Ordering number : ENA1120A

2SC5646A

RF Transistor
4V, 30mA, f_T=12.5GHz, NPN Single SSFP

ON Semiconductor®
http://onsemi.com

Features

- Low-noise : NF=1.5dB typ (f=2GHz)
- High cut-off frequency : f_T=10GHz typ (V_{CE}=1V)
  : f_T=12.5GHz typ (V_{CE}=3V)
- Low-voltage operation
- High gain : $|S21e|^2$=9.5dB typ (f=2GHz)
- Ultrasmall, slim flat-lead package (1.4mm×0.8mm×0.6mm)
- Halogen free compliance

Specifications

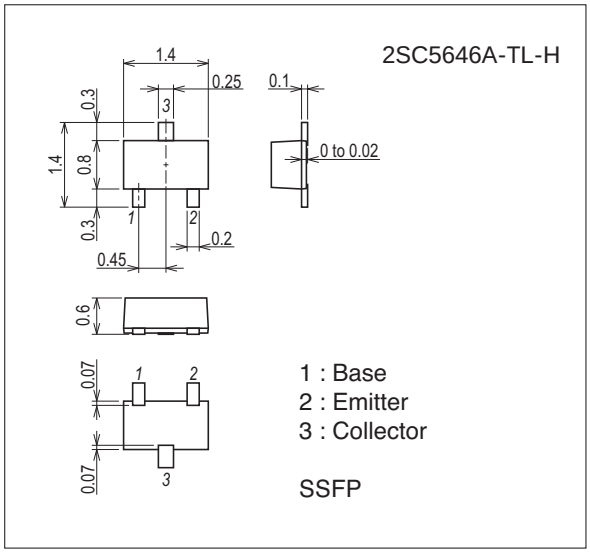
Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CBO}		9	V
Collector-to-Emitter Voltage	V_{CEO}		4	V
Emitter-to-Base Voltage	V_{EBO}		2	V
Collector Current	I_C		30	mA
Collector Dissipation	P_C		100	mW
Junction Temperature	Tj		150	°C
Storage Temperature	Tstg		−55 to +150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Package Dimensions

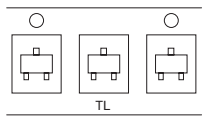
unit : mm (typ)
7029A-002



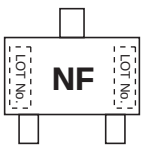
Product & Package Information

- Package : SSFP
- JEITA, JEDEC : SC-81
- Minimum Packing Quantity : 8,000 pcs./reel

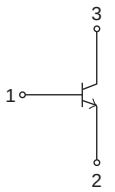
Packing Type: TL



Marking



Electrical Connection



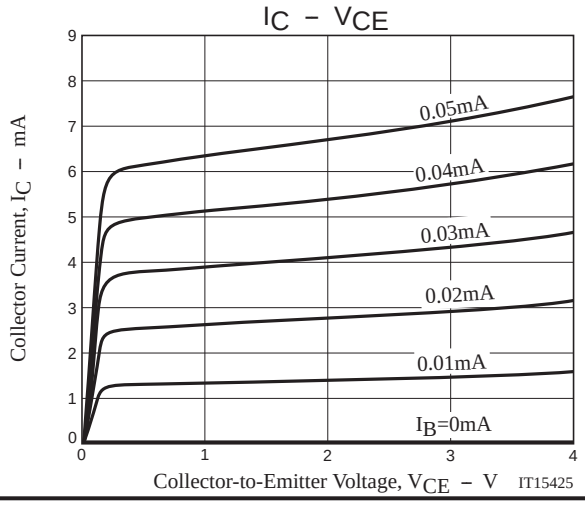
Semiconductor Components Industries, LLC, 2013

