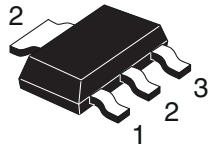
STN4NF20L

N-channel 200 V, 1.1 Ω, 1 A SOT-223 low gate charge STripFET™ II Power MOSFET

Features

Order code	V_{DSS}	$R_{DS(on)}$ max.	I_D
STN4NF20L	200 V	< 1.5 Ω	1 A

- 100% avalanche tested
- Low gate charge
- Exceptional dv/dt capability



SOT-223

Application

Switching applications

Description

This N-channel 200 V realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high efficiency isolated DC-DC converters.

Figure 1. Internal schematic diagram

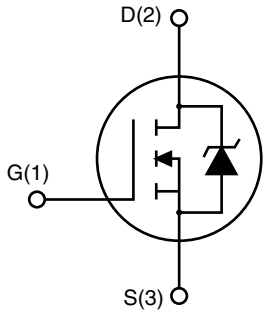


Table 1. Device summary

Order code	Marking	Package	Packaging
STN4NF20L	4NF20L	SOT-223	Tape and reel

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current continuous T_C = 25 °C	1	A
I_D	Drain current continuous T_C = 100 °C	0.63	A
I_{DM} (1)	Drain current pulsed	4	A
P_{TOT}(2)	Total dissipation at T_C = 25 °C	3.3	W
dv/dt (3)	Peak diode recovery voltage slope	20	V/ns
T_j T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	°C

1. Pulse width limited by safe operating area.
2. This value is rated according to Rthj-amb ≤ 10 sec.
3. Isd ≤ 1 A, di/dt ≤ 200 A/µs, V_{DD} ≤ 80% $V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}amb}$(1)	Thermal resistance junction to ambient	38	°C/W
$R_{thj\text{-}amb}$(2)		62.5	°C/W

1. When mounted on 1 inch² FR-4 board, 2 oz. Cu, (t < 10 sec).
2. When mounted on 1 inch² FR-4 board, 2 oz. Cu, (t > 10 sec).

Table 4. Thermal data

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetetive or not repetetive(1)	1	A
E_{AS}	Single pulse avalanche energy (2)	90	mJ

1. Pulse width limited by T_{JMAX}.
2. Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V.

2 Electrical characteristics

(Tcase = 25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C				1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V, V_{DS}=0			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{GS} = V_{DS}, I_D = 250 µA	1	2	3	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 0.5 A V_{GS} = 5 V, I_D = 0.5 A		1.1 1.13	1.5 1.55	Ω Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	-	150 30 4	-	pF pF pF
R_g	Instrinsic gate resistance	f=1 MHz open drain	-	5.5	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 160 V, I_D = 1 A, V_{GS} = 10 V (see *Figure 13*)	-	0.9 2.6 6.9	-	nC nC nC

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(v)}$ t_r t_f $t_{c(off)}$	Voltage delay time Voltage rise time Current fall time Crossing time	V_{DD} = 100 V, I_D = 0.5 A, R_G = 4.7 Ω, V_{GS} = 10 V (see *Figure 12*)	-	3.6 2 10.4 15.4	-	ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		1 4	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 1 A, V_{GS} = 0	-		1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 14*)	-	51 90 3.5		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 14*)	-	56 105 3.7		ns nC 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

