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ALPHA & OMEGA SEMICONDUCTOR

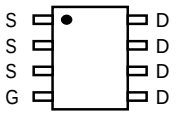
AO4456
N-Channel Enhancement Mode Field Effect Transistor

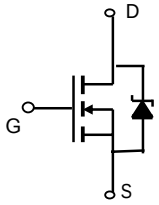
General Description

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)
$R_{DS(ON)}$ < 4.6mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 5.6mΩ (V_{GS} = 4.5V)





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

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	31	40	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		59	75	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	16	24	°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		0.008	0.1	mA
		T_J=125°C		9	20	
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		3.8	4.6	mΩ
		T_J=125°C		5.9	7.4	
		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 $R_{\theta JA}$ 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 TJ(MAX)=150°C, using t ≤ 10s junction-to-ambient thermal resistance.
B: Repetitive rating, pulse width limited by junction temperature TJ(MAX)=150°C.
C. The R θJA is the sum of the thermal impedence 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

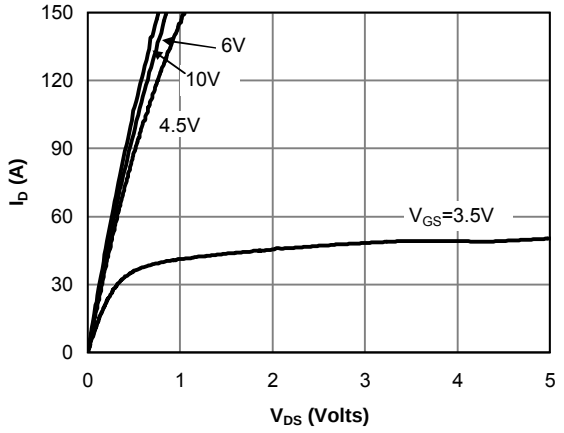

Fig 1: On-Region Characteristics

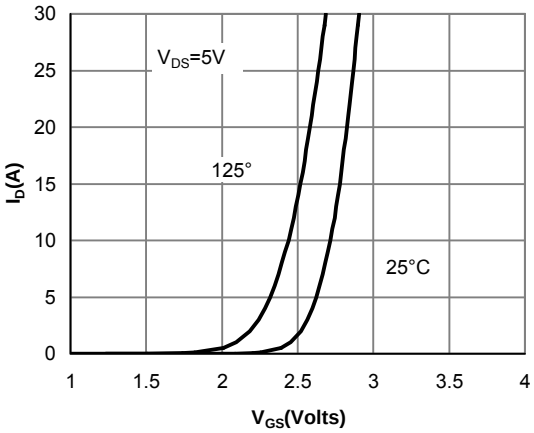

Figure 2: Transfer Characteristics

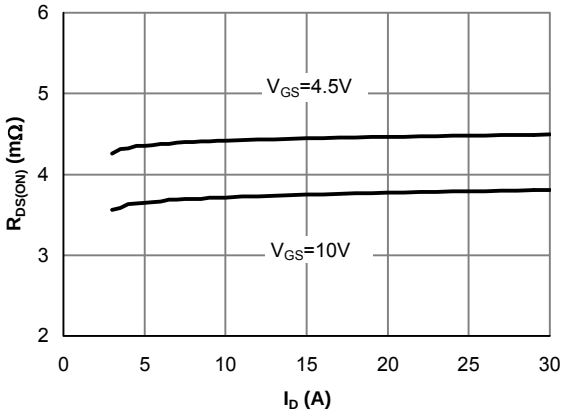

Figure 3: On-Resistance vs. Drain Current and Gate Voltage

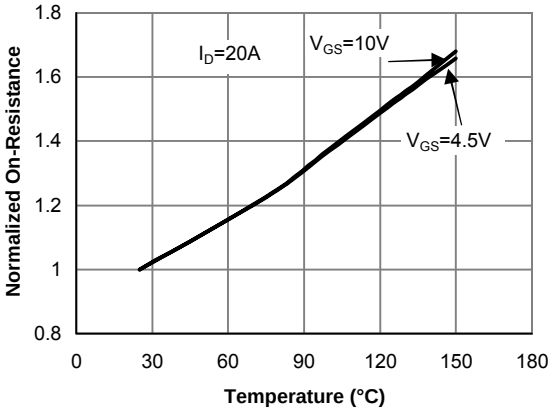

Figure 4: On-Resistance vs. Junction Temperature

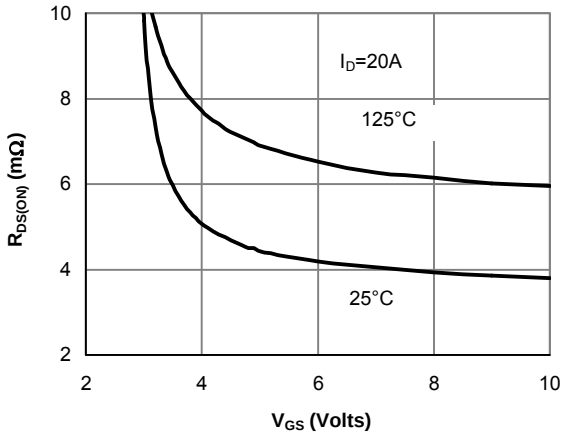

Figure 5: On-Resistance vs. Gate-Source Voltage

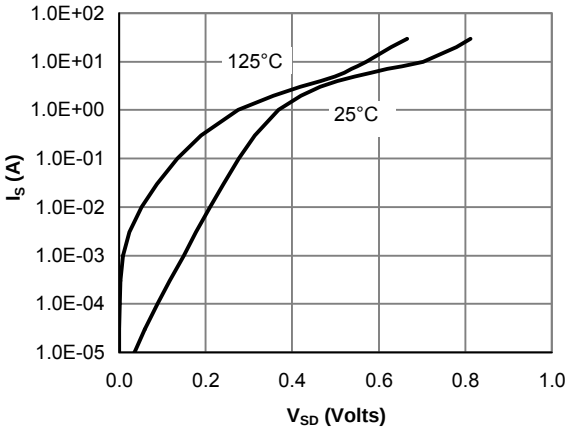

Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

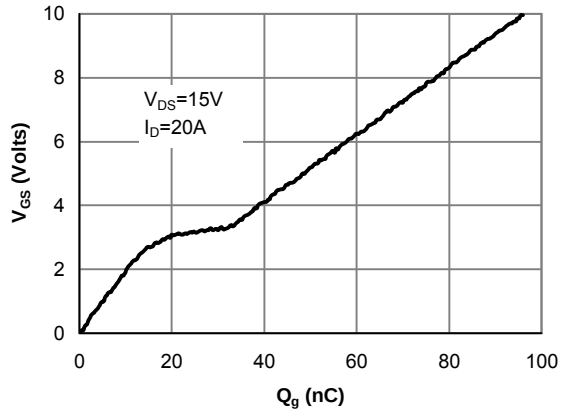

Figure 7: Gate-Charge Characteristics

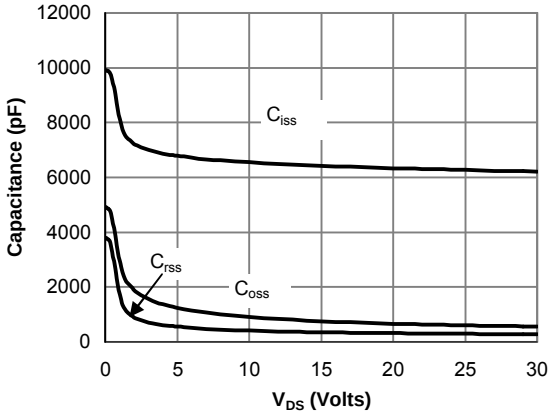

Figure 8: Capacitance Characteristics

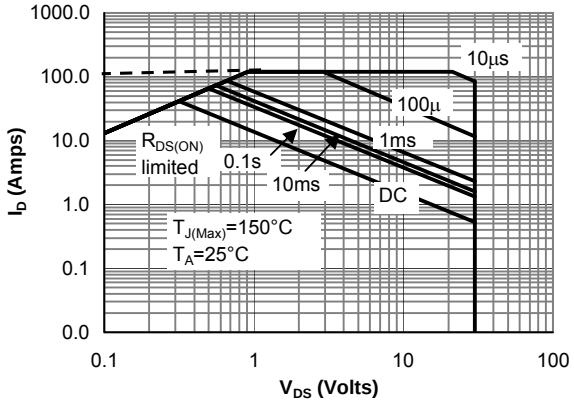

Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

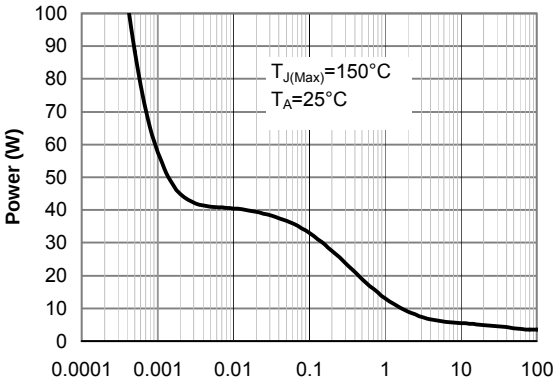

Figure10: Single Pulse Power Rating Junction-to-Ambient (Note E)

