



# Data Sheet

**NT52601TT**

640 Channels Output TFT-LCD Gate Driver

V1.0

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## Revision History

NT52601TT Specification Revision History						
Version	Contents	Page	Prepare	Check	Approve	Date
1.0	Original	All	DJ Lin	Joe Cheng	Alex Tang	2017/1/4

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## Features

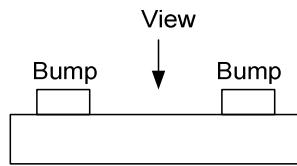
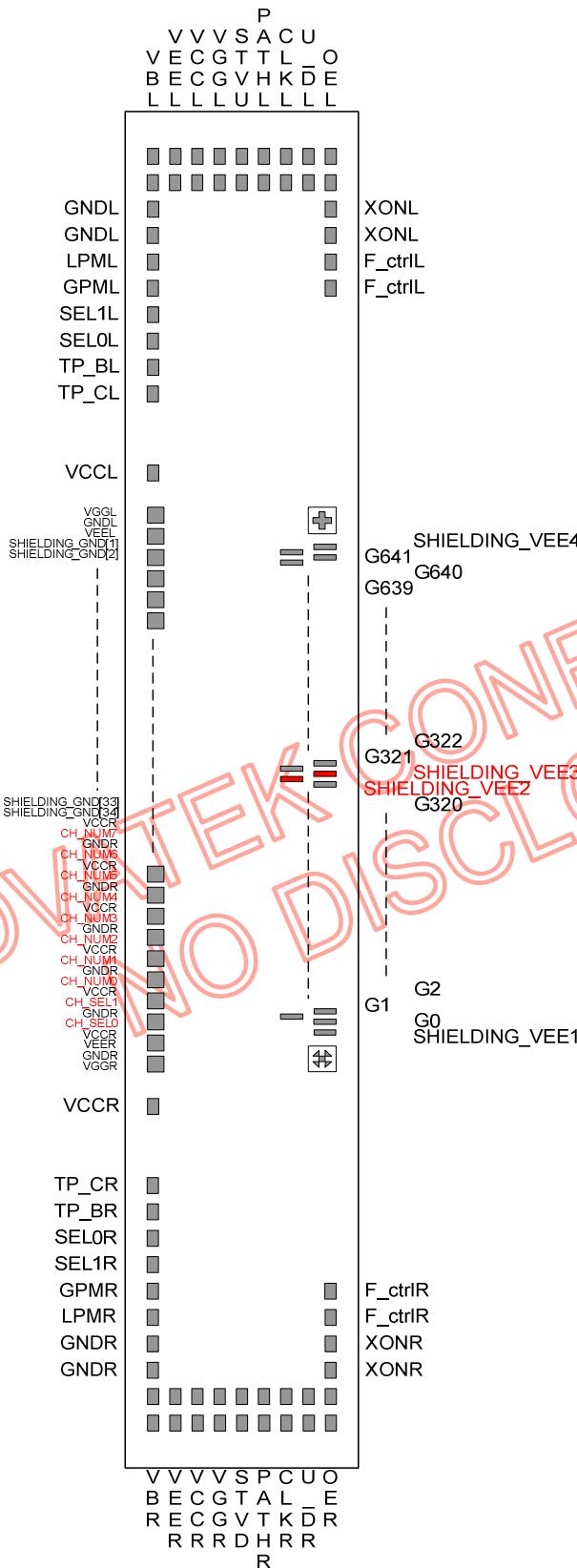
- Gate driver for TFT-LCD panels
- 640~100(Multiples of 2) channel outputs and 2 channel outputs which are fixed to VEE
- Bi-directional shift function
- Driving voltage : VEE+40V
- Logical supply voltage : 2.7 ~ 3.6 V
- Built-in Gate Pulse Modulation (GPM) function
- Support XON function
- Support Pre-Charge function (Long/Dual/Third Start Pulse)
- COG solution
- Chip size=14095um\*665um、Output bump pitch=18um
- Output bump size=16 um\*71 um
- Operating temperature : -40°C ~ +105°C

## General Descriptions

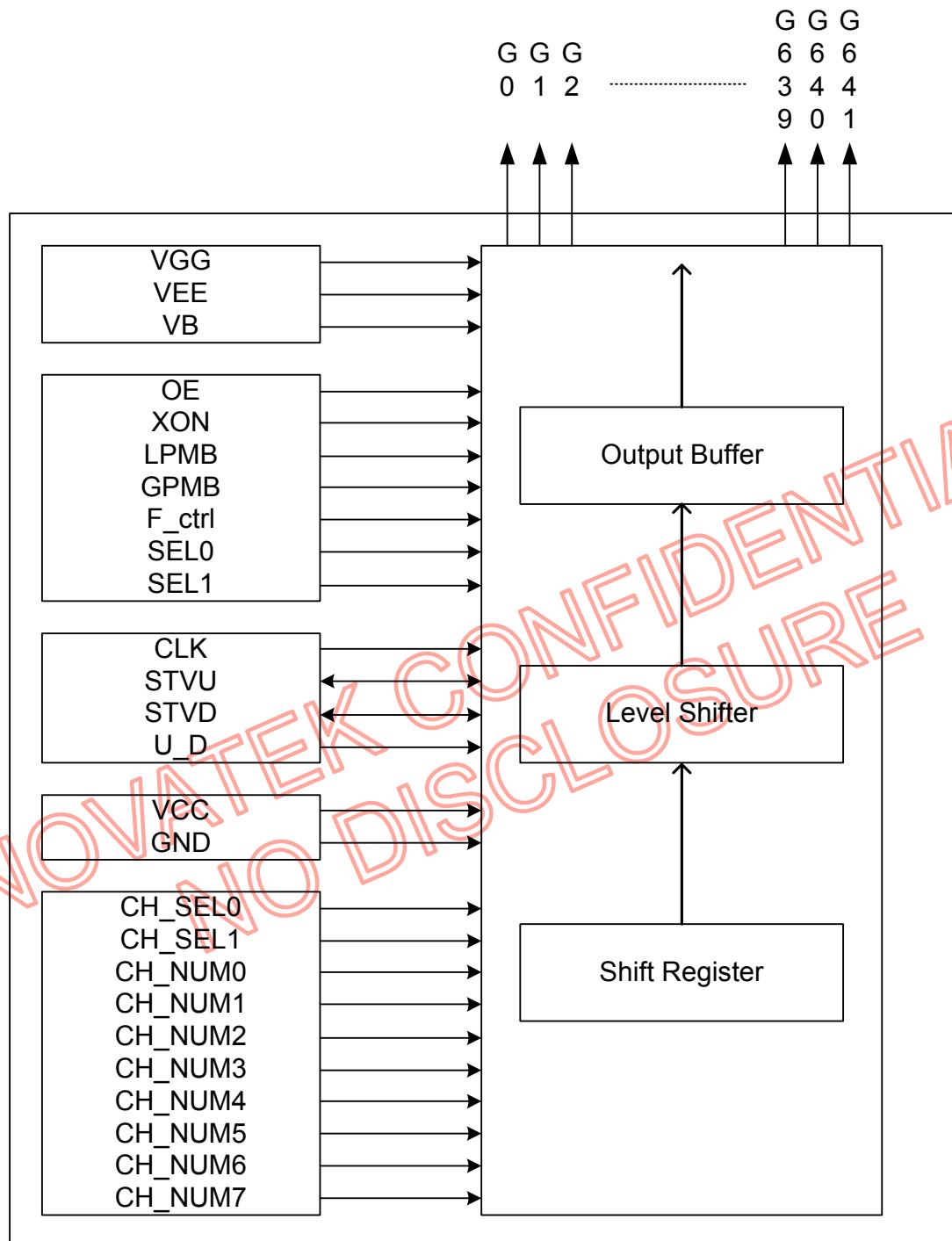
NT52601TT is a dedicated gate driver IC for TFT-LCD panels. After a start pulse is triggered, channel output pins will sequentially output high-driving voltage pulses as the gate signals on TFT-LCD panels. NT52601TT also provides shift up/down selection. The special pin location is designed for COG type.

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## Pin Assignment

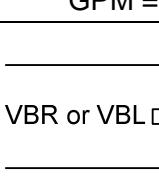
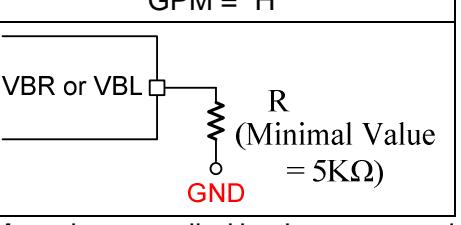
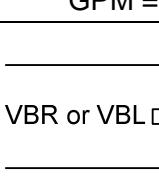
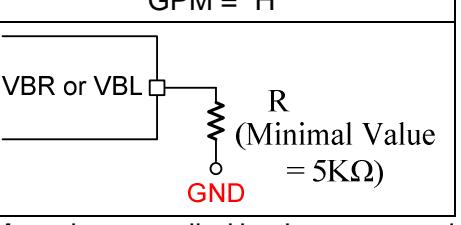
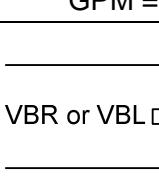
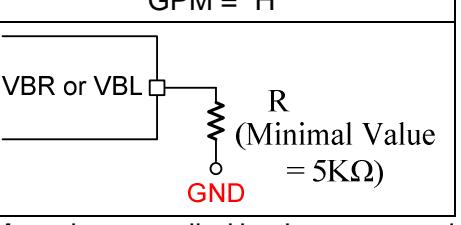


## Block Diagram



## Pin Descriptions

Symbol	I/O	Description
XONR, XONL (pull-H)	I	When XON goes "L", all outputs are fixed to VGG. XON signal has priority over OE. Normally pull-H. Recommended to connect VCC or controlled by other electronic component.
OER, OEL (pull-L)	I	This pin is used to control channel output (G1 to G640) OE = "H", The driver output are fixed to VEE voltage. OE = "L", Normal operation. (Default)
U_DR, U_DL (pull-H)	I	Shift up/down control signal. Normally pull-H. U_D = "H": up shift: STVD (Input) → G1 ~ G640 → STVU (Output) (Default) U_D = "L": down shift: STVU (Input) → G640 ~ G1 → STVD (Output)
CLKR, CLKL	I	This is the clock input for chip internal shift register and control driver status.
PATHR, PATHL	S	Internally connected together
STVD	I/O	This pin operates as an input pin under the condition of U_D="H" and receives a pulse signal; this pin operates as an output pin under the condition of U_D="L" and send a pulse signal. Please refer to the descriptions of "STVU" and "U_D".
STVU	I/O	This pin operates as an input pin under the condition of U_D="L" and receives a pulse signal; this pin operates as an output pin under the condition of U_D="H" and send a pulse signal. Please refer to the descriptions of "STVD" and "U_D".
VGGR, VGGL	P	Positive power supply for G1 ~ G640 outputs
VEER, VEEL	P	Negative power supply for G0 ~ G641 outputs
VCCR, VCCL	P	Power supply for digital circuits
GNDR, GNDL	P	Ground
G1 ~ G640	O	Pulse signals for driving the gates on TFT-LCD VGG minus VEE is the amplitude of G1 ~ G640. The timing of G1 ~ G640 is synchronous with the rising edge of the shift clock CLK.
G0, G641	O	Auxiliary pins. Regardless of shift data, G0 and G641 always output the potential of VEE.

GPMR, GPML (pull-L)	I	Gate pulse modulation(GPM) control pin. Normally pull-L. GPM = "H": GPM function enabled. Please refer to 4-1 & 4-2 Operation Waveforms. GPM = "L": Normal operation. (Default)															
VBR, VBL	P	The slew rate controll of gate pulse modulation. The application circuits are as follows. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">GPM = "L" (defult)</td> <td style="text-align: center;">GPM = "H"</td> </tr> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> </table> <p>When GPM="H", the falling slew rate of GPM can be controlled by the connected resistor R. The value of resistor R depends on the loading of gate output. Please refer to 4-1 waveforms.</p>	GPM = "L" (defult)	GPM = "H"													
GPM = "L" (defult)	GPM = "H"																
																	
LPMR, LPML (pull-L)	I	Long pulse mode select pin. Normally pull-L. LPM = "H": Long pulse mode. For odd driver outputs: 1. Only odd OEs are activated. 2. GPM function only enabled for even CLK falling period. For even driver outputs: 1. Only even OEs are activated. 2. GPM function only enabled for odd CLK falling period.  LPM = "L": Single pulse mode. (Default) When OE= H, all driver outputs are fixed to VEE voltage. Please refer to 4-1 & 4-2															
F_ctrlR, F_ctrlL (pull-L)	I	Frame control. This pin decides to inverse the output sequence or not in odd or even frame. Normally pull-L. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th>Frame</th> <th>F_Ctrl</th> </tr> <tr> <td>Odd</td> <td>L</td> </tr> <tr> <td>Even</td> <td>H</td> </tr> </table> <p>Note: Frame control function only support in the single pulse mode and Multiples of 8 output mode between 640~100.</p>	Frame	F_Ctrl	Odd	L	Even	H									
Frame	F_Ctrl																
Odd	L																
Even	H																
SEL0R SEL0L SEL1R SEL1L (pull-L)	I	Output sequence control. This pin controls the driver output sequence. Normally pull-L. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>SEL1</th> <th>SEL0</th> <th>Scan type</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>H</td> <td>Z+ Z</td> </tr> <tr> <td>H</td> <td>L</td> <td>Z</td> </tr> <tr> <td>L</td> <td>H</td> <td>Z</td> </tr> <tr> <td>L</td> <td>L</td> <td>Z</td> </tr> </tbody> </table> <p>Note: SEL function only support in the single pulse mode and Multiples of 8 output mode between 640~100.</p>	SEL1	SEL0	Scan type	H	H	Z+ Z	H	L	Z	L	H	Z	L	L	Z
SEL1	SEL0	Scan type															
H	H	Z+ Z															
H	L	Z															
L	H	Z															
L	L	Z															
SHIELDING_GND[1]~ SHIELDING_GND[34]	SD	This pin is connected to GND internally. Not connected.															
SHIELDING_VEE1~ SHIELDING_VEE4	SD	This pin is connected to VEE internally. Not connected.															

CH_SEL0 CH_SEL1 (floating)	I	To set the channels output with CH_NUM[7:0] pins. <b>"CH_SEL[1:0]" are floating pins that must be pull-H or pull-L externally.</b> Please refer to the following table. Using upper and lower channels output. <b>The VCC(2)/GND(2) bump near CH_SEL[1:0] can't connect to Power.</b>
CH_NUM0 CH_NUM1 CH_NUM2 CH_NUM3 CH_NUM4 CH_NUM5 CH_NUM6 CH_NUM7 (floating)	I	To set the channels output with CH_SEL[1:0] pins. <b>"CH_NUM[7:0]" are floating pins that must be pull-H or pull-L externally.</b> Please refer to the following table. Using upper and lower channels output. <b>The VCC(2)/GND(2) bump near CH_NUM[7:0] can't connect to Power.</b>
TP_BR, TP_BL TP_CR, TP_CL	I	Test pin for Novatek. Not connected.

Note1: I: Input; O: Output; I/O: Input/Output; P: Power; S: Shorted line; SD: Shielding pad.

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**Set the channels output**

Note 1 : Keep unused channels output floating.

Note 2 : CH\_SEL[1:0] &amp; CH\_NUM[7:0] are floating pins that must be pull-H or pull-L externally.

