



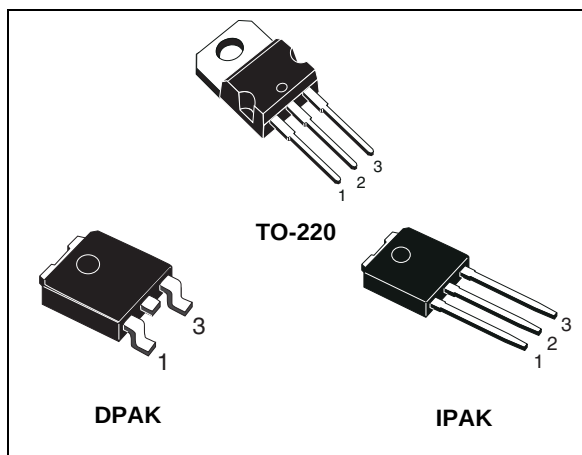
STD60N3LH5 STP60N3LH5, STU60N3LH5

N-channel 30 V, 0.0072 Ω , 48 A DPAK, IPAK, TO-220
STripFET™ V Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)} max	I _D
STD60N3LH5	30 V	0.008 Ω	48 A
STP60N3LH5	30 V	0.0084 Ω	48 A
STU60N3LH5	30 V	0.0084 Ω	48 A

- R_{DS(on)} * Q_g industry benchmark
- Extremely low on-resistance R_{DS(on)}
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses



Application

- Switching applications

Description

This STripFET™V Power MOSFET technology is among the latest improvements, which have been especially tailored to achieve very low on-state resistance providing also one of the best-in-class FOM.

Figure 1. Internal schematic diagram

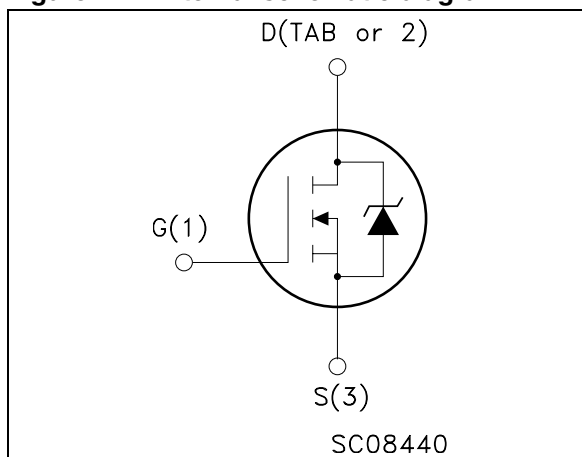


Table 1. Device summary

Order codes	Marking	Package	Packaging
STD60N3LH5	60N3LH5	DPAK	Tape and reel
STP60N3LH5	60N3LH5	TO-220	Tube
STU60N3LH5	60N3LH5	IPAK	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS}=0$)	30	V
V_{DS}	Drain-source voltage ($V_{GS} = 0$) @ T_{JMAX}	35	V
V_{GS}	Gate-Source voltage	± 22	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	48	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	42.8	A
$I_{DM}^{(2)}$	Drain current (pulsed)	192	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	60	W
	Derating factor	0.4	W/ $^{\circ}\text{C}$
$E_{AS}^{(3)}$	Single pulse avalanche energy	160	mJ
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 175	$^{\circ}\text{C}$

1. Limited by wire bonding
2. Pulse width limited by safe operating area
3. Starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_d = 24\text{ A}$, $V_{dd} = 12\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.5	$^{\circ}\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-case max	100	$^{\circ}\text{C/W}$
T_j	Maximum lead temperature for soldering purpose	275	$^{\circ}\text{C}$

