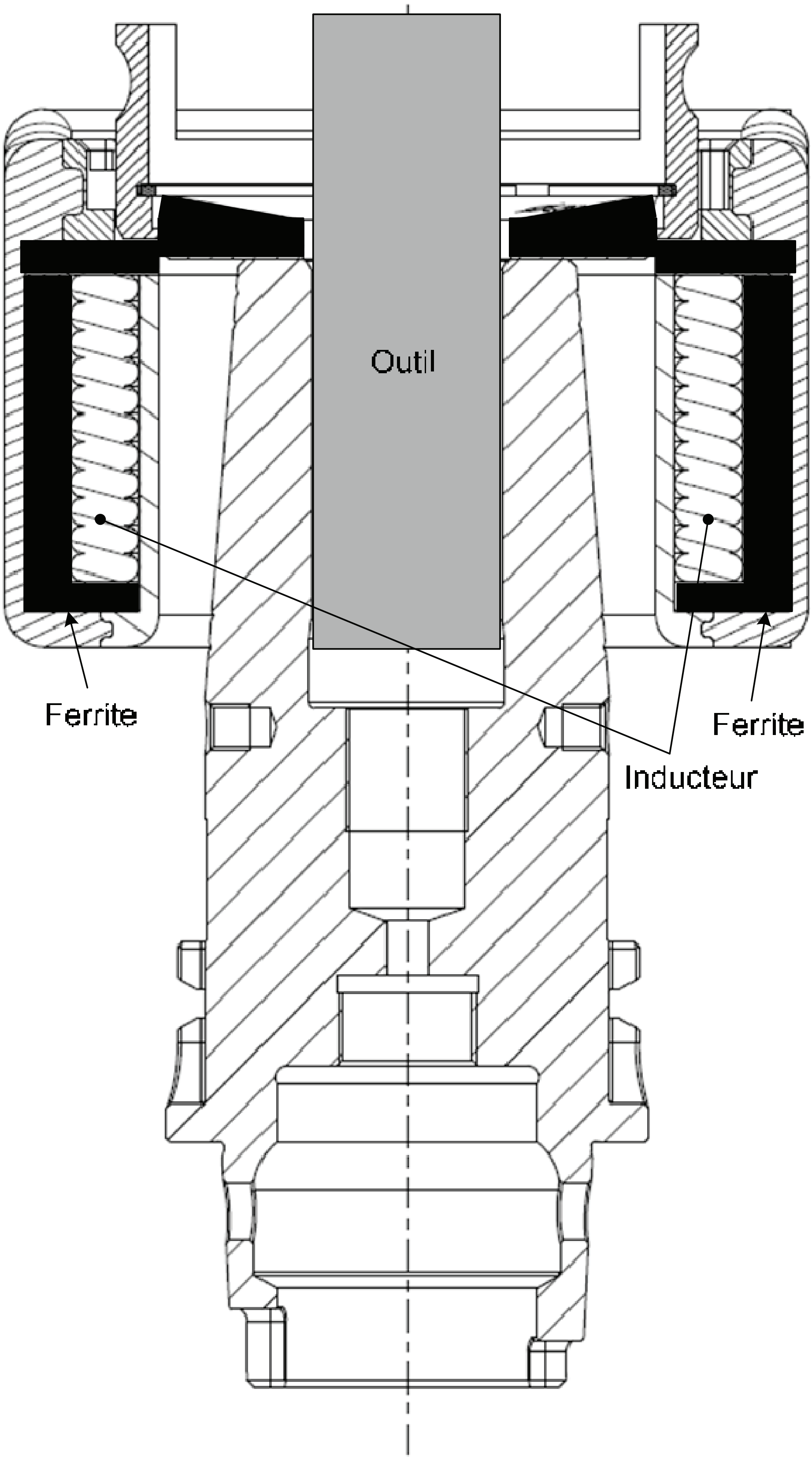
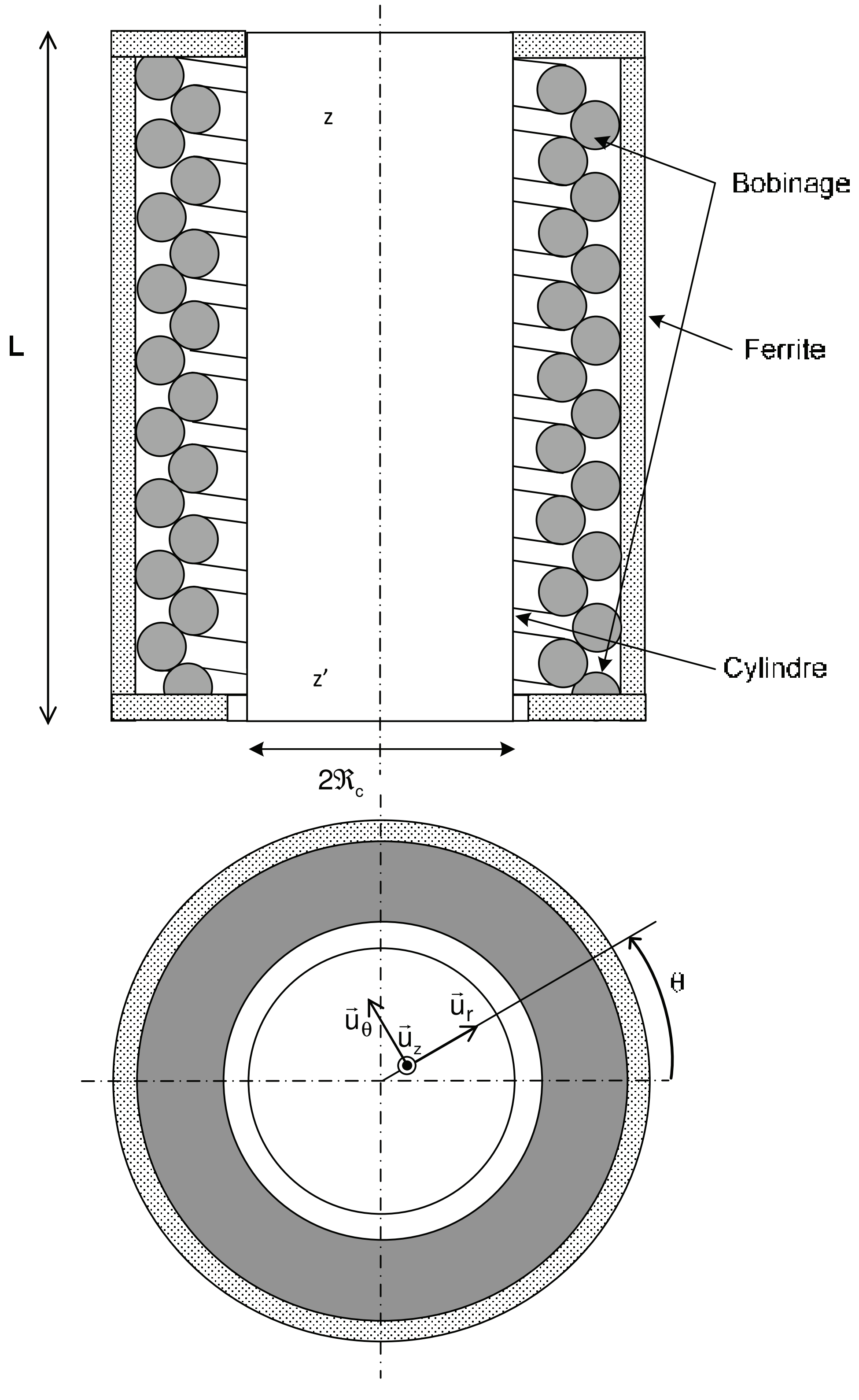
