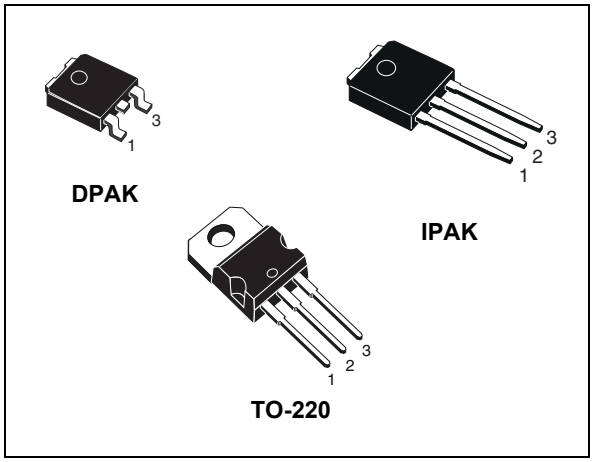
STD95N2LH5
STP95N2LH5, STU95N2LH5

N-channel 25 V, 0.0038 Ω, 80 A, DPAK, IPAK, TO-220 STripFET™ V Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STD95N2LH5	25 V	< 0.0045 Ω	80 A
STP95N2LH5	25 V	< 0.0049 Ω	80 A
STU95N2LH5	25 V	< 0.0049 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

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 FOM (figure of merit).

Figure 1. Internal schematic diagram

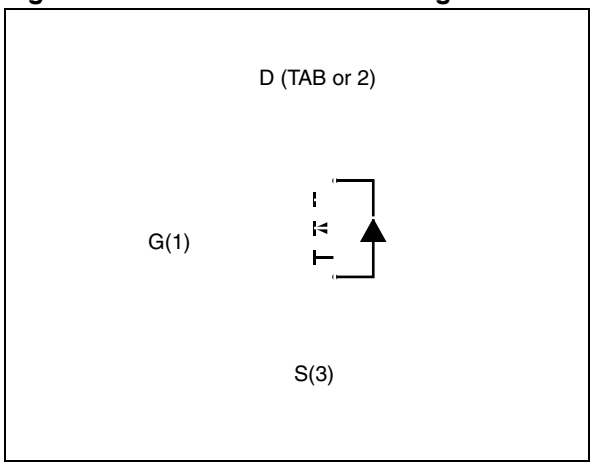


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD95N2LH5	95N2LH5	DPAK	Tape and reel
STP95N2LH5	95N2LH5	TO-220	Tube
STU95N2LH5	95N2LH5	IPAK	Tube

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2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		DPAK/IPAK	TO-220	
V_{DS}	Drain-source voltage (V_{GS}=0)	25		V
V_{GS}	Gate-Source voltage	± 22		V
I_D (1)	Drain current (continuous) at T_C = 25°C	80	95	A
I_D	Drain current (continuous) at T_C = 100°C	67		A
I_{DM} (2)	Drain current (pulsed)	320	380	A
P_{TOT}	Total dissipation at T_C = 25°C	70	80	W
	Derating factor	0.47		W/°C
E_{AS} (3)	Single pulse avalanche energy	165		mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175		°C

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting Tj = 25°C, Id = 40 A, Vdd = 20 V

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2.14	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-case max	100	°C/W
T_j	Maximum lead temperature for soldering purpose	275	°C

2 Electrical characteristics

(T_{CASE}=25 °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 µA, V_{GS}= 0	25			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 25 V V_{DS} = 25 V,Tc = 125°C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 22 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 250 µA	1			V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 40 A SMD version		0.0038	0.0045	Ω
		V_{GS}= 10 V, I_D= 40 A		0.0044	0.0049	Ω
		V_{GS}= 5 V, I_D= 40 A SMD version		0.005	0.006	Ω
		V_{GS}= 5 V, I_D= 40 A		0.006	0.007	Ω

Table 5. 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	-	1817 420 67	-	pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=13 V, I_D = 80 A V_{GS} =5 V *Figure 18*	-	13.4 6.7 4.1	-	nC nC nC
Q_{gs1} Q_{gs2}	Pre V_{th} gate-to-source charge Post V_{th} gate-to-source charge	V_{DD}=13 V, I_D = 80 A *Figure 21*	-	3.5 3.2	-	nC nC
R_G	Gate input resistance	f=1 MHz gate bias Bias= 0 test signal level=20 mV open drain	-	1.1	-	Ω

