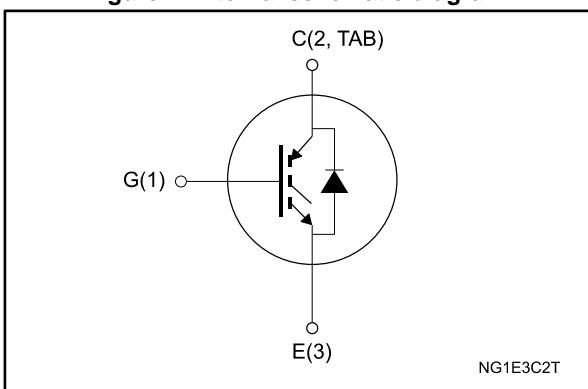


**Figure 1: Internal schematic diagram**



### Features

- 10  $\mu$ s of short-circuit withstand time
- $V_{CE(sat)} = 1.85$  V (typ.) @  $I_c = 8$  A
- Tight parameter distribution
- Safer paralleling
- Low thermal resistance
- Soft and very fast recovery antiparallel diode

### Applications

- Industrial drives
- UPS
- Solar
- Welding

### Description

These devices are IGBTs developed using an advanced proprietary trench gate field-stop structure. These devices are part of the M series IGBTs, which represent an optimal balance between inverter system performance and efficiency where low-loss and short-circuit functionality are essential. Furthermore, the positive  $V_{CE(sat)}$  temperature coefficient and tight parameter distribution result in safer paralleling operation.

**Table 1: Device summary**

Order code	Marking	Package	Packing
STGW8M120DF3	G8M120DF3	TO-247	Tube
STGWA8M120DF3		TO-247 long leads	

**Contents**

<b>1</b>	<b>Electrical ratings .....</b>	<b>3</b>
<b>2</b>	<b>Electrical characteristics .....</b>	<b>4</b>
2.1	Electrical characteristics (curves).....	6
<b>3</b>	<b>Test circuits .....</b>	<b>11</b>
<b>4</b>	<b>Package information .....</b>	<b>12</b>
4.1	TO-247 package information.....	12
4.2	TO-247 long leads package information .....	14
<b>5</b>	<b>Revision history .....</b>	<b>16</b>

# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0$ V)	1200	V
$I_c$	Continuous collector current at $T_c = 25$ °C	16	A
$I_c$	Continuous collector current at $T_c = 100$ °C	8	A
$I_{CP}^{(1)}$	Pulsed collector current	32	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
$I_F$	Continuous forward current at $T_c = 25$ °C	16	A
$I_F$	Continuous forward current at $T_c = 100$ °C	8	A
$I_{FP}^{(1)}$	Pulsed forward current	32	A
$P_{TOT}$	Total dissipation at $T_c = 25$ °C	167	W
$T_{STG}$	Storage temperature range	-55 to 150	°C
$T_J$	Operating junction temperature range	-55 to 175	°C

**Notes:**

(1)Pulse width limited by maximum junction temperature.

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance junction-case IGBT	0.9	°C/W
$R_{thJC}$	Thermal resistance junction-case diode	1.47	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	50	°C/W

## 2 Electrical characteristics

$T_C = 25^\circ\text{C}$  unless otherwise specified

Table 4: Static characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0 \text{ V}, I_C = 2 \text{ mA}$	1200			V
$V_{CE(\text{sat})}$	Collector-emitter saturation voltage	$V_{GE} = 15 \text{ V}, I_C = 8 \text{ A}$		1.85	2.3	V
		$V_{GE} = 15 \text{ V}, I_C = 8 \text{ A}, T_J = 125^\circ\text{C}$		2.1		
		$V_{GE} = 15 \text{ V}, I_C = 8 \text{ A}, T_J = 175^\circ\text{C}$		2.2		
$V_F$	Forward on-voltage	$I_F = 8 \text{ A}$		2.4	3.35	V
		$I_F = 8 \text{ A}, T_J = 125^\circ\text{C}$		1.75		
		$I_F = 8 \text{ A}, T_J = 175^\circ\text{C}$		1.55		
$V_{GE(\text{th})}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 500 \mu\text{A}$	5	6	7	V
$I_{CES}$	Collector cut-off current	$V_{GE} = 0 \text{ V}, V_{CE} = 1200 \text{ V}$			25	$\mu\text{A}$
$I_{GES}$	Gate-emitter leakage current	$V_{GE} = \pm 20 \text{ V}, V_{CE} = 0 \text{ V}$			$\pm 250$	nA

Table 5: Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GE} = 0 \text{ V}$	-	542	-	pF
$C_{oes}$	Output capacitance		-	74.4	-	
$C_{res}$	Reverse transfer capacitance		-	21	-	
$Q_g$	Total gate charge	$V_{CC} = 960 \text{ V}, I_C = 8 \text{ A}, V_{GE} = 0 \text{ to } 15 \text{ V}$ (see <a href="#">Figure 30: "Gate charge test circuit"</a> )	-	32	-	nC
$Q_{ge}$	Gate-emitter charge		-	4.5	-	
$Q_{gc}$	Gate-collector charge		-	18.5	-	

