



# THE DATASHEET OF STB85NS04Z





# STB85NS04Z STB85NS04Z-1

N-channel 11mΩ - 80A - D<sup>2</sup>PAK - I<sup>2</sup>PAK  
SAFeFET™ Power MOSFET

## General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STB85NS04Z	Clamped	< 0.015Ω	80A <sup>(1)</sup>
STB85NS04Z-1	Clamped	< 0.015Ω	80A <sup>(1)</sup>

1. Current limited by wire bonding

- 100% avalanche tested
- Low capacitance and gate charge
- 175°C maximum junction temperature

## Description

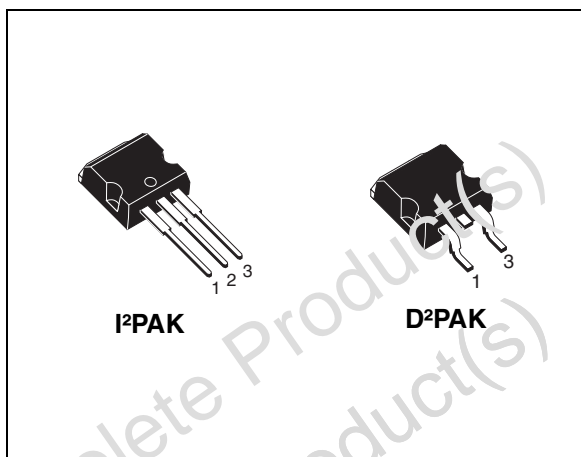
This fully clamped Power MOSFET is produced by using the latest advanced Company's Mesh Overlay™ process which is based on a novel strip layout. The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.

## Applications

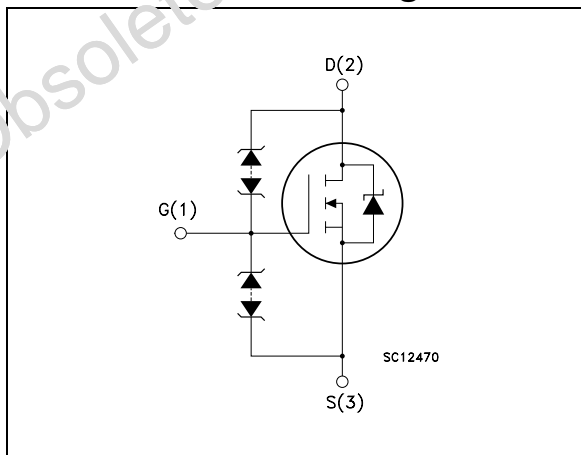
- Switching application
  - Automotive

## Order codes

Part number	Marking	Package	Packaging
STB85NS04ZT4	B85NS04Z	D <sup>2</sup> PAK	Tape & reel
STB85NS04Z-1	B85NS04Z-1	I <sup>2</sup> PAK	Tube



## Internal schematic diagram



# Contents

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

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		D <sup>2</sup> PAK	I <sup>2</sup> PAK	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> =0)	33 <sup>(1)</sup>		V
V <sub>GS</sub>	Gate-source voltage	± 18		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25°C	80 <sup>(2)</sup>		A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100°C	60		A
I <sub>DG</sub>	Drain gate current (continuous)	± 50		nA
I <sub>GS</sub>	Gate source current (continuous)	± 50		mA
I <sub>DM</sub> <sup>(3)</sup>	Drain current (pulsed)	320		A
	Derating factor	1.43		W/°C
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	215		W
V <sub>ESD(G-S)</sub>	Gate-source ESD (HBM-C=100pF, R=1.5kΩ)	2		kV
V <sub>ESD(G-D)</sub>	Gate-drain ESD (HBM-C=100pF, R=1.5kΩ)	4		kV
V <sub>ESD(D-S)</sub>	Drain-source ESD (HBM-C=100pF, R=1.5kΩ)	4		kV
T <sub>j</sub>	Operating junction temperature	-55 to 175		°C
T <sub>stg</sub>	Storage temperature			

