DIO78XX
Wide Input Voltage, Low Dropout Regulator

Features

- Operating input voltage range: 2.5 V to 30 V
- Fixed voltage options available: 9 V, 12 V, 15 V, 18 V, 24 V (upon request)
- Adjustable voltage option from 5 V to 24 V
- PSRR: 60dB at 1 kHz
- Stable with small 1 μF ceramic capacitor
- Soft−start to reduce inrush current and overshoots
- Thermal shutdown and current limit protection
- SOA limiting for high V_{IN}/High I_{OUT} – Static/ Dynamic
- Active discharge option available (upon request)
- Available in SOT89-3, SOT23-5 and SOIC-8 packages
- These devices are Pb−free, halogen free/BFR free and are RoHS compliant

Descriptions

The DIO78XX is a 150 mA LDO (linear voltage regulator). It has a very wide input voltage range (up to 30 V). The regulator incorporates several protective features such as thermal shutdown and current limiting.

Applications

- Wireless chargers
- Portable equipment
- Communication systems

Typical Applications

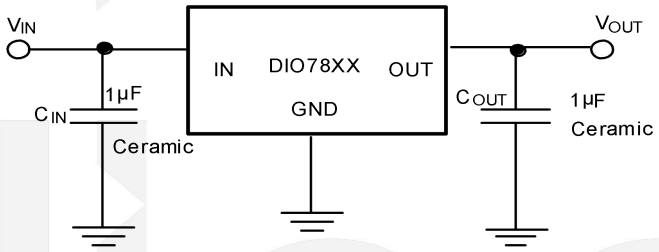


Figure 1. Typical application schematic - fixed output

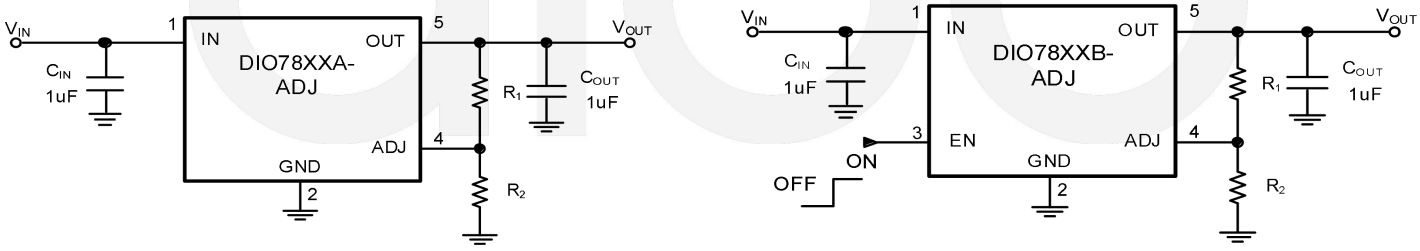
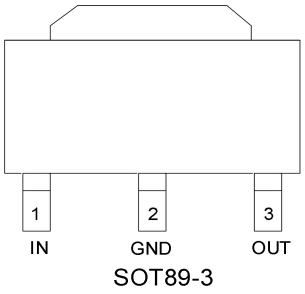


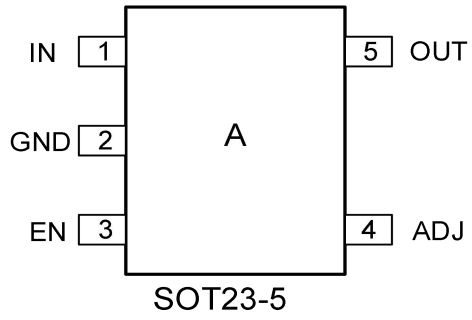
Figure 2. Typical application schematic - adjustable output

