

## LM6511 180 ns 3V Comparator

 Check for Samples: [LM6511](#)

### FEATURES

- (Typical Unless Otherwise Noted)
- Operates at +2.7V, +3V, +3.3V, +5V
- Low Power Consumption <9.45 mW @  $V^+ = 2.7V$  (max)
- Fast Response Time of 180 ns

### APPLICATIONS

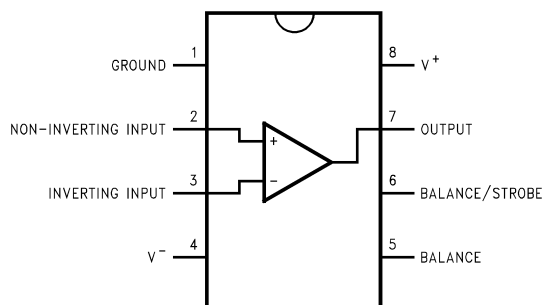
- Portable Equipment
- Cellular Phones
- Digital Level Shifting

### DESCRIPTION

The LM6511 voltage comparator is ideal for analog-digital interface circuitry when only a +3V or +3.3V supply is available. The open-collector output permits signal compatibility with a wide variety of digital families: +5V CMOS, +3V CMOS, TTL and so on. Supply voltage may range from 2.7V to 36V between supply voltage leads. The LM6511 operates with little power consumption ( $P_{diss} < 9.45$  mW at  $V^+ = +2.7V$  and  $V^- = 0V$ ).

This voltage comparator offers many features that are available in traditional sub-microsecond comparators: output sync strobe, inputs and output may be isolated from system ground, and wire-ORing. Also, the LM6511 uses the industry-standard, single comparator pinout configuration.

### Connection Diagram



**Figure 1. 8-Pin SOIC  
See Package Number D**



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.



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### Absolute Maximum Ratings<sup>(1)(2)</sup>

Supply Voltage	–0.3 to +36V	
Output to Negative Supply Voltage	50V	
Ground to Negative Supply Voltage	30V	
Differential Input Voltage	±30V	
Input Voltage	See <sup>(1)</sup>	
Storage Temperature Range	–65°C to +150°C	
Soldering Information:	SOIC Package (Vapor Phase in 60 sec)	215°C
	SOIC Package (Infrared in 15 sec)	220°C
Power Dissipation	500 mW	
Output Short Circuit Duration	10s	
Junction Temperature	150°C	
ESD Rating (C = +100 pF, R = 1.5 kΩ)	300V	

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.

### Operating Ratings<sup>(1)</sup>

Supply Voltage	2.5V to 30V	
Temperature Range	–40°C ≤ T <sub>J</sub> ≤ +85°C	
Thermal Resistance (θ <sub>JA</sub> )	SOIC Package	170°C/W

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

### DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T<sub>J</sub> = 25°C. **Boldface** limits apply at the temperature extremes. V<sup>+</sup> = 2.7V, V<sup>–</sup> = 0V, 50Ω ≤ R<sub>L</sub> ≤ 50kΩ, and I<sub>L</sub> = 1.0 mA unless otherwise specified

Symbol	Parameter	Conditions	Typical	LM6511	Units (Limits)
				Limit	
V <sub>OS</sub>	Offset Voltage	R <sub>S</sub> ≤ 50 kΩ <sup>(1)</sup>	1.5	5	mV
				<b>8</b>	max
I <sub>B</sub>	Input Bias Current		38	130 <b>200</b>	nA max
I <sub>OS</sub>	Input Offset Current	R <sub>S</sub> ≤ 50 kΩ <sup>(1)</sup>	1.5	20 <b>50</b>	nA max
I <sub>S</sub>	Positive Supply Current		2.7	3.5 <b>5</b>	mA max
	Negative Supply Current		1.5	2.0 <b>2.5</b>	
V <sub>SAT</sub>	Saturation Voltage	V <sub>IN</sub> ≤ 10 mV I <sub>SINK</sub> = 8 mA	0.23	0.4 <b>0.4</b>	V max
A <sub>V</sub>	Large Signal Voltage Gain	ΔV <sub>OUT</sub> = 2V	40		V/mV
CMRR	Common Mode Rejection Ratio		72		dB
I <sub>STROBE</sub>	Strobe ON Current	See <sup>(2)</sup>	2.0	5.0	mA max

- (1) The offset voltage and offset current limits are the maximum values required to drive the output within a volt of either supply with a 1 mA load. Therefore, these parameters define an error band and take into account the worst-case effects of voltage gain and input impedance.
- (2) This specification gives the range of current which must be drawn from the strobe pin to ensure the output is properly disabled. Do not short the strobe pin to ground; it should be current driven at 3 mA to 5 mA.

