

---

---

## N-Channel, Depletion-Mode, Vertical DMOS FET

---

---

### Features

- High-input impedance
- Low-input capacitance
- Fast switching speeds
- Low on-resistance
- Free from secondary breakdown
- Low input and output leakage

### Applications

- Normally-on switches
- Solid state relays
- Converters
- Linear amplifiers
- Constant current sources
- Battery operated systems
- Telecom

### Description

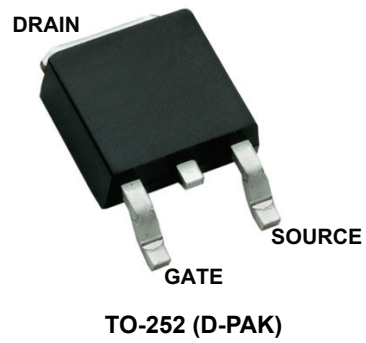
This low threshold, depletion-mode, normally-on, transistor utilizes an advanced vertical Diffusion Metal Oxide Semiconductor (DMOS) structure and a well proven silicon-gate manufacturing process. This combination produces a device with the power-handling capabilities of bipolar transistors, plus the high-input impedance and positive-temperature coefficient inherent in Metal-Oxide Semiconductor (MOS) devices. Characteristic of all MOS structures, this device is free from thermal runaway and thermally-induced secondary breakdown.

Vertical DMOS Field-Effect Transistors (FETs) are ideally suited to a wide range of switching and amplifying applications where a very low threshold voltage, high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

# DN2470

---

## Package Type



See [Table 2-1](#) for pin information

## 1.0 ELECTRICAL CHARACTERISTICS

### ABSOLUTE MAXIMUM RATINGS†

Drain-to-source voltage.....	$BV_{DSX}$
Drain-to-gate voltage.....	$BV_{DGX}$
Gate-to-source voltage.....	$\pm 20V$
Operating and storage temperature.....	$-55^{\circ}C$ to $+150^{\circ}C$

† **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.

### DC AND AC CHARACTERISTICS

Electrical Specifications: Unless otherwise specified, for all specifications $T_A = T_J = +25^{\circ}C$						
Parameter	Symbol	Min	Typ	Max	Units	Conditions
<b>DC Parameters (Note 1, unless otherwise stated)</b>						
Drain-to-source breakdown voltage	$BV_{DSX}$	700	–	–	V	$V_{GS} = -5.0V, I_D = 100\mu A$
Gate-to-source off voltage	$V_{GS(OFF)}$	-1.5	–	-3.5	V	$V_{DS} = 25V, I_D = 10\mu A$
Change in $V_{GS(OFF)}$ with temperature	$\Delta V_{GS(OFF)}$	–	–	-4.5	mV/ $^{\circ}C$	$V_{DS} = 25V, I_D = 10\mu A$ ((Note 2))
Gate body leakage current	$I_{GSS}$	–	–	100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$
Drain-to-source leakage current	$I_{D(OFF)}$	–	–	1.0	$\mu A$	$V_{DS} = BV_{DSX}, V_{GS} = -10V$
		–	–	1.0	mA	$V_{DS} = 0.8 BV_{DSX}, V_{GS} = -10V, T_A = 125^{\circ}C$ ((Note 2))
Saturated drain-to-source current	$I_{DSS}$	–	500	–	mA	$V_{GS} = 0V, V_{DS} = 25V$
Static drain-to-source on-state resistance	$R_{DS(ON)}$	–	–	42	$\Omega$	$V_{GS} = 0V, I_D = 100mA$
Change in $R_{DS(ON)}$ with temperature	$\Delta R_{DS(ON)}$	–	–	1.1	%/ $^{\circ}C$	$V_{GS} = 0V, I_D = 100mA$ (Note 2)
<b>AC Parameters (Note 2)</b>						
Forward transconductance	$G_{FS}$	100	–	–	mmho	$V_{DS} = 10V, I_D = 100mA$
Input capacitance	$C_{ISS}$	–	–	540	pF	$V_{GS} = -10V, V_{DS} = 25V, f = 1.0 MHz$
Common source output capacitance	$C_{OSS}$	–	–	60		
Reverse transfer capacitance	$C_{RSS}$	–	–	25		
Turn-on delay time	$t_{d(ON)}$	–	–	30	ns	$V_{DD} = 25V, I_D = 100mA, R_{GEN} = 25\Omega,$
Rise time	$t_r$	–	–	45		
Turn-off delay time	$t_{d(OFF)}$	–	–	45		
Fall time	$t_f$	–	–	60		
<b>Diode Parameters</b>						
Diode forward voltage drop	$V_{SD}$	–	–	1.8	V	$V_{GS} = -5.0V, I_{SD} = 200mA$ (Note 1)
Reverse recovery time	$t_{rr}$	–	800	–	ns	$V_{GS} = -5.0V, I_{SD} = 200mA$ (Note 2)

**Note 1:** All DC parameters are 100% tested at  $25^{\circ}C$  unless otherwise stated. Pulse test: 300  $\mu s$  pulse, 2% duty cycle.

