

# DIO1280

## Over-Voltage Protection Load Switch

### Features

- Surge Protection  
IEC 61000-4-5: >100V
- Over-Voltage Protection (OVP)
- Over-Temperature Protection (OTP)
- ESD Protection  
IEC 61000-4-2 Air Discharge: > 15kV  
IEC 61000-4-2 Contact Discharge: > 8kV
- +/- 100V EOS Protection
- Negative Voltage Protection(-30V)

### Applications

- Mobile Handsets and Tablets
- Portable Media Players
- MP3 Players

### Descriptions

The DIO1280 features a low-  $R_{ON}$  internal FET and an operating range of 2.5  $V_{DC}$  to 25  $V_{DC}$  (absolute maximum of 30  $V_{DC}$ ). An internal clamp is capable of shunting surge voltages >100V, protecting downstream components and enhancing system robustness. The DIO1280 features over-voltage protection that powers down the internal FET if the input voltage exceeds the OVP threshold. The OVP threshold is adjustable with optional external resistors. Over-temperature protection also powers down the device at 130°C (typical). Exceptionally low off-state current (<1 $\mu$ A maximum) facilitates compliance with standby power requirements.

The DIO1280 is available in a EP-SOIC8 package and a fully “green” compliant 1.3mm x 1.8mm Wafer-Level Chip-Scale Package (WLCSP) with backside laminate.

### Function Block Diagram

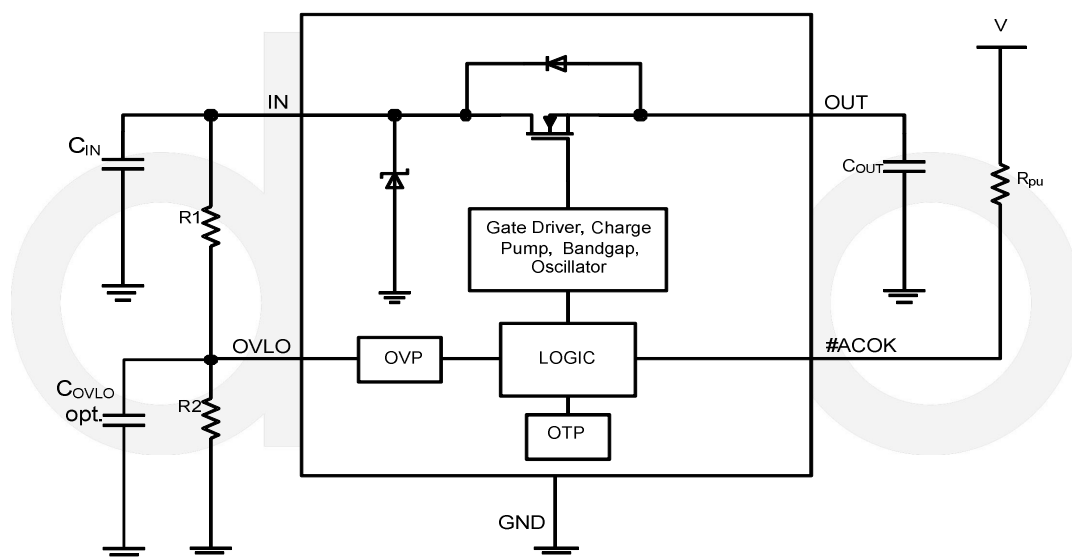
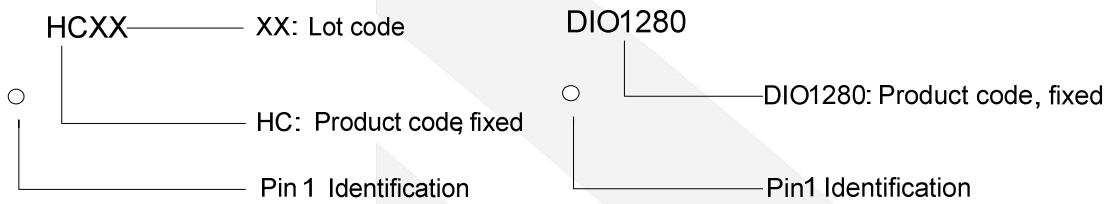


Figure 1 Functional Block Diagram

## Ordering Information

| Order Part Number | Top Marking |       | T <sub>A</sub> | Package                 |                   |
|-------------------|-------------|-------|----------------|-------------------------|-------------------|
| DIO1280WL12       | HCXX        | Green | -40 to +85°C   | WLCSP-12<br>0.4mm pitch | Tape & Reel, 3000 |
| DIO1280XS8        | DIO1280     | Green | -40 to +85°C   | EP-SOIC8                | Tape & Reel, 2500 |

