AT1808

1.5A Ultra Low Dropout Regulator

Immense Advance Tech.

FEATURES

- Adjustable Output from 0.8V
- Input Voltage as Low as 1.8V
- Enable Pin
- 250mV Dropout @1A
- Over Current and Over Temperature Protection
- 5μA Quiescent Current in Shutdown
- P-CH Design to Reduce the Operation Current
- Full Industrial Temperature Range
- Vout Power Good Signal

APPLICATION

- Notebook computers
- Battery Powered Systems
- Motherboards/Peripheral Cards
- Telecom/Networking Cards
- Industrial Applications
- Set Top Boxes
- Wireless Infrastructure
- Medical Equipment

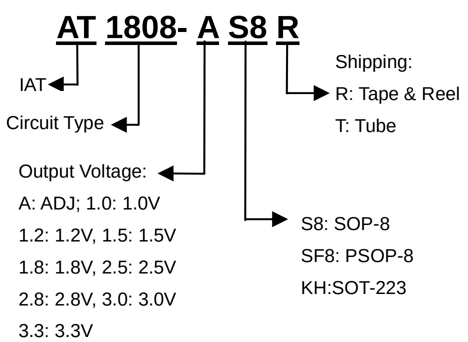
DESCRIPTION

The AT1808 is a high performance positive voltage regulator designed for use in applications requiring very low input voltage and very low dropout voltage at up to 1.5A amps. It operates with a V_{IN} as low as 1.8V, with output voltage programmable as low as 0.8V. The AT1808 features ultra low dropout, ideal for applications where V_{OUT} is very close to V_{IN}. Additionally, the AT1808 has an enable pin to further reduce power dissipation while shut down. The enable pin may be tied to VIN if it is not required for ON/OFF control. The AT1808 provides excellent regulation over variations in line , load and temperature. The AT1808 provides a Power Good signal to indicate if the voltage level of V_{OUT} reaches 92% of its rating value.

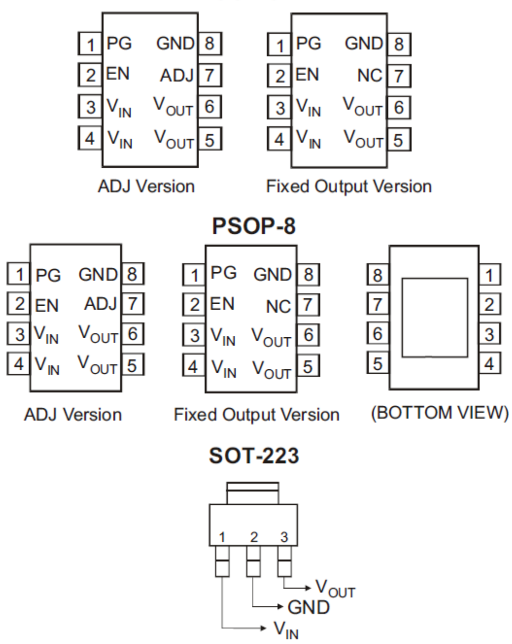
The optimum thermal condition has to consider the layout placement and application to achieve its satisfied high output current requirement.

The AT1808 are available in SOP-8, PSOP-8 and SOT-223 packages.

ORDER INFORMATION



PIN CONFIGURATIONS (TOP VIEW)

