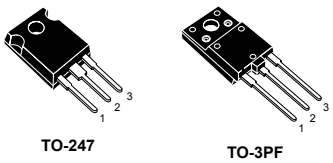
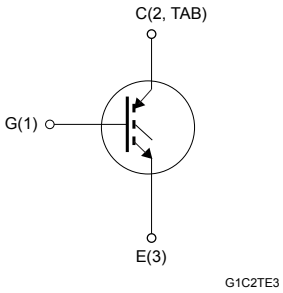
STGFW30H65FB, STGW30H65FB

Datasheet

Trench gate field-stop 650 V, 30 A high speed HB series IGBT



TO-247 TO-3PF



Features

- Maximum junction temperature: T_J = 175 °C
- High speed switching series
- Minimized tail current
- $V_{CE(sat)}$ = 1.55 V (typ.) at I_C = 30 A
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance

Applications

- Photovoltaic inverters
- Power factor correction
- Welding
- High-frequency converters

Description

These devices are IGBTs developed using an advanced proprietary trench gate field-stop structure. These devices are part of the new HB series of IGBTs, which represent an optimum compromise between conduction and switching loss to maximize the efficiency of any frequency converter. Furthermore, the slightly positive $V_{CE(sat)}$ temperature coefficient and very tight parameter distribution result in safer paralleling operation.

Product status links
STGFW30H65FB
STGW30H65FB

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-247	TO-3PF	
V_{CES}	Collector-emitter voltage (V_{GE} = 0 V)	650		V
I_C	Continuous collector current at T_C = 25 °C	60		A
	Continuous collector current at T_C = 100 °C	30		A
I_{CP}(1)	Pulsed collector current	120		A
V_{GE}	Gate-emitter voltage	±20		V
P_{TOT}	Total power dissipation at T_C = 25 °C	260	92	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_c = 25 °C)		3.5	kV
T_{stg}	Storage temperature range	-55 to 150		°C
T_J	Operating junction temperature range	-55 to 175		°C

1. *Pulse width is limited by maximum junction temperature.*

Table 2. Thermal data

Symbol	Parameter	Value		Unit
		TO-247	TO-3PF	
R_{thJC}	Thermal resistance, junction-to-case	0.58	1.63	°C/W
R_{thJA}	Thermal resistance, junction-to-ambient	50		°C/W

2 Electrical characteristics

T_J = 25 °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 V, I_C = 2 mA	650			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 30 A		1.55	2	V
		V_{GE} = 15 V, I_C = 30 A, T_J = 125 °C		1.65		
		V_{GE} = 15 V, I_C = 30 A, T_J = 175 °C		1.75		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 1 mA	5	6	7	V
I_{CES}	Collector cut-off current	V_{GE} = 0 V, V_{CE} = 650 V			25	µA
I_{GES}	Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = ±20 V			250	nA

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0 V	-	3659	-	pF
C_{oes}	Output capacitance		-	101	-	pF
C_{res}	Reverse transfer capacitance		-	76	-	pF
Q_g	Total gate charge	V_{CC} = 520 V, I_C = 30 A, V_{GE} = 0 to 15 V (see Figure 27. Gate charge test circuit)	-	149	-	nC
Q_{ge}	Gate-emitter charge		-	25	-	nC
Q_{gc}	Gate-collector charge		-	62	-	nC

Table 5. Switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 30 A, R_G = 10 Ω, V_{GE} = 15 V (see Figure 26. Test circuit for inductive load switching)	-	37	-	ns
t_r	Current rise time		-	14.6	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1643	-	A/µs
$t_{d(off)}$	Turn-off delay time		-	146	-	ns
t_f	Current fall time		-	23	-	ns
E_{on} (1)	Turn-on switching energy		-	151	-	µJ
E_{off} (2)	Turn-off switching energy		-	293	-	µJ
E_{ts}	Total switching energy		-	444	-	µJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 400 V, I_C = 30 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C (see Figure 26. Test circuit for inductive load switching)	-	35	-	ns
t_r	Current rise time		-	16.1	-	ns
$(di/dt)_{on}$	Turn-on current slope		-	1496	-	A/µs
$t_{d(off)}$	Turn-off-delay time		-	158	-	ns
t_f	Current fall time		-	65	-	ns
E_{on} (1)	Turn-on switching energy		-	175	-	µJ
E_{off} (2)	Turn-off switching energy		-	572	-	µJ
E_{ts}	Total switching energy		-	747	-	µJ

