STGW40H60DLFB, STGWT40H60DLFB

Trench gate field-stop IGBT, HB series 600 V, 40 A high speed

Datasheet - production data

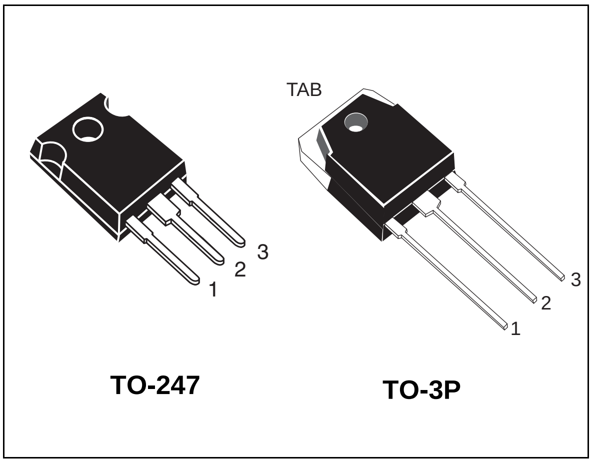
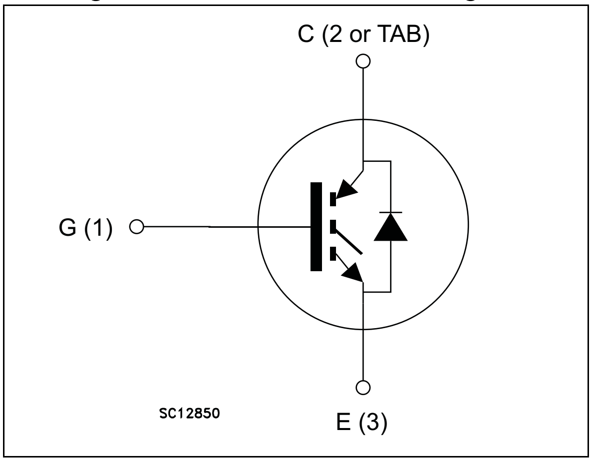


Figure 1. Internal schematic diagram



Features

- Maximum junction temperature: T_J = 175 °C
- High speed switching series
- Minimized tail current
- Low saturation voltage: $V_{CE(sat)}$ = 1.6 V (typ.) @ I_C = 40 A
- Tight parameters distribution
- Safe paralleling
- Low thermal resistance
- Low V_F soft recovery co-packaged diode
- Lead free package

Applications

- Induction heating
- Microwave oven
- Resonant converters

Description

This device is an IGBT developed using an advanced proprietary trench gate field stop structure. The device is part of the new HB series of IGBTs, which represent an optimum compromise between conduction and switching losses to maximize the efficiency of any frequency converter. 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	Packaging
STGW40H60DLFB	GW40H60DLFB	TO-247	Tube
STGWT40H60DLFB	GWT40H60DLFB	TO-3P	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	600	V
I_C	Continuous collector current at T_C = 25 °C	80	A
I_C	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 forward current at T_C = 25 °C	80	A
I_F	Continuous forward 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	283	W
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature	- 55 to 175	°C

1. Pulse width limited by maximum junction temperature

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJC}	Thermal resistance junction-case IGBT	0.53	°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_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	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 15 V, I_C = 40 A		1.6	2	V
		V_{GE} = 15 V, I_C = 40 A T_J = 125 °C		1.7		
		V_{GE} = 15 V, I_C = 40 A T_J = 175 °C		1.8		
V_F	Forward on-voltage	I_F = 40 A		1.55	1.8	V
		I_F = 40 A T_J = 125 °C		1.3		
		I_F = 40 A T_J = 175 °C		1.25		
$V_{GE(th)}$	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_{CE} = 600 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	-	5412	-	pF
C_{oes}	Output capacitance		-	198	-	pF
C_{res}	Reverse transfer capacitance		-	107	-	pF
Q_g	Total gate charge	V_{CC} = 480 V, I_C = 40 A, V_{GE} = 15 V, see *Figure 27*	-	210	-	nC
Q_{ge}	Gate-emitter charge		-	39	-	nC
Q_{gc}	Gate-collector charge		-	82	-	nC

Table 6. IGBT switching characteristics (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off delay time	V_{CE} = 400 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, see *Figure 25*		142		ns
t_f	Current fall time		-	27.6	-	ns
E_{off}(1)	Turn-off switching losses		-	363	-	µJ
$t_{d(off)}$	Turn-off delay time	V_{CE} = 400 V, I_C = 40 A, R_G = 10 Ω, V_{GE} = 15 V, T_J = 175 °C, see *Figure 25*		141		ns
t_f	Current fall time		-	61	-	ns
E_{off}(1)	Turn-off switching losses		-	764	-	µJ

1. Turn-off losses include also the tail of the collector current.

Table 7. IGBT switching characteristics (capacitive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{off}(1)	Turn-off switching losses	V_{CC} = 320 V, R_G = 10 Ω, I_C = 40 A, L = 100 µH, C_{snub} = 20 nF, see *Figure 26*	-	190	-	µJ
		V_{CC} = 320 V, R_G = 10 Ω, I_C = 40 A, L = 100 µH, C_{snub} = 20 nF, T_J = 175 °C, see *Figure 26*	-	290	-	

