



ALPHA & OMEGA
SEMICONDUCTOR

AO4456

N-Channel Enhancement Mode Field Effect Transistor



General Description

The AO4456 uses advanced trench technology with a monolithically integrated Schottky diode to provide excellent $R_{DS(ON)}$ and low gate charge. This device is suitable for use as a low side FET in SMPS, load switching and general purpose applications. *Standard Product AO4456 is Pb-free (meets ROHS & Sony 259 specifications). AO4456 is a Green Product ordering option. AO4456 and AO4456 are electrically identical.*

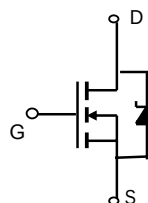
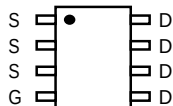
Features

V_{DS} (V) = 30V

I_D = 20A (V_{GS} = 10V)

$R_{DS(ON)} < 4.6m\Omega$ (V_{GS} = 10V)

$R_{DS(ON)} < 5.6m\Omega$ (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}	± 12	V
Continuous Drain Current ^A	$T_A=25^\circ\text{C}$	20	A
	$T_A=70^\circ\text{C}$	16	
Pulsed Drain Current ^B	I_{DM}	120	
Power Dissipation	$T_A=25^\circ\text{C}$	3.1	W
	$T_A=70^\circ\text{C}$	2.0	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$t \leq 10\text{s}$	$R_{\theta JA}$	31	40	$^\circ\text{C/W}$
Maximum Junction-to-Ambient ^A	Steady-State		59	75	$^\circ\text{C/W}$
Maximum Junction-to-Lead ^C	Steady-State	$R_{\theta JL}$	16	24	$^\circ\text{C/W}$

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV _{DSS}	Drain-Source Breakdown Voltage	I _D =1mA, V _{GS} =0V	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =24V, V _{GS} =0V T _J =125°C		0.008 9	0.1 20	mA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±12V			0.1	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.4	1.8	2.4	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	120			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =20A T _J =125°C		3.8 5.9	4.6 7.4	mΩ
		V _{GS} =4.5V, I _D =20A		4.5	5.6	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =20A		112		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.37	0.5	V
I _S	Maximum Body-Diode + Schottky Continuous Current				5	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		6430	7716	pF
C _{oss}	Output Capacitance			756		pF
C _{rss}	Reverse Transfer Capacitance			352		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		0.9	1.4	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =20A		96	115	
Q _g (4.5V)	Total Gate Charge			44	53	nC
Q _{gs}	Gate Source Charge			17		nC
Q _{gd}	Gate Drain Charge			13		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =0.75Ω, R _{GEN} =3Ω		17.5		ns
t _r	Turn-On Rise Time			10		ns
t _{D(off)}	Turn-Off DelayTime			56		ns
t _f	Turn-Off Fall Time			10.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A, dI/dt=300A/μs		20	25	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =20A, dI/dt=300A/μs		26		nC

A: The value of R_{θJA} is measured with the device in a still air environment with T_A=25°C. The power dissipation P_{DSM} and current rating I_{DSM} are based on T_J(MAX)=150°C, using t ≤ 10s junction-to-ambient thermal resistance.

B: Repetitive rating, pulse width limited by junction temperature T_J(MAX)=150°C.

C: The R_{θJA} is the sum of the thermal impedance from junction to lead R_{qJL} and lead to ambient.

D: The static characteristics in Figures 1 to 6 are obtained using <300 ms pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev1: June 2006

