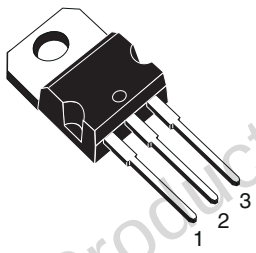
STP22NF03L

N-channel 30 V, 0.0038 Ω, 22 A, TO-220 STripFET™ II Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STP22NF03L	30 V	< 0.05 Ω	22 A

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



TO-220

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

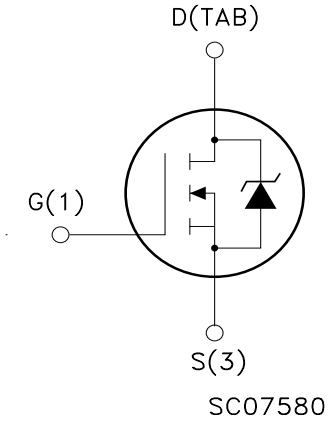


Table 1. Device summary

Order code	Marking	Package	Packaging
STP22NF03L	P22NF03L@	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	30	V
V_{DGR}	Drain-gate voltage (R_{GS} = 20 kΩ)	30	V
V_{GS}	Gate- source voltage	± 15	V
I_D	Drain current (continuous) at T_C = 25 °C	22	A
I_D(1)	Drain current (continuous) at T_C = 100 °C	16	A
I_{DM}(1)	Drain current (pulsed)	88	A
P_{tot}	Total dissipation at T_C = 25 °C	45	W
	Derating factor	0.3	W/°C
dv/dt(2)	Peak diode recovery voltage slope	6	V/ns
E_{AS} (3)	Single pulse avalanche energy	200	mJ
T_{stg}	Storage temperature	-55 to 175	°C
T_j	Max. operating junction temperature		

1. Pulse width limited by safe operating area.
2. $I_{SD} \leq 22$ A, di/dt $\leq$ 300 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$
3. Starting T_j = 25 °C, I_D = 11 A, V_{DD} = 15 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	3.33	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	62.5	°C/W
T_J	Maximum lead temperature for soldering purpose	300	°C

2 Electrical characteristics

(T_{CASE} = 25 °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 µA, V_{GS} =0	30			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = max ratings V_{DS} = max ratings, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	1			V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 11 A V_{GS} = 5 V, I_D = 11 A		0.038 0.045	0.05 0.06	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS}= 15 V , I_D = 11 A		7		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		330 90 40		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} = 15 V, I_D = 11 A R_G = 4.7 Ω V_{GS} = 5 V (see *Figure 13*)		13 4 12 5		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 24 V, I_D = 22 A, V_{GS} = 5 V (see *Figure 14*)		6.5 3.6 2	9	nC nC nC

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

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)				22 88	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 22 A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 22 A, di/dt = 100 A/µs, V_{DD} = 15 V, T_j = 150 °C (see *Figure 15*)		30 18 1.2		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

