1.2A, 1.4MHZ HIGH EFFICIENCY SYNCHRONOUS DC-DC BUCK CONVERTER

Description

The AP3407/A is a 1.4MHz fixed frequency, current mode, PWM synchronous buck (step-down) DC-DC converter, capable of driving a 1.2A load with high efficiency, excellent line and load regulation. The device integrates synchronous P-channel and N-channel power MOSFET switches with low on-resistance. It is ideal for powering portable equipment that runs from a single Li-ion battery.

A standard series of inductors are available from several different manufacturers optimized for use with the AP3407/A. This feature greatly simplifies the design of switch-mode power supplies.

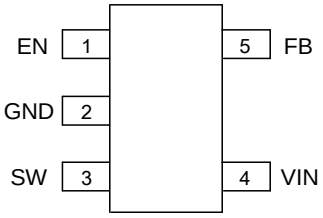
The AP3407/A is available in SOT-23-5.

Features

- Input Voltage Range: 2.5V to 5.5V
- Output Voltage: 0.6V to V_{IN}
- ADJ Output
- Fixed 1.4MHz Frequency
- High Efficiency up to 95%
- Output Current: 1.2A
- Current Mode Control
- 100% Duty Cycle in Dropout
- Built-in Over Current Protection
- Built-in Short Circuit Protection
- Built-in Thermal Shutdown Protection
- Built-in UVLO Function
- Built-in Soft-start
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

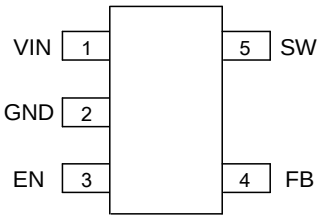
Pin Assignments

(Top View)



SOT-23-5 for AP3407

(Top View)



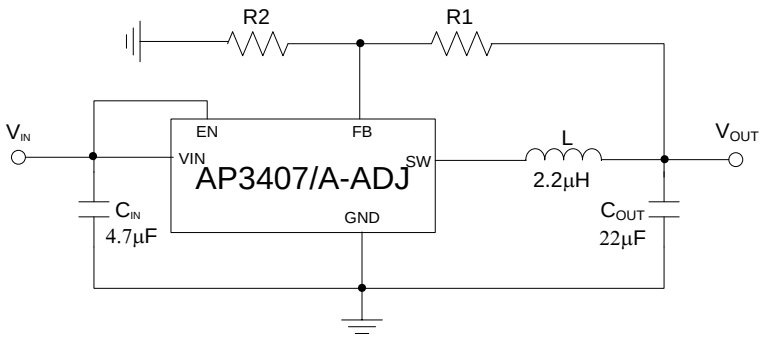
SOT-23-5 for AP3407A

Applications

- Datacom
- Portable Device
- Smart Phone

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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.

