



# STGW38IH130D, STGWT38IH130D

33 A - 1300 V - very fast IGBT

Datasheet – production data

## Features

- Low saturation voltage
- High current capability
- Low switching loss
- Low static and peak forward voltage drop free-wheeling diode

## Applications

- Induction cooking, microwave ovens
- Soft-switching applications

## Description

This device is a very fast IGBT developed using advanced PowerMESH™ technology. This process guarantees an excellent trade-off between switching performance and low on-state behavior. This device is well-suited for resonant or soft-switching applications.

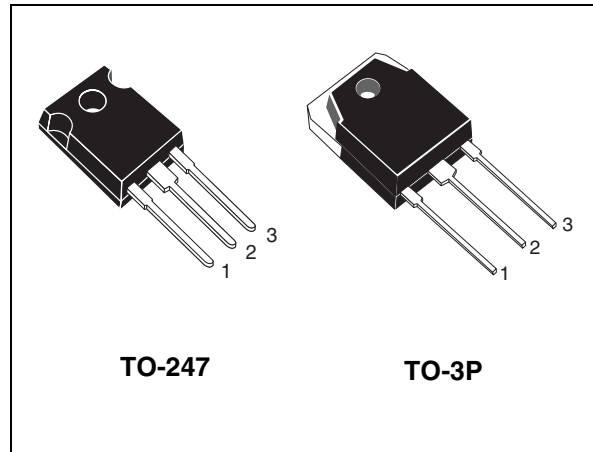


Figure 1. Internal schematic diagram

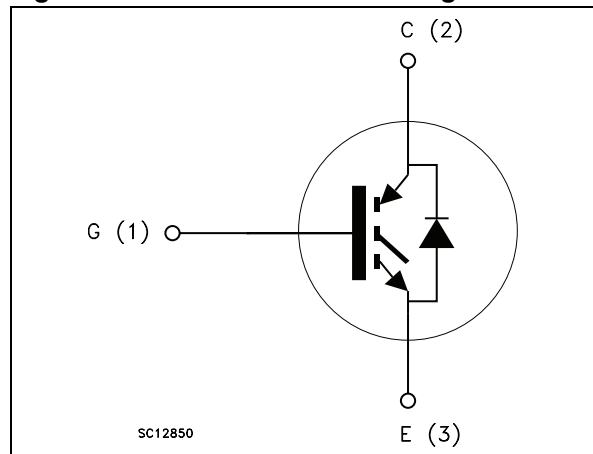


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGW38IH130D	GW38IH130D	TO-247 long leads	Tube
STGWS38IH130D		TO-247	
STGWT38IH130D		TO-3P	

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-3P, TO-247 long leads	TO-247	
V <sub>CES</sub>	Collector-emitter voltage (V <sub>GE</sub> = 0)	1300		V
I <sub>C</sub> <sup>(1)</sup>	Continuous collector current at T <sub>C</sub> = 25 °C	63	55	A
I <sub>C</sub> <sup>(1)</sup>	Continuous collector current at T <sub>C</sub> = 100 °C	33	25	A
I <sub>CL</sub> <sup>(2)</sup>	Turn-off latching current	40		A
I <sub>CP</sub> <sup>(3)</sup>	Pulsed collector current	125		A
V <sub>GE</sub>	Gate-emitter voltage	±25		V
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	250	180	W
I <sub>F</sub>	Diode RMS forward current at T <sub>C</sub> = 25 °C	30		A
I <sub>FSM</sub>	Surge non repetitive forward current t <sub>p</sub> = 10 ms sinusoidal	100		A
T <sub>j</sub>	Operating junction temperature	-55 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<sub>clamp</sub> = 960 V, T<sub>j</sub> = 150 °C, R<sub>G</sub> = 10 Ω, V<sub>GE</sub> = 15 V

3. Pulse width limited by maximum permissible junction temperature and turn-off within RBSOA

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-3P, TO-247 long leads	TO-247	
R <sub>thj-case</sub>	Thermal resistance junction-case IGBT	0.5	0.7	°C/W
R <sub>thj-case</sub>	Thermal resistance junction-case diode	2	2.1	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-ambient	50		°C/W

## 2 Electrical characteristics

$T_J = 25\text{ °C}$  unless otherwise specified.