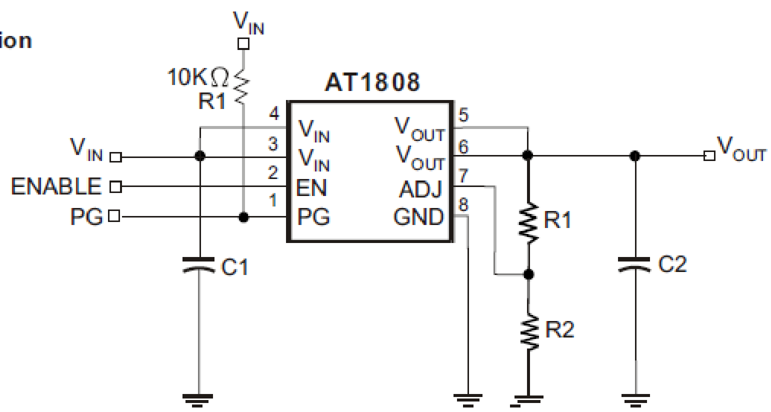


PIN DESCRIPTIONS

Pin Name	Pin Description
PG	Assert high once V_{OUT} reaches 92% of its rating voltage. Open-drain output.
EN	Enable Input. Pulling this pin below 0.4V turns the regulator off, reducing the quiescent current to a fraction of its operating value. The device will be enabled if this pin is left open. Connect to V_{IN} if not being used.
V_{IN}	Input Voltage. A large bulk capacitance should be placed closely to this pin to ensure that the input supply does not sag below 1.8V.
V_{OUT}	The pin is the power output of the device.
ADJ	For the adjustable versions of the AT1808. This is the input to the error amplifier. The addition reference voltage is 0.8Vreferenced to ground. The output range is 0.8V to 5V: $V_{OUT} = \frac{0.8(R1+R2)}{R2}$ Volts
GND	Reference Ground.
THERMAL PAD	Pad for heatsinking purposes. Connect to ground plane using multiple vias. Not electrically connected internally.

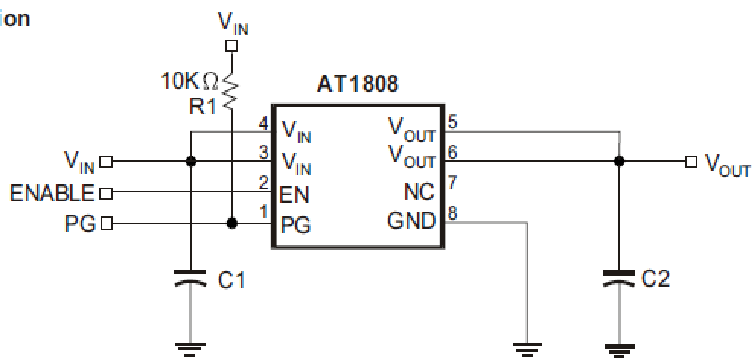
TYPICAL APPLICATION CIRCUITS

Adjustable Version

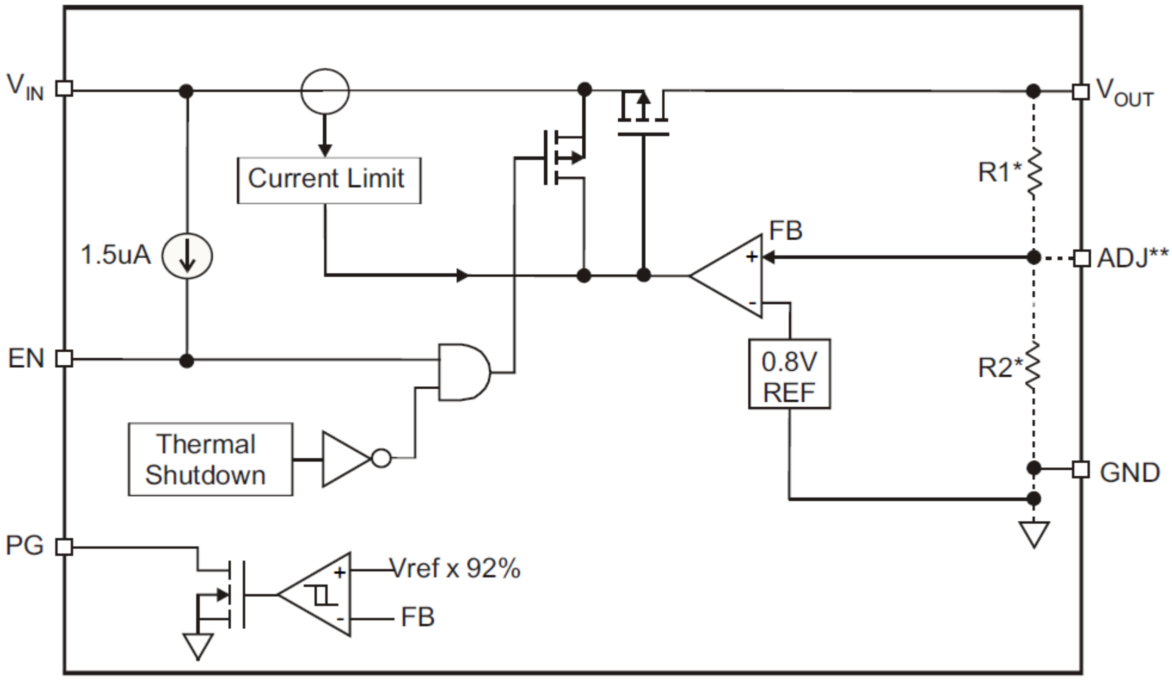


$$V_{OUT} = \frac{0.8\,(R1+R2)}{R2}\ \text{Volts}$$

Fixed Output Version



BLOCK DIAGRAM



* Feedback network in fixed versions only
* *Adjustable version only

ABSOLUTE MAXIMUM RATINGS(Note 1)

