

## Description

The AH5794 is a single chip solution for driving single-coil brushless direct current (BLDC) fans and motors. The integrated full-bridge driver output stage uses soft switching to minimize audible switching noise and electromagnetic interference (EMI) providing a low noise solution.

Low operating voltage down to 1.8V allows motor speed to be controlled by varying the supply voltage.

To help protect the motor coil, the AH5794 provides Rotor Lock Protection which shuts down the output drive if rotor lock is detected. The device automatically re-starts when the rotor lock is removed. Over temperature shutdown provides thermal protection for the device.

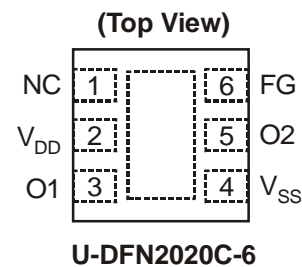
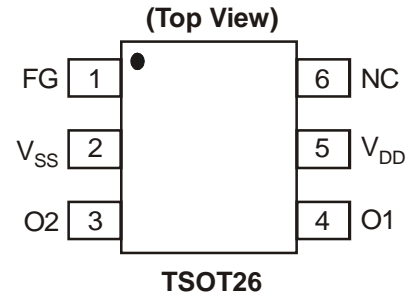
A Tachometer output is provided by open-drain Frequency Generator (FG) Pin which allows external interface to monitor motor rotation or speed. The FG output is the magnetic change frequency.

The AH5794 is available in space saving and low profile TSOT26 and U-DFN2020C-6 packages.

## Features

- Supports single-coil full-wave BLDC fan drivers
- Built-in Hall sensor and input amplifier
- Operating voltage: 1.8V to 6V
- $V_{DD}$  voltage speed control
- Soft switching for low noise DC fan motor applications
- Rotor Lock Protection (Lock detection, output shutdown and automatic re-start)
- Thermal protection
- Tachometer (FG) output
- No external timing capacitor - Reduces the numbers of external components required
- Low profile package: TSOT26 and U-DFN2020C-6
- Halogen and Antimony free "Green" packages.
- Lead Free Finish/ RoHS Compliant

