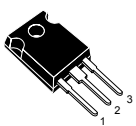
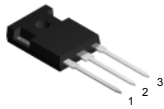


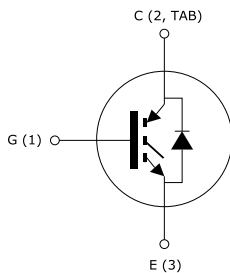
## Trench gate field-stop IGBT, H series 1200 V, 25 A high speed



TO-247



TO-247 long leads



## Features

- Maximum junction temperature:  $T_J = 175\text{ °C}$
- High speed switching series
- Minimized tail current
- $V_{CE(sat)} = 2.1\text{ V (typ.) @ } I_C = 25\text{ A}$
- 5  $\mu\text{s}$  minimum short circuit withstand time at  $T_J = 150\text{ °C}$
- Safe paralleling
- Low thermal resistance
- Very fast recovery antiparallel diode

## Applications

- Photovoltaic inverters
- Uninterruptible power supply
- Welding
- Power factor correction
- High frequency converters

## Description

This device is an IGBT developed using an advanced proprietary trench gate field-stop structure. The device is part of the H series of IGBTs, which represents an optimum compromise between conduction and switching losses to maximize the efficiency of high-switching frequency converters. Furthermore, a slightly positive  $V_{CE(sat)}$  temperature coefficient and very tight parameter distribution result in safer paralleling operation.



## Product status links

[STGW25H120DF2](#)
[STGWA25H120DF2](#)

## Product summary

Order code	STGW25H120DF2
Marking	G25H120DF2
Package	TO-247
Packing	Tube
Order code	STGWA25H120DF2
Marking	G25H120DF2
Package	TO-247 long leads
Packing	Tube

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{GE} = 0\text{ V}$ )	1200	V
$I_C$	Continuous collector current at $T_C = 25\text{ °C}$	50	A
	Continuous collector current at $T_C = 100\text{ °C}$	25	
$I_{CP}^{(1)}$	Pulsed collector current	100	A
$V_{GE}$	Gate-emitter voltage	$\pm 20$	V
	Transient gate-emitter voltage ( $t_p \leq 10\text{ }\mu\text{s}$ , $D \leq 0.01$ )	$\pm 30$	
$I_F$	Continuous forward current at $T_C = 25\text{ °C}$	50	A
	Continuous forward current at $T_C = 100\text{ °C}$	25	
$I_{FP}^{(1)}$	Pulsed forward current	100	A
$P_{TOT}$	Total power dissipation at $T_C = 25\text{ °C}$	375	W
$T_J$	Operating junction temperature range	- 55 to 175	°C
$T_{STG}$	Storage temperature range	- 55 to 150	°C

1. Pulse width limited by maximum junction temperature.

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Thermal resistance, junction-to-case IGBT	0.4	°C/W
	Thermal resistance, junction-to-case diode	1.47	
$R_{thJA}$	Thermal resistance, junction-to-ambient	50	°C/W

## 2 Electrical characteristics

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

**Table 3. 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
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 25\text{ A}$		2.1	2.6	V
		$V_{GE} = 15\text{ V}, I_C = 25\text{ A}, T_J = 125\text{ °C}$		2.4		
		$V_{GE} = 15\text{ V}, I_C = 25\text{ A}, T_J = 175\text{ °C}$		2.5		
$V_F$	Forward on-voltage	$I_F = 25\text{ A}$		3.8	4.9	V
		$I_F = 25\text{ A}, T_J = 125\text{ °C}$		3.05		
		$I_F = 25\text{ A}, T_J = 175\text{ °C}$		2.8		
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}, I_C = 1\text{ mA}$	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	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$			250	nA

**Table 4. Dynamic characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{ies}$	Input capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0\text{ V}$	-	2010	-	pF
$C_{oes}$	Output capacitance		-	146	-	pF
$C_{res}$	Reverse transfer capacitance		-	49	-	pF
$Q_g$	Total gate charge	$V_{CC} = 960\text{ V}, I_C = 25\text{ A}, V_{GE} = 0\text{ to }15\text{ V}$ (see Figure 28. Gate charge test circuit)	-	100	-	nC
$Q_{ge}$	Gate-emitter charge		-	11	-	nC
$Q_{gc}$	Gate-collector charge		-	52	-	nC

