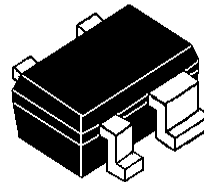




# START405

## NPN Silicon RF Transistor

- LOW NOISE FIGURE: NF<sub>min</sub> = 1.1dB  
@ 1.8GHz, 2mA, 2V
- COMPRESSION P1dB = 5dBm  
@ 1.8GHz, 5mA, 2V
- TRANSITION FREQUENCY 42GHz
- LOW CURRENT CONSUMPTION
- ULTRA MINIATURE SOT343 PACKAGE



SOT343 (SC70)

**ORDER CODE**  
START405TR

**BRANDING**  
405

### DESCRIPTION

The START405 is a member of the START family that provide the state of the art of RF silicon process to the market. Manufactured in the third generation of ST proprietary bipolar process, it offers the best mix of gain and NF for given breakdown voltage(BV<sub>ceo</sub>).

It offers performance level only archived with GaAs products before.

### APPLICATIONS

- LNA FOR GSM/DCS, DECT, PCS, PCN, CDMA, W-CDMA
- GENERAL PURPOSE 500MHz-5GHz

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>ceo</sub>	Collector emitter voltage	4.5	V
V <sub>cbo</sub>	Collector base voltage	15	V
V <sub>ebo</sub>	Emitter base voltage	1.5	V
I <sub>c</sub>	Collector current	10	mA
I <sub>b</sub>	Base current	1	mA
P <sub>tot</sub>	Total dissipation, T <sub>s</sub> = TBD	45	mW
T <sub>stg</sub>	Storage temperature	-65 to 150	°C
T <sub>j</sub>	Max. operating junction temperature	150	°C

### ABSOLUTE MAXIMUM RATINGS

R <sub>thjs</sub>	Thermal Resistance Junction soldering point	270	°C/W
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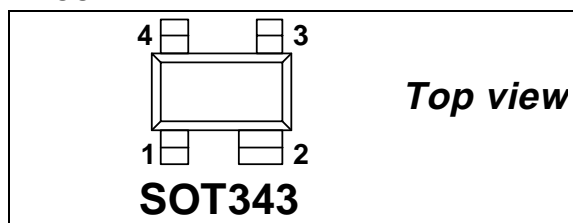
## START405

### ELECTRICAL CHARACTERISTICS ( $T_j=25\text{ }^\circ\text{C}$ , unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{cbo}$	Collector cutoff current	$V_{cb} = 5V, I_e = 0A$			150	nA
$I_{ebo}$	Emitter-base cutoff current	$V_{eb} = 1.5V, I_c = 0A$			15	$\mu A$
Hfe	DC current gain	$I_c = 5mA, V_{ce} = 4V$		160		
NFmin	Minimum noise figure	$I_c = 2mA, V_{ce} = 2V, f = 1.8GHz$		1.1		dB
Ga	NFmin associated gain	$I_c = 2mA, V_{ce} = 2V, f = 1.8GHz$		19		dB
$ S_{21} ^2$	Insertion power gain	$I_c = 5mA, V_{ce} = 2V, f = 1.8GHz$		17.4		dB
Gms <sup>(1)</sup>	Maximum stable gain	$I_c = 5mA, V_{ce} = 2V, f = 1.8GHz$		24.2		dB
P <sub>-1dB</sub>	1dB compression point	$I_c = 5mA, V_{ce} = 2V, f = 1.8GHz$		5		dBm
OIP3	Output third order intercept point	$I_c = 5mA, V_{ce} = 2V, f = 1.8GHz$		15		dBm

