

## DIO6073

# 3-Channel PMU with 36V BUCK, 18V Boost and Super Capacitor Charger

## Features

- 3 in 1, Buck, Boost and Super Capacitor Charger
- Buck wide working range: 8.2V-36V, 42V input standoff
- Output Power for Buck: 3.3V/500mA
- Output Power for Boost at 2.5V input: 12V/500mA
- Accuracy for Charger CV voltage: 1%
- Constant charge current: 70mA
- High Efficiency PFM mode at light load
- Enable pin to auto-switch boost and charger
- Package: EP-SOIC8 and QFN3\*4-24

## Descriptions

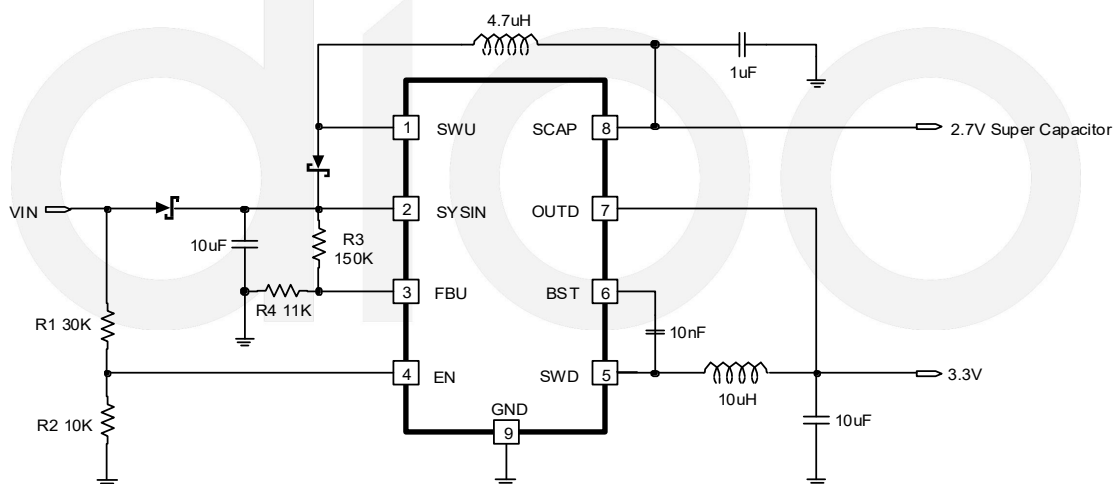
The DIO6073 is a three-channel PMU, including a 36V input, high efficiency synchronous buck converter, a low startup, high efficiency 18V boost converter and a super capacitor Charger. The buck converter withstands input voltage up to 42V and provides a 3.3V output with up to 500mA current. The boost converter can provide output of up to 500mA to 12V from a single cell super capacitor or a battery at 2.5V. A linear super capacitor charger also integrates a very high accuracy CV voltage. The output voltage of boost can be adjusted by external resistor divider.

All three power modules are packaged in EP-SOIC8 and QFN3\*4-24 packages.

## Applications

- Power Meters
- PLC modules
- Any system that needs super capacitor as a backup power

## Typical Application



## Ordering Information

Order Part Number	Top Marking		T <sub>A</sub>	Package	
DIO6073XS8	DIOFVG3	Green	-40 to 85°C	EP-SOIC8	Tape & Reel, 2500
DIO6073QN24	DFVG3	Green	-40 to 85°C	QFN3*4-24	Tape & Reel, 5000

