



# STB30NM60N, STI30NM60N, STF30NM60N STP30NM60N, STW30NM60N

N-channel 600 V, 0.1  $\Omega$ , 25 A, MDmesh™ II Power MOSFET  
TO-220, TO-220FP, TO-247, D<sup>2</sup>PAK, I<sup>2</sup>PAK

## Features

Type	V <sub>DSS</sub> @ T <sub>Jmax</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>	P <sub>W</sub>
STB30NM60N	650 V	<0.13 $\Omega$	25A	190 W
STI30NM60N	650 V	<0.13 $\Omega$	25A	190 W
STF30NM60N	650 V	<0.13 $\Omega$	25A <sup>(1)</sup>	40 W
STP30NM60N	650 V	<0.13 $\Omega$	25A	190 W
STW30NM60N	650 V	<0.13 $\Omega$	25A	190 W

1. Limited only by maximum temperature allowed

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

## Application

- Switching applications

## Description

This series of devices is designed 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.

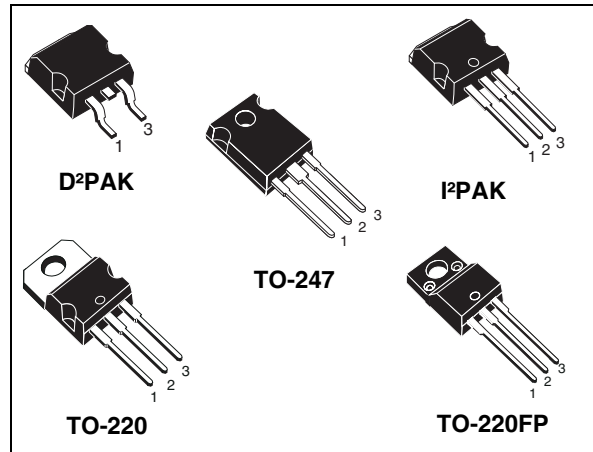


Figure 1. Internal schematic diagram

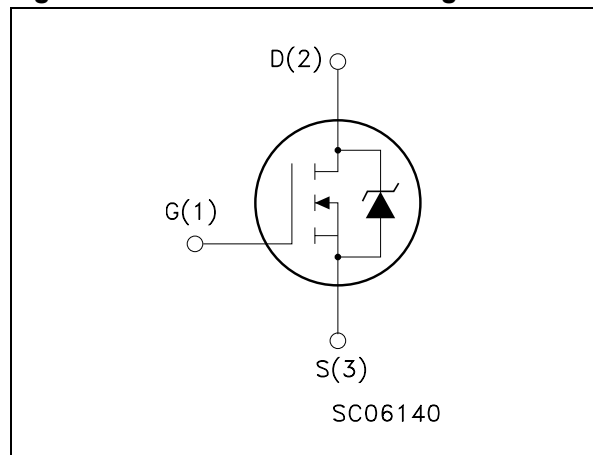


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB30NM60N	30NM60N	D <sup>2</sup> PAK	Tape and reel
STI30NM60N	30NM60N	I <sup>2</sup> PAK	Tube
STF30NM60N	30NM60N	TO-220FP	Tube
STP30NM60N	30NM60N	TO-220	Tube
STW30NM60N	30NM60N	TO-247	Tube

## Contents

<b>1</b>	<b>Electrical ratings</b> .....	<b>3</b>
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
	2.1 Electrical characteristics (curves) .....	6
<b>3</b>	<b>Test circuits</b> .....	<b>9</b>
<b>4</b>	<b>Package mechanical data</b> .....	<b>10</b>
<b>5</b>	<b>Packaging mechanical data</b> .....	<b>16</b>
<b>6</b>	<b>Revision history</b> .....	<b>17</b>

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value					Unit
		TO-220	I <sup>2</sup> PAK	TO-247	D <sup>2</sup> PAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> =0)	600					V
V <sub>GS</sub>	Gate-source voltage	± 30					V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	25			25 <sup>(1)</sup>		A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	15.8			15.8 <sup>(1)</sup>		A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	100			100 <sup>(1)</sup>		A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	190			40		W
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>stg</sub>	Storage temperature	-55 to 150					°C
T <sub>j</sub>	Max. operating junction temperature	150					°C

- Limited only by maximum temperature allowed
- Pulse width limited by safe operating area
- I<sub>SD</sub> ≤ 25A, di/dt ≤ 400A/μs, V<sub>DD</sub> = 80% V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

Symbol	Parameter	TO-220	I <sup>2</sup> PAK	TO-247	D <sup>2</sup> PAK	TO-220FP	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	0.66				3.1	°C/W
R <sub>thj-pcb</sub>	Thermal resistance junction-pcb max	--	--	--	30	--	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-amb max	62.5		50	--	62.5	°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purposes	300					°C

**Table 4. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>j</sub> max)	12	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> = 50V)	900	mJ

## 2 Electrical characteristics

(T<sub>case</sub> =25°C unless otherwise specified)

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0	600			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max rating V <sub>DS</sub> = Max rating, T <sub>C</sub> =125°C			1 100	μA μA
I <sub>GSS</sub>	Gate-body leakage current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ± 20 V			100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2	3	4	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 12.5 A		0.1	0.13	Ω

