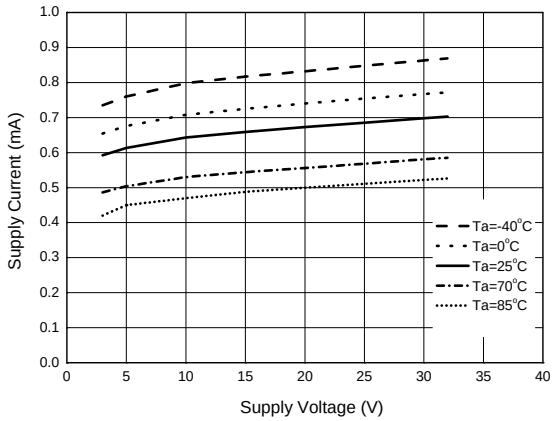
Electrical Characteristics (Limits in standard typeface are for T_A = +25°C, **bold** typeface applies over T_A = -40°C to +85°C (Note 6), V_{CC} = 5V, GND = 0V, unless otherwise specified.)

Parameter	Conditions		Min	Typ	Max	Unit
Input Offset Voltage	V_O = 1.4V, R_S = 0Ω, V_{CC} = 5 to 30V	AS393	—	1.0	5.0	mV
			—	—	7	
		AS393A	—	1.0	3.0	
			—	—	5	
Input Bias Current	I_{IN}+ or I_{IN}- with output in linear range, V_{CM} = 0V		—	25	250	nA
			—	—	400	
Input Offset Current	I_{IN}+-I_{IN}-, V_{CM} = 0V		—	5.0	50	nA
			—	—	200	
Input Common Mode Voltage Range (Note 7)	V_{CC} = 30V		0	—	V_{CC}-1.5	V
Supply Current	R_L = ∞	V_{CC} = 5V	—	0.4	1.0	mA
			—	—	2	
		V_{CC} = 30V	—	0.7	1.7	
			—	—	3	
Voltage Gain	V_{CC} = 15V, R_L ≥ 15kΩ, V_O = 1V to 11V		50	200	—	V/mV
Large Signal Response Time	V_{IN} = TTL Logic Swing, V_{REF} = 1.4V, V_{RL} = 5V, R_L = 5.1k		—	200	—	ns
Response Time	V_{RL} = 5V, R_L = 5.1k		—	1.3	—	µs
Output Sink Current	V_{IN}- = 1V, V_{IN}+ = 0V, V_O = 1.5V		6.0	16	—	mA
Output Leakage Current	V_{IN}- = 0V, V_{IN}+ = 1V, V_O = 5V		—	0.1	—	nA
	V_{IN}- = 0V, V_{IN}+ = 1V, V_O = 30V		—	—	1	µA
Saturation Voltage	V_{IN}- = 1V, V_{IN}+ = 0, I_{SINK} ≤ 4mA		—	200	400	mV
			—	—	500	
Thermal Resistance (Junction to Case)	SO-8		—	9	—	°C/W
	TSSOP-8		—	15	—	
	MSOP-8		—	24	—	
Thermal Resistance (Junction to Ambient)	SO-8		—	108	—	
	TSSOP-8		—	179	—	
	MSOP-8		—	151	—	

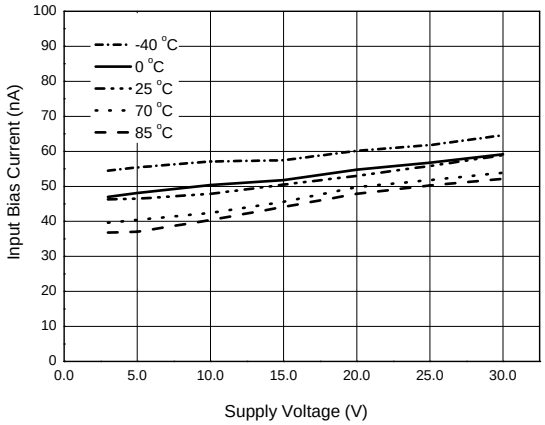
Notes: 6. These specifications are limited to -40°C ≤ T_A ≤ +85°C. Limits over temperature are guaranteed by design, but not tested in production.
7. The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at +25°C). The upper end of the common-mode voltage range is V_{CC}-1.5V (at +25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the V_{CC}.

