



STGB19NC60W STGP19NC60W, STGW19NC60W

19 A - 600 V - ultra fast IGBT

Features

- High frequency operation
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)

Applications

- High frequency motor controls, inverters, UPS
- HF, SMPS and PFC in both hard switch and resonant topologies

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior.

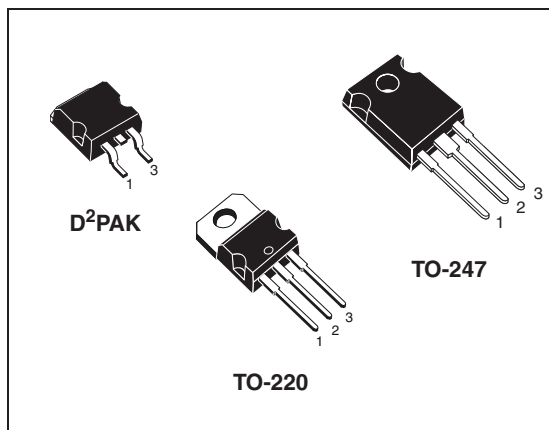


Figure 1. Internal schematic diagram

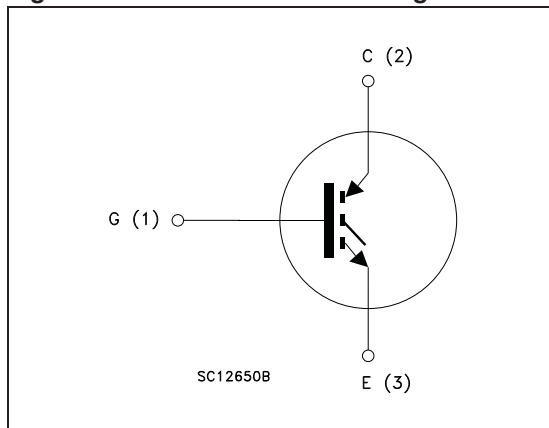


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB19NC60WT4	GB19NC60W	D²PAK	Tape and reel
STGP19NC60W	P19NC60W	TO-220	Tube
STGW19NC60W	W19NC60W	TO-247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		D ² PAK TO-220	TO-247	
V _{CES}	Collector-emitter voltage (V _{GE} = 0)	600		V
I _C ⁽¹⁾	Collector current (continuous) at T _C = 25°C	40	42	A
I _C ⁽¹⁾	Collector current (continuous) at T _C = 100°C	22	23	A
I _{CL} ⁽²⁾	Turn-off latching current	30		A
V _{GE}	Gate-emitter voltage	±20		V
P _{TOT}	Total dissipation at T _C = 25°C	130	140	W
T _j	Operating junction temperature	-65 to 150		°C

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. V_{CLAMP} = 80% (V_{CES}), V_{GE} = 15 V, R_G = 10 Ω, T_J = 150 °C

Table 3. Thermal resistance

Symbol	Parameter	Value		Unit
		D ² PAK TO-220	TO-247	
R _{thj-case}	Thermal resistance junction-case max	0.95	0.9	°C/W
R _{thj-amb}	Thermal resistance junction-ambient max	62.5	50	°C/W

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ($V_{GE} = 0$)	$I_C = 1 \text{ mA}$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15 \text{ V}$, $I_C = 12 \text{ A}$ $V_{GE} = 15 \text{ V}$, $I_C = 12 \text{ A}$, $T_C = 125^{\circ}\text{C}$		2.1 1.8	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250 \mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = 600 \text{ V}$ $V_{CE} = 600 \text{ V}$, $T_C = 125^{\circ}\text{C}$			150 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20 \text{ V}$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15 \text{ V}$, $I_C = 12 \text{ A}$		10		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25 \text{ V}$, $f = 1 \text{ MHz}$, $V_{GE} = 0$		1180		pF
C_{oes}	Output capacitance			130		pF
C_{res}	Reverse transfer capacitance			26		pF
Q_g	Total gate charge	$V_{CE} = 390 \text{ V}$, $I_C = 12 \text{ A}$,		53		nC
Q_{ge}	Gate-emitter charge	$V_{GE} = 15 \text{ V}$,		10		nC
Q_{gc}	Gate-collector charge	Figure 16		21		nC

