ACE724C

18V 2A Synchronous PFM/PWM Buck Converter

Description

The ACE724C is a high efficiency current-mode synchronous, 18V/2A buck converter. Its input voltage ranges from 3.5V 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 ACE724C will automatically switch between PFM and PWM mode based on the load current, thus to enhance the converter efficiency at light load.

ACE724C 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.

Features

- Adjustable Output Voltage, Vfb=0.923V
- Maximum output current is 2A
- Range of operation input voltage: Max 18V
- UVLO: 3.4V (typ.)
- 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℃~85℃

Application

- 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

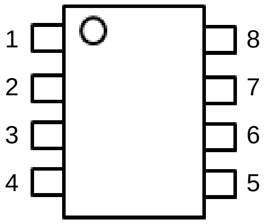
Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input voltage		30	V
Ambien temperature	T_A	-20~85	℃
Package thermal resistance SOP-8 ESOP-8	Θ_{JC}	45 25	℃/W
Max Operation junction temperature	Tj	125	℃
ESD (HBM)		>2000	V
Storage temperature range	T_S	-40~125	℃

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

Packaging Type

SOP-8 / ESOP-8



SOP-8/ESOP-8	Description	Function
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

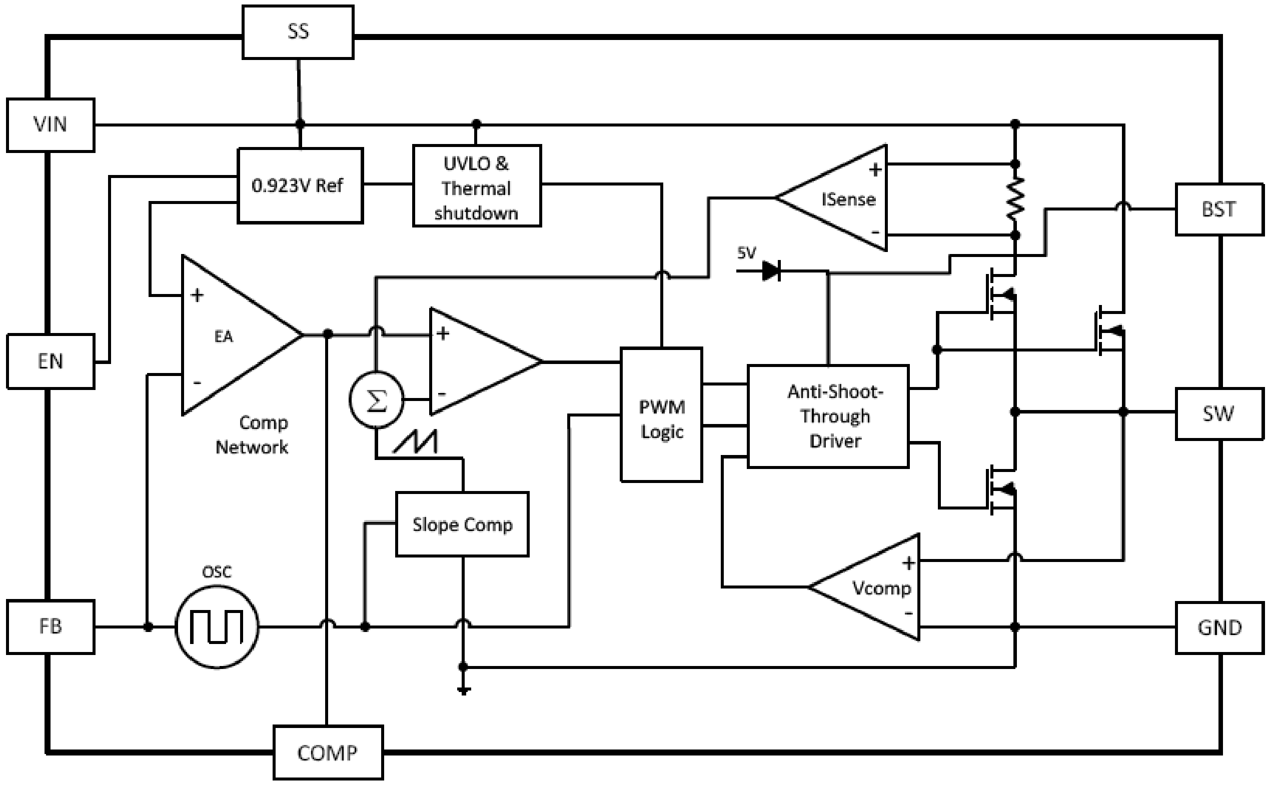
Ordering information

Selection Guide

ACE724C XX + H

- H: Halogen - free
- +: Pb - free
- XX: FM : SOP-8, IM : ESOP-8

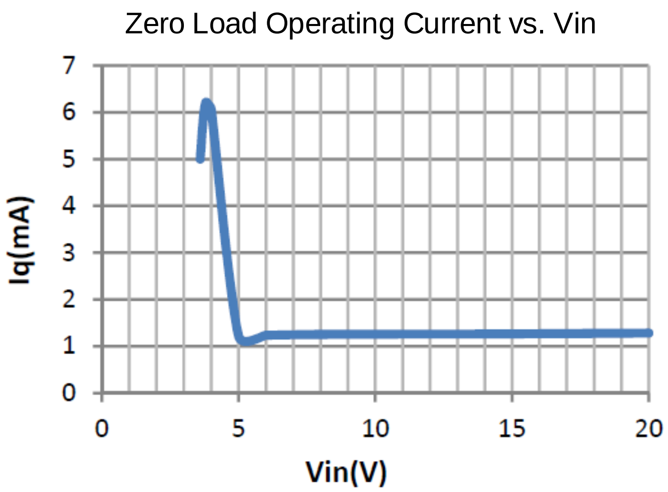
Block Diagram



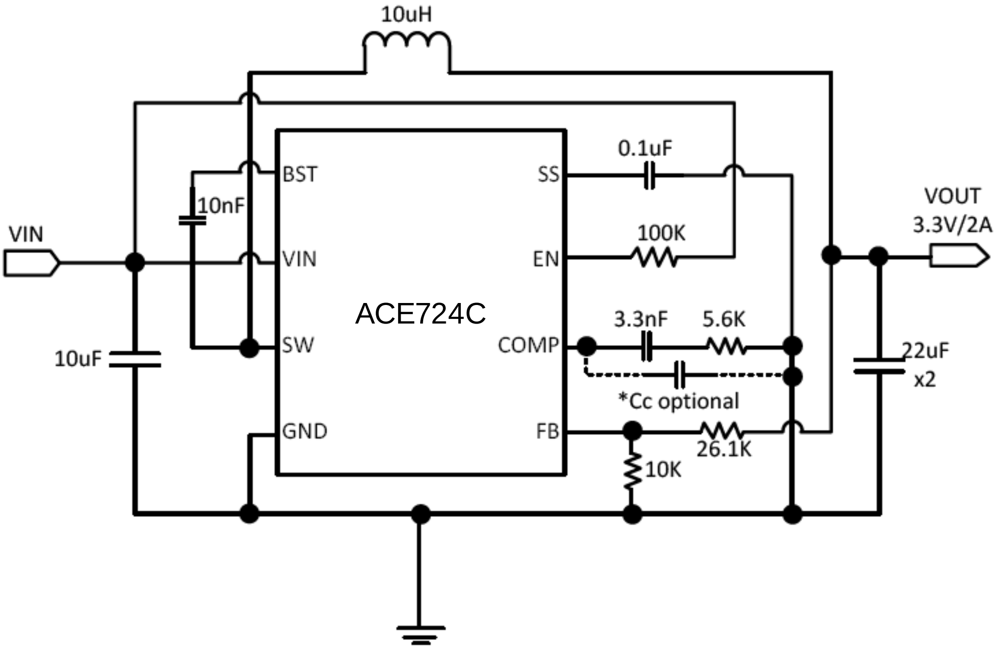
Recommended Work Conditions

Item	Value	Unit
Input voltage range	Max. 18	V
Operating junction temperature	-20~125	°C

PFM at Light Load



Typical Application



$$V_{OUT} = (1+\frac{R1}{R2}) \times V_{FB}$$

* When Vin is as low as 5V, Cc is recommended to be 100pf, but not needed when Vin larger than 5V.