Channels Output	CH_NUM7	CH_NUM6	CH_NUM5	CH_NUM4	CH_NUM3	CH_NUM2	CH_NUM1	CH_NUM0	Channels Output code	Use Channels Output
<b>CH_SEL1="0", CH_SEL0="0 or 1"</b>										
640	0	0	0	0	0	0	0	0	AA	G1~G640
638	0	0	0	0	0	0	0	1	AB	G1~G319, G322~G640
636	0	0	0	0	0	0	1	0	AC	G1~G318, G323~G640
634	0	0	0	0	0	0	1	1	AD	G1~G317, G324~G640
632	0	0	0	0	0	1	0	0	AE	G1~G316, G325~G640
630	0	0	0	0	0	1	0	1	AF	G1~G315, G326~G640
628	0	0	0	0	0	1	1	0	AG	G1~G314, G327~G640
626	0	0	0	0	0	1	1	1	AH	G1~G313, G328~G640
624	0	0	0	0	1	0	0	0	AI	G1~G312, G329~G640
622	0	0	0	0	1	0	0	1	AJ	G1~G311, G330~G640
620	0	0	0	0	1	0	1	0	AK	G1~G310, G331~G640
618	0	0	0	0	1	0	1	1	AL	G1~G309, G332~G640
616	0	0	0	0	1	1	0	0	AM	G1~G308, G333~G640
614	0	0	0	0	1	1	0	1	AN	G1~G307, G334~G640
612	0	0	0	0	1	1	1	0	AO	G1~G306, G335~G640
610	0	0	0	0	1	1	1	1	AP	G1~G305, G336~G640
608	0	0	0	1	0	0	0	0	AQ	G1~G304, G337~G640
606	0	0	0	1	0	0	0	1	AR	G1~G303, G338~G640
604	0	0	0	1	0	0	1	0	AS	G1~G302, G339~G640
602	0	0	0	1	0	0	1	1	AT	G1~G301, G340~G640
600	0	0	0	1	0	1	0	0	AU	G1~G300, G341~G640
598	0	0	0	1	0	1	0	1	AV	G1~G299, G342~G640

596	0	0	0	1	0	1	1	0	AW	G1~G298, G343~G640
594	0	0	0	1	0	1	1	1	AX	G1~G297, G344~G640
592	0	0	0	1	1	0	0	0	AY	G1~G296, G345~G640
590	0	0	0	1	1	0	0	1	AZ	G1~G295, G346~G640
588	0	0	0	1	1	0	1	0	BA	G1~G294, G347~G640
586	0	0	0	1	1	0	1	1	BB	G1~G293, G348~G640
584	0	0	0	1	1	1	0	0	BC	G1~G292, G349~G640
582	0	0	0	1	1	1	0	1	BD	G1~G291, G350~G640
580	0	0	0	1	1	1	1	0	BE	G1~G290, G351~G640
578	0	0	0	1	1	1	1	1	BF	G1~G289, G352~G640
576	0	0	1	0	0	0	0	0	BG	G1~G288, G353~G640
574	0	0	1	0	0	0	0	1	BH	G1~G287, G354~G640
572	0	0	1	0	0	0	1	0	BI	G1~G286, G355~G640
570	0	0	1	0	0	0	1	1	BJ	G1~G285, G356~G640
568	0	0	1	0	0	1	0	0	BK	G1~G284, G357~G640
566	0	0	1	0	0	1	0	1	BL	G1~G283, G358~G640
564	0	0	1	0	0	1	1	0	BM	G1~G282, G359~G640
562	0	0	1	0	0	1	1	1	BN	G1~G281, G360~G640
560	0	0	1	0	1	0	0	0	BO	G1~G280, G361~G640
558	0	0	1	0	1	0	0	1	BP	G1~G279, G362~G640
556	0	0	1	0	1	0	1	0	BQ	G1~G278, G363~G640
554	0	0	1	0	1	0	1	1	BR	G1~G277, G364~G640
552	0	0	1	0	1	1	0	0	BS	G1~G276, G365~G640
550	0	0	1	0	1	1	0	1	BT	G1~G275, G366~G640
548	0	0	1	0	1	1	1	0	BU	G1~G274, G367~G640

546	0	0	1	0	1	1	1	1	BV	G1~G273, G368~G640
544	0	0	1	1	0	0	0	0	BW	G1~G272, G369~G640
542	0	0	1	1	0	0	0	1	BX	G1~G271, G370~G640
540	0	0	1	1	0	0	1	0	BY	G1~G270, G371~G640
538	0	0	1	1	0	0	1	1	BZ	G1~G269, G372~G640
536	0	0	1	1	0	1	0	0	CA	G1~G268, G373~G640
534	0	0	1	1	0	1	0	1	CB	G1~G267, G374~G640
532	0	0	1	1	0	1	1	0	CC	G1~G266, G375~G640
530	0	0	1	1	0	1	1	1	CD	G1~G265, G376~G640
528	0	0	1	1	1	0	0	0	CE	G1~G264, G377~G640
526	0	0	1	1	1	0	0	1	CF	G1~G263, G378~G640
524	0	0	1	1	1	0	1	0	CG	G1~G262, G379~G640
522	0	0	1	1	1	0	1	1	CH	G1~G261, G380~G640
520	0	0	1	1	1	1	0	0	CI	G1~G260, G381~G640
518	0	0	1	1	1	1	0	1	CJ	G1~G259, G382~G640
516	0	0	1	1	1	1	1	0	CK	G1~G258, G383~G640
514	0	0	1	1	1	1	1	1	CL	G1~G257, G384~G640
512	0	1	0	0	0	0	0	0	CM	G1~G256, G385~G640
510	0	1	0	0	0	0	0	1	CN	G1~G255, G386~G640
508	0	1	0	0	0	0	1	0	CO	G1~G254, G387~G640
506	0	1	0	0	0	0	1	1	CP	G1~G253, G388~G640
504	0	1	0	0	0	1	0	0	CQ	G1~G252, G389~G640
502	0	1	0	0	0	1	0	1	CR	G1~G251, G390~G640
500	0	1	0	0	0	1	1	0	CS	G1~G250, G391~G640
498	0	1	0	0	0	1	1	1	CT	G1~G249, G392~G640

496	0	1	0	0	1	0	0	0	CU	G1~G248, G393~G640
494	0	1	0	0	1	0	0	1	CV	G1~G247, G394~G640
492	0	1	0	0	1	0	1	0	CW	G1~G246, G395~G640
490	0	1	0	0	1	0	1	1	CX	G1~G245, G396~G640
488	0	1	0	0	1	1	0	0	CY	G1~G244, G397~G640
486	0	1	0	0	1	1	0	1	CZ	G1~G243, G398~G640
484	0	1	0	0	1	1	1	0	DA	G1~G242, G399~G640
482	0	1	0	0	1	1	1	1	DB	G1~G241, G400~G640
480	0	1	0	1	0	0	0	0	DC	G1~G240, G401~G640
478	0	1	0	1	0	0	0	1	DD	G1~G239, G402~G640
476	0	1	0	1	0	0	1	0	DE	G1~G238, G403~G640
474	0	1	0	1	0	0	1	1	DF	G1~G237, G404~G640
472	0	1	0	1	0	1	0	0	DG	G1~G236, G405~G640
470	0	1	0	1	0	1	0	1	DH	G1~G235, G406~G640
468	0	1	0	1	0	1	1	0	DI	G1~G234, G407~G640
466	0	1	0	1	0	1	1	1	DJ	G1~G233, G408~G640
464	0	1	0	1	1	0	0	0	DK	G1~G232, G409~G640
462	0	1	0	1	1	0	0	1	DL	G1~G231, G410~G640
460	0	1	0	1	1	0	1	0	DM	G1~G230, G411~G640
458	0	1	0	1	1	0	1	1	DN	G1~G229, G412~G640
456	0	1	0	1	1	1	0	0	DO	G1~G228, G413~G640
454	0	1	0	1	1	1	0	1	DP	G1~G227, G414~G640
452	0	1	0	1	1	1	1	0	DQ	G1~G226, G415~G640
450	0	1	0	1	1	1	1	1	DR	G1~G225, G416~G640
448	0	1	1	0	0	0	0	0	DS	G1~G224, G417~G640

446	0	1	1	0	0	0	0	1	DT	G1~G223, G418~G640
444	0	1	1	0	0	0	1	0	DU	G1~G222, G419~G640
442	0	1	1	0	0	0	1	1	DV	G1~G221, G420~G640
440	0	1	1	0	0	1	0	0	DW	G1~G220, G421~G640
438	0	1	1	0	0	1	0	1	DX	G1~G219, G422~G640
436	0	1	1	0	0	1	1	0	DY	G1~G218, G423~G640
434	0	1	1	0	0	1	1	1	DZ	G1~G217, G424~G640
432	0	1	1	0	1	0	0	0	EA	G1~G216, G425~G640
430	0	1	1	0	1	0	0	1	EB	G1~G215, G426~G640
428	0	1	1	0	1	0	1	0	EC	G1~G214, G427~G640
426	0	1	1	0	1	0	1	1	ED	G1~G213, G428~G640
424	0	1	1	0	1	1	0	0	EE	G1~G212, G429~G640
422	0	1	1	0	1	1	0	1	EF	G1~G211, G430~G640
420	0	1	1	0	1	1	1	0	EG	G1~G210, G431~G640
418	0	1	1	0	1	1	1	1	EH	G1~G209, G432~G640
416	0	1	1	1	0	0	0	0	EI	G1~G208, G433~G640
414	0	1	1	1	0	0	0	1	EJ	G1~G207, G434~G640
412	0	1	1	1	0	0	1	0	EK	G1~G206, G435~G640
410	0	1	1	1	0	0	1	1	EL	G1~G205, G436~G640
408	0	1	1	1	0	1	0	0	EM	G1~G204, G437~G640
406	0	1	1	1	0	1	0	1	EN	G1~G203, G438~G640
404	0	1	1	1	0	1	1	0	EO	G1~G202, G439~G640
402	0	1	1	1	0	1	1	1	EP	G1~G201, G440~G640
400	0	1	1	1	1	0	0	0	EQ	G1~G200, G441~G640
398	0	1	1	1	1	0	0	1	ER	G1~G199, G442~G640

396	0	1	1	1	1	0	1	0	ES	G1~G198, G443~G640
394	0	1	1	1	1	0	1	1	ET	G1~G197, G444~G640
392	0	1	1	1	1	1	0	0	EU	G1~G196, G445~G640
390	0	1	1	1	1	1	0	1	EV	G1~G195, G446~G640
388	0	1	1	1	1	1	1	0	EW	G1~G194, G447~G640
386	0	1	1	1	1	1	1	1	EX	G1~G193, G448~G640
384	1	0	0	0	0	0	0	0	EY	G1~G192, G449~G640
382	1	0	0	0	0	0	0	1	EZ	G1~G191, G450~G640
380	1	0	0	0	0	0	1	0	FA	G1~G190, G451~G640
378	1	0	0	0	0	0	1	1	FB	G1~G189, G452~G640
376	1	0	0	0	0	1	0	0	FC	G1~G188, G453~G640
374	1	0	0	0	0	1	0	1	FD	G1~G187, G454~G640
372	1	0	0	0	0	1	1	0	FE	G1~G186, G455~G640
370	1	0	0	0	0	1	1	1	FF	G1~G185, G456~G640
368	1	0	0	0	1	0	0	0	FG	G1~G184, G457~G640
366	1	0	0	0	1	0	0	1	FH	G1~G183, G458~G640
364	1	0	0	0	1	0	1	0	FI	G1~G182, G459~G640
362	1	0	0	0	1	0	1	1	FJ	G1~G181, G460~G640
360	1	0	0	0	1	1	0	0	FK	G1~G180, G461~G640
358	1	0	0	0	1	1	0	1	FL	G1~G179, G462~G640
356	1	0	0	0	1	1	1	0	FM	G1~G178, G463~G640
354	1	0	0	0	1	1	1	1	FN	G1~G177, G464~G640
352	1	0	0	1	0	0	0	0	FO	G1~G176, G465~G640
350	1	0	0	1	0	0	0	1	FP	G1~G175, G466~G640
348	1	0	0	1	0	0	1	0	FQ	G1~G174, G467~G640

346	1	0	0	1	0	0	1	1	FR	G1~G173, G468~G640
344	1	0	0	1	0	1	0	0	FS	G1~G172, G469~G640
342	1	0	0	1	0	1	0	1	FT	G1~G171, G470~G640
340	1	0	0	1	0	1	1	0	FU	G1~G170, G471~G640
338	1	0	0	1	0	1	1	1	FV	G1~G169, G472~G640
336	1	0	0	1	1	0	0	0	FW	G1~G168, G473~G640
334	1	0	0	1	1	0	0	1	FX	G1~G167, G474~G640
332	1	0	0	1	1	0	1	0	FY	G1~G166, G475~G640
330	1	0	0	1	1	0	1	1	FZ	G1~G165, G476~G640
328	1	0	0	1	1	1	0	0	GA	G1~G164, G477~G640
326	1	0	0	1	1	1	0	1	GB	G1~G163, G478~G640
324	1	0	0	1	1	1	1	0	GC	G1~G162, G479~G640
322	1	0	0	1	1	1	1	1	GD	G1~G161, G480~G640
<b>CH_SEL1="1", CH_SEL0="0"</b>										
320	0	0	0	0	0	0	0	0	GE	G1~G160, G481~G640
318	0	0	0	0	0	0	0	1	GF	G1~G159, G482~G640
316	0	0	0	0	0	0	1	0	GG	G1~G158, G483~G640
314	0	0	0	0	0	0	1	1	GH	G1~G157, G484~G640
312	0	0	0	0	0	1	0	0	GI	G1~G156, G485~G640
310	0	0	0	0	0	1	0	1	GJ	G1~G155, G486~G640
308	0	0	0	0	0	1	1	0	GK	G1~G154, G487~G640
306	0	0	0	0	0	1	1	1	GL	G1~G153, G488~G640
304	0	0	0	0	1	0	0	0	GM	G1~G152, G489~G640
302	0	0	0	0	1	0	0	1	GN	G1~G151, G490~G640
300	0	0	0	0	1	0	1	0	GO	G1~G150, G491~G640
298	0	0	0	0	1	0	1	1	GP	G1~G149, G492~G640

296	0	0	0	0	1	1	0	0	GQ	G1~G148, G493~G640
294	0	0	0	0	1	1	0	1	GR	G1~G147, G494~G640
292	0	0	0	0	1	1	1	0	GS	G1~G146, G495~G640
290	0	0	0	0	1	1	1	1	GT	G1~G145, G496~G640
288	0	0	0	1	0	0	0	0	GU	G1~G144, G497~G640
286	0	0	0	1	0	0	0	1	GV	G1~G143, G498~G640
284	0	0	0	1	0	0	1	0	GW	G1~G142, G499~G640
282	0	0	0	1	0	0	1	1	GX	G1~G141, G500~G640
280	0	0	0	1	0	1	0	0	GY	G1~G140, G501~G640
278	0	0	0	1	0	1	0	1	GZ	G1~G139, G502~G640
276	0	0	0	1	0	1	1	0	HA	G1~G138, G503~G640
274	0	0	0	1	0	1	1	1	HB	G1~G137, G504~G640
272	0	0	0	1	1	0	0	0	HC	G1~G136, G505~G640
270	0	0	0	1	1	0	0	1	HD	G1~G135, G506~G640
268	0	0	0	1	1	0	1	0	HE	G1~G134, G507~G640
266	0	0	0	1	1	0	1	1	HF	G1~G133, G508~G640
264	0	0	0	1	1	1	0	0	HG	G1~G132, G509~G640
262	0	0	0	1	1	1	0	1	HH	G1~G131, G510~G640
260	0	0	0	1	1	1	1	0	HI	G1~G130, G511~G640
258	0	0	0	1	1	1	1	1	HJ	G1~G129, G512~G640
256	0	0	1	0	0	0	0	0	HK	G1~G128, G513~G640
254	0	0	1	0	0	0	0	1	HL	G1~G127, G514~G640
252	0	0	1	0	0	0	1	0	HM	G1~G126, G515~G640
250	0	0	1	0	0	0	1	1	HN	G1~G125, G516~G640
248	0	0	1	0	0	1	0	0	HO	G1~G124, G517~G640

