

MAGCHIP™

Single Track ASIC For Magnetic Stripes



ID TECH's MagChip™ Application-Specific Integrated Chip (ASIC) is for reading and decoding a single track on a magnetic stripe. Because MagChip is an Integrated Circuit (IC) designed specifically to perform reading and decoding functions, it is smaller, consumes less power, and costs less than a general-purpose processor chip while delivering superior performance. MagChip decodes the analog output from a magnetic "read" head and produces a digital data-bit stream with clock and "media detect" outputs.

- Low power—sleeps when not reading
- Less than 1.0mA typical when reading a card
- Less than 30µA when in "sleep" mode (15µA typical)
- Operation from 2.7V to 5.5V
- True AGC handles signal amplitudes from 1mV to 1V p-p
- Excellent data jitter, media glitch, and drop-out immunity
- ±2000V Electro-Static Discharge (ESD) protection
- Typical card swipe speeds from 7.5 to 200+ cm/sec (3 to 80+ IPS)
- Provided in a plastic, industry standard SOIC-8 surface mount package
- Only two external capacitors recommended
- Compatible with a wide range of available read heads
- Supports bi-directional card swiping and decoding

Functional Description

ID TECH's MagChip has two input pins for the connection of a magnetic read head. The head signals are amplified by MagChip using an auto-scaling amplifier. The amplified signal is used to decode the magnetic stripe signal (dual-frequency data encoded using the principals of Aiken's F2F encoding) into a digital data format consisting of the magnetic stripe data, clock, and "media detect" outputs, all of which are CMOS level signals. Additionally, MagChip has an automatic power-down sleep mode that saves energy.

The F2F data rate ranges from less than 200 to greater than 30,000 magnetic flux reversals per second, depending upon data density and the velocity at which the magnetic stripe is passed across the "read" head. One clock pulse is required for each data bit, and the "media detect" signal is held true while magnetic head signals are present.

Data Output

Data output is a serial stream of digital bits, the level of which, with the corresponding clock, represents each data bit that was recorded on the magnetic stripe track. No data filtering is required, as the first 6 to 9 bits (after MagChip wake-up) from the leading edge of a magnetic stripe are not provided as output. These bits are used for circuit synchronization. A data output high level is a ZERO value data bit, and a low level is a ONE value data bit. The data output is last-bit-first when media is passed by the head in a reverse direction.

Clock Output

Clocking output is normally high, and goes low to indicate a data sample time. The data output is stable and may be sampled on the falling or rising edge of clock, or at any time while the clock is low.

The MagChip clock goes low approximately 2 µsec after the data output is valid. The clock width changes with speed. (Please refer to the AC Characteristics table for minimum/maximum signal timing.) The receiving interface for MagChip data must sense the high-to-low clock transition (leading edge) and acquire the data bit level during clock pulse.

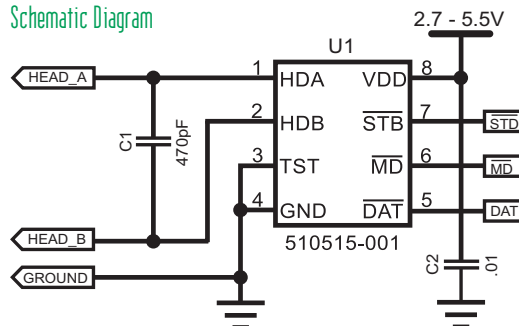
"Media Detect" Output

This output indicates the presence of encoded magnetic media passing the read head. This signal is normally high; a low output indicates encoded media. The output is an open drain type with high impedance; the outputs of several MagChip circuits can be connected together. A pull-up resistor is needed for proper operation of this output if it is to be used.

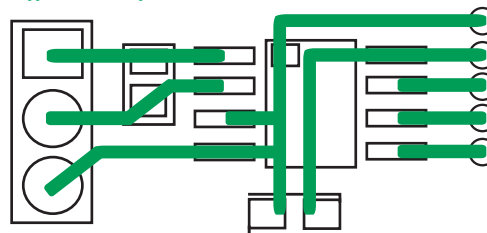
Sleep Mode Function

The MagChip will automatically enter a power-down sleep mode when a magnetic head signal is not present. The MagChip will automatically wake-up when a magnetic head signal is present. The outputs Data, Clock, and Media Detect are at a high level during sleep mode.

Schematic Diagram



Suggested PCB Layout



Note: Keep digital signals (data, clock, and media detect) away from head input traces.

Head Input Capacitance

The MagChip "read" head input pins should have a 470 pico-farad capacitor when used with a 100 milli-Henry inductance read head.

