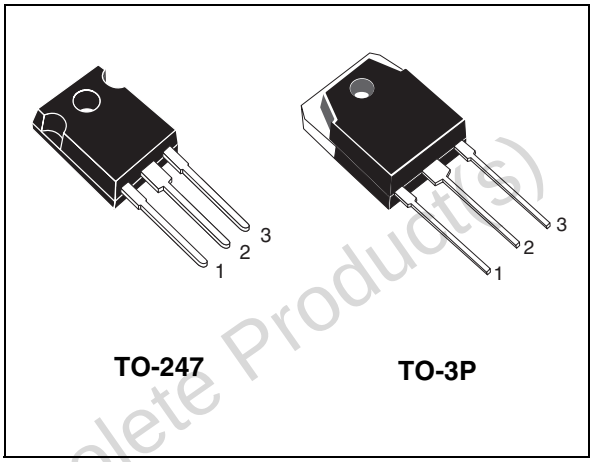
STGW38IH130D, STGWT38IH130D

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

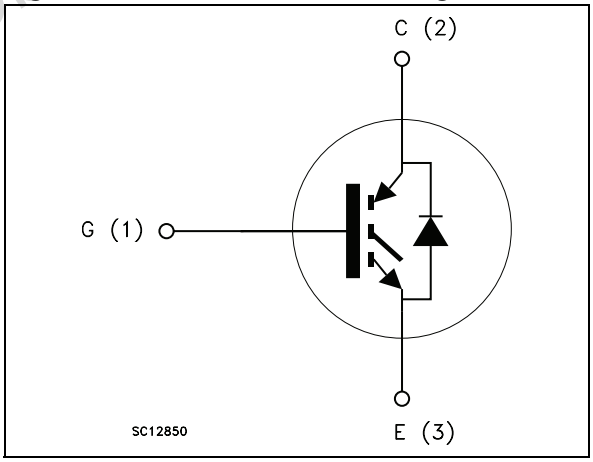


Table 1. Device summary

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

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-3P, TO-247 long leads	TO-247	
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1300		V
I_C (1)	Continuous collector current at T_C = 25 °C	63	55	A
I_C (1)	Continuous collector current at T_C = 100 °C	33	25	A
I_{CL} (2)	Turn-off latching current	40		A
I_{CP} (3)	Pulsed collector current	125		A
V_{GE}	Gate-emitter voltage	±25		V
P_{TOT}	Total dissipation at T_C = 25 °C	250	180	W
I_F	Diode RMS forward current at T_C = 25 °C	30		A
I_{FSM}	Surge non repetitive forward current t_p = 10 ms sinusoidal	100		A
T_j	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_{clamp} = 960 V, T_j =150 °C, R_G=10 Ω, V_{GE}=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	
$R_{thj\text{-}case}$	Thermal resistance junction-case IGBT	0.5	0.7	°C/W
$R_{thj\text{-}case}$	Thermal resistance junction-case diode	2	2.1	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	50		°C/W

2 Electrical characteristics

T_J= 25 °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 mA	1300			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE}= 15 V, I_C= 20 A V_{GE}= 15 V, I_C= 20 A, T_J =125 °C		2.1 2.0	2.8	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE}= V_{GE}, I_C= 1 mA	3.75		5.75	V
I_{CES}	Collector-cut-off current (V_{GE} = 0)	V_{CE} =1300 V V_{CE} =1300 V, T_J=125 °C			1 10	mA mA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} =± 20 V			± 100	nA
g_{fs} (1)	Forward transconductance	V_{CE} = 25 V, I_C= 20 A		20		S
V_F	Diode forward voltage	I_F = 20 A I_F = 20 A, T_J = 125 °C		 1.3	1.9 1.7	V V

1. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

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 V, f = 1 MHz, V_{GE}=0	-	2900 155 30	-	pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 960 V, I_C= 20 A,V_{GE}=15 V	-	127 18 50	-	nC nC nC

