



## STS4C3F60L

N-channel 60V - 0.045  $\Omega$  - 4A SO-8  
Complementary pair STripFET™ Power MOSFET

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STS4C3F60L(N-channel)	60V	<0.056 $\Omega$	4A
STS4C3F60L(P-channel)	60V	<0.120 $\Omega$	3A

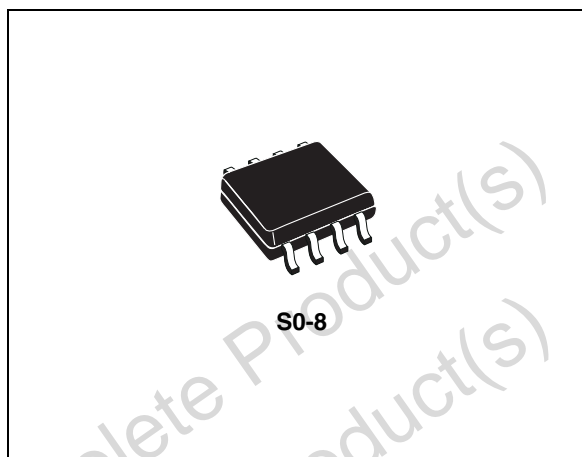
- Standard outline for easy automated surface mount assembly
- Low threshold drive

### Description

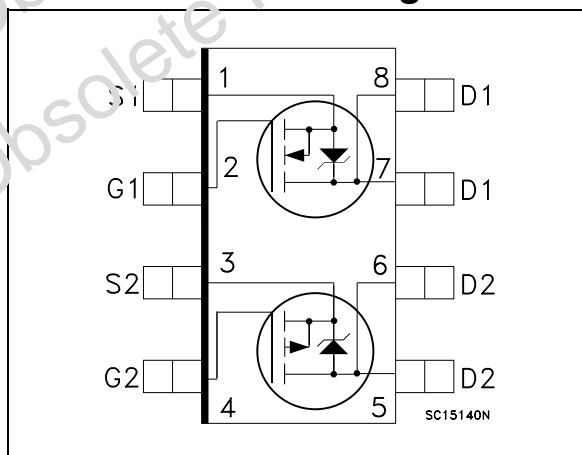
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### Applications

- Switching application



### Internal schematic diagram



### Order codes

Part number	Marking	Package	Packaging
STS4C3F60L	S4C3F60L	SO-8	Tape & reel

# Contents

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Obsolete Product(s) - Obsolete Product(s)  
Obsolete Product(s) - Obsolete Product(s)

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		N-channel	P-channel	
$V_{DS}$	Drain-source voltage ( $v_{GS} = 0$ )	60		V
$V_{GS}$	Gate- source voltage	$\pm 16$		V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	4	3	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	2.5	1.9	A
$I_{DM}^{(1)}$	Drain current (pulsed)	16	12	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	2		W
$T_{stg}$ $T_j$	Storage temperature Max. operating junction temperature	-55 to 150		$^\circ\text{C}$

1. Pulse width limited by safe operating area

Note: For the P-CHANNEL MOSFET actual polarity of voltages and current has to be reversed

**Table 2. Thermal data**

$R_{thj-a}^{(1)}$	Thermal resistance junction-ambient	62.5	$^\circ\text{C/W}$
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1. When mounted on 1 in<sup>2</sup> pad of 2 oz. copper,  $t \leq 10$  sec.

## 2 Electrical characteristics

(T<sub>CASE</sub>=25°C unless otherwise specified)

**Table 3. On/off states**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V <sub>(BR)DS</sub> s	Drain-source Breakdown voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	n-ch	60			V
			p-ch	60			V
I <sub>DSS</sub>	Zero gate voltage Drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating V <sub>DS</sub> =Max rating, T <sub>C</sub> =125°C	n-ch			1	μA
			p-ch			10	μA
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±16V	n-ch			±100	nA
			p-ch			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	n-ch	1			V
			p-ch	1.5			V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2A V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.5A V <sub>GS</sub> = 10V, I <sub>D</sub> = 2A V <sub>GS</sub> = 10V, I <sub>D</sub> = 1.5A	n-ch		0.045	0.055	Ω
			p-ch		0.100	0.120	Ω
			n-ch		0.050	0.065	Ω
			p-ch		0.130	0.160	Ω

