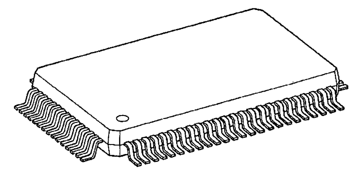
TOSHIBA Bi−CMOS INTEGRATED CIRCUIT SILICON MONOLITHIC

# TD62C805FG

## 48BIT THERMAL HEAD DRIVER

The TD62805FG is a general purpose 48bit driver IC consisting of 8 block 8bit shift register and 48bit drivers (Open Drain).
This device is best suited as a 48 dot thermal printer head drivers.
The suffix (G) appended to the part number represents a Lead (Pb)-Free product.



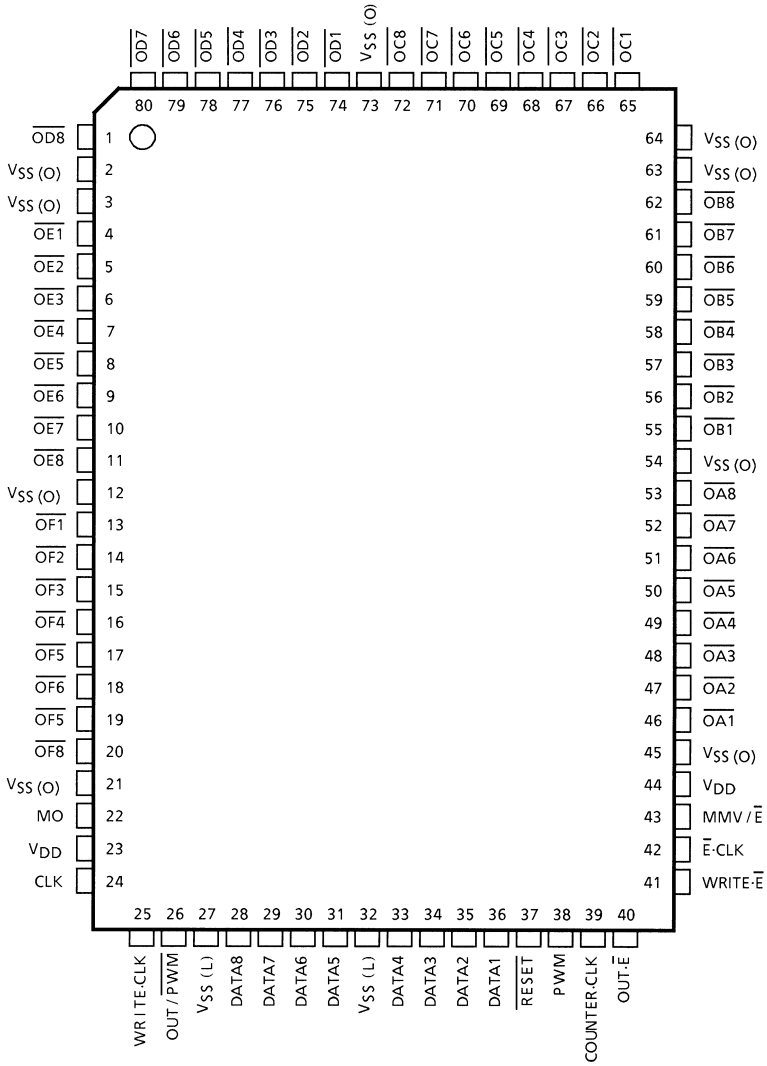
QFP80-P-1420-0.80C

Weight: 1.53 g (typ.)