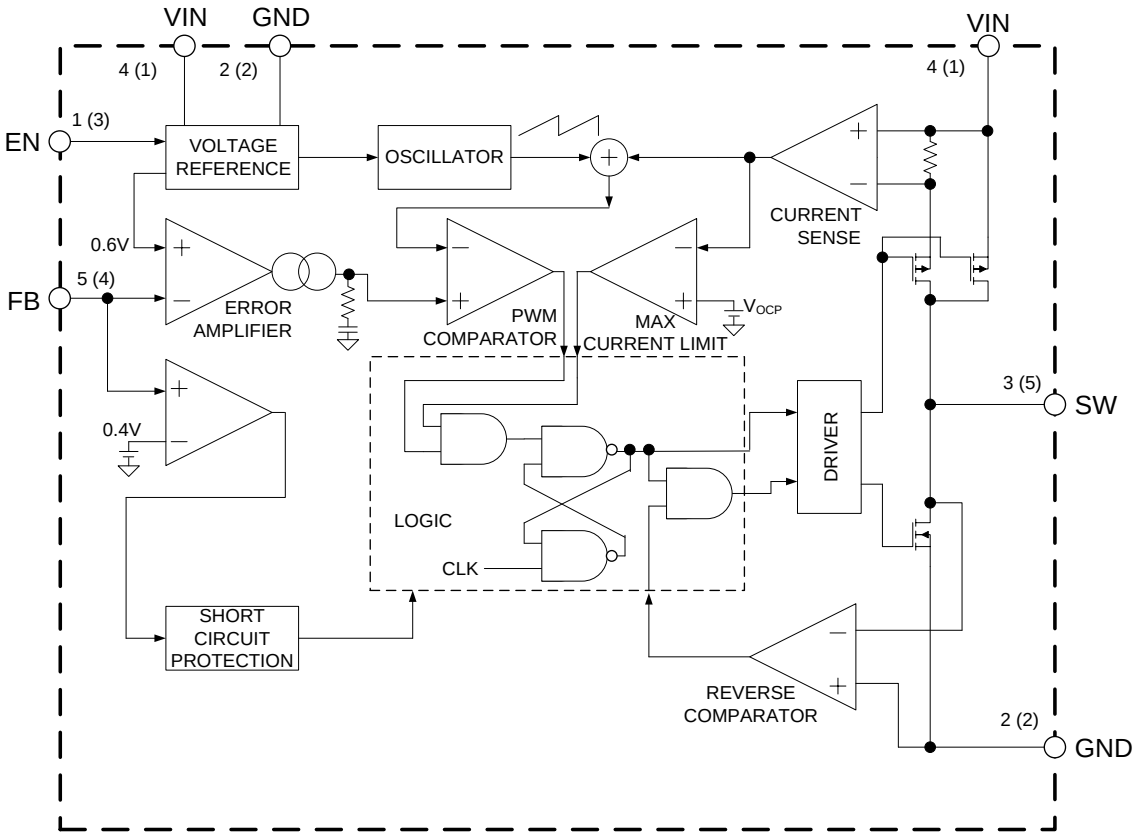
Typical Applications Circuit



Pin Descriptions

Pin Number		Pin Name	Function
AP3407	AP3407A		
1	3	EN	Control input pin. Forcing this pin above 1.5V enables the IC. Forcing this pin below 0.4V shuts down the IC. When the IC is in shutdown mode, all functions are disabled to decrease the supply current below 1.2A
2	2	GND	Ground pin
3	5	SW	Power switch output pin. Inductor connection to drain of the internal PFET and NFET switches
4	1	VIN	Supply input pin. Bypass to GND with a 4.7μF or greater ceramic capacitor
5	4	FB	This is the feedback pin of the device. Connect this pin directly to the output if the fixed output voltage version is used. For the adjustable version an external resistor divider is connected to this pin.

Functional Block Diagram



A (B)
A for AP3407
B for AP3407A

Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating	Unit
V_{IN}	Input Voltage	-0.3 to 6.0	V
V_{FB}	Feedback Voltage	-0.3 to V_{IN} +0.3	V
V_{EN}	EN Pin Voltage	-0.3 to V_{IN}+0.3	V
V_{SW}	SW Pin Voltage	-0.3 to V_{IN}+0.3 (Note 6)	V
θ_{JA}	Thermal Resistance (Junction to Ambient)	265	°C/W
θ_{JC}	Thermal Resistance (Junction to Case)	60	°C/W
P_D	Power Dissipation	0.377	W
T_J	Operating Junction Temperature (Note 5)	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260	°C

Notes:
4. 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.
5. The junction temperature rise is given by $T_{RISING} = P_D*\theta_{JA}$, where P_D is the power dissipated by regulator, θ_{JA} is the thermal resistance from junction of the die to the ambient temperature; The junction temperature, T_J is given by $T_J = T_A+T_R$, where T_A is the ambient temperature.
6. DC voltage rating, for short period of spike voltage, the minimum voltage rating is -1V, in 20nS.

