

## Low-Charge Injection, 16-Channel, High-Voltage Analog Switch

### Features

- High-Voltage CMOS Technology for High Performance
- 16-Channel High-Voltage Analog Switch
- 3.3V Input Logic Level Compatible
- 20 MHz Data Shift Clock Frequency
- Very Low Quiescent Power Dissipation ( $-10 \mu\text{A}$ )
- Low Parasitic Capacitance
- DC to 50 MHz Small Signal Frequency Response
- $-60 \text{ dB}$  Typical OFF-Isolation at 5.0 MHz
- CMOS Logic Circuitry for Low Power
- Excellent Noise Immunity
- Cascadable Serial Data Register with Latches
- Flexible Operating Supply Voltages
- Integrated Bleed Resistors on the Outputs (HV2701 Only)

### Applications

- Medical Ultrasound Imaging
- NDT Metal Flaw Detection
- Piezoelectric Transducer Drivers
- Optical MEMS Modules

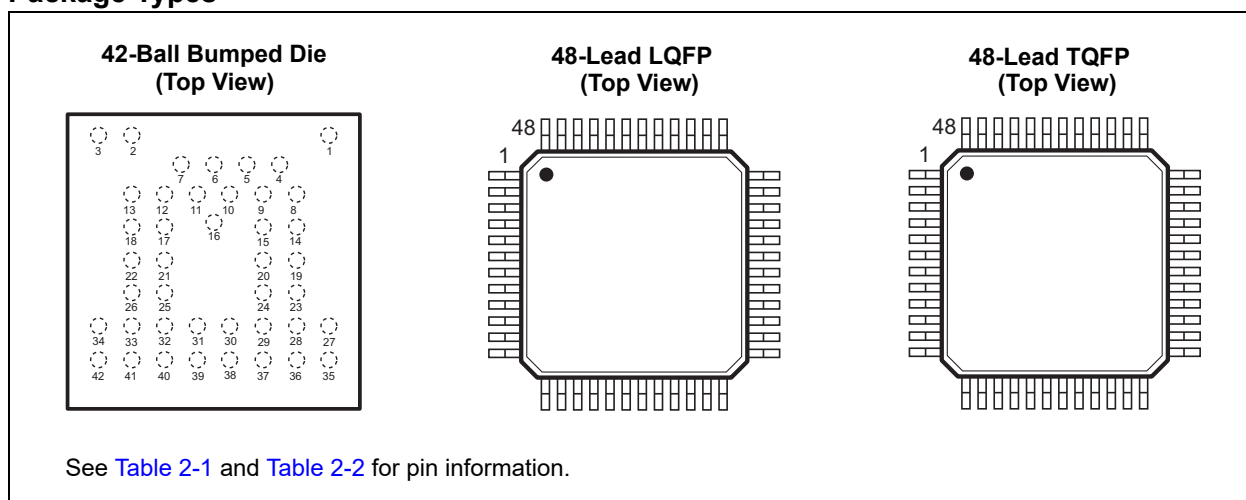
### General Description

The HV2601/HV2701 devices are low-charge injection, 16-channel, high-voltage analog switch integrated circuits (ICs). These devices are designed for use in applications requiring high-voltage switching controlled by low-voltage control signals, such as medical ultrasound imaging and other piezoelectric transducer drivers. The HV2701 has integrated bleed resistors which eliminate voltage build-up on capacitive loads, such as piezoelectric transducers.

These ICs shift input data into a 16-bit shift register that can then be retained in a 16-bit latch. To reduce any possible clock feed-through noise, the latch enable bar should be left high until all bits are clocked in. Data are clocked in during the rising edge of the clock. Using High-Voltage CMOS technology, these devices combine high-voltage, bilateral DMOS switches and low-power CMOS logic to provide efficient control of high-voltage analog signals.

The device is suitable for various combinations of high-voltage supplies, e.g.,  $V_{PP}/V_{NN}$ :  $+40\text{V}/-160\text{V}$ ,  $+100\text{V}/-100\text{V}$ , and  $+160\text{V}/-40\text{V}$ .

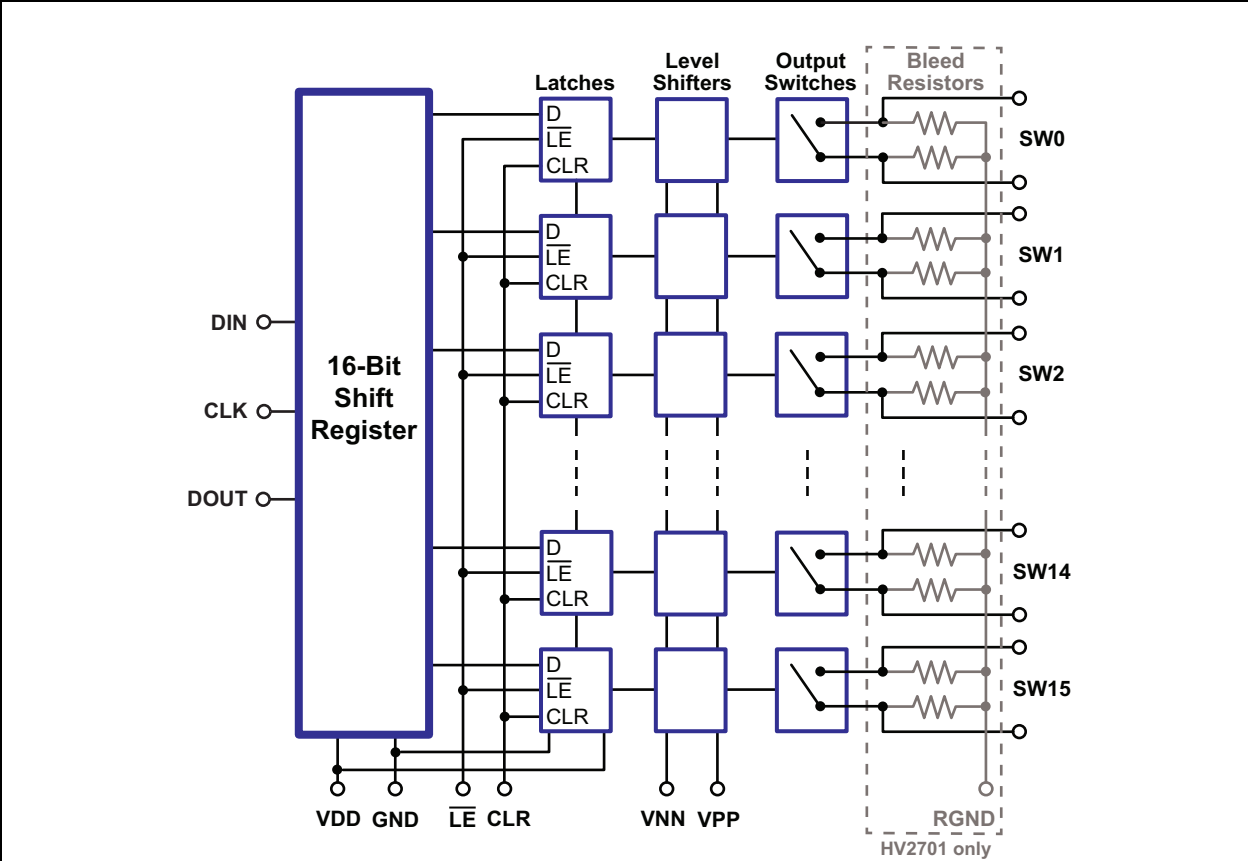
### Package Types<sup>†</sup>



<sup>†</sup> **Notice:** The LQFP package is not recommended for new designs. Please use TQFP package as an alternative.

