

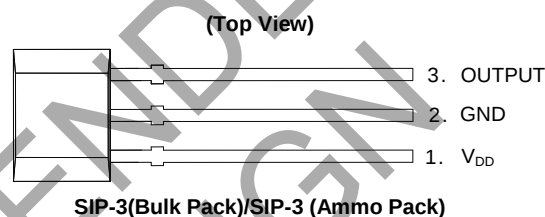
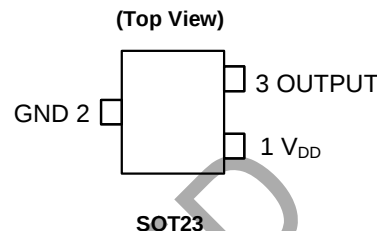
HIGH-VOLTAGE HIGH-SENSITIVITY HALL-EFFECT LATCH WITH INTERNAL PULLUP RESISTOR

Description

The AH3781 is a high-voltage, high-sensitivity Hall-effect latch IC with internal pullup resistor designed for commutation of brushless DC motors, flow meters, linear encoders and position sensors in industrial, consumer home appliance 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 AH3781 provides a reliable solution over the whole operating range. For robustness and protection, the device has a Zener clamp on the supply. The output has an overcurrent limit and a Zener clamp.

The internally pulled-up 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 part marking surface is larger than the operate point (B_{OP}) the output is switched on (pulled low). The output is held latched until the magnetic flux density reverses and becomes lower than the release point (B_{RP}).

Pin Assignments



Features

- Bipolar Latch Operation (South Pole: On, North Pole: Off)
- 3.0V to 28V Operating Voltage Range
- High Sensitivity: B_{OP} and B_{RP} of +25G and -25G Typical
- Internally Pullup Resistor on the Output Pin
- Output Overcurrent Limit
- Chopper Stabilized Design Provides
 - Superior Temperature Stability
 - Minimal Switch Point Drift
 - Enhanced Immunity to Stress
- Good RF Noise Immunity
- Zener Clamp on Supply and Output Pins
- -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/>

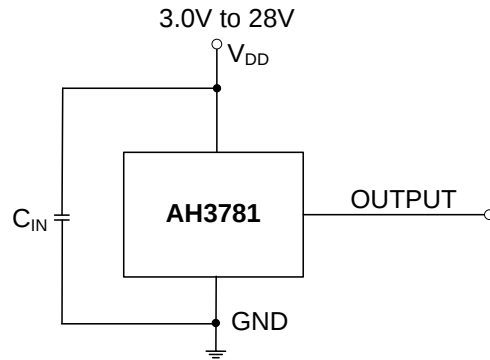
Applications

- 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



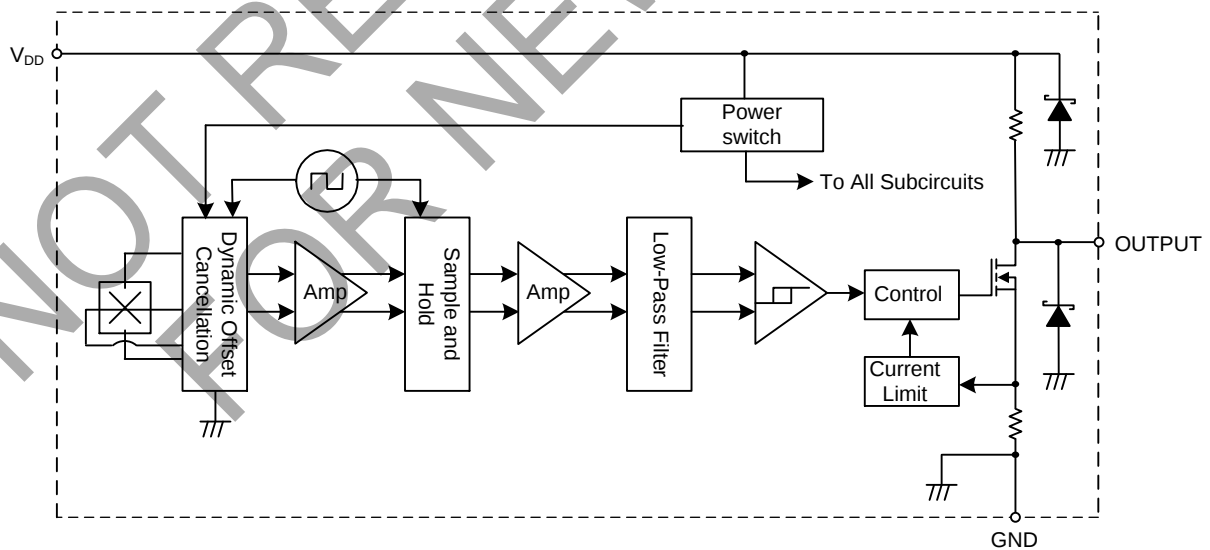
Note: 4. C_{IN} is for power stabilization and to strengthen the noise immunity, the recommended capacitance is 10nF to 100nF. R_L is the pullup resistor.