1. *Including the reverse recovery of the external SiC diode STPSC206W.*
2. *Including the tail of the collector current.*

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics (T_J = 25°C)

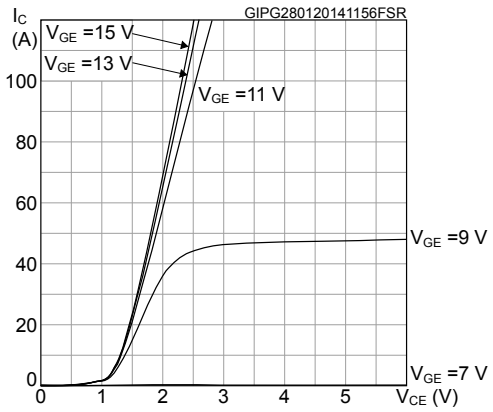


Figure 2. Output characteristics (T_J = 175°C)

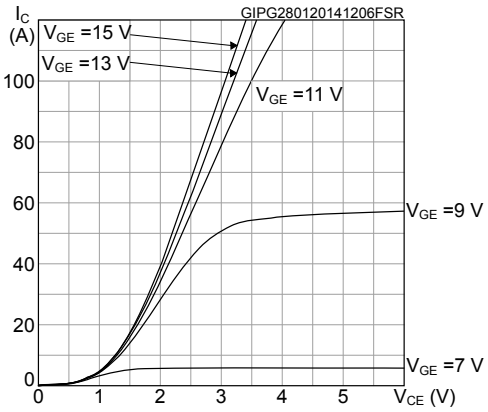


Figure 3. Transfer characteristics

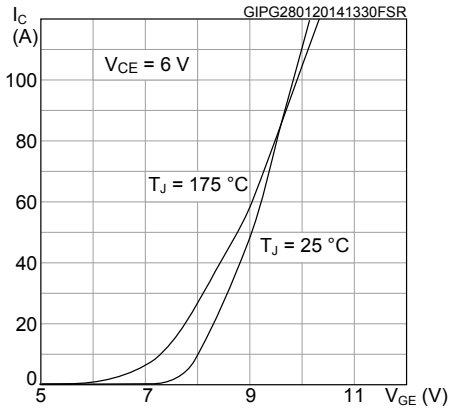


Figure 4. Collector current vs case temperature for TO-247

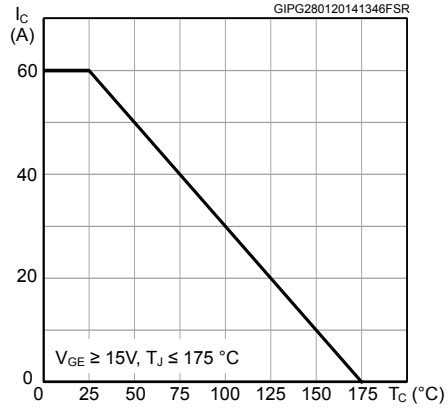


Figure 5. Collector current vs case temperature for TO-3PF

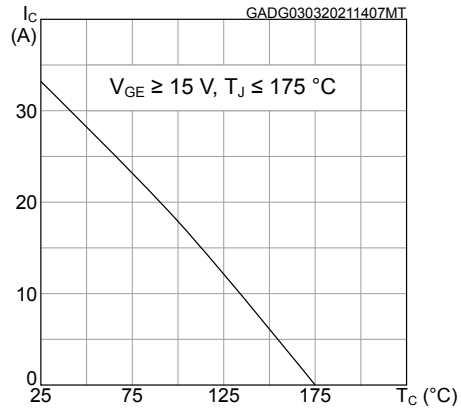


