



# STGB30NC60W - STGP30NC60W STGW30NC60W

30 A - 600 V - ultra fast IGBT

## Features

- High frequency operation
- Lower  $C_{RES} / C_{IES}$  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.

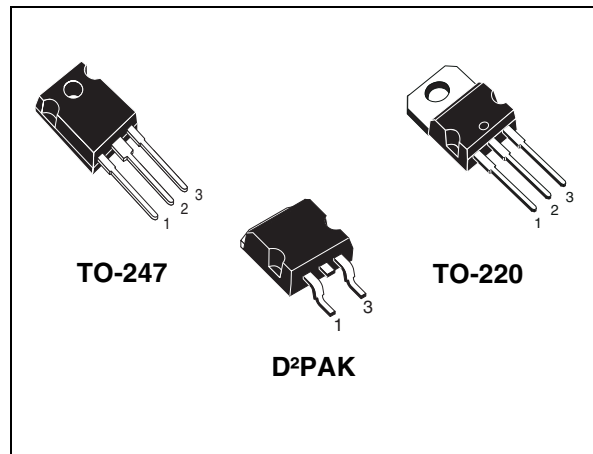


Figure 1. Internal schematic diagram

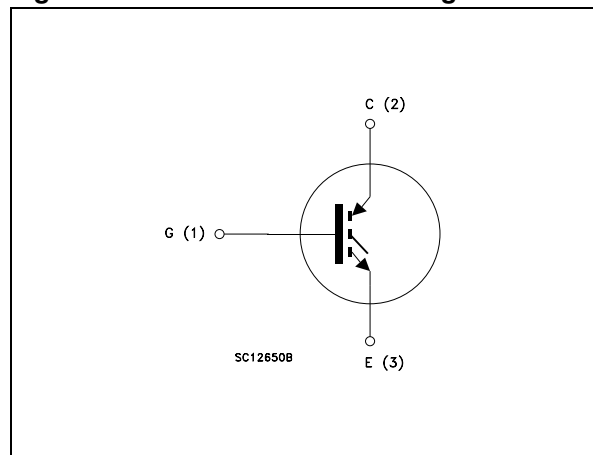


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB30NC60WT4	GB30NC60W	D <sup>2</sup> PAK	Tape and reel
STGP30NC60W	GP30NC60W	TO-220	Tube
STGW30NC60W	GW30NC60W	TO-247	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0$ )	600	V
$I_C^{(1)}$	Collector current (continuous) at 25 °C	60	A
$I_C^{(1)}$	Collector current (continuous) at 100 °C	30	A
$I_{CL}^{(2)}$	Turn-off latching current	150	A
$I_{CP}^{(3)}$	Pulsed collector current	150	A
$V_{GE}$	Gate-emitter voltage	± 20	V
$P_{TOT}$	Total dissipation at $T_C = 25$ °C	200	W
$T_j$	Operating junction temperature	- 55 to 150	°C

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

2.  $V_{clamp} = 80\%(V_{CES})$ ,  $T_j = 150$  °C,  $R_G = 10$  Ω,  $V_{GE} = 15$  V  
 3. Pulse width limited by max junction temperature allowed

**Table 3. Thermal resistance**

Symbol	Parameter	Value		Unit
		TO-247	TO-220 D <sup>2</sup> PAK	
$R_{thj-case}$	Thermal resistance junction-case max	0.62		°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	62.5	°C/W

## 2 Electrical characteristics

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

**Table 4. Static electrical characteristics**

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	$V_{GE}=15 \text{ V}, I_C= 20 \text{ A}$ $V_{GE}=15 \text{ V}, I_C= 20 \text{ A}, T_c= 125^{\circ}C$		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 ( $V_{GE} = 0$ )	$V_{CE} = 600 \text{ V}$ $V_{CE} = 600 \text{ V}, T_c=125^{\circ}C$			10 1	$\mu\text{A}$ mA
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20 \text{ V}$			$\pm 100$	nA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 15 \text{ V}, I_C= 20 \text{ A}$		15		S