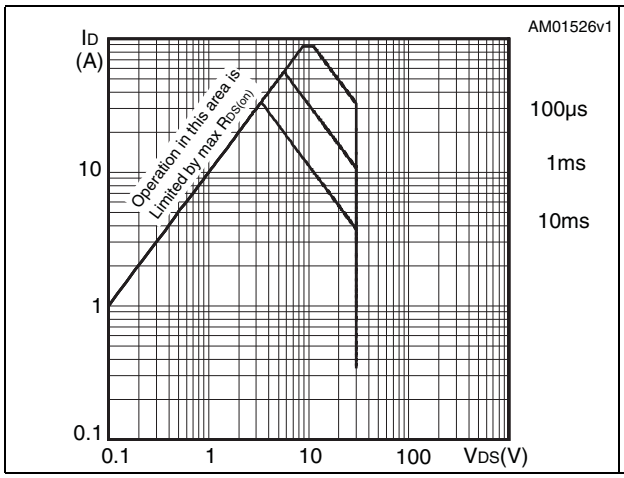


Figure 3. Thermal impedance

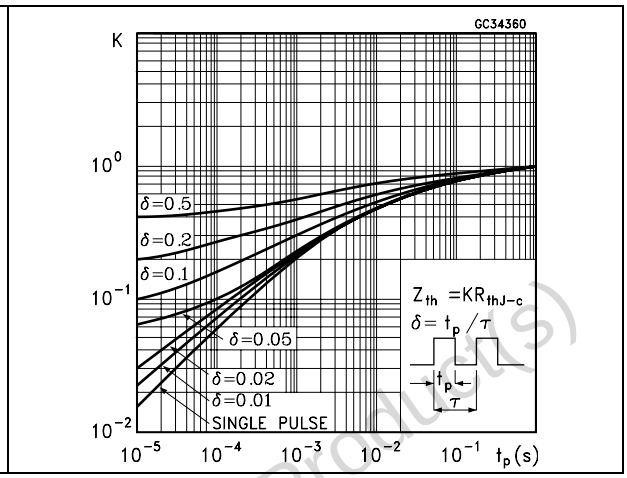


Figure 4. Output characteristics

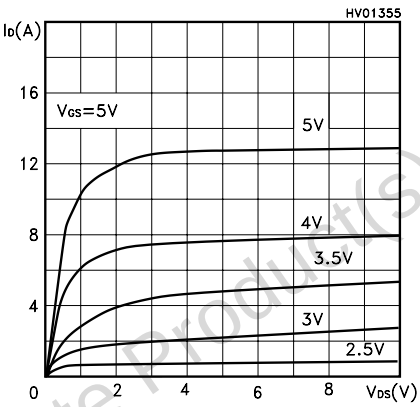


Figure 5. Transfer characteristics

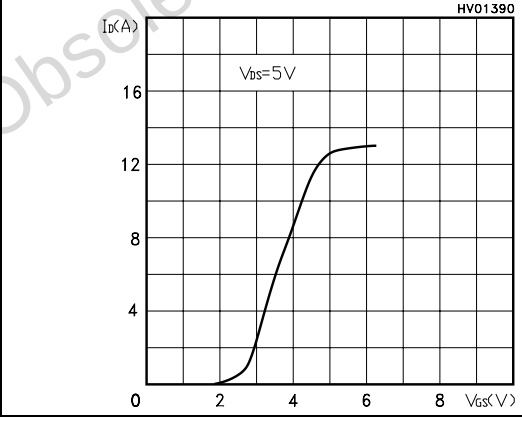


Figure 6. Transconductance

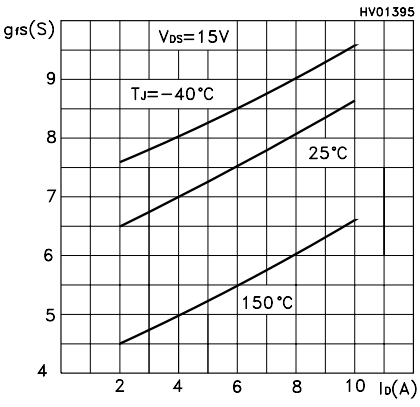


Figure 7. Static drain-source on resistance

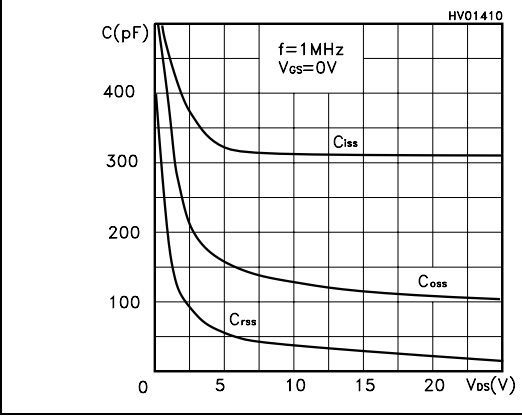


