

TC7W66F, TC7W66FU, TC7W66FK

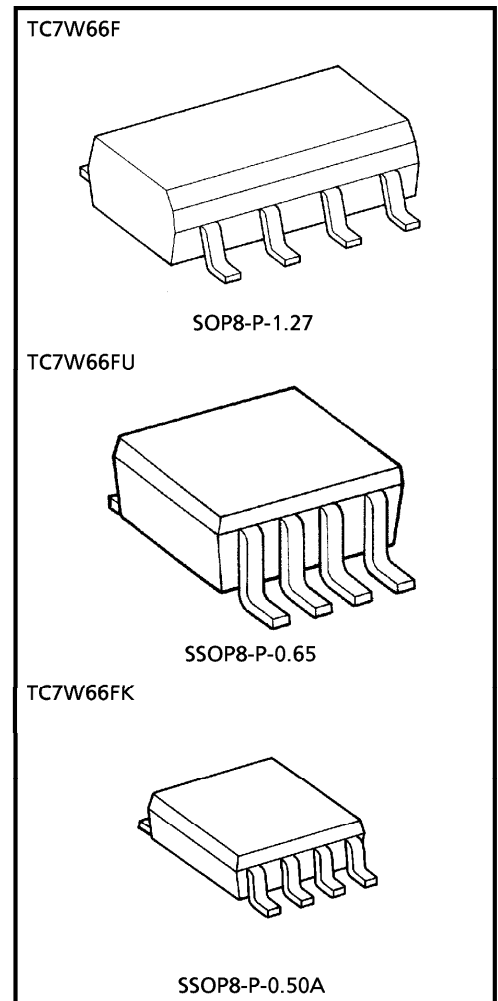
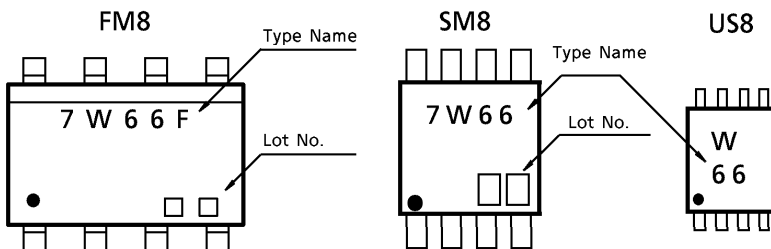
DUAL BILATERAL SWITCH

The TC7W66 is a high speed CMOS DUAL BILATERAL SWITCH fabricated with silicon gate CMOS technology. It consists of four independent high speed switches capable of controlling either digital or analog signals while maintaining the CMOS low power dissipation. Control input (C) is provided to control the switch. The switch turns ON while the C input is high, and the switch turns OFF while low. All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES

- High Speed $t_{pd} = 7ns$ (Typ.) at $V_{CC} = 5V$
- Low Power Dissipation $I_{CC} = 1\mu A$ (Max.) at $T_a = 25^\circ C$
- High Noise Immunity $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Low ON Resistance $R_{ON} = 50\Omega$ (Typ.) at $V_{CC} = 9V$
- High Degree of Linearity $THD = 0.05$ (Typ.) at $V_{CC} = 5V$
- Pin and Function Compatible with TC4W66

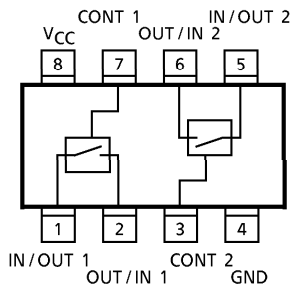
MARKING



Weight

| | |
|---------------|----------------|
| SOP8-P-1.27 | : 0.05g (Typ.) |
| SSOP8-P-0.65 | : 0.02g (Typ.) |
| SSOP8-P-0.50A | : 0.01g (Typ.) |

PIN ASSIGNMENT (TOP VIEW)



