STB11NB40
STB11NB40-1

N-CHANNEL 400V - 0.48 Ω - 10.7A D^2PAK/I^2PAK PowerMESH™ MOSFET

Table 1. General Features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STB11NB40	400 V	< 0.55 Ω	10.7 A
STB11NB40-1	400 V	< 0.55 Ω	10.7 A

FEATURES SUMMARY

- TYPICAL $R_{DS(on)}$ = 0.48 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

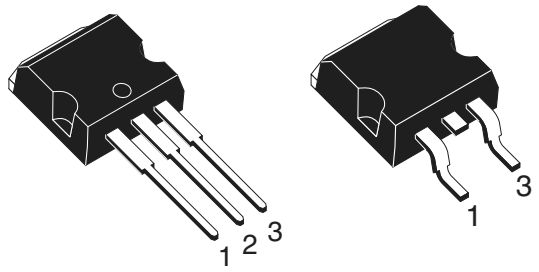
DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest $R_{DS(on)}$ per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE

Figure 1. Package



I^2PAK TO-262 D^2PAK TO-263

Figure 2. Internal Schematic Diagram

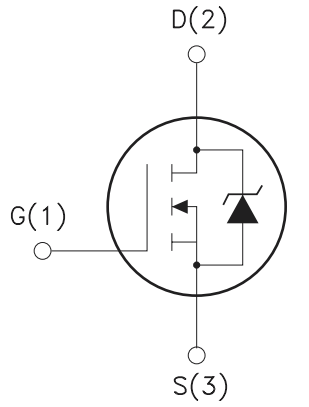


Table 2. Order Codes

Part Number	Marking	Package	Packaging
STB11NB40T4	B11NB40	D^2PAK	TAPE & REEL
STB11NB40-1	B11NB40	I^2PAK	TUBE

Table 3. Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	400	V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	400	V
V_{GS}	Gate-source Voltage	± 30	V
I_D	Drain Current (cont.) at T_C = 25 °C	10.7	A
I_D	Drain Current (cont.) at T_C = 100 °C	6.7	A
I_{DM} (1)	Drain Current (pulsed)	42.8	A
P_{tot}	Total Dissipation at T_C = 25 °C	125	W
	Derating Factor	1.0	W°/C
dv/dt (2)	Storage Temperature	4.5	V/ns
T_{stg}	Storage Temperature	-65 to 150	°C
T_j	Max. Operating Junction Temperature	150	°C

Note: 1. Pulse width limited by safe operating area
2. $I_{SD} \leq 11A$, di/dt ≤ 200 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

Table 4. Thermal Data

Symbol	Parameter		Value	Unit
$R_{thj\text{-}case}$	Thermal Resistance Junction-case	Max	1.0	°C/W
$R_{thj\text{-}amb}$	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, $\delta < 1\%$)	10.7	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C; $I_D = I_{AR}$; V_{DD} = 50 V)	530	mJ

ELECTRICAL CHARACTERISTICS (T_{case} = 25°C unless otherwise specified)

Table 6. Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 μA; V_{GS} = 0	400			V
I_{DSS}	Zero Gate Voltage	V_{DS} = Max Rating			1	μA
	Drain Current (V_{GS} = 0)	V_{DS} = Max Rating Tc = 125 °C			50	μA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 30 V			± 100	nA

Table 7. On (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}; I_D = 250 μA	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V; I_D = 5.3 A		0.48	0.55	Ω

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

Table 8. Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{DS} > $I_{D(on)}$ x $R_{DS(on)max}$; I_D = 5.3 A	5	6.5		S
C_{iss}	Input Capacitance	V_{DS} = 25 V; f = 1 MHz; V_{GS} = 0		1115	1450	pF
C_{oss}	Output Capacitance			210	280	pF
C_{rss}	Reverse Transfer Capacitance			22	30	pF

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

Table 9. Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
td(on)	Turn-on Time	V_{DD} = 200 V; I_D = 5.3 A; R_G = 4.7 Ω		17	25	ns
tr	Rise Time	V_{GS} = 10 V (see test circuit, Figure 16)		10	15	ns
Q_g	Total Gate Charge	V_{DD} = 320 V; I_D = 10.7 A; V_{GS} = 10 V		29.5	43	nC
Q_{gs}	Gate-Source Charge			10.6		nC
Q_{gd}	Gate-Drain Charge			11.8		nC

