



HV5308 / HV5408

32-Channel, Serial-to-Parallel Converter with High-Voltage Push-Pull Outputs

Features

- Processed with High-Voltage CMOS technology
- Low power-level shifting
- Source/sink current minimum 20mA
- Shift register speed 8.0 MHz
- Latched data outputs
- CMOS compatible inputs
- Forward and reverse shifting options
- Diode to V_{PP} allows efficient power recovery

Description

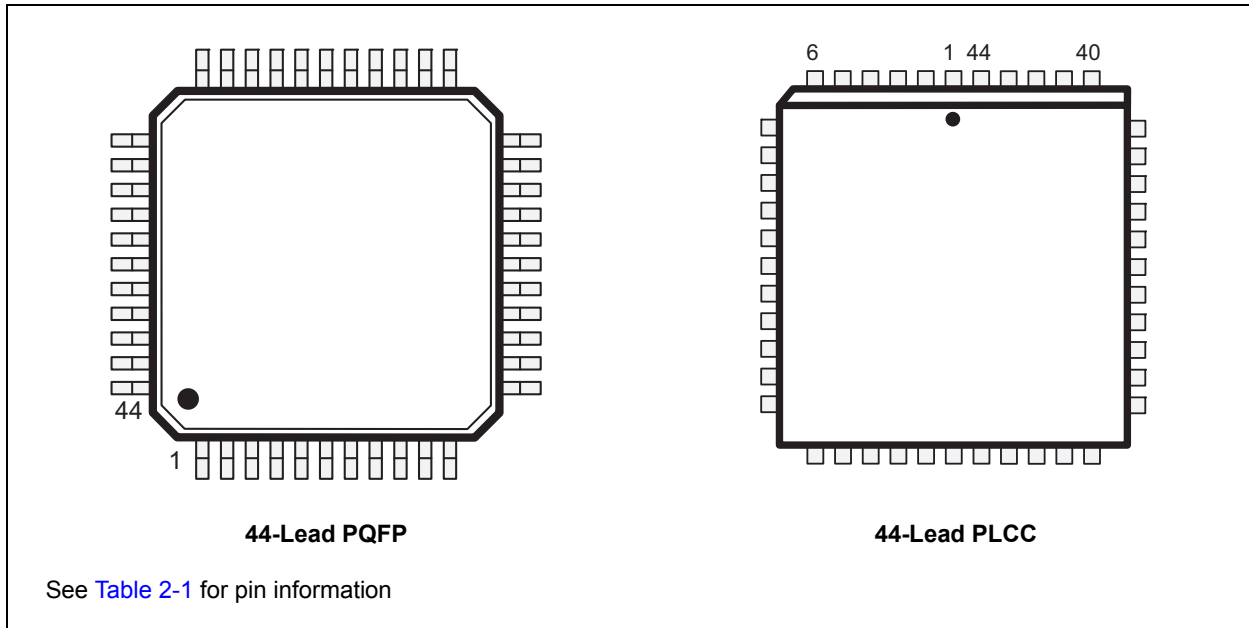
HV5308 and HV5408 are low-voltage serial to high-voltage parallel converters with push-pull outputs. These devices have been designed for use as a driver for AC-electroluminescent displays. HV5308 / HV5408 can also be used in any application requiring multiple output high-voltage, current sourcing, and sinking capabilities such as driving plasma panels, vacuum fluorescent, or large matrix LCD displays.

These devices consist of a 32-bit shift register, 32 latches, and control logic to enable outputs. Data is shifted through the shift register on the low-to-high transition of the clock. HV5308 shifts in the clockwise direction, when viewed from the top of the package, and HV5408 shifts in the counter-clockwise direction.

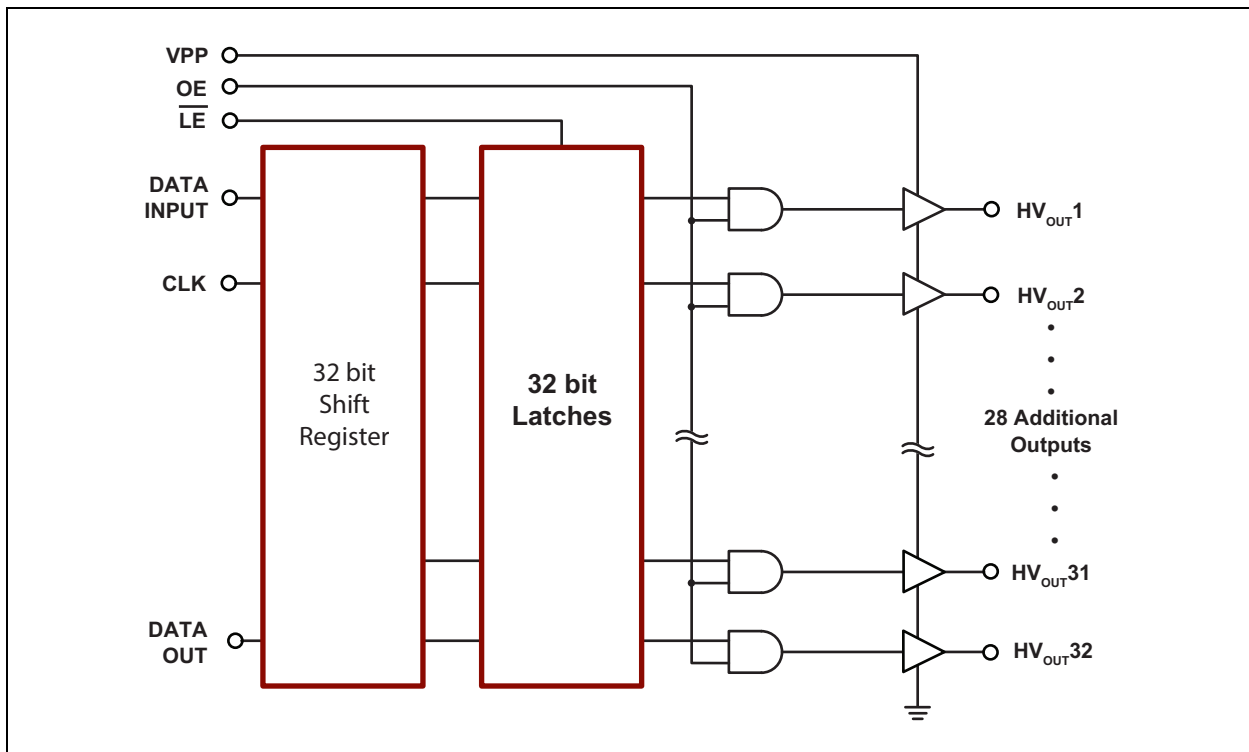
A data output buffer is provided for cascading devices. This output reflects the current status of the last bit of the shift register (32). Operation of the shift register is not affected by the \overline{LE} (latch enable) or the OE (output enable) inputs. Transfer of data from the shift register to the latch occurs when the \overline{LE} input is high. The data in the latch is retained when LE is low.

