



## STC5NF20V

N-channel 20V - 0.030Ω - 5A - TSSOP8  
2.7V-drive STripFET™ II Power MOSFET

### Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STC5NF20V	20V	< 0.040 Ω (@ 4.5 V) < 0.045 Ω (@ 2.7 V)	5A

- Ultra low threshold gate drive (2.7V)
- Standard outline for easy automated surface mount assembly

### Application

- Switching applications

### 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.

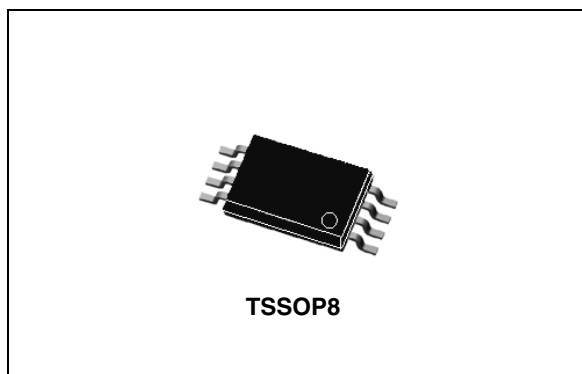


Figure 1. Internal schematic diagram

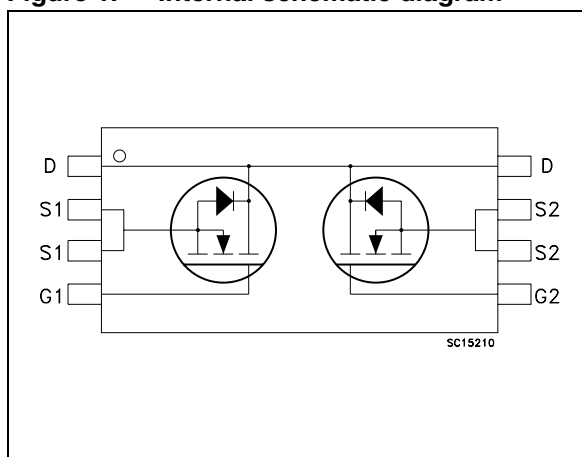


Table 1. Device summary

Order code	Marking	Package	Packaging
STC5NF20V	5N20V	TSSOP8	Tape & reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	20	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20K\Omega$ )	20	V
$V_{GS}$	Gate-source voltage	$\pm 12$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	5	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	3	A
$I_{DM}^{(1)}$	Drain current (pulsed)	20	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	1.5	W
$T_{stg}$	Storage temperature	-55 to 150	$^\circ\text{C}$
$T_J$	Max. Operating junction temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJ-PBC}$	Thermal resistance junction-PBC Max	100 <sup>(1)</sup>	$^\circ\text{C}/\text{W}$
$R_{thJ-PBC}$	Thermal resistance junction-PBC Max	83.5 <sup>(2)</sup>	$^\circ\text{C}/\text{W}$

1. When Mounted on FR-4 board with 1 inch<sup>2</sup> pad, 2 oz. of Cu. and  $t = 10$  sec.

2. When Mounted on minimum recommended footprint

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	20			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating} @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 12V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	0.6			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 4.5V, I_D = 2.5A$ $V_{GS} = 2.7V, I_D = 2.5A$		0.030 0.037	0.040 0.045	$\Omega$ $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 2.5A$		9.5		S
$C_{iss}$	Input capacitance	$V_{DS} = 15V, f = 1\text{ MHz},$ $V_{GS} = 0$		460		pF
$C_{oss}$	Output capacitance			200		pF
$C_{rss}$	Reverse transfer capacitance			50		pF
$Q_g$	Total gate charge	$V_{DD} = 10V, I_D = 4.5A$ $V_{GS} = 4.5V$		8.5	11.5	nC
$Q_{gs}$	Gate-source charge			1.8		nC
$Q_{gd}$	Gate-drain charge			2.4		nC

