

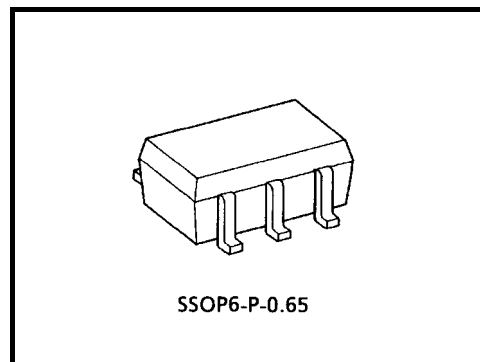
TG2211AFT

RF SPDT Switch

Antenna switch for Bluetooth class 2 and 3
Antenna switch for diversity
Switch for receive filters for mobile handsets
Switch for local signals

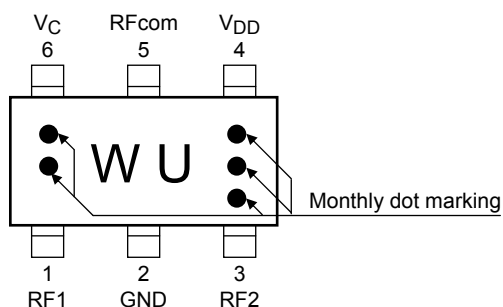
Features

- Small external circuit: Built-in inverter
- Low insertion loss : Loss = 0.45dB (typ.) @1.0 GHz
- High isolation : ISL = 25dB (typ.) @1.0 GHz
- Low voltage operation: $V_{DD} = V_C$ (Hi) = 2.4 V (min.)
- Small package : SSOP6-P-0.65 (TU6) package
(2.0 mm × 2.1 mm × 0.6 mm)

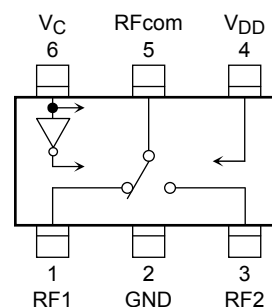


Weight: 0.0045 g (typ.)

Pin Configuration and Marking (top view)



Equivalent Circuit



Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$, $Z_g = Z_l = 50\ \Omega$)

Characteristic	Symbol	Conditions	Rating	Unit
Supply voltage	V_{DD}	$P_i \leq 15\ \text{dBmW}$	-0.5 (min.) / 6 (max.)	V
Control voltage	V_C	$P_i \leq 15\ \text{dBmW}$, $V_C - V_{DD} \leq 1.5\ \text{V}$	-0.5 (min.) / 6 (max.)	V
Input power	P_i	$V_{DD} = 2.4 \sim 2.7\ \text{V}$, $V_C = -0.2 \sim 3.3\ \text{V}$	25	dBmW
Total power dissipation	P_D	(Note 1)	250	mW
Operating temperature range	T_{opr}	—	-40 ~ 85	$^\circ\text{C}$
Storage temperature range	T_{stg}	—	-55 ~ 150	$^\circ\text{C}$

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 and the operating ranges.

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.).

Note 1: When mounted on a 20 mm × 24 mm × 0.4 mm double-sided Teflon printed circuit board (the entire reverse side is a ground connection) at $T_a = 25^\circ\text{C}$.

Caution

This device is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer.

See Note 5 for the power supply sequencing requirement.

Electrical Characteristics

$V_{DD} = 2.4 \sim 2.7$ V, V_C (Hi) = 2.4 ~ 3.3 V, V_C (Lo) = 0 V, $T_a = 25^\circ\text{C}$, $Z_g = Z_l = 50\ \Omega$, unless otherwise stated.

