

**1.5MHz Synchronous Step-down DC-DC Converter**

**AP3410B**

**General Description**

The AP3410B is a high efficiency step-down DC-DC voltage converter. The chip operation is optimized by peak-current mode architecture with built-in synchronous power MOSFET switchers. The oscillator and timing capacitors are all built-in providing an internal switching frequency of 1.5MHz that allows the use of small surface mount inductors and capacitors for portable product implementations.

Integrated Soft Start (SS), Under Voltage Lock Out (UVLO), Thermal Shutdown Detection (TSD) and Short Circuit Protection are designed to provide reliable product applications.

The device is available in adjustable output voltage version ranging from 0.6V to  $0.9 \times V_{IN}$  when input voltage range is from 2.5V to 5.5V, and is able to deliver up to 1.2A.

The AP3410B is available in SOT-23-5 package.

**Features**

- High Efficiency Buck Power Converter
- Wide Input Voltage Range: 2.5V to 5.5V
- Adjustable Output Voltage: 0.6V to  $0.9 \times V_{IN}$
- Low  $R_{DS(ON)}$  Internal Switches: 200m $\Omega$  ( $V_{IN}=5V$ )
- Built-in Power Switches for Synchronous Rectification with High Efficiency
- Output Current: 1.2A
- Feedback Voltage: 600mV
- 1.5MHz Constant Frequency Operation
- Thermal Shutdown Protection
- Low Dropout Operation at 100% Duty Cycle
- No Schottky Diode Required
- Input Over Voltage Protection
- Output Over Voltage Protection
- Over Current Protection
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100 /101/200, 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**

- Post DC-DC Voltage Regulation
- PDA and Notebook Computer

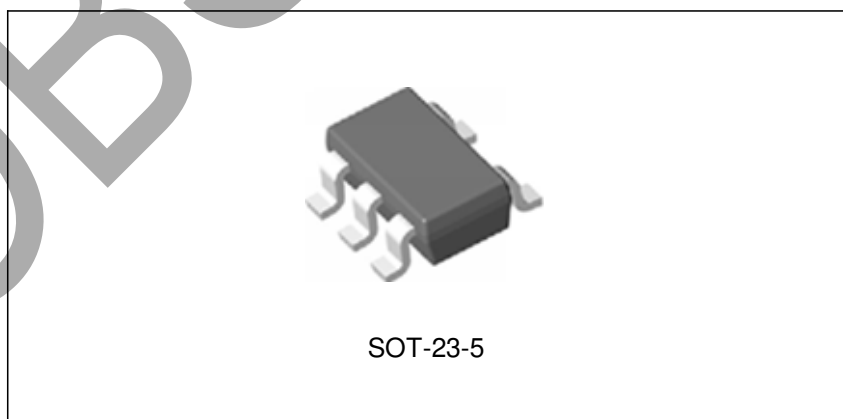


Figure 1. Package Type of AP3410B

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**Pin Configuration**

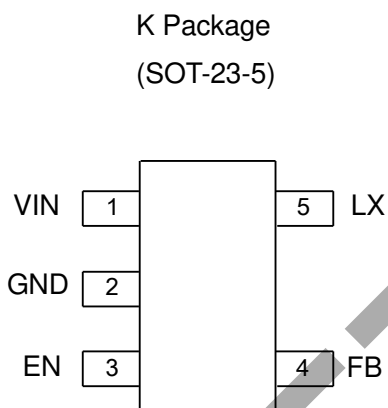


Figure 2. Pin Configuration of AP3410B (Top View)

**Pin Description**

Pin Number	Pin Name	Function
1	VIN	Power supply
2	GND	Ground pin
3	EN	Chip enable pin. Active high
4	FB	Feedback voltage of output
5	LX	Switch output pin

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**Functional Block Diagram**

