300 mA, 24 V, 4 μA I_Q Low Dropout Regulator

Features

- Operating input voltage range: 2.5 V to 24 V
- Fixed output voltage: 5 V
- Maximum output current: 300 mA
- Ultra−low quiescent current: 4 μA (typ.) over temperature
- Output voltage accuracy: ±2% (max.) over temperature
- PSRR: 60 dB at 1 kHz
- Stable with small 1 μF ceramic capacitor
- Soft−start to reduce inrush current and overshoots
- Thermal shutdown and current limit protection
- Operating temperature range: -40°C to 105°C

Applications

- Wireless chargers
- Portable equipment
- Communication system

Package Information

Part Number	Package	Body Size
DIO7805	TO252-3	6.6mm × 6.1mm
	DFN-6	2mm × 2mm
	SOT89-3	4.5mm × 2.5mm
	SOT23-3	2.9mm × 1.6mm

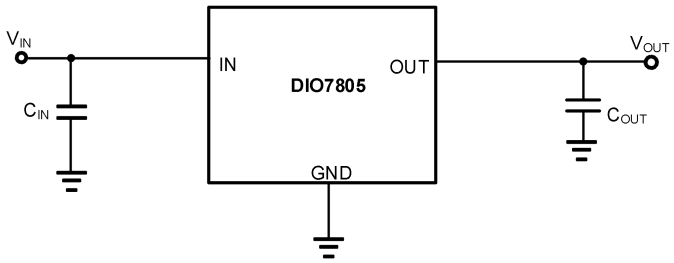
Description

The DIO7805 is a 300 mA high voltage linear voltage regulator. It is a very stable and accurate device with ultra−low quiescent current consumption (typical 4 μA over the full temperature range). The DIO7805 is designed for applications requiring low quiescent current and provides fast line and load transient performance.

The DIO7805 operates with an input voltage range from 2.5 V to 24 V and the output voltage is 5 V.

The DIO7805 is stable with small ceramic output capacitors, allowing for a small overall solution size. An error amplifier and precision band-gap provide an accuracy of ±2% over temperature. The regulator incorporates several protection features such as thermal shutdown and current limiting.

Simplified Schematic



Ordering Information

Ordering Part No.	Voltage Option	Top Marking	RoHS	MSL	T_A	Package	
DIO7805TA3	5.0 V	DIO78H	Green	3	-40 to 105°C	TO252-3	Tape & Reel,2500
DIO7805CD6	5.0 V	D78H	Green	3	-40 to 105°C	DFN2*2-6	Tape & Reel,3000
DIO7805TC3	5.0 V	DIO78H	Green	3	-40 to 105°C	SOT89-3	Tape & Reel,2500
DIO7805RTC3	5.0 V	DIO78R	Green	3	-40 to 105°C	SOT89-3	Tape & Reel,2500
DIO7805SU3	5.0 V	YW0E	Green	3	-40 to 105°C	SOT23-3	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.

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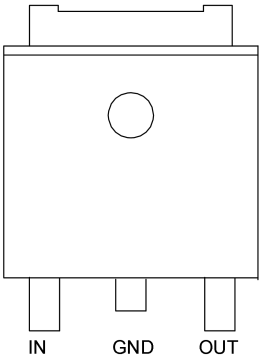
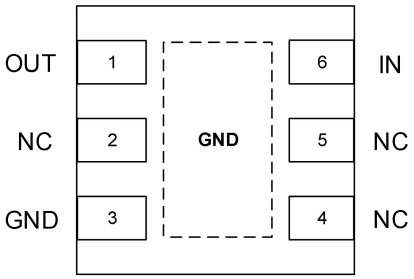
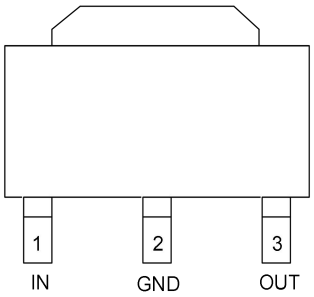
1. Pin Assignment and Functions