HV5308 / HV5408

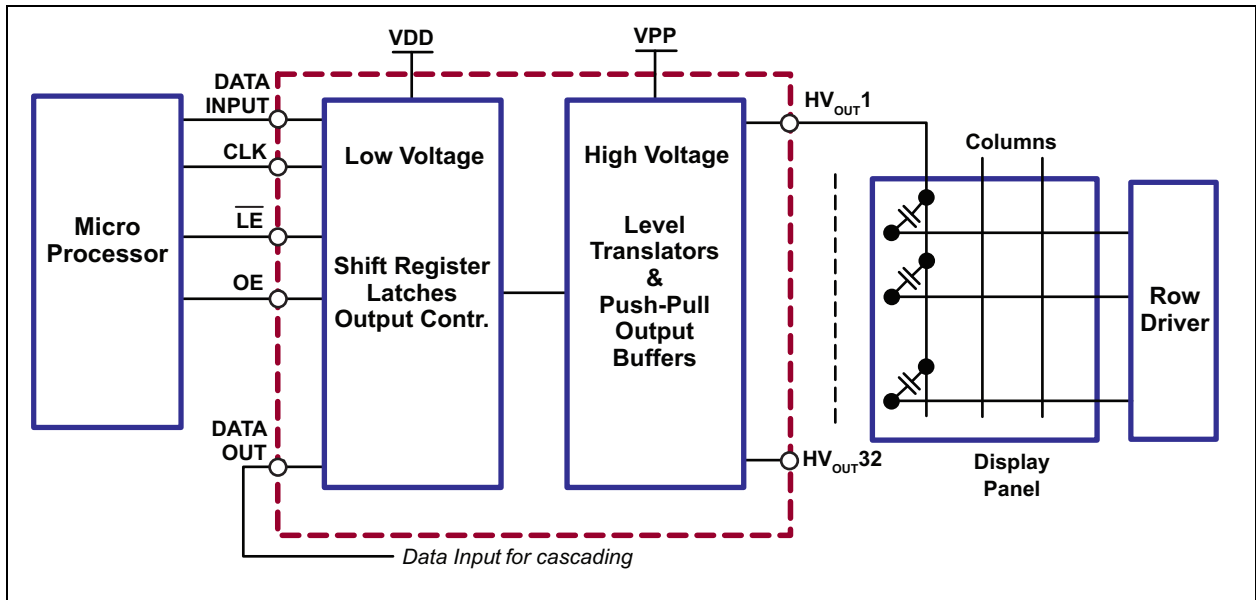
Package Type



Functional Block Diagram



Typical Application Circuit



HV5308 / HV5408

1.0 ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS†

Supply voltage, V_{DD}	-0.5V to +16V
Supply voltage, V_{PP}	-0.5V to +90V
Logic input levels	-0.5V to $V_{DD}+0.5V$
Ground current ¹	1.5A
Continuous total power dissipation ²	1200mW
Operating temperature range	-40°C to +85°C
Storage temperature range	-65°C to +150°C

† **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.

- 1: Duty cycle is limited by the total power dissipated in the package.
- 2: For operation above 25°C ambient derate linearly to maximum operating temperature at 20mW/°C.