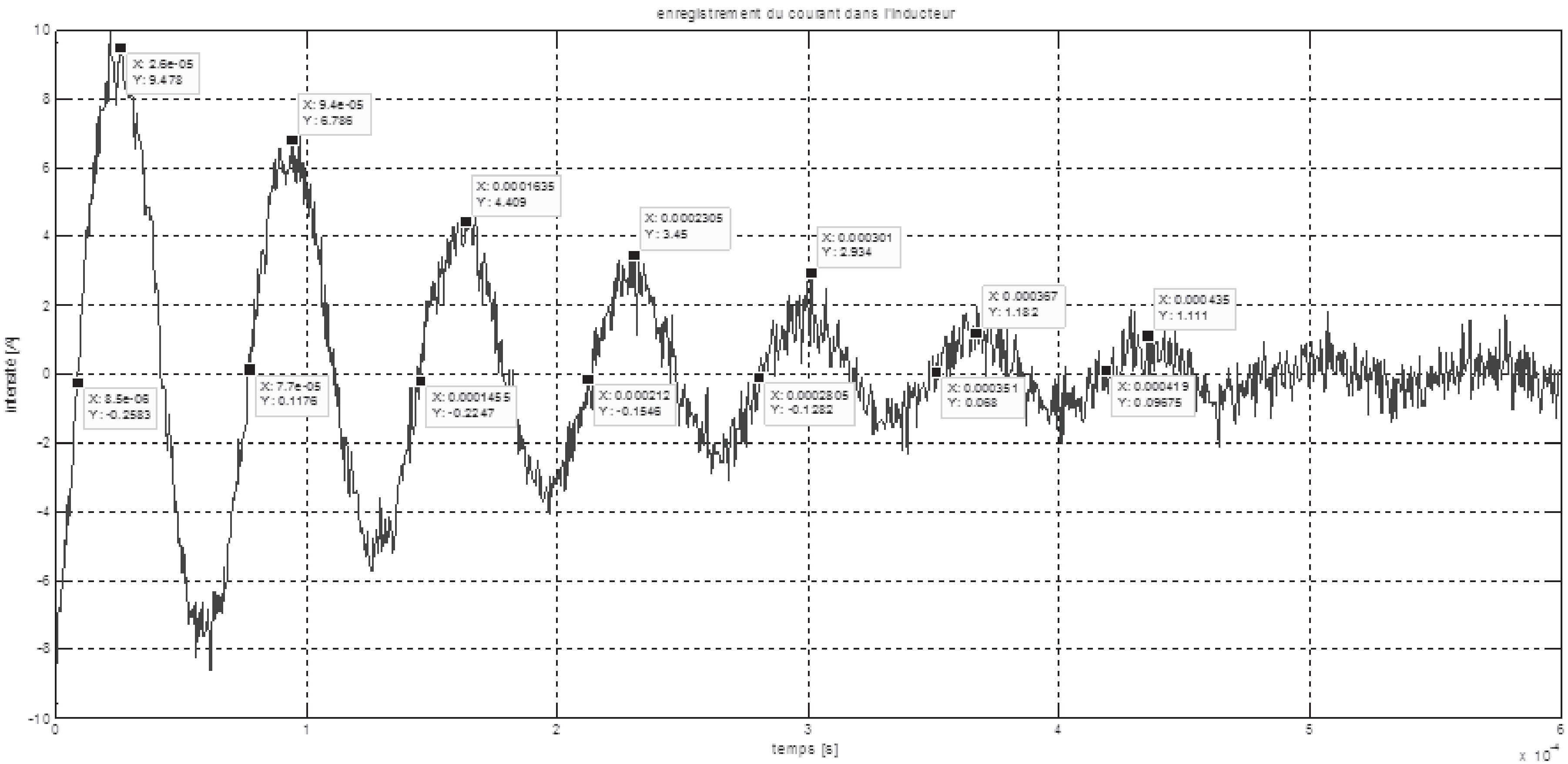
Document ressource DR C1
Vue en coupe du porte-outil



