

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

Product Summary

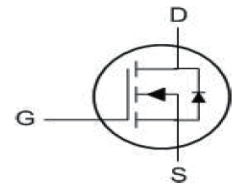
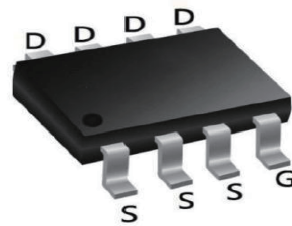
RoHS

BVDSS	R <sub>DS(on)</sub>	I <sub>D</sub>
40V	12mΩ	9A

Description

The 4009S is the high cell density trenched N ch MOSFETs, which provide excellent R<sub>DS(on)</sub> and gate charge for most of the synchronous buck converter applications. The 4009S meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

SOP8 Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-Source Voltage	40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current-Continuous	9	A
I <sub>D</sub> (100°C)	Drain Current-Continuous(T <sub>c</sub> =100°C)	6.4	A
I <sub>DM</sub>	Pulsed Drain Current	40	A
P <sub>D</sub>	Maximum Power Dissipation	2	W
T <sub>J</sub> , T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 To 150	°C
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient <sup>(Note 2)</sup>	62.5	°C/W

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

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	40	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=40V, V_{GS}=0V$	-	-	1	$\mu A$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics (Note 3)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.5	2	V
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=10V, I_D=8A$	-	12	16	m $\Omega$
		$V_{GS}=4.5V, I_D=4A$	-	19	24	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5V, I_D=8A$	33	-	-	S
<b>Dynamic Characteristics (Note 4)</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=20V, V_{GS}=0V, F=1.0MHz$	-	964	-	PF
$C_{oss}$	Output Capacitance		-	109	-	PF
$C_{riss}$	Reverse Transfer Capacitance		-	96	-	PF
<b>Switching Characteristics (Note 4)</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD}=20V, R_L=2.5\Omega$ $V_{GS}=10V, R_{GEN}=3\Omega$	-	5.5	-	nS
$t_r$	Turn-on Rise Time		-	14	-	nS
$t_{d(off)}$	Turn-Off Delay Time		-	24	-	nS
$t_f$	Turn-Off Fall Time		-	12	-	nS
$Q_g$	Total Gate Charge	$V_{DS}=20V, I_D=8A, V_{GS}=10V$	-	22.9	-	nC
$Q_{gs}$	Gate-Source Charge		-	3.5	-	nC
$Q_{gd}$	Gate-Drain Charge		-	5.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage (Note 3)	$V_{GS}=0V, I_S=9A$	-	0.8	1.2	V

**Notes:**

- 1.Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

Typical Electrical and Thermal Characteristics (Curves)

