



# Differential Comparator – LM111

## Differential Comparator with Strobe in bare die form

Rev 1.1  
21/02/19

### Description

The LM111 voltage comparator operates over a wide range of supply voltages; from standard  $\pm 15V$  Op-Amp supplies down to a single 3V supply and with low input currents. Device output is compatible with RTL, DTL, and TTL as well as MOS circuits. The device can drive lamps or relays, switching voltages up to 50V at currents as high as 50mA. Both the inputs and the outputs of the LM111 can be isolated from system ground, and the output can drive loads referred to ground, the positive supply, or the negative supply. Offset balancing and strobe capability are provided and outputs can be wire-ORed.

### Features:

- Operates from single 5V supply
- Input bias current: 150nA max over temperature
- Offset current: 20nA max over temperature
- Differential input voltage range:  $\pm 30V$
- Power consumption: 135mW at  $\pm 15V$
- Offset voltage null capability
- Strobe capability
- Characterized over full military temperature range.

### Ordering Information

The following part suffixes apply:

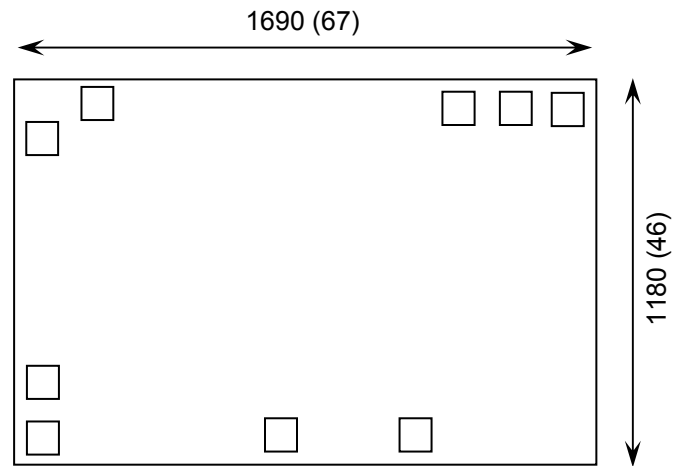
- No suffix - MIL-STD-883 /2010B Visual Inspection
- “H” - MIL-STD-883 /2010B Visual Inspection + MIL-PRF-38534 Class H LAT
- “K” - MIL-STD-883 /2010A Visual Inspection (Space) + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

[www.siliconsupplies.com/quality/bare-die-lot-qualification](http://www.siliconsupplies.com/quality/bare-die-lot-qualification)

### Die Dimensions in $\mu m$ (mils)



### Supply Formats:

- Default – Die in Waffle Pack (100 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness  $\leftrightarrow$  280 $\mu m$ (11 Mils) – On request
- Assembly into Metal or Ceramic Package – On request

### Mechanical Specification

Die Size (Unsawn)	1690 x 1180 67 x 46	$\mu m$ mils
Minimum Bond Pad Size	90 x 90 3.54 x 3.54	$\mu m$ mils
Die Thickness	280 ( $\pm 20$ ) 11.02 ( $\pm 0.79$ )	$\mu m$ mils
Top Metal Composition	Al 1%Si 1.1 $\mu m$	
Back Metal Composition	N/A – Bare Si	