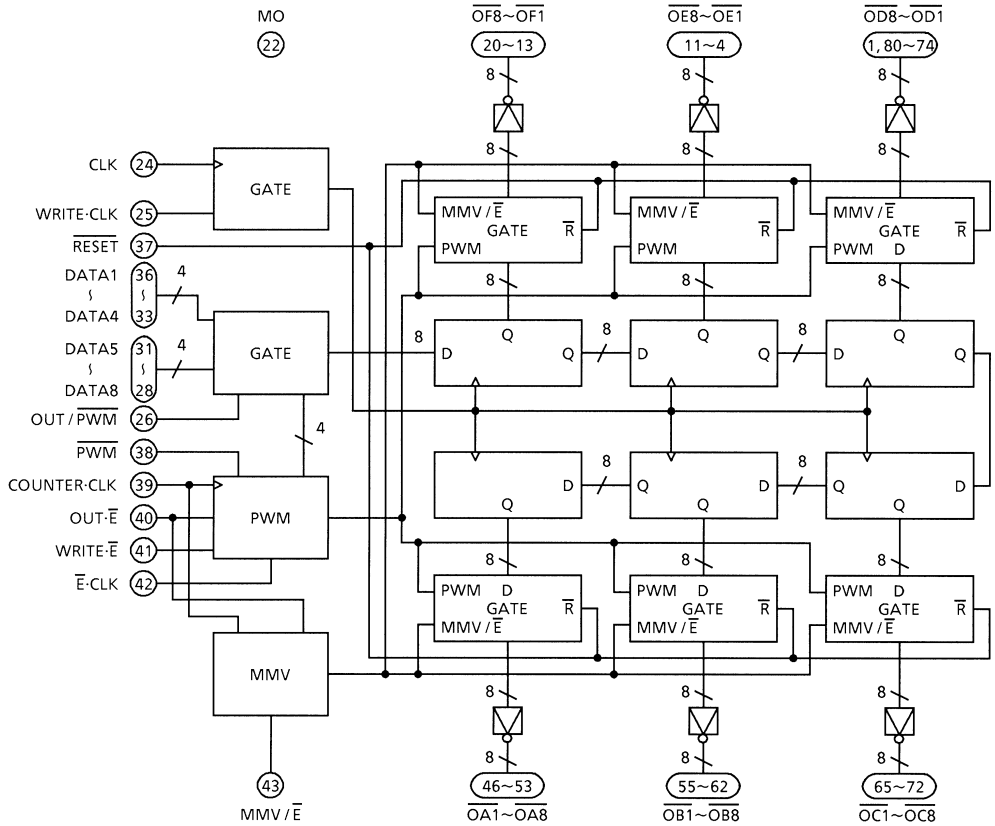
### Features

- 8bit parallel input and 6 block 8bit shift register
- CMOS compatible input.
- High driverability ········· 30 V / 100 mA / ch
- Built in monostable multivibrator for head protection
- 16 steps gray scale operating with 4bit data
- 48bit open drain outputs
- Package ························· μPFP−80 pin