Figure 6. $V_{CE(sat)}$ vs junction temperature

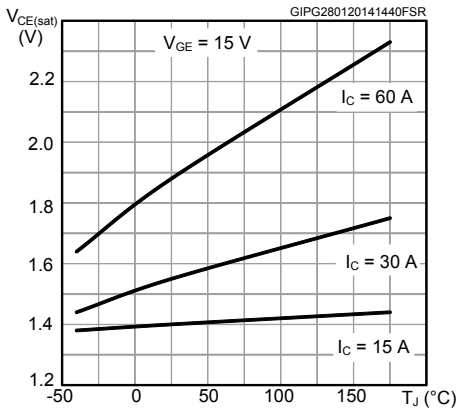


Figure 7. Power dissipation vs case temperature for TO-247

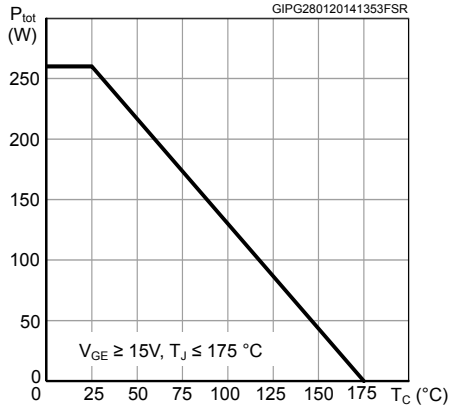


Figure 8. Power dissipation vs case temperature for TO-3PF

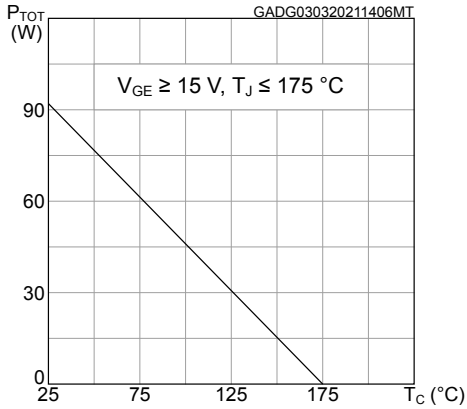


Figure 9. Forward bias safe operating area for TO-247

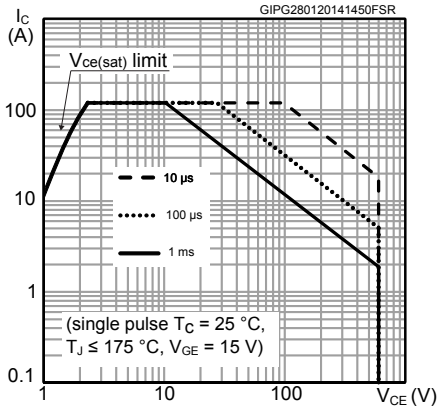


Figure 10. Forward bias safe operating area for TO-3PF

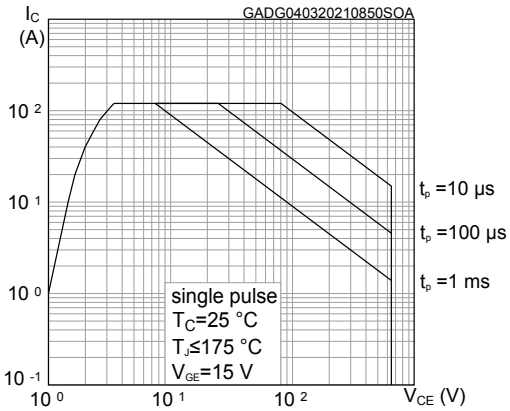


Figure 11. Collector current vs switching frequency for TO-247

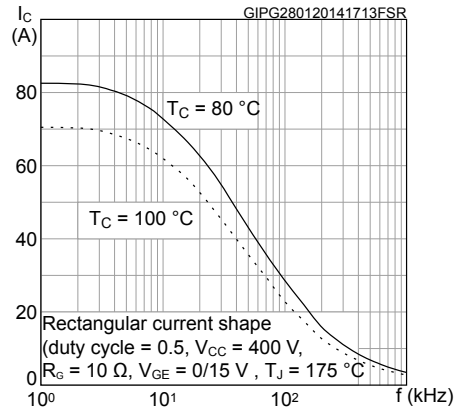