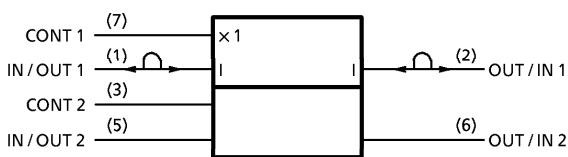
TRUTH TABLE

| CONTROL | SWITCH FUNCTION |
|---------|-----------------|
| H | ON |
| L | OFF |

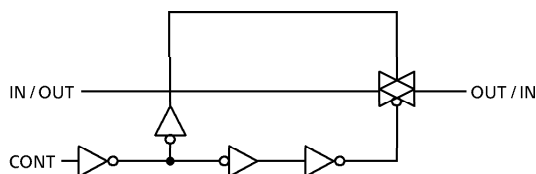
MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---------------------------------|------------------|-----------------------------|------|
| Supply Voltage Range | V _{CC} | - 0.5~13 | V |
| Control Input Voltage | V _{IN} | - 0.5~V _{CC} + 0.5 | V |
| Switch I/O Voltage | V _{OUT} | - 0.5~V _{CC} + 0.5 | V |
| Control Input Diode Current | I _{IK} | ± 20 | mA |
| I/O Diode Current | I _{OK} | ± 20 | mA |
| Switch Through Current | I _{OUT} | ± 25 | mA |
| DC V _{CC} /GND Current | I _{CC} | ± 25 | mA |
| Power Dissipation | P _D | 300 (FM8, SM8) | mW |
| | | 200 (US8) | |
| Storage Temperature | T _{stg} | - 65~150 | °C |
| Lead Temperature (10 s) | T _L | 260 | °C |

LOGIC SYMBOL



LOGIC DIAGRAM (1 / 2 TC7W66)



RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|--------------------------|------------|----------------------------|------|
| Supply Voltage | V_{CC} | 2~12 | V |
| Control Input Voltage | V_{IN} | 0~ V_{CC} | V |
| Switch I/O Voltage | $V_{I/O}$ | 0~ V_{CC} | V |
| Operating Temperature | T_{opr} | -40~85 | °C |
| Input Rise and Fall Time | t_r, t_f | 0~1000 ($V_{CC} = 2.0V$) | ns |
| | | 0~500 ($V_{CC} = 4.5V$) | |
| | | 0~400 ($V_{CC} = 6.0V$) | |
| | | 0~250 ($V_{CC} = 10.0V$) | |

DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC | SYMBOL | TEST CONDITION | $T_a = 25^\circ C$ | | | | $T_a = -40 \sim 85^\circ C$ | | UNIT |
|--|-----------|--|--|-----------------|---|-----------|-----------------------------|------------|----------|
| | | | V_{CC} | MIN. | TYP. | MAX. | MIN. | MAX. | |
| High-Level Control Input Voltage | V_{IHC} | | 2.0 | 1.5 | — | — | 1.5 | — | V |
| | | | 4.5 | 3.15 | — | — | 3.15 | — | |
| | | | 9.0 | 6.3 | — | — | 6.3 | — | |
| | | | 12.0 | 8.4 | — | — | 8.4 | — | |
| Low-Level Control Input Voltage | V_{ILC} | | 2.0 | — | — | 0.5 | — | 0.5 | V |
| | | | 4.5 | — | — | 1.35 | — | 1.35 | |
| | | | 9.0 | — | — | 2.7 | — | 2.7 | |
| | | | 12.0 | — | — | 3.6 | — | 3.6 | |
| ON Resistance | R_{ON} | $V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ to GND $I_{I/O} \leq 1mA$ | 4.5 | — | 96 | 170 | — | 200 | Ω |
| | | | 9.0 | — | 55 | 85 | — | 100 | |
| | | | 12.0 | — | 45 | 80 | — | 90 | |
| | | | 2.0 | — | 160 | — | — | — | |
| | | $V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ or GND $I_{I/O} \leq 1mA$ | 4.5 | — | 70 | 100 | — | 130 | |
| | | | 9.0 | — | 50 | 75 | — | 95 | |
| | | | 12.0 | — | 45 | 70 | — | 90 | |
| | | | Difference of ON Resistance Between Switches | ΔR_{ON} | $V_{IN} = V_{IHC}$ $V_{I/O} = V_{CC}$ to GND $I_{I/O} \leq 1mA$ | 4.5 | — | 10 | |
| 9.0 | — | 5 | | | | — | — | — | |
| 12.0 | — | 5 | | | | — | — | — | |
| Input/Output Leakage Current (SWITCH OFF) | I_{OFF} | $V_{OS} = V_{CC}$ or GND $V_{IS} = GND$ or V_{CC} $V_{IN} = V_{ILC}$ | 12.0 | — | — | ± 100 | — | ± 1000 | nA |
| Switch Input Leakage Current (SWITCH ON OUTPUT OPEN) | I_{IZ} | $V_{OS} = V_{CC}$ or GND $V_{INH} = V_{IHC}$ | 12.0 | — | — | ± 100 | — | ± 1000 | nA |
| Control Input Current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | ± 100 | — | ± 1000 | nA |
| Quiescent Supply Current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 1.0 | — | 10.0 | μA |
| | | | 9.0 | — | — | 4.0 | — | 40.0 | |
| | | | 12.0 | — | — | 8.0 | — | 80.0 | |