1. Voltage is limited by zener diodes
2. Current limited by wire bonding
3. Pulse width limited by safe operating area

**Table 2. Thermal data**

Symbol	Parameter	Value		Unit
		D <sup>2</sup> PAK	I <sup>2</sup> PAK	
R <sub>thj-case</sub>	Thermal resistance junction-case max	0.7		°C/W
R <sub>thj-pcb</sub> <sup>(1)</sup>	Thermal resistance junction-pcb max	35	--	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-amb max	62.5		°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purpose	300		°C

1. When mounted on 1inch<sup>2</sup> FR-4 board, 2 oz Cu

**Table 3. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
$I_{AS}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	60	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J=25^{\circ}\text{C}$ , $I_D=I_{AS}$ , $V_{DD}=30\text{V}$ )	550	mJ

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Obsolete Product(s) - Obsolete Product(s)

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	33			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = 16V,$ $V_{DS} = 16V, T_c=125^{\circ}C$			10 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 10V$			10	$\mu A$
$V_{GSS}$	Gate-source breakdown voltage	$I_{GS} = 100\mu A$	13		25	V
$R_G$	Series gate resistance			14		$\Omega$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1mA$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 30A$		11	15	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward transconductance	$V_{DS} = 25V, I_D = 30A$		50		S
$C_{iss}$	Input capacitance			2500		pF
$C_{oss}$	Output capacitance	$V_{DS} = 25V, f = 1MHz, V_{GS} = 0$		800		pF
$C_{rss}$	Reverse transfer capacitance			150		pF
$Q_g$	Total gate charge	$V_{DD} = 16V, I_D = 60A$		68	100	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		15		nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)		19		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$	Off-voltage rise time	$V_{clamp}=30V, I_D=60A$ $R_G=4.7\Omega, V_{GS}=10V$ <i>(see Figure 15)</i>		85		ns
$t_f$	Fall time			145		ns
$t_c$	Cross-over time				90	

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				80	A
$I_{SDM}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD}=60A, V_{GS}=0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD}=60A, V_{DD}=100V$ $di/dt=25A/\mu s, T_j=150^\circ C$ <i>(see Figure 18)</i>		65		ns
$Q_{rr}$	Reverse recovery charge			0.15		$\mu C$
$I_{RRM}$	Reverse recovery current			4.5		A

