

Low Quiescent Current, PFM/PWM Synchronous Boost Regulator**with True Output Disconnect or Input/Output Bypass Option****■ General Description**

The HG1215 is a compact, high-efficiency, fixed frequency, synchronous step-up DC-DC converter. This family of devices provides an easy-to-use power supply solution for applications powered by either one-cell, two-cell or three-cell alkaline, NiCd, NiMH, one-cell Li-Ion or Li-Polymer batteries. A low-voltage technology allows the regulator to start up without high inrush current or output voltage overshoot from a low voltage input. High efficiency is accomplished by integrating the low-resistance N-Channel boost switch and synchronous P-Channel switch. All compensation and protection circuitry are integrated to minimize external components. HG1215 operates and consumes less than 14 μA from battery, while operating at no load ($V_{\text{OUT}} = 3.3\text{V}$, $V_{\text{IN}} = 1.5\text{V}$). The devices provide a true disconnect from input to output (HG1215AE) or an input-to-output bypass (HG1215BE), while in shutdown ($\text{EN} = \text{GND}$). Both options consume less than 0.6 μA from battery. Output voltage is set by a small external resistor divider.

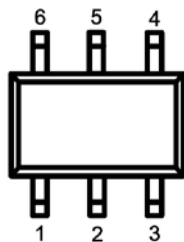
■ Applications

- One, Two and Three Cell Alkaline and NiMH/NiCd Portable Products
- Solar Cell Applications
- Personal Care and Medical Products
- Bias for Status LEDs
- Smartphones, MP3 Players, Digital Cameras
- Remote controllers, Portable Instruments
- Wireless Sensors
- Bluetooth Headsets
- +3.3V to +5.0V Distributed Power Supply

■ Features

- Up to 96% Typical Efficiency
- 1.0A Typical Peak Input Current Limit:
 - $I_{\text{OUT}} > 200 \text{ mA}$ @ 3.3V V_{OUT} , 1.2V V_{IN}
 - $I_{\text{OUT}} > 400 \text{ mA}$ @ 3.3V V_{OUT} , 2.4V V_{IN}
 - $I_{\text{OUT}} > 400 \text{ mA}$ @ 5.0V V_{OUT} , 3.3V V_{IN}
- Low Device Quiescent Current:
 - Output Quiescent Current: < 4 μA typical, device is not switching ($V_{\text{OUT}} > V_{\text{IN}}$, excluding feedback divider current)
 - Input Sleep Current: 1 μA
 - No Load Input Current: 14 μA typical
- Shutdown Current: 0.6 μA typical
- Low Start-up Voltage: 0.82V, 1 mA load
- Low Operating Input Voltage: down to 0.65V
- Adjustable Output Voltage Range: 1.8V to 5.5V
- Maximum Input Voltage: $V_{\text{OUT}} < 5.5\text{V}$
- Automatic PFM/PWM Operation:
 - PWM Operation: 500 KHz
 - PFM Output Ripple: 150 mV typical
- Feedback voltage: 1.215V
- Internal Synchronous Rectifier
- Internal Compensation
- Inrush Current Limiting and Internal Soft Start (1 ms typical)
- Selectable, Logic Controlled, Shutdown States:
 - True Load Disconnect Option (HG1215AE)
 - Input to Output Bypass Option (HG1215BE)
- Anti-Ringing Control
- Over temperature Protection
- Output Short Protection
- Available Packages:
 - SOT-23-6

■ PIN CONFIGURATION



HG1215①②

DESIGNATOR	SYMBOL	DESCRIPTION
①	A	Disconnect option
	B	Bypass option
②	E/ER	Package: SOT-23-6

PIN NO.		PIN NAME	FUNCTION
E	ER		
1	1	SW	Switch Node, Boost Inductor Input Pin
2	2	GND	Ground Pin
3	4	V_{FB}	Feedback Voltage Pin
4	3	EN	Enable Control Input Pin
5	5	V_{OUT}	Output Voltage Pin
6	6	V_{IN}	Input Voltage Pin

