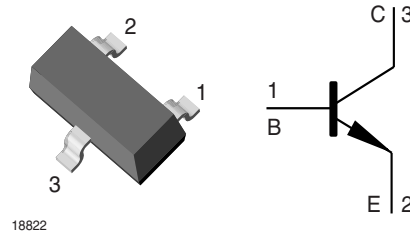


## Small Signal Transistors (NPN)

### Features

- NPN Silicon Epitaxial Planar Transistors
- Suited for low level, low noise, low frequency applications in hybrid circuits.
- Low Current, Low Voltage.
- As complementary types, BCW61 Series PNP transistors are recommended.



### Mechanical Data

**Case:** SOT-23 Plastic case

**Weight:** approx. 8.8 mg

### Marking:

BCW60A = AA  
 BCW60B = AB  
 BCW60C = AC  
 BCW60D = AD

### Packaging Codes/Options:

GS18 / 10 k per 13" reel (8 mm tape), 10 k/box  
 GS08 / 3 k per 7" reel (8 mm tape), 15 k/box

### Pinning:

1 = Base, 2 = Emitter, 3 = Collector

### Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

Parameter	Test condition	Symbol	Value	Unit
Collector-emitter voltage		$V_{CEO}$	32	V
		$V_{CBO}$	32	V
Emitter-base voltage		$V_{EBO}$	5.0	V
Collector current (DC)		$I_C$	100	mA
Collector peak current		$I_{CM}$	200	mA
Base current (DC)		$I_B$	50	mA
Power dissipation	$T_A = 25\text{ }^{\circ}\text{C}$	$P_{tot}$	250	mW

### Maximum Thermal Resistance

Parameter	Test condition	Symbol	Value	Unit
Maximum junction temperature		$T_J$	150	$^{\circ}\text{C}$
Storage temperature range		$T_S$	- 65 to + 150	$^{\circ}\text{C}$
Thermal resistance junction to ambient air		$R_{\theta JA}$	500 <sup>1)</sup>	$^{\circ}\text{C/W}$

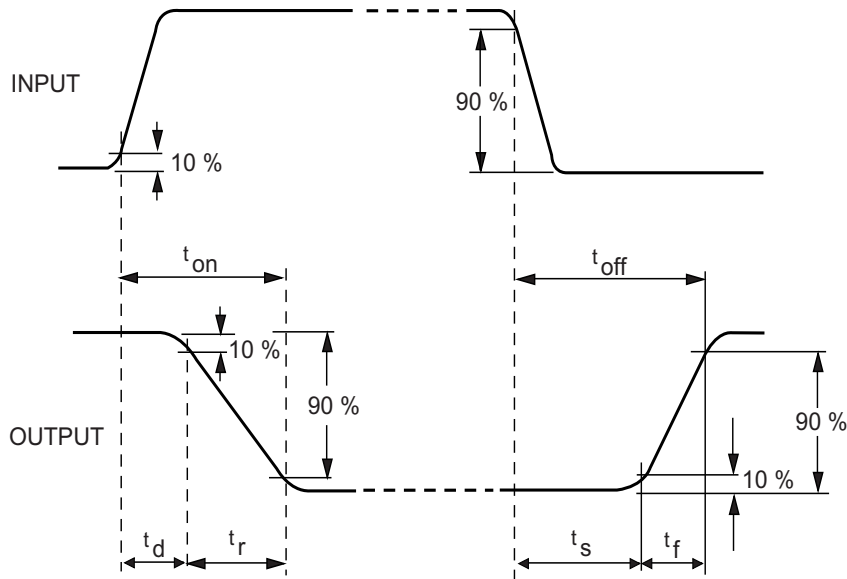
<sup>1)</sup> Mounted on FR-4 printed-circuit board.

## Electrical DC Characteristics

Parameter	Test condition	Part	Symbol	Min	Typ	Max	Unit
DC current gain	$V_{CE} = 5\text{ V}, I_C = 10\ \mu\text{A}$	BCW60A	$h_{FE}$				
		BCW60B	$h_{FE}$	20			
		BCW60C	$h_{FE}$	40			
		BCW60D	$h_{FE}$	100			
	$V_{CE} = 5\text{ V}, I_C = 2\text{ mA}$	BCW60A	$h_{FE}$	120		220	
		BCW60B	$h_{FE}$	180		310	
		BCW60C	$h_{FE}$	250		460	
		BCW60D	$h_{FE}$	380		630	
	$V_{CE} = 1\text{ V}, I_C = 50\text{ mA}$	BCW60A	$h_{FE}$	50			
		BCW60B	$h_{FE}$	70			
		BCW60C	$h_{FE}$	90			
		BCW60D	$h_{FE}$	100			
Collector - emitter saturation voltage	$I_C = 10\text{ mA}, I_B = 0.25\text{ mA}$		$V_{CEsat}$	50		350	mV
	$I_C = 50\text{ mA}, I_B = 1.25\text{ mA}$		$V_{CEsat}$	100		550	mV
Base - emitter saturation voltage	$I_C = 10\text{ mA}, I_B = 0.25\text{ mA}$		$V_{BEsat}$	600		850	mV
	$I_C = 50\text{ mA}, I_B = 1.25\text{ mA}$		$V_{BEsat}$	700		1050	mV
Base - emitter voltage	$V_{CE} = 5\text{ V}, I_C = 2\text{ mA}$		$V_{BE}$	550	650	750	mV
	$V_{CE} = 5\text{ V}, I_C = 10\ \mu\text{A}$		$V_{BE}$		520		mV
	$V_{CE} = 1\text{ V}, I_C = 50\text{ mA}$		$V_{BE}$		780		mV
Collector-emitter cut-off current	$V_{CE} = 32\text{ V}, V_{BE} = 0\text{ V}$		$I_{CES}$			20	nA
	$V_{CE} = 32\text{ V}, V_{BE} = 0\text{ V}, T_A = 150\text{ }^\circ\text{C}$		$I_{CES}$			20	$\mu\text{A}$
Emitter - base cut - off current	$V_{EB} = 4\text{ V}, I_C = 0$		$i_{EBO}$			20	nA

