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PCA3000

5V 6 CHANNEL MAGNETO-RESISTIVE READ/ THIN FILM WRITE PRE-AMPLIFIER

The GEC Plessey Semiconductors PCA3000 is a bipolar monolithic integrated circuit designed for use with a combined magneto-resistive read head and thin film write head.

The GPS PCA3000 can be used in disk drive applications with up to 6 channels, and provides the necessary bias current for the MR head from a single 5 volt supply whilst keeping the voltage on the MR head to a minimum.

CIRCUIT OPERATION

With the chip select input (CS) high the chip is put in its idle state with supply current reduced to the minimum for power saving.

With chip select low the function of the chip is controlled by the read/write pin (R/W), and the head selection by the HS pins. CS and R/W have internal pull-up resistors and the HS pins have internal pull-down resistors.

FEATURES

- Designed for operation with Single Stripe MR Heads
- Single +5 volt supply operation
- High performance read circuit features
 - Adjustable Bias Current = 5 to 15mA
 - Typical MR Head Voltage = 225mV
 - Gain = 320V/V
 - Input Noise = 0.7nV/ $\sqrt{\text{Hz}}$ max.
 - Input Capacitance = 10pF typ.
 - Bandwidth = 60MHz
- Thin Film Write Circuit Features
 - 20:1 Programmable Write Current Source
 - Minimum Head Voltage Swing 6Vpp
 - Write Unsafe Indicator
 - Head Short to Ground Protection
 - Power Supply Fault Protection