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10V, I_D = 2.5A,$ $R_G = 4.7\Omega, V_{GS} = 4.5V$ <i>Figure 14 on page 8</i>		7		ns
$t_r$	Rise time			33		ns
$t_{d(off)}$	Turn-off delay time			27		ns
$t_f$	Fall time			10		ns
$t_{d(off)}$	Off-voltage rise time	$V_{clamp} = 16V, I_D = 5A$ $R_G = 4.7\Omega, V_{GS} = 4.5V$ <i>Figure 16 on page 8</i>		26		ns
$t_f$	Fall time			11		ns
$t_c$	Cross-over time			21		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$I_{SD}$	Source-drain current				5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5A, V_{GS} = 0$			1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 5A,$ $di/dt = 100A/\mu s,$ $V_{DD} = 10V, T_J = 150^\circ C$ <i>Figure 16 on page 8</i>		26		ns
$Q_{rr}$	Reverse recovery charge			13		$\mu C$
$I_{RRM}$	Reverse recovery current			1		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

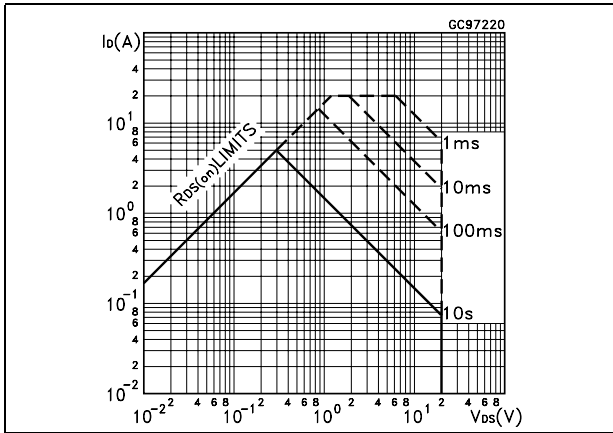


Figure 3. Thermal impedance

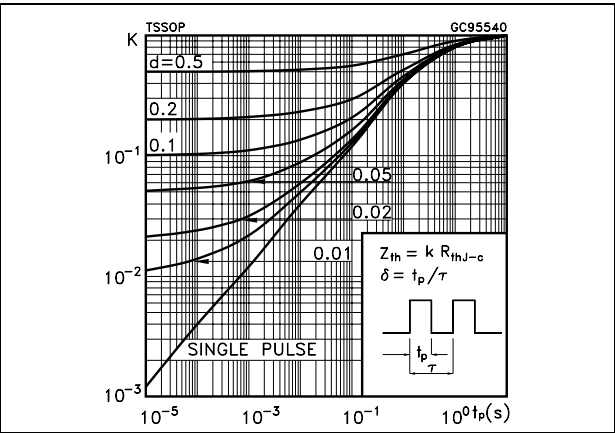


Figure 4. Output characteristics

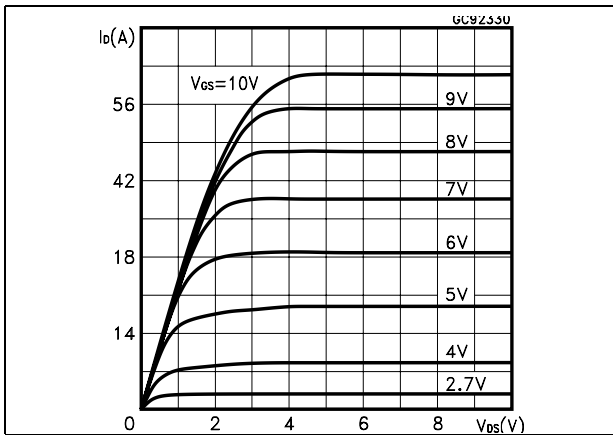


Figure 5. Transfer characteristics

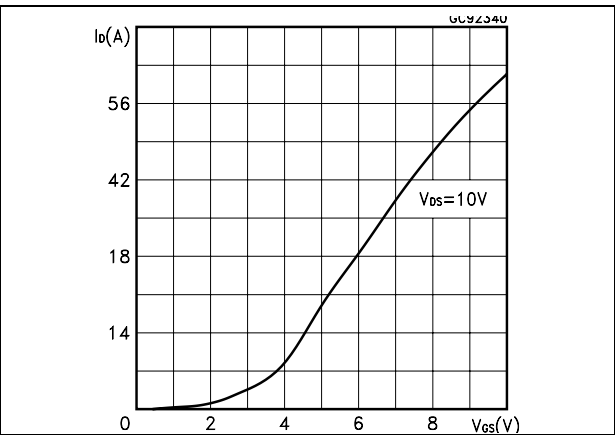


Figure 6. Transconductance

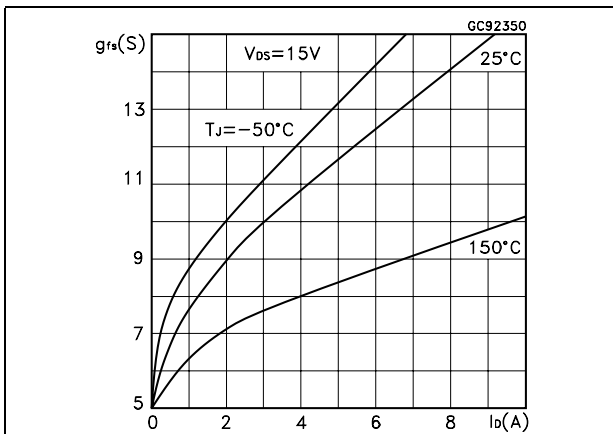


Figure 7. Static drain-source on resistance

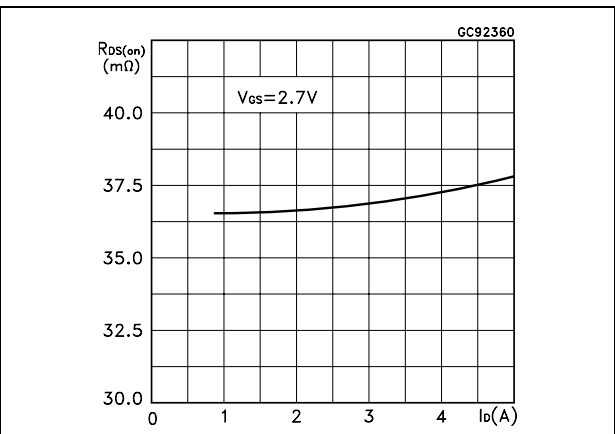


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

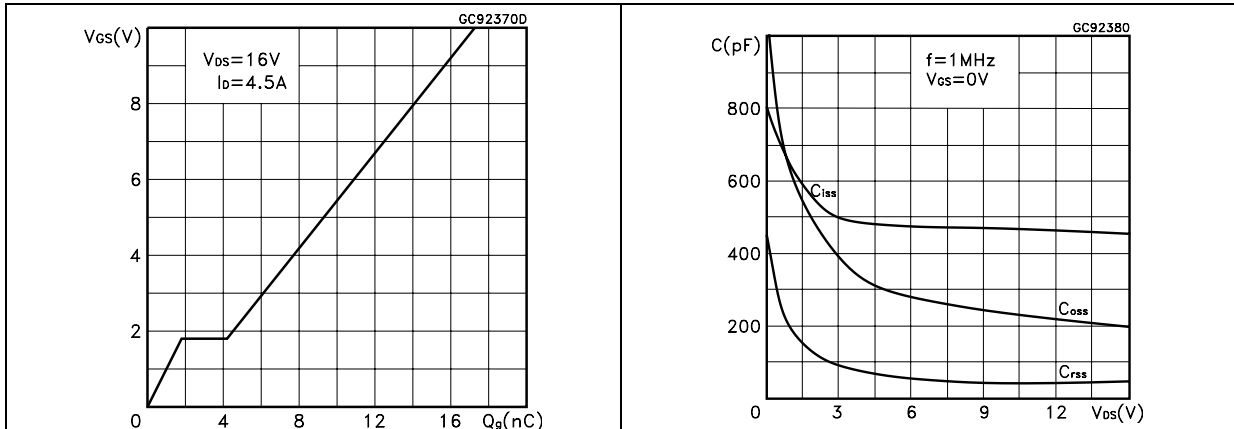


Figure 10. Normalized gate threshold voltage vs. temperature Figure 11. Normalized on resistance vs. temperature

