



# STD40NF10

N-channel 100 V, 0.025  $\Omega$ , 50 A DPAK  
low gate charge STripFET™ II Power MOSFET

## Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>
STD40NF10	100 V	< 0.028 $\Omega$	50 A

- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested

## Application

Switching applications

## Description

This N-channel 100 V 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 allowing remarkable manufacturing reproducibility.

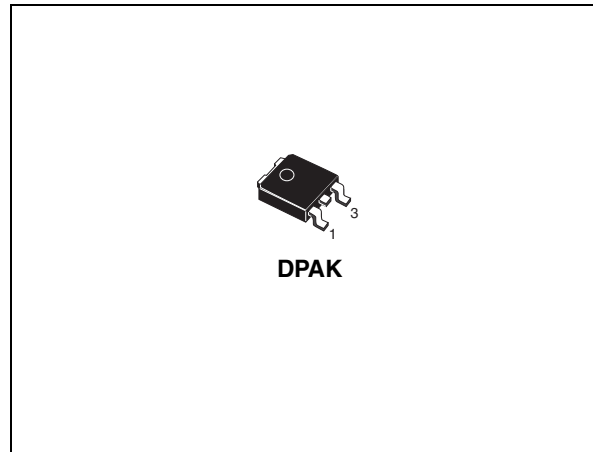


Figure 1. Internal schematic diagram

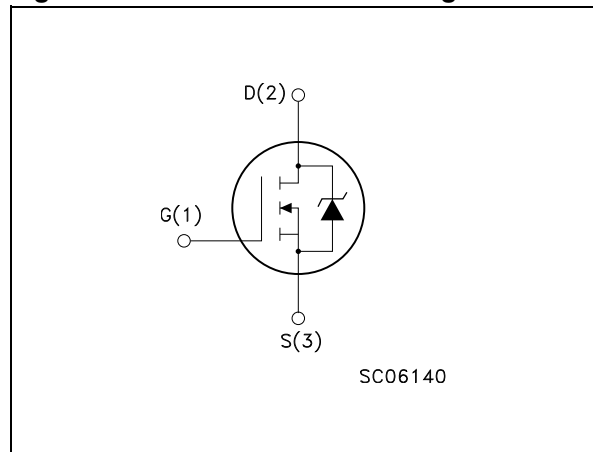


Table 1. Device summary

Order code	Marking	Package	Packaging
STD40NF10	D40NF10	DPAK	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $v_{GS} = 0$ )	100	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	50	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	35	A
$I_{DM}^{(2)}$	Drain current (pulsed)	200	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	125	W
	Derating factor	0.83	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	27	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	385	mJ
$T_{stg}$	Storage temperature	- 55 to 175	$^\circ\text{C}$
$T_j$	Max. operating junction temperature		

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 50\text{ A}$ ,  $di/dt \leq 600\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$ .
4. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 50\text{ A}$ ,  $V_{DD} = 25\text{ V}$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.2	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified)

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	100			V
I <sub>DSS</sub>	Zero gate voltage Drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating V <sub>DS</sub> =Max rating, T <sub>C</sub> =125°C			1 10	μA μA
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±20V			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2	3	4	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 25 A		0.025	0.028	Ω

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> <sup>(1)</sup>	Forward transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 28 A		22		S
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0		2180		pF
C <sub>oss</sub>	Output capacitance			298		pF
C <sub>rss</sub>	Reverse transfer capacitance			83.7		pF
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 50 V, I <sub>D</sub> = 40 A, V <sub>GS</sub> = 10 V <i>(see Figure 15)</i>		46.5	62	nC
Q <sub>gs</sub>	Gate-source charge			13.3		nC
Q <sub>gd</sub>	Gate-drain charge			17.5	22.5	nC

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

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on delay time	V <sub>DD</sub> = 50 V, I <sub>D</sub> = 25 A R <sub>G</sub> = 4.7 Ω V <sub>GS</sub> = 10 V <i>(see Figure 14)</i>		21		ns
t <sub>r</sub>	Rise time			46		ns
t <sub>d(off)</sub>	Turn-off-delay time				54	
t <sub>f</sub>	Fall time			13		ns

