HV853

High-Voltage Low-Noise Inductorless EL Lamp Driver

Features

- No External Components required when using an External Electroluminescent (EL) Clock Frequency
- EL Frequency can be set by an External Resistor
- Low Noise
- DC to AC Converter
- Drives up to 5.3 nF (approximately 1.5 in^2 Lamp) Load
- Output Voltage Regulation
- Enable Function
- EL Lamp Dimming

Applications

- Cellular Phone Keypad
- Watches
- Small Handheld Wireless Devices
- MP3 Players

General Description

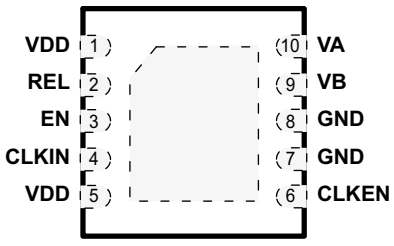
The HV853 is a high-voltage low-noise, inductorless EL lamp driver. It is the low-noise version of the HV852 with improved electromagnetic interference (EMI) performance, operating over an input voltage range of 3.2V to 5V. It is designed to drive EL lamps of up to 1.5 in^2, with capacitive values of up to 5.3 nF. The HV853 converts a low-voltage DC input to a high-voltage AC output across an EL lamp. A nominal regulated output voltage of ±80V is applied to the EL lamp. It uses a charge pump scheme to boost the input voltage, eliminating the need for an external inductor, diode, and high-voltage capacitor commonly found in conventional topologies.

The charge pump circuit discharges its energy into an EL lamp through a high-voltage H-bridge. Once the voltage reaches its regulated limit, it is turned off to conserve power. The EL lamp is then discharged to ground and the H-bridge changes state to allow the charge pump to charge the EL lamp in the opposite direction.

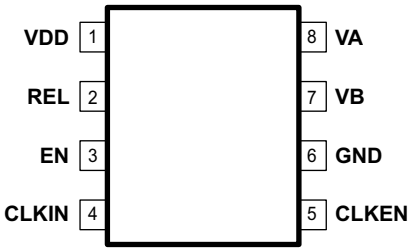
The EL lamp frequency can be set either by an external resistor R_{EL} or by applying an external clock where the clock frequency is divided by 128 to set the EL lamp frequency.

Package Types

10-lead WDFN
(Top view)

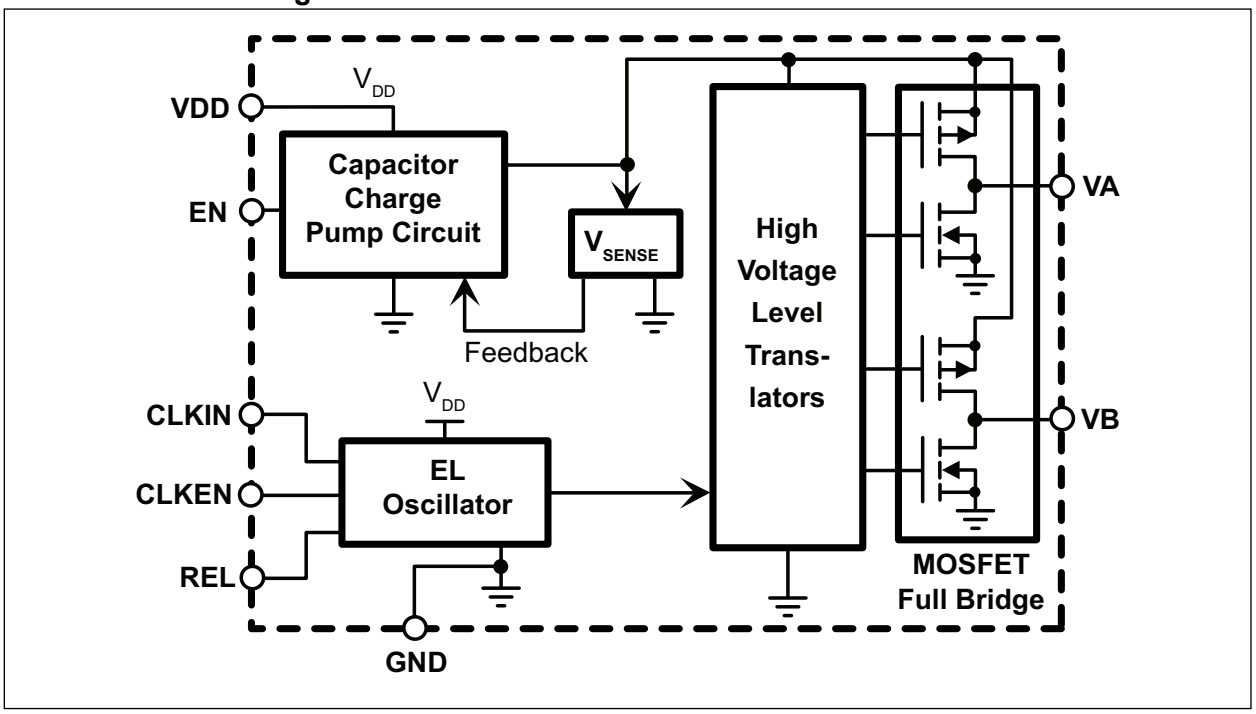


8-lead MSOP
(Top view)

