STP8NM60 - STP8NM60FP
STB8NM60 - STD5NM60 - STD5NM60-1

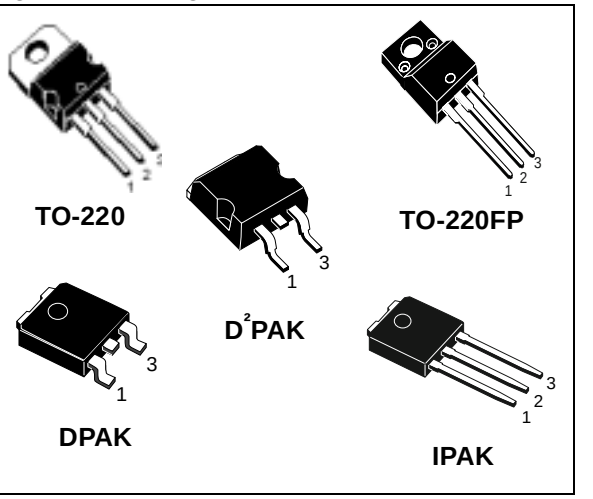
N-CHANNEL 650V@Tjmax-0.9Ω-8A TO-220/FP/D/IPAK/D²PAK
STripFET™ II MOSFET

Table 1: General Features

TYPE	V_{DSS}	$R_{DS(on)}$	I_D	Pw
STP8NM60	650 V	< 1 Ω	8 A	100 W
STP8NM60FP	650 V	< 1 Ω	8 A(*)	30 W
STD5NM60	650 V	< 1 Ω	5 A	96 W
STD5NM60-1	650 V	< 1 Ω	5 A	96 W
STB8NM60	650 V	< 1 Ω	5 A	96 W

- TYPICAL $R_{DS}(on)$ = 0.9Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE

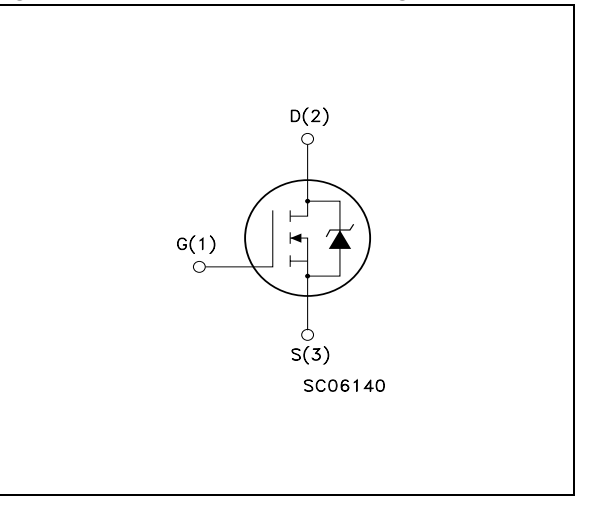
Figure 1: Package



DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar completition's products.

Figure 2: Internal Schematic Diagram



APPLICATIONS

The MDmesh™ family is very suitable for increase the power density of high voltage converters allowing system miniaturization and higher efficiencies.

Table 2: Order Codes

Sales Type	Marking	Package	Packaging
STP8NM60	P8NM60	TO-220	TUBE
STP8NM60FP	P8NM60FP	TO-220FP	TUBE
STD5NM60	D5NM60	DPAK	TAPE & REEL
STD5NM60-1	D5NM60	IPAK	TUBE
STB8NM60	B8NM60	D²PAK	TAPE & REEL

Rev. 2

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value			Unit
		TO-220/D²PAK	TO-220FP	DPAK/IPAK	
V_{GS}	Gate- source Voltage	± 30			V
I_D	Drain Current (continuous) at T_C = 25°C	8	8 (*)	5	A
I_D	Drain Current (continuous) at T_C = 100°C	5	5 (*)	3.1	A
I_{DM} (•)	Drain Current (pulsed)	32	32 (*)	20	A
P_{TOT}	Total Dissipation at T_C = 25°C	100	30	96	W
	Derating Factor	0.8	0.24	0.4	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15	15	15	V/ns
V_{ISO}	Insulation Withstand Voltage (DC)	-	2500	-	V
T_j T_{stg}	Operating Junction Temperature Storage Temperature	-55 to 150			°C

(•) Pulse width limited by safe operating area
(1) $I_{SD} \le 5A$, $di/dt \le 400A/\mu s$, $V_{DD} \le V_{(BR)DSS}$, $T_j \le T_{JMAX}$.
(*) Limited only by maximum temperature allowed

Table 4: Thermal Data

		TO-220/D²PAK	TO-220FP	DPAK/IPAK	
Rthj-case	Thermal Resistance Junction-case Max	1.25	4.16	1.3	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5			°C/W
T_l	Maximum Lead Temperature For Soldering Purpose	300			°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)	2.5	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	200	mJ

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

Table 6: On/Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 µA, V_{GS} = 0	600			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 30V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250µA	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V, I_D = 2.5 A		0.9	1	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward Transconductance	$V_{DS} = I_{D(on)} \times R_{DS(on)max}$, $I_D = 2.5A$		2.4		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		440 100 10		pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent Output Capacitance	V_{GS} = 0V, V_{DS} = 0V to 480V		50		pF
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 300 V, I_D = 2.5 A R_G = 4.7Ω V_{GS} = 10 V (Resistive Load see, Figure 3)		14 10		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 400V, I_D = 5 A, V_{GS} = 10V		13 5 6	18	nC nC nC