Table 7. 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	$I_{SD} = 50 \text{ A}$ , $V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 50 \text{ A}$ , $V_{DD} = 25 \text{ V}$ $di/dt = 100 \text{ A}/\mu\text{s}$ , $T_j = 150 \text{ }^\circ\text{C}$ <i>(see Figure 16)</i>		80		ns
$Q_{rr}$	Reverse recovery charge			250		nC
$I_{RRM}$	Reverse recovery current			6.4		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

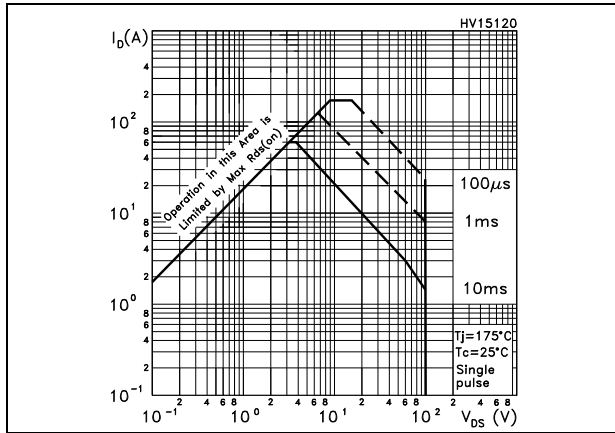


Figure 3. Thermal impedance

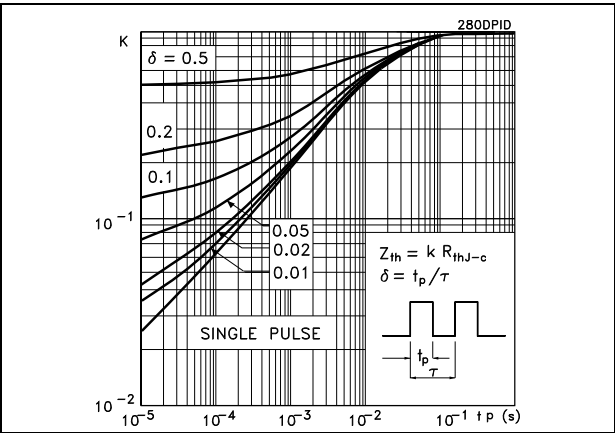


Figure 4. Output characteristics

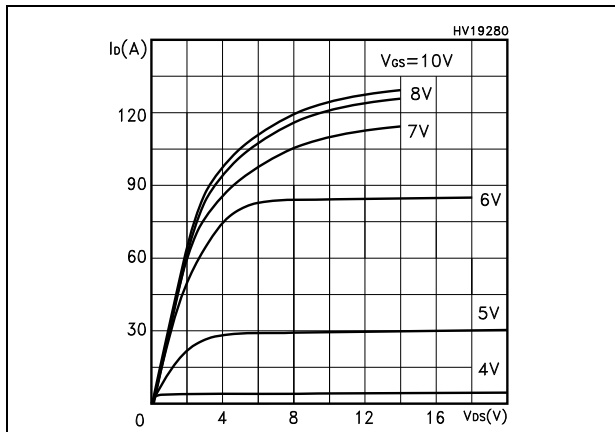


Figure 5. Transfer characteristics

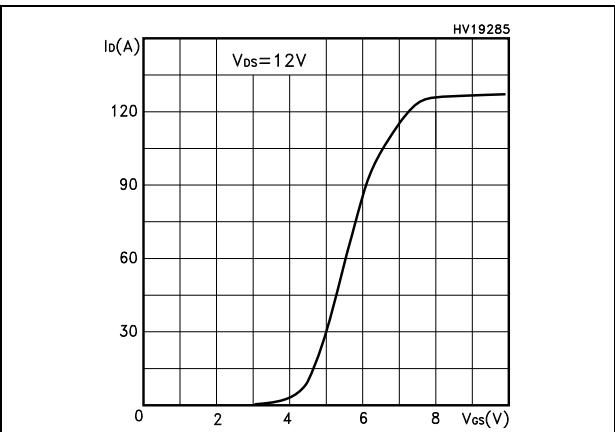


Figure 6. Transconductance

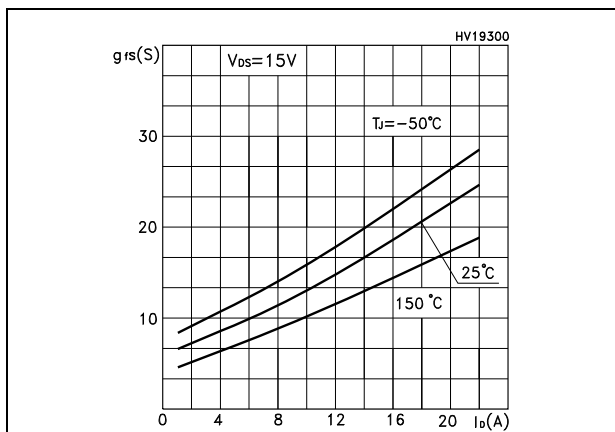


Figure 7. Static drain-source on resistance

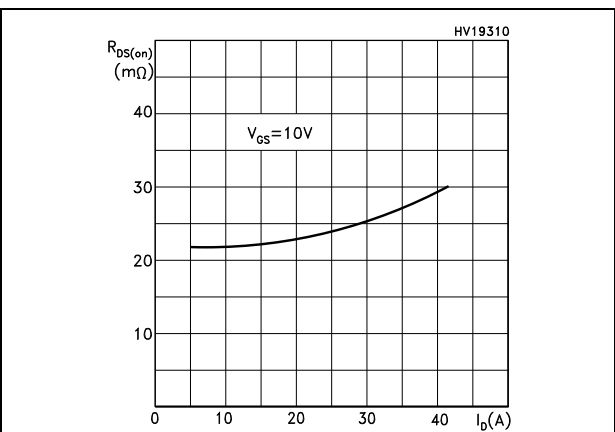


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

