STP1N120
STU1N120

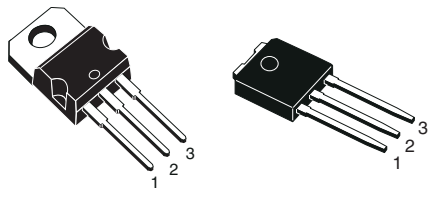
N-channel 1200 V - 30 Ω - 500 mA - TO-220 - IPAK Zener - protected SuperMESH™ Power MOSFET

Preliminary Data

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D	P_W
STP1N120	1200 V	< 38 Ω	500 mA	45 W
STU1N120	1200 V	< 38 Ω	500 mA	45 W

- 100% avalanche tested
- Extremely high dv/dt capability
- ESD improved capability
- New high voltage benchmark
- Gate charge minimized



TO-220 IPAK

Application

- Switching applications

Description

The SuperMESH™ series is obtained through an extreme optimization of ST's well established strip-based PowerMESH™ layout. In addition to pushing on-resistance significantly down, special care is taken to ensure a very good dv/dt capability for the most demanding applications. Such series complements ST full range of high voltage Power MOSFETs including revolutionary MDmesh™ products.

Figure 1. Internal schematic diagram

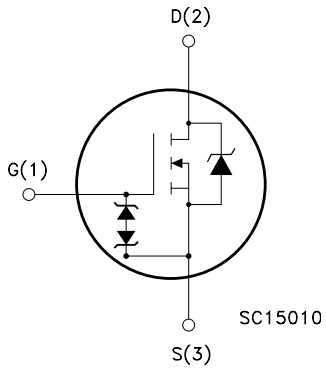


Table 1. Device summary

Order codes	Marking	Package	Packaging
STP1N120	1N120	TO-220	Tube
STU1N120	1N120	IPAK	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS}=0)	1200	V
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current (continuous) at T_C = 25 °C	500	mA
I_D	Drain current (continuous) at T_C = 100 °C	315	mA
I_{DM} (1)	Drain current (pulsed)	2	A
	Derating factor	0.36	W/°C
P_{TOT}	Total dissipation at T_C = 25 °C	45	W
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Max operating junction temperature	150	°C

1. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value		Unit
		TO-220	IPAK	
$R_{thj\text{-}case}$	Thermal resistance junction-case max	2.78		°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-amb max	62.5	100	°C/W
T_l	Maximum lead temperature for soldering purpose	300		°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj max)	0.5	A
E_{AS}	Single pulse avalanche energy (starting Tj=25 °C, I_D=I_{AS}, V_{DD}= 50 V)	300	mJ

2 Electrical characteristics

(T_{CASE}=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	1200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating,Tc=125 °C			1 50	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ± 30 V			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS}= V_{GS}, I_D = 50 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 0.25 A		30	38	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 20 V, I_D = 0.25 A		1		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25 V, f=1 MHz, V_{GS}=0		189 24 3	246	pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 960 V		24		pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=960 V, I_D = 500 mA V_{GS} =10 V *(see Figure 3)*		7.3 1.3 4.4		nC nC nC
R_g	Intrinsic gate resistance	f= 1 MHz open drain		2.3		Ω

1. Pulsed: pulse duration=300µs, duty cycle 1.5%
2. Coss eq. is defined as a constant equivalent capacitance giving the same charging time as Coss when V_{DS} increases from 0 to 80% V_{DSS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD}=600 V, I_D=0.25 A, R_G=4.7 Ω, V_{GS}=10 V *(see Figure 5)*		10.7 28.5 28 88		ns ns ns ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD} I_{SDM}	Source-drain current Source-drain current (pulsed)				500 2	mA A
V_{SD} (1)	Forward on voltage	I_{SD}= 500 mA, V_{GS}=0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=500 mA,V_{DD}=100 V di/dt = 50 A/µs *(see Figure 4)*		332 0.56 3.4		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=500 mA,V_{DD}=100 V di/dt=50 A/µs,Tj=150 °C *(see Figure 4)*		326 0.58 6.3		ns µC A

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

Table 9. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
BV_{GSO} (1)	Gate-source breakdown voltage	Igs ± 1 mA, (open drain)	30			V

1. The built-in-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possibile voltage transients that may occasionally be applied from gate to source. In this respect the zener voltage is appropriate to achieve an efficient and ost-effective intervention to protect the device's integrity. These integrated zener diodes thus avoid the usage of external components.