Parameter		Symbol	Max Value	Unit
V_{IN}, EN, V_{OUT}, PG, addition Absolute Voltage			6	V
Power Dissipation		P_D	Internally Limited	W
Thermal Resistance Junction to Ambient	SOP-8	θ_{JA}	160	℃/W
	PSOP-8(Note 2)		36	
	SOT-223		136	
Operating Ambient Temperature Range		T_A	-40 to 85	℃
Operating Junction Temperature Range		T_J	-40 to +125	℃
Storage Temperature Range		T_{STG}	-65 to +125	
Lead Temperature(Soldering) 5 Sec.		T_{LEAD}	260	℃
ESD Rating (Human Body Mode) (Note 3)		V_{ESD}	2	kV

Note 1: Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

Note 2: 2 square inch of FR-4 , double sided, 1 oz. minimum copper weight.

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

ELECTRICAL CHARACTERISTICS

Unless specified: V_{EN}=V_{IN}. Adjustable version: V_{IN}=3.3V and I_{LOAD}= 10µA to 1A, Fixed version: V_{IN}= V_{OUT}+0.5V and I_{LOAD}= 10µA to 1A.T_J=25℃

Parameter	Symbol	Condition	Min	Typ	Max	Unit
V_{IN}						
Supply Voltage Range	V_{IN}		1.8	—	5.5	V
Supply Current	I_{SS}		—	0.4	1.45	uA
Quiescent Current	I_Q	V_{IN} = 5.5V, V_{EN} = 0V	—	5	10	uA
V_{OUT}						
Output Voltage (Note 4)(Fixed Voltage)	V_{OUT}	V_{OUT}≤1.3V, V_{IN}=1.8V,I_{LOAD}=10mA V_{OUT} >1.3V, V_{IN}=(V_{OUT}+0.5V),I_{LOAD}=10mA	-2%	V_{OUT}	+2%	V
Line Regulation (Note 4)	Reg_line	V_{OUT}≤1.3V, V_{IN}=1.8V to 5.5V,I_{LOAD}=10mA V_{OUT} >1.3V,V_{IN}=(V_{OUT} +0.5V) to 5.5V,10mA ≤I_{LOAD}=10mA	—	0.2	1.0	%/V
Load Regulation (Note 4)	Reg_load	V_{OUT}≤1.3V, V_{IN}=1.8V,10mA≤I_{LOAD}≤1A V_{OUT} >1.3V, V_{IN}=(V_{OUT} +0.5V) ,10mA≤ I_{LOAD}≤1A	—	0.1	1.0	%
Dropout Voltage (Note 4,5)	V_D	Fix.1.2V≤V_{OUT}≤1.5, I_{LOAD}=1A Fix.V_{OUT} >1.5V_{OUT}, I_{LOAD}=1A	—	550 250	650 350	mV
		Adj. V_{OUT}=2.5v, I_{LOAD}=1A	—	250	350	
$V_{OUT(CONT)}$						
Current Limit (Note 6)	I_{CL}		1.6	2	—	A
ADJ						
Reference Voltage (Note 3)	V_{REF}	V_{IN} =3.3V, V_{ADJ}=V_{OUT}, I_{LOAD} =10mA	0.788	0.8	0.812	V
Adjust Pin Current (Note 6)	I_{ADJ}	V_{ADJ} = V_{REF}	—	80	200	nA
Adjust Pin Threshold (Note 7)	$V_{TH(ADJ)}$		0.05	0.16	0.40	V
EN						
Enable Pin Current	I_{EN}	V_{EN}=0V	—	1.5	10	µA
Enable Pin Threshold	V_{IH}		1.6	—	—	V
	V_{IL}		—	—	0.4	V
PG						
VOUT Power Good Voltage	V_{THPG}		—	92	—	%
Hysteresis	T_{HYPG}		—	7	—	%
Over Temperature Protection						
High Trip Level	T_{HI}		—	160	—	℃
Hysteresis	T_{HYST}		—	20	—	℃

Note 5: Low duty cycle pulse testing with Kelvin connections required.