AC ELECTRICAL CHARACTERISTICS ($C_L = 50\text{pF}$, Input $t_r = t_f = 6\text{ns}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | Ta = 25°C | | | Ta = -40~85°C | | UNIT | |
|---|------------------------|---|-----------------|------|------|---------------|------|------|------|
| | | | V _{CC} | MIN. | TYP. | MAX. | MIN. | | MAX. |
| Phase Difference Between Input and Output | $\phi_{I/O}$ | | 2.0 | — | 10 | 50 | — | 65 | ns |
| | | | 4.5 | — | 4 | 10 | — | 13 | |
| | | | 9.0 | — | 3 | 8 | — | 10 | |
| | | | 12.0 | — | 3 | 7 | — | 9 | |
| Output Enable Time | t_{pZL} t_{pZH} | $R_L = 1\text{k}\Omega$ | 2.0 | — | 18 | 100 | — | 125 | ns |
| | | | 4.5 | — | 8 | 20 | — | 25 | |
| | | | 9.0 | — | 6 | 12 | — | 22 | |
| | | | 12.0 | — | 6 | 12 | — | 18 | |
| Output Disable Time | t_{pLZ} t_{pHZ} | $R_L = 1\text{k}\Omega$ | 2.0 | — | 20 | 115 | — | 145 | ns |
| | | | 4.5 | — | 10 | 23 | — | 29 | |
| | | | 9.0 | — | 8 | 20 | — | 25 | |
| | | | 12.0 | — | 8 | 18 | — | 22 | |
| Maximum Control Input Frequency | | $R_L = 1\text{k}\Omega$ $C_L = 15\text{pF}$ $V_{OUT} = 1/2V_{CC}$ | 2.0 | — | 30 | — | — | — | MHz |
| | | | 4.5 | — | 30 | — | — | — | |
| | | | 9.0 | — | 30 | — | — | — | |
| | | | 12.0 | — | 30 | — | — | — | |
| Control Input Capacitance | C_{IN} | | — | 5 | 10 | — | 10 | pF | |
| Switch Terminal Capacitance | $C_{I/O}$ | | — | 6 | — | — | — | pF | |
| Feed Through Capacitance | C_{IOS} | | — | 0.5 | — | — | — | pF | |
| Power Dissipation Capacitance | C_{PD} | (Note 1) | — | 15 | — | — | — | pF | |

