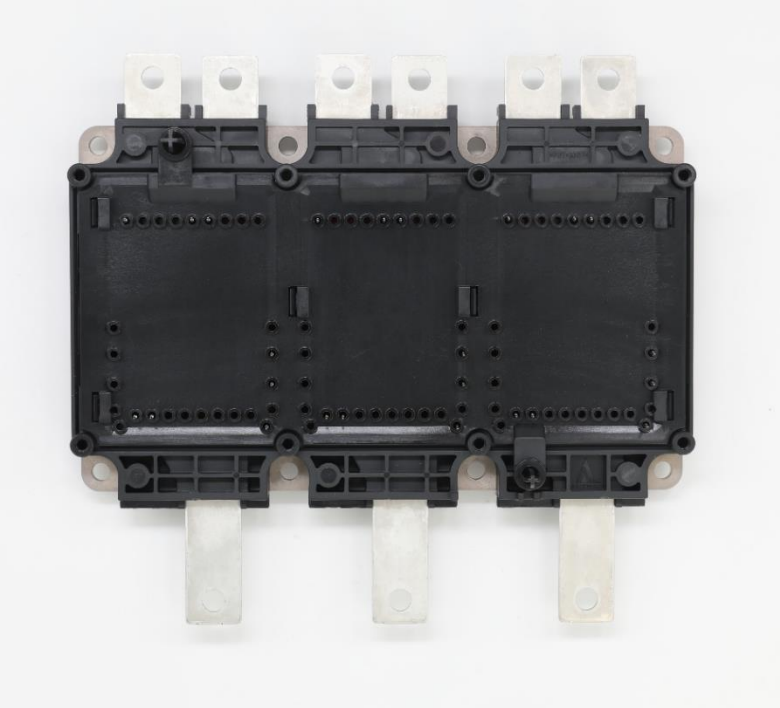
Power Module

AEPR20B12C1LT

PRELIMINARY
DATASHEET

V0.1, 2023/01

AEPR20B12C1LT
Power Module



Applications

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

Electrical Features

- Low $R_{DS(on)}$
- T_j op = 150°C
- Blocking voltage 1200V
- Low Switching Losses
- Low Inductive Design
- SiC High Performance Chip

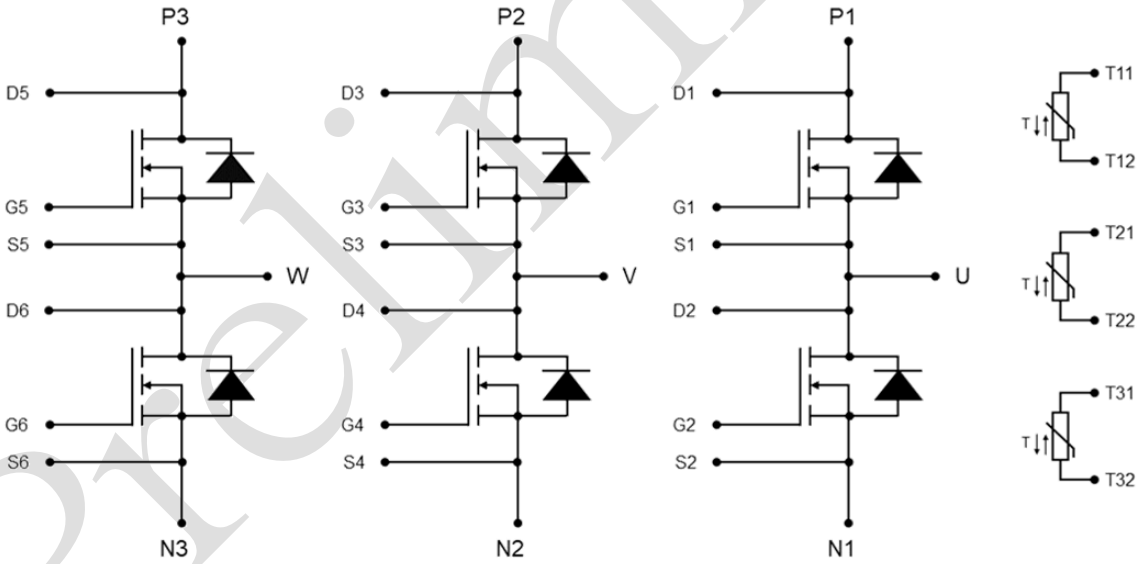
Mechanical Features

- 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 SiC module
- High reliability, high durability module

