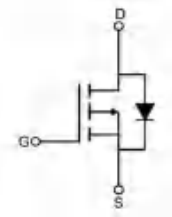


AP4409S

P-Channel Enhancement Mosfet

Feature

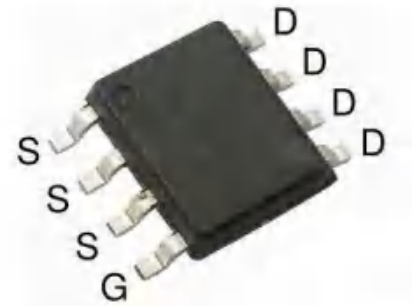
- -40V,-12A
 $R_{DS(ON)} < 14m\Omega @ V_{GS} = -10V$
 $R_{DS(ON)} < 20m\Omega @ V_{GS} = -4.5V$
- Advanced Trench Technology
- Lead free product is acquired



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}	± 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 ⁽¹⁾	I_{DM}	-26	A
Singel Pulsed Avalanche Energy ⁽²⁾	E_{AS}	146	mJ
Power Dissipation	P_D	2.5	W
Thermal Resistance from Junction to Case ⁽⁴⁾	$R_{\theta JC}$	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
Static Characteristics						
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	μA
Gate-body leakage current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$	-	-	± 100	nA
Gate threshold voltage ⁽³⁾	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	-1.0	-1.6	-2.5	V
Drain-source on-resistance ⁽³⁾	$R_{DS(on)}$	$V_{GS} = -10V, I_D = -10A$	-	12	14	m Ω
		$V_{GS} = -4.5V, I_D = -8A$	-	17.5	20	
Dynamic characteristics						
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	-	
Switching characteristics						
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	-	
Source-Drain Diode characteristics						
Diode Forward voltage ⁽³⁾	V_{DS}	$V_{GS} = 0V, I_S = -1A$	-	-	-1.2	V
Diode Forward current ⁽⁴⁾	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

