



# STF34NM60N STP34NM60N, STW34NM60N

N-channel 600 V, 0.092  $\Omega$ , 29 A MDmesh™ II Power MOSFET  
TO-220, TO-247, TO-220FP

Preliminary data

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STF34NM60N	600 V	0.105 $\Omega$	29 A	40 W
STP34NM60N	600 V	0.105 $\Omega$	29 A	210 W
STW34NM60N	600 V	0.105 $\Omega$	29 A	210 W

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

## Application

- Switching applications

## Description

These devices are made using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

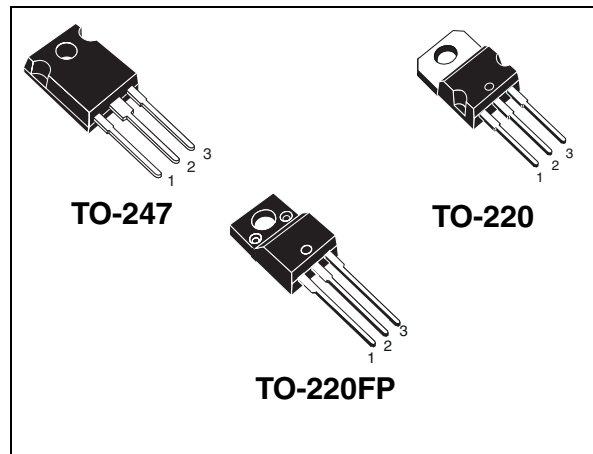


Figure 1. Internal schematic diagram

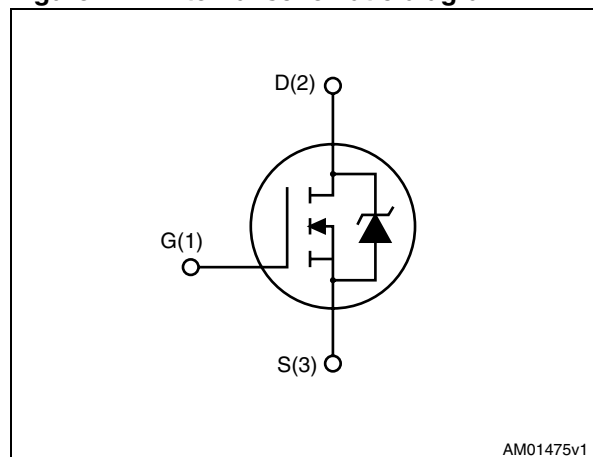


Table 1. Device summary

Order codes	Marking	Package	Packaging
STF34NM60N	34NM60N	TO-220FP	Tube
STP34NM60N		TO-220	
STW34NM60N		TO-247	

# Contents

1	Electrical ratings .....	3
2	Electrical characteristics .....	4
3	Test circuits .....	6
4	Package mechanical data .....	7
5	Revision history .....	11

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220, TO-247	TO-220FP	
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	600		V
$V_{GS}$	Gate- source voltage	$\pm 25$		V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	29	29 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	18	18	A
$I_{DM}^{(2)}$	Drain current (pulsed)	116	116	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	210	40	W
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_J$ max)	12		A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	345		mJ
$dv/dt^{(3)}$	Peak diode recovery voltage slope	15		V/ns
$T_{stg}$	Storage temperature	- 55 to 150		$^\circ\text{C}$
$T_J$	Max. operating junction temperature	150		

- Limited only by maximum temperature allowed.
- Pulse width limited by safe operating area.
- $I_{SD} \leq 29\text{ A}$ ,  $di/dt \leq 600\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$

**Table 3. Thermal data**

Symbol	Parameter	TO-220	TO-247	TO-220FP	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.60		3.13	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	50	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300			$^\circ\text{C}$

