

## KD2304A-VB Datasheet

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

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$R_{DS(on)}(\Omega)$	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	4.5 110			

## **FEATURES**

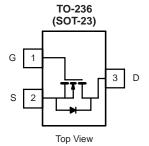
- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- 100 % R<sub>g</sub> Tested
- Compliant to RoHS Directive 2002/95/EC

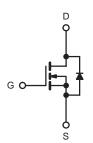


ROHS COMPLIANT HALOGEN FREE

### **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	V		
	T <sub>C</sub> = 25 °C		6.5 <sup>a</sup>			
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 70 °C	I <sub>D</sub>	6.0			
	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>			
Maximum Power Dissipation	T <sub>C</sub> = 25 °C		1.7			
	T <sub>C</sub> = 70 °C	P <sub>D</sub>	1.1	w		
	T <sub>A</sub> = 25 °C	] 'b	1.1 <sup>b, c</sup>	T **		
	T <sub>A</sub> = 70 °C		0.7 <sup>b, c</sup>	-		
Operating Junction and Storage Temperatur	e Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C		
Soldering Recommendations (Peak Tempera	ature) <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  $^{\circ}\text{C/W}.$



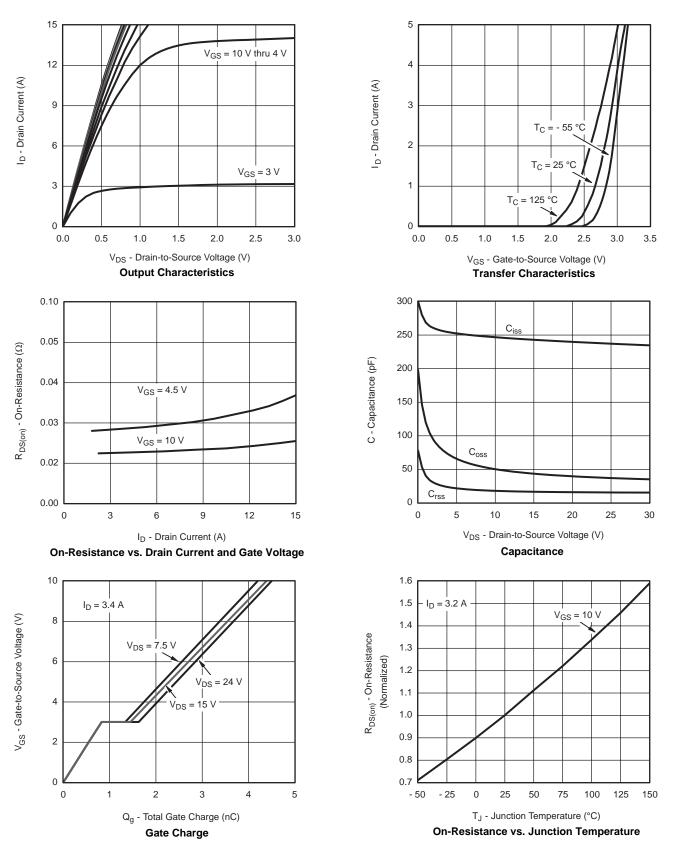
Parameter	Symbol	Test Conditions	Min.	Тур.	Max.	Unit
Static					L	
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	30			V
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$	I 250 · · A		31		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = 250 μA		- 5		
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
		$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$			1	μΑ
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
		$V_{GS} = 10 \text{ V}, I_D = 3.2 \text{ A}$		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 <sub>DS</sub> = 15 V, I <sub>D</sub> = 4.8 A		11		S
Dynamic <sup>b</sup>						
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		
Total Oats Observe	$Q_g$	$V_{DS} = 15 \text{ V}, V_{GS} = 10 \text{ V}, I_{D} = 3.4 \text{ A}$	1	4.5	6.7	nC
Total Gate Charge				2.1	3.2	
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		
Gate-Drain Charge	$Q_{gd}$			0.65		
Gate Resistance	$R_g$	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 V, $R_L$ = 5.6 $\Omega$		50	75	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong$ 2.7 A, $V_{GEN}$ = 4.5 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 V, $R_L$ = 5.6 $\Omega$		12	20	-
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong$ 2.7 A, $V_{GEN}$ = 10 V, $R_g$ = 1 $\Omega$		10	15	
Fall Time	t <sub>f</sub>			5	10	1
<b>Drain-Source Body Diode Characteristic</b>	cs					
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			1.4	Δ
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>	$I_F = 2.7 \text{ A}, \text{ dI/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 \text{ °C}$		5	10	nC
Reverse Recovery Fall Time	t <sub>a</sub>	1 <sub>F</sub> = 2.1 A, αι/αι = 100 A/μs, 1 <sub>J</sub> = 25 °C		6		
Reverse Recovery Rise Time	t <sub>b</sub>			4		ns

### Notes:

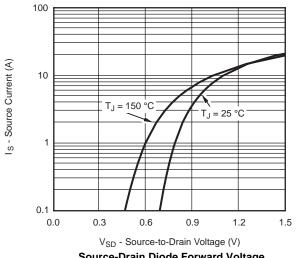
- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%$
- b. Guaranteed by design, not subject to production testing.