1. Turn-off losses include also the tail of the collector current.

2.1 Electrical characteristics (curves)

Figure 2. Power dissipation vs. case temperature

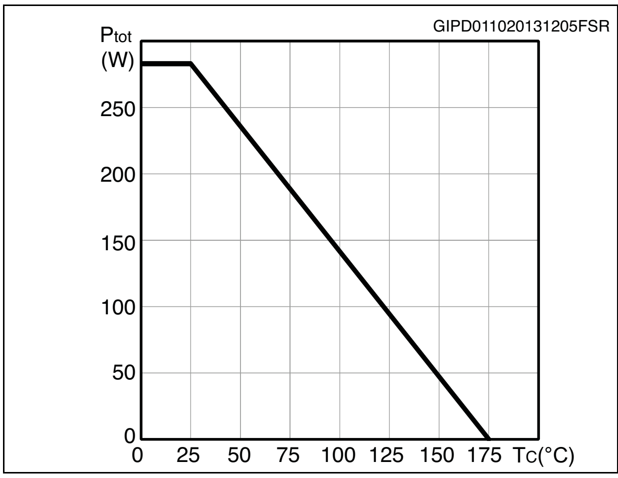


Figure 3. Collector current vs. case temperature

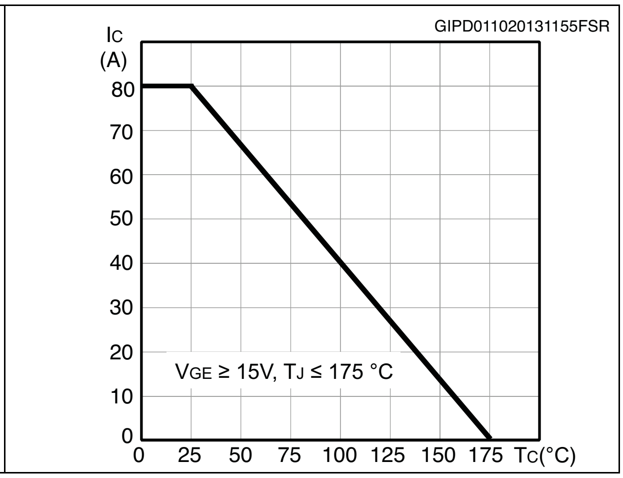


Figure 4. Output characteristics (T_J = 25°C)

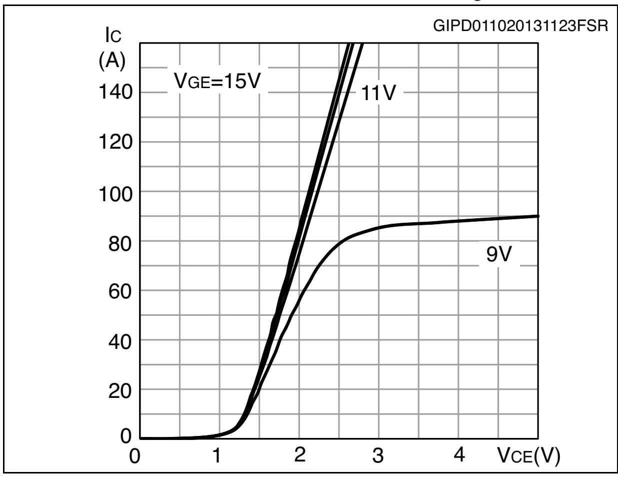


Figure 5. Output characteristics (T_J = 175°C)

