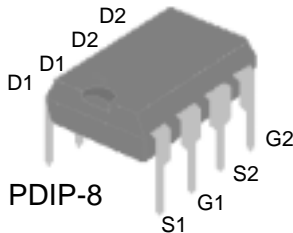


# Dual N-channel Enhancement-mode Power MOSFETs

## PRODUCT SUMMARY

$BV_{DSS}$	60V
$R_{DS(ON)}$	50m $\Omega$
$I_D$	5A

 **Pb-free; RoHS-compliant SO-8**



## DESCRIPTION

The SSM9971GD achieves fast switching performance with low gate charge without a complex drive circuit. It is suitable for low voltage applications such as DC/DC converters and general load-switching circuits.

The SSM2310GD is supplied in an RoHS-compliant PDIP-8 package, which is widely used for medium power commercial and industrial applications, where through-hole insertion into the board is required.

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Units
$V_{DS}$	Drain-source voltage	60	V
$V_{GS}$	Gate-source voltage	$\pm 25$	V
$I_D$	Continuous drain current <sup>3</sup> , $T_A = 25^\circ\text{C}$	5	A
		$T_A = 70^\circ\text{C}$	3.2
$I_{DM}$	Pulsed drain current <sup>1,2</sup>	20	A
$P_D$	Total power dissipation <sup>3</sup> , $T_A = 25^\circ\text{C}$	2	W
	Linear derating factor	0.016	W/ $^\circ\text{C}$
$T_{STG}$	Storage temperature range	-55 to 150	$^\circ\text{C}$
$T_J$	Operating junction temperature range	-55 to 150	$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Units
$R_{\theta JA}$	Maximum thermal resistance, junction-ambient <sup>3</sup>	62.5	$^\circ\text{C}/\text{W}$

### Notes:

1. Pulse width must be limited to avoid exceeding the maximum junction temperature of 150 $^\circ\text{C}$ .
2. Pulse width <300us, duty cycle <2%.
3. Mounted on a square inch of copper pad on FR4 board; 90 $^\circ\text{C}/\text{W}$  when mounted on the minimum pad area required for soldering.

**ELECTRICAL CHARACTERISTICS** (at  $T_j = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-source breakdown voltage	$V_{GS}=0V, I_D=250\mu A$	60	-	-	V
$\Delta BV_{DSS}/\Delta T_j$	Breakdown voltage temperature coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	-	0.06	-	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static drain-source on-resistance <sup>2</sup>	$V_{GS}=10V, I_D=5A$	-	-	50	$\text{m}\Omega$
		$V_{GS}=4.5V, I_D=2.5A$	-	-	60	$\text{m}\Omega$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	1	-	3	V
$g_{fs}$	Forward transconductance	$V_{DS}=10V, I_D=5A$	-	7	-	S
$I_{DSS}$	Drain-source leakage current	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
		$V_{DS}=48V, V_{GS}=0V, T_j = 70^\circ\text{C}$	-	-	25	$\mu A$
$I_{GSS}$	Gate-source leakage current	$V_{GS}=\pm 25V$	-	-	$\pm 100$	nA
$Q_g$	Total gate charge <sup>2</sup>	$I_D=5A$	-	32.5	-	nC
$Q_{gs}$	Gate-source charge	$V_{DS}=48V$	-	4.9	-	nC
$Q_{gd}$	Gate-drain ("Miller") charge	$V_{GS}=10V$	-	8.8	-	nC
$t_{d(on)}$	Turn-on delay time <sup>2</sup>	$V_{DS}=30V$	-	9.6	-	ns
$t_r$	Rise time	$I_D=5A$	-	10	-	ns
$t_{d(off)}$	Turn-off delay time	$R_G=3.3\Omega, V_{GS}=10V$	-	30	-	ns
$t_f$	Fall time	$R_D=6\Omega$	-	5.5	-	ns
$C_{iss}$	Input capacitance	$V_{GS}=0V$	-	1560	-	pF
$C_{oss}$	Output capacitance	$V_{DS}=25V$	-	156	-	pF
$C_{rss}$	Reverse transfer capacitance	$f=1.0\text{MHz}$	-	110	-	pF