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r (di/dt) _{on}	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, <i>Figure 17</i>		25 7 1600		ns ns A/ μ s
$t_{d(on)}$ t_r (di/dt) _{on}	Turn-on delay time Current rise time Turn-on current slope	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_C = 125^\circ\text{C}$ <i>Figure 17</i>		25 8 1400		ns ns A/ μ s
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, <i>Figure 17</i>		22 90 43		ns ns ns
$t_r(V_{off})$ $t_{d(off)}$ t_f	Off voltage rise time Turn-off delay time Current fall time	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_C = 125^\circ\text{C}$ <i>Figure 17</i>		47 127 77		ns ns ns

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}^{(1)}$ $E_{off}^{(2)}$ E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, <i>Figure 17</i>		81 125 206		μ J μ J μ J
$E_{on}^{(1)}$ $E_{off}^{(2)}$ E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	$V_{CC} = 390\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\ \Omega$, $V_{GE} = 15\text{ V}$, $T_C = 125^\circ\text{C}$ <i>Figure 17</i>		161 255 416		μ J μ J μ J

1. E_{on} is the turn-on losses when a typical diode is used in the test circuit in *Figure 15*. 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

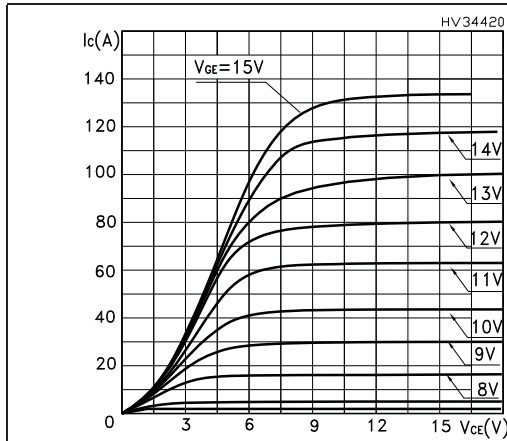


Figure 3. Transfer characteristics

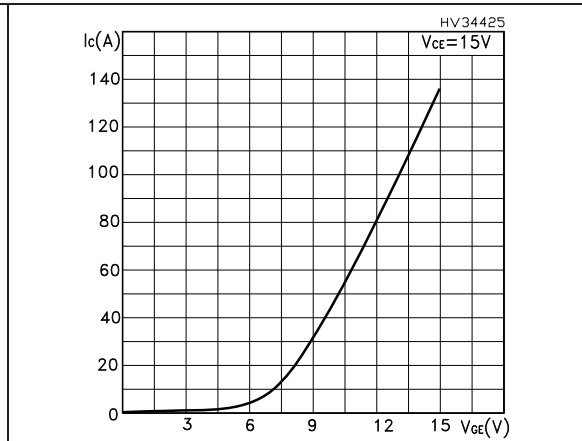


Figure 4. Transconductance

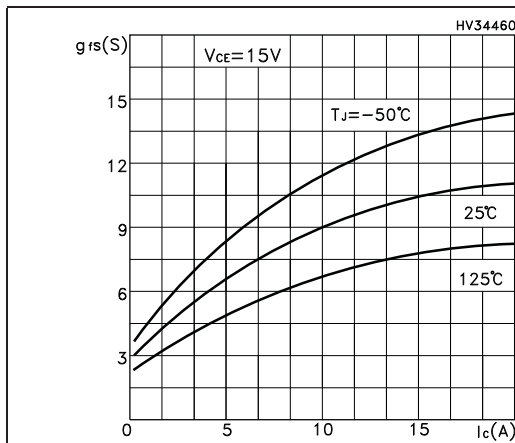


Figure 5. Collector-emitter on voltage vs temperature

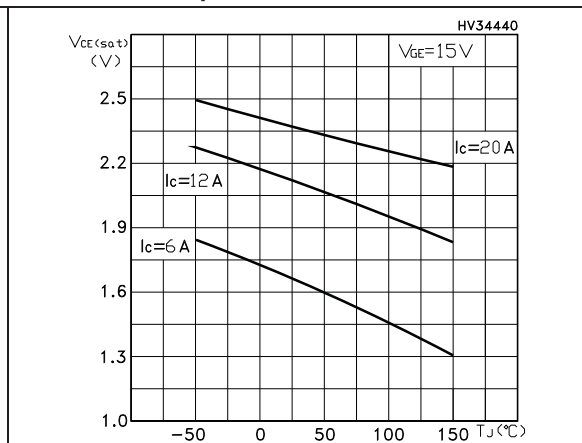