Figure 8. Gate charge vs. gate-source voltage

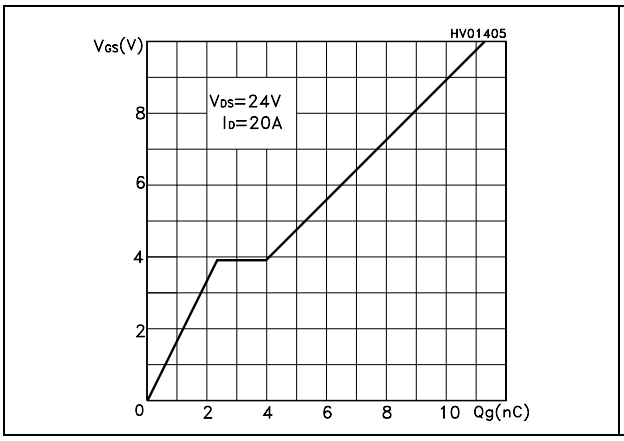


Figure 9. Capacitance variations

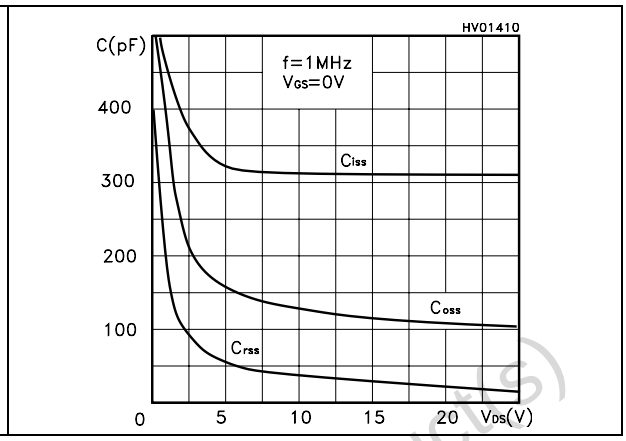


Figure 10. Normalized gate threshold voltage vs. temperature

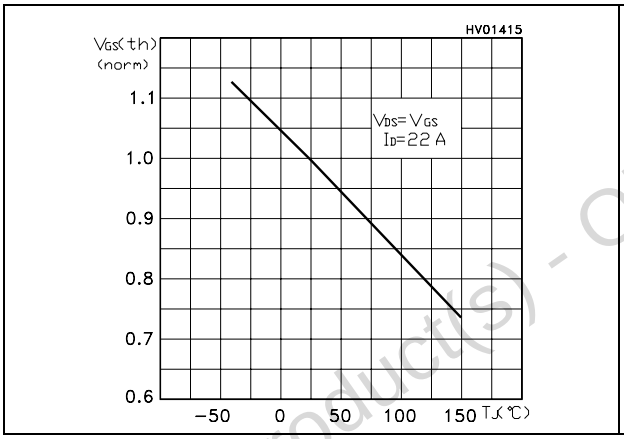


Figure 11. Normalized on resistance vs. temperature

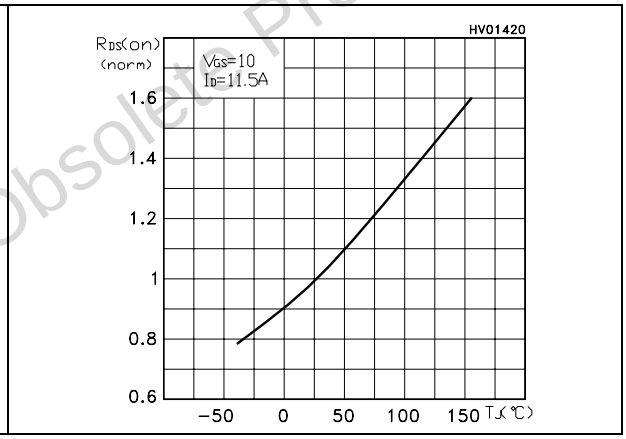
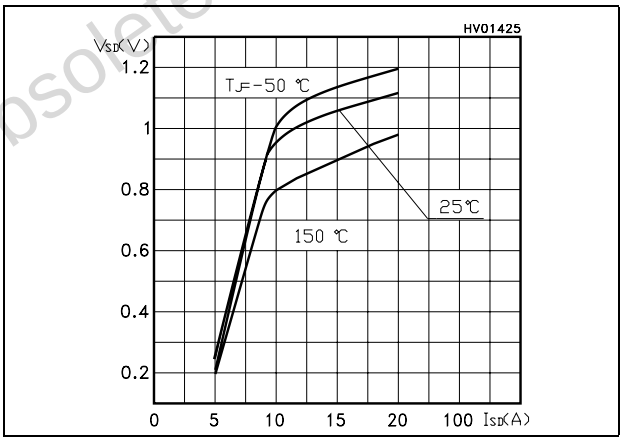


