DIO7231

5.5V Low Loss Power Distribution Switch

Features

- Input voltage: 2.7V to 5.5V
- Typical 135mΩ on-resistance
- Under voltage lockout
- Over current protection, short circuit protection and over temperature protection
- Fault time 5ms typically with blanking
- Reverse blocking (no body diode)
- No reverse current when power ON or power OFF
- Compact SOT23 packages

Applications

- USB Ports/Hubs
- Digital TV
- Set-Top Boxes
- VOIP Phones

Descriptions

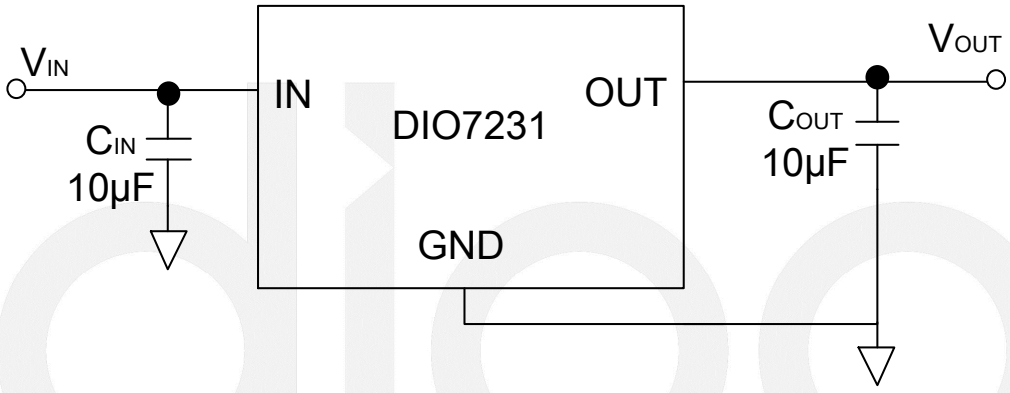
The DIO7231 power distribution switch is intended for applications where precision current limiting is required or heavy capacitive loads and short circuits are encountered. The power switch rising and falling times are controlled to minimize current surges during turning on/off.

The DIO7231 provide 275mA current level.

The DIO7231 device limits the output current under a safe level by using a constant current mode when the output load exceeds the current limit threshold.

The DIO7231 is available in the SOT23 package. It is rated over the -40°C to +85°C temperature range.

Typical Application



Ordering Information

Order Part Number	Top Marking		Package	
DIO7231ST3	YW31	Green	SOT23	Tape & Reel, 3000

Pin Assignments

SOT23 (Top View)

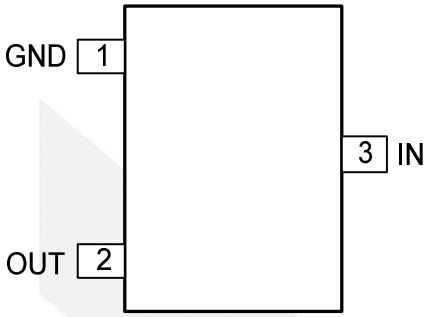


Figure 1 Pin Assignment

Pin Description

Pin Name	Pin Description
OUT	Output pin, decoupled with a 10μF capacitor to GND
GND	Ground pin
IN	Input pin, decoupled with a 10μF capacitor to GND

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 maxim rating conditions for extended periods may affect device reliability.

Parameter		Rating	Unit
All pins		-0.3 to 6	V
Package Thermal Resistance	θ_{JA} , SOT23	215	°C/W
Junction Temperature Range		150	°C
Lead Temperature (Soldering, 10 sec)		260	°C
Storage Temperature Range (T_{STG})		-65 to 150	°C
ESD Susceptibility	HBM (Human Body Mode)	6	kV
	CDM (Charged Device Mode)	2	

Note: Input and output negative ratings may be exceeded if input and output diode current ratings are observed.

