HM1450

0.2A Synchronous Step-Down DC/DC Converter

GENERAL DESCRIPTION

The HM1450 Series synchronous buck converter is a high frequency step-down voltage regulator with COT mode. It can output continuous 200mA with excellent line and load regulation. The quiescent current is only 290nA and less than 100nA at shutdown. This device is the ideally solution for small space and board level power supply application.

This device integrates PWM controller, power switch and compensation network, required only three components to implement a switching power supply. It has internal quasi 1MHz frequency and makes application circuit smaller.

The HM1450 Series is available in fixed output voltage version 1.2V /1.5V/ 1.8V /2.1V /2.5V /2.8V /3.0V /3.3V, The HM1450-series products are available in DFN2*2-8 and SOT23-6 package.

FEATURES

- 290nA Quiescent Current
- 200mA Continuous Output Capability
- High Efficiency up to 92%
- 2.7V to 5.5V Input Range
- Various optional output voltages
- Required Only 3 External Components
- 1MHz Frequency Operation
- Under Voltage Lockout, Over Current, Short Current, and Thermal Protection
- Operating Temperature: -40°C to +85°C
- Available in tiny DFN2*2-8 and SOT23-6 Package
- ESD-HBM 8KV

APPLICATIONS

Ultra-Low Power Applications
2-Cell and 3-Cell Alkaline-Powered Applications
Energy Harvesting
Solar Chargers
Thermal Electric Generator (TEG) Harvesting
Wireless Sensor Networks (WSN)
Low-Power Wireless Monitoring
Environmental Monitoring
Bridge and Structural Health Monitoring (SHM)
Smart Building Controls
Portable and Wearable Health Devices

