STGW40H120DF2, STGWA40H120DF2

Trench gate field-stop IGBT, H series 1200 V, 40 A high speed

Datasheet - production data

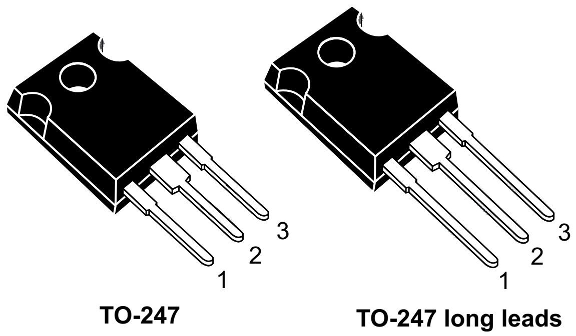
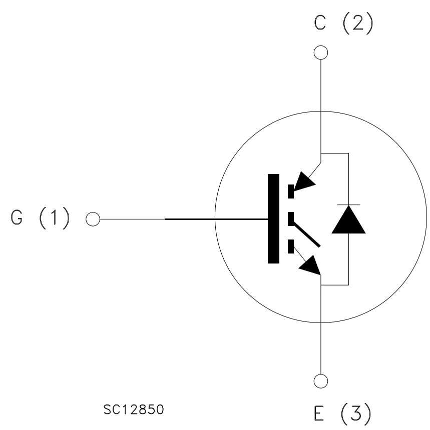


Figure 1. Internal schematic diagram



Features

- Maximum junction temperature: T_J = 175 °C
- High speed switching series
- Minimized tail current
- $V_{CE(sat)}$ = 2.1 V (typ.) @ I_C = 40 A
- 5 µs minimum short circuit withstand time at T_J=150 °C
- Safe paralleling
- Very fast recovery antiparallel diode
- Low thermal resistance

Applications

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

Description

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

Table 1. Device summary

Order code	Marking	Package	Packing
STGW40H120DF2	G40H120DF2	TO-247	Tube
STGWA40H120DF2	G40H120DF2	TO-247 long leads	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	1200	V
I_C	Continuous collector current at T_C = 25 °C	80	A
	Continuous collector current at T_C = 100 °C	40	A
I_{CP} (1)	Pulsed collector current	160	A
V_{GE}	Gate-emitter voltage	±20	V
I_F	Continuous collector current at T_C = 25 °C	80	A
	Continuous collector current at T_C = 100 °C	40	A
I_{FP} (1)	Pulsed forward current	160	A
P_{TOT}	Total dissipation at T_C = 25 °C	468	W
T_J	Operating junction temperature	– 55 to 175	°C
T_{STG}	Storage temperature range	– 55 to 150	

1. Pulse width limited by maximum junction temperature.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.32	°C/W
R_{thJC}	Thermal resistance junction-case diode	1.3	°C/W
R_{thJA}	Thermal resistance junction-ambient	50	°C/W

2 Electrical characteristics

T_J = 25 °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)	I_C = 2 mA	1200			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 40 A		2.1	2.6	V
		V_{GE} = 15 V, I_C = 40 A T_J = 125 °C		2.4		
		V_{GE} = 15 V, I_C = 40 A T_J = 175 °C		2.5		
V_F	Forward on-voltage	I_F = 40 A		3.9	4.9	V
		I_F = 40 A, T_J = 125 °C		3.05		
		I_F = 40 A, T_J = 175 °C		2.8		
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C = 2 mA	5	6	7	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 1200 V			25	µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE} = ± 20 V			250	nA

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0	-	3200	-	pF
C_{oes}	Output capacitance		-	220	-	pF
C_{res}	Reverse transfer capacitance		-	80	-	pF
Q_g	Total gate charge	V_{CC} = 960 V, I_C = 40 A, V_{GE} = 15 V, see *Figure 30*	-	158	-	nC
Q_{ge}	Gate-emitter charge		-	17	-	nC
Q_{gc}	Gate-collector charge		-	85	-	nC

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 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, see *Figure 31*		18	-	ns
t_r	Current rise time			37	-	ns
$(di/dt)_{on}$	Turn-on current slope			1755	-	A/µs
$t_{d(off)}$	Turn-off delay time			152	-	ns
t_f	Current fall time			83	-	ns
E_{on}	Turn-on switching losses			1	-	mJ
E_{off}(1)	Turn-off switching losses			1.32	-	mJ
E_{ts}	Total switching losses			2.32	-	mJ
$t_{d(on)}$	Turn-on delay time	V_{CE} = 600 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C, see *Figure 31*		36	-	ns
t_r	Current rise time			20	-	ns
$(di/dt)_{on}$	Turn-on current slope			1580	-	A/µs
$t_{d(off)}$	Turn-off delay time			161	-	ns
t_f	Current fall time			190	-	ns
E_{on}	Turn-on switching losses			1.81	-	mJ
E_{off}(1)	Turn-off switching losses			2.46	-	mJ
E_{ts}	Total switching losses			4.27	-	mJ
t_{sc}	Short-circuit withstand time	V_{CE} = 600 V, V_{GE} = 15 V, T_J = 150 °C,	5		-	µs

1. Turn-off losses include also 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 = 40 A, V_R = 600 V, di/dt=500 A/µs, V_{GE} = 15 V, see *Figure 31*	-	488	-	ns
Q_{rr}	Reverse recovery charge		-	2.59	-	µC
I_{rrm}	Reverse recovery current		-	11.6	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	406	-	A/µs
E_{rr}	Reverse recovery energy		-	0.38	-	mJ
t_{rr}	Reverse recovery time	I_F = 40 A, V_R = 600 V, di/dt=500 A/µs, V_{GE} = 15 V, T_J = 175 °C, see *Figure 31*	-	484	-	ns
Q_{rr}	Reverse recovery charge		-	4.5	-	µC
I_{rrm}	Reverse recovery current		-	18.6	-	A
dI_{rr}/dt	Peak rate of fall of reverse recovery current during t_b		-	170	-	A/µs
E_{rr}	Reverse recovery energy		-	0.94	-	mJ

