Vincotech

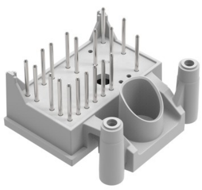
10-0B06PRA004RC-L022C09
datasheet

flow PIM 0B	600 V / 4 A

Features

- IGBT in TRENCHSTOP RC technology
- Open emitter topology
- New ultra-compact housing
- Single-screw heat sink mounting

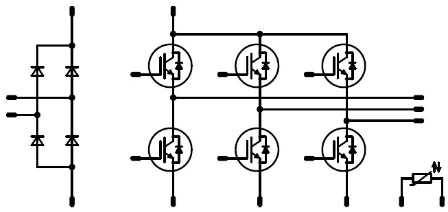
***flow* 0 B housing**



Target applications

- Embedded drives
- Industrial Drives

Schematic



Types

- 10-0B06PRA004RC-L022C09

Maximum Ratings

T_j=25°C, unless otherwise specified

Parameter	Symbol	Condition		Value	Unit
Inverter Switch					
Collector-emitter break down voltage	V_{CES}			600	V
DC collector current	I_C	T_j=$T_j$max	T_h=80°C	8	A
Pulsed collector current	I_{Cpulse}	t_p limited by $T_j$max		12	A
Turn off safe operating area		Tj≤ 150°C, VCE≤ 600V		8	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C	37	W
Gate-emitter peak voltage	V_{GE}			±20	V
Short circuit ratings	t_{SC} V_{CC}	Tj≤ 150°C VGE= 15V		5 400	μs V
Maximum Junction Temperature	$T_j$max			175	°C

Parameter	Symbol	Conditions		Value	Unit
Rectifier Diode					
Peak Repetitive Reverse Voltage	V_{RRM}			1600	V
DC forward current	I_{FAV}	T_j=$T_j$max	T_h=80°C	13	A
Non-repetitive peak surge current	I_{FSM}	60Hz Single Half Sine Wave		150	A
Power dissipation	P_{tot}	T_j=$T_j$max	T_h=80°C	34	W
Maximum Junction Temperature	$T_j$max			150	°C

Characteristic Values

Inverter Switch

Parameter	Symbol	Conditions					Value			Unit
			V_{GE} [V]	V_{CE} [V]	I_C [A]	T_j [°C]	Min	Typ	Max	
Static										
Gate emitter threshold voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$			0,000075	25 125	4,4	5	5,6	V
Collector-emitter saturation voltage	$V_{CE(sat)}$		15		4	25 125 150	1,88	2,20 2,30 2,29	2,62	V
Collector-emitter cut-off	I_{CES}		0	600		25 125			2	µA
Gate-emitter leakage current	I_{GES}		20	0		25 125			120	nA
Integrated Gate resistor	R_{gint}							none		Ω
Input capacitance	C_{ies}	f=1 MHz	0	25		25		305		pF
Output capacitance	C_{oss}							18		
Reverse transfer capacitance	C_{rss}							9		
Gate charge	Q_{Gate}		15	480	4	25		27		nC
Thermal										
Thermal resistance chip to heatsink	R_{thJH}	Phase-Change Material λ=3,4W/mK						2,60		K/W
IGBT Switching										
Turn-on delay time	$t_{d(on)}$	Rgoff=64Ω Rgon=64Ω	±15	400	4	25 125		88 81		ns
Rise time	t_r					25 125		15 18		
Turn-off delay time	$t_{d(off)}$					25 125		84 98		
Fall time	t_f					25 125		25 47		
Turn-on energy loss per pulse	E_{on}	QrrFWD=0,2µC QrrFWD=0,4µC				25 125		0,099 0,158		mWs
Turn-off energy loss per pulse	E_{off}					25 125		0,049 0,079		
FWD Switching										
Peak recovery current	I_{RRM}	di/dt=447A/µs di/dt=196A/µs	±15	400	4	25 125		4 4		A
Reverse recovery time	t_{rr}					25 125		164 219		ns
Reverse recovery charge	Q_{rr}					25 125		0,199 0,379		µC
Reverse recovered energy	E_{rec}					25 125		0,051 0,096		mWs
Peak rate of fall of recovery current	di(rec)max /dt					25 125		47 45		A/µs

Rectifier Diode

Parameter	Symbol	Conditions					Value			Unit
		dI_F/dt [A/us]		V_r [V]	I_F [A]	T_j	Min	Typ	Max	
Static										
Forward voltage	V_F				7	25°C 125°C 150°C		1,04 0,97 -	1,14	V
Reverse leakage current	I_r			1600		25°C 150°C			20 -	µA
Thermal										
Thermal resistance chip to heatsink per chip	R_{thJH}	Phase-Change Material λ=3,4W/mK						2,09		K/W

Thermistor

Parameter	Symbol	Conditions				T_j	Min	Typ	Max	Unit
Rated resistance	R					25		22		kΩ
Deviation of R_{100}	$\Delta_{R/R}$	R_{100} = 1484 Ω				100	-5		5	%
Power dissipation	P					25		5		mW
Power dissipation constant						25		1,5		mW/K
B-value	$B_{(25/50)}$	Tol. ±1 %				25		3962		K
B-value	$B_{(25/100)}$	Tol. ±1 %				25		4000		K
Vincotech NTC Reference									I	

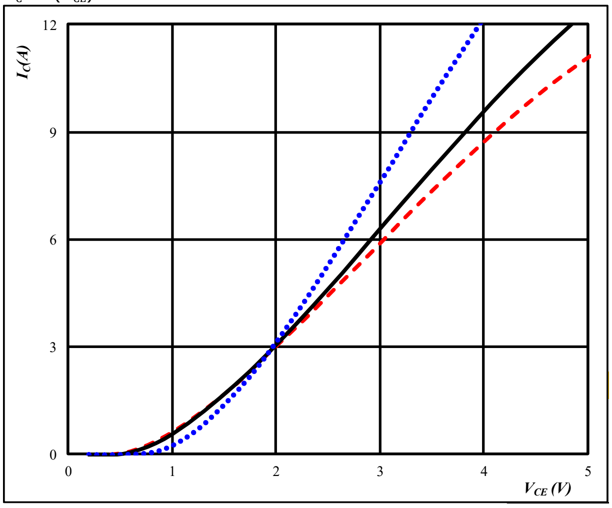
Module Properties

Parameter	Symbol	Conditions		Value	Unit
Thermal Properties					
Storage temperature	T_{stg}			-40…+125	°C
Operation temperature under switching condition	T_{op}			-40…+(Tjmax - 25)	°C
Insulation Properties					
Insulation voltage	V_{is}	DC voltage	t=2s	4000	V
Creepage distance				min 12,7	mm
Clearance				min 12,7	mm
Comparative tracking index	CTI			>200	

