



STGB10NB37LZ STGP10NB37LZ

10 A - 400 V internally clamped IGBT

Features

- Low threshold voltage
- Low on-voltage drop
- Low gate charge
- High current capability
- High voltage clamping feature

Applications

- Automotive ignition

Description

This IGBT utilizes the advanced Power MESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior. The built in collector-gate Zener exhibits a very precise active clamping while the gate-emitter Zener supplies an ESD protection.

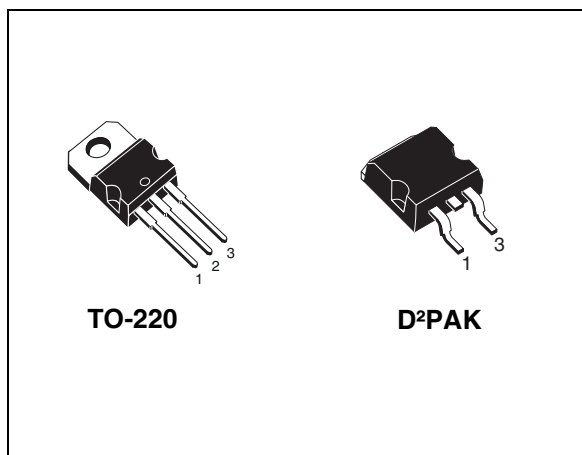


Figure 1. Internal schematic diagram

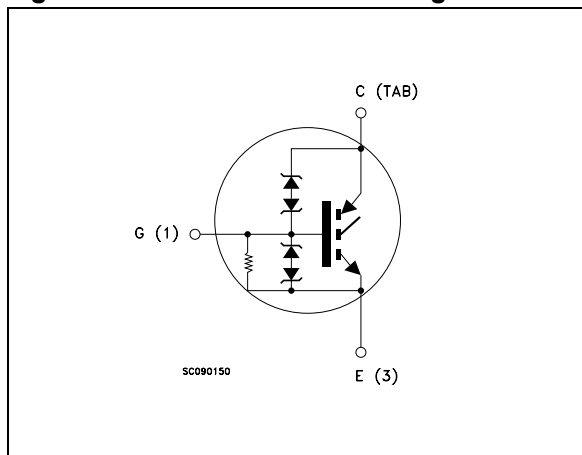


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB10NB37LZT4	GB10NB37LZ	D²PAK	Tape and reel
STGP10NB37LZ	GP10NB37LZ	TO-220	Tube

Contents

1 **Electrical ratings** 3

2 **Electrical characteristics** 4

 2.1 Electrical characteristics (curves) 6

3 **Test circuits** 9

4 **Package mechanical data** 10

5 **Packaging mechanical data** 13

6 **Revision history** 14

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage ($V_{GE} = 0$)	V_{CES} (clamped)	V
V_{ECS}	Emitter collector voltage ($V_{GE} = 0$)	18	V
$I_C^{(1)}$	Collector current (continuous) at $T_C = 25\text{ °C}$	20	A
$I_C^{(1)}$	Collector current (continuous) at $T_C = 100\text{ °C}$	10	A
$I_{CP}^{(2)}$	Pulsed collector current	40	A
$I_{CL}^{(3)}$	Turn-off latching current	40	A
V_{GE}	Gate-emitter voltage	V_{GE} (clamped)	V
P_{TOT}	Total dissipation at $T_C = 25\text{ °C}$	125	W
ESD(HBM)	Electrostatic sensitive discharge, human body model applied to all three pins (C=100 pF, R=1.5 kΩ)	4	kV
E_{AS}	Single pulse energy at $T_C = 25\text{ °C}$	300	mJ
T_{stg}	Storage temperature	– 65 to 175	°C
T_j	Operating junction temperature		

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Pulse width limited by max. temperature allowed

3. $V_{clamp} = 328\text{ V}$, $T_C = 125\text{ °C}$, $R_G = 1\text{ k}\Omega$, $V_{GE} = 5\text{ V}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	1.2	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	°C/W

