

Item No.

DN4015B

DS12456

Rev.	Spec. No.	Date(M-D-Y)
1	P-R	JUL-27-00
2	T-R	OCT-10-00
3	T-R1	OCT-24-00
4	T-R2	MAR-16-01

Quality Specification	TT-91-3329
Reliability Test Condition	TT-99-3050A

Absolute Maximum Ratings

Parameter	Symbol	Terminal	Ratings	Unit
Filament Voltage 1)	Ef	F1-F2	9.5	Vac
Logic Supply Voltage 2)	V _{DD1}	V _{DD1}	-0.3~7.0	V
Display Supply Voltage 2)	V _{DD2}	V _{DD2}	-0.3~60	V
Input Voltage 2)	V _{IN}	SI, CLK, LAT, BK	V _{SS} -0.3~V _{DD1} +0.3	V
Storage Temperature	T _s		-50~+85	°C

Notes

- 1) Effective value of AC 50 or 60Hz.
- 2) Voltages based V_{SS}=0V

Recommended Operating Conditions

Parameter	Symbol	MIN	TYP	MAX	Unit
Filament Voltage 1)	Ef	7.1	7.9	8.7	Vac
Logic Supply Voltage 3)	V _{DD1}	4.5	5.0	5.5	V
Display Supply Voltage 3)	V _{DD2}	43.0	53.0	55.0	V
Filament Bias Voltage 2)	Ek	7.5	8.0	9.0	V
Operating Temperature	T _o	-40	-	+85	°C

Notes

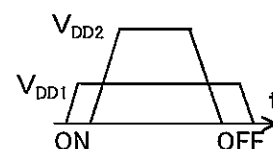
- 1) Effective value of AC 50 or 60Hz.
- 2) With respect to filament center-tap (F.C.T.).

3) Power Supply Sequence

V_{DD1} should be applied and higher than 4.5V when applying V_{DD2}.

V_{DD1} and V_{DD2} should be ON at the same time, or V_{DD2} should be ON after V_{DD1} is ON.

V_{DD1} and V_{DD2} should be OFF at the same time, or V_{DD1} should be OFF after V_{DD2} is OFF.



Power supply sequence

CAUTION

Precautions should be taken to minimize the possibility of static charges occurring during handling and assembly of the VFDs.

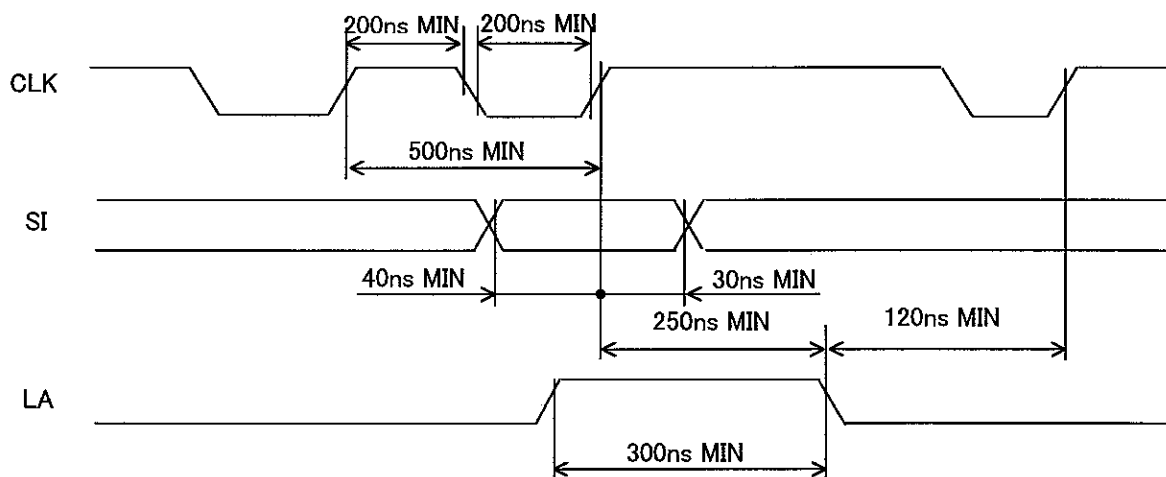
Electrical and Optical Characteristics

At typical operating condition, all segments turned on, $f_{CLK}=1\text{MHz}$, $V_{SS}=0\text{V}$ unless otherwise noted.