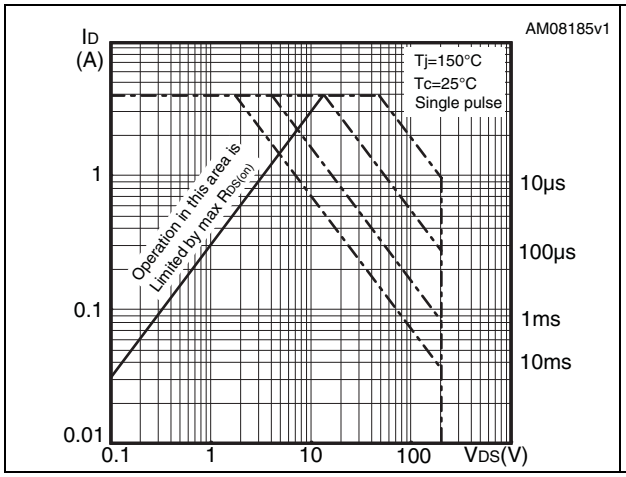


Figure 3. Thermal impedance

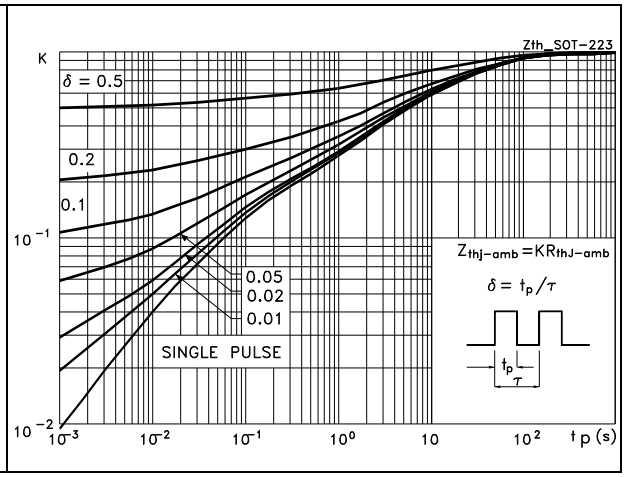


Figure 4. Output characteristics

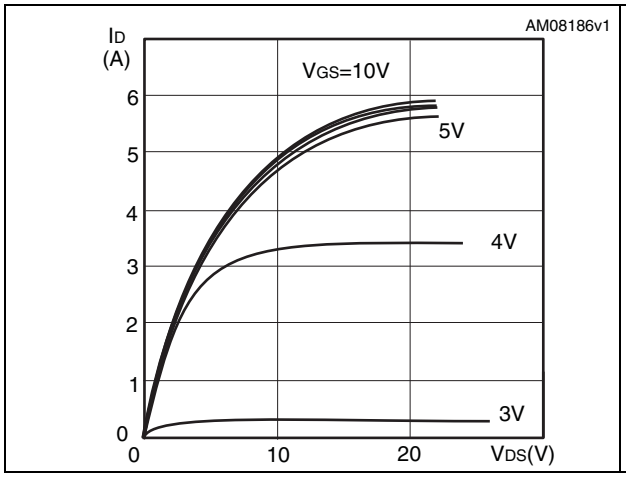


Figure 5. Transfer characteristics

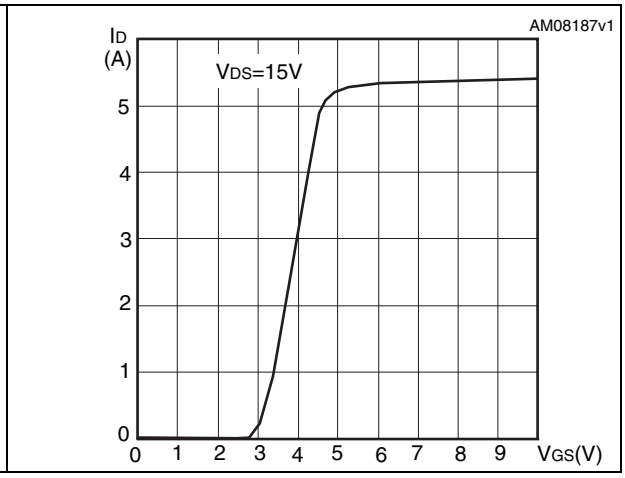


Figure 6. Normalized B_{VDSS} vs temperature

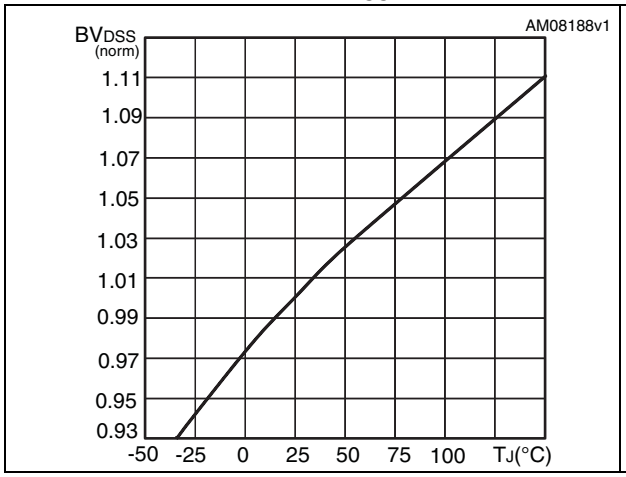


