DIO7305
Overvoltage and Over-Current Protection IC

Features

- Withstands high input voltage: 30 V (max)
- Adjustable over-current protection
- Input overvoltage protection
- Battery overvoltage protection
- High-accuracy protection thresholds
- Fault signal output
- Enable control
- Undervoltage lockout
- Output short-circuit protection
- Over-temperature protection
- Package: DFN2*2-8
- RoHS compliant and halogen-free

Applications

- Cell phones
- Digital cameras
- Portable instruments

Descriptions

The DIO7305 is a highly integrated circuits. It is used to protect low-voltage system from abnormally high input voltage. The IC continuously check the input voltage, the input current, and the battery voltage. The power MOS will be turned off upon the occurrence of any protection-triggering event. Hence the DIO7305 ensures functionality against incidents.

The current limit can be adjusted by external resistor between ISET and GND. And the current is also limited to prevent charging the battery with an excessive current. The DIO7305 also monitors the Li-ion battery voltage, when the battery voltage exceeds 4.35 V, the IC will turn off the MOS.

Other features include over-temperature protection and undervoltage lockout (UVLO). The DIO7305 is available in the DFN2*2-8 package.

Ordering Information

Part Number	Top Marking	RoHS	T$_A$	Package	
DIO7305CN8	GC0E	Green	-40 to 85°C	DFN2*2-8	Tape & Reel, 3000

Pin Assignments

DFN2*2-8
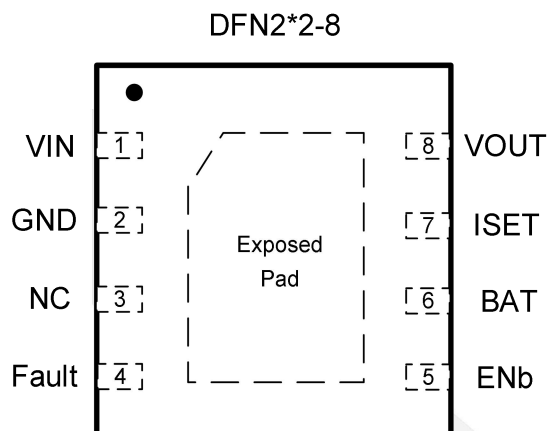
Figure 1. Top view

Pin Description

Pin No.	Pin Name	Description
1	VIN	Power source input. Connect a ceramic capacitor between VIN and GND.
2	GND	Ground.
3	NC	No connect.
4	Fault	Fault output pin. Open-drain output, device status.
5	ENb	Enable pin.
6	BAT	Battery voltage detector input.
7	ISET	OCP level setting by an external resistor to GND.
8	VOUT	Output through the power MOSFET.
	Exposed pad	Connecting EP to GND is suggested.

