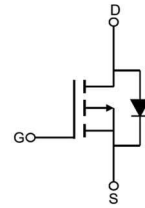


# AP4409S

## P-Channel Enhancement Mosfet

### Feature

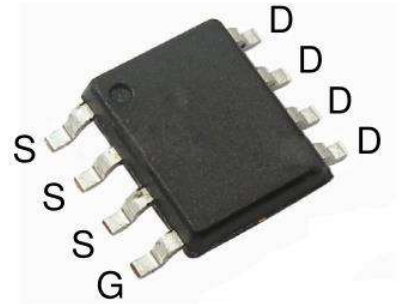
- -40V,-12A  
 $R_{DS(ON)} < 14m\Omega @ V_{GS} = -10V$   
 $R_{DS(ON)} < 20m\Omega @ V_{GS} = -4.5V$
- Advanced Trench Technology
- Lead free product is acquired



Schematic diagram

### Application

- PWM applications
- Load Switch
- Power management



SOP-8

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
4409S	AP4409S	SOP-8	13 inch	-	4000

### ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_a = 25^\circ\text{C}$ )	$I_D$	-12	A
Continuous Drain Current ( $T_a = 100^\circ\text{C}$ )	$I_D$	-8.5	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	-26	A
Singel Pulsed Avalanche Energy <sup>(2)</sup>	$E_{AS}$	146	mJ
Power Dissipation	$P_D$	2.5	W
Thermal Resistance from Junction to Case <sup>(4)</sup>	$R_{\theta JC}$	16	$^\circ\text{C}/\text{W}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55~ +150	$^\circ\text{C}$

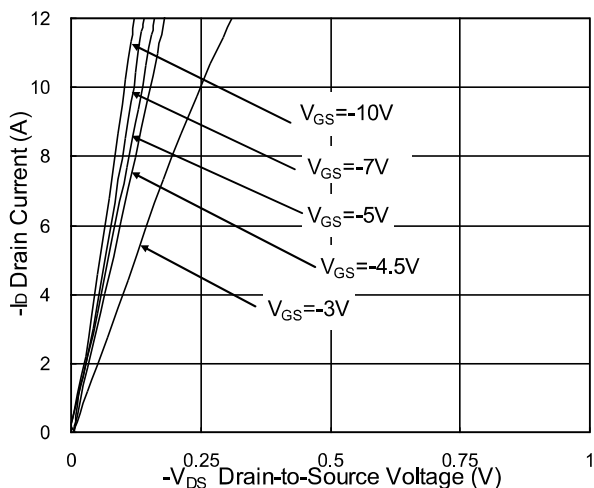
MOSFET ELECTRICAL CHARACTERISTICS( $T_a=25^{\circ}\text{C}$  unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-40	-	-	V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -40V, V_{GS} = 0V$	-	-	-1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	$\pm 100$	nA
Gate threshold voltage <sup>(3)</sup>	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	-1.0	-1.6	-2.5	V
Drain-source on-resistance <sup>(3)</sup>	$R_{DS(on)}$	$V_{GS} = -10V, I_D = -10A$	-	12	14	m $\Omega$
		$V_{GS} = -4.5V, I_D = -8A$	-	17.5	20	
<b>Dynamic characteristics</b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -15V, V_{GS} = 0V, f = 1MHz$	-	3500	-	pF
Output Capacitance	$C_{oss}$		-	323	-	
Reverse Transfer Capacitance	$C_{rss}$		-	222	-	
<b>Switching characteristics</b>						
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -15V, I_D = -1A,$ $V_{GS} = -10V, R_G = 3.3\Omega$	-	40	-	ns
Turn-on rise time	$t_r$		-	35	-	
Turn-off delay time	$t_{d(off)}$		-	10	-	
Turn-off fall time	$t_f$		-	9.6	-	
Total Gate Charge	$Q_g$	$V_{DS} = -20V, I_D = -6A,$ $V_{GS} = -4.5V$	-	28	-	nC
Gate-Source Charge	$Q_{gs}$		-	7.7	-	
Gate-Drain Charge	$Q_{gd}$		-	7.5	-	
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(3)</sup>	$V_{DS}$	$V_{GS} = 0V, I_S = -1A$	-	-	-1.2	V
Diode Forward current <sup>(4)</sup>	$I_S$		-	-	-12	A

