Preliminary

SGA-5489

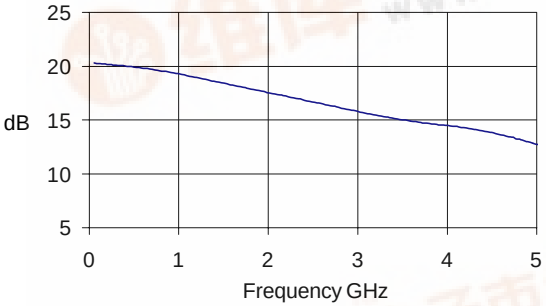
DC-4000 MHz Silicon Germanium HBT Cascadeable Gain Block

Product Description

Stanford Microdevices' SGA-5489 is a high performance cascadeable 50-ohm amplifier designed for operation at voltages as low as 3.3V. This RFIC uses the latest Silicon Germanium Heterostructure Bipolar Transistor (SiGe HBT) process featuring 1 micron emitters with F_T up to 50 GHz.

This circuit uses a darlington pair topology with resistive feedback for broadband performance as well as stability over its entire temperature range. Internally matched to 50 ohm impedance, the SGA-5489 requires only DC blocking and bypass capacitors for external components.

Small Signal Gain vs. Frequency



Product Features

- **DC-4000 MHz Operation**
- **Single Voltage Supply**
- **High Output Intercept: +30.8dBm typ. at 850 MHz**
- **Low Current Draw: 60mA at 3.3V typ.**
- **Low Noise Figure: 2.8dB typ. at 850 MHz**

Applications

- **Oscillator Amplifiers**
- **PA for Low Power Applications**
- **IF/ RF Buffer Amplifier**
- **Drivers for CATV Amplifiers**

Symbol	Parameters: Test Conditions: Z_0 = 50 Ohms, I_D = 60 mA, T = 25°C		Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1dB Compression	f = 850 MHz f = 1950 MHz f = 2400 MHz	dBm dBm dBm		16.0 14.6 13.5	
IP_3	Third Order Intercept Point Power out per tone = 0 dBm	f = 850 MHz f = 1950 MHz f = 2400 MHz	dBm dBm dBm		30.8 27.4 25.7	
S_{21}	Small Signal Gain	f = 850 MHz f = 1950 MHz f = 2400 MHz	dB dB dB		19.7 17.9 17.1	
BW_{3dB}	3dB Bandwidth		MHz		2100	
Bandwidth	(Determined by S_{11}, S_{22} Values)		MHz		4000	
S_{11}	Input VSWR	f = DC-5000 MHz	-		1.50:1	
S_{22}	Output VSWR	f = DC-5000 MHz	-		1.50:1	
S_{12}	Reverse Isolation	f = 850 MHz f = 1950 MHz f = 2400 MHz	dB dB dB		23.5 23.5 23.1	
NF	Noise Figure, Z_S = 50 Ohms	f = 1950 MHz	dB		2.4	
V_D	Device Voltage		V	3.1	3.3	4.1
$R_{th,j-l}$	Thermal Resistance (junction - lead)		° C/W		97	

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Absolute Maximum Ratings

Operation of this device above any one of these parameters may cause permanent damage.

Bias Conditions should also satisfy the following expression:
$I_D V_D$ (max) < (T_J - T_{OP})/Rth, j-l

Parameter	Value	Unit
Supply Current	120	mA
Operating Temperature	-40 to +85	C
Maximum Input Power	+10	dBm
Storage Temperature Range	-40 to +150	C
Operating Junction Temperature	+150	C

Key parameters, at typical operating frequencies:

Parameter	Typical 25°C	Unit	Test Condition (I_D = 60 mA, unless otherwise noted)
500 MHz			
Gain	20.2	dB	
Noise Figure	3.0	dB	Z_S = 50 Ohms
Output IP3	31.3	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	16.3	dBm	
Input Return Loss	20.3	dB	
Isolation	23.3	dB	
850 MHz			
Gain	19.7	dB	
Noise Figure	2.8	dB	Z_S = 50 Ohms
Output IP3	30.8	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	16.0	dBm	
Input Return Loss	17.5	dB	
Isolation	23.5	dB	
1950 MHz			
Gain	17.9	dB	
Noise Figure	2.4	dB	Z_S = 50 Ohms
Output IP3	27.4	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	14.6	dBm	
Input Return Loss	15.2	dB	
Isolation	23.5	dB	
2400 MHz			
Gain	17.1	dB	
Noise Figure	3.7	dB	Z_S = 50 Ohms
Output IP3	25.7	dBm	Tone spacing = 1 MHz, Pout per tone = 0 dBm
Output P1dB	13.5	dBm	
Input Return Loss	14.7	dB	
Isolation	23.1	dB	

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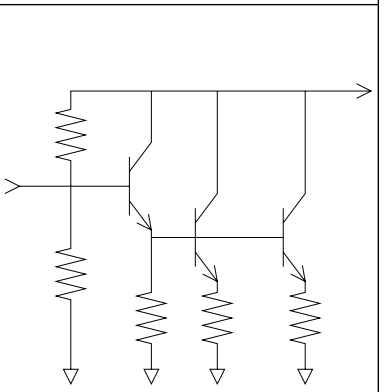
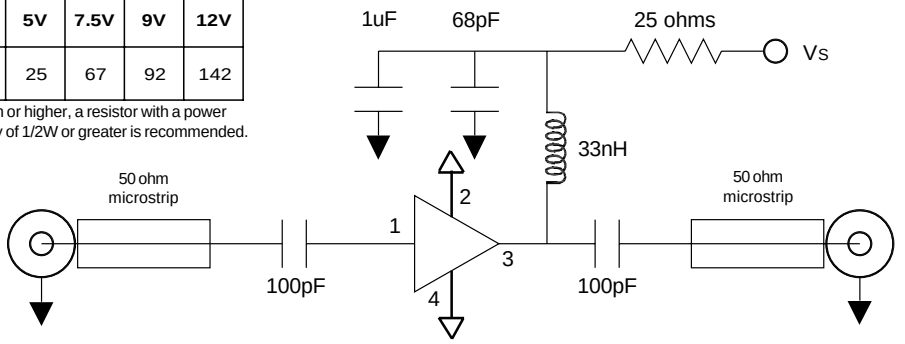
Pin #	Function	Description	Device Schematic
1	RF IN	RF input pin. This pin requires the use of an external DC blocking capacitor chosen for the frequency of operation.	
2	GND	Connection to ground. Use via holes for best performance to reduce lead inductance. Place vias as close to ground leads as possible.	
3	RF OUT/Vcc	RF output and bias pin. Bias should be supplied to this pin through an external series resistor and RF choke inductor. Because DC biasing is present on this pin, a DC blocking capacitor should be used in most applications (see application schematic). The supply side of the bias network should be well bypassed.	
4	GND	Same as Pin 2.	

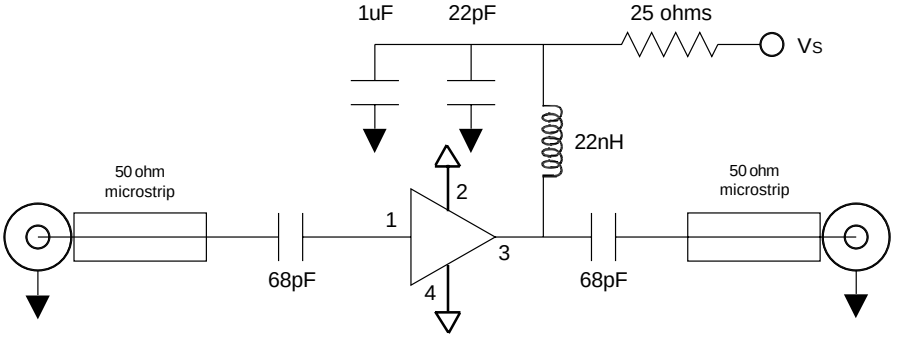
Application Schematic for Operation at 850 MHz

