

TFT_LCD 2 Channel Charge Pump Power IC

Features

- Charge pump x2 mode for positive AVDD and x-1 mode for negative AVEE
- 2.5V to 4.8V input supply voltage range
- AVDD output range : 5.8V to 6.0V
- AVEE output range : -5.8V to -6.0V
- Charge pump clock synchronized with PSYNC for benefit of low noise
- Positive and Negative regulated charge Pump with Diode free
- External Capacitor 5C or 7C only
- UDFN1.5X2.4-12 (1.5mm * 2.4mm * 0.5 mm) package is available
- Control signals voltage 1.65V to 4.8V

Applications

- TFT LCD POWER IC

General Description

The G2138 is a high-performance step-up charge pump and inverter to generate two output voltages, it is including pumping controllers for positive and negative output voltage. The following content contains the detailed description and the information of component selection.

The positive charge-pump controller provides adjustable regulated output AVDD and fixed -1 ratio of AVEE to supply the TFT.

The pumping clock can be generated by internal circuit, to reduce the control signal from driver IC. Or the charge and pump state can be synchronized with LCD display TE signal (PSYNC), it can reduce the interference to display quality when states change.

The device requires only five (12 pins) small and low-cost ceramic capacitors is available in UDFN1.5X2.4-12 package for smart phone LCD panel's driver IC.

Ordering Information

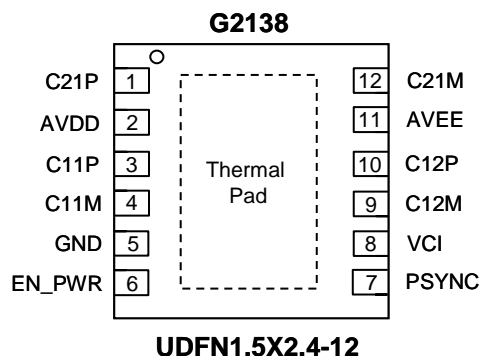
ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2138N51U	2138	-40°C to +85°C	UDFN1.5X2.4-12

Note:N5: UDFN1.5X2.4-12

1: Bonding Code

U: Tape & Reel

Pin Configuration



Note: Recommend connecting the Thermal Pad to the Ground for excellent power dissipation.

Absolute Maximum Ratings

Supply Voltage, V_{IN} - 0.3V to 5V
 Other Pins. - 0.3V to 6V
 Thermal Resistance of Junction to Ambient (θ_{JA})
 UDFN1.5X2.4-12 TBD°C/W
 Continuous Power Dissipation ($T_A = +25^\circ\text{C}$)
 UDFN1.5X2.4-12 TBDmW
 Junction Temperature +150°C
 Storage Temperature Range -65°C to +150°C
 Lead Temperature (soldering, 10sec) 260°C

ESD Susceptibility (HBM). 2kV
 ESD Susceptibility (MM). 200V

Recommended Operation Conditions

Supply Input Voltage Range, V_{CI} 2.5V to +4.8V
 Junction Temperature Range. -40°C to +125°C
 Ambient Temperature Range. -40°C to +80°C
 Operating Junction Temperature. +150°C

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

Absolute Maximum Ratings :

Parameter	Symbol	Value	Unit
Supply voltage	VCI	-0.3~5	V
Control signals output current (charge pump clock for fly caps)	Output current	TBD	mA
Control signals voltage range (EN_PWR , EN_VCL , PSYNC)	Logic input	-0.3~6	V
Output control driver	Output voltage AVDD	0~6	V
	Output voltage AVEE	0~6	V

Thermal Information :

Parameter	Symbol	Spec			Units
		Min	Typical	Max	
Operating junction temperature	TJ	TBD	-	TBD	°C
Operating temperature range	TOP	-40	-	85	°C
Storage temperature range	TSTG	-65	-	160	°C
Lead soldering temperature , 10 second	-	-	-	260	°C

