

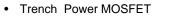
## KD2304-VB Datasheet

## N-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$R_{DS(on)}\left(\Omega\right)$	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)			
30	0.030 at V <sub>GS</sub> = 10 V	6.5	4.5 nC			
	0.033 at V <sub>GS</sub> = 4.5 V	6.0				

#### **FEATURES**

 Halogen-free According to IEC 61249-2-21 Definition



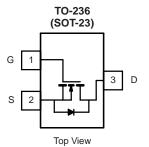
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC

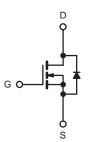


ROHS COMPLIANT HALOGEN FREE

#### **APPLICATIONS**

DC/DC Converter





N-Channel MOSFET

<b>ABSOLUTE MAXIMUM RATINGS</b> T <sub>A</sub> = 25 °C, unless otherwise noted					
Parameter		Symbol	Limit	Unit	
Drain-Source Voltage		$V_{DS}$	30	V	
Gate-Source Voltage		$V_{GS}$	± 20		
	T <sub>C</sub> = 25 °C		6.5 <sup>a</sup>		
Continuous Drain Current (T <sub>.1</sub> = 150 °C)	T <sub>C</sub> = 70 °C	I <sub>D</sub>	6.0		
Continuous Brain Carron (1) = 100 C)	T <sub>A</sub> = 25 °C		5.3		
	T <sub>A</sub> = 70 °C		5.0	Α	
Pulsed Drain Current		I <sub>DM</sub>	25		
	T <sub>C</sub> = 25 °C		1.4		
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	0.9 <sup>b, c</sup>		
	T <sub>C</sub> = 25 °C		1.7		
Maximum Power Dissipation	$T_C = 70  ^{\circ}C$	P <sub>D</sub>	1.1	w	
Waximum Tower Dissipation	$T_A = 25  ^{\circ}C$		1.1 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		0.7 <sup>b, c</sup>		
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	
Soldering Recommendations (Peak Tempera	ture) <sup>d, e</sup>		260		

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 5 s	$R_{thJA}$	90	115	°C/W	
Maximum Junction-to-Foot (Drain)	Steady State	$R_{thJF}$	60	75	0/11	

#### Notes:

- a. Package limited
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 5 s.
- d. Maximum under steady state conditions is 130  $^{\circ}\text{C/W}.$



<b>SPECIFICATIONS</b> $T_J = 25  ^{\circ}C$ ,					ı	
Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit
Static						,
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V, I}_{D} = 250 \mu\text{A}$	30			V
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	I <sub>D</sub> = 250 μA		31		mV/°
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_{J}$			- 5		11107
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}$ , $I_D = 250 \mu A$	0.7	1.1	2.0	V
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	l	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$			1	μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 ^{\circ}\text{C}$			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	10			Α
	В	$V_{GS} = 10 \text{ V, I}_{D} = 3.2 \text{ A}$		0.030		Ω
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	$V_{GS} = 4.5 \text{ V}, I_D = 2.8 \text{ A}$		0.033		
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	$V_{DS} = 15 \text{ V}, I_D = 4.8 \text{ A}$		11		S
Dynamic <sup>b</sup>				1	l	
Input Capacitance	C <sub>iss</sub>			335		
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		45		pF
Reverse Transfer Capacitance	C <sub>rss</sub>			17		
<u> </u>		V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.4 A		4.5	6.7	
Total Gate Charge	Q <sub>g</sub> D <sub>S</sub> 10 1, 1GS 10 1, 1D 01111		2.1	3.2	1 _	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 3.4 \text{ A}$		0.85		nC
Gate-Drain Charge	Q <sub>gd</sub>			0.65		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.8	4.4	8.8	Ω
Turn-On Delay Time	t <sub>d(on)</sub>			12	20	
Rise Time	t <sub>r</sub>	$V_{DD} = 15 \text{ V}, R_1 = 5.6 \Omega$		50	75	- - -
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 2.7 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$		12	20	
Fall Time	t <sub>f</sub>	-		22	35	
Turn-On Delay Time	t <sub>d(on)</sub>			5	10	ns
Rise Time	t <sub>r</sub>	$V_{DD} = 15 \text{ V}, R_1 = 5.6 \Omega$		12	20	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 2.7 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 1 \Omega$		10	15	
Fall Time	t <sub>f</sub>	· ·		5	10	
<b>Drain-Source Body Diode Characteristi</b>	cs					<u>l</u>
Continuous Source-Drain Diode Current	Is	T <sub>C</sub> = 25 °C			1.4	
Pulse Diode Forward Current	I <sub>SM</sub>				15	A
Body Diode Voltage	V <sub>SD</sub>	$I_S = 2.7 \text{ A}, V_{GS} = 0 \text{ V}$		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>			10	20	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	1 07 A 11/4 400 A/v- T 05 00		5	10	nC
Reverse Recovery Fall Time	t <sub>a</sub>	$I_F = 2.7 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 ^{\circ}\text{C}$		6		
Reverse Recovery Rise Time				4		ns

