Supertex inc.

HV254

Demo Kit Available

32-Channel High Voltage Amplifier Array

Features

❑ 32 independent high voltage amplifiers

❑ Output voltage up to 250V

❑ 3V/μs output slew rate

❑ Fixed gain of 50V/V

❑ High value internal feedback resistors

❑ Very low operating current (typically 45μA per channel)

❑ Integrated silicon diode for temperature sensing

Application

❑ MEMS (microelctromechanical systems) driver

❑ Piezoelectric transducer driver

❑ Optical crosspoint switches (using MEMS technology)

General Description

The Supertex HV254 is a 32-channel high voltage amplifier array integrated circuit. It operates on a 275V high voltage supply and two low voltage supplies: +5.0V and –5.0V. Each channel has its own input and output. An integrated diode is included to help monitor die temperature.

The input voltage can be from a DAC with a voltage range of 0V to the low voltage supply, V+. The output of the HV254FG will swing from 7V to 250V. It cannot swing to ground. With the internal gain set at 50V/V, a minimum input signal of 140mV will still maintain linearity. Input voltages below 140mV can be applied without damage to the device. The amplifier, however, will be saturated. Typical output load is equivalent to a 125Mohm resistor in parallel with a 100pF capacitor. The outputs have a guaranteed slew rate of at least 3V/μs. The internal closed loop gain is set at a nominal value of 34.0dB (50V/V).

The HV254 is designed to operate with minimal power consumption while maintaining a guaranteed slew rate of 3V/μs. High value resistors are used for the gain setting to minimize current on the feedback path.