(Note 1) : C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

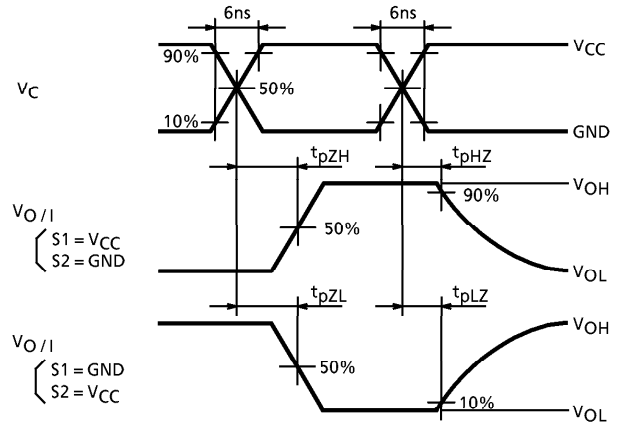
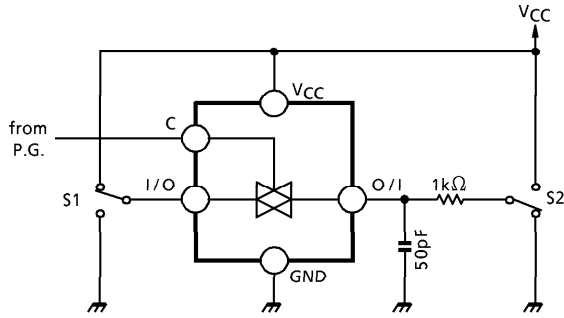
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2$$

ANALOG SWITCH CHARACTERISTICS (GND = 0V, Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | V _{CC} | TYP. | UNIT |
|---|------------------|--|-----------------|------|------|
| | | | | | |
| Sine Wave Distortion (T.H.D) | | f _{IN} = 1kHz, V _{IN} = 4.0Vp-p @V _{CC} = 4.5V R _L = 10kΩ, V _{IN} = 8.0Vp-p @V _{CC} = 9.0V C _L = 50pF | 4.5 | 0.05 | % |
| | | | 9.0 | 0.04 | |
| Frequency Response (Switch ON) | f _{MAX} | Adjust f _{IN} voltage to obtain 0dBm at V _{OS} Increase f _{IN} Frequency until dB Meter reads -3dB R _L = 50Ω, C _L = 10pF f _{IN} = 1MHz, Sine Wave | 4.5 | 200 | MHz |
| | | | 9.0 | 200 | |
| Feedthrough Attenuation (Switch OFF) | | V _{in} is centered at V _{CC} / 2 Adjust input for 0dBm R _L = 600Ω, C _L = 50pF f _{IN} = 1MHz, Sine Wave | 4.5 | -60 | dB |
| | | | 9.0 | -60 | |
| Crosstalk (Control Input to Signal Output) | | R _L = 600Ω, C _L = 50pF f _{IN} = 1MHz, Square Wave (t _r = t _f = 6ns) | 4.5 | 60 | mV |
| | | | 9.0 | 100 | |
| Crosstalk (Between any switches) | | Adjust V _{IN} to obtain 0dBm at Input R _L = 600Ω, C _L = 50pF f _{IN} = 1MHz, Sine Wave | 4.5 | -60 | dB |
| | | | 9.0 | -60 | |

