DIO6073

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

Features

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

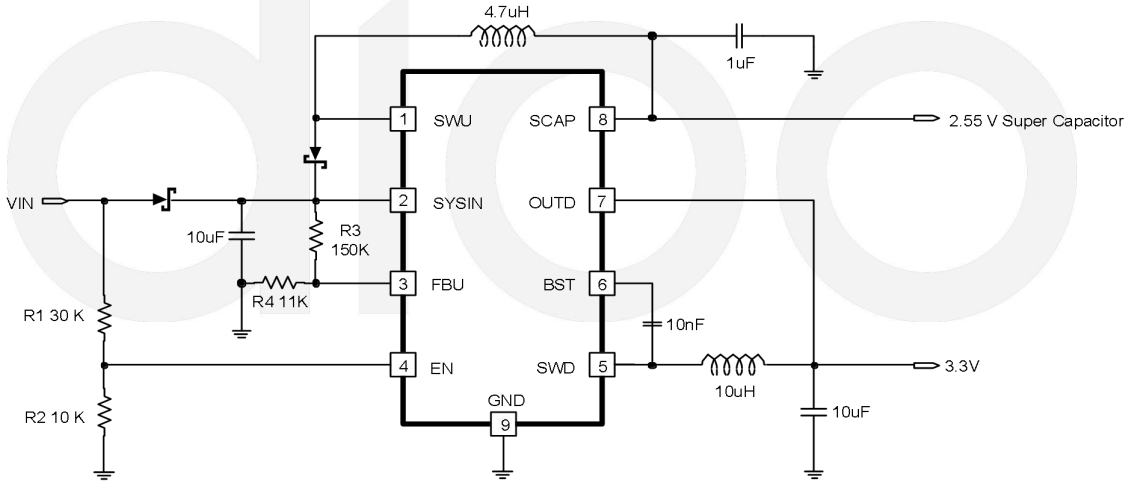
Applications

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

Descriptions

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

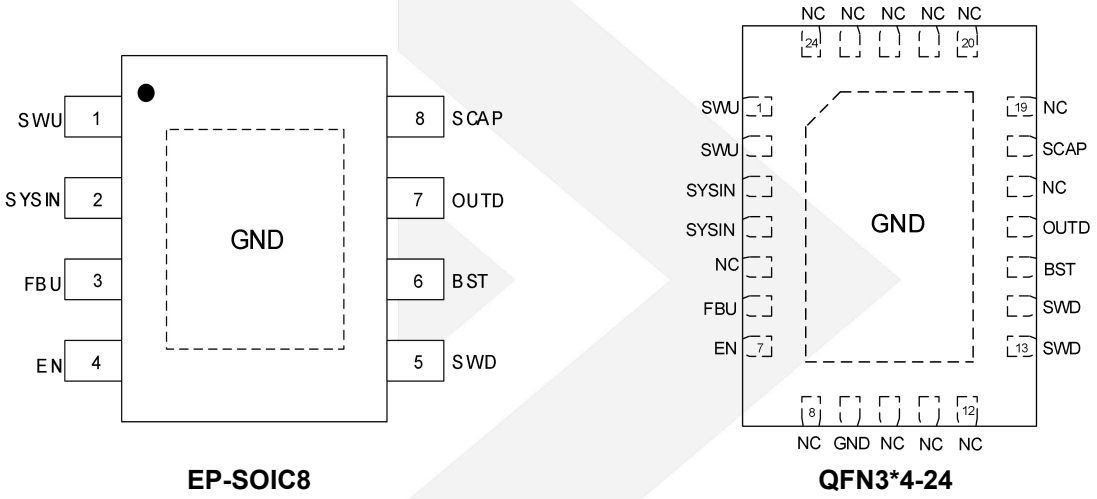
Typical Application



Ordering Information

Part Number	Top Marking	RoHS	T_A	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



EP-SOIC8 **QFN3*4-24**

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 10 nF or bigger cap from BST to SWD.
OUTD	Output voltage pin for buck. It is internally set to 3.3 V. It is also the input of charger.
SCAP	Super capacitor output. It is internally programed to CV at 2.55 V.
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.