## Pin Assignment

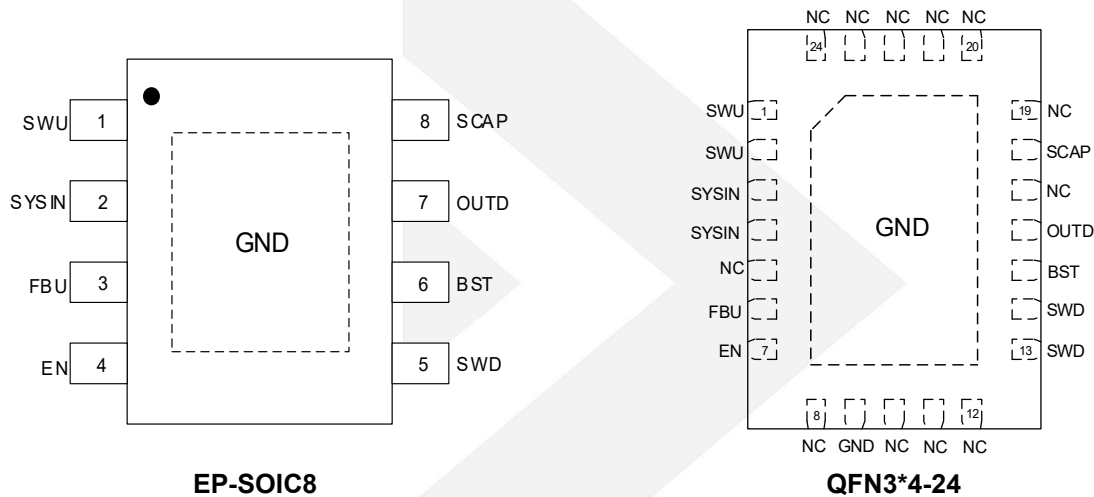


Figure 1 Top View

## Pin Descriptions

Pin Name	Description
SWU	Switch pin for BOOST.
SYSIN	System Power input pin.
FBU	External Feedback pin for BOOST.
EN	Enable pin for auto-switching BOOST and Charger. EN=0, BOOST is ON and Charger is OFF; EN=1, Charger is ON and BOOST is OFF.
SWD	Switch pin for BUCK.
BST	Bootstrap pin for BUCK. Connect a 10nF or bigger cap from BST to SWD.
OUTD	Output voltage pin for BUCK. It is internally set to 3.3V. It is also the input of CHARGER.
SCAP	Super capacitor output. It is internally programed to CV at 2.55V.
GND	Ground.
NC	Not Connected.

## Absolute Maximum Ratings

Stresses beyond those listed under "Absolute Maximum Rating" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

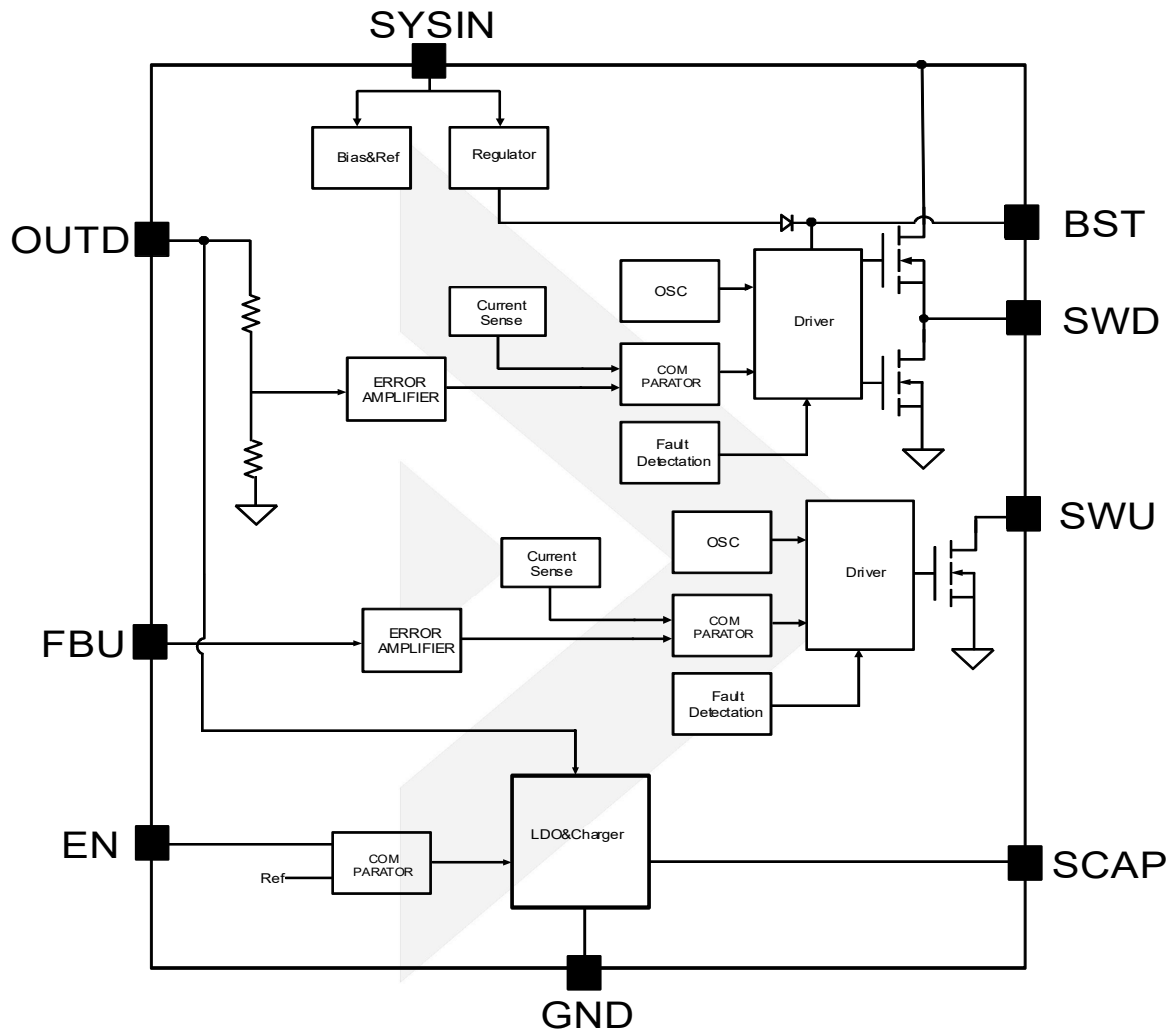
Parameter			Rating	Unit
SYSIN Voltage			-0.3 to 42	V
SWD, EN Voltage			-0.3 to SYSIN+0.3	V
SWU Voltage			-0.3 to 18	V
BST to SWD Voltage			-0.3 to 6	V
All Other Pin Voltage			-0.3 to 6	V
Operating Temperature Range			-40 to 85	°C
Storage Temperature Range			-65 to 150	°C
Thermal Resistance	EP-SOIC8	Θ <sub>JC</sub>	15	°C /W
		Θ <sub>JA</sub>	50	°C /W
	QFN3*4-24	Θ <sub>JC</sub>	12	°C /W
		Θ <sub>JA</sub>	52	°C /W
Lead Temperature(Soldering, 10sec)			260	°C
ESD		Human Body Model (HBM)	2	kV