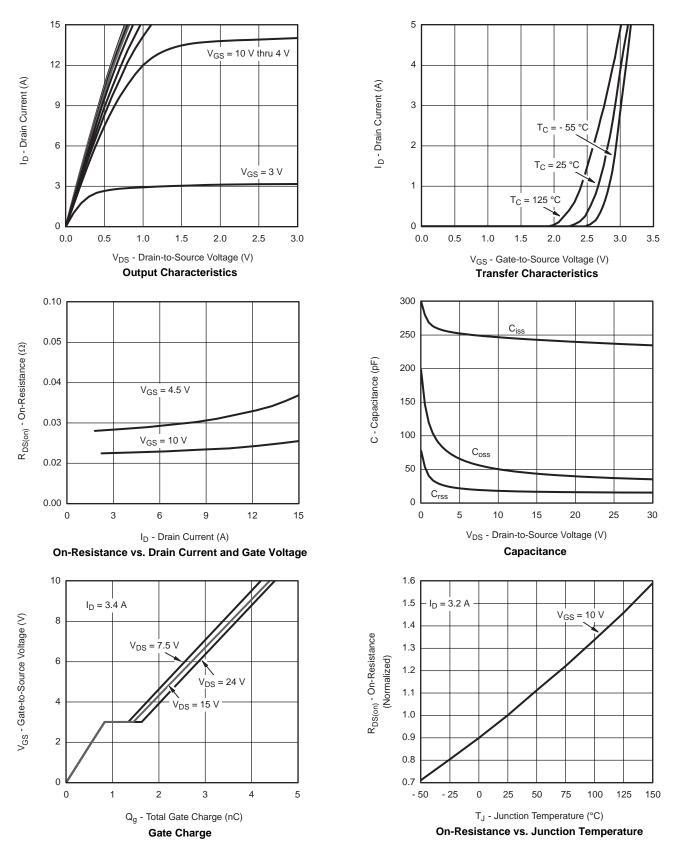
#### Notes:

- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%$
- b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted





T<sub>J</sub> = 125 °C

T<sub>J</sub> = 25 °C

10

#### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted





0.14

0.12

0.10

0.08

0.06

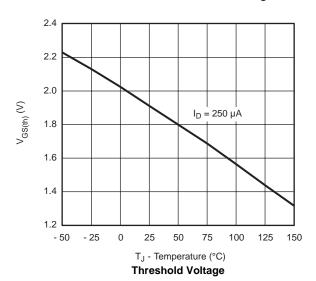
0.04

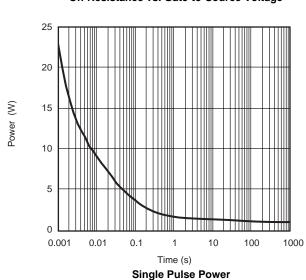
0

2

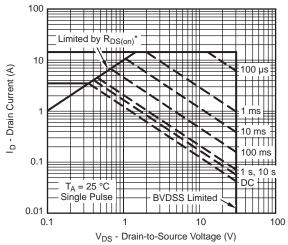
 $R_{DS(on)}$  - On-Resistance  $(\Omega)$ 

 $I_D = 3.2 A$ 





4

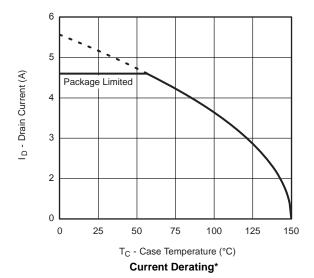


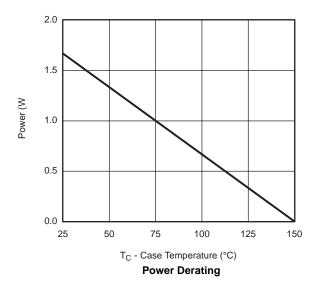
\* V<sub>GS</sub> > minimum V<sub>GS</sub> at which R<sub>DS(on)</sub> is specified

Safe Operating Area, Junction-to-Ambient



### TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

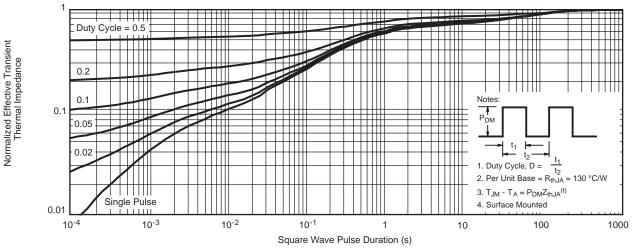




<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



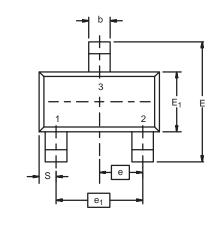
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot



## SOT-23 (TO-236): 3-LEAD







Dim	MILLIM	IETERS	INCHES		
	Min	Max	Min	Max	
Α	0.89	1.12	0.035	0.044	
A <sub>1</sub>	0.01	0.10	0.0004	0.004	
A <sub>2</sub>	0.88	1.02	0.0346	0.040	
b	0.35	0.50	0.014	0.020	
С	0.085	0.18	0.003	0.007	
D	2.80	3.04	0.110	0.120	
E	2.10	2.64	0.083	0.104	
E <sub>1</sub>	1.20	1.40	0.047	0.055	
е	0.95 BSC		0.0374 Ref		
e <sub>1</sub>	1.90 BSC		0.0748 Ref		
L	0.40	0.60	0.016	0.024	
L <sub>1</sub>	0.64 Ref		0.025 Ref		
S	0.50 Ref		0.020 Ref		
q	3°	8°	3°	8°	
ECN: S-03946-Rev. K. 09-	Jul-01				

DWG: 5479



#### **RECOMMENDED MINIMUM PADS FOR SOT-23**



Recommended Minimum Pads Dimensions in Inches/(mm)

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