



STD40N2LH5 STU40N2LH5

N-channel 25 V, 0.01 Ω , 40 A, DPAK, IPAK
STripFET™ V Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STD40N2LH5	25 V	0.0118 Ω	40 A
STU40N2LH5	25 V	0.0124 Ω	40 A

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

Application

- Switching applications

Description

This STripFET™ V 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).

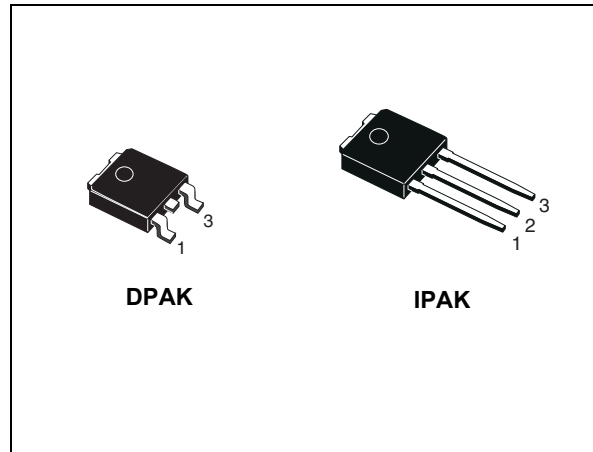


Figure 1. Internal schematic diagram

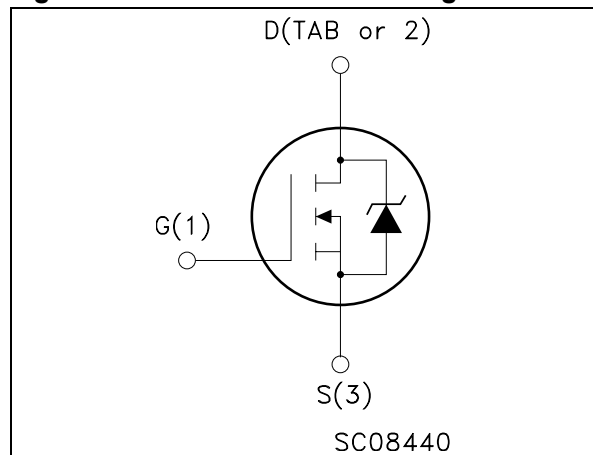


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD40N2LH5	40N2LH5	DPAK	Tape and reel
STU40N2LH5	40N2LH5	IPAK	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuits	8
4	Package mechanical data	10
5	Packaging mechanical data	13
6	Revision history	14

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS}=0$)	25	V
V_{GS}	Gate-Source voltage	± 22	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	40	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	28	A
$I_{DM}^{(1)}$	Drain current (pulsed)	160	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	35	W
	Derating factor	0.23	W/ $^\circ\text{C}$
$E_{AS}^{(2)}$	Single pulse avalanche energy	110	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2. Starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = 24\text{ A}$, $V_{DD} = 12\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	4.3	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-case max	100	$^\circ\text{C/W}$
T_l	Maximum lead temperature for soldering purpose	275	$^\circ\text{C}$

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	$I_D = 250 \mu A, V_{GS} = 0$	25			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 25 V$ $V_{DS} = 25 V, T_C = 125^{\circ}C$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 22 V$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 V, I_D = 20 A$ SMD version		0.01	0.0118	Ω
		$V_{GS} = 10 V, I_D = 20 A$		0.0106	0.0124	Ω
		$V_{GS} = 5 V, I_D = 20 A$ SMD version		0.0135	0.0155	Ω
		$V_{GS} = 5 V, I_D = 20 A$		0.0141	0.0161	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 20 V, f = 1 MHz,$ $V_{GS} = 0$	-	700	-	pF
C_{oss}	Output capacitance			160		pF
C_{rss}	Reverse transfer capacitance			27		pF
Q_g	Total gate charge	$V_{DD} = 15 V, I_D = 40 A$	-	6.3	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 5 V$		2.4		nC
Q_{gd}	Gate-drain charge	(<i>Figure 14</i>)		2.7		nC

