

18V (30V spike) 2A Synchronous PFM/PWM Buck Converter

DESCRIPTION

The BL8091 is a high efficiency current-mode synchronous, 18V/2A buck converter. Its input voltage ranges from 4.5V to 18V and it provides an adjustable regulated output voltage from 0.923V to 15V while delivering up to 2A of output current.

The internal synchronous switches increase efficiency and eliminate the need for an external Schottky diode. The switching frequency is set to 340KHz. And the BL8091 will automatically switch between PFM and PWM mode based on the load current, thus to enhance the converter efficiency at light load.

BL8091 consists of many protection block such as UVLO, input voltage over voltage protection to stand much higher input voltage spike, thermal protection and output short circuit protection.

The BL8091 is available in the SOP8 and ESOP8 (with exposed pad for heat dissipation) package

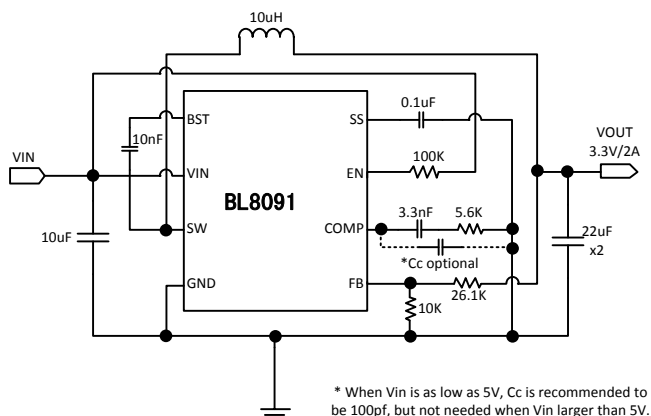
FEATURES

- Adjustable Output Voltage, $V_{fb}=0.923V$
- Maximum output current is 2A
- Range of operation input voltage: Max 18V
- Withstand input voltage spike >30V
- Standby current: 1mA (typ.)
- Operating current at zero load: 1.2mA (typ.)
- Line regulation: 0.1%/V (typ.)
- Load regulation: 10mV (typ.)
- High efficiency, up to 95%
- Environment Temperature: $-20^{\circ}C \sim 85^{\circ}C$

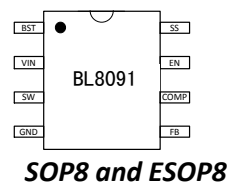
APPLICATIONS

- Set-top-box
- Consumer Electronic Device for automobile
- LCD Monitor and LCD TV
- Portable DVD
- ADSL Modem, WLAN router
- Other 12V or double cell Li-ion battery powered device