**Table 5. IGBT switching characteristics (inductive load)**

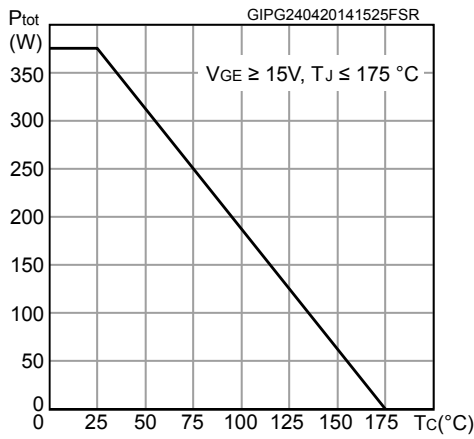
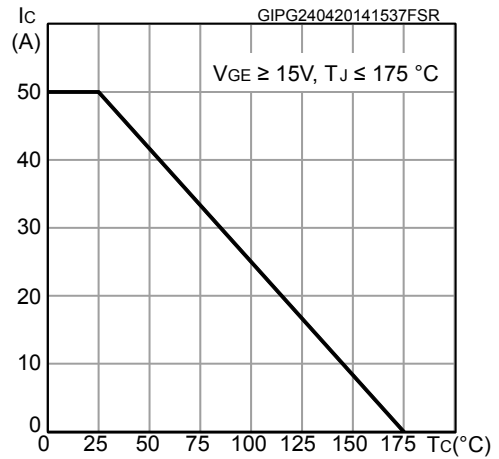
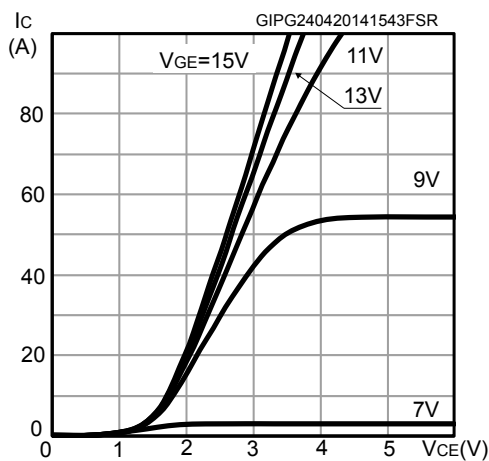
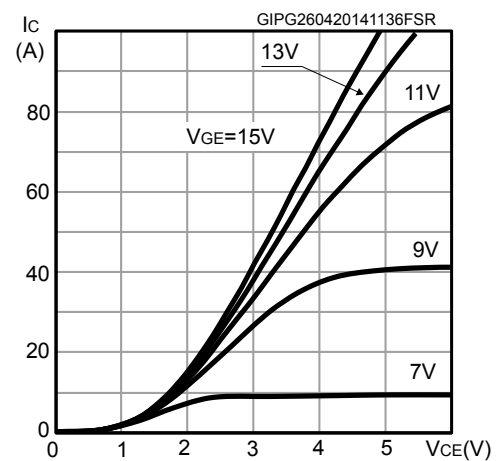
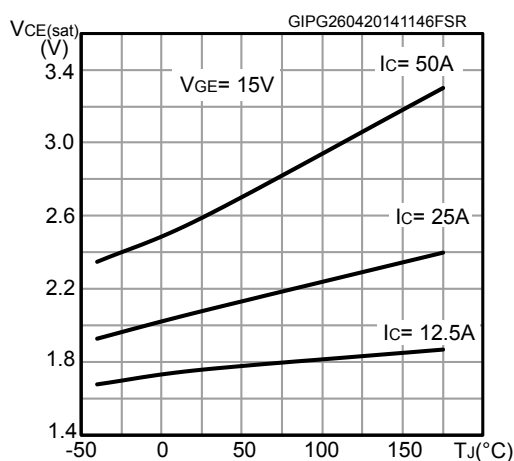
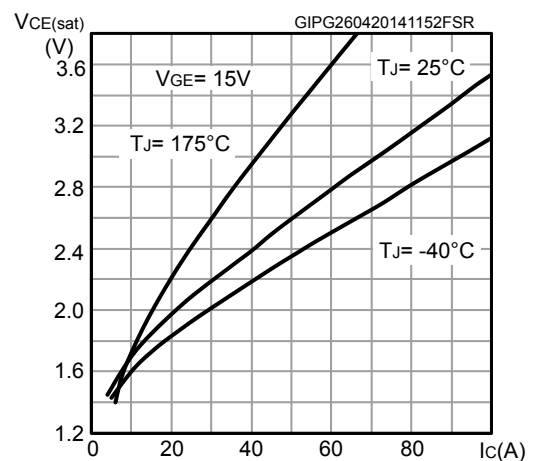
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 600\text{ V}$ , $I_C = 25\text{ A}$ , $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ (see Figure 27. Test circuit for inductive load switching)		29	-	ns
$t_r$	Current rise time			12	-	ns
$(di/dt)_{on}$	Turn-on current slope			1774	-	A/ $\mu$ s
$t_{d(off)}$	Turn-off delay time			130	-	ns
$t_f$	Current fall time			106	-	ns
$E_{on}^{(1)}$	Turn-on switching energy			0.6	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			0.7	-	mJ
$E_{ts}$	Total switching energy			1.3	-	mJ
$t_{d(on)}$	Turn-on delay time	$V_{CE} = 600\text{ V}$ , $I_C = 25\text{ A}$ , $R_G = 10\ \Omega$ , $V_{GE} = 15\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching)		27.5	-	ns
$t_r$	Current rise time			13.5	-	ns
$(di/dt)_{on}$	Turn-on current slope			1522	-	A/ $\mu$ s
$t_{d(off)}$	Turn-off delay time			139	-	ns
$t_f$	Current fall time			200	-	ns
$E_{on}^{(1)}$	Turn-on switching energy			1.05	-	mJ
$E_{off}^{(2)}$	Turn-off switching energy			1.65	-	mJ
$E_{ts}$	Total switching energy			2.7	-	mJ
$t_{sc}$	Short-circuit withstand time	$V_{CE} = 600\text{ V}$ , $V_{GE} = 15\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$ ,	5		-	$\mu$ s