Recommended Bias Resistor Values				
Supply Voltage(Vs)	5V	7.5V	9V	12V
Rbias (Ohms)	25	67	92	142

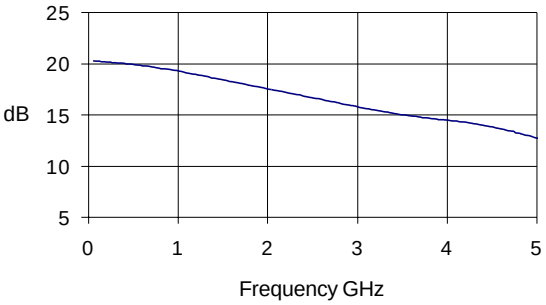
For 7.5V operation or higher, a resistor with a power handling capability of 1/2W or greater is recommended.



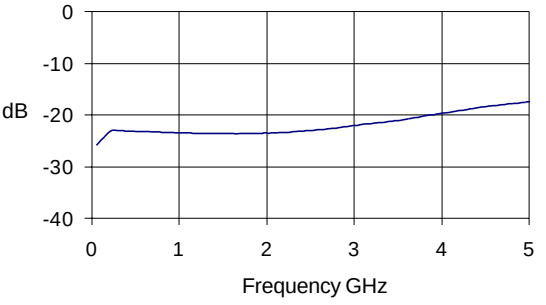
Application Schematic for Operation at 1950 MHz



