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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	55	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	80	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	300	W
	Derating factor	2	W/ $^\circ\text{C}$
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 175	$^\circ\text{C}$

1. Current limited package

2. Pulse width limited by safe operating area

**Table 3. Thermal resistance**

Symbol	Parameter	Value			Unit
		D <sup>2</sup> PAK	TO-220	TO-247	
$R_{thj-case}$	Thermal resistance junction-case max	0.5			$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	35 <sup>(1)</sup>	62.5	50	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300			$^\circ\text{C}$

1. When mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz Cu

**Table 4. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	40	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 30\text{ V}$ )	1000	mJ

## 2 Electrical characteristics

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

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$	55			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating@ } 125\text{ }^{\circ}\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 100$	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	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$		0.0065	0.008	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 18\text{ A}$		40		S
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		3740		pF
$C_{oss}$	Output capacitance			830		pF
$C_{rss}$	Reverse transfer capacitance			265		pF
$Q_g$	Total gate charge	$V_{DD} = 27\text{ V}$ , $I_D = 80\text{ A}$		112	155	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10\text{ V}$		20		nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)		40		nC

1. Pulsed: pulse duration=300  $\mu\text{s}$ , duty cycle 1.5%

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 27\text{ V}$ , $I_D = 40\text{ A}$ $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 13)		20		ns
$t_r$	Rise time			110		ns
$t_{d(off)}$	Turn-off-delay time			75		ns
$t_f$	Fall time			35		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}$	Forward on voltage	$I_{SD} = 80\text{ A}$ , $V_{GS} = 0$			1.5	V
$t_{rr}^{(2)}$	Reverse recovery time	$I_{SD} = 80\text{ A}$ , $V_{DD} = 25\text{ V}$ $di/dt = 100\text{ A}/\mu\text{s}$ , $T_j = 150\text{ }^\circ\text{C}$ (see Figure 18)		80		ns
$Q_{rr}$	Reverse recovery charge			230		nC
$I_{RRM}$	Reverse recovery current			5.7		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

