



# STB18NM60N, STF18NM60N STP18NM60N, STW18NM60N

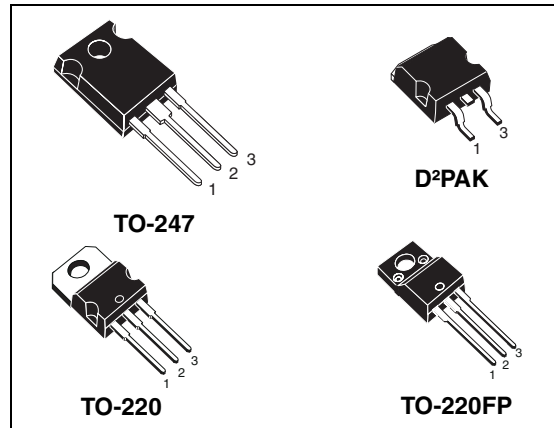
N-channel 600 V, 13 A, TO-220, TO-220FP, TO-247, D<sup>2</sup>PAK  
second generation MDmesh™ Power MOSFET

Preliminary data

## Features

Type	V <sub>DSS</sub> (@T <sub>jmax</sub> )	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>W</sub>
STB18NM60N	600 V	< 0.285 Ω	13 A	80 W
STF18NM60N	600 V	< 0.285 Ω	13 A	30 W
STP18NM60N	600 V	< 0.285 Ω	13 A	80 W
STW18NM60N	600 V	< 0.285 Ω	13 A	80 W

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



## Application

- Switching applications

## Description

MDmesh™ technology applies the benefits of the multiple drain process to STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product offers low on-resistance, high dv/dt capability and excellent avalanche characteristics.

Figure 1. Internal schematic diagram

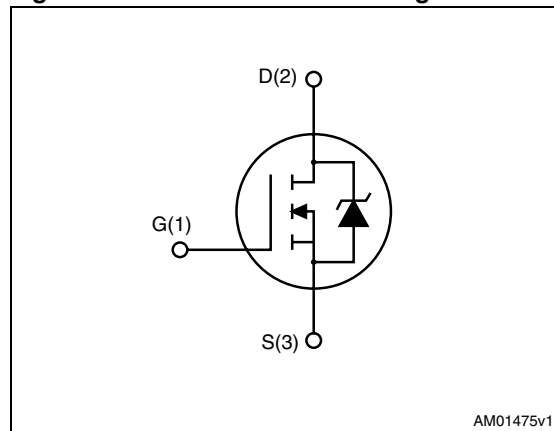


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB18NM60N	18NM60N	D <sup>2</sup> PAK	Tape and reel
STF18NM60N	18NM60N	TO-220FP	Tube
STP18NM60N	18NM60N	TO-220	Tube
STW18NM60N	18NM60N	TO-247	Tube

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		D <sup>2</sup> PAK, TO-220,TO-247	TO-220FP	
V <sub>GS</sub>	Gate- source voltage	600		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	13	13 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	8.2	8.2 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	52	52 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	80	30	W
I <sub>AR</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>J</sub> max)	TBD		A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>J</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	TBD		mJ
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	15		V/ns
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1 s;T <sub>C</sub> =25 °C)		2500	V
T <sub>J</sub> T <sub>stg</sub>	Operating junction temperature Storage temperature	-55 to 150		°C

- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
- I<sub>SD</sub> ≤ 13 A, di/dt ≤ 400 A/μs, peak V<sub>DS</sub> ≤ V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

Symbol	Parameter	D <sup>2</sup> PAK	TO-220	TO-247	TO-220FP	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	1.56			4.17	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-amb max		62.5	50	62.5	°C/W
T <sub>I</sub>	Maximum lead temperature for soldering purpose	300				°C

## 2 Electrical characteristics

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

**Table 4. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	600			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 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 25\text{ V}$ ; $V_{DS} = 0$			0.1	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 100\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{ A}$			0.285	W

