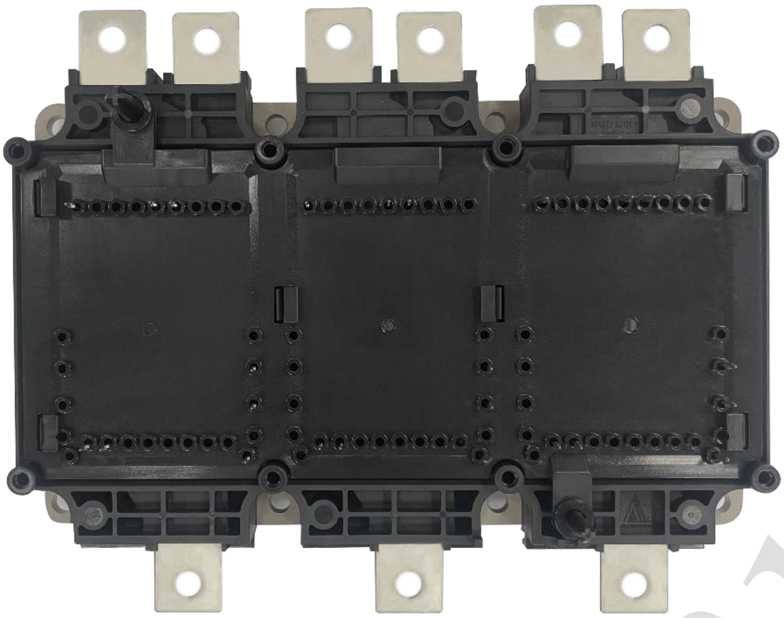
Power Module

AEP380B12TFST

PRELIMINARY
DATASHEET

V1.0, 2023/03



Applications

- Motor Drives
- All-Terrain Vehicles
- Automotive Applications
- Hybrid Electrical Vehicles (H) EV
- Commercial Agriculture Vehicles

Electrical Features

- Low Q_g
- T_j op = 150°C
- Low Inductive Design
- Blocking voltage 1200V
- Fast and soft reverse recovery
- Low V_{CEsat} and Switching Losses

Mechanical Features

- Compact design
- 4.2KV DC Insulation
- UL 94 Module frame
- Temperature sense included
- Direct Water Cooling Base Plate
- Easy to Integrate 6-pack Topology
- Pb-free device and RoHS compliant
- Guiding elements for PCB and cooler assembly

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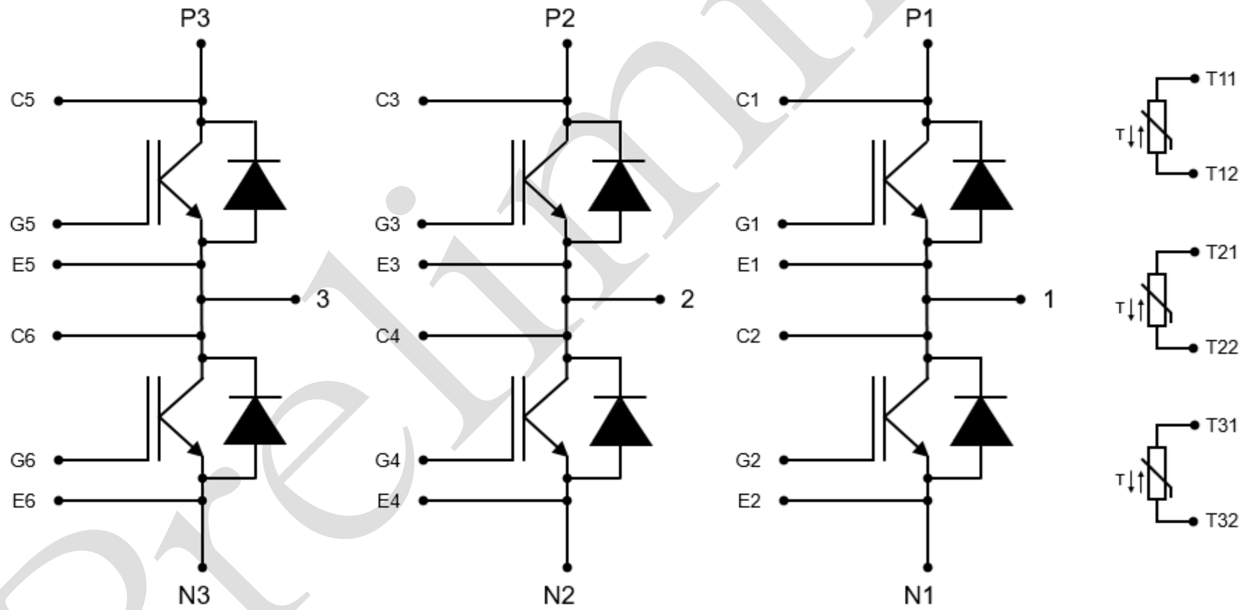
FEATURES

