General-Purpose Low-Voltage Open-Drain Output Comparator

Product Description

The LMV331 and LMV393 is the single and dual comparator version, the LMV339 is quad comparator version, and both are open-drain output comparators for maximum flexibility. It can operate from 1.8V to 5.5V, and have low power consuming 50μA (TYP) per channel.

The LMV331, LMV393 and LMV339 are the most cost- effective solutions for applications where low voltage operation, low power and space saving are the primary specifications in circuit design for portable consumer products.

The LMV331, LMV393 and LMV339 are available in Green SOT23-5, SC70-5, SOP8, MSOP8, SOP14 and TSSOP14 packages. operates over an ambient temperature range of -40°C to +125°C.

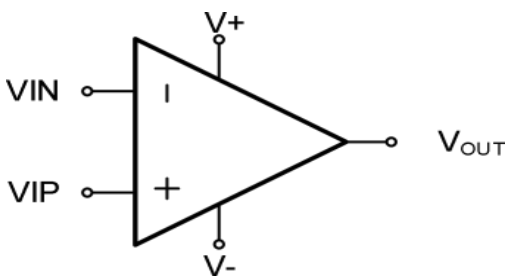
Features

- Supply range: +1.8V to +5.5V
- Low supply current 50μA per channel at Vs =5V
- Input common-Mode voltage range includes ground
- Operating temperature from -40℃ to +125℃
- Low output saturation voltage 100mV typical
- Open-Drain output for maximum flexibility

Applications

- Hysteresis comparators
- Oscillators
- Window comparators
- Industrial equipment
- Test and measurement

Circuit Diagram



Device Summary, Pin and Packages

Table. 5-1. Pin Definition

Serial Name	Part Name	Package	Body Size (Nom)	Marking(2)	MSL(3)	Package Qty
LMV331	LMV331W	SOT23-5	2.90mm×1.60mm×1.10mm	LMV331 WDJXX	3	Tape and Reel,3000
LMV331	LMV331C	SC70-5	2.10mm×1.25mm×1.00mm	LMV331 WDJXX	3	Tape and Reel,3000
LMV393	LMV393IDRW	SOP8	6.00mm×3.90mm×1.75mm	LMV393 WDJXX	3	Tape and Reel,2500
LMV393	LMV393M8	MSOP8	3.00mm×3.00mm×1.10mm	LMV393 WDJXX	3	Tape and Reel,2500
LMV339	LMV339IDRW	SOP14	8.65mm×3.90mm×1.75mm	LMV339 WDJ XX	3	Tape and Reel,2500
LMV339	LMV339MTW	TSSOP14	5.00mm×4.40mm×1.20mm	LMV339 WDJ XX	3	Tape and Reel,2500

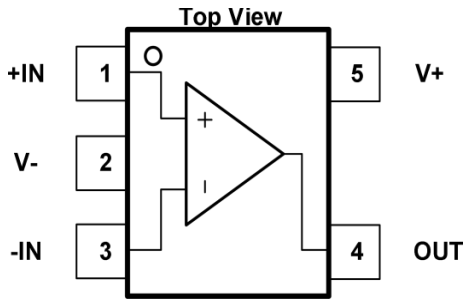
(1) For all available packages, please contact product sales.

(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) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

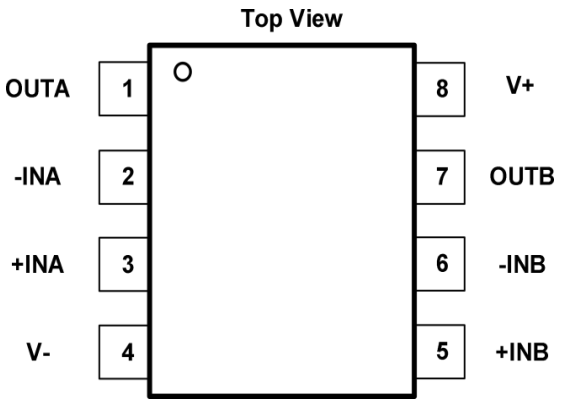
(4) WDJ is logo, "XX" in Marking will be appeared as the batch code.

