

μ A111 • μ A311 Voltage Comparators

Linear Division Comparators

Description

The μ A111 and μ A311 are monolithic, low input current voltage comparators, each constructed using the Fairchild Planar Epitaxial process. The μ A111 series operates from the single 5.0 V integrated circuit logic supply to the standard ± 15 V operational amplifier supplies. The μ A111 series is intended for a wide range of applications including driving lamps or relays and switching voltages up to 50 V at currents as high as 50 mA. The output stage is compatible with RTL, DTL, TTL and MOS logic. The input stage current can be raised to increase input slew rate.

- Low Input Bias Current 100 nA Max (μ A111), 250 nA Max (μ A311)
- Low Input Offset Current 10 nA Max (μ A111), 50 nA Max (μ A311)
- Differential Input Voltage ± 30 V
- Power Supply Voltage Single 5.0 V Supply To ± 15 V
- Offset Voltage Null Capability
- Strobe Capability

Absolute Maximum Ratings¹

Storage Temperature Range

Metal Can	-65°C to +175°C
Molded DIP and SO-8	-65°C to +150°C

Operating Temperature Range

Extended (μ A111M)	-55°C to +125°C
Commercial (μ A311C)	0°C to 70°C

Lead Temperature

Metal Can (soldering, 60 s)	300°C
Molded DIP and SO-8 (soldering, 10 s)	265°C

Internal Power Dissipation^{2, 3}

8L-Metal Can	1.00 W
8L-Molded DIP	0.93 W
SO-8	0.81 W

Voltage between V+ and V-

36 V

Output to V-

(μ A111)	50 V
(μ A311)	40 V

Ground to V-

30 V

Differential Input Voltage

	± 30 V
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Input Voltage

	± 15 V
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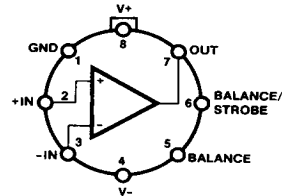
Output Short Circuit Duration

10 s

Notes

1. This rating applies for ± 15 V supplies. The positive input voltage limit is 30 V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30 V below the positive supply, whichever is less.
2. T_J Max = 150°C for the Molded DIP and SO-8, and 175°C for the Metal Can.
3. Ratings apply to ambient temperature at 25°C. Above this temperature, derate the 8L-Metal Can at 6.7 mW/°C, the 8L-Molded DIP at 7.5 mW/°C, and the SO-8 at 6.5 mW/°C.

Connection Diagram 8-Lead Metal Package (Top View)



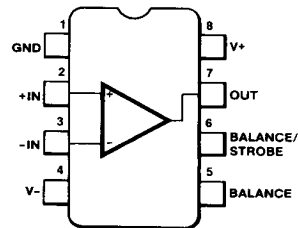
CD01000F

Lead 4 connected to case

Order Information

Device Code	Package Code	Package Description
μ A111HM	5W	Metal
μ A311HC	5W	Metal

Connection Diagram 8-Lead DIP and SO-8 Package (Top View)