Performance Characteristics

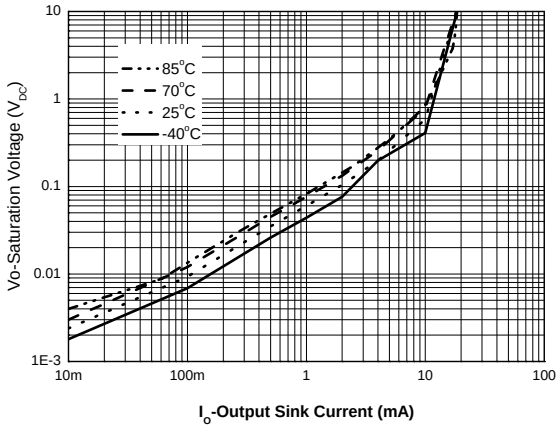
Supply Voltage vs. Supply Current



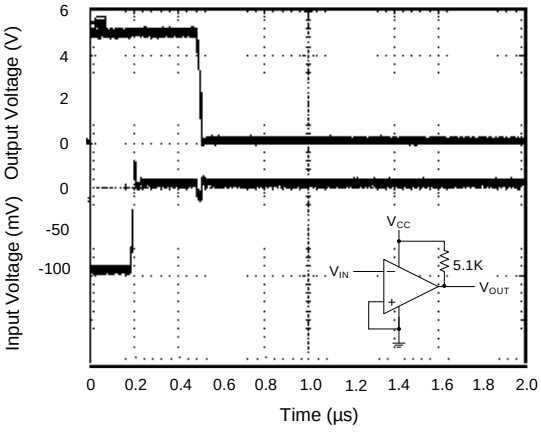
Supply Voltage vs. Input Bias Current



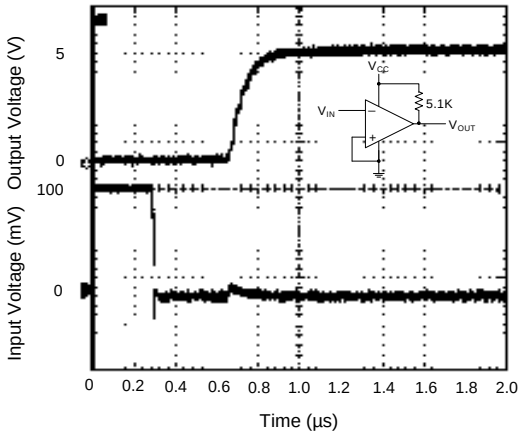
Output Sink Current vs. Saturation Voltage



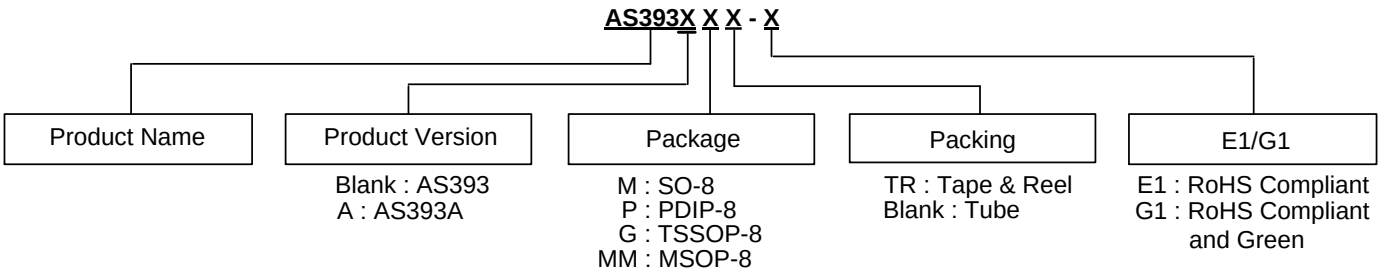
Response Time for 5mV Input Overdrive – Negative Transition