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{CES(\text{clamped})}$	Collector emitter clamped voltage ($V_{GE} = 0$)	$I_C = 2\text{ mA}$, $T_C = -40\text{ °C to }150\text{ °C}$	380	410	440	V
$V_{(BR)ECS}$	Emitter collector break-down voltage ($V_{GE} = 0$)	$I_{EC} = 75\text{ mA}$	18			V
$V_{GE(\text{clamped})}$	Gate emitter clamped voltage	$I_G = \pm 2\text{ mA}$	12		16	V
$V_{CE(\text{sat})}$	Collector-emitter saturation voltage	$V_{GE} = 4.5\text{ V}$, $I_C = 10\text{ A}$ $V_{GE} = 4.5\text{ V}$, $I_C = 20\text{ A}$		1.2 1.3	1.8	V V
$V_{GE(\text{th})}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$ $T_C = -40\text{ °C to }150\text{ °C}$	0.6		2.2	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 15\text{ V}$, $T_C = 150\text{ °C}$ $V_{CE} = 200\text{ V}$, $T_C = 150\text{ °C}$			10 100	μA μA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 10\text{ V}$			± 700	nA
R_{GE}	Gate emitter resistance			20		k Ω
g_{fs}	Forward transconductance	$V_{CE} = 25\text{ V}$, $I_C = 20\text{ A}$		18		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0$		1300 105 12		pF pF pF
Q_g	Total gate charge	$V_{CE} = 328\text{ V}$, $I_C = 10\text{ A}$, $V_{GE} = 5\text{ V}$, (see Figure 18)		28		nC

Table 6. Functional characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
U.I.S.	Unclamped inductive switching current	$R_{G\text{OFF}} = 1\text{ k}\Omega$, $L = 1\text{ mH}$, $T_C = 125\text{ °C}$	13			A

Table 7. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$		1300		ns
t_r	Current rise time	$R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$		270		ns
$(di/dt)_{on}$	Turn-on current slope	(see Figure 19)		60		A/ μ s
t_c	Cross-over time	$V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$		3.6		μ s
$t_r(V_{off})$	Off voltage rise time	$R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$		2		μ s
$t_{d(off)}$	Delay time	(see Figure 19)		8		μ s
t_f	Fall time			1.4		μ s
t_c	Cross-over time	$V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$		5.7		μ s
$t_r(V_{off})$	Off voltage rise time	$R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$,		2.7		μ s
$t_{d(off)}$	Delay time	$T_C = 125 \text{ }^\circ\text{C}$		9.2		μ s
t_f	Fall time	(see Figure 19)		2.8		μ s

Table 8. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$		2.4		mJ
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$		5		mJ
E_{ts}	Total switching losses	(see Figure 19)		7.4		mJ
$E_{on}^{(1)}$	Turn-on switching losses	$V_{CC} = 328 \text{ V}$, $I_C = 10 \text{ A}$		2.6		mJ
$E_{off}^{(2)}$	Turn-off switching losses	$R_G = 1 \text{ k}\Omega$, $V_{GE} = 5 \text{ V}$,		8.7		mJ
E_{ts}	Total switching losses	$T_C = 125 \text{ }^\circ\text{C}$ (see Figure 19)		11.3		mJ

1. E_{on} is the turn-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pak diode, the co-pak diode is used as external diode. IGBTs & Diode are at the same temperature (25°C and 125°C)
2. Turn-off losses include also the tail of the collector current

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

Figure 3. Transfer characteristics

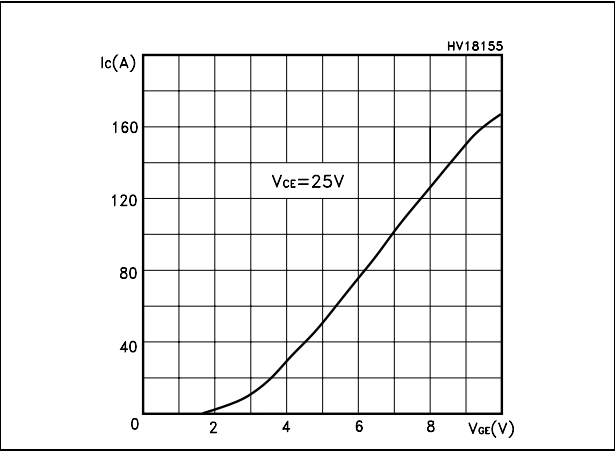
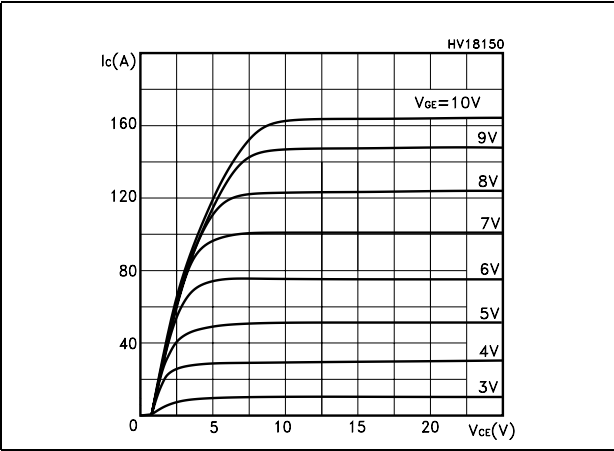