Characteristic		Symbol	Test Conditions	Min	Typ	Max	Unit
Insertion loss		Loss (1)	f = 1.0 GHz, P _i = 0 dBmW	—	0.45	0.75	dB
		Loss (2)	f = 2.0 GHz, P _i = 0 dBmW	—	0.5	0.8	
		Loss (3)	f = 2.5 GHz, P _i = 0 dBmW	—	0.6	0.85	
Isolation	between RFcom and RF1 between RFcom and RF2	ISL (1)	f = 1.0 GHz, P _i = 0 dBmW	20	25	—	
		ISL (2)	f = 2.0 GHz, P _i = 0 dBmW	20	25	—	
		ISL (3)	f = 2.5 GHz, P _i = 0 dBmW	20	24	—	
	between RF1 and RF2	ISL (4)	f = 1.0 GHz, P _i = 0 dBmW	20	25	—	
		ISL (5)	f = 2.0 GHz, P _i = 0 dBmW	17	20	—	
		ISL (6)	f = 2.5 GHz, P _i = 0 dBmW	14	17	—	
Input power at 1dB compression point (Note 3)		P _{i1dB} (1)	f = 1.0 GHz (Note 2)	17	23	—	dBmW
		P _{i1dB} (2)	f = 2.0 GHz (Note 2)	17	23	—	
		P _{i1dB} (3)	f = 2.5 GHz (Note 2)	16	22	—	
Supply current		I _{DD}	No RF signal (Note 2)	—	0.20	0.35	mA
Control current		I _C	No RF signal (Note 2)	—	0.03	0.05	mA
Switching time		tsw	f = 100 MHz, P _i = 0 dBmW	—	80	200	ns

Note 2: When $V_{DD} = 2.7$ V, V_C (Hi / Lo) = 2.7 V / 0 V.

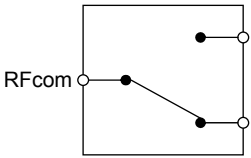
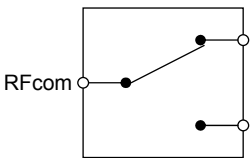
Note 3: P_{i1dB} is the input power level when the insertion loss increases by 1 dB from that of the linear range.

Recommended Operating Ranges ($T_a = 25^\circ\text{C}$)

Characteristic	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	2.4	—	2.7	V
Control voltage	V_C (Hi)	2.4	—	3.3	V
	V_C (Lo)	-0.2	0	0.2	V
Voltage difference	$V_{DD} - V_C$ (Lo)	2.4	—	2.9	V
	V_C (Hi) - V_{DD}	-0.2	0	0.6	V

Note 4: Always apply a voltage within the recommended range to V_{DD} pin when the device is operating, i.e. when any voltage other than 0 V is applied to V_C pin or RF signal is input to any RF port.

Switch Condition ($V_{DD} = 2.4 \sim 2.7$ V)

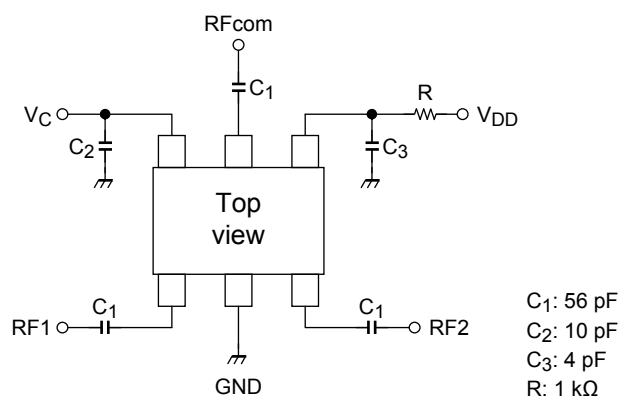
V_C Voltage Level	Internal Connection	RFcom – RF1	RFcom – RF2
High		ON	OFF
Low		OFF	ON

Pin Description

Pin No.	Symbol	Description
1	RF1	RF port. Connected to RFcom when V_C = High. Connect the capacitor (C_1) to block internal DC voltage of the IC.
2	GND	GND pin. Connect to the ground pattern of the circuit board.
3	RF2	RF port. Connected to RFcom when V_C = Low. Connect the capacitor (C_1) to block internal DC voltage of the IC.
4	V_{DD}	Power supply and RF-GND pin. Must be RF-grounded via the capacitor (C_3), and should be done as close as possible for better RF performance. The value of the capacitor significantly affects the isolation. Connect the resistor (R) behind the capacitor to block RF leakage. Apply a voltage within the recommended range of V_{DD} to the far end of the resistor.
5	RFcom	RF port. Connection can be switched to RF1 or RF2 by varying the level of the voltage applied to the V_C pin. Connect the capacitor (C_1) to block internal DC voltage of the IC.
6	V_C	Switch connection control pin. The switch connections can be controlled by varying the level of the voltage to this pin. Connect the bypass capacitor (C_2) to the pin.