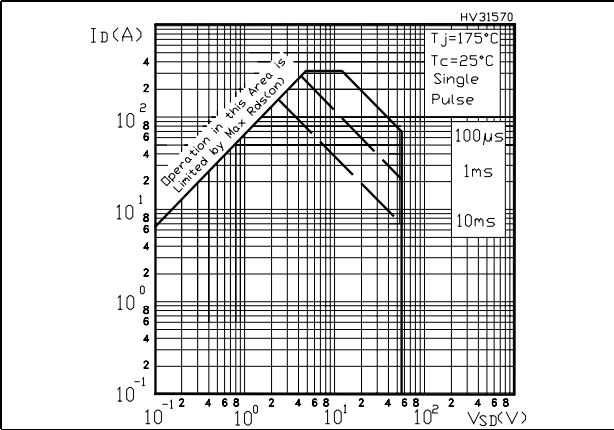


Figure 3. Thermal impedance

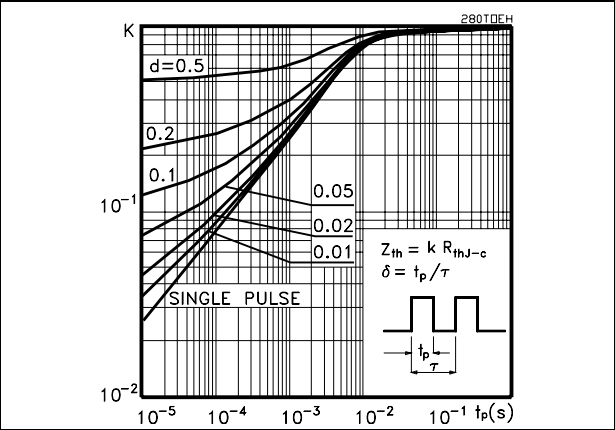


Figure 4. Output characteristics

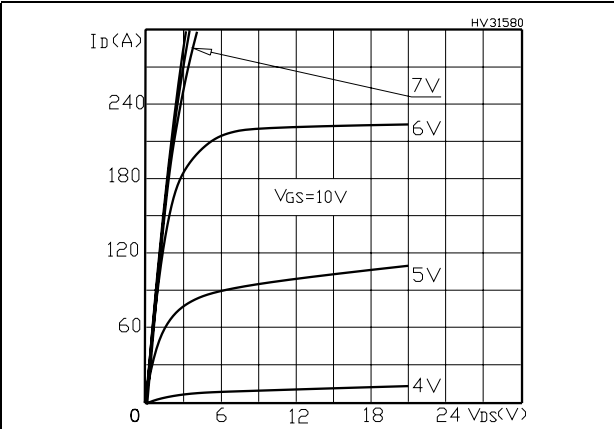


Figure 5. Transfer characteristics

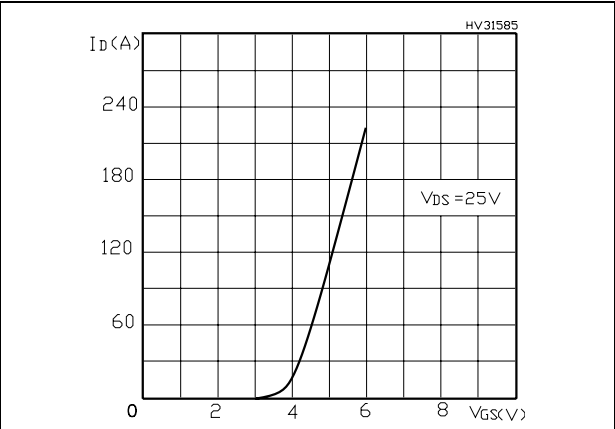


Figure 6. Normalized BV<sub>DSS</sub> vs temperature

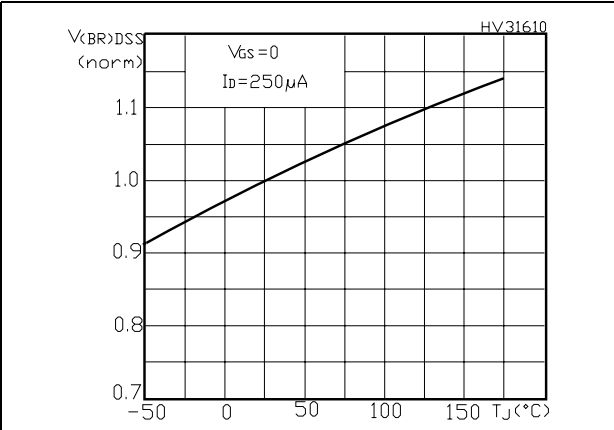


