

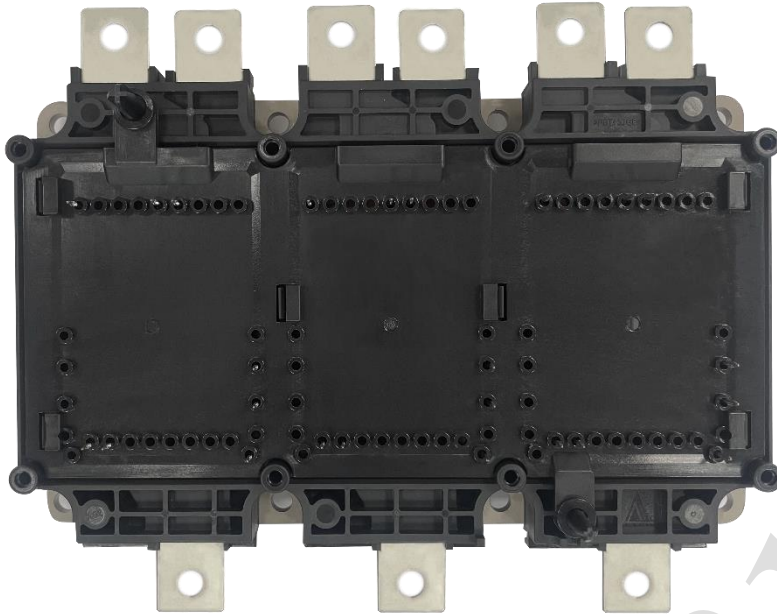


Power Module

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
- $T_j \text{ op} = 150^\circ\text{C}$
- Low Inductive Design
- Blocking voltage 1200V
- Fast and soft reverse recovery
- Low V_{CEsat} and Switching Losses

Mechanical Features

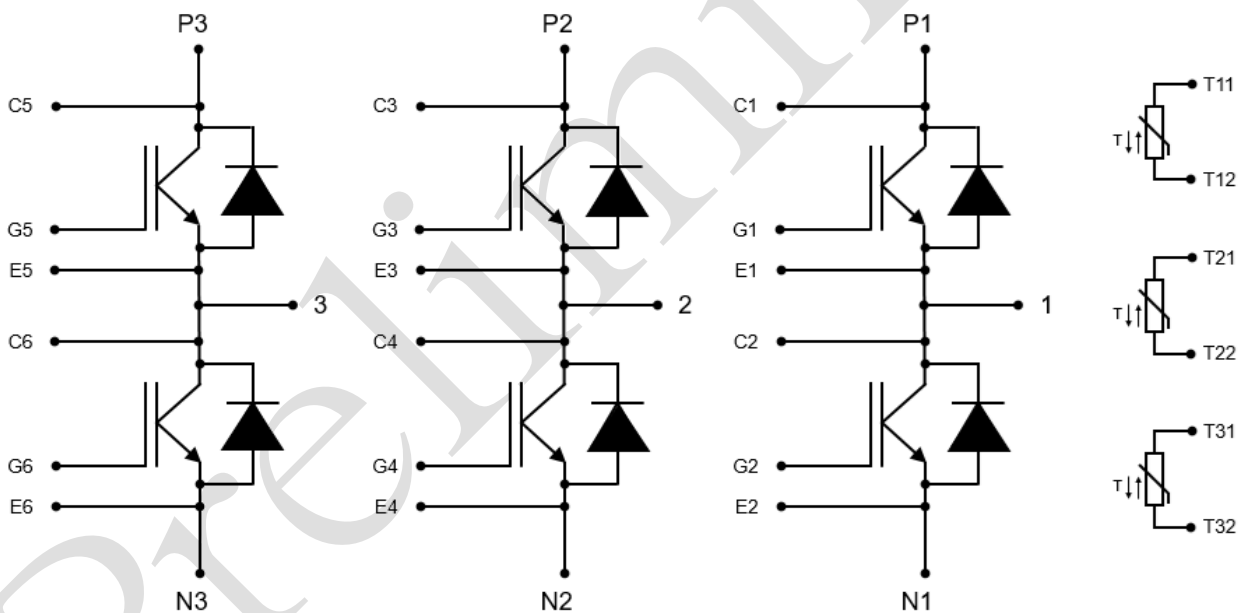
- Compact design
- 4.2KV DC Insulation
- UL 94 Module frame
- Temperature sense included
- Direct Water Cooling Base Plate
- Easy to Integrate 6-pack Topology
- Pb-free device and RoHS compliant
- Guiding elements for PCB and cooler assembly



