

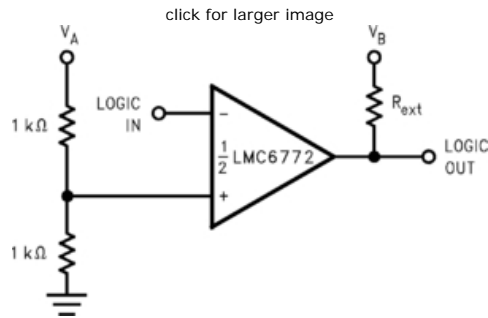
LMC6772 - Dual MicroPower Rail-to-Rail Input CMOS Comparator with Open Drain Output



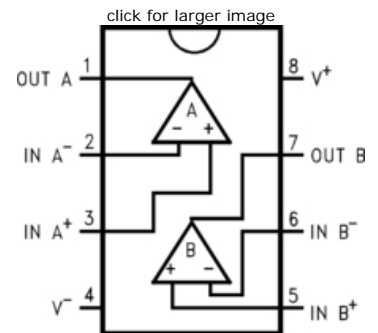
Features

- (Typical unless otherwise noted)
- Low power consumption (max): $I_s = 10 \mu\text{A}/\text{comp}$
- Wide range of supply voltages: 2.7V to 15V
- Rail-to-Rail input common mode voltage range
- Open drain output
- Short circuit protection: 40 mA
- Propagation delay (@ $V_s = 5\text{V}$, 100 mV overdrive): 5 μs
- LMC6772Q is AEC-Q qualified
- LMC6772Q has -40°C to 125°C temperature range

Typical Application



Connection Diagram



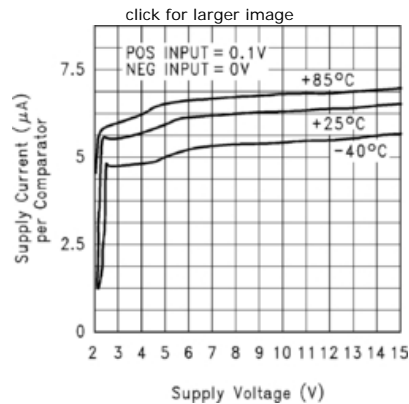
Parametric Table

Response Time	4 μs
Output Bus	Open Drain
Supply Min	2.7 Volt
Supply Max	15 Volt
Channels	2 Channels
Offset Voltage max, 25C	15, 5 mV
Output Current	45 mA
Input Range	R-R Input
Supply Current Per Channel	0.006 mA
PowerWise Rating 3	24 $\mu\text{A} \times \mu\text{s}$
Max Input Bias Current	0.001 nA
Special Features	Undefined
Temperature Min	-40 deg C
Temperature Max	85 deg C
Function	Comparator
Automotive Selection Guide	Yes

Applications

- Laptop computers
- Mobile phones
- Metering systems
- Hand-held electronics
- RC timers
- Alarm and monitoring circuits
- Window comparators, multivibrators

Typical Performance





RoHS Compliance Information

LMC6772/LMC6772Q Dual Micropower Rail-To-Rail Input CMOS Comparator with Open Drain Output
LMC6772/LMC6772Q Dual Micropower Rail-To-Rail Input CMOS Comparator with Open Drain Output (Japanese)

Package Availability, Models

Part Number	Package						Factory Lead Time		Models	Std Pack Size	Package Marking Format
	Type	Pins	Spec.	MSL Rating	Peak Reflow	RoHS Report	Weeks	Qty			
LMC6772AIM	SOIC NARROW	8	STD	1	235	RoHS	Full production		LMC6772A.MOD	rail of 95	NSZXTT LMC6772AIM
			NOPB	1	260		6 weeks	1000			
LMC6772BIM	SOIC NARROW	8	STD	1	235	RoHS	Full production		LMC6772B.MOD	rail of 95	NSZXTT LMC6772BIM
			NOPB	1	260		6 weeks	2000			
LMC6772AIMX	SOIC NARROW	8	STD	1	235	RoHS	Full production		LMC6772A.MOD	reel of 2500	NSZXTT LMC6772AIM
			NOPB	1	260		6 weeks	3000			
LMC6772BIMX	SOIC NARROW	8	STD	1	235	RoHS	Full production		LMC6772B.MOD	reel of 2500	NSZXTT LMC6772BIM
			NOPB	1	260		6 weeks	7500			
LMC6772QMM	MINI SOIC	8	NOPB	1	260	RoHS	Full production		N/A	reel of N/A	ZXTT AX5A
							6 weeks	2000			
LMC6772QMMX	MINI SOIC	8	NOPB	1	260	RoHS	Full production		N/A	reel of N/A	ZXTT AX5A
							8 weeks	5000			
LMC6772AIMM	MINI SOIC	8	STD	1	260	RoHS	Full production		LMC6772A.MOD	reel of 1000	ZXTT C21
			NOPB	1	260		6 weeks	5000			
LMC6772AIMMX	MINI SOIC	8	STD	1	260	RoHS	Full production		LMC6772A.MOD	reel of 3500	ZXTT C21
			NOPB	1	260		6 weeks	25000			
LMC6772BIN	MDIP	8	STD	1	NA	RoHS	Full production		LMC6772B.MOD	rail of 40	NSUZYTT LMC6772 BIN
			NOPB	1	NA		6 weeks	500			