Figure 7. Static drain-source on resistance

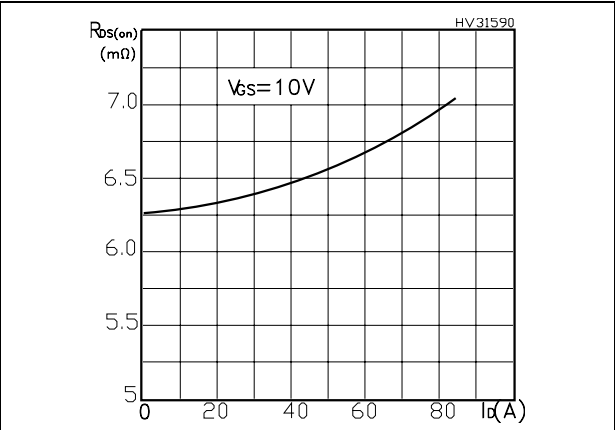


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

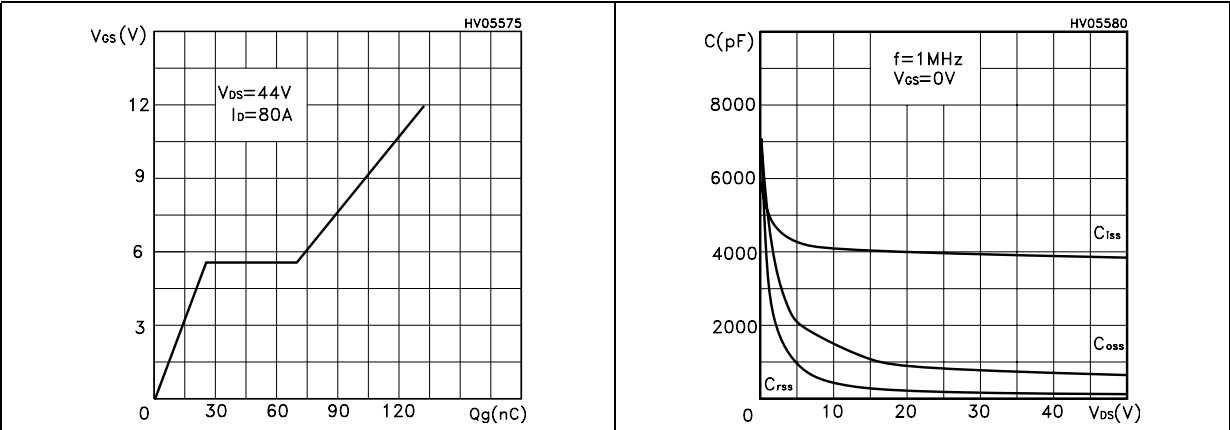


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

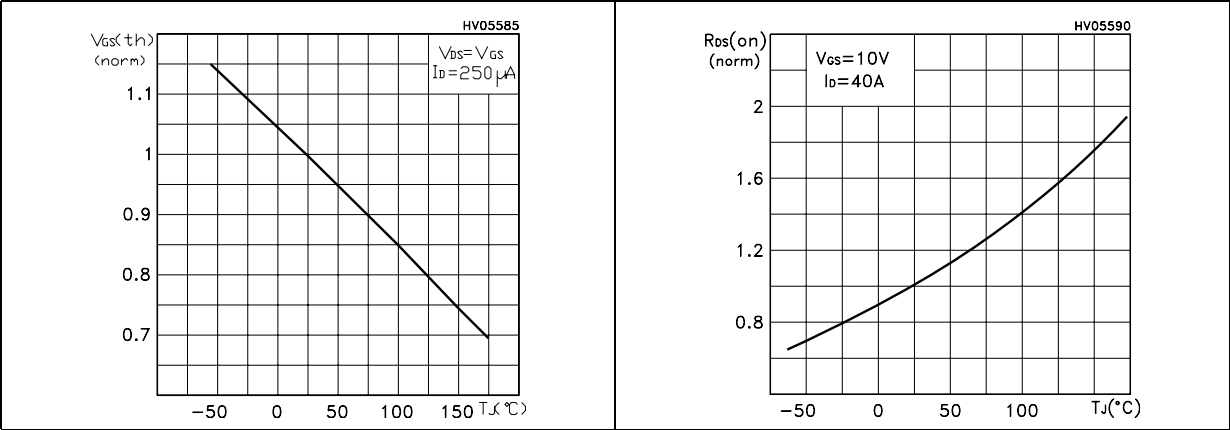
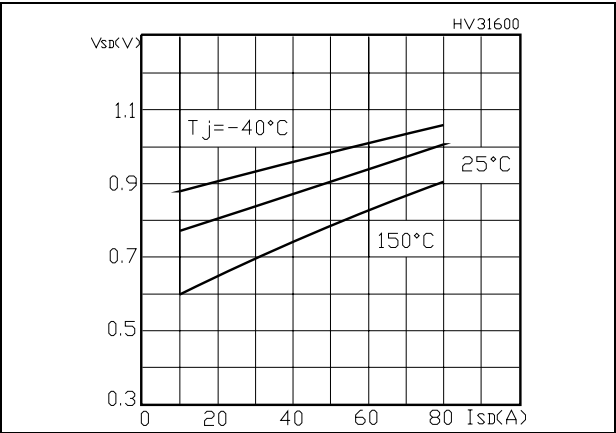
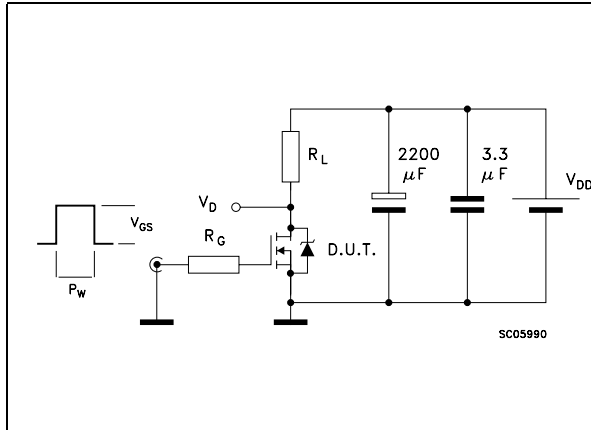