Note 5: This device requires the power supply sequencing in which V_{DD} is powered up first and powered down last. Always apply a voltage within the recommended range to V_{DD} pin when the device is operating, i.e. when any voltage other than 0 V is applied to V_C pin or RF signal is input to any RF port.

RF Test Circuit

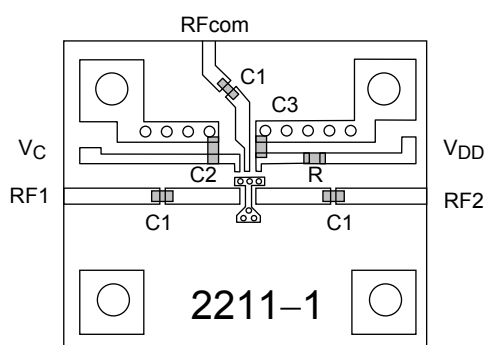


The values of external capacitors and resistor should be chosen to accommodate the operation frequency, bandwidth, switching speed and the pattern layout of the actual circuit board in the user's system. Be sure to take this into consideration when designing circuits.

List of External Components for Reference

	50~300 MHz	300~500 MHz	0.5~2.5 GHz	Chip Series	
C_1	1000 pF	100 pF	56 pF	GRM1552C1H series	MURATA
C_2	100 pF	10 pF	10 pF	GRM1552C1H series	MURATA
C_3	100 pF	100 pF	4 pF	GRM1552C1H series	MURATA
R	1 kΩ	1 kΩ	1 kΩ	MCR01MZSJ series	ROHM