Circuit Diagram



MOSFET

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Drain-source voltage	T_j = 25°C	V_{DSS}	1200	V
Gate-source voltage		V_{GS}	-5/+20	V
DC drain current	V_{GS} = 15 V, T_F = 70°C, T_j = 175°C	$I_{D\ nom}$	400	A
Pulsed drain current	t_p limited by $T_{j,\ max}$	$I_{D\ pulse}$	800	A

Characteristics Values

Parameter	Conditions		Symbol	Min.	Typ.	Max.	Unit
Drain-source on resistance	I_D = 400 A, V_{GS} = 15 V	T_j = 25°C	$R_{DS(on)}$		2.00	2.70	mΩ
	I_D = 400 A, V_{GS} = 15 V	T_j = 150°C			4.00		
	I_D = 400 A, V_{GS} = 15 V	T_j = 175°C			4.40		
Gate threshold voltage	I_D = 210 mA, V_{GS} = V_{DS}	T_j = 25°C	V_{GSth}	2.70	3.60	4.50	V
Drain-source leakage current	V_{DS} = 1200 V, V_{GS} = 0 V	T_j = 25°C	I_{DSS}			100	μA
Gate-source leakage current	V_{DS} = 0 V, V_{GS} = 20 V	T_j = 25°C	I_{GSS}			400	nA
Gate Charge	V_{GS} = -5 V / + 15 V, V_{DS} = 600V	T_j = 25°C	Q_g		2.5		μC
Input capacitance	f = 1 MHz, V_{DS} = 200 V V_{GS} = 0 V	T_j = 25°C	C_{iss}		46		nF
Output capacitance	f = 1 MHz, V_{DS} = 200 V V_{GS} = 0 V	T_j = 25°C	C_{oss}		2.8		nF
Reverse transfer capacitance	f = 1 MHz, V_{DS} = 200 V V_{GS} = 0 V	T_j = 25°C	C_{rss}		1.7		nF
Turn-on delay time, inductive load	I_D = 400 A, V_{DS} = 600 V V_{GS} = -5 V / + 15 V R_{GON} = 5.0 Ω	T_j = 25°C	$t_{d(on)}$		110		ns
Rise time, inductive load	I_D = 400 A, V_{DS} = 600 V V_{GS} = -5 V / + 15 V R_{GON} = 5.0 Ω	T_j = 25°C	t_r		120		ns
Turn-on energy loss per pulse	I_D = 400 A, V_{DS} = 600 V L_S = 30nH V_{GS} = -5 V / + 15 V R_{GON} = 5.0 Ω, di/dt = 2500 A/μs (25°C)	T_j = 25°C	E_{on}		31.0		mJ

Turn-off delay time, inductive load	I_D = 400 A, V_{DS} = 600 V V_{GS} = -5 V / + 15 V R_{Goff} = 5.0 Ω	T_j = 25°C	$t_{d(off)}$		330		ns
Fall time, inductive load	I_D = 400 A, V_{DS} = 600 V V_{GS} = -5 V / + 15 V R_{Goff} = 5.0 Ω	T_j = 25°C	t_f		75		ns
Turn-off energy loss per pulse	I_D = 400 A, V_{DS} = 600 V L_S = 30nH V_{GS} = -5 V / + 15 V R_{Goff} = 5.0 Ω, dV/dt = 9700 A/µs (25°C)	T_j = 25°C	E_{off}		13.0		mJ
Thermal resistance, junction to cooling fluid	Per MOSFET; ΔV/ΔT = 10 dm^3/min, T_F = 60°C		R_{thJF}		0.12		K/W

Body diode

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
DC body diode forward current	V_{GS} = -5 V, T_j = 175°C	I_{SD}	210	A
Pulsed body diode current	t_p limited by $T_{j, max}$	$I_{SD\ pulse}$	800	A

