STB130NH02L
STP130NH02L

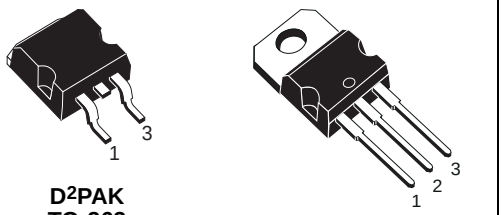
N-CHANNEL 24V - 0.0034 Ω - 120A D²PAK/TO-220
STripFET™ III POWER MOSFET FOR DC-DC CONVERSION

Table 1: General Features

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STB130NH02L	24 V	< 0.0044 Ω	90 A(2)
STP130NH02L	24 V	< 0.0044 Ω	90 A(2)

- TYPICAL R_{DS}(on) = 0.0034 Ω @ 10 V
- TYPICAL R_{DS}(on) = 0.005 Ω @ 5 V
- $R_{DS(ON)}$ * Qg INDUSTRY's BENCHMARK
- CONDUCTION LOSSES REDUCED
- SWITCHING LOSSES REDUCED
- LOW THRESHOLD DEVICE
- SURFACE-MOUNTING D²PAK (TO-263) POWER PACKAGE IN TUBE (NO SUFFIX) OR IN TAPE & REEL (SUFFIX "T4")

Figure 1:Package



D²PAK
TO-263
(Suffix "T4")

TO-220

DESCRIPTION

The STB_P130NH02L utilizes the latest advanced design rules of ST's proprietary STripFET™ technology. It is ideal in high performance DC-DC converter applications where efficiency is to be achieved at very high output currents.

APPLICATIONS

- SYNCHRONOUS RECTIFICATIONS FOR TELECOM AND COMPUTER
- OR-ING DIODE

Figure 2: Internal Schematic Diagram

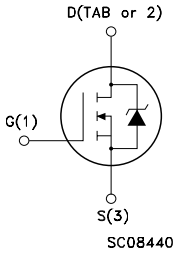


Table 2: Ordering Information

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB130NH02LT4	B130NH02L	TO-263	TAPE & REEL
STP130NH02L	P130NH02L	TO-220	TUBE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{spike(1)}$	Drain-source Voltage Rating	30	V
V_{DS}	Drain-source Voltage (V_{GS} = 0)	24	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	24	V
V_{GS}	Gate- source Voltage	± 20	V
I_D(2)	Drain Current (continuous) at T_C = 25°C	90	A
I_D(2)	Drain Current (continuous) at T_C = 100°C	90	A
I_{DM}(3)	Drain Current (pulsed)	360	A
P_{tot}	Total Dissipation at T_C = 25°C	150	W
	Derating Factor	1	W/°C
E_{AS} (4)	Single Pulse Avalanche Energy	900	mJ
T_{stg}	Storage Temperature	-55 to 175	°C
T_j	Max. Operating Junction Temperature		

Table 4: THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	1.0	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300	°C

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

Table 5: OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 25 mA, V_{GS} = 0	24			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = 20 V V_{DS} = 20 V T_C = 125°C			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ± 20 V			±100	nA

Table 6: ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	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 = 45 A V_{GS} = 5 V I_D = 22.5 A		0.0034 0.005	0.0044 0.008	Ω Ω

Table 7: DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (5)	Forward Transconductance	V_{DS} = 10 V I_D = 45 A		55		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 15V f = 1 MHz V_{GS} = 0		4450 1126 141		pF pF pF
R_G	Gate Input Resistance	f = 1 MHz Gate DC Bias = 0 Test Signal Level = 20 mV Open Drain		1.6		Ω

ELECTRICAL CHARACTERISTICS (continued)

Table 8: SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 10 V I_D = 45 A R_G = 4.7 Ω V_{GS} = 10 V (Resistive Load, Figure)		14 224		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD}=10 V I_D=90 A V_{GS}=10 V		69 13 9	93	nC nC nC
Q_{oss}(6)	Output Charge	V_{DS}= 16 V V_{GS}= 0 V		27		nC
Q_{gls}(7)	Third-quadrant Gate Charge	V_{DS}< 0 V V_{GS}= 10 V		64		nC

Table 9: SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$ t_f	Turn-off Delay Time Fall Time	V_{DD} = 10 V I_D = 45 A R_G = 4.7Ω, V_{GS} = 10 V (Resistive Load, Figure 3)		69 40	54	ns ns

Table 10: SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}	Source-drain Current Source-drain Current (pulsed)				90 360	A A
V_{SD} (5)	Forward On Voltage	I_{SD} = 45 A V_{GS} = 0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 90 A di/dt = 100A/µs V_{DD} = 15 V T_j = 150°C (see test circuit, Figure 5)		47 58 2.5		ns nC A