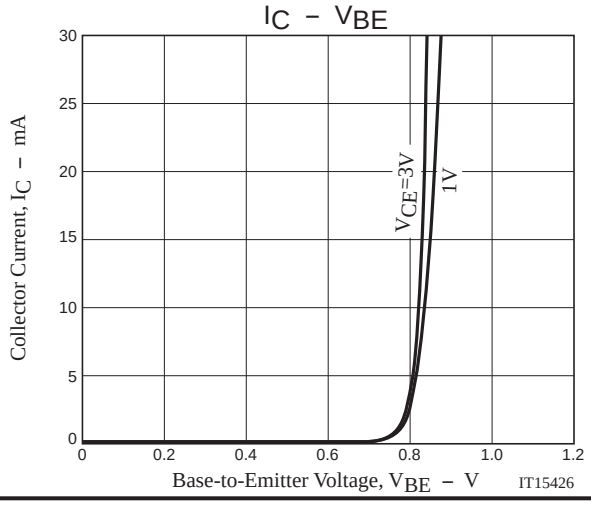
Electrical Characteristics at Ta=25°C

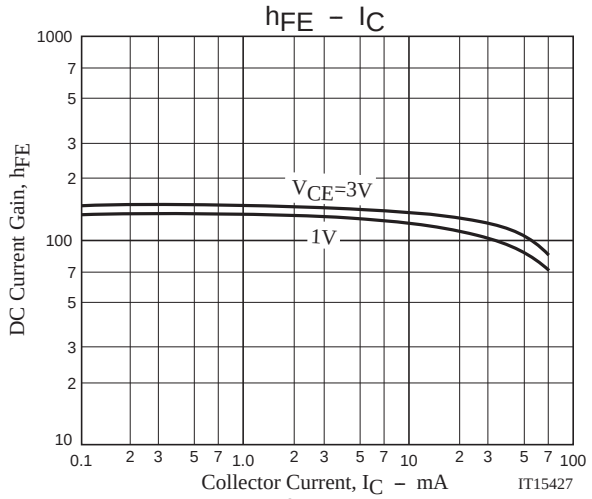
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	V_{CB}=5V, I_E=0A			1.0	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0A			10	μA
DC Current Gain	h_{FE}	V_{CE}=1V, I_C=5mA	100		160	
Gain-Bandwidth Product	f_T1	V_{CE}=1V, I_C=5mA	8	10		GHz
	f_T2	V_{CE}=3V, I_C=15mA		12.5		GHz
Output Capacitance	Cob	V_{CB}=1V, f=1MHz		0.55	0.7	pF
Reverse Transfer Capacitance	Cre			0.4		pF
Forward Transfer Gain	$\|S21e\|^2 1$	V_{CE}=1V, I_C=5mA, f=2GHz	8	9.5		dB
	$\|S21e\|^2 2$	V_{CE}=3V, I_C=15mA, f=2GHz		10.5		dB
Noise Figure	NF	V_{CE}=1V, I_C=3mA, f=2GHz		1.5	2.3	dB

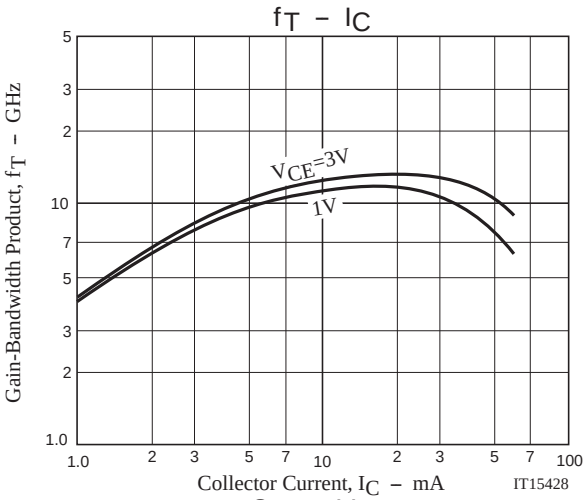
Ordering Information

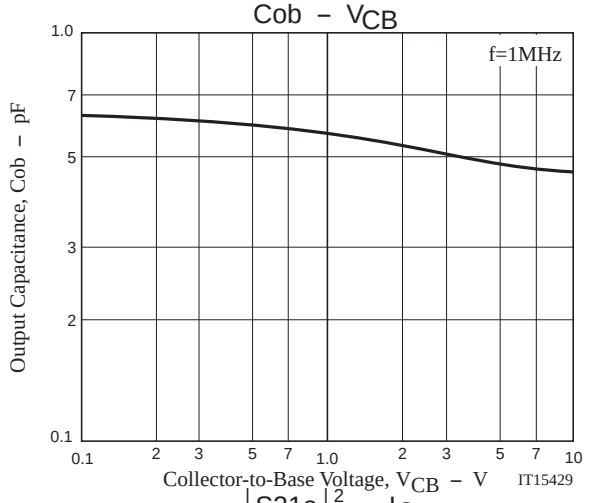
Device	Package	Shipping	memo
2SC5646A-TL-H	SSFP	8,000pcs./reel	Pb Free and Halogem Free