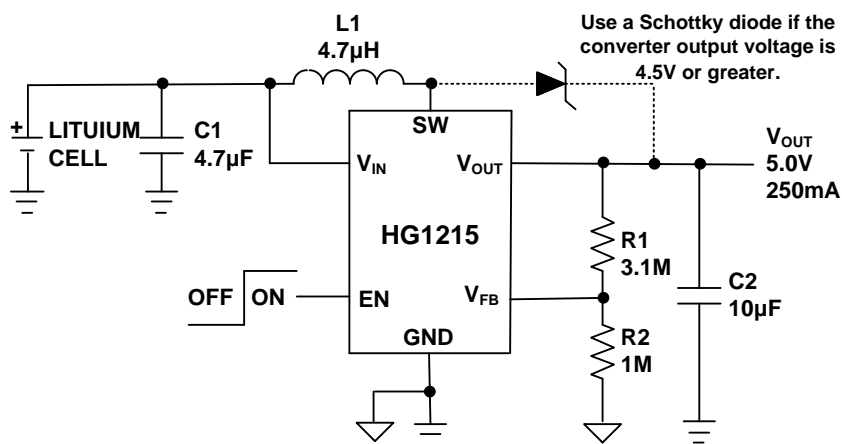
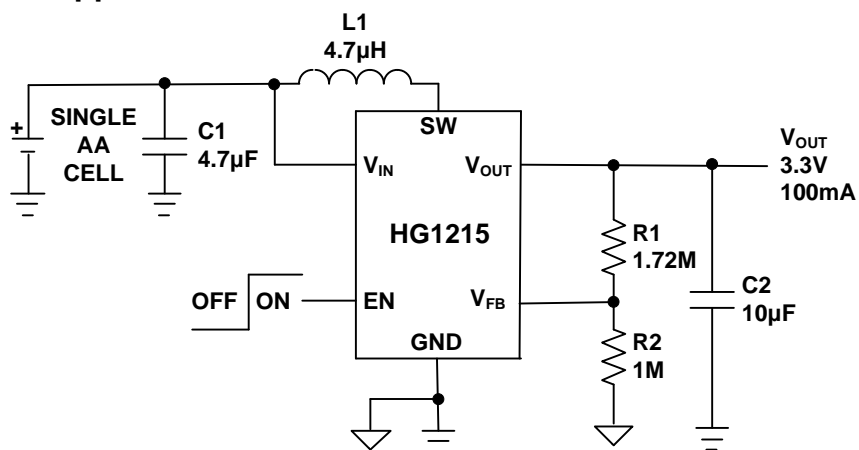
■ ABSOLUTE MAXIMUM RATINGS

($T_a=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNITS
Input Voltage	V_{IN}	-0.3~6	V
SW Voltage		-0.3~6	V
CE, FB Voltage		-0.3~6	V
Output Voltage	V_{OUT}	-0.3~6	V
Output Current Bypass Mode		1000	mA
Power dissipation	PD	Internally Limited	mW
Ambient Temp. with Power Applied	T_{opr}	-40 ~ +85	$^{\circ}\text{C}$
Operating Junction Temperature	T_{stg}	-40 ~ +125	$^{\circ}\text{C}$
Soldering Temperature	T_{solder}	-65 ~ +150	$^{\circ}\text{C}$
ESD rating	Human Body Model -(HBM)	4	KV
	Machine Model- (MM)	400	V

Notice: Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

■ Typical Application



■ ELECTRICAL CHARACTERISTICS

(Unless otherwise indicated, $V_{IN} = 1.5V$, $C_{OUT} = C_{IN} = 10 \mu F$, $L = 4.7 \mu H$, $V_{OUT} = 3.3V$, $I_{OUT} = 0 \text{ mA}$, $T_A = +25^\circ C$. Boldface specifications apply over the T_A range of $-40^\circ C$ to $+85^\circ C$.)

