Voltage Comparators/Buffers

LM111/LM211 voltage comparators

general description

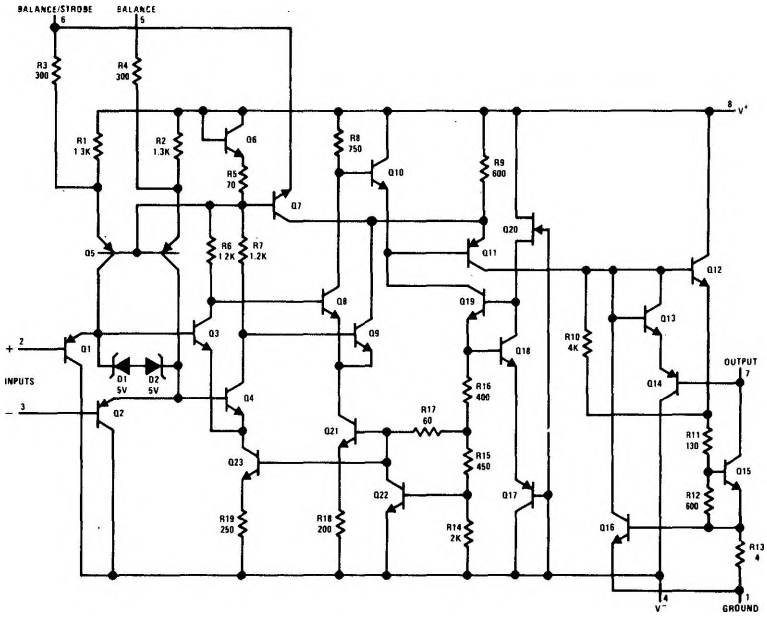
The LM111 and LM211 are voltage comparators that have input currents nearly a thousand times lower than devices like the LM106 or LM710. They are also designed to operate over a wider range of supply voltages: from standard ±15V op amp supplies down to the single 5V supply used for IC logic. Their output is compatible with RTL, DTL and TTL as well as MOS circuits. Further, they can drive lamps or relays, switching voltages up to 50V at currents as high as 50 mA. Outstanding characteristics include:

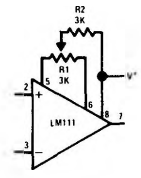
- Operates from single 5V supply
- Input current: 150 nA max. over temperature
- Offset current: 20 nA max. over temperature
- Differential input voltage range: ±30V
- Power consumption: 135 mW at ±15V

Both the inputs and the outputs of the LM111 or the LM211 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 OR'ed. Although slower than the LM106 and LM710 (200 ns response time vs 40 ns) the devices are also much less prone to spurious oscillations. The LM111 has the same pin configuration as the LM106 and LM710.

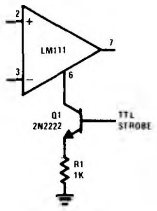
The LM211 is identical to the LM111, except that its performance is specified over a −25°C to 85°C temperature range instead of −55°C to 125°C.

schematic diagram and auxiliary circuits

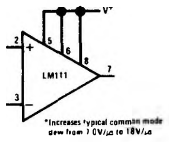




Offset Balancing

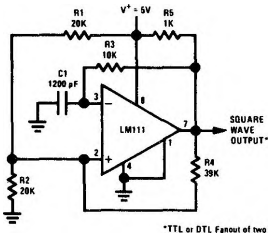


Strobing

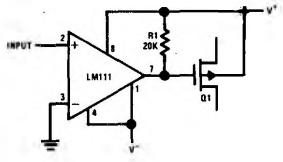


Increasing Input Stage Current*

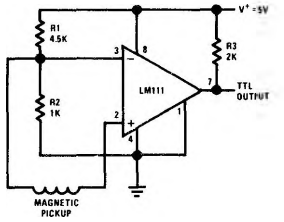
typical applications



100 kHz Free Running Multivibrator



Zero Crossing Detector Driving MOS Switch



Detector for Magnetic Transducer

absolute maximum ratings

Total Supply Voltage (V_{84})	36V
Output to Negative Supply Voltage (V_{74})	50V
Ground to Negative Supply Voltage (V_{14})	30V
Differential Input Voltage	±30V
Input Voltage (Note 1)	±15V
Power Dissipation (Note 2)	500 mW
Output Short Circuit Duration	10 sec
Operating Temperature Range LM111	−55°C to 125°C
LM211	−25°C to 85°C
Storage Temperature Range	−65°C to 150°C
Lead Temperature (soldering, 10 sec)	300°C

