



# STD20NF06

N-channel 60V - 0.032Ω - 24A - DPAK  
STripFET™ II Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STD20NF06	60V	<0.040Ω	24A

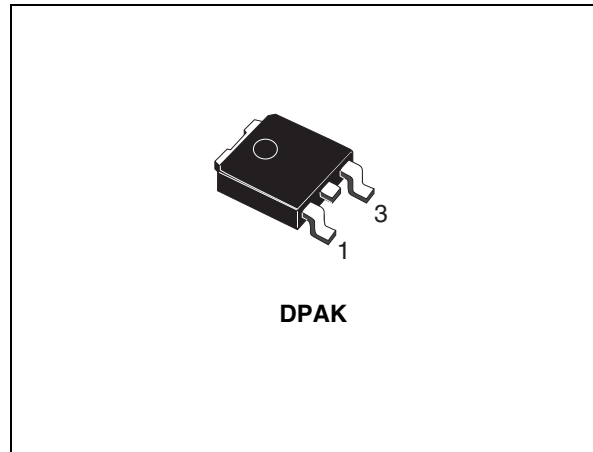
- Exceptional dv/dt capability
- Application oriented characterization
- 100% avalanche tested

## Description

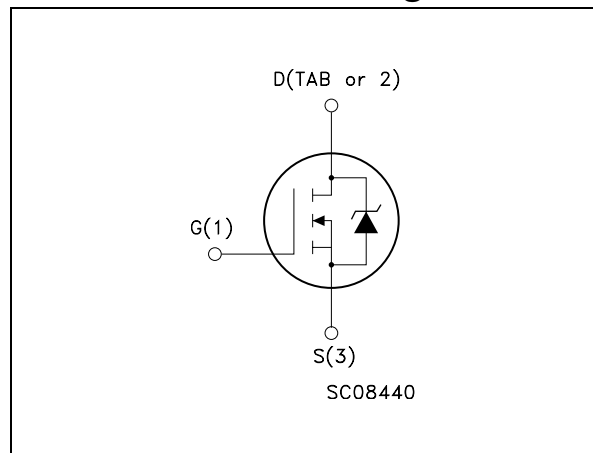
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## Applications

- Switching application



## Internal schematic diagram



## Order code

Part number	Marking	Package	Packaging
STD20NF06T4	D20NF06	DPAK	Tape & reel

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	60	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 20 \text{ k}\Omega$ )	60	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	24	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	17	A
$I_{DM}^{(1)}$	Drain current (pulsed)	96	A
$P_{tot}$	Total dissipation at $T_C = 25^\circ\text{C}$	60	W
	Derating Factor	0.4	W/°C
$dv/dt^{(2)}$	Peak diode recovery avalanche energy	10	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	300	mJ
$T_{stg}$	Storage temperature	-55 to 175	°C
$T_j$	Max. operating junction temperature		

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 24\text{A}$ ,  $di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DD} = V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$
3. Starting  $T_j = 25^\circ\text{C}$ ,  $I_D = 10\text{A}$ ,  $V_{DD} = 45\text{V}$

**Table 2. Thermal data**

$R_{thj-case}$	Thermal resistance junction-case max	2.5	°C/W
$R_{thj-amb}$	Thermal resistance junction-to ambient max	100	°C/W
$T_J$	Maximum lead temperature for soldering purpose <sup>(1)</sup>	275	°C

1. 1.6 mm from case, for 10 sec.

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating},$ $T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 12A$		0.032	0.040	$\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 25V, I_D = 12A$		15		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$		690 170 68		pF pF pF
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 30V, I_D = 10A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see <a href="#">Figure 13</a> )		10 30 30 8		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 30V, I_D = 20A,$ $V_{GS} = 10V, R_G = 4.7\Omega$ (see <a href="#">Figure 14</a> )		23 5 7.5	31	nC nC nC

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

**Table 5. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)				24 96	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 24A, V_{GS} = 0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD} = 20A, di/dt = 100A/\mu s,$ $V_{DD} = 30V, T_j = 150^\circ C$ (see <a href="#">Figure 15</a> )		65 150 4.6		ns nC 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 1. Safe operating area

