

# LMV331 SINGLE, LMV393 DUAL, LMV339 QUAD GENERAL PURPOSE LOW-VOLTAGE COMPARATORS

SLCS136A – AUGUST 1999 – REVISED JANUARY 2000

- **2.7-V and 5-V Performance**
- **Low Supply Current:**  
 LMV331 . . . 60  $\mu$ A Typ  
 LMV393 . . . 100  $\mu$ A Typ  
 LMV339 . . . 170  $\mu$ A Typ
- **Input Common-Mode Voltage Range Includes Ground**
- **Low Output Saturation Voltage . . . 200 mV Typ**
- **Package Options Include Plastic Small-Outline (D), Small-Outline Transistor (SOT-23 DBV, DCK), and Thin Shrink Small-Outline (PW) Packages**

## description

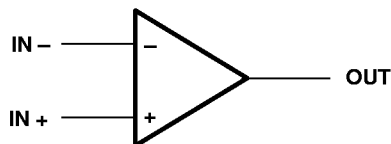
The LMV393 and LMV339 are low-voltage (2.7 V to 5.5 V) versions of the dual and quad comparators, LM393 and LM339, which operate from 5 V to 30 V. The LMV331 is the single-comparator version.

The LMV331, LMV339, and LMV393 are the most cost-effective solutions for applications where low-voltage operation, low power, space saving, and price are the primary specifications in circuit design for portable consumer products. These devices offer specifications that meet or exceed the familiar LM339 and LM393 devices at a fraction of the supply current.

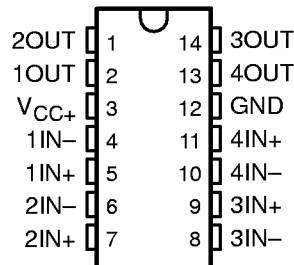
The LMV331 is available in the ultra-small DCK package, which is approximately half the size of the five-pin SOT-23. The small package saves space on printed circuit boards and enables the design of small portable electronic devices. It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

The LMV331, LMV339, and LMV393 devices are characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

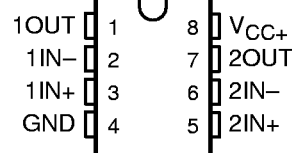
## symbol (each comparator)



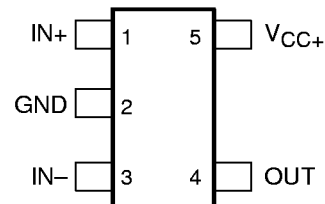
LMV339 . . . D OR PW PACKAGE  
(TOP VIEW)



LMV393 . . . D OR PW PACKAGE  
(TOP VIEW)



LMV331 . . . DBV OR DCK PACKAGE  
(TOP VIEW)



PRODUCT PREVIEW



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



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## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGE TYPE	PACKAGED DEVICES		
		SINGLE	DUAL	QUADRUPLE
-40°C to 85°C	5-pin DCK	LMV331DCKR	—	—
	5-pin DBV	LMV331DBVR	—	—
	8-pin SOIC	—	LMV393D	—
	8-pin TSSOP	—	LMV393PWR	—
	14-pin SOIC	—	—	LMV339D
	14-pin TSSOP	—	—	LMV339PWR

The D package is available taped and reeled. Add the suffix R to the device type (e.g., LMV393DR). The DCK, DBV, and PW packages are only available left-end taped and reeled.

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, V <sub>CC</sub> (see Note 1)	5.5 V
Differential input voltage, V <sub>ID</sub> (see Note 2)	±5.5 V
Input voltage range, V <sub>I</sub> (either input)	0 to 5.5°C
Operating virtual junction temperature range	0 to 150°C
Package thermal impedance, θ <sub>JA</sub> (see Notes 3 and 4):	
D (8-pin) package	197°C/W
D (14-pin) package	127°C/W
DBV package	347°C/W
DCK package	389°C/W
PW (8-pin) package	243°C/W
PW (14-pin) package	170°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds:	
D or PW package	260°C
DBV or DCK package	TBD
Storage temperature range, T <sub>stg</sub>	-65 to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may 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-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values (except differential voltages and V<sub>CC</sub> specified for the measurement of I<sub>O5</sub>) are with respect to the network GND.
  2. Differential voltages are at IN+ with respect to IN-.
  3. Maximum power dissipation is a function of T<sub>J(max)</sub>, θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> - T<sub>A</sub>)/θ<sub>JA</sub>. Selecting the maximum of 150 °C can impact reliability.
  4. The package thermal impedance is calculated in accordance with JESD 51.