## Marking Definition



## Pin Configuration

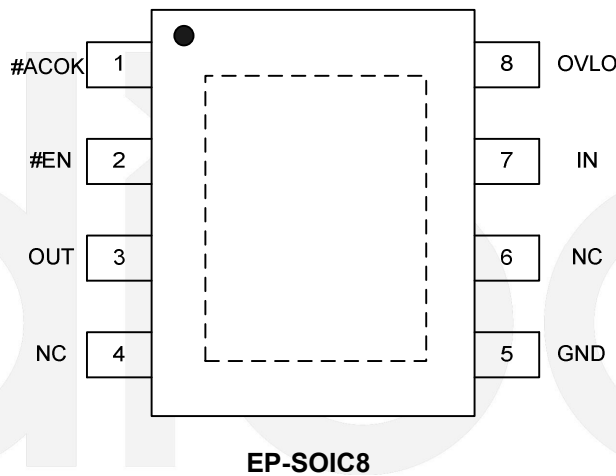
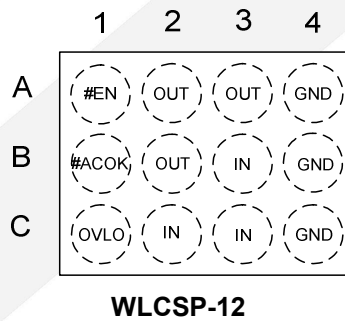


Figure 2 Pin Assignment (Top View)



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Over-Voltage Protection Load Switch

## Pin Definitions

| Name  | Bump     | Type         | Description                         |  |
|-------|----------|--------------|-------------------------------------|--|
| IN    | B3,C2,C3 | Input/Supply | Switch Input and Device Supply      |  |
| OUT   | A2,A3,B2 | Output       | Switch Output to Load               |  |
| #ACOK | B1       | Output       | Power Good                          | 1 $V_{IN} < V_{IN\_min}$ or $V_{IN} \geq V_{OVLO}$ |
|       |          |              |                                     | 0 Voltage Stable                                   |
| #EN   | A1       | Input        | Device Enable, Low is enable.       |  |
| OVLO  | C1       | Input        | Over-Voltage Lockout Adjustment Pin |  |
| GND   | A4,B4,C4 | Supply       | Device Ground                       |  |
| NC    |          | NC           | No Connect                          |  |

## 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.

| Symbol           | Parameter                                     | Rating               | Unit         |    |
|------------------|---|----------------------|--------------|----|
| $V_{IN}$         | $V_{IN}$ to GND                               | -30 to +30           | V            |    |
| $V_{OUT}$        | $V_{OUT}$ to GND                              | -0.3 to $V_{IN}+0.3$ | V            |    |
| $V_{OVLO}$       | OVLO to GND                                   | -0.3 to 30           | V            |    |
| $V_{\#EN\_ACOK}$ | Maximum DC Voltage Allowed on #EN or ACOK Pin | 6                    | V            |    |
| $I_{IN}$         | Switch I/O Current (Continuous)               | 4.5                  | A            |    |
| $t_{PD}$         | Total Power Dissipation at $T_A=25^\circ C$   | 1.48                 | W            |    |
| $T_{STG}$        | Storage Temperature Range                     | -65 to 150           | $^\circ C$   |    |
| $T_J$            | Maximum Junction Temperature                  | 150                  | $^\circ C$   |    |
| $T_L$            | Lead Temperature (Soldering, 10 Seconds)      | 260                  | $^\circ C$   |    |
| $\theta_{JA}$    | Thermal Resistance, Junction-to-Ambient       | 84.1                 | $^\circ C/W$ |    |
| ESD              | IEC 61000-4-2 System ESD                      | Air Gap              | 15.0         | kV |
|                  |   | Contact              | 8.0          |    |
| Surge            | IEC 61000-4-5, Surge Protection               | $V_{IN}$             | 100          | V  |



# DIO1280

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended Operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not Recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol    | Parameter             | Min | Typ. | Max  | Unit |
|-----------|-----------------------|-----|------|------|------|
| $V_{IN}$  | Supply Voltage        | 2.5 |      | 25   | V    |
| $T_A$     | Operating Temperature | -40 |      | +105 | °C   |
| $I_{OUT}$ | Output Current        |     |      | 3    | A    |

## Electrical Characteristics

$T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ , unless otherwise specified. Typical values are  $V_{IN}=5.0\text{V}$ ,  $I_{IN}\leq 3\text{A}$ ,  $C_{IN}=0.1\mu\text{F}$  and  $T_A=25^{\circ}\text{C}$ .

