

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

2SC5088

VHF~UHF Band Low Noise Amplifier Applications

- Low noise figure, high gain.
- $NF = 1.1\text{dB}$, $|S_{21e}|^2 = 13\text{dB}$ ($f = 1\text{GHz}$)

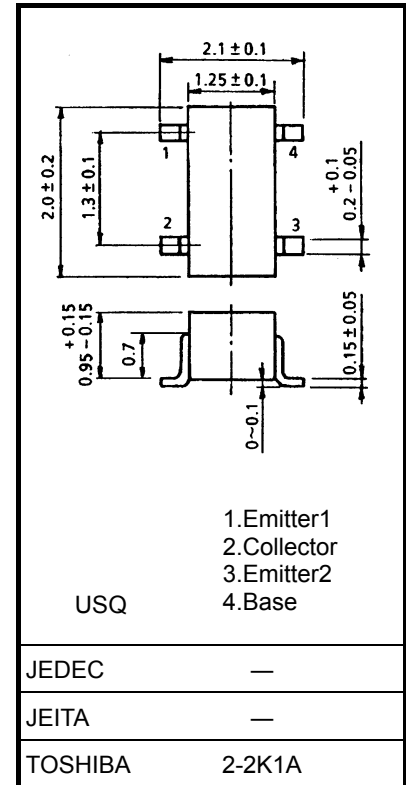
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Collector-base voltage	V_{CBO}	20	V
Collector-emitter voltage	V_{CEO}	12	V
Emitter-base voltage	V_{EBO}	3	V
Base current	I_B	40	mA
Collector current	I_C	80	mA
Collector power dissipation	P_C	100	mW
Junction temperature	T_j	125	$^\circ\text{C}$
Storage temperature range	T_{stg}	-55~125	$^\circ\text{C}$

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Unit: mm



Weight: 0.006 g (typ.)

Microwave Characteristics ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition frequency	f_T	$V_{CE} = 10\text{V}$, $I_C = 20\text{mA}$	5	7	—	GHz
Insertion gain	$ S_{21e} ^2 (1)$	$V_{CE} = 10\text{V}$, $I_C = 20\text{mA}$, $f = 500\text{MHz}$	—	18	—	dB
	$ S_{21e} ^2 (2)$	$V_{CE} = 10\text{V}$, $I_C = 20\text{mA}$, $f = 1\text{GHz}$	9.5	13	—	
Noise figure	NF (1)	$V_{CE} = 10\text{V}$, $I_C = 5\text{mA}$, $f = 500\text{MHz}$	—	1	—	dB
	NF (2)	$V_{CE} = 10\text{V}$, $I_C = 5\text{mA}$, $f = 1\text{GHz}$	—	1.1	2	

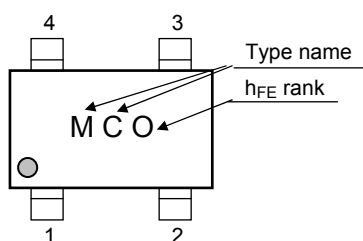
Electrical Characteristics (Ta = 25°C)