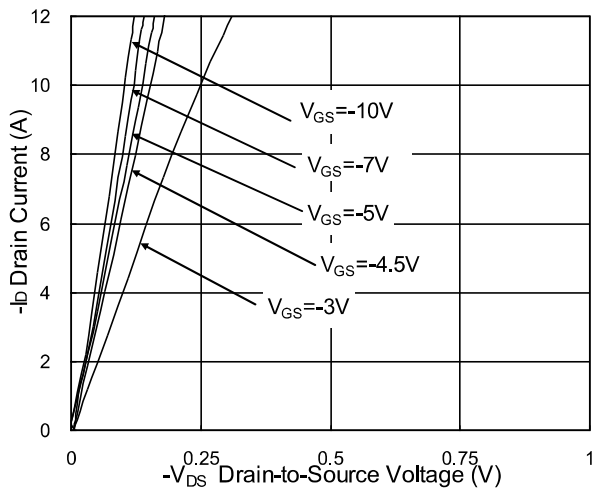


Fig.1 Typical Output Characteristics

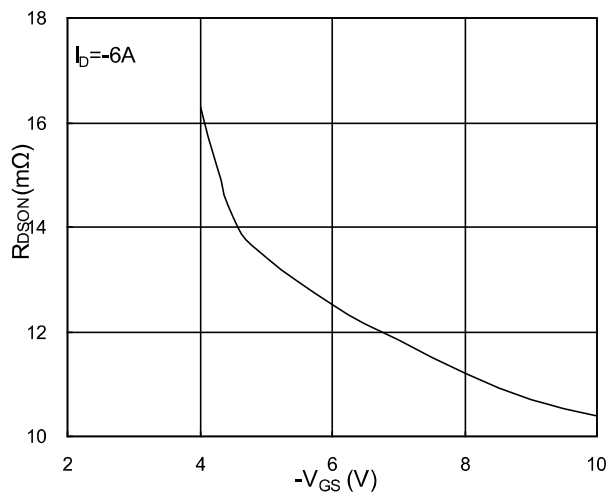


Fig.2 On-Resistance v.s Gate-Source

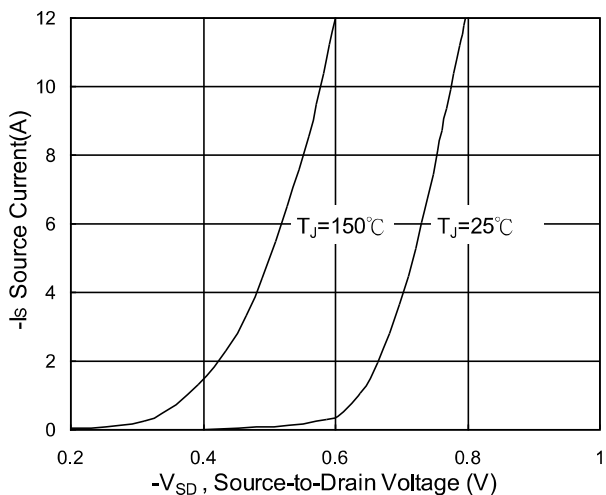


Fig.3 Forward Characteristics Of Reverse

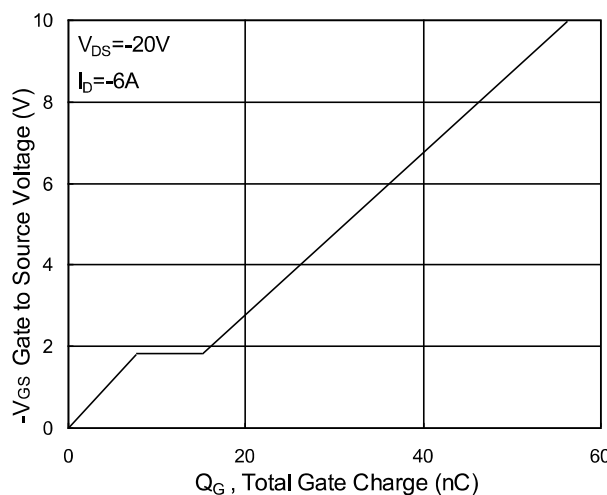


Fig.4 Gate-Charge Characteristics