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

**Table 5. Dynamic electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25 \text{ V}, f = 1 \text{ MHz},$ $V_{GE}=0$		2080		pF
$C_{oes}$	Output capacitance			175		pF
$C_{res}$	Reverse transfer capacitance			52		pF
$Q_g$	Total gate charge	$V_{CE} = 390 \text{ V}, I_C = 20 \text{ A},$ $V_{GE} = 15 \text{ V},$ <i>(see Figure 17)</i>		102		nC
$Q_{ge}$	Gate-emitter charge			17.5		nC
$Q_{gc}$	Gate-collector charge			47		nC

**Table 6. Switching on/off (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}, I_C = 20\text{ A}$		29.5		ns
$t_r$	Current rise time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ (see Figure 16)		12		ns
$(di/dt)_{on}$	Turn-on current slope			1640		A/ $\mu$ s
$t_{d(on)}$	Turn-on delay time	$V_{CC} = 390\text{ V}, I_C = 20\text{ A}$		29		ns
$t_r$	Current rise time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_C = 125\text{ }^\circ\text{C}$ (see Figure 16)		13.5		ns
$(di/dt)_{on}$	Turn-on current slope			1600		A/ $\mu$ s
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}, I_C = 20\text{ A},$		19.5		ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V}$ (see Figure 18)		118		ns
$t_f$	Current fall time			27		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 390\text{ V}, I_C = 20\text{ A},$		46		ns
$t_{d(off)}$	Turn-off delay time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_C = 125\text{ }^\circ\text{C}$ (see Figure 18)		151		ns
$t_f$	Current fall time			38		ns

**Table 7. Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{on}$	Turn-on switching losses	$V_{CC} = 390\text{ V}, I_C = 20\text{ A}$		305		$\mu$ J
$E_{off}^{(1)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ (see Figure 18)		181		$\mu$ J
$E_{ts}$	Total switching losses			486		$\mu$ J
$E_{on}$	Turn-on switching losses	$V_{CC} = 390\text{ V}, I_C = 20\text{ A}$		455		$\mu$ J
$E_{off}^{(1)}$	Turn-off switching losses	$R_G = 10\ \Omega, V_{GE} = 15\text{ V},$ $T_C = 125\text{ }^\circ\text{C}$ (see Figure 18)		355		$\mu$ J
$E_{ts}$	Total switching losses			801		$\mu$ J