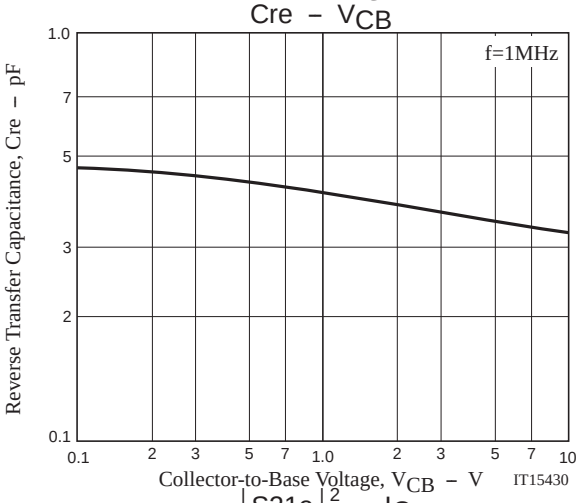


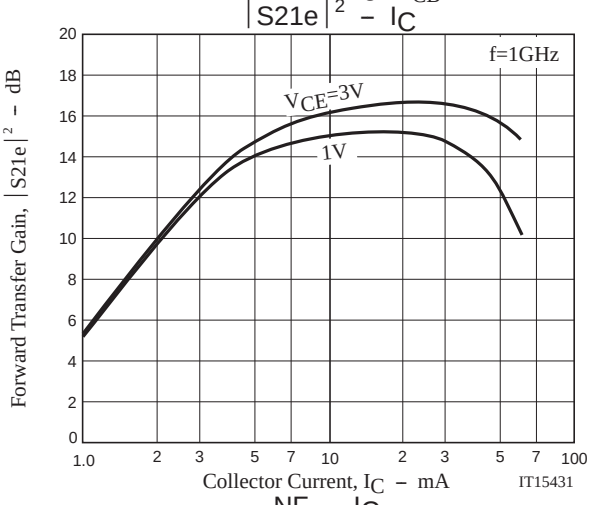


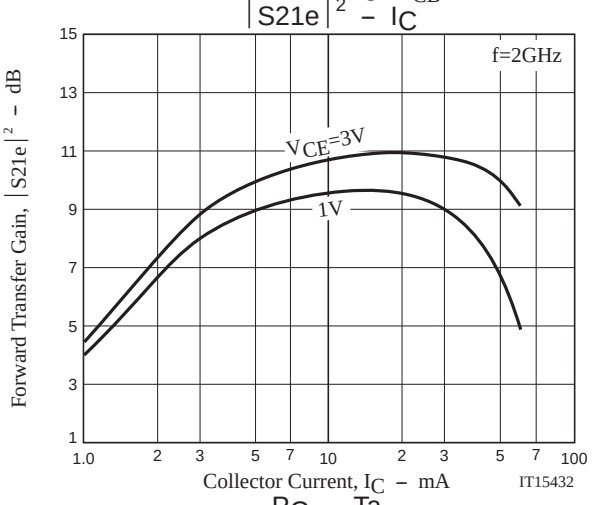

hFE – IC
DC Current Gain, hFE
VCE=3V
1V
Collector Current, IC – mA
IT15427

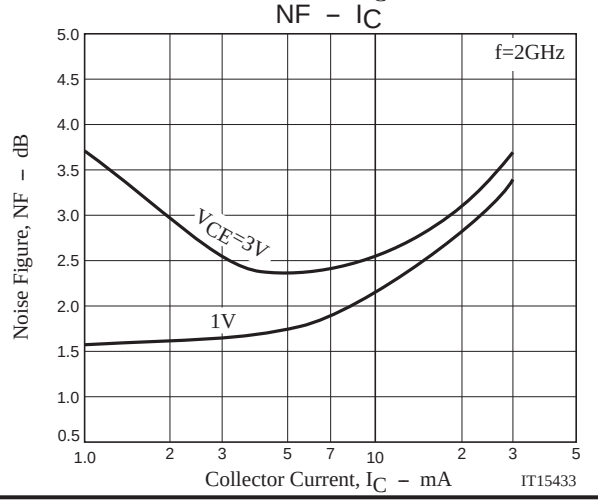

fT – IC
Gain-Bandwidth Product, fT – GHz
VCE=3V
1V
Collector Current, IC – mA
IT15428

