

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 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

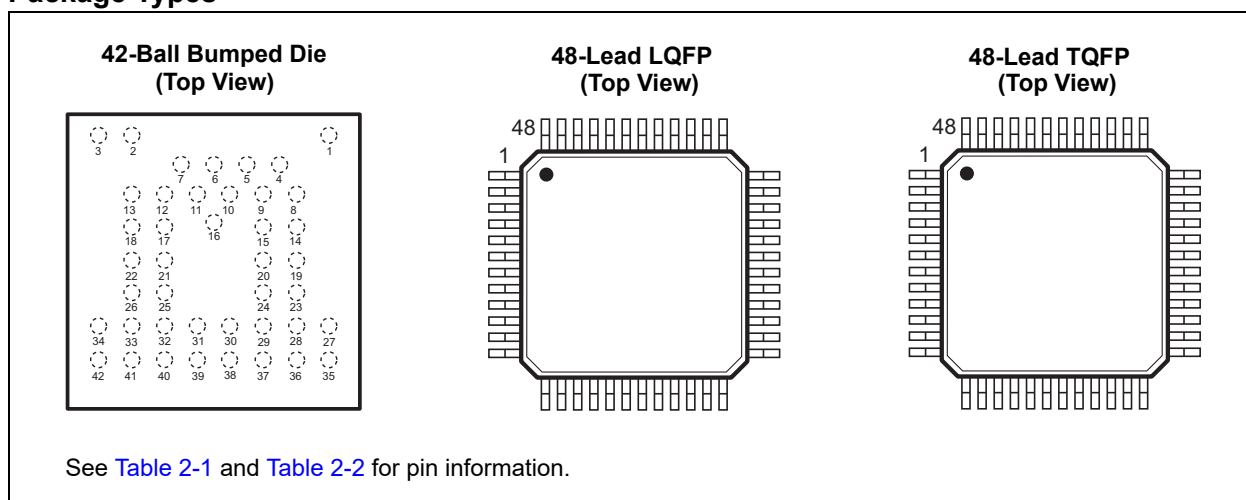
General Description

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 $+160\text{V}/-40\text{V}$.

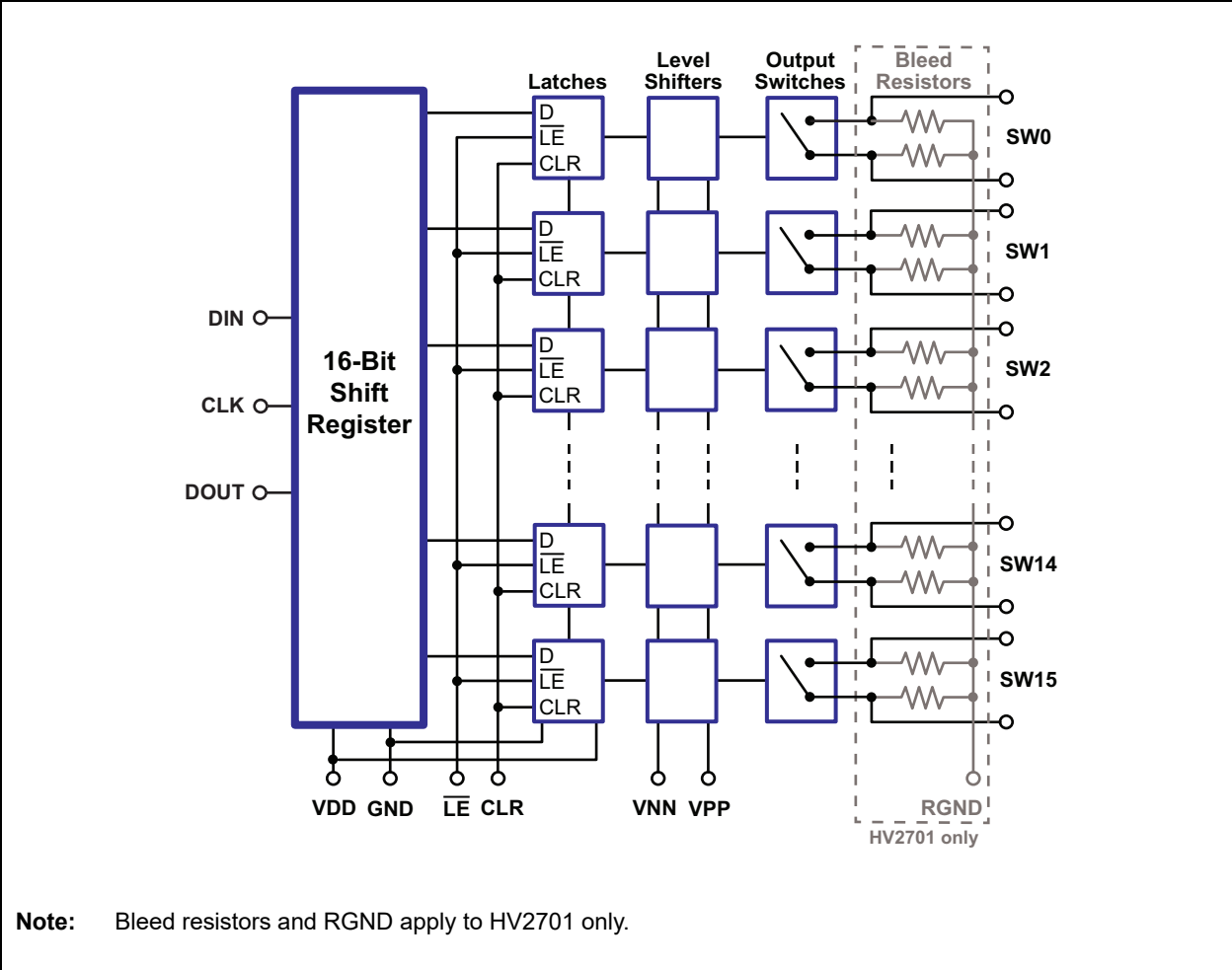
Package Types[†]