**Table 4. Static**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage ( $V_{GE} = 0$ )	$I_C = 1\text{ mA}$	1300			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$ , $I_C = 20\text{ A}$ $V_{GE} = 15\text{ V}$ , $I_C = 20\text{ A}$ , $T_J = 125\text{ °C}$		2.1 2.0	2.8	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$ , $I_C = 1\text{ mA}$	3.75		5.75	V
$I_{CES}$	Collector-cut-off current ( $V_{GE} = 0$ )	$V_{CE} = 1300\text{ V}$ $V_{CE} = 1300\text{ V}$ , $T_J = 125\text{ °C}$			1 10	mA mA
$I_{GES}$	Gate-emitter leakage current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{ V}$			$\pm 100$	nA
$g_{fs}^{(1)}$	Forward transconductance	$V_{CE} = 25\text{ V}$ , $I_C = 20\text{ A}$		20		S
$V_F$	Diode forward voltage	$I_F = 20\text{ A}$ $I_F = 20\text{ A}$ , $T_J = 125\text{ °C}$		1.3	1.9 1.7	V V

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

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GE} = 0$	-	2900	-	pF
$C_{oes}$	Output capacitance			155		pF
$C_{res}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{CE} = 960\text{ V}$ , $I_C = 20\text{ A}$ , $V_{GE} = 15\text{ V}$	-	127	-	nC
$Q_{ge}$	Gate-emitter charge			18		nC
$Q_{gc}$	Gate-collector charge			50		nC

**Table 6. Inductive load switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 960\text{ V}$ , $I_C = 20\text{ A}$ $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , (see Figure 16)	-	102	-	ns
$t_d(off)$	Turn-off delay time			284		ns
$t_f$	Current fall time			180		ns
$t_r(V_{off})$	Off voltage rise time	$V_{CC} = 960\text{ V}$ , $I_C = 20\text{ A}$ $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 125\text{ °C}$ (see Figure 16)	-	200	-	ns
$t_d(off)$	Turn-off delay time			424		ns
$t_f$	Current fall time			316		ns

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

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$E_{\text{off}}^{(1)}$	Turn-off switching losses	$V_{\text{CC}} = 960 \text{ V}$ , $I_{\text{C}} = 20 \text{ A}$ $R_{\text{G}} = 10 \ \Omega$ , $V_{\text{GE}} = 15 \text{ V}$ , (see Figure 16)	-	3.4	-	mJ
$E_{\text{off}}^{(1)}$	Turn-off switching losses	$V_{\text{CC}} = 960 \text{ V}$ , $I_{\text{C}} = 20 \text{ A}$ $R_{\text{G}} = 10 \ \Omega$ , $V_{\text{GE}} = 15 \text{ V}$ , $T_{\text{J}} = 125 \text{ }^\circ\text{C}$ (see Figure 16)	-	6.4	-	mJ