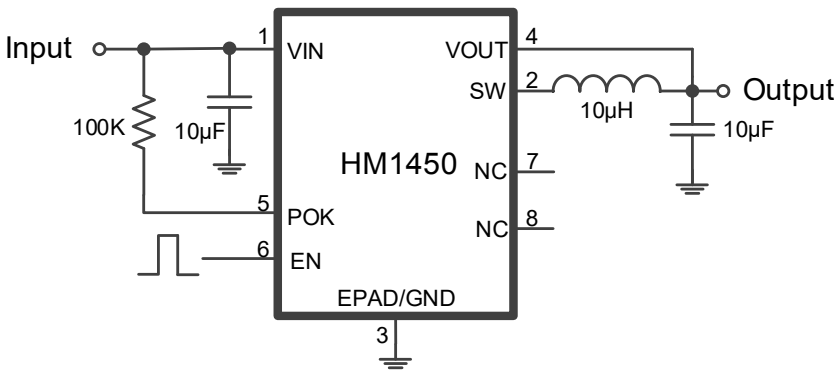


Figure 1. Typical Application Circuit

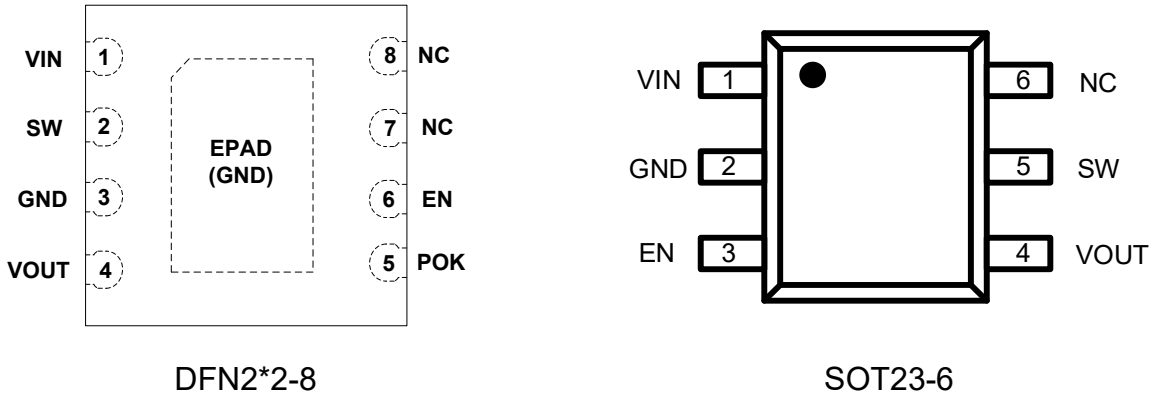
ORDERING INFORMATION

PART NUMBER	OUTPUT VOLTAGE(V)	PACKAGE	TOP MARK
HM1450D12	1.2	DFN2*2-8	M5021 R12YW
HM1450D15	1.5	DFN2*2-8	M5021 R15YW
HM1450D18	1.8	DFN2*2-8	M5021 R18YW
HM1450D21	2.1	DFN2*2-8	M5021 R21YW
HM1450D25	2.5	DFN2*2-8	M5021 R25YW
HM1450D28	2.8	DFN2*2-8	M5021 R28YW
HM1450D30	3.0	DFN2*2-8	M5021 R30YW
HM1450D33	3.3	DFN2*2-8	M5021 R33YW

PART NUMBER	OUTPUT VOLTAGE(V)	PACKAGE	TOP MARK
HM1450N12	1.2	SOT23-6	M5021 N12YW
HM1450N15	1.5	SOT23-6	M5021 N15YW
HM1450N18	1.8	SOT23-6	M5021 N18YW
HM1450N21	2.1	SOT23-6	M5021 N21YW
HM1450N25	2.5	SOT23-6	M5021 N25YW
HM1450N28	2.8	SOT23-6	M5021 N28YW
HM1450N30	3.0	SOT23-6	M5021 N30YW
HM1450N33	3.3	SOT23-6	M5021 N33YW

Note: “YW” is manufacture date code, “Y” means the year, “W” means the week.

PIN CONFIGURATION



TOP View

Figure 2. PIN Configuration

PIN DESCRIPTION

HM1450 Pin NUMBER		Pin Name	Pin Description
DFN2*2-8	SOT23-6		
1	1	VIN	Power Input. VIN supplies the power to the IC, as well as the step-down converter switches. Driver VIN with a 2.5 to 5.5V power source. Bypass VIN to GND with a suitably large capacitor to eliminate noise on the input to the IC
2	5	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load
3	2	GND	Ground
4	4	VOUT	Power Output
5	/	POK	Open-Drain Charge Status Output. Power good status indicated.
6	3	EN	Enable Input. EN is a digital input that turns the regulator on or off. Drive EN high to turn on the regulator, driver it low to turn it off.
7	6	NC	No Connect
8	/	NC	No Connect

ABSOLUTE MAXIMUM RATINGS

(NOTE: DO NOT EXCEED THESE LIMITS TO PREVENT DAMAGE TO THE DEVICE. EXPOSURE TO ABSOLUTE MAXIMUM RATING CONDITIONS FOR LONG PERIODS MAY AFFECT DEVICE RELIABILITY.)

PARAMETER	VALUE	UNIT
Supply Voltage VIN	-0.3 to 7	V
EN Voltage	-0.3 to VIN+0.3	V
SW Voltage	-0.3 to VIN+0.3	V
Operating Ambient Temperature	-40 to 85	°C
Maximum Junction Temperature	125	°C
Storage Temperature	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)	300	°C