2.1 Electrical characteristics (curves)

Figure 2. Power dissipation vs. case temperature

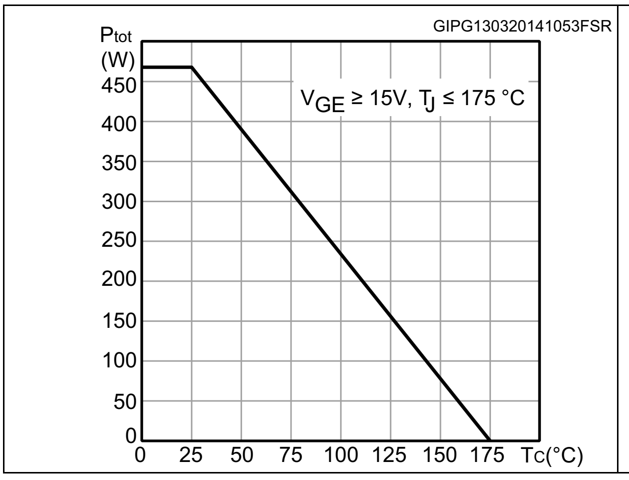


Figure 3. Collector current vs. case temperature

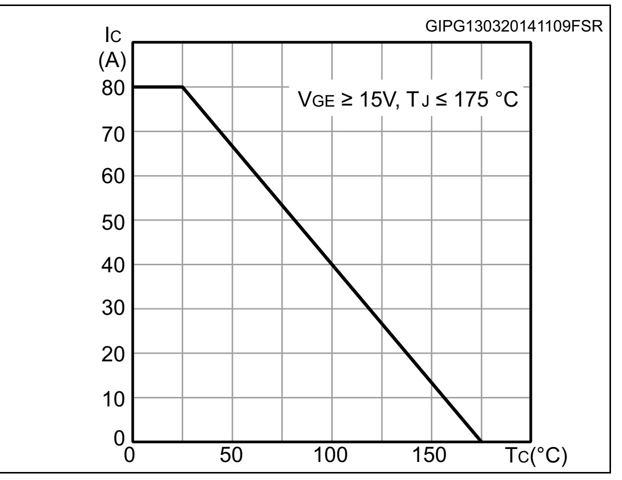


Figure 4. Output characteristics (T_J = 25°C)

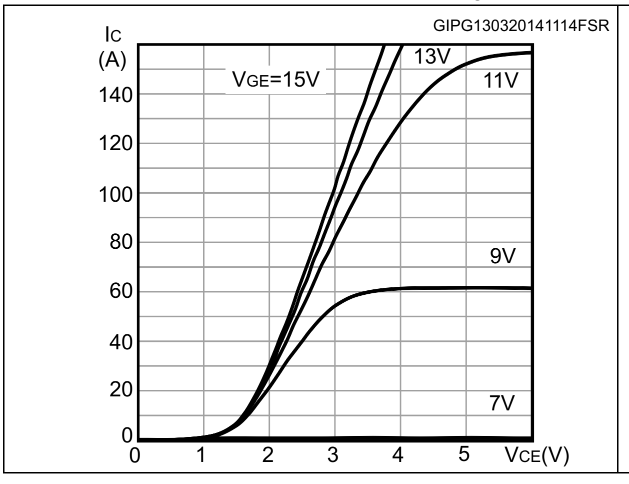


Figure 5. Output characteristics (T_J = 175°C)