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0$	30			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = 30\text{ V}$ $V_{DS} = 30\text{ V}$, $T_c = 125\text{ }^{\circ}\text{C}$			1 10	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 22\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1	1.8	3	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 24\text{ A}$ SMD version		0.0072	0.008	Ω
		$V_{GS} = 10\text{ V}$, $I_D = 24\text{ A}$		0.0076	0.0084	Ω
		$V_{GS} = 5\text{ V}$, $I_D = 24\text{ A}$ SMD version		0.0088	0.011	Ω
		$V_{GS} = 5\text{ V}$, $I_D = 24\text{ A}$		0.0092	0.0114	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$	-	1350	-	pF
C_{oss}	Output capacitance			265		pF
C_{rss}	Reverse transfer capacitance			32		pF
Q_g	Total gate charge	$V_{DD} = 15\text{ V}$, $I_D = 48\text{ A}$	-	8.8	-	nC
Q_{gs}	Gate-source charge	$V_{GS} = 5\text{ V}$		4.7		nC
Q_{gd}	Gate-drain charge	(<i>Figure 14</i>)		2.2		nC
Q_{gs1}	Pre V_{th} gate-to-source charge	$V_{DD} = 15\text{ V}$, $I_D = 48\text{ A}$	-	2.2	-	nC
Q_{gs2}	Post V_{th} gate-to-source charge	$V_{GS} = 5\text{ V}$ (<i>Figure 19</i>)		2.5		nC
R_G	Gate input resistance	$f = 1\text{ MHz}$ gate bias Bias = 0 test signal level = 20 mV open drain	-	1.1	-	Ω

Table 6. Switching on/off (resistive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time Rise time	$V_{DD}=10\text{ V}$, $I_D=24\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (Figure 13 and Figure 18)	-	6 33	-	ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	$V_{DD}=10\text{ V}$, $I_D=24\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=10\text{ V}$ (Figure 13 and Figure 18)	-	19 4.2	-	ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}	Source-drain current Source-drain current (pulsed) ⁽¹⁾		-		48 192	A A
V_{SD}	Forward on voltage	$I_{SD}=24\text{ A}$, $V_{GS}=0$	-		1.1	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=48\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$, $V_{DD}=20\text{ V}$, (Figure 15)	-	25 18.5 1.5		ns nC A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