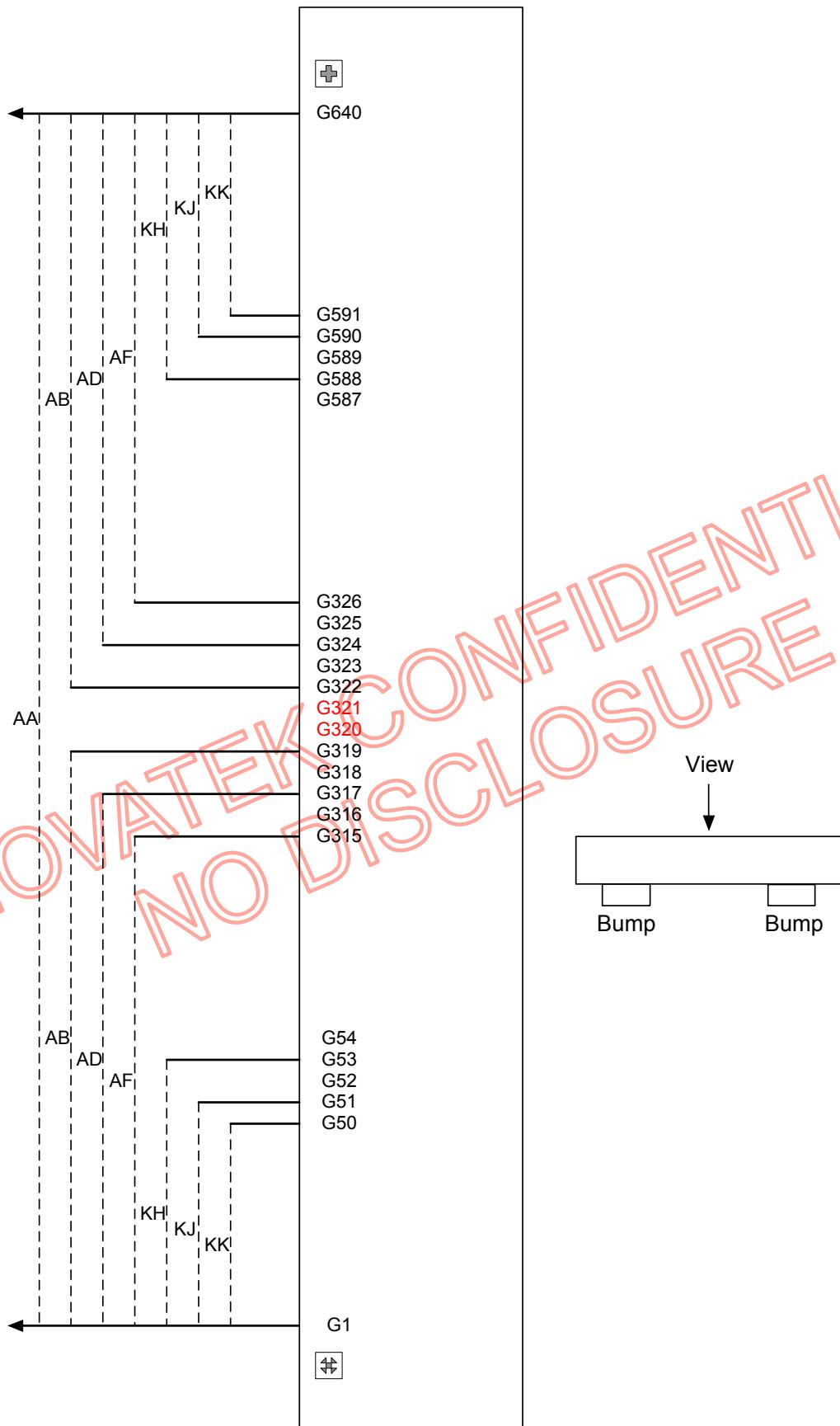
246	0	0	1	0	0	1	0	1	HP	G1~G123, G518~G640
244	0	0	1	0	0	1	1	0	HQ	G1~G122, G519~G640
242	0	0	1	0	0	1	1	1	HR	G1~G121, G520~G640
240	0	0	1	0	1	0	0	0	HS	G1~G120, G521~G640
238	0	0	1	0	1	0	0	1	HT	G1~G119, G522~G640
236	0	0	1	0	1	0	1	0	HU	G1~G118, G523~G640
234	0	0	1	0	1	0	1	1	HV	G1~G117, G524~G640
232	0	0	1	0	1	1	0	0	HW	G1~G116, G525~G640
230	0	0	1	0	1	1	0	1	HX	G1~G115, G526~G640
228	0	0	1	0	1	1	1	0	HY	G1~G114, G527~G640
226	0	0	1	0	1	1	1	1	HZ	G1~G113, G528~G640
224	0	0	1	1	0	0	0	0	IA	G1~G112, G529~G640
222	0	0	1	1	0	0	0	1	IB	G1~G111, G530~G640
220	0	0	1	1	0	0	1	0	IC	G1~G110, G531~G640
218	0	0	1	1	0	0	1	1	ID	G1~G109, G532~G640
216	0	0	1	1	0	1	0	0	IE	G1~G108, G533~G640
214	0	0	1	1	0	1	0	1	IF	G1~G107, G534~G640
212	0	0	1	1	0	1	1	0	IG	G1~G106, G535~G640
210	0	0	1	1	0	1	1	1	IH	G1~G105, G536~G640
208	0	0	1	1	1	0	0	0	II	G1~G104, G537~G640
206	0	0	1	1	1	0	0	1	IJ	G1~G103, G538~G640
204	0	0	1	1	1	0	1	0	IK	G1~G102, G539~G640
202	0	0	1	1	1	0	1	1	IL	G1~G101, G540~G640
200	0	0	1	1	1	1	0	0	IM	G1~G100, G541~G640
198	0	0	1	1	1	1	0	1	IN	G1~G99, G542~G640

196	0	0	1	1	1	1	1	0	IO	G1~G98, G543~G640
194	0	0	1	1	1	1	1	1	IP	G1~G97, G544~G640
192	0	1	0	0	0	0	0	0	IQ	G1~G96, G545~G640
190	0	1	0	0	0	0	0	1	IR	G1~G95, G546~G640
188	0	1	0	0	0	0	1	0	IS	G1~G94, G547~G640
186	0	1	0	0	0	0	1	1	IT	G1~G93, G548~G640
184	0	1	0	0	0	1	0	0	IU	G1~G92, G549~G640
182	0	1	0	0	0	1	0	1	IV	G1~G91, G550~G640
180	0	1	0	0	0	1	1	0	IW	G1~G90, G551~G640
178	0	1	0	0	0	1	1	1	IX	G1~G89, G552~G640
176	0	1	0	0	1	0	0	0	IY	G1~G88, G553~G640
174	0	1	0	0	1	0	0	1	IZ	G1~G87, G554~G640
172	0	1	0	0	1	0	1	0	JA	G1~G86, G555~G640
170	0	1	0	0	1	0	1	1	JB	G1~G85, G556~G640
168	0	1	0	0	1	1	0	0	JC	G1~G84, G557~G640
166	0	1	0	0	1	1	0	1	JD	G1~G83, G558~G640
164	0	1	0	0	1	1	1	0	JE	G1~G82, G559~G640
162	0	1	0	0	1	1	1	1	JF	G1~G81, G560~G640

**CH\_SEL1="1", CH\_SEL0="1"**

160	0	0	0	0	0	0	0	0	JG	G1~G80, G561~G640
158	0	0	0	0	0	0	0	1	JH	G1~G79, G562~G640
156	0	0	0	0	0	0	1	0	JI	G1~G78, G563~G640
154	0	0	0	0	0	0	1	1	JJ	G1~G77, G564~G640
152	0	0	0	0	0	1	0	0	JK	G1~G76, G565~G640
150	0	0	0	0	0	1	0	1	JL	G1~G75, G566~G640
148	0	0	0	0	0	1	1	0	JM	G1~G74, G567~G640

146	0	0	0	0	0	1	1	1	JN	G1~G73, G568~G640
144	0	0	0	0	1	0	0	0	JO	G1~G72, G569~G640
142	0	0	0	0	1	0	0	1	JP	G1~G71, G570~G640
140	0	0	0	0	1	0	1	0	JQ	G1~G70, G571~G640
138	0	0	0	0	1	0	1	1	JR	G1~G69, G572~G640
136	0	0	0	0	1	1	0	0	JS	G1~G68, G573~G640
134	0	0	0	0	1	1	0	1	JT	G1~G67, G574~G640
132	0	0	0	0	1	1	1	0	JU	G1~G66, G575~G640
130	0	0	0	0	1	1	1	1	JV	G1~G65, G576~G640
128	0	0	0	1	0	0	0	0	JW	G1~G64, G577~G640
126	0	0	0	1	0	0	0	1	JX	G1~G63, G578~G640
124	0	0	0	1	0	0	1	0	JY	G1~G62, G579~G640
122	0	0	0	1	0	0	1	1	JZ	G1~G61, G580~G640
120	0	0	0	1	0	1	0	0	KA	G1~G60, G581~G640
118	0	0	0	1	0	1	0	1	KB	G1~G59, G582~G640
116	0	0	0	1	0	1	1	0	KC	G1~G58, G583~G640
114	0	0	0	1	0	1	1	1	KD	G1~G57, G584~G640
112	0	0	0	1	1	0	0	0	KE	G1~G56, G585~G640
110	0	0	0	1	1	0	0	1	KF	G1~G55, G586~G640
108	0	0	0	1	1	0	1	0	KG	G1~G54, G587~G640
106	0	0	0	1	1	0	1	1	KH	G1~G53, G588~G640
104	0	0	0	1	1	1	0	0	KI	G1~G52, G589~G640
102	0	0	0	1	1	1	0	1	KJ	G1~G51, G590~G640
100	0	0	0	1	1	1	1	0	KK	G1~G50, G591~G640



**Pass line name**

Pass Line No.	Pad Name	
1	XONR	XONL
2	OER	OEL
3	U_DR	U_DL
4	CLKR	CLKL
5	PATHR	PATHL
6	VGGR	VGGL
7	VEER	VEEL
8	VCCR	VCCL
9	GNDR	GNDL
10	GPMR	GPMI
11	TP_BR	TP_BL
12	TP_CR	TP_CL
13	VBR	VBL
14	LPMR	LPML
15	F_ctrlR	F_ctrlL
16	SEL0R	SEL0L
17	SEL1R	SEL1L

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NO DISCLOSURE

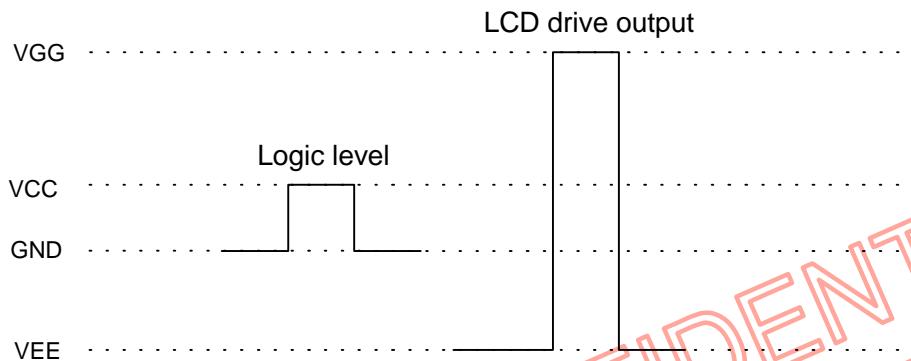
## Functional Descriptions

### 1. Power on/off sequence

This IC is a high-voltage LCD driver, so it may be damaged by a large current flow if an incorrect power sequence is used. A recommended sequence is to connect the driver powers, VEE & VGG or VGG & VEE, after the logical power, VCC.

For power-off sequence, either turning off logic system after shutting off the driver power or turning off all power simultaneously at the same time are suggested.

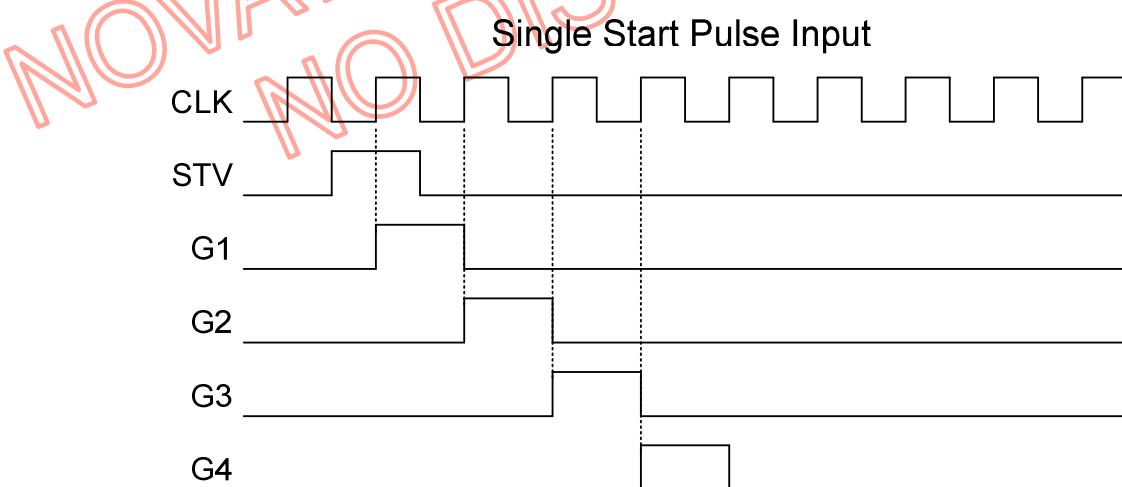
### 2. Power level



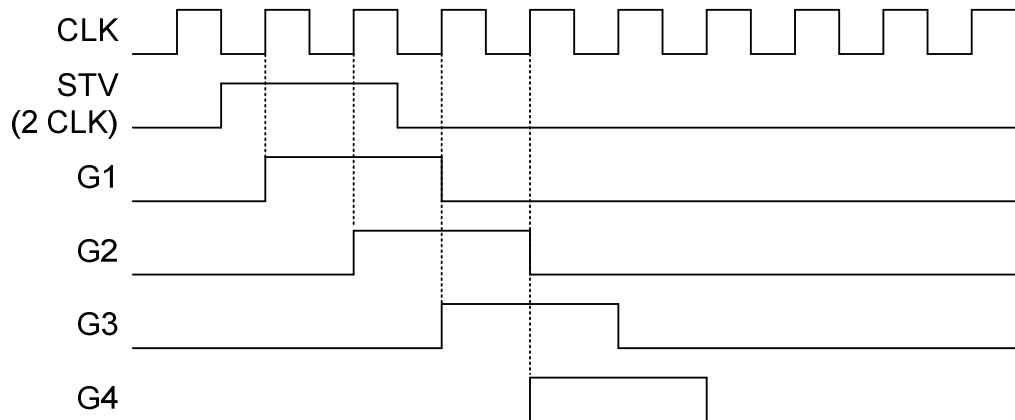
Note1: For the input signals: CLK, LPM, GPM, XON, OE, U\_D, STVD & STVU.....and so on.  
 "High" level = VCC, "Low" level = GND.

### 3. Start Pulse Usage

The available start pulse is in the following diagram.