ELECTRICAL CHARACTERISTICS

Electrical Specifications: $V_{PP} = 60V$, $V_{DD} = 12V$, $T_A = 25^\circ C$						
Parameter	Symbol	Min	Max	Units	Conditions	
DC Characteristics						
V_{PP} supply current	I_{PP}	-	0.5	mA	HV _{OUTPUTS} high to low	
I_{DD} supply current (quiescent)	I_{DDQ}	-	100	μA	All inputs = V_{DD} or GND	
I_{DD} supply current (operating)	I_{DD}	-	15	mA	$V_{DD} = V_{DD} \text{ max}$, $f_{CLK} = 8.0\text{MHz}$	
High level logic input current	I_{IH}	-	1.0	μA	$V_{IN} = V_{DD}$	
Low level logic input current	I_{IL}	-	-1.0	μA	$V_{IN} = 0$	
High level output voltage	HV _{OUT}	V_{OH}	52	-	V	$I_{OH} = -20\text{mA}$, -40 to 85°C $I_{OH} = -15\text{mA}$, -55 to 125°C
	Data out		10.5	-	V	$I_O = -100\mu A$
Low level output voltage	HV _{OUT}	V_{OL}	-	8.0	V	$I_{OL} = 20\text{mA}$, -40 to 85°C $I_{OL} = 15\text{mA}$, -55 to 125°C
	Data out		-	1.0	V	$I_O = 100\mu A$
HV output clamp diode voltage	V_{OC}	-	-1.5	V	$I_{OL} = -100\text{mA}$	
AC Characteristics						
Clock frequency	f_{CLK}	-	8.0	MHz	---	
Clock width, High or Low	t_{WL} or t_{WH}	62	-	ns	---	
Setup time before CLK rises	t_{SU}	25	-	ns	---	
Hold time after CLK rises	t_H	10	-	ns	---	
Data output delay after L to H CLK	t_{DLH} (Data)	-	110	ns	$C_L = 15\text{pF}$, (Note 1)	
Data output delay after H to L CLK	t_{DHL} (Data)	-	110	ns	$C_L = 15\text{pF}$, (Note 1)	
\overline{LE} delay after L to H CLK	t_{DLE}	50	-	ns	(Note 1)	
Width of \overline{LE} pulse	t_{WLE}	50	-	ns	---	
\overline{LE} setup time before L to H CLK	t_{SLE}	50	-	ns	(Note 1)	
Delay from \overline{LE} to HV _{OUT} , L to H	t_{ON}	-	500	ns	(Note 1)	
Delay from \overline{LE} to HV _{OUT} , H to L	t_{OFF}	-	500	ns	(Note 1)	

Note 1: L to H = Low to High; H to L = High to Low.

TEMPERATURE SPECIFICATIONS

Electrical Specifications: Unless otherwise specified, for all specifications $T_A = T_J = +25^\circ\text{C}$						
Parameter	Symbol	Min	Typ	Max	Units	Conditions
Temperature Ranges						
Operating Temperature		-40	–	85	$^\circ\text{C}$	
Storage Temperature		-65	–	150	$^\circ\text{C}$	
Package Thermal Resistances						
Thermal Resistance, 44-Lead PQFP	θ_{ja}	–	51	–	$^\circ\text{C/W}$	
Thermal Resistance, 44-Lead PLCC	θ_{ja}	–	37	–	$^\circ\text{C/W}$	

HV5308 / HV5408

2.0 PIN DESCRIPTION

The locations of the pins are listed in [Package Type](#).

TABLE 2-1: PIN DESCRIPTION PQFP

Pin #	HV5308	HV5408	Description
1	HV _{OUT} 22	HV _{OUT} 11	High voltage outputs. High voltage push-pull outputs, which, depending on controlling low voltage data, can drive loads either to GND, or to V _{PP} rail levels.
2	HV _{OUT} 21	HV _{OUT} 12	
3	HV _{OUT} 20	HV _{OUT} 13	
4	HV _{OUT} 19	HV _{OUT} 14	
5	HV _{OUT} 18	HV _{OUT} 15	
6	HV _{OUT} 17	HV _{OUT} 16	
7	HV _{OUT} 16	HV _{OUT} 17	
8	HV _{OUT} 15	HV _{OUT} 18	
9	HV _{OUT} 14	HV _{OUT} 19	
10	HV _{OUT} 13	HV _{OUT} 20	
11	HV _{OUT} 12	HV _{OUT} 21	
12	HV _{OUT} 11	HV _{OUT} 22	
13	HV _{OUT} 10	HV _{OUT} 23	
14	HV _{OUT} 9	HV _{OUT} 24	
15	HV _{OUT} 8	HV _{OUT} 25	
16	HV _{OUT} 7	HV _{OUT} 26	
17	HV _{OUT} 6	HV _{OUT} 27	
18	HV _{OUT} 5	HV _{OUT} 28	
19	HV _{OUT} 4	HV _{OUT} 29	
20	HV _{OUT} 3	HV _{OUT} 30	
21	HV _{OUT} 2	HV _{OUT} 31	
22	HV _{OUT} 1	HV _{OUT} 32	
23	DATA OUT	DATA OUT	Serial data output. Data output for cascading to the data input of the next device.
24	N/C	N/C	No connect.
25			
26			
27	CLK	CLK	Data shift register clock Input are shifted into the shift register on the positive edge of the clock.
28	GND	GND	Logic and high voltage ground
29	VPP	VPP	High voltage power rail.
30	VDD	VDD	Low voltage logic power rail.
31	\overline{LE}	\overline{LE}	Latch enable input. When \overline{LE} is High, shift register data is transferred into a data latch. When \overline{LE} is Low, data is latched, and new data can be clocked into the shift register.
32	DATA IN	DATA IN	Serial data input. Data needs to be present before each rising edge of the clock.
33	OE	OE	Output enable input. When OE is Low, all HV outputs are forced into a Low state, regardless of data in each channel. When OE is High, all HV outputs reflect data latched.
34	N/C	N/C	No connect.

