

VM775430FSSL VM775630FSSL

4 or 6-CHANNEL, 5-VOLT,
THIN-FILM HEAD, READ/WRITE
PREAMPLIFIER with MULTIPLE
SERVO WRITE CAPABILITY

970801

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GENERAL FEATURES

- *General*
 - Single Power Supply (5 V ± 10%)
 - Power Up/Down Data Protect Circuitry
 - Very Low Power Dissipation (3 mW Typical in Sleep Mode)
 - Reduced Write-to-Read Recovery Time
 - Head Inductance Range = 0.2 – 1 μH (0.54 μH Typical)
 - Write Unsafe Detection
 - Available in 4 or 6 Channels
- *High Performance Reader*
 - Read Gain = 300 V/V Typical
 - Input Noise = 0.49nV/√Hz Typical
 - Low Input Capacitance = 11 pF Typical
- *High Speed Writer*
 - Write Current Range 5 - 20 mA
 - I_W Rise/Fall Times = 3.5 ns ($L_H = 0.54 \mu H$, $I_W = 10 \text{ mA b-p}$)
 - PECL Write Data Inputs
 - Multi-Channel Servo Write
 - Write Data Flip-Flop Optional

GENERAL DESCRIPTION

The VM775x30FSSL is a high-performance read/write preamplifier designed for use in high-end disk drives. It provides write current control, data protection circuitry, and a low-noise read preamplifier for four or six channels.

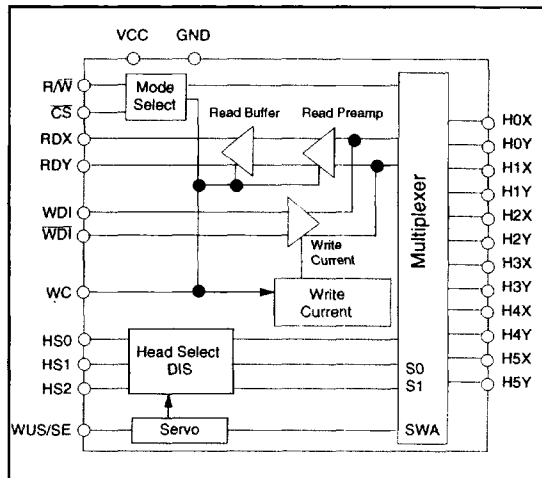
Fault protection is provided so that during power supply sequencing the write current generator is disabled. System write-to-read recovery time is minimized by maintaining the read channel common-mode output voltage in write mode.

Very low-power dissipation from the +5V supply is achieved through use of high-speed bipolar processing and innovative circuit design techniques. When unselected, the device enters a sleep mode, with power dissipation reduced to less than 3mW.

In multi-channel servo write mode, all heads are written simultaneously. The VM775x30FSSL servo mode is activated via the WUS/SE line.

The VM775x30FSSL is available in several different packages. Please contact VTC for package availability.

GENERAL BLOCK DIAGRAM



2 - TERMINAL
5V PREAMPS

ABSOLUTE MAXIMUM RATINGS

Power Supply:	
V_{CC}	-0.3V to +7V
Write Current I_W	30mA
Input Voltages:	
Digital Input Voltage V_{IN}	-0.3V to ($V_{CC} + 0.3$)V
Head Port Voltage V_H	-0.3V to ($V_{CC} + 0.3$)V
WUS Pin Voltage Range V_{WUS}	-0.3V to +7V
Output Current:	
RDX, RDY: I_O	-10mA
WUS: I_{WUS}	+12mA
Junction Temperature	150°C
Storage Temperature Tstg	-65° to 150°C
Thermal Characteristics, θ_{JA} :	
20-lead SSOP	110°C/W
24-lead SSOP	100°C/W

RECOMMENDED OPERATING CONDITIONS

Power Supply Voltage:	
V_{CC}	+5V ± 10%
Write current (I_W)	5 to 20mA
Head Inductance (L_H)	0.2 to 1μH
Junction Temperature (T_J)	25°C to 125°C



CIRCUIT OPERATION

The VM775x30FSSL addresses four or six two-terminal thin-film heads, providing write drive or read amplification. Mode control is accomplished with pins \overline{CS} and R/\overline{W} , as shown in Table 1. (Note that the 6-channel preamplifier does not have a \overline{CS} pin in the 24-lead package. The \overline{CS} pad is bonded low and the part does not have a sleep mode.) Head selection is accomplished with pins HS0-HS2, as shown in Table 2.

