
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

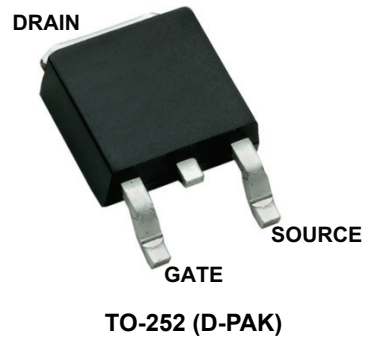
Description

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
DC Parameters (Note 1, unless otherwise stated)						
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	μA	$V_{DS} = BV_{DSX}, V_{GS} = -10V$
		–	–	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	Ω	$V_{GS} = 0V, I_D = 100mA$
Change in $R_{DS(ON)}$ with temperature	$\Delta R_{DS(ON)}$	–	–	1.1	%/ $^{\circ}C$	$V_{GS} = 0V, I_D = 100mA$ (Note 2)
AC Parameters (Note 2)						
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		
Diode Parameters						
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 μs 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
Temperature Ranges						
Operating and Storage temperature		-55	–	150	$^\circ\text{C}$	
Package Thermal Resistances						
Thermal Resistance, TO-252 (D-PAK)	θ_{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.

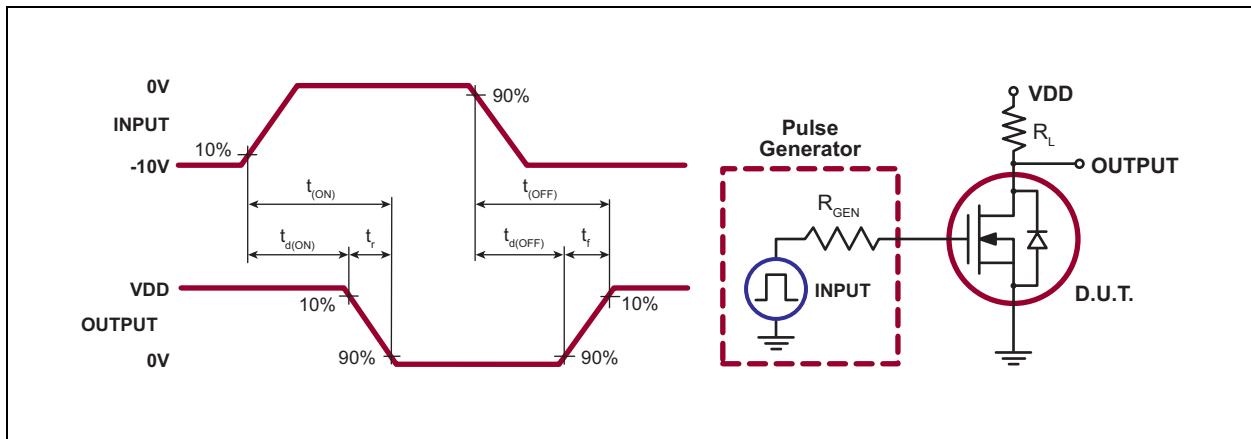


FIGURE 3-1: Switching Waveforms and Test Circuit

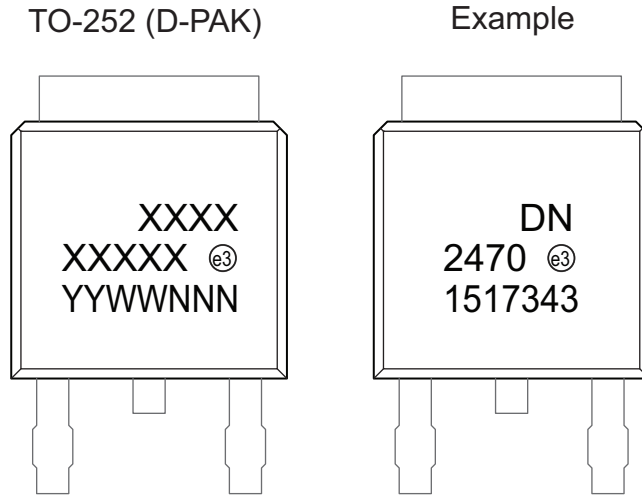
Product Summary

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

DN2470

4.0 PACKAGING INFORMATION

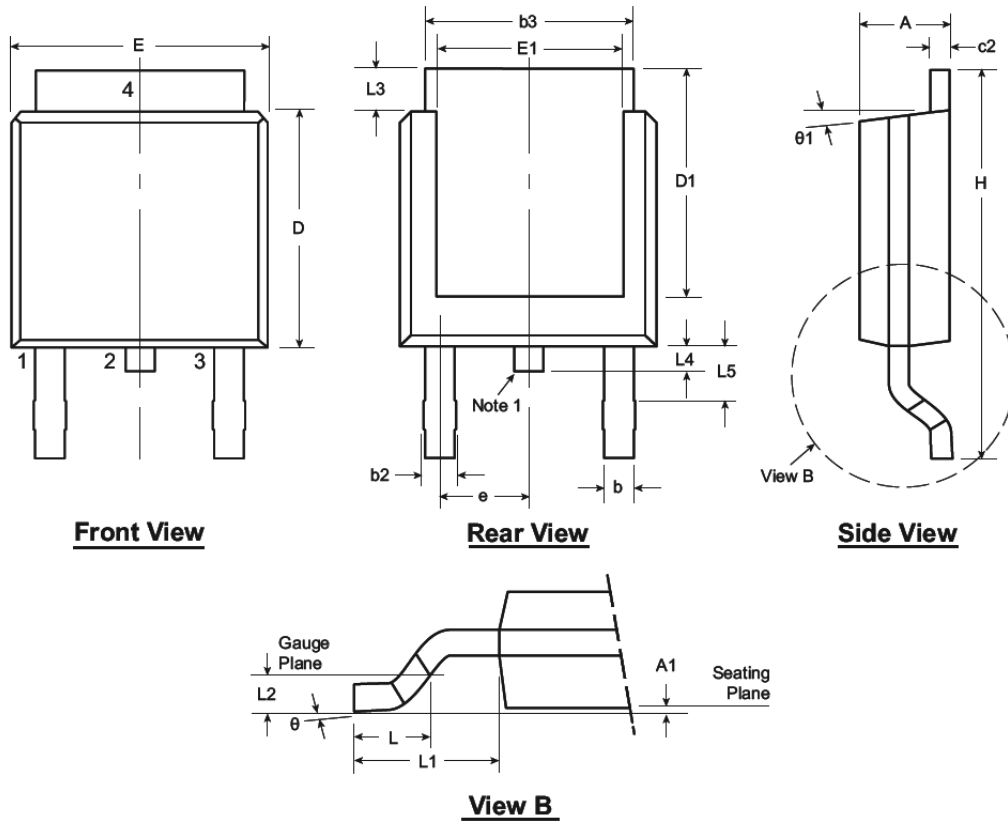
4.1 Package Marking Information



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.

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.

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	.018	.235	.205	.250	.170	.370	.055			.035	.025*	.035†	0°	0°
	NOM	-	-	-	-	-	.240	-	-	-	.090 BSC	-	.060	.108 REF	.020 BSC	-	-	-	-	-
	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, Klear, 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, KlearNet, KlearNet 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[®] 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>
 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