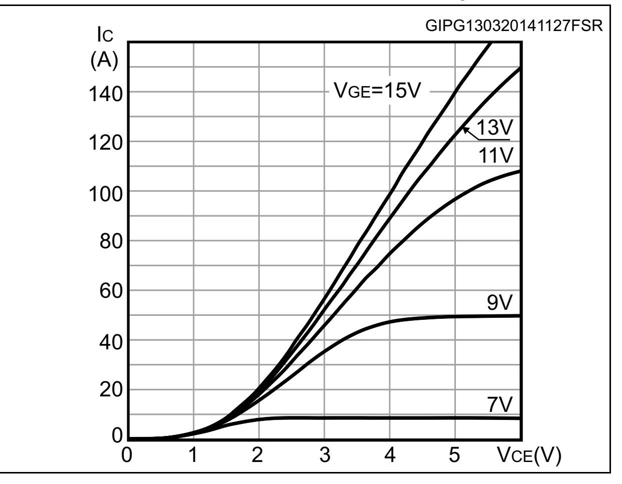


Figure 6. $V_{CE(sat)}$ vs. junction temperature

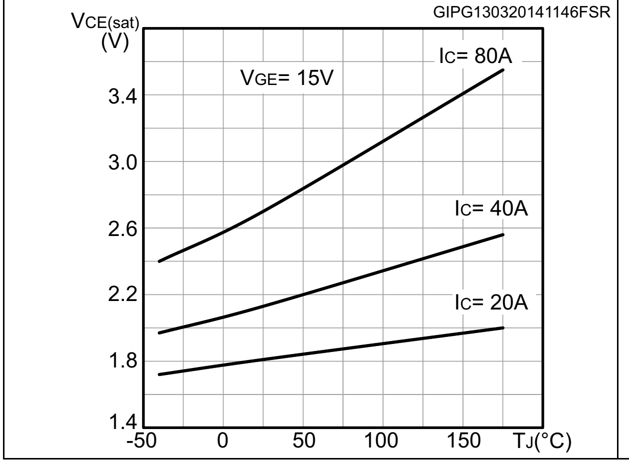


Figure 7. $V_{CE(sat)}$ vs. collector current

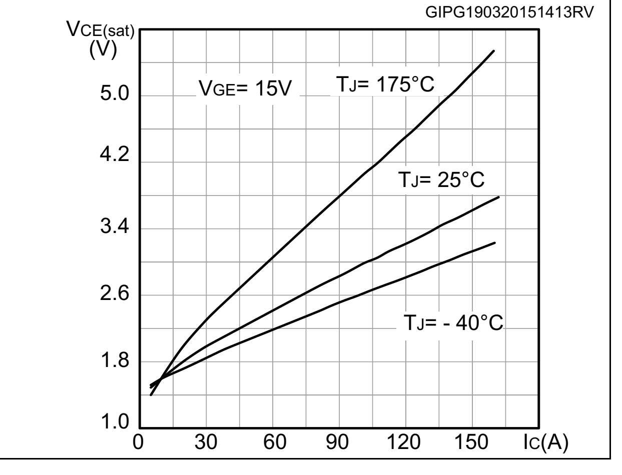


Figure 8. Collector current vs. switching frequency

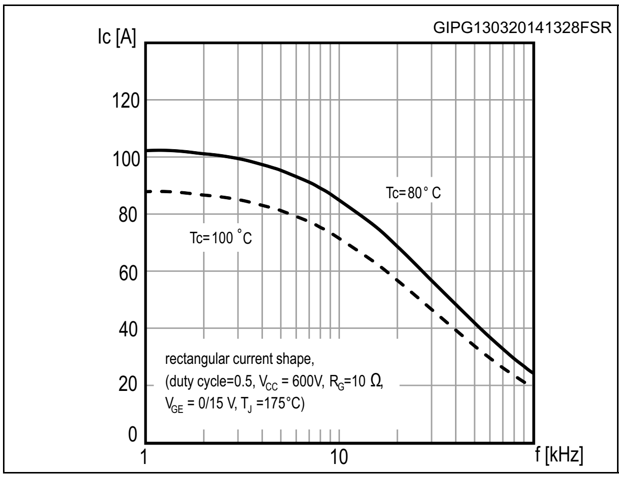


Figure 9. Forward bias safe operating area

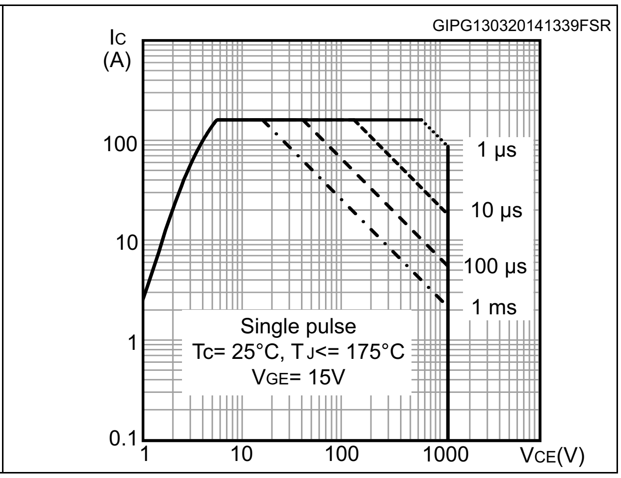


Figure 10. Transfer characteristics

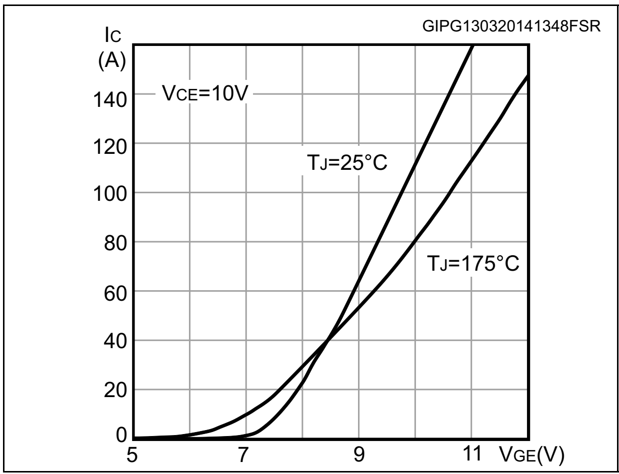


Figure 11. Diode V_F vs. forward current