DIO7305

Function Diagram
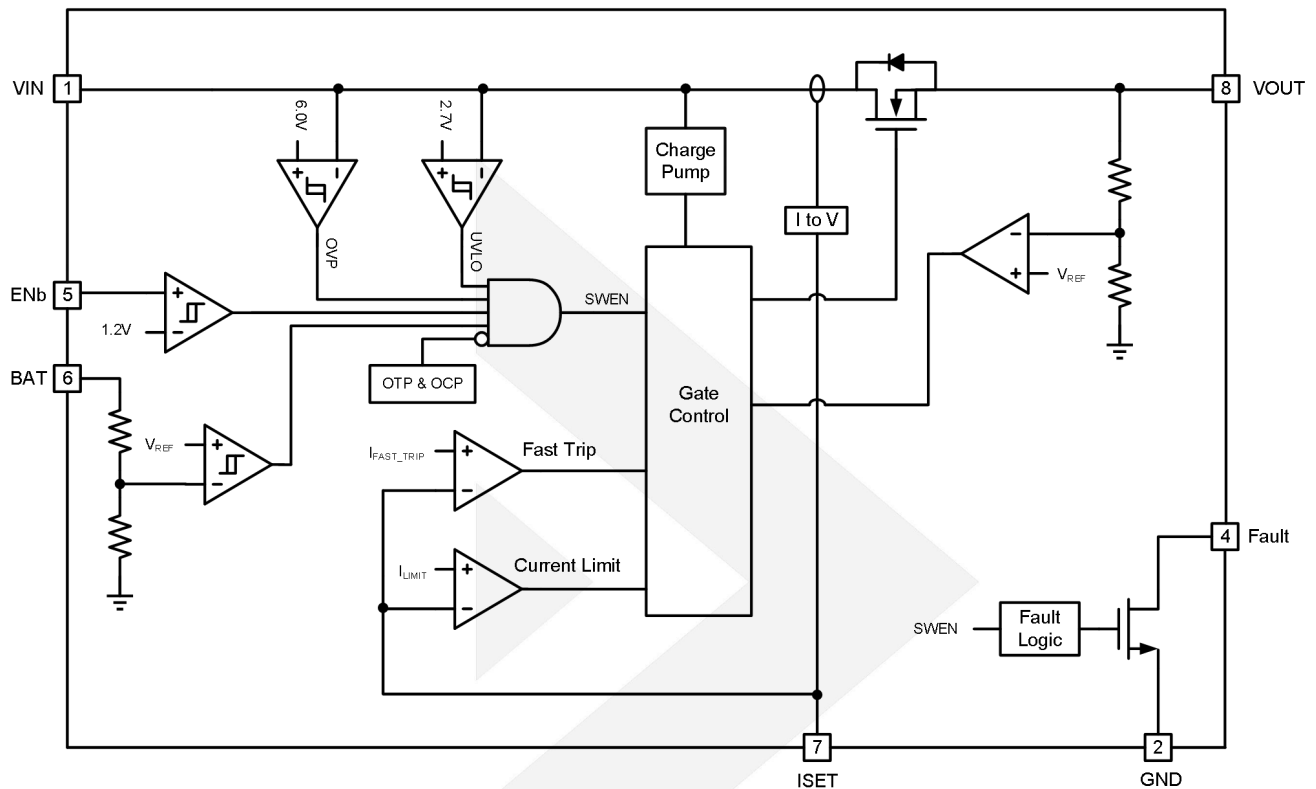
Typical Application
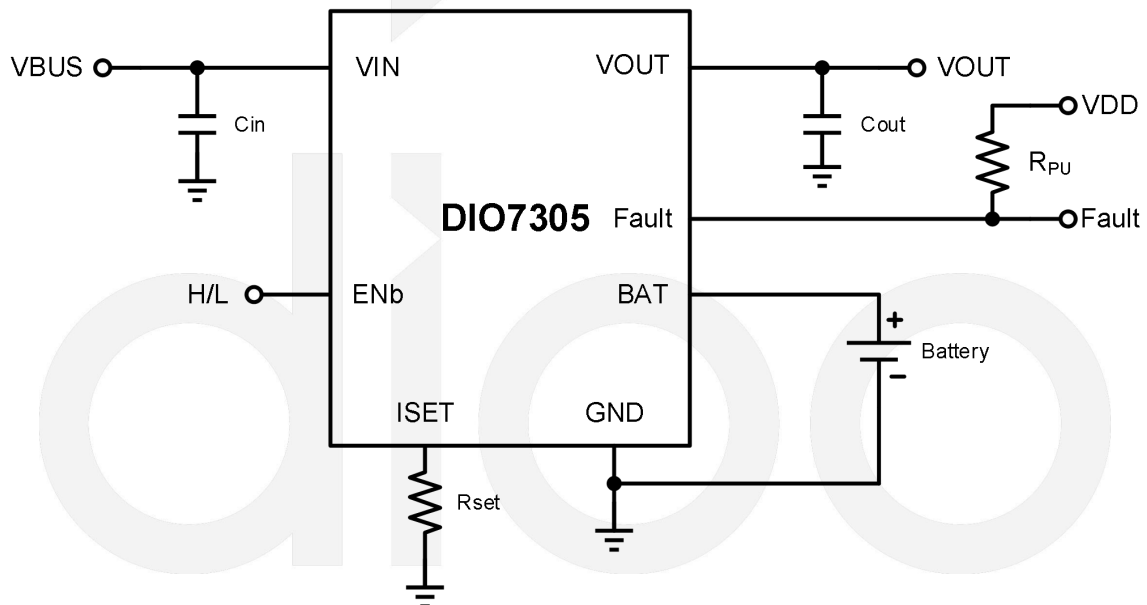
Absolute Maximum Ratings

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
	VIN to GND	-0.3 to 36	V
	VOUT to GND	-0.3 to 7	V
	All other pin to GND	-0.3 to 7	V
T_J	Operating junction temperature range	-40 to 150	°C
T_A	Operation ambient temperature range	-40 to 105	°C
T_{STG}	Storage temperature range	-65 to 150	°C
T_L	Maximum soldering temperature (at leads, 10 s)	260	°C

