

**NOT RECOMMENDED FOR NEW DESIGNS
POSSIBLE SUBSTITUTE PRODUCT
CA3127, HFA3127**

High-Frequency NPN Transistor Array For Low-Power Applications at Frequencies Up to 1.5GHz

The CA3227 consists of five general purpose silicon NPN transistors on a common monolithic substrate. Each of the transistors exhibits a value of f_T in excess of 3GHz, making them useful from DC to 1.5GHz. The monolithic construction of these devices provides close electrical and thermal matching of the five transistors.

Ordering Information

PART NUMBER (BRAND)	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CA3227M (3227)	-55 to 125	16 Ld SOIC	M16.15
CA3227M96 (3227)	-55 to 125	16 Ld SOIC Tape and Reel	M16.15

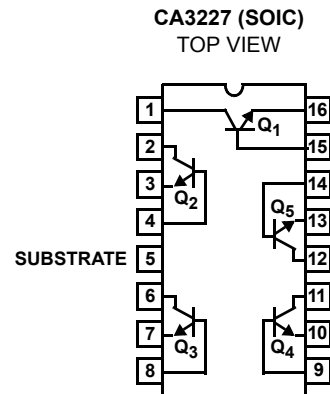
Features

- Gain-Bandwidth Product (f_T) >3GHz
- Five Transistors on a Common Substrate

Applications

- VHF Amplifiers
- VHF Mixers
- Multifunction Combinations - RF/Mixer/Oscillator
- IF Converter
- IF Amplifiers
- Sense Amplifiers
- Synthesizers
- Synchronous Detectors
- Cascade Amplifiers

Pinout



Absolute Maximum Ratings

Collector to Emitter Voltage (V_{CEO}) 8V
 Collector to Base Voltage (V_{CBO}) 12V
 Collector to Substrate Voltage (V_{CIO} , Note 1) 20V
 Collector Current (I_C) 20mA

Operating Conditions

Temperature Range -55°C to 125°C

Thermal Information

Thermal Resistance (Typical, Note 2) θ_{JA} (°C/W)
 16 Ld SOIC Package 185
 Maximum Power Dissipation (Any One Transistor) 85mW
 Maximum Junction Temperature (Die) 175°C
 Maximum Junction Temperature (Plastic Package) 150°C
 Maximum Storage Temperature Range -65°C to 150°C
 Maximum Lead Temperature (Soldering 10s) 300°C
 (SOIC - Lead Tips Only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. The collector of each transistor of these devices is isolated from the substrate by an integral diode. The substrate (Terminal 5) must be connected to the most negative point in the external circuit to maintain isolation between transistors and to provide for normal transistor action.
2. θ_{JA} is measured with the component mounted on a low effective thermal conductivity test board in free air. See Tech Brief TB379 for details.

Electrical Specifications $T_A = 25^\circ\text{C}$

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS FOR EACH TRANSISTOR						
Collector to Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}, I_E = 0$	12	20	-	V
Collector to Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 1\text{mA}, I_B = 0$	8	10	-	V
Collector to Substrate Breakdown Voltage	$V_{(BR)CIO}$	$I_{C1} = 10\mu\text{A}, I_B = 0, I_E = 0$	20	-	-	V
Emitter Cutoff Current (Note 3)	I_{EBO}	$V_{EB} = 4.5\text{V}, I_C = 0$	-	-	10	μA
Collector Cutoff Current	I_{CEO}	$V_{CE} = 5\text{V}, I_B = 0$	-	-	1	μA
Collector Cutoff Current	I_{CBO}	$V_{CB} = 8\text{V}, I_E = 0$	-	-	100	nA
DC Forward Current Transfer Ratio	h_{FE}	$V_{CE} = 6\text{V}$	$I_C = 10\text{mA}$	-	110	-
			$I_C = 1\text{mA}$	40	150	-
			$I_C = 0.1\text{mA}$	-	150	-
Base to Emitter Voltage	V_{BE}	$V_{CE} = 6\text{V}$	0.62	0.71	0.82	V
Collector to Emitter Saturation Voltage	$V_{CE\text{ SAT}}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$	-	0.13	0.50	V
Base to Emitter Saturation Voltage	$V_{BE\text{ SAT}}$	$I_C = 10\text{mA}, I_B = 1\text{mA}$	0.74	-	0.94	V

NOTE:

3. On small-geometry, high-frequency transistors, it is very good practice never to take the Emitter Base Junction into reverse breakdown. To do so may permanently degrade the h_{FE} . Hence, the use of I_{EBO} rather than $V_{(BR)EBO}$. These devices are also susceptible to damage by electrostatic discharge and transients in the circuits in which they are used. Moreover, CMOS handling procedures should be employed.