Figure 1: Switching Test Circuit

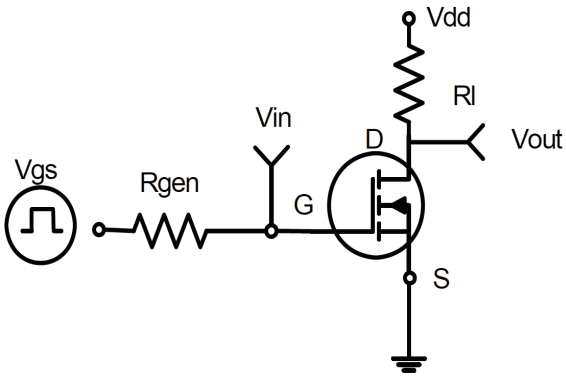


Figure 2: Switching Waveforms

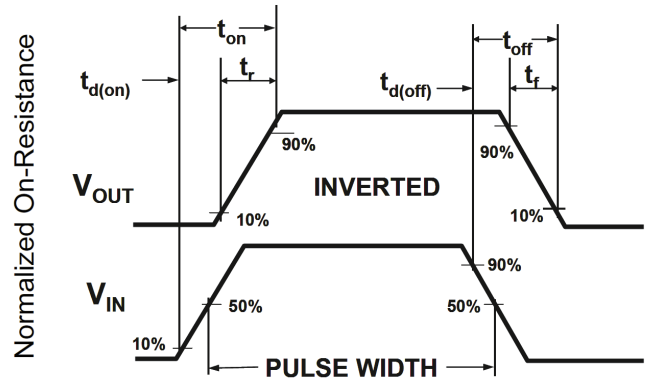


Figure 3: Output Characteristics

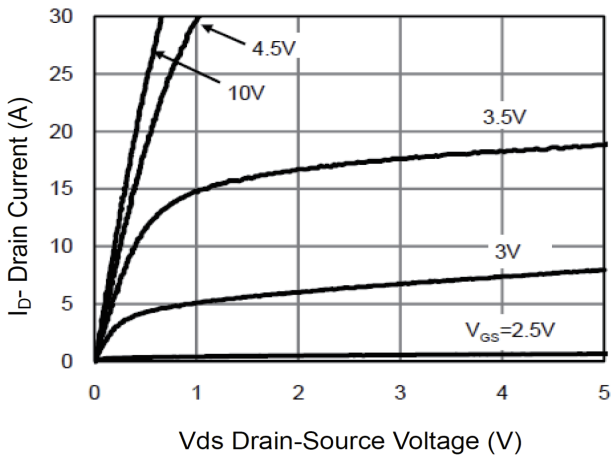


Figure 4: Transfer Characteristics

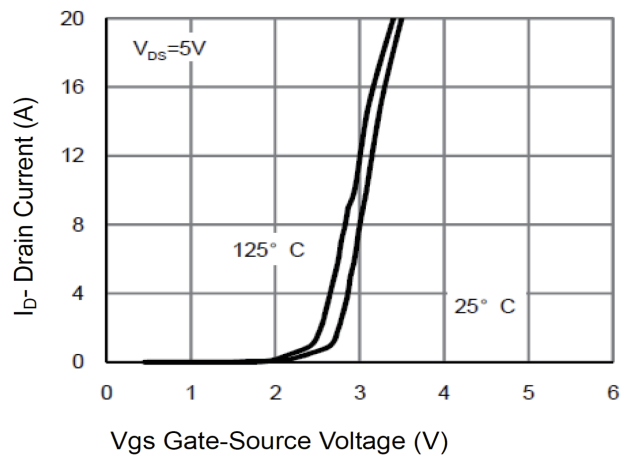


Figure 5: Drain-Source On-Resistance

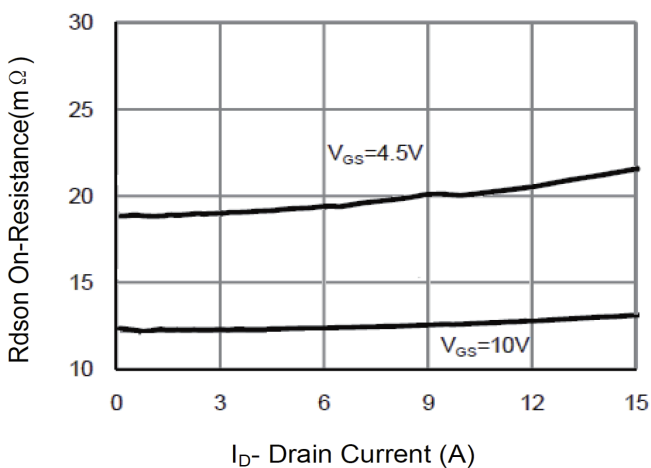
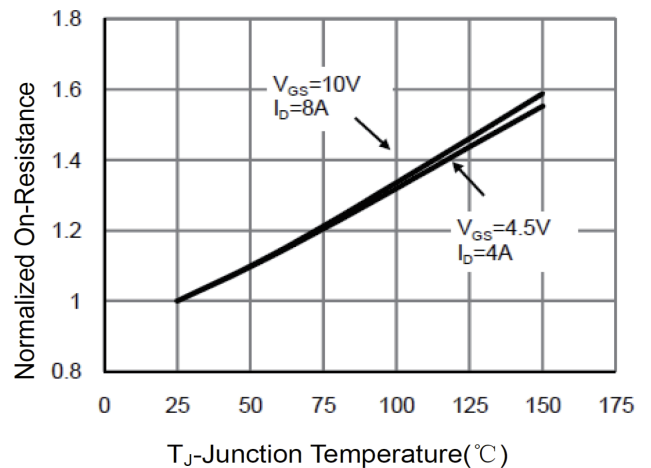