Parameters	Sym	Min	Typ	Max	Units	Conditions
Minimum Start-Up Voltage	V_{IN}	—	0.82	—	V	Note 1
Minimum Input Voltage After Start-Up	V_{IN}	—	0.65	—	V	Note 1
Input Voltage range	V_{IN}	0.82		5.5	V	
Output Voltage Adjust Range	V_{OUT}	1.8		5.5	V	$V_{OUT} \geq V_{IN}$; Note 2
Maximum Output Current	I_{OUT}		200	—	mA	1.2V V_{IN} , 2.0V V_{OUT}
			400	—		2.4V V_{IN} , 3.3V V_{OUT}
			400	—		3.3V V_{IN} , 5.0V V_{OUT}
Feedback Voltage	V_{FB}	1.179	1.215	1.251	V	
Feedback Input Bias Current	I_{VFB}	—	10	—	nA	
V_{OUT} Quiescent Current	I_{QOUT}	—	4.0	8	μA	$I_{OUT} = 0 \text{ mA}$, device is not switching, $EN = V_{IN} = 4.0V$, $V_{OUT} = 5.0V$, does not include feedback divider current; Note 3
V_{IN} Sleep Current	I_{QIN}	—	1.0	2.3	μA	$I_{OUT} = 0 \text{ mA}$, $EN = V_{IN}$; Note 3, Note 5
No Load Input Current	I_{INO}	—	14	25	μA	$I_{OUT} = 0 \text{ mA}$, device is switching
Quiescent Current – Shutdown	I_{QSHDN}	—	0.6	—	μA	$V_{OUT} = EN = GND$; includes N-Channel and P-Channel Switch Leakage

Note :

1. $3.3 \text{ k}\Omega$ resistive load, $3.3V_{OUT}$ (1 mA).
2. For $V_{IN} > V_{OUT}$, V_{OUT} will not remain in regulation.
3. I_{QOUT} is measured at V_{OUT} , V_{OUT} is external supplied for $V_{OUT} > V_{IN}$ (device is not switching), I_{QIN} is measured at V_{IN} pin during Sleep period, no load.
4. 220Ω resistive load, $3.3V_{OUT}$ (15 mA).
5. Determined by characterization, not production tested.

■ ELECTRICAL CHARACTERISTICS (CONTINUED)