Note(1):  $G_{ms} = |S_{21} / S_{12}|$

### PINOUT



### PIN CONNECTION

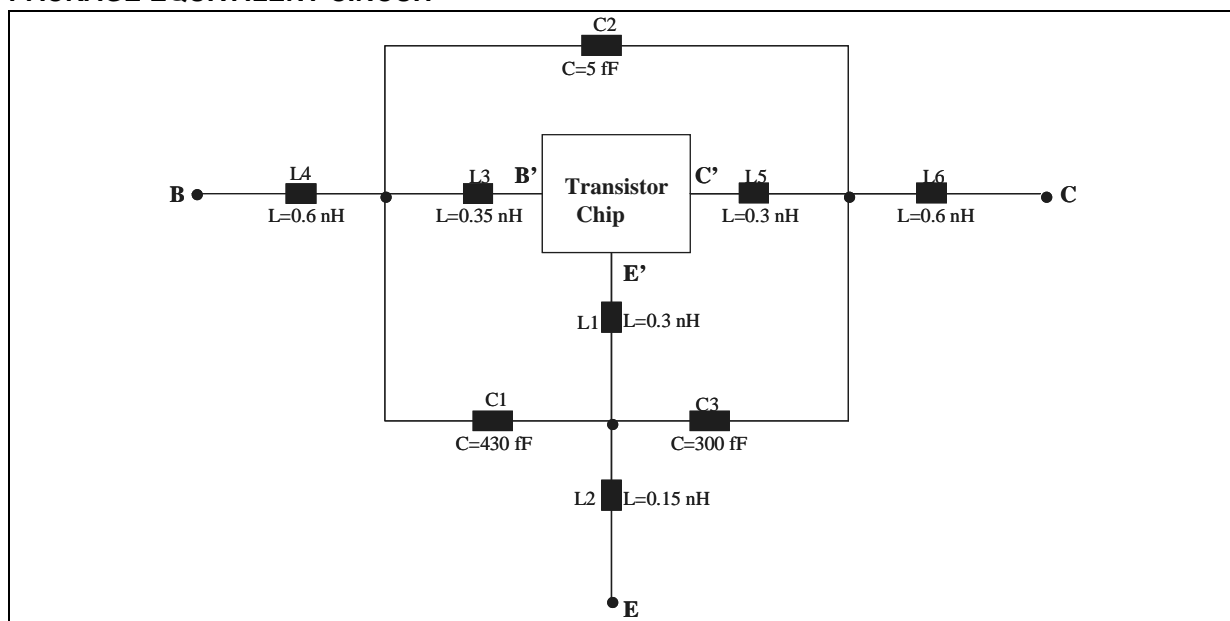
Pin No.	Description
1	BASE
3	COLLECTOR
2,4	EMITTER

**SPICE PARAMETERS (Gummel-Poon Model, Berkley-SPICE 2G.6 Syntax)**

**TRANSISTOR CHIP DATA**

Symbol	Value	Symbol	Value	Symbol	Value
TMEAS	27.0	FC	0.5	XJBC	0.3
IS	1.9E-17	EG	1.12	XTI	3.57
ISE	1.58E-13	NF	1	BF	340
NR	1	NE	2.711	VAF	79
ISC	7.40E-17	BR	8.59	VAR	2.35
IKF	{0.151*((T(°C)+273.15)/300.15)^(-1.774)}	NC	1.312	TF	4.1E-12
TR	7E-10	PTF	38	VTF	14.7
XTF	42	ITF	0.42	MJE	0.414
RB	34.07	RBM	6.1	MJC	0.266
RC	7.9	RE	1.25	MJS	0.22
CJE	111E-15	VJE	1.1	IKR	2.29E-3
CJC	53E-15	VJC	0.69	XTB	-0.744
CJS	33E-15	VJS	0.4		

**PACKAGE EQUIVALENT CIRCUIT**



In order to avoid high complexity of the package equivalent circuit, the two emitter leads of SOT-343 package are combined in one electrical connection.

**FOR MORE ACCURACY SIMULATION IN SATURATION REGION :**

Adding the 5 Spice parameters showed in Table A and using **ST Spice Library** (available on request) you can achieve a more accuracy simulation in the saturation region. ST Spice library is compatible with following simulators: ELDO MENTOR (any version), SPECTRE CADENCE (any version), ADS (version 2001 only).

