0.9V Startup,1.2μA IQ, Supper High Efficiency Synchronous Boost

DESCRIPTION

ETA1069 is a high efficiency synchronous step-up converter with ultra-low quiescent current down to 1.2μA. It is capable of delivering at least 3W of power from a low voltage source, i.e. 0.6A at 5V output. It also features a true-shutoff function that disconnects the input from output, during shutdown and output short-circuit conditions. This eliminates the need for an external MOSFET and its control circuitry to disconnect the input from output and provides robust output overload protection.

A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny and low profile inductors and ceramic capacitors. An internal synchronous MOSFET provides high efficiency and with a current mode control that is internally compensated, external parts count is reduced to minimal. With the ultra-low IQ feature, ETA1069 is ideal for solution that requires low standby power and compact board size such as IoT applications.

ETA1069 is available in a SOT23-6 ,DFN2x2-6 package

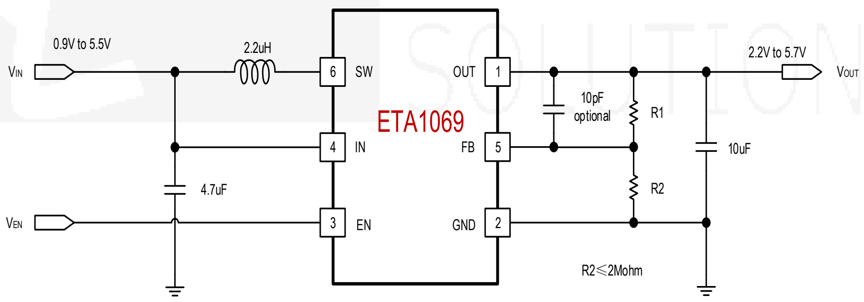
FEATURES

- Ultra-low IQ
  - 1.2uA for adjustable version
  - 1.25uA for fixed voltage version
- 0.9V Startup
- Output to Input Reversed Current Protection
- Up to 96% Efficiency
- Short-circuit Protection
- Adjustable version and Fixed voltage version
- SOT23-6 and DFN2x2-6 Package
- RoHS Compliant

APPLICATIONS

- Tablet, MID
- Smart Phone
- Battery Powered Systems
- Low Power Wireless Applications

TYPICAL APPLICATION

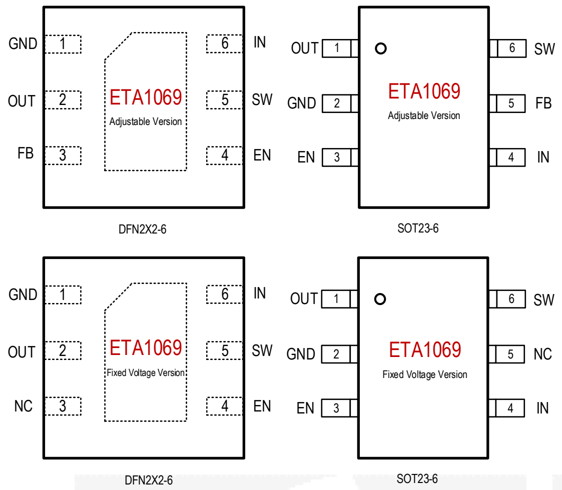


*For fixed voltage version,R1,R2 and 10pF are not needed and pin5 is NC.

ORDERING INFORMATION

PART No.	Version	PACKAGE	TOP MARK	Pcs/Reel
ETA1069S2G	Adjustable	SOT23-6	PBYW	3000
ETA1069V33S2G	Fixed 3.3V Output	SOT23-6	PLYW	3000
ETA1069V50S2G	Fixed 5.0V Output	SOT23-6	PVYW	3000
ETA1069D2G	Adjustable	DFN2x2-6	P6YW	3000
ETA1069V33D2G	Fixed 3.3V Output	DFN2x2-6	PiYW	3000
ETA1069V50D2G	Fixed 5.0V Output	DFN2x2-6	PwYW	3000