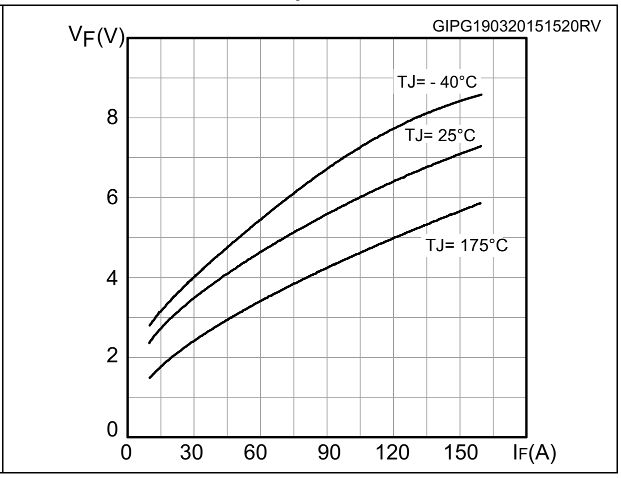


Figure 12. Normalized $V_{GE(th)}$ vs junction temperature

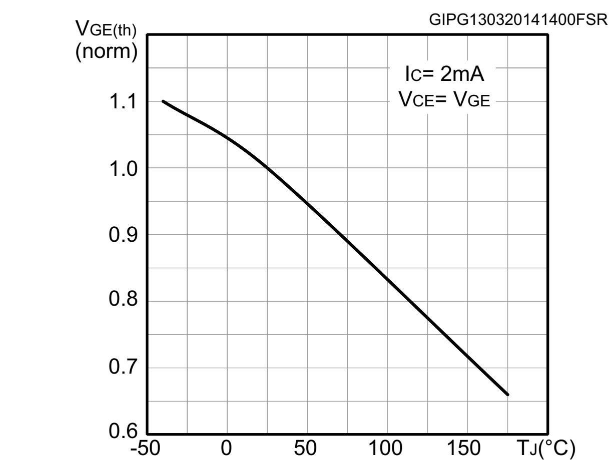


Figure 13. Normalized $V_{(BR)CES}$ vs. junction temperature

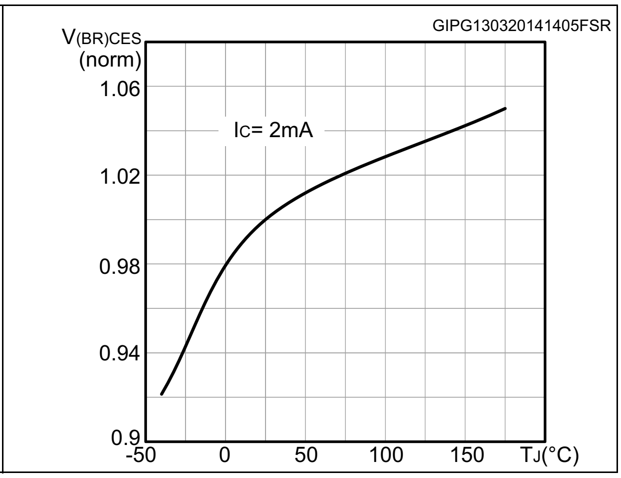


Figure 14. Capacitance variation

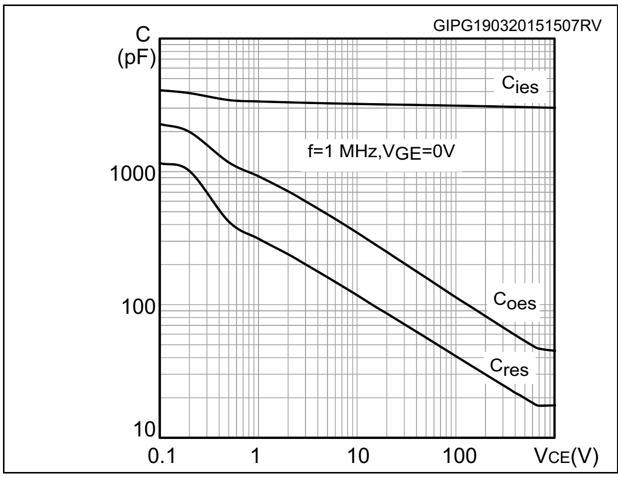


Figure 15. Gate charge vs. gate-emitter voltage

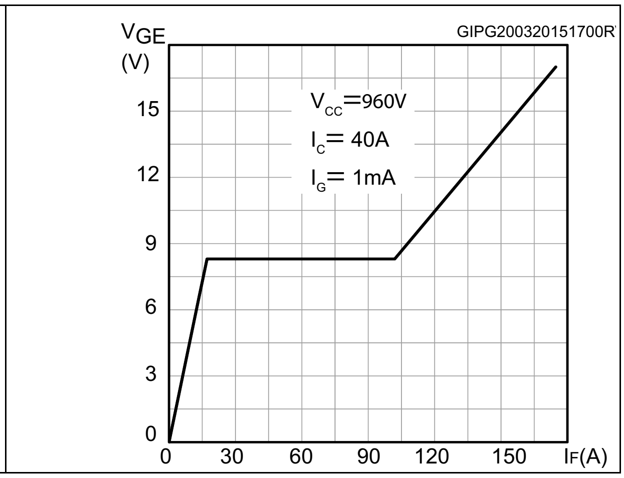


Figure 16. Switching loss vs collector current

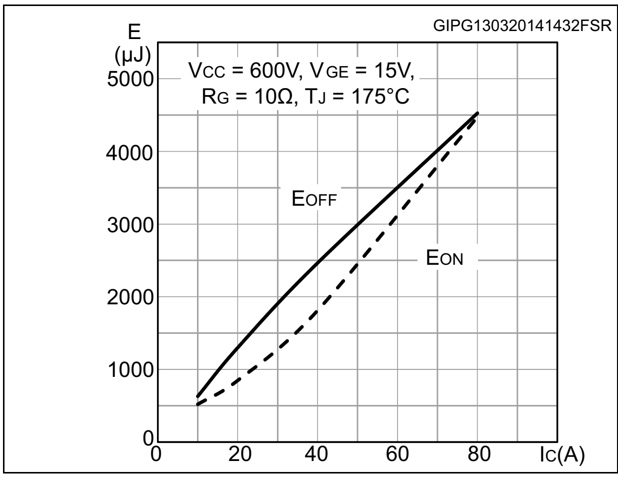


