

Revision History

<u>Rev. No.</u>	<u>History</u>	<u>Issue Date</u>
1.0	New issue	Sep. 10, 2012
1.1	Add Current Limit=300mA(Min.) Delete TSOT-23-6 Package Add TDFN-6 and SOT-23-6 Package Modify Ordering information and Marking information Add ESD Rating	May. 06, 2013
1.2	Modify TDFN-6L ,P <sub>D</sub>	Apr. 10, 2014

## 300mA 2CH Low Dropout Voltage Linear Regulators

### General Description

The CS3121 is a low noise and high accuracy, high ripple rejection ratio, low dropout, dual CMOS LDO voltage regulators with enable function. The EN function allows the output of each regulator to be turned off independently, resulting in greatly reduced power consumption.

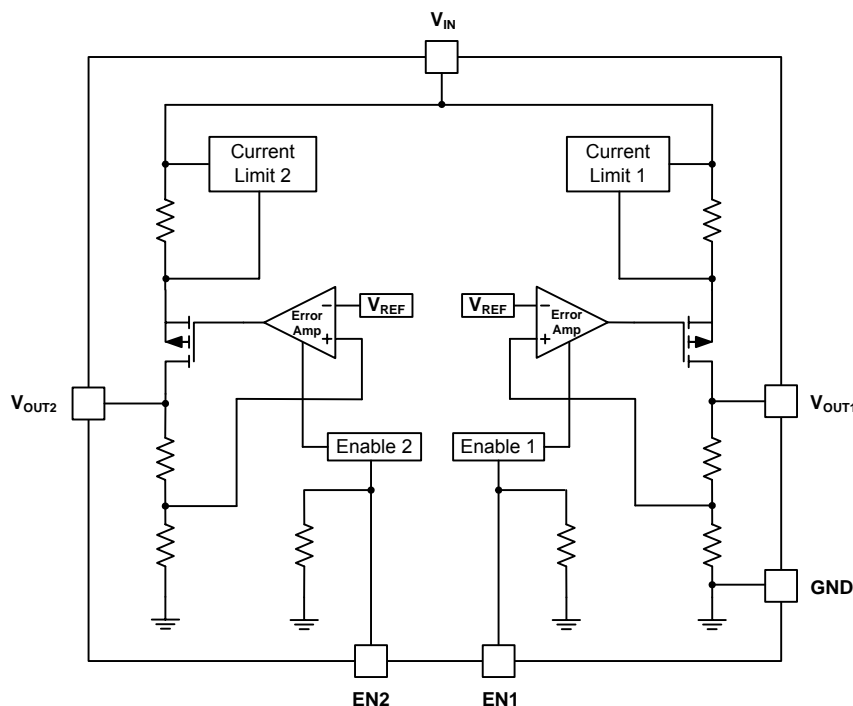
The current limit of CS3121 is over 350mA per channel and also operates as a short protection for the output current limiter. The output voltage for each regulator is set independently by metal trimming.

The CS3121 comes with low design cost and outstanding output stability and its compatibility of working with low ESR ceramic capacitors is undoubted. This high level output stability is maintained even during frequent load fluctuations, due to the excellent transient response performance and high PSRR achieved across a broad range of frequency, so these ICs are suitable for hand-held communication equipment power supply.