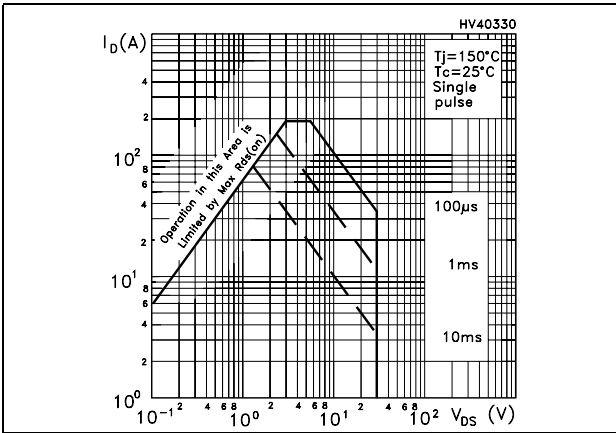


Figure 3. Thermal impedance

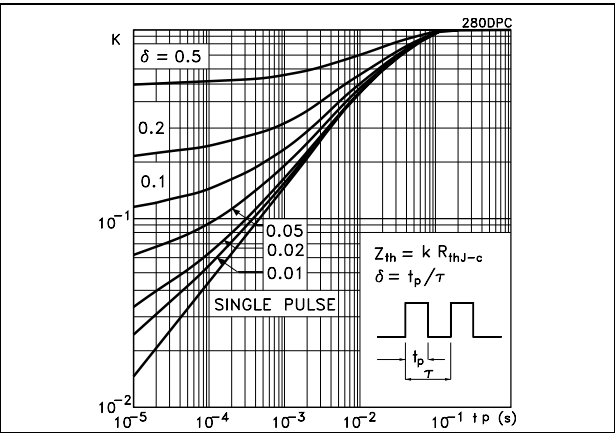


Figure 4. Output characteristics

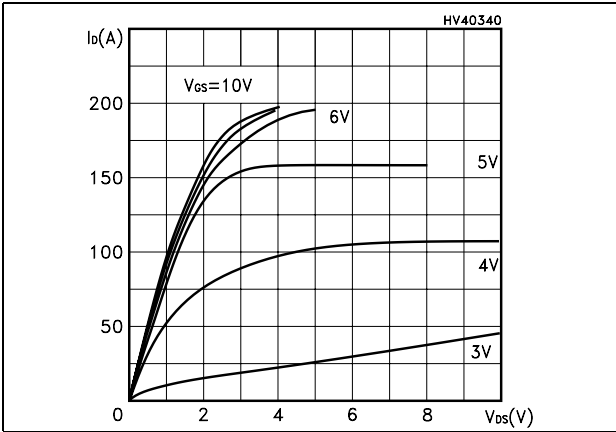


Figure 5. Transfer characteristics

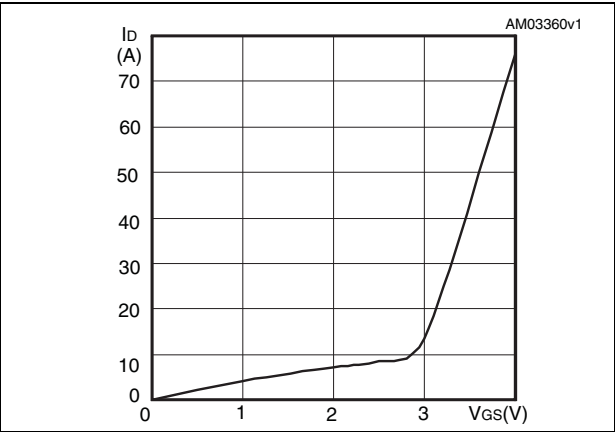


Figure 6. Normalized BvDSS vs temperature

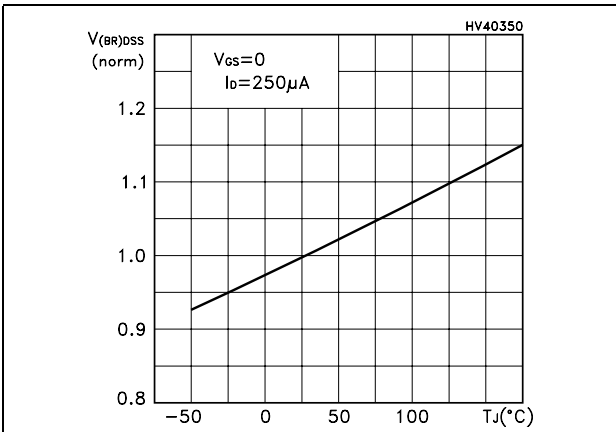


Figure 7. Static drain-source on resistance