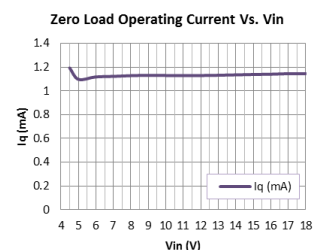
TYPICAL APPLICATION



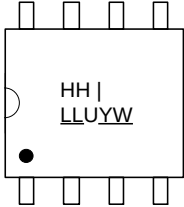
PIN OUT



PFM at Light Load



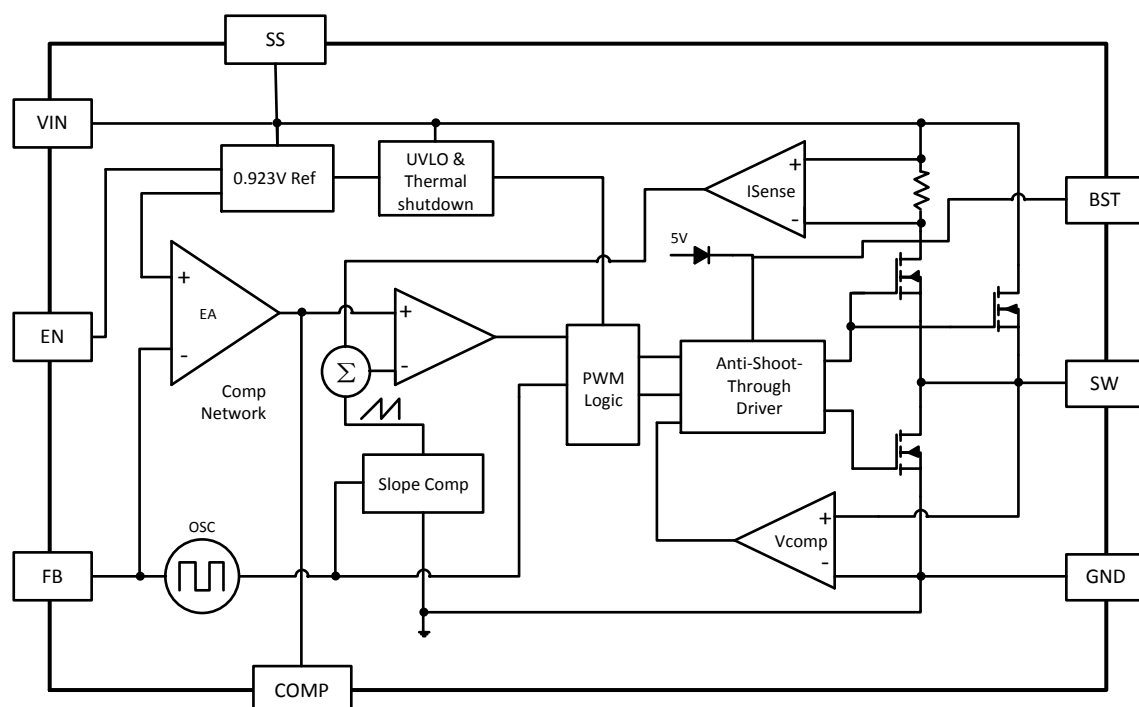
MARK and ORDERING INFORMATION

Mark Explanation		Ordering Information	
HH : Product Code		SOP8	
LL: Lot No.		2500pcs/reel	BL8091CD8TR
U: Fab code		ESOP8	
YW: Date code		2500pcs/reel	BL8091CS8TR

PINOUT DESCRIPTION

PIN #	NAME	DESCRIPTION
1	BST	High side power transistor gate drive boost input
2	VIN	Power input, the input capacitor should be placed as close to VIN and GND pin as possible
3	SW	Power switching node to connect inductor
4	GND	Ground.
5	FB	Feedback input with reference voltage set to 0.923
6	COMP	Compensation node. A serial RC connected to this pin is required to maintain the Buck converter control loop stable.
7	EN	Enable input. Setting it to high level or connecting to Vin via a resistor may turn on the chip, while setting it to ground level will turn off the chip.
8	SS	Soft-start node. Connecting a 0.1uF capacitor to ground make the Buck converter output rise smoothly.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Parameter		Value
Max Input Voltage		30V
Max Operating Junction Temperature(Tj)		125°C
Ambient Temperature(Ta)		-20°C – 85°C
Package Thermal Resistance (θ_{jc})	SOP-8L	45°C / W
	ESOP-8L	10°C / W
Storage Temperature(Ts)		-40°C - 150°C
Lead Temperature & Time		260°C, 10S
ESD (HBM)		>2000V

Note: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

RECOMMENDED WORK CONDITIONS

Parameter		Value
Input Voltage Range		Max. 18V
Operating Junction Temperature(Tj)		-20°C –125°C