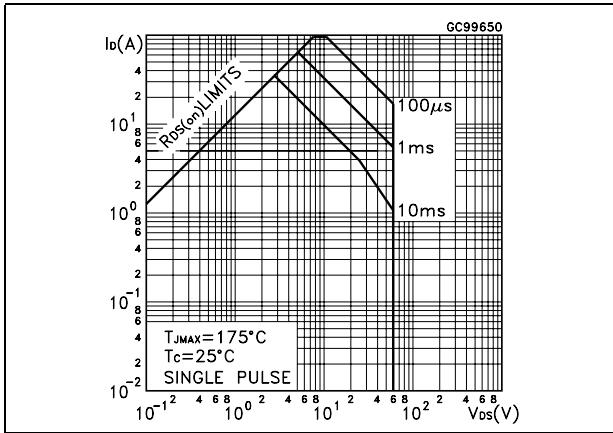


Figure 2. Thermal impedance

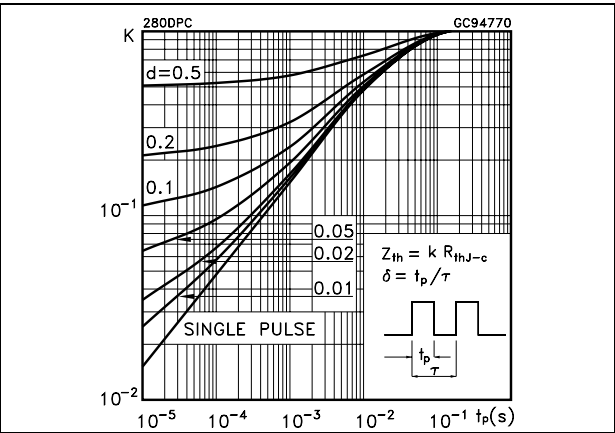


Figure 3. Output characteristics

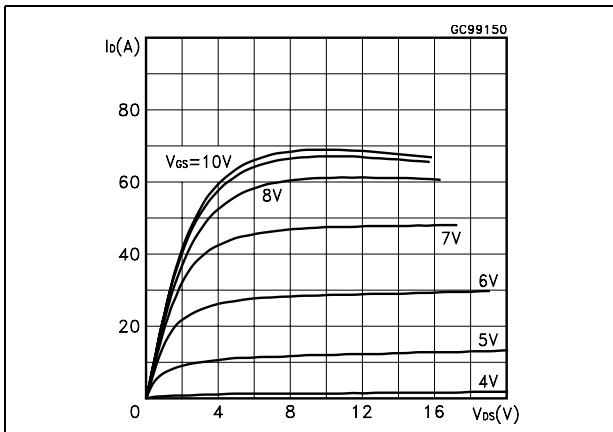


Figure 4. Transfer characteristics

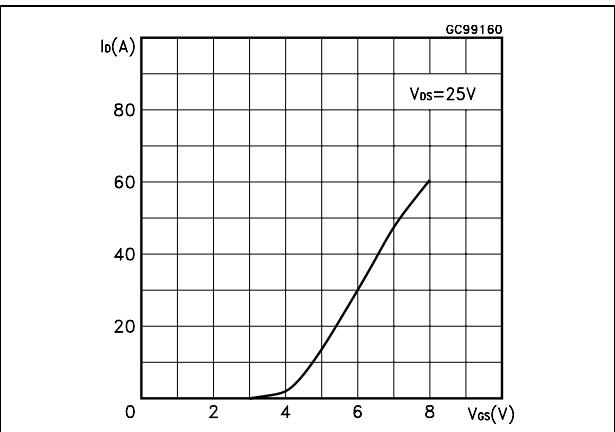


Figure 5. Transconductance

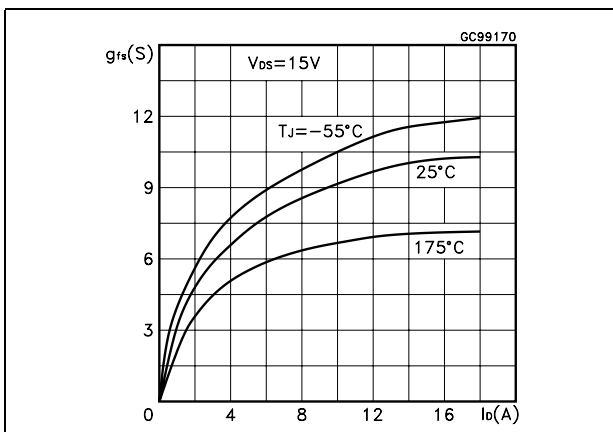


Figure 6. Static drain-source on resistance