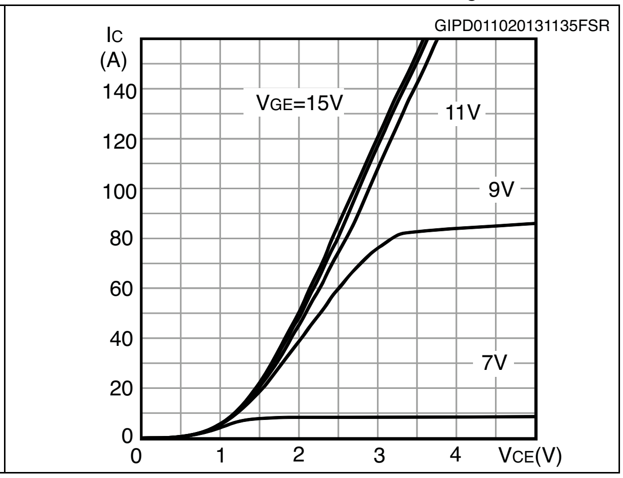


Figure 6. $V_{CE(sat)}$ vs. junction temperature

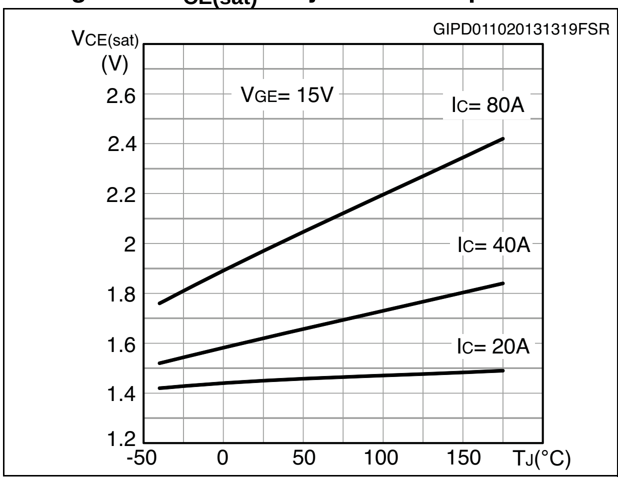


Figure 7. $V_{CE(sat)}$ vs. collector current

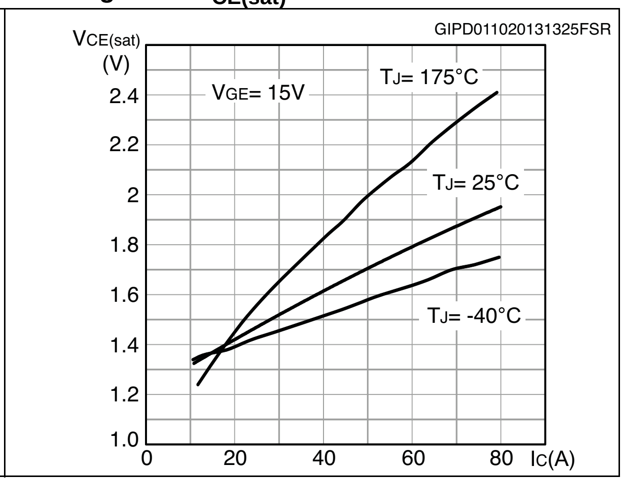


Figure 8. Collector current vs. switching frequency

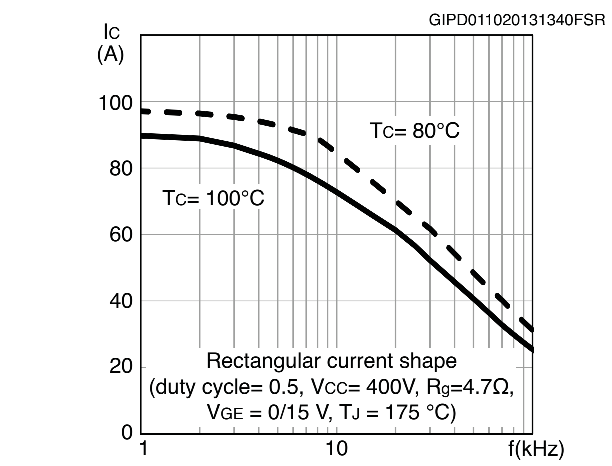


Figure 9. Forward bias safe operating area

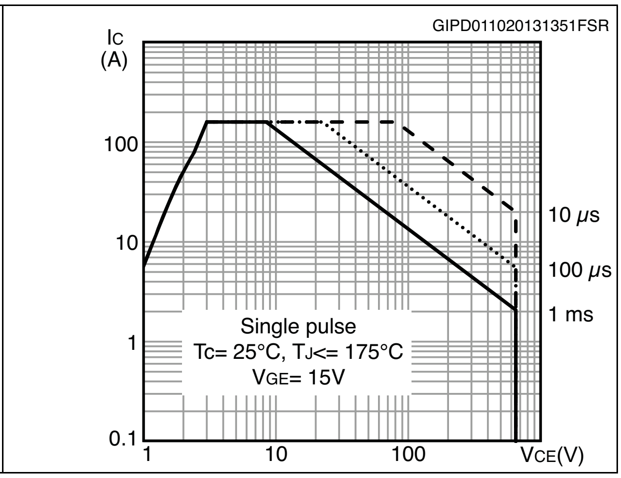


Figure 10. Transfer characteristics