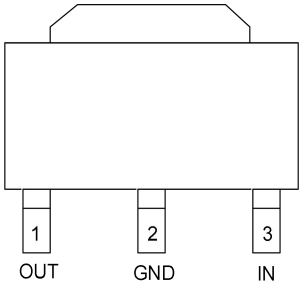
TO252-3



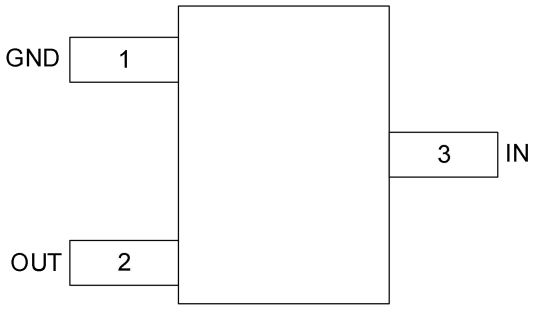
DFN2*2-6



SOT89-3
DIO7805TC3



SOT89-3
DIO7805RTC3



SOT23-3

Figure 1. Top view

Name	Description
IN	Input pin. A small capacitor is needed from this pin to ground to assure stability.
GND	Power supply ground.
OUT	Regulated output voltage pin. A small 1 μF ceramic capacitor is needed from this pin to ground to assure stability.
NC	No connection.

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}	Input voltage	−0.3 to 24	V
V_{OUT}	Output voltage	−0.3 to V_{IN} + 0.3 (max. 6)	V
t_{SC}	Output short circuit duration	Indefinite	s
$T_{J(MAX)}$	Maximum junction temperature	150	°C
T_{STG}	Storage temperature	-55 to 150	°C

3. Recommended Operating Condition

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}	Input voltage	2.5 to 24	V
T_A	Operating free-air temperature	-40 to 105	ºC

4. Thermal Considerations

Symbol	Thermal Metric	TO252-3	DFN2*2-6	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	45.1	72	°C/W

5. Electrical Characteristics

-40°C ≤ T_J ≤ 125°C; V_{IN} = 6 V; I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF, unless otherwise noted. Typical values are at T_J = 25°C.(1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN}	Operating input voltage		2.5		24	V
V_{OUT}	Output voltage accuracy (fixed versions)	−40°C ≤ T_J ≤ 125°C, 6 V < V_{IN} < 16 V, 0.1 mA < I_{OUT} < 300 mA	-2		2	%
Reg_{LINE}	Line regulation	6 V ≤ V_{IN} ≤ 16 V, I_{OUT} = 1 mA		10		mV
Reg_{LOAD}	Load regulation	I_{OUT} = 0.1 mA to 300 mA		10		mV
V_{DO}(2)	Dropout voltage	V_{DO} = V_{IN} - ($V_{OUT(NOM)}$ - 3%), I_{OUT} = 150 mA		240		mV
I_{LIM}	Maximum output current	V_{IN} = 6 V	300		800	mA
I_Q	Quiescent current	I_{OUT} = 0 mA		4.0	8.0	μA
I_{GND}	Ground current	I_{OUT} = 10 mA		50		μA
		I_{OUT} = 300 mA		300		
PSRR	Power supply rejection ratio	V_{IN} = 6 V + 100 mV_{pp}, V_{OUT} = 5 V, I_{OUT} = 1 mA, C_{OUT} = 1 μF, f = 1 kHz		60		dB
T_{SD}(2)	Thermal shutdown temperature	Temperature increasing from T_J = 25°C		150		°C
T_{SDH}(2)	Thermal shutdown hysteresis	Temperature falling from T_{SD}		25		°C

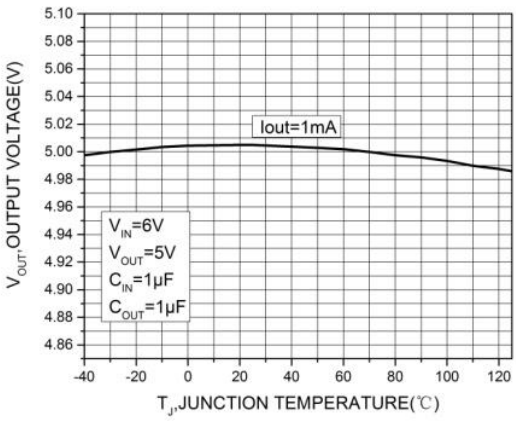
Note:

(1) Performance guaranteed over the indicated operating temperature range by design and/or characterization production tested at T_J = T_A = 25°C. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.

