DIO7552B/7553B

Precision Adjustable Current-Limited Power Distribution Switches

Features

- **70mΩ(typ) High-Side MOSFET**
- **2.31A Maximum Continuous Load Current**
- **±10% Current-Limit Accuracy at 1A typically**
- **Adjustable Current Limit: 400mA–2.57A (typ)**
- **Operating Range: 4.75V to 5.5V**
- **70µA(typ) Quiescent Current**
- **2µs Fast Over current Response Typically**
- **Reverse Input-Output Voltage Protection**
- **Built-in 450Ω(typ) output discharge resistor**
- **6kV HBM ESD Protection**
- **2ms(typical) soft start time**
- **Green package: SOT23-6 and DFN2*2-6 is pin compatible**

Application

- **USB Ports & USB Hubs**
- **Digital TV and**
- **Set-Top Boxes**
- **VOIP Phones**
- **Short-Circuit Protections**

Descriptions

The DIO7552B/7553B is power distribution switches that intended for applications where precision current limiting is required or heavy capacitive loads and short circuits are encountered and provide up to 2.31A of continuous load current.

A programmable current-limit threshold is offered between 400mA and 2.57A (typ) via an external resistor. Current-limit accuracy is ±10% @1A. The power-switch rise and fall times are controlled to minimize current surges during turn on/off. A constant-current mode is used when the output load exceeds the current-limit threshold.

The DIO7552B/7553B limits the output current to a safe level by using a constant-current mode when the output load exceeds the current-limit threshold. An internal reverse voltage comparator disables the power switch when the output voltage is driven higher than the input to protect devices on the input side.
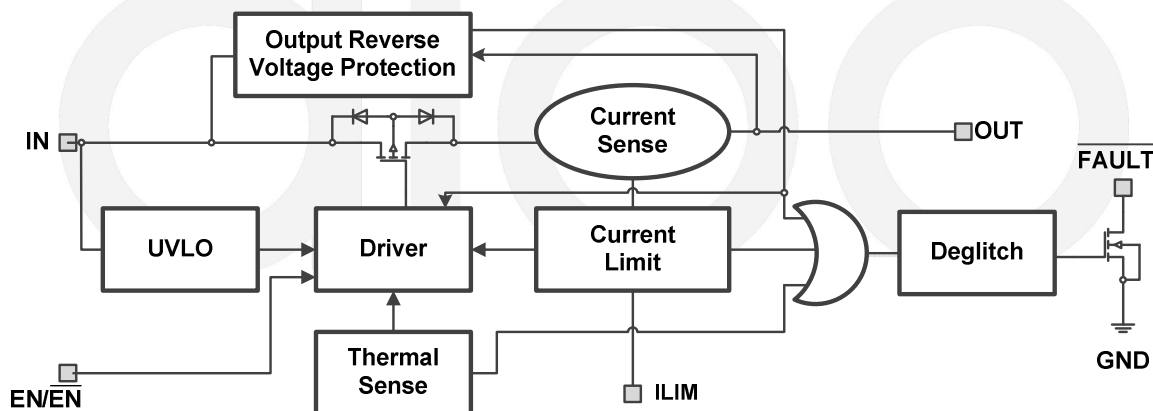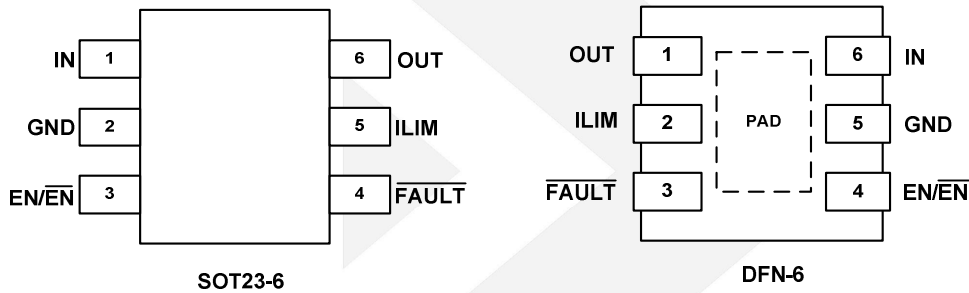
Block Diagram

Figure 1 Functional Block Diagram

DIO7552B/7553B

Ordering Information

Order Part Number	Top Marking	Green	T_A	Package	
DIO7552BST6	W52B	Yes	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO7553BST6	W53B	Yes	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO7552BCD6	52B	Yes	-40 to 85°C	DFN-6	Tape & Reel, 3000
DIO7553BCD6	53B	Yes	-40 to 85°C	DFN-6	Tape & Reel, 3000