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD}=12.5 V, I_D= 40 A, R_G= 4.7 Ω, V_{GS}= 10 V *Figure 17*	-	7 38	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD}=12.5 V, I_D= 40 A, R_G= 4.7 Ω, V_{GS}= 10 V *Figure 17*	-	22 7	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)		-		80 320	A A
V_{SD}(2)	Forward on voltage	I_{SD}= 35 A, V_{GS}=0	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 80 A, V_{DD}= 20 V di/dt =100 A/µs, *Figure 19*	-	32.4 27.1 1.7		ns nC 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 for DPAK, IPAK

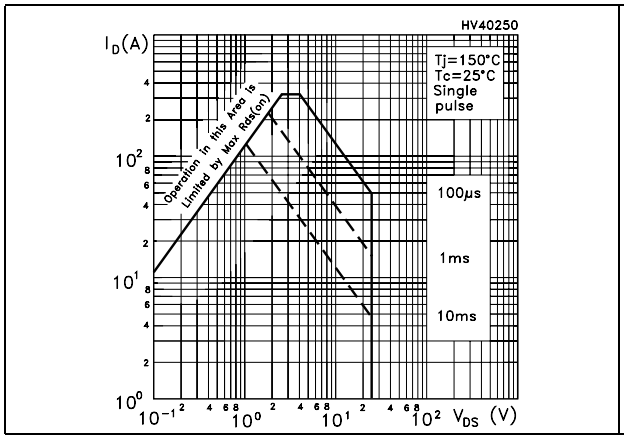


Figure 3. Thermal impedance for DPAK, IPAK

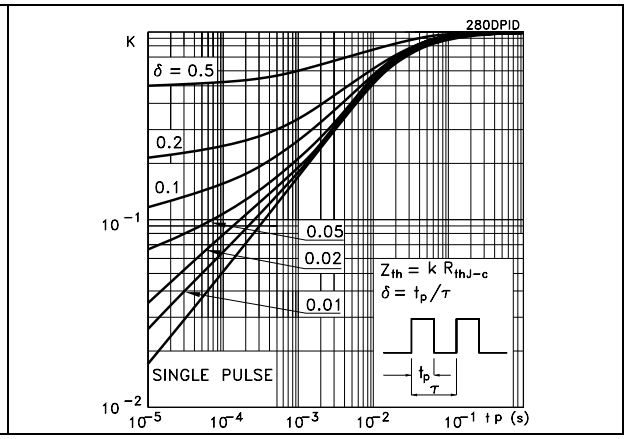


Figure 4. Safe operating area for TO-220

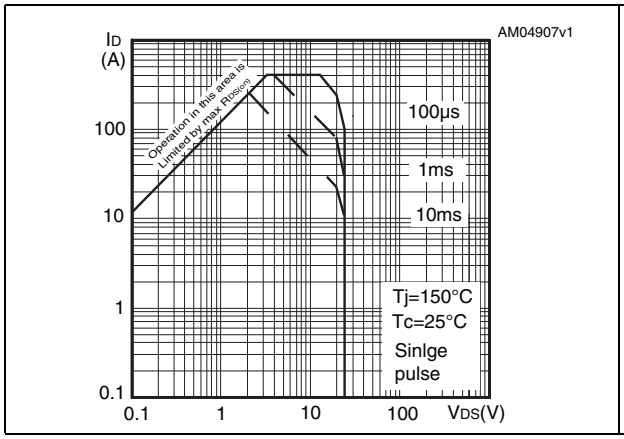


Figure 5. Thermal impedance for TO-220

Figure 6. Output characteristics

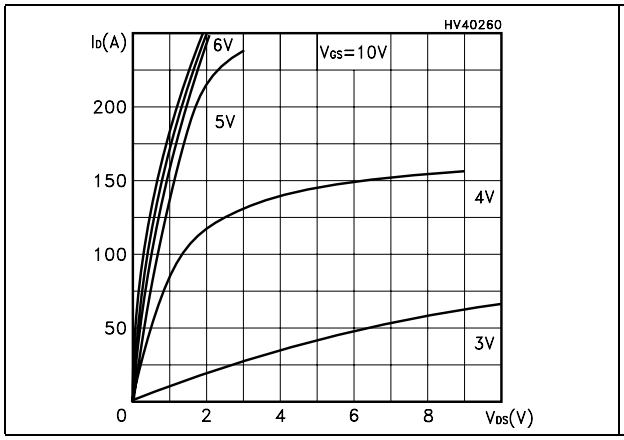


Figure 7. Transfer characteristics

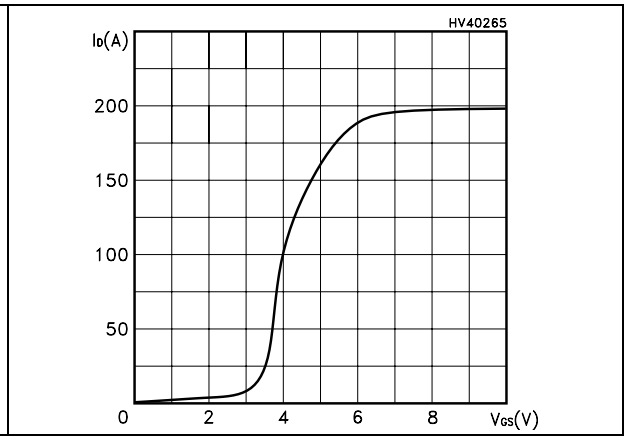


Figure 8. Normalized B_{VDSS} vs temperature

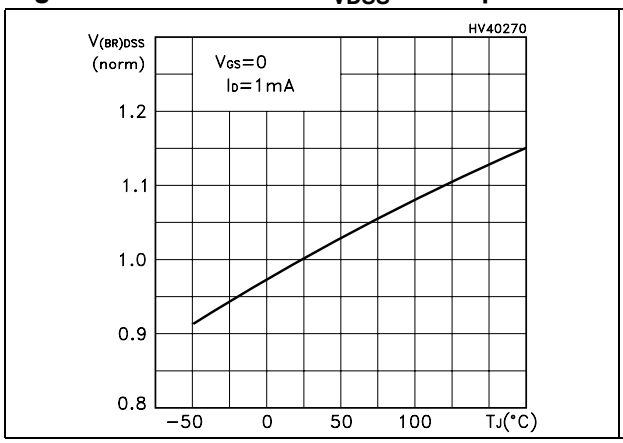