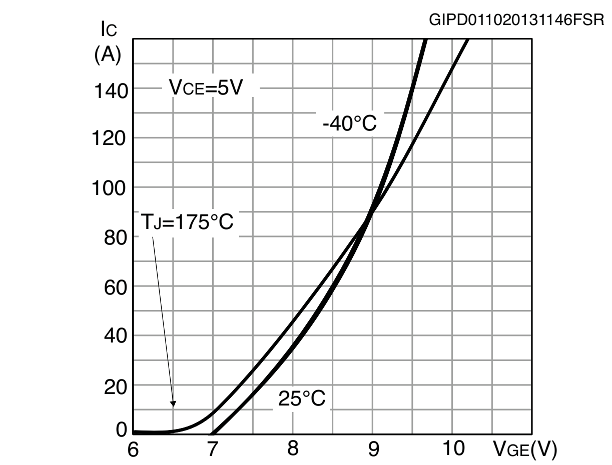


Figure 11. Diode V_F vs. forward current

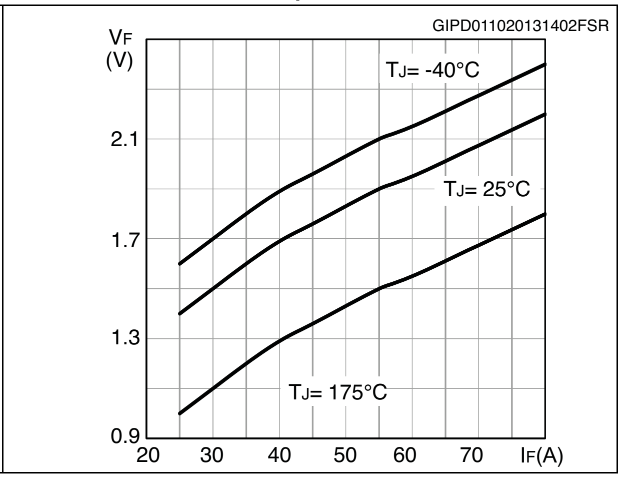


Figure 12. Normalized $V_{GE(th)}$ vs junction temperature

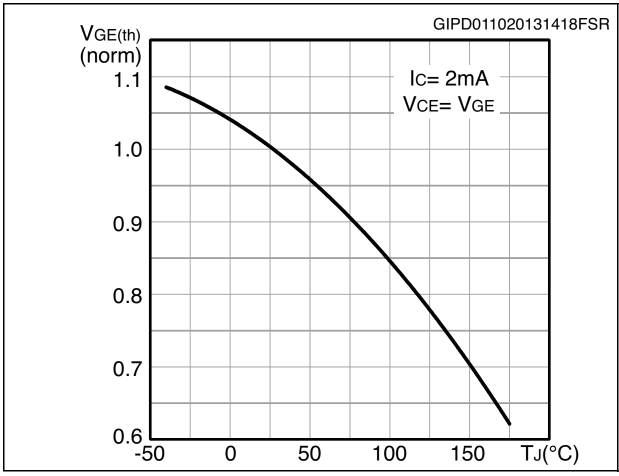


Figure 13. Normalized $V_{(BR)CES}$ vs. junction temperature

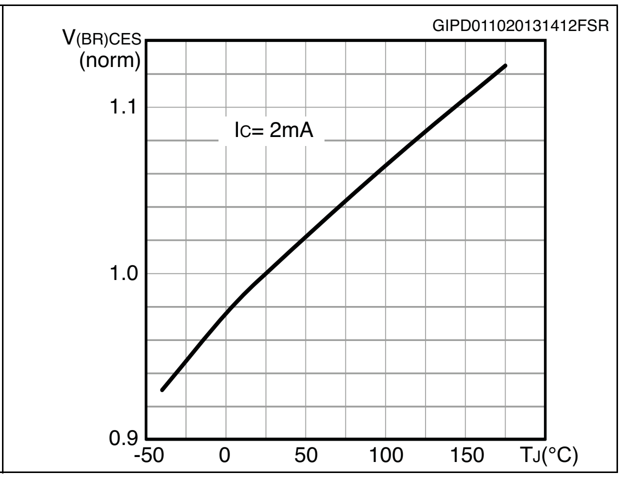


Figure 14. Capacitance variation

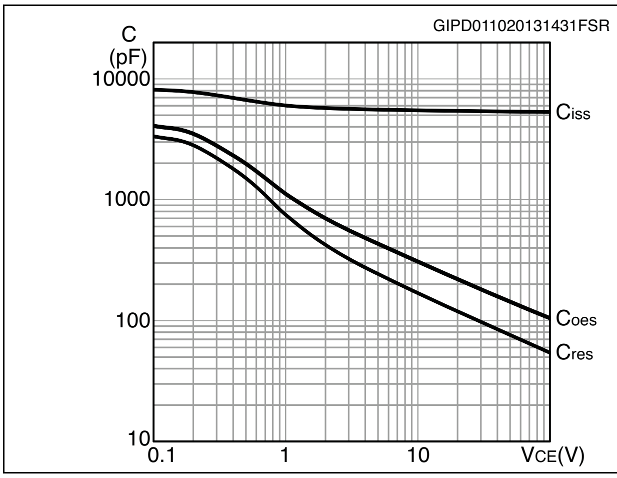