1. Turn-off losses include also the tail of the collector current

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

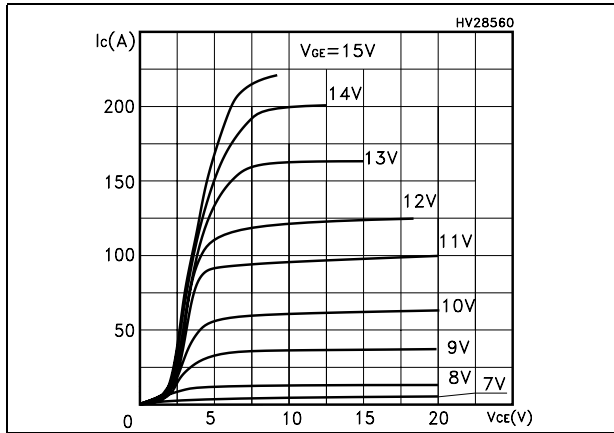


Figure 3. Transfer characteristics

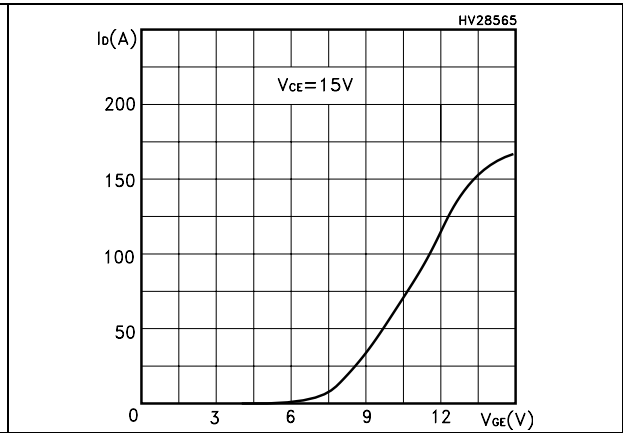


Figure 4. Transconductance

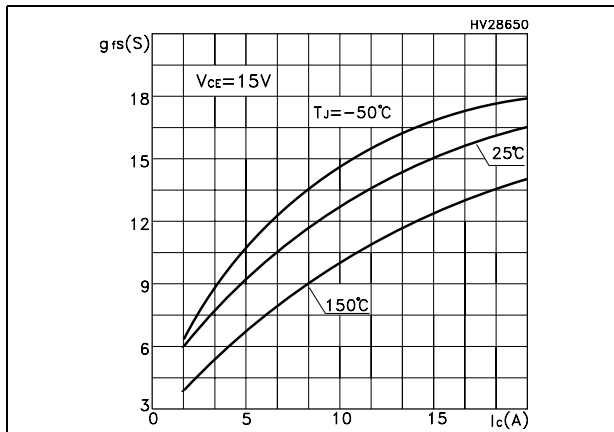


Figure 5. Collector-emitter on voltage vs temperature

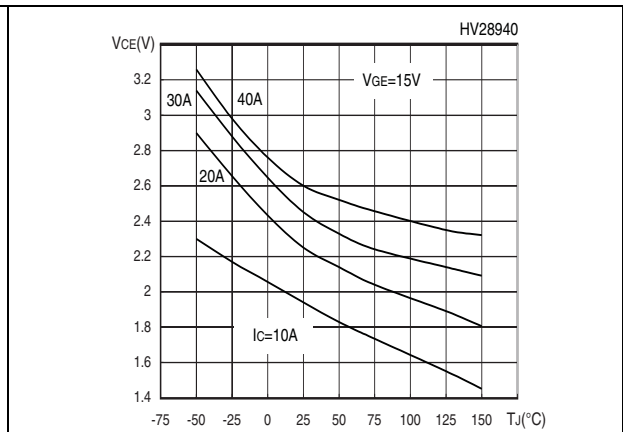


