

HFA3046, HFA3096, HFA3127, HFA3128

Ultra High Frequency Transistor Arrays

FN3076
Rev.16.00
Jan 24, 2019

The [HFA3046](#), [HFA3096](#), [HFA3127](#) and the [HFA3128](#) are ultra high frequency transistor arrays that are fabricated from the Renesas complementary bipolar UHF-1 process. Each array consists of five dielectrically isolated transistors on a common monolithic substrate. The NPN transistors exhibit a f_T of 8GHz while the PNP transistors provide a f_T of 5.5GHz. Both types exhibit low noise (3.5dB), making them ideal for high frequency amplifier and mixer applications.

The HFA3046 and HFA3127 are all NPN arrays while the HFA3128 has all PNP transistors. The HFA3096 is an NPN-PNP combination. Access is provided to each of the terminals for the individual transistors for maximum application flexibility. Monolithic construction of these transistor arrays provides close electrical and thermal matching of the five transistors.

Application note [AN9315](#) illustrates the use of these devices as RF amplifiers.

Related Literature

For a full list of related documents, visit our website:

- [HFA3046](#), [HFA3096](#), [HFA3127](#), [HFA3128](#) device pages

Features

- NPN transistor (f_T) 8GHz
- NPN current gain (h_{FE}) 130
- NPN early voltage (V_A) 50V
- PNP transistor (f_T) 5.5GHz
- PNP current gain (h_{FE}) 60
- PNP early voltage (V_A) 20V
- Noise figure (50Ω) at 1.0GHz 3.5dB
- Collector to collector leakage <1pA
- Complete isolation between transistors
- Pin compatible with industry standard 3XXX series arrays
- Pb-free (RoHS compliant)

Applications

- VHF/UHF amplifiers
- VHF/UHF mixers
- IF converters
- Synchronous detectors

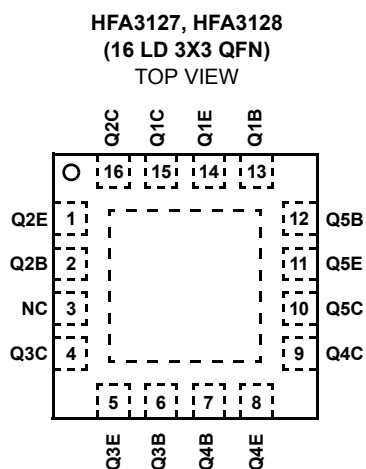
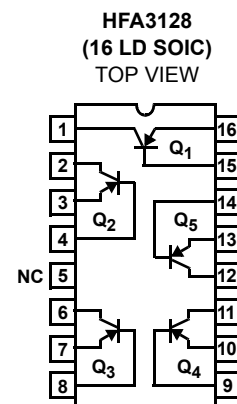
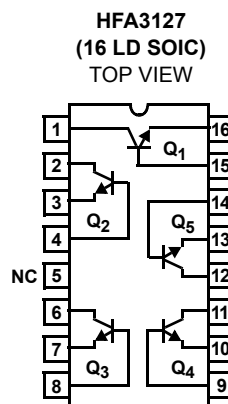
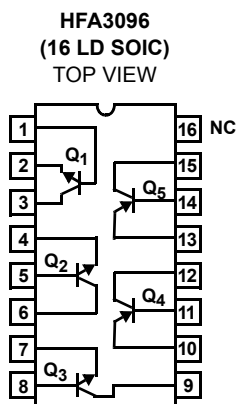
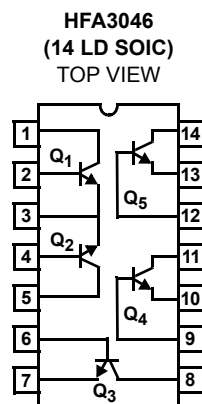
Ordering Information

PART NUMBER (Notes 2, 3)	PART MARKING	TEMP. RANGE (°C)	TAPE AND REEL (UNITS) (Note 1)	PACKAGE (RoHS Compliant)	PKG. DWG. #
HFA3046BZ	HFA3046BZ	-55 to +125	-	14 Ld SOIC	M14.15
HFA3096BZ	HFA3096BZ	-55 to +125	-	16 Ld SOIC	M16.15
HFA3096BZ96	HFA3096BZ	-55 to +125	2.5k	16 Ld SOIC	M16.15
HFA3127BZ	HFA3127BZ	-55 to +125	-	16 Ld SOIC	M16.15
HFA3127BZ96	HFA3127BZ	-55 to +125	2.5k	16 Ld SOIC	M16.15
HFA3127RZ	127Z	-55 to +125	-	16 Ld 3x3 QFN	L16.3x3
HFA3127RZ96	127Z	-55 to +125	6k	16 Ld 3x3 QFN	L16.3x3
HFA3128BZ (No longer available or supported)	HFA3128BZ	-55 to +125	-	16 Ld SOIC	M16.15
HFA3128RZ (No longer available or supported)	128Z	-55 to +125	-	16 Ld 3x3 QFN	L16.3x3

NOTE:

1. See [TB347](#) for details about reel specifications.
2. These Pb-free plastic packaged products employ special Pb-free material sets, molding compounds/die attach materials, and 100% matte tin plate plus anneal (e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations). Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
3. For Moisture Sensitivity Level (MSL), see the [HFA3046](#), [HFA3096](#), [HFA3127](#), or [HFA3128](#) device page. For more information about MSL, see [TB363](#).

