AT814

1A Low Voltage Low Dropout Regulator

Immense Advance Tech.

FEATURES

- Adjustable Voltage Versions
- Output Current up to 1A
- Current limiting and thermal shutdown
- Low Ground Current
- Fast Transient Response
- Reverse-Battery Protection
- Reverse-Leakage Protection
- Low Dropout Voltage 410mV @ 1A
  - **Ideal for 3.0V to 2.5 Vconversion**
  - **Ideal for 2.5V to 1.8V conversion**

APPLICATIONS

- LDO Linear Regulator for PC add-in Cards
- PowerPC Power Supplies
- High-efficiency linear power supplies
- SMPS Post Regulaor
- Multimedia and PC Processor Supplies
- Battery Chargers
- Low-Voltage Micro Controllers and Digital Logic

DESCRIPTION

The AT814 is a high current, high accuracy,low - dropout voltage regulator. Using process with a PNP pass element, this regulator is ideal for PC add-in cards that need to convert from standard 5V to 3.3V, 3.3V to 2.5V or 2.5V to 1.8V.

The AT814 feature 410mV (@1A) dropout voltage and very low ground Current. Designed for high current loads, this device also finds applictions in lower current, extremely low dropout-critical systems, where its tiny dropout voltage and ground current values are important attributes.

The AT814 is fully protected with over current limiting , thermal shutdown, and reversed-battery production. The AT814 feature logic level ON/OFF control and with adjustable output voltage from 1.24V to 8V. On the AT814, the ENABLE pin may be tied to V_{IN} if it is not required for ON/OFF control. The AT814 is available in the SOP-8 package.

TYPICAL APPLICATION CIRCUITS
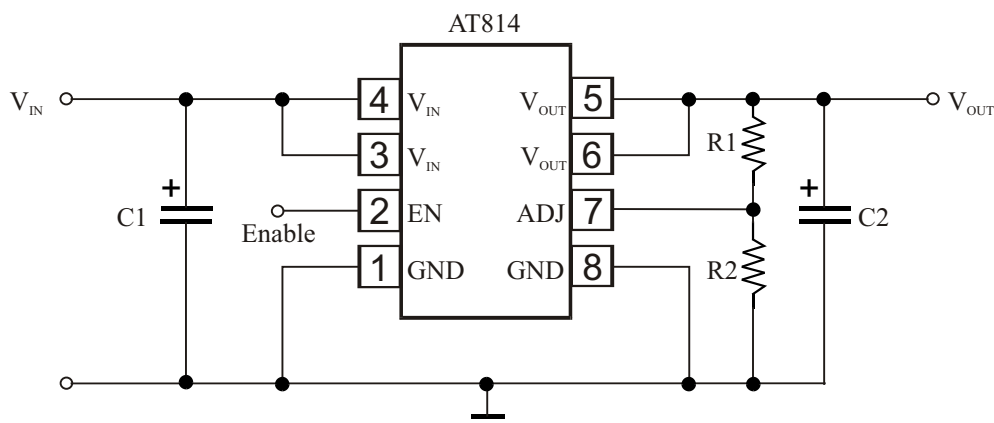
$$V_{OUT} = 1.24 \cdot [1 + \frac{R1}{R2}] \text{ Volts}$$

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ABSOLUTE MAXIMUM RATINGS (Note1)

Parameter	Symbol	Max Value	Unit
Power Dissipation**(Note2)**	P_D	Internally limited	W
Input Supply Voltage	V_{IN}	± 20	V
Enable Voltage	V_{EN}	20	V
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature(Soldering, 5 sec)	T_{LEAD}	260	°C
ESD		**(Note3)**	

OPERATING RATINGS (Note4)

Parameter	Symbol	Max Value	Unit
Maximum Operating Input Voltage	V_{IN}	2.25 to 16	V
Maximum Operating Enable Voltage	V_{EN}	2.25 to 16	V
Operating junction Temperature Range	T_J	0 to +125	°C
Thermal Resistance Junction to Ambient SOP-8 PSOP-8	Θ_{JA}	160 36	°C/W

