40V,330mA,2.8uA,Low-Dropout Voltage Regulator

Features

- Input voltage range: 3.0V to 40V
- Maximum output current: 330mA
- High output voltage accuracy: ±1%/±2%
- Low dropout: 1000mV at I_{OUT} = 300mA (V_{OUT}=5V)
- Low quiescent current: 2.8uA (Typ.)
- Excellent load transient response
- Excellent line transient response
- High PSRR : 52dB typical at 1kHz
- Optional output voltages: 6V~12V
- Package:SOT89-3

Applications

- Regulation to noise sensitive applications
- Communications and infrastructure
- Medical and healthcare
- Industrial and instrumentation

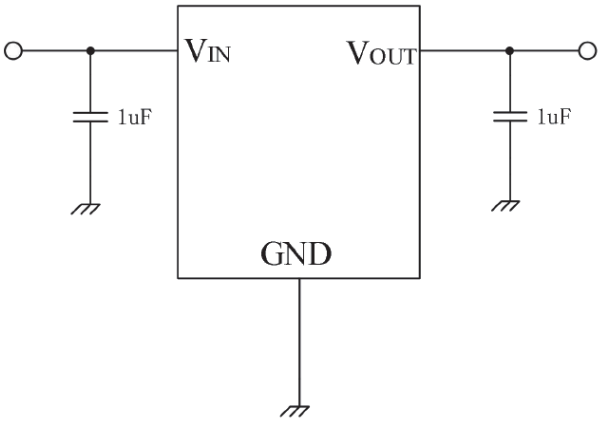
Description

OSU24LXX series are the high input very low IQ 330mA LDO with enable function that operates output from 6V, 9V and 13V is designed specifically for portable battery-powered applications which require ultra-low quiescent current. The very-low consumption of type 2.8uA ensures long battery life and dynamic transient boost feature improves device transient response for wireless communication applications.

Device Information

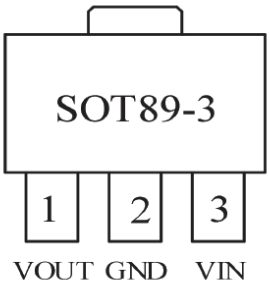
PART NUMBER	PACKAGE	BODYSIZE(NOM)
OSU24LXXA/BTS-C	SOT89-3	4.5mm*4.2mm

Typical Application



40V,Low-Dropout Voltage Regulator

Pin Configuration and Functions



Pin	Pin name	Function
1	VOUT	Regulated output voltage
2	GND	Ground
3	VIN	Input voltage

Absolute Maximum Ratings

Parameter	Description	Min	Max	Unit
V_{IN}	Input voltage(1)	-0.3	45	V
V_{OUT}	Output voltage	-0.3	16	V
V_{EN}	Chip enable input	-0.3	45	V
$T_{J(MAX)}$	Maximum junction temperature	150		℃
T_{STG}	Storage temperature	-65	150	℃
ESD(2)	Human body model(HBM)	2000		V
L_U(2)	Latch up current maximum rating	200		mA

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Note1. Refer to electrical characteristics and application information for safe operating area.
Note2. This device series incorporates ESD protection and is tested by the following methods:
ESD HBM tested per EIA/JESD22-A114;
Latch up tested per JEDEC78.

