

Dual High-Voltage Isolated MOSFET Driver

Features

- $\pm 400\text{V}$ Input to Output Isolation
- $\pm 700\text{V}$ Isolation between Outputs
- No External Voltage Supply Required
- Dual Isolated Output Drivers
- Internal and External Clock Options

Applications

- Telecommunications
- Modems
- Solid-state Relays
- High-side Switches
- High-end Audio Switches
- Avionics
- Automatic Test Equipment

General Description

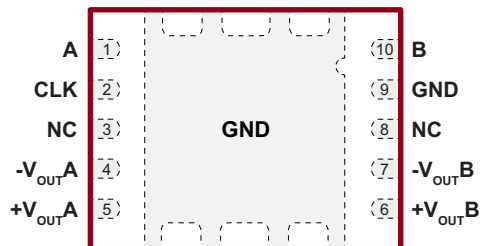
HT0440 is a dual high-voltage isolated MOSFET driver that uses HVCMOS technology. It is designed to drive discrete MOSFETs configured as bidirectional or unidirectional switches. In addition, it can drive N-channel MOSFETs as high-side switches up to 400V. The HT0440 generates two independent DC-isolated voltages to the outputs V_{OUTA} and V_{OUTB} when logic inputs A and B are at logic high.

The internal clock of the HT0440 can be disabled by applying an external clock signal to the CLK pin. This allows the power dissipation and AC characteristics to be customized to meet specific needs. The CLK pin should be connected to ground when not in use. The HT0440 does not require any external power supplies. The internal supply voltage is provided by either of the two logic inputs, A or B, when these inputs are at logic high.

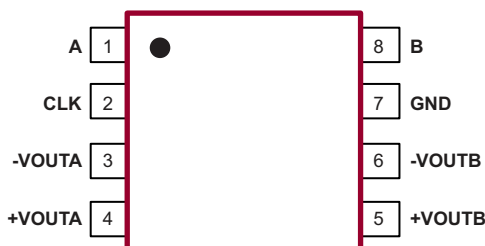
For detailed circuit application information, please refer to application note, *AN-D26 High-Voltage Isolated MOSFET Driver*.

Package Types

10-lead (3 X 4) DFN
(Top View)