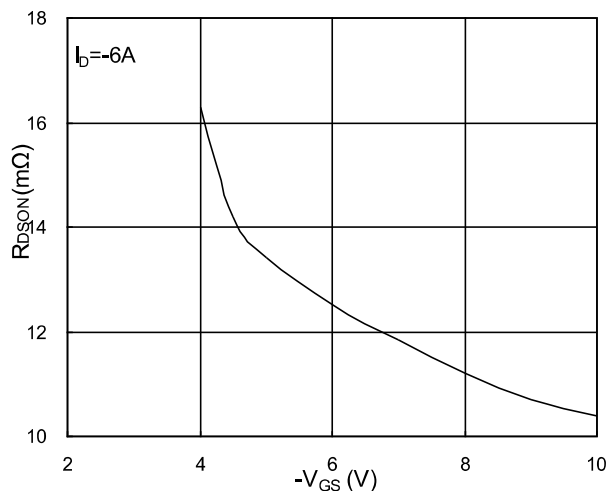
**Notes:**

1. Repetitive Rating: pulse width limited by maximum junction temperature
2. EAS Condition:  $T_J = 25^{\circ}\text{C}, V_{DD} = -25V, R_G = 25\Omega, L = 0.1\text{mH}, I_{AS} = -54A$
3. Pulse Test: pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$
4. Surface Mounted on FR4 Board,  $t \leq 10\text{ sec}$

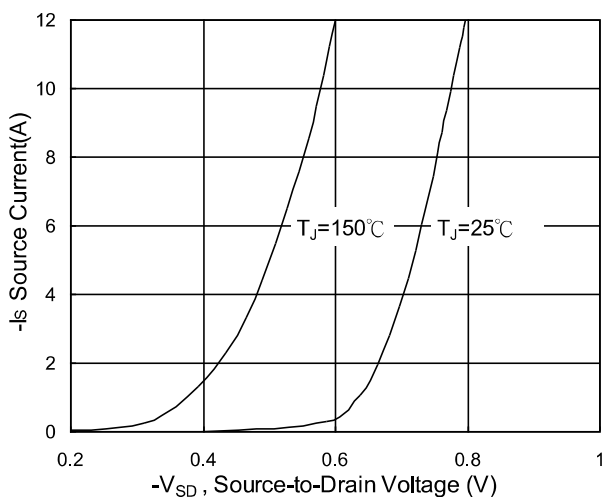
**Typical Characteristics**



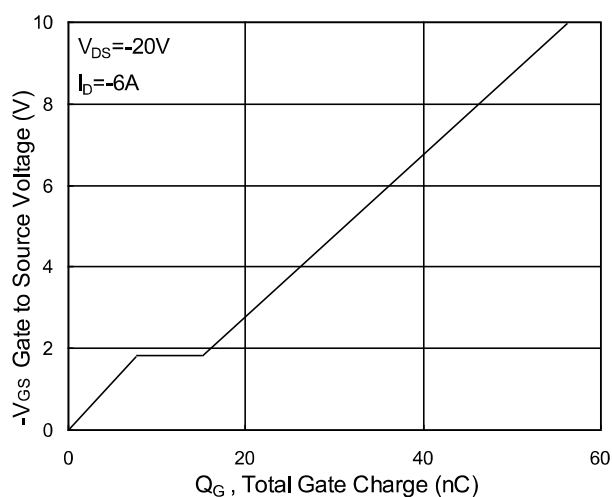
**Fig.1 Typical Output Characteristics**