Figure 4. Transconductance

Figure 5. Collector-emitter on voltage vs temperature

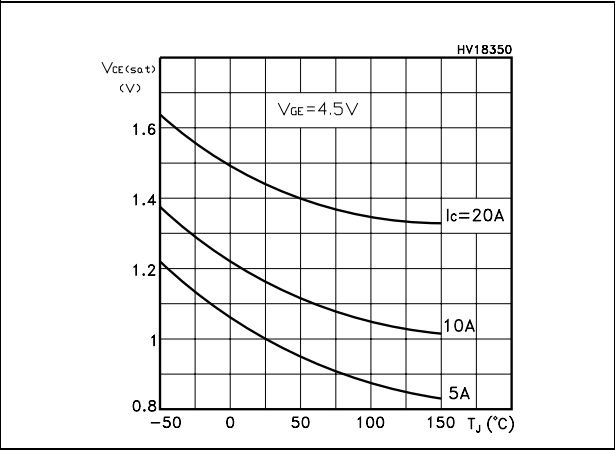
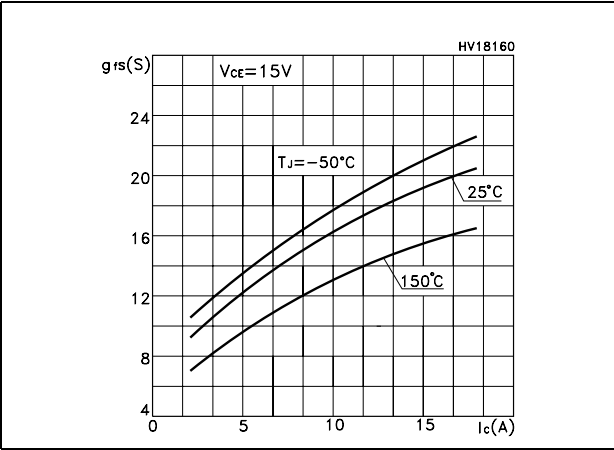


Figure 6. Gate charge vs gate-source voltage

Figure 7. Capacitance variations

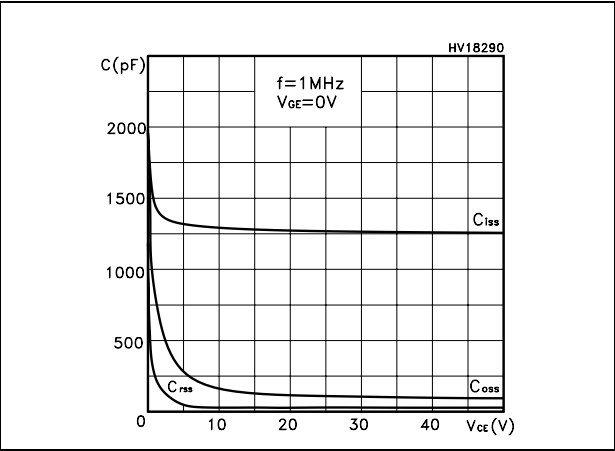
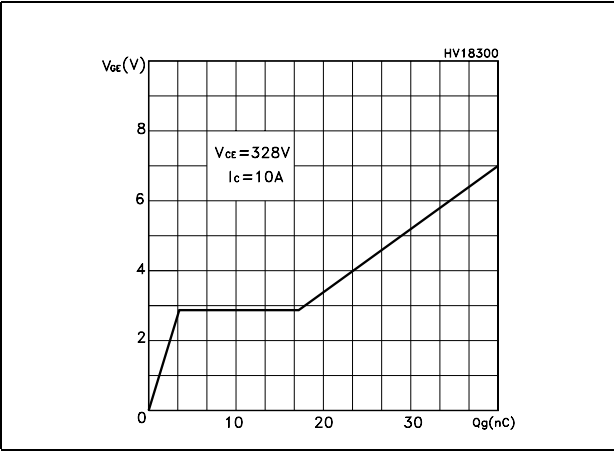