FEATURES

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

Circuit Diagram





IGBT Inverter

Maximum Rated Values

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

Characteristics Values

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



AEP380B12TFLT Power Module

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Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Turn-on energy loss per pulse	$I_C = 250A, V_{CE} = 600V,$ $L_S = 30nH$ $V_{GE} = -8V / +15V,$ $R_{GON} = 2.0\ \Omega$ $di/dt = 4500\ A/\mu s (25^\circ C)$	$T_j = 25^\circ C$	E_{on}		18.5		mJ
Turn-off delay time, inductive load	$I_C = 250A, V_{CE} = 600V,$ $V_{GE} = -8V / +15V$ $R_{Goff} = 2.0\ \Omega$	$T_j = 25^\circ C$	$t_{d(off)}$		0.35		μs
Fall time, inductive load	$I_C = 250A, V_{CE} = 600V,$ $V_{GE} = -8V / +15V$ $R_{Goff} = 2.0\ \Omega$	$T_j = 25^\circ C$	t_f		0.12		μs
Turn-off energy loss per pulse	$I_C = 250A, V_{CE} = 600V,$ $L_S = 30nH$ $V_{GE} = -8V / +15V,$ $R_{Goff} = 2.0\ \Omega$ $dv/dt = 4800\ V/\mu s (25^\circ C)$	$T_j = 25^\circ C$	E_{off}		16.5		mJ
SC data	$V_{GE} \leq 15V, V_{CC} = 800V$ $t_p \leq 8\ \mu s$	$T_j = 25^\circ C$	I_{sc}		1400		A
Thermal resistance, junction to cooling fluid	Per IGBT; $\Delta V/\Delta T = 10\ dm^3/min,$ $T_F = 75^\circ C$		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	$T_j = 25^\circ\text{C}$	V_{RRM}	1200	V
Implemented forward current		I_{FN}	380	A
Continuous DC forward current		I_F	250	A
Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	760	A

Characteristics Values

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



NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_c = 25^\circ\text{C}$	R_{25}		5.0		$\text{k}\Omega$
Resistance tolerance	$T_c = 100^\circ\text{C}$	$\Delta R/R$	5		5	%
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15 \text{ K}))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15 \text{ K}))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15 \text{ K}))]$	$B_{25/100}$		3433		K



Module

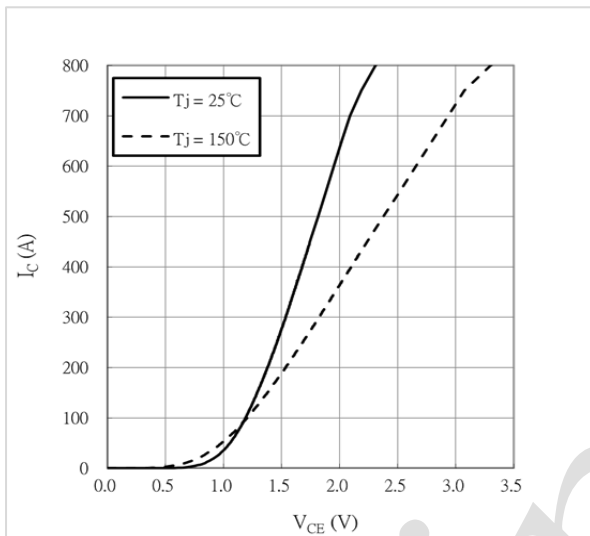
Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 0 Hz, t = 1 sec	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material			Al ₂ O ₃	
Creepage distance	Terminal to Heat sink	d_{cree}	9.0	mm
	Terminal to Terminal		9.0	
Clearance	Terminal to heat sink	d_{clear}	4.5	mm
	Terminal to Terminal		4.5	
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