Pinouts



Absolute Maximum Ratings

Collector to Emitter Voltage (Open Base)	8V
Collector to Base Voltage (Open Emitter)	12V
Emitter to Base Voltage (Reverse Bias)	5.5V
Collector Current (100% Duty Cycle)	18.5mA at $T_J = +150^{\circ}\text{C}$ 34mA at $T_J = +125^{\circ}\text{C}$ 37mA at $T_J = +110^{\circ}\text{C}$
Peak Collector Current (Any Condition)	65mA

Operating Information

Temperature Range -55°C to $+125^{\circ}\text{C}$

Thermal Information

Thermal Resistance (Typical)	θ_{JA} ($^{\circ}\text{C}/\text{W}$)	θ_{JC} ($^{\circ}\text{C}/\text{W}$)
14 Ld SOIC Package (Note 4)	120	N/A
16 Ld SOIC Package (Note 4)	115	N/A
QFN Package (Notes 5, 6)	57	10
Maximum Power Dissipation (Any One Transistor)	0.15W	
Maximum Junction Temperature (Die)	$+175^{\circ}\text{C}$	
Maximum Junction Temperature (Plastic Package)	$+150^{\circ}\text{C}$	
Maximum Storage Temperature Range	-65°C to $+150^{\circ}\text{C}$	
Pb-Free Reflow Profile	see TB493	

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" can 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:

- θ_{JA} is measured with the component mounted on an evaluation PC board in free air.
- For θ_{JC} , the "case temp" location is the center of the exposed metal pad on the package underside.
- θ_{JA} is measured with the component mounted on a high-effective thermal conductivity test board in free air. See [TB379](#) for details.

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

PARAMETER	TEST CONDITIONS	DIE			SOIC, QFN			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
DC NPN CHARACTERISTICS								
Collector to Base Breakdown Voltage, V _{(BR)CBO}	I _C = 100μA, I _E = 0	12	18	-	12	18	-	V
Collector to Emitter Breakdown Voltage, V _{(BR)CEO}	I _C = 100μA, I _B = 0	8	12	-	8	12	-	V
Collector to Emitter Breakdown Voltage, V _{(BR)CES}	I _C = 100μA, Base Shorted to Emitter	10	20	-	10	20	-	V
Emitter to Base Breakdown Voltage, V _{(BR)EBO}	I _E = 10μA, I _C = 0	5.5	6	-	5.5	6	-	V
Collector-Cutoff-Current, I _{CEO}	V _{CE} = 6V, I _B = 0	-	2	100	-	2	100	nA
Collector-Cutoff-Current, I _{CBO}	V _{CB} = 8V, I _E = 0	-	0.1	10	-	0.1	10	nA
Collector to Emitter Saturation Voltage, V _{CE(SAT)}	I _C = 10mA, I _B = 1mA	-	0.3	0.5	-	0.3	0.5	V
Base to Emitter Voltage, V _{BE}	I _C = 10mA	-	0.85	0.95	-	0.85	0.95	V
DC Forward-Current Transfer Ratio, h _{FE}	I _C = 10mA, V _{CE} = 2V	40	130	-	40	130	-	
Early Voltage, V _A	I _C = 1mA, V _{CE} = 3.5V	20	50	-	20	50	-	V
Base to Emitter Voltage Drift	I _C = 10mA	-	-1.5	-	-	-1.5	-	mV/°C
Collector to Collector Leakage		-	1	-	-	1	-	pA
DYNAMIC NPN CHARACTERISTICS								
Noise Figure	f = 1.0GHz, V _{CE} = 5V, I _C = 5mA, Z _S = 50Ω	-	3.5	-	-	3.5	-	dB
f _T Current Gain-Bandwidth Product	I _C = 1mA, V _{CE} = 5V	-	5.5	-	-	5.5	-	GHz
	I _C = 10mA, V _{CE} = 5V	-	8	-	-	8	-	GHz
Power Gain-Bandwidth Product, f _{MAX}	I _C = 10mA, V _{CE} = 5V	-	6	-	-	2.5	-	GHz
Base to Emitter Capacitance	V _{BE} = -3V	-	200	-	-	500	-	fF
Collector to Base Capacitance	V _{CB} = 3V	-	200	-	-	500	-	fF

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

PARAMETER	TEST CONDITIONS	DIE			SOIC, QFN			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
DC PNP CHARACTERISTICS								
Collector to Base Breakdown Voltage, V _{(BR)CBO}	I _C = -100μA, I _E = 0	10	15	-	10	15	-	V
Collector to Emitter Breakdown Voltage, V _{(BR)CEO}	I _C = -100μA, I _B = 0	8	15	-	8	15	-	V
Collector to Emitter Breakdown Voltage, V _{(BR)CES}	I _C = -100μA, Base Shorted to Emitter	10	15	-	10	15	-	V
Emitter to Base Breakdown Voltage, V _{(BR)EBO}	I _E = -10μA, I _C = 0	4.5	5	-	4.5	5	-	V
Collector Cutoff Current, I _{CEO}	V _{CE} = -6V, I _B = 0	-	2	100	-	2	100	nA
Collector Cutoff Current, I _{CBO}	V _{CB} = -8V, I _E = 0	-	0.1	10	-	0.1	10	nA
Collector to Emitter Saturation Voltage, V _{CE(SAT)}	I _C = -10mA, I _B = -1mA	-	0.3	0.5	-	0.3	0.5	V
Base to Emitter Voltage, V _{BE}	I _C = -10mA	-	0.85	0.95	-	0.85	0.95	V
DC Forward-Current Transfer Ratio, h _{FE}	I _C = -10mA, V _{CE} = -2V	20	60	-	20	60	-	
Early Voltage, V _A	I _C = -1mA, V _{CE} = -3.5V	10	20	-	10	20	-	V
Base to Emitter Voltage Drift	I _C = -10mA	-	-1.5	-	-	-1.5	-	mV/°C
Collector to Collector Leakage		-	1	-	-	1	-	pA
DYNAMIC PNP CHARACTERISTICS								
Noise Figure	f = 1.0GHz, V _{CE} = -5V, I _C = -5mA, Z _S = 50Ω	-	3.5	-	-	3.5	-	dB
f _T Current Gain-Bandwidth Product	I _C = -1mA, V _{CE} = -5V	-	2	-	-	2	-	GHz
	I _C = -10mA, V _{CE} = -5V	-	5.5	-	-	5.5	-	GHz
Power Gain-Bandwidth Product	I _C = -10mA, V _{CE} = -5V	-	3	-	-	2	-	GHz
Base to Emitter Capacitance	V _{BE} = 3V	-	200	-	-	500	-	fF
Collector to Base Capacitance	V _{CB} = -3V	-	300	-	-	600	-	fF