Figure 6. Gate charge vs gate-source voltage

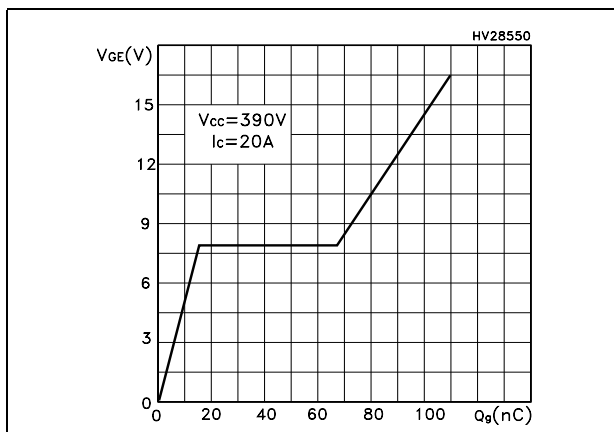


Figure 7. Capacitance variations

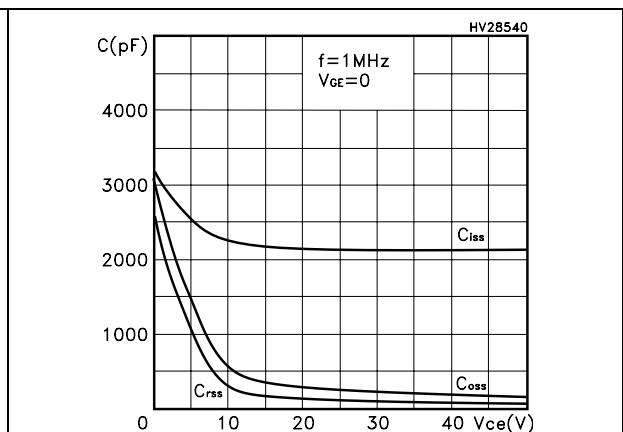


Figure 8. Normalized gate threshold voltage vs temperature

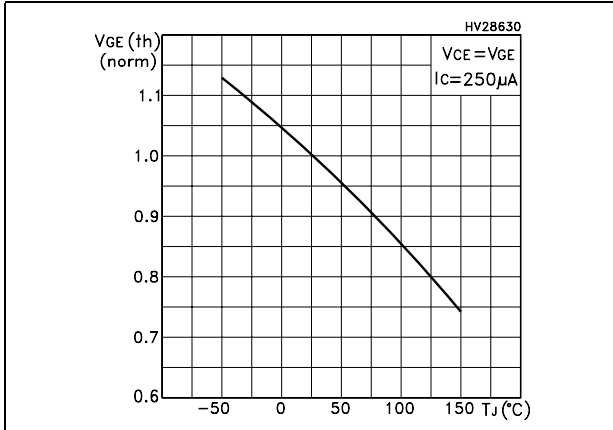


Figure 9. Collector-emitter on voltage vs collector current

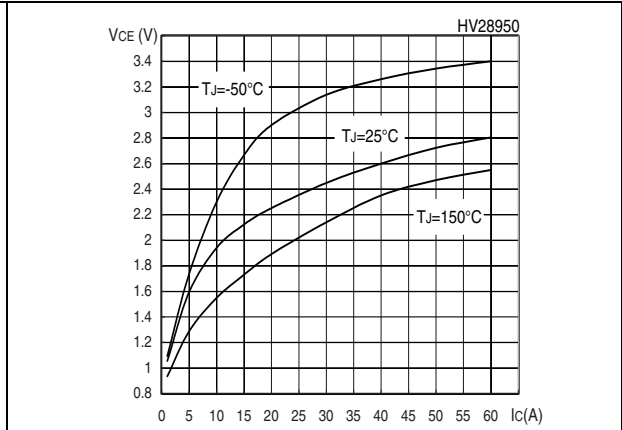


Figure 10. Normalized breakdown voltage vs temperature