Table 8: Switching On/Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	V_{DD} = 300 V, I_D = 2.5 A R_G = 4.7Ω V_{GS} = 10 V (Resistive Load see, Figure 3)		23 10		ns ns
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{DD} = 480V, I_D = 5 A, R_G = 4.7Ω, V_{GS} = 10V (Inductive Load see, Figure 5)		7 10 17		ns ns ns

Table 9: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (•)	Source-drain Current Source-drain Current (pulsed)				8 32	A A
V_{SD} (2)	Forward On Voltage	I_{SD} = 5 A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 5 A, di/dt = 100A/µs V_{DD} = 100 V, T_j = 25°C (see test circuit, Figure 5)		300 1950 13		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 5 A, di/dt = 100A/µs V_{DD} = 100 V, T_j = 150°C (see test circuit, Figure 5)		445 3005 13.5		ns µC A

(2) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.

Figure 3: Safe Operating Area for TO-220/ D²PAK

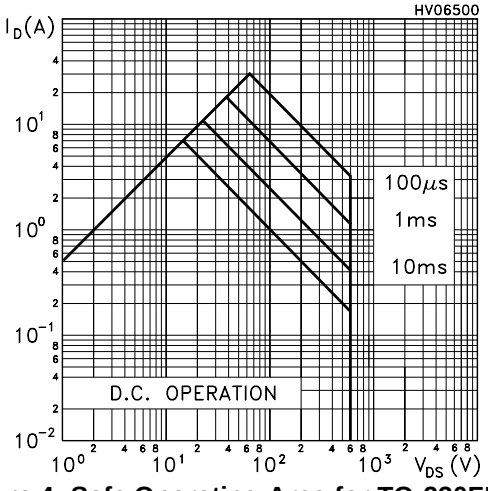


Figure 4: Safe Operating Area for TO-220FP

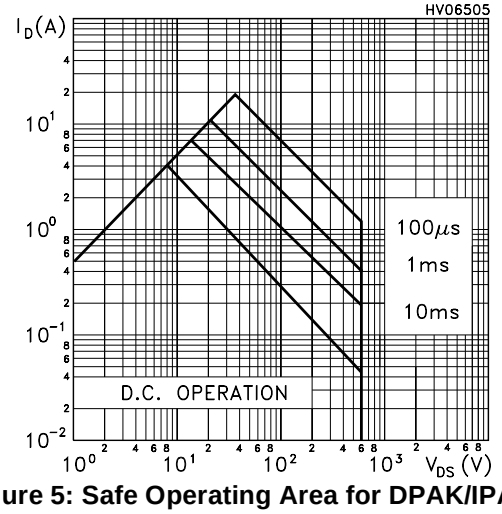


Figure 5: Safe Operating Area for DPAK/IPAK

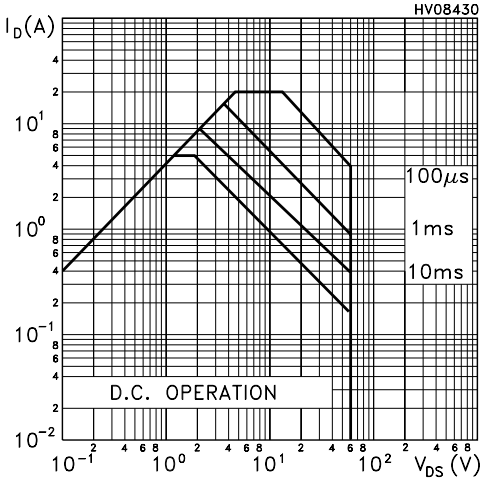


Figure 6: Thermal Impedance for TO-220/ D²PAK

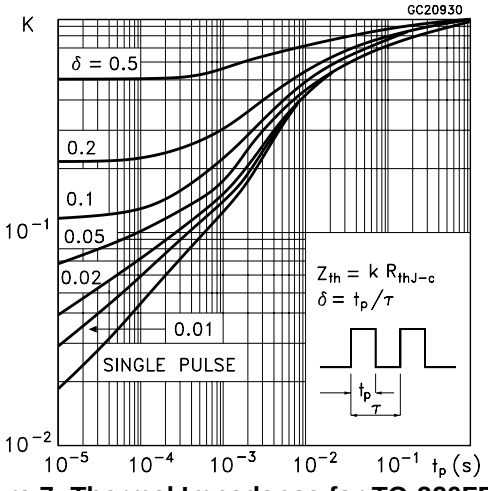


Figure 7: Thermal Impedance for TO-220FP

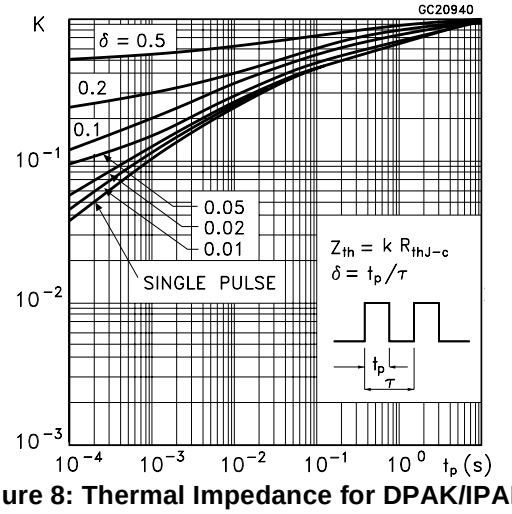


Figure 8: Thermal Impedance for DPAK/IPAK