Parameter	Symbol	Test Condition	MIN	TYP	MAX	Unit
Filament Current 1)	I_f	$V_{DD1}=V_{DD2}=0\text{V}$	67.0	75.0	83.0	mAac
Logic Supply Current	I_{DD1}	$f_{CLK}=1\text{MHz}$	—	3.0	6.0	mA
Display Supply Current	I_{DD2}	All segment ON	—	10.0	20.0	mA
H-Level Input Voltage	V_{IH}		$V_{SS}+2.4$	—	V_{DD1}	V
L-Level Input Voltage	V_{IL}		V_{SS}	—	$V_{SS}+0.7$	V
H-Level Input Current	I_{IH}	$V_{IH}=V_{DD1}$	—	—	0.1	μA
L-Level Input Current	I_{IL}	$V_{IL}=V_{SS}$	-250	-70	-35	μA
Luminance	L	$T_a=20^\circ\text{C}$ Duty=1/42	350	(900)	—	cd/m^2
Color of illumination	Green (Blue Green)					—

Note 1) Effective value of AC 50 or 60Hz.

AC Characteristics

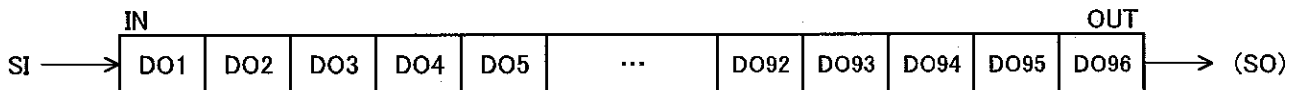


Notes:

- 1) Refer to the following notice to avoid data error.
 - Keep CLK H-level in principle.
 - Do not change BK H→L or L→H while data writing.
 - Do not change BK H→L or L→H while CLK is L.
- 2) Refer to Timing Chart for the relation to BK.

Shift Register Assignment

Upper Row	Register No.
Lower Row	Assignment

[illegible]

