

- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology
- ★ 100% EAS Guaranteed

Product Summary



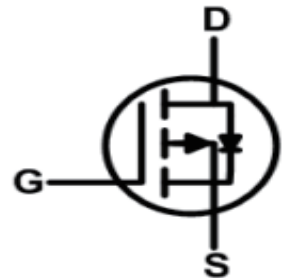
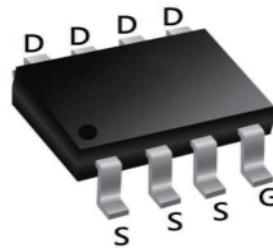
BVDSS	RDS(on)	ID
-30V	5.8mΩ	-18A

Description

The 4409A is the high cell density trenched P-ch MOSFETs, which provide excellent RDS(on) and gate charge for most of the synchronous buck converter applications.

The 4409A meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

SOP8 Pin Configuration



Absolute Maximum Ratings (TA=25°C unless otherwise specified)

Symbol	Parameter	Max.	Units
V _{DS}	Drain-Source voltage	-30	V
V _{GS}	Gate-Source voltage	±20	V
I _D	Continuous Drain Current	T _A =25°C	-18
		T _A =100°C	-8.8
I _{DM}	Pulsed Drain Current	-53	A
EAS	Single Pulse Avalanche Energy	80	mJ
P _D	Total Power Dissipation	3	W
T _J , T _{STG}	Operating Junction and Storage Temperature Range	-55 to 150	°C

Thermal Data

Symbol	Parameter	Value	Unit
R _{θJA}	Thermal Resistance from Junction-to-Ambients	41.6	°C/W

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Units
Static Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = -250\mu A$	-30	-	-	V
I_{GSS}	Gate-body Leakage current	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	± 100	nA
I_{DSS}	Zero Gate Voltage Drain Current	$T_J = 25^\circ\text{C}$	-	-	-1	μA
		$T_J = 100^\circ\text{C}$	-	-	-100	μA
$V_{GS(th)}$	Gate-Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	-1	-	-2.5	V
$R_{DS(on)}$	Drain-Source on-Resistance ⁴	$V_{GS} = -10V, I_D = -12A$	-	5.8	9.2	m Ω
		$V_{GS} = -4.5V, I_D = -10A$	-	8	14	m Ω
g_{fs}	Forward Transconductance ⁴	$V_{DS} = -10V, I_D = -10A$	-	50	-	S
Dynamic Characteristics⁵						
C_{iss}	Input Capacitance	$V_{DS} = -15V, V_{GS} = 0V,$ $f = 1\text{MHz}$	-	3100	-	pF
C_{oss}	Output Capacitance		-	430	-	pF
C_{rss}	Reverse Transfer Capacitance		-	358	-	pF
R_g	Gate Resistance	$f = 1\text{MHz}$	-	2	-	Ω
Switching Characteristics⁵						
Q_g	Total Gate Charge	$V_{GS} = -10V, V_{DS} = -15V,$ $I_D = -12A$	-	35	-	nC
Q_{gs}	Gate-Source Charge		-	9.9	-	nC
Q_{gd}	Gate-Drain Charge		-	10.5	-	nC
$t_{d(on)}$	Turn-on Delay Time	$V_{GS} = -10V, V_{DD} = -15V,$ $R_G = 3\Omega, I_D = -12A$	-	10.8	-	ns
t_r	Rise Time		-	13.2	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	73	-	ns
t_f	Fall Time		-	35	-	ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F = -12A, di/dt = 100A/\mu S$	-	69	-	ns
Q_{rr}	Body Diode Reverse Recovery Charge		-	141	-	nC
Drain-Source Body Diode Characteristics						
V_{SD}	Diode Forward Voltage ⁴	$I_S = 20A, V_{GS} = 0V$	-	-	-1.2	V
I_S	Continuous Source Current	$T_C = 25^\circ\text{C}$	-	-	-14	A

Notes:

1. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)} = 150^\circ\text{C}$.
2. The EAS data shows Max. rating .The test condition is $V_{DD} = -25V, V_{GS} = -10V, L = 0.1\text{mH}, I_{AS} = -40A$.
3. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed ,pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
5. This value is guaranteed by design hence it is not included in the production test.

