

## DIO7195

### 5.5V Full-Function 2.5A DC Load Switch with Adjustable Current Limit

#### Features

- Input voltage: 1.8V to 5.5V
- Quiescent supply current 80 $\mu$ A with open load
- Turn-on controlled
- Continuous Current Max:2.5A
- DIO7195 : 45mA Current
- DIO7195B : 0.1A-2.5A Current
- P-channel MOSFET current-limited architecture
- Under-Voltage Lockout
- Over-Voltage Lockout
- Low shutdown current
- Fast current limit response
- Thermal shutdown protection
- Reverse current blocking
- Package: six ball advanced 0.98x1.48mm WLCSP-6

#### Applications

- Handheld electronic device
- Portable Enterprise / Industrial Devices
- Digital Cameras
- Peripheral Ports and Accessories
- Medical Equipment
- Hot Swap

#### Block Diagram

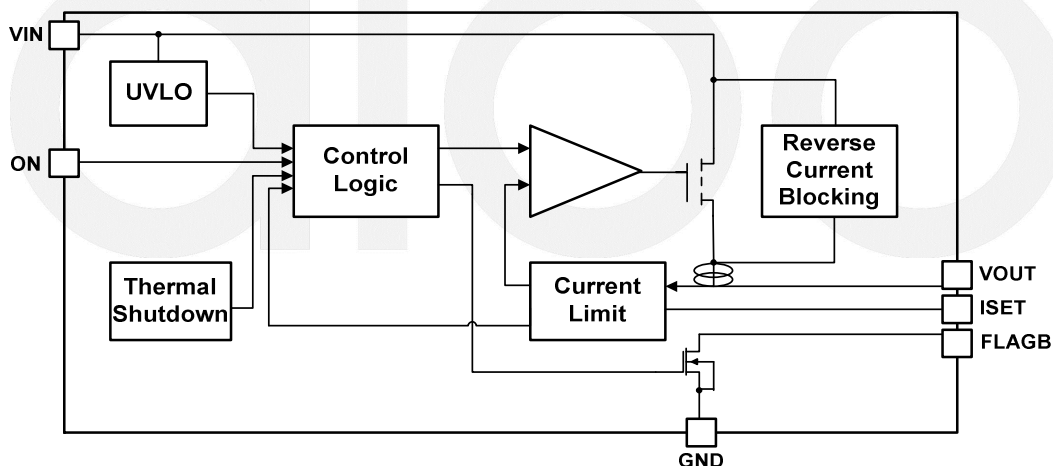


Figure 1 Functional Block Diagram

#### Descriptions

The DIO7195 are series of load switch that provides full protection to systems and loads that may encounter large current conditions.

A P-channel MOSFET current-limit makes the current prevented, when the MOSFET is off. And the output voltage higher than input in addition. The perfectly thermal shutdown protection that what shuts off the switch to prevent damage to the part when a continuous over-current condition causes excessive heating.

When the switch current reaches the current limit, the parts operate in a constant-current mode to prohibit excessive currents from causing damage.

The DIO7195 does not turn off after a current limit fault, but remains in the constant-current mode indefinitely.



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## Ordering Information

Order Part Number	Top Marking		T <sub>A</sub>	Package	
DIO7195WL6	D795	Green	-40 to +85°C	WLCSP-6	Tape & Reel,3000
DIO7195BWL6	795B	Green	-40 to +85°C	WLCSP-6	Tape & Reel,3000

## Pin Assignment

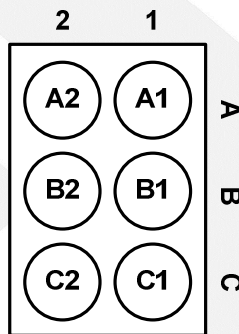


Figure 2 Pin Assignment (bottom view)

## Pin Definitions

Pin Name	Name	Pin Description
A1	FLAGB	Fault Output. Active low, open-drain output that indicates an over-current supply, under-voltage, or over-temperature state.
B1	VOUT	Switch Output. Output of the power switch.
C1	ISET	Current Limit Set Input. A resistor from ISET to ground sets the current limit for the switch.
C2	GND	GND.
B2	VIN	Supply Input. Input to the power switch and the supply voltage.
A2	ON	Active high, ON control input.



