STD2NK70Z - STD2NK70Z-1

N-CHANNEL 700 V - 6 Ω - 1.6 A DPAK/IPAK Zener-Protected SuperMESH™ MOSFET

Table 1: General Features

TYPE	V_{DSS}	$R_{DS(on)}$	I_D	Pw
STD2NK70Z	700 V	7 Ω	1.6 A	45 W
STD2NK70Z-1	700 V	7 Ω	1.6 A	45 W

- TYPICAL R_{DS}(on) = 6 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- ESD IMPROVED CAPABILITY
- 100% AVALANCHE TESTED
- NEW HIGH VOLTAGE BENCHMARK
- GATE CHARGE MINIMIZED

Figure 1: Package

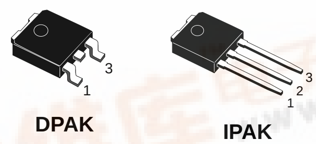
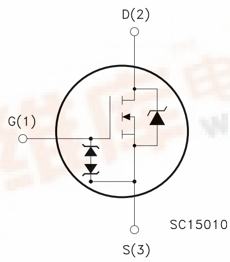


Figure 2: Internal Schematic Diagram



DESCRIPTION

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding application. Such series complements ST full range of high vltage MOS-FETs including revolutionary MDmesh™ products.

APPLICATIONS

- SINGLE-ENDED SMPS IN MONITORS, COMPUTER AND INDUSTRIAL APPLICATION
- WELDING EQUIPMENT
- FLYBACK CONFIGURATION FOR BATTERY CHARGER

Table 2: Order Codes

Sales Type	Marking	Package	Packaging
STD2NK70ZT4	D2NK70Z	DPAK	TAPE & REEL
STD2NK70Z-1	D2NK70Z	IPAK	TUBE

Rev. 2

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	700	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 KΩ)	700	V
V_{GS}	Gate- source Voltage	± 30	V
I_D	Drain Current (continuous) at T_C = 25°C	1.6	A
I_D	Drain Current (continuous) at T_C = 100°C	1	A
I_{DM}(*)	Drain Current (pulsed)	6.4	A
P_{TOT}	Total Dissipation at T_C = 25°C	45	W
	Derating Factor	0.36	W/°C
$V_{ESD(G-S)}$	Gate source ESD (HBM-C = 100pF, R = 1.5 KΩ)	2000	V
dv/dt (1)	Peak Diode Recovery voltage slope	4.5	V/ns
T_{stg}	Storage Temperature	-55 to 150	°C
T_j	Max. Operating Junction Temperature		

(*) Pulse width limited by safe operating area
(1) $I_{SD} \leq$ 1.6 A, di/dt ≤ 200 A/µs, VDD ≤ $V_{(BR)DSS}$

Table 4: Thermal Data

Rthj-case	Thermal Resistance Junction-case Max	2.78	°C/W
Rthj-amb T_l	Thermal Resistance Junction-ambient Max Maximum Lead Temperature For Soldering Purpose	100 300	°C/W °C

Table 5: Avalanche Characteristics

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	1.6	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	110	mJ

Table 6: Gate-Source Zener Diode

Symbol	Parameter	Test Condition	Min.	Typ.	Max	Unit
BV_{GSO}	Gate-Source Breakdown Voltage	Igs= ± 1mA (Open Drain)	30			A

PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

TABLE 7: ELECTRICAL CHARACTERISTICS (T_{CASE} =25°C UNLESS OTHERWISE SPECIFIED)

On /Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 1 mA, V_{GS} = 0	700			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			± 10	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10 V, I_D = 0.8 A		6	7	Ω

Table 8: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{DS} = 15 V, I_D = 0.8 A		1.4		S
$C_{oss\ eq.}$(3)	Equivalent Output Capacitance	V_{GS} = 0 V, V_{DS} = 0 to 560 V		17		
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		280 35 6.5		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} = 350 V, I_D = 0.8 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 17)		7 17 20 35		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 560 V, I_D = 0.8 A, V_{GS} = 10 V (see Figure 20)		11.4 2 6.8	15	nC nC nC

