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STS4DNF60L

N-channel 60 V, 0.045 Ω , 4 A, SO-8
STripFET™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)}	I _D
STS4DNF60L	60V	<0.055 Ω	4A

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

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.

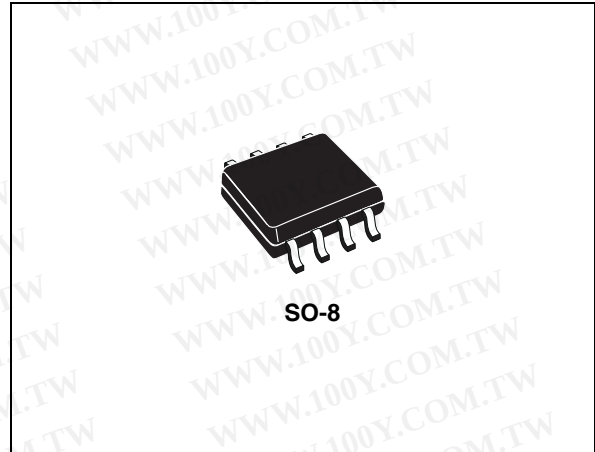


Figure 1. Internal schematic diagram

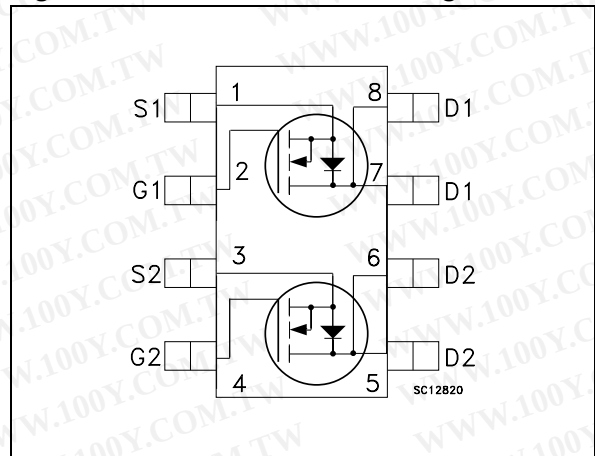


Table 1. Device summary

Order code	Marking	Package	Packaging
STS4DNF60L	4DF60L	SO-8	Tape & reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	60	V
V_{GS}	Gate- source voltage	± 15	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	4	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	2.5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	16	A
$P_{TOT}^{(2)}$	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	2	W
$E_{AS}^{(3)}$	Single pulse avalanche energy	80	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	$^{\circ}\text{C}$

1. Pulse width limited by safe operating area
2. $P_{TOT}=1.6\text{ W}$ for single operation
3. Starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = 4\text{ A}$, $V_{DD} = 30\text{ V}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-pcb}$	Thermal resistance junction-pcb D.O. ⁽¹⁾	62.5	$^{\circ}\text{C/W}$

1. When mounted on inch² FR-4 board, 2 Oz Cu, $t \leq 10\text{sec}$, dual operation

2 Electrical characteristics

($T_C = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 4. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	60			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125\text{ }^{\circ}\text{C}$			1 10	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 15\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1	1.7	2.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 2\text{ A}$ $V_{GS} = 4.5\text{ V}$, $I_D = 2\text{ A}$		0.045 0.050	0.055 0.065	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward transconductance	$V_{DS} = 25\text{ V}$, $I_D = 2\text{ A}$	-	25	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1030 140 40	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 48\text{ V}$, $I_D = 4\text{ A}$, $V_{GS} = 4.5\text{ V}$ (see Figure 13)	-	15 4 4	-	nC nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 30\text{ V}$, $I_D = 2.2\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 12)	-	15	-	ns
t_r	Rise time			28		ns
$t_{d(off)}$	Turn-off delay time		-	45	-	ns
t_f	Fall time			10		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current	$I_{SD} = 4\text{ A}$, $V_{GS} = 0$	-		4	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				16	A
$V_{SD}^{(2)}$	Forward on voltage				1.2	V
t_{rr}	Reverse recovery time	$I_{SD} = 4\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 20\text{ V}$ (see Figure 17)	-	85		ns
Q_{rr}	Reverse recovery charge			85		nC
I_{RRM}	Reverse recovery current			2		A