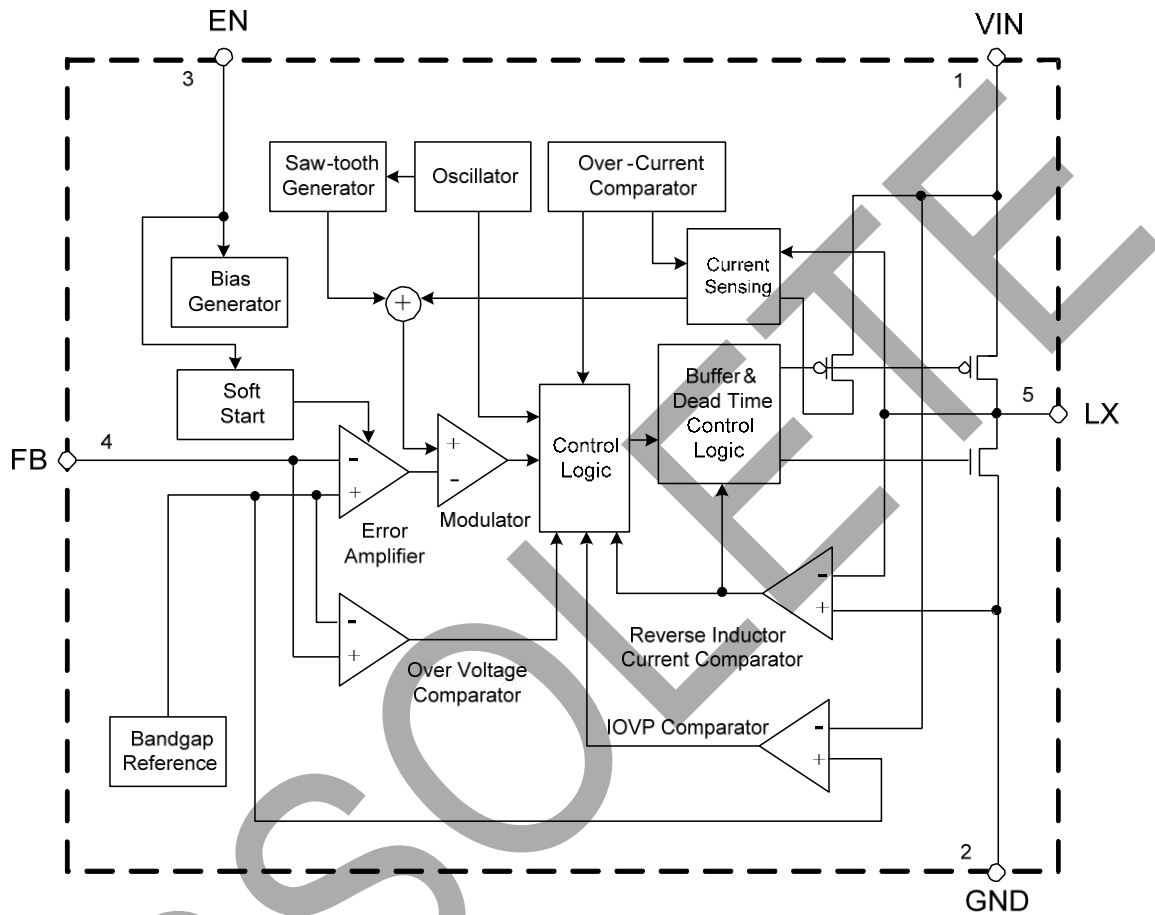


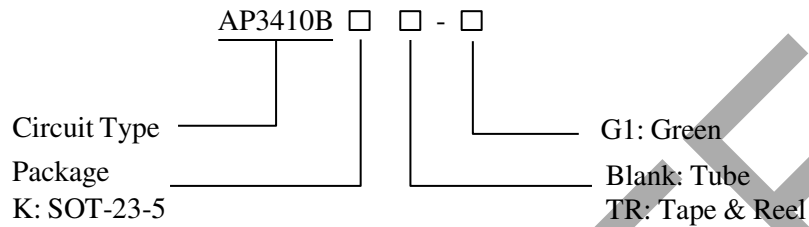
Figure 3. Functional Block Diagram of AP3410B

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**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-5	-40 to 85°C	AP3410BK-G1	G3U	Tube
		AP3410BKTR-G1	G3U	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" in the part number, are RoHS compliant and green.