Figure 17. Switching loss vs gate resistance

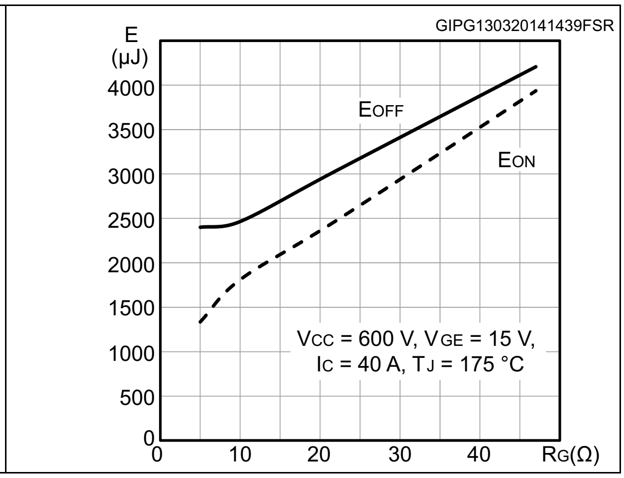


Figure 18. Switching loss vs temperature

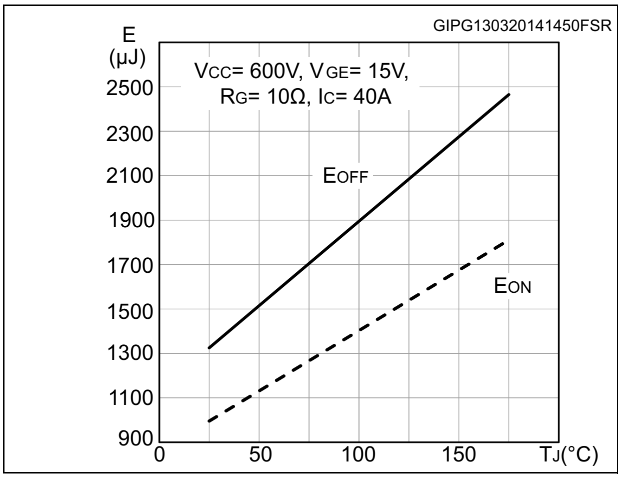


Figure 19. Switching loss vs collector-emitter voltage

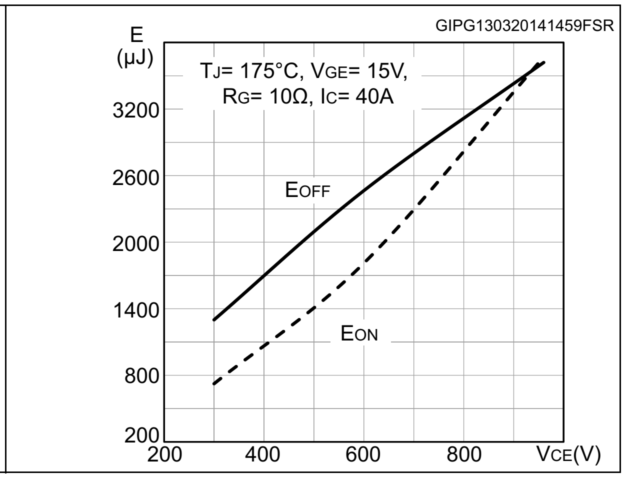


Figure 20. Switching times vs. collector current

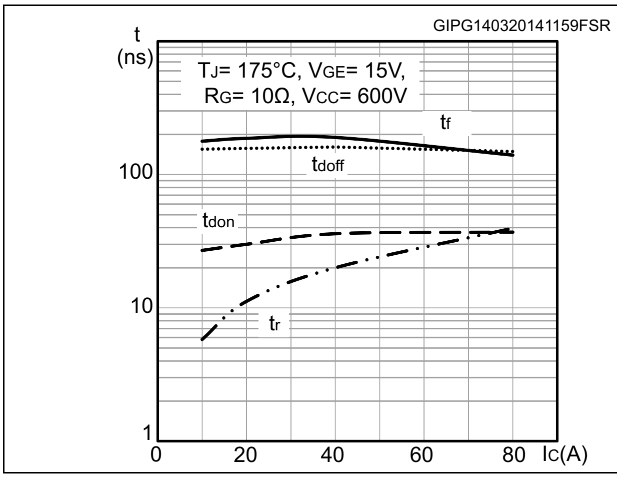


Figure 21. Switching times vs. gate resistance

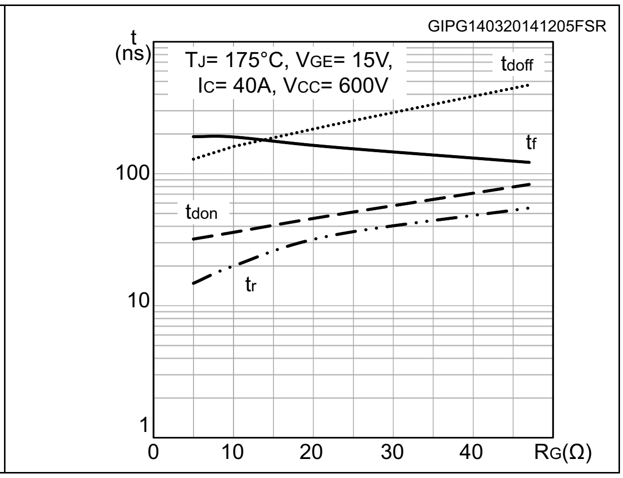


Figure 22. Reverse recovery current vs. diode current slope

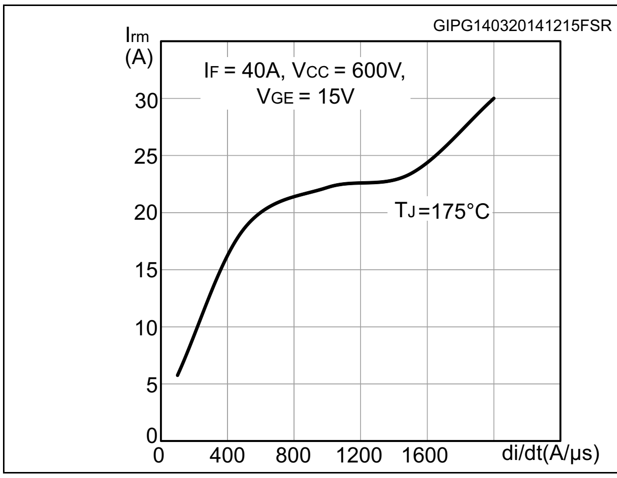