Inverter Switch Characteristics

Typical output characteristics — IGBT

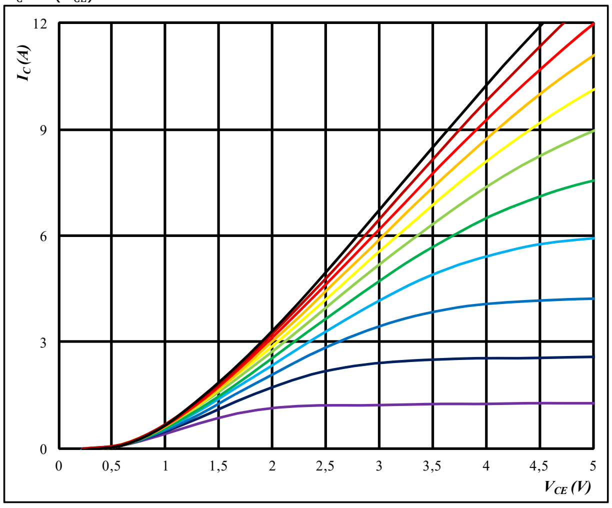
$I_C = f(V_{CE})$



t_p =	250	µs		25 °C	dotted
V_{GE}=	15	V	T_j:	125 °C	solid
				150 °C	dashed

Typical output characteristics — IGBT

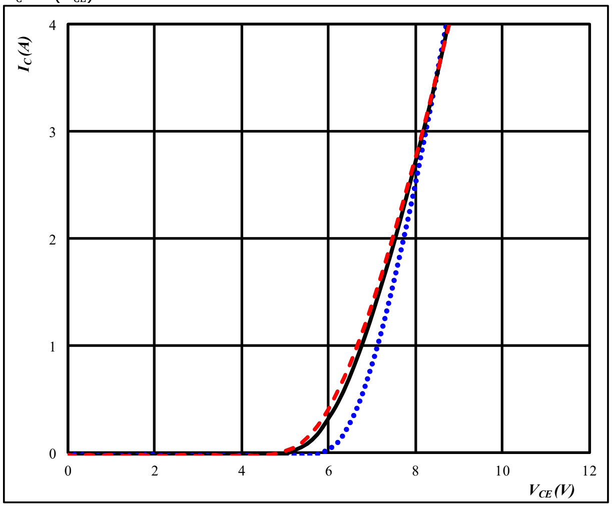
$I_C = f(V_{CE})$



t_p = 250 µs
T_j = 150 °C
V_{GE} from 7 V to 17 V in steps of 1 V

Typical transfer characteristics — IGBT

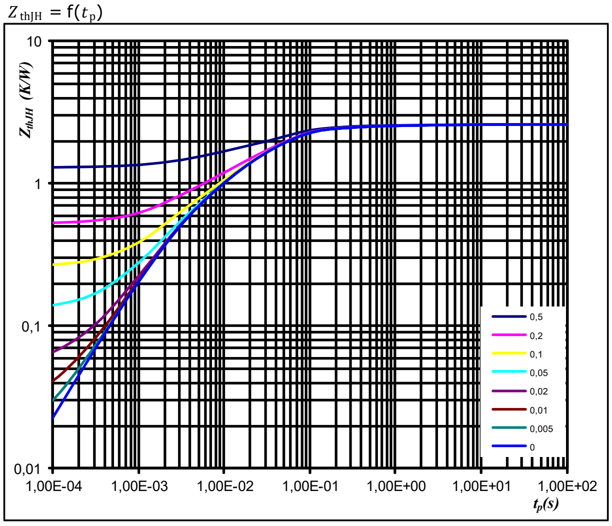
$I_C = f(V_{CE})$



t_p =	100	µs		25 °C	dotted
V_{CE} =	10	V	T_j:	125 °C	solid
				150 °C	dashed

Transient thermal impedance as a function of pulse v — IGBT

$Z_{thJH} = f(t_p)$



D = t_p / T
R_{thJH} = 2,60 K/W

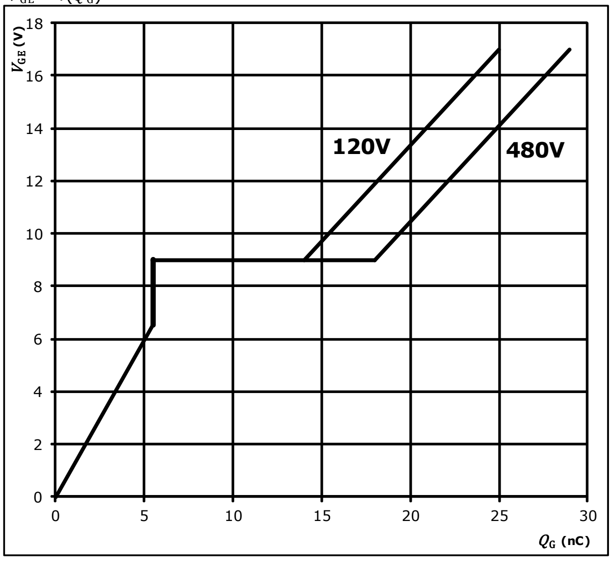
IGBT thermal model values

R (K/W)	Tau (s)
7,48E-02	2,66E+00
1,91E-01	2,47E-01
1,40E+00	4,11E-02
4,54E-01	1,27E-02
4,75E-01	2,92E-03

Inverter Switch Characteristics

Gate voltage vs Gate charge — IGBT

$V_{GE} = f(Q_G)$

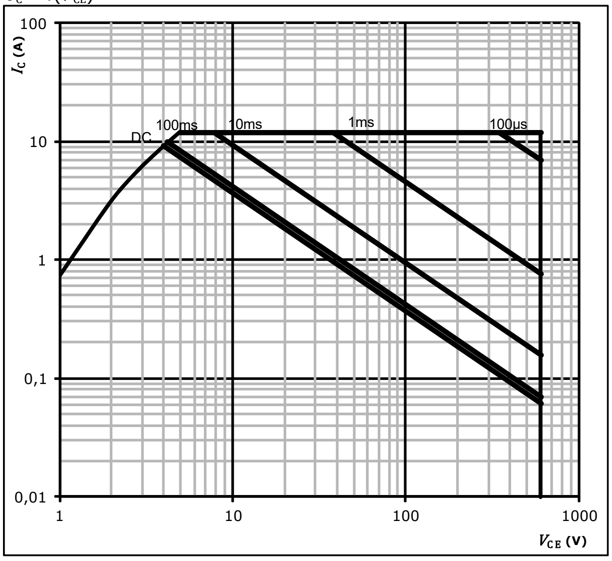


At

I_C =	4	A