Table 10. Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage Rise Time	V_{DD} = 320 V; I_D = 10.7 A; R_G = 4.7 Ω		10	14	ns
t_f	Fall Time	V_{GS} = 10 V; (see test circuit, Figure 18)		10	14	ns
t_c	Cross-over Time			17	25	ns

Table 11. Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				10.7	A
I_{SDM} (1)	Source-drain Current (pulsed)				42.8	A
V_{SD} (2)	Forward On Voltage	I_{SD} = 10.7 A; V_{GS} = 0			1.6	V
t_{rr}	Reverse Recovery Time	I_{SD} = 10.7 A; di/dt = 100 A/µs		400		ns
Q_{rr}	Reverse RecoveryCharge	V_{DD} = 100 V; T_j = 150 °C (see test circuit, Figure 18)		3.4		µC
I_{RRAM}	Reverse RecoveryCharge			17		A

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

Figure 3. Safe Operating Area

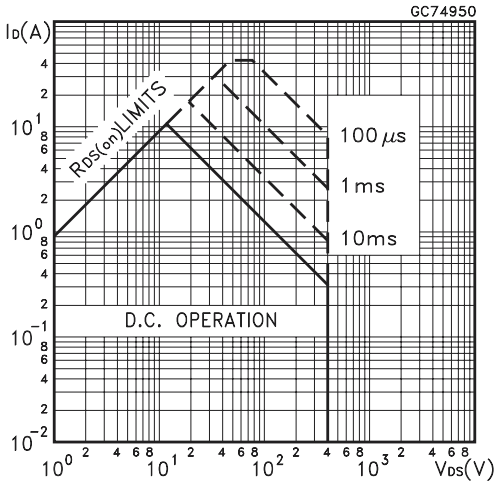


Figure 4. Thermal Impedance

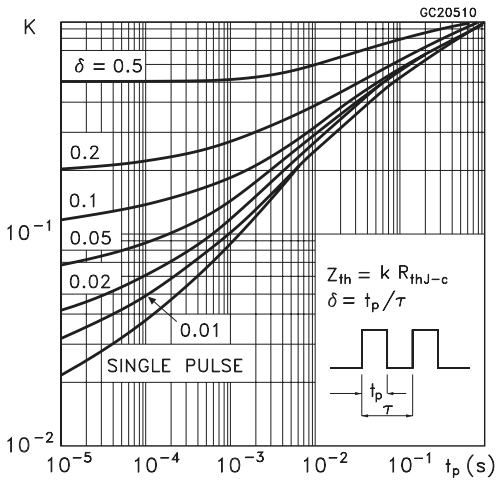


Figure 5. Output Characteristics

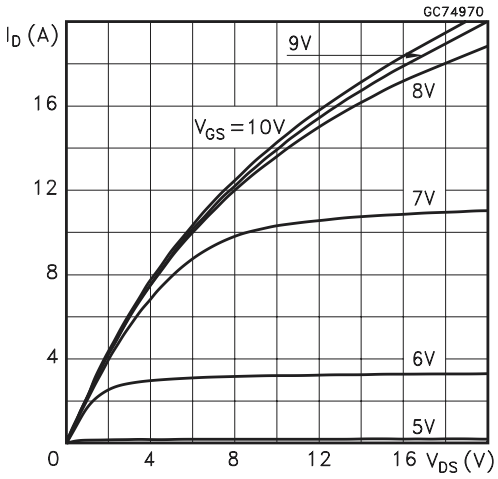


Figure 6. Transfer Characteristics

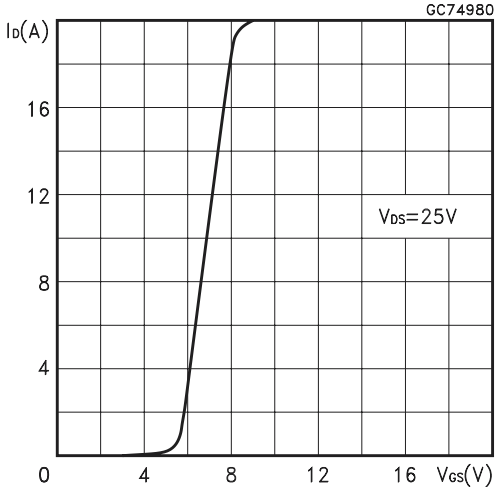


Figure 7. Transconductance