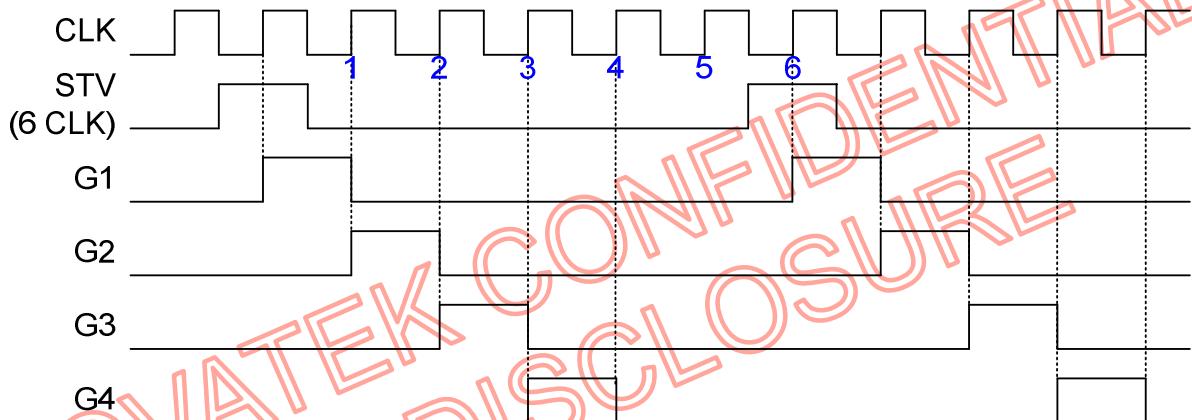
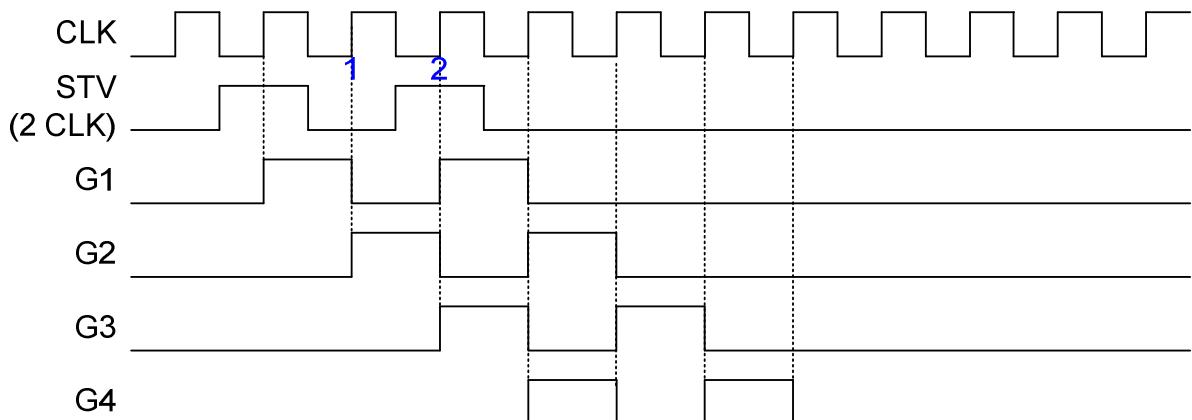
### Long Start Pulse Input



Note 1: For Long Start Pulse Input, the length of Start Pulse must be equal to the length of 2 CLK.

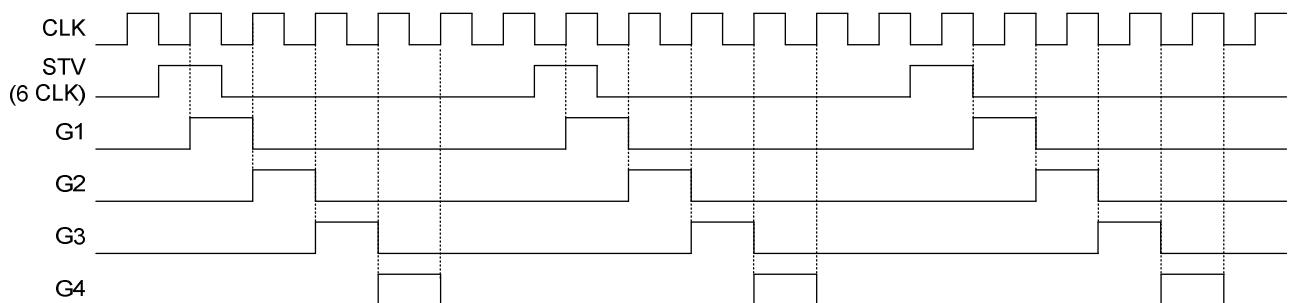
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NO DISCLOSURE

### Dual Start Pulse Input



Note 1: For Dual Start Pulse Input, the space of STV between two pulses must be less than or equal to 14 CLK.

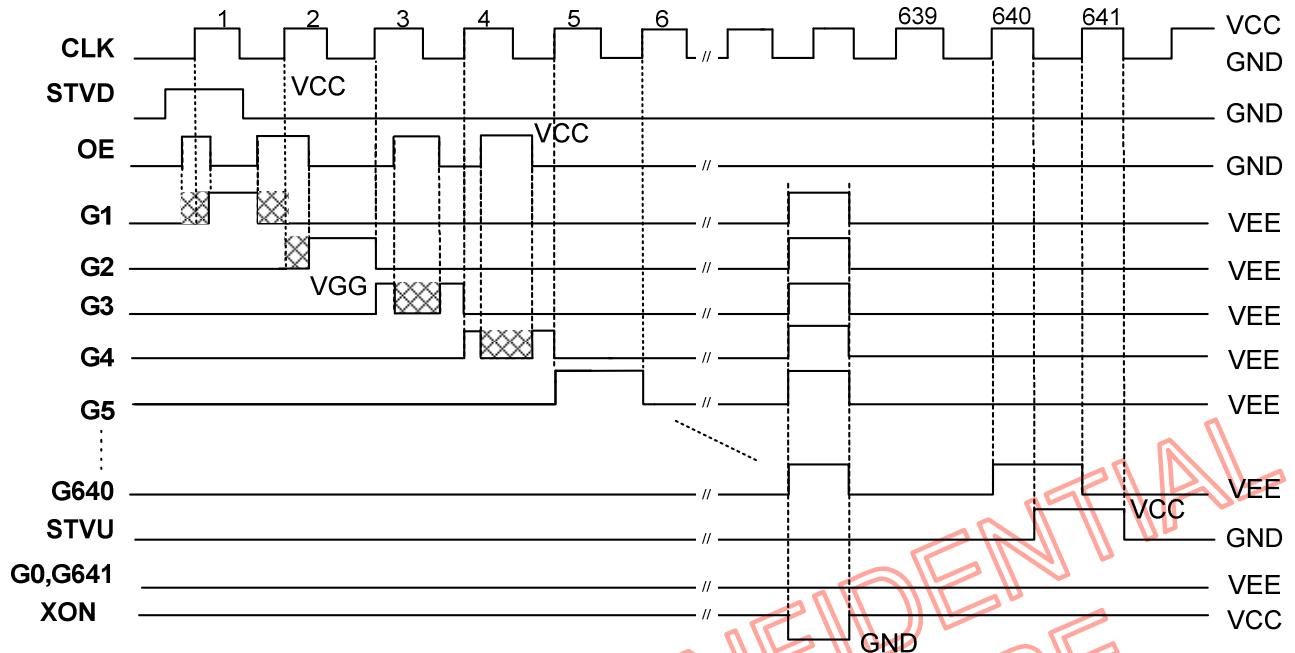
### Third Start Pulse Input



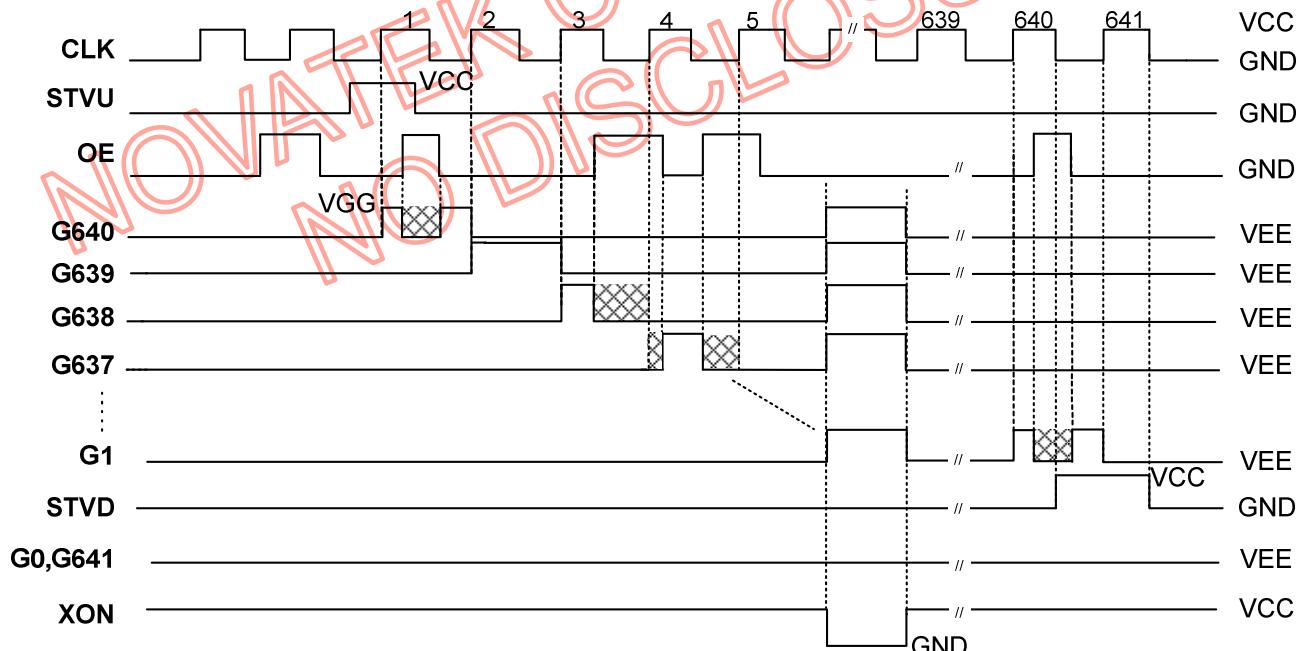
Note 1: For Third Start Pulse Input, the space of STV between head and tail pulses must be less than or equal to 14 CLK.

#### 4. Operating Condition

##### 1. U\_D = 'H'



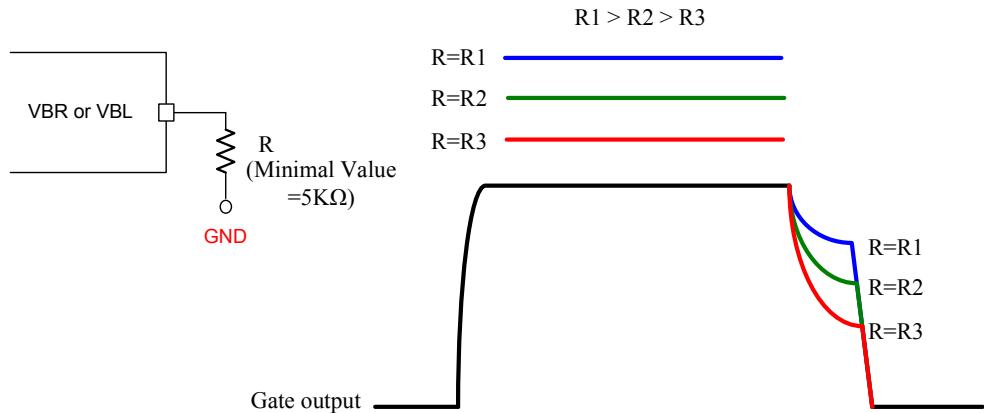
##### 2. U\_D = 'L'



XXXXX : Deleted from normal output by OE

#### 4-1 GPM falling slew rate function

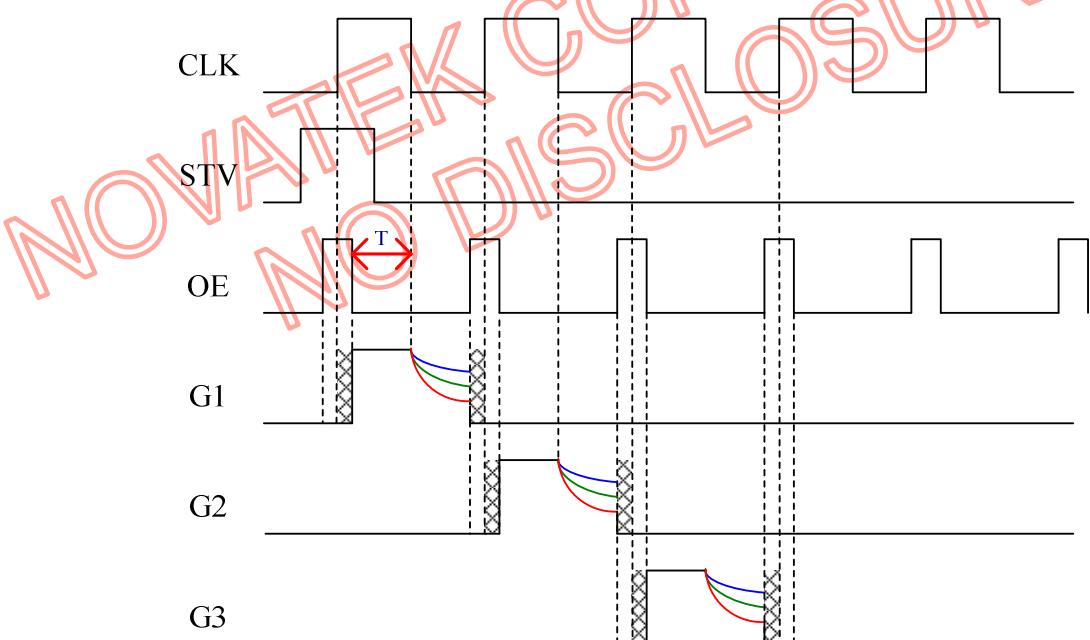
Adjusting GPM falling slew rate by modified the resistor R between VBR/ VBL and GND.



#### 4-2 Built-in GPM timing

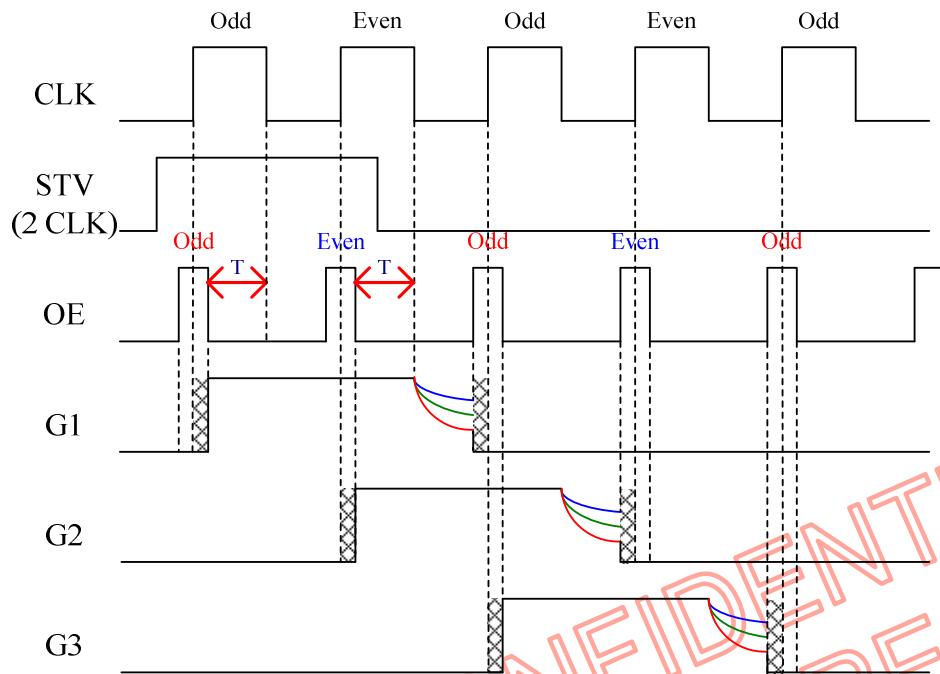
Multiple pulse (Dual/Third pulse) mode don't support GPM & F\_ctrl/SEL0/SEL1 function. As shown below, input waveform must meet the following diagram. **Regardless in any case, please let falling time of CLK after falling time of OE( $T > 0.5 \mu\text{s}$ ).**

##### 4-2-1 Single pulse mode (GPM = 'H' & LPM = 'L')



 : Deleted from normal output by OE.

#### 4-2-2 Long pulse mode (GPM = 'H' & LPM = 'H')



 : Deleted from normal output by OE.

Notice 1: In long pulse mode, please make sure the timing of STV and OE is matched above picture.