Obsolete Versions

Obsolete Part	Alternate Part or Supplier	Source	Last Time Buy Date
LMC6772AIN	TLC3702	TEXAS INSTRUMENTS	06/07/2005

General Description

The LMC6772 is an ultra low power dual comparator with a maximum 10 µA/comparator power supply current. It is designed to operate over a wide range of supply voltages, with a minimum supply voltage of 2.7V.

The common mode voltage range of the LMC6772 exceeds both the positive and negative supply rails, a significant advantage in single supply applications. The open drain output of the LMC6772 allows for wired-OR configurations. The open drain output also offers the advantage of allowing the output to be pulled to any voltage rail up to 15V, regardless of the supply voltage of the LMC6772.

The LMC6772 is targeted for systems where low power consumption is the critical parameter. Guaranteed operation at supply voltages of 2.7V and rail-to-rail performance makes this comparator ideal for battery-powered applications.

Refer to the LMC6762 datasheet for a push-pull output stage version of this device.

Reliability Metrics

Part Number	Process	EFR Reject	EFR Sample Size	PPM *	LTA Rejects	LTA Device Hours	FITS	MTTF (Hours)
LMC6772AIM	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772AIMM	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772AIMMX	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772AIMX	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772BIM	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772BIMX	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772BIN	P2CMOS	0	48295	0	1	4172500	2	536440139
LMC6772QMM	P2CMOS	0	48295	0	1	4172500	2	536440139

LMC6772/LMC6772Q Dual Micropower Rail-To-Rail Input CMOS Comparator with Open Drain Output

General Description

The LMC6772 is an ultra low power dual comparator with a maximum 10 μA /comparator power supply current. It is designed to operate over a wide range of supply voltages, with a minimum supply voltage of 2.7V.

The common mode voltage range of the LMC6772 exceeds both the positive and negative supply rails, a significant advantage in single supply applications. The open drain output of the LMC6772 allows for wired-OR configurations. The open drain output also offers the advantage of allowing the output to be pulled to any voltage rail up to 15V, regardless of the supply voltage of the LMC6772.

The LMC6772 is targeted for systems where low power consumption is the critical parameter. Guaranteed operation at supply voltages of 2.7V and rail-to-rail performance makes this comparator ideal for battery-powered applications.

Refer to the LMC6762 datasheet for a push-pull output stage version of this device.

Features

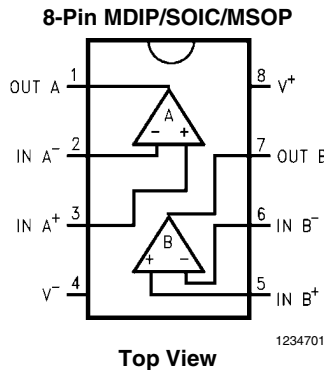
(Typical unless otherwise noted)

- Low power consumption (max): $I_S = 10 \mu\text{A}/\text{comp}$
- Wide range of supply voltages: 2.7V to 15V
- Rail-to-Rail input common mode voltage range
- Open drain output
- Short circuit protection: 40 mA
- Propagation delay (@ $V_S = 5\text{V}$, 100 mV overdrive): 5 μs
- LMC6772Q is AEC-Q qualified
- LMC6772Q has -40°C to 125°C temperature range

Applications

- Laptop computers
- Mobile phones
- Metering systems
- Hand-held electronics
- RC timers
- Alarm and monitoring circuits
- Window comparators, multivibrators