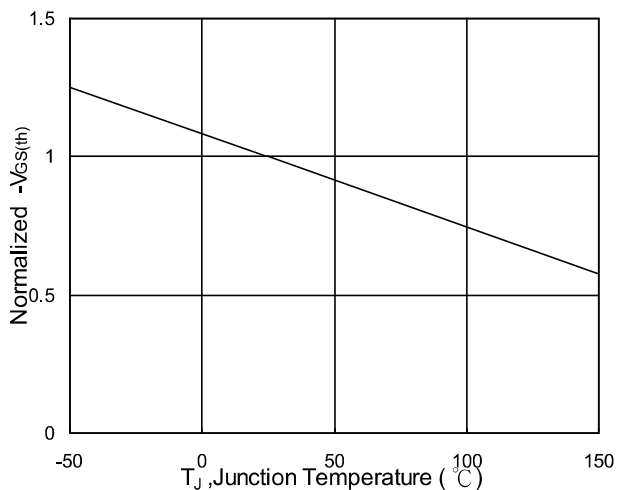


Fig.5 Normalized $V_{GS(th)}$ v.s T_J

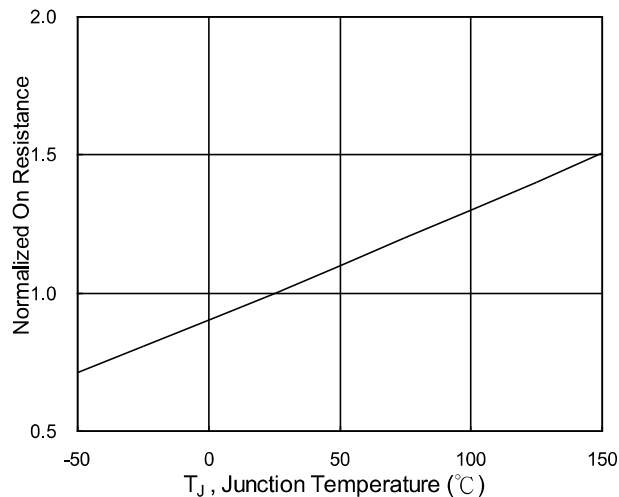


Fig.6 Normalized $R_{DS(on)}$ v.s T_J

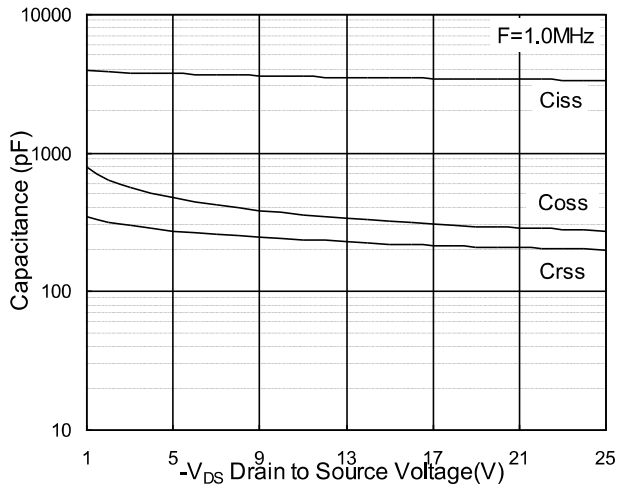


Fig.7 Capacitance

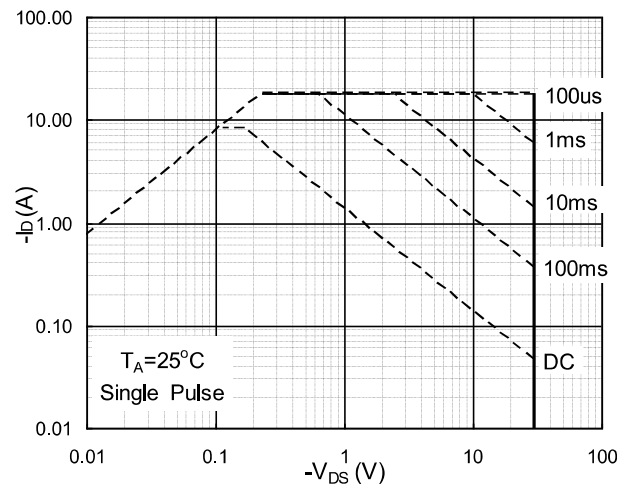


Fig.8 Safe Operating Area

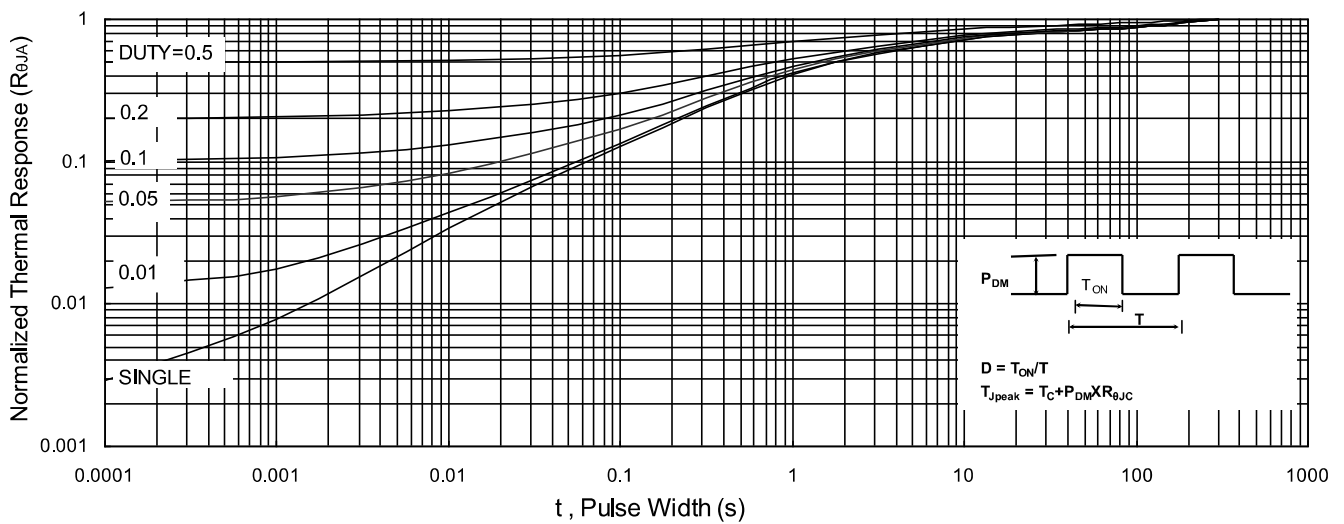