**2:** Specification is obtained by characterization and is not 100% tested.

# DN2470

## 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
<b>Temperature Ranges</b>						
Operating and Storage temperature		-55	–	150	$^\circ\text{C}$	
<b>Package Thermal Resistances</b>						
Thermal Resistance, TO-252 (D-PAK)	$\theta_{ja}$	–	132	–	$^\circ\text{C/W}$	

**TABLE 1-1: THERMAL CHARACTERISTICS**

Package	$I_D^1$ continuous (mA)	$I_D$ pulsed (mA)	Power Dissipation @ $T_A = 25^\circ\text{C}$ (W)	$I_{DR}^1$ (mA)	$I_{DRM}$ (mA)
TO-252 (D-PAK)	170	500	$2.5^2$	170	500

1.  $I_D$  continuous is limited by max rated  $T_j$
2. Mounted on FR4 board, 25mm x 25mm x 1.57 mm

## 2.0 PIN DESCRIPTION

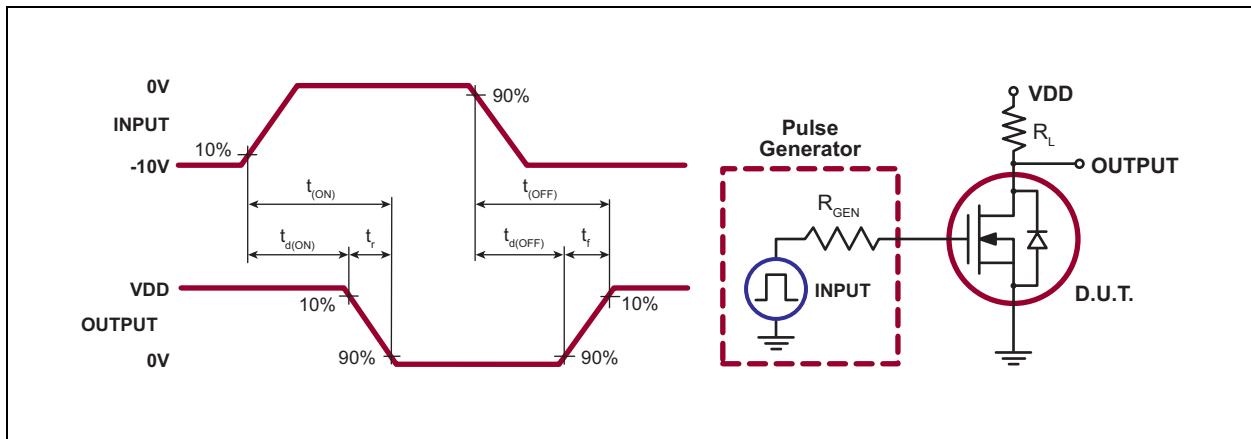
The locations of the pins are listed in [Package Type](#).

**TABLE 2-1: PIN DESCRIPTION**

Pin # TO-252	Function
1	GATE
3	SOURCE
2,4	DRAIN

## 3.0 APPLICATION INFORMATION

Figure 3-1 shows the switching waveform and test circuit for DN2450.



**FIGURE 3-1:** Switching Waveforms and Test Circuit

### Product Summary

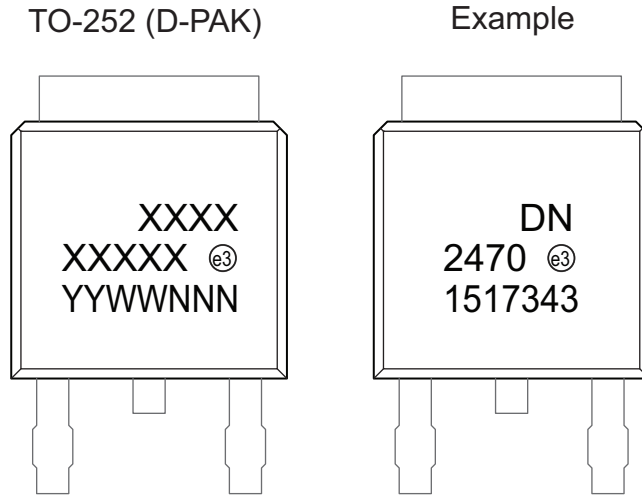
$BV_{DSX}/BV_{DGX}$ (V)	$R_{DS(ON)}$ (max) ( $\Omega$ )	$I_{DSS}$ (typ) (mA)
700	42	500