# HV2601/HV2701

## Functional Block Diagram



**Note:** Bleed resistors and RGND apply to HV2701 only.

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings<sup>†</sup>

$V_{DD}$ Logic Supply .....	-0.5V to +7.0V
$V_{PP} - V_{NN}$ Differential Supply .....	220V
$V_{PP}$ Positive Supply .....	-0.5V to $V_{NN} + 200V$
$V_{NN}$ Negative Supply .....	+0.5V to -200V
Logic Input Voltage .....	-0.5V to $V_{DD} + 0.3V$
Analog Signal Range .....	$V_{NN}$ to $V_{PP}$
Peak Analog Signal Current/Channel .....	3.0A
Storage Temperature .....	-65°C to +150°C
Power Dissipation 42-Ball Bumped Die .....	1.5W
Power Dissipation 48-Lead LQFP/TQFP .....	1.0W

**† Notice:** Stresses above those listed under “Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### RECOMMENDED OPERATING CONDITIONS (1, 2, 3)

Symbol	Parameter	Value
$V_{DD}$	Logic Power Supply Voltage	3.0V to 5.5V
$V_{PP}$	Positive High-Voltage Supply	+40V to $V_{NN} + 200V$
$V_{NN}$	Negative High-Voltage Supply	-40V to -160V
$V_{IH}$	High-Level Input Voltage	$0.9V_{DD}$ to $V_{DD}$
$V_{IL}$	Low-Level Input Voltage	0V to $0.1 V_{DD}$
$V_{SIG}$	Analog Signal Voltage Peak-to-Peak	$V_{NN} + 10V$ to $V_{PP} - 10V$
$T_A$	Operating Free Air Temperature	0°C to 70°C

**Note 1:** Power-up/down sequence is arbitrary except GND must be powered-up first and powered-down last.

**2:**  $V_{SIG}$  must be within  $V_{NN}$  and  $V_{PP}$  or floating during power-up/down transition.

**3:** Rise and fall times of power supplies  $V_{DD}$ ,  $V_{PP}$ , and  $V_{NN}$  should not be less than 1 ms.

### DC ELECTRICAL CHARACTERISTICS

**Electrical Specifications:** Over recommended operating conditions unless otherwise noted.

Parameter	Symbol	0°C		+25°C			+70°C		Units	Conditions
		Min.	Max.	Min.	Typ.	Max.	Min.	Max.		
Small Signal Switch ON-Resistance	$R_{ONS}$	—	30	—	26	38	—	48	$\Omega$	$I_{SIG} = 5.0 \text{ mA}$ , $V_{PP} = +40V$
		—	25	—	22	27	—	32		$I_{SIG} = 200 \text{ mA}$ , $V_{NN} = -160V$
		—	25	—	22	27	—	30		$I_{SIG} = 5.0 \text{ mA}$ , $V_{PP} = +100V$
		—	18	—	18	24	—	27		$I_{SIG} = 200 \text{ mA}$ , $V_{NN} = -100V$
		—	23	—	20	25	—	30		$I_{SIG} = 5.0 \text{ mA}$ , $V_{PP} = +160V$
		—	22	—	16	25	—	27		$I_{SIG} = 200 \text{ mA}$ , $V_{NN} = -40V$
Small Signal Switch ON-Resistance Matching	$\Delta R_{ONS}$	—	20	—	5.0	20	—	20	%	$I_{SIG} = 5.0 \text{ mA}$ , $V_{PP} = +100V$ , $V_{NN} = -100V$
Large Signal Switch ON-Resistance	$R_{ONL}$	—	—	—	15	—	—	—	$\Omega$	$V_{SIG} = V_{PP} - 10V$ , $I_{SIG} = 1.0A$

# HV2601/HV2701

## DC ELECTRICAL CHARACTERISTICS (CONTINUED)

Electrical Specifications: Over recommended operating conditions unless otherwise noted.										
Parameter	Symbol	0°C		+25°C			+70°C		Units	Conditions
		Min.	Max.	Min.	Typ.	Max.	Min.	Max.		
Value of Output Bleed Resistor (HV2701 Only)	$R_{INT}$	—	—	20	35	50	—	—	k $\Omega$	Output Switch to $R_{GND}$ $I_{RINT} = 0.5 \text{ mA}$
Switch OFF Leakage per Switch	$I_{SOL}$	—	5.0	—	1.0	10	—	15	$\mu\text{A}$	$V_{SIG} = V_{PP} - 10\text{V}$ and $V_{NN} + 10\text{V}$ (Note 1)
DC Offset Switch OFF	$V_{OS}$	—	300	—	100	300	—	300	mV	HV2601: 100 k $\Omega$ load HV2701: no load (Note 1)
DC Offset Switch ON		—	500	—	100	500	—	500	mV	
Quiescent $V_{PP}$ Supply Current	$I_{PPQ}$	—	—	—	10	50	—	—	$\mu\text{A}$	All switches OFF
Quiescent $V_{NN}$ Supply Current	$I_{NNQ}$	—	—	—	-10	-50	—	—	$\mu\text{A}$	All switches OFF
Quiescent $V_{PP}$ Supply Current	$I_{PPQ}$	—	—	—	10	50	—	—	$\mu\text{A}$	All switches ON, $I_{SW} = 5.0 \text{ mA}$
Quiescent $V_{NN}$ Supply Current	$I_{NNQ}$	—	—	—	-10	-50	—	—	$\mu\text{A}$	All switches ON, $I_{SW} = 5.0 \text{ mA}$
Switch Output Peak Current	$I_{SW}$	—	3.0	—	3.0	2.0	—	2.0	A	$V_{SIG}$ duty cycle < 0.1%
Output Switching Frequency	$f_{SW}$	—	—	—	—	50	—	—	kHz	Duty cycle = 50%
Average $V_{PP}$ Supply Current	$I_{PP}$	—	6.5	—	—	7.0	—	8.0	mA	All output switches are turning ON and OFF at 50 kHz with no load.
		—	4.0	—	—	5.5	—	5.5		
		—	4.0	—	—	5.0	—	5.5		
Average $V_{NN}$ Supply Current	$I_{NN}$	—	6.5	—	—	7.0	—	8.0	mA	All output switches are turning ON and OFF at 50 kHz with no load.
		—	4.0	—	—	5.0	—	5.5		
		—	4.0	—	—	5.0	—	5.5		
Average $V_{DD}$ Supply Current	$I_{DD}$	—	4.0	—	—	4.0	—	4.0	mA	$f_{CLK} = 5.0 \text{ MHz}$ , $V_{DD} = 5.0\text{V}$
Quiescent $V_{DD}$ Supply Current	$I_{DDQ}$	—	10	—	—	10	—	10	$\mu\text{A}$	All logic inputs are static
Data Out Source Current	$I_{SOR}$	0.45	—	0.45	0.70	—	0.40	—	mA	$V_{OUT} = V_{DD} - 0.7\text{V}$
Data Out Sink Current	$I_{SINK}$	0.45	—	0.45	0.70	—	0.40	—	mA	$V_{OUT} = 0.7\text{V}$
Logic Input Capacitance	$C_{IN}$	—	10	—	—	10	—	10	pF	

Note 1: See Figure 3-1.

## AC ELECTRICAL CHARACTERISTICS

Electrical Specifications: $V_{DD}=5.0V$ , $t_R = t_F \leq 5.0$ ns, 50% duty cycle, $C_{LOAD} = 20$ pF, unless otherwise noted.										
Parameter	Symbol	0°C		+25°C			+70°C		Units	Conditions
		Min.	Max.	Min.	Typ.	Max.	Min.	Max.		
Setup Time Before LE Rises	$t_{SD}$	25	—	25	—	—	25	—	ns	
Time Width of $\overline{LE}$	$t_{WLE}$	56	—	—	56	—	56	—	ns	$V_{DD} = 3.0V$
		12	—	—	12	—	12	—		$V_{DD} = 5.0V$
Clock Delay Time to Data Out	$t_{DO}$	50	100	50	78	100	50	100	ns	$V_{DD} = 3.0V$
		15	40	15	30	40	15	40		$V_{DD} = 5.0V$
Time Width of CLR	$t_{WCLR}$	55	—	55	—	—	55	—	ns	
Setup Time Data to Clock	$t_{SU}$	21	—	—	21	—	21	—	ns	$V_{DD} = 3.0V$
		7.0	—	—	7.0	—	7.0	—		$V_{DD} = 5.0V$
Hold Time Data from Clock	$t_H$	2.0	—	2.0	—	—	2.0	—	ns	$V_{DD} = 3.0$ or $5.0V$
Clock Frequency	$f_{CLK}$	—	8.0	—	—	8.0	—	8.0	MHz	$V_{DD} = 3.0V$
		—	20	—	—	20	—	20		$V_{DD} = 5.0V$
Clock Rise and Fall Times	$t_R, t_F$	—	50	—	—	50	—	50	ns	
Turn ON Time	$t_{ON}$	—	5.0	—	—	5.0	—	5.0	$\mu s$	$V_{SIG} = V_{PP} - 10V$ , $R_{LOAD} = 10$ k $\Omega$ ( <b>Note 1</b> )
Turn OFF Time	$t_{OFF}$	—	5.0	—	—	5.0	—	5.0	$\mu s$	$V_{SIG} = V_{PP} - 10V$ , $R_{LOAD} = 10$ k $\Omega$ ( <b>Note 1</b> )
Maximum $V_{SIG}$ Slew Rate	dv/dt	—	20	—	—	20	—	20	V/ns	$V_{PP} = +40V$ , $V_{NN} = -160V$
		—	20	—	—	20	—	20		$V_{PP} = +100V$ , $V_{NN} = -100V$
		—	20	—	—	20	—	20		$V_{PP} = +160V$ , $V_{NN} = -40V$
OFF Isolation	$K_O$	-30	—	-30	-33	—	-30	—	dB	$f = 5.0$ MHz, 1.0 k $\Omega$ /15 pF load ( <b>Note 1</b> )
		-58	—	-58	—	—	-58	—		$f = 5.0$ MHz, 50 $\Omega$ load ( <b>Note 1</b> )
Switch Crosstalk	$K_{CR}$	-60	—	-60	-70	—	-60	—	dB	$f = 5.0$ MHz, 50 $\Omega$ load ( <b>Note 1</b> )
Output Switch Isolation Diode Current	$I_{ID}$	—	300	—	—	300	—	300	mA	300 ns pulse width, 2.0% duty cycle ( <b>Note 1</b> )
OFF Capacitance SW to GND	$C_{SG(OFF)}$	5.0	17	5.0	12	17	5.0	17	pF	0V, $f = 1.0$ MHz
ON Capacitance SW to GND	$C_{SG(ON)}$	25	50	25	38	50	25	50	pF	0V, $f = 1.0$ MHz
Output Voltage Spike	$+V_{SPK}$	—	—	—	—	150	—	—	mV	$V_{PP} = +40V$ , $V_{NN} = -160V$ , $R_{LOAD} = 50\Omega$ ( <b>Note 1</b> )
	$-V_{SPK}$	—	—	—	—	150	—	—		$V_{PP} = +100V$ , $V_{NN} = -100V$ , $R_{LOAD} = 50\Omega$ ( <b>Note 1</b> )
	$+V_{SPK}$	—	—	—	—	150	—	—		$V_{PP} = +160V$ , $V_{NN} = -40V$ , $R_{LOAD} = 50\Omega$ ( <b>Note 1</b> )
	$-V_{SPK}$	—	—	—	—	150	—	—		
	$-V_{SPK}$	—	—	—	—	150	—	—		
Charge Injection	QC	—	—	—	820	—	—	—	pC	$V_{PP} = +40V$ , $V_{NN} = -160V$ , $V_{SIG} = 0V$ ( <b>Note 1</b> )
		—	—	—	600	—	—	—		$V_{PP} = +100V$ , $V_{NN} = -100V$ , $V_{SIG} = 0V$ ( <b>Note 1</b> )
		—	—	—	350	—	—	—		$V_{PP} = +160V$ , $V_{NN} = -40V$ , $V_{SIG} = 0V$ ( <b>Note 1</b> )