Document ressource DR C2
Constitution de l'inducteur



Document ressource DR D1 - Enregistrement du courant inducteur



Passage par zéro		Autres valeurs mesurées		
Date (µs)	Intensité (A)	Numéro	Date (µs)	Intensité (A)
8,5	-0,26	1	26	9,418
77	0,118	2	94	6,786
145,5	-0,225	3	163,5	4,409
212	-0,155	4	230,5	3,450
280,5	-0,128	5	301	2,934
351	0,068	6	367	1,182
419	0,097	7	435	1,111

Document ressource DR D2
Formulaire (feuille 1 / 2)

Soient $\mathbf{A} = \begin{pmatrix} 0 & 1 \\ -\omega_0^2 & -2\zeta\omega_0 \end{pmatrix}$ et $B = \begin{pmatrix} 0 \\ \omega_0^2 \end{pmatrix}$ avec $\zeta < 1$.

Le facteur de qualité Q est défini par $Q = \dfrac{1}{2\zeta}$

On a les résultats suivants :

1.

$$\mathbf{A}^{-1} = \frac{1}{{\omega_0}^2} \cdot \begin{pmatrix} -2\zeta\omega_0 & -1 \\ {\omega_0}^2 & 0 \end{pmatrix}$$

$$e^{At} = e^{-\zeta.\omega_0.t} \begin{pmatrix} \cos(\omega_1.t) + \dfrac{\zeta}{\sqrt{1-\zeta^2}} \sin(\omega_1.t) & \dfrac{\sin(\omega_1.t)}{\omega_1} \\ \dfrac{-\omega_0.\sin(\omega_1.t)}{\sqrt{1-\zeta^2}} & \cos(\omega_1.t) - \dfrac{\zeta}{\sqrt{1-\zeta^2}} \sin(\omega_1.t) \end{pmatrix}$$

avec : $\omega_1 = \omega_0.\sqrt{1-\zeta^2}$

2.

$$\int_0^t \mathbf{e}^{\mathbf{A}.\tau}.\mathbf{B}.d\tau = \mathbf{A}^{-1} \cdot \left(e^{\mathbf{A}t} - \mathbf{I}_2\right) \cdot \mathbf{B} = \begin{pmatrix} 1 - e^{-\zeta.\omega_0.t}.\left(\dfrac{\zeta}{\sqrt{1-\zeta^2}}.\sin(\omega_1.t) + \cos(\omega_1.t)\right) \\ e^{-\zeta.\omega_0.t}.\dfrac{\omega_0}{\sqrt{1-\zeta^2}}.\sin(\omega_1.t) \end{pmatrix}$$

3.