CA3227

Electrical Specifications T_A = 25°C, 200MHz, Common Emitter, Typical Values Intended Only for Design Guidance

PARAMETER	SYMBOL		TEST CONDITIONS	TYPICAL VALUES	UNITS
DYNAMIC CHARACTERISTICS FOR EACH TRANSISTOR					
Input Admittance	Y ₁₁	b ₁₁	I _C = 1mA, V _{CE} = 5V	4	mS
		g ₁₁		0.75	mS
Output Admittance	Y ₂₂	b ₂₂	I _C = 1mA, V _{CE} = 5V	2.7	mS
		g ₂₂		0.13	mS
Forward Transfer Admittance	Y ₂₁	Y ₂₁	I _C = 1mA, V _{CE} = 5V	29.3	mS
		θ ₂₁		-33	Degrees
Reverse Transfer Admittance	Y ₁₂	Y ₁₂	I _C = 1mA, V _{CE} = 5V	0.38	mS
		θ ₁₂		-97	Degrees
Input Admittance	Y ₁₁	b ₁₁	I _C = 10mA, V _{CE} = 5V	4.8	mS
		g ₁₁		2.85	mS
Output Admittance	Y ₂₂	b ₂₂	I _C = 10mA, V _{CE} = 5V	2.75	mS
		g ₂₂		0.9	mS
Forward Transfer Admittance	Y ₂₁	Y ₂₁	I _C = 10mA, V _{CE} = 5V	95	mS
		θ ₂₁		-62	Degrees
Reverse Transfer Admittance	Y ₁₂	Y ₁₂	I _C = 10mA, V _{CE} = 5V	0.39	mS
		θ ₁₂		-97	Degrees
Small Signal Forward Current Transfer Ratio	h ₂₁		I _C = 1mA, V _{CE} = 5V	7.1	
			I _C = 10mA, V _{CE} = 5V	17	
TYPICAL CAPACITANCE AT 1MHz, THREE-TERMINAL MEASUREMENT					
Collector to Base Capacitance	C _{CB}		V _{CB} = 6V	0.3	pF
Collector to Substrate Capacitance	C _{CI}		V _{CI} = 6V	1.6	pF
Collector to Emitter Capacitance	C _{CE}		V _{CE} = 6V	0.4	pF
Emitter to Base Capacitance	C _{EB}		V _{EB} = 3V	0.75	pF

Spice Model (Spice 2G.6)

.model NPN

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+      BF = 2.610E + 02      BR = 4.401E + 00      IS = 6.930E - 16      RB = 130.0E + 00
+      RC = 1.000E + 01      RE = 7.396E - 01      VA = 6.300E + 01      VB = 2.208E + 00
+      IK = 1.000E - 01      ISE = 1.87E - 14      NE = 1.653E + 00      IKR = 1.000E - 02
+      ISC = 9.25E - 14      NC = 1.333E + 00      TF = 1.775E - 11      TR = 1.000E - 09
+      CJS = 1.800E - 12      CJE = 1.010E - 12      PE = 8.350E - 01      ME = 4.460E - 01
+      CJC = 9.100E - 13      PC = 3.850E - 01      MC = 2.740E - 01      KF = 0.000E + 00
+      AF = 1.000E + 00      EF = 1.000E + 00      FC = 5.000E - 01      PJS = 5.410E - 01
+      MJS = 3.530E - 01      RBM = 30.00      RBV = 100      IRB = 0.00

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Please Note: No measurements have been made to model the reverse AC operation (tr is an estimation).

