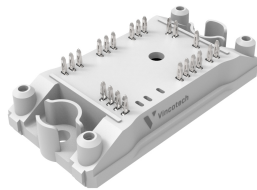
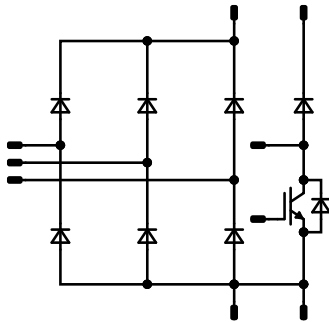




flowCON 0		1600 V / 75 A	
Features		flow 0 12 mm housing	
<ul style="list-style-type: none">• Three-phase input rectifier• Brake chopper			
Target applications		Schematic	
<ul style="list-style-type: none">• Industrial Drives• Embedded Drives• UPS			
Types			
<ul style="list-style-type: none">• V23990-P640-G06Y-PM			

**Maximum Ratings** $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Brake Switch				
Collector-emitter voltage	V_{CES}		1200	V
Collector current (DC current)	I_C	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	35	A
Repetitive peak collector current	I_{CRM}	t_p limited by T_{jmax}	70	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	72	W
Gate-emitter voltage	V_{GES}		± 20	V
Maximum junction temperature	T_{jmax}		150	°C
Brake Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	23	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	50	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	41	W
Maximum junction temperature	T_{jmax}		150	°C
Brake Sw. Protection Diode				
Peak repetitive reverse voltage	V_{RRM}		1200	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	3	A
Repetitive peak forward current	I_{FRM}	t_p limited by T_{jmax}	6	A
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	19	W
Maximum junction temperature	T_{jmax}		150	°C

**Maximum Ratings** $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Rectifier Diode				
Peak repetitive reverse voltage	V_{RRM}		1600	V
Forward current (DC current)	I_F	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	78	A
Surge (non-repetitive) forward current	I_{FSM}	Single Half Sine Wave, $t_p = 10\text{ ms}$ $T_j = 150\text{ °C}$	740	A
Surge current capability	I^2t		2740	A ² s
Total power dissipation	P_{tot}	$T_j = T_{jmax}$ $T_s = 80\text{ °C}$	88	W
Maximum junction temperature	T_{jmax}		150	°C

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 Test Voltage* $t_p = 2\text{ s}$	6000	V
Creepage distance			>12,7	mm
Clearance			9,11	mm
Comparative Tracking Index	CTI		> 200	

*100 % tested in production



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Values			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	$V_{GE(th)}$	$V_{CE} = V_{GE}$			0,0015	25	5	5,8	6,5	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		35	25 125	1,35	1,74 1,98	2,05 ⁽¹⁾	V
Collector-emitter cut-off current	I_{CES}		0	1200		25			250	μA
Gate-emitter leakage current	I_{GES}		30	0		25			600	nA
Internal gate resistance	r_g							6		Ω
Input capacitance	C_{ies}							2530		pF
Output capacitance	C_{oes}	$f = 1$ Mhz	0	25		25		132		pF
Reverse transfer capacitance	C_{res}							115		pF

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,97		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

Dynamic

Turn-on delay time	$t_{d(on)}$	$R_{gon} = 32$ Ω $R_{goff} = 16$ Ω	0/15	700	35	25		87		ns
Rise time	t_r					125		84		ns
Turn-off delay time	$t_{d(off)}$					25		521		ns
Fall time	t_f					125		615		ns
Turn-on energy (per pulse)	E_{on}					25		50,22		ns
						125		141,88		ns
Turn-off energy (per pulse)	E_{off}					25		3,49		mWs
		125		4,47		mWs				
		25		2,68		mWs				
		125		4,32		mWs				



Vincotech

V23990-P640-G06Y-PM
datasheet

Characteristic Values

Parameter	Symbol	Conditions					Values			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				25	25 125	1,23	1,78 1,8	1,97 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25			20	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						1,72		K/W
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Dynamic

Peak recovery current	I_{RRM}	$di/dt=2239$ A/μs $di/dt=2068$ A/μs	0/15	700	35	25		37,42		A
	125						45,3			
Reverse recovery time	t_{rr}					25		301,34		ns
	125						419,53			
Recovered charge	Q_r					25		2,75		μC
	125		5,03							
Reverse recovered energy	E_{rec}	25		1,04		mWs				
	125		2,06							
Peak rate of fall of recovery current	$(di/dt)_{max}$	25		2619		A/μs				
	125		1765							

Brake Sw. Protection Diode

Static

Forward voltage	V_F				3	25 125	1,23	1,67 1,59	1,97 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1200$ V				25			27	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						3,72		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----



Vincotech

Characteristic Values

Parameter	Symbol	Conditions					Values			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		

Rectifier Diode

Static

Forward voltage	V_F				80	25 125 150		1,18 1,15	1,23 ⁽¹⁾ 1,17 ⁽¹⁾	V
Reverse leakage current	I_R	$V_r = 1600$ V				25 150			50 1500	μA

Thermal

Thermal resistance junction to sink ⁽²⁾	$R_{th(j-s)}$	$\lambda_{paste} = 3,4$ W/mK (PSX)						0,79		K/W
--	---------------	---------------------------------------	--	--	--	--	--	------	--	-----

⁽¹⁾ Value at chip level

⁽²⁾ Only valid with pre-applied Vincotech thermal interface material.