Figure 23. Reverse recovery time vs. diode current slope

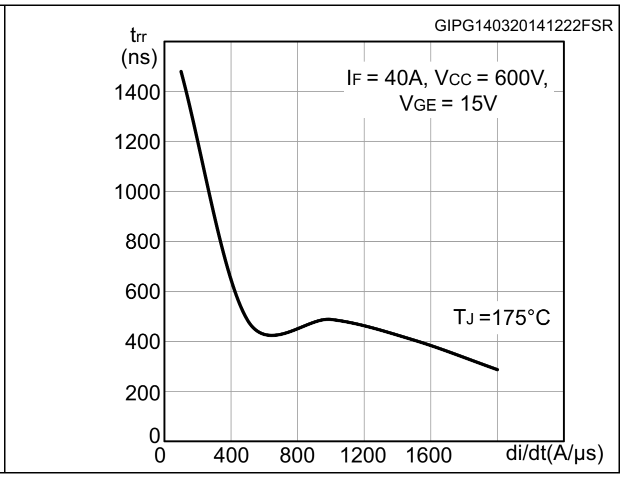


Figure 24. Reverse recovery charge vs. diode current slope

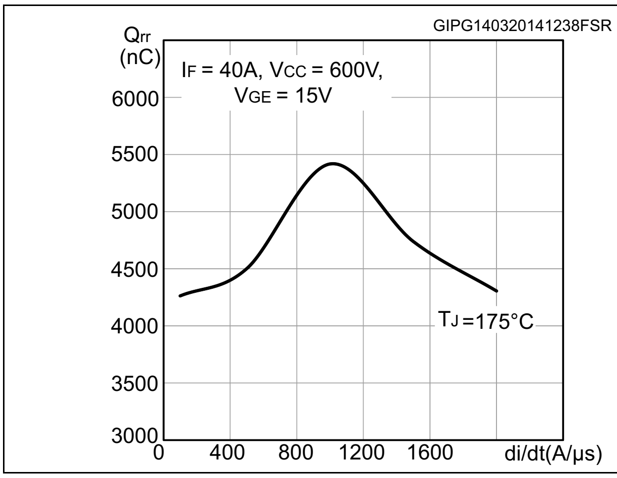


Figure 25. Reverse recovery energy vs. diode current slope

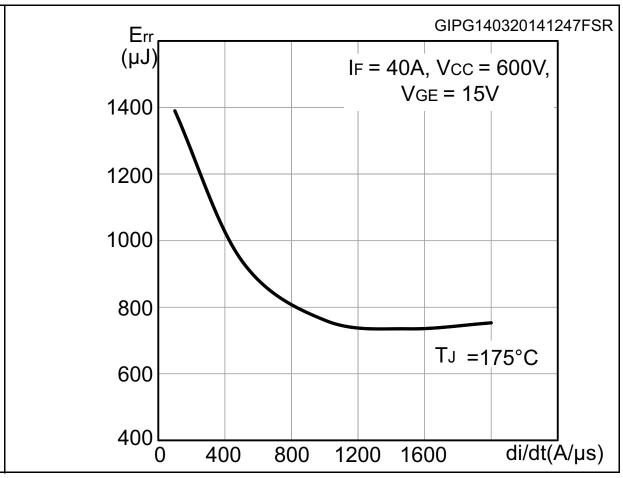


Figure 26. Short circuit time and current vs.V_{GE}

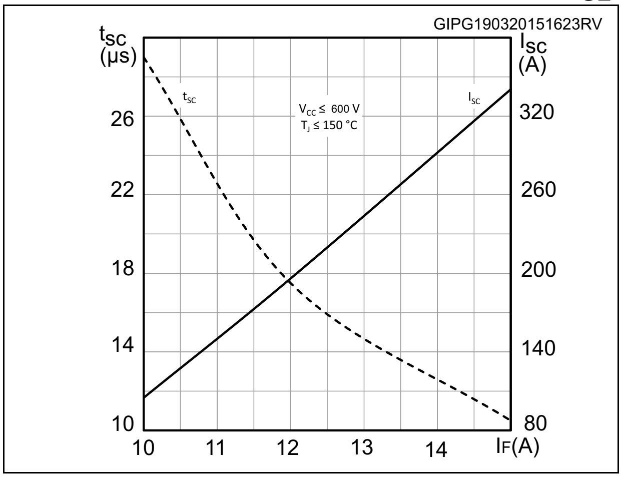


Figure 27. Thermal impedance for IGBT

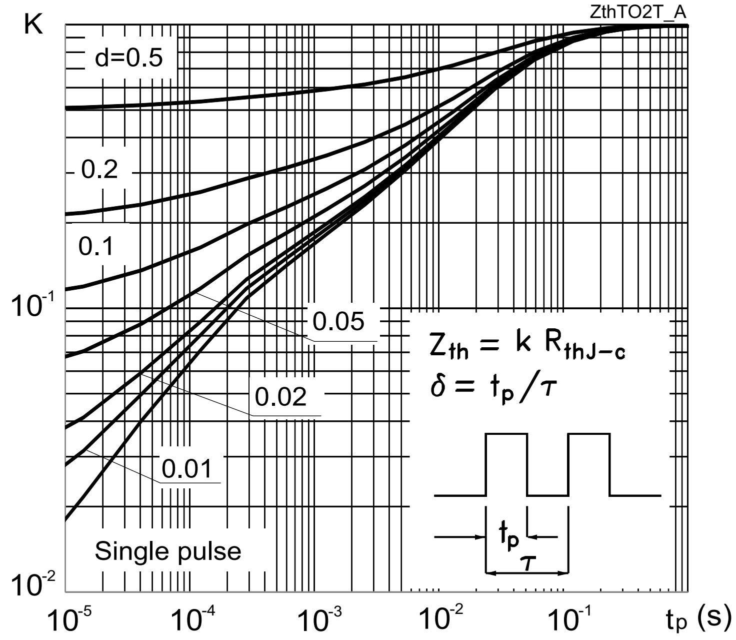
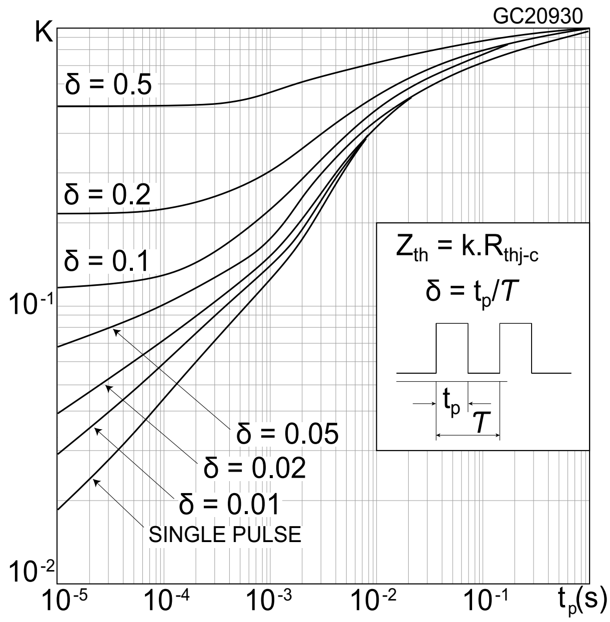