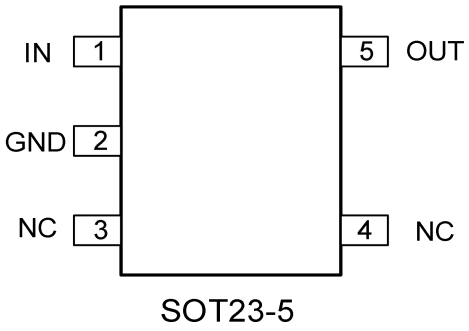
Ordering Information

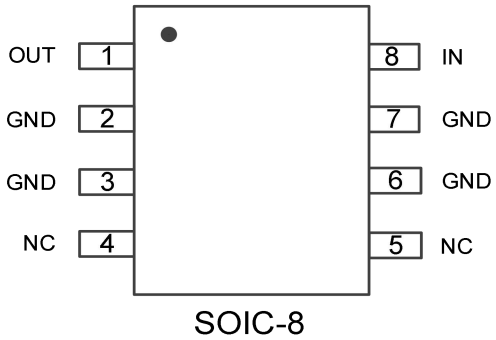
Order Part Number	Voltage Option	Top Marking	Option		T_J	Package	
DIO7809TC3	9 V	DGH0J	Without active output discharge	Green	-40 to 125°C	SOT89-3	Tape & Reel, 2500
DIO7809SO8	9 V	DGH0J		Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO7809ST5	9 V	YWH0J		Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7812TC3	12 V	DGH1B		Green	-40 to 125°C	SOT89-3	Tape & Reel, 2500
DIO7812SO8	12 V	DGH1B		Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO7812ST5	12 V	YWH1B		Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7812AADJST5	ADJ	YWHMA	With active output discharge	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7812BADJST5	ADJ	YWHMB	Without active output discharge	Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7815TC3	15 V	DGH1E		Green	-40 to 125°C	SOT89-3	Tape & Reel, 2500
DIO7815SO8	15 V	DGH1E		Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO7815ST5	15 V	YWH1E		Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7818TC3	18 V	DGH1H		Green	-40 to 125°C	SOT89-3	Tape & Reel, 2500
DIO7818SO8	18 V	DGH1H		Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO7818ST5	18 V	YWH1H		Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000
DIO7824TC3	24 V	DGH2D		Green	-40 to 125°C	SOT89-3	Tape & Reel, 2500
DIO7824SO8	24 V	DGH2D		Green	-40 to 125°C	SOIC-8	Tape & Reel, 2500
DIO7824ST5	24 V	YWH2D		Green	-40 to 125°C	SOT23-5	Tape & Reel, 3000

Pin Assignment









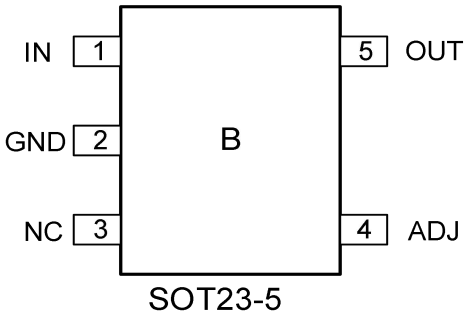


Figure 3. Top View

Pin Descriptions

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
EN	Driving this pin high turns on the regulator. Driving EN pin low puts the regulator into shutdown mode.
ADJ	Feedback pin for set−up output voltage. Use resistor divider for voltage selection.

Absolute Maximum Ratings

Stresses beyond those listed under the Absolute Maximum Rating table may cause permanent damage to the device. Below are stress ratings only. 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.

Symbol	Parameter	Rating	Unit
V_{IN}	Input voltage (Note 1)	−0.3 to 30	V
V_{EN}	Enable voltage	−0.3 to 5.5	V
V_{ADJ}	ADJ voltage	−0.3 to 5.5	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

Thermal Information

Thermal Metric		Package	Value	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	SOT89-3	55	°C/W
		SOIC-8	70	
		SOT23-5	250	

Electrical Characteristics

-40°C ≤ T_J ≤ 125°C; V_{IN} = 2.5 V or 30 V, whichever is greater; I_{OUT} = 1 mA, C_{IN} = C_{OUT} = 1 μF, unless otherwise noted.