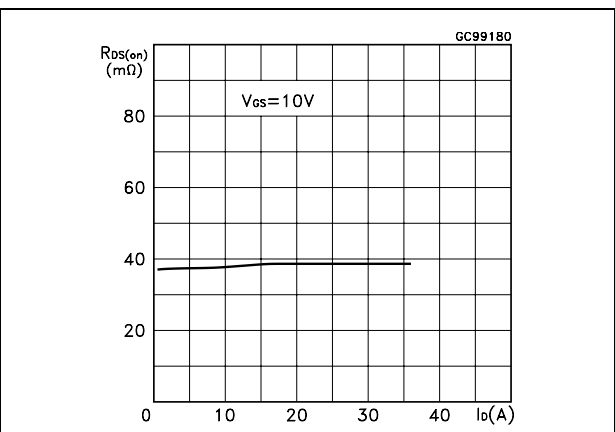


Figure 7. Gate charge vs. gate-source voltage Figure 8. Capacitance variations

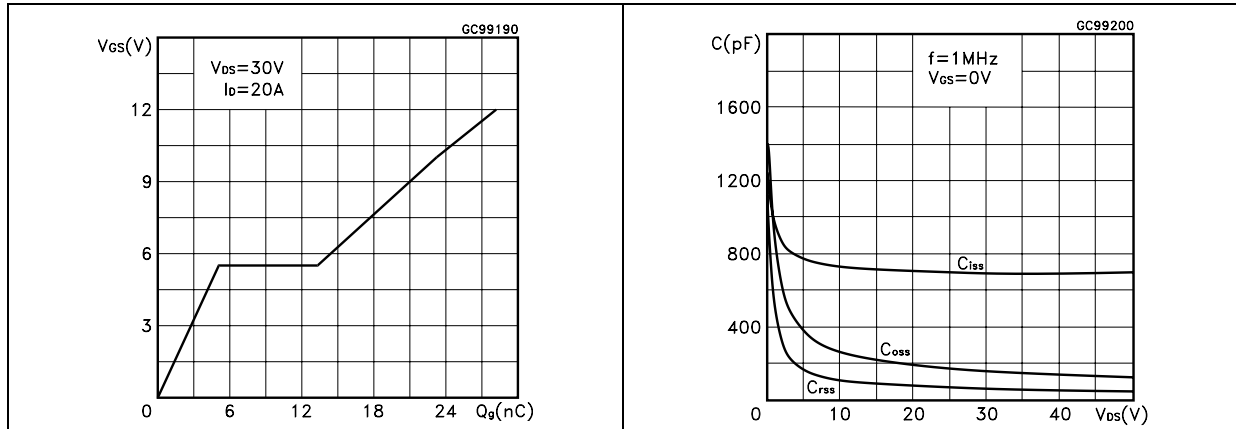


Figure 9. Normalized gate threshold voltage vs. temperature Figure 10. Normalized on resistance vs. temperature

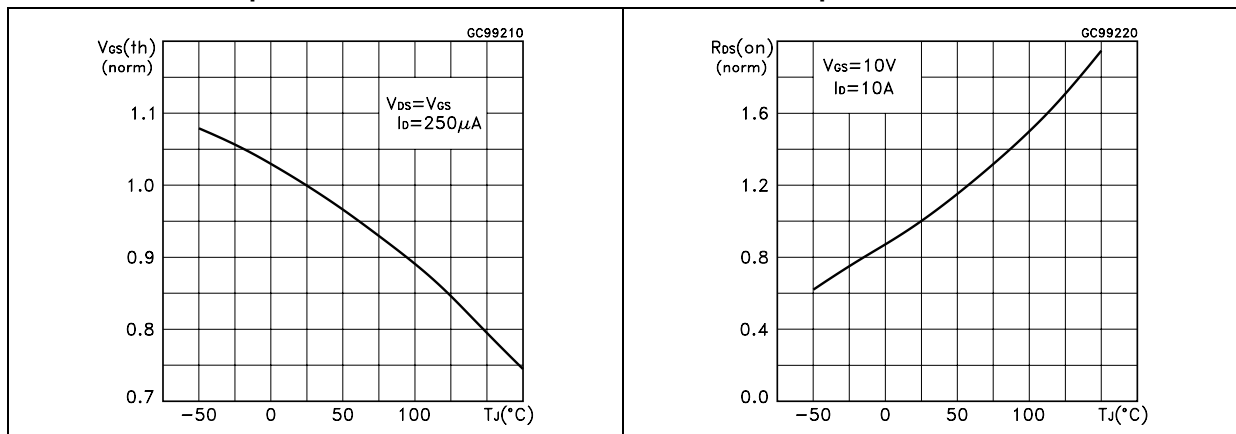
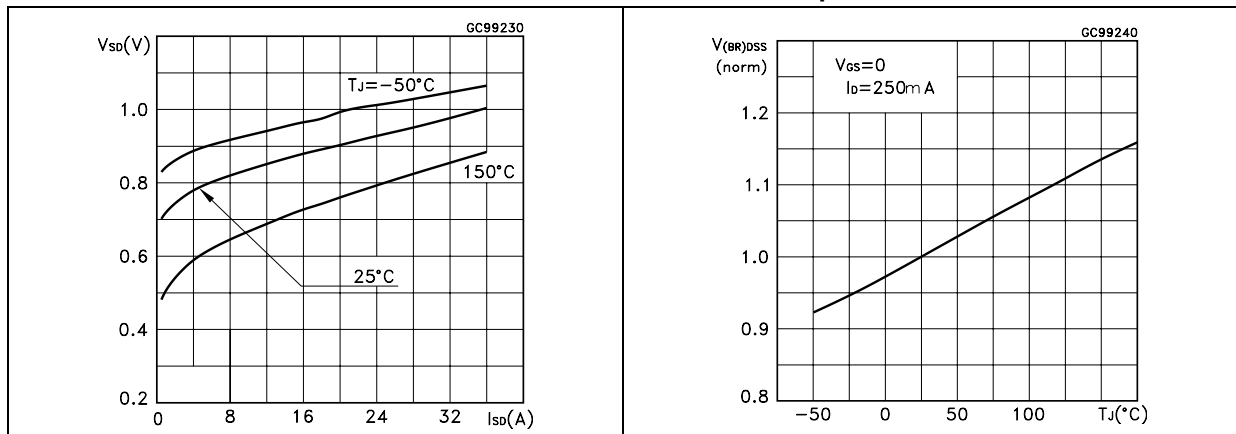