Table 6. Switching on/off (resistive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 10 V, I_D = 20 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (<i>Figure 13</i> and <i>Figure 18</i>)	-	4.8	-	ns
t_r	Rise time			13.6		ns
$t_{d(off)}$	Turn-off delay time	$V_{DD} = 10 V, I_D = 20 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (<i>Figure 13</i> and <i>Figure 18</i>)	-	17.6	-	ns
t_f	Fall time			3.5		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		40	A
I_{SDM}	Source-drain current (pulsed) ⁽¹⁾		-		160	A
V_{SD}	Forward on voltage	$I_{SD}= 20\text{ A}$, $V_{GS}=0$	-		1.1	V
t_{rr}	Reverse recovery time	$I_{SD}= 40\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}= 20\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ (<i>Figure 15</i>)	-	17.6		ns
Q_{rr}	Reverse recovery charge			9.2		nC
I_{RRM}	Reverse recovery current			1		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

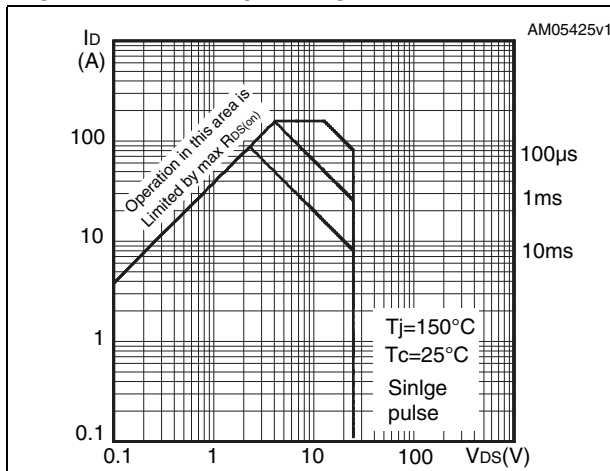


Figure 3. Thermal impedance

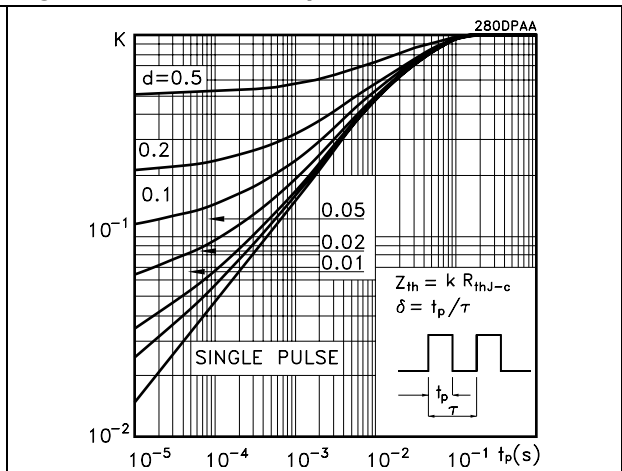


Figure 4. Output characteristics

