

Precision Adjustable Current-Limited Power Distribution Switches

■ Features

- 55 mΩ (typ) high-side MOSFET
- 2.31 A continuous load current (max)
- ±10% current-limit accuracy at 1 A (typ)
- Adjustable current limit: 0.2 A ~ 2.59 A (typ)
- Operating range: 2.7 V to 5.5 V
- 36 μA (typ) quiescent current
- 2 μs fast overcurrent response (typ)
- Reverse input-output voltage protection
- Quick output discharge:
 - DIO75530H: available, EN high
 - DIO75530NH: not available, EN high
 - DIO75530L: available, EN low
 - DIO75530NL: not available, EN low

■ Applications

- USB ports & USB hubs
- Digital TVs
- Set-top boxes
- VOIP phones
- Short circuit protections

■ Package Information

Part Number	Package	Body Size
DIO75530	SOT23-6	2.93 mm × 1.63 mm
	DFN2*2-6	2.00 mm × 2.00 mm

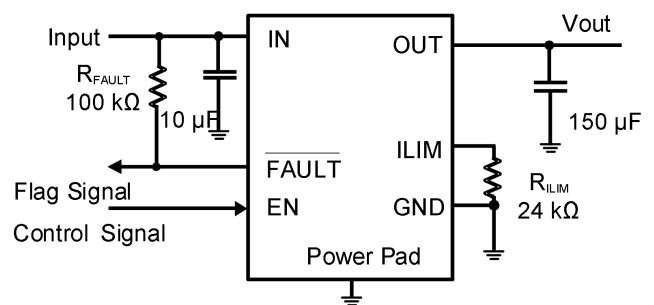
■ Description

The DIO75530 is power distribution switch intended for applications where precision current limiting is required or heavy capacitive loads and short circuits are encountered. The device provides up to 2.31 A of continuous load current. When the voltage is higher than the maximum voltage of 5%, the chip could be maintained for at least 10 ms without damage.

A programmable current-limit threshold is offered between 200 mA and 2.59 A (typ) via an external resistor. Current-limit accuracy is ±10% at 1 A. The power-switch rise and fall times are controlled to minimize current surges during turning on/off. A constant-current mode is used when the output load exceeds the current-limit threshold.

The DIO75530 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.

■ Simplified Schematic



■ Ordering Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIO75530HST6	W3VH	3	Green	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO75530HCD6	E3VH	3	Green	-40 to 85°C	DFN2*2-6	Tape & Reel, 3000
DIO75530NHST6	W3NH	3	Green	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO75530NHCD6	E3NH	3	Green	-40 to 85°C	DFN2*2-6	Tape & Reel, 3000
DIO75530LST6	W3VL	3	Green	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO75530LCD6	E3VL	3	Green	-40 to 85°C	DFN2*2-6	Tape & Reel, 3000
DIO75530NLST6	W3NL	3	Green	-40 to 85°C	SOT23-6	Tape & Reel, 3000
DIO75530NLCD6	E3NL	3	Green	-40 to 85°C	DFN2*2-6	Tape & Reel, 3000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

Table of Contents

1. Pin Assignment and Functions	1
2. Absolute Maximum Ratings	2
3. Recommended Operating Conditions	2
4. ESD Ratings	2
5. Thermal Considerations	3
6. Electrical Characteristics	3
7. Typical Performance Characteristics	4
8. Typical Application	6
9. Application Information	7
9.1. Operation information	7
9.2. Overcurrent protection	7
9.3. Reverse-voltage protection	7
9.4. Supply filter capacitor	7
9.5. Current limiting setting	7
10. Physical Dimension	8
10.1. SOT23-6	8
10.2. DFN2*2-6	9