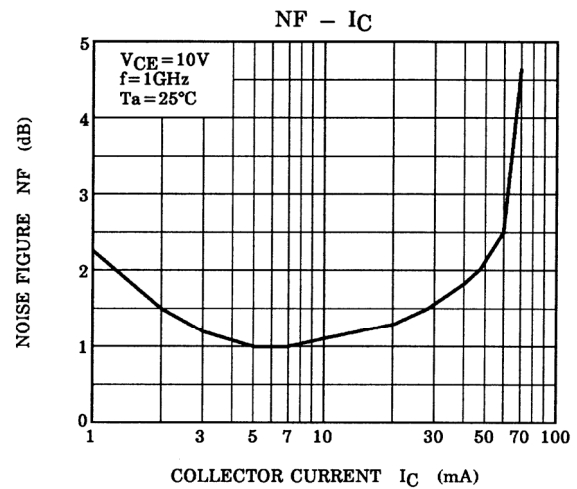
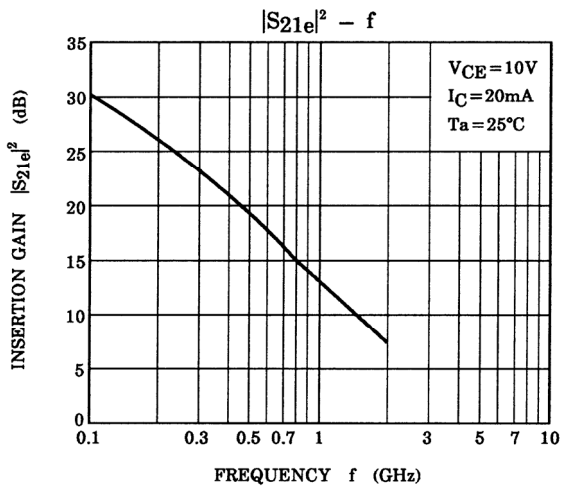
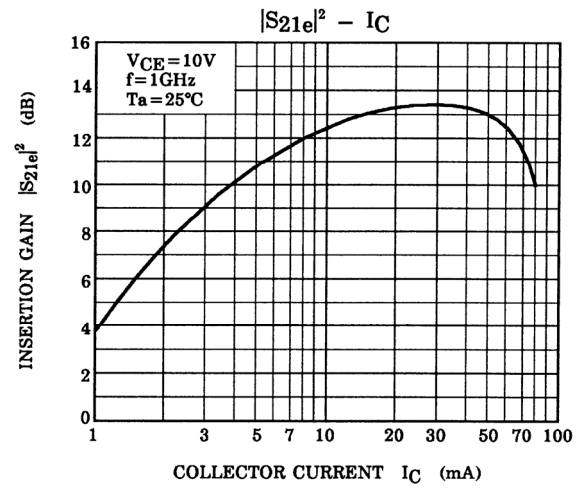
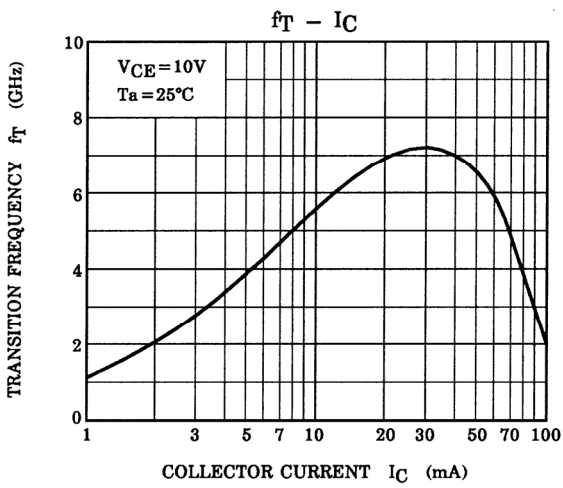
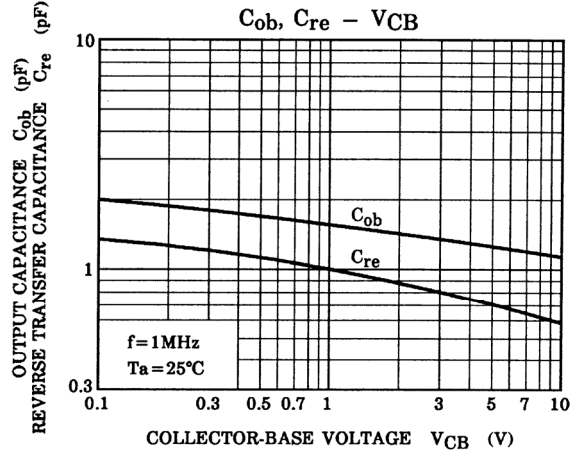
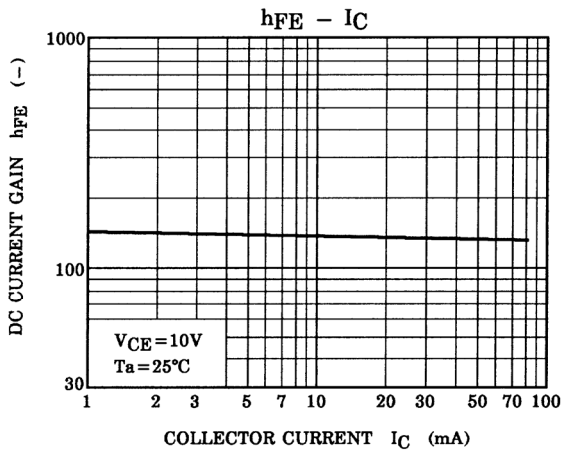
Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector cut-off current	I_{CBO}	$V_{CB} = 10\text{ V}, I_E = 0$	—	—	1	μA
Emitter cut-off current	I_{EBO}	$V_{EB} = 1\text{ V}, I_C = 0$	—	—	1	μA
DC current gain	h_{FE} (Note 1)	$V_{CE} = 10\text{ V}, I_C = 20\text{ mA}$	80	—	240	
Output capacitance	C_{ob}	$V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ (Note 2)	—	1.1	1.6	pF
Reverse transfer capacitance	C_{re}		—	0.65	1.05	pF