electrical characteristics (Note 3)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage (Note 4)	$T_A = 25°C$, $R_S \leq 50k$		0.7	3.0	mV
Input Offset Current (Note 4)	$T_A = 25°C$		4.0	10	nA
Input Bias Current	$T_A = 25°C$		60	100	nA
Voltage Gain	$T_A = 25°C$		200		V/mV
Response Time (Note 5)	$T_A = 25°C$		200		ns
Saturation Voltage	$V_{IN} \leq -5$ mV, $I_{OUT} = 50$ mA $T_A = 25°C$		0.75	1.5	V
Strobe On Current	$T_A = 25°C$		3.0		mA
Output Leakage Current	$V_{IN} \geq 5$ mV, $V_{OUT} = 35V$ $T_A = 25°C$		0.2	10	nA
Input Offset Voltage (Note 4)	$R_S \leq 50k$			4.0	mV
Input Offset Current (Note 4)				20	nA
Input Bias Current				150	nA
Input Voltage Range			±14		V
Saturation Voltage	$V^+ \geq 4.5V$, $V^- = 0$ $V_{IN} \leq -6$ mV, $I_{SINK} \leq 8$ mA		0.23	0.4	V
Output Leakage Current	$V_{IN} \geq 5$ mV, $V_{OUT} = 35V$		0.1	0.5	μA
Positive Supply Current	$T_A = 25°C$		5.1	6.0	mA
Negative Supply Current	$T_A = 25°C$		4.1	5.0	mA

Note 1: This rating applies for ±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.

Note 2: The maximum junction temperature of the LM111 is 150°C, while that of the LM211 is 110°C. For operating at elevated temperatures, devices in the TO-5 package must be derated based on a thermal resistance of 150°C/W, junction to ambient, or 45°C/W, junction to case. For the flat package, the derating is based on a thermal resistance of 185°C/W when mounted on a 1/16-inch-thick epoxy glass board with ten, 0.03-inch-wide, 2-ounce copper conductors. The thermal resistance of the dual-in-line package is 100°C/W, junction to ambient.

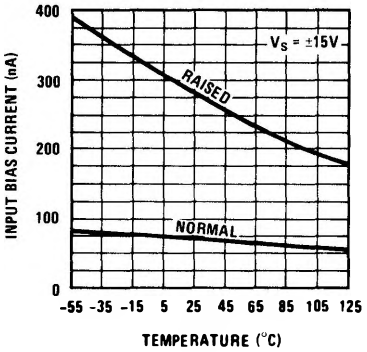
Note 3: These specifications apply for $V_S = \pm 15V$ and $-55°C \leq T_A \leq 125°C$, unless otherwise stated. With the LM211, however, all temperature specifications are limited to $-25°C \leq T_A \leq 85°C$. The offset voltage, offset current and bias current specifications apply for any supply voltage from a single 5V supply up to ±15V supplies.

Note 4: 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 mA load. Thus, these parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

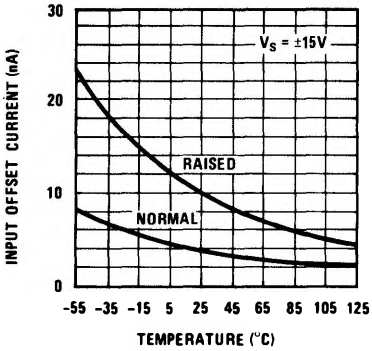
Note 5: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive.