- High speed, low loss IGBT module
- High reliability, high durability module

Circuit Diagram



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IGBT Inverter

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Collector-emitter voltage	T_j = 25°C	V_{CES}	1200	V
Gate-emitter peak voltage		V_{GES}	±20	V
Implemented collector current		I_{CN}	380	A
Continuous DC collector current	T_F = 70°C, T_j = 175°C	$I_{C\,nom}$	250	A
Repetitive peak collector current	t_p = 1 ms	I_{CRM}	760	A
Total power dissipation	T_F = 75°C, T_j = 175°C	P_{tot}	870	W
Maximum Junction Temperature		$T_{j,max}$	175	°C

Characteristics Values

Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	I_C = 250A, V_{GE} = 15V	T_j = 25°C	$V_{CE,sat}$		1.50	1.85	V
	I_C = 250A, V_{GE} = 15V	T_j = 150°C			1.70		
	I_C = 380A, V_{GE} = 15V	T_j = 25°C			1.75		
	I_C = 380A, V_{GE} = 15V	T_j = 150°C			2.05		
Gate threshold voltage	I_C = 9.75mA, V_{CE} = V_{GE}	T_j = 25°C	V_{GEth}	5.1	5.8	6.4	V
Collector-emitter cut-off current	V_{CE} = 1200V, V_{GE} = 0V	T_j = 25°C	I_{CES}			1.0	mA
Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V	T_j = 25°C	I_{GES}			400	nA
Gate Charge	V_{GE} = -8 V / + 15 V, V_{CE} = 600V	T_j = 25°C	Q_g		1.6		µC
Input capacitance	f = 1MHz, V_{CE} = 25 V, V_{GE} = 0V	T_j = 25°C	C_{ies}		25		nF
Output capacitance	f = 1MHz, V_{CE} = 25 V, V_{GE} = 0V	T_j = 25°C	C_{oes}		2.5		nF
Reverse transfer capacitance	f = 1MHz, V_{CE} = 25 V, V_{GE} = 0V	T_j = 25°C	C_{res}		1.0		nF
Turn-on delay time, inductive load	I_C = 250A, V_{CE} = 600V, V_{GE} = -8 V / + 15 V R_{GON} = 2.0 Ω	T_j = 25°C	$t_{d(on)}$		0.13		µs
Rise time, inductive load	I_C = 250A, V_{CE} = 600V, V_{GE} = -8 V / + 15 V R_{GON} = 2.0 Ω	T_j = 25°C	t_r		0.05		µs

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Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Turn-on energy loss per pulse	I_C = 250A, V_{CE} = 600V, L_S = 30nH V_{GE} = -8 V / + 15 V, R_{GON} = 2.0 Ω di/dt = 4500 A/µs (25°C)	T_j = 25°C	E_{on}		18.5		mJ
Turn-off delay time, inductive load	I_C = 250A, V_{CE} = 600V, V_{GE} = -8 V / + 15 V R_{Goff} = 2.0 Ω	T_j = 25°C	$t_{d(off)}$		0.35		µs
Fall time, inductive load	I_C = 250A, V_{CE} = 600V, V_{GE} = -8 V / + 15 V R_{Goff} = 2.0 Ω	T_j = 25°C	t_f		0.12		µs
Turn-off energy loss per pulse	I_C = 250A, V_{CE} = 600V, L_S = 30nH V_{GE} = -8 V / + 15 V, R_{Goff} = 2.0 Ω dv/dt = 4800 V/µs (25°C)	T_j = 25°C	E_{off}		16.5		mJ
SC data	V_{GE} ≦ 15 V, V_{CC} = 800 V t_p ≦ 8 µs	T_j = 25°C	I_{SC}		1400		A
Thermal resistance, junction to cooling fluid	Per IGBT; ΔV/ΔT = 10 dm^3/min, T_F = 75°C		R_{thJF}		0.135	0.155	K/W