**Source-Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{SD}$	Forward voltage <sup>2</sup>	$I_S=1.6A, V_{GS}=0V$	-	-	1.2	V
$t_{rr}$	Reverse-recovery time	$I_S=5A, V_{GS}=0V,$	-	29.2	-	ns
$Q_{rr}$	Reverse-recovery charge	$dI/dt=100A/\mu s$	-	48	-	nC

**Notes:**

1. Pulse width must be limited to avoid exceeding the maximum junction temperature of  $150^\circ\text{C}$ .

2. Pulse width  $<300\mu s$ , duty cycle  $<2\%$ .

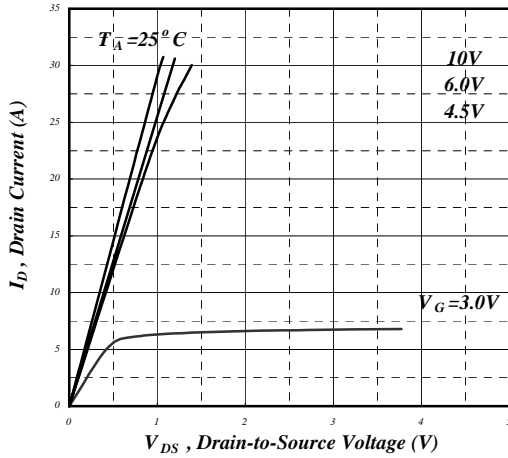


Fig 1. Typical output characteristics

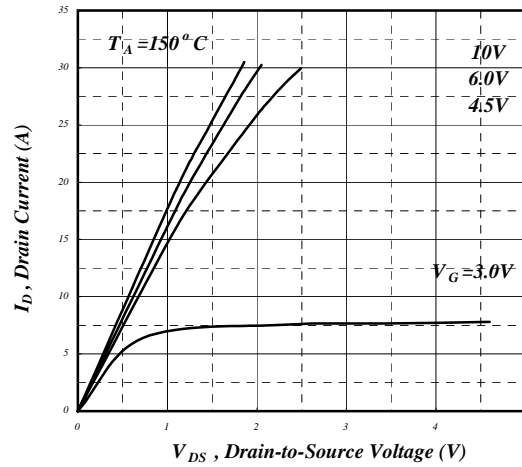


Fig 2. Typical output characteristics

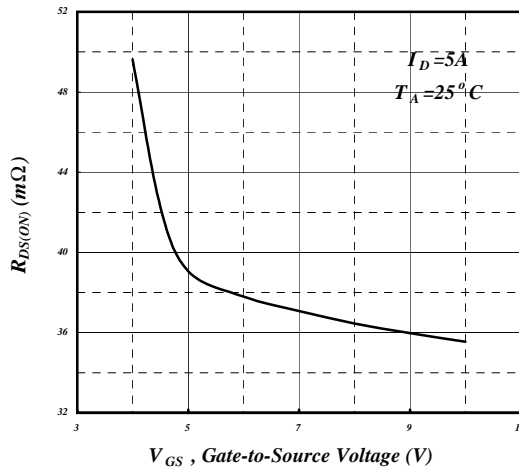


