

# AN1702FHK

## Gray-scale voltage generating IC for liquid crystal display

### ■ Overview

The AN1702FHK has been designed for LCD applications, and features built-in functions such as a gray-scale voltage generator that supports 256 gradations, a reference voltage of 1.23 V, 16 output buffer amp circuits and a COM amplifier circuit.

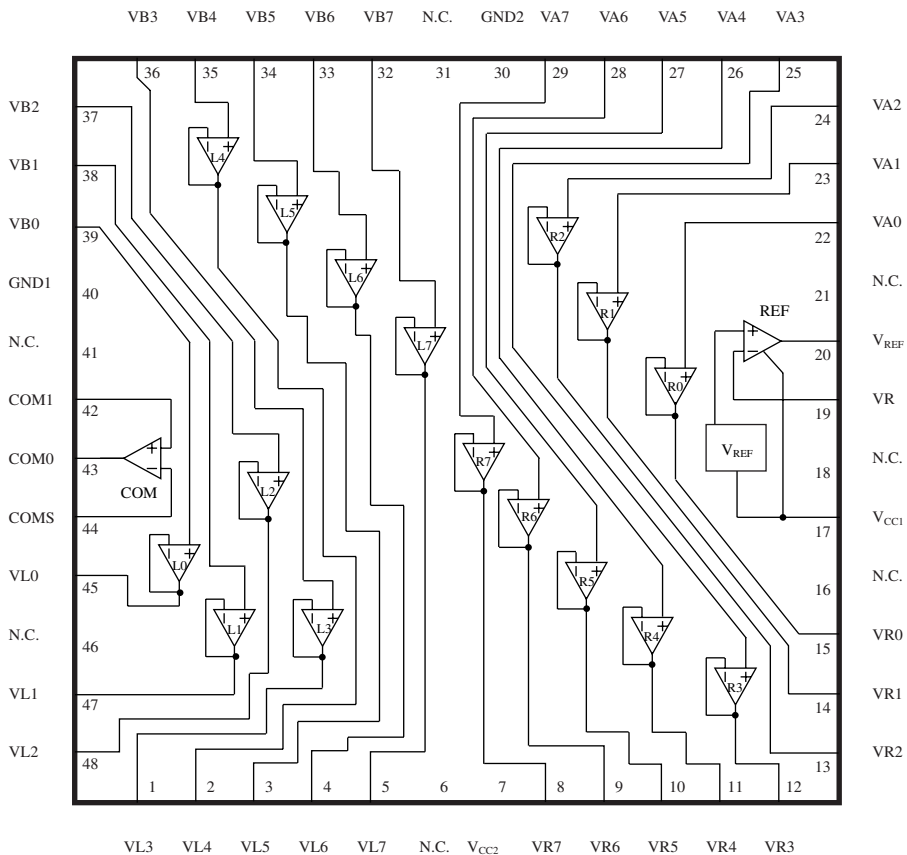
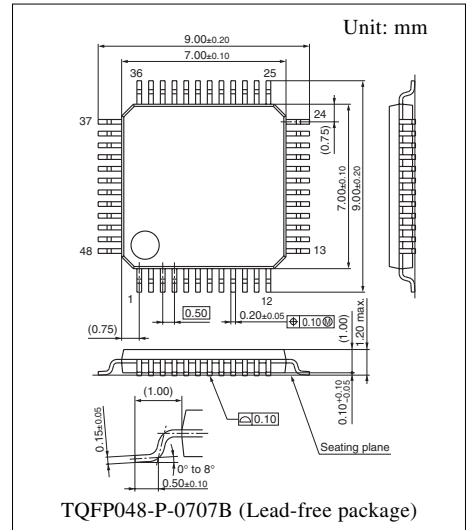
### ■ Features

- Built-in 1.23 V (typical) high-precision reference voltage power source
- Wide buffer amp. dynamic range output:  $V_{CC} - 0.2$  V (top stage) to GND + 0.15 V (bottom stage)
- Large  $\pm 100$  mA (max.) COM amp. driving current