Typical values are at T_J = 25°C. (Note 2)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		2.5		30	V
V_{OUT}	Output voltage accuracy (fixed versions)	−40°C ≤ T_J ≤ 125°C, 6 V < V_{IN} < 30 V, 0.1 mA < I_{OUT} < 150 mA (Note 3)	−2%	5	2%	V
				9		
				12		
				15		
				18		
				24		
V_{ADJ}	Reference voltage	-40°C ≤ T_J ≤ 125°C, V_{OUT} + 1 V < V_{IN} < 30 V		1.2		V
Reg_{LINE}	Line regulation	6 V ≤ V_{IN} ≤ 30 V, I_{OUT} = 1 mA		0.04		%
Reg_{LOAD}	Load regulation	I_{OUT} = 0.1 mA to 150 mA		0.25	1	%
V_{DO}	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 (Note 3)	150			mA
I_Q	Quiescent current	I_{OUT} = 0 mA		30	50	μA
I_{GND}	Ground current	I_{OUT} = 150 mA		600		μA
PSRR	Power supply rejection ratio	V_{IN} = V_{OUT} + 100 mV, V_{OUT} = 5 V to 24 V, I_{OUT} = 1 mA, C_{OUT} = 1 μF, f = 1 kHz		60		dB
V_N	Output noise voltage	V_{OUT} = 5 V to 24 V, I_{OUT} = 10 mA, f = 100 Hz to 100 kHz		36		μVrms
V_{EN_HI}	Enable input threshold voltage	Voltage increasing	1.2			V
V_{EN_LO}		Voltage decreasing			0.4	
I_{EN}	EN pin current	V_{EN} = 5.5 V		100		nA
T_{SD}	Thermal shutdown temperature (Note 4)	Temperature increasing from T_J = 25°C		150		°C
T_{SDH}	Thermal shutdown hysteresis (Note 4)	Temperature falling from T_{SD}		25		°C

Specifications subject to change without notice.

Note:

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. 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.
3. Respect SOA.
4. Guaranteed by design and characterization.

