

CA3045, CA3046

General-Purpose N-P-N Transistor Arrays

Three Isolated Transistors and One Differentially-Connected Transistor Pair

For Low-Power Applications at Frequencies from DC through the VHF Range

Features

- Two matched pairs of transistors
 - V_{BE} matched ± 5 mV
 - Input offset current $2 \mu A$ max. at $I_C = 1$ mA
- 5 general purpose monolithic transistors

- Operation from DC to 120 MHz
- Wide operating current range
- Low noise figure - - 3.2 dB typ. at 1 kHz
- Full military temperature range for CA3045
-55 to +125°C

The CA3045 and CA3046 each consist of five general-purpose silicon n-p-n transistors on a common monolithic substrate. Two of the transistors are internally connected to form a differentially-connected pair.

The transistors of the CA3045 and CA3046 are well suited to a wide variety of applications in low power systems in the DC through VHF range. They may be used as discrete transistors in conventional circuits. However, in addition, they provide the very significant inherent integrated circuit advantages of close electrical and thermal matching.

The CA3045 is supplied in a 14-lead dual-in-line hermetic (welded-seal) ceramic package and the CA3045F in a 14-lead dual-in-line hermetic (frit-seal) ceramic package.

The CA3046 is electrically identical to the CA3045 but is supplied in a dual-in-line plastic package for applications requiring only a limited temperature range.

Applications

- General use in all types of signal processing systems operating anywhere in the frequency range from DC to VHF
- Custom designed differential amplifiers
- Temperature compensated amplifiers
- See RCA Application Note, ICAN-5296 "Application of the RCA-CA3018 Integrated-Circuit Transistor Array" for suggested applications.

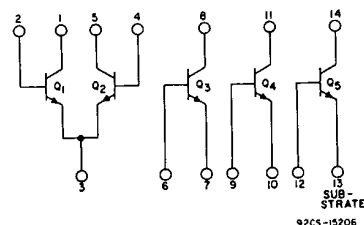


Fig.1 - Schematic diagram.

The CA3045 and CA3046 are available in the packages shown below

Package	Suffix Letter	CA3045	CA3046
14-Lead Dual-In-Line Plastic	E		✓
14-Lead Dual-In-Line Ceramic	D	✓	
14-Line Dual-In-Line Frit-Seal Ceramic	F	✓	
Chip	H	✓	

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ABSOLUTE MAXIMUM RATINGS AT $T_A = 25^\circ\text{C}$

	CA3045		CA3046, CA3045F		
	Each Transistor	Total Package	Each Transistor	Total Package	
Power Dissipation:					
T_A up to 55°C	—	—	300	750	mW
$T_A > 55^\circ\text{C}$	—	—	Derate at 6.67		mW/ $^\circ\text{C}$
T_A up to 75°C	300	750	—	—	mW
$T_A > 75^\circ\text{C}$	Derate at 8		—	—	mW/ $^\circ\text{C}$
Collector-to-Emitter Voltage, V_{CE0}	15	—	15	—	V
Collector-to-Base Voltage, V_{CBO}	20	—	20	—	V
Collector-to-Substrate Voltage, V_{CIO}	20	—	20	—	V
Emitter-to-Base Voltage, V_{EBO}	5	—	5	—	V
Collector Current	50	—	50	—	mA
Temperature Range:					
Operating	-55 to $+125$		-55 to $+125$		$^\circ\text{C}$
Storage	-65 to $+150$		-65 to $+150$		$^\circ\text{C}$
Lead Temperature (During Soldering):					
At distance $1/16 \pm 1/32$ " (1.59 ± 0.79 mm)					
from case for 10 seconds max.	$+265$		$+265$		$^\circ\text{C}$

* The collector of each transistor of the CA3045 and CA3046 is isolated from the substrate by an integral diode. The substrate (terminal 13) must be connected to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.

ELECTRICAL CHARACTERISTICS, at $T_A = 25^\circ\text{C}$

Characteristics apply for each transistor in the CA3045 and CA3046 as specified.