Pin Configuration



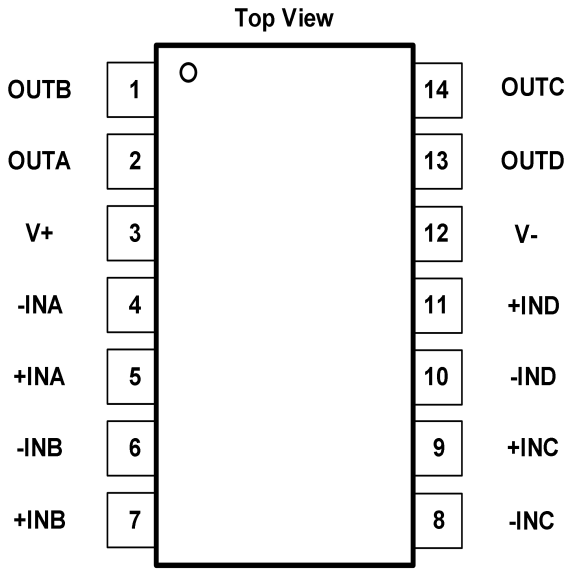
LMV331:W (SOT23-5) Package

LMV331:C (SC70-5) Package



LMV393: IDRW (SOP8) Package

LMV393:M8 (MSOP8) Package



LMV339:IDRW (SOP14) Package

LMV339:MTW (TSSOP14) Package

Voltage, Temperature, ESD and Thermal ratings

Absolute Maximum Ratings (1)

Parameters		Min.	Max.	Unit
Voltage	Supply, Vs=(V+) - (V-)		6.5	V
	Input pin (IN+, IN-) (2)	(V-)-0.3	(V+) +0.3	
	Signal output pin (3)	(V-)-0.3	(V+) +0.3	
Current	Signal input pin (IN+, IN-) (2)	-10	10	mA
	Signal output pin (3)	-55	55	mA
	Output short-circuit (4)	Continuous		
Temperature	Operating range, TA	-40	125	°C

(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 0.5V 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 0.5V beyond the supply rails should be current-limited to ±55mA or less.

(4) Short-circuit from output to VCC can cause excessive heating and eventual destruction.

ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-body model (HBM)	8 K	V
		Charged device Model (CDM)	2 K	V

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

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

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

Parameters		MIN	NOM	MAX	UNIT
Supply voltage， Vs= (V+) - (V-)	Single-supply	1.8		5.5	V
	Dual-supply	±0.9		±2.75	

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
SC70-5	400	150	°C/W
SOT23-5	250	81	°C/W
MSOP8	210	45	°C/W
SOP8(SOIC8)	158	43	°C/W
TSSOP14	180	35	°C/W
SOP4(SOIC14)	120	36	°C/W

Electrical Characteristics(V_S = 5.0V)

At TA=+25°C, V_{CM}=Vs/2.(unless otherwise noted)

PARAMETER		CONDITIONS	LMV331/LMV393/LMV339			
			MIN	TYP	MAX	UINTS
POWER SUPPLY						
Vs	Operating Voltage Range		1.8		5.5	V
I_Q	Quiescent Current/per Channel			50	100	μA
PSRR	Power-Supply Rejection Ratio	Vs=1.8V to 5.5V, VCM=(V)+0.5V		57		dB
INPUT						
V_{OS}	Input Offset Voltage		-4.5	±1.1	4.5	mV
ΔVos/ ΔT	Input Offset Voltage Drift	VCM=Vs/2, -40°C≤TA≤125°C		3		μV/°C
I_B	Input Bias Current			15		pA
I_{OS}	Input Offset Current			15		pA
V_{CM}	Common-Mode Voltage Range	TA=–40°C to 125°C	(V-)-0.1		(V+)+0.1	V
CMRR	Common-Rejection Ratio	VCM=-0.1 to 5.6V		67		dB
OUTPUT						
V_{SAT}	Saturation Voltage	Io≤4mA		170	350	mV
V_{OH}	Output Pull-up Voltage Range				5.6	V
I_O	Output Current(sinking)	VO≤1.5V		30		mA
I_{LEAK}	Output Leakage Current			0.01	10	nA
SWITCHING						
TPHL	Propagation Delay H To L	RPU=5.1KΩ , Overdrive=10mV		205		ns
		RPU=5.1KΩ , Overdrive=100mV		190		
TPLH	Propagation Delay L To H	RPU=5.1KΩ , Overdrive=10mV		520		
		RPU=5.1KΩ , Overdrive=100mV		475		
TF	Fall Time	RPU=5.1KΩ , Overdrive=100mV		24		ns