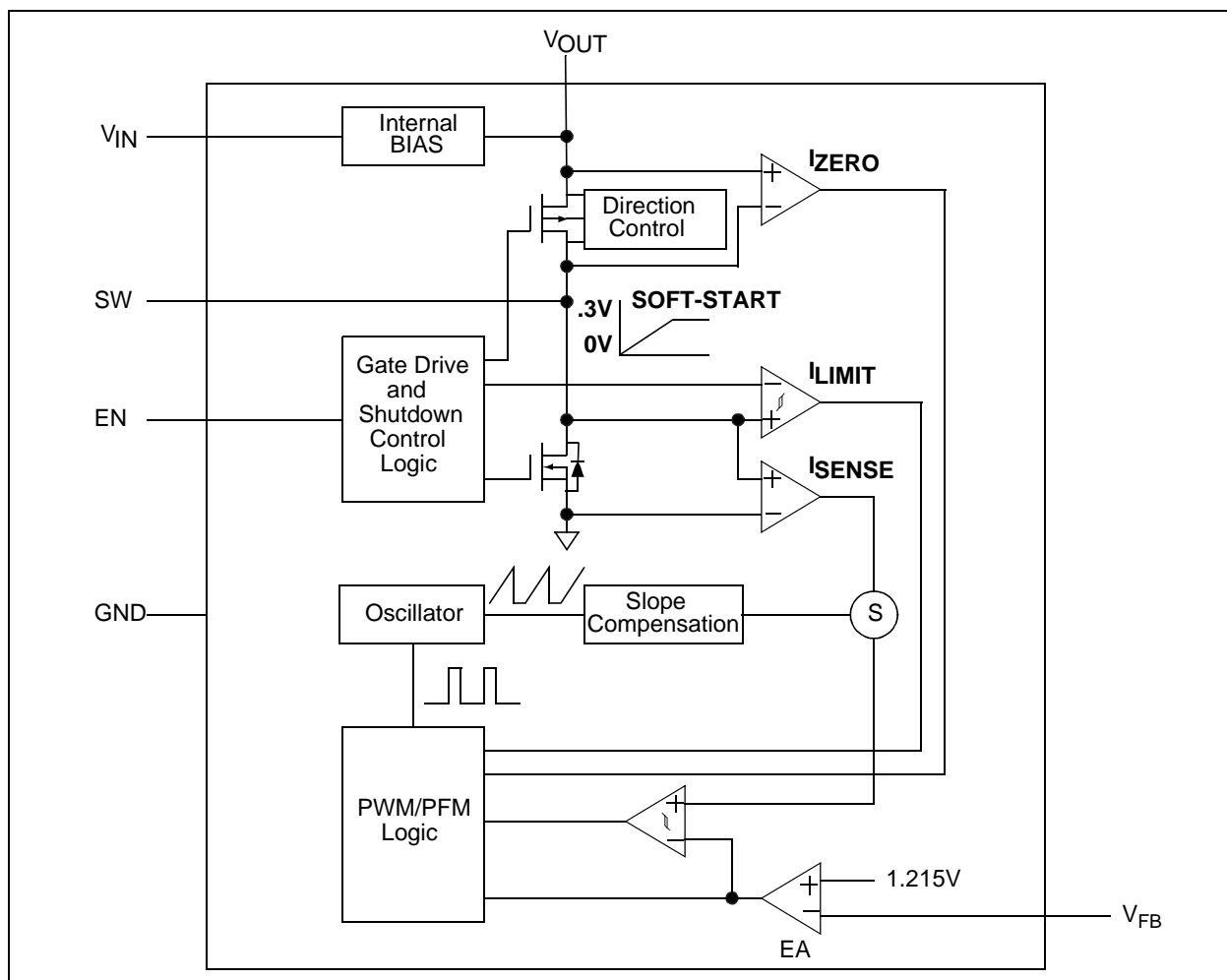
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Parameters	Sym	Min	Typ	Max	Units	Conditions
NMOS Switch Leakage	I_{NLK}	—	0.15	—	μA	$V_{IN} = V_{SW} = 5V$ $V_{OUT} = 5.5V$ $V_{EN} = V_{FB} = GND$
PMOS Switch Leakage	I_{PLK}	—	0.15	—	μA	$V_{IN} = V_{SW} = GND$; $V_{OUT} = 5.5V$
NMOS Switch ON Resistance	$R_{DS(ON)N}$	—	0.25	—	Ω	$V_{IN} = 3.3V$, $I_{SW} = 100 \text{ mA}$
PMOS Switch ON Resistance	$R_{DS(ON)P}$	—	0.5	—	Ω	$V_{IN} = 3.3V$, $I_{SW} = 100 \text{ mA}$
NMOS Peak Switch Current Limit	$I_{N(MAX)}$	—	1	—	A	Note 5
V_{OUT} Accuracy	$V_{OUT\%}$	-3	—	+3	%	Includes Line and Load Regulation; $V_{IN} = 1.5V$
Line Regulation	$ \frac{\Delta V_{OUT}/V_{OUT}}{\Delta V_{IN}} $	-0.4	0.3	0.4	%/V	$V_{IN} = 1.5V$ to $2.8V$ $I_{OUT} = 50 \text{ mA}$
Load Regulation	$ \Delta V_{OUT}/V_{OUT} $	-1.5	0.1	1.5	%	$I_{OUT} = 25 \text{ mA}$ to 100 mA ; $V_{IN} = 1.5V$
Maximum Duty Cycle	DC_{MAX}	87	89	91	%	Note 5
Switching Frequency	f_{SW}		500		KHz	
EN Input Logic High	V_{IH}	70	—	—	%of V_{IN}	$I_{OUT} = 1 \text{ mA}$
EN Input Logic Low	V_{IL}	—	—	20	%of V_{IN}	$I_{OUT} = 1 \text{ mA}$
EN Input Leakage Current	I_{ENLK}	—	5.0	—	nA	$V_{EN} = 5V$
Soft Start Time	t_{SS}	—	1		ms	EN Low to High, 90% of V_{OUT} ; Note 4, Note 5
Thermal Shutdown Die Temperature	T_{SD}	—	160	—	$^\circ C$	$I_{OUT} = 20 \text{ mA}$, $V_{IN} > 1.4V$
Die Temperature Hysteresis	T_{SDHYS}	—	20	—	$^\circ C$	