(1) Garanted when external Rg=4.7 Ω and $t_f < t_{fmax}$.
(2) Value limited by wire bonding
(3) Pulse width limited by safe operating area.
(4) Starting T_j = 25 °C, I_D = 45A, V_{DD} = 10V .
(5) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(6) Q_{oss} = C_{oss}*Δ V_{in} , C_{oss} = C_{gd} + C_{ds} . See Appendix A
(7) Gate charge for synchronous operation

Figure 3: Safe Operating Area

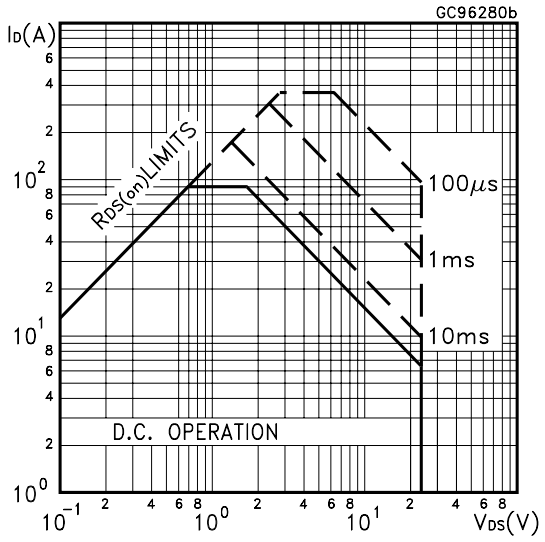


Figure 4: Thermal Impedance

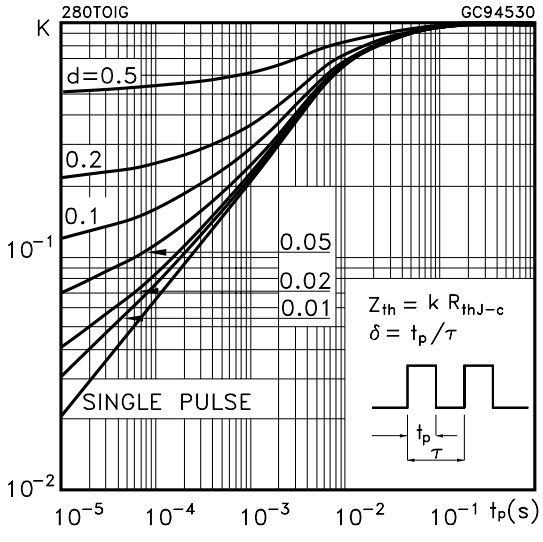