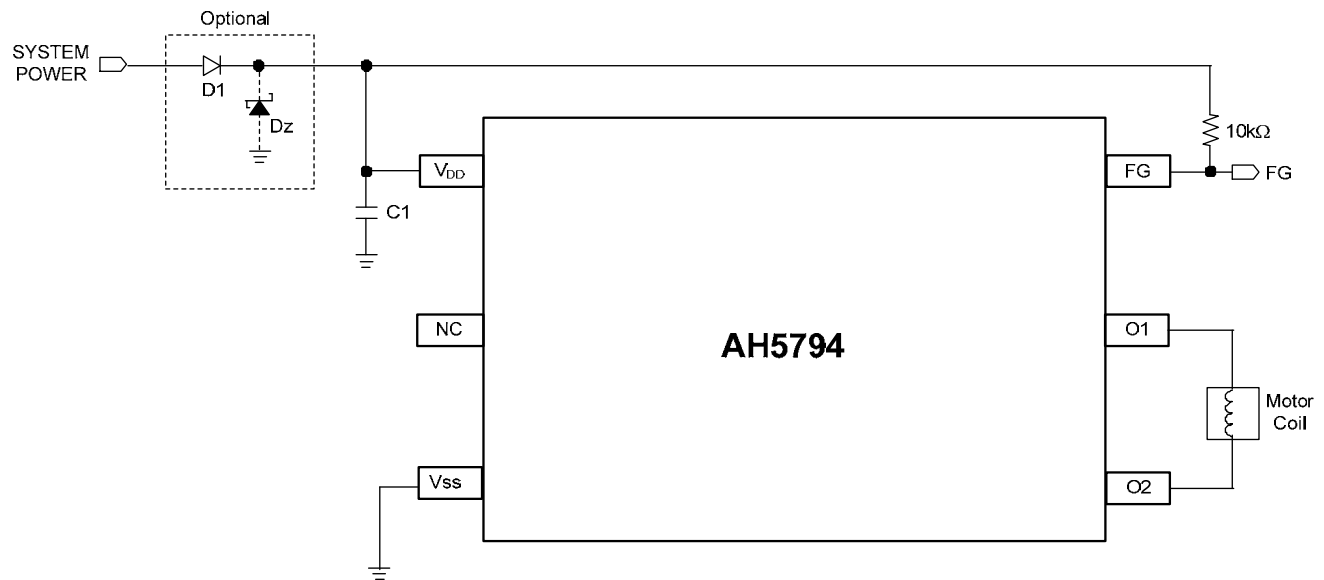
## Pin Assignments



## Applications

- 3V/ 3.3V/ 5V BLDC Cooling Fans
- Netbook/ Notebook BLDC fans
- Instruments cooling fans
- Low Voltage/ Low Power BLDC Motors

## Typical Application Circuit

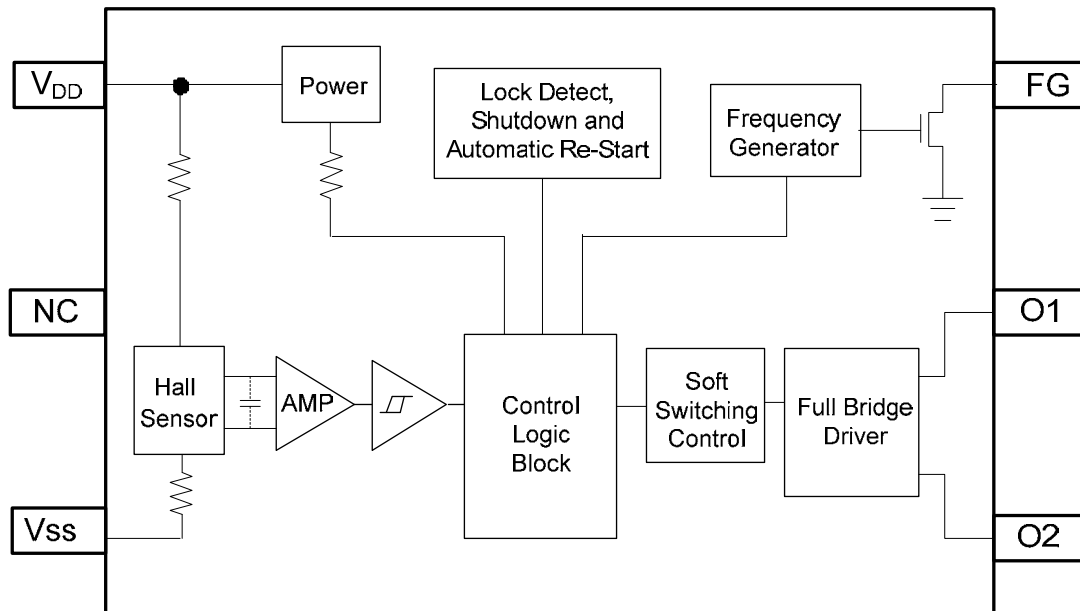


## Pin Descriptions

Pin Name	Description
V <sub>DD</sub>	Power supply pin
V <sub>SS</sub>	Ground pin
O1	Output driving & sinking pin
O2	Output driving & sinking pin
NC	No connection
FG	Frequency generator (Note 1)

Notes: 1. The FG output is the same as the magnetic change frequency.

### Functional Block Diagram (Note 2)



Notes: 2.The AH5794 has an open-drain tachometer FG output that follows the magnetic change frequency. Typically a pull-up resistor of 10k $\Omega$  is recommended from FG pin to the supply voltage.

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ , unless otherwise noted, Note 3)

Symbol	Characteristics	Values	Unit
$V_{DD}$	Supply Voltage	7	V
$I_{O(PEAK)}$	Maximum Output Current (Peak)	1000	mA
$P_D$	Power Dissipation	TSOT26	mW
		U-DFN2020C-6	
$T_{ST}$	Storage Temperature Range	-65 ~ +150	$^\circ\text{C}$
ESD HBM	Human Body Model ESD Protection	4	kV

Notes:

- Stresses greater than the 'Absolute Maximum Ratings' specified above, may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions exceeding those indicated in this specification is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time
- U-DFN2020C-6 exposed pad soldered to minimum recommended landing pads (see Package Outline Dimension section) on a two-layer 2oz. copper FR4 PCB (1.6mm thickness) with no thermal vias in exposed PADs or any copper flood connecting to the landing pattern of the exposed pad.