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	600			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating @ } 125\text{ °C}$			1 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 14.5\text{ A}$		0.092	0.105	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	2722	-	pF
$C_{oss}$	Output capacitance			173		pF
$C_{rss}$	Reverse transfer capacitance			1.75		pF
$C_{oss\text{ eq.}}^{(1)}$	Equivalent output capacitance	$V_{GS} = 0$ , $V_{DS} = 0\text{ to } 480\text{ V}$	-	458	-	pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 14.5\text{ A}$ $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 7</a> ), (see <a href="#">Figure 2</a> )	-	TBD	-	ns
$t_r$	Rise time			TBD		ns
$t_{d(off)}$	Turn-off delay time			TBD		ns
$t_f$	Fall time			TBD		ns
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 29\text{ A}$ , $V_{GS} = 10\text{ V}$ , (see <a href="#">Figure 3</a> )	-	80	-	nC
$Q_{gs}$	Gate-source charge			16		nC
$Q_{gd}$	Gate-drain charge			41		nC
$R_g$	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20 mV Open drain	-	2.9	-	$\Omega$

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

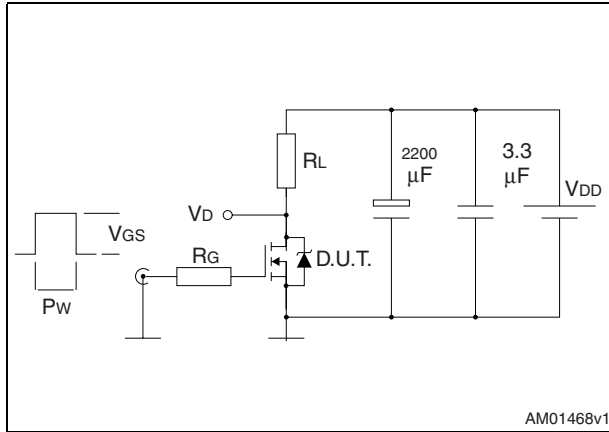
**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$I_{SD}$	Source-drain current		-		29	A	
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		116	A	
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 29\text{ A}, V_{GS} = 0$	-		TBD	V	
$t_{rr}$	Reverse recovery time	$I_{SD} = 29\text{ A}, V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ (see <a href="#">Figure 4</a> )	-	TBD		ns	
$Q_{rr}$	Reverse recovery charge			TBD			μC
$I_{RRM}$	Reverse recovery current			TBD			
$t_{rr}$	Reverse recovery time	$I_{SD} = 29\text{ A}, V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 150\text{ }^\circ\text{C}$ (see <a href="#">Figure 4</a> )	-	TBD		ns	
$Q_{rr}$	Reverse recovery charge			TBD			μC
$I_{RRM}$	Reverse recovery current			TBD			

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

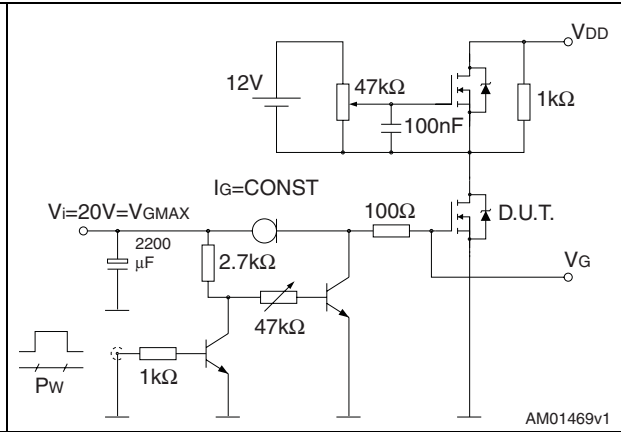
### 3 Test circuits

**Figure 2. Switching times test circuit for resistive load**



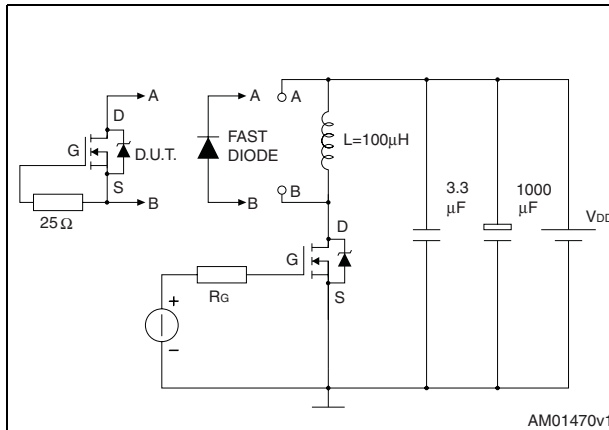
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**Figure 3. Gate charge test circuit**