CHARACTERISTICS	SYMBOLS	SPECIAL TEST CONDITIONS	LIMITS			UNITS	CHARACTERISTIC CURVES
			Type CA3045 Type CA3046				
			MIN.	TYP.	MAX.		FIG.
STATIC CHARACTERISTICS							
Collector-to-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10 \mu A, I_E = 0$	20	60	-	V	-
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1 \text{ mA}, I_B = 0$	15	24	-	V	-
Collector-to-Substrate Breakdown Voltage	$V_{(BR)CIO}$	$I_C = 10 \mu A, I_{CI} = 0$	20	60	-	V	-
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10 \mu A, I_C = 0$	5	7	-	V	-
Collector-Cutoff Current	I_{CBO}	$V_{CB} = 10 \text{ V}, I_E = 0$	-	0.002	40	nA	2
Collector-Cutoff Current	I_{CEO}	$V_{CE} = 10 \text{ V}, I_B = 0$	-	See curve	0.5	μA	3
Static Forward Current-Transfer Ratio (Static Beta)	h_{FE}	$V_{CE} = 3 \text{ V} \begin{cases} I_C = 10 \text{ mA} \\ I_C = 1 \text{ mA} \\ I_C = 10 \mu A \end{cases}$	-	100	-	-	4
			40	100	-	-	
			-	54	-	-	
Input Offset Current for Matched Pair Q_1 and Q_2 , $ I_{O1} - I_{O2} $		$V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	0.3	2	μA	5
Base-to-Emitter Voltage	V_{BE}	$V_{CE} = 3 \text{ V} \begin{cases} I_E = 1 \text{ mA} \\ I_E = 10 \text{ mA} \end{cases}$	-	0.715	-	V	6
			-	0.800	-		
Magnitude of Input Offset Voltage for Differential Pair $ V_{BE1} - V_{BE2} $		$V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	0.45	5	mV	6,8
Magnitude of Input Offset Voltage for Isolated Transistors $ V_{BE3} - V_{BE4} $, $ V_{BE4} - V_{BE5} $, $ V_{BE5} - V_{BE3} $		$V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	0.45	5	mV	6,8
Temperature Coefficient of Base-to-Emitter Voltage	$\frac{\Delta V_{BE}}{\Delta T}$	$V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	-1.9	-	mV/°C	7
Collector-to-Emitter Saturation Voltage	V_{CES}	$I_B = 1 \text{ mA}, I_C = 10 \text{ mA}$	-	0.23	-	V	-
Temperature Coefficient: Magnitude of Input-Offset Voltage	$\frac{ \Delta V_{IO} }{\Delta T}$	$V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	1.1	-	$\mu V/^\circ C$	8

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ELECTRICAL CHARACTERISTICS (Cont'd.)

DYNAMIC CHARACTERISTICS							
Low-Frequency Noise Figure	NF	$f = 1 \text{ kHz}, V_{CE} = 3 \text{ V}, I_C = 100 \mu\text{A}$ Source Resistance = $1 \text{ k}\Omega$	-	3.25	-	dB	9(b)
Low-Frequency, Small-Signal Equivalent-Circuit Characteristics:							
Forward Current-Transfer Ratio	h_{fe}	$f = 1 \text{ kHz}, V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	110	-	-	10
Short-Circuit Input Impedance	h_{ie}		-	3.5	-	$\text{k}\Omega$	
Open-Circuit Output Impedance	h_{oe}		-	15.6	-	μmho	
Open-Circuit Reverse Voltage-Transfer Ratio	h_{re}		-	1.8×10^{-4}	-	-	
Admittance Characteristics:							
Forward Transfer Admittance	Y_{fe}	$f = 1 \text{ MHz}, V_{CE} = 3 \text{ V}, I_C = 1 \text{ mA}$	-	$31 - j1.5$	-	-	11
Input Admittance	Y_{ie}		-	$0.3 + j0.04$	-	-	12
Output Admittance	Y_{oe}		-	$0.001 + j0.03$	-	-	13
Reverse Transfer Admittance	Y_{re}		-	See curve	-	-	14
Gain-Bandwidth Product	f_T	$V_{CE} = 3 \text{ V}, I_C = 3 \text{ mA}$	300	550	-	-	15
Emitter-to-Base Capacitance	C_{EB}	$V_{EB} = 3 \text{ V}, I_E = 0$	-	0.6	-	pF	-
Collector-to-Base Capacitance	C_{CB}	$V_{CB} = 3 \text{ V}, I_C = 0$	-	0.58	-	pF	-
Collector-to-Substrate Capacitance	C_{CI}	$V_{CS} = 3 \text{ V}, I_C = 0$	-	2.8	-	pF	-

