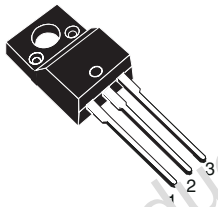
STF24NF12

N-channel 120V - 0.070Ω - 24A TO-220FP
Low gate charge STripFET™ II MOSFET

General features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STF24NF12	120V	<0.077Ω	24A

- Exceptional dv/dt capability
- Low gate charge at 100°C
- Application oriented characterization
- 100% avalanche tested

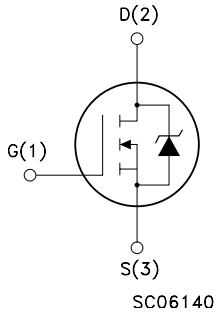


TO-220FP

Description

This 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 avalance characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

Internal schematic diagram



Applications

- Switching application

Order codes

Part number	Marking	Package	Packaging
STF24NF12	F24NF12	TO-220FP	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	120	V
V_{GS}	Gate-source voltage	± 20	V
I_D(1)	Drain current (continuous) at T_C = 25°C	24	A
I_D	Drain current (continuous) at T_C=100°C	13	A
I_{DM}(2)	Drain current (pulsed)	96	A
P_{TOT}	Total dissipation at T_C = 25°C	30	W
	Derating Factor	0.2	W/°C
dv/dt(3)	Peak diode recovery voltage slope	9	V/ns
E_{AS}(4)	Single pulse avalanche energy	220	mj
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Pulse with limited by safe operating area
2. Pulse width limited by safe operating area
3. I_{SD} ≤24A, di/dt ≤600A/µs, V_{DD} ≤$V_{(BR)DSS}$, T_j ≤T_{JMAX}
4. Starting T_j=25°C, I_D=12A, V_{DD}=30V

Table 2. Thermal data

$R_{thj\text{-}case}$	Thermal resistance junction-case Max	5	°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient Max	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

2 Electrical characteristics

(T_{CASE}=25°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 µA, V_{GS}= 0	120			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating @125°C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±20V			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10V, I_D= 12A		0.070	0.077	Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 15V, I_D = 15A		10		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1 MHz, V_{GS}=0		870 125 50		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=80V, I_D = 24A V_{GS} =10V (see Figure 13)		30 6 10	72	nC nC nC

1. Pulsed: pulse duration=300µs, 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	V_{DD} = 50V, I_D = 12A, R_G = 4.7Ω, V_{GS} = 10V (see Figure 12)		60 45		ns ns
$t_{d(off)}$ t_f	Turn-off-delay time Fall time	V_{DD} = 50V, I_D = 12A, R_G = 4.7Ω, V_{GS} =10V (see Figure 12)		50 20		ns ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current				13	A
I_{SDM}(1)	Source-drain current (pulsed)				96	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}=24A, di/dt = 100A/µs, V_{DD}=30V, Tj=150°C (see Figure 14)		100 375 7.5		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