Common Emitter S-Parameters of NPN $3\mu\text{m} \times 50\mu\text{m}$ Transistor

FREQ. (Hz)	$ S_{11} $	PHASE(S_{11})	$ S_{21} $	PHASE(S_{21})	$ S_{12} $	PHASE(S_{12})	$ S_{22} $	PHASE(S_{22})
$V_{CE} = 5\text{V}$ and $I_C = 5\text{mA}$								
1.0E+08	0.83	-11.78	11.07	168.57	1.41E-02	78.88	0.97	-11.05
2.0E+08	0.79	-22.82	10.51	157.89	2.69E-02	68.63	0.93	-21.35
3.0E+08	0.73	-32.64	9.75	148.44	3.75E-02	59.58	0.86	-30.44
4.0E+08	0.67	-41.08	8.91	140.36	4.57E-02	51.90	0.79	-38.16
5.0E+08	0.61	-48.23	8.10	133.56	5.19E-02	45.50	0.73	-44.59
6.0E+08	0.55	-54.27	7.35	127.88	5.65E-02	40.21	0.67	-49.93
7.0E+08	0.50	-59.41	6.69	123.10	6.00E-02	35.82	0.62	-54.37
8.0E+08	0.46	-63.81	6.11	119.04	6.27E-02	32.15	0.57	-58.10
9.0E+08	0.42	-67.63	5.61	115.57	6.47E-02	29.07	0.53	-61.25
1.0E+09	0.39	-70.98	5.17	112.55	6.63E-02	26.45	0.50	-63.96

Common Emitter S-Parameters of NPN 3 μ m $\times$ 50 μ m Transistor (Continued)

FREQ. (Hz)	S ₁₁	PHASE(S ₁₁)	S ₂₁	PHASE(S ₂₁)	S ₁₂	PHASE(S ₁₂)	S ₂₂	PHASE(S ₂₂)
1.1E+09	0.36	-73.95	4.79	109.91	6.75E-02	24.19	0.47	-66.31
1.2E+09	0.34	-76.62	4.45	107.57	6.85E-02	22.24	0.45	-68.37
1.3E+09	0.32	-79.04	4.15	105.47	6.93E-02	20.53	0.43	-70.19
1.4E+09	0.30	-81.25	3.89	103.57	7.00E-02	19.02	0.41	-71.83
1.5E+09	0.28	-83.28	3.66	101.84	7.05E-02	17.69	0.40	-73.31
1.6E+09	0.27	-85.17	3.45	100.26	7.10E-02	16.49	0.39	-74.66
1.7E+09	0.25	-86.92	3.27	98.79	7.13E-02	15.41	0.38	-75.90
1.8E+09	0.24	-88.57	3.10	97.43	7.17E-02	14.43	0.37	-77.05
1.9E+09	0.23	-90.12	2.94	96.15	7.19E-02	13.54	0.36	-78.12
2.0E+09	0.22	-91.59	2.80	94.95	7.21E-02	12.73	0.35	-79.13
2.1E+09	0.21	-92.98	2.68	93.81	7.23E-02	11.98	0.35	-80.09
2.2E+09	0.20	-94.30	2.56	92.73	7.25E-02	11.29	0.34	-80.99
2.3E+09	0.20	-95.57	2.45	91.70	7.27E-02	10.64	0.34	-81.85
2.4E+09	0.19	-96.78	2.35	90.72	7.28E-02	10.05	0.33	-82.68
2.5E+09	0.18	-97.93	2.26	89.78	7.29E-02	9.49	0.33	-83.47
2.6E+09	0.18	-99.05	2.18	88.87	7.30E-02	8.96	0.33	-84.23
2.7E+09	0.17	-100.12	2.10	88.00	7.31E-02	8.47	0.33	-84.97
2.8E+09	0.17	-101.15	2.02	87.15	7.31E-02	8.01	0.33	-85.68
2.9E+09	0.16	-102.15	1.96	86.33	7.32E-02	7.57	0.33	-86.37
3.0E+09	0.16	-103.11	1.89	85.54	7.32E-02	7.16	0.33	-87.05
V_{CE} = 5V and I_C = 10mA								
1.0E+08	0.72	-16.43	15.12	165.22	1.27E-02	75.41	0.95	-14.26
2.0E+08	0.67	-31.26	13.90	152.04	2.34E-02	62.89	0.88	-26.95
3.0E+08	0.60	-43.76	12.39	141.18	3.13E-02	52.58	0.79	-37.31
4.0E+08	0.53	-54.00	10.92	132.57	3.68E-02	44.50	0.70	-45.45
5.0E+08	0.47	-62.38	9.62	125.78	4.05E-02	38.23	0.63	-51.77
6.0E+08	0.42	-69.35	8.53	120.37	4.31E-02	33.34	0.57	-56.72
7.0E+08	0.37	-75.26	7.62	116.00	4.49E-02	29.47	0.51	-60.65
8.0E+08	0.34	-80.36	6.86	112.39	4.63E-02	26.37	0.47	-63.85
9.0E+08	0.31	-84.84	6.22	109.36	4.72E-02	23.84	0.44	-66.49
1.0E+09	0.29	-88.83	5.69	106.77	4.80E-02	21.75	0.41	-68.71
1.1E+09	0.27	-92.44	5.23	104.51	4.86E-02	20.00	0.39	-70.62
1.2E+09	0.25	-95.73	4.83	102.53	4.90E-02	18.52	0.37	-72.28
1.3E+09	0.24	-98.75	4.49	100.75	4.94E-02	17.25	0.35	-73.76
1.4E+09	0.22	-101.55	4.19	99.16	4.97E-02	16.15	0.34	-75.08
1.5E+09	0.21	-104.15	3.93	97.70	4.99E-02	15.19	0.33	-76.28
1.6E+09	0.20	-106.57	3.70	96.36	5.01E-02	14.34	0.32	-77.38
1.7E+09	0.20	-108.85	3.49	95.12	5.03E-02	13.60	0.31	-78.41
1.8E+09	0.19	-110.98	3.30	93.96	5.05E-02	12.94	0.31	-79.37
1.9E+09	0.18	-113.00	3.13	92.87	5.06E-02	12.34	0.30	-80.27

