



GENERAL PURPOSE LOW VOLTAGE COMPARATOR

Description

The LMV331/LMV393 series are low-voltage, (2.7V to 5.5V) single and dual comparators, which are designed to effectively reduce cost and space at low-voltage levels.

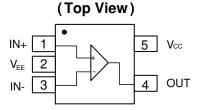
These devices offer specifications that meet or exceed the familiar LM331/LM393 devices operating with a lower supply voltage and consuming a far lower supply current.

The LMV331 is available in 5-Pin SOT353/SOT25 packages that reduce space on PC boards and portable electronic devices. LMV393 is available in industry standard SOP-8 and MSOP-8 packages.

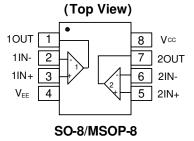
Features

- Guaranteed 2.7V and 5.5V performance
- Operating temperature range (-40°C to +125°C)
- Low supply current 40 μA/comparator Typ
- Input Common Mode Voltage Range includes ground
- Open Collector Output for Maximums Flexibility
- SOT353, SOT25, MSOP-8, SO-8: Available in "Green" Molding Compound (No Br, Sb)
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

Pin Assignments



SOT25/SOT353



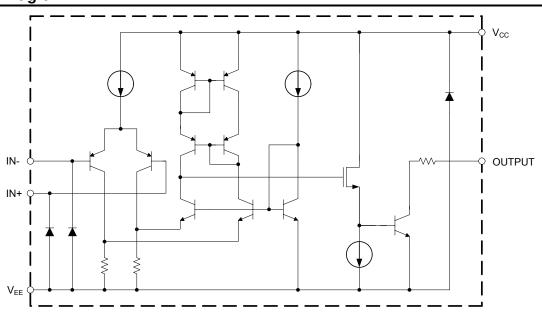
Applications

- Mobile Communications
- Battery Powered Devices
- Notebooks and PDA's
- General Purpose Low-Voltage Applications
- General Purpose Portable Devices

Notes:

- 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- 2. See http://www.diodes.com/quality/lead_free.html 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.

Schematic Diagram



Each Comparator



Pin Descriptions

LMV331		
Pin Name	Pin#	Function
IN+	1	Non-Inverting Input
V_{EE}	2	Chip Supply Voltage(Negative)/GND
IN-	3	Inverting Input
OUT	4	Output
V _{CC}	5	Chip Supply Voltage(Positive)
LMV393		
1OUT	1	Channel 1 Output
1IN-	2	Channel 1 Inverting Input
1IN+	3	Channel 1 Non-inverting Input
V _{EE}	4	Chip Supply Voltage(Negative)/GND
2IN+	5	Channel 2 Non-inverting Input
2IN-	6	Channel 2 Inverting Input
2OUT	7	Channel 2 Output
V _{CC}	8	Chip Supply Voltage(Positive)

Absolute Maximum Ratings (Note 4) ($@T_A = +25^{\circ}C$, unless otherwise specified.)

Symbol	Description		Rating	Unit		
ESD HBM	Human Body Model ESD Protection		6.0	KV		
ESD MM	Machine Model ESD Protection		200	V		
V_{ID}	Differential Input Voltage		±Supply Voltage	V		
V _{CC} -V _{EE}	Supply Voltage		5.5	V		
		SOT353 (Note 5)	371			
0	Thermal Resistance Junction-to-	SOT25 (Note 5)	204	°C/W		
θ_{JA}	Ambient	Ambient Ambient	Ambient SO-8 (Note 5)	SO-8 (Note 5)	120	- C/VV
		MSOP-8 (Note 5)	180			
T _{ST}	Storage Temperature		-65 to +150	°C		
TJ	Maximum Junction Temperature		+150	°C		

Notes:

Recommended Operating Conditions (@T_A = +25°C, unless otherwise specified.)

Symbol	Description	Rating	Unit
V _{CC} -V _{EE}	Supply Voltage	2.7 to 5.5	V
T _A	Operating Ambient Temperature Range	-40 to +125	°C

Stresses greater than the 'Absolute Maximum Ratings' specified above, may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be effected by exposure to absolute maximum rating conditions for extended periods of time.
 All numbers are typical, and apply for packages soldered directly onto a PC board in still air.