Figure 5: Output Characteristics

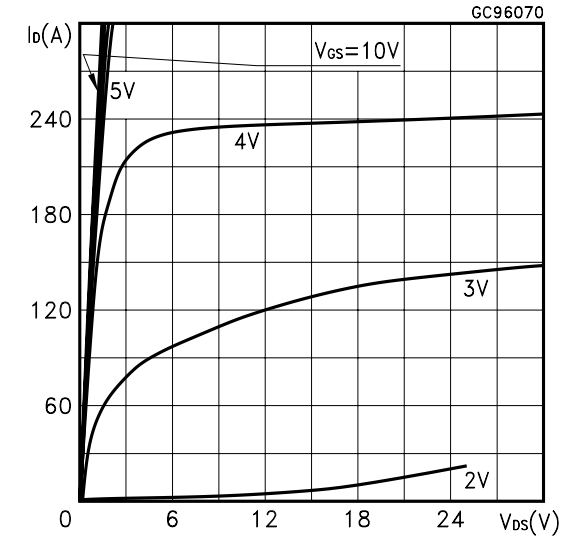


Figure 6: Transfer Characteristics

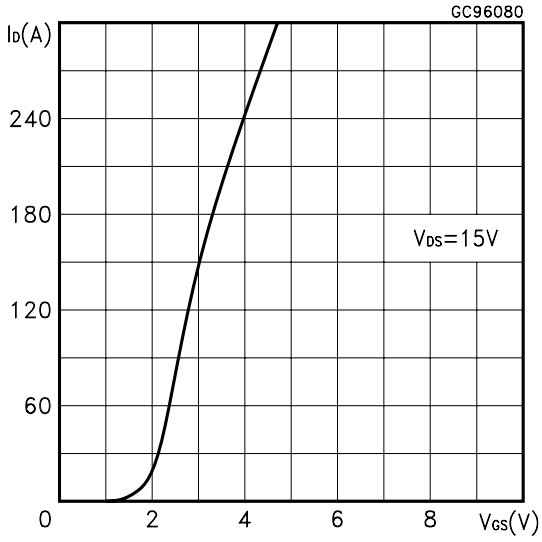


Figure 7: Transconductance

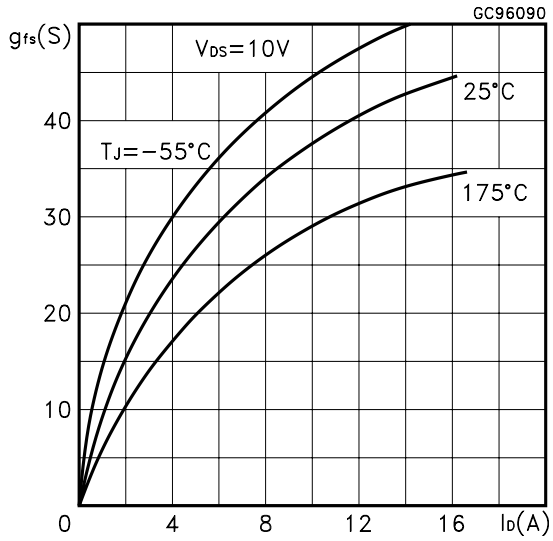


Figure 8: Static Drain-source On Resistance

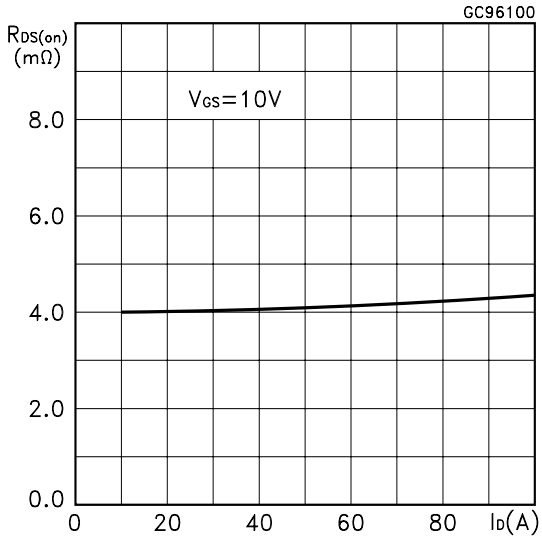


Figure 9: Gate Charge vs Gate-source Voltage

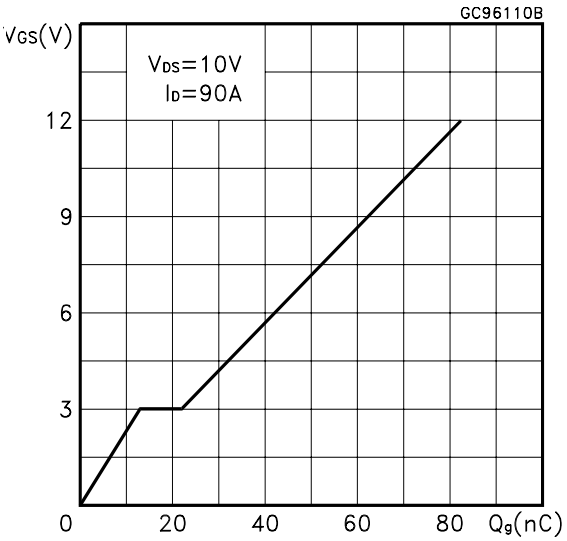


Figure 10: Capacitance Variations

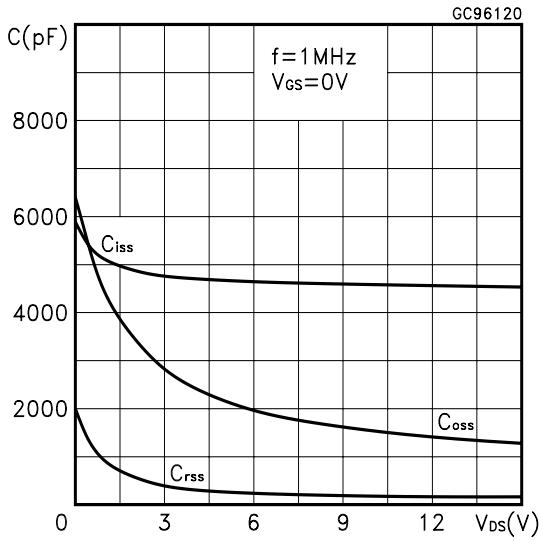


Figure 11: Normalized Gate Threshold Voltage vs Temperature