### Electrical Characteristics

$V_{IN} = 12V$ , unless otherwise noted. Typical values are at  $T_A = 25^\circ C$ .

Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>BUCK</b>					
Buck Input Standoff Voltage		42			V
Buck Input Voltage Range		8.2		36	V
Buck Input UVLO Rising			7.8	8.2	V
Buck Input UVLO Falling			4.1		V
Buck Input OVP	Rising, Hysteresis=1V		37		V
$V_{OUTD}$ Voltage	Internally SET	3.233	3.300	3.370	V
Buck Switching Frequency			630		kHz
High side Switch On Resistance	$I_{SWD}=100mA$		600		mΩ
Low side switch On Resistance	$I_{SWD}=100mA$		330		mΩ
High side Switch Current Limit			1		A
Low side Zero Crossing limit			30		mA
<b>BOOST</b>					
Boost Input Range		0.75		6	V
FBU Feedback Voltage		784	800	816	mV
FBU Input Current	$V_{FBU}=0$ or 2V			100	nA
Boost Output Voltage Range		3		24	V
Boost Switching Frequency			1		MHZ
Maximum Duty Cycle		92			%
NMOS Switch On Resistance	$I_{SWU}=100mA$		80		mΩ
NMOS Switch Current Limit			4		A
SWU Leakage Current	$V_{SWU}=0$ or 12V, $V_{EN}=GND$			10	uA
<b>CHARGER</b>					
CV voltage		2.52	2.55	2.58	V
Charge current			70		mA
Dropout voltage	$I_{OUT}=30mA$		50		mV
<b>SYSTEM</b>					
Quiescent current of SYSIN at EN=0	$V_{FBU}=0.9V$ , $V_{OUTD}=3.6V$		750		uA
Quiescent current of SYSIN at EN=1	$V_{FBU}=0.9V$ , $V_{OUTD}=3.6V$ , $V_{SCAP}=3V$		500		uA
EN input current	$V_{EN}=12V$		5		uA
EN threshold	Rising, Hysteresis=0.2V		1.5		V
Thermal shutdown	Rising, Hysteresis=40°C		150		°C

## Functional Block Diagram



## Functional Description

The DIO6073 is a three-channel PMU that includes a wide input, high efficiency synchronous buck converter, a low startup, high efficiency boost converter and a super capacitor Charger. The buck converter withstands input voltage up to 42V and delivers a 3.3V output with up to 500mA current. The boost converter is capable of providing up to 500mA to 12V output from a single cell super capacitor or a battery at 2.5V. A linear super capacitor charger is also integrated with a very high accuracy CV voltage. The output voltage of boost can be adjusted by external resistor divider.

