

BCW60

SOT23 NPN SILICON PLANAR SMALL SIGNAL TRANSISTORS

ISSUE 2 – AUGUST 1995

BCW60

ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated).

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS.
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	32			V	$I_C = 2\text{mA}$
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	5			V	$I_{EBO} = 1\mu\text{A}$
Collector-Emitter Cut-off Current	I_{CES}			20	nA	$V_{CES} = 32\text{V}, T_{amb} = 150^{\circ}\text{C}$
Emitter-Base Cut-Off Current	I_{EBO}			20	nA	$V_{EBO} = 4\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$		0.12 0.20	0.35 0.55	V	$I_C = 10\text{mA}, I_B = 0.25\text{mA}$ $I_C = 50\text{mA}, I_B = 1.25\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	0.60 0.70	0.70 0.83	0.85 1.05	V	$I_C = 10\text{mA}, I_B = 0.25\text{mA}$ $I_C = 50\text{mA}, I_B = 1.25\text{mA}$
Base - Emitter Voltage	V_{BE}	0.55	0.52 0.65 0.78	0.75	V	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
Static BCW60A Forward Current Transfer Ratio	h_{FE}	120 50	78 170	220		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
BCW60C	h_{FE}	20	145	310		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
		40	220	460		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
		250	350	630		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
BCW60D	h_{FE}	100	300	630		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
		380	500	800		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
Transition Frequency	f_T	125	250		MHz	$I_C = 10\text{mA}, V_{CE} = 5\text{V}$ $f = 100\text{MHz}$
Emitter-Base Capacitance	C_{ebo}		8		pF	$V_{EBO} = 0.5\text{V}, f = 1\text{MHz}$
Collector-Base Capacitance	C_{cbo}		2	4.5	pF	$V_{CBO} = 10\text{V}, f = 1\text{MHz}$
Noise Figure	N			6	dB	$I_C = 0.2\text{mA}, V_{CE} = 5\text{V}$ $R_G = 2\text{K}\Omega, f = 1\text{kHz}$ $\Delta f = 200\text{Hz}$
Switching times:						
Delay Time	t_d		35		ns	
Rise Time	t_r		50		ns	
Turn-on Time	t_{on}		85	150	ns	$I_C = 1\text{mA}, I_{B2} = 10:1:1\text{mA}$
Storage Time	t_s		400		ns	$R_1 = 5\text{K}\Omega, R_2 = 5\text{K}\Omega$
Fall Time	t_f		80		ns	$V_{BB} = 3.6\text{V}, R_L = 990\Omega$
Turn-Off Time	t_{off}		480	800	ns	

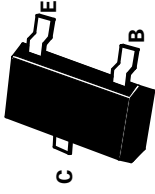
*Measured under pulsed conditions. Pulse width=300µs. Duty cycle
Spice parameter data is available upon request for this device

PARTMARKING DETAILS

- BCW60A – AA
- BCW60B – AB
- BCW60C – AC
- BCW60D – AD
- BCW60AR – CR
- BCW60BR – DR
- BCW60CR – AR
- BCW60DR – BR

COMPLEMENTARY TYPE

BCW61



SOT23

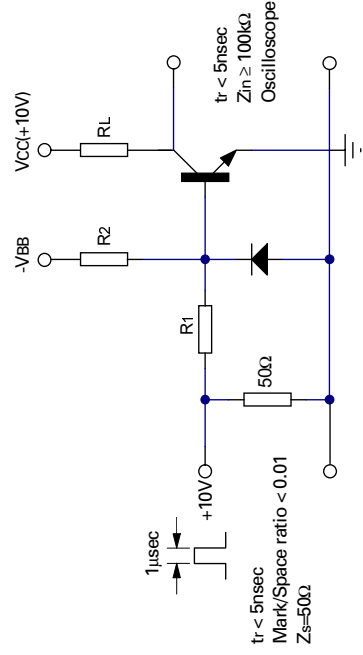
ABSOLUTE MAXIMUM RATINGS.