Table 6. Inductive load switching times

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

Table 7. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off} (1)	Turn-off switching losses	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, *(see Figure 16)*	-	3.4	-	mJ
E_{off} (1)	Turn-off switching losses	V_{CC} = 960 V, I_C = 20 A R_G= 10 Ω, V_{GE}= 15 V, T_J= 125 °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

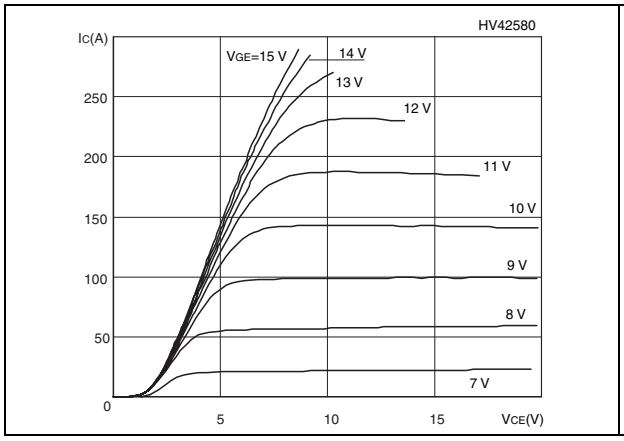


Figure 3. Transfer characteristics

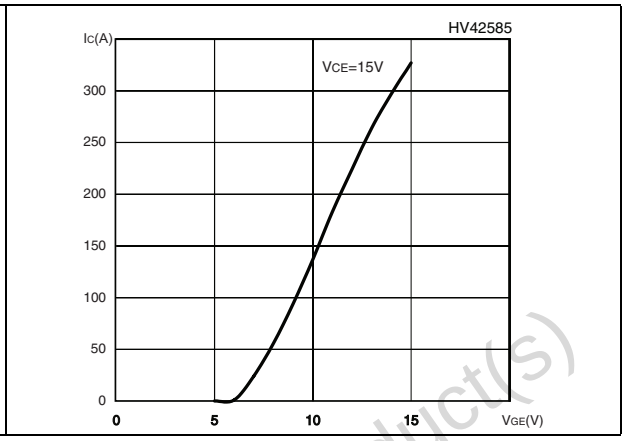


Figure 4. Transconductance

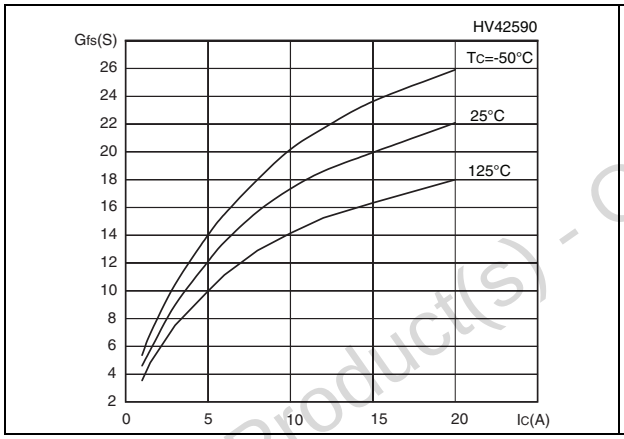


Figure 5. Collector-emitter on voltage vs. temperature

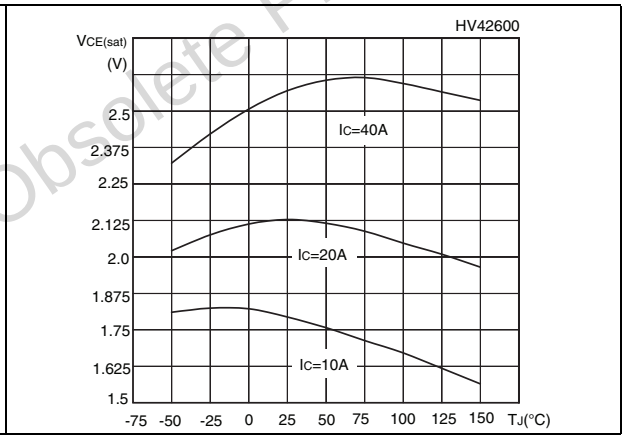


Figure 6. Normalized breakdown voltage vs. temperature

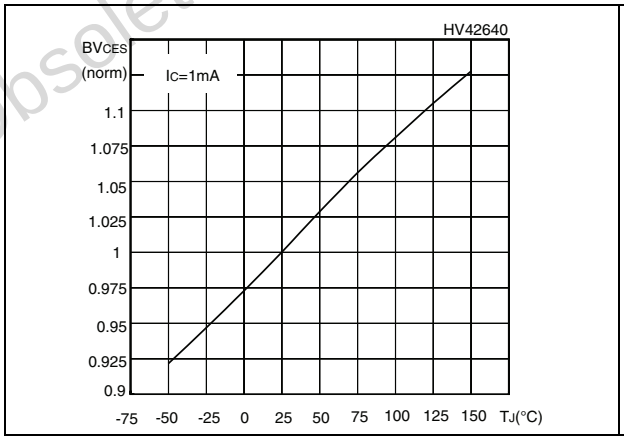


Figure 7. Gate-charge vs. gate-emitter

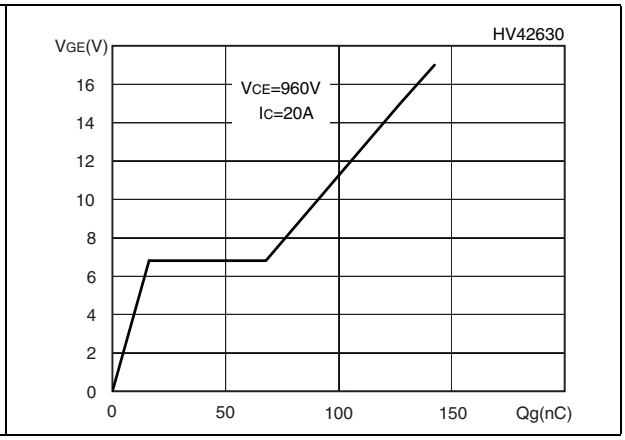