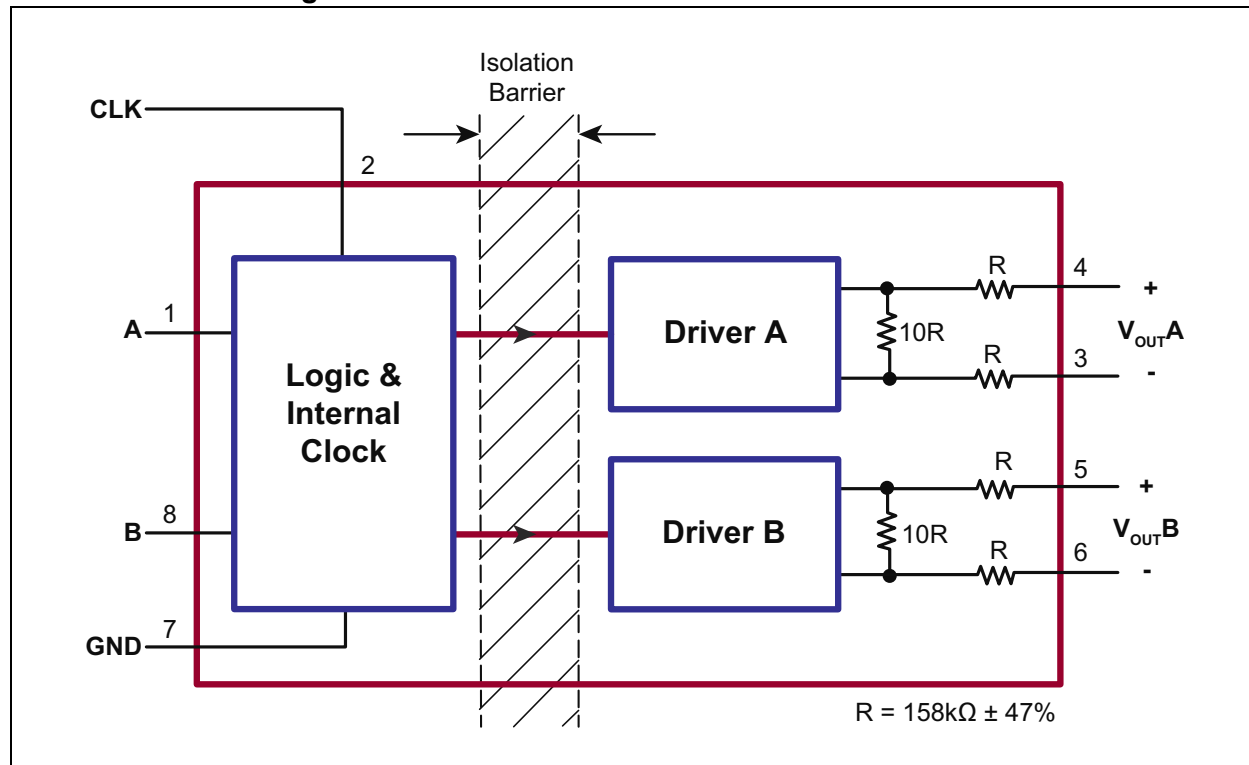


8-lead SOIC (Narrow Body)
(Top View)



Refer to [Table 2-1](#) and [Table 2-2](#) for pin information.

Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings†

Input to Output Isolation Voltage, V_{ISO}	±400V
Logic Input Voltage, V_A, V_B	–0.5V to +7V
Maximum Junction Temperature, T_{JMAX}	+125°C
Storage Temperature, T_S	–55°C to +150°C
Maximum Junction Temperature, T_J	+125°C

† **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

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
External Clock Frequency	CLK	0.5	—	2	MHz	
Clock Input High Voltage	V_{IHCLK}	3.15	—	5.5	V	
Clock Input Low Voltage	V_{ILCLK}	0	—	0.5	V	
Logic Input High Voltage	V_{IH}	3.15	—	5.5	V	
Logic Input Low Voltage	V_{IL}	0	—	0.5	V	
Operating Temperature	T_A	–40	—	+85	°C	

DC ELECTRICAL CHARACTERISTICS

Electrical Specifications: $T_A = 25^\circ\text{C}$ unless otherwise indicated.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Total Logic High Input Current	$I_{HA} + I_{HB}$	—	—	300	μA	$V_A = 3.5\text{V}, V_B = 3.5\text{V}, \text{CLK} = 0\text{V}$
		—	—	500	μA	$V_A = 3.5\text{V}, V_B = 3.5\text{V}, \text{CLK} = 500\text{ kHz}$
		—	—	2	mA	$V_A = 3.5\text{V}, V_B = 3.5\text{V}, \text{CLK} = 2\text{ MHz}$
		—	—	1	mA	$V_A = 5.5\text{V}, V_B = 5.5\text{V}, \text{CLK} = 0\text{V}$
		—	—	2	mA	$V_A = 5.5\text{V}, V_B = 5.5\text{V}, \text{CLK} = 500\text{ kHz}$
Output Voltage	V_{OUTA}, V_{OUTB}	6	—	—	V	$V_A = 3.15\text{V}, V_B = 3.15\text{V}, \text{CLK} = 0\text{V}, \text{No load}$
		5	—	—	V	$V_A = 3.15\text{V}, V_B = 3.15\text{V}, \text{CLK} = 500\text{ kHz}, \text{No load}$
		6	—	—	V	$V_A = 3.15\text{V}, V_B = 3.15\text{V}, \text{CLK} = 2\text{ MHz}, \text{No load}$
		10	—	—	V	$V_A = 4.5\text{V}, V_B = 4.5\text{V}, \text{CLK} = 0\text{V}, \text{No load}$
		8	—	—	V	$V_A = 4.5\text{V}, V_B = 4.5\text{V}, \text{CLK} = 500\text{ kHz}, \text{No load}$
Logic Low Input A Current	I_{ILA}	—	—	10	μA	$V_A = 0.5\text{V}, V_B = \text{High}$
Logic Low Input B Current	I_{ILB}	—	—	10	μA	$V_A = \text{High}, V_B = 0.5\text{V}$
Quiescent Current	I_{ILQ}	—	—	10	μA	$V_A = 0.5\text{V}, V_B = 0.5\text{V}$
Input to Output Isolation Voltage	V_{ISO}	±400	—	—	V	
Output to Output Isolation Voltage	V_{CISO}	±700	—	—	V	