Pin Descriptions

Packages: SOT23/SIP-3 (Bulk Pack)/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		-0.3	V
V _{OUT_MAX}	Output Off Voltage (Note 6)		32V	V
I _{OUT}	Continuous Output Current		60	mA
B	Magnetic Flux Density		Unlimited	
P _D	Package Power Dissipation	SIP-3 (Bulk Pack)	550	mW
		SIP-3 (Ammo Pack)		
		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:
- 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.
 - 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	15	μA
I _{DD}	Supply Current	Output open, V _{DD} = 12V, T _A = +25°C	—	3.8	4.9	mA
		Output open, T _A = -40°C to +125°C	—	3.8	5.8	mA
R _{PU}	Internal Pullup Resistance	T _A = -40°C to +125°C	10	14	18	kΩ
t _{ST}	Device Startup Time	V _{DD} ≥ 3V, B > B _{OP} (Note 7)	—	10	—	μs
f _C	Chopping Frequency	V _{DD} = 3V to 28V	—	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

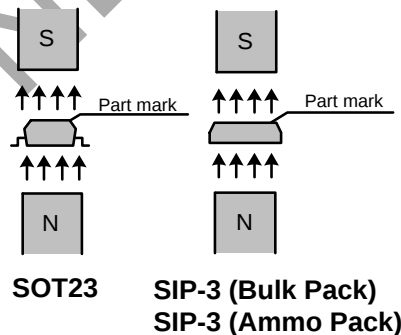
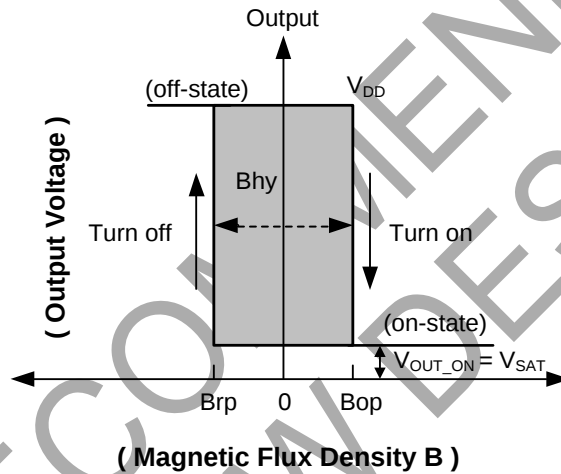
- Notes:
- When power is initially turned on, V_{DD} must be within its correct operating range (3.0V to 28V) to guarantee the output sampling. The output state is valid after the startup time of 10μs typical from the operating voltage reaching 3V.
 - Typical values are defined at T_A = +25°C, V_{DD}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

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

(1mT=10 Gauss)

