



STFW6N120K3 STP6N120K3, STW6N120K3

N-channel 1200 V, 1.85 Ω , 5 A, TO-3PF, TO-220, TO-247
Zener-protected SuperMESH3™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on) max}	I _D	P _w
STFW6N120K3	1200 V	< 2.4 Ω	5 A	TBD
STP6N120K3	1200 V	< 2.4 Ω	5 A	150 W
STW6N120K3	1200 V	< 2.4 Ω	5 A	150 W

- 100% avalanche tested
- Extremely large avalanche performance
- Gate charge minimized
- Very low intrinsic capacitances
- Zener-protected

Application

- Switching applications

Description

The new SuperMESH3™ series is obtained through the combination of a further fine tuning of ST's well established strip-based PowerMESH™ layout with optimized vertical structure. In addition to pushing on-resistance significantly down, special attention has been taken to ensure a very good dynamic performances coupled with a very large avalanche capability for the most demanding application.

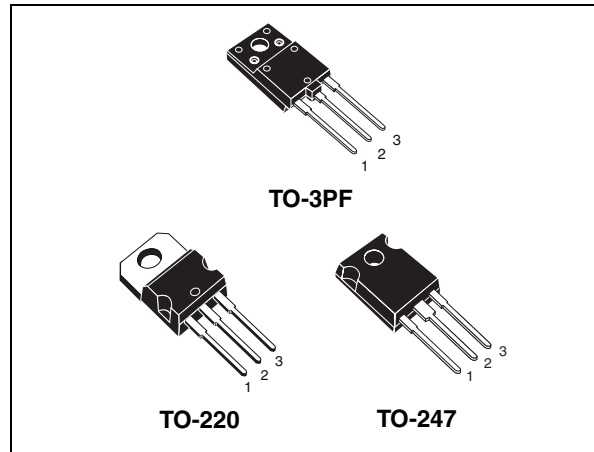


Figure 1. Internal schematic diagram

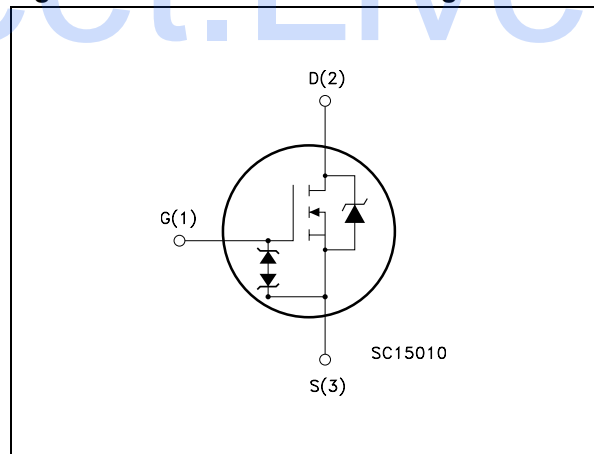


Table 1. Device summary

Order codes	Marking	Package	Packaging
STFW6N120K3	6N120K3	TO-3PF	Tubes
STP6N120K3	6N120K3	TO-220	Tubes
STW6N120K3	6N120K3	TO-247	Tubes

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value			Unit
		TO-3PF	TO-220	TO-247	
V_{GS}	Gate- source voltage	30			V
I_D	Drain current (continuous) at $T_C = 25\text{ °C}$	5			A
I_D	Drain current (continuous) at $T_C = 100\text{ °C}$	3.2			A
$I_{DM}^{(1)}$	Drain current (pulsed)	20			A
P_{TOT}	Power dissipation at $T_C = 25\text{ °C}$	TBD	150	150	W
I_{AR}	Max current during repetitive or single pulse avalanche (pulse width limited by T_{JMAX})	TBD			A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25\text{ °C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{ V}$)	TBD			mJ
$dv/dt^{(2)}$	Peak diode recovery voltage slope	TBD			V/ns
$V_{ESD(G-S)}$	G-S ESD (HBM-C = 100 pF, R = 1.5 k Ω)	4000			V
V_{ISO}	Insulation withstand voltage (AC)	3500	-	-	V
T_{stg}	Storage temperature	-55 to 150			°C
T_J	Operating junction temperature				