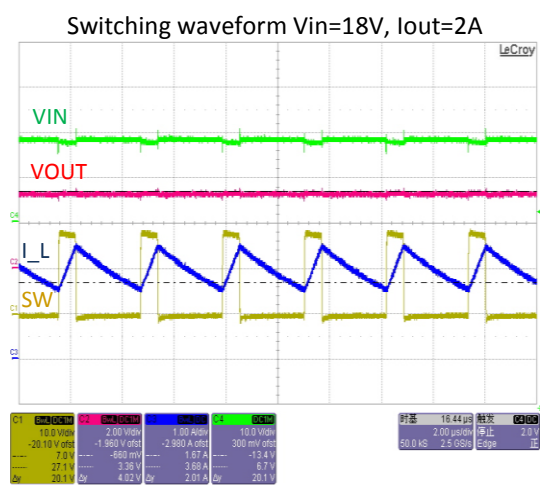
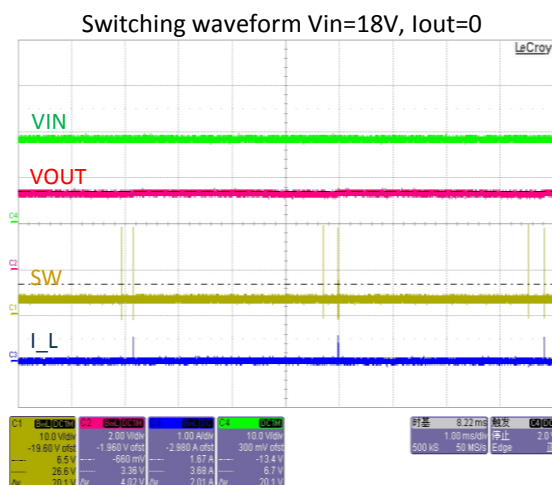
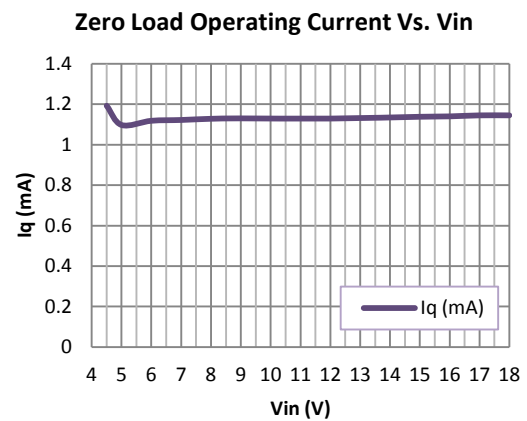
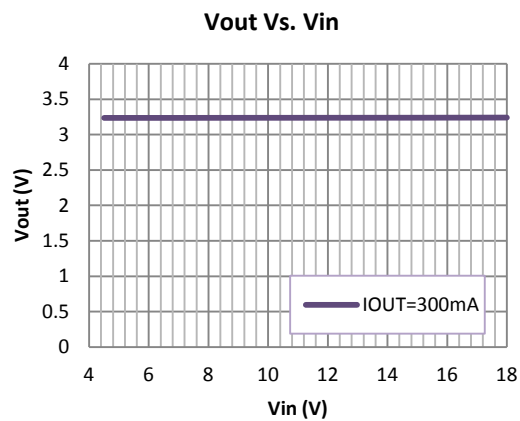
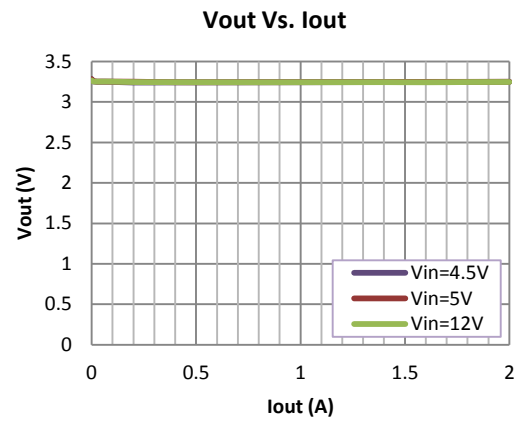
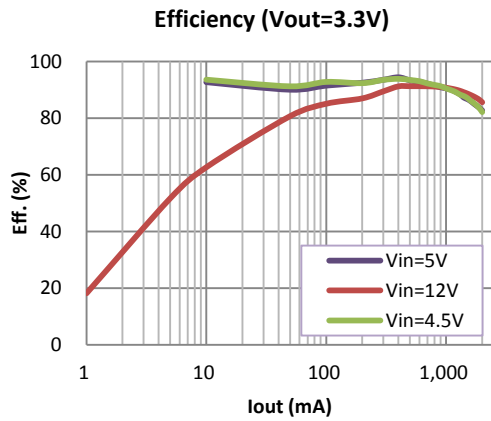
ELECTRICAL CHARACTERISTICS