Figure 9. Static drain-source on resistance

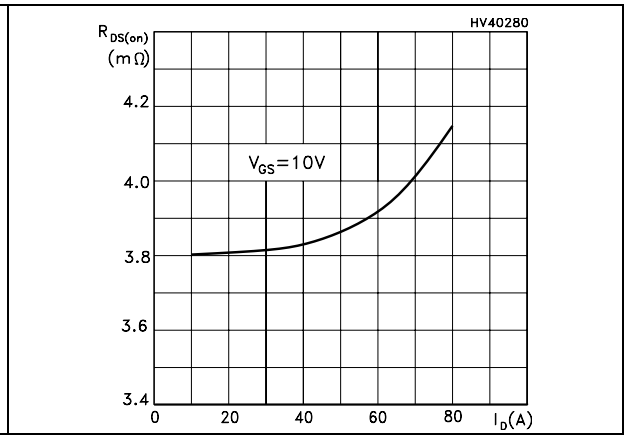


Figure 10. Gate charge vs gate-source voltage

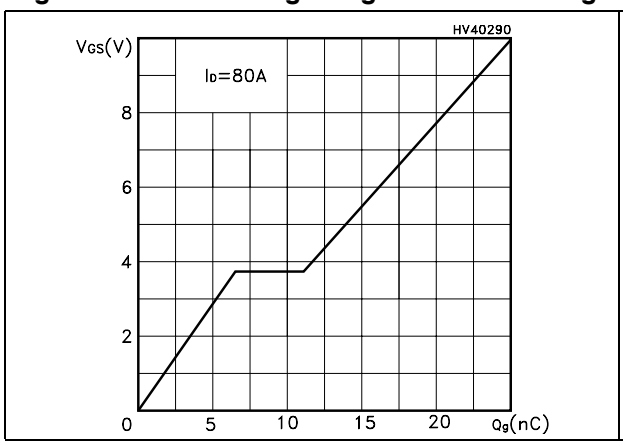


Figure 11. Capacitance variations

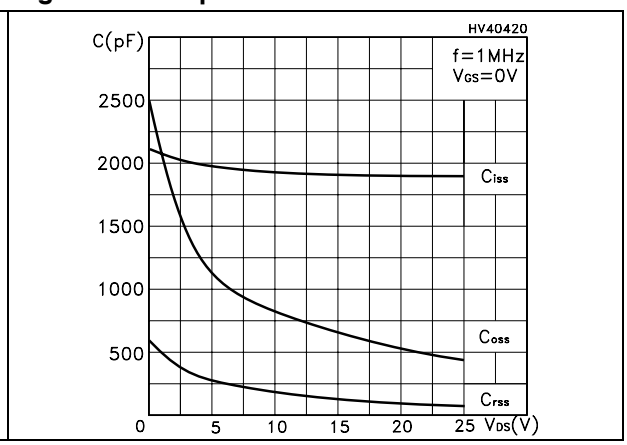


Figure 12. Normalized gate threshold voltage vs temperature

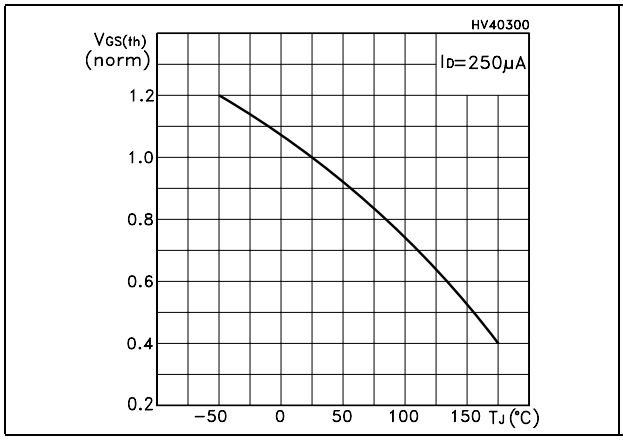


Figure 13. Normalized on resistance vs temperature

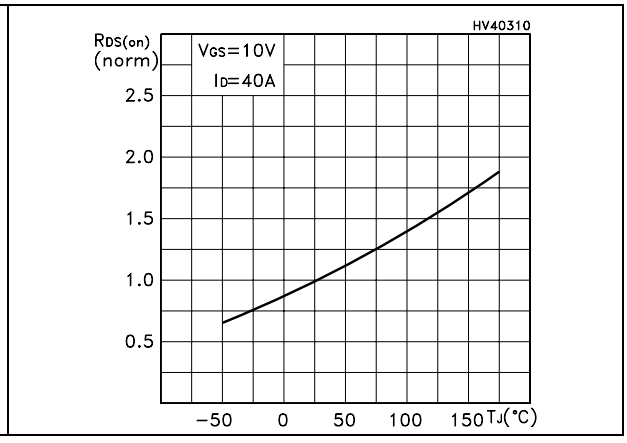
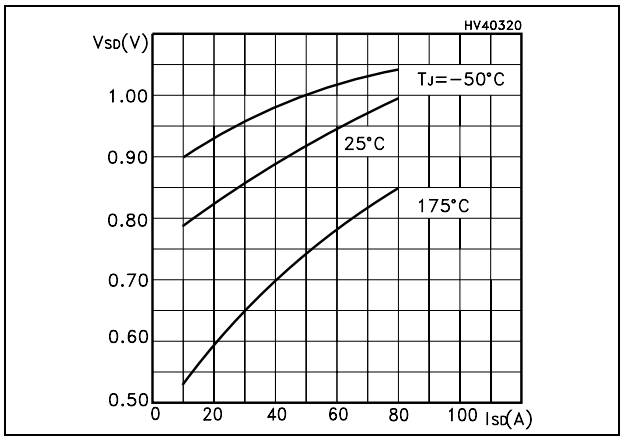