Electrical Characteristics(V_S = 2.7V)

At TA=+25°C, V_{CM}=Vs/2.(unless otherwise noted)

PARAMETER		CONDITIONS	LMV331/LMV393/LMV339			
			MIN	TYP	MAX	UINTS
POWER SUPPLY						
Vs	Operating Voltage Range		1.8		5.5	V
I_Q	Quiescent Current/per Channel			48	80	μA
PSRR	Power-Supply Rejection Ratio	Vs=1.8V to 5.5V, VCM=(V)+0.5V		57		dB
INPUT						
V_{OS}	Input Offset Voltage		-4.5	1.1	4.5	mV
ΔVos/ΔT	Input Offset Voltage Drift	VCM=Vs/2, -40°C≤TA≤125°C		3		μV/°C
I_B	Input Bias Current			15		pA
I_{OS}	Input Offset Current			15		pA
V_{CM}	Common-Mode Voltage Range	TA=–40°C to 125°C	(V-)-0.1		(V+)+0.1	V
CMRR	Common-Rejection Ratio	VCM=-0.1 to 2.8V		67		dB
OUTPUT						
V_{SAT}	Saturation Voltage	Io≤2.2mA		130		mV
V_{OH}	Output Pull-up Voltage Range				5.6	V
I_O	Output Current(sinking)	VO≤1.5V		15		mA
I_{LEAK}	Output Leakage Current			0.01	10	nA
SWITCHING						
TPHL	Propagation Delay H To L	RPU=5.1KΩ , Overdrive=10mV		192		ns
		RPU=5.1KΩ, Overdrive=100mV		185		
TPLH	Propagation Delay L To H	RPU=5.1KΩ , Overdrive=10mV		486		
		RPU=5.1KΩ, Overdrive=100mV		483		
TF	Fall Time	RPU=5.1KΩ, Overdrive=100mV		30		ns

Electrical Characteristics(V_S = 1.8V)

At TA=+25°C, V_{CM}=Vs/2.(unless otherwise noted)

PARAMETER		CONDITIONS	LMV331/LMV393/LMV339			
			MIN	TYP	MAX	UINTS
POWER SUPPLY						
Vs	Operating Voltage Range		1.8		5.5	V
I_Q	Quiescent Current/per Channel			40	70	μA
PSRR	Power-Supply Rejection Ratio	Vs=1.8V to 5.5V, VCM=(V)+0.5V		57		dB
INPUT						
V_{OS}	Input Offset Voltage		-4.5	±1.1	4.5	mV
ΔVos/ΔT	Input Offset Voltage Drift	VCM=Vs/2, -40°C≤TA≤125°C		3		μV/°C
IB	Input Bias Current			15		pA
I_{OS}	Input Offset Current			15		pA
V_{CM}	Common-Mode Voltage Range	TA=–40°C to 125°C	(V-)-0.1		(V+)+0.1	V
CMRR	Common-Rejection Ratio	VCM=-0.1 to 1.9V		67		dB
OUTPUT						
V_{SAT}	Saturation Voltage	Io≤1.5mA		130		mV
V_{OH}	Output Pull-up Voltage Range				5.6	V
I_O	Output Current(sinking)	VO≤0.8V		5.8		mA
I_{LEAK}	Output Leakage Current			0.01	10	nA
SWITCHING						
TPHL	Propagation Delay H To L	RPU=5.1KΩ , Overdrive=10mV		271		ns
		RPU=5.1KΩ, Overdrive=100mV		258		
TPLH	Propagation Delay L To H	RPU=5.1KΩ , Overdrive=10mV		520		
		RPU=5.1KΩ, Overdrive=100mV		487		
TF	Fall Time	RPU=5.1KΩ, Overdrive=100mV		60		ns

Typical Characteristics

At TA=+25°C, VCM=Vs/2. (unless otherwise noted)