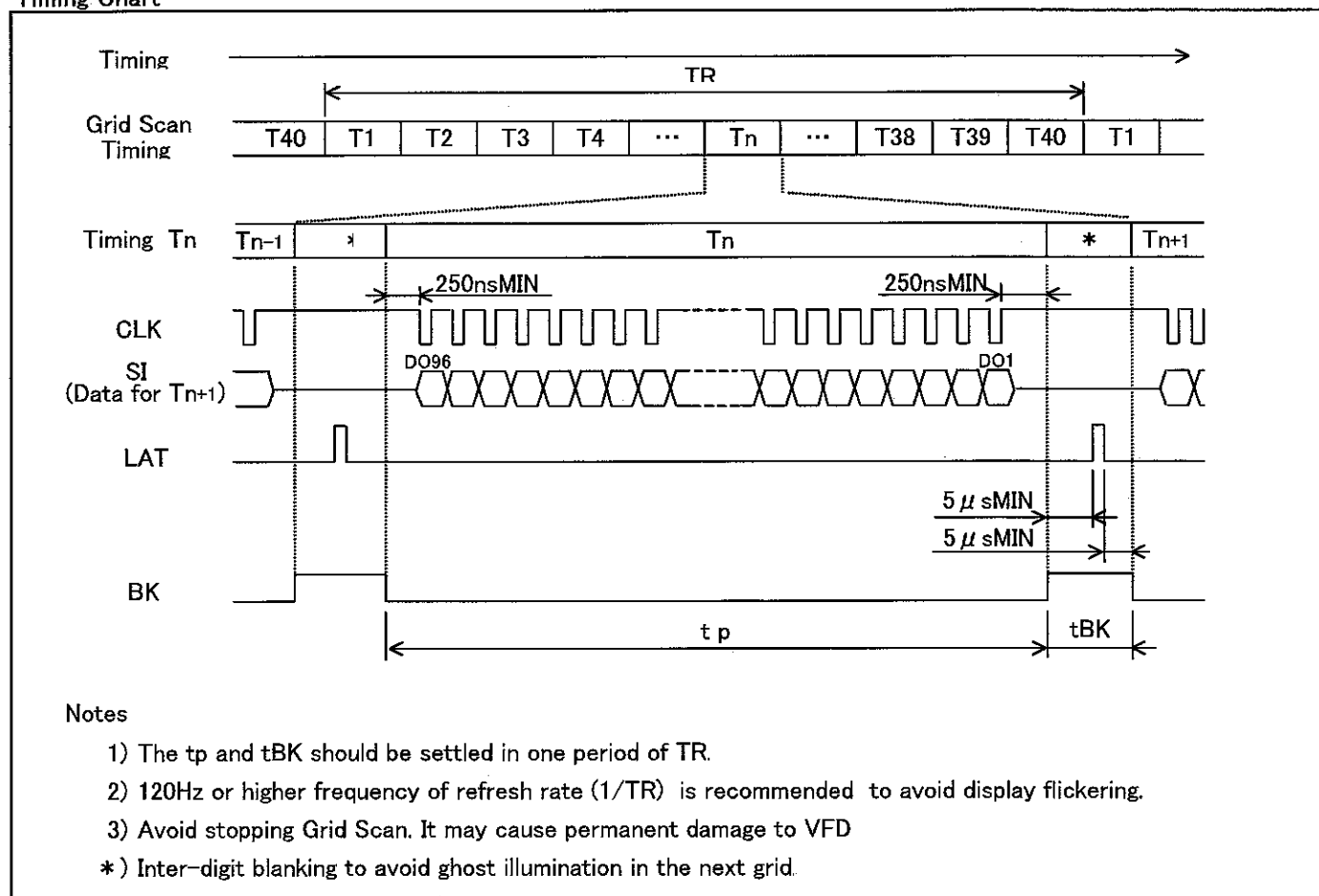
Note: NC : No Connection (Set "L" for NC)
Gxx : Grid
Pxx : Anode

Grid Scan

Timing	Grid to be ON	Grid Data													
		DO1	DO2	DO3	DO4	DO5	DO6	...	DO35	DO36	DO37	D38	DO39	DO40	
		G40	G39	G38	G37	G36	G35	...	G6	G5	G4	G3	G2	G1	
T40	G40	H	L	L	L	L	L	...	L	L	L	L	L	L	
T1	G1	L	L	L	L	L	L	...	L	L	L	L	L	H	
T2	G2	L	L	L	L	L	L	...	L	L	L	L	H	L	
T3	G3	L	L	L	L	L	L	...	L	L	L	H	L	L	
T4	G4	L	L	L	L	L	L	...	L	L	H	L	L	L	
T5	G5	L	L	L	L	L	L	...	L	H	L	L	L	L	
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	
T36	G36	L	L	L	L	H	L	...	L	L	L	L	L	L	
T37	G37	L	L	L	H	L	L	...	L	L	L	L	L	L	
T38	G38	L	L	H	L	L	L	...	L	L	L	L	L	L	
T39	G39	L	H	L	L	L	L	...	L	L	L	L	L	L	
T40	G40	H	L	L	L	L	L	...	L	L	L	L	L	L	
T1	G1	L	L	L	L	L	L	...	L	L	L	L	L	H	