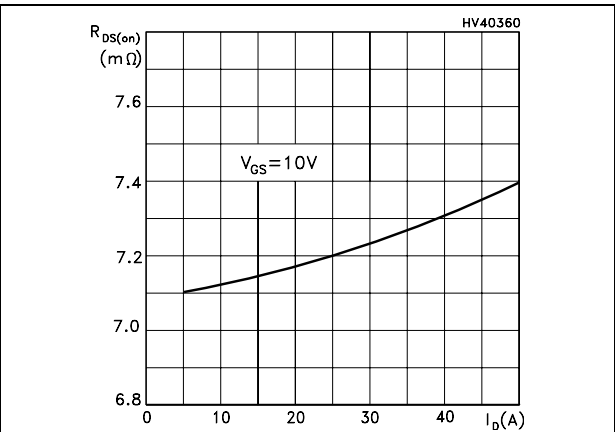


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

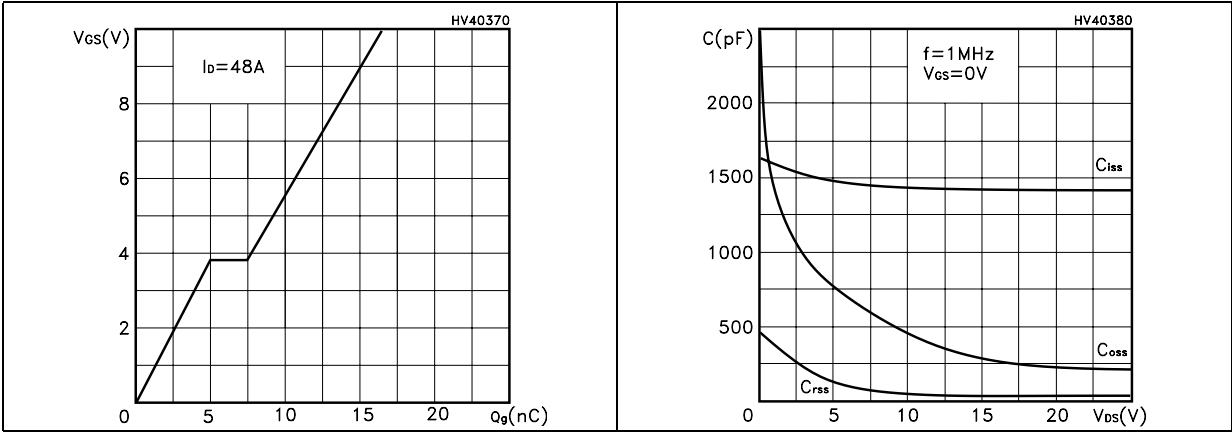


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

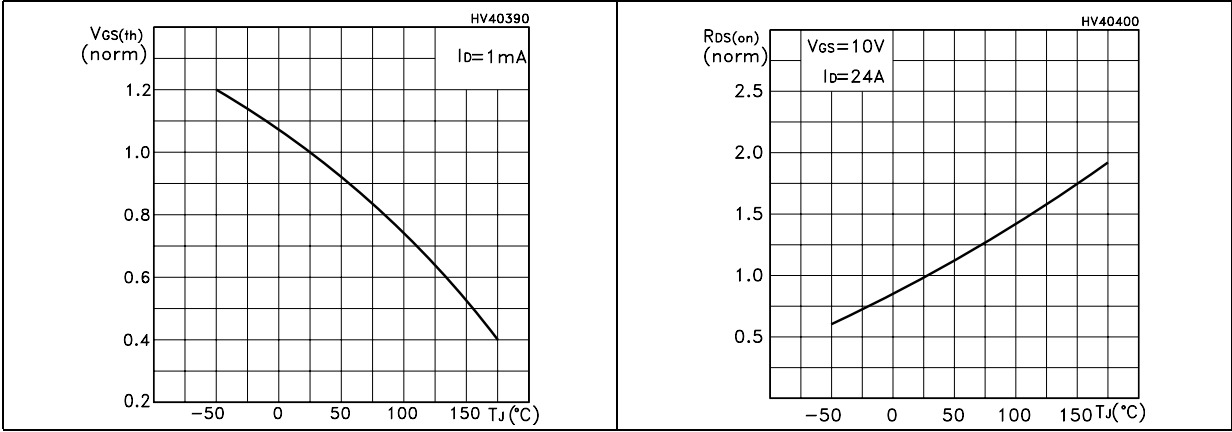


Figure 12. Source-drain diode forward characteristics

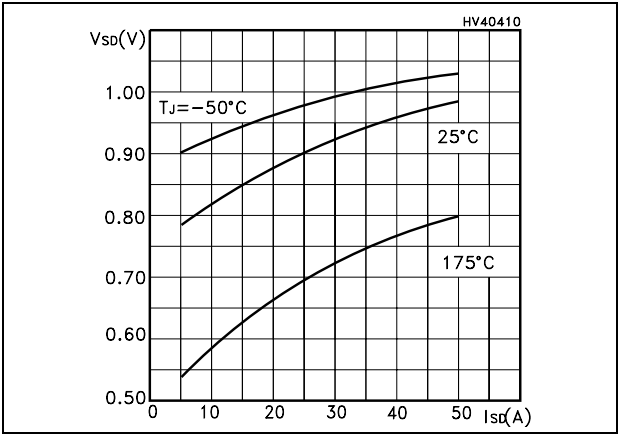
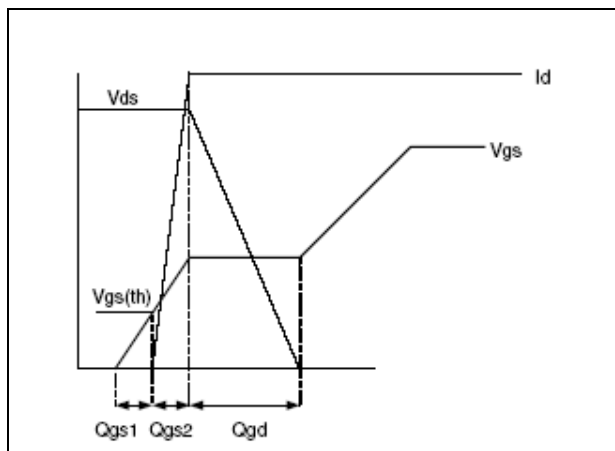


