Technical Information

IFF2400P17AE440989

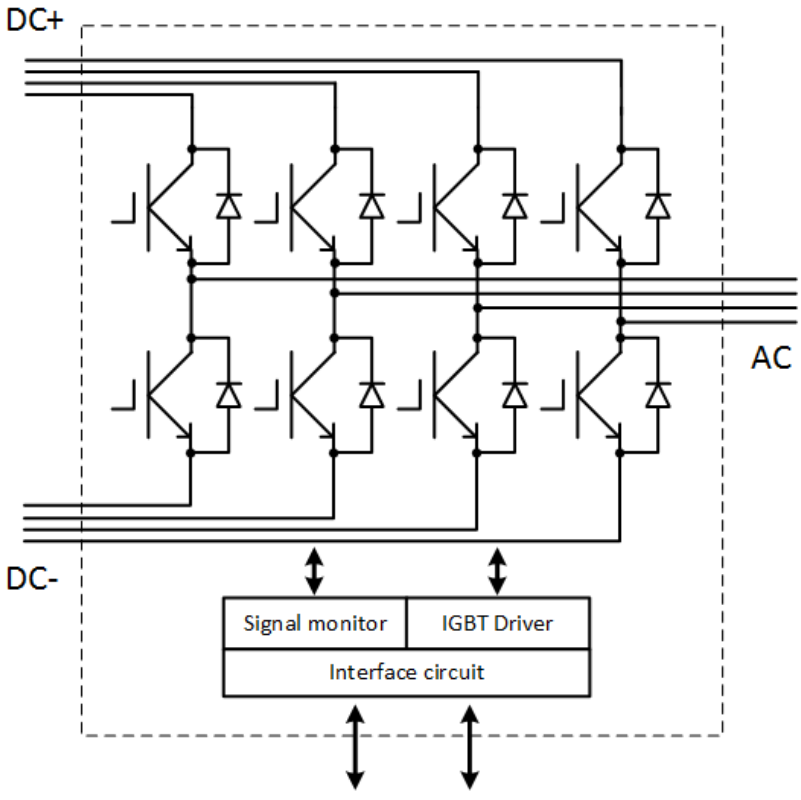
Preliminary data

General information

IPM for typical voltages up to 690 V_{RMS}
Rated output current 650 A_{RMS}

Features
- Integrated current, voltage and temperature measurement
- Tvjop max=150°C
- Real time Tvj simulation
- IGBT4 technology
- Smart protection
- TIM and pressfit technology
- Modbus interface
- 100% tested IPM
- ROHS compliant
- Integrated chip current : 2400A
- Integrated chip voltage: 1700V

Topology	half bridge
Application	Energy Storage, Smart Grid, Wind, Drives, Solar
Heatsink	air cooled
Implemented sensors	voltage, current, temperature
Driver signals IGBT	+15V
Approvals	UL61800-5-1
Sales - name	IFF2400P17AE440989



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Characteristic values

IGBT characteristic value

			min.	typ.	max.	
Collector-emitter voltage	I_C = 2400 A, T_{vj} = 25°C	$V_{ce\ sat}$		1.95	2.30	V
	I_C = 2400 A, T_{vj} = 150°C			2.45		V
Turn on energy loss	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 25°C	E_{on}		730		mJ
	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 150°C			1170		mJ
Turn off energy loss	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 25°C	E_{off}		460		mJ
	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 150°C			810		mJ
Thermal resistance junction to ambient for diode due diode housing	per IPM switch, Air flow rate= 550m³/h	$R_{thja\ IGBT<-IGBT}$		0.0619		K/W
Thermal resistance junction to ambient for IGBT due IGBT housing	per IPM switch, Air flow rate= 550m³/h	$R_{thja\ IGBT<-diode}$		0.0492		K/W

Notes
Tinlet = 25°C
For further details about the thermal resistance please refer to the handbook.

Diode characteristic value

			min.	typ.	max.	
Forward voltage	I_C = 2400 A, T_{vj} = 25°C	V_F		1.80	2.20	V
	I_C = 2400 A, T_{vj} = 150°C			1.95		V
Reverse recovery energy	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 25°C	E_{rec}		250		mJ
	I_C = 2400 A, V_{DC} = 900 V, L_S = 17 nH, T_{vj} = 150°C			530		mJ
Thermal resistance junction to ambient for diode due diode housing	per IPM switch, Air flow rate= 550m³/h	$R_{thja\ diode<-diode}$		0.0721		K/W
Thermal resistance junction to ambient for IGBT due IGBT housing	per IPM switch, Air flow rate= 550m³/h	$R_{thja\ diode<-IGBT}$		0.0485		K/W

Notes
Tinlet = 25°C
For further details about the thermal resistance please refer to the handbook.