Figure 12. Source-drain diode forward characteristics

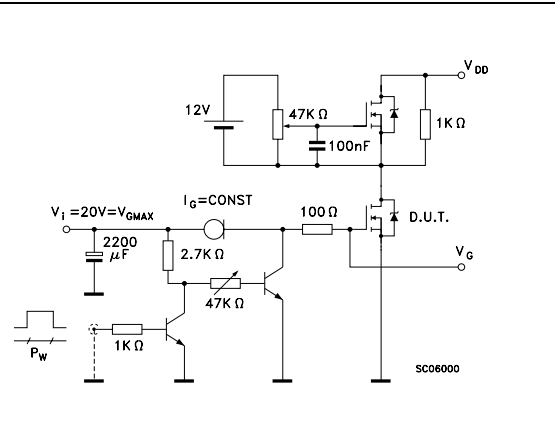


### 3 Test circuits

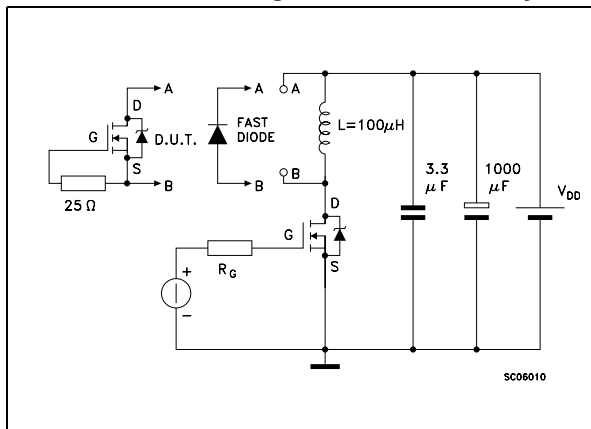
**Figure 13. Switching times test circuit for resistive load**



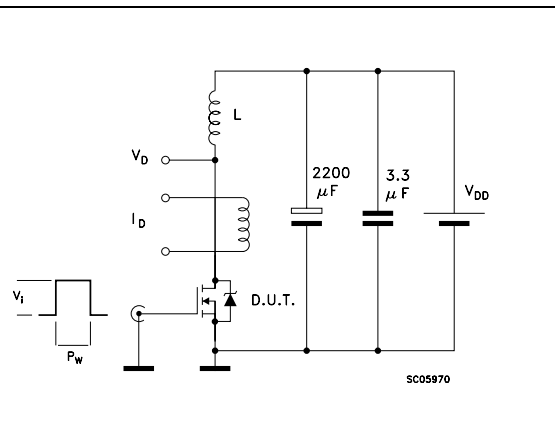
**Figure 14. Gate charge test circuit**



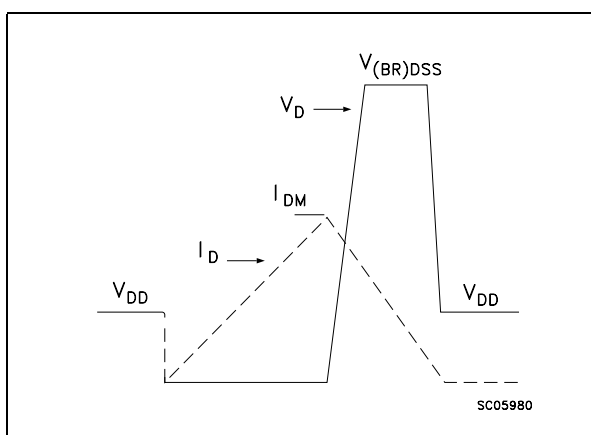
**Figure 15. Test circuit for inductive load switching and diode recovery times**



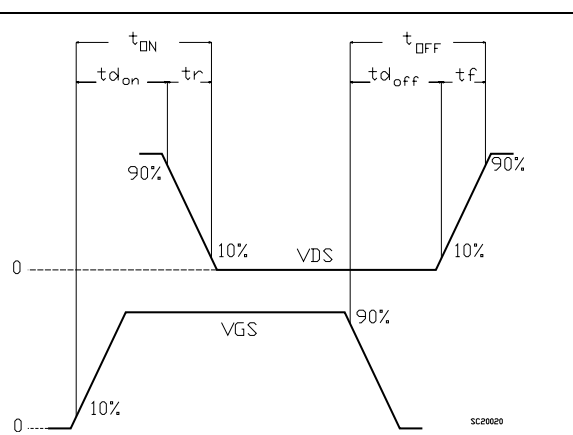
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