1. Pulse width limited by safe operating area

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

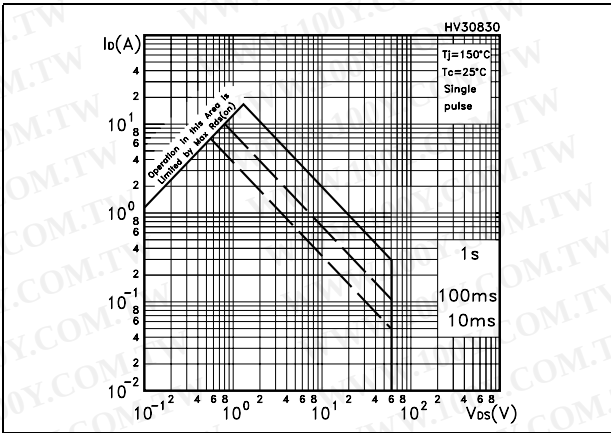


Figure 3. Thermal impedance

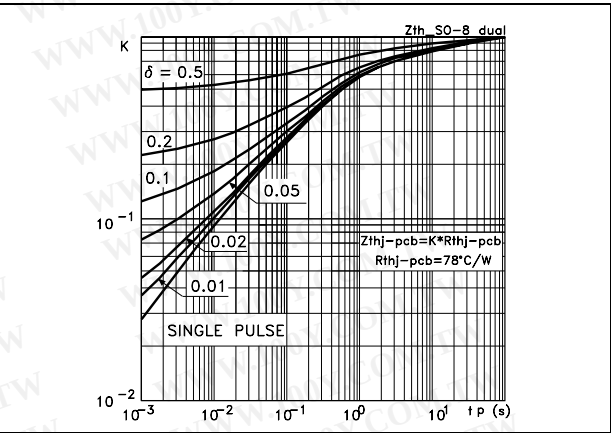


Figure 4. Output characteristics

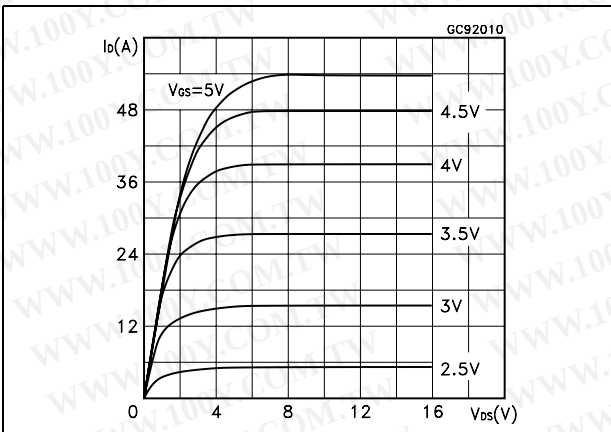


Figure 5. Transfer characteristics