**Table A (Spice Parameters extracted in saturation region)**

RW	Vjj	ENP	VRP	RP
2.594	0.769	2.045	{8.67*((TEMPER+273.15)/300.15)^(0.839)}	1.00E-6

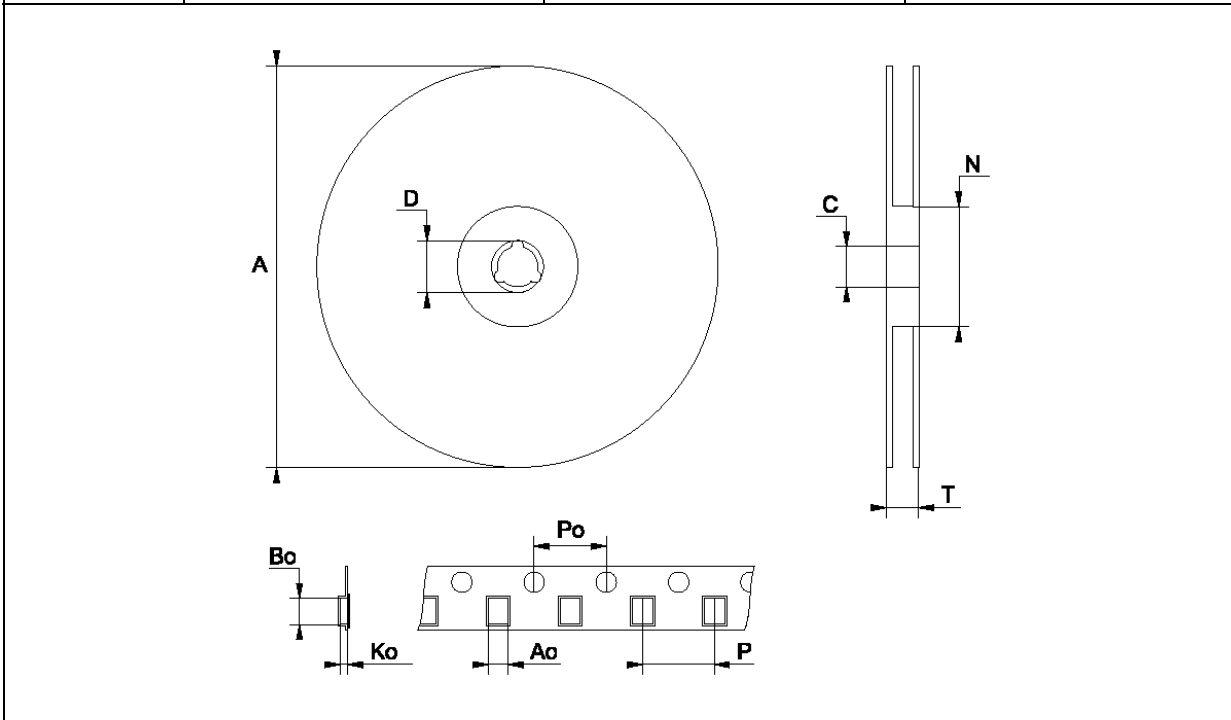
## START405

### COMMON EMITTER S-PARAMETERS ( $V_{CE} = 2V$ , $I_C = 5mA$ )

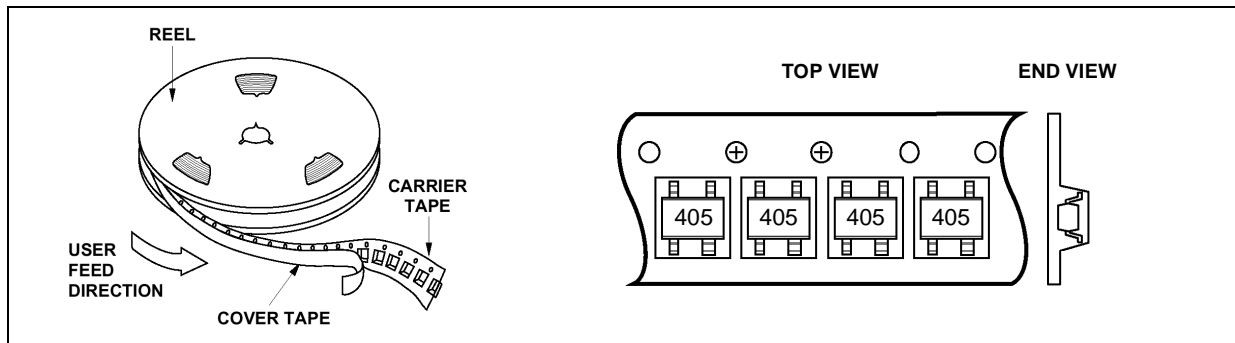
FREQ (MHz)	$ S_{11} $	$S_{11}\angle\Phi$	$ S_{21} $	$S_{21}\angle\Phi$	$ S_{12} $	$S_{12}\angle\Phi$	$ S_{22} $	$S_{22}\angle\Phi$
0.1	0.903	-5	12.29	176	0.007	95	0.991	-2
0.5	0.882	-23	10.96	174	0.014	97	0.971	-11
0.9	0.825	-38	9.71	174	0.021	98	0.918	-19
1	0.809	-41	9.42	175	0.022	99	0.906	-20
1.5	0.713	-53	8.11	177	0.027	107	0.850	-24
1.8	0.674	-58	7.43	180	0.028	114	0.829	-27
2	0.642	-61	6.99	178	0.028	122	0.820	-28
2.5	0.579	-64	6.01	172	0.028	148	0.815	-30
3	0.523	-64	5.12	164	0.030	175	0.815	-31
3.5	0.462	-67	4.31	156	0.039	131	0.787	-35
4	0.372	-78	3.48	146	0.065	94	0.644	-41