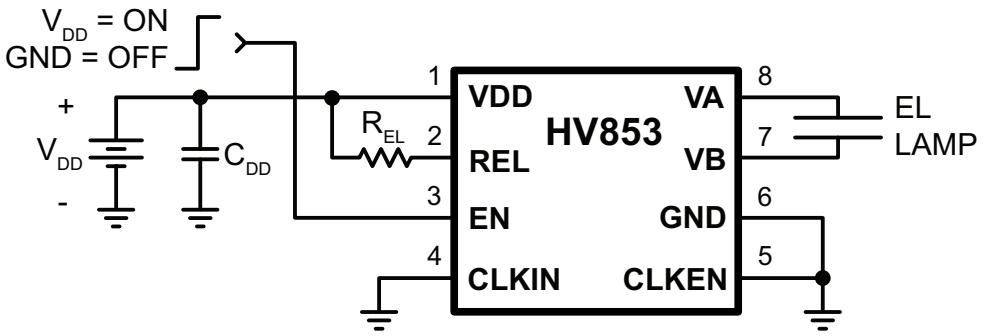


WDFN pads are at the bottom of the package. Center heat slug is at ground potential. See Table 2-1 for pin information.

Functional Block Diagram

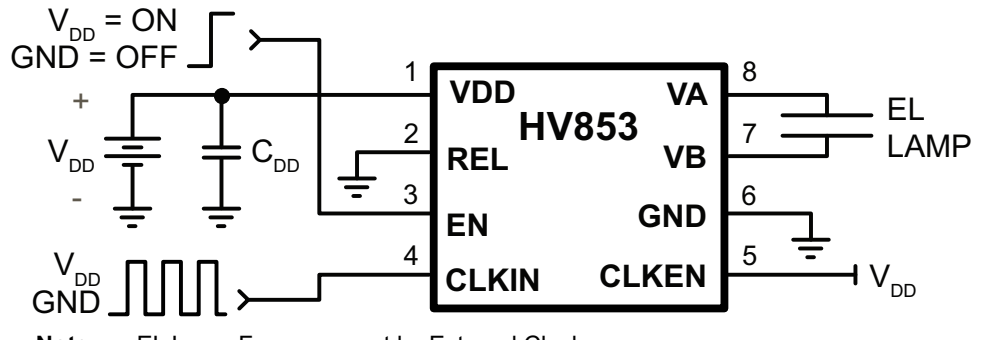


Typical Application Circuit 1



Note: EL Lamp Frequency set by R_EL.

Typical Application Circuit 2



Note: EL Lamp Frequency set by External Clock.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings(†)

Supply Voltage, V_{DD} ..... –0.5V to 6.5V
Storage Temperature Range, T_S ..... –65°C to +150°C
Operating Temperature Range, T_A ..... –25°C to +85°C
Power Dissipation:
10-lead WDFN 1.6W
8-lead MSOP ..... 300 mW

† **Notice:** Stresses above those listed under “Absolute 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 sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Input Voltage	V_{DD}	3.2	—	5	V	
EL Lamp Frequency	f_{EL}	50	—	500	Hz	
EL Lamp Capacitance	C_{LOAD}	0	—	5.3	nF	
Operating Temperature	T_A	–25	—	+85	°C	

ELECTRICAL CHARACTERISTICS

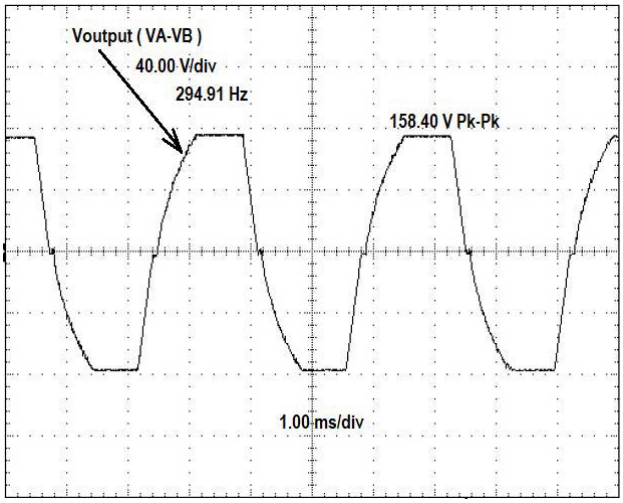
Electrical Specifications: Over recommended operating conditions unless otherwise specified, T_A = 25°C.