Figure 8. Normalized gate threshold voltage vs. temperature

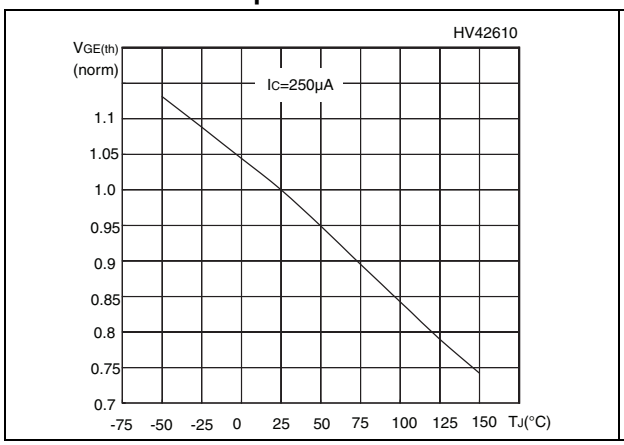


Figure 9. Collector-emitter on voltage vs. collector current

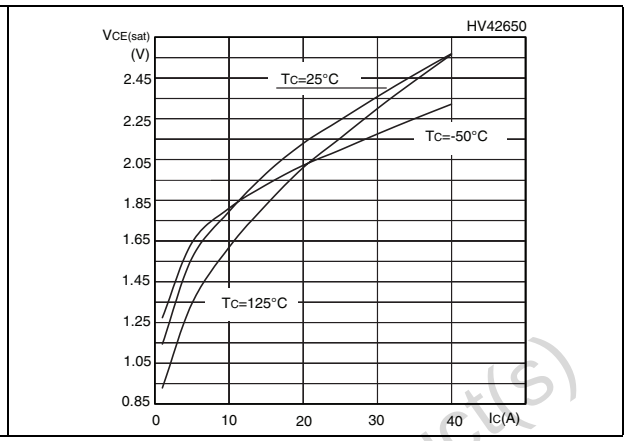


Figure 10. Switching losses vs. temperature

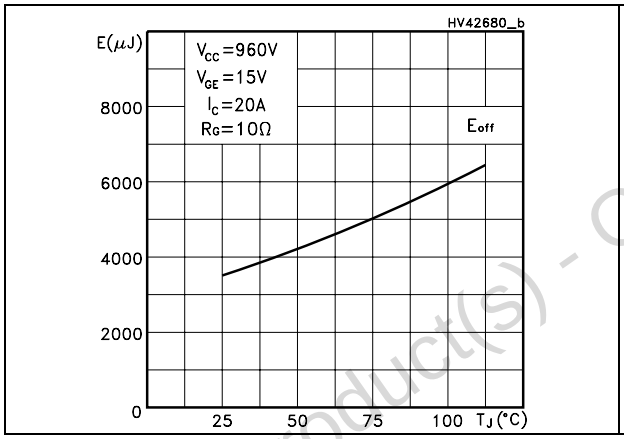


Figure 11. Switching losses vs. gate resistance

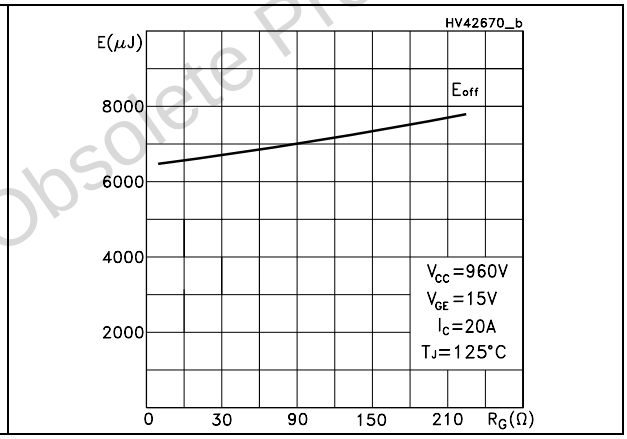


Figure 12. Switching losses vs. collector current

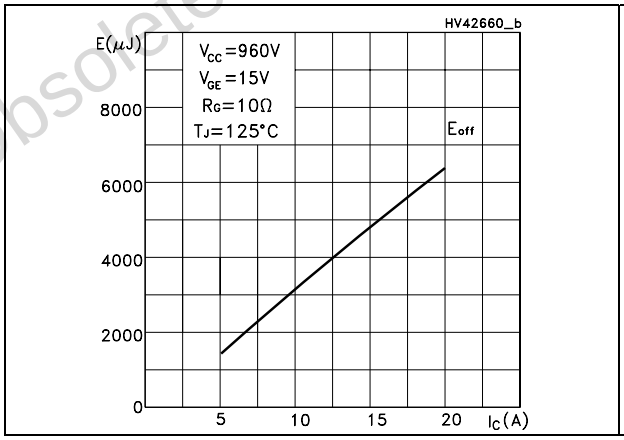