Typical Performance Characteristic

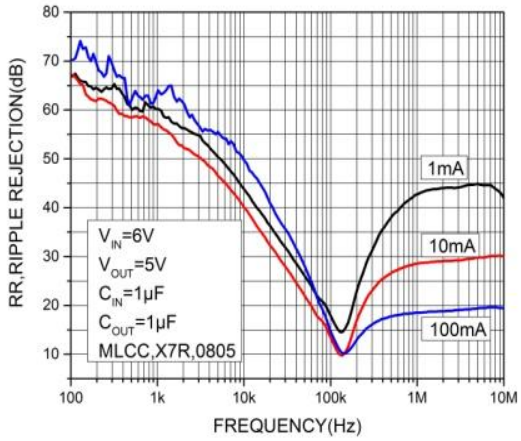


Figure 4. Power supply rejection ratio vs Current

V_{IN} = 6 V, C_{OUT} = 1 μF

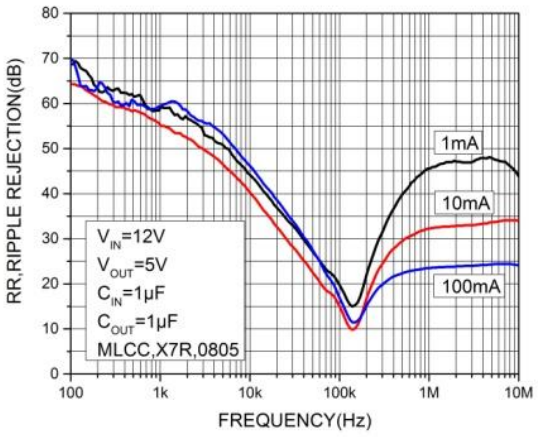


Figure 5. Power supply rejection ratio vs Current

V_{IN} = 12 V, C_{OUT} = 1 μF

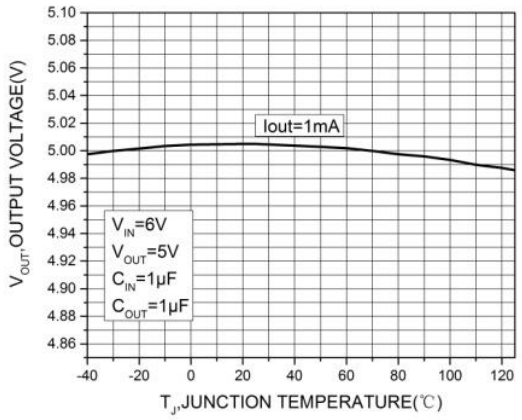


Figure 6. Output voltage vs Temperature

V_{OUT} = 5 V

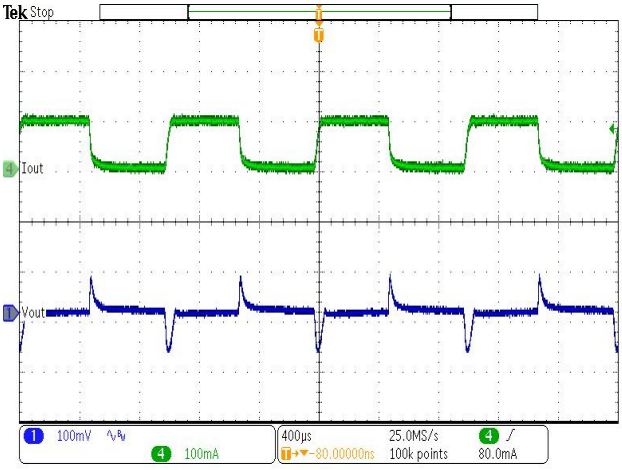
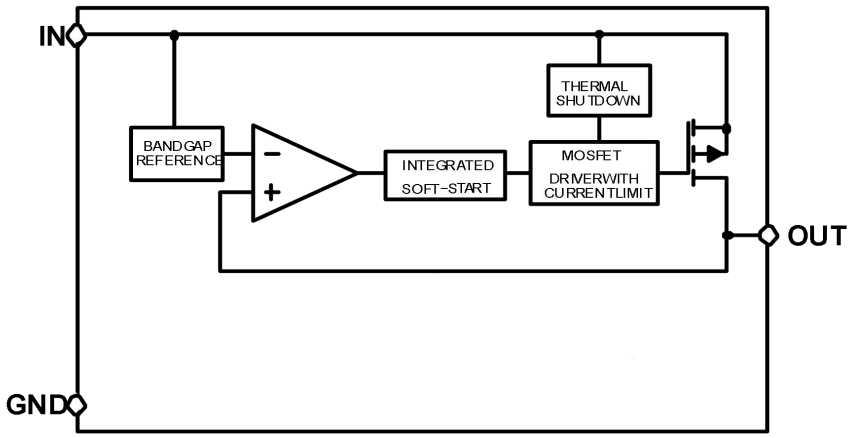