| Symbol             | Parameter                             | Test Conditions   | Min      | Typ  | Max  | Unit          |
|--------------------|---------------------------------------|---|----------|------|------|---------------|
| $V_{IN\_CLAMP}$    | Input Clamping Voltage                | $I_{IN}=10\text{mA}$  |          | 35   |      | V             |
| $I_Q$              | Input Quiescent Current               | $V_{IN}=5\text{V}$ , #EN=0V   |          | 80   | 110  | $\mu\text{A}$ |
| $I_{IN\_Q}$        | OVLO Supply Current                   | $V_{OVLO}=3\text{V}$ , $V_{IN}=5\text{V}$ . $V_{OUT}=0\text{V}$           |          | 70   | 96   | $\mu\text{A}$ |
| $V_{UVLO}$         | Under Voltage Trip Level              | $V_{IN}$ Rising   |          | 2.25 | 2.4  | V             |
|                    |                                       | $V_{IN}$ Falling  |          | 1.95 | 2.1  | V             |
| $V_{IN\_OVLO}$     | Internal Over-Voltage Trip Level      | $V_{IN}$ Rising, OVLO=GND   | 6.6      | 6.8  | 7.0  | V             |
|                    |                                       | $V_{IN}$ Falling  | 6.2      |      |      | V             |
| $V_{OVLO\_TH}$     | OVLO Set Threshold                    | $V_{IN}=2.5\text{V}$ to $V_{OVLO}$  | 1.18     | 1.20 | 1.22 |               |
| $V_{OVLO\_RNG}$    | Adjustable OVLO Threshold Range       | $V_{IN}=2.5\text{V}$ to $V_{OVLO}$  | 4        |      | 25   | V             |
| $V_{OVLO\_SELECT}$ | External OVLO Select Threshold        |   | 0.28     | 0.30 | 0.32 | V             |
| $R_{ON}$           | Resistance from $V_{IN}$ to $V_{OUT}$ | $V_{IN}=5\text{V}$ ,<br>$I_{OUT}=1\text{A}$ ,<br>$T_A=25^{\circ}\text{C}$ | WLCSP-12 | 30   |      | m $\Omega$    |
|                    |                                       |   | EP-SOIC8 | 60   |      |               |
| $C_{OUT}$          | OUT Load Capacitance                  | $V_{IN}=5\text{V}$  |          |      | 1000 | $\mu\text{F}$ |
| $I_{OLVO}$         | OVLO Input Leakage Current            | $V_{OVLO}=V_{OVLO\_TH}$   | -100     |      | 100  | nA            |
| $T_{SDN}$          | Thermal Shutdown                      |   |          | 130  |      | °C            |
| $T_{SDN\_HYS}$     | Thermal Shutdown Hysteresis           |   |          | 20   |      | °C            |

### Digital Signals

|          |                          |                       |  |  |     |   |
|----------|--------------------------|-----------------------|--|--|-----|---|
| $V_{OL}$ | #ACOK Output Low Voltage | $I_{SINK}=1\text{mA}$ |  |  | 0.4 | V |
|----------|--------------------------|-----------------------|--|--|-----|---|