## Pin Connection (top view)



## Block Diagram

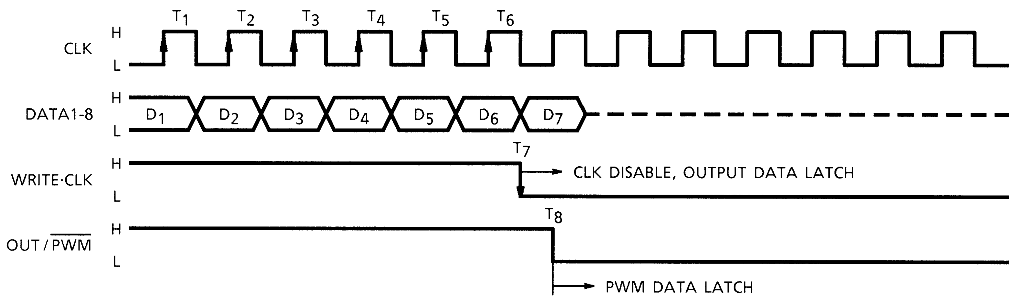


## Pin Function

| PIN No. | PIN NAME | FUNCTION |
|---|---|---|
| 24 | CLK | “↑” : Data shift |
| 25 | WRITE·CLK | “H” : enable clock signal, “L” : disable clock signal pull−up input terminal |
| 37 | $\overline{RESET}$ | “L” : all outputs “OFF”, reset PWM counter reset PWM counter and MMV circuit<br>Pull−up input terminal |
| 28~36 | DATA1~8 | Input terminals for output data<br>“H” : output “ON”, “L” : output “OFF”<br>And input terminals for PWM data |
| 26 | OUT / $\overline{PWM}$ | “H” : enable output data for shift register<br>“L” : enable PWM data for counter |
| 38 | $\overline{PWM}$ | “L” : output enable (PWM operating) |
| 39 | COUNTER·CLOCK | Input terminal for clock of PWM counter and for trigger of MMV |
| 40 | OUT· $\overline{E}$ | “L” : all outputs “ON” |
| 42 | $\overline{E}$ ·CLK | “↓” : outputs “OFF” when OUT·E is “High”. Outputs “ON” when OUT·E is “Low”.<br>Pull−up input terminal |
| 41 | WRITE· $\overline{E}$ | “H” : enable E−CLK signal pull−up input terminal |
| 43 | MMV / E | CR connection terminal for MMV |
| 22 | MO | ON / OFF monitor terminal of output $\overline{OF8}$ |
| 23, 44 | $V_{DD}$ | Supply voltage terminal for control logic |
| — | $V_{SS\ (O)}$ | GND terminals for driver<br>PIN No. : 2, 3, 12, 21, 45, 54, 63, 64, 73 |
| 27, 32 | $V_{SS\ (L)}$ | GND terminals for control logic |

### (1) Data Input

$D_1$~$D_6$ of Input Dates are entered to shift Register by the clock signal with the timing of rise.
Outputs are latched by holding the WRITE·CLK "Low" or to stop the clock signal.
PWM Data (DATA1~4) are latched by OUT / PWM signal "Low".

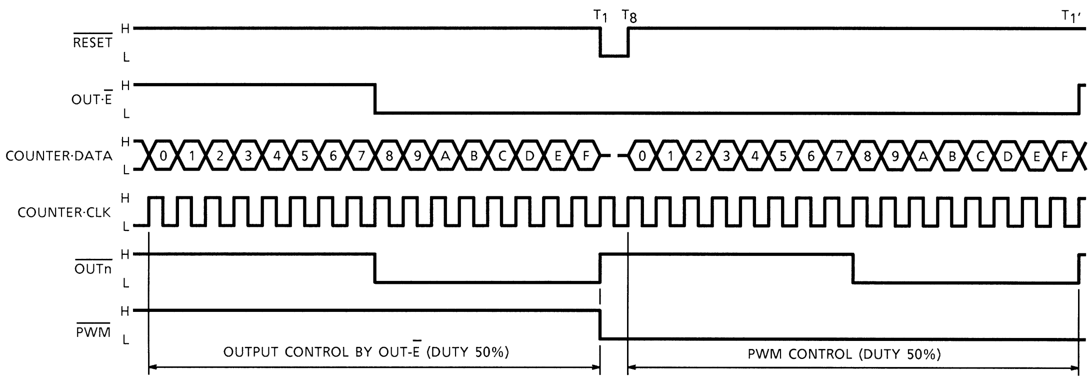



### (2) Output Enable

Outputs become "OFF" at the first rising edge of E·CLK after the OUT·E to "High", and become "ON" at the first rising edge of E·CLK after the OUT·E to "Low".
Output ON / OFF duty is controlled by controlling OUT·E signal directly or to change the timing of WRITE·E and E·CLK.

### (3) PWM Control

Outputs ON / OFF duty are controlled by OUT·$\overline{E}$ and PWM DATA of $D_1$~$D_4$ PWM control is performed by comparing the internal 4bit PWM Counter out and PWM DATA of $D_1$~$D_4$.
For example, when PWM DATA is 7, 50% Output Duty is obtained.
(Refer to tables below.)

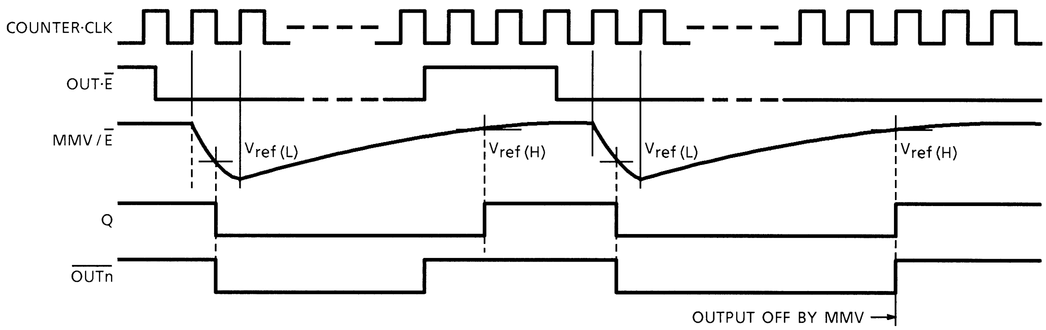



| PWM DATA | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| Duty (%) | 0 | 6.25 | 12.50 | 18.75 | 25.00 | 31.25 | 37.50 | 43.75 | 50.00 | 56.25 |