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

IN, OUT, SW, FB, EN pin Voltage..............................-0.3V to 6.5V

SW to ground current ....Internally limited

Operating Temperature Range ....–40°C to 85°C

Storage Temperature Range....................–55°C to 150°C

Thermal Resistance θ_{JA} θ_{JC}

SOT23-6..........................180..............90…….................°C/W

DFN2x2-6.........................80...............30….........................°C/W

Lead Temperature (Soldering 10sec) ....260°C

ESD HBM (Human Body Mode) 4KV

ESD CDM (Charged Device Mode) 1KV

ELECTRICAL CHARACTERISTICS

(V_{IN}=3.6V, V_{OUT} = 5V, unless otherwise specified. Typical values are at TA = 25°C.)

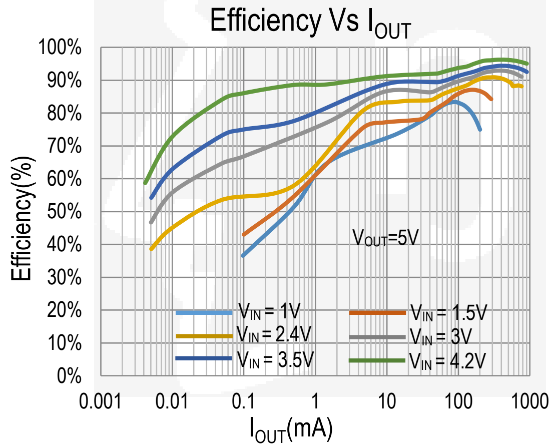
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Quiescent Current at OUT pin, adjustable version	V_{EN}=V_{IN}, No load, Not switching		1.2	2	μA
Quiescent Current at OUT pin, fixed voltage version	V_{EN}=V_{IN}, No load, Not switching		1.25	2.5	μA
Quiescent Current at IN pin, fixed 3.3V version	V_{EN}=V_{IN}=3.6V		2	3	uA
Shutdown Supply Current at IN pin	V_{EN} =GND		0.32		μA
Input Startup Voltage	I_{OUT}=1mA，Hysteresis=200mV		0.9		V
Input Operation Voltage	After Start-up	0.75		5.5	V
Output Voltage at 5V		4.85	5	5.15	V
Output Voltage at 3.3V		3.2	3.3	3.4	V
Min Output Voltage	V_{IN_MIN}=1V, I_{OUT_MAX}=10mA		2.2		V
Feedback Voltage		0.92	0.94	0.97	V
Switching Frequency			1		MHz
NMOS Switch On Resistance	I_{SW}=100mA		140		mΩ
PMOS Switch On Resistance	I_{SW}=100mA		120		mΩ
SW Leakage Current	V_{OUT}=5.2V,V_{EN}=GND,V_{SW}=5.2V or V_{SW}= 0V			3	μA
NMOS Switch Current Limit			1.6		A
Start-up Current Limit			0.7		A
Short Circuit Hiccup time	ON		2		ms
	OFF		42		ms
EN Input Current	V_{EN} = 5V or 0V	-1	0	1	μA
EN High Voltage	V_{OUT} = 5V	1.2			V
EN low Voltage	V_{OUT} = 5V			0.4	V
Thermal Shutdown	Rising, Hysteresis = 25°C		150		°C