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Program Vout to 5.0V, V_{IN}=Vout + 1V; V_{EN}=2.25V. **Bold** values are guaranteed across the operating junction temperature range.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reference Voltage	V_{REF}	I_O = 10mA	1.222 **1.210**	1.240	1.258 **1.270**	V
Reference Voltage Temp. Coeifficient	$\Delta V_{REF}/\Delta T$	**(Note6)**		20		ppm/°C
Adjust Pin Bias Current	I_{ADJ}	I_O = 10mA		40	80 **120**	nA
Adjust Pin Bias Current Temp. Coeifficient	$\Delta I_{ADJ}/\Delta T$			0.1	99.2	nA/°C
Line Regulation	$REG_{(LINE)}$	I_O = 10mA, $(V_{OUT}+1V) \le V_{IN} \le 16V$		0.06	0.5	%
Load Regulation **(Note 5,7,8)**	$REG_{(LOAD)}$	$10mA \le I_{LOAD} \le 1A$		0.20	1.5	%
Ground Current **(Note 5)**	I_G	I_O = 1A		12	**30**	mA
Dropout Voltage **(Note 5,9)**	V_D	V_{OUT} = -1% , I_{LOAD} = 1A		410	550 **630**	mV
Current Limit **(Notes 7,8)**	I_{CL}	V_{OUT} = 0 V		1.8	**2.5**	A

ELECTRICAL CHARACTERISTICS (continued)

Program Vout to 5.0V, V_{IN}=Vout + 1V; V_{EN}=2.25V. **Bold** values are guaranteed across the operating junction temperature r

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Enable Input						
Input Logic Voltage Low (OFF) High (ON)	V_{IL} V_{IH}		**2.25**		**0.8**	V
Enable Pin Input Current	I_{IH}	V_{EN}= 2.25V	1	15	30 **75**	µA
	I_{IL}	V_{EN}= 0.8V			2 4	µA

Note 1 : Exceeding the absolute maximum ratings may damage the device.

Note 2 : $PD_{(max)}$= [$T_{J(max)}$ - T_A] / Θ_{JA}, where Θ_{JA} = junction-to-ambient thermal resistance.

Note 3 : Devices are ESD sensitive. Handling precautions recommended.

Note 4 : The device is not guaranteed to function outside its operating rating.

Note 5 : Pulse testing techniques are used to maintain junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately. Maximum power dissipation mustn't exceed 0.625W for SOP8 package.
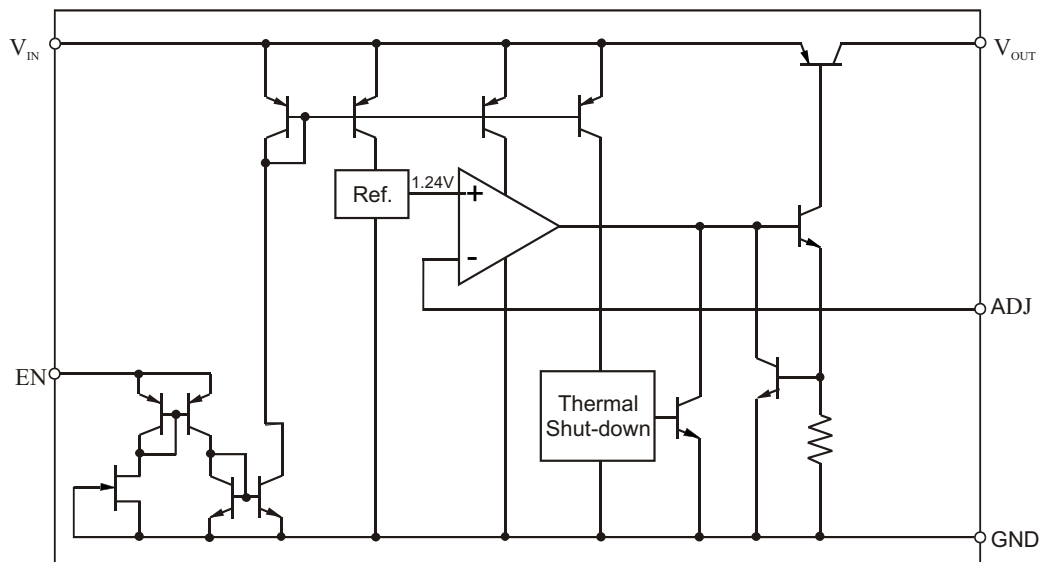
Note 6 : Reference voltage temperature coefficient is .V_{REF} (worst case) / ($T_{J(max)}$ - $T_{J(min)}$) where $T_{J(max)}$ is +125 °C and $T_{J(min)}$ is 0 °C.

Note 7 : Low duty cycle pulse testing with kelvin connections required.

Note 8 : V_{IN} = V_{OUT} (nominal) + 1V. Employ pulse-testing procedures to minimize temperature rise.