Notice 2: long pulse mode don't support F\_ctrl/SEL0/SEL1 function

## 5. Output Sequence & Frame Control

### 5-1 Output Sequence Control

#### U\_D=H , 640 channels output

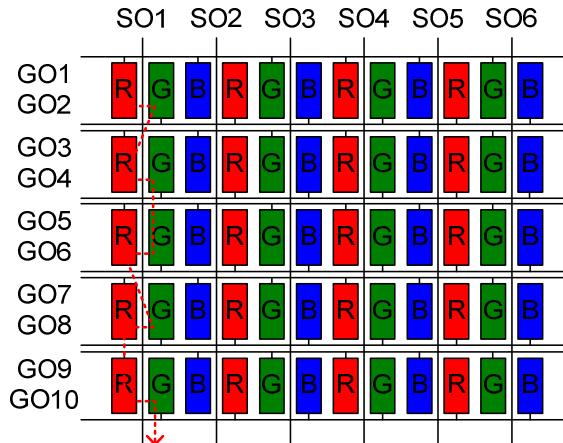
SEL0	SEL1	F_Ctrl	Scan type	Output Sequence
1	1	0	Z+ $\Xi$	G1→G2→G3→G4→G6→G5→G8→G7→...(Note 1)
		1	Inverse (Z+ $\Xi$ )	G2→G1→G4→G3→G5→G6→G7→G8→...
1	0	0	$\Xi$	G1→G2→G4→G3→G5→G6→G8→G7→...(Note 2)
		1	Inverse $\Xi$	G2→G1→G3→G4→G6→G5→G7→G8→...
0	X	0	Z	G1→G2→G3→G4→G5→G6→G7→G8→...(Note 3)
		1	Inverse Z	G2→G1→G4→G3→G6→G5→G8→G7→...(Note 4)

#### U\_D=L , 640 channels output

SEL0	SEL1	F_Ctrl	Scan type	Output Sequence
1	1	0	Z+ $\Xi$	G640→G639→G638→G637→G635→G636→G633→G634→ G632→G631→..
		1	Inverse (Z+ $\Xi$ )	G639→G640→G637→G638→G636→G635→G634→G633→ G631→G632→..
1	0	0	$\Xi$	G640→G639→G637→G638→G636→G635→G633→G634→..
		1	Inverse $\Xi$	G639→G640→G638→G637→G635→G636→G634→G633→..
0	X	0	Z	G640→G639→G638→G637→G636→G635→G634→G633→..
		1	Inverse Z	G639→G640→G637→G638→G635→G636→G633→G634→..

Note 1:

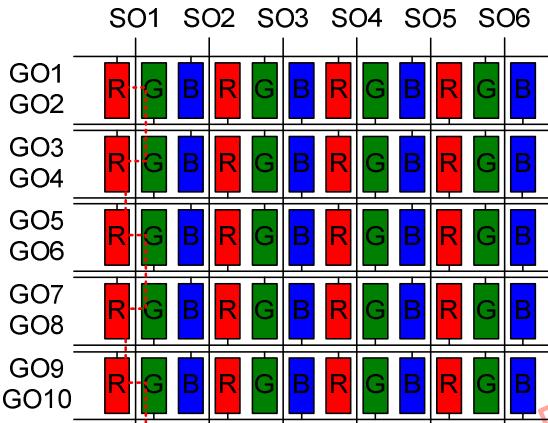
**SEL0=1, SEL1=1, F\_ctrl=0**



GO1->GO2->GO3->GO4->**GO6**->GO5->GO8->G07

Note 2:

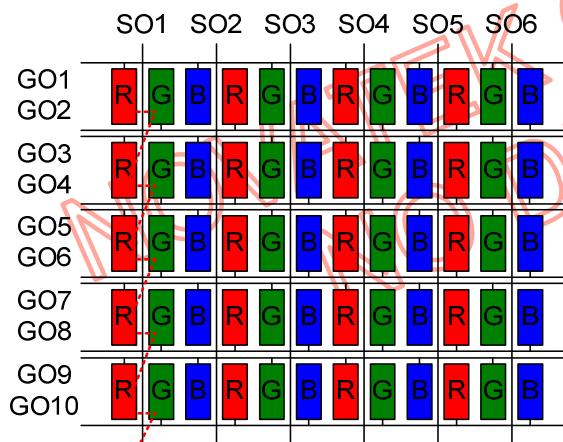
**SEL0=1, SEL1=0, F\_ctrl=0**



GO1->GO2->**GO4**->GO3->GO5->GO6->**GO8**->G07

Note 3:

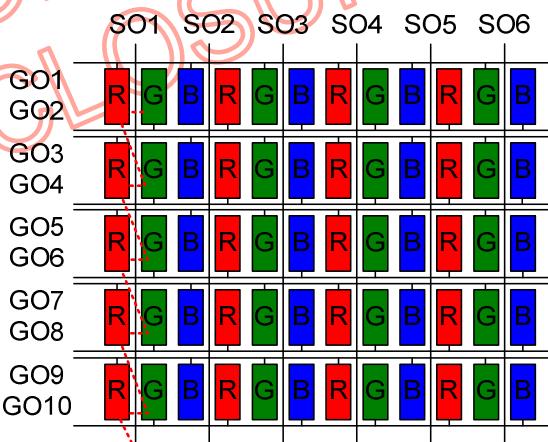
**SEL0=0, SEL1=X, F\_ctrl=0**



GO1->GO2->GO3->GO4->GO5->GO6->GO7->G08

Note 4:

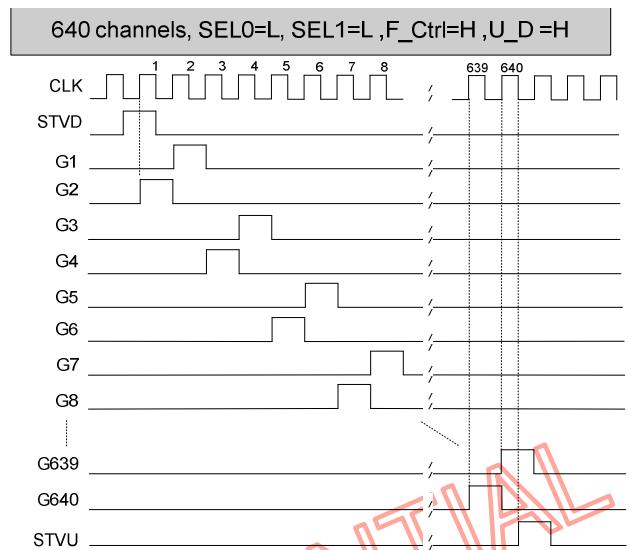
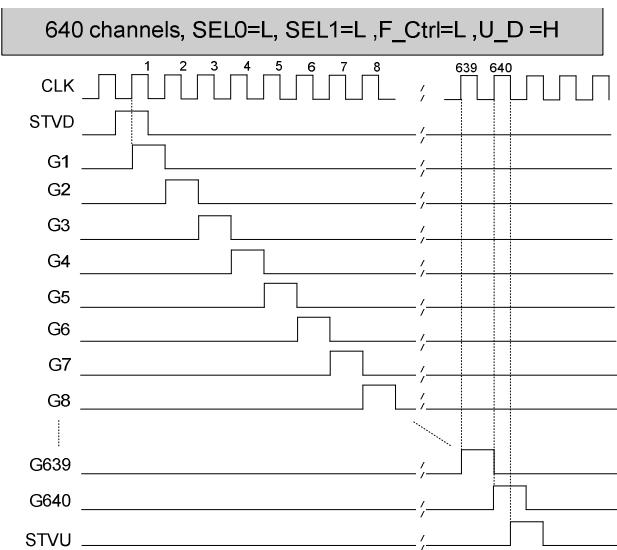
**SEL0=0, SEL1=X, F\_ctrl=1**



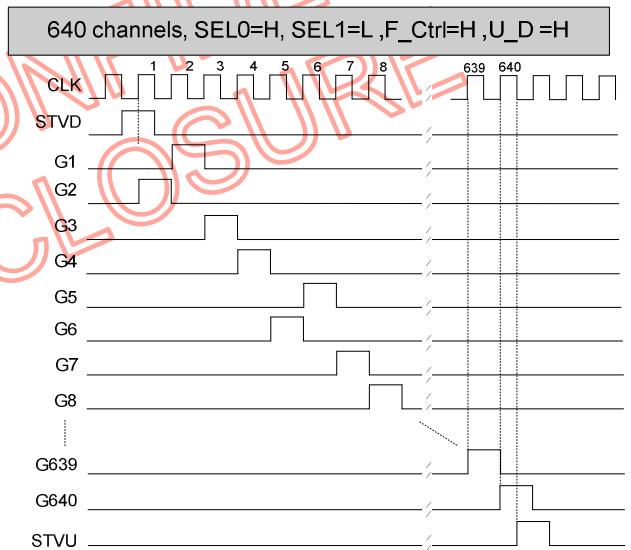
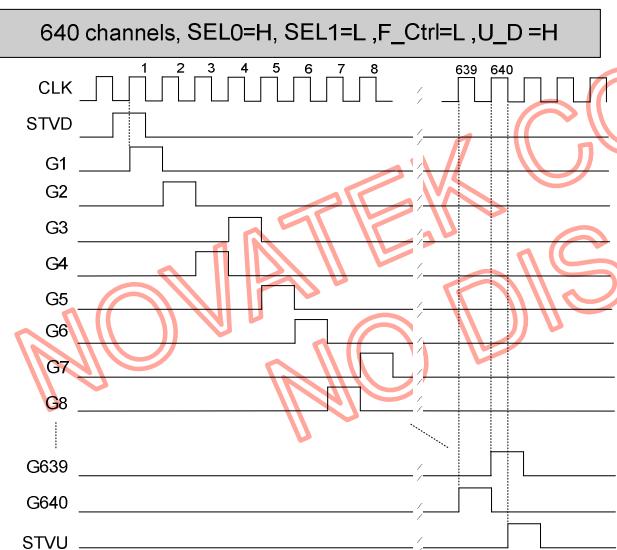
GO2->GO1->**GO4**->GO3->GO6->GO5->GO8->G07

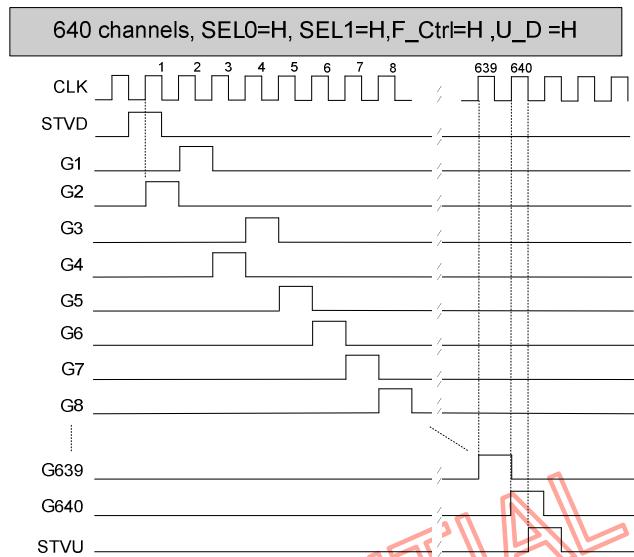
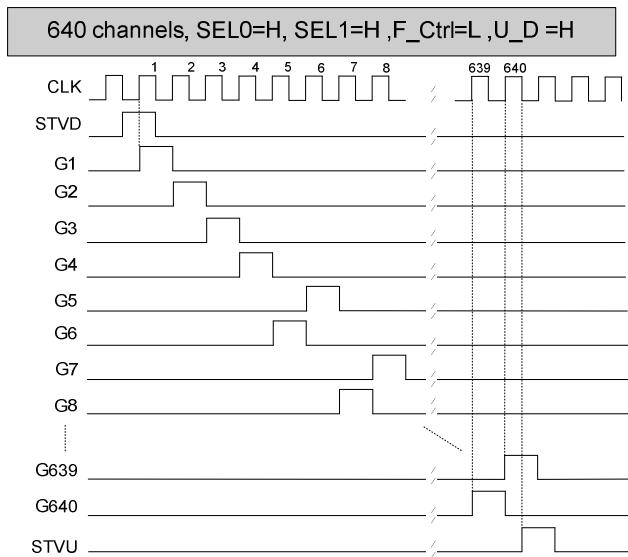
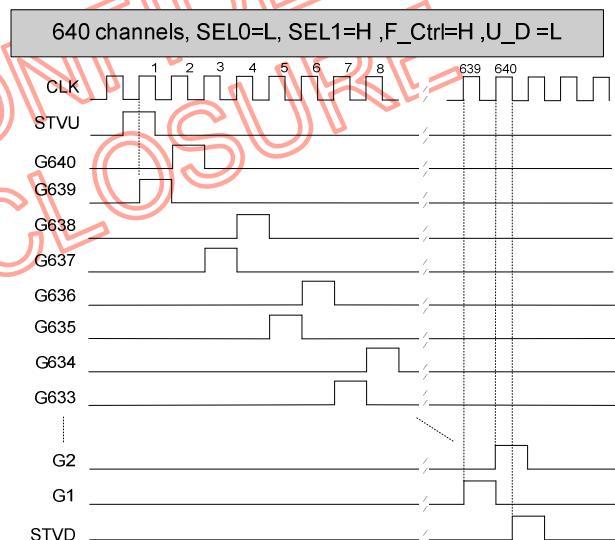
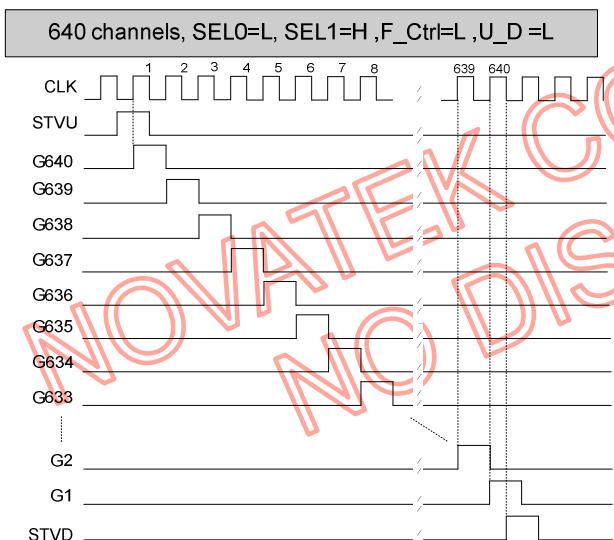
## 5-2 Output Sequence Timing

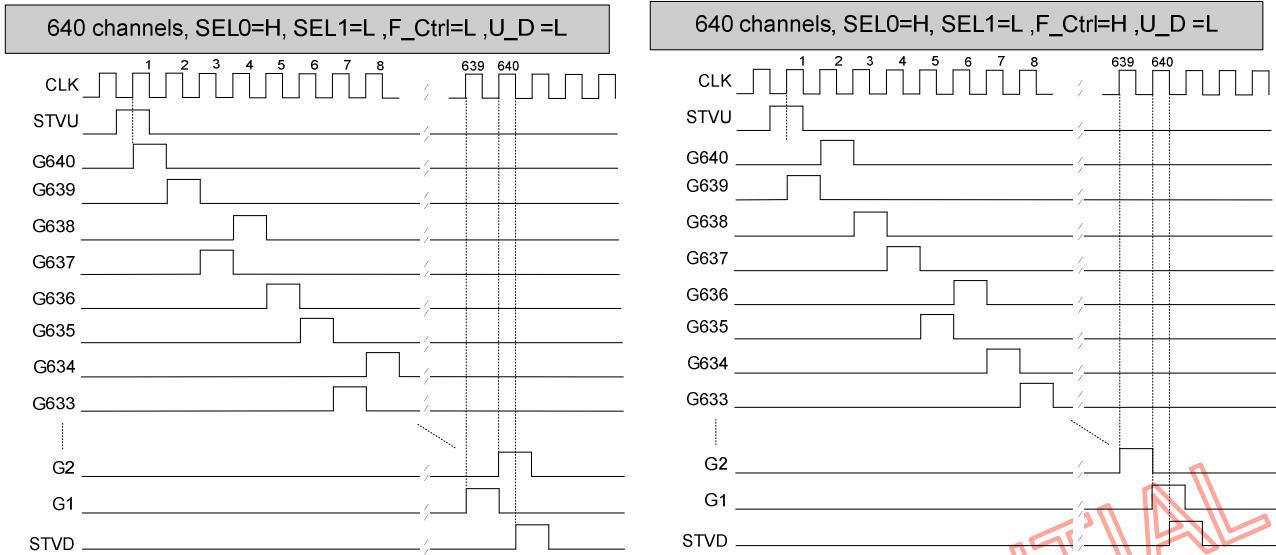
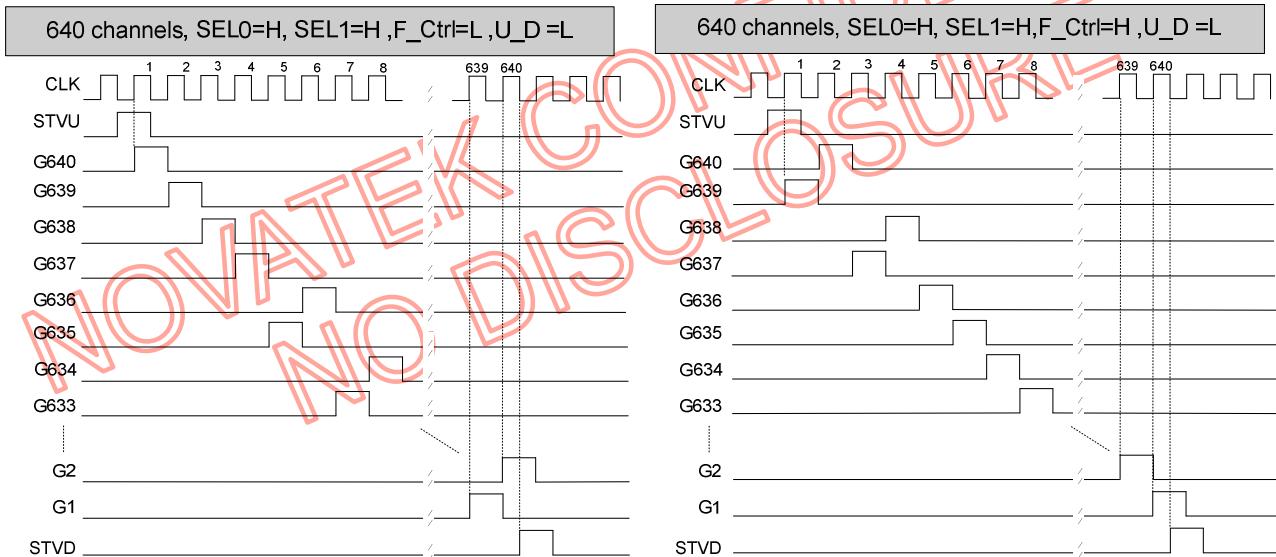
**Case 1:**



