



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.*

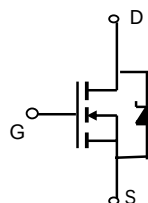
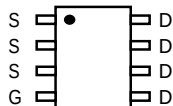
Features

$V_{DS} (V) = 30V$

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

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

$R_{DS(ON)} < 5.6m\Omega (V_{GS} = 4.5V)$



Absolute Maximum Ratings $T_A=25^\circ C$ 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	$T_A=25^\circ C$	20	A
	$T_A=70^\circ C$	16	
Pulsed Drain Current ^B	I_{DM}	120	
Power Dissipation	$T_A=25^\circ C$	3.1	W
	$T_A=70^\circ C$	2.0	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ C$

Thermal Characteristics

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

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	VGS=10V, VDS=15V, ID=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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

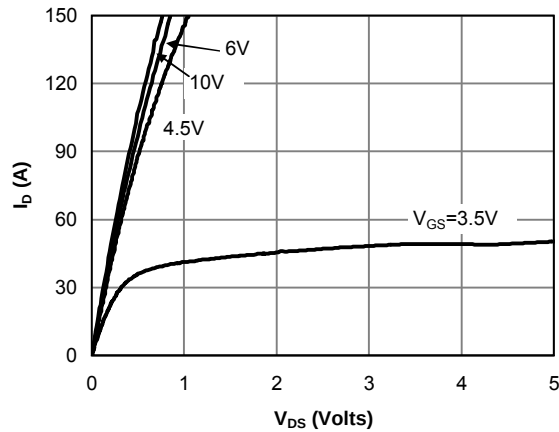


Fig 1: On-Region Characteristics

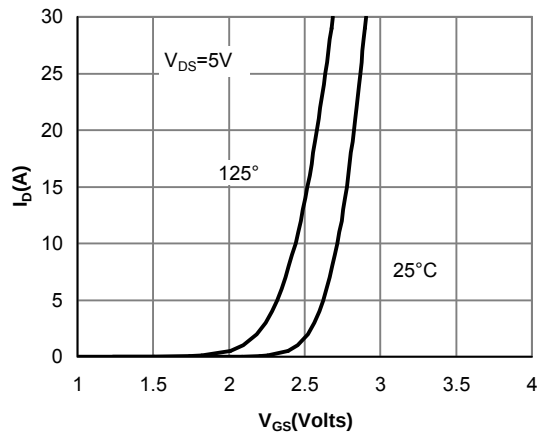


Figure 2: Transfer Characteristics

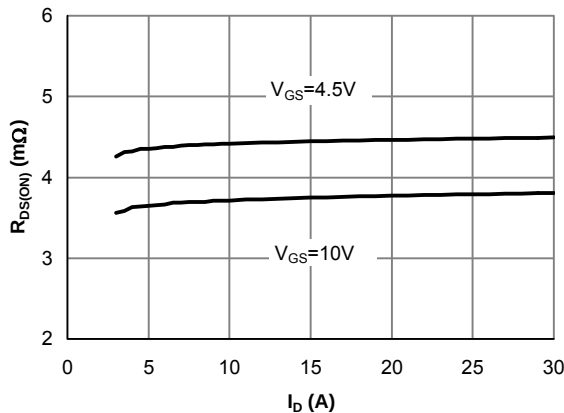


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

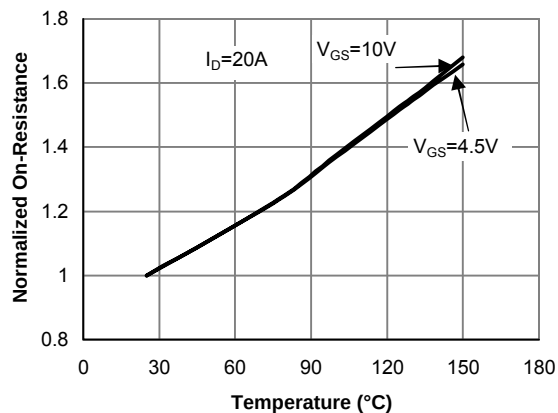


Figure 4: On-Resistance vs. Junction Temperature