Safe operating area — IGBT

$I_C = f(V_{CE})$

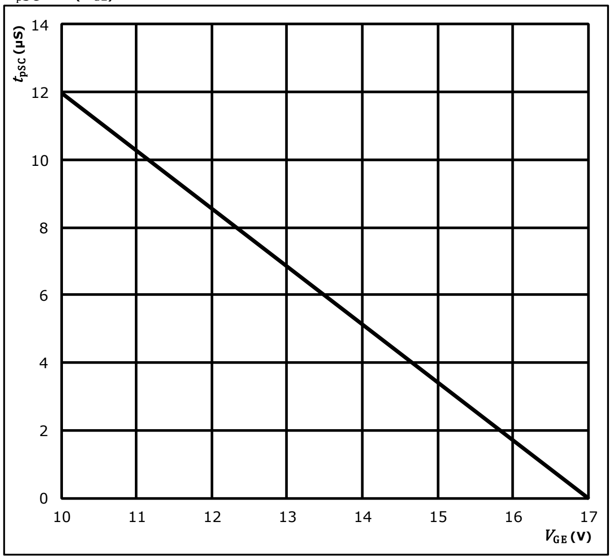


At

D =	single pulse	
T_s =	80	ºC
V_{GE} =	±15	V
T_j =	T_{jmax}	ºC

Short circuit duration as a function of V_{GE} — IGBT

$t_{pSC} = f(V_{GE})$

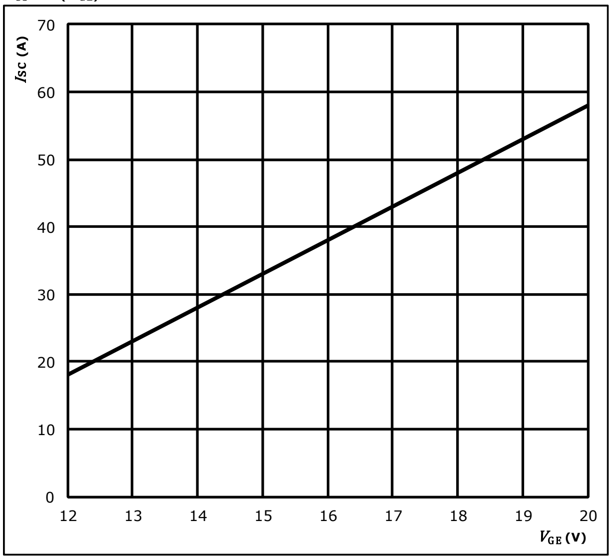


At

V_{CE} =	400	V
Start at T_j ≤	150	ºC

Typical short circuit current as a function of V_{GE} — IGBT

$I_{SC} = f(V_{GE})$



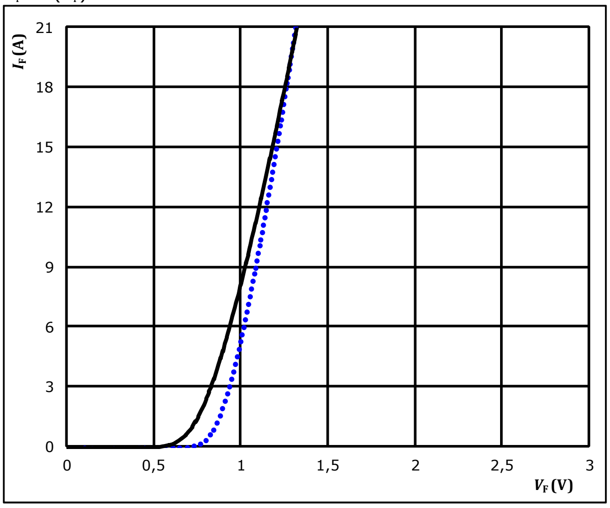
At

V_{CE} ≤	400	V
Start at T_j :	25	ºC

Rectifier characteristics

Typical forward characteristics — **Rectifier Diode**

$I_F = f(V_F)$

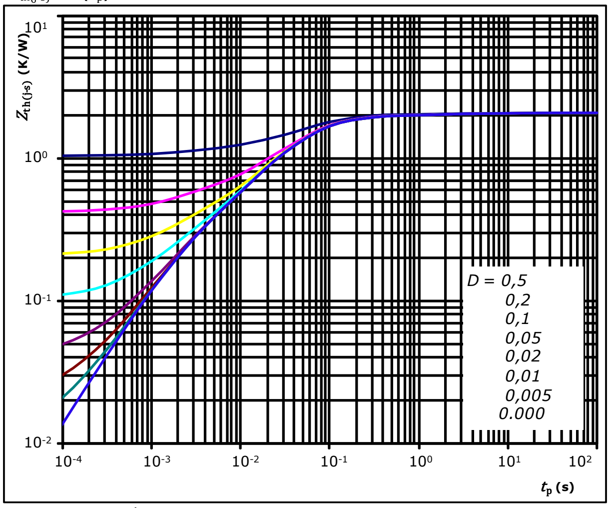


t_p = 250 μs

T_j: 25 °C, 125 °C, 150 °C

Transient thermal impedance as a function of pulse width — **Rectifier Diode**

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



$D = t_p / T$

$R_{th(j-s)}$ = 2,09 K/W

Diode thermal model values

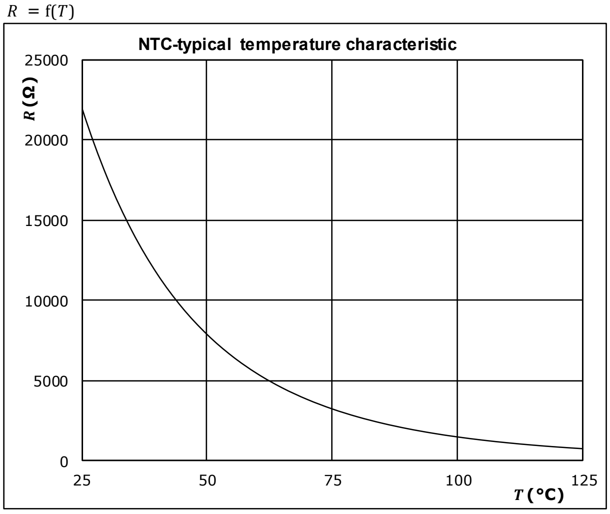
R (K/W)	τ (s)
4,86E-02	1,03E+01
1,45E-01	6,91E-01
1,18E+00	6,09E-02
5,40E-01	1,88E-02
1,74E-01	1,96E-03