Electrical Characteristics

(At T_A = 25°C, C_{IN} =1uF, V_{IN} = V_{OUTNOM} + 2.0V, I_{OUT} = 10mA,C_{OUT} = 1uF, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{IN}[3]	Operating input voltage		3.0	—	40	V
I_{GND}	Quiescent current	I_{OUT} = 0mA	—	2.8	6.5	uA
V_{OUT}	Output voltage	T_A = +25°C	V_{OUTNOM} * 0.98	V_{OUTNOM}	V_{OUTNOM} *1.02	V
V_{DROP}[4]	Dropout voltage I_{OUT} = 300mA	V_{OUT} = 6.0~12V	—	1000	1500	mV
Reg_{LOAD}	Load regulation	V_{IN} = V_{OUTNOM} + 2V, 1mA ≤ I_{OUT} ≤ 300mA	—	90	180	mV
Reg_{Line}	Line regulation	V_{IN} = V_{OUTNOM} + 1V to 40V, I_{OUT} = 10mA	—	40	90	mV
I_{LIMIT}	Current limit	V_{IN} = V_{OUTNOM} + 2V	—	450	800	mA
I_{SHORT}	Short current limit	V_{OUT} = 0V	—	55	120	mA
V_{TRLN}	Line transient	V_{IN} = V_{OUT}+2V to V_{OUT}+10V in 10us, I_{OUT} = 1mA,T_A = +25ºC	—	50	—	mV
		V_{IN} = V_{OUT}+10V to V_{OUT}+2V in 10us, I_{OUT} = 1mA,T_A = +25ºC	—	50	—	mV
V_{TRLD}	Load transient	I_{OUT} = 1mA to 300mA in 10us V_{IN} = V_{OUT}+2V,T_A = +25º C	—	210	—	mV
		I_{OUT} = 300mA to 1mA in 10us V_{IN} = V_{OUT}+2V,T_A = +25º C	—	160	—	mV
T_{SD}	Thermal shutdown temperature	Shutdown, temperature increasing	—	155	—	℃
		Reset, temperature decreasing	—	130	—	
e_n[5]	Output voltage noise	V_{IN} = V_{OUTNOM} + 2V , I_{OUT} = 1mA,f = 10Hz to 100kHz, V_{OUT} =3V,C_{OUT} = 1uF	—	30* V_{OUT}	—	uV_{RMS}
PSRR	Power supply rejection ratio	V_{IN} = V_{OUTNOM} + 2V , I_{OUT} = 20mA, f = 1kHz	—	52	—	dB

Note3. Here V_{IN} means internal circuit can work normal. If V_{IN} < V_{OUT}, Output voltage follow V_{IN}(I_{OUT} = 1mA), circuit is safety.

Note4. V_{DROP} FT test method: test the V_{OUT} voltage at V_{OUT}+$V_{DROPMAX}$ with 300mA output current.

Note5. Guaranteed by design and characterization. not a FT item.