3 Test circuits

Figure 2. Switching times test circuit for resistive load

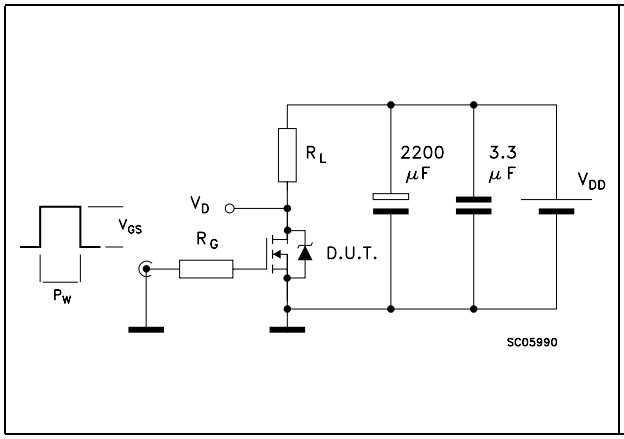


Figure 3. Gate charge test circuit

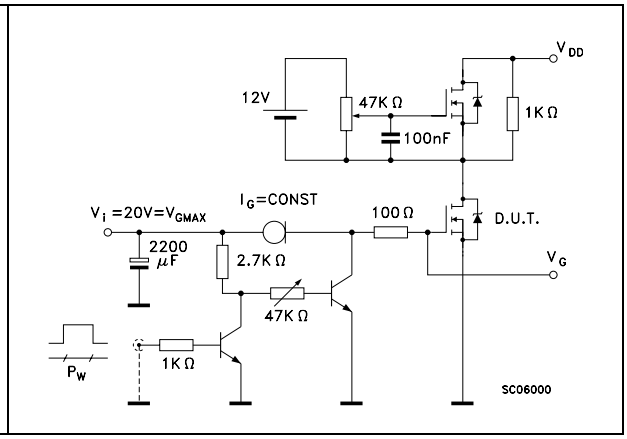


Figure 4. Test circuit for inductive load switching and diode recovery times

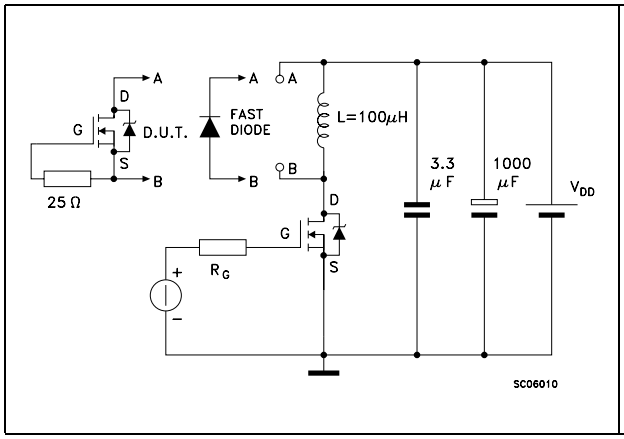


Figure 5. Unclamped inductive load test circuit

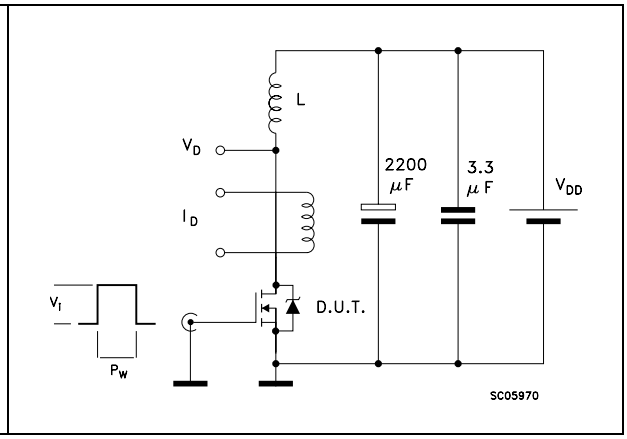


Figure 6. Unclamped inductive waveform

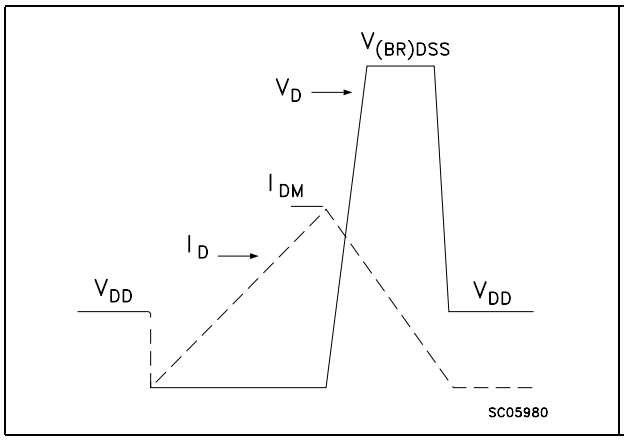
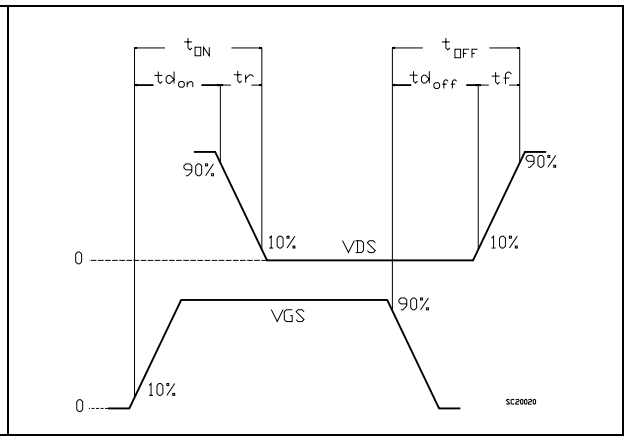