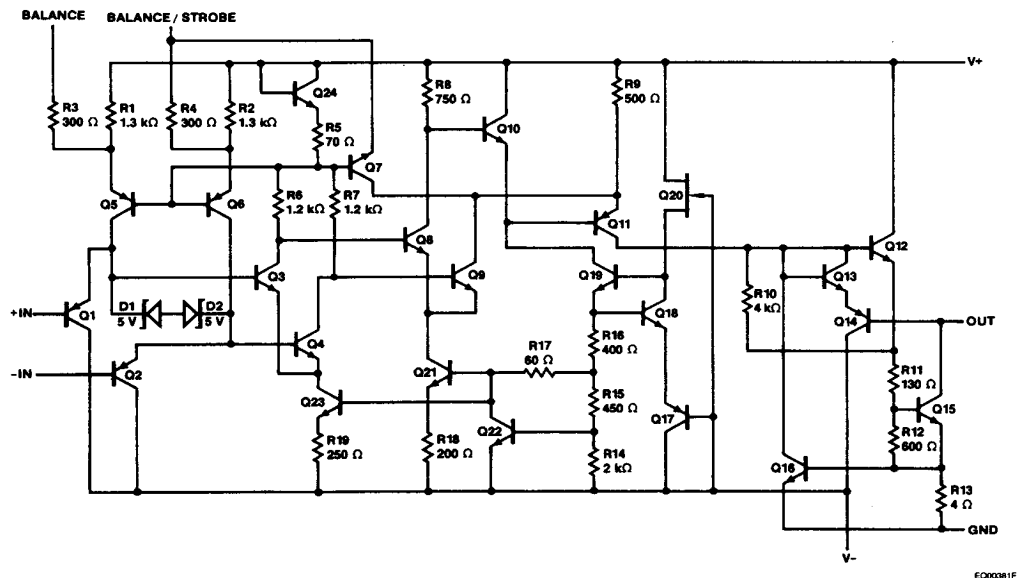


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Order Information

Device Code	Package Code	Package Description
μ A311TC	9T	Molded DIP
μ A311SC	KC	Molded Surface Mount

Equivalent Circuit



μA111

Electrical Characteristics $T_A = 25^\circ\text{C}$, $V_{CC} = \pm 15\text{ V}$, unless otherwise specified.¹

Symbol	Characteristic	Condition	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage ²	$R_S \leq 50\text{ k}\Omega$		0.7	3.0	mV
I_{IO}	Input Offset Current ²			4.0	10	nA
I_{IB}	Input Bias Current			60	100	nA
A_{VS}	Large Signal Voltage Gain			200		V/mV
t_{PD}	Response Time ³			200		ns
V_{SAT}	Saturation Voltage	$V_I \leq -5.0\text{ mV}$, $I_{OL} = 50\text{ mA}$		0.75	1.5	V
$I_{O(ST)}$	Strobe On Current			3.0		mA
I_{CEX}	Output Leakage Current	$V_I \geq 5.0\text{ mV}$, $V_O = 35\text{ V}$		0.2	10	nA

The following specifications apply for $-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$.

V_{IO}	Input Offset Voltage ²	$R_S \leq 50\text{ k}\Omega$			4.0	mV
I_{IO}	Input Offset Current ²				20	nA
I_{IB}	Input Bias Current				150	nA
V_{IR}	Input Voltage Range			± 14		V
V_{SAT}	Saturation Voltage	$V_+ \geq 4.5\text{ V}$, $V_- = 0\text{ V}$, $V_I \leq -6.0\text{ mV}$, $I_{OL} \leq 8.0\text{ mA}$		0.23	0.4	V

μA111 (Cont.)**Electrical Characteristics** $-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$, $V_{\text{CC}} = \pm 15 \text{ V}$, unless otherwise specified.¹

Symbol	Characteristic	Condition	Min	Typ	Max	Unit
I_{CEX}	Output Leakage Current	$V_I \geq 5.0 \text{ mV}$, $V_O = 35 \text{ V}$		0.1	0.5	μA
I_+	Positive Supply Current	$T_A = 25^{\circ}\text{C}$		5.1	6.0	mA
I_-	Negative Supply Current	$T_A = 25^{\circ}\text{C}$		4.1	5.0	mA

 μA311 **Electrical Characteristics** $T_A = 25^{\circ}\text{C}$, $V_{\text{CC}} = \pm 15 \text{ V}$, unless otherwise specified.¹

Symbol	Characteristic	Condition	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage ²	$R_S \leq 50 \text{ k}\Omega$		2.0	7.5	mV
I_{IO}	Input Offset Current ²			6.0	50	nA
I_{IB}	Input Bias Current			100	250	nA
A_{VS}	Large Signal Voltage Gain			200		V/mV
t_{PD}	Response Time ³			200		ns
V_{SAT}	Saturation Voltage	$V_I \leq -10 \text{ mV}$, $I_O = 50 \text{ mA}$		0.75	1.5	V
$I_{\text{O(ST)}}$	Strobe On Current			3.0		mA
I_{CEX}	Output Leakage Current	$V_I \geq 10 \text{ mV}$, $V_O = 35 \text{ V}$		0.2	50	nA

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The following specifications apply for $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$.

