



## STD36NH02L

N-channel 24V - 0.011 $\Omega$  - 30A - DPAK  
STripFET™ III Power MOSFET

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STD36NH02L	24V	<0.0145 $\Omega$	30A <sup>(1)</sup>

1. Guaranteed when external R<sub>g</sub>=4.7 $\Omega$  and t<sub>r</sub> < t<sub>rmax</sub>

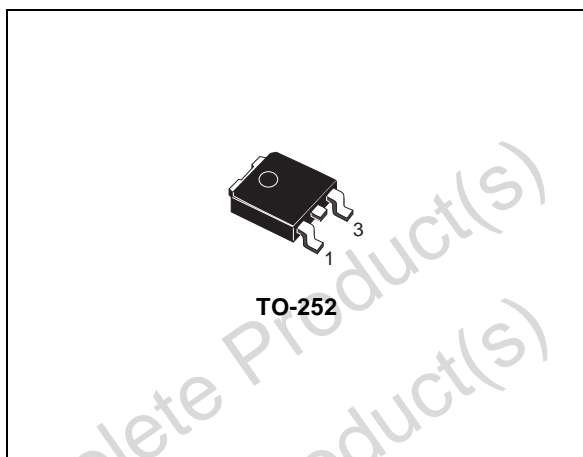
- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry's benchmark
- Conduction losses reduced
- Switching losses reduced

### Description

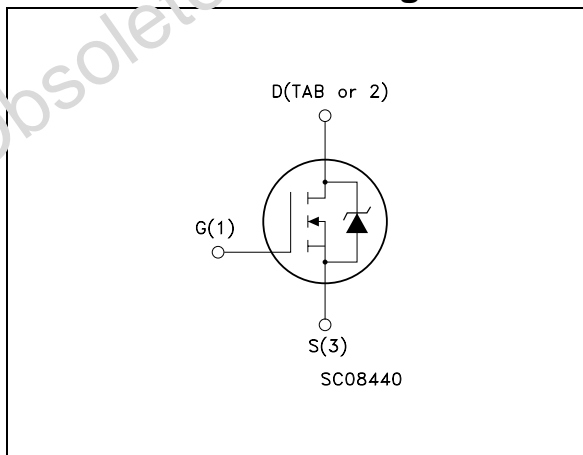
This series of products utilizes the last advanced design rules of ST's proprietary STripFET™ technology. This is suitable for the most demanding DC-DC converter application where high efficiency is to be achieved.

### Applications

- Switching application



### Internal schematic diagram



### Order codes

Part number	Marking	Package	Packaging
STD36NH02L	D36NH02L	DPAK	Tape & reel

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Obsolete Product(s) - Obsolete Product(s)  
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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{\text{spike}}^{(1)}$	Drain-source voltage rating	30	V
$V_{\text{DS}}$	Drain-Source Voltage ( $V_{\text{GS}} = 0$ )	24	V
$V_{\text{GS}}$	Gate-Source Voltage	$\pm 20$	V
$I_{\text{D}}^{(2)}$	Drain Current (continuous) at $T_{\text{C}} = 25^{\circ}\text{C}$	30	A
$I_{\text{D}}$	Drain Current (continuous) at $T_{\text{C}}=100^{\circ}\text{C}$	30	A
$I_{\text{DM}}^{(3)}$	Drain Current (pulsed)	120	A
$P_{\text{TOT}}$	Total Dissipation at $T_{\text{C}} = 25^{\circ}\text{C}$	45	W
	Derating Factor	0.27	W/ $^{\circ}\text{C}$
$E_{\text{AS}}^{(4)}$	Single pulse avalanche energy	200	mJ
$T_{\text{J}}$ $T_{\text{stg}}$	Operating Junction Temperature Storage Temperature	-55 to 175	$^{\circ}\text{C}$

1. Guaranteed when external  $R_{\text{g}}=4.7\Omega$  and  $t_{\text{r}} < t_{\text{fmax}}$
2. Value limited by wire bonding
3. Pulse width limited by safe operating area.
4. Starting  $T_{\text{j}}=25^{\circ}\text{C}$ ,  $I_{\text{D}}=19\text{A}$ ,  $V_{\text{DD}}=18\text{V}$

**Table 2. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{\text{thj-case}}$	Thermal resistance junction-case Max	3.33	$^{\circ}\text{C}/\text{W}$
$R_{\text{thj-amb}}$	Thermal resistance junction-ambient Max	100	$^{\circ}\text{C}/\text{W}$
$T_{\text{l}}$	Maximum lead temperature for soldering purpose	275	$^{\circ}\text{C}$