Table 9: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				1.6 6.4	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 1.6 A, V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 1.6, di/dt = 100 A/µs V_{DD} =50 V, T_j = 25°C (see Figure 18)		334 918 5.5		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 1.6, di/dt = 100 A/µs V_{DD} = 50 V, T_j = 150°C (see Figure 18)		350 1050 6		ns µC A

(1) Pulsed: Pulse duration = 300 µs, duty cycle 1.5%
(2) Pulse width limited by safe operating area
(3) $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Figure 3: Safe Operating Area

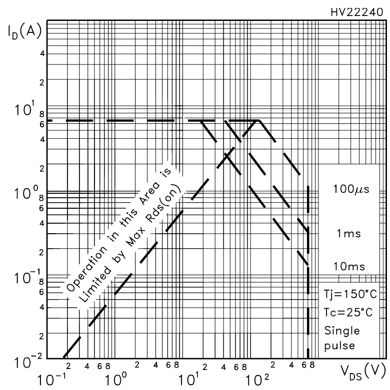


Figure 4: Output Characteristics

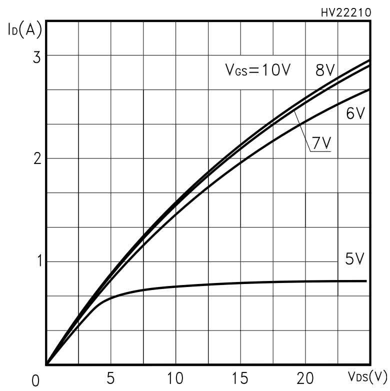