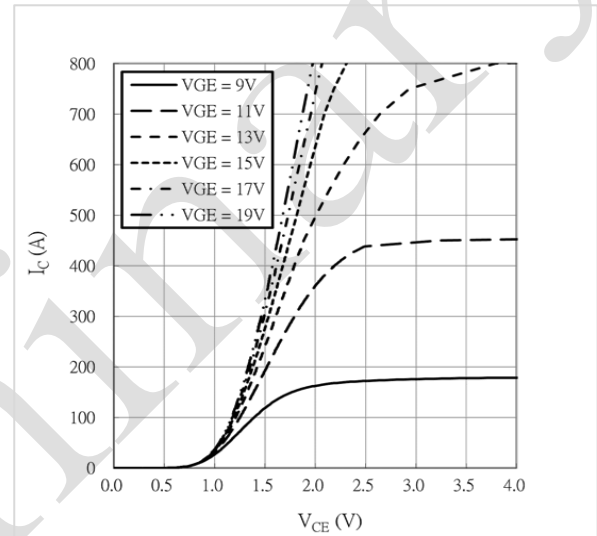
¹⁾ Extracted by following UL 746A

Characteristics Diagrams

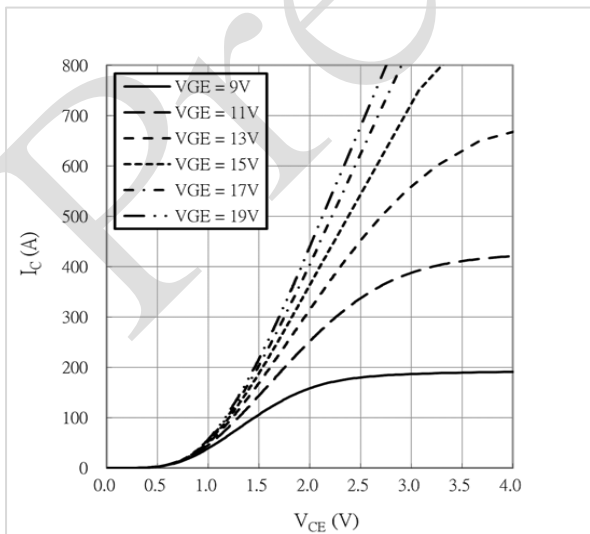
Output characteristics IGBT, Inverter
 $V_{GE} = 15\text{ V}$



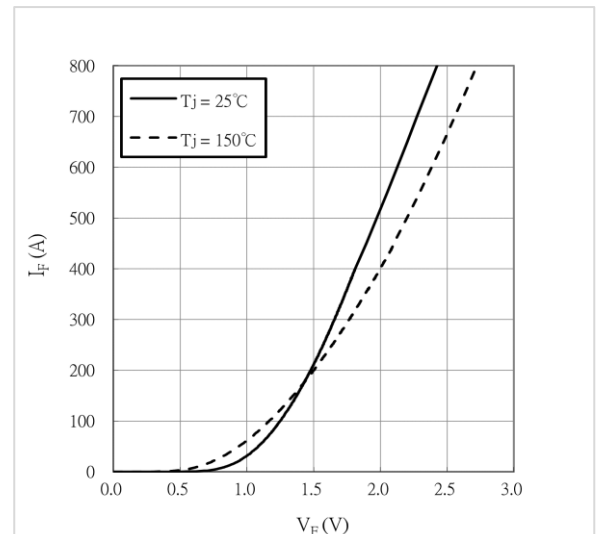
Output characteristics IGBT, Inverter
 $T_j = 25^\circ\text{C}$



