Vincotech

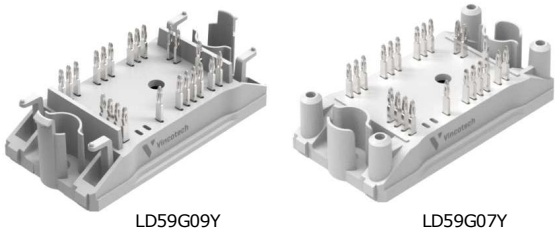
10-P0166BA050RW-LD59G09Y
10-PD166BA050RW-LD59G07Y
datasheet

flow **CON 0** **1600 V / 50 A**

Features

- Input rectifier
- Brake chopper
- Integrated temperature sensor

flow 0 17 mm housing

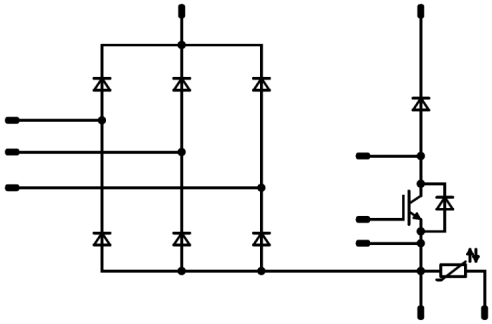


LD59G09Y LD59G07Y

Target applications

- Industrial Drives
- Embedded Drives

Schematic



Types

- 10-P0166BA050RW-LD59G09Y
- 10-PD166BA050RW-LD59G07Y

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current	I_C	$T_j = T_{jmax}$ T_s = 80 °C	32	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	75	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	69	W
Gate-emitter voltage	V_{GES}		±20	V
Maximum junction temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Brake Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_h = 80°C	21	A
Repetitive peak forward current	I_{FRM}		30	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_h = 80°C	42	W
Maximum Junction Temperature	T_{jmax}		150	°C
Brake Sw. Protection Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1200	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	4	A
Repetitive peak forward current	I_{FRM}		6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	57	W
Maximum Junction Temperature	T_{jmax}		150	°C
Rectifier Diode				
Peak Repetitive Reverse Voltage	V_{RRM}		1600	V
Continuous (direct) forward current	I_F	$T_j = T_{jmax}$ T_s = 80 °C	59	A
Surge (non-repetitive) forward current	I_{FSM}	50 Hz Single Half Sine Wave t_p = 10 ms T_j = 150 °C	520	A
Surge current capability	I^2t		1350	A^2s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ T_s = 80 °C	73	W
Maximum Junction Temperature	T_{jmax}		150	°C

Maximum Ratings

T_j = 25 °C, unless otherwise specified

Parameter	Symbol	Condition	Value	Unit
Module Properties				
Thermal Properties				
Storage temperature	T_{stg}		-40…+125	°C
Operation temperature under switching condition	T_{jop}		-40…(T_{jmax} - 25)	°C
Isolation Properties				
Isolation voltage	V_{isol}	DC Voltage* t_p = 2 s	6000	V
		AC Voltage t_p = 1 min	2500	V
Creepage distance			min. 12,7	mm
Clearance			min. 12,7	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Switch										
Static										
Gate-emitter threshold voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$			0,001	25	5	5,8	6,5	V
Collector-emitter saturation voltage	V_{CEsat}		15		25	25 125	1,35	1,63 1,84	2,05	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			150	µA
Gate-emitter leakage current	I_{GES}		20	0		25			600	nA
Internal gate resistance	r_g							8		Ω
Input capacitance	C_{ies}	f= 1 MHz	0	25		25		1808		pF
Output capacitance	C_{oes}							95		
Reverse transfer capacitance	C_{res}							82		
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,02		K/W
Dynamic										
Turn-on delay time	$t_{d(on)}$	R_{goff} = 8 Ω R_{gon} = 16 Ω	15/0	600	25	25 125		38 34		ns
Rise time	t_r					25 125		13 21		
Turn-off delay time	$t_{d(off)}$					25 125		418 512		
Fall time	t_f					25 125		140 161		
Turn-on energy (per pulse)	E_{on}	Q_{rFWD} = 2 µC Q_{rFWD} = 3,6 µC				25 125		1,040 1,411		mWs
Turn-off energy (per pulse)	E_{off}					25 125		1,792 2,788		

Characteristic Values

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Brake Diode										
Static										
Forward voltage	V_F				15	25 125		1,76 1,73		V
Reverse leakage current	I_r			1200		25			250	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,68		K/W
Dynamic										
Peak recovery current	I_{RRM}	di/dt = 2114 A/µs di/dt = 2713 A/µs	15/0	600	25	25 125		55 56		A
Reverse recovery time	t_{rr}					25 125		37 130		ns
Recovered charge	Q_r					25 125		2,049 3,620		µC
Reverse recovered energy	E_{rec}					25 125		0,792 1,544		mWs
Peak rate of fall of recovery current	$(di_{rf}/dt)_{max}$					25 125		3820 2914		A/µs
Brake Sw. Protection Diode										
Static										
Forward voltage	V_F				3	25 150		1,65 1,51	2,3	V
Reverse leakage current	I_r			1200		25			250	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						1,23		K/W
Rectifier Diode										
Static										
Forward voltage	V_F				42	25 125		1,10 1,04		V
Reverse leakage current	I_r			1600		25 175			20 1500	µA
Thermal										
Thermal resistance junction to sink	$R_{th(j-s)}$	phase-change material λ = 3,4 W/mK						0,97		K/W

Characteristic Values

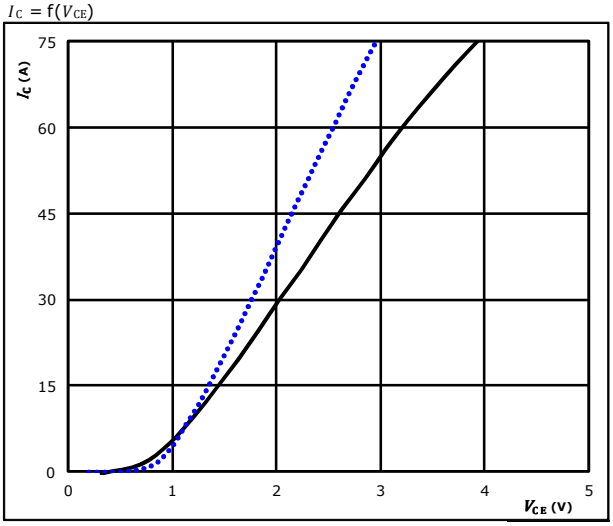
Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V] V_{GS} [V]	V_{CE} [V] V_{DS} [V] V_F [V]	I_C [A] I_D [A] I_F [A]	T_j [°C]	Min	Typ	Max	
Thermistor										
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1486 Ω				100	-12		+14	%
Power dissipation	P					25		200		mW
Power dissipation constant						25		2		mW/K
B-value	$B_{(25/50)}$	Tol. ±3%				25		3950		K
B-value	$B_{(25/100)}$	Tol. ±3%				25		3998		K
Vincotech NTC Reference									B	