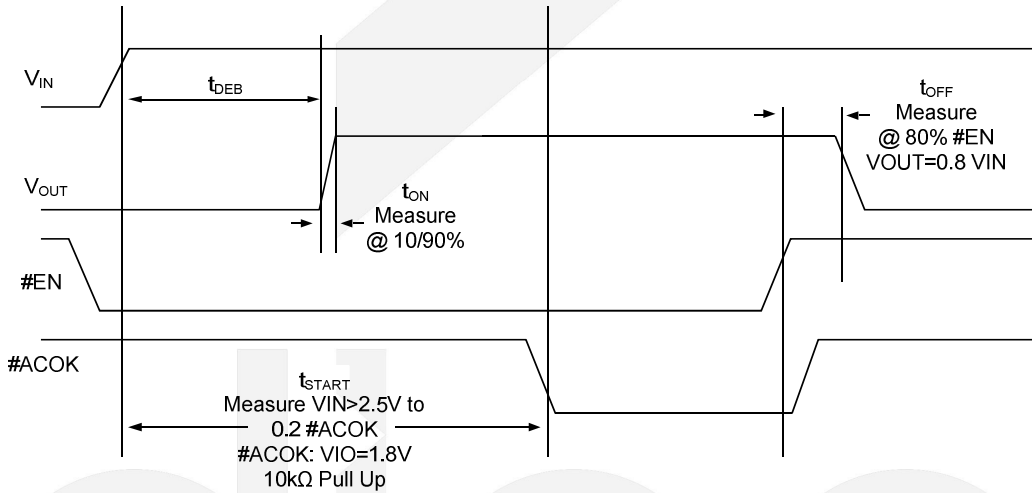
# DIO1280

|                               |  |   |      |     |     |         |
|-------------------------------|--|---|------|-----|-----|---------|
| VIH_#EN                       | Enable HIGH Voltage                      | $V_{IN}=2.5V$ to $V_{OVLO}$   | 1.2  |     |     | V       |
| VIL_#EN                       | Enable LOW Voltage                       | $V_{IN}=2.5V$ to $V_{OVLO}$   |      |     | 0.5 | V       |
| I <sub>ACOK_LEAK</sub>        | #ACOK Leakage Current                    | $V_{ACOK}=3V$ , #ACOK Deasserted  | -0.5 |     | 0.5 | $\mu A$ |
| #EN_Leak                      | #EN Leakage Current                      | $V_{IN}=5.0V$ , $V_{OUT}=Float$   | -1.0 |     | 1.0 | $\mu A$ |
| <b>Timing Characteristics</b> |  |   |      |     |     |         |
| t <sub>DEB</sub>              | Debounce Time                            | Time from $2.5V < V_{IN} < V_{IN\_OVLO}$ to $V_{OUT}=0.1 \times V_{IN}$                                 |      | 15  |     | ms      |
| t <sub>START</sub>            | Soft-Start Time                          | Time from $V_{IN}=V_{IN\_min}$ to $0.2 \times \#ACOK$ , $V_{IO}=1.8V$ with $10k\Omega$ Pull-up Resistor |      | 30  |     | ms      |
| t <sub>ON</sub>               | Switch Turn-On Time <sup>(Note 1)</sup>  | $R_L=100\Omega$ , $C_L=22\mu F$ , $V_{OUT}$ from $0.1 \times V_{IN}$ to $0.9 \times V_{IN}$             | 1.5  | 2   | 4   | ms      |
| t <sub>OFF</sub>              | Switch Turn-Off Time <sup>(Note 1)</sup> | $R_L=100\Omega$ , $C_L=0\mu F$ , $V_{IN} > V_{OVLO}$ to $V_{OUT}=0.8 \times V_{IN}$                     | 80   | 125 | 200 | ns      |

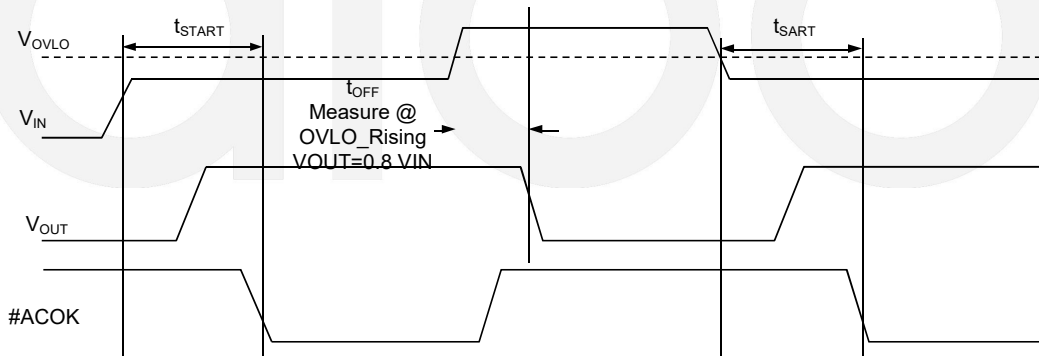
Specifications subject to change without notice.

Note 1: guaranteed by characterization under room temperature.

## Timing Diagrams:



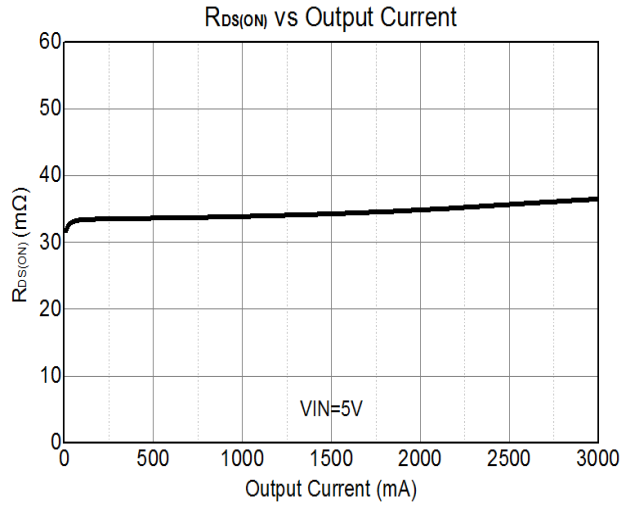
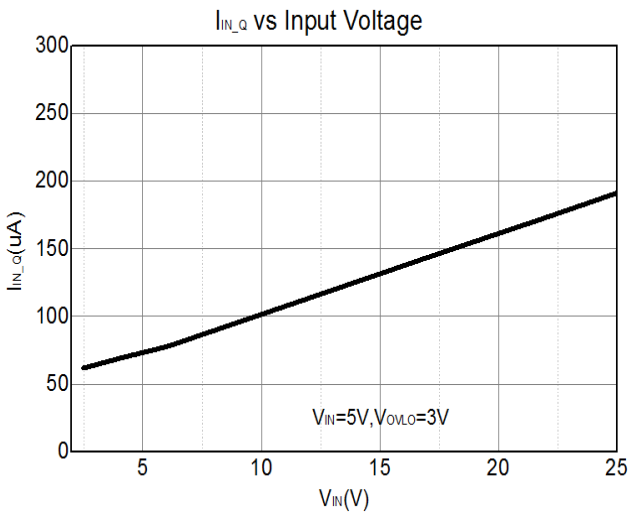
**Figure 3 Timing for Power Up and Normal Operation**