Recommended Operating Conditions

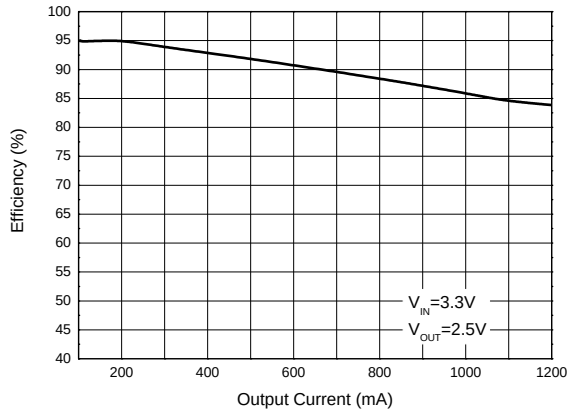
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	2.5	5.5	V
$I_{OUT (MAX)}$	Maximum Output Current	1.2	–	A
T_A	Operating Ambient Temperature	-40	+85	ºC

Electrical Characteristics (@V_{IN} = V_{DD} = V_{PVDD} = 3.3V, T_A = +25°C, unless otherwise specified.)

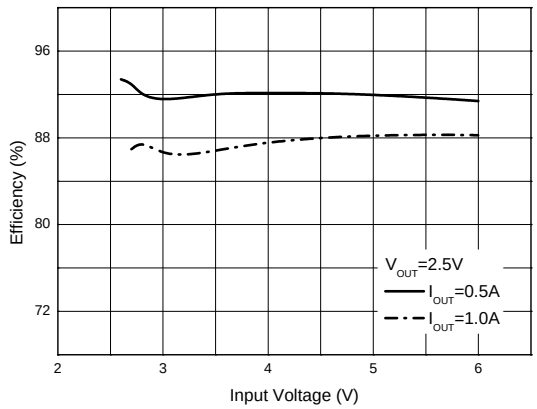
Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage	–	2.5	–	5.5	V
I_Q	Quiescent Current	V_{FB} = 0.65V	–	62	100	μA
I_{STBY}	Shutdown Supply Current	V_{EN} = GND	–	0.1	1	μA
V_{REF}	Reference Voltage	For Adjustable Output Voltage	0.588	0.6	0.612	V
I_{FB}	Feedback Bias Current	V_{FB} = V_{IN}	-0.1	–	0.1	μA
ΔV_{OUT}	Output Voltage Accuracy	–	-2		2	%
$R_{DS(ON)\_P}$	PMOSFET R_{ON}	I_{SW} = 200mA	–	0.28	–	Ω
$R_{DS(ON)\_N}$	NMOSFET R_{ON}	I_{SW} = -200mA	–	0.25	–	Ω
I_{LIM}	Switch Current Limit	V_{FB} = 0.55V	1.5	2.0	–	A
V_H	EN Pin Threshold	–	1.5	–	–	V
V_L		–	–	–	0.4	
V_{UVLO}	UVLO Threshold	V_{DD} Rising	–	2.3	–	V
V_{HYS}	UVLO Hysteresis	–	–	0.2	–	
f_{OSC}	Oscillator Frequency	–	1.12	1.40	1.68	MHz
D_{MAX}	Max. Duty Cycle	V_{FB} = 0V	100	–	–	%
D_{MIN}	Min. Duty Cycle	V_{FB} = 6.5V	–	–	0	
–	N-MOS SW Leakage Current	V_{IN} = 3.3V, V_{SW} = 3.3V	–	0.1	–	μA
t	Soft-start Time	–	–	1	–	ms
T_{OTSD}	Thermal Shutdown	–	–	+160	–	ºC
T_{HYS}	Thermal Shutdown Hysteresis	–	–	+20	–	ºC