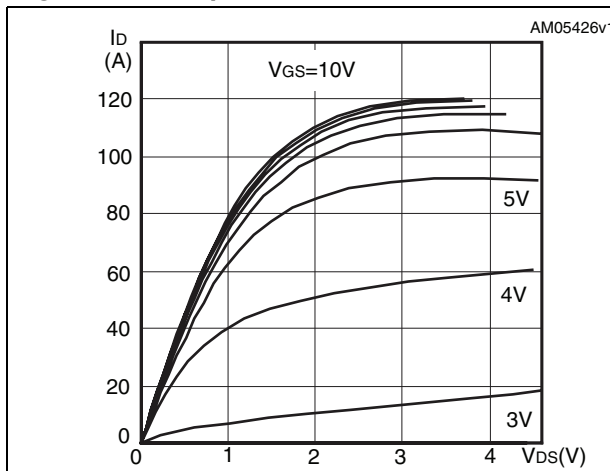


Figure 5. Transfer characteristics

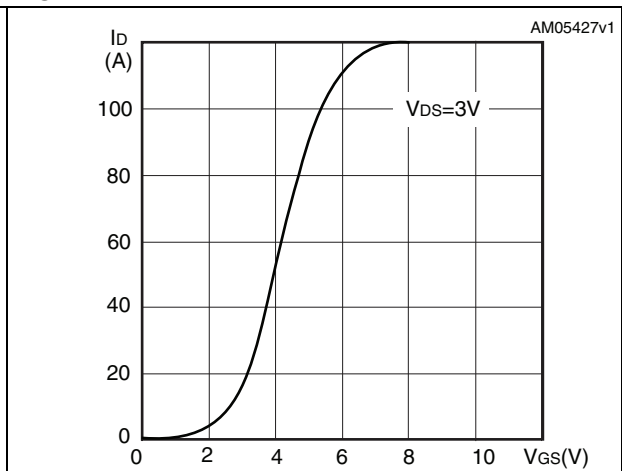


Figure 6. Normalized BV_{DSS} vs temperature

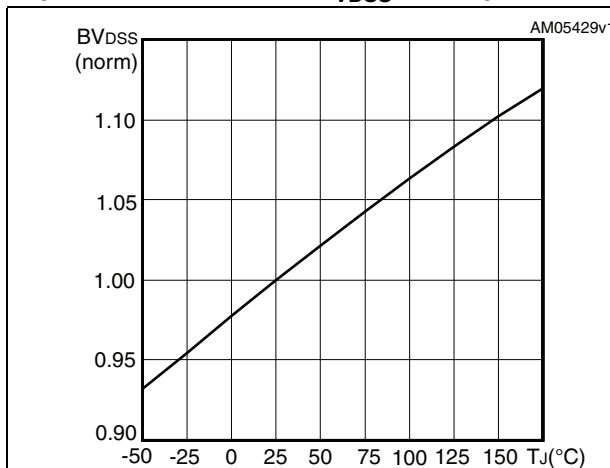


Figure 7. Static drain-source on resistance

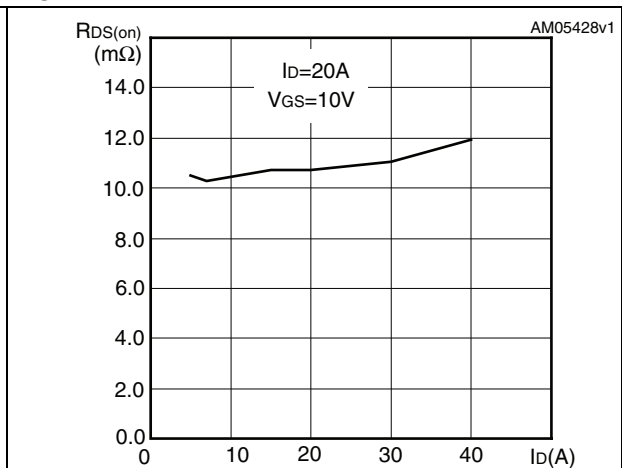


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

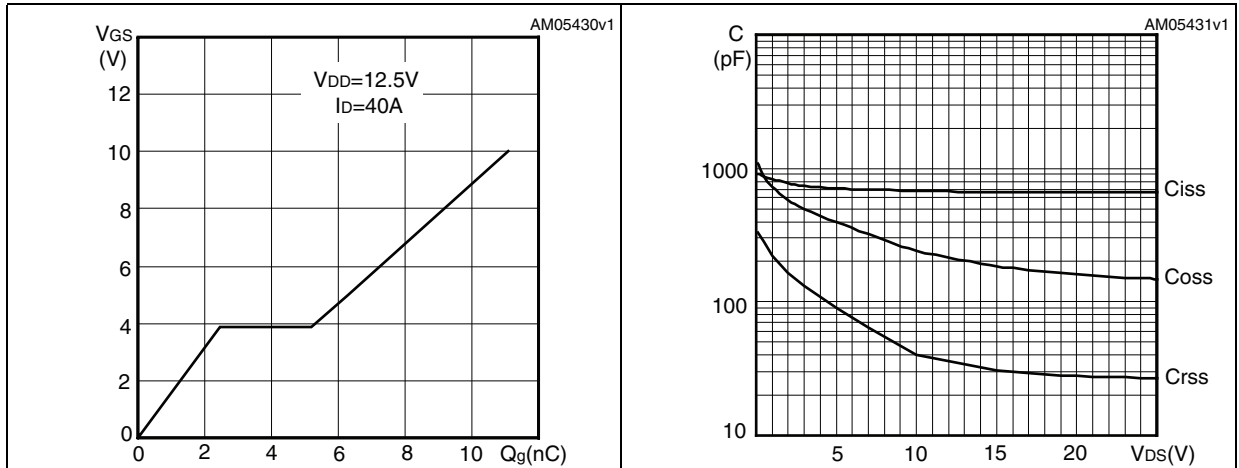


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

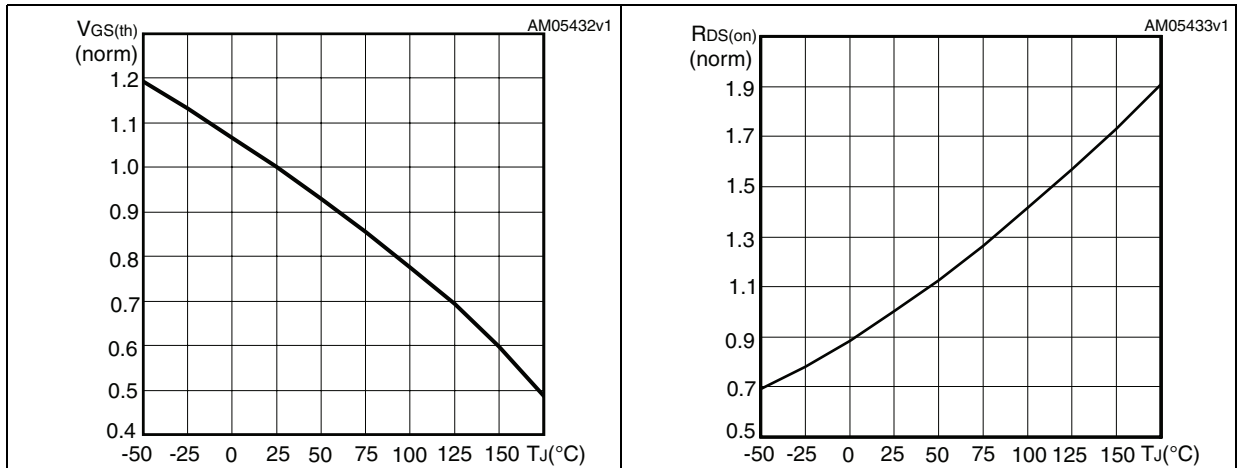
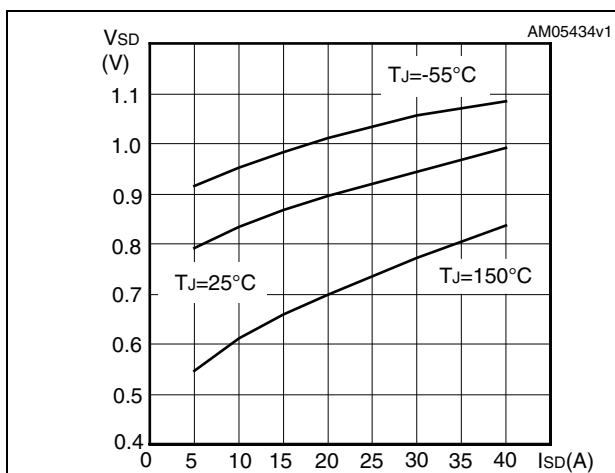