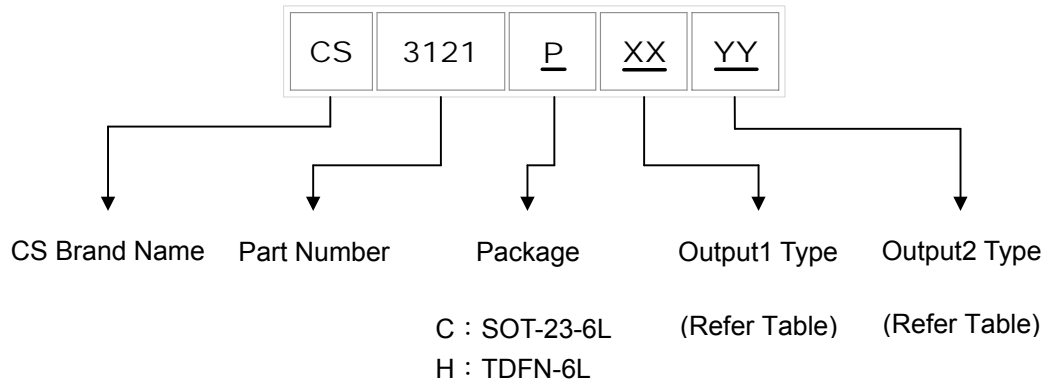
### Features

- ◆ **Input Voltage Range : 2V to 6V**
- ◆ **Varied Fixed Output Voltage Combinations**
- ◆ **250mV Dropout at 150mA Output Current ( $V_{out} \geq 2.1V$ )**
- ◆ **Low Quiescent Current**
- ◆ **Standby Current : 0.01 $\mu$ A (typ)**
- ◆ **Current Limit and Short Current Protections**
- ◆ **Fast Transient Response**
- ◆ **Low ESR Capacitor Compatible (X7R, X5R)**
- ◆ **Available in the 6-Pin Pb-Free SOT-23-6L and TDFN1.6x1.6-6L Packages**

### Functional Block Diagram

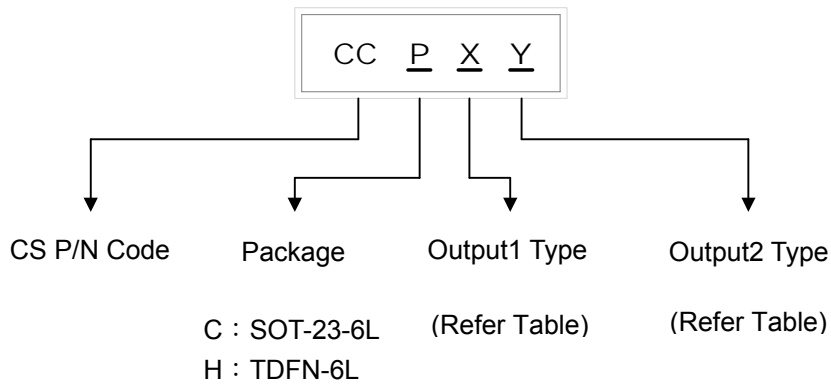


[Ordering Information](#)



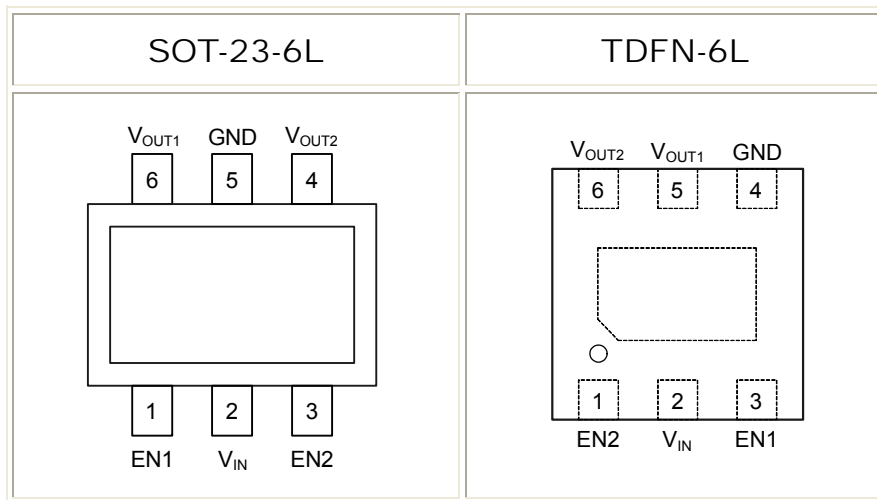
Output Type Code		
12: 1.2V	25: 2.5V	33: 3.3V
15: 1.5V	28: 2.8V	
18: 1.8V	30: 3.0V	

[Marking Information](#)



Output Type Code		
A: 1.2V	D: 2.5V	G: 3.3V
B: 1.5V	E: 2.8V	
C: 1.8V	F: 3.0V	

## Pin Configuration



## Absolute Maximum Rating (Note 1)

- Power Input Voltage ( $V_{IN}$ ): \_\_\_\_\_ 【GND -0.3~6V】
- Enable Voltage ( $V_{EN1} / V_{EN2}$ ): \_\_\_\_\_ 【GND -0.3~ $V_{IN}$ 】
- Storage Temperature Range ( $T_{STG}$ ): \_\_\_\_\_ 【-40°C to +150°C】
- ESD Rating:(Note 2)
  - HBM (Human Body Mode) : \_\_\_\_\_ 【2KV】
  - MM (Machine Mode) : \_\_\_\_\_ 【200V】