Thermistor Characteristics

figure 1. — **Thermistor**

Typical NTC characteristic as a function of temperature

$R = f(T)$

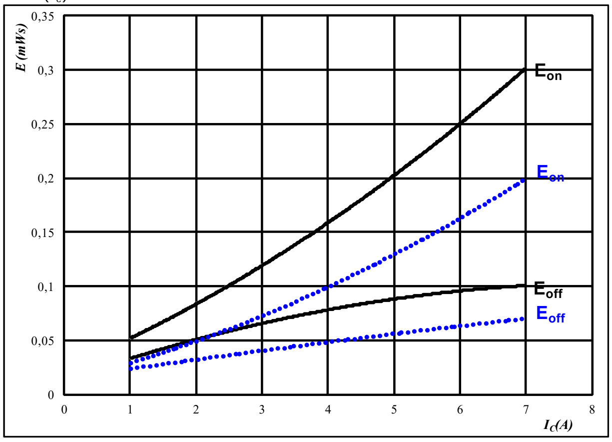


Inverter Switching Definitions

Figure 1. IGBT

Typical switching energy losses as a function of collector current

$E = f(I_C)$



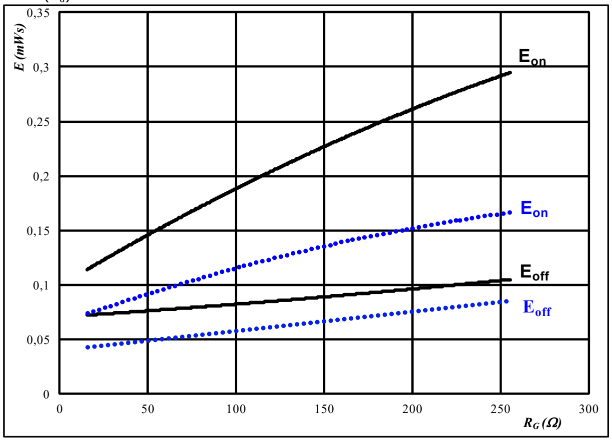
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	·············
V_{GE} =	±15	V		125 °C	———
R_{gon} =	64	Ω		150 °C	– – – –
R_{goff} =	64	Ω			

Figure 2. IGBT

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$



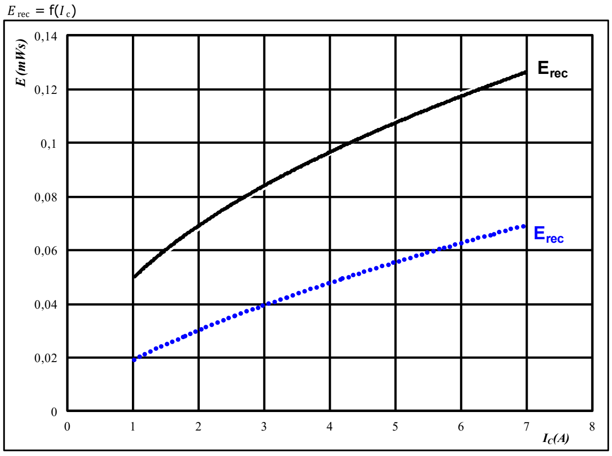
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	·············
V_{GE} =	±15	V		125 °C	———
I_C =	4	A		150 °C	– – – –

Figure 3. FWD

Typical reverse recovery energy loss as a function of collector current

$E_{rec} = f(I_c)$



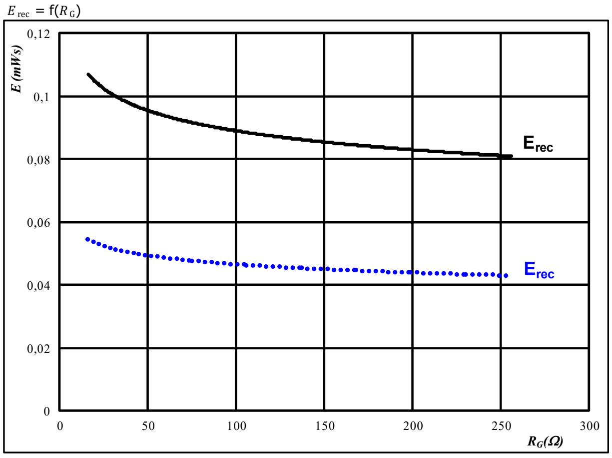
With an inductive load at

V_{CE} =	400	V	T_j:	25 °C	·············
V_{GE} =	±15	V		125 °C	———
R_{gon} =	64	Ω		150 °C	– – – –

Figure 4. FWD

Typical reverse recovery energy loss as a function of gate resistor

$E_{rec} = f(R_G)$



With an inductive load at

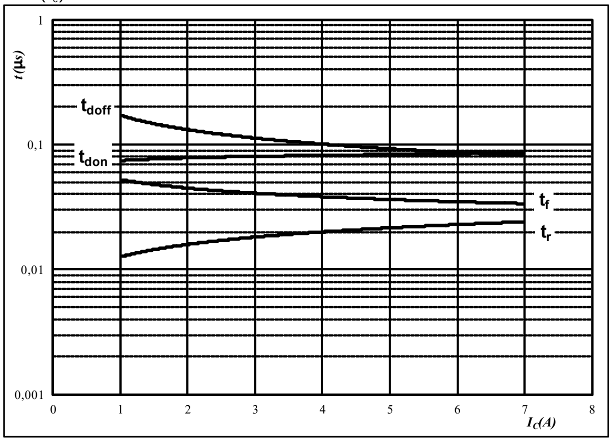
V_{CE}=	400	V	T_j:	25 °C	·············
V_{GE}=	±15	V		125 °C	———
I_C=	4	A		150 °C	– – – –

Inverter Switching Definitions

Figure 5. IGBT

Typical switching times as a function of collector current

$t = f(I_C)$



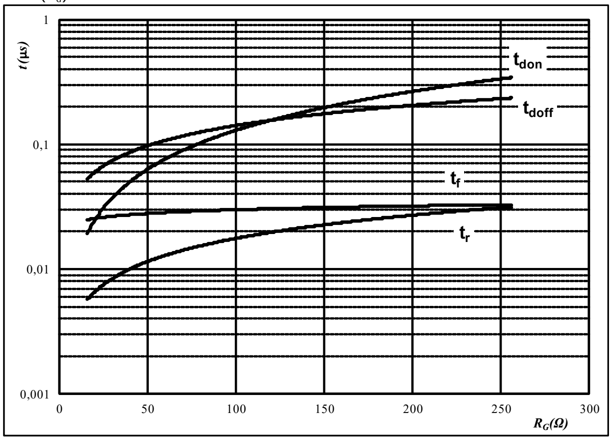
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω
R_{goff} =	64	Ω