Figure 8. Normalized gate threshold voltage vs temperature

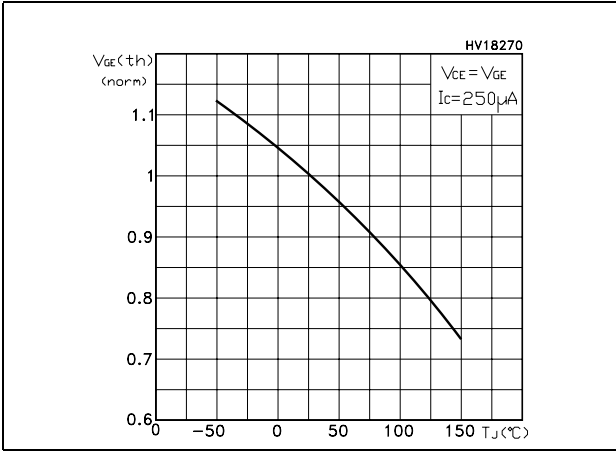


Figure 9. Collector-emitter on voltage vs collector current

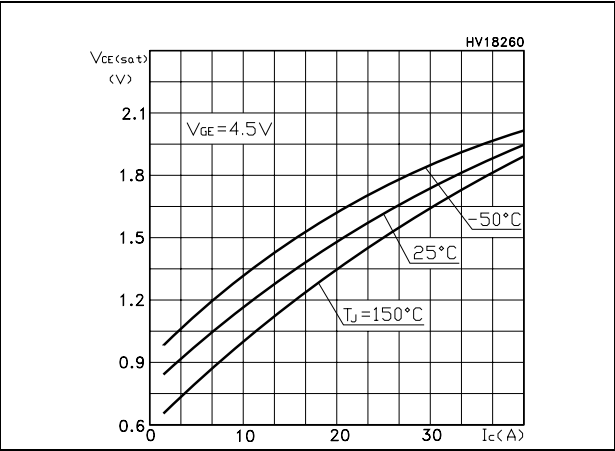


Figure 10. Normalized clamping voltage vs temperature

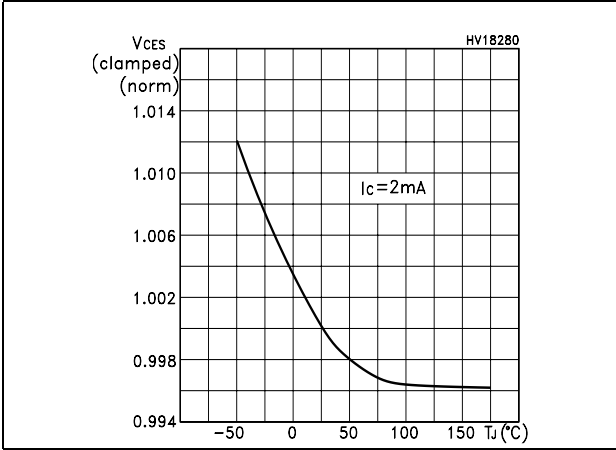


Figure 11. Switching losses vs temperature

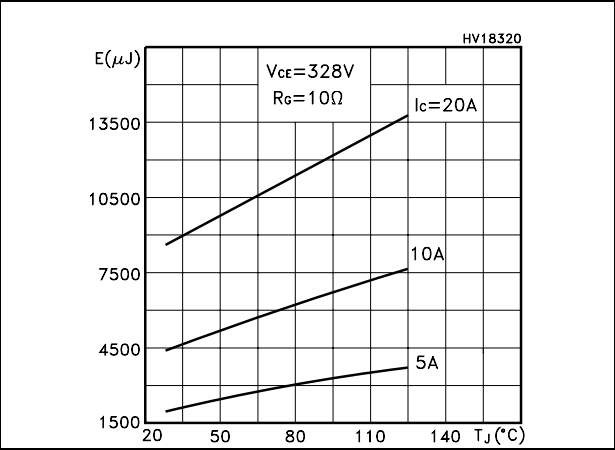