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  unless otherwise specified)

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	24			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 20V,$ $V_{DS} = 20V @ 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1	1.8	2.5	V
$R_{DS(on)}$	Static Drain-Source On Resistance	$V_{GS} = 10V, I_D = 15A$ $V_{GS} = 5V, I_D = 15A$		0.011 0.013	0.0145 0.026	$\Omega$ $\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 10V, I_D = 15A$		18		S
$C_{iss}$	Input capacitance	$V_{DS} = 15V, f = 1 MHz,$ $V_{GS} = 0$		860		pF
$C_{oss}$	Output Capacitance			255		pF
$C_{rss}$	Reverse transfer capacitance			45		pF
$Q_g$	Total gate charge	$0.44V \leq V_{DD} \leq 10V,$ $I_D = 30A, V_{GS} = 10V$ (see Figure 14)		15.5	20	nC
$Q_{gs}$	Gate-source charge			4.1		nC
$Q_{gd}$	Gate-drain charge			1.7		nC
$Q_{OSS}^{(2)}$	Output charge	$V_{DS} = 16V, V_{GS} = 0$		6		ns
$R_G$	Gate input resistance	f=1 MHz Gate DC Bias = 0 Test signal level = 20mV open drain		3		$\Omega$

1. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

2.  $Q_{OSS} = C_{OSS} * \Delta V_{IN}$ ,  $C_{OSS} = C_{gd} + C_{ds}$

**Table 5. Switching times**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=10V, I_D=15A,$ $R_G=4.7\Omega, V_{GS}=10V$ (see Figure 13)		8		ns
$t_r$	Rise time			70		ns
$t_{d(off)}$	Turn-off delay time			22		ns
$t_f$	Fall time			15		ns

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				30	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				120	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 15A, V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 30A, di/dt = 100A/\mu s,$ $V_{DD}=15V, T_j=150^\circ C$ (see Figure 15)		24		ns
$Q_{rr}$	Reverse recovery charge			16		nC
$I_{RRM}$	Reverse recovery current			1.3		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

