



Pages 1 to 15

## **TRANSISTORS, HIGH VOLTAGE, NPN**

**BASED ON TYPE 2N5551**

**ESCC Detail Specification No. 5201/019**

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DCR No.	CHANGE DESCRIPTION
187, 303	Specification up issued to incorporate editorial and technical changes per DCR.

**TABLE OF CONTENTS**

<b><u>1.</u></b>	<b><u>GENERAL</u></b>	<b><u>5</u></b>
1.1	Scope	5
1.2	Applicable Documents	5
1.3	Terms, Definitions, Abbreviations, Symbols and Units	5
1.4	The ESCC Component Number and Component Type Variants	5
1.4.1	The ESCC Component Number	5
1.4.2	Component Type Variants	5
1.5	Maximum Ratings	6
1.6	Physical Dimensions and Terminal Identification	7
1.6.1	Metal Can Package (TO-18) - 3 lead	7
1.6.2	Chip Carrier Package (CCP) - 3 terminal	8
1.6.3	Metal Can Package (TO-39) - 3 lead	9
1.7	Functional Diagram	10
1.8	Materials and Finishes	10
<b><u>2.</u></b>	<b><u>REQUIREMENTS</u></b>	<b><u>10</u></b>
2.1	General	10
2.1.1	Deviations from the Generic Specification	10
2.2	Marking	11
2.3	Terminal Strength	11
2.4	Electrical Measurements at Room, High and Low Temperatures	11
2.4.1	Room Temperature Electrical Measurements	11
2.4.2	High and Low Temperatures Electrical Measurements	13
2.5	Parameter Drift Values	13
2.6	Intermediate and End-Point Electrical Measurements	14
2.7	Power Burn-in Conditions	14
2.8	Operating Life Conditions	14
	APPENDIX 'A'	15

**1. GENERAL**

**1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

**1.2 APPLICABLE DOCUMENTS**

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. 5000
- (b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices

**1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS**

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

**1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS**

**1.4.1 The ESCC Component Number**

The ESCC Component Number shall be constituted as follows:

Example: 520101901

- Detail Specification Reference: 5201019
- Component Type Variant Number: 01 (as required)

**1.4.2 Component Type Variants**

The component type variants applicable to this specification are as follows:

Variant Number	Based on Type	Case	Lead/Terminal Material and/or Finish	Weight max g
01	2N5551	TO-18	D2	0.4
02	2N5551	TO-18	D3 or D4	0.4
04	2N5551	CCP	2	0.06
05	2N5551	CCP	4	0.06
06	2N5551	TO-39	D2	1.5
07	2N5551	TO-39	D3 or D4	1.5

The lead/terminal material and/or finish shall be in accordance with the requirements of ESCC Basic Specification No. 23500.

1.5 **MAXIMUM RATINGS**

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

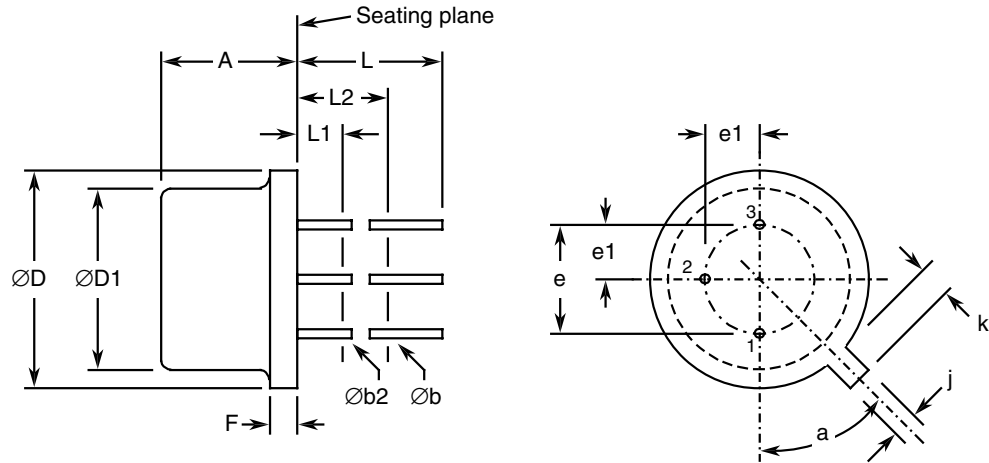
Characteristics	Symbols	Maximum Ratings	Unit	Remarks
Collector-Base Voltage	$V_{CBO}$	180	V	Over entire operating temperature range
Collector-Emitter Voltage	$V_{CEO}$	160	V	
Emitter-Base Voltage	$V_{EBO}$	6	V	
Collector Current For TO-18 and TO-39 For CCP	$I_C$	600 500	mA	Continuous
Power Dissipation For TO-18, TO-39 and CCP For CCP For TO-18 and TO-39	$P_{tot1}$	0.36	W	At $T_{amb} \leq +25^{\circ}C$ Note 1
	$P_{tot2}$	0.58 (Note 2)	W	
	$P_{tot3}$	1.2	W	At $T_{case} \leq +25^{\circ}C$ Note 1
Operating Temperature Range	$T_{op}$	-65 to +200	$^{\circ}C$	Note 3
Storage Temperature Range	$T_{stg}$	-65 to +200	$^{\circ}C$	Note 3
Soldering Temperature For TO-18 and TO-39 For CCP	$T_{sol}$	+260	$^{\circ}C$	Note 4
		+245		Note 5