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Diode Inverter

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	T_j = 25°C	V_{RRM}	1200	V
Implemented forward current		I_{FN}	380	A
Continuous DC forward current		I_F	250	A
Repetitive peak forward current	t_p = 1 ms	I_{FRM}	760	A

Characteristics Values

Parameter	Conditions		Symbol	Typ.	Max.	Unit
Forward voltage	I_F = 250A, V_{GE} = 0V	T_j = 25°C	V_F	1.60	2.00	V
	I_F = 250A, V_{GE} = 0V	T_j = 150°C		1.55		
	I_F = 380A, V_{GE} = 0V	T_j = 25°C		1.85		
	I_F = 380A, V_{GE} = 0V	T_j = 150°C		1.80		
Recovered charge	I_F = 250A, V_R = 600V, V_{GE} = -8V, $-di_F/dt$ = 6000 A/µs (25°C)	T_j = 25°C	Q_{rr}	16.0		µC
Reverse recovery energy	I_F = 250A, V_R = 600V, V_{GE} = -8V, $-di_F/dt$ = 6000 A/µs (25°C)	T_j = 25°C	E_{rec}	4.5		mJ
Peak reverse recovery current	I_F = 250A, V_R = 600V, V_{GE} = -8V, $-di_F/dt$ = 6000 A/µs (25°C)	T_j = 25°C	I_{RM}	215		A
Thermal resistance, junction to cooling fluid	Per diode; $\Delta V/\Delta T$ = 10 dm^3/min, T_F = 75°C		R_{thJF}	0.210	0.240	K/W

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NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_c = 25°C$	R_{25}		5.0		kΩ
Resistance tolerance	$T_c = 100°C$	$\Delta R/R$	5		5	%
B-value	$R_2 = R_{25}$ exp $[B_{25/50}(1/T_2 - 1/(298.15\ K))$	$B_{25/50}$		3375		K
B-value	R2 = R25 exp [B25/80(1/T2 – 1/(298.15 K))	$B_{25/80}$		3411		K
B-value	R2 = R25 exp [B25/100(1/T2 – 1/(298.15 K))	$B_{25/100}$		3433		K

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Module

Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 0 Hz, t = 1 sec	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material			Al_2O_3	
Creepage distance	Terminal to Heat sink Terminal to Terminal	d_{cree}	9.0 9.0	mm
Clearance	Terminal to heat sink Terminal to Terminal	d_{clear}	4.5 4.5	mm
Comparative tracking index [1)]		CTI	> 200	

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Module stray inductance				8		
Storage temperature		T_{stg}	-40		125	°C
Weight		G		755		g

1) Extracted by following UL 746A

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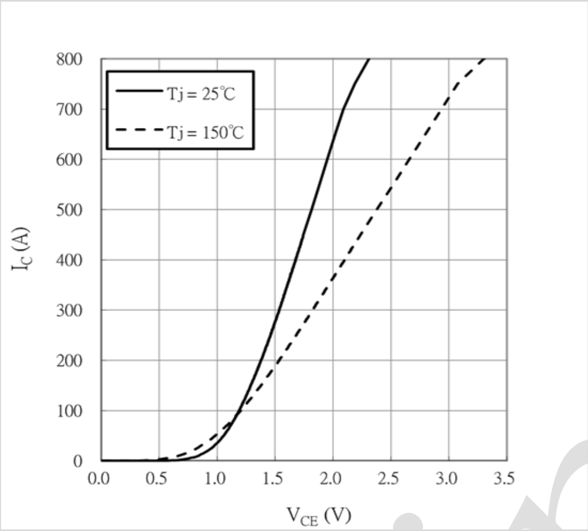
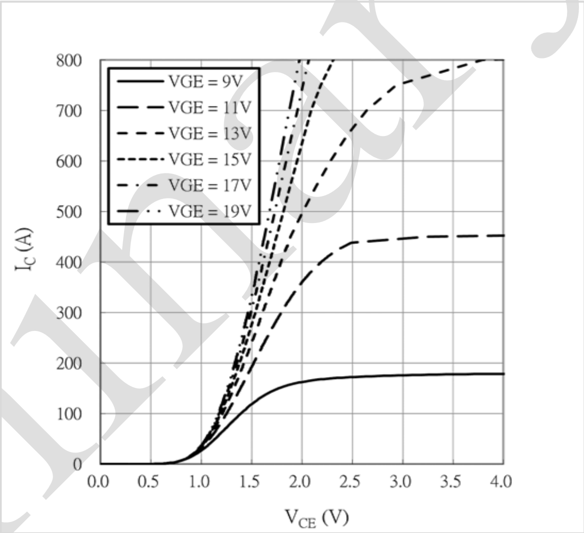
Characteristics Diagrams