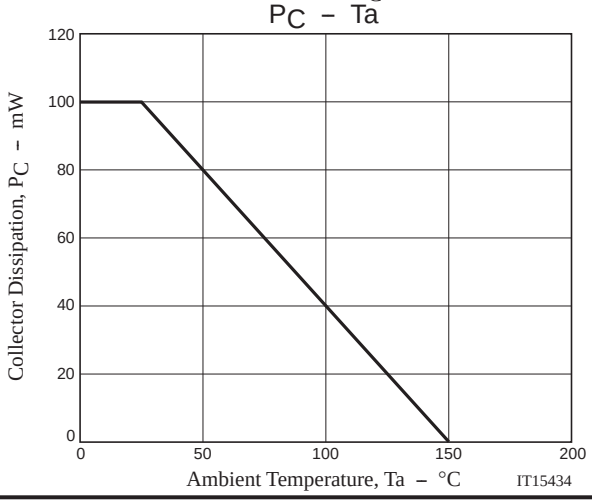

Cob – VCB
f=1MHz
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
IT15429


Cre – VCB
f=1MHz
Reverse Transfer Capacitance, Cre – pF
Collector-to-Base Voltage, VCB – V
IT15430


|S21e|2 – IC
f=1GHz
VCE=3V
1V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
IT15431


|S21e|2 – IC
f=2GHz
VCE=3V
1V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
IT15432


NF – IC
f=2GHz
VCE=3V
1V
Noise Figure, NF – dB
Collector Current, IC – mA
IT15433


PC – Ta
Collector Dissipation, PC – mW
Ambient Temperature, Ta – °C
IT15434

S Parameters (Common emitter)

V_{CE}=1V, I_C=1mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.967	-13.5	2.360	164.5	0.050	74.0	0.982	-11.4
400	0.929	-26.2	2.289	150.8	0.093	67.5	0.933	-21.8
600	0.888	-36.3	1.944	138.2	0.128	58.3	0.878	-31.2
800	0.821	-51.9	2.239	128.0	0.156	50.6	0.819	-38.6
1000	0.773	-61.9	2.046	119.0	0.172	44.5	0.763	-45.2
1200	0.724	-72.5	1.952	110.3	0.190	39.5	0.717	-50.9
1400	0.662	-84.6	1.956	101.8	0.198	35.4	0.675	-56.1
1600	0.629	-91.8	1.777	95.0	0.204	31.7	0.642	-60.9
1800	0.589	-101.5	1.720	88.5	0.206	29.3	0.612	-65.0
2000	0.554	-110.4	1.649	82.4	0.208	27.2	0.589	-69.1
2200	0.537	-116.0	1.521	76.7	0.207	25.9	0.569	-73.0
2400	0.510	-124.3	1.473	71.7	0.207	24.8	0.555	-76.4
2600	0.496	-130.1	1.393	67.1	0.203	24.4	0.543	-80.2
2800	0.481	-136.1	1.328	62.6	0.201	24.2	0.533	-83.4
3000	0.468	-142.2	1.280	58.5	0.199	25.1	0.527	-86.8

V_{CE}=1V, I_C=5mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.826	-30.9	9.413	151.9	0.039	70.9	0.866	-27.2
400	0.679	-61.6	8.593	130.9	0.068	56.4	0.681	-44.5
600	0.576	-83.1	7.017	117.1	0.082	49.2	0.547	-55.2
800	0.485	-105.2	6.080	105.2	0.091	47.6	0.457	-61.3
1000	0.436	-120.0	5.151	97.1	0.098	48.0	0.398	-66.0
1200	0.408	-131.3	4.423	90.8	0.109	48.1	0.362	-69.5
1400	0.388	-140.8	3.896	85.3	0.115	49.4	0.331	-72.8
1600	0.376	-148.8	3.465	80.6	0.125	50.8	0.311	-76.1
1800	0.368	-155.4	3.122	76.4	0.132	51.6	0.297	-78.6
2000	0.363	-161.1	2.846	72.6	0.141	52.5	0.289	-81.8
2200	0.361	-166.5	2.621	68.8	0.150	53.6	0.280	-84.6
2400	0.358	-171.3	2.426	65.4	0.160	54.1	0.276	-87.5
2600	0.358	-175.7	2.262	62.1	0.171	54.7	0.273	-90.5
2800	0.357	-179.9	2.125	58.9	0.181	54.9	0.271	-93.3
3000	0.356	176.4	2.003	56.1	0.190	55.7	0.271	-96.4

