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℃ (typical). Exceptionally low off-state current (<1μA maximum) facilitates compliance with standby power requirements.

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

Function Block Diagram

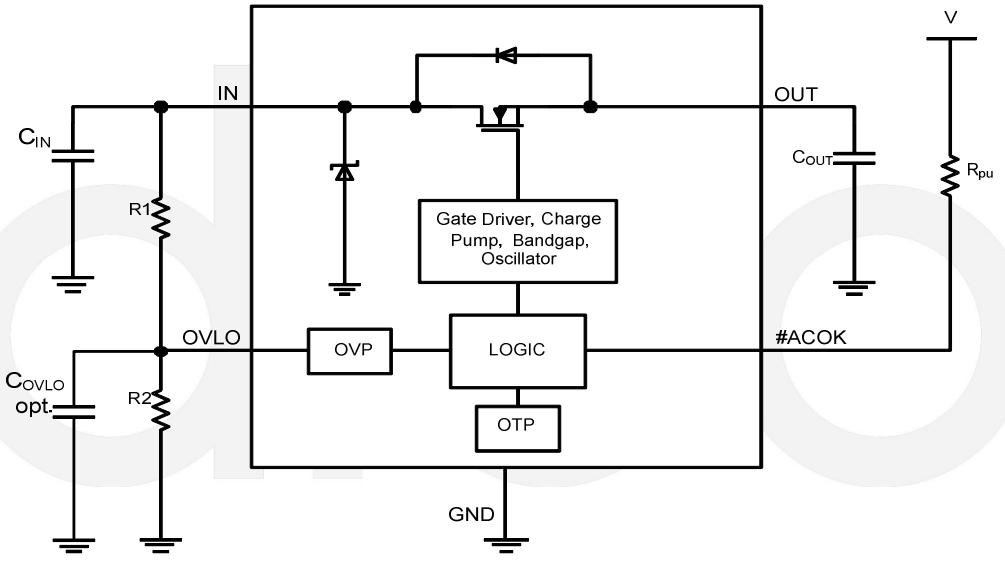
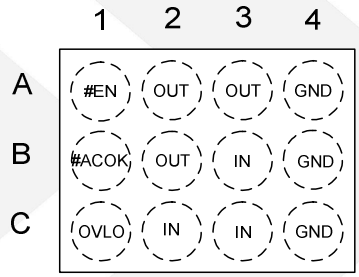


Figure 1 Functional Block Diagram

Ordering Information

Order Part Number	Top Marking		T_A	Package	
DIO1280WL12	HC80	Green	-40 to 85°C	WLCSP-12 0.4mm pitch	Tape & Reel, 3000

Pin Configuration



WLCSP-12

Figure 2 Pin Assignment (Top View)

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		

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℃		1.48	W
T_{STG}	Storage Temperature Range		-65 to 150	℃
T_J	Maximum Junction Temperature		150	℃
T_L	Lead Temperature (Soldering, 10 Seconds)		260	℃
θ_{JA}	Thermal Resistance, Junction-to-Ambient		84.1	℃/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

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		85	℃
I_{OUT}	Output Current			3	A