### DC Electrical Characteristics (continued)

Unless otherwise specified, all limits guaranteed for  $T_J = 25^\circ\text{C}$ . **Boldface** limits apply at the temperature extremes.  $V^+ = 2.7\text{V}$ ,  $V^- = 0\text{V}$ ,  $50\Omega \leq R_L \leq 50\text{k}\Omega$ , and  $I_L = 1.0\text{ mA}$  unless otherwise specified

Symbol	Parameter	Conditions	Typical	LM6511	Units (Limits)
				Limit	
$V_{IN}$	Input Voltage Range			0.50	V min
				$V^+ - 1.25$	V max
	Output Leakage Current	$V_{IN} \geq 10\text{ mV}$ , $V_{OUT} = 35\text{V}$ , $I_{STROBE} = 3\text{ mA}$	0.2		nA max

### AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for  $T_J = 25^\circ\text{C}$ . **Boldface** limits apply at the temperature extremes.  $V^+ = 2.7\text{V}$ ,  $V^- = 0\text{V}$ ,  $50\Omega \leq R_L \leq 50\text{k}\Omega$ , and  $I_L = 1.0\text{ mA}$  unless otherwise specified

Symbol	Parameter	Conditions	Typical	LM6511	Units (Limits)
				Limit	
$T_R$	Response Time	See <sup>(1)</sup>	180		ns

(1) This specification is for a 100 mV input step with a 25 mV overdrive.

### LM6511 Typical Performance Characteristics

$V_S = 3V$  unless otherwise noted

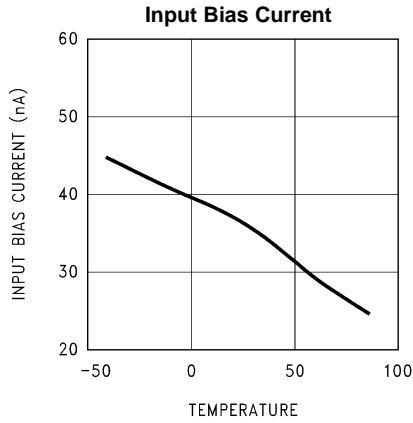


Figure 2.

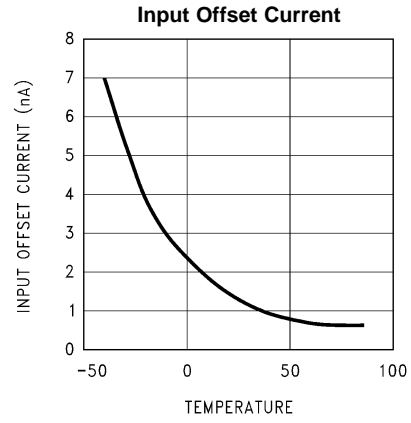


Figure 3.

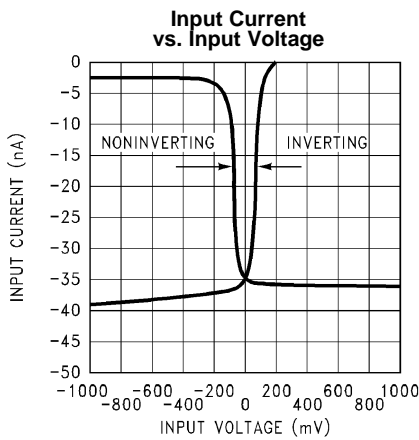


Figure 4.

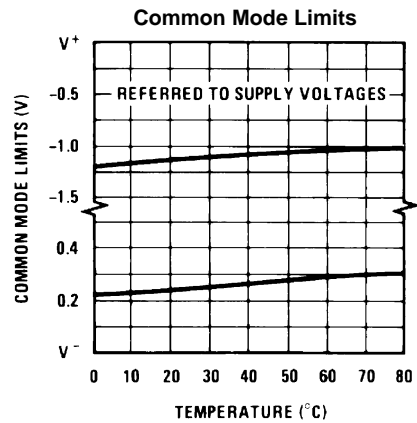


Figure 5.

