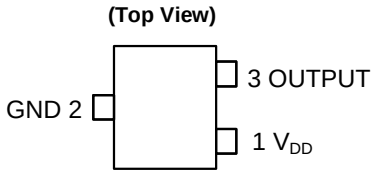
HIGH-VOLTAGE, MEDIUM-SENSITIVITY HALL-EFFECT LATCH

Description

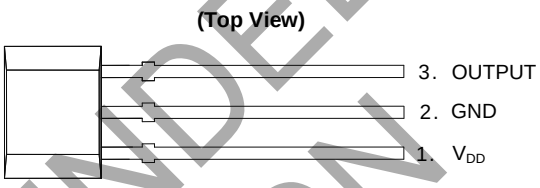
The AH3776 is a high-voltage, medium-sensitivity Hall-effect latch IC designed for commutation of brushless DC motors, flow meters, linear encoders and position sensors in industrial and consumer home appliances and personal care applications. To support a wide range of the demanding applications, the design is optimized to operate over the supply range of 3.0V to 28V. With chopper stabilized architecture and an internal bandgap regulator to provide temperature compensated supply for internal circuits, the AH3776 provides a reliable solution over the whole operating range. For robustness and protection, the device has a reverse blocking diode with a Zener clamp on the supply. The output has an overcurrent limit and a Zener clamp.

The single, open-drain output can be switched on with South pole of sufficient strength and switched off with North pole of sufficient strength. When the magnetic flux density (B) perpendicular to the package is larger than the operate point (B_{OP}) the output is switched on (pulled low). The output is held latched until magnetic flux density reverses and becomes lower than the release point (B_{RP}).

Pin Assignments



SOT23



SIP-3 (Bulk Pack)/SIP-3 (Ammo Pack)

Features

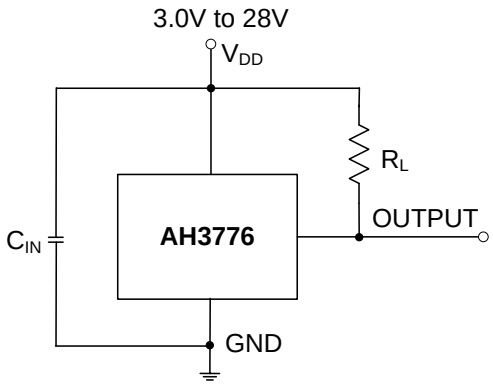
- Bipolar Latch (South Pole: On, North Pole: Off)
- 3.0V to 28V Operating Voltage Range
- High Sensitivity: B_{OP} and B_{RP} of +110G and -110G Typical
- Single, Open-Drain Output with Overcurrent Limit
- Chopper Stabilized Design Provides
  - Superior Temperature Stability
  - Minimal Switch Point Drift
  - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Reverse Blocking Diode and Zener Clamp on Supply
- -40°C to +125°C Operating Temperature
- ESD (HBM): 6kV
- Industry Standard SOT23, SIP-3 (Bulk Pack) and SIP-3 (Ammo Pack) Packages
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

- Brushless DC motor commutation
- Revolution per minute (RPM) measurement
- Flow meters
- Angular and linear encoders and position sensors
- Contactless commutation, speed measurement and angular position sensing/indexing in consumer home appliances, office equipment and industrial applications