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	Rating	Unit
V_{IN}	Input voltage	3 to 5	V
I_{OUT}	Output current	0.3 to 1.5	A
R_{SET}	OCP set resistance	1.5 to 9	kΩ
T_J	Junction temperature	-40 to 125	°C

Electrical Characteristics

V_{IN} = 5 V, T_A = 25°C, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
General Function						
V_{IN}	Power source voltage	T_J = +25 °C	3.0	5	30	V
V_{UVLO}	Input UVLO threshold	VIN rising	2.5	2.7	2.9	V
ΔV_{UVLO}	UVLO threshold hysteresis	Falling hysteresis		200		mV
$t_{Deglitch}$	Power on deglitch time			8.0		ms
t_{SS}	Soft-start time			1.2		ms
I_{IN}	Power source current	V_{IN} = 5 V, ENb = L		150	200	µA
I_{SD}	Shutdown current	V_{IN} = 5 V, ENb = H		10	15	µA
T_{SD}	Thermal shutdown threshold			150		°C
ΔT_{SD}	Thermal shutdown threshold hysteresis			20		°C
Logic Function						
V_{ENH}	ENb threshold voltage		1.2			V
V_{ENL}					0.4	V
I_{EN}	ENb input current	ENb = 2 V		1.5		µA
	FAULT output logic low	Sink 5 mA		0.2		V
	FAULT logic high leakage current	Fault = 5 V			2	µA
Power MOS						
$R_{DS(ON)}$	Switch on resistance	I_{OUT} = 0.5 A		110	160	mΩ
Regulation Function						
V_{LDO}	Output voltage regulation	V_{IN} = 5.7 V	5.3	5.5	5.7	V
Protection Functions						
V_{IOVP}	Input overvoltage protect threshold	V_{IN} from 5 V to 10 V	5.8	6	6.2	V
ΔV_{IOVP}	Input OVP threshold hysteresis	V_{IN} from 10 V to 5 V		100		mV
t_{OVPR}	Input OVP recovery delay time			8.0		ms
I_{OCP}	Overcurrent protection	R_{SET} = 2.5 kΩ, V_{IN} - V_{OUT} = 1 V	0.9	1	1.1	A
t_{OCP}	OCP blanking time			200		µs
t_{OCR}	Over current recover delay			64		ms
V_{BOVP}	Battery voltage OVP	V_{IN} = 5 V	4.263	4.350	4.437	V
ΔV_{BOVP}	Battery OVP hysteresis	V_{IN} = 5 V	0.220	0.275	0.330	V
t_{BOVP}	Battery OVP blanking time	V_{IN} = 5 V		250		µs
I_{BAT}	Bat pin leakage current	V_{IN} = 5 V, V_{BAT} = 4.4 V			200	nA

Typical Performance Characteristics

V_{CC} = 5 V, R_L = 3.3 Ω, R_{ISET} = 3.6 kΩ,
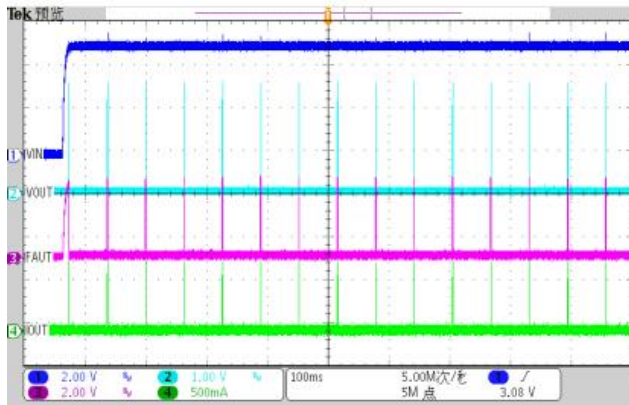
current limit = 1 A, monitoring Fault, V_{CC}, and I_{IN}