List of Figures

Figure 1. Pin assignment (Top view)	1
Figure 2. Quiescent current vs. Input voltage	4
Figure 3. Quiescent current vs. Ambient temperature	4
Figure 4. Enable voltage vs. Input voltage	4
Figure 5. Static drain-source on-state resistance vs. Input voltage	4
Figure 6. Static drain-source on-state resistance vs. Ambient temperature	4
Figure 7. Current limit threshold vs. Current limit resistor	4
Figure 8. Input voltage turn on rise time	5
Figure 9. Input voltage turn off fall time	5
Figure 10. Enable voltage turn on rise time	5
Figure 11. Enable voltage turn off fall time	5
Figure 12. No load to short transient response	5
Figure 13. Short to no load transient response	5
Figure 14. Heavy load to short transient response	5
Figure 15. Short to heavy load transient response	5
Figure 16. Typical characteristics reference schematic in SOT23-6 package	6

1. Pin Assignment and Functions

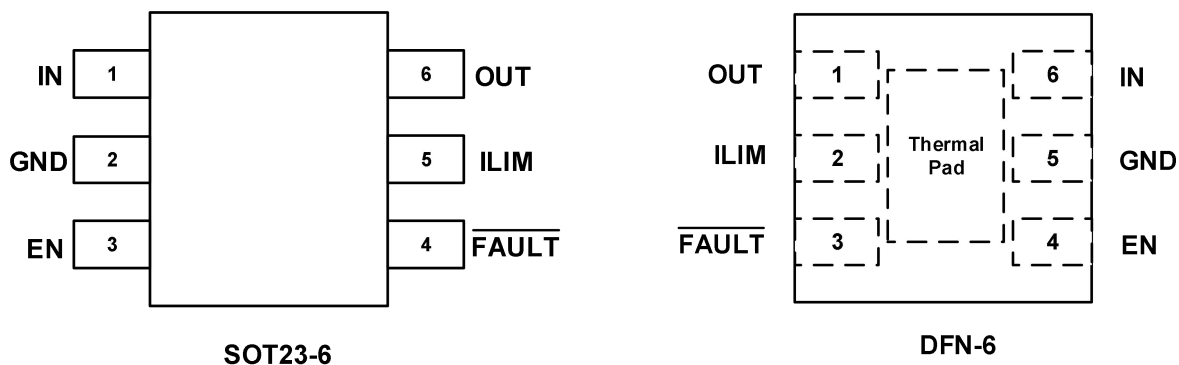


Figure 1. Pin assignment (Top view)

Name	Function
IN	Input voltage, connect a 0.1 μF 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.
$\overline{\text{FAULT}}$	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 $10 \text{ k}\Omega \leq R_{\text{ILIM}} \leq 130 \text{ k}\Omega$.
OUT	Power-switch output.
Thermal pad	The thermal pad is left floating. Connect to the GND plane for improved thermal performance.

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{IN}	Operation voltage (with respect to GND)	-0.3 to 6.0	V
	Other inputs	-0.3 to 6.0	
V_{FLG}	Fault flag voltage	-0.3 to 6.0	V
I_{FLG}	Fault flag current	10	mA
T_J	Maximum junction temperature	150	°C
T_A	Operating temperature	-40 to 85	°C
T_{STG}	Storage temperature	-65 to 150	°C
T_L	Lead temperature rating	260	°C

3. Recommended Operating Conditions

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Rating	Unit
V_{IN}	Operation voltage	2.7 to 5.5	V
	Terminal voltage at all other pins	0 to 5.5	V
T_J	Junction temperature range	-40 to 125	°C
T_A	Ambient temperature range	-40 to 85	°C

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition	Value	Unit
Human-body model	JEDEC: JESD22-A114	±2	kV
Charged-Device Model	JEDEC: JESD22-C101	±2	kV

5. Thermal Considerations

The thermal resistance determines the heat insulation property of a material. The higher the thermal resistance is, the lower the heat loss. Accumulation of heat energy degrades the performance of semiconductor components.