Electrical Specifications

Parameter	Symbol	Condition	Spec			Units
			Min	Typical	Max	
Input power supply						
Supply voltage	VCI	-	2.5	-	4.8	V
Supply current	I_VCI	-	-	-	150	mA
Output Power Supply						
Positive output voltage	AVDD	Input = 3V	-	-	6.0	V
Negative output voltage	AVEE	Input = 3V	-	-	-6.0	V
Positive output current	I_AVDD	Input = 3V	-	-	30	mA
Negative output current	I_AVEE	Input = 3V	-	-	30	mA
Control Signal Voltage Level						
Input high voltage	VIH	-	1.1	-	VCI	V
Input low voltage	VIL	-	0	-	0.3	V
Output Power Supply						
Output / Input	Efficiency	-	-	-	-	%

External Component List

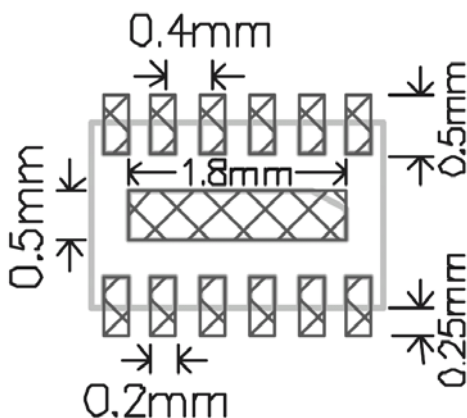
Number	Pad Name	Connection	Typical Value
1	AVDD	Connect a capacitor (Max. 10V) : AVDD ----- ----- GND	2.2 μ F
2	AVEE	Connect a capacitor (Max. 10V) : AVEE ----- ----- GND	2.2 μ F
3	C11P/M	Connect a capacitor (Max. 10V) : C11P ----- ----- C11M	1.0 μ F
4	C12P/M	Connect a capacitor (Max. 10V) : C12P ----- ----- C12M	1.0 μ F
5	C21P/M	Connect a capacitor (Max. 10V) : C21P ----- ----- C21M	1.0 μ F
6	VCI	Connect a capacitor (Max. 10V) : VCI ----- ----- GND	2.2 μ F

Note: Due to the pump efficiency is sensitive to the performance of capacitors, please select the capacitor which is not various by the frequency, temperature, and environments. (X7R series is recommended; do not use Y5V series of capacitor.)

capacitor	size	parts recommandatio
1.0 μ F	0603	GRM188R61C105KA93D
2.2 μ F	0603	GRM188R61C225KE15D
2.2 μ F	0805	GRM21BR61C225KA88L

