General Description

The EA9104 is designed for portable RF and wireless applications with demanding performance and space requirements. The EA9104 performance is optimized for battery-powered systems to deliver ultra low noise and low quiescent current. Regulator ground current increases only slightly in dropout, further prolonging the battery life. The EA9104 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices. The EA9104 consumes less than 0.1uA in shutdown mode and has fast turn-on time less than 50us. The other features include ultra low dropout voltage, high output accuracy, current limiting protection and high ripple rejection ratio. The EA9104 is available in the 5-lead of SOT23-5 package.

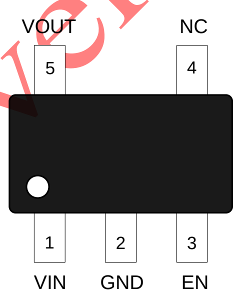
Features

- Ultra-Low-Noise for RF Application
- 2V to 5.5V Input Voltage Range
- Low Dropout: 210mV@300mA
- 300mA Output Current, 550mA Peak Current
- High PSRR: -70dB at 1KHz
- < 0.1uA Standby Current When Shutdown
- TTL-Logic-Controlled Shutdown Input
- Ultra-Fast Response in Line/Load transient
- Current Limiting and Thermal Shutdown Protection
- Quick Start-up (typically 50us)
- Available in SOT-23-5 Package

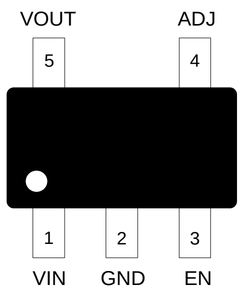
Applications

- Portable Media Players/MP3 players
- Cellular and Smart Mobile Phone
- LCD TVs and Flat TVs
- Wireless System

Pin Configurations



Fixed Output Voltage



Adjustable Output Voltage

Pin Description

Pin Name	Function Description	Pin No. Fixed VOUT	Pin No. Adjustable VOUT
VIN	Power input voltage pin.	1	1
GND	Ground pin.	2	2
EN	Enable pin. There is an internal pull low 1MΩ resistor connected to GND.	3	3
NC	Not Connect.	4	--
ADJ	Adjustable pin.	--	4
VOUT	Output voltage pin.	5	5

Function Block Diagram

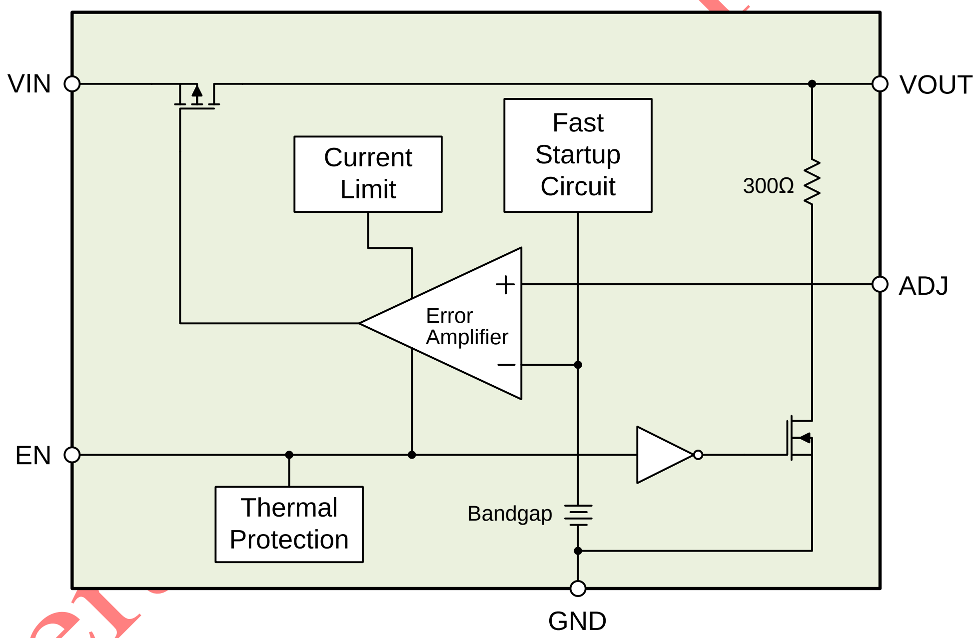


Figure 1. EA9104 internal function block diagram (Adjustable Output Voltage)

Absolute Maximum Ratings

Parameter	Value
Input Supply Voltage (V_{IN})	-0.3V to +6V
Lead Temperature (Soldering, 10 sec)	+260°C
Storage Temperature Range (T_S)	-65°C to +150°C
ESD Susceptibility (HBM)	2kV
ESD Susceptibility (MM)	200V

Note (1):Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to "Absolute Maximum Ratings" conditions for extended periods may affect device reliability and lifetime.