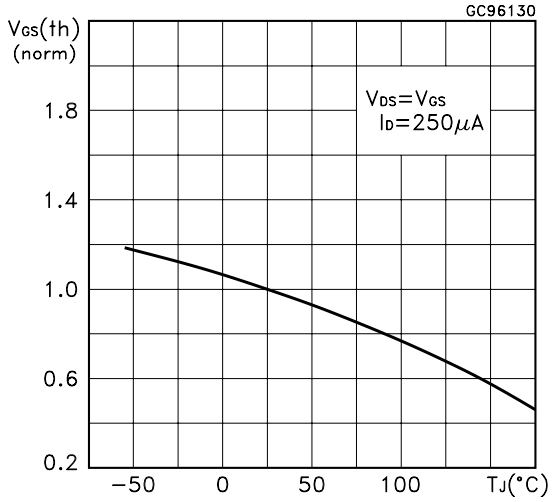


Figure 12: Normalized on Resistance vs Temperature

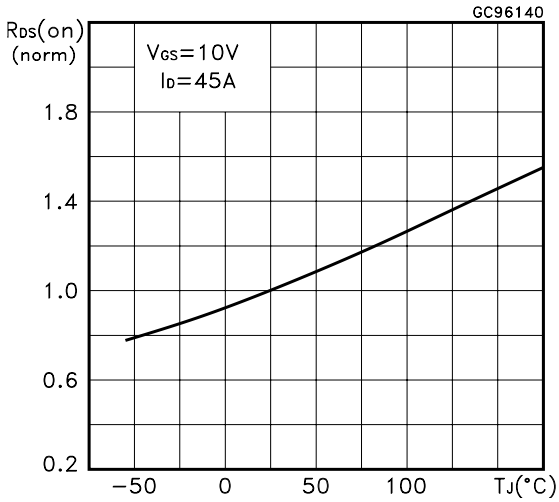


Figure 13: Source-drain Diode Forward Characteristics

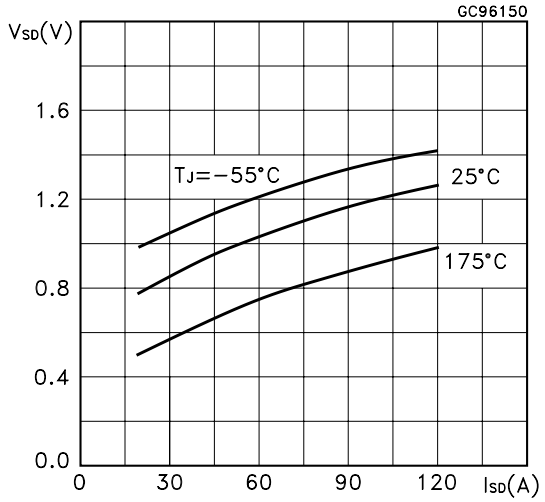


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Figure 14: Normalized Breakdown Voltage vs Temperature

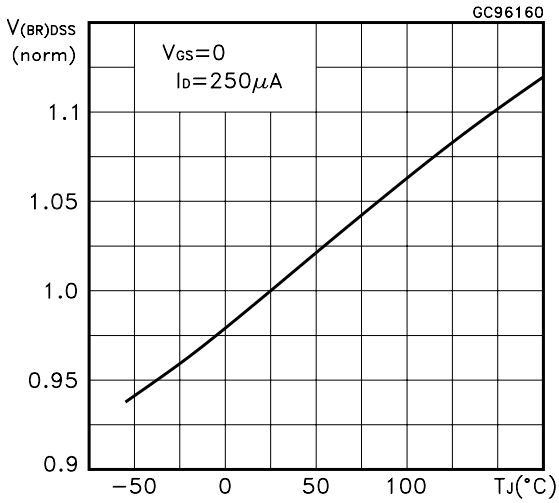

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Figure 15: Unclamped Inductive Load Test Circuit