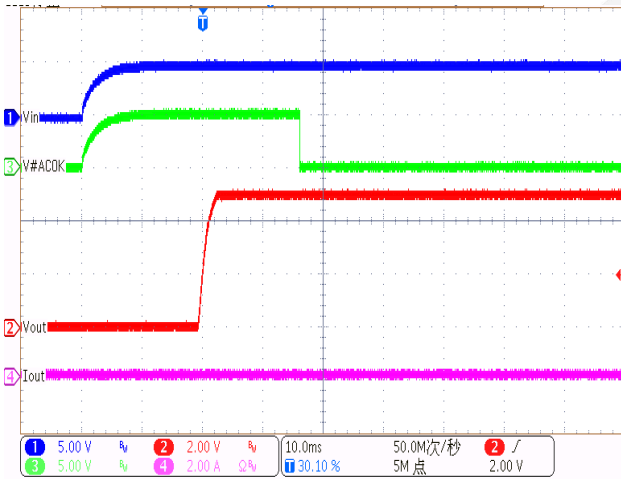
**Figure 4 Timing for OVLO Trip**

## Typical Performance Characteristics

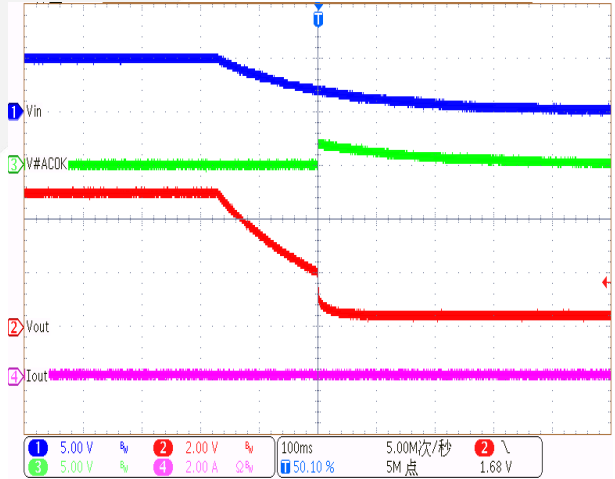
Ambient temperature is 25°C,  $V_{IN}=5V$ ,  $I_{IN}\leq 3A$ ,  $C_{IN}=1\mu F$ ,  $C_{OUT}=1\mu F$ , unless otherwise noted.



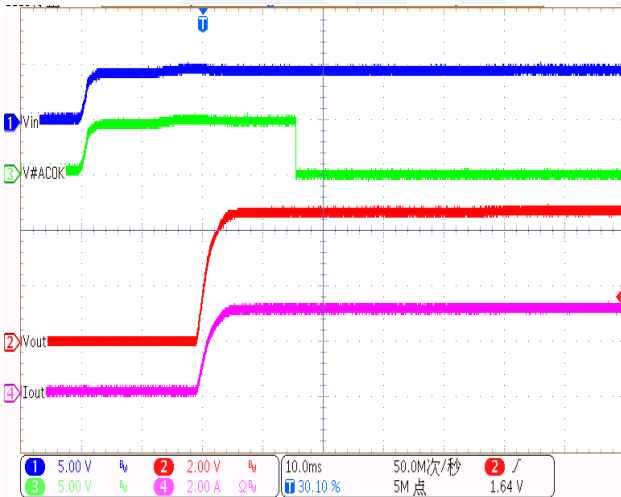
VIN Power ON ( $V_{IN}=5V$ , No Load)