Recommended Operating Conditions

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

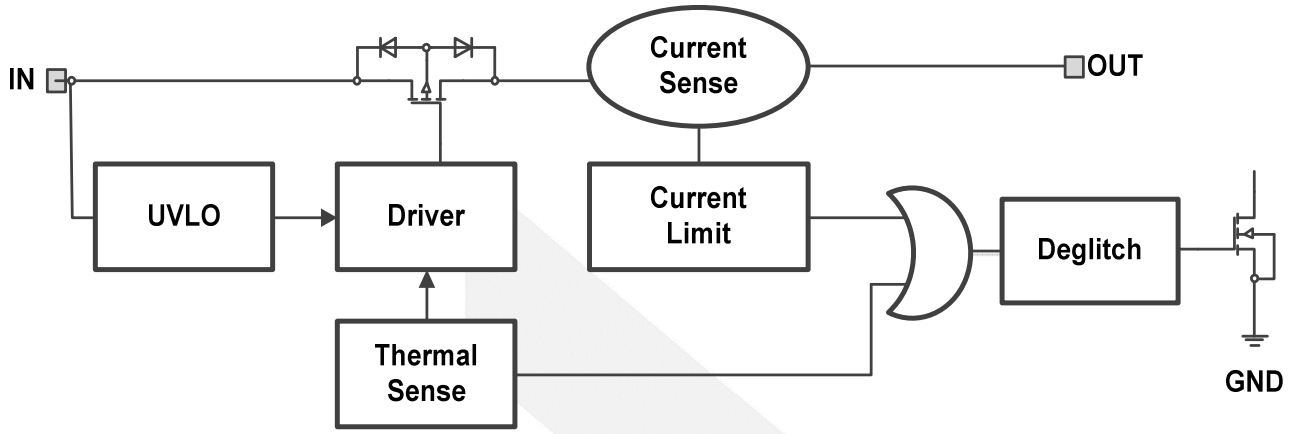
Parameter	Rating	Unit
IN	2.7 to 5.5	V
All other pins	0 to 5.5	V
Junction Temperature Range	-40 to 125	°C
Ambient Temperature Range	-40 to 85	°C

Electrical Characteristics

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage Range		2.7		5.5	V
I_Q	Quiescent Supply Current	Open load, IC Disabled		50	88	μA
$R_{DS(ON)}$	FET R_{ON}	I_{OUT}=100mA		135	176	mΩ
V_{IN_UVLO}	IN UVLO Threshold				2.5	V
V_{IN_HYS}	IN UVLO Hysteresis			240	400	mV
I_{LIM}	Current Limit		300	425	550	mA
I_{OS}	Short Current Limit			$I_{LIM,Typ}$ ×1.2	$I_{LIM,Max}$ ×1.2	A
T_{ON}	Turn-on Time	R_L=10Ω, C_{OUT}=1μF		400		μs
T_{OFF}	Turn-off Time	R_L=10Ω, C_{OUT}=1μF		20		μs
T_{SD}	Thermal Shut down Temperature			140		°C
	Thermal Shut down Hysteresis			20		°C

Block Diagram



Application Information

Power Supply Considerations

A 10μF ceramic capacitor from V_{IN} to GND to prevent the input voltage from dropping during the hot-plug condition is strongly recommended. However higher capacitance could help reduce the voltage drop. Further more, bypassing the input with a 10μF ceramic capacitor improves the immunity of the device to short-circuit transients, because 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.

Under Voltage Lockout

A voltage sense circuit monitors the input voltage. When the input voltage is below approximately 2.4V, a control signal turns off the power switch.

Over-Current Protection

The DIO7231 responds to over current conditions by limiting output current to the I_{LIM} level. When an over current condition is detected, the device maintains a constant output current and reduces the output voltage accordingly. Complete shut down occurs only if the fault is present long enough to activate thermal limit.

Two possible overload conditions can occur. In the first condition, an excessive load occurs while the device is enabled. When the excessive load occurs, very high currents may flow for a short time before the current limit circuit can react. After the current limit circuit has tripped (reached the overcurrent trip threshold) the device switches into constant current mode to limit the current close to I_{LIM}.

In the second condition, the load is gradually increasing beyond the recommended operating current. The current is permitted to rise until the currentlimit threshold (I_{LIM}) is reached or until the thermal limit of the device is exceeded. The DIO7231 is capable of delivering current up to the current limit threshold (I_{LIM}) without damaging the device. Once the threshold has been reached, the device switches into its constant current mode.

