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STB140NF55 - STB140NF55-1 STP140NF55

N-channel 55V - 0.0065Ω - 80A - D²PAK - I²PAK - TO-220
STripFET™ II Power MOSFET

General features

Type	V _{DSS}	R _{DS(on)}	I _D ⁽¹⁾
STB140NF55	55V	<0.008Ω	80A
STB140NF55-1	55V	<0.008Ω	80A
STP140NF55	55V	<0.008Ω	80A

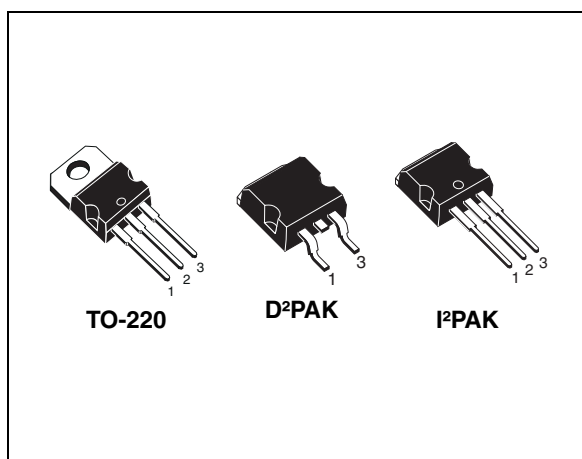
1. Current limited by package

Description

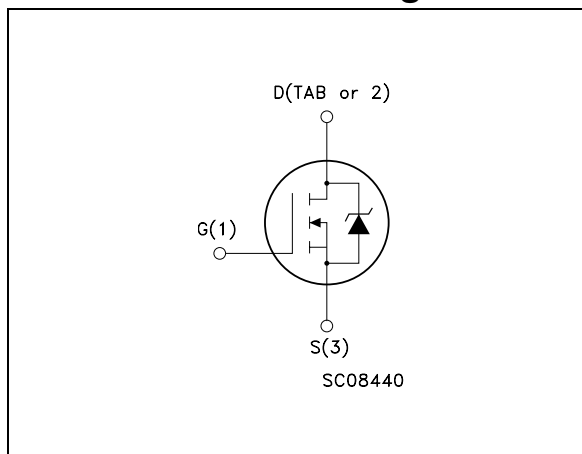
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

Applications

- Motor control
- High current, switching application



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STB140NF55	B140NF55	D ² PAK	Tape & reel
STB140NF55-1	B140NF55	I ² PAK	Tube
STP140NF55	P140NF55	TO-220	Tube

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STB140NF55 - STB140NF55-1 - STP140NF55

Electrical ratings

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	55	V
V_{GS}	Gate- source voltage	± 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	80	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	10	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	1.3	J
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Operating junction temperature		

1. Current limited by package
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80\text{A}$, $di/dt \leq 300\text{A}/\mu\text{s}$, $V_{DD} = 80\%V_{(BR)DSS}$
4. Starting $T_j = 25^\circ\text{C}$, $I_D = 40\text{A}$, $V_{DD} = 30\text{V}$

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		TO-220 - I ² PAK	D ² PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.5		$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	--	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	--	35	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose (for 10 sec, 1.6mm from case)	300		$^\circ\text{C}$

1. When mounted on 1 inch², FR4 board, 2 oz Cu

Electrical characteristics

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2 Electrical characteristics

(T_{CASE}=25°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 = 250 μA, V _{GS} = 0	55			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} = ±20V			±100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250μA	2	3	4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 40 A		0.0065	0.008	Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g _{fs} ⁽¹⁾	Forward transconductance	V _{DS} = 15V, I _D = 40 A		100		S
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 25V, f = 1 MHz V _{GS} = 0		5300 1000 290		pF pF pF
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 44V, I _D = 80A V _{GS} = 10V (see Figure 14)		142 27 55		nC nC nC