Absolute maximum rated values

Collector-emitter voltage	IGBT; T_{vj} = 25°C	V_{CES}	1700	V
Repetitive peak reverse voltage	Diode; T_{vj} = 25°C	V_{RRM}	1700	V
DC link voltage		V_{DC}	1450	V
Peak switching current		I_{peak}	4000	A
Insulation test voltage	f = 50 Hz, t = 60 s	V_{ISOL}	3.4	kV_{RMS}
Junction temperature	under switching conditions	T_{vjop}	150	°C
Operational ambient temperature min.		T_{amb}	-40	°C
Switching frequency operation values		f_{sw2}	10	kHz

Notes

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Operation values

			min.	typ.	max.	
Rated continuous current	V_{DC} = 1100 V, V_{AC} = 690 V_{RMS}, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, f_{sw} = 3000 Hz, T_{inlet} = 25°C, $T_j \leq$ 150 °C	I_{AC}		650		A_{RMS}
Power losses	I_{AC} = 650 A, V_{DC} = 1100 V, V_{AC} = 690 V_{RMS}, cos(φ) = 0.85, $f_{AC\ sine}$ = 50 Hz, f_{sw} = 3000 Hz, T_{inlet} = 25 °C, $T_j \leq$ 150 °C	P_{loss}		4000		W

Controller interface

			min.	typ.	max.	
Auxiliary voltage		V_{aux}	19.2	24	28.3	V
Auxiliary power requirement	V_{aux} = 24 V	P_{aux}			48	W
Digital input level		$V_{in\ low}$			2	V
		$V_{in\ high}$	8.5		16	V
Digital output level	max. 1 mA	$V_{out\ low}$			2	V
		$V_{out\ high}$	13.5	15	16.5	V
Interlock time	default value	$t_{interlock}$		4		µs
Propagation delay for PWM	default value	t_{prop}		4		µs
Analog output for phase current	for 650 A	$V_{Iac\ ana}$		1.54		V
Over current shut down	default value, response time 15 µs	$I_{ac\ trip}$		4200		A
Analog DC link voltage sensor output	load max 5 mA, @ 1100 V	$V_{DC\ ana}$		7.86		V
Over voltage shut down	default value, response time 500 µs	$V_{dc\ trip}$		1340		V
Chip over temperature shut down	default value, response time 1000 µs	$T_{vj\ trip}$		150		°C
Analog ouput for junction temperature	for 150°C	$V_{Tvj\ ana}$		10		V
PCB ambient over temperature shut down	default value, response time 1 s	$T_{pcb\ err}$		85		°C
Serial BUS	Modbus, RS485			19200		Bit/s

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System data

				min.	typ.	max.	
EMC robustness	according to IEC61800 at named interfaces	power	V_{Burst}		2		kV
		control	V_{Burst}		2		kV
Storage temperature			T_{stor}	-40		85	°C
Operational ambient temperature			$T_{op\ amb}$	-40		65	°C
Stray inductance			L_S		8.5		nH
Lead resistance			$R_{CC\ EE}$		1.2		mΩ
Impuls test voltage	Power to logic side, acc .IEC 61800-5-1				12		kV
Isolation test voltage	RMS, f = 50 Hz, t = 60 s		V_{ISOL}		3.4		kV
Creepage distance	Power side to heatsink across housing				13		mm
Clearance	Power side to heatsink				8		mm
Protection degree					IP00		
Pollution degree					2		
Dimensions	width x depth x height			215	338	166	mm
Weight					11.5		kg

Notes
Partical discharge test, power side to logic side, according to IEC 61800-5-1, TE > 1920V
Housing CTI > 175
For further details about the system data please refer to the handbook.