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

## 2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

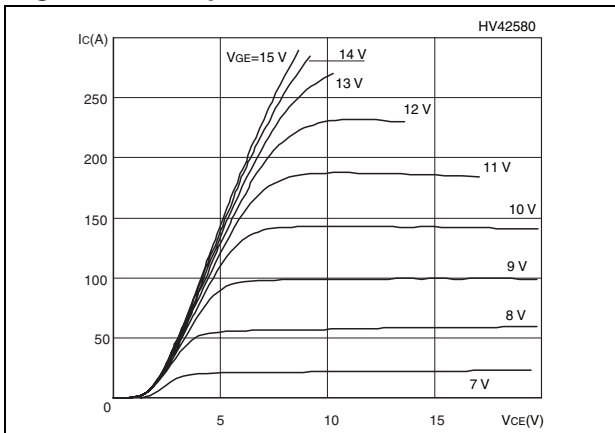


Figure 3. Transfer characteristics

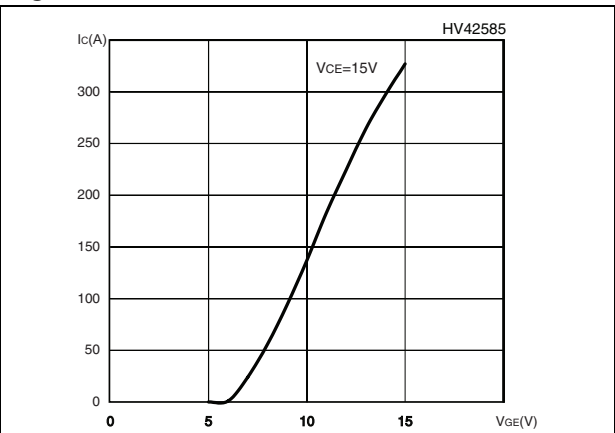


Figure 4. Transconductance

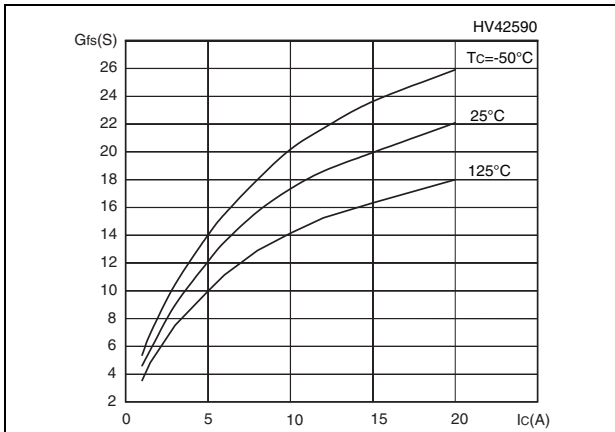


Figure 5. Collector-emitter on voltage vs. temperature

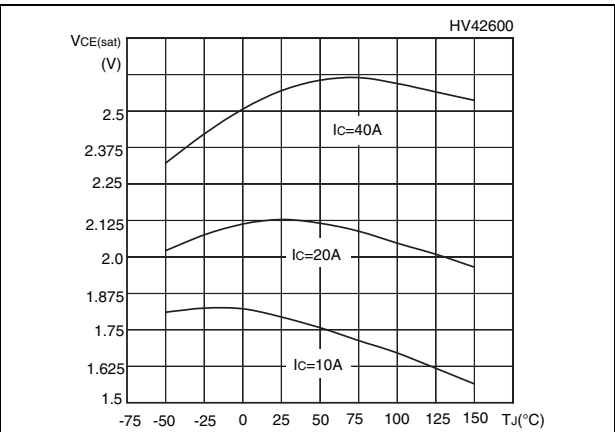