Figure 6. Gate charge vs gate-source voltage

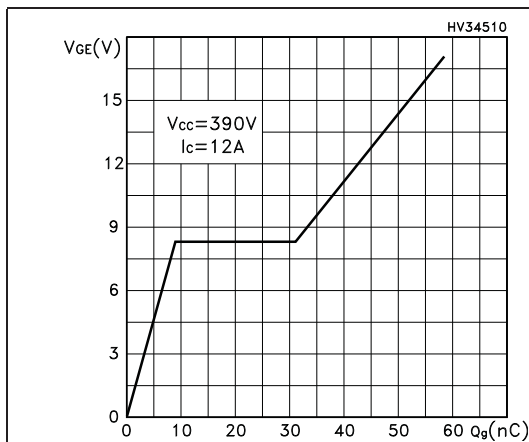


Figure 7. Capacitance variations

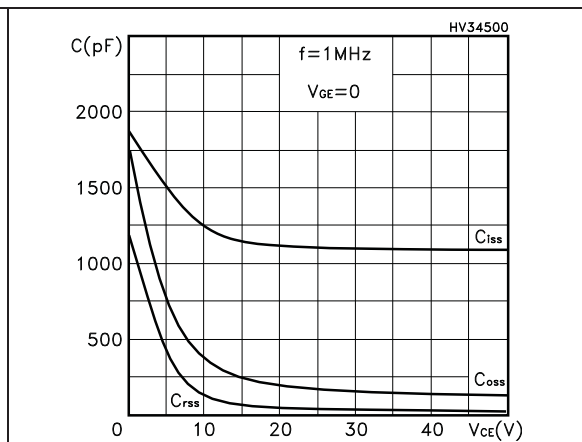


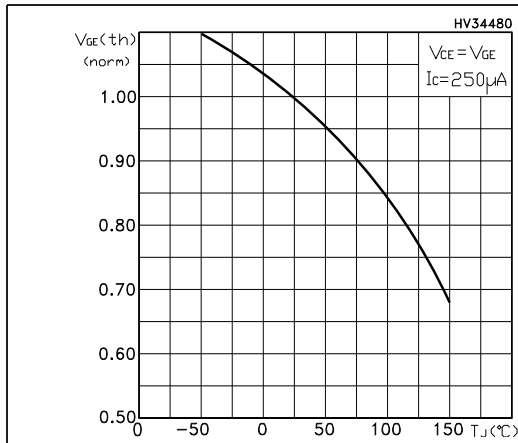
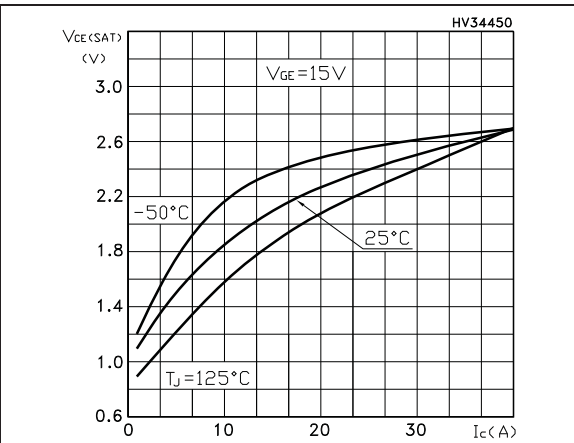
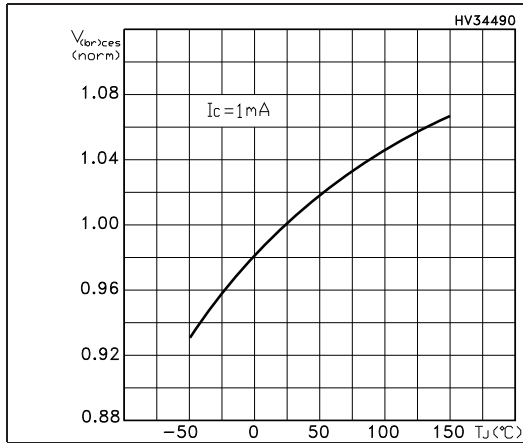
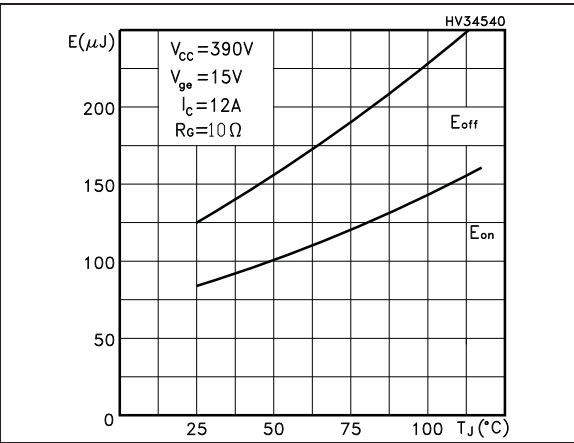
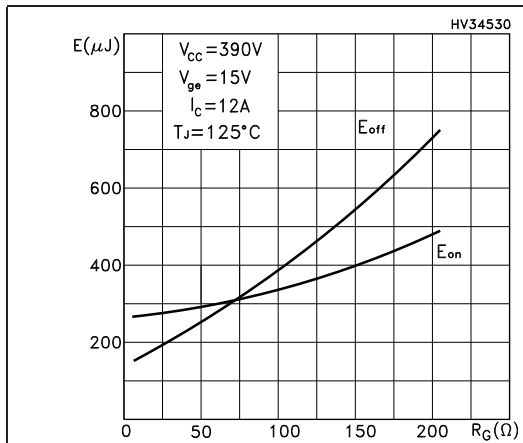
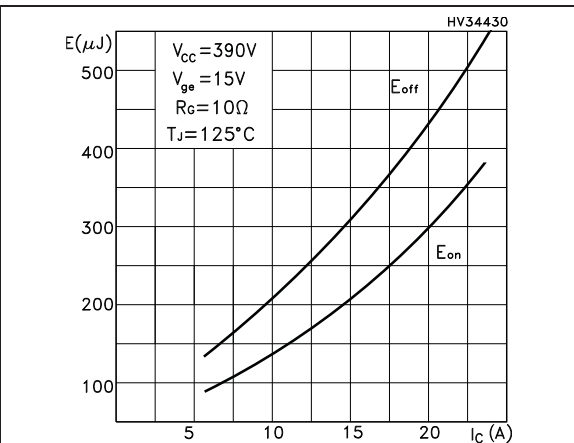
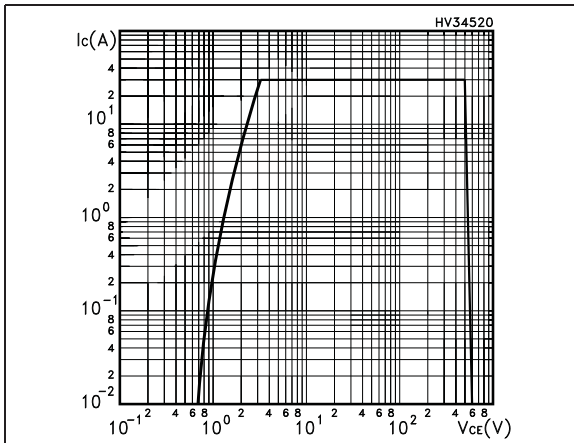
Figure 8. Normalized gate threshold voltage vs temperature**Figure 9. Collector-emitter on voltage vs collector current****Figure 10. Normalized breakdown voltage vs temperature****Figure 11. Switching losses vs temperature****Figure 12. Switching losses vs gate resistance****Figure 13. Switching losses vs collector current**