Note 9 : Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value with V_{OUT} + 1V applied to V_{IN} .
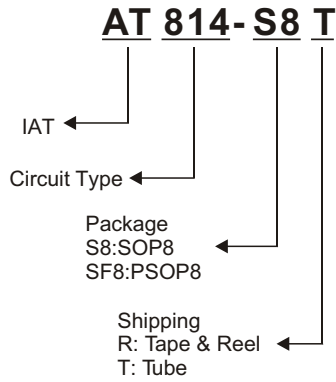
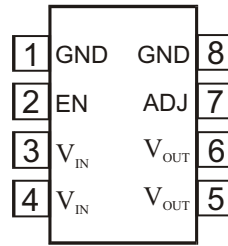# BLOCK DIAGRAM

AT814

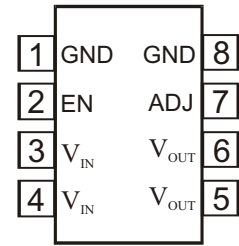## 1A Low Voltage Low Dropout Regulator

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ORDERING INFORMATION

AT 814- S8 T

IAT ←

Circuit Type ←

Package
S8:SOP8
SF8:PSOP8

Shipping
R: Tape & Reel
T: Tube

PIN CONFIGURATIONS (TOP VIEW)

SOP-8

PSOP8(SOIC-8EDP)

PIN DESCRIPTIONS

| Pin Number	Pin Name	Pin Desciption
Pin 7	ADJ	Feedback for setting the output voltage, connect external resistors network for adjustable output. $$V_{OUT} = \frac{1.24(R1+R2)}{R2} \text{ Volts}$$
Pin 2	EN	Enable/Shutdown. TTL/CMOS compatible input. Pulling this pin below 0.8V turns the regulator off. Pulling up 2.25V the regulator on.
Pin 1&8	GND	Ground
Pin 3&4	V_{IN}	Regulator Input supply voltage can range 2.4V to 16V.
Pin 5&6	V_{OUT}	Regulator Output. Adjustable from 1.24V reference voltage to 8V.

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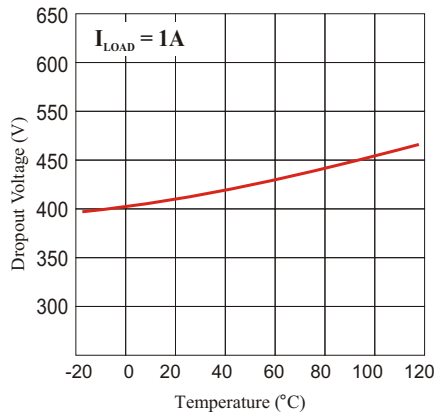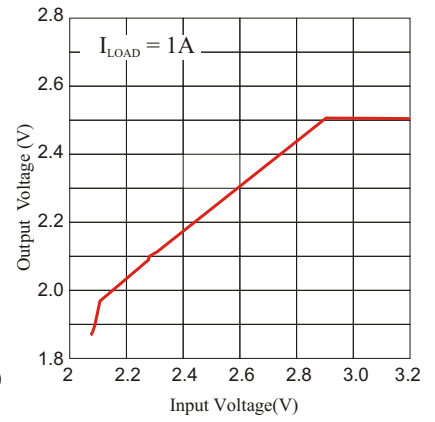
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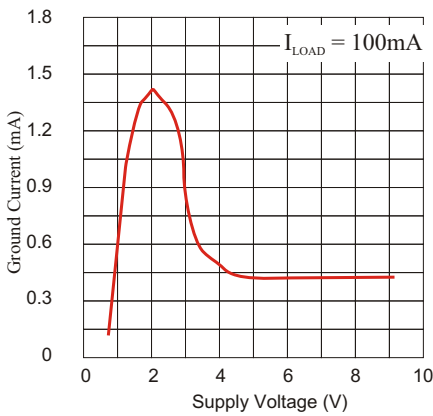# TYPICAL OPERATING CHARACTERISTICS
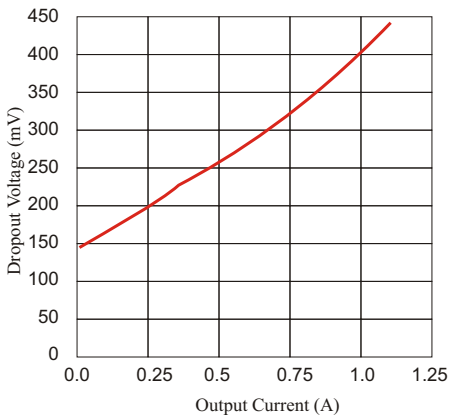
Dropout Voltage vs. Output Current
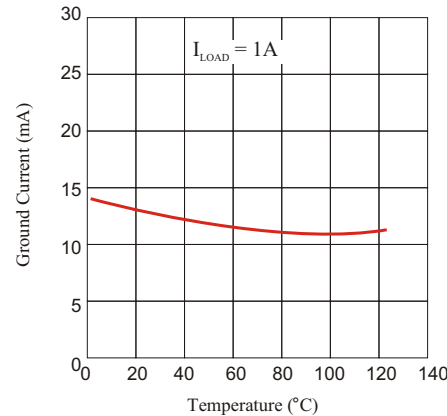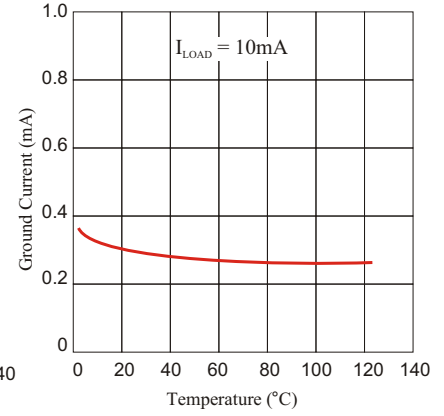**Adjust Vout to 1.8V**