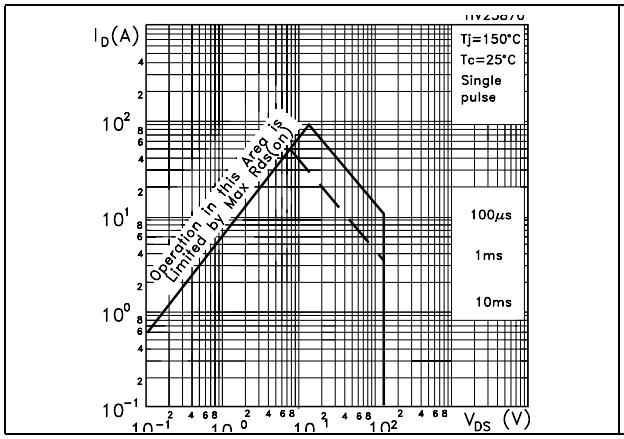


Figure 2. Thermal impedance

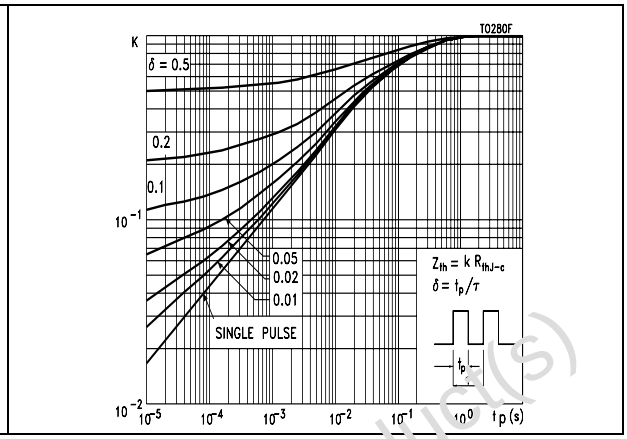


Figure 3. Output characterisics

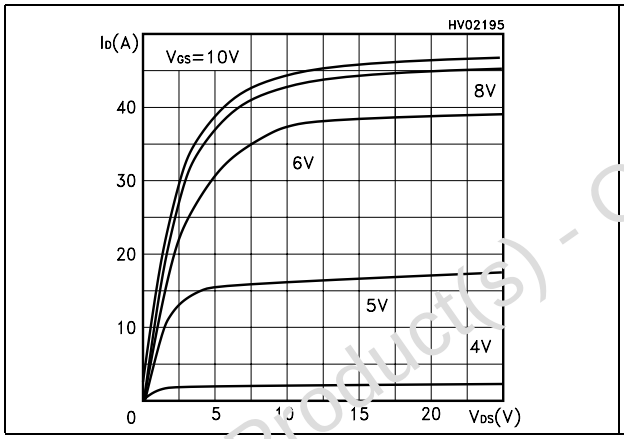


Figure 4. Transfer characteristics

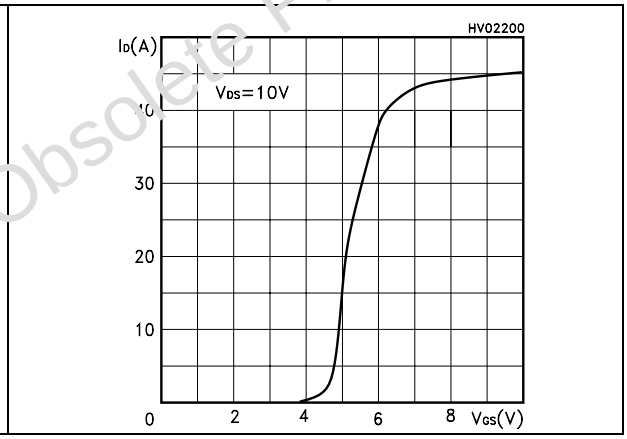


Figure 5. Transconductance

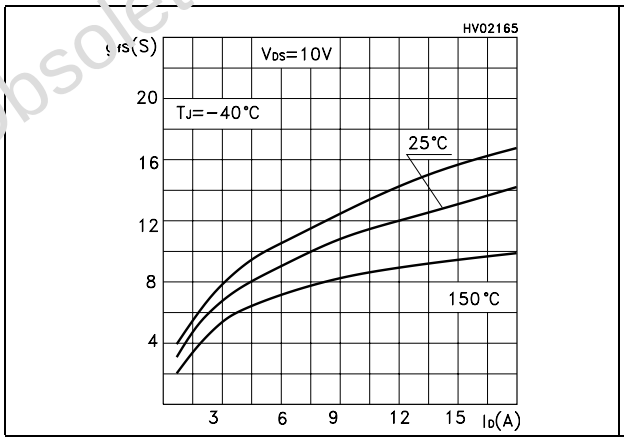


Figure 6. Static drain-source on resistance

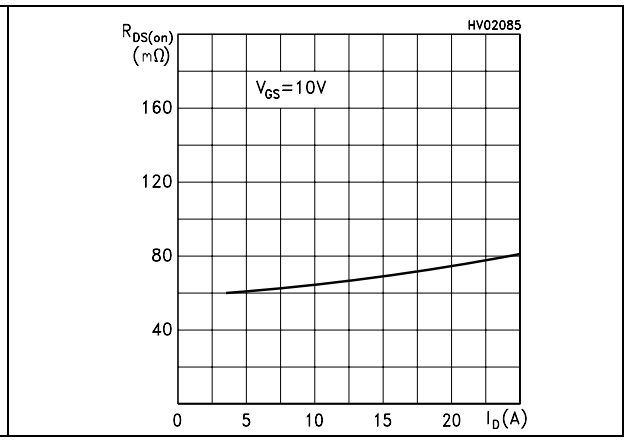


