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STD86N3LH5

N-channel 30 V, 0.0045 Ω , 80 A, DPAK
STripFET™ V Power MOSFET

Features

Order code	V _{DSS}	R _{DS(on)} max	I _D
STD86N3LH5	30 V	< 0.005 Ω	80 A

- R_{DS(on)} * Q_G industry benchmark
- Extremely low on-resistance R_{DS(on)}
- High avalanche ruggedness
- Low gate drive power losses

Application

- Switching applications
 - Automotive

Description

This product utilizes the 5th generation of design rules of ST's proprietary STripFET™ technology. The lowest available R_{DS(on)}*Q_G, in the standard packages, makes this device suitable for the most demanding DC-DC converter applications, where high power density is to be achieved.

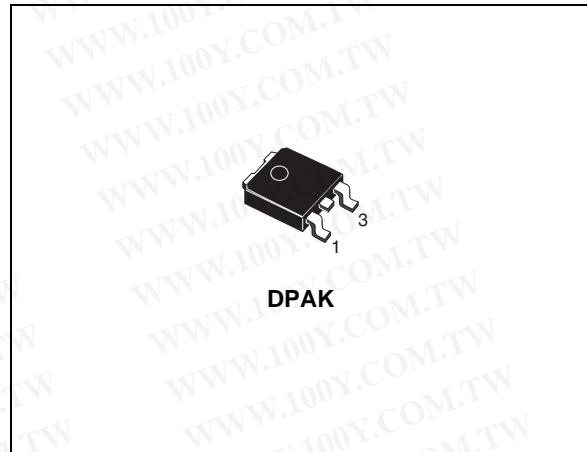


Figure 1. Internal schematic diagram

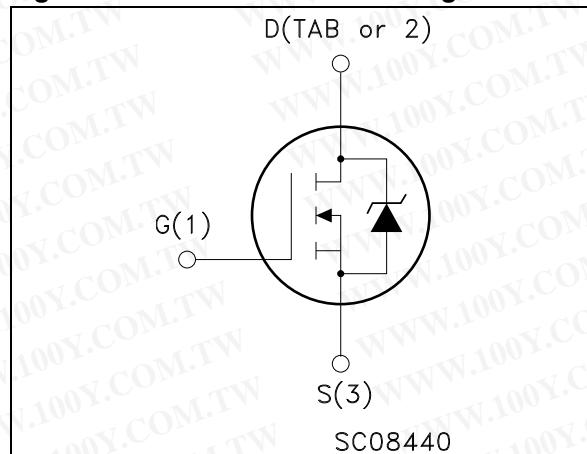


Table 1. Device summary

Order code	Marking	Package	Packaging
STD86N3LH5	86N3LH5	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 ($V_{GS} = 0$)	30	V
V_{DS}	Drain-source voltage ($V_{GS} = 0$) @ T_{JMAX}	35	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	Drain current (continuous) at $T_C = 100^\circ\text{C}$	55	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	70	W
	Derating factor	0.47	W/ $^\circ\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	165	mJ
T_{stg}	Storage temperature	-55 to 175	$^\circ\text{C}$
T_j	Max. operating junction temperature	175	$^\circ\text{C}$

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting $T_j = 25^\circ\text{C}$, $I_D = 40 \text{ A}$, $V_{DD} = 25 \text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.14	$^\circ\text{C/W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb max	50	$^\circ\text{C/W}$