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

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Electrical characteristics

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 27.5\text{ V}$, $I_D = 40\text{ A}$		30		ns
t_r	Rise time	$R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13)		150		ns
$t_{d(off)}$	Turn-off-delay time	$V_{DD} = 27.5\text{ V}$, $I_D = 40\text{ A}$,		125		ns
t_f	Fall time	$R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see Figure 13)		45		ns

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 80\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$,		90		ns
Q_{rr}	Reverse recovery charge	$V_{DD} = 20\text{ V}$, $T_j = 150^\circ\text{C}$		275		nC
I_{RRM}	Reverse recovery current	(see Figure 15)		6.5		A

1. Pulse width limited safe operating area

2. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Electrical characteristics

STB140NF55 - STB140NF55-1 - STP140NF55

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

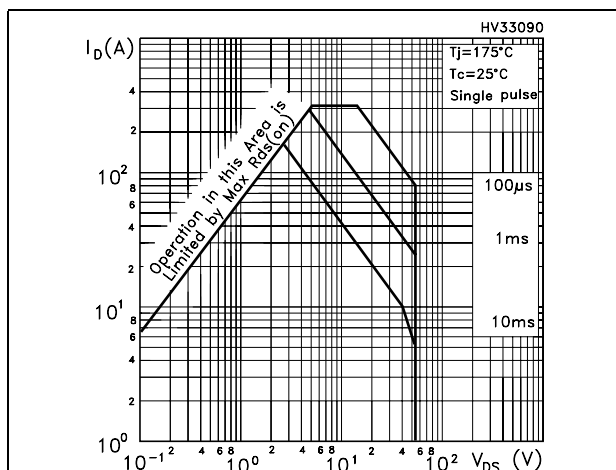


Figure 2. Thermal impedance

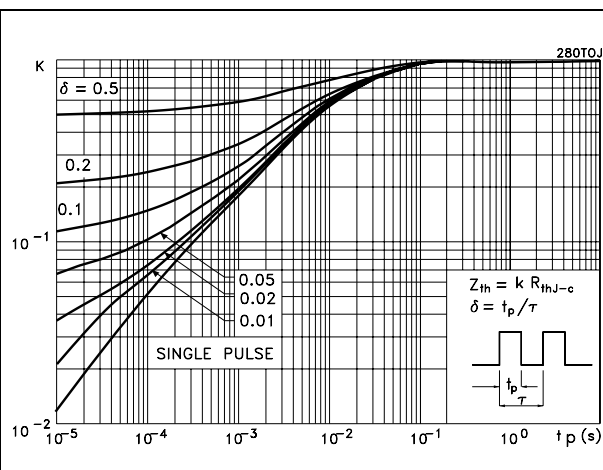


Figure 3. Output characteristics

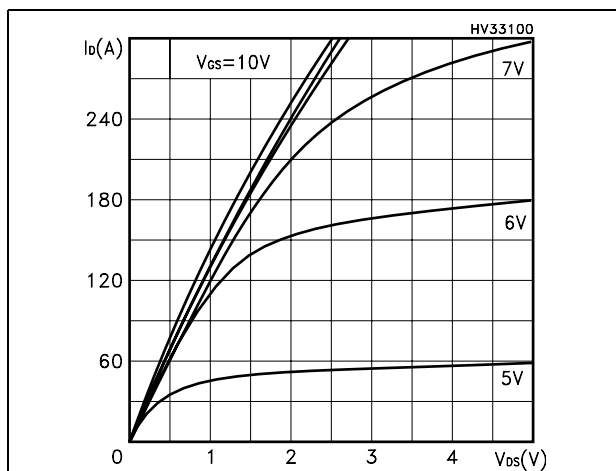


Figure 4. Transfer characteristics

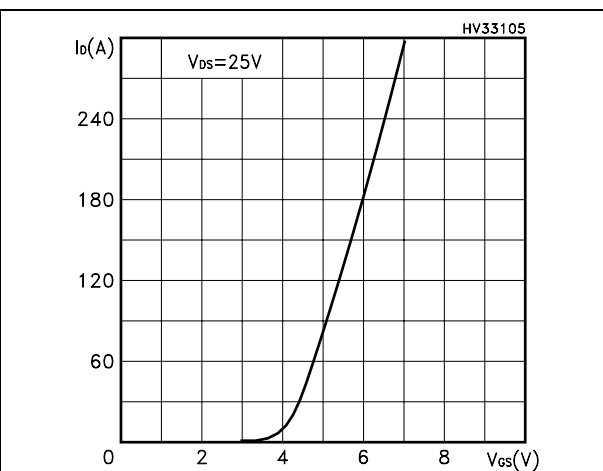


Figure 5. Transconductance

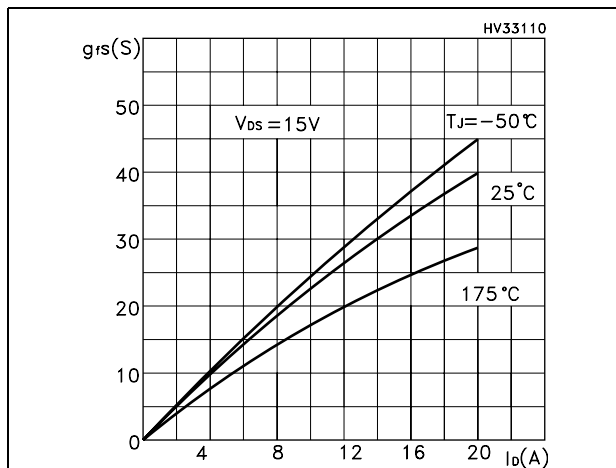
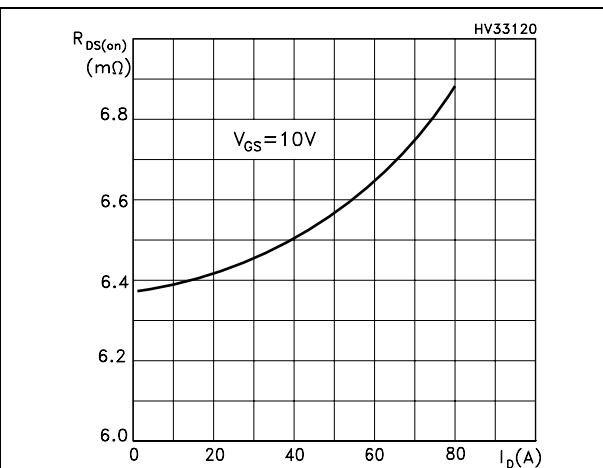