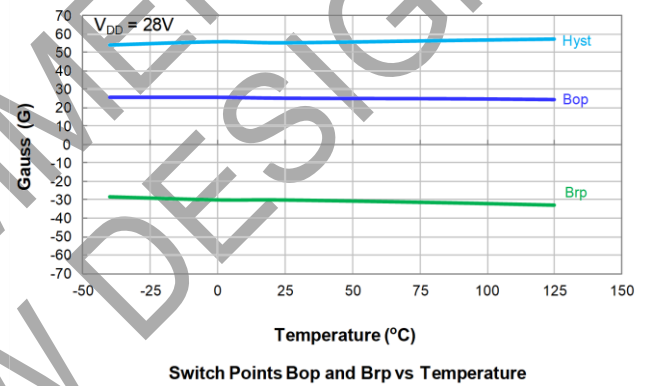
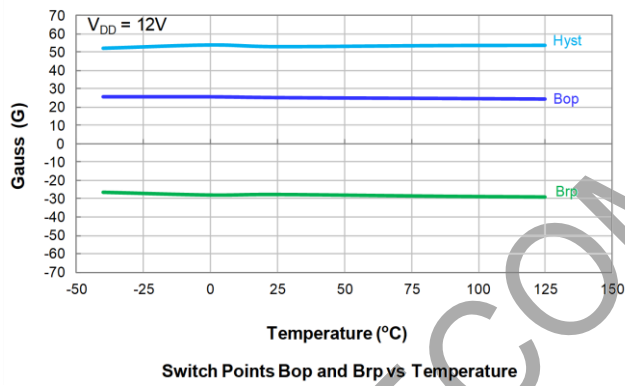
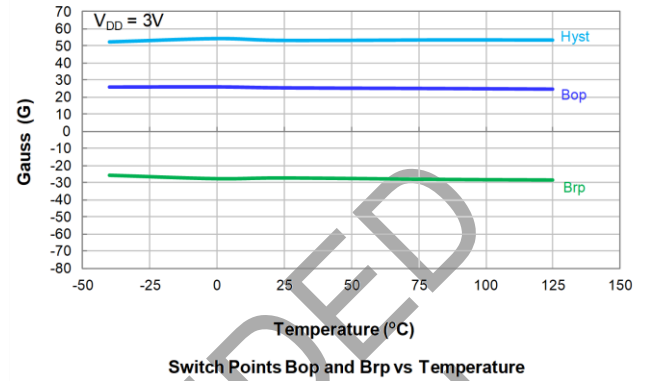
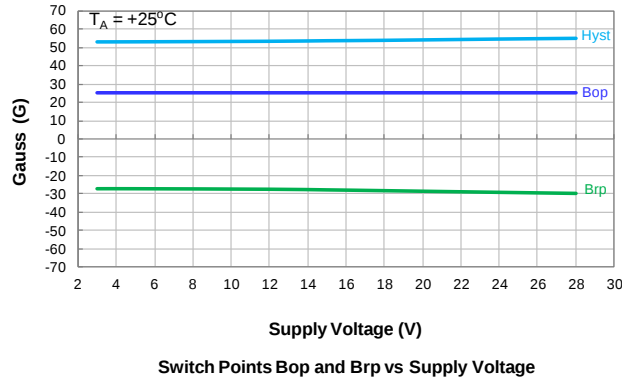
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
B_{OP} (South pole to part marking side)	Operation Point	$V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$	—	25	—	Gauss
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	10	25	40	
B_{RP} (North pole to part marking side)	Release Point	$V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$	—	-25	—	
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	-40	-25	-10	
B_{HY} ($ B_{OPX} - B_{RPX} $)	Hysteresis (Note 13)	$V_{DD} = 12\text{V}$, $T_A = +25^\circ\text{C}$	—	50	—	
		$T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	20	50	80	

- Notes:
- 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 10 μs typical from the operating voltage reaching 3V.
 - Typical values are defined at $T_A = +25^\circ\text{C}$, $V_{DD} = 12\text{V}$. Maximum and minimum values over the operating temperature range is not tested in production but guaranteed by design, process control and characterization.
 - Maximum and minimum hysteresis is guaranteed by design, process control and characterization.