Brake Switch Characteristics

figure 1. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

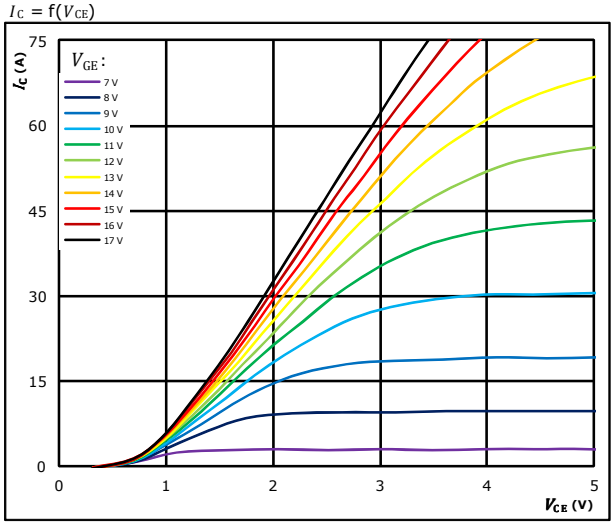


t_p =	250	µs	T_j:	25 °C	
V_{GE} =	15	V		125 °C	

figure 2. **IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

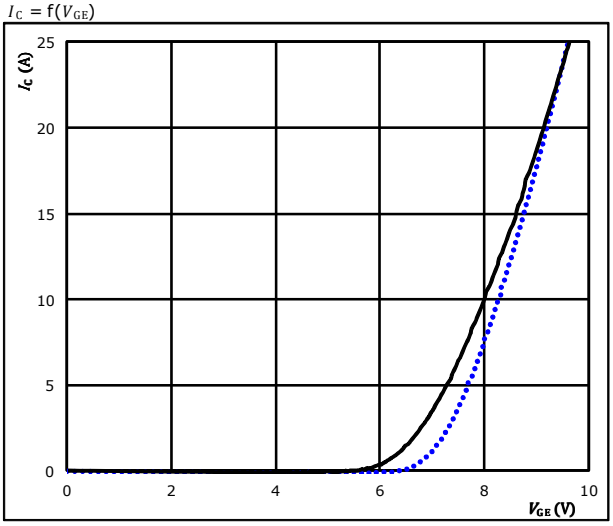


t_p =	250	µs
T_j =	125	°C
V_{GE} from	7 V to 17 V in steps of 1 V	

figure 3. **IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

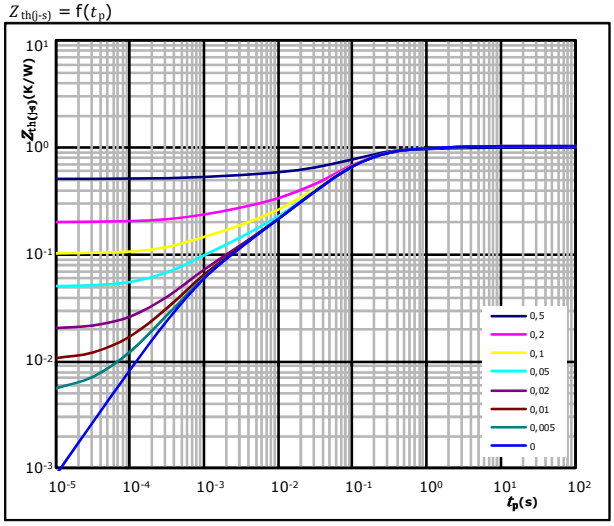


t_p =	100	µs	T_j:	25 °C	
V_{CE} =	10	V		125 °C	

figure 4. **IGBT**

Transient thermal impedance as function of pulse duration

$Z_{th(j-s)} = f(t_p)$



D =	t_p / T	
$R_{th(j-s)}$ =	1,02	K/W

IGBT thermal model values

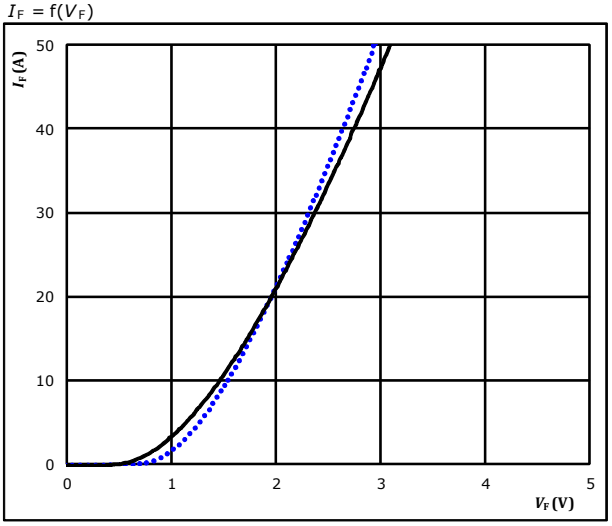
R (K/W)	τ (s)
5,47E-02	2,51E+00
1,19E-01	4,47E-01
5,66E-01	9,65E-02
1,43E-01	3,25E-02
7,86E-02	7,01E-03
5,00E-02	9,80E-04
8,79E-03	5,47E-04

Brake Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

$I_F = f(V_F)$



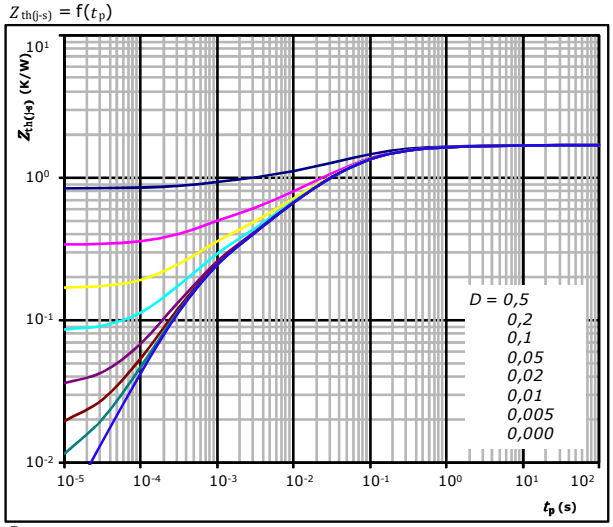
t_p = 250 µs

T_j: 25 °C, 125 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 1,68 K/W

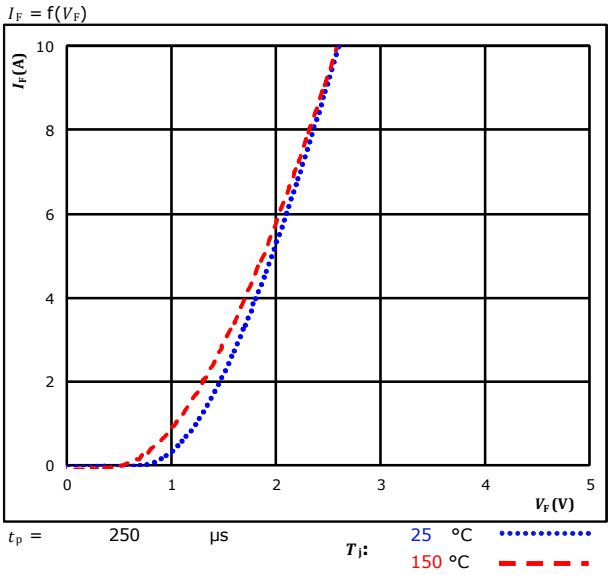
FWD thermal model values

R (K/W)	τ (s)
6,16E-02	2,79E+00
1,70E-01	3,75E-01
6,30E-01	6,95E-02
4,31E-01	1,59E-02
2,09E-01	3,39E-03
1,67E-01	5,09E-04