Table 6: IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 600 \text{ V}, I_C = 8 \text{ A}, V_{GE} = 15 \text{ V}, R_G = 33 \Omega$ (see <a href="#">Figure 29: "Test circuit for inductive load switching"</a> )		20	-	ns
$t_r$	Current rise time			8.4	-	ns
$(di/dt)_{on}$	Turn-on current slope			800	-	A/ $\mu\text{s}$
$t_{d(off)}$	Turn-off-delay time			126	-	ns
$t_f$	Current fall time			136	-	ns
$E_{on}^{(1)}$	Turn-on switching energy			0.39	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			0.37	-	mJ
$E_{ts}$	Total switching energy			0.76	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 600 \text{ V}, I_C = 8 \text{ A}, V_{GE} = 15 \text{ V}, R_G = 33 \Omega, T_J = 175 \text{ }^\circ\text{C}$ (see <a href="#">Figure 29: "Test circuit for inductive load switching"</a> )		19	-	ns
$t_r$	Current rise time			9.8	-	ns
$(di/dt)_{on}$	Turn-on current slope			656	-	A/ $\mu\text{s}$
$t_{d(off)}$	Turn-off-delay time			134	-	ns
$t_f$	Current fall time			222	-	ns
$E_{on}^{(1)}$	Turn-on switching energy			0.66	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			0.58	-	mJ
$E_{ts}$	Total switching energy			1.24	-	mJ
$t_{sc}$	Short-circuit withstand time	$V_{CC} \leq 600 \text{ V}, V_{GE} = 15 \text{ V}, T_{Jstart} \leq 150 \text{ }^\circ\text{C}$	10		-	$\mu\text{s}$

**Notes:**

(1) Including the reverse recovery of the diode

(2) Including the tail of the collector current

Table 7: Diode switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 8 \text{ A}, V_R = 600 \text{ V}, V_{GE} = 15 \text{ V}, R_G = 33 \Omega$ ( $di/dt = 1000 \text{ A}/\mu\text{s}$ ) (see <a href="#">Figure 29: "Test circuit for inductive load switching"</a> )	-	103	-	ns
$Q_{rr}$	Reverse recovery charge		-	0.87	-	$\mu\text{C}$
$I_{rrm}$	Reverse recovery current		-	19.2	-	A
$dI_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$		-	720	-	A/ $\mu\text{s}$
$E_{rr}$	Reverse recovery energy		-	211	-	$\mu\text{J}$
$t_{rr}$	Reverse recovery time		-	280	-	ns
$Q_{rr}$	Reverse recovery charge	$I_F = 8 \text{ A}, V_R = 600 \text{ V}, V_{GE} = 15 \text{ V}, T_J = 175 \text{ }^\circ\text{C}, R_G = 33 \Omega$ ( $di/dt = 840 \text{ A}/\mu\text{s}$ ) (see <a href="#">Figure 29: "Test circuit for inductive load switching"</a> )	-	1.9	-	$\mu\text{C}$
$I_{rrm}$	Reverse recovery current		-	21.8	-	A
$dI_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$		-	450	-	A/ $\mu\text{s}$
$E_{rr}$	Reverse recovery energy		-	404	-	$\mu\text{J}$