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

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

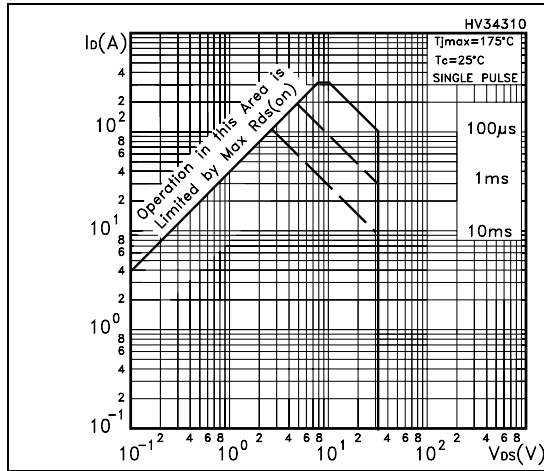


Figure 2. Thermal impedance

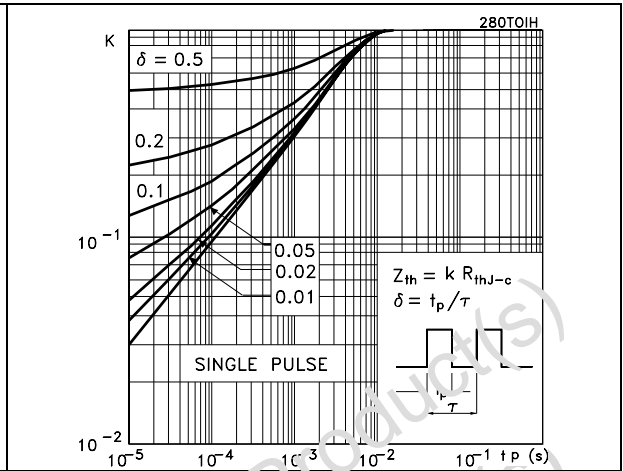


Figure 3. Output characteristics