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized breakdown voltage vs. temperature



### 3 Test circuit

Figure 13. Switching times test circuit for resistive load



Figure 14. Gate charge test circuit



Figure 15. Test circuit for inductive load switching and diode recovery times



Figure 16. Unclamped Inductive load test circuit



Figure 17. Unclamped inductive waveform



Figure 18. Switching time waveform



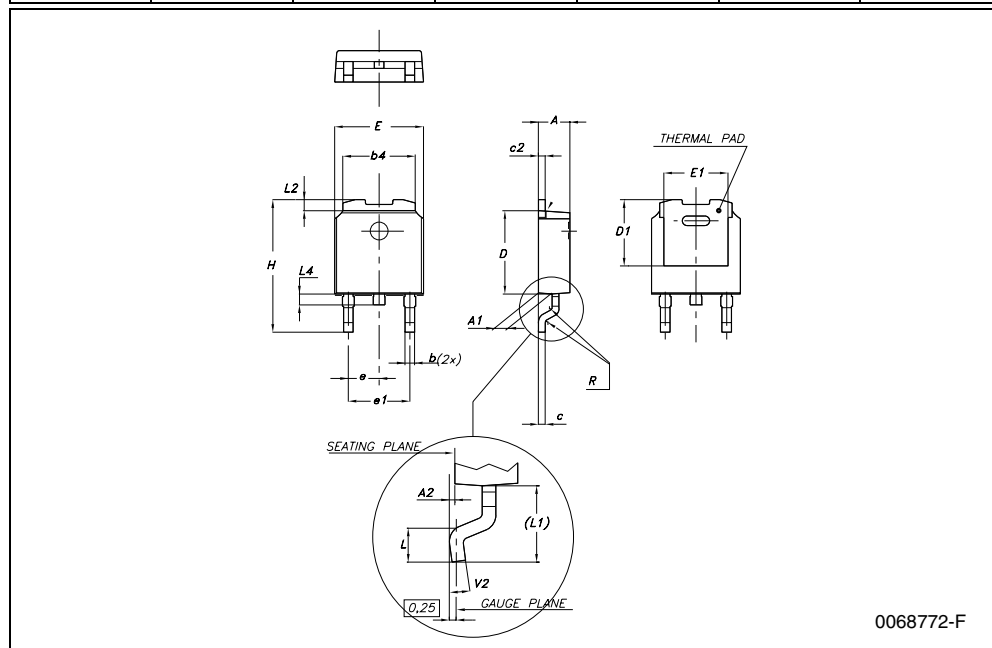


## 4 Package mechanical data

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)

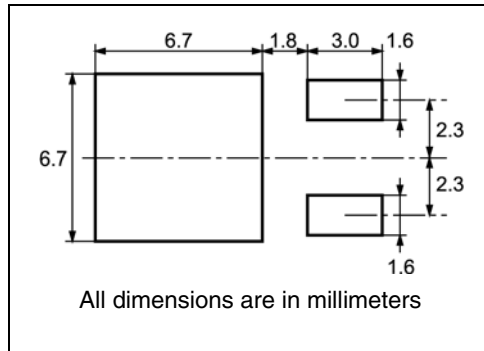
**DPAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



## 5 Packing mechanical data

### DPAK FOOTPRINT



### TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

#### REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

#### TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

#### BASE QTY

2500
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#### BULK QTY

2500
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TOP COVER TAPE

User Direction of Feed

Center line of cavity

TRL

FEED DIRECTION

Bending radius R min.

10 pitches cumulative tolerance on tape +/- 0.2 mm

For machine ref. only including draft and radii concentric around B0

## 6 Revision history

**Table 6. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
22-Jun-2004	1	First release
16-Jul-2004	2	Change status from preliminary to definitive datasheet
09-Sep-2004	3	Typing error
03-Jul-2006	4	New template, no content change
20-Feb-2007	5	Typo mistake on page 1

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