Figure 7. Switching time waveform

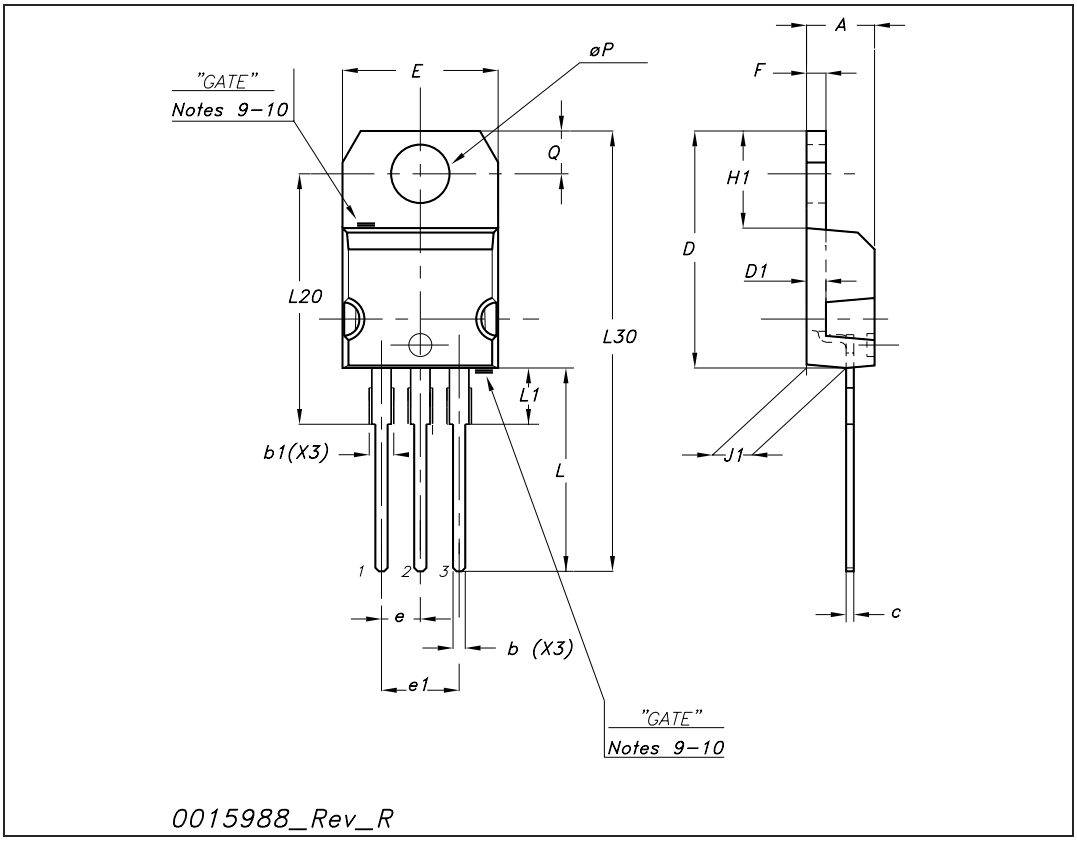


4 Package mechanical data

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*

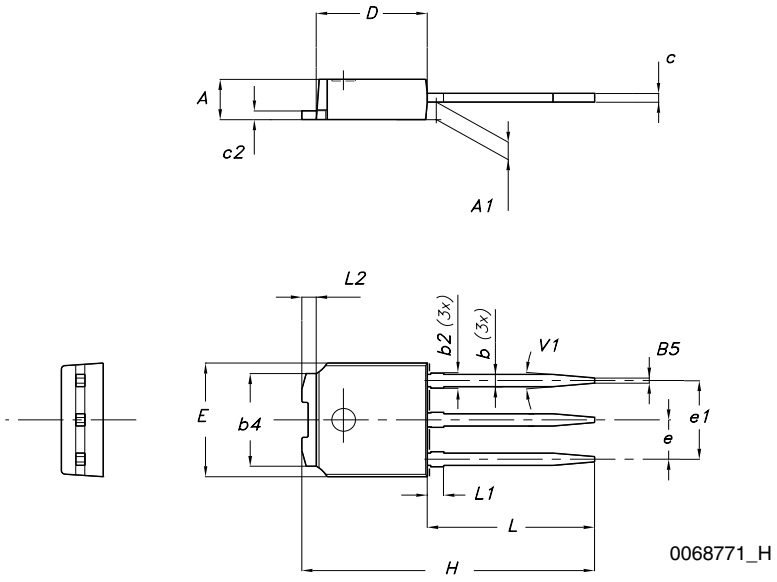
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



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 °	



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
11-Oct-2006	1	First release
20-Mar-2008	2	Added IPAK package, preliminary version

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