

## 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  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , 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

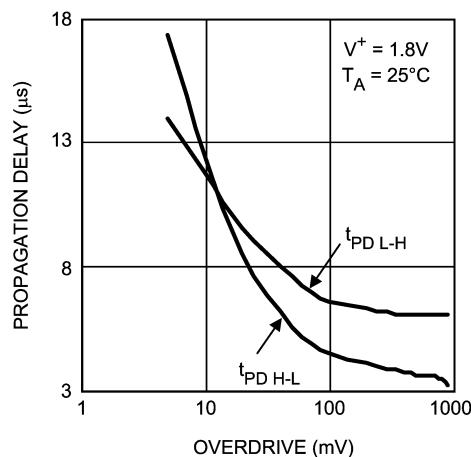
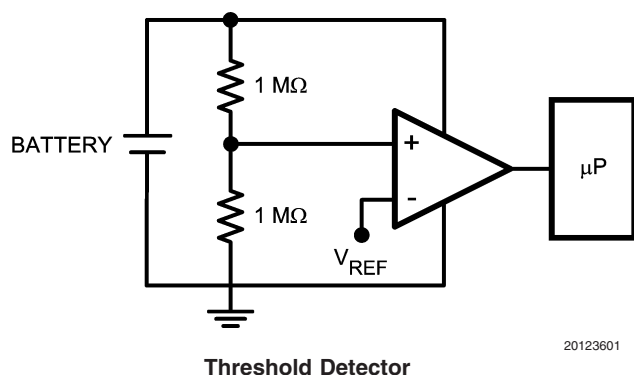
(Typical unless otherwise noted)

- Ultra low power consumption 580 nA
- Wide supply voltage range 1.8V to 5.5V
- Propagation delay 4.5  $\mu\text{s}$
- Push-Pull output current drive 19 mA
- Temperature range  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- 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



Propagation Delay vs. Overdrive



**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	$\pm 2.5V$
Supply Voltage ( $V^+ - V^-$ )	6V
Voltage at Input/Output pins	$V^+ + 0.3V, V^- - 0.3V$
Storage Temperature Range	$-65^\circ C$ to $+150^\circ C$
Junction Temperature (Note 3)	$+150^\circ C$

## Soldering Information

Infrared or Convection (20 sec)	$235^\circ C$
Wave Soldering Lead Temp. (10 sec)	$260^\circ C$

**Operating Ratings** (Note 1)

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

**1.8V Electrical Characteristics** (Note 8)

Unless otherwise specified, all limits are guaranteed for  $T_J = 25^\circ C$ ,  $V^+ = 1.8V$ ,  $V^- = 0V$ , 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	$V_{CM} = 0.3V, T_A = 25^\circ C$		580	645	nA
		$V_{CM} = 0.3V, -40^\circ C$ to $85^\circ C$			<b>681</b>	
		$V_{CM} = 0.3V, -40^\circ C$ to $125^\circ C$			<b>980</b>	
		$V_{CM} = 1.5V, T_A = 25^\circ C$		790	875	
		$V_{CM} = 1.5V, -40^\circ C$ to $85^\circ C$			<b>912</b>	
		$V_{CM} = 1.5V, -40^\circ C$ to $125^\circ C$			<b>1155</b>	
$V_{OS}$	Input Offset Voltage	$V_{CM} = 0V$ $V_{CM} = 1.8V$		$\pm 0.3$	$\pm 3$ <b><math>\pm 4</math></b>	mV
TC $V_{OS}$	Input Offset Average Drift	(Note 7)		$\pm 2$		$\mu V/C$
$I_B$	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 $\geq 50$ dB	<b>1.8</b>		<b>0</b>	V
$A_V$	Voltage Gain			120		dB
$V_O$	Output Swing High	$I_O = 500 \mu A$		1.68		V
		$I_O = 1 \text{ mA}$		1.54		
	Output Swing Low	$I_O = -500 \mu A$		120		mV
		$I_O = -1 \text{ mA}$		260		
$I_{OUT}$	Output Current	Source	2.0	2.26		mA
		Sink	2.7	3.1		
	Propagation Delay (High to Low)	Overdrive = 10 mV		13		$\mu s$
		Overdrive = 100 mV		4.5		
	Propagation Delay (Low to High)	Overdrive = 10 mV		12.5		$\mu s$
		Overdrive = 100 mV		6.6		
$t_{rise}$	Rise Time	Overdrive = 10 mV $C_L = 30 \text{ pF}, R_L = 1 \text{ M}\Omega$		80		ns
		Overdrive = 100 mV $C_L = 30 \text{ pF}, R_L = 1 \text{ M}\Omega$		80		