(2) Guaranteed by design.

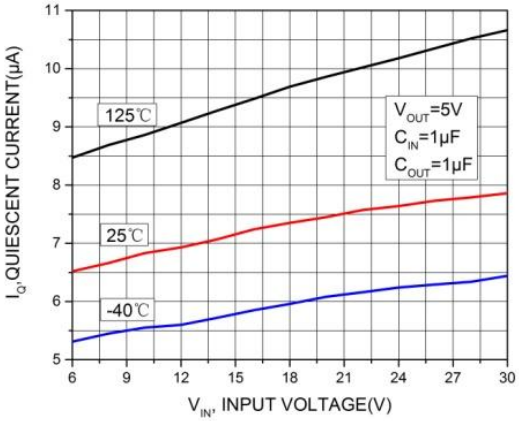
(3) Specifications subject to change without notice.

6. Typical Performance Characteristic



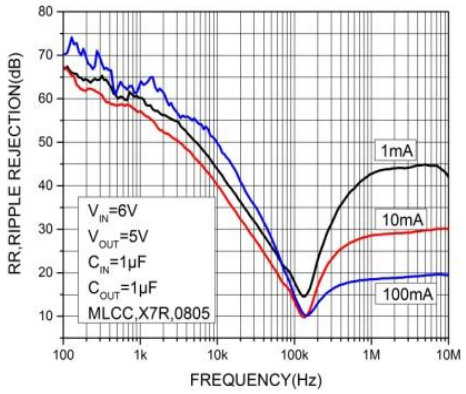
V_{OUT} = 5 V

Figure 2. Output voltage vs. Temperature



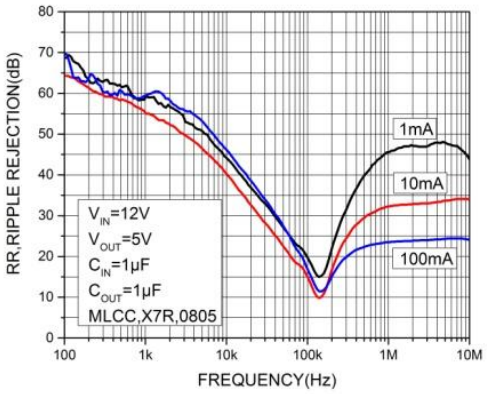
V_{OUT} = 5 V

Figure 3. Quiescent current vs. Input voltage



V_{IN} = 6 V, C_{OUT} = 1 μF

Figure 4. Power supply rejection ratio vs. Current



V_{IN} = 12 V, C_{OUT} = 1 μF

Figure 5. Power supply rejection ratio vs. Current

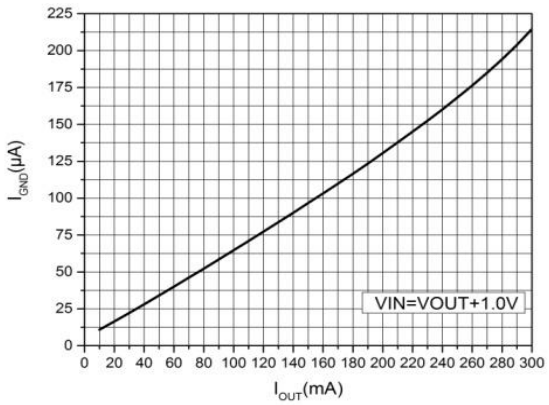
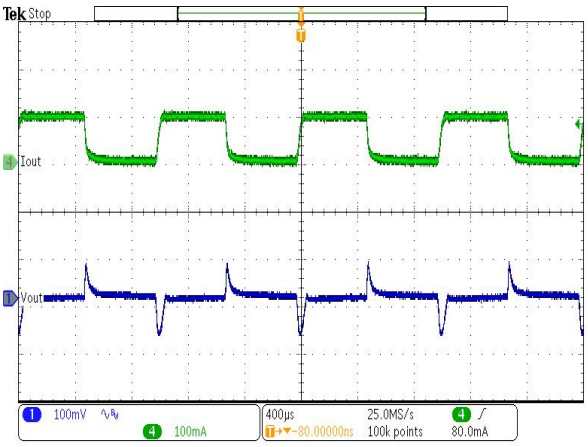