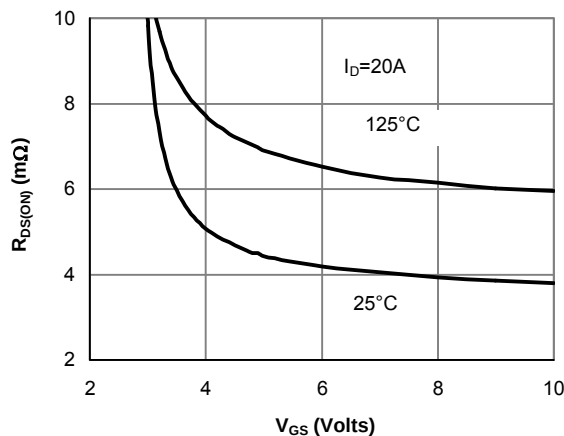


Figure 5: On-Resistance vs. Gate-Source Voltage

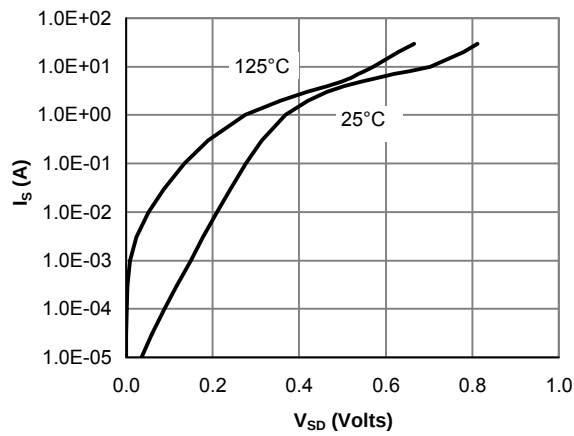


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

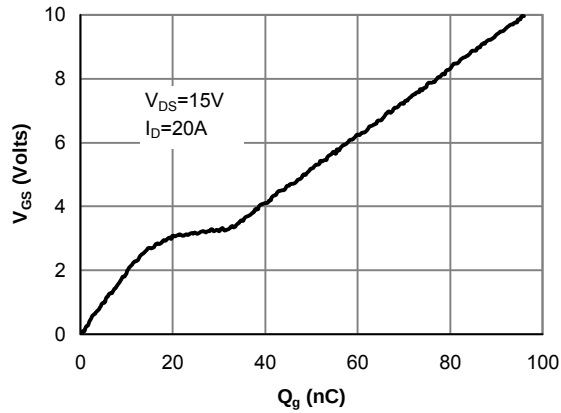


Figure 7: Gate-Charge Characteristics

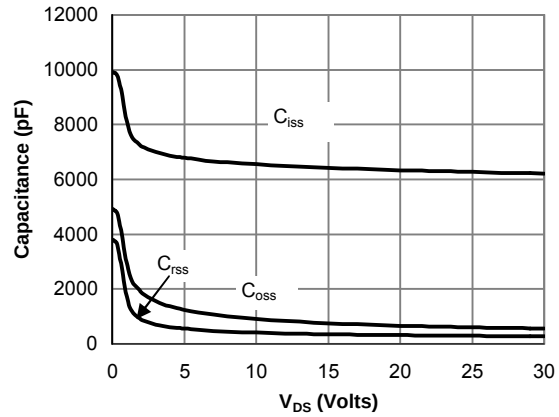


Figure 8: Capacitance Characteristics

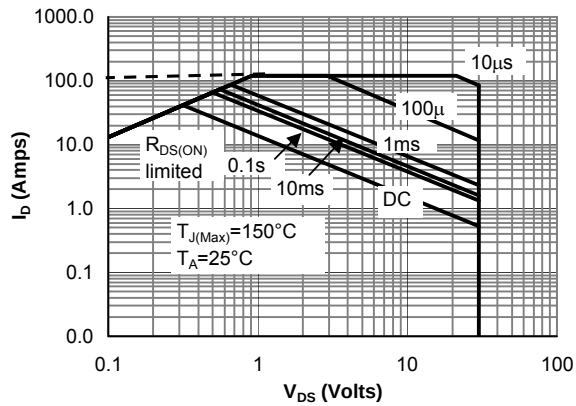


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

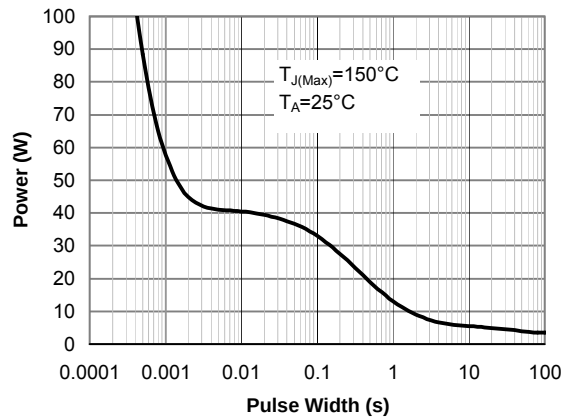


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

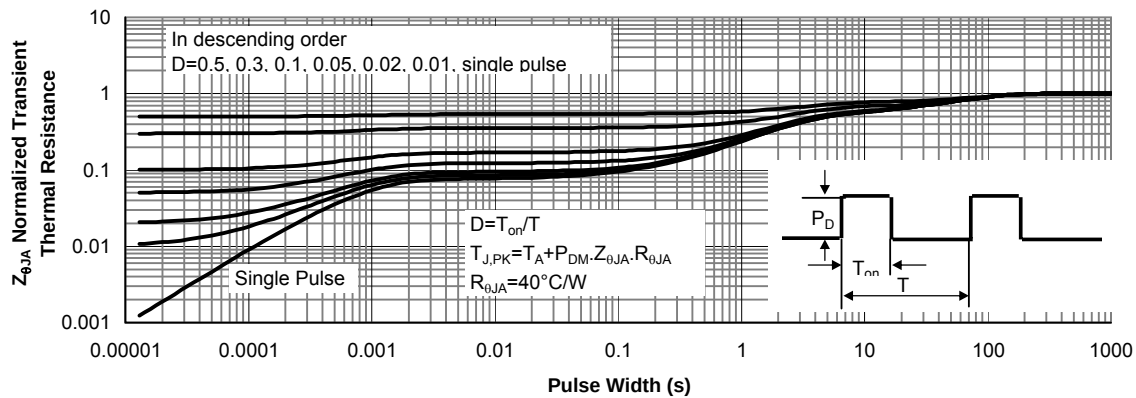


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