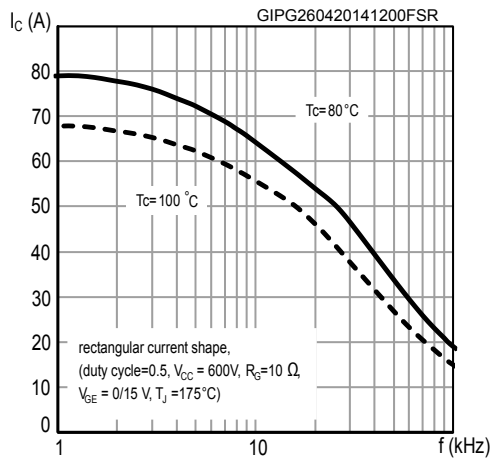
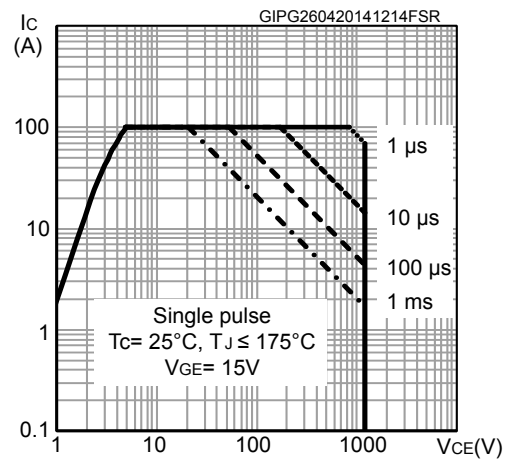
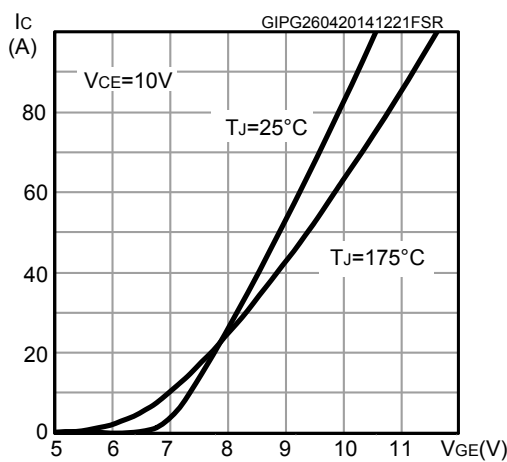
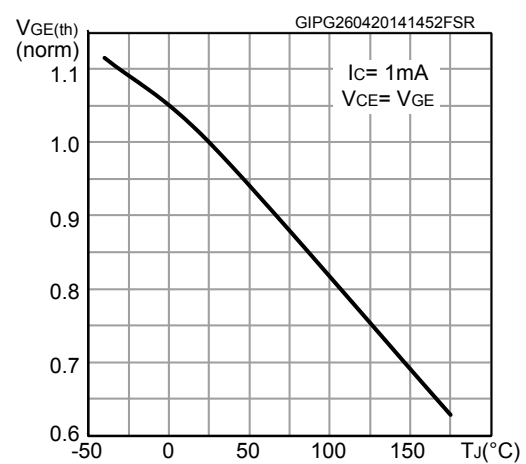
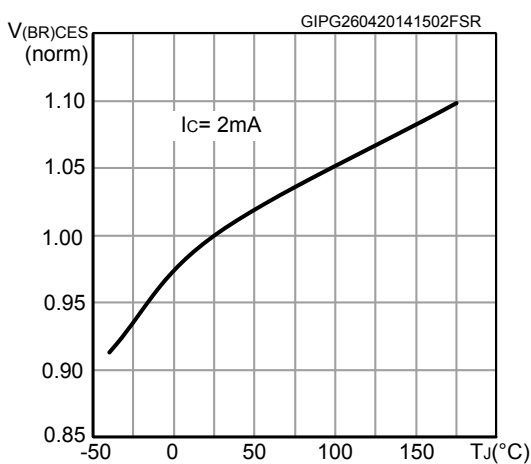
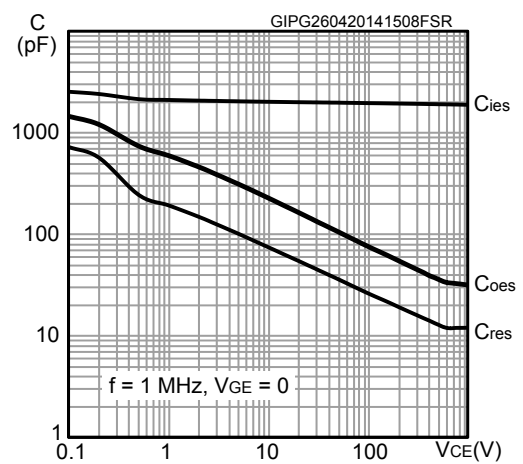
1. Including the reverse recovery of the diode.