## Thermal Information(Note 3)

- Thermal Resistance
  - Junction to Ambient ( $\theta_{JA}$ ):
    - SOT-23-6L : \_\_\_\_\_ 【330°CW】
    - TDFN-6L : \_\_\_\_\_ 【175°CW】
  - Junction to Case ( $\theta_{JC}$ ):
    - SOT-23-6L : \_\_\_\_\_ 【100°CW】
    - TDFN-6L : \_\_\_\_\_ 【65°CW】
- Power Dissipation,  $P_D$  @  $T_A = 25^\circ\text{C}$ (Note 4)
  - SOT-23-6L : \_\_\_\_\_ 【300mW】
  - TDFN-6L : \_\_\_\_\_ 【570mW】

## Recommended Operation Conditions (Note 5)

- Operating Junction Temperature Range ( $T_J$ ): \_\_\_\_\_ **[-40°C to +125°C]**
- Operating Ambient Temperature Range ( $T_{OPA}$ ): \_\_\_\_\_ **[-40°C to +85°C]**

Note 1: Stresses listed as the above “Absolute Maximum Ratings” may cause permanent damage to the device.

These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

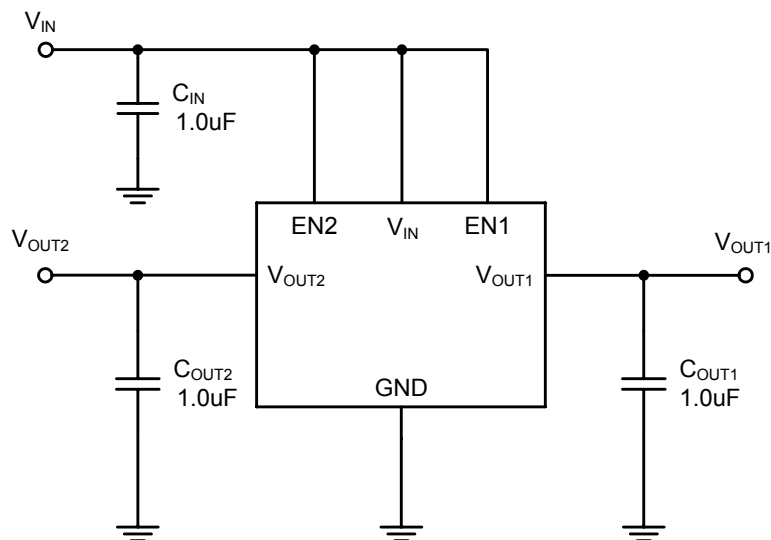
Note 2: Devices are ESD sensitive. Handling precaution recommended.

Note 3: Thermal Resistance is specified with approximately 1 square of 1 oz copper.

Note 4: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at  $T_A=25^\circ\text{C}$ .

Note 5: The device is not guaranteed to function outside its operating conditions.

## Typical Applications



 **Application Information**

The CS3121 requires input and output decoupling capacitors. The device is specifically designed for portable applications requiring minimum board space and smallest components. These capacitors must be correctly selected for good performance. Please note that linear regulators with a low dropout voltage have high internal loop gains which require care in guarding against oscillation caused by insufficient decoupling capacitance.

**Input Capacitor**

An input capacitance of 1 $\mu$ F is required space between input pin and ground pin directly (the amount of the capacitance may be increased without limit). The input capacitor must be located less than 1cm from the device to assure input stability. A lower ESR capacitor allows the use of less capacitance, while higher ESR type (like aluminum electrolytic) requires more capacitance. Capacitor types (aluminum, ceramic and tantalum) can be mixed in parallel, but the total equivalent input capacitance ESR must be defined as above to stable operation. There are no requirements for the ESR on the input capacitor, but tolerance and temperature coefficient must be considered when selecting the capacitor to ensure the capacitance will be 1 $\mu$ F over the entire operating temperature range.