[†] **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[†]

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	Ω	$I_{SIG} = 5.0 \text{ mA}$, $V_{PP} = +40V$ $I_{SIG} = 200 \text{ mA}$, $V_{NN} = -160V$
		—	25	—	22	27	—	32		
		—	25	—	22	27	—	30		$I_{SIG} = 5.0 \text{ mA}$, $V_{PP} = +100V$ $I_{SIG} = 200 \text{ mA}$, $V_{NN} = -100V$
		—	18	—	18	24	—	27		
		—	23	—	20	25	—	30		$I_{SIG} = 5.0 \text{ mA}$, $V_{PP} = +160V$ $I_{SIG} = 200 \text{ mA}$, $V_{NN} = -40V$
		—	22	—	16	25	—	27		
Small Signal Switch ON-Resistance Matching	ΔR_{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	—	—	—	Ω	$V_{SIG} = V_{PP} - 10V$, $I_{SIG} = 1.0A$

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 Ω	Output Switch to R_{GND} $I_{RINT} = 0.5 \text{ mA}$
Switch OFF Leakage per Switch	I_{SOL}	—	5.0	—	1.0	10	—	15	μA	$V_{SIG} = V_{PP} - 10\text{V}$ and $V_{NN} + 10\text{V}$ (Note 1)
DC Offset Switch OFF	V_{OS}	—	300	—	100	300	—	300	mV	HV2601: 100 k Ω load HV2701: no load (Note 1)
DC Offset Switch ON		—	500	—	100	500	—	500	mV	
Quiescent V_{PP} Supply Current	I_{PPQ}	—	—	—	10	50	—	—	μA	All switches OFF
Quiescent V_{NN} Supply Current	I_{NNQ}	—	—	—	-10	-50	—	—	μA	All switches OFF
Quiescent V_{PP} Supply Current	I_{PPQ}	—	—	—	10	50	—	—	μA	All switches ON, $I_{SW} = 5.0 \text{ mA}$
Quiescent V_{NN} Supply Current	I_{NNQ}	—	—	—	-10	-50	—	—	μA	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	μA	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	μs	$V_{SIG} = V_{PP} - 10V$, $R_{LOAD} = 10$ k Ω (Note 1)
Turn OFF Time	t_{OFF}	—	5.0	—	—	5.0	—	5.0	μs	$V_{SIG} = V_{PP} - 10V$, $R_{LOAD} = 10$ k Ω (Note 1)
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 Ω /15 pF load (Note 1)
		-58	—	-58	—	—	-58	—		$f = 5.0$ MHz, 50 Ω load (Note 1)
Switch Crosstalk	K_{CR}	-60	—	-60	-70	—	-60	—	dB	$f = 5.0$ MHz, 50 Ω load (Note 1)
Output Switch Isolation Diode Current	I_{ID}	—	300	—	—	300	—	300	mA	300 ns pulse width, 2.0% duty cycle (Note 1)
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	$V_{PP} = +40V$, $V_{NN} = -160V$, $R_{LOAD} = 50\Omega$ (Note 1)
	$-V_{SPK}$	—	—	—	—	150	—	—		$V_{PP} = +100V$, $V_{NN} = -100V$, $R_{LOAD} = 50\Omega$ (Note 1)
	$+V_{SPK}$	—	—	—	—	150	—	—		$V_{PP} = +160V$, $V_{NN} = -40V$, $R_{LOAD} = 50\Omega$ (Note 1)
	$-V_{SPK}$	—	—	—	—	150	—	—		
	$-V_{SPK}$	—	—	—	—	150	—	—		
Charge Injection	QC	—	—	—	820	—	—	—	pC	$V_{PP} = +40V$, $V_{NN} = -160V$, $V_{SIG} = 0V$ (Note 1)
		—	—	—	600	—	—	—		$V_{PP} = +100V$, $V_{NN} = -100V$, $V_{SIG} = 0V$ (Note 1)
		—	—	—	350	—	—	—		$V_{PP} = +160V$, $V_{NN} = -40V$, $V_{SIG} = 0V$ (Note 1)

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 _{PP}	V _{PP}	Positive supply voltage
3	V _{NN}	V _{NN}	Negative supply voltage
4	D _{OUT}	D _{OUT}	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 _{DD}	V _{DD}	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 _{IN}	D _{IN}	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 _{NN}	V _{NN}	Negative supply voltage
14	NC	NC	No connect
15	V _{PP}	V _{PP}	Positive supply voltage
16	NC	NC	No connect
17	GND	GND	Ground
18	V _{DD}	V _{DD}	Logic supply voltage
19	D _{IN}	D _{IN}	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 _{OUT}	D _{OUT}	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

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

Pin #	HV2601	HV2701	Description
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