Fig 3. On-resistance vs. gate voltage

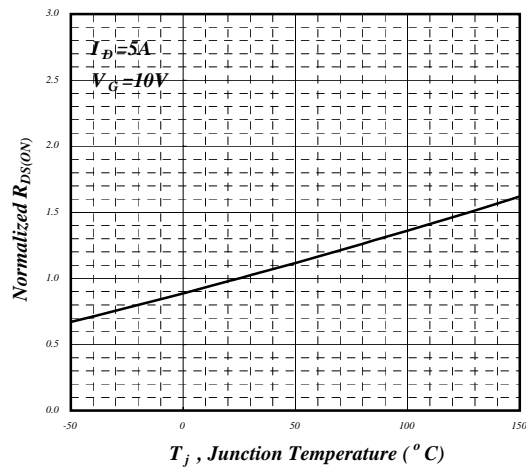


Fig 4. Normalized on-resistance vs. junction temperature

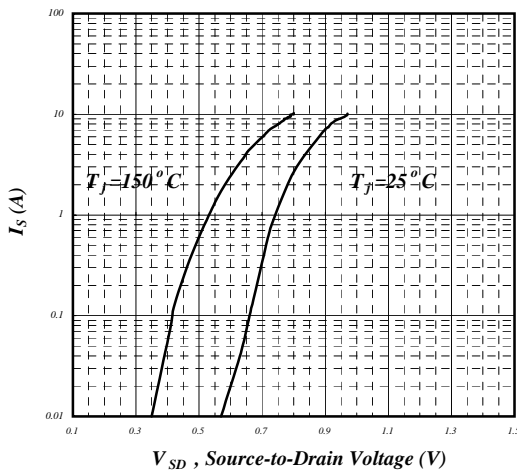


Fig 5. Forward characteristic of the reverse diode

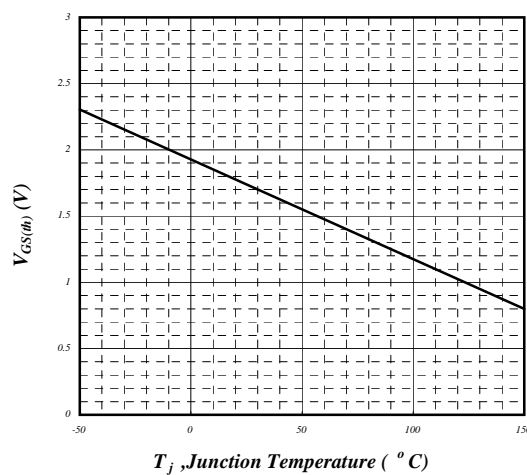


Fig 6. Gate threshold voltage vs. junction temperature

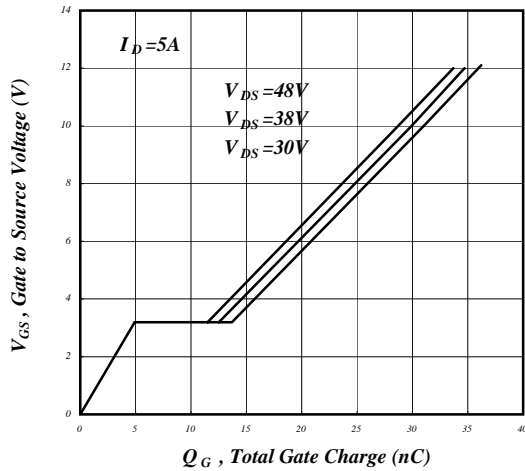


Fig 7. Gate charge characteristics

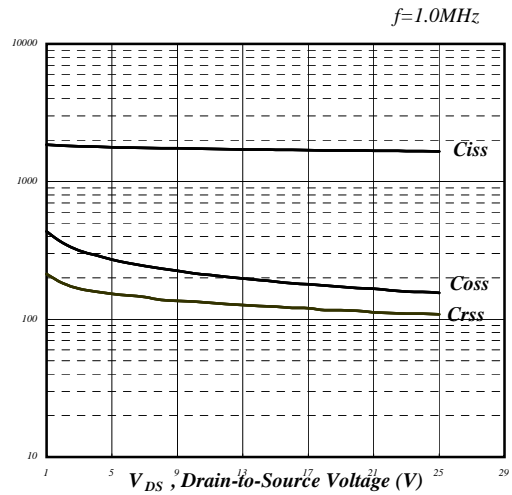


Fig 8. Typical capacitance characteristics

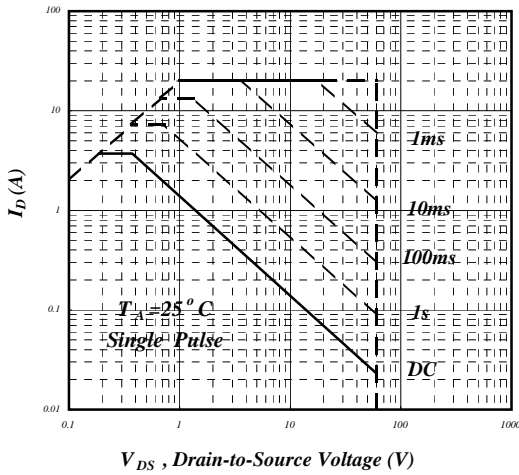


Fig 9. Maximum safe operating area

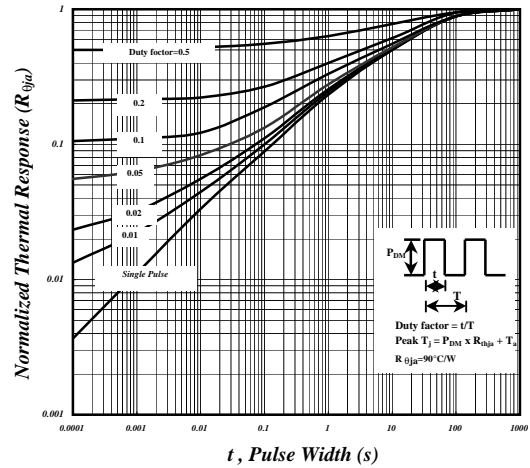


Fig 10. Effective transient thermal impedance