Characteristics Values

Parameter	Conditions		Symbol	Typ.	Max.	Unit
Forward voltage	I_{SD} = 400 A, V_{GS} = -5 V	T_j = 25°C	V_{SD}	4.25	6.15	V
Peak reverse recovery current	I_{SD} = 400 A, V_R = 600 V V_{GE} = -5 V	T_j = 25°C	I_{RM}	60		A
Recovered charge	I_{SD} = 400 A, V_R = 600 V V_{GE} = -5 V	T_j = 25°C	Q_{rr}	1.75		µC
Reverse recovery energy	I_{SD} = 400 A, V_R = 600 V V_{GE} = -5 V -di/dt = 3300 A/µs (25°C)	T_j = 25°C	E_{rec}	0.15		mJ

NTC-Thermistor

Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit
Rated resistance	T_c = 25°C	R_{25}	5.0		kΩ
Resistance tolerance	T_c = 100°C	△R/R		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	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 – 1/(298.15\ K))$	$B_{25/80}$	3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 – 1/(298.15\ K))$	$B_{25/100}$	3433		K

Module

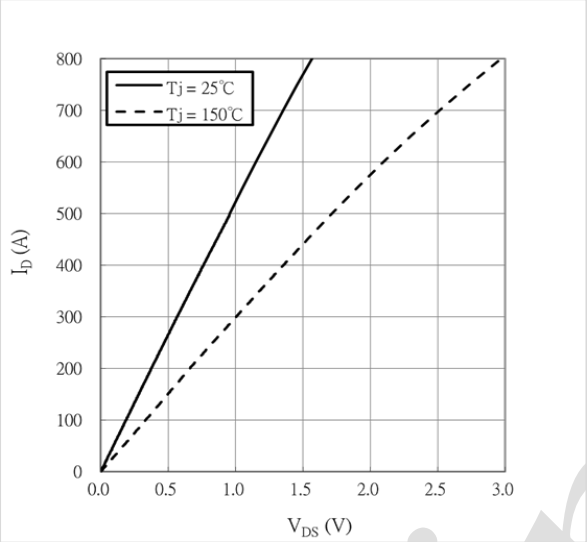
Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, f = 0 Hz, t = 1 sec	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material			Si3N4	
Creepage distance	Terminal to Heat sink Terminal to Terminal	d_{cree}	9.0 9.0	mm
Clearance	Terminal to heat sink Terminal 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		L_{sCE}		9		nH
Storage temperature		T_{stg}	-40		125	°C
Weight		G		745		g