**NOTES:**

- For  $T_{amb}$  or  $T_{case} > +25^{\circ}C$ , derate linearly to 0W at +200 $^{\circ}C$ .
- When mounted on an 8 x 10 x 0.6mm ceramic substrate.
- For Variants with tin-lead plating or hot solder dip lead finish all testing performed at  $T_{amb} > +125^{\circ}C$  shall be carried out in a 100% inert atmosphere.
- Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same lead shall not be resoldered until 3 minutes have elapsed.
- Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed.

1.6 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

1.6.1 Metal Can Package (TO-18) - 3 lead



Symbols	Dimensions mm		Notes
	Min	Max	
A	4.32	5.33	
Øb	0.406	0.533	2, 3
Øb2	0.406	0.483	2, 3
ØD	5.31	5.84	
ØD1	4.52	4.95	
e	2.54 BSC		4
e1	1.27 BSC		4
F	-	0.762	
j	0.914	1.17	
k	0.711	1.22	5
L	12.7	-	2
L1	-	1.27	3
L2	6.35	-	3
a	45° BSC		1, 4, 6

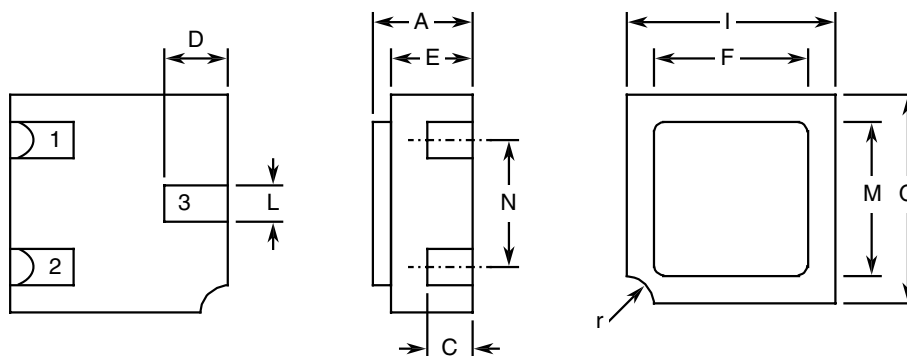
**NOTES:**

- Terminal identification is specified by reference to the tab position where lead 1 = emitter, lead 2 = base, lead 3 = collector.
- Applies to all leads.
- Øb2 applies between L1 and L2. Øb applies between L2 and 12.7mm from the seating plane. Diameter is uncontrolled within L1 and beyond 12.7mm from the seating plane.
- Leads having maximum diameter 0.483mm measured in the gauging plane 1.37(+0.025,-0)mm

below the seating plane of the device shall be within 0.178mm of their true position relative to a maximum-width-tab.