Response Time for 5mV Input Overdrive – Positive Transition



Ordering Information

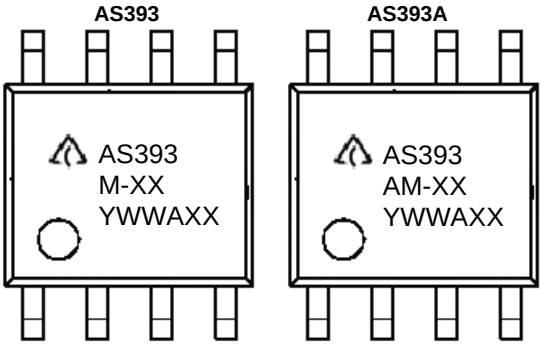


Orderable Part Number	Package (Note 9)	RoHS Compliant Lead Free / Green	Marking ID	Packing		Status (Note 8)	Alternative
				Qty.	Carrier		
AS393MTR-E1	SO-8	Lead Free	AS393M-E1	4000	Tape & Reel	NRND	AS393MTR-G1
AS393MTR-G1		Green	AS393M-G1	4000	Tape & Reel	In Production	—
AS393AMTR-E1		Lead Free	AS393AM-E1	4000	Tape & Reel	NRND	AS393AMTR-G1
AS393AMTR-G1		Green	AS393AM-G1	4000	Tape & Reel	In Production	—
AS393P-E1	PDIP-8	Lead Free	AS393P-E1	50	Tube	EOL	—
AS393AP-E1		Lead Free	AS393AP-E1	50	Tube	EOL	—
AS393GTR-E1	TSSOP-8	Lead Free	EG3C	4000	Tape & Reel	EOL	—
AS393GTR-G1		Green	GG3C	4000	Tape & Reel	EOL	—
AS393MMTR-G1	MSOP-8	Green	AS393MM-G1	2500	Tape & Reel	In Production	—

Notes: 8. All variants in PDIP-8 & TSSOP-8 packages are End of life without replacements.
NRND: Not Recommended for New Design.
9. For packaging details, go to our website at: https://www.diodes.com/design/support/packaging/diodes-packaging/.

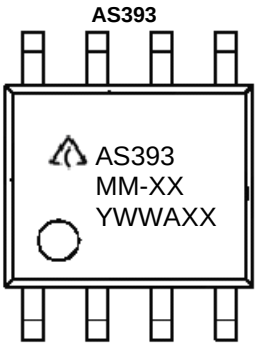
Marking Information

(1) SO-8



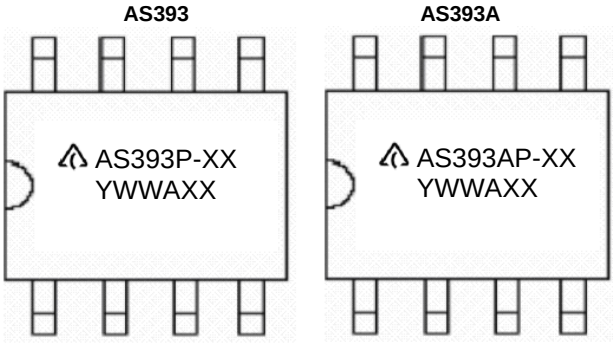
First and Second Lines: Logo and Marking ID
(See Ordering Information)
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

(2) MSOP-8



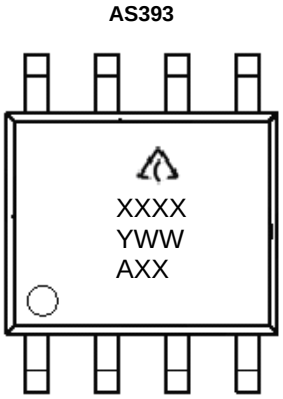
First and Second Lines: Logo and Marking ID
(See Ordering Information)
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

(3) PDIP-8



First Line: Logo and Marking ID (See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

