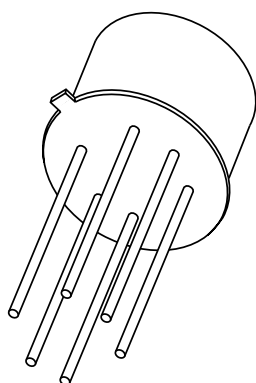


**DISCRETE SEMICONDUCTORS**

# DATA SHEET



## **BCY87; BCY88; BCY89** NPN general purpose transistors

Product specification  
Supersedes data of September 1994  
File under Discrete Semiconductors, SC04

1997 Jun 20

## NPN general purpose transistors

## BCY87; BCY88; BCY89

### FEATURES

- Low current (max. 30 mA)
- Low voltage (max. 45 V).

### APPLICATIONS

- Differential amplifier applications in general industrial service e.g. instrumentation and control
- The BCY87 and BCY88 are intended for use in pre-stages of differential amplifiers where low offset, low drift and low noise are of prime importance
- The BCY89 is intended for use in second stages of differential amplifiers, long-tailed pairs and more general applications.

### DESCRIPTION

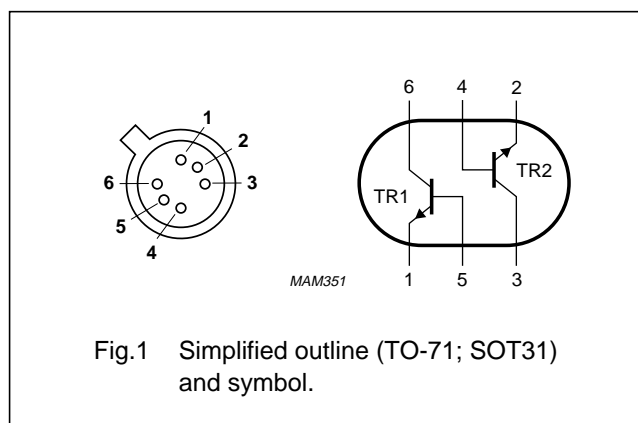
Matched dual NPN transistors in a TO-71; SOT31 metal package. Products are divided into 3 types according to their matching accuracy.

### PINNING

PIN <sup>(1)</sup>	DESCRIPTION
1	emitter TR1
2	emitter TR2
3	collector TR2
4	basis TR2
5	basis TR1
6	collector TR1

### Note

1. All leads insulated from the case.



### QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>Per transistor</b>					
$V_{CBO}$	collector-base voltage	open emitter	–	45	V
$V_{CEO}$	collector-emitter voltage	open base	–	40	V
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	–	150	mW
$h_{FE}$	DC current gain	$V_{CE} = 10\text{ V}$			
	BCY87	$I_C = 5\text{ }\mu\text{A}$	80	–	
	BCY88	$I_C = 500\text{ }\mu\text{A}$	120	600	
	BCY89	$I_C = 10\text{ mA}$	100	600	
$h_{FE}$	DC current gain	$I_C = 50\text{ }\mu\text{A}; V_{CE} = 10\text{ V}$	100	450	
$f_T$	transition frequency	$I_C = -50\text{ }\mu\text{A}; V_{CE} = 10\text{ V}; f = 100\text{ MHz}$	10	–	MHz
		$I_C = -500\text{ }\mu\text{A}; V_{CE} = 10\text{ V}; f = 100\text{ MHz}$	50	–	MHz

## NPN general purpose transistors

## BCY87; BCY88; BCY89

## LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	45	V
$V_{CEO}$	collector-emitter voltage	open base	–	40	V
$V_{EBO}$	emitter-base voltage	open collector	–	5	V
$I_C$	collector current (DC)		–	30	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	–	150	mW
$T_{stg}$	storage temperature		–65	+150	°C
$T_j$	junction temperature		–	175	°C

## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient	in free air	1	K/mW

## CHARACTERISTICS

 $T_{amb} = 25\text{ °C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Per transistor</b>						
$I_{CBO}$	collector cut-off current BCY87 BCY88	$I_E = 0; V_{CB} = 20\text{ V}; T_{amb} = 90\text{ °C}$	–	–	5 20	nA nA
$I_{CBO}$	collector cut-off current BCY89	$I_E = 0; V_{CB} = 20\text{ V}$	–	–	10	nA
$h_{FE}$	DC current gain BCY87 BCY88 BCY89	$V_{CE} = 10\text{ V}$ $I_C = 5\text{ }\mu\text{A}$ $I_C = 500\text{ }\mu\text{A}$ $I_C = 10\text{ mA}$	80 120 100	– – –	– 600 600	
$h_{FE}$	DC current gain	$I_C = 50\text{ }\mu\text{A}; V_{CE} = 10\text{ V}$	100	–	450	
$C_c$	collector capacitance	$I_E = I_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	–	3.5	pF
$f_T$	transition frequency	$I_E = -50\text{ }\mu\text{A}; V_{CE} = 10\text{ V};$ $f = 100\text{ MHz}$ $I_E = -500\text{ }\mu\text{A}; V_{CE} = 10\text{ V};$ $f = 100\text{ MHz}$	10 50	– –	– –	MHz MHz
F	noise figure	$I_C = 200\text{ }\mu\text{A}; V_{CE} = 5\text{ V};$ $R_S = 2\text{ k}\Omega; f = 10\text{ Hz to }15.7\text{ kHz}$	–	–	4	dB
F	noise figure BCY87 BCY88; BCY89	$I_C = 200\text{ }\mu\text{A}; V_{CE} = 5\text{ V};$ $R_S = 2\text{ k}\Omega; f = 1\text{ kHz}; B = 200\text{ Hz}$	– –	– –	4 5	dB dB