ELECTRICAL CHARACTERISTICS

(V_{IN} = 5V, T_A= 25°C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range	V_{IN}		2.7		5.5	V
Input under voltage protection	V_{UVLO}	V_{IN} falling			2.6	V
Operating Supply Current	I_{SUPPLY}	V_{FB} =0.7V or V_{OUT} =110%, I_{Load} =0		0.29	1	μA
Shutdown Supply Current		V_{EN} =0V, V_{IN} =4.2V			0.1	
Minimum Off Time	T_{OFF_MIN}			150		ns
Reference Voltage Line Regulation		V_{IN} =3 V to 5.5V		0.04	0.4	%
Regulated Output Voltage	V_{OUT}	V_{OUT} =2.5V; I_{OUT} =100mA	V_{OUT}* 99%		V_{OUT}* 101%	V
Output Voltage Load Regulation	V_{OUT}	I_{OUT} =0~200mA		0.5		%
Peak Inductor Current	I_{PEAK}	V_{FB} =0.5V or V_{OUT} =90%, Duty Cycle<35%		0.4		A
Oscillator Frequency	F_{OSC}	V_{FB}=0.6V or V_{OUT} =100%	0.8	1	1.2	MHz
Rds(ON) of P-channel FET		I_{SW} =100mA		0.6		Ohm
Rds(ON) of N-channel FET		I_{SW} =100mA		0.4		Ohm
Voltage of EN Low Disable		V_{IN} = 3V to 5.5V			0.3	V
Voltage of EN High Enable		V_{IN} = 3V to 5.5V	1.5			V
Enable Leakage Current			-0.1		0.1	μA
SW Leakage Current		V_{EN} = 0V, V_{SW} = 0V or 5V	-1		1	μA
Power OK output	V_{pokl}		V_{OUT}* 85%		V_{OUT}* 95%	V

Note1: Please find out V_{out} voltage from order information according to IC part number.