**Output Capacitor**

The CS3121 is designed specifically to work with very small ceramic output capacitors. A ceramic capacitor (temperature characteristics X7R, X5R) in 1 $\mu$ F is suitable for the CS3121 application. The recommended minimum capacitance for the device is 1 $\mu$ F (X5R or X7R dielectric ceramic), between  $V_{OUT}$  and GND for stability, but it may be increased without limit. Higher capacitance values help to improve transient. The output capacitor's ESR is critical because it forms a zero to provide phase lead which is required for loop stability.

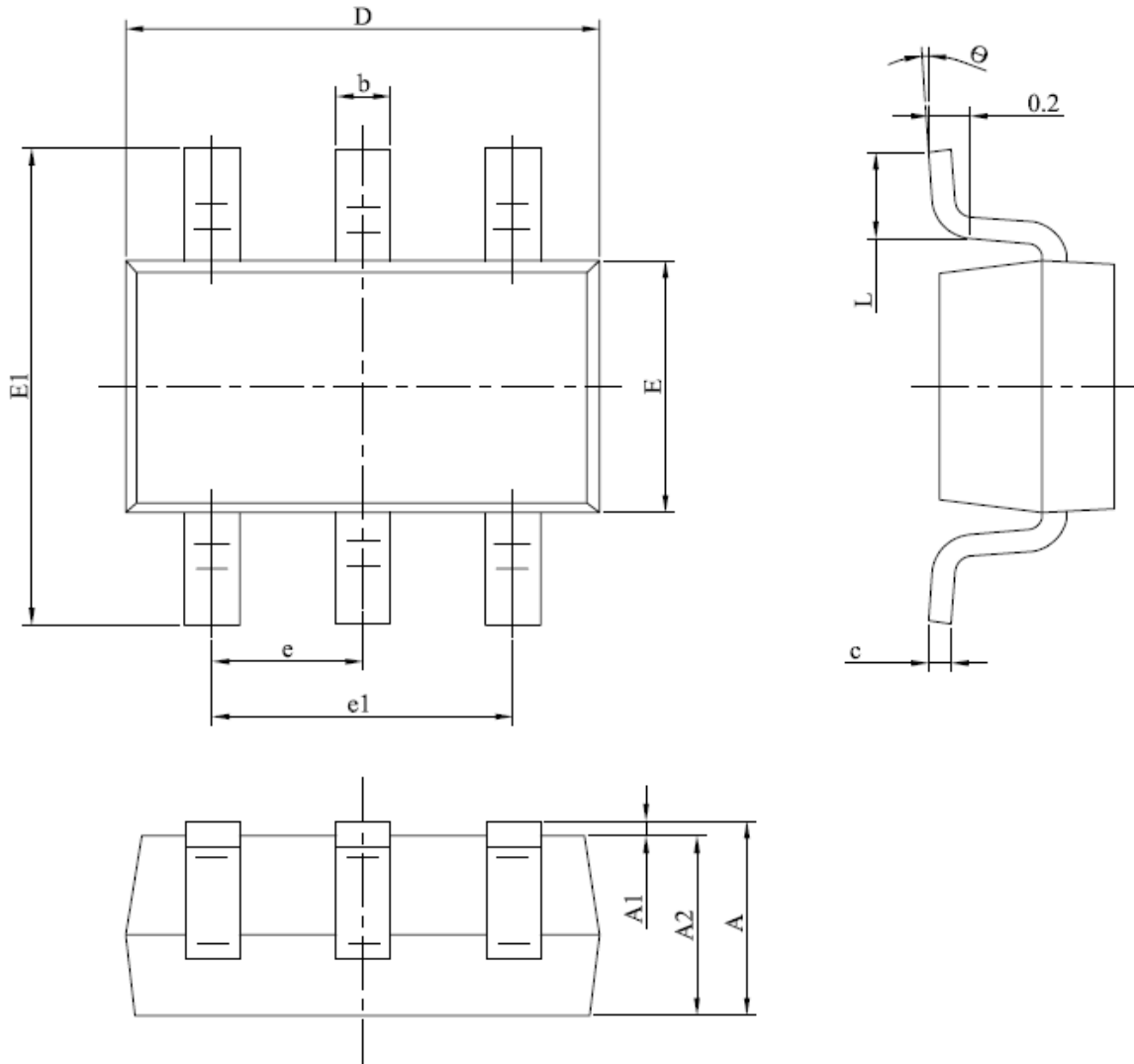
**Thermal Considerations**

The CS3121 series can provide a current of up to 300mA/channel over the full operating junction temperature range. However, the maximum output current must be debated at higher ambient temperature to ensure the junction temperature does not exceed 125°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN}$	Input Voltage		2.0		6.0	V
$V_{OUT}$	Output Voltage	$I_{OUT}=1\text{mA}$ , $V_{IN}=5\text{V}$ $V_{OUT} > 2.0\text{V}$	-2		2	%
		$I_{OUT}=1\text{mA}$ , $V_{IN}=5\text{V}$ $V_{OUT} \leq 2.0\text{V}$	-0.04		0.04	V
$I_{SS}$	Supply Current	$I_{OUT1,2}=0\text{mA}$ , $V_{IN}=5\text{V}$		50		$\mu\text{A}$
$V_{DROP}$	Dropout Voltage(Note 6)	$V_{OUT} < 1.5\text{V}$ , $I_{OUT}=150\text{mA}$			1.00	V