Symbol	Metric	Value	Unit
R _{θJA}	Junction-to-ambient thermal resistance	SOT23-6	190
		DFN2*2-6	140

6. Electrical Characteristics

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

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
V _{IN}	Operation voltage			2.7		5.5	V
R _{DS(ON)}	On resistance	V _{IN} = 5 V, I _{OUT} = 100 mA	T _A = 25°C		55	100	mΩ
			-40°C ≤ T _A ≤ 85°C			130	mΩ
I _{OS}	Overcurrent limit	R _{SET} = 10 kΩ	-40°C ≤ T _A ≤ 85°C	2.331	2.590	2.849	A
		R _{SET} = 25.9 kΩ	-40°C ≤ T _A ≤ 85°C	0.900	1.000	1.100	A
		R _{SET} = 51 kΩ	-40°C ≤ T _A ≤ 85°C	0.457	0.508	0.559	A
		R _{SET} = 130 kΩ	-40°C ≤ T _A ≤ 85°C	0.169	0.199	0.229	A
I _Q	Quiescent supply current	Open load, IC enabled			36		μA
t _R	Output turn-on rise time	R _L = 100 Ω, 90% settling			0.6		ms
t _F	Output turn-off time	R _L = 100 Ω, 10% settling			0.3		ms
V _{EN(H)}	EN input threshold-high V _{IH}			0.85			V
V _{EN(L)}	EN input threshold-low V _{IL}					0.4	V
t _{ON}	EN turn-on time	C _L = 1 μF, R _L = 100 Ω			400		μs
t _{OFF}	EN turn-off time	C _L = 1 μF, R _L = 100 Ω			7		μs
	FLAG deglitch time	FLAG assertion or desertion		4	8	15	ms
	Output reverse voltage deglitch time			2.5	4	7	ms
V _{reverse}	Reverse voltage comparator trip point				175		mV
I _{SHDN}	Shutdown input current	Open load, IC disabled				1	μA
T _{SD}	Thermal shutdown				140		°C
	Thermal limit hysteresis				20		°C

Note:

(1) Specifications subject to change without notice.