Dropout Voltage vs. Temperature

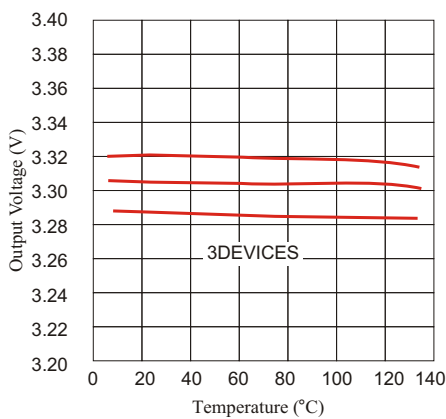**Dropout Characteristics**
Adjust Vout to 2.5V

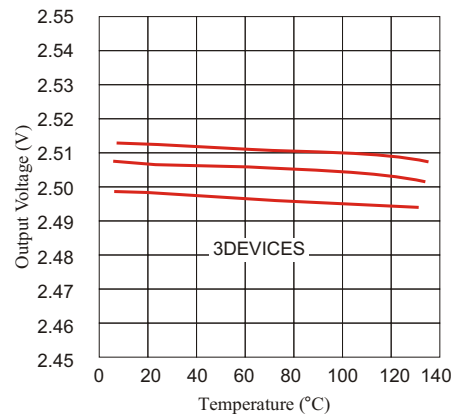**Ground Current vs. Supply Voltage**
Adjust Vout to 2.5V

Ground Current vs. Temperature

Ground Current vs. Temperature

Output Voltage vs. Temperature
Adjust Vout to 3.3V

Output Voltage vs. Temperature
Adjust Vout to 2.5V

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APPLICATION INFORMATION

The AT814 is a high-performance low drop-out voltage regulator suitable for moderate to high current voltage regulator applications. Its 630mVdropout voltage at full load and over temperature makes it especially valuable in battery-powered systems and as high-efficiency noise filters in post-regulator applications. Unlike older NPN-pass transistor designs, where the minimum dropout voltage is limited by the base-to-emitter voltage drop and collector-to-emitter saturation voltage, dropout performance of the PNP output of these devices is limited only by the low V_{CE} saturation voltage.

The AT814 regulator is fully protected from damage due to fault conditions. Linear current limiting is provided. Output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device (and load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.
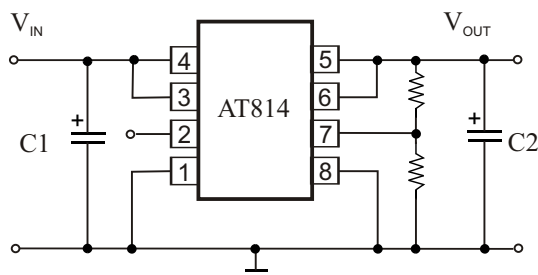

Figure 1. Linear regulators require only two capacitors for operation.

Output Capacitor

The AT814 requires an output capacitor to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation.

The AT814 output capacitor selection is dependent upon the ESR (equivalent series resistance)of the output capacitor to maintain stability.