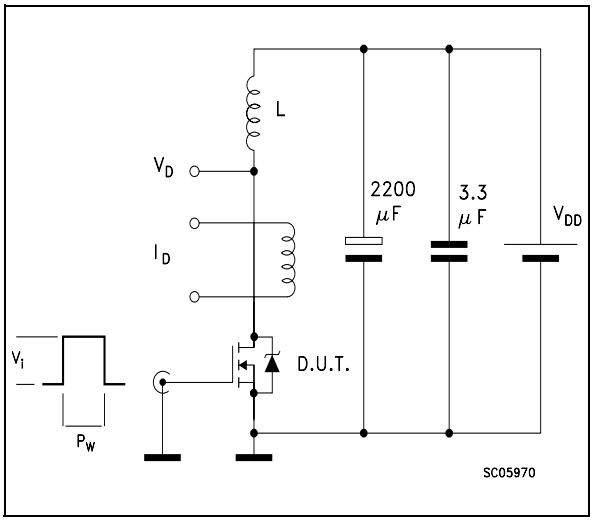


Figure 16: Unclamped Inductive Waveform

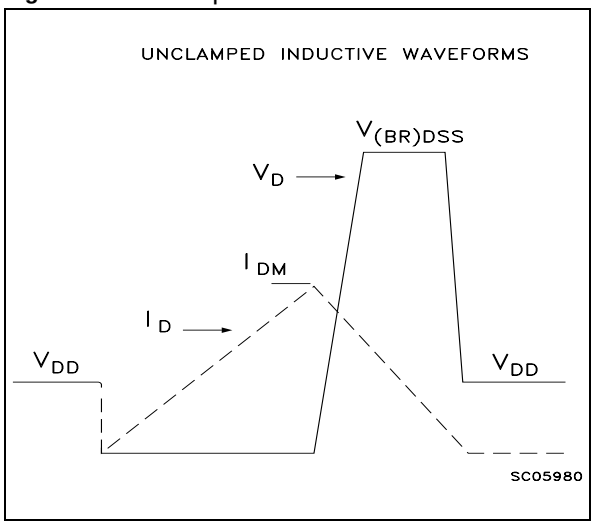


Figure 17: Switching Times Test Circuits For Resistive Load