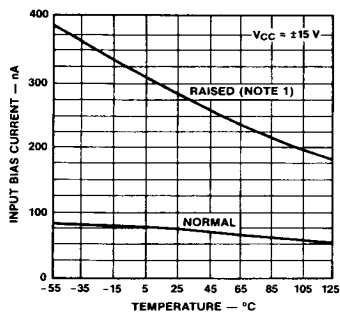
V_{IO}	Input Offset Voltage ²	$R_S \leq 50 \text{ k}\Omega$			10	mV
I_{IO}	Input Offset Current ²				70	nA
I_{IB}	Input Bias Current				300	nA
V_{IR}	Input Voltage Range			± 14		V
V_{SAT}	Saturation Voltage	$V_+ \geq 4.5 \text{ V}$, $V_- = 2.25 \text{ V}$, $V_I \leq -10 \text{ mV}$, $I_{\text{OL}} \leq 8.0 \text{ mA}$		0.23	0.4	V
I_+	Positive Supply Current	$T_A = 25^{\circ}\text{C}$		5.1	7.5	mA
I_-	Negative Supply Current	$T_A = 25^{\circ}\text{C}$		4.1	5.0	mA

Notes

1. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5.0 V supply to $\pm 15 \text{ V}$ supplies.
2. 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.
3. The response time specified is for a 100 mV input step with 5.0 mV overdrive.

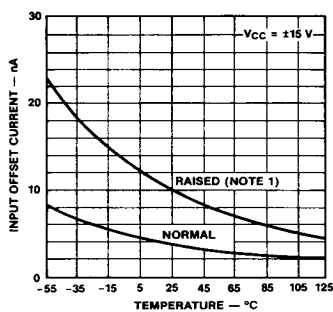
Typical Performance Curves for $\mu A111$

Input Bias Current vs Temperature



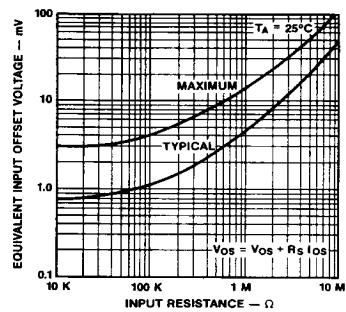
PC06720F

Input Offset Current vs Temperature



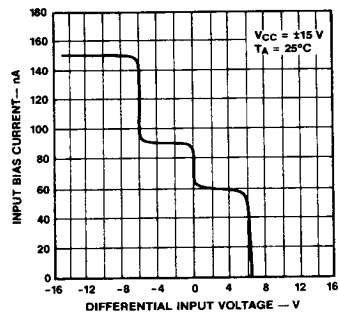
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Offset Voltage vs Input Resistance



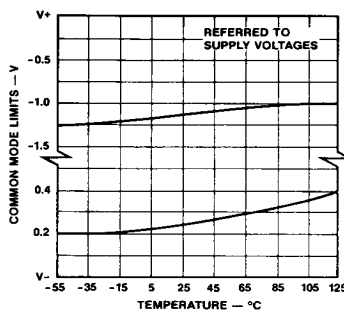
PC06740F

Input Bias Current vs Differential Input Voltage



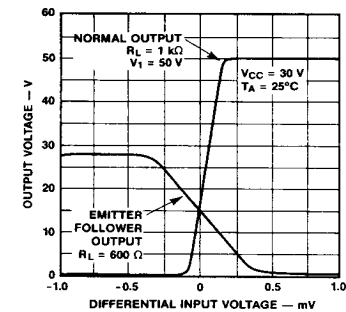
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Common Mode Limits vs Temperature



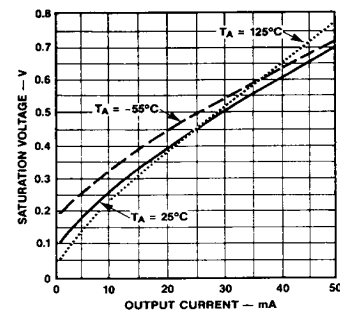
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Output Voltage vs Differential Input Voltage



