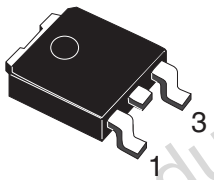
STD3NK60ZD

N-channel 600 V, 3.3 Ω, 2.4 A, DPAK SuperFREDMesh™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STD3NK60ZD	600 V	< 3.6Ω	2.4 A

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitances
- Fast internal recovery diode



DPAK

Application

- Switching applications

Description

The SuperFREDMesh™ series associates all advantages of reduced on-resistance, Zener gate protection and very high dv/dt capability with a fast body-drain recovery diode. Such series complements the “FDmesh™” advanced technology.

Figure 1. Internal schematic diagram

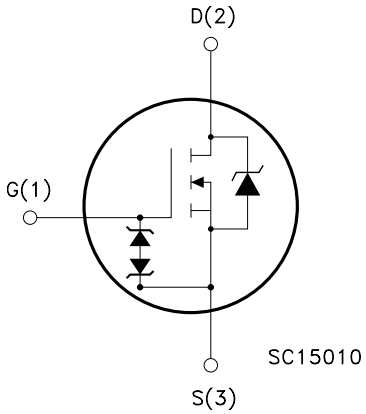


Table 1. Device summary

Order code	Marking	Package	Packaging
STD3NK60ZD	3NK60ZD	DPAK	Tape and reel

Obsolete Product(s) - Obsolete Product(s)

Contents

1 Electrical ratings 3

2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuits 9

4 Package mechanical data 10

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Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	600	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at T_C = 25 °C	2.4	A
I_D	Drain current (continuous) at T_C = 100 °C	1.51	A
I_{DM} (1)	Drain current (pulsed)	9.6	A
P_{TOT}	Total dissipation at T_C = 2 5°C	45	W
	Derating factor	0.36	W/°C
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 2.4$ A, di/dt $\leq$ 600 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
Rthj-amb	Thermal resistance junction-ambient max	100	°C/W
Rthj-pcb	Thermal resistance junction-pcb max	50	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	2.4	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V)	150	mJ

Obsolete Product(s) - Obsolete Product(s)

2 Electrical characteristics

(Tcase =25 °C unless otherwise specified)

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	600			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C				1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			± 10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 1.2 A		3.3	3.6	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		311 43 8		pF pF pF
$C_{oss\ eq}$ (1)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 400 V		27		pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 400 V, I_D = 2.4 A, V_{GS} = 10 V (see *Figure 16*)		11.8 2.6 6.4		nC nC nC

1. $C_{oss\ eq}$. is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_DS increases from 0 to 80% V_{DSS}

Obsolete Product(s) - Obsolete Product(s)

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 480 V, I_D = 3 A,		9		ns
t_r	Rise time	R_G = 4.7 Ω, V_{GS} = 10 V		14		ns
$t_{d(off)}$	Turn-off-delay time	(see *Figure 15*)		19		ns
t_f	Fall time			14		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				2.4	A
I_{SDM} (1)	Source-drain current (pulsed)				9.6	A
V_{SD} (2)	Forward on voltage	I_{SD} = 10 A, V_{GS} = 0			1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 2.4 A, di/dt = 100 A/µs		98		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V		170		nC
I_{RRM}	Reverse recovery current	(see *Figure 20*)		3.4		A
t_{rr}	Reverse recovery time	I_{SD} = 2.4 A, di/dt = 100 A/µs		105		ns
Q_{rr}	Reverse recovery charge	V_{DD} = 60 V, T_j = 150 °C		184		nC
I_{RRM}	Reverse recovery current	(see *Figure 20*)		3.5		A