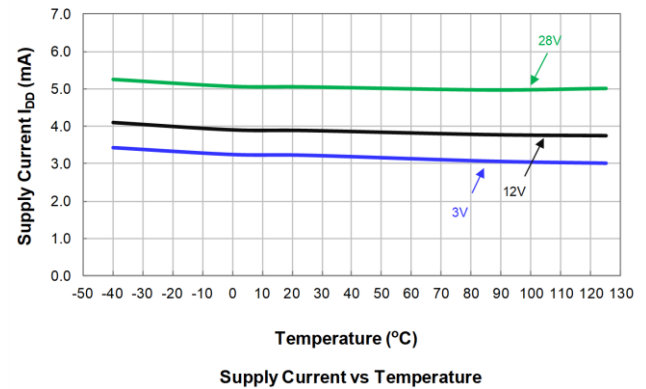
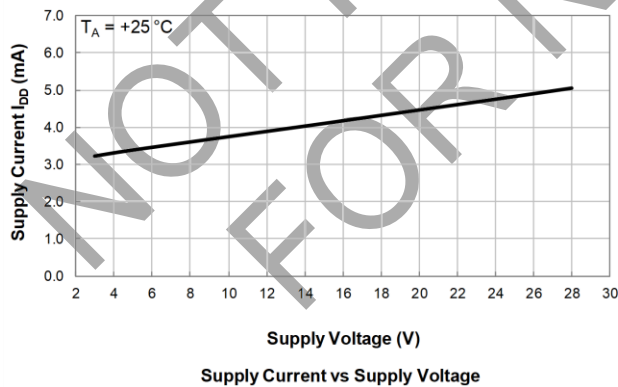


Typical Operating Characteristics

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

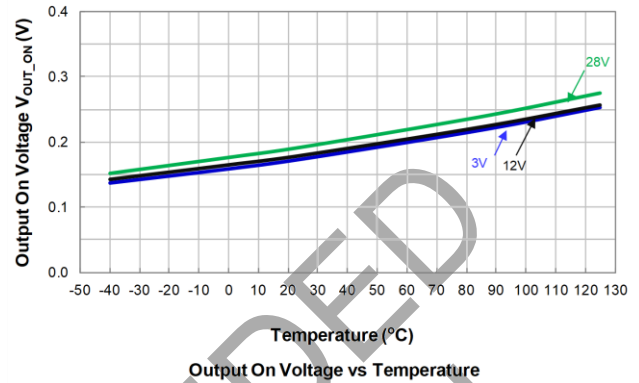
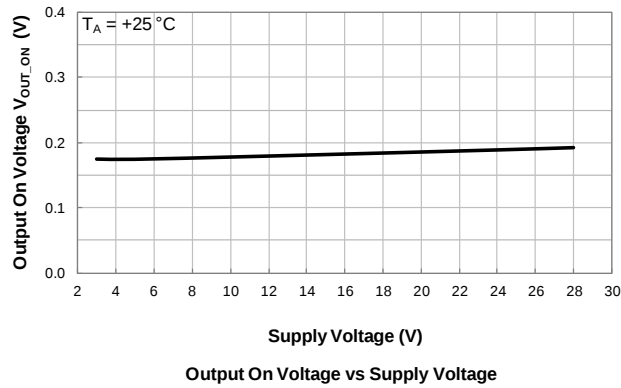


Supply Current

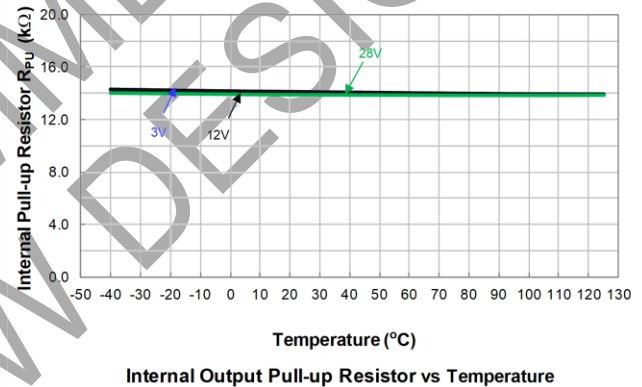
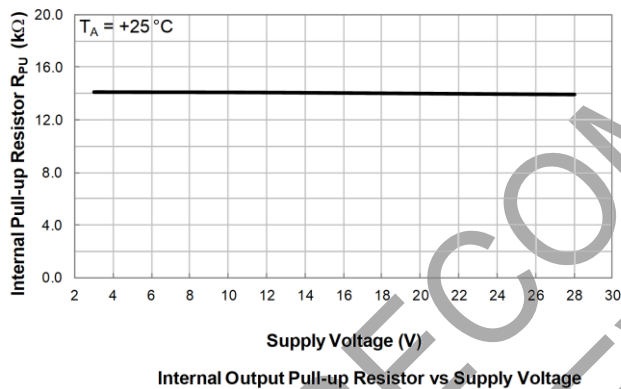