**Table 4. Dynamic**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward transconductance	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 2A V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3A	n-ch		7		S
			p-ch		7.2		S
C <sub>iss</sub>	Input capacitance		n-ch		1030		pF
			p-ch		630		pF
C <sub>oss</sub>	Output capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0	n-ch		140		pF
			p-ch		121		pF
C <sub>rss</sub>	Reverse transfer capacitance		n-ch		40		pF
			p-ch		49		pF
Q <sub>g</sub>	Total gate charge	<b>N-channel</b> V <sub>DD</sub> =48V I <sub>D</sub> 4A V <sub>GS</sub> =4.5V	n-ch		15	20.4	nC
			p-ch		11.6	15.7	nC
Q <sub>gs</sub>	Gate-source charge	<b>P-channel</b> V <sub>DD</sub> = 48V I <sub>D</sub> = 3A	n-ch		4		nC
			p-ch		4.5		nC
Q <sub>gd</sub>	Gate-drain charge	V <sub>GS</sub> = 4.5V (see Figure 26)	n-ch		4		nC
			p-ch		4.7		nC

1. Pulsed: Pulse duration = 300 μs, duty cycle 1.5.

**Table 5. Switching times**

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	<b>N-channel</b> $V_{DD} = 30\text{ V}, I_D = 2\text{ A}$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$	n-ch		15		ns
			p-ch		124		ns
		<b>P-channel</b> $V_{DD} = 30\text{ V}, I_D = 1.5\text{ A}$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$ (see Figure 25)	n-ch		28		ns
			p-ch		54		ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	<b>N-channel</b> $V_{DD} = 30\text{ V}, I_D = 2\text{ A}$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$	n-ch		45		ns
			p-ch		39		ns
		<b>P-channel</b> $V_{DD} = 30\text{ V}, I_D = 1.5\text{ A}$ $R_G = 4.7\ \Omega, V_{GS} = 4.5\text{ V}$ (see Figure 25)	n-ch		10		ns
			p-ch		14.5		ns

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions		Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current		n-ch			4	A
			p-ch			3	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		n-ch			16	A
			p-ch			12	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 4\text{ A}, V_{GS} = 0$ $I_{SD} = 3\text{ A}, V_{GS} = 0$	n-ch			1.2	V
			p-ch			1.2	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time	<b>N-channel</b> $I_{SD} = 4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}, T_j = 150\text{ }^\circ\text{C}$	n-ch		85		ns
			p-ch		44		ns
	Reverse recovery charge		n-ch		85		nC
			p-ch		68.2		nC
Reverse recovery current	<b>P-channel</b> $I_{SD} = 3\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}, T_j = 150\text{ }^\circ\text{C}$ (see Figure 27)	n-ch		2		A	
		p-ch		3.1		A	