### ■ Applications

- Gray-scale power sources for LCDs

### ■ Block Diagram



### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	15.8	V
Supply current	$I_{CC}$	—	mA
Power dissipation *2	$P_D$	200	mW
Operating ambient temperature *1	$T_{opr}$	0 to +75	°C
Storage temperature *1	$T_{stg}$	-55 to +125	°C
REF amplifier output source current	$I_{O_{SOURCE}}$	-5	mA
R0 amplifier output source current	$I_{O_{-R0}}$	-15	mA
R0 amplifier output sink current	$I_{O_{+R0}}$	0.05	mA
R0, R1, R2, R3, R4, R5, L5, L4, L3, L2, L1 amplifier output source current	$I_{O_{-R1-R5, L1-L5}}$	-10	mA
R6, R7, L7, L6 amplifier output source current	$I_{O_{-R6-L6}}$	-15	mA
R0, R1, R2, R3, R4, R5, L5, L4, L3, L2, L1 amplifier output sink current	$I_{O_{+R1-R5, L1-L5}}$	10	mA
R6, R7, L7, L6 amplifier output sink current	$I_{O_{+R6-L6}}$	15	mA
L0 amplifier output source current	$I_{O_{-L0}}$	-0.05	mA
L0 amplifier output sink current	$I_{O_{+L0}}$	15	mA
COM amplifier output source current	$I_{O_{-COM}}$	-100	mA
COM amplifier output sink current	$I_{O_{+COM}}$	100	mA
REF amplifier maximum load capacitance	$C_{OREF}$	0.2	μF
R0, R1, R2, R3, R4, R5, R6, R7, L7, L6, L5, L4, L3, L2, L1, L0 amplifier maximum load capacitance	$C_{ORL}$	0.1	μF
COM amplifier maximum load capacitance	$C_{OCOM}$	10	μF

Note) 1. Do not apply external currents or voltages to any pins not specifically mentioned.

For circuit currents, '+' denotes current flowing into the IC, and '-' denotes current flowing out of the IC.

2. \*1: Except for the power dissipation, operating ambient temperature and storage temperature, all ratings are for  $T_a = 25^\circ\text{C}$ .

\*2:  $T_a = 75^\circ\text{C}$ . For the independent IC without a heat sink.

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	$V_{CC}$	7 to 15.5	V
Load capacitance	R0 to L0	CLOAD	0.01
	COM		0.1 to 1
	REF		0.1
			μF