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 0$ , $I_D = 0$	-	TBD	-	S
$C_{iss}$	Input capacitance	$V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	1000	-	pF
$C_{oss}$	Output capacitance			70		pF
$C_{rss}$	Reverse transfer capacitance			3		pF
$C_{o(tr)}^{(2)}$	Eq. capacitance time related	$V_{DS} = 0$ , to $480\text{ V}$ $V_{GS} = 0$	-	TBD	-	pF
$C_{o(er)}^{(3)}$	Eq. capacitance energy relate	$V_{DS} = 0$ , to $480\text{ V}$ $V_{GS} = 0$	-	TBD	-	pF
$R_g$	Intrinsic resistance	$f = 1\text{ MHz}$ open drain	-	4	-	W
$Q_g$	Total gate charge	$V_{DD} = 480\text{ V}$ , $I_D = 13\text{ A}$	-	35	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$		TBD		nC
$Q_{gd}$	Gate-drain charge	(see Figure 3)		TBD		nC

1. Pulsed: pulse duration=300is, duty cycle 1.5%
2.  $C_{oss\text{ eq}}$  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.  $C_{oss\text{ eq}}$  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**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 13\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (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		-		13	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				52	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 13\text{ A}$ , $V_{GS}=0$	-		TBD	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 13\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD} = 60\text{ V}$ (see Figure 4)	-	TBD		ns
$Q_{rr}$	Reverse recovery charge			TBD		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			TBD		A
$t_{rr}$	Reverse recovery time	$V_{DD} = 60\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $I_{SD} = 13\text{ A}$ $T_j = 150^\circ\text{C}$ (see Figure 4)	-	TBD		ns
$Q_{rr}$	Reverse recovery charge			TBD		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			TBD		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