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward transconductance	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 12.5 A		25		S
C <sub>iss</sub> C <sub>oss</sub> C <sub>rss</sub>	Input capacitance Output capacitance Reverse transfer capacitance	V <sub>DS</sub> = 50 V, f = 1 MHz, V <sub>GS</sub> = 0		2700 210 22		pF pF pF
C <sub>oss eq.</sub>	Equivalent Output capacitance	V <sub>GS</sub> = 0, V <sub>DS</sub> = 0 to 480 V		66		pF
R <sub>g</sub>	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20 mV open drain		3		Ω
Q <sub>g</sub> Q <sub>gs</sub> Q <sub>gd</sub>	Total gate charge Gate-source charge Gate-drain charge	V <sub>DD</sub> =480 V, I <sub>D</sub> = 25 A, V <sub>GS</sub> = 10 V (see Figure 19)		91 14 50		nC nC nC

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

**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N Electrical characteristics**
**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$ , $I_D = 12.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 18)		20		ns
$t_r$	Rise time			24		ns
$t_{d(off)}$	Turn-off-delay time			125		ns
$t_f$	Fall time			70		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				25	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				100	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 25\text{ A}$ , $V_{GS} = 0$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 25\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ (see Figure 23)		540		ns
$Q_{rr}$	Reverse recovery charge			10		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			36		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 25\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150^\circ\text{C}$ (see Figure 23)		630		ns
$Q_{rr}$	Reverse recovery charge			12		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			36		A

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220 / D<sup>2</sup>PAK / I<sup>2</sup>PAK