### Recommended Operating Conditions ( $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{DD}$	Supply Voltage at $V_{DD}$ pin	DC supply speed control mode	1.8	6.0	V
$T_A$	Operating Ambient Temperature Range	Operating	-40	+105	$^\circ\text{C}$

### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ , $V_{DD} = 5\text{V}$ )

Symbol	Characteristics	Conditions	Min	Typ.	Max	Unit
$I_{DD}$	Supply Current	No Load	-	2.2	-	mA
$V_{OH}$	Output Voltage High	$I_{OUT} = 300\text{mA}$	4.70	4.88	-	V
		$I_{OUT} = 500\text{mA}$	4.5	4.8	-	V
$V_{OL}$	Output Voltage Low	$I_{OUT} = 300\text{mA}$	-	0.12	0.3	V
		$I_{OUT} = 500\text{mA}$	-	0.2	0.5	V
$V_{OH} + V_{OL}$	Output voltage of N- and PMOS combined	$I_{OUT} = 300\text{mA}$		0.3	0.5	V
		$I_{OUT} = 500\text{mA}$		0.5		V
$T_{SW}$	Output Switching Slope Duration	17 $\Omega$ load on O1/O2	-	200	-	$\mu\text{s}$
$I_{LEAK}$	FG Output Leakage Current		-	-	5	$\mu\text{A}$
$V_{FGOL}$	FG Output Voltage Low	$I_{FG} = 5\text{mA}$	-	-	0.4	V
$T_{ON}$	On Time		350	500	650	ms
$R_{DR}$	Duty Ratio	$T_{OFF} / T_{ON}$	-	10	-	
$T_{J\_SDN\_TH}$	IC junction temperature thermal shutdown threshold			175		$^\circ\text{C}$
$T_{J\_SDN\_HYST}$	IC junction temperature thermal shutdown hysteresis			25		$^\circ\text{C}$

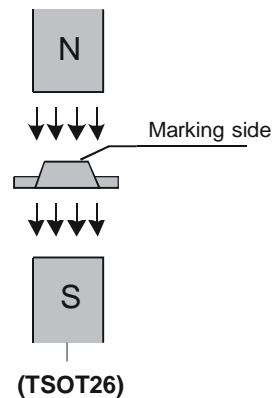
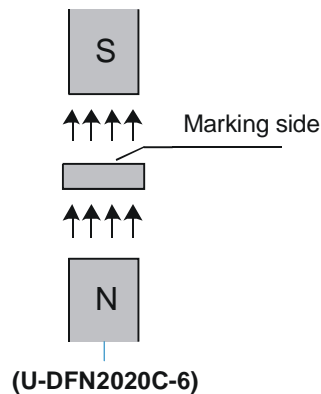
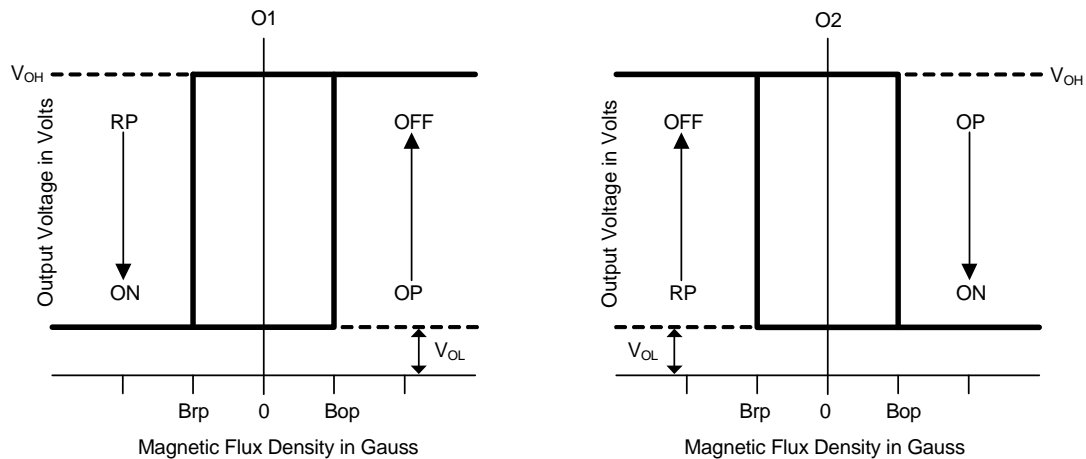
**Magnetic Characteristics ( $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 1.8\text{V to } 6\text{V}$ , Note 5)**