## 1.8V Electrical Characteristics (Note 8) (Continued)

Unless otherwise specified, all limits are guaranteed for  $T_J = 25^\circ\text{C}$ ,  $V^+ = 1.8\text{V}$ ,  $V^- = 0\text{V}$ , 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 $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		70		ns
		Overdrive = 100 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		70		

## 2.7V Electrical Characteristics (Note 8)

Unless otherwise specified, all limits are guaranteed for  $T_J = 25^\circ\text{C}$ ,  $V^+ = 2.7\text{V}$ ,  $V^- = 0\text{V}$ , 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	$V_{CM} = 0.3\text{V}$ , $T_A = 25^\circ\text{C}$		605	670	nA
		$V_{CM} = 0.3\text{V}$ , $-40^\circ\text{C}$ to $85^\circ\text{C}$			<b>707</b>	
		$V_{CM} = 0.3\text{V}$ , $-40^\circ\text{C}$ to $125^\circ\text{C}$			<b>1005</b>	
		$V_{CM} = 2.4\text{V}$ , $T_A = 25^\circ\text{C}$		815	905	
		$V_{CM} = 2.4\text{V}$ , $-40^\circ\text{C}$ to $85^\circ\text{C}$			<b>940</b>	
		$V_{CM} = 2.4\text{V}$ , $-40^\circ\text{C}$ to $125^\circ\text{C}$			<b>1220</b>	
$V_{OS}$	Input Offset Voltage	$V_{CM} = 0\text{V}$		$\pm 0.3$	$\pm 3$	mV
		$V_{CM} = 2.7\text{V}$			<b><math>\pm 4</math></b>	
TC $V_{OS}$	Input Offset Average Drift	(Note 7)		$\pm 1$		$\mu\text{V}/\text{C}$
$I_B$	Input Bias Current (Note 6)	$V_{CM} = 0.5\text{V}$		-5		fA
		$V_{CM} = 2.2\text{V}$				
$I_{OS}$	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	$V^+ = 1.8\text{V}$ to $5\text{V}$ , $V_{CM} = 0\text{V}$	75	93		dB
CMVR	Input Common-Mode Voltage Range	CMRR $\geq 50\text{ dB}$	<b>2.7</b>		<b>0</b>	V
$A_V$	Voltage Gain			120		dB
$V_O$	Output Swing High	$I_O = 500\text{ }\mu\text{A}$		2.62		V
		$I_O = 1\text{ mA}$		2.54		
	Output Swing Low	$I_O = -500\text{ }\mu\text{A}$		80		mV
		$I_O = -1\text{ mA}$		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		$\mu\text{s}$
		Overdrive = 100 mV		6		
	Propagation Delay (Low to High)	Overdrive = 10 mV		15		
		Overdrive = 100 mV		8		
$t_{rise}$	Rise time	Overdrive = 10 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		90		ns
		Overdrive = 100 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		85		
$t_{fall}$	Fall time	Overdrive = 10 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		85		ns
		Overdrive = 100 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		75		