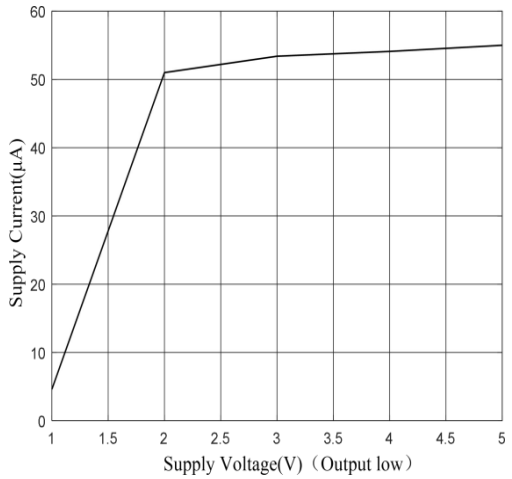


Fig.8-3. Supply Current vs Supply Voltage Output Low

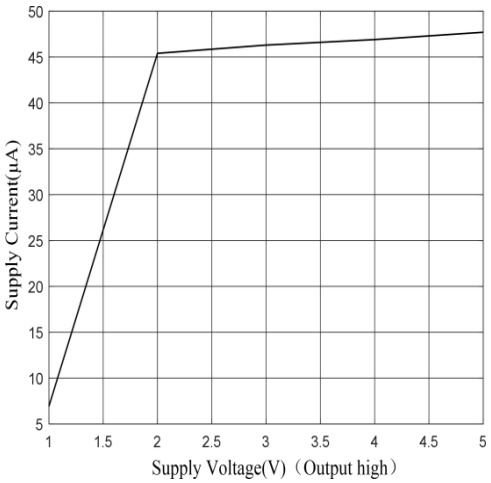


Fig.8-4. Supply Current vs Supply Voltage Output High

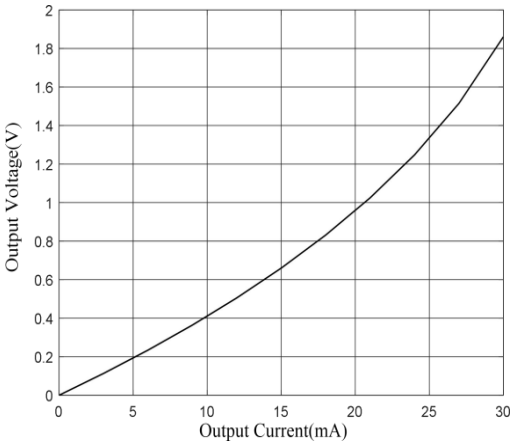


Fig.8-5. Output Voltage vs Output Current

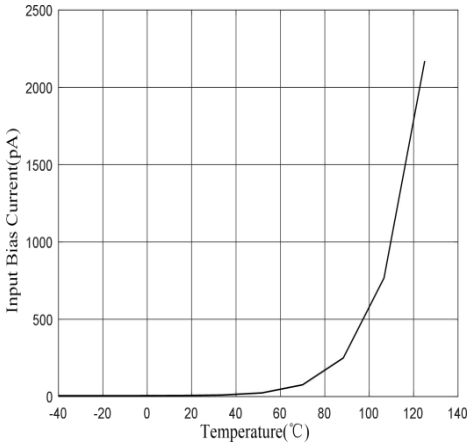


Fig.8-6. Input bias current vs temperature

7 Detailed Description

The LMV331, LMV393 and LMV339 family of comparators can operate up to 5.5V on the supply pin. This standard device has proven ubiquity and versatility across a wide range of applications. This is due to its low power and high speed. The open-drain output allows the user to configure the output's logic low voltage (V_{OL}) and can be utilized to enable the comparator to be used in AND functionality.

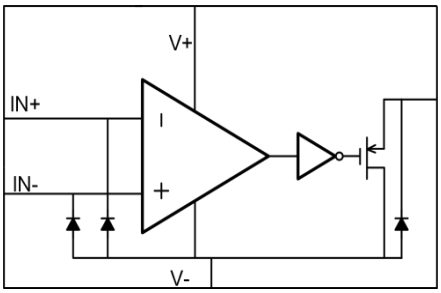


Fig.9-1. Funtional Block Diagram

8 Application Note

LMV331, LMV393 and LMV339 will typically be used to compare a single signal to a reference or two signals against each other. Many users take advantage of the open drain output (logic high with pull-up) to drive the comparison logic output to a logic voltage level to an MCU or logic device.

For fast response and comparison applications with noisy or AC inputs, it is recommended to use a bypass capacitor on the supply pin to reject any variation on the supply voltage. This variation causes temporary fluctuations in the comparator's input common mode range and create an inaccurate comparison.