TAPE & REEL DIMENSIONS

	mm		
	MIN.	TYP.	MAX
A	178.5	179	179.5
C	12.8	13.0	13.5
D	20.2		
N	54.5	55	55.5
T			14.4
Ao		2.25	
Bo		2.7	
Ko		1.2	
Po	3.8 (cumulative 10 Po)	4.0	4.2 (cumulative 10 Po)
P		4.0	

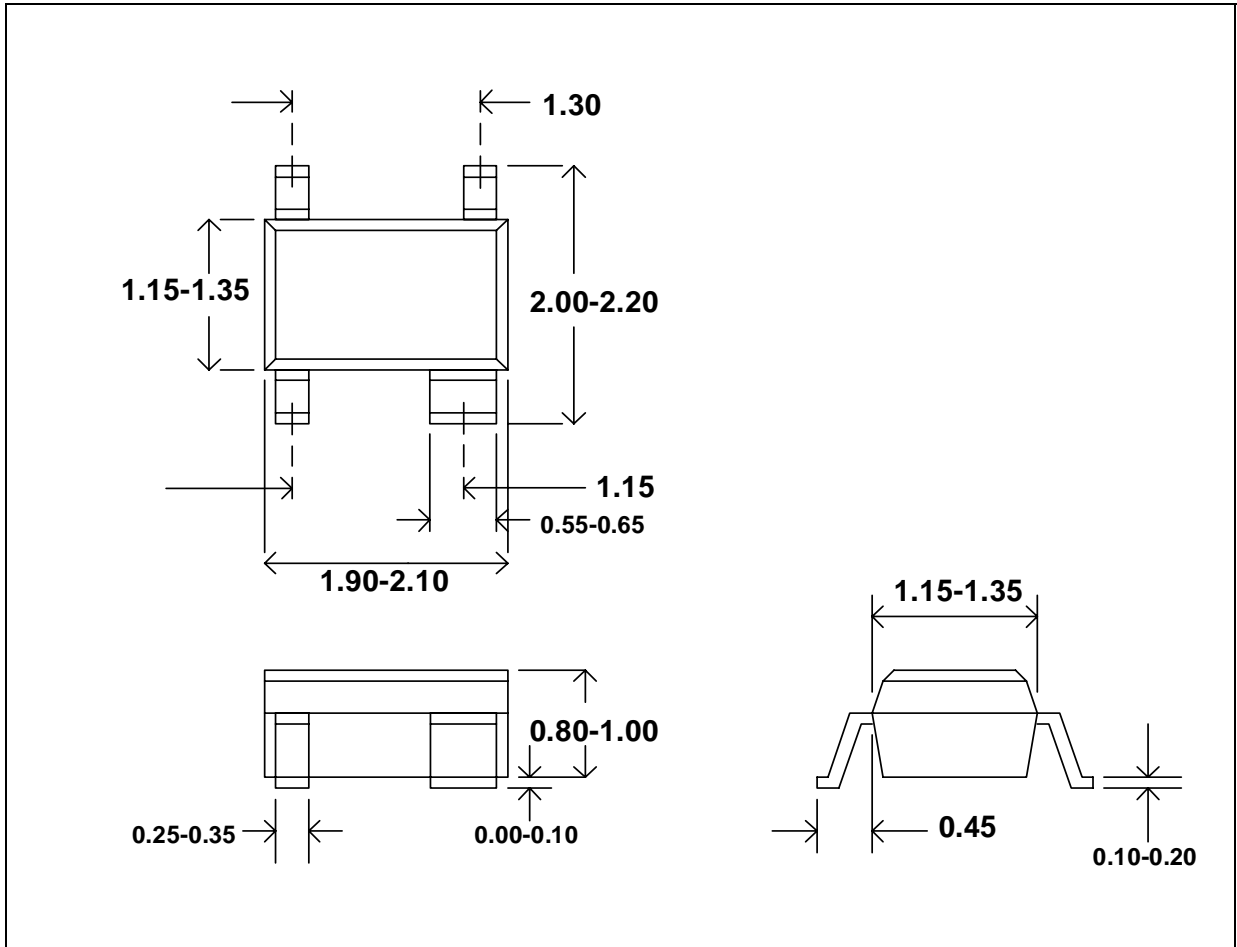


DEVICE ORIENTATION



**START405**

**PACKAGE DIMENSIONS SOT343 (SC-70 4 leads)**



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