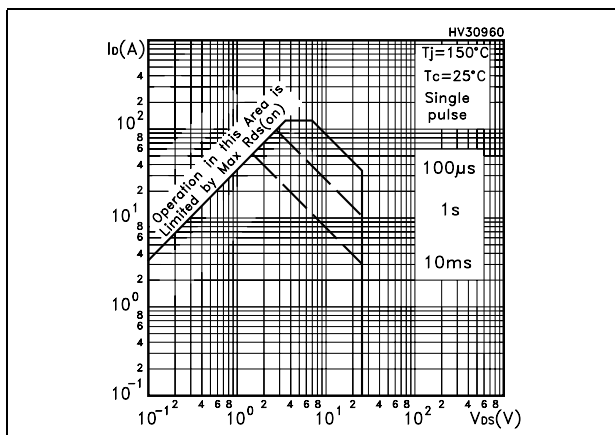


Figure 2. Thermal impedance

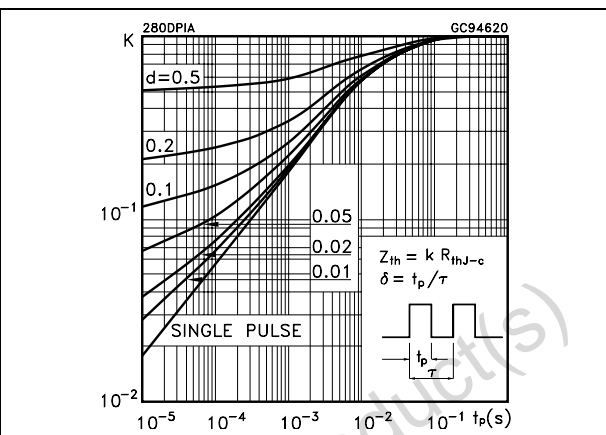


Figure 3. Output characteristics

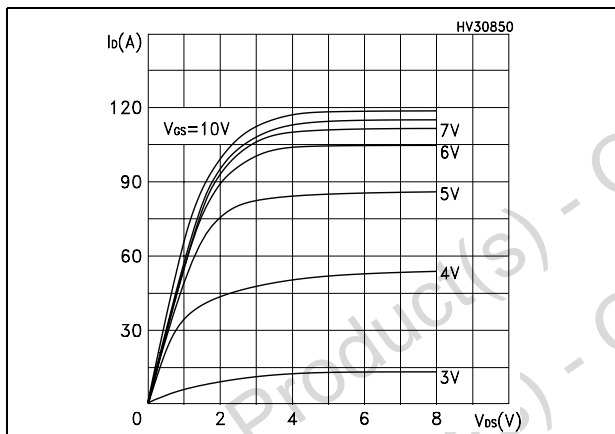


Figure 4. Transfer characteristics

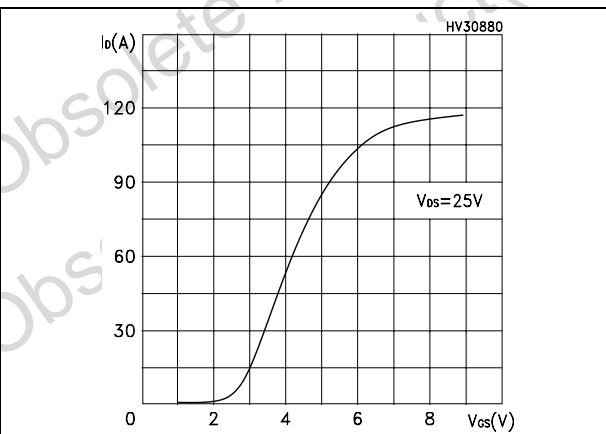


Figure 5. Transconductance

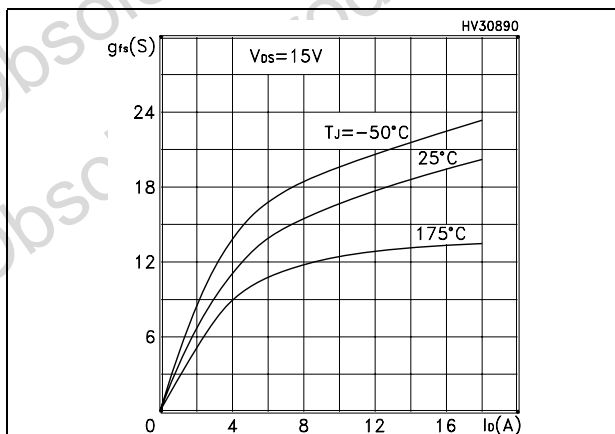


Figure 6. Static drain-source on resistance