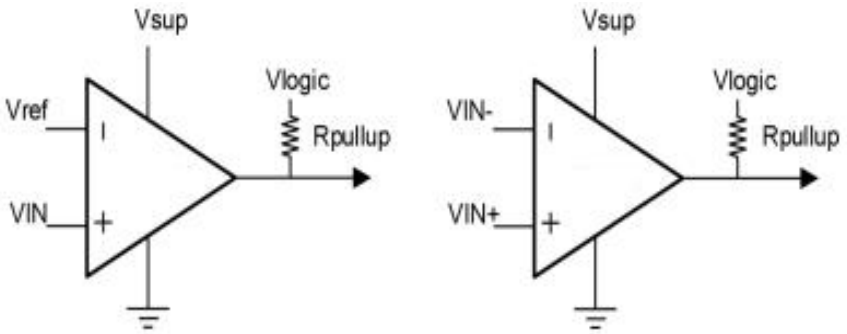
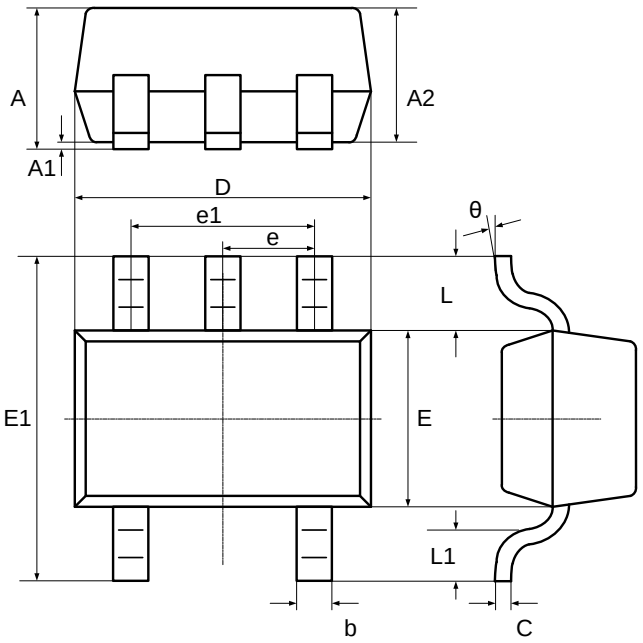


Fig.10-1. Typical Application Schematic

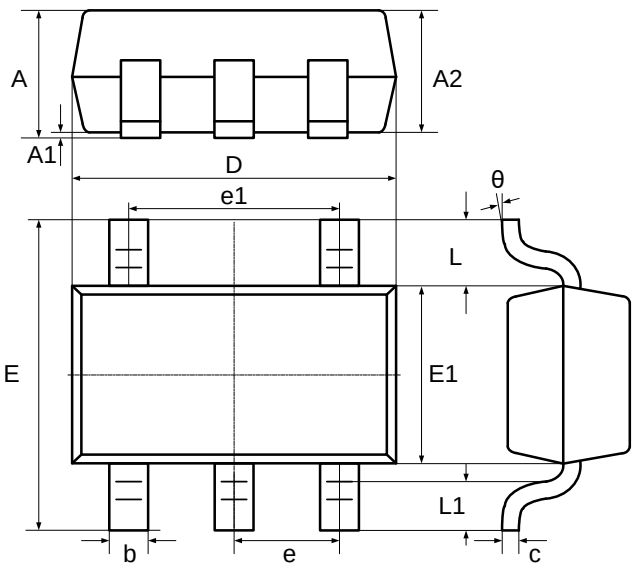
Package Outlines

SC70-5 (SOT353)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.90	1.10	0.035	0.043
A1	0.00	0.10	0.000	0.004
A2	0.90	1.00	0.035	0.039
b	0.15	0.35	0.006	0.014
C	0.08	0.15	0.003	0.006
D	2.00	2.20	0.079	0.087
E	1.15	1.35	0.045	0.053
E1	2.15	2.45	0.085	0.096
e	0.65 TYP.		0.026 TYP.	
e1	1.20	1.40	0.047	0.055
L	0.525 REF.		0.021 REF.	
L1	0.26	0.46	0.010	0.018
θ	0°	8°	0°	8°