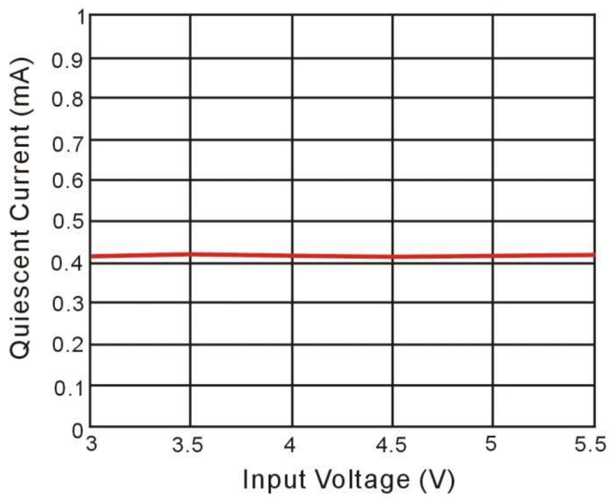
Note 4: Defined as the input to output differential at which the output voltage drops to 2% below the value measured at a differential of 0.8V, and V_{OUT} set to 2.5V .

Note 5: Guaranteed by design.

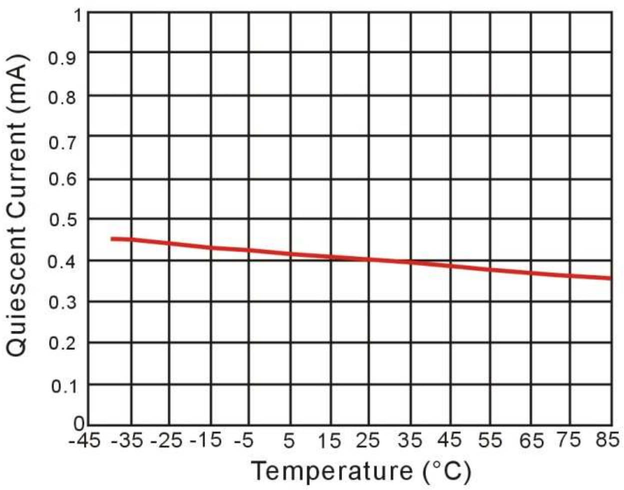
Note 6: When V_{ADJ} exceeds this threshold, the "Sense Select" switch disconnects the internal feedback chain from the error amplifier and connects V_{ADJ} instead.