FUNCTIONAL BLOCK DIAGRAM

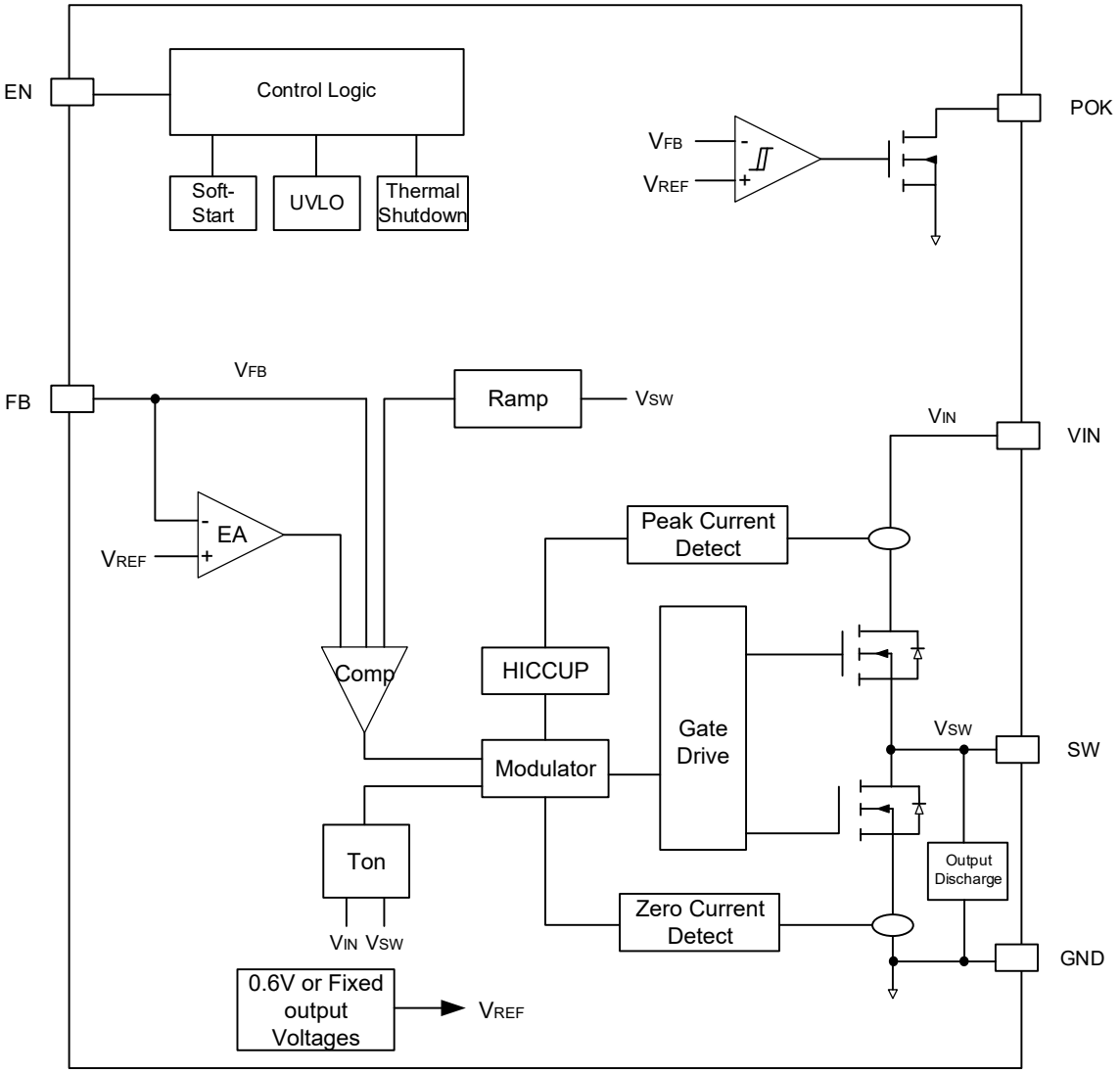


Figure 3. Functional Block Diagram

FUNCTIONAL DESCRIPTION

NORMAL OPERATION

In normal operation the high-side MOSFET turns on each cycle and remains on until the current comparator turns it off. At this point the low-side MOSFET turns on and remains on until either the end of the switching cycle or until the inductor current approaches zero. The error amplifier adjusts the current comparator's threshold as necessary in order to ensure that the output remains in regulation.

APPLICATION INFORMATION

INDUCTOR SELECTION

In normal operation, the inductor maintain-ns continuous current to the output. The inductor current has a ripple that is depend-ent on the inductance value. The high indu-ctance reduces the ripple current. In gener-al, select the inductance by the following equation:

$$L = \frac{V\text{out} \bullet (V\text{in} - V\text{out})}{V\text{in} \bullet f \bullet \Delta I}$$

Where V_{OUT} is the output voltage, V_{IN} is the input voltage, f is the switch frequency, and ΔI is the peak-to-peak inductor ripple current. Typically, choose ΔI as the 30% of the maximum output current.

Manufac-turer	Part Number	Induct-ance(uH)	DC Re-sistance @20°C (mΩ)	Dimen-sions L*W*H (mm3)
WURTH	74404032 100	10	230	3*3*1.5
Sunlord	WPN3012 H100MT	10	395 ~474	3*3*1.2

Table1. Recommend Surface Mount Inductors

INPUT CAPACITOR SELECTION

The input capacitor reduces input voltage ripple to the converter, low ESR ceramic capacitor is highly recommended. For most applications, a 10uF capacitor is used. The input capacitor should be placed as close as possible to V_{IN} and GND.

OUTPUT CAPACITOR SELECTION

A low ESR output capacitor is required in order to maintain low output voltage ripple. In the case of ceramic output capacitors, capacitor ESR is very small and does not contribute to the ripple, so a lower capacitance value is acceptable when ceramic capacitors are used. A 10uF ceramic output capacitor is suitable for most applications.

OVERCURRENT OPERATION

The part has internal current limit function, which is detected cycle by cycle. When it-s maximum inductor current limit is reache-d the charging cycle is terminated, and the low-side MOSFET is turned on to allow the inductor current to decrease. Under extreme overloads, such as short-circuit conditions, it reduces the oscillator frequency to 220 KHz to allow further inductor current reduction and to minimize power dissipation.

LAYOUT SUGGESTION

The several guidelines should be followed when doing the PCB layout.

(1)The input and output capacitors should be placed very close to the device, to keep the loop resistance very low and the switching loop very small.

(2)All ground connection must be tied together. Use a broad ground plane to establish the lowest resistance possible between all connections.

(3)The switch node connection should be low resistance to reduce power losses.