Common Emitter S-Parameters of NPN 3 μ m x 50 μ m Transistor (Continued)

FREQ. (Hz)	S ₁₁	PHASE(S ₁₁)	S ₂₁	PHASE(S ₂₁)	S ₁₂	PHASE(S ₁₂)	S ₂₂	PHASE(S ₂₂)
2.0E+09	0.18	-114.90	2.98	91.85	5.07E-02	11.81	0.30	-81.13
2.1E+09	0.17	-116.69	2.84	90.87	5.08E-02	11.33	0.30	-81.95
2.2E+09	0.17	-118.39	2.72	89.94	5.09E-02	10.89	0.29	-82.74
2.3E+09	0.16	-120.01	2.60	89.06	5.10E-02	10.50	0.29	-83.50
2.4E+09	0.16	-121.54	2.49	88.21	5.11E-02	10.13	0.29	-84.24
2.5E+09	0.16	-122.99	2.39	87.39	5.12E-02	9.80	0.29	-84.95
2.6E+09	0.15	-124.37	2.30	86.60	5.12E-02	9.49	0.29	-85.64
2.7E+09	0.15	-125.69	2.22	85.83	5.13E-02	9.21	0.29	-86.32
2.8E+09	0.15	-126.94	2.14	85.09	5.13E-02	8.95	0.29	-86.98
2.9E+09	0.15	-128.14	2.06	84.36	5.14E-02	8.71	0.29	-87.62
3.0E+09	0.14	-129.27	1.99	83.66	5.15E-02	8.49	0.29	-88.25

Common Emitter S-Parameters of PNP 3 μ m x 50 μ m Transistor

FREQ. (Hz)	S ₁₁	PHASE(S ₁₁)	S ₂₁	PHASE(S ₂₁)	S ₁₂	PHASE(S ₁₂)	S ₂₂	PHASE(S ₂₂)
V_{CE} = -5V and I_C = -5mA								
1.0E+08	0.72	-16.65	10.11	166.77	1.66E-02	77.18	0.96	-10.76
2.0E+08	0.68	-32.12	9.44	154.69	3.10E-02	65.94	0.90	-20.38
3.0E+08	0.62	-45.73	8.57	144.40	4.23E-02	56.39	0.82	-28.25
4.0E+08	0.57	-57.39	7.68	135.95	5.05E-02	48.66	0.74	-34.31
5.0E+08	0.52	-67.32	6.86	129.11	5.64E-02	42.52	0.67	-38.81
6.0E+08	0.47	-75.83	6.14	123.55	6.07E-02	37.66	0.61	-42.10
7.0E+08	0.43	-83.18	5.53	118.98	6.37E-02	33.79	0.55	-44.47
8.0E+08	0.40	-89.60	5.01	115.17	6.60E-02	30.67	0.51	-46.15
9.0E+08	0.38	-95.26	4.56	111.94	6.77E-02	28.14	0.47	-47.33
1.0E+09	0.36	-100.29	4.18	109.17	6.91E-02	26.06	0.44	-48.15
1.1E+09	0.34	-104.80	3.86	106.76	7.01E-02	24.33	0.41	-48.69
1.2E+09	0.33	-108.86	3.58	104.63	7.09E-02	22.89	0.39	-49.05
1.3E+09	0.32	-112.53	3.33	102.72	7.16E-02	21.67	0.37	-49.26
1.4E+09	0.30	-115.86	3.12	101.01	7.22E-02	20.64	0.36	-49.38
1.5E+09	0.30	-118.90	2.92	99.44	7.27E-02	19.76	0.34	-49.43
1.6E+09	0.29	-121.69	2.75	98.01	7.32E-02	19.00	0.33	-49.44
1.7E+09	0.28	-124.24	2.60	96.68	7.35E-02	18.35	0.32	-49.43
1.8E+09	0.28	-126.59	2.47	95.44	7.39E-02	17.79	0.31	-49.40
1.9E+09	0.27	-128.76	2.34	94.29	7.42E-02	17.30	0.30	-49.38
2.0E+09	0.27	-130.77	2.23	93.19	7.45E-02	16.88	0.30	-49.36
2.1E+09	0.26	-132.63	2.13	92.16	7.47E-02	16.52	0.29	-49.35
2.2E+09	0.26	-134.35	2.04	91.18	7.50E-02	16.20	0.28	-49.35
2.3E+09	0.26	-135.96	1.95	90.24	7.52E-02	15.92	0.28	-49.38
2.4E+09	0.25	-137.46	1.87	89.34	7.55E-02	15.68	0.28	-49.42

Common Emitter S-Parameters of PNP 3 μ m $\times$ 50 μ m Transistor (Continued)