V_{CE}=1V, I_C=10mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.680	-49.0	14.963	141.8	0.037	61.7	0.745	-37.5
400	0.504	-91.9	11.934	117.7	0.051	54.2	0.514	-55.1
600	0.426	-116.8	8.944	104.8	0.064	52.9	0.393	-63.2
800	0.389	-133.6	7.032	96.3	0.073	55.8	0.324	-68.3
1000	0.371	-145.4	5.768	90.2	0.083	57.7	0.282	-71.5
1200	0.362	-154.0	4.888	85.2	0.094	59.1	0.255	-74.0
1400	0.356	-161.3	4.240	80.8	0.105	60.4	0.239	-77.0
1600	0.352	-166.8	3.750	76.8	0.116	60.2	0.226	-79.4
1800	0.354	-172.1	3.363	73.2	0.128	61.2	0.221	-82.9
2000	0.353	-176.4	3.059	69.8	0.139	62.3	0.215	-86.1
2200	0.353	179.5	2.804	66.5	0.151	61.9	0.211	-88.9
2400	0.354	175.8	2.592	63.4	0.163	62.0	0.210	-91.8
2600	0.357	172.4	2.417	60.5	0.176	62.0	0.210	-95.3
2800	0.357	169.1	2.263	57.5	0.187	62.0	0.212	-98.4
3000	0.357	166.1	2.133	54.8	0.200	61.4	0.215	-101.4

S Parameters (Common emitter)

V_{CE}=1V, I_C=20mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.492	-82.8	19.544	128.7	0.030	59.2	0.601	-47.3
400	0.399	-124.0	13.186	107.6	0.042	57.9	0.381	-61.9
600	0.377	-143.8	9.339	97.6	0.052	61.4	0.284	-68.1
800	0.367	-155.4	7.181	91.0	0.065	64.4	0.235	-71.6
1000	0.364	-163.4	5.837	85.9	0.077	66.8	0.209	-74.0
1200	0.363	-169.7	4.913	81.5	0.089	66.5	0.192	-76.9
1400	0.363	-174.8	4.250	77.7	0.102	67.0	0.182	-79.9
1600	0.364	-178.8	3.751	74.1	0.114	67.7	0.178	-82.7
1800	0.365	177.3	3.361	70.8	0.128	67.4	0.174	-85.9
2000	0.367	173.9	3.049	67.6	0.142	67.5	0.173	-89.1
2200	0.369	170.8	2.798	64.5	0.154	67.0	0.174	-93.0
2400	0.372	167.9	2.584	61.5	0.166	66.4	0.175	-95.8
2600	0.373	165.1	2.403	58.6	0.178	66.0	0.178	-98.7
2800	0.375	162.3	2.254	55.9	0.194	65.3	0.180	-102.0
3000	0.378	159.8	2.119	53.2	0.207	64.8	0.185	-104.8

V_{CE}=3V, I_C=1mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.969	-12.0	2.363	165.7	0.043	77.2	0.981	-9.8
400	0.942	-23.4	2.289	153.2	0.076	71.1	0.950	-18.6
600	0.906	-32.6	1.955	141.5	0.107	62.0	0.903	-27.0
800	0.847	-46.8	2.285	131.9	0.131	54.9	0.853	-33.7
1000	0.804	-55.8	2.076	123.6	0.149	48.8	0.803	-39.9
1200	0.755	-65.9	2.018	115.0	0.163	44.0	0.761	-45.1
1400	0.694	-77.3	2.042	106.9	0.173	40.0	0.721	-49.8
1600	0.662	-84.0	1.857	100.1	0.179	35.6	0.691	-54.3
1800	0.618	-93.6	1.822	93.6	0.182	33.6	0.660	-58.2
2000	0.579	-102.1	1.755	87.5	0.183	31.4	0.637	-62.0
2200	0.560	-107.6	1.616	81.9	0.183	30.1	0.616	-65.6
2400	0.529	-116.0	1.582	76.7	0.182	29.1	0.600	-68.9
2600	0.510	-121.7	1.492	72.0	0.181	28.7	0.588	-72.4
2800	0.493	-127.9	1.428	67.5	0.180	29.6	0.577	-75.5
3000	0.475	-134.3	1.381	63.3	0.177	29.8	0.569	-78.8