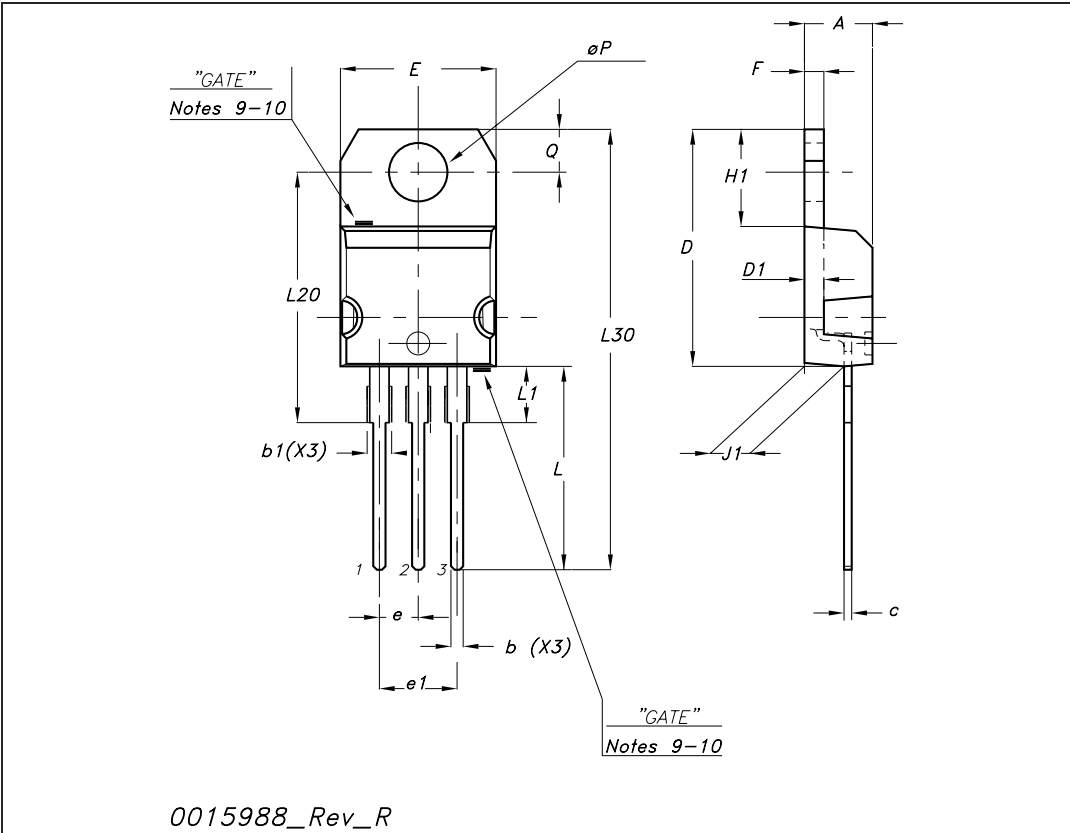
## 4 Package mechanical data

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.