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
Quiescent Current	I_{DDQ}	—	—	150	nA	EN = 0V
Peak Output Voltage	V_A or V_B	68	80	92	V	No load
Peak-to-Peak Output Voltage	V_A–V_B	136	160	184	V	
Operating Current	I_{DD}	—	15	30	mA	V_{DD} = 3.5V, R_{EL} = 1.5 MΩ, Load = 3.3 nF +1 kΩ (See Figure 3-1.)
Peak Output Voltage	V_A or V_B	68	80	92	V	
Peak-to-Peak Output Voltage	V_A–V_B	136	160	184	V	
EL Lamp Frequency	f_{EL}	240	280	320	Hz	
Output Voltage Rise Time	t_{rout}	—	450	—	µs	1 in^2 lamp 0V to 90% of final value
Output Voltage Fall Time	t_{fout}	150	—	—	µs	90% to 10% of final value
LOGIC INPUTS						
Input Logic Low Voltage	V_{IL}	0	—	0.5	V	
Input Logic High Voltage	V_{IH}	2	—	VDD	V	
Input Logic Low Current	I_{IL}	—	—	1	µA	
Input Logic High Current	I_{IH}	—	—	1	µA	
Enable Input Rise Time (For Delay Turn-off)	EN_{rise}	0.01	—	10	ms	Using external R-C circuit (See Figure 3-2.)
Enable Input Fall Time (For Delay Turn-off)	EN_{fall}	10µ	—	5	s	
Logic Input Capacitance	C_{in}	—	—	10	pF	

TEMPERATURE SPECIFICATIONS

Parameter	Sym.	Min.	Typ.	Max.	Unit	Conditions
TEMPERATURE RANGE						
Storage Temperature	T_S	–65	—	+150	°C	
Operating Temperature	T_A	–25	—	+85	°C	
PACKAGE THERMAL RESISTANCE						
10-lead WDFN	θ_{JA}	—	41	—	°C/W	
8-lead MSOP	θ_{JA}	—	216	—	°C/W	

Typical Output Waveform



TYPICAL PERFORMANCE

LOAD	R_{EL} (MΩ)	V_{DD} (V)	I_{DD} (mA)	V_A–V_B (V)	f_{EL} (Hz)
3.3 nF + 1 kΩ	1.5	3.2	13.1	158	294
		3.5	12.9	158	
		3.8	12.7	158	
		4.2	12.5	158	
		5	12.3	158	

Note: This table specifies observed performance when driving a 1.0 in^2 green lamp.

2.0 PIN DESCRIPTION

The details on the pins of HV853 are listed in Table 2-1.
See location of pins in **Package Types**.

TABLE 2-1: PIN FUNCTION TABLE

10-lead WDFN Pin Number	8-lead MSOP Pin Number	Pin Name	Description
1	1	VDD	Input supply voltage pin
2	2	REL	An external resistor to V_{DD} will set the EL lamp frequency. The EL frequency is inversely proportional to the R_{EL} resistor value. A 1.5 MΩ resistor would provide a nominal lamp frequency of 280 Hz. $$f_{EL} = \frac{1.5M\Omega \times 280Hz}{R_{EL}}$$ When using an external clock to set the EL lamp frequency, the R_{EL} pin should be connected to ground.
3	3	EN	Enable input pin. Logic high will turn on the device. An external R-C circuit can be added for a delayed turn-off.
4	4	CLKIN	Logic input pin. An external logic clock applied to this pin can be used to set the EL lamp frequency. (See Figure 3-3.) The EL lamp frequency is the external clock frequency divided by 128. This is useful for applications requiring the EL lamp to be synchronized with a system clock. Connect to ground when not in use.
5	—	NC	No connect
6	5	CLKEN	Logic input pin. Logic high will cause the EL lamp frequency to be set by the CLKIN input. Logic low will cause the EL lamp frequency to be set by the external R_{EL} resistor.
7, 8	6	GND	IC ground pin
9	7	VB	EL lamp driver output pin. The EL lamp is connected across V_A and V_B terminals.
10	8	VA	EL lamp driver output pin. The EL lamp is connected across V_A and V_B terminals.