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



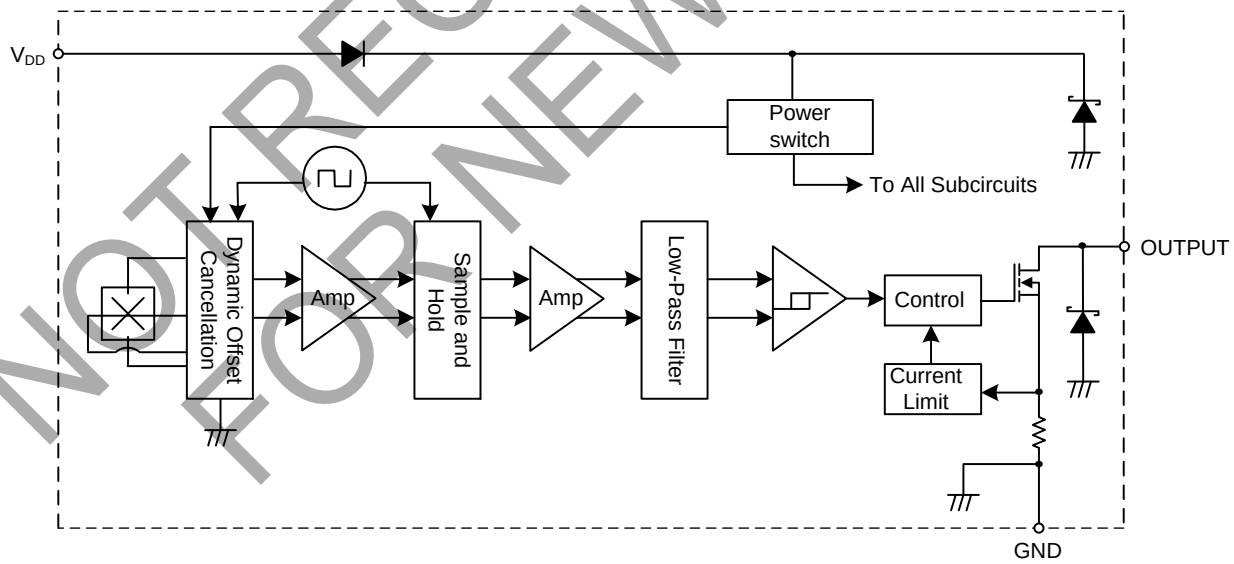
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

Pin Descriptions

Packages: SOT23, SIP-3 (Bulk Pack) and SIP-3 (Ammo Pack)

Pin Number	Pin Name	Function
1	V_{DD}	Power Supply Input
2	GND	Ground
3	OUTPUT	Output Pin

Functional Block Diagram



Absolute Maximum Ratings (Notes 5 & 6) (@T_A = +25°C, unless otherwise specified.)

Symbol	Characteristic		Value	Unit
V_{DD}	Supply Voltage (Note 6)		32	V
V_{DDR}	Reverse Supply Voltage		-32	V
V_{OUT_MAX}	Output Off Voltage (Note 6)		32V	V
I_{OUT}	Continuous Output Current		60	mA
I_{OUT_R}	Reverse Output Current		-50	mA
B	Magnetic Flux Density		Unlimited	
P_D	Package Power Dissipation	SIP-3 (Bulk Pack) SIP-3 (Ammo Pack)	550	mW
		SOT23	230	mW
T_S	Storage Temperature Range		-65 to +165	°C
T_J	Maximum Junction Temperature		+150	°C
ESD	Electrostatic Discharge Withstand Capability - Human Body Model		6	kV

Notes:
5. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.
6. The absolute maximum V_{DD} of 32V is a transient stress rating and is not meant as a functional operating condition. It is not recommended to operate the device at the absolute maximum rated conditions for any period of time.

Recommended Operating Conditions (@T_A = -40°C to +125°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Rating	Unit
V_{DD}	Supply Voltage	Operating	3.0 to 28	V
T_A	Operating Temperature Range	Operating	-40 to +125	°C

Electrical Characteristics (Notes 7 & 8) (@T_A = -40°C to +125°C, V_{DD} = 3V to 28V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT_ON}	Output ON Voltage	I_{OUT} = 20mA, B > B_{OP}	—	0.2	0.4	V
I_{OUT_OFF}	Output Leakage Current	V_{OUT} = 28V, B < B_{RP}, Output off	—	< 0.1	10	μA
I_{DD}	Supply Current	Output open, T_A = +25°C	—	3	—	mA
		Output open, T_A = -40°C to +125°C	—	—	4	mA
I_{DD_R}	Reverse Battery Current	V_{DD} = -18V, T_A = -40°C to +125°C	—	-0.01	1	mA
		V_{DD} = -28V, T_A = -40°C to +125°C	—	-0.01	1.5	mA
t_{ST}	Device Startup Time	V_{DD} ≥ 3V, B > B_{OP} (Note 7)	—	10	—	μs
f_c	Chopping Frequency	V_{DD} ≥ 3V	—	800	—	kHz
t_d	The time delay from magnetic threshold reached to the start of the output rise or fall	(Note 9)	—	3.75	—	μs
t_r	Output Rising Time (External pullup resistor R_L and load capacitance dependent)	R_L = 1kΩ, C_L = 20pF	—	0.2	1	μs
t_f	Output Falling Time (Internal switch resistance and load capacitance dependent)	R_L = 1kΩ, C_L = 20pF	—	0.1	1	μs
I_{OCL}	Output Current Limit	B > B_{OP} (Note 10)	30	—	55	mA
V_Z	Zener Clamp Voltage	I_{DD} = 5mA	28	—	—	V