La transformée de Laplace de :

$$f(t) = \frac{\omega_0}{\sqrt{1-\zeta^2}} e^{-\zeta.\omega_0.t} \sin\left(\omega_0\sqrt{1-\zeta^2}.t\right) \quad \text{est :} \quad F(p) = \frac{1}{1 + \dfrac{2\zeta.p}{\omega_0} + \dfrac{p^2}{\omega_0^2}}$$

La transformée de Laplace de :

$$g(t) = \frac{-\omega_0^2}{\sqrt{1-\zeta^2}} e^{-\zeta.\omega_0.t} \sin\left(\omega_0\sqrt{1-\zeta^2}.t - \text{Arccos}\zeta\right) \quad \text{est :} \quad G(p) = \frac{p}{1 + \dfrac{2\zeta.p}{\omega_0} + \dfrac{p^2}{\omega_0^2}}$$

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Document ressource DR D2
Formulaire (feuille 2 / 2)

4.
La réponse indicielle r(t) de :

$$H(p) = \frac{1}{1 + 2\zeta \frac{p}{\omega_0} + \frac{p^2}{\omega_0^{\ 2}}}$$

s'écrit :

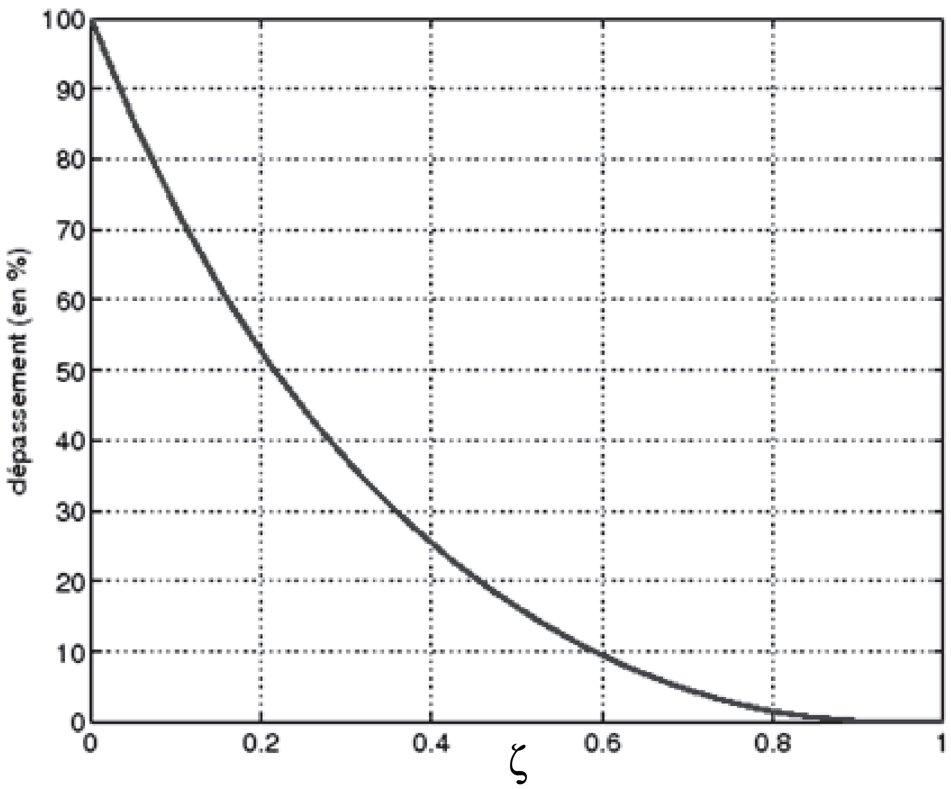
$$r(t) = 1 - \frac{e^{-\zeta\omega_0 t}}{\sqrt{1-\zeta^2}} \sin\left(\omega_1 t + \mathrm{Arccos}(\zeta)\right)$$

5.

Le premier dépassement de la réponse indicielle k(t) a lieu à l'instant t_1 et vaut D avec :

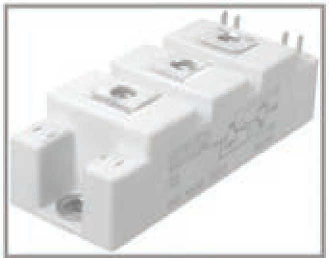
$$t_1 = \frac{\pi}{\omega_0 \sqrt{1-\zeta^2}}$$

$$D\% = 100 \cdot \exp\left(\frac{-\zeta\pi}{\sqrt{1-\zeta^2}}\right)$$



Document ressource DR E1-1
Documentation IGBT feuille 1/2

SKM 195GB066D



SEMITRANS® 2

Trench IGBT Modules

SKM195GB066D

Absolute Maximum Ratings			T_{case} = 25°C, unless otherwise specified	
Symbol	**Conditions**		**Values**	**Units**
IGBT				
V_{CES}	T_j = 25 °C		600	V
I_C	T_j = 175 °C	T_c = 25 °C	265	A
		T_c = 80 °C	200	A
I_{CRM}	I_{CRM}=2xI_{Cnom}		400	A
V_{GES}			± 20	V
t_{psc}	V_{CC} = 360 V; V_{GE} ≤ 15 V; VCES < 600 V	T_j = 150 °C	6	µs
Inverse Diode				
I_F	T_j = 175 °C	T_c = 25 °C	200	A
		T_c = 80 °C	130	A
I_{FRM}	I_{FRM}=2xI_{Fnom}		400	A
I_{FSM}	t_p = 10 ms; sin.	T_j = 175 °C	1400	A
Module				
$I_{t(RMS)}$			200	A
T_{vj}			- 40 ... + 175	°C
T_{stg}			- 40 ... + 125	°C
V_{isol}	AC, 1 min.		4000	V