Functional Description

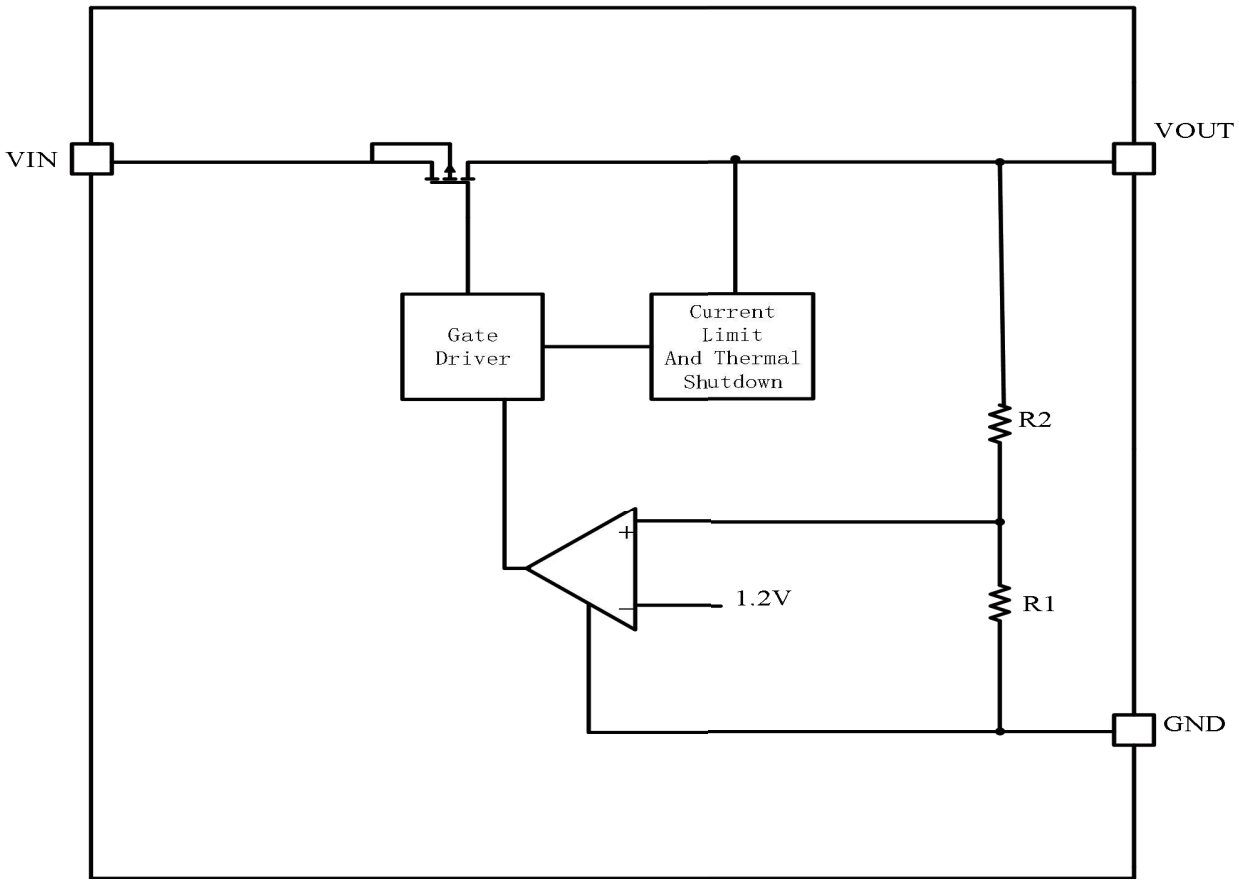
Input Capacitor

A 0.47uF~10uF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 0.47uF to 10uF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to VOUT and GND pins.

Functional Block Diagram



Functional Block Diagram

Dropout Voltage

The OSU24LXX uses a PMOS pass transistor to achieve low dropout. When (V_{IN}–V_{OUT}) is less than the dropout voltage (V_{DROP}), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the RDS(ON) of the PMOS pass element. V_{DROP} scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as (V_{IN}–V_{OUT}) approaches dropout operation.

Thermal Shutdown

Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°C, the output circuitry is again enabled. Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the (V_{IN}–V_{OUT}) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance.

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, θ_{JA}.

Current-Limit Protection

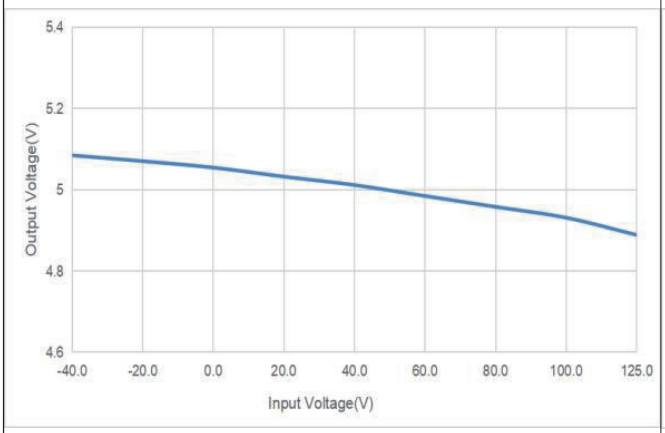
The OSU24LXX provides current limit function to prevent the device from damages during over- load or shorted-circuit condition. This current is detected by an internal sensing transistor.

Layout Guidelines

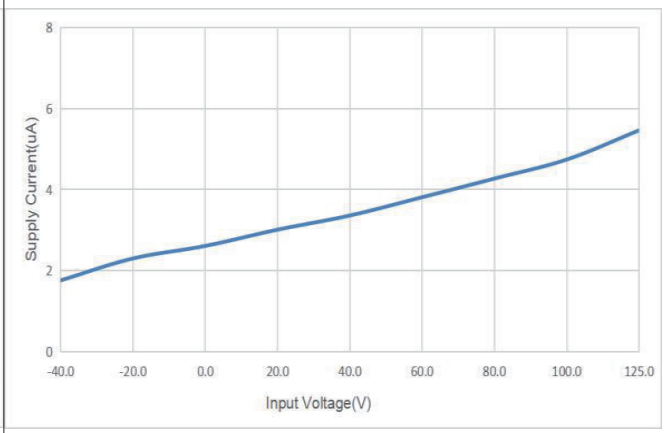
- Place input and output capacitors as close to the device as possible.
- Use copper planes for device connections in order to optimize thermal performance.
- Place thermal vias around the device to distribute heat.

