



# THE DATASHEET OF STD55N4F5





# STD55N4F5

N-channel 40 V, 7.3 m $\Omega$ , 40 A, DPAK  
STripFET™ V Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>	P <sub>w</sub>
STD55N4F5	40 V	< 8.5 m $\Omega$	55 A	60 W

- Standard threshold drive
- 100% avalanche tested
- Surface mounting DPAK (TO-252)

## Applications

- Switching applications
  - Automotive

## Description

The STD55N4F5 is a N-channel STripFET™ V. This Power MOSFET technology is among the latest improvements, which have been especially tailored to achieve very low on-state resistance providing also one of the best-in-class figure of merit (FOM).

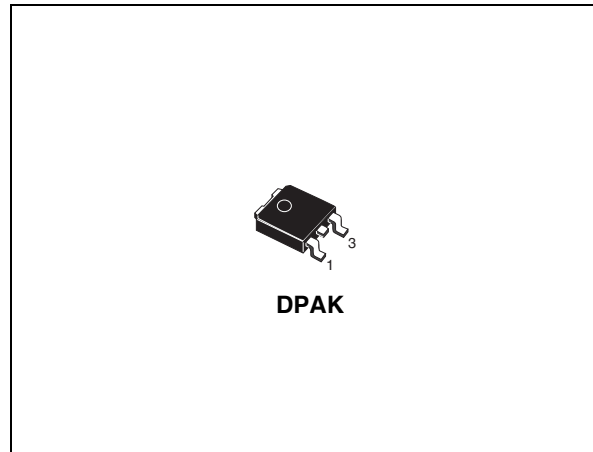


Figure 1. Internal schematic diagram

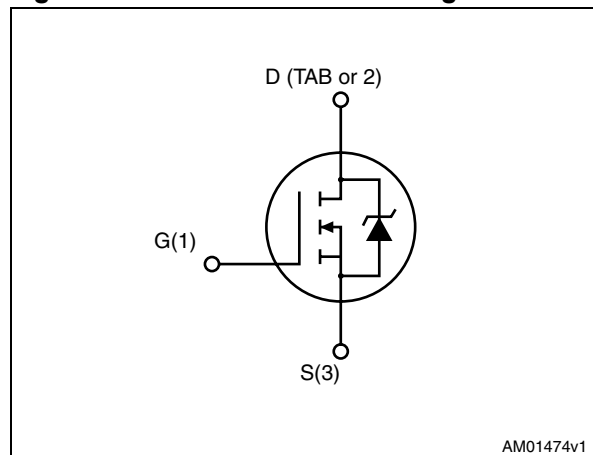


Table 1. Device summary

Order code	Marking	Package	Packaging
STD55N4F5	55N4F5	DPAK	Tape and reel

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS}=0$ )	40	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	55	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	39	A
$I_{DM}^{(2)}$	Drain current (pulsed)	220	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	60	W
	Derating factor	0.4	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	100	mJ
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	- 55 to 175	$^\circ\text{C}$

1. Current limited by package
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 55\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{jmax}$
4. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 27.5\text{ A}$ ,  $V_{DD} = 25\text{ V}$

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.5	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$

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

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$  unless otherwise specified)

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\ \mu A, V_{GS} = 0$	40			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating},$ $V_{DS} = \text{Max rating}, T_c = 125\text{ °C}$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}, I_D = 27.5\text{ A}$		7.3	8.5	m $\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0$	-	1600	-	pF
$C_{oss}$	Output capacitance			230		pF
$C_{riss}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{DD} = 20\text{ V}, I_D = 27.5\text{ A}$	-	25	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$		7		nC
$Q_{gd}$	Gate-drain charge	<a href="#">Figure 14</a>		6		nC

**Table 6. Switching on/off (resistive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD}=20\text{ V}$ , $I_D=27.5\text{ A}$ , $R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$ <i>Figure 16</i>	-	15 15	-	ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD}=20\text{ V}$ , $I_D=27.5\text{ A}$ , $R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$ <i>Figure 16</i>	-	25 6	-	ns ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		55	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		220	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=55\text{ A}$ , $V_{GS}=0$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD}=55\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 32\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$ <i>Figure 15</i>	-	40		ns
$Q_{rr}$	Reverse recovery charge		-	55		nC
$I_{RRM}$	Reverse recovery current		-	3		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