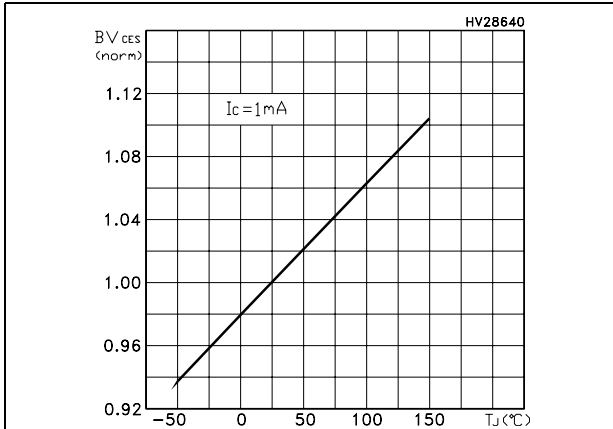


Figure 11. Switching losses vs temperature

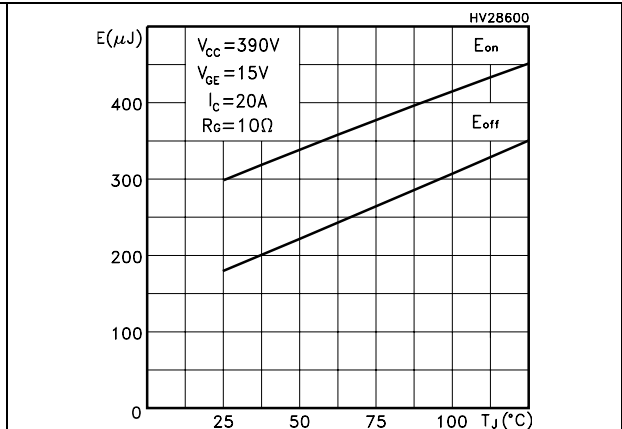


Figure 12. Switching losses vs gate resistance

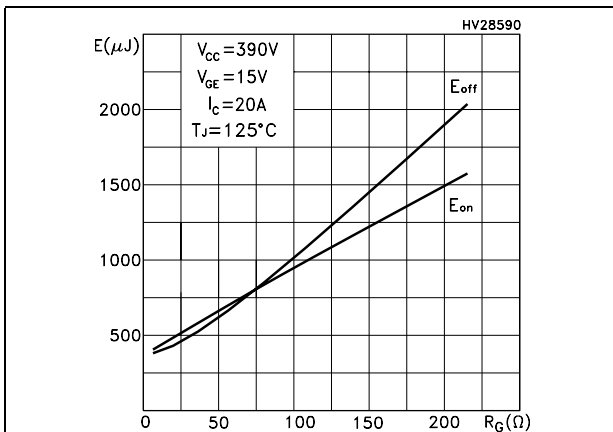


Figure 13. Switching losses vs collector current

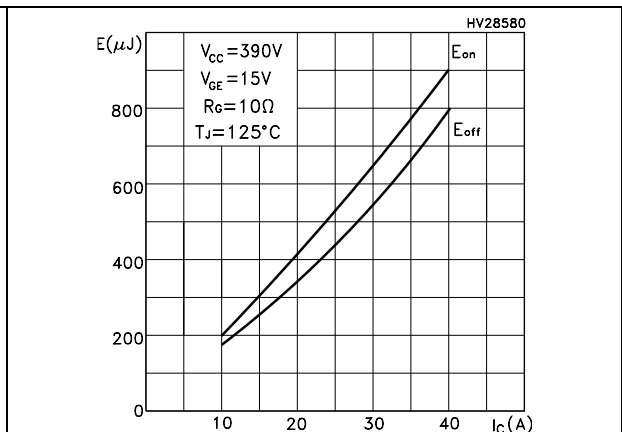


Figure 14. Thermal impedance

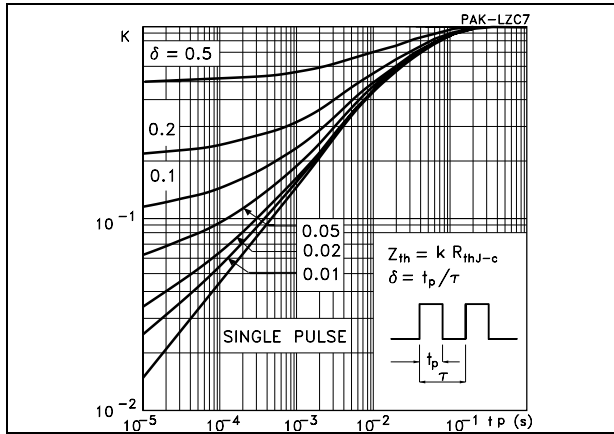
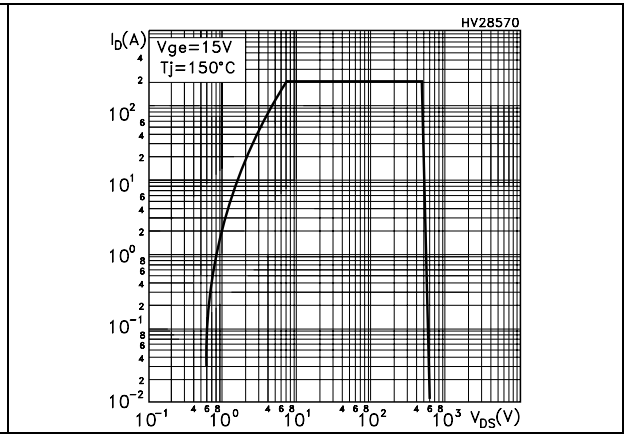