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

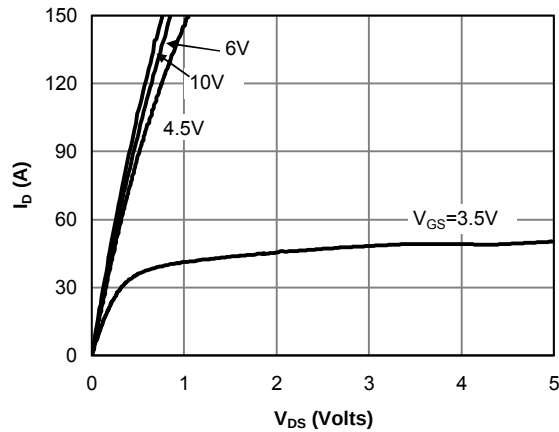


Fig 1: On-Region Characteristics

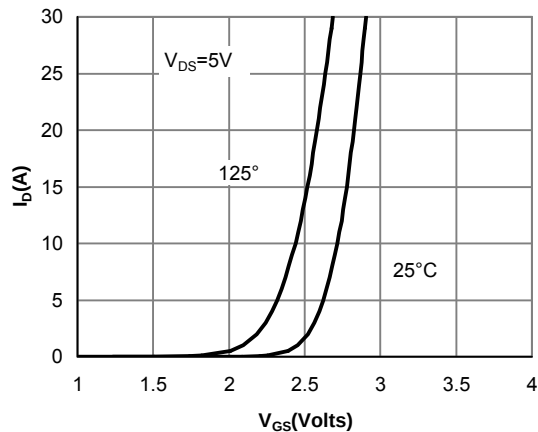


Figure 2: Transfer Characteristics

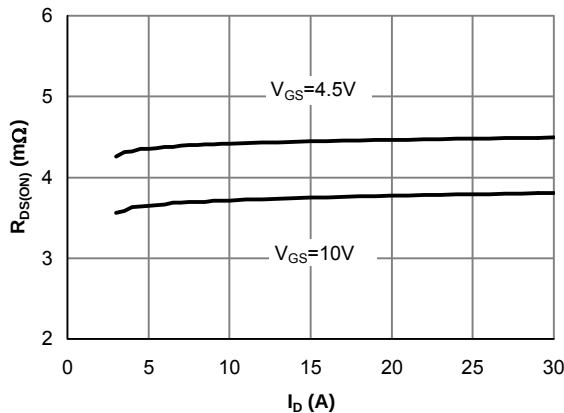


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

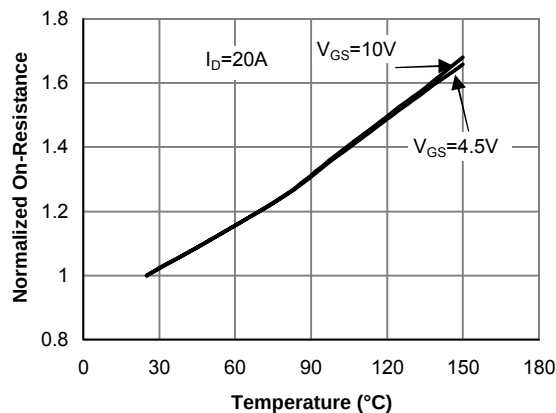