Block Diagram
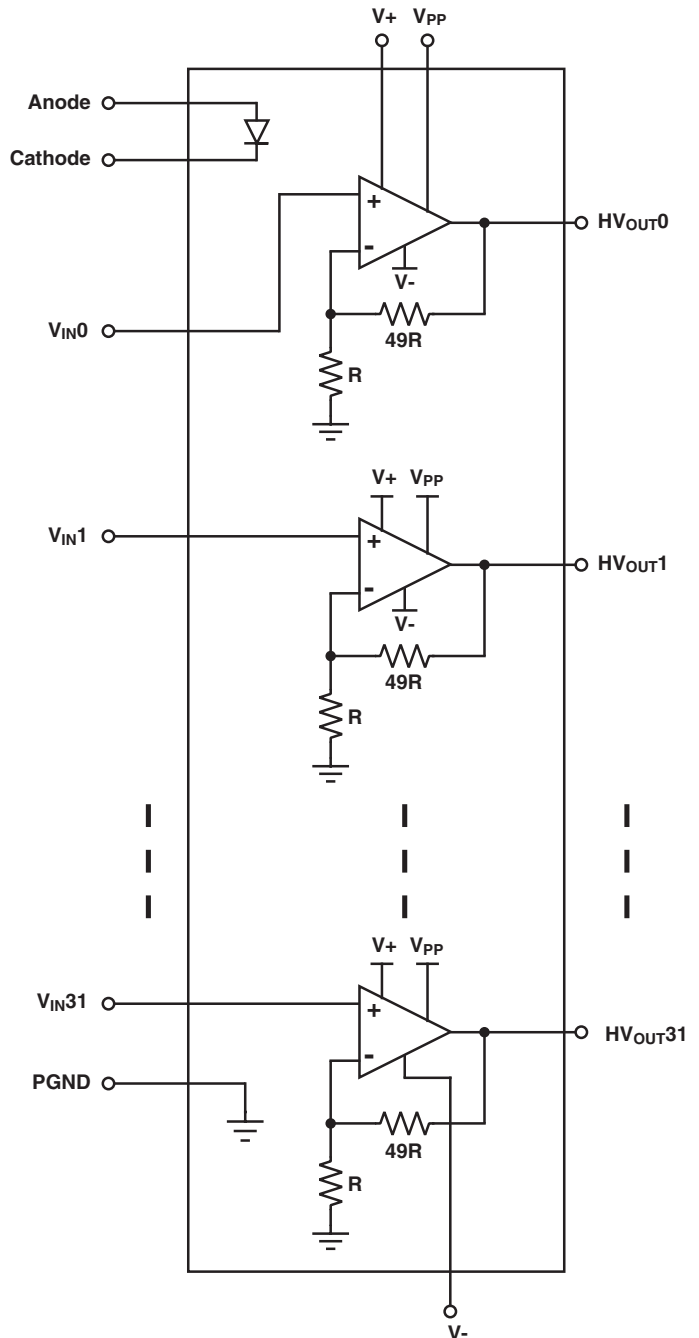
Ordering Information

Device	Maximum Output Voltage	Package Options	
		100 Lead MQFP	Die
HV254	250V	HV254FG	HV254X

Absolute Maximum Ratings*

V_{PP}, High voltage supply	275V
V+, Low voltage positive supply	7.0V
V-, Low voltage negative supply	-7.0V
HV_{OUT}, Output voltage	0V to 275V
V_{IN}, Analog input signal	0V to 5.0V
Storage temperature range	-65°C to 150°C
Maximum junction temperature	150°C

*Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

Electrical Characteristics *(Over operating conditions unless otherwise noted.)*

| Symbol	Parameter	Min	Typ	Max	Units	Conditions
Operating Conditons						
V_{PP}	High voltage positive supply	50		275	V	
V+	Low voltage positive supply	4.75	5.0	5.25	V	
V-	Low voltage negative supply	-4.75	-5.0	-5.25	V	
I_{PP}	V_{PP} supply current	1.0		2.5	mA	V_{PP}=275V, All inputs set at 140mV. Typically 45μA per channel
I+	V+ supply current			1.0	mA	V+ = 5.25V
I-	V_{NN} supply current			-3.0	mA	V- = -5.25V
T_A	Ambient temperature range	-10		70	° C	
T_J	Junction temperature range	-10		125	° C	
High Voltage Amplifier Output						
HV_{OUT}	HV_{OUT} voltage swing	7.0		250	V	V_{PP} = 275V, Load=125MΩ//100pF
V_{IN}	Input Voltage Range	0.14		V+	V	
HV_{OS}	HV_{OUT} DC offset		±1.5	±1.52	V	V_{PP} = 275V. 30mV input offset
SR	HV_{OUT} slew rate	3.0			V/μs	V_{PP} = 275V, Load = 125MΩ//100pF
R_{FB}	Feedback impedance	8	12		MΩ	
A_V	Closed loop gain	47.5	50.0	52.5	V/V	
BW	HV_{OUT} -3dB channel bandwidth	5.0			KHz	V_{PP} = 275V
C_{LOAD}	HV_{OUT} capacitive load	0		100	pF	
	Stability (max drift)			500	mV	Measured at HV_{OUT}

Diode

Symbol	Parameter	Min	Typ	Max	Units	Conditions
PIV	Peak inverse voltage			5.0	V	cathode to anode
V_F	Forward diode drop			0.8	V	If=100µA, anode to cathode
I_F	Forward diode current			100	µA	anode to cathode
T_C	V_F Temperature coefficient		-2.20		mV/°C	anode to cathode

Power Up/Down Sequence

The device can be damaged due to improper power up / down sequence. To prevent damage, please follow the acceptable power up /down sequences and add two external diodes as shown in the diagram below. The first diode is a high voltage diode across Vpp and V+ where the anode of the diode is connected to V+ and the cathode of the diode is connected to Vpp. Any low current high voltage diode such as a 1N4004 will be adequate. The second diode is a schottky diode across V- and DGnd where the anode of the schottky diode is connected to V- and the cathode is connected to DGnd. Any low current schottky diode such as a 1N5817 will be adequate.