AC ELECTRICAL CHARACTERISTICS

Electrical Specifications: $T_A = 25^\circ\text{C}$ unless otherwise indicated.						
Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Turn-on Delay Time	$t_{d(ON)}$	—	—	50	μs	See Timing Waveforms and Test Circuit . CLK = 0V, CL = 600 pF
Rise Time	t_r	—	—	650	μs	
Turn-off Delay Time	$t_{d(OFF)}$	—	—	150	μs	
Fall Time	t_f	—	—	3	ms	

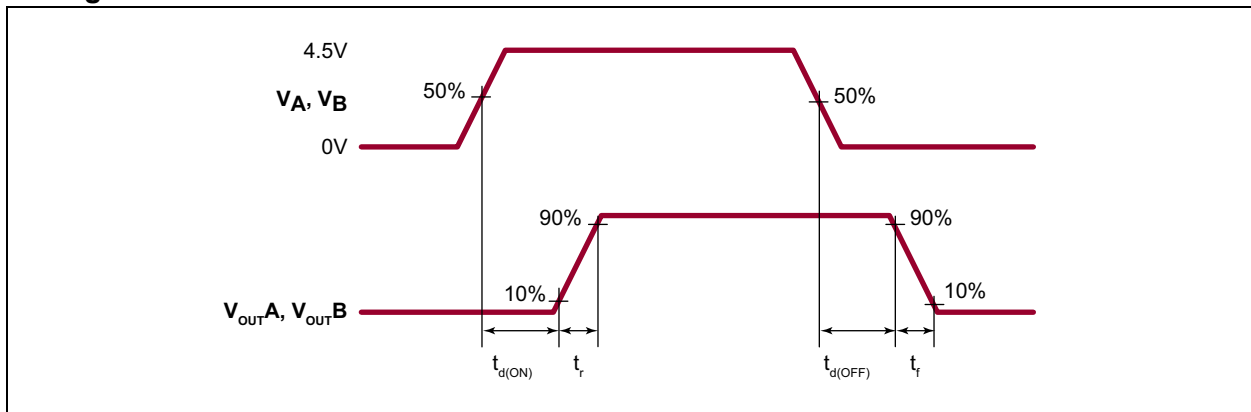
TEMPERATURE SPECIFICATIONS

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
TEMPERATURE RANGES						
Junction Temperature	T_J	—	—	+125	$^\circ\text{C}$	
Operating Temperature	T_A	-40	—	+85	$^\circ\text{C}$	
Storage Temperature	T_S	-55	—	+150	$^\circ\text{C}$	
PACKAGE THERMAL RESISTANCES						
10-lead DFN	θ_{JA}	—	40	—	$^\circ\text{C/W}$	
8-lead SOIC (Narrow Body)	θ_{JA}	—	101	—	$^\circ\text{C/W}$	

TABLE 1-1: TRUTH TABLE

A	B	CLK	V_{OUTA}	V_{OUTB}	Internal Clock
0	0	0	OFF	OFF	OFF
0		0	OFF	ON	ON
	0	0	ON	OFF	ON
1	1	0	ON	ON	ON
0	0	CLK	OFF	OFF	OFF
0		CLK	OFF	ON	OFF
	0	CLK	ON	OFF	OFF
1	1	CLK	ON	ON	OFF

Timing Waveforms



2.0 PIN DESCRIPTION

The details on the pins of HT0440 are listed in [Table 2-1](#) and [Table 2-2](#). Refer to [Package Types](#) for the location of pins.