Electrical Characteristics

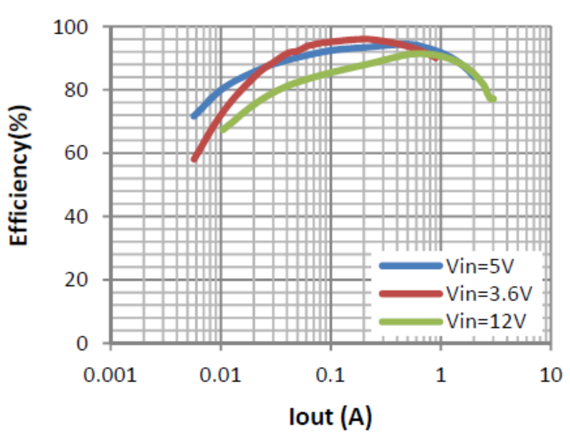
(Vin=12V, T_A=25℃)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input voltage range	VDD		3.5		18	V
Feedback voltage	Vref	Vin=12V, Ven=5V	0.90	0.923	0.946	V
UVLO Voltage	V_{UVLO}	Vin H->L, Iout=0.5A		3.4		V
Feedback leakage current	Ifb			0.1	0.4	uA
Quiescent current	Iq	Active, Vfb=1V, No switching		1.1	1.5	mA
		Shutdown, Vin=8V		6	10	uA
Line regulation	LnReg	Vin=5V to 12V		0.1		%/V
Load regulation	LdReg	Iout=0.1 to 2A		0.02		%/A
Switching	Fsoc	Ven=2V, Vin=12V		340		KHz
PMOS Rdson	RdsonP			130		mΩ
NMOS Rdson	RdsonN			110		mΩ
Peak current limit	Llimit			3.5		A
EN high threshold	Venh		1	1.5	2	V
EN low threshold	Venl				0.5	V
Input over-voltage	Vovp	Ven=2V	18			V
Over temperature proection	TSD			150		℃

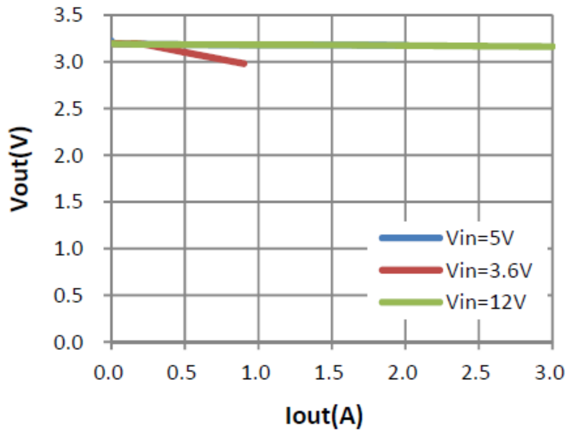
Typical performance characteristics

(Vin=12V, Vout=3.3V, L=10uH, Cin=10uF, Cout=22uF, T_A=25℃, unless otherwise stated)

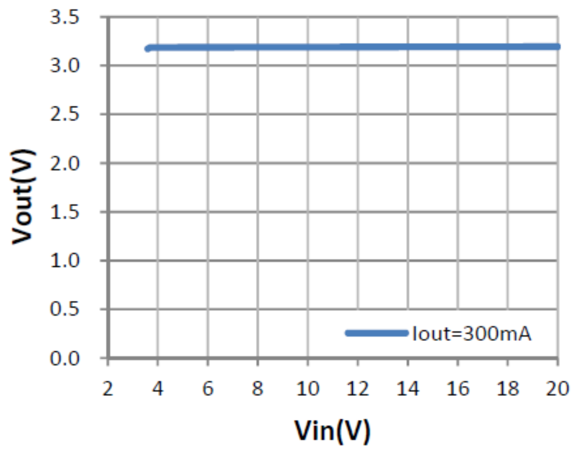
Efficiency(Vout=3.3V)