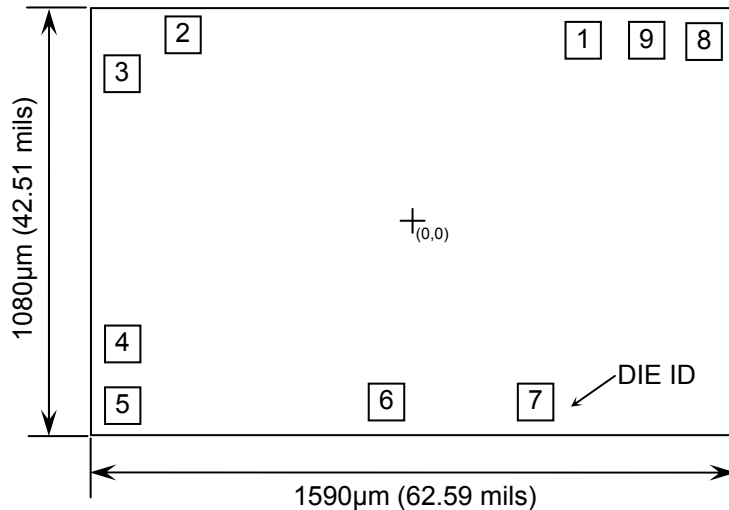




# Differential Comparator – LM111

Rev 1.1  
21/02/19

## Pad Layout and Functions

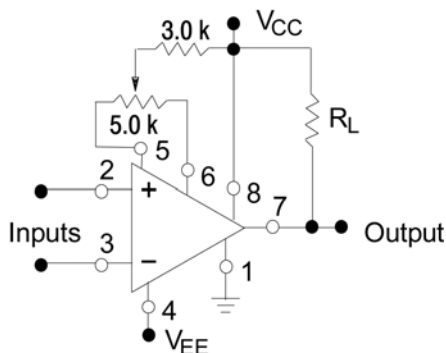


NOTE: EITHER PAD 7 OR PAD 8 CAN BE USED AS OUTPUT FOR FLEXIBILITY IN LAYOUT

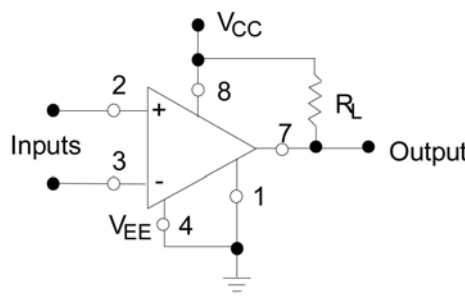
PAD	FUNCTION	COORDINATES (µm)	
		X	Y
1	GND	424	461
2	INPUT +	-574	469
3	INPUT -	-724	376
4	V <sub>EE</sub>	-724	-319
5	BALANCE	-724	-469
6	BAL/STROBE	-69	-463
7	OUTPUT	298	-469
8	OUTPUT	724	455
9	V <sub>CC</sub>	574	461

CHIP BACK POTENTIAL IS FLOAT

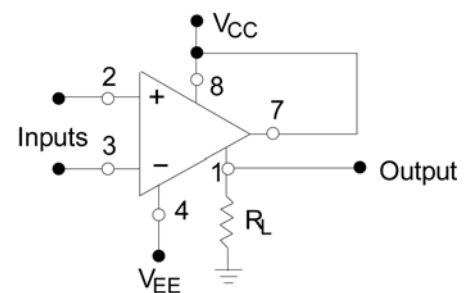
## Typical Configurations



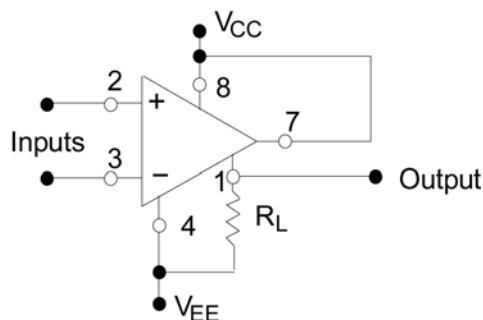
Split Power Supply with Offset Balance



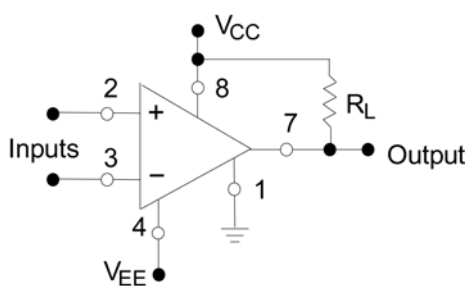
Single Supply



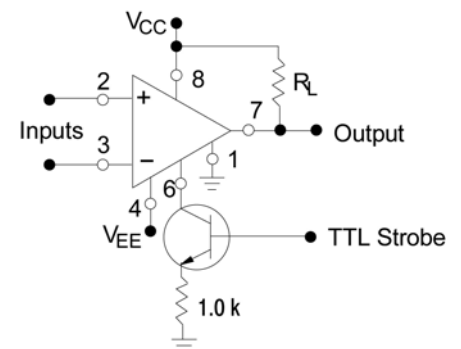
Ground Referred Load  
(Input polarity reversed if GND is output)