7. Typical Performance Characteristics

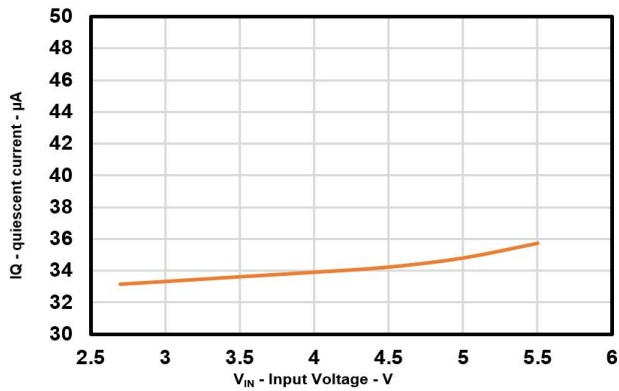


Figure 2. Quiescent current vs. Input voltage

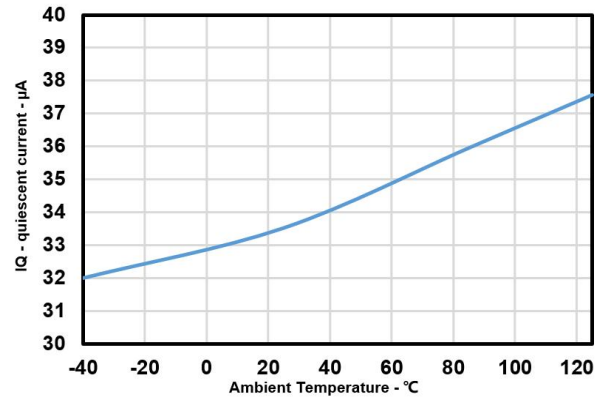


Figure 3. Quiescent current vs. Ambient temperature

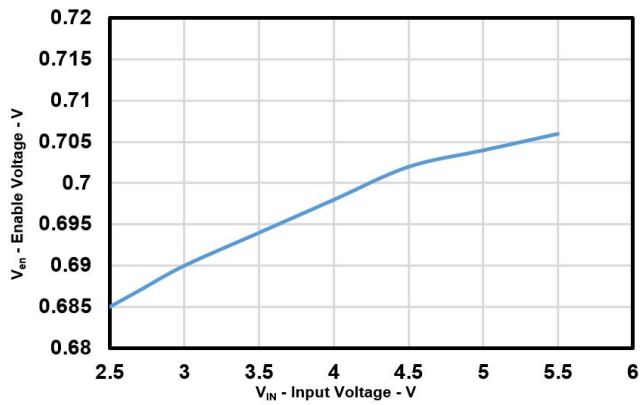


Figure 4. Enable voltage vs. Input voltage

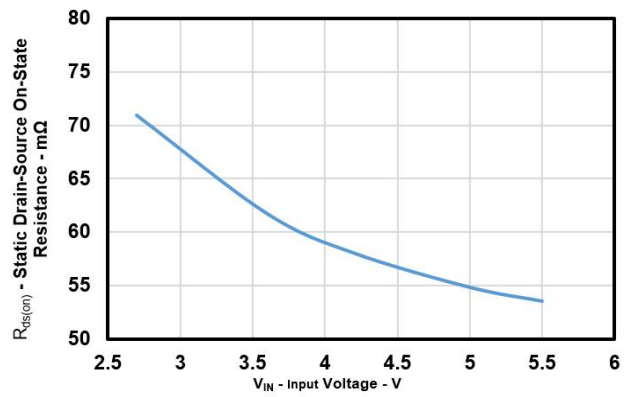


Figure 5. Static drain-source on-state resistance vs. Input voltage

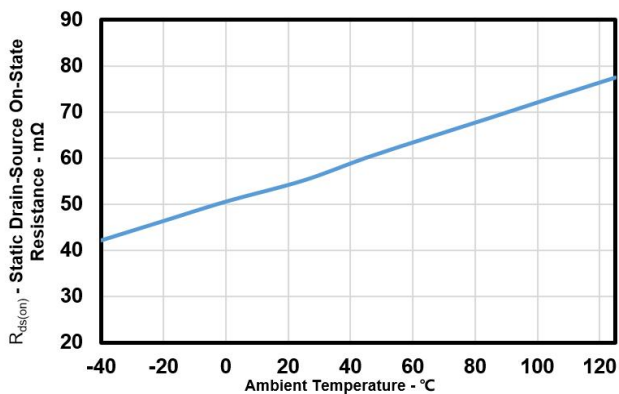


Figure 6. Static drain-source on-state resistance vs. Ambient temperature

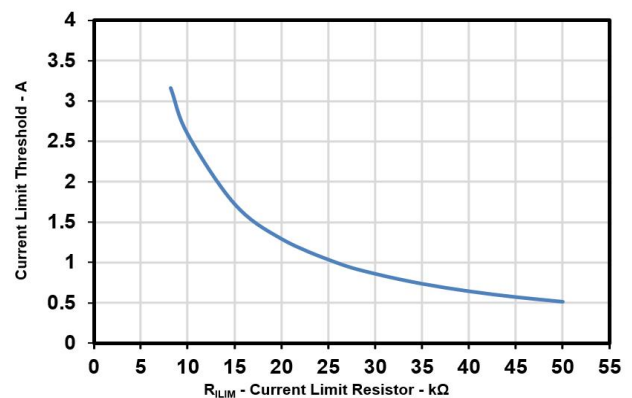


Figure 7. Current limit threshold vs. Current limit resistor

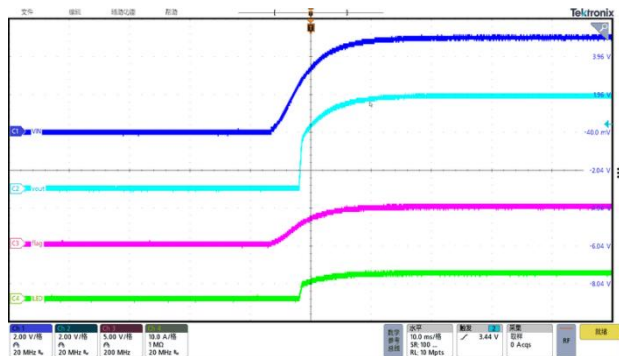


Figure 8. Input voltage turn on rise time

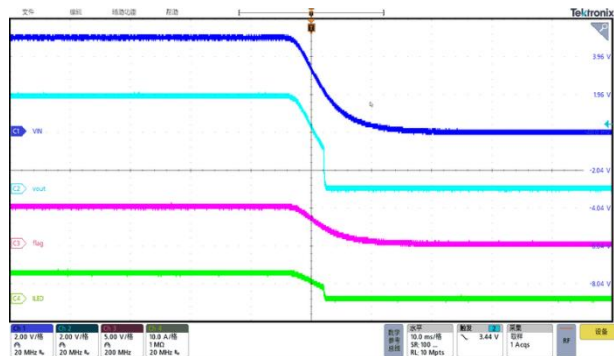


Figure 9. Input voltage turn off fall time

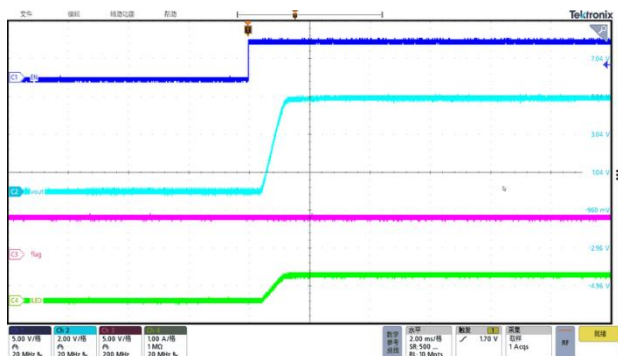