Figure 12. Collector current vs switching frequency for TO-3PF

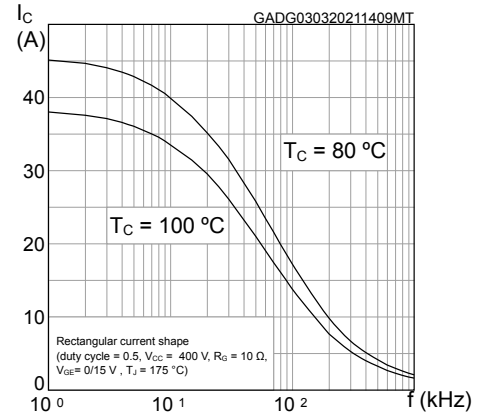


Figure 13. Normalized $V_{GE(th)}$ vs junction temperature

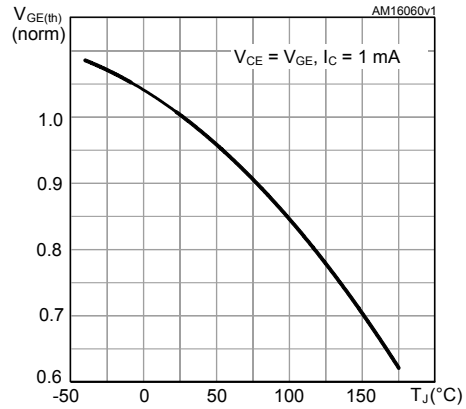


Figure 14. Normalized $V_{(BR)CES}$ vs junction temperature

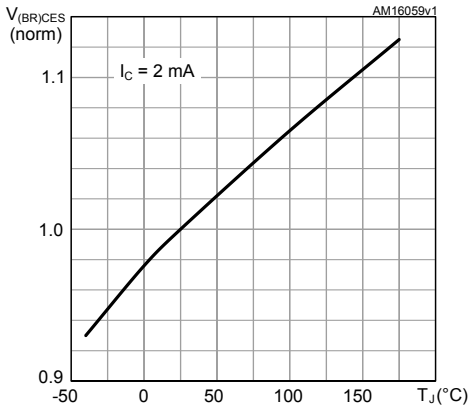


Figure 15. Switching energy vs temperature

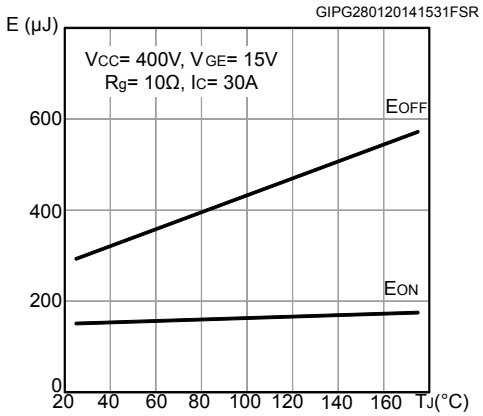


Figure 16. Switching energy vs gate resistance

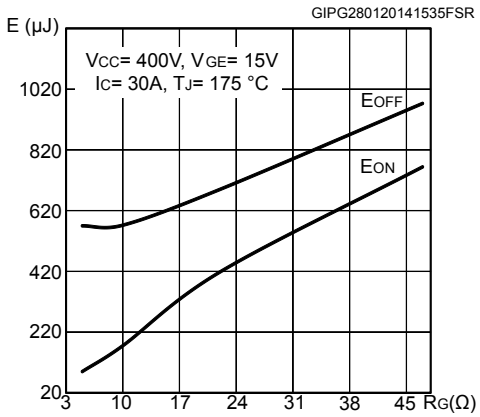


Figure 17. Switching energy vs collector current

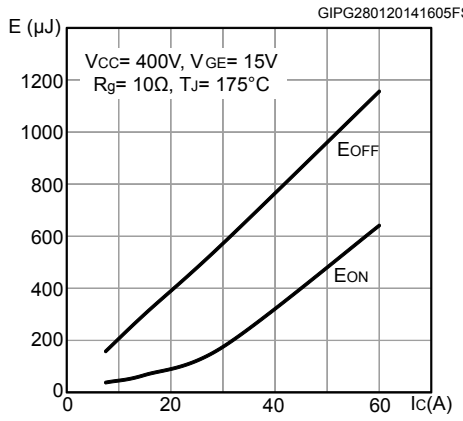


Figure 18. Switching energy vs collector emitter voltage