STATIC CHARACTERISTICS

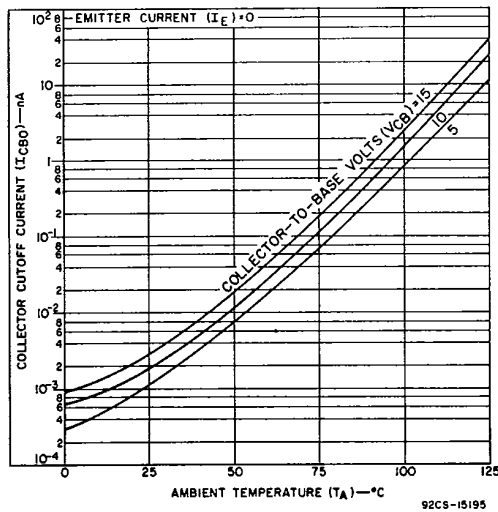


Fig. 2 - Typical collector-to-base cutoff current vs ambient temperature for each trans

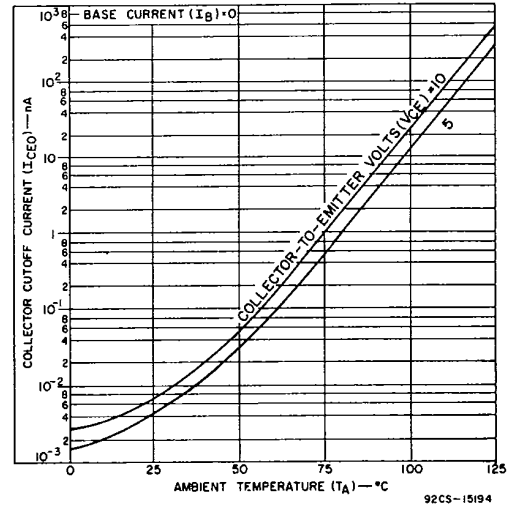


Fig. 3 - Typical collector-to-emitter cutoff current vs ambient temperature for each transistor.

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STATIC CHARACTERISTICS

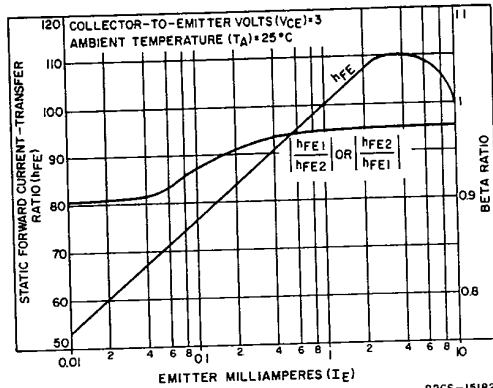


Fig. 4 - Typical static forward current-transfer ratio and beta ratio for transistors Q_1 and Q_2 vs emitter current.

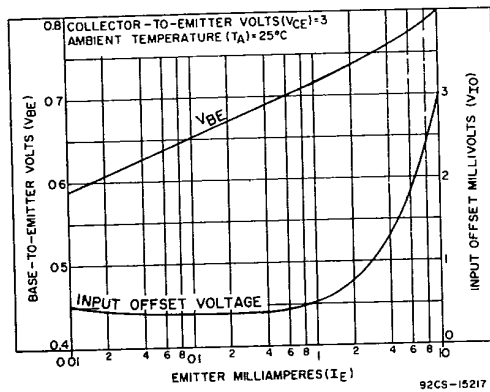


Fig. 6 - Typical static base-to-emitter voltage characteristic and input offset voltage for differential pair and paired isolated transistors vs emitter current.

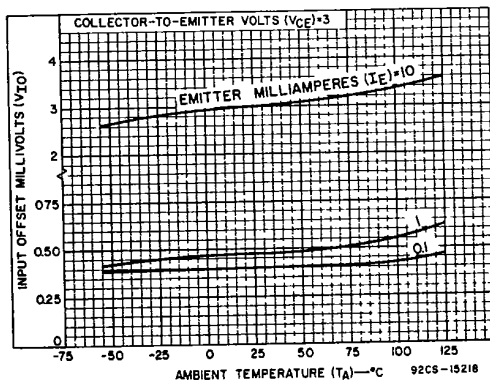


Fig. 8 - Typical input offset voltage characteristics for differential pair and paired isolated transistors vs ambient temperature.