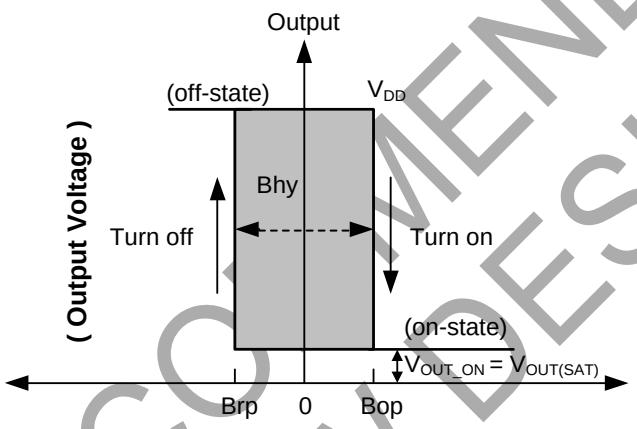
Notes:
7. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10μs typical from the operating voltage reaching 3V.
8. Typical values are defined at T_A = +25°C, V_{DD} = 12V. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization.
9. Guaranteed by design, process control and characterization. Not tested in production.
10. The device will limit the output current I_{OUT} to current limit of I_{OCL}.

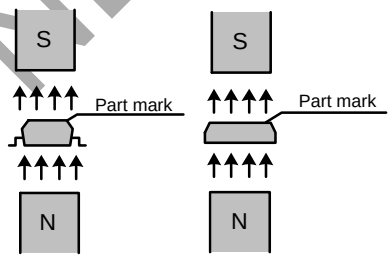
Magnetic Characteristics (Notes 11 & 12) (T_A = -40°C to +125°C, V_{DD} = 3.0V to 28V, unless otherwise specified)

(1mT=10 Gauss)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
B_{OP} (South pole to part marking side)	Operation Point	V_{DD} = 12V, T_A = +25°C	—	110	—	Gauss
		T_A = -40°C to +125°C	80	110	140	
B_{RP} (North pole to part marking side)	Release Point	V_{DD} = 12V, T_A = +25°C	—	-110	—	
		T_A = -40°C to +125°C	-140	-110	-80	
B_{HY} ($\|B_{OPX}\|$-$\|B_{RPX}\|$)	Hysteresis (Note 13)	V_{DD} = 12V, T_A = +25°C	—	220	—	
		T_A = -40°C to +125°C	160	220	280	

Notes:
11. When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10µs typical from the operating voltage reaching 3V.
12. Typical values are defined at T_A = +25°C, V_{DD} = 12V. Maximum and minimum values over the operating temperature range are not tested in production but guaranteed by design, process control and characterization.
13. Maximum and minimum hysteresis are guaranteed by design, process control and characterization.

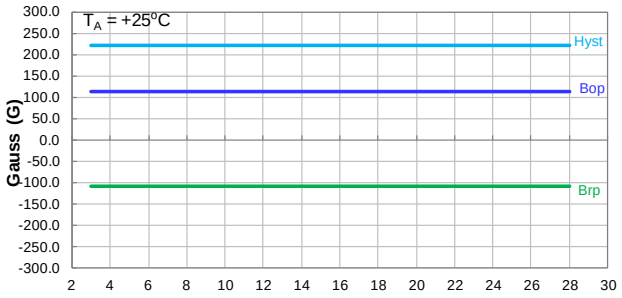




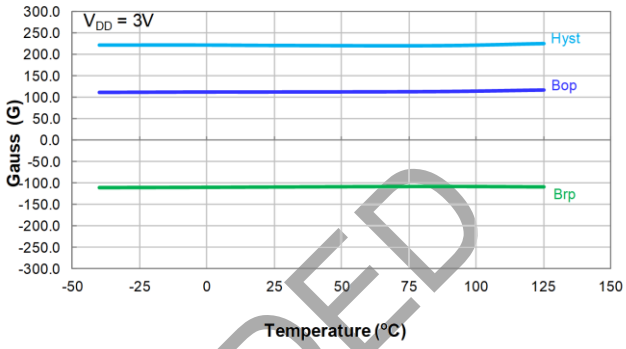
SOT23 **SIP-3 (Bulk Pack)**
SIP-3 (Ammo Pack)