Electrical Characteristics

T_A=-40℃ to 85℃, unless otherwise specified. Typical values are V_{IN}=5.0V, I_{IN}≤3A, C_{IN}=0.1μF and T_A=25℃.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN_CLAMP}	Input Clamping Voltage	I_{IN}=10mA		35		V
I_Q	Input Quiescent Current	V_{IN}=5V, #EN=0V		80	110	μA
I_{IN_Q}	OVLO Supply Current	V_{OVLO}=3V, V_{IN}=5V. V_{OUT}=0V		70	96	μA
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}=2.5V to V_{OVLO}	1.18	1.20	1.22	
V_{OVLO_RNG}	Adjustable OVLO Threshold Range	V_{IN}=2.5V 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}=5V, I_{OUT}=1A, T_A=25℃		30		mΩ
C_{OUT}	OUT Load Capacitance	V_{IN}=5V			1000	μF
I_{OLVO}	OVLO Input Leakage Current	V_{OVLO}=V_{OVLO_TH}	-100		100	nA
T_{SDN}	Thermal Shutdown			130		℃
T_{SDN_HYS}	Thermal Shutdown Hysteresis			20		℃
Digital Signals						
V_{OL}	#ACOK Output Low Voltage	I_{SINK}=1mA			0.4	V
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_{ACOK_LEAK}	#ACOK Leakage Current	V_{ACOK}=3V, #ACOK Deasserted	-0.5		0.5	μA
#EN_Leak	#EN Leakage Current	V_{IN}=5.0V, V_{OUT}=Float	-1.0		1.0	μA
Timing Characteristics						
t_{DEB}	Debounce Time	Time from 2.5V<V_{IN}<V_{IN_OVLO} to V_{OUT}=0.1 x V_{IN}		15		ms
t_{START}	Soft-Start Time	Time from V_{IN}=V_{IN_min} to 0.2 x #ACOK, V_{IO}=1.8V with 10kΩ Pull-up Resistor		30		ms
t_{ON}	Switch Turn-On Time (Note 1)	R_L=100Ω, C_L=22μF, V_{OUT} from 0.1 x V_{IN} to 0.9 x V_{IN}	1.5	2	4	ms

t_{OFF}	Switch Turn-Off Time(Note 1)	R_L=100Ω, C_L=0μF, V_{IN}>V_{OVLO} to V_{OUT}=0.8 x V_{IN}	80	125	200	ns

Specifications subject to change without notice.

Note 1: guaranteed by characterization under room temperature.

Timing Diagrams:

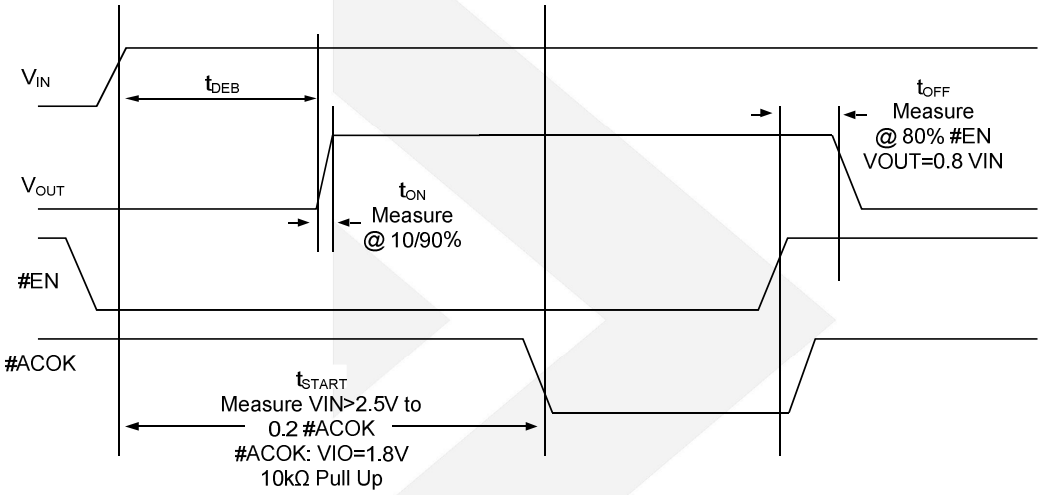


Figure 3 Timing for Power Up and Normal Operation

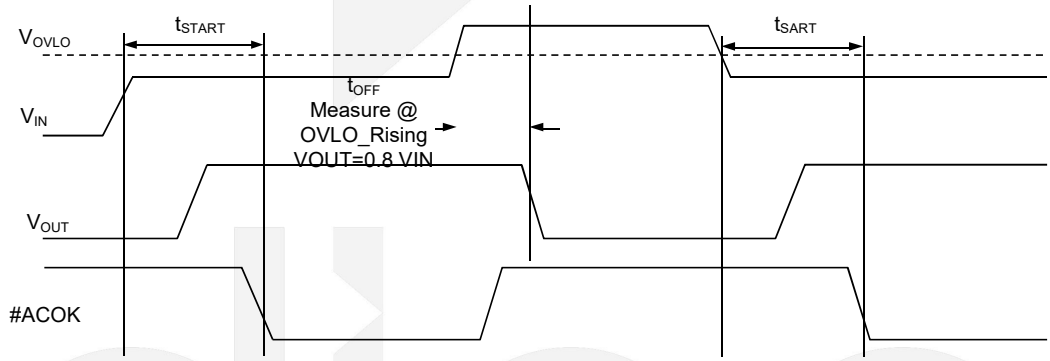
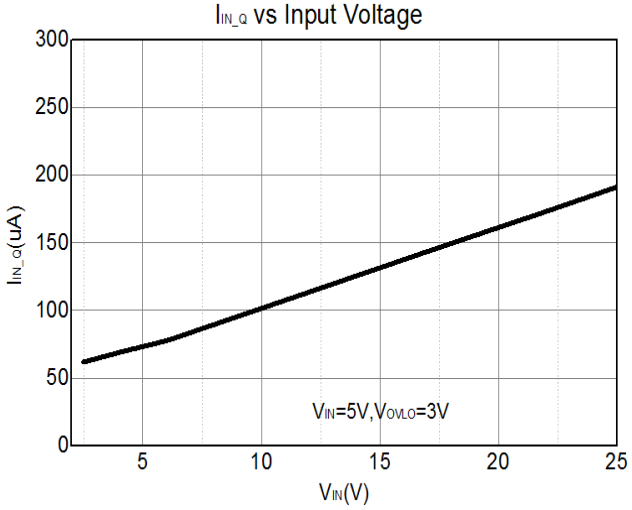


Figure 4 Timing for OVLO Trip

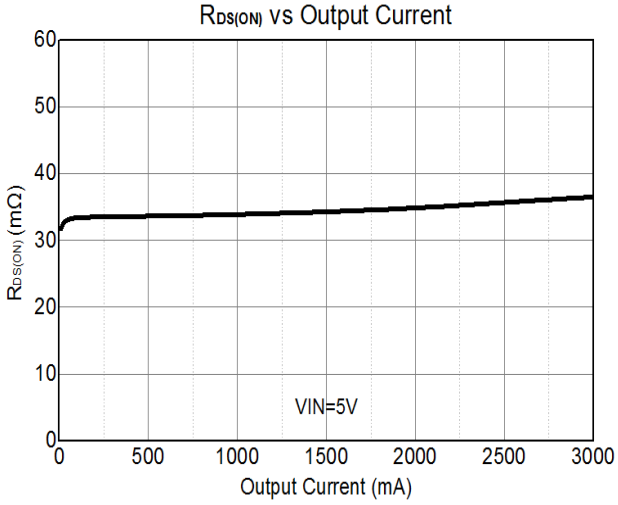
Typical Performance Characteristics

Ambient temperature is 25°C, V_{IN}=5V, I_{IN}≤3A, C_{IN} =1uF, C_{OUT} =1μF, unless otherwise noted.