(1mT = 10 G)

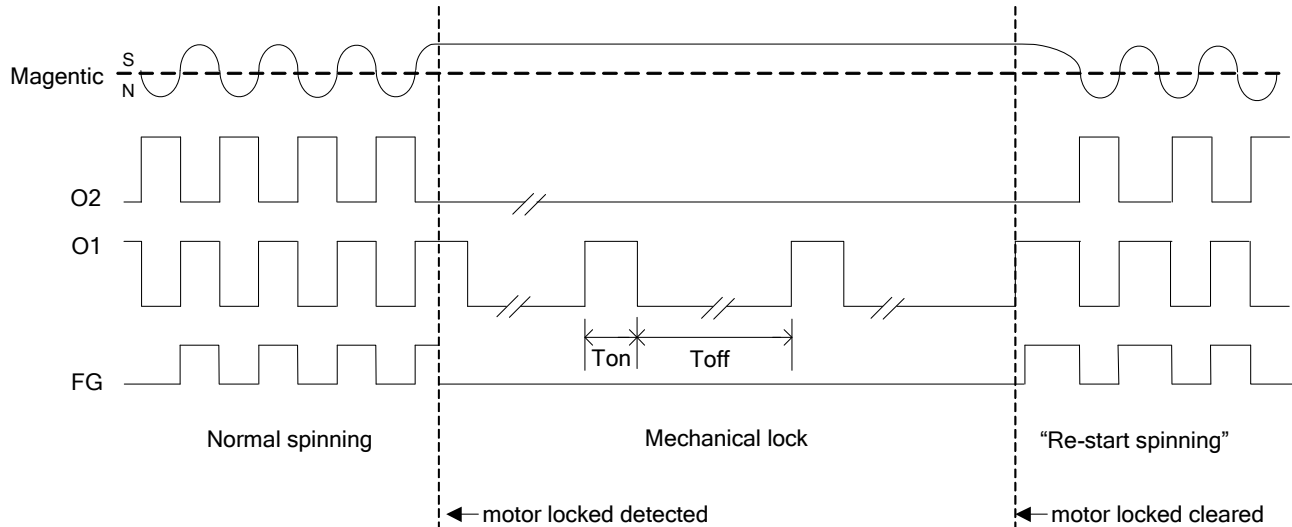
Symbol	Parameter	Min	Typ.	Max	Unit
$B_{OP}$	Operate Point	10	25	50	Gauss
$B_{RP}$	Release Point	-50	-25	-10	
$B_{hy}$	Hysteresis	-	50	-	

Notes: 5. Magnetic characteristics may vary with supply voltage, operating temperature and after soldering.

**Operating Characteristics**



**Operating Characteristics (Note 6, 7, 8 and 9)**



**Truth Table**

O1	O2	FG
L	H	L
H	L	H
L	L	X (Note 9)

- Notes:
- In "Normal spinning", the FG changes its state at each edge of O1.
  - When the motor locks with South pole at the Hall element, O2 is kept on "L" and O1 is a clock with Ton/Toff ratio. When motor locks with North pole at the Hall element, O1 is kept on "L", O2 is a clock with Ton/Toff ratio.
  - When "Re-start spinning" occurs, the motor speed ramps up to the "Normal Spinning" speed from zero. Speed ramp-up profile depends on motor characteristics.
  - X: H or L depends on magnetic pole North or South