V_{CE}=3V, I_C=5mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.849	-26.5	9.604	154.4	0.034	68.7	0.895	-22.2
400	0.716	-52.4	8.894	134.9	0.056	59.5	0.736	-37.2
600	0.615	-71.2	7.356	121.6	0.072	52.4	0.605	-46.2
800	0.503	-92.9	6.628	109.2	0.081	50.8	0.519	-51.4
1000	0.441	-107.5	5.685	100.8	0.088	50.2	0.460	-54.9
1200	0.402	-118.7	4.918	94.3	0.098	51.3	0.419	-57.5
1400	0.373	-129.0	4.350	88.6	0.104	52.5	0.390	-60.0
1600	0.355	-137.2	3.872	83.8	0.112	53.4	0.369	-62.3
1800	0.343	-144.4	3.502	79.5	0.120	54.1	0.352	-64.6
2000	0.332	-151.2	3.197	75.5	0.129	55.6	0.340	-67.1
2200	0.327	-156.8	2.940	71.8	0.136	56.2	0.332	-69.5
2400	0.322	-162.0	2.724	68.4	0.146	57.1	0.326	-72.0
2600	0.320	-167.1	2.541	65.0	0.156	58.0	0.322	-74.8
2800	0.319	-171.4	2.384	61.9	0.165	58.4	0.319	-77.2
3000	0.317	-175.6	2.247	58.9	0.175	58.8	0.316	-80.1

S Parameters (Common emitter)

V_{CE}=3V, I_C=10mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.721	-40.7	15.749	145.6	0.028	64.8	0.794	-30.5
400	0.531	-78.2	13.000	122.1	0.046	57.2	0.583	-44.9
600	0.428	-102.2	9.969	108.6	0.056	58.2	0.458	-51.3
800	0.372	-120.2	7.950	99.6	0.066	56.8	0.387	-54.3
1000	0.342	-133.0	6.549	93.0	0.077	59.1	0.344	-56.1
1200	0.325	-142.5	5.564	87.9	0.084	60.8	0.314	-57.6
1400	0.316	-150.8	4.833	83.4	0.095	61.6	0.296	-59.3
1600	0.309	-157.5	4.276	79.4	0.106	63.2	0.284	-61.2
1800	0.306	-162.9	3.835	75.8	0.117	63.7	0.275	-63.4
2000	0.304	-168.1	3.486	72.4	0.128	64.3	0.268	-65.7
2200	0.304	-172.5	3.197	69.2	0.138	64.2	0.263	-67.8
2400	0.304	-176.5	2.955	66.1	0.149	64.3	0.261	-70.8
2600	0.305	179.5	2.753	63.1	0.161	64.6	0.260	-73.5
2800	0.308	176.0	2.576	60.2	0.172	64.3	0.258	-76.4
3000	0.308	172.8	2.423	57.5	0.184	64.2	0.259	-78.9

V_{CE}=3V, I_C=20mA, Z_O=50Ω

Freq(MHz)	|S11|	∠S11	|S21|	∠S21	|S12|	∠S12	|S22|	∠S22
200	0.537	-63.4	22.589	134.4	0.024	61.2	0.673	-37.7
400	0.387	-106.2	15.289	111.6	0.038	58.4	0.458	-48.4
600	0.336	-128.8	10.917	100.7	0.047	62.9	0.356	-51.5
800	0.318	-143.0	8.424	93.7	0.059	65.4	0.304	-52.6
1000	0.309	-152.8	6.849	88.4	0.069	69.0	0.275	-53.4
1200	0.306	-160.1	5.773	84.0	0.081	68.8	0.258	-54.5
1400	0.305	-166.3	4.995	80.1	0.092	69.1	0.247	-56.1
1600	0.303	-171.2	4.410	76.6	0.103	70.3	0.240	-58.2
1800	0.304	-175.4	3.947	73.3	0.116	69.6	0.234	-60.1
2000	0.304	-179.2	3.576	70.1	0.128	69.2	0.233	-62.6
2200	0.308	177.4	3.275	67.1	0.139	69.2	0.230	-65.6
2400	0.310	174.1	3.027	64.3	0.152	69.3	0.229	-68.1
2600	0.310	170.9	2.815	61.5	0.164	68.3	0.229	-71.1
2800	0.314	168.1	2.639	58.7	0.176	68.2	0.231	-74.1
3000	0.315	165.2	2.479	56.2	0.187	67.8	0.232	-76.9