Figure 12. Source-drain diode forward characteristics



3 Test circuits

Figure 13. Switching times test circuit for resistive load

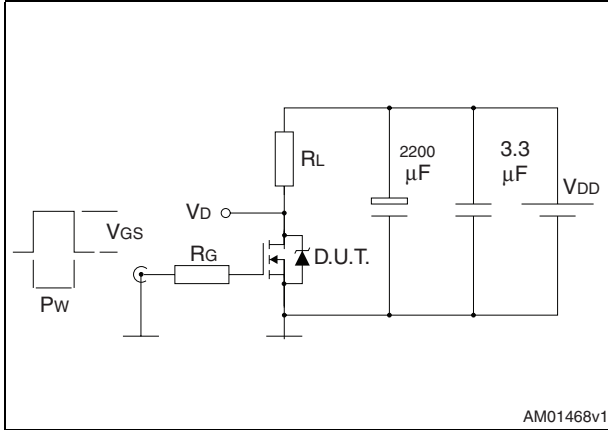


Figure 14. Gate charge test circuit

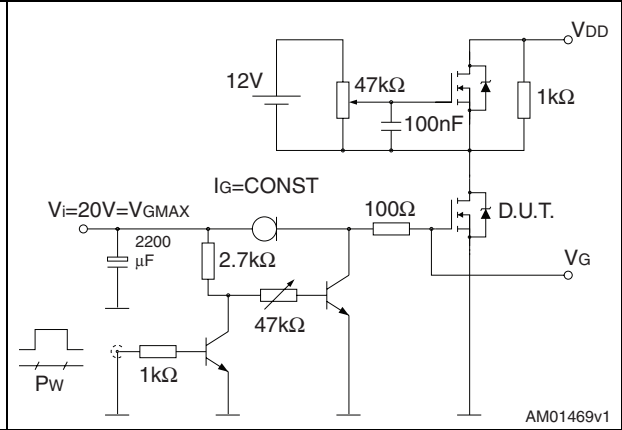


Figure 15. Test circuit for inductive load switching and diode recovery times