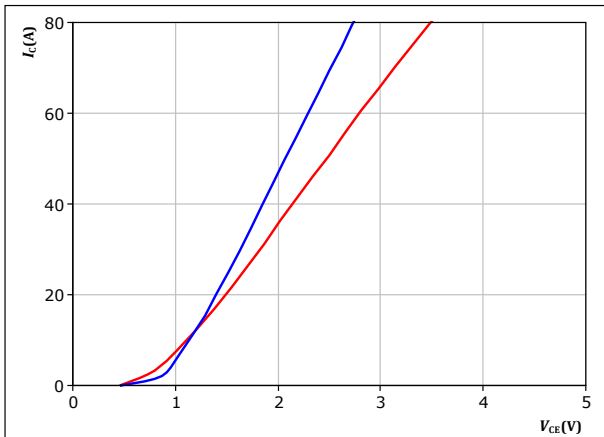


Brake Switch Characteristics

figure 1. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

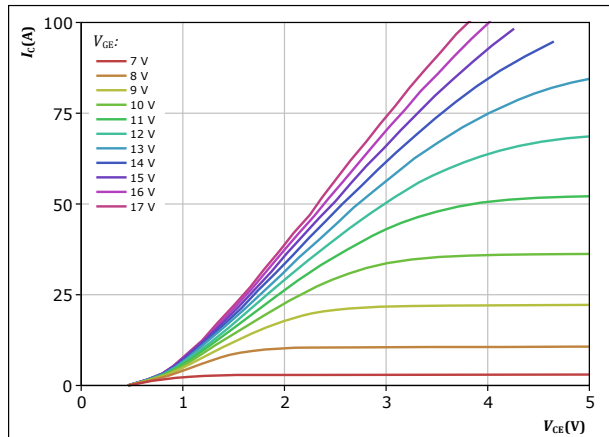


$t_p = 250 \mu s$
 $V_{GE} = 15 V$
 $T_j: 25^\circ C$ (blue line)
 $125^\circ C$ (red line)

figure 2. IGBT

Typical output characteristics

$$I_C = f(V_{CE})$$

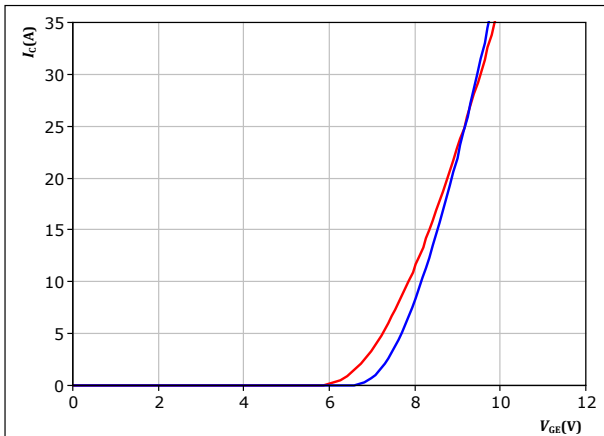


$t_p = 250 \mu s$
 $T_j = 125^\circ C$
 V_{GE} from 7 V to 17 V in steps of 1 V

figure 3. IGBT

Typical transfer characteristics

$$I_C = f(V_{GE})$$

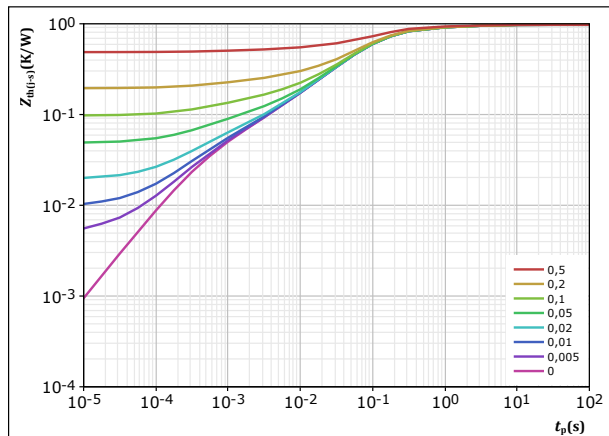


$t_p = 250 \mu s$
 $V_{CE} = 10 V$
 $T_j: 25^\circ C$ (blue line)
 $125^\circ C$ (red line)

figure 4. IGBT

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 0,974 K/W$

IGBT thermal model values

R (K/W)	τ (s)
6,59E-02	3,01E+00
1,61E-01	3,99E-01
6,07E-01	8,47E-02
7,79E-02	1,42E-02
3,57E-02	2,31E-03
2,73E-02	4,08E-04