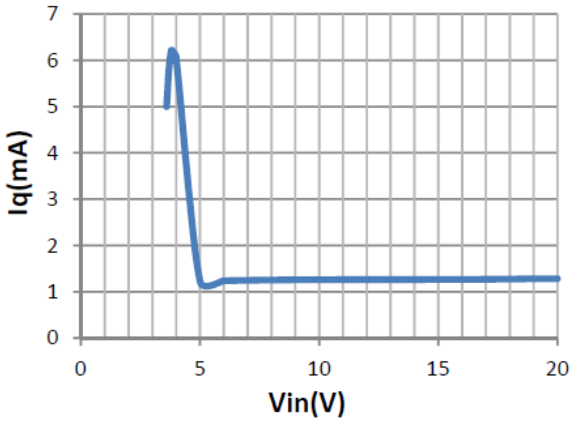
Vout vs. Iout



Vout vs. Iout

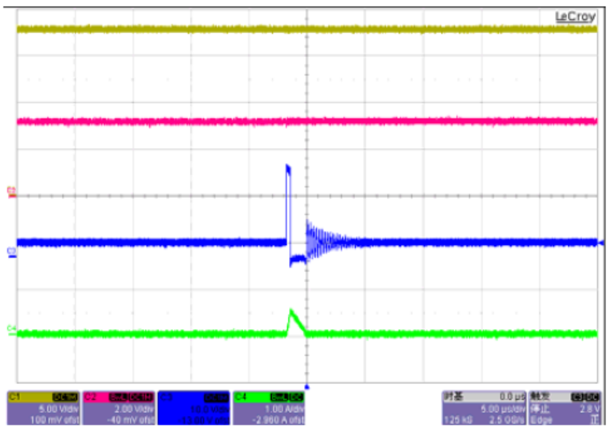


Zero Load Operating Current vs. Vin



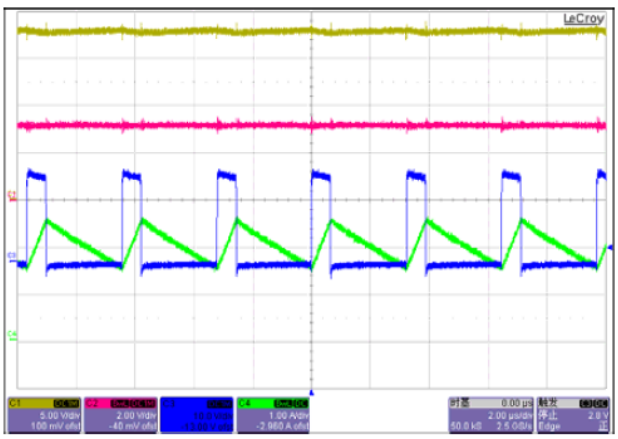
Switching waveform Vin=18V, Iout=0

(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



Switching waveform Vin=18V, Iout=2A

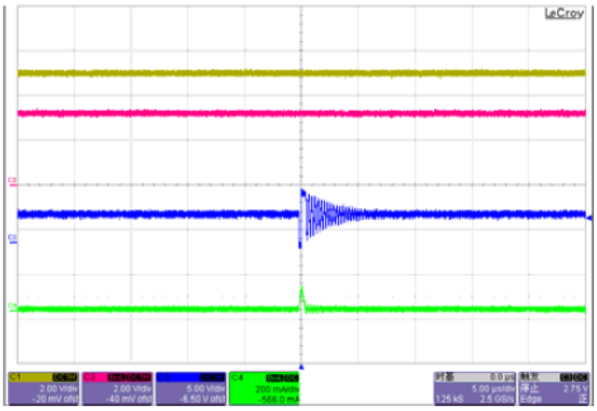
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