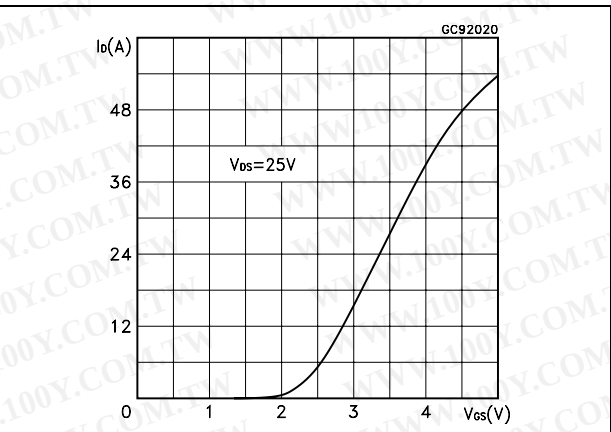


Figure 6. Source-drain diode forward characteristics

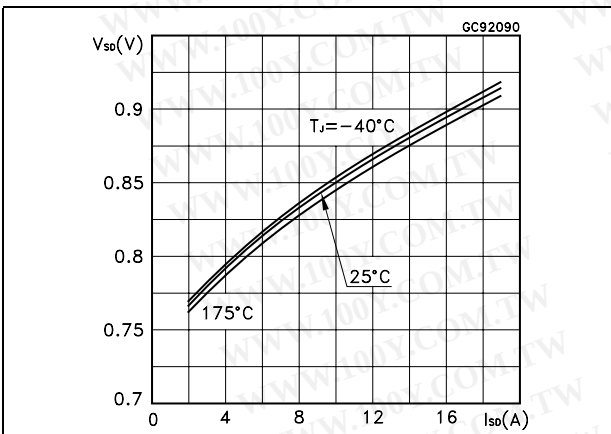


Figure 7. Static drain-source on resistance

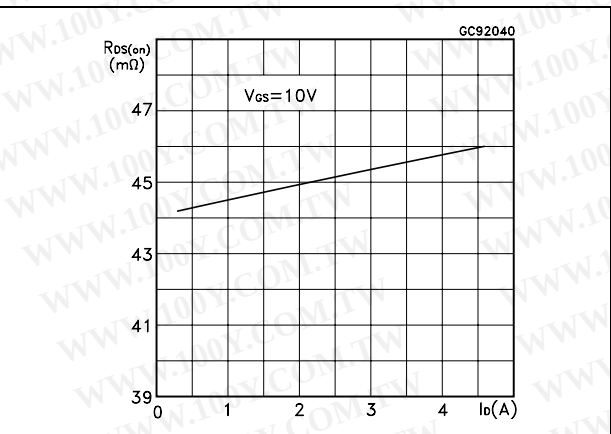


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

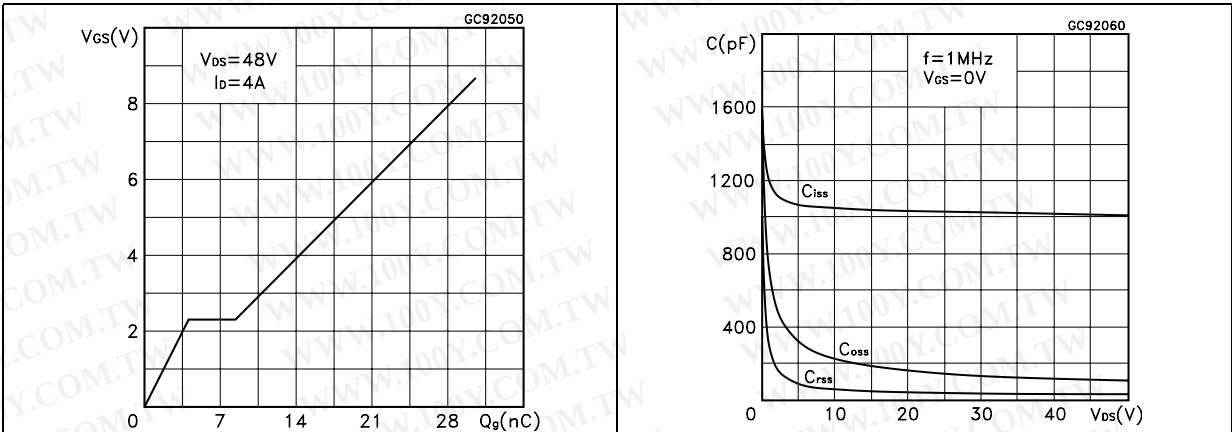
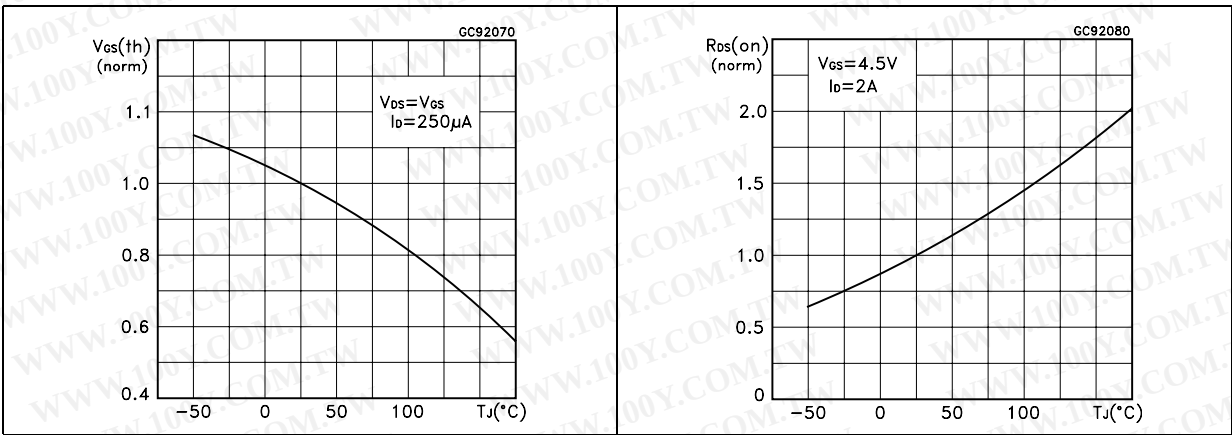