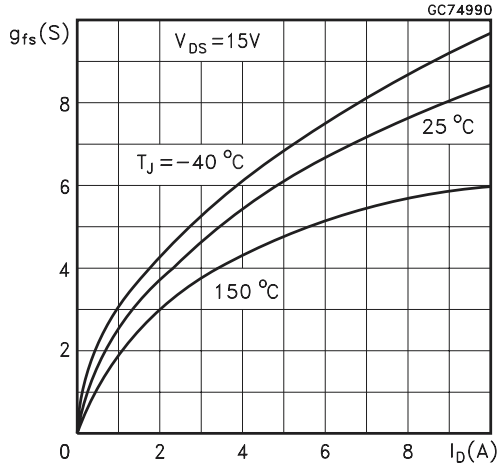


Figure 8. Static Drain-source On Resistance

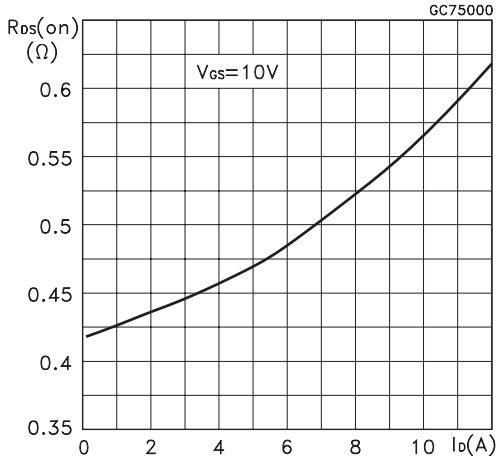


Figure 9. Gate Charge vs Gate-source Voltage

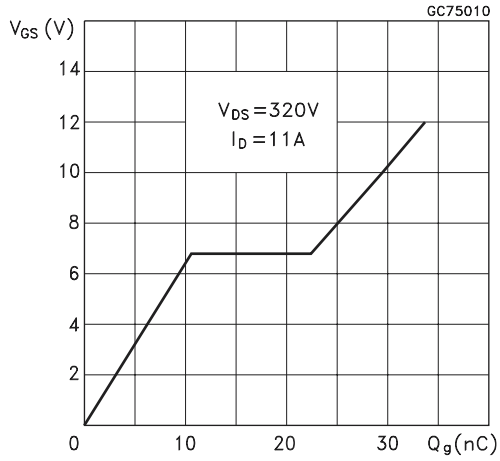


Figure 10. Capacitance Variations

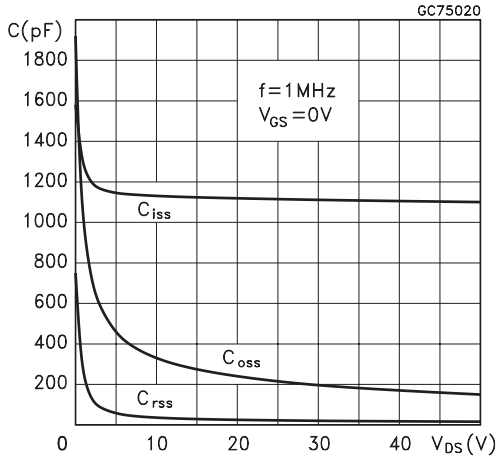


Figure 11. Normalized Gate Thresold Voltage vs Temperature

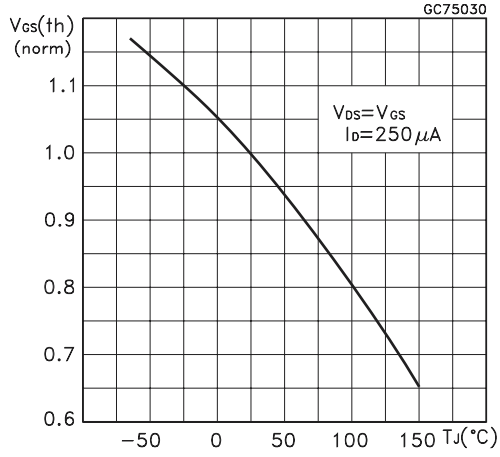


Figure 12. Normalized On Resistance vs Temperature

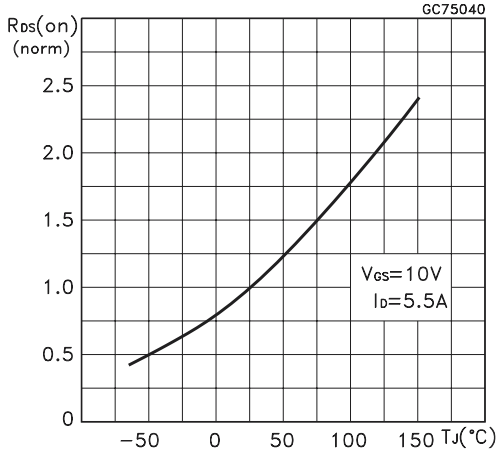