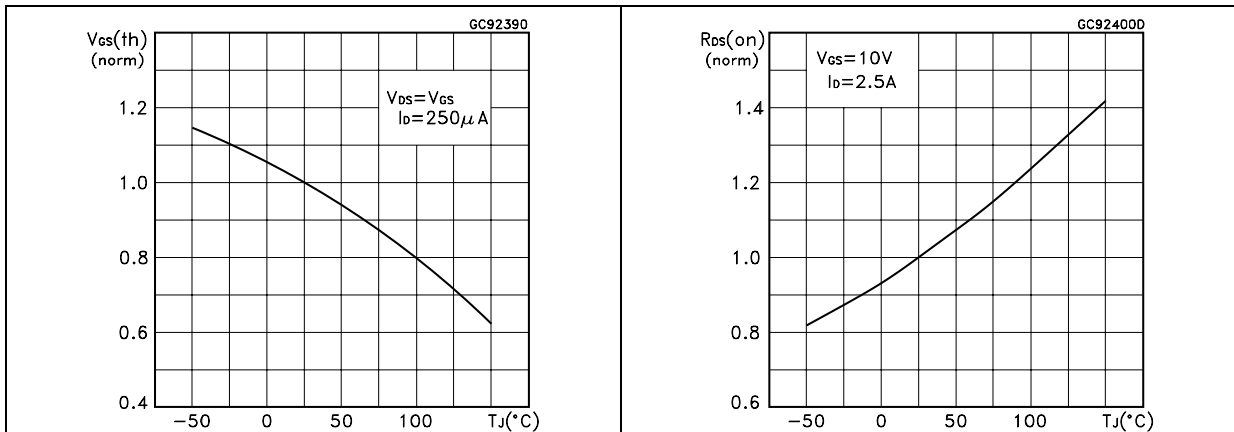
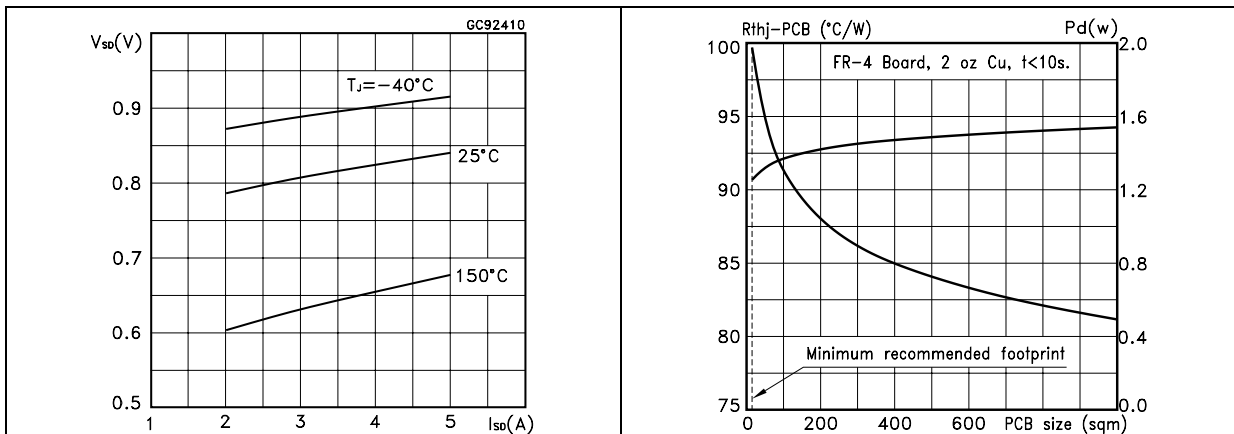


Figure 12. Source-drain diode forward characteristics Figure 13. Thermal resistance and max power