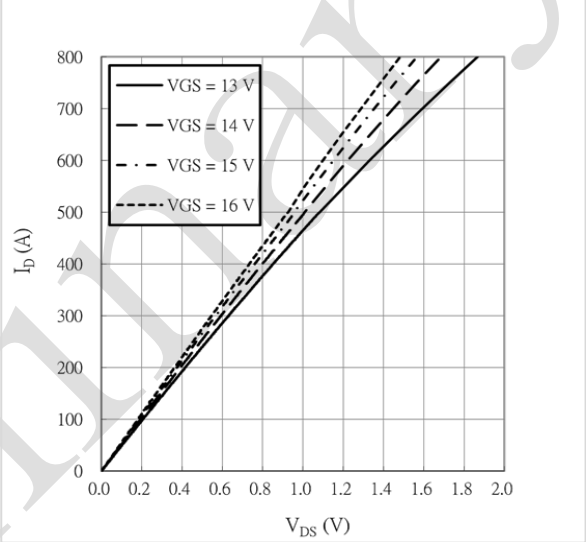
1) Extracted by following UL 746A

Characteristics Diagrams

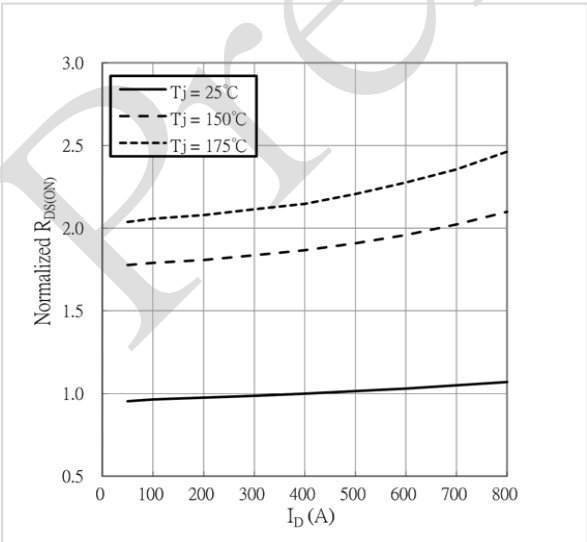
Output characteristics, MOSFET
V_{GS} = 15 V, I_D = f(V_{DS})



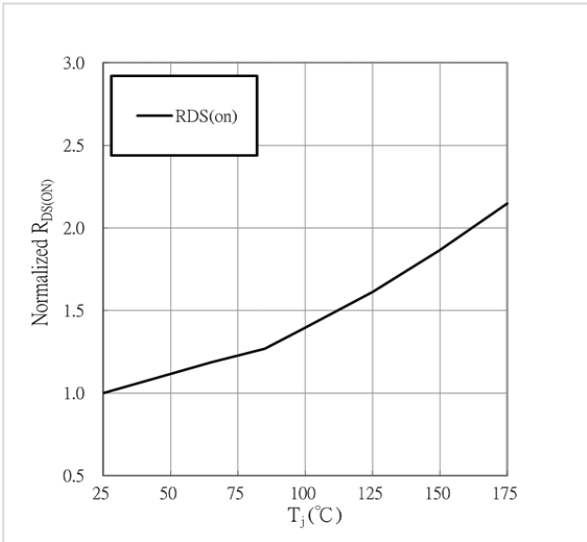
Output characteristics, MOSFET
T_j = 25°C, I_D = f(V_{DS})



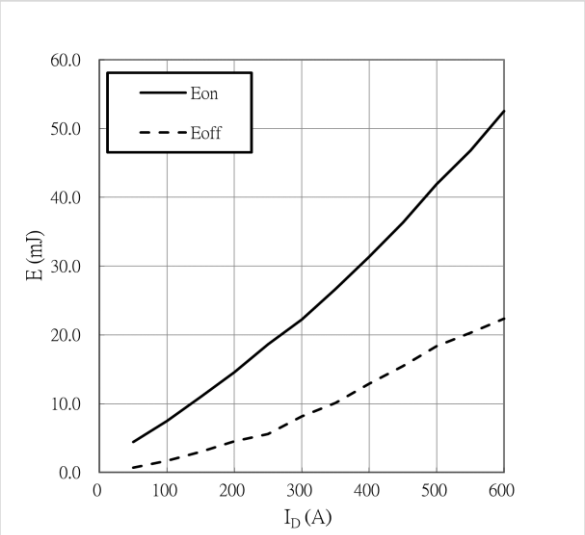
Drain source on-resistance, MOSFET
V_{GS} = 15 V, $R_{DS(ON)}$ = f(I_D)



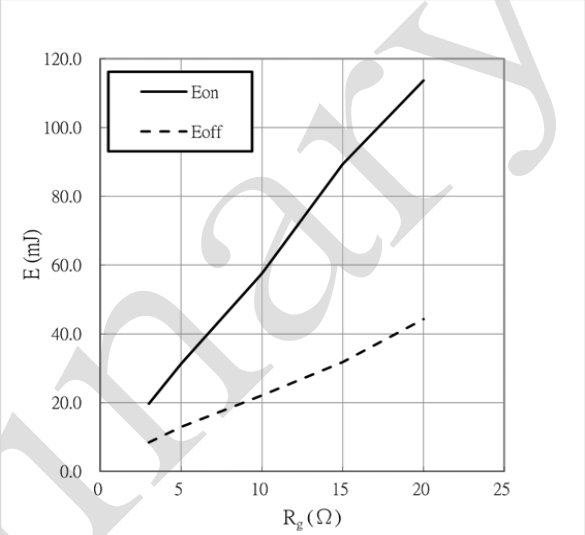
Drain source on-resistance, MOSFET
I_D = 400 A, V_{GS} = 15 V, $R_{DS(ON)}$ = f(T_j)