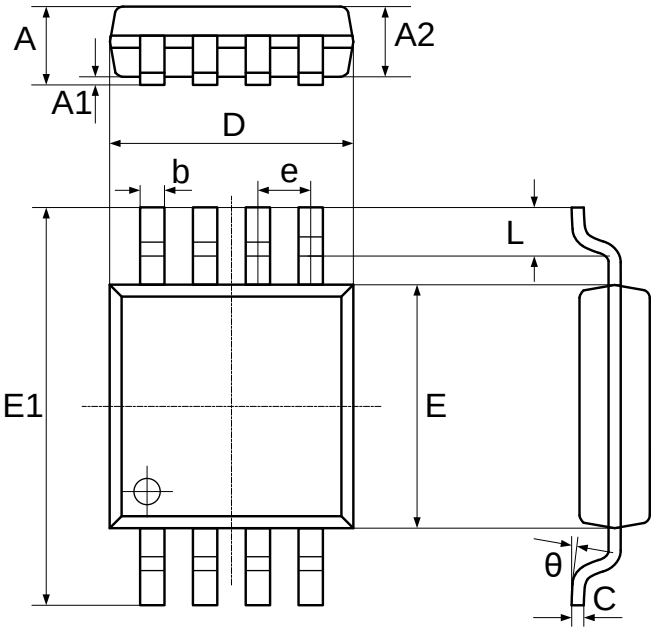
SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.25	-	0.049
A1	0.04	0.10	0.002	0.004
A2	1.00	1.20	0.039	0.047
b	0.33	0.41	0.013	0.016
c	0.15	0.19	0.006	0.007
D	2.820	3.02	0.111	0.119
E1	1.50	1.70	0.059	0.067
E	2.60	3.00	0.102	0.118
e	0.95 BSC.		0.037 BSC.	
e1	1.90 BSC.		0.075 BSC.	
L	0.60 REF		0.024 REF	
L1	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

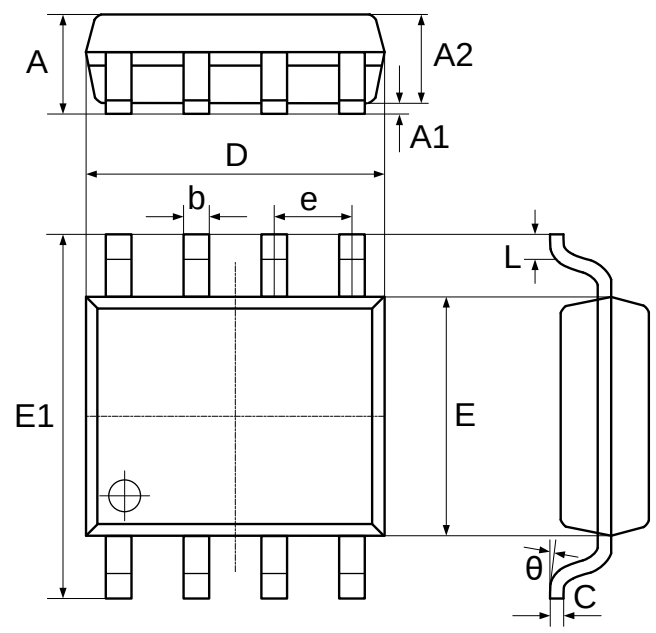
Package Outlines (continued)

MSOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.033	0.045
A1	0.050	0.150	0.002	0.006
A2	0.750	0.950	0.031	0.039
b	0.290	0.380	0.012	0.016
C	0.150	0.200	0.006	0.008
D	2.900	3.100	0.118	0.127
E	2.900	3.100	0.118	0.127
E1	4.700	5.100	0.192	0.208
e	0.650 TYP.		0.026 TYP.	
L	0.400	0.700	0.016	0.029
θ	0°	8°	0°	8°