## Buck converter

The Buck is a wide input range, high-efficiency, synchronous step-down switching regulator which output is fixed at 3.3V, capable of delivering up to 0.5A of output current. With a fixed switching frequency of 630KHz, this current mode PWM controlled converter allows the use of small external components, such as ceramic input and output caps, as well as small inductors. An OVP function protects the IC itself and its downstream system against input voltage surges. With this OVP function, the IC can stand off input voltage as high as 42V.

**Boost converter**

The BOOST is a high efficiency no-synchronous step up converter. It is capable of delivering at least 6W of power from 2.5V, eg: 0.5A at 12V output. A switching frequency of 1MHz minimizes solution footprint by allowing the use of tiny and low-profile inductors and ceramic capacitors. The output of BOOST can be set by external resistor divider at FBU pin.

**Charger**

The CHARGER is fully integrated constant current (CC) / constant voltage (CV) function. It can deliver 70mA of charge current with a final float voltage of 1%.

**Enable**

EN is a digital control pin that turns the BOOST and CHARGER on and off. Drive EN High to turn on the CHARGER and turn off the BOOST, drive it Low to turn off the CHARGER and turn on the BOOST.

**Over-Temperature Protection**

Thermal protection disables BUCK, BOOST and CHARGER when the junction temperature rises to approximately 150°C, allowing the device to cool down. When the junction temperature cools to approximately 135°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the device from damage as a result of overheating.

**Application Information****BOOST Output Voltage Setting**

The DIO6073 BOOST OUTPUT is programmed using an external resistor divider. The output voltage is calculated using below equation.

$$V_{OUT} = V_{REF} * (1 + \frac{R3}{R4})$$

Where:  $V_{REF}$  = 0.8V typically, Resistors R4 is the resistor between FBU and GND and R3 is the one between output and FBU pin. R4 has to be between 1kΩ to 20kΩ and thus R3 is calculated by following equation.

$$R3 = (\frac{V_{OUT}}{V_{REF}} - 1) * R4$$

**BOOST and Super-Capacitor Charger Auto-Switching Threshold Voltage Setting**

The DIO6073's EN pin also serves as a threshold voltage for auto-switching Super Capacitor Charger and the Boost. When the VIN drops, and EN's voltage is below the falling threshold voltage (1.3V), the super-capacitor charger is disabled and the boost converter is then enabled at the same time. With a resistor ladder, R1 from VIN to EN and R2 from EN to GND, the VIN dropping threshold thus is programmed by the equation below.

$$V_{INThreshold} = 1.3 * (1 + \frac{R1}{R2})$$

R2 has to be between 1kΩ to 20kΩ and thus R1 is calculated by following equation.