Connection Diagram



Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

ESD Tolerance (Note 2)	1.5 kV
Differential Input Voltage	(V ⁺)+0.3V to (V ⁻)-0.3V
Voltage at Input/Output Pin	(V ⁺)+0.3V to (V ⁻)-0.3V
Supply Voltage (V ⁺ -V ⁻)	16V
Current at Input Pin (Note 8)	±5 mA
Current at Output Pin (Notes 3, 7)	±30 mA
Current at Power Supply Pin, LMC6772	40 mA
Lead Temperature (Soldering, 10 seconds)	260°C

Storage Temperature Range	-65°C to 150°C
Junction Temperature (Note 4)	150°C

Operating Ratings (Note 1)

Supply Voltage	2.7 ≤ V _S ≤ 15V
Junction Temperature Range	
LMC6772AI, LMC6772BI	40°C ≤ T _J ≤ 85°C
LMC6772Q	40°C ≤ T _J ≤ 125°C
Thermal Resistance (θ _{JA})	
N Package, 8-Pin Molded DIP	100°C/W
M Package, 8-Pin Surface Mount	172°C/W

2.7V Electrical Characteristics

Unless otherwise specified, all limits guaranteed for T_J = 25°C, V⁺ = 2.7V, V⁻ = 0V, V_{CM} = V⁺/2. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LMC6772AI Limit (Note 6)	LMC6772BI Limit (Note 6)	LMC6772Q Limit (Note 6)	Units
V _{OS}	Input Offset Voltage		3	5 8	15 18	10 13	mV max
TCV _{OS}	Input Offset Voltage Temperature Drift		2.0				μV/°C
	Input Offset Voltage Average Drift	(Note 10)	3.3				μV/ Month
I _B	Input Current		0.02				pA
I _{OS}	Input Offset Current		0.01				pA
CMRR	Common Mode Rejection Ratio		75				dB
PSRR	Power Supply Rejection Ratio	±1.35V < V _S < ±7.5V	80				dB
A _V	Voltage Gain	(By Design)	100				dB
V _{CM}	Input Common-Mode Voltage Range	CMRR > 55 dB	3.0	2.9 2.7	2.9 2.7	2.9 2.7	V min
			-0.3	-0.2 0.0	-0.2 0.0	-0.2 0.2	V max
V _{OL}	Output Voltage Low	I _{LOAD} = 2.5 mA	0.2	0.3 0.4	0.3 0.4	0.3 0.45	V max
I _S	Supply Current	For Both Comparators (Output Low)	12	20 25	20 25	20 25	μA max
I _{Leakage}	Output Leakage Current	V _{IN(+)} = 0.5V, V _{IN(-)} = 0V, V _O = 15V	0.1	500	500	500 1000	nA

5.0V and 15.0V Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 5.0\text{V}$ and 15.0V , $V^- = 0\text{V}$, $V_{CM} = V^+/2$. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Typ (Note 5)	LMC6772AI Limit (Note 6)	LMC6772BI Limit (Note 6)	LMC6772Q Limit (Note 6)	Units
V_{OS}	Input Offset Voltage		3	5 8	15 18	10 13	mV max
TCV_{OS}	Input Offset Voltage Temperature Drift	$V^+ = 5\text{V}$	2.0				$\mu\text{V}/^\circ\text{C}$
		$V^+ = 15\text{V}$	4.0				
	Input Offset Voltage Average Drift	$V^+ = 5\text{V}$ (Note 10)	3.3				$\mu\text{V}/$ Month
		$V^+ = 15\text{V}$ (Note 10)	4.0				
I_B	Input Current	$V = 5\text{V}$	0.04				pA
I_{OS}	Input Offset Current	$V^+ = 5\text{V}$	0.02				pA
CMRR	Common Mode Rejection Ratio	$V^+ = 5\text{V}$	75				dB
		$V^+ = 15\text{V}$	82				
PSRR	Power Supply Rejection Ratio	$\pm 2.5\text{V} < V_S < \pm 5\text{V}$	80				dB
A_V	Voltage Gain	(By Design)	100				dB
V_{CM}	Input Common-Mode Voltage Range	$V^+ = 5.0\text{V}$ CMRR > 55 dB	5.3	5.2 5.0	5.2 5.0	5.2 5.0	V min
			-0.3	-0.2 0.0	-0.2 0.0	-0.2 0.0	Vmax
		$V^+ = 15.0\text{V}$ CMRR > 55 dB	15.3	15.2 15.0	15.2 15.0	15.2 15.0	V min
			-0.3	-0.2 0.0	-0.2 0.0	-0.2 0.0	V max
V_{OL}	Output Voltage Low	$V^+ = 5\text{V}$ $I_{LOAD} = 5\text{ mA}$	0.2	0.4 0.55	0.4 0.55	0.4 0.55	V max
		$V^+ = 15\text{V}$ $I_{LOAD} = 5\text{ mA}$	0.2	0.4 0.55	0.4 0.55	0.4 0.55	V max
I_S	Supply Current	For Both Comparators (Output Low)	12	20 25	20 25	20 25	μA max
I_{SC}	Short Circuit Current	$V^+ = 15\text{V}$, Sinking, $V_O = 12\text{V}$ (Note 7)	45				mA