Figure 28. Thermal impedance for diode



3 Test circuits

Figure 29. Test circuit for inductive load switching

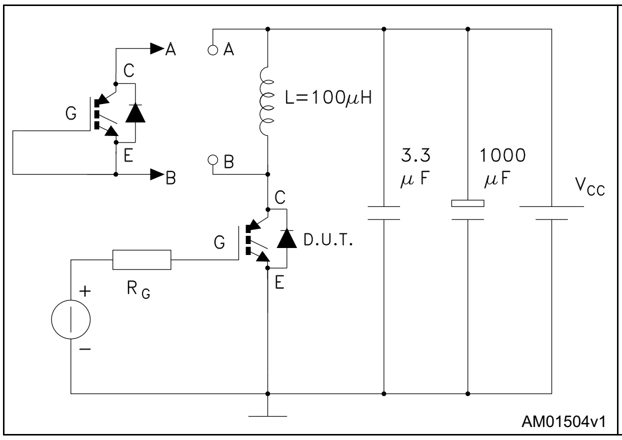


Figure 30. Gate charge test circuit

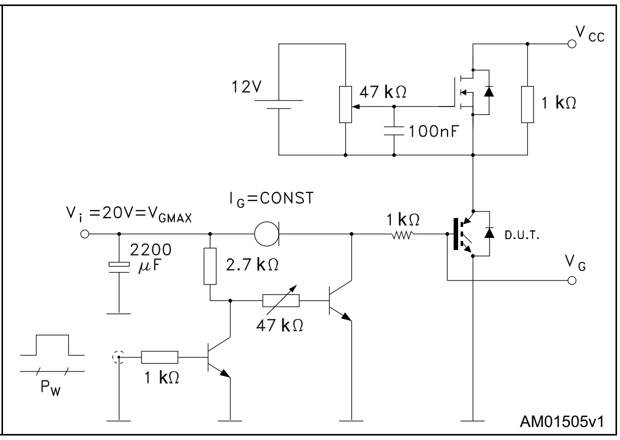


Figure 31. Switching waveform

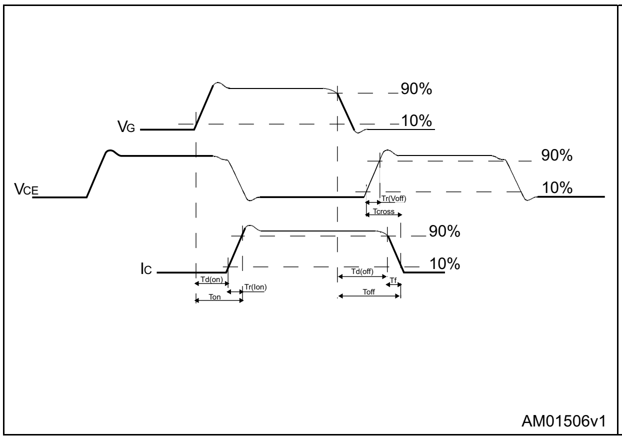
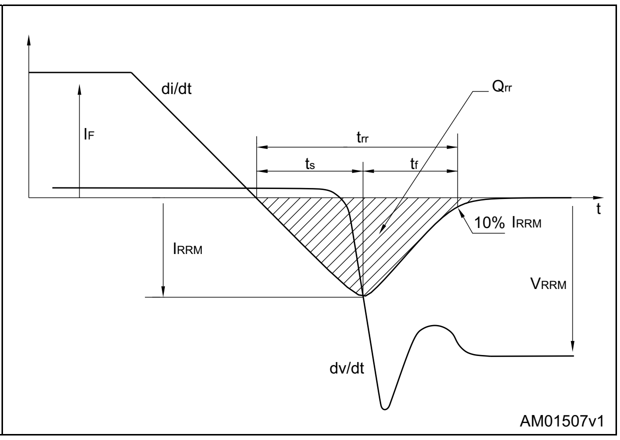


Figure 32. Diode reverse recovery waveform



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. ECOPACK® is an ST trademark.