1. When mounted on 1 inch² FR-4 Oz Cu board

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0$	30	-	-	V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 20 V$ $V_{DS} = 20 V, T_c = 125^\circ C$	-	-	10	μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 V$	-	-	± 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	$V_{GS} = 10 V, I_D = 40 A$	-	0.0045	0.005	Ω
		$V_{GS} = 5 V, I_D = 40 A$	-	0.0055	0.0065	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance			1850		pF
C_{oss}	Output capacitance	$V_{DS} = 25 V, f=1 MHz$	-	380	-	pF
C_{rss}	Reverse transfer capacitance	$V_{GS} = 0$		58		pF
Q_g	Total gate charge			14		nC
Q_{gs}	Gate-source charge	$V_{DD} = 15 V, I_D = 80 A$	-	6.8	-	nC
Q_{gd}	Gate-drain charge	$V_{GS} = 5 V$ <i>Figure 16</i>		4.7		nC
Q_{gs1}	Pre V_{th} gate-to-source charge	$V_{DD} = 15 V, I_D = 80 A$		2.3		nC
Q_{gs2}	Post V_{th} gate-to-source charge	$V_{GS} = 5 V$ <i>Figure 16</i>	-	4.5	-	nC
R_G	Gate input resistance	$f = 1 MHz$ gate bias Bias = 0 test signal level = 20 mV open drain	-	1.2	-	Ω

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15 \text{ V}$, $I_D = 40 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 5 \text{ V}$	-	6	-	ns
t_r	Rise time			14	-	ns
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 15 \text{ V}$, $I_D = 40 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 5 \text{ V}$ <i>Figure 15</i>	-	23.6	-	ns
t_f	Fall time			10.8	-	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	$I_{SD} = 40 \text{ A}$, $V_{GS} = 0$	-	-	1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 80 \text{ A}$,		31.8	-	ns
Q_{rr}	Reverse recovery charge	$dI/dt = 100 \text{ A}/\mu\text{s}$,		26.1	-	nC
I_{RRM}	Reverse recovery current	$V_{DD} = 20 \text{ V}$ <i>Figure 17</i>		1.6	-	A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