Heatsink air cooled

			min.	typ.	max.	
Air flow	T_{air} = 25 °C, P_{air} = 5.5 hPa, dry and dust free, measured at the side of the heat sink	$\Delta V/\Delta t$		550		m³/h
Air inlet temperature		T_{inlet}		40		°C

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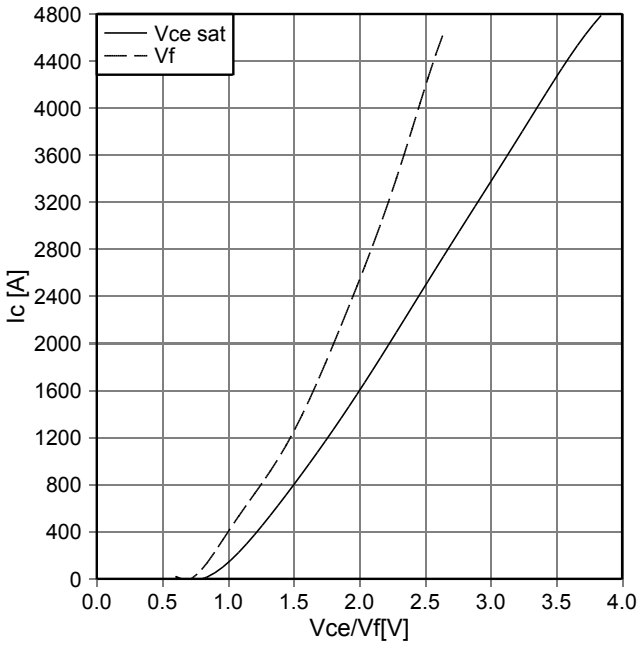
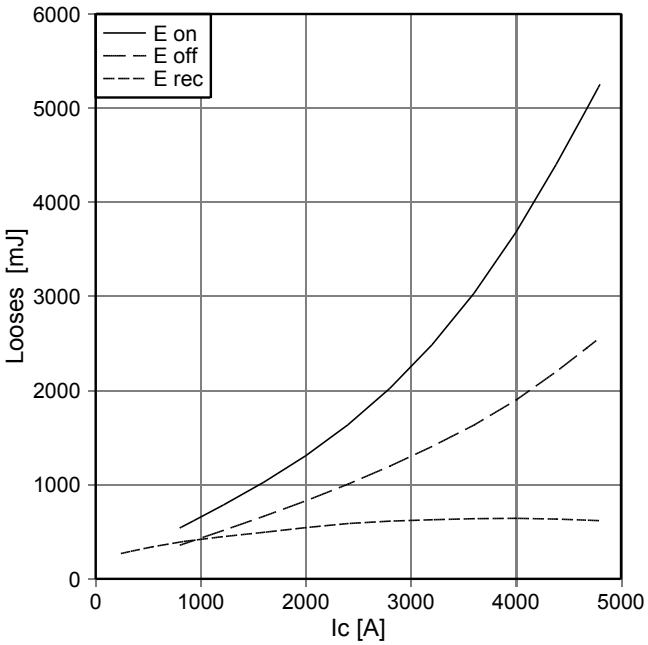
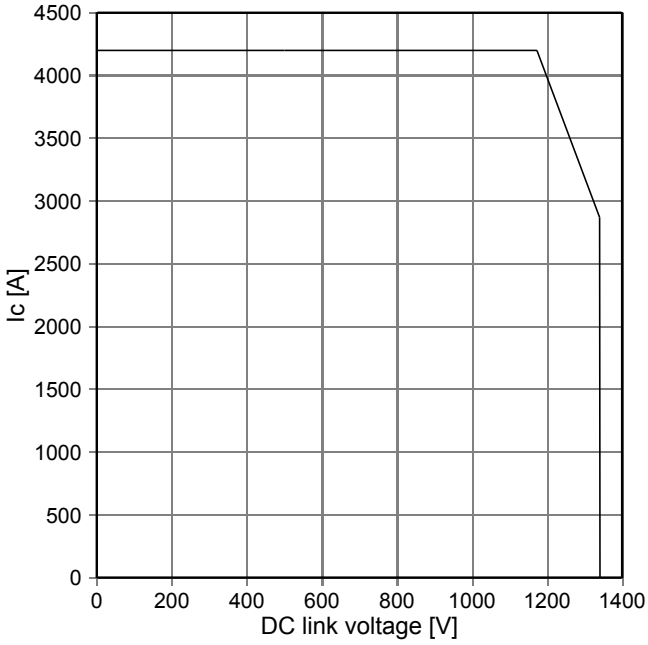
output characteristic IGBT/Diode
Tvj = 150°C