1. Pulse width limited by safe operating area

2. $I_{SD} \leq 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{Peak} < V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	TO-3PF	TO-220	TO-247	Unit
$R_{thj-case}$	Thermal resistance junction-case	TBD	0.83		°C/W
$R_{thj-pcb}$	Thermal resistance junction to pcb minimum footprint	-	-	-	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	62.5	50	°C/W
T_J	Maximum lead temperature for soldering purpose	300			°C

2 Electrical characteristics

($T_C = 25\text{ °C}$ unless otherwise specified)

Table 4. On / off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$, $V_{GS} = 0$	1200	-	-	V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_J = 125\text{ °C}$	-	-	1 50	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0$	-	-	± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 100\text{ }\mu\text{A}$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 2.5\text{ A}$	-	1.85	2.4	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{ V}$, $I_D = 2.5\text{ A}$	-	TBD	-	S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 100\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1050 70 1	-	pF pF pF
$C_{O(tr)}^{(2)}$	Equivalent capacitance time related	$V_{GS} = 0$, $V_{DS} = 0\text{ to }960\text{ V}$	-	TBD	-	pF
$C_{O(er)}^{(3)}$	Equivalent capacitance energy related	$V_{GS} = 0$, $V_{DS} = 0\text{ to }960\text{ V}$	-	TBD	-	pF
R_G	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain	-	3	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 960\text{ V}$, $I_D = 5\text{ A}$, $V_{GS} = 10\text{ V}$ (see Figure 3)	-	32 TBD TBD	-	nC nC nC

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

Table 6. Switching times on/off

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 600\text{ V}$, $I_D = 2.5\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 2)	-	TBD	-	ns
t_r	Rise time			TBD		ns
$t_{d(off)}$	Turn-off-delay time			TBD		ns
t_f	Fall time			TBD		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-	-	5	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				20	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 5\text{ A}$, $V_{GS} = 0$	-	--	1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 25\text{ }^\circ\text{C}$ (see Figure 7)	-	TBD	-	ns
Q_{rr}	Reverse recovery charge			TBD		nC
I_{RRM}	Reverse recovery current			TBD		A
t_{rr}	Reverse recovery time	$I_{SD} = 5\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 60\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ (see Figure 7)	-	TBD	-	ns
Q_{rr}	Reverse recovery charge			TBD		nC
I_{RRM}	Reverse recovery current			TBD		A

1. Pulse width limited by safe operating area

2. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

Table 8. Gate-source Zener diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
BV_{GSO}	Gate-source breakdown voltage	$I_{GS} = \pm 1\text{ mA}$ (open drain)	30	-	-	V

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-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