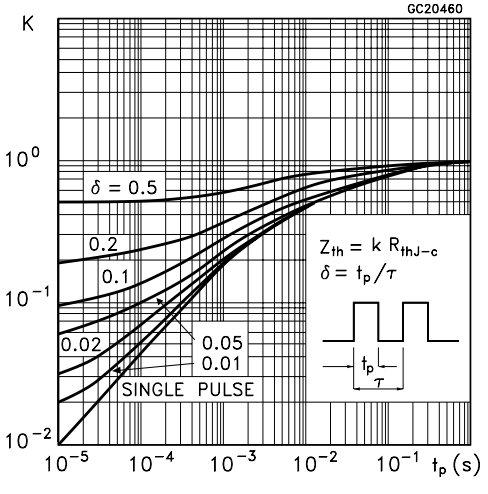


Figure 9: Output Characteristics

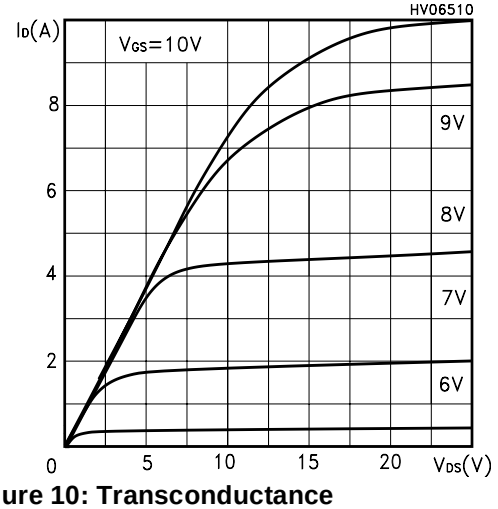


Figure 10: Transconductance

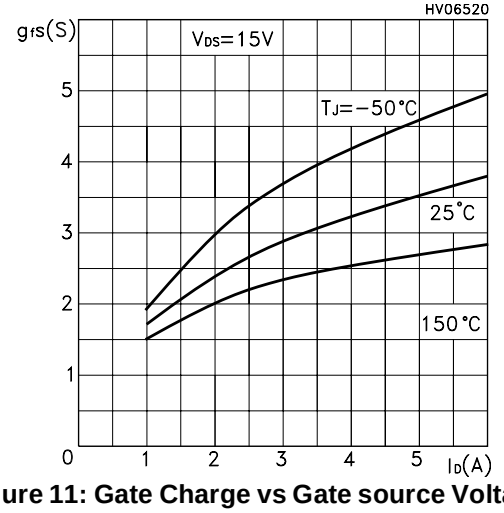


Figure 11: Gate Charge vs Gate source Voltage

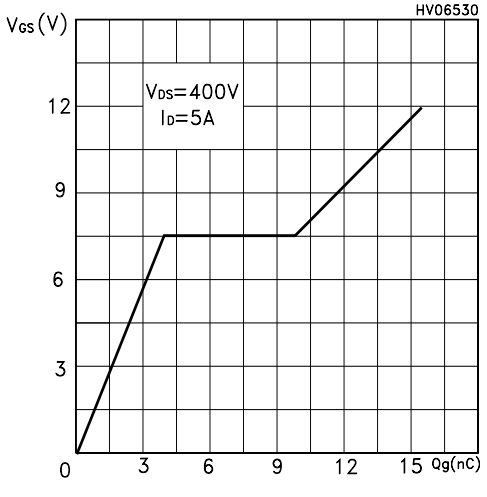


Figure 12: Transfer Characteristics

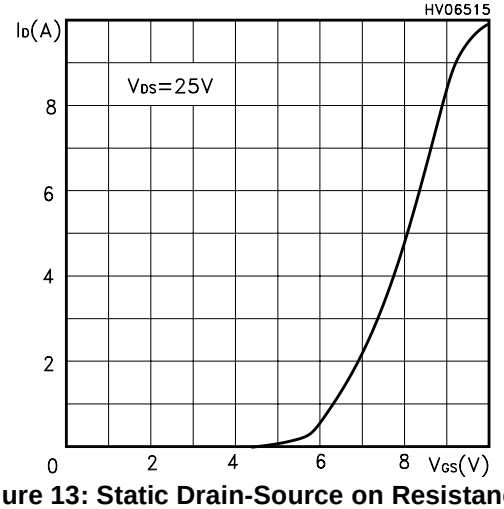


Figure 13: Static Drain-Source on Resistance

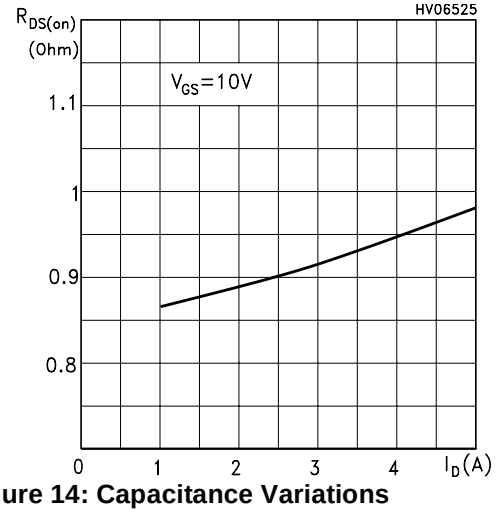


Figure 14: Capacitance Variations

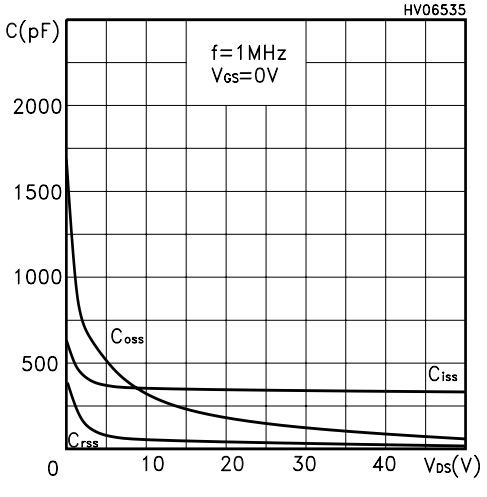


Figure 15: Normalized Gate Thereshold Voltage vs Temperature j

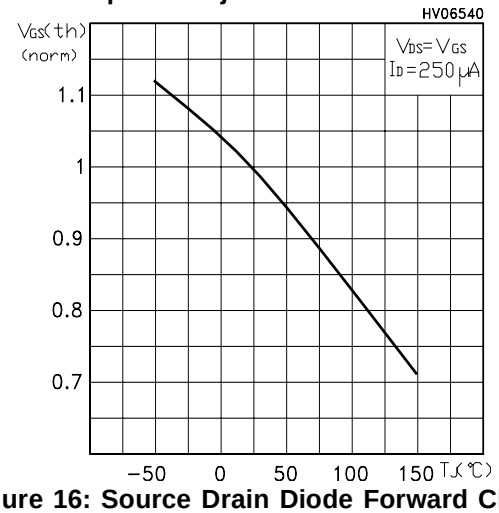