$$R1 = (\frac{V_{INThreshold}}{1.3} - 1) * R2$$

### Typical Performance Characteristics

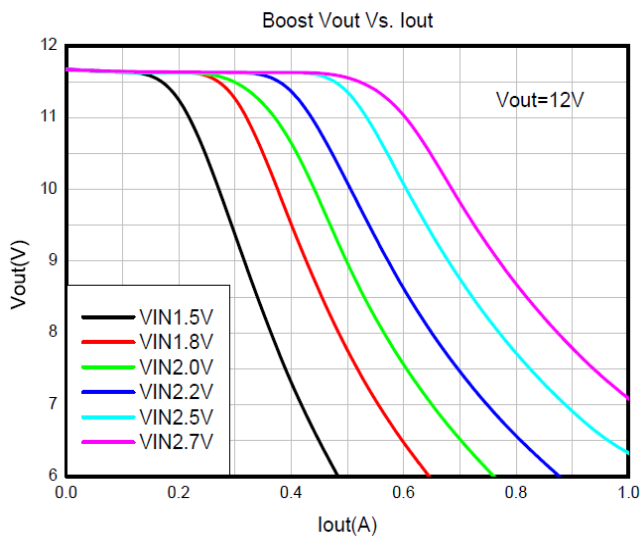


Figure 2 Boost Vout Vs. Iout

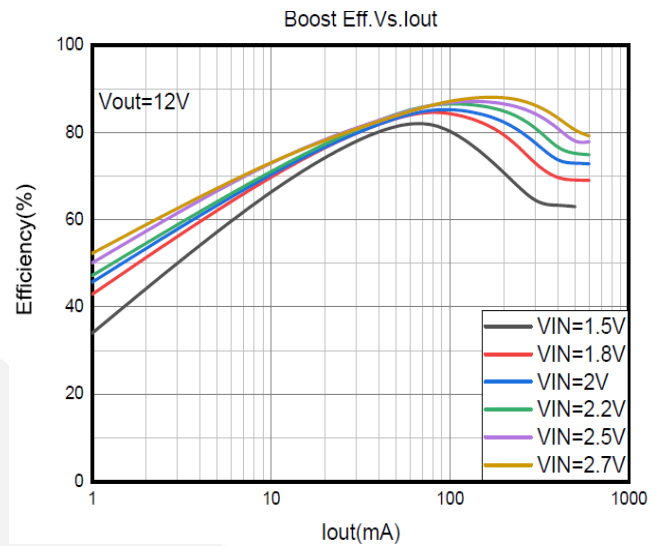


Figure 3 Boost Eff. Vs. Iout

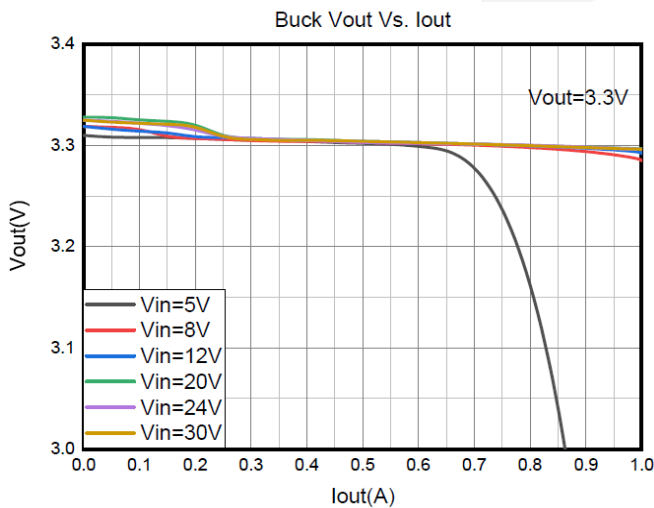


Figure 4 Buck Vout Vs. Iout