Minimum Footprint PCB Layout Section

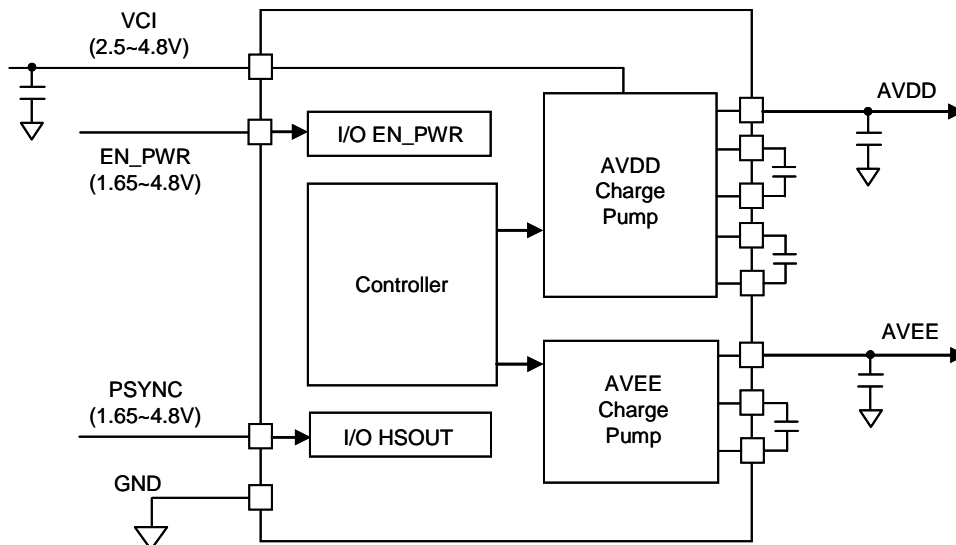
UDFN1.5X2.4-12



Pin Description

PIN	NAME	FUNCTION
1	C21P	Capacitor connection pin for the step-up circuit which generate AVEE.
2	AVDD	Positive AVDD output pin.
3	C11P	Capacitor connection pin for the step-up circuit which generate AVDD.
4	C11M	Capacitor connection pin for the step-up circuit which generate AVDD.
5	GND	Ground pin.
6	EN_PWR	Power enable control signal.
7	PSYNC	Power-sync control signal generated from driver IC. Note : If not used this clock synchronized signal, please tie to GND.
8	VCI	Power supply input pin.
9	C12M	Capacitor connection pin for the step-up circuit which generate AVDD.
10	C12P	Capacitor connection pin for the step-up circuit which generate AVDD.
11	AVEE	Negative AVEE output pin.
12	C21M	Capacitor connection pin for the step-up circuit which generate AVEE.
13	Thermal-pad	Thermal-pad Connect to GND.