Pin Assignment

EN = Active Low for the DIO7552B, EN = Active High for the DIO7553B

Figure 2 Pin Assignment

Pin Description

Name	Function
IN	Input voltage; connect a 0.1µF or greater ceramic capacitor from IN to GND as close to the IC as possible.
GND	Ground pin.
EN	Enable input, logic high turns on power switch.
$\overline{EN}$	Enable input, logic low turns on power switch.
$\overline{FAULT}$	Active-low open-drain output, asserted during over current, over temperature, or reverse-voltage conditions.
ILIM	External resistor used to set current-limit threshold; recommended 15kΩ ≤ R_{ILIM} ≤ 64kΩ.
OUT	Power-switch output.

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
Terminal Voltage(With respect to GND)	V_{IN}	-0.3 to 6.0	V
	Other Inputs	-0.3 to 6.0	
Fault Flag Voltage	V_{FLG}	-0.3 to 6.0	V
Fault Flag Current	I_{FLG}	10	mA
Package Thermal Resistance	SOT23-6	190	°C/W
	DFN-6	140	°C/W
Maximum Junction Temperature		150	°C
Operating Temperature/T_A		-40 to 85	°C
Storage Temperature/T_{STO}		-65 to 150	°C
Lead Temperature Rating		300	°C
ESD Susceptibility	HBM (Human Body Mode)	6	kV

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.

Parameter	Rating	Unit
IN	4.75 to 5.5	V
All other pins	0 to 5.5	V
Junction Temperature Range	-40 to 125	°C
Ambient Temperature Range	-40 to 85	°C

Electrical Characteristics

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

Symbol	Parameters	Conditions		Min	Typ.	Max	Unit
V_{IN}	Operation Voltage			4.75		5.5	V
$R_{DS(ON)}$	On Resistance	V_{IN}=5V			70		mΩ
Ios	Over Current Limit	R_{SET}=10kΩ	-40°C≤T_A≤85°C	2.31	2.57	3.08	A
		R_{SET}=15kΩ	-40°C≤T_A≤85°C	1.54	1.7	1.96	A
		R_{SET}=24kΩ	-40°C≤T_A≤85°C	0.97	1.07	1.18	A
I_Q	Quiescent Supply Current	Open load, IC Enabled.			70		µA
t_{ON}+t_R	Turn-On time & Output turn on Rise Time	V_{IN}=5.5V, C_L=1µF, R_L=100Ω, See Figure 3			3	4.5	ms
t_{OFF}+t_F	Turn-Off time & Output turn off Rise Time	V_{IN}=5.5V, C_L=1µF, R_L=100Ω, See Figure 3		0.1		1.5	ms
$V_{EN(H)}$	EN Input Threshold-High V_{IH}			1.4			V
$V_{EN(L)}$	EN Input Threshold-Low V_{IL}					0.4	V
	FLAG Deglitch Time	FLAG assertion or desertion		4	8	15	ms
	Output Reverse Voltage Deglitch Time			2.5	4	7	ms
R_{DIS}	Discharge Resistance	V_{IN}=5V, Disabled, I_{OUT}=1mA			450		Ω
I_{SHDN}	Shutdown Input Current	Open load, IC Disabled.				1	µA
T_{SD}	Thermal Shutdown				140		°C
	Thermal Limit Hysteresis				20		°C

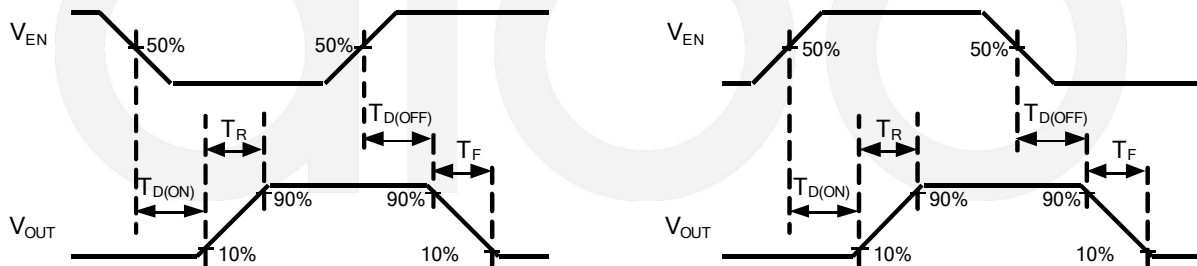Specifications subject to change without notice.