4.1 TO-247 package information

Figure 33. TO-247 package outline

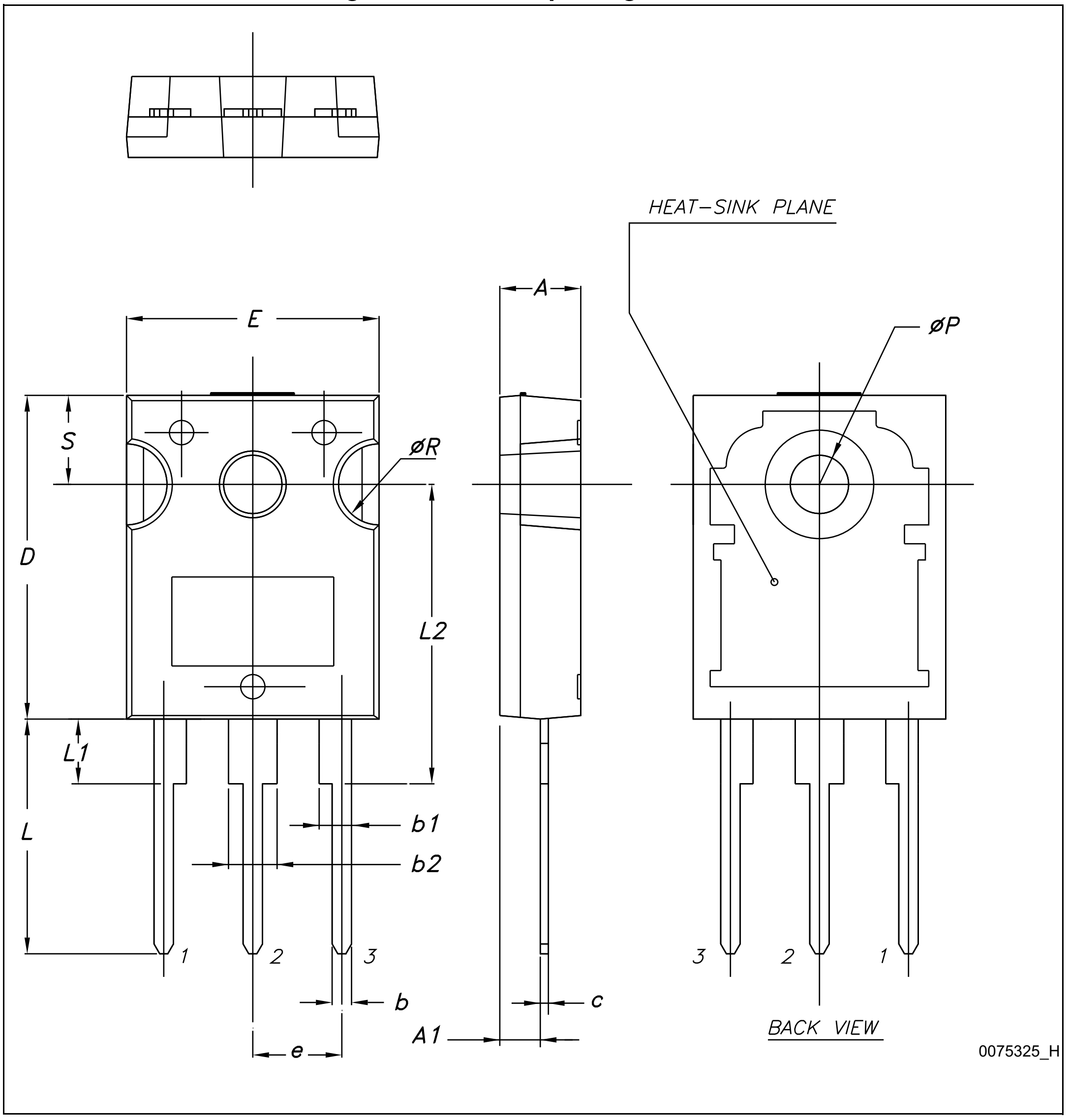


Table 8. TO-247 package mechanical data

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	
∅P	3.55		3.65
∅R	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

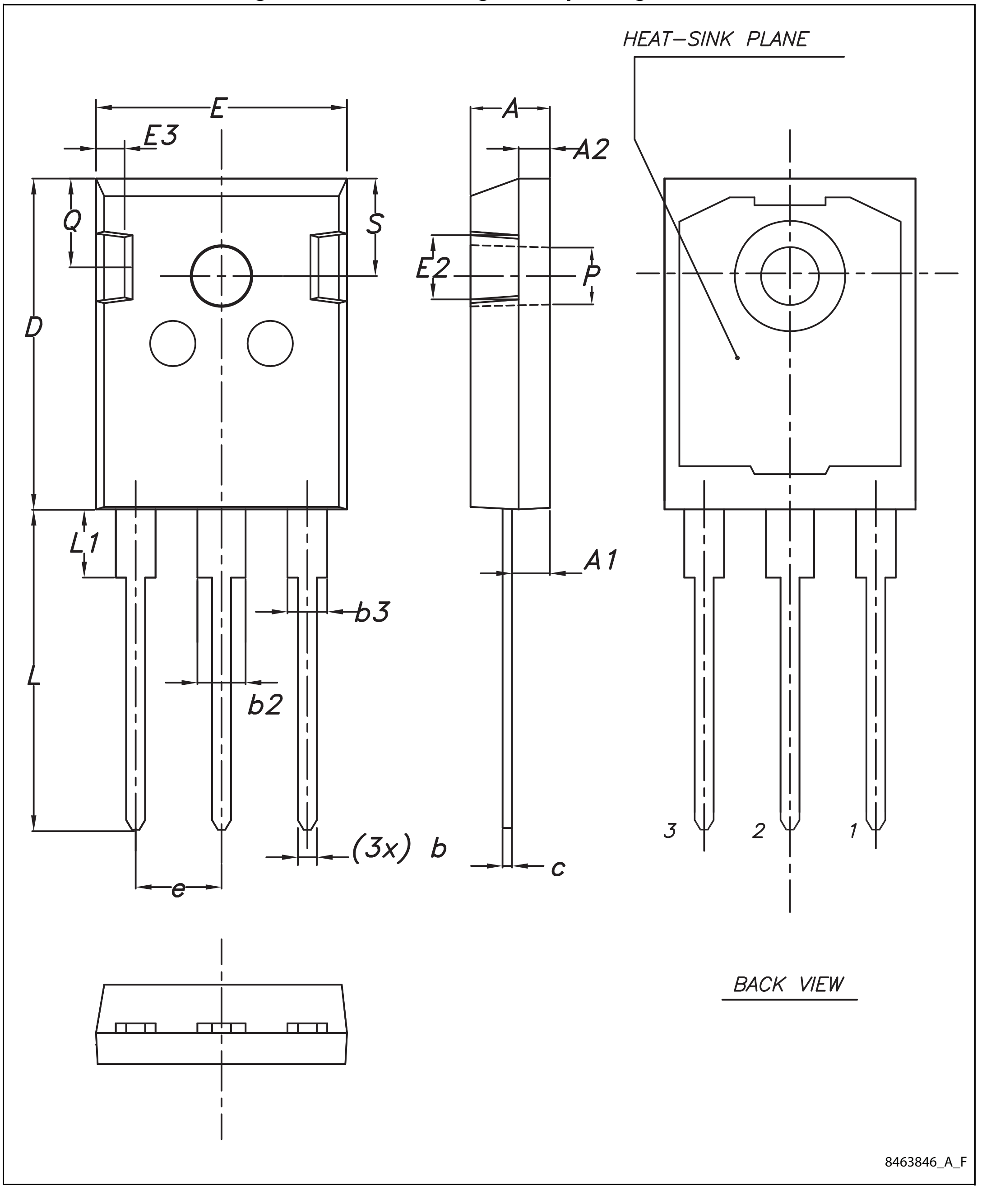


Table 9. TO-247 long leads package mechanical data

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
03-Oct-2012	1	Initial release.
29-Jan-2014	2	Updated features in cover page. Updated *Table 4: Static characteristics*, *Table 5: Dynamic characteristics* and *Table 7: Diode switching characteristics (inductive load)*. Minor text changes.
24-Mar-2014	3	Updated title and description in cover page. Updated *Table 4: Static characteristics*, *Table 5: Dynamic characteristics* and *Table 7: Diode switching characteristics (inductive load)*. Added *Section 2.1: Electrical characteristics (curves)*.
31-Mar-2015	4	Added device in TO-247 long leads Updated *4: Package information* Updated *Figure 7*, *Figure 11*, *Figure 14*, *Figure 15*, *Figure 20*, *Figure 21* and added *Figure 26*. Minor text changes.

Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- 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.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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Факс: 8 (812) 320-02-42
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Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.