Load Referred to Negative Supply  
(Input polarity reversed if GND is output)



Load Referred to Positive Supply



Strobe Capability





# Differential Comparator – LM111

Rev 1.1  
21/02/19

## Absolute Maximum Ratings<sup>1</sup>

PARAMETER	SYMBOL	VALUE	UNIT
Total Supply Voltage	$V_{CC} +  V_{EE} $	36	V
Output to Negative Supply Voltage	$V_O - V_{EE}$	50	V
Ground to Negative Supply Voltage	$V_{EE}$	30	V
Input Differential Voltage	$V_{ID}$	$\pm 30$	V
Input Voltage <sup>2</sup>	$V_{IN}$	$\pm 15$	V
Voltage at Strobe Pin	-	$V_{CC}$ to $V_{CC}-5$	V
Junction Temperature	$T_J$	175	°C
Power Dissipation in Still Air	$P_D$	810	mW

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.
2. This rating applies for  $\pm 15V$  supplies. The positive input voltage limit is 30V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30V below the positive supply, whichever is less.

## Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS
DC Supply Voltage	$V_S$	$\pm 3.5$ or +5	$\pm 15$	V
Operating Temperature	$T_A$	-55	+125	°C

## DC Electrical Characteristics ( $V_{CC} = +15V$ , $V_{EE} = -15V$ , $T_A = 25^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	LIMITS			UNITS	
			MIN	TYP	MAX		
Input Offset Voltage <sup>3</sup>	$V_{IO}$	$R_S \leq 50k\Omega$	25°C	-	0.7	3	mV
			Full range	-	-	4	
Input Bias Current	$I_B$	$R_S \leq 50k\Omega$	25°C	-	60	100	nA
			Full range	-	-	150	
Input Offset Current <sup>3</sup>	$I_{IO}$	-	25°C	-	4	10	nA
			Full range	-	-	20	
Input Common Mode Voltage Range	$V_{ICR}$	-	25°C	-14.5	+13.8,-14.7	+13	V
			Full range	-	-	-	
Positive Supply Current	$I_{CC}$	-	-	5.1	6	mA	
Negative Supply Current	$I_{EE}$	-	-	4.1	5		
Voltage Gain	$A_V$	-	40	200	-	V/mV	
Response Time	$t_{re}$	100 mV input step with 5 mV overdrive	-	200	-	ns	

3. The offset voltages and offset currents given are the maximum values required to drive the output within a volt of either supply with a 1.0 mA load. Thus, these parameters define an error band and take into account the "worst case" effects of voltage gain and input impedance.