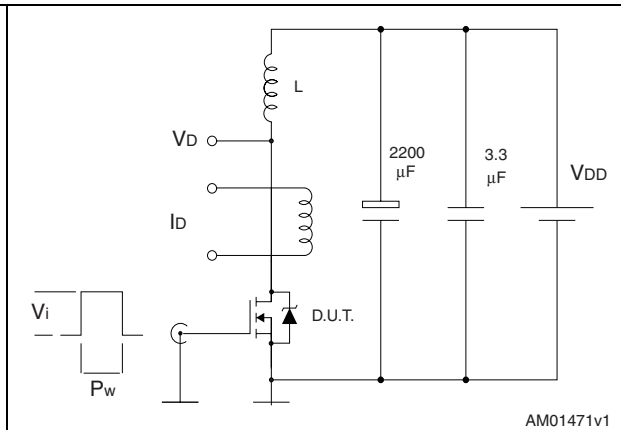
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**Figure 4. Test circuit for inductive load switching and diode recovery times**



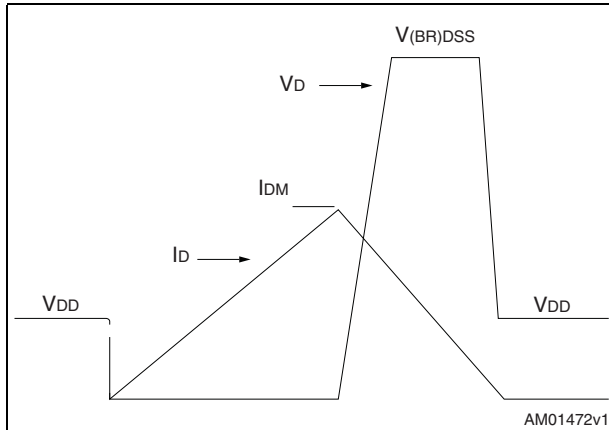
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**Figure 5. Unclamped inductive load test circuit**



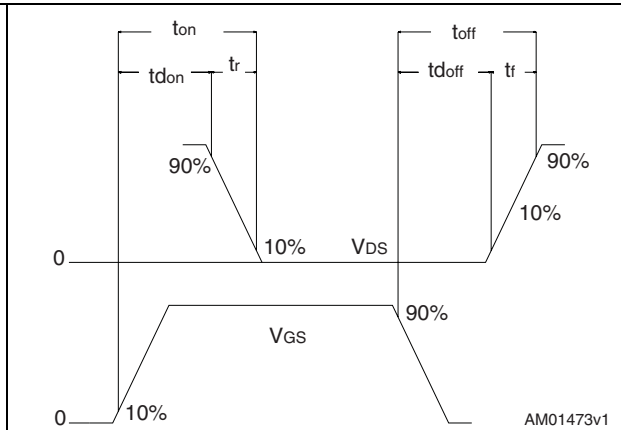
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**Figure 6. Unclamped inductive waveform**



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**Figure 7. Switching time waveform**