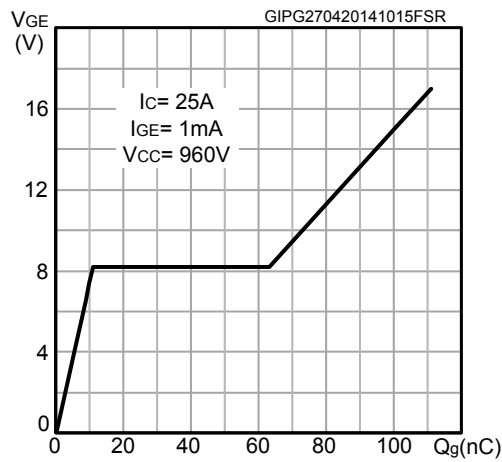
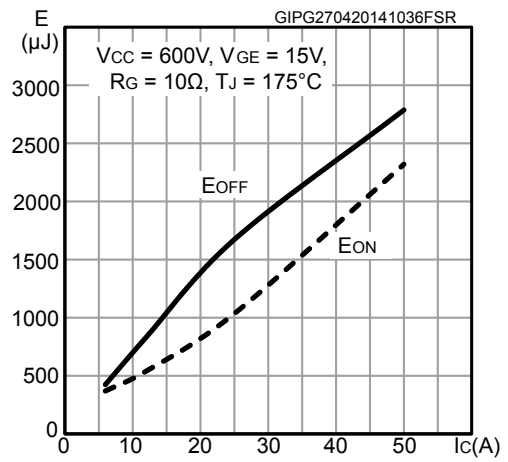
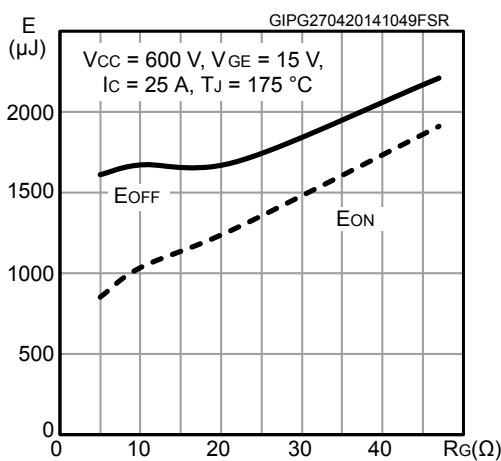
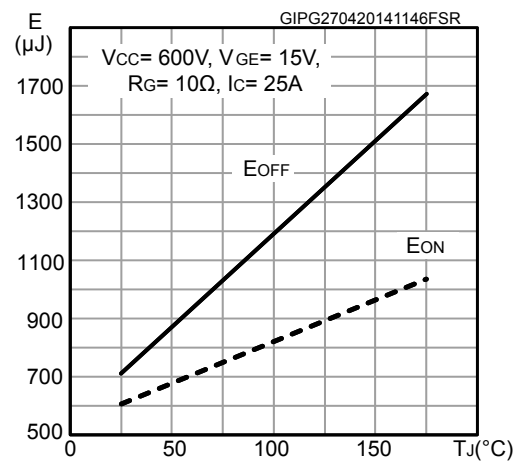
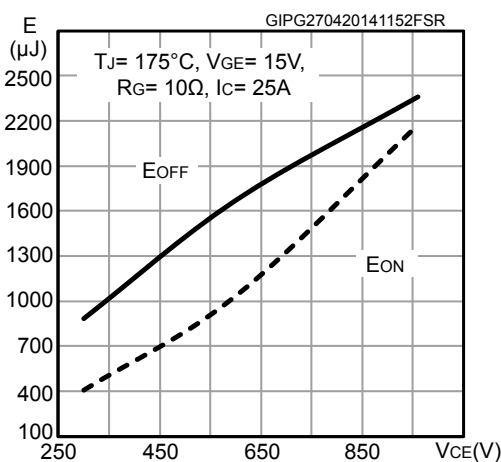
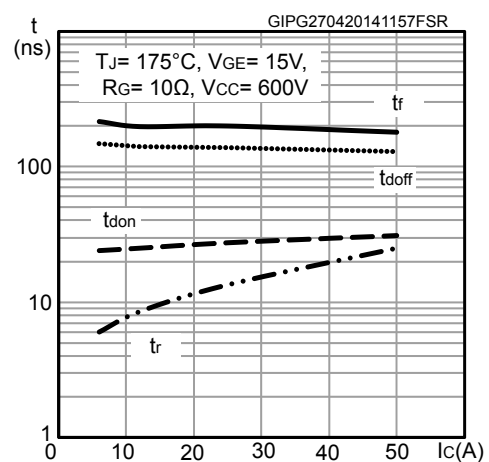
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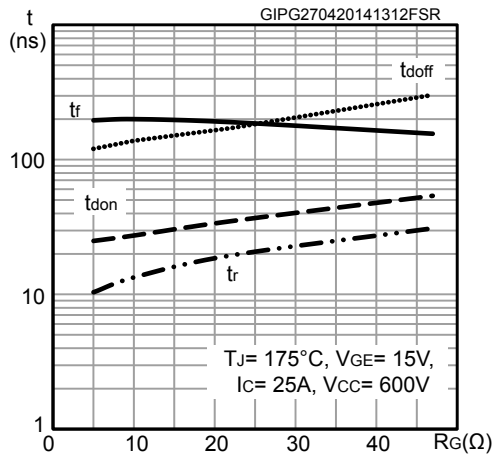
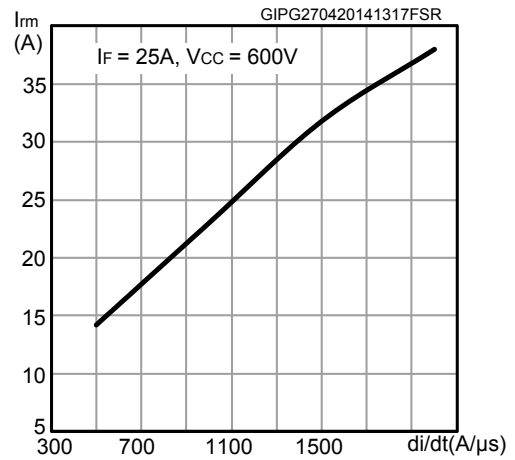
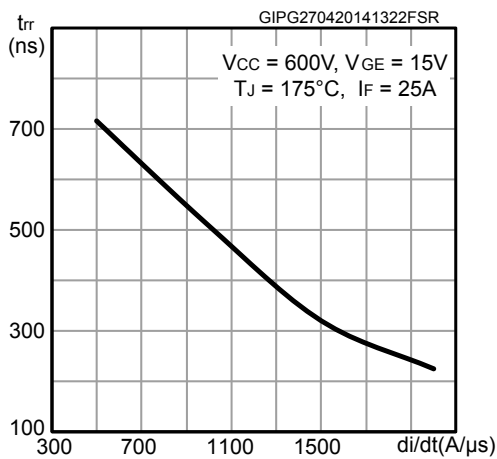
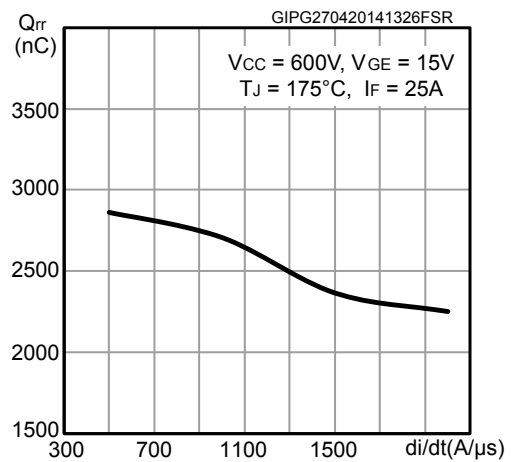
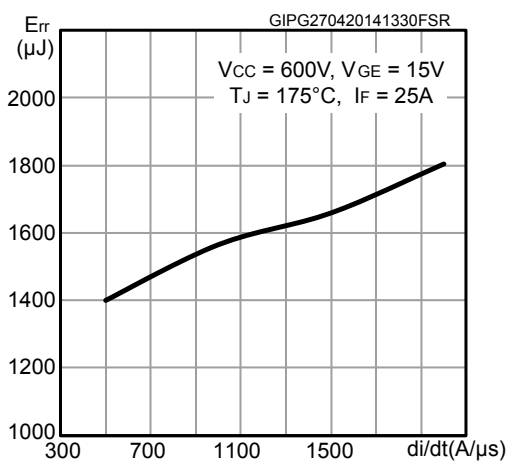
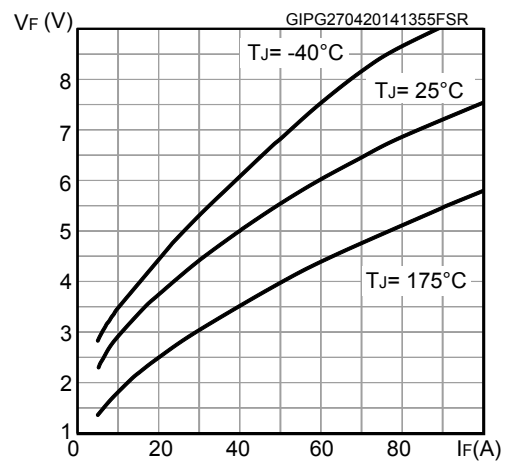
**Table 6. Diode switching characteristics (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$t_{rr}$	Reverse recovery time	$I_F = 25\text{ A}$ , $V_R = 600\text{ V}$ , $di/dt = 500\text{ A}/\mu\text{s}$ , $V_{GE} = 15\text{ V}$ (see Figure 27. Test circuit for inductive load switching)	-	303	-	ns	
$Q_{rr}$	Reverse recovery charge			-	0.93	-	$\mu$ C
$I_{rrm}$	Reverse recovery current			-	15.3	-	A
$dI_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$			-	400	-	A/ $\mu$ s
$E_{rr}$	Reverse recovery energy			-	0.52	-	mJ
$t_{rr}$	Reverse recovery time	$I_F = 25\text{ A}$ , $V_R = 600\text{ V}$ , $di/dt = 500\text{ A}/\mu\text{s}$ , $V_{GE} = 15\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$ (see Figure 27. Test circuit for inductive load switching)	-	508	-	ns	
$Q_{rr}$	Reverse recovery charge			-	2.71	-	$\mu$ C
$I_{rrm}$	Reverse recovery current			-	23	-	A
$dI_{rr}/dt$	Peak rate of fall of reverse recovery current during $t_b$			-	680	-	A/ $\mu$ s
$E_{rr}$	Reverse recovery energy			-	1.56	-	mJ