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating n-ch

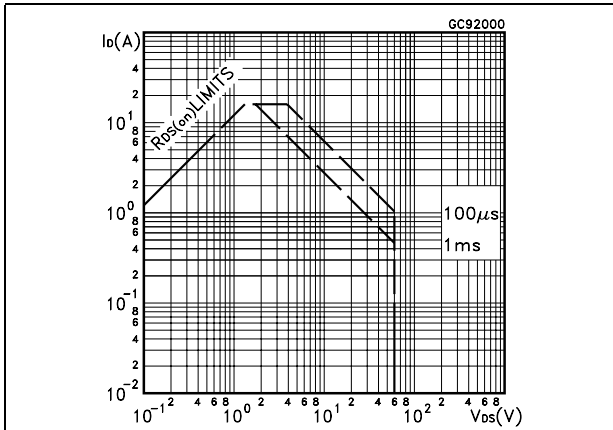


Figure 2. Thermal impedance for complementary pair

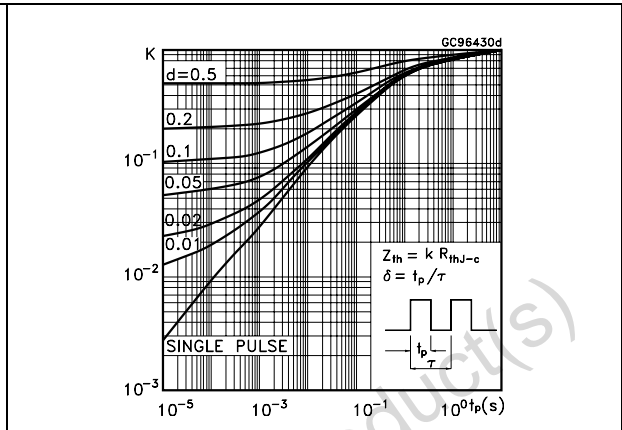


Figure 3. Output characteristics n-ch

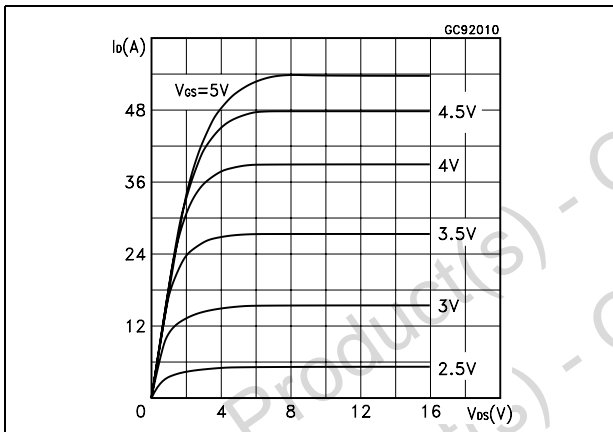


Figure 4. Transfer characteristics n-ch

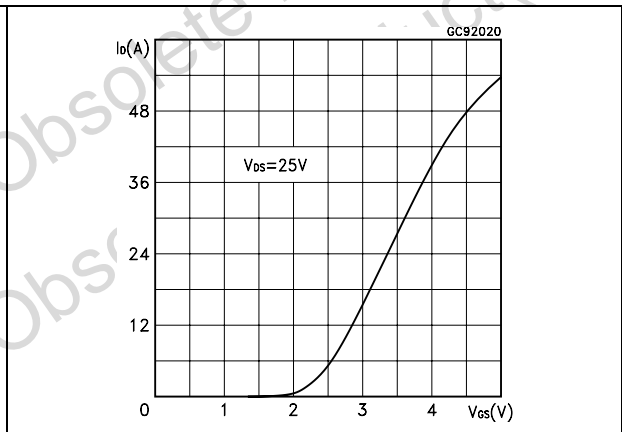


Figure 5. Transconductance n-ch

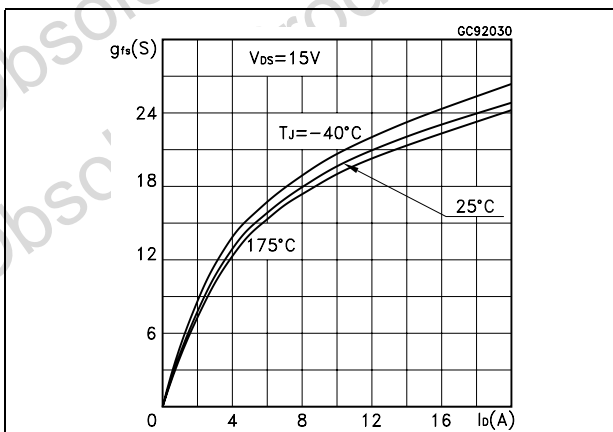


Figure 6. Static drain-source on resistance n-ch

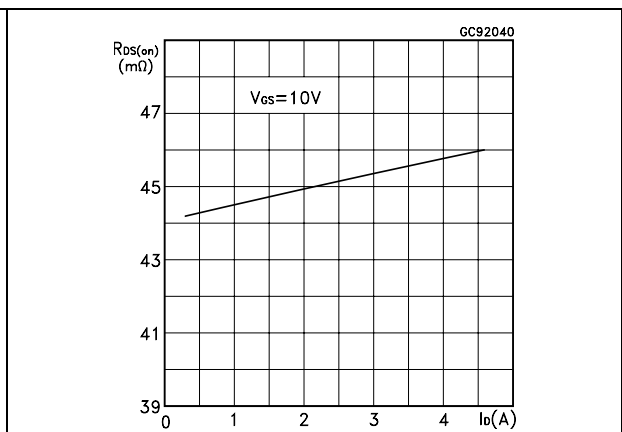


Figure 7. Gate charge vs. gate-source voltage Figure 8. Capacitance variations n-ch n-ch

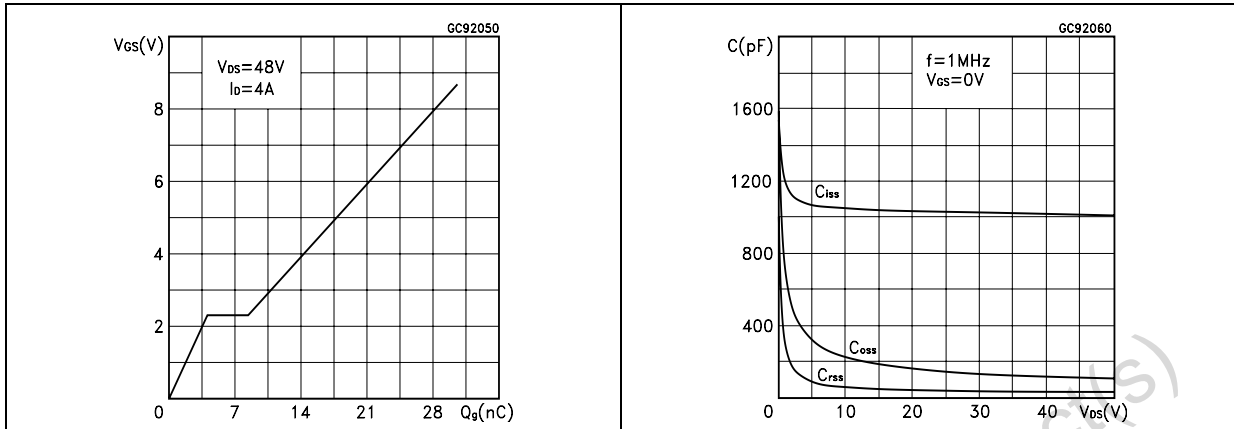


Figure 9. Normalized gate threshold voltage vs. temperature n-ch Figure 10. Normalized on resistance vs. temperature n-ch