typical performance

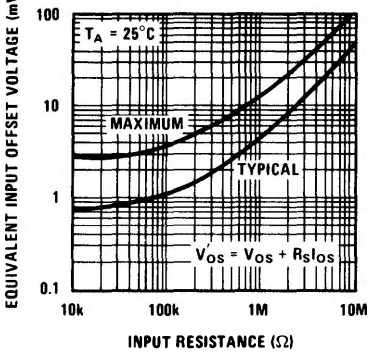
Input Bias Current



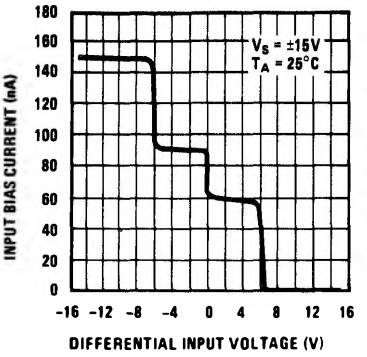
Input Offset Current



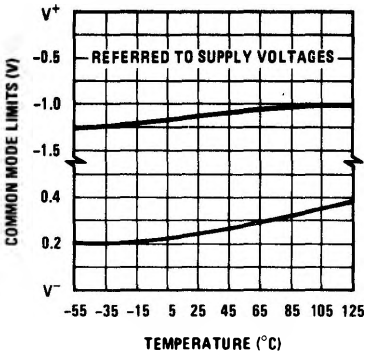
Offset Error



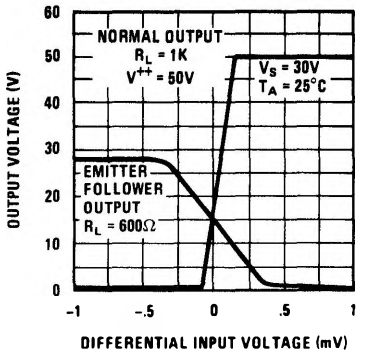
Input Characteristics



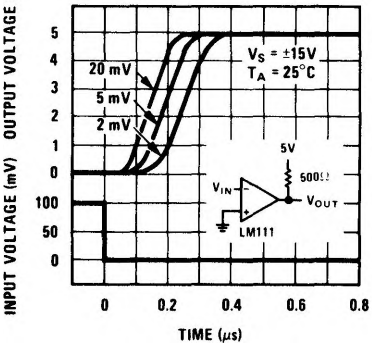
Common Mode Limits



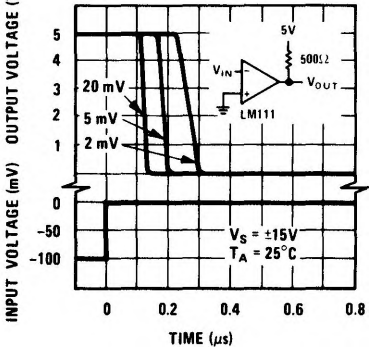
Transfer Function



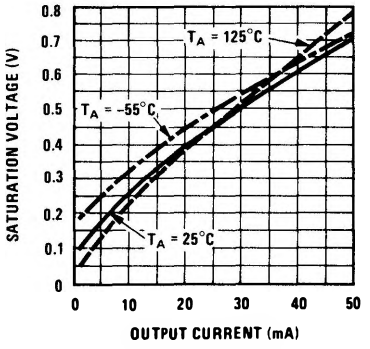
Response Time for Various Input Overdrives



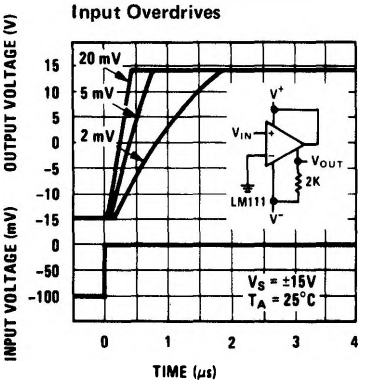
Response Time for Various Input Overdrives



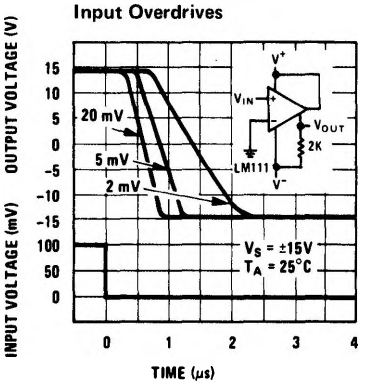
Output Saturation Voltage



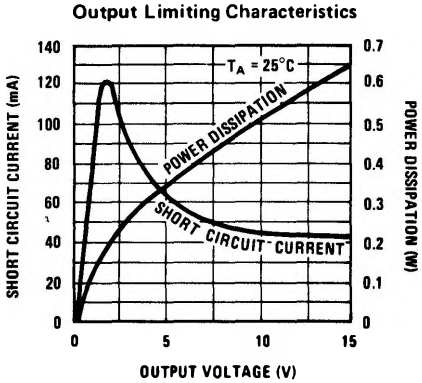
Response Time for Various Input Overdrives