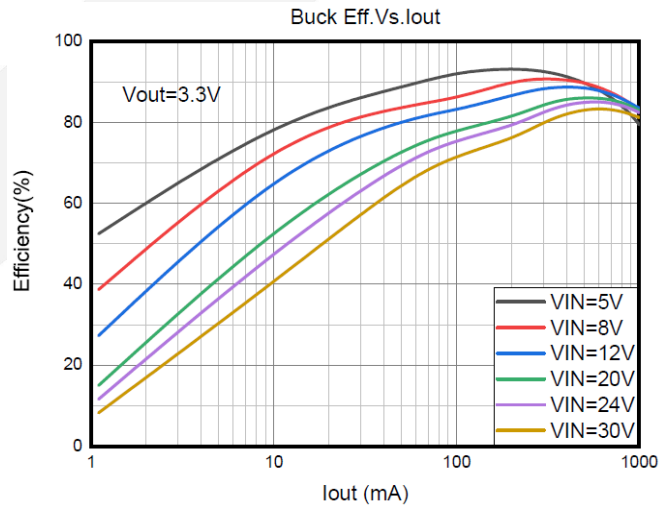


Figure 5 Buck Eff. Vs. Iout

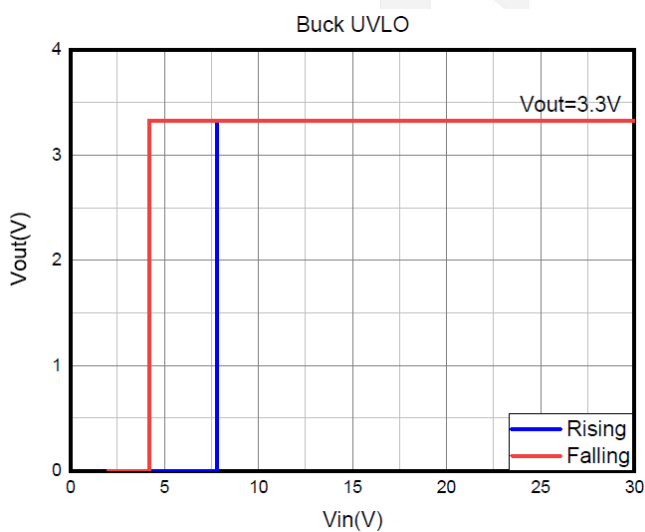


Figure 6 Buck UVLO

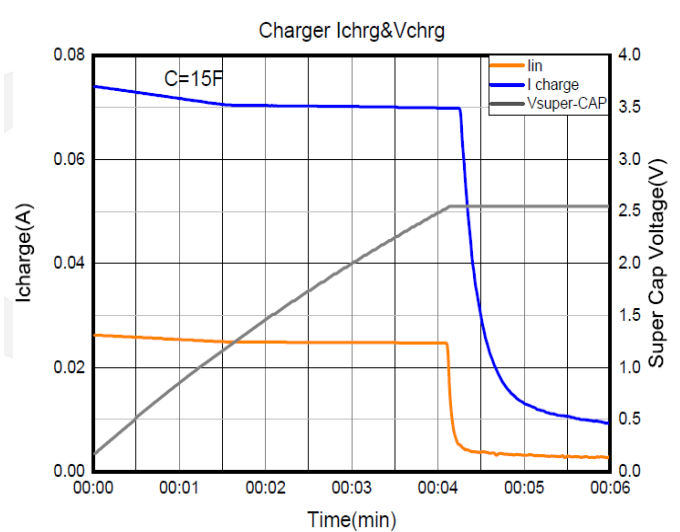


Figure 7 Charger Icharge & Vchrg

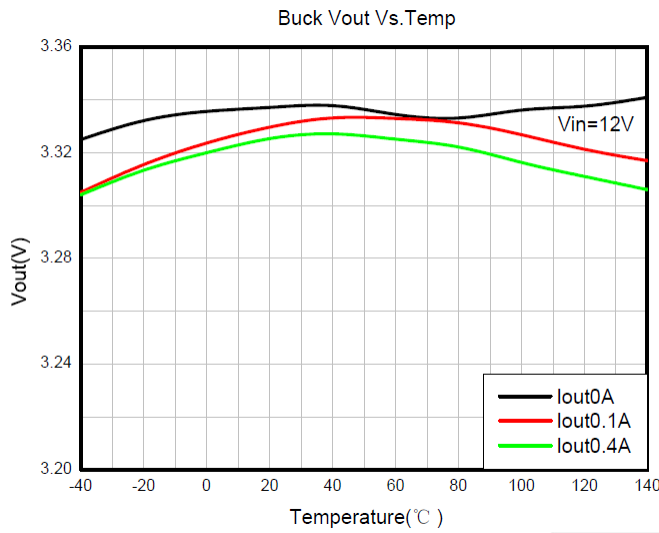


Figure 8 Buck Vout Vs.Temp

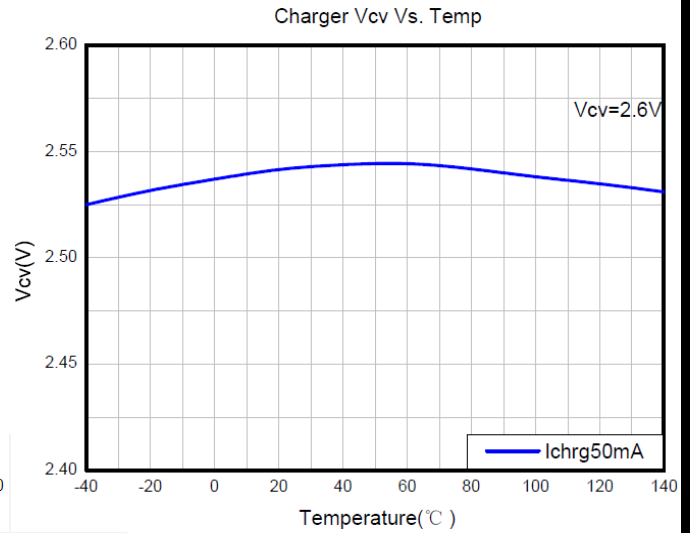