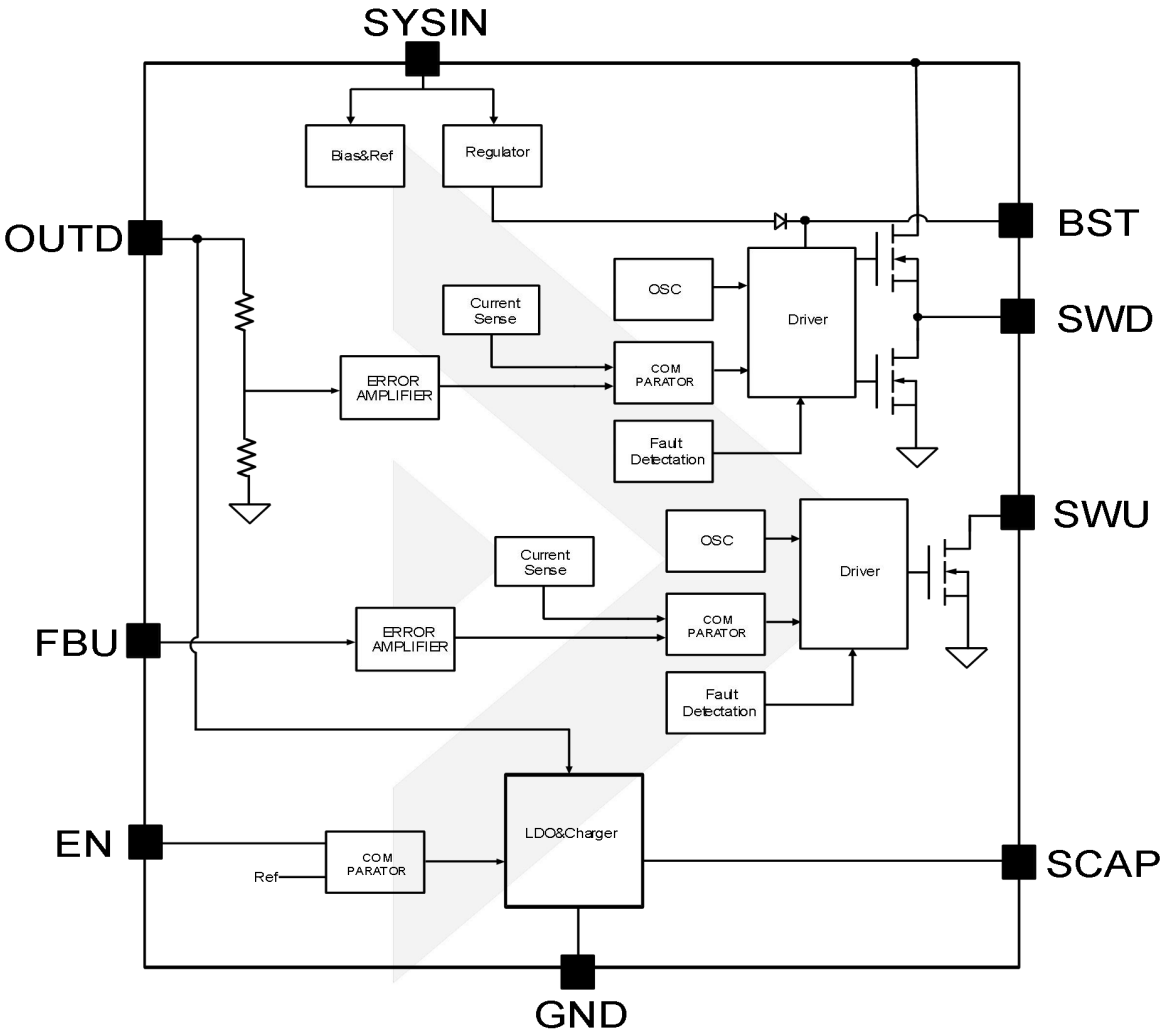
Parameter			Rating	Unit
SYSIN Voltage			−0.3 to 42	V
SWD, EN Voltage			−0.3 to SYSIN+0.3	V
SWU Voltage			−0.3 to 18	V
BST to SWD Voltage			−0.3 to 6	V
All Other Pin Voltage			−0.3 to 6	V
Operating Temperature Range			−40 to 85	°C
Storage Temperature Range			−65 to 150	°C
Thermal Resistance	EP-SOIC8	Θ_{JC}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

Electrical Characteristics

V_{IN} = 12 V, unless otherwise noted. Typical values are at T_A = 25°C.

