Low-Power Rail-to-Rail Input Single-supply Comparator

Features

- **Ultra-Fast, 6ns Propagation Delay**
- **1.3mA (Typ) Low Power Consumption**
- **Single-Supply Operation from +2.7V ~ +5.5V**
- **Low Offset Voltage: 5mV (Max)**
- **Rail-to-Rail Input and Output**
- **CMOS/TTL-Compatible Output**
- **Internal Hysteresis for Clean Switching**
- **No Phase Reversal for Overdriven Inputs**
- **Operating Temperature: -40°C ~ +85°C**

Applications

- High-speed Line or Digital Line Receivers
- High Speed Sampling Circuits
- Peak and Zero-crossing Detectors
- Logic Level Shifting or Translation
- Clock and Data Signal Restoration
- Window Comparators
- IR Receivers
- Portable Systems

Pin Configuration

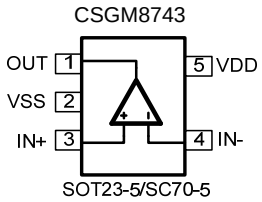


Figure 1. Pin Assignment Diagram

Absolute Maximum Ratings

Condition	Min	Max
Power Supply Voltage (V_{DD} to Vss)	-0.5V	+7.5V
Analog Input Voltage (IN+ or IN-)	Vss-0.5V	V_{DD}+0.5V
PDB Input Voltage	Vss-0.5V	+7V
Operating Temperature Range	-40°C	+85°C
Junction Temperature	+160°C	
Storage Temperature Range	-55°C	+150°C
Lead Temperature (soldering, 10sec)	+260°C	
Package Thermal Resistance (T_A=+25℃)		
SOT23-5, θ_{JA}	190°C/W	
SOT23-6, θ_{JA}	190°C/W	
SC70-5, θ_{JA}	333°C/W	
ESD Susceptibility		
HBM	4KV	
MM	300V	

Electrical Characteristics

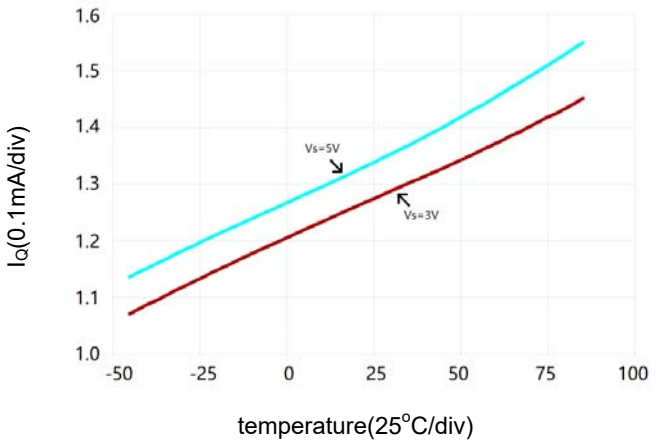
(At V_S = +5V, V_{CM} = 0V, C_L = 15pF, and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TYP	MIN	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage	V_{OS}	V_{CM} = 0V	0.4		5	mV
Input Bias Current	I_B		6			pA
Input Offset Current	I_{OS}		4			pA
Input Hysteresis	V_{hys}		3			mV
Common-Mode Voltage Range	V_{CM}	V_S = 5.5V	-0.1 to +5.6			V
Common-Mode Rejection Ratio	CMRR	V_S = 5V, V_{CM} = 0V to 5V	77	60		dB
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	V_{OH}	Vs=5V, I_O = 4mA	Vs - 0.166		Vs - 0.25	V
	V_{OL}		132		211	mV
Output Short-Circuit Current	I_{SOURCE}	V_S = 5V, Out to V_S/2	42.6	30		mA
	I_{SINK}		43.7	31		
POWER SUPPLY						
Operating Voltage Range			2.7			V
			5.5			V
Power Supply Rejection Ratio	PSRR	V_S = +2.7V to +5.5V, V_{CM} = 0V	74	58		dB
Quiescent Current / Comparator	I_Q		1.3			mA
DYNAMIC PERFORMANCE (CL = 15pF)						
Propagation Delay (Low to High)	T_{dLH}	V_S = 3V, Overdrive = 10mV	11			ns
		V_S = 3V, Overdrive = 100mV	6			ns
Propagation Delay (High to Low)	T_{dHL}	V_S = 3V, Overdrive = 10mV	11			ns
		V_S = 3V, Overdrive = 100mV	6			ns
Rise Time	T_r	V_S = 3V, Overdrive = 10mV	3.6			ns
		V_S = 3V, Overdrive = 100mV	3.5			ns
Fall Time	T_f	V_S = 3V, Overdrive = 10mV	3.1			ns
		V_S = 3V, Overdrive = 100mV	3			ns