$\hline \textbf{Electrical Characteristics} \text{ (Notes 6 \& 7) (@T_A = +25 °C, V_{EE} = 0 V, V_{CM} = 0 V \text{ and } R_L = 5.1 K\Omega, \text{ unless otherwise specified.)}$

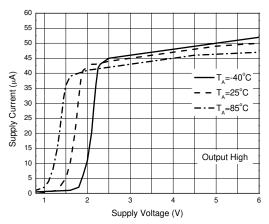
Symbol	Parameter		Test Conditions	Min	Тур	Max	Unit
-	ical Characteristic	es			- 71		
V _{OS}	Input Offset Voltage		_	-	1.7	7	mV
TCV _{OS}	Input Offset Voltage Input Offset Voltage Average Drift		T _A = full range	_	5	-	μV/°C
10008	10 Vos Imput Onset Voltage Avera		TA = Tuil Tarige	_	10	250	μν/ Ο
I _B	Input Bias Curren	nt	T. full range	<u> </u>	-	400	nA
			T _A = full range	<u> </u>	5	50	
los	Input Offset Curre	ent	T full ronge	<u> </u>	3	150	nA
V	Common Mode I	anut Valtaga Danga	T _A = full range		-		V
V _{CM}		nput Voltage Range		-0.1	-	+2.0	<u> </u>
V _{SAT}	Saturation Voltag		I _{SINK} ≤ 1mA	<u>-</u>	120	-	mV
Io	Output Sink Curre	ent	V _O ≤ 1.5V	5	23	-	mA
l _{OL}	Output Leakage	Current	-	-	0.003	-	μΑ
.02	output _outlago	T	$T_A = \text{full range}$	-	-	1	, , , , , , , , , , , , , , , , , , ,
		LMV331	-	-	40	100	μΑ
Is	Supply Current	LMV393	_	_	70	150	uA
		(Both Comparators)					471
2.7V AC Electr	ical Characteristic	S			1 1000	I	T
tpHL	Propagation dela	y high to low	Input overdrive= 10mV	-	1,000	-	ns
			Input overdrive= 100mV	-	350	-	ns
t _{PLH}	Propagation dela	y low to high	Input overdrive= 10mV	-	500	-	ns
	-1 01	-	Input overdrive= 100mV	-	400	-	ns
5V DC Electric	al Characteristics		1		1 4 7		1
V _{OS}	Input Offset Volta	age		-	1.7	7	mV
			T _A = full range	-	-	9	
TCV _{OS}	Input Offset Voltage Average Drift		T_A = full range	-	5	-	μV/°C
I _B	Input Bias Currer	nt	-	-	25	250	nA
	IB Imput bias current		$T_A = \text{full range}$	-	-	400	
Ios	Input Offset Curre	ont .	-	-	2	50	nA
105	Input Onset Our	Ont	$T_A = \text{full range}$	-	-	150	
V_{CM}	Common-Mode I	nput Voltage Range	-	-0.1	-	4.2	V
Av	Large Signal Diff	erential Voltage Gain	-	20	50	-	V/mV
			I _{SINK} ≤ 4mA	-	200	400	mV
V_{SAT}	Saturation Voltag	je	$I_{SINK} \le 4mA$, $T_A = full$			700	
			range	1	-	700	
Io	Output Sink Curr	ent	V _O ≤ 1.5V	10	84	-	mA
	Outrout Lands	C	-	-	0.003	-	
I _{OL}	Output Leakage	Current	T _A = full range	-	-	1	μΑ
		1.1.0.400.4	-	-	60	120	_
		LMV331	T _A = full range	-	-	150	μΑ
I _S Supply	Supply Current LMV393		-	-	100	200	_
	(Both Comparators)		T _A =full range	-	-	250	uA
5VAC Electrica	al Characteristics			1	1	1	L
		1.1.1	Input overdrive = 10mV	-	600	-	ns
t _{PHL}	Propagation dela	y nigh to low	Input overdrive = 100mV	-	200	-	ns
	Dunnanation	lata biab	Input overdrive = 10mV	-	450	-	ns
t _{PLH}	Propagation dela	v iow to man	Input overdrive = 100mV	-	300	-	ns

Notes:

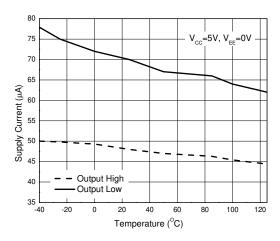
^{6.} Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration. The typical values are not tested and are not guaranteed on shipped production material.7. All limits are guaranteed by testing or statistical analysis.