Figure 12. Switching losses vs gate resistance

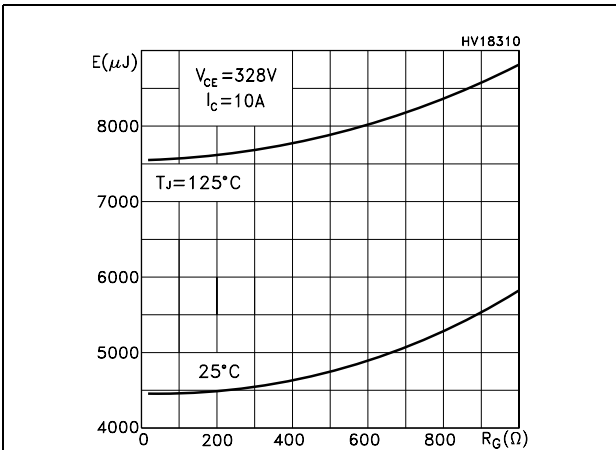


Figure 13. Switching losses vs collector current

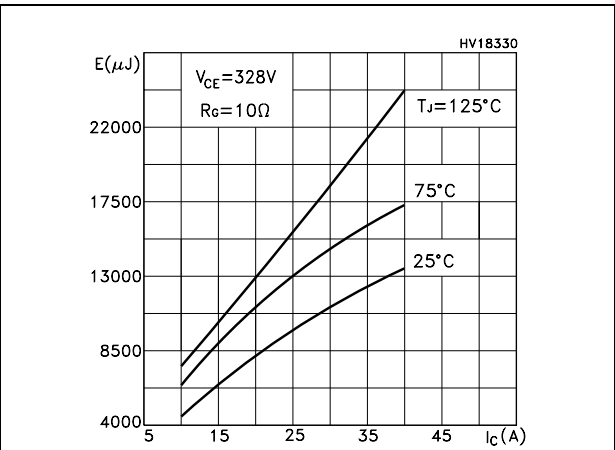


Figure 14. Thermal impedance

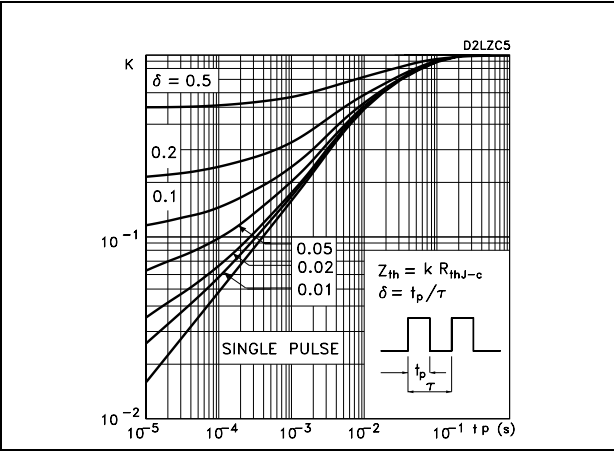


Figure 15. Turn-off SOA

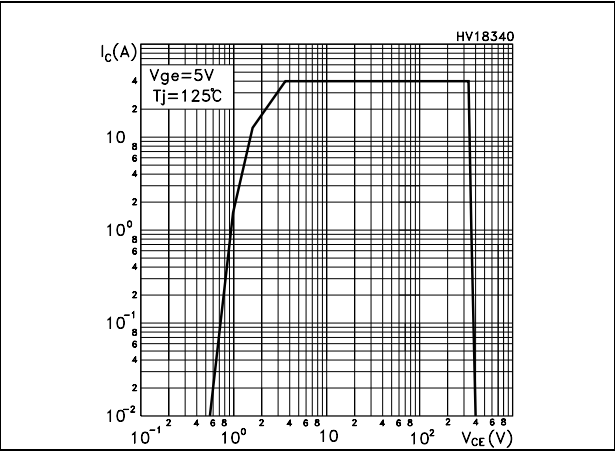
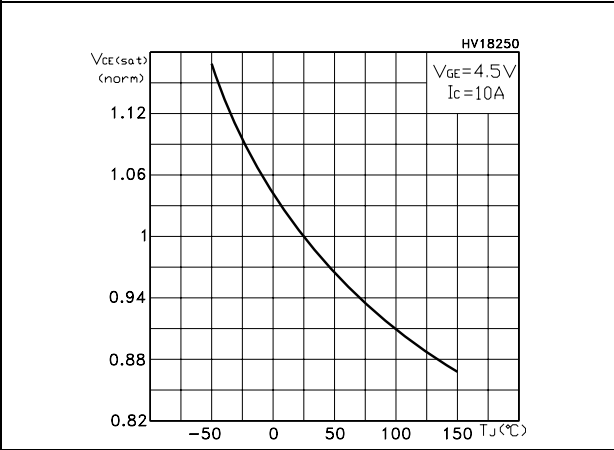