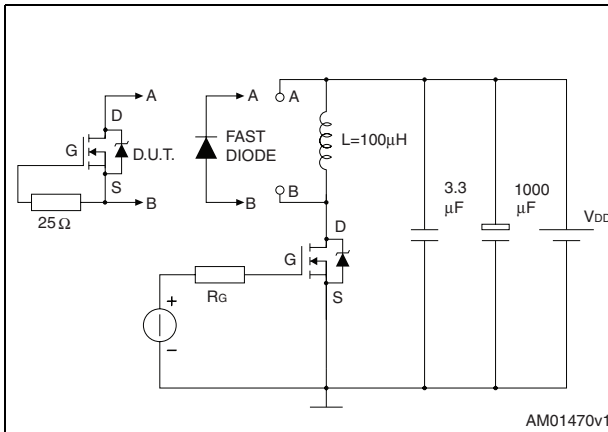


Figure 16. Unclamped Inductive load test circuit

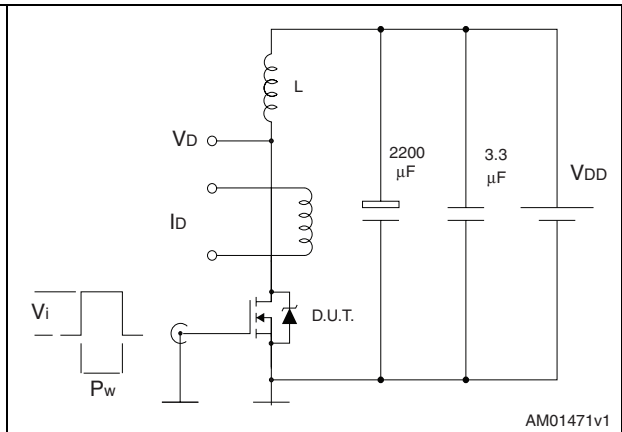


Figure 17. Unclamped inductive waveform

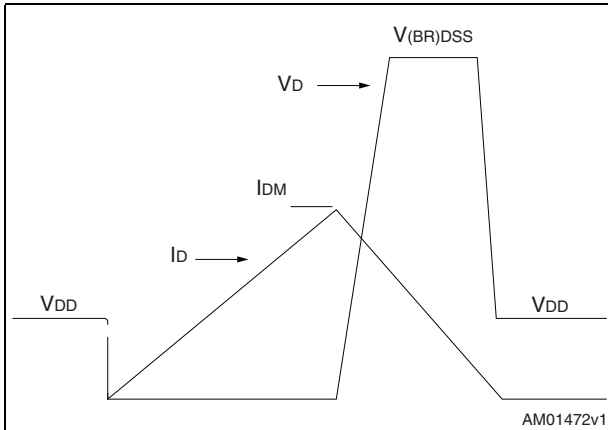


Figure 18. Switching time waveform

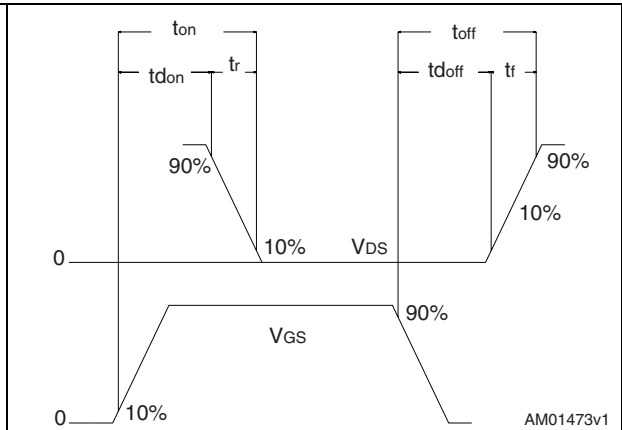
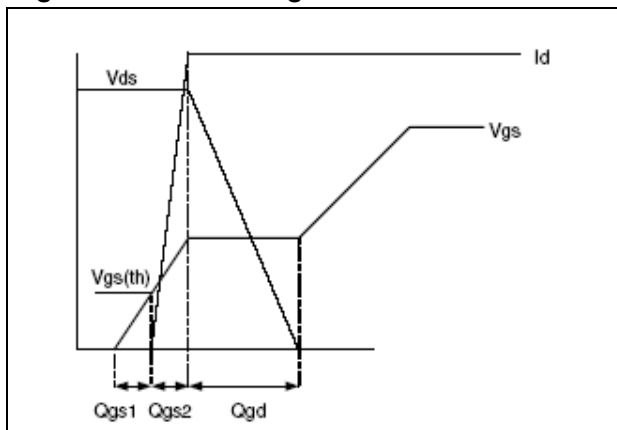