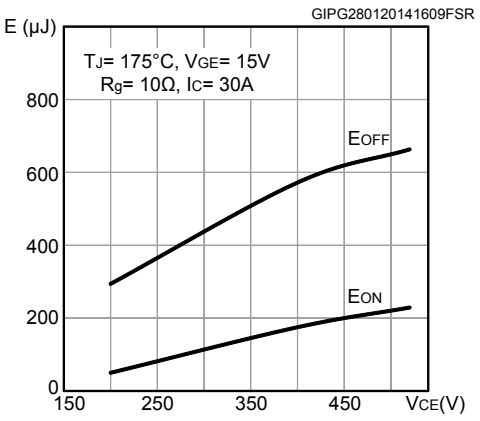


Figure 19. Switching times vs collector current

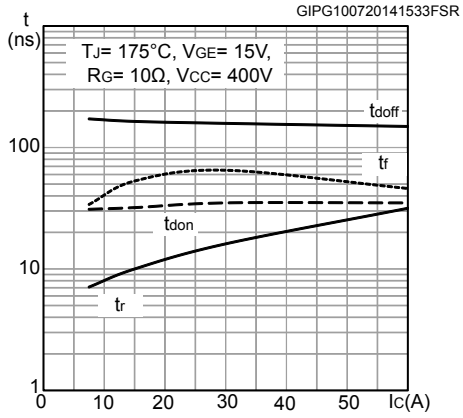


Figure 20. Switching times vs gate resistance

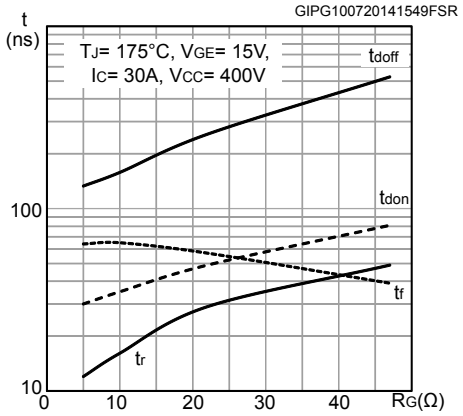


Figure 21. Capacitance variations

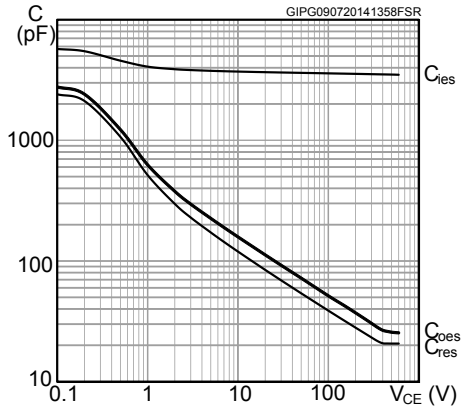


Figure 22. $V_{CE(sat)}$ vs collector current

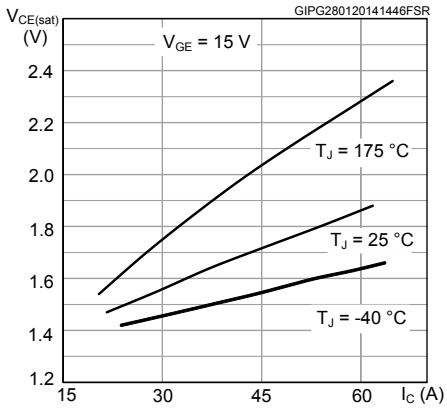


Figure 23. Gate charge vs gate-emitter voltage

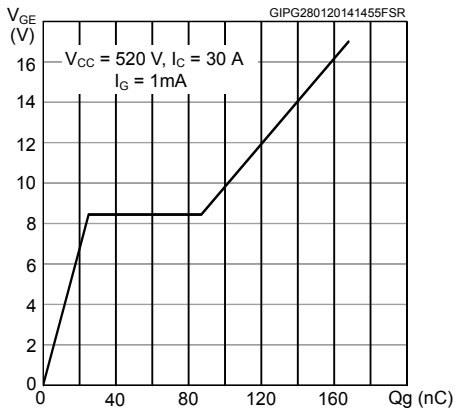


Figure 24. Thermal impedance for TO-247

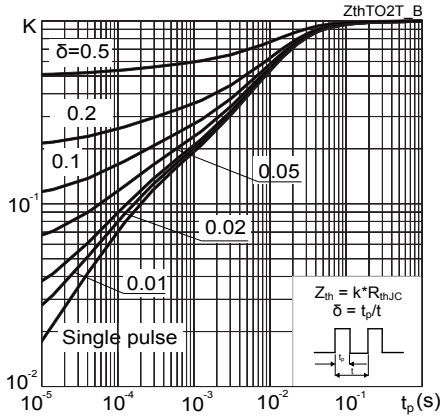
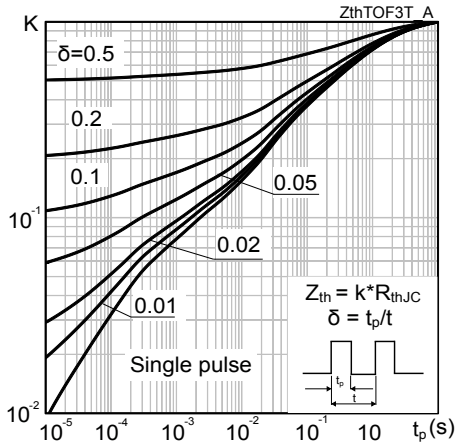