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## 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
All pins		-0.3 to 6	V
Package Thermal Resistance	$\theta_{JA}$	85	°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)	7	kV

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
VIN		1.8 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



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## Electrical Characteristics

$T_A=25^{\circ}\text{C}$   $V_{IN}=3.3\text{V}$ , unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{IN}$	Input Voltage Range		1.8		5.5	V
$I_Q$	Quiescent Supply Current	$I_{OUT}=0\text{mA}$ , $V_{ON}=V_{IN}$	$V_{IN}=1.8\text{V}$	70		$\mu\text{A}$
			$V_{IN}=3.3\text{V}$	75		$\mu\text{A}$
			$V_{IN}=5.5\text{V}$	80		$\mu\text{A}$
$R_{DS(ON)}$	On Resistance	$T_A=25^{\circ}\text{C}$ , $I_{OUT}=200\text{mA}$		55	80	m $\Omega$
		$T_A=-40$ to $85^{\circ}\text{C}$ , $I_{OUT}=200\text{mA}$			135	
$V_{IH}$	On Input Logic High Voltage On	$V_{IN}=1.8\text{V}$	0.8			V
		$V_{IN}=5.5\text{V}$	1.4			
$V_{IL}$	On Input Logic Low Voltage	$V_{IN}=1.8\text{V}$			0.5	V
		$V_{IN}=5.5\text{V}$			1.0	
$I_{IN}$	On Input Leakage	$V_{ON}=V_{IN}$ or GND	-1	0	1	$\mu\text{A}$
$V_{IN\_SD}$	$V_{IN}$ Shutdown Current	$V_{ON}=0\text{V}$ , $V_{IN}=5.5\text{V}$ , $V_{OUT}=\text{Short to GND}$	-2		2	$\mu\text{A}$
$V_{FLB\_L}$	FLAGB Output Logic Low Voltage	$V_{IN}=5\text{V}$ , $I_{SINK}=2\text{mA}$		0.05	0.20	V
		$V_{IN}=1.8\text{V}$ , $I_{SINK}=2\text{mA}$		0.12	0.30	V
$I_{FLB\_H}$	FLAGB Output Logic High Leakage Current	$V_{IN}=5\text{V}$ , Switch ON			1	$\mu\text{A}$
$I_{SDT}$	$V_{OUT}$ Shutdown Current	$V_{ON}=0\text{V}$ , $V_{OUT}=5.5\text{V}$ , $V_{IN}=\text{Short-to-GND}$	2		2	$\mu\text{A}$
$V_{BREAKDOWN}$	Reverse Breakdown Voltage	$V_{IN}=V_{ON}=0\text{V}$ , $I_{OUT}=200\mu\text{A}$		8		V
$I_{LIM}$	Current Limit	$V_{IN}=4.5\text{V}$ , $V_{OUT}=4.2\text{V}$ (DIO7195B)	$R_{SET}=430\Omega$		2.5	A
			$R_{SET}=680\Omega$		1.6	
			$R_{SET}=1\text{k}\Omega$		1	
			$R_{SET}=1.5\text{k}\Omega$		0.5	
		$V_{IN}=4.5\text{V}$ , $V_{OUT}=4.2\text{V}$ (DIO7195)	$R_{SET}=15.8\text{k}\Omega$		45	mA
$T_{SD}$	Thermal Shutdown Temperature	Shutdown Threshold		140		$^{\circ}\text{C}$
		Return from Shutdown		130		$^{\circ}\text{C}$
	Thermal Shutdown Hysteresis			10		$^{\circ}\text{C}$



