National Semiconductor

PRELIMINARY
September 2005

LPV7215
580 nA Rail-to-Rail Input and Output, 1.8V, Push-Pull Output Comparator

General Description

The LPV7215 is an ultra low-power comparator with a typical power supply current of 580 nA. It has the best-in-class power supply current versus propagation delay performance available among National's low-power comparators. The propagation delay is as low as 4.5 microseconds with 100 mV overdrive at 1.8V supply.

Designed to operate over a wide range of supply voltages, from 1.8V to 5.5V, the LPV7215, with guaranteed operation at 1.8V, 2.7V and 5.0V, is ideal for use in a variety of battery-powered applications. With rail-to-rail common mode voltage range, the LPV7215 is well suited for single-supply operation.

Featuring a push-pull output stage, the LPV7215 allows for operation with absolute minimum power consumption when driving any capacitive or resistive load.

With an operating temperature range of –40˚C to 125˚C, this comparator can be adopted for extreme temperature applications. Available in a choice of space-saving packages, the LPV7215 is ideal for use in handheld electronics and mobile phone applications. The LPV7215 is manufactured with National's advanced VIP50 process.

Features

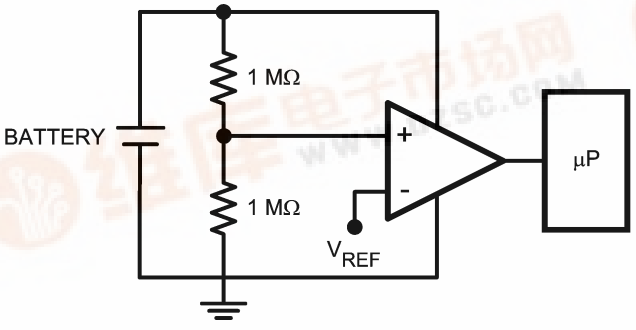
(Typical unless otherwise noted)

- Ultra low power consumption 580 nA
- Wide supply voltage range 1.8V to 5.5V
- Propagation delay 4.5 µs
- Push-Pull output current drive 19 mA
- Temperature range -40˚C to 125˚C
- Rail-to-rail input
- Tiny SOT23-5 and SC70-5 packages

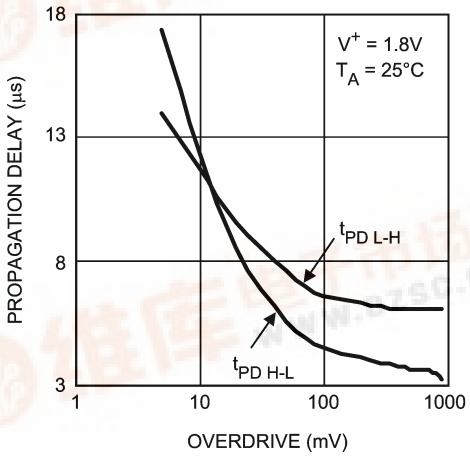
Applications

- Laptop computers
- Mobile phones
- RC timers
- Alarm and monitoring circuits
- Window comparators
- Multivibrators

Typical Application



Threshold Detector



Propagation Delay vs. Overdrive

LPV7215 580 nA Rail-to-Rail Input and Output, 1.8V Push-Pull Output Comparator

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)	
Human Body	2000V
Machine Model	200V
V_{IN} Differential	±2.5V
Supply Voltage (V^+ - V^-)	6V
Voltage at Input/Output pins	V^+ +0.3V, V^- −0.3V
Storage Temperature Range	−65˚C to +150˚C
Junction Temperature (Note 3)	+150˚C
Soldering Information	
Infrared or Convection (20 sec)	235˚C
Wave Soldering Lead Temp. (10 sec)	260˚C

Operating Ratings (Note 1)

Temperature Range (Note 3)	−40˚C to +125˚C
Supply Voltage ($V^+ - V^-$)	1.8V to 5.5V
Package Thermal Resistance (θ_{JA} (Note 3))	
5-Pin SOT23	234˚C/W
5-Pin SC70	456˚C/W

1.8V Electrical Characteristics (Note 8)