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

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

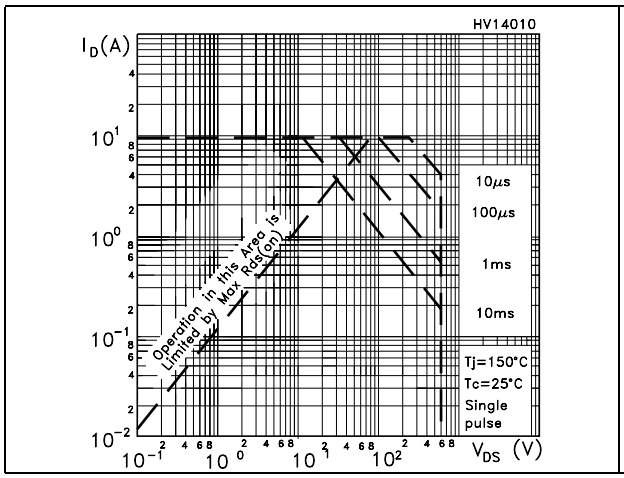


Figure 3. Thermal impedance

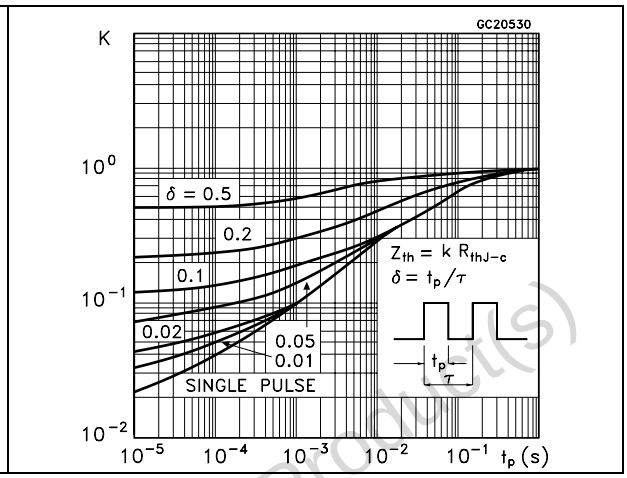


Figure 4. Output characteristics

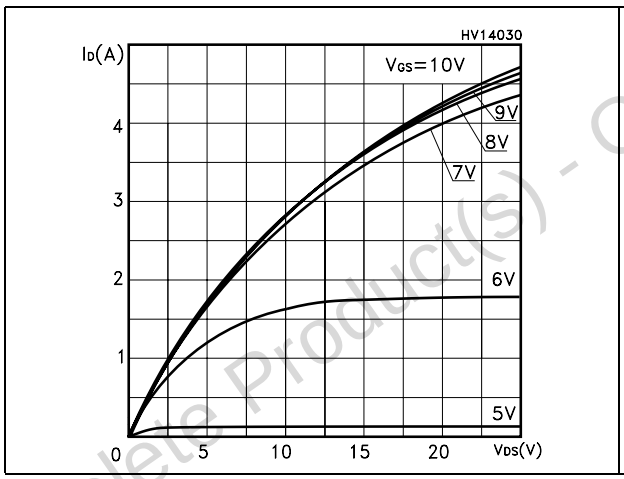