Figure 4: On-Resistance vs. Junction Temperature

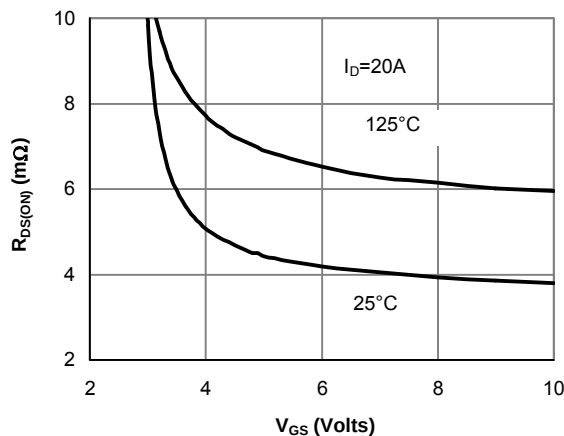


Figure 5: On-Resistance vs. Gate-Source Voltage

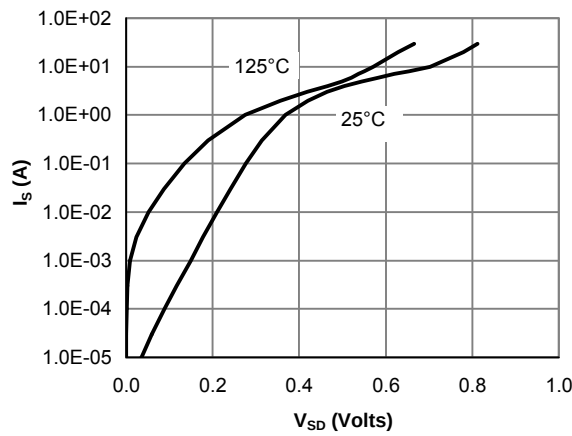
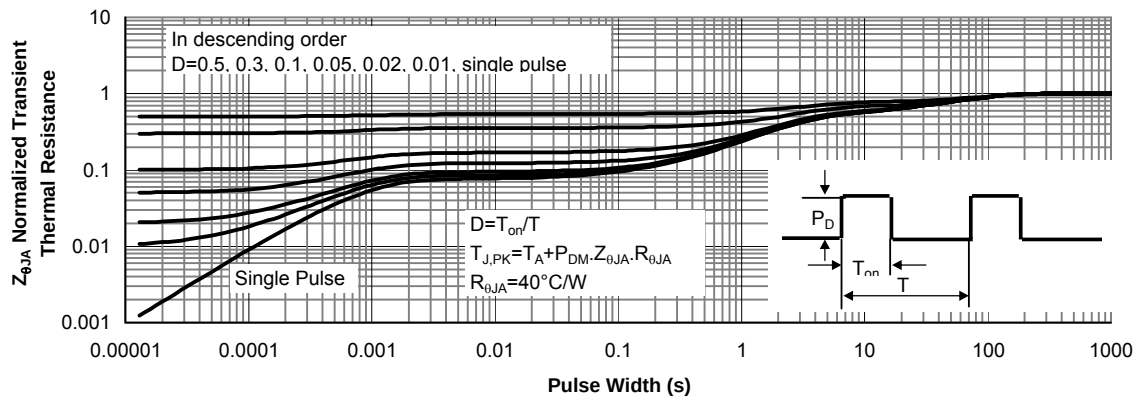
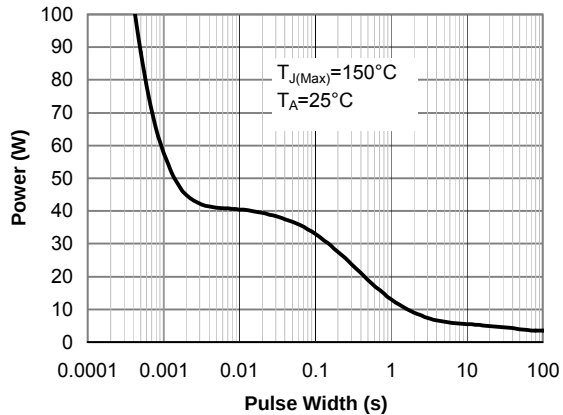
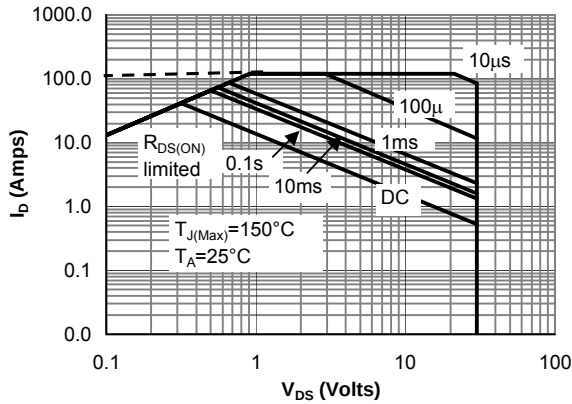
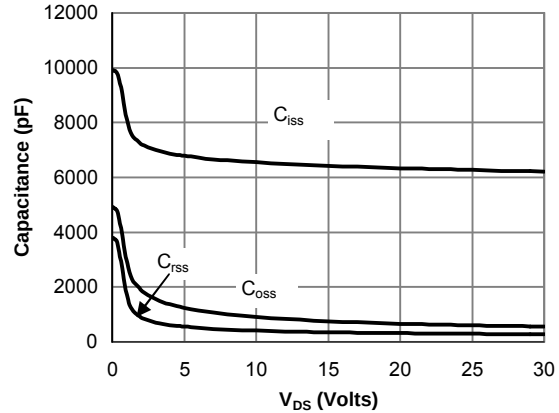
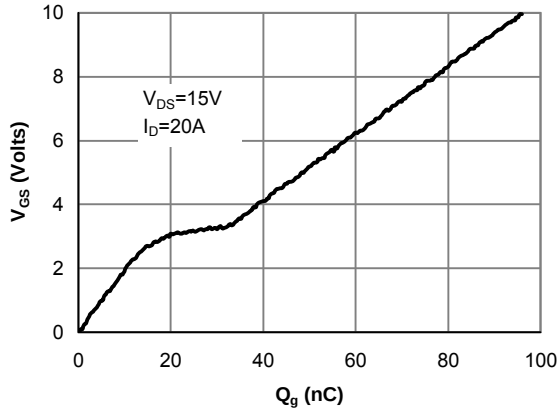