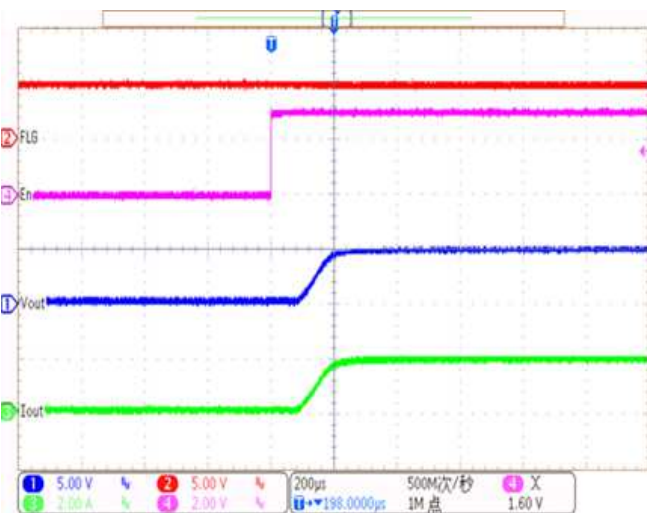
# DIO7195

V <sub>OVLO</sub>	Over-Voltage Lockout	V <sub>IN</sub> Increasing	5.65	5.8	5.95	V
V <sub>OVLO_HYST</sub>	Over-Voltage Lockout Hysteresis			200		mV
T <sub>FD</sub>	Delay time	From current limit to FLAGB		3		ms
V <sub>UVLO</sub>	Under-Voltage Lockout	V <sub>IN</sub> Increasing	1.55	1.65	1.75	V
V <sub>UVLO_HYST</sub>	Under-Voltage Lockout Hysteresis			50		mV
t <sub>ON</sub>	Delay On Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		80		μs
t <sub>R</sub>	V <sub>OUT</sub> Rise Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		80		μs
t <sub>ON</sub>	Turn On Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		160		μs
t <sub>OFF</sub>	Delay Off Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		7		μs
t <sub>F</sub>	V <sub>OUT</sub> Fall Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		140		μs
t <sub>OFF</sub>	Turn Off Time	R <sub>L</sub> =500Ω, C <sub>L</sub> =0.1μF		146		μs
t <sub>SC</sub>	Short-Circuit Response Time	V <sub>IN</sub> =V <sub>OUT</sub> =3.3V		5		μs

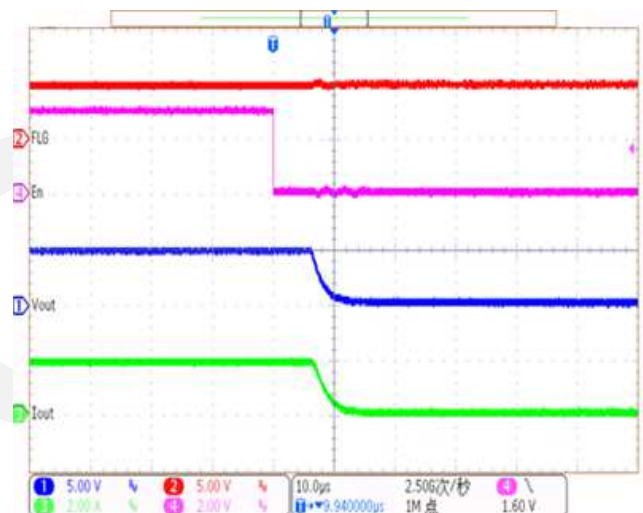
## Typical Performance Characteristics

Typical value: V<sub>IN</sub> = 3.3V, C<sub>IN</sub> = 1μF, C<sub>OUT</sub> = 1μF, T<sub>A</sub> = 25°C, unless otherwise specified.

