

# Low Voltage Comparator

## FAN156



SIP6 1.45x1.0  
CASE 127EB

### Description

The FAN156 is a low-power single comparator that typically consumes less than 10  $\mu\text{A}$  of supply current. It is guaranteed to operate at a low voltage of 1.6 V and is fully operational up to 5.5 V, making it convenient for use in 1.8, 3.0 V, and 5.0 V systems.

The FAN156 has a complementary push-pull P- and N-channel output stage capable of driving a rail-to-rail output swing with a load ranging up to 5.0 mA.

### Features

- Low Supply Current:  $I_{DD}$  6  $\mu\text{A}$  (Typical)
- Single Power Supply Operation
- Wide Common-Mode Input Voltage Range
- Push-Pull Output Circuit
- Low Input Bias Current
- Internal Hysteresis
- Packaged in MicroPak™ 6
- This is a Pb-Free Device

### Applications

- Mobile Phones
- Alarm and Security Systems
- Personal Digital Assistants

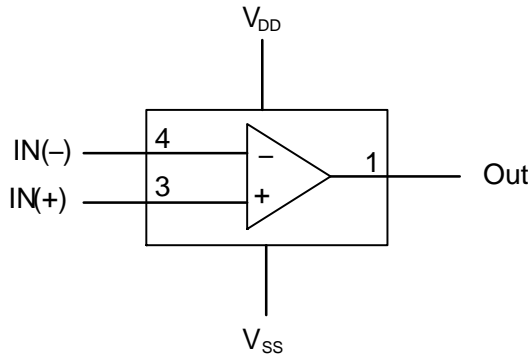
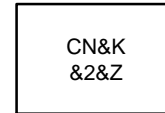


Figure 1. Functional Diagram

### MARKING DIAGRAM



CN = Specific Device Code  
&K = 2-Digits Lot Run Traceability Code  
&2 = 2-Digit Date Code  
&Z = Assembly Plant Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

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## PIN CONFIGURATION

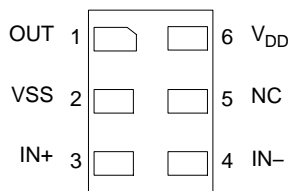


Figure 2. Pin Configuration (Top-Through View)

### PIN DEFINITIONS

Pin #	Name	Description
1	OUT	Comparator Output
2	$V_{SS}$	Negative Supply Voltage
3	IN+	Non-Inverting Input
4	IN-	Inverting Input
5	NC	No Connect
6	$V_{DD}$	Positive Supply Voltage