Typical Operating Characteristics

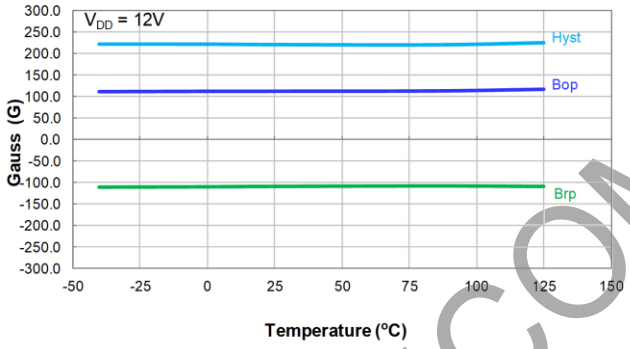
Magnetic Operating Switch Points – B_{OP} and B_{RP}



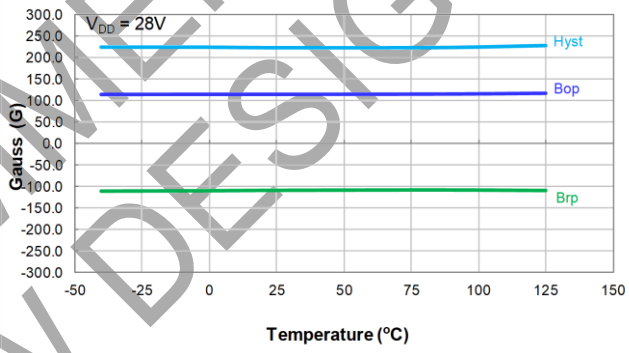
Switch Points Bop and Brp vs Supply Voltage