Figure 14. Source-drain diode forward characteristics



3 Test circuits

Figure 15. Unclamped inductive load test circuit

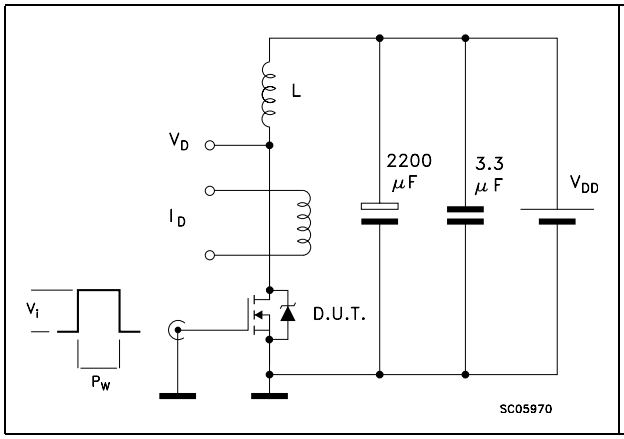


Figure 16. Unclamped inductive waveform

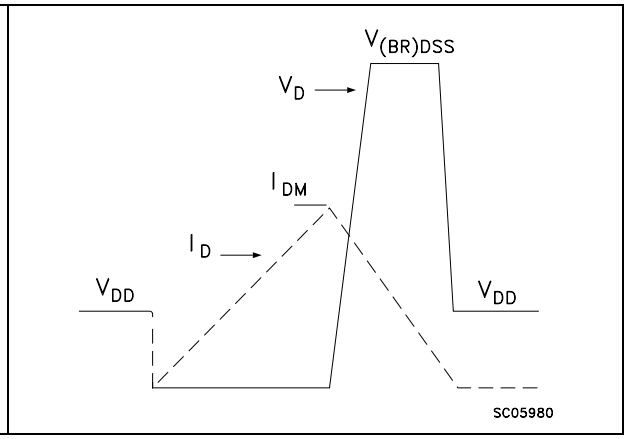


Figure 17. Switching times test circuit for resistive load

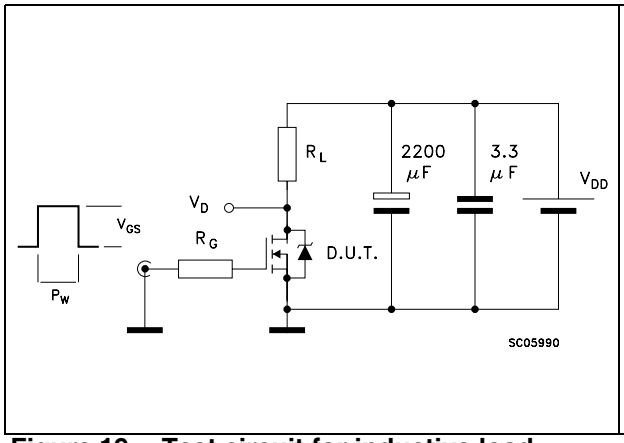