### FUNCTION TABLE

Inputs	Outputs
$IN(-) > IN(+)$	Output LOW
$IN(+ > IN(-)$	Output HIGH

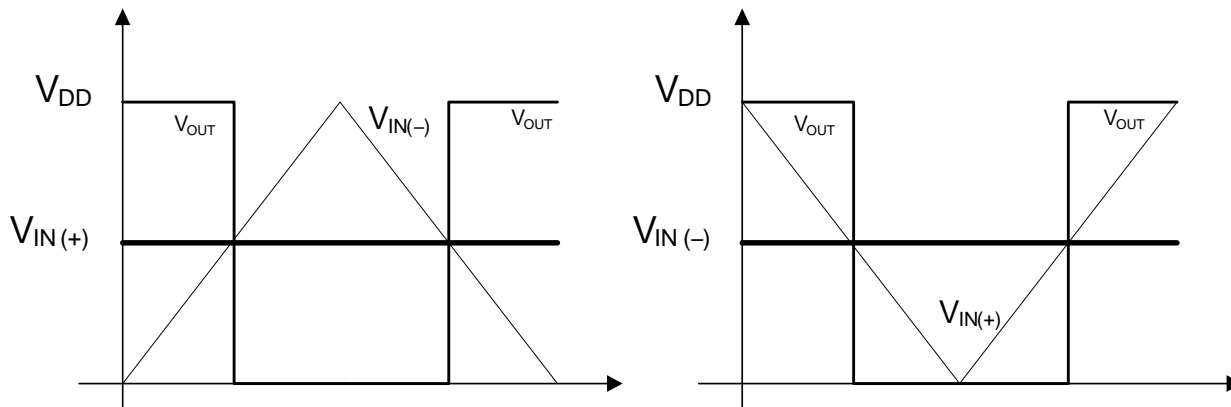


Figure 3.  $V_{IN}$  vs.  $V_{OUT}$

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## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Condition	Min.	Max.	Unit
$V_{DD}$ to $V_{SS}$	Supply Voltage		-3.0	+3.0	V
			0	6.0	
$DV_{IN}$	Differential Input Voltage			$\pm 6$	
$V_{IN}$	Input Voltage			$V_{SS}$ to $V_{DD}$	V
$t_s$	Output Short Circuit Duration (Note 1)			Indefinite	s
$T_J$	Junction Temperature			+150	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature Range		-65	+150	$^{\circ}\text{C}$
$P_D$	Power Dissipation			194	mW
$\Theta_{JA}$	Thermal Resistance			335	$^{\circ}\text{C}/\text{W}$
ESD	IEC 61000-4-2 System ESD	Air Gap		15	kV
		Contact		8	
	JEDEC JESD22-A114, Human Body Model	All Pins		8	
		Pin to Pin: IN(-), IN(+) to $V_{DD}$ or $V_{SS}$		12	
	JEDEC JESD22-C101, Charged Device Model	All Pins		2	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. The maximum total power dissipation must not be exceeded.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Condition	Min.	Max.	Unit
$V_{DD}$ to $V_{SS}$	Power Supply		-2.75	+2.75	V
			0	5.50	
$V_{DD}$	Power Supply	$V_{SS}$ 0 V	1.6	5.5	V
$V_{IN}$	Input Voltage			$V_{SS}$ to $V_{DD}$	V
$I_{OH}/I_{OL}$	Output Sink/Source Current	$V_{DD}$ 5.0 V		5	mA
		$V_{DD}$ 3.0 V		3	
		$V_{DD}$ 1.6 V		1	
$T_A$	Operating Temperature, Free Air		-40	+85	$^{\circ}\text{C}$

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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## ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
<b>V<sub>DD</sub> = 5.5 V, V<sub>SS</sub> = GND, and T<sub>A</sub> = +25°C</b>						
V <sub>HYS</sub>	Input Hysteresis	V <sub>CM</sub> = 0.5 V <sub>DD</sub>		4		mV
V <sub>IO</sub>	Input Offset Voltage (Note 2)	V <sub>CM</sub> = 0.5 V <sub>DD</sub>	-15	±1	+15	mV
I <sub>IO</sub>	Input Offset Current			10		µA
I <sub>I</sub>	Input Bias Current			10		µA
V <sub>CM</sub>	Common Mode Input Voltage		V <sub>SS</sub>		V <sub>DD</sub>	V
CMRR	Common Mode Rejection Ratio (Note 3)	V <sub>CM</sub> = V <sub>DD</sub>		68		dB
I <sub>DD</sub>	Supply Current			6	17	µA
PSRR	Power Supply Rejection Ratio (Note 3)	ΔV <sub>DD</sub> = 0.5 V	45	80		dB
I <sub>OS</sub>	Output Short Circuit Current	V <sub>O</sub> = V <sub>DD</sub>		60		mA
		V <sub>O</sub> = V <sub>SS</sub>		90		
V <sub>OL</sub>	Low-Level Output Voltage	I <sub>SINK</sub> = 5.0 mA		0.1	0.3	V
V <sub>OH</sub>	High-Level Output Voltage	I <sub>SOURCE</sub> = 5.0 mA	5.2	5.4		V
t <sub>PLH</sub>	Propagation Delay (Turn-On)	Overdrive 20 mV, C <sub>L</sub> = 15 pF		0.40		µs
t <sub>PHL</sub>	Propagation Delay (Turn-Off)	Overdrive = 20 mV, C <sub>L</sub> = 15 pF		0.42		µs
t <sub>TLH</sub>	Response Time, Output Rise/Fall (Note 4)	C <sub>L</sub> = 50 pF		4.0		ns
t <sub>THL</sub>				5.4		