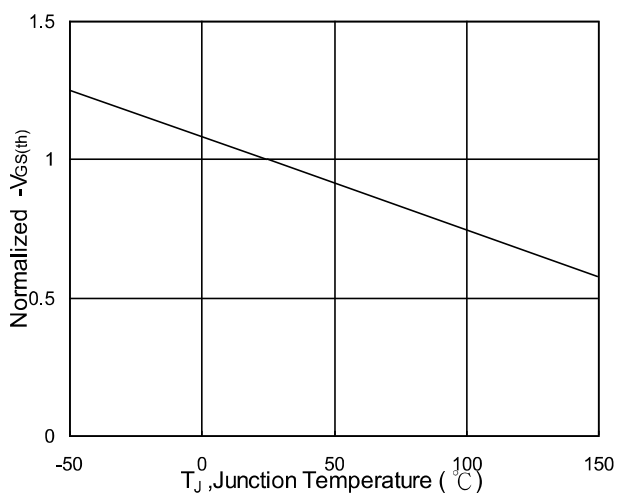
**Fig.2 On-Resistance v.s Gate-Source**



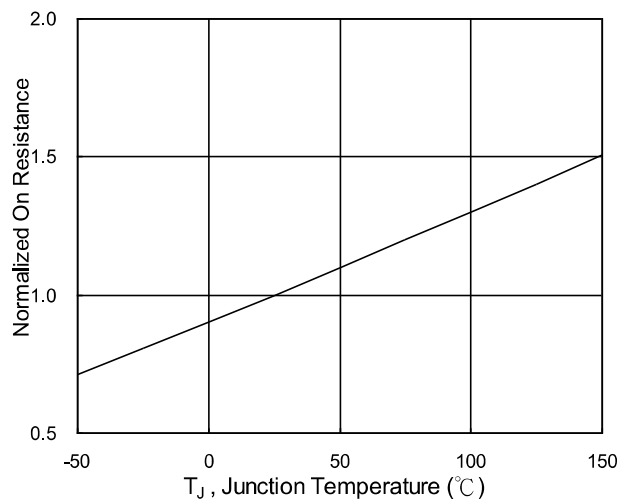
**Fig.3 Forward Characteristics Of Reverse**



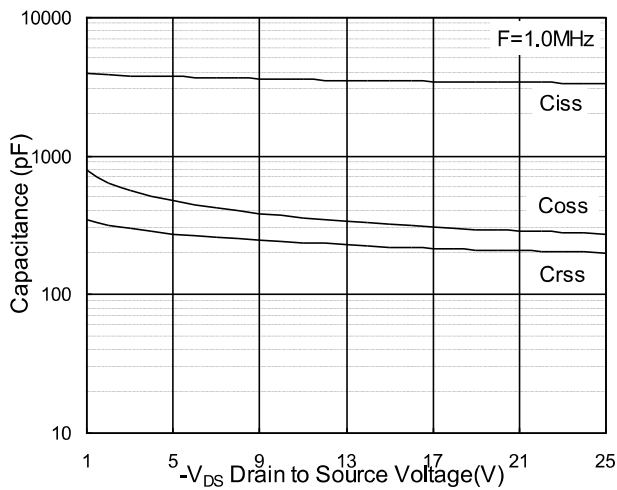
**Fig.4 Gate-Charge Characteristics**



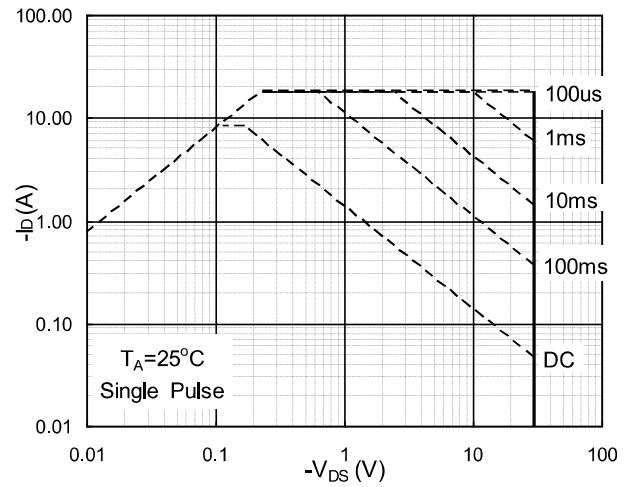
**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**



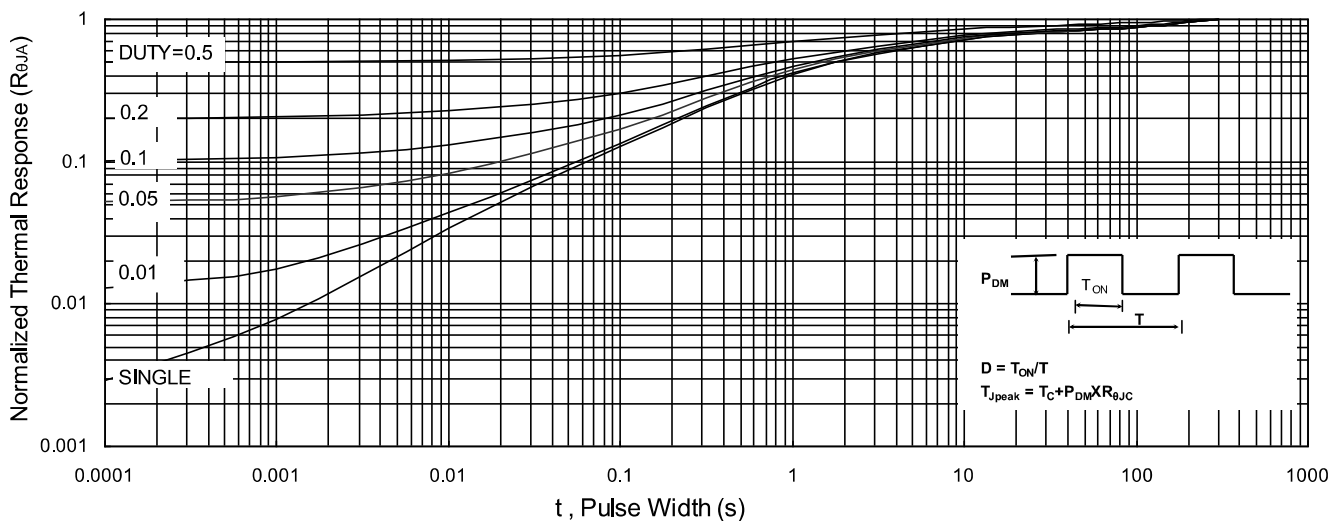
**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**