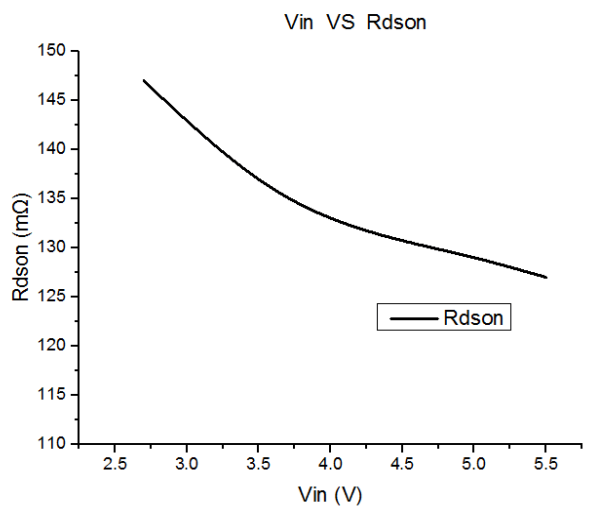
Thermal Protection

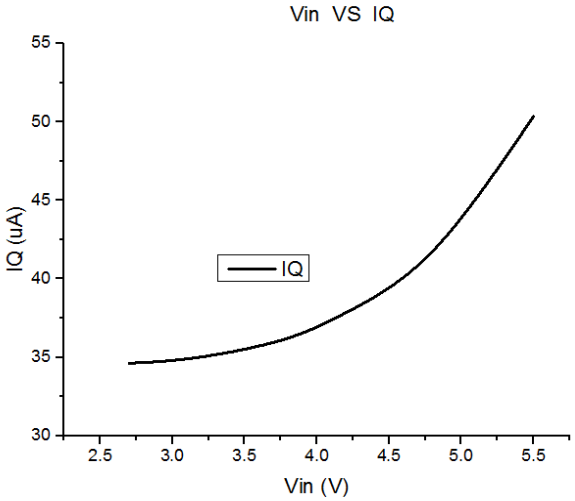
Thermal protection prevents damage to the IC when heavy overload or short circuit conditions are present for

extended periods of time. The conditions force the DIO7231 into constant current mode, and under short circuit conditions, the voltage across the switch is equal to the input voltage. The increased dissipation causes the junction temperature to rise to high levels. The protection circuit senses the junction temperature of the switch and shuts it off. Hysteresis is built into the thermal sense circuit, and after the device has cooled approximately 20 degrees, the switch turns back on. The switch continuesto cycle in this way until the overload or input power is removed.

Typical Performance Characteristics

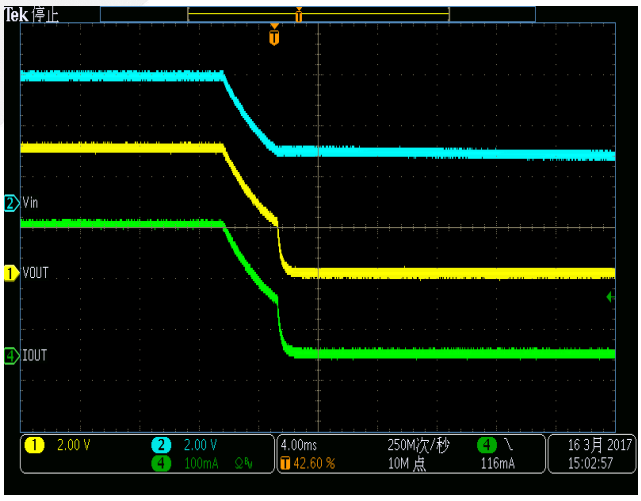
T_A=25°C V_{IN} = 5V, unless otherwise noted.



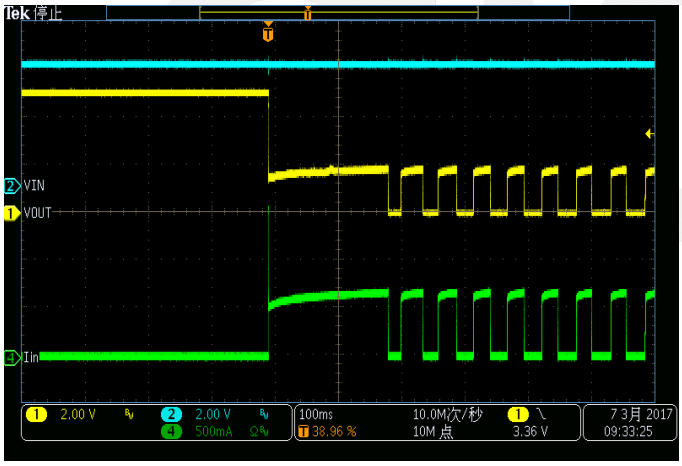


VIN Turn On
(Vin=5V, Rload=20ohm)