Figure 15. Gate charge vs. gate-emitter voltage

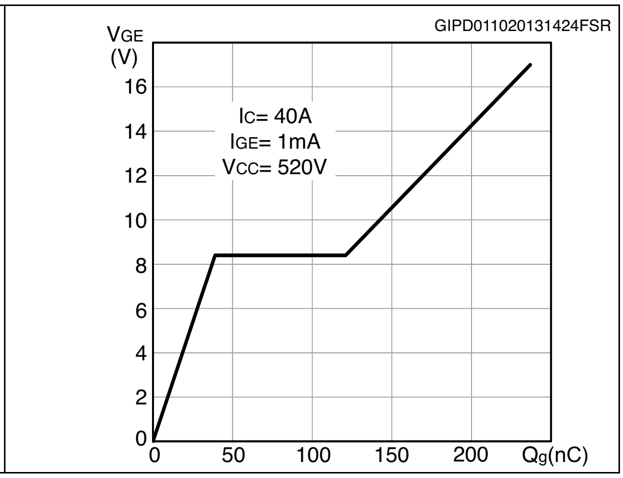


Figure 16. Switching-off loss vs collector current

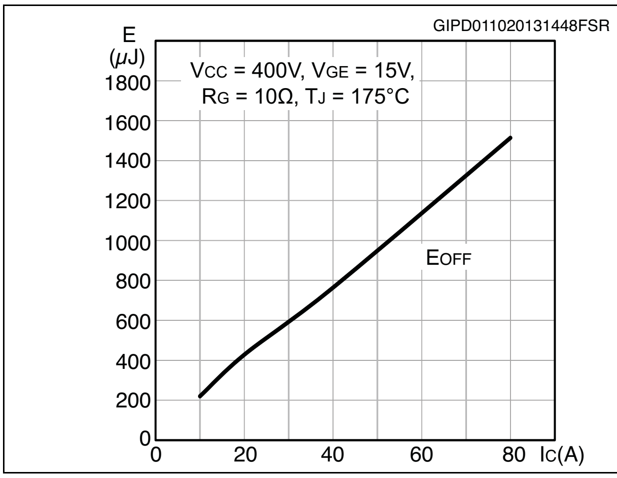


Figure 17. Switching-off loss vs gate resistance

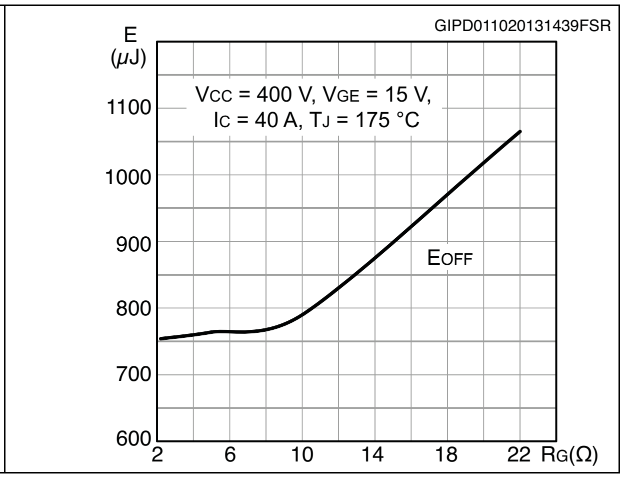


Figure 18. Switching-off loss vs temperature

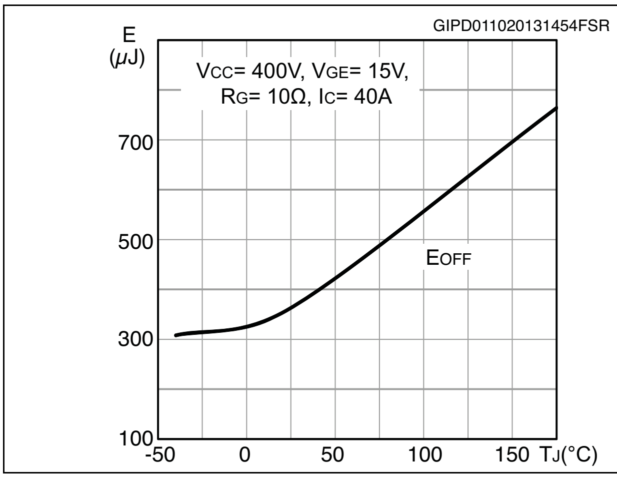


Figure 19. Switching-off loss vs collector-emitter voltage