Figure 5. Transfer characteristics

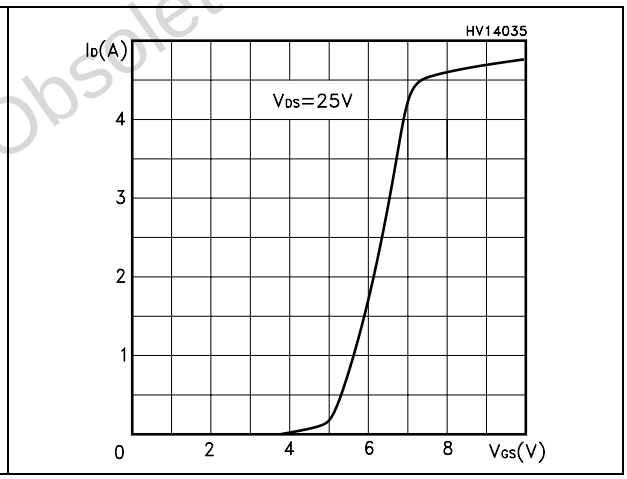


Figure 6. Transconductance

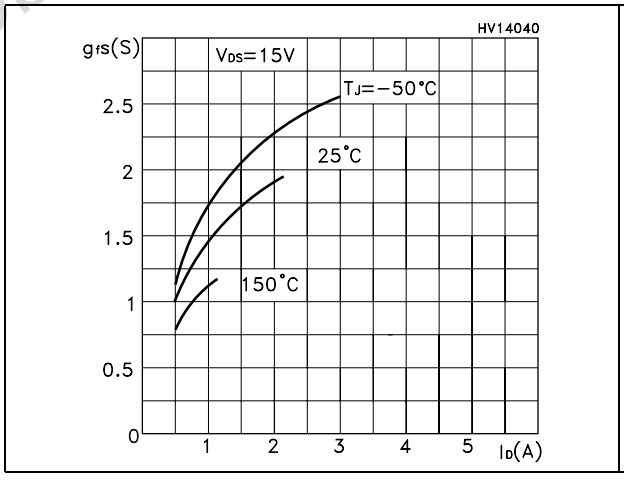
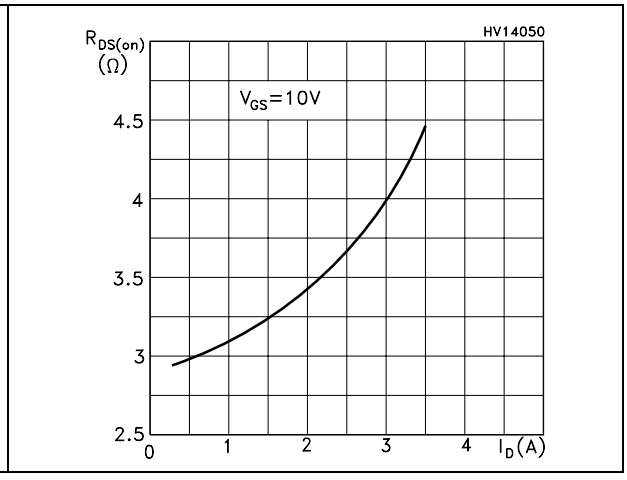


Figure 7. Static drain-source on resistance



Obsolete Product(s) - Obsolete Product(s)