Figure 6. IGBT

Typical switching times as a function of gate resistor

$t = f(R_G)$



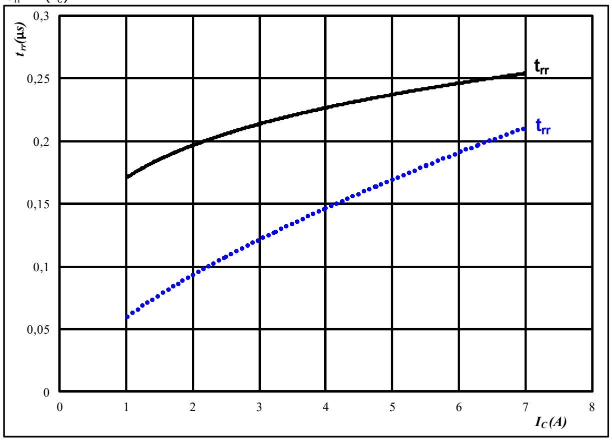
With an inductive load at

T_j =	125	°C
V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

Figure 7. FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = f(I_C)$

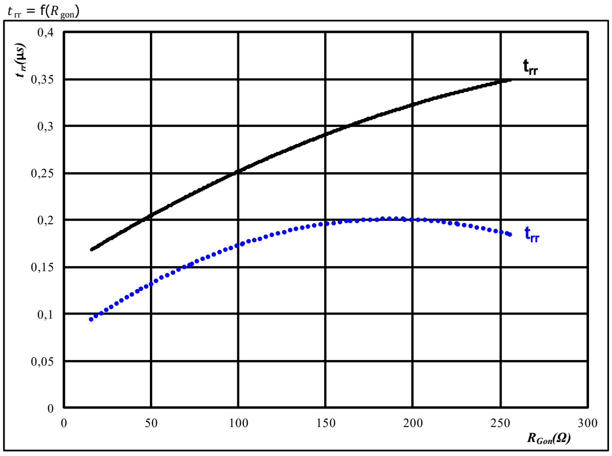


At					
V_{CE}=	400	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
R_{gon} =	64	Ω		150 °C	– – – –

Figure 8. FWD

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

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



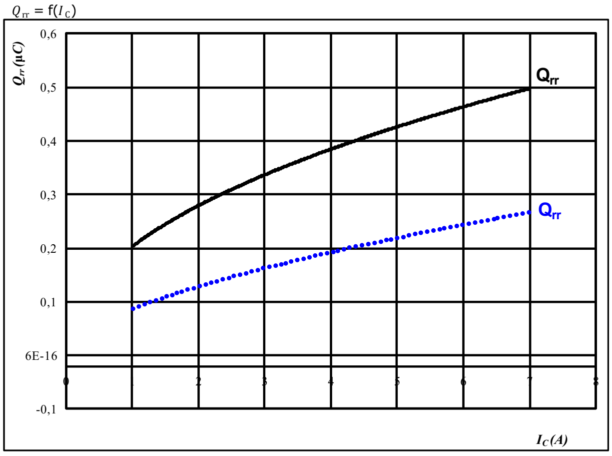
At					
V_{CE}=	400	V		25 °C	············
V_{GE} =	±15	V	T_j:	125 °C	———
I_C=	4	A		150 °C	– – – –

Inverter Switching Definitions

Figure 9. FWD

Typical reverse recovery charge as a function of collector current

$Q_{rr} = f(I_C)$

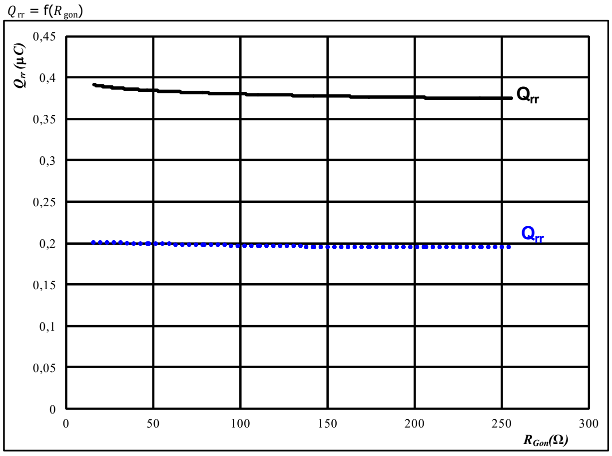


At	V_{CE} =	400	V		**25 °C**	·············
	V_{GE} =	±15	V	T_j:	**125 °C**	———
	R_{gon} =	64	Ω		**150 °C**	– – – –

Figure 10. FWD

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

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

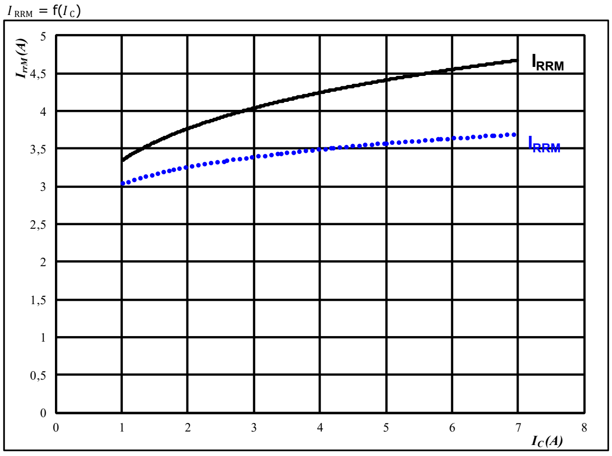


At	V_{CE} =	400	V		**25 °C**	·············
	V_{GE} =	±15	V	T_j:	**125 °C**	———
	I_C =	4	A		**150 °C**	– – – –

Figure 11. FWD

Typical reverse recovery current as a function of collector current

$I_{RRM} = f(I_C)$

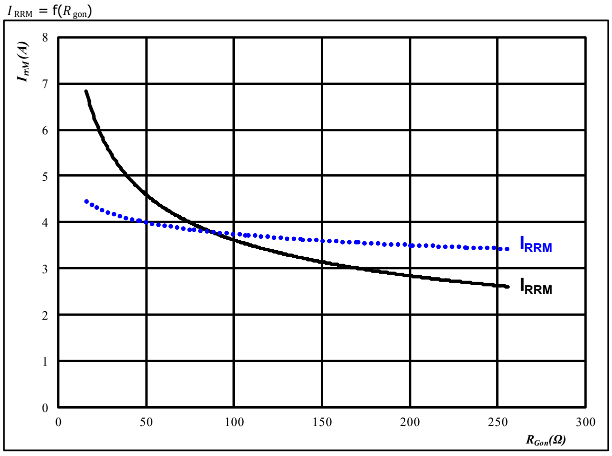


At	V_{CE} =	400	V		**25 °C**	·············
	V_{GE} =	±15	V	T_j:	**125 °C**	———
	R_{gon} =	64	Ω		**150 °C**	– – – –