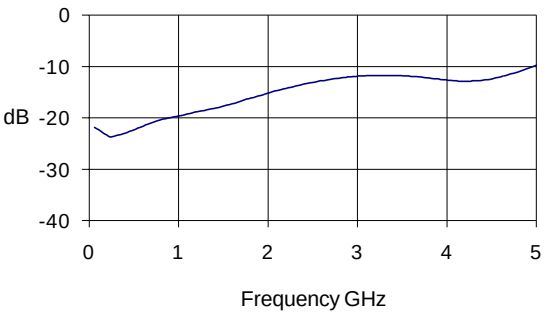
S21, I_D=60mA, T=+25C



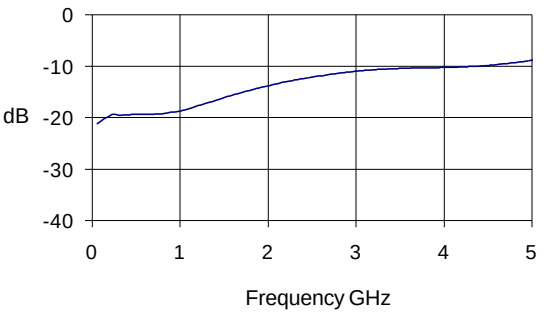
S12, I_D =60mA, T=+25C



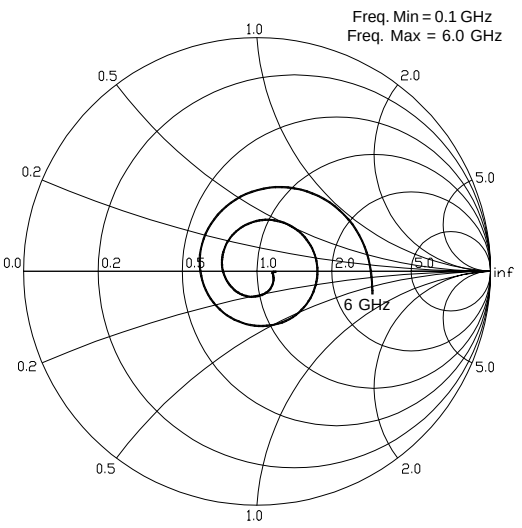
S11, I_D =60mA, T=+25C



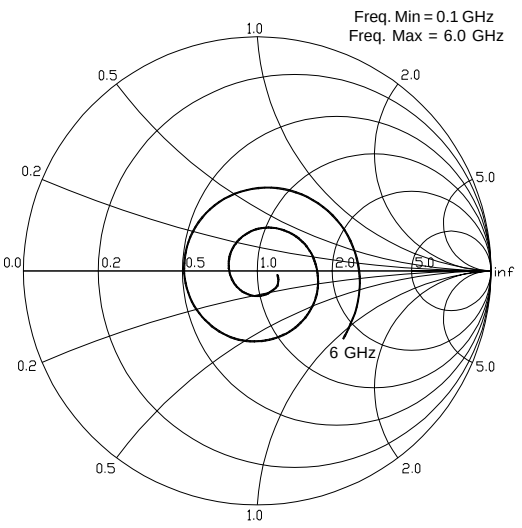
S22, I_D =60mA, T=+25C



S11, I_D=60mA, Ta=25C



S22, I_D=60mA, Ta=25C



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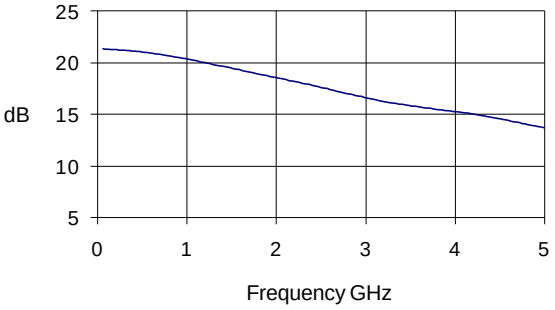
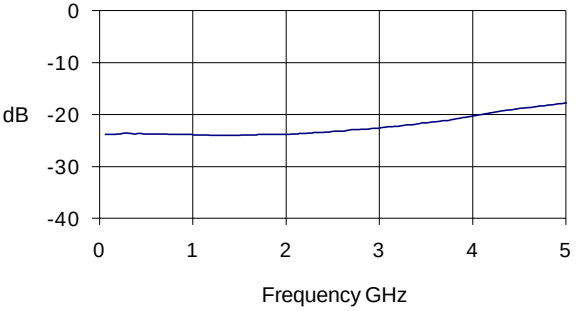
S21, I_D =60mA, T=-40C



S12, I_D =60mA, T=-40C



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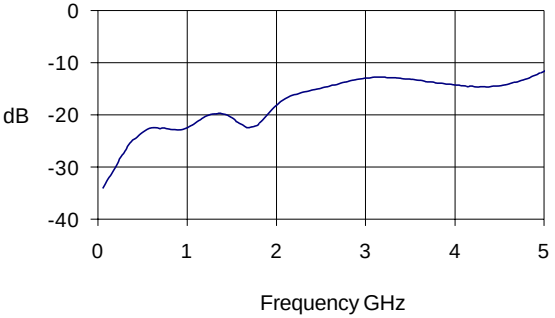

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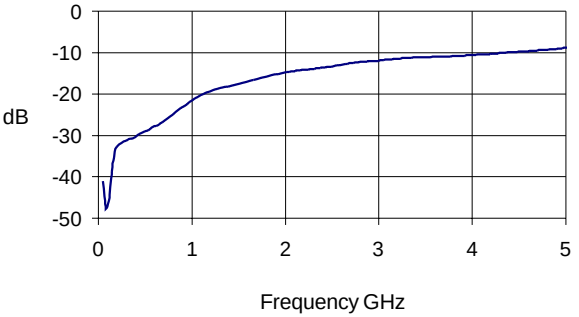