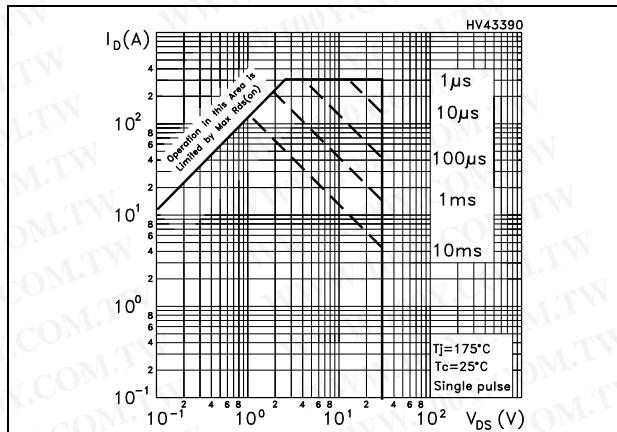


Figure 3. Thermal impedance

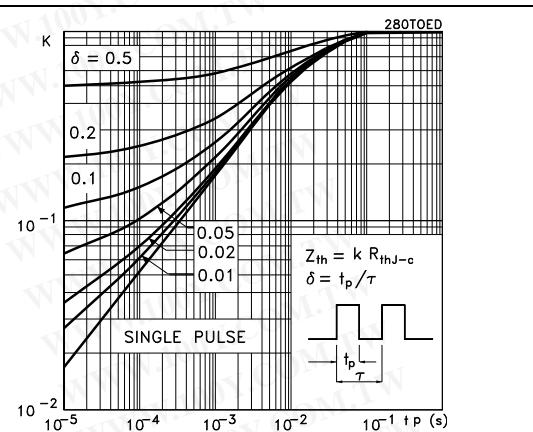


Figure 4. Output characteristics

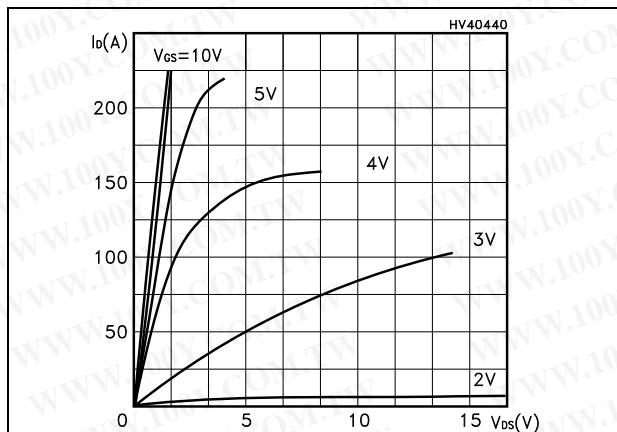


Figure 5. Transfer characteristics

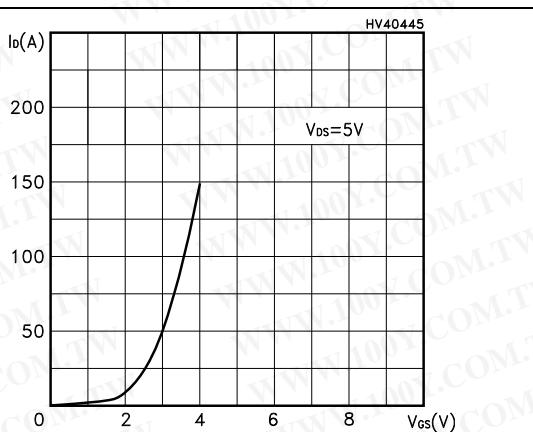
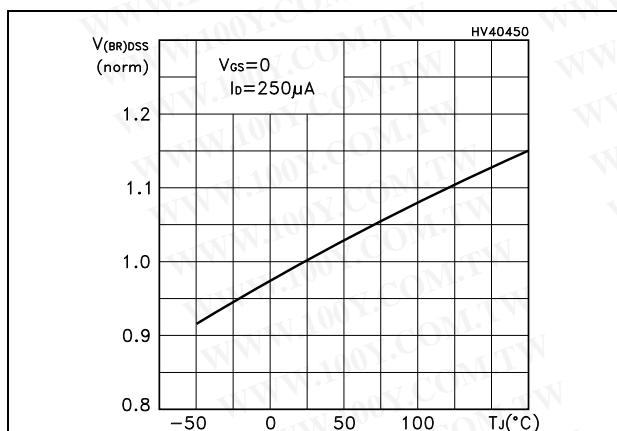
Figure 6. Normalized B_{VDSS} vs temperature