3.0 APPLICATION INFORMATION

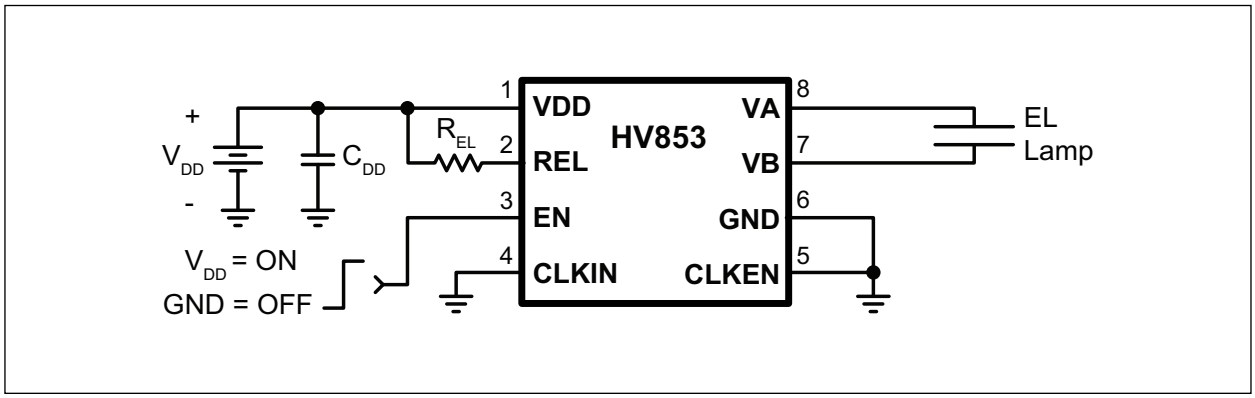


FIGURE 3-1: *Typical Application.*

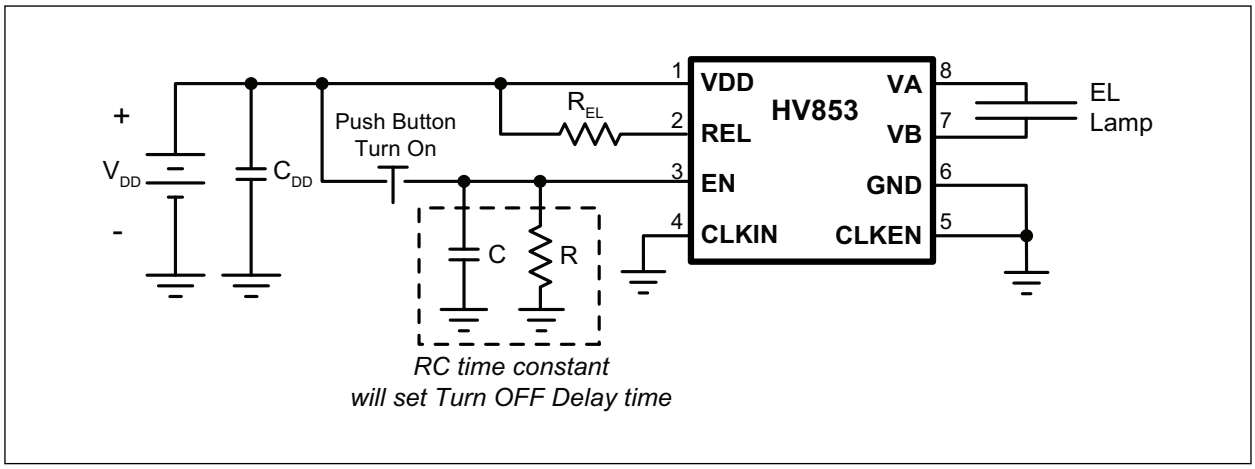


FIGURE 3-2: *Push Button Turn-on with Delay Turn-off.*

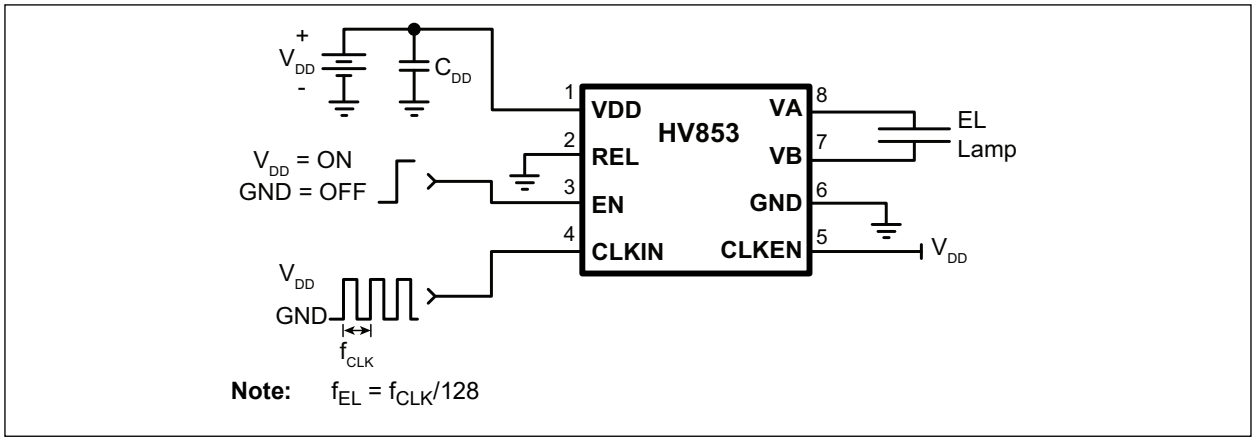


FIGURE 3-3: *Independent Programmable Output Frequency (f_{EL}).*

3.1 EL Lamp Dimming Using PWM

EL lamp dimming can be achieved by applying a PWM signal to the Enable pin. EL Lamp brightness is proportional to the PWM signal duty cycle. This is done by pulse skipping the output pulses. The PWM frequency should be kept below the EL frequency but above 50 Hz to avoid flickering. Refer to Figure 3-4.