Switch Points Bop and Brp vs Temperature

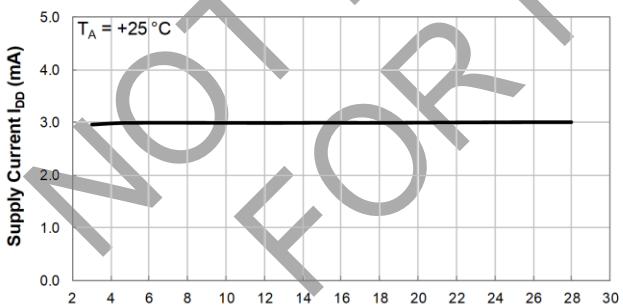


Switch Points Bop and Brp vs Temperature

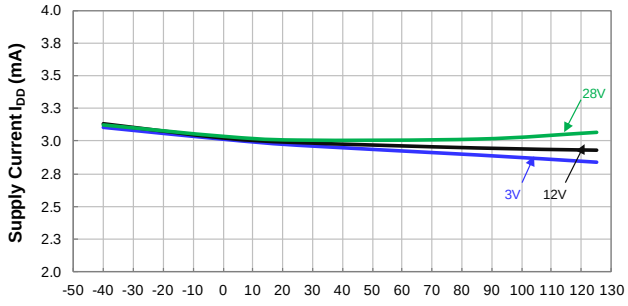


Switch Points Bop and Brp vs Temperature

Supply Current



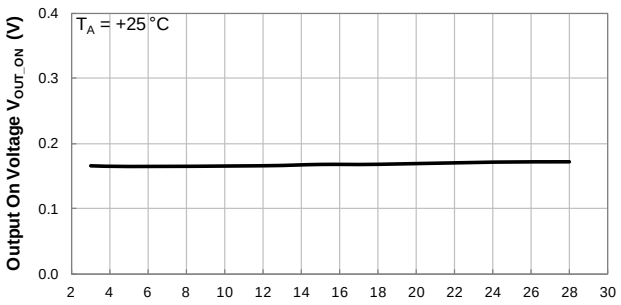
Supply Current vs Supply Voltage



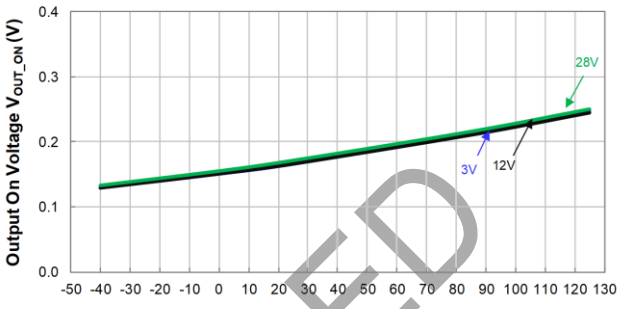
Supply Current vs Temperature

Typical Operating Characteristics (continued)