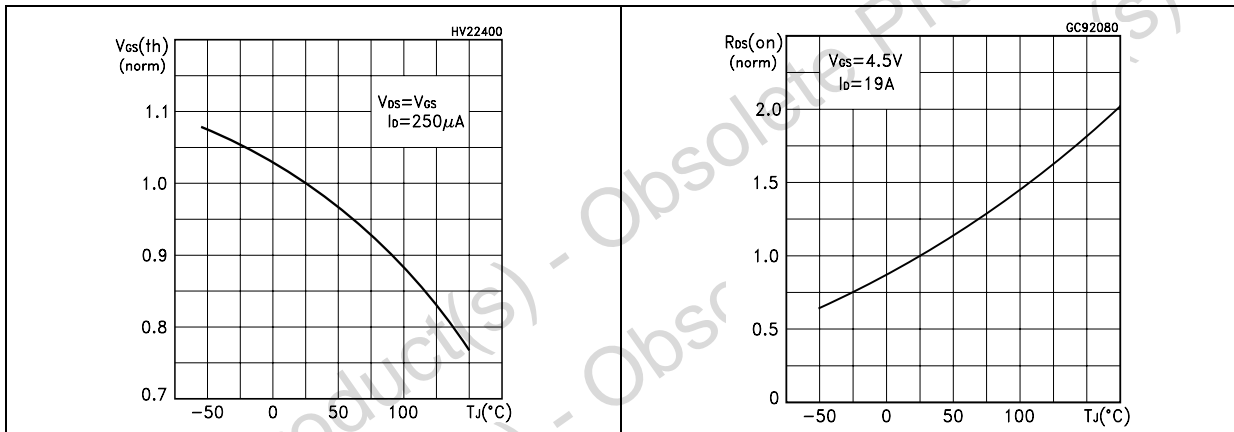


Figure 11. Source-drain diode forward characteristics n-ch Figure 12. Normalized breakdown voltage vs. temperature n-ch