Internal pull-up resistors provided on pins \overline{CS} and R/\overline{W} force the device into a non-writing condition if either control line is opened accidentally.

Write Mode

The write mode configures the VM775x30FSSL as a current switch and activates the write unsafe (WUS) detection circuitry.

Write current is toggled between the X and Y direction of a selected head on each transition on pins WDI and \overline{WDI} (write data inputs). Current flows into H0Y on the high-to-low transition of WDI. Current flows into H0X on the high-to-low transition of \overline{WDI} .

An internally-generated 2.5 V reference voltage is present at the WC pin. The write current magnitude is determined by an external resistor connected between the WC pin and ground and is defined by the equation:

$$I_W = K_W/R_{WC} + 0.3mA = (50/R_{WC}) + 0.3mA \quad (eq. 1)$$

(0-pk ± 10%)

Fault Protection

Power supply fault protection improves data security by disabling the write current generator during a voltage fault or power-up. Additionally, the write unsafe circuitry will flag any of the conditions below as a high level on the open collector output pin WUS.

- No write current
- WDI frequency too low
- Device in read or sleep mode

Two transitions on pin WDI, after the fault is corrected, may be required to clear the WUS flag.

Multi-Channel Servo Write Mode

In servo write mode, the operation is the same as described above except that all channels are written simultaneously. Servo mode is controlled using the WUS/SE pin.

To initiate servo mode:

1. Enter read mode (bring R/\overline{W} high).
2. Select Head 1 (bring HS0 high).
3. Supply ~10mA source current into the WUS/SE pin.
4. Enter servo mode (drop the R/\overline{W} line low).

Note: If any other head is selected during servo, the part will temporarily exit servo and write only the selected head. Unless servo is "formally" exited by removing the current from the WUS/SE pin, servo mode will return whenever head 1 is selected.

To exit servo mode:

1. Enter read mode (bring R/\overline{W} high).
2. Remove the applied current from the WUS/SE pin (to return to "normal" read mode).

Read Mode

The read mode configures the VM775x30FSSL as a low-noise differential amplifier and deactivates the write current generator and write unsafe detection circuitry. The RDX and RDY outputs are emitter followers and are in phase with the "X" and "Y" head ports. These outputs should be AC-coupled to the load. The RDX, RDY common-mode voltage is maintained in the write mode, minimizing the transient between the write mode and the read mode, thereby substantially reducing the recovery time delay to the subsequent pulse detection circuitry.

Sleep Mode (4-channel only)

In sleep mode (\overline{CS} high), most of the circuit is idle and power dissipation is reduced to 3mW typical. The reader outputs are high impedance in this mode; this allows multiple chip connection by simply wiring the reader outputs together.

Table 1 Mode Select

R/\overline{W}	\overline{CS}	MODE
0	0	Write
1	0	Read
X	1	Sleep

Table 2 Head Selection

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
1	1	0	Illegal Op*
1	1	1	Illegal Op*

* - This head selection code is not allowed for 6-channel preamplifiers.

PIN DESCRIPTIONS

NAME	I/O	DESCRIPTION
HS0 - HS2	I*	Head Select: Selects one of up to six heads.
H0X - H5X H0Y - H5Y	I/O	X, Y Head Terminals
WDI, $\overline{\text{WDI}}$	I*	Write Data Inputs: PECL input signal; each transition toggles the direction of head current.
$\overline{\text{CS}}$	I	Chip Select: A high level signal places chip in sleep mode; a low level awakens chip. (6-channel 24-lead package excluded)
R/W	I*	Read/Write select: A high level selects read mode; a low level selects write mode.
WUS/SE	O*	Write Unsafe/Servo Enable: (open collector output) A high level indicates a write unsafe condition. Note: The WUS/SE pin is also used to enter servo mode. See the "Multi-Channel Servo Write Mode" section.
WC		Write Current Adjust: A resistor between the WC pin and ground determines the level of write current.
RDX-RDY	O	Read Data Output: Differential output data.
VCC		+5 volt supply
GND		Ground

* May be wire-OR'ed for multi-chip usage.