Package Thermal Characteristics

Parameter	Value
SOT-23-5 Thermal Resistance (θ_{JC})	125°C/W
SOT-23-5 Thermal Resistance (θ_{JA})	250°C/W
SOT-23-5 Power Dissipation at T_A=25°C (P_{Dmax})	0.4W

Note (1): P_{Dmax} is calculated according to the formula: $P_{DMAX}=(T_{JMAX}-T_A)/\theta_{JA}$.

Recommended Operating Conditions

Parameter	Value
Ambient Temperature Range (T_A)	-20°C to +85°C
Junction Temperature Range (T_J)	-40°C to +125°C

Electrical Characteristics

V_{IN}= V_{OUT} +1V, C_{IN}= C_{OUT} =1uF, T_A=25°C, unless otherwise noted

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Output Voltage Accuracy	ΔV_{OUT}	I_{OUT} = 1mA	-2		2	%
Output Loading Current	I_{LOAD}	V_{EN} = V_{IN}, V_{IN} >2.5V		300		mA
Current Limit	I_{LIM}	R_{LOAD} = 1Ω	450	550		mA
Adjustable Voltage Reference	V_{FB}		0.784	0.8	0.816	V
Quiescent Current	I_Q	V_{EN} ≥ 1.2V, I_{OUT} = 0mA		100	130	uA
Dropout Voltage	V_{DROP}	I_{OUT} = 200mA, V_{OUT} > 2.8V		140	180	mV
		I_{OUT} = 300mA, V_{OUT} > 2.8V		210	270	mV
Line Regulation	ΔV_{LINE}	V_{IN} = (V_{OUT}+1V) to 5.5V, I_{OUT} = 1mA			0.3	%
Load Regulation	ΔLOAD	1mA < I_{OUT} < 300mA			2	%
Standby Current	I_{STBY}	V_{EN} = GND, Shutdown		0.1	1	uA
EN Input Bias Current	I_{IBSD}	V_{EN} = 3.5V	2	3.5	5	uA
EN Threshold Low Voltage	VIL	VIN = 3V to 5.5V, Shutdown			0.4	V
EN Threshold High Voltage	VIH	VIN = 3V to 5.5V, Start-up	1.2			V
Output Noise Voltage		10Hz to 100kHz, I_{OUT} = 200mA, C_{OUT} = 1uF		100		uVRMS
Power Supply Rejection Rate f = 100Hz	PSRR	C_{OUT} = 1uF, I_{OUT} = 10mA		-76		dB
Power Supply Rejection Rate f = 10kHz				-65		dB
Thermal Shutdown Threshold	T_{SD}			165		°C

Note (1): MOSFET on-resistance specifications are guaranteed by correlation to wafer level measurements.
(2): Thermal shutdown specifications are guaranteed by correlation to the design and characteristics analysis.

Application Circuit Diagram

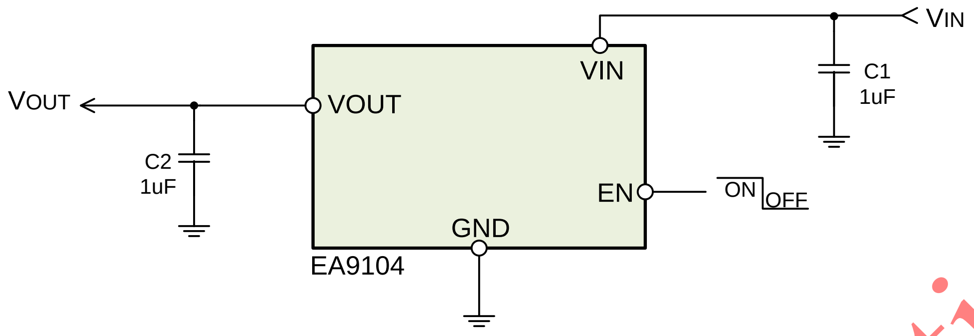


Figure 2. Typical application circuit diagram (Fixed output voltage)