AC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J = 25^\circ\text{C}$, $V^+ = 5\text{V}$, $V^- = 0\text{V}$, $V_{CM} = V_O = V^+/2$. **Boldface** limits apply at the temperature extreme.

Symbol	Parameter	Conditions	Typ (Note 5)	LMC6772AI Limit (Note 6)	LMC6772BI Limit (Note 6)	Units
t_{RISE}	Rise Time	$f = 10\text{ kHz}$, $C_L = 50\text{ pF}$, Overdrive = 10 mV (Note 9)	0.3			μs
t_{FALL}	Fall Time	$f = 10\text{ kHz}$, $C_L = 50\text{ pF}$, Overdrive = 10 mV (Note 9)	0.3			μs

Symbol	Parameter	Conditions	Typ (Note 5)	LMC6772AI Limit (Note 6)	LMC6772BI Limit (Note 6)	Units
t _{PHL}	Propagation Delay (High to Low)	f = 10 kHz, C _L = 50 pF (Note 9)	10 mV	10		μs
			100 mV	4		μs
		V ⁺ = 2.7V, f = 10 kHz, C _L = 50 pF (Note 9)	10 mV	10		μs
			100 mV	4		μs
t _{PLH}	Propagation Delay (Low to High)	f = 10 kHz, C _L = 50 pF (Note 9)	10 mV	10		μs
			100 mV	4		μs
		V ⁺ = 2.7V, f = 10 kHz, C _L = 50 pF (Note 9)	10 mV	8		μs
			100 mV	4		μs

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the electrical characteristics.

Note 2: Human body model, 1.5 kΩ in series with 100 pF. The output pins of the two comparators (pin 1 and pin 7) have an ESD tolerance of 1.5 kV. All other pins have an ESD tolerance of 2 kV.

Note 3: Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C. Output currents in excess of ±30 mA over long term may adversely affect reliability.

Note 4: The maximum power dissipation is a function of T_{J(MAX)}, θ_{JA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A)/θ_{JA}. All numbers apply for packages soldered directly into a PC board.

Note 5: Typical Values represent the most likely parametric norm.

Note 6: All limits are guaranteed by testing or statistical analysis.

Note 7: Do not short circuit output to V⁺, when V⁺ is > 12V or reliability will be adversely affected.

Note 8: Limiting input pin current is only necessary for input voltages that exceed absolute maximum input voltage ratings.

Note 9: C_L includes the probe and jig capacitance. The rise time, fall time and propagation delays are measured with a 2V input step.