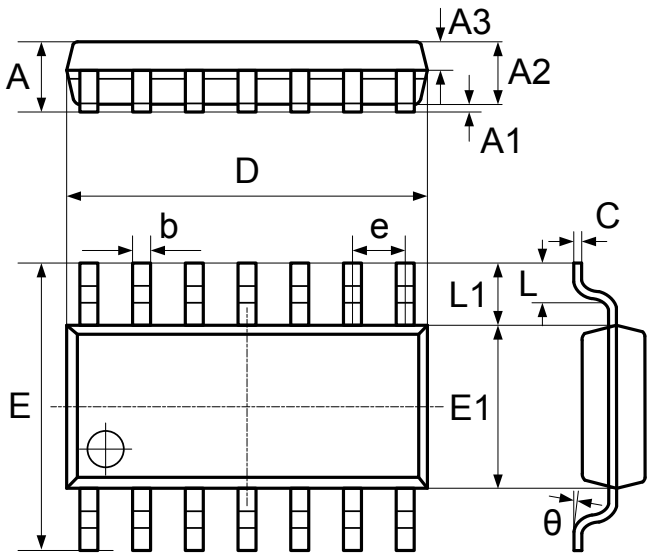
SO-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.370	1.670	0.056	0.068
A1	0.070	0.170	0.003	0.007
A2	1.300	1.500	0.053	0.061
b	0.306	0.506	0.013	0.021
C	0.203 TYP.		0.008 TYP.	
D	4.700	5.100	0.192	0.208
E	3.820	4.020	0.156	0.164
E1	5.800	6.200	0.237	0.253
e	1.270 TYP.		0.050 TYP.	
L	0.450	0.750	0.018	0.306
θ	0°	8°	0°	8°

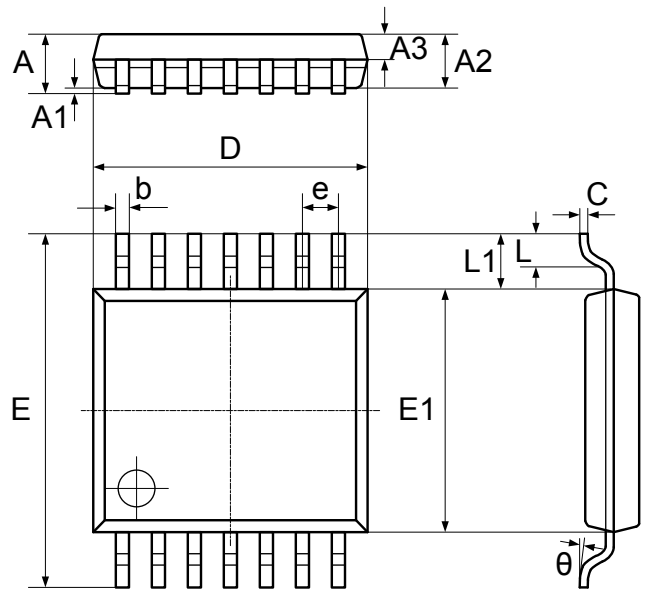
Package Outlines

SO-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.850	0.059	0.076
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.055	0.063
A3	0.550	0.750	0.022	0.031
b	0.406 typ.		0.017 typ.	
C	0.203 typ.		0.008 typ.	
D	8.630	8.830	0.352	0.360
E	5.840	6.240	0.238	0.255
E1	3.850	4.050	0.157	0.165
e	1.270 typ.		0.050 typ.	
L1	1.040 ref.		0.041 ref.	
L	0.350	0.750	0.014	0.031
θ	2°	8°	2°	8°

TSSOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.200	-	0.0472
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.037	0.043
A3	0.390	0.490	0.016	0.020
b	0.200	0.290	0.008	0.012
C	0.130	0.180	0.005	0.007
D	4.860	5.060	0.198	0.207
E	6.200	6.600	0.253	0.269
E1	4.300	4.500	0.176	0.184
e	0.650 typ.		0.0256 typ.	
L1	1.000 ref.		0.0393 ref.	
L	0.450	0.750	0.018	0.031
θ	0°	8°	0°	8°

Important statement:

➢WDJ Semiconductor Co,Ltd. reserves the right to change the products and services provided without notice. Customers should obtain the latest relevant information before ordering,and verify the timeliness and accuracy of this information.

➢Any and all WDJ Semiconductor products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems,orother applications whose failure can be reasonably expected to result in serious physical and/or material damage.Consultwithyour WDJ Semiconductor representative nearest you before using any WDJ Semiconductor products describedor contained herein in such applications.

➢WDJ Semiconductor Co,Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to otherproperty.When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur.Such measuresinclude but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.

➢In the event that any or all WDJ Semiconductor products (including technical data, services) described or contained hereinare controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining theexport license from the authorities concerned in accordance with the above law.

➢WDJ Semiconductor assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all WDJ Semiconductor products described or contained herein.

➢Specifications of any and all WDJ Semiconductor products described or contained herein stipulate the performance,characteristics, and functions of the described products in the independent state, and are not guarantees of the performance,characteristics, and functions of the described products as mounted in the customer's products or equipment.To verify symptoms andstates that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in thecustomer's products or equipment.