Figure 8. Gate charge vs gate-source voltage

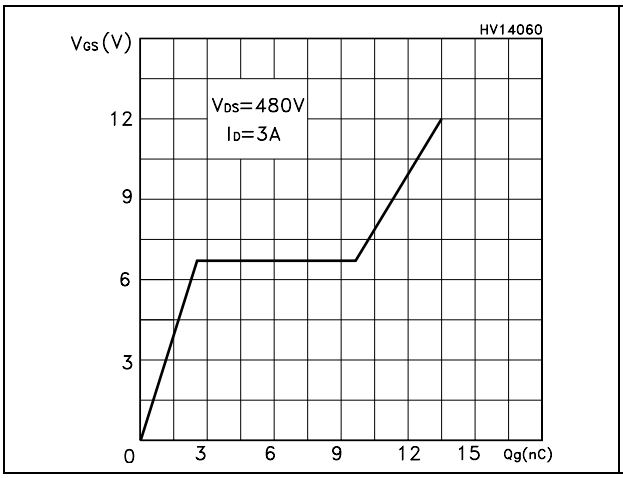


Figure 9. Capacitance variations

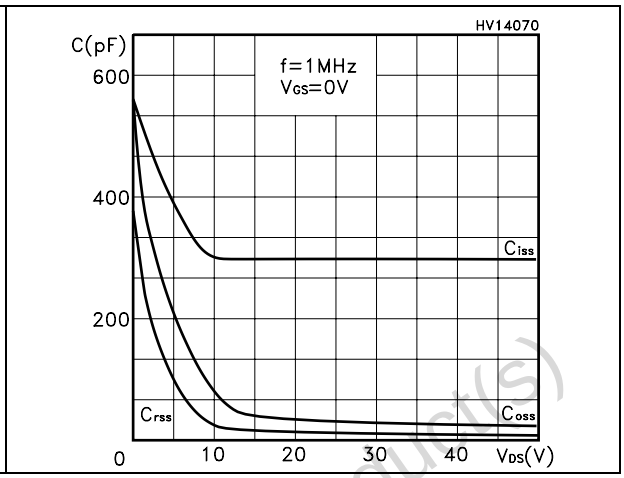


Figure 10. Normalized gate threshold voltage vs temperature

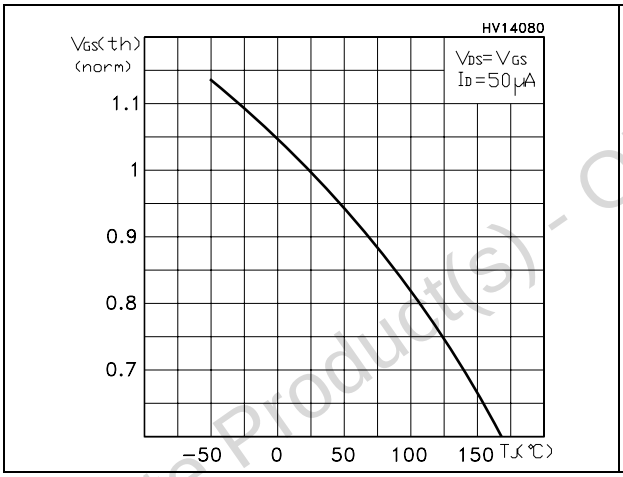