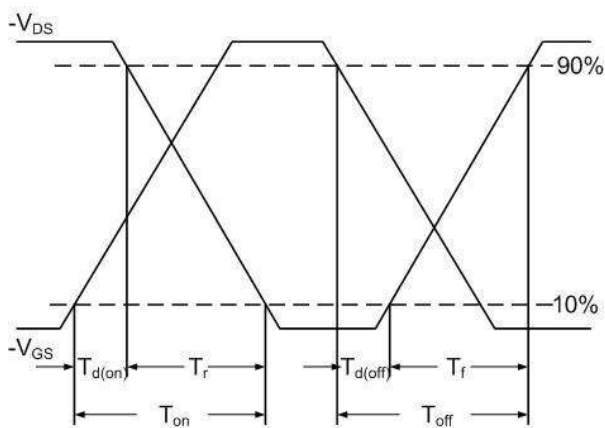
**Fig.7 Capacitance**



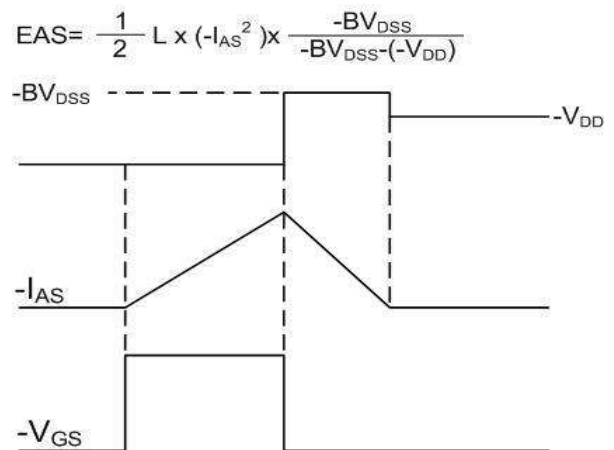
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**

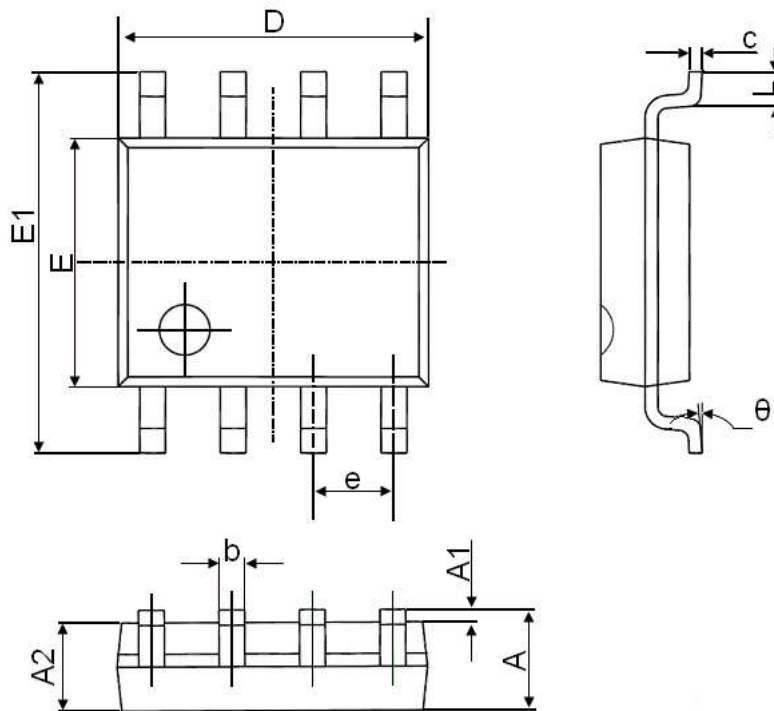


**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Waveform**

**SOP-8 Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

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