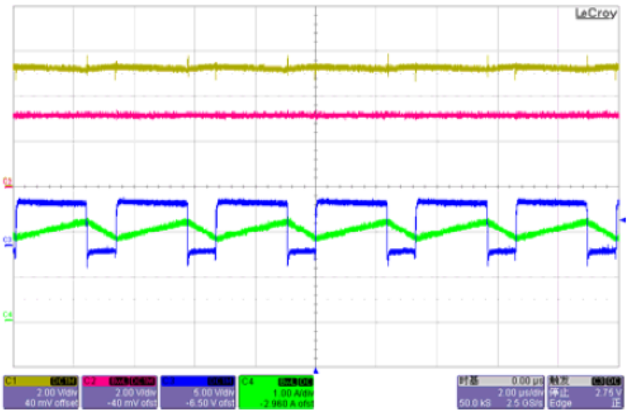
Typical performance characteristics

(Vin=12V, Vout=3.3V, L=10uH, Cin=10uF, Cout=22uF, T_A=25℃, unless otherwise stated)

Switching waveform Vin=5V, Iout=0
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



Switching waveform Vin=5V, Iout=2A
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



Functional Descriptions

Loop Operation

The ACE724C is a wide input range, high -efficien
of delivering up to 2A of output current, integrated with a 110m□ synchronous MOSFET, eliminating the need for external diode. It uses a PWM current -mode c
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 5A (typ). When the current flowing -side MO
out of SW exceeds this limit, the high -side M
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 it does 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. ACE724C 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 ACE724C for different output voltage, please use following recommended component value for the best performance.

V_{OUT}(V)	C_{OUT}(μF)	L(μH)
8	22*2	22
5	22*2	15
3.3	22*2	10
2.5	22*2	6.8
1.8	22*2	4.7
1.2	22*2	3.3

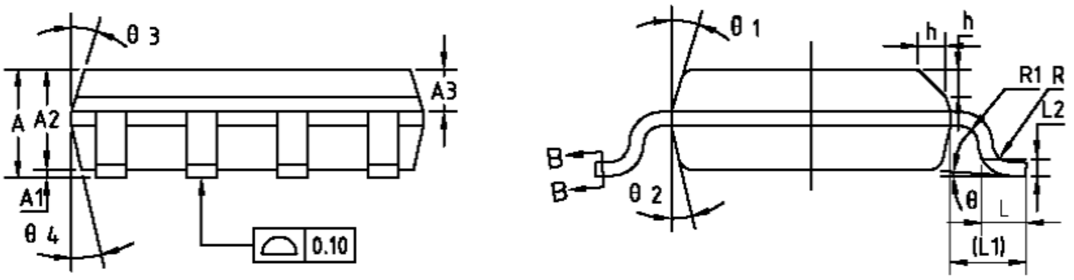
Thermal consideration

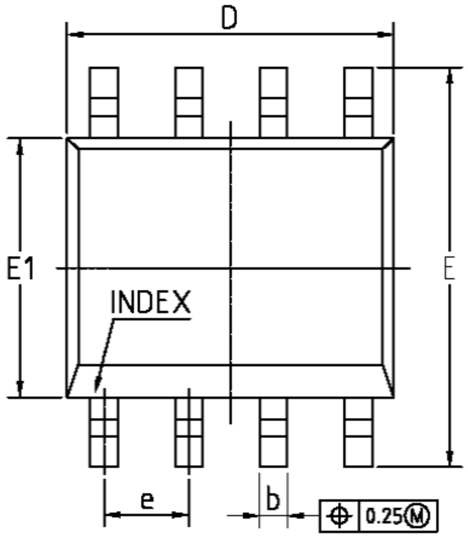
ACE724C is high efficiency Buck converter, which means it consumes very few power when converting the high voltage to low voltage. However, when output power is very large, like 5V/2A, the output power is as high as 10W, a heat dissipation path is strongly recommended to be routed on PCB. ACE724C has 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.