Figure 2. Over-current protection
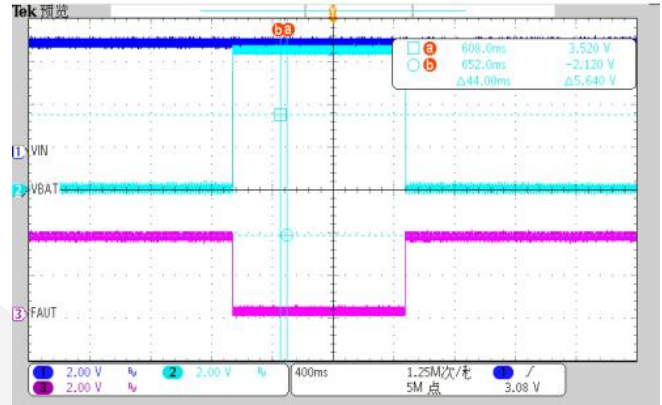
V_{CC} = 5 V, V_{BAT} = 6.5 V, monitoring Fault, V_{BAT}
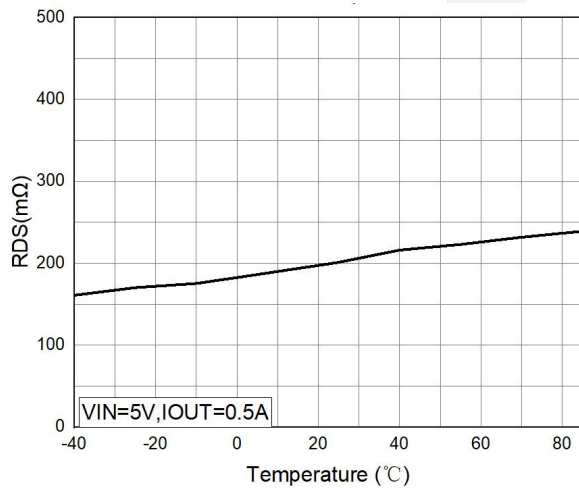
Figure 3. Over-voltage protection
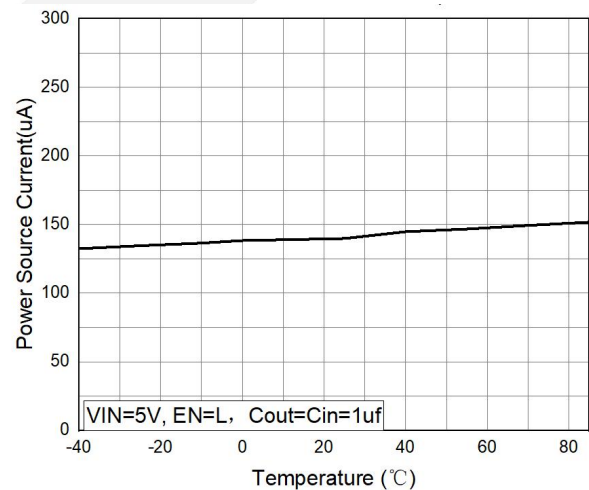

Figure 4. R$_{DS}$ vs. Temperature

Figure 5. Power source current vs. Temperature

Application Information

The DIO7305 device monitors the input voltage, battery voltage, and output current to protects the charging system with a Li-Ion battery. When enabled, the system is protected against input overvoltage: the internal switch is turned off and the power is immediately removed from the charging circuit. For an over-current condition, the device limits the output current at the setting value, and if the over-current persists, the switch will be turned off after a blanking time. Additionally, the device also monitors its own temperature and switches off if device is too hot.

Undervoltage lockout (UVLO)

The DIO7305 has an UVLO internal circuit that will enable the device as soon as the voltage on the V_{IN} voltage exceeds the UVLO threshold voltage.

Input overvoltage protection

The DIO7305 input has an overvoltage protection to protect the battery charging system. When the VIN voltage rises above 6 V (typ.), the system will turns the switch off.

Battery overvoltage protection

The battery overvoltage threshold V_{BOVP} is internally set to 4.35 V. If the battery voltage exceeds the threshold, the switch is turned off, and the Fault pin goes low. As soon as the battery voltage drops to (V_{BOVP} - ΔV_{BOVP}), the switch is turned back on. And the switch is turned off permanently when battery overvoltage occurs 15 times in one charge cycle. To clear this event, the VIN power or EN need to be re-cycled.

Over-temperature protection

The DIO7305 device enters over temperature protection (OTP) if its junction temperature exceeds 150°C (typ.). During over-temperature protection, none of the device's functions are available. To resume normal operation, the junction temperature needs to be cooled down, and the outputs will restart.

Enable control

The DIO7305 has an enable pin that can be used to enable or disable the device. When the EN pin is driven high, the switch is turned off. The EN pin has an internal pull-down resistor can be left floating.