**Case 2:**



**Case 3:**

**Case 4:**


**Case 5:**

**Case 6:**


## Absolute Maximum Ratings\*

### Voltage

**Test condition:** GND = 0V, TA = 25°C

Parameter	Min.	Max.	Unit
Logic Voltage, VCC	-0.3	+7.0	V
Supply Voltage, VGG	-0.3	VEE+40.0	V
Supply Voltage, VEE	-20.0	+0.3	V
Supply range, VGG-VEE	-0.3	+40.0	V

### Temperature

Parameter	Min.	Max.	Unit
Operating temperature	-40	105	°C
Storage temperature	-55	125	°C

### Comment:

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposed to absolute maximum rating conditions for extended periods may affect device reliability.

## Recommended Operating Range

**Test condition:** GND = 0V, TA = -40 to +105°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
VGG Voltage	VGG	7	-	VEE + 40	V	
VEE Voltage	VEE	-20	-	-5	V	
Voltage Range of VGG – VEE	V <sub>xo</sub>	12	-	40	V	VCC = 3.3V
VCC Supplied Voltage	VCC	2.7	3.3	3.6	V	

## DC Electrical Characteristics

Test condition: VCC= 2.7 to 3.6V, GND= 0V, TA= -40 to +105°C, GPM="L"

Symbol	Parameters	Min.	Typ.	Max.	Unit	Conditions
VIH	High Level Input Voltage	0.7*VCC	-	VCC	V	VCC = 3.3V, OE/U_D/CLK/CH_NUM[7:0]/ STVD/STVU/LPM/GPM
VIL	Low Level Input Voltage	0	-	0.3*VCC	V	VCC = 3.3V, OE/U_D/CLK/CH_NUM[7:0]/ STVD/STVU/LPM/GPM
VIH	High Level Input Voltage	0.8*VCC	-	VCC	V	VCC = 3.3V, <b>XON</b>
VIL	Low Level Input Voltage	0	-	0.2*VCC	V	VCC = 3.3V, <b>XON</b>
IXOH	High Level Output Current	0.5	-	-	mA	VGG=25V, VEE=-15V, Driving current, VO = VGG - 0.5V
IXOL	Low Level Output Current	0.5	-	-	mA	VGG=25V, VEE=-15V, Sinking current, VO = VEE + 0.5V
IPOH	High Level Output Current	200	-	-	uA	VCC=3.3V, STVD/STVU, VO = VCC - 0.3V
IPOL	Low Level Output Current	200	-	-	uA	VCC=3.3V, STVD/STVU, VO = 0.3V
Rin	Pull-up/down Impedance	130K	230K	520K	ohm	VCC=3.3V and TA=25°C
IIL	Input Leakage Current	-	-	$\pm 1$	uA	Except XON/U_D pin
ICC	Operating Current Consumption	-	-	150	uA	VCC=3.3V, Fclk=100KHz, No load
IGG	Operating Current Consumption	-	-	750	uA	VGG=25V, Fclk=100KHz, No load
IEE	Operating Current Consumption	-	-	750	uA	VEE=-15V, Fclk=100KHz, No load

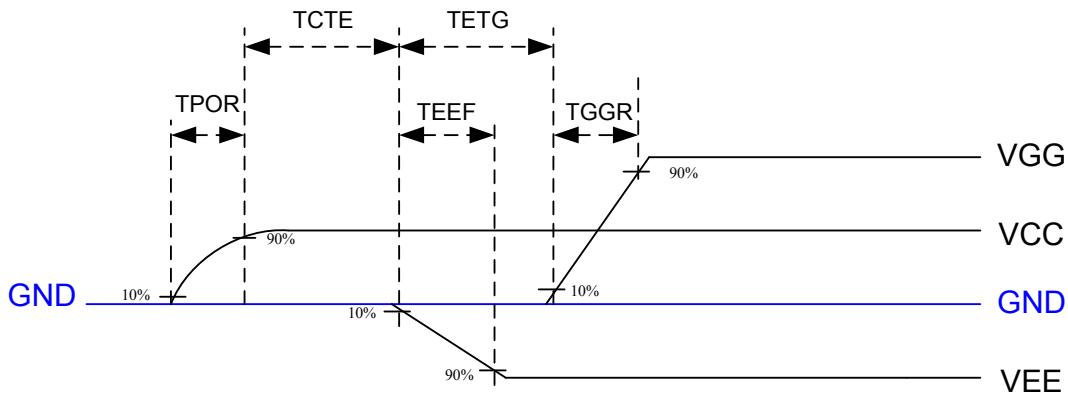
## AC Electrical Characteristics

**Test condition: VCC= 2.7 to 3.6V, GND= 0V, TA= -40 to +105°C, GPM="L"**

Symbol	Parameters	Min.	Typ.	Max.	Unit	Conditions
Tdt	STVD/STVU Delay Time	-	-	500	ns	VCC=3.3V, CL = 20pF
Tdo	Driver Output Delay Time	-	-	900	ns	VGG=25V,VEE=-15V, VCC=3.3V,CL = 200pF
Tthl	Output Falling Time	-	400	800	ns	VGG=25V,VEE=-15V, VCC=3.3V,CL = 200pF, 90% to 10%
Ttlh	Output Rising Time	-	500	1000	ns	VGG=25V,VEE=-15V, VCC=3.3V,CL = 200pF, 10% to 90%
Txon	XON to Driver Output Delay Time	-	-	50	us	VGG=25V,VEE=-15V, VCC=3.3V,CL = 200pF
Toe	OEx to Driver Output Delay Time	-	-	900	ns	VGG=25V,VEE=-15V, VCC=3.3V,CL = 200pF
Fclk	Clock Frequency	-	-	200	KHz	
Trck	Clock Rising Time	-	-	100	ns	CL = 20pF
Tfck	Clock Falling Time	-	-	100	ns	CL = 20pF
PWCLK	Clock Pulse Width (High & Low)	500	-	-	ns	GPM disable
Tsu	STVD/STVU Set-Up Time	400	-	-	ns	VCC=3.3V
Thd	STVD/STVU Hold Time	500	-	-	ns	VCC=3.3V
Twcl	Output Enabled Pulse Width	1	-	-	us	
TPOR	Power-On Reset Slew Time	-	-	20	ms	From 10% to 90% VCC
TCTE	VCC to VEE Time	0			ms	From 90% VCC to 10% VEE
TETC	VEE to VCC Time	0			ms	From 10% VEE to 90% VCC
TETG	VEE to VGG Time	1			ms	From 10% VEE to 10% VGG
TGTE	VGG to VEE Time	0			ms	From 10% VGG to 10% VEE
TGGR	VGG Rising Time	TEEF			ms	From 10% to 90% VGG
TRES	VCC resettle time	1			s	
Vpor	Power on reset voltage	0		100	mV	

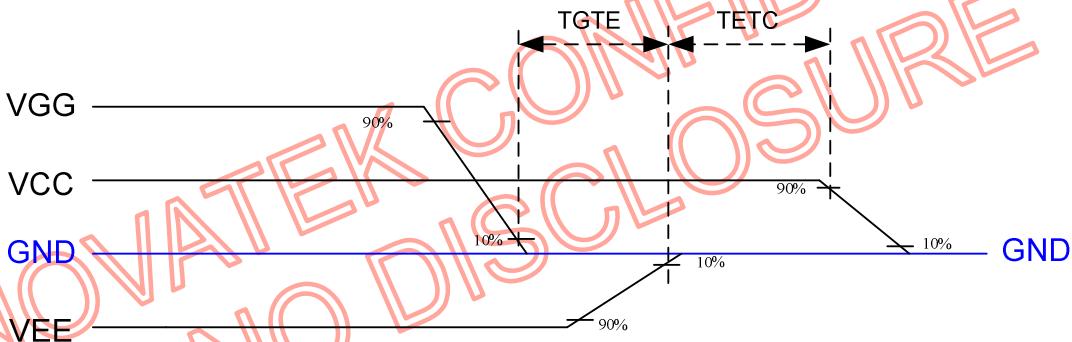
Note: TEEF => VEE Falling Time, From 10% to 90% VEE.

### ■ Power on sequence (VCC → VEE → VGG)

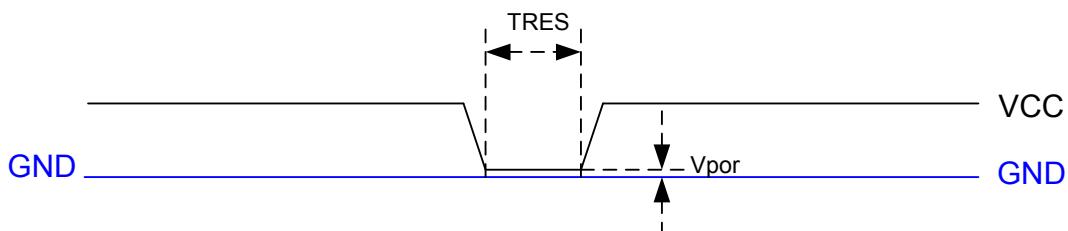


Note1: TPOR=>Power-On Reset slew time. Refer to [page-15](#).

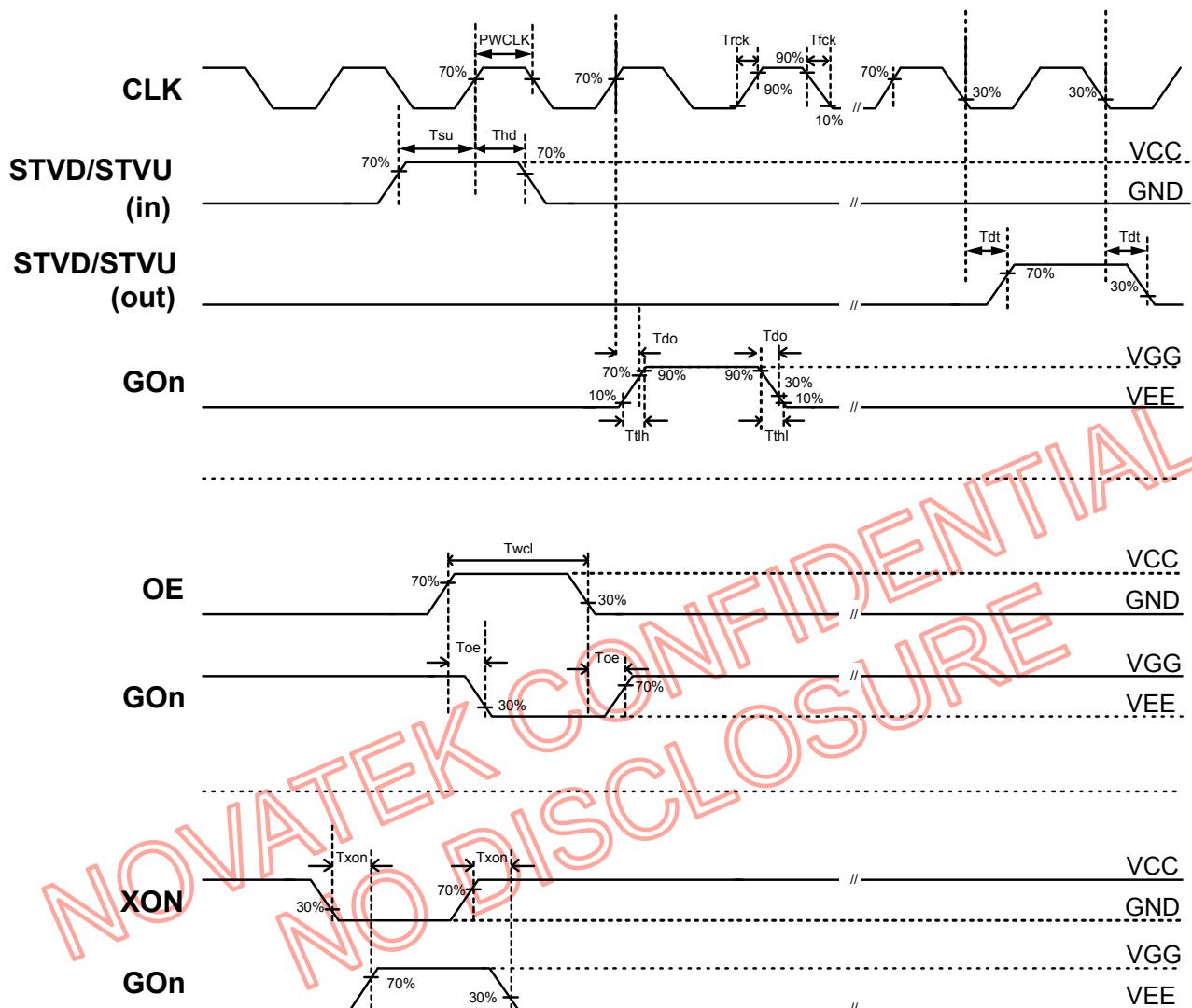
### ■ Power off sequence (VGG → VEE → VCC)



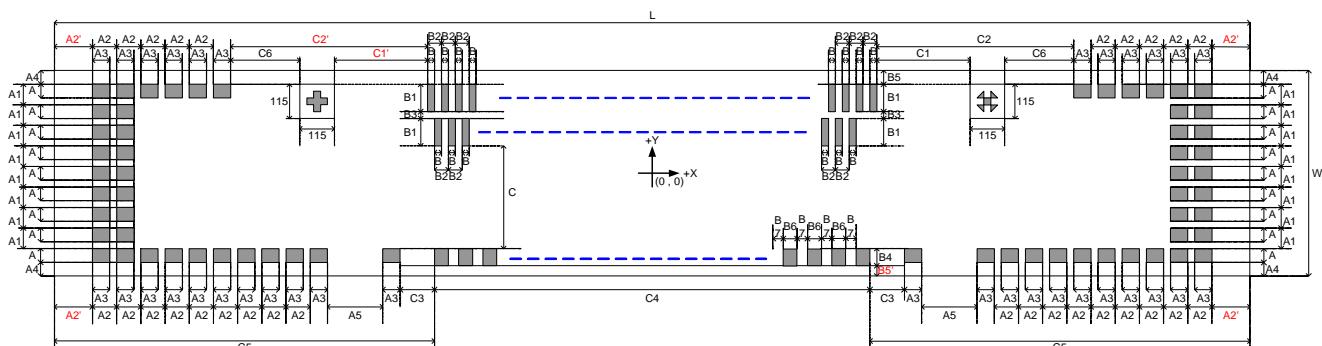
### ■ VCC timing



## Timing Waveforms

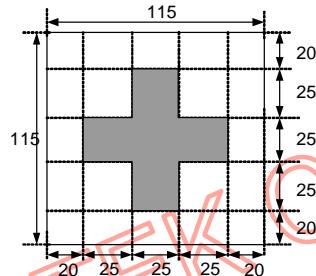


## Chip Outline Dimensions

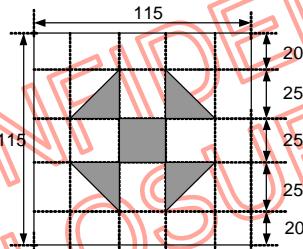


### Alignment Mark Dimensions

**Left Side**



**Right Side**



Symbol	Dimensions (um)	Symbol	Dimensions (um)	Symbol	Dimensions (um)
A	36	B	16	C	336
A1	64	B1	71	C1	192
A2	86	B2	36	C1'	210
A3	66	B3	34	C2	576
A4	58.5	B4	40	C2'	594
A5	192	B5	58.5	C3	20
A2'	144.5	B5'	54.5	C4	11570
		B6	170	C5	1262.5
		B7	20	C6	269
				L	14095(Max)
				W	665(Max)