Figure 6. Normalized breakdown voltage vs. temperature

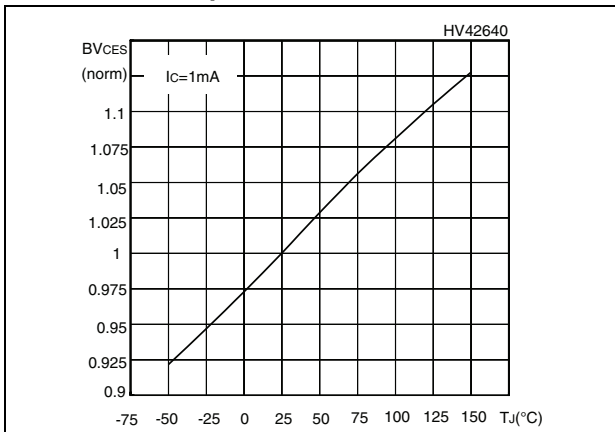


Figure 7. Gate-charge vs. gate-emitter

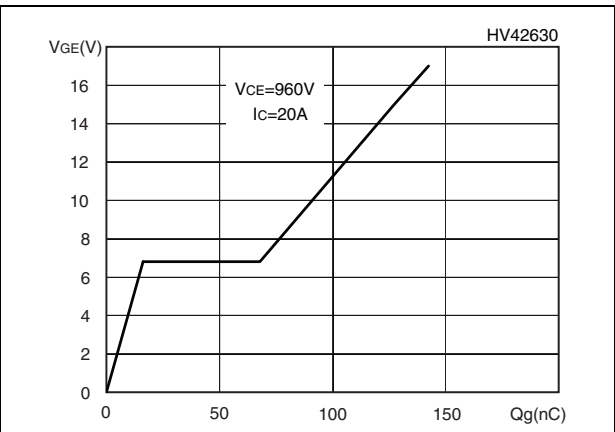


Figure 8. Normalized gate threshold voltage vs. temperature

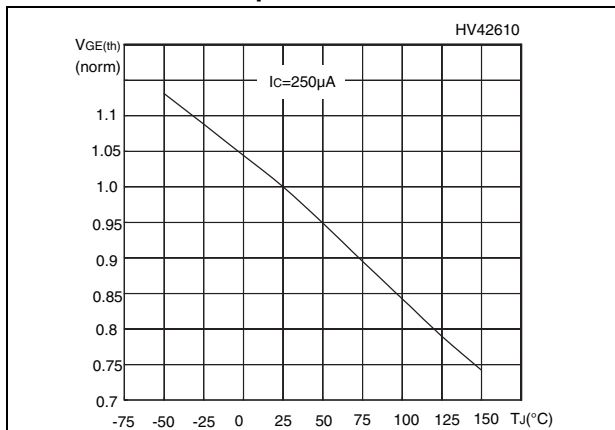


Figure 9. Collector-emitter on voltage vs. collector current

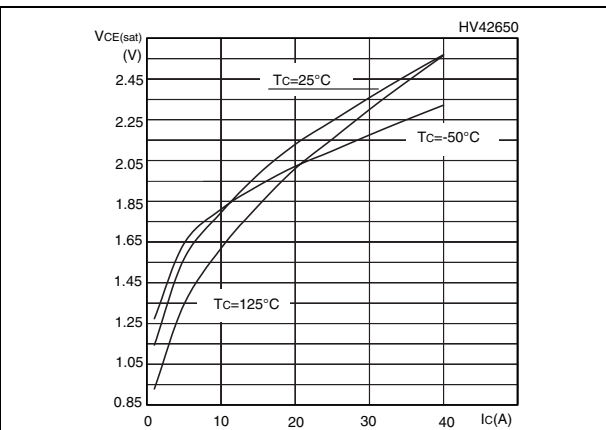


Figure 10. Switching losses vs. temperature