Figure 13. Source-drain Diode Forward Characteristics

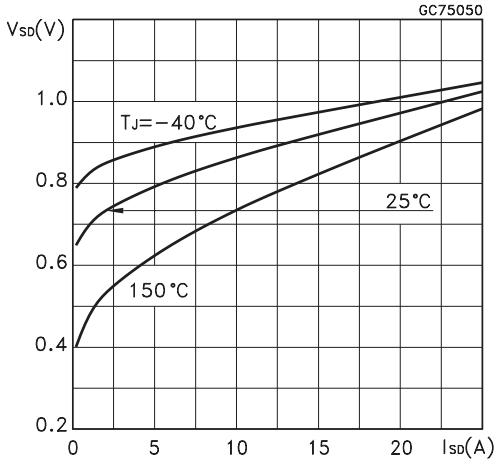


Figure 14. Unclamped Inductive Load Test Circuit

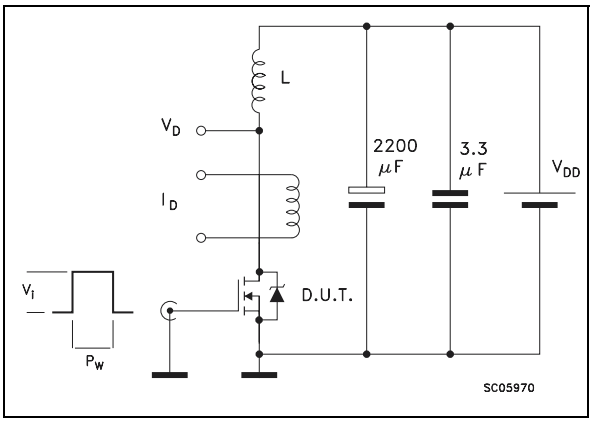


Figure 15. Unclamped Inductive Waveforms

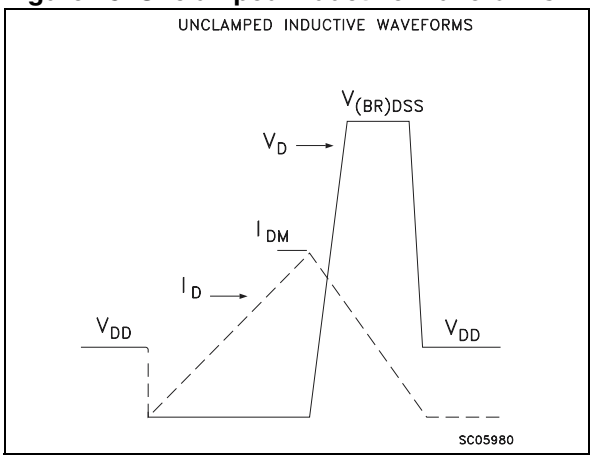


Figure 16. Switching Times Test Circuits For Resistive Load

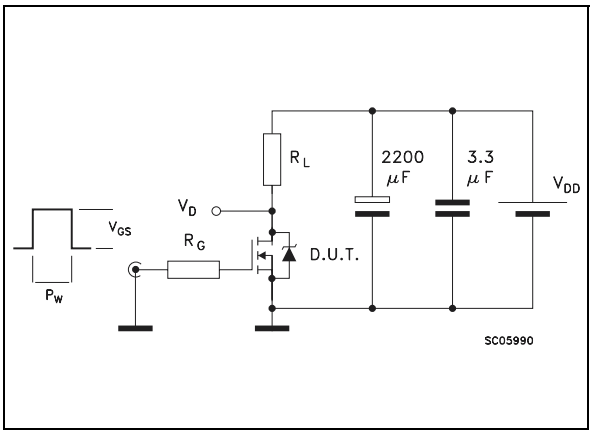


Figure 17. Gate Charge Test Circuit

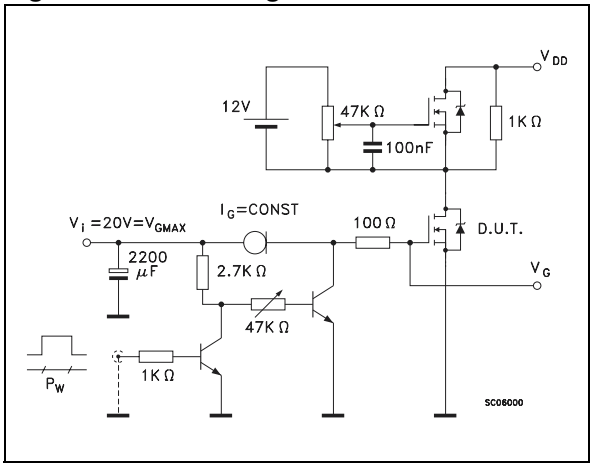
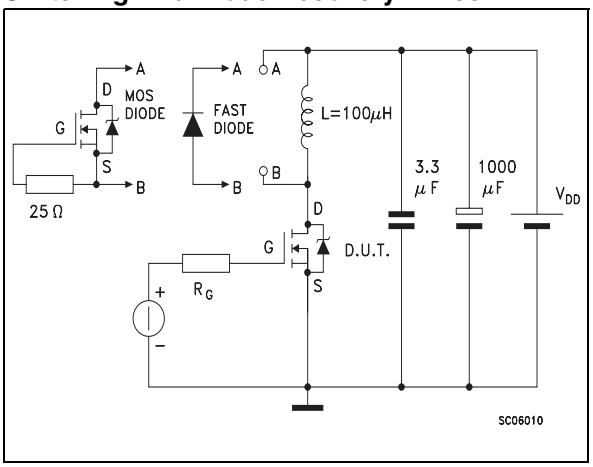