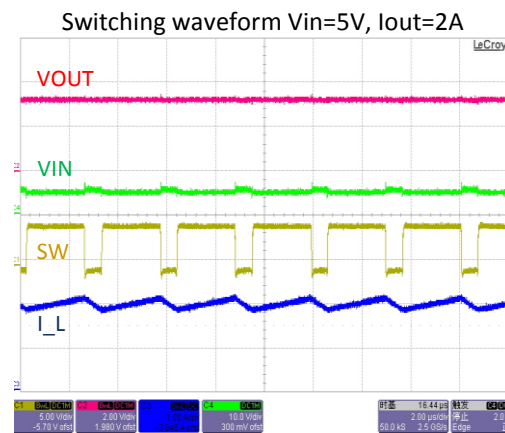
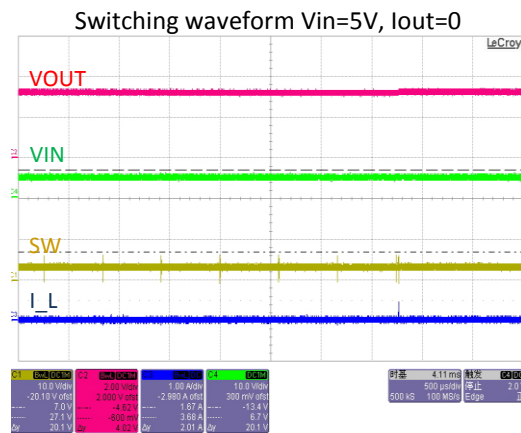
(VIN=12V, TA=25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VDD	Input Voltage Range		4.5		18	V
UVLO_UP	UVLO,IN UVLO Rising	Record VIN pin voltage as V(UVLO) when measure I(IN)> 500uA	3.8	4.1	4.4	V
Vref	Feedback Voltage	Vin=12V, Ven=5V	0.900	0.923	0.946	V
I _{fb}	Feedback Leakage current			0.1	0.4	uA
I _q	Quiescent Current	Active, Vfb=1V, No Switching		1.1	1.5	mA
		Shutdown, Vin=8V		6	10	uA
LnReg	Line Regulation	Vin=5V to 12V		0.1		%/V
LdReg	Load Regulation	I _{out} =0.1 to 2A		0.02		%/A
F _{soc}	Switching Frequency	Ven=2V, Vin=12V		340		KHz
R _{dsonP}	PMOS R _{dson}			130		mohm
R _{dsonN}	NMOS R _{dson}			110		mohm
I _{limit}	Peak Current Limit			2.5		A
V _{enh}	EN High Threshold		1	1.5	2	V
V _{enl}	EN Low Threshold				0.5	V
V _{ovp}	Input Over-Voltage Protection	Ven=2V	18			V
TSD	Over Temperature Proection			160		°C

TYPICAL PERFORMANCE CHARACTERISTICS

($V_{in}=12V$, $V_{out}=3.3V$, $L=10\mu H$, $C_{in}=10\mu F$, $C_{out}=22\mu F$, $T_A=25^\circ C$, unless otherwise stated)





FUNCTIONAL DESCRIPTIONS

Loop Operation

The BL8091 is a wide input range, high-efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current, integrated with a 110mΩ synchronous MOSFET, eliminating the need for external diode. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

Current Limit

There is a cycle-by-cycle current limit on the high-side MOSFET of 3A(typ). When the current flowing out of SW exceeds this limit, the high-side MOSFET turns off and the synchronous rectifier turns on. Unlike the traditional method of current limiting by limiting the voltage at the compensation pin, which usually has large variation due to duty cycle variance, this type of peak current limiting scheme provides a relatively more accurate limit for output current, thereby lowering the requirements for system design.

Light Load Operation

Traditionally, a fixed current mode constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite RDSOns of the MOSFETs and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. BL8091 employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power save mode during light load, thereby extending the range of high efficiency operation.

Faster Transient Response

Normally, people use 3.3nF and 5.6Kohm RC for compensation to keep the loop stable. However, if one needs to have faster load transient response, 3.3nF and 8.5Kohm is recommended.