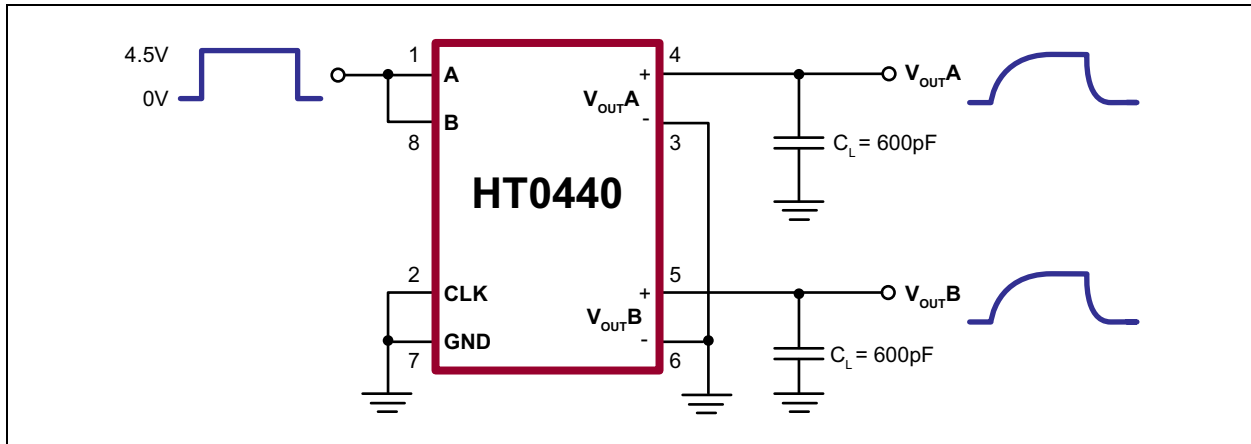
TABLE 2-1: 10-LEAD DFN PIN TABLE

Pin Number	Pin Name	Description
1	A	Logic input for controlling Output A.
2	CLK	Clock input for the IC. Connect to GND to use internal clock. Connect to external clock signal to use external Clock. External clock frequency should be between 500 kHz and 2 MHz.
3	NC	No connect pin. Leave unconnected.
4	–VOUTA	Channel A isolated output. +VOUTA is the positive terminal and –VOUTA is the negative terminal. Connect to the load.
5	+VOUTA	
6	+VOUTB	Channel B isolated output. +VOUTB is the positive terminal and –VOUTB is the negative terminal. Connect to the load.
7	–VOUTB	
8	NC	No connect pin. Leave unconnected.
9	GND	GND connection. Connect to GND of the input digital signals.
10	B	Logic input for controlling Output B.
Thermal pad	GND	GND connection. Connect to GND of the input digital signals.

TABLE 2-2: 8-LEAD SOIC PIN TABLE

Pin Number	Pin Name	Description
1	A	Logic input for controlling Output A.
2	CLK	Clock input for the IC. Connect to GND to use internal clock. Connect to external clock signal to use external Clock. External clock frequency should be between 500 kHz and 2 MHz.
3	–VOUTA	Channel A isolated output. +VOUTA is the positive terminal and –VOUTA is the negative terminal. Connect to the load.
4	+VOUTA	
5	+VOUTB	Channel B isolated output. +VOUTB is the positive terminal and –VOUTB is the negative terminal. Connect to the load.
6	–VOUTB	
7	GND	GND connection. Connect to GND of the input digital signals.
8	B	Logic input for controlling Output B.