Figure 13. RBSOA

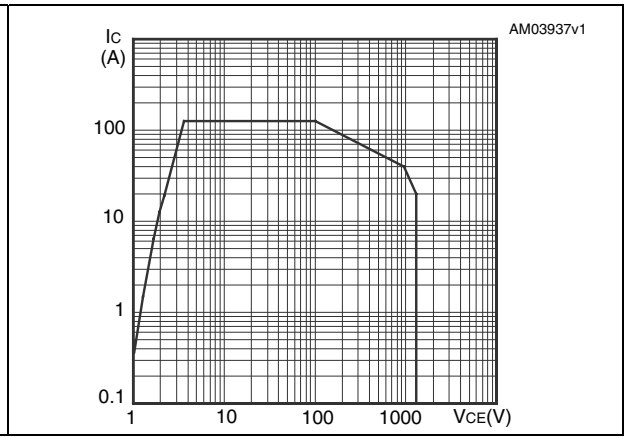


Figure 14. Emitter-collector diode characteristics

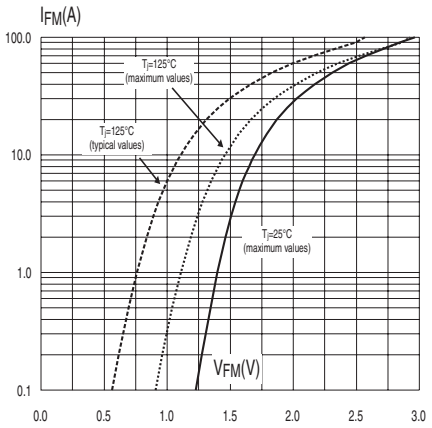
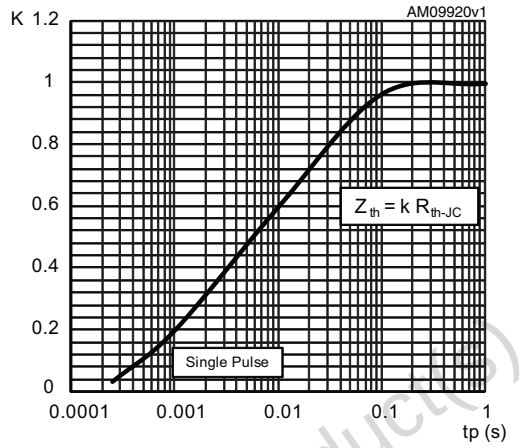


Figure 15. Thermal impedance



3 Test circuits

Figure 16. Test circuit for inductive load switching

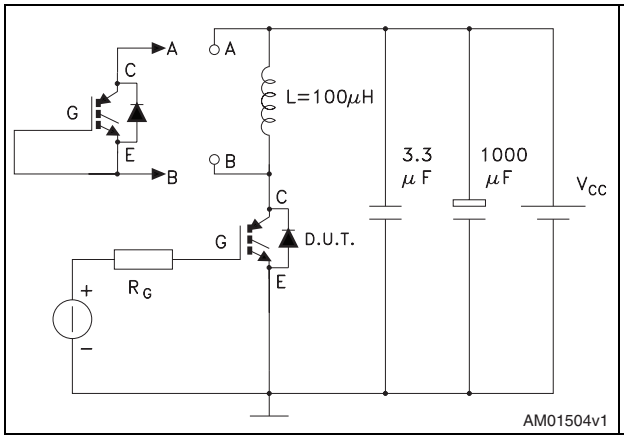


Figure 17. Gate charge test circuit

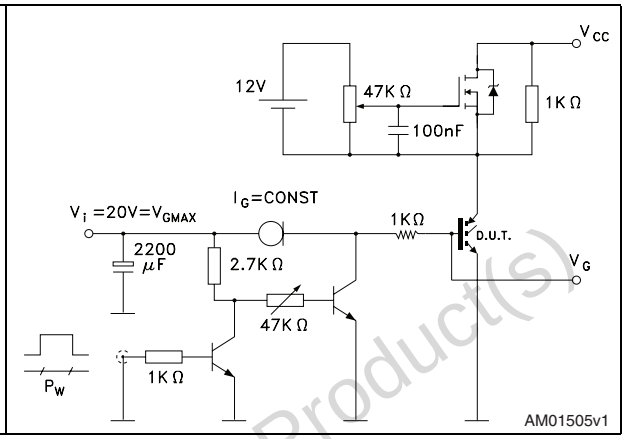
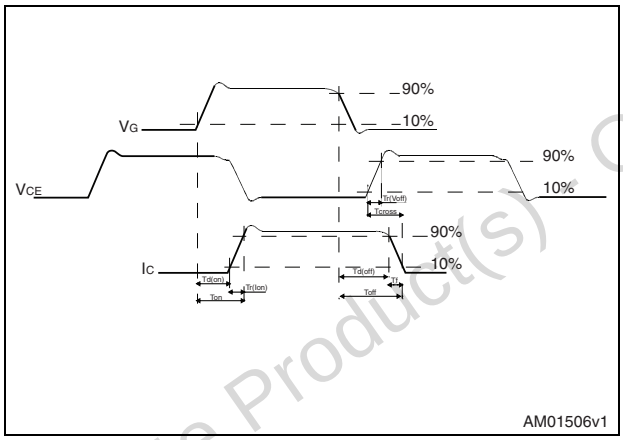