Typical Performance Characteristics

Figure 1: Output Characteristics

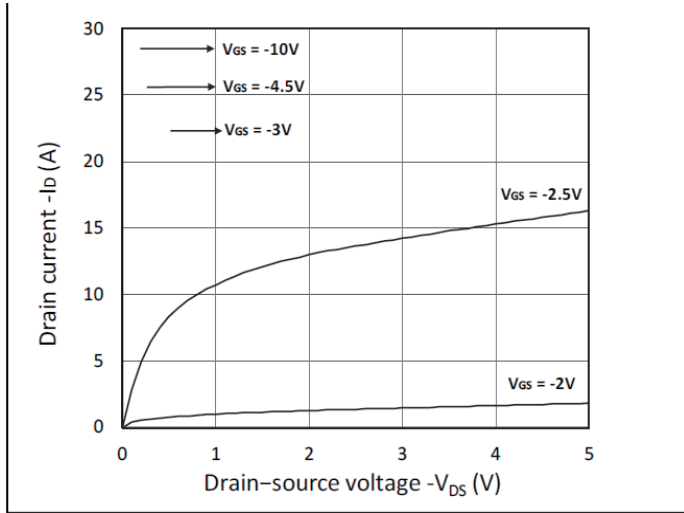


Figure 2: Typical Transfer Characteristics

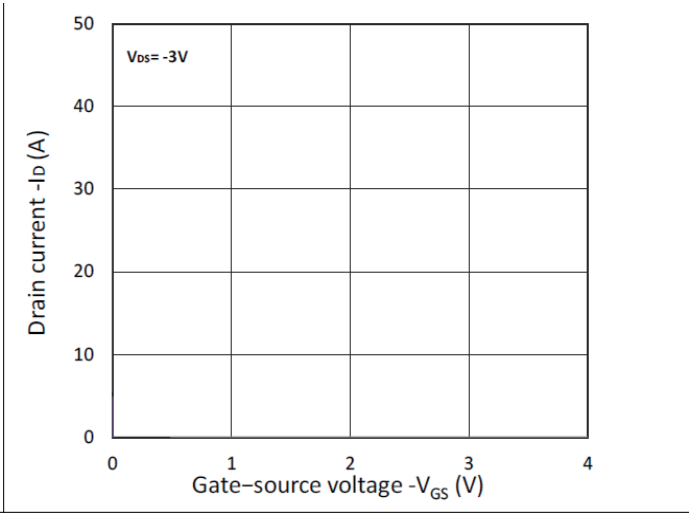


Figure 3: Forward Characteristics of Reverse