Figure 16: Source Drain Diode Forward Characteristics

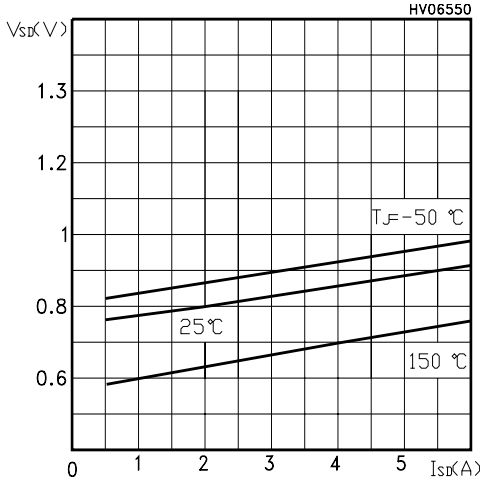


Figure 17: Normalized on Resistance vs Temperature

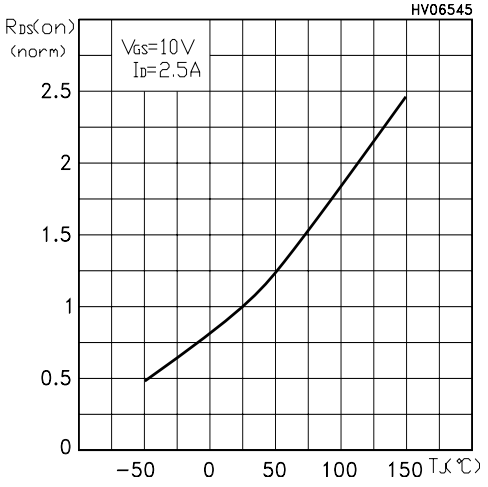


Figure 18: Unclamped Inductive Load Test Circuit

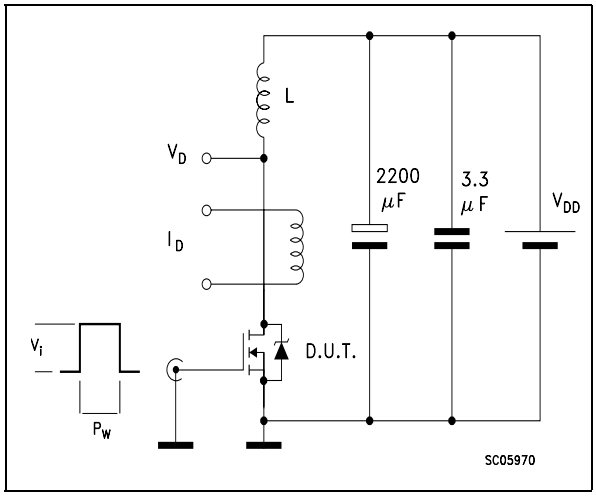


Figure 19: Switching Times Test Circuit For Resistive Load

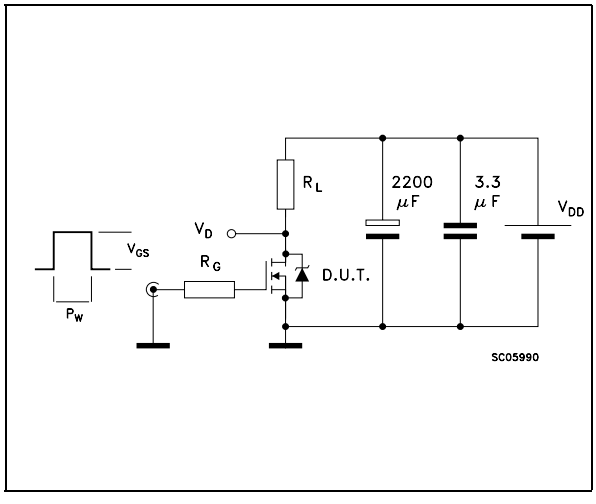


Figure 20: Test Circuit For Inductive Load Switching and Diode Recovery Times

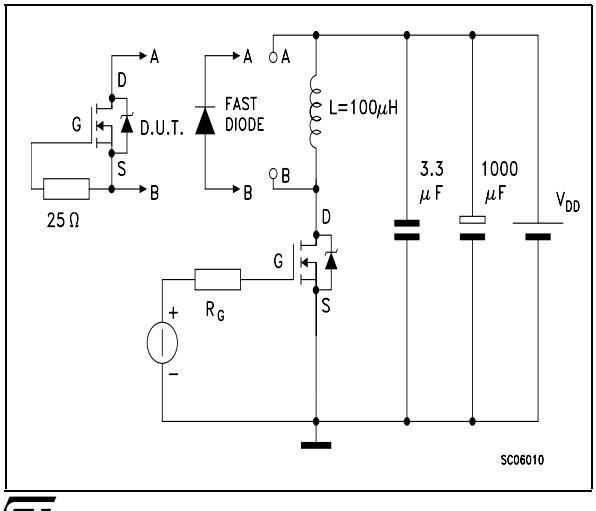


Figure 21: Unclamped Inductive Wafeform

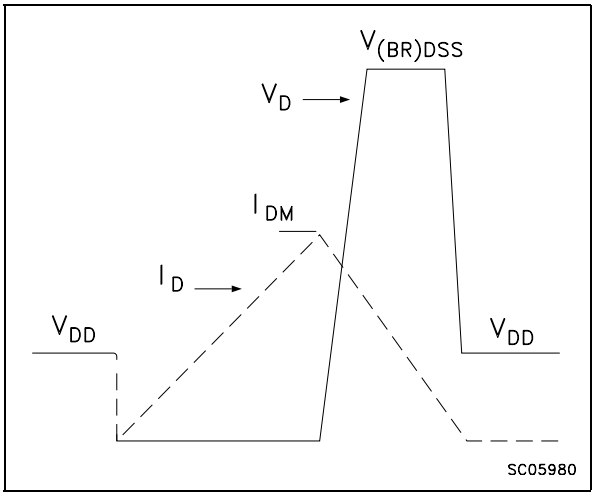
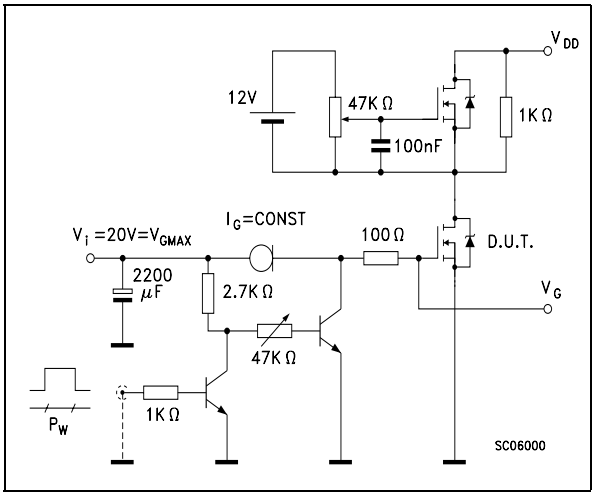
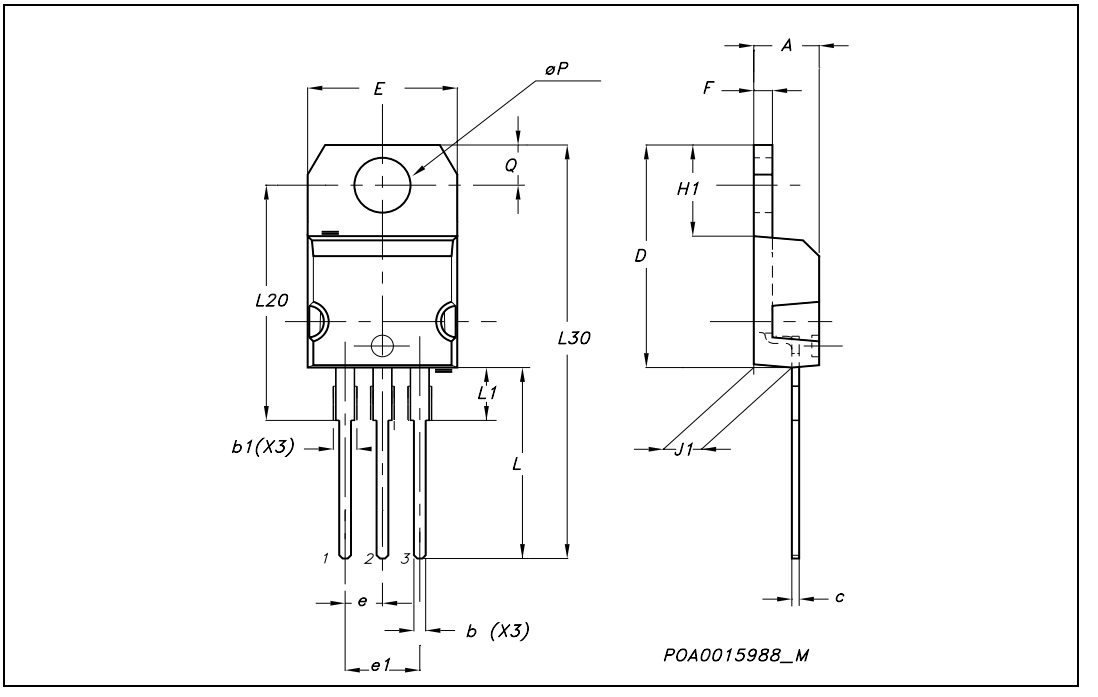