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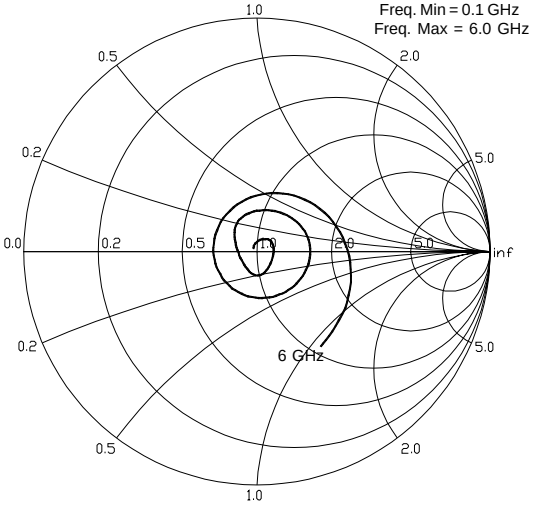
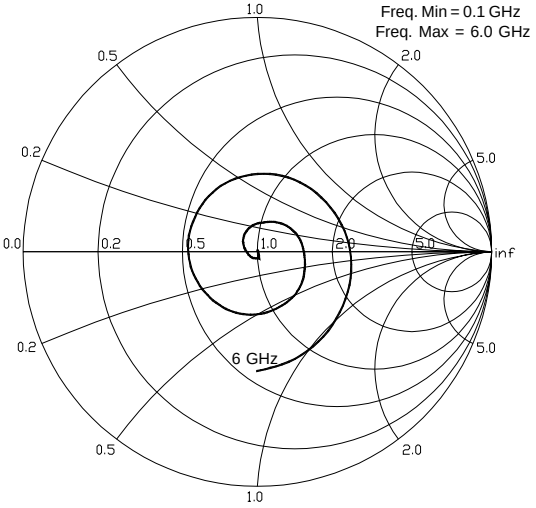
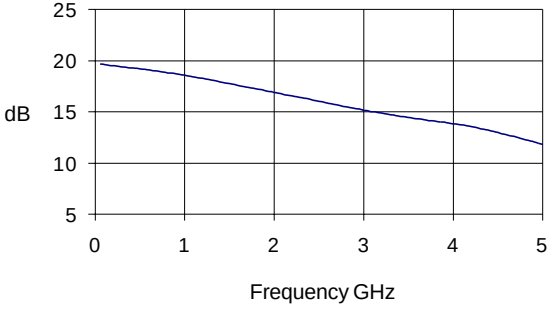


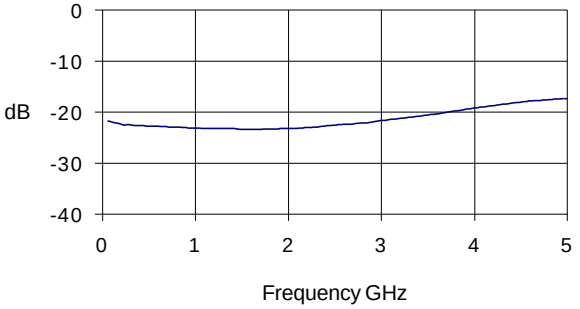
S22, I_D=60mA, Ta= -40C



S21, I_D =60mA, T=85C



S12, I_D =60mA, T=85C



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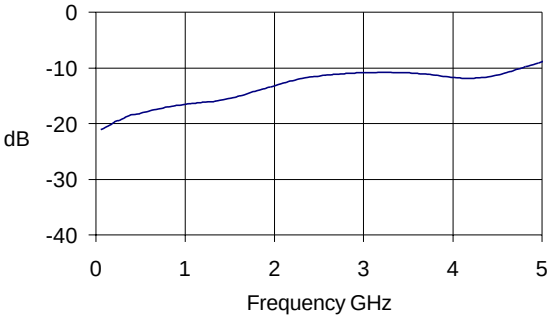