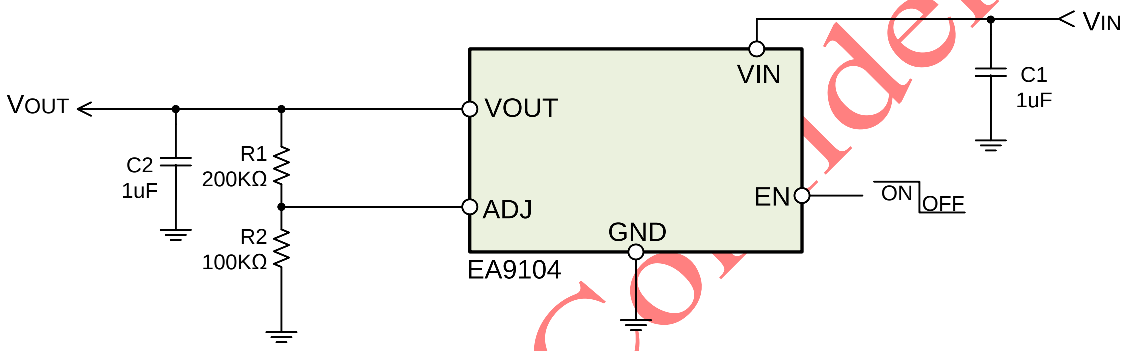


Figure 3. Typical application circuit diagram (Adjustable output voltage)

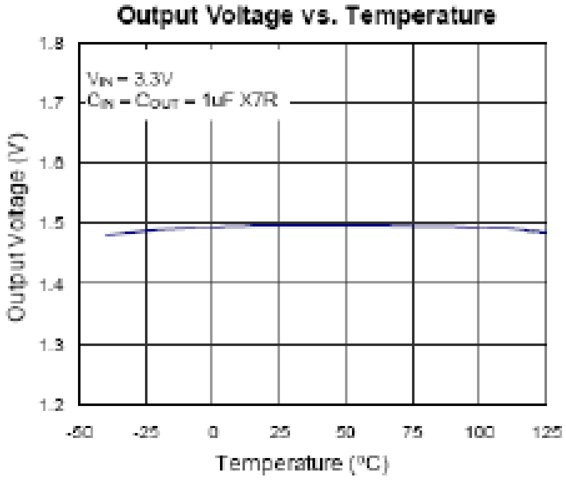
Ordering Information

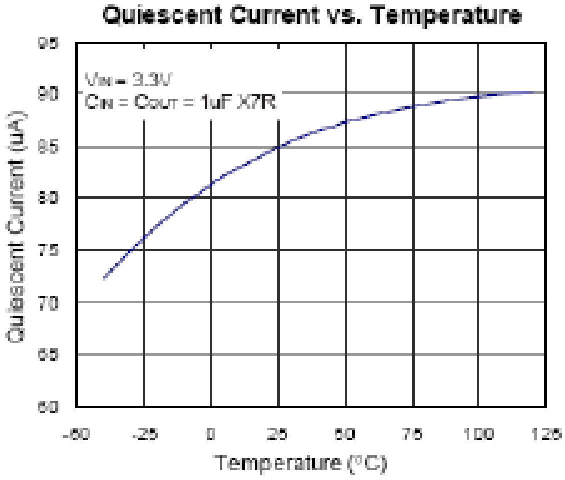
Part Number	Package Type	Packing Information
EA9104VVT5R	SOT-23-5	Tape & Reel / 3000

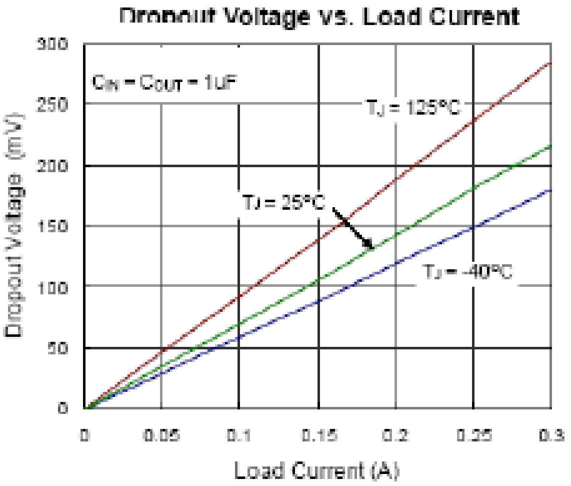
Note (1):"VV": Output voltage version code.
(2):"T5": Package type code.
(3):"R": Tape & Reel.