Brake Sw. Protection Diode Characteristics

figure 1. **FWD**

Typical forward characteristics

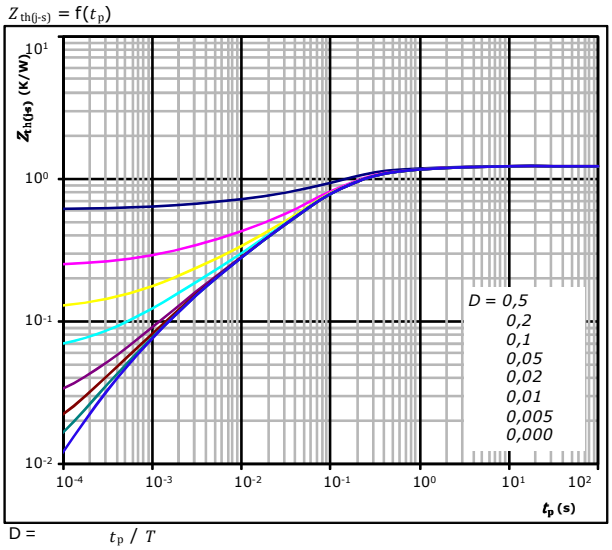


t_p = 250 µs

T_j: 25 °C, 150 °C

figure 2. **FWD**

Transient thermal impedance as a function of pulse width



D = t_p / T

$R_{th(j-s)}$ = 1,23 K/W

FWD thermal model values

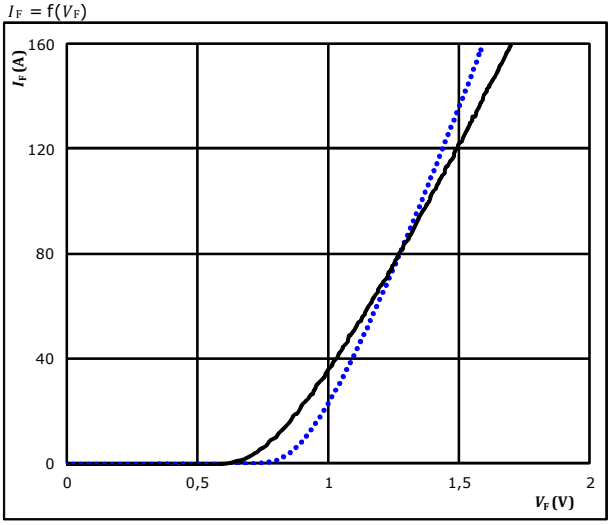
R (K/W)	τ (s)
7,01E-02	2,72E+00
2,08E-01	4,07E-01
6,56E-01	9,02E-02
1,61E-01	1,73E-02
9,43E-02	2,74E-03
1,66E-02	3,24E-03
2,74E-02	3,76E-04

Rectifier Diode Characteristics

figure 1. **Rectifier Diode**

Typical forward characteristics

$I_F = f(V_F)$



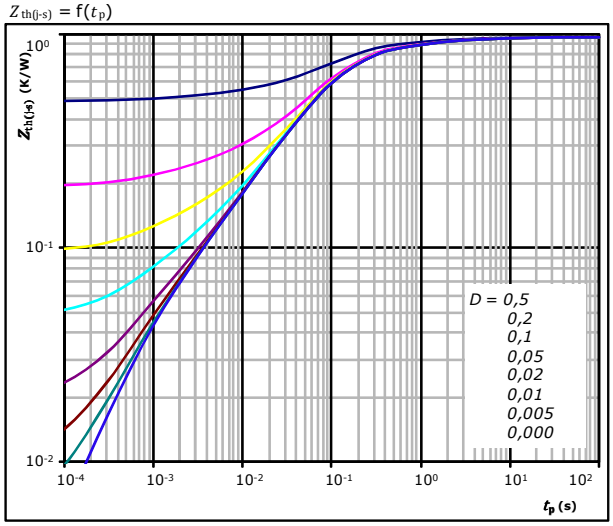
t_p = 250 µs 25 °C

T_j: 125 °C

figure 2. **Rectifier Diode**

Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$



D = t_p / T

$R_{th(j-s)}$ = 0,97 K/W

Diode thermal model values

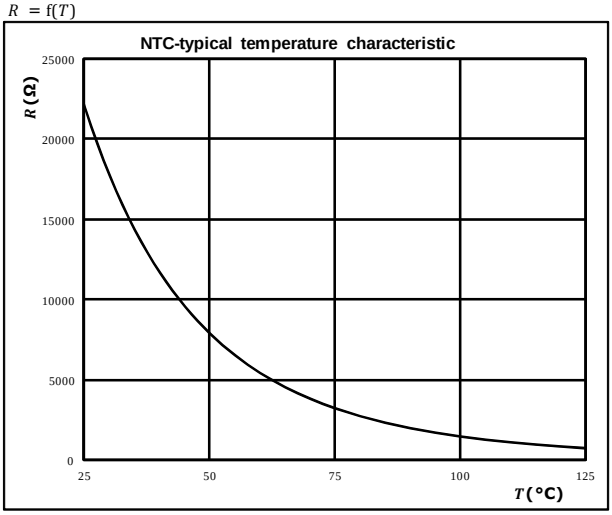
R (K/W)	τ (s)
3,98E-02	7,88E+00
1,29E-01	8,64E-01
4,20E-01	1,32E-01
2,76E-01	4,24E-02
6,63E-02	5,80E-03
3,37E-02	8,90E-04