Features

- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability, self limiting to 6 x I_C

Typical Applications*

- AC inverter drives
- UPS
- Electronic welders

Remarks

- Case temperature limited to T_c = 125°C max., product rel. results valid for T_j ≤150°C
- SC data: Use of soft R_G necessary!
- Take care of over-voltage caused by stray induct.

Characteristics			T_{case} = 25°C, unless otherwise specified			
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
IGBT						
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 3,2 mA		5	5,8	6,5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = V_{CES}	T_j = 25 °C		0,13	0,38	mA
V_{CE0}		T_j = 25 °C		0,9	1	V
		T_j = 150 °C		0,85	0,9	V
r_{CE}	V_{GE} = 15 V	T_j = 25°C		2,8	4,5	mΩ
		T_j = 150°C		4,3	6	mΩ
$V_{CE(sat)}$	I_{Cnom} = 200 A, V_{GE} = 15 V	T_j = 25°$C_{chiplev.}$		1,45	1,9	V
		T_j = 150°$C_{chiplev.}$		1,7	2,1	V
C_{ies}	V_{CE} = 25, V_{GE} = 0 V	f = 1 MHz		12,3		nF
C_{oes}				0,77		nF
C_{res}				0,37		nF
Q_G	V_{GE} = -8V...+15V			1500		nC
R_{Gint}	T_j = °C			2		Ω
$t_{d(on)}$	R_{Gon} = 3 Ω	V_{CC} = 300V		160		ns
t_r		I_C= 200A		68		ns
E_{on}				14		mJ
$t_{d(off)}$	R_{Goff} = 3 Ω	T_j = 150 °C		520		ns
t_f		V_{GE} = -8V/+15V		49		ns
E_{off}				8		mJ
$R_{th(j-c)}$	per IGBT				0,22	K/W

SEMITRANS® 2

Trench IGBT Modules

SKM195GB066D

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Units**
Inverse Diode						
V_F = V_{EC}	I_{Fnom} = 200 A; V_{GE} = 0 V	T_j = 25 °$C_{chiplev.}$		1,4	1,6	V
V_{F0}		T_j = 25 °C		0,95	1	V
r_F		T_j = 25 °C		2,3	3	mΩ
I_{RRM}	I_F = 200 A	T_j = 150 °C		100		A
Q_{rr}	di/dt = 2000 A/µs			30		µC
E_{rr}	V_{GE} = -8 V; V_{CC} = 300 V			5,6		mJ
$R_{th(j-c)D}$	per diode				0,4	K/W
Module						
L_{CE}					30	nH
$R_{CC'+EE'}$	res., terminal-chip	T_{case}= 25 °C		0,75		mΩ
		T_{case}= 125 °C		1		mΩ
$R_{th(c-s)}$	per module				0,05	K/W
M_s	to heat sink M6		3		5	Nm
M_t	to terminals M5		2,5		5	Nm
w					150	g