(4) TSSOP-8

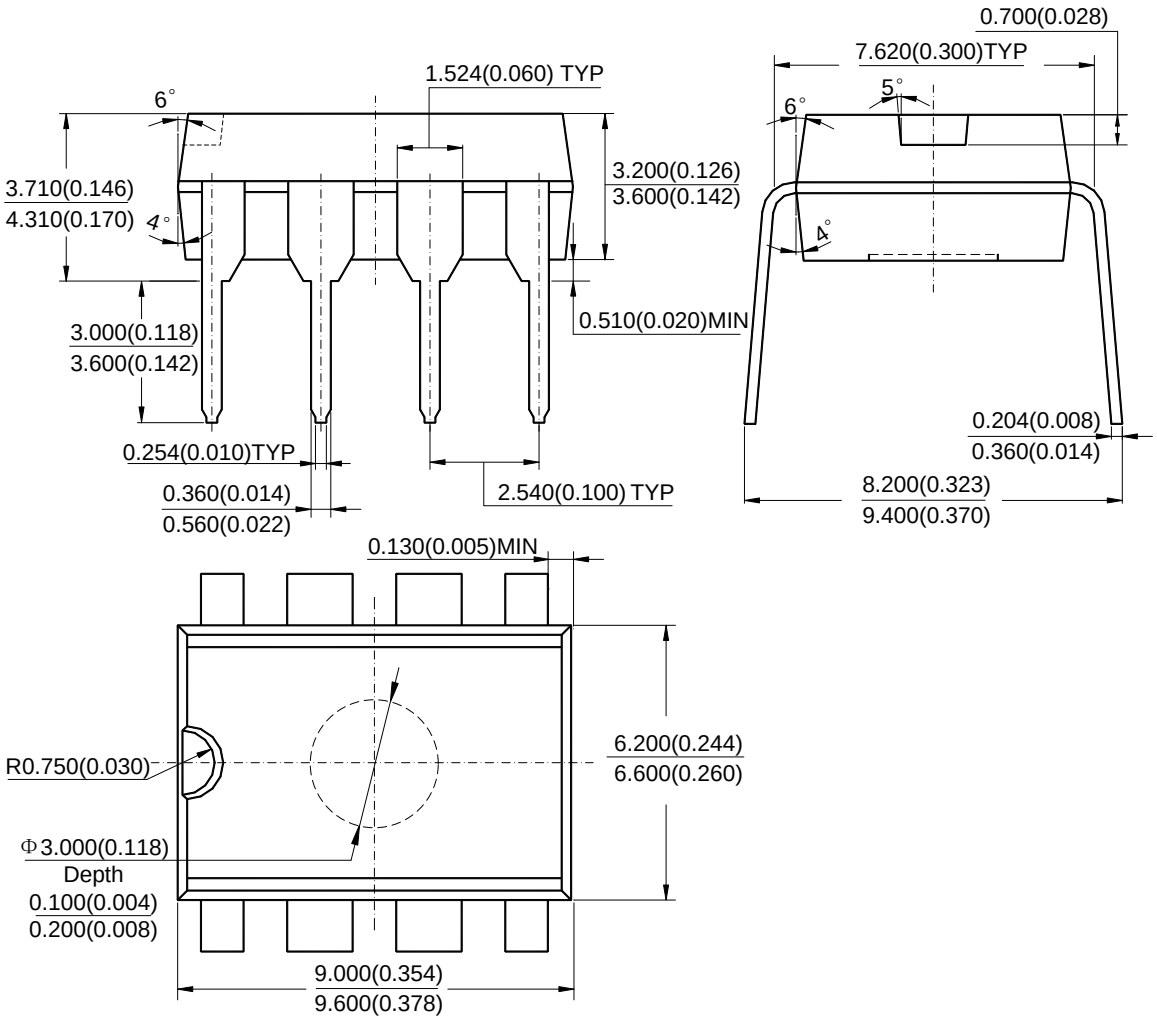


First Line: Logo
Second Line: Marking ID (See Ordering Information)
Third and Fourth Lines: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

Package Outline Dimensions (All dimensions in mm(inch).)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: PDIP-8