Response Time for Various Input Overdrives

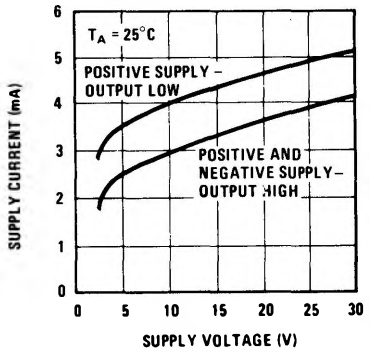


Output Limiting Characteristics

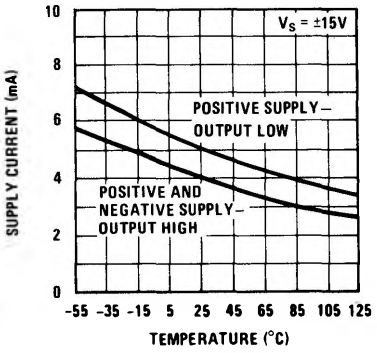


typical performance

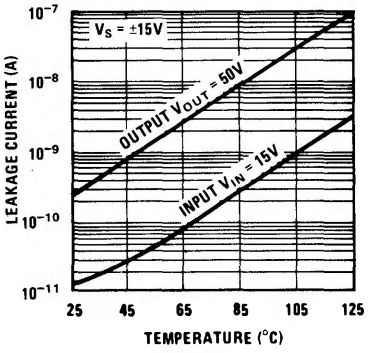
Supply Current



Supply Current

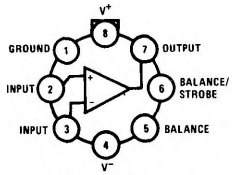


Leakage Currents



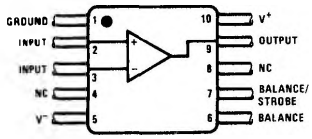
connection diagrams *

Metal Can



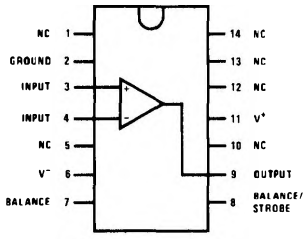
NOTE: Pin 4 connected to case.
TOP VIEW

Flat Package



NOTE: Pin 5 connected to bottom of package.
TOP VIEW

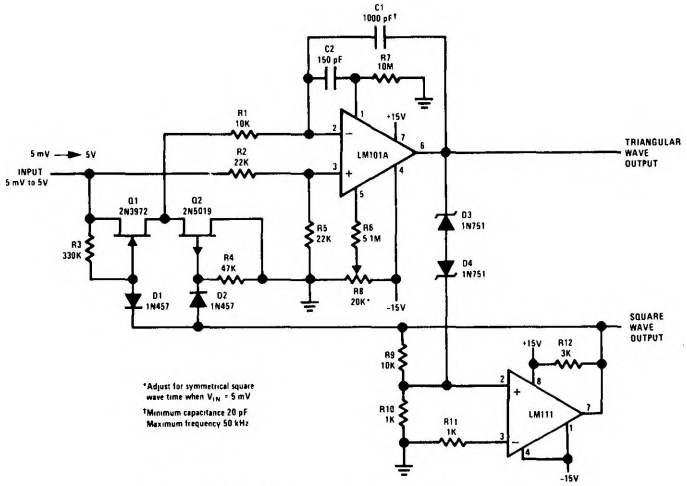
Dual-In-Line



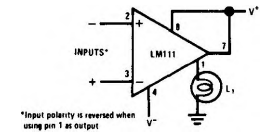
NOTE: Pin 6 connected to bottom of package.
TOP VIEW

*Pin connections shown on schematic diagram and typical applications are for TO-5 package.

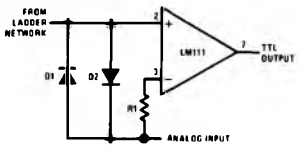
typical applications



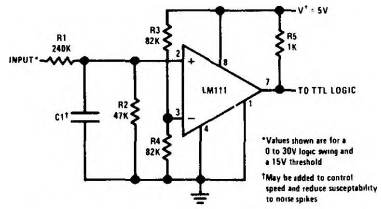
10 Hz to 10 kHz Voltage Controlled Oscillator