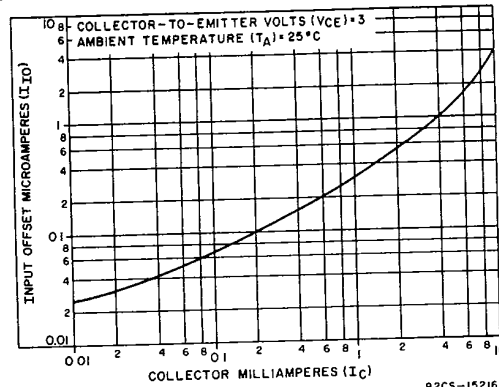


Fig. 5 - Typical input offset current for matched transistor pair Q_1Q_2 vs collector current.

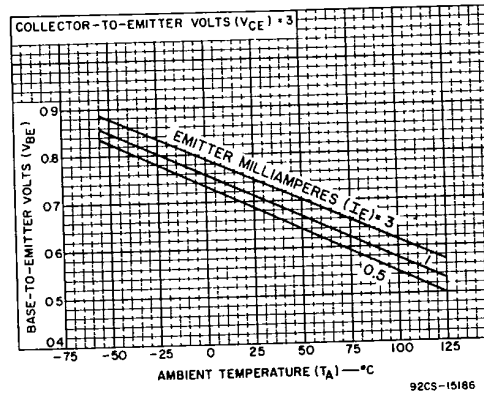


Fig. 7 - Typical base-to-emitter voltage characteristic vs ambient temperature for each transistor.

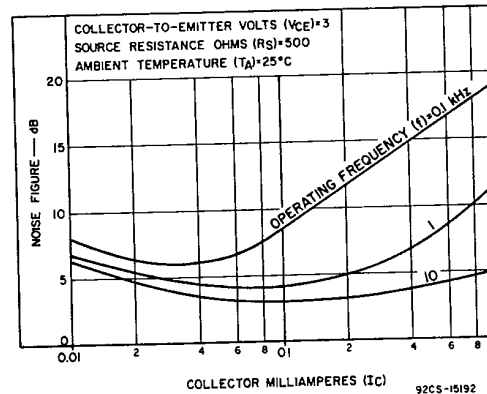


Fig. 9(a) - Typical noise figure vs collector current.

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DYNAMIC CHARACTERISTICS FOR EACH TRANSISTOR

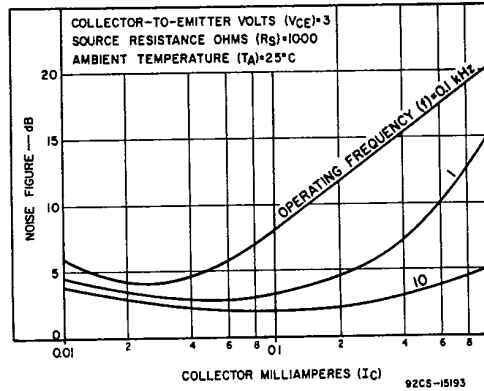


Fig.9(b) - Typical noise figure vs collector current.

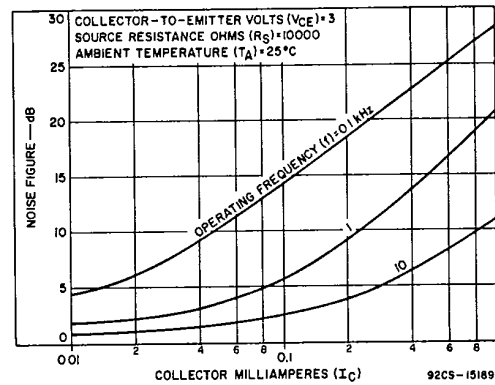


Fig.9(c) - Typical noise figure vs collector current.