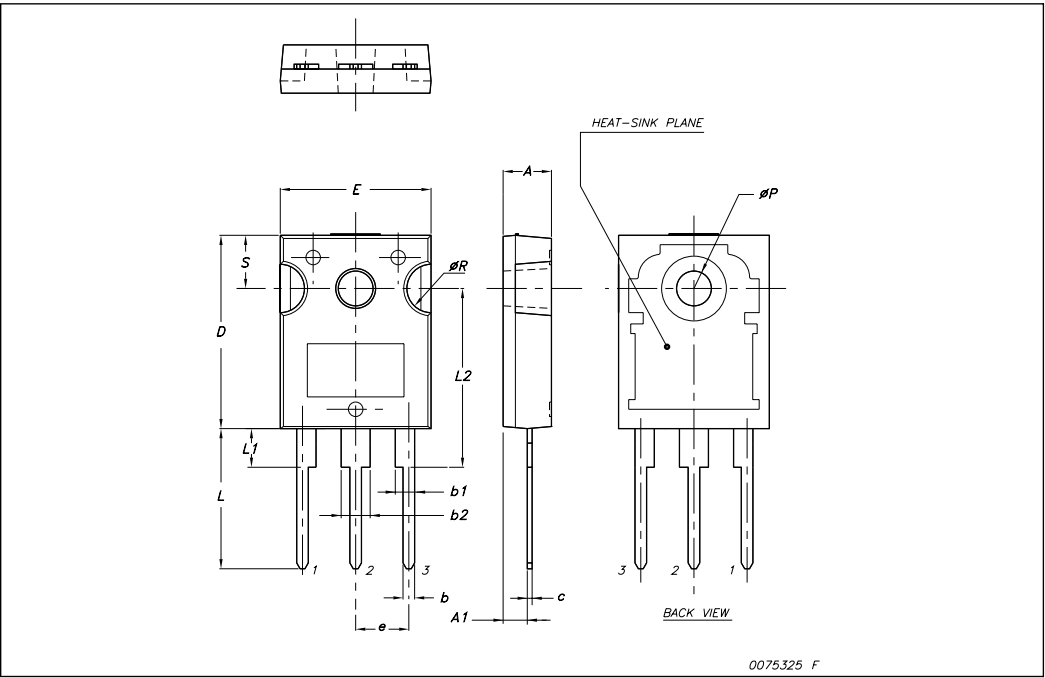
TO-220 mechanical data

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



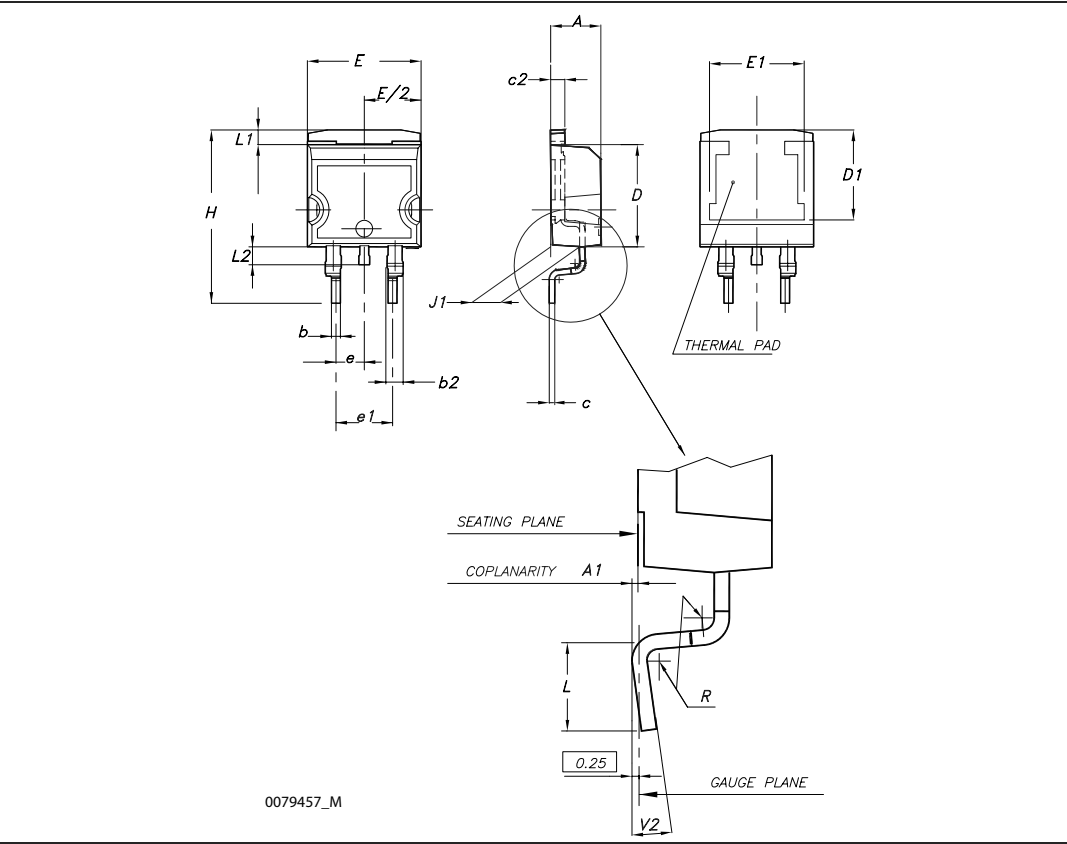
TO-247 Mechanical data

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	



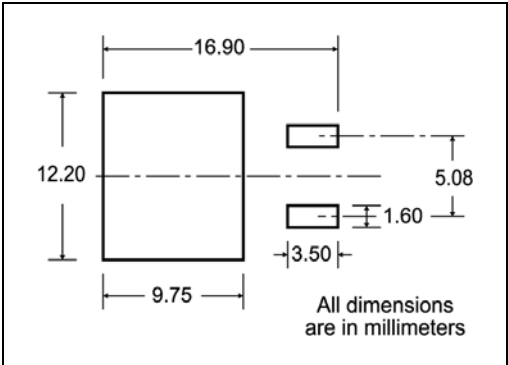
D<sup>2</sup>PAK (TO-263) mechanical data