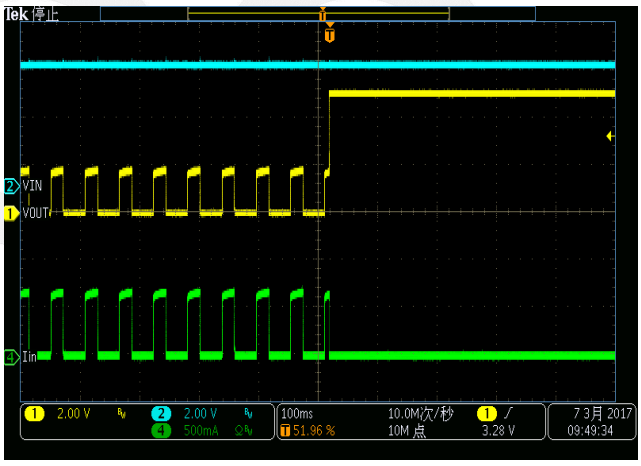
VIN Turn Off
(Vin=5V, Rload=20ohm)



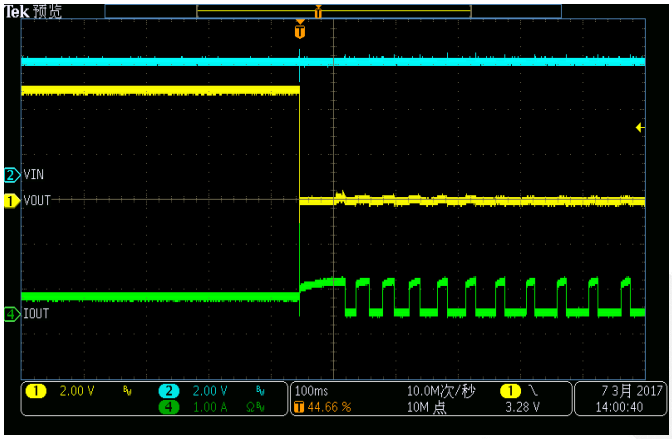
No-Load to Over-Load Transient Response
(Vin=5V, Rload=2.7ohm)



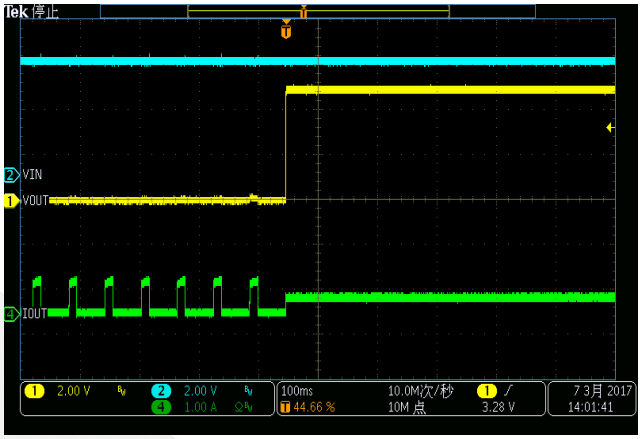
Over-Load to No-Load Recovery Response
(Vin=5V, Rload=2.7ohm)



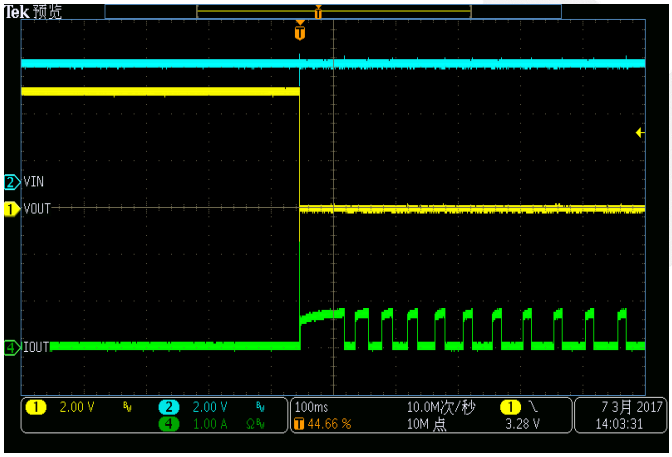
Full-Load to Short-Circuit Transient Response
(Vin=5V Rload=16.7ohm)