Output Switch On Voltage

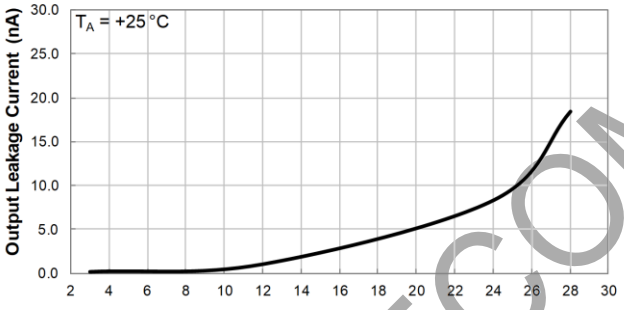


Output On Voltage vs Supply Voltage

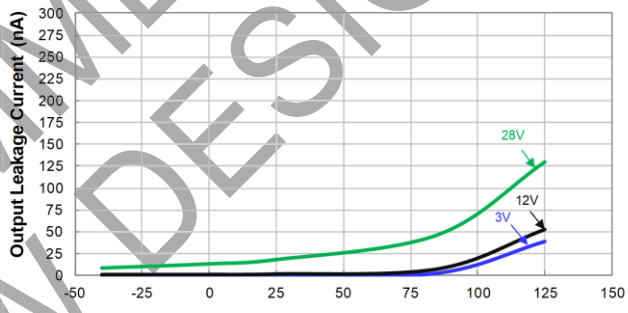


Output On Voltage vs Temperature

Output Switch Leakage Current

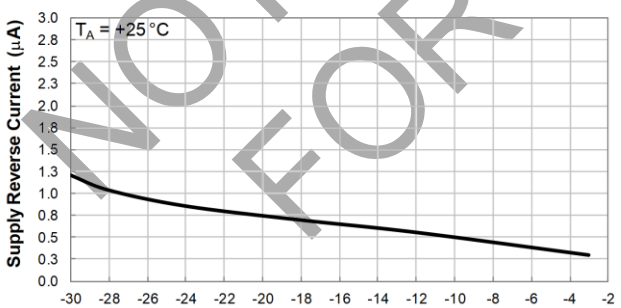


Output Leakage Current vs Supply Voltage

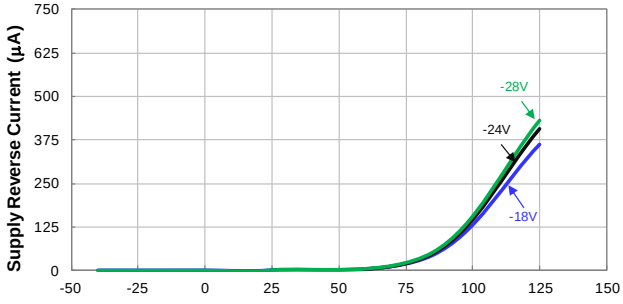


Output Leakage Current vs Temperature

Supply Reverse Current



Supply Reverse Current vs Supply Voltage

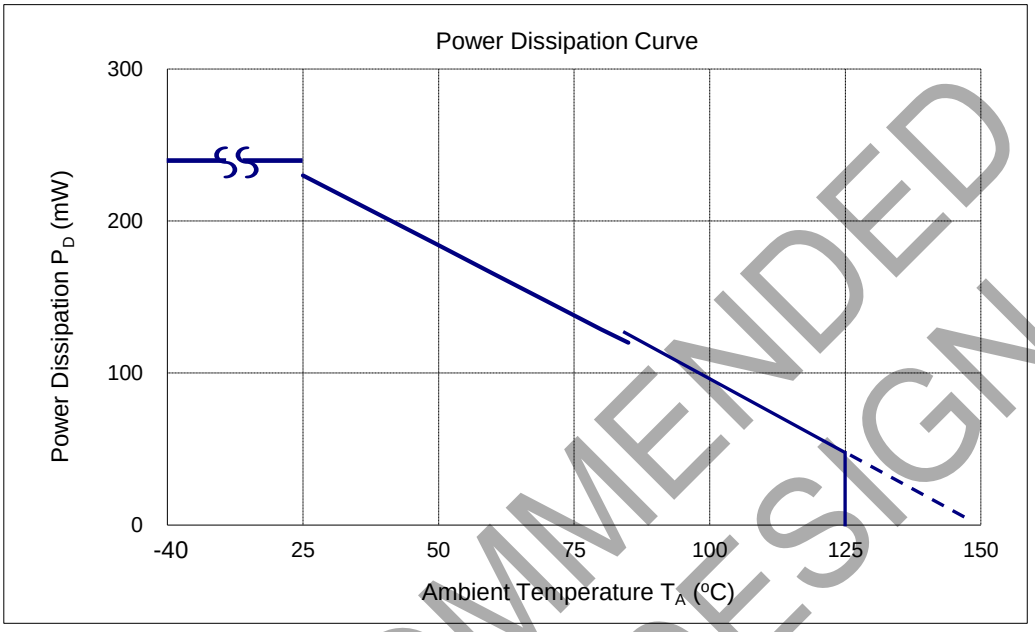


Supply Reverse Current vs Temperature

Thermal Performance Characteristics

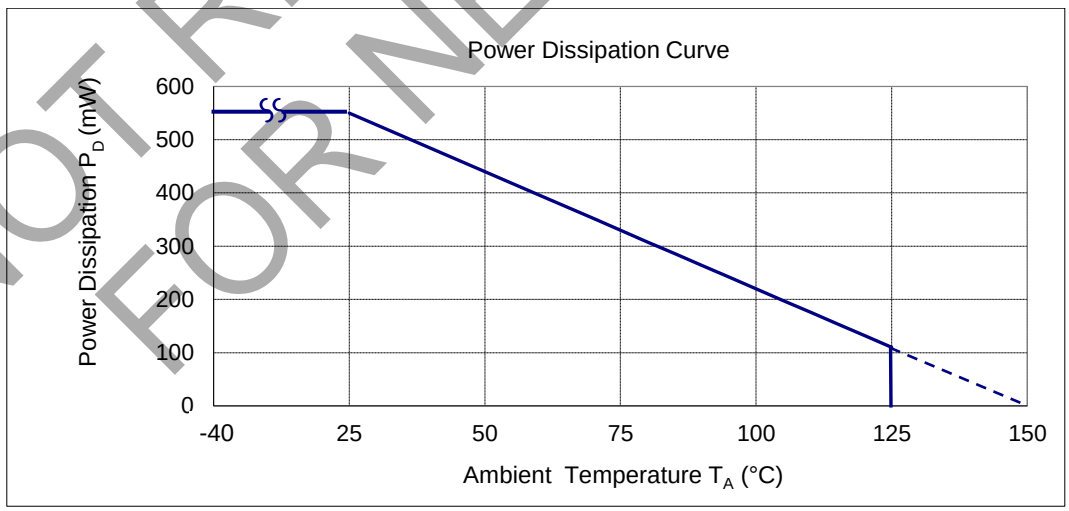
(1) Package Type: SOT23

T_A (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P_D (mW)	230	184	166	147	129	120	110	92	83	74	55	46	37	18	0



(2) Package Types: SIP-3 (Bulk Pack) and SIP-3 (Ammo Pack)

T_A (°C)	25	50	60	70	80	85	90	100	105	110	120	125	130	140	150
P_D (mW)	550	440	396	362	308	286	264	220	198	176	132	110	88	44	0



Ordering Information

AH3776 - X - X

Package	Packing
P : SIP-3 (Bulk Pack)/ SIP-3 (Ammo Pack) SA : SOT23	7 : Tape & Reel A : Ammo Box (Note 14) B : Bulk (Note 15)

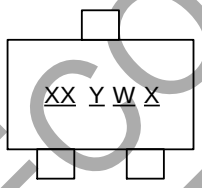
Part Number	Package Code	Package	Part Number Suffix	Packing	
				Qty.	Carrier
AH3776-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3776-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3776-SA-7	SA	SOT23	-7	3,000	7" Tape & Reel

Notes: 14. Ammo Box is for SIP-3 Spread Lead.
15. Bulk is for SIP-3 Straight Lead.