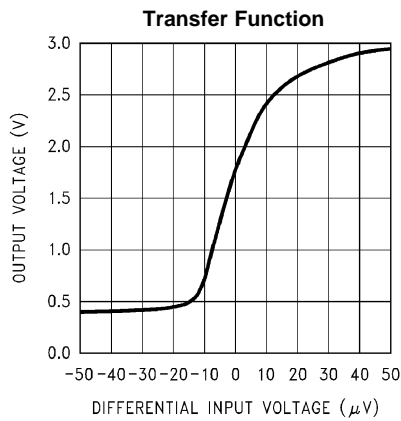


Figure 6.

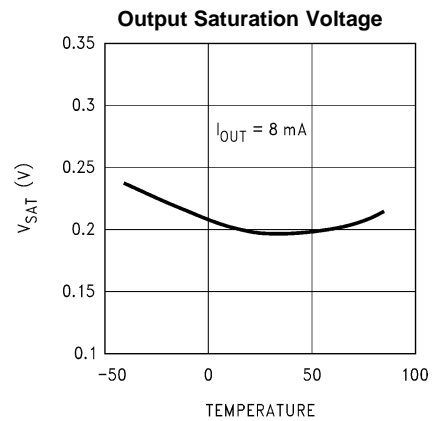


Figure 7.

LM6511 Typical Performance Characteristics (continued)

V<sub>S</sub> = 3V unless otherwise noted

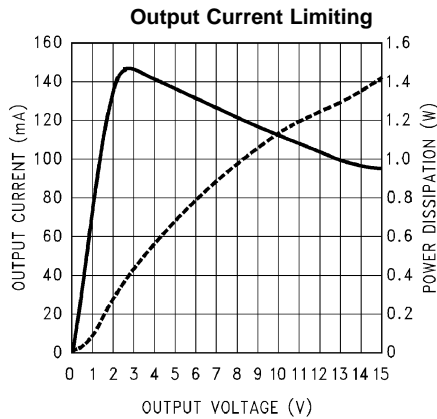


Figure 8.

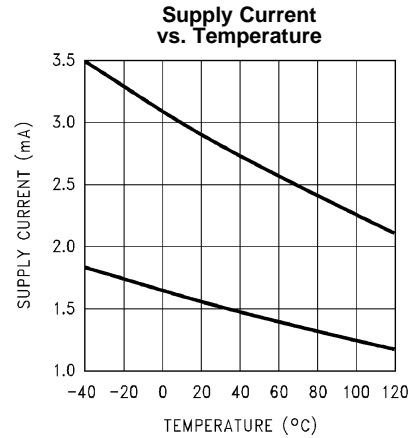


Figure 9.

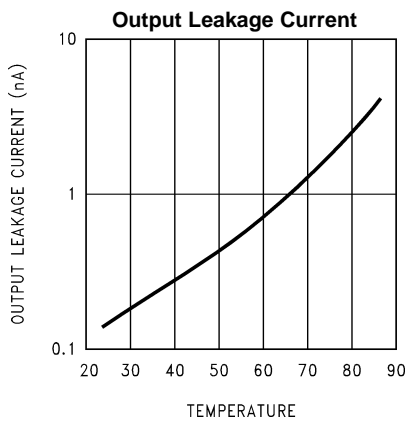


Figure 10.

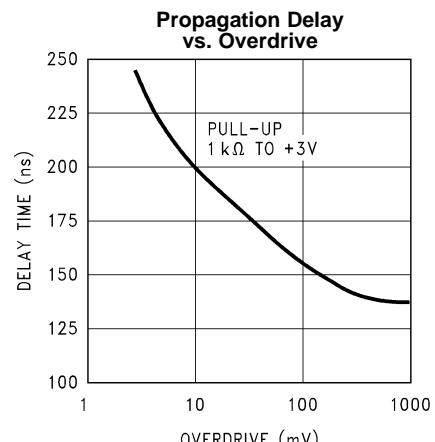
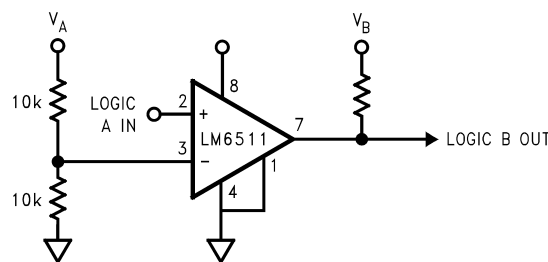


Figure 11.