(VIN=VEN=5V, L=10uH, CIN=10uF, COUT=10uF)

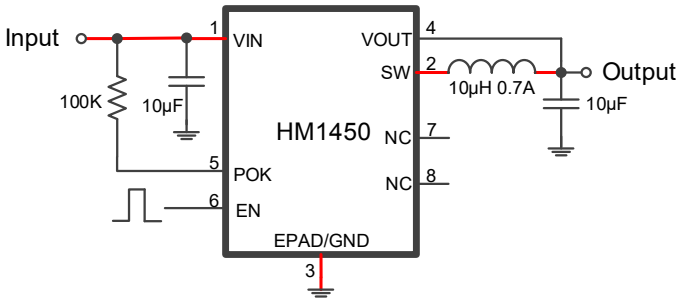
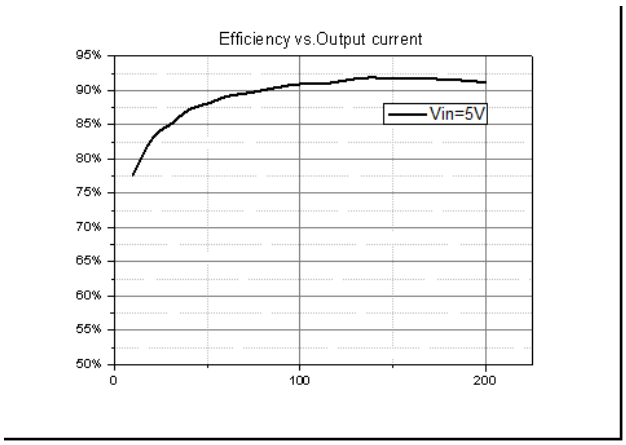
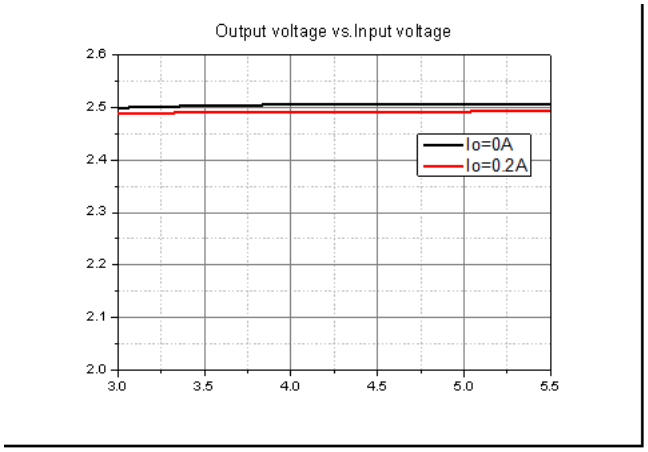