Figure 25. Thermal impedance for in TO-3PF



3 Test circuits

Figure 26. Test circuit for inductive load switching

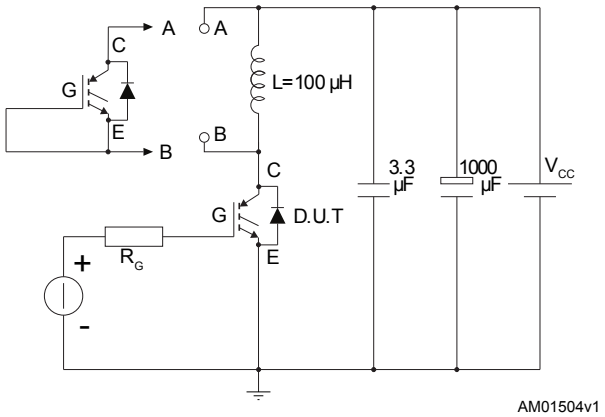


Figure 27. Gate charge test circuit

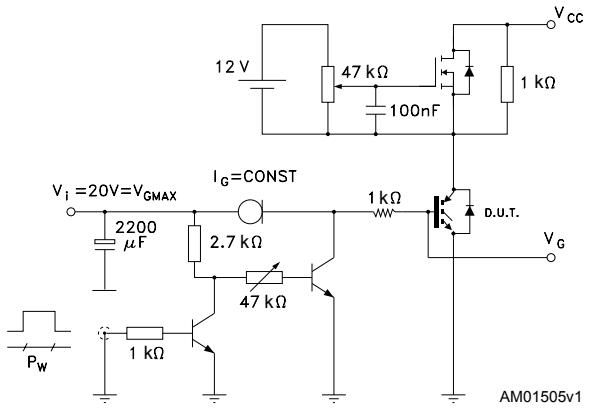
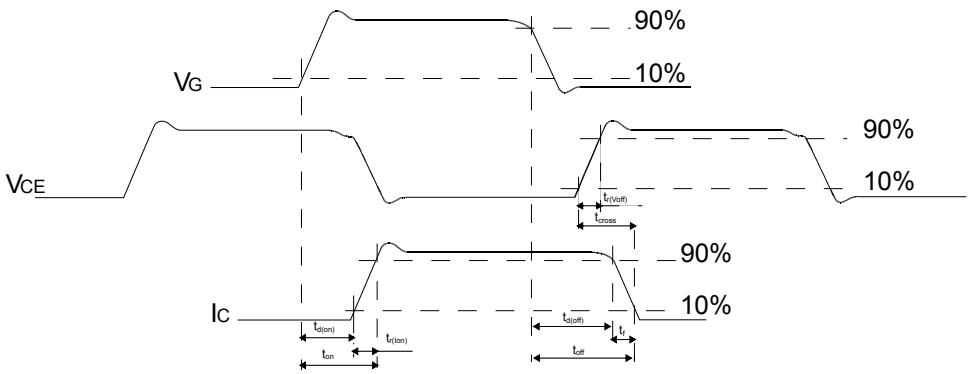


Figure 28. Switching waveform



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. ECOPACK is an ST trademark.