FREQ. (Hz)	S ₁₁	PHASE(S ₁₁)	S ₂₁	PHASE(S ₂₁)	S ₁₂	PHASE(S ₁₂)	S ₂₂	PHASE(S ₂₂)
2.5E+09	0.25	-138.86	1.80	88.48	7.57E-02	15.48	0.27	-49.49
2.6E+09	0.25	-140.17	1.73	87.65	7.59E-02	15.30	0.27	-49.56
2.7E+09	0.25	-141.39	1.67	86.85	7.61E-02	15.15	0.26	-49.67
2.8E+09	0.25	-142.54	1.61	86.07	7.63E-02	15.01	0.26	-49.81
2.9E+09	0.24	-143.62	1.56	85.31	7.65E-02	14.90	0.26	-49.96
3.0E+09	0.24	-144.64	1.51	84.58	7.67E-02	14.81	0.26	-50.13
V_{CE} = -5V, I_C = -10mA								
1.0E+08	0.58	-23.24	13.03	163.45	1.43E-02	73.38	0.93	-13.46
2.0E+08	0.53	-44.07	11.75	149.11	2.58E-02	60.43	0.85	-24.76
3.0E+08	0.48	-61.50	10.25	137.78	3.38E-02	50.16	0.74	-33.10
4.0E+08	0.43	-75.73	8.88	129.12	3.90E-02	42.49	0.65	-38.83
5.0E+08	0.40	-87.36	7.72	122.49	4.25E-02	36.81	0.58	-42.63
6.0E+08	0.37	-96.94	6.78	117.33	4.48E-02	32.59	0.51	-45.07
7.0E+08	0.35	-104.92	6.01	113.22	4.64E-02	29.39	0.47	-46.60
8.0E+08	0.33	-111.64	5.39	109.85	4.76E-02	26.94	0.43	-47.49
9.0E+08	0.32	-117.36	4.87	107.05	4.85E-02	25.04	0.40	-47.97
1.0E+09	0.31	-122.27	4.44	104.66	4.92E-02	23.55	0.37	-48.18
1.1E+09	0.30	-126.51	4.07	102.59	4.97E-02	22.37	0.35	-48.20
1.2E+09	0.30	-130.21	3.76	100.76	5.02E-02	21.44	0.33	-48.11
1.3E+09	0.29	-133.46	3.49	99.14	5.06E-02	20.70	0.32	-47.95
1.4E+09	0.29	-136.33	3.25	97.67	5.09E-02	20.11	0.31	-47.77
1.5E+09	0.28	-138.89	3.05	96.33	5.12E-02	19.65	0.30	-47.58
1.6E+09	0.28	-141.17	2.87	95.10	5.15E-02	19.29	0.29	-47.39
1.7E+09	0.28	-143.21	2.70	93.96	5.18E-02	19.01	0.28	-47.23
1.8E+09	0.28	-145.06	2.56	92.90	5.21E-02	18.80	0.27	-47.09
1.9E+09	0.27	-146.73	2.43	91.90	5.23E-02	18.65	0.27	-46.98
2.0E+09	0.27	-148.26	2.31	90.95	5.26E-02	18.55	0.26	-46.91
2.1E+09	0.27	-149.65	2.20	90.05	5.28E-02	18.49	0.26	-46.87
2.2E+09	0.27	-150.92	2.10	89.20	5.30E-02	18.46	0.25	-46.87
2.3E+09	0.27	-152.10	2.01	88.37	5.33E-02	18.47	0.25	-46.90
2.4E+09	0.27	-153.18	1.93	87.59	5.35E-02	18.50	0.25	-46.97
2.5E+09	0.27	-154.17	1.86	86.82	5.38E-02	18.55	0.24	-47.07
2.6E+09	0.26	-155.10	1.79	86.09	5.40E-02	18.62	0.24	-47.18
2.7E+09	0.26	-155.96	1.72	85.38	5.42E-02	18.71	0.24	-47.34
2.8E+09	0.26	-156.76	1.66	84.68	5.45E-02	18.80	0.24	-47.55
2.9E+09	0.26	-157.51	1.60	84.01	5.47E-02	18.91	0.24	-47.76
3.0E+09	0.26	-158.21	1.55	83.35	5.50E-02	19.03	0.23	-48.00