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**Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Input Voltage for the MOSFET Switch	$V_{IN}$	0 to 6.0	V
Enable Input Voltage	$V_{EN}$	-0.3 to $V_{IN}+0.3$	V
LX Pin Switch Current	$I_{LX}$	1.8	A
Power Dissipation (On PCB, $T_A=25^{\circ}C$ )	$P_D$	0.4	W
Thermal Resistance (Junction to Ambient, Simulation)	$\theta_{JA}$	250	$^{\circ}C/W$
Thermal Resistance (Junction to Case, Simulation)	$\theta_{JC}$	130	$^{\circ}C/W$
Operating Junction Temperature	$T_J$	155	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55 to 150	$^{\circ}C$
Operating Temperature	$T_{OP}$	-40 to 85	$^{\circ}C$
ESD (Machine Model)	$V_{MM}$	200	V
ESD (Human Body Model)	$V_{HBM}$	2000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may 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 may affect device reliability.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Supply Input Voltage	$V_{IN}$	2.5	5.5	V
Operating Ambient Temperature	$T_A$	-40	85	$^{\circ}C$
Operating Junction Temperature	$T_J$	-40	125	$^{\circ}C$

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**Electrical Characteristics**

$V_{IN}=V_{EN}=5V$ ,  $V_{OUT}=1.2V$ ,  $V_{FB}=0.6V$ ,  $L=2.2\mu H$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=10\mu F$ ,  $T_A=25^\circ C$ , unless otherwise specified.

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage Range	$V_{IN}$		2.5		5.5	V
Shutdown Current	$I_{OFF}$	$V_{EN}=0$			0.1	$\mu A$
Active Current	$I_{ON}$	$V_{FB}=0.55V$		220		$\mu A$
Regulated Feedback Voltage	$V_{FB}$		0.588	0.6	0.612	V
Regulated Output Voltage Accuracy	$\Delta V_{OUT}/V_{OUT}$	$V_{IN}=2.5V$ to $5.5V$ , $I_{OUT}=0$ to $1.2A$	-3		3	%
Peak Inductor Current	$I_{PK}$		1.5	1.9		A
Oscillator Frequency	$f_{OSC}$	$V_{IN}=2.5V$ to $5.5V$	1.2	1.5	1.8	MHz
PMOSFET $R_{DS(ON)}$	$R_{DS(ON)P}$	$V_{IN}=5V$		200		$m\Omega$
NMOSFET $R_{DS(ON)}$	$R_{DS(ON)N}$	$V_{IN}=5V$		200		$m\Omega$
EN High Level Input Voltage	$V_{EN\_H}$		1.5			V
EN Low Level Input Voltage	$V_{EN\_L}$				0.4	V
EN Input Current	$I_{EN}$				0.1	$\mu A$
Soft Start Time	$t_{SS}$			400		$\mu s$
Maximum Duty Cycle	$D_{MAX}$		100			%
Under Voltage Lock Out Threshold	$V_{UVLO}$	Rising		2.3		V
		Falling		2.1		
		Hysteresis		0.2		
Thermal Shutdown	$T_{SD}$	Hysteresis= $30^\circ C$		155	160	$^\circ C$

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**Typical Performance Characteristics**

$V_{IN}=5V$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.