Typical Operating Characteristics (continued)

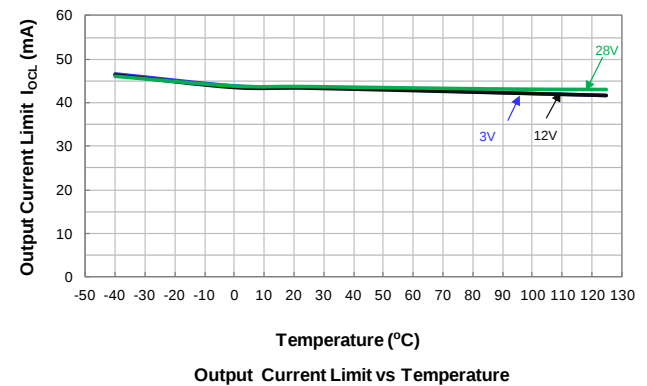
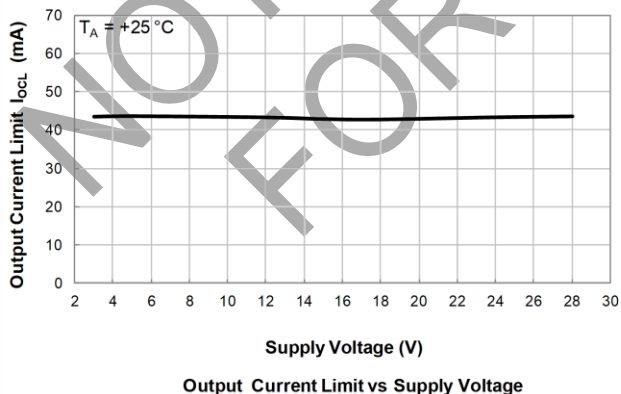
Output Switch On Voltage



Output Pullup Resistor (Internal)