Evaluation Board



Notice

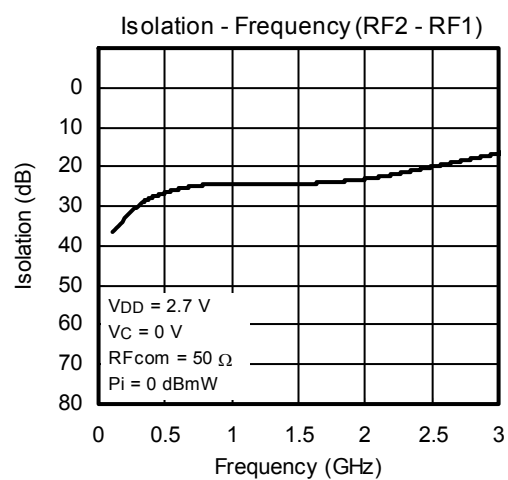
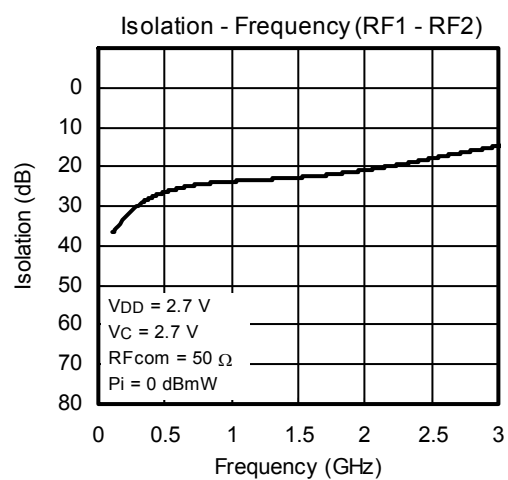
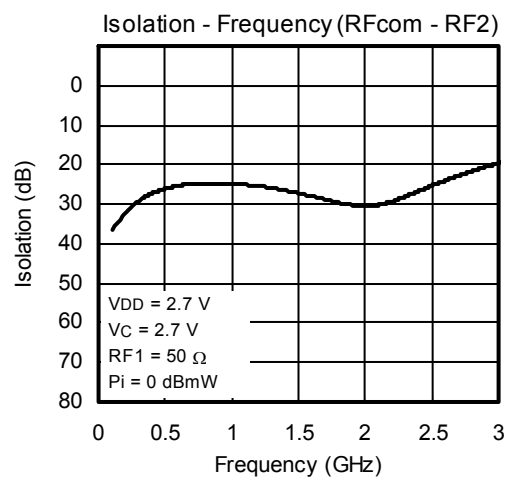
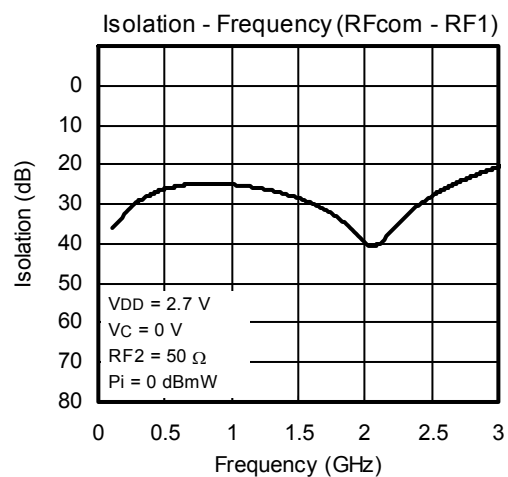
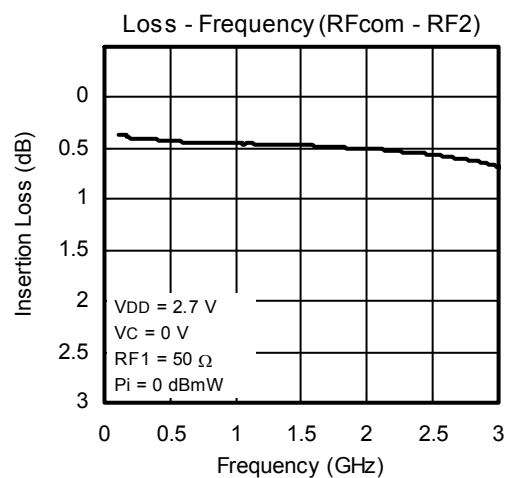
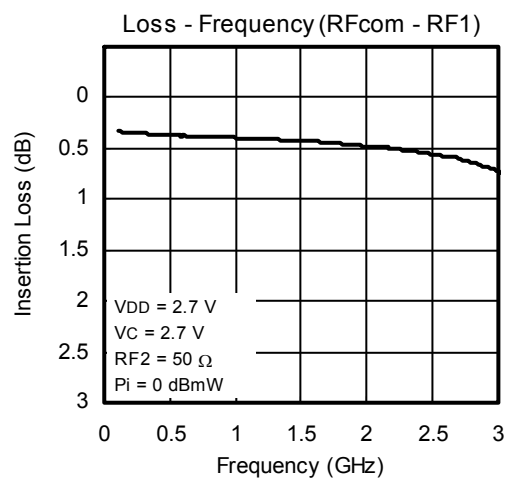
The circuits and measurements contained in this document are given in the context of example applications of the product only.

Moreover, these example application circuits are not intended for mass production since the high-frequency characteristics (i.e., the AC characteristics) of the device will be affected by the external components that the customer uses, by the design of the circuit and by various other conditions.