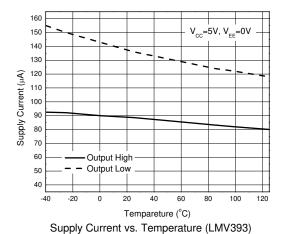
Typical Performance Characteristics (@T_A = +25°C, unless otherwise specified.)

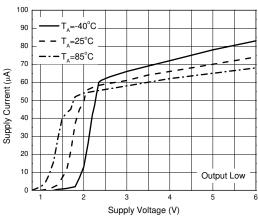


Supply Current vs. Supply Voltage (LMV331)

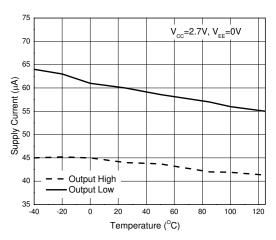


Supply Current vs. Temperature (LMV331)

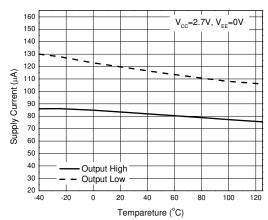




Supply Current vs. Supply Voltage (LMV331)



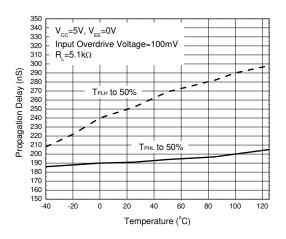
Supply Current vs. Temperature (LMV331)



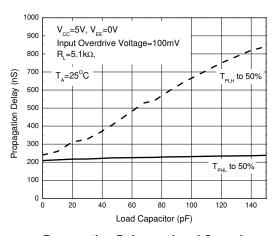
Supply Current vs. Temperature (LMV393)



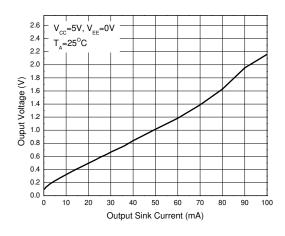
Typical Performance Characteristics (continued) (@ T_A = +25°C, unless otherwise specified.)



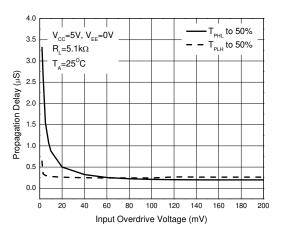
Propagation Delay vs. Temperature



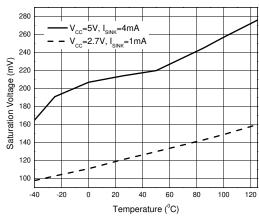
Propagation Delay vs. Load Capacitors



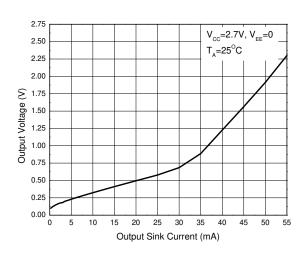
Output Voltage vs. Output Sink Current



Propagation Delay vs. Input Overdrive Voltage



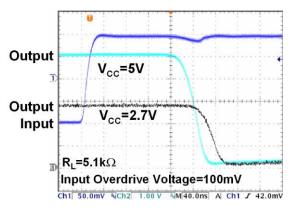
Saturation Voltage vs. Temperature



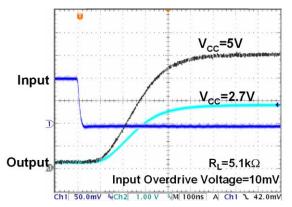
Output Voltage vs. Output Sink Current



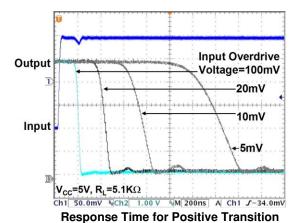
Typical Performance Characteristics (cont.) (@ T_A = +25°C, unless otherwise specified.)