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

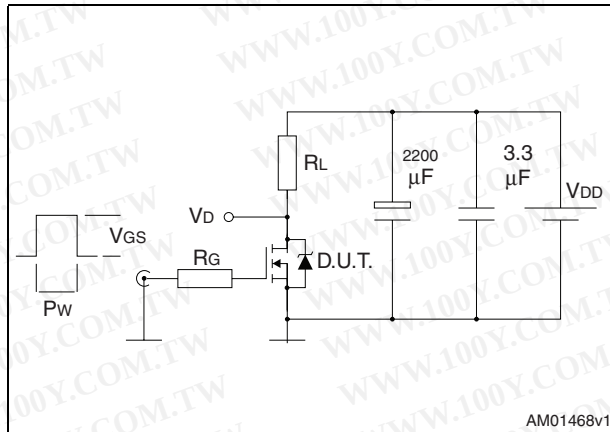


Figure 13. Gate charge test circuit

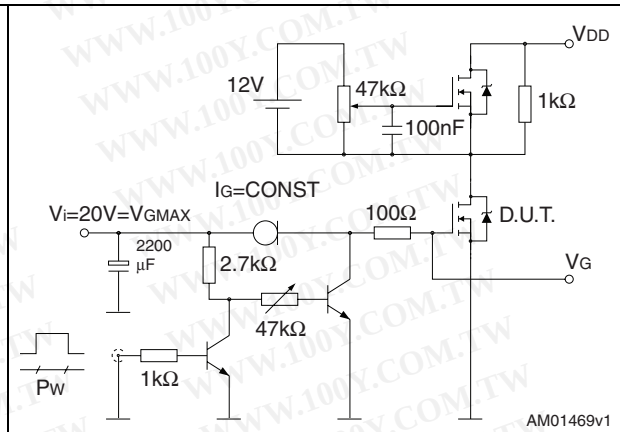


Figure 14. Test circuit for inductive load switching and diode recovery times

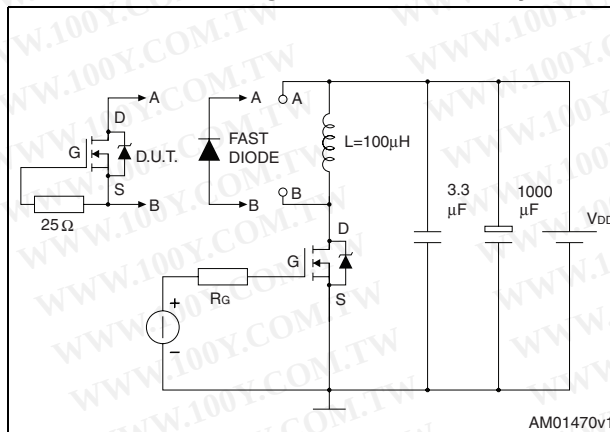


Figure 15. Unclamped Inductive load test circuit

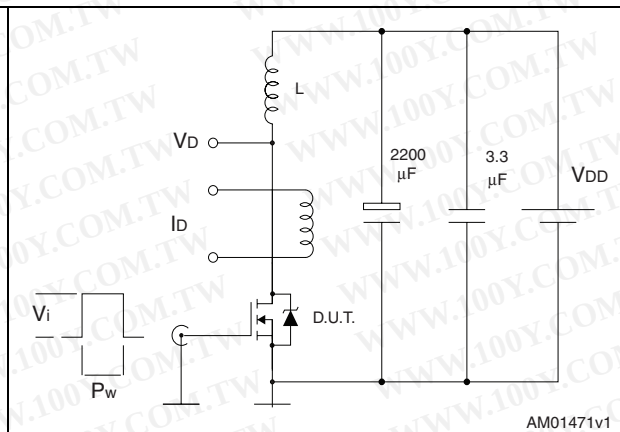


Figure 16. Unclamped inductive waveform

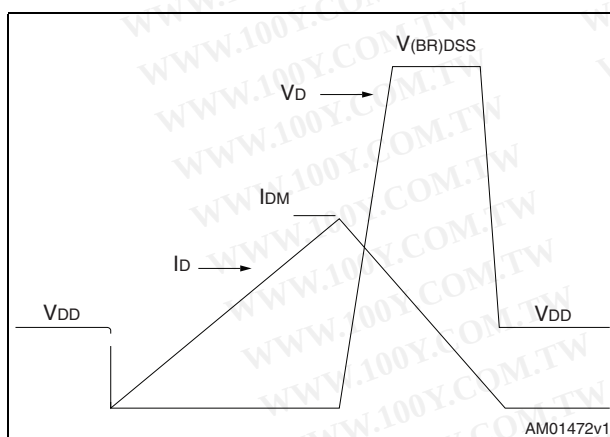
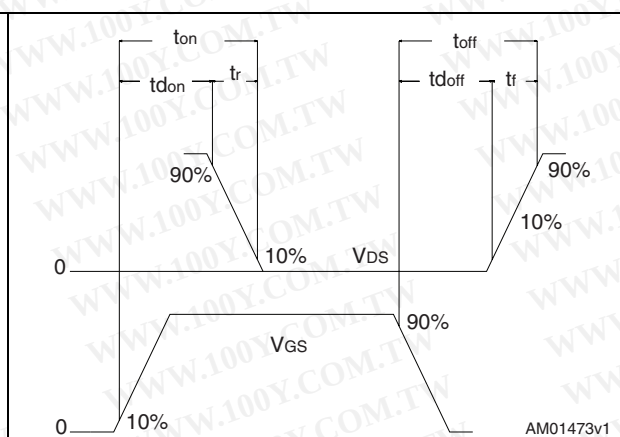