Unless otherwise specified, all limits are guaranteed for T_J = 25˚C, V^+ = 1.8V, V^- = 0V, and V_{CM} = V^+/2, V_O= V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min (Note 5)	Typ (Note 4)	Max (Note 5)	Units
I_S	Supply Current	V_{CM} = 0.3V, T_A= 25˚C			645	nA
		V_{CM} = 0.3V, −40˚C to 85˚C		580	**681**	
		V_{CM} = 0.3V, −40˚C to 125˚C			**980**	
		V_{CM} = 1.5V, T_A= 25˚C			875	
		V_{CM} = 1.5V, −40˚C to 85˚C		790	**912**	
		V_{CM} = 1.5V, −40˚C to 125˚C			**1155**	
V_{OS}	Input Offset Voltage	V_{CM} = 0V V_{CM} = 1.8V		±0.3	±3 **±4**	mV
TC V_{OS}	Input Offset Average Drift	(Note 7)		±2		µV/C
I_B	Input Bias Current (Note 6)	V_{CM} = 0.5V		−5		fA
		V_{CM} = 1.3V				
I_{OS}	Input Offset Current			1		fA
CMRR	Common Mode Rejection Ratio	V_{CM} Stepped from 0V to 0.7V V_{CM} Stepped from 1.2V to 1.8V	80	90		dB
PSRR	Power Supply Rejection Ratio	V^+ = 1.8V to 5V, V_{CM} = 0V	75	93		dB
CMVR	Input Common-Mode Voltage Range	CMRR ≥ 50 dB	**1.8**		**0**	V
A_V	Voltage Gain			120		dB
V_O	Output Swing High	I_O = 500 µA		1.68		V
		I_O = 1 mA		1.54		
	Output Swing Low	I_O = −500 µA		120		mV
		I_O = −1 mA		260		
I_{OUT}	Output Current	Source	2.0	2.26		mA
		Sink	2.7	3.1		
	Propagation Delay (High to Low)	Overdrive = 10 mV Overdrive = 100 mV		13 4.5		µs
	Propagation Delay (Low to High)	Overdrive = 10 mV Overdrive = 100 mV		12.5 6.6		µs
t_{rise}	Rise Time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		80		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		80		

1.8V Electrical Characteristics (Note 8) (Continued)

Unless otherwise specified, all limits are guaranteed for T_J = 25˚C, V^+ = 1.8V, V^- = 0V, and V_{CM} = V^+/2, V_O= V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min (Note 5)	Typ (Note 4)	Max (Note 5)	Units
t_{fall}	Fall Time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		70		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		70		

2.7V Electrical Characteristics (Note 8)

Unless otherwise specified, all limits are guaranteed for T_J = 25˚C, V^+ = 2.7V, V^- = 0V, and V_{CM} = V^+/2, V_O= V^-. **Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min (Note 5)	Typ (Note 4)	Max (Note 5)	Units
I_S	Supply Current	V_{CM} = 0.3V, T_A = 25˚C		605	670	nA
		V_{CM} = 0.3V, −40˚C to 85˚C			**707**	
		V_{CM} = 0.3V, −40˚C to 125˚C			**1005**	
		V_{CM} = 2.4V, T_A= 25˚C		815	905	
		V_{CM} = 2.4V, −40˚C to 85˚C			**940**	
		V_{CM} = 2.4V, −40˚C to 125˚C			**1220**	
V_{OS}	Input Offset Voltage	V_{CM} = 0V		±0.3	±3	mV
		V_{CM} = 2.7V			**±4**	
TC V_{OS}	Input Offset Average Drift	(Note 7)		±1		µV/C
I_B	Input Bias Current (Note 6)	V_{CM} = 0.5V		−5		fA
		V_{CM} = 2.2V				
I_{OS}	Input Offset Current			1		fA
CMRR	Common Mode Rejection Ratio	V_{CM} Stepped from 0V to 1.6V	80	90		dB
		V_{CM} Stepped from 2.1V to 2.7V				
PSRR	Power Supply Rejection Ratio	V^+ = 1.8V to 5V, V_{CM} = 0V	75	93		dB
CMVR	Input Common-Mode Voltage Range	CMRR ≥ 50 dB	**2.7**		**0**	V
A_V	Voltage Gain			120		dB
V_O	Output Swing High	I_O = 500 µA		2.62		V
		I_O = 1 mA		2.54		
	Output Swing Low	I_O = −500 µA		80		mV
		I_O = −1 mA		160		
I_{OUT}	Output Current	Source	5.3	5.7		mA
		Sink	6	7.5		
	Propagation Delay (High to Low)	Overdrive = 10 mV		14.5		µs
		Overdrive = 100 mV		6		
	Propagation Delay (Low to High)	Overdrive = 10 mV		15		
		Overdrive = 100 mV		8		
t_{rise}	Rise time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		90		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		85		
t_{fall}	Fall time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		85		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		75		

5V Electrical Characteristics (Note 8)

Unless otherwise specified, all limits are guaranteed for T_J = 25˚C, V^+ = 5V, V^- = 0V, and V_{CM} = V^+/2, V_O= V^-.**Boldface** limits apply at the temperature extremes.