Typical Performance Curves

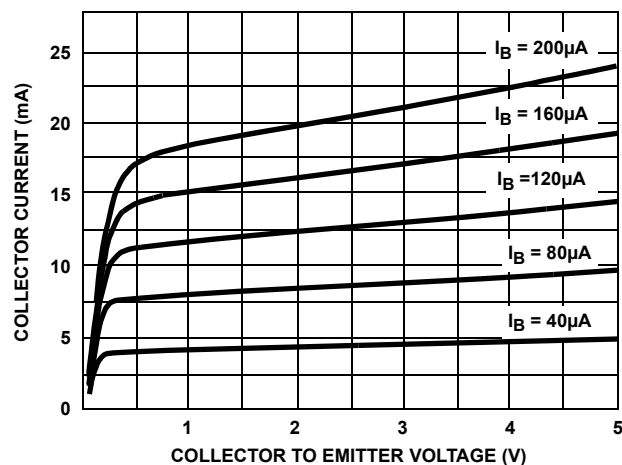


FIGURE 1. NPN COLLECTOR CURRENT vs COLLECTOR TO EMITTER VOLTAGE

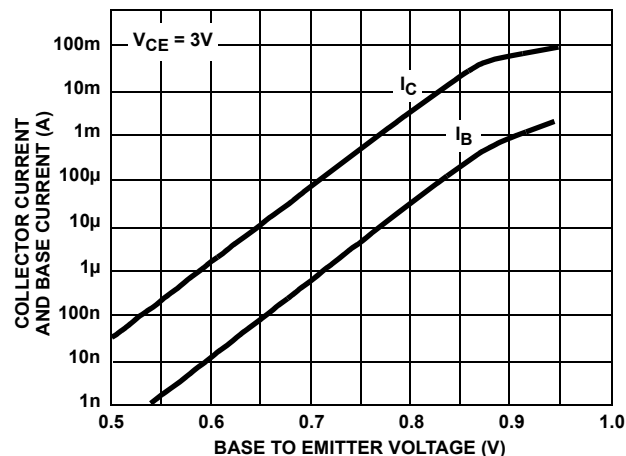


FIGURE 2. NPN COLLECTOR CURRENT AND BASE CURRENT vs BASE TO EMITTER VOLTAGE

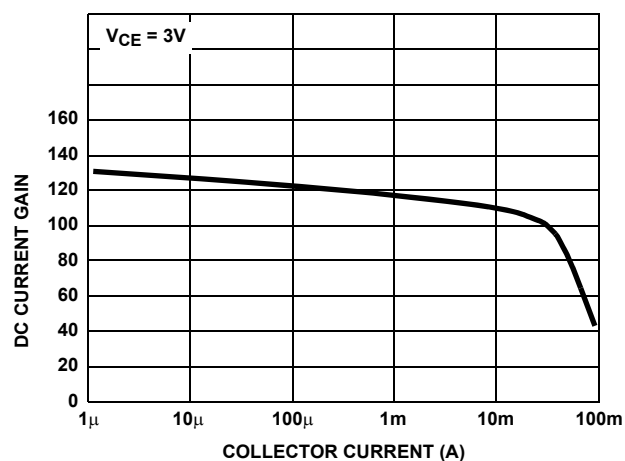


FIGURE 3. NPN DC CURRENT GAIN vs COLLECTOR CURRENT

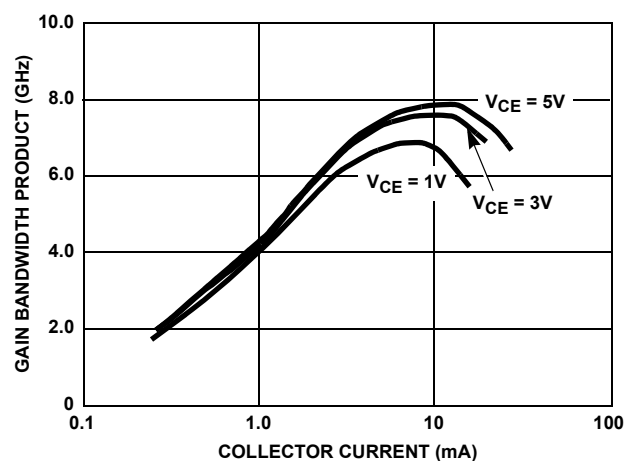


FIGURE 4. NPN GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT (UHF 3 x 50 WITH BOND PADS)

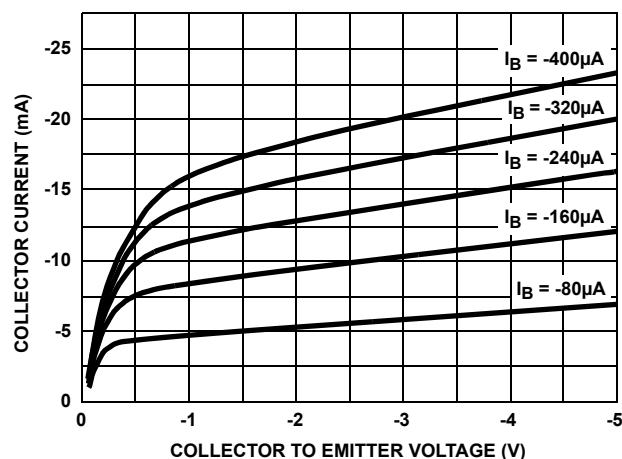


FIGURE 5. PNP COLLECTOR CURRENT vs COLLECTOR TO EMITTER VOLTAGE

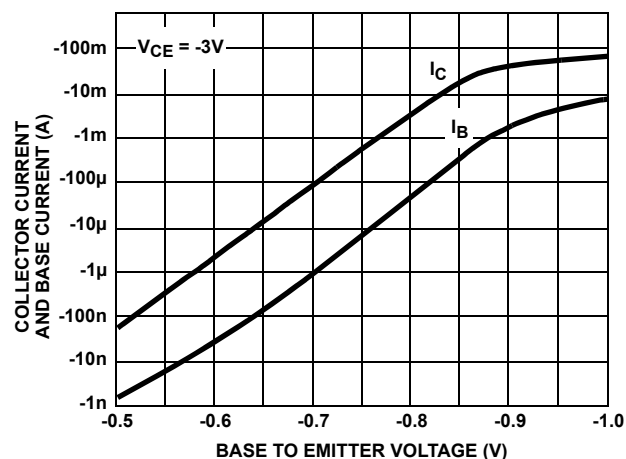


FIGURE 6. PNP COLLECTOR CURRENT AND BASE CURRENT vs BASE TO EMITTER VOLTAGE

Typical Performance Curves (Continued)

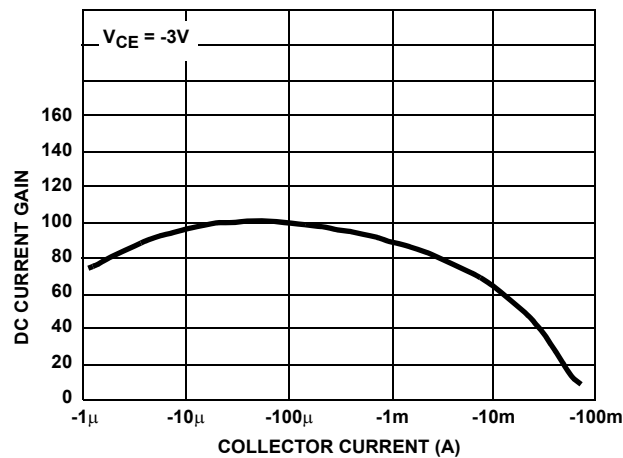


FIGURE 7. PNP DC CURRENT GAIN vs COLLECTOR CURRENT

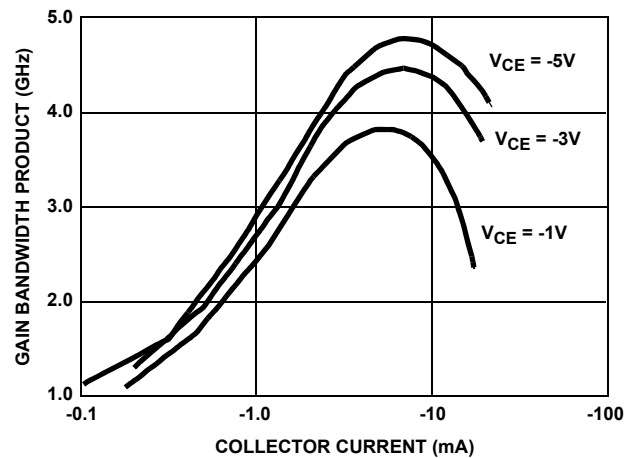


FIGURE 8. PNP GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT (UHF 3 x 50 WITH BOND PADS)