Figure 15. Turn-off SOA





### 3 Test circuit

Figure 16. Test circuit for inductive load switching

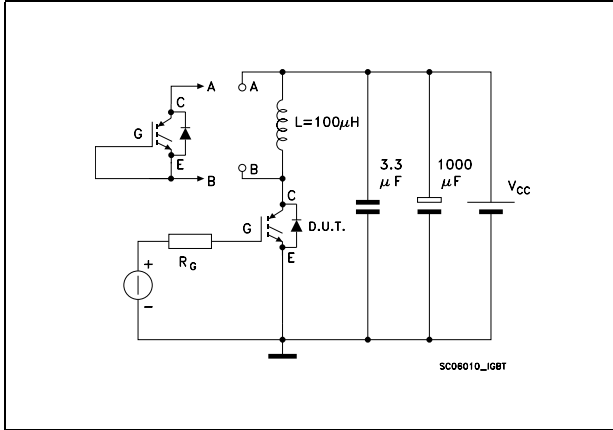


Figure 17. Gate charge test circuit

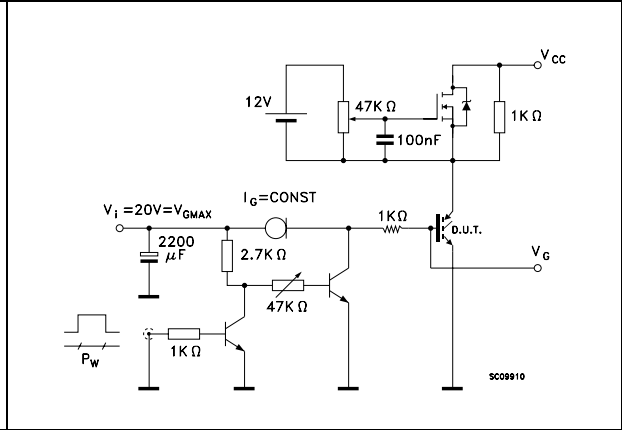
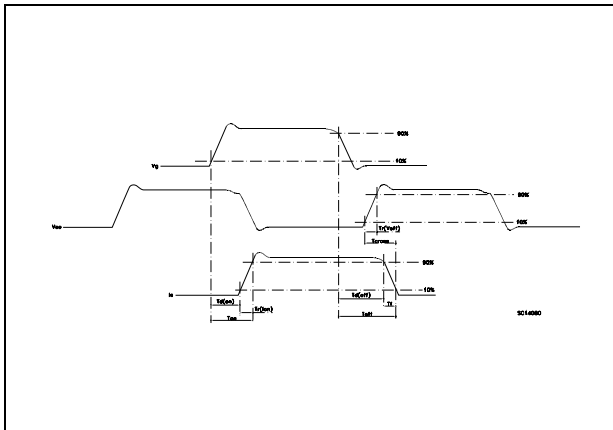