Figure 12. FWD

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

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



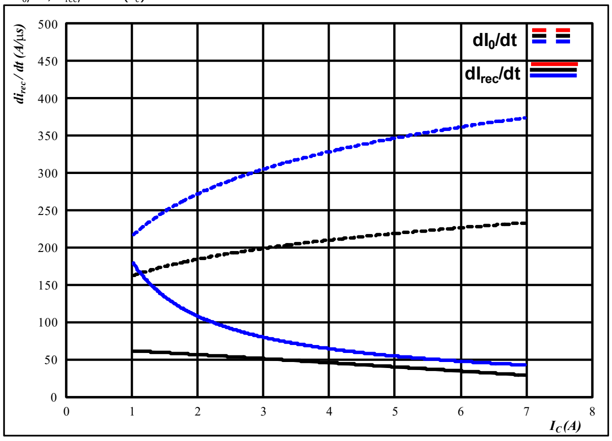
At	V_{CE} =	400	V		**25 °C**	·············
	V_{GE} =	±15	V	T_j:	**125 °C**	———
	I_C =	4	A		**150 °C**	– – – –

Inverter Switching Definitions

Figure 13. FWD

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

$dI_0/dt, dI_{rec}/dt = f(I_c)$

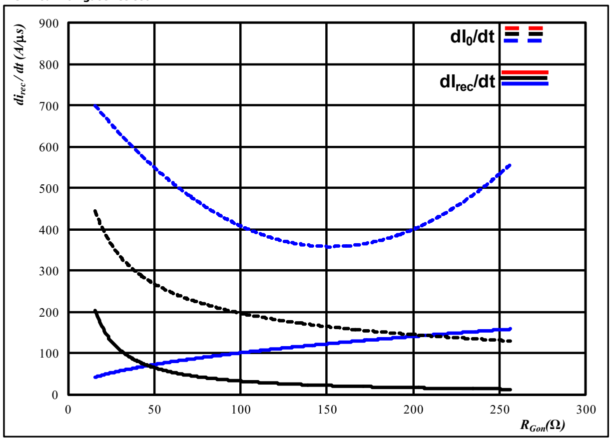


At

V_{CE} =	400	V
V_{GE} =	±15	V
R_{gon} =	64	Ω

Figure 14. FWD

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



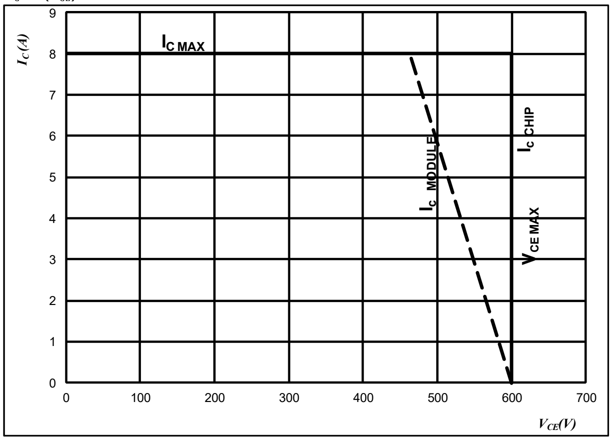
At

V_{CE} =	400	V
V_{GE} =	±15	V
I_C =	4	A

Figure 15. IGBT

Reverse bias safe operating area

$I_C = f(V_{CE})$



At

T_j =	175	°C
R_{gon} =	64	Ω
R_{goff} =	64,015	Ω

Vincotech

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datasheet

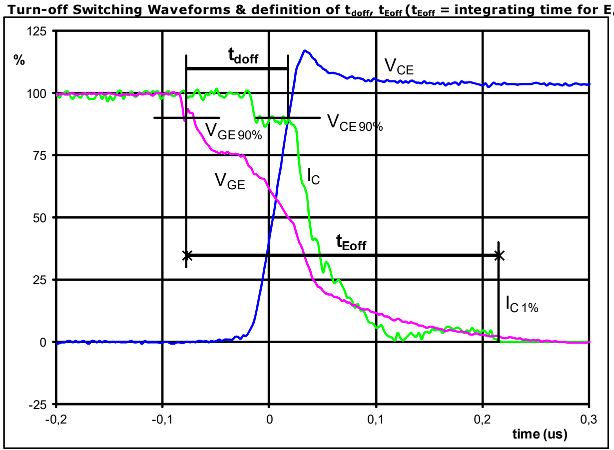
Inverter Switching Definitions

General conditions

T_j	=	125 °C
R_{gon}	=	64 Ω
R_{goff}	=	64 Ω

Figure 1. IGBT

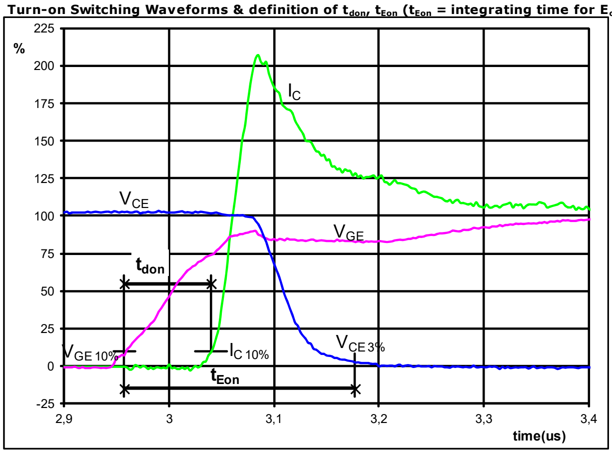
Turn-off Switching Waveforms & definition of t_{doff}, t_{Eoff} (t_{Eoff} = integrating time for E_{off})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	4	A
t_{doff} =	0,098	μs
t_{Eoff} =	0,293	μs