Parameter	Conditions	Min	Typ	Max	Unit
Buck					
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 = 1 V		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} = 100 mA		600		mΩ
Low side switch On resistance	I_{SWD} = 100 mA		330		mΩ
High side switch current limit			1		A
Low side zero crossing limit			30		mA
Boost					
Boost input range		0.75		6	V
FBU feedback voltage		784	800	816	mV
FBU input current	V_{FBU} = 0 or 2 V			100	nA
Boost output voltage range		3		24	V
Boost switching frequency			1		MHZ
Maximum duty cycle		92			%
NMOS switch on resistance	I_{SWU} = 100 mA		80		mΩ
NMOS switch current limit			4		A
SWU leakage current	V_{SWU} = 0 or 12 V, V_{EN} = GND			10	μA
Charger					
CV voltage		2.52	2.55	2.58	V
Charge current			70		mA
Dropout voltage	I_{OUT} = 30 mA		50		mV
System					
Quiescent current of SYSIN at EN = 0	V_{FBU} = 0.9 V, V_{OUTD} = 3.6 V		750		μA
Quiescent current of SYSIN at EN = 1	V_{FBU} = 0.9 V, V_{OUTD} = 3.6 V, V_{SCAP} = 3 V		500		μA
EN input current	V_{EN} = 12 V		5		μA
EN threshold	Rising, Hysteresis = 0.2 V		1.5		V
Thermal shutdown	Rising, Hysteresis = 40°C		150		°C

Functional Block Diagraph



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 42 V and delivers a 3.3 V output with up to 500 mA current. The boost converter is capable of providing up to 500 mA to 12 V output from a single cell super capacitor or a battery at 2.5 V. A linear super capacitor charger is also integrated with a very high accuracy constant voltage. The output voltage of the boost can be adjusted by an external resistor divider.

Buck converter

The buck is a wide input range, high-efficiency, synchronous step-down switching regulator, the output of which is fixed at 3.3 V, capable of delivering up to 0.5 A of output current. With a fixed switching frequency of 630 kHz, 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 42 V.

Boost converter

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

Charger

The charger is a fully integrated constant current (CC) / constant voltage (CV) function. It can deliver 70 mA 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, and drive it low to turn off the charger and turn on the boost.

Over-Temperature Protection

Thermal protection disables the 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 by using an external resistor divider. The output voltage is calculated using the following equation.

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

Where: V_{REF} = 0.8 V 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 1 kΩ to 20 kΩ and thus R3 is calculated by following equation.

$$R3 = (\frac{V_{OUT}}{V_{REF}} - 1) * R4 \quad (2)$$

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 (1.3 V), 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.