Thermistor Characteristics

figure 1. **Thermistor**

Typical NTC characteristic
as a function of temperature

$R = f(T)$

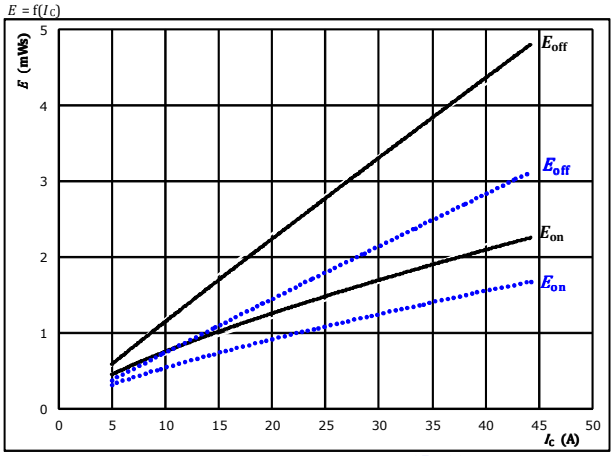


Brake Switching Characteristics

figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



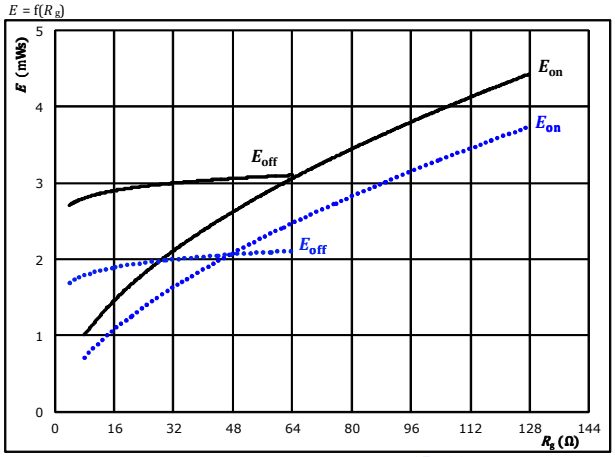
With an inductive load at 25 °C

V_{CE} =	600	V	T_J:	125 °C
V_{GE} =	15/0	V		
R_{gon} =	16	Ω		
R_{goff} =	8	Ω		

figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_g)$



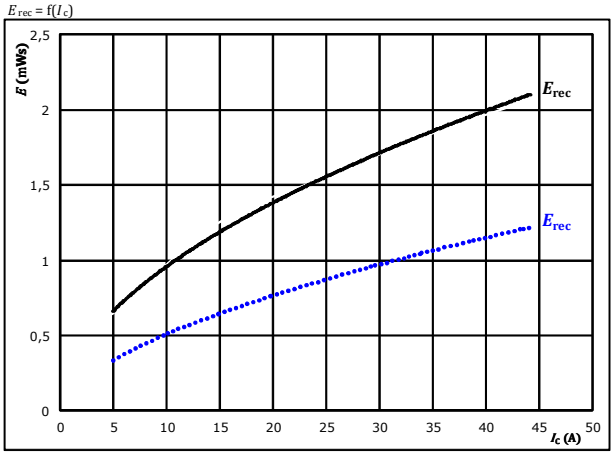
With an inductive load at 25 °C

V_{CE} =	600	V	T_J:	125 °C
V_{GE} =	15/0	V		
I_C =	25	A		

figure 3. FWD

Typical reverse recovered energy loss as a function of collector current

$E_{rec} = f(I_C)$



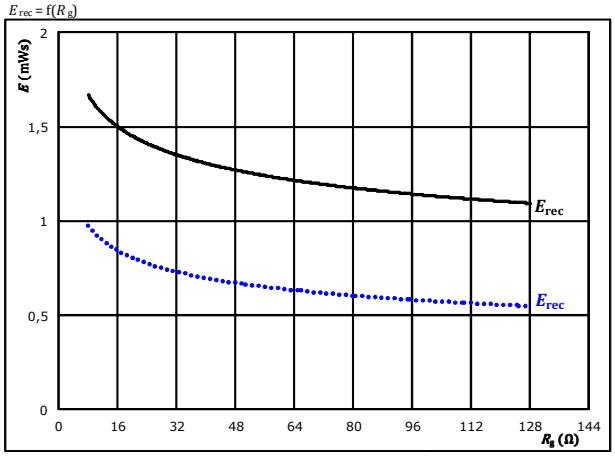
With an inductive load at 25 °C

V_{CE} =	600	V	T_J:	125 °C
V_{GE} =	15/0	V		
R_{gon} =	16	Ω		

figure 4. FWD

Typical reverse recovered energy loss as a function of gate resistor

$E_{rec} = f(R_g)$



With an inductive load at 25 °C

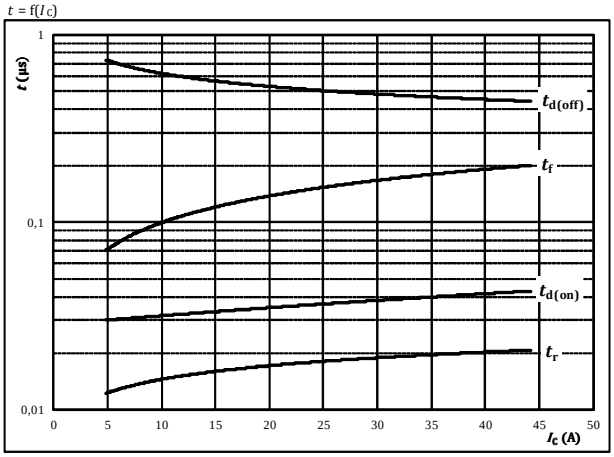
V_{CE} =	600	V	T_J:	125 °C
V_{GE} =	15/0	V		
I_C =	25	A		

Brake Switching Characteristics

figure 5. **IGBT**

Typical switching times as a function of collector current

$t = f(I_C)$



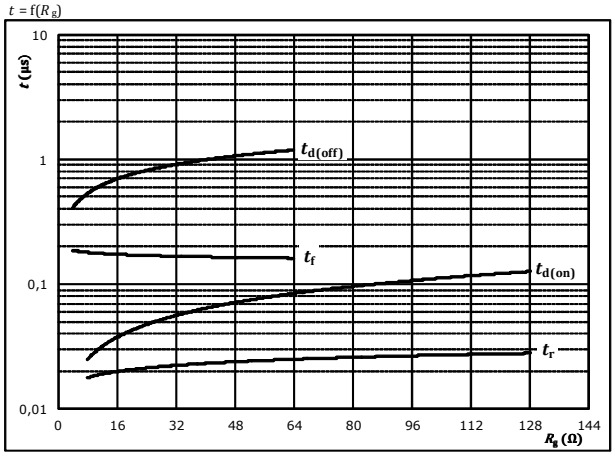
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
R_{gon} =	16	Ω
R_{goff} =	8	Ω