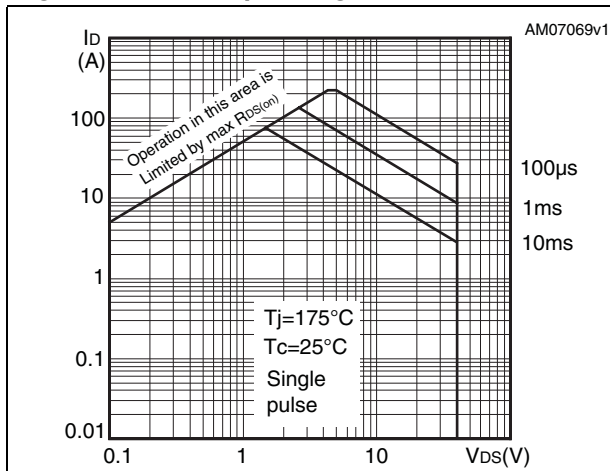


Figure 3. Thermal impedance

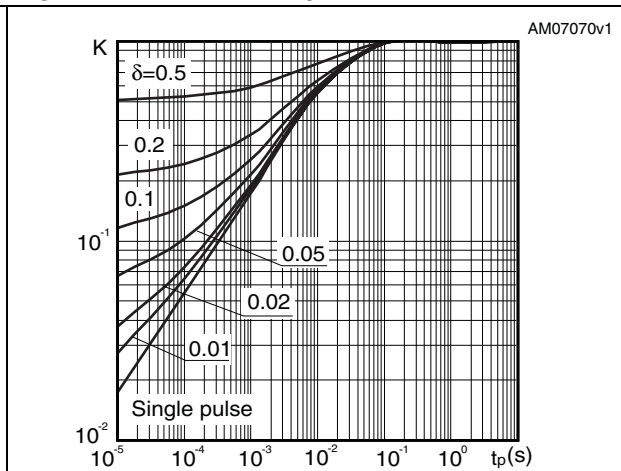


Figure 4. Output characteristics

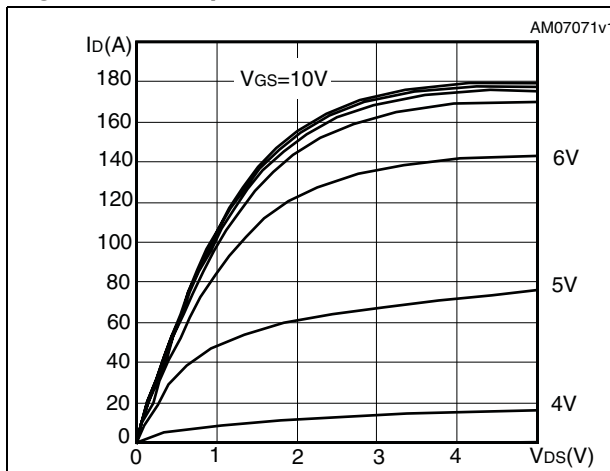


Figure 5. Transfer characteristics