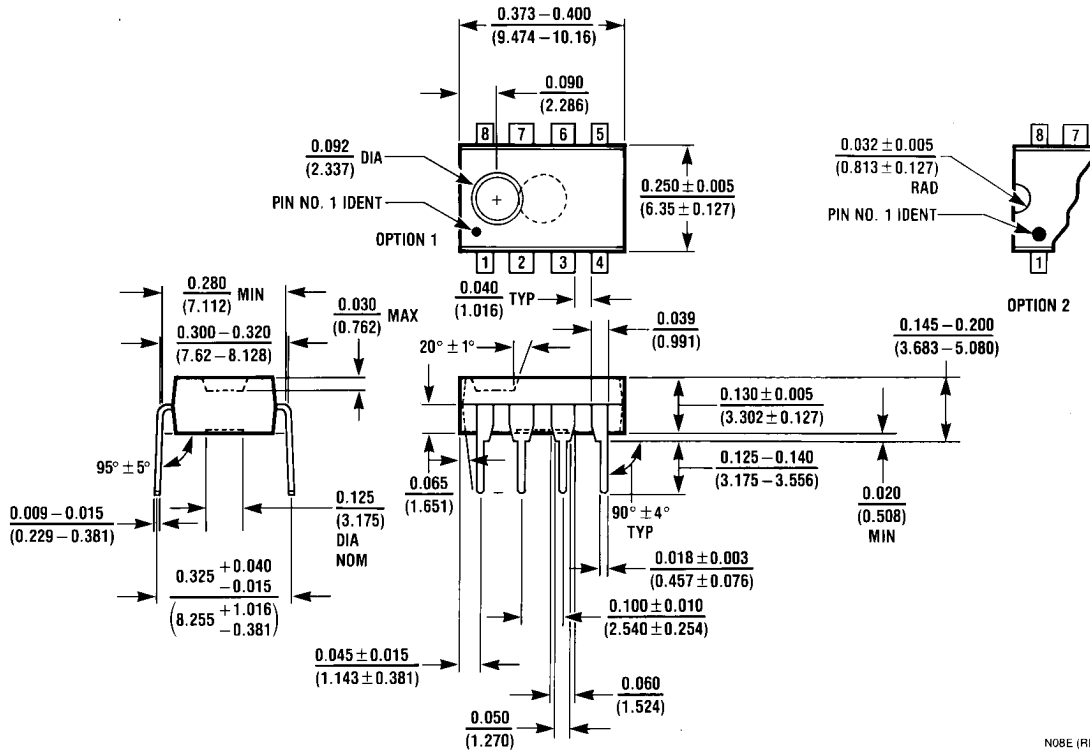
Note 10: Input offset voltage Average Drift is calculated by dividing the accelerated operating life drift average by the equivalent operational time. The input offset voltage average drift represents the input offset voltage change at worst-case input conditions.

Ordering Information

Package	Temperature Range -40°C to 85°C	Package Marking	Transport Media	NSC Drawing	Features
8-Pin MDIP	LMC6772BIN	LMC6772BIN	40 Units/Rail	N08E	
8-Pin SOIC	LMC6772AIM	LMC6772AIM	95 Units/Rail	M08A	
	LMC6772AIMX		2.5k Units Tape and Reel		
	LMC6772BIM	LMC6772BIM	95 Units/Rail		
	LMC6772BIMX		2.5k Units Tape and Reel		
8-Pin MSOP	LMC6772AIMM	C21	1k Units Tape and Reel	MUA08A	AEC-Q100 Grade 1 qualified. Automotive Grade Production Flow*
	LMC6772AIMMX		3.5k Units Tape and Reel		
	LMC6772QMM	AX5A	1k Units Tape and Reel		
	LMC6772QMMX		3.5k Units Tape and Reel		

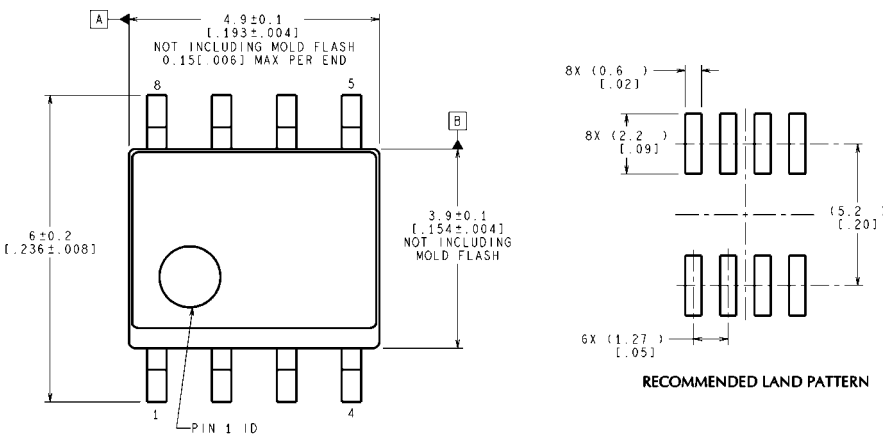
*Automotive Grade (Q) product incorporates enhanced manufacturing and support processes for the automotive market, including defect detection methodologies. Reliability qualification is compliant with the requirements and temperature grades defined in the AEC-Q100 standard. Automotive grade products are identified with the letter Q.

Physical Dimensions inches (millimeters) unless otherwise noted



8-Pin MDIP
NS Package Number N08E

N08E (REV F)



CONTROLLING DIMENSION IS MILLIMETER
 VALUES IN [] ARE INCHES
 DIMENSIONS IN () FOR REFERENCE ONLY

8-Pin SOIC
NS Package Number M08A

M08A (Rev L)