Figure 7. Gate charge vs gate-source voltage

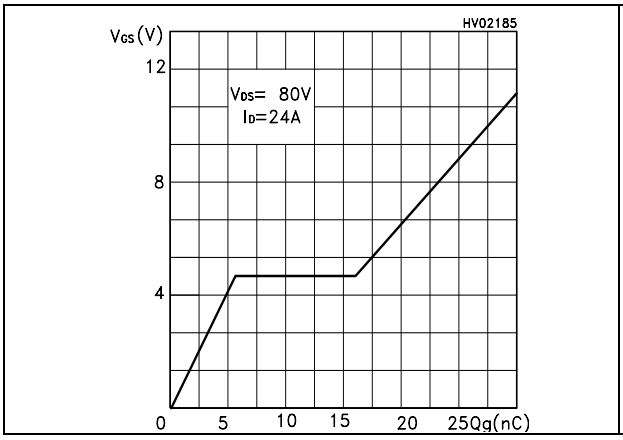


Figure 8. Capacitance variations

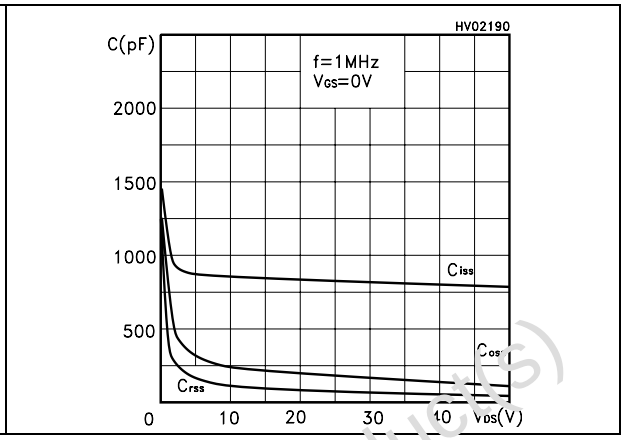


Figure 9. Normalized gate threshold voltage vs temperature

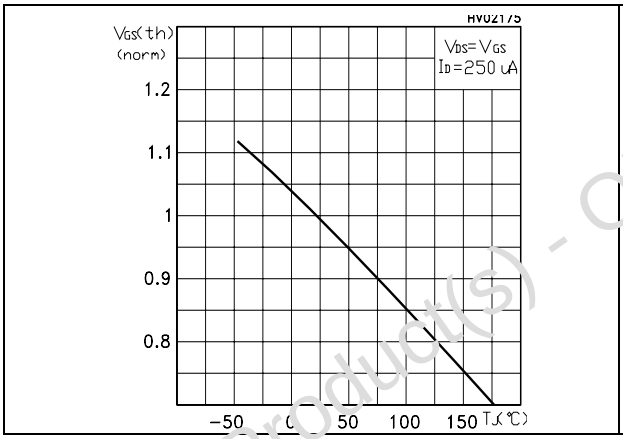


Figure 10. Normalized on resistance vs temperature

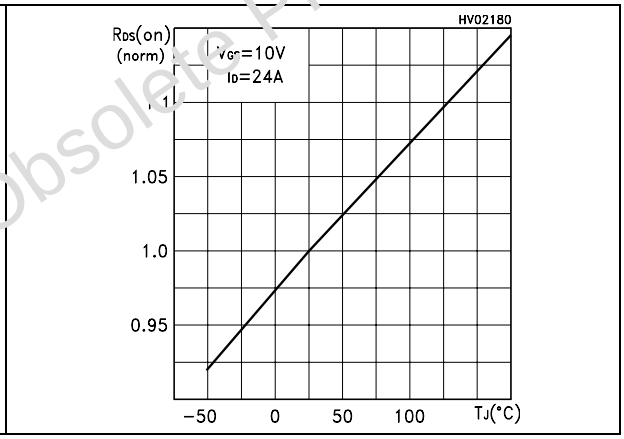
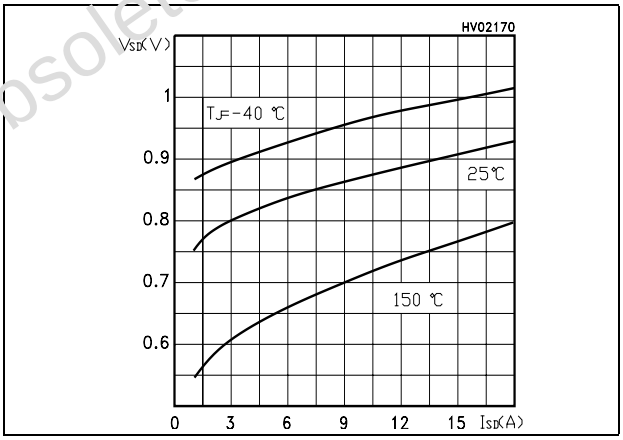