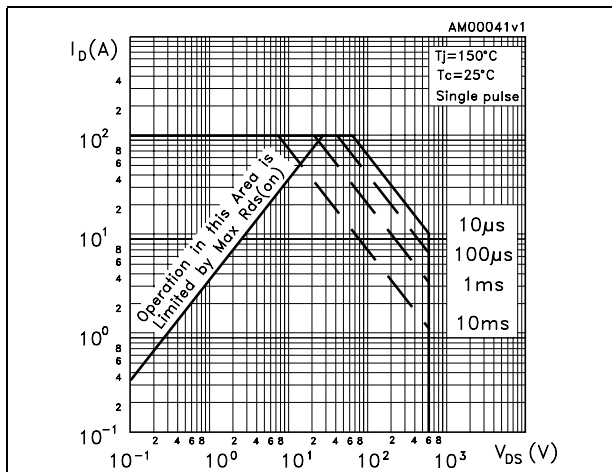


Figure 3. Thermal impedance for TO-220 / D<sup>2</sup>PAK / I<sup>2</sup>PAK

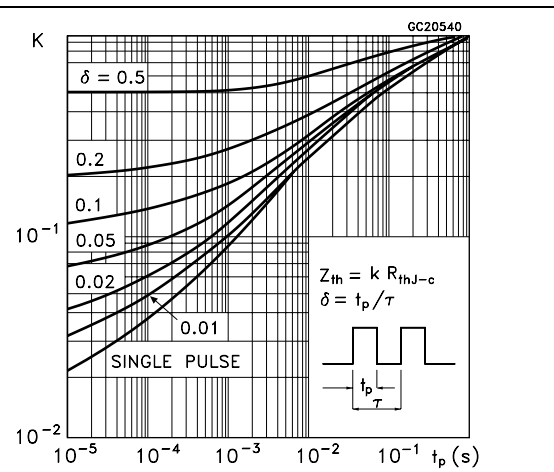


Figure 4. Safe operating area for TO-220FP

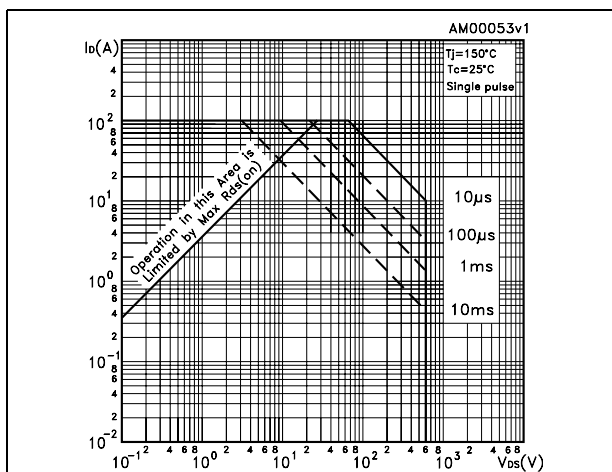


Figure 5. Thermal impedance for TO-220FP

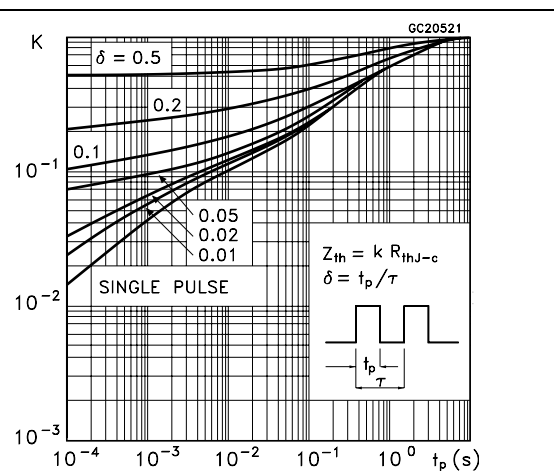


Figure 6. Safe operating area for TO-247

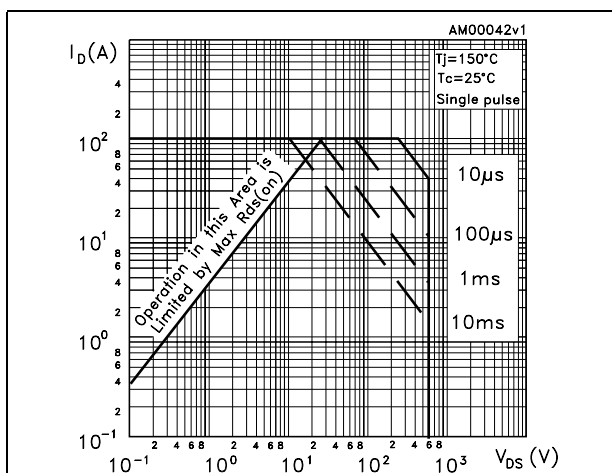
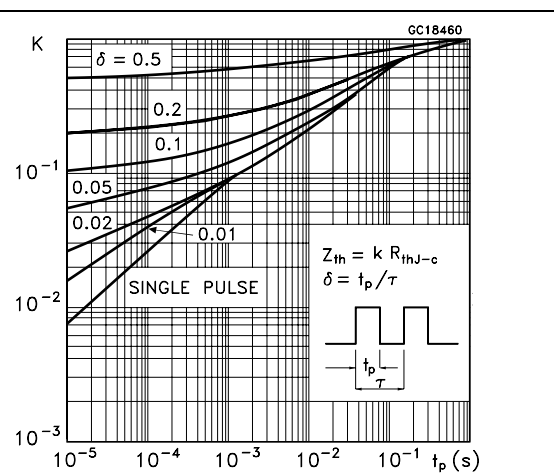
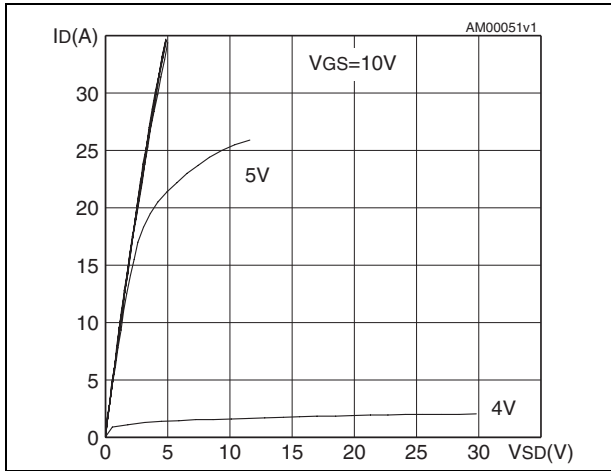