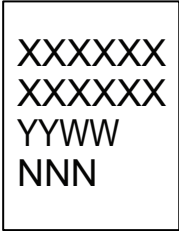
Test Circuit



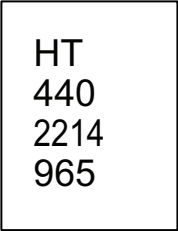
3.0 PACKAGING INFORMATION

3.1 Package Marking Information

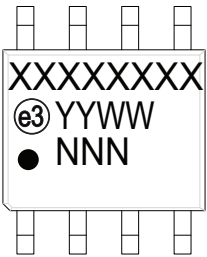
10-lead DFN



Example



8-lead SOIC



Example

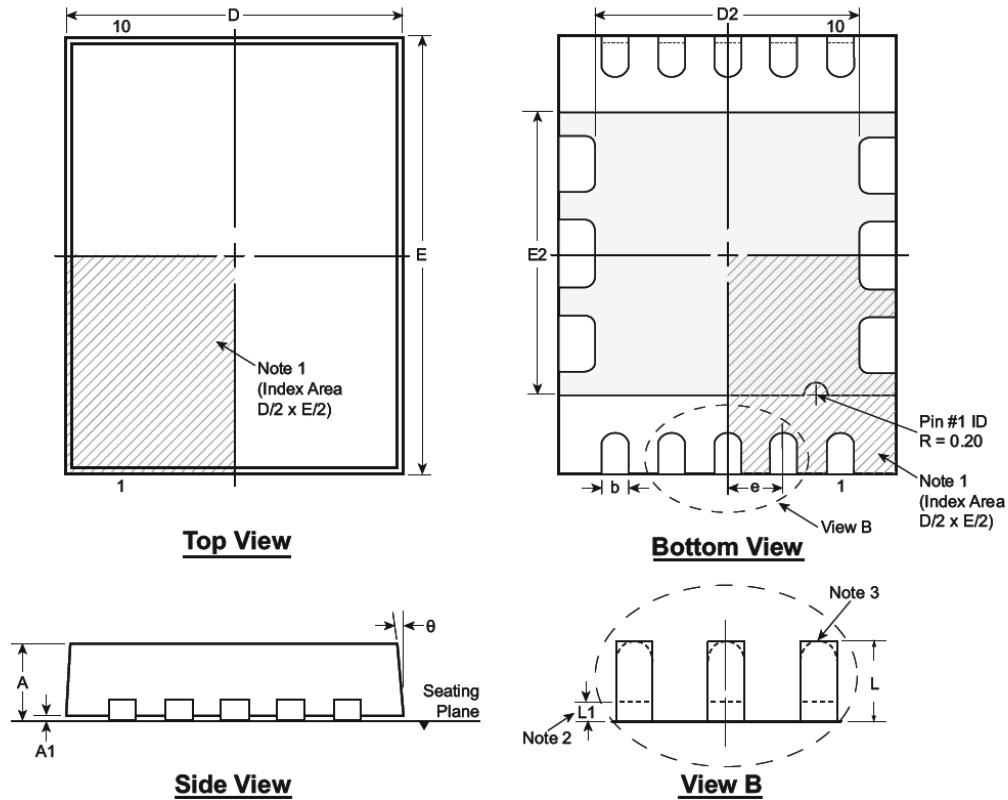


Legend:	XX...X	Product Code or Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package 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 DFN Package Outline (K6)