Fault flag

The Fault pin is an open-drain output, including input overvoltage, output over-current, battery overvoltage, and over temperature.

Over-current protection

The over-current threshold can adjustable by an external resistor R_{SET} that is connected from the ISET pin to GND. The OCP threshold can be calculated from:

$$I_{OCP} = 2500 \div R_{SET} \qquad\qquad 1$$

If the output current exceeds the I_{OCP} threshold, the device limits the current for a blanking duration of t_{OCP}. If the over current situation exceeds the t_{OCP}, the switch will be turned off, and the Fault pin is go low. The switch will initiate a soft-start again after t_{OCR}. And the switch is turned off permanently when over-current event occurs 15 times in one charge cycle. To clear this event, the VIN power or EN need to be re-cycled.

Layout consideration

The proper PCB layout and component placement are critical for all circuit. The DIO7305 is meant to protect the downstream circuit. Here are some suggestions to the layout design.

1. Connected all grounds together with one uninterrupted ground plane, which includes a power ground and an analog ground.

2. The input and output capacitor should be located as closed as possible to the chip and the ground plane.

3. Other components should be located close to the chip.

Physical Dimensions: DFN2*2-8

Over Voltage and Over Current Protection IC

TOP VIEW

SIDE VIEW

SIDE VIEW

BOTTOM VIEW
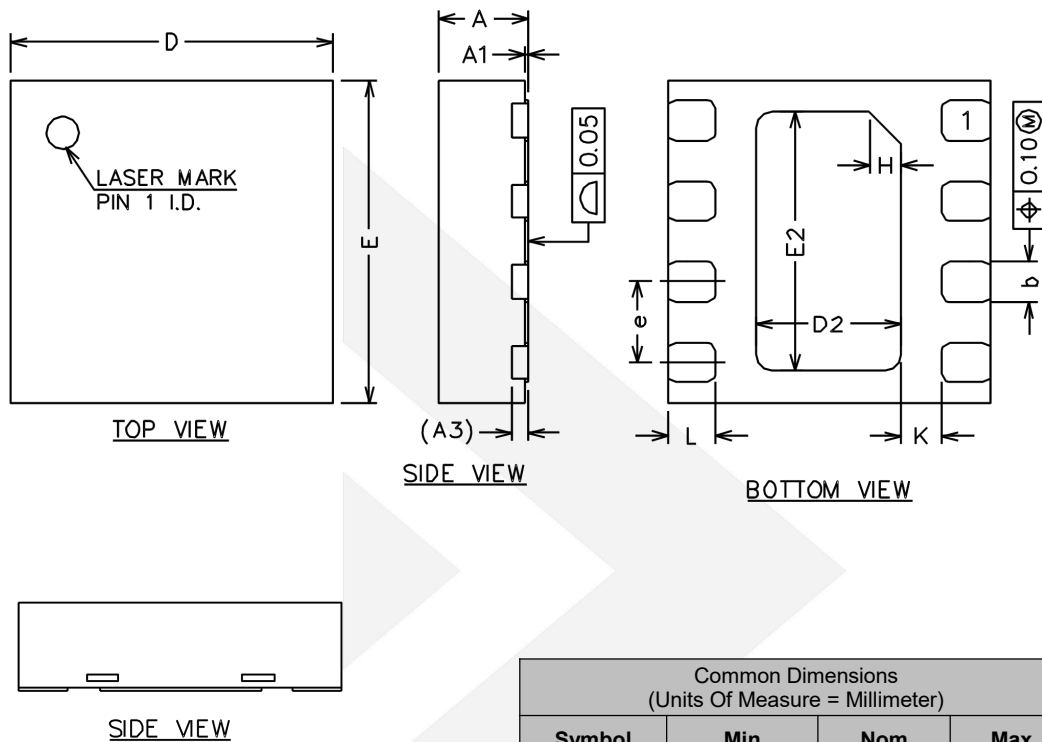
Common Dimensions (Units Of Measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	0.50	0.55	0.65
A1	0.00	0.02	0.05
A3	0.10REF		
b	0.20	0.25	0.30
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.80	0.90	1.00
E2	1.50	1.60	1.70
e	0.40	0.50	0.60
H	0.20REF		
K	0.15	0.25	0.35
L	0.25	0.30	0.35

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CONTACT US

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