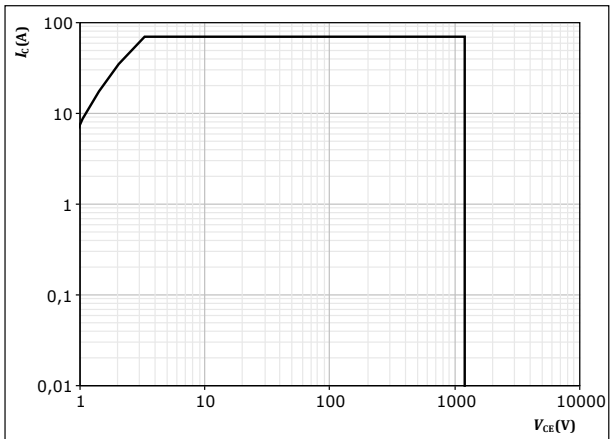


Brake Switch Characteristics

figure 5. IGBT

Safe operating area

$$I_C = f(V_{CE})$$



$D =$ single pulse

$T_s = 80$ °C

$V_{CE} = 15$ V

$T_j = T_{jmax}$

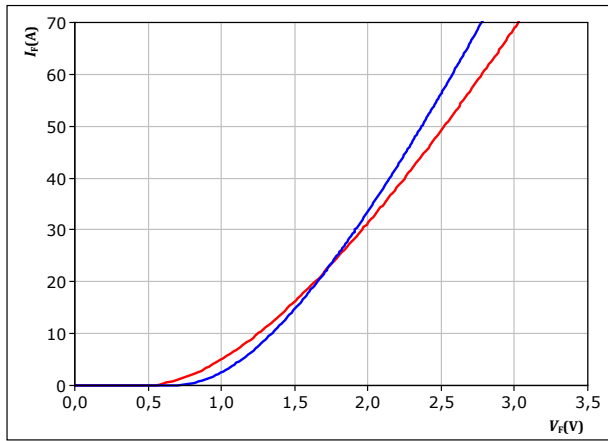


Brake Diode Characteristics

figure 6. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

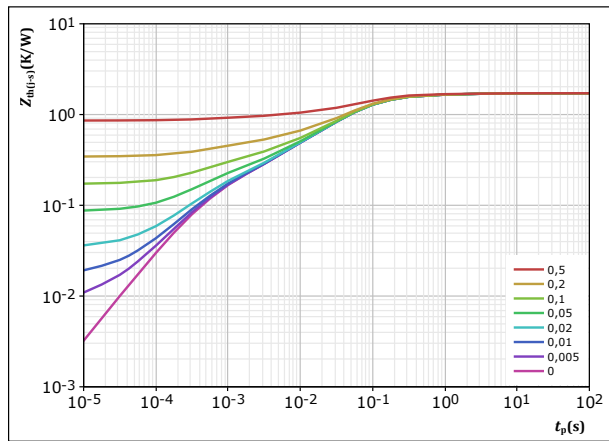


$t_p = 250 \mu s$
 T_j : — 25 °C
 — 125 °C

figure 7. FWD

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$
 $R_{th(j-s)} = 1,717 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
5,74E-02	3,42E+00
1,85E-01	4,11E-01
9,45E-01	7,07E-02
2,69E-01	1,95E-02
1,43E-01	3,59E-03
1,19E-01	4,63E-04



Brake Sw. Protection Diode Characteristics

figure 8. FWD

Typical forward characteristics

$$I_F = f(V_F)$$

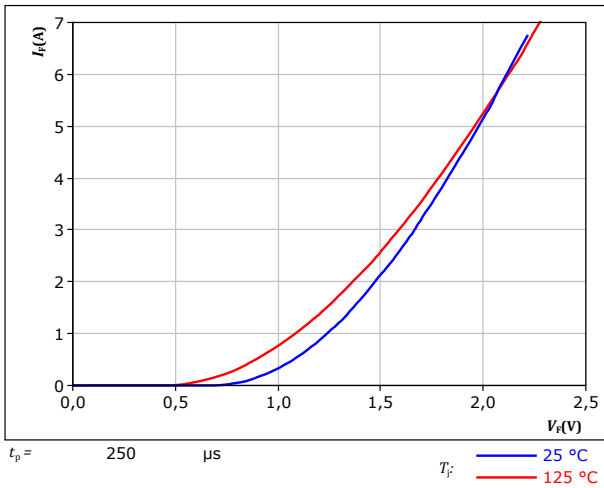
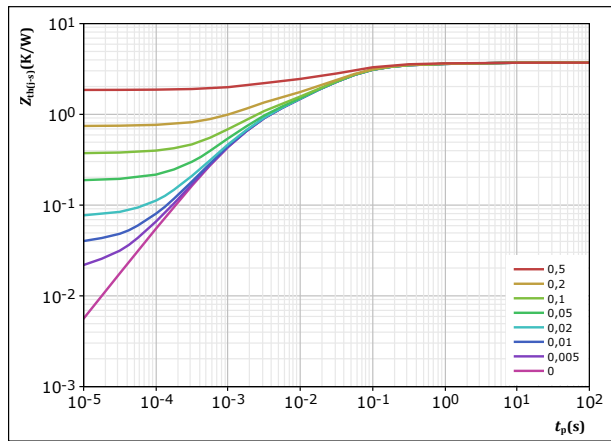


figure 9. FWD

Transient thermal impedance as a function of pulse width

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



$D = \frac{t_p}{T}$
 $R_{th(j-s)} = 3,715 \text{ K/W}$
 FWD thermal model values

R (K/W)	τ (s)
1,58E-01	3,25E+00
5,74E-01	1,68E-01
1,74E+00	4,01E-02
5,91E-01	8,37E-03
6,54E-01	1,47E-03



Rectifier Diode Characteristics

figure 10. Rectifier

Typical forward characteristics

$$I_F = f(V_F)$$

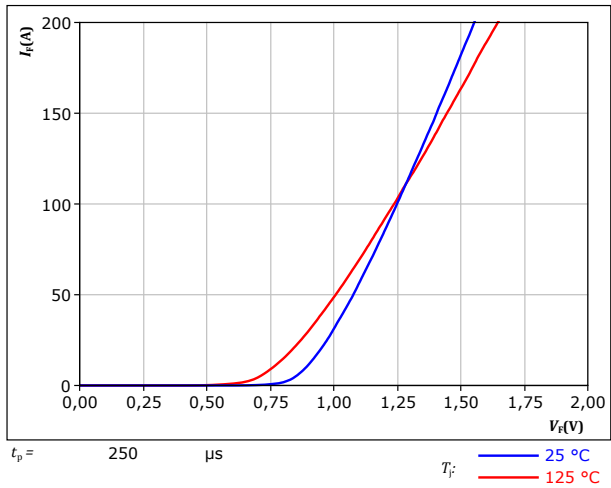
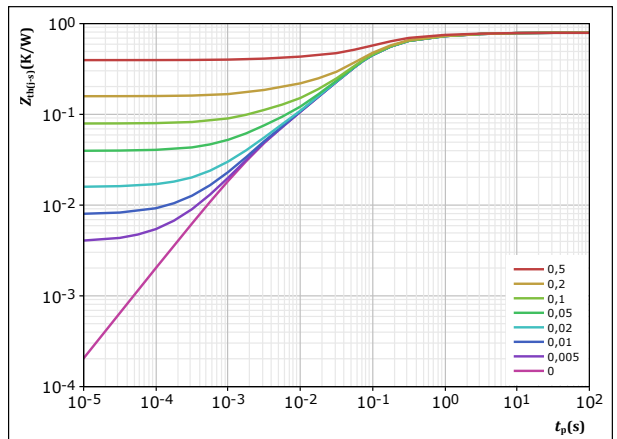