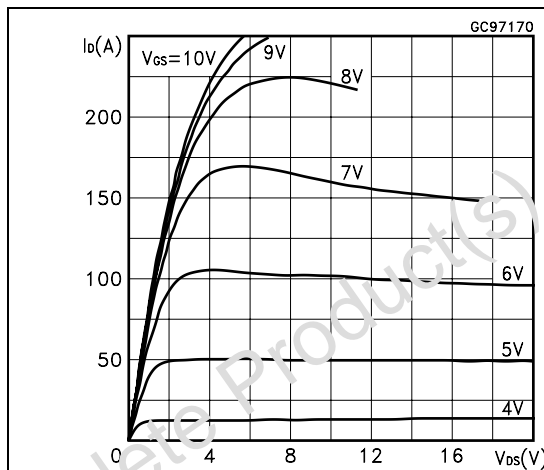


Figure 4. Transfer characteristics

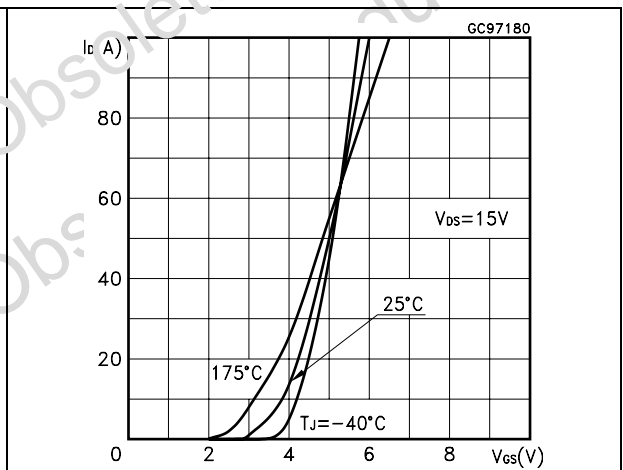


Figure 5. Transconductance

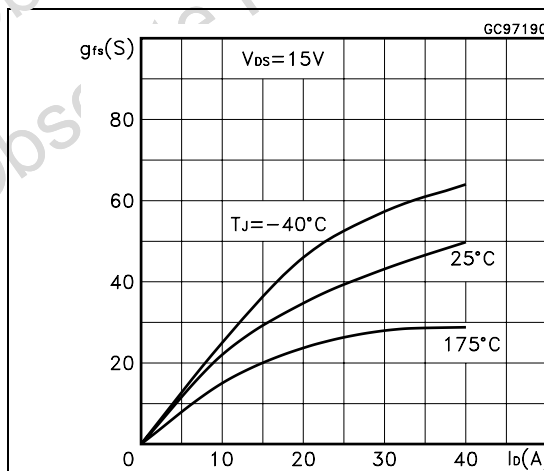


Figure 6. Static drain-source on resistance