Figure 3 Voltage Waveforms: DIO7552B(left), DIO7553B(right)

Typical Applicaion

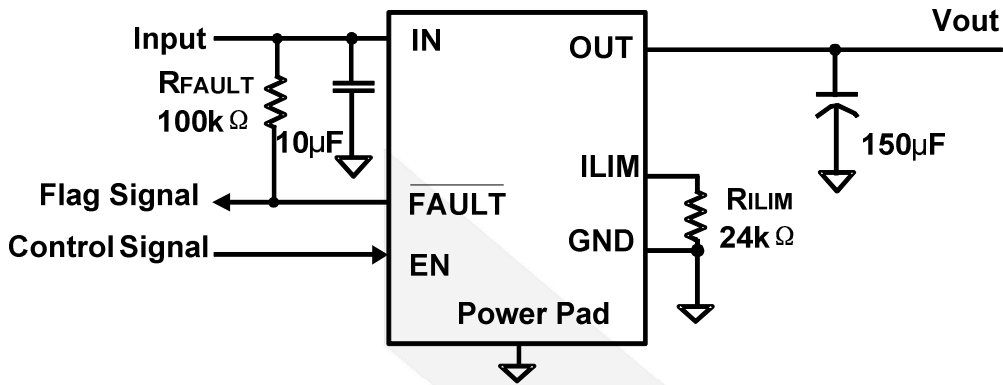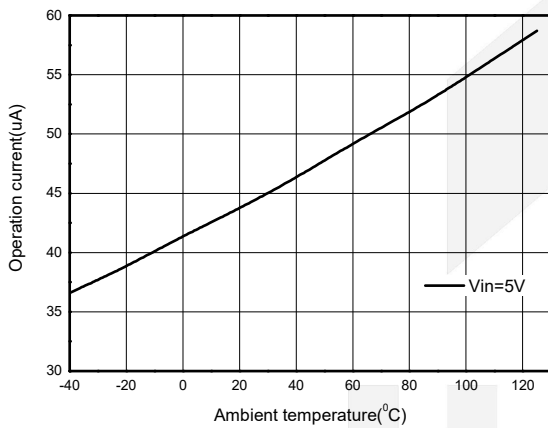**Figure 4 Typical Characteristics Reference Schematic**
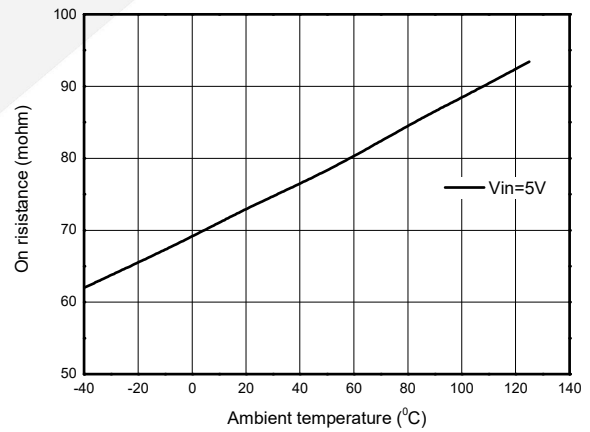
Typical Performance Characteristic

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

Operation Current vs. Ambient temperature

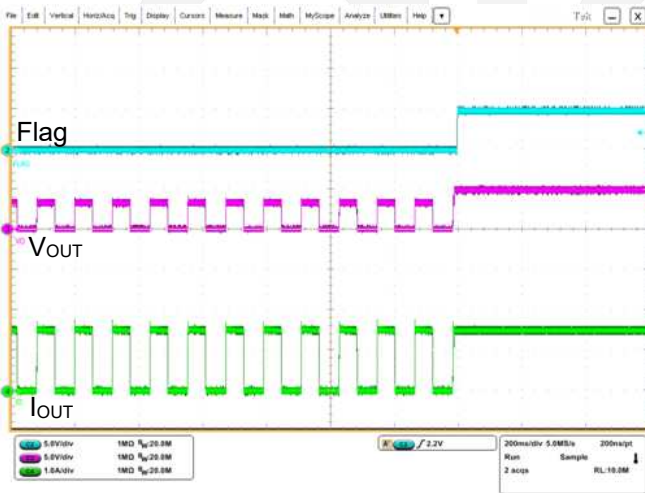**On Resistance vs. Ambient Temperature**

Overload to Heavy Load Recovery

(V_{IN}=5V,V_{EN}=V_{IN},R_{OUT}=1.8→3.3Ω)