**V<sub>DD</sub> = 3 V, V<sub>SS</sub> = GND, and T<sub>A</sub> = +25°C**

V <sub>HYS</sub>	Input Hysteresis	V <sub>CM</sub> = 0.5 V <sub>DD</sub>		4		mV
V <sub>IO</sub>	Input Offset Voltage (Note 2)	V <sub>CM</sub> = 0.5 V <sub>DD</sub>	-15	±1	+15	mV
I <sub>IO</sub>	Input Offset Current			10		µA
I <sub>I</sub>	Input Bias Current			10		µA
V <sub>CM</sub>	Common Mode Input Voltage		V <sub>SS</sub>		V <sub>DD</sub>	V
CMRR	Common Mode Rejection Ratio (Note 3)	V <sub>CM</sub> = V <sub>DD</sub>		60		dB
I <sub>DD</sub>	Supply Current			5.5	15.0	µA
PSRR	Power Supply Rejection Ratio (Note 3)	ΔV <sub>DD</sub> = 0.5 V	45	80		dB
I <sub>OS</sub>	Output Short Circuit Current	V <sub>O</sub> = V <sub>DD</sub>		27		mA
		V <sub>O</sub> = V <sub>SS</sub>		35		
V <sub>OL</sub>	Low-Level Output Voltage	I <sub>SINK</sub> = 3.0 mA		0.15	0.35	V
V <sub>OH</sub>	High-Level Output Voltage	I <sub>SOURCE</sub> = 3.0 mA	2.65	2.85		V
t <sub>PLH</sub>	Propagation Delay (Turn-On)	Overdrive = 20 mV, C <sub>L</sub> = 15 pF		0.45		µs
t <sub>PHL</sub>	Propagation Delay (Turn-Off)	Overdrive = 20 mV, C <sub>L</sub> = 15 pF		0.47		µs
t <sub>TLH</sub>	Response Time, Output Rise/Fall (Note 4)	C <sub>L</sub> = 50 pF		6.1		ns
t <sub>THL</sub>				6.2		

**V<sub>DD</sub> = 1.6 V, V<sub>SS</sub> = GND, and T<sub>A</sub> = +25°C**

V <sub>HYS</sub>	Input Hysteresis	V <sub>CM</sub> = 0.5 V <sub>DD</sub>		3.5		mV
V <sub>IO</sub>	Input Offset Voltage (Note 2)	V <sub>CM</sub> = 0.5 V <sub>DD</sub>	-15	±1	+15	mV
I <sub>IO</sub>	Input Offset Current			10		µA
I <sub>I</sub>	Input Bias Current			10		µA
V <sub>CM</sub>	Common Mode Input Voltage		V <sub>SS</sub>		V <sub>DD</sub>	V
CMRR	Common Mode Rejection Ratio (Note 3)	V <sub>CM</sub> = V <sub>DD</sub>		56		dB

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## ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
$V_{DD} = 1.6\text{ V}$ , $V_{SS} = \text{GND}$ , and $T_A = +25^\circ\text{C}$						
$I_{DD}$	Supply Current			5	15	$\mu\text{A}$
PSRR	Power Supply Rejection Ratio (Note 3)	$\Delta V_{DD} = 0.5\text{ V}$	45	80		dB
$I_{OS}$	Output Short Circuit Current	$V_O = V_{DD}$		5.5		mA
		$V_O = V_{SS}$		7.5		
$V_{OL}$	Low-Level Output Voltage	$I_{SINK} = 5.0\text{ mA}$		0.10	0.25	V
$V_{OH}$	High-Level Output Voltage	$I_{SOURCE} = 5.0\text{ mA}$	1.35	1.50		V
$t_{PLH}$	Propagation Delay (Turn-On)	Overdrive 20 mV, $C_L = 15\text{ pF}$		0.52		$\mu\text{s}$
$t_{PHL}$	Propagation Delay (Turn-Off)	Overdrive = 20 mV, $C_L = 15\text{ pF}$		0.54		$\mu\text{s}$
$t_{TLH}$	Response Time, Output Rise/Fall (Note 4)	$C_L = 50\text{ pF}$		16.5		ns
$t_{THL}$				13.0		

2. Differential input switching level is guaranteed at the minimum or maximum offset voltage, minus or plus half the maximum hysteresis voltage.