**Note 1:** See [Figure 3-1](#).

# HV2601/HV2701

## 2.0 PIN DESCRIPTION

The locations of the pads/balls are listed in [Package Types†](#).

**TABLE 2-1: PIN DESCRIPTION: 42-BALL BUMPED DIE PACKAGE**

Pin #	HV2601	HV2701	Description
1	NC	RGND	No connect/Ground for bleed resistor
2	V <sub>PP</sub>	V <sub>PP</sub>	Positive supply voltage
3	V <sub>NN</sub>	V <sub>NN</sub>	Negative supply voltage
4	D <sub>OUT</sub>	D <sub>OUT</sub>	Data out logic output
5	CLR	CLR	Latch clear logic input
6	CLK	CLK	Clock logic input for shift register
7	GND	GND	Ground
8	SW15A	SW15A	Analog switch 15 terminal A
9	SW15B	SW15B	Analog switch 15 terminal B
10	$\overline{\text{LE}}$	$\overline{\text{LE}}$	Latch-enable logic input, low active
11	V <sub>DD</sub>	V <sub>DD</sub>	Logic supply voltage
12	SW0A	SW0A	Analog switch 0 terminal A
13	SW0B	SW0B	Analog switch 0 terminal B
14	SW14A	SW14A	Analog switch 14 terminal A
15	SW14B	SW14B	Analog switch 14 terminal B
16	D <sub>IN</sub>	D <sub>IN</sub>	Data in logic input
17	SW1A	SW1A	Analog switch 1 terminal A
18	SW1B	SW1B	Analog switch 1 terminal B
19	SW13A	SW13A	Analog switch 13 terminal A
20	SW13B	SW13B	Analog switch 13 terminal B
21	SW2A	SW2A	Analog switch 2 terminal A
22	SW2B	SW2B	Analog switch 2 terminal B
23	SW12A	SW12A	Analog switch 12 terminal A
24	SW12B	SW12B	Analog switch 12 terminal B
25	SW3A	SW3A	Analog switch 3 terminal A
26	SW3B	SW3B	Analog switch 3 terminal B
27	SW11A	SW11A	Analog switch 11 terminal A
28	SW11B	SW11B	Analog switch 11 terminal B
29	SW9B	SW9B	Analog switch 9 terminal B
30	SW8B	SW8B	Analog switch 8 terminal B
31	SW7A	SW7A	Analog switch 7 terminal A
32	SW6A	SW6A	Analog switch 6 terminal A
33	SW4A	SW4A	Analog switch 4 terminal A
34	SW4B	SW4B	Analog switch 4 terminal B
35	SW10B	SW10B	Analog switch 10 terminal B
36	SW10A	SW10A	Analog switch 10 terminal A
37	SW9A	SW9A	Analog switch 9 terminal A
38	SW8A	SW8A	Analog switch 8 terminal A
39	SW7B	SW7B	Analog switch 7 terminal B
40	SW6B	SW6B	Analog switch 6 terminal B
41	SW5B	SW5B	Analog switch 5 terminal B
42	SW5A	SW5A	Analog switch 5 terminal A

**TABLE 2-2: PIN DESCRIPTION: 48-LEAD LQFP/TQFP**

Pin #	HV2601	HV2701	Description
1	NC	NC	No connect
2	NC	NC	No connect
3	SW4B	SW4B	Analog switch 4 terminal B
4	SW4A	SW4A	Analog switch 4 terminal A
5	SW3B	SW3B	Analog switch 3 terminal B
6	SW3A	SW3A	Analog switch 3 terminal A
7	SW2B	SW2B	Analog switch 2 terminal B
8	SW2A	SW2A	Analog switch 2 terminal A
9	SW1B	SW1B	Analog switch 1 terminal B
10	SW1A	SW1A	Analog switch 1 terminal A
11	SW0B	SW0B	Analog switch 0 terminal B
12	SW0A	SW0A	Analog switch 0 terminal A
13	V <sub>NN</sub>	V <sub>NN</sub>	Negative supply voltage
14	NC	NC	No connect
15	V <sub>PP</sub>	V <sub>PP</sub>	Positive supply voltage
16	NC	NC	No connect
17	GND	GND	Ground
18	V <sub>DD</sub>	V <sub>DD</sub>	Logic supply voltage
19	D <sub>IN</sub>	D <sub>IN</sub>	Data in logic input
20	CLK	CLK	Clock logic input for shift register
21	$\overline{\text{LE}}$	$\overline{\text{LE}}$	Latch-enable logic input, low active
22	CLR	CLR	Latch clear logic input
23	D <sub>OUT</sub>	D <sub>OUT</sub>	Data out logic output
24	NC	RGND	No connect/Ground for bleed resistor
25	SW15B	SW15B	Analog switch 15 terminal B
26	SW15A	SW15A	Analog switch 15 terminal A
27	SW14B	SW14B	Analog switch 14 terminal B
28	SW14A	SW14A	Analog switch 14 terminal A
29	SW13B	SW13B	Analog switch 13 terminal B
30	SW13A	SW13A	Analog switch 13 terminal A
31	SW12B	SW12B	Analog switch 12 terminal B
32	SW12A	SW12A	Analog switch 12 terminal A
33	SW11B	SW11B	Analog switch 11 terminal B
34	SW11A	SW11A	Analog switch 11 terminal A
35	NC	NC	No connect
36	NC	NC	No connect
37	SW10B	SW10B	Analog switch 10 terminal B
38	SW10A	SW10A	Analog switch 10 terminal A
39	SW9B	SW9B	Analog switch 9 terminal B
40	SW9A	SW9A	Analog switch 9 terminal A
41	SW8B	SW8B	Analog switch 8 terminal B
42	SW8A	SW8A	Analog switch 8 terminal A
43	SW7B	SW7B	Analog switch 7 terminal B
44	SW7A	SW7A	Analog switch 7 terminal A