### 3 Test circuits

Figure 2. Switching times test circuit for resistive load

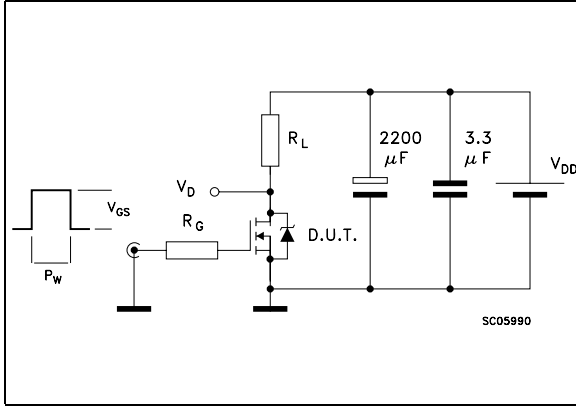


Figure 3. Gate charge test circuit

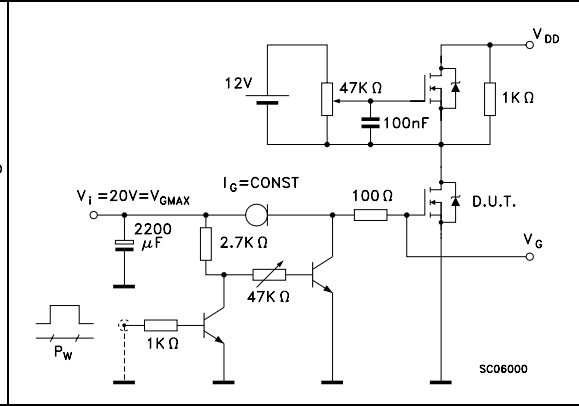


Figure 4. Test circuit for inductive load switching and diode recovery times

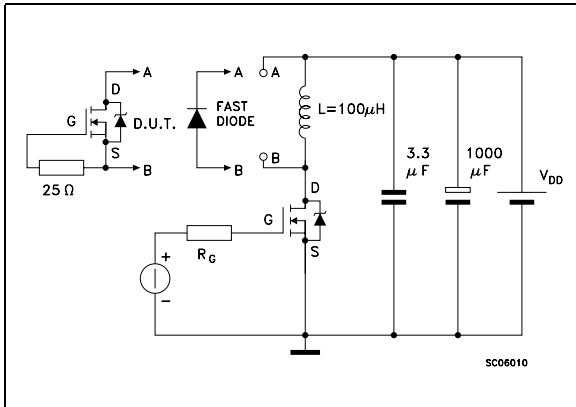


Figure 5. Unclamped inductive load test circuit

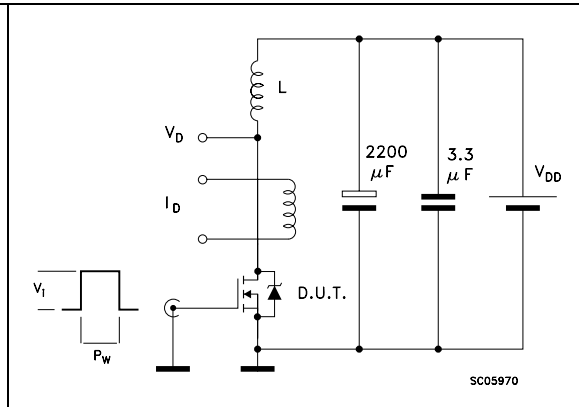


Figure 6. Unclamped inductive waveform

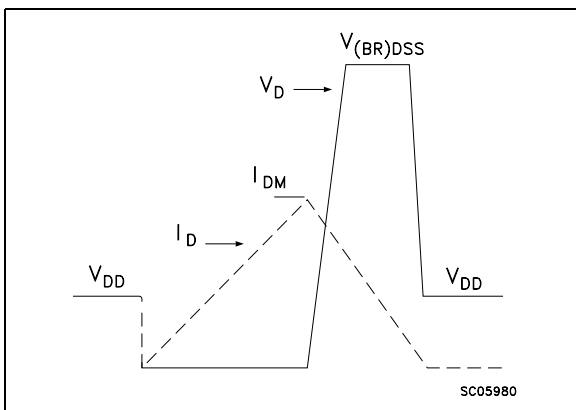
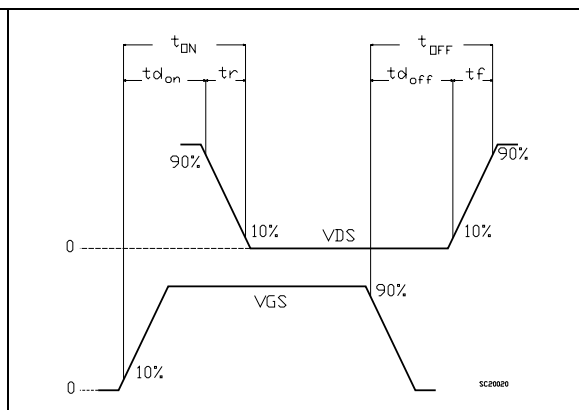