# Differential Comparator – LM111

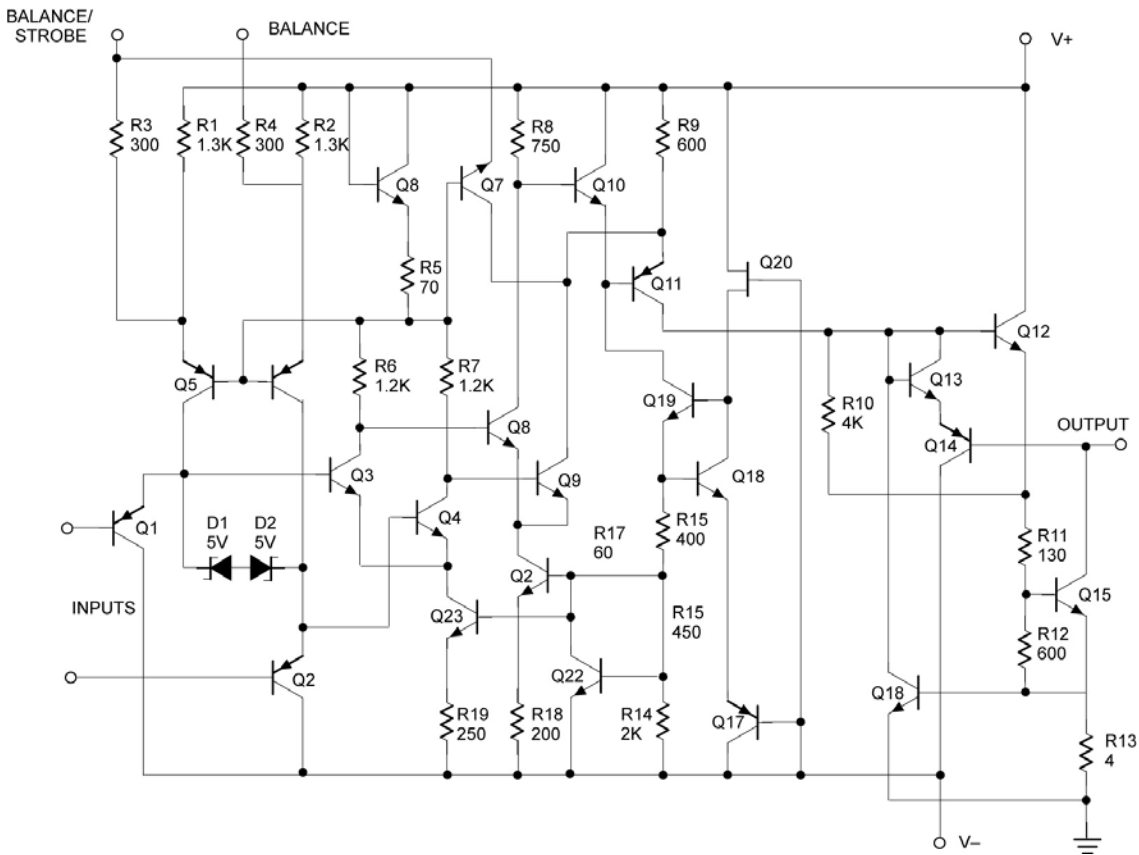
Rev 1.1  
21/02/19

## DC Electrical Characteristics ( $V_{CC} = +15V$ , $V_{EE} = -15V$ , $T_A = 25^\circ C$ unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS	LIMITS			UNITS
			MIN	TYP	MAX	
Saturation Voltage	$V_{SAT}$	$V_{IN} \leq -5mV$ $I_{OUT} = 50mA$ $25^\circ C$	-	0.75	1.5	V
		$V_{CC} \geq 4.5V$ , $V_{EE} = 0$ , $V_{IN} \leq -6mV$ , $I_{OUT} \leq 8mA$ Full range	-	0.23	0.4	V
Strobe ON Current <sup>4</sup>	$I_{STROBE}$	- $25^\circ C$	-	2	5	mA
Output Leakage Current	$I_{OL}$	$V_{IN} \geq 5mV$ , $V_{OUT} = 35V$ , $I_{STROBE} = 3mA$ $25^\circ C$	-	0.2	10	nA
		$V_{IN} \geq 5mV$ , $V_{OUT} = 35V$ Full range	-	0.1	0.5	$\mu A$