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SKM 195GB066D

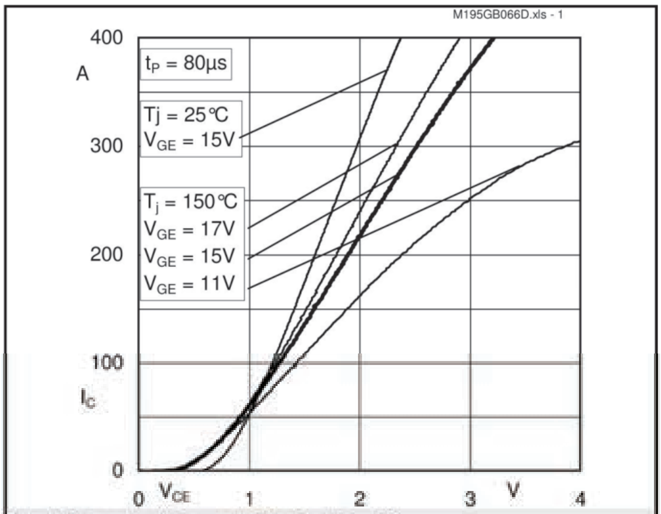

Fig. 1 Typ. output characteristic, inclusive $R_{CC'+EE'}$

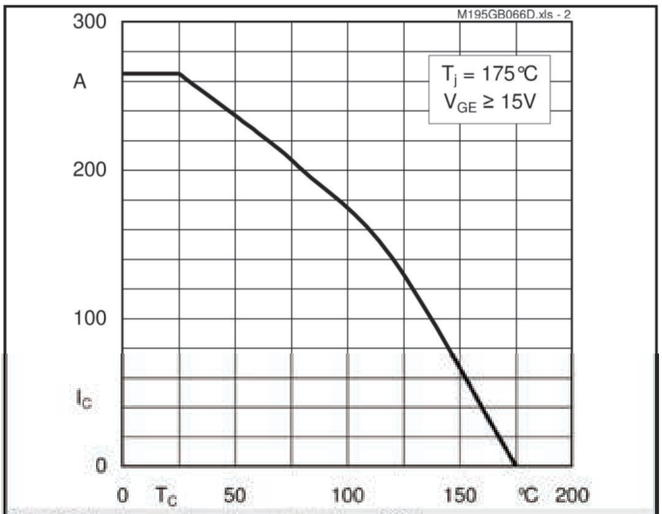

Fig. 2 Rated current vs. temperature $I_C = f(T_C)$

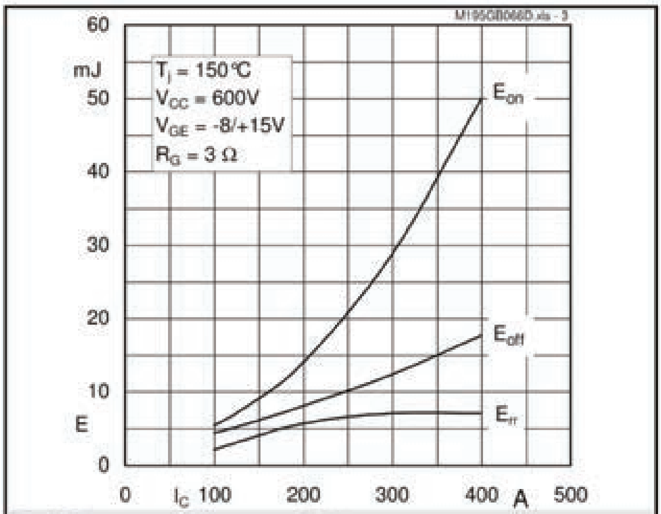

Fig. 3 Typ. turn-on /-off energy = f (I_C)

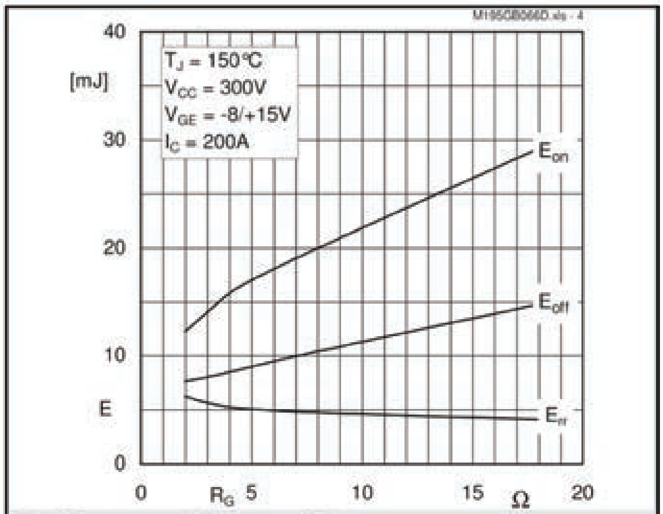

Fig. 4 Typ. turn-on /-off energy = f (R_G)