Figure 18. Test Circuit For Inductive Load Switching And Diode Recovery Times

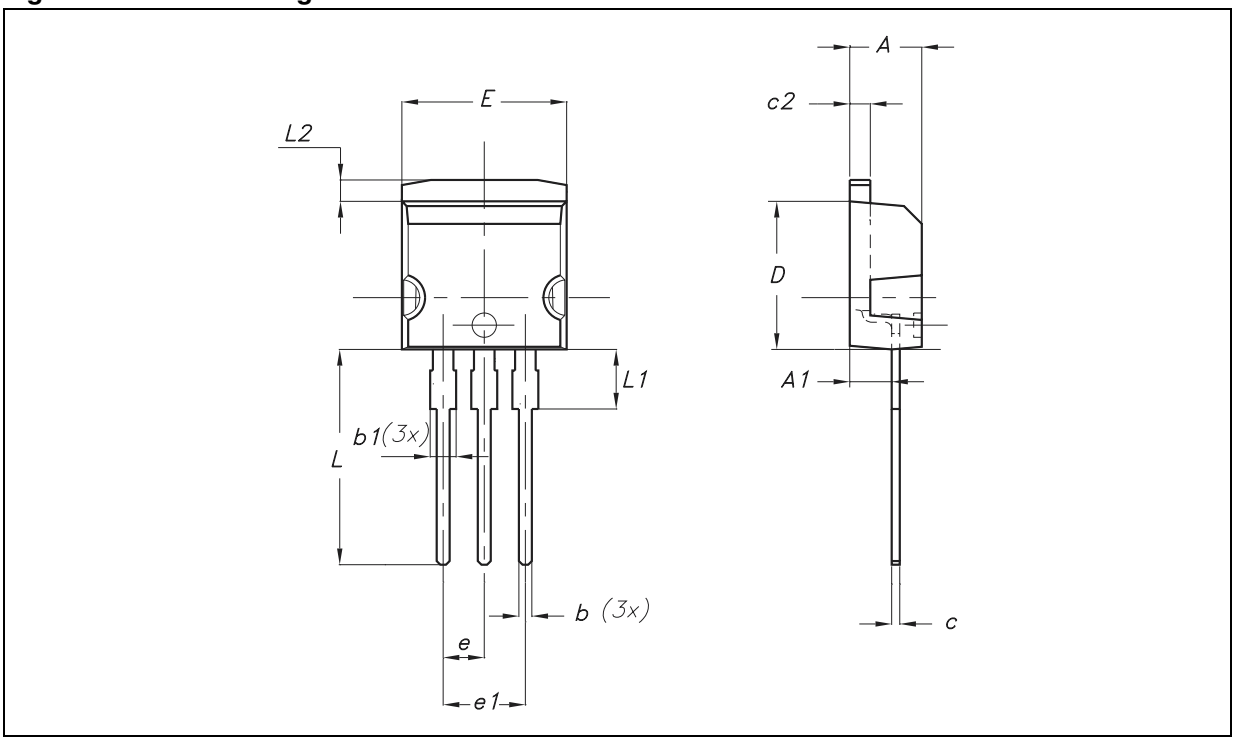


PACKAGE MECHANICAL

Table 12. I²PAK Mechanical Data

Symbol	millimeters			inches		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.349
b1	1.14		1.70	0.045		0.067
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.195		0.203
E	10.00		10.40	0.394		0.409
L	13.00		14.00	0.511		0.551
L1	3.50		3.93	0.138		0.154
L2	1.27		1.40	0.050		0.055

Figure 19. I²PAK Package Dimensions

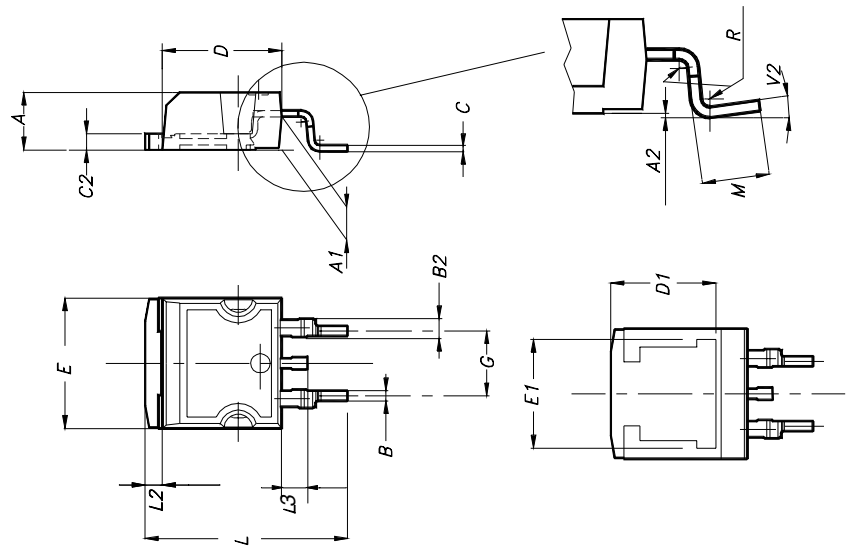


Note: Drawing is not to scale.

Table 13. D²PAK Mechanical Data

Symbol	millimeters			inches		
	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	0°		4°			

Figure 20. D²PAK Package Dimensions



Note: Drawing is not to scale.

REVISION HISTORY

Table 14. Revision History

Date	Revision	Description of Changes
March-1998	1	First Issue
14-Apr-2004	2	Stylesheet update. No content change.