Note: L = Low , H = High

Timing Chart



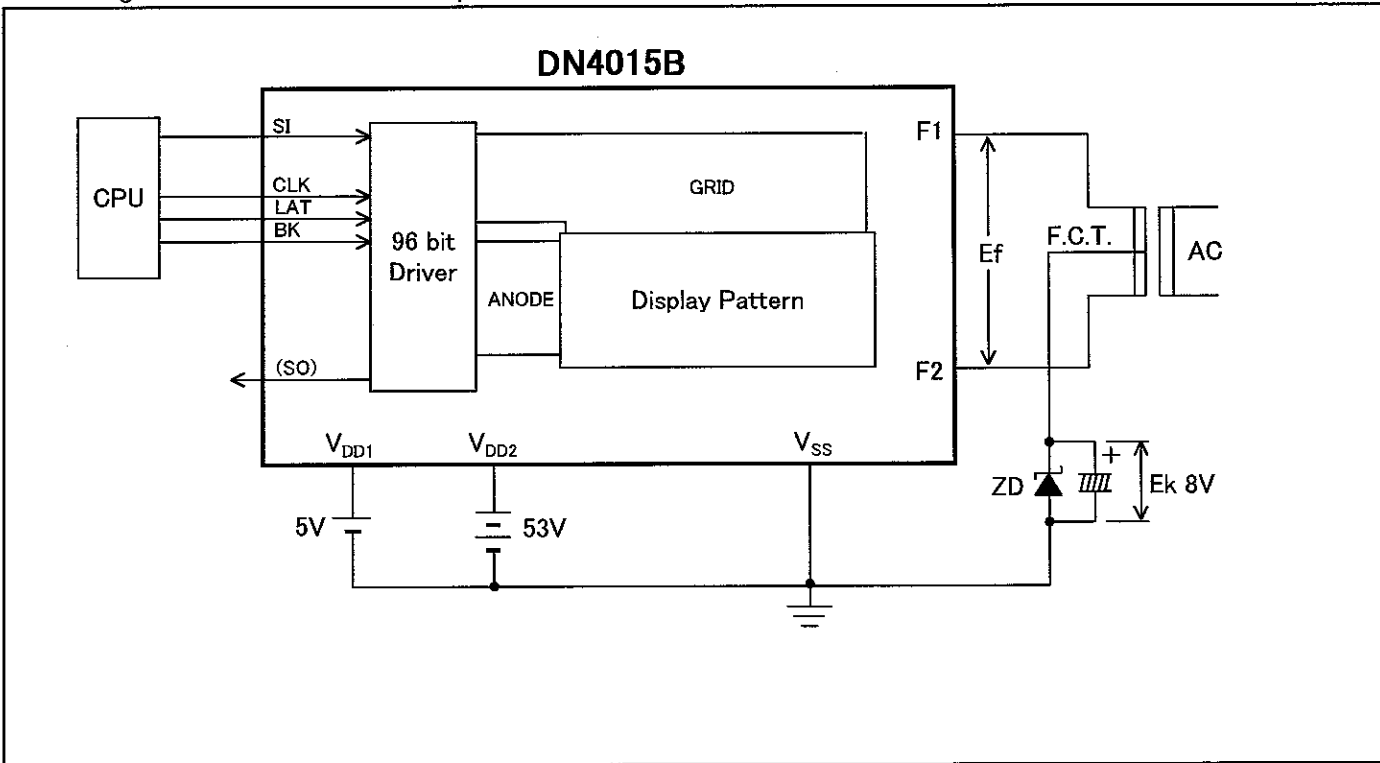
Function Table

Function	Symbol	Description
Shift Register Clock	CLK	↑ : Data shift
Serial Data Input	SI	H : ON, L : OFF
Serial Data Output	SO	For grid scan watching use only
Data Latch Control	LAT	H : Data through, L : Data latch
Driver Output Blanking	BK	L : All output ON, H: All output OFF
Ground	V _{SS}	Ground 0V
Logic Supply Voltage	V _{DD1}	5VDC
Display Supply Voltage	V _{DD2}	53VDC
Filament Voltage	F1–F2	AC filament voltage input
No Pin	NP	There is no pin.