5. Measured from the maximum diameter of the actual device.
6. Tab centreline.

1.6.2 Chip Carrier Package (CCP) - 3 terminal



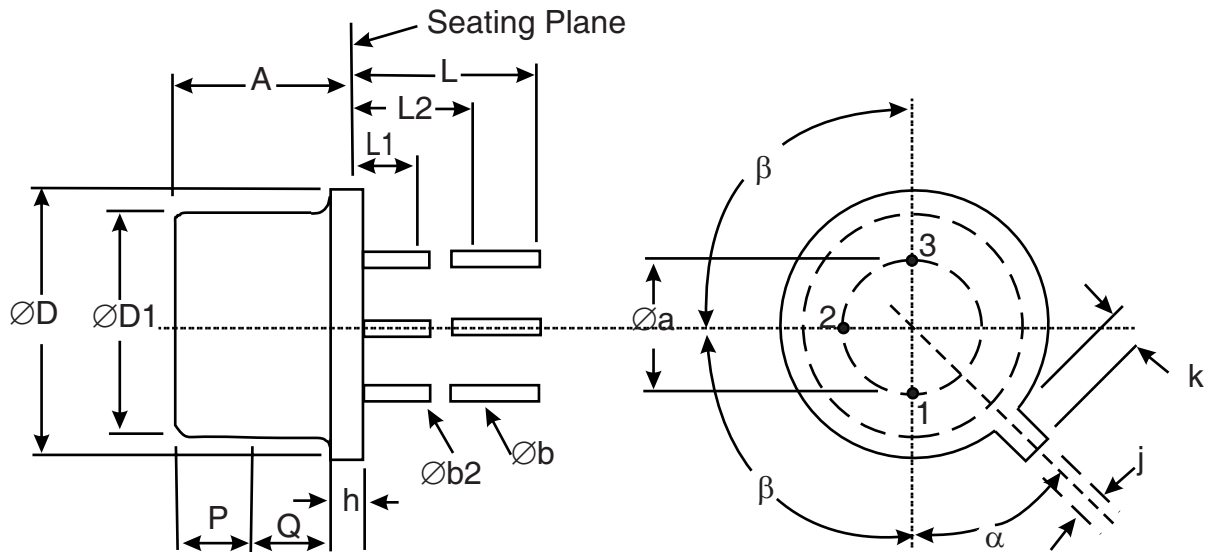
Symbols	Dimensions mm		Notes
	Min	Max	
A	1.15	1.5	
C	0.45	0.56	2
D	0.6	0.91	2
E	0.91	1.12	
F	1.9	2.15	
G	2.9	3.25	
I	2.4	2.85	
L	0.4	0.6	2
M	2.4	2.65	
N	1.8	2	
r	0.3 TYPICAL		1

**NOTES:**

1. Terminal identification is specified by reference to the corner notch position where terminal 1 = emitter, terminal 2 = base, terminal 3 = collector.
2. Applies to all terminals.



1.6.3 Metal Can Package (TO-39) - 3 lead



Symbols	Dimensions mm		Notes
	Min	Max	
$\varnothing a$	4.83	5.35	
A	6	6.6	
$\varnothing b$	0.4	0.533	2, 3
$\varnothing b2$	0.4	0.483	2, 3
$\varnothing D$	8.31	9.4	
$\varnothing D1$	7.75	8.51	
h	0.229	3.18	
j	0.71	0.864	
k	0.737	1.14	4
L	12.7	19	2
L1	-	1.27	2, 3
L2	6.35	-	2, 3
P	2.54	-	5
Q	-	-	6
$\alpha$	45° BSC		1, 7
$\beta$	90° BSC		1

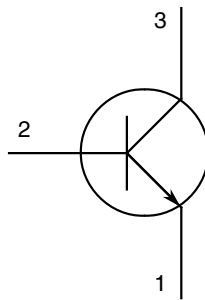
**NOTES:**

- Terminal identification is specified by reference to the tab position where Lead 1 = emitter, Lead 2 = base and Lead 3 = collector.
- Applies to all leads.
- $\varnothing b2$  applies between L1 and L2.  $\varnothing b$  applies between L1 and 12.7mm from the seating plane. Diameter is uncontrolled within L1 and beyond 12.7mm from the seating plane.
- Measured from the maximum diameter of the actual device.
- This zone is controlled for automatic handling. The variation in actual diameter within this zone shall

not exceed 0.254mm.

6. The details of outline in this zone are optional.
7. Measured from the Tab Centreline.

## 1.7 FUNCTIONAL DIAGRAM



1. Emitter.
2. Base.
3. Collector.

### **NOTES:**

1. For TO-18 and TO-39, the collector is internally connected to the case.
2. For CCP, the lid is not connected to any terminal.

## 1.8 MATERIALS AND FINISHES

Materials and finishes shall be as follows:

### a) Case

For metal can packages, the case shall be hermetically sealed and have a metal body with hard glass seals.

For the chip carrier package the case shall be hermetically sealed and have a ceramic body with a Kovar lid.

### b) Leads/Terminals

As specified in Component Type Variants.