		$1.5\text{V} \leq V_{OUT} \leq 2.0\text{V}$ , $I_{OUT}=150\text{mA}$		0.45	0.7	
		$2.1\text{V} \leq V_{OUT} \leq 4.8\text{V}$ , $I_{OUT}=150\text{mA}$		0.25	0.50	
$\Delta V_{LINE}$	Line Regulation	$I_{OUT}=1\text{mA}$ , $V_{IN}=V_{OUT}+1\text{V}$ to $6.0\text{V}$		0.2	0.3	%/V
$\Delta V_{LOAD}$	Load Regulation	$I_{OUT}=1 \sim 150\text{mA}$ , $V_{IN}=V_{OUT}+1\text{V}$		0.01	0.03	%/mA
PSRR	Ripple Rejection	$f=10\text{KHz}$ Ripple= $0.3V_{P-P}$ $V_{OUT} > 1.7\text{V}$ , $V_{IN} - V_{OUT}=1.0\text{V}$ $V_{OUT} \leq 1.7\text{V}$ , $V_{IN} - V_{OUT}=1.2\text{V}$ $I_{OUT}=10\text{mA}$		65		dB
$\Delta V_{OUT} / \Delta T$	Output Voltage Temperature Coefficient	$I_{OUT}=1\text{mA}$ , $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$		$\pm 100$		ppm/ $^{\circ}\text{C}$
$I_{LIMIT}$	Current Limit	$V_{IN} - V_{OUT}=1.0\text{V}$ , $V_{EN}=V_{IN}$	300			mA
$R_{PD}$	EN Pull-Down Resistance		0.7	2.0	8.0	M $\Omega$
$V_{EN(HI)}$	Enable Input Threshold		1.2		$V_{IN}$	V
$V_{EN(LO)}$					0.4	V
$I_{EN(HI)}$	EN Pin Current	$V_{EN1,2}=V_{IN}$		0.01	1	$\mu\text{A}$
$I_{STANDBY}$	Standby Current	$I_{OUT1,2}=0\text{mA}$ , $V_{IN}=5\text{V}$ , $EN_{1,2}=0\text{V}$		0.01	1	$\mu\text{A}$
eN	Output Noise Voltage	BW=10Hz to 100KHz, $C_O=1\mu\text{F}$		100		$\mu\text{Vrms}$
$R_{LOW}$	On Resistance for Auto Discharge	$V_{EN}=0\text{V}$		60		$\Omega$