Figure 7. Thermal impedance for TO-247

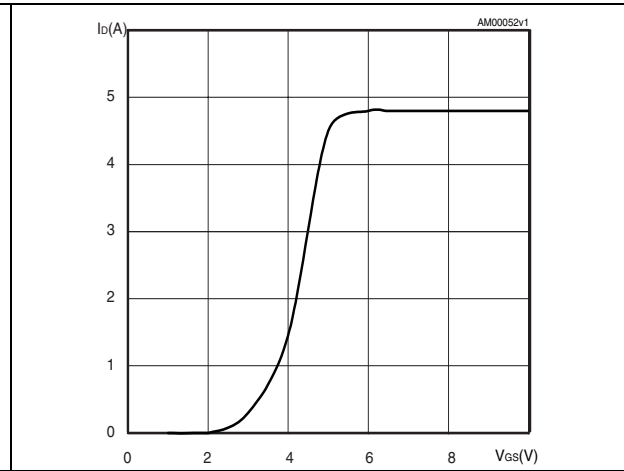


**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N Electrical characteristics**

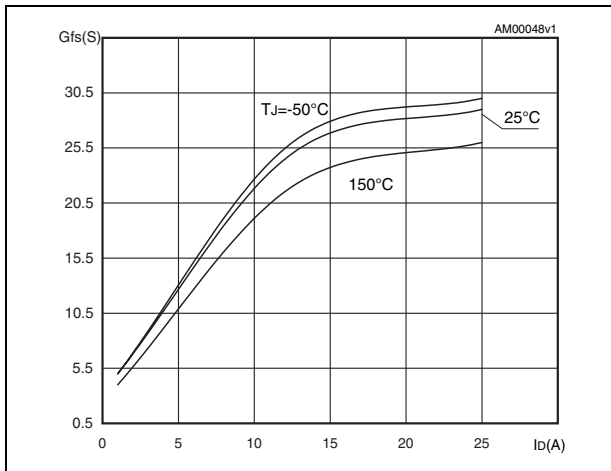
**Figure 8. Output characteristics**



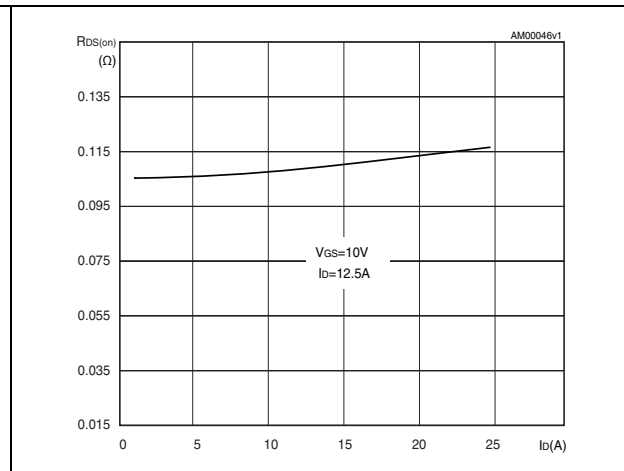
**Figure 9. Transfer characteristics**



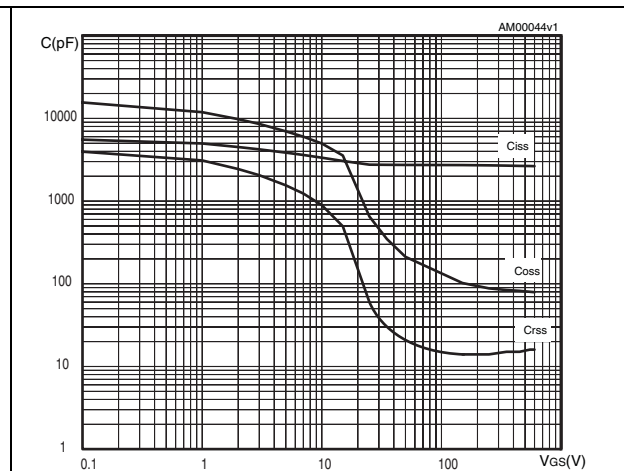
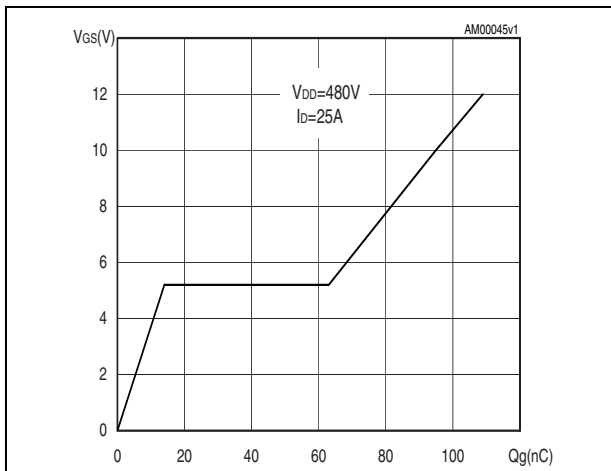
**Figure 10. Transconductance**



**Figure 11. Static drain-source on resistance**

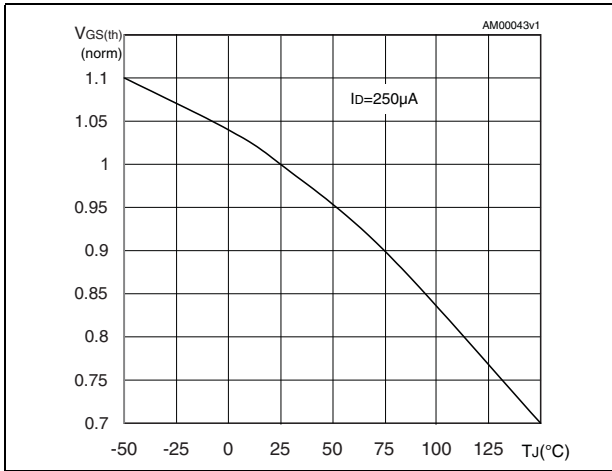


**Figure 12. Gate charge vs gate-source voltage** **Figure 13. Capacitance variations**

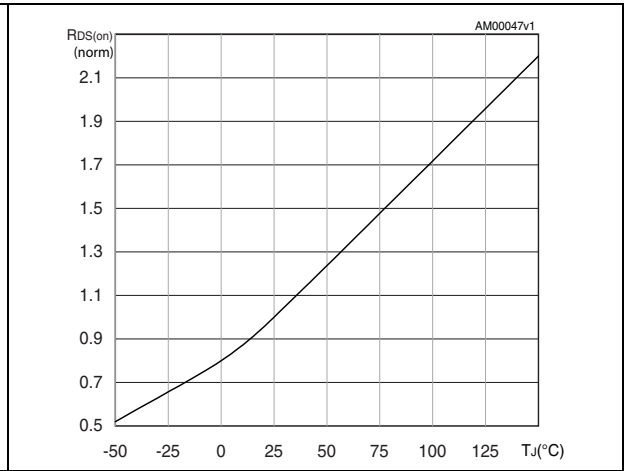


**Electrical characteristics STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N**

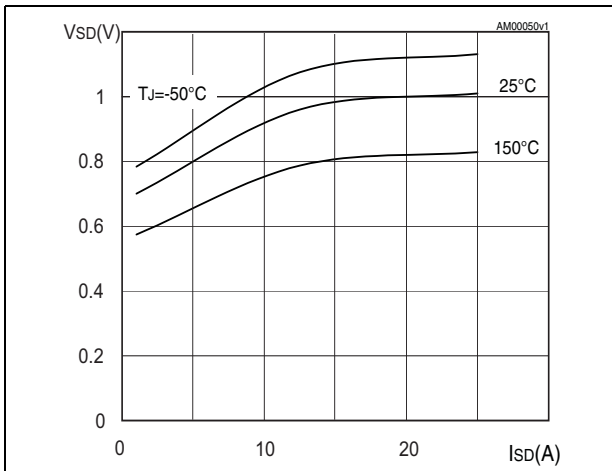
**Figure 14. Normalized gate threshold voltage vs temperature**