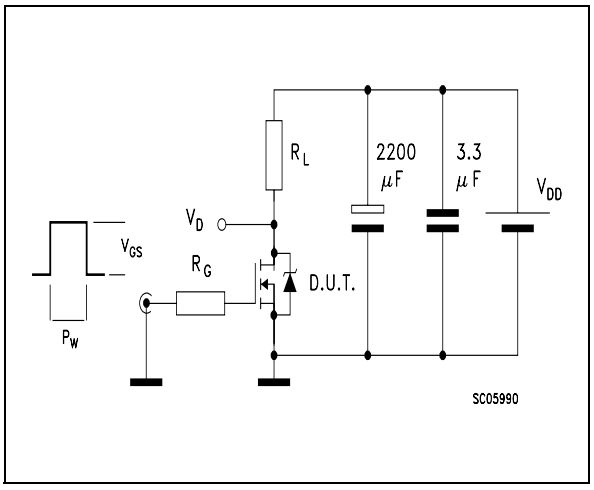


Figure 18: Gate Charge test Circuit

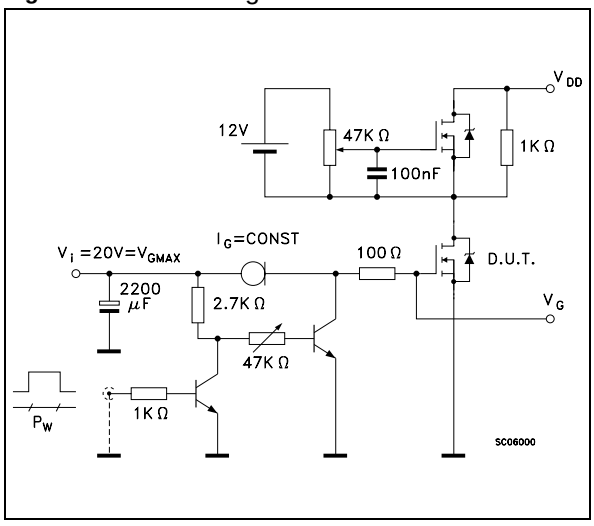
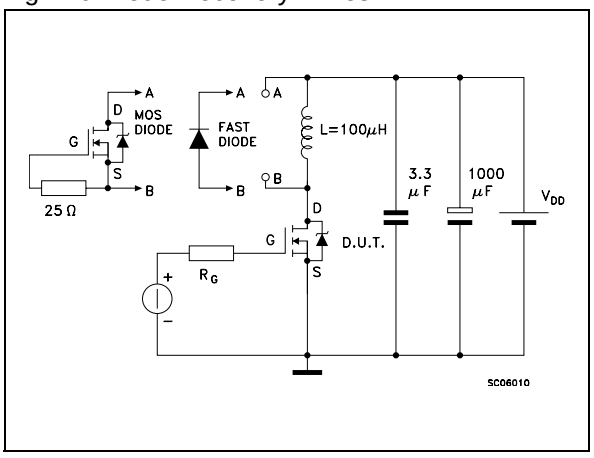
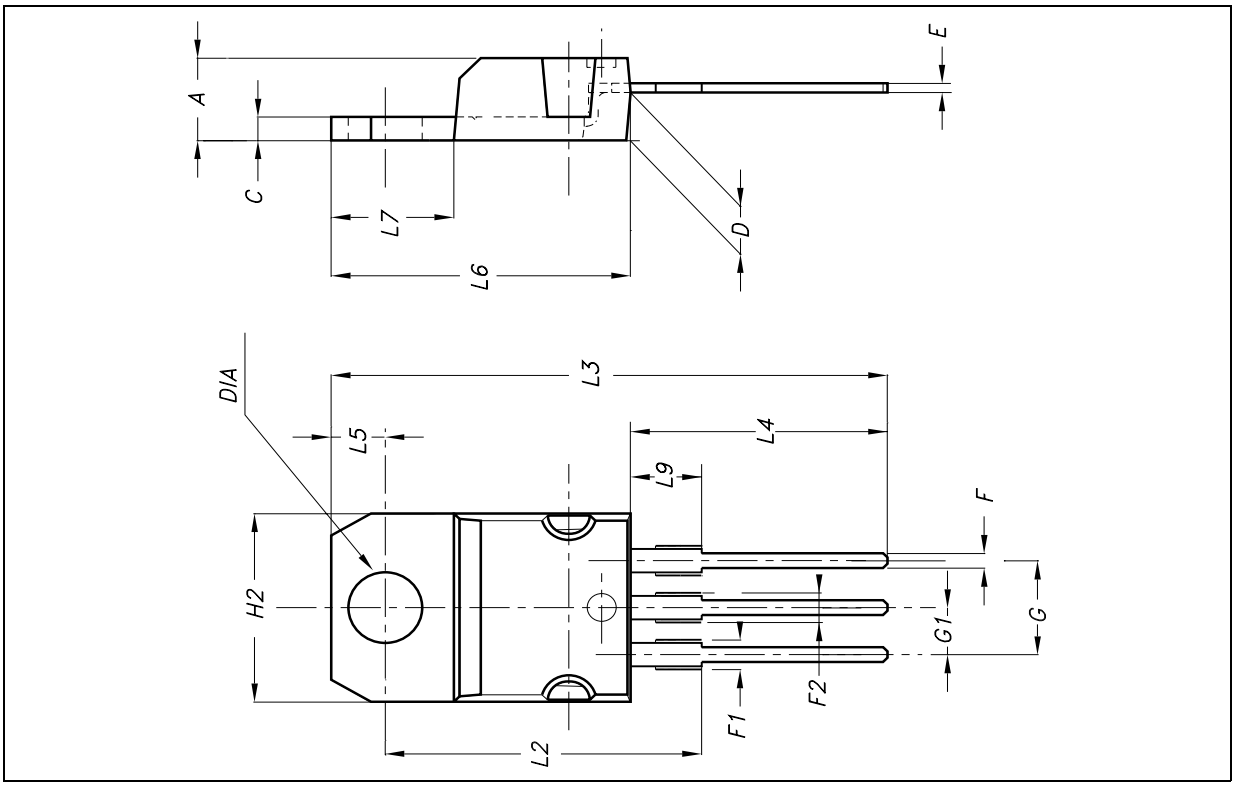