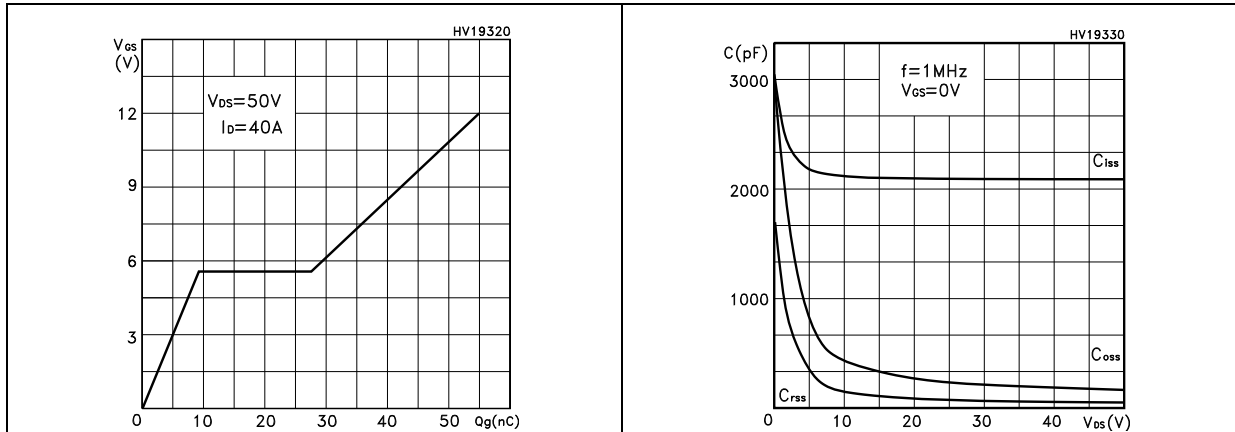


Figure 10. Normalized gate threshold voltage vs. temperature

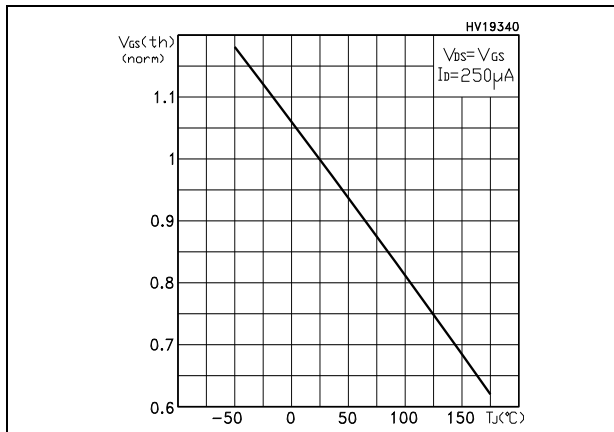


Figure 11. Normalized on resistance vs. temperature

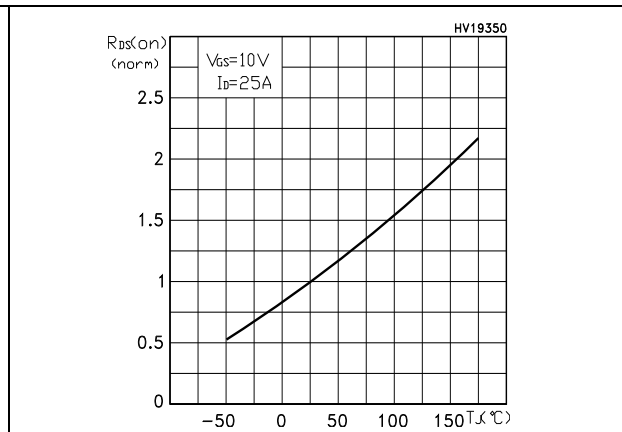


Figure 12. Source-drain diode forward characteristics

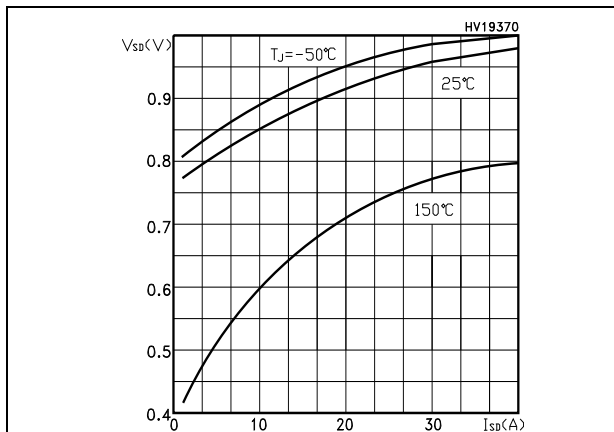
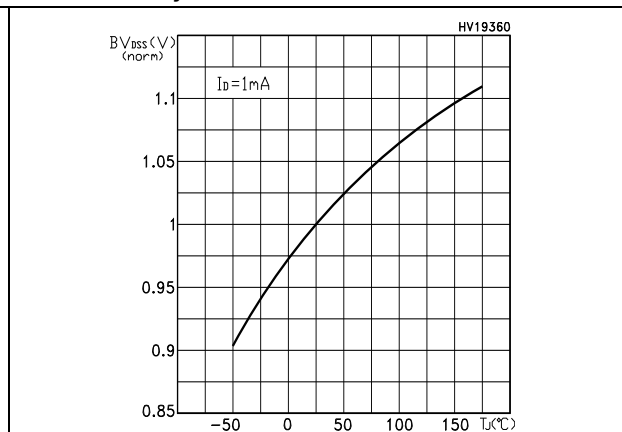
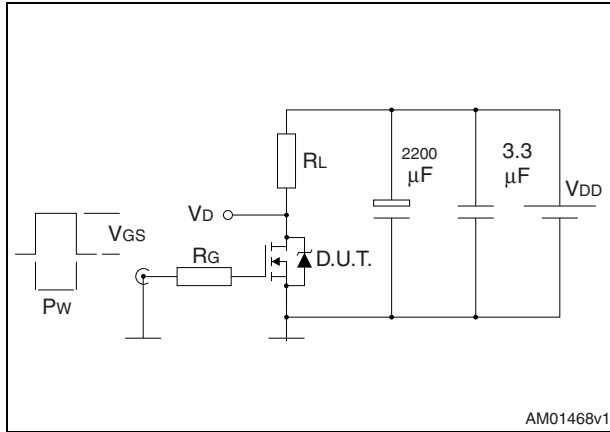