4. Do not short the strobe pin to ground; it should be current driven at 3.0 mA to 5.0 mA

## Schematic





# Differential Comparator – LM111

Rev 1.1  
21/02/19

## Typical Characteristics

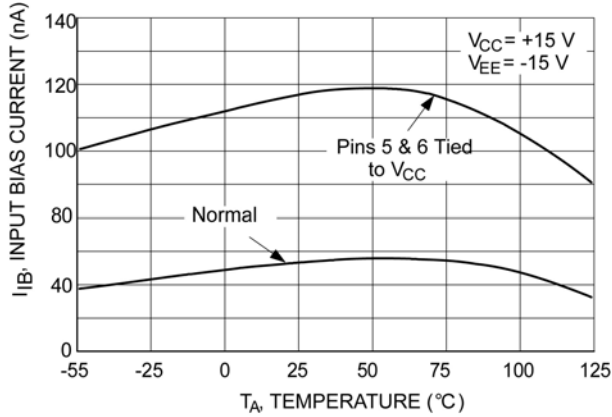


FIGURE 1. Input Bias Current versus Temperature

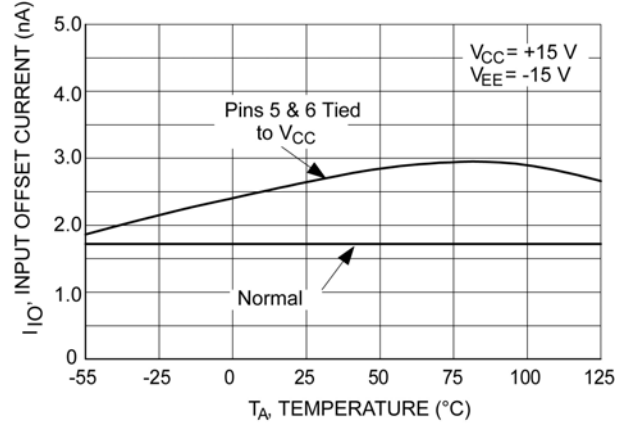


FIGURE 2. Input Offset Current versus Temperature

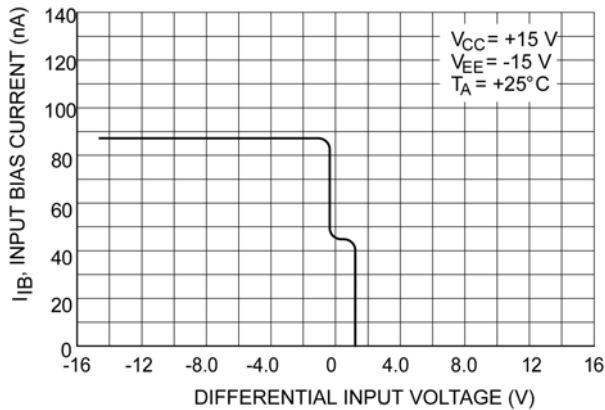


FIGURE 3. Input Bias Current versus Differential Input Voltage

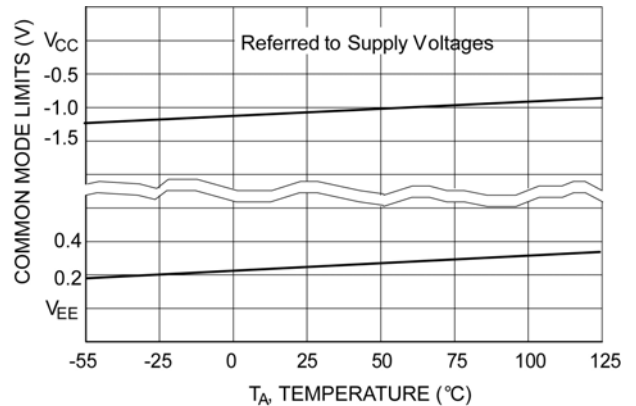


FIGURE 4. Common Mode Limits versus Temperature

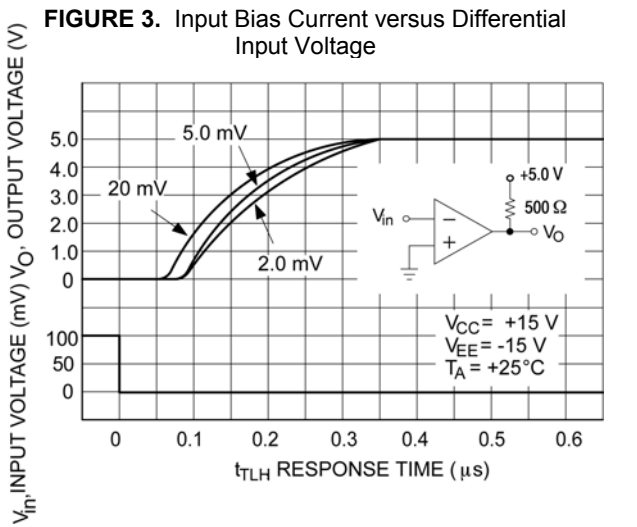


FIGURE 5. Response Time for Various Input Overdrives

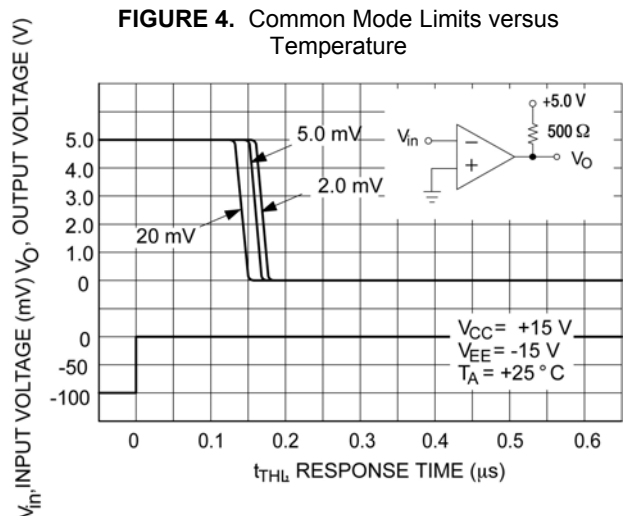