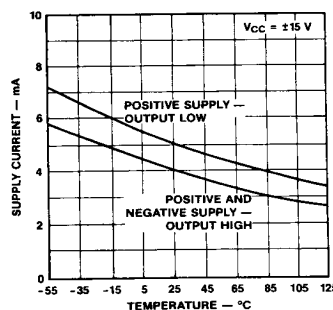
PC06770F

Saturation Voltage vs Output Current



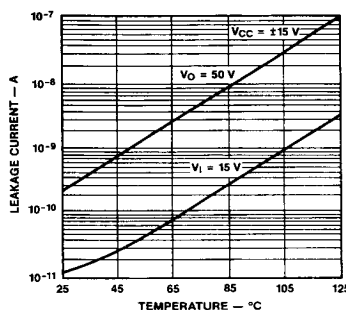
PC06780F

Supply Current vs Temperature



PC06790F

Leakage Current vs Temperature



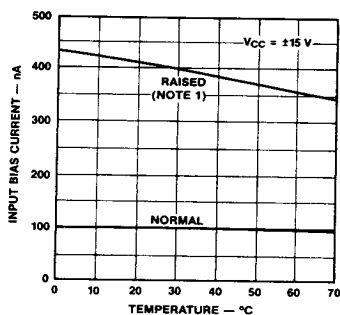
PC06800F

Note

1. Leads 5, 6 and 8 are shorted.

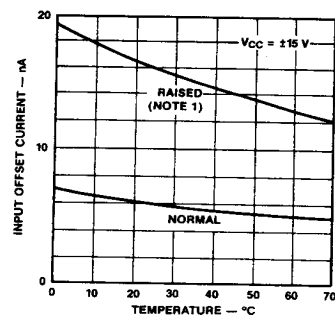
Typical Performance Curves for $\mu A311$

Input Bias Current vs Temperature



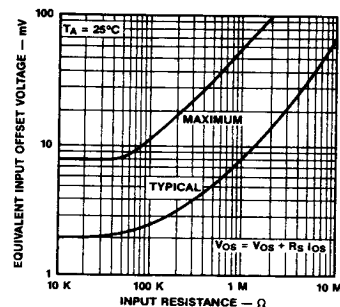
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Input Offset Current vs Temperature



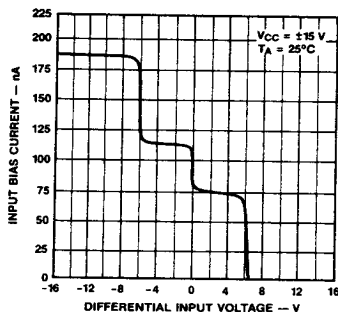
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Offset Voltage vs Input Resistance



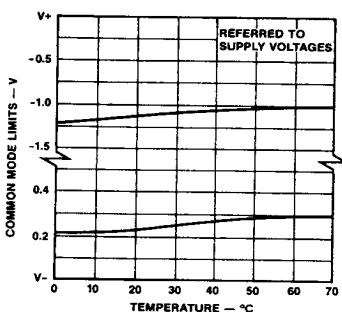
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Input Bias Current vs Differential Input Voltage



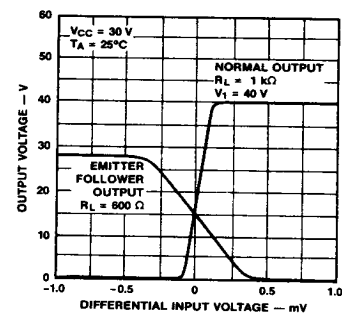
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Common Mode Limits vs Temperature



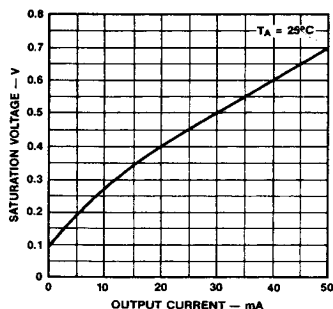
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Output Voltage vs Differential Input Voltage



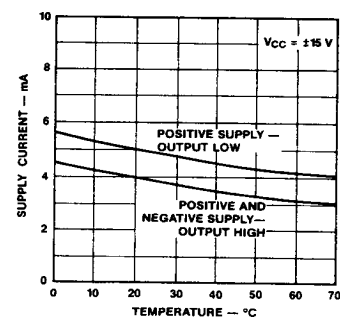
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Saturation Voltage vs Output Current



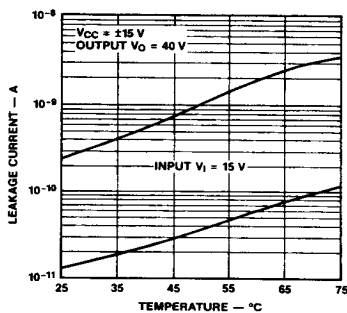
PC06870F

Supply Current vs Temperature



PC06880F

Leakage Current vs Temperature



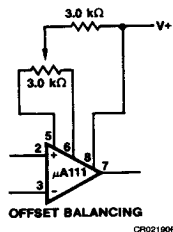
PC06890F

Note

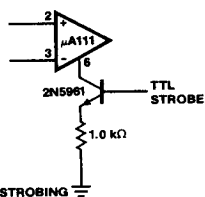
1. Leads 5, 6 and 8 are shorted.