Fig.9 Normalized Maximum Transient Thermal Impedance

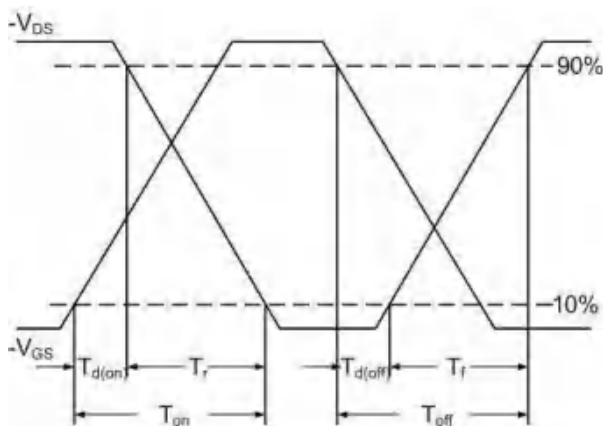


Fig.10 Switching Time Waveform

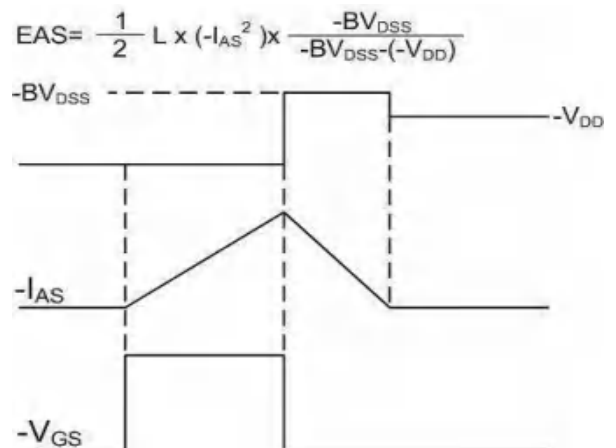
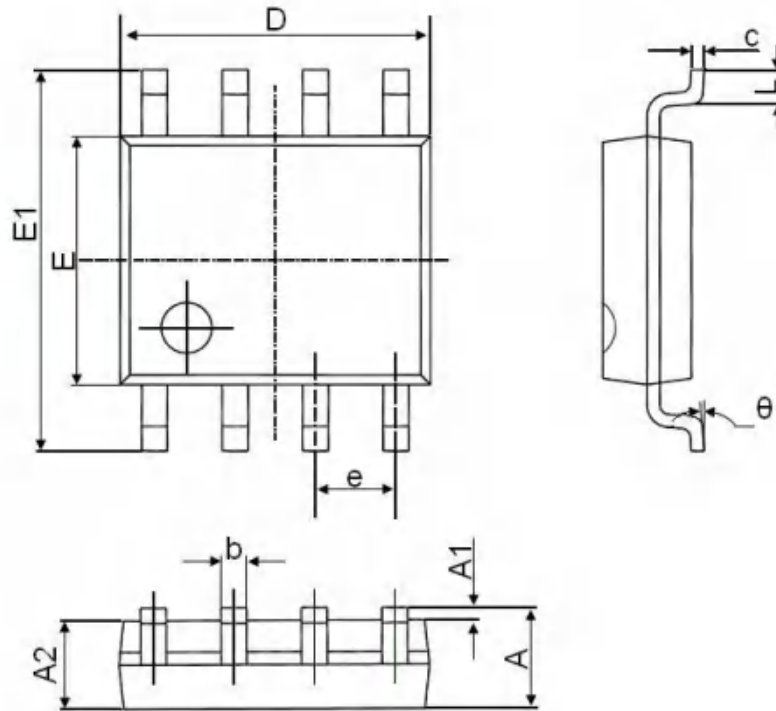


Fig.11 Unclamped Inductive Waveform

AP4409S

P-Channel Enhancement Mosfet

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
θ	0°	8°	0°	8°