VIN Start-Up

(EN=V_{IN},R_{OUT}=3.9Ω,V_{IN}=0 ↑ 5V)

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VIN Shut-down

$(EN=V_{IN}, R_{OUT}=3.9\Omega, V_{IN}=5V\downarrow0)$
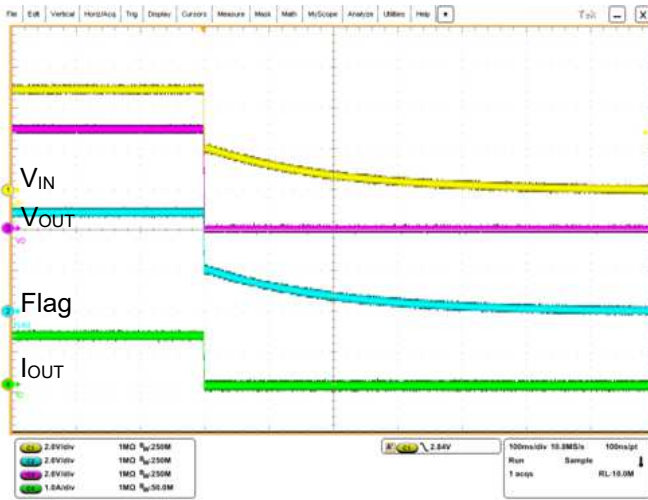
EN Start-Up

$(V_{IN}=5V, R_{OUT}=3.3\Omega, EN=0\uparrow5V)$

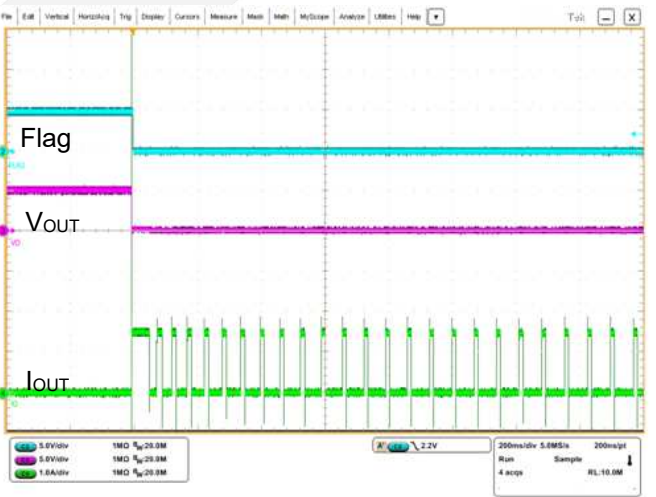### EN Shut-down
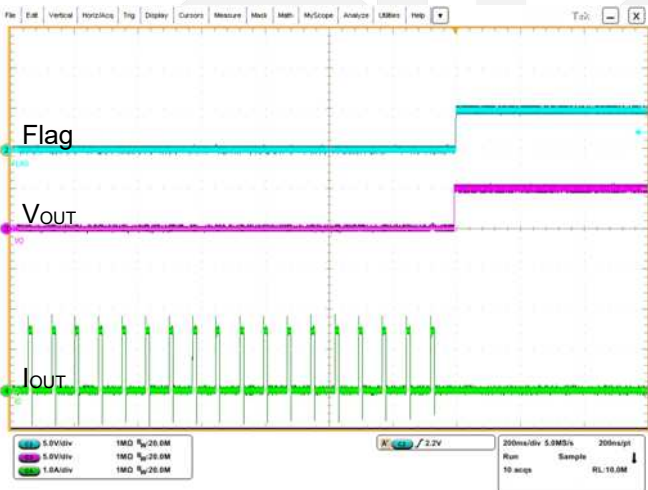
$(V_{IN}=5V, R_{OUT}=3.3\Omega, EN=5V\downarrow0)$