Figure 12. Source-drain diode forward characteristics



3 Test circuit

Figure 13. Switching times test circuit for resistive load

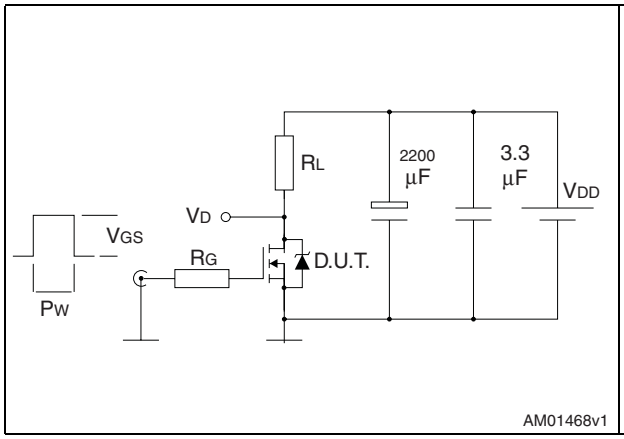


Figure 14. Gate charge test circuit

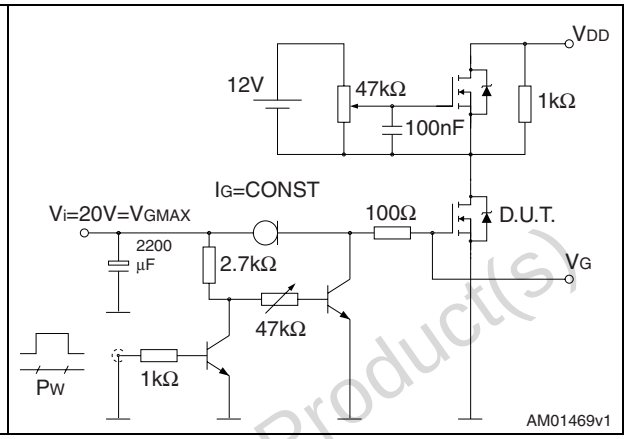


Figure 15. Test circuit for inductive load switching and diode recovery times

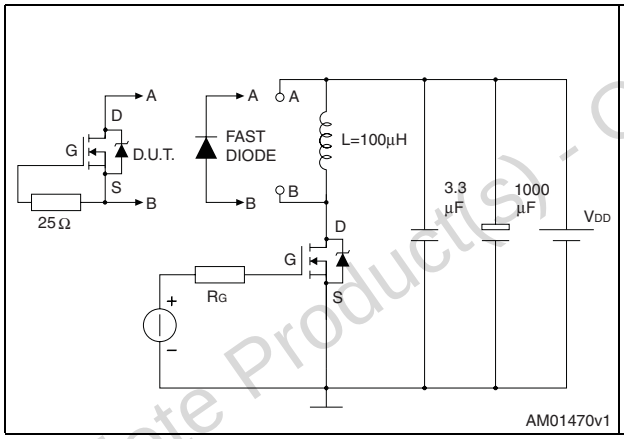


Figure 16. Unclamped Inductive load test circuit

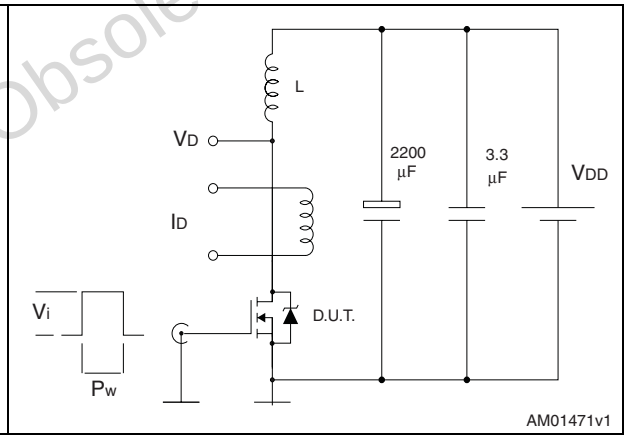


Figure 17. Unclamped inductive waveform

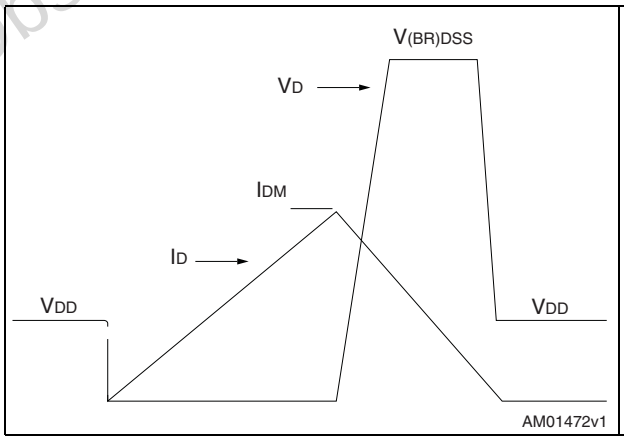
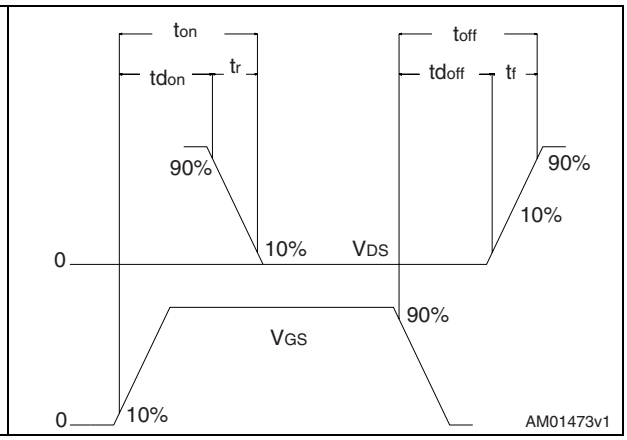