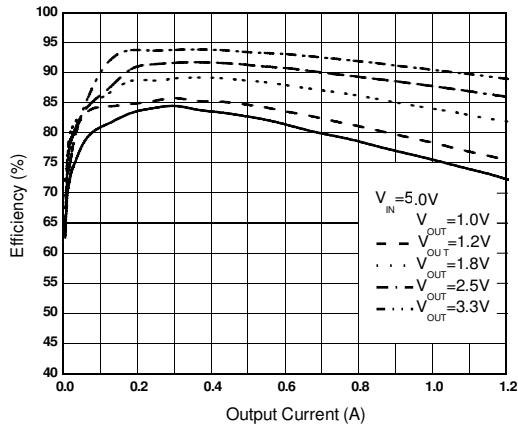


Figure 4. Efficiency vs. Output Current

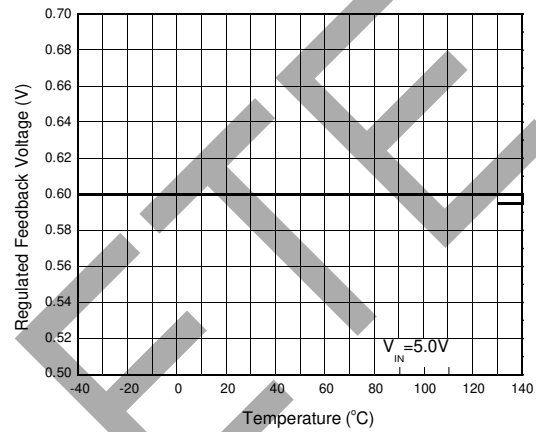


Figure 5. Regulated Feedback Voltage vs. Temperature

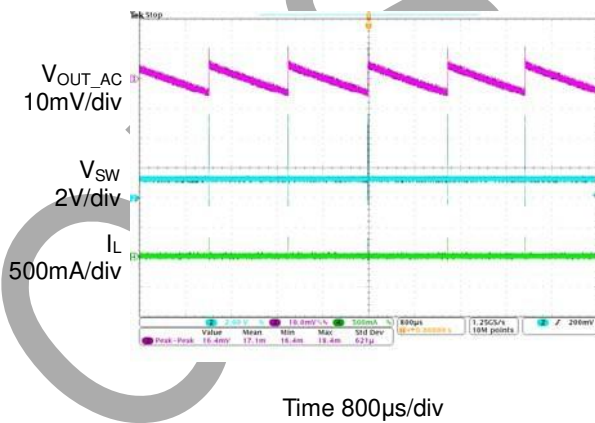


Figure 6. Output Ripple ( $I_{OUT}=0A$ )

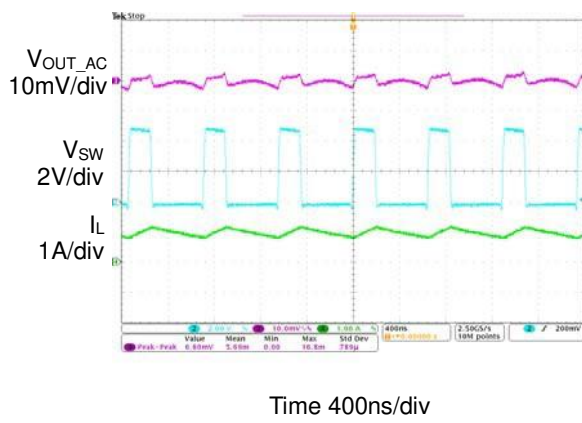


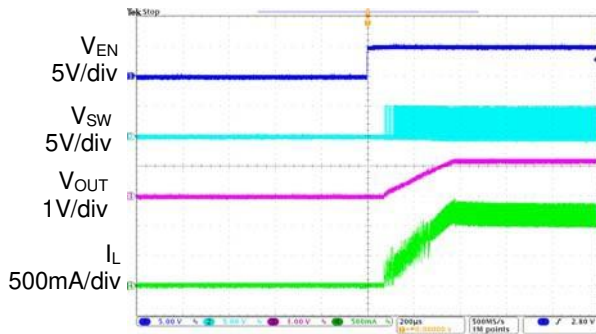
Figure 7. Output Ripple ( $I_{OUT}=1.2A$ )