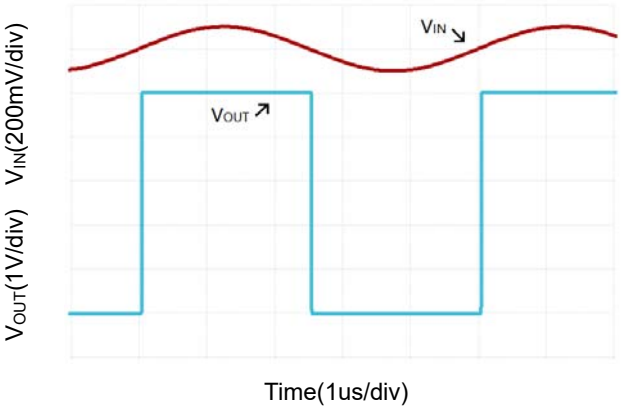
Typical Performance characteristics

At T_A=+25°C, V_S=+5V, and C_L=15pF, unless otherwise noted.

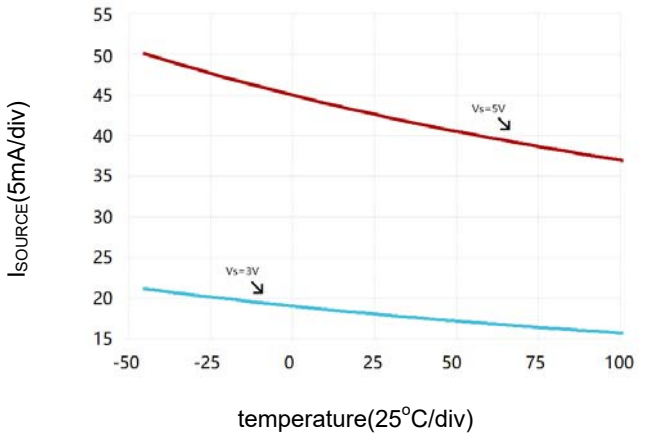
Supply Current vs. Temperature



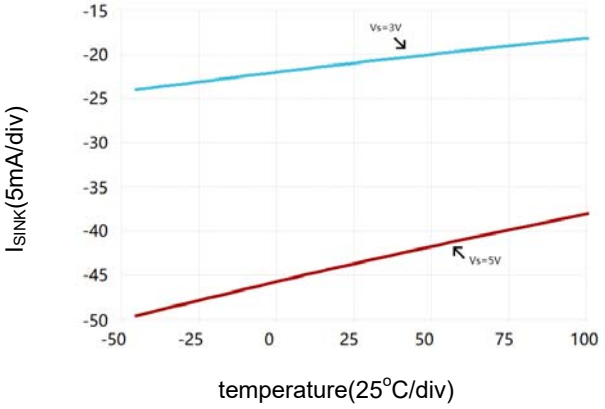
Sinusoid Response at 0.2MHz



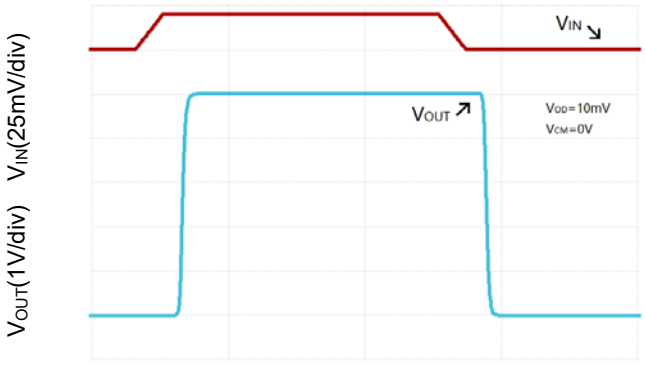
Output Short-Circuit (Source) Current vs. Temperature



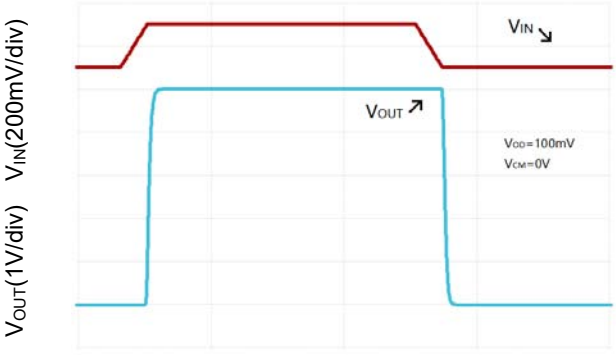
Small Signal Inverting Pulse Response



Progation Delay (L-H&H-L)