## Application Note

### Motor Speed Control

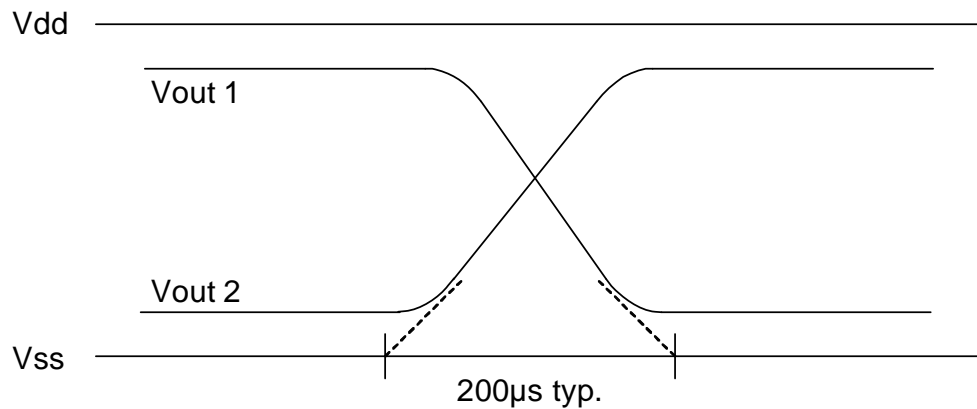
#### DC Supply Voltage ( $V_{DD}$ ) Speed Control

Motor speed can be controlled by varying the  $V_{DD}$  supply voltage between 1.8V to 6V.

With 5V nominal motor, changing  $V_{DD}$  voltage between 5V to 1.8V, speed can be controlled from 100% to 36% typically.

#### Soft Switching

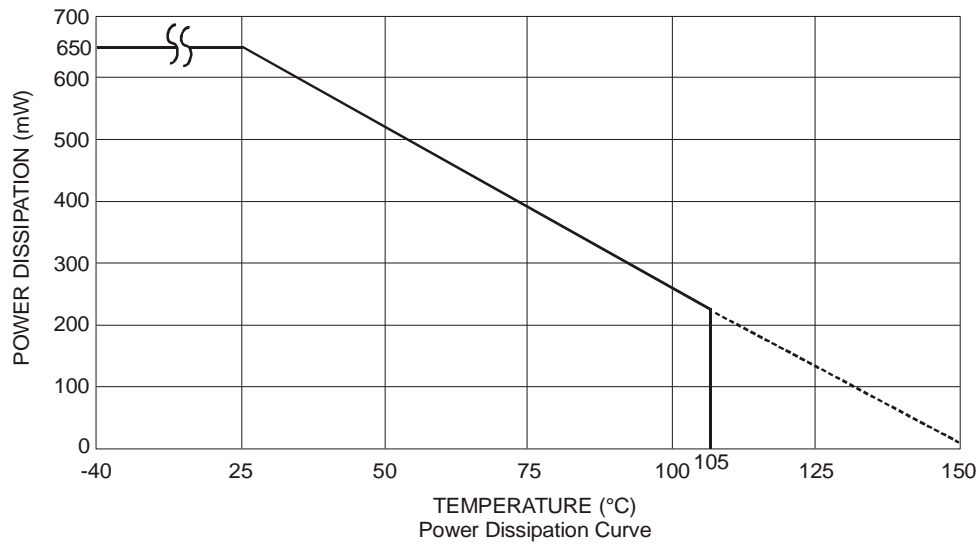
AH5794 uses soft switching of the motor coil current during commutation for to minimize audible switching noise and electromagnetic interference (EMI) to provide a low noise solution.



## Thermal Performance Characteristics

### (1) Package type: TSOT26

T <sub>A</sub> (°C)	25	50	60	70	75	80	85	90	95	100
P <sub>D</sub> (mW)	651	521	469	417	391	365	339	313	286	260
T <sub>A</sub> (°C)	105	110	115	120	125	130	135	140	145	150
P <sub>D</sub> (mW)	234	208	182	156	130	104	78	52	26	0