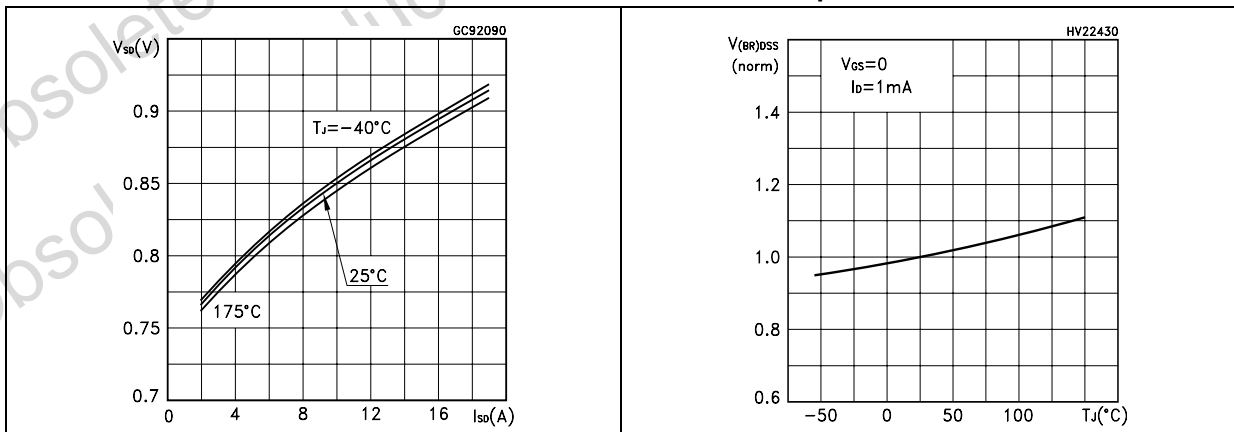


Figure 13. Safe operating p-ch

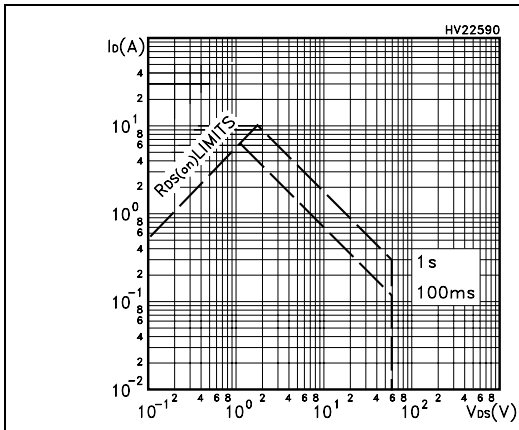


Figure 14. Thermal impedance p-ch

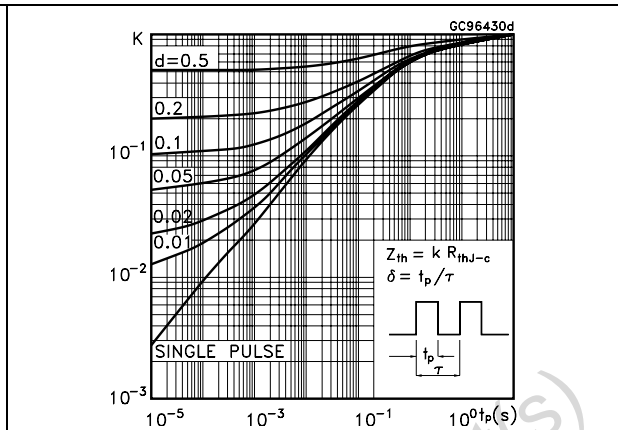


Figure 15. Output characteristics p-ch

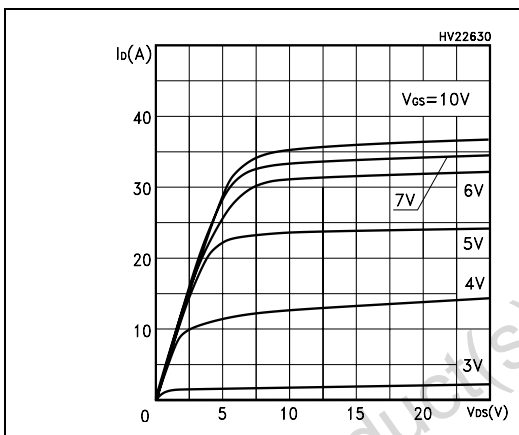


Figure 16. Transfer characteristics p-ch

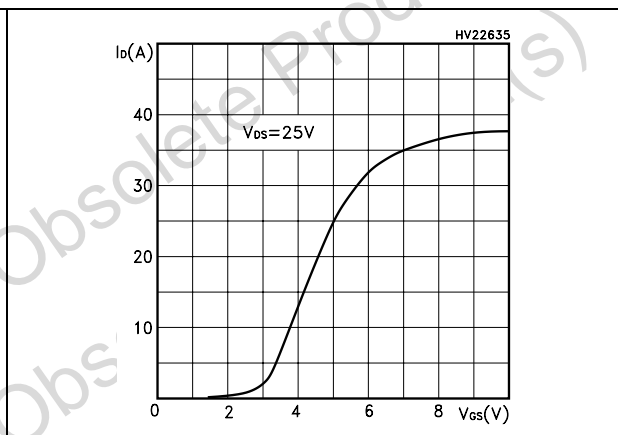


Figure 17. Transconductance p-ch

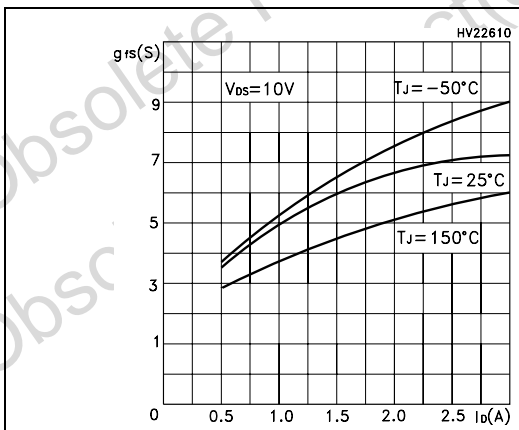


Figure 18. Static drain-source on resistance p-ch

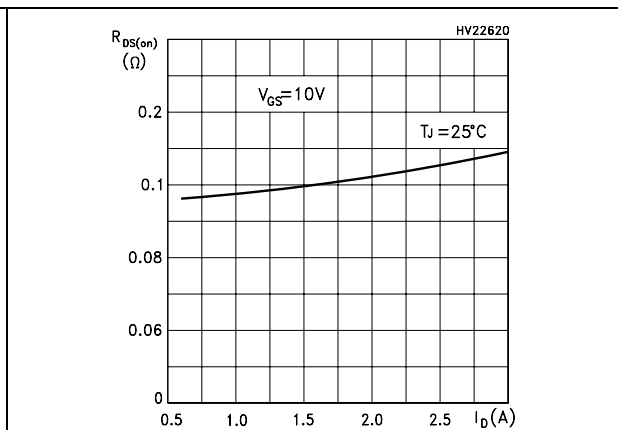




Figure 19. Gate charge vs. gate-source voltage Figure 20. Capacitance variations p-ch p-ch