## 2.1 Electrical characteristics (curves)

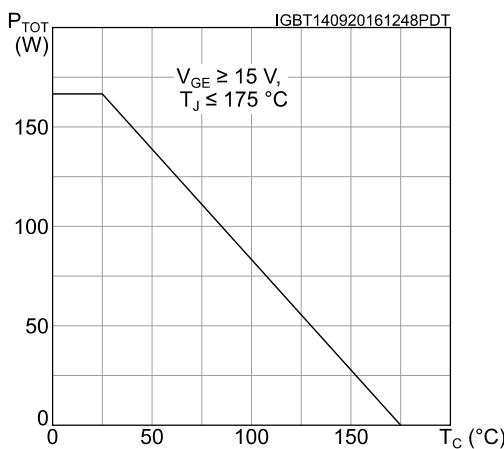
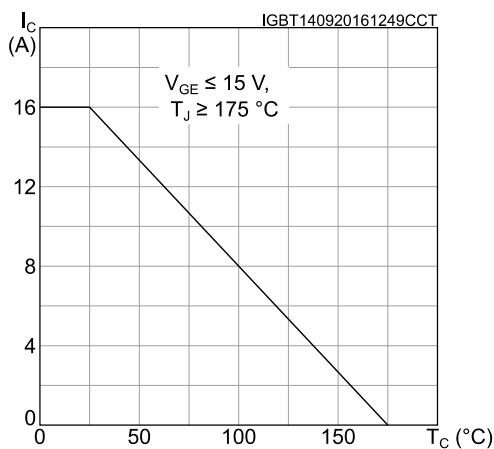
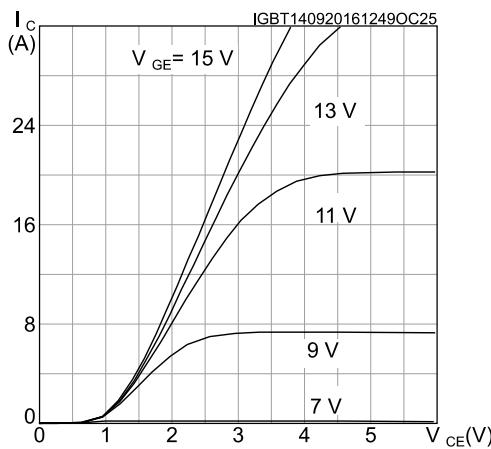
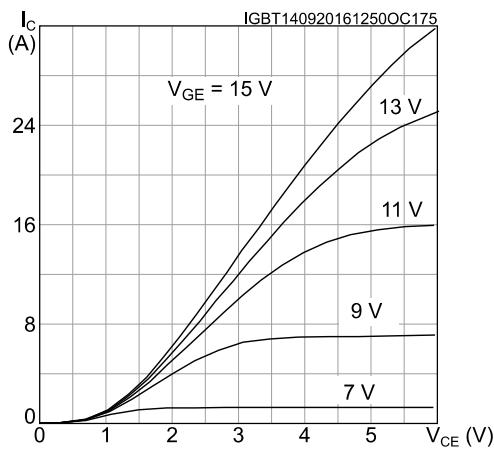
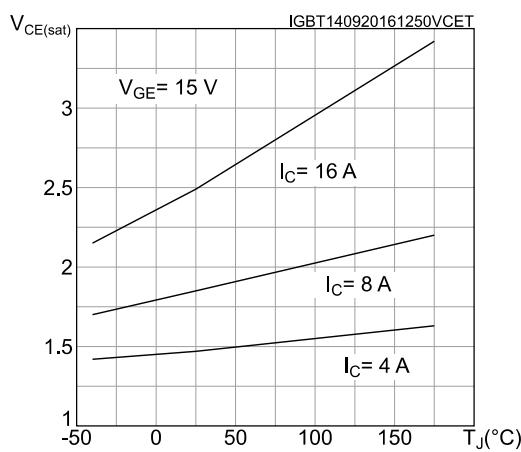
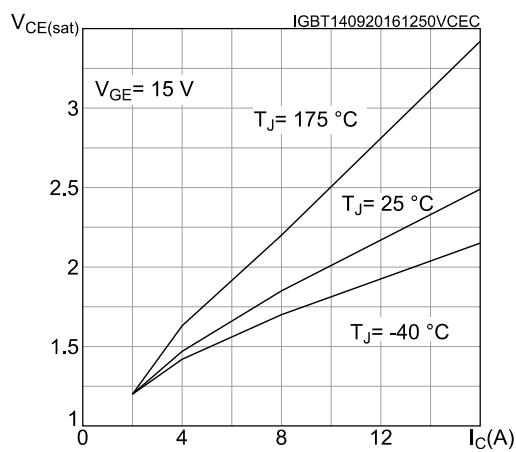
**Figure 2: Power dissipation vs case temperature****Figure 3: Collector current vs case temperature****Figure 4: Output characteristics ( $T_J = 25 \text{ }^{\circ}\text{C}$ )****Figure 5: Output characteristics ( $T_J = 175 \text{ }^{\circ}\text{C}$ )****Figure 6:  $V_{CE(sat)}$  vs junction temperature****Figure 7:  $V_{CE(sat)}$  vs collector current**

