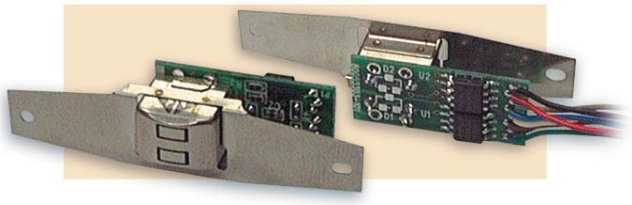
MAG CHIP™ HEAD

Read Head Assembly with Intergrated 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. Integrated with a"read" head for magnetic stripes, the MagChip Read Head Assembly delivers reading and decoding capabilities in the smallest possible package. One, two, or three MagChips are mounted directly on the read head to decode up to three tracks of data. The head, in turn, is mounted on a spring that provides support, deflection, and gimble for good contact with the magnetic stripe. Signals from the head-and-chip assembly are CMOS-level outputs of decoded serial bits.

- Low power—sleeps when not reading
- Less than 1.0mA per track typical when reading a card
- Less than 30µA per track when in "sleep" mode (15µA typical)
- Operation from 2.7V to 5.5 V
- 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)
- Supports bi-directional card swiping and decoding

Functional Description

The read head signals are amplified by the 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, the MagChip has a automatic power-down sleep mode that saves energy.

Since the MagChips are mounted directly on the read head, the low amplitude analog signals are amplified and digitized without exposure to external "noise" for maximum noise immunity. 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.

The assembly's standard configuration consists of the read head, one, two or three decoding circuits, wing spring mounting, and a cable assembly with 8-pin connector (for single or dual track configuration) or 10-pin connector (for triple track).

Durability

Head life is 1,000,000 card cycles (with media that meets ISO 7811 magnetic stripe properties) under a non-contaminated environment. Spring assembly is 1,000,000 card cycles as well.

Environmental

Operating: -35°C to 70°C (10% to 98% relative humidity). Storage: -45°C to 85°C (10% to 98% relative humidity).

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, as 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 and acquire the data bit level during clock pulse. The clock width changes with speed. (Please refer to the AC Characteristics table.)

"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.

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Absolute Maximum Ratings

Rating	Symbol	Value	Units
Supply Voltage	V_{DD}	6.0	Vdc
Storage Temperature	T_{stg}	-50 to +125	°C
DC Input Voltage (GND reference)	V_{in}	-0.5 to V_{DD} +0.5	V
DC Input Current, per pin	I_{in}	±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	±2000	V (1.5kΩ, 100pF)

DC Characteristics (25° 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} = -50µA
		4.5	4.49	4.4		
		5.5	5.49	5.4		
		2.7	2.3	2.18	V	I_{out} = -3mA
		5.5	5.25	5.15		I_{out} = -6mA
V_{OL}	Maximum Low Level Output Voltage	2.7	0.002	0.1	V	I_{out} = 50µA
		4.5	0.001	0.1		
		5.5	0.001	0.1		
		2.7	0.22	0.26	V	I_{out} = 3mA
		5.5	0.2	0.24		I_{out} = 6mA
I_{DD}	Maximum Per Track Active Supply Current	5.5	0.8	1.1	mA	V_{in} = V_{DD}
I_{SLEEP}	Maximum Per Track Sleep Supply Current	5.5	14	30	µA	

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

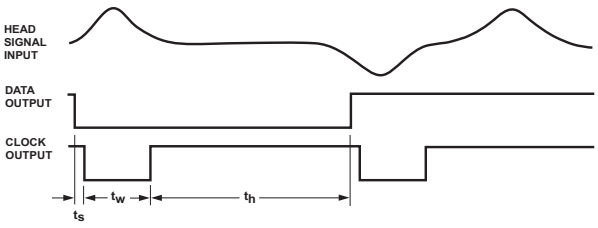
AC Characteristics (25° C)

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	µs	1
t_h	Hold Time, CLOCK Rising Edge to DATA Change*	1.33			µs	1
t_w	Pulse Width, CLOCK*	21.3	32	53.3	µs	1
t_0	Time Elapsed from Trip of V_{AWAKE} to the Point When the Counting of n_{MDL} Begins	0.7	1.0	1.75	ms	
n_{MDL}	Number of Bit-Cells between T_0 and Falling Edge of MD		6		-	
t_{MDH}	Last CLOCK Rising Edge to Rising Edge of MD **	120	-	1450	µs	

*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



Recommended Operating Conditons

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	°C
V_{GND}	Chassis Ground				V (GND-Chassis)

Pin-out Information

Pin	Function	Single Track[1] (Track 2)	Dual Track[2] (Tracks 1&2)	Dual Track[2] (Tracks 2&3)	Triple Track[3] (Tracks 1,2,3)
1	Ground	Gnd	Gnd	Gnd	Gnd
2	Clock Output	Stb 2	Stb 2	Stb 2	Stb 2
3	Data Output	Data 2	Data 2	Data 2	Data 2
4	Media Detect*	MD	MD	MD	MD
5	Clock Output†	--	Stb 1	Stb 3	Stb 1
6	Data Output†	--	Data 1	Data 3	Data 1
7	Chassis Gnd**	--	(MD 1)***	(MD 3)***	(MD1&3)***
8	+2.6 -5 V	+V	+V	+V	+V
9	Clock Output†	--	--	--	Stb 3
10	Data Output†	--	--	--	data 3

[1] The pin-out assumes that the track two magnetic stripe & the spring mounting hole centerlines are the same.

[2] The centerlines should be the same as assumed in Note 1 and the track 1 or 3 outputs are available by turning the head 180 degrees.

[3] The triple track MagChip Head Assembly has read gap spacing corresponding with ISO track spacing; therefore the head should be mounted with the track 3 gap for ISO track 3 location.

† Data output and clock output for tracks 1 and 3 will be switched if the head is installed with the PCA in the opposite direction from the one shown in the Outline Drawing on page 9.

* Media Detect for any one, two, or all three tracks.

** Chassis Ground should be connected to host chassis/earth ground.

*** Media Detect track 1 or 3 optional—must be specified at the time of order. If option is chosen, Chassis Ground will be connected to Ground (Signal).

Mounting Notes

The ID TECH MagChip Head must be mounted to provide good contact between the read head face and the magnetic stripe on cards. The read head face contains one or more read gaps, which must be perpendicular (within ± 30 minutes) to the card reference edge (perpendicular to the stripe length). The mounted head must apply only enough force between the head face and the card stripe so that the head face does follow the stripe contours and does not cause excessive wear, typically 2 to 6 ounces for single, dual, and triple-track heads respectively. The head gaps have a 0.06 inch reading width that should be centered on the magnetic tracks of the card stripe. ISO Specification 7811 is a good reference document.

The spring mounting hole centerline is on the magnetic stripe ISO track 2 centerline. The head face protrusion into a card slot should be sufficient so that the thinnest card used in the slot causes the head to be pushed back (deflection) by 0.010 inches minimum. Head deflection should be no greater than 0.055 inches. A guideline is that the head should have a force on the magnetic stripe of from 2 to 6 ounces. This guideline may require that the spring be pre-loaded (already flexed, pushing the head face into the card slot).

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