4.1 TO-3PF package information

Figure 29. TO-3PF package outline

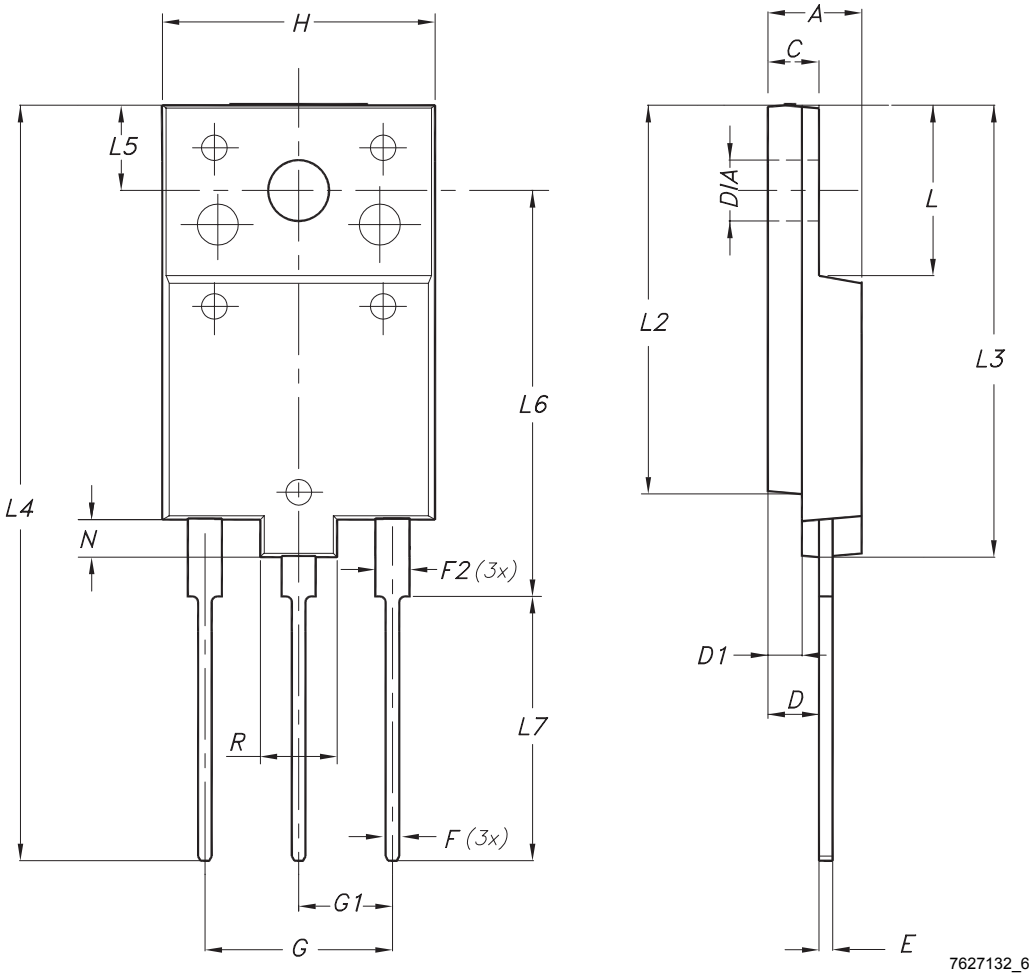
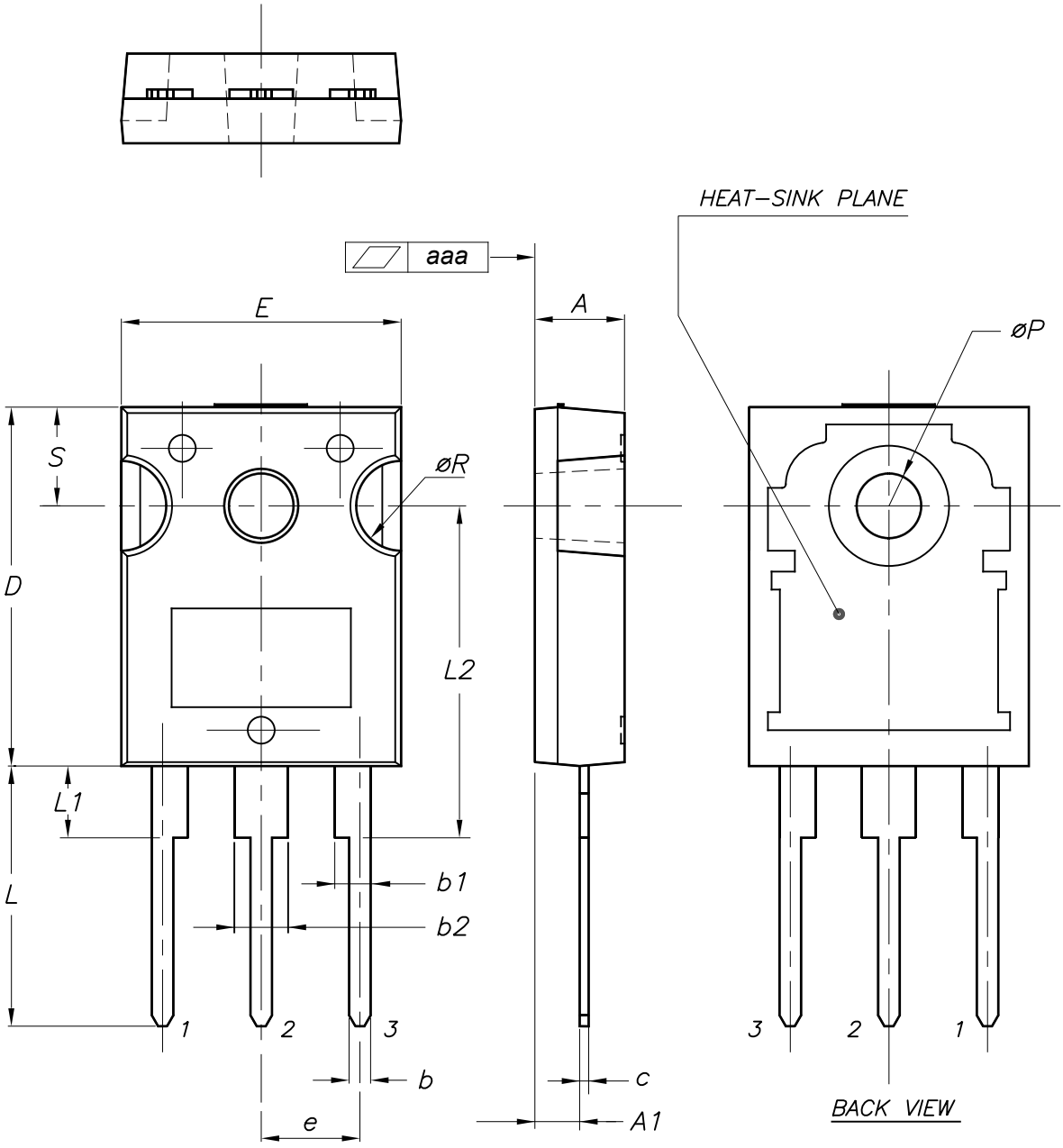