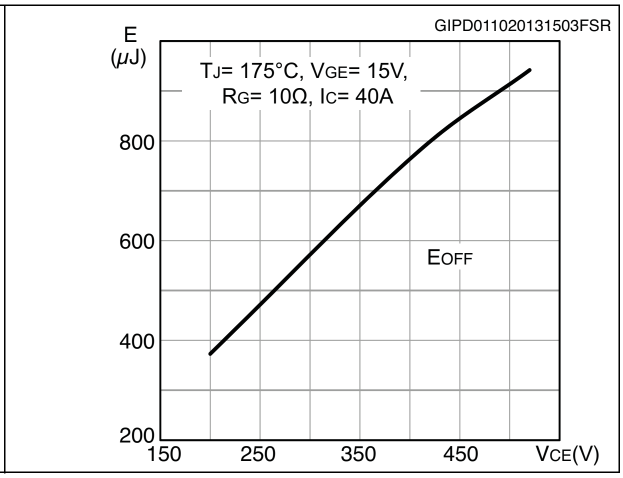


Figure 20. Switching times vs. collector current

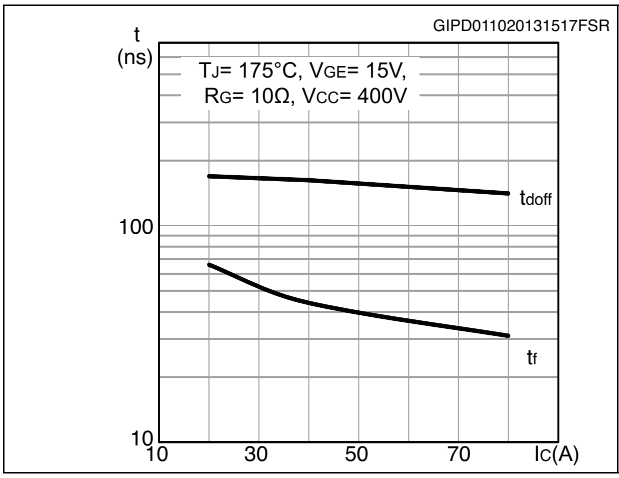


Figure 21. Switching times vs. gate resistance

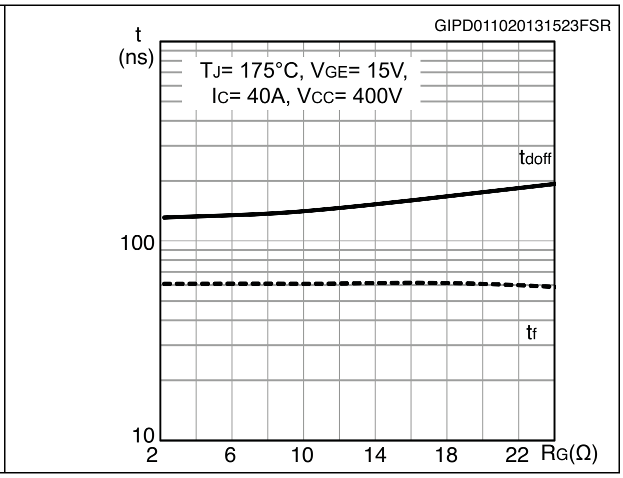


Figure 22. Switching-off losses vs. capacitive load

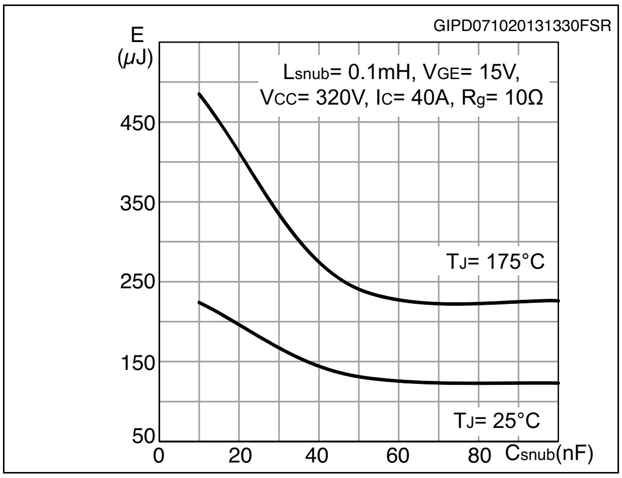


Figure 23. Thermal impedance for IGBT

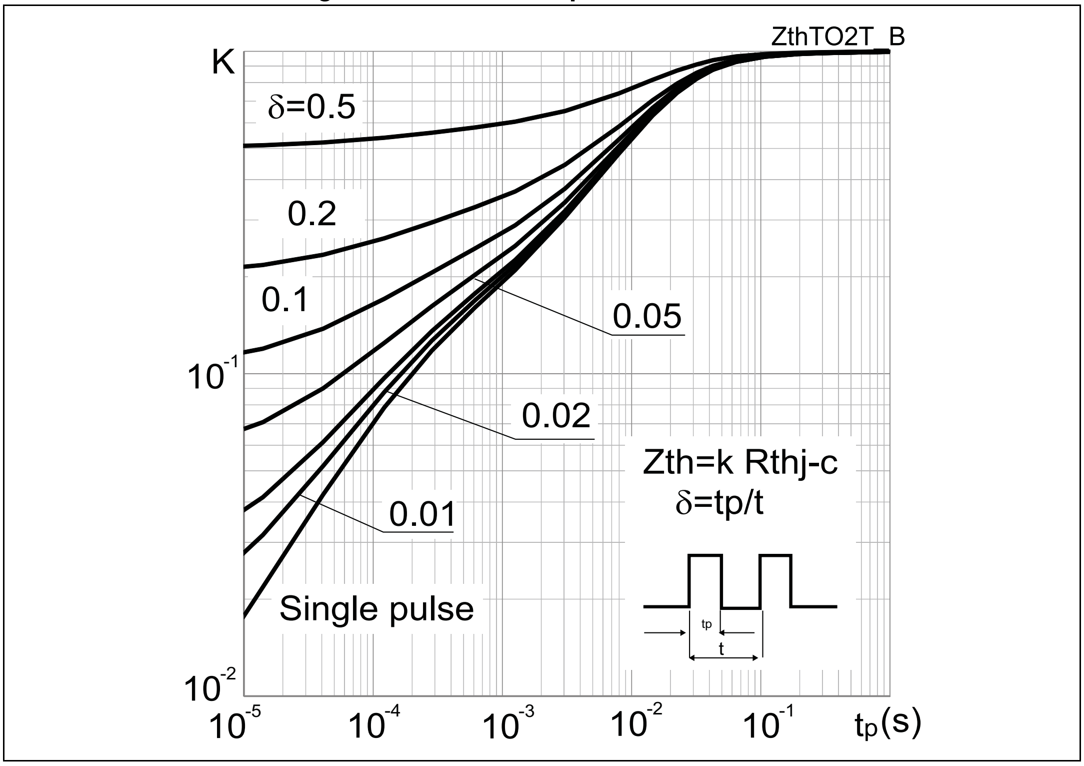
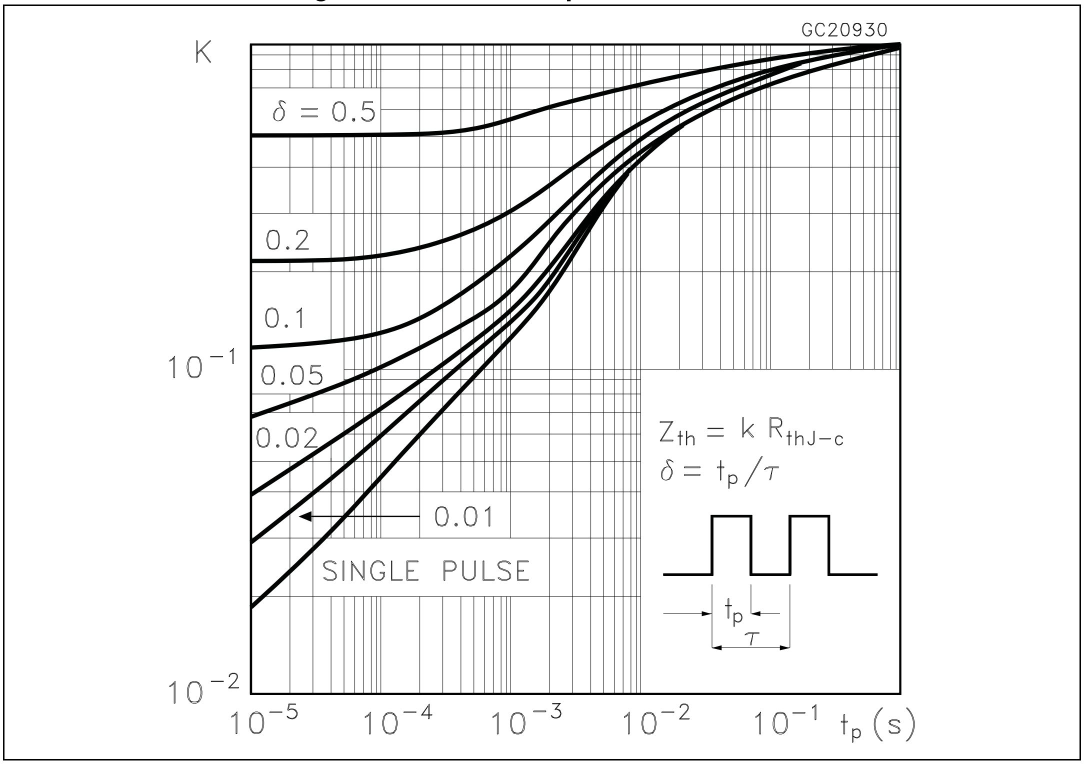