# HV2601/HV2701

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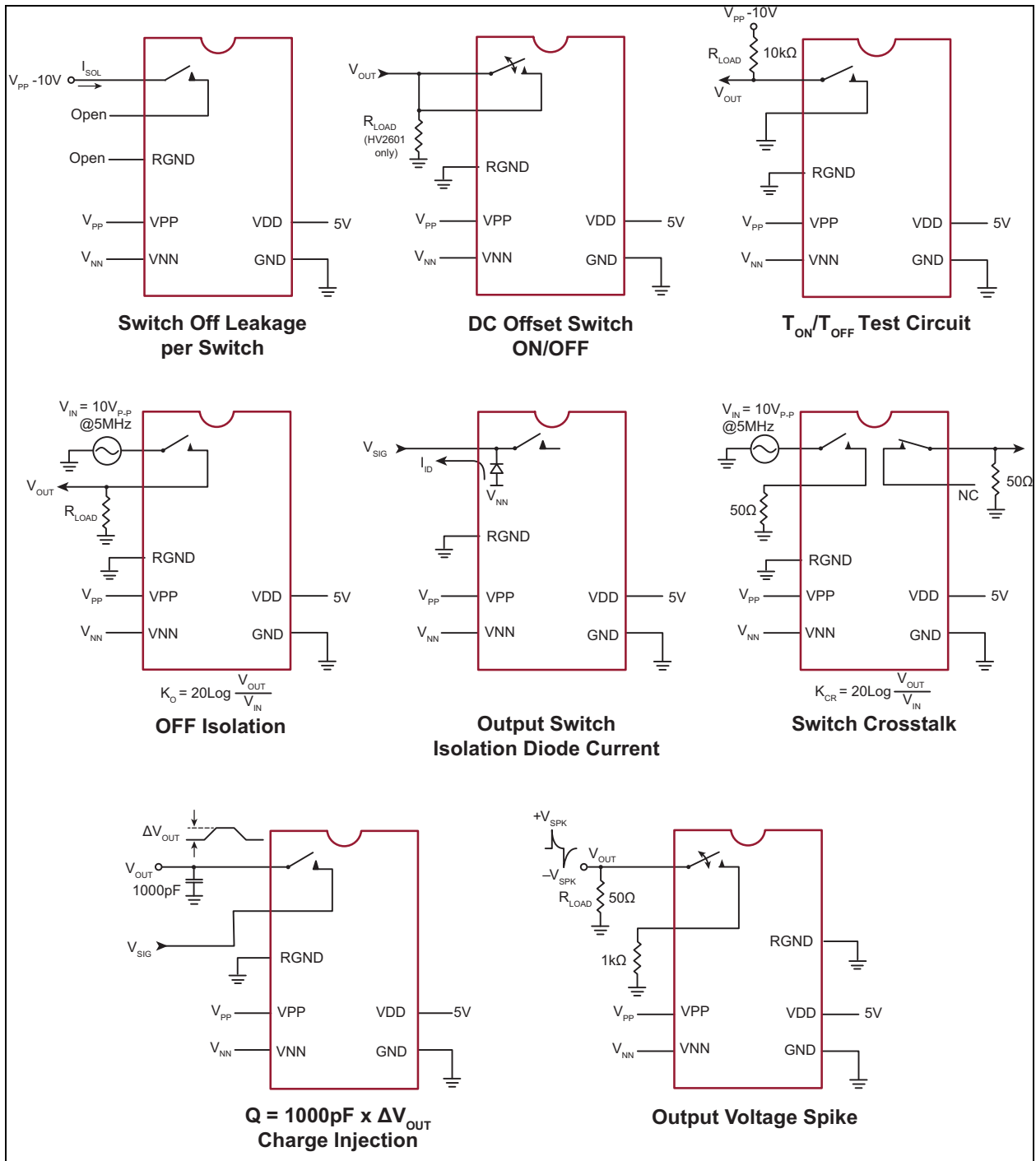
**TABLE 2-2: PIN DESCRIPTION: 48-LEAD LQFP/TQFP (CONTINUED)**

<b>Pin #</b>	<b>HV2601</b>	<b>HV2701</b>	<b>Description</b>
45	SW6B	SW6B	Analog switch 6 terminal B
46	SW6A	SW6A	Analog switch 6 terminal A
47	SW5B	SW5B	Analog switch 5 terminal B
48	SW5A	SW5A	Analog switch 5 terminal A



## 3.0 DETAILED DESCRIPTION

### 3.1 Application Information



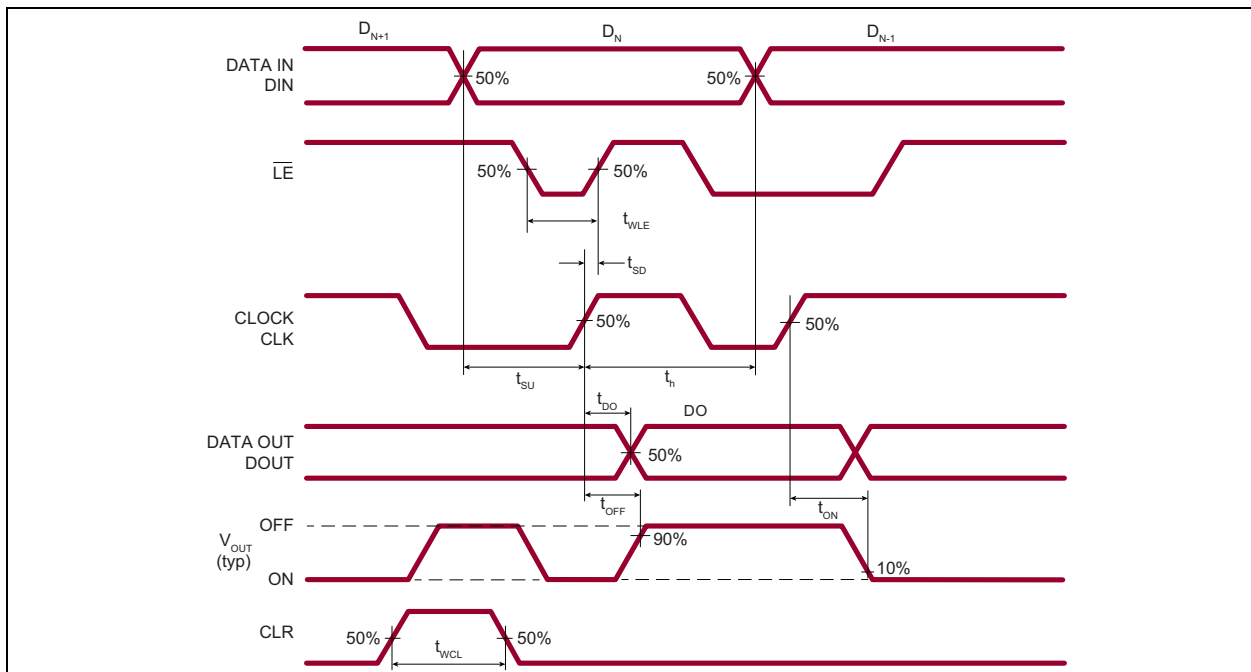
**FIGURE 3-1:** Test Circuits.

# HV2601/HV2701

**TABLE 3-1: LOGIC FUNCTION TABLE**

D0	D1	...	D7	D8	...	D15	LE	CLR	SW0	SW1	...	SW7	SW8	...	SW15
L	—		—	—		—	L	L	OFF	—		—	—		—
H	—		—	—		—	L	L	ON	—		—	—		—
—	L		—	—		—	L	L	—	OFF		—	—		—
—	H		—	—		—	L	L	—	ON		—	—		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		L	—		—	L	L	—	—		OFF	—		—
—	—		H	—		—	L	L	—	—		ON	—		—
—	—	...	—	L	...	—	L	L	—	—	...	—	OFF	...	—
—	—		—	H		—	L	L	—	—		—	ON		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		—	—		—	L	L	—	—		—	—		—
—	—		—	—		L	L	L	—	—		—	—		OFF
—	—		—	—		H	L	L	—	—		—	—		ON
X	X	X	X	X	X	X	H	L	HOLD PREVIOUS STATE						
X	X	X	X	X	X	X	X	H	ALL SWITCHES OFF						

- Note 1:** The 16 switches operate independently.
- 2:** Serial data is clocked in on the L to H transition of the CLK.
- 3:** All 16 switches go to a state retaining their latched condition at the rising edge of  $\overline{LE}$ . When  $\overline{LE}$  is low, the shift registers data flow through the latch.
- 4:**  $D_{OUT}$  is high when data in the shift register 15 are high.
- 5:** Shift registers clocking has no effect on the switch states if  $\overline{LE}$  is high.
- 6:** The CLR clear input overrides all other inputs.



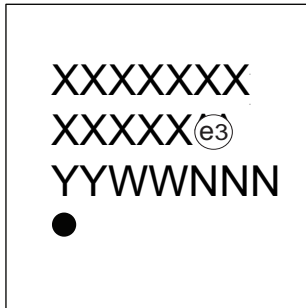
**FIGURE 3-2: Logic Timing Waveforms.**

## 4.0 PACKAGING INFORMATION†

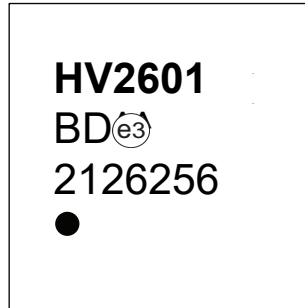
### 4.1 Package Marking Information

† **Notice:** The LQFP package is not recommended for new designs. Please use TQFP package as an alternative.