Typical Applications

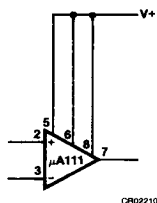
Offset Null Circuit



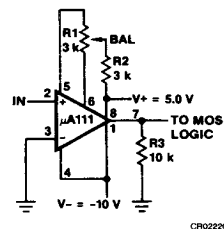
Strobe Circuit



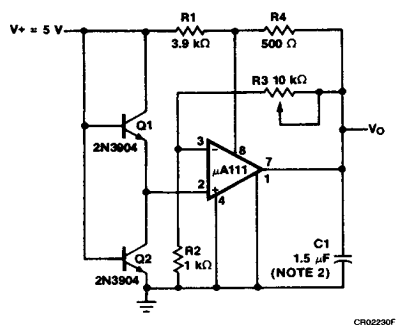
Increasing Input Stage Current (Note 1)



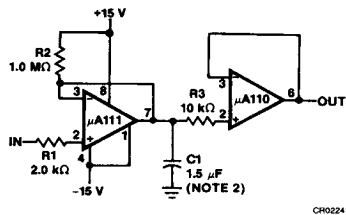
Zero Crossing Detector Driving MOS Logic (Note 3)



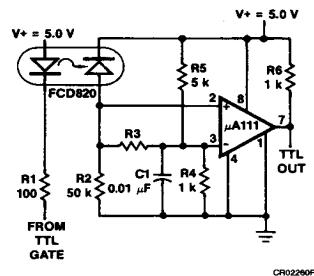
Adjustable Low Voltage Reference Supply



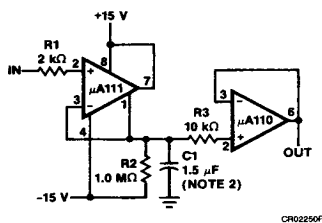
Negative Peak Detector



Digital Transmission Isolator (Note 3)



Positive Peak Detector

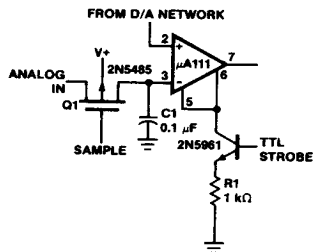


Notes

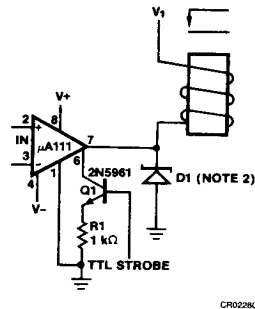
- 1) Increases typical common mode slew rate from 7.0 V/μs to 18 V/μs.
- 2) Solid Tantalum.
- 3) All resistor values in ohms.

Typical Applications (Cont.)

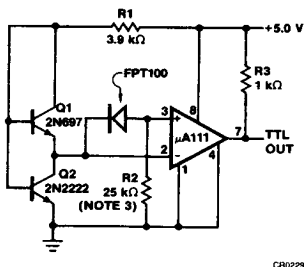
Strobing of Both Input And Output Stages (Note 1)



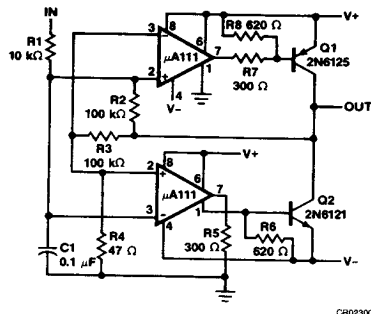
Relay Driver with Strobe



Precision Photodiode Comparator



Switching Power Amplifier



Notes

1. Typical input current is 50 pA with inputs strobed off.
2. Absorbs inductive kickback of relay and protects IC from severe voltage transients on V_I line.
3. R2 sets the comparison level. At comparison, the photodiode has less than 5.0 mV across it, decreasing leakages by an order of magnitude.

Switching Power Amplifier