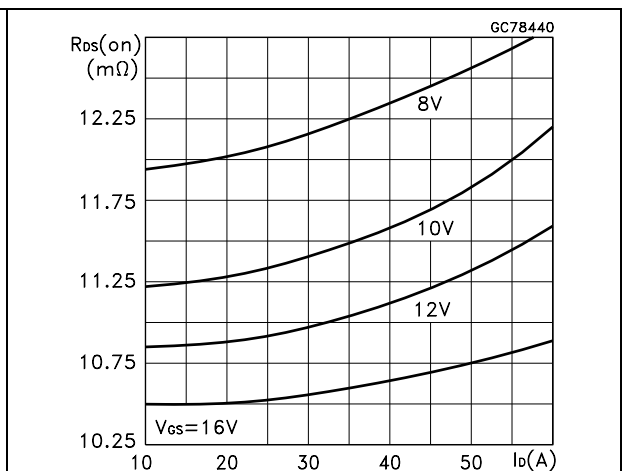


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

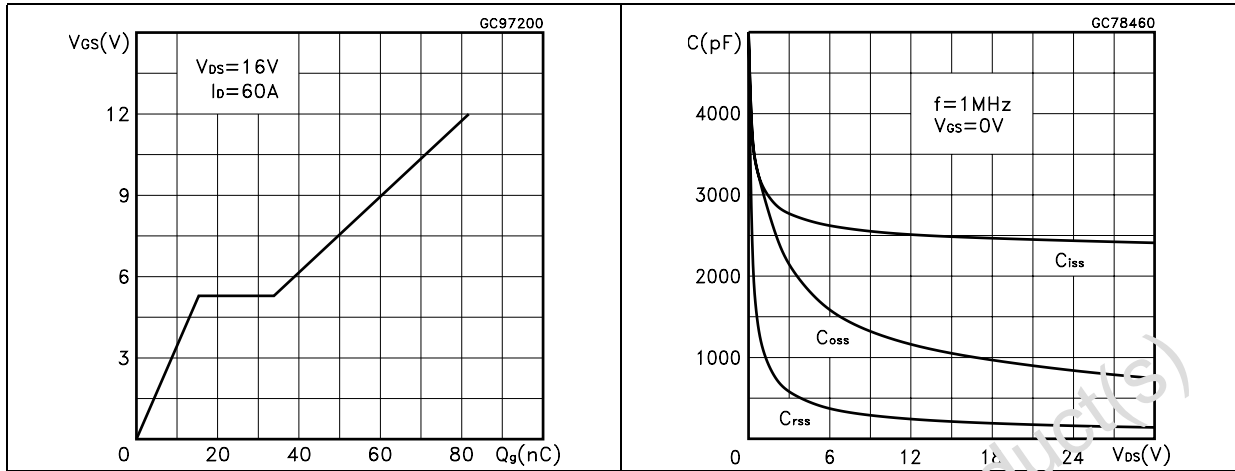


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

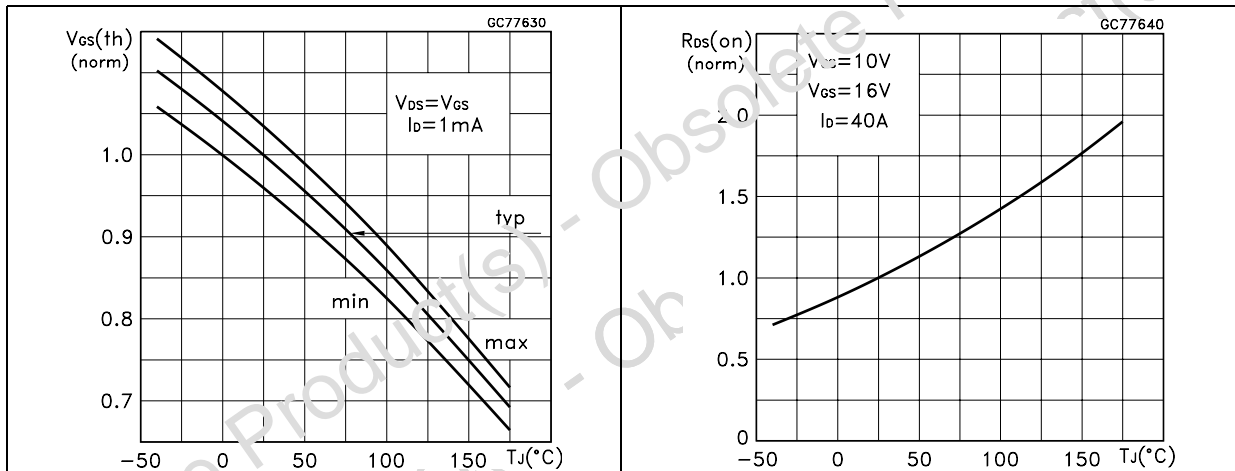
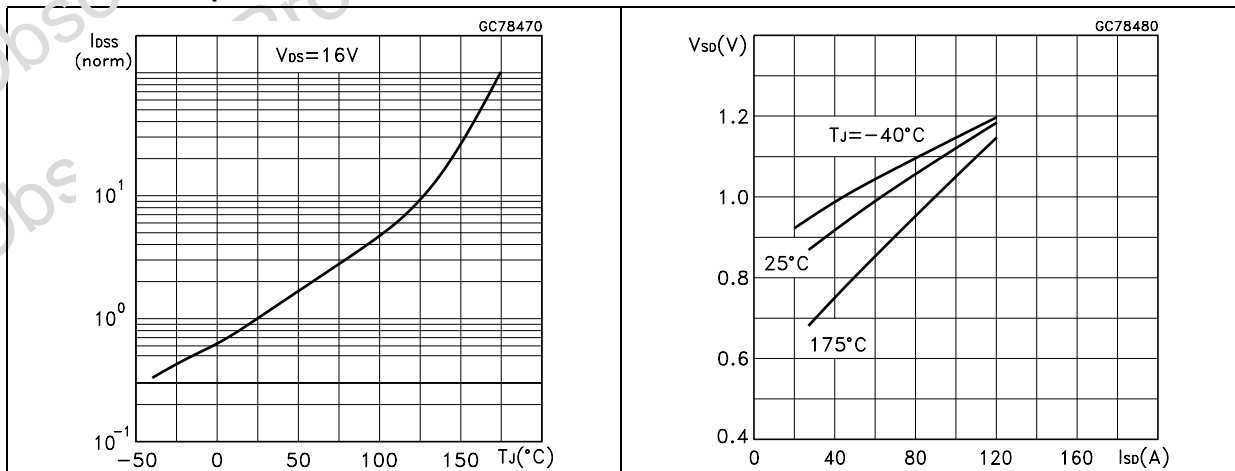