Figure 13. Normalized breakdown voltage vs.  $t_j$



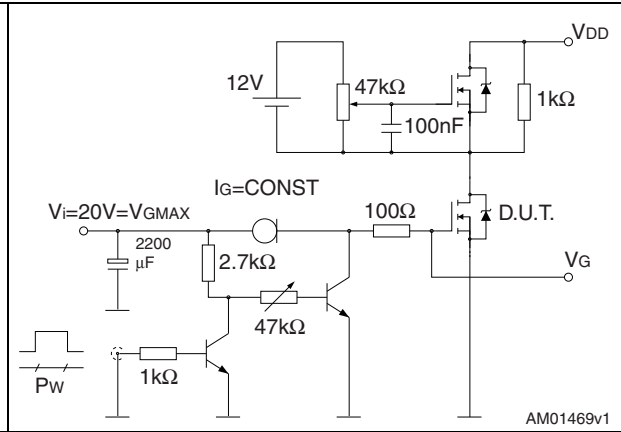
### 3 Test circuit

**Figure 14. Switching times test circuit for resistive load**



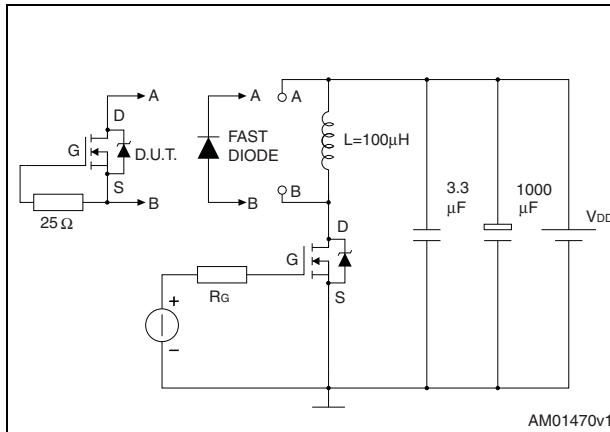
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**Figure 15. Gate charge test circuit**



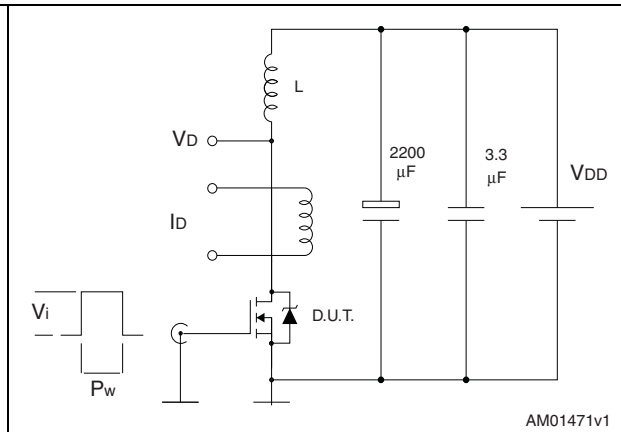
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**Figure 16. Test circuit for inductive load switching and diode recovery times**



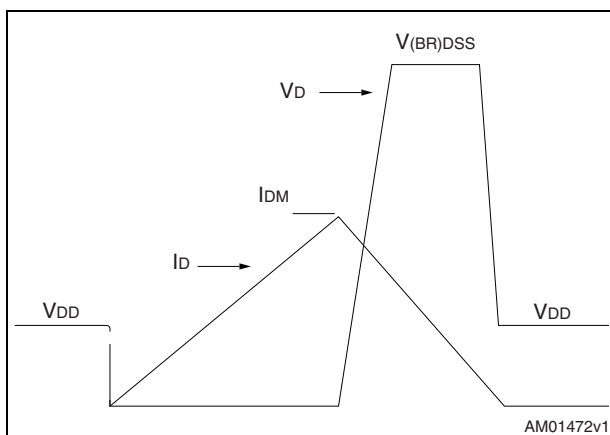
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**Figure 17. Unclamped Inductive load test circuit**