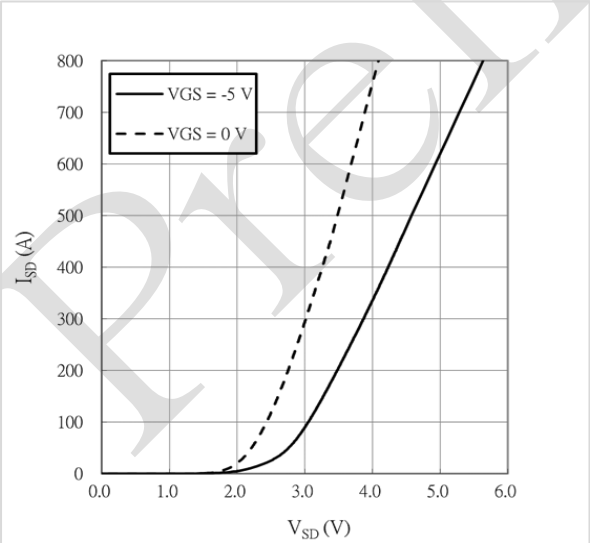
Switching losses (typical), MOSFET
V_{DS} = 600 V, R_{GON} = 5 Ω, R_{Goff} = 5 Ω,
V_{GS} = -5/15 V, T_j = 25°C, E = f(I_D)



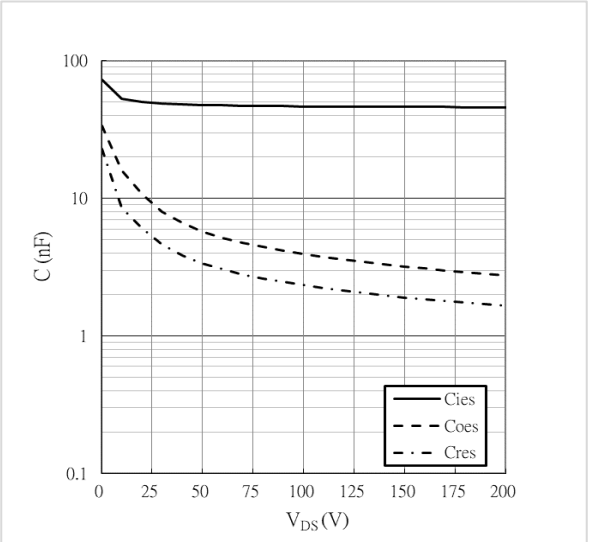
Switching losses (typical), MOSFET
V_{DS} = 600 V, I_D = 400A, V_{GS} = -5/15 V,
T_j = 25°C, E = f(R_g)



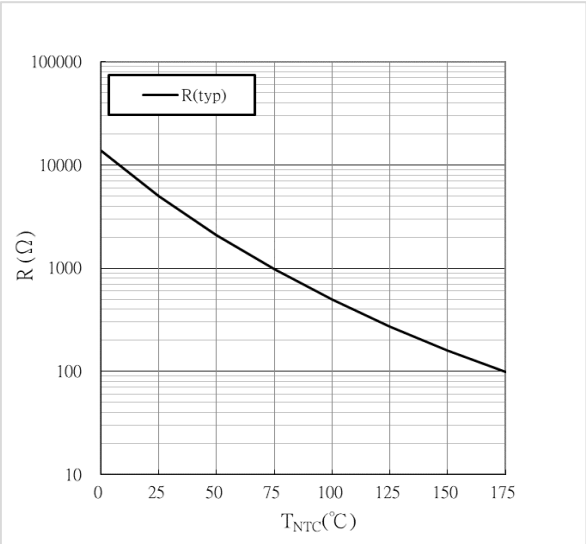
Forward characteristics of body diode,
MOSFET, T_j = 25°C, I_{SD} = f(V_{SD})