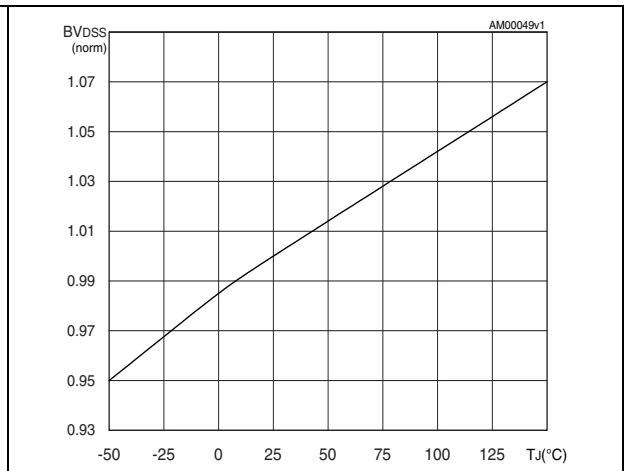
**Figure 15. Normalized on resistance vs temperature**



**Figure 16. Source-drain diode forward characteristics**



**Figure 17. Normalized B<sub>V</sub>DSS vs temperature**





### 3 Test circuits

Figure 18. Switching times test circuit for resistive load

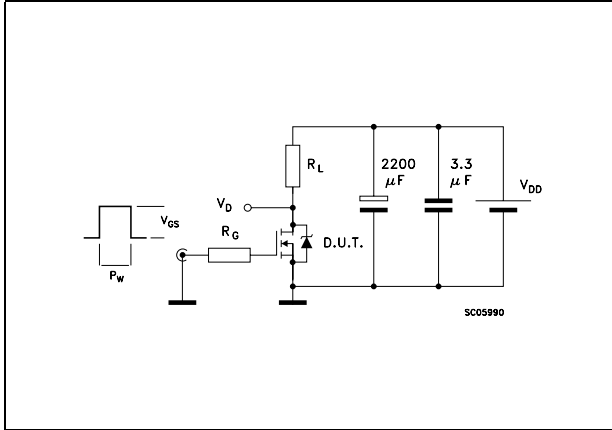


Figure 19. Gate charge test circuit

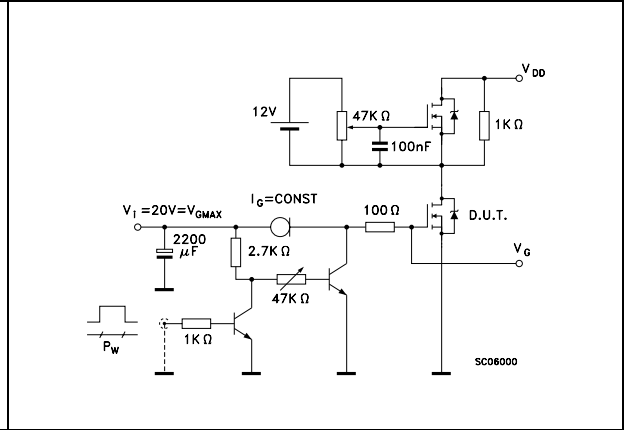


Figure 20. Test circuit for inductive load switching and diode recovery times