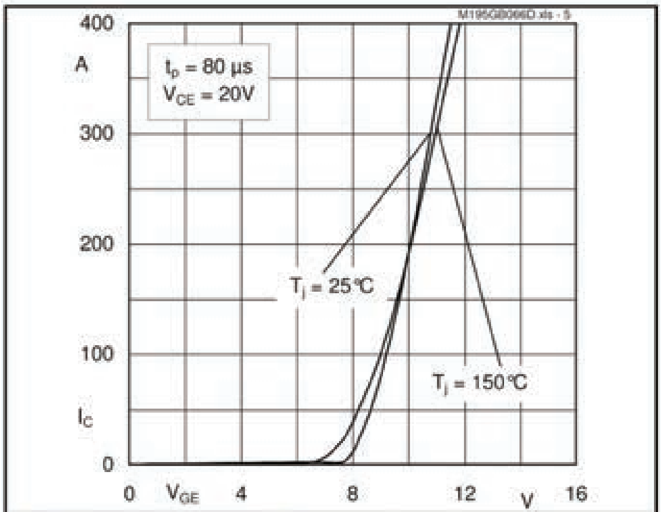

Fig. 5 Typ. transfer characteristic

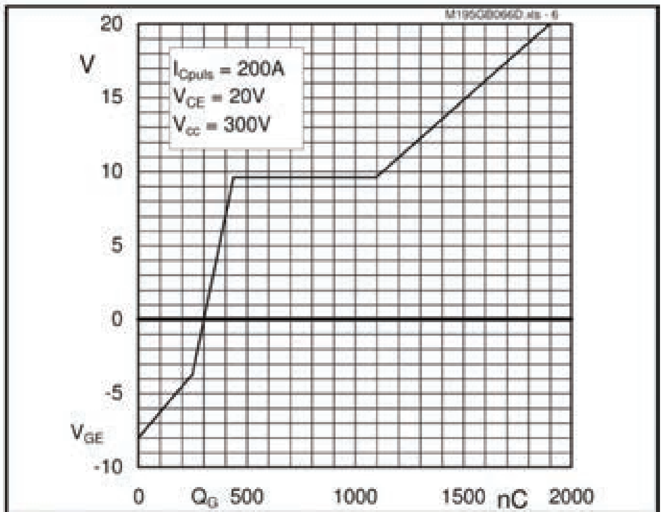

Fig. 6 Typ. gate charge characteristic

Document ressource DR E2
Documentation Driver IGBT

SEMIKRON

SKHI 21 A, SKHI 22 A / B

Absolute Maximum Ratings			
Symbol	Term	Values	Units
V_S	Supply voltage prim.	18	V
V_{iH}	Input signal volt. (High) SKHIxxA	V_S + 0,3	V
	SKHI22B	5 + 0,3	V
$Iout_{PEAK}$	Output peak current	8	A
$Iout_{AVmax}$	Output average current	40	mA
f_{max}	max. switching frequency	100	kHz
V_{CE}	Collector emitter voltage sense across the IGBT	1700	V
dv/dt	Rate of rise and fall of voltage secondary to primary side	50	kV/µs
V_{isolIO}	Isolation test voltage input-output (1 min.AC) Standard	2500	Vac
	Version „H4"	4000	Vac
V_{isol12}	Isolation test voltage ouput 1 - output 2 (1 min.AC)	1500	V
R_{Gonmin}	Minimum rating for R_{Gon}	3	Ω
$R_{Goffmin}$	Minimum rating for R_{Goff}	3	Ω
$Q_{out/pulse}$	Max. rating for output charge per pulse	4 [1]	µC
T_{op}	Operating temperature	- 40... + 85	°C
T_{stg}	Storage temperature	- 40... + 85	°C

Electrical Characteristics (T_a = 25 °C)		Values			
Symbol	Term	min.	typ.	max.	Units
V_S	Supply voltage primary side	14,4	15	15,6	V
I_{SO}	Supply current primary side (no load)	–	80	–	mA
	Supply current primary side (max.)	–	–	290	mA
V_i	Input signal voltage SKHIxxA on/off	–	15 / 0	–	V
	SKHI22B on/off	–	5 / 0	–	V
V_{iT+}	Input threshold voltage (High) SKHIxxA	10,9	11,7	12,5	V
	SKHI22B	3,5	3,7	3,9	V
V_{iT-}	Input threshold voltage (Low) SKHIxxA	4,7	5,5	6,5	V
	SKHI22B	1,5	1,75	2,0	V
R_{in}	Input resistance SKHIxxA	–	10	–	kΩ
	SKHI22B	–	3,3	–	kΩ
$V_{G(on)}$	Turn on gate voltage output	–	+15	–	V
$V_{G(off)}$	Turn off gate voltage output SKHI22x	–	-7	–	V
	SKHI21A	–	0	–	V
R_{GE}	Internal gate-emitter resistance	–	22	–	kΩ
f_{ASIC}	Asic system switching frequency	–	8	–	MHz
$t_{d(on)IO}$	Input-output turn-on propagation time	0,85	1	1,15	µs
$t_{d(off)IO}$	Input-output turn-off propagation time	0,85	1	1,15	µs
$t_{d(err)}$	Error input-output propagation time	–	0,6	–	µs
$t_{pERRRESET}$	Error reset time	–	9	–	µs
t_{TD}	Top-Bot Interlock Dead Time SKHI22x	3,3	–	4,3	µs
	SKHI21A	0	–	4,3	µs
V_{CEstat}	Reference voltage for V_{CE}-monitoring	–	5 [2]	10	V
		–	6 [3]	10	V
C_{ps}	Coupling capacitance primary secondary	–	12	–	pF
MTBF	Mean Time Between Failure T_a = 40° C	–	2,0	–	10^6 h
m	weight	–	45	–	g

SEMIDRIVER®
Hybrid Dual IGBT Driver
SKHI 22 A / B

- Double driver for halfbridge IGBT modules
- SKHI 22 A/B H4 is for 1700 V-IGBT
- SKHI 22 A is compatible to old SKHI 22
- SKHI 22 B has additional functionality

Hybrid Dual MOSFET Driver
SKHI 21 A

- drives MOSFETs with $V_{DS(on)} < 10$ V
- is compatible to old SKHI 21

Preliminary Data

Features

- CMOS compatible inputs
- Short circuit protection by V_{CE} monitoring and switch off
- Drive interlock top/bottom
- Isolation by transformers
- Supply undervoltage protection (13 V)
- Error latch/output