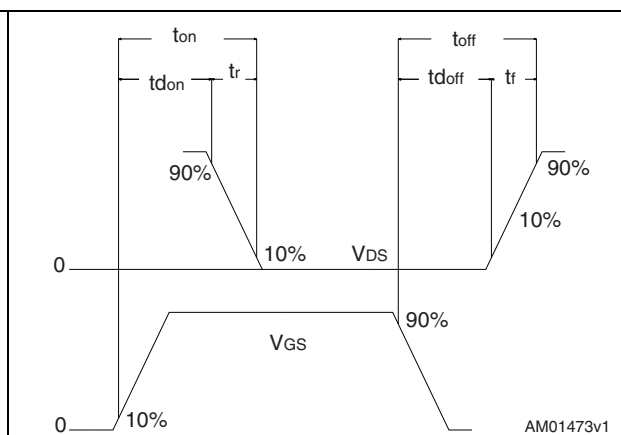
AM01471v1

**Figure 18. Unclamped inductive waveform**



AM01472v1

**Figure 19. Switching time waveform**



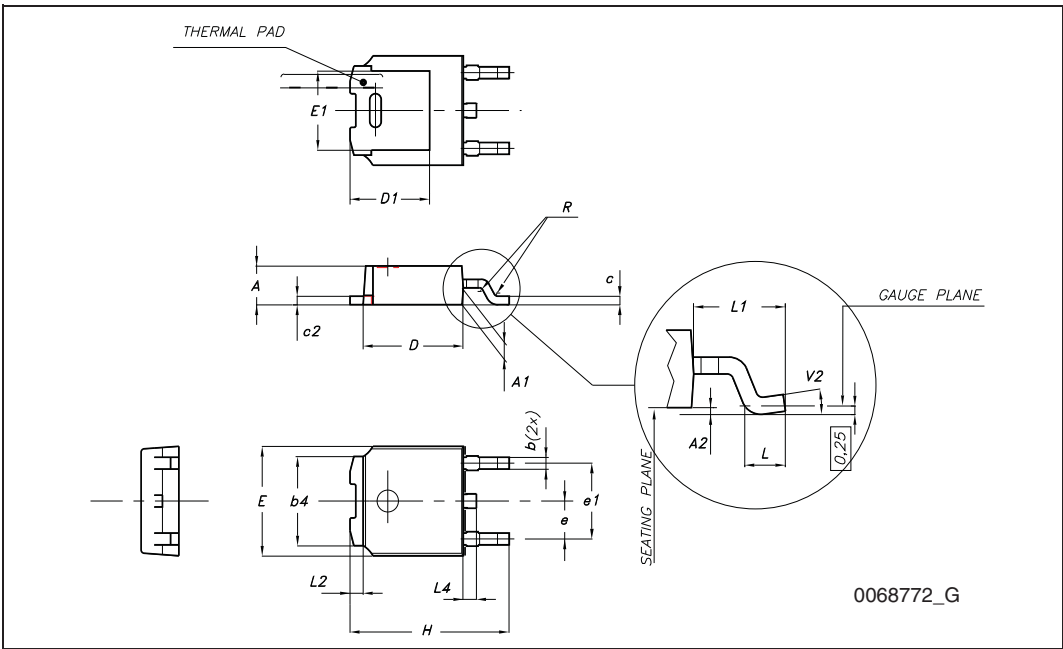
AM01473v1

## 4 Package mechanical data

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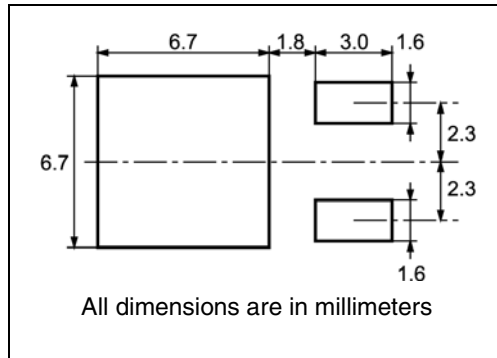
TO-252 (DPAK) mechanical data

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

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	

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

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
19-Nov-2010	1	First issue.

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