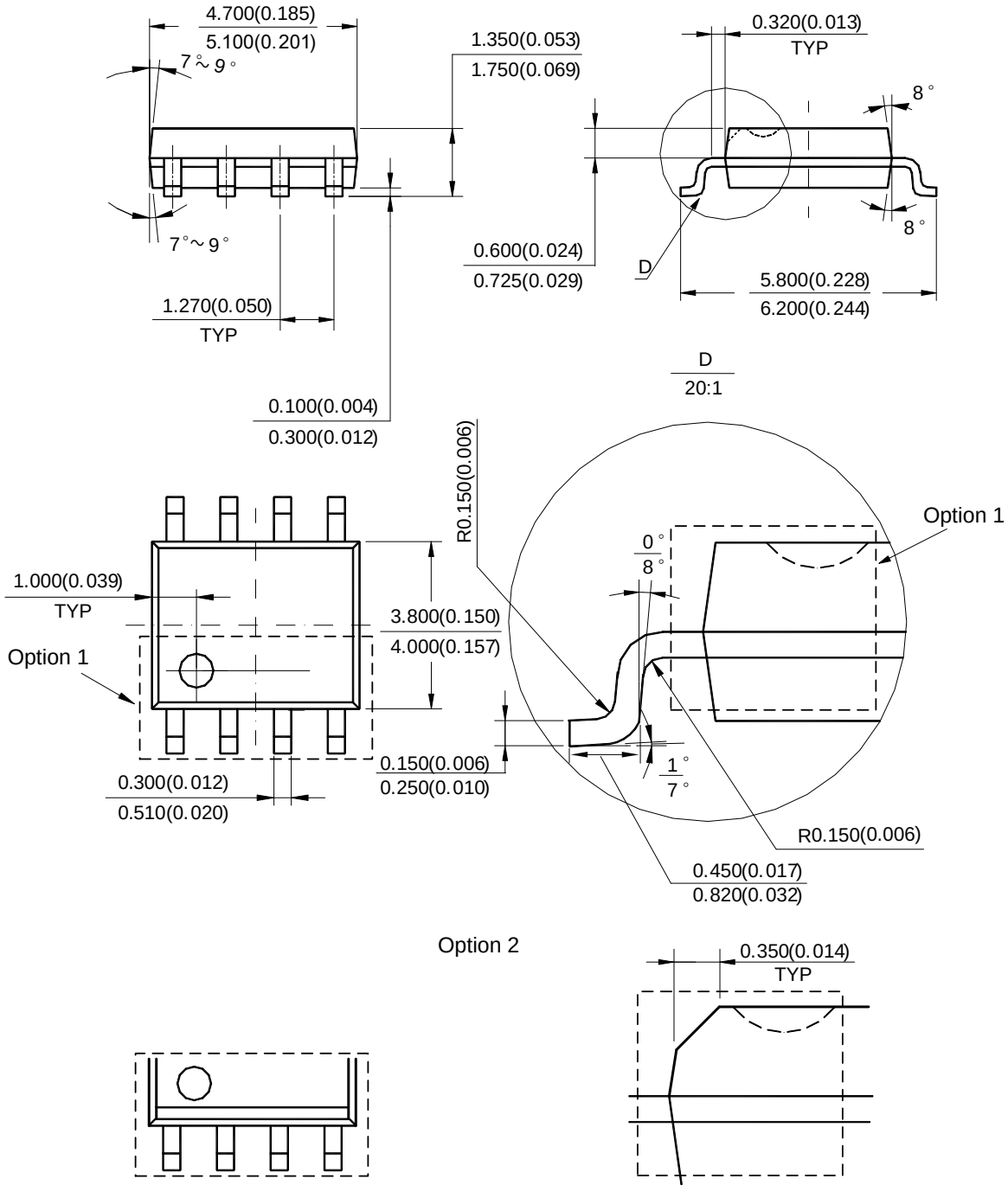


Note: Eject hole, oriented hole and mold mark is optional.