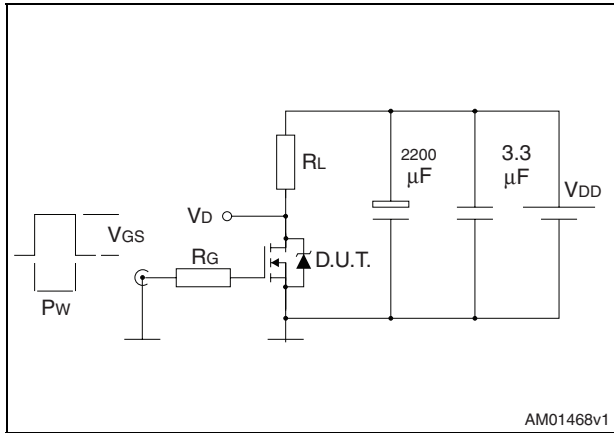


Figure 3. Gate charge test circuit

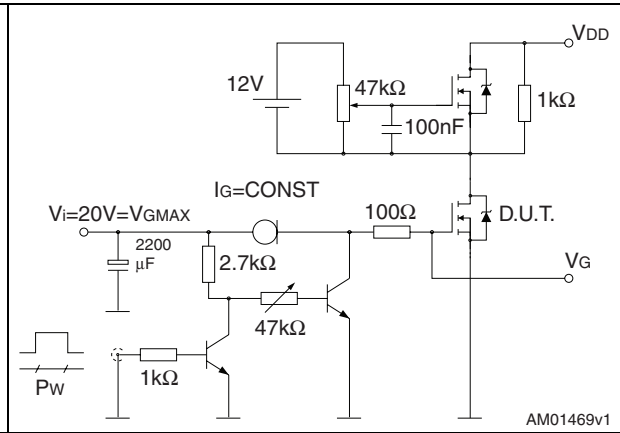


Figure 4. Test circuit for inductive load switching and diode recovery times

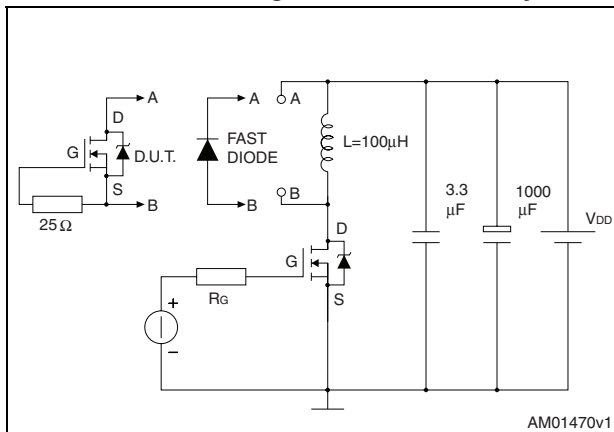


Figure 5. Unclamped inductive load test circuit

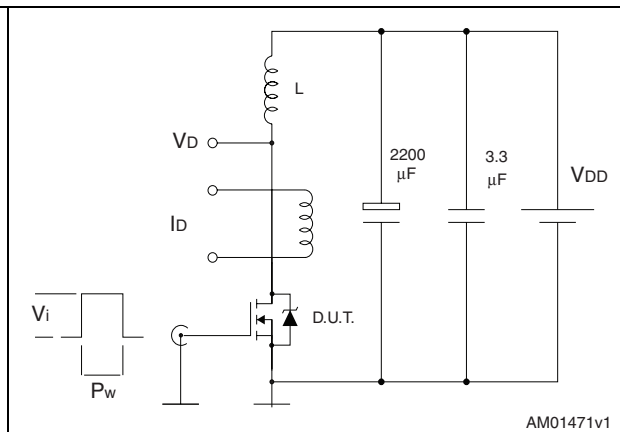


Figure 6. Unclamped inductive waveform

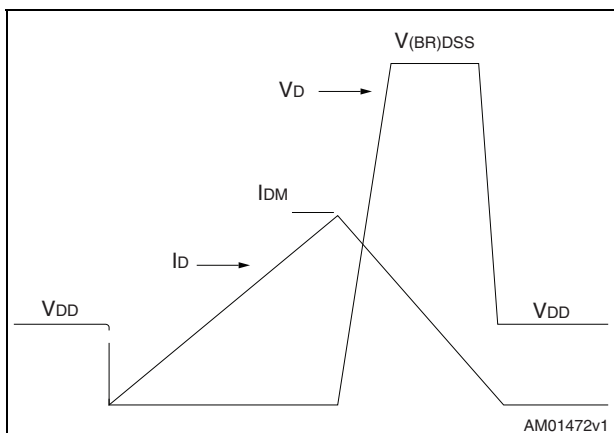
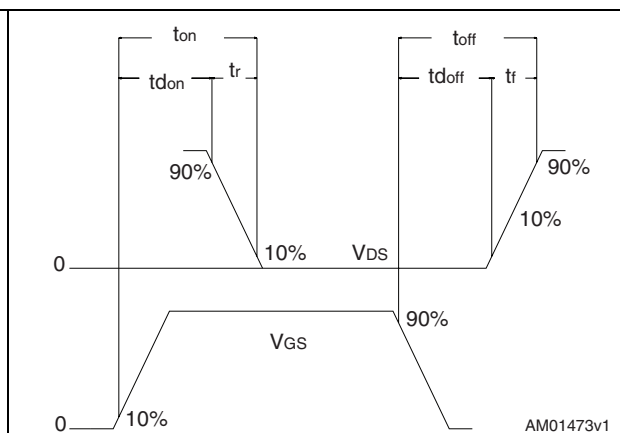