Figure 22: Gate Charge Test Circuit



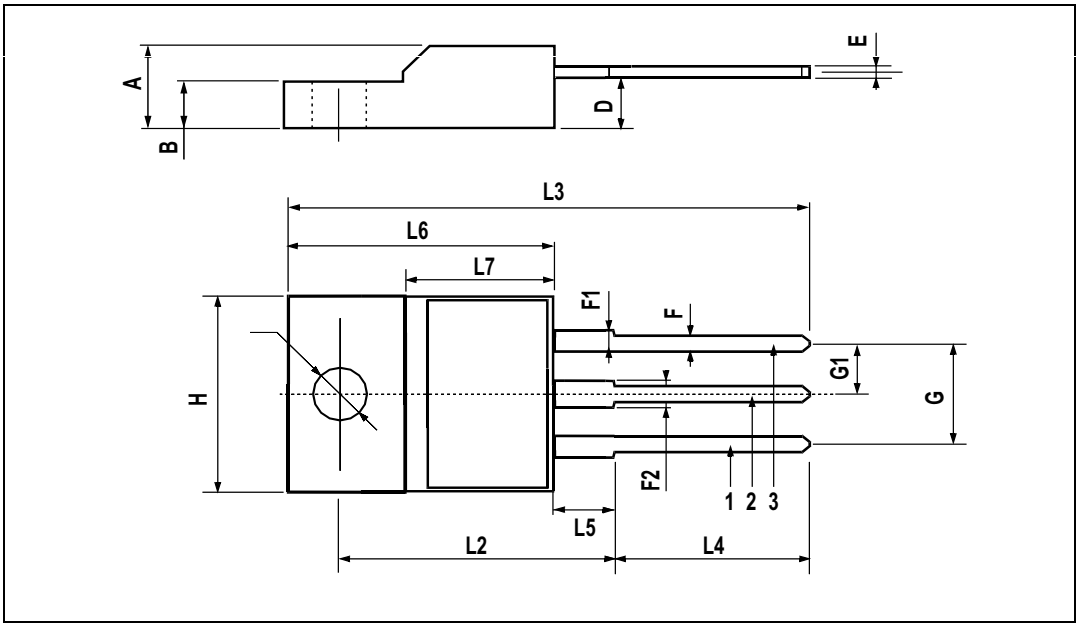
TO-220 MECHANICAL DATA

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	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
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		0.052
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	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



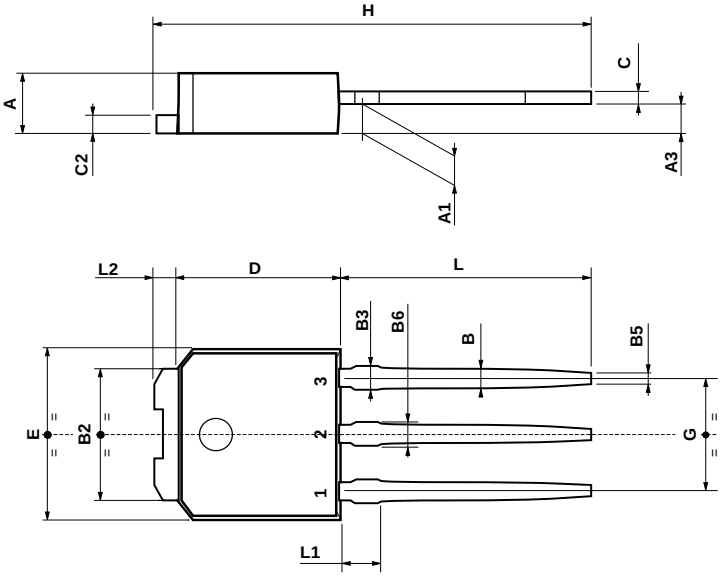
TO-220FP MECHANICAL DATA

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		1.7	0.045		0.067
F2	1.15		1.7	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