PARAMETER	SYMBOL	VALUE	UNIT
Collector-Base Voltage	V_{CBO}	32	V
Collector-Emitter Voltage	V_{CEO}	32	V
Emitter-Base Voltage	V_{EBO}	5	V
Continuous Collector Current	I_C	200	mA
Base Current	I_B	50	mA
Power Dissipation at $T_{amb} = 25^{\circ}\text{C}$	P_{TOT}	330	mW
Operating and Storage Temperature Range	t_j, stg	-55 to +150	$^{\circ}\text{C}$

FOUR TERMINAL NETWORK DATA ($I_C = 2\text{mA}, V_{CE} = 5\text{V}, f = 1\text{kHz}$)

	h_{FE} Group A		h_{FE} Group B		h_{FE} Group C		h_{FE} Group D	
	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Max.
h_{11e}	1.6	2.7	2.5	3.6	4.5	8.5	4.5	7.5
h_{12e}	1.5		2		2		3	
h_{21e}	200		260		330		520	
h_{22e}	18	30	24	50	30	60	50	100

SWITCHING CIRCUIT



BCW60

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Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	5			V	$I_{EBO} = 1\mu\text{A}$
Collector-Emitter Cut-off Current	I_{CES}			20	nA	$V_{CES} = 32\text{V}, T_{amb} = 150^{\circ}\text{C}$
Emitter-Base Cut-Off Current	I_{EBO}			20	nA	$V_{EBO} = 4\text{V}$
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$		0.12 0.20	0.35 0.55	V	$I_C = 10\text{mA}, I_B = 0.25\text{mA}$ $I_C = 50\text{mA}, I_B = 1.25\text{mA}$
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	0.60 0.70	0.70 0.83	0.85 1.05	V	$I_C = 10\text{mA}, I_B = 0.25\text{mA}$ $I_C = 50\text{mA}, I_B = 1.25\text{mA}$
Base - Emitter Voltage	V_{BE}	0.55	0.52 0.65 0.78	0.75	V	$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
Static BCW60A Forward Current Transfer Ratio	h_{FE}	120 50	78 170	220		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
BCW60C	h_{FE}	20	145	310		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
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		250	350	630		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
BCW60D	h_{FE}	100	300	630		$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
		380	500			$I_C = 10\mu\text{A}, V_{CE} = 5\text{V}$ $I_C = 2\text{mA}, V_{CE} = 5\text{V}$ $I_C = 50\text{mA}, V_{CE} = 1\text{V}$
Transition Frequency	f_T	125	250		MHz	$I_C = 10\text{mA}, V_{CE} = 5\text{V}$ $f = 100\text{MHz}$
Emitter-Base Capacitance	C_{ebo}		8		pF	$V_{EBO} = 0.5\text{V}, f = 1\text{MHz}$
Collector-Base Capacitance	C_{cbo}		2	4.5	pF	$V_{CBO} = 10\text{V}, f = 1\text{MHz}$
Noise Figure	N			6	dB	$I_C = 0.2\text{mA}, V_{CE} = 5\text{V}$ $R_G = 2\text{k}\Omega, f = 1\text{kHz}$ $\Delta f = 200\text{Hz}$
Switching times:	Delay Time		35		ns	
	Rise Time	t_r	50		ns	
	Turn-on Time	t_{on}	85		150	ns
	Storage Time	t_s	400			ns
	Fall Time	t_f	80			ns
	Turn-Off Time	t_{off}	480		800	ns

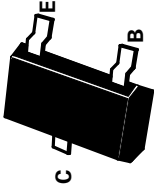
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ABSOLUTE MAXIMUM RATINGS.

PARAMETER	SYMBOL	VALUE	UNIT
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Collector-Emitter Voltage	V_{CEO}	32	V
Emitter-Base Voltage	V_{EBO}	5	V
Continuous Collector Current	I_C	200	mA
Base Current	I_B	50	mA
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	Min.	Typ.	Min.	Typ.	Min.	Typ.	Min.	Max.				
h_{11e}	1.6	2.7	4.5	2.5	3.6	6.0	4.5	8.5	4.5	7.5	12	k Ω
h_{12e}		1.5			2		2			3		10^{-4}
h_{21e}		200			260		330			520		
h_{22e}		18	30		24	50	30	60		50	100	μS

SWITCHING CIRCUIT