**■ Electrical Characteristics at  $T_a = 25^\circ\text{C}$** 

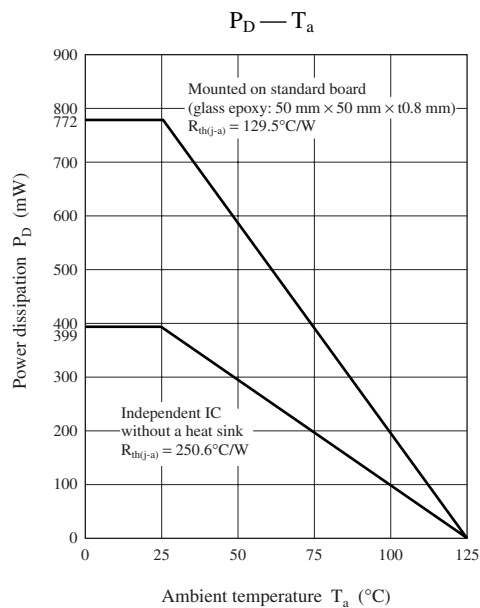
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Circuit current	$I_{CC}$		—	—	10	mA
Reference voltage	$V_{REF}$		1.19	1.23	1.27	V
Input bias current	$I_B$		—	—	500	nA
<b>REF amplifier block</b>						
Operating upper limit voltage	$V_H$	$I_{OUT} = -2 \text{ mA}, C_{OUT} \geq 0.1 \mu\text{F}$	$V_{CC} - 0.2$	—	—	V
Operating lower limit voltage	$V_L$	$C_{OUT} \geq 0.1 \mu\text{F}$	—	—	$V_{REF}$	V
<b>R0 amplifier block</b>						
Output upper limit voltage 1	$V_{HR01}$	$I_{OUT} = -10 \text{ mA}$	$V_{CC} - 0.2$	—	—	V
Output upper limit voltage 2	$V_{HR02}$	$I_{OUT} = -15 \text{ mA}$	$V_{CC} - 0.23$	—	—	V
Output lower limit voltage	$V_{LR0}$	$I_{OUT} = 0.05 \text{ mA}$	—	—	$V_{CC} - 3.0$	V
Offset voltage	$V_{OFFR0}$		—	—	10	mV
<b>R1 amplifier block</b>						
Output upper limit voltage	$V_{HR1}$	$I_{OUT} = -10 \text{ mA}$	$V_{CC} - 0.3$	—	—	V
Output lower limit voltage	$V_{LR1}$	$I_{OUT} = 10 \text{ mA}$	—	—	$V_{CC}/2$	V
Offset voltage	$V_{OFFR1}$		—	—	10	mV
<b>R2 amplifier block</b>						
Output upper limit voltage	$V_{HR2}$	$I_{OUT} = -10 \text{ mA}$	$V_{CC} - 0.7$	—	—	V
Output lower limit voltage	$V_{LR2}$	$I_{OUT} = 10 \text{ mA}$	—	—	$V_{CC}/2$	V
Offset voltage	$V_{OFFR2}$		—	—	10	mV
<b>R3, R4, R5, R6, R7, L3, L4, L5, L6, L7 amplifier block</b>						
Output upper limit voltage 1	$V_{HR3-R5}$	$I_{OUT} = -10 \text{ mA}$	$V_{CC} - 1.2$	—	—	V
Output upper limit voltage 2	$V_{HR6-R7}$	$I_{OUT} = -15 \text{ mA}$	$V_{CC} - 1.2$	—	—	V
Output lower limit voltage 1	$V_{LR3-R5}$	$I_{OUT} = 10 \text{ mA}$	—	—	2	V
Output lower limit voltage 2	$V_{LR6-R7}$	$I_{OUT} = 15 \text{ mA}$	—	—	2	V
Output upper limit voltage 3	$V_{HL3-L5}$	$I_{OUT} = -10 \text{ mA}$	$V_{CC} - 2.0$	—	—	V
Output upper limit voltage 4	$V_{HL6-L7}$	$I_{OUT} = -15 \text{ mA}$	$V_{CC} - 2.0$	—	—	V
Output lower limit voltage 3	$V_{LL3-L5}$	$I_{OUT} = 10 \text{ mA}$	—	—	1.2	V
Output lower limit voltage 4	$V_{LL6-L7}$	$I_{OUT} = 15 \text{ mA}$	—	—	1.2	V
Offset voltage	$V_{OFF34567}$		—	—	10	mV

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$ (continued)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>L2 amplifier block</b>						
Output upper limit voltage	$V_{HL2}$	$I_{OUT} = -10\text{ mA}$	$V_{CC} / 2$	—	—	V
Output lower limit voltage	$V_{LL2}$	$I_{OUT} = 10\text{ mA}$	—	—	0.7	V
Offset voltage	$V_{OFFL2}$		—	—	10	mV
<b>L1 amplifier block</b>						
Output upper limit voltage	$V_{HL1}$	$I_{OUT} = -10\text{ mA}$	$V_{CC} / 2$	—	—	V
Output lower limit voltage	$V_{LL1}$	$I_{OUT} = 10\text{ mA}$	—	—	0.25	V
Offset voltage	$V_{OFFL1}$		—	—	10	mV
<b>L0 amplifier block</b>						
Output upper limit voltage	$V_{HL0}$	$I_{OUT} = -0.05\text{ mA}$	3	—	—	V
Output lower limit voltage	$V_{LL0}$	$I_{OUT} = 15\text{ mA}$	—	—	0.15	V
Offset voltage	$V_{OFFL0}$		—	—	10	mV
<b>COM amplifier block</b>						
Output upper limit voltage	$V_{HCOM}$	$I_{OUT} = -100\text{ mA}$	$V_{CC}$ -2.5	—	—	V
Output lower limit voltage	$V_{LCOM}$	$I_{OUT} = 100\text{ mA}$	—	—	2.5	V
Offset voltage	$V_{OFFCOM}$	$V_{IN} = 5\text{ V}$	—	—	10	mV