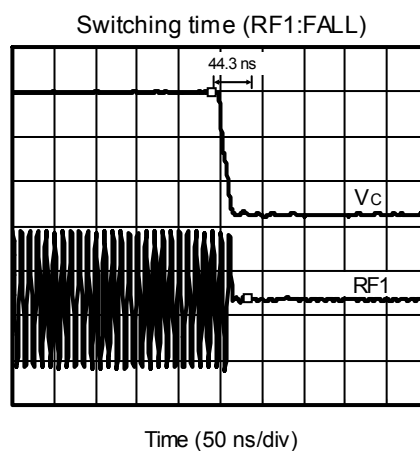
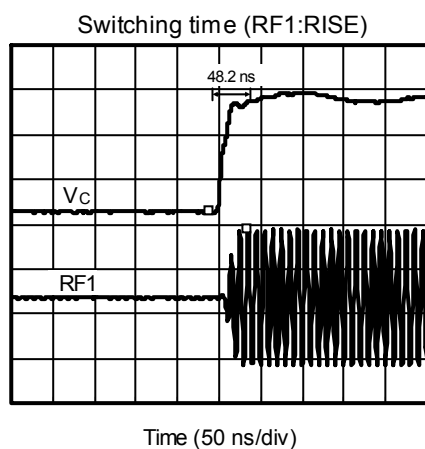
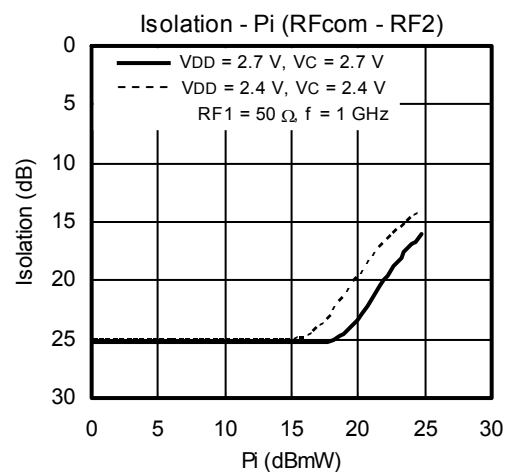
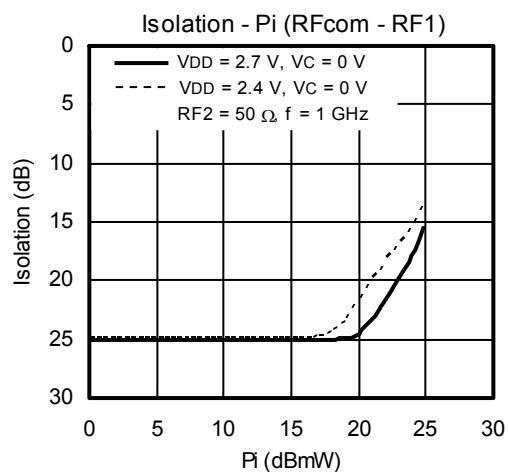
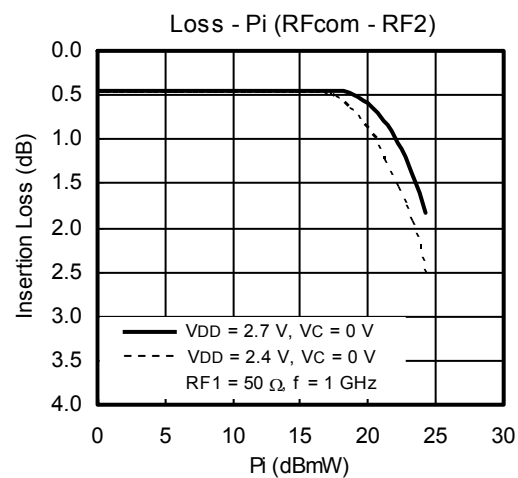
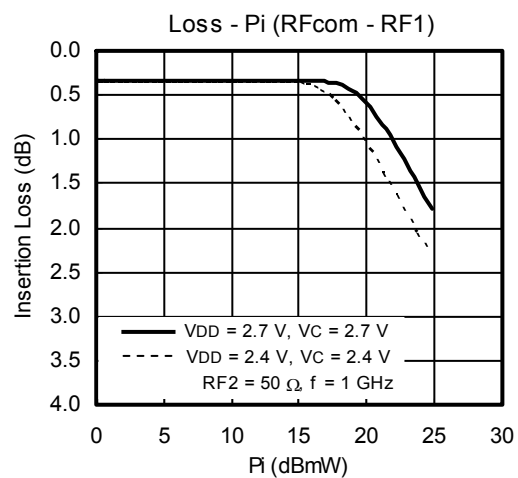
It is the responsibility of the customer to design external circuits that correctly implement the intended application and to check the characteristics of the design.