Die Characteristics

DIE DIMENSIONS:

53 mils x 52 mils
1340 μ m x 1320 μ m

METALLIZATION:

Type: Metal 1: AlCu(2%)/TiW
Thickness: Metal 1: 8k $\text{\AA}$ $\pm$ 0.4k $\text{\AA}$
Type: Metal 2: AlCu(2%)
Thickness: Metal 2: 16k $\text{\AA}$ $\pm$ 0.8k $\text{\AA}$

PASSIVATION:

Type: Nitride
Thickness: 4k $\text{\AA}$ $\pm$ 0.5k $\text{\AA}$

PROCESS:

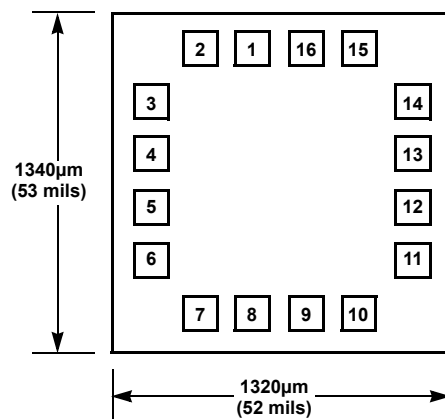
UHF-1

SUBSTRATE POTENTIAL: (POWERED UP)

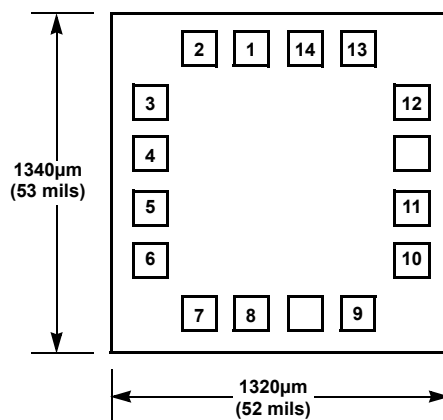
Unbiased

Metallization Mask Layout

HFA3096, HFA3127, HFA3128



HFA3046



Pad numbers correspond to SOIC pinout.

Revision History The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please go to the web to make sure that you have the latest revision.

DATE	REVISION	CHANGE
Jan 24, 2019	FN3076.16	Added Related Literature section. Updated ordering information table by adding tape and reel versions, and updating notes. Updated links throughout document. Updated POD M16.15 to the latest revision, changes are as follows: -Update graphics to new standard layout, removing the dimension table. Updated disclaimer.
Aug 11, 2015	FN3076.15	Added Revision History beginning with Rev 15. Updated ordering information table with "No longer available or supported" next to HFA3128 part numbers

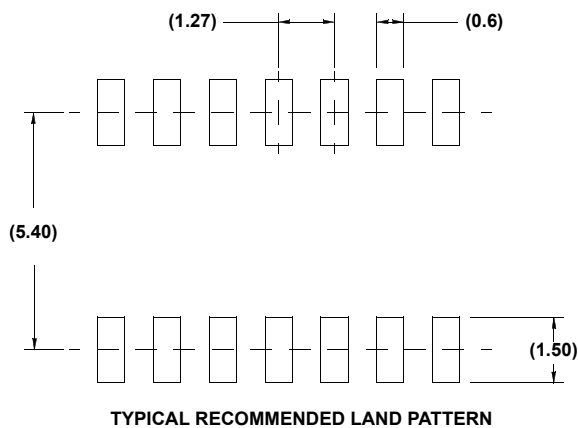
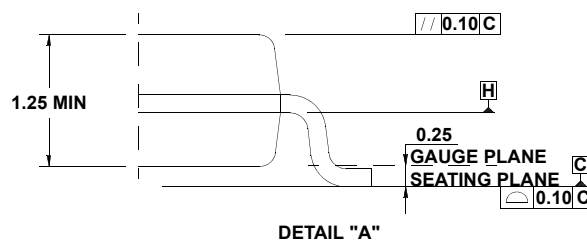
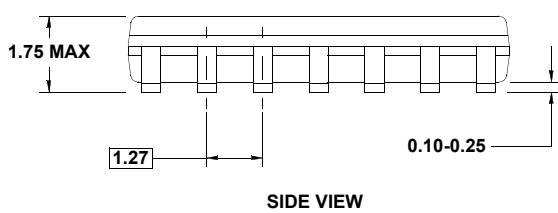
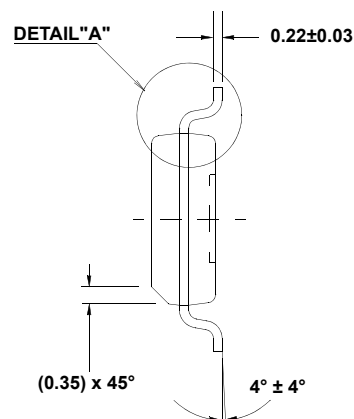
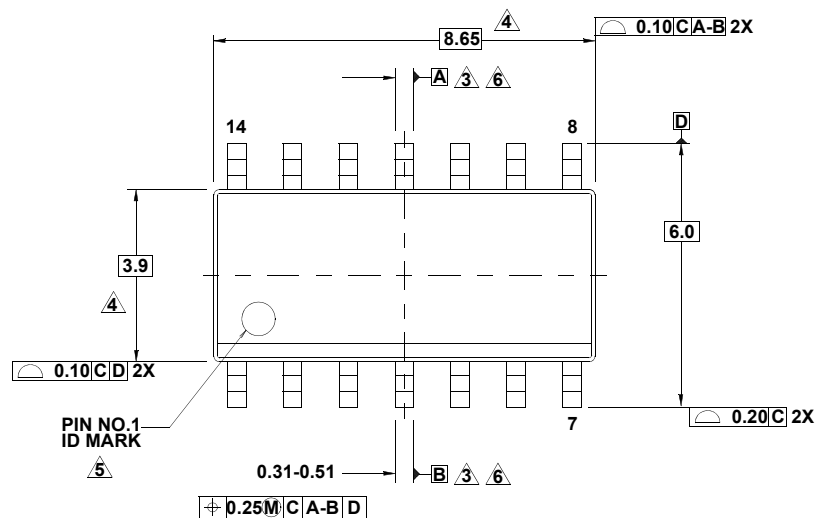
Package Outline Drawings

For the most recent package outline drawing, see [M14.15](#).