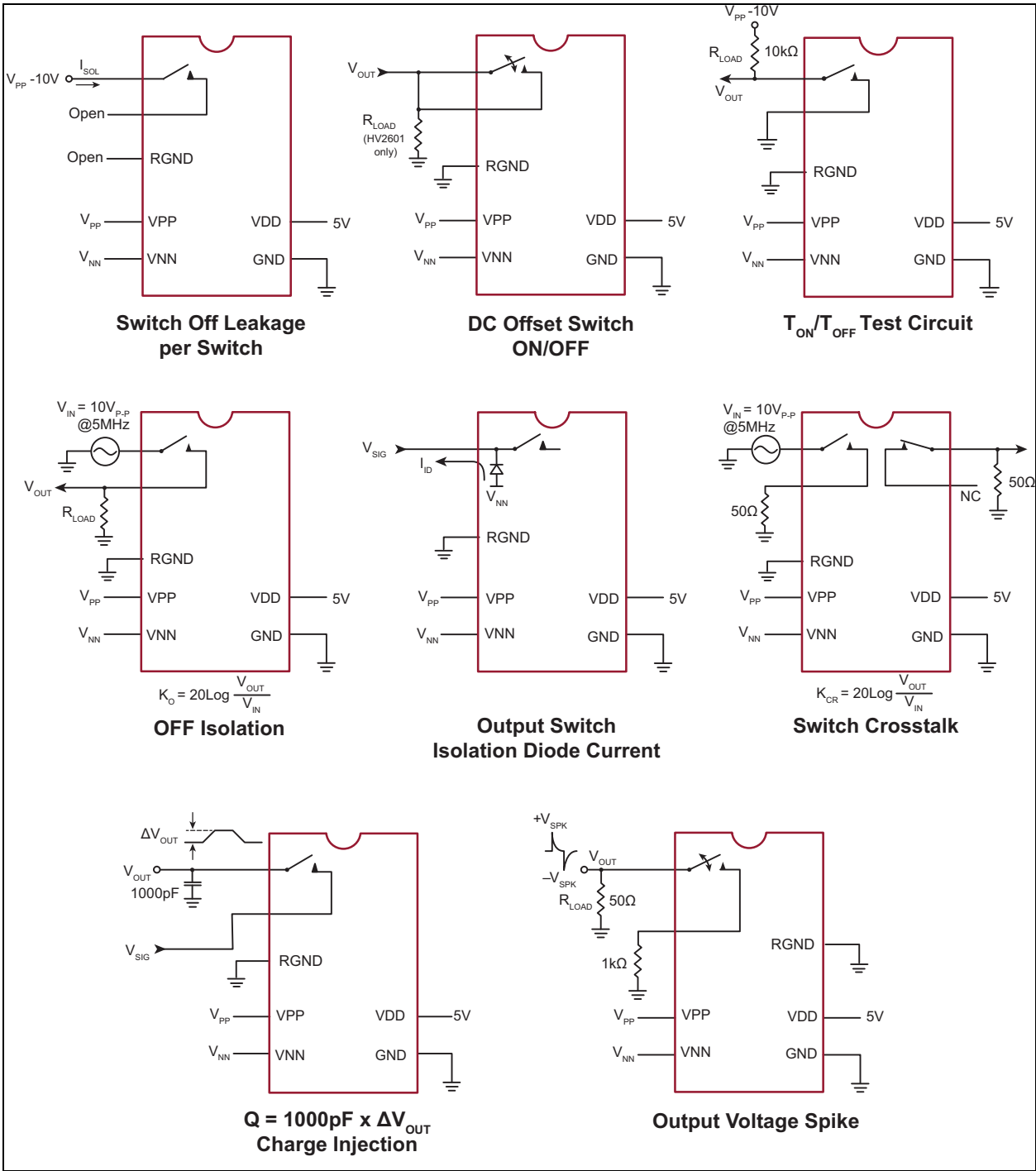


FIGURE 3-1: Test Circuits.

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	L	—		—	—		—	—	—
—	—	—	—	—	—	H	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.

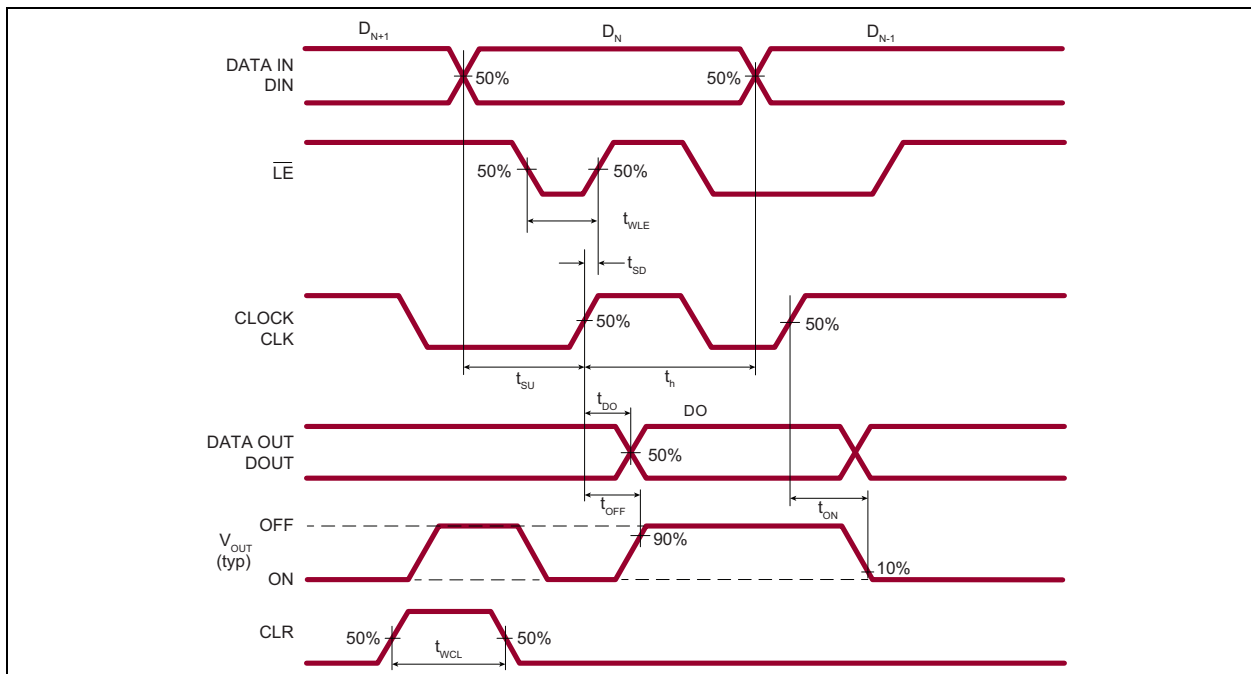


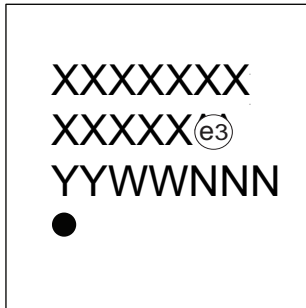
FIGURE 3-2: Logic Timing Waveforms.