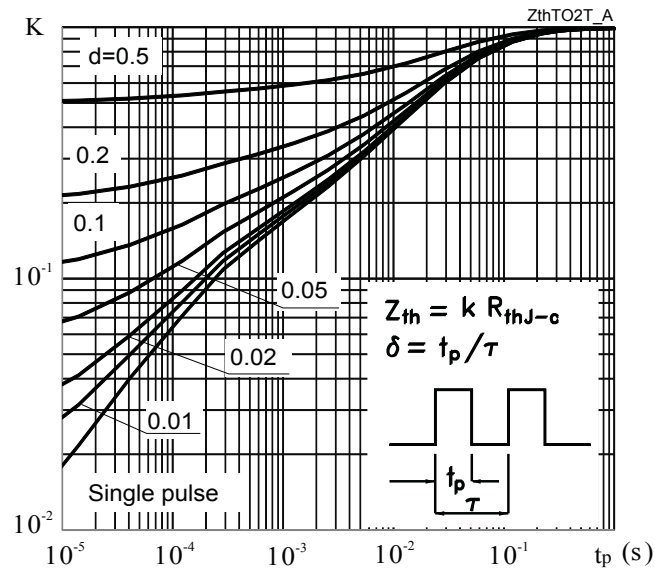
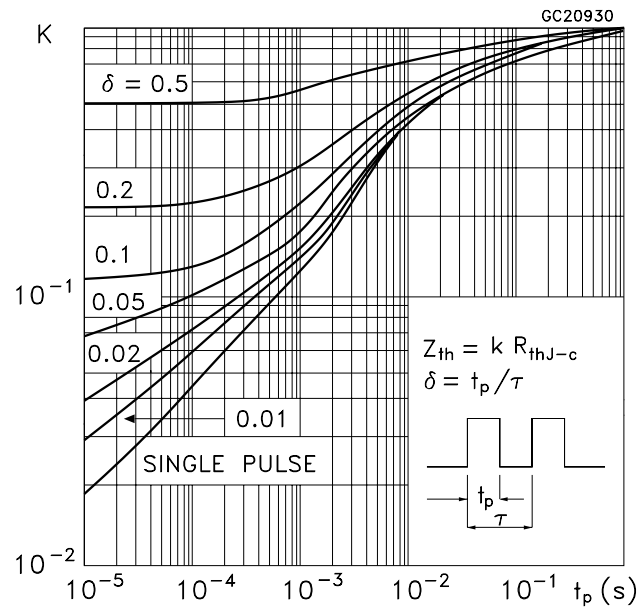
**2.1 Electrical characteristics (curves)**
**Figure 1. Power dissipation vs case temperature**