Performance Characteristics

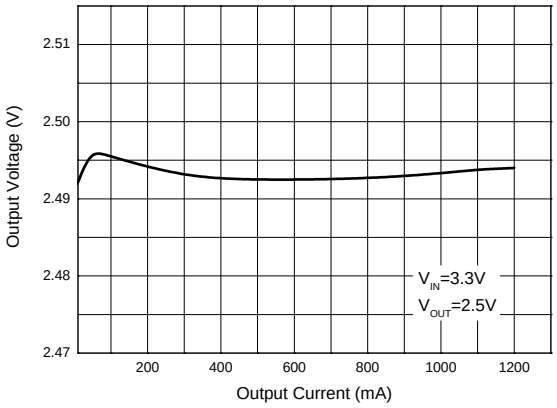
Efficiency vs. Output Current



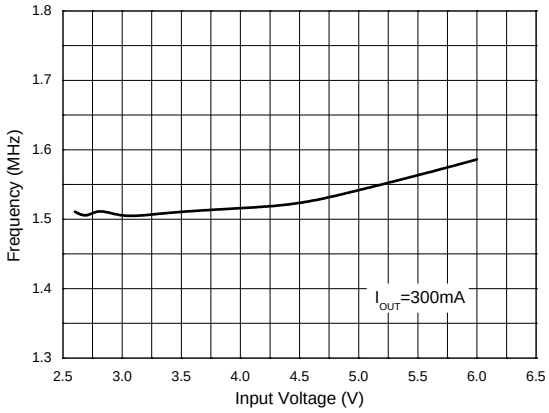
Efficiency vs. Input Voltage



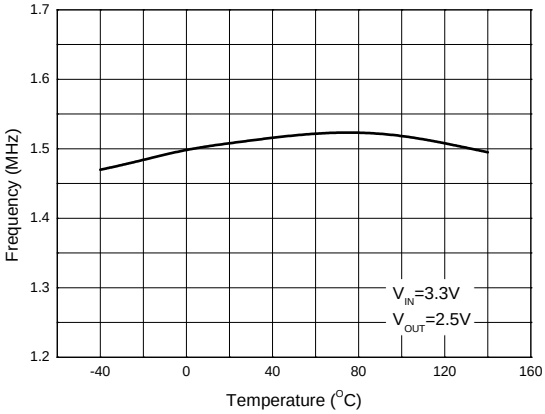
Output Voltage vs. Output Current



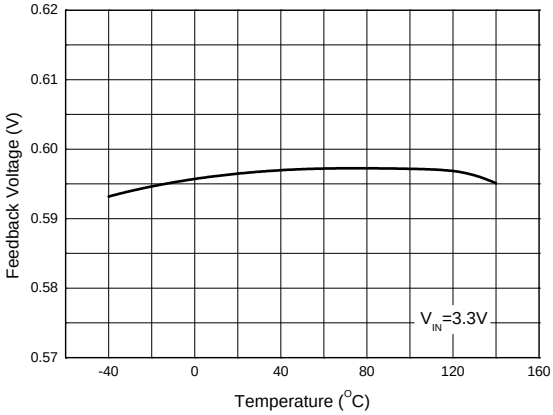
Frequency vs. Input Voltage



Frequency vs. Temperature

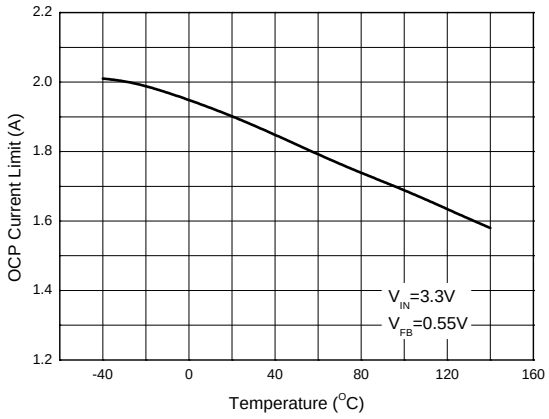


Feedback Voltage vs. Temperature

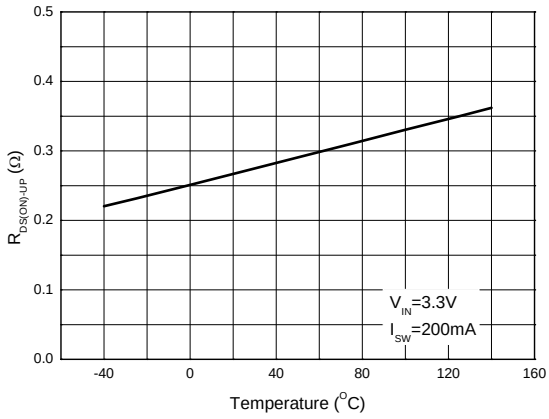


Performance Characteristics (Cont.)