Package Outline Dimensions (Continued. All dimensions in mm(inch).)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(2) Package Type: SO-8

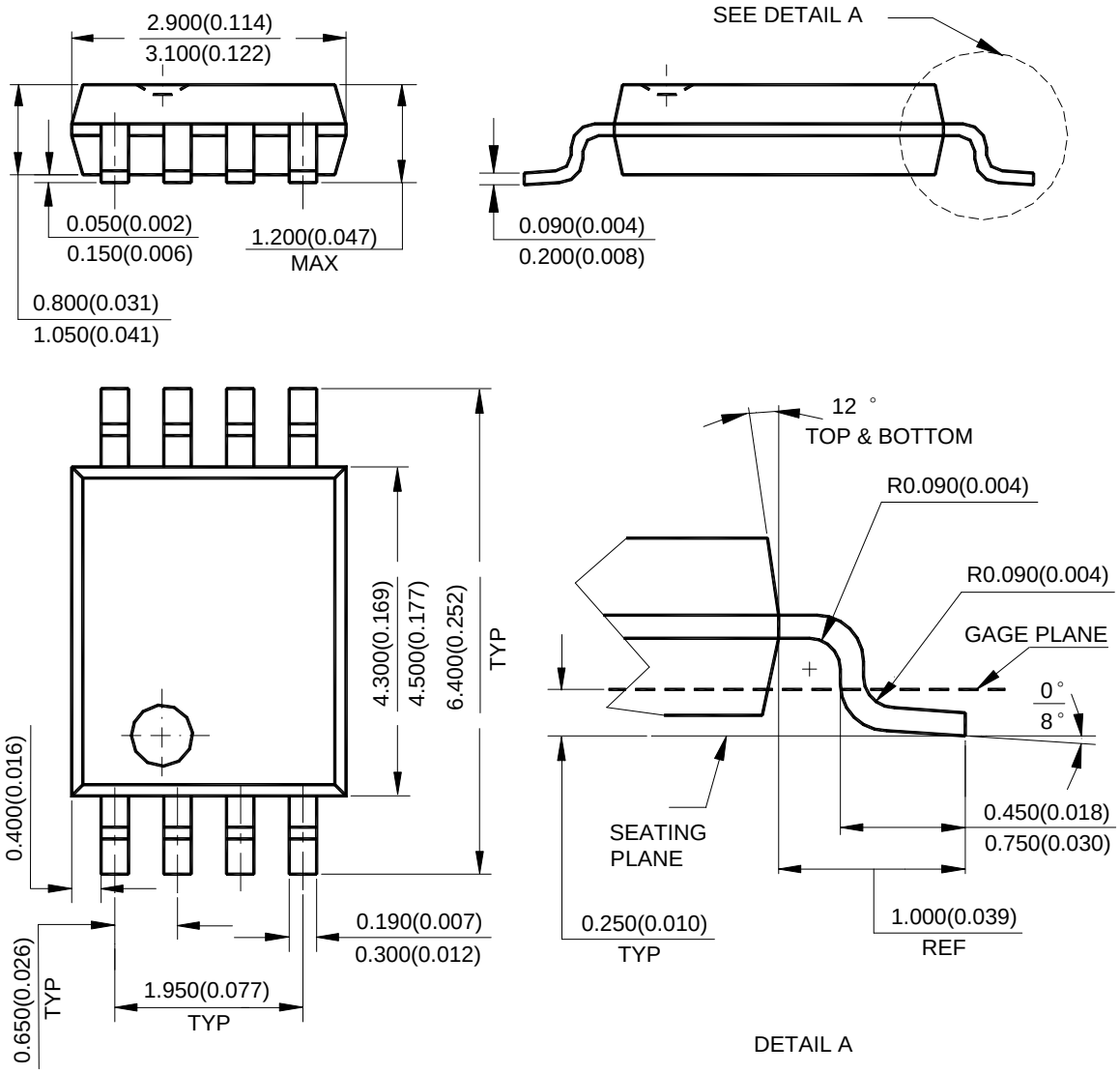


Note: Eject hole, oriented hole and mold mark is optional.