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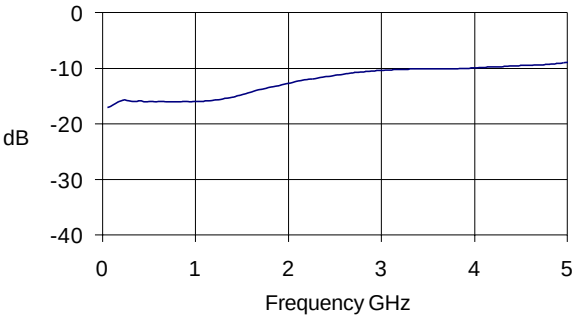

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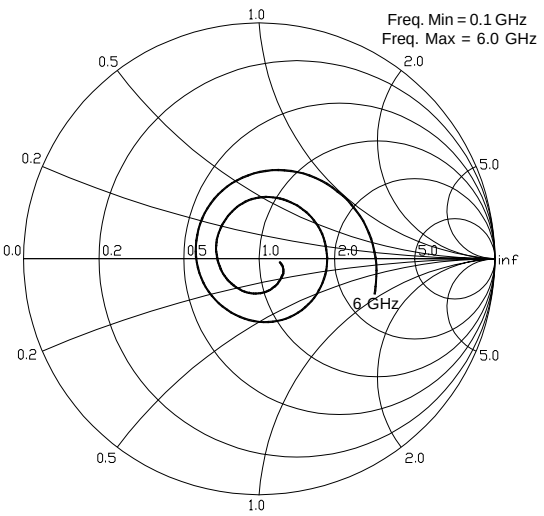

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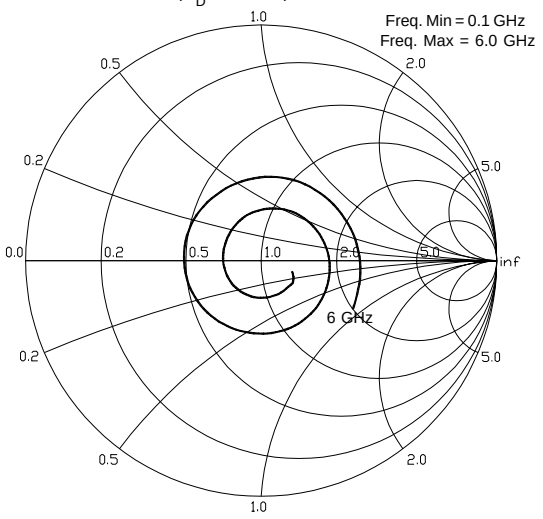

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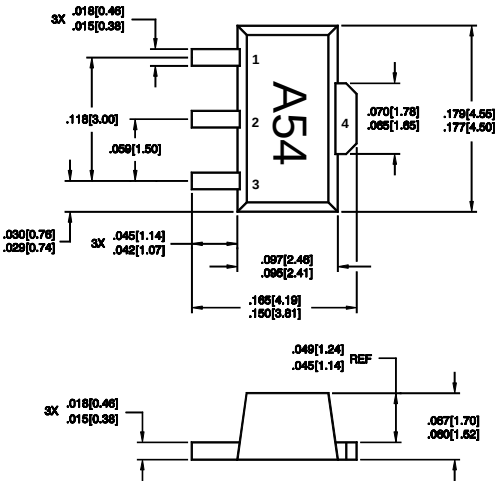
Caution ESD Sensitive:
Appropriate precautions in handling, packaging and testing devices must be observed.

Part Number Ordering Information

Part Number	Reel Size	Devices/Reel
SGA-5489	13"	3000

Package Dimensions

Outline Drawing



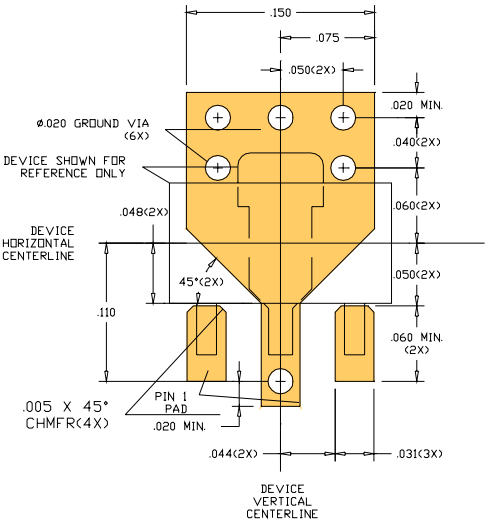
DIMENSIONS ARE IN INCHES [MM]