TABLE 2-1: PIN DESCRIPTION PQFP (CONTINUED)

Pin #	HV5308	HV5408	Description
35	HV _{OUT} 32	HV _{OUT} 1	High voltage outputs. High voltage push-pull outputs, which, depending on controlling low voltage data, can drive loads either to GND, or to V _{PP} rail levels.
36	HV _{OUT} 31	HV _{OUT} 2	
37	HV _{OUT} 30	HV _{OUT} 3	
38	HV _{OUT} 29	HV _{OUT} 4	
39	HV _{OUT} 28	HV _{OUT} 5	
40	HV _{OUT} 27	HV _{OUT} 6	
41	HV _{OUT} 26	HV _{OUT} 7	
42	HV _{OUT} 25	HV _{OUT} 8	
43	HV _{OUT} 24	HV _{OUT} 9	
44	HV _{OUT} 23	HV _{OUT} 10	

TABLE 2-2: PIN DESCRIPTION PLCC

Pin #	HV5308	HV5408	Description
1	HV _{OUT} 17	HV _{OUT} 16	High voltage outputs. High voltage push-pull outputs, which, depending on controlling low voltage data, can drive loads either to GND, or to V _{PP} rail levels.
2	HV _{OUT} 16	HV _{OUT} 17	
3	HV _{OUT} 15	HV _{OUT} 18	
4	HV _{OUT} 14	HV _{OUT} 19	
5	HV _{OUT} 13	HV _{OUT} 20	
6	HV _{OUT} 12	HV _{OUT} 21	
7	HV _{OUT} 11	HV _{OUT} 22	
8	HV _{OUT} 10	HV _{OUT} 23	
9	HV _{OUT} 9	HV _{OUT} 24	
10	HV _{OUT} 8	HV _{OUT} 25	
11	HV _{OUT} 7	HV _{OUT} 26	
12	HV _{OUT} 6	HV _{OUT} 27	
13	HV _{OUT} 5	HV _{OUT} 28	
14	HV _{OUT} 4	HV _{OUT} 29	
15	HV _{OUT} 3	HV _{OUT} 30	
16	HV _{OUT} 2	HV _{OUT} 31	
17	HV _{OUT} 1	HV _{OUT} 32	
18	DATA OUT	DATA OUT	Serial data output. Data output for cascading to the data input of the next device.
19	N/C	N/C	No connect.
20			
21			
22	CLK	CLK	Data shift register clock Input are shifted into the shift register on the positive edge of the clock.
23	GND	GND	Logic and high voltage ground
24	V _{PP}	V _{PP}	High voltage power rail.
25	V _{DD}	V _{DD}	Low voltage logic power rail.
26	LE	LE	Latch enable input. When \overline{LE} is High, shift register data is transferred into a data latch. When \overline{LE} is Low, data is latched, and new data can be clocked into the shift register.

HV5308 / HV5408

TABLE 2-2: PIN DESCRIPTION PLCC (CONTINUED)

Pin #	HV5308	HV5408	Description
27	DATA IN	DATA IN	Serial data input. Data needs to be present before each rising edge of the clock.
28	OE	OE	Output enable input. When OE is Low, all HV outputs are forced into a LOW state, regardless of data in each channel. When OE is High, all HV outputs reflect data latched.
29	N/C	N/C	No connect.
30	HVOUT32	HV _{OUT1}	High voltage outputs. High voltage push-pull outputs, which, depending on controlling low voltage data, can drive loads either to GND, or to V _{PP} rail levels.
31	HVOUT31	HV _{OUT2}	
32	HVOUT30	HV _{OUT3}	
33	HVOUT29	HV _{OUT4}	
34	HVOUT28	HV _{OUT5}	
35	HVOUT27	HV _{OUT6}	
36	HVOUT26	HV _{OUT7}	
37	HVOUT25	HV _{OUT8}	
38	HVOUT24	HV _{OUT9}	
39	HVOUT23	HV _{OUT10}	
40	HVOUT22	HV _{OUT11}	
41	HVOUT21	HV _{OUT12}	
42	HVOUT20	HV _{OUT13}	
43	HVOUT19	HV _{OUT14}	
44	HVOUT18	HV _{OUT15}	

3.0 FUNCTIONAL DESCRIPTION

Table 3-1 provides functional information about HV5308 / HV5408.

TABLE 3-1: FUNCTIONAL TABLE CLK

DATA IN	CLK	DATA OUT
H	↑	H
L	↑	L
X	No ↑	No change

Note: H = High level, L = Low level, ↑ = Low-to-High transition

TABLE 3-2: FUNCTIONAL TABLE \overline{LE} , OE

DATA IN	\overline{LE}	OE	HV _{OUT}
X	X	L	All HV _{OUT} = Low
X	L	H	Previous latched data
H	H	H	H
L	H	H	L

Note: H = High level, L = Low level, X= Don't Care

TABLE 3-3: RECOMMENDED OPERATING CONDITIONS (-40°C to 85°C)

Symbol	Parameter	Min	Max	Units
V _{DD}	Logic voltage supply	10.8	13.2	V
V _{PP}	High voltage supply	8.0	80	V
V _{IH}	Input high voltage	V _{DD} - 2.0	V _{DD}	V
V _{IL}	Input low voltage	0	2.0	V
f _{CLK}	Clock frequency	0	8.0	MHz

3.1 Power-Up and Recommended Operating Conditions

To power-up HV5308 / HV5408, perform the following power-up sequence:

1. Connect ground
2. Apply V_{DD}
3. Set all inputs (Data, CLK, \overline{LE} , etc.) to a known state
4. Apply V_{PP}
5. The V_{PP} should not fall below V_{DD} or float during operation.