TOSHIBA assumes no responsibility for the integrity of customer circuit designs or applications.

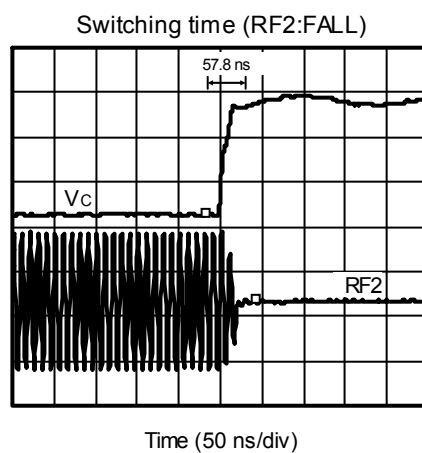
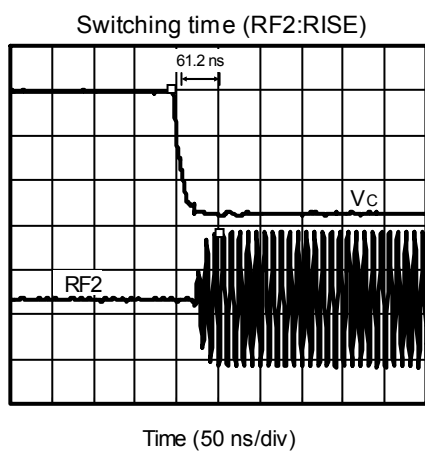
Typical Operating Characteristics



Typical Operating Characteristics (continued)

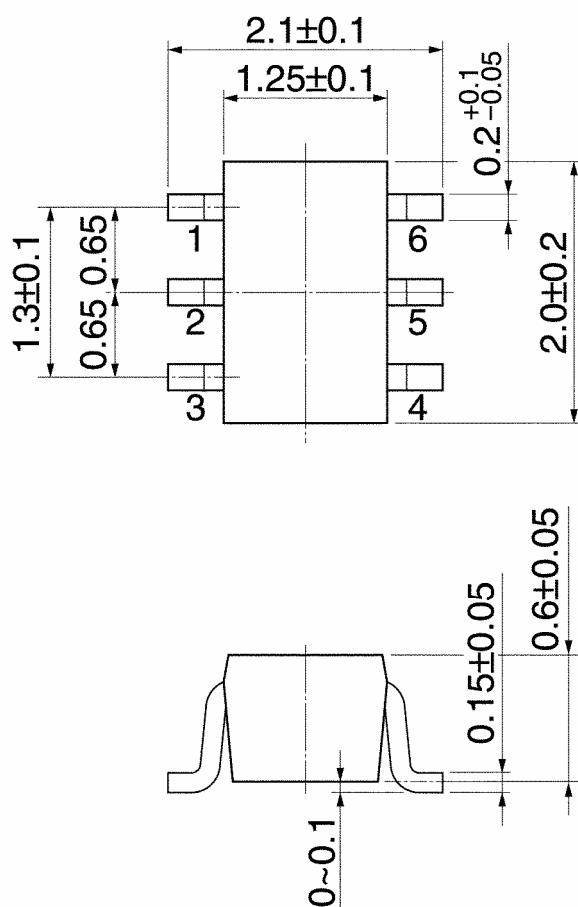


Typical Operating Characteristics (continued)



SSOP6-P-0.65

Unit: mm



Weight: 0.0045 g (typ.)

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.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- GaAs(Gallium Arsenide) is used in this product. The dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically.
- 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.