Figure 7. Switching time waveform

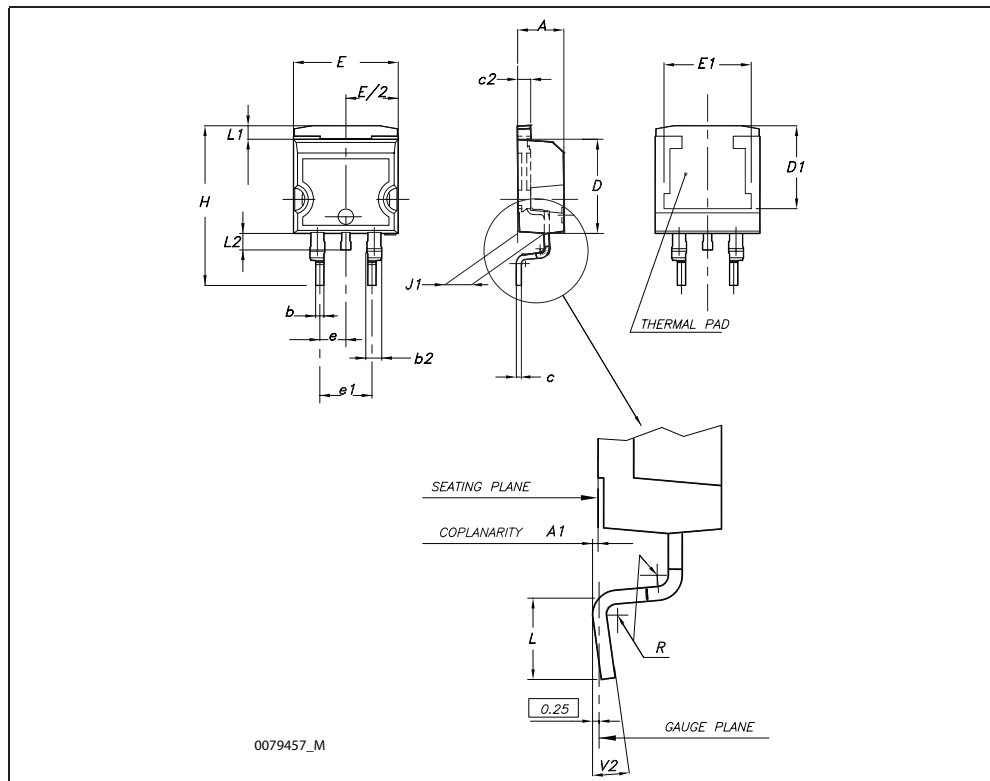


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

D<sup>2</sup>PAK (TO-263) mechanical data

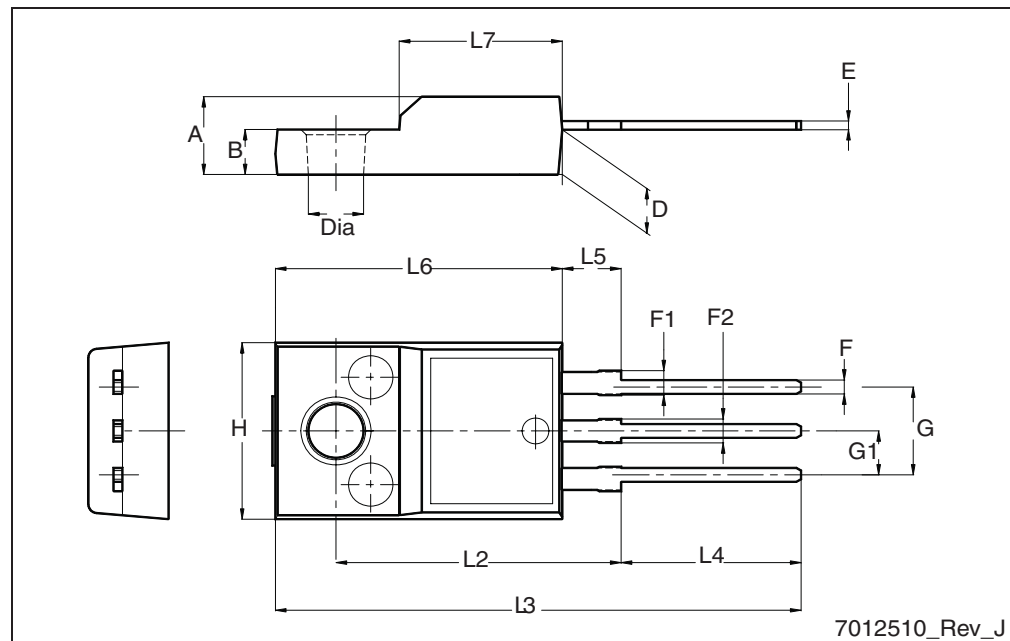
Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°





