



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AO4414**

**N-Channel Enhancement Mode Field Effect Transistor**

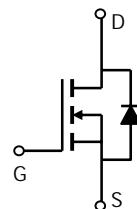
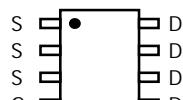


### General Description

The AO4414 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. This device is suitable for use as a load switch or in PWM applications. The source leads are separated to allow a Kelvin connection to the source, which may be used to bypass the source inductance. *Standard Product AO4414 is Pb-free (meets ROHS & Sony 259 specifications). AO4414L is a Green Product ordering option. AO4414 and AO4414L are electrically identical.*

### Features

$V_{DS}$  (V) = 30V  
 $I_D$  = 8.5A ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  < 26mΩ ( $V_{GS}$  = 10V)  
 $R_{DS(ON)}$  < 40mΩ ( $V_{GS}$  = 4.5V)



### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$I_D$	8.5	A
$T_A=70^\circ\text{C}$		7.1	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	50	
Power Dissipation	$P_D$	3	W
$T_A=70^\circ\text{C}$		2.1	
Junction and Storage Temperature Range	$T_J$ , $T_{STG}$	-55 to 150	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	31	40	°C/W
Steady-State		59	75	°C/W
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	16	24	°C/W

**Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{\text{GS}}=0\text{V}$	30			V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}}=24\text{V}, V_{\text{GS}}=0\text{V}$ $T_J=55^\circ\text{C}$		0.004	1	$\mu\text{A}$
					5	
$I_{\text{GSS}}$	Gate-Body leakage current	$V_{\text{DS}}=0\text{V}, V_{\text{GS}}= \pm 20\text{V}$			100	nA
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	$V_{\text{DS}}=V_{\text{GS}}, I_D=250\mu\text{A}$	1	1.9	3	V
$I_{\text{D}(\text{ON})}$	On state drain current	$V_{\text{GS}}=4.5\text{V}, V_{\text{DS}}=5\text{V}$	20			A
$R_{\text{DS}(\text{ON})}$	Static Drain-Source On-Resistance	$V_{\text{GS}}=10\text{V}, I_D=8.5\text{A}$ $T_J=125^\circ\text{C}$		20	26	$\text{m}\Omega$
				29.2	38	
		$V_{\text{GS}}=4.5\text{V}, I_D=5\text{A}$		31	40	$\text{m}\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}}=5\text{V}, I_D=5\text{A}$	10	17		S
$V_{\text{SD}}$	Diode Forward Voltage	$I_S=1\text{A}, V_{\text{GS}}=0\text{V}$		0.76	1	V
$I_S$	Maximum Body-Diode Continuous Current				4.3	A
<b>DYNAMIC PARAMETERS</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=15\text{V}, f=1\text{MHz}$		680	820	pF
$C_{\text{oss}}$	Output Capacitance			102		pF
$C_{\text{rss}}$	Reverse Transfer Capacitance			77		pF
$R_g$	Gate resistance	$V_{\text{GS}}=0\text{V}, V_{\text{DS}}=0\text{V}, f=1\text{MHz}$		3	3.6	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{\text{GS}}=10\text{V}, V_{\text{DS}}=15\text{V}, I_D=8.5\text{A}$		13.84	17	nC
$Q_g(4.5\text{V})$	Total Gate Charge			6.74	8.1	nC
$Q_{\text{gs}}$	Gate Source Charge			1.84		nC
$Q_{\text{gd}}$	Gate Drain Charge			3.32		nC
$t_{\text{D}(\text{on})}$	Turn-On Delay Time	$V_{\text{GS}}=10\text{V}, V_{\text{DS}}=15\text{V}, R_L=1.8\Omega, R_{\text{GEN}}=3\Omega$		4.5	6.5	ns
$t_r$	Turn-On Rise Time			4.2	6.3	ns
$t_{\text{D}(\text{off})}$	Turn-Off Delay Time			20.1	30	ns
$t_f$	Turn-Off Fall Time			4.9	7.5	ns
$t_{\text{rr}}$	Body Diode Reverse Recovery Time	$I_F=8.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		17.2	21	ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge	$I_F=8.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		8.6	10	nC

A: The value of  $R_{\text{thJA}}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $t \leq 10\text{s}$  thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The  $R_{\text{thJA}}$  is the sum of the thermal impedance from junction to lead  $R_{\text{thJL}}$  and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using 80  $\mu\text{s}$  pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