Figure 24. Thermal impedance for diode



3 Test circuits

Figure 25. Test circuit for inductive load switching

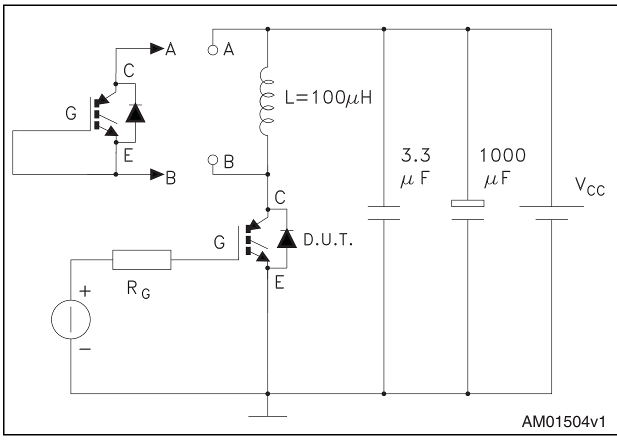


Figure 26. Test circuit for capacitive load switching

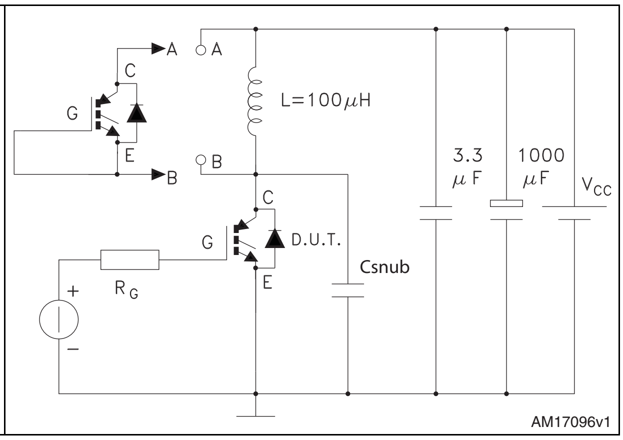


Figure 27. Gate charge test circuit

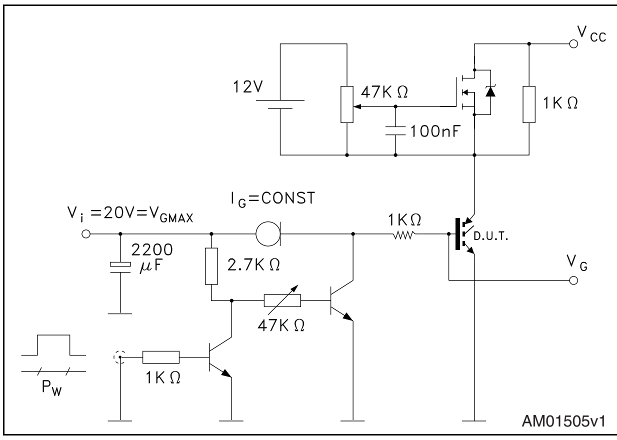


Figure 28. Switching waveform

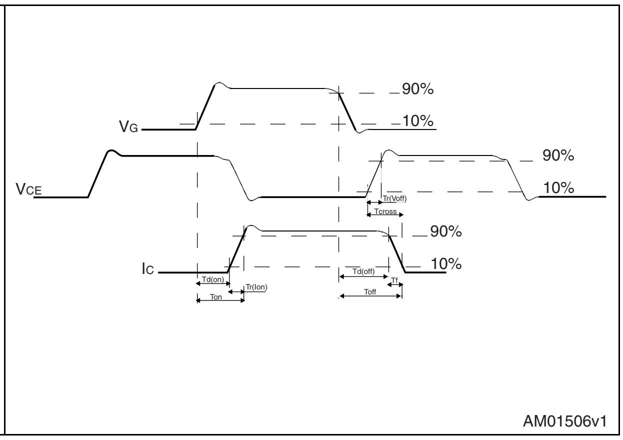
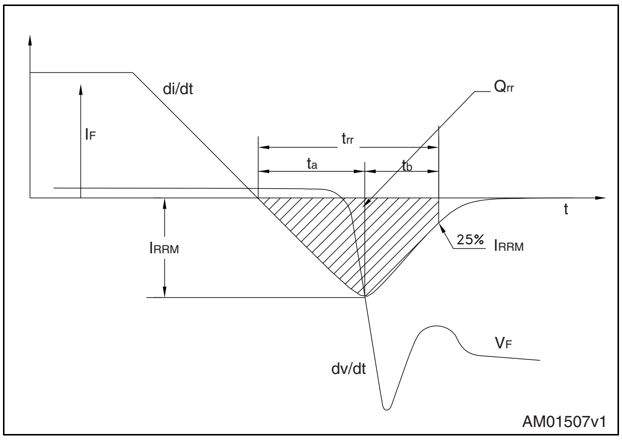


Figure 29. Diode recovery time waveform



4 Package mechanical data

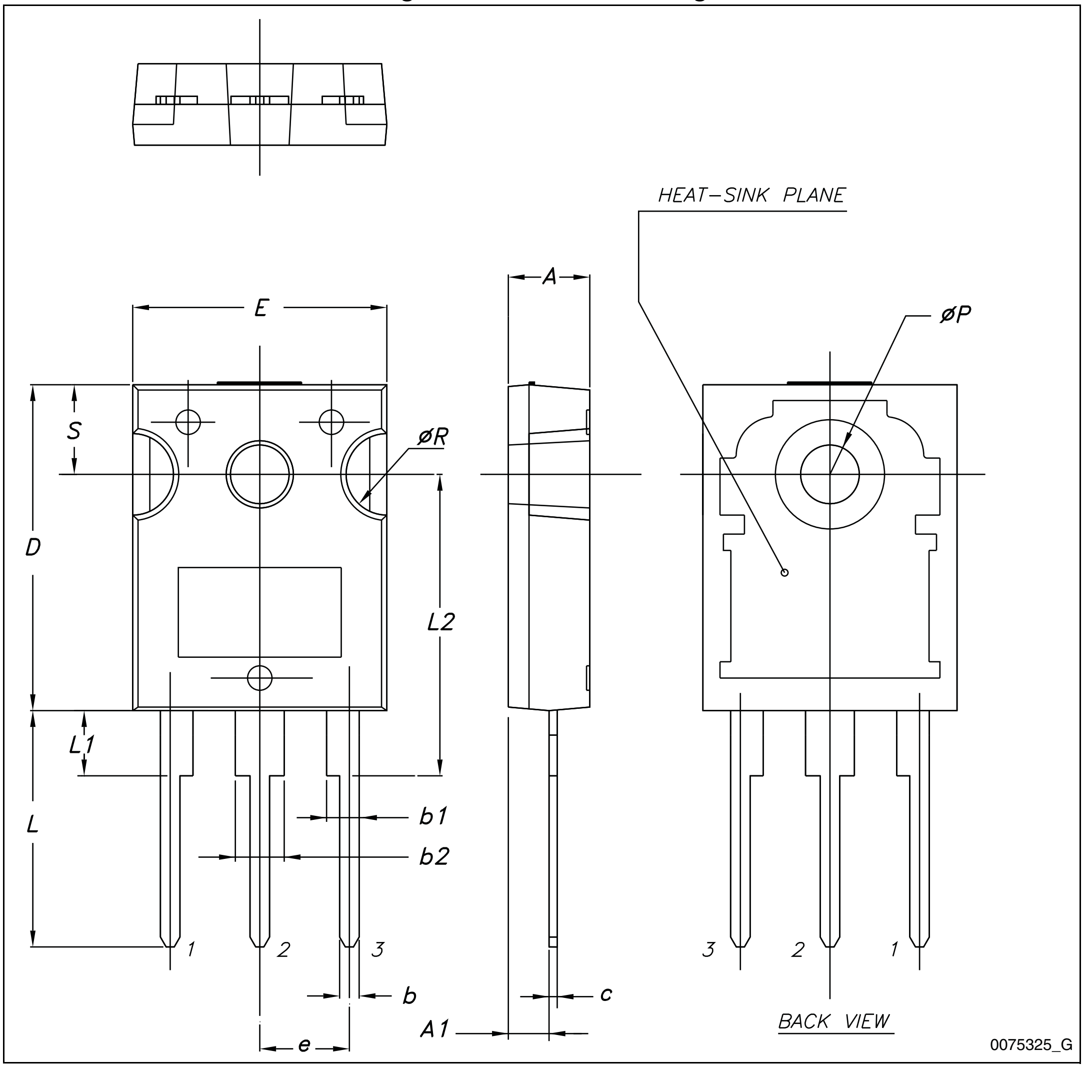
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