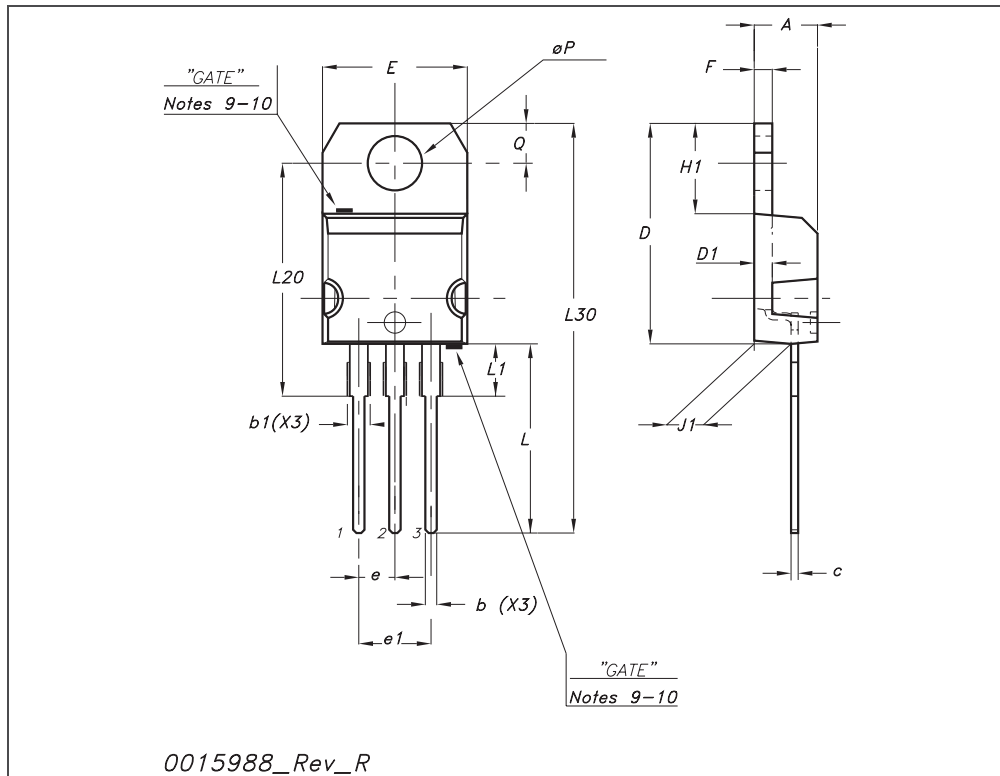
## TO-220FP mechanical data

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		1.5
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



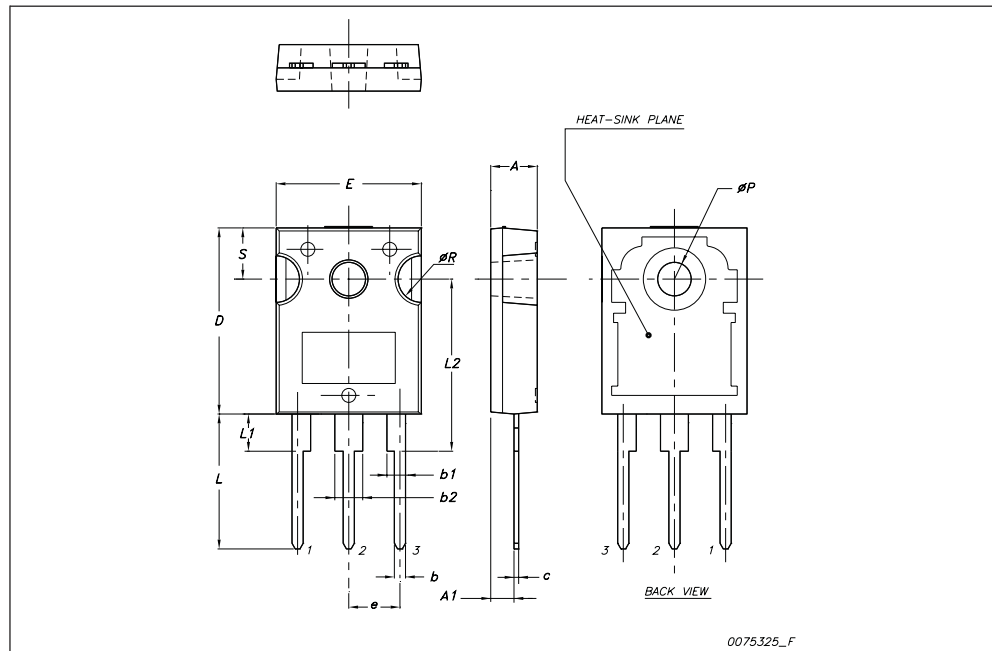
TO-220 mechanical data

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



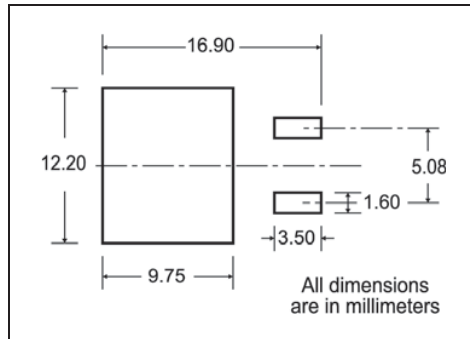
## TO-247 mechanical data

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 Packaging mechanical data

D<sup>2</sup>PAK FOOTPRINT



TAPE AND REEL SHIPMENT

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**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	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

## 6 Revision history

Table 8. Document revision history

Date	Revision	Changes
15-Jun-2009	1	First release

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