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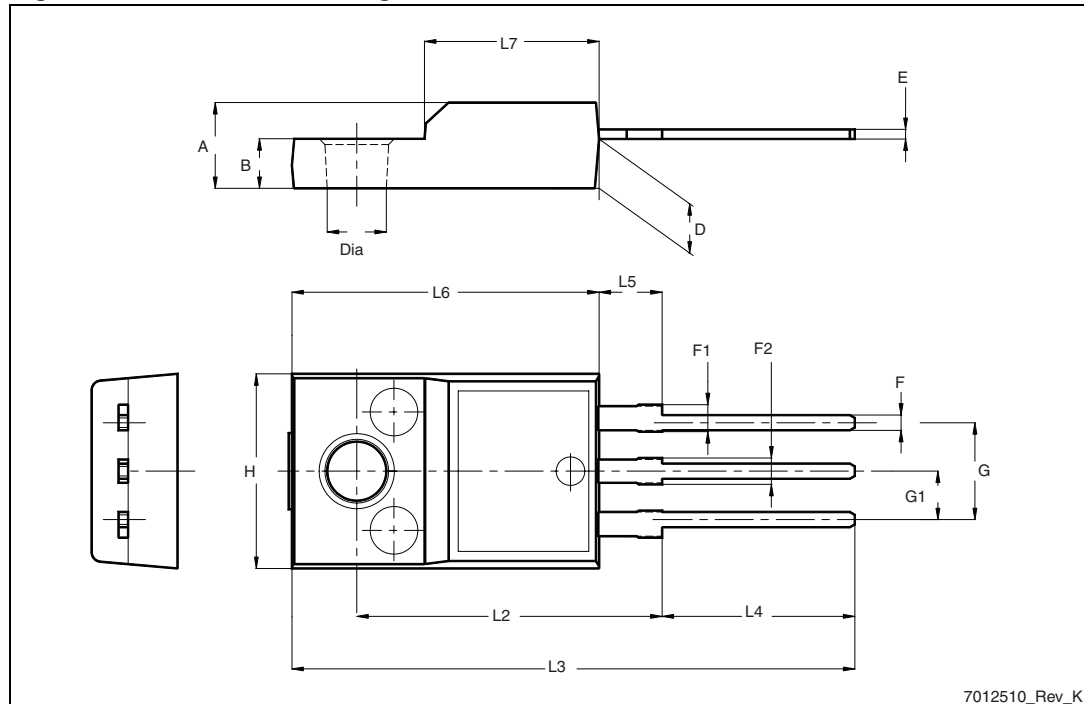
## 4 Package mechanical data

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](http://www.st.com). ECOPACK® is an ST trademark.

Table 7. TO-220FP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.4		4.6
B	2.5		2.7
D	2.5		2.75
E	0.45		0.7
F	0.75		1
F1	1.15		1.70
F2	1.15		1.70
G	4.95		5.2
G1	2.4		2.7
H	10		10.4
L2		16	
L3	28.6		30.6
L4	9.8		10.6
L5	2.9		3.6
L6	15.9		16.4
L7	9		9.3
Dia	3		3.2