To power-down the device, reverse the steps above.

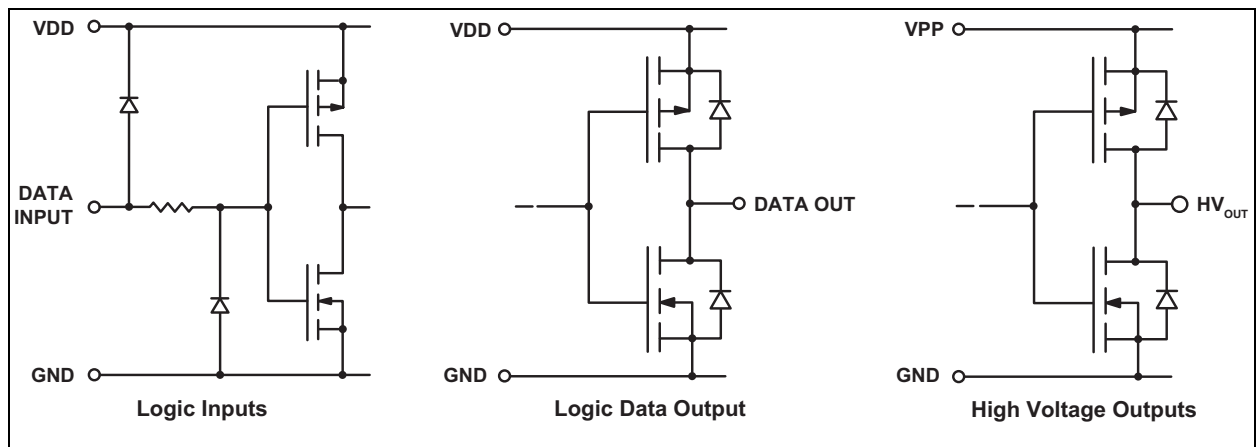


FIGURE 3-1: Input and Output Equivalent Circuits

HV5308 / HV5408

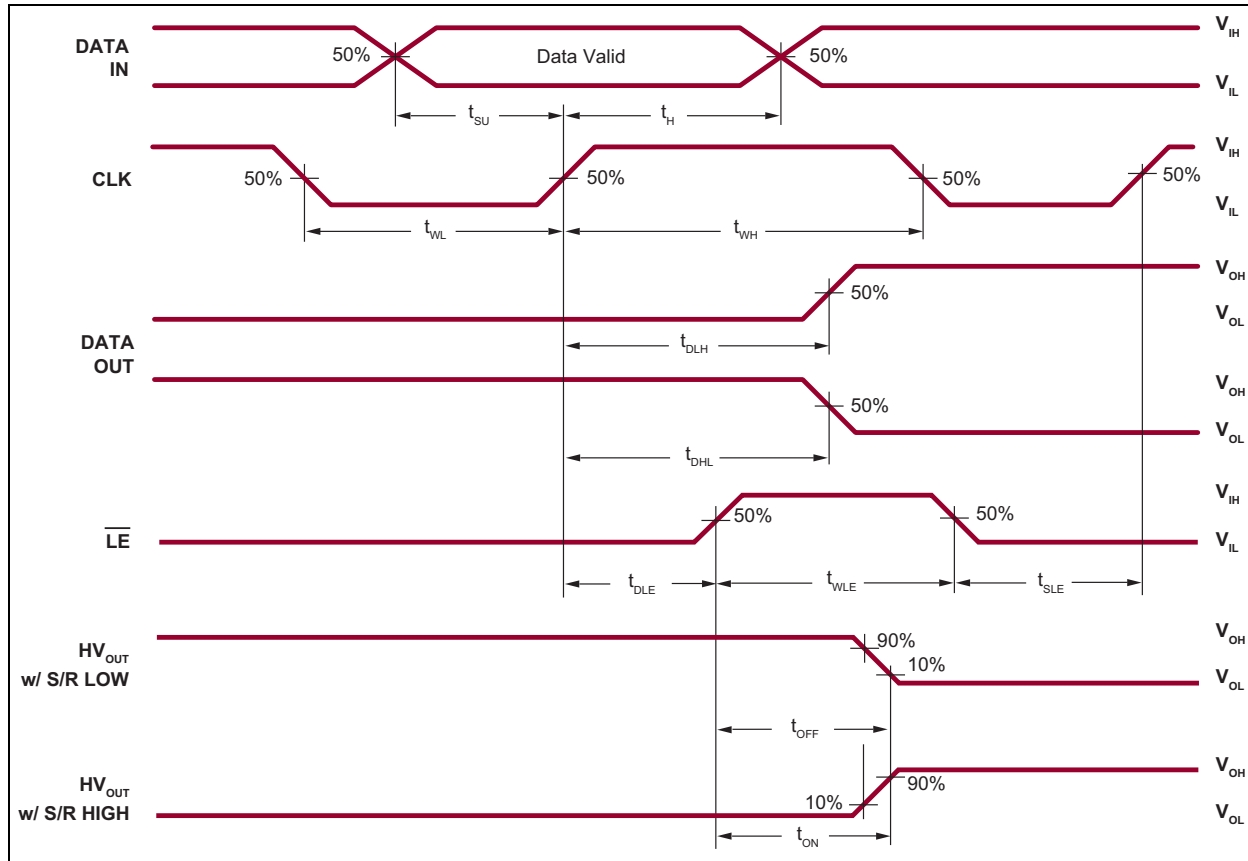
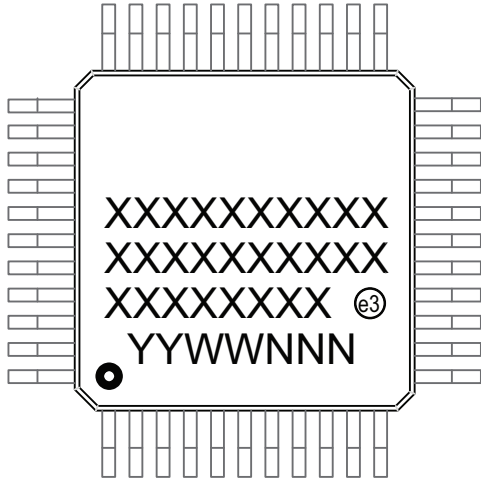