figure 11. Rectifier

Transient thermal impedance as a function of pulse width

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



$D = t_p / T$

$R_{th(j-s)} = 0,792 \text{ K/W}$

Rectifier thermal model values

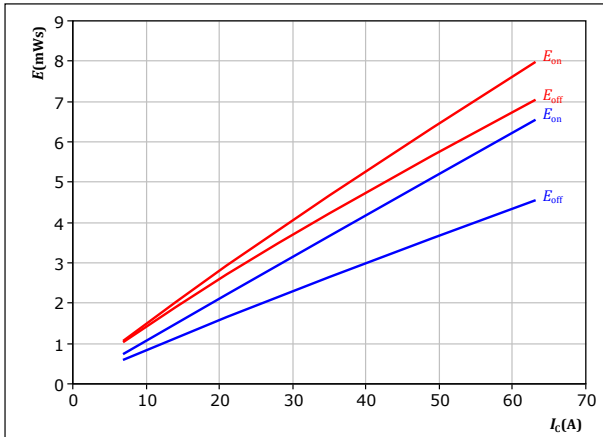
$R \text{ (K/W)}$	$\tau \text{ (s)}$
3,05E-02	5,90E+00
8,93E-02	1,13E+00
2,82E-01	1,79E-01
3,51E-01	6,17E-02
3,93E-02	3,00E-03



Brake Switching Characteristics

figure 12. IGBT

Typical switching energy losses as a function of collector current
 $E = f(I_c)$



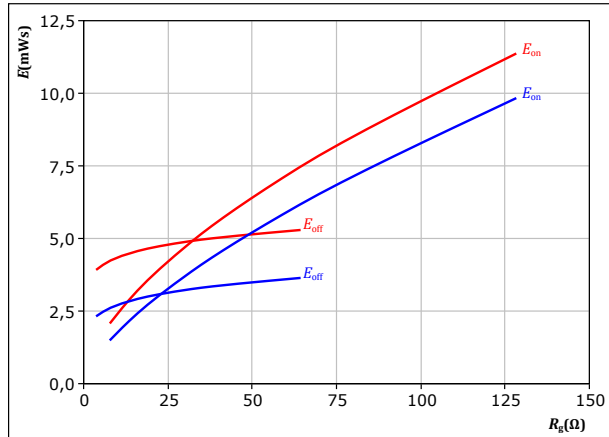
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{g(on)} = 32 \text{ } \Omega$
 $R_{g(off)} = 16 \text{ } \Omega$

T_j : — 25 °C
 — 125 °C

figure 13. IGBT

Typical switching energy losses as a function of gate resistor
 $E = f(R_g)$



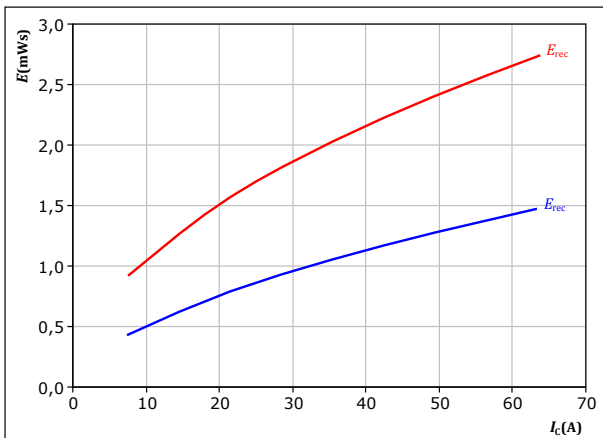
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 35 \text{ A}$

T_j : — 25 °C
 — 125 °C

figure 14. FWD

Typical reverse recovered energy loss as a function of collector current
 $E_{rec} = f(I_c)$



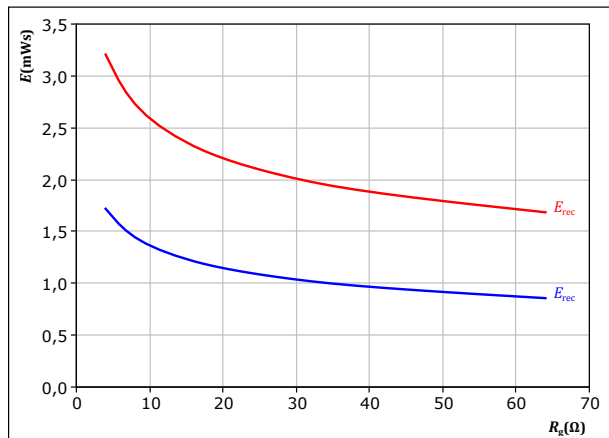
With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{g(on)} = 32 \text{ } \Omega$

T_j : — 25 °C
 — 125 °C

figure 15. FWD

Typical reverse recovered energy loss as a function of gate resistor
 $E_{rec} = f(R_g)$