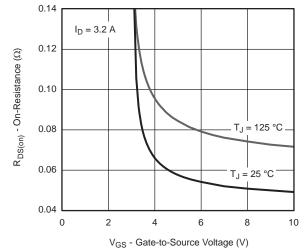
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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





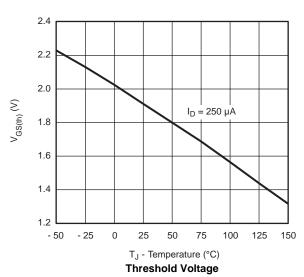


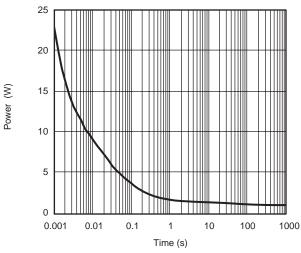




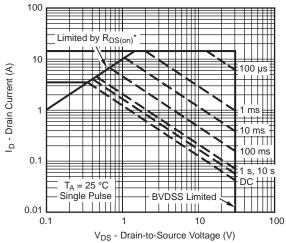
Source-Drain Diode Forward Voltage







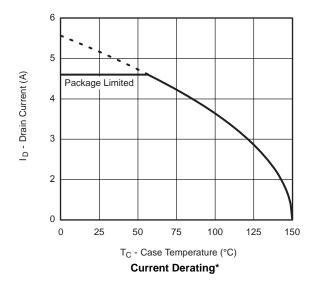
Single Pulse Power

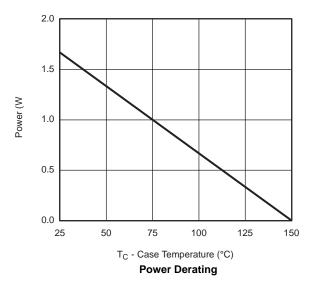


 $^*$   $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Ambient

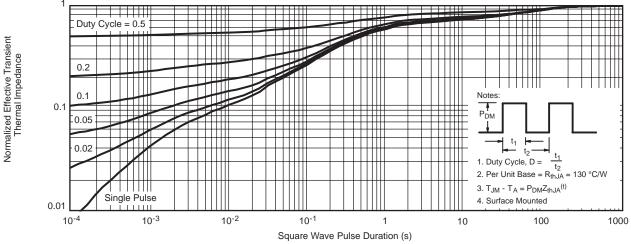






<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below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





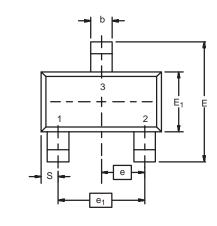
#### Normalized Thermal Transient Impedance, Junction-to-Ambient

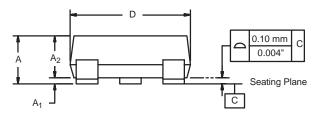


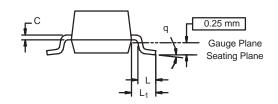
Normalized Thermal Transient Impedance, Junction-to-Foot



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







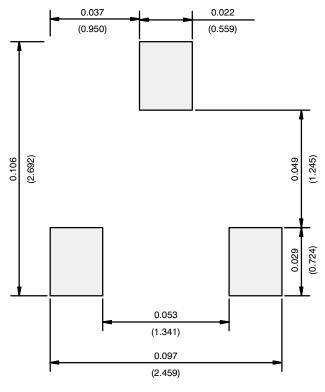
Min 0.89 0.01 0.88	<b>Max</b> 1.12 0.10	Min 0.035 0.0004	<b>Max</b> 0.044	
0.01	0.10			
		0.0004		
0.88		0.0001	0.004	
	1.02	0.0346	0.040	
0.35	0.50	0.014	0.020	
0.085	0.18	0.003	0.007	
2.80	3.04	0.110	0.120	
2.10	2.64	0.083	0.104	
1.20	1.40	0.047	0.055	
0.95 BSC		0.0374 Ref		
1.90 BSC		0.0748 Ref		
0.40	0.60	0.016	0.024	
0.64 Ref		0.025 Ref		
0.50 Ref		0.020 Ref		
3°	8°	3°	8°	
	0.35 0.085 2.80 2.10 1.20 0.95 E 1.90 E 0.40 0.64	0.35 0.50   0.085 0.18   2.80 3.04   2.10 2.64   1.20 1.40   0.95 BSC 1.90 BSC   0.40 0.60   0.64 Ref 0.50 Ref	0.35 0.50 0.014   0.085 0.18 0.003   2.80 3.04 0.110   2.10 2.64 0.083   1.20 1.40 0.047   0.95 BSC 0.0374   1.90 BSC 0.0748   0.40 0.60 0.016   0.64 Ref 0.025   0.50 Ref 0.020	

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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