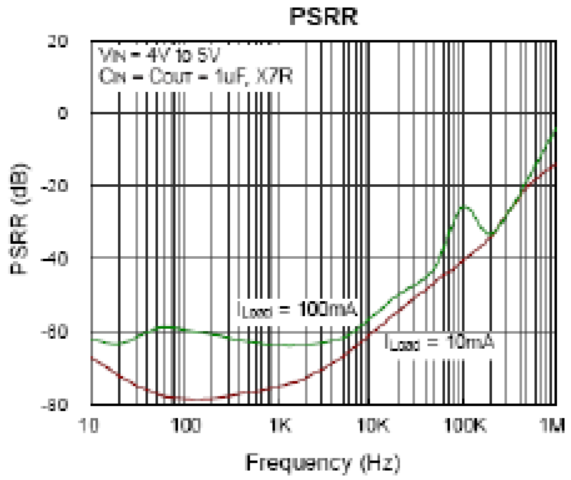
Output Voltage Version Code	Output Voltage
12	1.2V
15	1.5V
18	1.8V
25	2.5V
28	2.8V
30	3.0V
33	3.3V
36	3.6V
AD	Adjustable

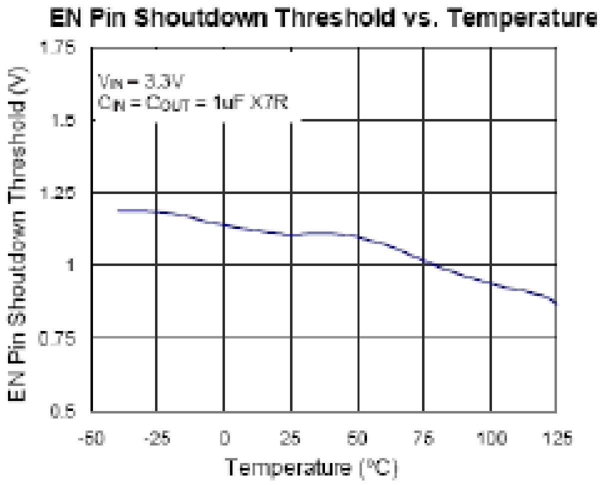
Typical Operating Characteristics

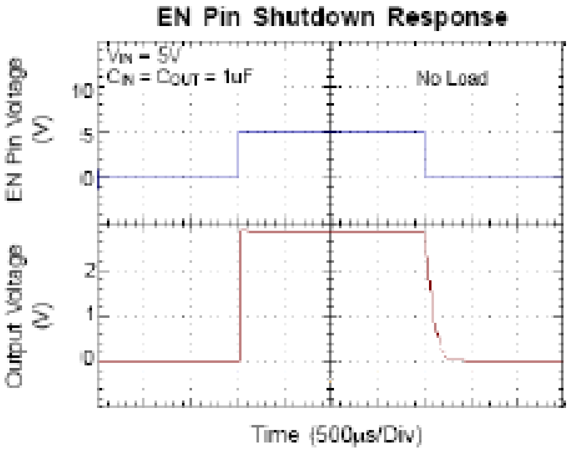






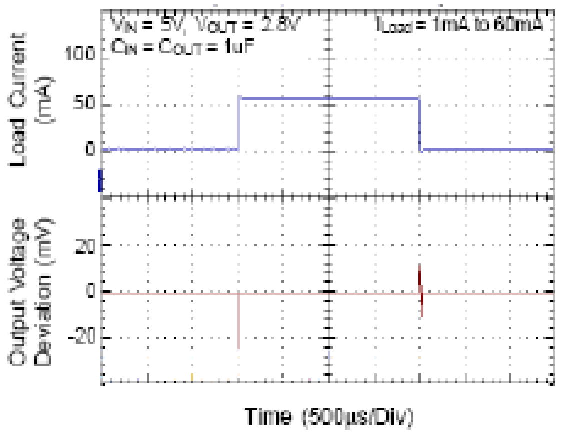




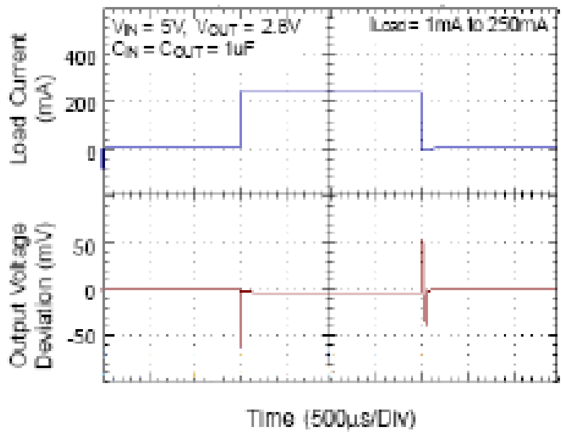


Typical Operating Characteristics

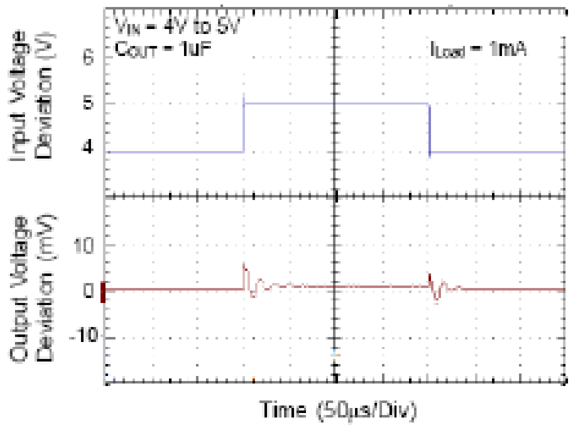
Load Transient Response



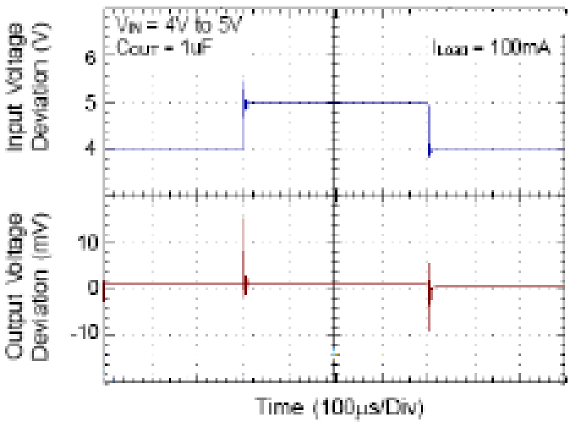
Load Transient Response



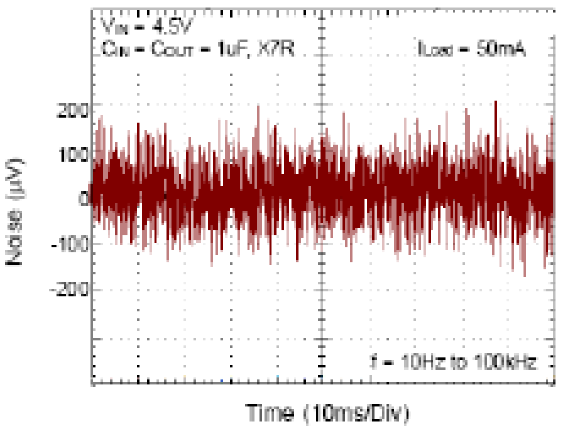
Line Transient Response



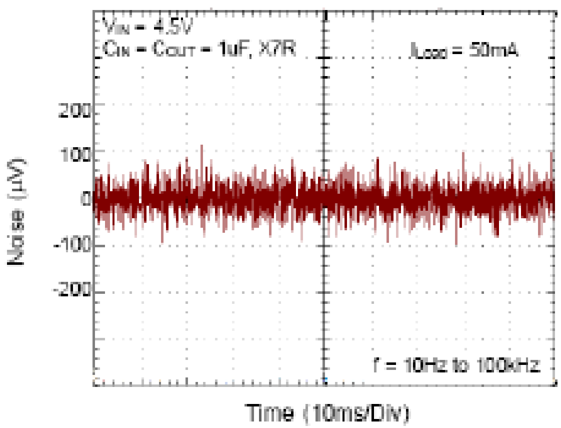
Line Transient Response



Noise



Noise



Application Information

Like any low-dropout regulator, the external capacitors used with the EA9104 must be carefully selected for regulator stability and performance. Using a capacitor whose value is > 1uF on the EA9104 input and the amount of capacitance can be increased without limit. The input capacitor must be located a distance that less than 0.5 inch from the input pin of the device to a clean analog ground. Any good quality ceramic or tantalum can be used for this capacitor. The capacitor with larger value and lower ESR (equivalent series