FIGURE 6. Response Time for Various Input Overdrives





# Differential Comparator – LM111

Rev 1.1  
21/02/19

## Typical Characteristics continued

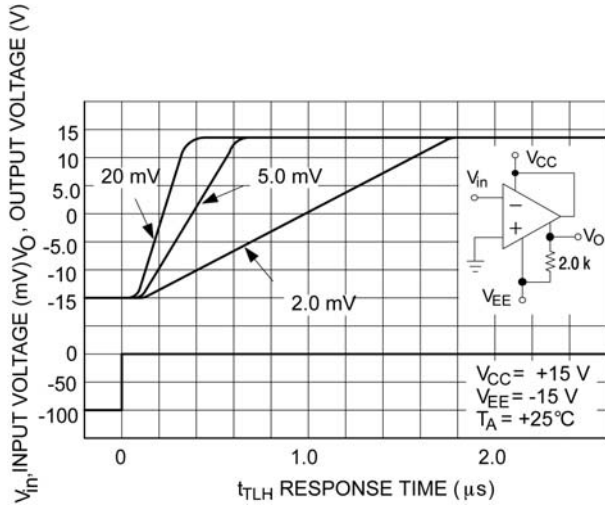


FIGURE 7. Response Time for Various Input Overdrives

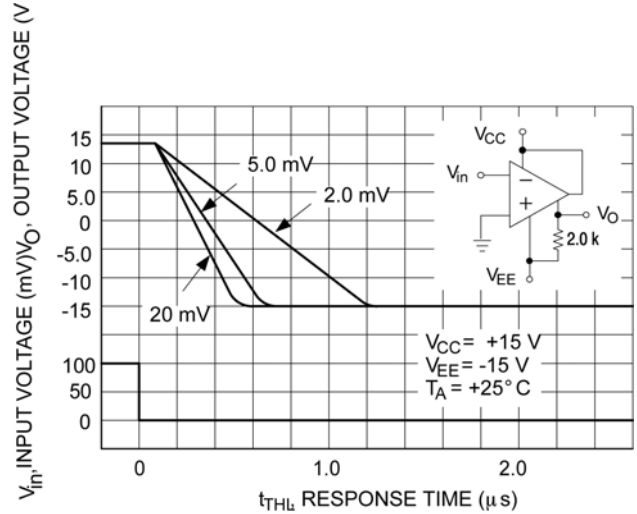


FIGURE 8. Response Time for Various Input Overdrives

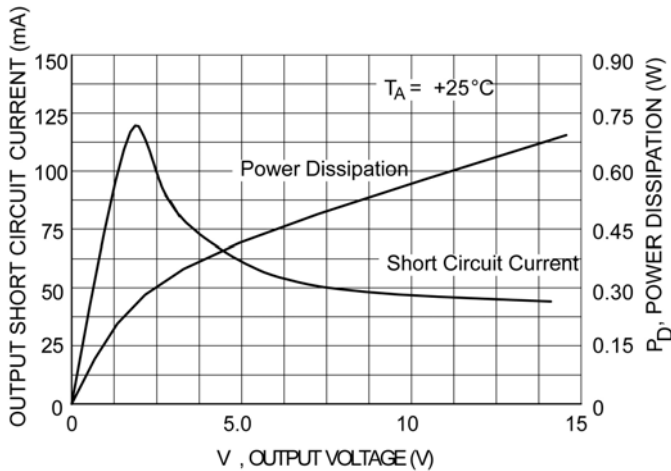


FIGURE 9. Output Short Circuit Current characteristics

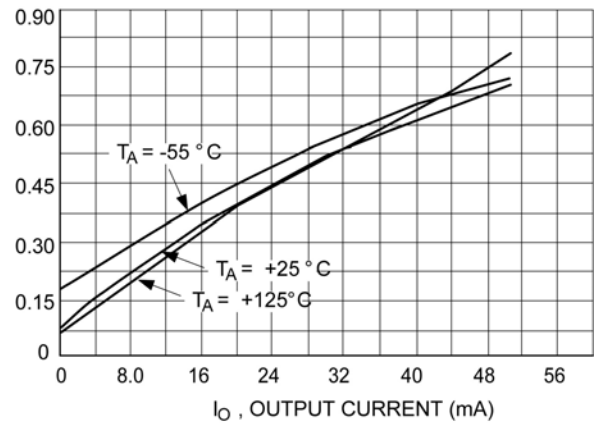


FIGURE 10. Output Saturation Voltage versus Output Current

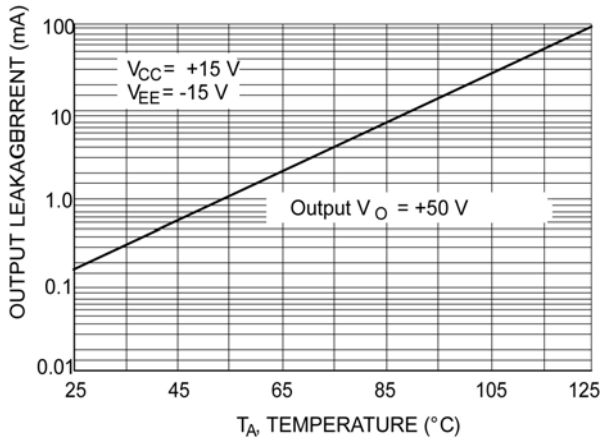


FIGURE 11. Output Leakage Current versus Temperature

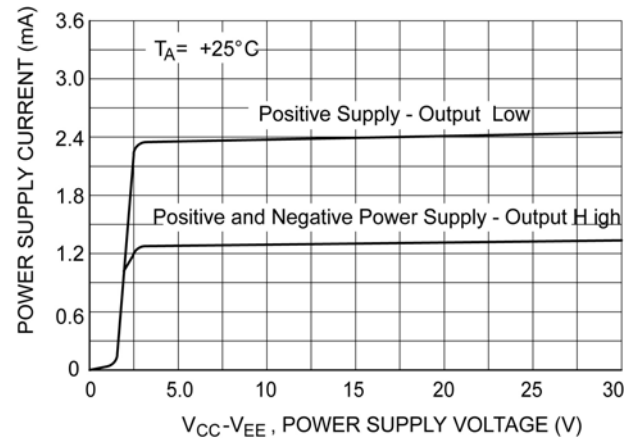