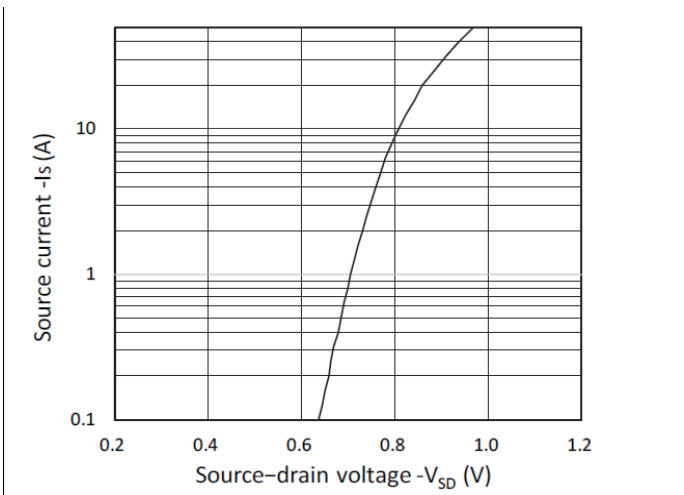


Figure 4: RDS(ON) vs. VGS

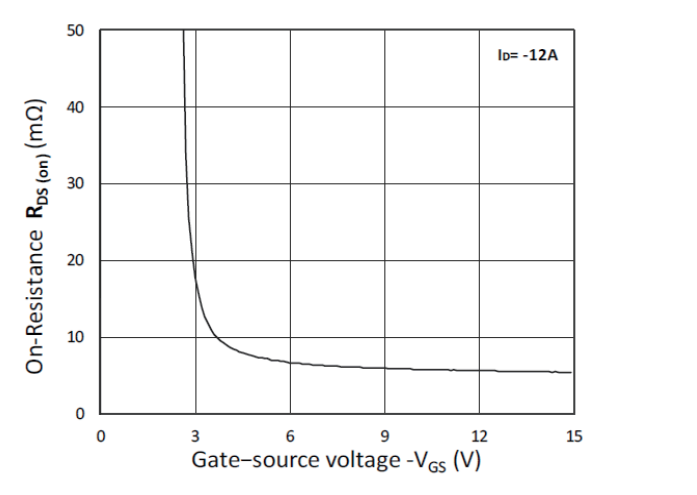


Figure 5: RDS(ON) vs. ID

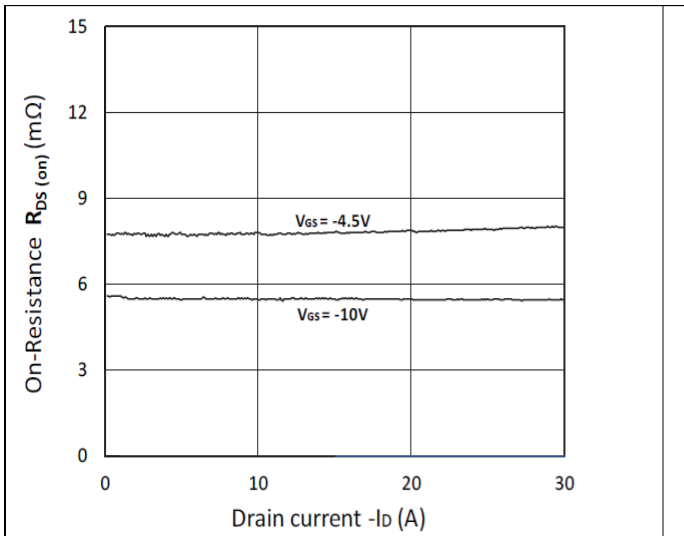
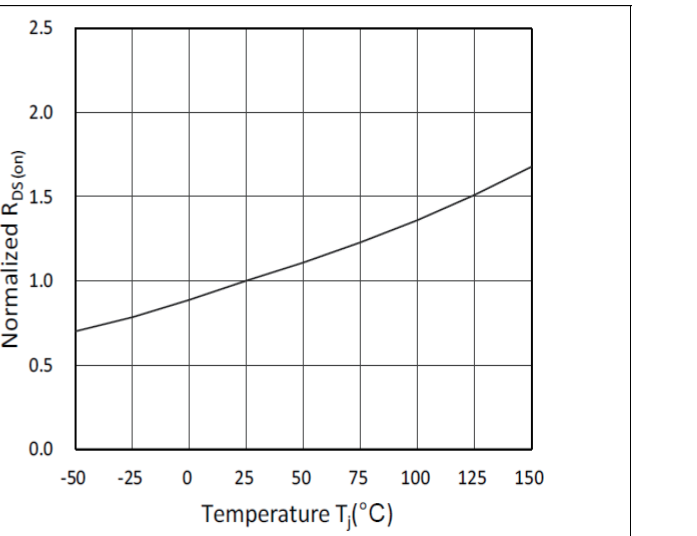