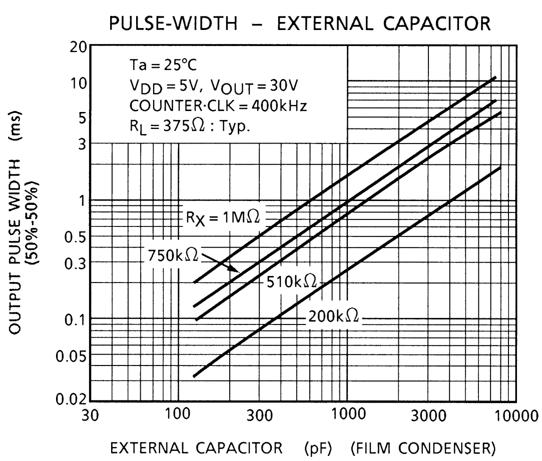
| PWM DATA | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| Duty (%) | 62.50 | 68.75 | 75.00 | 81.25 | 87.50 | 100.00 |

## MMV Operation

MMV output of Q becomes “L” when the MMV / E voltage becomes less than $V_{ref\ (L)}$ after the first rising edge of INTERNAL CLOCK.
And becomes “H” when the MMV / E voltage above $V_{ref\ (H)}$ after re−charging of external capacitance connect to MMV / E. The external capacitance and Resistor connect to MMV / E control MMV Output “ON” period.
So Output Load is protected from burn−out. It’s required enough discharging time of external capacitance. (Refer to figure below)

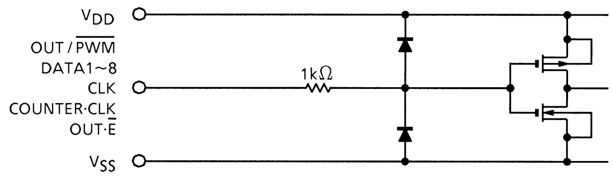



- **Pulse width of MMV**

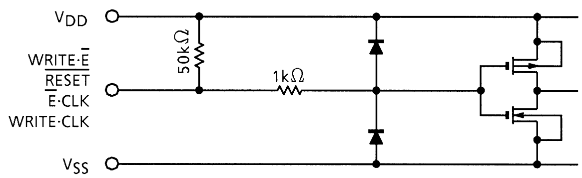


## Input Circuit

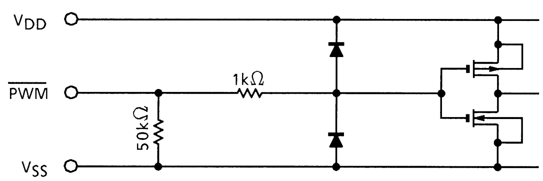
### 1. DATA1~8, CLK, COUNTER·CLK, OUT / $\overline{\text{PWM}}$ , OUT· $\overline{\text{E}}$




### 2. $\overline{\text{E}}$ ·CLK, $\overline{\text{RESET}}$ , WRITE· $\overline{\text{E}}$ , WRITE·CLK

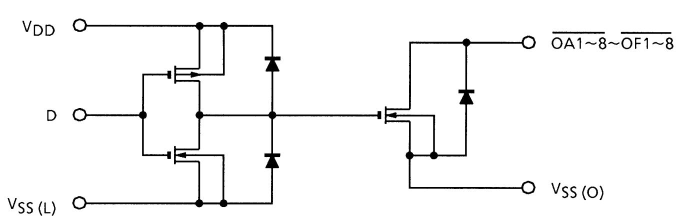



### 3. $\overline{\text{PWM}}$




## Output Circuit

### 1. $\overline{\text{OA1~8}}$ ~ $\overline{\text{OF1~8}}$



## Absolute Maximum Ratings (Ta = 25°C)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Supply Voltage | | $V_{DD}$ | 7 | V |
| Output Voltage | | $V_{DS}$ | 30 | V |
| Output Current | | $I_{DS}$ | 100 | mA / ch |
| Input Current | | $I_{IN}$ | ±5 | mA |
| Input Voltage | | $V_{IN}$ | −0.4~$V_{DD}$±0.4 | V |
| Power Dissipation | Free Air | $P_D$ | 1.0 | W |
| | On PCB (Note) | | 1.3 | |
| Operating Temperature | | $T_{opr}$ | −40~85 | °C |
| Storage Temperature | | $T_{stg}$ | −55~150 | °C |