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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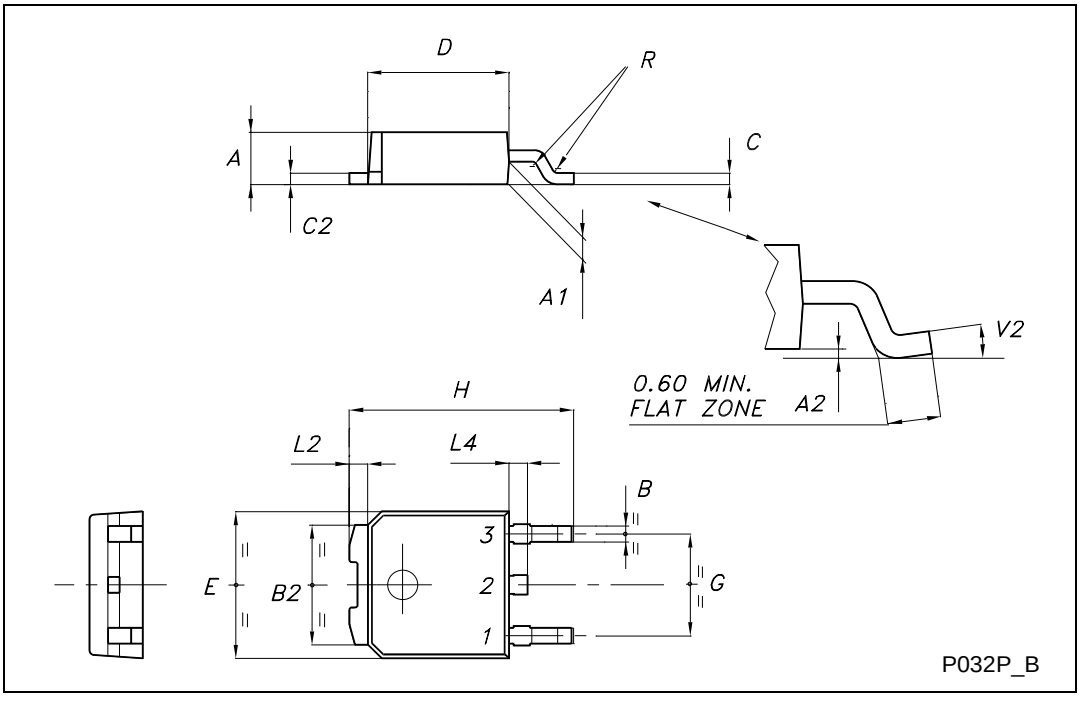
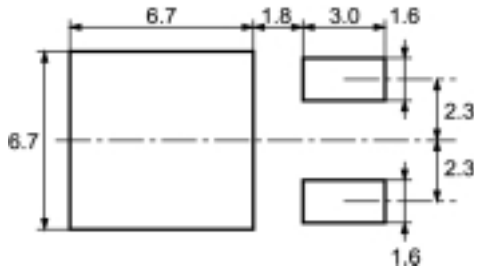
TO-252 (DPAK) MECHANICAL DATA