FIGURE 3-2: Switching Waveforms

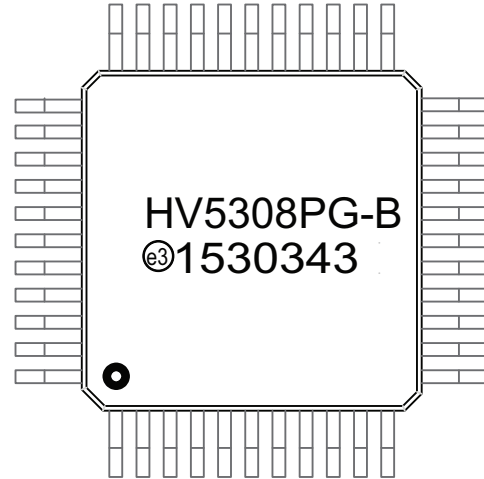
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

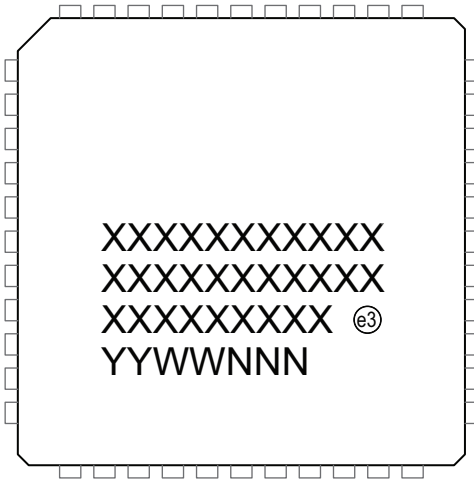
44-lead PQFP



Example



44-lead PLCC



Example

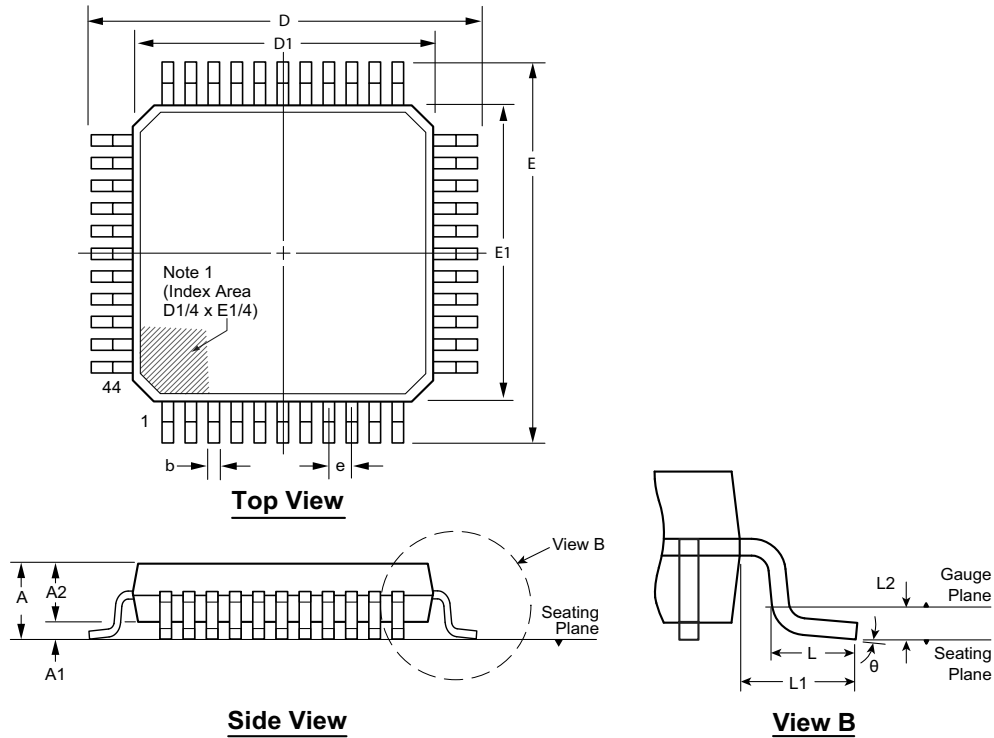


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package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

HV5308 / HV5408

44-Lead PQFP Package Outline (PG)

10.00x10.00mm body, 2.35mm height (max), 0.80mm pitch



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

Note:

1. A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.

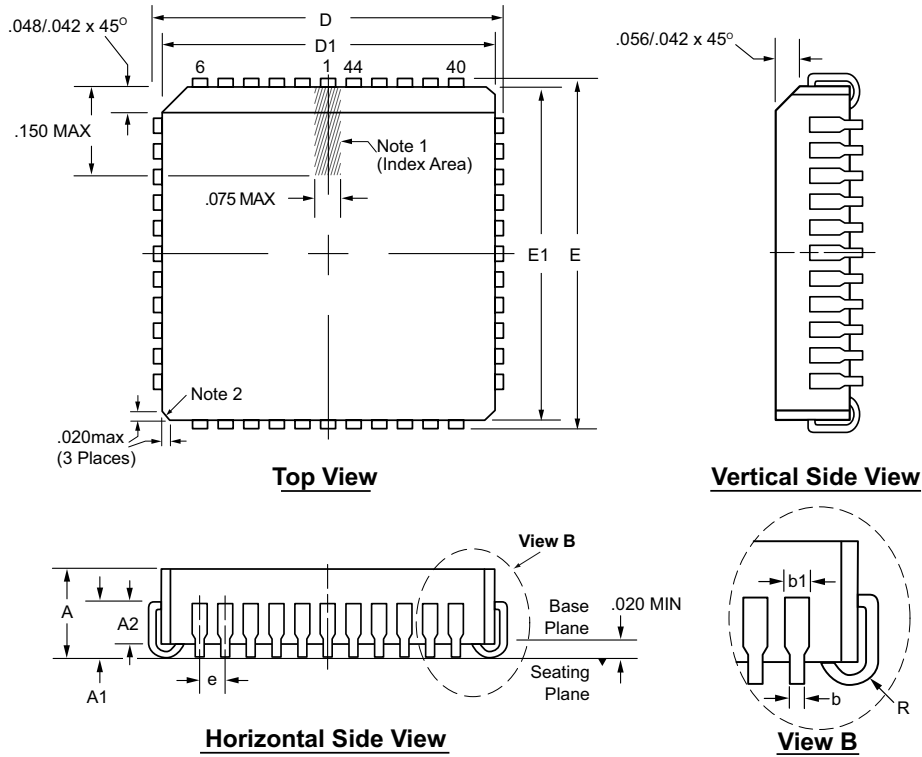
Symbol	A	A1	A2	b	D	D1	E	E1	e	L	L1	L2	θ	
Dimension (mm)	MIN	1.95*	0.00	1.95	0.30	13.65*	9.80*	13.65*	9.80*	0.80 BSC	0.73	1.95 REF	0.25 BSC	0°
	NOM	-	-	2.00	-	13.90	10.00	13.90	10.00		0.88			3.5°
	MAX	2.35	0.25	2.10	0.45	14.15*	10.20*	14.15*	10.20*		1.03			7°

JEDEC Registration MO-112, Variation AA-2, Issue B, Sep.1995.

* This dimension is not specified in the JEDEC drawing.

Drawings not to scale.

44-Lead PLCC Package Outline (PJ) .653x.653in body, .180in height (max), .050in pitch



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

Notes:

1. A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.
2. Actual shape of this feature may vary.

Symbol	A	A1	A2	b	b1	D	D1	E	E1	e	R
Dimension (inches)	MIN	.165	.090	.062	.013	.685	.650	.685	.650	.050 BSC	.025
	NOM	.172	.105	-	-	.690	.653	.690	.653		.035
	MAX	.180	.120	.083	.021	.695	.656	.695	.656		.045

JEDEC Registration MS-018, Variation AC, Issue A, June, 1993.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

HV5308 / HV5408

APPENDIX A: REVISION HISTORY

Revision A (December 2015)

- Updated file to Microchip format

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>	XX	-	X	-	X	-	X
Device	Package Options		Version		Environmental		Media Type
<p>Device:</p> <p style="margin-left: 20px;">HV5308 = 32-Channel Serial to Parallel Converter, with High-voltage Push-pull Outputs data shifts in clockwise direction</p> <p style="margin-left: 20px;">HV5408 = 32-Channel Serial to Parallel Converter, with High-voltage Push-pull Outputs data shifts in counter-clockwise direction</p> <p>Package:</p> <p style="margin-left: 20px;">PG = 44-Lead PQFP</p> <p style="margin-left: 20px;">PJ = 44-Lead PLCC</p> <p>Version</p> <p style="margin-left: 20px;">B = Revision B</p> <p>Environmental</p> <p style="margin-left: 20px;">G = Lead (Pb)-free/ROHS-compliant package</p> <p>Media Type:</p> <p style="margin-left: 20px;">(blank) = 96/Tray for PG package</p> <p style="margin-left: 20px;"> = 27/Tube for PJ package</p> <p style="margin-left: 20px;">M903 = 500/Reel for PG package</p> <p style="margin-left: 20px;">M919 = 500/Reel for PJ package</p>	<p>Examples:</p> <p>a) HV5308PG-B-G Clockwise data shift, 44-Lead PQFP package, 96/Tray</p> <p>b) HV5308PG-B-G-M919 Clockwise data shift, 44-Lead PQFP package, 500/Reel</p> <p>c) HV5308PJ-B-G Clockwise data shift, 44-Lead PLCC package, 27/Tube</p> <p>d) HV5308PJ-B-G-M903 Clockwise data shift, 44-Lead PLCC package, 500/Reel</p> <p>e) HV5408PG-B-G Counter-clockwise data shift, 44-Lead PQFP package, 96/Tray</p> <p>f) HV5408PJ-B-G Counter-clockwise data shift, 44-Lead PLCC package, 27/Tube</p>						

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

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like 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. 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 ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. 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.