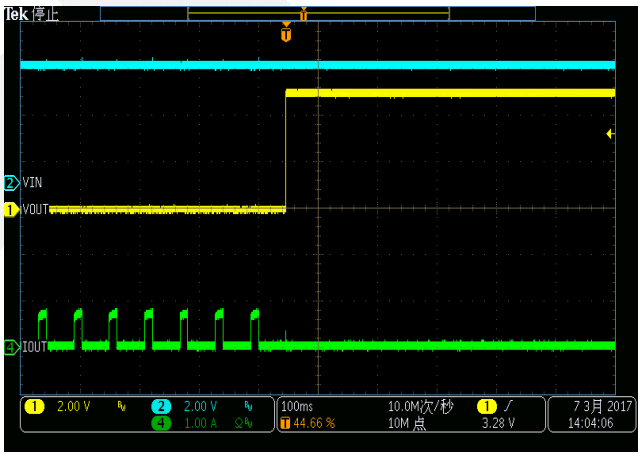
Short-Circuit to Full-Load Recovery Response
(Vin=5V Rload=16.7ohm)



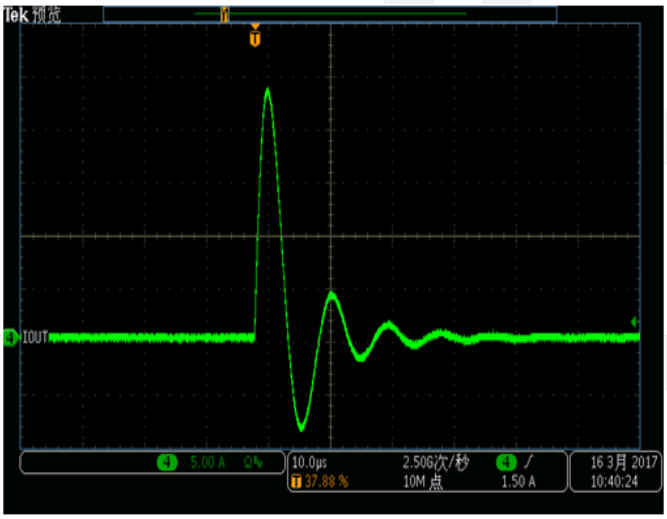
No-Load to Short-Circuit Transient Response
(Vin=5V)



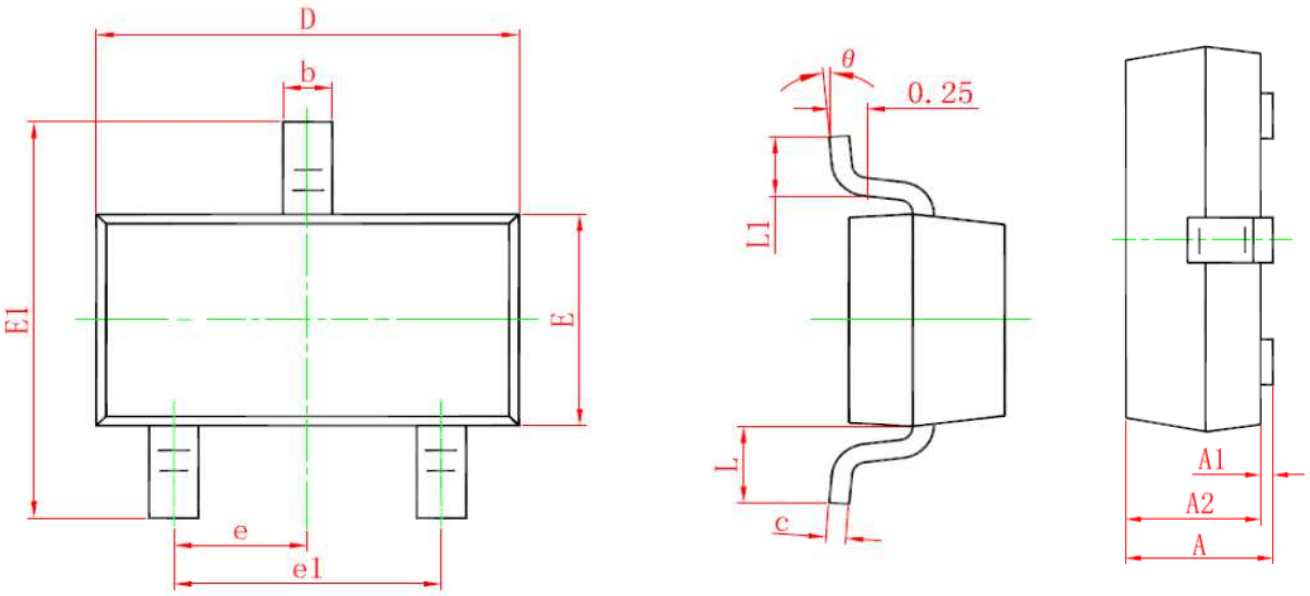
Short-Circuit to No-Load Recovery Response
(Vin=5V)



Output Short Response



Physical Dimensions: SOT23



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°