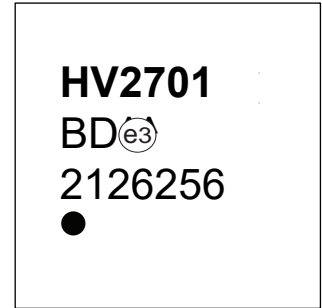
42-Ball Bumped Die



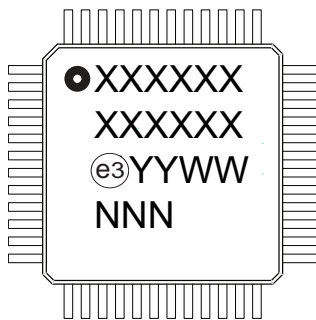
Example



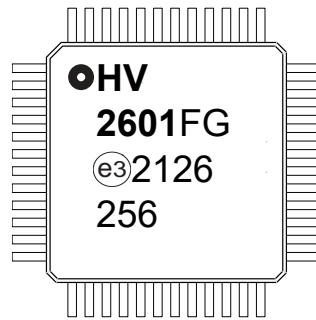
Example



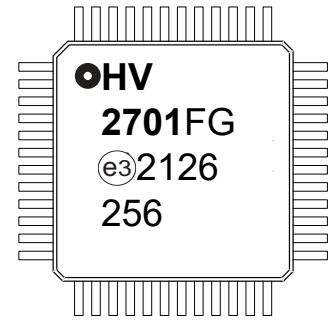
48-Lead LQFP



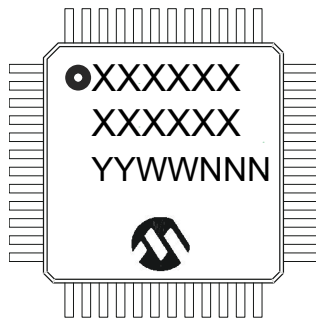
Example



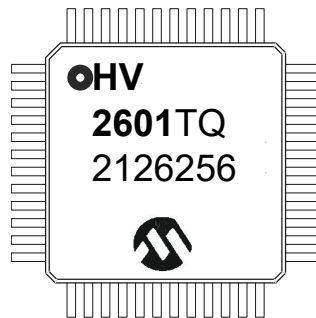
Example



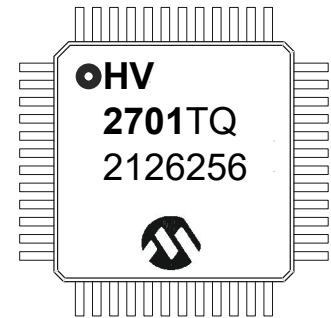
48-Lead TQFP



Example



Example



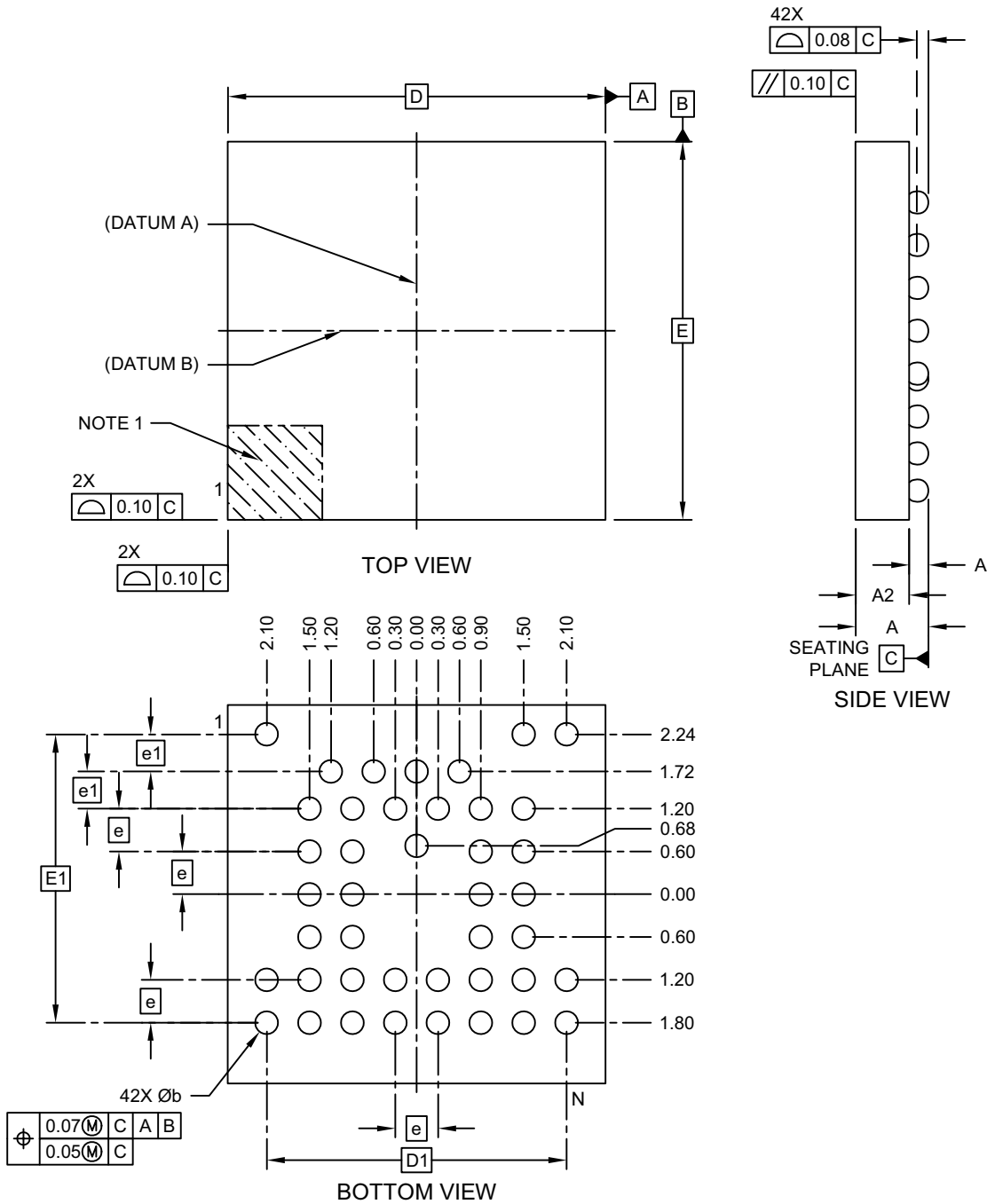
<b>Legend:</b>	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator (e3) can be found on the outer packaging for this package.

**Note:** In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for product code or customer-specific information. Package may or not include the corporate logo.

# HV2601/HV2701

## 42-Ball Chip Scale Package (75X) - 5.29x5.30x1.02 mm Body [CSP]

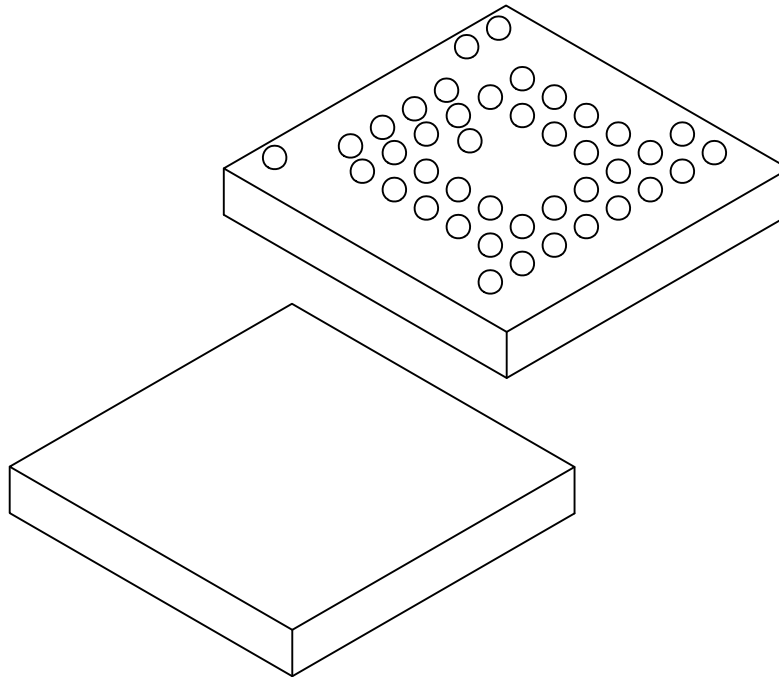
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-533-75X Rev B Sheet 1 of 2