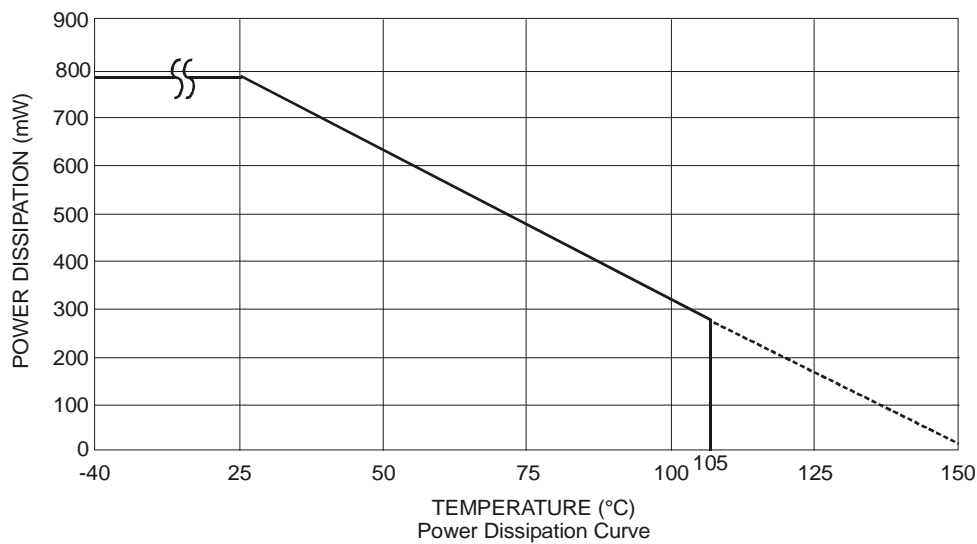




## Thermal Performance Characteristics (cont.)

### (2) Package type: U-DFN2020C-6 (Note 10)

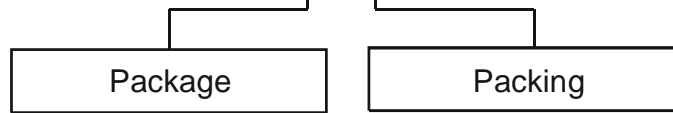
T <sub>A</sub> (°C)	25	50	60	70	75	80	85	90	95	100
P <sub>D</sub> (mW)	781	625	563	500	469	438	406	375	344	313
T <sub>A</sub> (°C)	105	110	115	120	125	130	135	140	145	150
P <sub>D</sub> (mW)	281	250	219	188	156	125	94	63	31	0



Notes: 10. U-DFN2020C-6 exposed pad soldered to minimum recommended landing pads (see Package Outline Dimension section) on a two-layer 2oz. copper FR4 PCB (1.6mm thickness) with no thermal vias in exposed PADs or any copper flood connecting to the landing pattern of the exposed pad.

## Ordering Information

**AH5794 - XXX - 7**



WU : TSOT26  
FDC : U-DFN2020C-6

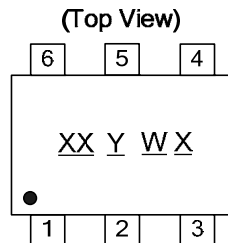
7 : Tape & Reel

Device	Package Code	Packaging (Note 11 & 12)	7" Tape and Reel	
			Quantity	Part Number Suffix
AH5794-WU-7	WU	TSOT26	3000/Tape & Reel	-7
AH5794-FDC-7	FDC	U-DFN2020C-6	3000/Tape & Reel	-7

Notes: 11. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>  
 12. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. No purposely added lead. Halogen and Antimony free. Please visit our website at [http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html)

## Marking Information

### (1) Package type: TSOT26

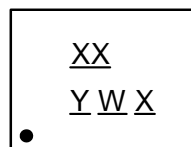


XX : Identification code  
Y : Year 0~9  
W : Week : A~Z : 1~26 week;  
 a~z : 27~52 week;  
 z represents 52 and 53 week  
X : A~Z : Internal code

Part Number	Package	Identification Code
AH5794-WU-7	TSOT26	J4

### (2) Package type: U-DFN2020C-6

( Top View )



XX : Identification Code  
Y : Year : 0~9  
W : Week : A~Z : 1~26 week;  
 a~z : 27~52 week; z represents  
 52 and 53 week  
X : A~Z : Internal code

Part Number	Package	Identification Code
AH5794-FDC-7	U-DFN2020C-6	J4

Figure 1: Dimensions and Land Pattern Recommendation for the 10-pin connector. The figure includes three views: a top view of the connector, a side view, and a cross-sectional view labeled "VIEW A-A".