Figure 7. Static drain-source on resistance

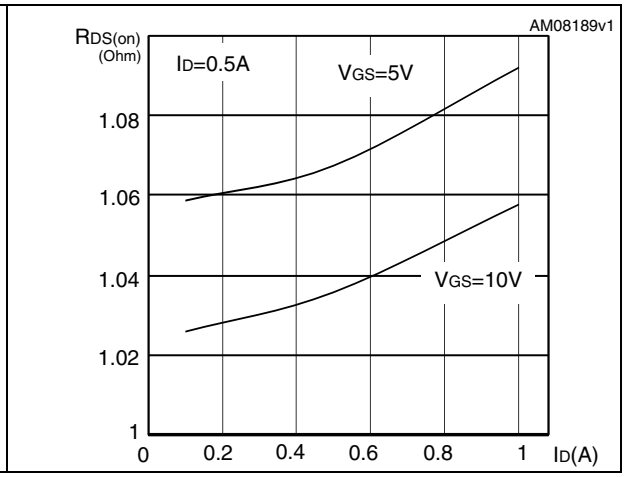


Figure 8. Gate charge vs gate-source voltage

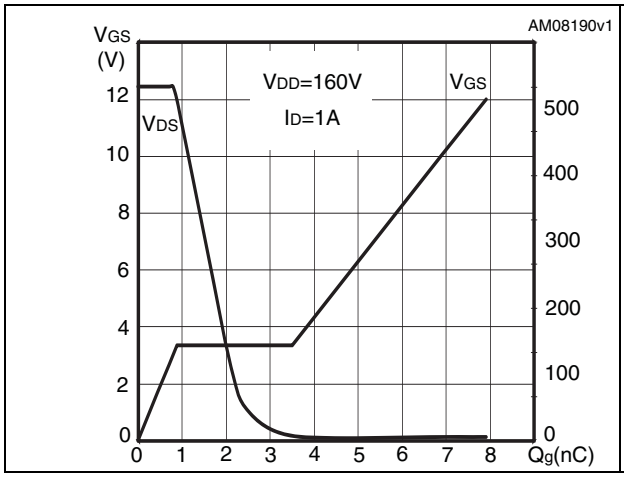


Figure 9. Capacitance variations

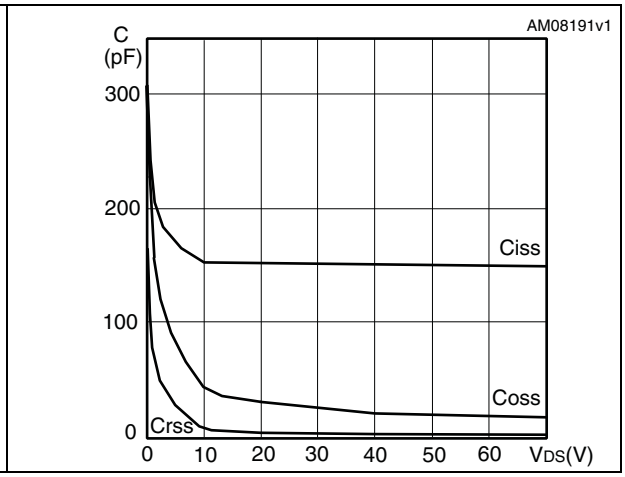


Figure 10. Normalized gate threshold voltage vs temperature

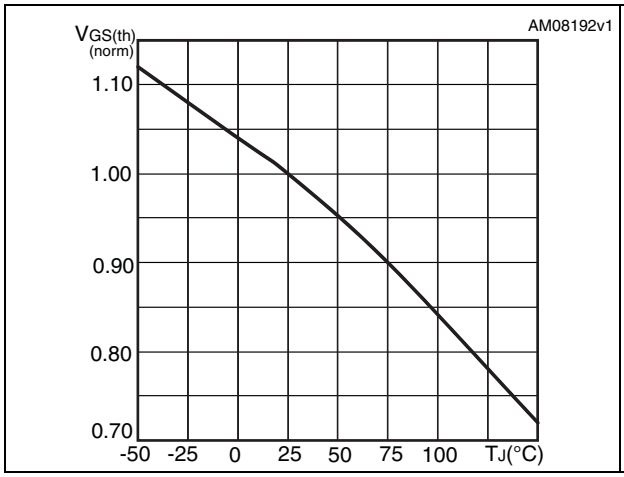
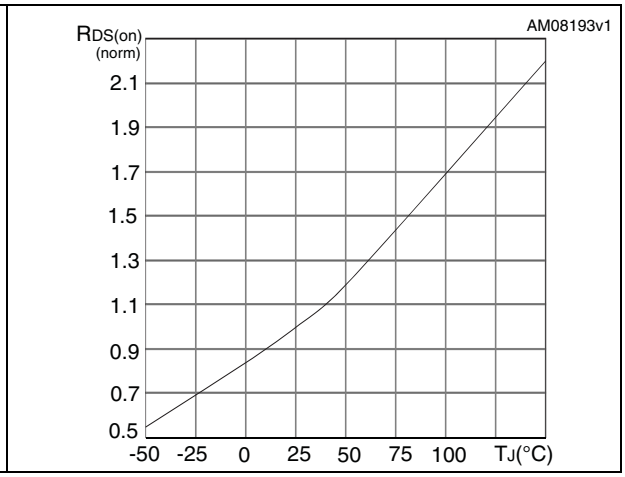