Figure 11. Normalized on resistance vs temperature

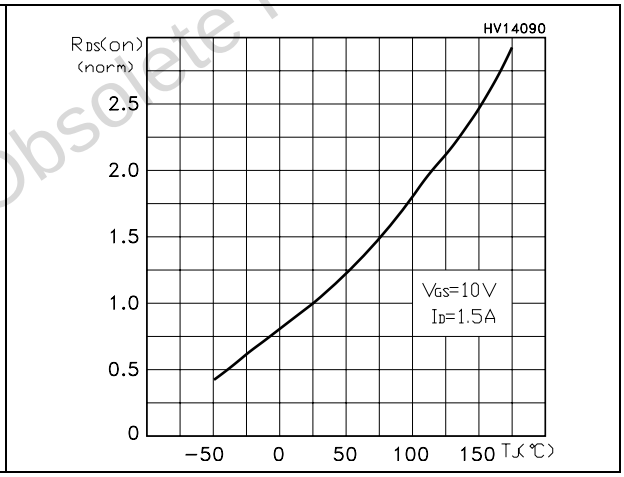


Figure 12. Source-drain diode forward characteristics

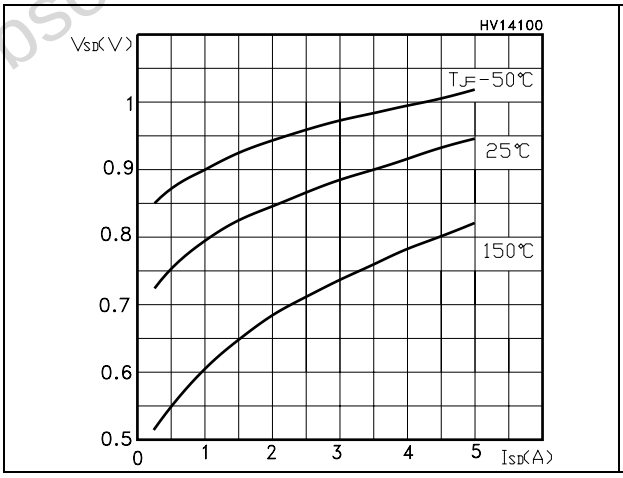
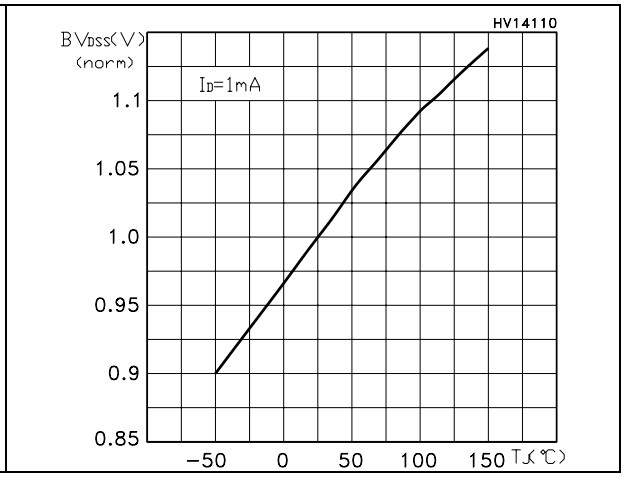
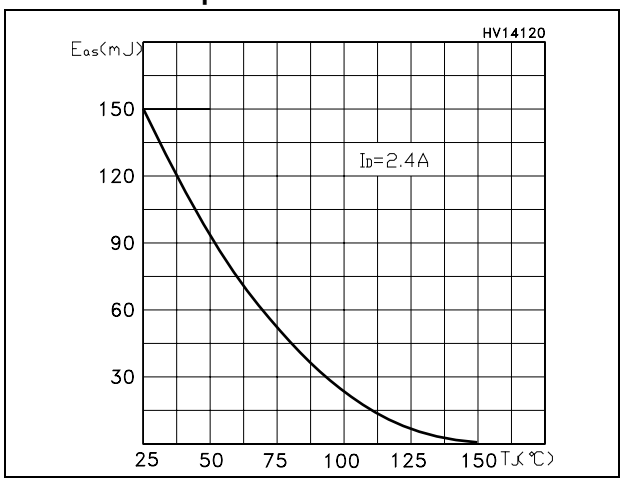