Figure 11. Zero gate voltage drain current vs temperature Figure 12. Source-drain diode forward characteristics



### 3 Test circuit

Figure 13. Switching times test circuit for resistive load

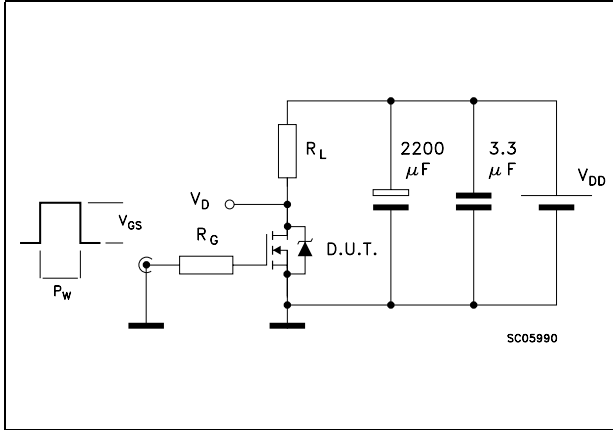


Figure 14. Gate charge test circuit

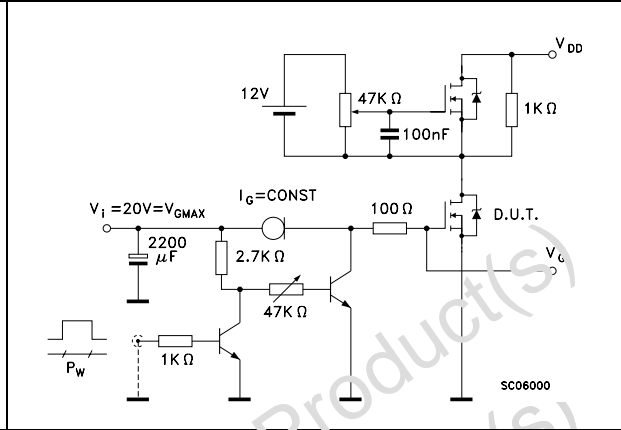


Figure 15. Test circuit for inductive load switching and diode recovery times

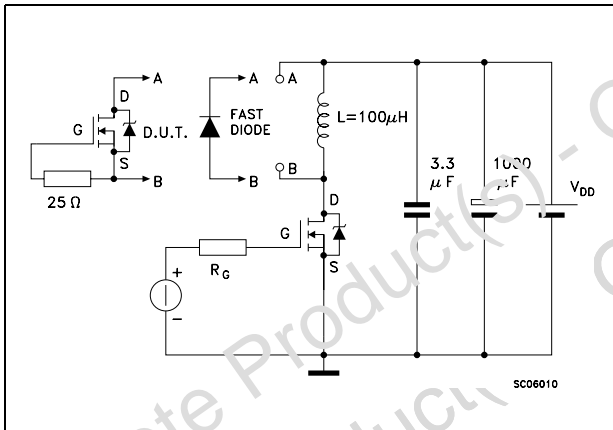


Figure 16. Unclamped inductive load test circuit

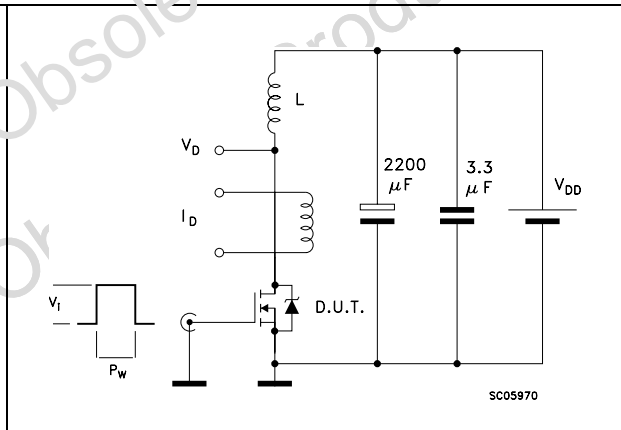


Figure 17. Unclamped inductive waveform

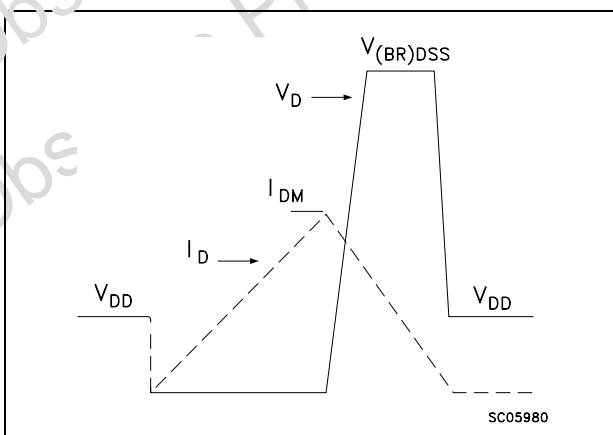
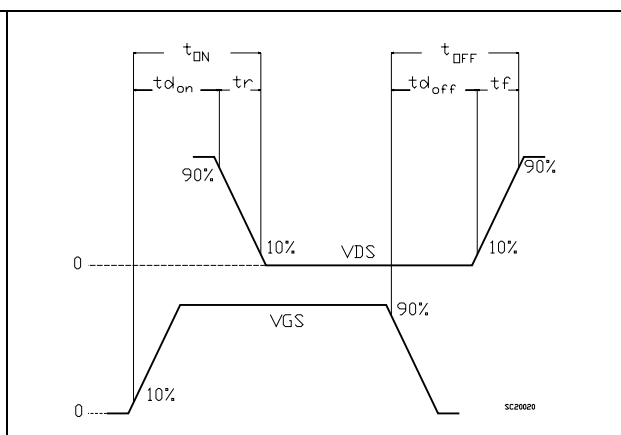