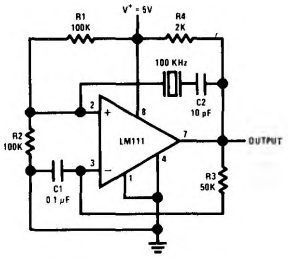
Driving Ground-Referred Load



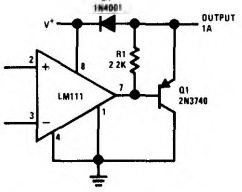
Using Clamp Diodes to Improve Response



TTL Interface with High Level Logic

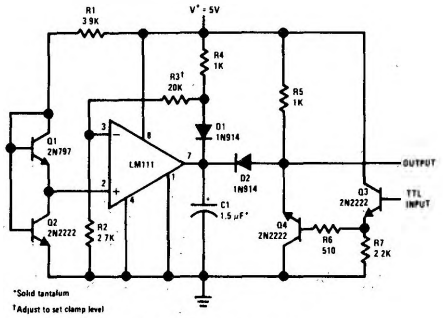


Crystal Oscillator

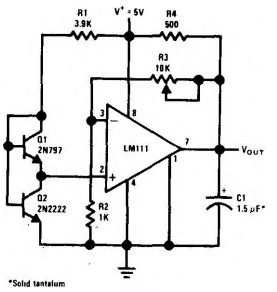


Comparator and Solenoid Driver

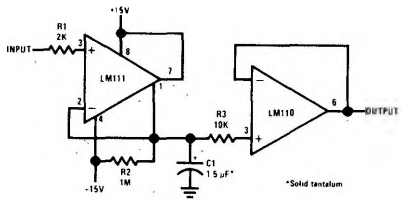
typical applications



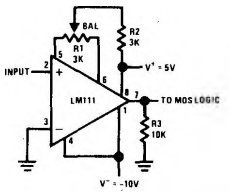
Precision Squarer



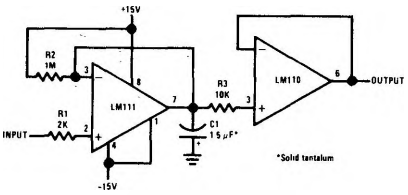
Low Voltage Adjustable Reference Supply



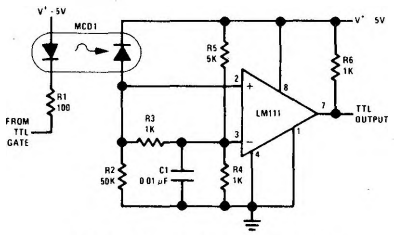
Positive Peak Detector



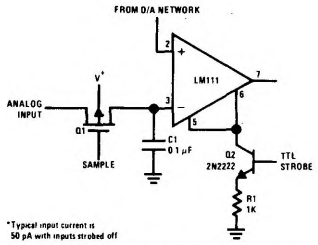
Zero Crossing Detector driving MOS logic



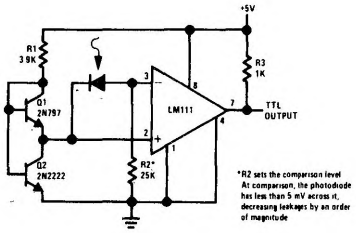
Negative Peak Dectector



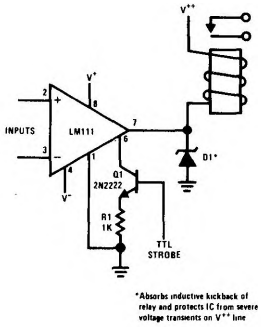
Digital Transmission Isolator



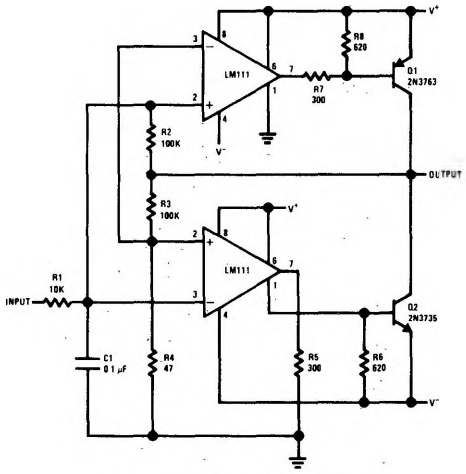
Strobing off Both Input* and Output Stages



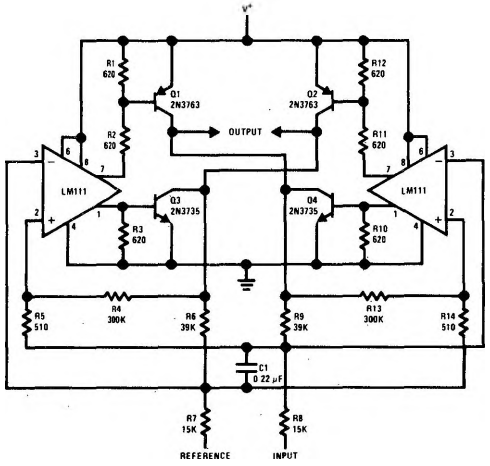
Precision Photodiode Comparator



Relay Driver with Strobe



Switching Power Amplifier



Switching Power Amplifier