V+ o———▷|———o **V$_{PP}$**

1N4004
or similar

V- o———▷|———o **PGND**

1N5817
or similar
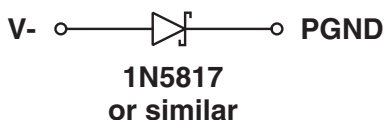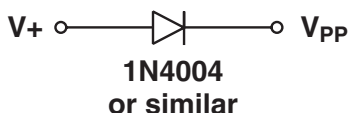
Acceptable Power Up Sequences

1) V$_{PP}$	2) V-	3) V+	4) Inputs & Anode
or			
1) V-	2) V+	3) V$_{PP}$	4) Inputs & Anode

**Acceptable Power Down Sequences**

1) Inputs & Anode	2) V+	3) V-	4) V$_{PP}$
or			
1) Inputs & Anode	2) V$_{PP}$	3) V+	4) V-

Pin Description

V$_{PP}$	High voltage positive supply.
V+	Analog low voltage positive supply
V-	Analog low voltage negative supply
PGND	Device ground
Anode	Anode side of a low voltage silicon diode that can be used to monitor die temperature.
Cathode	Cathode side of a low voltage silicon diode that can be used to monitor die temperature.
V$_{IN}$0 to V$_{IN}$31	Amplifier inputs
HV$_{OUT}$0 to HV$_{OUT}$31	Amplifier outputs

A113004

Pin Configuration

100-Lead MQFP (top view)
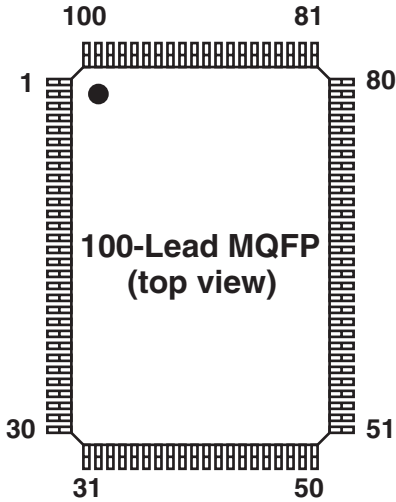
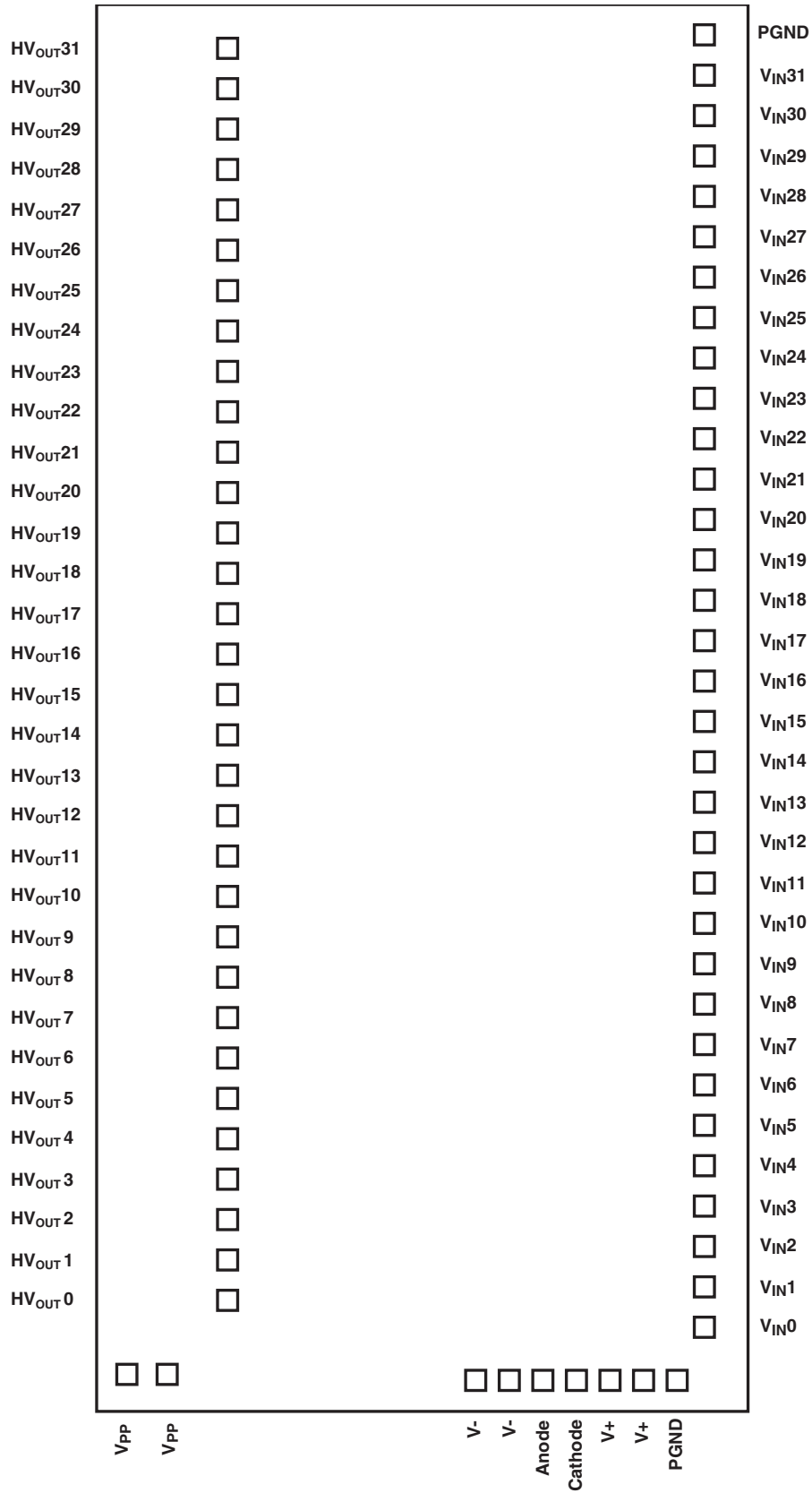## Pin Configuration