Typical Characteristics

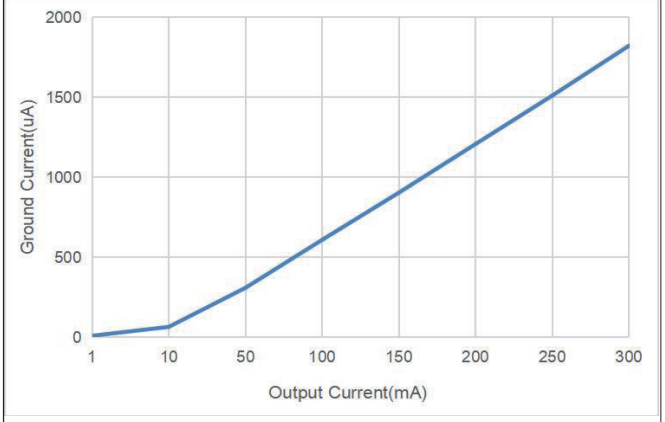
(V_{OUT} =5V, V_{IN} =7V, C_{IN} = C_{OUT}= 1uF, unless otherwise noted.Typical values are at T_A = +25°C.)



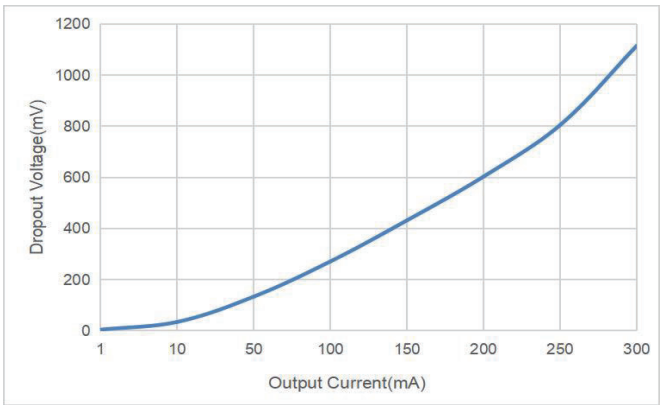
Output Voltage VS Temperature



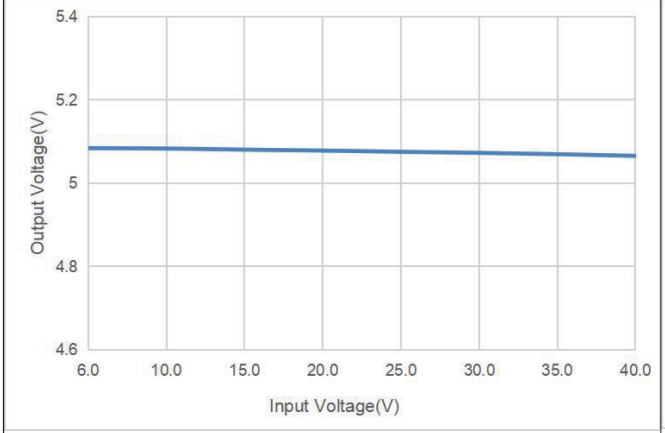
Quiescent Current VS Temperature



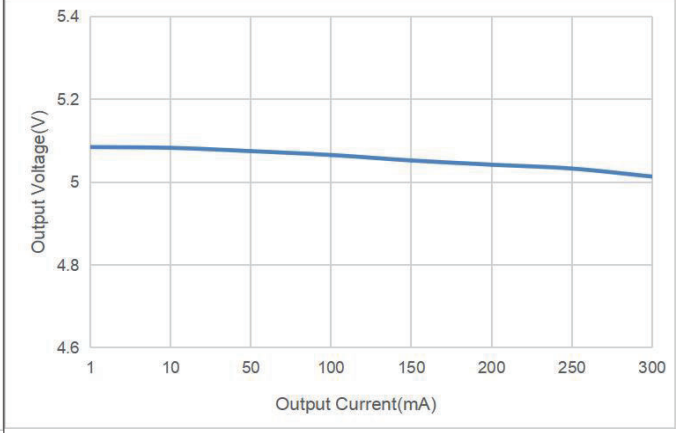
Ground Current VS Output Current



Dropout Voltage VS Output Current



Output Voltage VS Input Voltage

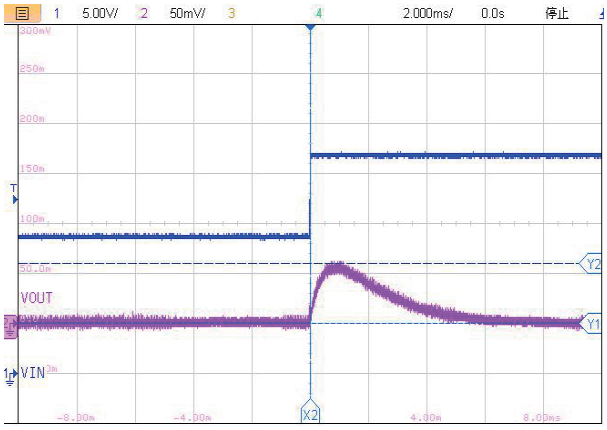


Output Voltage VS Output Current