resistance) provides better PSRR and line transient response. The output capacitor must meet both requirements for minimum amount of capacitance and ESR in all LDOs application. The EA9104 is designed specifically to work with low ESR ceramic output capacitor in space-saving and performance consideration. Using a ceramic capacitor whose value is at least 1uF with ESR is > 25mΩ on the EA9104 output ensures stability. The EA9104 still works well with output capacitor of other types due to the wide stable ESR range. Output capacitor of larger capacitance can reduce noise and improve load transient response, stability and PSRR. The EA9104 features an LDO regulator enable/disable function. To assure the LDO regulator will switch on, the EN turn on control level must be greater than 1.2V. The LDO regulator will go into the shutdown mode when the voltage on the EN pin falls below 0.4V. The EA9104 have a quick-discharge function to protecting the system. If the enable function is not needed in a specific application, it may be tied to VIN to keep the LDO regulator in a continuously on state.

Thermal Considerations

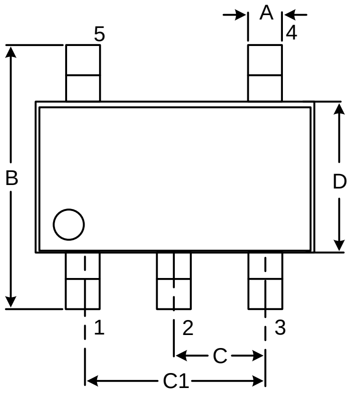