Response Time for Positive Transition



Response Time for Negative Transition



U_{CC}=5V

V_{CC}=5V

V_{CC}=5V

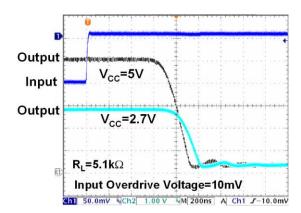
V_{CC}=2.7V

Output

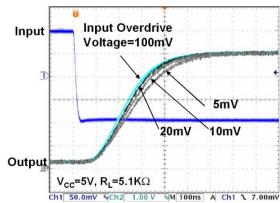
R_L=5.1kΩ

Input Overdrive Voltage=100mV

Response Time for Negative Transition



Response Time for Positive Transition

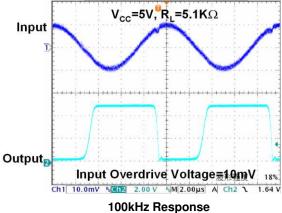


Response Time for Negative Transition

 $V_{cc}=5V$, $R_{L}=5.1K\Omega$

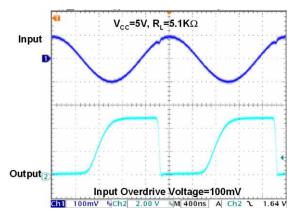


Typical Performance Characteristics (cont.) (@ $T_A = +25$ °C, unless otherwise specified.)





Input



500kHz Response



Application Information

Detailed Description

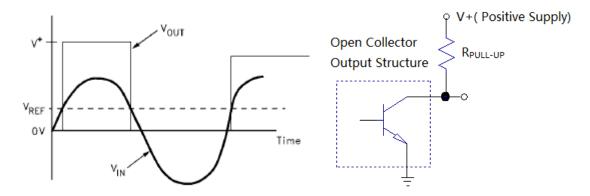
LMV331/LMV393 are low-voltage single/dual general- purpose comparators. They have a single supply operating voltage range from 2.7V to 5.5V; the common mode input voltage range extends from -0.1V below the negative supply to within 0.8V of the positive supply.

The LMV331/393 series is built using the BiCMOS process with bipolar input and output stages for improved noise performance. It is a cost-effective solution for portable consumer products where space, low voltage, low power and price are the primary specification in circuit design.

Basic Comparator

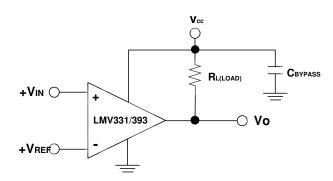
A basic comparator circuit is used for converting analog signal to digital output. The LMV331/393 has open-collector output structure, which required a pull-high resistor to positive supply voltage for the output to switch properly. When the internal output transistor is off, the output voltage will be pulled up to the external positive voltage.

The output pull- up resistor should be chosen high enough so as to avoid excessive power dissipation, yet low enough to supply enough drive to switch whatever load circuitry is used on the comparator output. On the LMV331/393 the pull-up resistor should range between $1K\Omega$ to $10K\Omega$.



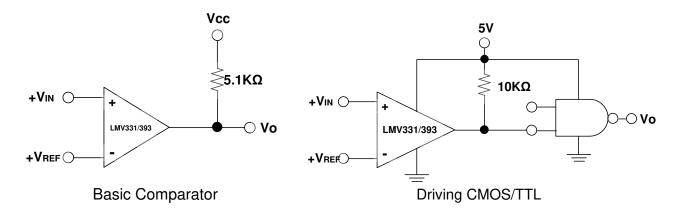
Power Supply Bypassing

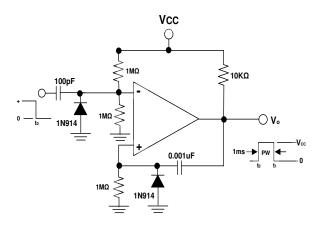
For better performance, power supply bypass capacitor is necessary. For a single-supply operation system, a minimum of $0.1\mu F$ bypass capacitor should be recommended to place as close as possible between V_{CC} pin and GND.