COMPONENT SELECTION

When setting up the BL8091 for different output voltage, please use following recommended component value for the best performance.

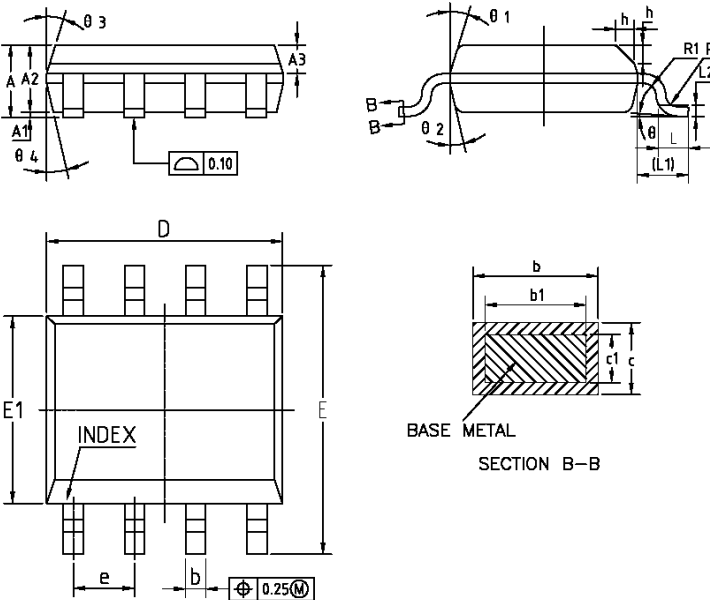
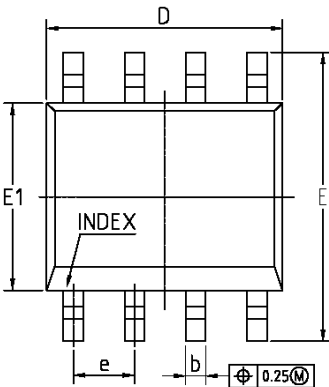
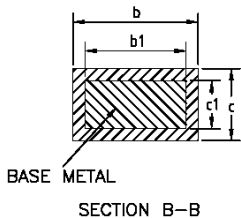
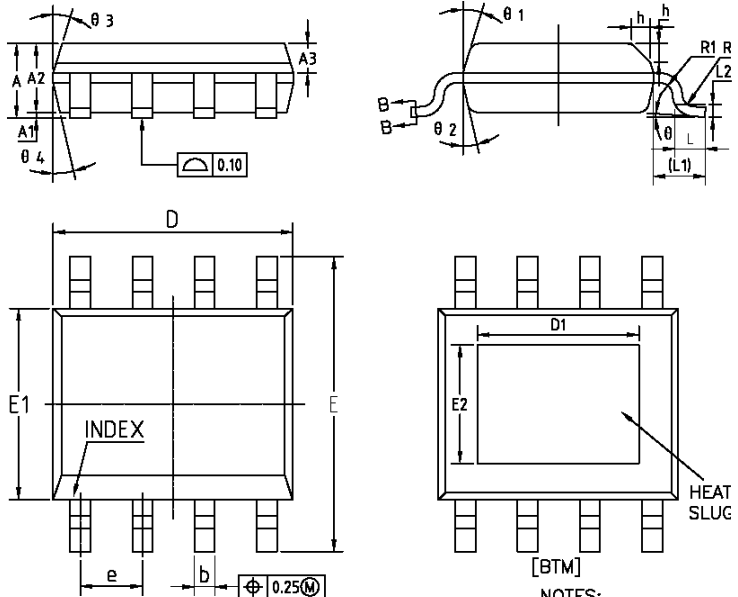
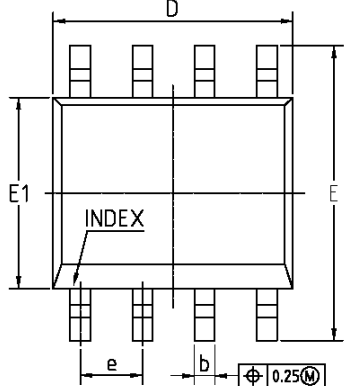
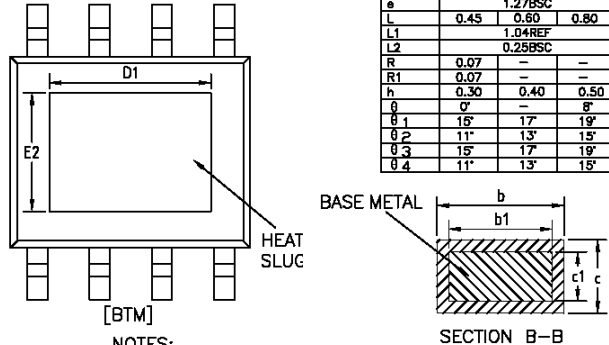
V _{OUT} (V)	C _{OUT} (μF)	L (μH)
8	22x2	22
5	22x2	15
3.3	22x2	10
2.5	22x2	6.8
1.8	22x2	4.7
1.2	22x2	3.3