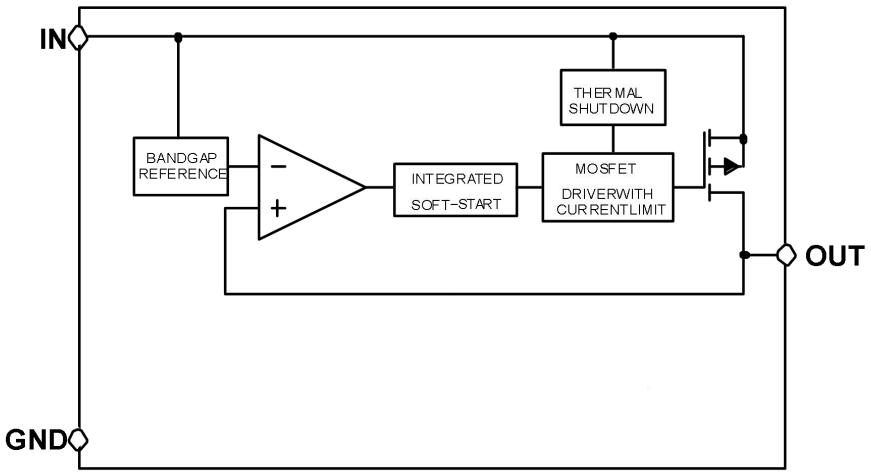
Figure 6. I_{GND} vs. I_{OUT}



V_{IN} = 6.0 V, V_{OUT} = 5.0 V, I_{LOAD} = 5 mA ~ 100 mA

Figure 7. Load transient response

7. Block Diagram



Fixed version

8. 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.

The DIO7805 is a member of the new family of wide input voltage range low dropout regulators that delivers ultra low ground current consumption, good noise, and power supply rejection ratio performance.

8.1. Input decoupling (C_{IN})

It is recommended to connect at least 1 μF ceramic X5R or X7R capacitor between IN and GND pin of the device. This capacitor will provide a low impedance path for any unwanted AC signals or noise superimposed onto constant input voltage. The good input capacitor will limit the influence of input trace inductances and source resistance during sudden load current changes.

Higher capacitance and lower ESR capacitors will improve the overall line transient response.

8.2. Output decoupling (C_{OUT})

The DIO7805 does not require a minimum Equivalent Series Resistance (ESR) for the output capacitor. The device is designed to be stable with standard ceramic capacitors with values of 1 μF or greater. The X5R and X7R types have the lowest capacitance variations over temperature thus they are recommended.

8.3. Power dissipation and heat sinking

The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material, and the ambient temperature affect the rate of junction temperature rise for the part. For reliable operational junction temperature should be limited to 125°C.
The maximum power dissipation the DIO7805 can handle is given by:

$$P_{D(MAX)} = \frac{[T_{J(MAX)} - T_A]}{R_{\theta JA}} \quad (1)$$

The power dissipated by the DIO7805 for given application conditions can be calculated from the following equations:

$$P_D \approx V_{IN} \times I_{GND} + I_{OUT}(V_{IN} - V_{OUT}) \quad (2)$$

or

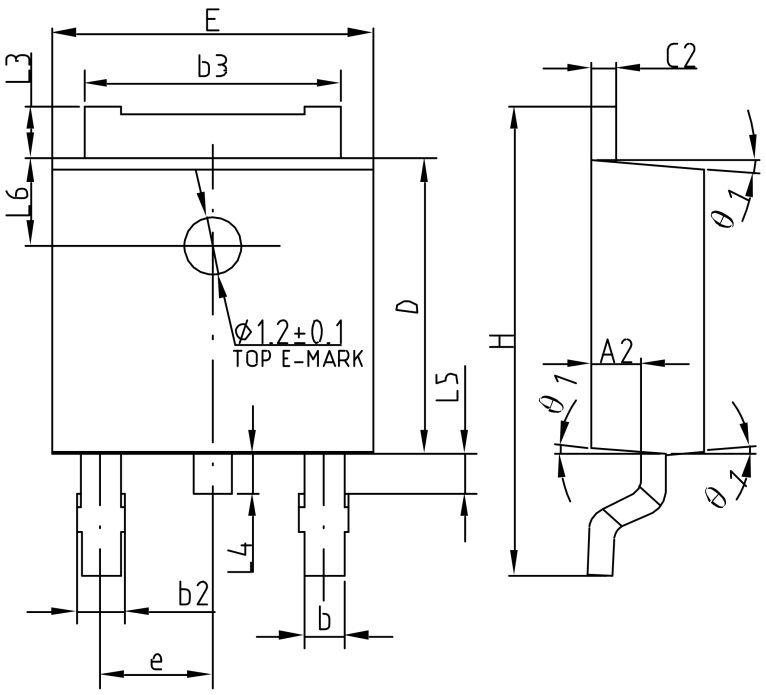
$$V_{IN(MAX)} \approx \frac{P_{D(MAX)} + (V_{OUT} \times I_{OUT})}{I_{OUT} + I_{GND}} \quad (3)$$

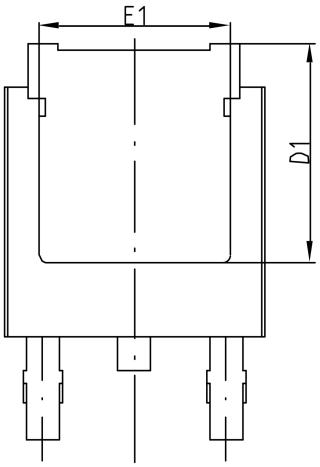
8.4. Hints

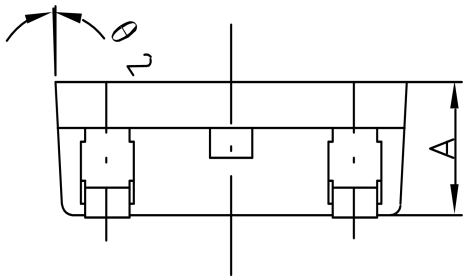
V_{IN} and GND printed circuit board traces should be as wide as possible. When the impedance of these traces is high, there is a chance to pick up noise or cause the regulator to malfunction. Place external components, especially the output capacitor, as close as possible to the DIO7805, and make traces as short as possible.