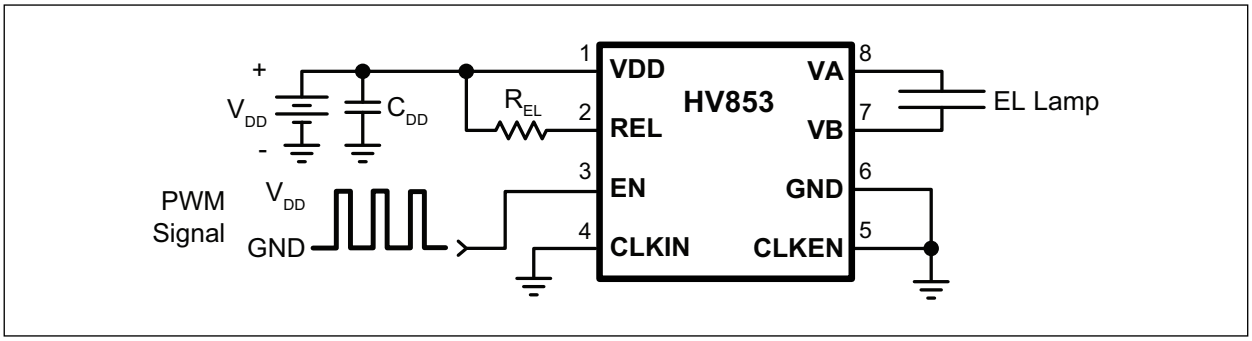
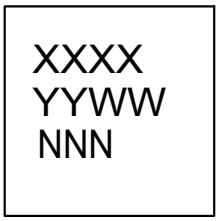