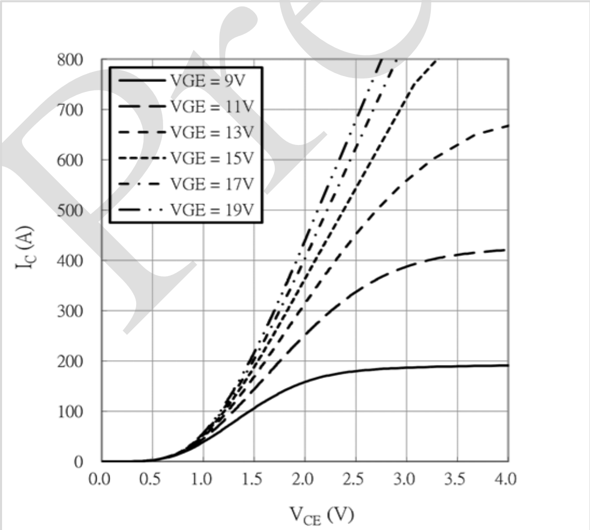
Output characteristics IGBT, Inverter
V_{GE} = 15 V



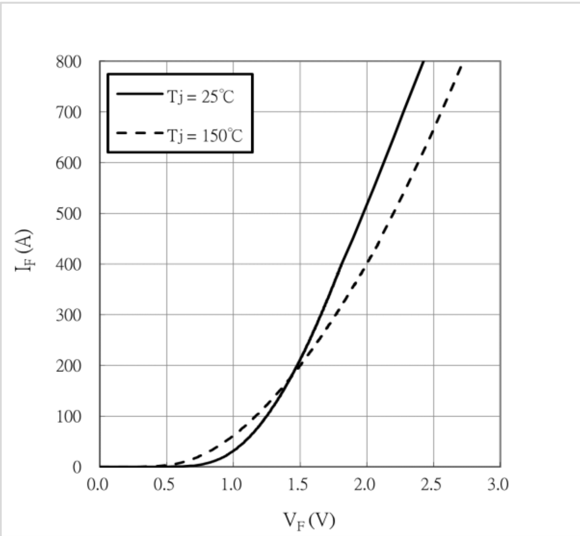
Output characteristics IGBT, Inverter
T_j = 25°C



Output characteristics IGBT, Inverter
T_j = 150°C



Forward characteristics of Diode, Inverter



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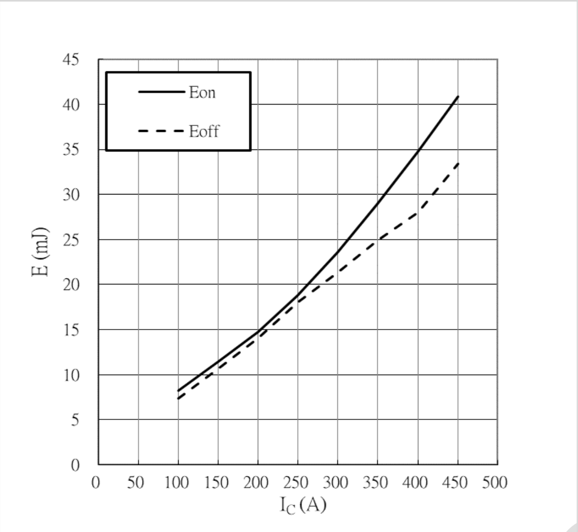
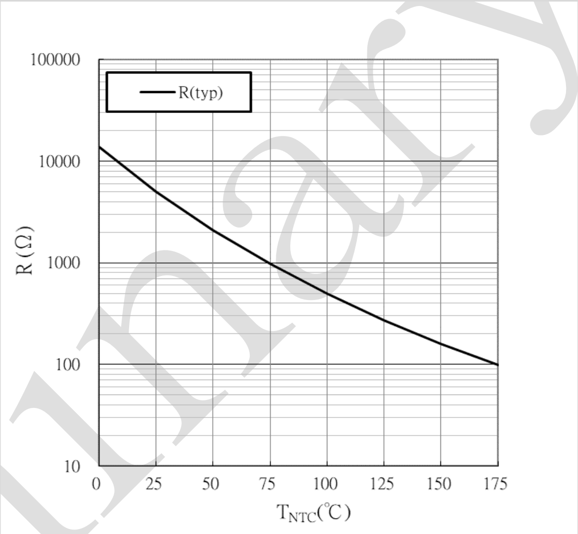
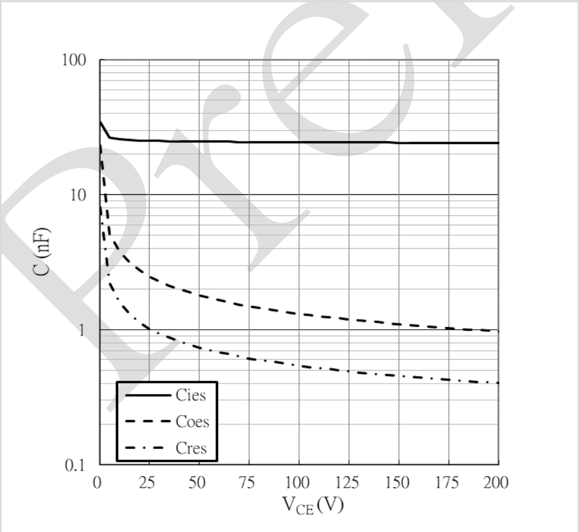
Switching losses IGBT, Inverter
V_{GE} = + 15 V / -8 V, R_{GON} = 2.0 Ω,
R_{Goff} = 2.0 Ω, V_{CE} = 600V, T_j = 25°C