Figure 8: Collector current vs switching frequency

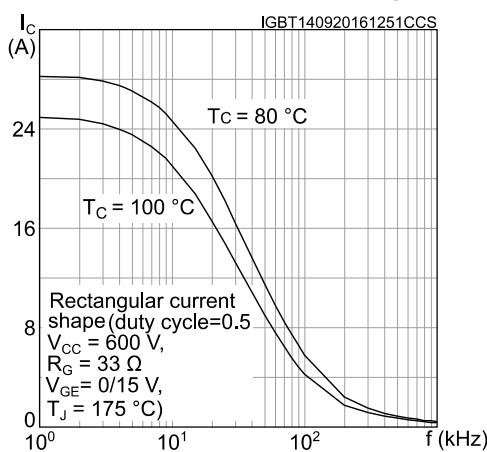


Figure 9: Forward bias safe operating area

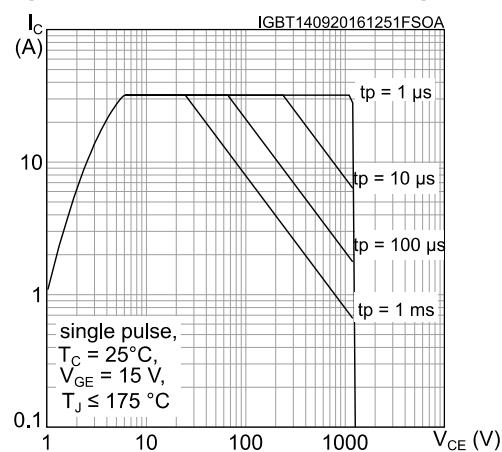
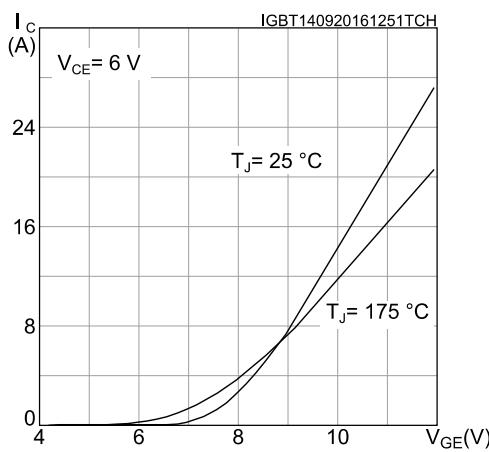
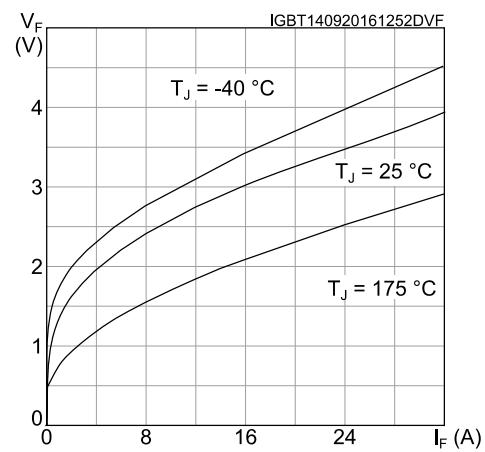
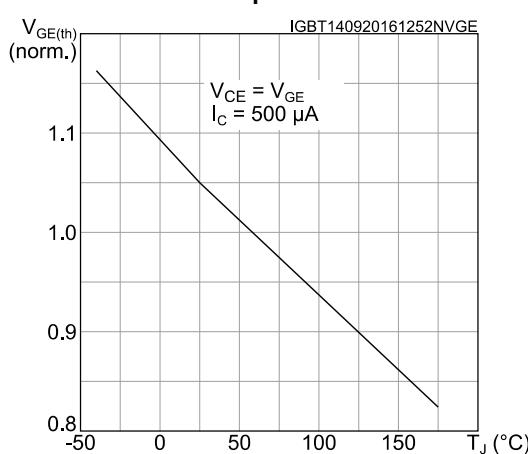
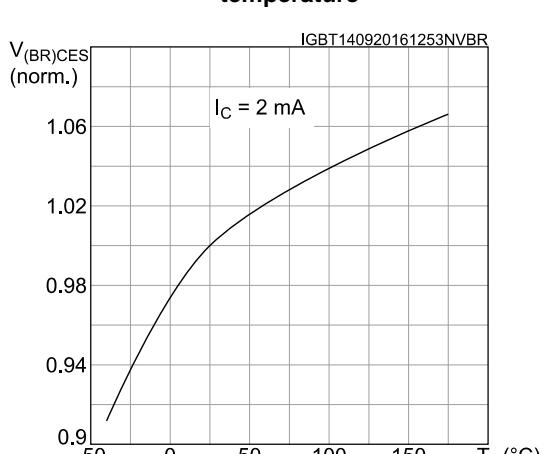


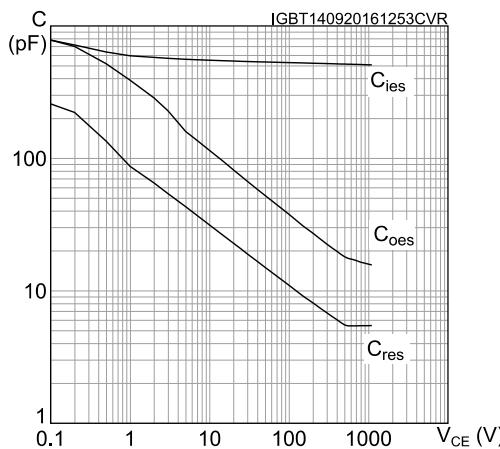
Figure 10: Transfer characteristics

Figure 11: Diode  $V_F$  vs forward currentFigure 12: Normalized  $V_{GE(\text{th})}$  vs junction temperatureFigure 13: Normalized  $V_{(BR)CES}$  vs junction temperature