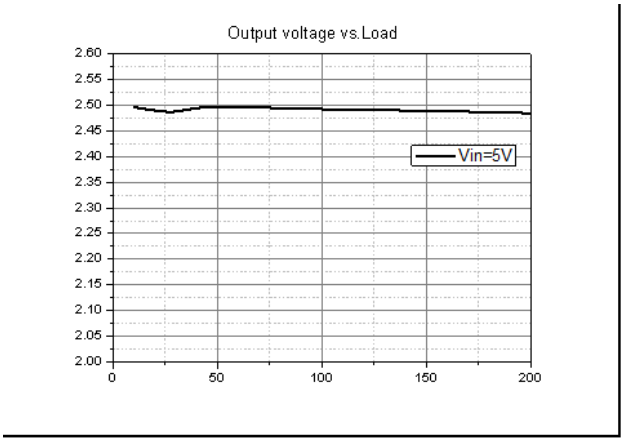
Figure 4. Typical Application Circuit

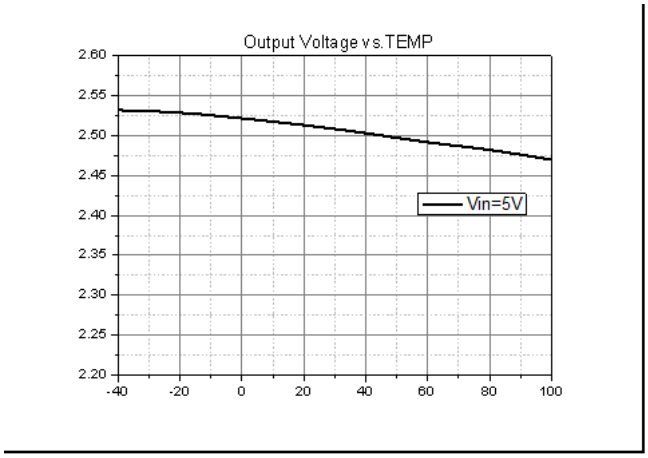
TYPICAL PERFORMANCE CHARACTERISTICS

(VIN=VEN=5V, L=10uH, CIN=10uF, COUT=10uF. if not mentioned)