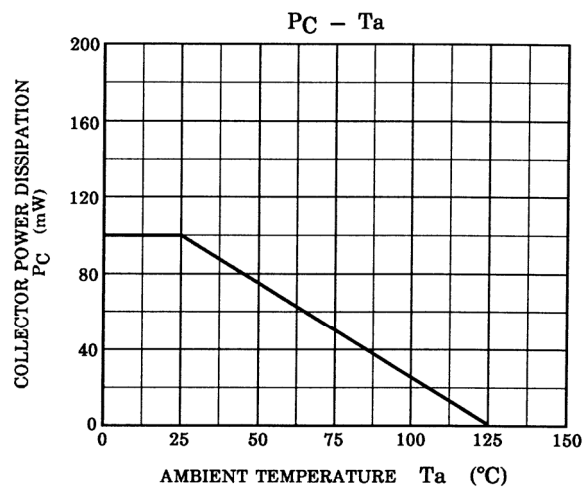
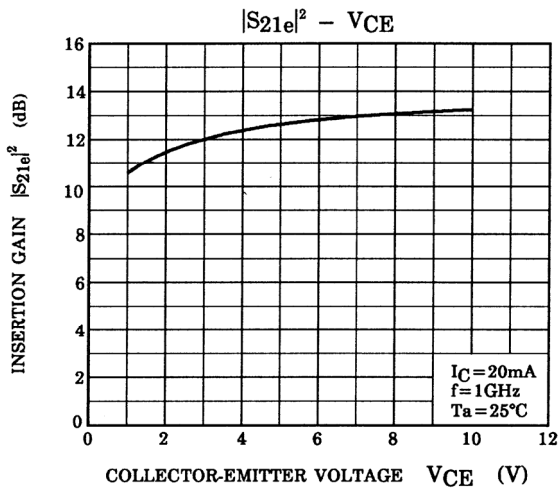
Note 1: h_{FE} classification O: 80~160, Y: 120~240

Note 2: C_{re} is measured by 3 terminal method with capacitance bridge.