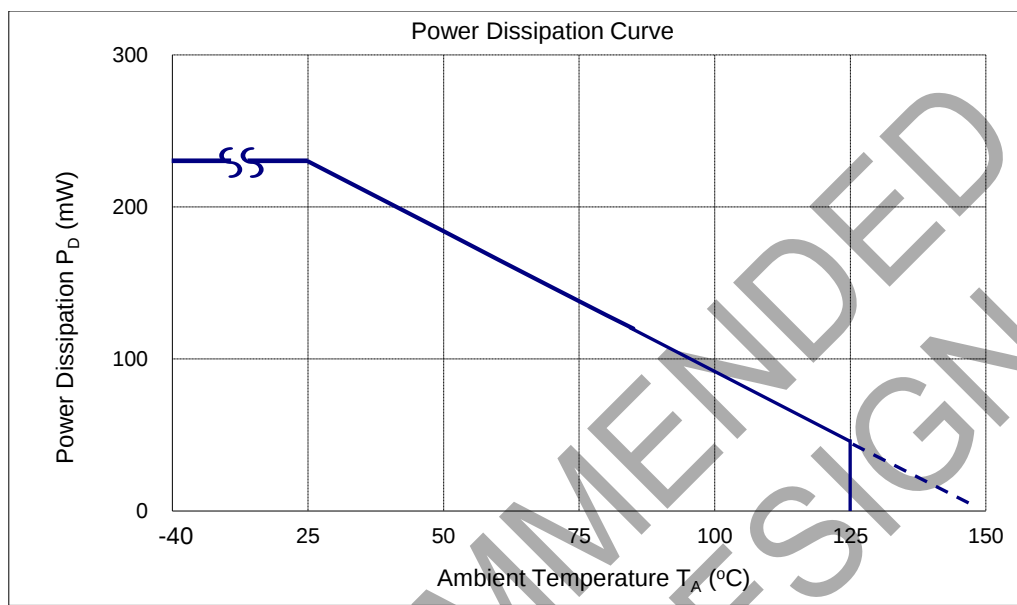
Output Current Limit



Thermal Performance Characteristics

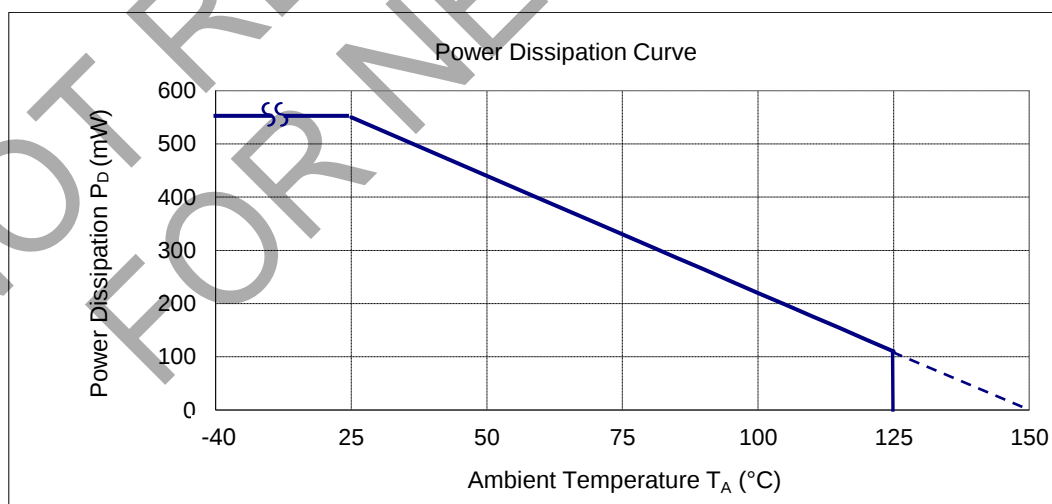
(1) Package Type: SOT23

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

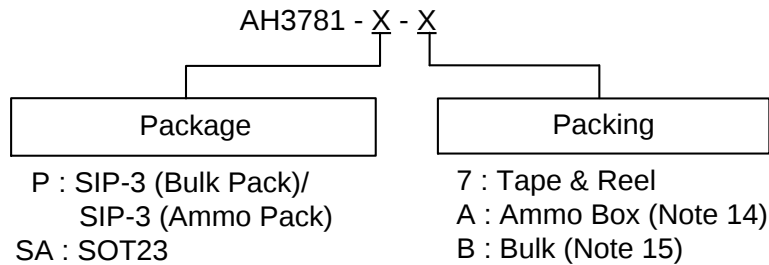


(2) Package Types: SIP-3 (Bulk Pack)/SIP-3 (Ammo Pack)

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



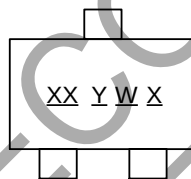
Part Number	Package Code	Package	Part Number Suffix	Packing	
				Qty.	Carrier
AH3781-P-A	P	SIP-3 (Ammo Pack)	-A	4,000	Ammo Box
AH3781-P-B	P	SIP-3 (Bulk Pack)	-B	1,000	Bulk
AH3781-SA-7	SA	SOT23	-7	3,000	7" Tape & Reel

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)

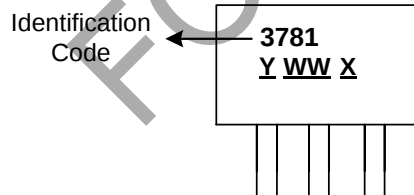


XX : Identification Code
Y : Year 0 to 9 (ex: 3 = 2023)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3781-SA-7	SOT23	WX