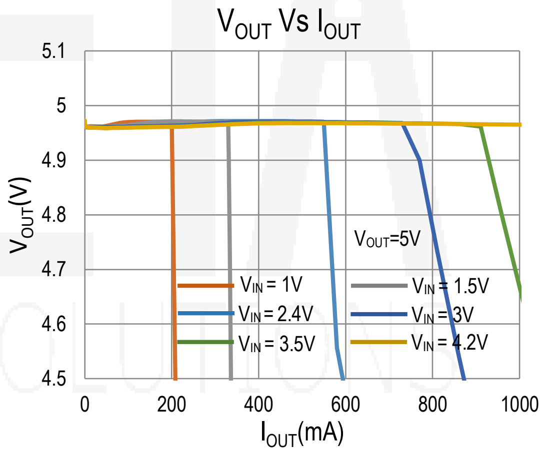
PIN DESCRIPTION

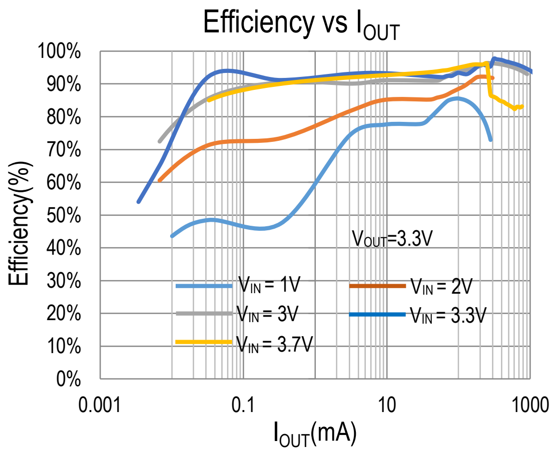
SOT23-6 PIN #	DFN2x2-6 PIN #	NAME	DESCRIPTION
1	2	OUT	Output Pin. Bypass with a 10μF or larger ceramic capacitor closely between this pin and GND
2	1	GND	Ground Pin
3	4	EN	Enable Pin for the IC. Drive this pin high to enable the part, low to disable.
4	6	IN	Input Supply Voltage pin. Bypass with a 4.7μF ceramic capacitor to GND
5	3	FB/NC	Feedback Input. Add an external resistor divider from the OUT to FB and GND to set V_{OUT} for adjustable output voltage. There is no FB pin for fixed voltage version. The pin is "Not Connected".
6	5	SW	Switch pin of converter. It is connected to the inductor.

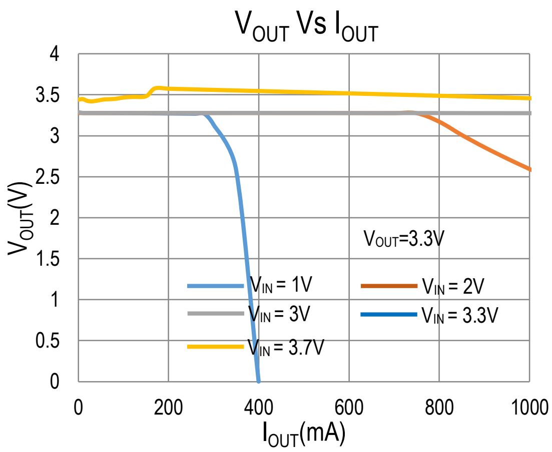
TYPICAL CHARACTERISTICS

(Typical values are at T_A = 25°C unless otherwise specified)







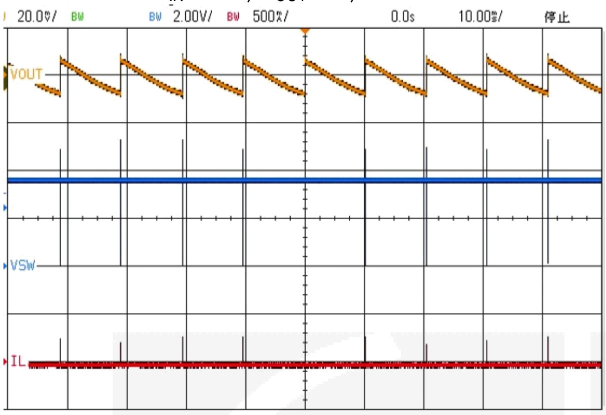


TYPICAL CHARACTERISTICS cont'd

(Typical values are at TA = 25℃unless otherwise specified)