## 42-Ball Chip Scale Package (75X) - 5.29x5.30x1.02 mm Body [CSP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Terminals	N	42		
Terminal Pitch	e	0.60 BSC		
Terminal Pitch	e1	0.52 BSC		
Overall Height	A	0.91	0.965	1.02
Standoff	A1	0.21	0.24	0.27
Terminal Thickness	A2	0.70	0.725	0.75
Overall Length	D	5.29 BSC		
Exposed Pad Length	D1	4.20 BSC		
Overall Width	E	5.30 BSC		
Exposed Pad Width	E1	4.04 BSC		
Terminal Width	b	0.29	0.32	0.35

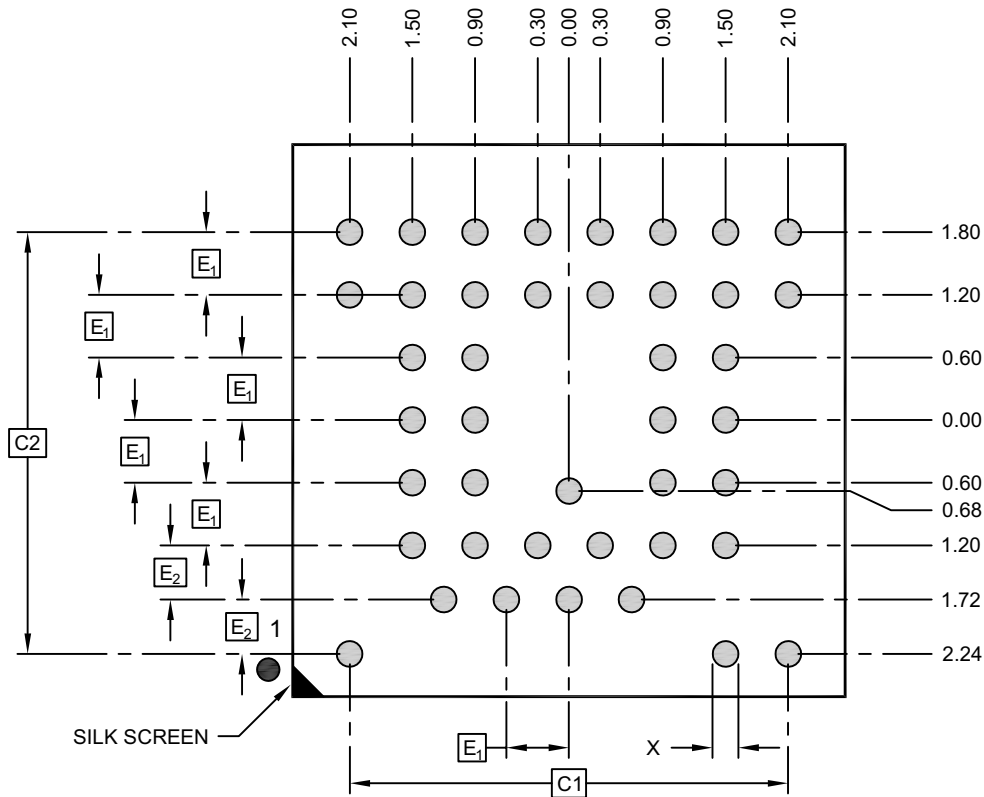
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensioning and tolerancing per ASME Y14.5M  
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
 REF: Reference Dimension, usually without tolerance, for information purposes only.

# HV2601/HV2701

## 42-Ball Chip Scale Package (75X) - 5.29x5.30x1.02 mm Body [CSP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	$E_1$		0.60 BSC	
Contact Pitch	$E_2$		0.52 BSC	
Contact Pad Spacing	$C_1$		4.20 BSC	
Contact Pad Spacing	$C_2$		4.04 BSC	
Contact Pad Width ( $X_{nn}$ )	$X$			0.25

**Notes:**

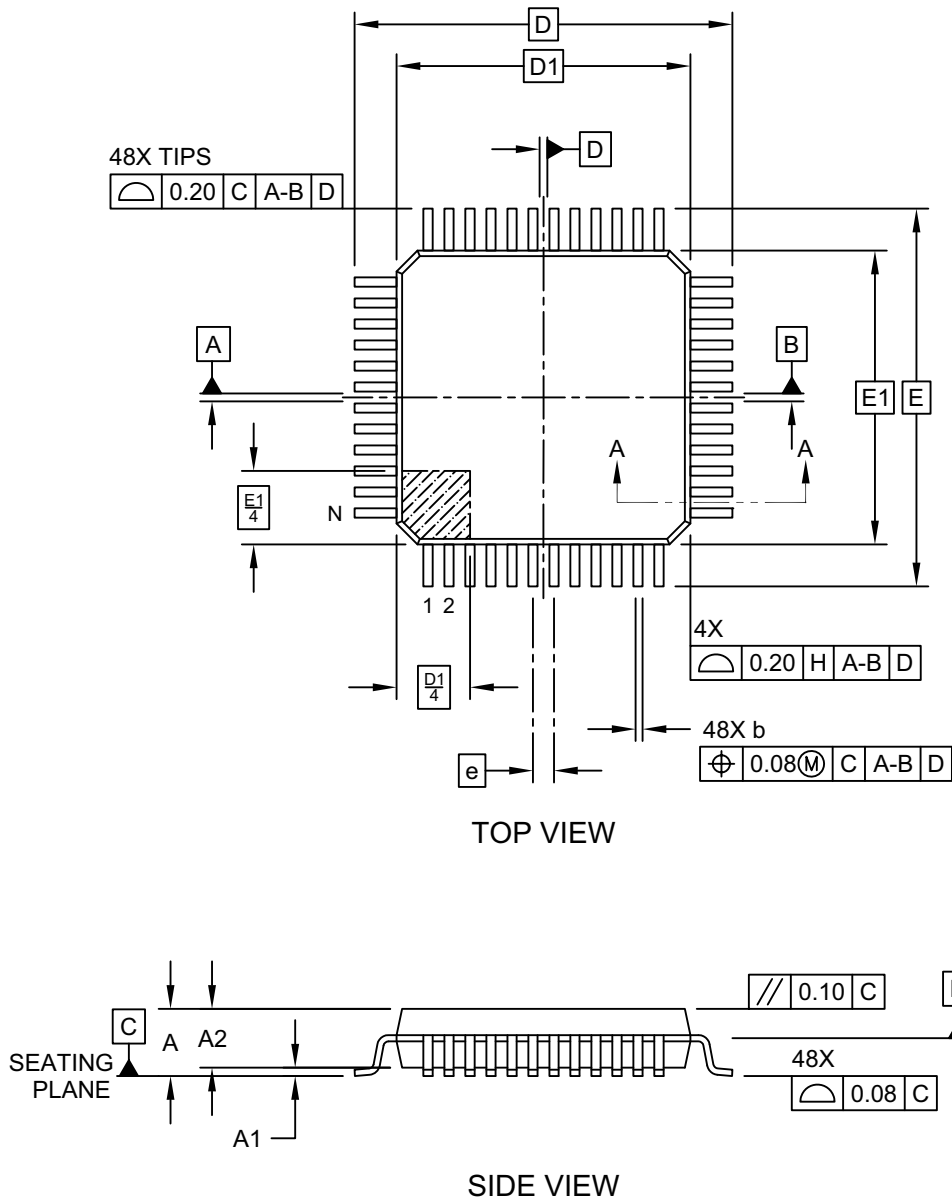
1. Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2533-75X Rev B

**Note:** For more information about ball coordinates, contact Microchip sales.

## 48-Lead Low-profile Plastic Quad Flat Pack Package (R8) -7x7 mm Body [LQFP] Supertex Legacy Package

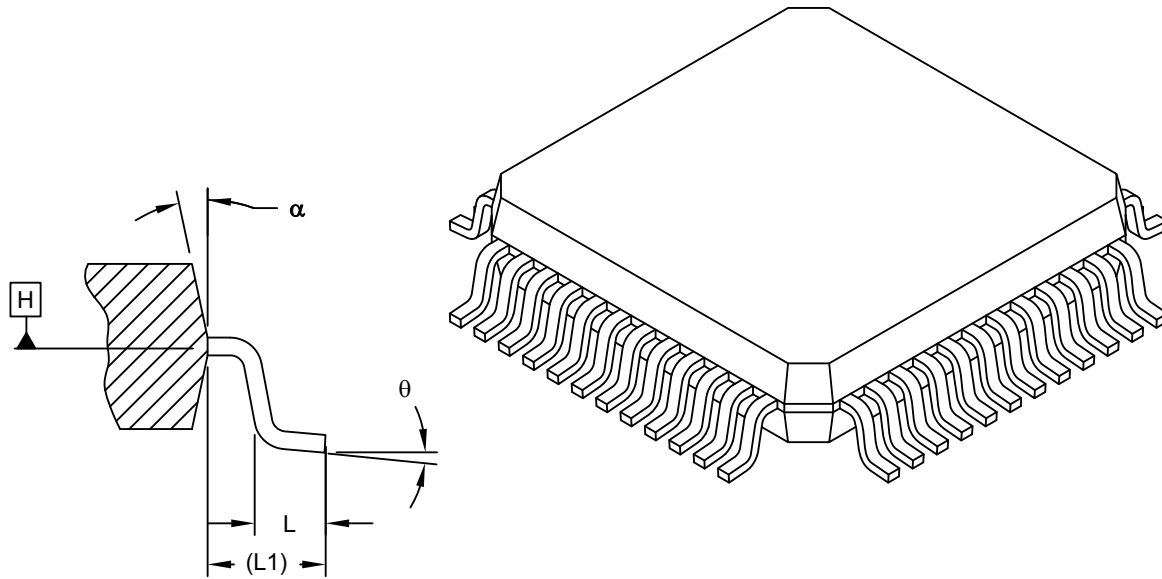
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