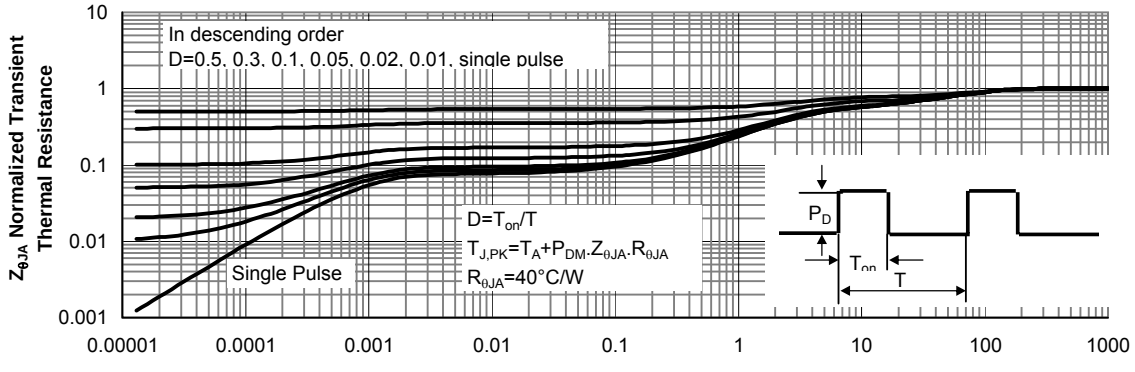

Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

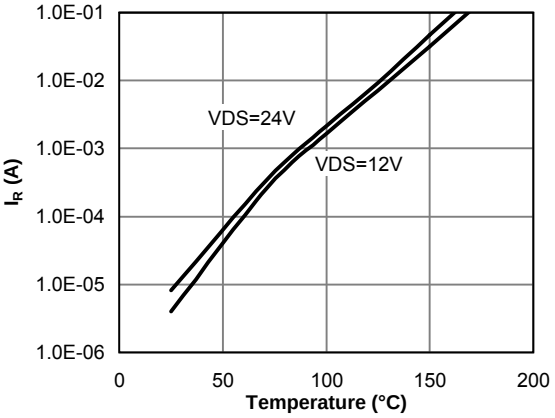

Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

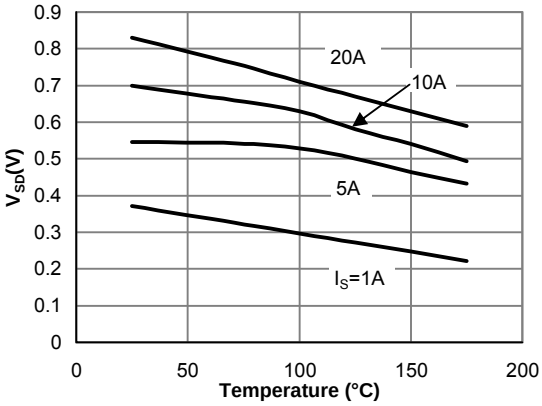

Figure 13: Diode Forward voltage vs. Junction Temperature

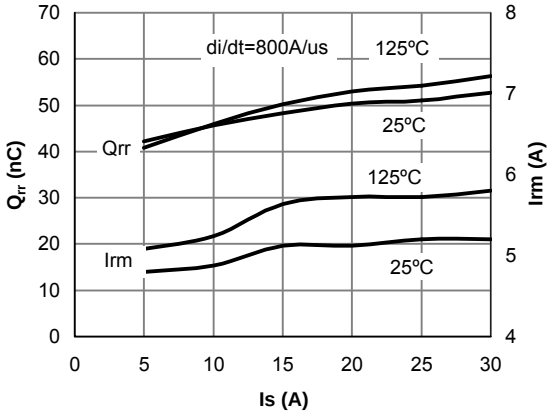