Figure 19. Gate charge waveform

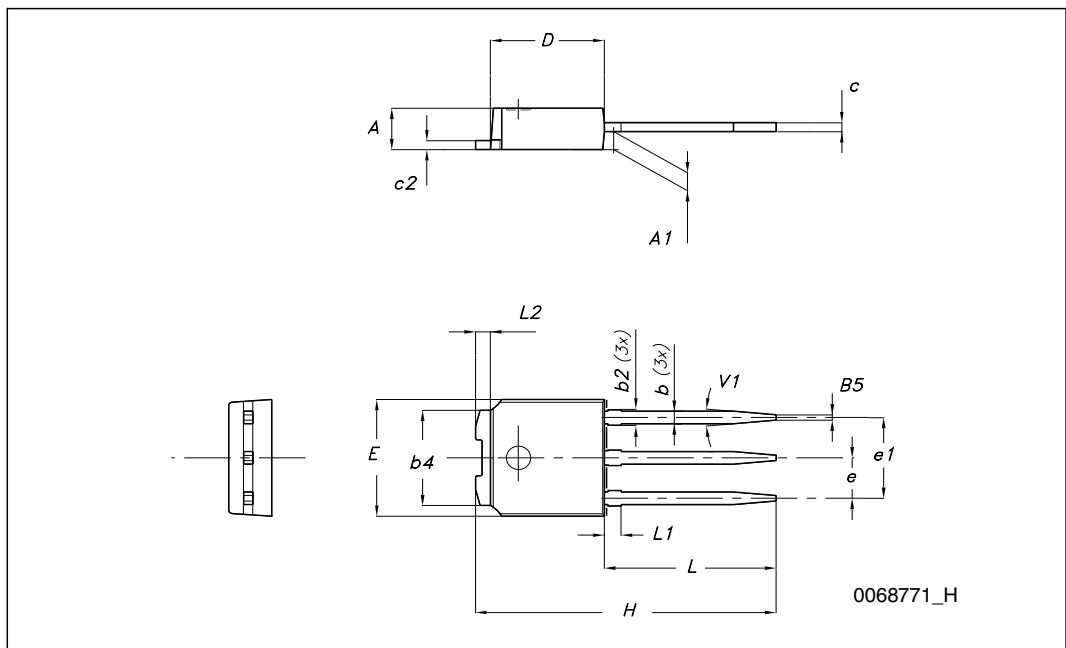


4 Package mechanical data

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

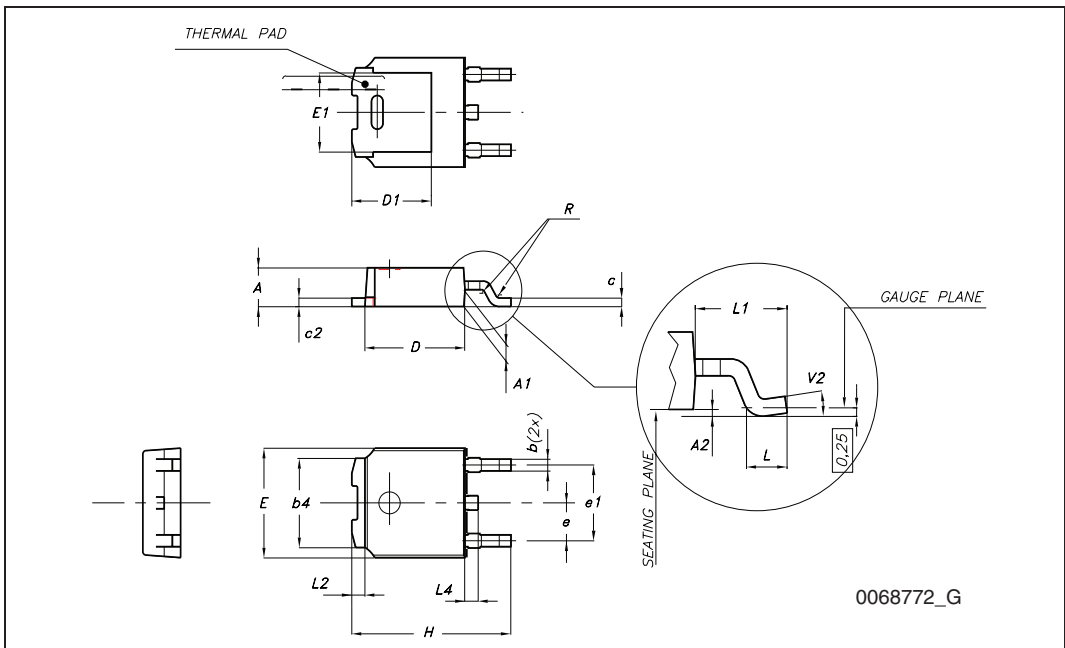
TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10°	



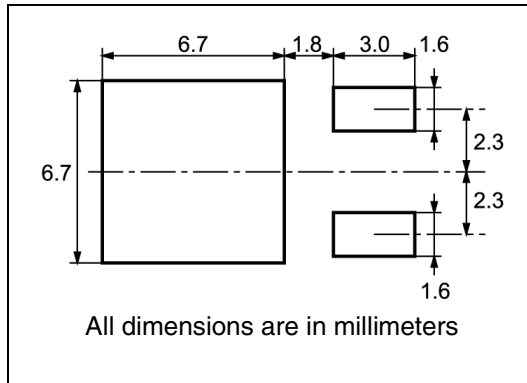
TO-252 (DPAK) mechanical data

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

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

BASE QTY	BULK QTY
2500	2500

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

10 pitches cumulative tolerance on tape +/- 0.2 mm

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

User Direction of Feed

Center line of cavity

FEED DIRECTION

Bending radius R min.

6 Revision history

Table 8. Document revision history

Date	Revision	Changes
24-Jul-2008	1	Initial release
23-Sep-2008	2	V_{GS} value has been changed on Table 2 and Table 5
10-Sep-2009	3	Document status promoted from preliminary data to datasheet.

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