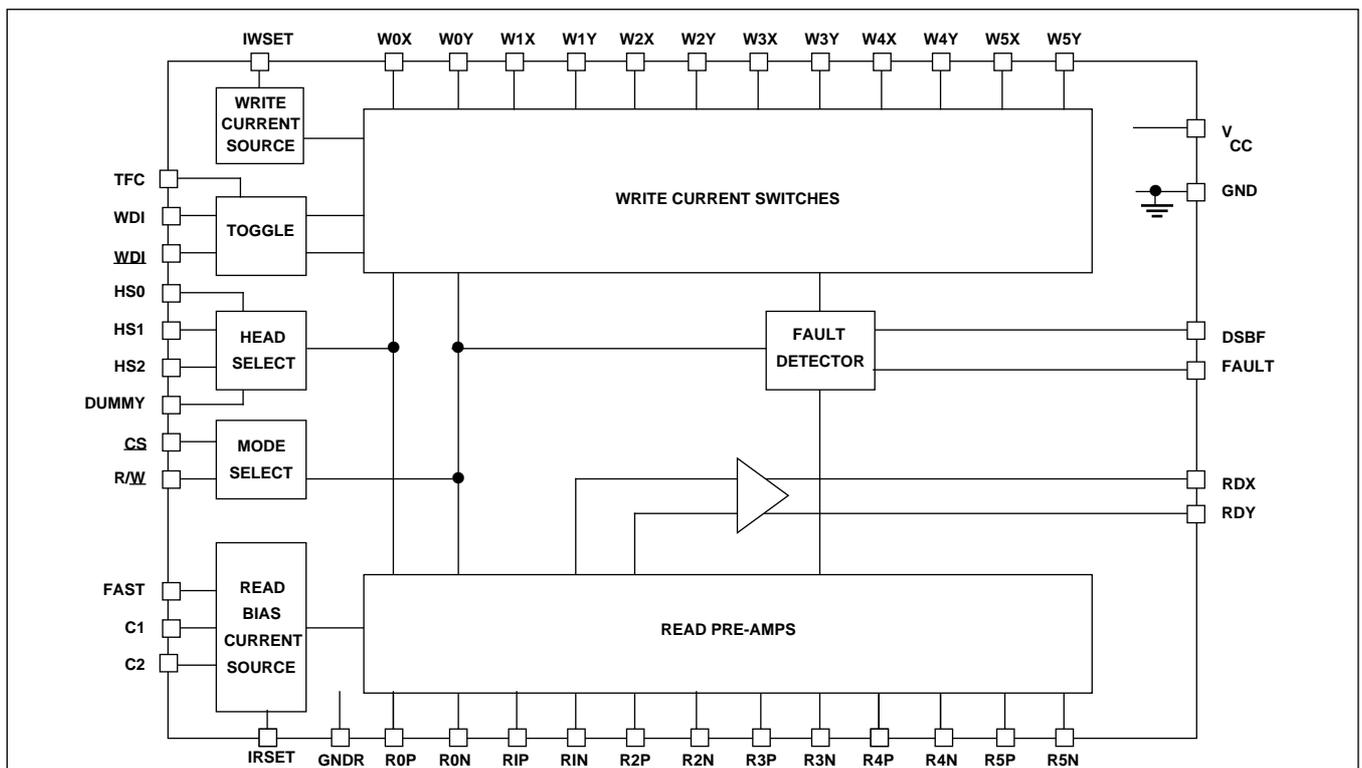


Fig. 1 Block diagram

PCA3000

READ MODE (MR)

In the MR read mode the MR bias currents, set by the IRSET pin, are applied to the selected single stripe magneto-resistive head. The differential output voltage is amplified and output on the RDX and RDY pins. In idle or write modes these two outputs become high impedance, allowing wire-OR connection for multiple head/chip applications.

The current in the read head is set by the external resistor R_{RC} where:

$$I_R = \frac{V_{RC}}{R_{RC}}$$

R_{RC} is connected between the pin IRSET and V_{CC} .

Pins are provided for filter capacitors for the bias generator and the current loop control.

The FAST pin enables either the fast or normal settling mode of the read current bias control loops.

WRITE MODE (TF)

In the write mode, the selected head switches current between X and Y sides of the head. If Toggle is enabled, the write current changes direction on the falling edge of the WDI input. On power-up or when selecting write mode, the write data flip-flop is initialised to pass current into the X side of the head. If toggle is disabled, the direction of the write current is determined by the polarity of the WDI/WDI inputs.

The current in the write driver is set by the external resistor R_{WC} where:

$$I_W = \frac{A_I \cdot V_{WC}}{R_{WC} + 40}$$

R_{WC} is connected between the pin IWSET and V_{CC} .

Note: In read and idle modes the write current source is deactivated.

MODE DESCRIPTION

<u>CS</u>	<u>R/W</u>	Mode
0	0	Write
0	1	Read
1	0	Idle
1	1	Idle

FAULT DETECTOR

In write mode this function disables the write current function when either of the faults below are detected.

- Power supply voltage too low
- Head short to ground

In addition the following conditions will put a high level on the FAULT open collector output.

- WDI Frequency too low
- Device in read mode
- Chip Disabled
- Write current to low
- Open circuit head

In read mode the voltage across the MR head is monitored and FAULT will be driven low in the case of an extended head to media short, or an open circuit read head. The read mode fault detection is enabled by pulling the DSBF pin low.

PACKAGING

The PCA3000 is available in surface mount packaging. The target package will be a 48 and 64 pin TQFP.

HS2	HS1	HS0	Head
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5

Any other combination of the HS inputs will select the dummy head if in read mode, or turn the write current driver off and set FAULT high if in write mode.

PIN DESCRIPTIONS

Name	Type	Description
HS0,HS1,HS2 †	I	Head Select: selects one of six heads
CS	I	Chip Select: a high inhibits the chip
R/W †	I	Read/Write: a high selects Read mode
DUMMY †	I	Selects a dummy Read head
FAULT †	O	FAULT - in Write mode a high indicates an unsafe writing condition - in Read mode a low indicates a head to media short
DSBF	I	High level disables read head fault flag
WDI - <u>WDI</u> †	I	Write Data In: changes the direction of the current in the recording head. Pseudo ECL inputs
W0X - W5X; W0Y - W5Y	O	X, Y Head Connections for thin film heads
R0P - R5P; R0N - R5N	I	Head Connections for MR read heads
RDX, RDY †	O	X, Y Read Data: differential read data output
IWSET †		Write Current set: used to set the magnitude of the write current
IRSET †		Read bias current set
C1		Filter for the MR bias current loop
C1S	O	Servo drive for C1
C2		Filter for the MR bias current set
C2S (64 TQFP)	O	Servo drive for C2
FAST	I	High level enables fast settling mode of the read
TFC	I	Toggle Flop Control high sets ÷2
VCC	I	+5V Supply
GND	I	Ground
GNDR	I	Read circuitry ground