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

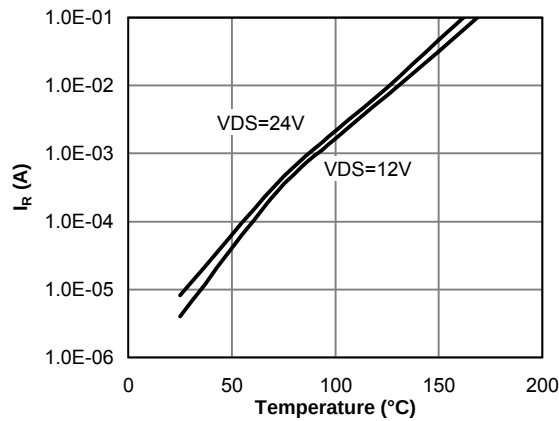


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

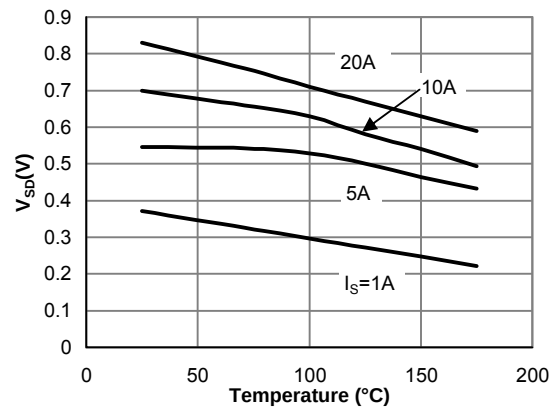


Figure 13: Diode Forward voltage vs. Junction Temperature

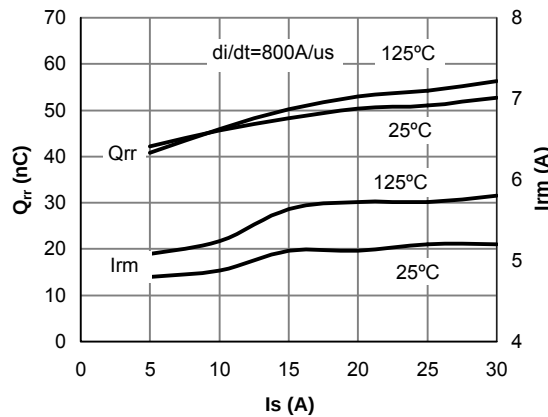


Figure 14: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

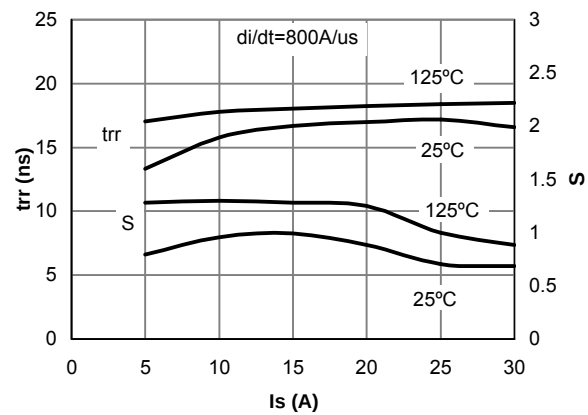


Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

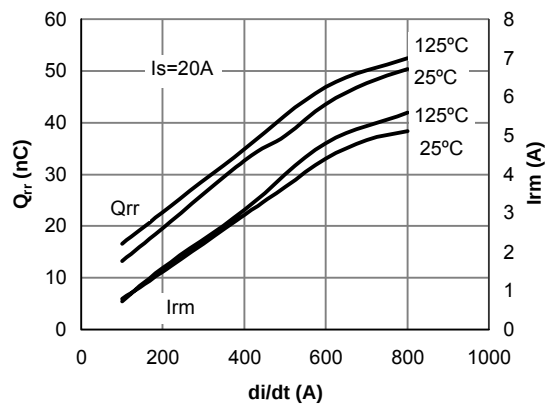


Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

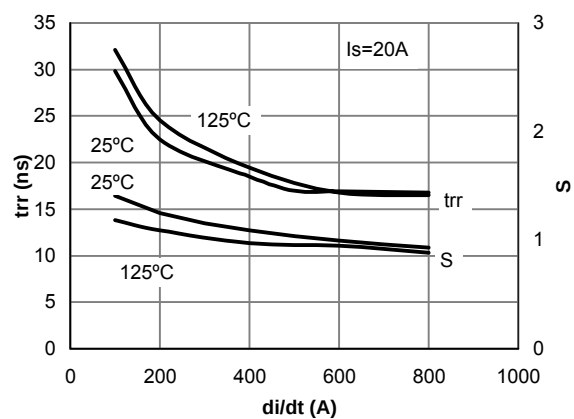


Figure 17: Diode Reverse Recovery Time and Soft Coefficient vs. di/dt