FIGURE 3-4: *PWM Dimming Circuit.*

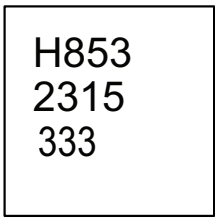
4.0 PACKAGING INFORMATION

4.1 Package Marking Information

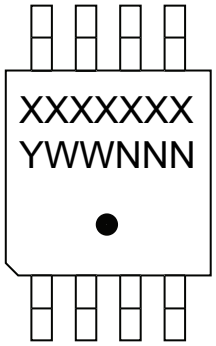
10-lead WDFN



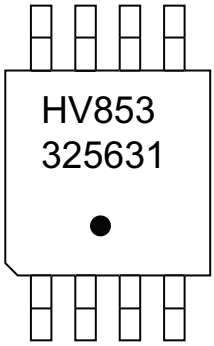
Example



8-lead MSOP



Example

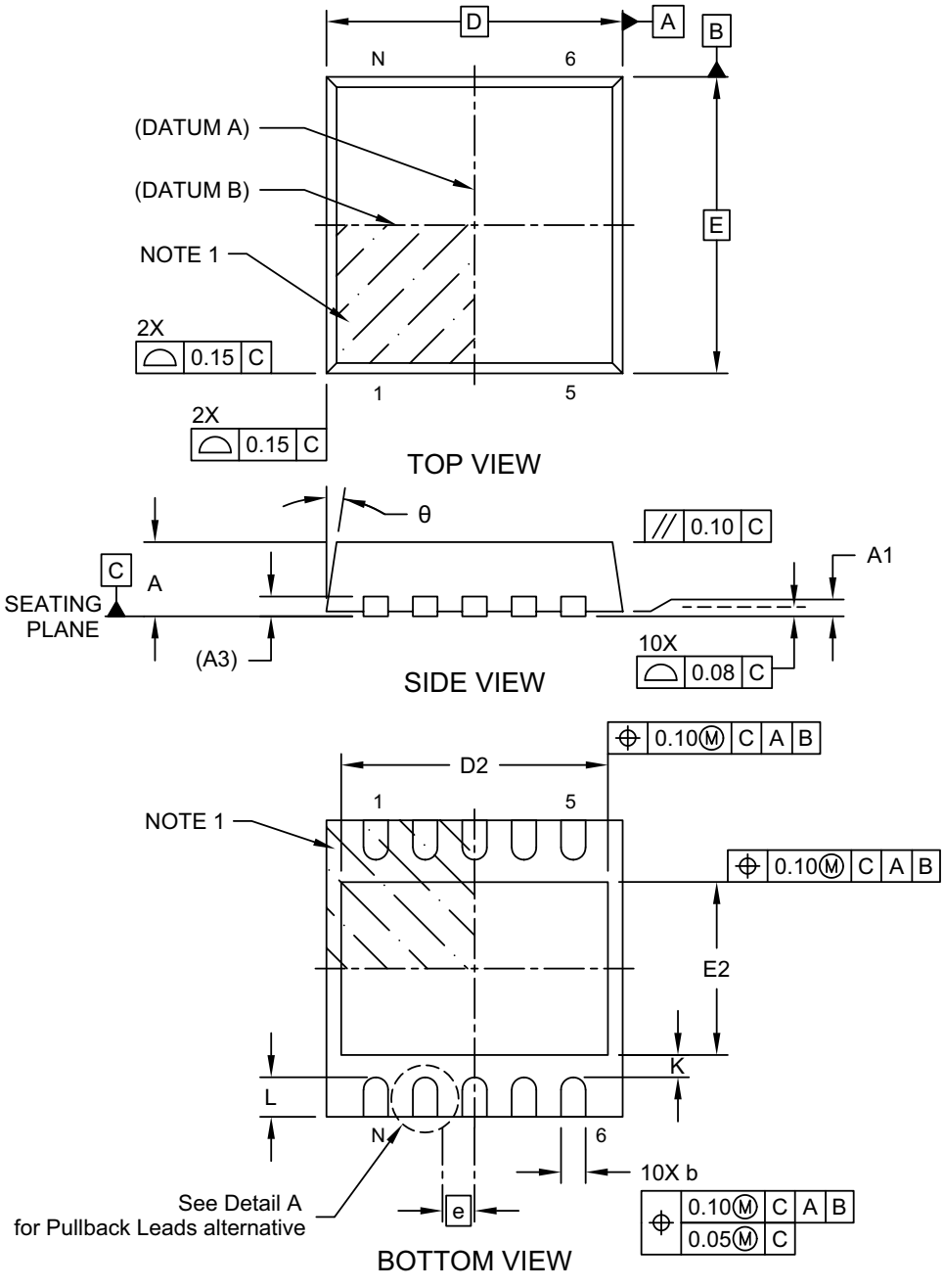


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package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

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UR) - 3x3 mm Body [WDFN]; Supertex Legacy Package

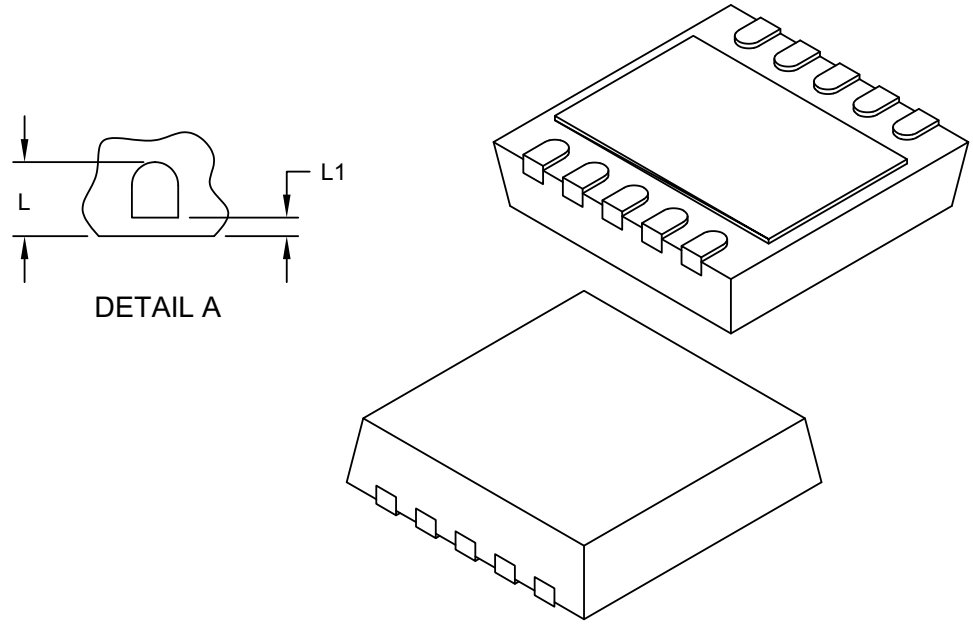
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-292 Rev A Sheet 1 of 2

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UR) - 3x3 mm Body [WDFN]; Supertex Legacy Package

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		10	
Pitch	e		0.50 BSC	
Overall Height	A	0.70	0.75	0.80
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.20 REF	
Overall Length	D		3.00 BSC	
Exposed Pad Length	D2	2.20	-	2.70
Overall Width	E		3.00 BSC	
Exposed Pad Width	E2	1.40	-	1.75
Terminal Width	b	0.18	0.25	0.30
Terminal Length	L	0.30	0.40	0.50
Pullback	L1	-	-	0.15
Mold Angle	θ	0°	7°	14°
Terminal-to-Exposed-Pad	K	0.20	-	-

Notes:

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

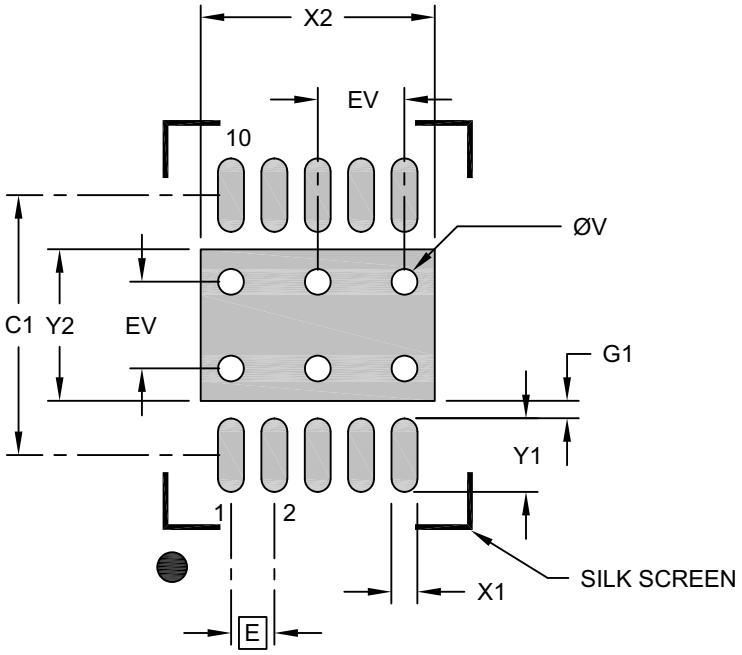
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing C04-292 Rev A Sheet 2 of 2