Figure 18. Gate charge test circuit

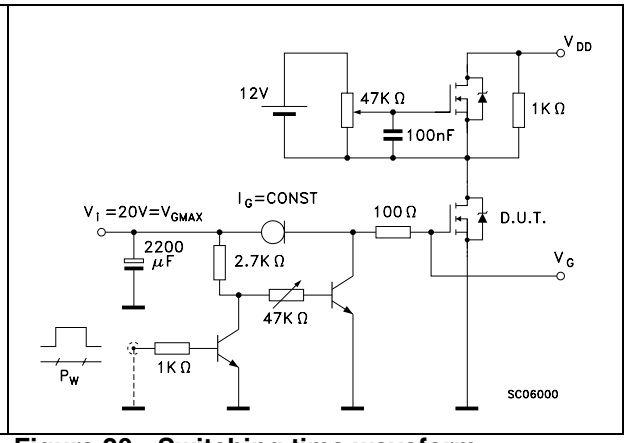


Figure 19. Test circuit for inductive load switching and diode recovery times

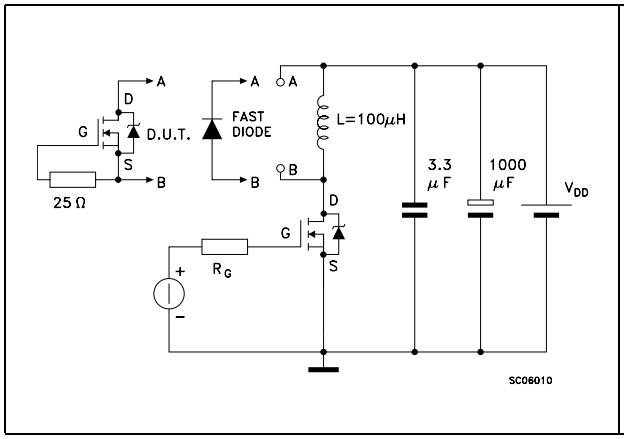


Figure 20. Switching time waveform

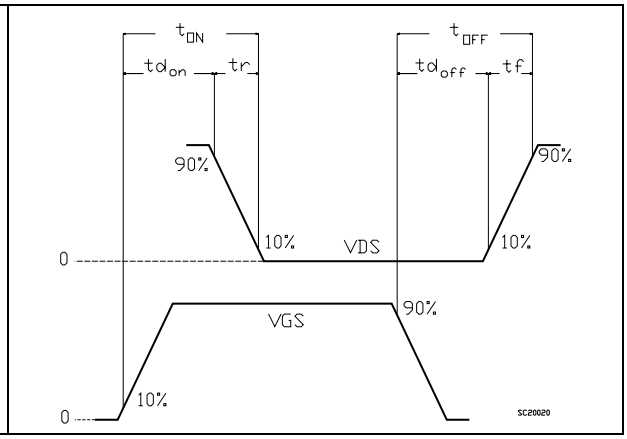
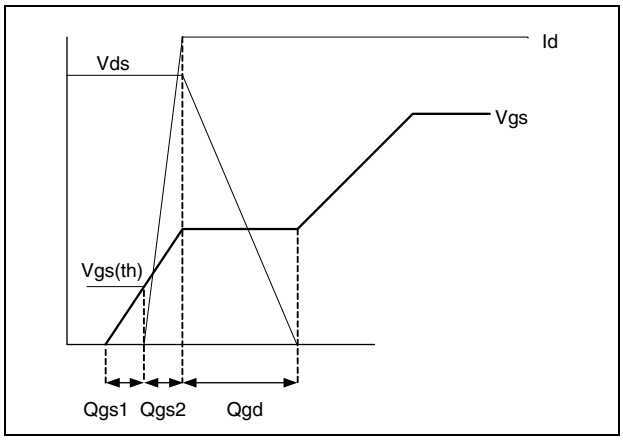