**GENERAL DC CHARACTERISTICS**

Recommended operating conditions apply unless otherwise specified.

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
Power Supply Voltage	V_{CC}		4.5	5.0	5.5	mA
Input High Voltage	V_{IH}		2		$V_{CC} + 0.3$	V
Input Low Voltage	V_{IL}		-0.3		0.7	V
Input High Current	I_{IH}	$V_{IH} = 2.7V$			80	μA
Input Low Current	I_{IL}	$V_{IL} = 0.4V$	-160			μA
WDI, \overline{WDI} Input High Voltage	V_{IH}	Pseudo ECL	$V_{CC} - 1.5$		$V_{CC} - 0.5$	V
WDI, \overline{WDI} Input Low Voltage	V_{IL}	Pseudo ECL	$V_{IH} - 1.5$		$V_{IH} - 0.5$	V
WDI, \overline{WDI} Input High Current	I_{IH}	$V_{IH} = V_{CC} - 0.7V$			100	μA
WDI, \overline{WDI} Input Low Current	I_{IL}	$V_{IH} = V_{CC} - 1.6V$			80	μA
WUS Output Low Voltage	V_{OL}	$I_{OL} = 4.0mA$		0.35	0.5	V
WUS Output High Current	I_{OH}	$V_{OH} = 5.0V$		13	100	μA
VCC Value for Write Current Turn Off		$I_H < 0.2mA$	3.0	3.5	3.7	V

Note: Please see the individual attachments at the end of this data sheet for part-specific information.



GENERAL WRITE CHARACTERISTICS

Recommended operating conditions apply unless otherwise specified; $L_H = 0.54\mu\text{H}$, $R_H = 20\Omega$, $I_W = 10\text{mA}$, $f_{\text{DATA}} = 5\text{MHz}$.

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
WC Pin Voltage	V_{WC}		2.2	2.5	2.9	V
I_{WC} to Head Current Gain	A_I			20		mA/mA
Write Current Constant	K_W	$V_{CC} = 5V \pm 10\%$	46	50	54	V
Write Current Range	I_W	$10.64\text{K}\Omega > R_{WC} > 2.54\text{K}\Omega$	5		20	mA
Write Current Tolerance	ΔI_W	$V_{CC} \pm 10\%$	-10		+10	%
Differential Head Voltage Swing	V_{DH}	Open head, $V_{CC} = 4.5V$	4.5	5.6		Vp-p
WDI Transition Frequency for Safe Condition	f_{DATA}	WUS = low	1			MHz
Differential Output Capacitance	C_{OUT}				15	pF
Differential Output Resistance	R_{OUT}		3.2			k Ω
Unselected Head Current	I_{UH}	$I_W = 20\text{mA}$		0.15	0.5	mA(pk)
RDX, RDY Common Mode Output Voltage	V_{CM}			$V_{CC} - 2.7$		V
Write Mode Damping Resistor	R_D	$T_A = 25^\circ\text{C}$	274	343	412	Ω

Note 1: Typical values are given at $V_{CC} = 5V$ and $T_A = 25^\circ\text{C}$.

Servo Write

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
Write Current Matching Between Channels	ΔI_W	$5\text{mA} < I_W < 20\text{mA}$			10	%
Write Current Tolerance Servo	ΔI_W	$V_{CC} \pm 10\%$	-14		+14	%
Duty Cycle (20mA/head)		$T_A \leq 50^\circ\text{C}$, $t_{s-on} < 5\text{ms}$ *			50	%
WUS Servo Enable	I_{WUS}		10	**	20	mA

* The ambient temperature (T_A) and servo-on time (t_{s-on}) limitation is used to keep the peak junction temperature under 125°C .

** 10 mA is the minimum current for which servo operation is guaranteed, although 5 mA is the typical current to enable servo.

**GENERAL READ CHARACTERISTICS**Recommended operating conditions apply unless otherwise specified; C_L (RDX, RDY) < 20pF, R_L (RDX, RDY) = 1k Ω .