With an inductive load at

$V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 35 \text{ A}$

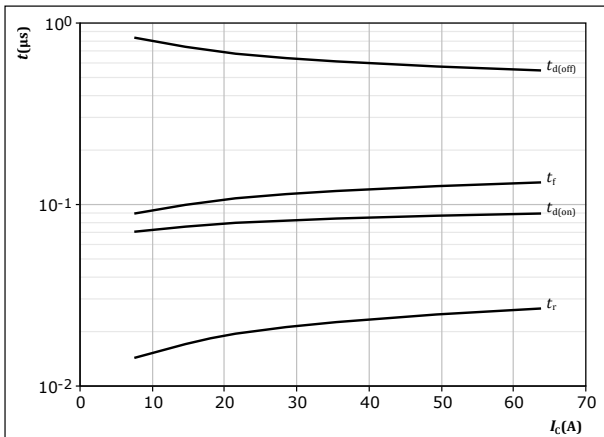
T_j : — 25 °C
 — 125 °C



Brake Switching Characteristics

figure 16. IGBT

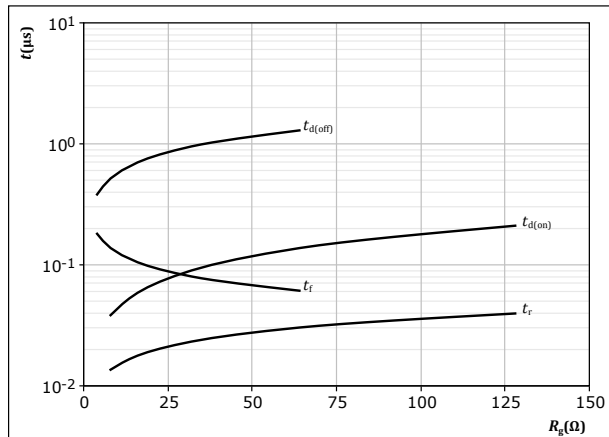
Typical switching times as a function of collector current
 $t = f(I_c)$



With an inductive load at
 $T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{g(on)} = 32 \text{ } \Omega$
 $R_{g(off)} = 16 \text{ } \Omega$

figure 17. IGBT

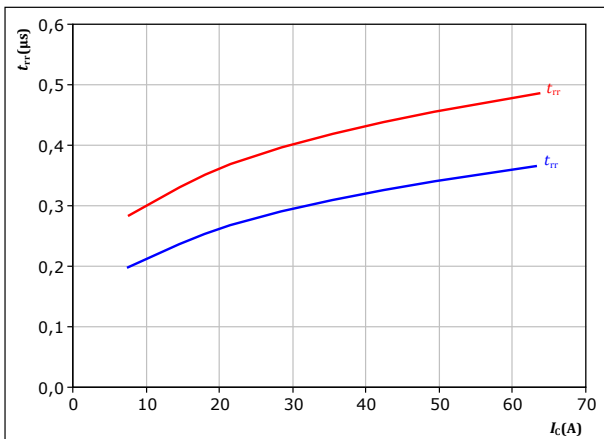
Typical switching times as a function of gate resistor
 $t = f(R_g)$



With an inductive load at
 $T_j = 125 \text{ }^\circ\text{C}$
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 35 \text{ A}$

figure 18. FWD

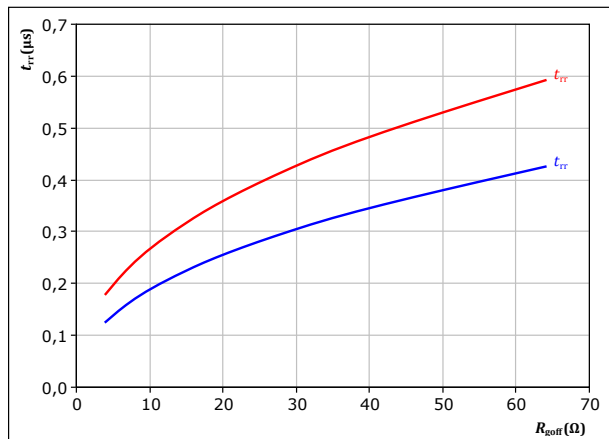
Typical reverse recovery time as a function of collector current
 $t_{rr} = f(I_c)$



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $R_{g(on)} = 32 \text{ } \Omega$
 T_j : — 25 °C
— 125 °C

figure 19. FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor
 $t_{rr} = f(R_{g(off)})$



With an inductive load at
 $V_{CE} = 700 \text{ V}$
 $V_{GE} = 0/15 \text{ V}$
 $I_c = 35 \text{ A}$
 T_j : — 25 °C
— 125 °C

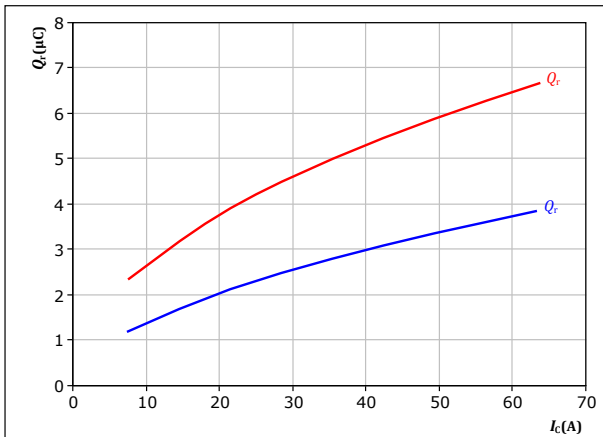


Brake Switching Characteristics

figure 20. FWD

Typical recovered charge as a function of collector current

$$Q_r = f(I_c)$$



With an inductive load at

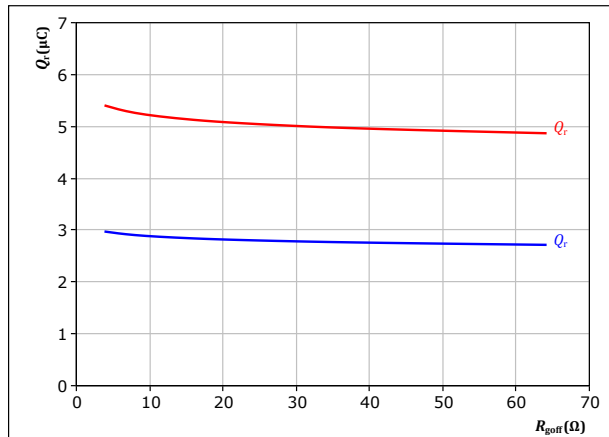
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{goff} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 21. FWD