Figure 9 Charger Vcv Vs.Temp

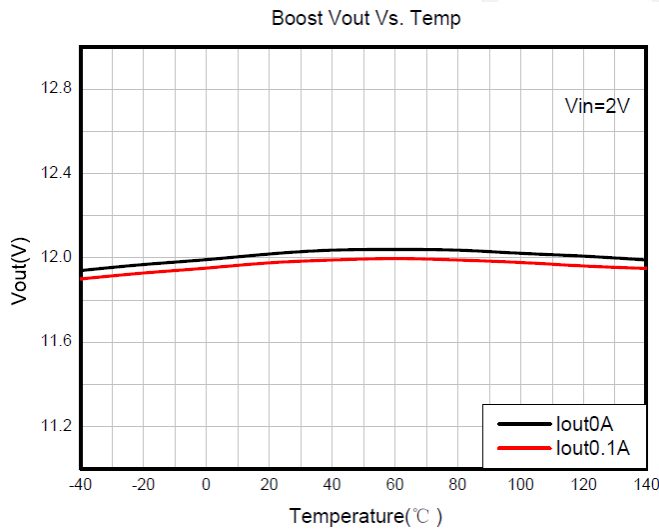


Figure 10 Boost Vout Vs.Temp

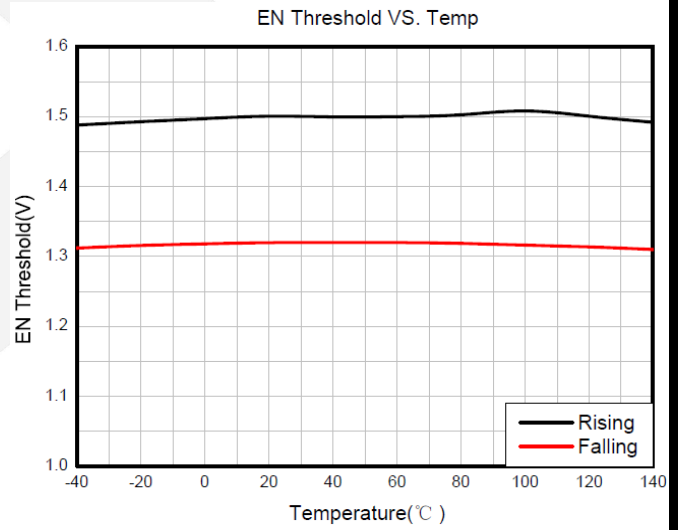
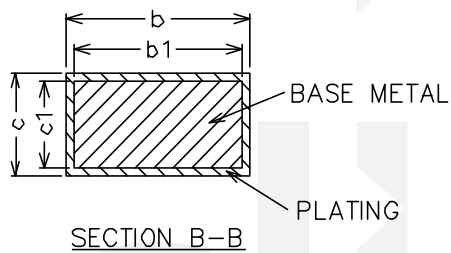
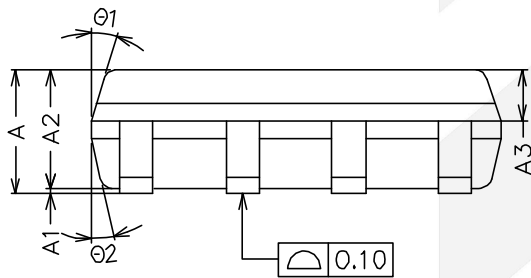
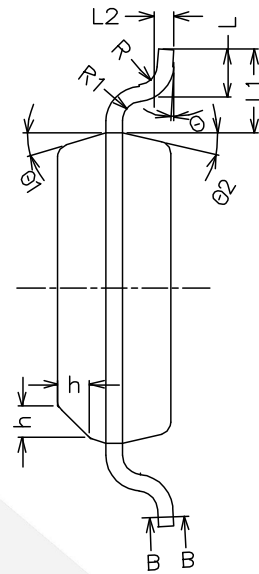
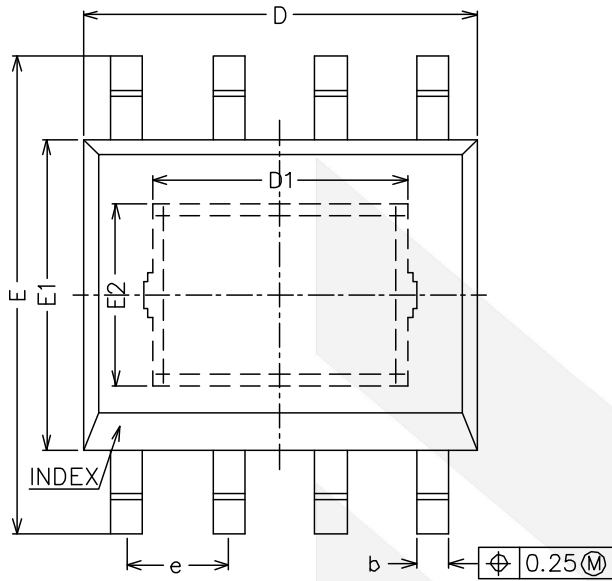