Figure 18. Switching waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in 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.

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	
∅P	3.55		3.65
∅R	4.50		5.50
S	5.30	5.50	5.70

Figure 19. TO-247 drawing

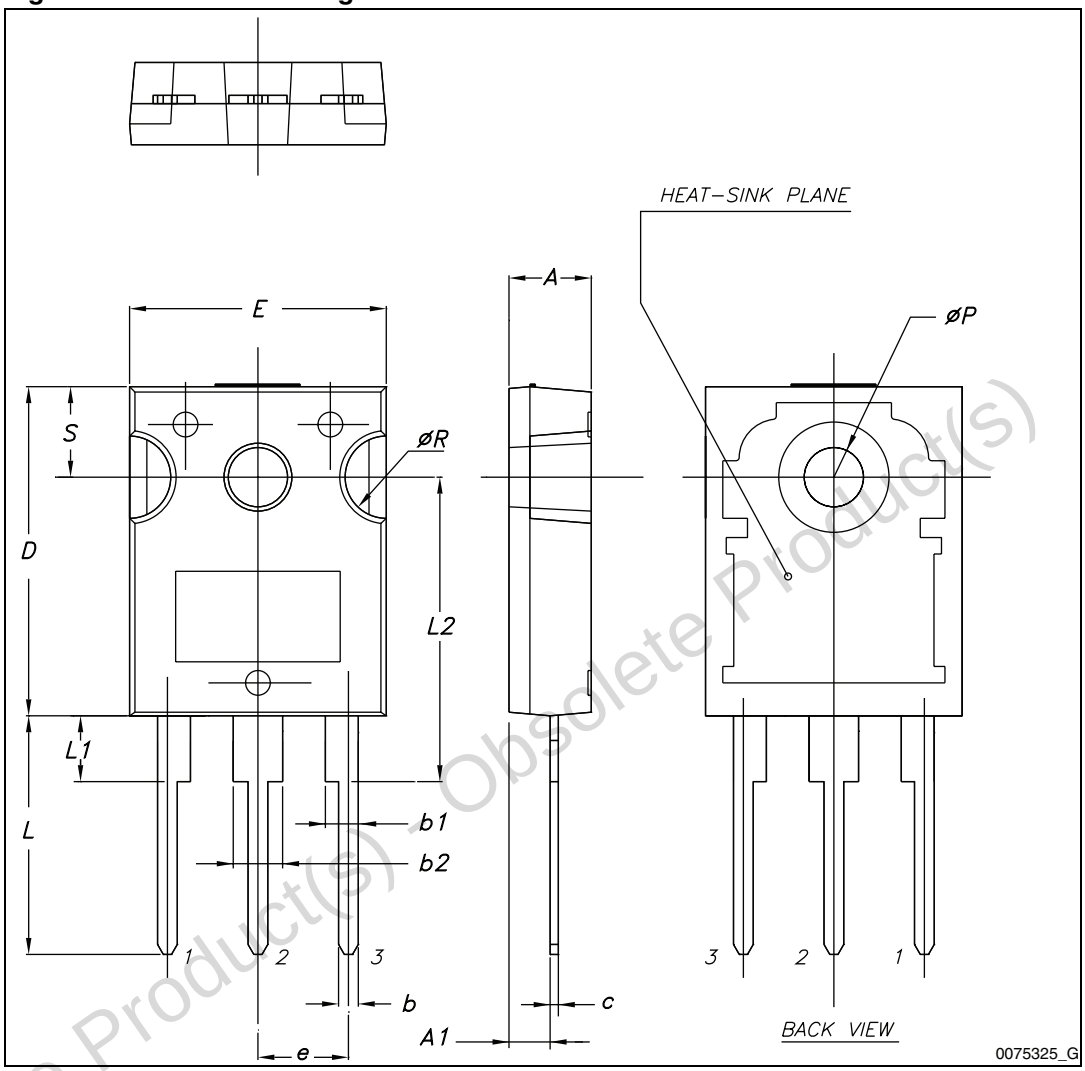


Table 9. TO-247 long leads mechanical data

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

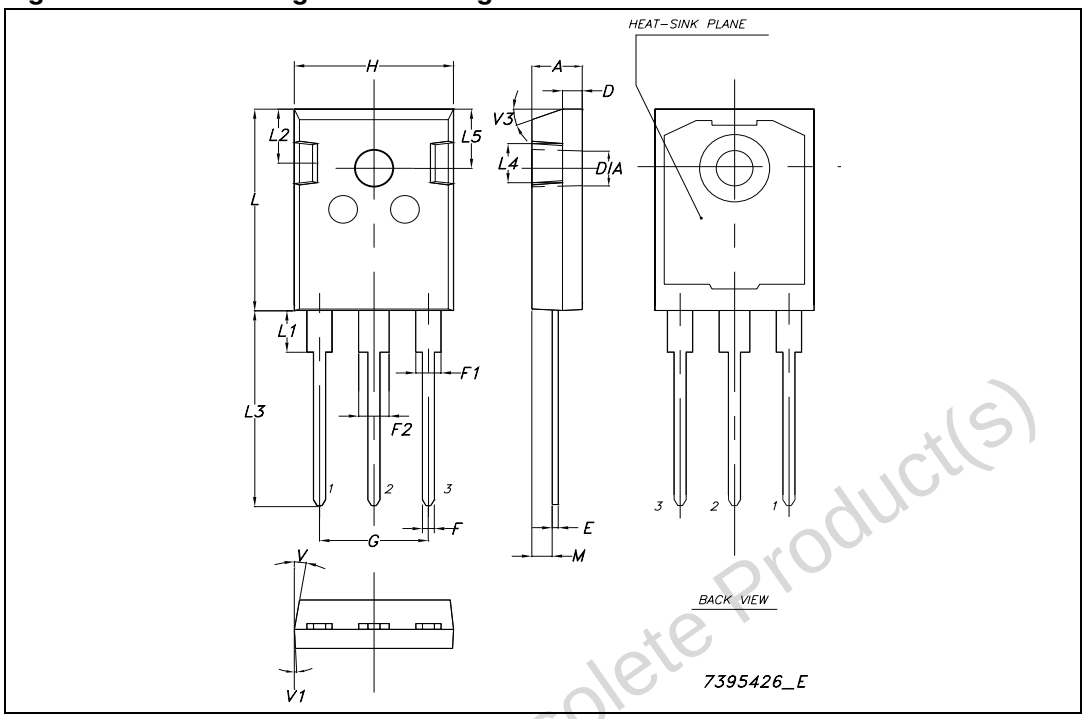
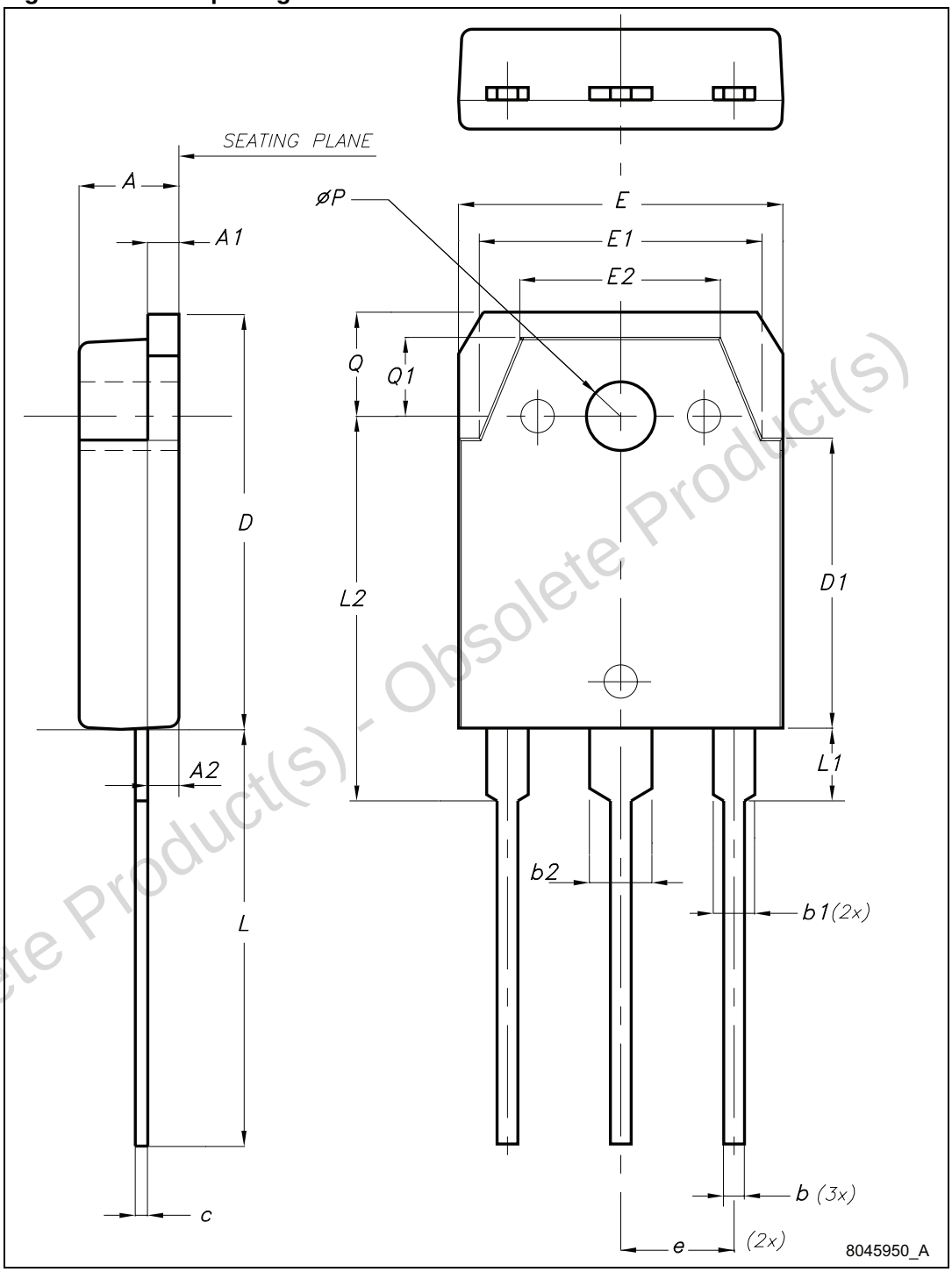


Table 10. TO-3P mechanical data

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: *Figure 15 on page 8* and new package mechanical data *Table 10 on page 14*, *Figure 21 on page 15*.
04-Sep-2012	4	Updated: *Table 1 on page 1*, TO-247 mechanical data *Table 8 on page 10* and *Figure 19 on page 11*.

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