# HV2601/HV2701

## 48-Lead Low-profile Plastic Quad Flat Pack Package (R8) -7x7 mm Body [LQFP] Supertex Legacy Package

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



SECTION A-A

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Leads	N	48		
Lead Pitch	e	0.50 BSC		
Overall Height	A	1.40	1.50	1.60
Standoff	A1	0.05	0.10	0.15
Molded Package Thickness	A2	1.35	1.40	1.45
Foot Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Foot Angle	$\theta$	0°	3.5°	7°
Overall Width	E	9.00 BSC		
Overall Length	D	9.00 BSC		
Molded Package Width	E1	7.00 BSC		
Molded Package Length	D1	7.00 BSC		
Lead Width	b	0.17	0.22	0.27
Mold Draft Angle Top	$\alpha$	11°	12°	13°

**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

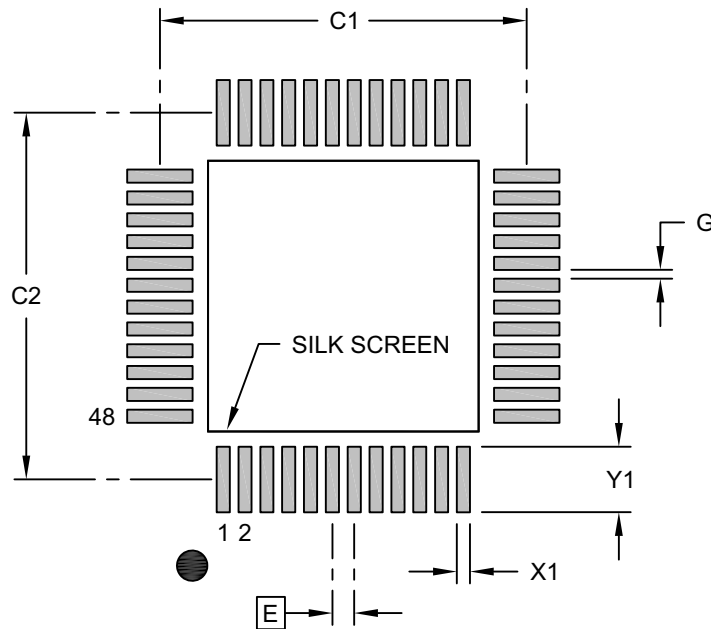
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-278A Sheet 2 of 2



## 48-Lead Low-profile Plastic Quad Flat Pack Package (R8) -7x7 mm Body [LQFP] Supertex Legacy Package

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Contact Pad Spacing	C1		8.40	
Contact Pad Spacing	C2		8.40	
Contact Pad Width (X48)	X1			0.30
Contact Pad Length (X48)	Y1			1.50
Contact Pad to Contact Pad (X44)	G	0.20		

**Notes:**

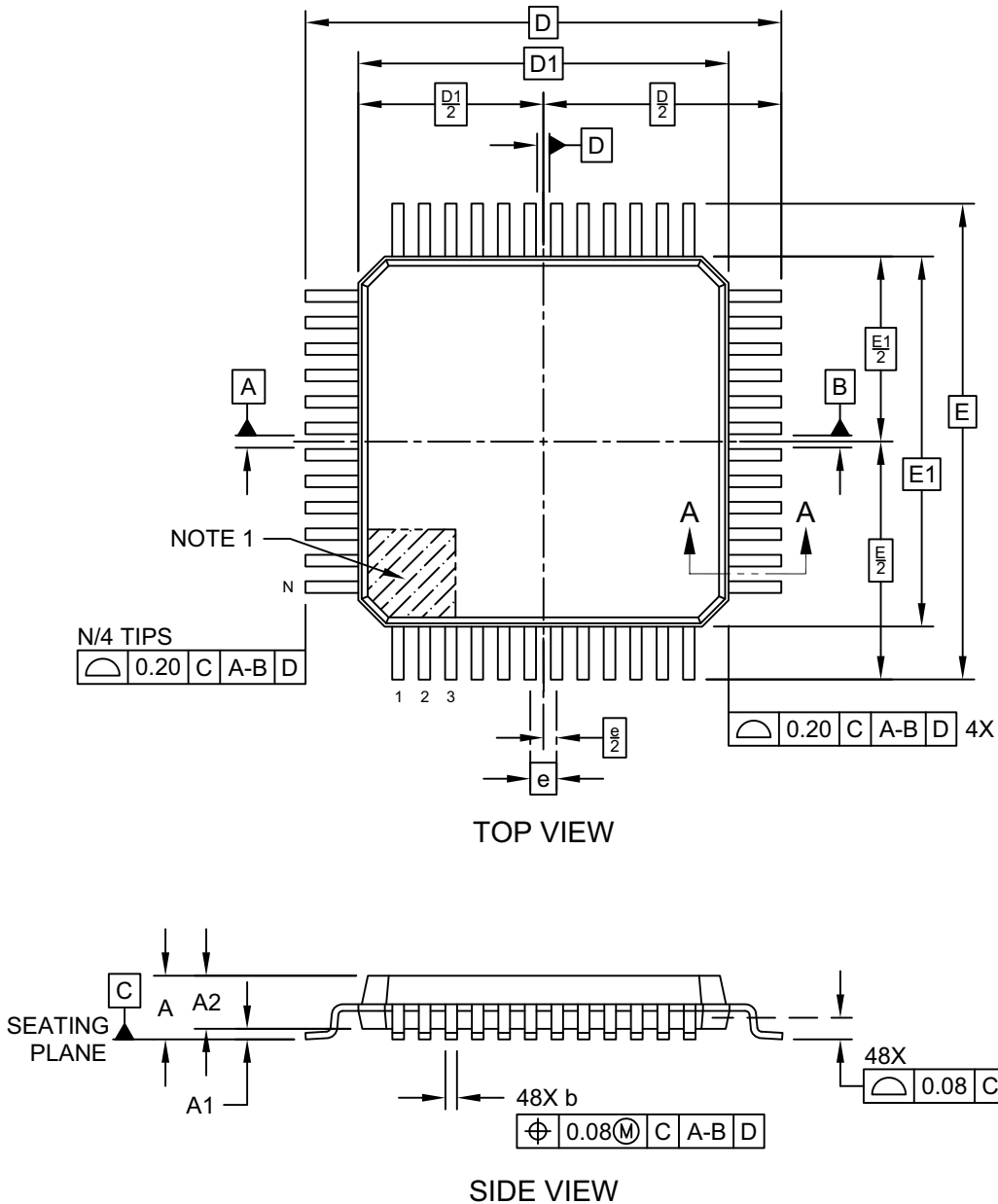
- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2278 Rev A