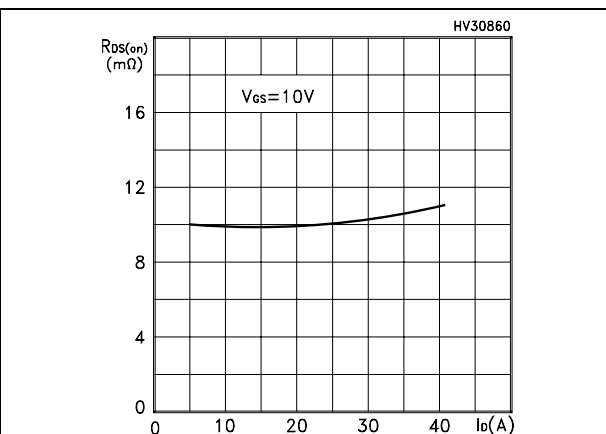


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

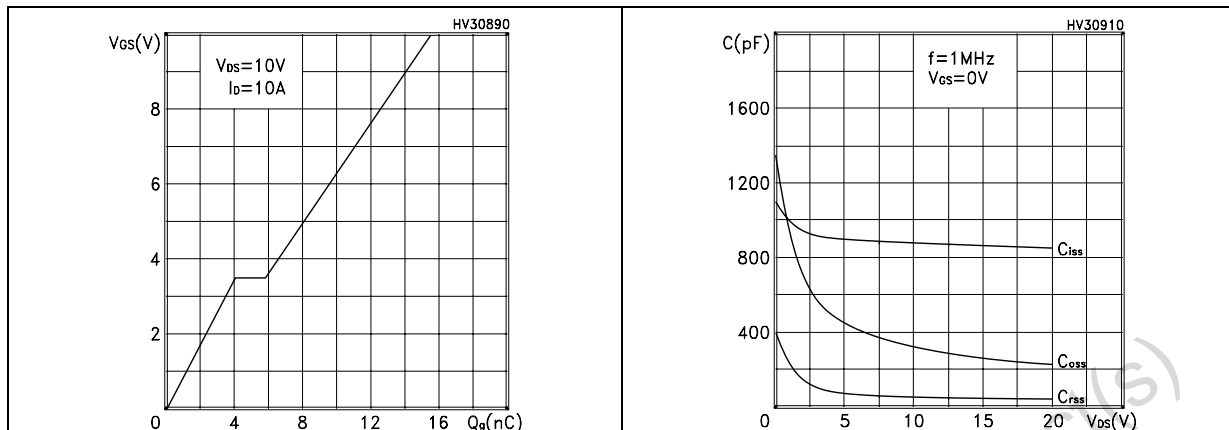


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

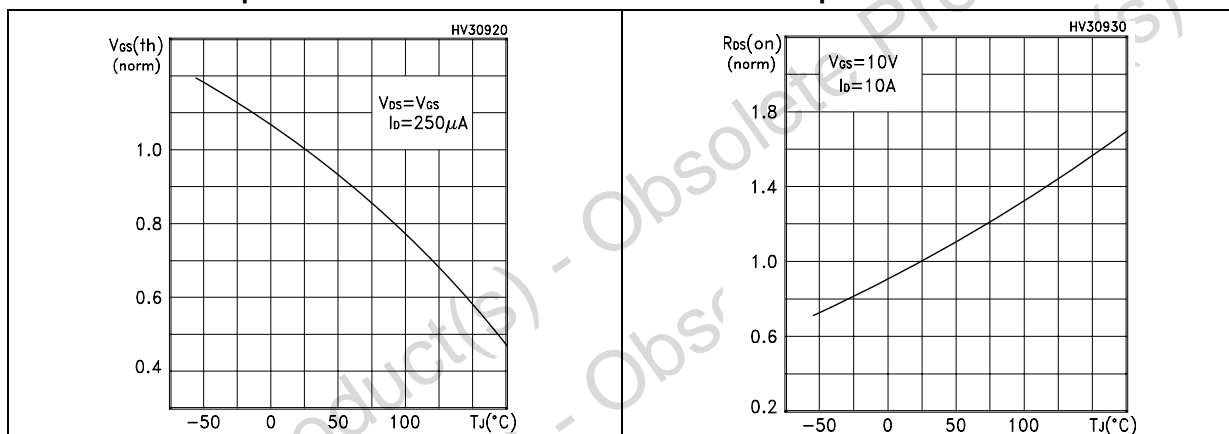
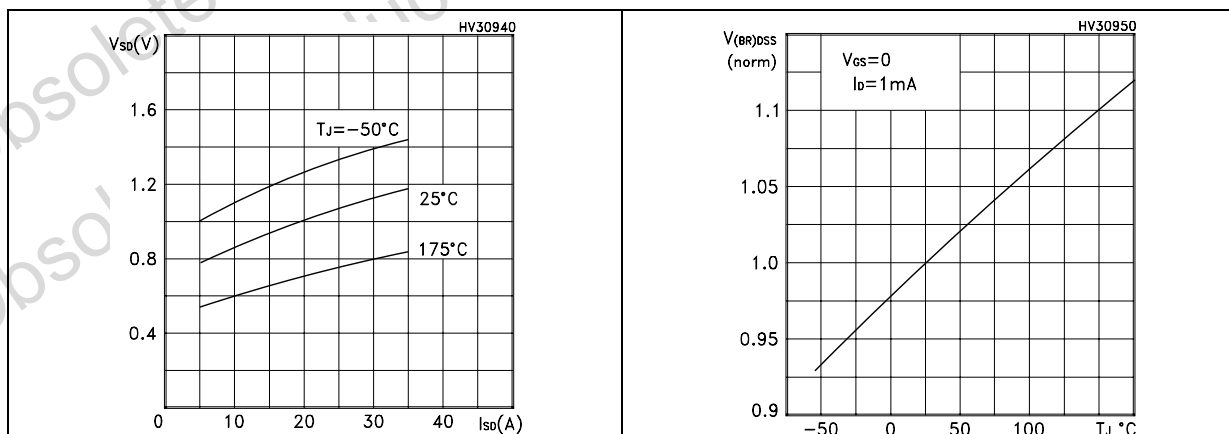


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized  $B_{V_{DS}}$  vs temperature