Figure 14: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

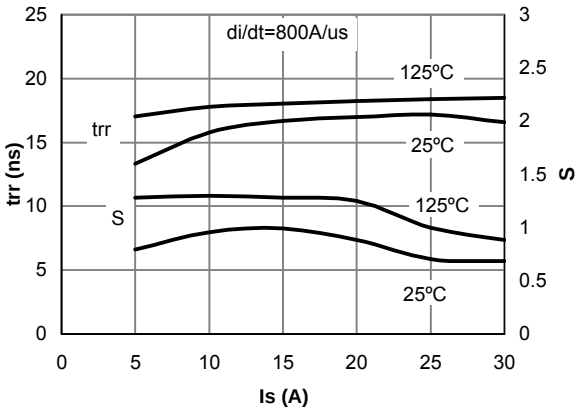

Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

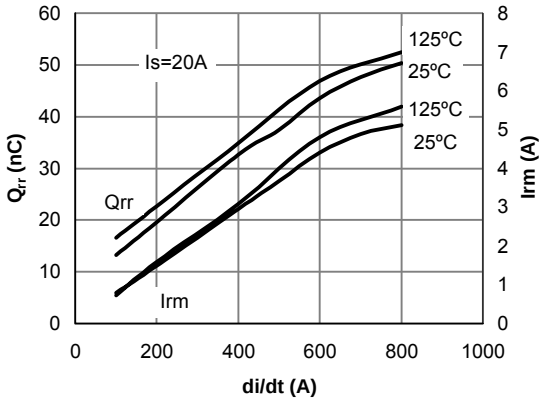

Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

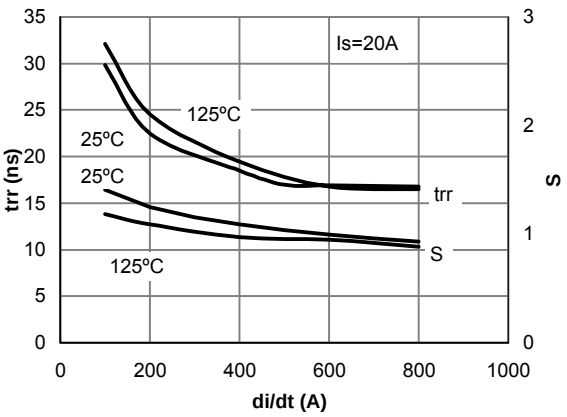

Figure 17: Diode Reverse Recovery Time and Soft Coefficient vs. di/dt