Symbol	Parameter	Conditions	Min (Note 5)	Typ (Note 4)	Max (Note 5)	Units
I_S	Supply Current	V_{CM} = 0.3V, T_A = 25˚C			677	nA
		V_{CM} = 0.3V, −40˚C to 85˚C		612	**740**	
		V_{CM} = 0.3V, −40˚C to 125˚C			**1240**	
		V_{CM} = 4.7V, T_A= 25˚C			920	
		V_{CM} = 4.7V, −40˚C to 85˚C		825	**970**	
		V_{CM} = 4.7V, −40˚C to 125˚C			**1450**	
V_{OS}	Input Offset Voltage	V_{CM} = 0V		±0.3	±3	mV
		V_{CM} = 5V			**±4**	
TC V_{OS}	Input Offset Average Drift	(Note 7)		±1		µV/C
I_B	Input Bias Current (Note 6)	V_{CM} = 0.5V		−5		fA
		V_{CM} = 4.5V				
I_{OS}	Input Offset Current			1		fA
CMRR	Common Mode Rejection Ratio	V_{CM} Stepped from 0V to 3.9V	80	90		dB
		V_{CM} Stepped from 4.4V to 5V				
PSRR	Power Supply Rejection Ratio	V^+ = 1.8V to 5V, V_{CM} = 0V	75	93		dB
CMVR	Input Common-Mode Voltage Range	CMRR ≥ 50 dB	**5**		0	V
V_O	Output Swing High	I_O = 500 µA		4.95		V
		I_O = 1 mA		4.9		
	Output Swing Low	I_O = −500 µA		50		mV
		I_O = −1 mA		100		
I_{OUT}	Output Current	Source	15.5	17		mA
		Sink	16.7	19		
	Propagation Delay (High to Low)	Overdrive = 10 mV		18		µs
		Overdrive = 100 mV		8		
	Propagation Delay (Low to High)	Overdrive = 10 mV		30		µs
		Overdrive = 100 mV		13		
t_{rise}	Rise Time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		100		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		100		
t_{fall}	Fall Time	Overdrive = 10 mV C_L = 30 pF, R_L = 1 MΩ		115		ns
		Overdrive = 100 mV C_L = 30 pF, R_L = 1 MΩ		95		

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 Tables.

Note 2: Human body model, 1.5 kΩ in series with 100 pF. Machine model: 0Ω in series with 200 pF.

Note 3: 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 $P_D = (T_{J(MAX)} - T_A)/ \theta_{JA}$. All numbers apply for packages soldered directly onto a PC board at the time of characterization.

Note 4: Typical values represent the most likely parametric norm.

Note 5: Limits are 100% production tested at 25˚C. Limits over the operating temperature range are guaranteed through correlations using statistical quality control (SQC) method.

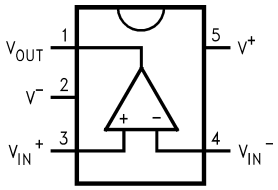
Note 6: Positive current corresponds to current flowing into the device.

Note 7: Offset voltage average drift determined by dividing the change in V_{OS} at temperature extremes into the total temperature change.

Note 8: Electrical table values apply only for factory testing conditions at the temperature indicated. Factory testing conditions result in very limited self-heating of the device.