THERMAL CONSIDERATION

BL8091 is high efficiency Buck converter, which means it consumes very few power when converting the high voltage to low voltage. However, when output power is very large, like 5V/2A, the output power is as high as 10W, a heat dissipation path is strongly recommended to be routed on PCB. BL8091 has two different SOP8 package. For the normal SOP8, the heat is conducted out via Pin 4 (GND), so the heat dissipation route on PCB should be connected to the Pin 4 of the chip. If ESOP8 is selected, the heat dissipation copper area should be exposed and connected to the exposed pad underneath the chip body.

When output power is larger than 10W, the ESOP8 package is recommended.

PACKAGE OUTLINE

Package	SOP8	Devices per reel	2500	Unit	mm																																																																																																								
Package specification:																																																																																																													
		<table><caption>COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)</caption><thead><tr><th>SYMBOL</th><th>MIN</th><th>NOM</th><th>MAX</th></tr></thead><tbody><tr><td>A</td><td>1.35</td><td>1.55</td><td>1.75</td></tr><tr><td>A1</td><td>0.10</td><td>0.15</td><td>0.25</td></tr><tr><td>A2</td><td>1.25</td><td>1.40</td><td>1.65</td></tr><tr><td>A3</td><td>0.50</td><td>0.60</td><td>0.70</td></tr><tr><td>b</td><td>0.38</td><td>—</td><td>0.51</td></tr><tr><td>b1</td><td>0.37</td><td>0.42</td><td>0.47</td></tr><tr><td>c</td><td>0.17</td><td>—</td><td>0.25</td></tr><tr><td>c1</td><td>0.17</td><td>0.20</td><td>0.23</td></tr><tr><td>D</td><td>4.80</td><td>4.90</td><td>5.00</td></tr><tr><td>E</td><td>5.80</td><td>6.00</td><td>6.20</td></tr><tr><td>E1</td><td>3.80</td><td>3.90</td><td>4.00</td></tr><tr><td>e</td><td>—</td><td>1.27BSC</td><td>—</td></tr><tr><td>L</td><td>0.45</td><td>0.60</td><td>0.80</td></tr><tr><td>L1</td><td>—</td><td>1.04REF</td><td>—</td></tr><tr><td>L2</td><td>—</td><td>0.25BSC</td><td>—</td></tr><tr><td>R</td><td>0.07</td><td>—</td><td>—</td></tr><tr><td>R1</td><td>0.07</td><td>—</td><td>—</td></tr><tr><td>h</td><td>0.30</td><td>0.40</td><td>0.50</td></tr><tr><td>θ</td><td>0°</td><td>—</td><td>8°</td></tr><tr><td>θ 1</td><td>15°</td><td>17°</td><td>19°</td></tr><tr><td>θ 2</td><td>11°</td><td>13°</td><td>15°</td></tr><tr><td>θ 3</td><td>15°</td><td>17°</td><td>19°</td></tr><tr><td>θ 4</td><td>11°</td><td>13°</td><td>15°</td></tr></tbody></table>				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°	θ 1	15°	17°	19°	θ 2	11°	13°	15°	θ 3	15°	17°	19°	θ 4	11°	13°	15°								
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°																																																																																																										
θ 1	15°	17°	19°																																																																																																										
θ 2	11°	13°	15°																																																																																																										
θ 3	15°	17°	19°																																																																																																										
θ 4	11°	13°	15°																																																																																																										
																																																																																																													