Block Diagram

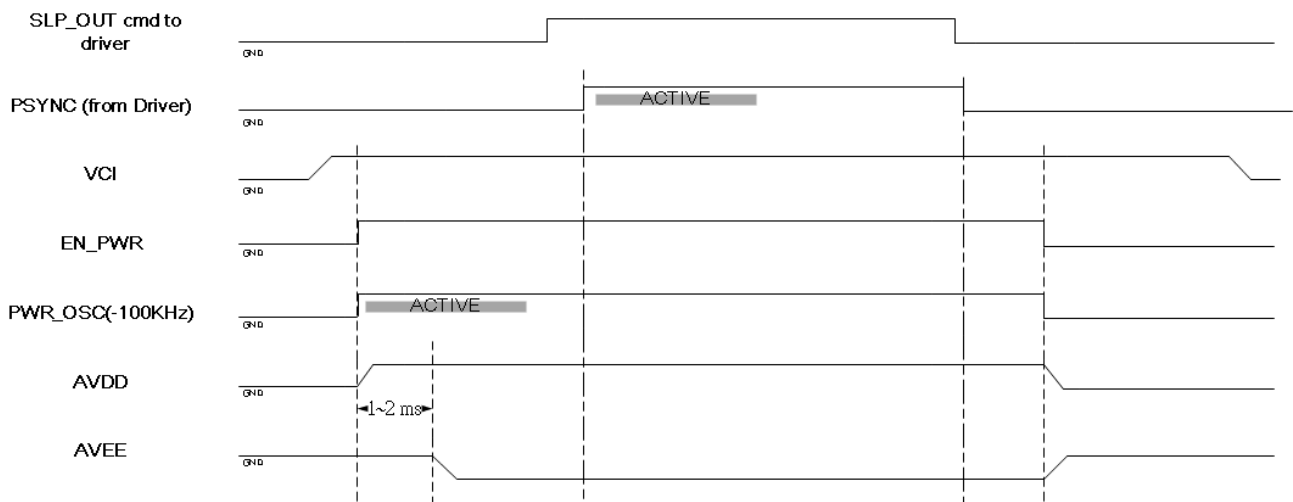


Application information

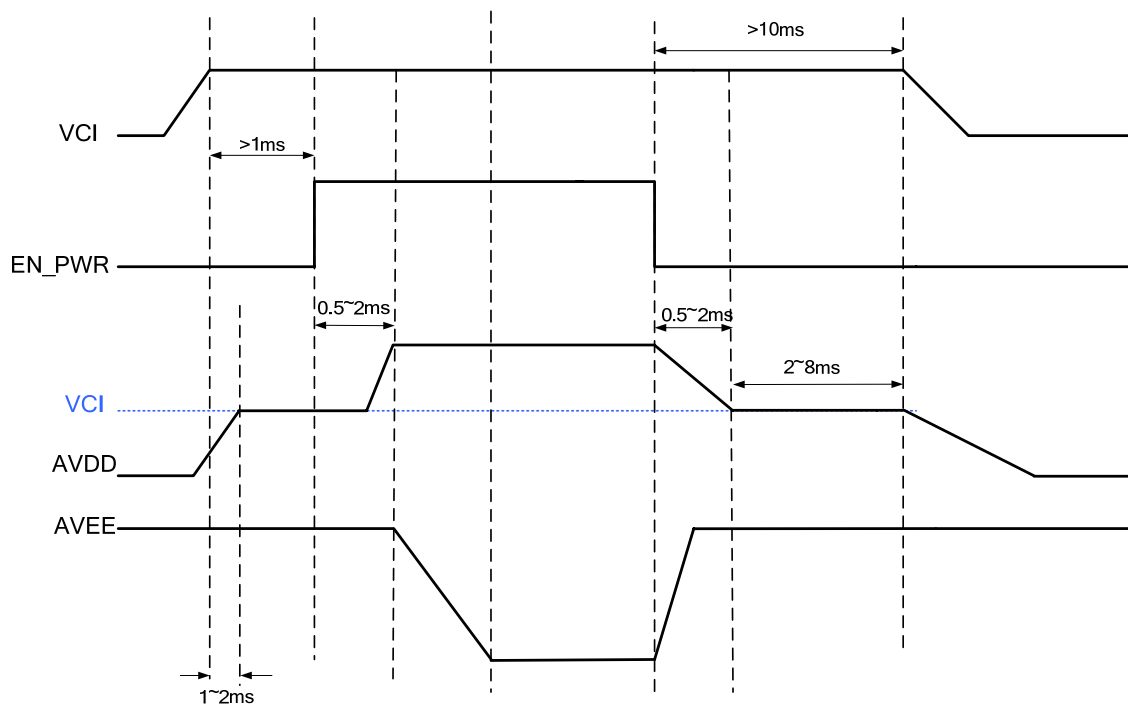
The G2138 can provide a suitable and stable voltage level to TFT LCD driver IC, and G2138 can refer to PSYNC signal to switch from charge state to pump state and vice versa. This function can avoid state changing noise to interfere display quality. If the driver IC or baseband can not provide PSYNC, please connect PSYNC signal to GND pin for free-running mode (Internal frequency=145KHz). The difference between free-running mode and sync mode is that the display quality may be worse in free-running mode. It needs larger stable capacitor to reduce the ripple noise. In sync mode, due to the noise is generated at display porch area; it will not be observed on the panels.

About the power on/off sequence, please refer to the next chapter in details.

Timing Control Sequence setting



Power ON/OFF Timing Sequence setting



Positive Charge Pump Controller

The G2138 can provide a trimming-able pump ratio for AVDD. The ratio is adjusted 1.5x or 2.0x or 3.0x by Metal option of VCI input voltage.

Negative Charge Pump Controller

The G2138 can provide a fixed pump ratio to generate AVEE. The ratio is fixed at -1.0x of AVDD.