Figure 6. Static drain-source on resistance



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Electrical characteristics

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

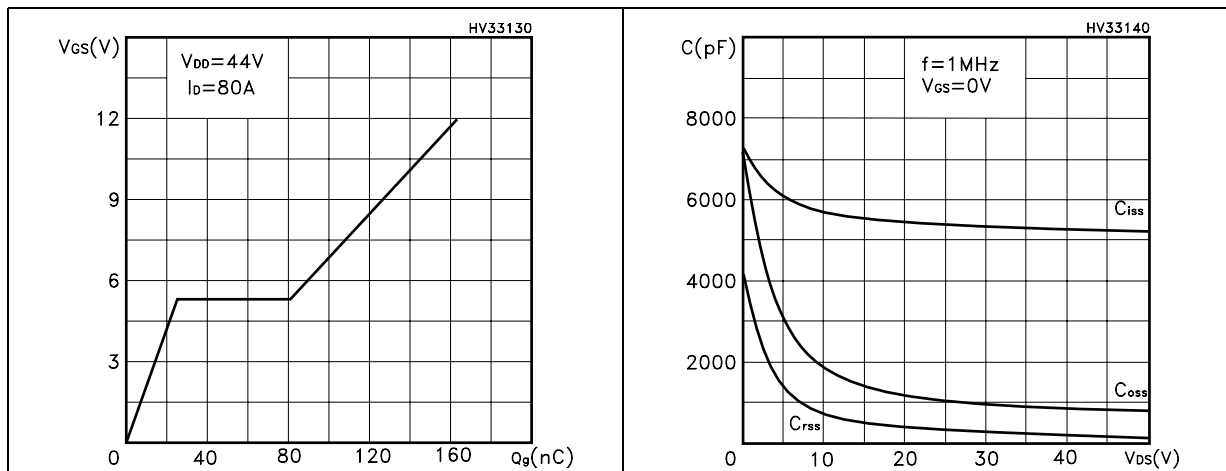


Figure 9. Normalized gate threshold voltage vs temperature

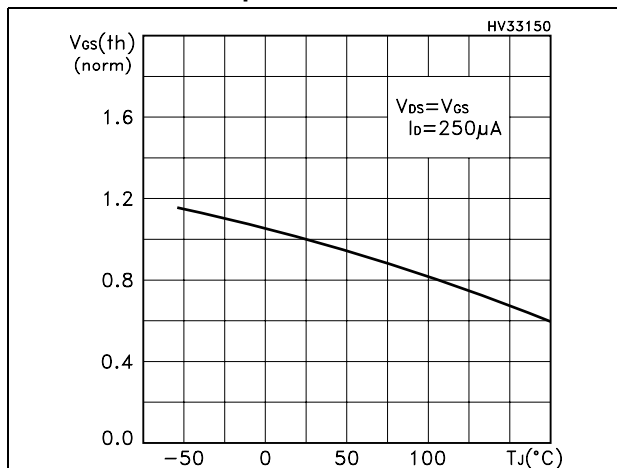


Figure 10. Normalized on resistance vs temperature

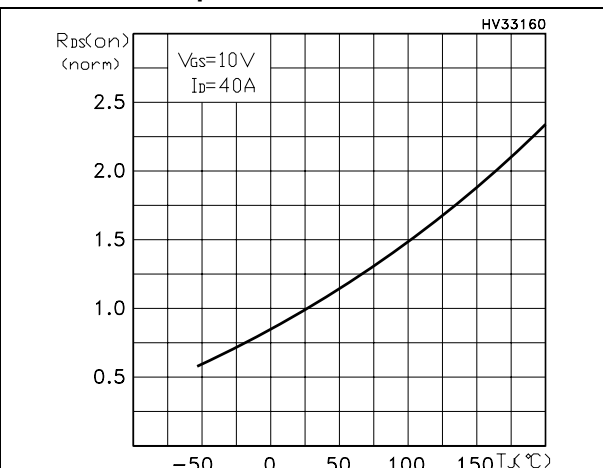


Figure 11. Source-drain diode forward characteristics

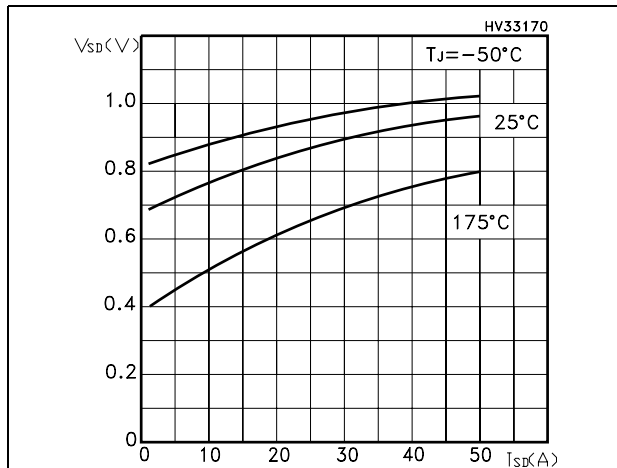
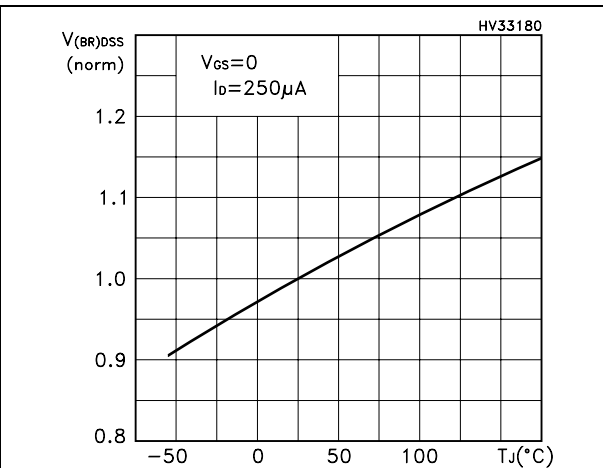