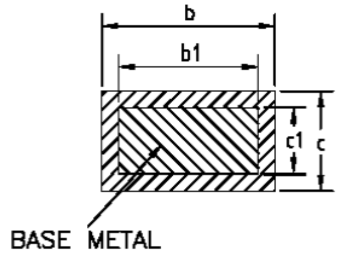
When output power is larger than 10W, the ESOP8 package is recommended.

Packing Information

SOP-8







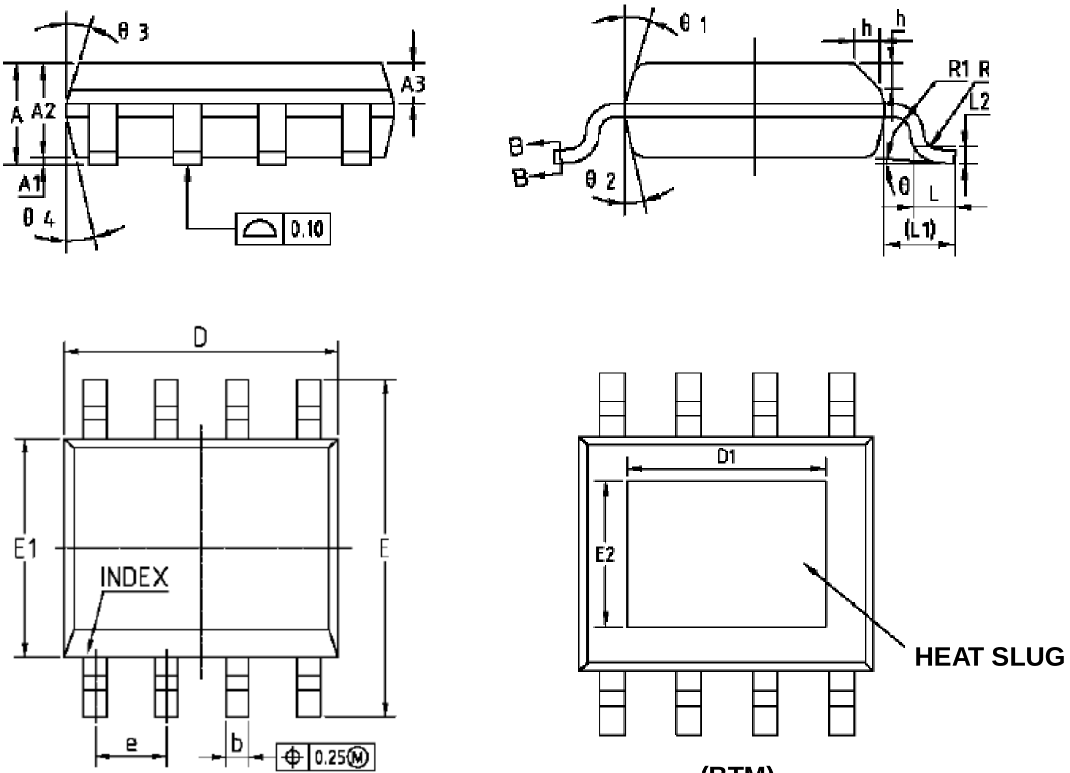
SECTION B–B

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°
θ 1	15°	17°	19°
θ 2	11°	13°	15°
θ 3	15°	17°	19°
θ 4	11°	13°	15°

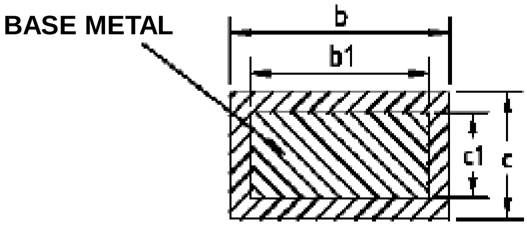
Packing Information

ESOP-8



(BTM)

NOTES: ALL DIMENSIONS REFER TO JEDEC STANDARD MS-012 AA DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.



SECTION B-B

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

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°
θ1	15°	17°	19°
θ2	11°	13°	15°
θ3	15°	17°	19°
θ4	11°	13°	15°

Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and shoes failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ACE Technology Co., LTD.
http://www.ace-ele.com/