**Figure 2. Collector current vs case temperature**

**Figure 3. Output characteristics ( $T_J = 25^\circ\text{C}$ )**

**Figure 4. Output characteristics ( $T_J = 175^\circ\text{C}$ )**

**Figure 5.  $V_{CE(sat)}$  vs junction temperature**

**Figure 6.  $V_{CE(sat)}$  vs collector current**


**Figure 7. Collector current vs switching frequency**

**Figure 8. Safe operating area**

**Figure 9. Transfer characteristics**

**Figure 10. Diode V<sub>F</sub> vs forward current**

**Figure 11. Normalized V<sub>(BR)CES</sub> vs junction temperature**

**Figure 12. Capacitance variations**


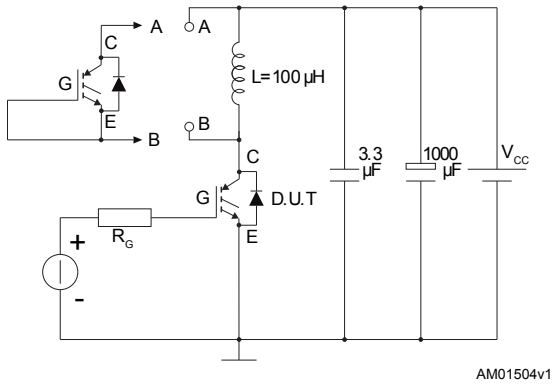
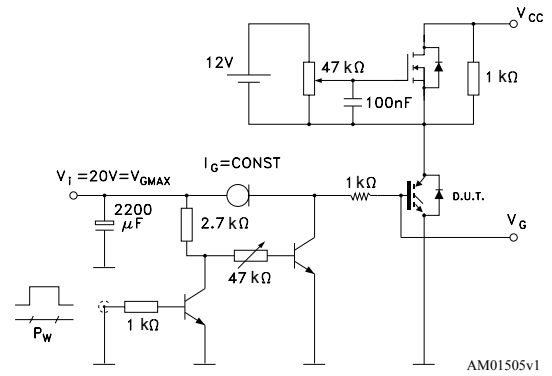
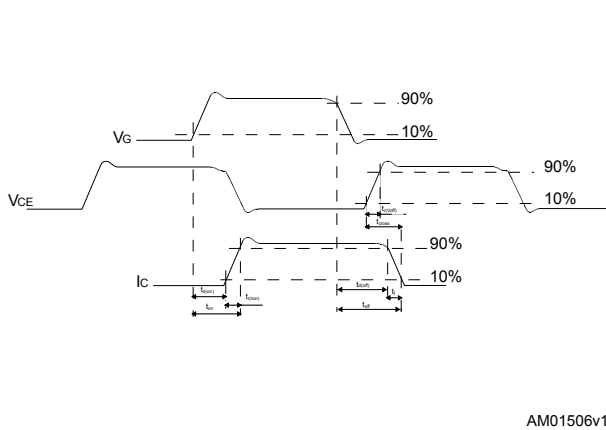
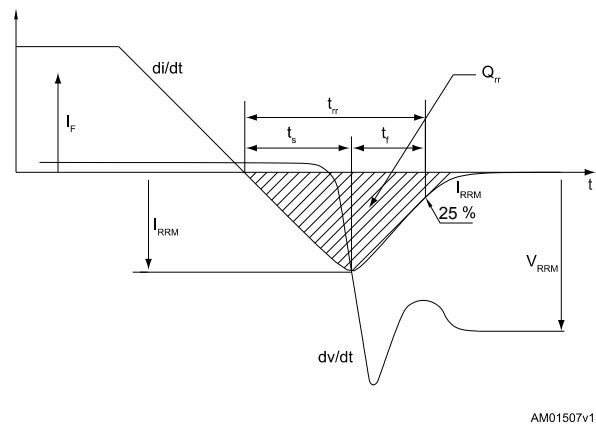
**Figure 13. Gate charge vs gate-emitter voltage**