Figure 12. Normalized $B_{V_{DS}}$ vs temperature



Test circuit

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3 Test circuit

Figure 13. Switching times test circuit for resistive load

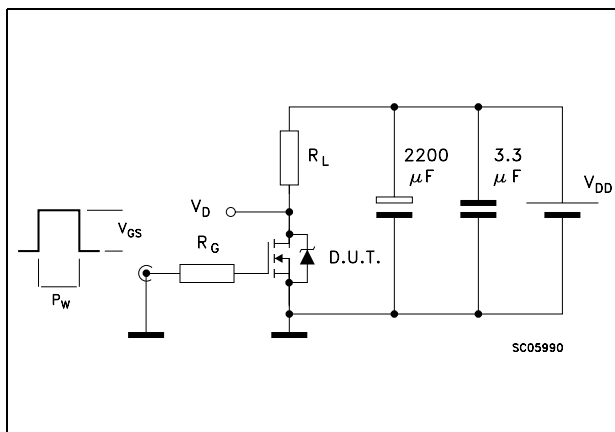


Figure 14. Gate charge test circuit

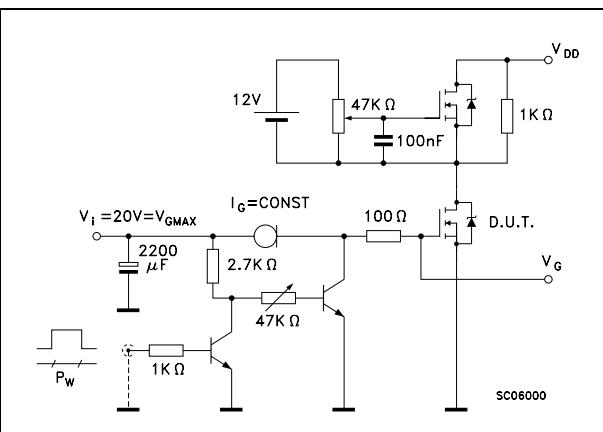


Figure 15. Test circuit for inductive load switching and diode recovery times

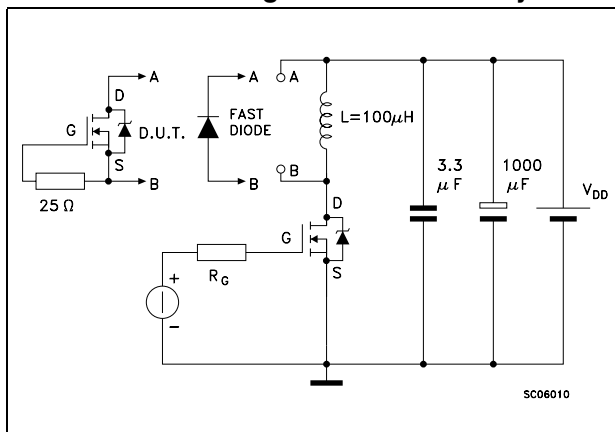


Figure 16. Unclamped inductive load test circuit

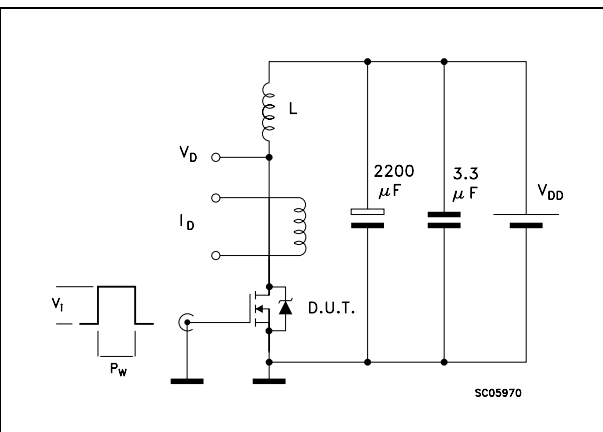


Figure 17. Unclamped inductive waveform

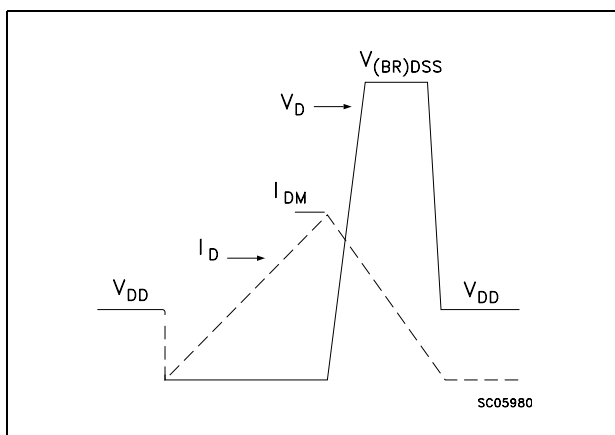