Marking Information

(1) Package Type: SOT23

(Top View)

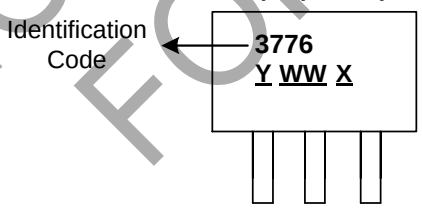


XX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3776-SA-7	SOT23	ZF

(2) Package Types: SIP-3 (Bulk Pack) and SIP-3 (Ammo Pack)

(Top View)



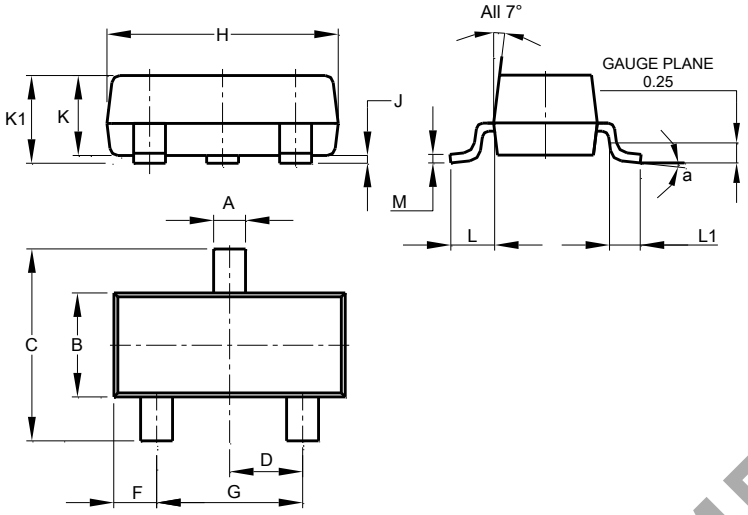
Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52, "52" represents week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3776-P-B	SIP-3 (Bulk Pack)	3776
AH3776-P-A	SIP-3 (Ammo Pack)	3776

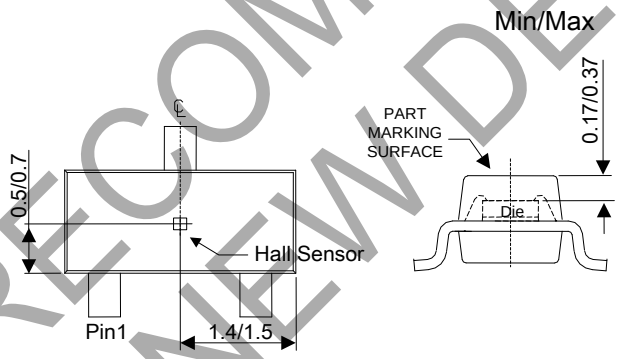
Package Outline Dimensions (All dimensions in mm.)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(1) Package Type: SOT23



SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			

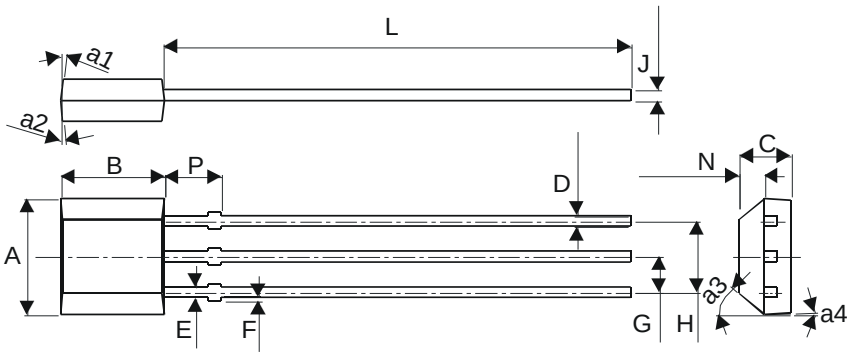


Sensor Location

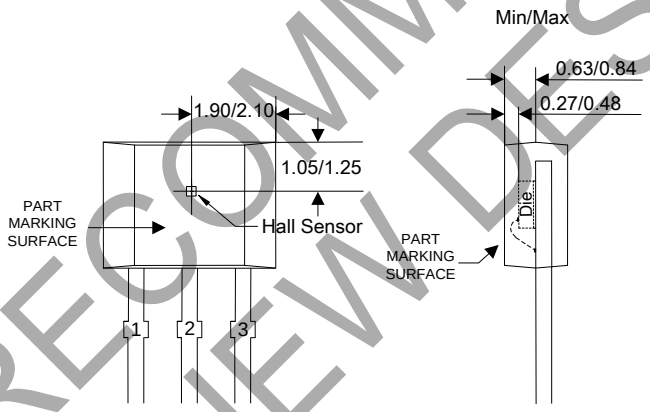
Package Outline Dimensions (continued) (All dimensions in mm.)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(2) Package Type: SIP-3 (Bulk Pack)



SIP-3 (Bulk Pack)		
Dim	**Min**	**Max**
A	3.9	4.3
a1	5° Typ	
a2	5°Typ	
a3	45° Typ	
a4	3°Typ	
B	2.8	3.2
C	1.40	1.60
D	0.33	0.432
E	0.40	0.508
F	0	0.2
G	1.24	1.30
H	2.51	2.57
J	0.35	0.43
L	14.0	15.0
N	0.63	0.84
P	1.55	-
All Dimensions in mm		

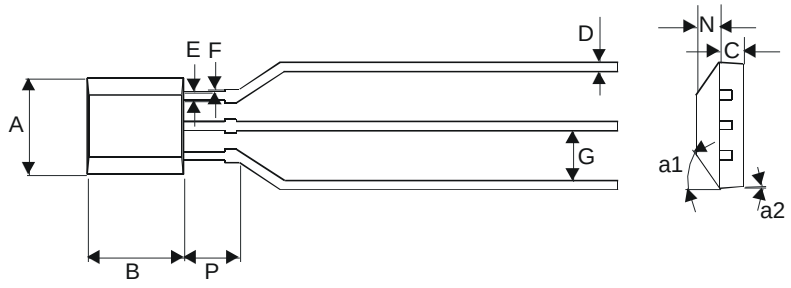


Sensor Location

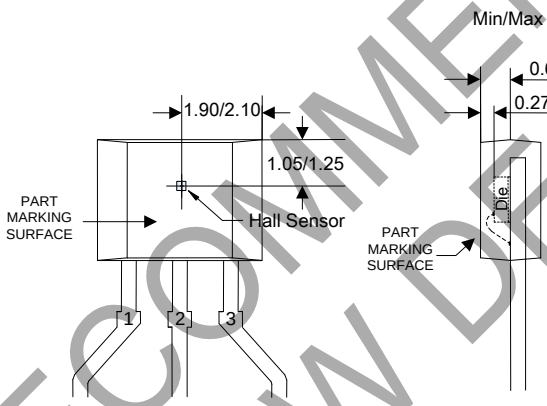
Package Outline Dimensions (continued) (All dimensions in mm.)

Please see http://www.diodes.com/package-outlines.html for the latest version.

(3) Package Type: SIP-3 (Ammo Pack)



SIP-3 (Ammo Pack)		
Dim	**Min**	**Max**
A	3.9	4.3
a1	45° Typ	
a2	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.35	0.41
E	0.43	0.48
F	0	0.2
G	2.4	2.9
N	0.63	0.84
P	1.55	-
All Dimensions in mm		

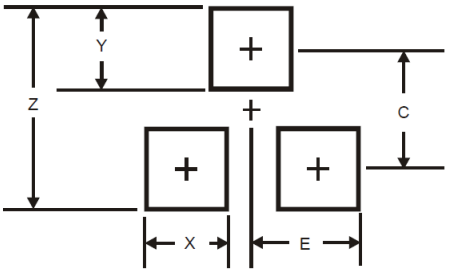


Sensor Location

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

Package Type: SOT23



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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