4.0 PACKAGING INFORMATION†

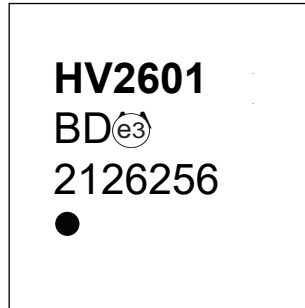
4.1 Package Marking Information

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

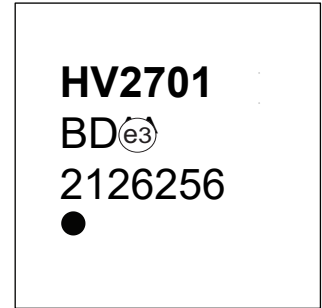
42-Ball Bumped Die



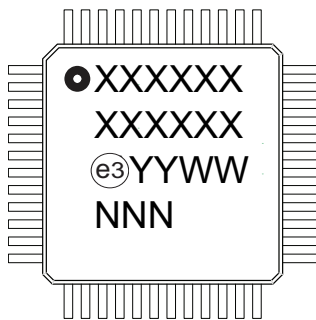
Example



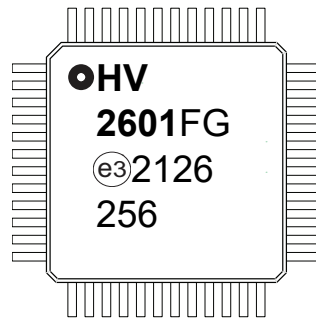
Example



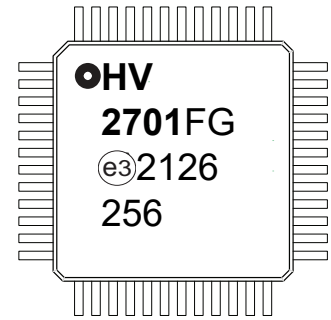
48-Lead LQFP



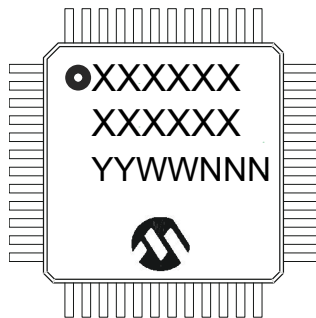
Example



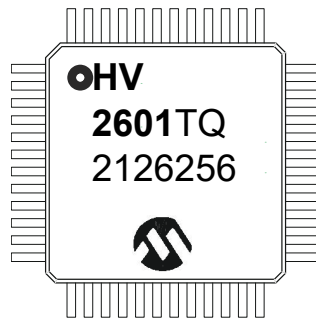
Example



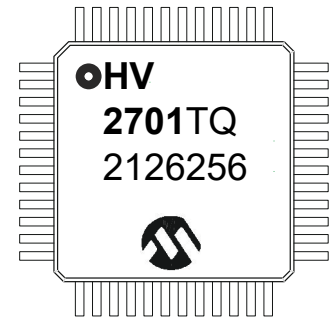
48-Lead TQFP



Example



Example



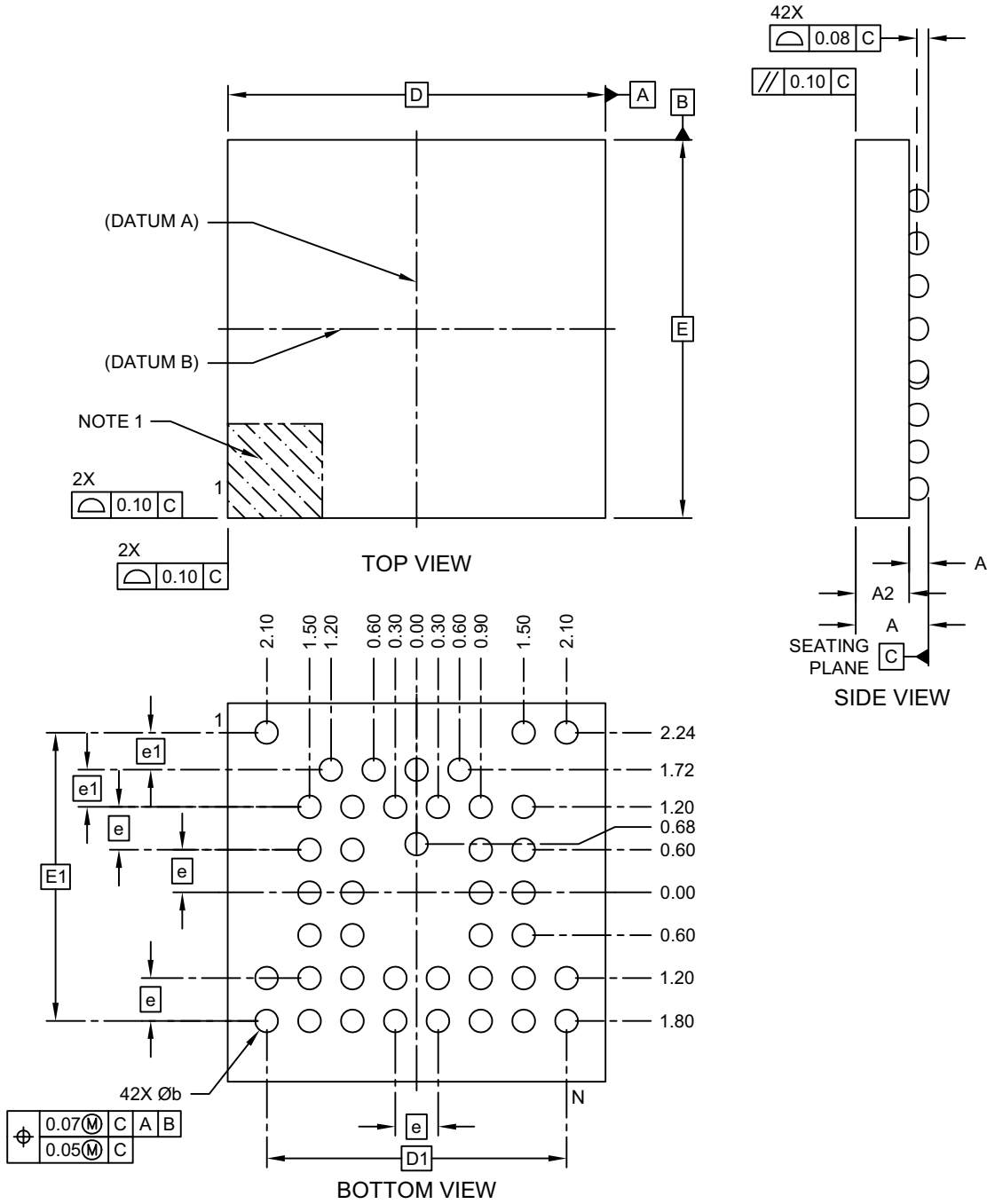
Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package 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]