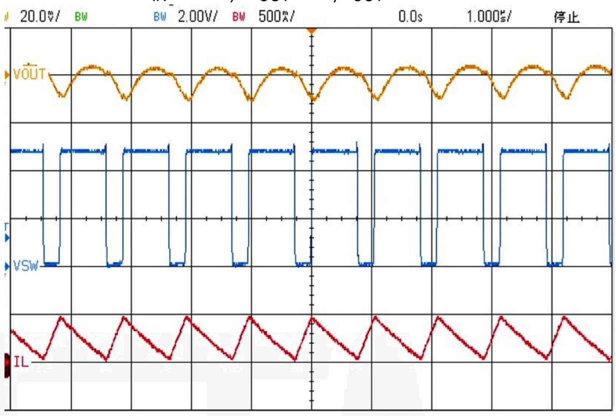
Output Waveform

V_{IN}=3.7V, V_{OUT}=5V, No load



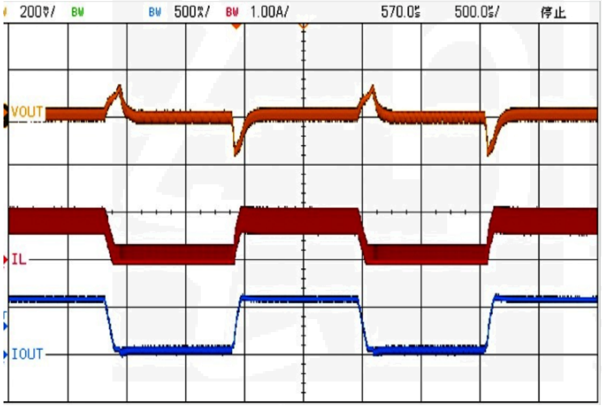
Output Waveform

V_{IN}=3.7V, V_{OUT}=5V, I_{OUT}=200mA



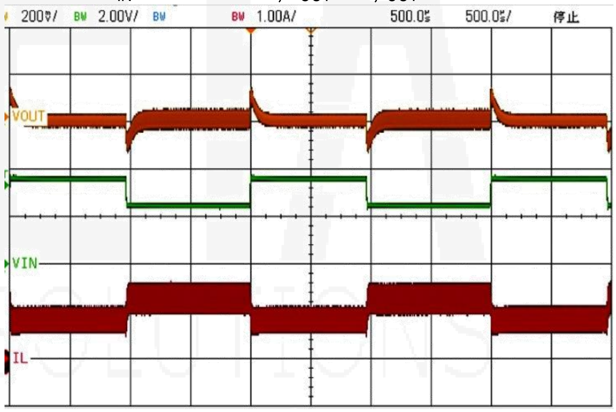
Load Transient

V_{IN}=3.7V,V_{OUT}=5V,I_{OUT}=60mA to 600mA



Line Transient

V_{IN}=2.4V to 3.7V,V_{OUT}=5V,I_{OUT}=600mA



APPLICATION INFORMATION

Loop Operation

ETA1069 is a high efficiency synchronous step-up converter with ultra-low quiescent current down to 1.2μA. It integrates a 140mΩ Low Side Main MOSFET and 120mΩ synchronous MOSFET. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

The peak current of the NMOS switch is also sensed to limit the maximum current flowing through the switch and the inductor. The typical peak current limit is set to 1.6A. An internal temperature sensor prevents the device from getting overheated in case of excessive power dissipation.

Ultra low current consumption at Light Load Operation

Traditionally, a fixed constant frequency PWM DC/DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite RDSONs of the MOSFETs and parasitic capacitances. At light load, switching loss is prominent and efficiency is therefore very low. ETA1069 employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power saving mode during light load and the no load quiescent current can be as low as 1.2μA.

Short-Circuit Protection

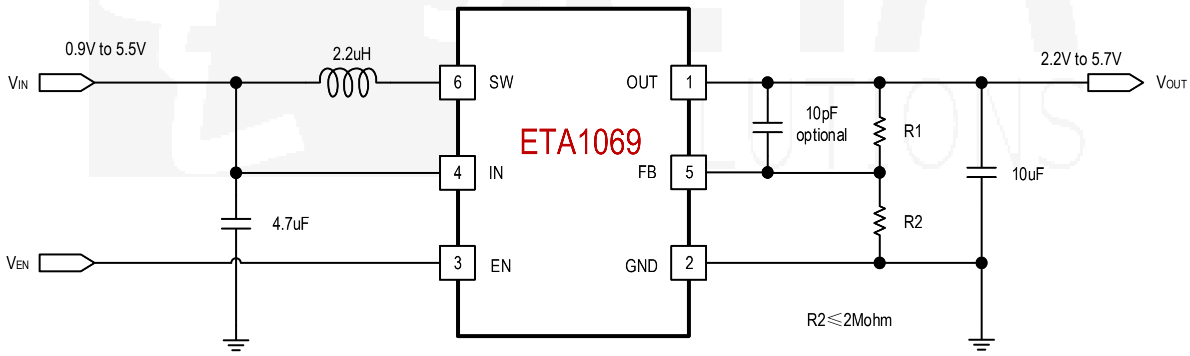
Unlike most step-up converters, the ETA1069 allows for short circuits on the output. In the event of a short circuit, the device first turns off the NMOS when the sensed current reaches the current limit. When OUT drops below IN, the device then enters a linear charge period with the current limited same as with the start-up period. In addition, the thermal shutdown circuits disable switching if the die temperature rises above 150°C.