NTC-Thermistor-temperature characteristics



Capacitance characteristics IGBT, inverter
VGE = 0 V, Tj = 25°C, f = 1 MHz



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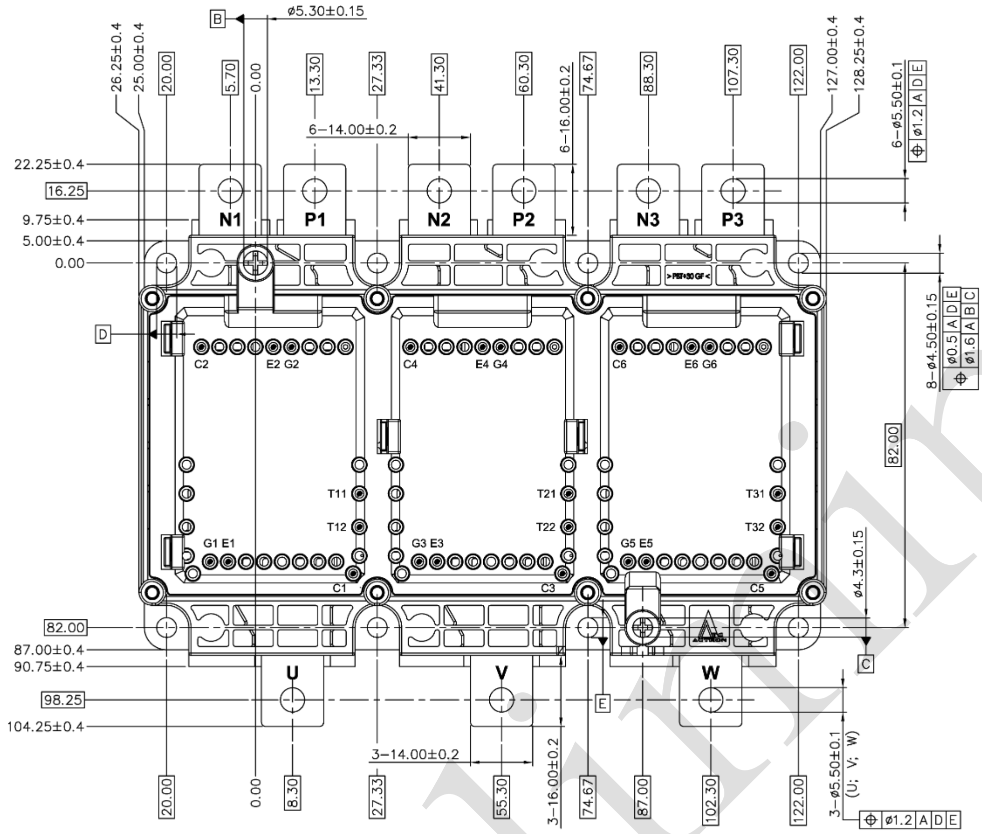