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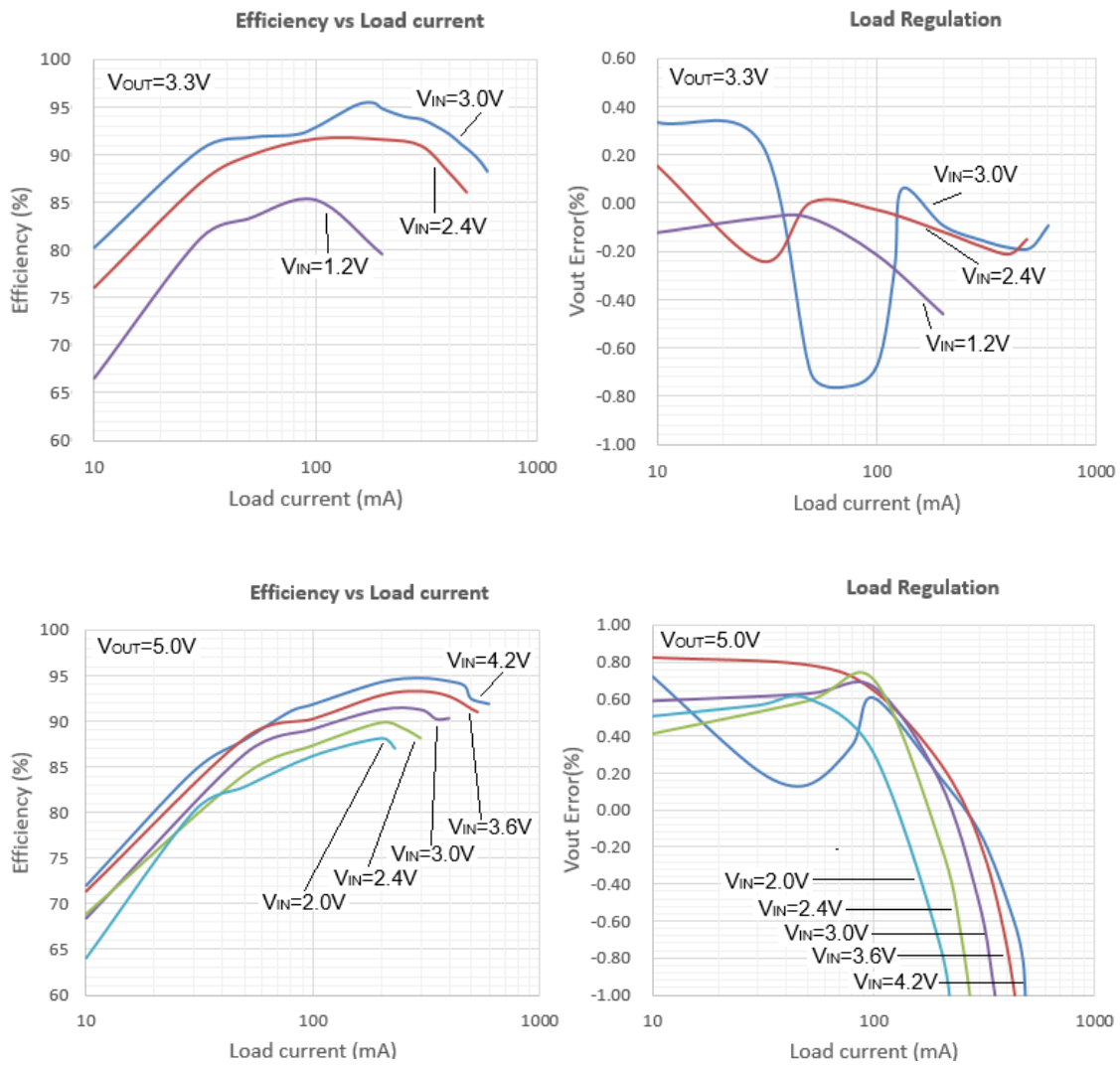
■ Functional Description