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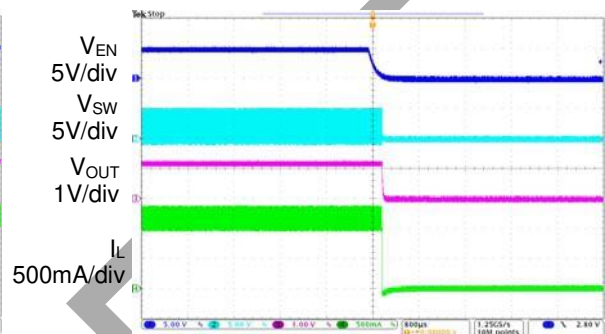
**Typical Performance Characteristics (Continued)**

$V_{IN}=5V$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.



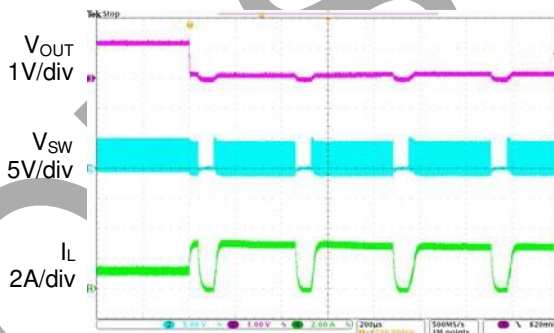
Time 200µs/div

Figure 8. Enable Turn On ( $I_{OUT}=1.2A$ )



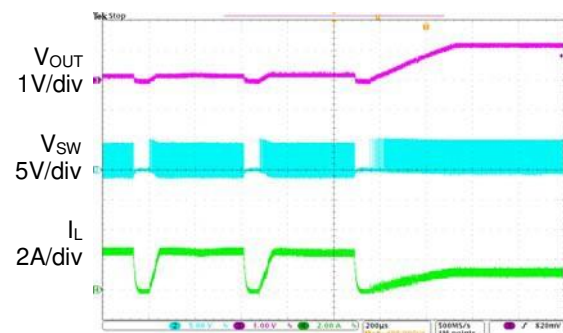
Time 800µs/div

Figure 9. Enable Turn Off ( $I_{OUT}=1.2A$ )



Time 200µs/div

Figure 10. Short Circuit Protection ( $I_{OUT}=1.2A$ )



Time 200µs/div

Figure 11. Short Circuit Protection Recovery ( $I_{OUT}=1.2A$ )