When the output capacitor is $10\mu F$ or greater ,the output capacitor should have an ESR less than 2 Ω .This will improve transient response as well as promote stability. Ultra-low-ESR capacitors ($<100m\Omega$) , such as ceramic chip capacitors, may promote instability. These very low ESR levels may cause an oscillation and/or under damped transient response. A low-ESR solid tantalum capacitor works extremely well provides good transient response and stability over temperature. Aluminum electrolytes can also be used, as long as the ESR of the capacitor is $<2\Omega$.

The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response and ripple rejection andreduce output noise.

Input Capacitor

An input capacitor of $1\mu F$ or greater is reco-mmended when the device is more than 4 inches away from the bulk ac supply capacitance or when the supply is a battery. Small, surface mount, ceramic chip capacitors can be used for bypassing. Larger values will help to improve ripple rejection by bypassing the input to the regulator, further improving the integrity of the output voltage.

Enable Input

The AT814 feature an active-high enable input(EN) that allows on-off control of the regulator. Current drain reduces to "zero" when the device is shutdown, with only micro amperes of leakage current. The EN input has TTL/CMOS compatible thresholds for simple logic interfacing. EN may be directly tied to V_{IN} and pulled up to the maximum supply voltage.

Transient Response and 3.3V to 2.5V or 2.5V to 1.8V Conversion

The AT814 has excellent transient response to variations in input voltage and load current. The device has been designed to respond quickly to load current variations and input voltage variations. Large output capacitors are not required to obtain this performance. A standard $10\mu F$ output capacitor, preferably tantalum, is all that is required. Larger values help to improve performance even further.

By virtue of its low-dropout voltage, this device does not saturate into dropout as readily as similar NPN-based designs. When converting from 3.3V to 2.5V or 2.5V to 1.8V, the NPN based regulators are already operating in dropout, with typical dropout requirements of 1.2V or greater. To convert down to 2.5V or 1.8V without operating in dropout, NPN based regulators require an input voltage of 3.7V at the very least. AT814 regulator will provide excellent performance with an input as low as 3.0V or 2.5V respectively. This gives the PNP based regulators adistinct advantage over older, NPN based linear Regulators.

Minimum Load Current

The AT814 regulator is specified between finite loads. If the output current is too small, leakage currents dominate and the output voltage rises. A 10mA minimum load current is necessary for proper regulation.
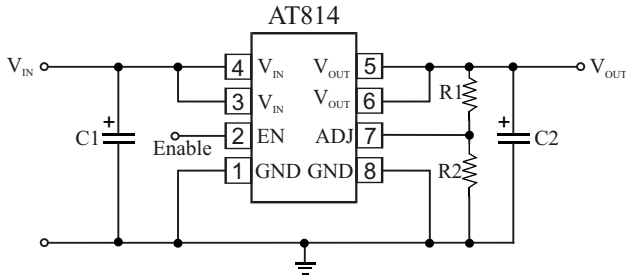

Figure 2. Adjustable Regulator with Resistor

Adjustable Regulator Design

The AT814 allows programming the output voltage anywhere between 1.24V and the 8V maximum operating rating of the family. Two resistors are used. The resistor values are calculated by:

$$V_{OUT} = 1.24 \cdot [1 + \frac{R1}{R2}] \text{ Volts}$$

Where Vout is the desired output voltage. Figure 2 shows component definition. Applications with widely varying load currents may scale the resistors to draw the minimum load current required for proper operation (see above).
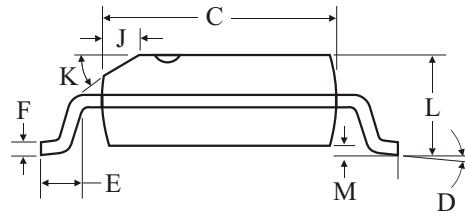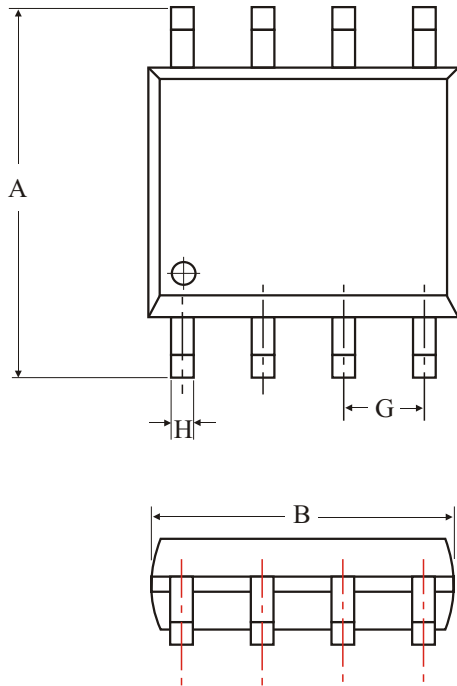
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SOP-8 PACKAGE OUTLINE DIMENSIONS

REF.	DIMENSIONS Millimeters	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.19	0.25
M	0.10	0.25
H	0.35	0.49
L	1.35	1.75
J	0.375 REF.	
K	45°	
G	1.27 TYP.	