Figure 19. Gate charge waveform

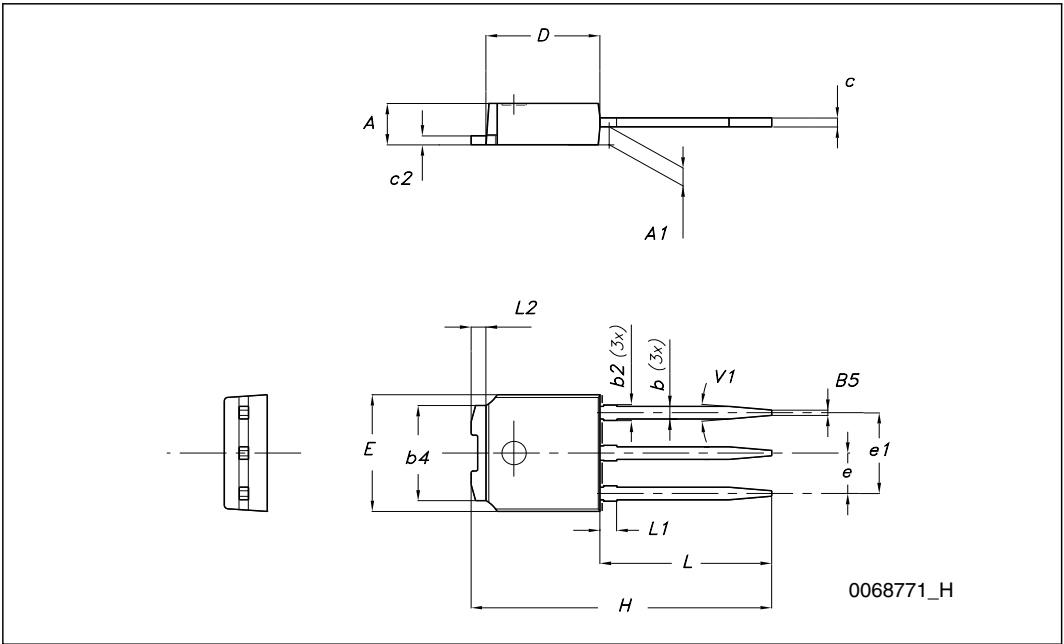


4 Package mechanical data

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.