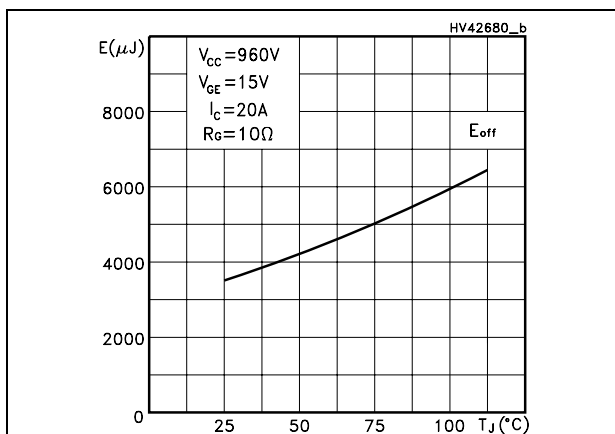


Figure 11. Switching losses vs. gate resistance

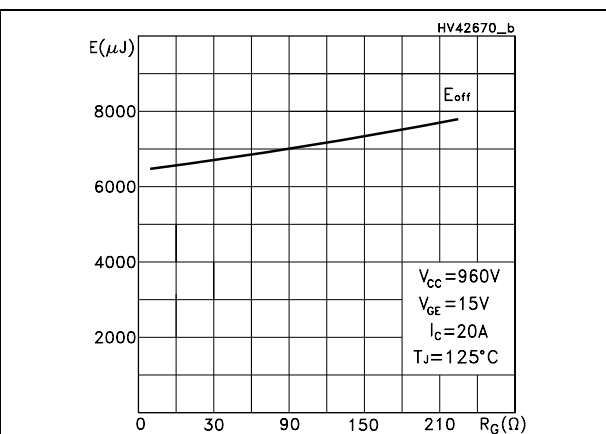


Figure 12. Switching losses vs. collector current

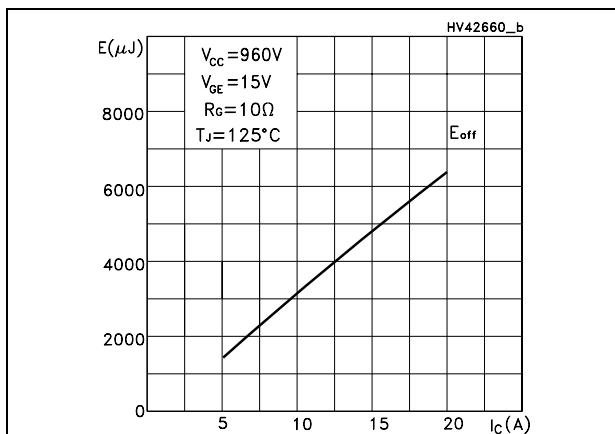


Figure 13. RBSOA

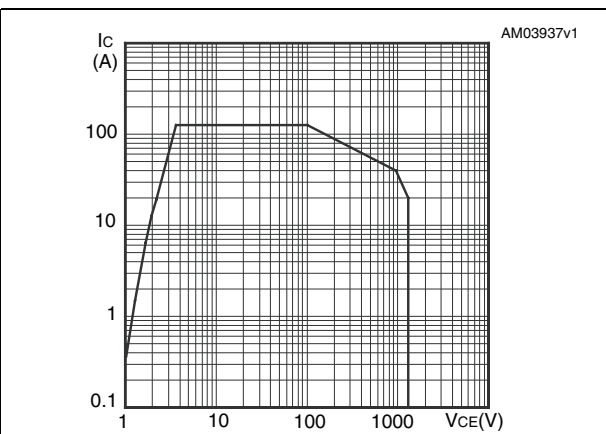


Figure 14. Emitter-collector diode characteristics

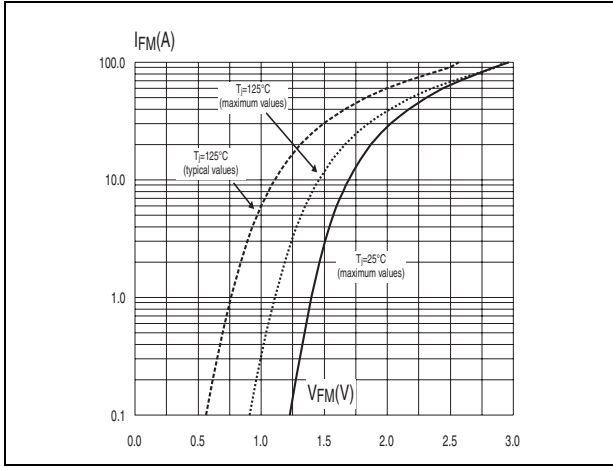
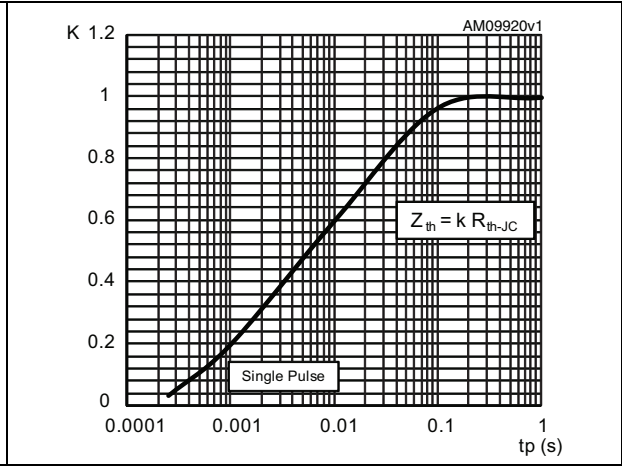