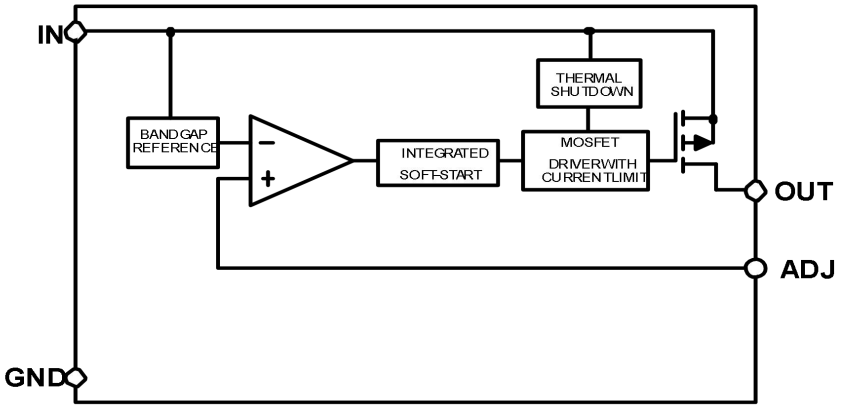
Figure 7. Load transient response

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

Functional Block Diagram

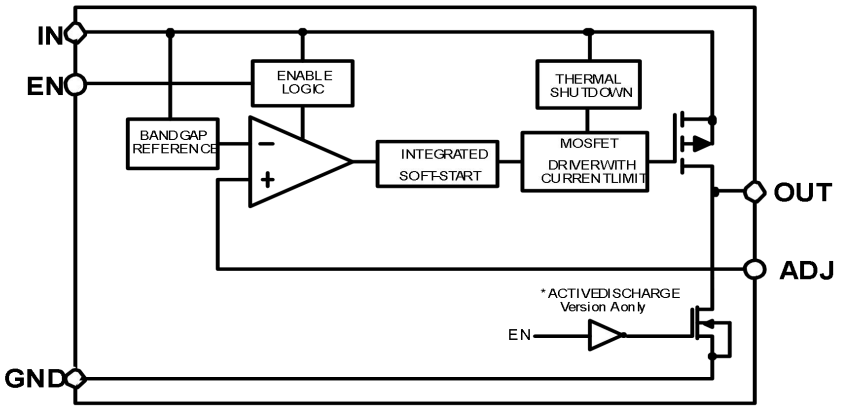


Fixed Version



Adjustable Version

（Without active output discharge）



Adjustable Version

（With active output discharge）

Figure 7. Functional block diagram

Application Information

The DIO78XX 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.

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 inductance and source resistance during sudden load current changes.

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

Output Decoupling (C_{OUT})

The DIO78XX 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 recommendable.

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 DIO78XX can handle is given by:

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

The power dissipated by the DIO78XX for given application conditions can be calculated from the following equations:

$$P_D \approx V_{IN}\ (I_{GND}\ (I_{OUT})) + I_{OUT}(V_{IN} - V_{OUT}) \qquad \text{(eq.2)}$$

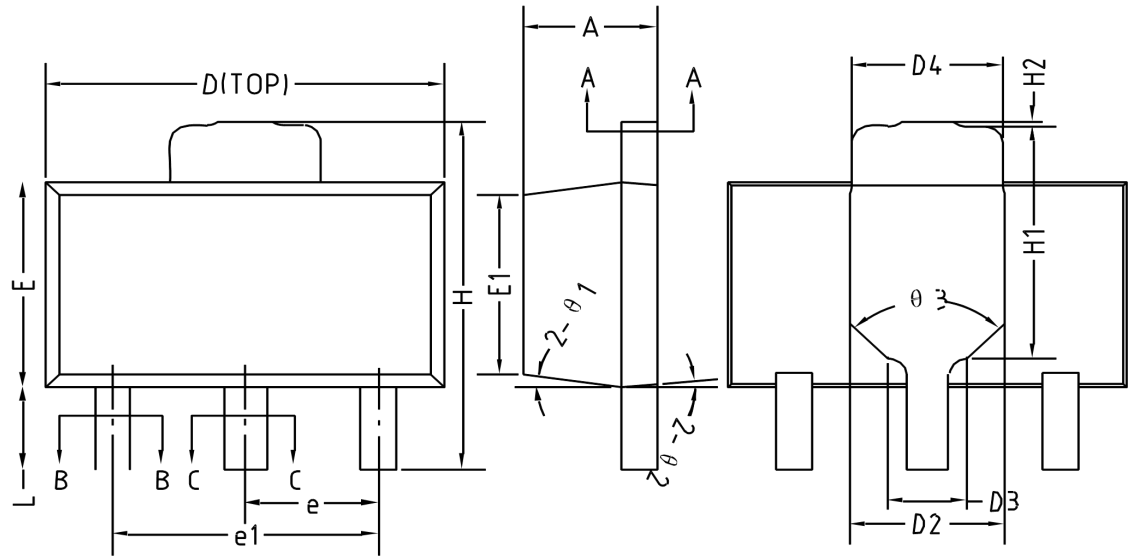
or

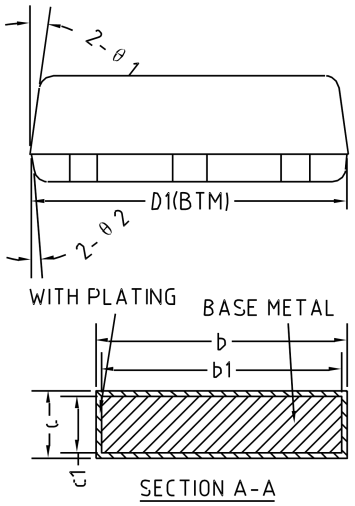
$$V_{IN(MAX)} \approx \frac{P_{D(MAX)} + (V_{OUT} \times I_{OUT})}{I_{OUT} + I_{GND}} \qquad \text{(eq.3)}$$