Figure 5: Transconductance

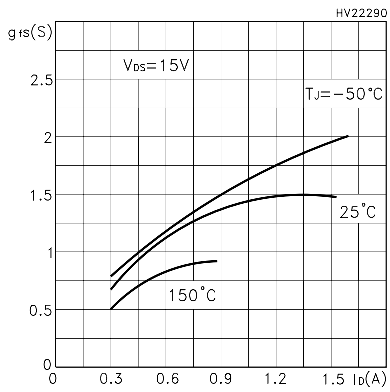


Figure 6: Thermal Impedance

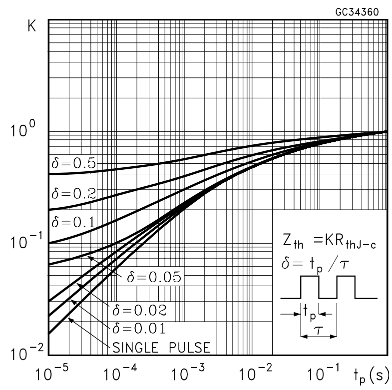


Figure 7: Transfer Characteristics

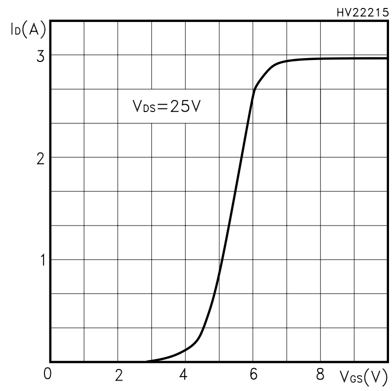


Figure 8: Static Drain-source On Resistance

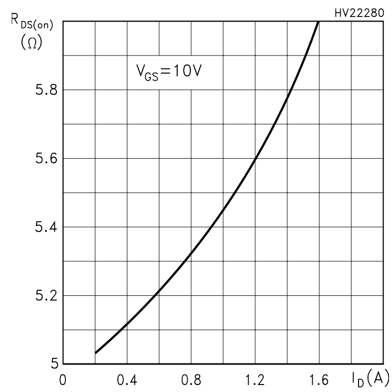


Figure 9: Gate Charge vs Gate-source Voltage

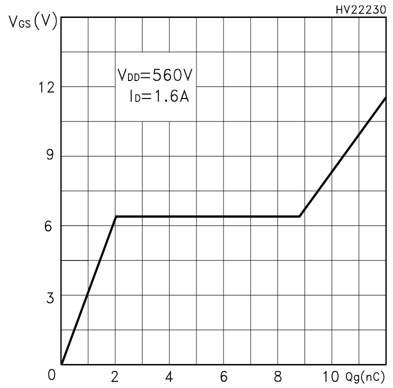


Figure 10: Normalized Gate Thereshold Voltage vs Temperature

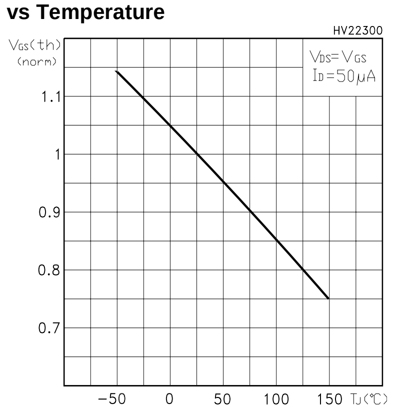


Figure 11: Dource-Drain Diode Forward Characteristics

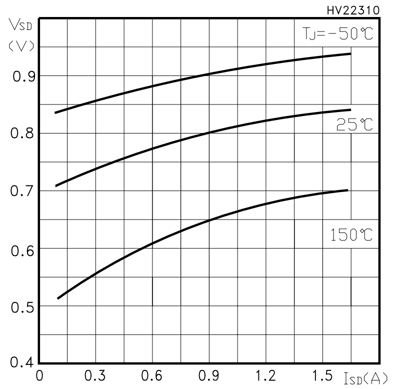


Figure 12: Capacitance Variations

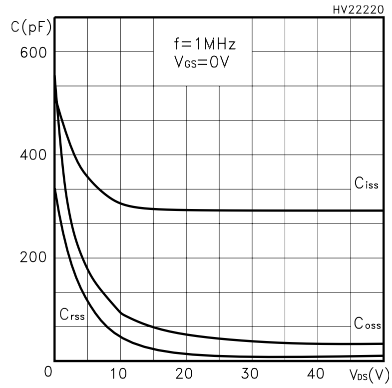


Figure 13: Normalized On Resistance vs Temperature