Figure 16. Normalized collector-emitter on voltage vs temperature



3 Test circuits

Figure 17. Test circuit for inductive load switching

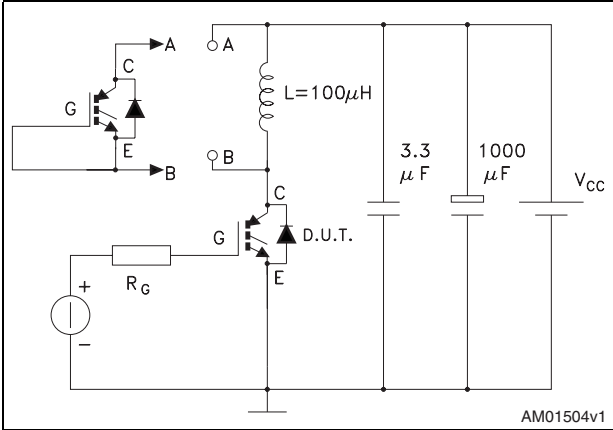


Figure 18. Gate charge test circuit

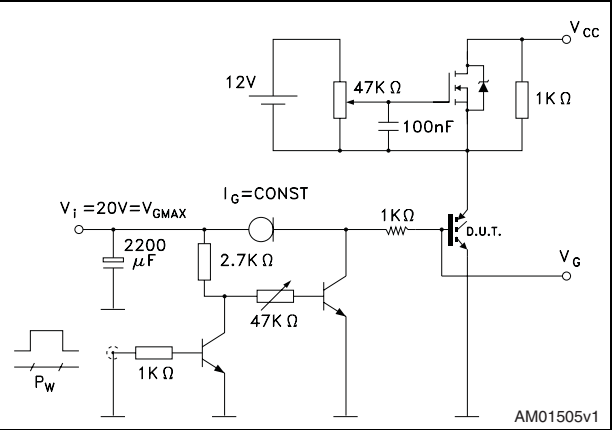
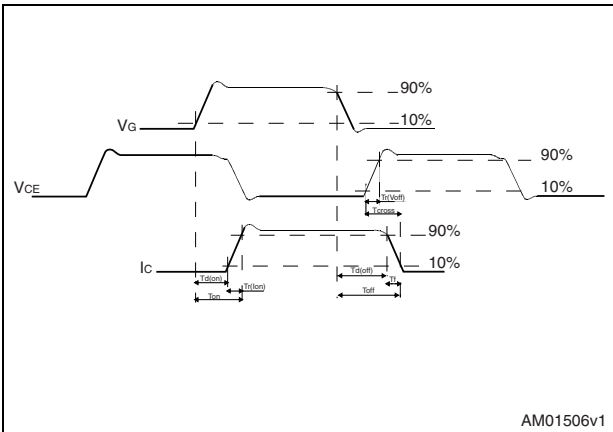