figure 6. **IGBT**

Typical switching times as a function of gate resistor

$t = f(R_g)$



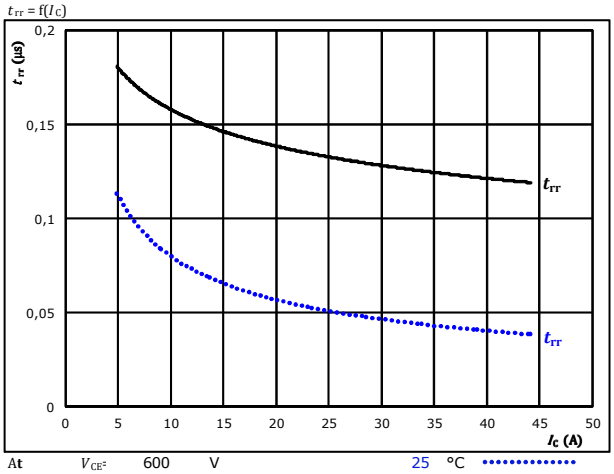
With an inductive load at

T_j =	125	°C
V_{CE} =	600	V
V_{GE} =	15/0	V
I_C =	25	A

figure 7. **FWD**

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

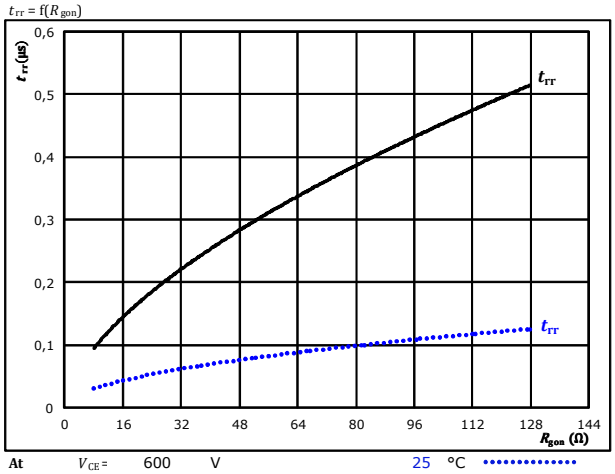


At					
	V_{CE} =	600	V	25 °C	•••••••••••••••
	V_{GE} =	15/0	V	T_j: 125 °C	———————
	R_{gon} =	16	Ω		

figure 8. **FWD**

Typical reverse recovery time as a function of IGBT turn on gate resistor

$t_{rr} = f(R_{gon})$



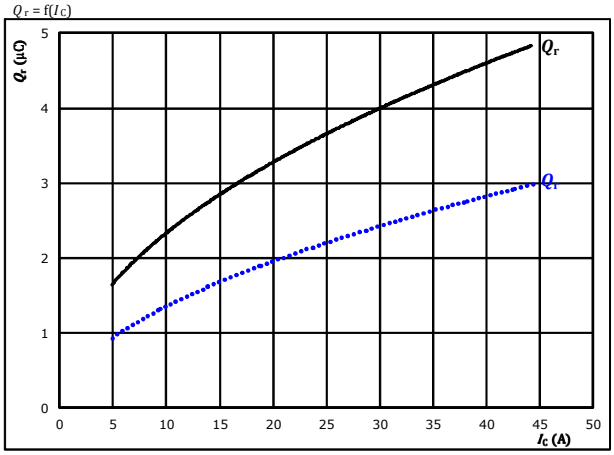
At					
	V_{CE} =	600	V	25 °C	•••••••••••••••
	V_{GE} =	15/0	V	T_j: 125 °C	———————
	I_C =	25	A		

Brake Switching Characteristics

figure 9. FWD

Typical recovered charge as a function of collector current

$Q_r = f(I_C)$

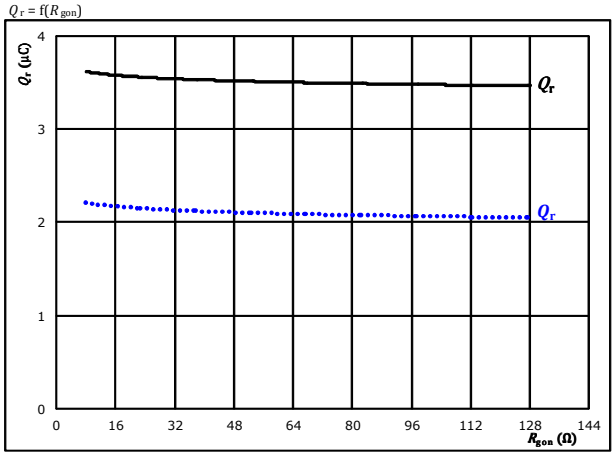


At	V_{CE} =	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	16	Ω			

figure 10. FWD

Typical recoved charge as a function of IGBT turn on gate resistor

$Q_r = f(R_{gon})$

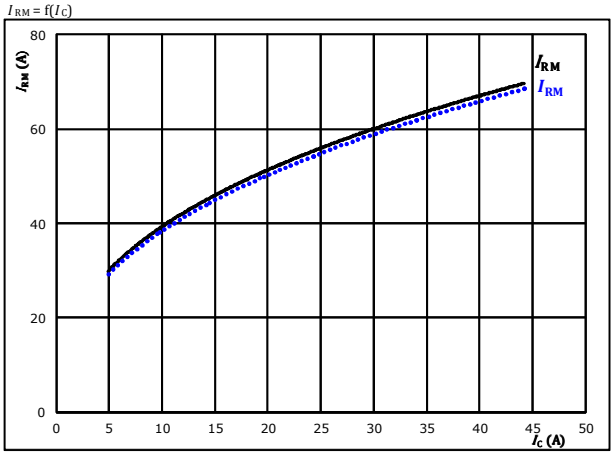


At	V_{CE}=	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C=	25	A			

figure 11. FWD

Typical peak reverse recovery current current as a function of collector current

$I_{RM} = f(I_C)$

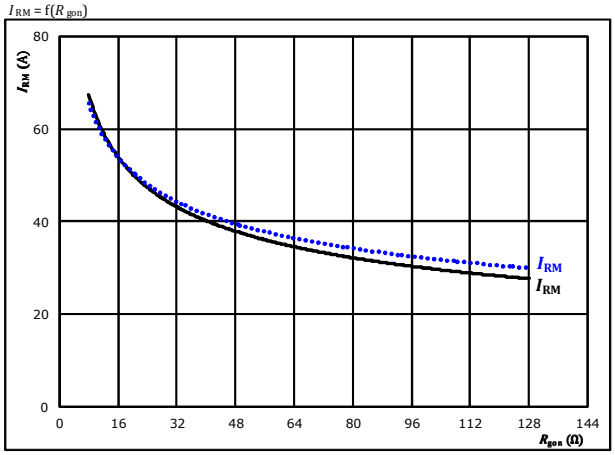


At	V_{CE}:	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	R_{gon} =	16	Ω			

figure 12. FWD

Typical peak reverse recovery current as a function of IGBT turn on gate resistor