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

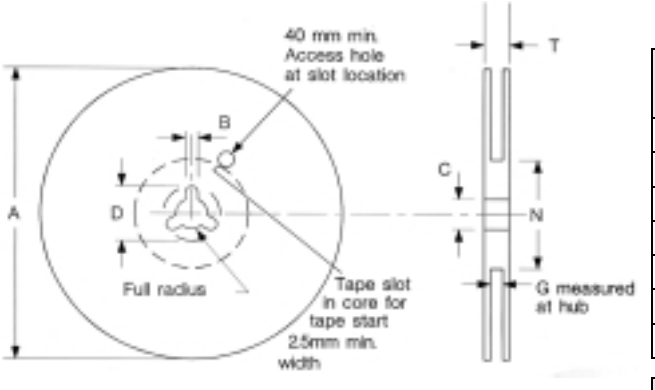


DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



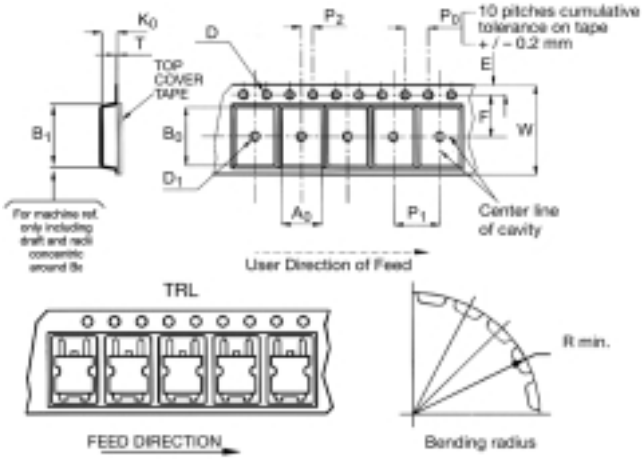
REEL MECHANICAL DATA

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

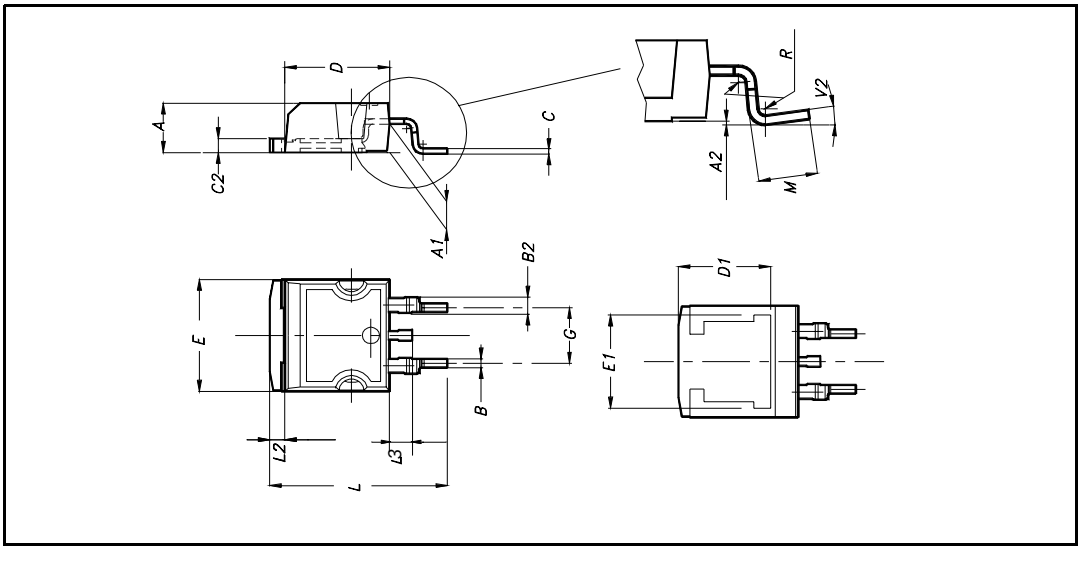
TAPE MECHANICAL DATA

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

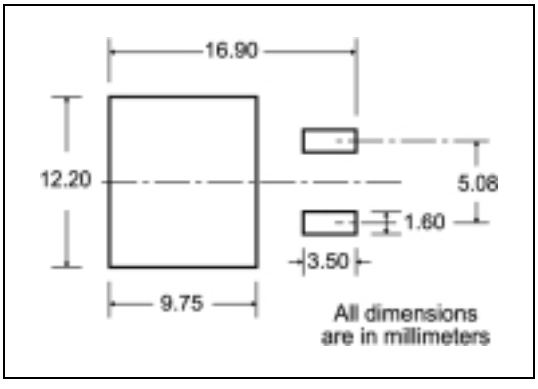


D^2PAK MECHANICAL DATA

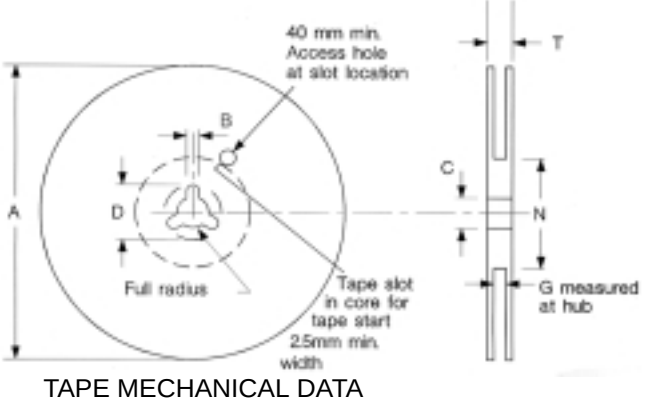
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0º		4º			



D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



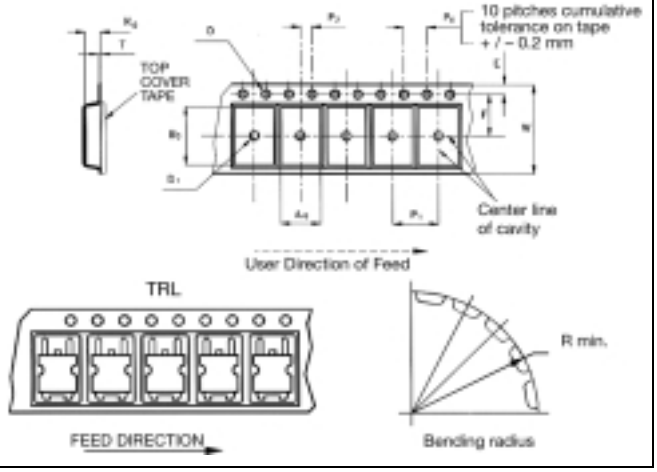
REEL MECHANICAL DATA

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		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956



* on sales type

Table 10: Revision History

Date	Revision	Description of Changes
11-Apr-2005	2	Inserted D²PAK.