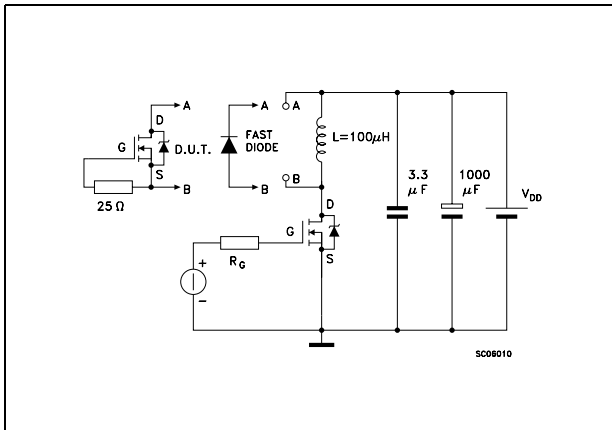


Figure 21. Unclamped inductive load test circuit

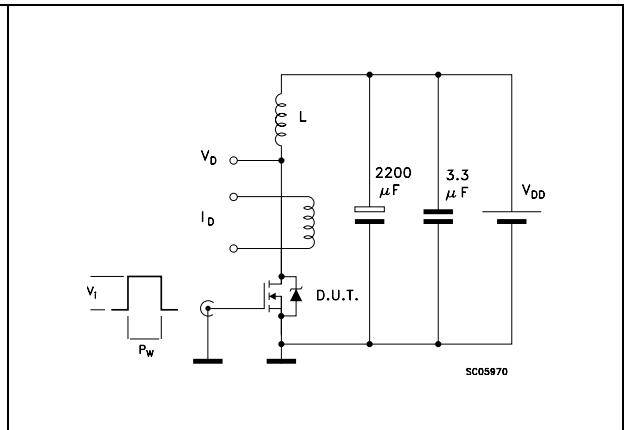


Figure 22. Unclamped inductive waveform

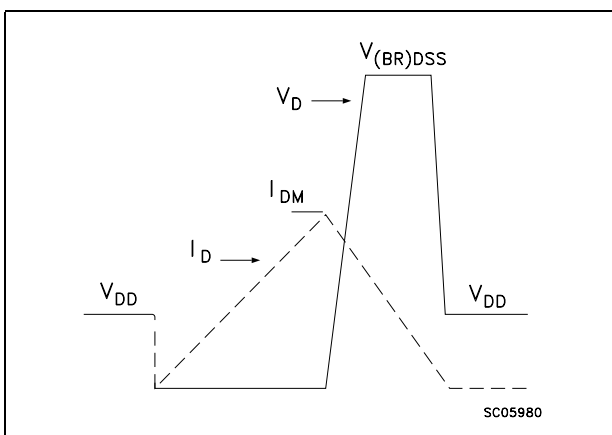
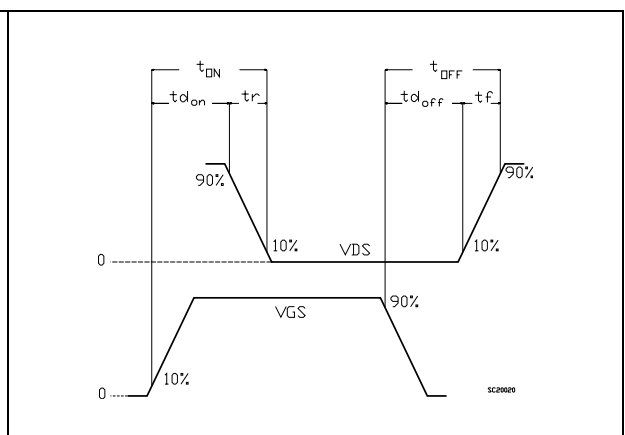


Figure 23. Switching time waveform

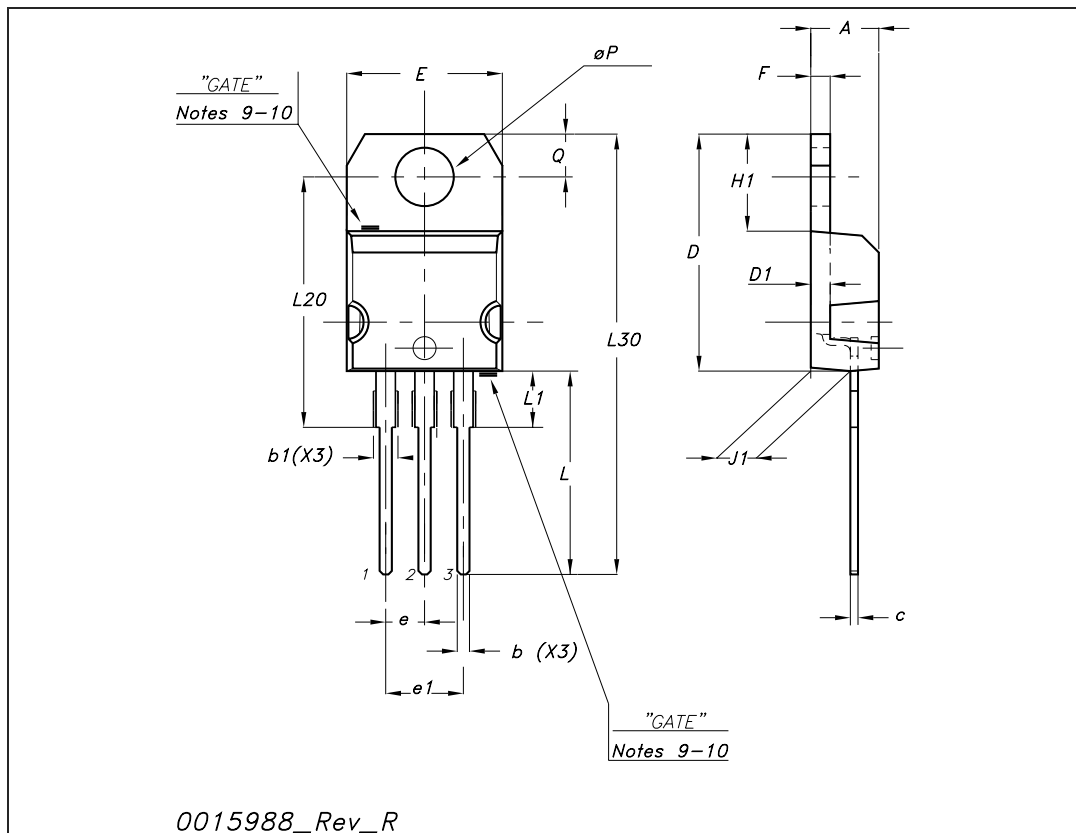


## 4 Package mechanical data

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](http://www.st.com)