Figure 7. Switching time waveform

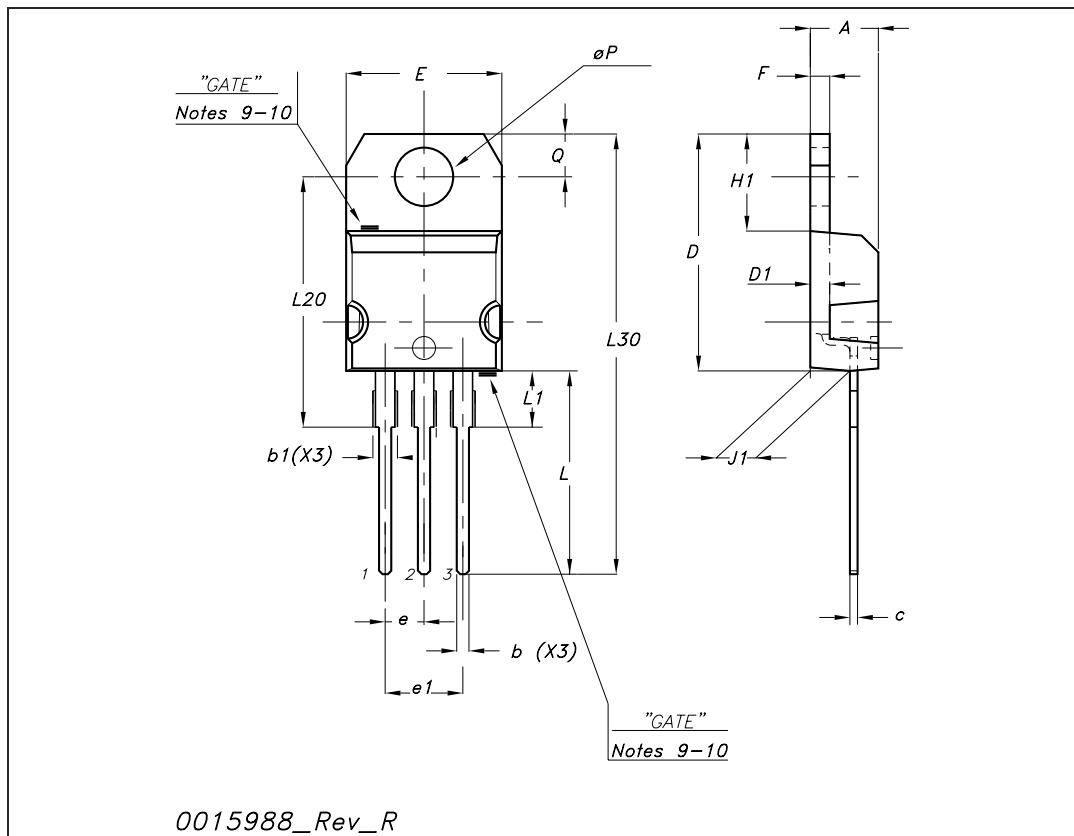


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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.