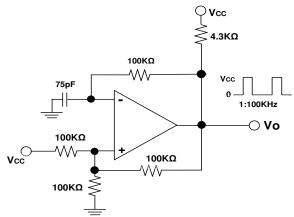


Typical Application Circuit

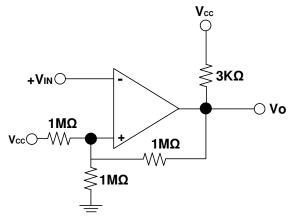




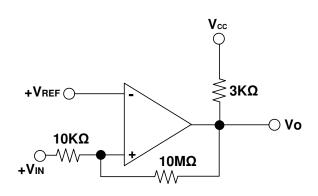
One-Shot Multivibrator



Squarewave Oscillator



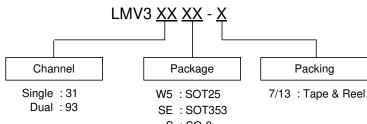
Inverting Comparator with Hysteresis



Non-Inverting Comparator with Hysteresis



Ordering Information



S:SO-8 M8: MSOP-8

Part Number Package C	Poekers Code Peekering	7"/13" Tape and Reel		
	Package Code	Packaging	Quantity	Part Number Suffix
LMV331W5-7	W5	SOT25	3,000/Tape & Reel	-7
LMV331SE-7	SE	SOT353	3,000/Tape & Reel	-7
LMV393S-13	S	SO-8	2,500/Tape & Reel	-13
LMV393M8-13	M8	MSOP-8	2,500/Tape & Reel	-13

Marking Information

(1) SOT25 and SOT353

(Top View)

XXYWX

2

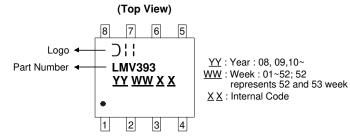
3

XX: Identification Code
Y: Year: 0~9
W: Week: A~Z: 1~26 week;
a~z: 27~52 week;
z: represents 52 and 53 week

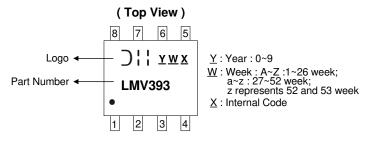
X : Internal Code

Device	Package type	Identification Code
LMV331W5	SOT25	CX
LMV331SF	SOT353	CY

(2) SO-8



(3) MSOP-8

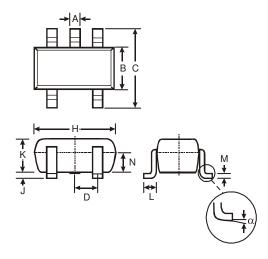




Package Outline Dimensions (All dimensions in mm.)

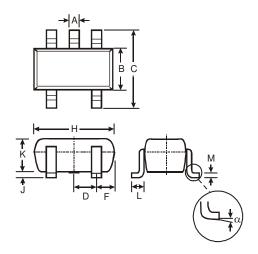
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

(1) Package Type: SOT25



	SOT25				
Dim	Min	Max	Тур		
Α	0.35	0.50	0.38		
В	1.50	1.70	1.60		
U	2.70	3.00	2.80		
D			0.95		
Н	2.90	3.10	3.00		
7	0.013	0.10	0.05		
K	1.00	1.30	1.10		
L	0.35	0.55	0.40		
М	0.10	0.20	0.15		
N	0.70	0.80	0.75		
α	0°	8°			
All Dimensions in mm					

(2) Package Type: SOT353



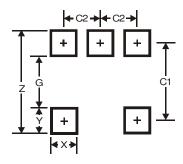
	SOT353			
Dim	Min	Max	Тур	
Α	0.10	0.30	0.25	
В	1.15	1.35	1.30	
С	2.00	2.20	2.10	
D	0	.65 Ty)	
F	0.40	0.45	0.425	
Н	1.80	2.20	2.15	
J	0	0.10	0.05	
K	0.90	1.00	1.00	
L	0.25	0.40	0.30	
М	0.10	0.22	0.11	
α	0°	8°	-	
All	All Dimensions in mm			



Suggested Pad Layout

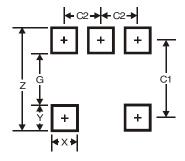
 $Please see AP02001 \ at \ http://www.diodes.com/datasheets/ap02001.pdf \ for \ the \ latest \ version.$

(1) Package Type: SOT25



Dimensions	Value (in mm)
Z	3.20
G	1.60
Х	0.55
Υ	0.80
C1	2.40
C2	0.95

(2) Package Type: SOT353



Dimensions	Value (in mm)
Z	2.5
G	1.3
Х	0.42
Υ	0.6
C1	1.9
C2	0.65



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 - 2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.
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