**Figure 14. Switching energy vs collector current**

**Figure 15. Switching energy vs gate resistance**

**Figure 16. Switching energy vs junction temperature**

**Figure 17. Switching energy vs collector-emitter voltage**

**Figure 18. Switching times vs collector current**


**Figure 19. Switching times vs gate resistance**

**Figure 20. Reverse recovery current vs diode current slope**

**Figure 21. Reverse recovery time vs diode current slope**

**Figure 22. Reverse recovery charge vs diode current slope**

**Figure 23. Reverse recovery energy vs diode current slope**

**Figure 24. Diode VF vs forward current**




**Figure 25. Thermal impedance for IGBT**

**Figure 26. Thermal impedance for diode**


### 3 Test circuits

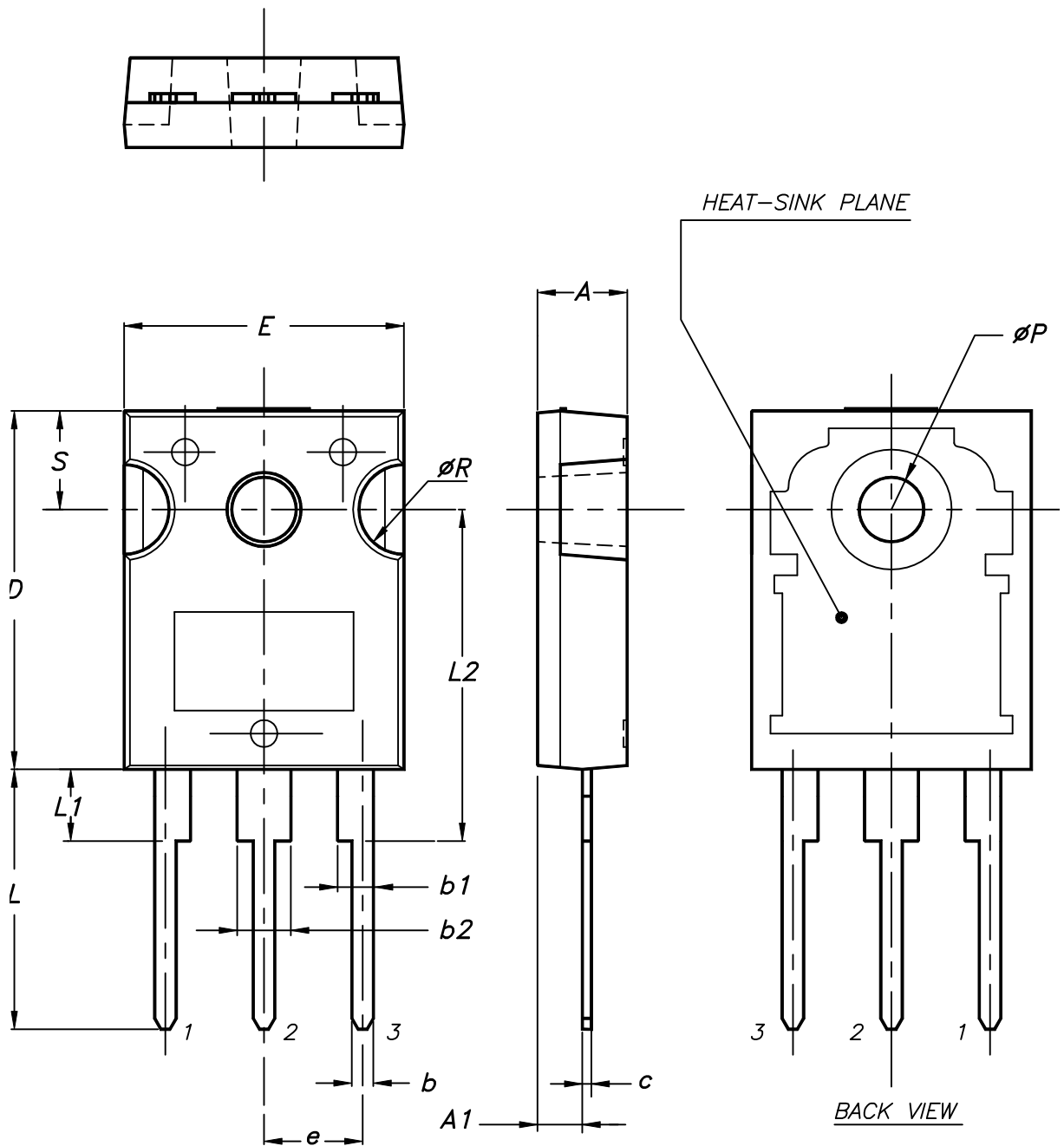
**Figure 27. Test circuit for inductive load switching**