Figure 11 EN Threshold Vs.Temp

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## Physical Dimensions: EP-SOIC8

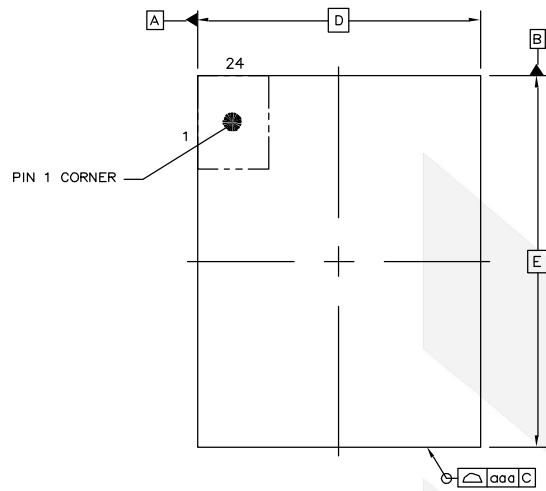


COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	1.35	1.45	1.65
A1	0	-	0.15
A2	1.35	1.40	1.55
A3	0.50	0.60	0.70
b	0.38	-	0.47
b1	0.37	0.40	0.43
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
D1	3.02	3.17	3.32
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.13	2.28	2.43
e	1.17	1.27	1.37
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
Θ	0°	-	8°
Θ1	15°	17°	19°
Θ2	11°	13°	15°

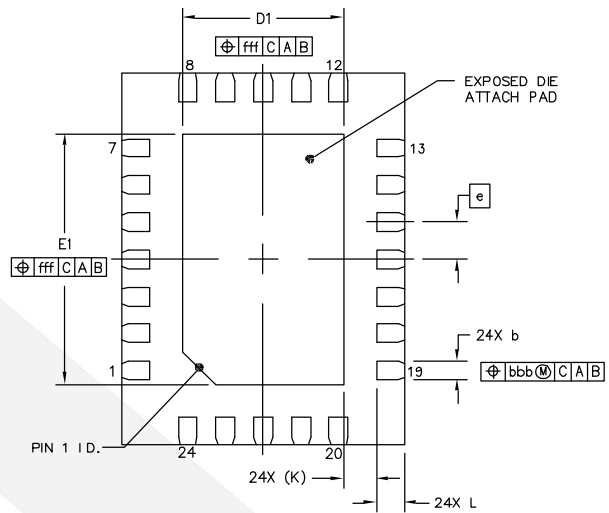
Synchronous Boost Converter with Ultra-Low Quiescent Current

## Physical Dimensions: QFN3\*4-24

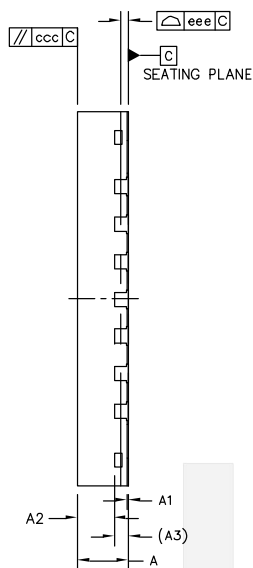
Synchronous Boost Converter with Ultra-Low Quiescent Current



TOP VIEW



BOTTOM VIEW



SIDE VIEW

COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
Symbol	MIN	NOM	MAX
A	0.5	0.55	0.6
A1	0	0.02	0.05
A2	-	0.4	-
A3	0.152 REF		
b	0.15	0.2	0.25
D	3 BSC		
E	4 BSC		
e	0.4 BSC		
D1	1.6	1.7	1.8
E1	2.6	2.7	2.8
L	0.25	0.3	0.35
K	0.35 REF		
aaa	0.1		
ccc	0.1		
eee	0.08		
bbb	0.1		
fff	0.1		

## CONTACT US

**Dioo** is a professional design and sales corporation for high-quality and performance analog semiconductors. The company focuses on industry markets, such as, cell phone, handheld products, laptop, and medical equipment and so on. Dioo's product families include analog signal processing and amplifying, LED drivers and charger IC. Go to <http://www.dioo.com> for a complete list of Dioo product families.

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