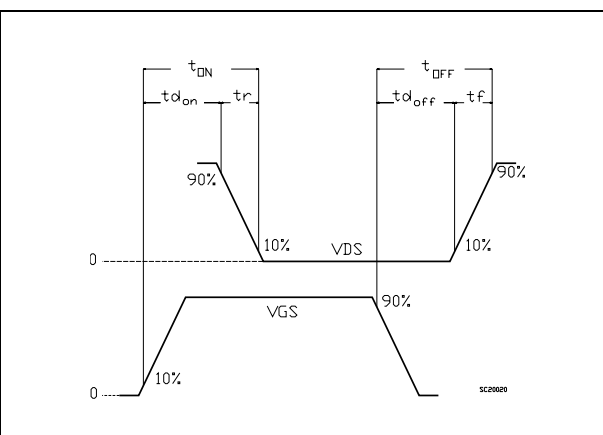


Figure 18. Switching time waveform



4 Package mechanical data

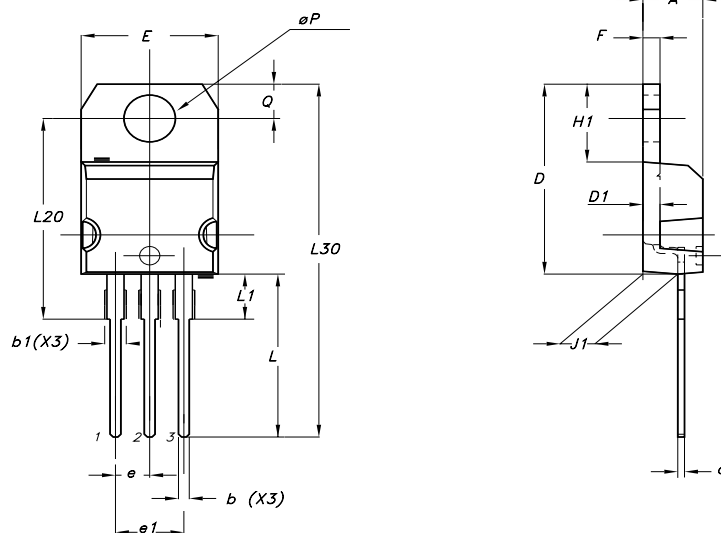
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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

Package mechanical data

STB140NF55 - STB140NF55-1 - STP140NF55

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	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
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		0.051
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	
θP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