† These signals can be wire OR'ed

RECOMMENDED OPERATING CONDITIONS

Parameter		Rating	Unit
DC Supply Voltage	V _{CC}	5±10%	VDC
Operating Junction Temperature	T _j	+25 to +110	°C
Write Head Load Range	L _h	0.2 to 1	μH
Read Head resistance	R _{MR}	15 to 45	

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ABSOLUTE MAXIMUM RATINGS

Operation at absolute maximum ratings is not implied. Exposure to stresses greater than those listed could cause permanent damage to the device.

Parameter		Rating	Units
DC Supply Voltage	V _{CC}	-0.3 to +6	VDC
Write Current	I _W	50	mA
Digital Input Voltage	V _{in}	-0.3 to V _{CC} +0.3	VDC
Head Port Voltage	V _H	-0.3 to V _{CC} +0.3	VDC
Output Current: RDX,RDY FAULT	I _O	-10	mA
		+12	mA
Storage Temperature	T _{stg}	-65 to +150	°C

DC CHARACTERISTICS

Recommended operating conditions apply.

Parameter	Condition	Min.	Typ.	Max.	Units
V _{CC} Supply Current	READ Mode I _W = 20mA		40+ I _R	56+ I _R	mA
	WRITE Mode I _R = 15mA		30+ I _W	42+ I _W	mA
	IDLE Mode		1	2	mA
Power Dissipation	READ Mode		TBA		mW
	WRITE Mode		TBA		mW
	IDLE Mode		TBA		mW

DIGITAL INPUTS

Recommended operating conditions apply.

Parameter	Condition	Min.	Max.	Units
Input Low Voltage V _{IL} *			0.8	V
Input High Voltage V _{IH} *		2.0		V
Input Low Current I _{IL} *	V _{IL} = 0.8V	-400		μA
Input High Current I _{IH} *	V _{IH} = 2.0V		100	μA
Input Low Voltage V _{IL} (WDI/WDI)		V _{CC} -1.9	V _{CC} -1.6	V
Input High Voltage V _{IH} (WDI/WDI)		V _{CC} -1.0	V _{CC} -0.7	V
Input Low Current I _{IL} (WDI/WDI)	V _{IL} = V _{CC} -1.6V		80	μA
Input High Current I _{IH} (WDI/WDI)	V _{IH} = V _{CC} -1.0V		100	μA
FAULT Output Low Voltage (VOL)	I _{OL} = 2mA		0.5	V
V _{CC} Fault Voltage	I _W < 0.2mA	3.5	4.2	V

*Except WDI/WDI

WRITE CHARACTERISTICS

Recommended operating conditions apply.

Parameter	Condition	Min.	Typ.	Max.	Units
Write Current Voltage (VWC)		TBD	1.27	TBD	V
I_W to Head Current Gain (A_I)		TBD	20	TBD	mA/mA
Differential Head Voltage Swing	Open Head	6			Vp-p
Unselected Head Current				1	mA(pk)
Write Driver Output Capacitance				25	pF
Write Driver Output Resistance			500		
Write Current Range (IW)		5		35	mA
Write Bandwidth		50			MHz

READ CHARACTERISTICS

Recommended operating conditions apply.