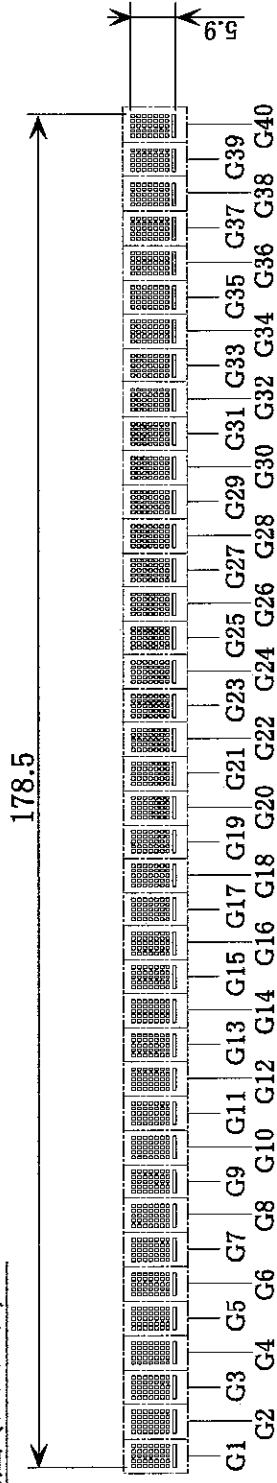
Pin Assignment

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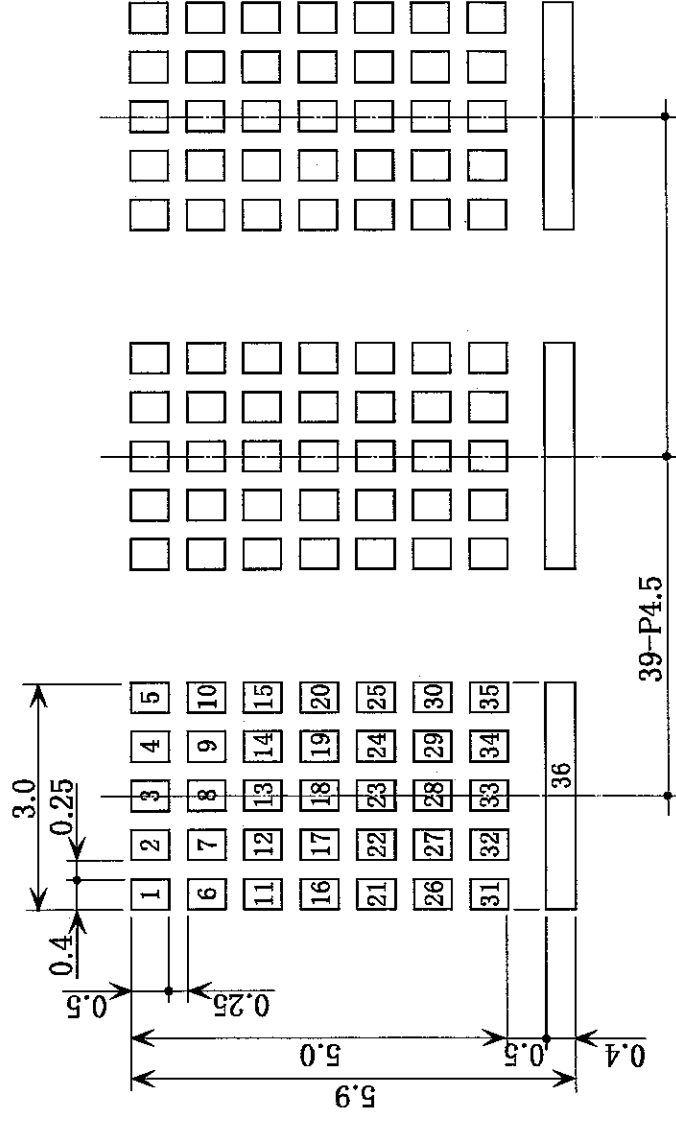
Block Diagram and Drive Circuit Example



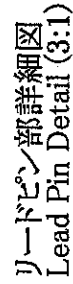
グリッド分割図 (Scale 1:1)



パターン詳細図 (Scale 10:1)



SHEET 7/7
DS12456b
Unit : mm
Scale 1:1



Notes *フリットガラスのはみだしを含む。 Included extra frit glass.

*** ガラス底面から3mmの位置の値とする。Within 3 mm from bottom of the glass substrate.

***この部分のフリットはみ出しは最大3mmとする。3mm maximum extra frit glass at this area.

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- ・ ガラスエッジ部分は研磨等の加工は行っておりませんので、ケガに注意して下さい。
- ・ ガラス容器から突起した部分(排気管)は割れやすいので、取扱時には力を加えないように注意して下さい。
- ・ フィラメント断線や蛍光体の脱落を生じることがありますので、本製品の超音波洗浄は行わないでください。

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【廃棄時のご注意】

- ・ Green(ブルーグリーン)以外の蛍光体には微量のカドミウムを含有しているものがあります。また、外容器の一部には鉛を含んだ材料を使用しておりますので、廃棄の際は関連法規に従ってください。

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We take no responsibility for circuitry problems in your application. Neither whole nor partial copying of these specifications are permitted without our approval.