### 3 Test circuit

Figure 14. Switching times test circuit for resistive load

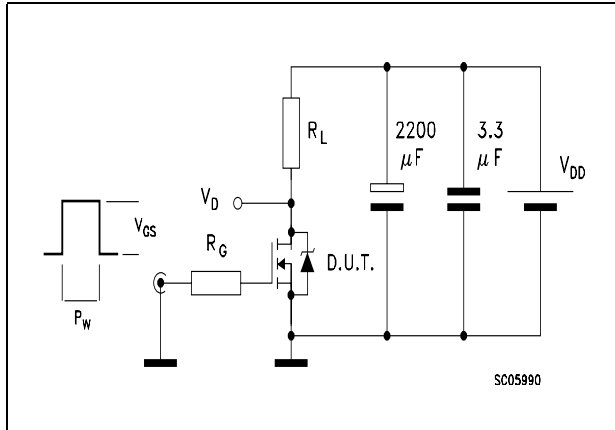


Figure 15. Gate charge test circuit

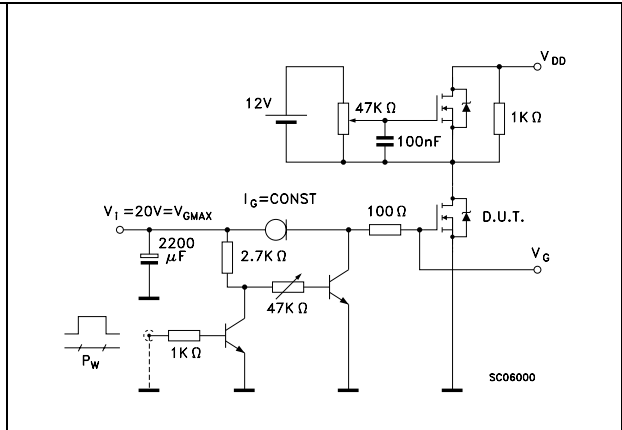


Figure 16. Test circuit for inductive load switching and diode recovery times

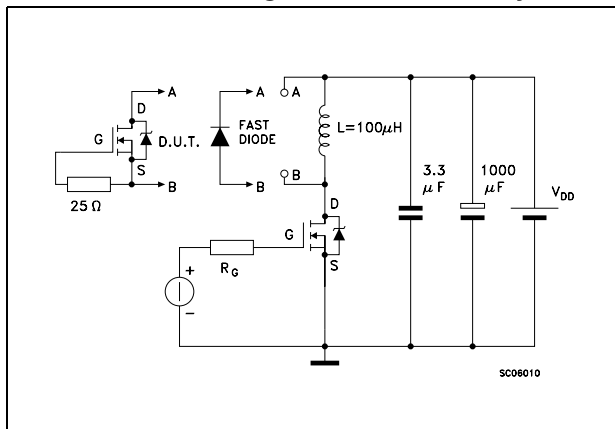


Figure 17. Unclamped Inductive load test circuit

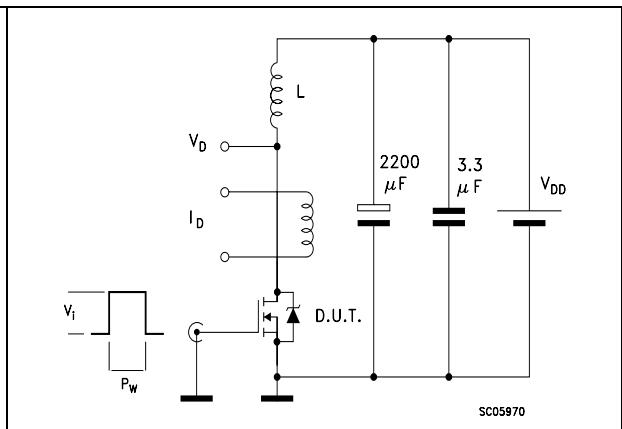
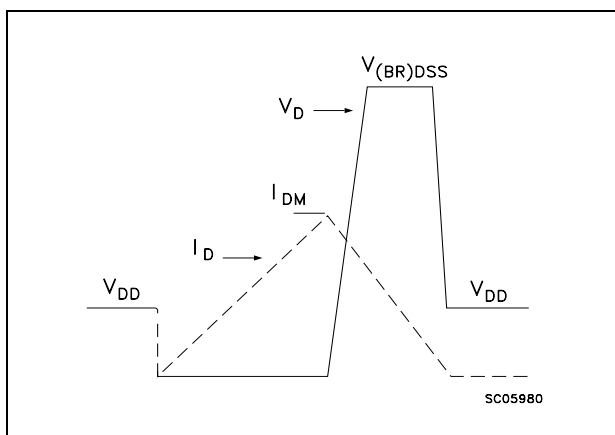