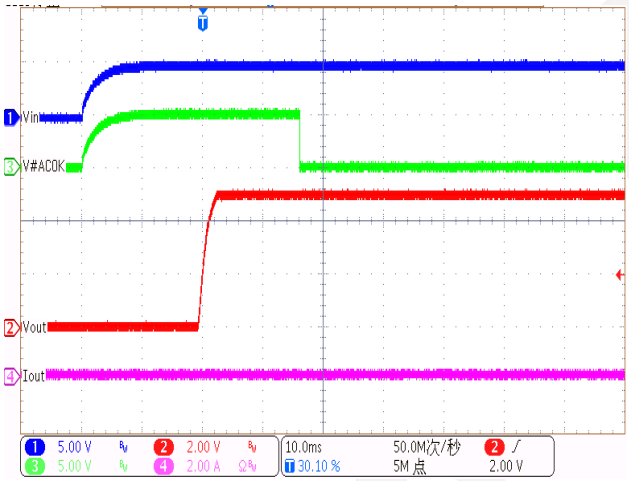
I_{IN_Q} vs Input Voltage



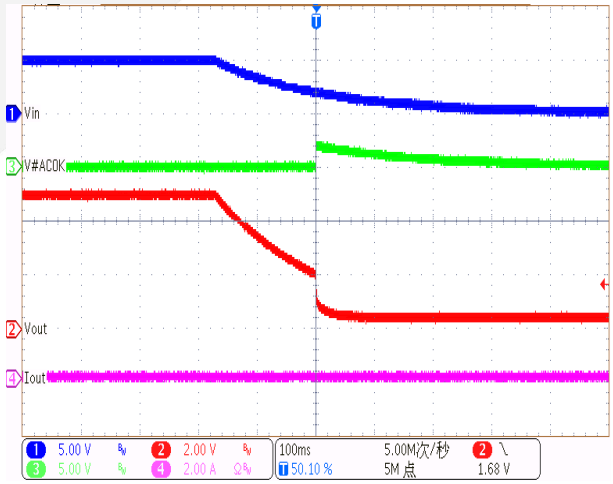
$R_{DS(ON)}$ vs Output Current



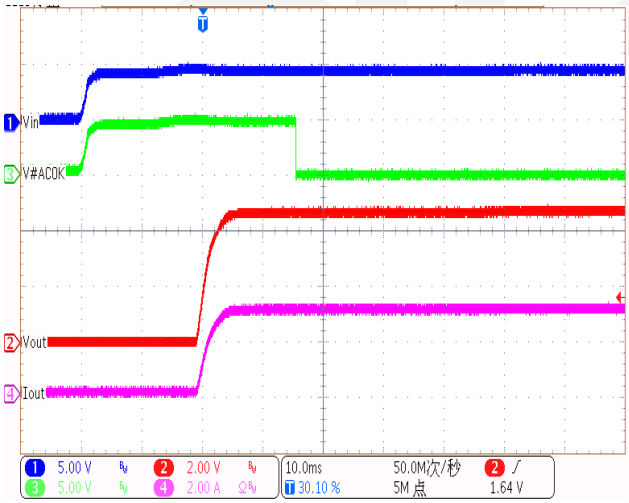
VIN Power ON (V_{IN}=5V, No Load)



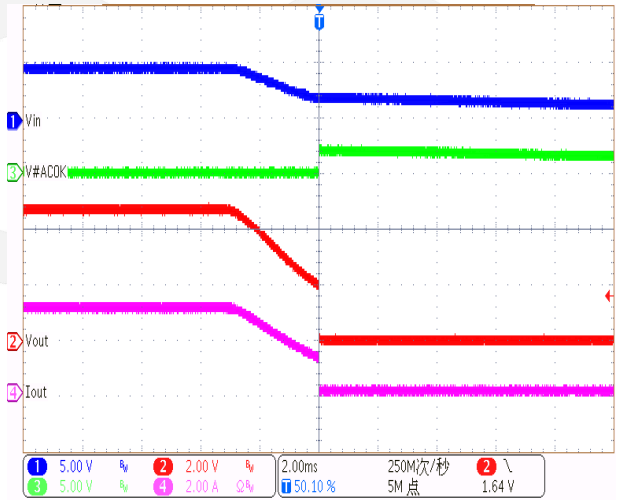
VIN Power OFF (V_{IN}=5V, No Load)



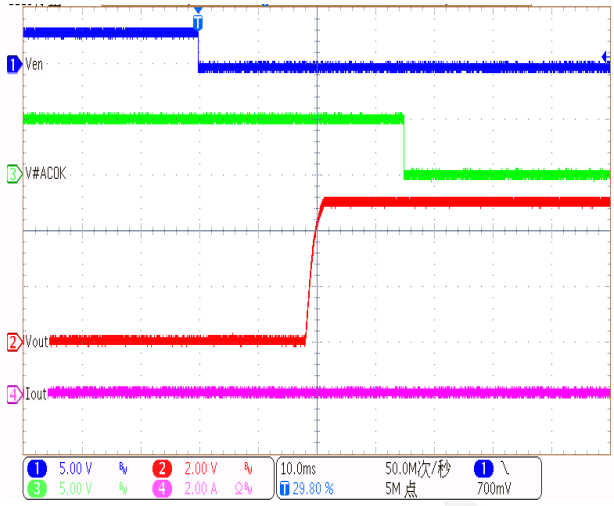
VIN Power ON (V_{IN}=5V, R_{Load}=1.6ohm)