Typical recovered charge as a function of turn off gate resistor

$$Q_r = f(R_{goff})$$



With an inductive load at

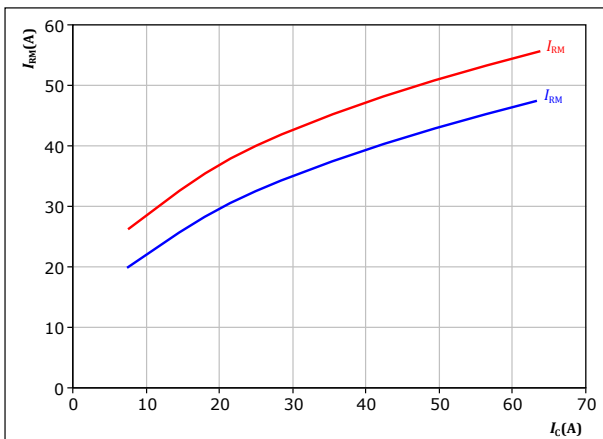
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 35$ A

T_j : — 25 °C
— 125 °C

figure 22. FWD

Typical peak reverse recovery current as a function of collector current

$$I_{RM} = f(I_c)$$



With an inductive load at

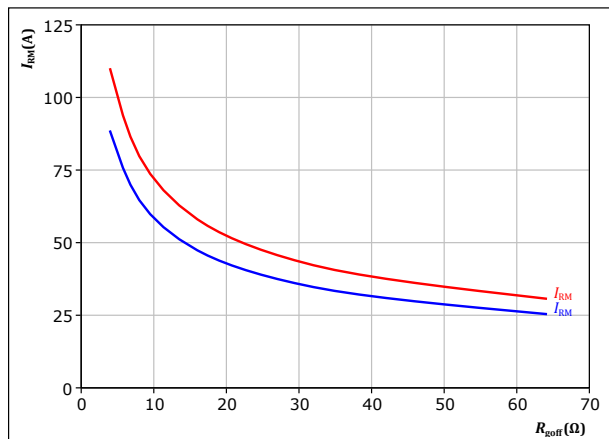
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{goff} = 32$ Ω

T_j : — 25 °C
— 125 °C

figure 23. FWD

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

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



With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 35$ A

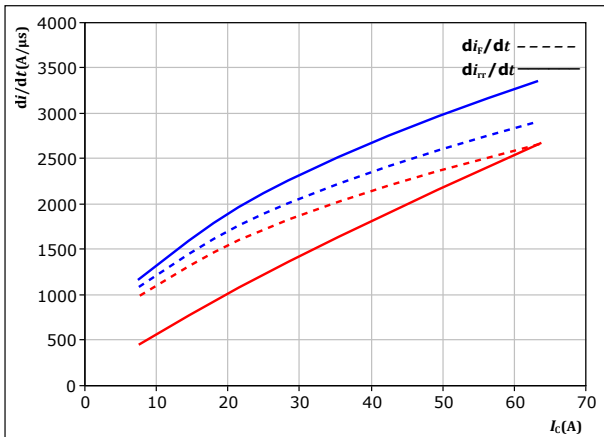
T_j : — 25 °C
— 125 °C



Brake Switching Characteristics

figure 24. FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current
 $di_f/dt, di_r/dt = f(I_c)$



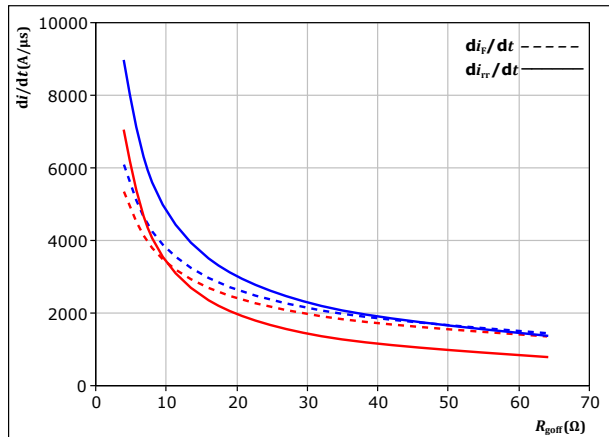
With an inductive load at

$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $R_{goff} = 32$ Ω

T_j : — 25 °C
 — 125 °C

figure 25. FWD

Typical rate of fall of forward and reverse recovery current as a function of turn off gate resistor
 $di_f/dt, di_r/dt = f(R_{goff})$



With an inductive load at

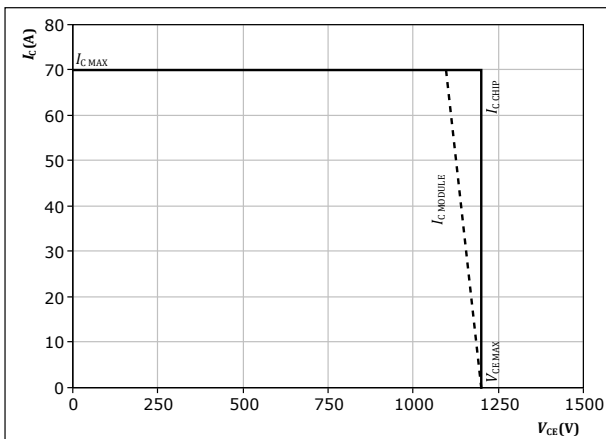
$V_{CE} = 700$ V
 $V_{GE} = 0/15$ V
 $I_c = 35$ A

T_j : — 25 °C
 — 125 °C

figure 26. IGBT

Reverse bias safe operating area

$I_c = f(V_{CE})$



At $T_j = 125$ °C
 $R_{goff} = 32$ Ω
 $R_{goff} = 16$ Ω



Brake Switching Definitions

figure 27. IGBT

Turn-off Switching Waveforms & definition of t_{doff} , t_{Eoff} (t_{Eoff} = integrating time for E_{off})