Figure 17. Switching time waveform

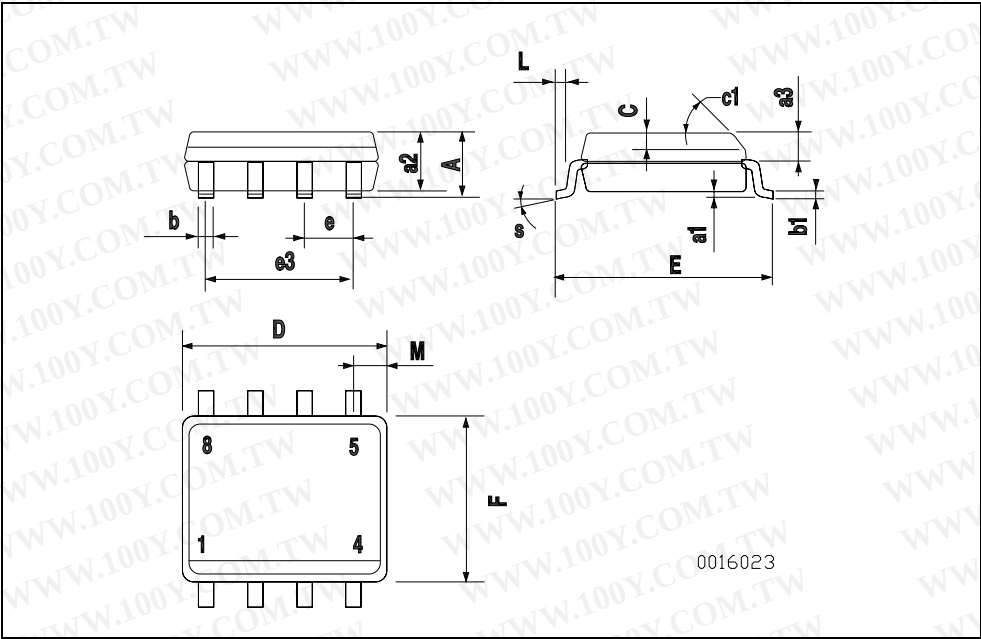


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

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 8. Document revision history

Date	Revision	Changes
30-May-2005	5	Initial electronic version
29-Mar-2006	6	Modified Figure 2 and Figure 3
16-May-2006	7	Modified internal schematic diagram
29-Aug-2007	8	Marking has been updated
30-Mar-2010	9	Inserted E _{AS} value in Table 2: Absolute maximum ratings

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