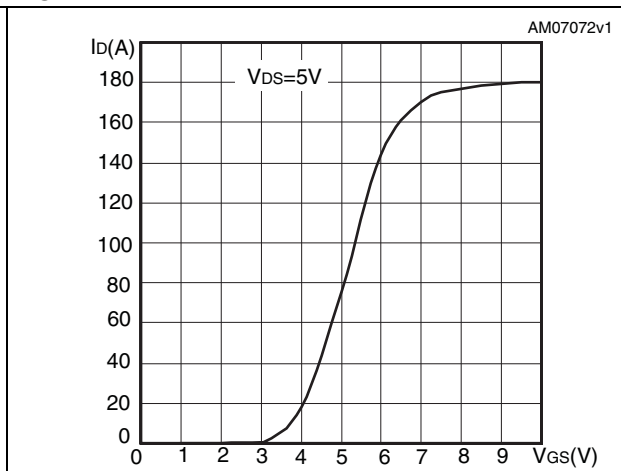


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

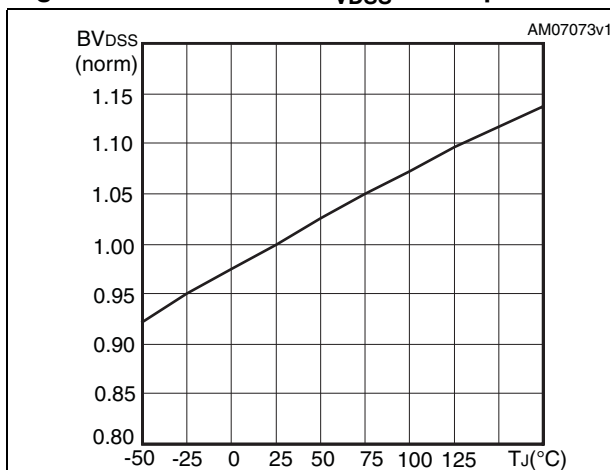


Figure 7. Static drain-source on resistance

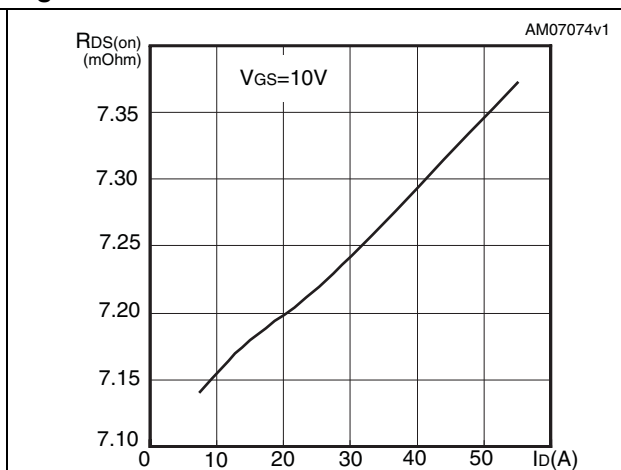


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