Figure 7. Static drain-source on resistance

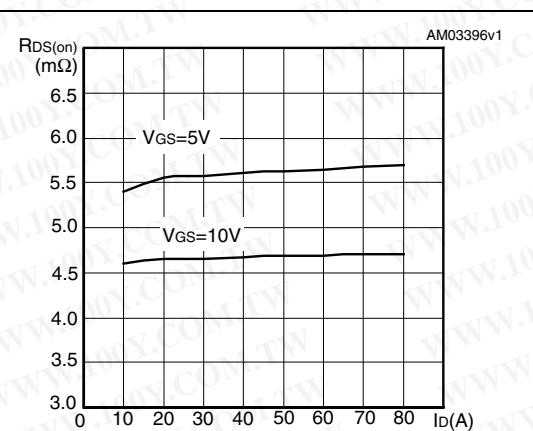
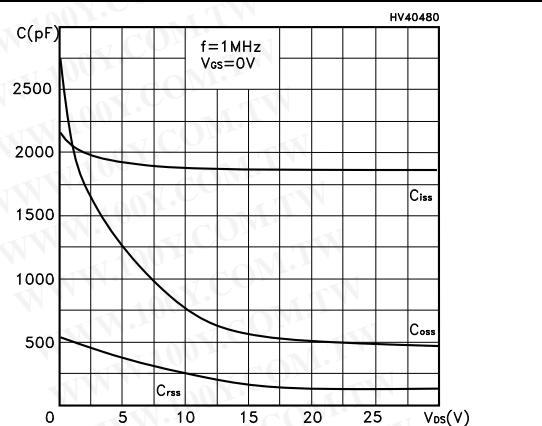
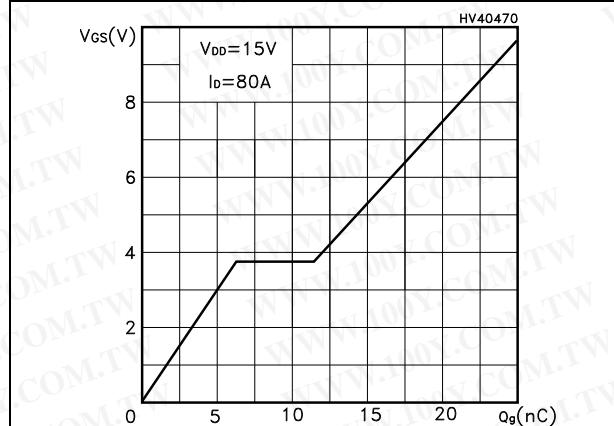
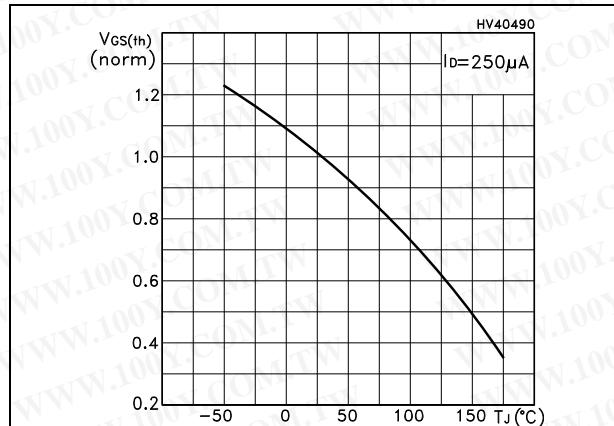
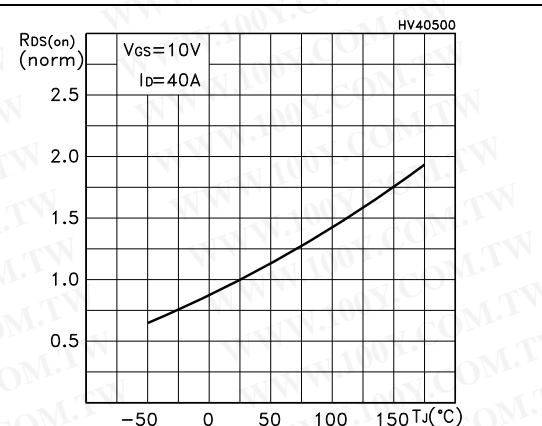
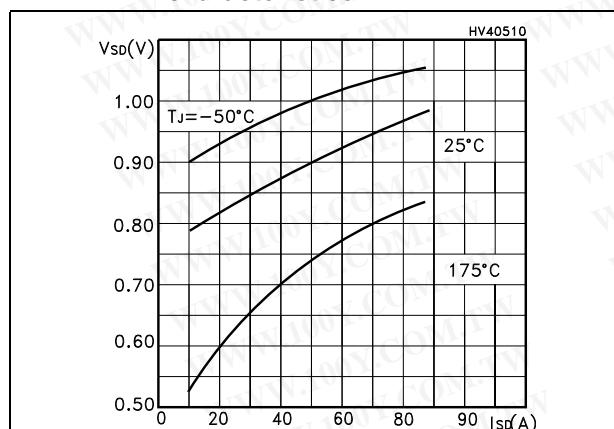


Figure 8. Gate charge vs gate-source voltage**Figure 10. Normalized gate threshold voltage vs temperature****Figure 11. Normalized on resistance vs temperature****Figure 12. Source-drain diode forward characteristics**