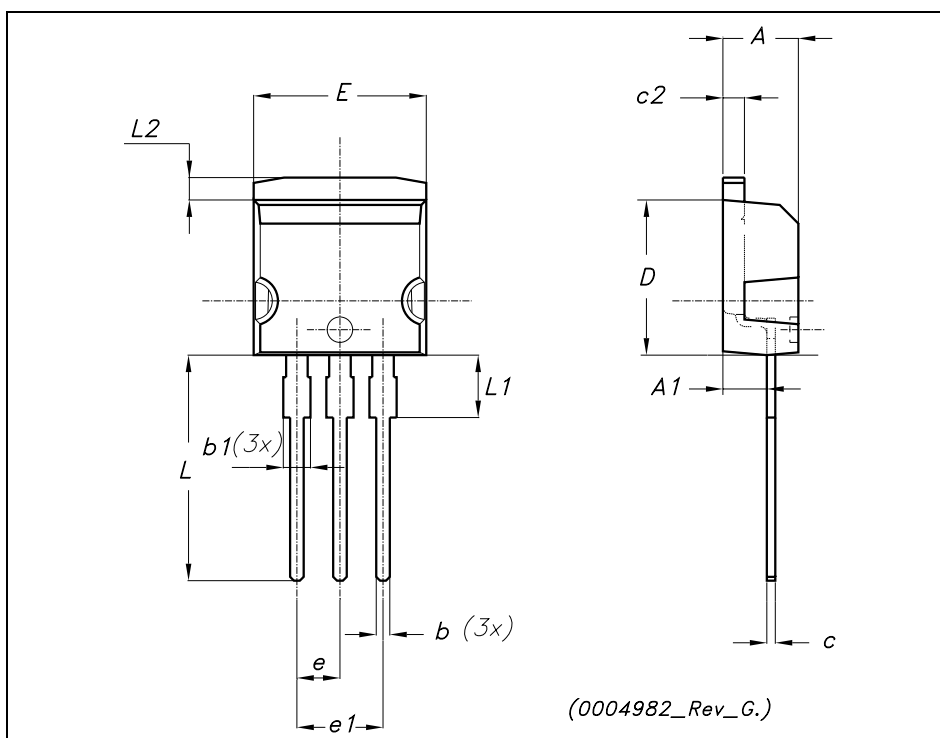
POA 0015988_P

STB140NF55 - STB140NF55-1 - STP140NF55

Package mechanical data

TO-262 (I²PAK) 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

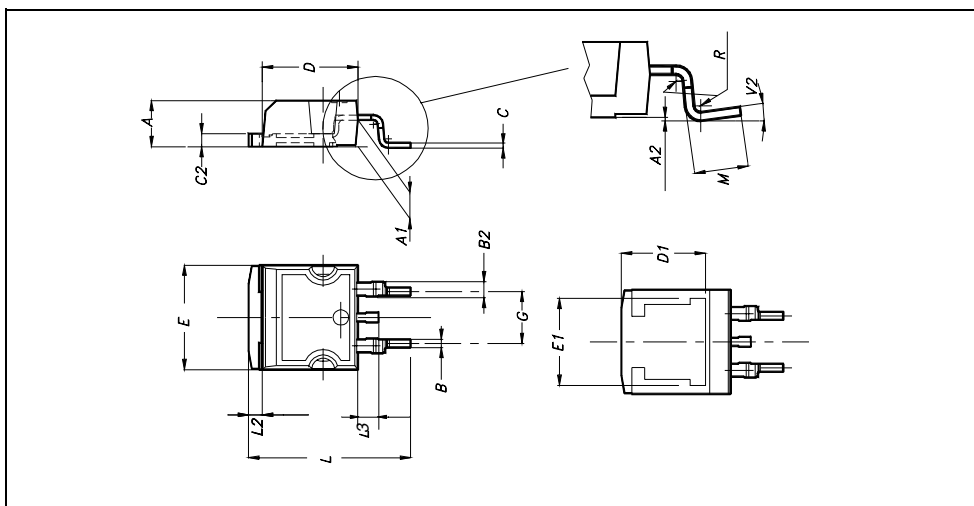


Package mechanical data

STB140NF55 - STB140NF55-1 - STP140NF55

D²PAK 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	0°		4°			

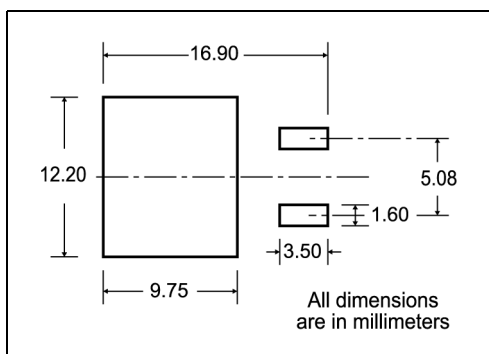


STB140NF55 - STB140NF55-1 - STP140NF55