Figure 14. Turn-off SOA



3 Test circuit

Figure 15. Test circuit for inductive load switching

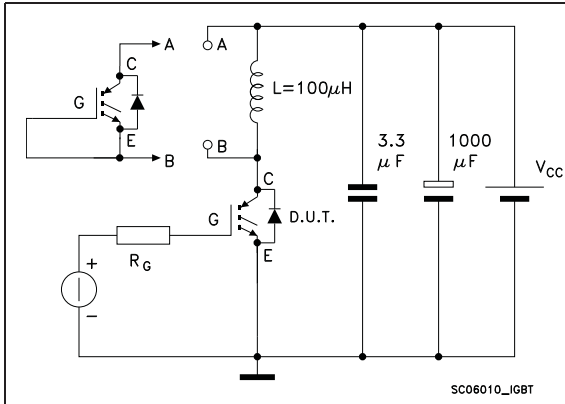


Figure 16. Gate charge test circuit

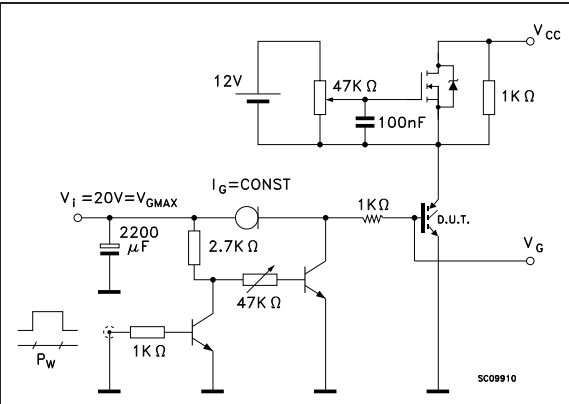
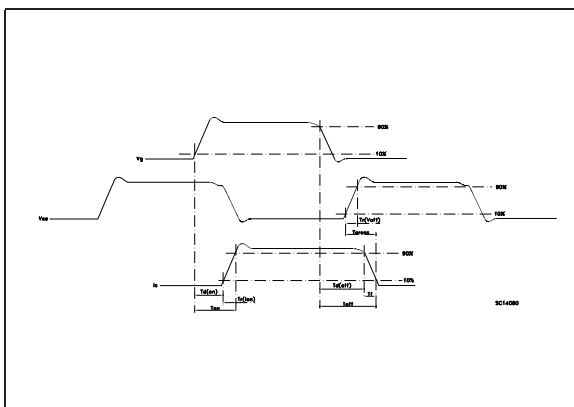