$I_{RM} = f(R_{gon})$



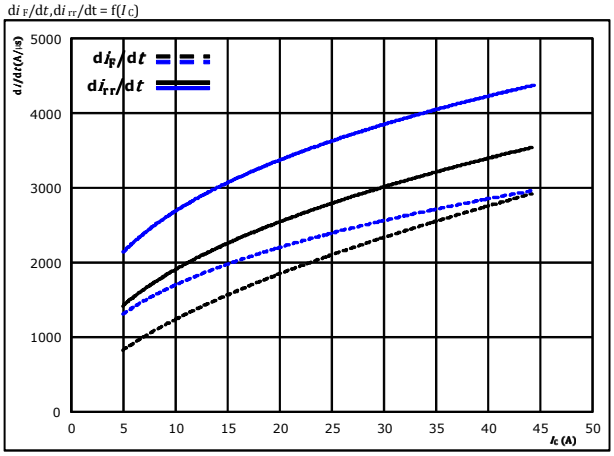
At	V_{CE} =	600	V		25 °C	
	V_{GE} =	15/0	V	T_j:	125 °C	
	I_C =	25	A			

Brake Switching Characteristics

figure 13. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of collector current

$di_F/dt, di_{rr}/dt = f(I_C)$

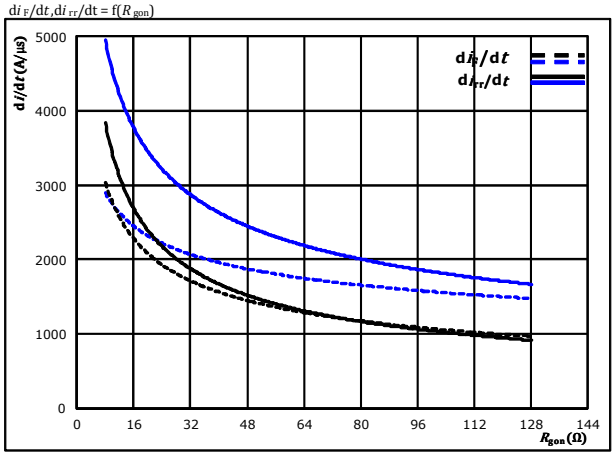


At						
V_{CE} =	600	V		25	°C	•••••••••••••
V_{GE} =	15/0	V	T_j:	125	°C	———
R_{gon} =	16	Ω				

figure 14. **FWD**

Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

$di_F/dt, di_{rr}/dt = f(R_{gon})$

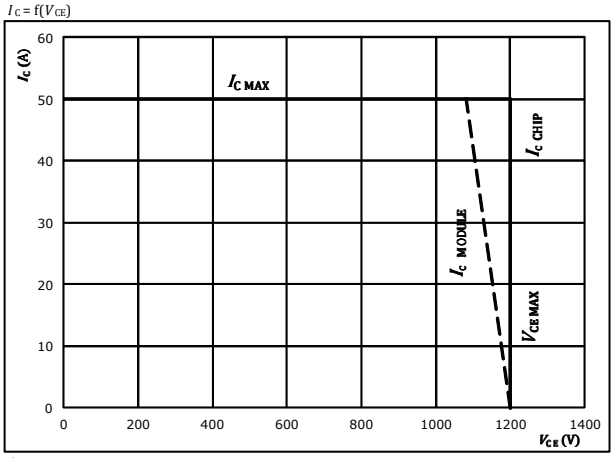


At						
V_{CE} =	600	V		25	°C	•••••••••••••
V_{GE} =	15/0	V	T_j:	125	°C	———
I_C=	25	A				

figure 15. **IGBT**

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

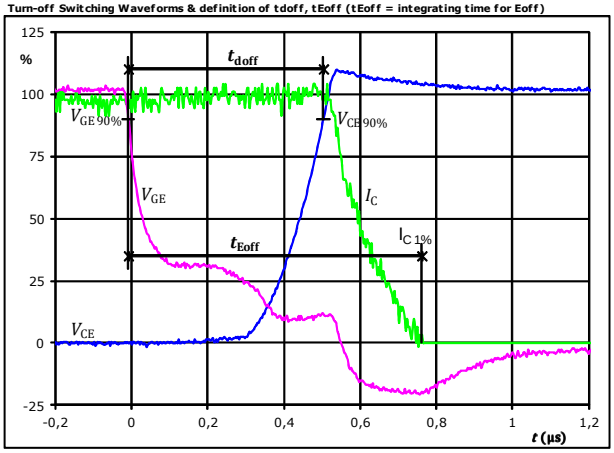
T_j =	150	°C
R_{gon} =	16	Ω
R_{goff} =	8	Ω

Brake Switching Characteristics

T_j	=	125 °C
R_{gon}	=	16 Ω
R_{goff}	=	8 Ω

figure 1. IGBT

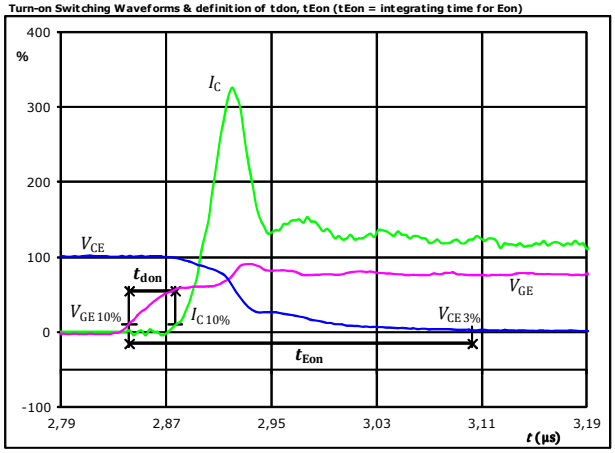
Turn-off Switching Waveforms & definition of tdoff, tEoff (tEoff = integrating time for Eoff)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{doff} =	0,512	µs
t_{Eoff} =	0,770	µs

figure 2. IGBT

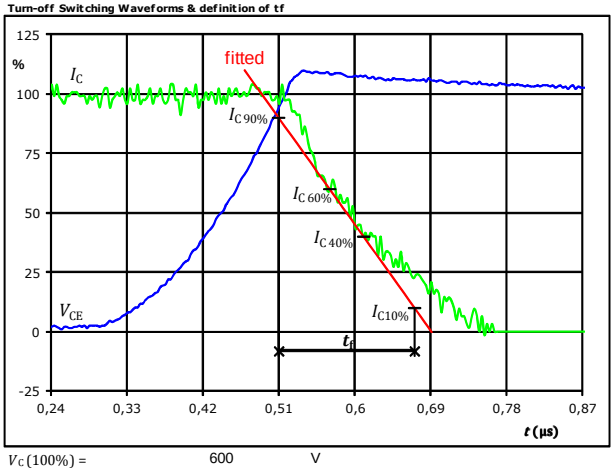
Turn-on Switching Waveforms & definition of tdon, tEon (tEon = integrating time for Eon)