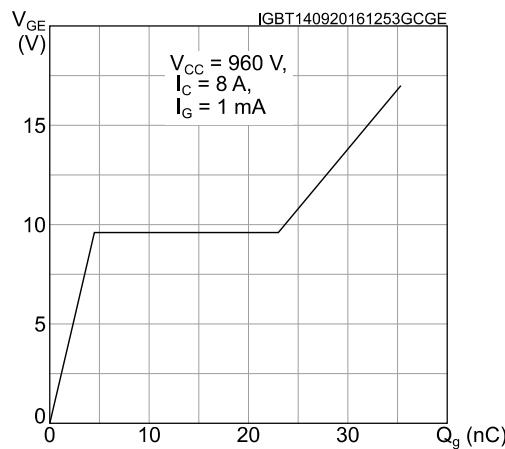
## Electrical characteristics

**STGW8M120DF3, STGWA8M120DF3**

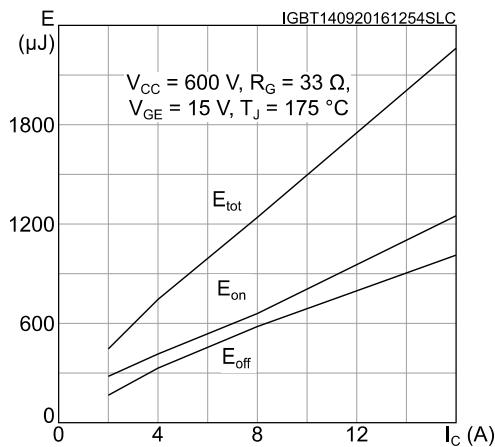
**Figure 14: Capacitance variations**



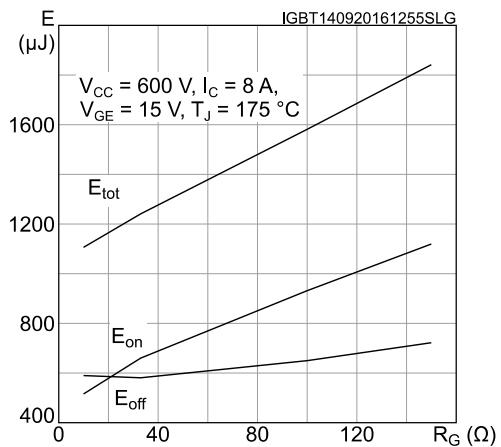
**Figure 15: Gate charge vs gate-emitter voltage**



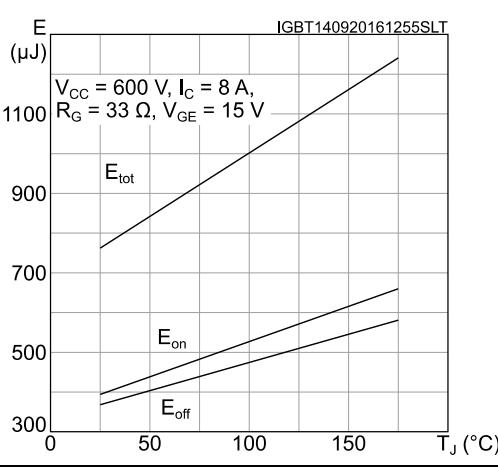
**Figure 16: Switching energy vs collector current**



**Figure 17: Switching energy vs gate resistance**



**Figure 18: Switching energy vs temperature**



**Figure 19: Switching energy vs collector-emitter voltage**

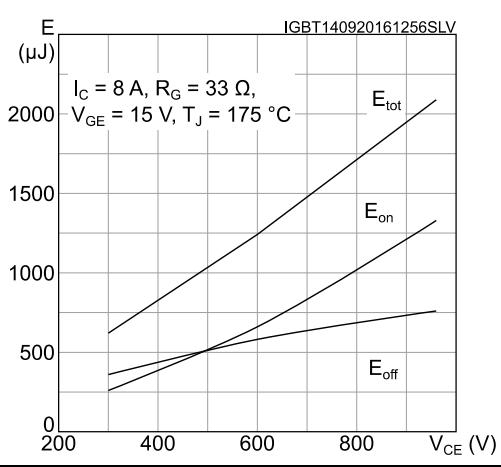


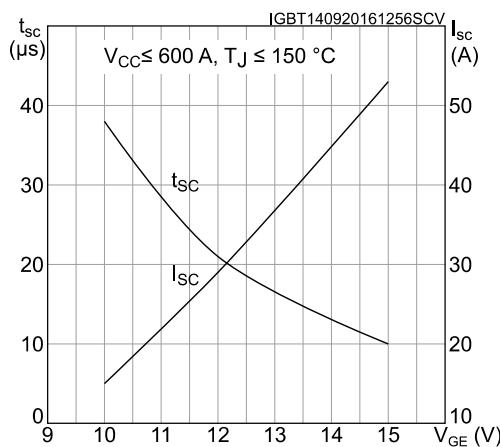
Figure 20: Short-circuit time and current vs  $V_{GE}$ 