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

(Top View)



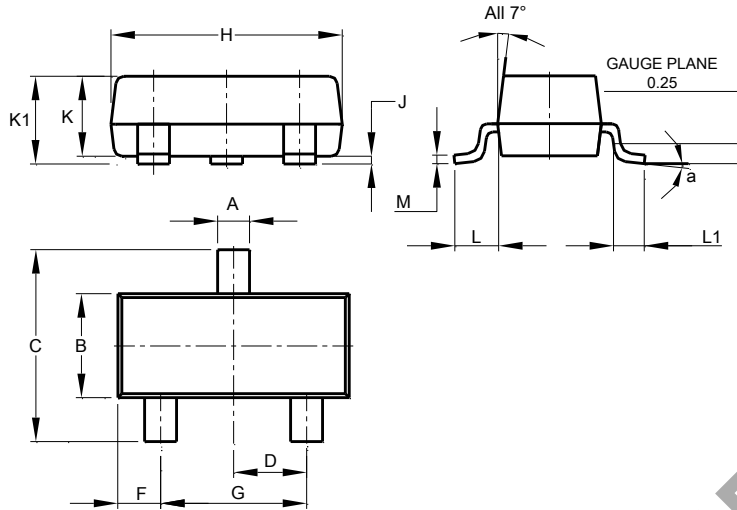
Y : Year : 0 to 9 (ex: 3 = 2023)
WW : Week : 01 to 52, "52" represents
week 52 and 53
X : Internal Code

Part Number	Package	Identification Code
AH3781-P-A	SIP-3 (Ammo Pack)	3781
AH3781-P-B	SIP-3 (Bulk Pack)	3781

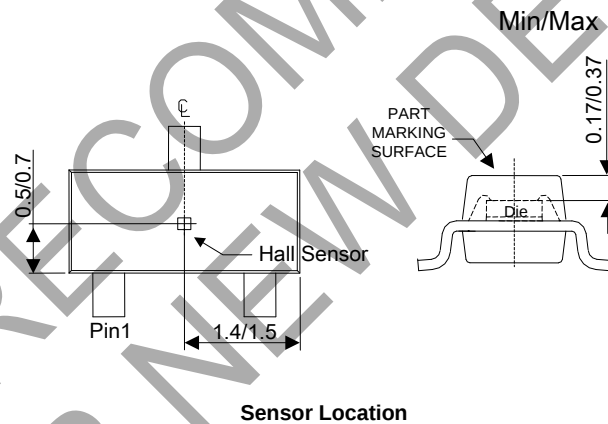
Package Outline Dimensions (All dimensions in mm.)

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

(1) Package Type: SOT23



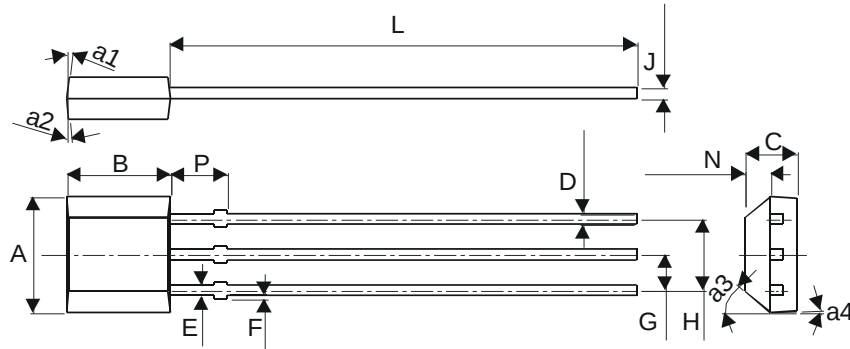
SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			