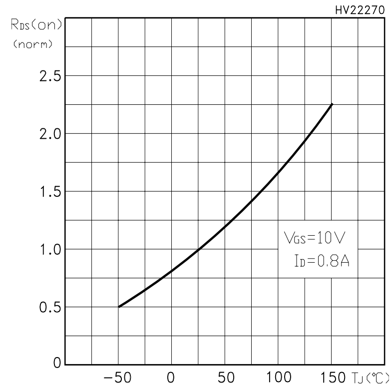


Figure 14: Normalized Breakdown Voltage vs Temperature

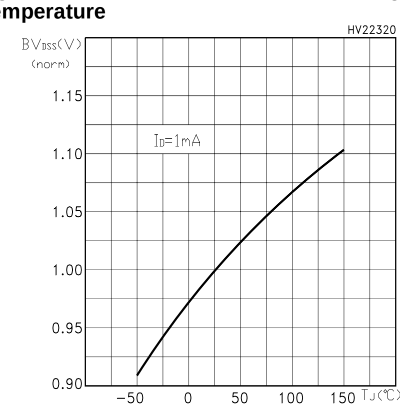


Figure 15: Maximum Avalanche Energy vs Temperature

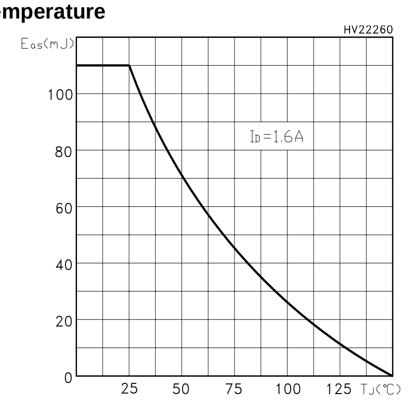


Figure 16: Unclamped Inductive Load Test Circuit

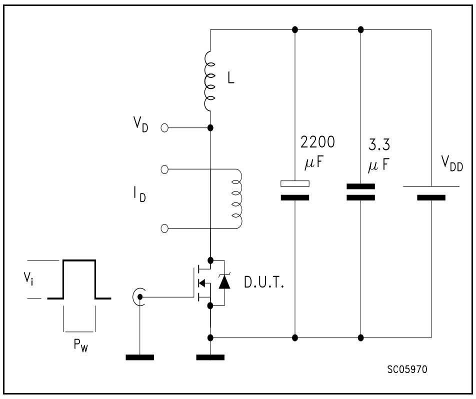


Figure 17: Switching Times Test Circuit For Resistive Load

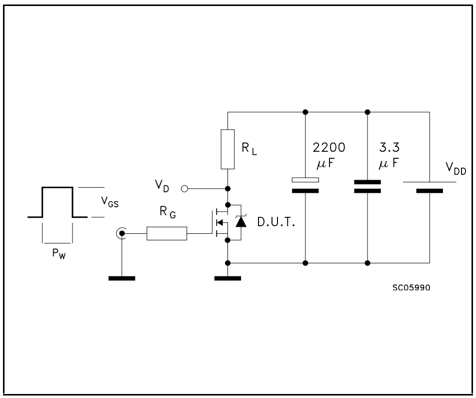


Figure 18: Test Circuit For Inductive Load Switching and Diode Recovery Times

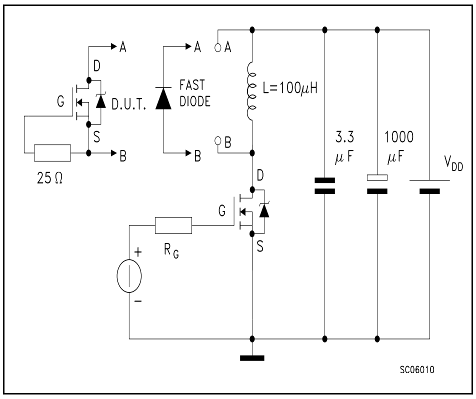


Figure 19: Unclamped Inductive Wafeform

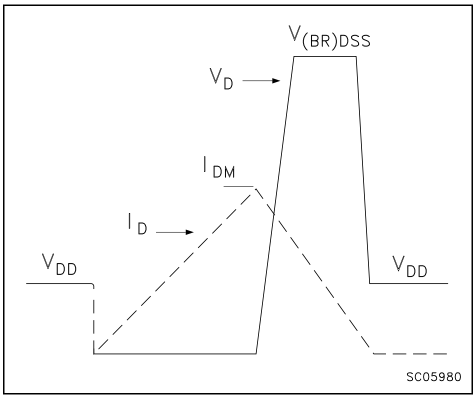
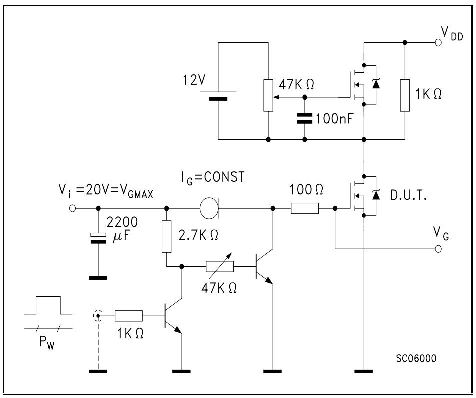
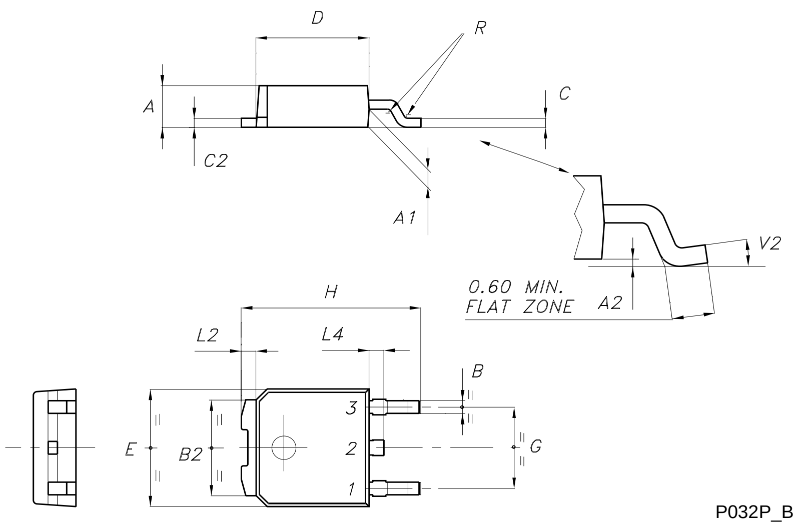