# DN2470

---

## 4.0 PACKAGING INFORMATION

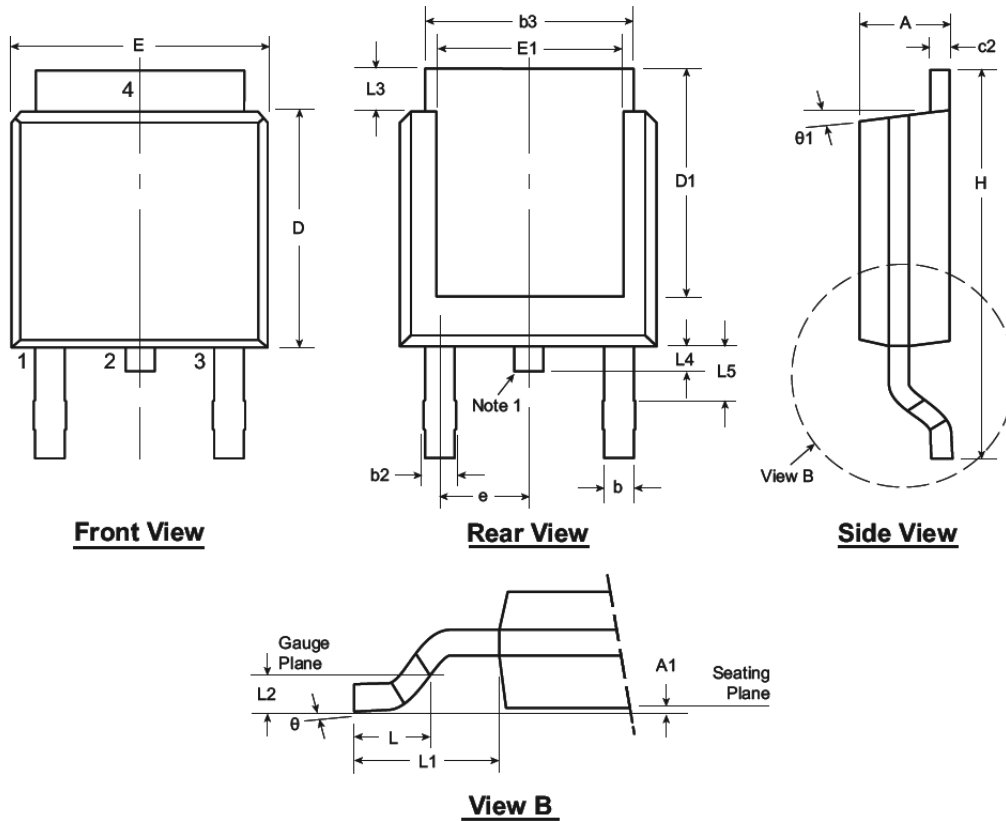
### 4.1 Package Marking Information



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

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

## 3-Lead TO-252 (D-PAK) Package Outline (K4)



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

**Note:**

1. Although 4 terminal locations are shown, only 3 are functional. Lead number 2 was removed.

Symbol	A	A1	b	b2	b3	c2	D	D1	E	E1	e	H	L	L1	L2	L3	L4	L5	θ	θ1		
Dimension (inches)	MIN	.086	.000*	.025	.030	.195	.235	.205	.250	.170	.090 BSC	.370	.055	.108 REF	.020 BSC	.035	.025*	.035†	0°	0°		
	NOM	-	-	-	-	-	.240	-	-	-		-	.060			-	-	-	-	-	-	-
	MAX	.094	.005	.035	.045	.215	.035	.245	.217*	.265		.200*	.410			.070	-	.050	.040	.060	10°	15°

JEDEC Registration TO-252, Variation AA, Issue E, June 2004.

\* This dimension is not specified in the JEDEC drawing.

† This dimension differs from the JEDEC drawing.

Drawings not to scale.

## APPENDIX A: REVISION HISTORY

### Revision A (October 2015)

- Updated file to new format. Released data sheet in the Microchip system.



## 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>X</u>
Device	Package Options		Environmental		Media Type
Device:	DN2470	=	N-Channel, Depletion-Mode, vertical DMOS FET		
Package:	K4	=	TO-252 (D-PAK)		
Environmental	G	=	Lead (Pb)-free/ROHS-compliant package		
Media Type:	(blank)	=	2000/Reel		

**Examples:**

a) DN2470K4-G      TO-252 package, 2000/reel

---

---

**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, PIC<sup>32</sup> 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, motorBench, 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: 978-1-63277-870-3

**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<sup>®</sup> MCUs and dsPIC<sup>®</sup> DSCs, KEELOQ<sup>®</sup> 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](http://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

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Microchip:](#)

[DN2470K4-G](#)