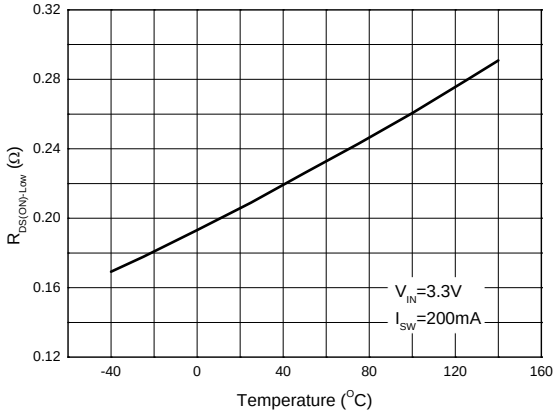
OCP Current Limit vs. Temperature



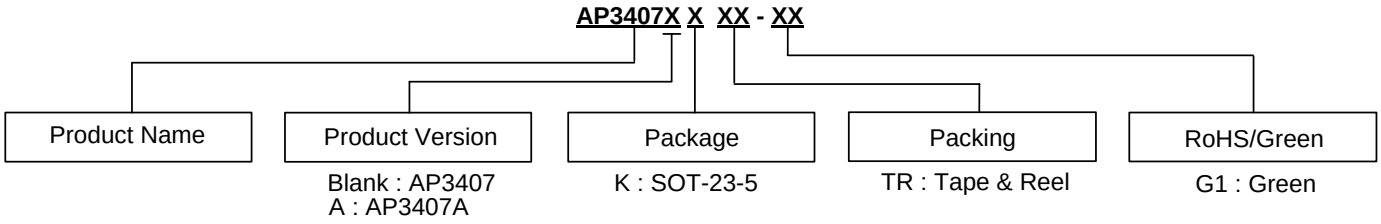
$R_{DS(ON)\_UP}$ vs. Temperature



$R_{DS(ON)\_LOW}$ vs. Temperature



Ordering Information

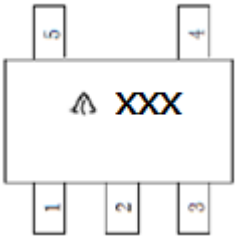


Package	Temperature Range	Part Number	Marking ID	Packing
SOT-23-5	-40 to +85ºC	AP3407KTR-G1	GJA	3000/Tape & Reel
		AP3407AKTR-G1	GJB	3000/Tape & Reel