Output characteristics IGBT, Inverter
 $T_j = 150^\circ\text{C}$

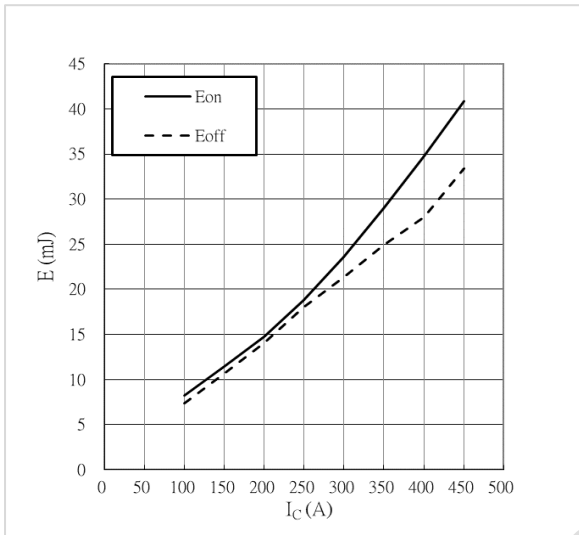


Forward characteristics of Diode, Inverter

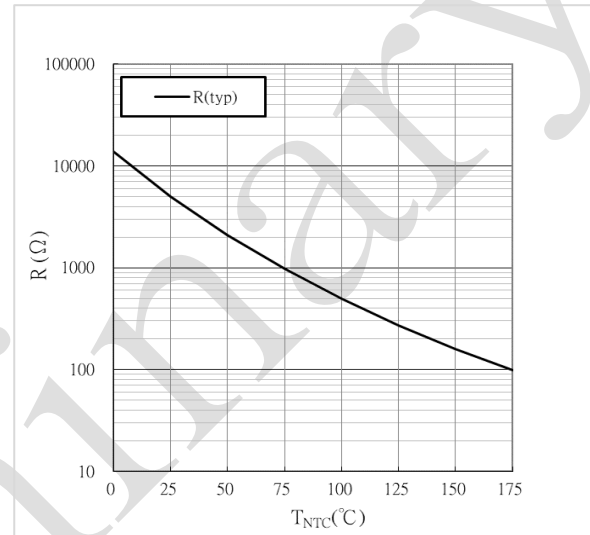




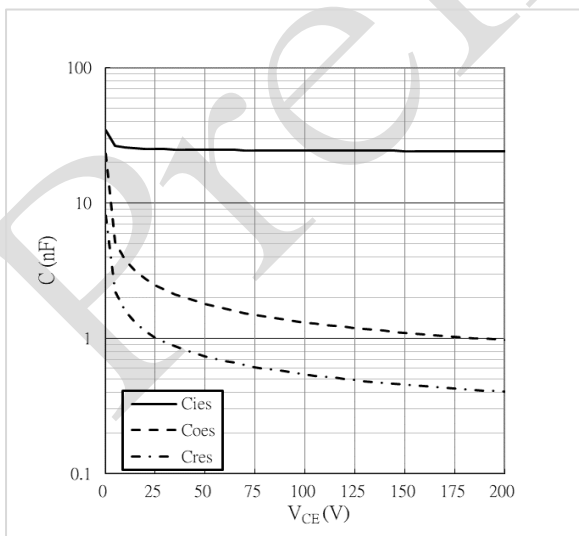
Switching losses IGBT, Inverter
 $V_{GE} = +15\text{ V} / -8\text{ V}$, $R_{GON} = 2.0\ \Omega$,
 $R_{Goff} = 2.0\ \Omega$, $V_{CE} = 600\text{V}$, $T_j = 25^\circ\text{C}$