Package Outline Dimensions (Continued. All dimensions in mm(inch).)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(3) Package Type: TSSOP-8

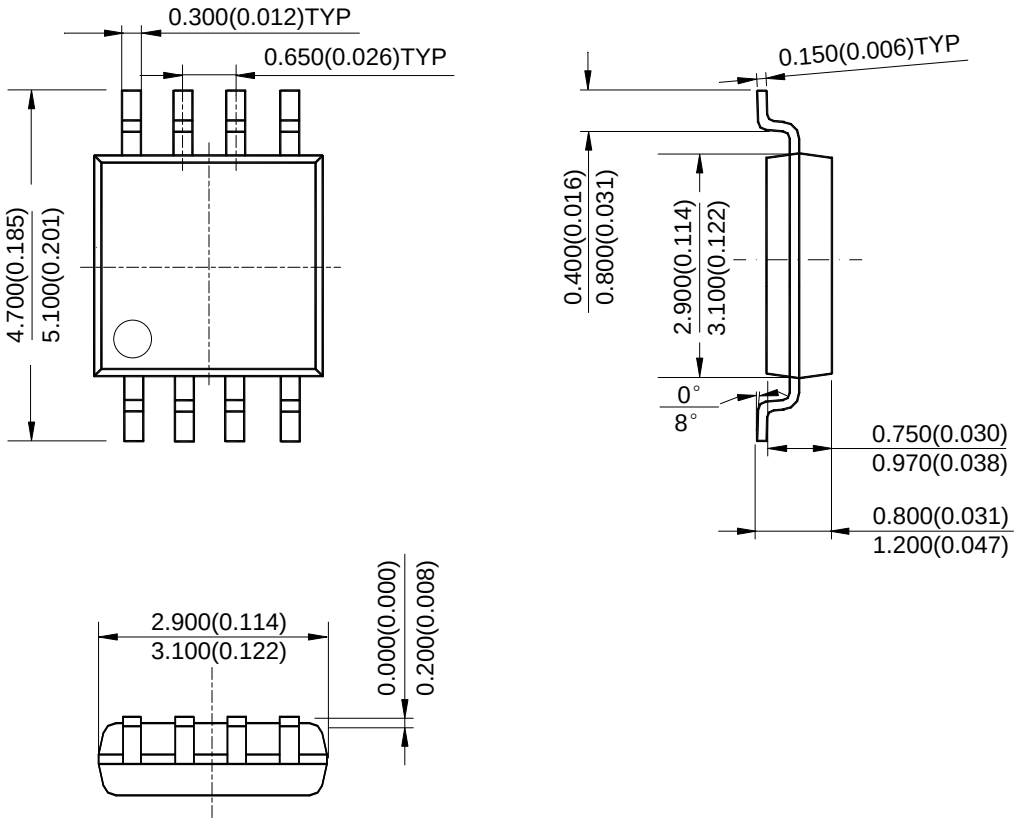


Note: Eject hole, oriented hole and mold mark is optional.

Package Outline Dimensions (Continued. All dimensions in mm(inch).)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(4) Package Type: MSOP-8