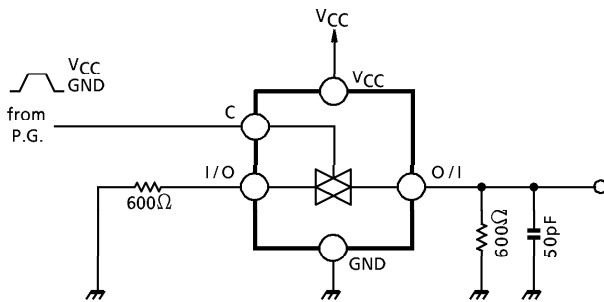
SWITCHING CHARACTERISTICS TEST CIRCUITS

1. t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}

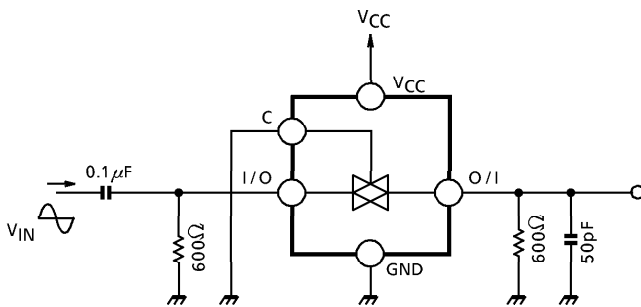


2. CROSS TALK (CONTROL INPUT-SWITCH OUTPUT)

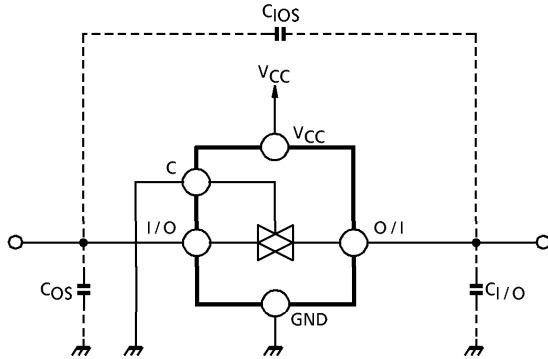
$f_{in} = 1\text{MHz}$, $\text{duty} = 50\%$, $t_r = t_f = 6\text{ns}$



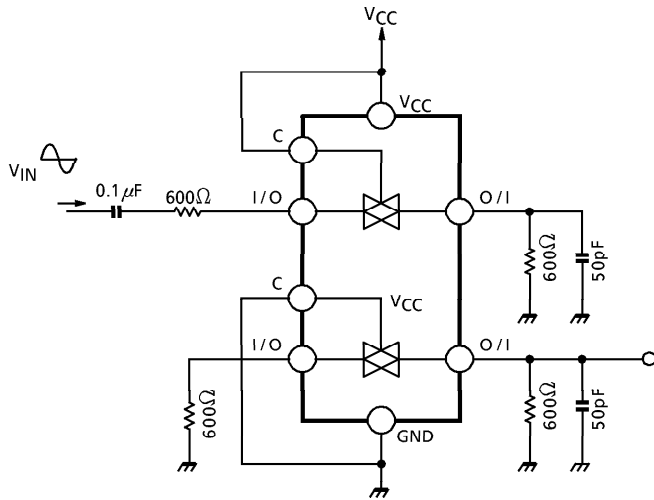
3. FEEDTHROUGH ATTENUATION



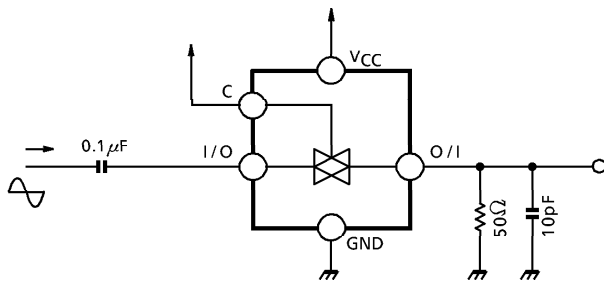
4. Clos, $C_{I/O}$



5. CROSS TALK (BETWEEN ANY TWO SWITCHES)

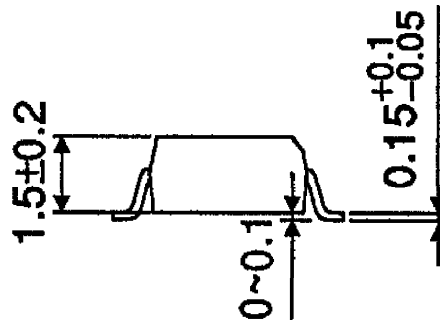
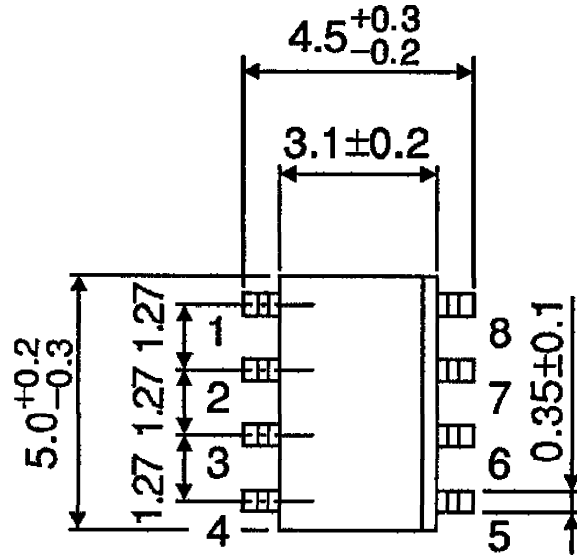