Figure 6: Drain-Source On-Resistance



Typical Performance Characteristics

Figure 7: R<sub>ds(on)</sub> vs V<sub>gs</sub>

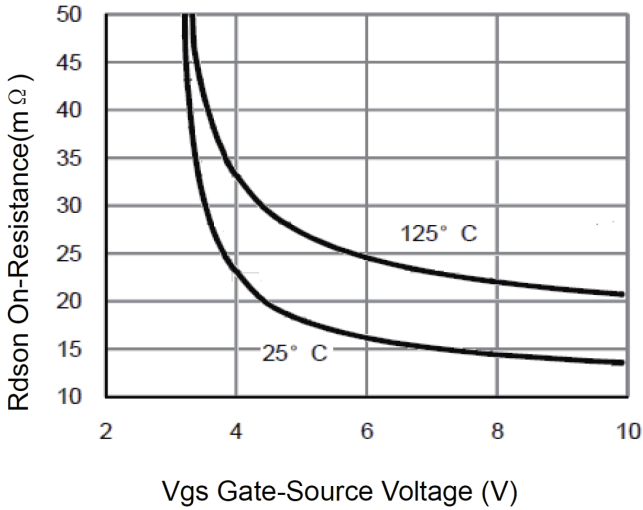


Figure 8: Power Dissipation

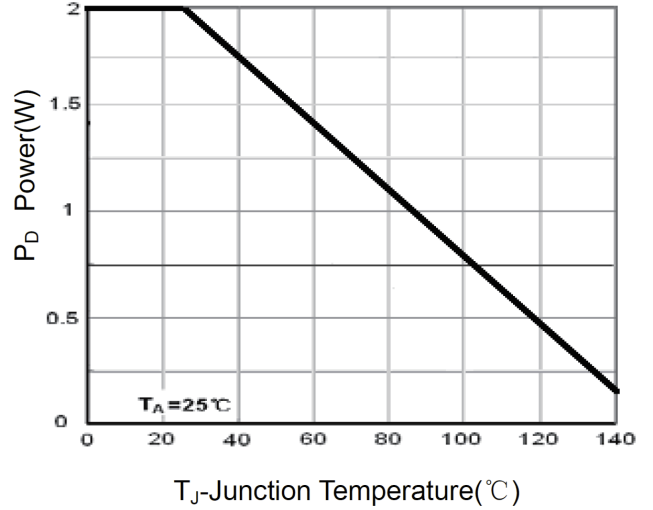


Figure 9: Gate Charge