$$V_{INThreshold} = 1.3 * (1 + \frac{R1}{R2}) \quad (3)$$

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

$$R1 = (\frac{V_{INThreshold}}{1.3} - 1) * R2 \quad (4)$$

Typical Performance Characteristics

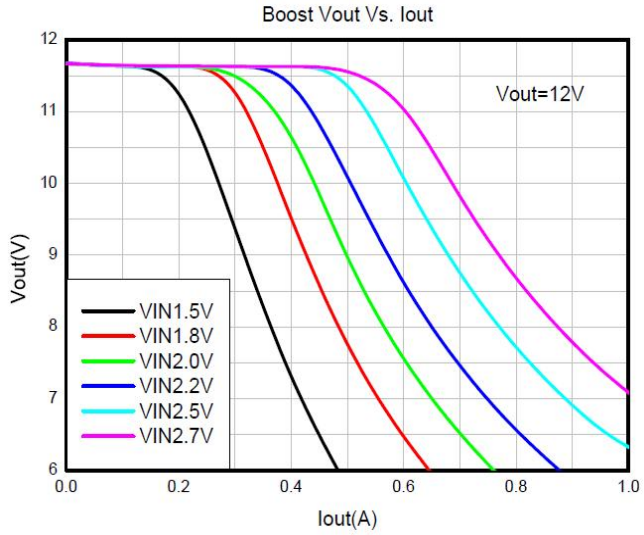


Figure 2. Boost V_{OUT} Vs. I_{OUT}

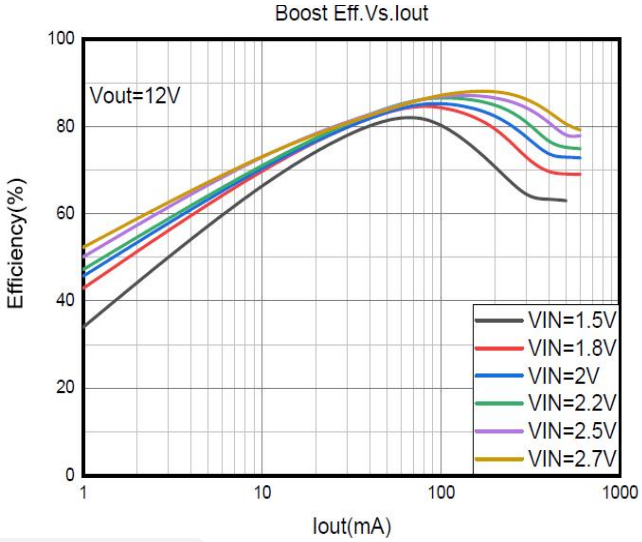


Figure 3. Boost Eff. Vs. I_{OUT}