Figure 6: Normalized RDS(on) vs. Temperature



Typical Performance Characteristics

Figure 7: Capacitance Characteristics

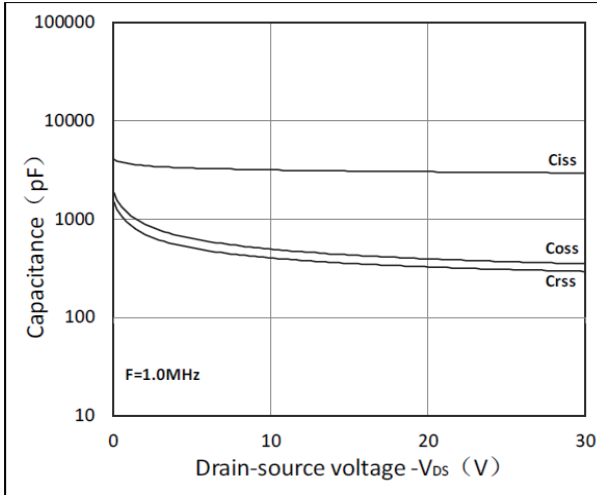


Figure 8: Gate Charge Characteristics

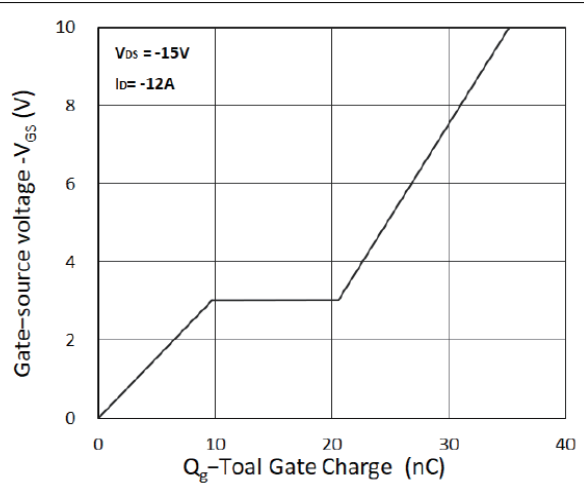


Figure 9: Power Dissipation

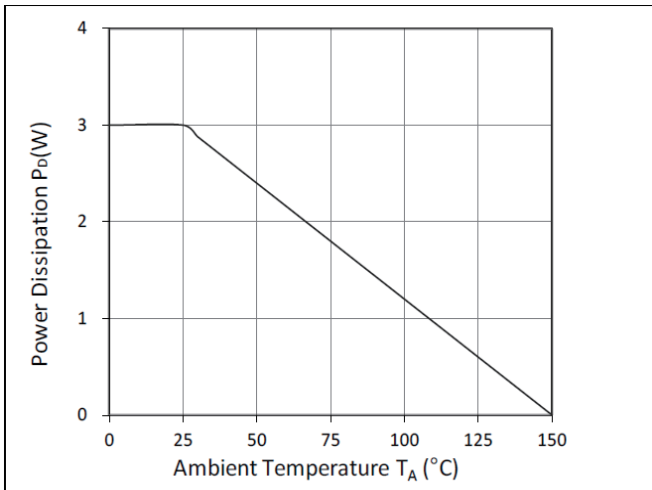


Figure 10: Safe Operating Area

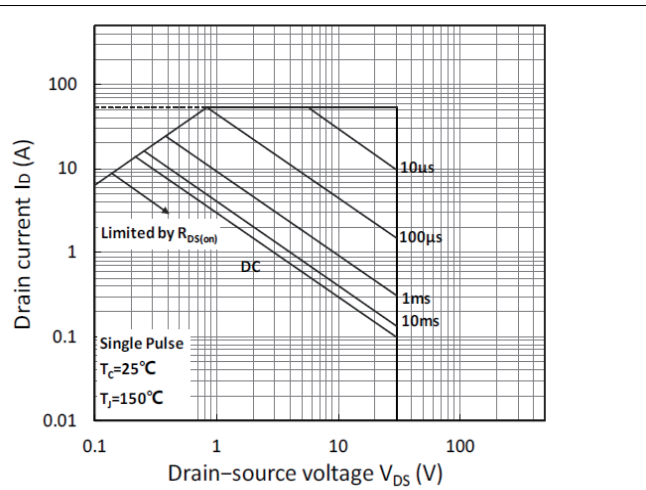
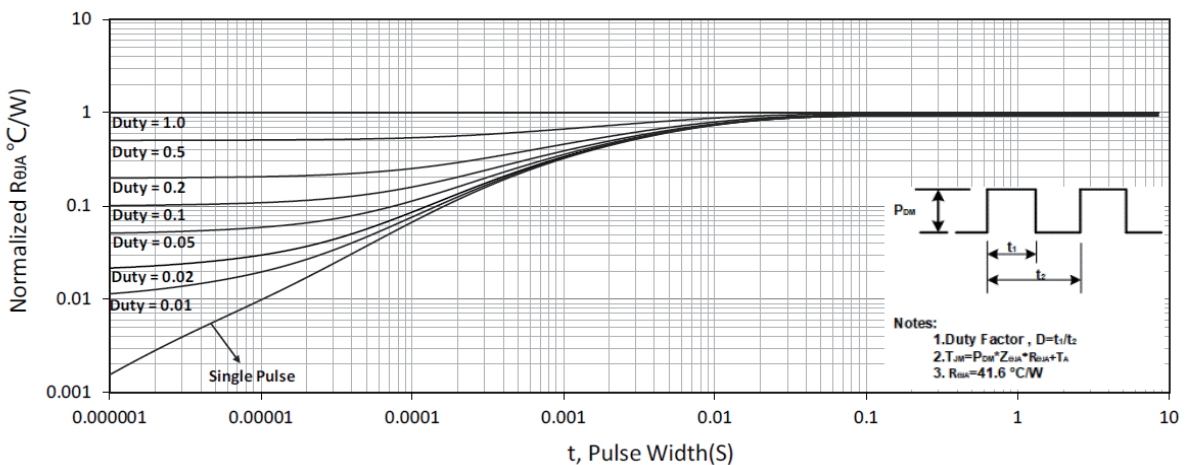