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°

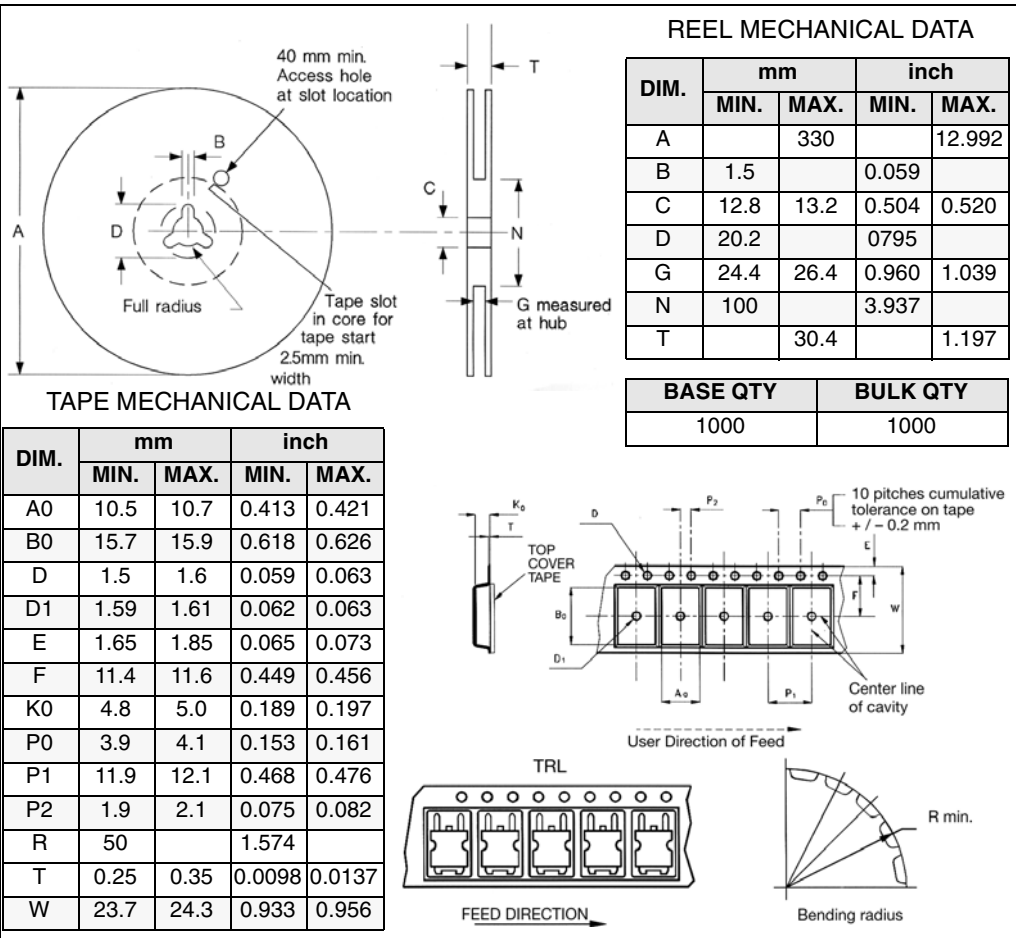


# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT



\* on sales type

## 6 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
03-Mar-2008	1	First release
15-Apr-2009	2	<i>Table 1: Device summary</i> has been updated

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