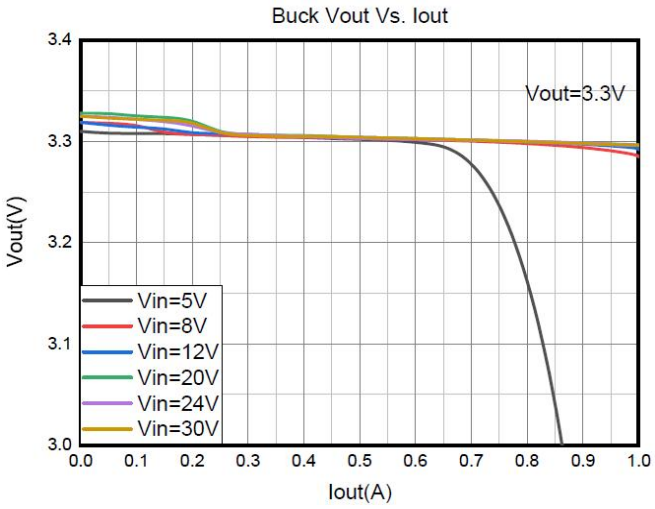


Figure 4. Buck V_{OUT} Vs. I_{OUT}

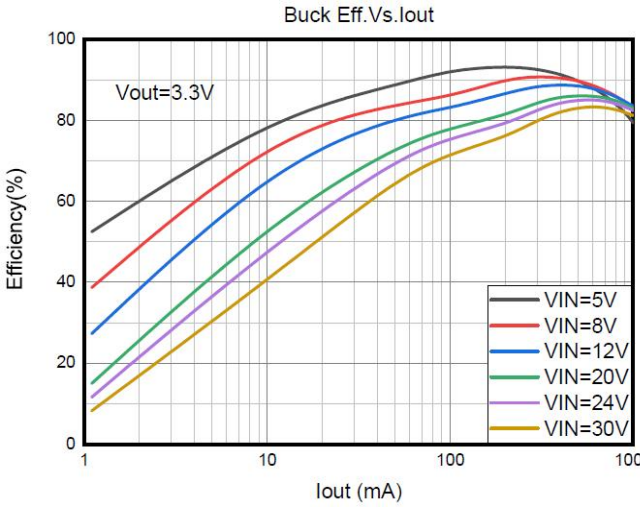


Figure 5. Buck Eff. Vs. I_{OUT}

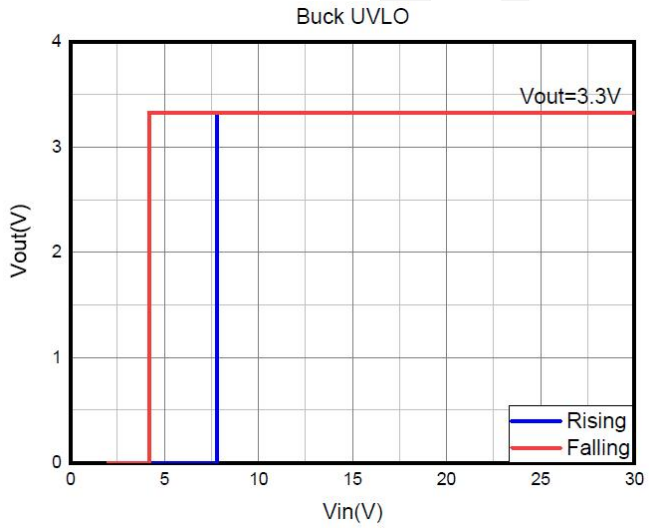


Figure 6. Buck UVLO

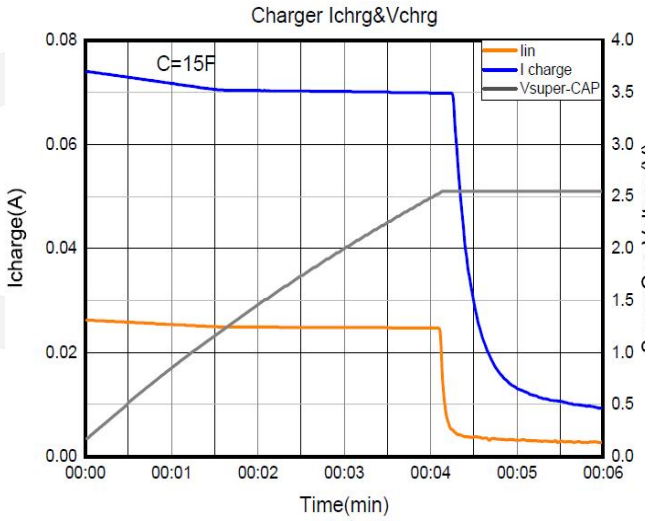


Figure 7. Charger I_{CHRG} & V_{CHRG}

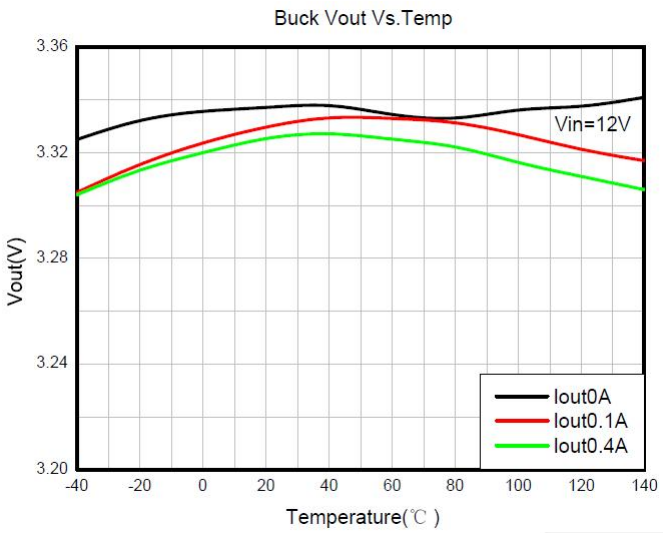