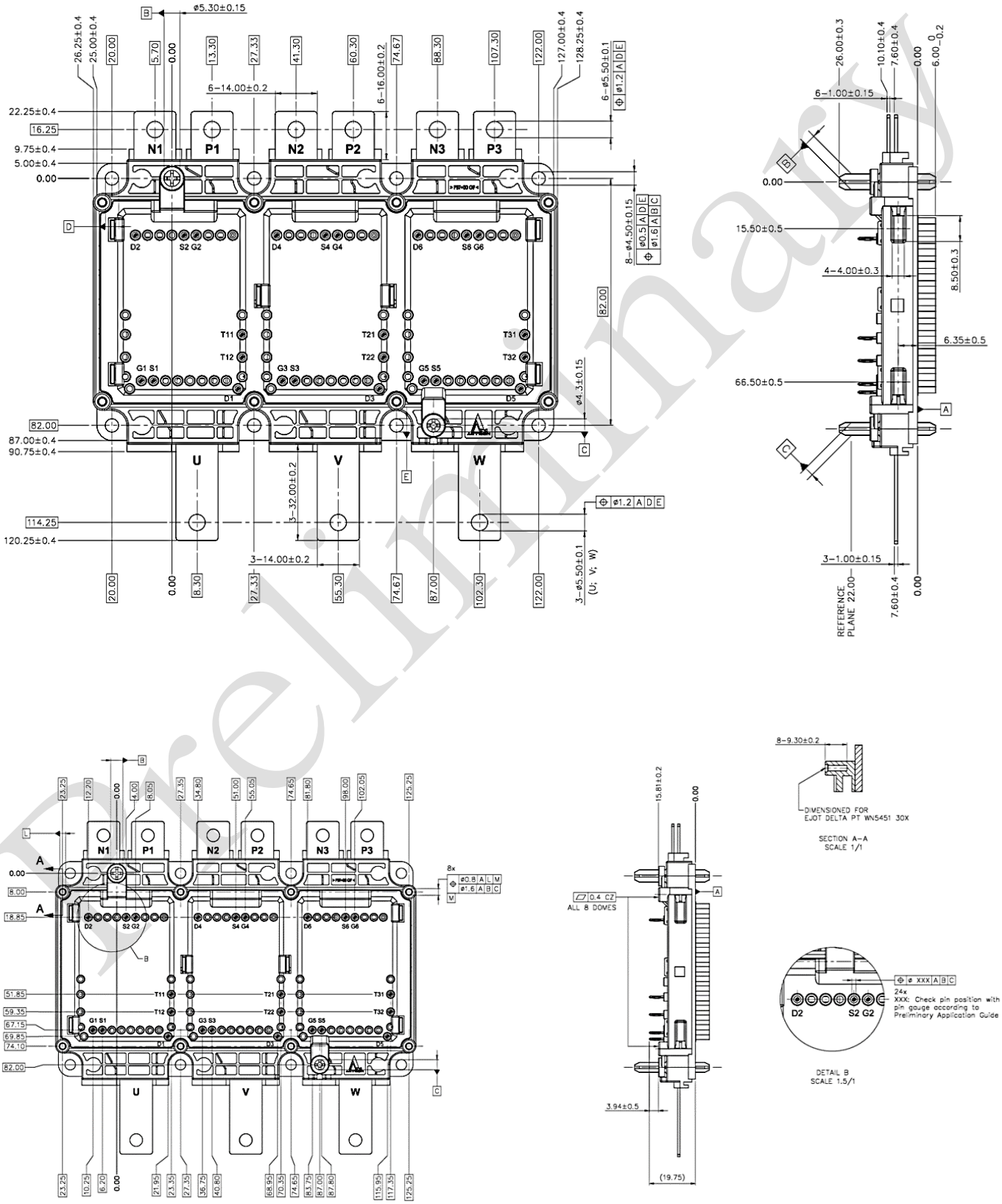
Capacitance characteristics MOSFET,
V_{GS} =0 V, T_j = 25°C, f = 1 MHz, C = f(V_{DS})



NTC-Thermistor-temperature characteristics



Package Outlines



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