Figure 2. IGBT

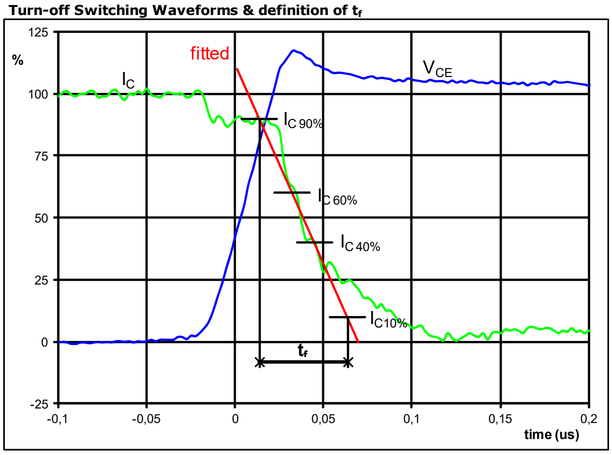
Turn-on Switching Waveforms & definition of t_{don}, t_{Eon} (t_{Eon} = integrating time for E_{on})



V_{GE} (0%) =	-15	V
V_{GE} (100%) =	15	V
V_C (100%) =	400	V
I_C (100%) =	4	A
t_{don} =	0,081	μs
t_{Eon} =	0,220	μs

Figure 3. IGBT

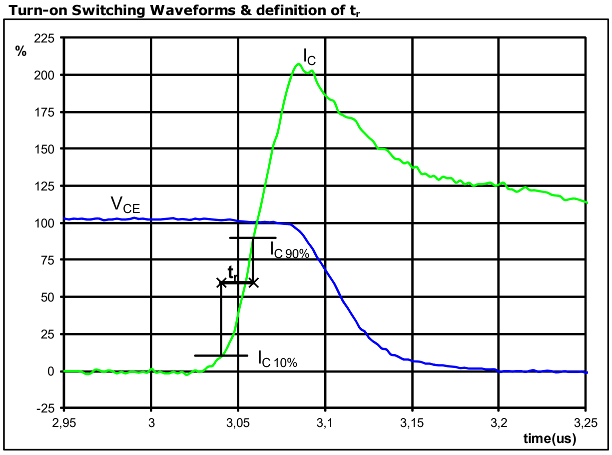
Turn-off Switching Waveforms & definition of t_f



V_C (100%) =	400	V
I_C (100%) =	4	A
t_f =	0,047	μs

Figure 4. IGBT

Turn-on Switching Waveforms & definition of t_r

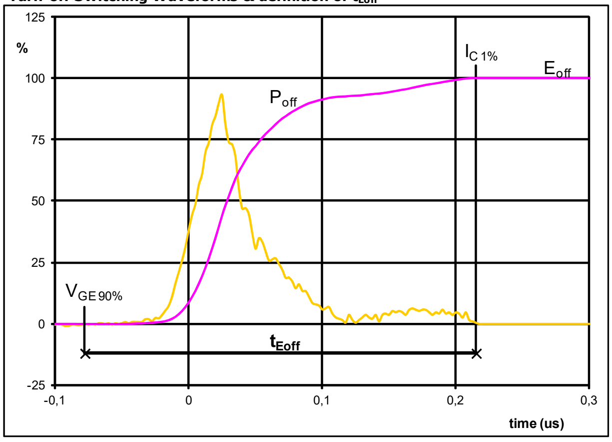


V_C (100%) =	400	V
I_C (100%) =	4	A
t_r =	0,018	μs

Inverter Switching Definitions

Figure 5. IGBT

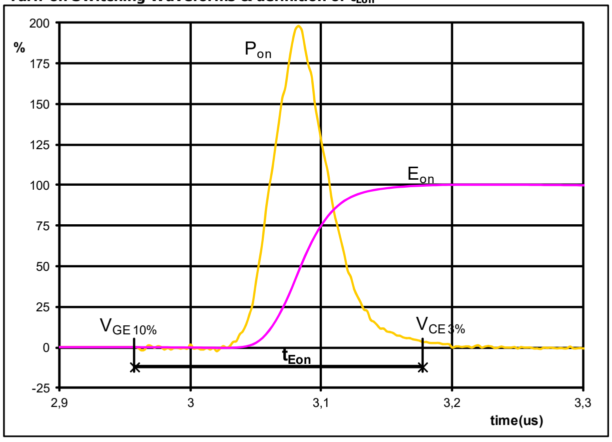
Turn-off Switching Waveforms & definition of t_{Eoff}



P_{off} (100%) =	1,59	kW
E_{off} (100%) =	0,08	mJ
t_{Eoff} =	0,29	μs

Figure 6. IGBT

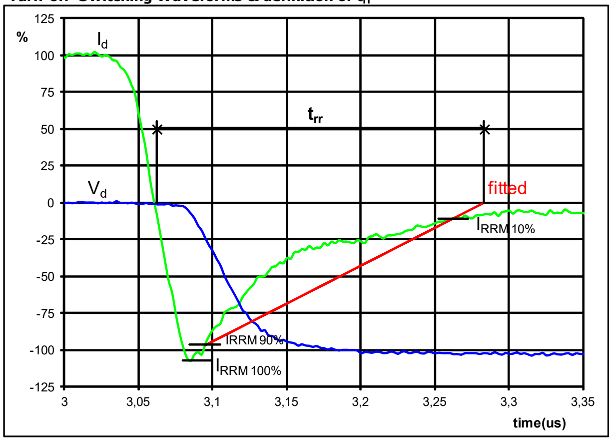
Turn-on Switching Waveforms & definition of t_{Eon}