Recommended Head Characteristics

Symbol	Parameter	Min	Typ	Max	Units	Conditions
L_{HEAD}	Inductance	50	100	150	mH	1kHz, 100 μ A RMS
R_{HEAD}	Resistance	100	280	450	Ω	
M_{HEAD}	Magnetic Gap Length	6	10	15	μ m	

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Units
V_{DD}	Supply Voltage	2.7	3.0	5.5	V
V_{in} , V_{out}	DC Input & Output Voltage	0		V_{DD}	V (Signal GND)
I_{OH}	Output Current - High			6	mA
I_{OL}	Output Current - Low			6	mA
T	Operating Temperature	-40	25	75	$^{\circ}$ C
V_{GND}	Chassis Ground				V (GND-Chassis)

Absolute Maximum Ratings

Rating	Symbol	Value	Units
Supply Voltage	V_{DD}	6.0	Vdc
Storage Temperature	T_{slg}	-50 to +125	$^{\circ}$ C
DC Input Voltage (GND reference)	V_{in}	-0.5 to V_{DD} +0.5	V
DC Input Current, per pin	I_{in}	\pm 10	mA
DC Output Voltage (GND reference)	V_{out}	-0.5 to V_{DD} +0.5	V
DC Output Sink/Source Current, per pin	I_{out}	10	mA
Differential Head Input Current	I_{diff}	1	mA
Electro-Static Discharge	ESD	\pm 2000	V (1.5k Ω , 100pF)

Circuit Description

MagChip uses low-power, low-voltage BiCMOS technology requiring a supply current of less than one milliamp (mA) when reading a card, and typically less than 30 microamps (μ A) when not reading a card ("sleep" mode). It will operate with supply voltages from 2.7V to 5.5V. Whenever the signal detector detects a signal from the magnetic head, it will wake up the chip.

DC Characteristics (25 $^{\circ}$ C)

Sym	Parameter	V_{DD} (V)	Typ	Guar. Limits	Uts.	Conditions
V_{OH}	Minimum High Level Output Voltage*	2.7	2.57	2.45	V	$I_{out} = -50\mu$ A
		4.5	4.49	4.4		
		5.5	5.49	5.4		
		2.7	2.3	2.18	V	$I_{out} = -3$ mA
V_{OL}	Maximum Low Level Output Voltage	5.5	5.25	5.15		$I_{out} = -6$ mA
		2.7	0.002	0.1	V	$I_{out} = 50\mu$ A
		4.5	0.001	0.1		
		5.5	0.001	0.1		
I_{DD}	Maximum Active Supply Current	2.7	0.22	0.26	V	$I_{out} = 3$ mA
		5.5	0.2	0.24		$I_{out} = 6$ mA
		5.5	0.8	1.1	mA	$V_{in} = V_{DD}$
		5.5	14	30	μ A	

*MD output is open drain type – maximum leakage in High-Z state is 1 μ A

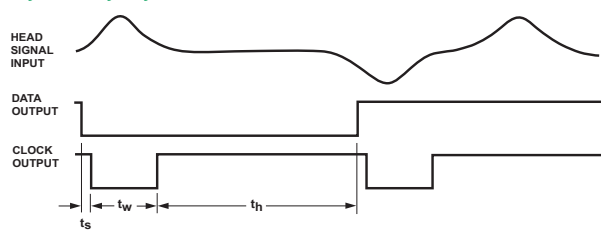
AC Characteristics (25 $^{\circ}$ C)

Sym.	Parameter	Min	Typ	Max	Units	Fig.#
f	Frequency of Decodable Data	<200		>30k	bps	
t_s	Setup Time, DATA Change to CLOCK Falling Edge	1.33	2	3.33	μ s	1
t_h	Hold Time, CLOCK Rising Edge to DATA Change*	1.33			μ s	1
t_w	Pulse Width, CLOCK*	21.3	32	53.3	μ s	1
t_0	Time Elapsed from Trip of V_{AWAKE} to the Point When the Counting of n_{MD} Begins	0.7	1.0	1.75	ms	
n_{MDL}	Number of Bit-Cells between T_n and Falling Edge of MD		6		-	
t_{MDH}	Last CLOCK Rising Edge to Rising Edge of MD**	120	-	1450	μ s	

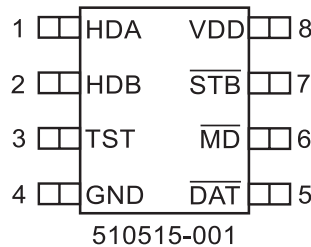
*CLOCK width is shortened as the data rate requires at high media speeds.

** t_{MDH} is longer for slower swipe speeds. The range shown is for 80 to 5 IPS.

Signal Timing Diagram



Pin-Outs



Pin	Sym.	Description
1	HDA	Magnetic read head input A (non-polarized)
2	HDB	Magnetic read head input B (non-polarized)
3	TST	Production only test pin (must be grounded)
4	GND	Power supply ground (must be de-coupled with V_{DD})
5	DAT	Digital Data output (a high level = a zero data bit value)
6	MD	Media Detect output (a low level indicates magnetic media)
7	STB	Data Clock output
8	V_{DD}	Power supply + rail (reference any shield plane to V_{DD})

Physical Description

The ID TECH MagChip ASIC is a mixed-signal, analog/digital Integrated Circuit (IC) using 0.8 micron BiCMOS technology. It is integrated into an eight-pin package measuring just 5.0 mm x 4.0 mm and 1.75 mm in thickness. There are two external capacitors.

IDTECH
Value through Innovation

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