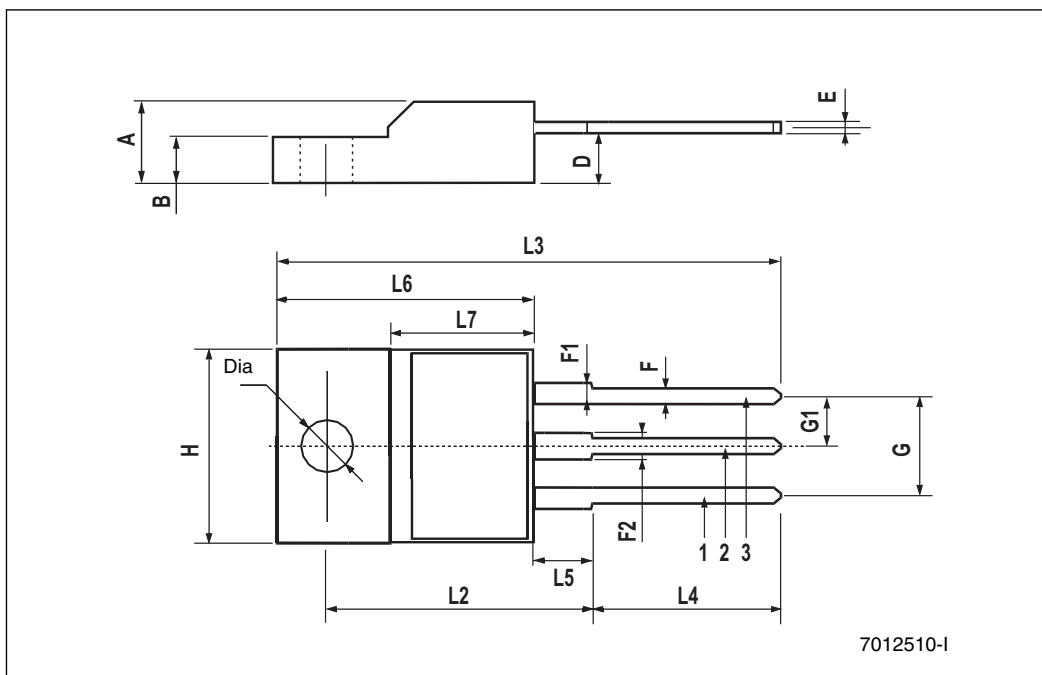
**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N Package mechanical data**
**TO-220 mechanical data**

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



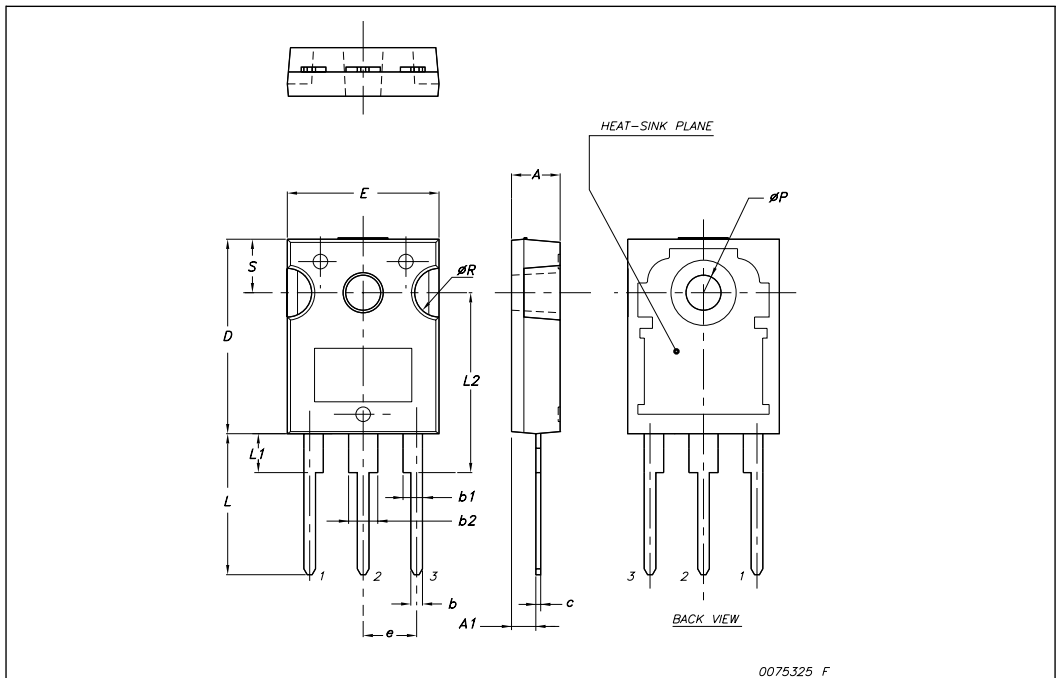
**Package mechanical data STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N**
**TO-220FP mechanical data**

Dim.	mm.			inch		
	Min.	Typ	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1.00	0.030		0.039
F1	1.15		1.50	0.045		0.067
F2	1.15		1.50	0.045		0.067
G	4.95		5.20	0.195		0.204
G1	2.40		2.70	0.094		0.106
H	10		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.80		10.60	0.385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.90		16.40	0.626		0.645
L7	9		9.30	0.354		0.366
Dia	3		3.2	0.118		0.126