3. Guaranteed by design and characterization data.

4. Input signal: 1 kHz, square-wave signal with 10 ns edge rate.

TYPICAL PERFORMANCE CHARACTERISTICS

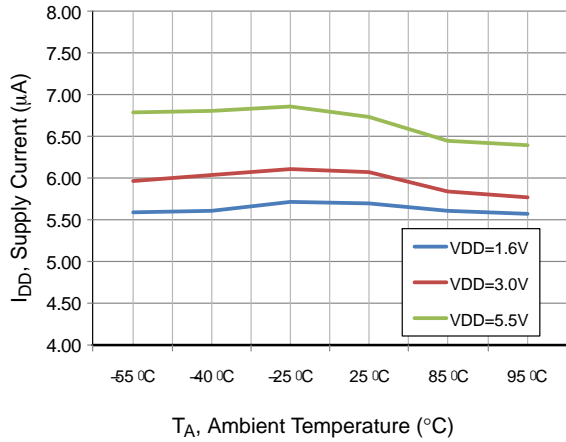


Figure 4. Supply Current vs. Temperature

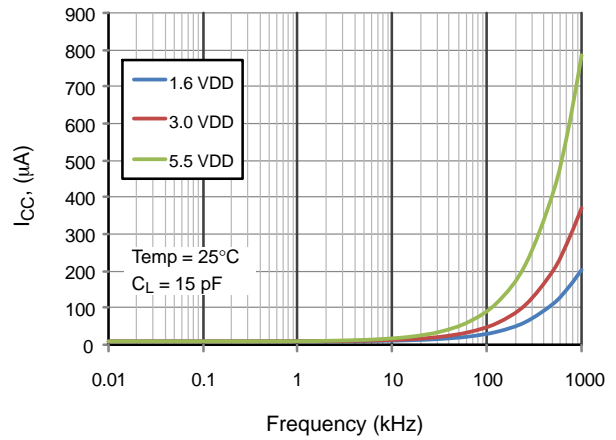


Figure 5. Supply Current vs. Output Transition Frequency

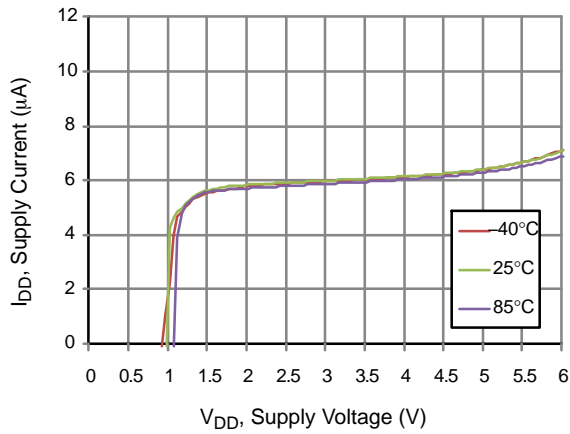


Figure 6. Supply Current vs. Supply Voltage

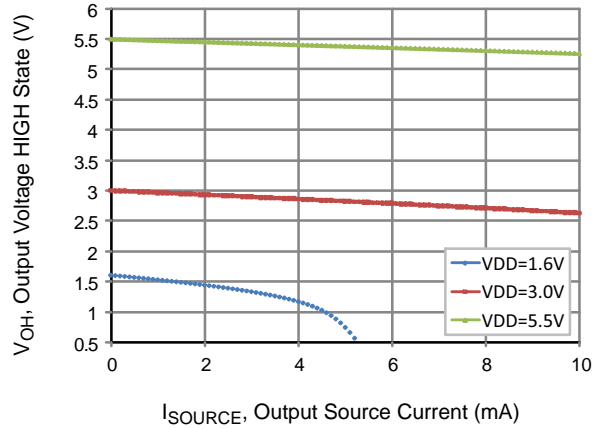


Figure 7. Output HIGH vs. Output Drive Current

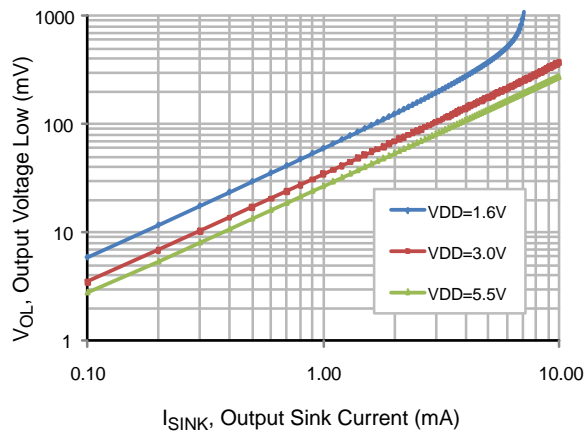


Figure 8. Output LOW vs. Output Drive Current

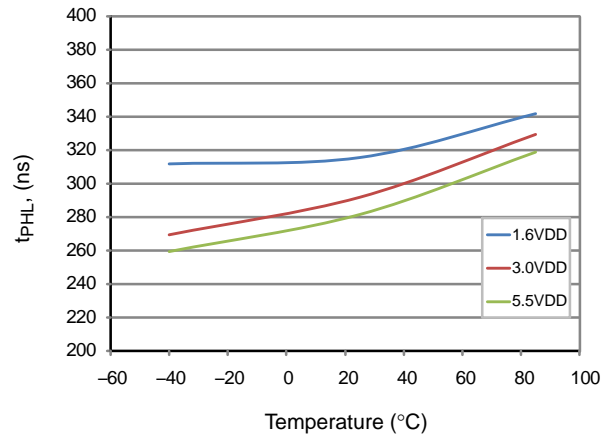
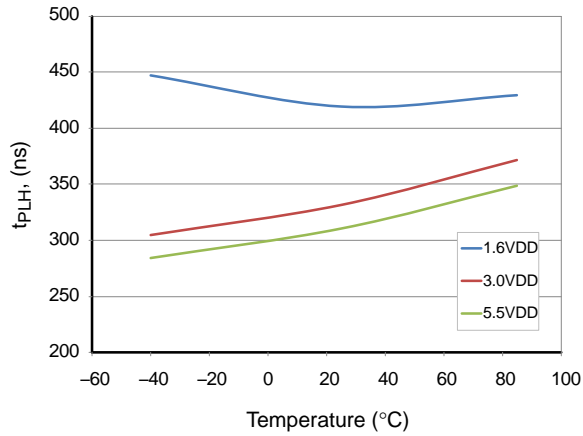


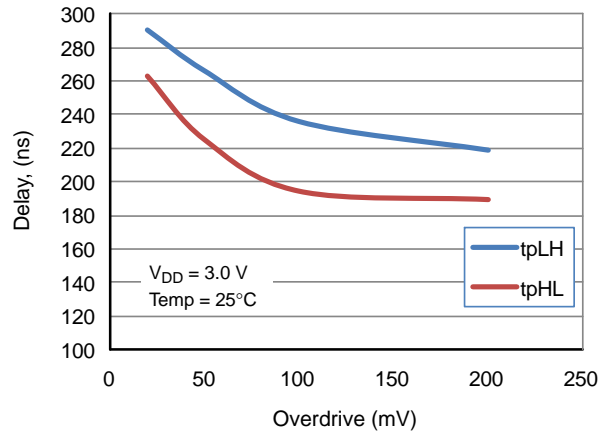
Figure 9. Propagation Delay  $t_{PHL}$  vs. Temperature

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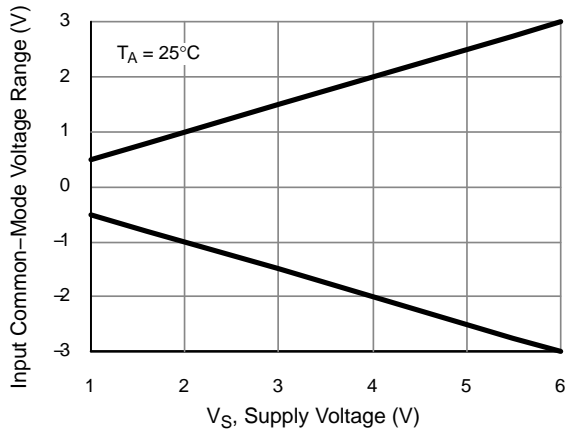