TYPICAL OPERATING CHARACTERISTICS

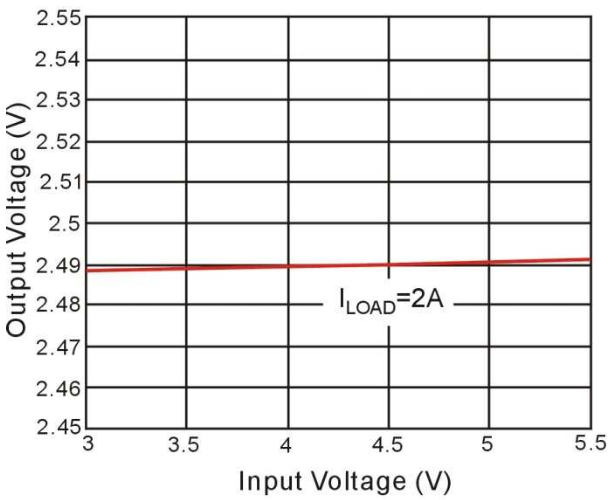
(1) Quiescent Current vs. Input Voltage



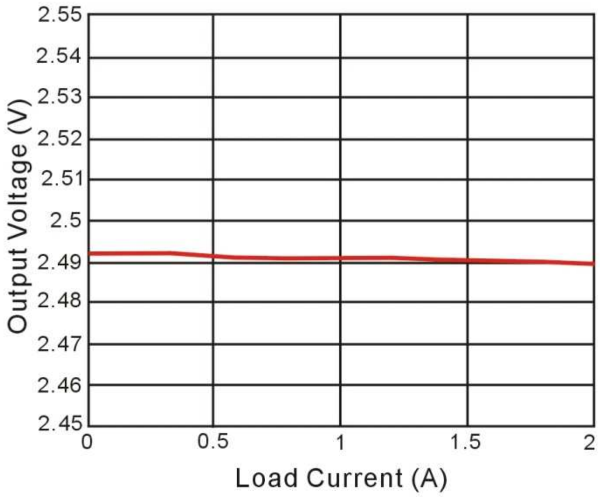
(2) Quiescent Current vs. Temperature



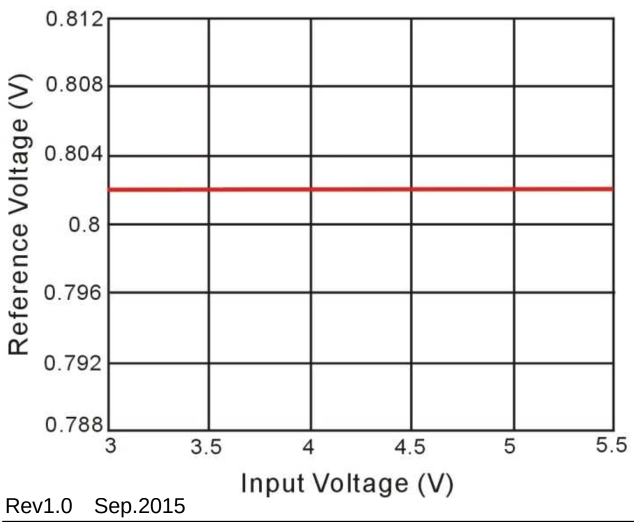
(3) Output Voltage vs. Input Voltage



(4) Output Voltage vs. Load Current



(5) Reference Voltage vs. Input Voltage



APPLICATION INFORMATION

Introduction

The AT1808 is intended for applications where high current capability and very low dropout voltage are required. It provides a very simple, low cost solu-tion that uses very little PCB real estate. Additional features include an enable pin to allow for a very low power consumption standby mode, and a fully adjustable output.

Component Selection

Input capacitor: A minimum of 10µF ceramic ca-pacitor is recommended to be placed directly next to the V_{IN} pin. This allows for the device being some distance from any bulk capacitance on the rail. Additionally, bulk capacitance of about 100µF may be added closely to the input supply pin of the AT1808 to ensure that VIN does not sag, improves load transient response.

Output Capacitor : A minimum bulk capacitance of 10µF, along with a 0.1µF ceramic decoupling ca-pacitor is recommended. Increasing the bulk ca-pacitance will improve the overall transient re-sponse. The use of multiple lower value ceramic ca-pacitors in parallel to achieve the desired bulk ca-pacitance will not cause stability issues. Although designed for use with ceramic output capacitors , and thus will also work comfortably with tantalum output capacitors.

External Voltage Selection Resistors : The use of 1% resistors, and consider for system stability and power losing , we recommend to design high dividing resistance (R1>100KΩ) to strengthen the benefits which AT1808 has inherent .

Noise Immunity : In very electrically noisy envi-ronments, it is recommended that 0.1µF ceramic capacitors be placed from VIN to GND and V_{OUT} to GND as close to the device pins as possible.

Parallel a small cap (ex:100p) would be ecom-mended to improve the transient response.

Thermal Considerations

The power dissipation in the AT1808 is approxi-mately equal to the product of the output current and the input to output voltage differential:

$$P_D \approx (V_{IN} - V_{OUT}) * I_{LOAD}$$

The absolute worst-case dissipation is given by:

$$P_{D(MAX)} = (V_{IN(MAX)} - V_{OUT(MIN)}) x I_{LOAD(MAX)} + V_{IN(MAX)} x I_{G(MAX)}$$

For a typical scenario, V_{IN}=3.3V ±5%,V_{OUT}=2.8V and I_{LOAD}=0.9A, therefore:

$V_{IN(MAX)}$ =3.465V,$V_{OUT(MIN)}$=2.744V and $I_{G(MAX)}$=1.75mA, Thus $P_{D(MAX)}$ =0.64W.

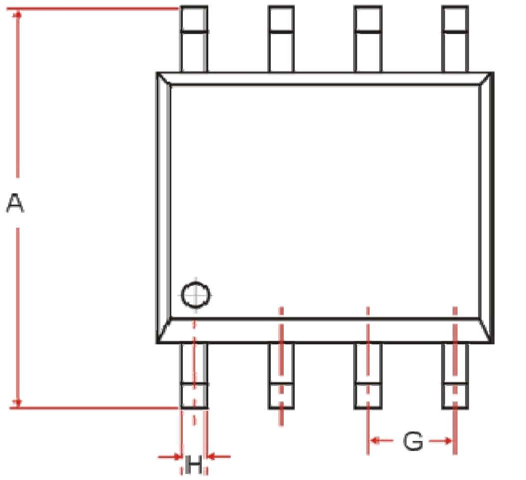
Using this formula, and assuming $T_{A(MAX)}$=85℃, we can calculate the maximum thermal impedance allowable to maintain $T_J \leq$125℃:

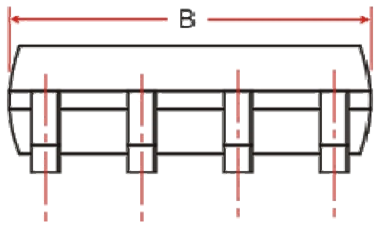
$$R_{\theta(J-A)(MAX)} = \frac{(T_{J(MAX)} - T_{A(MAX)})}{P_{D(MAX)}} = \frac{(125-85)}{0.64} = 62.5°C/W$$

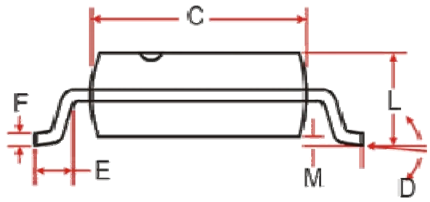
The package thermal performance may be en-hanced by attaching an external heat sink to the thermal pad.

PACKAGE OUTLINE DIMENSIONS

SOP-8 PACKAGE OUTLINE DIMENSIONS



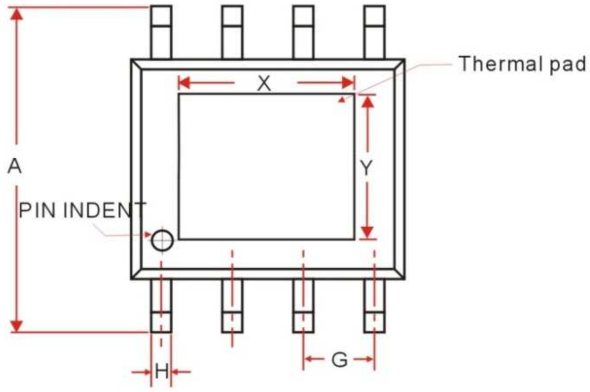


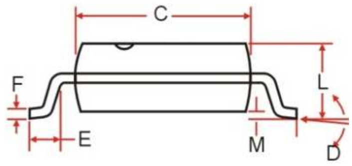


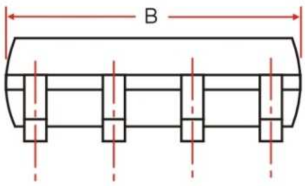
REF.	DIMENSIONS Millimeters	
	Min.	Min.
A	5.80	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	0.90
F	0.15	0.26
M	0	0.25
H	0.31	0.51
L	1.35	1.75
G	1.27 TYP.	

PACKAGE OUTLINE DIMENSIONS

PSOP-8 PACKAGE OUTLINE DIMENSIONS

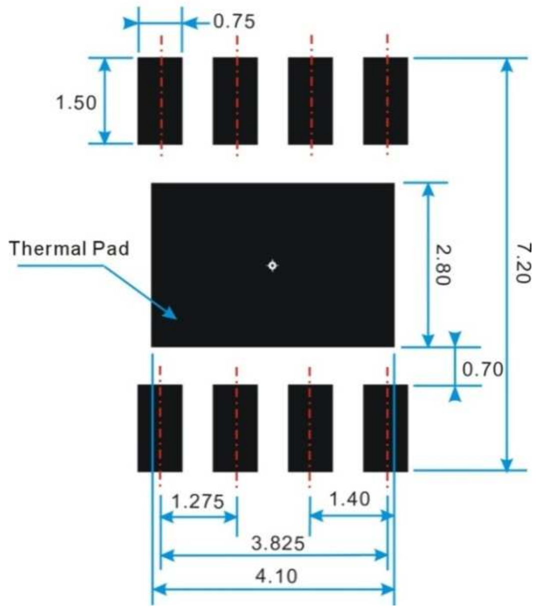






REF.	DIMENSIONS Millimeters	
	Min.	Max.
A	5.79	6.20
B	4.80	5.00
C	3.80	4.00
D	0°	8°
E	0.40	1.27
F	0.15	0.26
M	0	0.25
H	0.31	0.51
L	1.30	1.75
G	1.27 TYP.	
X	3.30 TYP.	
Y	2.50 TYP.	

PSOP-8 PACKAGE FOOTPRINT (mm)



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