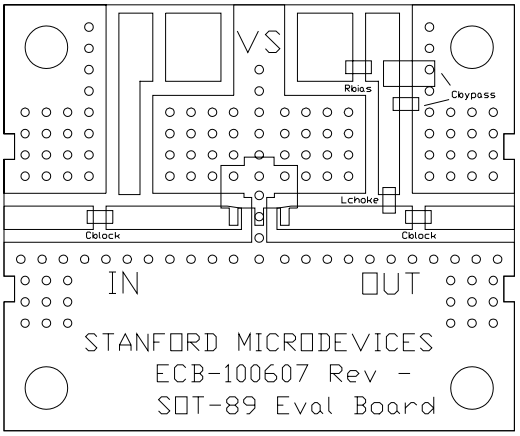
Pin assignments shown for reference only, not marked on part

Part Symbolization

The part will be symbolized with a "A54" designator on the top surface of the package.

PCB Pad Layout

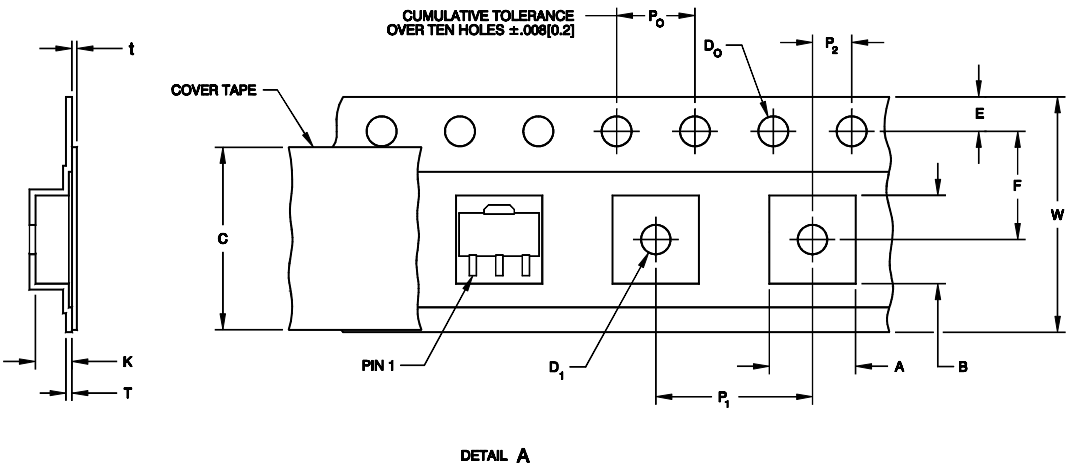




Component Tape and Reel Packaging

Tape Dimensions

For 89 Outline



Description		Symbol	Size (mm)
Cavity	Length	A	4.91 +/- 0.01
	Width	B	4.52 +/- 0.01
	Depth	K	1.90 +/- 0.01
	Pitch	P_1	8.00 +/- 0.01
	Bottom Hole Diameter	D_1	1.60 +/- 0.10
Perforation	Diameter	D_0	1.55 +/- 0.05
	Pitch	P_0	4.00 +/- 0.01
	Position	E	1.75 +/- 0.01
Cover Tape	Width	C	9.10 +/- 0.25
	Tape Thickness	t	0.05 +/- 0.01
Carrier Tape	Width	W	12.0 +/- 0.03
	Thickness	T	0.30 +/- 0.05
Distance	Cavity to Perforation (Width Direction)	F	5.50 +/- 0.10
	Cavity to Perforation (Length Direction)	P_2	2.00 +/- 0.10