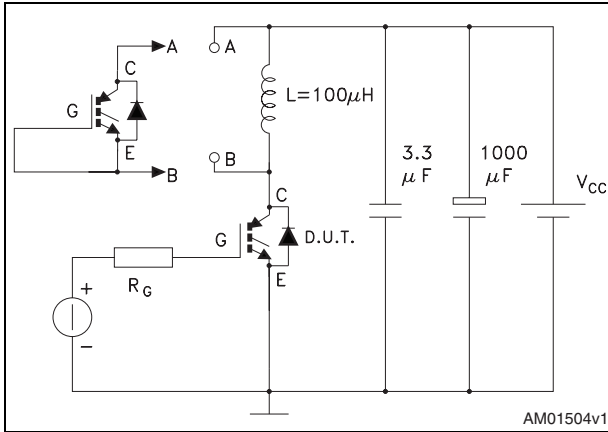
Figure 15. Thermal impedance





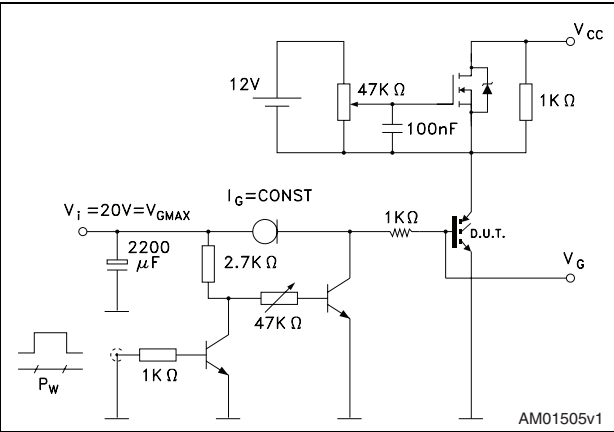
### 3 Test circuits

Figure 16. Test circuit for inductive load switching



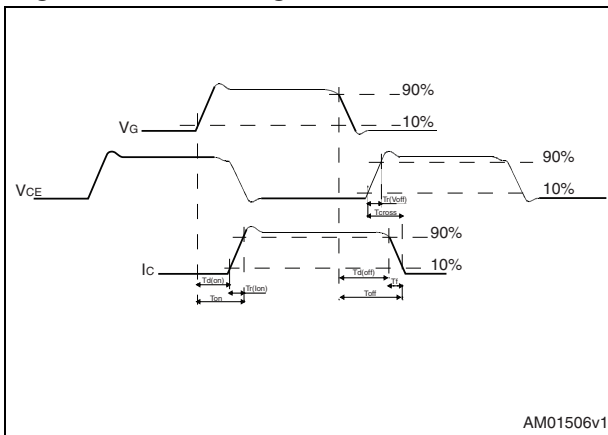
AM01504v1

Figure 17. Gate charge test circuit



AM01505v1

Figure 18. Switching waveform



AM01506v1

## 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<sup>®</sup> is an ST trademark.

**Table 8. 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	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

Figure 19. TO-247 drawing

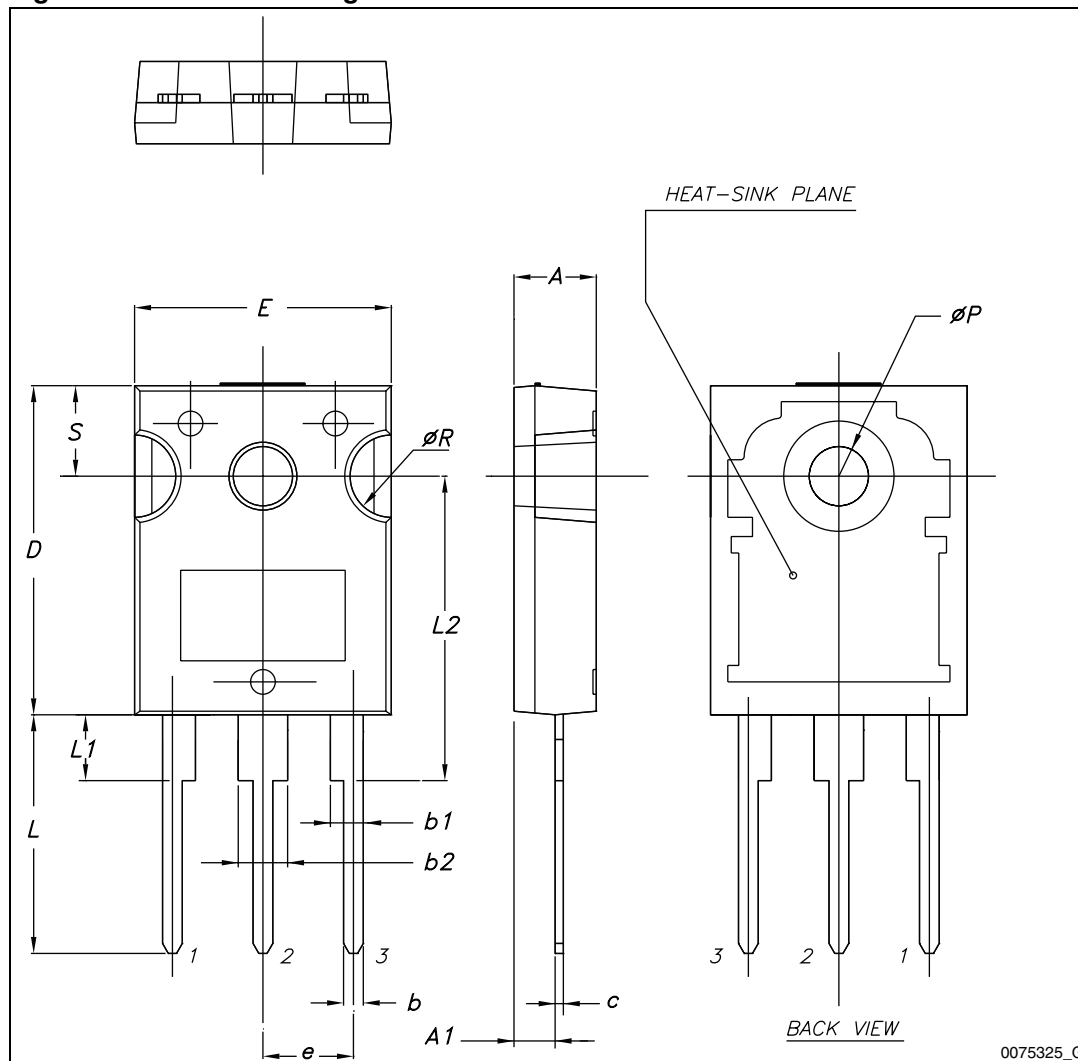


Table 9. TO-247 long leads mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90		5.15
D	1.85		2.10
E	0.55		0.67
F	1.07		1.32
F1	1.90		2.38
F2	2.87		3.38
G	10.90 BSC		
H	15.77		16.02
L	20.82		21.07
L1	4.16		4.47
L2	5.49		5.74
L3	20.05		20.30
L4	3.68		3.93
L5	6.04		6.29
M	2.27		2.52
V		10°	
V1		3°	
V3		20°	
Dia.	3.55		3.66