Note: On Glass Epoxy PCB (100 × 100 × 1.6 mm, Cu 40%)

## Recommended Operating Conditions (Ta = −40~85°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{DS}$ | — | — | — | 26 | V |
| Supply Voltage | $V_{DD}$ | — | 4.5 | — | 5.5 | V |
| Output Current | $I_{DS}$ | Duty 50% | — | — | 33.3 | mA /ch |
| | | Duty 80% | — | — | 26.4 | |
| | | Duty 100% | — | — | 23.6 | |
| Input Voltage | $V_{IN}$ | — | GND | — | $V_{DD}$ | V |
| Operating Clock Frequency | $f_{CLK}$ | Duty 50% | — | — | 5 | MHz |
| Clock Pulse Width | $t_w$ | COUNTER·CLK | 50 | — | — | ns |
| | | CLK | | | | |
| Data Set−Up Time | $t_{setup}$ | — | 20 | — | — | ns |
| Data Hold Time | $t_{hold}$ | | | | | |

## Electrical Characteristics (Ta = 25°C, $V_{DD}$ = 5.5 V)

| CHARACTERISTIC | | SYMBOL | TEST CIR-CUIT | TEST CONDITION | | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Input Voltage | "H" Level | $V_{IH}$ | — | — | | 3.5 | — | $V_{DD}$ + 0.4 | V |
| | "L" Level | $V_{IL}$ | — | — | | −0.4 | — | 1.5 | |
| Input Current | WRITE·CLK<br>$\overline{E}$ ·CLK, $\overline{RESET}$<br>WRITE· $\overline{E}$ | $I_{INH}$ | — | $V_{IN}$ = 0 V, $V_{DD}$ = 5 V | | −34 | −70 | −145 | μA |
| | $\overline{PWM}$ | $I_{INL}$ | — | $V_{IN}$ = 5 V, $V_{DD}$ = 5 V | | 34 | 70 | 145 | |
| Output Voltage | | $V_{DS}$ | — | OA1~OF8 | $I_{DS}$ = 80 mA | — | — | 960 | mV |
| | | | | | $I_{DS}$ = 50 mA | — | — | 600 | |
| Output On Resistor | | $R_{ON}$ | — | $I_{DS}$ = 50 mA | | — | — | 12.0 | Ω |
| Output Leak Current | | $I_{OZ}$ | — | $V_{DS}$ = 30 V | | — | — | 10 | μA |
| Quiescent Current | | $I_{DD}$ | — | — | | — | — | 20 | μA |
| Operating Supply Current | | $I_{DDopr}$ | — | $V_{DD}$ = 5 V, $f_{CLK}$ = 5MHz<br>Output OPEN | | — | — | 5 | μA |