3 Test circuit

Figure 13. Switching times test circuit for resistive load

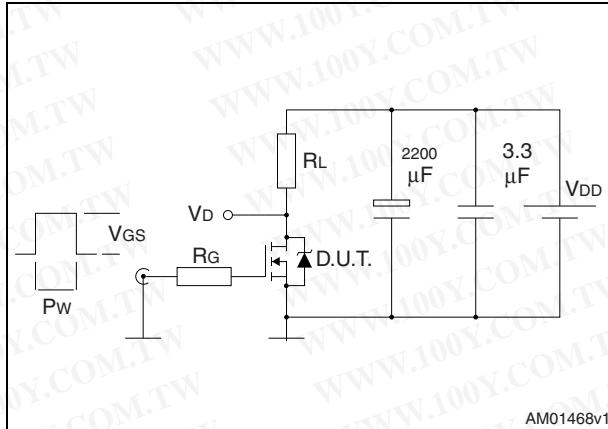


Figure 14. Gate charge test circuit

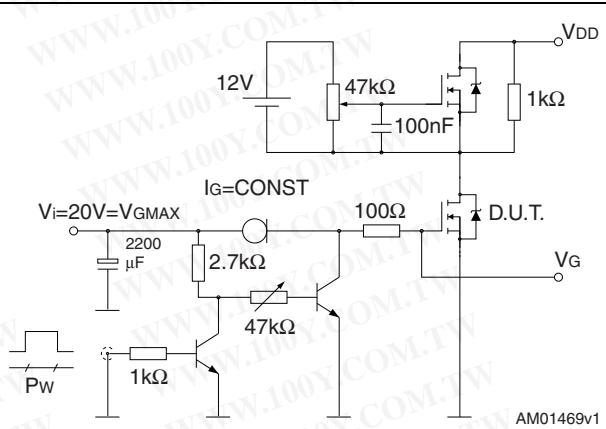


Figure 15. Test circuit for inductive load switching and diode recovery times

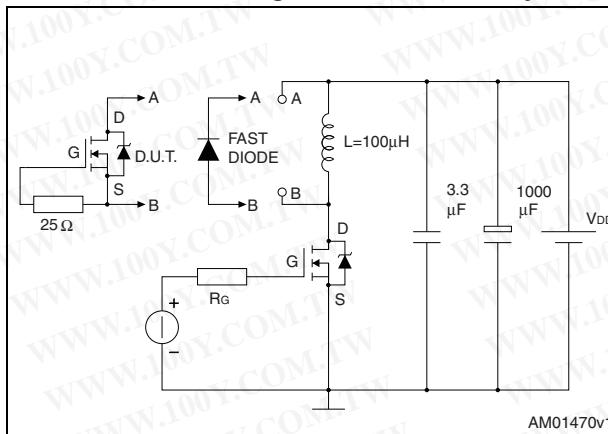