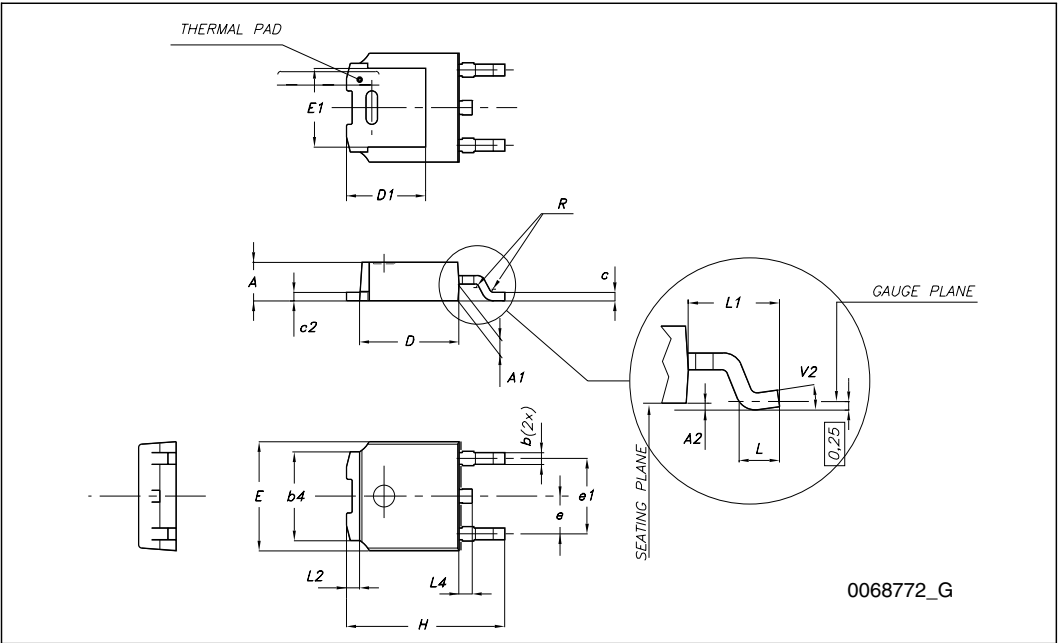
TO-251 (IPAK) mechanical data

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°	



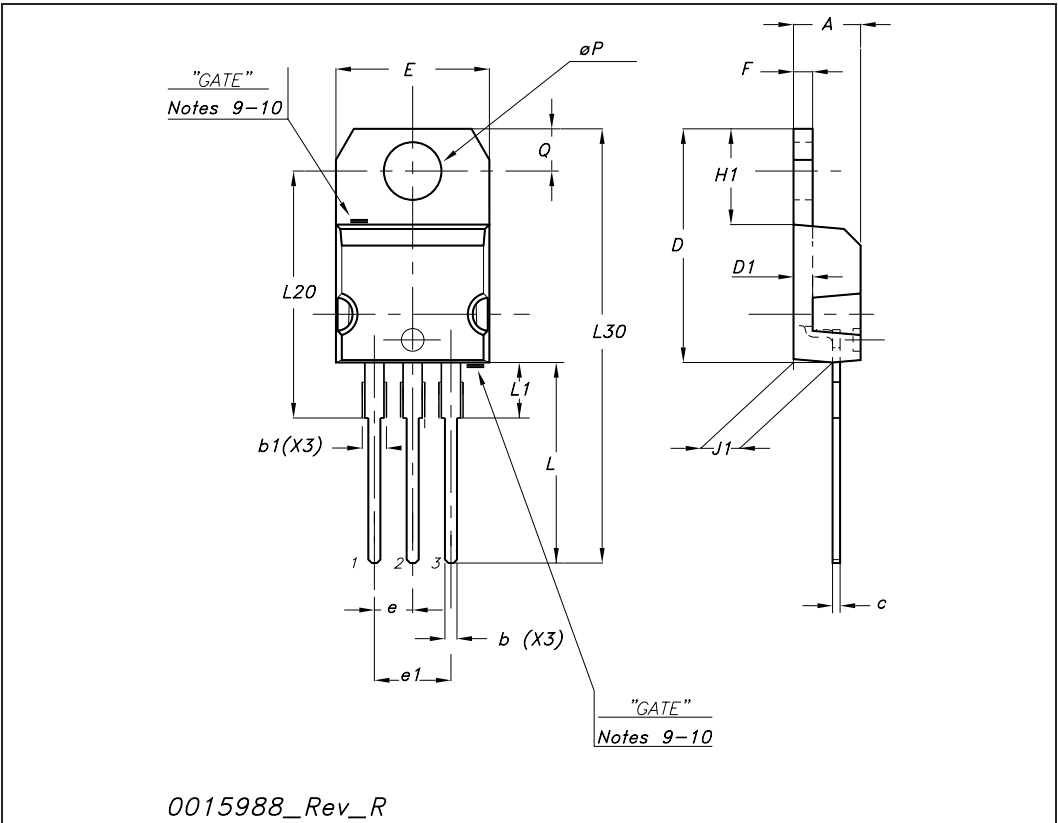
TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°