Marking







S-Parameter $Z_O = 50 \Omega, T_a = 25^\circ\text{C}$

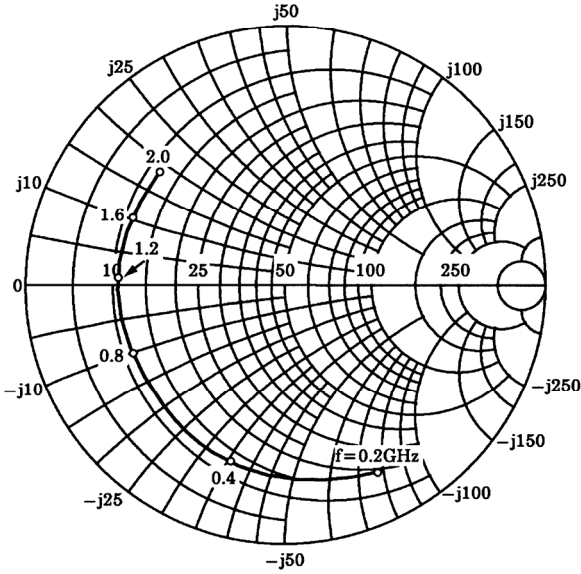
$V_{CE} = 10 \text{ V}, I_C = 5 \text{ mA}$

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.826	-64.3	9.839	139.2	0.056	59.2	0.844	-31.7
400	0.735	-106.8	7.058	115.2	0.083	43.8	0.663	-50.1
600	0.692	-134.4	5.233	99.5	0.094	36.8	0.558	-62.3
800	0.666	-154.3	4.106	88.1	0.100	33.3	0.496	-72.6
1000	0.656	-170.0	3.315	78.9	0.102	32.7	0.458	-81.8
1200	0.653	178.0	2.768	71.3	0.103	33.4	0.429	-90.6
1400	0.649	167.7	2.353	65.4	0.104	36.0	0.407	-99.4
1600	0.655	158.2	2.061	59.6	0.107	39.1	0.393	-107.8
1800	0.653	149.0	1.818	55.3	0.111	42.6	0.378	-115.3
2000	0.654	139.9	1.650	50.7	0.116	46.7	0.367	-121.9

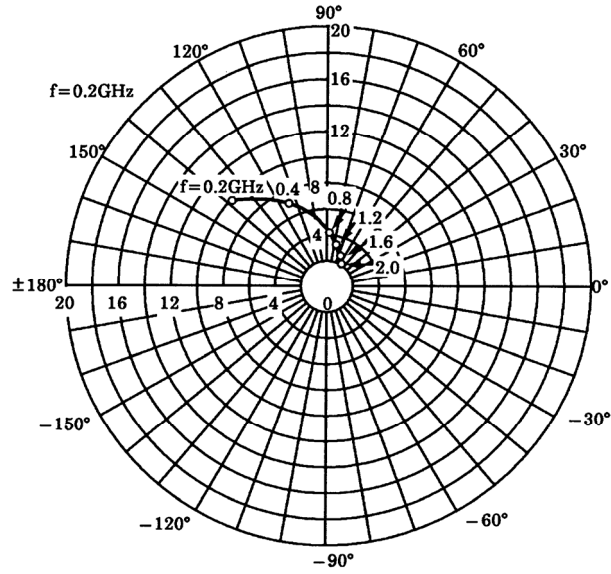
$V_{CE} = 10 \text{ V}, I_C = 20 \text{ mA}$

Frequency (MHz)	S11		S21		S12		S22	
	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.	Mag.	Ang.
200	0.747	-87.0	16.492	129.8	0.048	52.1	0.717	-47.1
400	0.675	-130.5	10.431	106.5	0.063	41.8	0.486	-69.1
600	0.648	-154.8	7.298	93.5	0.070	40.8	0.379	-82.0
800	0.636	-170.9	5.547	84.4	0.076	42.0	0.324	-93.0
1000	0.630	176.7	4.423	77.5	0.083	44.7	0.291	-102.7
1200	0.634	166.4	3.660	71.7	0.089	47.7	0.266	-112.1
1400	0.634	157.1	3.125	67.0	0.097	50.8	0.249	-120.8
1600	0.639	148.8	2.741	62.4	0.105	53.2	0.233	-128.9
1800	0.645	139.9	2.451	58.8	0.115	55.6	0.220	-135.8
2000	0.642	131.4	2.233	54.9	0.126	58.1	0.205	-141.2