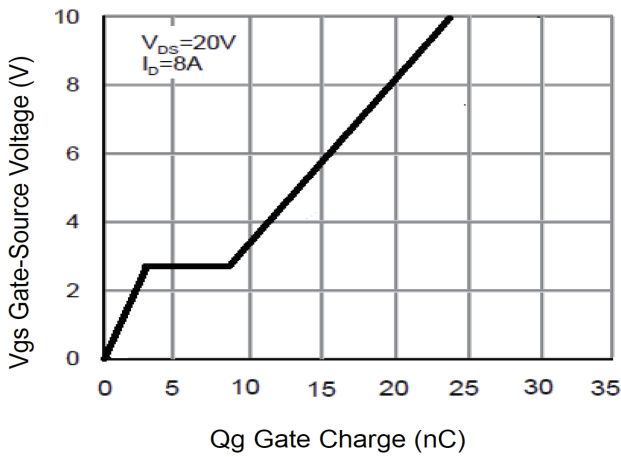


Figure 10: Source- Drain Diode Forward

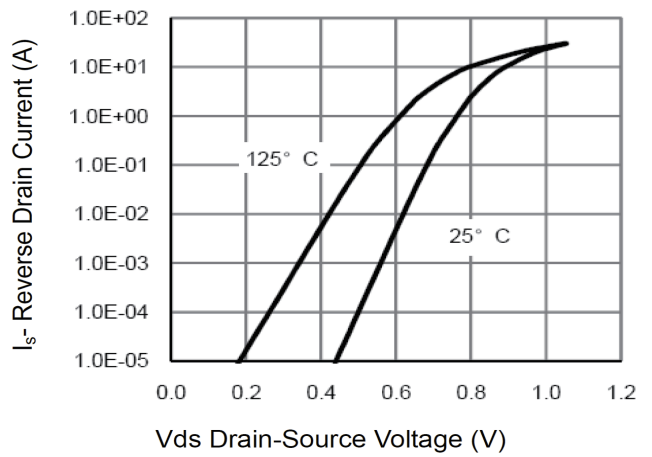


Figure 11: Capacitance vs V<sub>ds(on)-to-Amb</sub>

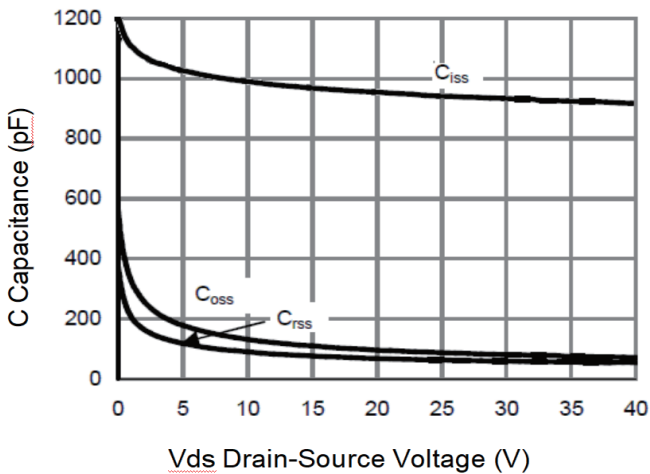
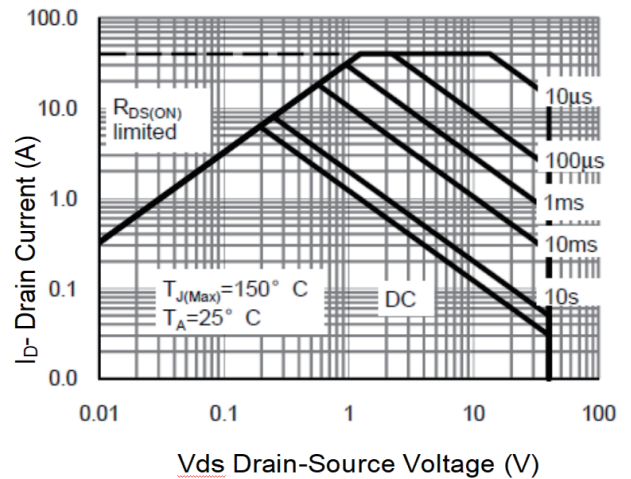
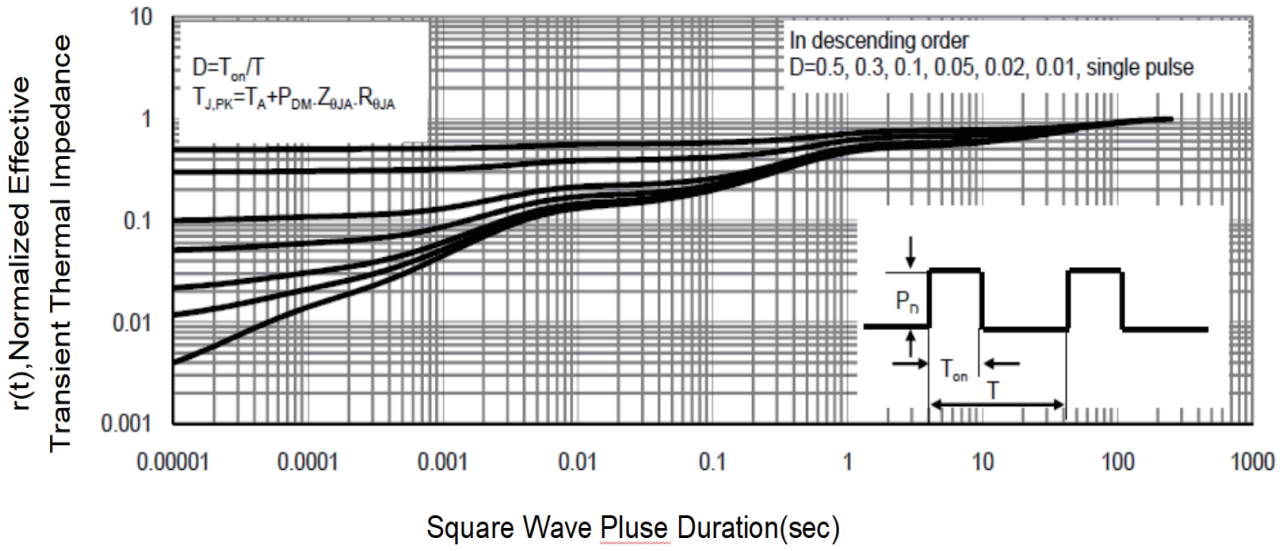