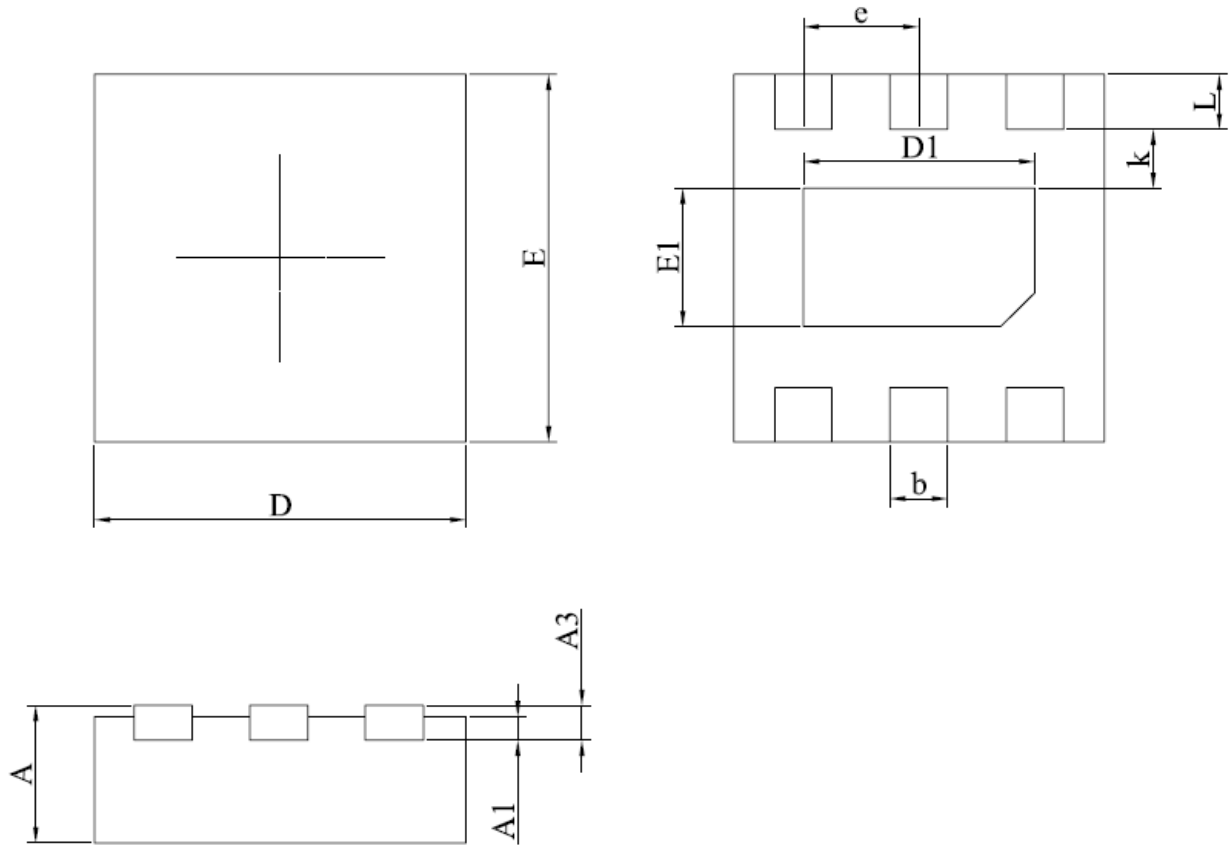
Note 6: Dropout voltage is tested by reducing input voltage until the output drops 2% below its nominal value.

## SOT-23-6L



SYMBOL		A	A1	A2	b	c	D	E	E1	e	e1	L	$\theta$	
UNIT														
mm	Min.	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950 (BSC)	1.800	0.300	0°	
	Nom.	-	-	-	-	-	-	-	-		-	-	-	-
	Max.	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950		2.000	0.600	8°	
inch	Min.	0.041	0.000	0.041	0.012	0.004	0.111	0.059	0.104	0.037 (BSC)	0.071	0.012	0°	
	Nom.	-	-	-	-	-	-	-	-		-	-	-	-
	Max.	0.049	0.004	0.045	0.020	0.008	0.119	0.067	0.116		0.079	0.024	8°	



**TDFN-1.6X1.6X0.5-6L**


SYMBOL		A	A1	A3	D	E	E1	D1	k	b	e	L
UNIT												
mm	Min.	0.450	0.000	0.152 REF.	1.550	1.550	0.550	0.950	0.200 REF.	0.200	0.500 (BSC)	0.164
	Nom.	-	-		-	-	-	-		-		
	Max.	0.550	0.050		1.650	1.650	0.650	1.050		0.300		0.316
inch	Min.	0.018	0.000	0.006 REF.	0.061	0.061	0.022	0.037	0.008 REF.	0.008	0.020 (BSC)	0.006
	Nom.	-	-		-	-	-	-		-		
	Max.	0.022	0.002		0.065	0.065	0.026	0.041		0.012		0.012