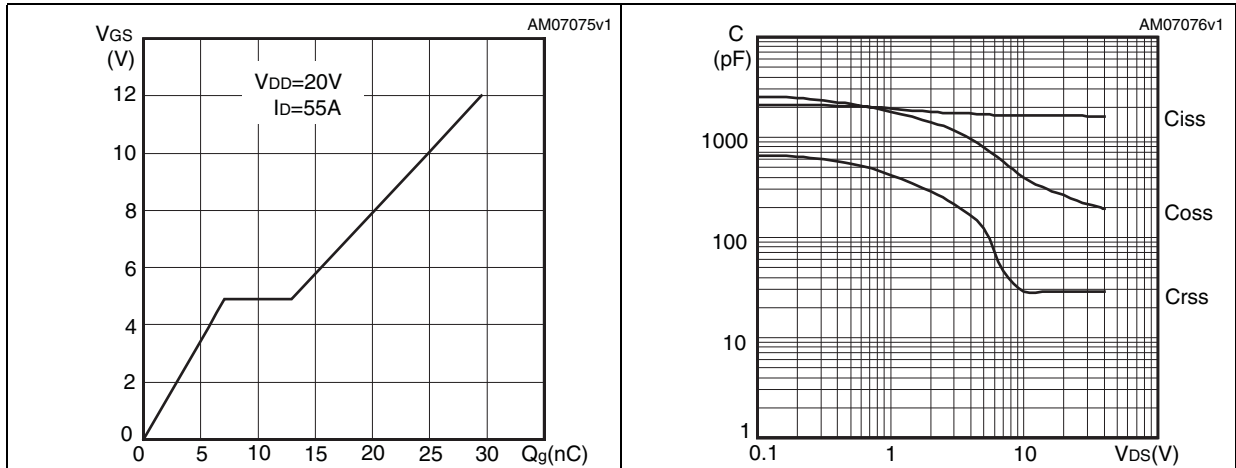


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

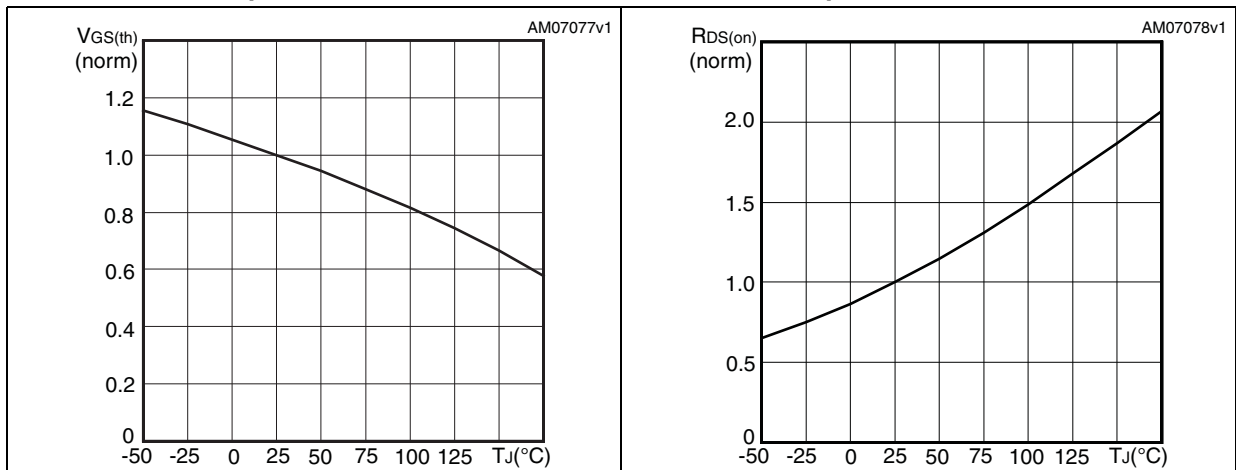
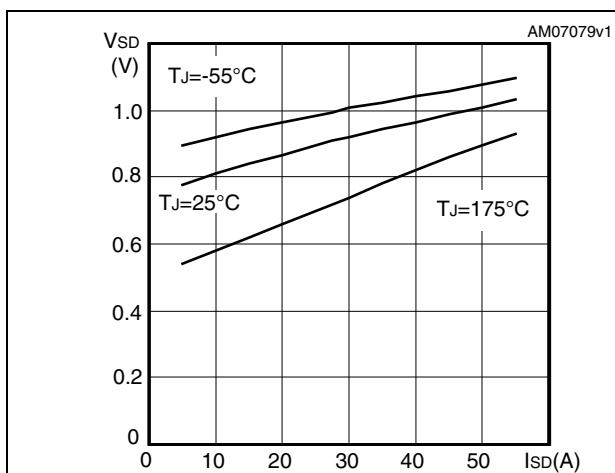
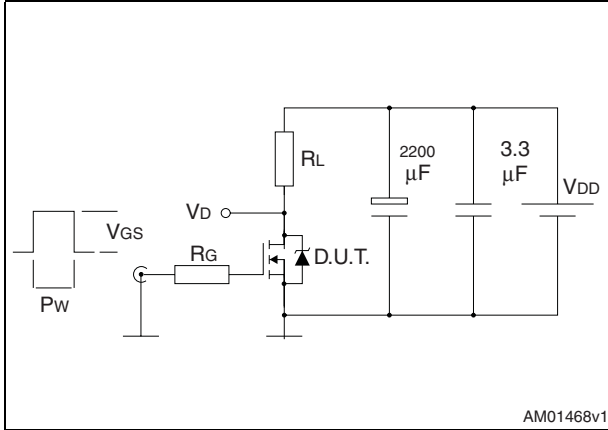