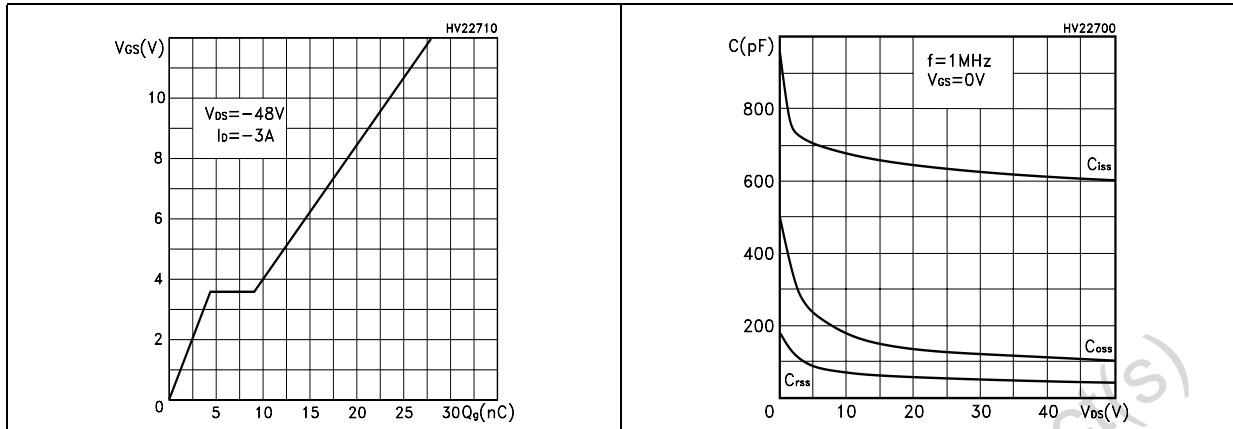


Figure 21. Normalized gate threshold voltage vs. temperature p-ch Figure 22. Normalized on resistance vs. temperature p-ch

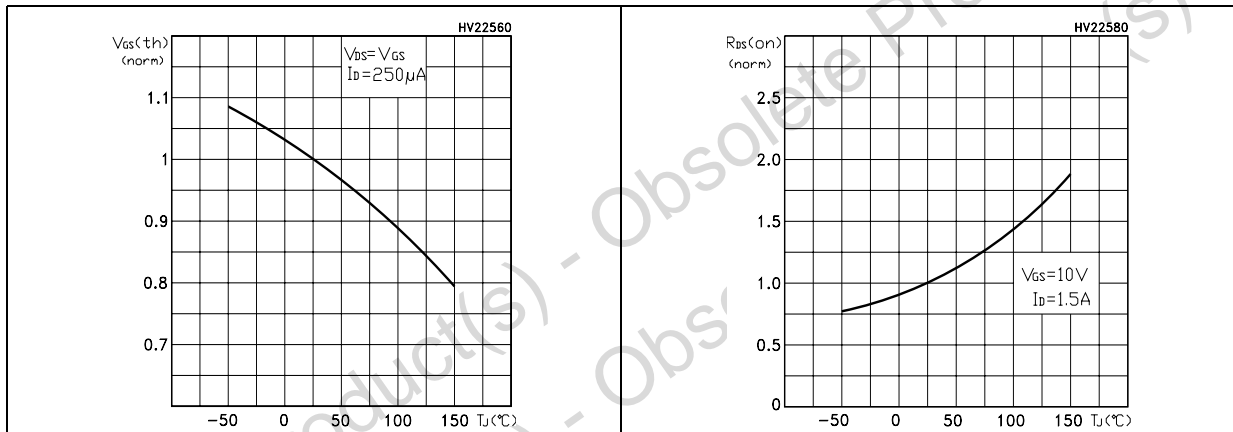
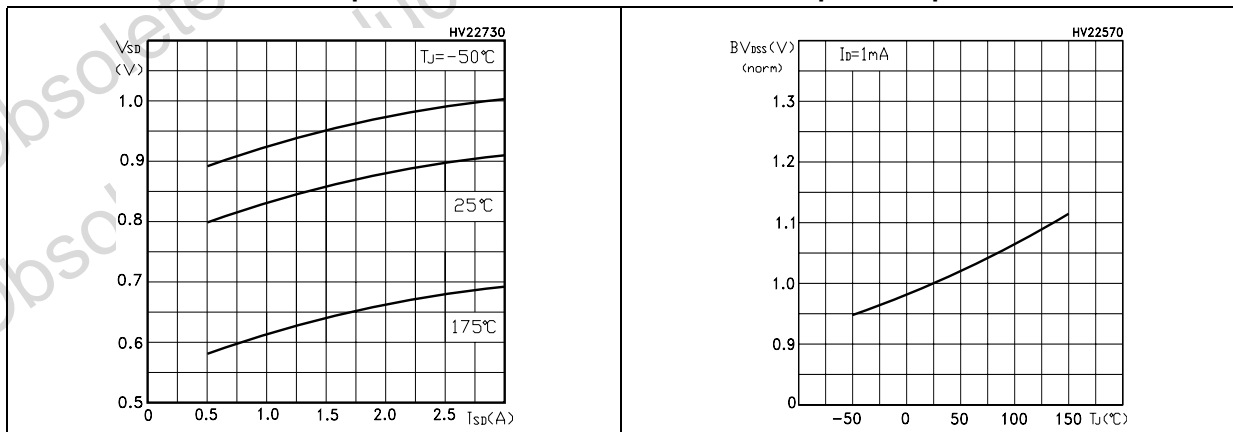