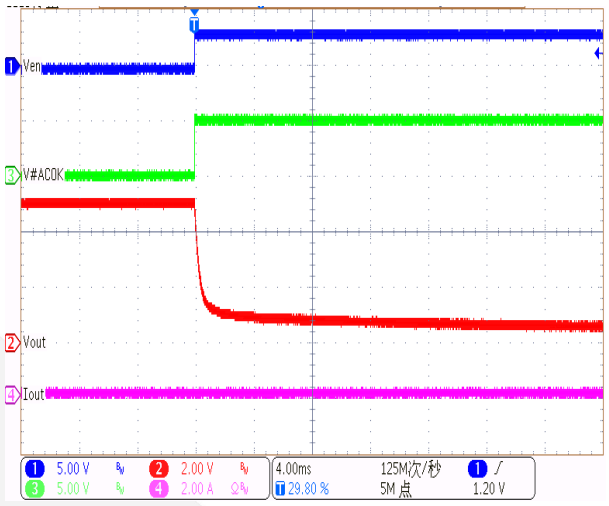
VIN Power OFF (V_{IN}=5V, R_{Load}=1.6ohm)



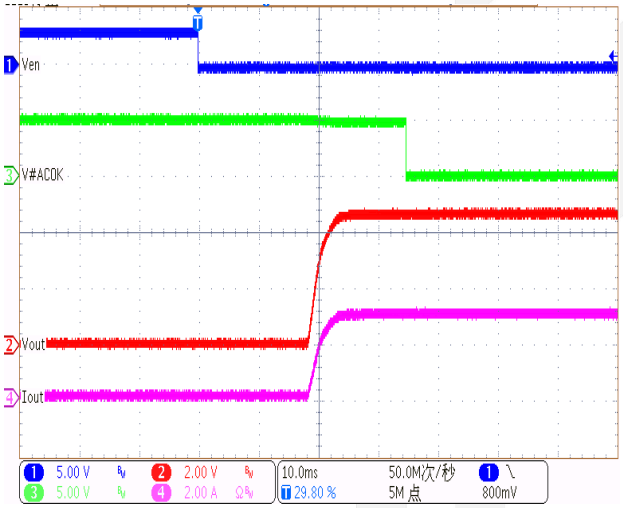
EN Power ON (V_{IN}=5V, No Load)



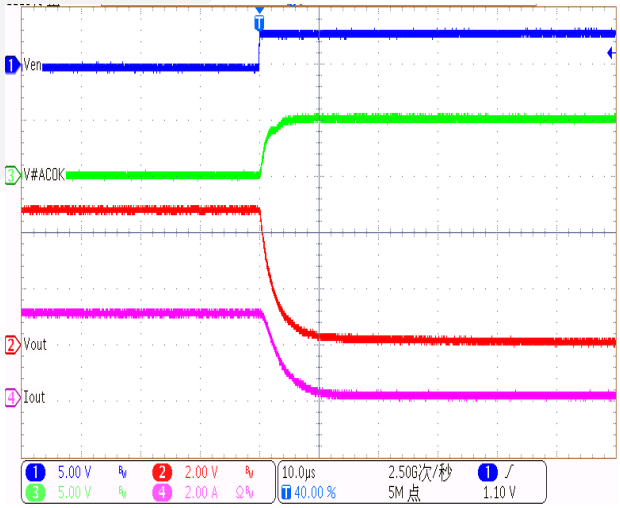
EN Power OFF (V_{IN}=5V, No Load)



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



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



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.

CONTACT US

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