NTC-Thermistor-temperature characteristics

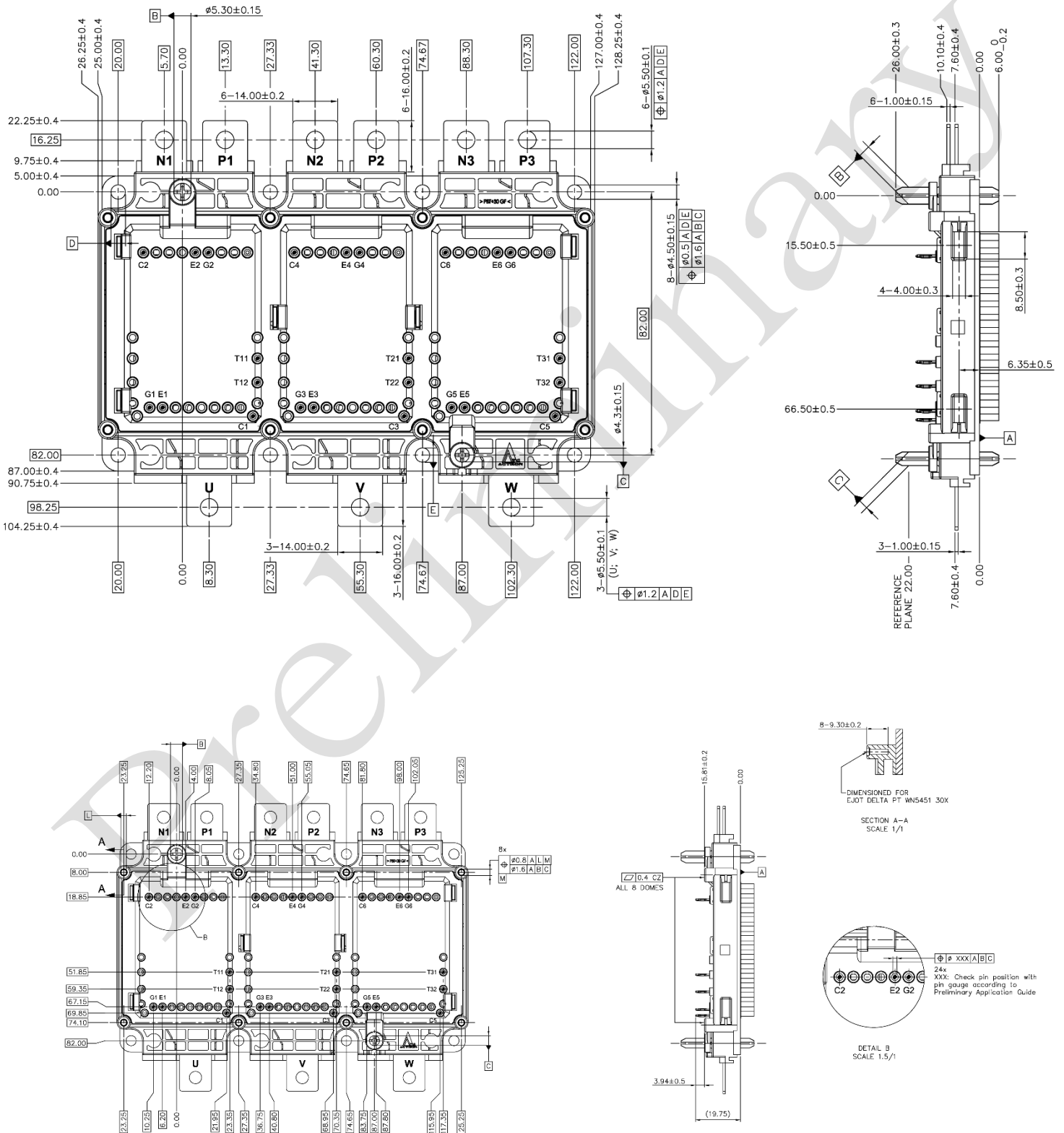


Capacitance characteristics IGBT, inverter
 $V_{GE} = 0\text{ V}$, $T_j = 25^\circ\text{C}$, $f = 1\text{ MHz}$





Package Outlines



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