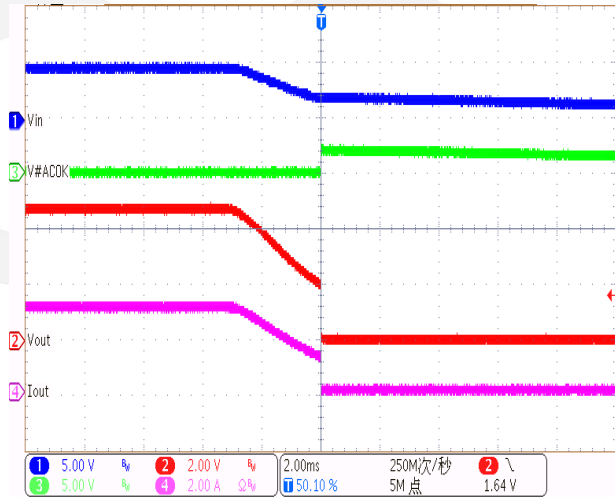
VIN Power OFF ( $V_{IN}=5V$ , No Load)



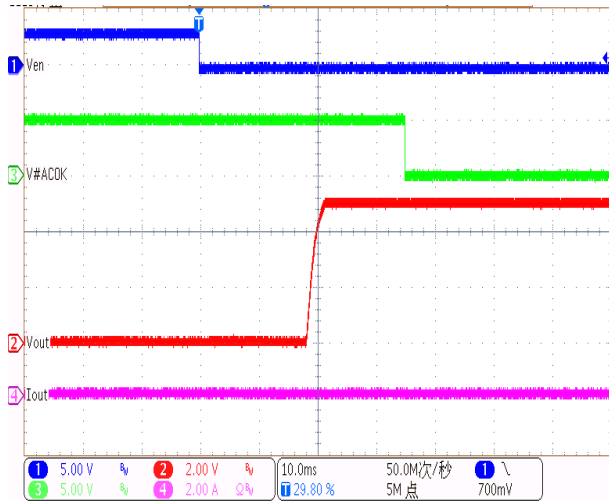
VIN Power ON ( $V_{IN}=5V, R_{Load}=1.6ohm$ )



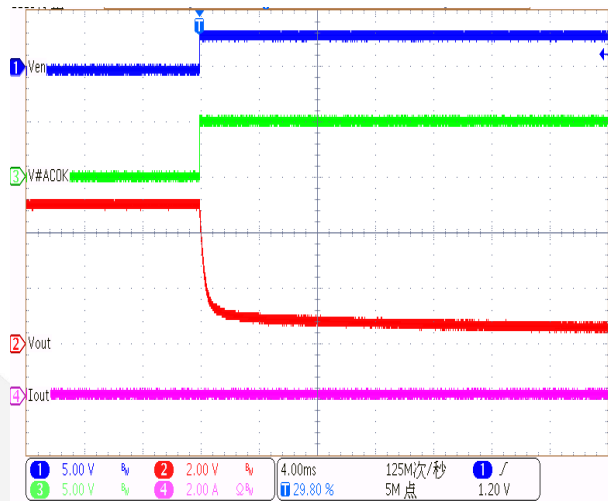
VIN Power OFF ( $V_{IN}=5V, R_{Load}=1.6ohm$ )



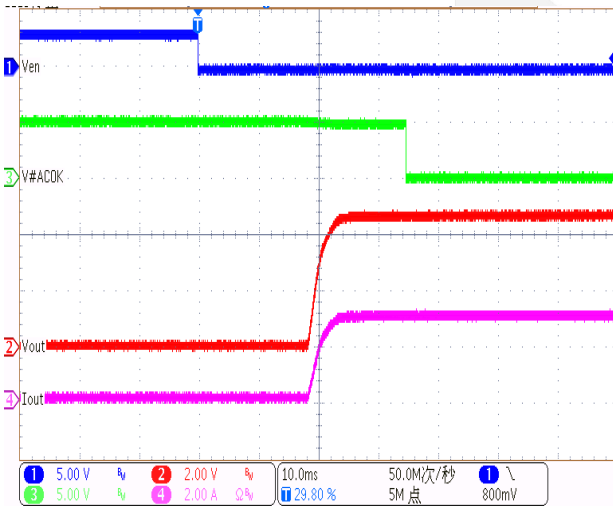
EN Power ON ( $V_{IN}=5V$ , No Load)