Figure 21. Gate charge waveform

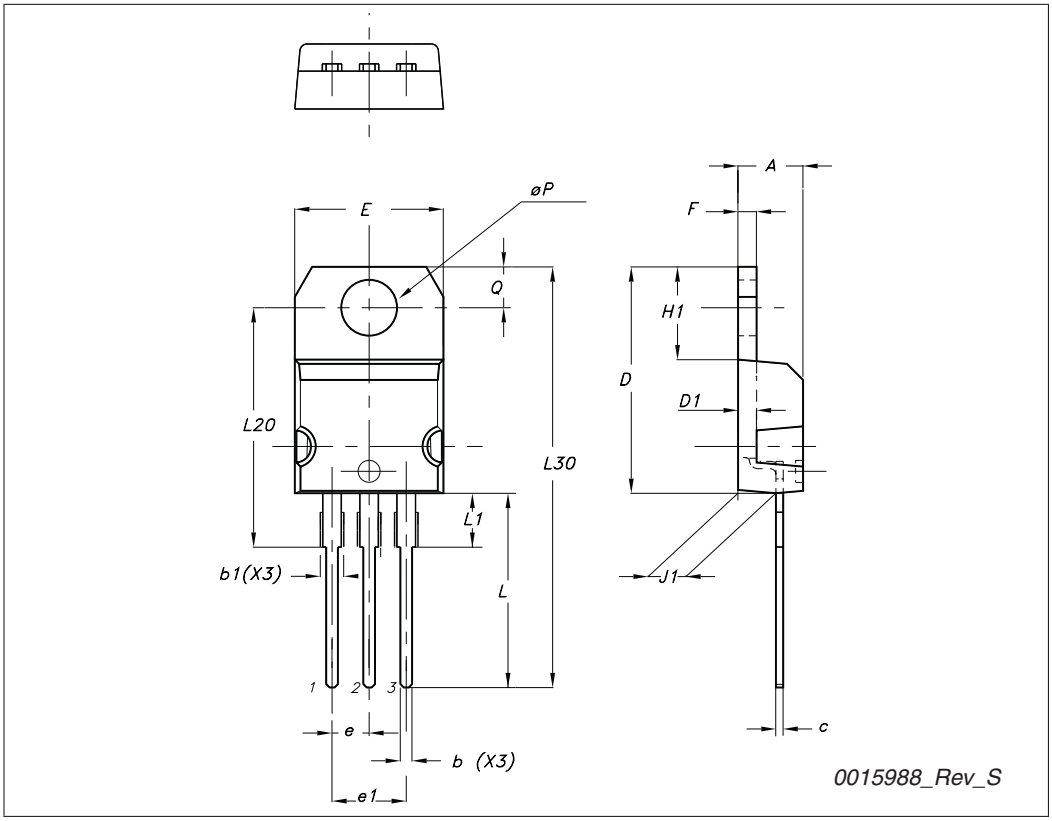


4 Package mechanical data

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.

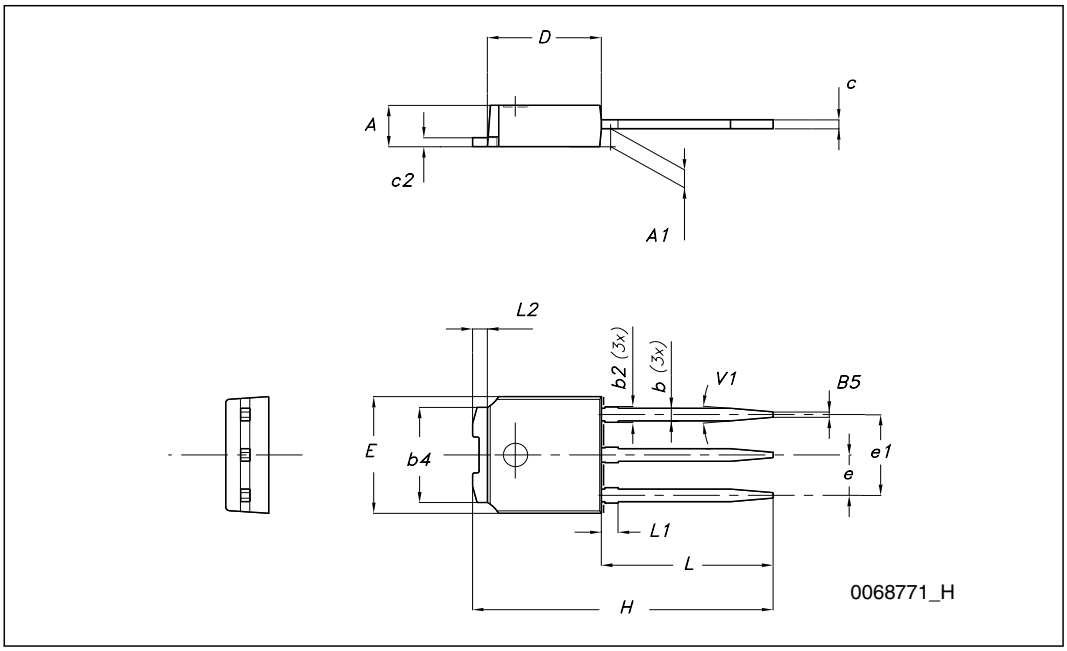
TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95



