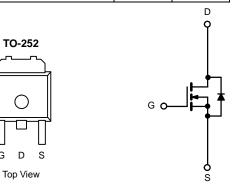


# K4178-E1-AY-VB Datasheet N-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$R_{DS(on)}(\Omega)$	I <sub>D</sub> (A) <sup>a, e</sup>	Q <sub>g</sub> (Typ)			
30	0.005 at V <sub>GS</sub> = 10 V	80	31 nC			
30	$0.006$ at $V_{GS} = 4.5 \text{ V}$	68	31110			



#### N-Channel MOSFET

## **FEATURES**

- Trench Power MOSFET
- 100 % R<sub>q</sub> and UIS Tested
- Compliant to RoHS Directive 2011/65/EU



#### **APPLICATIONS**

- OR-ing
- Server
- DC/DC

Parameter		Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	30	V		
Gate-Source Voltage		V <sub>GS</sub>		± 20	
	T <sub>C</sub> = 25 °C		80	A	
Continuous Drain Current (T <sub>.I</sub> = 175 °C)	T <sub>C</sub> = 70 °C	L	60		
Continuous Diam Current (1) = 173 C)	T <sub>A</sub> = 25 °C	I <sub>D</sub>	25.8 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		22 <sup>b, c</sup>		
Pulsed Drain Current	I <sub>DM</sub>	250			
Avalanche Current Pulse		I <sub>AS</sub>		39	
Single Pulse Avalanche Energy	L = 0.1 mH	E <sub>AS</sub>	94.8	mJ	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	l.	90 <sup>a, e</sup>		
Continuous Source-Diairi Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	3.13 <sup>b, c</sup>	A	
	T <sub>C</sub> = 25 °C		205 <sup>a</sup>		
Maximum Dawar Dingination	T <sub>C</sub> = 70 °C	P <sub>D</sub>	135	١٨/	
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	' D	3.75 <sup>b, c</sup>	W	
	T <sub>A</sub> = 70 °C		2.63 <sup>b, c</sup>		
Operating Junction and Storage Temperature Ra	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C		

THERMAL RESISTANCE RATINGS							
Parameter	Symbol	Тур.	Max.	Unit			
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 sec	R <sub>thJA</sub>	32	40	°C/W		
Maximum Junction-to-Case	Steady State	R <sub>thJC</sub>	0.5	0.6	- C/VV		

#### Notes:

- a. Based on T<sub>C</sub> = 25 °C.
  b. Surface mounted on 1" x 1" FR4 board.

- b. Striate informed on 1 X 1 114 board.
  c. t = 10 sec.
  d. Maximum under steady state conditions is 90 °C/W.
  e. Calculated based on maximum junction temperature. Package limitation current is 90 A.



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	$\Delta V_{DS}/T_{J}$	L = 250 uA		35		m\//0/
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250 \mu A$ $V_{DS} = V_{GS}, I_D = 250 \mu A$ 1.0		- 7.5		mV/°C
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1.0		2.5	V
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA
7. 0. 1/1. 5. 0		V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1	
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}, T_{J} = 55 \text{ °C}$			10	μA
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	90			Α
	D	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 38.8 A		0.005		Ω
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	$V_{GS} = 4.5 \text{ V}, I_D = 37 \text{ A}$		0.006		
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 38.8 A		160		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>			2201		pF
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		525		
Reverse Transfer Capacitance	C <sub>rss</sub>			270		
Total Cata Charma	Qg	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 38.8 A	61 1	107		
Total Gate Charge				31.5	50	nC
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 28.8 \text{ A}$		10		
Gate-Drain Charge	Q <sub>gd</sub>			6		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		1.4	2.1	Ω
Turn-On Delay Time	t <sub>d(on)</sub>			18	27	
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 0.625 $\Omega$		11	17	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong 24$ A, $V_{GEN}$ = 10 V, $R_g$ = 1 $\Omega$		70	105	
Fall Time	t <sub>f</sub>			10	15	
Turn-On Delay Time	t <sub>d(on)</sub>			55	83	ns
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 0.67 $\Omega$		180	270	<del>-</del> - -
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D\cong 22.5$ A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 $\Omega$		55	83	
Fall Time	t <sub>f</sub>			12	18	
<b>Drain-Source Body Diode Characteristic</b>	es					
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			120	Λ
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				120	Α
Body Diode Voltage	$V_{SD}$	I <sub>S</sub> = 22 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>			52	78	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	1 00 A di/d+ 100 A/:- T 05 00		70.2	105	nC
Reverse Recovery Fall Time	t <sub>a</sub>	$I_F = 20 \text{ A}, \text{ di/dt} = 100 \text{ A/}\mu\text{s}, T_J = 25 \text{ °C}$		27		
Reverse Recovery Rise Time		t <sub>b</sub>		25		ns

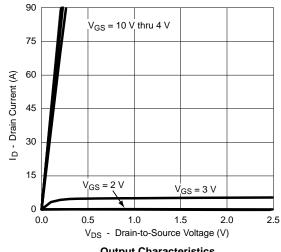
#### Notes:

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

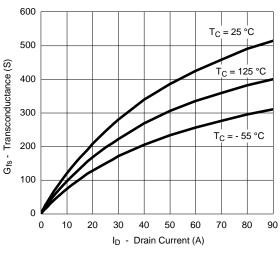
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