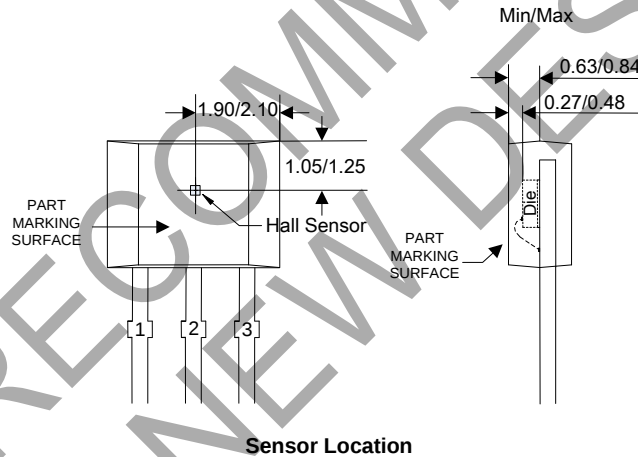
Package Outline Dimensions (continued) (All dimensions in mm.)

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

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



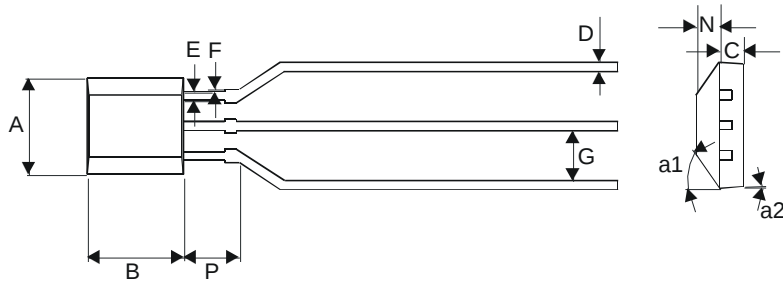
SIP-3 (Bulk Pack)		
Dim	Min	Max
A	3.9	4.3
a1	5° Typ	
a2	5° Typ	
a3	45° Typ	
a4	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.33	0.432
E	0.40	0.508
F	0	0.2
G	1.24	1.30
H	2.51	2.57
J	0.35	0.43
L	14.0	15.0
N	0.63	0.84
P	1.55	-
All Dimensions in mm		



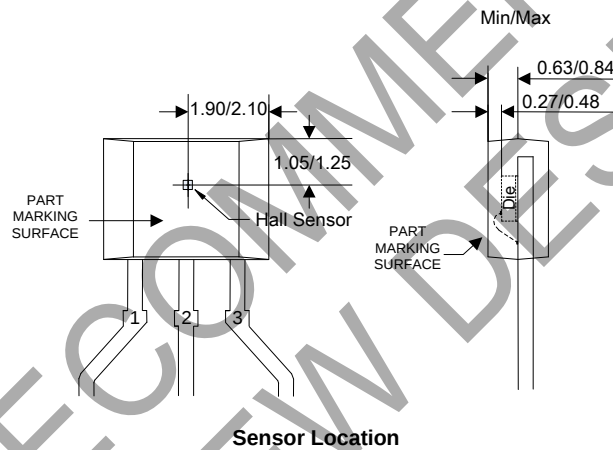
Package Outline Dimensions (continued) (All dimensions in mm.)

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

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



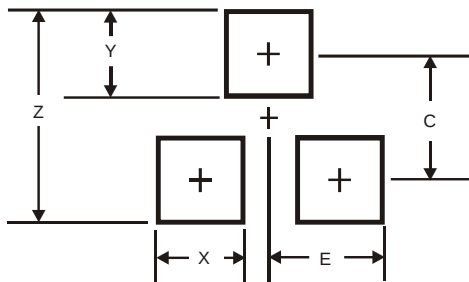
SIP-3 (Ammo Pack)		
Dim	Min	Max
A	3.9	4.3
a1	45° Typ	
a2	3° Typ	
B	2.8	3.2
C	1.40	1.60
D	0.35	0.41
E	0.43	0.48
F	0	0.2
G	2.4	2.9
N	0.63	0.84
P	1.55	-
All Dimensions in mm		



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

NOT RECOMMENDED
FOR NEW DESIGN

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