Figure 19: Test Circuit For Inductive Load Switching And Diode Recovery Times



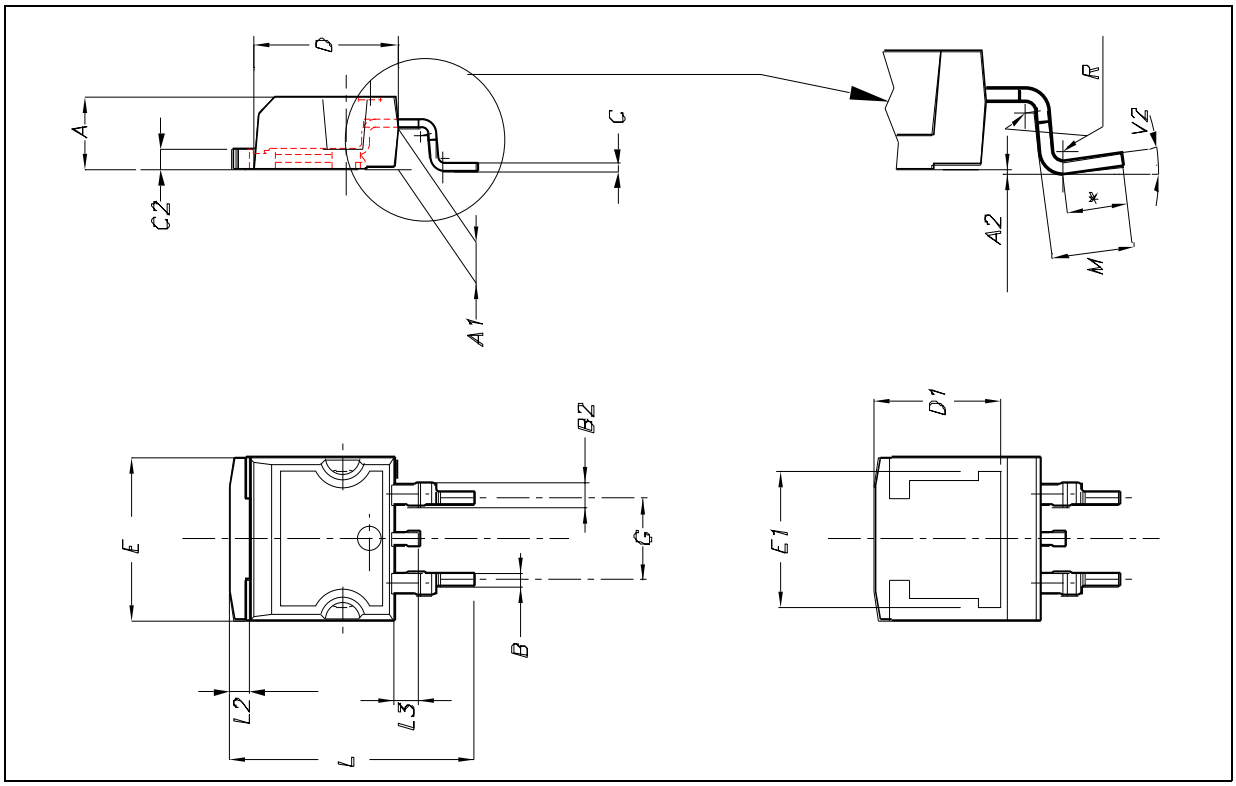
TO-220 MECHANICAL DATA

DIM.	mm.			inch.		
	MIN.	TYP.	MAX.	MIN.	TYP.	TYP.
A	4.4		4.6	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.40		2.70	0.094		0.106
H2	10		10.40	0.393		0.409
L2		16.40			0.645	
L3		28.90			1.137	
L4	13		14	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.20		6.60	0.244		0.260
L9	3.50		3.93	0.137		0.154
DIA	3.75		3.85	0.147		0.151

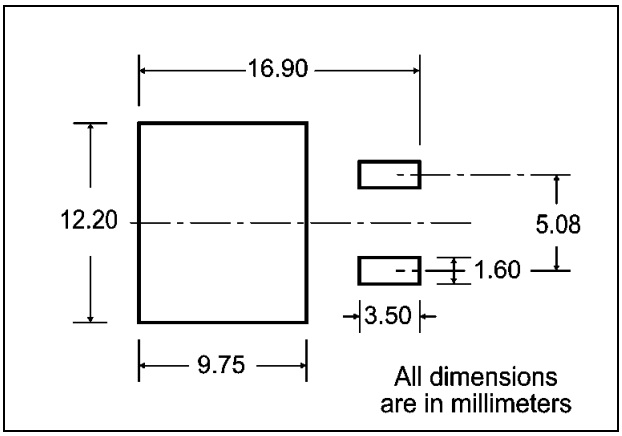


D²PAK MECHANICAL DATA

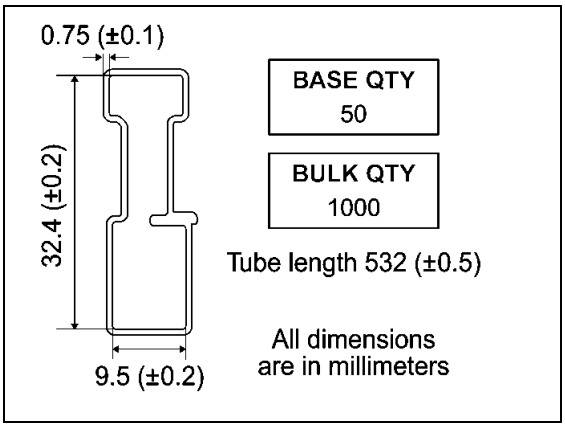
DIM.	mm.			inch.		
	MIN.	TYP.	MAX.	MIN.	TYP.	TYP.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.028		0.037
B2	1.14		1.7	0.045		0.067
C	0.45		0.6	0.018		0.024
C2	1.21		1.36	0.048		0.054
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.394		0.409
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.591		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.069
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		8°	0°		8°



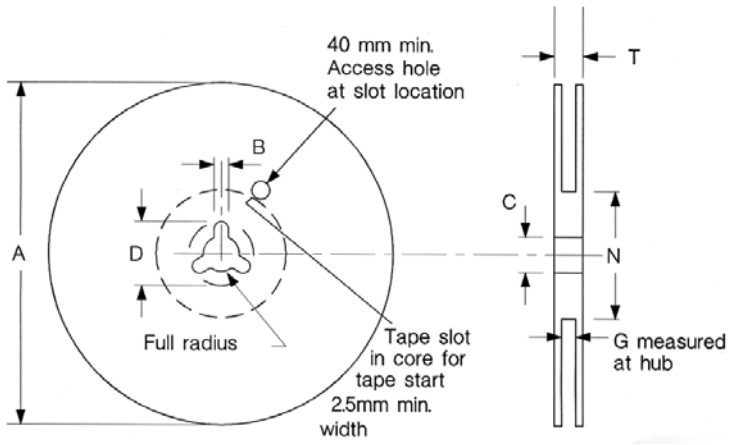
D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