Application Note

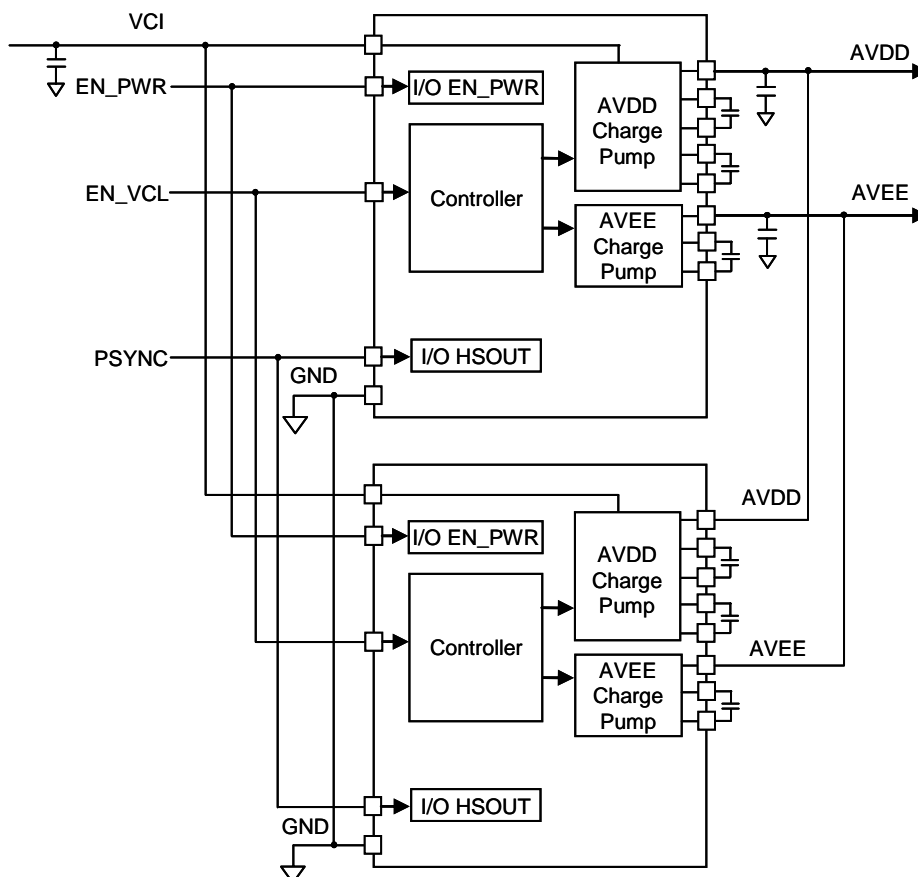
The G2138 has two control signals : EN_PWR / PSYNC

1. EN_PWR is used for enable AVDD and AVEE charge pump circuit. When EN_PWR keeps low, it will disable output voltage.

Note: Please do not connect EN_PWR to VCI. Host should enable EN_PWR pin while VCI power is ready

Paralleling two device circuit:

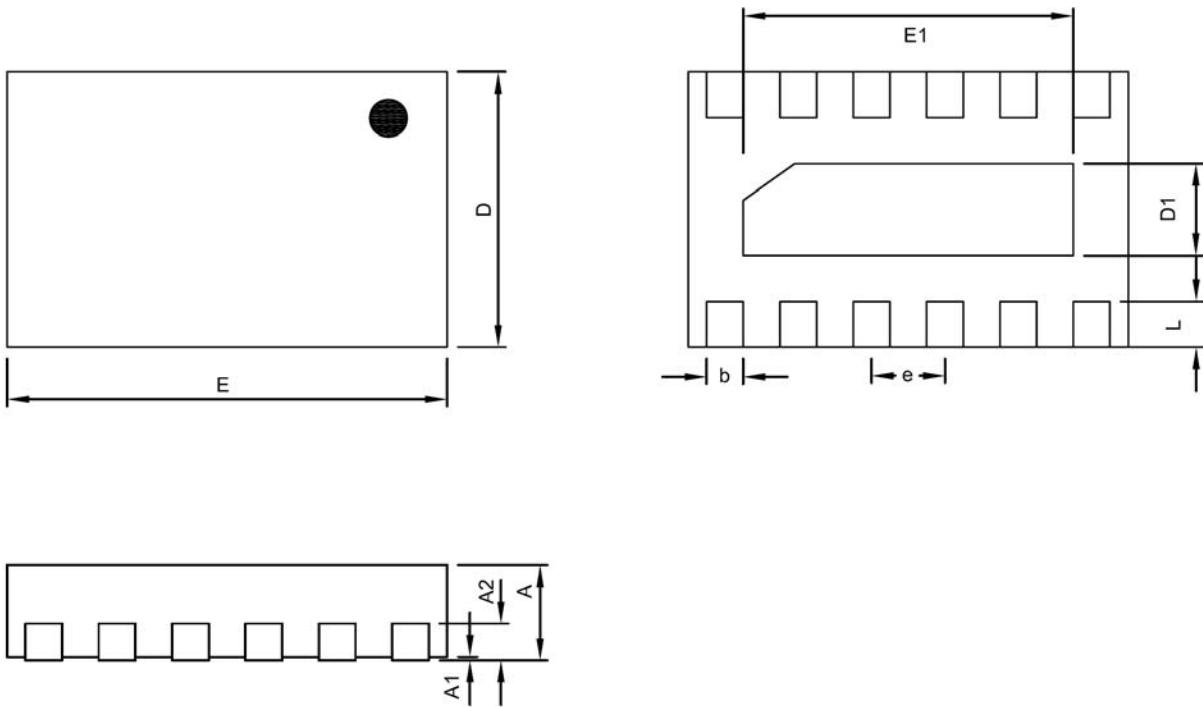
An increase in converter output current capability with a reduction in output resistance can be obtained by paralleling two devices. The output current capability is approximately equal to double for AVDD and AVEE. A single shared output capacitor is sufficient for proper operation but each device does require its own pump capacitor. Note that the output ripple frequency will be complex since the oscillators are not synchronized.



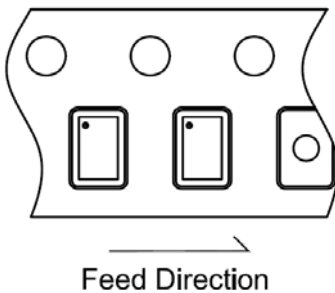
External component of Paralleling two device circuit

Number	Pad Name	Connection	Typical Value
1	AVDD	Connect a capacitor (Max. 10V) : AVDD ----- ----- GND	2.2 μ F
2	AVEE	Connect a capacitor (Max. 10V) : AVEE ----- ----- GND	2.2 μ F
3	C11P/M For First IC	Connect a capacitor (Max. 10V) : C11P ----- ----- C11M	1.0 μ F
4	C12P/M For First IC	Connect a capacitor (Max. 10V) : C12P ----- ----- C12M	1.0 μ F
5	C21P/M For First IC	Connect a capacitor (Max. 10V) : C21P ----- ----- C21M	1.0 μ F
6	VCI	Connect a capacitor (Max. 10V) : VCI ----- ----- GND	2.2 μ F
7	C11P/M For Second IC	Connect a capacitor (Max. 10V) : C11P ----- ----- C11M	1.0 μ F
8	C12P/M For Second IC	Connect a capacitor (Max. 10V) : C12P ----- ----- C12M	1.0 μ F
9	C21P/M For Second IC	Connect a capacitor (Max. 10V) : C21P ----- ----- C21M	1.0 μ F

<12pin external component table>

Package Information

UDFN1.5X2.4-12 Package

Symble	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.40	0.45	0.50	0.0157	0.0177	0.0197
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.152 REF			0.00598 REF		
D	1.40	1.50	1.60	0.0551	0.0590	0.0630
E	2.30	2.40	2.50	0.0906	0.0945	0.0984
D1	0.40	0.50	0.60	0.0157	0.0196	0.0236
E1	1.70	1.80	1.90	0.0669	0.0708	0.0748
b	0.15	0.20	0.25	0.0059	0.0078	0.0098
e	0.4 BSC			0.0157 BSC		
L	0.20	0.25	0.30	0.0078	0.0098	0.0118

Taping Specification


PACKAGE	Q'TY/REEL
UDFN1.5X2.4-12	3,000 ea

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