10-Lead Very, Very Thin Plastic Dual Flat, No Lead Package (UQ) - 3x3 mm Body [WDFN]; 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

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.50 BSC	
Optional Center Pad Width	X2			2.70
Optional Center Pad Length	Y2			1.75
Contact Pad Spacing	C1		3.00	
Contact Pad Width (X10)	X1			0.30
Contact Pad Length (X10)	Y1			0.85
Contact Pad to Center Pad (X10)	G1	0.20		
Thermal Via Diameter	V		0.30	
Thermal Via Pitch	EV		1.00	

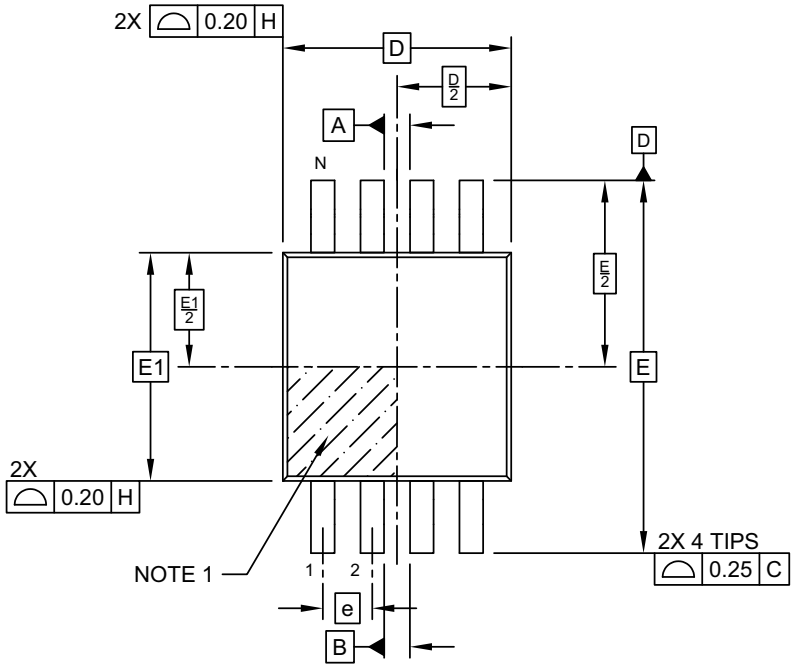
Notes:

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

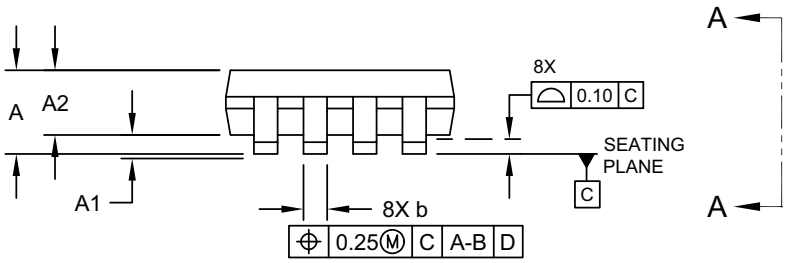
Microchip Technology Drawing C04-2292 Rev A

8-Lead Plastic Micro Small Outline Package (A3X) - 3x3 mm Body [MSOP]

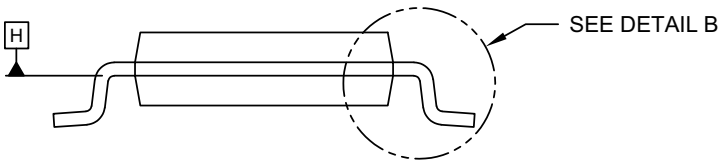
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