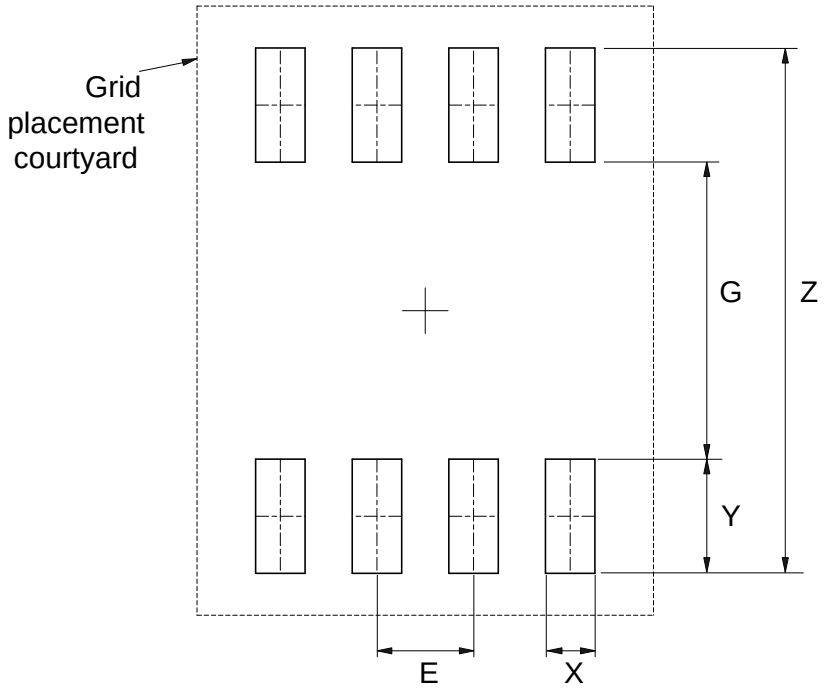


Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SO-8

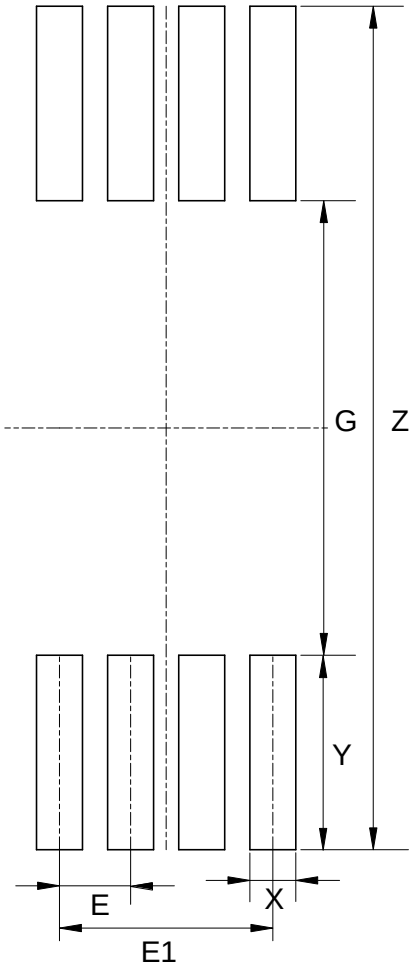


Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

Suggested Pad Layout (continued)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(2) Package Type: TSSOP-8

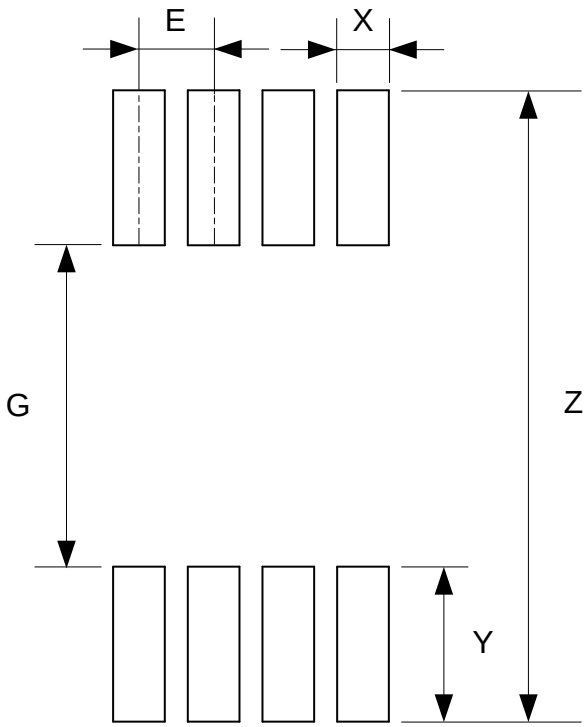


Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)	E1 (mm)/(inch)
Value	7.720/0.304	4.160/0.164	0.420/0.017	1.780/0.070	0.650/0.026	1.950/0.077

Suggested Pad Layout (continued)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(3) Package Type: MSOP-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	5.500/0.217	2.800/0.110	0.450/0.018	1.350/0.053	0.650/0.026

Mechanical Data

- Moisture Sensitivity:
  SO-8: Level 3 per J-STD-020
  MSOP-8: Level 1 (CAT) Level 3 (SAT) per J-STD-020
  TSSOP-8: Level 3
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight:
  SO-8: 0.076 grams (Approximate)
  MSOP-8: 0.0274 grams (Approximate)
  TSSOP-8: 0.041 grams (Approximate)
  PDIP-8: 0.489 grams (Approximate)

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