Figure 11. Normalized on resistance vs temperature



3 Test circuits

Figure 12. Switching times test circuit for resistive load

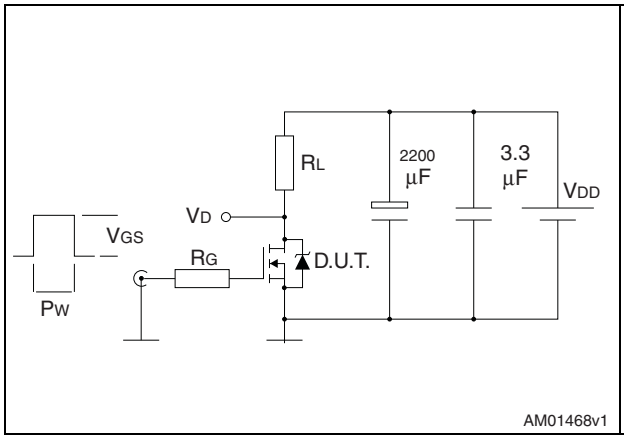


Figure 13. Gate charge test circuit

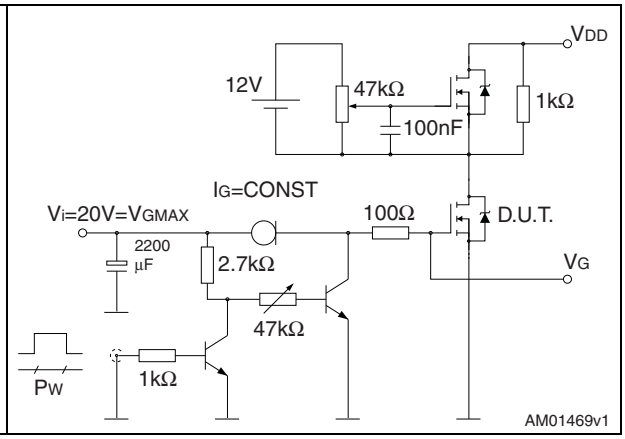


Figure 14. Test circuit for inductive load switching and diode recovery times

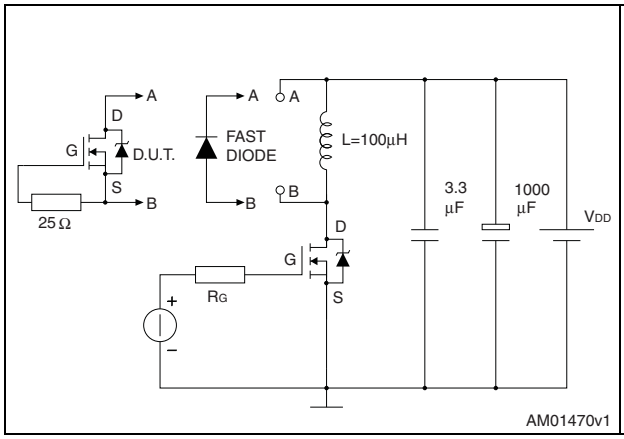


Figure 15. Unclamped inductive load test circuit

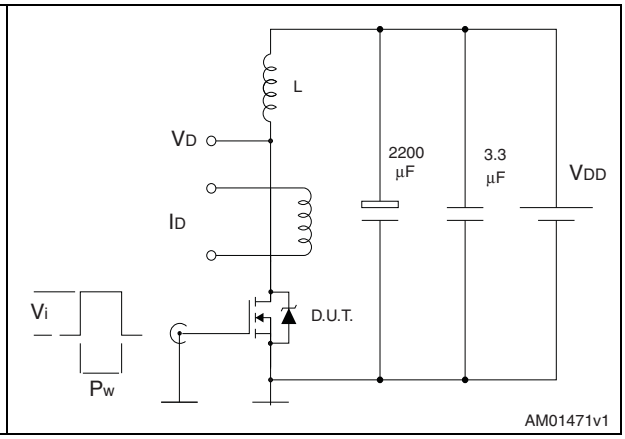


Figure 16. Unclamped inductive waveform

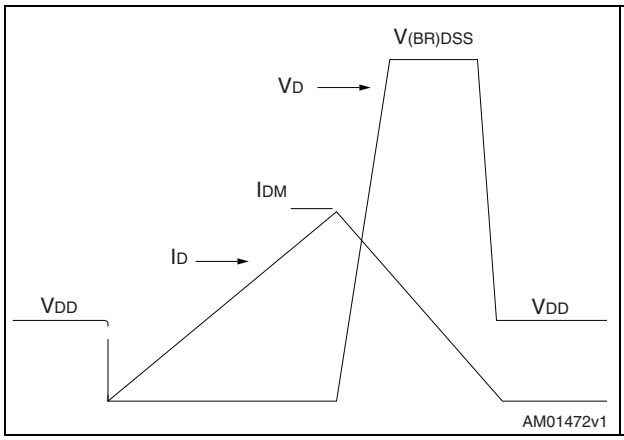
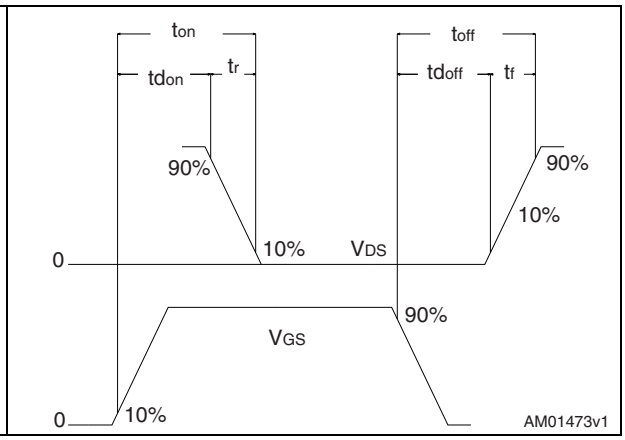