$V_{GE}(0\%)$ =	0	V
$V_{GE}(100\%)$ =	15	V
$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_{don} =	0,034	µs
t_{Eon} =	0,261	µs

figure 3. IGBT

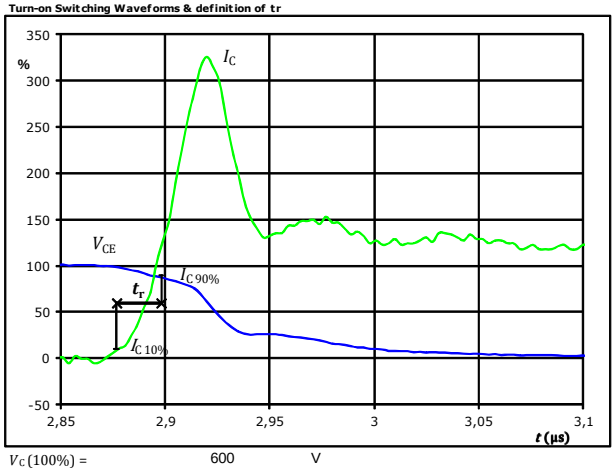
Turn-off Switching Waveforms & definition of tf



$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_f =	0,161	µs

figure 4. IGBT

Turn-on Switching Waveforms & definition of tr

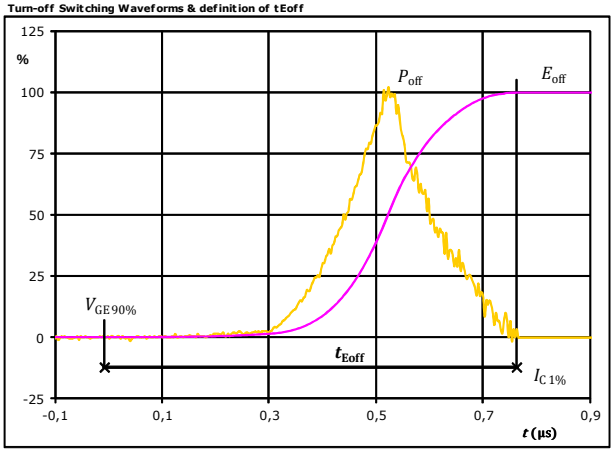


$V_C(100\%)$ =	600	V
$I_C(100\%)$ =	25	A
t_r =	0,021	µs

Brake Switching Characteristics

figure 5. IGBT

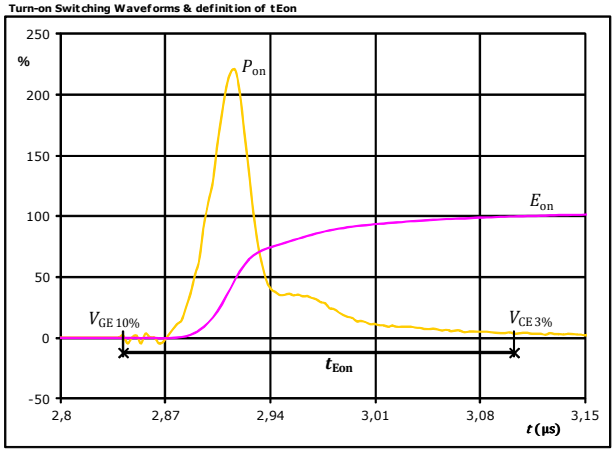
Turn-off Switching Waveforms & definition of tEoff



$P_{off}(100\%)$ =	14,79	kW
$E_{off}(100\%)$ =	2,79	mJ
t_{Eoff} =	0,77	µs

figure 6. IGBT

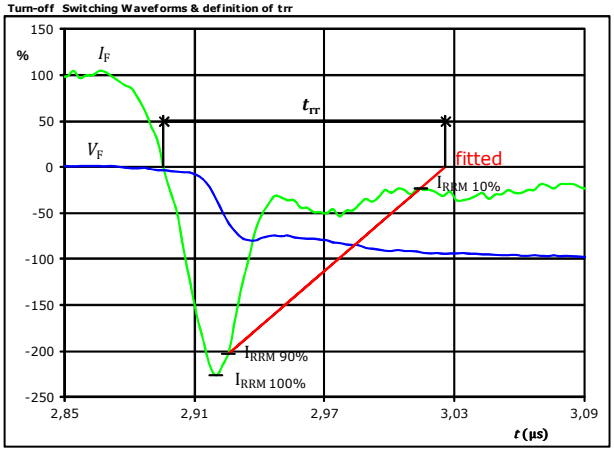
Turn-on Switching Waveforms & definition of tEon



$P_{on}(100\%)$ =	14,79	kW
$E_{on}(100\%)$ =	1,41	mJ
t_{Eon} =	0,26	µs

figure 7. FWD

Turn-off Switching Waveforms & definition of trr

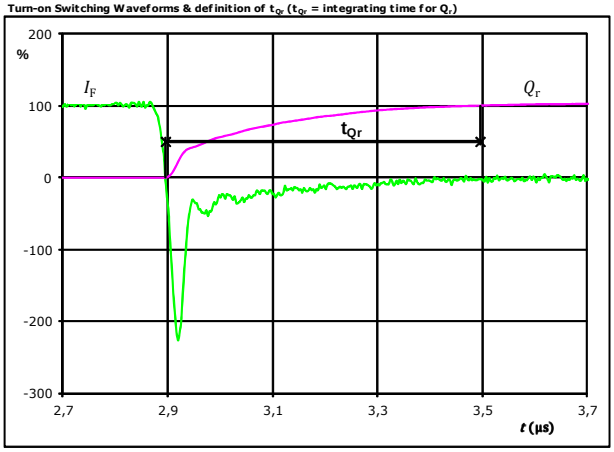


$V_F(100\%)$ =	600	V
$I_F(100\%)$ =	25	A
$I_{RRM}(100\%)$ =	56	A
t_{rr} =	0,130	µs

Brake Switching Characteristics

figure 8. **FWD**

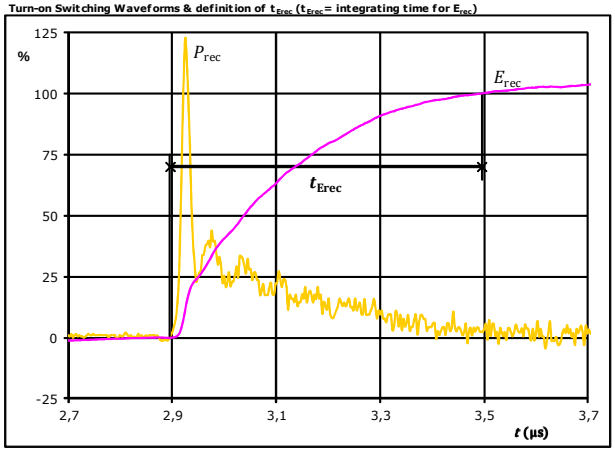
Turn-on Switching Waveforms & definition of t_{Qr} (t_{Qr} = integrating time for Q_r)



I_F (100%) =	25	A
Q_r (100%) =	3,62	µC
t_{Qr} =	0,60	µs

figure 9. **FWD**

Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec} = integrating time for E_{rec})