Figure 12. Source-drain diode forward characteristics



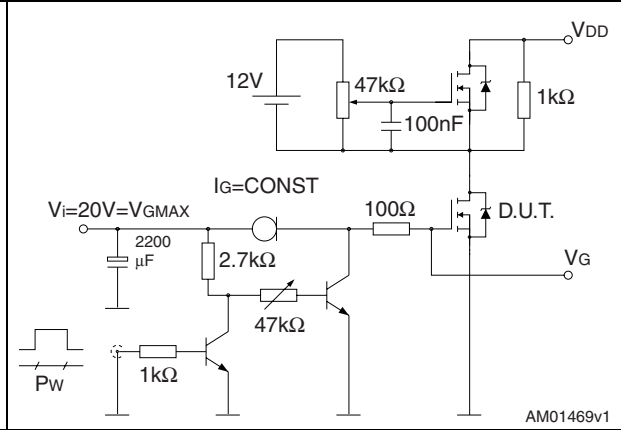
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



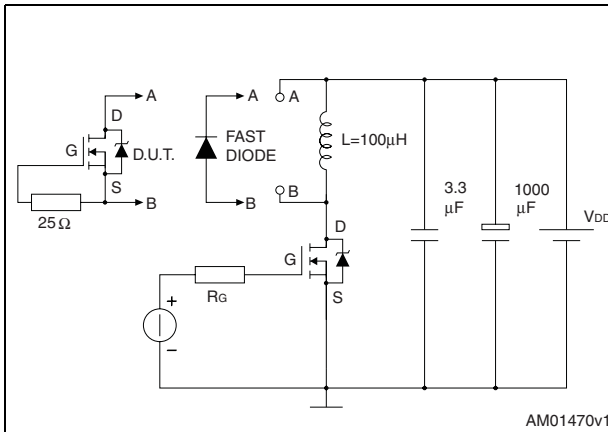
AM01468v1

**Figure 14. Gate charge test circuit**



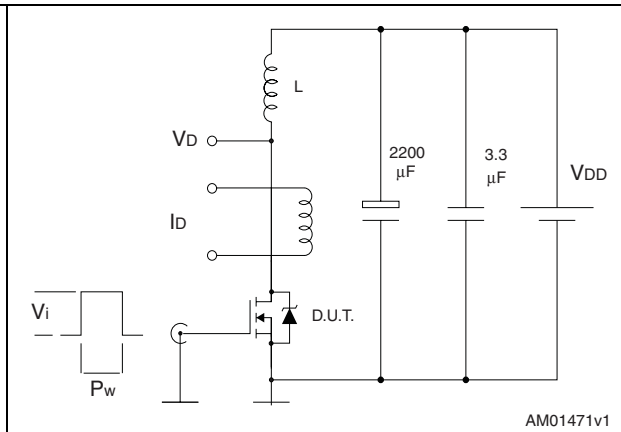
AM01469v1

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



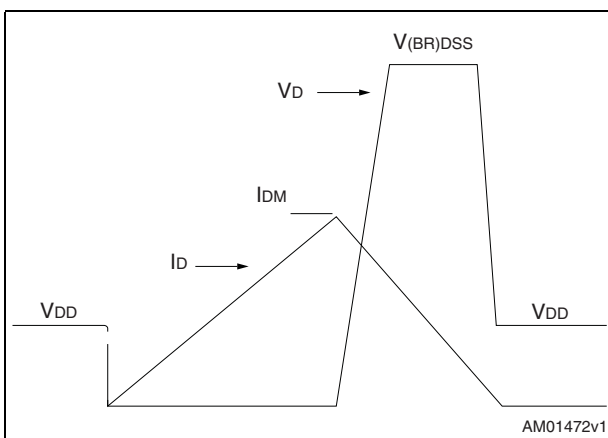
AM01470v1

**Figure 16. Unclamped inductive load test circuit**



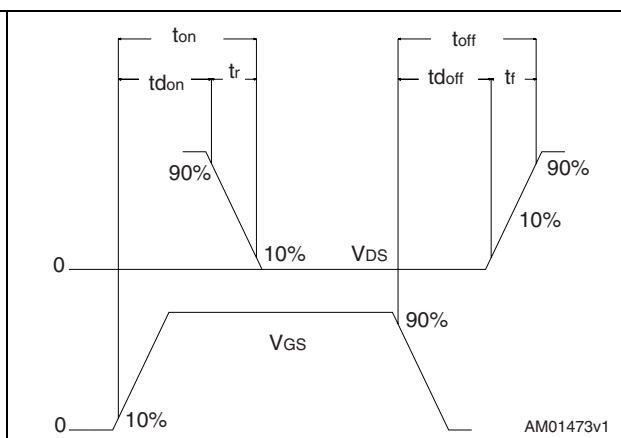
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



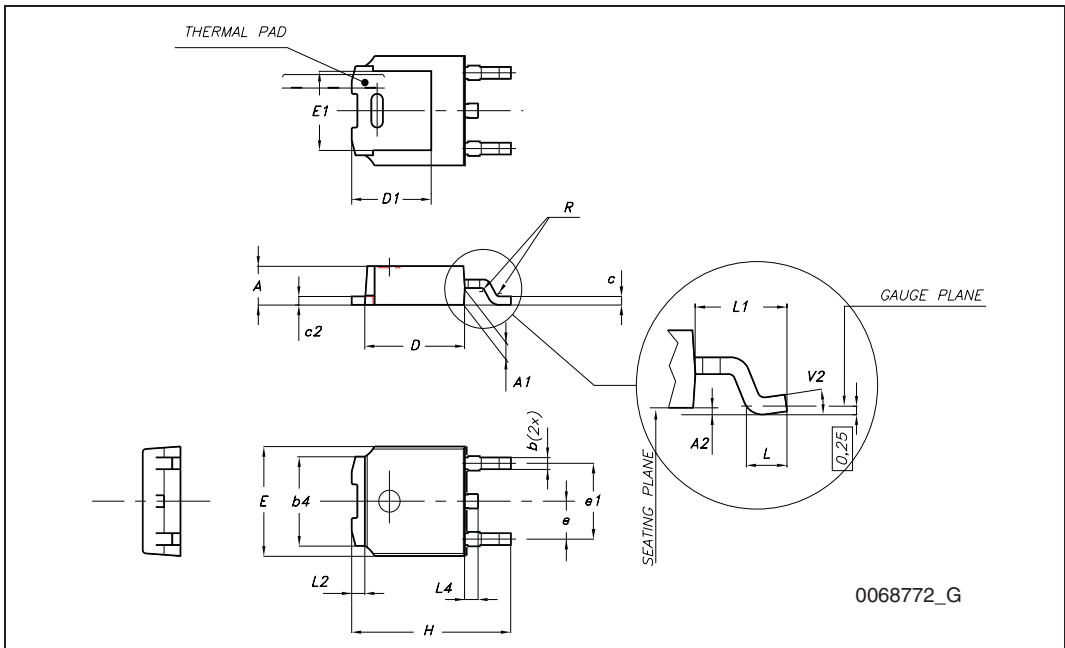
AM01473v1

## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

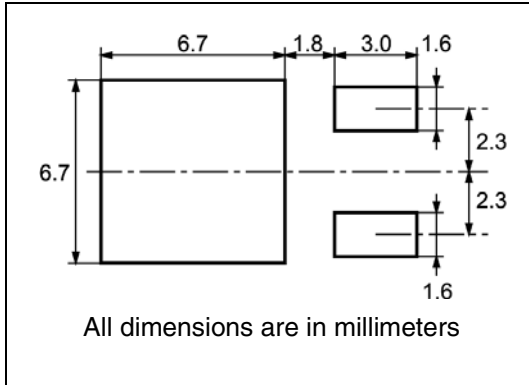
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	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

G measured at hub

### 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

### 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

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

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

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
06-May-2009	1	First release
10-Jul-2009	2	– Document status promoted from target specification to preliminary data – $R_{DS(on)}$ max value changed
22-Jun-2010	3	Document status promoted from preliminary data to datasheet

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