## NPN general purpose transistors

## BCY87; BCY88; BCY89

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Complete device; note 1</b>						
$\frac{I_{1C}}{I_{2C}}$	ratio of collector currents	$V_{1B-1E} = V_{2B-2E}$				
	BCY87		0.9	–	1.11	
	BCY88		0.8	–	1.25	
	BCY89		0.67	–	1.5	
$ V_{1B-1E} - V_{2B-2E} $	difference between base-emitter voltages	$I_{1C} = I_{2C}$				
	BCY87		–	–	3	mV
	BCY88		–	–	6	mV
	BCY89		–	–	10	mV
$ I_{1B} - I_{2B} $	difference between base currents	$V_{1B-1E} = V_{2B-2E}$				
	BCY87		–	–	25	nA
	BCY88		–	–	80	nA
	BCY89		–	–	300	nA
$\frac{h_{1FE}}{h_{2FE}}$	DC current gain ratio	$I_{1C} = I_{2C}$				
	BCY87		0.9	–	1.11	
	BCY88		0.8	–	1.25	
$\left  \frac{\Delta V}{\Delta T} \right $	equivalent differential voltage	$T_{amb} = -20\text{ °C to }+90\text{ °C}$				
	BCY87		–	1	3	$\mu\text{V/K}$
	BCY88		–	2	6	$\mu\text{V/K}$
	BCY89		–	4	10	$\mu\text{V/K}$
$\left  \frac{\Delta I}{\Delta T} \right $	equivalent differential current	$T_{amb} = -20\text{ °C to }+90\text{ °C}$				
	BCY87		–	–	0.5	nA/K
	BCY88		–	–	2	nA/K
	BCY89		–	–	10	nA/K

**Note**

1. These characteristics are valid under the following conditions:
  - a) Collector-base voltage of both transistors not exceeding 10 V; ( $V_{1C-1B} = V_{2C-2B} \leq 10\text{ V}$ ).
  - b) Sum of the emitter currents from 10 to 100  $\mu\text{A}$ ;  $-(I_{1E} + I_{2E}) = 10\text{ to }100\ \mu\text{A}$ .

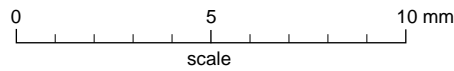
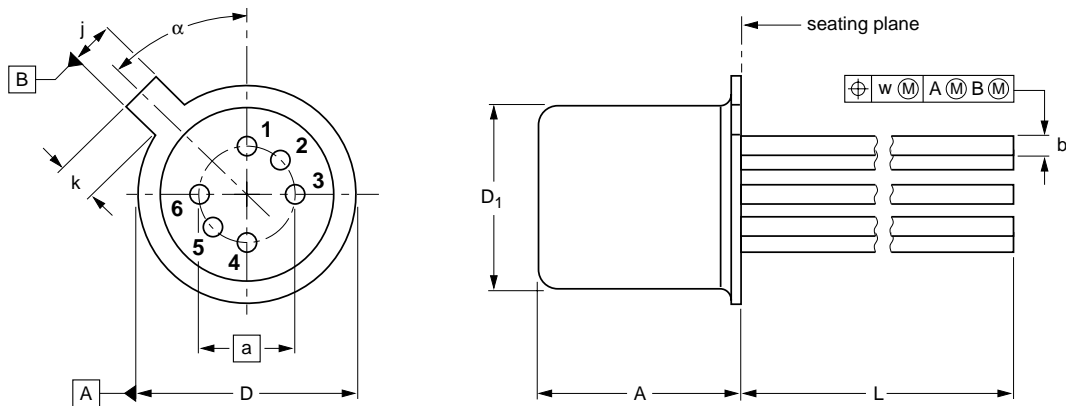
NPN general purpose transistors

BCY87; BCY88; BCY89

PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 6 leads

SOT31



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A max.	a	b max.	D max.	D <sub>1</sub> max.	j max.	k max.	L min.	w	α
mm	5.3	2.54	0.51	5.8	4.8	1.16	1.17	12.7	0.35	45°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT31		TO-71				97-06-18

## NPN general purpose transistors

BCY87; BCY88; BCY89

**DEFINITIONS**

<b>Data Sheet Status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

**LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

NPN general purpose transistors

BCY87; BCY88; BCY89

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