HG1215 Block Diagram

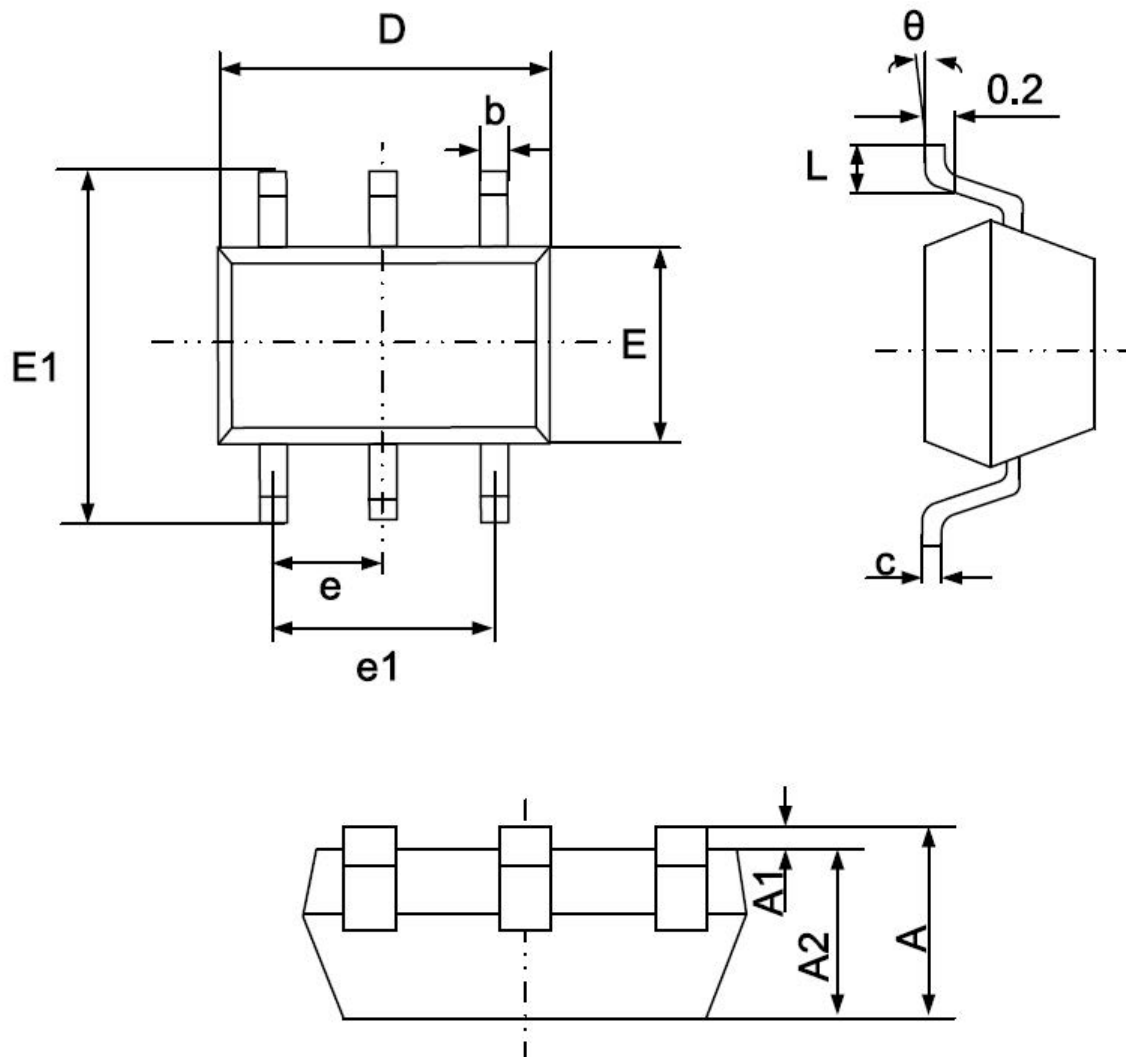
■ TYPICAL PERFORMANCE CHARACTERISTICS

($T_A=25^\circ\text{C}$, unless otherwise specified)



■ PACKAGING INFORMATION

- SOT23-6 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°