Figure 17. Switching time waveform

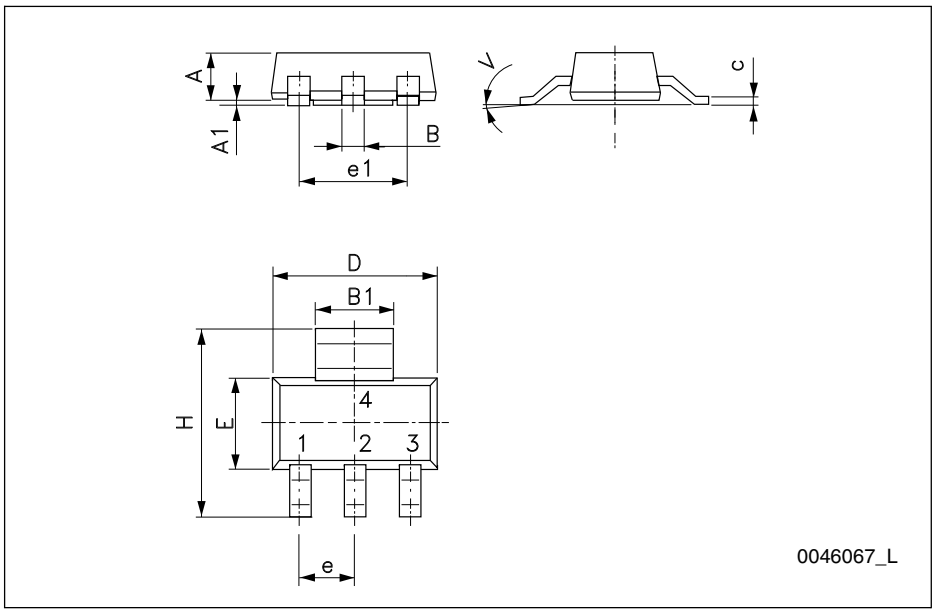


4 Package mechanical data

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.

SOT-223 mechanical data

DIM.	mm.		
	min.	typ	max.
A			1.80
A1	0.02		0.1
B	0.60	0.70	0.85
B1	2.90	3.00	3.15
c	0.24	0.26	0.35
D	6.30	6.50	6.70
e		2.30	
e1		4.60	
E	3.30	3.50	3.70
H	6.70	7.00	7.30
V			10 °



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Apr-2010	1	First release.
11-Oct-2010	2	Document status promoted from preliminary data to datasheet.

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