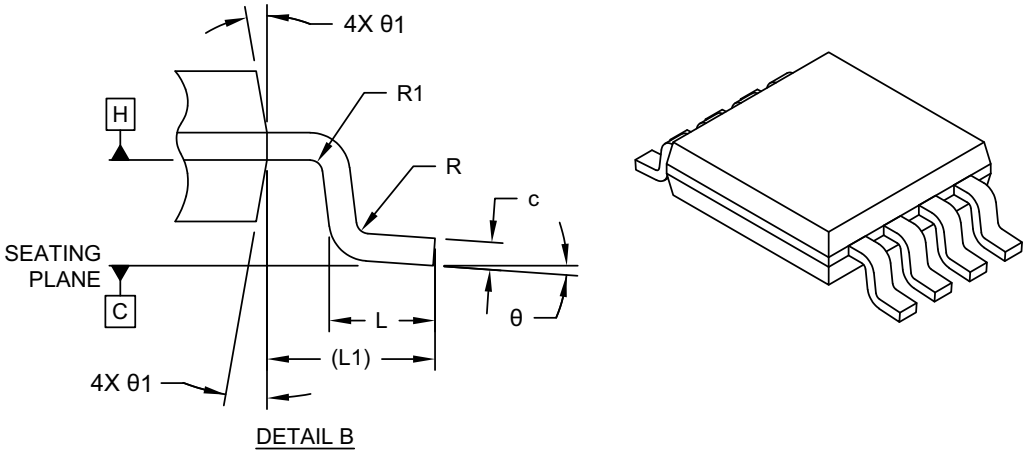


VIEW A–A

Microchip Technology Drawing C04-111-A3X Rev F Sheet 1 of 2

8-Lead Plastic Micro Small Outline Package (A3X) - 3x3 mm Body [MSOP]

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



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		8	
Pitch	e		0.65 BSC	
Overall Height	A	–	–	1.10
Standoff	A1	0.00	–	0.15
Molded Package Thickness	A2	0.75	0.85	0.95
Overall Length	D		3.00 BSC	
Overall Width	E		4.90 BSC	
Molded Package Width	E1		3.00 BSC	
Terminal Width	b	0.22	–	0.40
Terminal Thickness	c	0.08	–	0.23
Terminal Length	L	0.40	0.60	0.80
Footprint	L1		0.95 REF	
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°

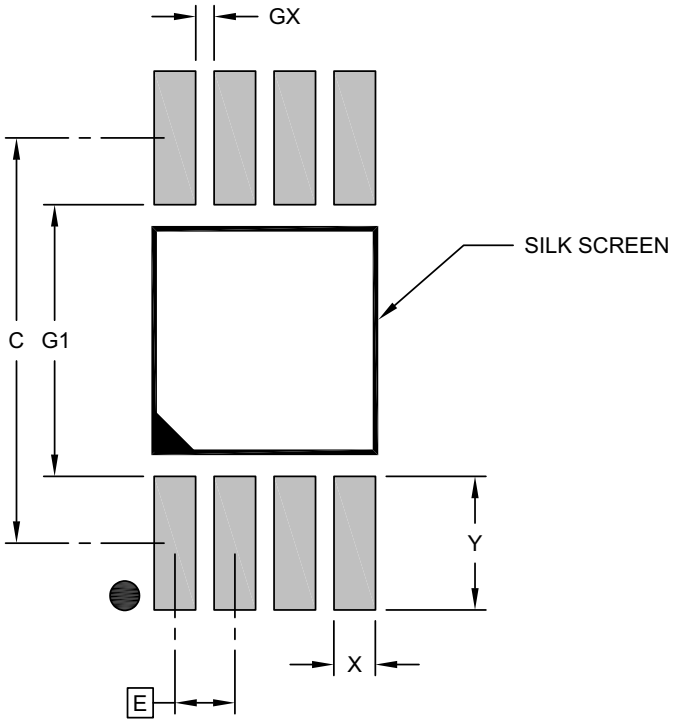
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
3. 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 C04-111-A3X Rev F Sheet 2 of 2

8-Lead Plastic Micro Small Outline Package (A3X) - 3x3 mm Body [MSOP]

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



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.65 BSC	
Contact Pad Spacing	C		4.40	
Contact Pad Width (X8)	X			0.45
Contact Pad Length (X8)	Y			1.45
Contact Pad to Contact Pad (X4)	G1	2.95		
Contact Pad to Contact Pad (X6)	GX	0.20		

Notes:

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

Microchip Technology Drawing C04-2111-A3X Rev F

NOTES:

APPENDIX A: REVISION HISTORY

Revision A (September 2023)

- Converted Supertex Doc# DSFP-HV853 to Microchip DS20005710A
- Changed the quantity of the 10-lead WDFN K7 package from 3000/Reel to 3300/Reel to align packaging specifications with the actual BQM
- Updated package outline drawing
- Made minor text changes throughout the document

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART NO.	XX	-	X	-	X
Device	Package Options		Environmental		Media Type

Device:	HV853	=	High-Voltage Low-Noise Inductorless EL Lamp Driver
Packages:	K7	=	10-lead WDFN
	MG	=	8-lead MSOP
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package
Media Type:	(blank)	=	3300/Reel for a WDFN Package
	(blank)	=	2500/Reel for an MSOP Package

Examples:

a) HV853K7-G: High-Voltage Low-Noise Inductorless EL Lamp Driver, 10-lead WDFN Package, 3300/Reel

b) HV853MG-G: High-Voltage Low-Noise Inductorless EL Lamp Driver, 8-lead MSOP Package, 2500/Reel

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.

Trademarks

ISBN: 978-1-6683-3114-9

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

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