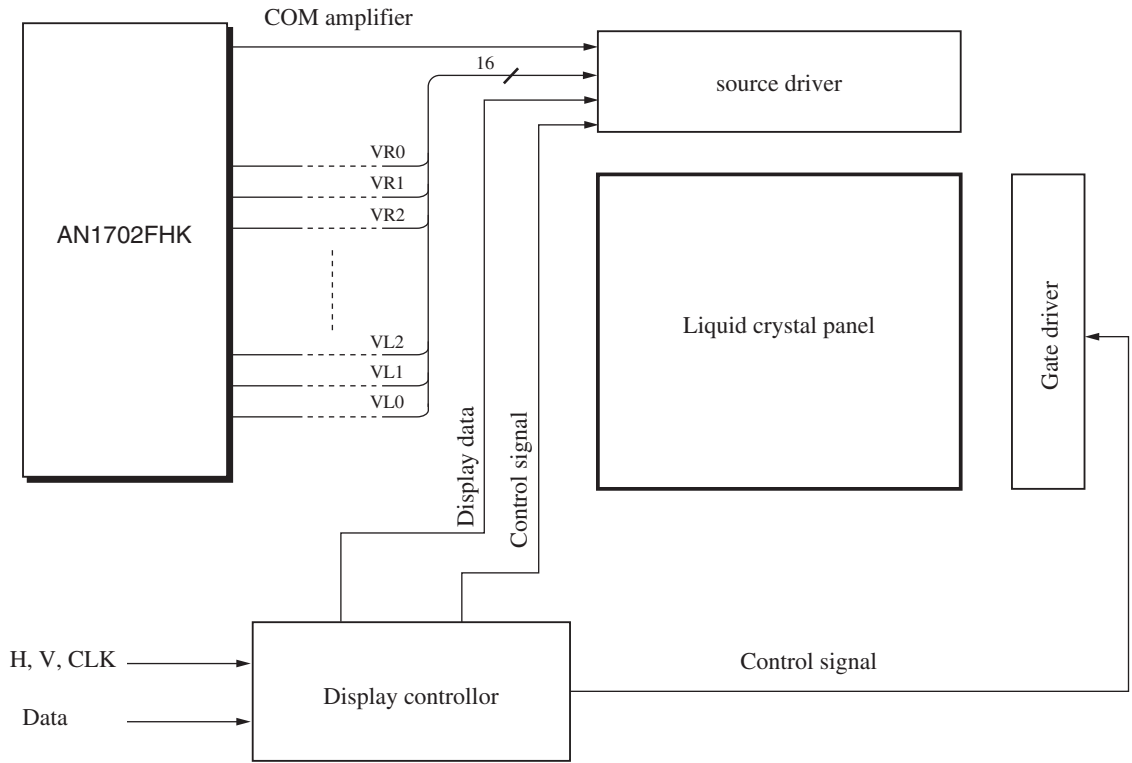
### ■ Technical Data

- $P_D - T_a$  curves of TQFP048-P-0707B



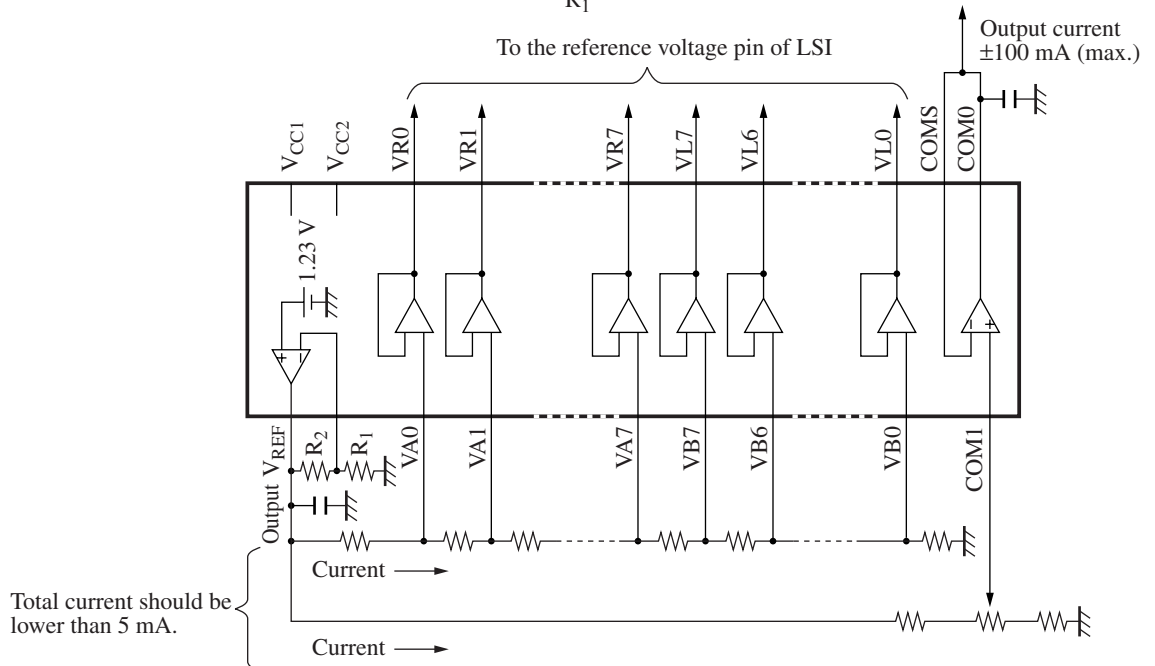
■ Application Circuit Example

- System configuration example



- Application circuit example

$$V_{REF} \text{ output voltage} = 1.23 \text{ V} \times \frac{R_1 + R_2}{R_1} \text{ (but this never exceeds } V_{CC})$$



## Request for your special attention and precautions in using the technical information and semiconductors described in this material

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this material is limited to showing representative characteristics and applied circuit examples of the products. It does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.
- (3) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this material are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.  
Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.
- (6) When using products for which dry packing is required, observe the conditions (including shelf life and after-unpacking standby time) agreed upon when specification sheets are individually exchanged.
- (7) No part of this material may be reprinted or reproduced by any means without written permission from our company.

## Please read the following notes before using the datasheets

- A. These materials are intended as a reference to assist customers with the selection of Panasonic semiconductor products best suited to their applications.  
Due to modification or other reasons, any information contained in this material, such as available product types, technical data, and so on, is subject to change without notice.  
Customers are advised to contact our semiconductor sales office and obtain the latest information before starting precise technical research and/or purchasing activities.
- B. Panasonic is endeavoring to continually improve the quality and reliability of these materials but there is always the possibility that further rectifications will be required in the future. Therefore, Panasonic will not assume any liability for any damages arising from any errors etc. that may appear in this material.
- C. These materials are solely intended for a customer's individual use.  
Therefore, without the prior written approval of Panasonic, any other use such as reproducing, selling, or distributing this material to a third party, via the Internet or in any other way, is prohibited.



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

[LittleDiode.com](http://LittleDiode.com)

Looking forward to providing you with the best possible service.