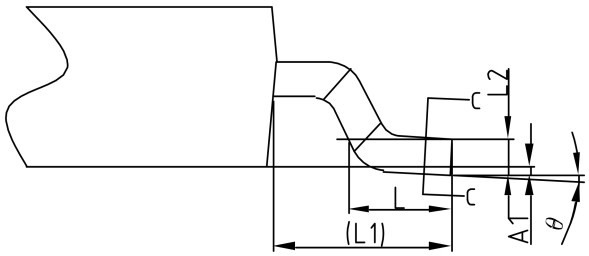
9. Physical Dimensions

9.1. TO252-3



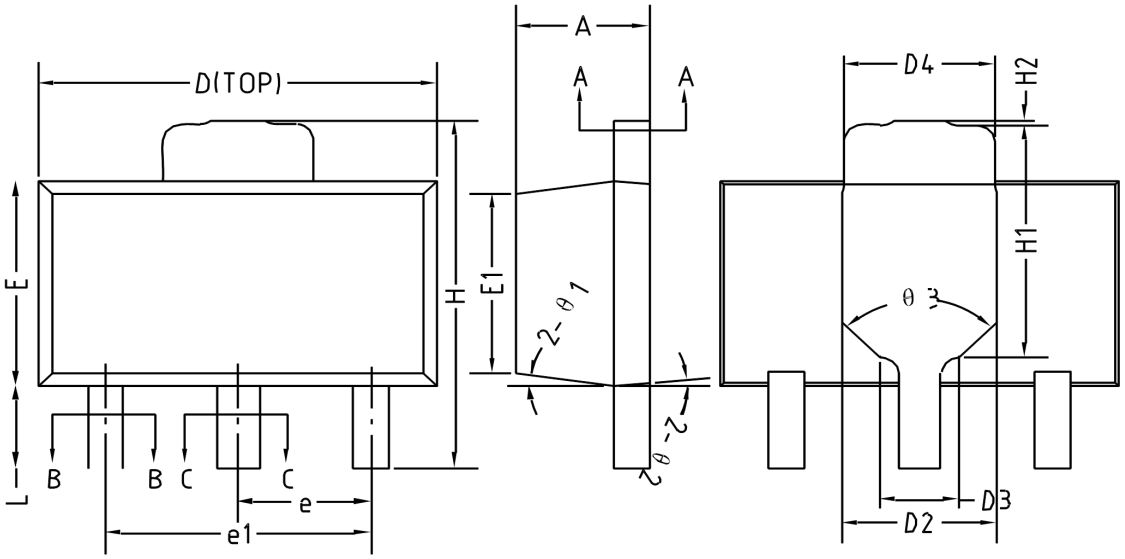


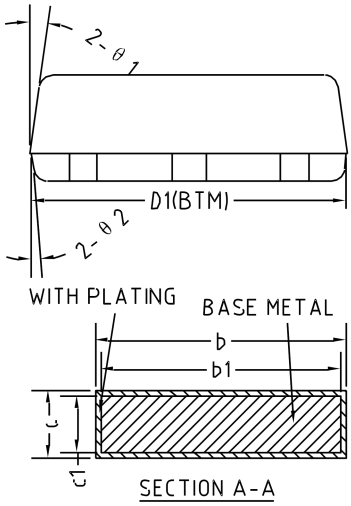


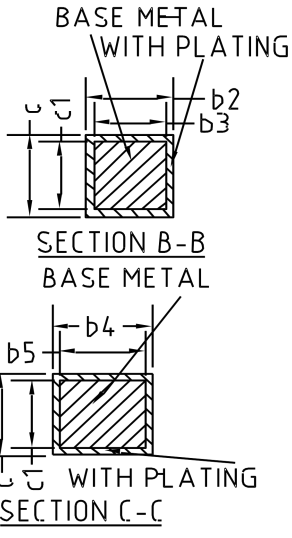


Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	2.20	2.30	2.38
A1	0	–	0.10
A2	0.90	1.00	1.10
b	0.77	–	0.89
b1	0.76	0.81	0.86
b2	0.77	–	1.10
b3	5.23	5.33	5.43
c	0.47	-	0.60
c1	0.46	0.51	0.56
c2	0.47	-	0.60
D	6.00	6.10	6.20
D1	5.25	-	-
E	6.50	6.60	6.70
E1	4.70	-	-
e	2.28 BSC		
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.51 BSC		
L3	0.90	-	1.25
L4	0.60	0.80	1.00
L5	0.90	-	1.50
L6	1.80 REF		
θ	0°	-	8°
θ1	3°	5°	7°
θ2	1°	3°	5°