P_{rec} (100%) =	14,79	kW
E_{rec} (100%) =	1,54	mJ
t_{Erec} =	0,60	µs

Vincotech

10-P0166BA050RW-LD59G09Y
10-PD166BA050RW-LD59G07Y
datasheet

Ordering Code & Marking

Version	Ordering Code
without thermal paste 17mm clip-in housing with Press-fit pins	10-P0166BA050RW-LD59G09Y
without thermal paste 17mm 4-tower housing with Press-fit pins	10-PD166BA050RW-LD59G07Y
with thermal paste 17mm clip-in housing with Press-fit pins	10-P0166BA050RW-LD59G09Y-/3/
with thermal paste 17mm 4-tower housing with Press-fit pins	10-PD166BA050RW-LD59G07Y-/3/

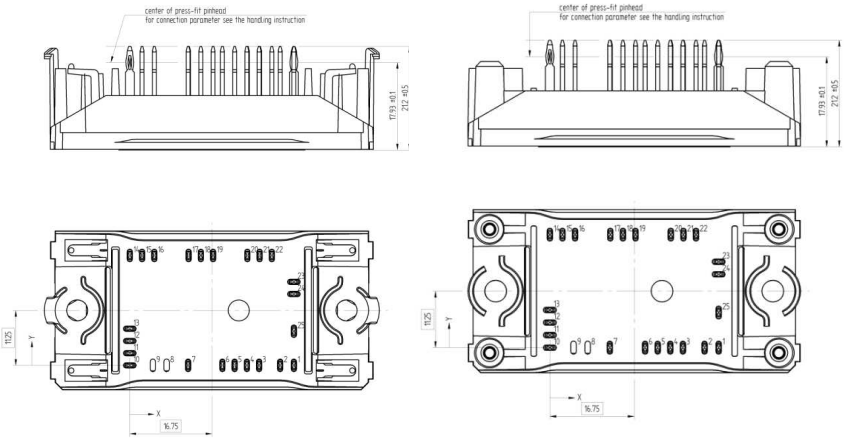
Text	Name	Date code	UL & VIN	Lot	Serial
	NN-NNNNNNNNNNNNN-TTTTTTVV	WWYY	UL VIN	LLLLL	SSSS

Datamatrix	Type&Ver	Lot number	Serial	Date code		
	TTTTTTTVV	LLLLL	SSSS	WWYY		

Outline

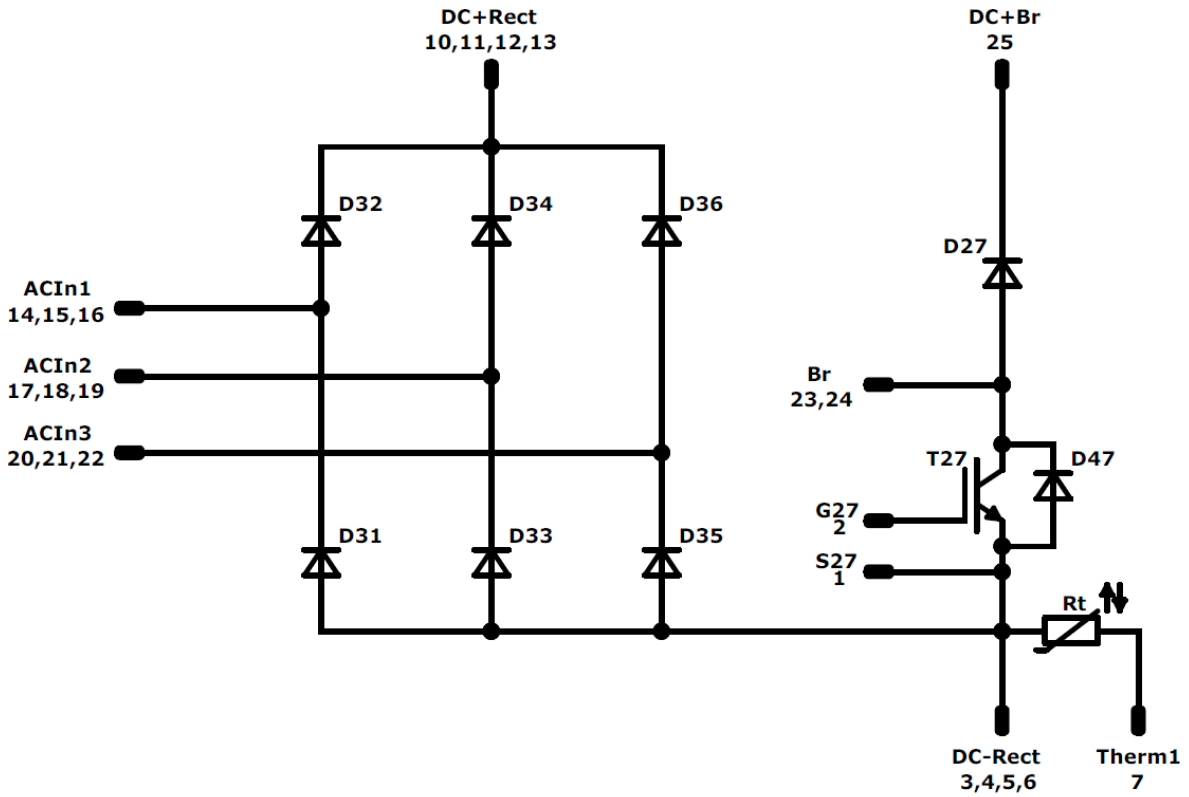
Pin table [mm]

Pin	X	Y	Function
1	33,5	0	S27
2	30,7	0	G27
3	26,4	0	DC-Rect
4	23,9	0	DC-Rect
5	21,4	0	DC-Rect
6	18,9	0	DC-Rect
7	11,9	0	Therm1
8	Not assembled		
9	Not assembled		
10	0	0	DC+Rect
11	0	2,5	DC+Rect
12	0	5	DC+Rect
13	0	7,5	DC+Rect
14	0	22,5	ACIn1
15	2,5	22,5	ACIn1
16	5	22,5	ACIn1
17	12	22,5	ACIn2
18	14,5	22,5	ACIn2
19	17	22,5	ACIn2
20	24	22,5	ACIn3
21	26,5	22,5	ACIn3
22	29	22,5	ACIn3
23	33,5	17,1	Br
24	33,5	14,6	Br
25	33,5	7	DC+Br



LD59G09Y LD59G07Y

Pinout



Identification

ID	Component	Voltage	Current	Function	Comment
T27	IGBT	1200 V	25 A	Brake Switch	
D27	FWD	1200 V	15 A	Brake Diode	
D47	FWD	1200 V	3 A	Brake Sw. Protection Diode	
D31,D32,D33 D34,D35,D36	Rectifier	1600 V	42 A	Rectifier Diode	
Rt	NTC			Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 135	>SPQ	Standard	<SPQ	Sample

Handling instruction
Handling instructions for *flow* 0 packages see vincotech.com website.

Package data
Package data for *flow* 0 packages see vincotech.com website.

UL recognition and file number
This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

Document No.:	Date:	Modification:	Pages
10-Px166BA050RW-LD59G0xY-D1-14	05 Sep. 2017		