## Switching Characteristics ($V_{DD}$ = 5.5 V, $V_{DS}$ = 26 V, Ta = 25°C)

| CHARACTERISTIC | | SYMBOL | TEST CONDITION | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Maximum Operating Clock Frequency | | $f_{MAX}$ | Duty 50% | 10 | — | — | MHz |
| Propagation Delay Time "L"−"H" | CLK− $\overline{OUTn}$ , WRITE·CLK− $\overline{OUTn}$ | $t_{pLH}$ | Duty 50%<br>$V_{IN (H)}$ = 4.5 V<br>$V_{IN (L)}$ = 0 V<br>$R_L$ = 375 Ω<br>$C_L$ = 15 pF | — | 80 | — | ns |
| | $\overline{RESET}$ − $\overline{OUTn}$ | | | — | 100 | — | |
| | COUNTER, CLK−OUTn (Note) | | | — | 110 | — | |
| | OUT· $\overline{E}$ − $\overline{OUTn}$ , WRITE· $\overline{E}$ − $\overline{OUTn}$<br>$\overline{E}$ ·CLK− $\overline{OUTn}$ | | | — | 100 | — | |
| | MMV / $\overline{E}$ − $\overline{OUTn}$ | | | — | 130 | — | |
| Propagation Delay Time "H"−"L" | CLK− $\overline{OUTn}$ , WRITE·CLK− $\overline{OUTn}$ | $t_{pHL}$ | | — | 60 | — | |
| | $\overline{RESET}$ − $\overline{OUTn}$ | | | — | 100 | — | |
| | COUNTER, CLK−OUTn (Note) | | | — | 90 | — | |
| | OUT· $\overline{E}$ − $\overline{OUTn}$ , WRITE· $\overline{E}$ − $\overline{OUTn}$<br>$\overline{E}$ ·CLK− $\overline{OUTn}$ | | | — | 70 | — | |
| | MMV / $\overline{E}$ − $\overline{OUTn}$ | | | — | 80 | — | |
| Minimum Clock Pulse Width | | $t_w$ | | 25 | | — | |
| Data Set Up Time | DATA−OUT / $\overline{PWM}$ | $t_{setup}$ | — | — | 10 | — | |
| | DATA−CLK | | | | | | |
| | OUT· $\overline{E}$ − $\overline{E}$ ·CLK | | | | | | |
| Data Hold Time | DATA−OUT / $\overline{PWM}$ | $t_{hold}$ | — | — | 10 | — | |
| | DATA−CLK | | | | | | |
| | OUT· $\overline{E}$ − $\overline{E}$ ·CLK | | | | | | |
| Maximum Rise Time | COUNTER·CLK | $t_r$ | — | — | — | 1 | μs |
| | CLK | | | | | | |
| Maximum Fall Time | COUNTER·CLK | $t_f$ | — | — | — | 1 | |
| | CLK | | | | | | |
| Output Rise Time | $\overline{OUTn}$ | $t_{or}$ | — | — | 0.02 | 1 | |
| Output Fall Time | | $t_{of}$ | — | — | 0.05 | 0.4 | |
| MMV Pulse Width | | $t_{MMV}$ | — | — | 3 | — | ms |