6. FREQUENCY RESPONSE (SWITCH ON)



PACKAGE DIMENSIONS
SOP8-P-1.27

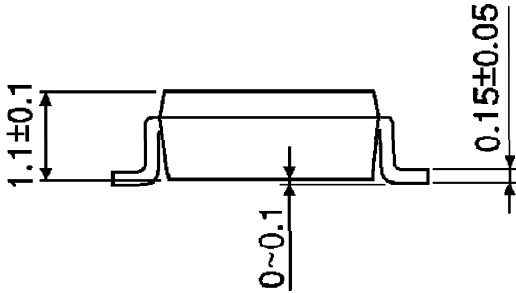
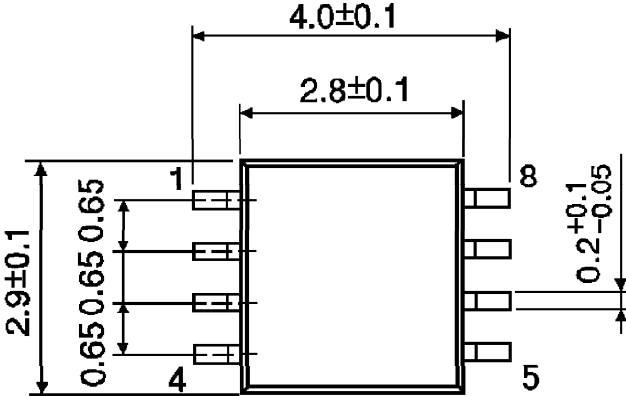
Unit : mm



Weight : 0.05g (Typ.)

PACKAGE DIMENSIONS
SSOP8-P-0.65

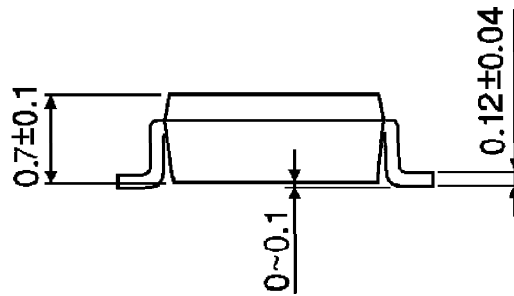
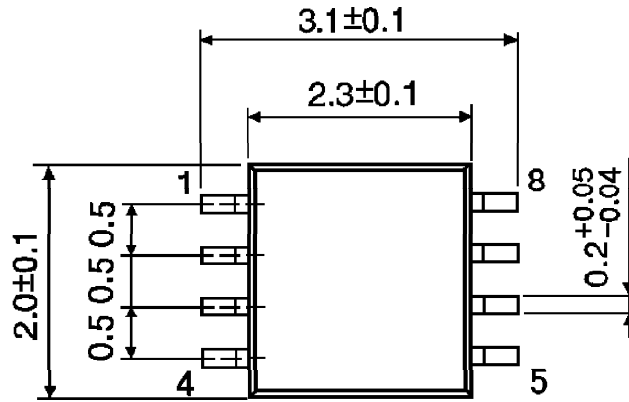
Unit : mm



Weight : 0.02g (Typ.)

PACKAGE DIMENSIONS
SSOP8-P-0.50A

Unit : mm



Weight : 0.01g (Typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- 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 are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.