FIGURE 12. Power Supply Current versus Supply Voltage





# Differential Comparator – LM111

Rev 1.1  
21/02/19

## Typical Characteristics continued

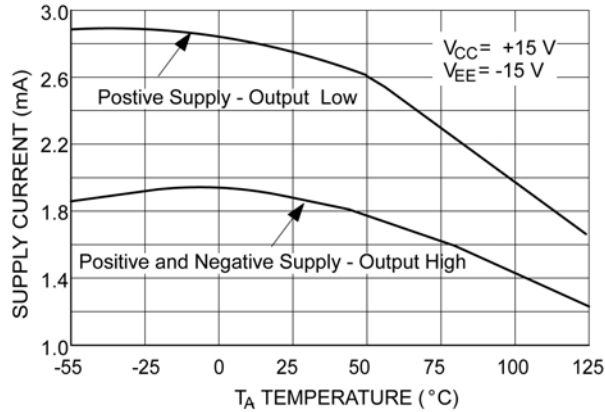


FIGURE 13. Power Supply Current versus Temperature

**DISCLAIMER:** The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Silicon Supplies Ltd hereby disclaims any and all warranties and liabilities of any kind.

**LIFE SUPPORT POLICY:** Silicon Supplies Ltd components may be used in life support devices or systems only with the express written approval of Silicon Supplies Ltd, if a failure of such components can reasonably be expected to cause the failure of that life support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