Figure 8. TO-220FP drawing

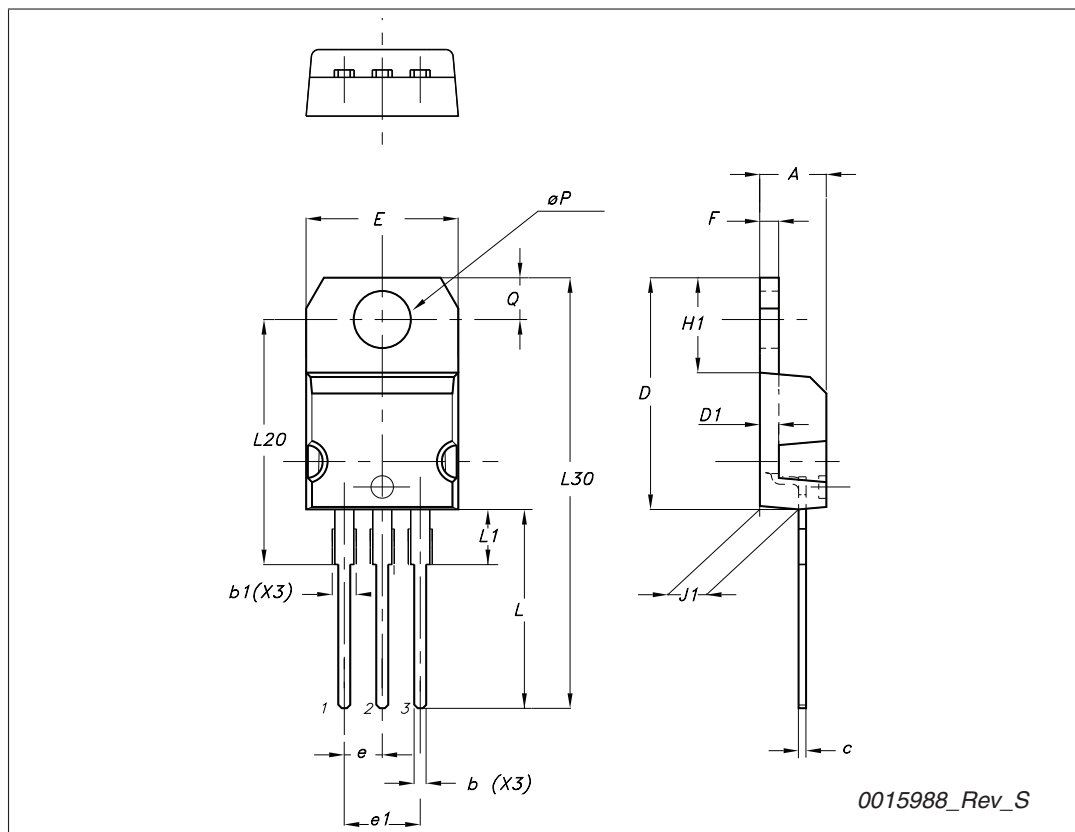


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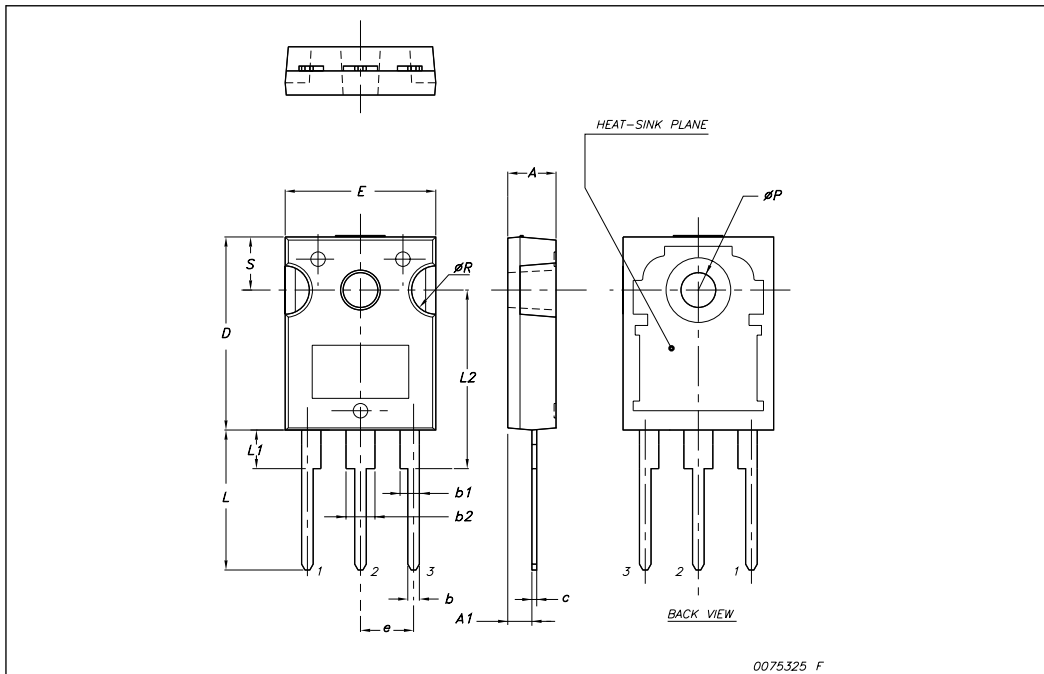
## TO-220 type A mechanical data

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-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 8. Document revision history**

Date	Revision	Changes
05-Aug-2010	1	Initial release.
02-Sep-2010	2	Updated title on cover page and <a href="#">Table 4: On/off states</a> .

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