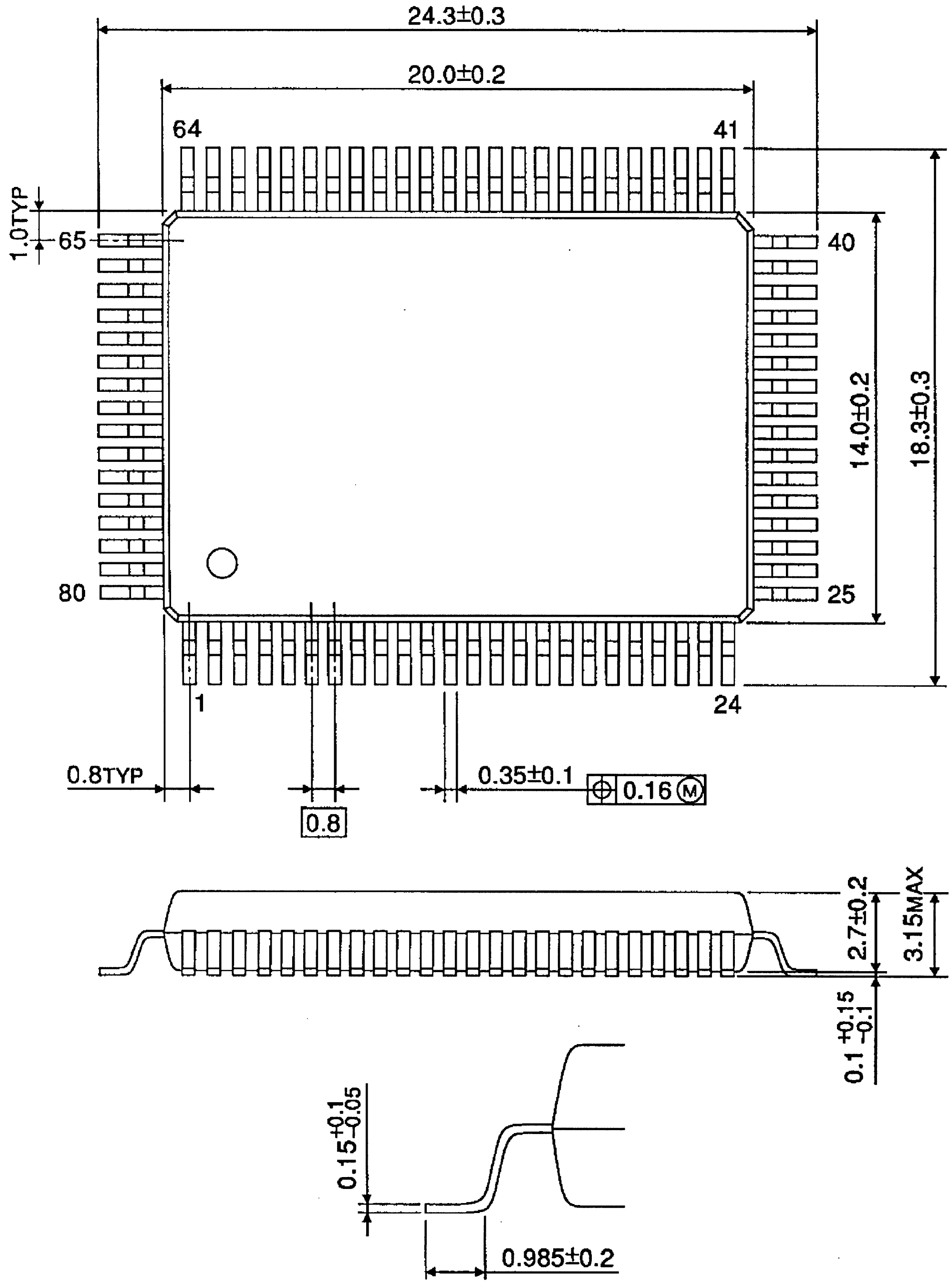
Note: COUNTER DATA = F

## Precautions for Using

This IC does not integrate protection circuits such as overcurrent and overvoltage protectors.
Thus, if excess current or voltage is applied to the IC, the IC may be damaged. Please design the IC so that excess current or voltage will not be applied to the IC.
Utmost care is necessary in the design of the output line, $V_{CC}$ and GND line since IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

## Package Dimensions

QFP80−P−1420−0.80C Unit: mm




Weight: 1.53 g (Typ.)

## Notes on Contents

### 1. Block Diagrams

Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purposes.

### 2. Equivalent Circuits

The equivalent circuit diagrams may be simplified or some parts of them may be omitted for explanatory purposes.

### 3. Timing Charts

Timing charts may be simplified for explanatory purposes.

## IC Usage Considerations

### Notes on Handling of ICs

(1) The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.
Exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.

(2) Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

(3) If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. IC breakdown may cause injury, smoke or ignition.
Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

(4) Do not insert devices in the wrong orientation or incorrectly.
Make sure that the positive and negative terminals of power supplies are connected properly.
Otherwise, the current or power consumption may exceed the absolute maximum rating, and exceeding the rating(s) may cause the device breakdown, damage or deterioration, and may result injury by explosion or combustion.
In addition, do not use any device that is applied the current with inserting in the wrong orientation or incorrectly even just one time.

(5) Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator.
If there is a large amount of leakage current such as input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure can cause smoke or ignition. (The over current can cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection type IC that inputs output DC voltage to a speaker directly.

## Points to Remember on Handling of ICs

(1) Heat Radiation Design
In using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (Tj) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.

(2) Back-EMF
When a motor rotates in the reverse direction, stops or slows down abruptly, a current flow back to the motor's power supply due to the effect of back-EMF. If the current sink capability of the power supply is small, the device's motor power supply and output pins might be exposed to conditions beyond absolute maximum ratings. To avoid this problem, take the effect of back-EMF into consideration in system design.

About solderability, following conditions were confirmed

- Solderability

(1) Use of Sn-37Pb solder Bath
- · solder bath temperature = 230°C
- · dipping time = 5 seconds
- · the number of times = once
- · use of R-type flux

(2) Use of Sn-3.0Ag-0.5Cu solder Bath
- · solder bath temperature = 245°C
- · dipping time = 5 seconds
- · the number of times = once
- · use of R-type flux