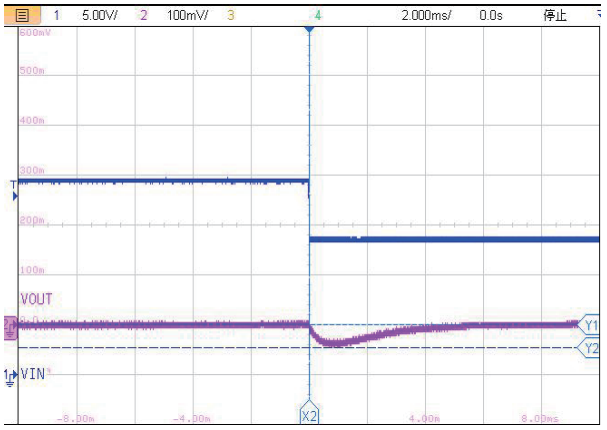
Typical Characteristics(Continued)

VOLTAGE VERSION 12V

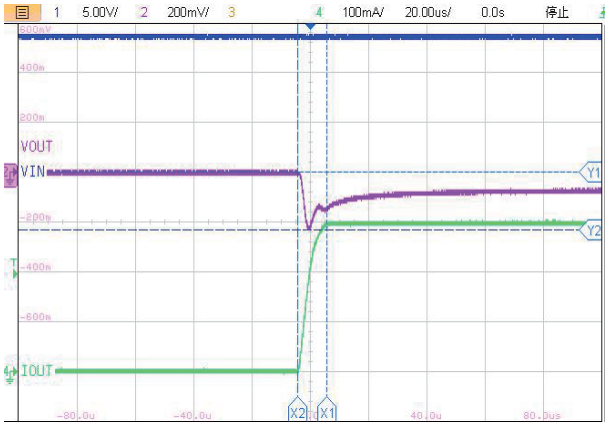
(V_{OUT}=12V, V_{IN} =14V, C_{IN} = C_{OUT} = 1uF, unless otherwise noted.Typical values are at T_A = +25°C.)



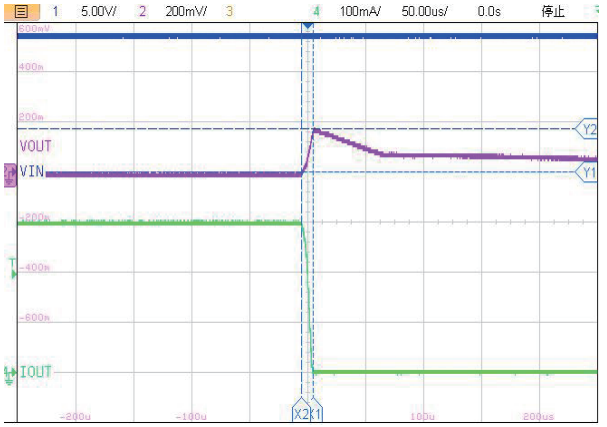
Input Transient(14~22V t=10us 10mA)



Input Transient(22~14V t=10us 10mA)



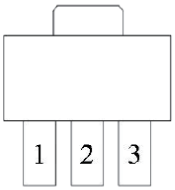
Load Transient(1mA~300mA t=10us)



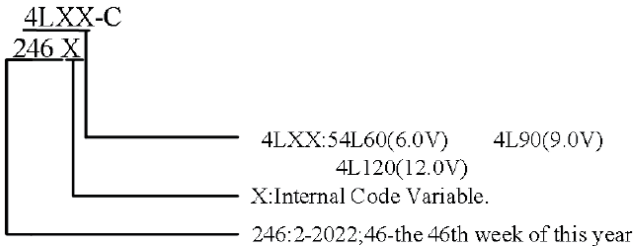
Load Transient(300mA~1mA t=10us)