Figure 17. Switching waveform

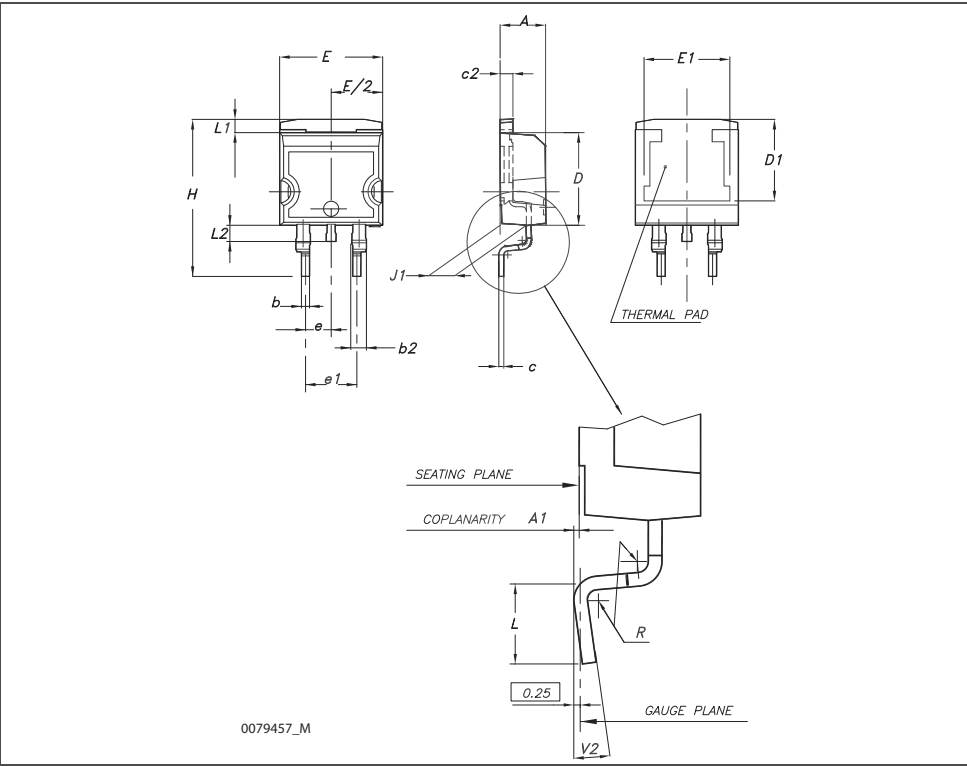


4 Package mechanical data

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

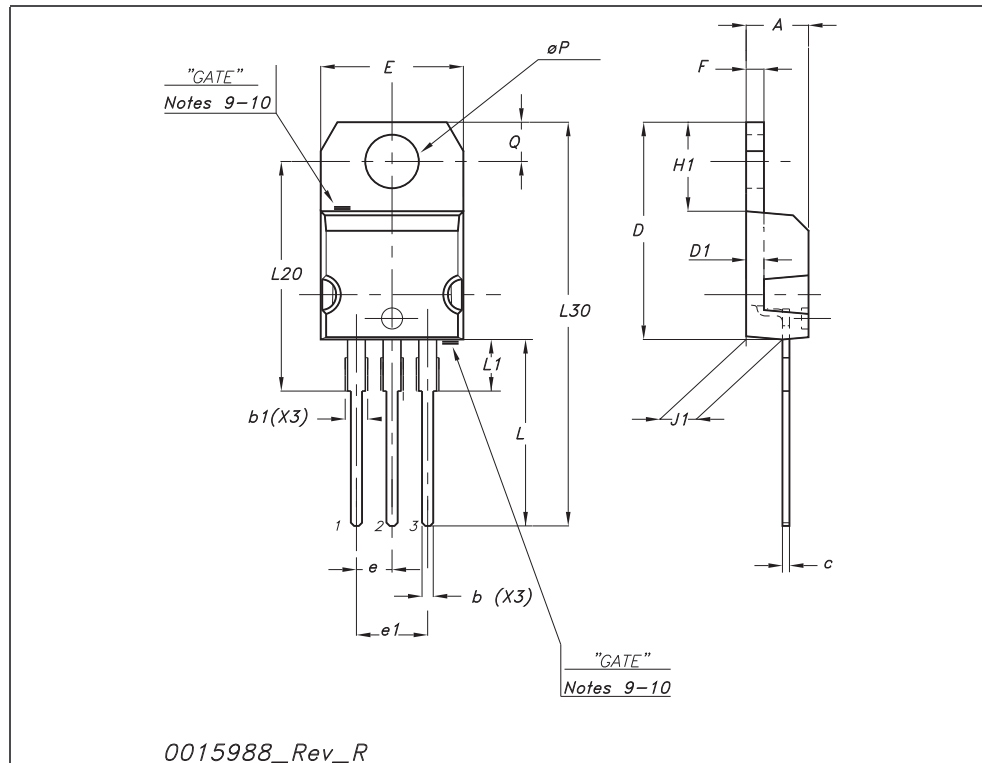
D²PAK (TO-263) mechanical data

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°



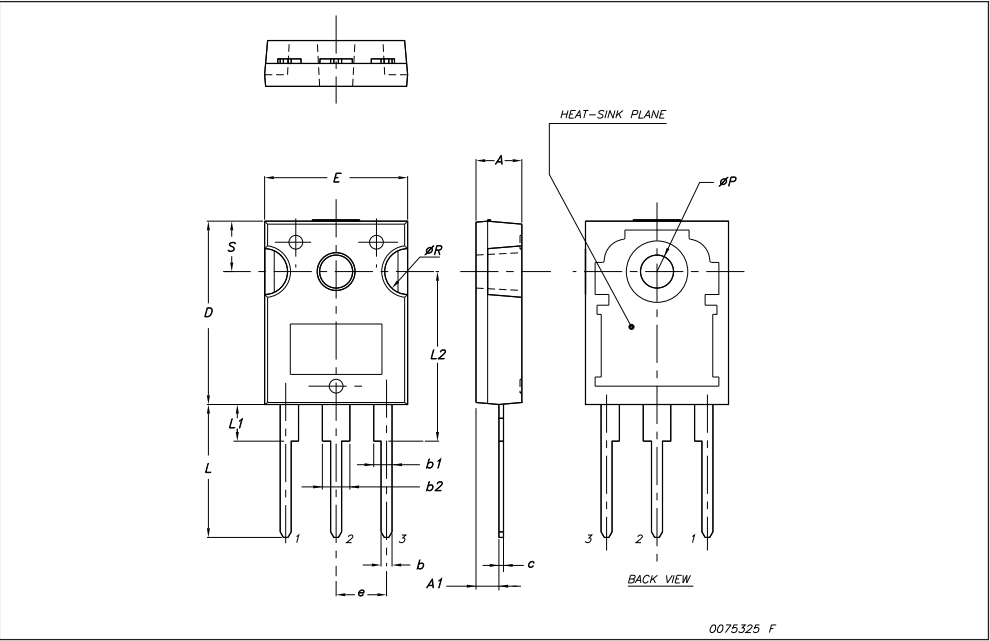
TO-220 mechanical data

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



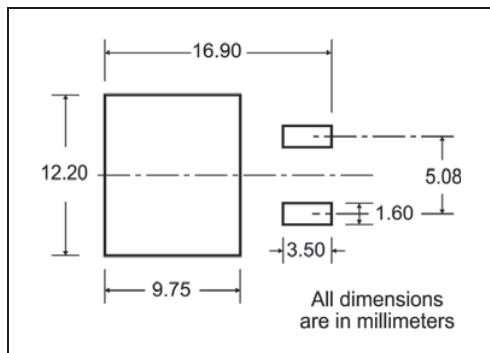