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load

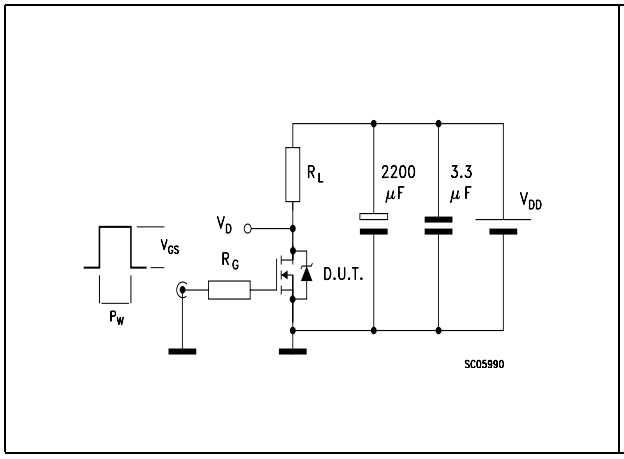


Figure 13. Gate charge test circuit

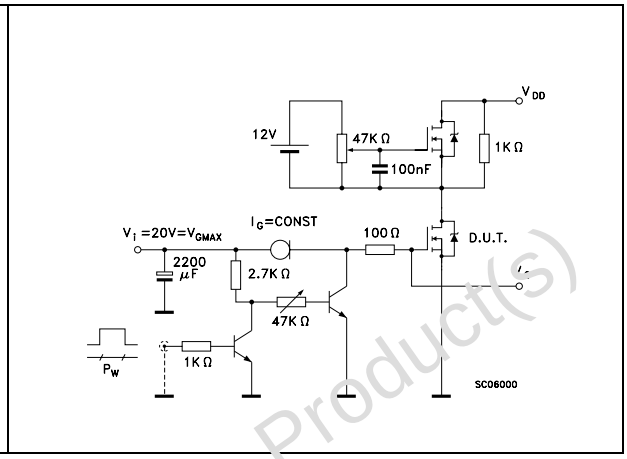


Figure 14. Test circuit for inductive load switching and diode recovery times

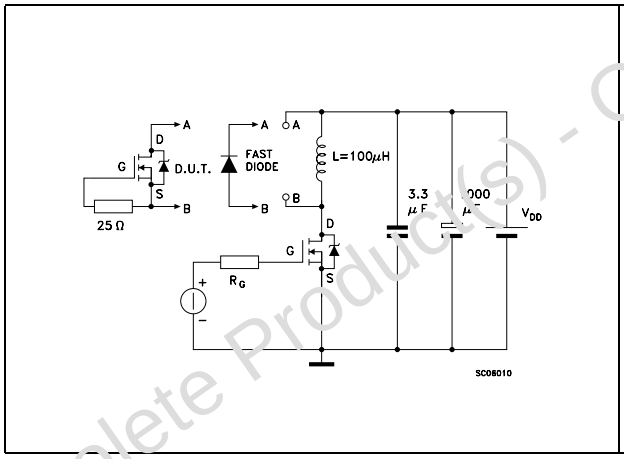


Figure 15. Unclamped Inductive load test circuit

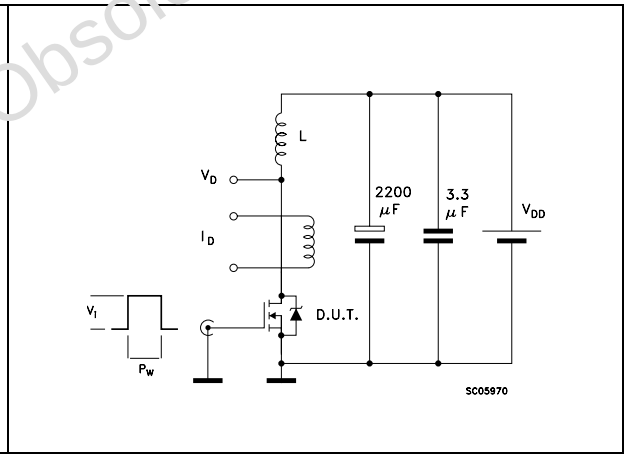


Figure 16. Unclamped inductive waveform

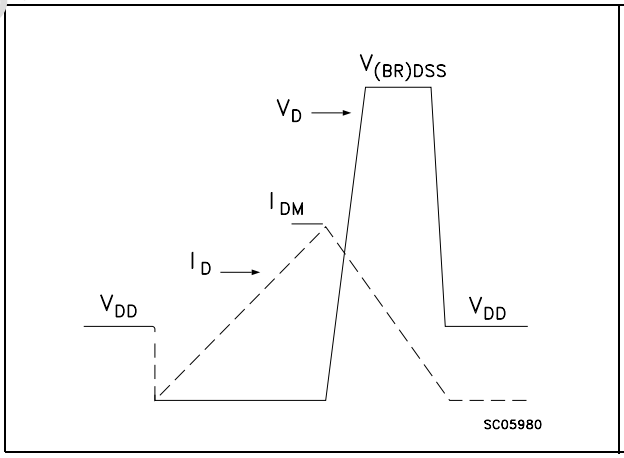