Figure 16. Unclamped inductive load test circuit

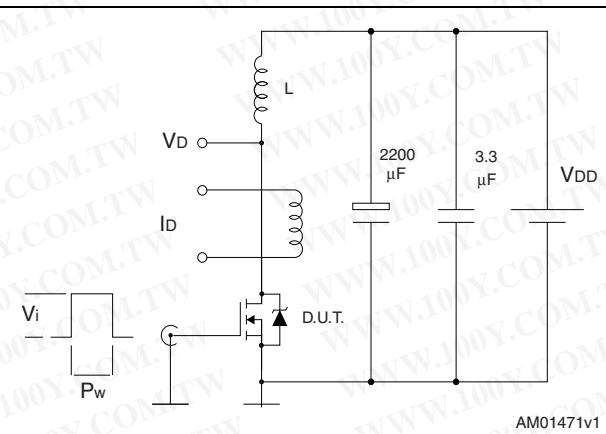


Figure 17. Unclamped inductive waveform

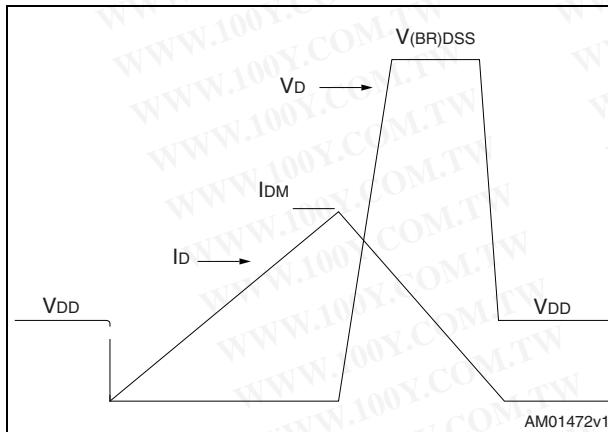


Figure 18. Switching time waveform

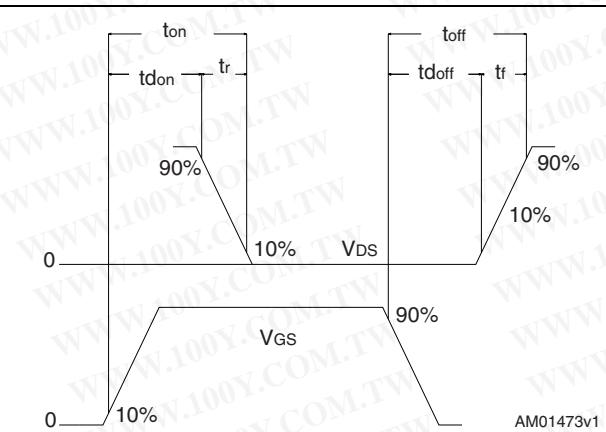
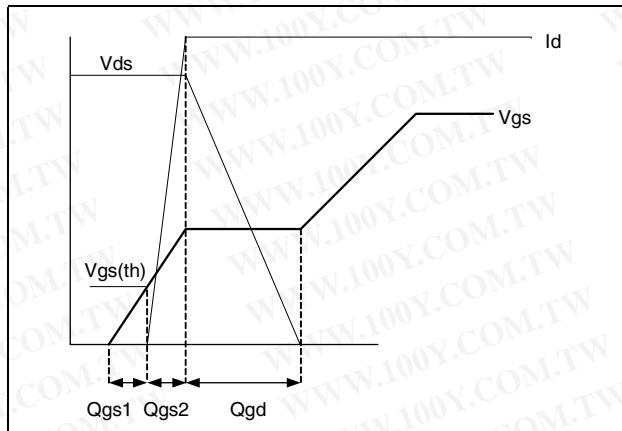