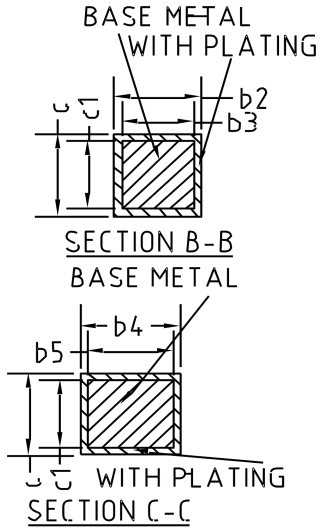
Hints

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 DIO78XX, and make traces as short as possible.

Physical Dimensions: SOT89-3

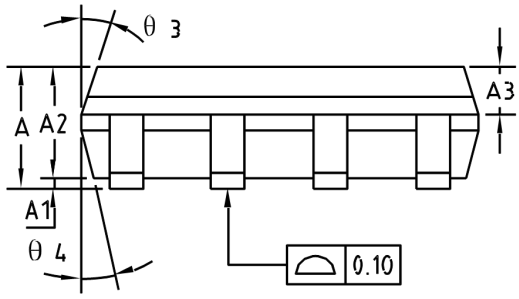


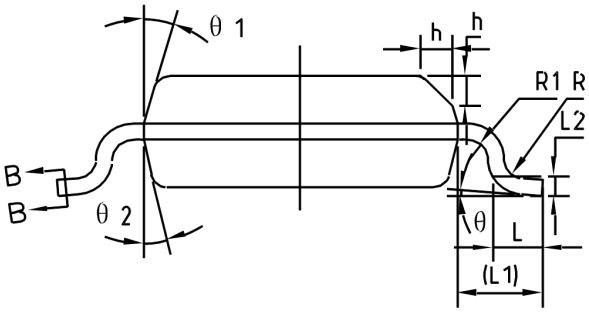


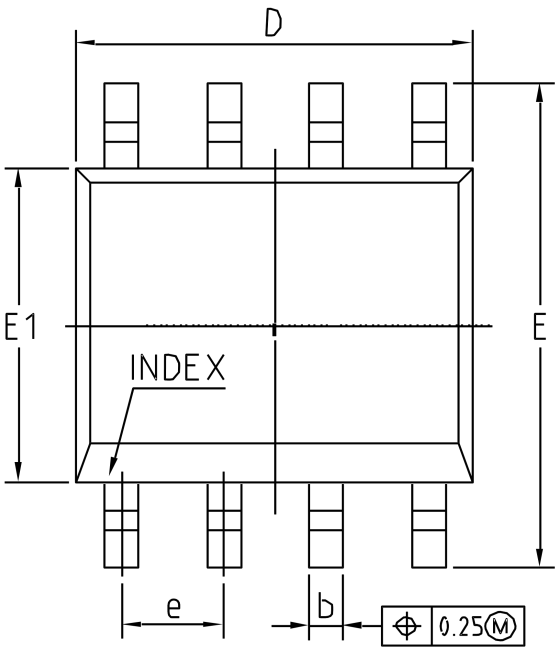


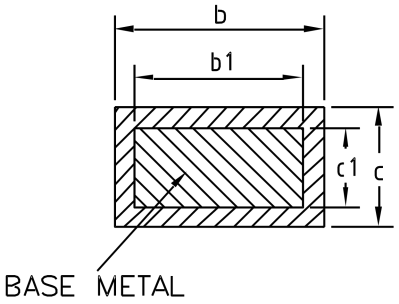
Symbol	Min	Nom	Max
A	1.40	1.50	1.60
b	1.68	-	1.77
b1	1.67	1.70	1.73
b2	0.38	-	0.47
b3	0.37	0.40	0.43
b4	0.46	-	0.55
b5	0.45	0.48	0.51
c	0.40	-	0.44
c1	0.39	0.40	0.41
D	4.40	4.50	4.60
D1	4.35	4.45	4.55
D2	1.60	1.75	1.90
D3	0.75	0.90	1.05
D4	1.60	1.70	1.80
E	2.40	2.50	2.60
E1	2.13	-	2.19
e	1.50BSC		
e1	3.00BSC		
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°