Adjustable Output Voltage Setting with FB pin

By adding a resistor divider at FB pin (R1 and R2 as shown in the circuit below), ETA1069 can be set to any voltage level less than 5.7V at output node. The R2 is recommended to be 2Mohm or less, which will add about 0.5uA or more at output. The output voltage is set by following equation:

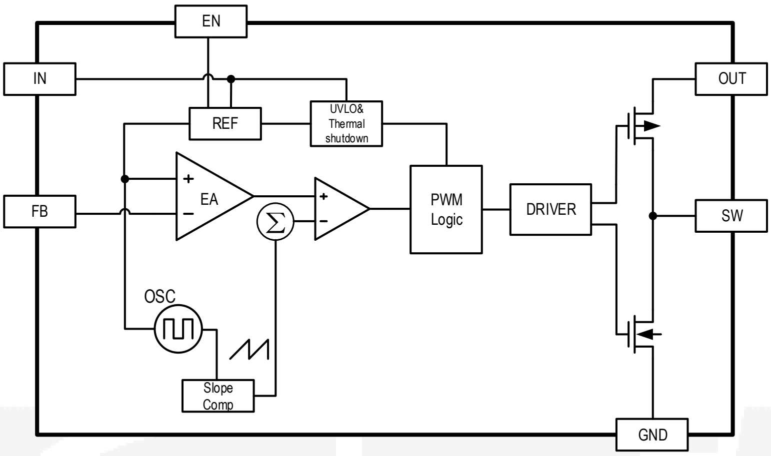
$$V_{OUT}=\frac{R1+R2}{R2}\times 0.94V$$

Application Circuit

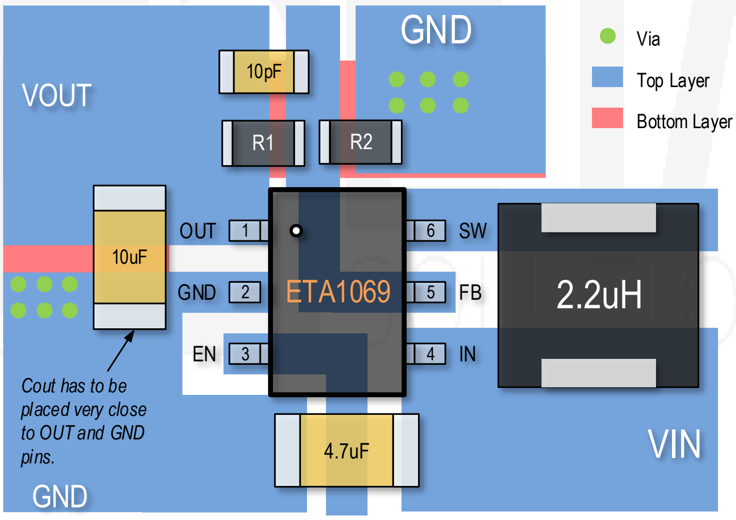


*For fixed voltage version,R1,R2 and 10pF are not needed and pin5 is NC.