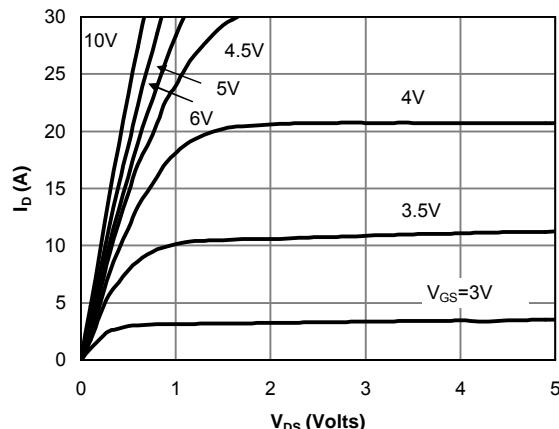


Fig 1: On-Region Characteristics

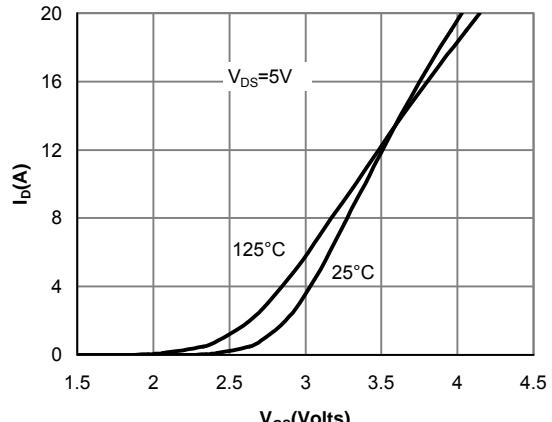


Figure 2: Transfer Characteristics

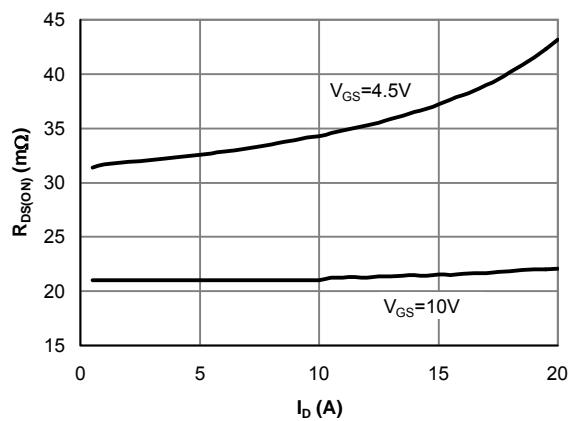


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

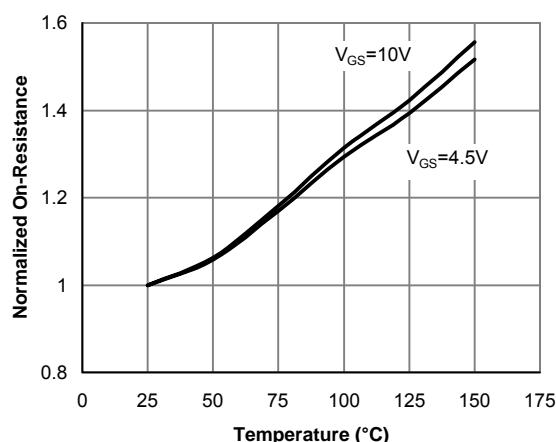


Figure 4: On-Resistance vs. Junction Temperature

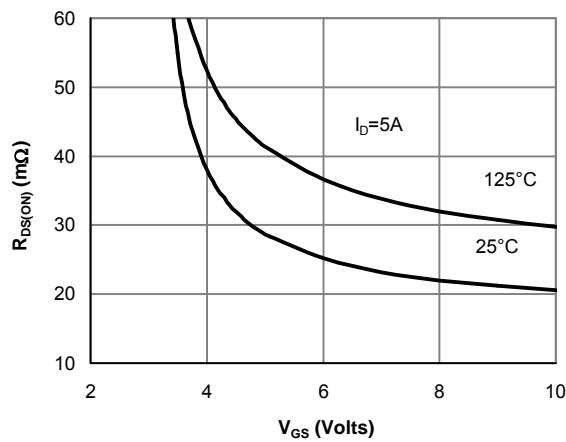


Figure 5: On-Resistance vs. Gate-Source Voltage

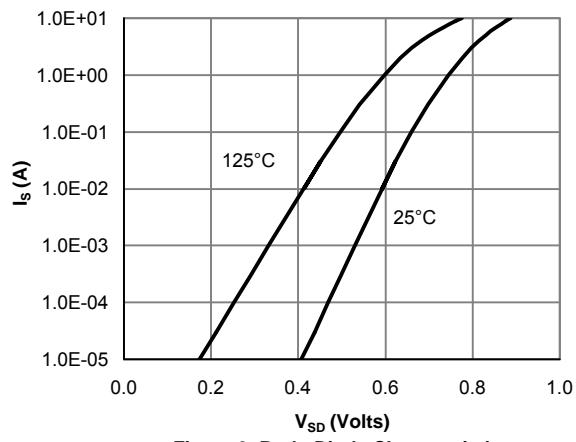


Figure 6: Body-Diode Characteristics

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