Table 6. **TO-3PF mechanical data**

Dim.	mm		
	Min.	Typ.	Max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10.00	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15.00
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80

4.2 TO-247 package information

Figure 30. **TO-247 package outline**



0075325_10

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
aaa		0.04	0.10

5 Ordering information

Table 8. **Order codes**

Order code	Marking	Package	Packing
STGFW30H65FB	G30H65FB	TO-3PF	Tube
STGW30H65FB	GW30H65FB	TO-247	

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
28-Jan-2014	1	Initial release.
24-Feb-2014	2	Updated units in *Table 6: Switching characteristics (inductive load)* for Ets, and updated note 1. Update *Figure 16: Switching losses vs temperature, Figure 17: Switching losses vs gate resistance* and *Figure 18: Switching losses vs collector current*. Updated title and features in cover page. Minor text changes.
10-Mar-2014	3	Added device in TO-3PF. Updated *Table 1: Device summary, Table 2: Absolute maximum ratings, Table 3: Thermal data.* Added *Figure 6: Collector current vs. case temperature for TO-3PF,* *Figure 9: Power dissipation vs. case temperature for TO-3PF,* *Figure 11: Forward bias safe operating area for TO-3PF* and *Figure 26: Thermal impedance for TO-3PF*. Updated *Section 4: Package information.*
20-May-2014	4	Updated *Table 2: Absolute maximum ratings*.
28-Jul-2015	5	Text and formatting changes throughout document Updated *Table 2: Absolute maximum ratings* Updated *Section 2.1: Electrical characteristics (curves)* Updated *Section 3: Test circuits* Updated *Section 4.2: TO-247 package information* Updated *Section 4.3: TO-3P package information*
27-Apr-2020	6	Updated applications in cover page. Updated *Table 8. Order codes*. Minor text changes.
16-Mar-2021	7	The part number STGWT30H65FB has been removed and the document has been updated accordingly. Updated Section 1 Electrical ratings and Section 2.1 Electrical characteristics (curves). Minor text changes.

Contents

1 **Electrical ratings** 2
2 **Electrical characteristics** 3
2.1 Electrical characteristics (curves) 5
3 **Test circuits** 10
4 **Package information** 11
4.1 TO-3PF package information 11
4.2 TO-247 package information 13
5 **Ordering information** 15
Revision history 16