Figure 23. Source-drain diode forward characteristics p-ch Figure 24. Normalized breakdown voltage vs. temperature p-ch



### 3 Test circuit

Figure 25. Switching times test circuit for resistive load

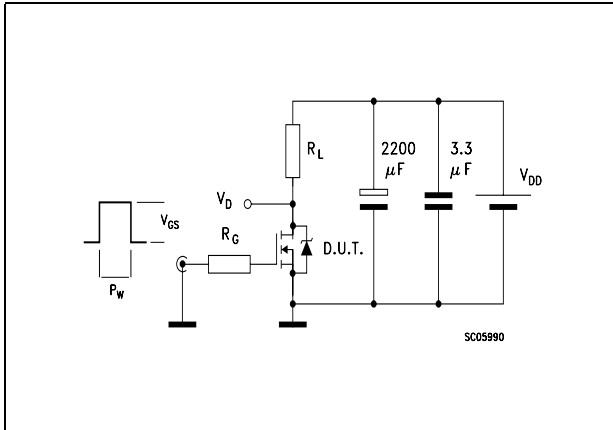


Figure 26. Gate charge test circuit

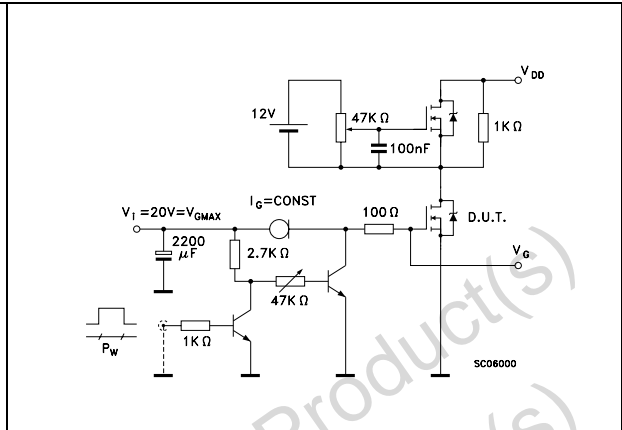


Figure 27. Test circuit for inductive load switching and diode recovery times

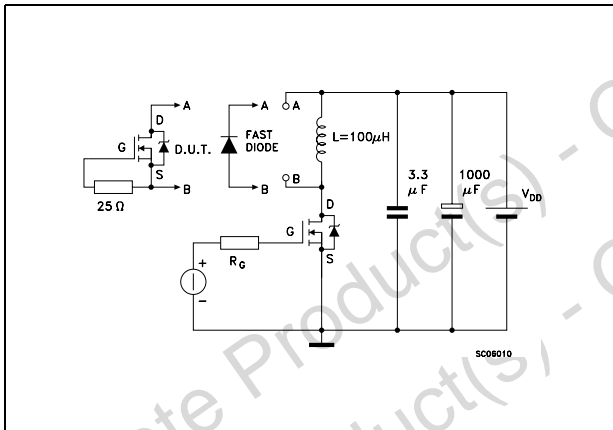


Figure 28. Unclamped Inductive load test circuit

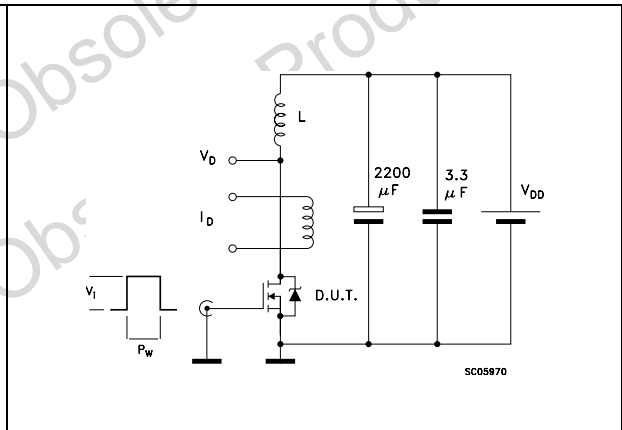


Figure 29. Unclamped inductive waveform

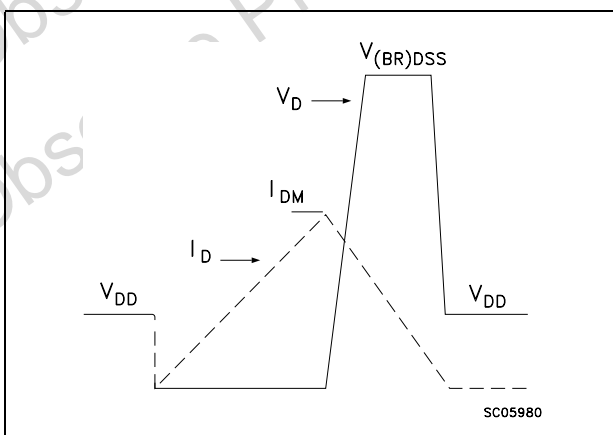
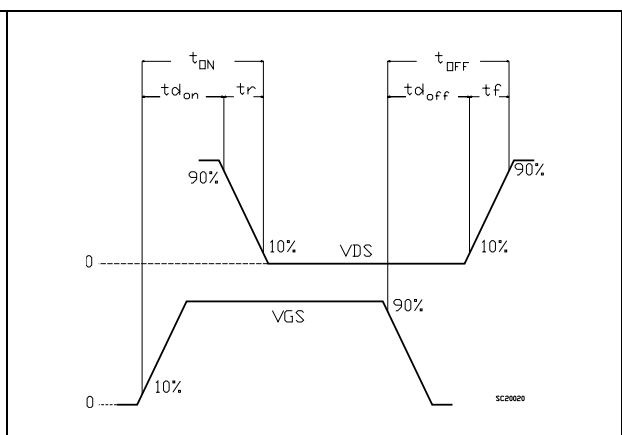


Figure 30. Switching time waveform



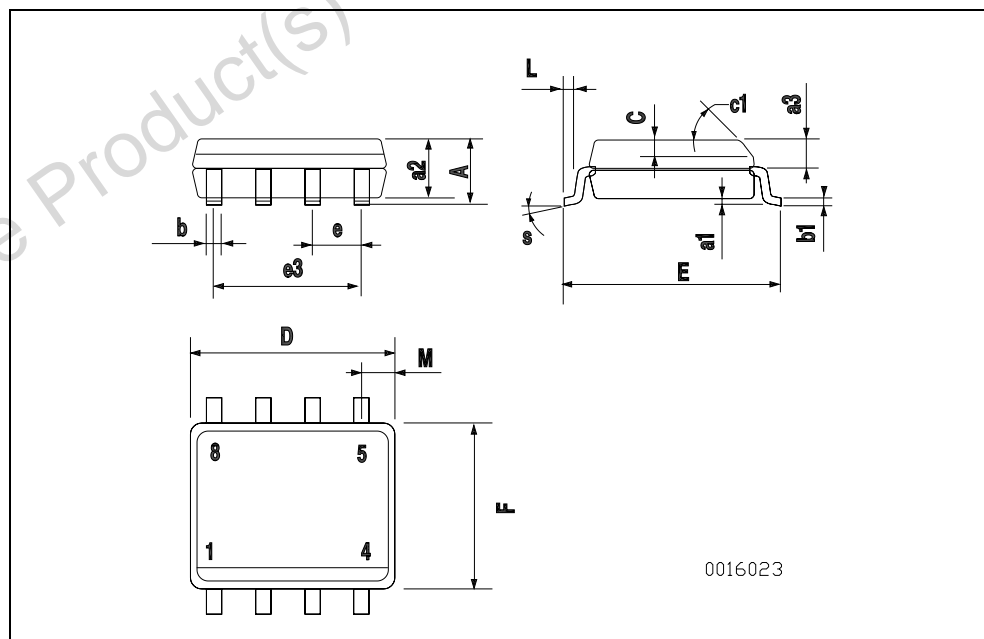
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at : [www.st.com](http://www.st.com)

Obsolete Product(s) - Obsolete Product(s)  
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**SO-8 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.003		0.009
a2			1.65			0.064
a3	0.65		0.85	0.025		0.033
b	0.35		0.48	0.013		0.018
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.019
c1	45 (typ.)					
D	4.8		5.0	0.188		0.196
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.14		0.157
L	0.4		1.27	0.015		0.050
M			0.6			0.023
S	8 (max.)					



## 5 Revision history

Table 7. Revision history

Date	Revision	Changes
28-Sep-2004	1	First release
13-Nov-2006	2	The document has been reformatted
26-Jan-2007	3	Typo mistake on <a href="#">Table 1</a> .

Obsolete Product(s) - Obsolete Product(s)  
Obsolete Product(s) - Obsolete Product(s)

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