**Enable Start up**  
(V<sub>in</sub>=5V, R<sub>Load</sub>=2.5ohm)



**Enable Shut down**  
(V<sub>in</sub>=5V, R<sub>Load</sub>=2.5ohm)

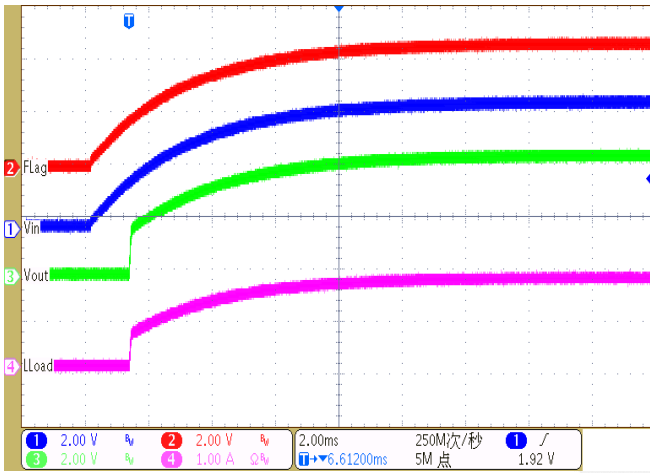




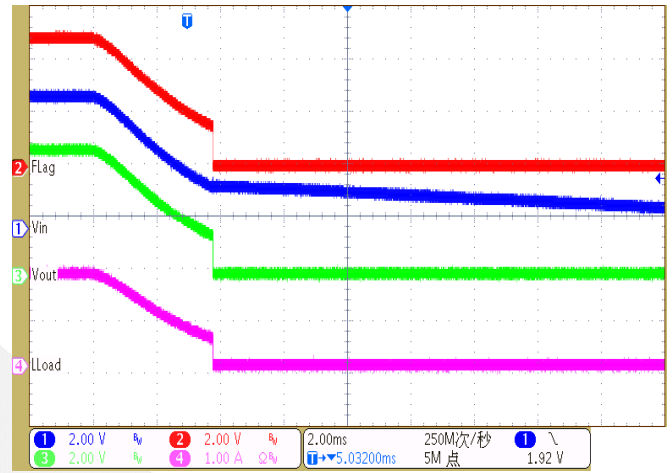
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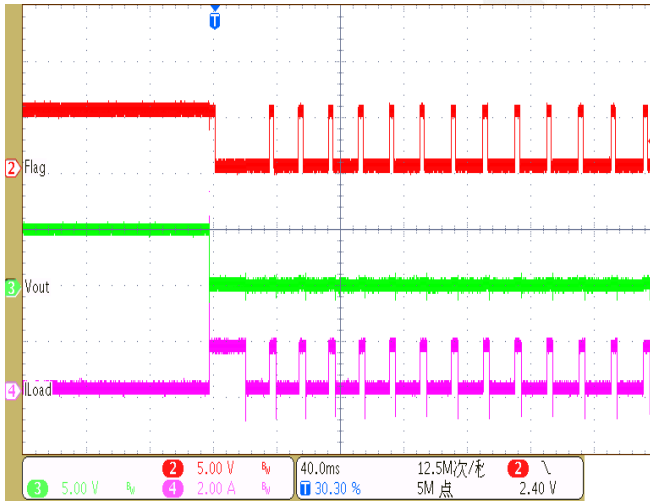
Power on (Vin=5V, RLoad=2.5ohm)



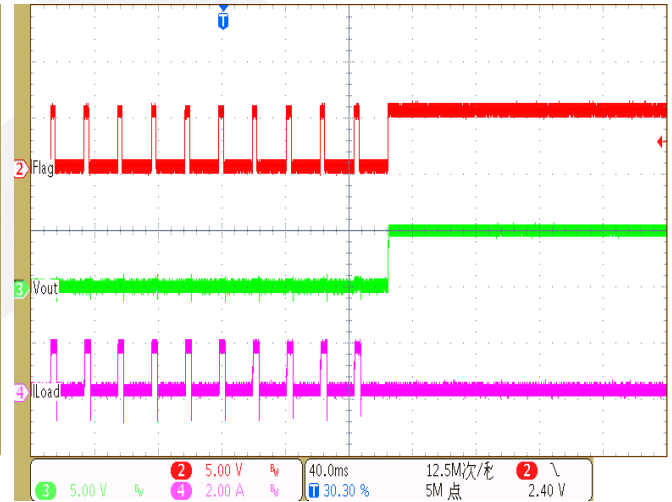
Power off (Vin=5V, RLoad=2.5ohm)