Figure 19. Switching waveform

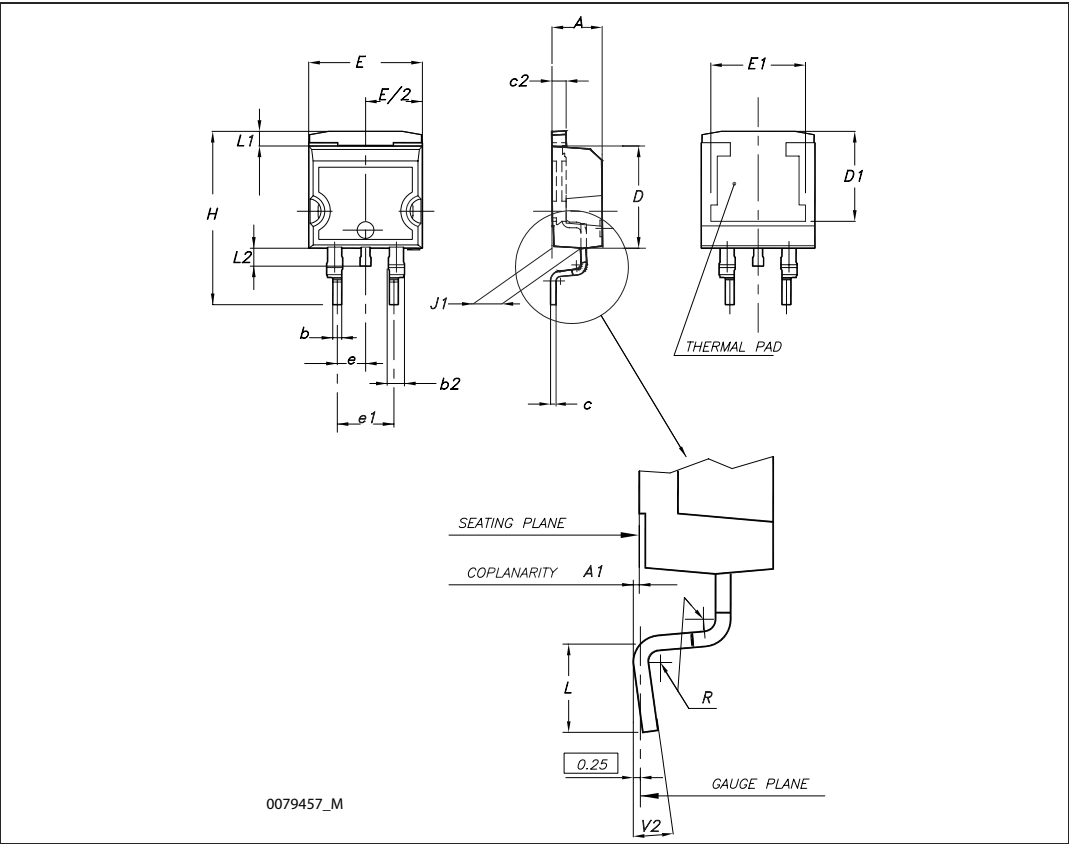


4 Package mechanical data

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.