Pin #	Function	Pin #	Function	Pin #	Function	Pin #	Function
1	$HV_{OUT}29$	26	$HV_{OUT}4$	51	$V_{IN}2$	76	$V_{IN}27$
2	$HV_{OUT}28$	27	$HV_{OUT}3$	52	$V_{IN}3$	77	$V_{IN}28$
3	$HV_{OUT}27$	28	$HV_{OUT}2$	53	$V_{IN}4$	78	$V_{IN}29$
4	$HV_{OUT}26$	29	$HV_{OUT}1$	54	$VI_{IN}5$	79	$V_{IN}30$
5	$HV_{OUT}25$	30	$HV_{OUT}0$	55	$V_{IN}6$	80	$V_{IN}31$
6	$HV_{OUT}24$	31	NC	56	$V_{IN}7$	81	PGND
7	$HV_{OUT}23$	32	NC	57	$V_{IN}8$	82	NC
8	$HV_{OUT}22$	33	NC	58	$V_{IN}9$	83	NC
9	$HV_{OUT}21$	34	NC	59	$V_{IN}10$	84	NC
10	$HV_{OUT}20$	35	NC	60	$V_{IN}11$	85	NC
11	$HV_{OUT}19$	36	V_{PP}	61	$V_{IN}12$	86	NC
12	$HV_{OUT}18$	37	V_{PP}	62	$V_{IN}13$	87	NC
13	$HV_{OUT}17$	38	NC	63	$V_{IN}14$	88	NC
14	$HV_{OUT}16$	39*	Ibias	64	$V_{IN}15$	89	NC
15	$HV_{OUT}15$	40	NC	65	$VI_{IN}16$	90	NC
16	$HV_{OUT}14$	41	V-	66	$V_{IN}17$	91	NC
17	$HV_{OUT}13$	42	V-	67	$V_{IN}18$	92	NC
18	$HV_{OUT}12$	43	Anode	68	$V_{IN}19$	93	NC
19	$HV_{OUT}11$	44	Cathode	69	$V_{IN}20$	94	NC
20	$HV_{OUT}10$	45	V+	70	$V_{IN}21$	95	NC
21	$HV_{OUT}9$	46	V+	71	$V_{IN}22$	96	NC
22	$HV_{OUT}8$	47	NC	72	$V_{IN}23$	97	NC
23	$HV_{OUT}7$	48	PGND	73	$V_{IN}24$	98	NC
24	$HV_{OUT}6$	49	$V_{IN}0$	74	$V_{IN}25$	99	$HV_{OUT}31$
25	$HV_{OUT}5$	50	$V_{IN}1$	75	$V_{IN}26$	100	$HV_{OUT}30$