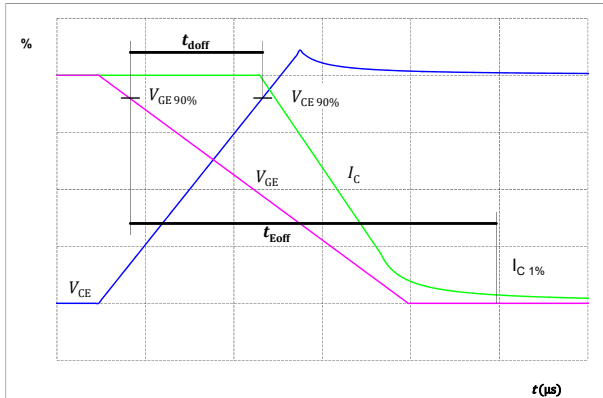


figure 28. IGBT

Turn-on Switching Waveforms & definition of t_{don} , t_{Eon} (t_{Eon} = integrating time for E_{on})

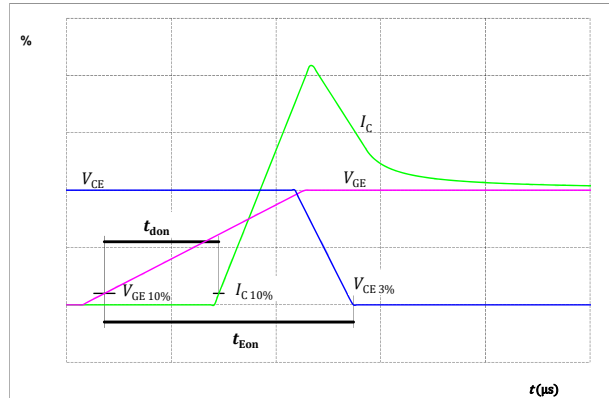


figure 29. IGBT

Turn-off Switching Waveforms & definition of t_f

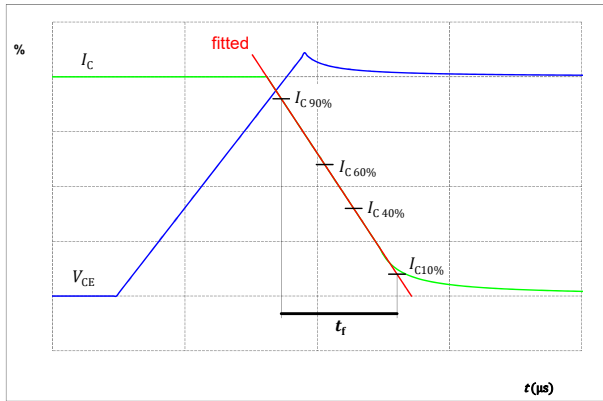
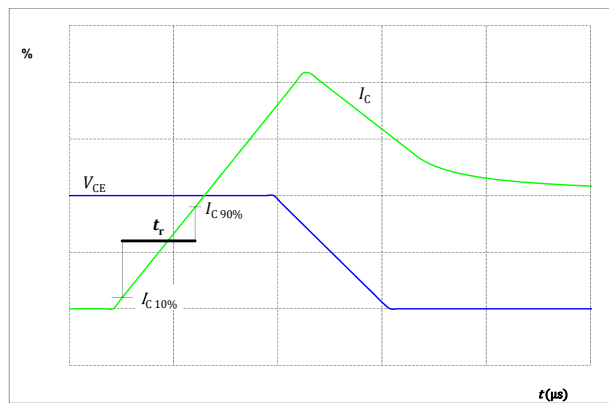


figure 30. IGBT

Turn-on Switching Waveforms & definition of t_r





Brake Switching Definitions

figure 31. FWD

Turn-off Switching Waveforms & definition of t_{rr}

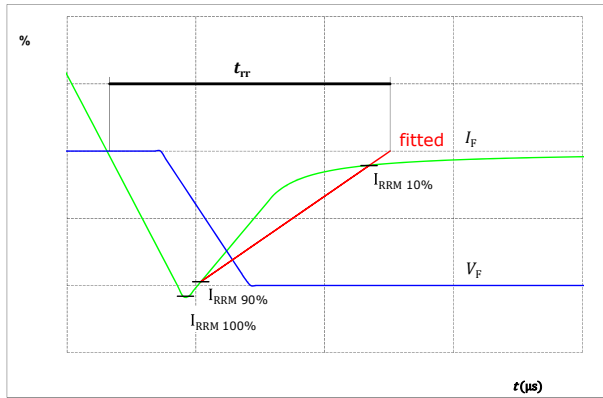
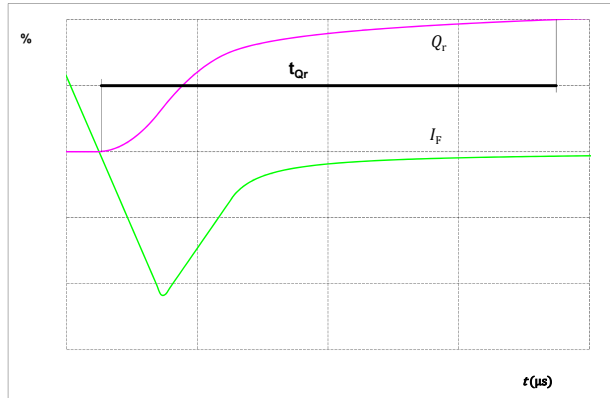


figure 32. FWD

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





Ordering Code	
Version	Ordering Code
Without thermal paste	V23990-P640-G06Y-PM
With thermal paste	V23990-P640-G06Y-/3/-PM

Marking							
	Text	VIN VIN	Date code WWYY	Type&Ver TTTTTTVW	UL UL	Lot LLLLL	Serial SSSS
	Datamatrix	Type&Ver	Lot number	Serial	Date code		
		TTTTTTVW	LLLLL	SSSS	WWYY		