Figure 20. TO-247 long leads drawing

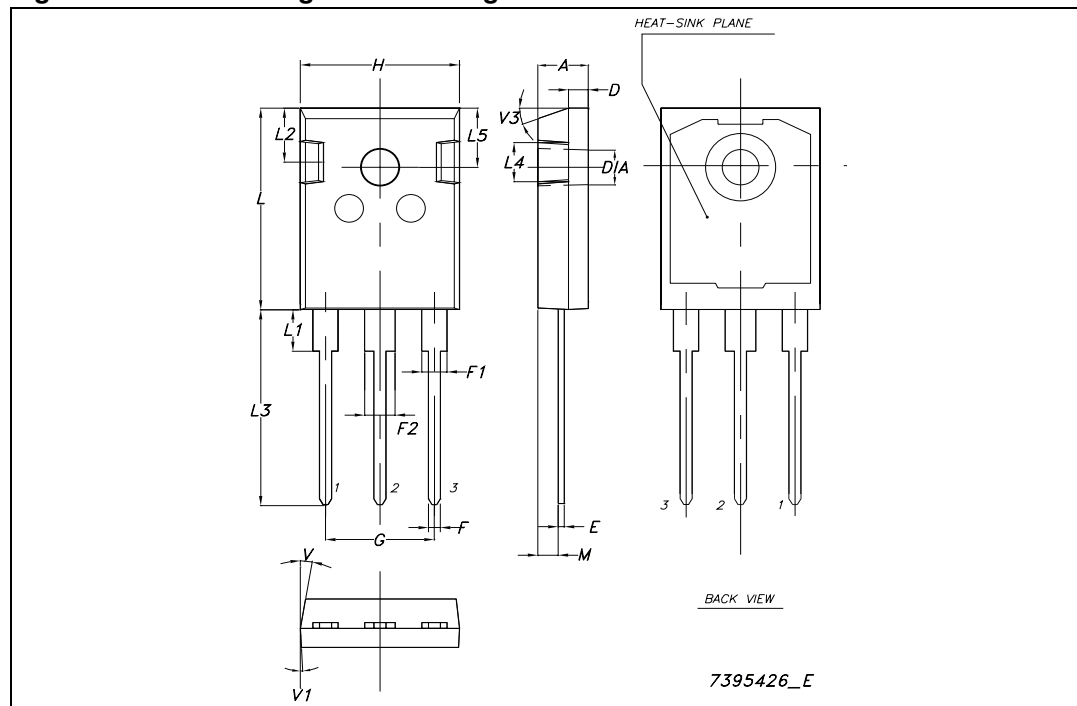
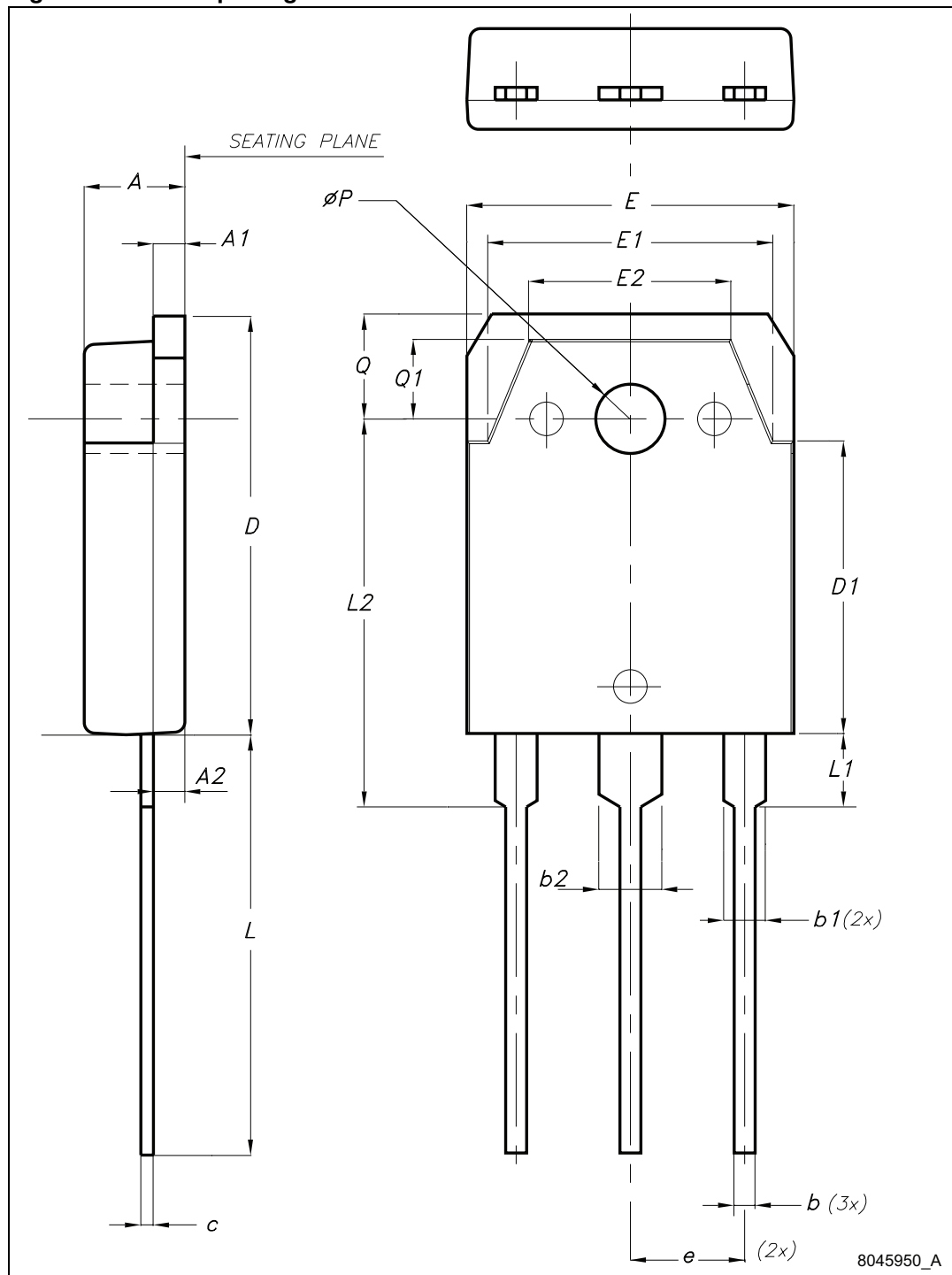


Table 10. TO-3P mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.60		5
A1	1.45	1.50	1.65
A2	1.20	1.40	1.60
b	0.80	1	1.20
b1	1.80		2.20
b2	2.80		3.20
c	0.55	0.60	0.75
D	19.70	19.90	20.10
D1		13.90	
E	15.40		15.80
E1		13.60	
E2		9.60	
e	5.15	5.45	5.75
L	19.50	20	20.50
L1		3.50	
L2	18.20	18.40	18.60
øP	3.10		3.30
Q		5	
Q1		3.80	

Figure 21. TO-3P package dimensions



## 5 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
11-May-2009	1	Initial release
16-Jul-2009	2	Document status promoted from preliminary data to datasheet
05-Jul-2011	3	Added: <a href="#">Figure 15 on page 8</a> and new package mechanical data <a href="#">Table 10 on page 14</a> , <a href="#">Figure 21 on page 15</a> .
04-Sep-2012	4	Updated: <a href="#">Table 1 on page 1</a> , TO-247 mechanical data <a href="#">Table 8 on page 10</a> and <a href="#">Figure 19 on page 11</a> .



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