Ordering And Marking Information

Part Number	
OSU24LXXBTS-C Pin definition Package definition Voltage accuracy Product name Company name	**Package Outline**
	Minimum Package
	Marking

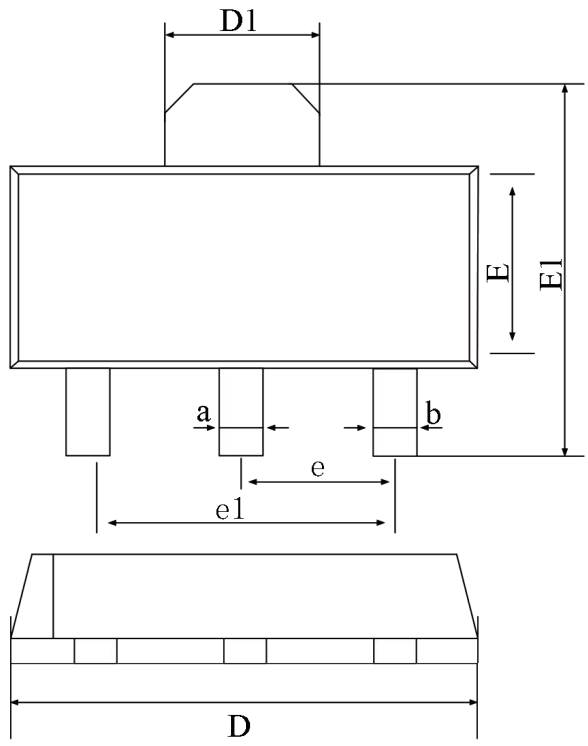


SOT89-3
1000pcs/Reel



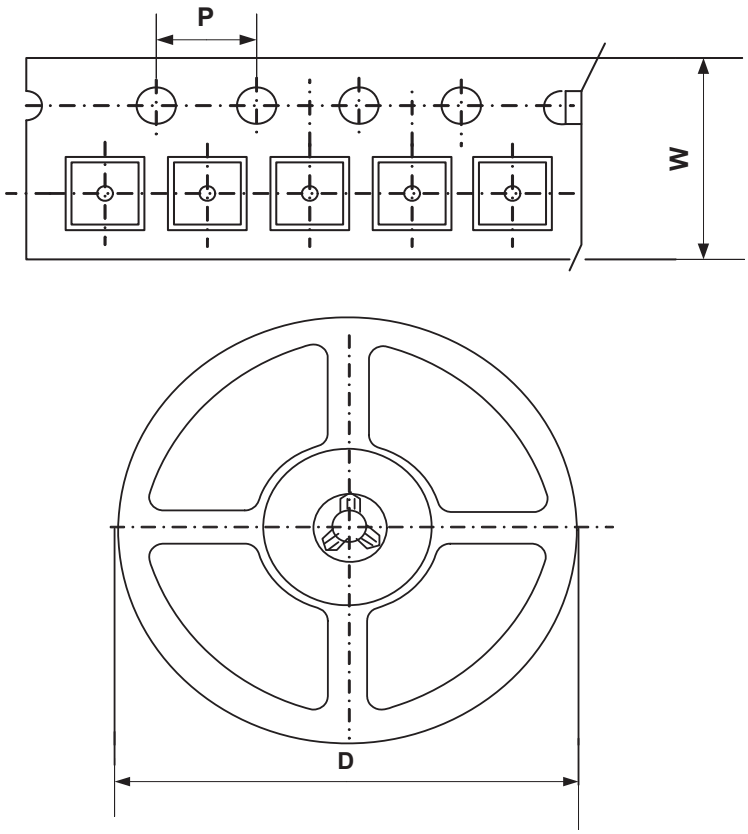
Package Outline

SOT89-3



REF.	Millimeter	
	Min.	Max.
A2	1.40	1.60
a	0.40	0.58
b	0.32	0.52
c	0.36	0.46
D	4.40	4.60
D1	1.60	1.80
E	2.30	2.60
E1	4.00	4.30
e	1.00	2.00
e1	2. 95	3.05

Packing Information



Type	W(mm)	P(mm)	D(mm)	Qty (pcs)
SOT89-3	12.0mm	4.0mm	178.0mm	1000pcs

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