Connection Diagram

SC70/SOT23



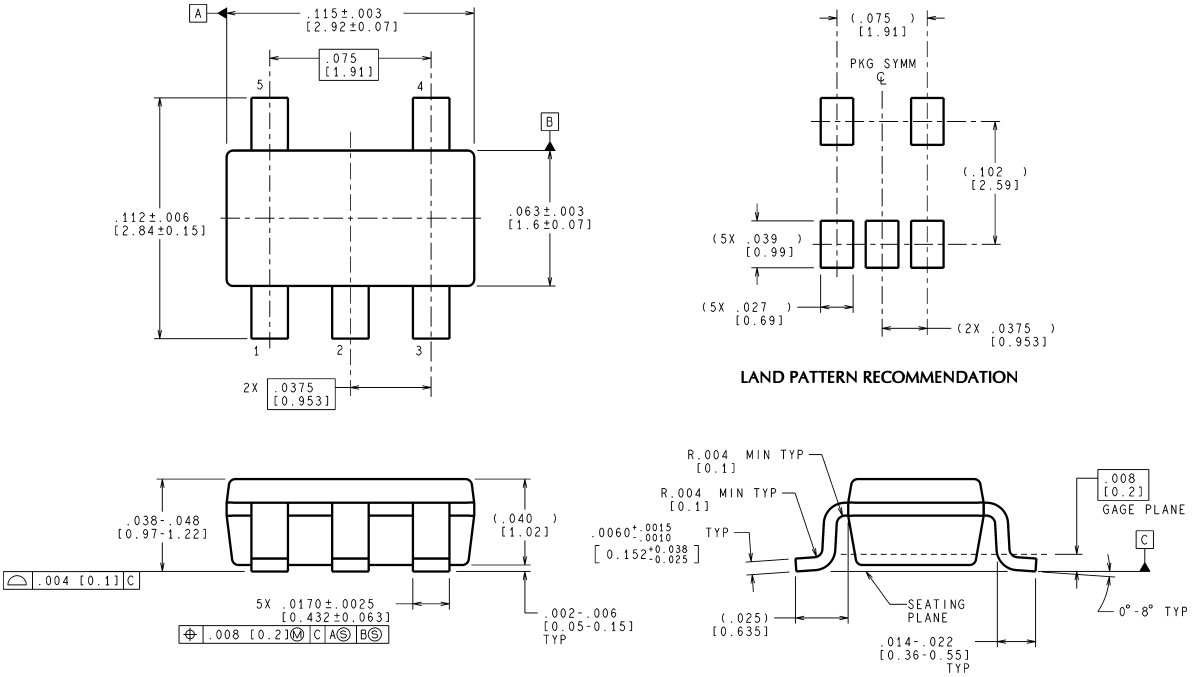
20123698

Top View

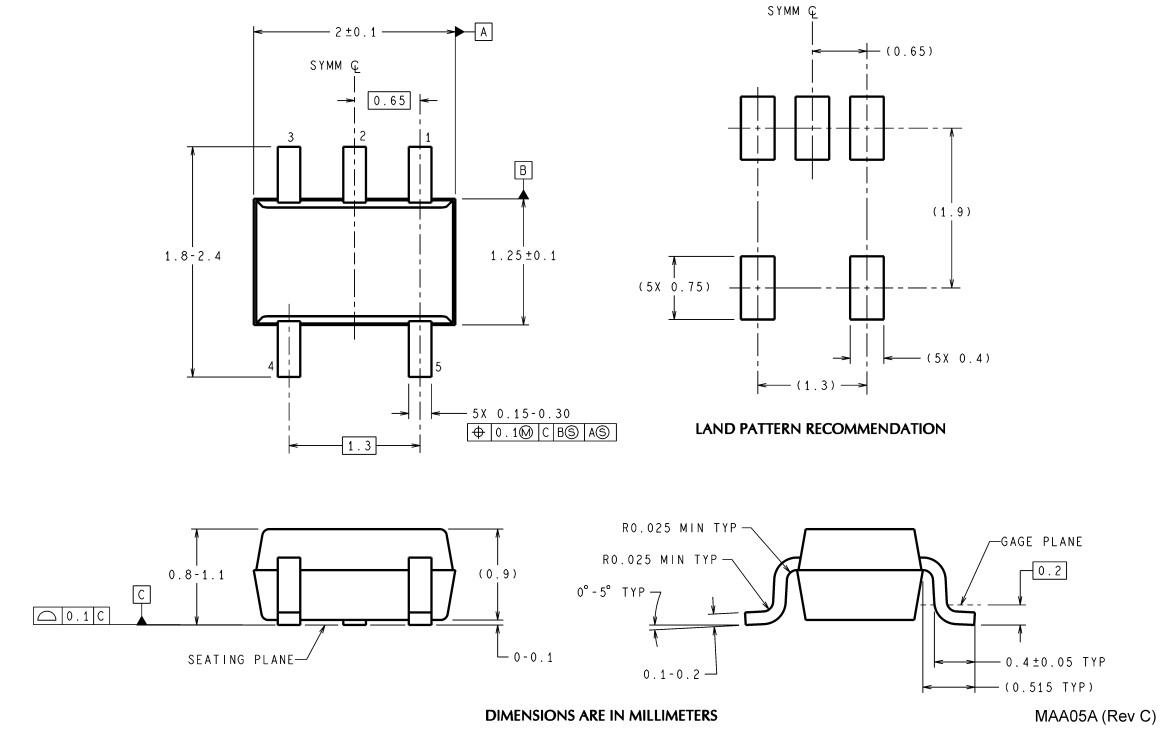
Ordering Information

Package	Part Number	Package Marking	Transport Media	NSC Drawing
5-Pin SOT-23	LPV7215MF	C30A	1k Units Tape and Reel	MF05A
	LPV7215MFX		3k Units Tape and Reel	
5-Pin SC70	LPV7215MG	C37	1k Units Tape and Reel	MAA05A
	LPV7215MGX		3k Units Tape and Reel	

Physical Dimensions inches (millimeters) unless otherwise noted



5-Pin SOT23
NS Package Number MF05A



5-Pin SC70
NS Package Number MAA05A

Notes

National Semiconductor
Americas Customer
Support Center
Email: new.feedback@nsc.com
Tel: 1-800-272-9959

www.national.com

National Semiconductor
Europe Customer Support Center
Fax: +49 (0) 180-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

National Semiconductor
Asia Pacific Customer
Support Center
Email: ap.support@nsc.com

National Semiconductor
Japan Customer Support Center
Fax: 81-3-5639-7507
Email: jpn.feedback@nsc.com
Tel: 81-3-5639-7560