Figure 8. Buck V_{OUT} Vs.Temp

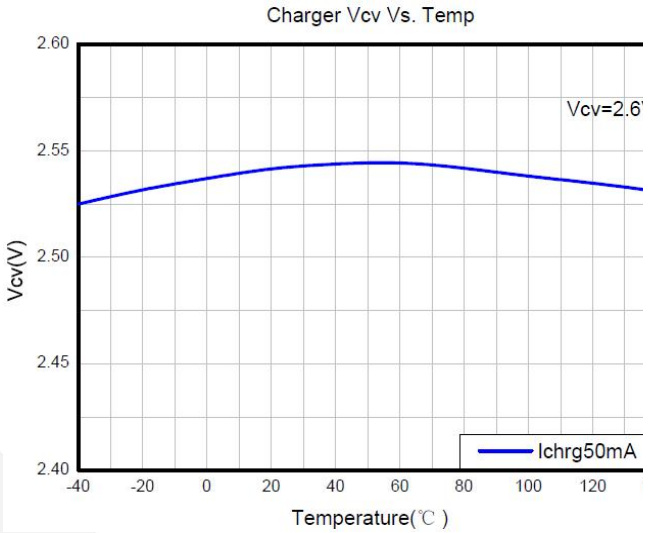


Figure 9. Charger V_{CV} Vs.Temp

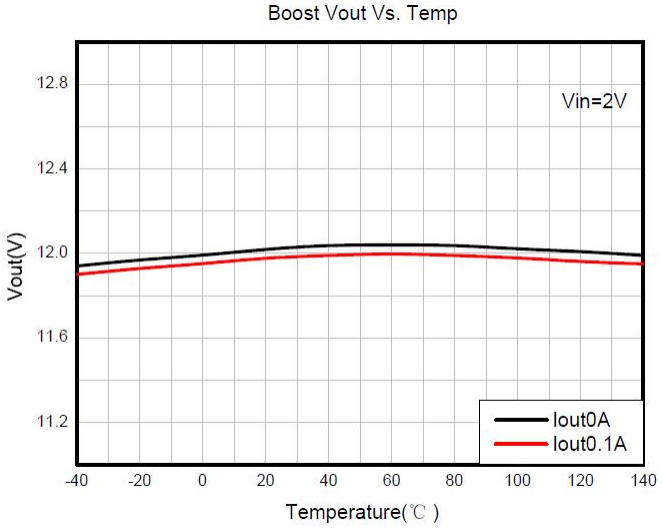


Figure 10. Boost V_{OUT} Vs.Temp

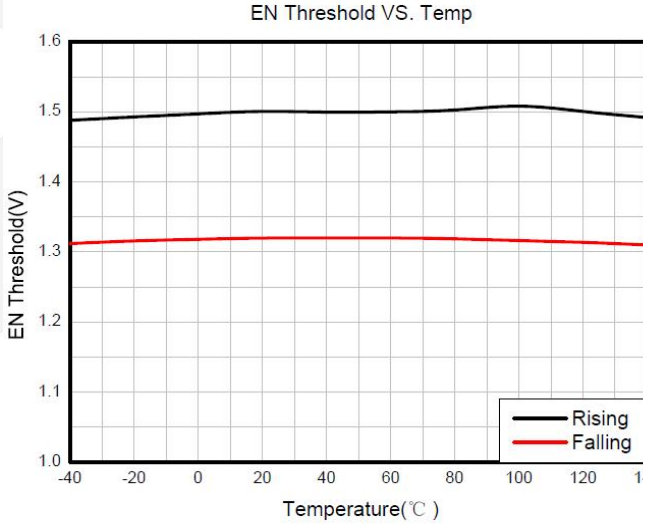
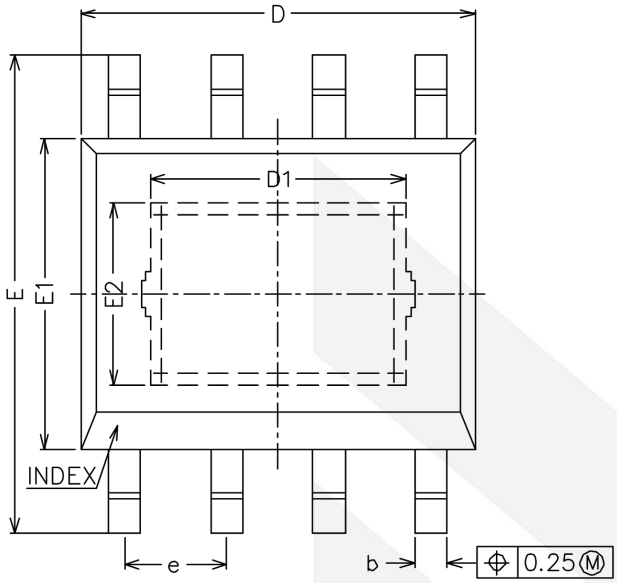
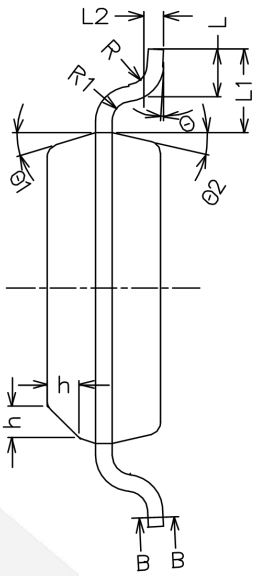
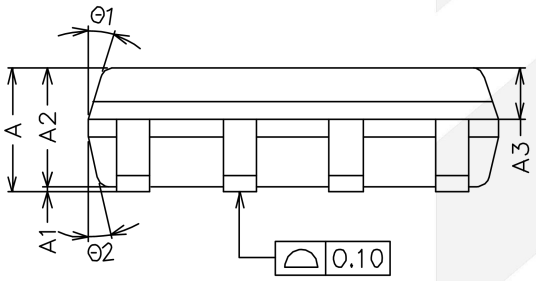