Typical Applications

- Driver for IGBT and MOSFET modules in bridge circuits in choppers, inverter drives, UPS and welding inverters
- DC bus voltage up to 1000V

[1] see fig. 6
[2] At R_{CE} = 18 kΩ, C_{CE} = 330pF
[3] At R_{CE} = 36 kΩ, C_{CE} = 470pF, R_{VCE} = 1kΩ

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Document ressource DR F1
Composant ADG619

CMOS, ±5 V/+5 V, 4 Ω, Single SPDT Switches

ADG619/ADG620

FEATURES

6.5 Ω (maximum) on resistance
0.8 Ω (maximum) on-resistance flatness
2.7 V to 5.5 V single supply
±2.7 V to ±5.5 V dual supply
Rail-to-rail operation
8-lead SOT-23, 8-lead MSOP
Typical power consumption (<0.1 μW)
TTL-/CMOS-compatible inputs

APPLICATIONS

Automatic test equipment
Power routing
Communication systems
Data acquisition systems
Sample-and-hold systems
Avionics
Relay replacement
Battery-powered systems

FUNCTIONAL BLOCK DIAGRAM

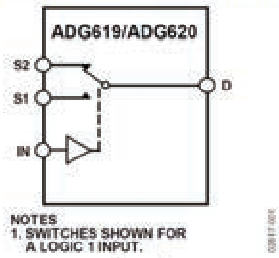


Figure 1.

GENERAL DESCRIPTION

The ADG619/ADG620 are monolithic, CMOS single-pole double-throw (SPDT) switches. Each switch conducts equally well in both directions when the device is on.

The ADG619/ADG620 offer a low on resistance of 4 Ω, which is matched to within 0.7 Ω between channels. These switches also provide low power dissipation, yet result in high switching speeds. The ADG619 exhibits break-before-make switching action, thus preventing momentary shorting when switching channels. The ADG620 exhibits make-before-break action.

The ADG619/ADG620 are available in an 8-lead SOT-23 and an 8-lead MSOP.

PRODUCT HIGHLIGHTS

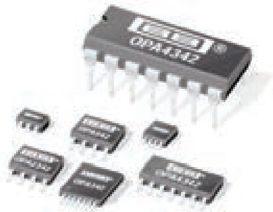
1. Low on resistance (R_{ON}): 4 Ω typical.
2. Dual ±2.7 V to ±5.5 V or single 2.7 V to 5.5 V supplies.
3. Low power dissipation.
4. Fast t_{ON}/t_{OFF}.
5. Tiny, 8-lead SOT-23 and 8-lead MSOP.

Table 1. Truth Table for the ADG619/ADG620

IN	Switch S1	Switch S2
0	On	Off
1	Off	On

Document ressource DR F2
Composant OPA342

Burr-Brown Products
from Texas Instruments



OPA342
OPA2342
OPA4342

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Low-Cost, Low-Power, Rail-to-Rail OPERATIONAL AMPLIFIERS
*Micro*Amplifier™ Series

FEATURES

- LOW QUIESCENT CURRENT: 150µA typ
- RAIL-TO-RAIL INPUT
- RAIL-TO-RAIL OUTPUT (within 1mV)
- SINGLE SUPPLY CAPABILITY
- LOW COST
- *Micro*SIZE PACKAGE OPTIONS:
  SOT23-5
  MSOP-8
  TSSOP-14
- BANDWIDTH: 1MHz
- SLEW RATE: 1V/µs
- THD + NOISE: 0.006%

APPLICATIONS

- COMMUNICATIONS
- PCMCIA CARDS
- DATA ACQUISITION
- PROCESS CONTROL
- AUDIO PROCESSING
- ACTIVE FILTERS
- TEST EQUIPMENT
- CONSUMER ELECTRONICS

DESCRIPTION

The OPA342 series rail-to-rail CMOS operational amplifiers are designed for low-cost, low-power, miniature applications. They are optimized to operate on a single supply as low as 2.5V with an input common-mode voltage range that extends 300mV beyond the supplies.

Rail-to-rail input/output and high-speed operation make them ideal for driving sampling Analog-to-Digital Converters (ADC). They are also well suited for general-purpose and audio applications and providing I/V conversion at the output of Digital-to-Analog Converters (DAC). Single, dual, and quad versions have identical specs for design flexibility.

The OPA342 series offers excellent dynamic response with a quiescent current of only 250µA max. Dual and quad designs feature completely independent circuitry for lowest crosstalk and freedom from interaction.

PACKAGE	SINGLE OPA342	DUAL OPA2342	QUAD OPA4342
SOT23-5	✓		
MSOP-8		✓	
SO-8	✓	✓	
TSSOP-14			✓
SO-14			✓
DIP-14			✓

SPICE MODEL available at www.burr-brown.com.