Figure 10. Enable voltage turn on rise time

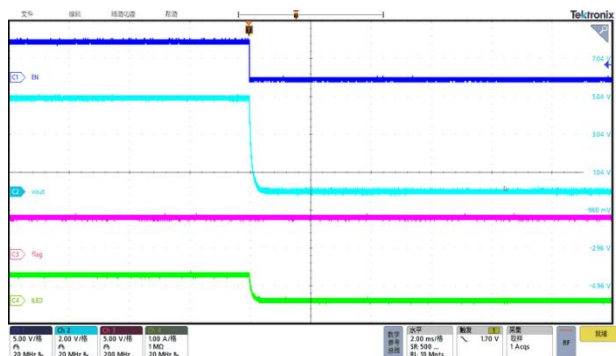


Figure 11. Enable voltage turn off fall time

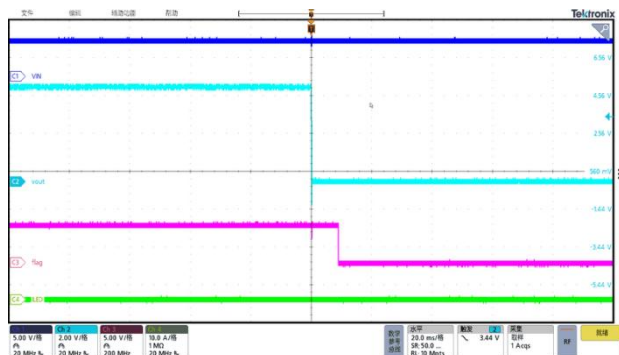


Figure 12. No load to short transient response

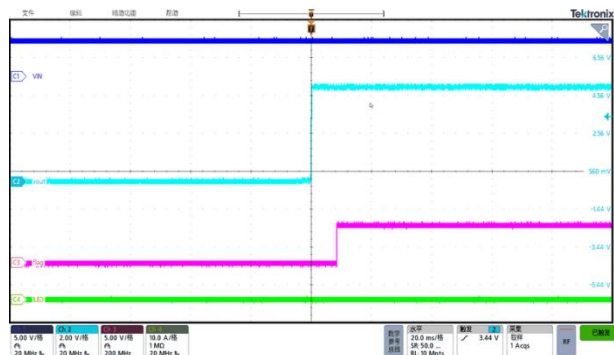


Figure 13. Short to no load transient response

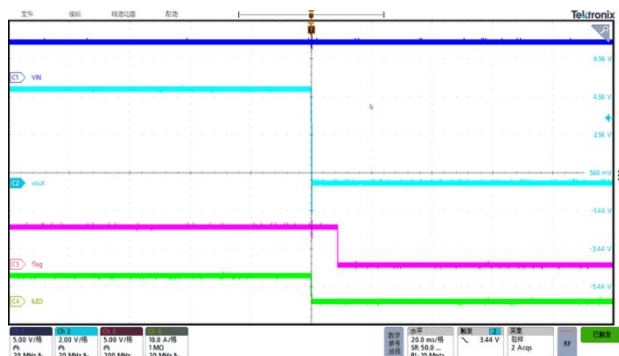


Figure 14. Heavy load to short transient response

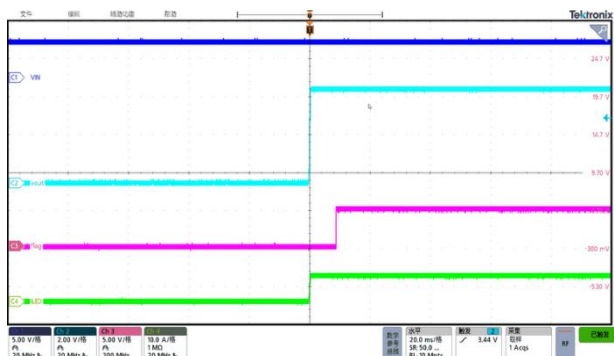


Figure 15. Short to heavy load transient response

8. Typical Application

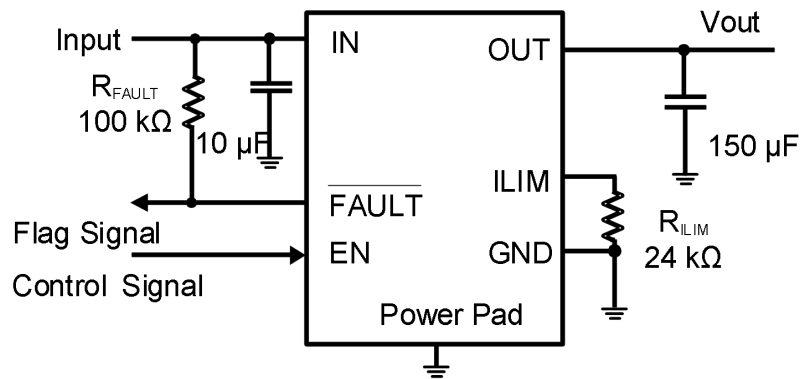


Figure 16. Typical characteristics reference schematic in SOT23-6 package

9. Application Information

Important notice: Validation and testing are the most reliable ways to confirm system functionality. The application information is not part of the specification and is for reference purposes only.

9.1. Operation information

The DIO75530 is a current limited P-channel MOSFET power switch with overcurrent 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.

9.2. Overcurrent protection

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

9.3. Reverse-voltage protection

The reverse-voltage protection feature turns off the P-channel MOSFET whenever the output voltage exceeds the input voltage by 175 mV (typ) for 4 ms (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 DIO75530 by preventing significant current from sinking into the input capacitance. The DIO75530 devices allow the P-channel MOSFET to turn on as soon as the output voltage goes below the input voltage for the same 4 ms deglitch time.

9.4. Supply filter capacitor

In order to prevent the input voltage from dropping during hot-plug condition, a 10 µF 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.