## 5V Electrical Characteristics (Note 8)

Unless otherwise specified, all limits are guaranteed for  $T_J = 25^\circ\text{C}$ ,  $V^+ = 5\text{V}$ ,  $V^- = 0\text{V}$ , 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	$V_{CM} = 0.3\text{V}$ , $T_A = 25^\circ\text{C}$		612	677	nA
		$V_{CM} = 0.3\text{V}$ , $-40^\circ\text{C}$ to $85^\circ\text{C}$			<b>740</b>	
		$V_{CM} = 0.3\text{V}$ , $-40^\circ\text{C}$ to $125^\circ\text{C}$			<b>1240</b>	
		$V_{CM} = 4.7\text{V}$ , $T_A = 25^\circ\text{C}$		825	920	
		$V_{CM} = 4.7\text{V}$ , $-40^\circ\text{C}$ to $85^\circ\text{C}$			<b>970</b>	
		$V_{CM} = 4.7\text{V}$ , $-40^\circ\text{C}$ to $125^\circ\text{C}$			<b>1450</b>	
$V_{OS}$	Input Offset Voltage	$V_{CM} = 0\text{V}$		$\pm 0.3$	$\pm 3$	mV
		$V_{CM} = 5\text{V}$			<b><math>\pm 4</math></b>	
TC $V_{OS}$	Input Offset Average Drift	(Note 7)		$\pm 1$		$\mu\text{V}/^\circ\text{C}$
$I_B$	Input Bias Current (Note 6)	$V_{CM} = 0.5\text{V}$		-5		fA
		$V_{CM} = 4.5\text{V}$				
$I_{OS}$	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	$V^+ = 1.8\text{V}$ to $5\text{V}$ , $V_{CM} = 0\text{V}$	75	93		dB
CMVR	Input Common-Mode Voltage Range	CMRR $\geq 50$ dB	<b>5</b>		0	V
$V_O$	Output Swing High	$I_O = 500\text{ }\mu\text{A}$		4.95		V
		$I_O = 1\text{ mA}$		4.9		
	Output Swing Low	$I_O = -500\text{ }\mu\text{A}$		50		mV
		$I_O = -1\text{ mA}$		100		
$I_{OUT}$	Output Current	Source	15.5	17		mA
		Sink	16.7	19		
	Propagation Delay (High to Low)	Overdrive = 10 mV Overdrive = 100 mV		18 8		$\mu\text{s}$
	Propagation Delay (Low to High)	Overdrive = 10 mV Overdrive = 100 mV		30 13		$\mu\text{s}$
$t_{rise}$	Rise Time	Overdrive = 10 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		100		ns
		Overdrive = 100 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		100		
$t_{fall}$	Fall Time	Overdrive = 10 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		115		ns
		Overdrive = 100 mV $C_L = 30\text{ pF}$ , $R_L = 1\text{ M}\Omega$		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 k $\Omega$  in series with 100 pF. Machine model: 0 $\Omega$  in series with 200 pF.

**Note 3:** The maximum power dissipation is a function of  $T_{J(MAX)}$ ,  $\theta_{JA}$ , 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  $25^\circ\text{C}$ . Limits over the operating temperature range are guaranteed through correlations using statistical quality control (SQC) method.

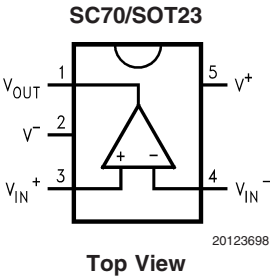
**Note 6:** Positive current corresponds to current flowing into the device.