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
Differential Voltage Gain	A_V	$V_{IN} = 1\text{mVrms}$, 1MHz	258	300	342	V/V
Bandwidth	BW	-1dB $ Z_s < 5\Omega$, $V_{IN} = 1\text{mVp-p}$	35	40		MHz
		-3dB $ Z_s < 5\Omega$, $V_{IN} = 1\text{mVp-p}$	65	70		
Input Noise Voltage	e_{in}	BW = 17MHz, $L_H = 0$, $R_H = 0$		0.49	0.65	nV/ $\sqrt{\text{Hz}}$
Differential Input Capacitance	C_{IN}	$V_{IN} = 1\text{mVp-p}$, $f = 5\text{MHz}$		11	15	pF
Differential Input Resistance	R_{IN}	$V_{IN} = 1\text{mVp-p}$, $f = 5\text{MHz}$	380	620		Ω
Dynamic Range	DR	AC input where A_V is 90% of gain at 0.2mVrms input	2	2.6		mVrms
Common Mode Rejection Ratio	CMRR	$V_{IN} = 100\text{mVp-p}$ @ 5MHz	50	70		dB
Power Supply Rejection Ratio	PSRR	100mVp-p @ 5MHz on V_{CC}	45	70		dB
Channel Separation	CS	Unselected channels: $V_{IN} = 20\text{mVp-p}$ @ 5MHz $V_{IN} = 0$ on selected head	45	75		dB
Output Offset Voltage	V_{OS}	Steady state read	-250	0	250	mV
RDX, RDY Common Mode Output Voltage	V_{OCM}	Read/Write Mode		$V_{CC} - 2.7$		
RDX, RDY Common Mode Output Voltage Difference Between Modes	ΔV_{OCM}		-350	0	+350	mV
Single-Ended Output Resistance	R_{SEO}	$f = 5\text{MHz}$		28	35	Ω
Output Current	I_O	AC coupled load, RDX to RDY	± 1.0			mA

Note 1: Typical values are given at $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

GENERAL SWITCHING CHARACTERISTICS Recommended operating conditions apply unless otherwise specified; $I_W = 10\text{mA}$, $f_{\text{DATA}} = 5\text{MHz}$, $L_H = 0.54\mu\text{H}$, $R_H = 20\Omega$, C_L (RD_X, RD_Y) $\leq 20\text{pF}$ (see Figure 1).

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
R/W Read to Write Delay	t_{RW}	R/W to 90% I_W		0.1	0.3	μs
R/W Write to Read Delay	t_{WR}	R/W to 90% of 100mV, 10 MHz read signal envelope		0.3	0.5	μs
$\overline{\text{CS}}$ Unselect to Select Delay	t_{IR}	$\overline{\text{CS}}$ to 90% I_W or 90% of 100mV, 10MHz read signal envelope		0.3	0.6	μs
$\overline{\text{CS}}$ Select to Unselect Delay	t_{RI}	$\overline{\text{CS}}$ to 10% of I_W		0.1	0.6	μs
HS0 - HS3 any Head Delay	t_{HS}	HS0 - HS3 to 90% of 100mV, 10MHz read signal envelope		0.2	0.6	μs
WUS Safe to Unsafe Delay	t_{D1}		0.6	2.5	3.6	μs
WUS Unsafe to Safe Delay	t_{D2}	$I_W = 10\text{mA}$		0.1	1.0	μs
Head Current Propagation	t_{D3}	$L_H = 0$, $R_H = 0$, from 50% points		25	30	ns
Head Current Asymmetry	A_{SYM}	50% duty cycle on WDI, 1ns rise/fall time; $L_H = 0$, $R_H = 0$.05	0.5	ns
Head Current Rise/Fall Time	t_r/t_f	10% to 90% points, $L_H = 0$, $R_H = 0$		1.5	4	ns
		10% to 90% points, $L_H = 540\text{nH}$, $R_H = 20\Omega$, $I_W = 10\text{mA}$		3.5	7	

Note 1: Typical values are given at $V_{\text{CC}} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