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**Typical Application**

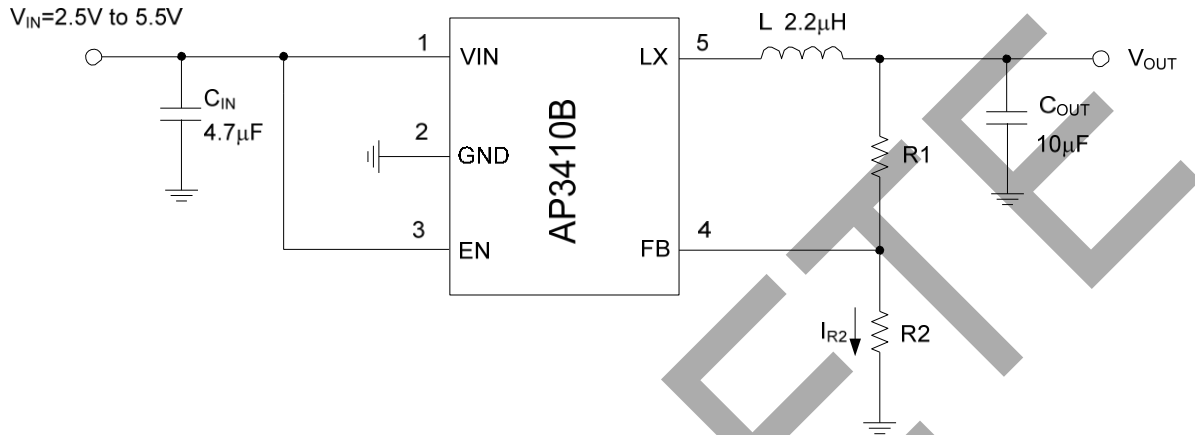


Figure 12. Typical Application of AP3410B

**Table 1. Component Guide**

V <sub>OUT</sub> (V)	R1 (kΩ)	R2 (kΩ)	L (µH)
3.3	450	100	2.2
2.5	320	100	2.2
1.8	200	100	2.2
1.2	100	100	2.2
1.0	66	100	2.2

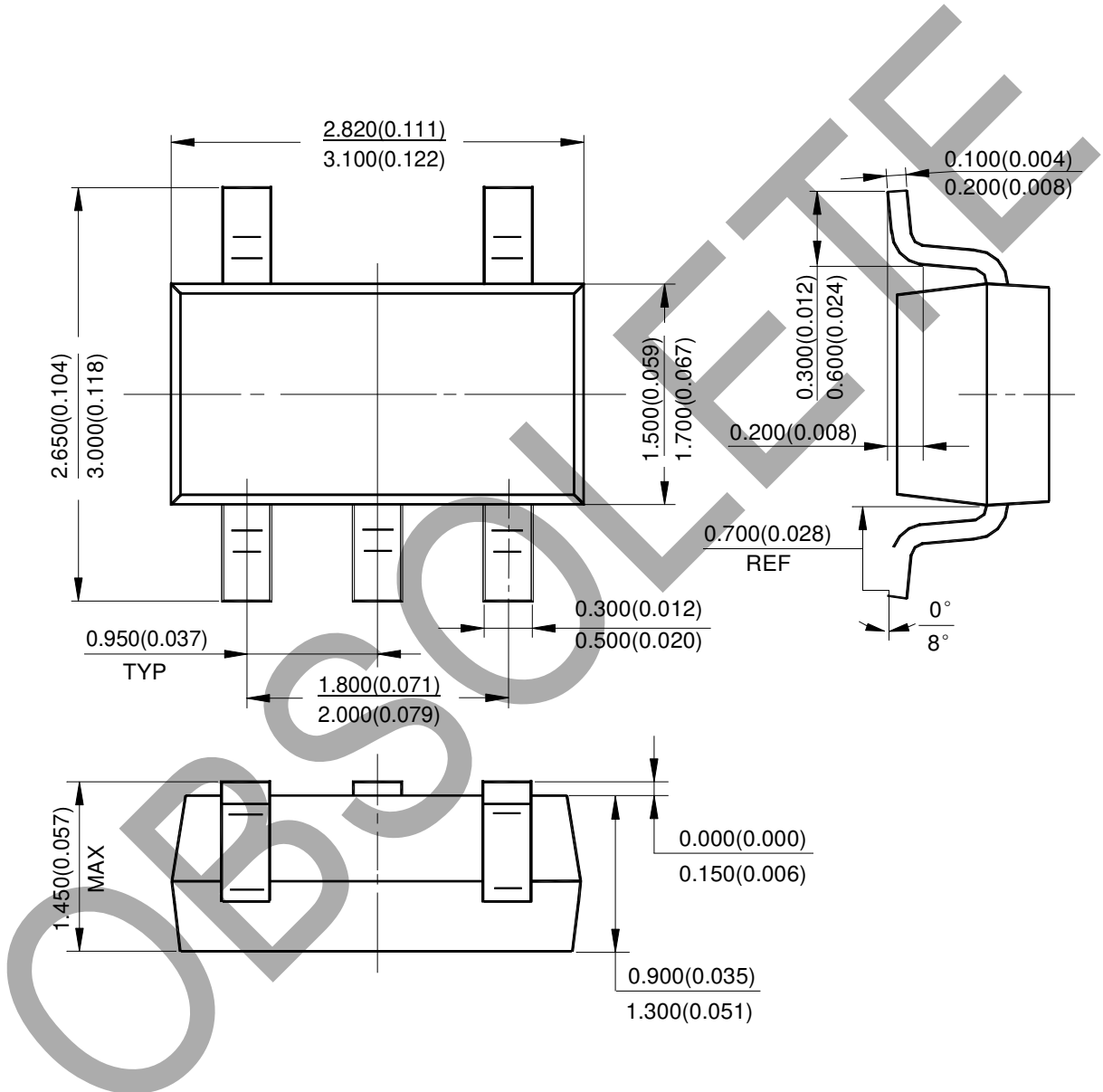
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**Mechanical Dimensions**