TO-247 Mechanical data

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	

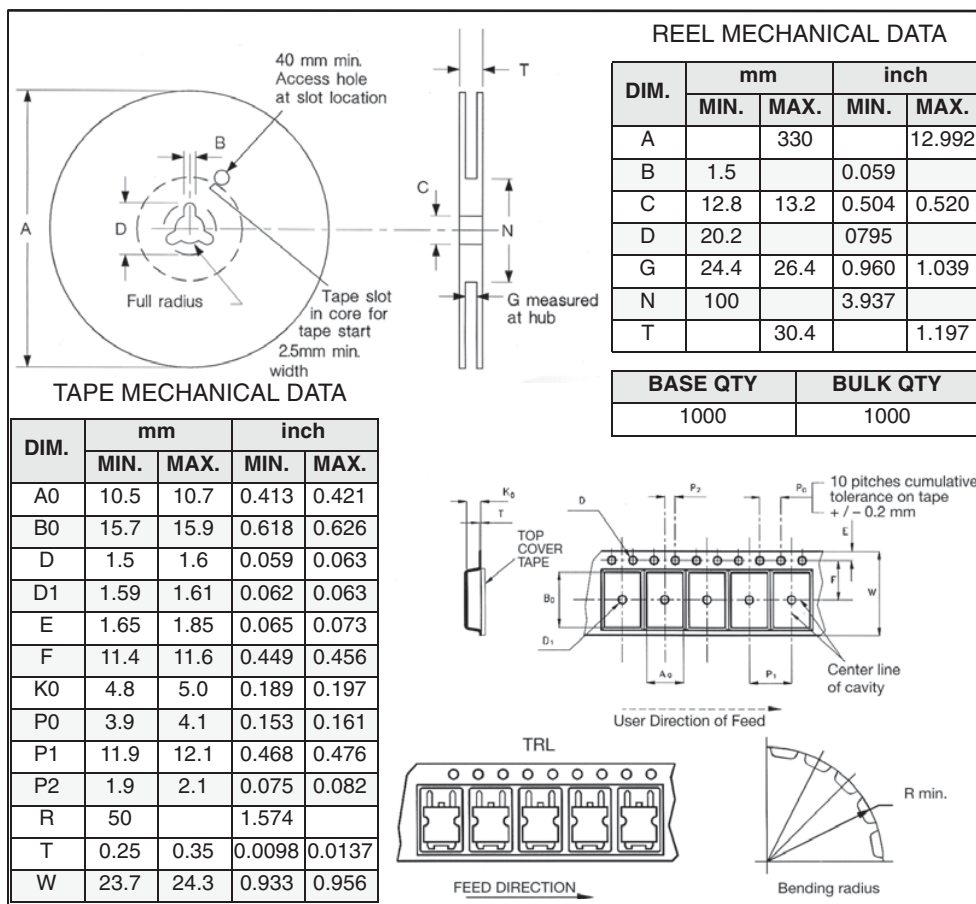


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



6 Revision history

Table 8. Document revision history

Date	Revision	Changes
04-Oct-2006	1	Initial release.
08-May-2007	2	Modified value on Table 2
20-Nov-2008	3	Inserted packages: D ² PAK and TO-247

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