Physical Dimensions: SOIC-8





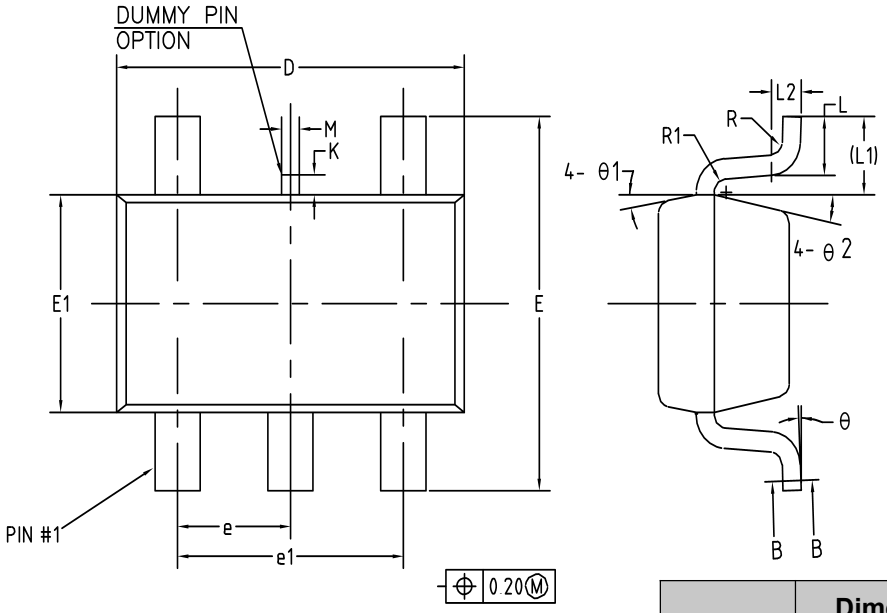


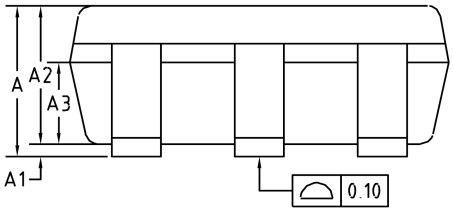


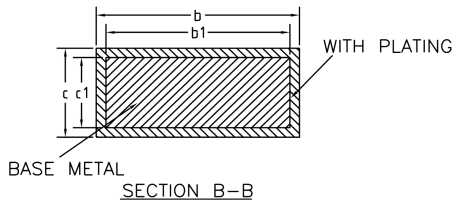
SECTION B–B

Common Dimensions (Units of measure = Millimeter)			
Symbol	**Min**	**Nom**	**Max**
A	1.35	1.55	1.75
A1	0.10	0.15	0.25
A2	1.25	1.40	1.65
A3	0.50	0.60	0.70
b	0.38	-	0.51
b1	0.37	0.42	0.47
c	0.17	-	0.25
c1	0.17	0.20	0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.45	0.60	0.80
L1	1.04REF		
L2	0.25BSC		
R	0.07	-	-
R1	0.07	-	-
h	0.30	0.40	0.50
Θ	0°	-	8°
Θ1	15°	17°	19°
Θ2	11°	13°	15°
Θ3	15°	17°	19°
Θ4	11°	13°	15°

Physical Dimensions: SOT23-5







Symbol	Dimensions in Millimeters		
	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	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e 1	1.80	1.90	2.00
K	0	-	0.25
L	0.30	0.40	0.60
L1		0.59REF	
L2		0.25BSC	
M	0.10	0.15	0.25
R	0.05	-	0.20
R1	0.05	-	0.20
Θ	0°	-	8°
Θ1	8°	10°	12°
Θ2	10°	12°	14°

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 phones, handheld products, laptops, medical equipment, and so on. Dioo's product families include analog signal processing and amplifying, LED drivers, and charger ICs. Go to http://www.dioo.com for a complete list of Dioo product families.

For additional product information or full datasheet, please contact our sales department or representatives.