Figure 21: Switching times vs collector current

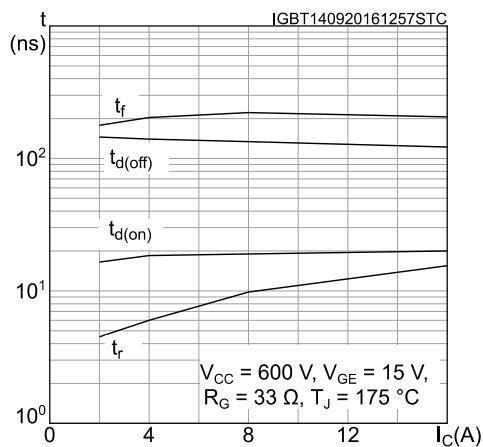


Figure 22: Switching times vs gate resistance

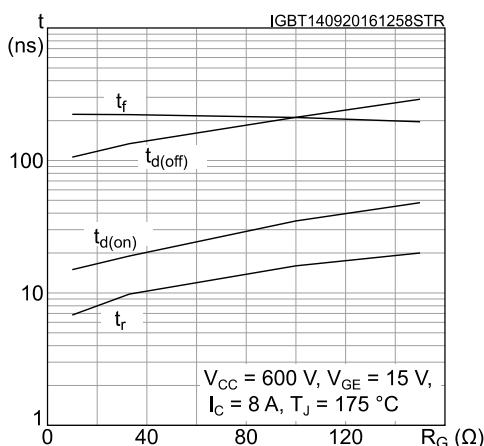


Figure 23: Reverse recovery current vs diode current slope

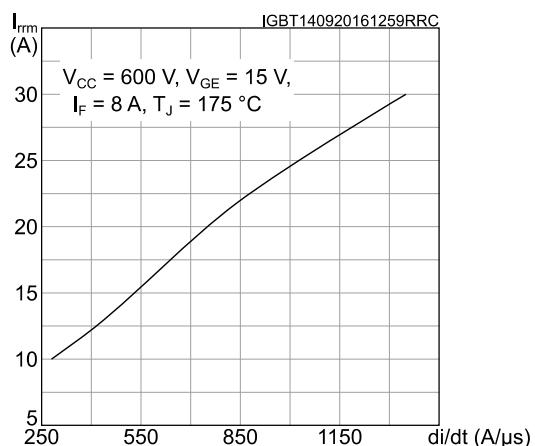


Figure 24: Reverse recovery time vs diode current slope

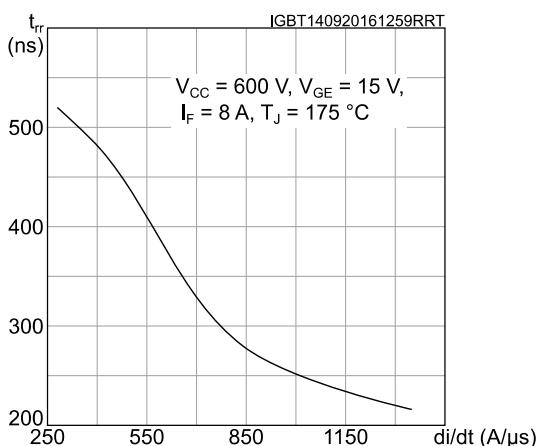


Figure 25: Reverse recovery charge vs diode current slope

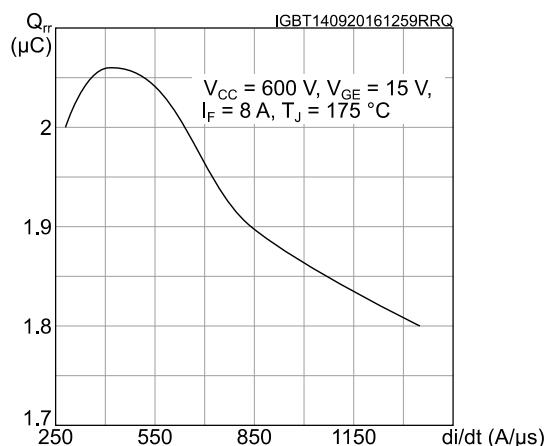


Figure 26: Reverse recovery energy vs diode current slope

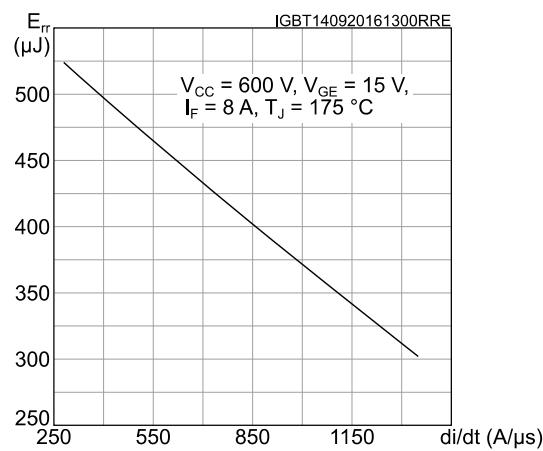


Figure 27: Thermal impedance for IGBT

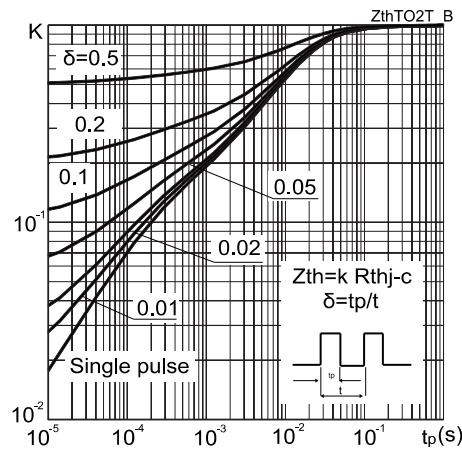
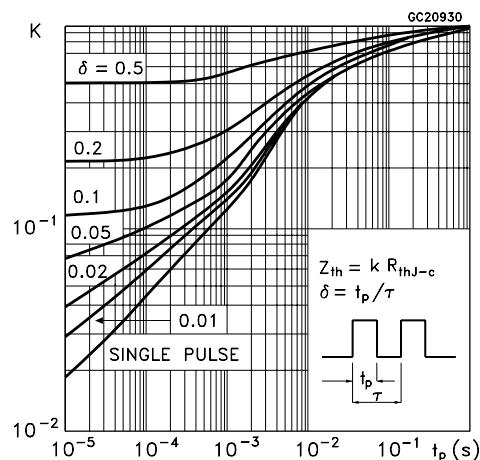
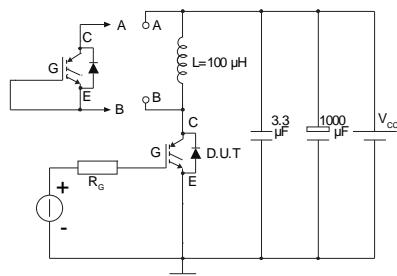