Progation Delay (L-H&H-L)



Non-Inverting Comparator with Hysteresis

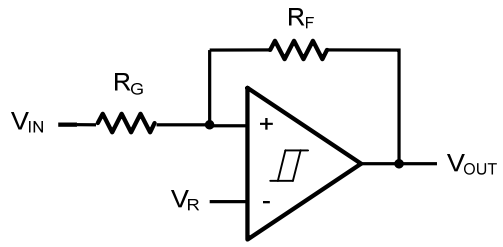


Figure 3. Non-Inverting Comparator with Hysteresis

A non-inverting comparator with hysteresis requires a two-resistor network, as shown in Figure 3 and a voltage reference (V_R) at the inverting input.

$$V_{TH} = \frac{R_G + R_F}{R_F} \times V_R$$

$$V_{TL} = \frac{R_G + R_F}{R_F} \times V_R - \frac{R_G}{R_F} \times V_{DD}$$

$$V_{HYS} = \frac{R_G}{R_F} \times V_{DD}$$

Inverting Comparator with Hysteresis

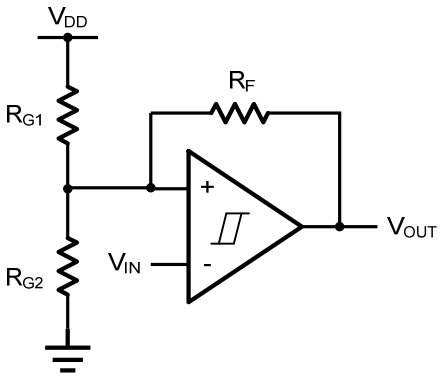


Figure 4. Inverting Comparator with Hysteresis

The inverting comparator with hysteresis requires a three-resistor network that is referenced to the comparator supply voltage (V_{DD}), as shown in Figure 4.

$$V_{TH} = \frac{R_{G2}}{R_{G1} \parallel R_F + R_{G2}} \times V_{DD}$$

$$V_{TL} = \frac{R_{G2} \parallel R_F}{R_{G2} \parallel R_F + R_{G1}} \times V_{DD}$$

$$V_{HYS} = \frac{R_{G1} \parallel R_{G2}}{R_{G1} \parallel R_{G2} + R_F} \times V_{DD}$$

Typical Application Circuits

Line Receiver

A Line Receiver using GM8743 is shown in Figure 5. Resistors R_{G1} and R_{G2} set the bias point at the comparator's inverting input. R_{IN} should be same as $R_{G1}||R_{G2}$ to get a better match. GM8743 detects the voltage of the Coax Line, and outputs logic high or logic low quickly with no glitch.