9.5. Current limiting setting

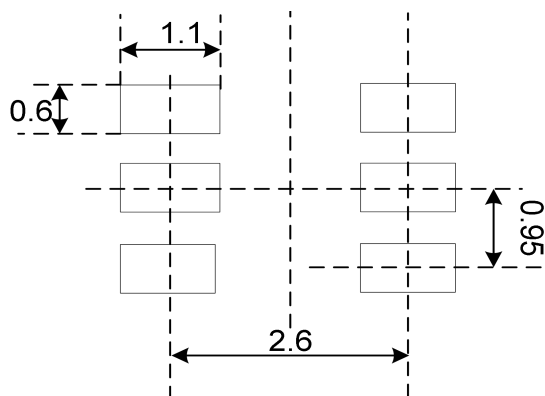
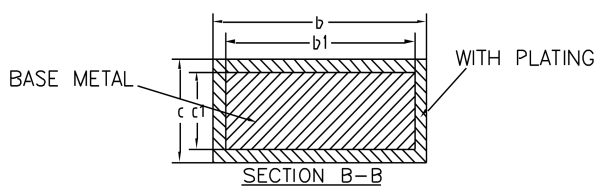
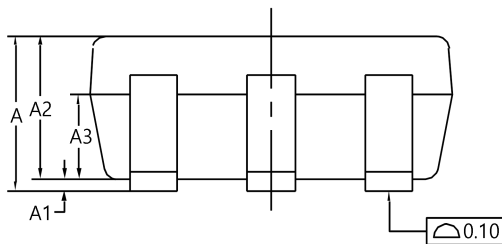
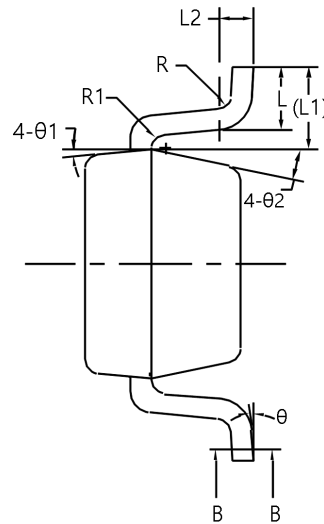
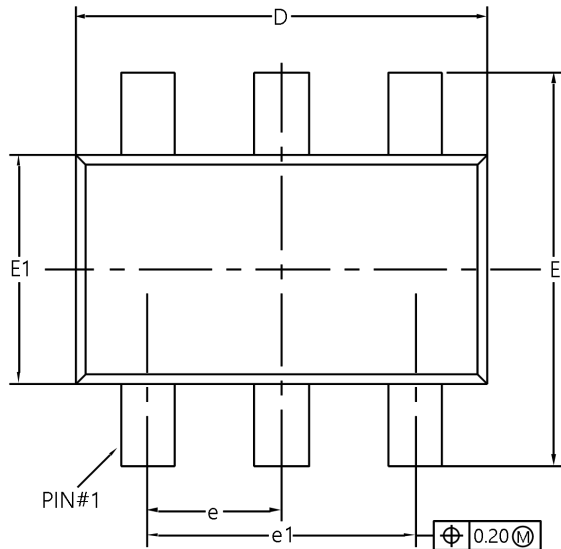
Current limit is programmable to protect the power source from overcurrent and short circuit conditions. Connect a resistor R_{SET} from I_{SET} pin to GND to program the current limit:

$$I_{OS} (A) = 25900 / R_{set} (\Omega) \quad (1)$$

The minimum current limit is 0.2 A. Current limit beyond 2.59 A is not recommended.