### 3 Test circuit

Figure 13. Switching times test circuit for resistive load

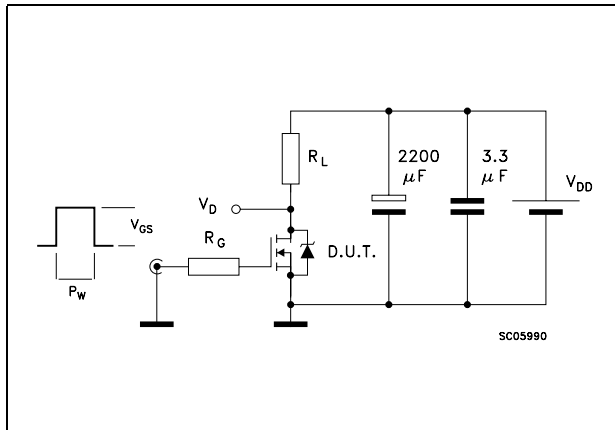


Figure 14. Gate charge test circuit

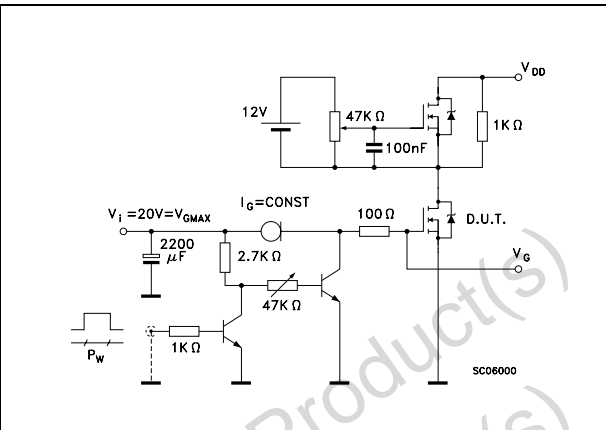


Figure 15. Test circuit for inductive load switching and diode recovery times

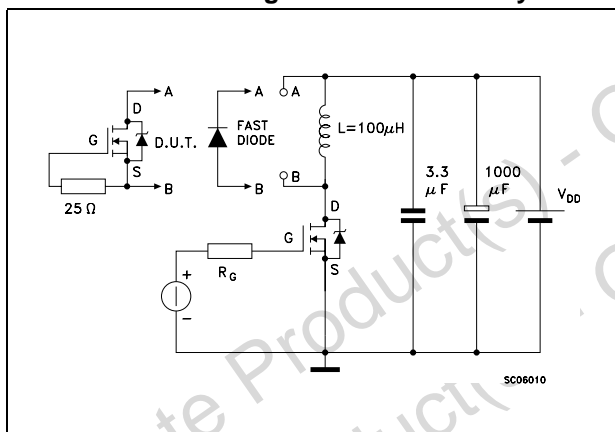


Figure 16. Unclamped inductive load test circuit

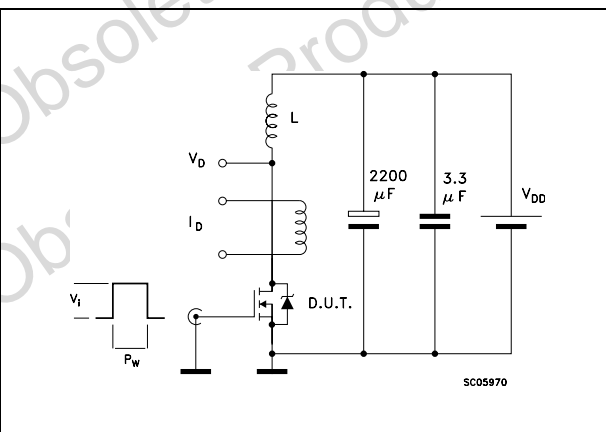


Figure 17. Unclamped inductive waveform

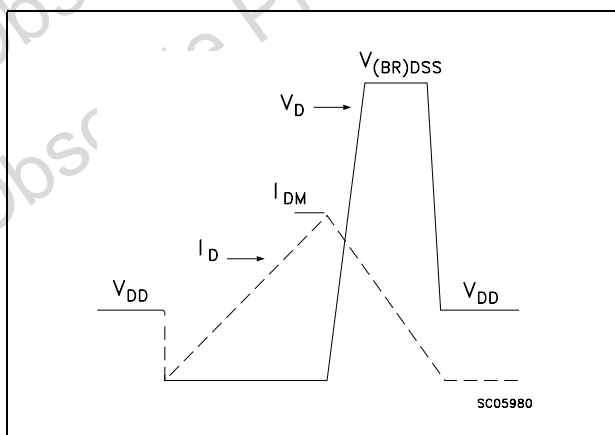
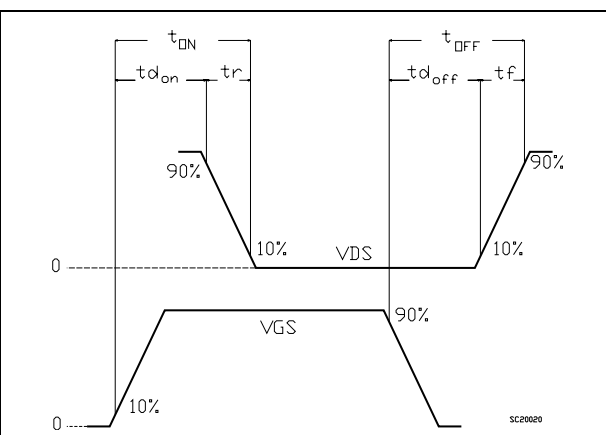


Figure 18. Switching time waveform





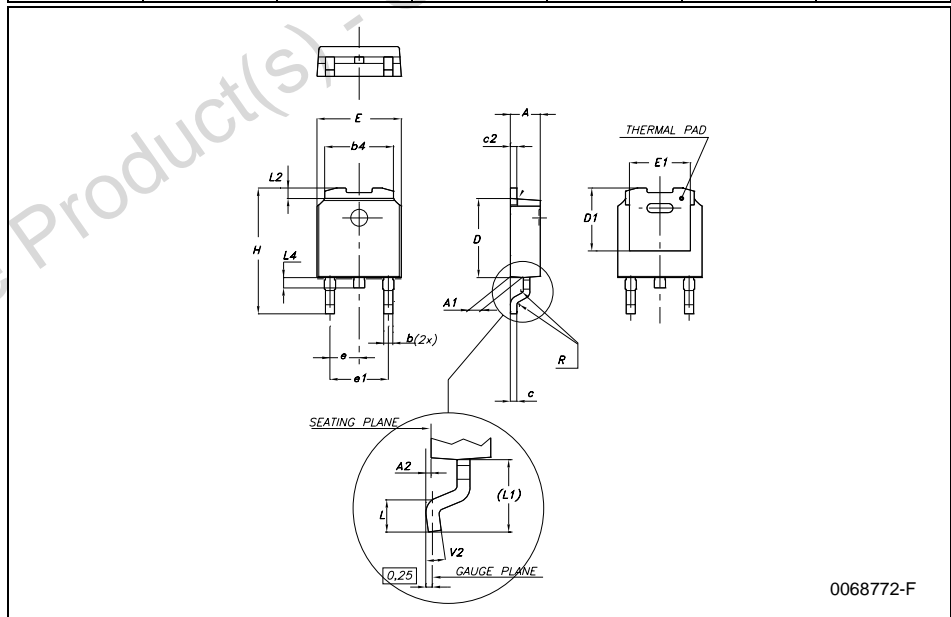
## 4 Package mechanical data

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](http://www.st.com)

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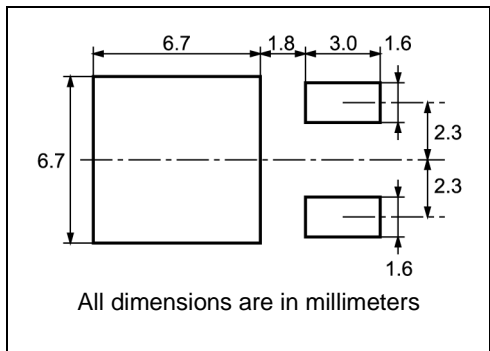
**DPAK MECHANICAL DATA**

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
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
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
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



# 5 Packaging mechanical data

## DPAK FOOTPRINT



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

### 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

TOP COVER TAPE

10 pitches cumulative tolerance on tape +/- 0.2 mm

User Direction of Feed

Center line of cavity

For machine ref. only including draft and radii concentric around B0

TRL

Bending radius R min.

FEED DIRECTION

## 6 Revision history

Table 7. Revision history

Date	Revision	Changes
27-Apr-2006	1	First Release

Obsolete Product(s) - Obsolete Product(s)  
Obsolete Product(s) - Obsolete Product(s)

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