P_{on} (100%) =	1,59	kW
E_{on} (100%) =	0,16	mJ
t_{Eon} =	0,22	μs

Figure 7. FWD

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

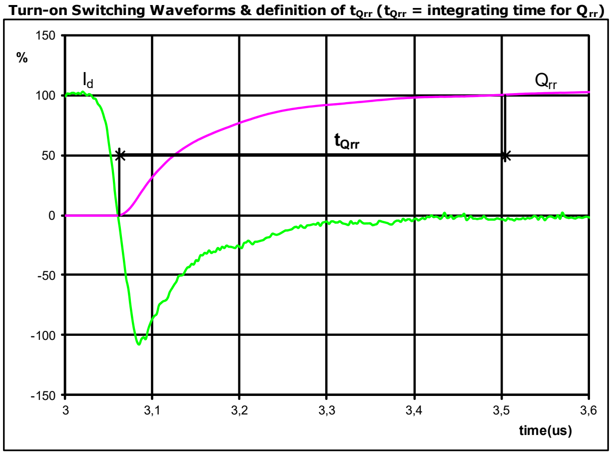


V_d (100%) =	400	V
I_d (100%) =	4	A
I_{RRM} (100%) =	-4	A
t_{rr} =	0,219	μs

Inverter Switching Definitions

Figure 8. FWD

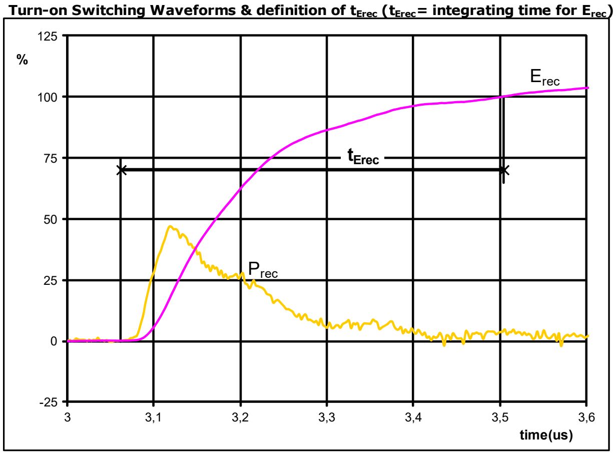
Turn-on Switching Waveforms & definition of t_{Qrr} (t_{Qrr} = integrating time for Q_{rr})



I_d (100%) =	4	A
Q_{rr} (100%) =	0,38	µC
t_{Qrr} =	0,44	µs

Figure 9. FWD

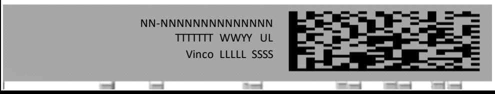
Turn-on Switching Waveforms & definition of t_{Erec} (t_{Erec}= integrating time for E_{rec})



P_{rec} (100%) =	1,59	kW
E_{rec} (100%) =	0,10	mJ
t_{Erec} =	0,44	µs

Ordering Code & Marking

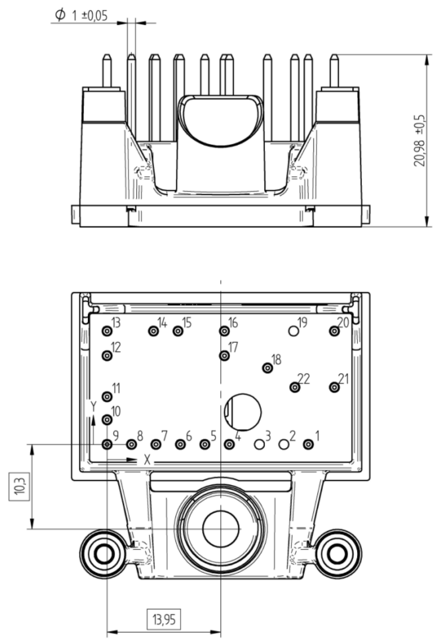
Version	Ordering Code	in DataMatrix as	in packaging barcode as
without thermal paste 17mm housing	10-0B06PRA004RC-L022C09	L022C09	L022C09



	Name		Date code	UL & Vinco	Lot	Serial
Text	NN-NNNNNNNNNNNNNN-TTTTTTT		WWYY	UL Vinco	LLLLL	SSSS
	Type	Lot number	Serial	Date code		
Datamatrix	TTTT-TTT	LLLLL	SSSS	WWYY		

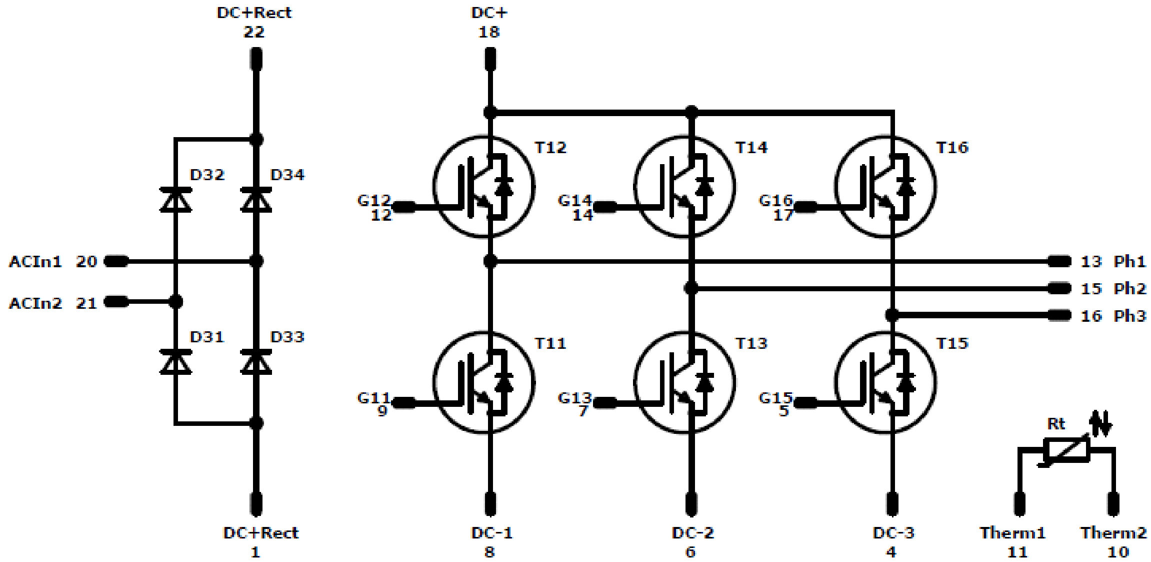
Outline

Pin table [mm]			
Pin	X	Y	Function
1	24,7	0	DC-Rect
2	not assembled		
3	not assembled		
4	15	0	DC-3
5	12	0	G15
6	9	0	DC-2
7	6	0	G13
8	3	0	DC-1
9	0	0	G11
10	0	3	Therm2
11	0	5,8	Therm1
12	0	10,8	G12
13	0	13,8	Ph1
14	5,7	13,8	G14
15	8,7	13,8	Ph2
16	14,4	13,8	Ph3
17	14,4	10,8	G16
18	19,7	9,3	DC+
19	not assembled		
20	27,9	13,8	ACIn1
21	27,9	6,95	ACIn2
22	23,05	6,95	DC+Rect



Tolerance of pinpositions: ±0,5mm at the end of pins
Dimension of coordinate axis is only offset without tolerance

Pinout



Identification

ID	Component	Voltage	Technology	Current	Function	Comment
T11-T16	IGBT	600V		4A	Inverter switch	
D31-D34	Diode	1600V		7A	Rectifier Diode	
R_t	NTC	-		-	Thermistor	

Packaging instruction				
Standard packaging quantity (SPQ) 160	>SPQ	Standard	<SPQ	Sample

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

Package data
Package data for *flow* 0 B 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
10-0B06PRA004RC-L022C09-D3-14	23 Mar. 2021	Update Thermistor	4, 7