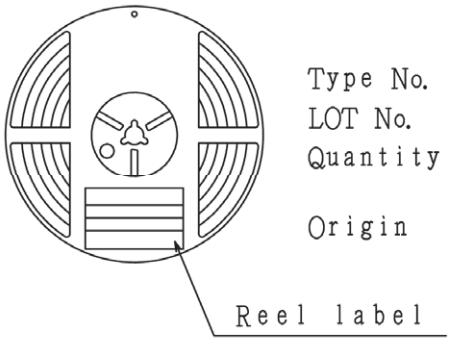
Embossed Taping Specification

2SC5646A-TL-H

1. Packing Format

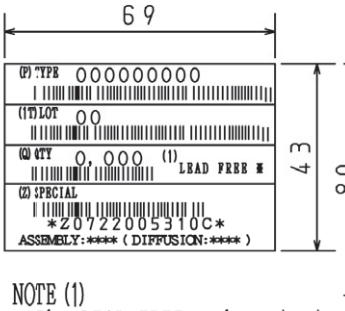
Package Name	Carrier Tape Type	Maximum Number of devices contained (pcs)			Packing format	
		Reel	Inner box	Outer box	Inner BOX (C-1)	Outer BOX (A-7)
SSFP	SSFP	8,000	40,000	240,000	5 reels contained Dimensions:mm (external) 183×72×185	6 inner boxes contained Dimensions:mm (external) 440×195×210

Packing method



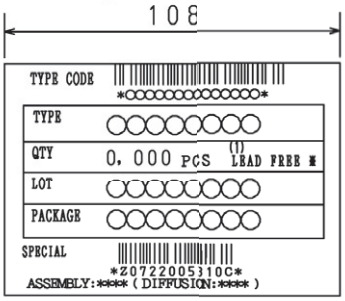
Reel label, Inner box label

(unit:mm)



Outer box label

It is a label at the time of factory shipments. The form of a label may change in physical distribution process.

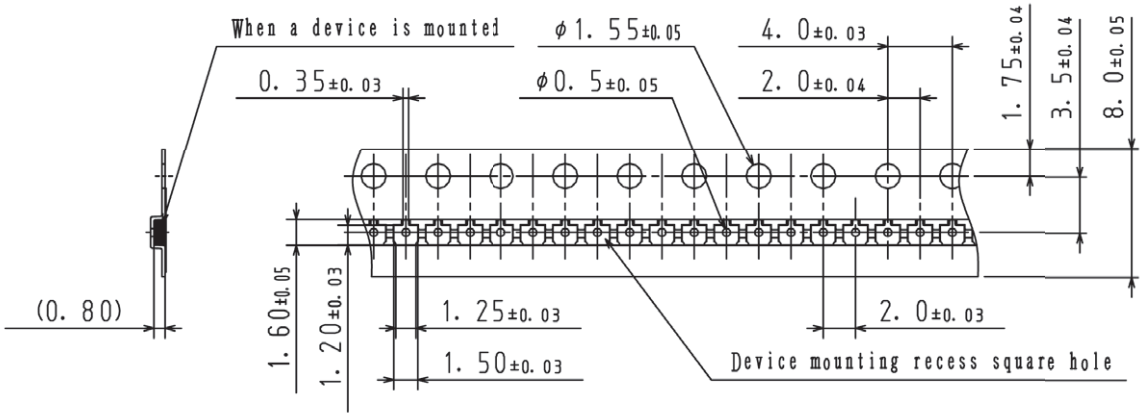


NOTE (1)
The LEAD FREE ※ description shows that the surface treatment of the terminal is lead free.