(scribe-line included)

## Pad Coordinate

Pad No.	Name	X-pos	Y-pos	X-size	Y-size
1	VBL	-6870	-256	66	36
2	VBL	-6784	-256	66	36
3	GNDL	-6698	-256	66	36
4	GNDL	-6612	-256	66	36
5	LPML	-6526	-256	66	36
6	GPM	-6440	-256	66	36
7	SEL1L	-6354	-256	66	36
8	SEL0L	-6268	-256	66	36
9	TP_BL	-6182	-256	66	36
10	TP_CL	-6096	-256	66	36
11	VCCL	-5838	-256	66	36
12	VGGL	-5700	-258	170	40
13	GNDL	-5510	-258	170	40
14	VEEL	-5320	-258	170	40
15	SHIELDING_GND[1]	-5130	-258	170	40
16	SHIELDING_GND[2]	-4940	-258	170	40
17	SHIELDING_GND[3]	-4750	-258	170	40
18	SHIELDING_GND[4]	-4560	-258	170	40
19	SHIELDING_GND[5]	-4370	-258	170	40
20	SHIELDING_GND[6]	-4180	-258	170	40
21	SHIELDING_GND[7]	-3990	-258	170	40
22	SHIELDING_GND[8]	-3800	-258	170	40
23	SHIELDING_GND[9]	-3610	-258	170	40
24	SHIELDING_GND[10]	-3420	-258	170	40
25	SHIELDING_GND[11]	-3230	-258	170	40
26	SHIELDING_GND[12]	-3040	-258	170	40
27	SHIELDING_GND[13]	-2850	-258	170	40
28	SHIELDING_GND[14]	-2660	-258	170	40
29	SHIELDING_GND[15]	-2470	-258	170	40
30	SHIELDING_GND[16]	-2280	-258	170	40
31	SHIELDING_GND[17]	-2090	-258	170	40
32	SHIELDING_GND[18]	-1900	-258	170	40
33	SHIELDING_GND[19]	-1710	-258	170	40
34	SHIELDING_GND[20]	-1520	-258	170	40
35	SHIELDING_GND[21]	-1330	-258	170	40
36	SHIELDING_GND[22]	-1140	-258	170	40
37	SHIELDING_GND[23]	-950	-258	170	40
38	SHIELDING_GND[24]	-760	-258	170	40
39	SHIELDING_GND[25]	-570	-258	170	40
40	SHIELDING_GND[26]	-380	-258	170	40
41	SHIELDING_GND[27]	-190	-258	170	40
42	SHIELDING_GND[28]	0	-258	170	40
43	SHIELDING_GND[29]	190	-258	170	40
44	SHIELDING_GND[30]	380	-258	170	40
45	SHIELDING_GND[31]	570	-258	170	40
46	SHIELDING_GND[32]	760	-258	170	40
47	SHIELDING_GND[33]	950	-258	170	40
48	SHIELDING_GND[34]	1140	-258	170	40
49	VCCR	1330	-258	170	40

Pad No.	Name	X-pos	Y-pos	X-size	Y-size
50	CH_NUM7	1520	-258	170	40
51	GNDR	1710	-258	170	40
52	CH_NUM6	1900	-258	170	40
53	VCCR	2090	-258	170	40
54	CH_NUM5	2280	-258	170	40
55	GNDR	2470	-258	170	40
56	CH_NUM4	2660	-258	170	40
57	VCCR	2850	-258	170	40
58	CH_NUM3	3040	-258	170	40
59	GNDR	3230	-258	170	40
60	CH_NUM2	3420	-258	170	40
61	VCCR	3610	-258	170	40
62	CH_NUM1	3800	-258	170	40
63	GNDR	3990	-258	170	40
64	CH_NUM0	4180	-258	170	40
65	VCCR	4370	-258	170	40
66	CH_SEL1	4560	-258	170	40
67	GNDR	4750	-258	170	40
68	CH_SEL0	4940	-258	170	40
69	VCCR	5130	-258	170	40
70	VEER	5320	-258	170	40
71	GNDR	5510	-258	170	40
72	VGGR	5700	-258	170	40
73	VCCR	5838	-256	66	36
74	TP_CR	6096	-256	66	36
75	TP_BR	6182	-256	66	36
76	SEL0R	6268	-256	66	36
77	SEL1R	6354	-256	66	36
78	GPMR	6440	-256	66	36
79	LPMR	6526	-256	66	36
80	GNDR	6612	-256	66	36
81	GNDR	6698	-256	66	36
82	VBR	6784	-256	66	36
83	VBR	6870	-256	66	36
84	VEER	6874	-192	66	36
85	VEER	6870	-192	66	36
86	VCCR	6874	-128	66	36
87	VCCR	6870	-128	66	36
88	VGGR	6784	-64	66	36
89	VGGR	6870	-64	66	36
90	STVD	6784	0	66	36
91	STVD	6870	0	66	36
92	PATHR	6784	64	66	36
93	PATHR	6870	64	66	36
94	CLKR	6784	128	66	36
95	CLKR	6870	128	66	36
96	U_DR	6784	192	66	36
97	U_DR	6870	192	66	36
98	OER	6784	256	66	36

<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>	<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>
99	OER	6870	256	66	36	150	G[45]	4977	133.5	16	71
100	XONR	6698	256	66	36	151	G[46]	4959	238.5	16	71
101	XONR	6612	256	66	36	152	G[47]	4941	133.5	16	71
102	F_ctrlR	6526	256	66	36	153	G[48]	4923	238.5	16	71
103	F_ctrlR	6440	256	66	36	154	G[49]	4905	133.5	16	71
104	SHIELDING_VEE[1]	5823	238.5	16	71	155	G[50]	4887	238.5	16	71
105	G[0]	5787	238.5	16	71	156	G[51]	4869	133.5	16	71
106	G[1]	5769	133.5	16	71	157	G[52]	4851	238.5	16	71
107	G[2]	5751	238.5	16	71	158	G[53]	4833	133.5	16	71
108	G[3]	5733	133.5	16	71	159	G[54]	4815	238.5	16	71
109	G[4]	5715	238.5	16	71	160	G[55]	4797	133.5	16	71
110	G[5]	5697	133.5	16	71	161	G[56]	4779	238.5	16	71
111	G[6]	5679	238.5	16	71	162	G[57]	4761	133.5	16	71
112	G[7]	5661	133.5	16	71	163	G[58]	4743	238.5	16	71
113	G[8]	5643	238.5	16	71	164	G[59]	4725	133.5	16	71
114	G[9]	5625	133.5	16	71	165	G[60]	4707	238.5	16	71
115	G[10]	5607	238.5	16	71	166	G[61]	4689	133.5	16	71
116	G[11]	5589	133.5	16	71	167	G[62]	4671	238.5	16	71
117	G[12]	5571	238.5	16	71	168	G[63]	4653	133.5	16	71
118	G[13]	5553	133.5	16	71	169	G[64]	4635	238.5	16	71
119	G[14]	5535	238.5	16	71	170	G[65]	4617	133.5	16	71
120	G[15]	5517	133.5	16	71	171	G[66]	4599	238.5	16	71
121	G[16]	5499	238.5	16	71	172	G[67]	4581	133.5	16	71
122	G[17]	5481	133.5	16	71	173	G[68]	4563	238.5	16	71
123	G[18]	5463	238.5	16	71	174	G[69]	4545	133.5	16	71
124	G[19]	5445	133.5	16	71	175	G[70]	4527	238.5	16	71
125	G[20]	5427	238.5	16	71	176	G[71]	4509	133.5	16	71
126	G[21]	5409	133.5	16	71	177	G[72]	4491	238.5	16	71
127	G[22]	5391	238.5	16	71	178	G[73]	4473	133.5	16	71
128	G[23]	5373	133.5	16	71	179	G[74]	4455	238.5	16	71
129	G[24]	5355	238.5	16	71	180	G[75]	4437	133.5	16	71
130	G[25]	5337	133.5	16	71	181	G[76]	4419	238.5	16	71
131	G[26]	5319	238.5	16	71	182	G[77]	4401	133.5	16	71
132	G[27]	5301	133.5	16	71	183	G[78]	4383	238.5	16	71
133	G[28]	5283	238.5	16	71	184	G[79]	4365	133.5	16	71
134	G[29]	5265	133.5	16	71	185	G[80]	4347	238.5	16	71
135	G[30]	5247	238.5	16	71	186	G[81]	4329	133.5	16	71
136	G[31]	5229	133.5	16	71	187	G[82]	4311	238.5	16	71
137	G[32]	5211	238.5	16	71	188	G[83]	4293	133.5	16	71
138	G[33]	5193	133.5	16	71	189	G[84]	4275	238.5	16	71
139	G[34]	5175	238.5	16	71	190	G[85]	4257	133.5	16	71
140	G[35]	5157	133.5	16	71	191	G[86]	4239	238.5	16	71
141	G[36]	5139	238.5	16	71	192	G[87]	4221	133.5	16	71
142	G[37]	5121	133.5	16	71	193	G[88]	4203	238.5	16	71
143	G[38]	5103	238.5	16	71	194	G[89]	4185	133.5	16	71
144	G[39]	5085	133.5	16	71	195	G[90]	4167	238.5	16	71
145	G[40]	5067	238.5	16	71	196	G[91]	4149	133.5	16	71
146	G[41]	5049	133.5	16	71	197	G[92]	4131	238.5	16	71
147	G[42]	5031	238.5	16	71	198	G[93]	4113	133.5	16	71
148	G[43]	5013	133.5	16	71	199	G[94]	4095	238.5	16	71
149	G[44]	4995	238.5	16	71	200	G[95]	4077	133.5	16	71

<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>	<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>
201	G[96]	4059	238.5	16	71	252	G[147]	3141	133.5	16	71
202	G[97]	4041	133.5	16	71	253	G[148]	3123	238.5	16	71
203	G[98]	4023	238.5	16	71	254	G[149]	3105	133.5	16	71
204	G[99]	4005	133.5	16	71	255	G[150]	3087	238.5	16	71
205	G[100]	3987	238.5	16	71	256	G[151]	3069	133.5	16	71
206	G[101]	3969	133.5	16	71	257	G[152]	3051	238.5	16	71
207	G[102]	3951	238.5	16	71	258	G[153]	3033	133.5	16	71
208	G[103]	3933	133.5	16	71	259	G[154]	3015	238.5	16	71
209	G[104]	3915	238.5	16	71	260	G[155]	2997	133.5	16	71
210	G[105]	3897	133.5	16	71	261	G[156]	2979	238.5	16	71
211	G[106]	3879	238.5	16	71	262	G[157]	2961	133.5	16	71
212	G[107]	3861	133.5	16	71	263	G[158]	2943	238.5	16	71
213	G[108]	3843	238.5	16	71	264	G[159]	2925	133.5	16	71
214	G[109]	3825	133.5	16	71	265	G[160]	2907	238.5	16	71
215	G[110]	3807	238.5	16	71	266	G[161]	2889	133.5	16	71
216	G[111]	3789	133.5	16	71	267	G[162]	2871	238.5	16	71
217	G[112]	3771	238.5	16	71	268	G[163]	2853	133.5	16	71
218	G[113]	3753	133.5	16	71	269	G[164]	2835	238.5	16	71
219	G[114]	3735	238.5	16	71	270	G[165]	2817	133.5	16	71
220	G[115]	3717	133.5	16	71	271	G[166]	2799	238.5	16	71
221	G[116]	3699	238.5	16	71	272	G[167]	2781	133.5	16	71
222	G[117]	3681	133.5	16	71	273	G[168]	2763	238.5	16	71
223	G[118]	3663	238.5	16	71	274	G[169]	2745	133.5	16	71
224	G[119]	3645	133.5	16	71	275	G[170]	2727	238.5	16	71
225	G[120]	3627	238.5	16	71	276	G[171]	2709	133.5	16	71
226	G[121]	3609	133.5	16	71	277	G[172]	2691	238.5	16	71
227	G[122]	3591	238.5	16	71	278	G[173]	2673	133.5	16	71
228	G[123]	3573	133.5	16	71	279	G[174]	2655	238.5	16	71
229	G[124]	3555	238.5	16	71	280	G[175]	2637	133.5	16	71
230	G[125]	3537	133.5	16	71	281	G[176]	2619	238.5	16	71
231	G[126]	3519	238.5	16	71	282	G[177]	2601	133.5	16	71
232	G[127]	3501	133.5	16	71	283	G[178]	2583	238.5	16	71
233	G[128]	3483	238.5	16	71	284	G[179]	2565	133.5	16	71
234	G[129]	3465	133.5	16	71	285	G[180]	2547	238.5	16	71
235	G[130]	3447	238.5	16	71	286	G[181]	2529	133.5	16	71
236	G[131]	3429	133.5	16	71	287	G[182]	2511	238.5	16	71
237	G[132]	3411	238.5	16	71	288	G[183]	2493	133.5	16	71
238	G[133]	3393	133.5	16	71	289	G[184]	2475	238.5	16	71
239	G[134]	3375	238.5	16	71	290	G[185]	2457	133.5	16	71
240	G[135]	3357	133.5	16	71	291	G[186]	2439	238.5	16	71
241	G[136]	3339	238.5	16	71	292	G[187]	2421	133.5	16	71
242	G[137]	3321	133.5	16	71	293	G[188]	2403	238.5	16	71
243	G[138]	3303	238.5	16	71	294	G[189]	2385	133.5	16	71
244	G[139]	3285	133.5	16	71	295	G[190]	2367	238.5	16	71
245	G[140]	3267	238.5	16	71	296	G[191]	2349	133.5	16	71
246	G[141]	3249	133.5	16	71	297	G[192]	2331	238.5	16	71
247	G[142]	3231	238.5	16	71	298	G[193]	2313	133.5	16	71
248	G[143]	3213	133.5	16	71	299	G[194]	2295	238.5	16	71
249	G[144]	3195	238.5	16	71	300	G[195]	2277	133.5	16	71
250	G[145]	3177	133.5	16	71	301	G[196]	2259	238.5	16	71
251	G[146]	3159	238.5	16	71	302	G[197]	2241	133.5	16	71