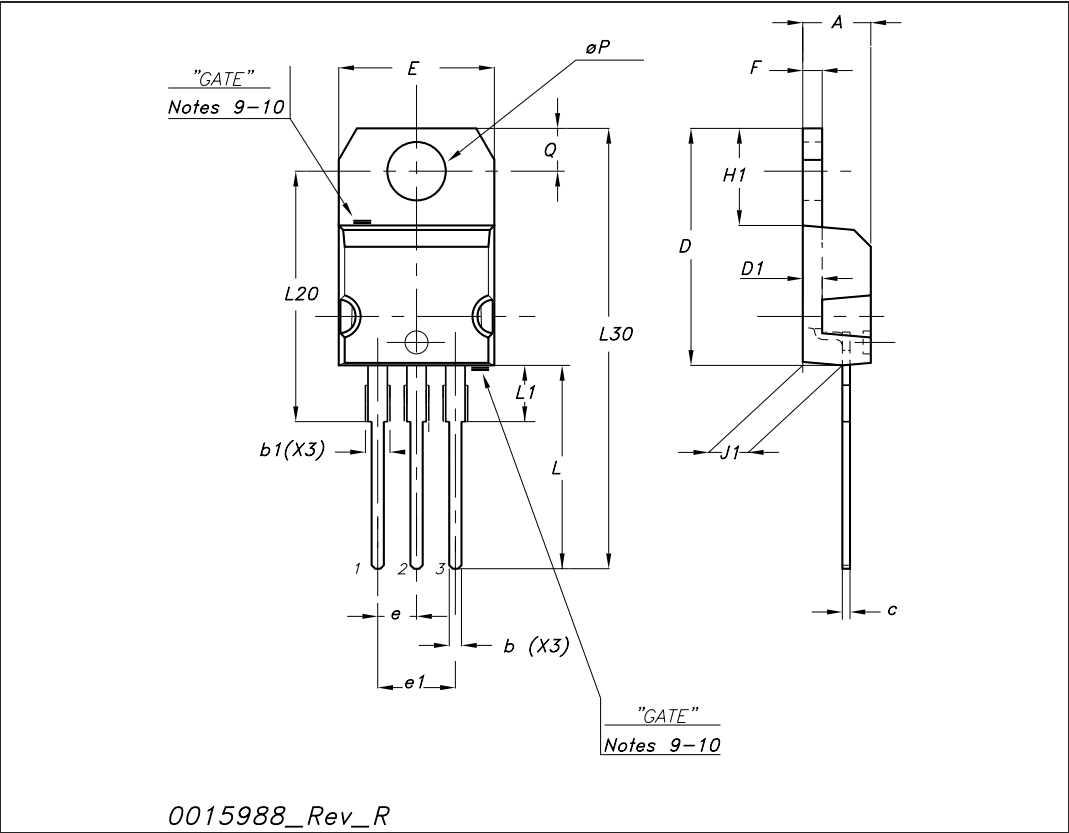
D²PAK (TO-263) mechanical data

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°



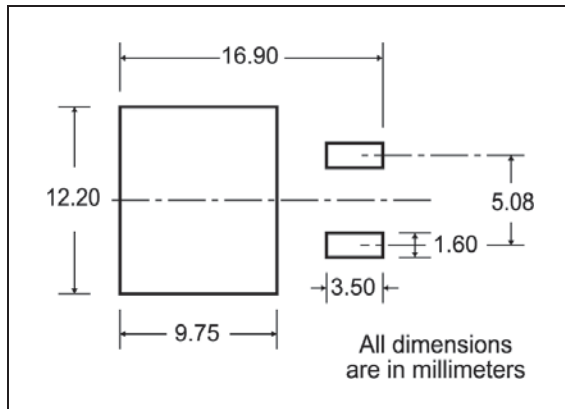
TO-220 mechanical data

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

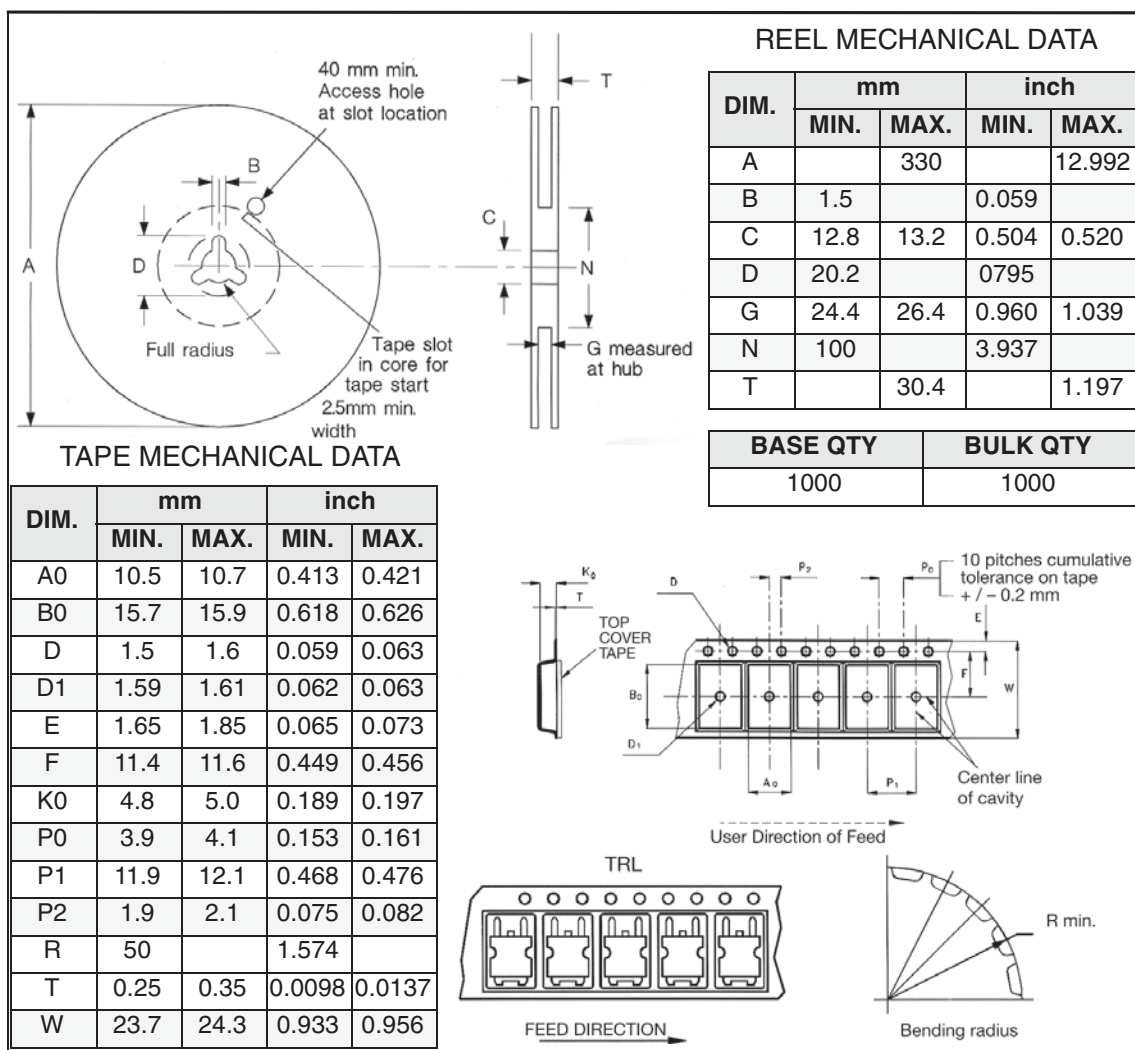


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



6 Revision history

Table 9. Document revision history

Date	Revision	Changes
23-Jan-2006	2	
11-Feb-2009	3	Added new package, mechanical data TO-220

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