Figure 13. Normalized B_{VDSS} vs temperature



Obsolete Product(s) - Obsolete Product(s)

Figure 14. Maximum avalanche energy vs temperature



Obsolete Product(s) - Obsolete Product(s)

3 Test circuits

Figure 15. Switching times test circuit for resistive load

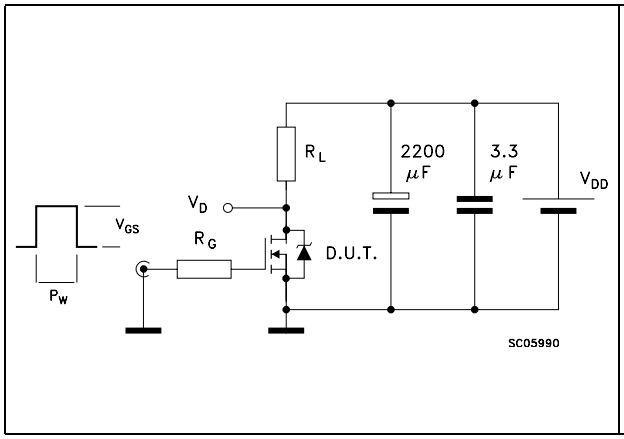


Figure 16. Gate charge test circuit

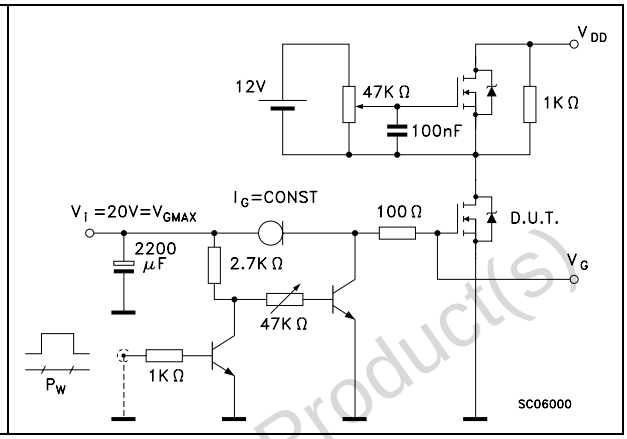


Figure 17. Test circuit for inductive load switching and diode recovery times

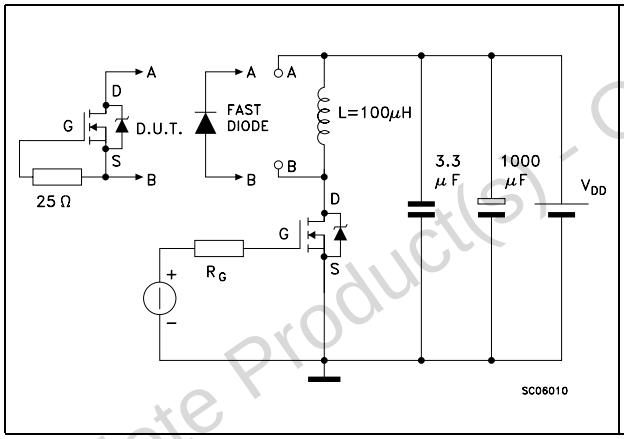


Figure 18. Unclamped Inductive load test circuit

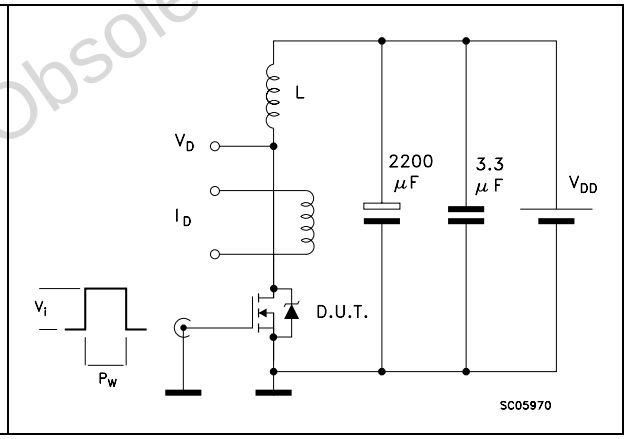


Figure 19. Unclamped inductive waveform

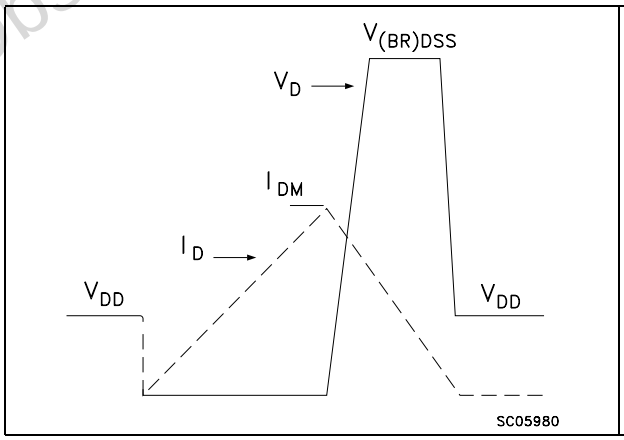
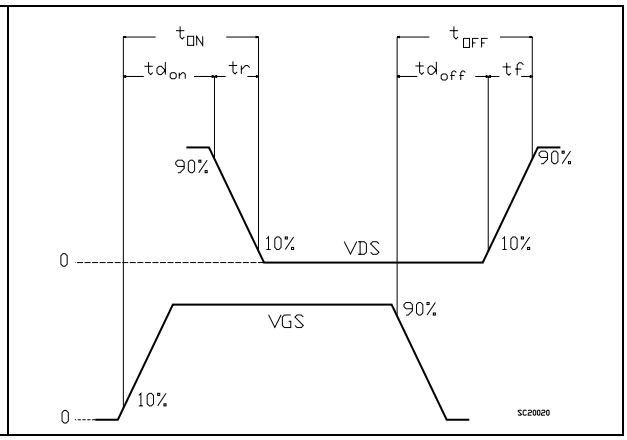