Figure 18. Switching time waveform



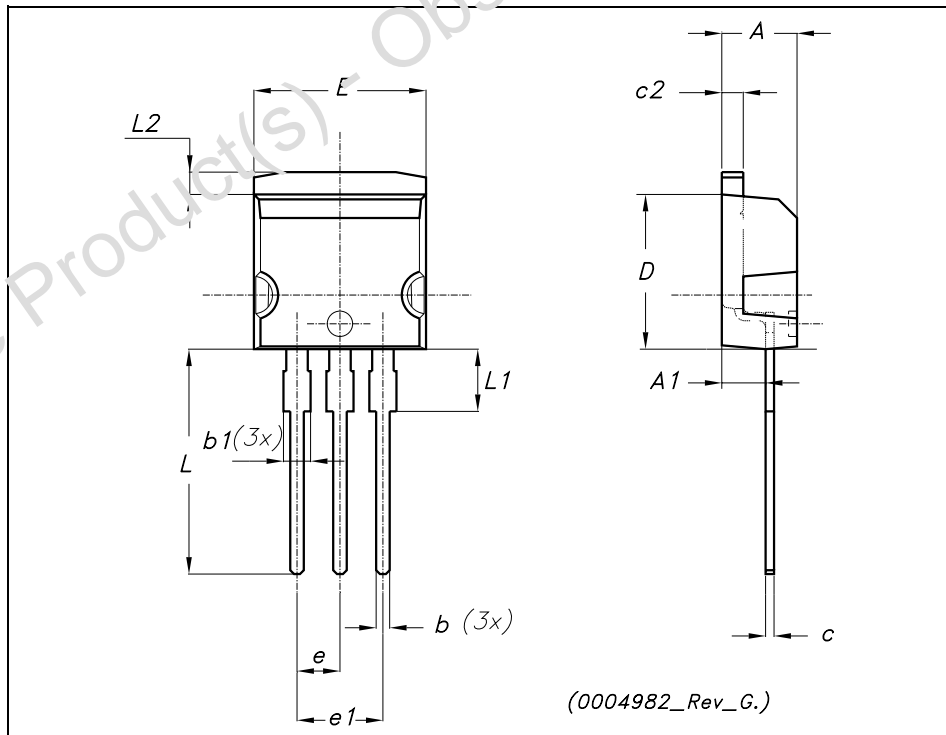
## 4 Package mechanical data

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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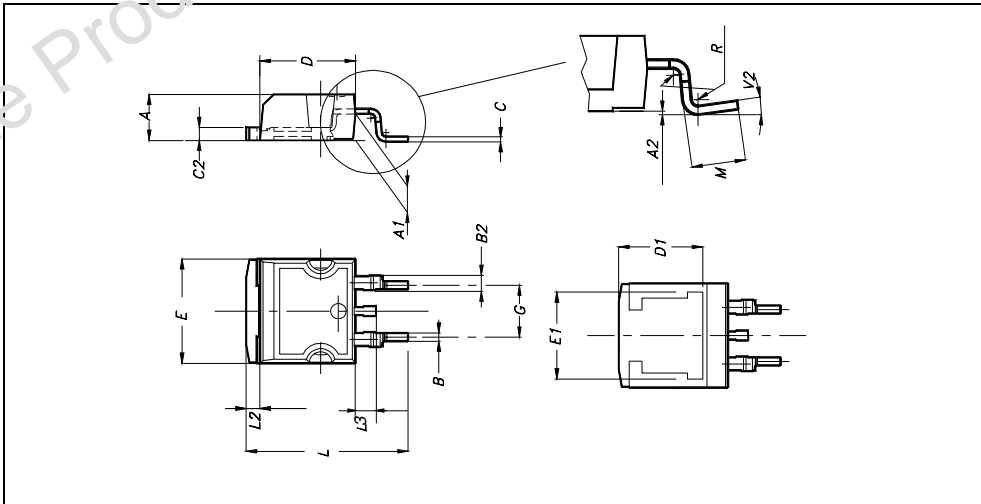
**TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA**

DIM.	mm.			inch		
	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		0.034
b1	1.14		1.70	0.044		0.066
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	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



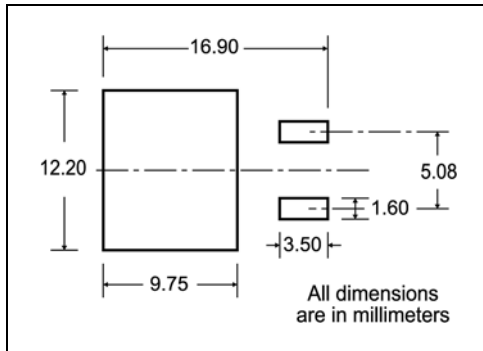
**D<sup>2</sup>PAK MECHANICAL DATA**

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		0.07
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°			



# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 25mm min. width

G measured at hub

TR

C

N

D

B

A

### 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.
AC	10.5	10.7	0.413	0.421
BC	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

10 pitches cumulative tolerance on tape +/- 0.2 mm

TOP COVER TAPE

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius

R min.

\* on sales type

## 6 Revision history

**Table 8. Revision history**

Date	Revision	Changes
25-Sep-2006	1	First release

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

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