(CL = 20pF RL = 1K)

Parameter	Condition	Min.	Typ.	Max.	Units
MR Read Bias Current Range (I_R)		5		15	mA
Read Current Voltage (V_{RC})			1.27		V
MR Head Potential	Note 1		225		mV
MR Differential Voltage Gain	Note 1 $V_{in} = 1\text{mV p-p}$ $f = 1\text{MHz}$		320		V/V
MR Bandwidth -3dB	$V_{in} = 1\text{mV p-p}$	60	80		MHz
MR Integrated Input Noise Voltage	Note 1 BW = 1MHz - 15MHz			0.7	nV/ $\sqrt{\text{Hz}}$
MR Input Capacitance			10		pF
MR Input Resistance	Note 1		4		
Power Supply Rejection Ratio	@5MHz	-30			dB
Channel Rejection Ratio		-45			dB
Differential Output Offset				200	mV
Single Ended Output Resistance				40	
Output Current		1			mA
Common Mode Output Voltage		2		3.5	V

Note 1: RMR = 20 , IMR = 11mA

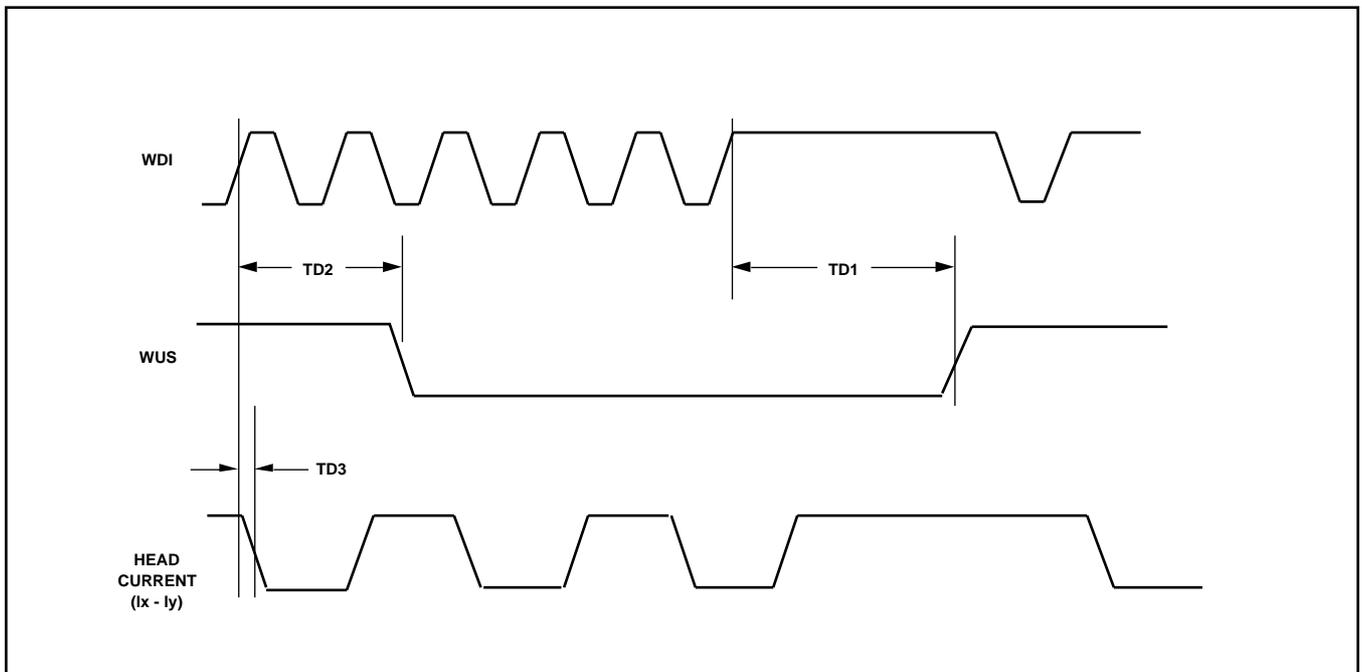
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SWITCHING CHARACTERISTICS