* For internal testing only. Leave floating.
NC=No Connect.

A113004

Pad Configuration *(Not Drawn to Scale)*

HV_{OUT}31	PGND
HV_{OUT}30	V_{IN}31

$HV_{OUT}31$ PGND
$HV_{OUT}30$ $V_{IN}31$
$HV_{OUT}29$ $V_{IN}30$
$HV_{OUT}28$ $V_{IN}29$
$HV_{OUT}27$ $V_{IN}28$
$HV_{OUT}26$ $V_{IN}27$
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$HV_{OUT}13$ $V_{IN}14$
$HV_{OUT}12$ $V_{IN}13$
$HV_{OUT}11$ $V_{IN}12$
$HV_{OUT}10$ $V_{IN}11$
$HV_{OUT}\,9$ $V_{IN}10$
$HV_{OUT}\,8$ $V_{IN}9$
$HV_{OUT}\,7$ $V_{IN}8$
$HV_{OUT}\,6$ $V_{IN}7$
$HV_{OUT}\,5$ $V_{IN}6$
$HV_{OUT}\,4$ $V_{IN}5$
$HV_{OUT}\,3$ $V_{IN}4$
$HV_{OUT}\,2$ $V_{IN}3$
$HV_{OUT}\,1$ $V_{IN}2$
$HV_{OUT}\,0$ $V_{IN}1$
       $V_{IN}0$

Bottom pads: V_{PP} V_{PP} V-   V-   Anode   Cathode   V+   V+   PGND

Die Size=4800μm X 11180μm (including scribes)

Center of the die is 0,0.

Coordinates for the four corners of the chip (not including scribe):

X (μm)	Y (μm)
-2402	5492
-2402	-5492
2335	5492
2335	-5492

Notes:

1) The two PGND pads are not electrically connected.

2) The two V_{PP} pads, V+ pads, and V- pads are electrically connected.

3) Backside potential is V_{PP}. Leave floating or connect to V_{PP}.

4) Anode and Cathode are connected to the P and N terminals (respectively) of a silicon diode which can be used to measure temperature.

Pad Description

V_{PP}	High voltage positive supply. Two V_{PP} pads.
V+	Low voltage positive supply. Two V+ pads.
V-	Low voltage negative supply. Two V- pads.
$V_{IN}0$ to $V_{IN}31$	Amplifier inputs.
$HV_{OUT}0$ to $HV_{OUT}31$	Amplifier outputs.
PGND	Power ground. Two PGND pads. Need to be externally connected together.
Anode	Anode side of diode.
Cathode	Cathode side of diode.