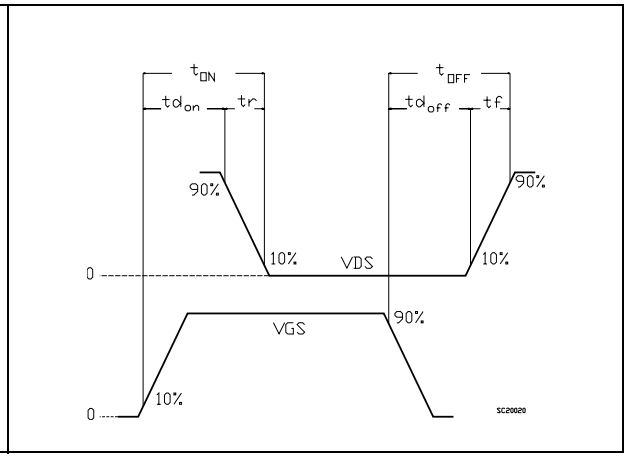


Figure 17. Switching time waveform

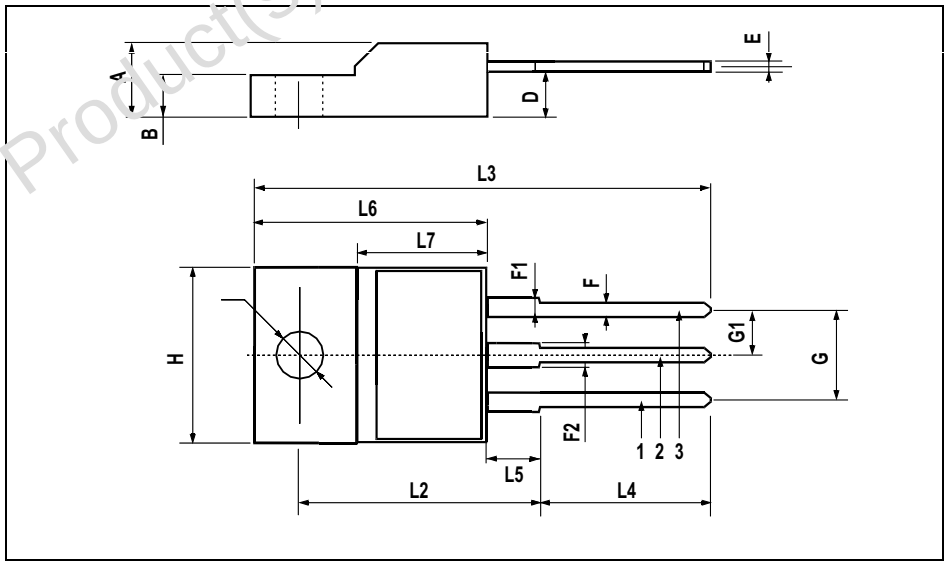


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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

TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.5	0.045		0.067
F2	1.15		1.5	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



5 Revision history

Table 7. Revision history

Date	Revision	Changes
31-may-2005	1	First issue
04-Sep-2006	2	New template, no content change