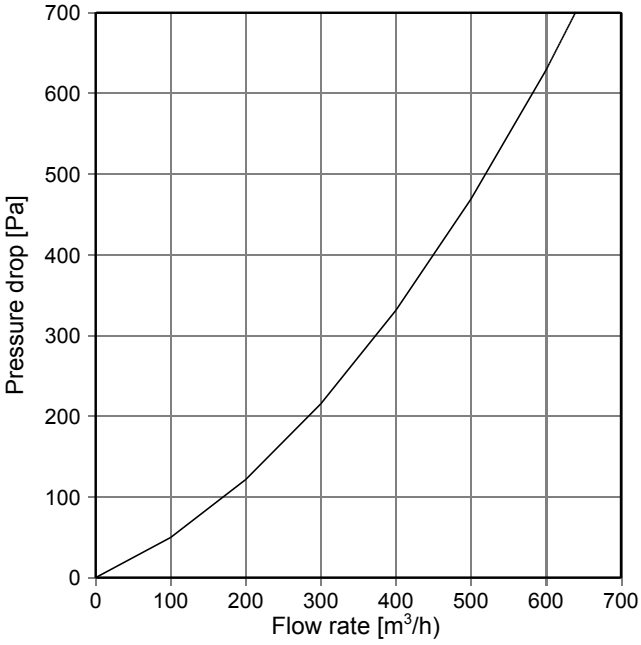
switching losses, Eon, Eoff, Erec
Vdc 1100V, T vj = 150°C



safe operating area



Pressure drop vs. flow rate
T inlet = 25°C



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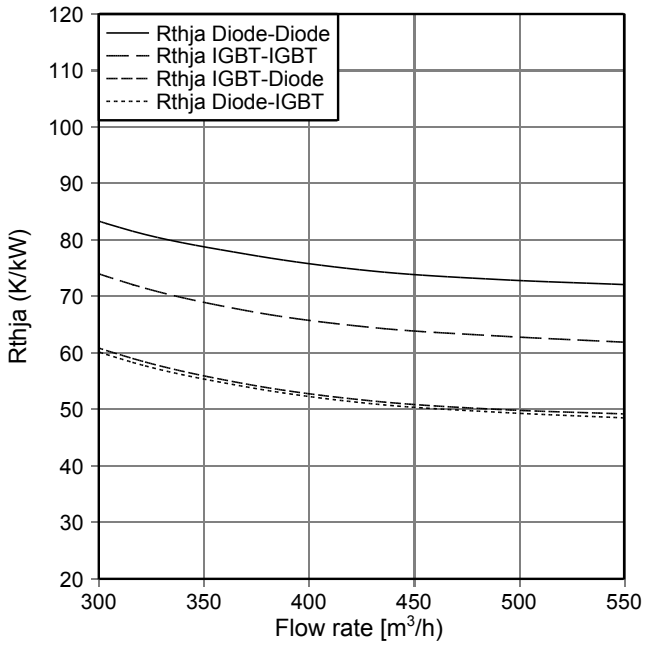
Thermal resistence vs. Flow rate
T inlet=25°C



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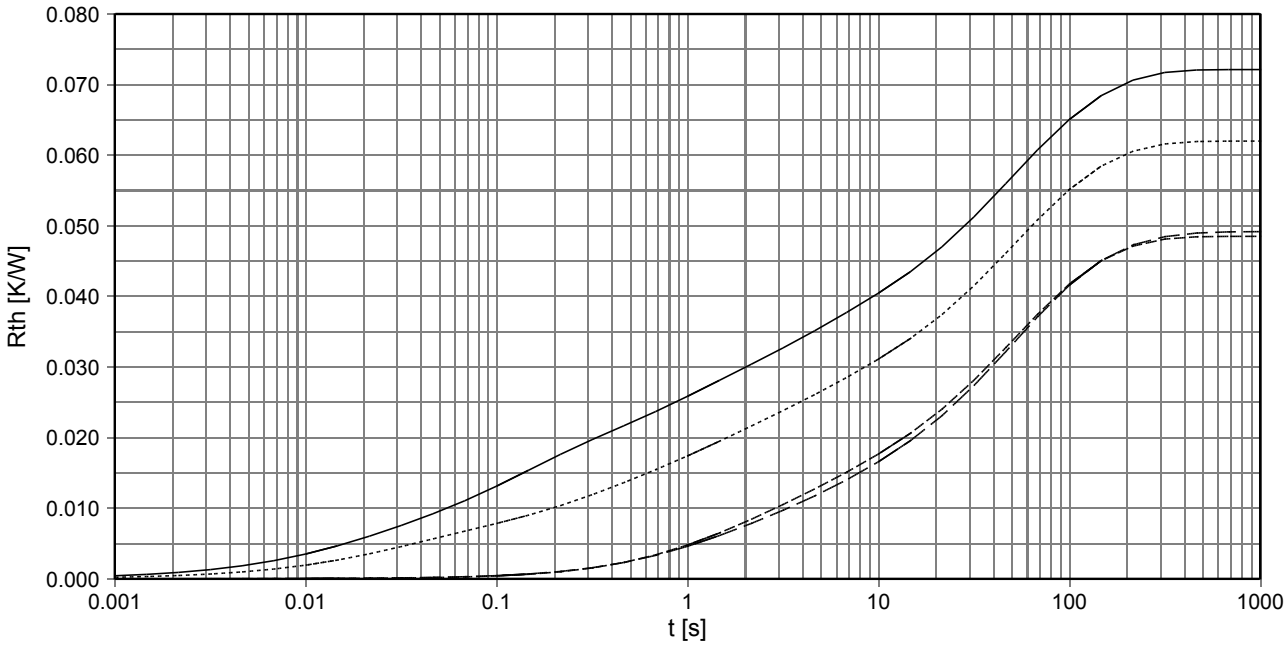
thermal impedance
Tinlet =25°C, Air flow rate= 550m3/h