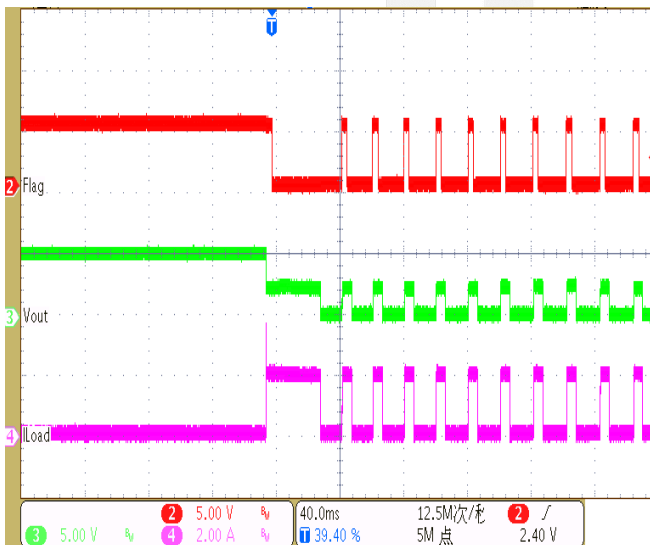
Short circuit protection



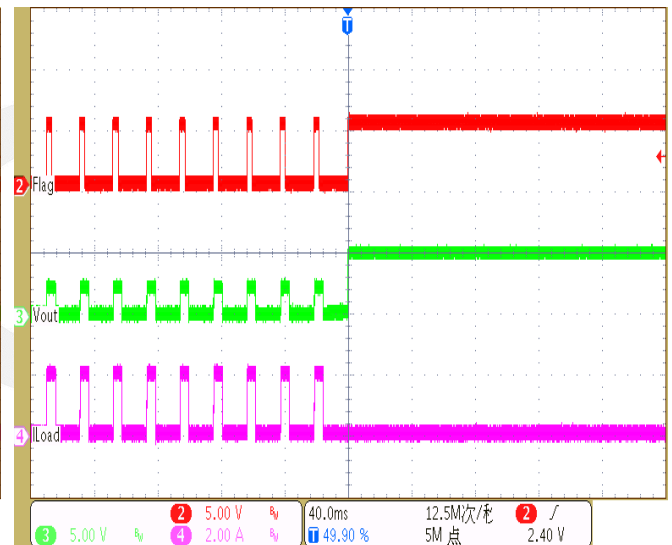
Short circuit protection recovery



Over Load (Load=0-1ohm)



Over Load (Load=1.0ohm-0)





## DIO7195

### Application Information

The DIO7195 is current-limited switch that protects system and load from damaged or disrupted by the application of high currents. The controller protects against system malfunctions through current limiting, under-voltage lockout, and thermal shutdown.

#### Current Limit

The current limit ensures the current through the switch does not exceed the maximum. The DIO7195 does not including limit blanking period, so it remains in a constant current state until the ON pin is deactivated or the thermal shutdown turns off the switch. The current limit is set with an external resistor connected between I<sub>SET</sub> and GND. This resistor is selected using the following equation:

$$I_{lim} \approx \frac{1000}{R_{SET}} (A)$$

A short-circuit detection feature is introduced to preventing the switch from large power dissipation during heavy load. The switch is put into short- circuit current-limiting mode if the switch is loaded with a heavy load.

The DIO7195 has no current limit blanking period. When the output voltage drops below 1.1V, the short-circuit detection threshold voltage, the current limit value is re-conditioned and the short-circuit current-limit value is decreased, this value is about 60% of typical current limit. This keeps the power dissipation of the part below a certain limit even at dead-short conditions at 5.5V input voltage.

#### On/Off Control

The ON/Off pin controls the state of the switch. The DIO7195 does not turn off in response to an over-current condition, but remains operating inconstant-current mode as long as ON is active and the thermal shutdown or under-voltage lockout have not activated.

#### Fault Report

FLAGB signals the fault mode by activating low up on the detection of an over-current, input under-voltage, over-voltage or over-temperature condition, the FLAGB goes low at the end of the blanking time, and remains low during the faults and immediately returns high at the end of the fault condition. FLAGB is an open-drain MOSFET that requires a pull-up resistor between VIN and FLAGB. During shutdown, the pull-down on FLAGB is disabled to reduce current draw from the supply.