Figure 18. Unclamped inductive waveform



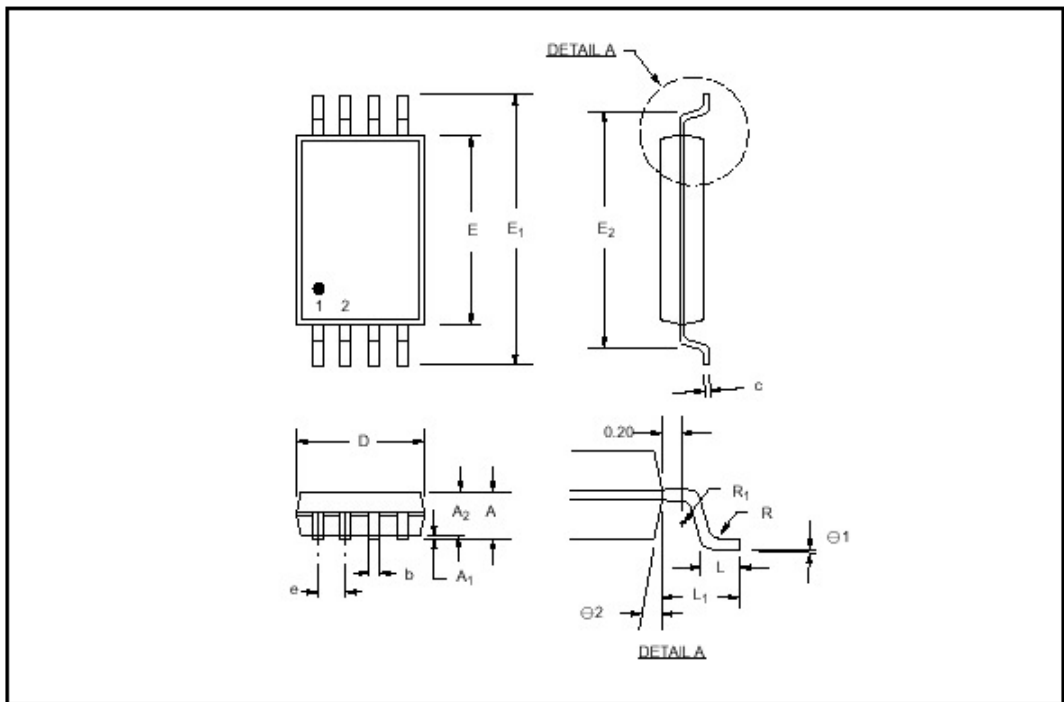


## 4 Package mechanical data

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)

**TSSOP8 MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	1.05		1.20	0.041		0.047
A1	0.05		0.15	0.002		0.006
A2	0.80		1.05	0.032		0.041
b	0.19		0.30	0.008		0.012
c		0.127			0.005	
D	2.90		3.10	0.114		0.122
E	4.30		4.50	0.170		0.177
E1	6.20		6.60	0.240		0.260
E2	5.14		5.24	0.202		0.206
e		0.65			0.025	
L	0.45		0.75	0.018		0.030
L1	0.90		1.10	0.0355		0.0433
R	0.09			0.004		
R1	0.09			0.004		
θ1	0°		8°	0°		8°
θ2	12°					



## 5 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
09-Sep-2004	3	Initial electronic version
03-Aug-2006	4	The document has been reformatted, SOA updated
01-Feb-2007	5	Typo mistake on <a href="#">Table 2</a> .
25-Oct-2007	6	Update marking on <a href="#">Table 1</a>

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