Package																																																																																																													
ESOP8	Devices per reel	2500	Unit	mm																																																																																																									
Package specification:																																																																																																													
		<table><caption>COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)</caption><thead><tr><th>SYMBOL</th><th>MIN</th><th>NOM</th><th>MAX</th></tr></thead><tbody><tr><td>A</td><td>1.35</td><td>1.55</td><td>1.75</td></tr><tr><td>A1</td><td>0</td><td>0.10</td><td>0.15</td></tr><tr><td>A2</td><td>1.25</td><td>1.40</td><td>1.65</td></tr><tr><td>A3</td><td>0.50</td><td>0.60</td><td>0.70</td></tr><tr><td>b</td><td>0.38</td><td>—</td><td>0.51</td></tr><tr><td>b1</td><td>0.37</td><td>0.42</td><td>0.47</td></tr><tr><td>c</td><td>0.17</td><td>—</td><td>0.25</td></tr><tr><td>c1</td><td>0.17</td><td>0.20</td><td>0.23</td></tr><tr><td>D</td><td>4.80</td><td>4.90</td><td>5.00</td></tr><tr><td>D1</td><td>3.10</td><td>3.30</td><td>3.50</td></tr><tr><td>E</td><td>5.80</td><td>6.00</td><td>6.20</td></tr><tr><td>E1</td><td>3.80</td><td>3.90</td><td>4.00</td></tr><tr><td>E2</td><td>2.20</td><td>2.40</td><td>2.60</td></tr><tr><td>e</td><td>—</td><td>1.27BSC</td><td>—</td></tr><tr><td>L</td><td>0.45</td><td>0.60</td><td>0.80</td></tr><tr><td>L1</td><td>—</td><td>1.04REF</td><td>—</td></tr><tr><td>L2</td><td>—</td><td>0.25BSC</td><td>—</td></tr><tr><td>R</td><td>0.07</td><td>—</td><td>—</td></tr><tr><td>R1</td><td>0.07</td><td>—</td><td>—</td></tr><tr><td>h</td><td>0.30</td><td>0.40</td><td>0.50</td></tr><tr><td>θ</td><td>0°</td><td>—</td><td>8°</td></tr><tr><td>θ 1</td><td>15°</td><td>17°</td><td>19°</td></tr><tr><td>θ 2</td><td>11°</td><td>13°</td><td>15°</td></tr><tr><td>θ 3</td><td>15°</td><td>17°</td><td>19°</td></tr><tr><td>θ 4</td><td>11°</td><td>13°</td><td>15°</td></tr></tbody></table>				SYMBOL	MIN	NOM	MAX	A	1.35	1.55	1.75	A1	0	0.10	0.15	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	D1	3.10	3.30	3.50	E	5.80	6.00	6.20	E1	3.80	3.90	4.00	E2	2.20	2.40	2.60	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°	θ 1	15°	17°	19°	θ 2	11°	13°	15°	θ 3	15°	17°	19°	θ 4	11°	13°	15°
SYMBOL	MIN	NOM	MAX																																																																																																										
A	1.35	1.55	1.75																																																																																																										
A1	0	0.10	0.15																																																																																																										
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																																																																																																										
D1	3.10	3.30	3.50																																																																																																										
E	5.80	6.00	6.20																																																																																																										
E1	3.80	3.90	4.00																																																																																																										
E2	2.20	2.40	2.60																																																																																																										
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°																																																																																																										
θ 1	15°	17°	19°																																																																																																										
θ 2	11°	13°	15°																																																																																																										
θ 3	15°	17°	19°																																																																																																										
θ 4	11°	13°	15°																																																																																																										
																																																																																																													
NOTES: ALL DIMENSIONS REFER TO JEDEC STANDARD MS-012 AA DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.																																																																																																													