#### Under-Voltage Lockout (UVLO)

The under-voltage lockout turns the switch off if the input voltage drops below the under-voltage lockout threshold. With the ON pin active, the input voltage rising above the under-voltage lockout threshold causes a controlled turn-on of the switch, which limits current over shoot.

#### Thermal Shutdown

The thermal shutdown protects the die from internally or externally generated excessive temperatures. During an over-temperature condition, FLAGB is activated and the switch is turned off. The switch automatically turns on again if temperature of the die drops below the threshold temperature.

## Reverse-Current Blocking

The reverse-current blocking feature that protects the input source against current flow from output to input. For a standard USB power design, this is an important feature to protect the USB host from being damaged due to reverse current flow on  $V_{BUS}$ .

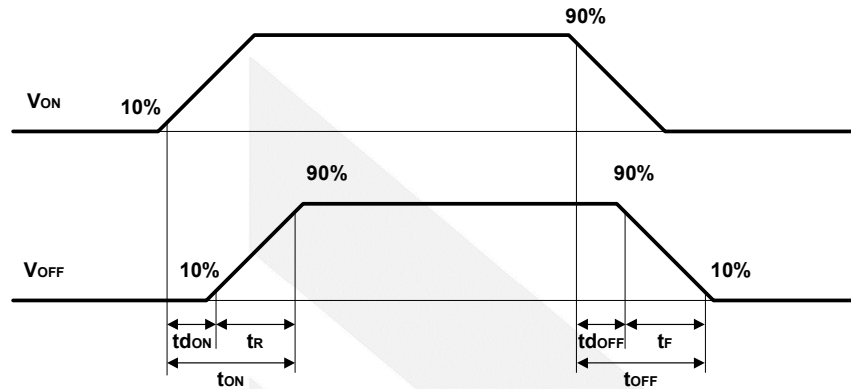


Figure 3 Timing diagram

$t_{dON}$ =Delay On Time;  $t_r$ =  $V_{OUT}$  Rise Time;  $t_{ON}$ =Turn-On Time.

$t_{dOFF}$ = Delay Off Time;  $t_f$ =  $V_{OUT}$  Fall Time.

$t_{OFF}$ =Turn-Off Time.

## Typical Application

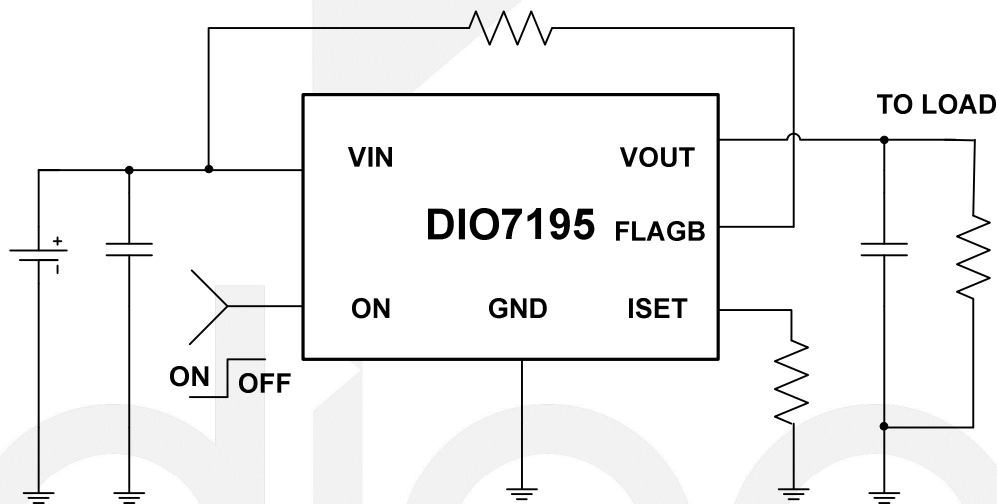


Figure 4 Typical application



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