Pad Coordinates

Pad Name	X (μm)	Y (μm)	Pad Name	X (μm)	Y (μm)	Pad Name	X (μm)	Y (μm)
$HV_{OUT}31$	-1447.5	5244	$HV_{OUT}6$	-1447.5	-2693.5	$V_{IN}9$	2156.5	-1899
$HV_{OUT}30$	-1447.5	4926.5	$HV_{OUT}5$	-1447.5	-3011	$V_{IN}10$	2156.5	-1585
$HV_{OUT}29$	-1447.5	4609	$HV_{OUT}4$	-1447.5	-3328.5	$V_{IN}11$	2156.5	-1271
$HV_{OUT}28$	-1447.5	4291.5	$HV_{OUT}3$	-1447.5	-3646	$V_{IN}12$	2156.5	-957
$HV_{OUT}27$	-1447.5	3974	$HV_{OUT}2$	-1447.5	-3963.5	$V_{IN}13$	2156.5	-643
$HV_{OUT}26$	-1447.5	3656.5	$HV_{OUT}1$	-1447.5	-4281	$V_{IN}14$	2156.5	-329
$HV_{OUT}25$	-1447.5	3339	$HV_{OUT}0$	-1447.5	-4598.5	$V_{IN}15$	2156.5	-15
$HV_{OUT}24$	-1447.5	3021.5	V_{PP}	-2057	-4985	$V_{IN}16$	2156.5	299
$HV_{OUT}23$	-1447.5	2704	V_{PP}	-1897	-4985	$V_{IN}17$	2156.5	613
$HV_{OUT}22$	-1447.5	2386.5	V-	1030.5	-5018	$V_{IN}18$	2156.5	927
$HV_{OUT}21$	-1447.5	2069	V-	1190.5	-5018	$V_{IN}19$	2156.5	1241
$HV_{OUT}20$	-1447.5	1751.5	Anode	1350.5	-5018	$V_{IN}20$	2156.5	1555
$HV_{OUT}19$	-1447.5	1434	Cathode	1550.5	-5018	$V_{IN}21$	2156.5	1869
$HV_{OUT}18$	-1447.5	1116.5	V+	1710.5	-5018	$V_{IN}22$	2156.5	2183
$HV_{OUT}17$	-1447.5	799	V+	1870.5	-5018	$V_{IN}23$	2156.5	2497
$HV_{OUT}16$	-1447.5	481.5	Pgnd	2034.5	-5018	$V_{IN}24$	2156.5	2811
$HV_{OUT}15$	-1447.5	164	$V_{IN}0$	2156.5	-4725	$V_{IN}25$	2156.5	3125
$HV_{OUT}14$	-1447.5	-153.5	$V_{IN}1$	2156.5	-4411	$V_{IN}26$	2156.5	3439
$HV_{OUT}13$	-1447.5	-471	$V_{IN}2$	2156.5	-4097	$V_{IN}27$	2156.5	3753
$HV_{OUT}12$	-1447.5	-788.5	$V_{IN}3$	2156.5	-3783	$V_{IN}28$	2156.5	4067
$HV_{OUT}11$	-1447.5	-1106	$V_{IN}4$	2156.5	-3469	$V_{IN}29$	2156.5	4381
$HV_{OUT}10$	-1447.5	-1423.5	$V_{IN}5$	2156.5	-3155	$V_{IN}30$	2156.5	4695
$HV_{OUT}9$	-1447.5	-1741	$V_{IN}6$	2156.5	-2841	$V_{IN}31$	2156.5	5009
$HV_{OUT}8$	-1447.5	-2058.5	$V_{IN}7$	2156.5	-2527	Pgnd	2156.5	5315.5
$HV_{OUT}7$	-1447.5	-2376	$V_{IN}8$	2156.5	-2213			

Supertex inc.

1235 Bordeaux Drive, Sunnyvale, CA 94809
TEL: (408) 222-8888 / FAX: (408) 222-4895
www.supertex.com

100-LEAD MQFP PACKAGE OUTLINE (FG)

Note: Circle (e.g. Ⓑ) indicates JEDEC Reference.

$$\text{Measurement Legend} = \frac{\text{Dimensions in Inches}}{\text{(Dimensions in Millimeters)}}$$