4.1 TO-247, STGW40H60DLFB

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 30. TO-247 drawing

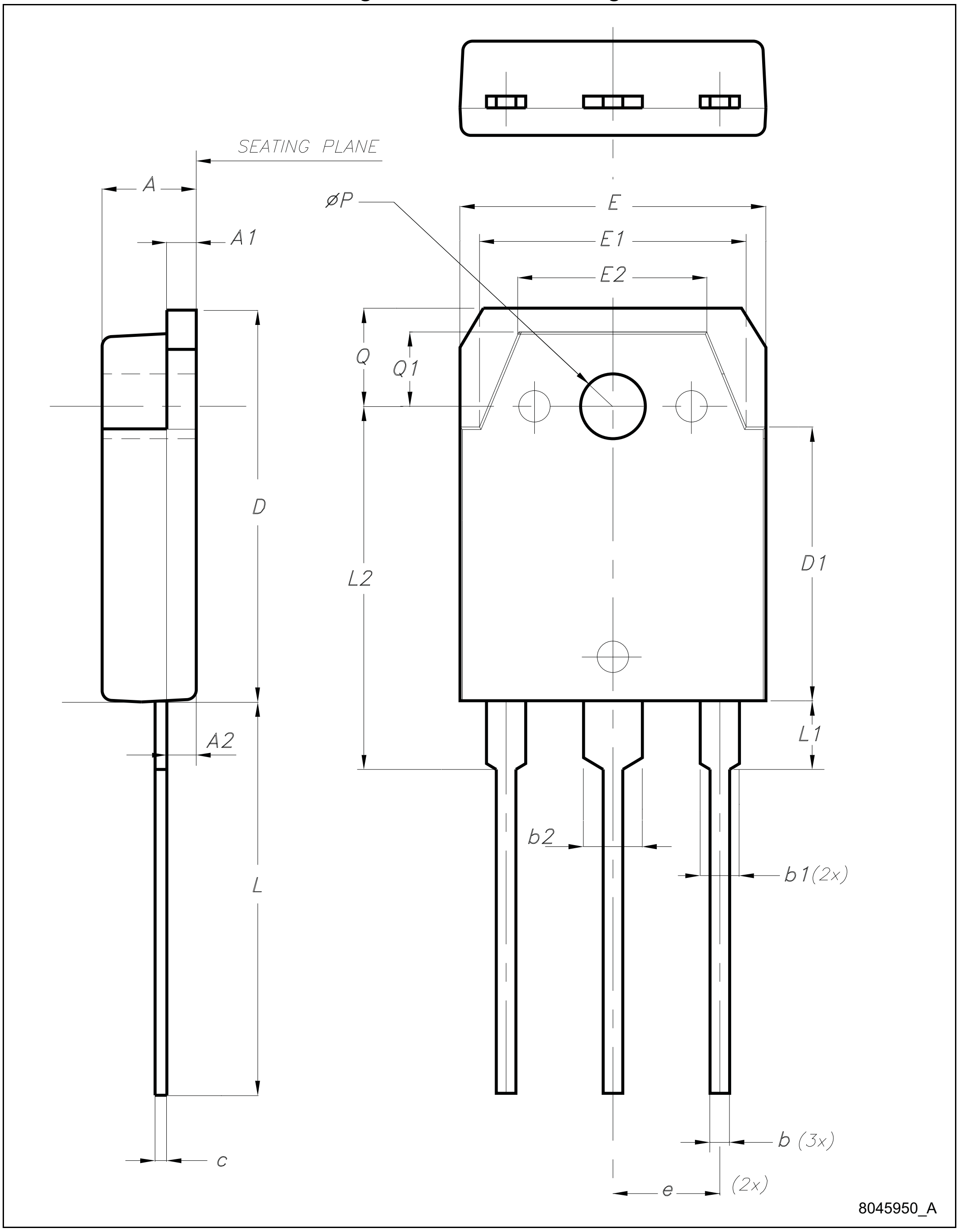


4.2 TO-3P, STGWT40H60DLFB

Table 9. 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 31. TO-3P drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
12-Mar-2013	1	Initial release.
07-Oct-2013	2	Document status changed from preliminary to production data. Added *Section 2.1: Electrical characteristics (curves)*. Minor text changes.
13-Mar-2014	3	Updated title and description in cover page.
18-Mar-2014	4	Updated title in cover page and *Section 4: Package mechanical data*.

ООО «ЛайфЭлектроникс» "LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

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- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

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- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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