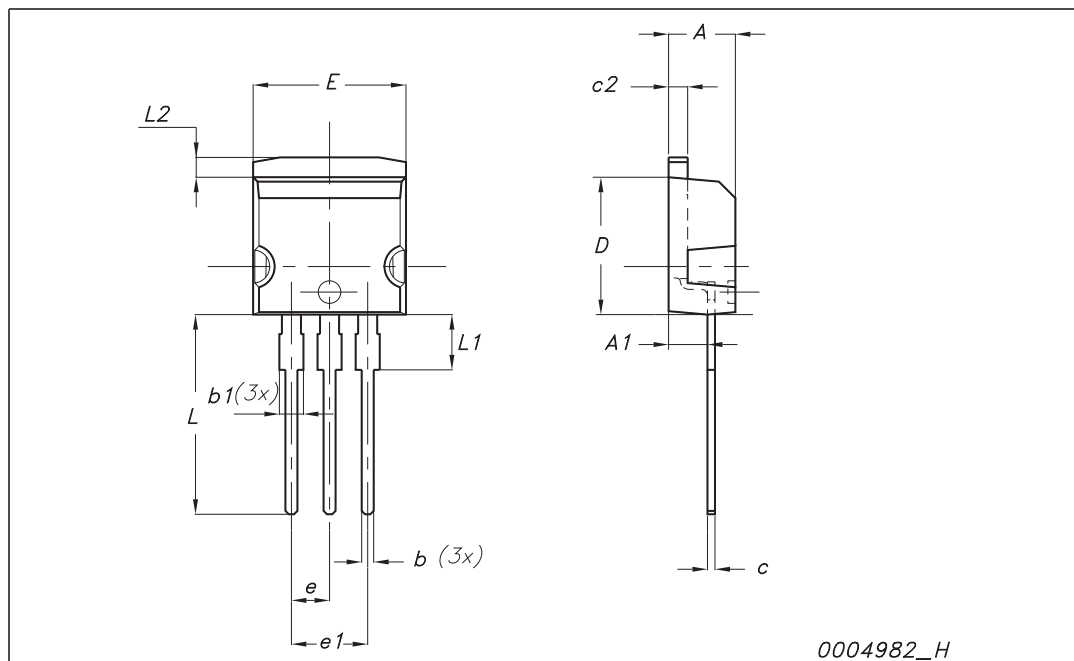
**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N Package mechanical data**
**TO-247 Mechanical data**

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	



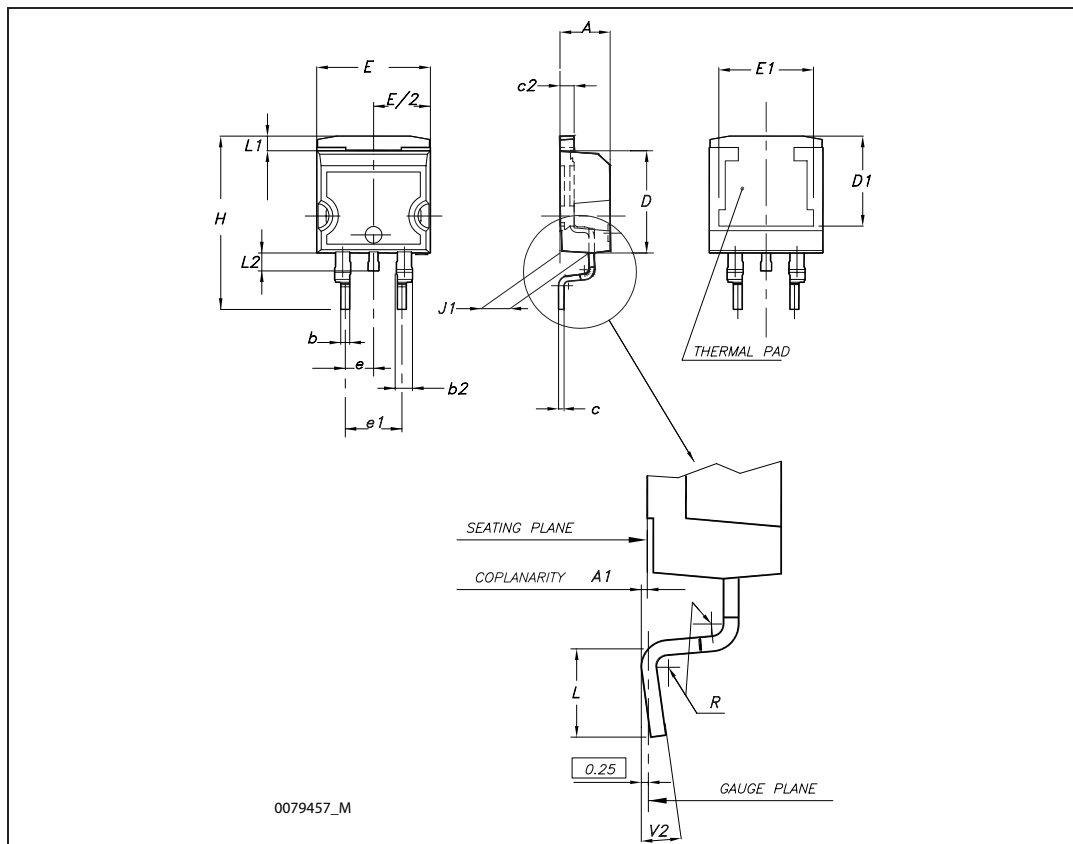
**Package mechanical data STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N**
**I<sup>2</sup>PAK (TO-262) mechanical data**

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N Package mechanical data**
**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°



# 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

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

TRL

Bending radius R min.

\* on sales type



## 6 Revision history

**Table 9. Document revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
23-Oct-2007	1	First release.
09-Jul-2008	2	Document status promoted: from preliminary data to datasheet.

**STB30NM60N,STI30NM60N,STF30NM60N,STP30NM60N,STW30NM60N**

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