Marking Information

SOT-23-5

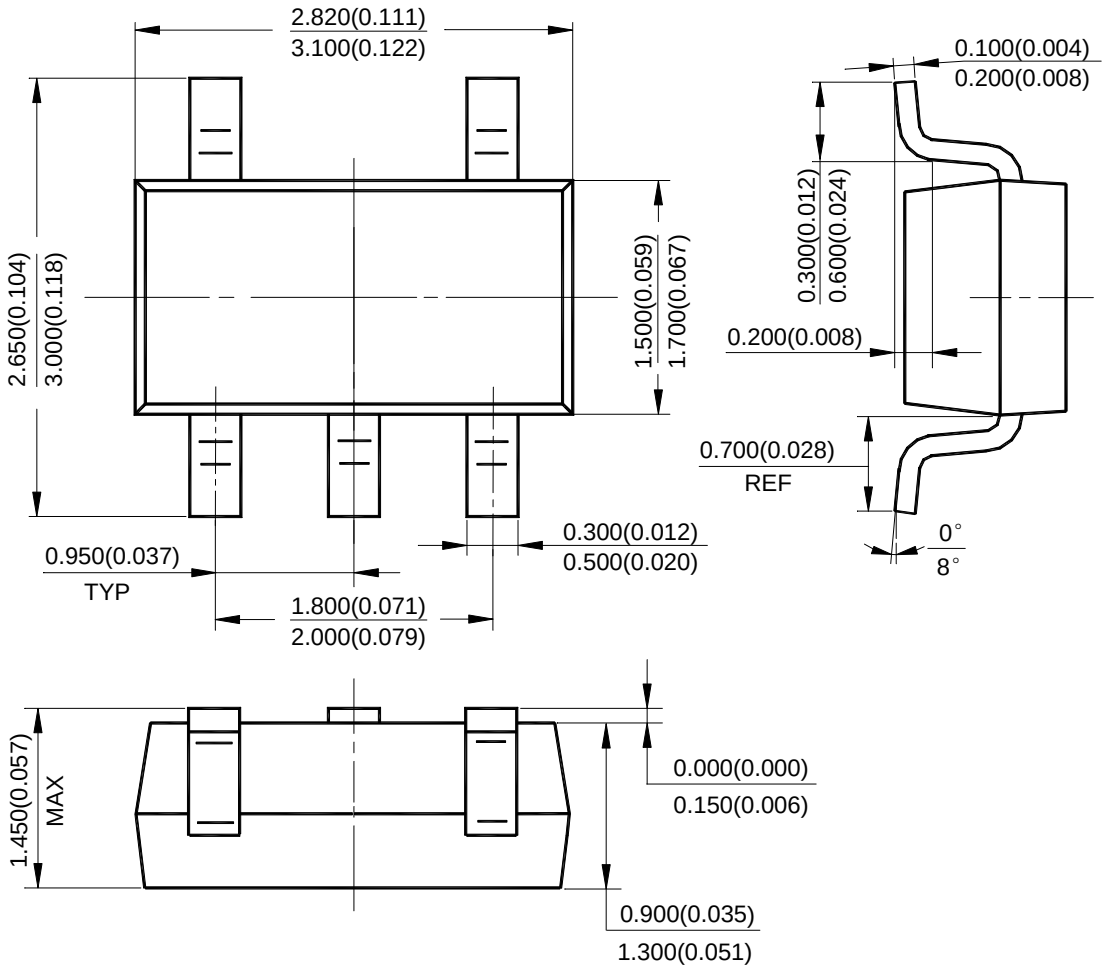
(Top View)



First Line: Logo and Marking ID
(See Ordering Information)

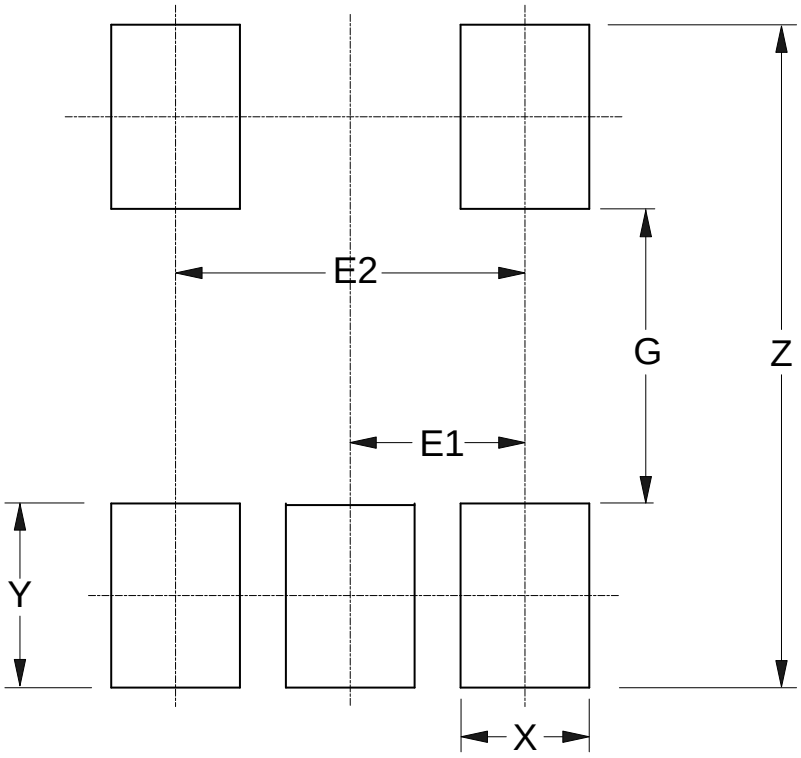
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT-23-5



Suggested Pad Layout

(1) Package Type: 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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