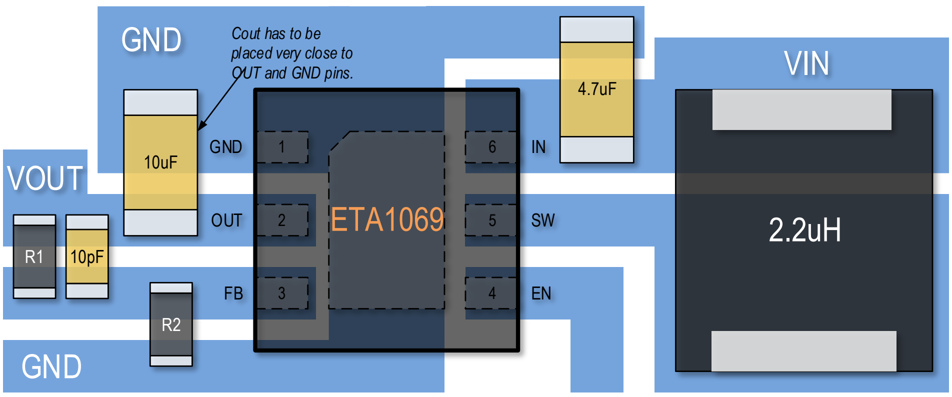
BLOCK DIAGRAM



PCB GUIDELINES



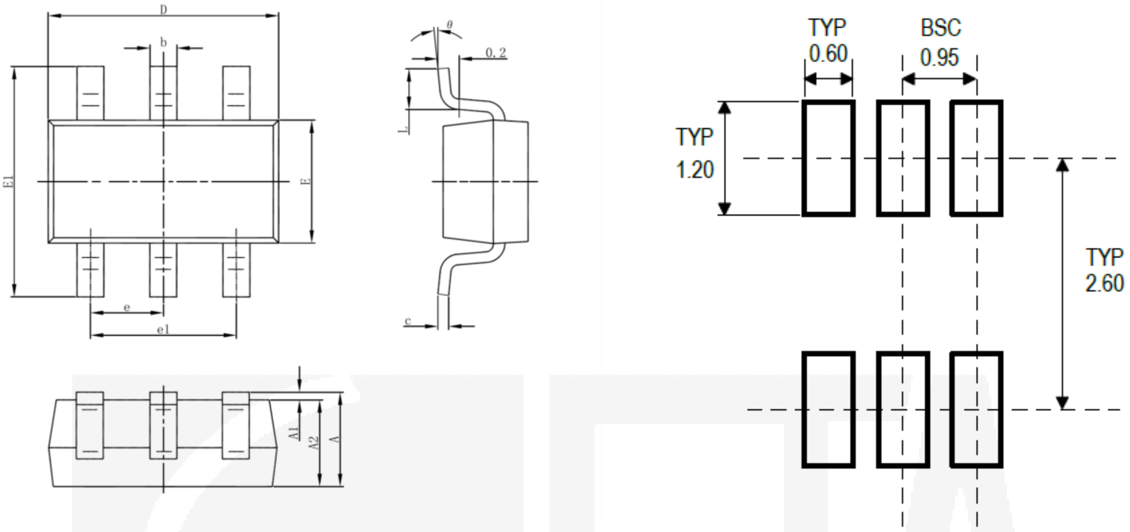
SOT23-6 package



DFN2x2-6 package

PACKAGE OUTLINE

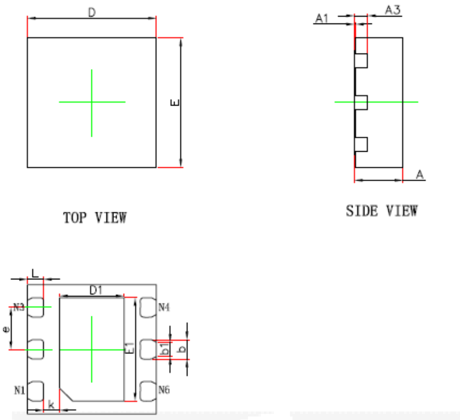
Package: SOT23-6



Symbol	Dimensions In Millimeters		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°