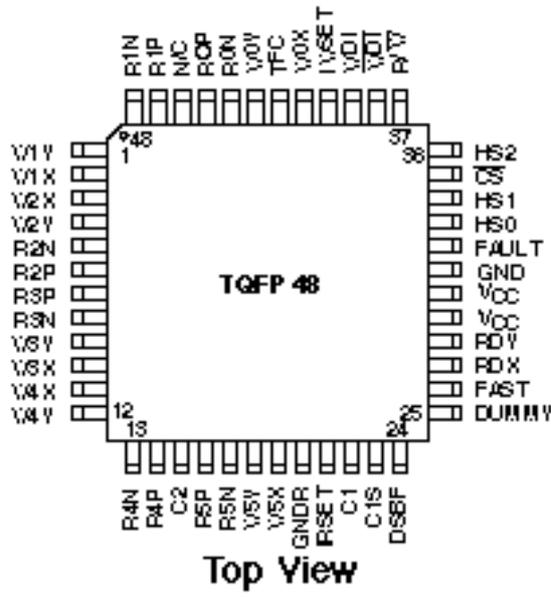
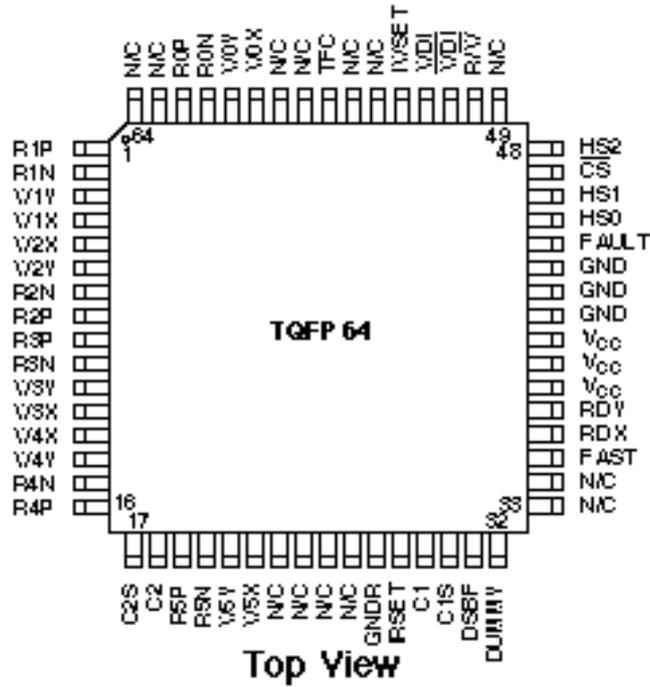
Recommended operating conditions apply unless otherwise specified.

IW = 20mA, Lh = 0.5μH, Rh = 30 , f(Data) = 5MHz.

Parameter	Conditions	Min.	Nom.	Max.	Units	
R/W	Read to Write		0.2	0.5	μs	
	Write to Read	Fast = Low		5	15	μs
		Fast = High		0.5	1	μs
CS	CS to Read	Fast = Low		10	25	
		Fast = High		3	5	μs
HS	HS to any Head		1	5	μs	
FAULT: Safe to Unsafe (TD1)		0.6		3.6	μs	
Unsafe to Safe (TD2)				1.0	μs	
Head Current:		Lh = 0, Rh = 0				
	WDI to Ix - Iy (TD3)	from 50% level		30	ns	
	Asymmetry	WDI has 1ns rise/fall time		1	ns	
Rise/fall Time	10% to 90% level Lh = 0 Rh = 0		3	5	ns	
		10% to 90% Lh = 0.5μH Rh = 30		7	ns	



PINOUT DIAGRAMS



PCA3000

PART NUMBERING

When ordering please use the following part numbers:

Part No.	Description	Package
PCA3006TPA	Six channel	64TQFP
PCA3006TPB	Six channel	48TQFP
PCA3004TPB	Four channel	48TQFP

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