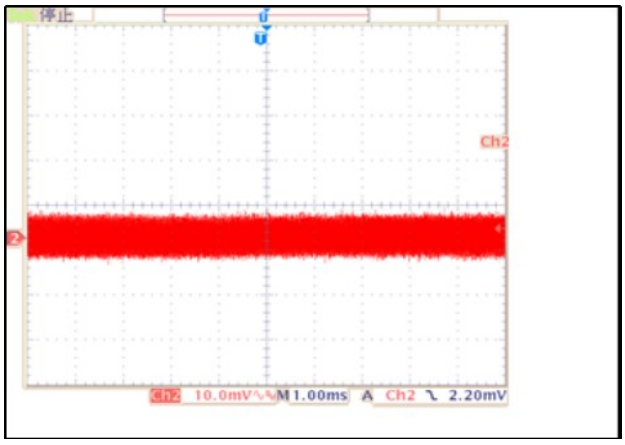




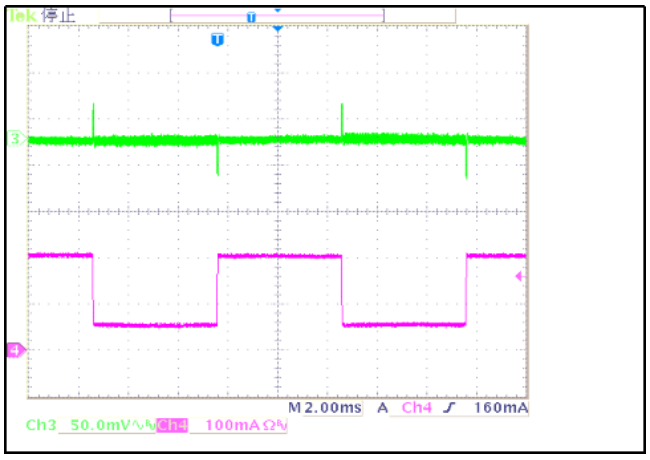




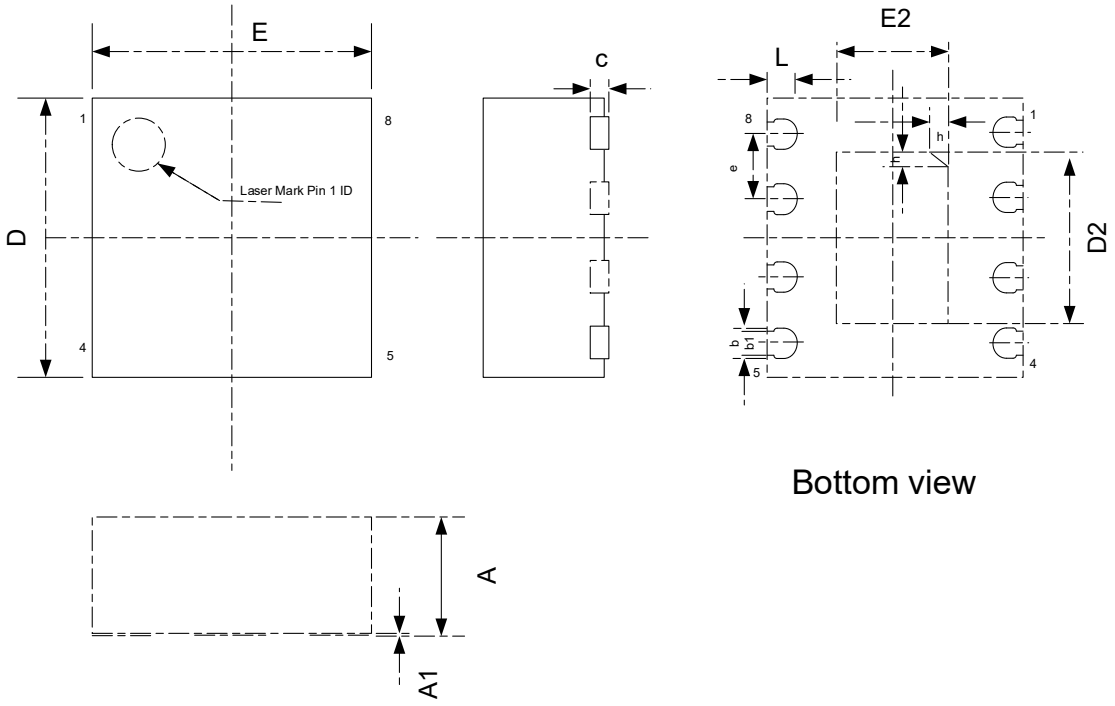
Ripple V_{IN}=5V, I_O=0.2A



Transient V_{out}=50mA~200mA

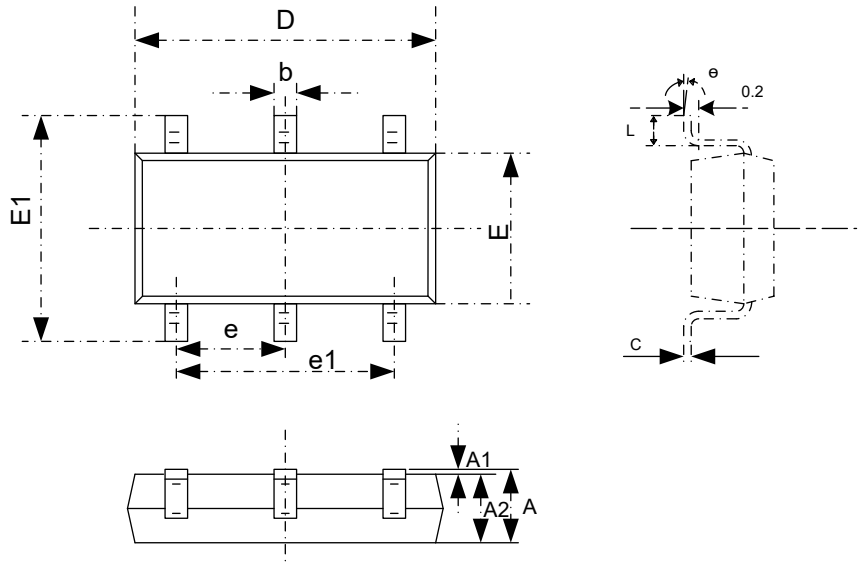


PACKAGE OUTLINE(DFN2x2-8)



Symbol	DIMENSIONS (mm)			Symbol	DIMENSIONS (mm)		
	MIN.	TYP.	MAX.		MIN.	TYP.	MAX.
A	0.70	0.75	0.80	e	0.50BSC		
A1	0.00	0.02	0.05	E	1.95	2.00	2.05
b	0.18	0.25	0.30	E2	0.65	0.70	0.75
b1	0.18(REF)			L	0.25	0.30	0.35
c	0.20(REF)			h	0.15	0.20	0.25
D	1.95	2.00	2.05		L/F size(mm):1.10*1.80		
D2	1.15	1.20	1.25				

PACKAGE OUTLINE(SOT23-6)



Symbol	Dimensions In Millimetres		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°