Short Protection

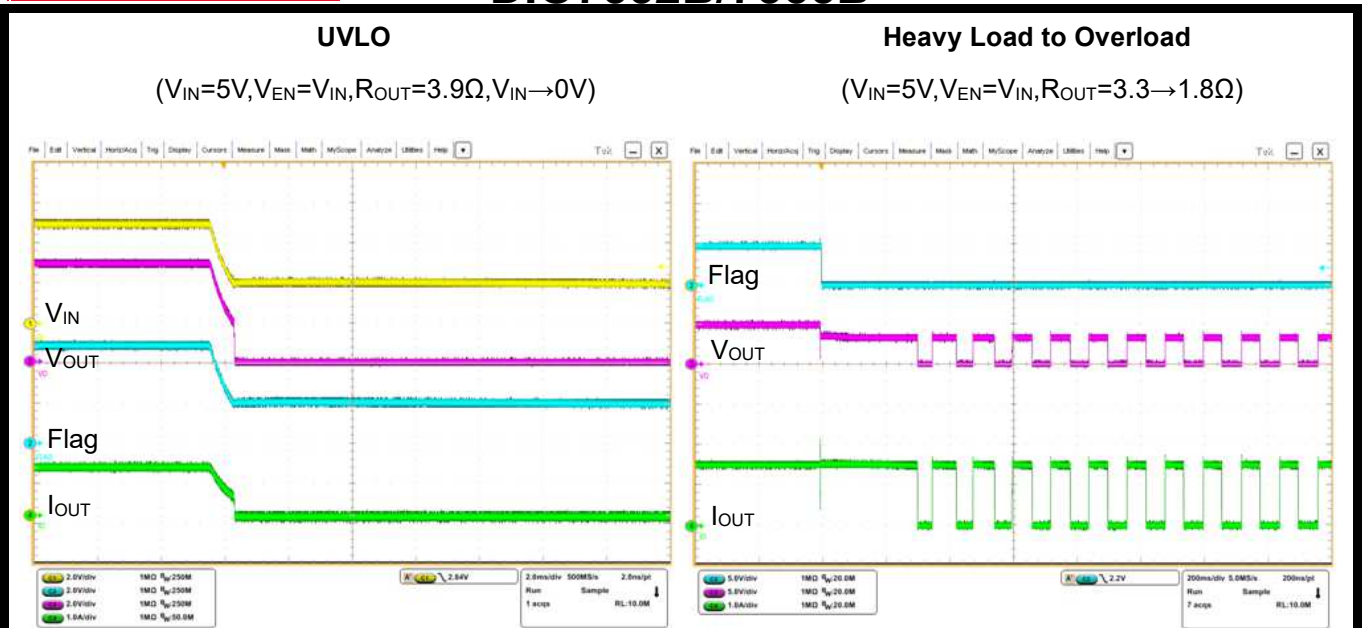$(\text{no load}, V_{EN}=V_{IN}, V_{OUT}\rightarrow0)$

Short Recovery

$(V_{EN}=V_{IN}=5V, V_{OUT}\rightarrow0)$

UVLO

$(V_{IN}=5V, V_{EN}=V_{IN}, R_{OUT}=3.9\Omega, V_{IN}\rightarrow5V)$

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UVLO	Heavy Load to Overload
(V_{IN}=5V,V_{EN}=V_{IN},R_{OUT}=3.9Ω,V_{IN}→0V)	(V_{IN}=5V,V_{EN}=V_{IN},R_{OUT}=3.3→1.8Ω)

Applicaion Information

Operation Information

DIO7552B/7553B is a current limited P-channel MOSFET power switch with over current and over temperature protection. There is no body diode across the drain and the source of the MOSFET. It prevents the current flow from the output to the input after the chip is disabled.

Over-current Protection

When the over-current condition is detected, the switch is regulated to achieve constant output current. If the over current condition lasts for a long time, and results in a junction temperature over 140°C, the switch will be shutdown. Once the junction temperature drops to 120°C, the part will restart.

Reverse-voltage Protection

The reverse-voltage protection feature turns off the P-channel MOSFET whenever the output voltage exceeds the input voltage by 135mV (typ) for 4ms (typ). A reverse current of (V_{OUT}-V_{IN})/$R_{DS(on)}$ will be present when this occurs. This prevents damage to devices on the input side of the DIO7552B/53B by preventing significant current from sinking into the input capacitance. The DIO7552B/53B devices allow the P-channel MOSFET to turn on once the output voltage goes bellow the input voltage for the same 4ms deglitch time.

Supply Filter Capacitor

In order to prevent the input voltage from dropping during hot-plug condition, a 10µF ceramic capacitor from V_{IN} to GND is strongly recommended. However, higher capacitance could help reduce the voltage drop. Furthermore an output short will cause ringing on the input without the input capacitor. It could destroy the internal circuitry when the input transient voltage exceeds the absolute maximum supply voltage even for a short duration.

Current Limiting Setting

Current limit is programmable to protect the power source from over current and short circuit conditions. Connect a resistor R_{SET} from I_{SET} pin to GND to program the current limit:

$$I_{OS} (A)=25752/Rset(Ω).$$

The minimum current limit is 0.4A. Current limit beyond 2.57A is not recommended.

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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