Trademarks

The Microchip name and logo, the Microchip logo, dsPIC, FlashFlex, flexPWR, JukeBlox, KEELOQ, KEELOQ logo, Kleer, LANCheck, MediaLB, MOST, MOST logo, MPLAB, OptoLyzer, PIC, PICSTART, PIC³² logo, RightTouch, SpyNIC, SST, SST Logo, SuperFlash and UNI/O are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

The Embedded Control Solutions Company and mTouch are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, BodyCom, chipKIT, chipKIT logo, CodeGuard, dsPICDEM, dsPICDEM.net, ECAN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, KleerNet, KleerNet logo, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, RightTouch logo, REAL ICE, SQI, Serial Quad I/O, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, 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.

Silicon Storage Technology is a registered trademark 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, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-0073-8

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
== ISO/TS 16949 ==

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC[®] MCUs and dsPIC[®] DSCs, KEELOQ[®] code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.



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](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

Cleveland

Independence, OH

Tel: 216-447-0464

Fax: 216-447-0643

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

Los Angeles

Mission Viejo, CA

Tel: 949-462-9523

Fax: 949-462-9608

New York, NY

Tel: 631-435-6000

San Jose, CA

Tel: 408-735-9110

Canada - Toronto

Tel: 905-673-0699

Fax: 905-673-6509

ASIA/PACIFIC

Asia Pacific Office

Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong

Tel: 852-2943-5100

Fax: 852-2401-3431

Australia - Sydney

Tel: 61-2-9868-6733

Fax: 61-2-9868-6755

China - Beijing

Tel: 86-10-8569-7000

Fax: 86-10-8528-2104

China - Chengdu

Tel: 86-28-8665-5511

Fax: 86-28-8665-7889

China - Chongqing

Tel: 86-23-8980-9588

Fax: 86-23-8980-9500

China - Dongguan

Tel: 86-769-8702-9880

China - Hangzhou

Tel: 86-571-8792-8115

Fax: 86-571-8792-8116

China - Hong Kong SAR

Tel: 852-2943-5100

Fax: 852-2401-3431

China - Nanjing

Tel: 86-25-8473-2460

Fax: 86-25-8473-2470

China - Qingdao

Tel: 86-532-8502-7355

Fax: 86-532-8502-7205

China - Shanghai

Tel: 86-21-5407-5533

Fax: 86-21-5407-5066

China - Shenyang

Tel: 86-24-2334-2829

Fax: 86-24-2334-2393

China - Shenzhen

Tel: 86-755-8864-2200

Fax: 86-755-8203-1760

China - Wuhan

Tel: 86-27-5980-5300

Fax: 86-27-5980-5118

China - Xian

Tel: 86-29-8833-7252

Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen

Tel: 86-592-2388138

Fax: 86-592-2388130

China - Zhuhai

Tel: 86-756-3210040

Fax: 86-756-3210049

India - Bangalore

Tel: 91-80-3090-4444

Fax: 91-80-3090-4123

India - New Delhi

Tel: 91-11-4160-8631

Fax: 91-11-4160-8632

India - Pune

Tel: 91-20-3019-1500

Japan - Osaka

Tel: 81-6-6152-7160

Fax: 81-6-6152-9310

Japan - Tokyo

Tel: 81-3-6880-3770

Fax: 81-3-6880-3771

Korea - Daegu

Tel: 82-53-744-4301

Fax: 82-53-744-4302

Korea - Seoul

Tel: 82-2-554-7200

Fax: 82-2-558-5932 or

82-2-558-5934

Malaysia - Kuala Lumpur

Tel: 60-3-6201-9857

Fax: 60-3-6201-9859

Malaysia - Penang

Tel: 60-4-227-8870

Fax: 60-4-227-4068

Philippines - Manila

Tel: 63-2-634-9065

Fax: 63-2-634-9069

Singapore

Tel: 65-6334-8870

Fax: 65-6334-8850

Taiwan - Hsin Chu

Tel: 886-3-5778-366

Fax: 886-3-5770-955

Taiwan - Kaohsiung

Tel: 886-7-213-7828

Taiwan - Taipei

Tel: 886-2-2508-8600

Fax: 886-2-2508-0102

Thailand - Bangkok

Tel: 66-2-694-1351

Fax: 66-2-694-1350

EUROPE

Austria - Wels

Tel: 43-7242-2244-39

Fax: 43-7242-2244-393

Denmark - Copenhagen

Tel: 45-4450-2828

Fax: 45-4485-2829

France - Paris

Tel: 33-1-69-53-63-20

Fax: 33-1-69-30-90-79

Germany - Dusseldorf

Tel: 49-2129-3766400

Germany - Karlsruhe

Tel: 49-721-625370

Germany - Munich

Tel: 49-89-627-144-0

Fax: 49-89-627-144-44

Italy - Milan

Tel: 39-0331-742611

Fax: 39-0331-466781

Italy - Venice

Tel: 39-049-7625286

Netherlands - Drunen

Tel: 31-416-690399

Fax: 31-416-690340

Poland - Warsaw

Tel: 48-22-3325737

Spain - Madrid

Tel: 34-91-708-08-90

Fax: 34-91-708-08-91

Sweden - Stockholm

Tel: 46-8-5090-4654

UK - Wokingham

Tel: 44-118-921-5800

Fax: 44-118-921-5820

07/14/15