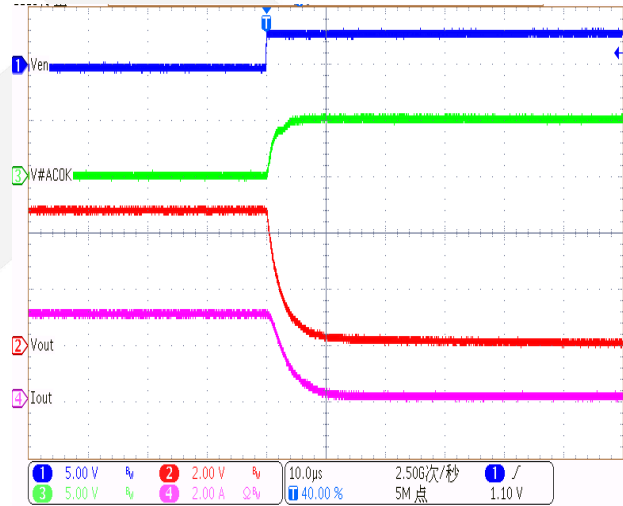
EN Power OFF ( $V_{IN}=5V$ , No Load)



EN Power ON ( $V_{IN}=5V$ ,  $R_{Load}=1.6ohm$ )



EN Power OFF ( $V_{IN}=5V$ ,  $R_{Load}=1.6ohm$ )





## DIO1280

### Over-Voltage Lockout (OVLO) Calculation:

OVLO can be set externally and override default OVP. By connecting an external resistor-driver to the OVLO pin. Equation (1) can produce the desired trip voltage and resistor values.

$$V_{IN\_OVLO} = V_{OVLO\_TH} \times [1 + R1 / R2] \quad (1)$$

Recommended minimum R1=820kΩ.

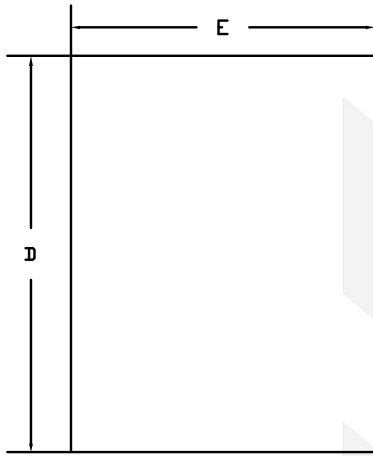
### On-The-Go (OTG) Functionality:

During OTG operation, the DIO1280 is initially disabled and the power FET's bulk diode is forward biased. The bulk diode represents ~0.7V drop across the device, which remains until the V\_IN voltage increases past 2.5V, when the device is fully enabled. While the device is disabled and the body diode is forward biased, the max DC current through the diode is 1.8A. This current is limited by the thermal performance of the device (0.7V x 1.8A=1.36W). The #EN pin must be pulled LOW to ensure the device fully enables and the transient should not exceed the RC time constant of the C\_IN and C\_OUT capacitors. At the system level, over-voltage and current protection should be provided outside the DIO1280.

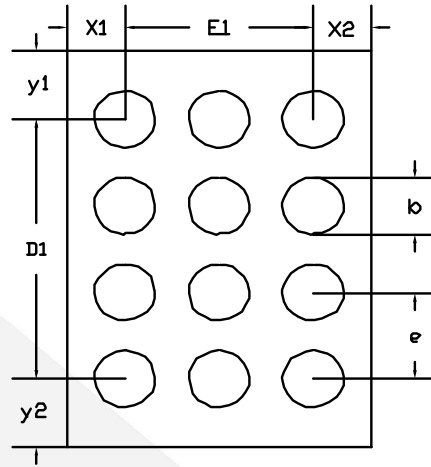




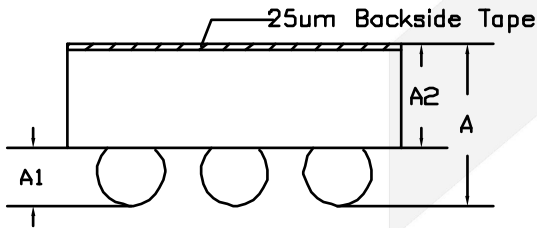
Physical Dimensions: WLCSP-12 0.4mm pitch



TOP VIEW  
(MARK SIDE)