Figure 28: Thermal impedance for diode



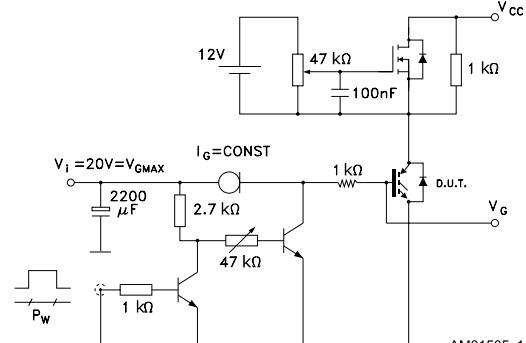
## 3 Test circuits

**Figure 29: Test circuit for inductive load switching**



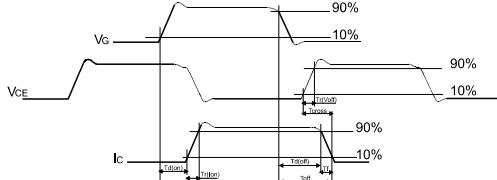
AM01504v1

**Figure 30: Gate charge test circuit**



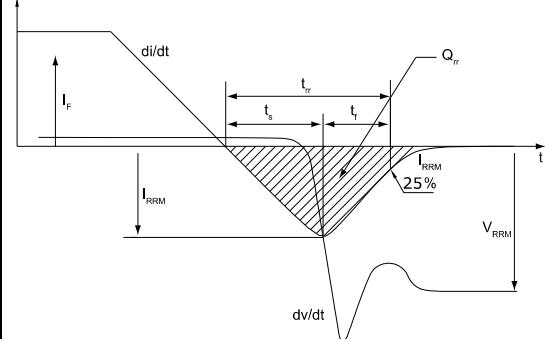
AM01505v1

**Figure 31: Switching waveform**



AM01506v1

**Figure 32: Diode reverse recovery waveform**



AM01507v1

## 4 Package information

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](http://www.st.com).  
ECOPACK® is an ST trademark.