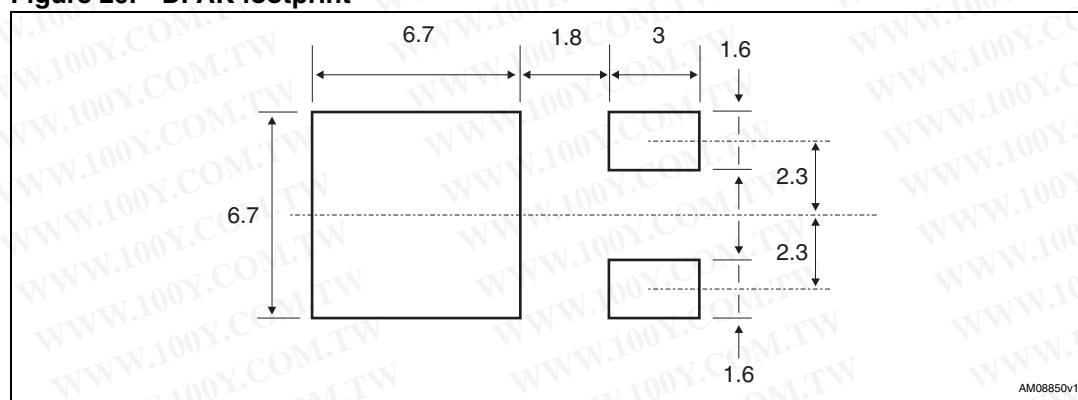
Figure 19. Gate charge waveform

4 Package mechanical data

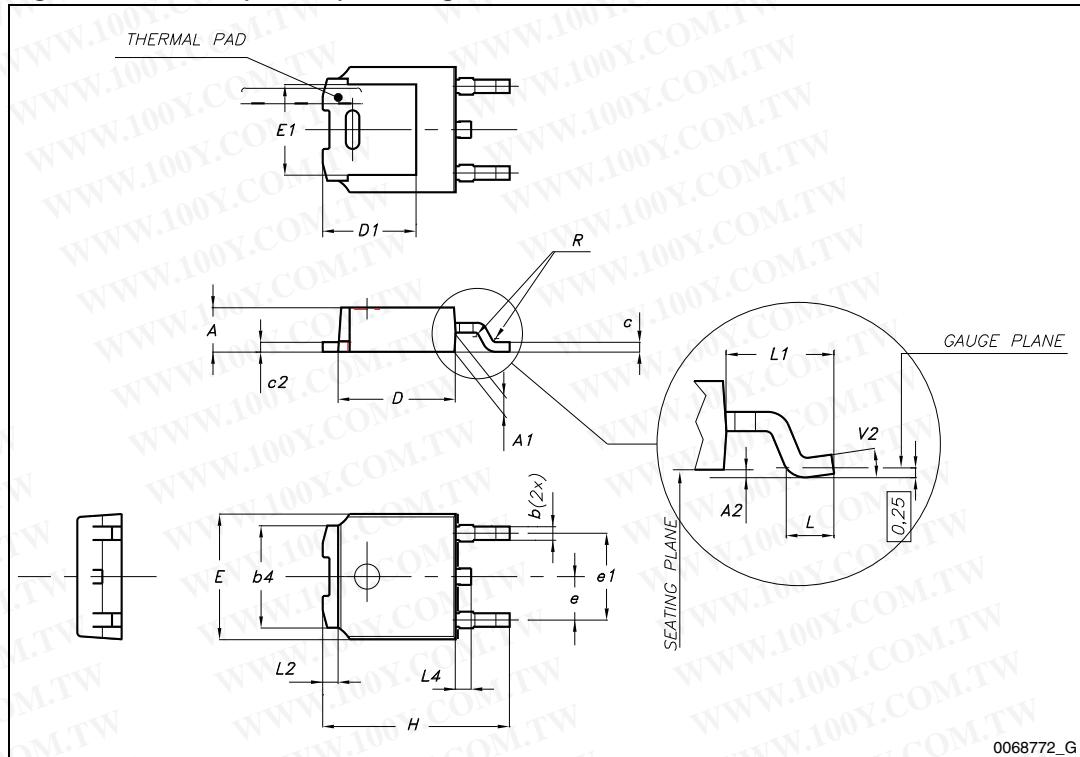
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Table 8. DPAK (TO-252) mechanical data

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°

Figure 20. DPAK footprint(a)