M14.15

14 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE

Rev 1, 10/09



NOTES:

1. Dimensions are in millimeters.
Dimensions in () for Reference Only.
2. Dimensioning and tolerancing conform to AMSEY14.5m-1994.
3. Datums A and B to be determined at Datum H.
4. Dimension does not include interlead flash or protrusions.
Interlead flash or protrusions shall not exceed 0.25mm per side.
5. The pin #1 identifier may be either a mold or mark feature.
6. Does not include dambar protrusion. Allowable dambar protrusion shall be 0.10mm total in excess of lead width at maximum condition.
7. Reference to JEDEC MS-012-AB.

For the most recent package outline drawing, see [M16.15](#).

TOP VIEW

16 9 6.0 3.9 9.90 0.10 C A-B 2X 0.10 C D 2X 0.51 0.31 0.25 M C A-B D 0.20 C 2X 8° 0° 0.25 0.19 0.50 0.25 x 45°

SIDE VIEW

1.75 MAX 1.27 0.25 0.10 16X 0.10 C 0.10 C A-B 2X

DETAIL 'A'

SIDE VIEW "B"

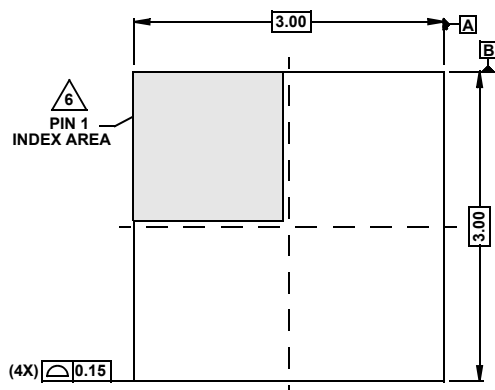
TYPICAL RECOMMENDED LAND PATTERN

NOTES:

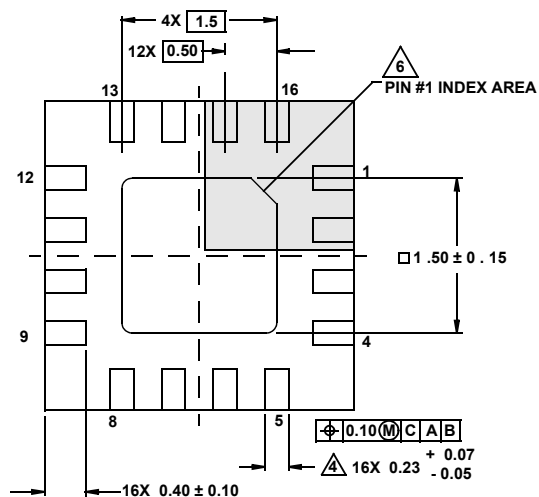
1. Dimensions are in millimeters.
2. Dimensioning and tolerancing conform to AMSE Y14.5m-1994.
3. Datums A and B to be determined at Datum H.
4. Dimension does not include interlead flash or protrusions. Interlead flash or protrusions shall not exceed 0.25mm per side.
5. The pin #1 identifier may be either a mold or mark feature.
6. Does not include dambar protrusion. Allowable dambar protrusion shall be 0.10mm total in excess of lead width at maximum condition.
7. Reference to JEDEC MS-012-AC

L16.3x3**16 LEAD QUAD FLAT NO-LEAD PLASTIC PACKAGE**

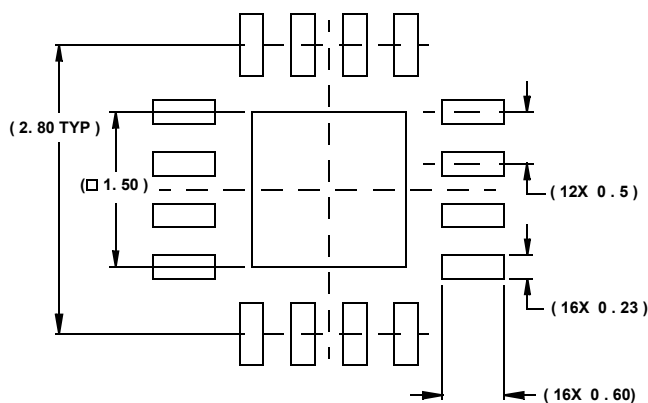
Rev 2, 4/07

For the most recent package outline drawing, see [L16.3x3](#).

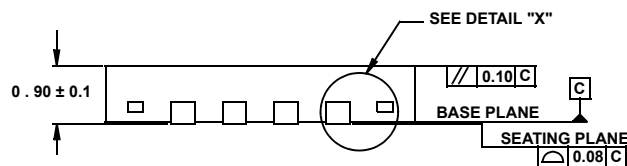
TOP VIEW



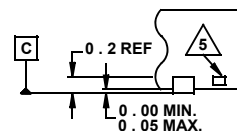
BOTTOM VIEW



TYPICAL RECOMMENDED LAND PATTERN



SIDE VIEW



DETAIL "X"

NOTES:

1. Dimensions are in millimeters.
Dimensions in () for Reference Only.
2. Dimensioning and tolerancing conform to AMSE Y14.5m-1994.
3. Unless otherwise specified, tolerance : Decimal ± 0.05
4. Dimension b applies to the metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
5. Tiebar shown (if present) is a non-functional feature.
6. The configuration of the pin #1 identifier is optional, but must be located within the zone indicated. The pin #1 identifier may be either a mold or mark feature.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
 2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
 3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
 4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
 5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.
 - "Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.
 - "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.
 6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
 7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
 8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
 9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
 10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
 11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
 12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.
- (Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.
- (Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/