<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>	<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>
303	G[198]	2223	238.5	16	71	354	G[249]	1305	133.5	16	71
304	G[199]	2205	133.5	16	71	355	G[250]	1287	238.5	16	71
305	G[200]	2187	238.5	16	71	356	G[251]	1269	133.5	16	71
306	G[201]	2169	133.5	16	71	357	G[252]	1251	238.5	16	71
307	G[202]	2151	238.5	16	71	358	G[253]	1233	133.5	16	71
308	G[203]	2133	133.5	16	71	359	G[254]	1215	238.5	16	71
309	G[204]	2115	238.5	16	71	360	G[255]	1197	133.5	16	71
310	G[205]	2097	133.5	16	71	361	G[256]	1179	238.5	16	71
311	G[206]	2079	238.5	16	71	362	G[257]	1161	133.5	16	71
312	G[207]	2061	133.5	16	71	363	G[258]	1143	238.5	16	71
313	G[208]	2043	238.5	16	71	364	G[259]	1125	133.5	16	71
314	G[209]	2025	133.5	16	71	365	G[260]	1107	238.5	16	71
315	G[210]	2007	238.5	16	71	366	G[261]	1089	133.5	16	71
316	G[211]	1989	133.5	16	71	367	G[262]	1071	238.5	16	71
317	G[212]	1971	238.5	16	71	368	G[263]	1053	133.5	16	71
318	G[213]	1953	133.5	16	71	369	G[264]	1035	238.5	16	71
319	G[214]	1935	238.5	16	71	370	G[265]	1017	133.5	16	71
320	G[215]	1917	133.5	16	71	371	G[266]	999	238.5	16	71
321	G[216]	1899	238.5	16	71	372	G[267]	981	133.5	16	71
322	G[217]	1881	133.5	16	71	373	G[268]	963	238.5	16	71
323	G[218]	1863	238.5	16	71	374	G[269]	945	133.5	16	71
324	G[219]	1845	133.5	16	71	375	G[270]	927	238.5	16	71
325	G[220]	1827	238.5	16	71	376	G[271]	909	133.5	16	71
326	G[221]	1809	133.5	16	71	377	G[272]	891	238.5	16	71
327	G[222]	1791	238.5	16	71	378	G[273]	873	133.5	16	71
328	G[223]	1773	133.5	16	71	379	G[274]	855	238.5	16	71
329	G[224]	1755	238.5	16	71	380	G[275]	837	133.5	16	71
330	G[225]	1737	133.5	16	71	381	G[276]	819	238.5	16	71
331	G[226]	1719	238.5	16	71	382	G[277]	801	133.5	16	71
332	G[227]	1701	133.5	16	71	383	G[278]	783	238.5	16	71
333	G[228]	1683	238.5	16	71	384	G[279]	765	133.5	16	71
334	G[229]	1665	133.5	16	71	385	G[280]	747	238.5	16	71
335	G[230]	1647	238.5	16	71	386	G[281]	729	133.5	16	71
336	G[231]	1629	133.5	16	71	387	G[282]	711	238.5	16	71
337	G[232]	1611	238.5	16	71	388	G[283]	693	133.5	16	71
338	G[233]	1593	133.5	16	71	389	G[284]	675	238.5	16	71
339	G[234]	1575	238.5	16	71	390	G[285]	657	133.5	16	71
340	G[235]	1557	133.5	16	71	391	G[286]	639	238.5	16	71
341	G[236]	1539	238.5	16	71	392	G[287]	621	133.5	16	71
342	G[237]	1521	133.5	16	71	393	G[288]	603	238.5	16	71
343	G[238]	1503	238.5	16	71	394	G[289]	585	133.5	16	71
344	G[239]	1485	133.5	16	71	395	G[290]	567	238.5	16	71
345	G[240]	1467	238.5	16	71	396	G[291]	549	133.5	16	71
346	G[241]	1449	133.5	16	71	397	G[292]	531	238.5	16	71
347	G[242]	1431	238.5	16	71	398	G[293]	513	133.5	16	71
348	G[243]	1413	133.5	16	71	399	G[294]	495	238.5	16	71
349	G[244]	1395	238.5	16	71	400	G[295]	477	133.5	16	71
350	G[245]	1377	133.5	16	71	401	G[296]	459	238.5	16	71
351	G[246]	1359	238.5	16	71	402	G[297]	441	133.5	16	71
352	G[247]	1341	133.5	16	71	403	G[298]	423	238.5	16	71
353	G[248]	1323	238.5	16	71	404	G[299]	405	133.5	16	71

<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>	<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>
405	G[300]	387	238.5	16	71	456	G[349]	-531	133.5	16	71
406	G[301]	369	133.5	16	71	457	G[350]	-549	238.5	16	71
407	G[302]	351	238.5	16	71	458	G[351]	-567	133.5	16	71
408	G[303]	333	133.5	16	71	459	G[352]	-585	238.5	16	71
409	G[304]	315	238.5	16	71	460	G[353]	-603	133.5	16	71
410	G[305]	297	133.5	16	71	461	G[354]	-621	238.5	16	71
411	G[306]	279	238.5	16	71	462	G[355]	-639	133.5	16	71
412	G[307]	261	133.5	16	71	463	G[356]	-657	238.5	16	71
413	G[308]	243	238.5	16	71	464	G[357]	-675	133.5	16	71
414	G[309]	225	133.5	16	71	465	G[358]	-693	238.5	16	71
415	G[310]	207	238.5	16	71	466	G[359]	-711	133.5	16	71
416	G[311]	189	133.5	16	71	467	G[360]	-729	238.5	16	71
417	G[312]	171	238.5	16	71	468	G[361]	-747	133.5	16	71
418	G[313]	153	133.5	16	71	469	G[362]	-765	238.5	16	71
419	G[314]	135	238.5	16	71	470	G[363]	-783	133.5	16	71
420	G[315]	117	133.5	16	71	471	G[364]	-801	238.5	16	71
421	G[316]	99	238.5	16	71	472	G[365]	-819	133.5	16	71
422	G[317]	81	133.5	16	71	473	G[366]	-837	238.5	16	71
423	G[318]	63	238.5	16	71	474	G[367]	-855	133.5	16	71
424	G[319]	45	133.5	16	71	475	G[368]	-873	238.5	16	71
425	G[320]	27	238.5	16	71	476	G[369]	-891	133.5	16	71
426	SHIELDING_VEE[2]	9	133.5	16	71	477	G[370]	-909	238.5	16	71
427	SHIELDING_VEE[3]	-9	238.5	16	71	478	G[371]	-927	133.5	16	71
428	G[321]	-27	133.5	16	71	479	G[372]	-945	238.5	16	71
429	G[322]	-45	238.5	16	71	480	G[373]	-963	133.5	16	71
430	G[323]	-63	133.5	16	71	481	G[374]	-981	238.5	16	71
431	G[324]	-81	238.5	16	71	482	G[375]	-999	133.5	16	71
432	G[325]	-99	133.5	16	71	483	G[376]	-1017	238.5	16	71
433	G[326]	-117	238.5	16	71	484	G[377]	-1035	133.5	16	71
434	G[327]	-135	133.5	16	71	485	G[378]	-1053	238.5	16	71
435	G[328]	-153	238.5	16	71	486	G[379]	-1071	133.5	16	71
436	G[329]	-171	133.5	16	71	487	G[380]	-1089	238.5	16	71
437	G[330]	-189	238.5	16	71	488	G[381]	-1107	133.5	16	71
438	G[331]	-207	133.5	16	71	489	G[382]	-1125	238.5	16	71
439	G[332]	-225	238.5	16	71	490	G[383]	-1143	133.5	16	71
440	G[333]	-243	133.5	16	71	491	G[384]	-1161	238.5	16	71
441	G[334]	-261	238.5	16	71	492	G[385]	-1179	133.5	16	71
442	G[335]	-279	133.5	16	71	493	G[386]	-1197	238.5	16	71
443	G[336]	-297	238.5	16	71	494	G[387]	-1215	133.5	16	71
444	G[337]	-315	133.5	16	71	495	G[388]	-1233	238.5	16	71
445	G[338]	-333	238.5	16	71	496	G[389]	-1251	133.5	16	71
446	G[339]	-351	133.5	16	71	497	G[390]	-1269	238.5	16	71
447	G[340]	-369	238.5	16	71	498	G[391]	-1287	133.5	16	71
448	G[341]	-387	133.5	16	71	499	G[392]	-1305	238.5	16	71
449	G[342]	-405	238.5	16	71	500	G[393]	-1323	133.5	16	71
450	G[343]	-423	133.5	16	71	501	G[394]	-1341	238.5	16	71
451	G[344]	-441	238.5	16	71	502	G[395]	-1359	133.5	16	71
452	G[345]	-459	133.5	16	71	503	G[396]	-1377	238.5	16	71
453	G[346]	-477	238.5	16	71	504	G[397]	-1395	133.5	16	71
454	G[347]	-495	133.5	16	71	505	G[398]	-1413	238.5	16	71
455	G[348]	-513	238.5	16	71	506	G[399]	-1431	133.5	16	71

<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>	<b>Pad No.</b>	<b>Name</b>	<b>X-pos</b>	<b>Y-pos</b>	<b>X-size</b>	<b>Y-size</b>
507	G[400]	-1449	238.5	16	71	558	G[451]	-2367	133.5	16	71
508	G[401]	-1467	133.5	16	71	559	G[452]	-2385	238.5	16	71
509	G[402]	-1485	238.5	16	71	560	G[453]	-2403	133.5	16	71
510	G[403]	-1503	133.5	16	71	561	G[454]	-2421	238.5	16	71
511	G[404]	-1521	238.5	16	71	562	G[455]	-2439	133.5	16	71
512	G[405]	-1539	133.5	16	71	563	G[456]	-2457	238.5	16	71
513	G[406]	-1557	238.5	16	71	564	G[457]	-2475	133.5	16	71
514	G[407]	-1575	133.5	16	71	565	G[458]	-2493	238.5	16	71
515	G[408]	-1593	238.5	16	71	566	G[459]	-2511	133.5	16	71
516	G[409]	-1611	133.5	16	71	567	G[460]	-2529	238.5	16	71
517	G[410]	-1629	238.5	16	71	568	G[461]	-2547	133.5	16	71
518	G[411]	-1647	133.5	16	71	569	G[462]	-2565	238.5	16	71
519	G[412]	-1665	238.5	16	71	570	G[463]	-2583	133.5	16	71
520	G[413]	-1683	133.5	16	71	571	G[464]	-2601	238.5	16	71
521	G[414]	-1701	238.5	16	71	572	G[465]	-2619	133.5	16	71
522	G[415]	-1719	133.5	16	71	573	G[466]	-2637	238.5	16	71
523	G[416]	-1737	238.5	16	71	574	G[467]	-2655	133.5	16	71
524	G[417]	-1755	133.5	16	71	575	G[468]	-2673	238.5	16	71
525	G[418]	-1773	238.5	16	71	576	G[469]	-2691	133.5	16	71
526	G[419]	-1791	133.5	16	71	577	G[470]	-2709	238.5	16	71
527	G[420]	-1809	238.5	16	71	578	G[471]	-2727	133.5	16	71
528	G[421]	-1827	133.5	16	71	579	G[472]	-2745	238.5	16	71
529	G[422]	-1845	238.5	16	71	580	G[473]	-2763	133.5	16	71
530	G[423]	-1863	133.5	16	71	581	G[474]	-2781	238.5	16	71
531	G[424]	-1881	238.5	16	71	582	G[475]	-2799	133.5	16	71
532	G[425]	-1899	133.5	16	71	583	G[476]	-2817	238.5	16	71
533	G[426]	-1917	238.5	16	71	584	G[477]	-2835	133.5	16	71
534	G[427]	-1935	133.5	16	71	585	G[478]	-2853	238.5	16	71
535	G[428]	-1953	238.5	16	71	586	G[479]	-2871	133.5	16	71
536	G[429]	-1971	133.5	16	71	587	G[480]	-2889	238.5	16	71
537	G[430]	-1989	238.5	16	71	588	G[481]	-2907	133.5	16	71
538	G[431]	-2007	133.5	16	71	589	G[482]	-2925	238.5	16	71
539	G[432]	-2025	238.5	16	71	590	G[483]	-2943	133.5	16	71
540	G[433]	-2043	133.5	16	71	591	G[484]	-2961	238.5	16	71
541	G[434]	-2061	238.5	16	71	592	G[485]	-2979	133.5	16	71
542	G[435]	-2079	133.5	16	71	593	G[486]	-2997	238.5	16	71
543	G[436]	-2097	238.5	16	71	594	G[487]	-3015	133.5	16	71
544	G[437]	-2115	133.5	16	71	595	G[488]	-3033	238.5	16	71
545	G[438]	-2133	238.5	16	71	596	G[489]	-3051	133.5	16	71
546	G[439]	-2151	133.5	16	71	597	G[490]	-3069	238.5	16	71
547	G[440]	-2169	238.5	16	71	598	G[491]	-3087	133.5	16	71
548	G[441]	-2187	133.5	16	71	599	G[492]	-3105	238.5	16	71
549	G[442]	-2205	238.5	16	71	600	G[493]	-3123	133.5	16	71
550	G[443]	-2223	133.5	16	71	601	G[494]	-3141	238.5	16	71
551	G[444]	-2241	238.5	16	71	602	G[495]	-3159	133.5	16	71
552	G[445]	-2259	133.5	16	71	603	G[496]	-3177	238.5	16	71
553	G[446]	-2277	238.5	16	71	604	G[497]	-3195	133.5	16	71
554	G[447]	-2295	133.5	16	71	605	G[498]	-3213	238.5	16	71
555	G[448]	-2313	238.5	16	71	606	G[499]	-3231	133.5	16	71
556	G[449]	-2331	133.5	16	71	607	G[500]	-3249	238.5	16	71
557	G[450]	-2349	238.5	16	71	608	G[501]	-3267	133.5	16	71



Pad No.	Name	X-pos	Y-pos	X-size	Y-size	Pad No.	Name	X-pos	Y-pos	X-size	Y-size
711	G[604]	-5121	238.5	16	71	743	G[636]	-5697	238.5	16	71
712	G[605]	-5139	133.5	16	71	744	G[637]	-5715	133.5	16	71
713	G[606]	-5157	238.5	16	71	745	G[638]	-5733	238.5	16	71
714	G[607]	-5175	133.5	16	71	746	G[639]	-5751	133.5	16	71
715	G[608]	-5193	238.5	16	71	747	G[640]	-5769	238.5	16	71
716	G[609]	-5211	133.5	16	71	748	G[641]	-5787	133.5	16	71
717	G[610]	-5229	238.5	16	71	749	SHIELDING_VEE[4]	-5805	238.5	16	71
718	G[611]	-5247	133.5	16	71	750	F_ctrlL	-6440	256	66	36
719	G[612]	-5265	238.5	16	71	751	F_ctrlL	-6526	256	66	36
720	G[613]	-5283	133.5	16	71	752	XONL	-6612	256	66	36
721	G[614]	-5301	238.5	16	71	753	XONL	-6698	256	66	36
722	G[615]	-5319	133.5	16	71	754	OEL	-6784	256	66	36
723	G[616]	-5337	238.5	16	71	755	OEL	-6870	256	66	36
724	G[617]	-5355	133.5	16	71	756	U_DL	-6784	192	66	36
725	G[618]	-5373	238.5	16	71	757	U_DL	-6870	192	66	36
726	G[619]	-5391	133.5	16	71	758	CLKL	-6784	128	66	36
727	G[620]	-5409	238.5	16	71	759	CLKL	-6870	128	66	36
728	G[621]	-5427	133.5	16	71	760	PATHL	-6784	64	66	36
729	G[622]	-5445	238.5	16	71	761	PATHL	-6870	64	66	36
730	G[623]	-5463	133.5	16	71	762	STVU	-6784	0	66	36
731	G[624]	-5481	238.5	16	71	763	STVU	-6870	0	66	36
732	G[625]	-5499	133.5	16	71	764	VGGL	-6784	-64	66	36
733	G[626]	-5517	238.5	16	71	765	VGGL	-6870	-64	66	36
734	G[627]	-5535	133.5	16	71	766	VCCL	-6784	-128	66	36
735	G[628]	-5553	238.5	16	71	767	VCCL	-6870	-128	66	36
736	G[629]	-5571	133.5	16	71	768	VEEL	-6784	-192	66	36
737	G[630]	-5589	238.5	16	71	769	VEEL	-6870	-192	66	36
738	G[631]	-5607	133.5	16	71	770	Alignment_left	-6080.5	216.5	115	115
739	G[632]	-5625	238.5	16	71	771	Alignment_right	6080.5	216.5	115	115
740	G[633]	-5643	133.5	16	71						
741	G[634]	-5661	238.5	16	71						
742	G[635]	-5679	133.5	16	71						

## Important Notice

NT52601TT is not specifically designed and marketed to and directly and knowingly sold or used for any.

- i. military products or proliferation application (including but not limited to missiles, nuclear, chemical and biological weapons); or
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