## Electrical AC Characteristics

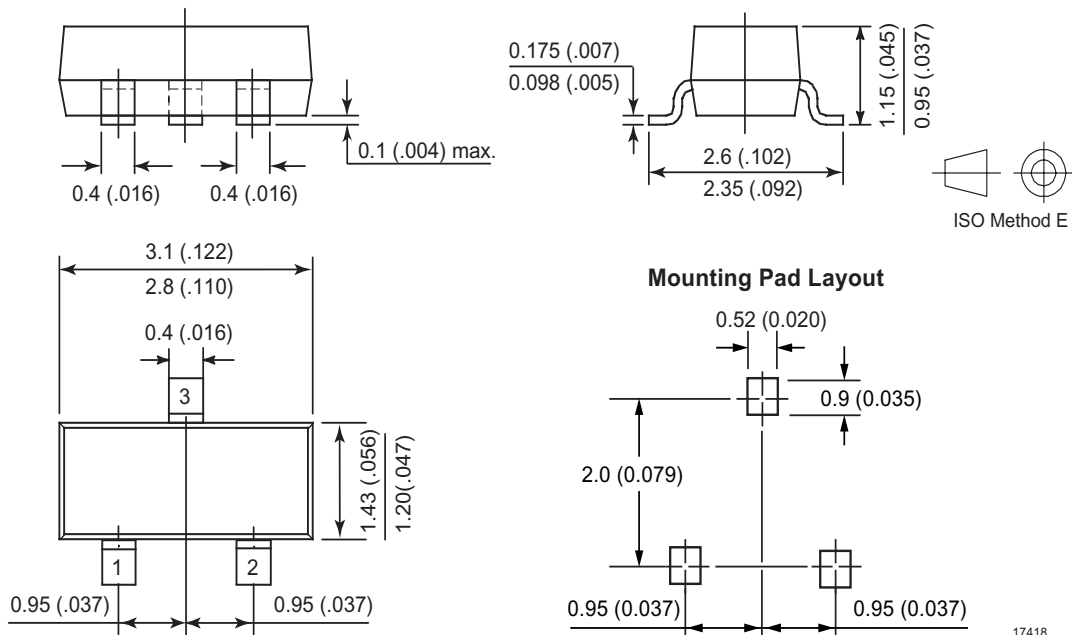
Parameter	Test condition	Part	Symbol	Min	Typ	Max	Unit
Gain - bandwidth product	$V_{CE} = 5\text{ V}, I_C = 10\text{ mA}, f = 100\text{ MHz}$		$f_T$	100	250		MHz
Collector - base capacitance	$V_{CB} = 10\text{ V}, f = 1\text{ MHz}, I_E = 0$		$C_{CBO}$		2.5		pF
Emitter - base capacitance	$V_{EB} = 0.5\text{ V}, f = 1\text{ MHz}, I_C = 0$		$C_{EBO}$		8		pF
Noise figure	$V_{CE} = 5\text{ V}, I_C = 200\ \mu\text{A}, R_S = 2\text{ k}\Omega, f = 1\text{ kHz}, B = 200\text{ Hz}$		F		2	6	dB
Small signal current gain	$V_{CE} = 5\text{ V}, I_C = 2\text{ mA}, f = 1.0\text{ kHz}$	BCW60A	$h_{fe}$		200		
		BCW60B	$h_{fe}$		260		
		BCW60C	$h_{fe}$		330		
		BCW60D	$h_{fe}$		520		
Turn - on time	$R_L = 990\ \Omega$ (see fig.1) $V_{CC} = 10\text{ V}, I_C = 10\text{ mA}, I_{B(on)} = - I_{B(off)} = 1\text{ mA}$		$t_{on}$		85	150	ns
Turn - off time	$R_L = 990\ \Omega$ (see fig.1) $V_{CC} = 10\text{ V}, I_C = 10\text{ mA}, I_{B(on)} = - I_{B(off)} = 1\text{ mA}$		$t_{off}$		480	800	ns



19203

Figure 1. Switching Waveform

## Package Dimensions in mm (Inches)



### Ozone Depleting Substances Policy Statement

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**Vishay Semiconductor GmbH** has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

**Vishay Semiconductor GmbH** can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

**We reserve the right to make changes to improve technical design  
and may do so without further notice.**

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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