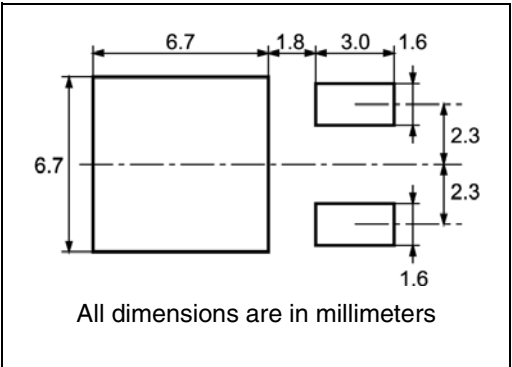
TO-220 mechanical data

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	
ØP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116

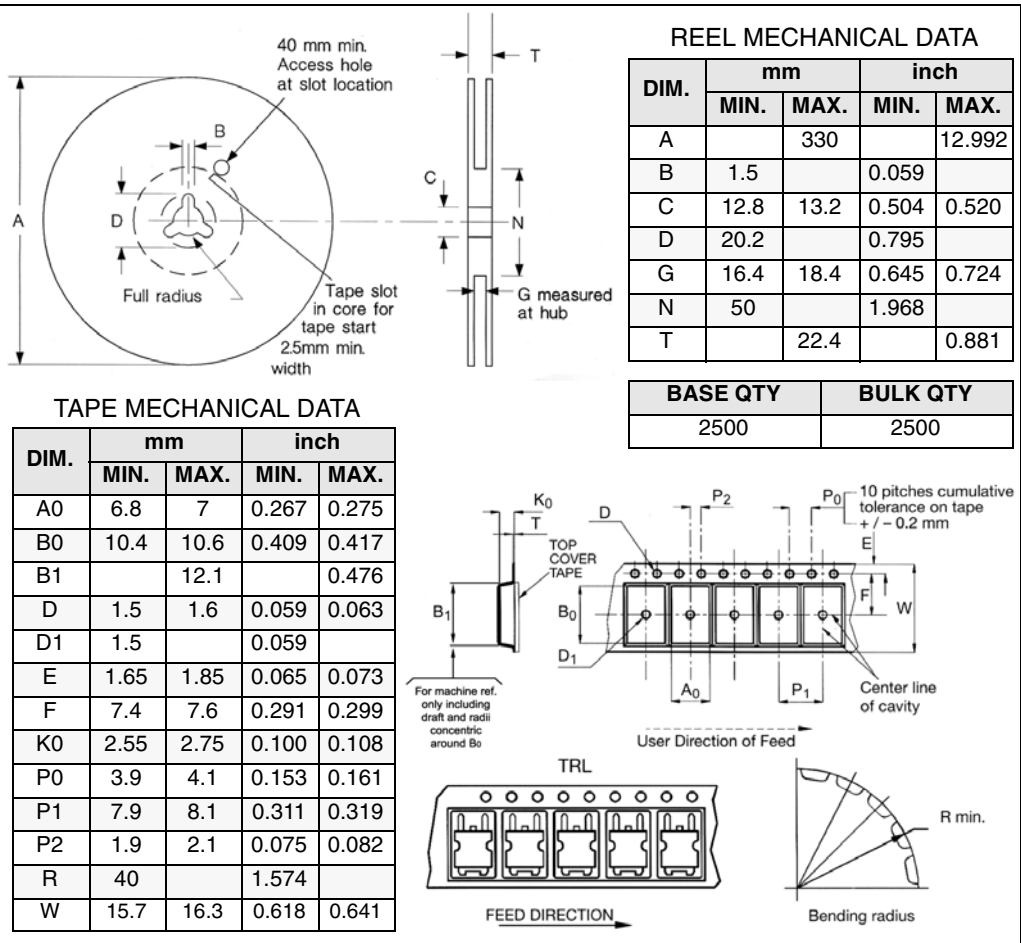


5 Packaging mechanical data

DPAK FOOTPRINT



TAPE AND REEL SHIPMENT



6 Revision history

Table 8. Document revision history

Date	Revision	Changes
19-Oct-2007	1	First release
23-Sep-2008	2	V_{GS} value has been changed on Table 2 and Table 5
20-Apr-2009	3	– Inserted typical and maximum value in $V_{GS(th)}$ parameter – Figure 5: Transfer characteristics has been updated – Added device in TO-220

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