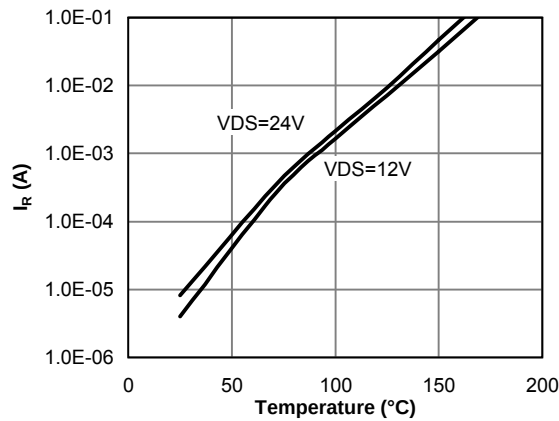


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

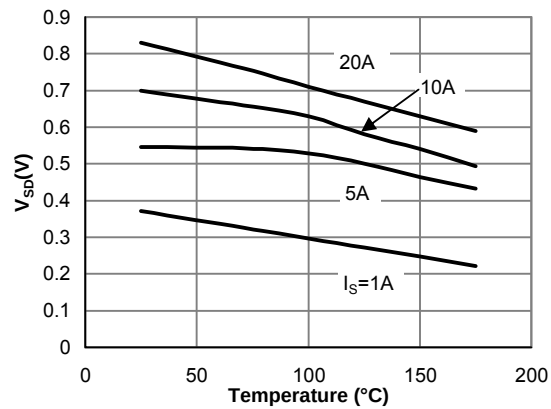


Figure 13: Diode Forward voltage vs. Junction Temperature

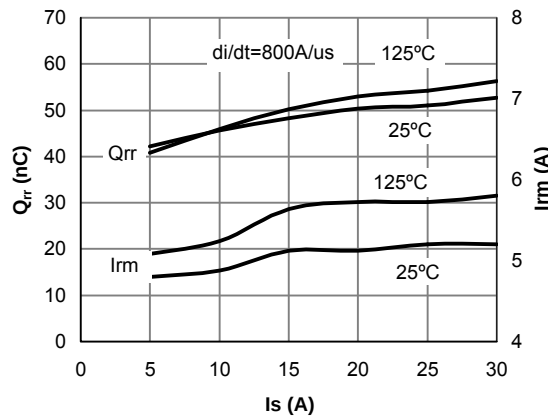


Figure 14: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

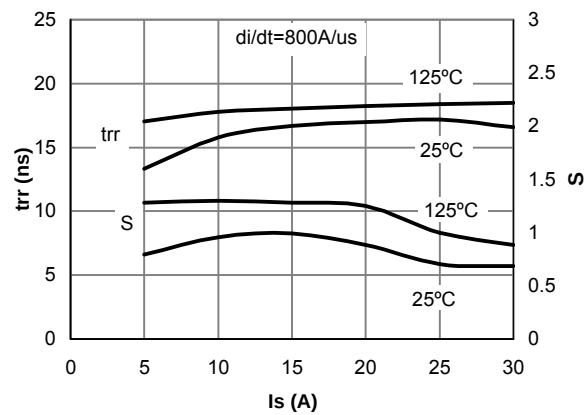


Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

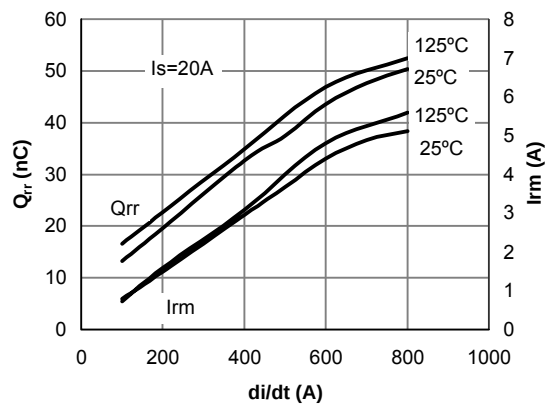


Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

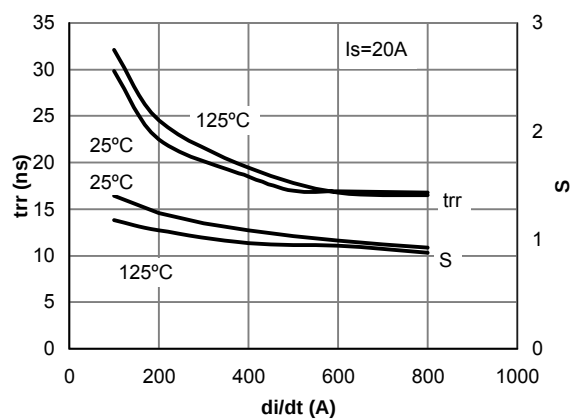


Figure 17: Diode Reverse Recovery Time and Soft Coefficient vs. di/dt