**SOT-23-5**

**Unit: mm(inch)**



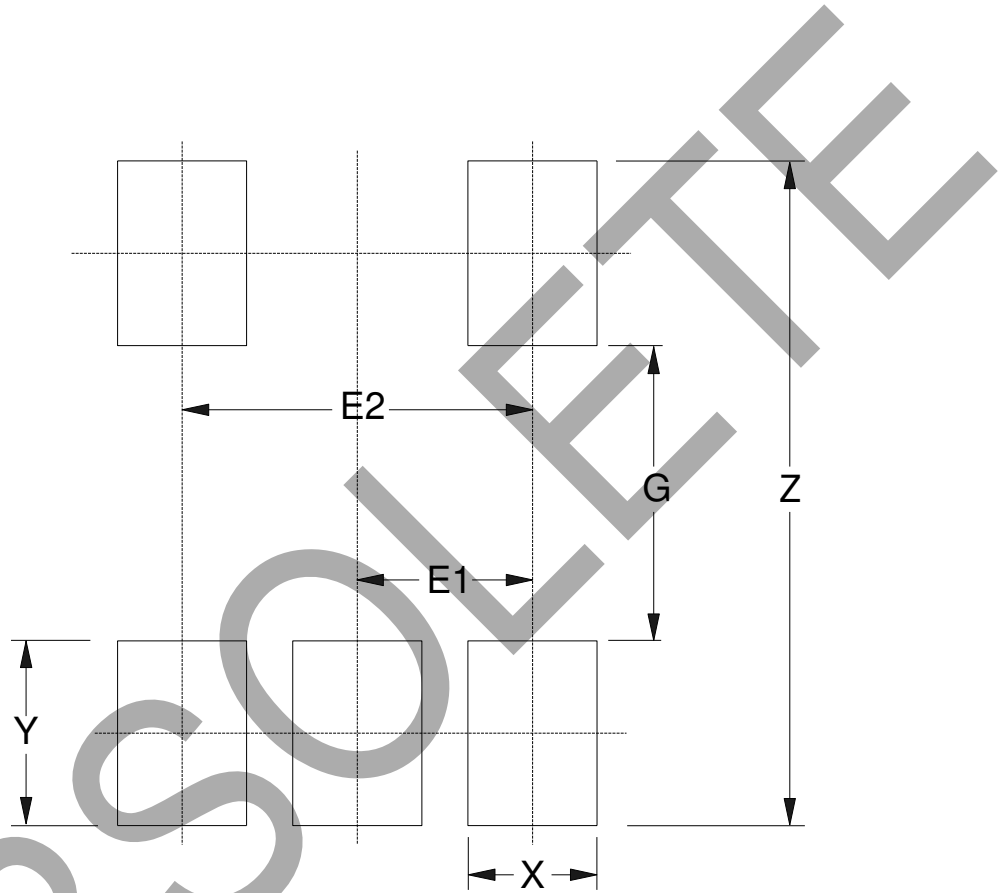
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**Mounting Pad Layout**

**SOT-23-5**



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

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