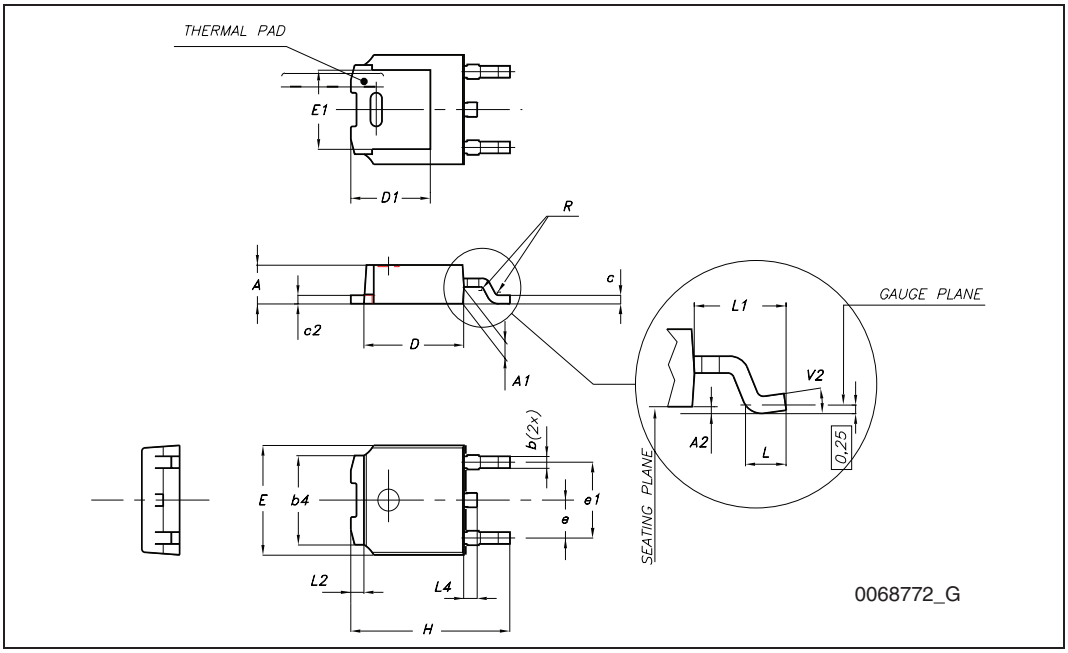
TO-251 (IPAK) mechanical data

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 °	



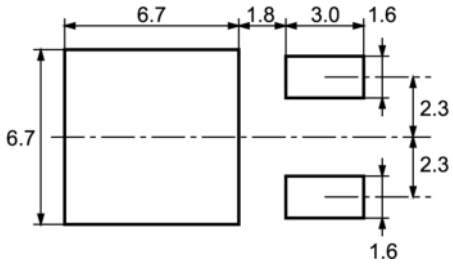
TO-252 (DPAK) mechanical data

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 °



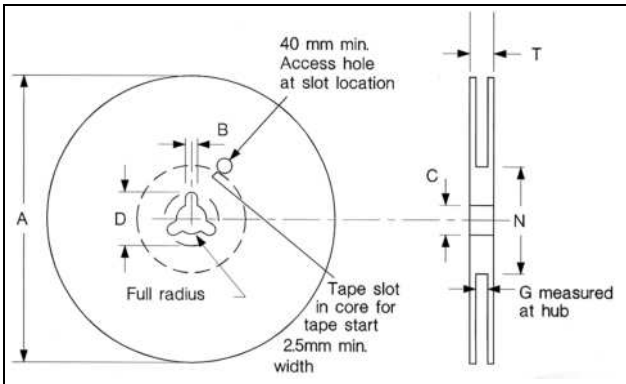
5 Packaging mechanical data

DPAK FOOTPRINT



All dimensions are in millimeters

TAPE AND REEL SHIPMENT



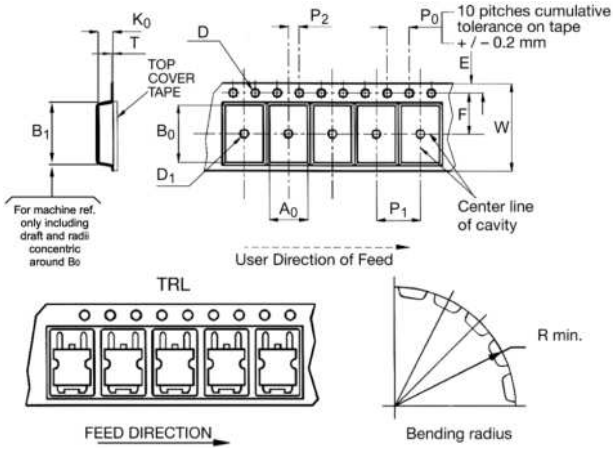
REEL MECHANICAL DATA

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



6 Revision history

Table 8. Document revision history

Date	Revision	Changes
16-Oct-2007	1	First release
20-Feb-2008	2	Modified *Table 4.: Static*
23-Sep-2008	3	V_{GS} value has been changed on *Table 2* and *Table 5*
20-Apr-2009	4	Added device in TO-220
26-Apr-2010	5	– *Table 1: Device summary* has been corrected – *Section 4: Package mechanical data* has been updated

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