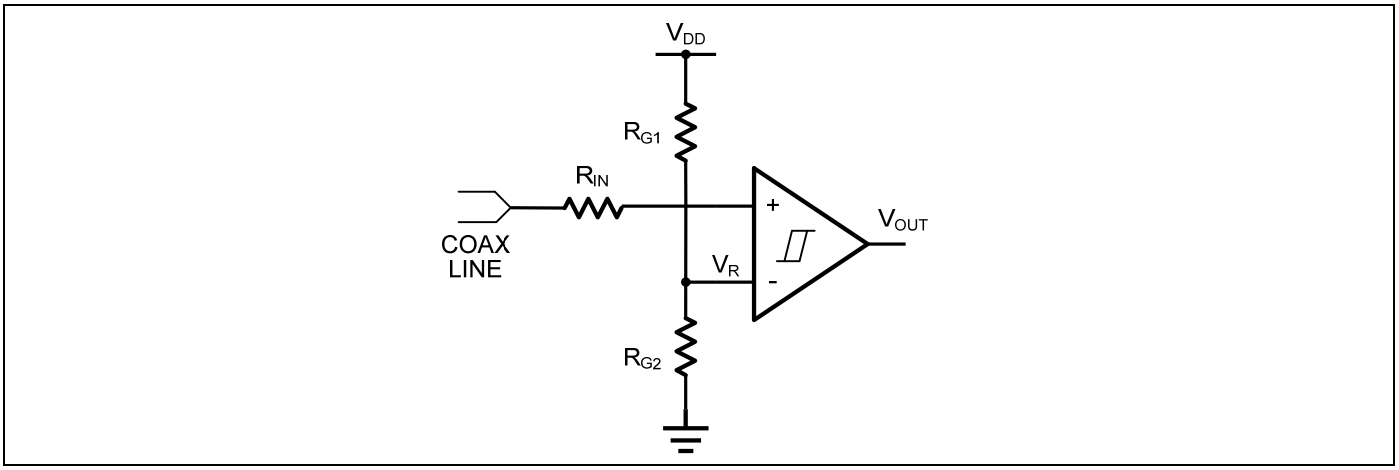


Figure 5. Line Receiver

IR Receiver

GM8743 is an ideal candidate to be used as an infrared receiver shown in Figure 6. The infrared photo diode creates a current relative to the amount of infrared light present. The current creates a voltage across R_{IN}. When this voltage level cross the voltage applied by the voltage divider to the inverting input, the output transitions. Optional R_F provides additional hysteresis for noise immunity.

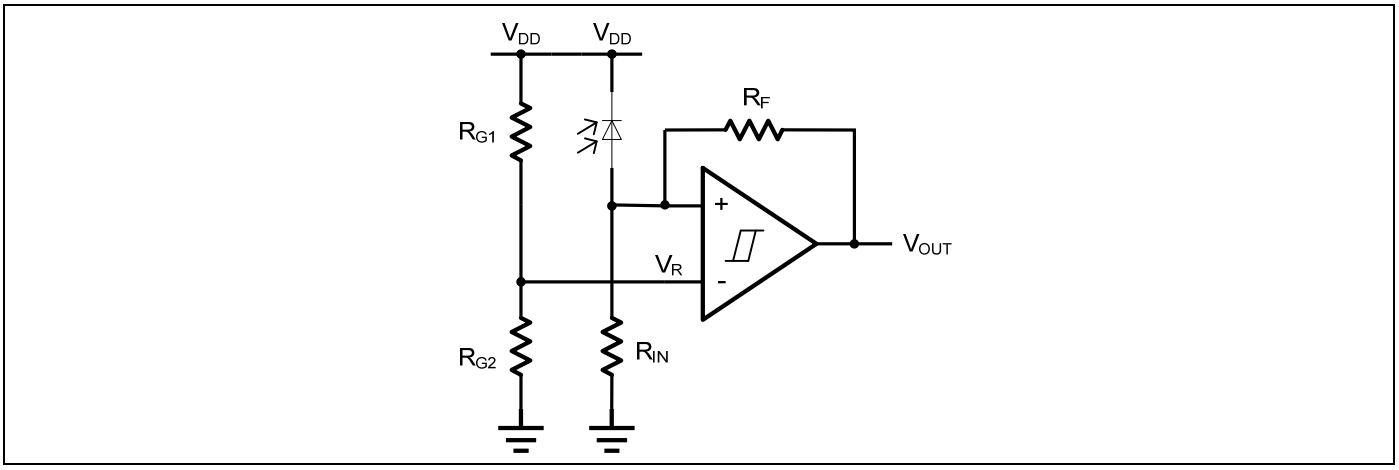


Figure 6. IR Receiver

Oscillator

A oscillator using GM8743 is shown in Figure 7. Resistors R_{G1} and R_{G2} set the bias point at the comparator's inverting input. The period of oscillator is set by the time constant of R_C and C_{IN}. The maximum frequency is limited by the large signal propagation delay of the comparator. GM8743 is low propagation delay guarantees the high frequency oscillation.

If R_{G1}=R_{G2}= R_F, then the frequency of the oscillator is:

$$f_{OSC} = \frac{1}{2 \times \ln 2 \times R_C \times C_{IN}}$$

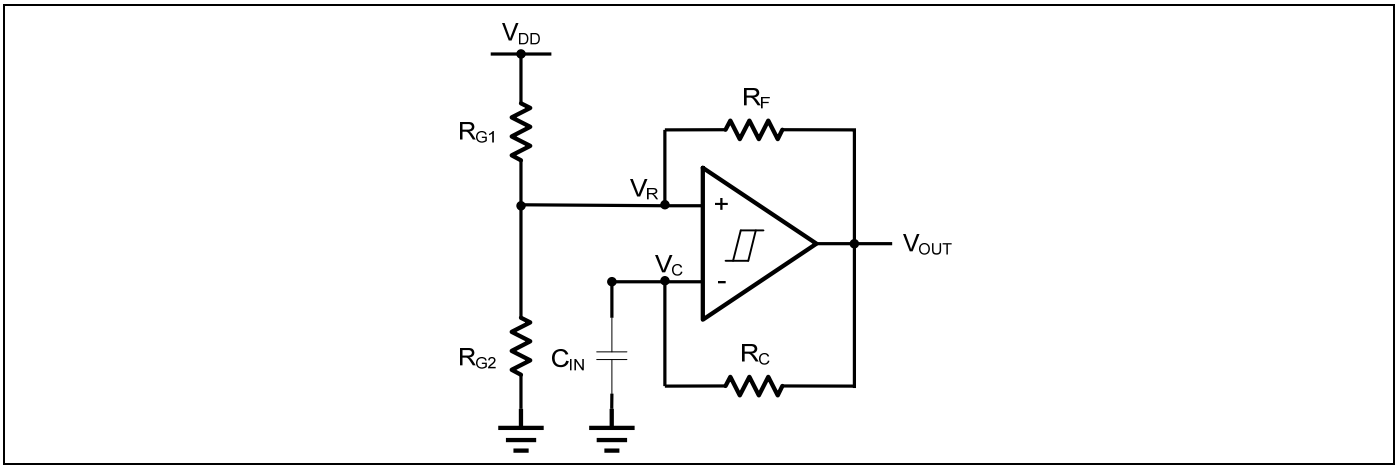
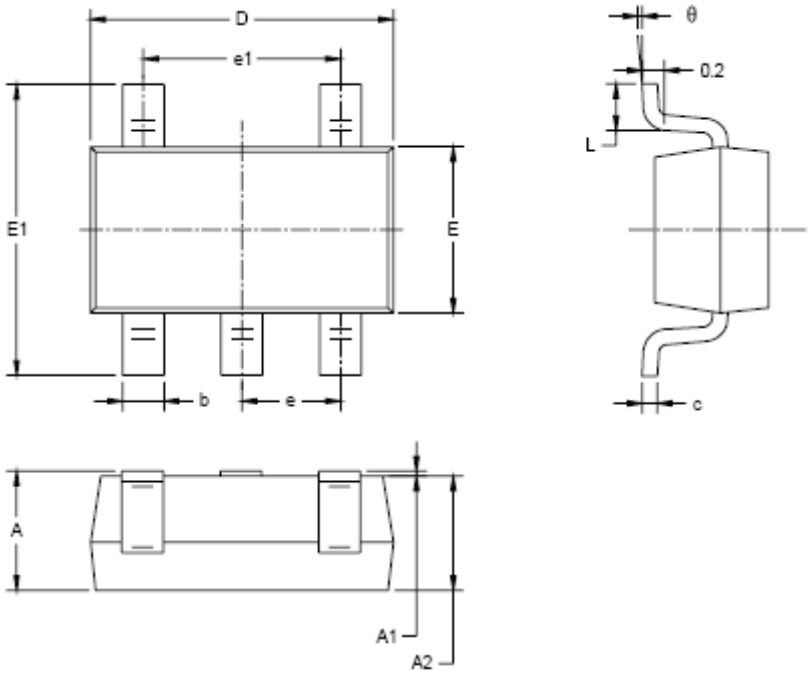


Figure 7. Oscillator

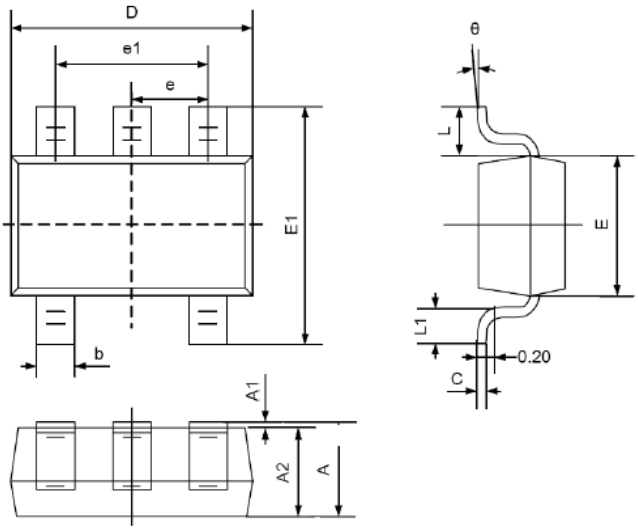
Package Information

SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SC70-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
C	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650TYP		0.026TYP	
e1	1.200	1.400	0.047	0.055
L	0.525REF		0.021REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°