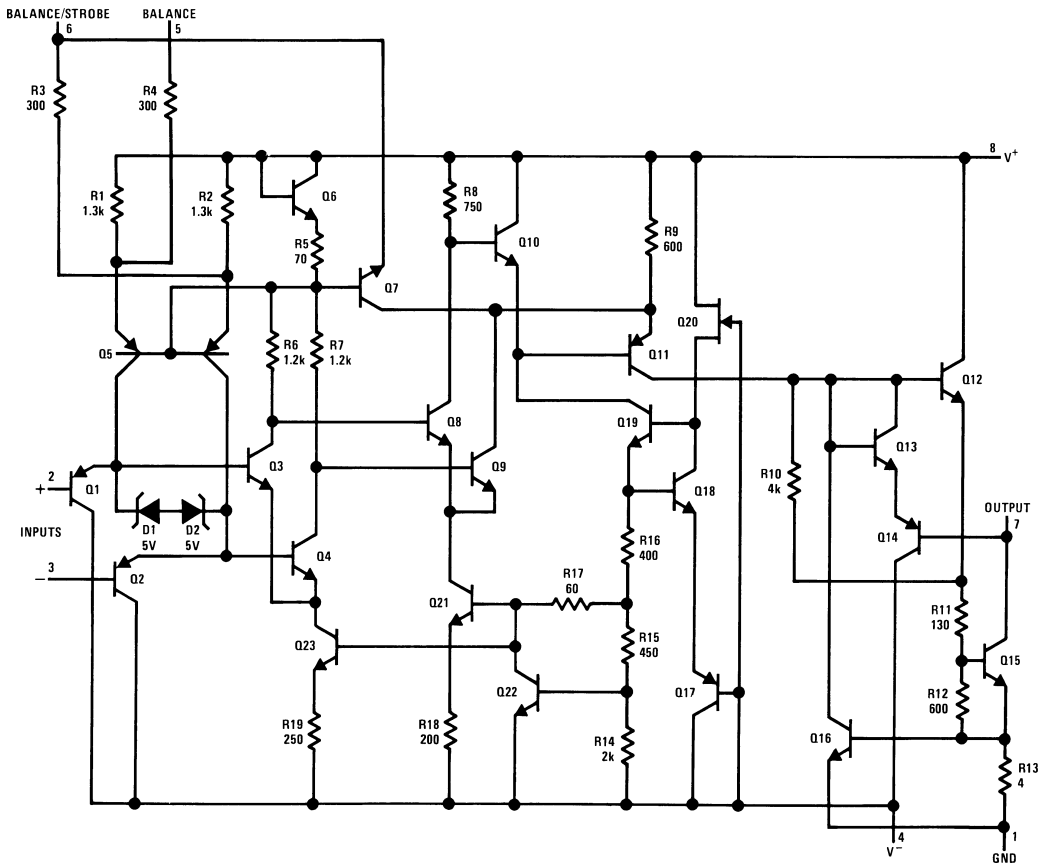
Typical Application



**Notes:** Because of the very wide operating and output voltage range, the LM6511 may be used to shift logic levels from 3V to TTL or CMOS to the other way around. By biasing the input to ½ of the input logic supply (V<sub>A</sub>), this assures that this input remains within the input voltage range. The pull-up resistor should go to the output logic supply (V<sub>B</sub>).

Figure 12. Universal Logic Level Shifter

### Schematic Diagram



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**REVISION HISTORY**

<b>Changes from Revision B (March 2013) to Revision C</b>	<b>Page</b>
<hr/> <ul style="list-style-type: none"><li>• Changed layout of National Data Sheet to TI format .....</li></ul>	<hr/> <b>6</b>

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM6511IM	Obsolete	Production	SOIC (D)   8	-	-	Call TI	Call TI	-40 to 85	LM65 11IM
LM6511IM/NOPB	Active	Production	SOIC (D)   8	95   TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 85	LM65 11IM
LM6511IM/NOPB.B	Active	Production	SOIC (D)   8	95   TUBE	Yes	SN	Level-1-260C-UNLIM	-40 to 85	LM65 11IM
LM6511IMX/NOPB	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	LM65 11IM
LM6511IMX/NOPB.B	Active	Production	SOIC (D)   8	2500   LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	LM65 11IM

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM6511IMX/NOPB	SOIC	D	8	2500	330.0	12.4	6.5	5.4	2.0	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM6511IMX/NOPB	SOIC	D	8	2500	367.0	367.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
LM6511IM/NOPB	D	SOIC	8	95	495	8	4064	3.05
LM6511IM/NOPB.B	D	SOIC	8	95	495	8	4064	3.05



D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

## NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
 EXPOSED METAL SHOWN  
 SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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