Figure 20. Switching time waveform



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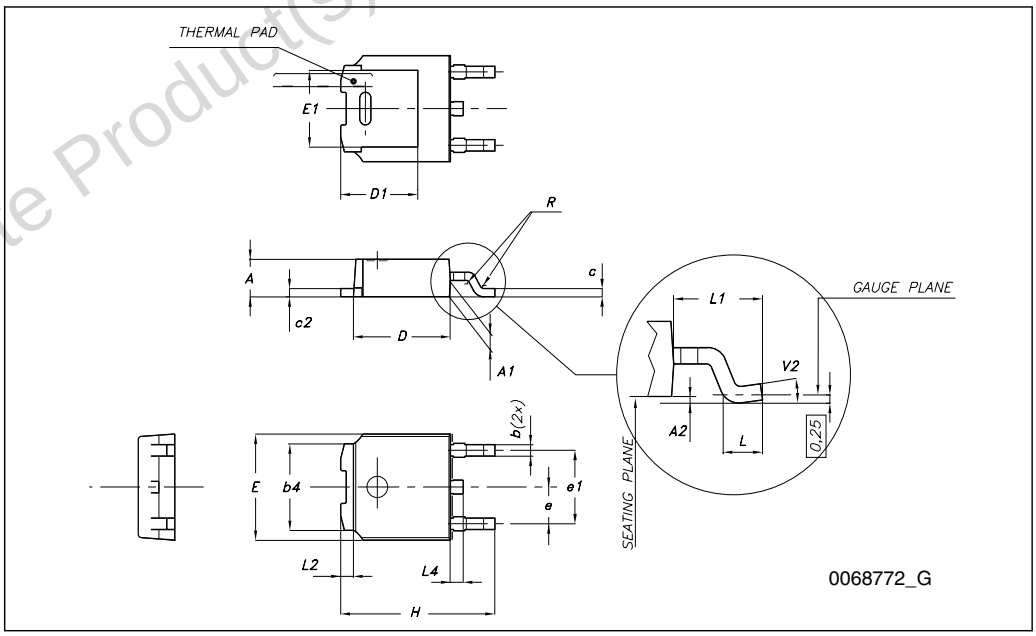
4 Package mechanical data

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

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TO-252 (DPAK) mechanical data

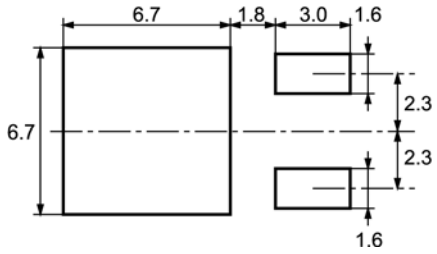
DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0 °		8 °



Obsolete Product(s) - Obsolete Product(s)

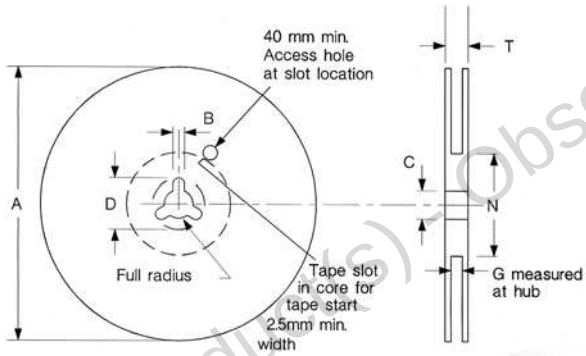
5 Package mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



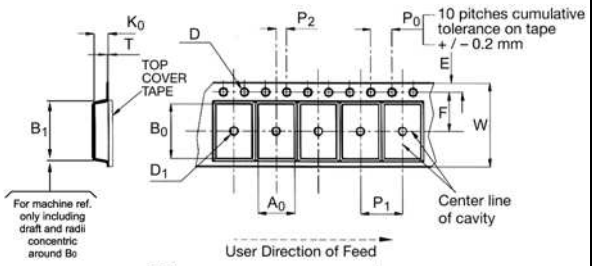
REEL MECHANICAL DATA

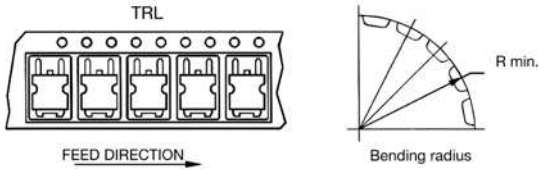
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

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





Obsolete Product(s) - Obsolete Product(s)

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
24-Jul-2008	1	First release
11-Sep-2008	2	Document status changed from preliminay data to datasheet

Obsolete Product(s) - Obsolete Product(s)

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