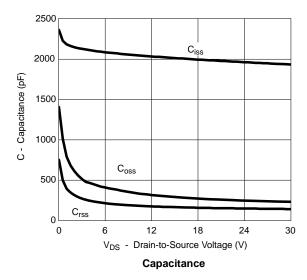
# TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



### **Output Characteristics**

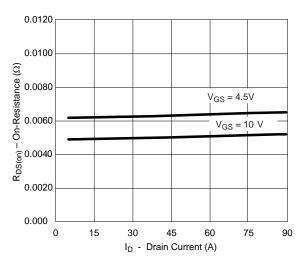


**Transconductance** 

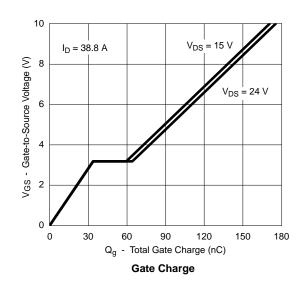


3.0 2.4 I<sub>D</sub> - Drain Current (A) 1.8 1.2 T<sub>C</sub> = 25 °C 0.6 T<sub>C</sub> = 125 °C T<sub>C</sub> = - 55 °C 0.0 V<sub>GS</sub> - Gate-to-Source Voltage (V)

**Transfer Characteristics** 

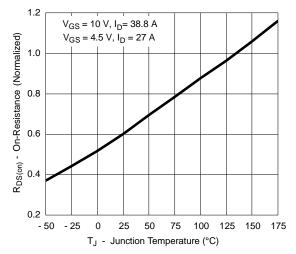


R<sub>DS(on)</sub> vs. Drain Current





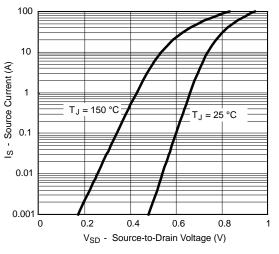
# TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



On-Resistance vs. Junction Temperature



 $\rm R_{\rm DS(on)}$  vs.  $\rm V_{\rm GS}$  vs. Temperature



Forward Diode Voltage vs. Temperature



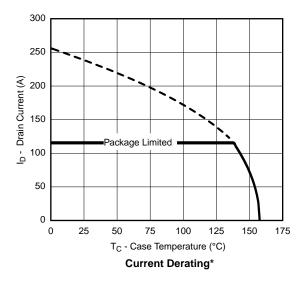
Threshold Voltage

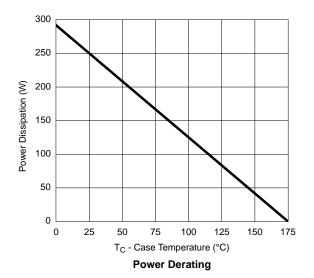


Safe Operating Area, Junction-to-Ambient



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





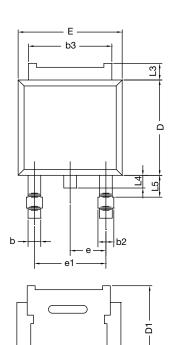
\*The power dissipation  $P_D$  is based on  $T_{J(max)}$  = 175 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



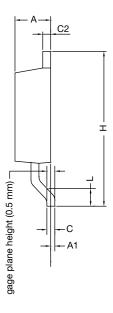
Normalized Thermal Transient Impedance, Junction-to-Case



# **TO-252AA CASE OUTLINE**



E1



	MILLIMETERS		INCHES			
DIM.	MIN.	MAX.	MIN.	MAX.		
Α	2.18	2.38	0.086	0.094		
A1	-	0.127	-	0.005		
b	0.64	0.88	0.025	0.035		
b2	0.76	1.14	0.030	0.045		
b3	4.95	5.46	0.195	0.215		
С	0.46	0.61	0.018	0.024		
C2	0.46	0.89	0.018	0.035		
D	5.97	6.22	0.235	0.245		
D1	5.21	-	0.205	-		
Е	6.35	6.73	0.250	0.265		
E1	4.32	-	0.170	-		
Н	9.40	10.41	0.370	0.410		
е	2.28	BSC	0.090	BSC		
e1	4.56	BSC	0.180 BSC			
L	1.40	1.78	0.055	0.070		
L3	0.89	1.27	0.035	0.050		
L4	-	1.02	-	0.040		
L5	1.14	1.52	0.045	0.060		
ECN: X12-0247-Rev. M. 24-Dec-12						

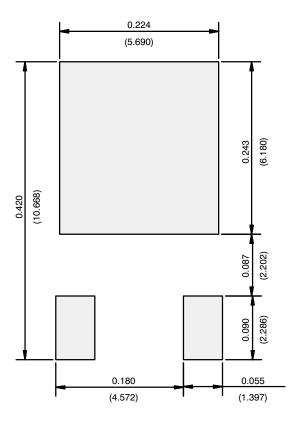
ECN: X12-0247-Rev. M, 24-Dec-12 DWG: 5347

#### Note

• Dimension L3 is for reference only.



# **RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)**



Recommended Minimum Pads Dimensions in Inches/(mm)

服务热线:400-655-8788 7



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