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



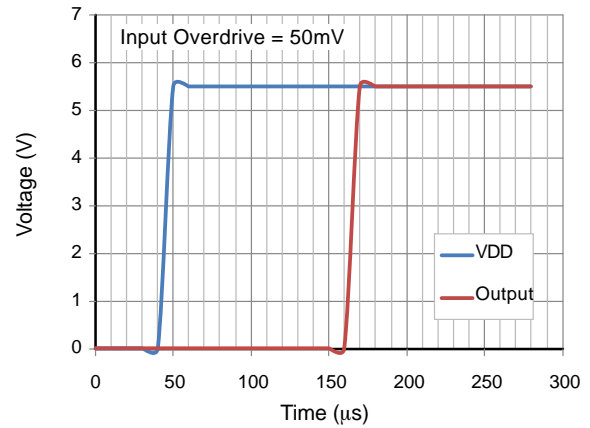
**Figure 10. Propagation Delay  $t_{(PLH)}$  vs. Temperature**



**Figure 11. Propagation Delay vs. Input Overdrive**



**Figure 12. Input Common-Mode Voltage Range vs. Supply Voltage**



**Figure 13. Power-Up Delay**

### ORDERING INFORMATION

Device	Operating Temperature Range	Top Mark	Package	Shipping†
FAN156L6X	-40°C to +85°C	CN	6-Lead, SIP6 1.45x1.0 (MicroPak™) (Pb-Free)	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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**SIP6 1.45X1.0**  
CASE 127EB  
ISSUE O

DATE 31 AUG 2016



**NOTES:**

1. CONFORMS TO JEDEC STANDARD MO-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-2009
4. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

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