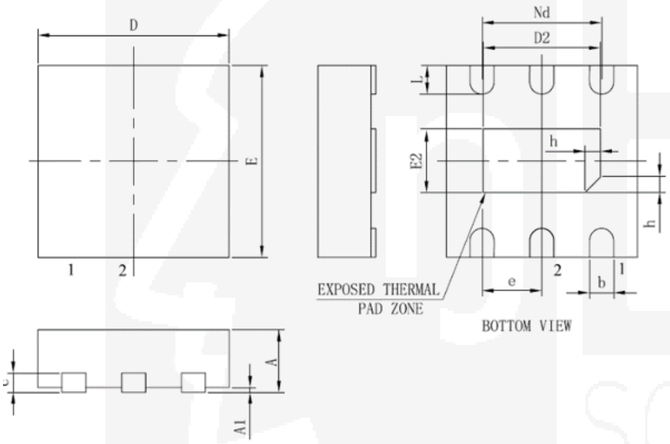
Package: DFN2x2-6

From assembly house 1：

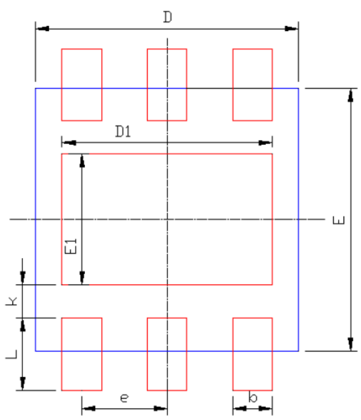


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	1.500	1.700	0.059	0.067
k	0.250 REF.		0.010REF.	
b	0.250	0.350	0.010	0.014
b1	0.220 REF.		0.009 REF.	
e	0.650BSC.		0.026BSC.	
L	0.174	0.326	0.007	0.013

From assembly house 2：



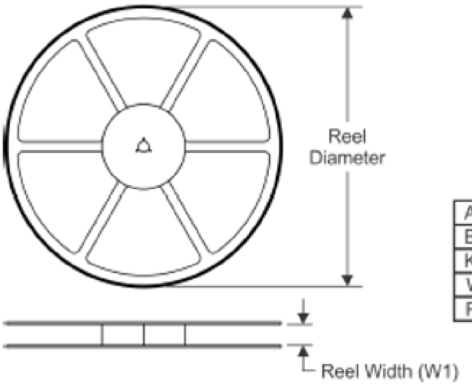
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0. 70	0.75	0. 80
A1	—	0.02	0. 05
b	0. 25	0.30	0. 35
c	0. 18	0.20	0. 25
D	1. 95	2. 00	2. 05
D2	1. 00	1. 23	1. 45
e	0. 65BSC		
Nd	1. 30BSC		
E	1. 95	2. 00	2. 05
E2	0. 50	0. 68	0. 85
L	0. 25	0.30	0. 40
h	0. 10	0. 15	0. 20



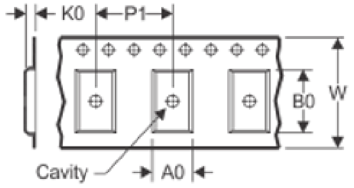
Dimensions	Value (in mm)
D	2
E	2
D1	1.6
E1	1
e	0.65
b	0.3
L	0.55
k	0.25(min⩾0.2)

TAPE AND REEL INFORMATION

REEL DIMENSIONS

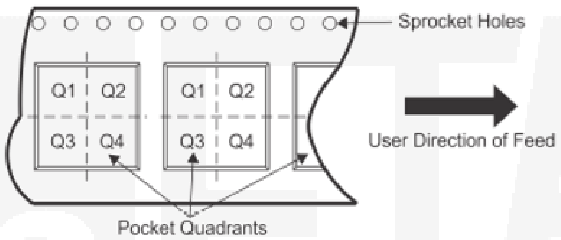


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA1069S2G	SOT23-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3
ETA1069V33S2G	SOT23-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3
ETA1069V50S2G	SOT23-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3
ETA1069D2G	DFN2x2-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3
ETA1069V33D2G	DFN2x2-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3
ETA1069V50D2G	DFN2x2-6	6	3000	180	9.5	3.17	3.23	1.37	4	8	Q3