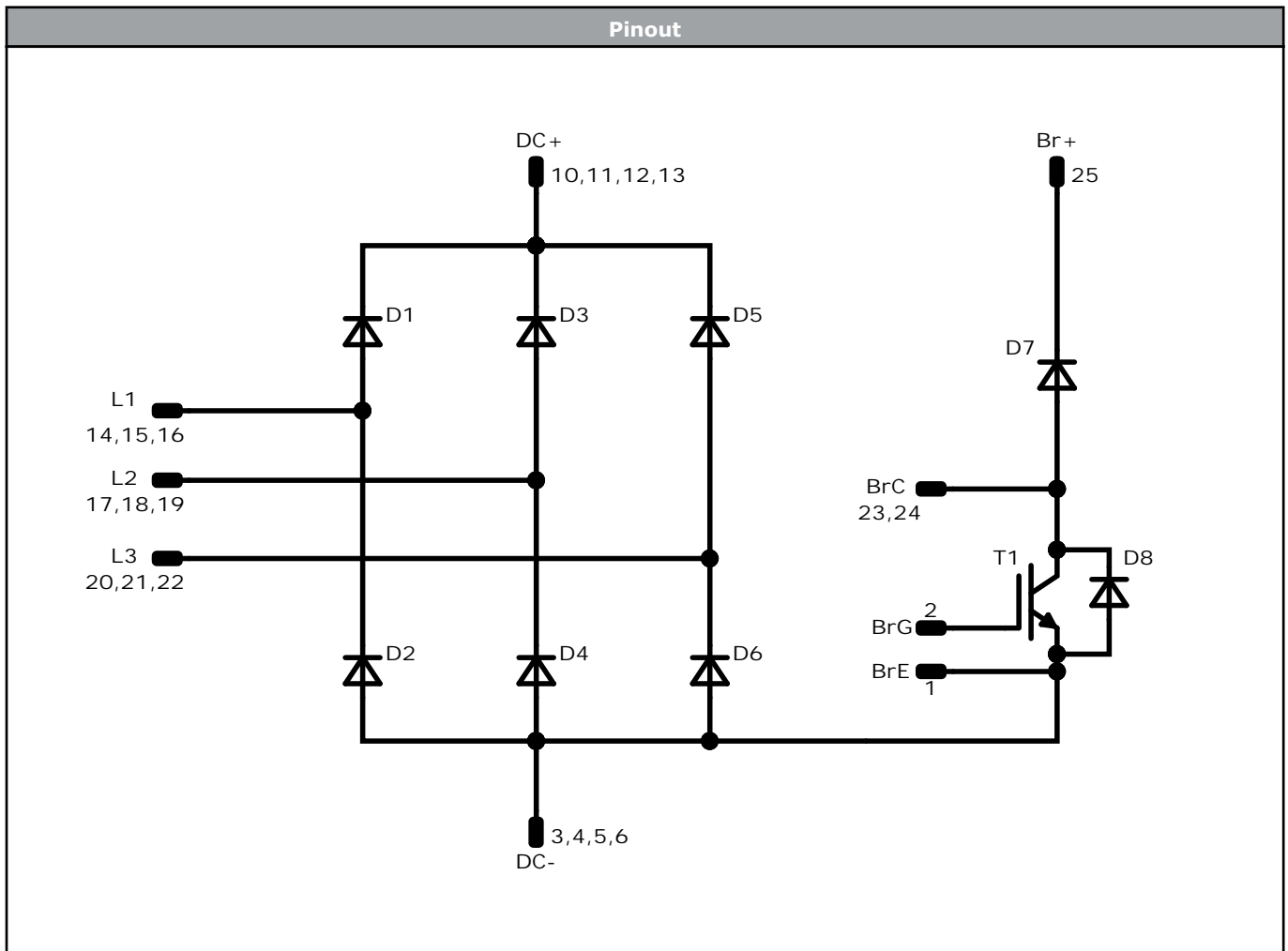
Pin table [mm]			
Pin	X	Y	Function
1	33,5	0	BrE
2	30,7	0	BrG
3	26,4	0	DC-
4	23,9	0	DC-
5	21,4	0	DC-
6	18,9	0	DC-
7	not assembled		
8	not assembled		
9	not assembled		
10	0	0	DC+
11	0	2,5	DC+
12	0	5	DC+
13	0	7,5	DC+
14	0	22,5	L1
15	2,5	22,5	L1
16	5	22,5	L1
17	12	22,5	L2
18	14,5	22,5	L2
19	17	22,5	L2
20	24	22,5	L3
21	26,5	22,5	L3
22	29	22,5	L3
23	33,5	17,1	BrC
24	33,5	14,6	BrC
25	33,5	7	Br+

center of press-fit pin head
pin head type "Y", PCB plated through-hole $\varnothing 1.5 \text{ mm} \pm 0.09 / -0.06$
for further PCB design rules refer to the latest handling instruction

18,9 ±0,1
8,2 ±0,5

16,75

Tolerance of proportions: ±0.5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance



Identification					
ID	Component	Voltage	Current	Function	Comment
T1	IGBT	1200 V	35 A	Brake Switch	
D7	FWD	1200 V	25 A	Brake Diode	
D8	FWD	1200 V	3 A	Brake Sw. Protection Diode	
D2, D1, D4, D3, D6, D5	Rectifier	1600 V	80 A	Rectifier Diode	




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

Handling instruction
Handling instructions for <i>flow 0</i> packages see vincotech.com website.

Package data
Package data for <i>flow 0</i> packages see vincotech.com website.

Vincotech thermistor reference
See Vincotech thermistor reference table at 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
V23990-P640-G06Y-PM-D1-14	30 Apr. 2021		

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.