## 2. REQUIREMENTS

### 2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

#### 2.1.1 Deviations from the Generic Specification

- (a) Deviation from Screening Tests - Chart F3

High Temperature Reverse Bias Burn-in and the subsequent Final Measurements for HTRB shall be omitted.

## 2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

- (a) The ESCC qualified components symbol (for ESCC qualified components only).
- (b) The ESCC Component Number.
- (c) Traceability information.

## 2.3 TERMINAL STRENGTH

The test conditions for terminal strength, tested as specified in the ESCC Generic Specification, shall be as follows:

For TO-18 and TO-39, Test Condition: E, lead fatigue.

## 2.4 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures.

### 2.4.1 Room Temperature Electrical Measurements

The measurements shall be performed at  $T_{amb}=+22 \pm 3^{\circ}\text{C}$ .

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	3001	$I_C = 100\mu A$ , Bias condition D	180	-	V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	3011	$I_C = 1mA$ , Bias condition D	160	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	3026	$I_E = 10\mu A$ , Bias condition D	6	-	V
Collector-Base Cut-off Current	$I_{CBO}$	3036	$V_{CB} = 120V$ , Bias condition D	-	50	nA
Emitter-Base Cut-off Current	$I_{EBO}$	3061	$V_{EB} = 4V$ , Bias condition D	-	50	nA
Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$	3071	$I_C=10mA$ $I_B=1mA$ Note 1	-	150	mV
	$V_{CE(sat)2}$		$I_C=50mA$ $I_B=5mA$ Note 1	-	200	mV
Base-Emitter Saturation Voltage	$V_{BE(sat)1}$	3066	$I_C=10mA$ $I_B=1mA$ Test condition A Note 1	-	1	V
	$V_{BE(sat)2}$		$I_C=50mA$ $I_B=5mA$ Test condition A Note 1	-	1	V
Forward-Current Transfer Ratio	$h_{FE1}$	3076	$V_{CE}=5V ; I_C = 1mA$	80	-	-
	$h_{FE2}$		$V_{CE}=5V ; I_C = 10mA$ Note 1	80	250	-
	$h_{FE3}$		$V_{CE}=5V ; I_C = 50mA$ Note 1	30	-	-
Small-Signal Short-Circuit Forward-Current Transfer Ratio	$h_{fe1}$	3206	$V_{CE}=10V$ , $I_{CE}=1mA$ $f=1kHz$ Note 2	50	200	-
High Frequency Small-Signal Short-Circuit Forward-Current Transfer Ratio	$h_{fe2}$	3306	$V_{CE}=10V$ , $I_C=10mA$ $f>100MHz$ Note 2	1	-	-

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units
				Min	Max	
Emitter-Base Capacitance	$C_{ebo}$	3240	$V_{EB}=500mV$ , $I_C=0A$ $f=1MHz$ Note 2	-	20	pF
Output Capacitance	$C_{obo}$	3236	$V_{CB}=10V$ $I_E=0A$ $f=1MHz$ Note 2	-	6	pF

**NOTES:**

1. Pulse measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$
2. For AC characteristics read and record measurements shall be performed on a sample of 32 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.4.2 High and Low Temperatures Electrical Measurements

Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions Note 2	Limits		Units
				Min	Max	
Collector-Base Cut-off Current	$I_{CBO}$	3036	$T_{amb}=+150(+0-5)^{\circ}C$ $V_{CB}=120V$ , Bias condition D	-	50	$\mu A$
Forward-Current Transfer Ratio 2	$h_{FE2}$	3076	$T_{amb}=-55(+5-0)^{\circ}C$ $V_{CE}=5V$ $I_C=10mA$ Note 1	20	-	-

**NOTES:**

1. Pulse measurement: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
2. Read and record measurements shall be performed on a sample of 5 components with 0 failures allowed. Alternatively a 100% inspection may be performed.

2.5 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at  $T_{amb}=+22 \pm 3^{\circ}C$ .

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values ( $\Delta$ ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits			Units
		Drift Value $\Delta$	Absolute		
			Min	Max	
Collector-Base Cut-off Current	$I_{CBO}$	$\pm 5$ or (1) $\pm 100\%$	-	50	nA
Collector-Emitter Saturation Voltage 2	$V_{CE(sat)2}$	$\pm 30$ or (1) $\pm 15\%$	-	200	mV
Forward-Current Transfer Ratio 2	$h_{FE2}$	$\pm 15\%$	80	250	-

**NOTES:**

1. Whichever is the greater referred to the initial value.

2.6

**INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS**

Unless otherwise specified, the measurements shall be performed at  $T_{amb} = +22 \pm 3^\circ C$ .