Typical Performance Curves

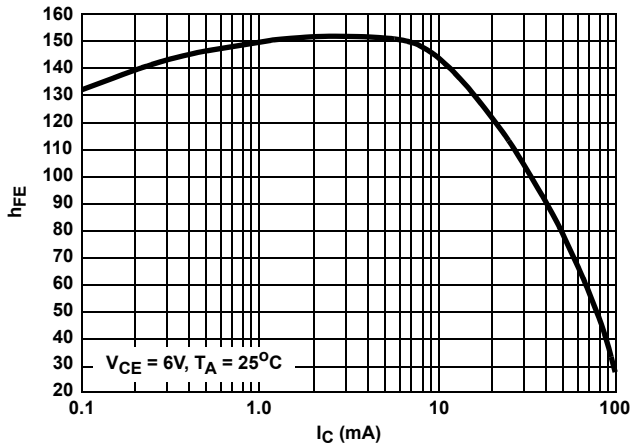


FIGURE 1. h_{FE} vs COLLECTOR CURRENT

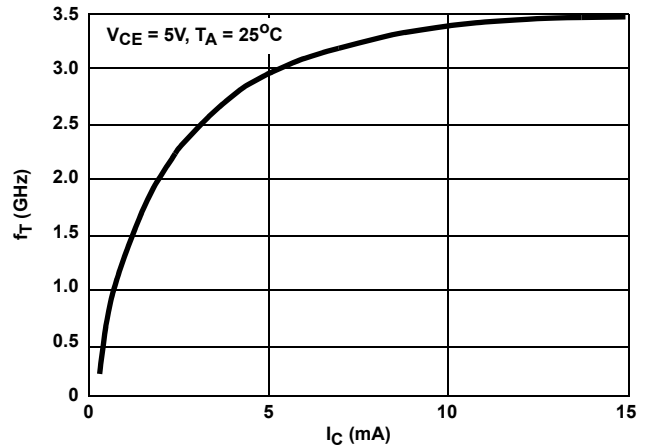


FIGURE 2. f_T vs COLLECTOR CURRENT

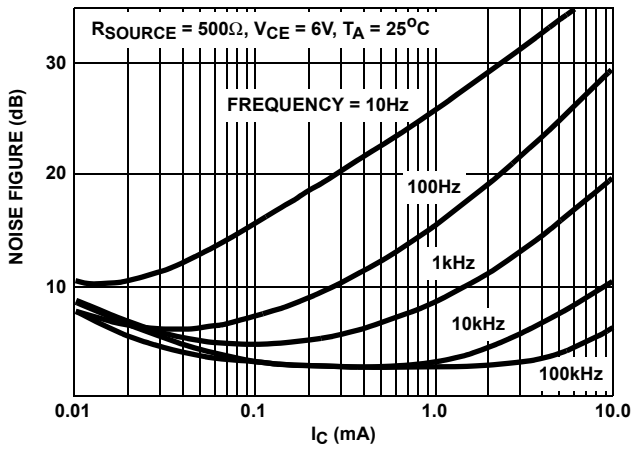


FIGURE 3. NOISE FIGURE vs COLLECTOR CURRENT

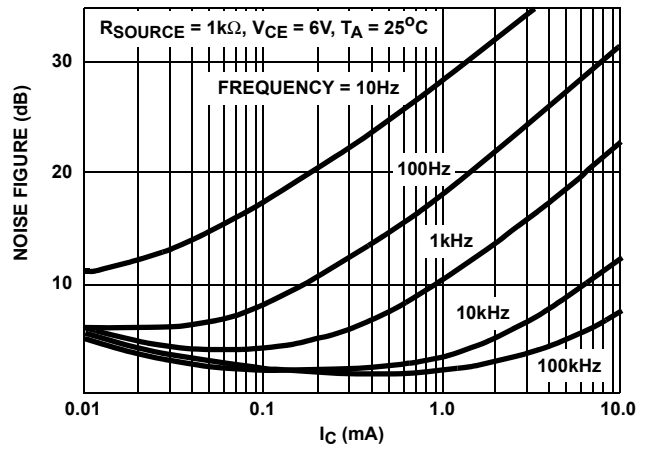


FIGURE 4. NOISE FIGURE vs COLLECTOR CURRENT

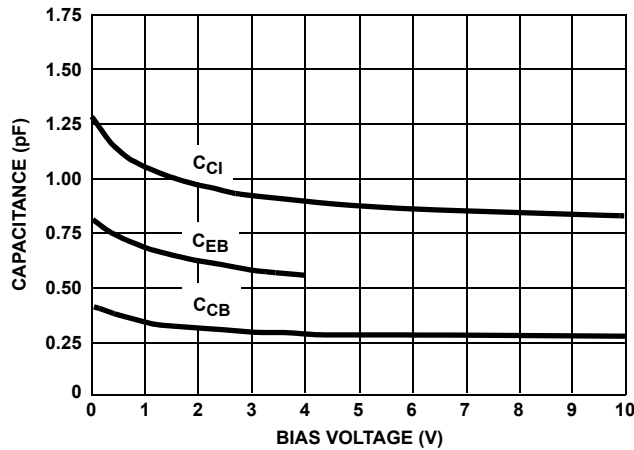


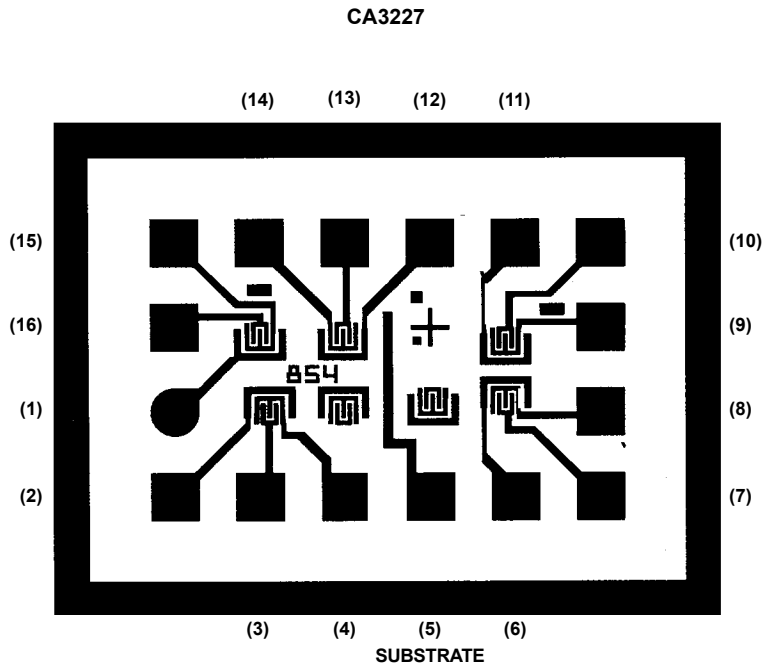
FIGURE 5. CAPACITANCE vs BIAS VOLTAGE

Die Characteristics

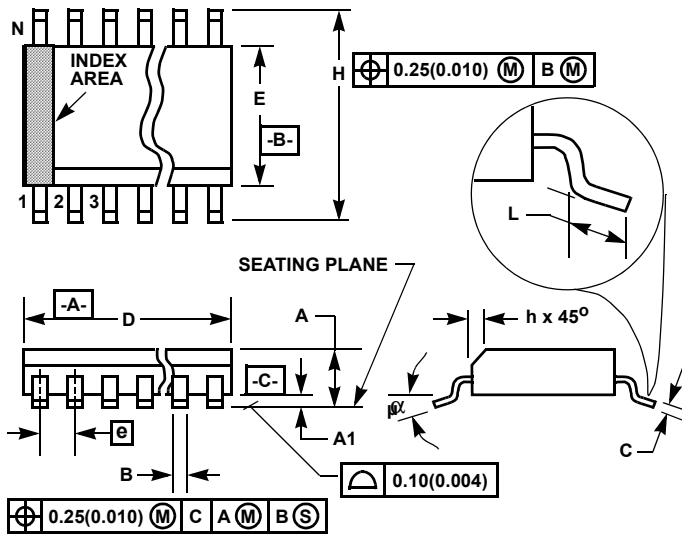
DIE DIMENSIONS:

46 mils x 32 mils

Metallization Mask Layout



Small Outline Plastic Packages (SOIC)



M16.15 (JEDEC MS-012-AC ISSUE C)
16 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN	MAX	MIN	MAX	
A	0.0532	0.0688	1.35	1.75	-
A1	0.0040	0.0098	0.10	0.25	-
B	0.013	0.020	0.33	0.51	9
C	0.0075	0.0098	0.19	0.25	-
D	0.3859	0.3937	9.80	10.00	3
E	0.1497	0.1574	3.80	4.00	4
e	0.050 BSC		1.27 BSC		-
H	0.2284	0.2440	5.80	6.20	-
h	0.0099	0.0196	0.25	0.50	5
L	0.016	0.050	0.40	1.27	6
N	16		16		7
α	0°	8°	0°	8°	-

NOTES:

- Symbols are defined in the "MO Series Symbol List" in Section 2.2 of Publication Number 95.
- Dimensioning and tolerancing per ANSI Y14.5M-1982.
- Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion and gate burrs shall not exceed 0.15mm (0.006 inch) per side.
- Dimension "E" does not include interlead flash or protrusions. Interlead flash and protrusions shall not exceed 0.25mm (0.010 inch) per side.
- The chamfer on the body is optional. If it is not present, a visual index feature must be located within the crosshatched area.
- "L" is the length of terminal for soldering to a substrate.
- "N" is the number of terminal positions.
- Terminal numbers are shown for reference only.
- The lead width "B", as measured 0.36mm (0.014 inch) or greater above the seating plane, shall not exceed a maximum value of 0.61mm (0.024 inch).
- Controlling dimension: MILLIMETER. Converted inch dimensions are not necessarily exact.

Rev. 0 12/93

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