# HV2601/HV2701

## 48-Lead Plastic Thin Quad Flatpack (Y8X) - 7x7x1.0 mm Body [TQFP]

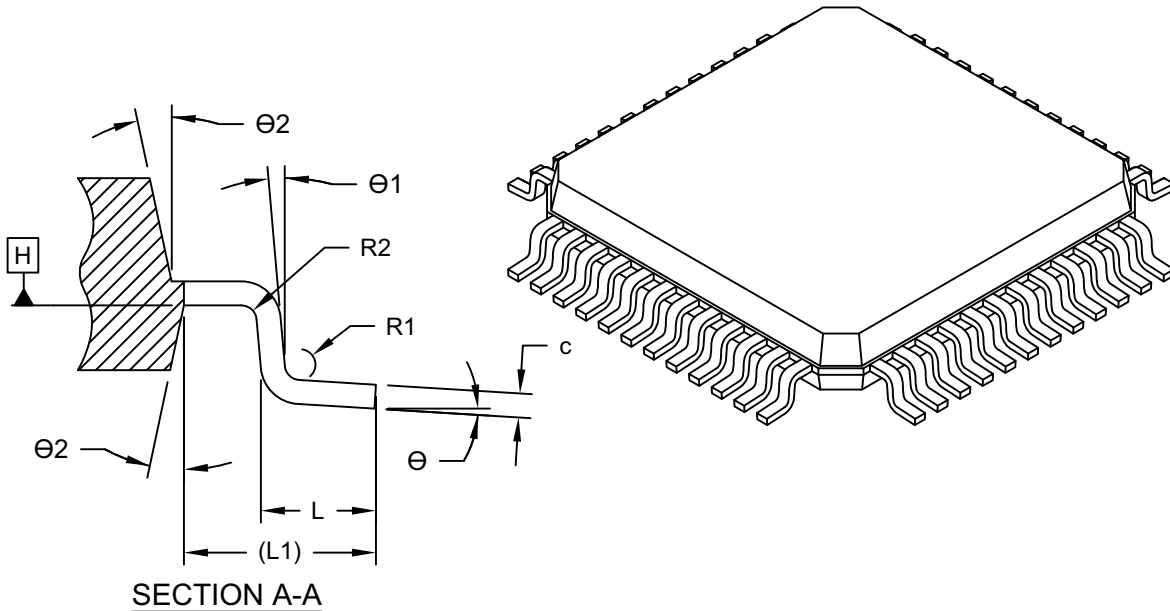
**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-300-Y8X Rev D Sheet 1 of 2

## 48-Lead Plastic Thin Quad Flatpack (Y8X) - 7x7x1.0 mm Body [TQFP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Terminals	N	48		
Pitch	e	0.50 BSC		
Overall Height	A	-	-	1.20
Standoff	A1	0.05	-	0.15
Molded Package Thickness	A2	0.95	1.00	1.05
Overall Length	D	9.00 BSC		
Molded Package Length	D1	7.00 BSC		
Overall Width	E	9.00 BSC		
Molded Package Width	E1	7.00 BSC		
Terminal Width	b	0.17	0.22	0.27
Terminal Thickness	c	0.09	-	0.16
Terminal Length	L	0.45	0.60	0.75
Footprint	L1	1.00 REF		
Lead Bend Radius	R1	0.08	-	-
Lead Bend Radius	R2	0.08	-	0.20
Foot Angle	Θ	0°	3.5°	7°
Lead Angle	Θ1	0°	-	-
Mold Draft Angle	Θ2	11°	12°	13°

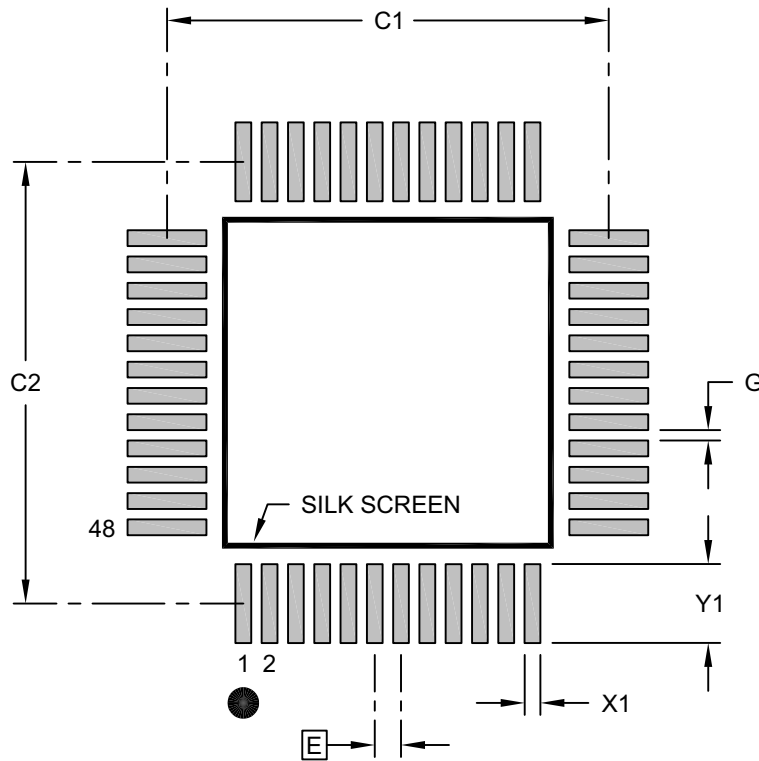
**Notes:**

- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensioning and tolerancing per ASME Y14.5M  
 BSC: Basic Dimension. Theoretically exact value shown without tolerances.  
 REF: Reference Dimension, usually without tolerance, for information purposes only.

# HV2601/HV2701

## 48-Lead Plastic Thin Quad Flatpack (Y8X) - 7x7x1.0 mm Body [TQFP]

**Note:** For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



### RECOMMENDED LAND PATTERN

Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Contact Pad Spacing	C1		8.40	
Contact Pad Spacing	C2		8.40	
Contact Pad Width (X48)	X1			0.30
Contact Pad Length (X48)	Y1			1.50
Distance Between Pads	G	0.20		

**Notes:**

- Dimensioning and tolerancing per ASME Y14.5M  
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2300-Y8X Rev D

## APPENDIX A: REVISION HISTORY

### Revision E (May 2022)

- Minor layout changes.
- Added 48-Lead LQFP package notice to [Package Types†](#) and [Packaging Information†](#).

### Revision D (August 2021)

- Added 48-Lead TQFP package.

### Revision C (August 2020)

- Corrected [Note 2](#) in table [Recommended Operating Conditions \(1, 2, 3\)](#).
- Made minor typographical corrections.

### Revision B (March 2016)

The following is the list of modifications:

- Moved [Functional Block Diagram](#) to page 2 and made a minor change for clarity.
- Removed Confidential status from document.

### Revision A (December 2015)

The following is the list of modifications:

- Converted Supertex Doc #s DSFP-HV2601 and DSFP-HV2701 to Microchip DS20005391E.
- Combined HV2601/HV2701 into one document.
- Revised [Section 4.0 “Packaging Information†”](#)
- Removed package GA from the data sheet.
- Made minor text changes throughout.

# HV2601/HV2701

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NOTES:

# HV2601/HV2701

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office

<u>PART NO.</u>	<u>XX</u>	<u>-X</u>	<u>-XXXX</u>																																																								
Device	Package	Environmental	Media Type																																																								
<table border="1"> <tr> <td><b>Devices:</b></td> <td>HV2601 = 16-Channel HV Analog Switch</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>HV2701 = 16-Channel HV Analog Switch with Bleed Resistors</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>Package:</b></td> <td>BD = 42-Ball Bumped Die</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>FG = 48-lead LQFP</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>TQ = 48-lead TQFP</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>Environmental:</b></td> <td>G = Lead (Pb)-free/ROHS-compliant package (not used for BD packages)</td> <td></td> <td></td> <td></td> </tr> <tr> <td><b>Media Type:</b></td> <td>(Blank) = 250/Tray for FG package</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>(Blank) = 250/Tray for TQ package</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>M931 = 1000/Reel for FG package</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>M931 = 1600/Reel for TQ package</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>M936 = 2500/Reel for BD package</td> <td></td> <td></td> <td></td> </tr> </table>					<b>Devices:</b>	HV2601 = 16-Channel HV Analog Switch					HV2701 = 16-Channel HV Analog Switch with Bleed Resistors				<b>Package:</b>	BD = 42-Ball Bumped Die					FG = 48-lead LQFP					TQ = 48-lead TQFP				<b>Environmental:</b>	G = Lead (Pb)-free/ROHS-compliant package (not used for BD packages)				<b>Media Type:</b>	(Blank) = 250/Tray for FG package					(Blank) = 250/Tray for TQ package					M931 = 1000/Reel for FG package					M931 = 1600/Reel for TQ package					M936 = 2500/Reel for BD package			
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	M931 = 1600/Reel for TQ package																																																										
	M936 = 2500/Reel for BD package																																																										
<b>Examples:</b>																																																											
a)	HV2601FG-G:			16-Channel HV Analog Switch, 48-Lead LQFP package, 250/Tray																																																							
b)	HV2601FG-G-M931:			16-Channel HV Analog Switch, 48-Lead LQFP package, 1000/Reel																																																							
c)	HV2701TQ-G:			16-Channel HV Analog Switch with Bleed Resistors, 48-Lead TQFP package, 250/Tray																																																							
d)	HV2701TQ-G-M931:			16-Channel HV Analog Switch with Bleed Resistors, 48-Lead TQFP package, 1600/Reel																																																							
e)	HV2701BD-M936			16-Channel HV Analog Switch with Bleed Resistors, 42-Ball Bumped die, 2500/Reel																																																							

**Note:** HV2601BD and HV2701BD are RoHS-compliant products.

**NOTES:**



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