## recommended operating conditions

	MIN	MAX	UNIT
V <sub>CC</sub> Supply voltage (single-supply operation)	2.7	5.5	V
T <sub>A</sub> Operating free-air temperature	-40	85	°C

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**electrical characteristics at specified free-air temperature,  $V_{CC+} = 2.7\text{ V}$ ,  $GND = 0\text{ V}$  (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT	
$V_{IO}$	Input offset voltage		25°C		1.7	7	mV	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage		-40°C to 85°C		5		$\mu\text{V}/^\circ\text{C}$	
$I_{IB}$	Input bias current		25°C		10	250	nA	
			-40°C to 85°C			400		
$I_{IO}$	Input offset current		25°C		5	50	nA	
			-40°C to 85°C			150		
$I_O$	Output current	$V_O \leq 1.5\text{ V}$	25°C	5	23		mA	
			25°C		0.003			$\mu\text{A}$
			-40°C to 85°C			1		
$V_{ICR}$	Common-mode input voltage range		25°C	-0.1 to 2			V	
$V_{SAT}$	Saturation voltage	$I_O \leq 1\text{ mA}$	25°C		200		mV	
$I_{CC}$	Supply current	LMV331	25°C		40	100	$\mu\text{A}$	
		LMV393 (both comparators)	25°C		70	140		
		LMV339 (all four comparators)	25°C		140	200		

**switching characteristics  $T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 2.7\text{ V}$ ,  $R_L = 5.1\text{ k}\Omega$ ,  $GND = 0\text{ V}$  (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PHL}$	Propagation delay, high- to low-level output switching	Input overdrive = 10 mV		1000		ns
		Input overdrive = 100 mV		350		
$t_{PLH}$	Propagation delay, low- to high-level output switching	Input overdrive = 10 mV		500		ns
		Input overdrive = 100 mV		400		

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electrical characteristics at specified free-air temperature,  $V_{CC+} = 5\text{ V}$ ,  $GND = 0\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage		25°C		1.7	7	mV
		-40°C to 85°C			9	
$\alpha_{V_{IO}}$ Average temperature coefficient of input offset voltage		25°C		5		$\mu\text{V}/^\circ\text{C}$
$I_{IB}$ Input bias current		25°C		25	250	nA
		-40°C to 85°C			400	
$I_{IO}$ Input offset current		25°C		2	50	nA
		-40°C to 85°C			150	
$I_O$ Output current	$V_O \leq 1.5\text{ V}$	25°C	10	84		mA
Output leakage current		25°C		0.003		$\mu\text{A}$
		-40°C to 85°C			1	
$V_{ICR}$ Common-mode input voltage range		25°C		-0.1 to 4.2		V
$A_{VD}$ Large-signal differential voltage gain		25°C	20	50		V/mV
$V_{SAT}$ Saturation voltage	$I_O \leq 4\text{ mA}$	25°C		200	400	mV
		-40°C to 85°C			700	
$I_{CC}$ Supply current	LMV331	25°C		60	120	$\mu\text{A}$
		-40°C to 85°C			150	
	LMV393 (both comparators)	25°C		100	200	
		-40°C to 85°C			250	
	LMV339 (all four comparators)	25°C		170	300	
		-40°C to 85°C			350	

switching characteristics at specified free-air temperature,  $T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{ V}$ ,  $R_L = 5.1\text{ k}\Omega$ ,  $GND = 0\text{ V}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PHL}$ Propagation delay, high- to low-level output switching	Input overdrive = 10 mV		600		ns
	Input overdrive = 100 mV		200		
$t_{PLH}$ Propagation delay, low- to high-level output switching	Input overdrive = 10 mV		450		ns
	Input overdrive = 100 mV		300		

PRODUCT PREVIEW