**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

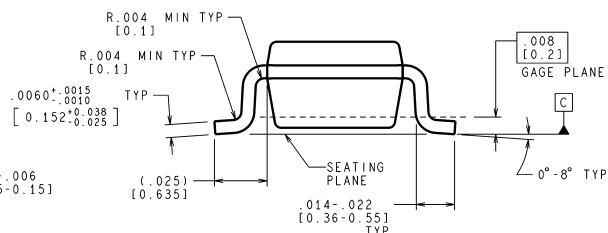
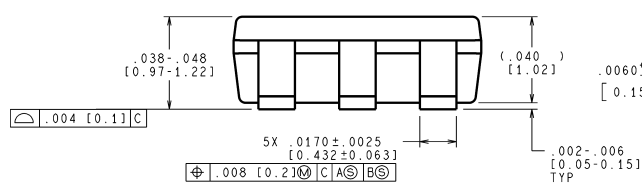
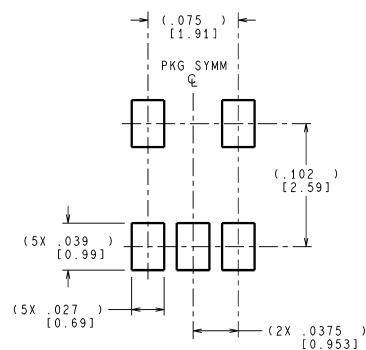
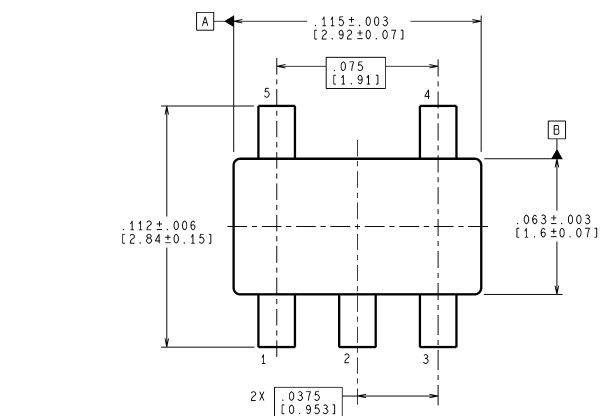


Ordering Information

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	



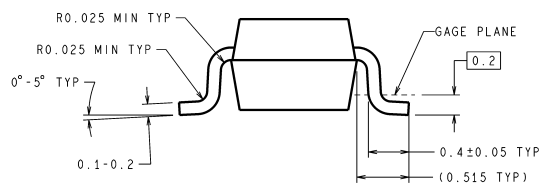
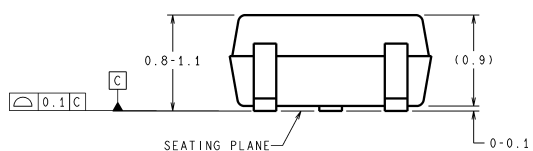
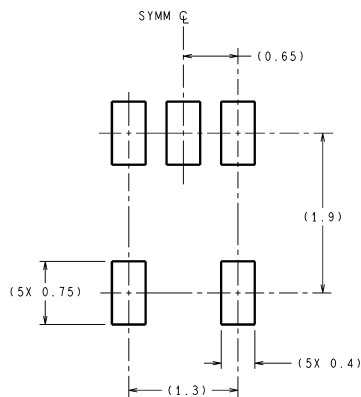
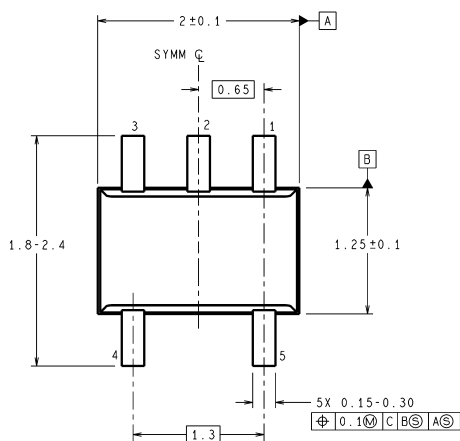
# Physical Dimensions inches (millimeters) unless otherwise noted



CONTROLLING DIMENSION IS INCH  
VALUES IN [ ] ARE MILLIMETERS

MF05A (Rev B)

## 5-Pin SOT23 NS Package Number MF05A



DIMENSIONS ARE IN MILLIMETERS

MAA05A (Rev C)

## 5-Pin SC70 NS Package Number MAA05A



## Notes

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