Figure 18. Switching waveform

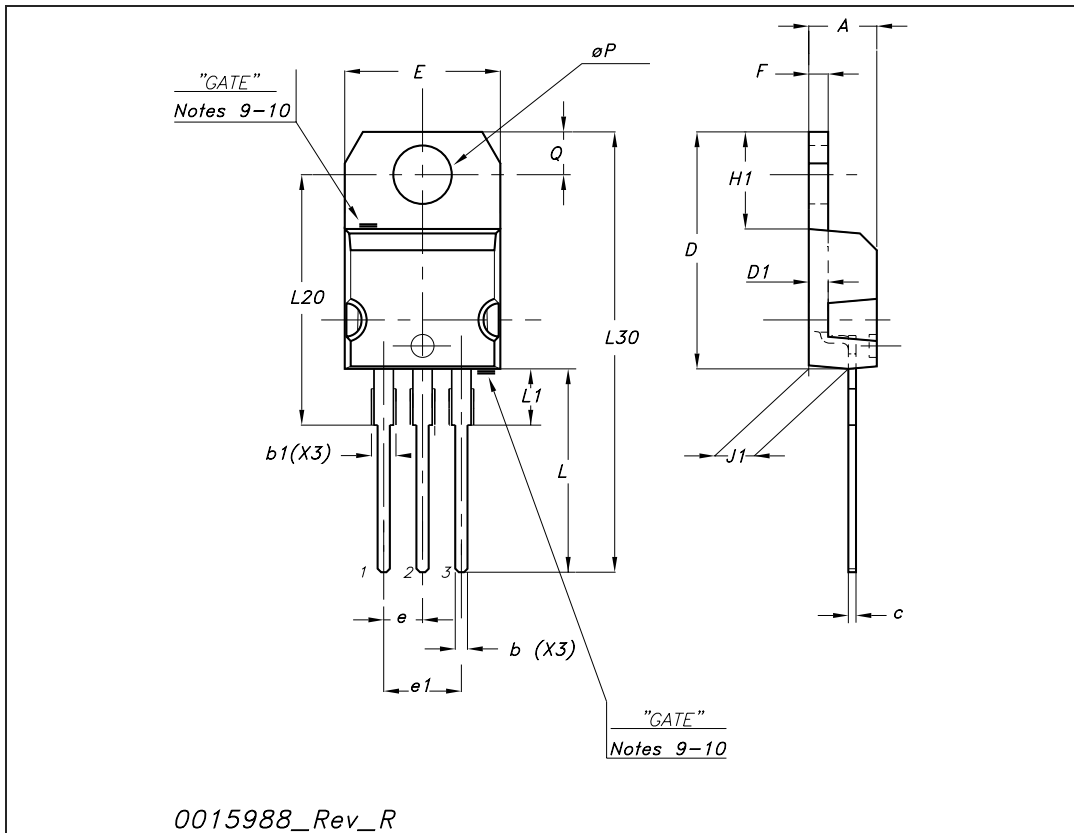


## 4 Package mechanical data

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

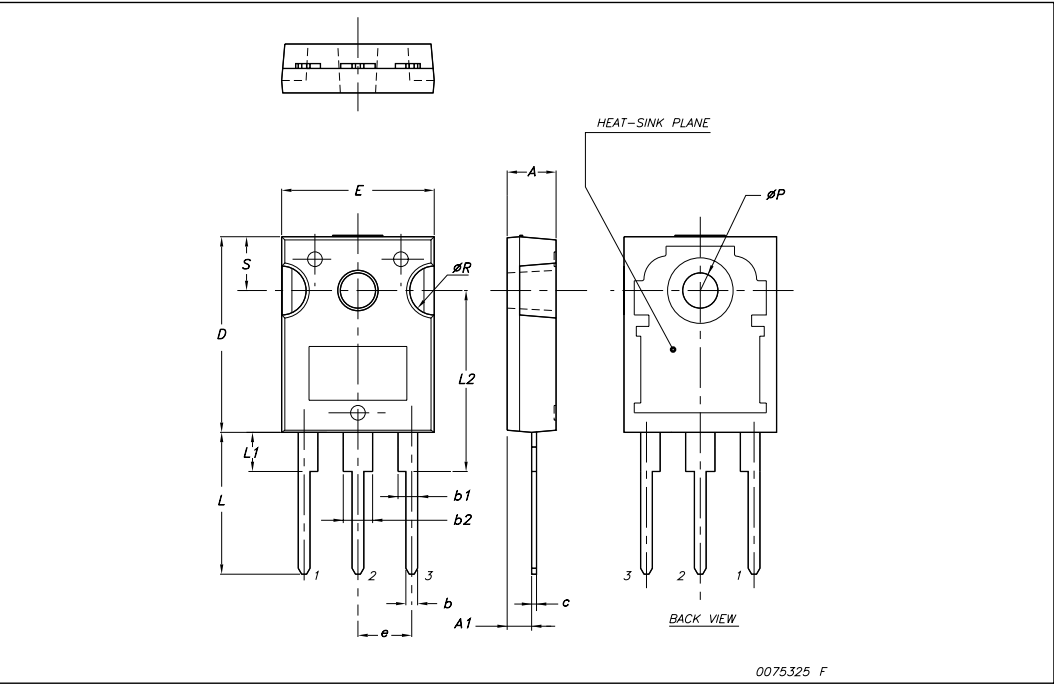
TO-220 mechanical data

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



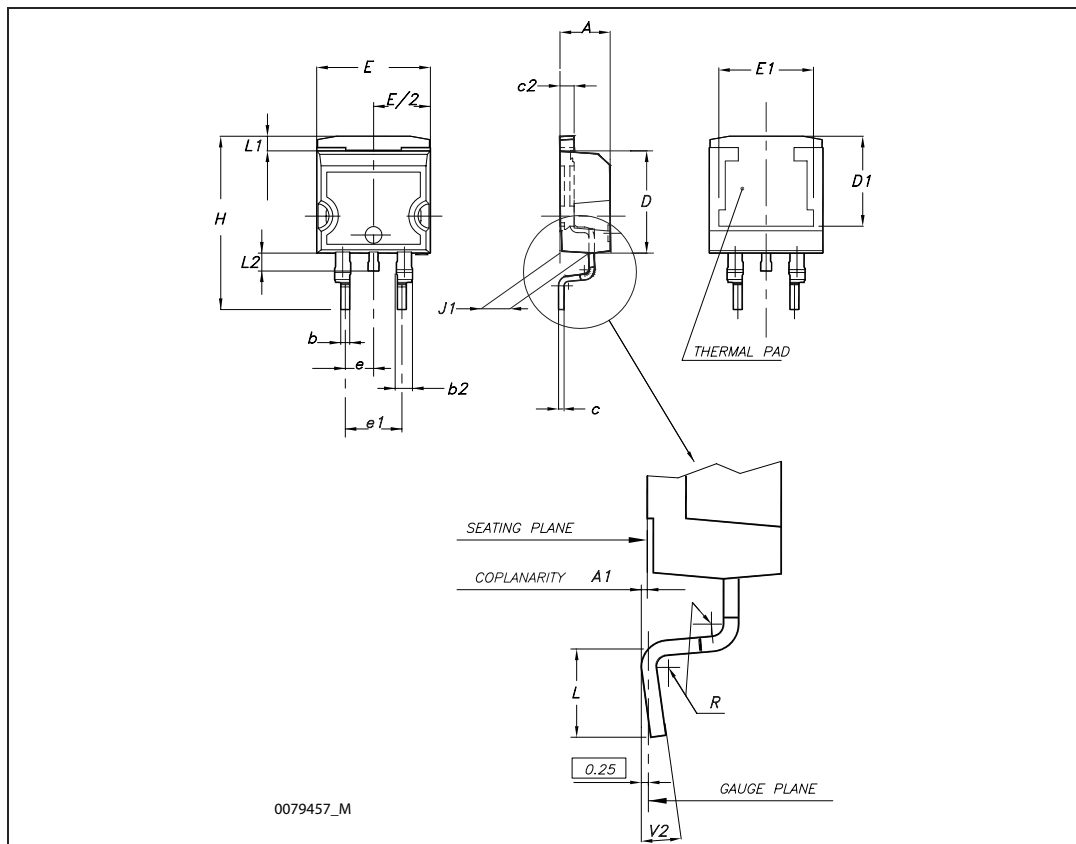
**TO-247 Mechanical data**

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	



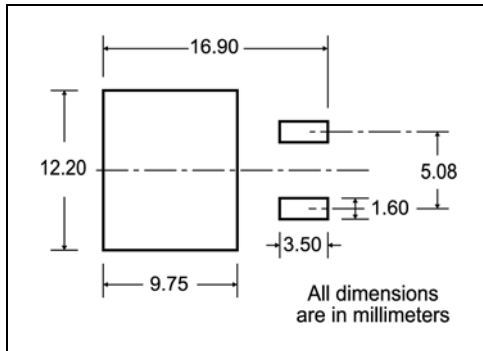
D<sup>2</sup>PAK (TO-263) mechanical data

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

**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

TRL

FEED DIRECTION

Bending radius R min.

\* on sales type

## 6 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
15-Sep-2005	1	Initial release.
04-Jan-2006	2	Inserted TO-220. Complete version
18-Dec-2006	3	The document has been reformatted
15-Feb-2007	4	Mechanical data TO-220 has been updated
26-Mar-2007	5	Typo mistake on page 1
12-Jul-2007	6	Corrected <a href="#">Figure 11</a> , <a href="#">Figure 12</a> , <a href="#">Figure 13</a>
04-Oct-2007	7	Symbol on <a href="#">Table 4</a> has been corrected
17-Mar-2008	8	<a href="#">Figure 5</a> and <a href="#">Figure 9</a> have been updated Inserted device in D <sup>2</sup> PAK

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