**Figure 28. Gate charge test circuit**

**Figure 29. Switching waveform**

**Figure 30. Diode reverse recovery waveform**


## 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 31. TO-247 package outline



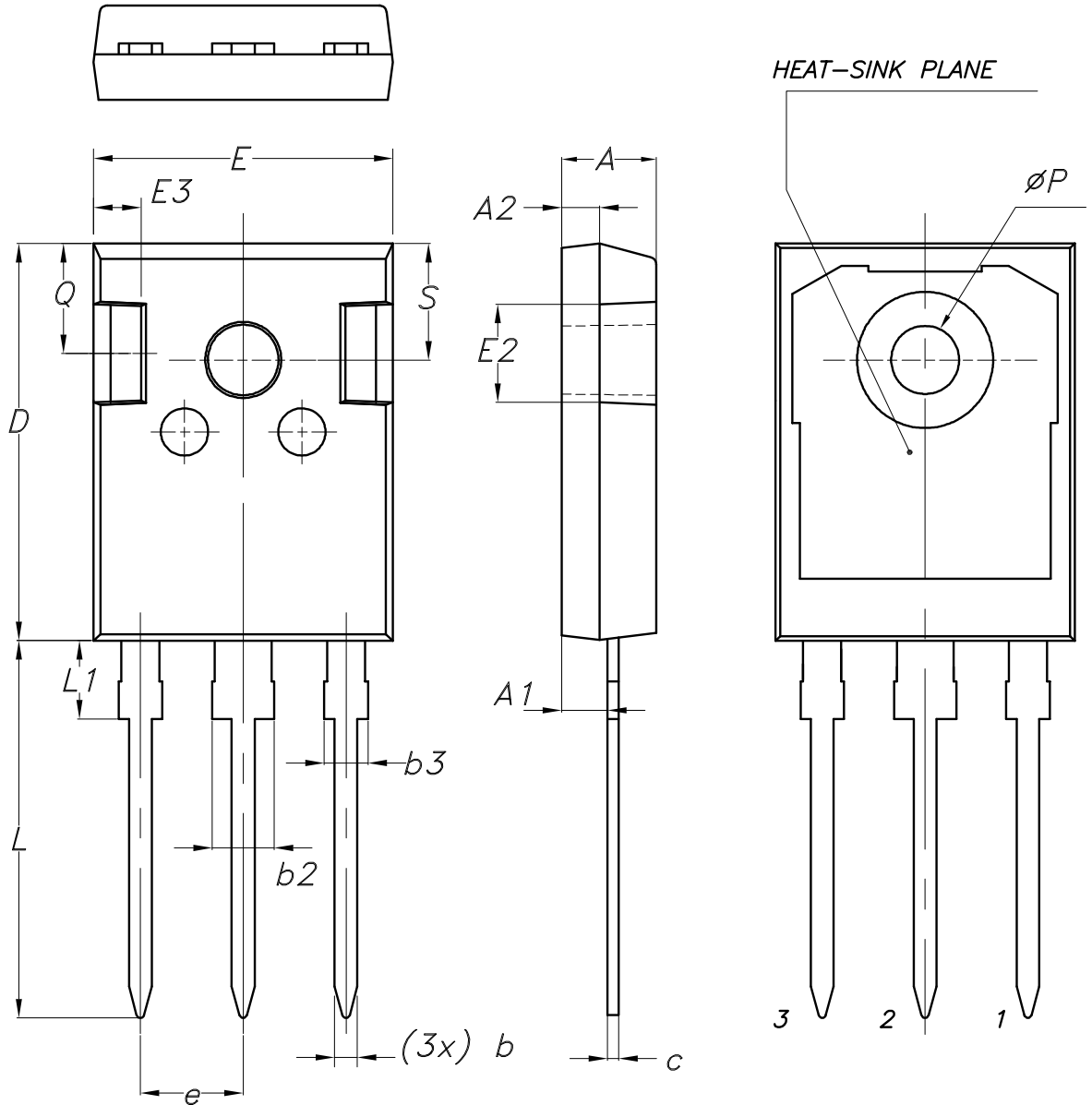
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Table 7. TO-247 package mechanical data

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 32. TO-247 long leads package outline



8463846\_2\_F

**Table 8. 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

## Revision history

**Table 9. Document revision history**

Date	Revision	Changes
03-Oct-2012	1	Initial release.
28-Feb-2014	2	Updated title and features in cover page. Minor text changes.
31-Mar-2014	3	Document status promoted from preliminary to production data. Updated <i>Table 4: Static characteristics</i> and <i>Table 6: IGBT switching characteristics (inductive load)</i> . Added Section 2.1: Electrical characteristics (curves).
06-Mar-2015	4	Added 4.2: <i>TO-247 long leads, package information</i> . Minor text changes.
10-Mar-2021	5	Updated <i>Table 1. Absolute maximum ratings</i> . Minor text changes.

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	<b>Revision history</b> .....	<b>15</b>





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