This product is not designed for military, aerospace, medical or other life-critical applications. If you choose to use this product for these applications, please ask for our prior consultation. This product is not designed to work in a high radiation atmosphere.

Warranty Period:

The specifications or purchase contract will provide details of our warranty. The basic warranty period is one year from purchase.

Handling and Usage Precautions:

Please follow the available appropriate product application notes for proper usage, safety and for operation standards within maximum performance.

Safety:

The edge of the glass is not perfectly smooth so handle with caution. The exhaust pipe is not designed for high stress so be careful to avoid breakage. If disposing of this product, do not break for safety concerns.

Assembly:

Please handle carefully to avoid surface scratching and breakage of the exhaust pipe during the assembly process. We recommend the use of gloves and finger shields to keep the product clean and the solder surface smooth at the lead pins.

Please provide enough space around the process area to avoid accidentally breaking the exhaust pipe and avoid applying too much stress to your fixture that may also break the exhaust pipe.

Please use shock absorbers when the product is secured with stands inside the fixture to avoid cracking the glass.

The lead pins should not be touched by conductive material because they are the display electrodes.

When designing your application, please consider the sealing glass paste that surrounds the vacuum fluorescent display.

When cutting the lead pins after soldering avoid applying shock and vibration that exceeds specifications.

When bending the lead pins, avoid stress to the corner of the glass where the pins are bent. Overstress may cause glass cracking or breakage and unstable conductivity.

When securing the circuit board to the application, avoid warping of the circuit board that may cause damage to the glass or pins.

The sealing glass materials may be damaged by acid and alkaline substance. Please carefully select chemicals and fluxes. When chemicals and fluxes are applied, please provide a sufficient washing process.

Do not apply ultrasonic cleaning that may cause damage to the filament wires and phosphor materials.

Drive:

Please follow the rating in the specifications to maximize performance.

Filament voltage (E_f) is the most important factor to drive the display properly. Exceeding the recommended conditions will result in a severe reduction in life expectancy and possibly cause other damage. Please refer to the power design applying the typical voltage recommendations in the specifications.

We define the recommended operating conditions to guarantee the operation, performance and quality of the product. If the product is operated outside the maximum and minimum ratings, the product may be damaged. When designing the circuit, please apply the typical conditions in the specifications as your design center.

The absolute maximum rating is defined as the value that cannot be exceeded. You cannot apply conditions that exceed the maximum absolute value. When you exceed conditions that are greater than the maximum absolute value, damage may occur to the product.

When designing the circuitry, please closely consider the variation of power voltage, the variation in components, environmental temperatures, surge, and spikes.

Brightness controls (dimming) by the filament voltage, anode and grid voltage, or display driving voltage, the display may appear with uneven brightness. If brightness control is required, please adjust the blanking pulse width of anode and grid voltage, or blanking control (BK) in BD series. See the application note.

Due to the product characteristics, there may appear a brightness difference between the segments that are frequently used and those that are less frequently on. Please try to design your display patterns where there is an even distribution of segments that are turned on. Try to avoid using some segments that are excessively or permanently on when compared with the rest. If this cannot be avoided, please consult us.

Storage:

Please follow the environmental conditions described in the specifications. Please avoid storing in high humidity, saline and sulfur rich environments. These environmental factors may result in deterioration of the characteristics for soldering lead pins and insulation between lead pins.

Extended time storage may result in initial dimming due to the characteristics of the product. We recommend using the product within three months of receipt. The brightness level returns after tuning the product on for several hours (one to two hours) under typical conditions.

Precaution for disposal:

Some of the phosphor material excluding blue-green, contain a very small quantity of cadmium. Also part of the display glass package contains lead glass. Please follow the prescribed related regulation and legislation for industrial wastes.