### 4.1 TO-247 package information

Figure 33: TO-247 package outline

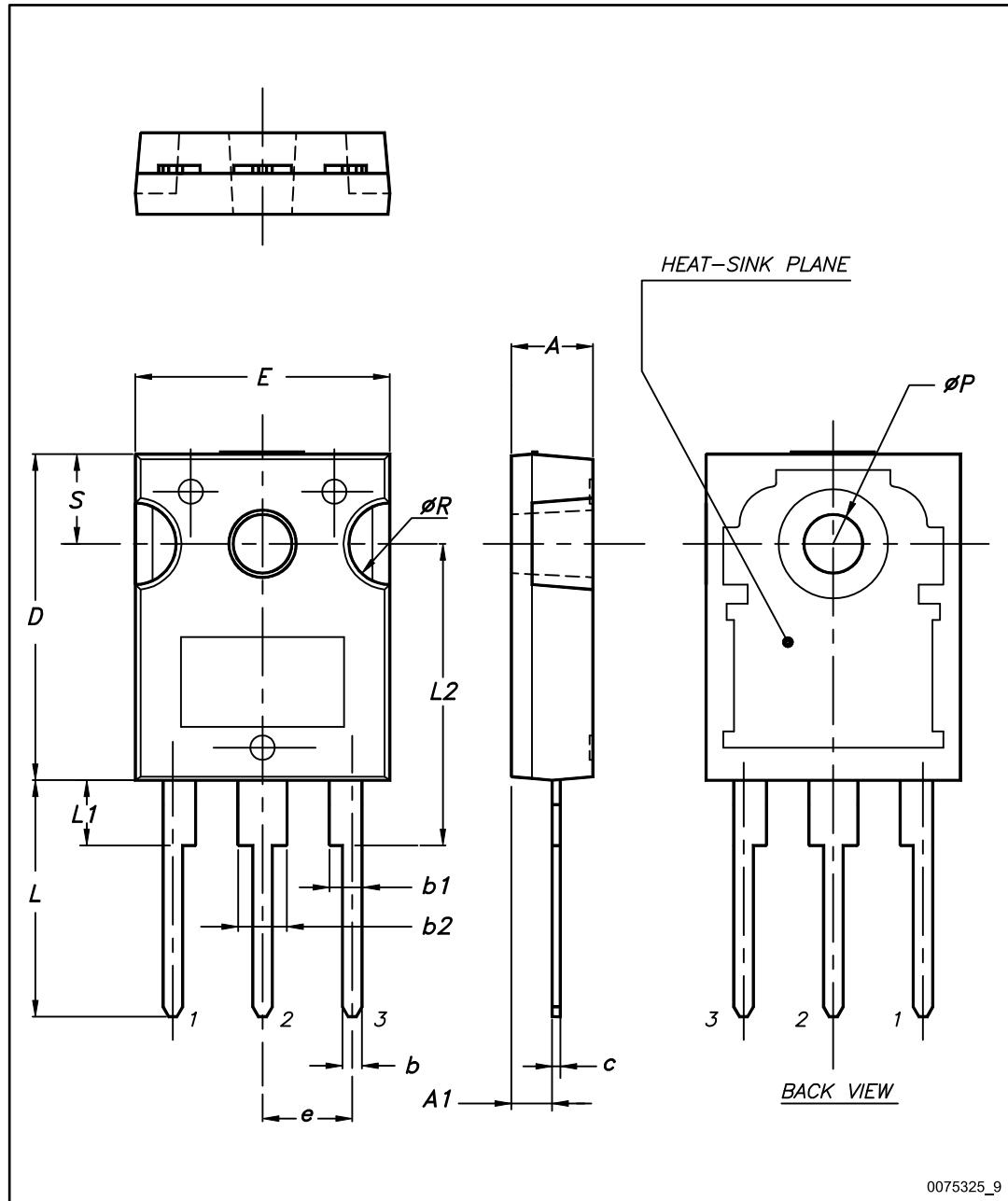


Table 8: TO-247 package mechanical data

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

## 4.2 TO-247 long leads package information

Figure 34: TO-247 long leads package outline

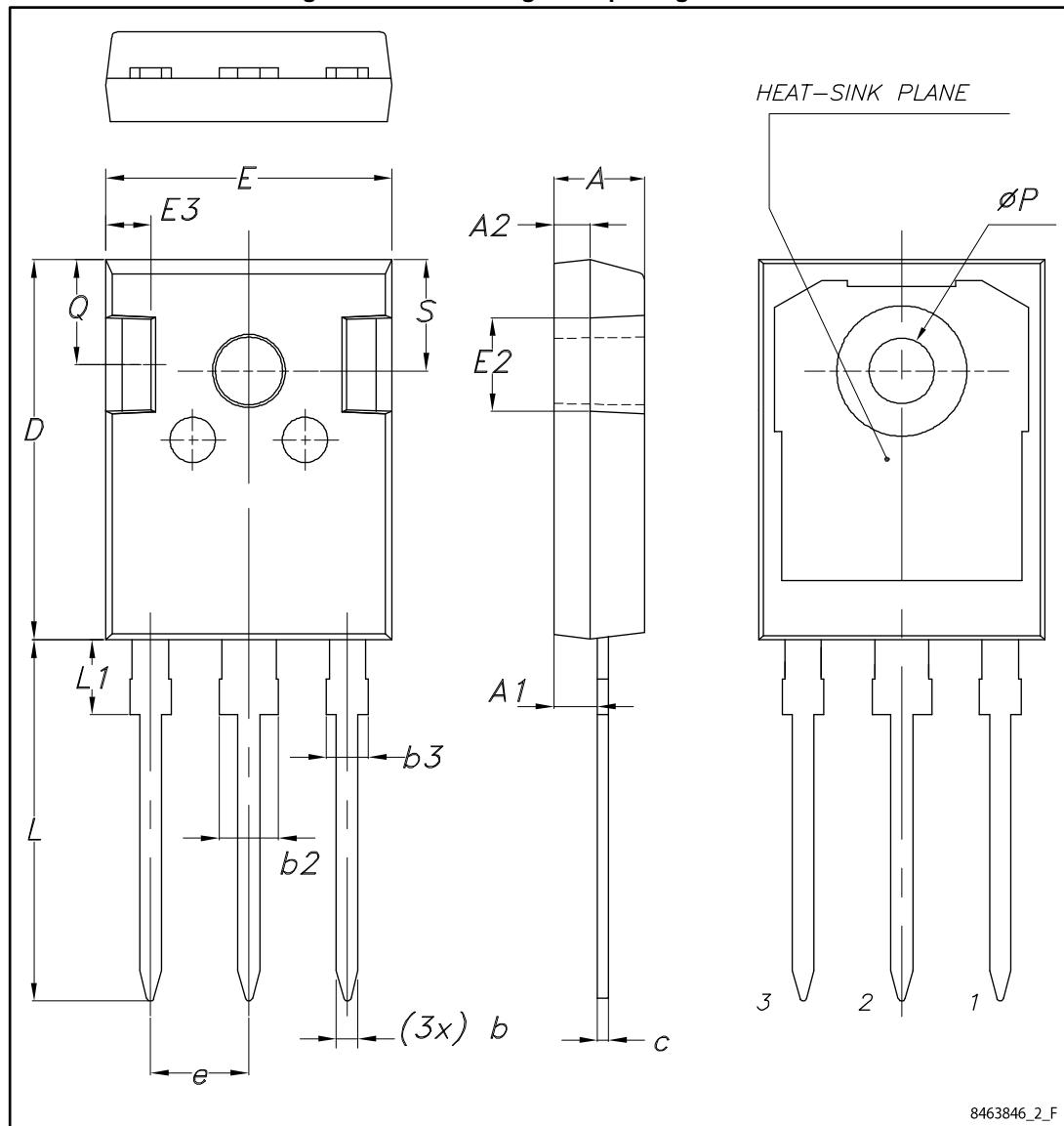


Table 9: TO-247 long leads package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25

## 5 Revision history

Table 10: Document revision history

Date	Revision	Changes
11-May-2016	1	First release.
19-Sep-2016	2	Datasheet promoted from preliminary to production data. Updated <i>Table 2: "Absolute maximum ratings"</i> . Updated <i>Section 2: "Electrical characteristics"</i> . Added <i>Section 2.1: "Electrical characteristics (curves)"</i> .
31-Oct-2017	3	Updated package silhouette on cover page. Updated <i>Table 4: "Static characteristics"</i> and <i>Table 5: "Dynamic characteristics"</i> . Minor text changes

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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



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