Figure.11: Normalized Maximum Transient



Test Circuit

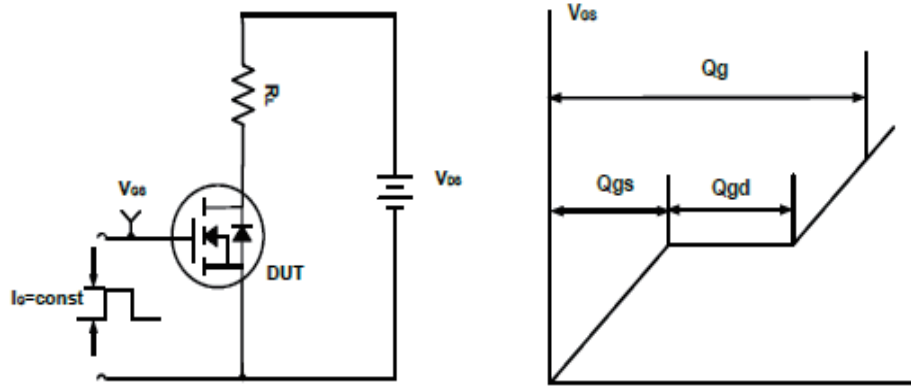


Figure A. Gate Charge Test Circuit & Waveforms

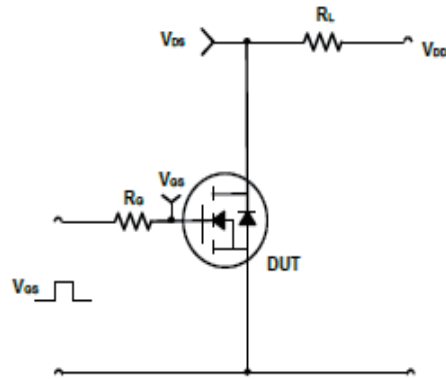


Figure B. Switching Test Circuit & Waveforms

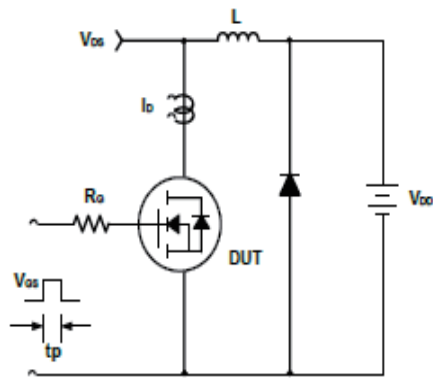
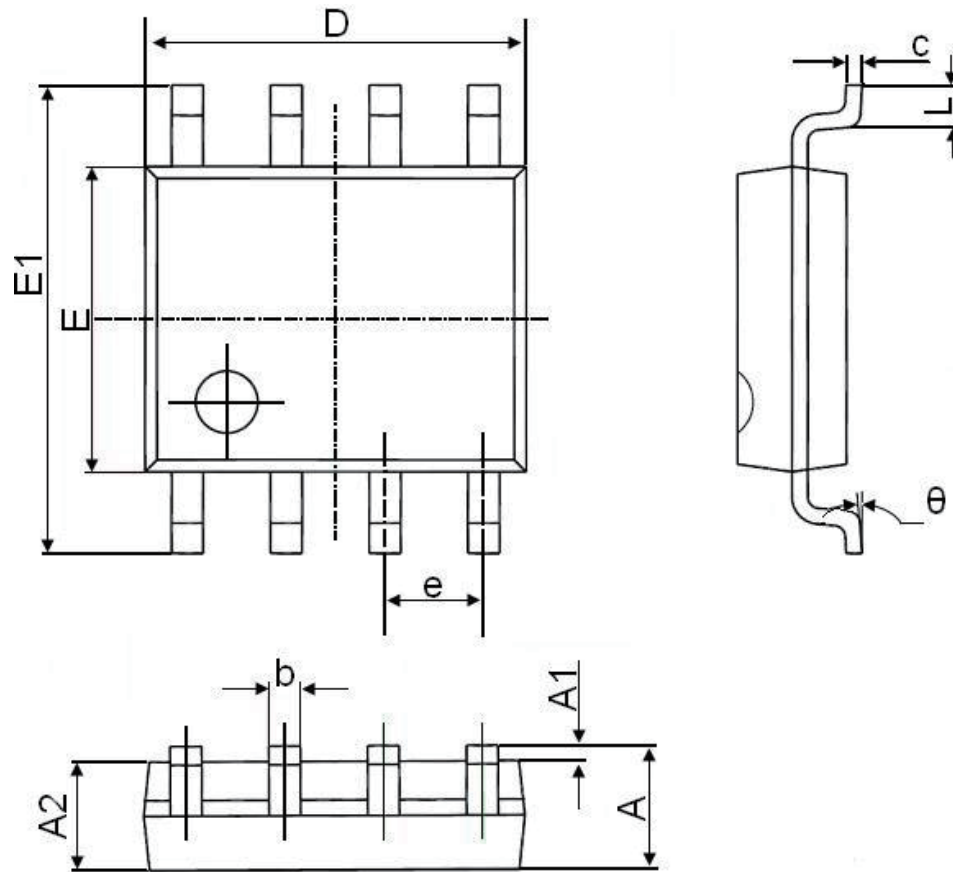


Figure C. Unclamped Inductive Switching Circuit & Waveforms

Package Mechanical Data-SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.35	1.75	0.053	0.069
A1	0.1	0.25	0.004	0.01
A2	1.35	1.55	0.053	0.061
b	0.33	0.51	0.013	0.02
c	0.17	0.25	0.006	0.01
D	4.7	5.1	0.185	0.2
E	3.8	4	0.15	0.157
E1	5.8	6.2	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.4	1.27	0.016	0.05
θ	0°	8°	0°	8°