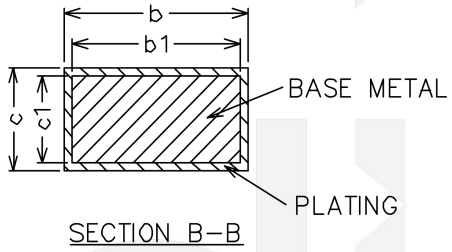
Figure 11. EN Threshold Vs.Temp

Physical Dimensions: EP-SOIC8



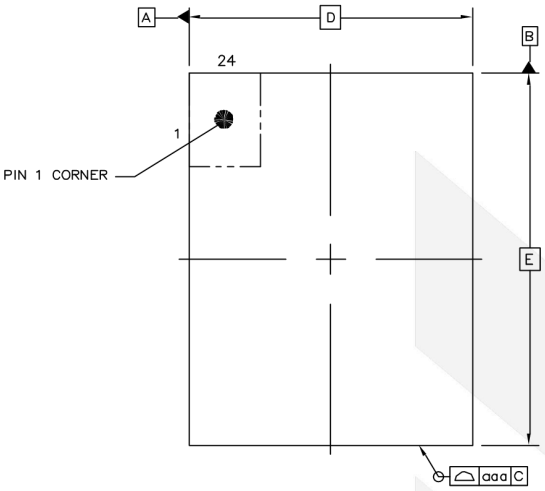




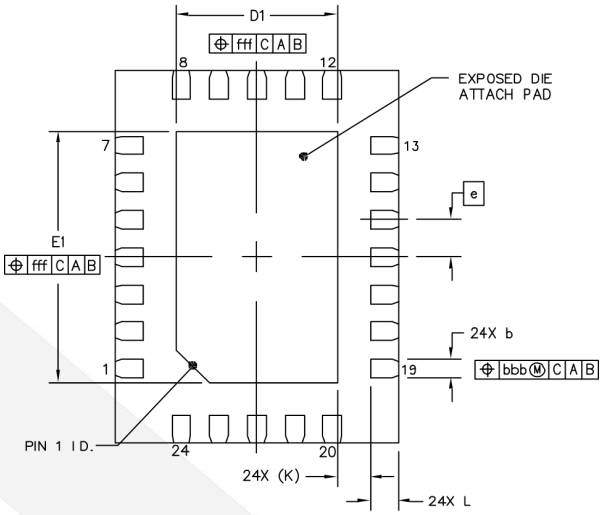


Common Dimensions (Units of Measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.45	1.65
A1	0	-	0.15
A2	1.35	1.40	1.55
A3	0.50	0.60	0.70
b	0.38	-	0.47
b1	0.37	0.40	0.43
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
D1	3.02	3.17	3.32
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
E2	2.13	2.28	2.43
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°

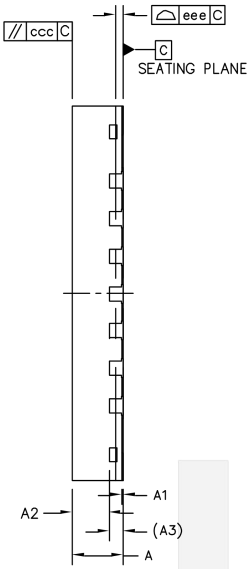
Physical Dimensions: QFN3*4-24



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.

For additional product information, or full datasheet, please contact with our Sales Department or Representatives.