Figure 12: Safe Operation Area, Junction

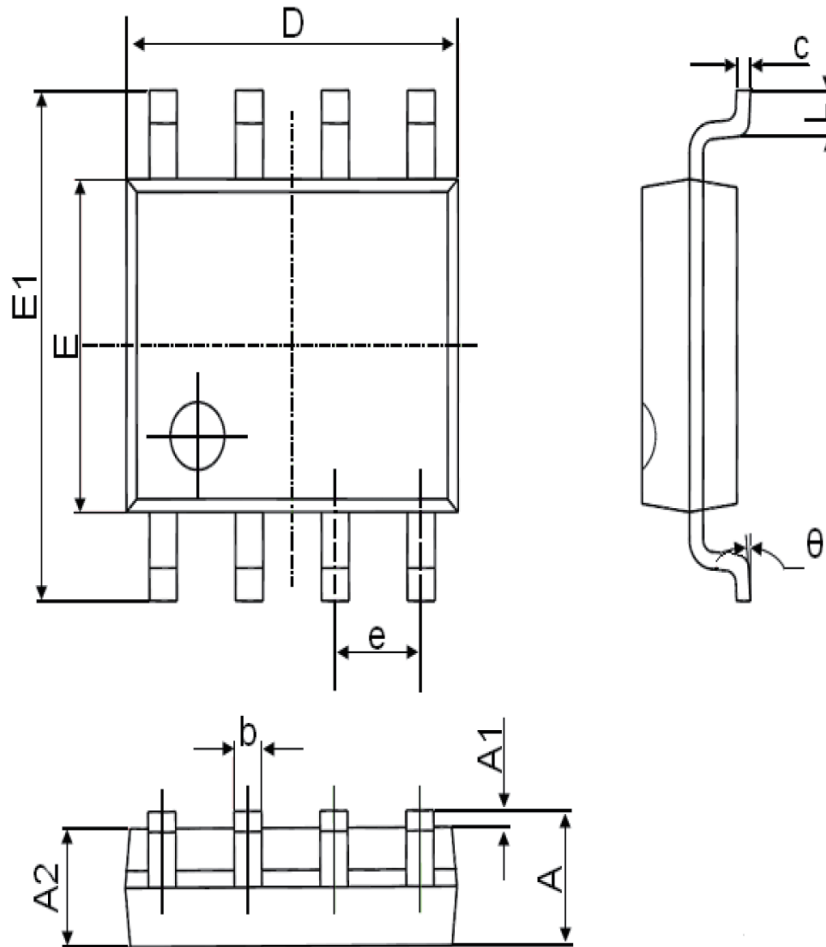


Typical Performance Characteristics

Figure 13: Normalized Maximum Transient Thermal Impedance



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°