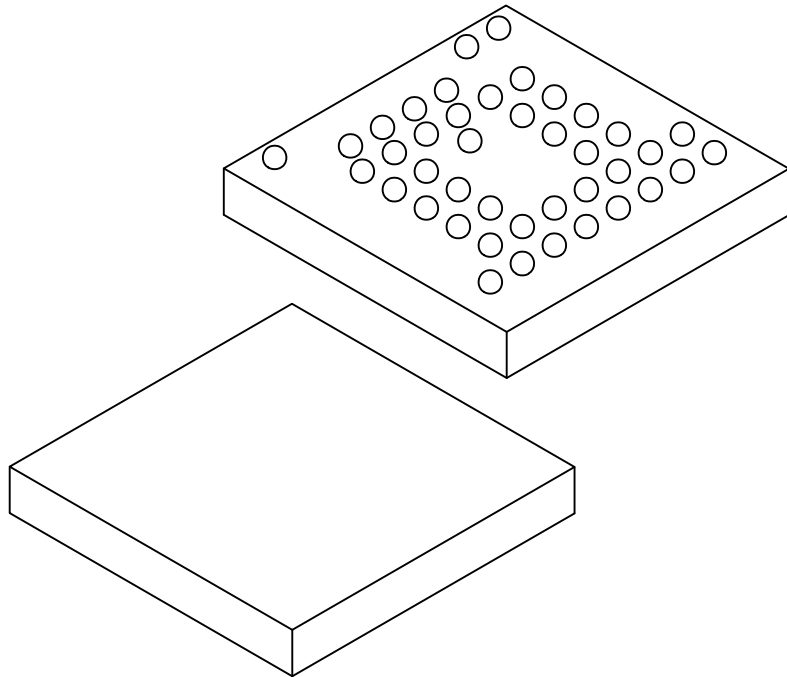
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



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

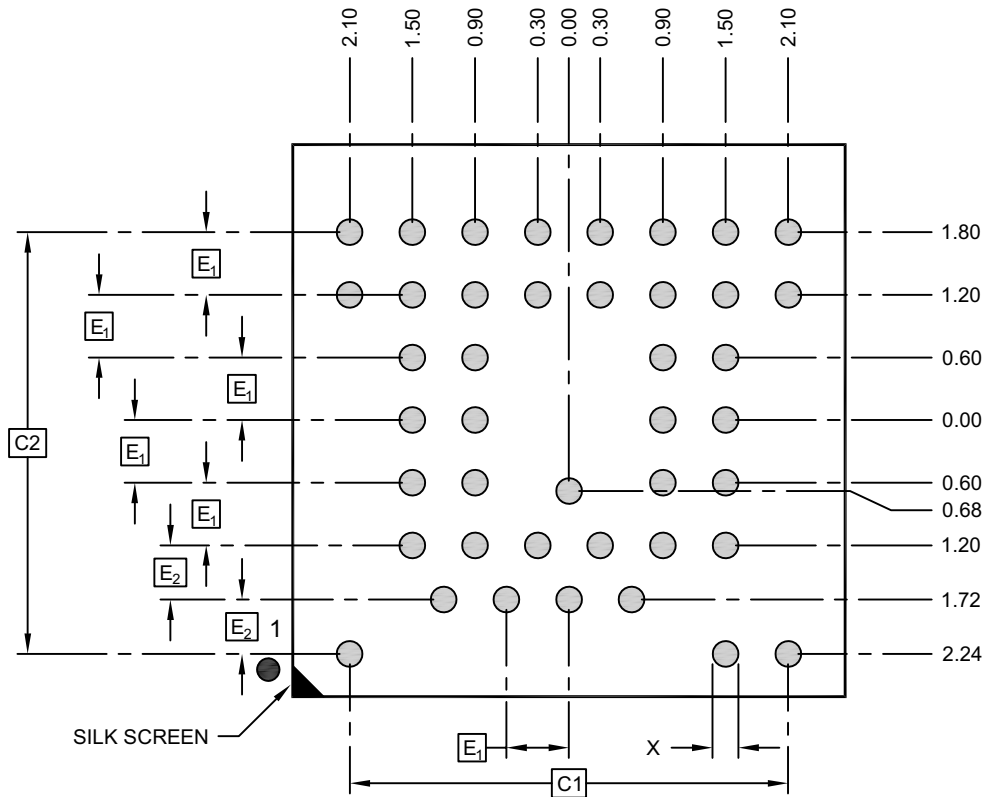
Notes:

- 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	C1		4.20 BSC	
Contact Pad Spacing	C2		4.04 BSC	
Contact Pad Width (Xnn)	X			0.25

Notes:

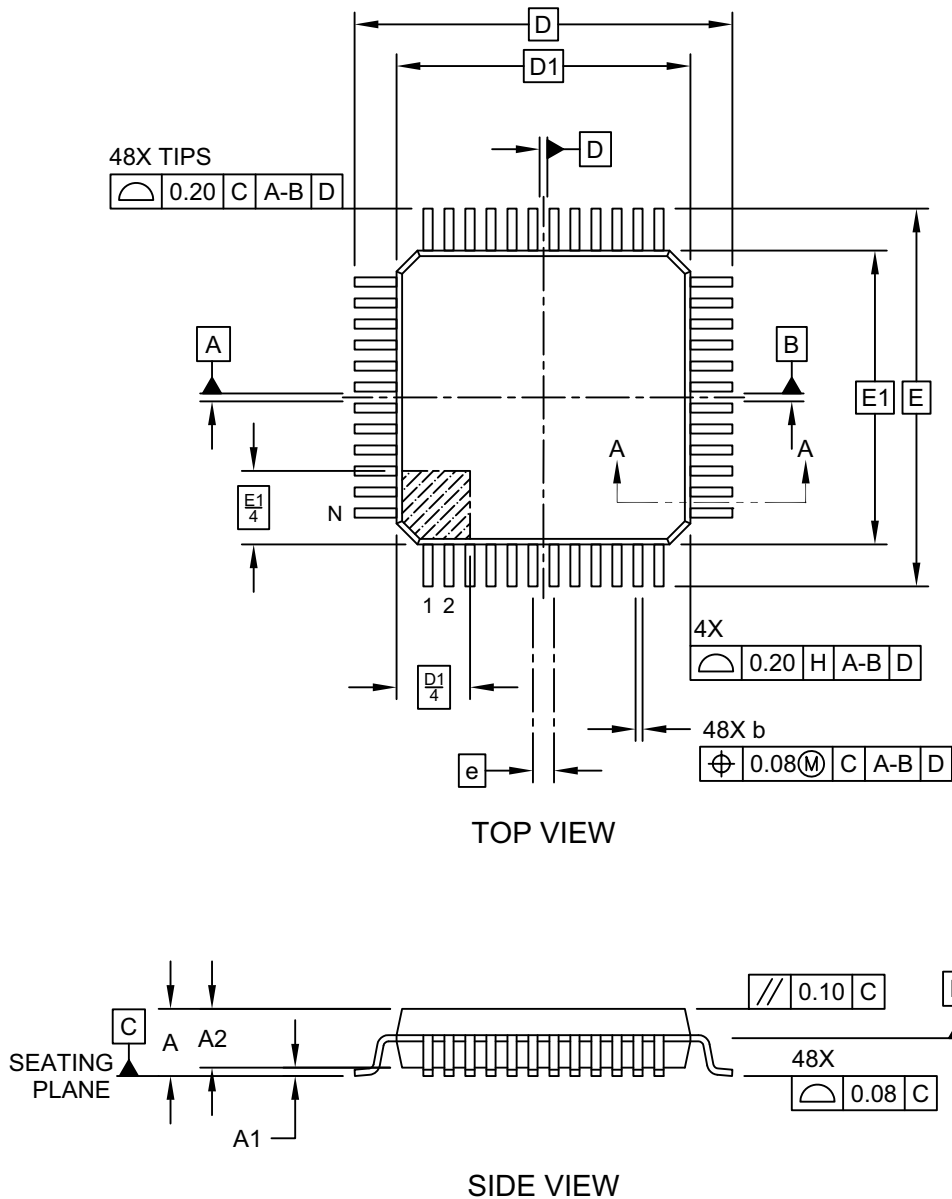
1. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

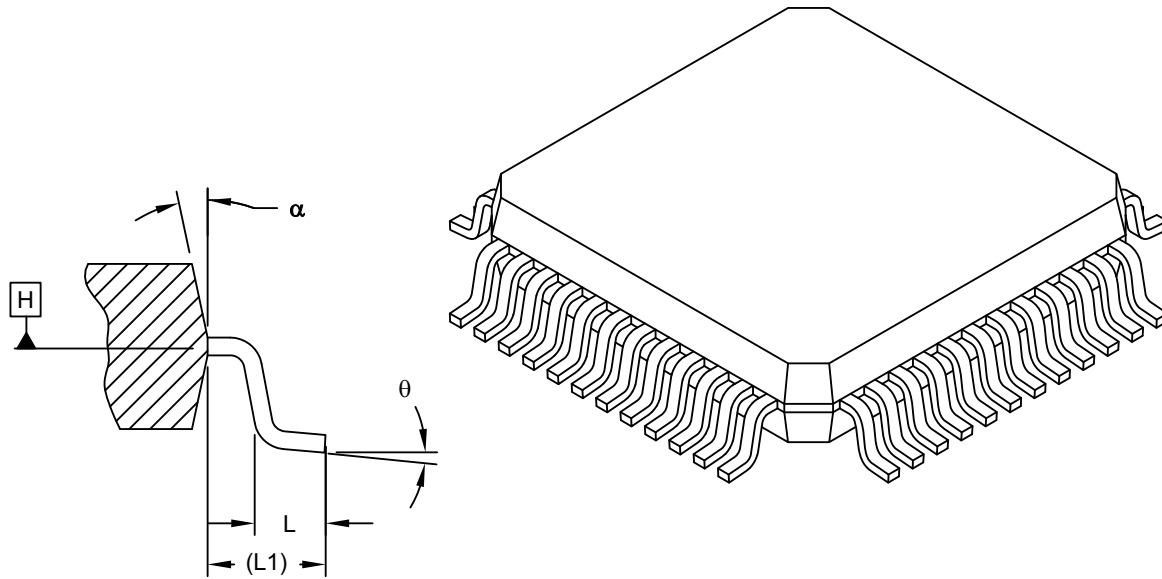
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



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	θ	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	α	11°	12°	13°

Notes:

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

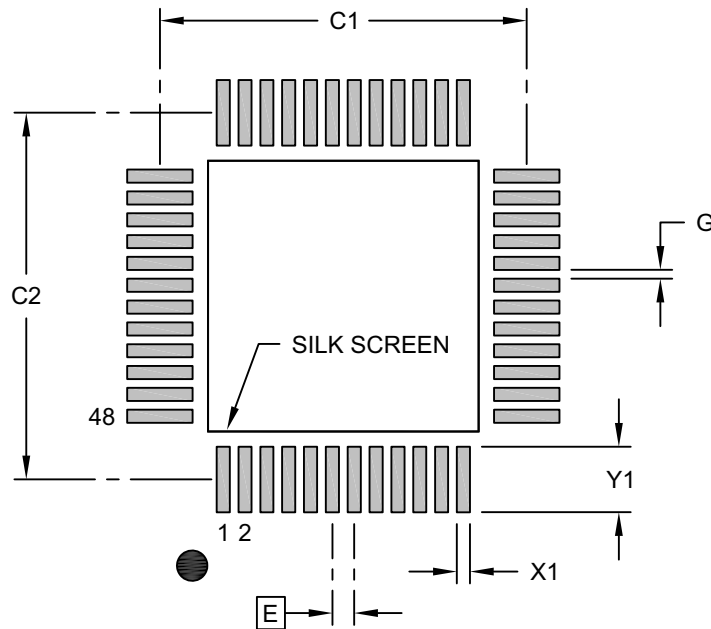
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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:

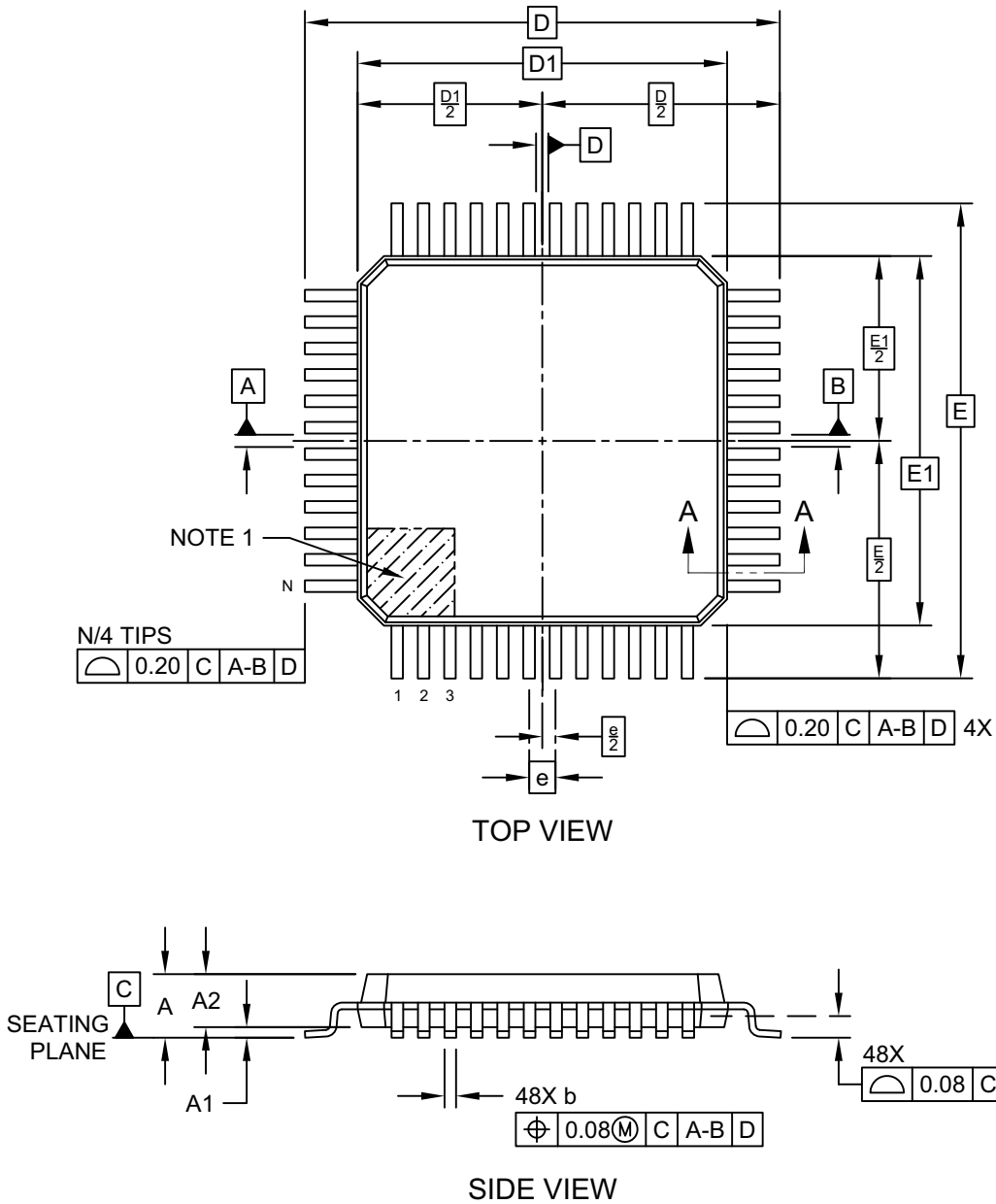
- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2278 Rev A