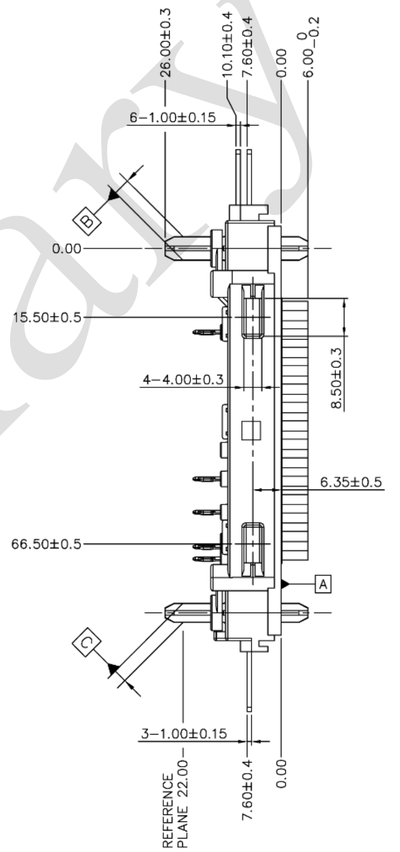
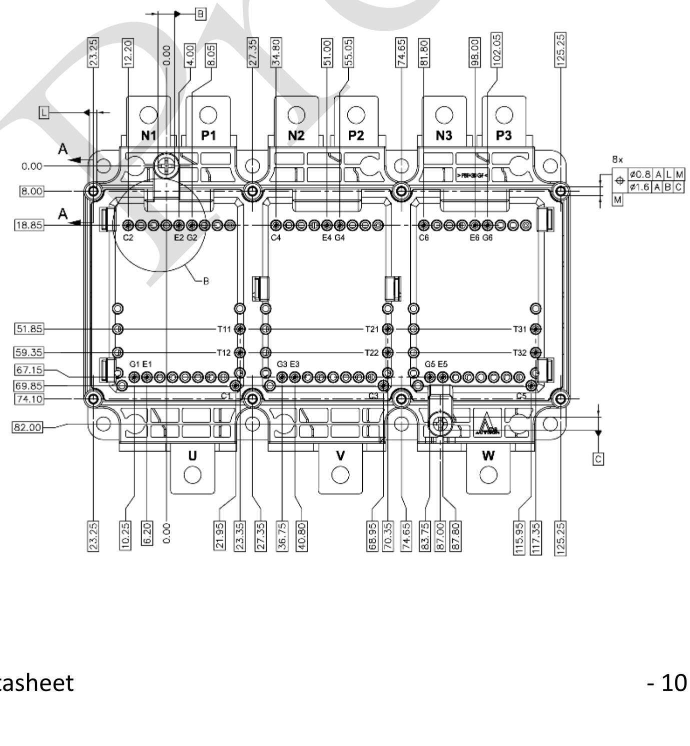
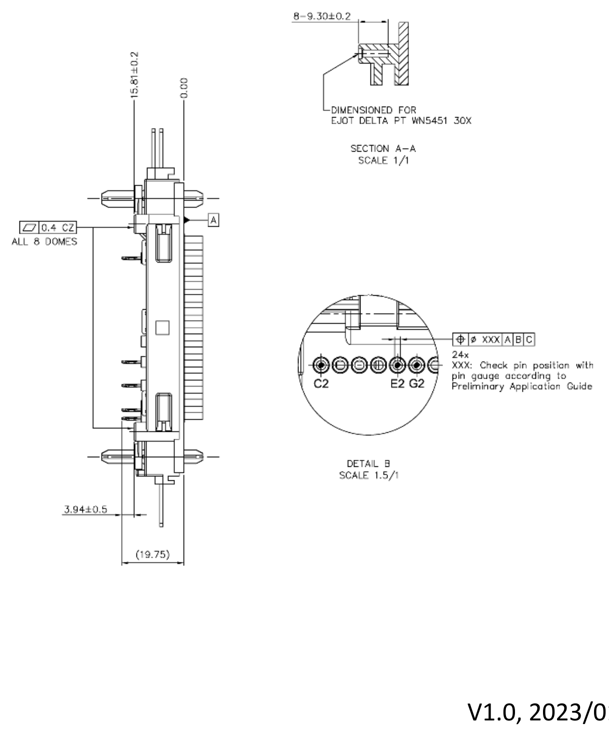
Package Outlines









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