Figure 20: Gate Charge Test Circuit



TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0^o		8^o	0^o		0^o



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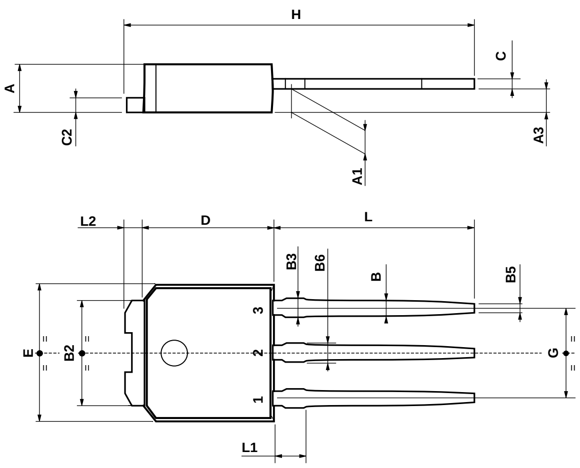
TO-251 (IPAK) MECHANICAL DATA

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
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
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
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



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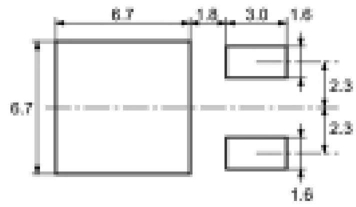
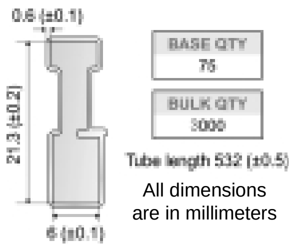
DPAK FOOTPRINT



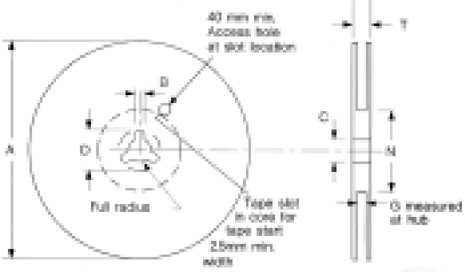
All dimensions are in millimeters

TUBE SHIPMENT (no suffix)*



All dimensions are in millimeters

TAPE AND REEL SHIPMENT (suffix "T4")*



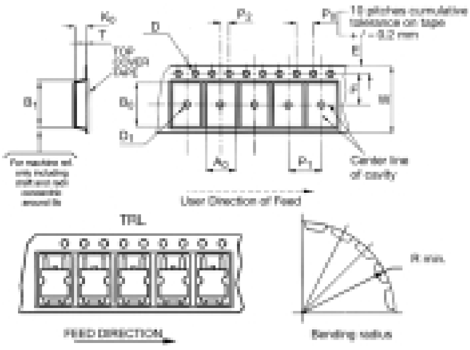
REEL MECHANICAL DATA

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

BASE QTY	BULK QTY
2500	2500

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



* on sales type

Table 10: Revision History

Date	Revision	Description of Changes
07-Sep-2004	1	First Release, complete document.
24-Jan-2005	2	New curve, figure 3, and new Rds(on) value Max.