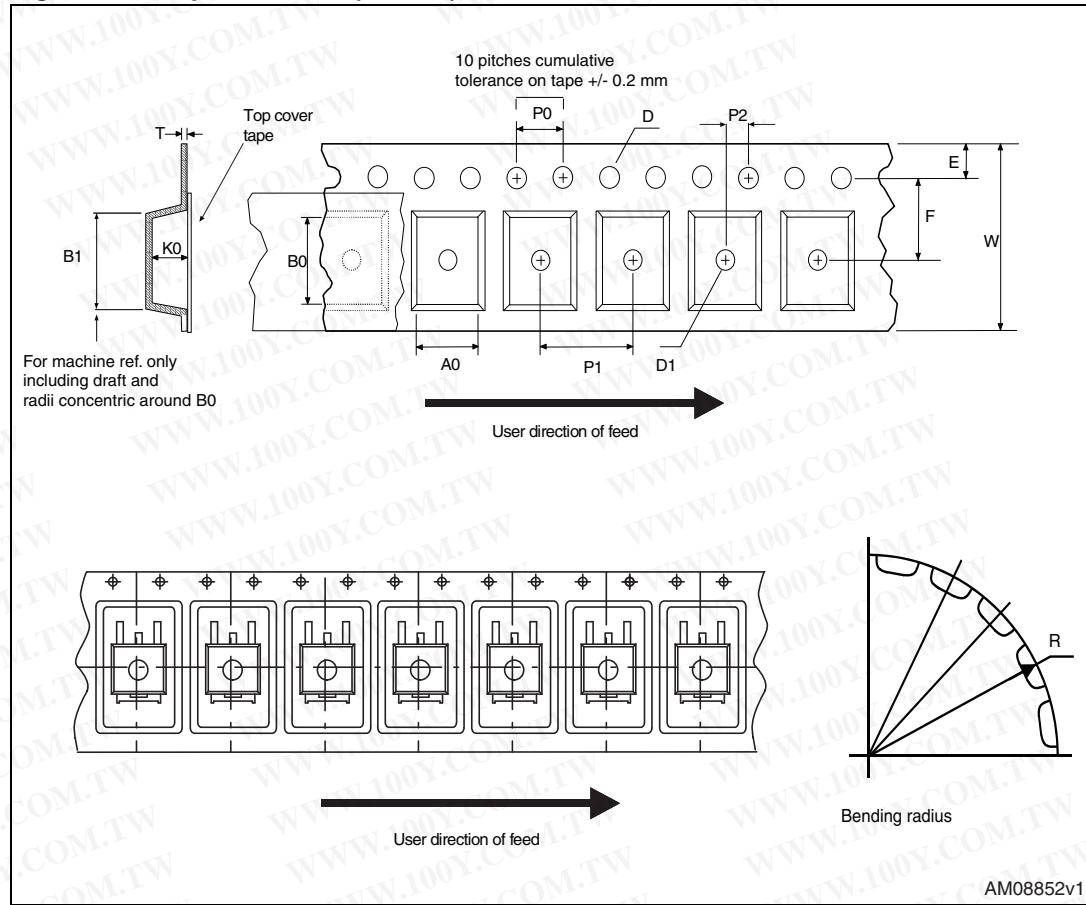
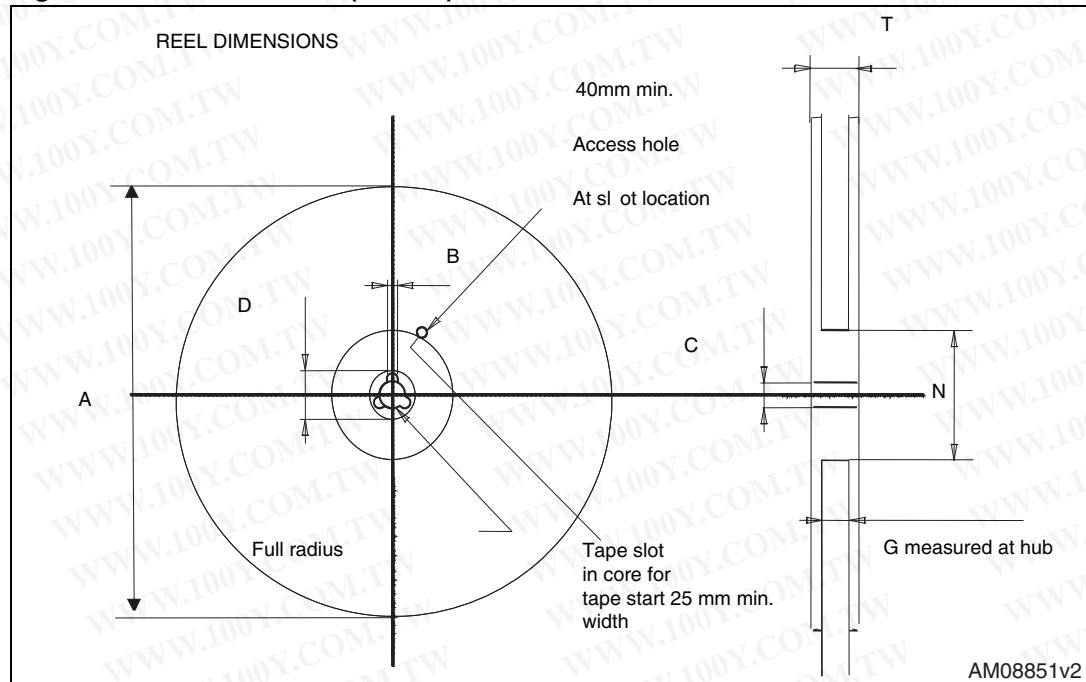
a. All dimension are in millimeters

Figure 21. DPAK (TO-252) drawing

5 Packaging mechanical data

Table 9. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1		Base qty.	2500
P1	7.9	8.1		Bulk qty.	2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 22. Tape for DPAK (TO-252)**Figure 23. Reel for DPAK (TO-252)**

6 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-Apr-2009	1	First release.
22-Mar-2011	2	V_{GS} value has been corrected in <i>Table 2</i> and <i>Table 4</i> .

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