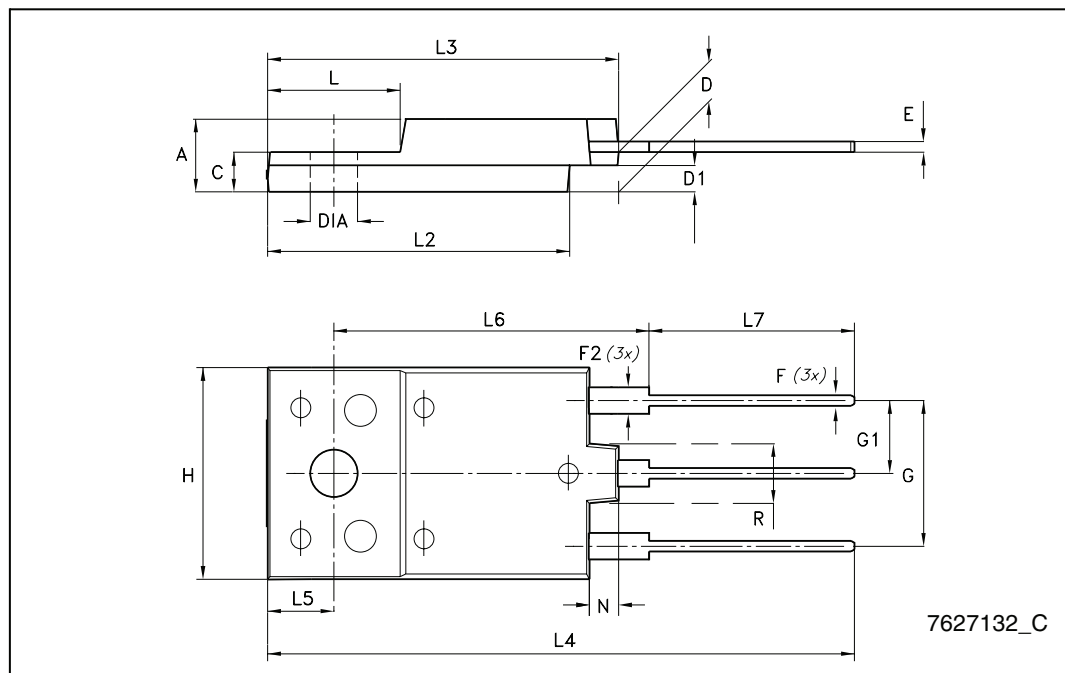
TO-220 mechanical data

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



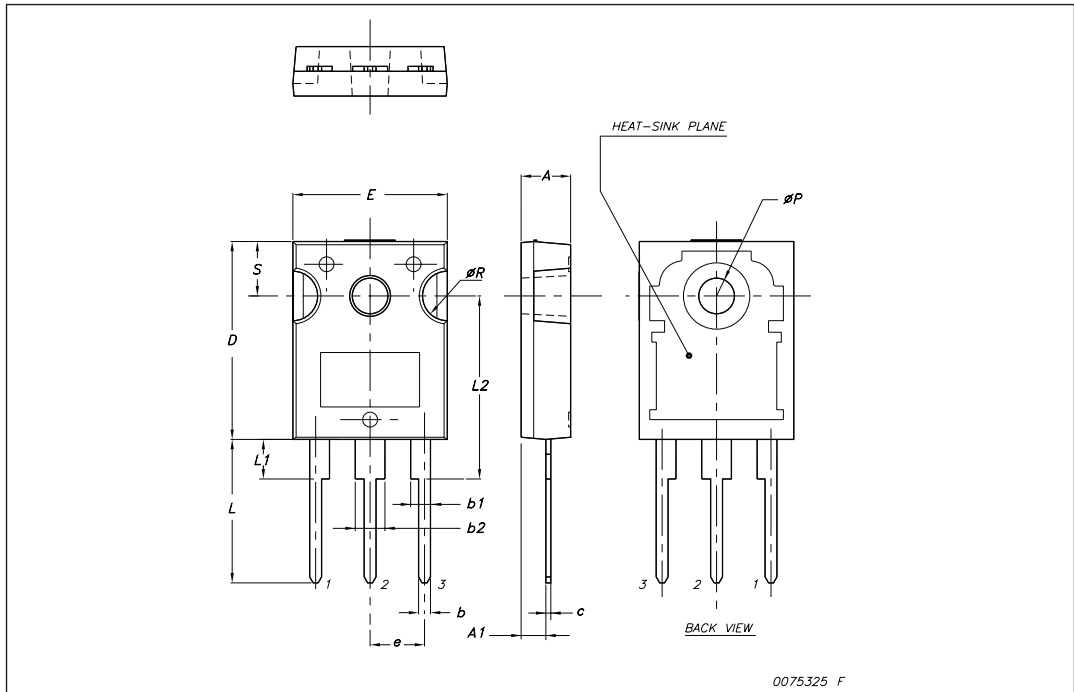
TO-3PF mechanical data

DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80



TO-247 mechanical data

Dim.	mm.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
15-Apr-2009	1	First release

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