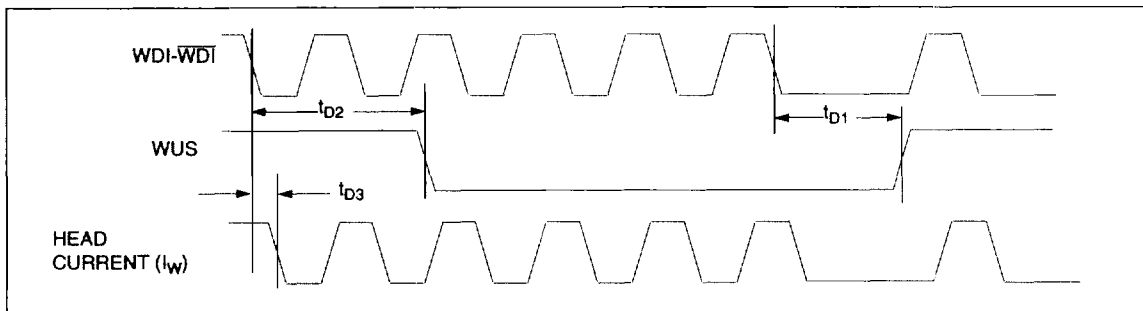
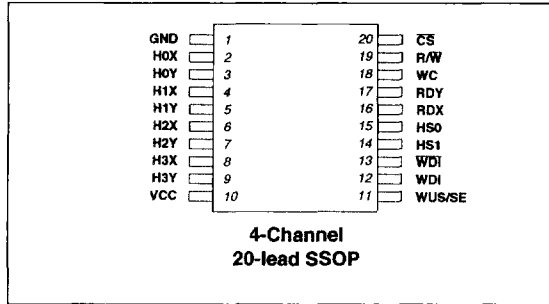


Figure 1: Write Mode Timing Diagram for VM775x30FSSL

2 - TERMINAL
3V PRELEADS

VM775430FSSL

4-CHANNEL CONNECTION DIAGRAM


 2 - TERMINAL
5V PREAMPS

Specific DC CHARACTERISTICS

Recommended operating conditions apply unless otherwise specified.

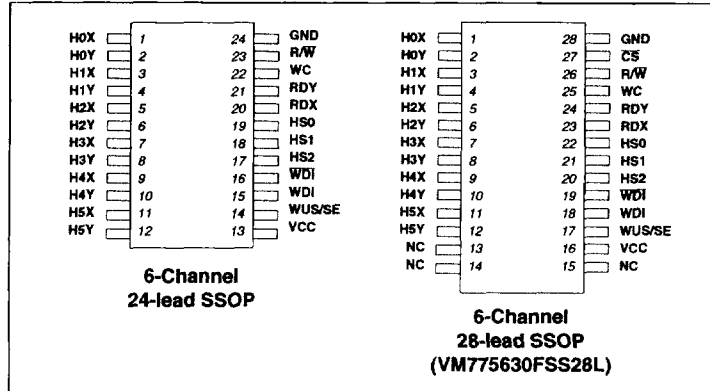
Please see the general data sheet for other common specification information.

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
VCC Supply Current	I _{CC}	Read Mode		31 + 0.05I _W	44	mA
		Write Mode, I _W = 10mA, Normal		26 + 1.05I _W	43	
		Write Mode, Servo (4-Channel)		55 + 4.3I _W	115	
		Sleep Mode		0.5	3	
Power Supply Power Dissipation	PD	Read Mode		175	250	mW
		Write Mode, I _W = 10mA, Normal		200	240	
		Write Mode, Servo, I _W = 10mA (4-Channel)		540	633	
		Sleep Mode		3	16.5	



VM775630FSSL

6-CHANNEL CONNECTION DIAGRAMS



2-TERMINAL 3V PRELAPPS

Specific DC CHARACTERISTICS

Recommended operating conditions apply unless otherwise specified.
Please see the general data sheet for other common specification information.

PARAMETER	SYM	CONDITIONS	MIN	TYP	MAX	UNITS
VCC Supply Current	I _{CC}	Read Mode		31 + 0.05I _W	44	mA
		Write Mode, I _W = 10mA, Normal		26 + 1.05I _W	43	
		Write Mode, Servo (6-Channel)		70 + 6.5I _W	155	
		Sleep Mode		0.5	3	
Power Supply Power Dissipation	PD	Read Mode		175	250	mW
		Write Mode, I _W = 10mA, Normal		200	240	
		Write Mode, Servo, I _W = 10mA (6-Channel)		750	853	
		Sleep Mode		3	16.5	