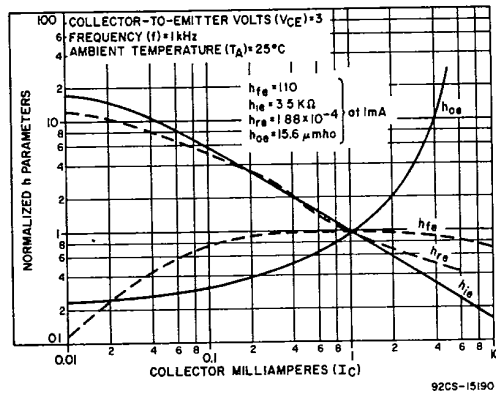


Fig.10 - Typical normalized forward current-transfer ratio, short-circuit input impedance, open-circuit output impedance, and open-circuit reverse voltage-transfer ratio vs collector current.

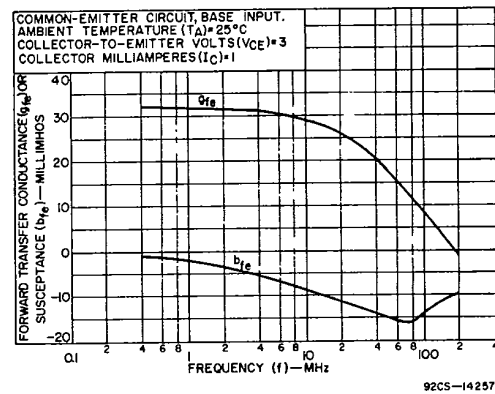


Fig.11 - Typical forward transfer admittance vs frequency.

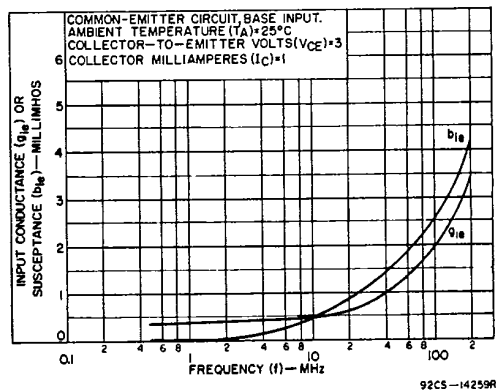


Fig.12 - Typical input admittance vs frequency.

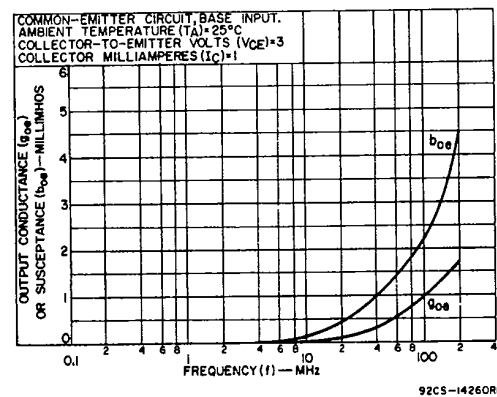


Fig.13 - Typical output admittance vs frequency.

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DYNAMIC CHARACTERISTICS FOR EACH TRANSISTOR

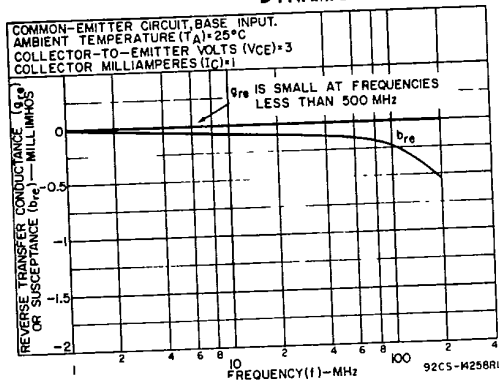


Fig.14 - Typical reverse transfer admittance vs frequency.

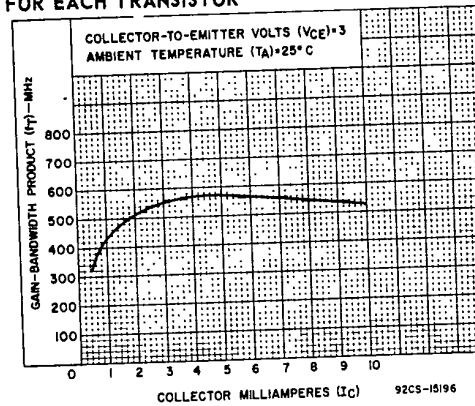


Fig.15 - Typical gain-bandwidth product vs collector current.