Thermal protection limits power dissipation in EA9104. When the operation junction temperature exceeds 165°C, the OTP circuit starts the thermal shutdown function turn the pass element off. The pass element turn on again after the junction temperature cools by 30°C. For continue operation, do not exceed absolute maximum operation junction temperature 125°C. The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula:

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

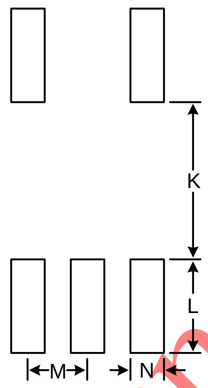
Where $T_{J(MAX)}$ is the maximum operation junction temperature 125°C, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance. For recommended operating conditions specification of EA9104, the $T_{J(MAX)}$ is the maximum junction temperature of the die (125°C) and T_A is the maximum ambient temperature. The junction to ambient thermal resistance θ_{JA} for SOT23-5 package is 250°C/W.

Package Information

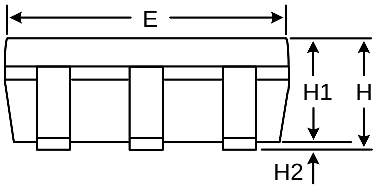
SOT-23-5 Package



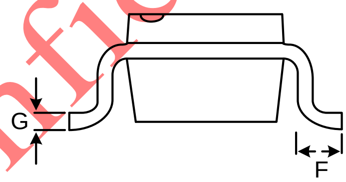
Top View



Recommended Layout Pattern



Side View



Front View

Unit: mm

Symbol	Dimension Min	Dimension Max	Symbol	Dimension Typ
A	0.30	0.52	K	1.40
B	2.59	3.01	L	1.40
C	0.85	1.05	M	0.95
C1	1.70	2.10	N	0.65
D	1.40	1.80		
E	2.70	3.10		
F	0.30	0.61		
G	0.08	0.25		
H	0.89	1.35		
H1	0.89	1.20		
H2	0.00	0.15		