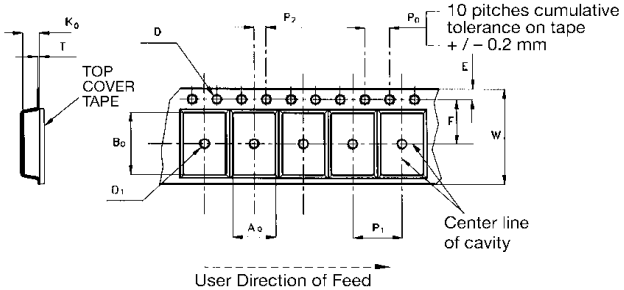
REEL MECHANICAL DATA

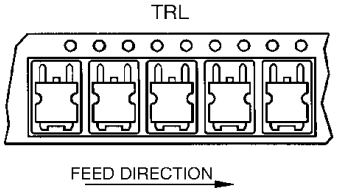
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

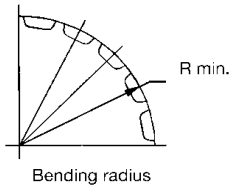
BASE QTY	BULK QTY
1000	1000

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	0075	0.082
R	50		1.574	
T	0.25	0.35	.0.0098	0.0137
W	23.7	24.3	0.933	0.956

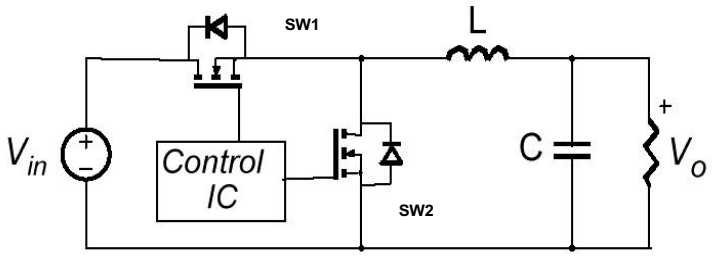






* on sales type

APPENDIX A
Buck Converter: Power Losses Estimation



The power losses associated with the FETs in a Synchronous Buck converter can be estimated using the equations shown in the table below. The formulas give a good approximation, for the sake of performance comparison, of how different pairs of devices affect the converter efficiency. However a very important parameter, the working temperature, is not considered. The real device behavior is really dependent on how the heat generated inside the devices is removed to allow for a safer working junction temperature.
The low side (**SW2**) device requires:

- Very low $R_{DS(on)}$ to reduce conduction losses
- Small Q_{gls} to reduce the gate charge losses
- Small C_{oss} to reduce losses due to output capacitance
- Small Q_{rr} to reduce losses on SW_1 during its turn-on
- The C_{gd}/C_{gs} ratio lower than V_{th}/V_{gg} ratio especially with low drain to source voltage to avoid the cross conduction phenomenon;

The high side (**SW1**) device requires:

- Small R_g and L_s to allow higher gate current peak and to limit the voltage feedback on the gate
- Small Q_g to have a faster commutation and to reduce gate charge losses
- Low $R_{DS(on)}$ to reduce the conduction losses.

		High Side Switch (SW1)	Low Side Switch (SW2)
$P_{conduction}$		$R_{DS(on)SW1} * I_L^2 * \delta$	$R_{DS(on)SW2} * I_L^2 * (1-\delta)$
$P_{switching}$		$V_{in} * (Q_{gsth(SW1)} + Q_{gd(SW1)}) * f * \frac{I_L}{I_g}$	Zero Voltage Switching
P_{diode}	Recovery	Not Applicable	[1] $V_{in} * Q_{rr(SW2)} * f$
	Conduction	Not Applicable	$V_{f(SW2)} * I_L * t_{deadtime} * f$
$P_{gate(Q_G)}$		$Q_{g(SW1)} * V_{gg} * f$	$\mathbf{Q_{gls(SW2)} * V_{gg} * f}$
P_{Qoss}		$\frac{V_{in} * Q_{oss(SW1)} * f}{2}$	$\frac{V_{in} * Q_{oss(SW2)} * f}{2}$

Parameter	Meaning
d	Duty-cycle
Q_{gsth}	Post threshold gate charge
Q_{gls}	Third quadrant gate charge
Pconduction	On state losses
Pswitching	On-off transition losses
Pdiode	Conduction and reverse recovery diode losses
Pgate	Gate drive losses
P_{Qoss}	Output capacitance losses

[1] Dissipated by SW1 during turn-on

Table 11:Revision History

Date	Revision	Description of Changes
April 2005	2.0	ADDED PACKAGE TO-220

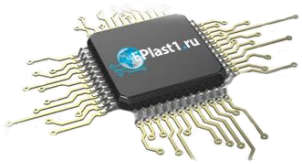
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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