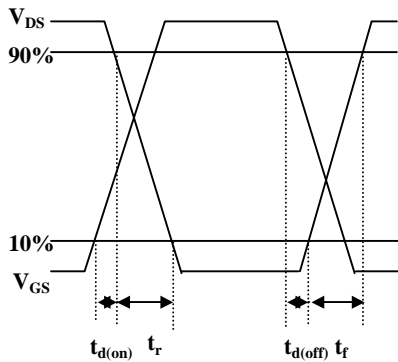


Fig 11. Switching time waveforms

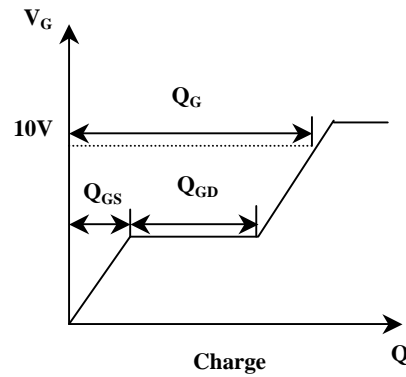
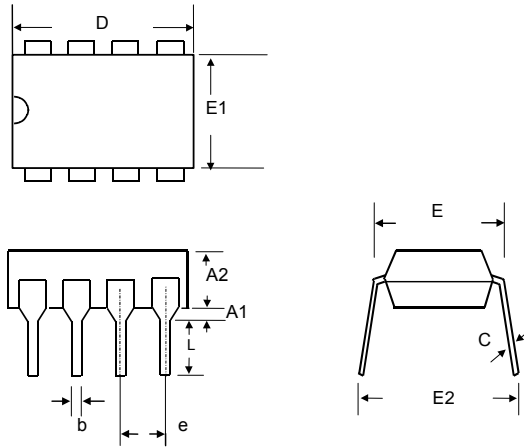


Fig 12. Gate charge diagram

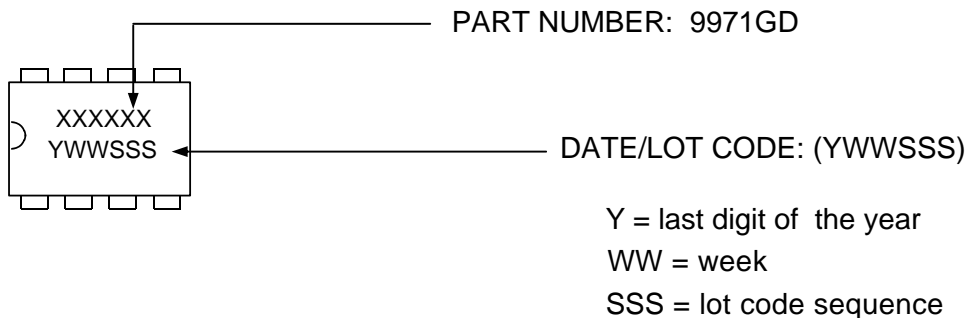
## PHYSICAL DIMENSIONS



SYMBOL	MIN	MAX
A1	0.38	—
A2	2.90	5.00
b	0.35	0.56
C	0.20	0.36
D	9.00	10.20
E	7.62	8.26
E1	6.09	7.20
e	2.54 (TYP)	
E2	8.3	11.00
L	2.92	—

All dimensions in millimeters.  
Dimensions do not include mold protrusions.

## PART MARKING



## PACKING: Moisture sensitivity level MSL1

50 pcs in antistatic tube, 20 tubes (1000 pieces) per box.

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