3.00x4.00mm body, 1.00mm height (max), 0.50mm pitch



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

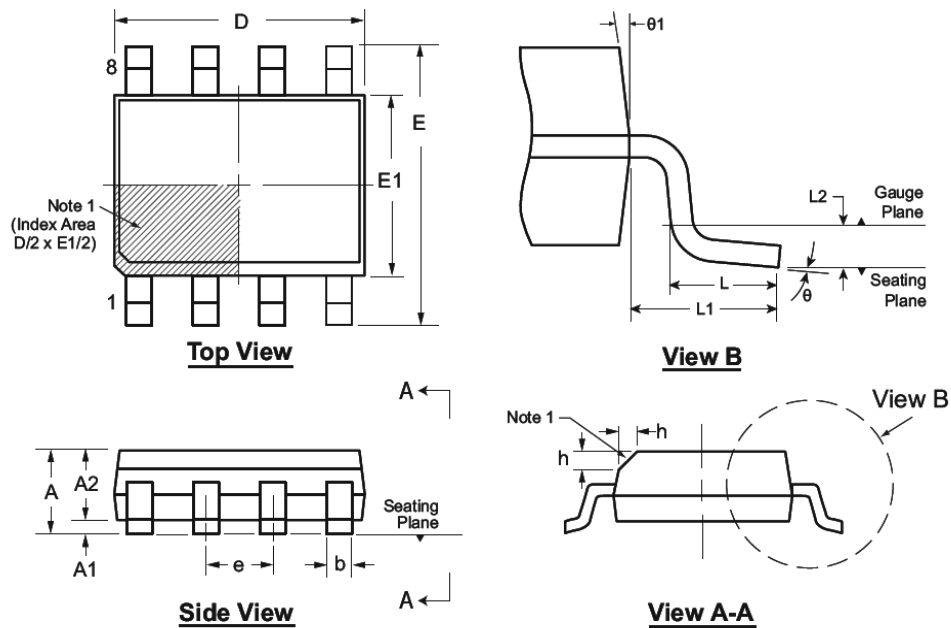
Notes:

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. Depending on the method of manufacturing, a maximum of 0.15mm pullback ($L1$) may be present.
3. The inner tip of the lead may be either rounded or square.

Symbol		A	A1	b	D	D2	E	E2	e	L	L1	θ
Dimension (mm)	MIN	0.80	0.00	0.18	2.95	2.20	3.95	2.50	0.50 BSC	0.30	0.00	0°
	NOM	0.90	0.02	0.25	3.00	2.35	4.00	2.65		0.40	-	-
	MAX	1.00	0.05	0.30	3.05	2.45	4.05	2.75		0.50	0.15	14°

Drawings not to scale.

8-Lead SOIC (Narrow Body) Package Outline (LG/TG) 4.90x3.90mm body, 1.75mm height (max), 1.27mm pitch



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

Note:

1. This chamfer feature is optional. 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	E	E1	e	h	L	L1	L2	θ	θ1
Dimension (mm)	MIN	1.35*	0.10	1.25	0.31	4.80*	5.80*	3.80*	1.27 BSC	0.25	0.40	1.04 REF	0.25 BSC	0°	5°
	NOM	-	-	-	-	4.90	6.00	3.90		-	-			-	-
	MAX	1.75	0.25	1.65*	0.51	5.00*	6.20*	4.00*		0.50	1.27			8°	15°

JEDEC Registration MS-012, Variation AA, Issue E, Sept. 2005.

* This dimension is not specified in the JEDEC drawing.

Drawings are not to scale.

APPENDIX A: REVISION HISTORY

Revision A (September 2022)

- Converted Supertex Doc# DSFP-HT440 to Microchip DS20005606A.
- 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.

<u>PART NO.</u>	<u>XX</u>	-	<u>X</u>	-	<u>X</u>
Device	Package Options		Environmental		Media Type
Device:	HT0440	=	Dual High-Voltage Isolated MOSFET Driver		
Package:	K6	=	10-lead (3 x 4) DFN		
	LG	=	8-lead SOIC		
Environmental:	G	=	Lead (Pb)-free/RoHS-compliant Package		
Media Type:	(blank)	=	3300/Reel for an KG Package		
			3300/Reel for an LG Package		
Examples:					
a) HT0440K6-G: Dual High-Voltage Isolated MOSFET Driver, 10-lead (3 x 4) DFN Package, 3300/Reel					
b) HT0440LG-G: Dual High-Voltage Isolated MOSFET Driver, 8-lead SOIC Package, 3300/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.
-

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, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, CryptoMemory, CryptoRF, dsPIC, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Klear, 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, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, TrueTime, 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, Clockstudio, 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, IntelliMOS, Inter-Chip Connectivity, JitterBlocker, Knob-on-Display, KoD, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, 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, SQI, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, Trusted Time, 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, and Symmcom 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.

© 2022, Microchip Technology Incorporated and its subsidiaries.

All Rights Reserved.

ISBN: 978-1-6683-1329-9

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