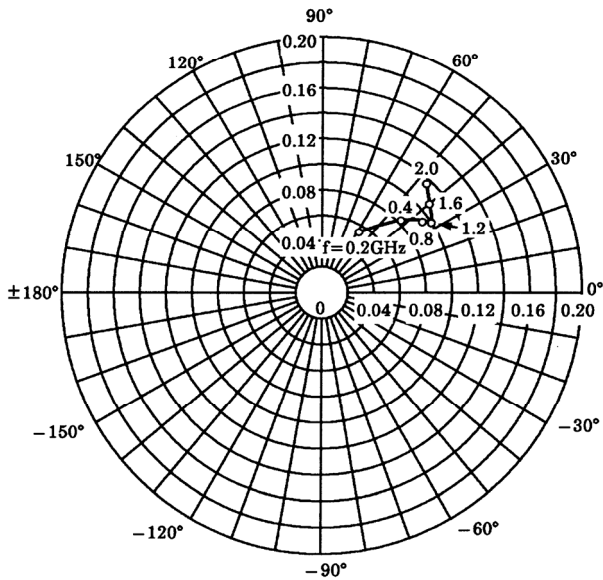
S11e
 VCE = 10V
 IC = 5mA
 Ta = 25°C
 (Unit : Ω)



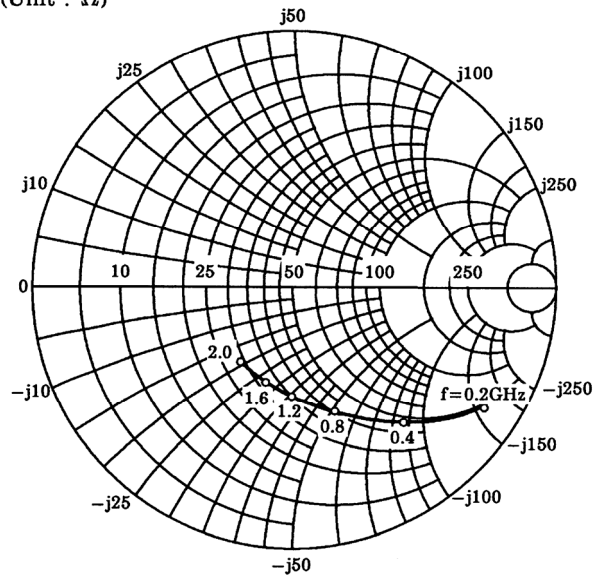
S21e
 VCE = 10V
 IC = 5mA
 Ta = 25°C



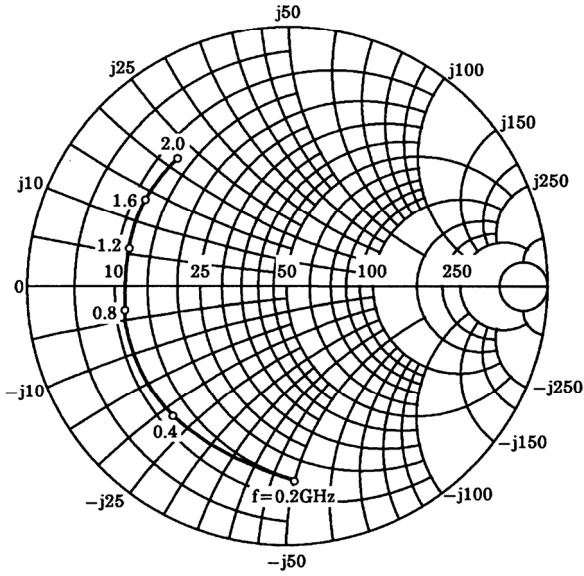
S12e
 VCE = 10V
 IC = 5mA
 Ta = 25°C



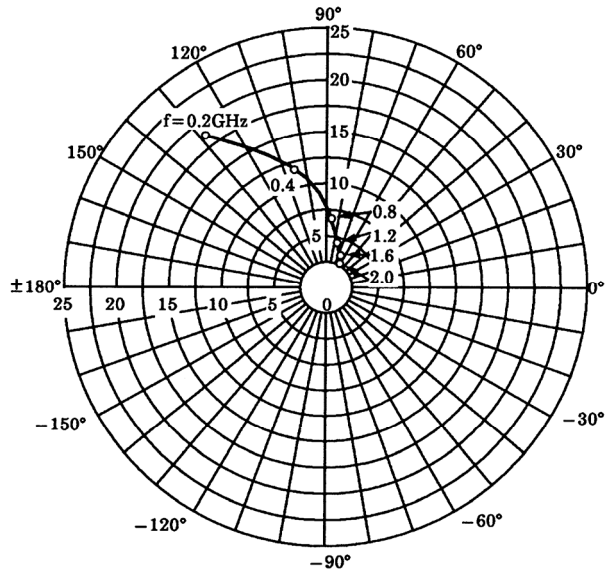
S22e
 VCE = 10V
 IC = 5mA
 Ta = 25°C
 (Unit : Ω)