—— Rthja Diode - Diode

i:	1	2	3	4	5	6
r_i[K/W]:	0.0045	0.01125	0.0084	0.00975	0.01473	0.0235
τ_i[s]:	0.014	0.102	0.638	3.11	30.44	78

— – Rthja IGBT - Diode

i:	1	2	3	4	5	6
r_i[K/W]:	-0.00052	0.00429	0.00628	0.00458	0.0263	0.00825
τ_i[s]:	0.172	0.942	3.525	22.34	51.9	125

– – – Rthja Diode-IGBT

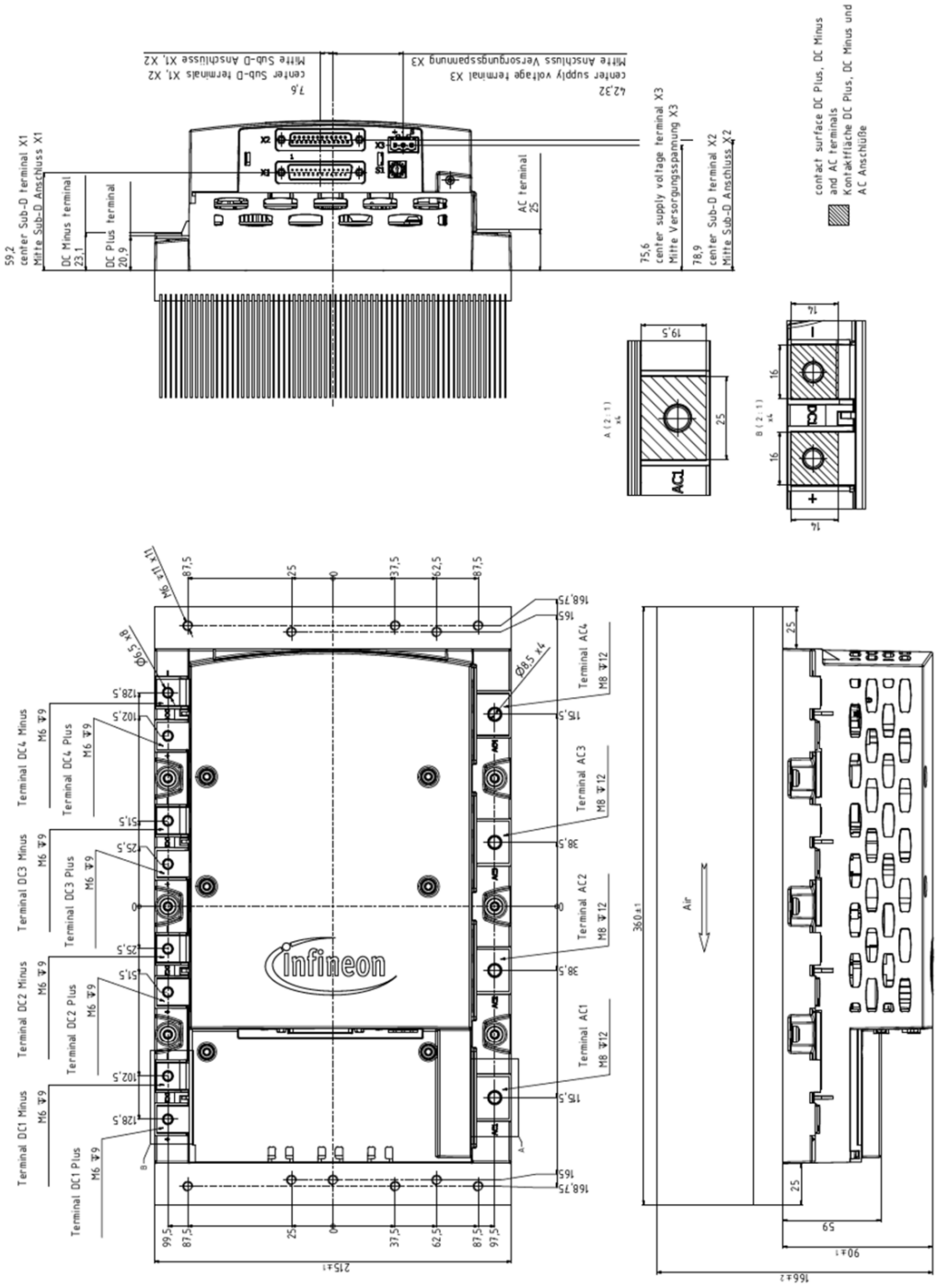
i:	1	2	3	4	5	6
r_i[K/W]:	-0.00059	0.00523	0.00694	0.00185	0.01666	0.01842
τ_i[s]:	0.164	1.165	3.71	19.85	39.7	81.6