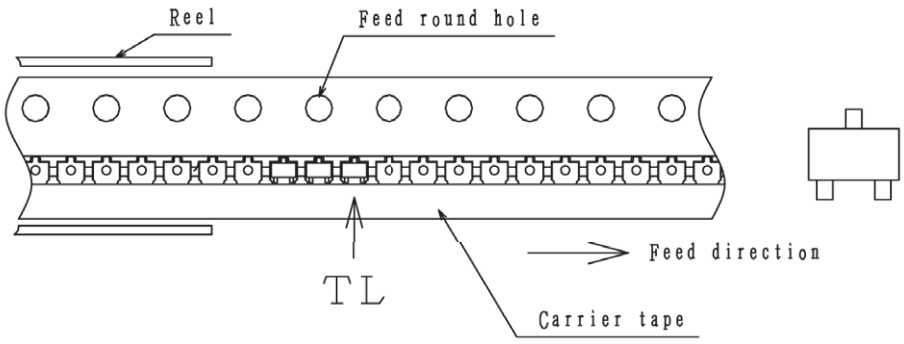
Label	JEITA Phase
LEAD FREE 3	JEITA Phase 3A
LEAD FREE 4	JEITA Phase 3

2. Taping configuration

2-1. Carrier tape size (unit:mm)



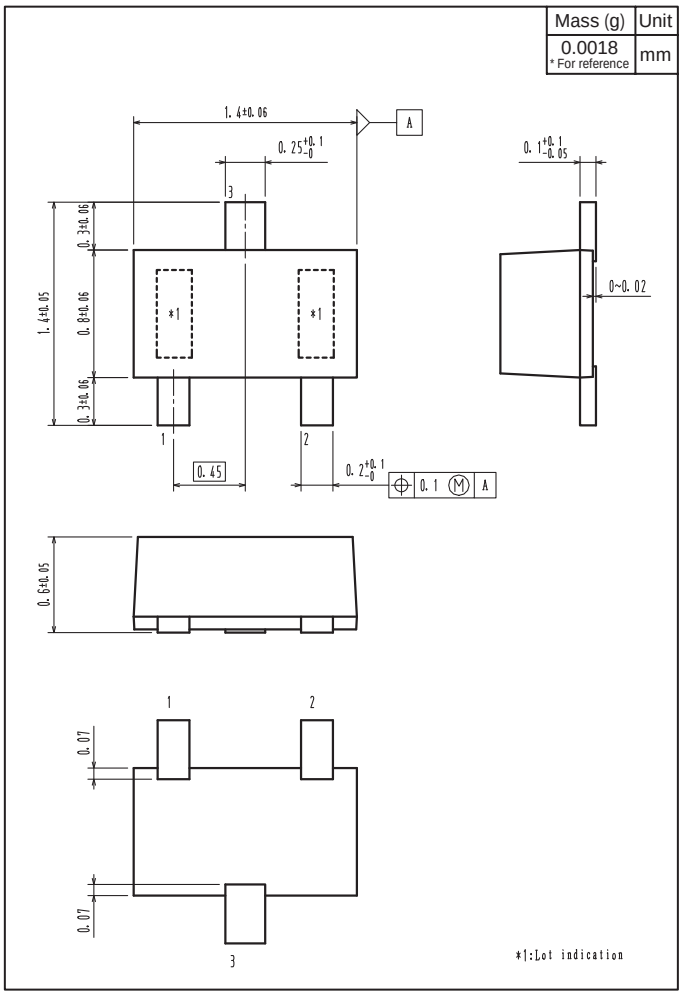
2-2. Device placement direction



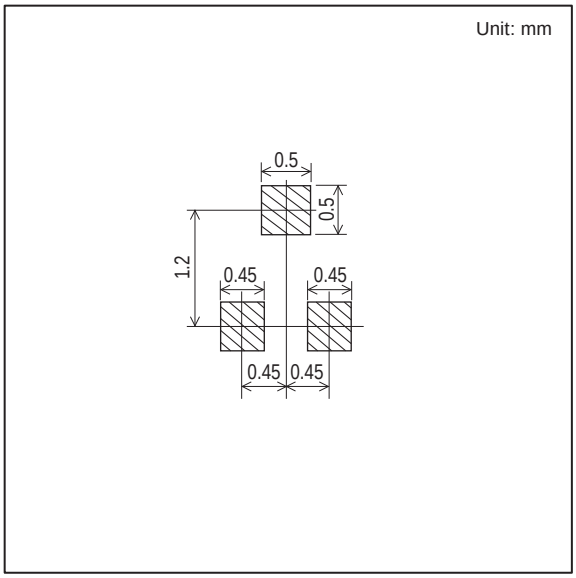
Those with pin 1 index on the feed hole side……TL

Outline Drawing

2SC5646A-TL-H



Land Pattern Example



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