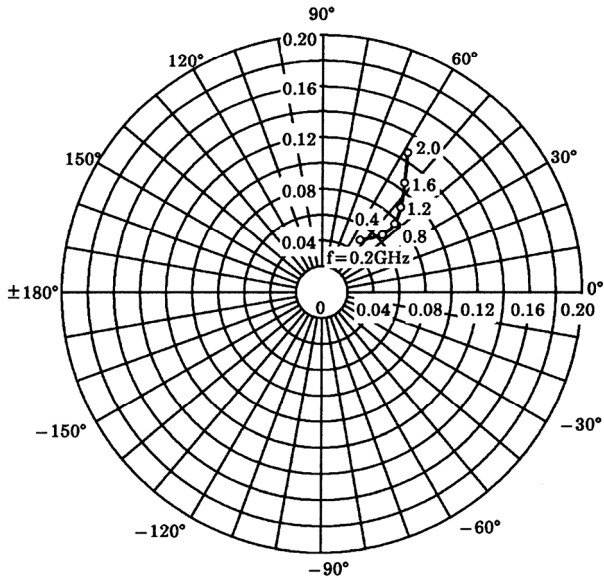
S11e
 VCE=10V
 IC=20mA
 Ta=25°C
 (Unit : Ω)



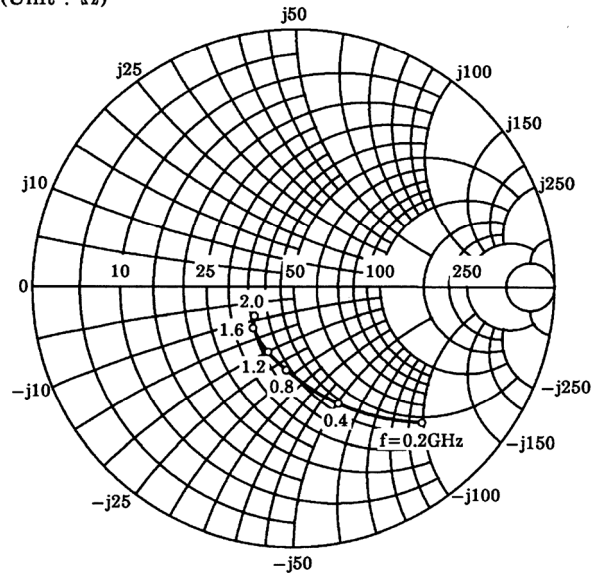
S21e
 VCE=10V
 IC=20mA
 Ta=25°C



S12e
 VCE=10V
 IC=20mA
 Ta=25°C



S22e
 VCE=10V
 IC=20mA
 Ta=25°C
 (Unit : Ω)



RESTRICTIONS ON PRODUCT USE

20070701-EN

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.