HV2601/HV2701

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

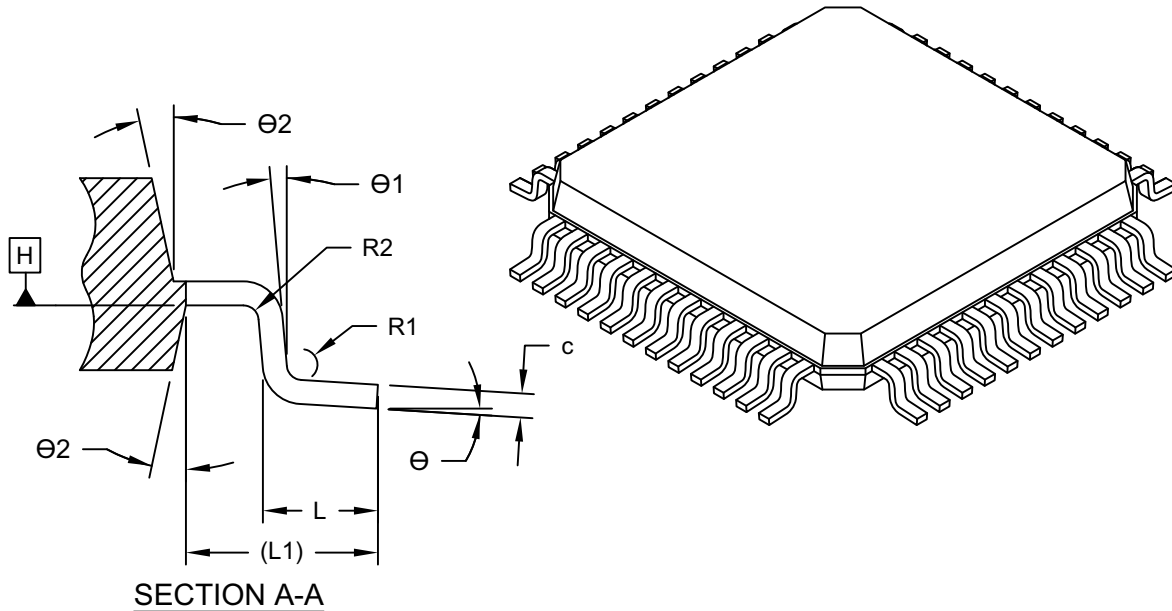
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



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	theta	0°	3.5°	7°
Lead Angle	theta1	0°	-	-
Mold Draft Angle	theta2	11°	12°	13°

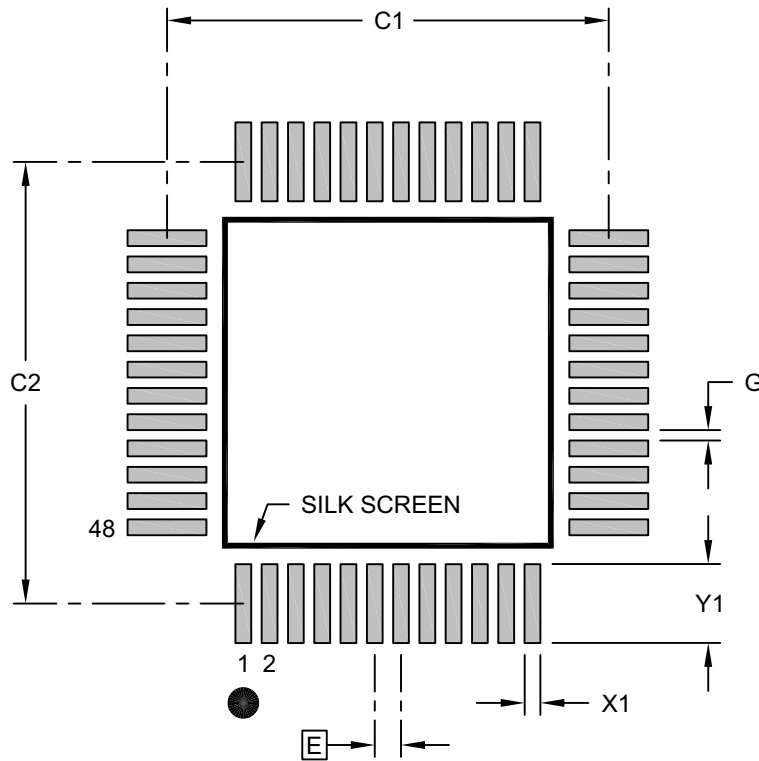
Notes:

- 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:

1. Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. 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

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>Devices:</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>Package:</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>Environmental:</td> <td>G = Lead (Pb)-free/ROHS-compliant package (not used for BD packages)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Media Type:</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>					Devices:	HV2601 = 16-Channel HV Analog Switch					HV2701 = 16-Channel HV Analog Switch with Bleed Resistors				Package:	BD = 42-Ball Bumped Die					FG = 48-lead LQFP					TQ = 48-lead TQFP				Environmental:	G = Lead (Pb)-free/ROHS-compliant package (not used for BD packages)				Media Type:	(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			
Devices:	HV2601 = 16-Channel HV Analog Switch																																																										
	HV2701 = 16-Channel HV Analog Switch with Bleed Resistors																																																										
Package:	BD = 42-Ball Bumped Die																																																										
	FG = 48-lead LQFP																																																										
	TQ = 48-lead TQFP																																																										
Environmental:	G = Lead (Pb)-free/ROHS-compliant package (not used for BD packages)																																																										
Media Type:	(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																																																										
Examples: <ul style="list-style-type: none"> 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:

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at <https://www.microchip.com/en-us/support/design-help/client-support-services>.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, CryptoMemory, CryptoRF, dsPIC, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, Flashtec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, QuietWire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, TrueTime, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, GridTime, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, Knob-on-Display, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, NVM Express, NVMe, Omniscient Code Generation, PICDEM, PICDEM.net, PICKit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SmartHLS, SMART-I.S., storClad, SQL, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, Symmcom, and Trusted Time are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2015-2022, Microchip Technology Incorporated and its subsidiaries.

All Rights Reserved.

ISBN: 978-1-6683-0323-8



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta

Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX

Tel: 512-257-3370

Boston

Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago

Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas

Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit

Novi, MI
Tel: 248-848-4000

Houston, TX

Tel: 281-894-5983

Indianapolis

Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles

Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC

Tel: 919-844-7510

New York, NY

Tel: 631-435-6000

San Jose, CA

Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto

Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880-3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820