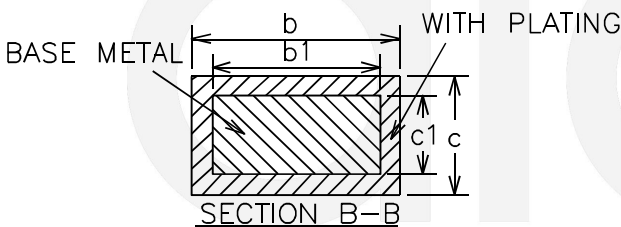
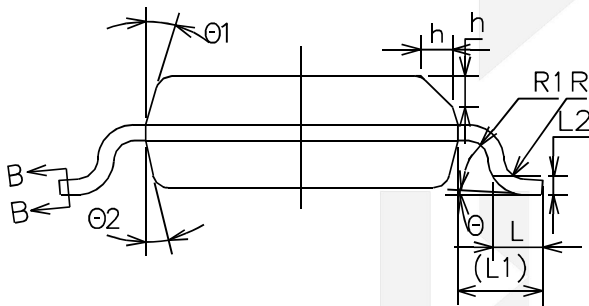
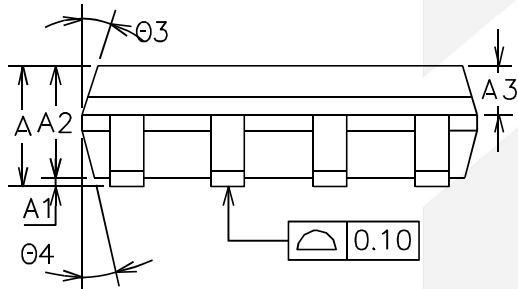
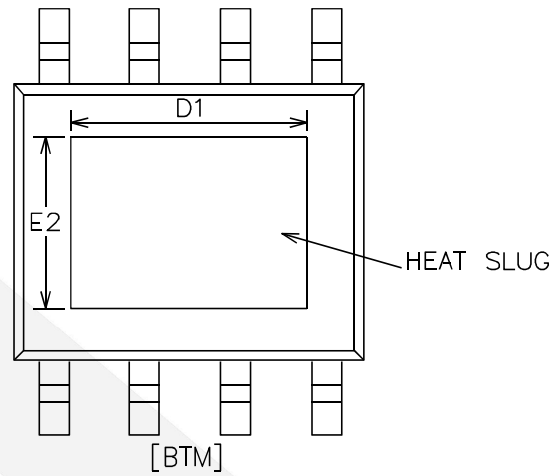
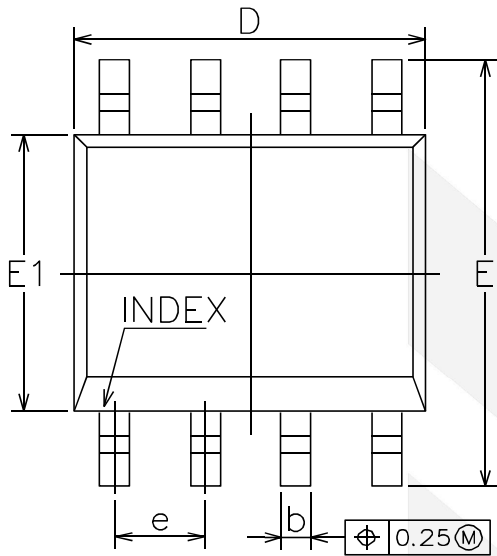
BOTTOM VIEW  
(BALL SIDE)



SIDE VIEW

| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |          |       |       |
|--|----------|-------|-------|
| Symbol   | MIN      | NOM   | MAX   |
| A  | 0.567    | 0.607 | 0.647 |
| A1   | 0.182    | 0.202 | 0.222 |
| A2   | 0.385    | 0.405 | 0.425 |
| D  | 1.808    | 1.828 | 1.848 |
| D1   | 1.200BSC |       |       |
| E  | 1.268    | 1.288 | 1.308 |
| E1   | 0.800BSC |       |       |
| b  | 0.230    | 0.260 | 0.290 |
| e  | 0.400BSC |       |       |
| x1   | 0.244REF |       |       |
| x2   | 0.244REF |       |       |
| y1   | 0.314REF |       |       |
| y2   | 0.314REF |       |       |

Physical Dimensions: EP-SOIC8



| COMMON DIMENSIONS<br>(UNITS OF MEASURE=MILLIMETER) |         |      |      |
|--|---------|------|------|
| Symbol   | MIN     | NOM  | MAX  |
| A  | 1.35    | 1.55 | 1.70 |
| A1   | 0       | 0.10 | 0.15 |
| A2   | 1.25    | 1.40 | 1.65 |
| A3   | 0.50    | 0.60 | 0.70 |
| b  | 0.38    | -    | 0.51 |
| b1   | 0.37    | 0.42 | 0.47 |
| c  | 0.17    | -    | 0.25 |
| c1   | 0.17    | 0.20 | 0.23 |
| D  | 4.80    | 4.90 | 5.00 |
| D1   | 3.10    | 3.30 | 3.50 |
| E  | 5.80    | 6.00 | 6.20 |
| E1   | 3.80    | 3.90 | 4.00 |
| E2   | 2.20    | 2.40 | 2.60 |
| e  | 1.17    | 1.27 | 1.37 |
| L  | 0.45    | 0.69 | 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°  |
| θ3   | 15°     | 17°  | 19°  |
| θ4   | 11°     | 13°  | 15°  |



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### 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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