**Top View Dimensions:**

- Overall width: 2.8/3.0 mm
- Overall height: 2.6/3.0 mm
- Pin pitch (top): 0.3/0.51 (6x)
- Pin height (top): 0.75±0.10 mm
- Pin pitch (bottom): 0.75/0.90 mm
- Pin height (bottom): 0.75/1.0 mm
- Hall Sensor position: 1.5/1.7 mm from top edge, 1.1±0.15 mm from left edge
- Bottom edge features: 5°Nom. (4x) and 7°Nom. (4x) chamfers
- Bottom edge dimensions: 0.95Typ. mm and 1.90Typ. mm
- Base thickness: 0.10 mm

**Side View Dimensions:**

- Overall height: 0.75/1.0 mm
- Base thickness: 0.10 mm
- Top section height: 0.53±0.07 mm

**Cross-sectional View (VIEW A-A) Dimensions:**

- Gauge Plane: 0.25 mm
- Pin height: 0.10/0.20 mm
- Pin width: 0.50/0.70 mm
- Pin thickness: 0.3/0.6 mm

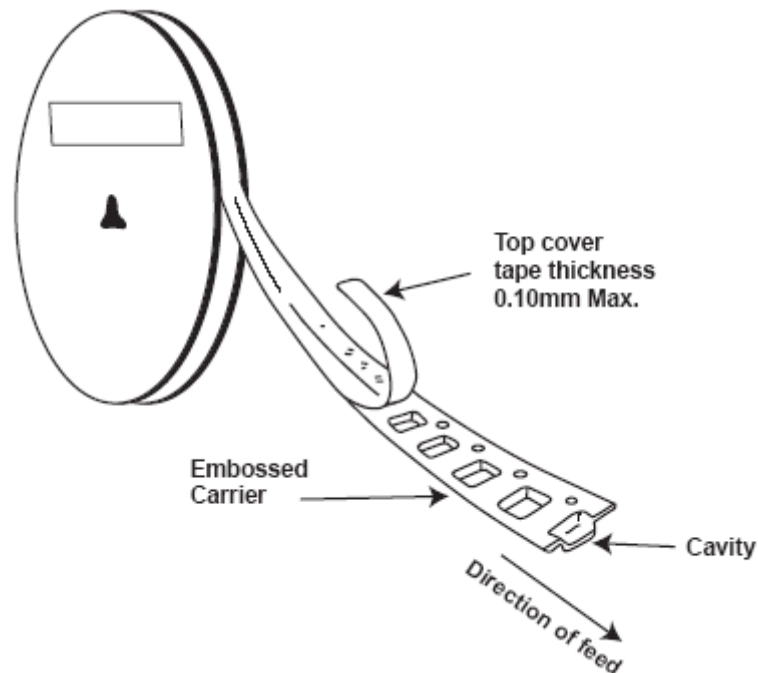
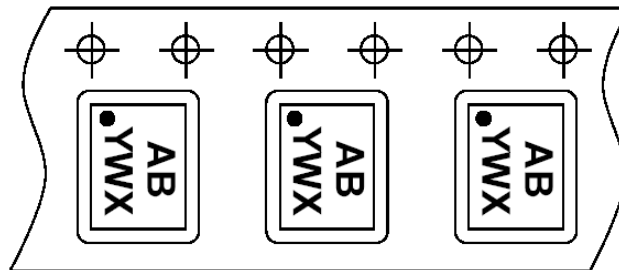
**Land Pattern Recommendation (Unit:mm):**

- Top pins: 6x-0.60 mm
- Bottom pins: 4x-0.95 mm
- Pin pitch: 6x-1.1 mm

Figure 1: Mechanical drawing of the package. The drawing includes a Top View, Bottom View, and a side cross-sectional view. The Top View shows a square package with dimensions 1.95/2.075 mm on all sides. It features a central square area with a red crosshair, surrounded by four rectangular pads. The distance between the pads is 0.65 mm. The side view shows the package height with a top layer of 0.57/0.63 mm, a middle layer of 0.15 mm, and a bottom layer of 0.43 mm. A Hall Sensor is indicated on the top surface. The bottom view shows the pin connections with dimensions 1.95/2.075 mm and 0.65 mm. The side view also shows a 'Top Mark' and a 'Seating plane'.

## Taping Orientation

(1) Package Type: U-DFN2020C-6



Notes: 11. The taping orientation of the other package type can be found on our website at <http://www.diodes.com/datasheets/ap02007.pdf>.

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