Figure 18. Switching time waveform

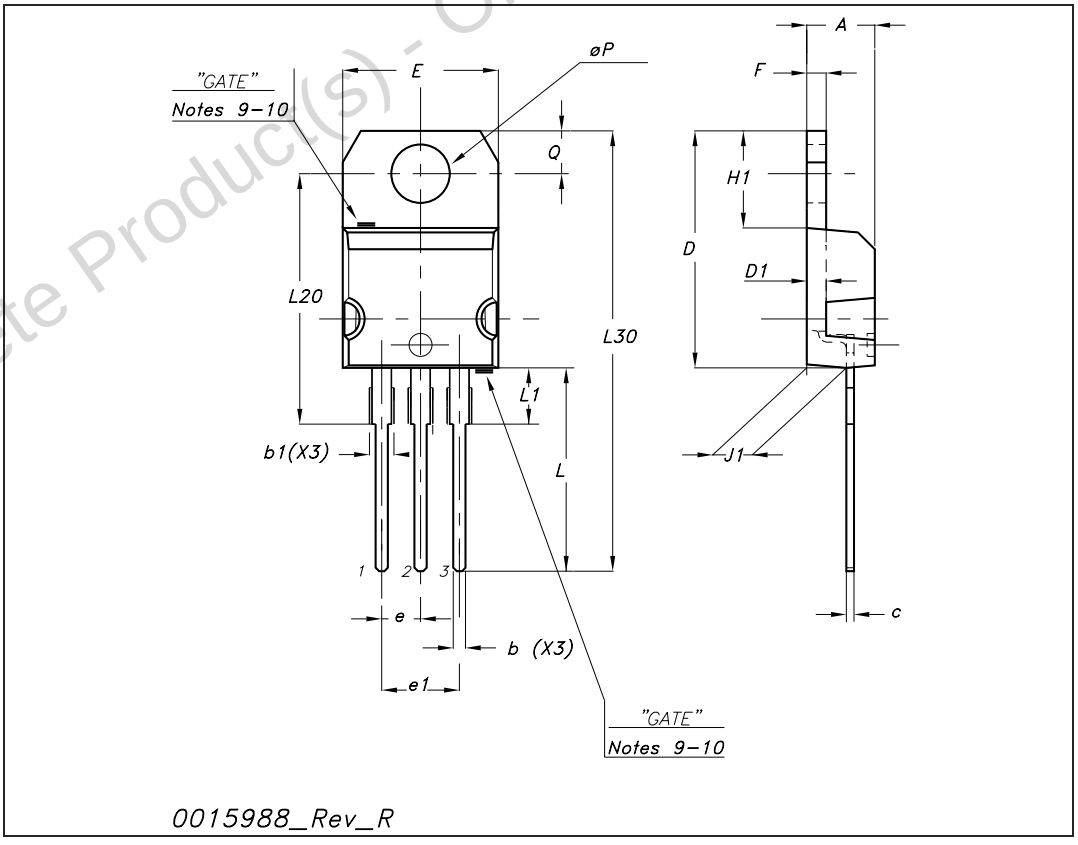


4 Package mechanical data

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

TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



5 Revision history

Table 7. Document revision history

Date	Revision	Changes
09-Sep-2004	1	Datasheet according to PCN DSG-TRA/04/532
09-Aug-2006	2	New template, no content change
20-Feb-2007	3	Typo mistake on page 1
03-Sep-2007	4	*Figure 2: Safe operating area* has been update.
08-Oct-2008	5	*Figure 2: Safe operating area* has been update.