10. Physical Dimension

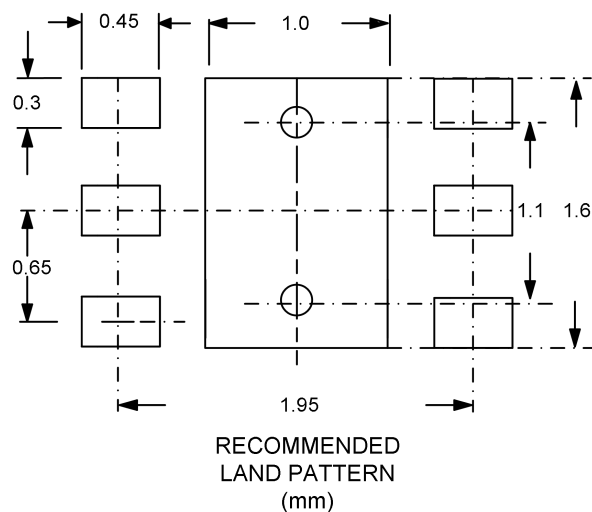
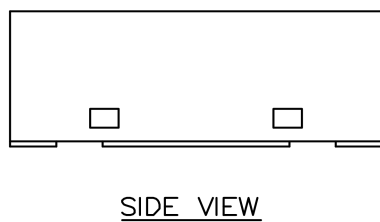
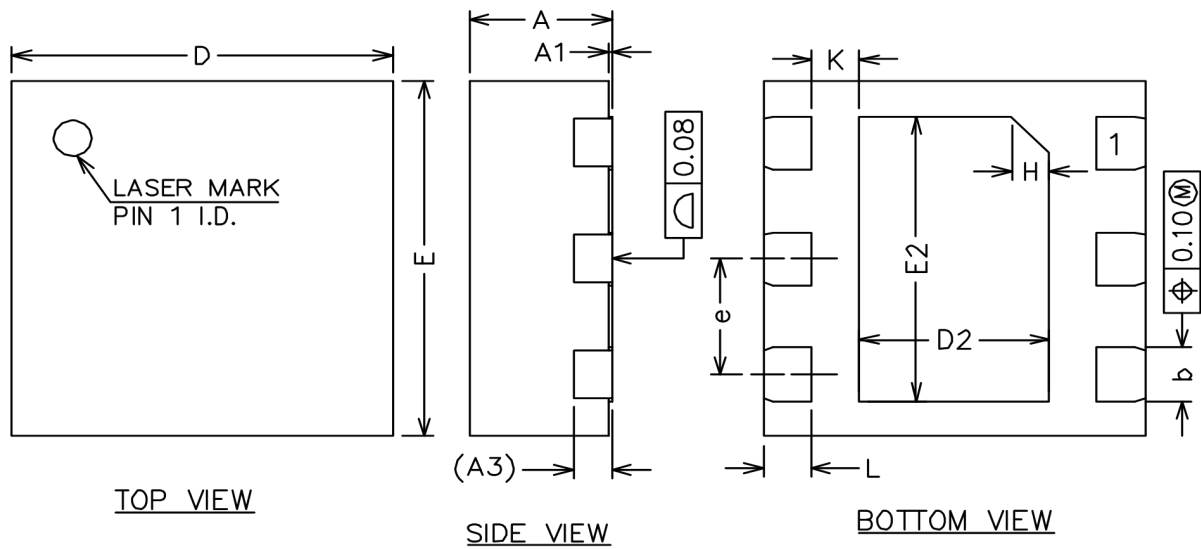
10.1. SOT23-6



RECOMMENDED LAND PATTERN

Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.34	-	0.45
b1	0.34	0.38	0.41
c	0.12	-	0.20
c1	0.12	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.700
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
L	0.30	0.40	0.60
L1		0.59 REF	
L2		0.25 BSC	
R	0.05	-	0.20
R1	0.05	-	0.20
θ	0°	-	8°
θ1	8°	10°	12°
θ2	10°	12°	14°

10.2. DFN2*2-6



Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0	0.02	0.05
A3	0.20 REF		
b	0.25	0.30	0.35
D	1.90	2.00	2.10
E	1.90	2.00	2.10
D2	0.90	1.00	1.10
E2	1.50	1.60	1.70
e	0.55	0.65	0.75
K	0.15	0.25	0.35
L	0.20	0.25	0.30
H	0.20 REF		

Disclaimer

This specification and information contained herein are provided on an “AS IS” basis and WITH ALL FAULTS. All product specifications, statements, information, and data (collectively, the “Information”) in this datasheet or made available on the website of www.dioo.com are subject to change without notice. The customer is responsible for checking and verifying the extent to which the Information contained in this publication is applicable to his/her application. All Information given herein is believed to be accurate and reliable, but it is presented without guarantee, warranty, or responsibility of any kind, express or implied.