ALL DIMENSIONS IN MIL IMETER

SOP-8 PACKAGE OUTLINE DIMENSIONS 2
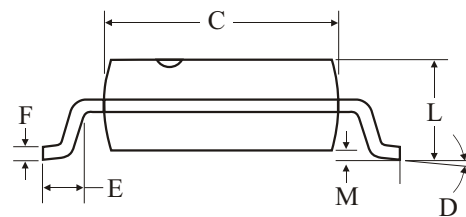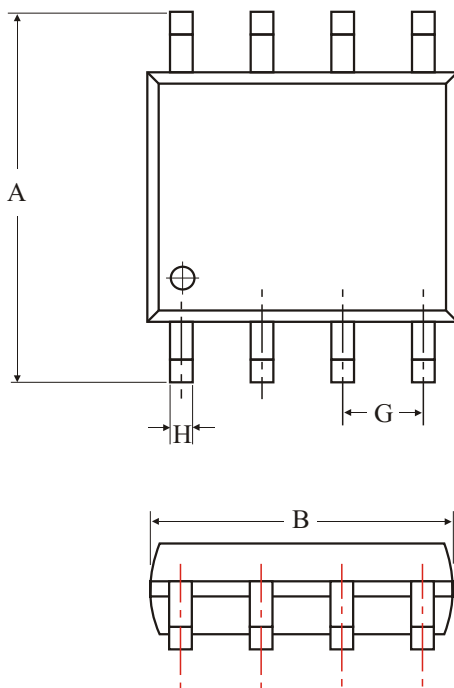
REF.	DIMENSIONS Millimeters	
	Min.	Max.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
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F	0.19	0.25
M	0.10	0.25
H	0.35	0.49
L	1.35	1.75
G	1.27 TYP.	

ALL DIMENSIONS IN MIL IMETER

AT814

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PSOP8(SOIC-8EDP) PACKAGE OUTLINE DIMENSIONS

Thermal pad (See Note A)

PIN INDENT

NOTE A: Thermal Pad Dimensions 3.3 X 2.4 ± 0.1
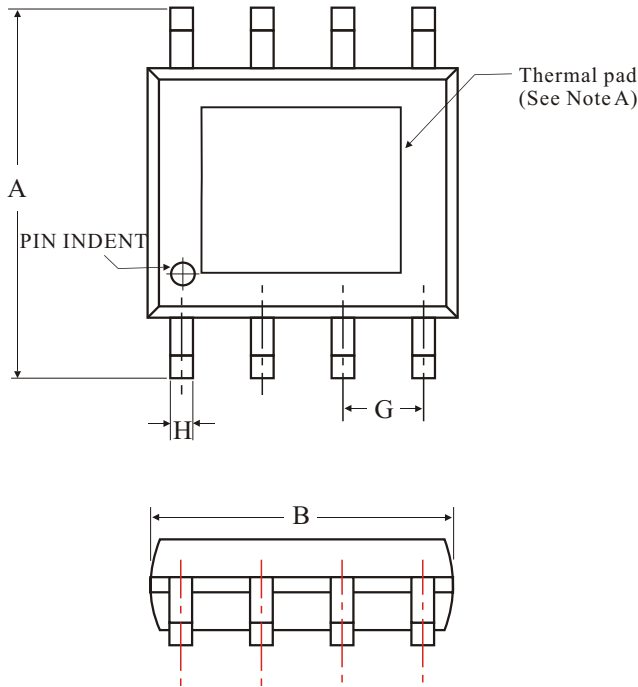
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F	0.19	0.25
M	0	0.15
H	0.35	0.49
L	1.35	1.75
J	0.375 REF.	
K	45°	
G	1.27 TYP.	

UNLESS OTHERWISE SPECIFIED
.X   ±0.3   .XXX   ±0.02
.XX   ±0.10   .XXXX   ±0.005
.X°   ±0.5°
ALL DIMENSIONS IN MILIMETER