------ Rthja IGBT-IGBT

i:	1	2	3	4	5	6
r_i[K/W]:	0.005	0.0047	0.0072	0.0083	0.0164	0.0204
τ_i[s]:	0.026	0.2	0.848	3.525	35.58	80.37

Preliminary data

Mechanical drawing



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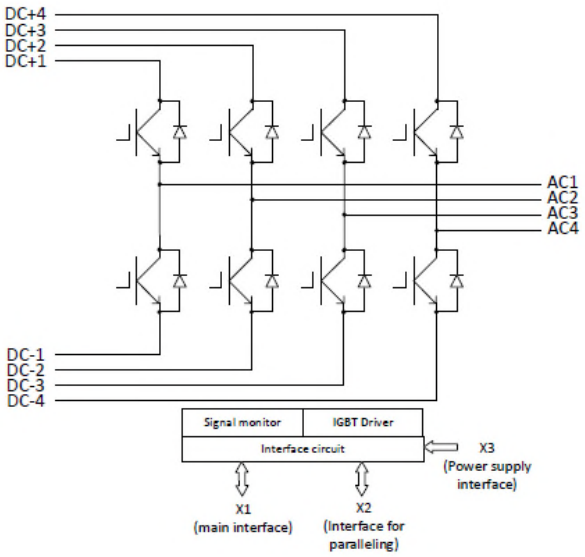
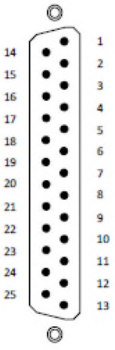
Circuit diagram



Pin configuration for X1 (main control interface)

Pin	Signal	I/O	Pin	Signal	I/O
1	24V_supply	PWR	14	GND_supply	PWR
2	24V_supply	PWR	15	GND_supply	PWR
3	+15_DC	PWR	16	GND_DC	PWR
4	Alert	OUT	17	Enable	IN
5	Fault	IN/OUT	18	Warn_OV	IN/OUT
6	ANA_Tj	ANA OUT	19	ID_det	IN/OUT
7	ANA_Vdc	ANA OUT	20	GND_ana	PWR
8	PWM_top	IN	21	PWM_bot	IN
9	Warn_OC	IN/OUT	22	GND_dig	PWR
10	ANA_Ic	ANA OUT	23	Warn_OT	IN/OUT
11	TX/RX_IN+	IN/OUT	24	TX/RX_IN-	IN/OUT
12	TX/RX_Out+	IN/OUT	25	TX/RX_Out-	IN/OUT
13	Shield		Housing is shield		

Detail information for X1, X2 and X3 refer to handbook



Sub-D 25, male
with UNC thread

Preliminary data

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