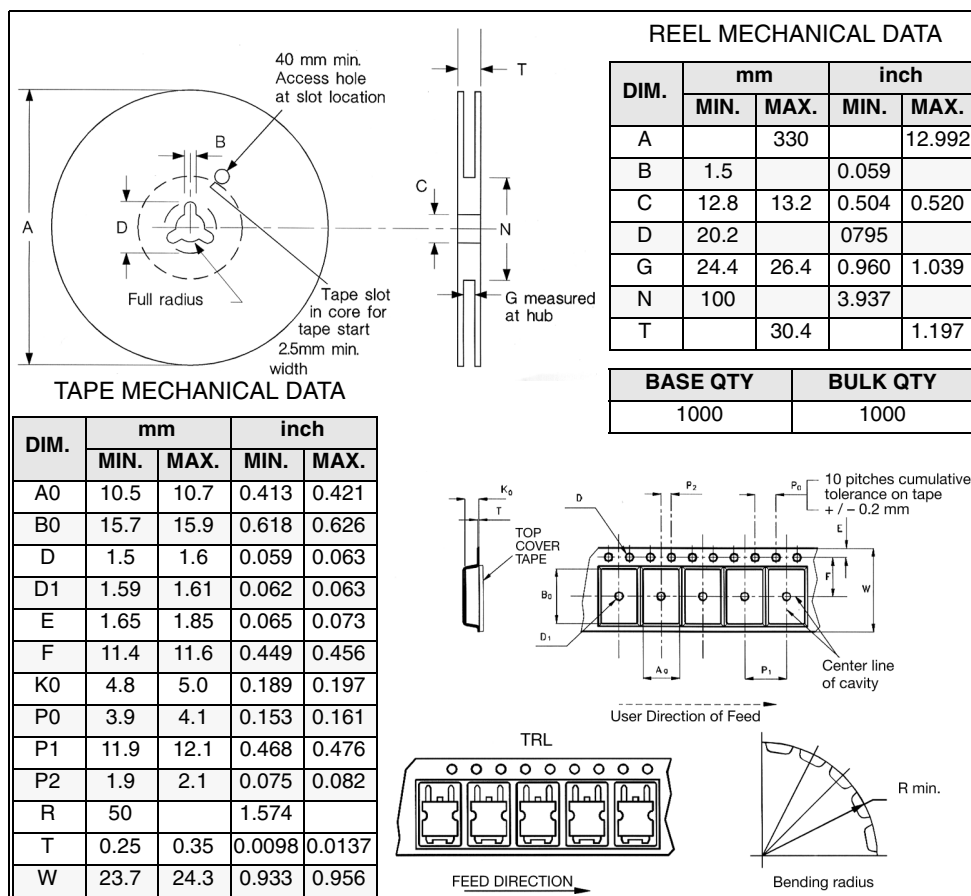
Packaging mechanical data

5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* on sales type

Revision history

STB140NF55 - STB140NF55-1 - STP140NF55

6 Revision history

Table 7. Revision history

Date	Revision	Changes
07-Dec-2004	1	Initial release.
07-Apr-2006	2	Updated Figure 8
04-Aug-2006	3	New template, modified Figure 1
02-Mar-2007	4	Applications have been updated

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