9.2. SOT89-3

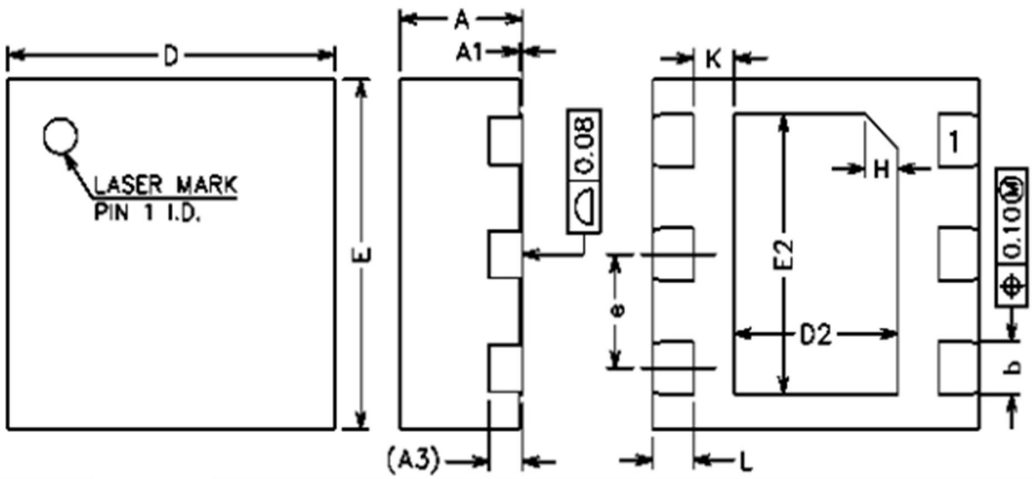


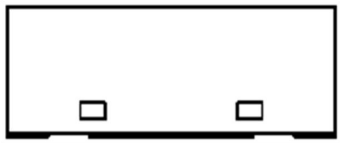




Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.40	1.50	1.60
b	1.68	-	1.77
b1	1.67	1.70	1.73
b2	0.38	-	0.47
b3	0.37	0.40	0.43
b4	0.46	-	0.55
b5	0.45	0.48	0.51
c	0.40	-	0.44
c1	0.39	0.40	0.41
D	4.40	4.50	4.60
D1	4.35	4.45	4.55
D2	1.60	1.75	1.90
D3	0.75	0.90	1.05
D4	1.60	1.70	1.80
E	2.40	2.50	2.60
E1	2.13	-	2.19
e	1.50 BSC		
e1	3.00 BSC		
H	4.05	-	4.25
H1	2.70	-	3.00
H2	0	-	0.10
L	0.89	-	1.20
θ1	6°	8°	10°
θ2	3°	5°	7°
θ3	85°	90°	95°

9.3. DFN2*2-6

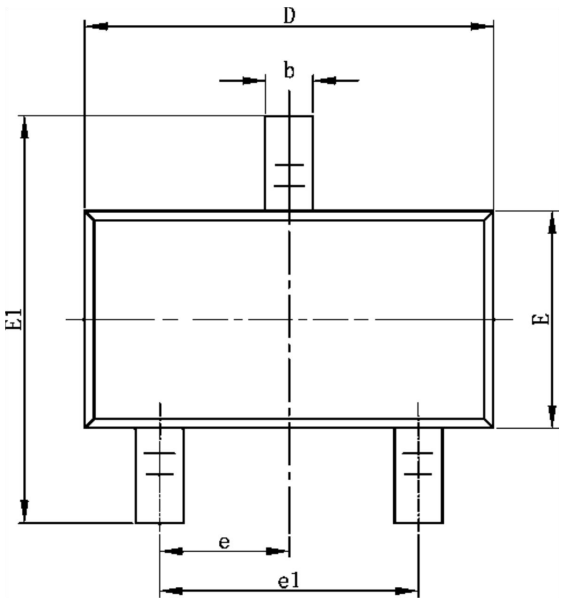


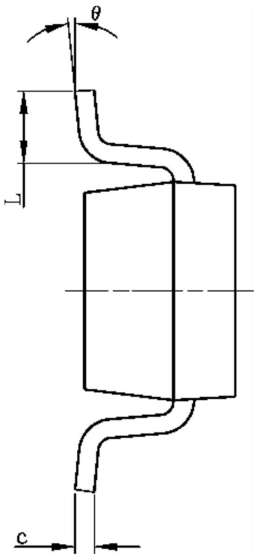


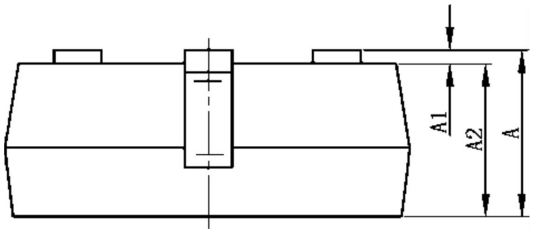
SIDE VIEW

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	

9.4. SOT23-3







Common Dimensions (Units of Measure = Millimeter)		
Symbol	**Min**	**Max**
A	1.050	1.250
A1	0.000	0.100
A2	1.050	1.150
A3	0.60	0.70
b	0.300	0.500
c	0.100	0.200
D	2.820	3.020
E	1.500	1.700
E1	2.650	2.950
e	0.950 BSC	
e1	1.800	2.000
L	0.300	0.600
e	0°	8°

Disclaimer

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