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The limit values for each characteristic shall not be exceeded.

Characteristics	Symbols	Limits		Units
		Min	Max	
Collector-Base Cut-off Current	$I_{CBO}$	-	50	nA
Collector-Emitter Saturation Voltage 2	$V_{CE(sat)2}$	-	200	mV
Forward-Current Transfer Ratio 2	$h_{FE4}$	80	250	-

2.7

**POWER BURN-IN CONDITIONS**

Characteristics	Symbols	Test Conditions	Units
Ambient Temperature	$T_{amb}$	+25 to +50	$^\circ C$
Power Dissipation	$P_{tot}$	As per Maximum Ratings $P_{tot1}$ derated at the chosen $T_{amb}$	W
Collector-Base Voltage	$V_{CB}$	90	V

2.8

**OPERATING LIFE CONDITIONS**

The conditions shall be as specified for Power Burn-in.

**APPENDIX 'A'**

**AGREED DEVIATIONS FOR STMICROELECTRONICS (F)**

ITEMS AFFECTED	DESCRIPTION OF DEVIATIONS																												
Deviations from Production Control-Chart F2	Special In-process Control Internal Visual Inspection. For CCP packages the criteria specified for voids in the fillet and minimum die mounting material around the visible die perimeter for die mounting defects may be omitted providing that a radiographic inspection to verify the die-attach process is performed on a sample basis in accordance with STMicroelectronics procedure 0076637.																												
Deviations from Room Temperature Electrical Measurements	All AC characteristics (Room Temperature Electrical Measurement Note 2) may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes AC characteristic measurements per the Detail Specification.  A summary of the pilot lot testing shall be provided if required by the Purchase Order.  Characteristics $h_{fe2}$ , and $C_{ebo}$ , shall be as follows: <table border="1" data-bbox="549 972 1465 1357"> <thead> <tr> <th data-bbox="549 972 740 1088" rowspan="2">Characteristics</th> <th data-bbox="740 972 880 1088" rowspan="2">Symbols</th> <th data-bbox="880 972 1054 1088" rowspan="2">MIL-STD-750 Test Method</th> <th data-bbox="1054 972 1206 1088" rowspan="2">Test Conditions</th> <th colspan="2" data-bbox="1206 972 1383 1088">Limits</th> <th data-bbox="1383 972 1465 1088" rowspan="2">Units</th> </tr> <tr> <th data-bbox="1206 1039 1294 1088">Min.</th> <th data-bbox="1294 1039 1383 1088">Max.</th> </tr> </thead> <tbody> <tr> <td data-bbox="549 1088 740 1236">High Frequency Small-Signal Short-Circuit Forward-Current Transfer Ratio</td> <td data-bbox="740 1088 880 1236"><math>h_{fe2}</math></td> <td data-bbox="880 1088 1054 1236">3306</td> <td data-bbox="1054 1088 1206 1236"><math>V_{CE}=10V</math> <math>I_C=10mA</math> <math>f=20MHz</math> Note 2</td> <td data-bbox="1206 1088 1294 1236">2.5</td> <td data-bbox="1294 1088 1383 1236">-</td> <td data-bbox="1383 1088 1465 1236">-</td> </tr> <tr> <td data-bbox="549 1236 740 1357">Emitter-Base Capacitance</td> <td data-bbox="740 1236 880 1357"><math>C_{ebo}</math></td> <td data-bbox="880 1236 1054 1357">3240</td> <td data-bbox="1054 1236 1206 1357"><math>V_{EB}=500mV</math> <math>I_C=0A</math> <math>f=1MHz</math> Note 2</td> <td data-bbox="1206 1236 1294 1357">-</td> <td data-bbox="1294 1236 1383 1357">45</td> <td data-bbox="1383 1236 1465 1357">pF</td> </tr> </tbody> </table>						Characteristics	Symbols	MIL-STD-750 Test Method	Test Conditions	Limits		Units	Min.	Max.	High Frequency Small-Signal Short-Circuit Forward-Current Transfer Ratio	$h_{fe2}$	3306	$V_{CE}=10V$ $I_C=10mA$ $f=20MHz$ Note 2	2.5	-	-	Emitter-Base Capacitance	$C_{ebo}$	3240	$V_{EB}=500mV$ $I_C=0A$ $f=1MHz$ Note 2	-	45	pF
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