

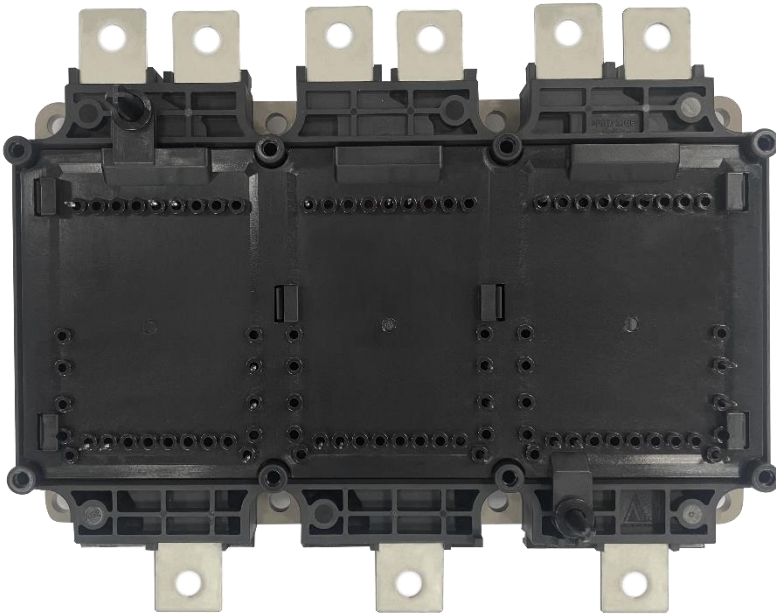


Power Module

AEP820B08TFST

DATASHEET

V1.2, 2022/12



Applications

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

Electrical Features

- Low Q_g
- $T_{j,op} = 150^{\circ}\text{C}$
- Low Inductive Design
- Blocking voltage 750V
- Fast and soft reverse recovery
- Low V_{CEsat} and Switching Losses

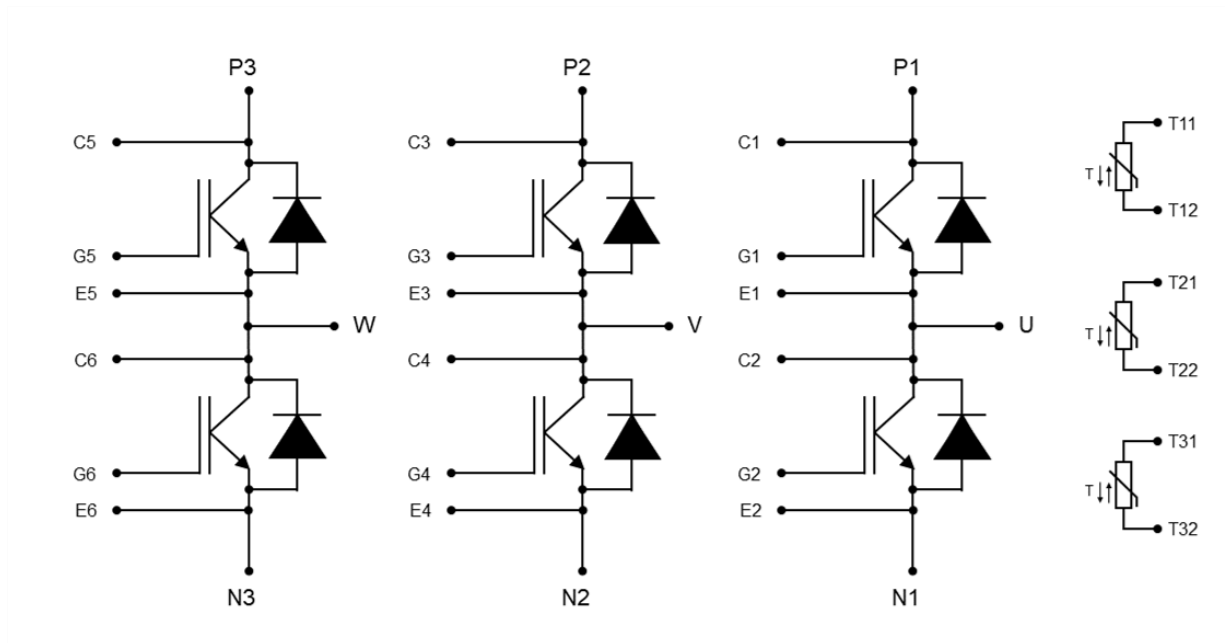
Mechanical Features

- Compact design
- 4.2KV DC Insulation
- UL 94 V0 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}	750	V
Gate-emitter peak voltage		V_{GES}	± 20	V
Implemented collector current		I_{CN}	820	A
Continuous DC collector current	$T_F = 70^{\circ}\text{C}$, $T_j = 175^{\circ}\text{C}$	$I_{\text{C nom}}$	450	A
Repetitive peak collector current	$t_p = 1 \text{ ms}$	I_{CRM}	1640	A
Maximum Junction Temperature		$T_{j,\text{max}}$	175	$^{\circ}\text{C}$

Characteristics Values

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$I_{\text{C}} = 450\text{A}$, $V_{\text{GE}} = 15\text{V}$	$V_{\text{CE,sat}}$		1.15	1.45	V
	$I_{\text{C}} = 450\text{A}$, $V_{\text{GE}} = 15\text{V}$			1.25		
	$I_{\text{C}} = 450\text{A}$, $V_{\text{GE}} = 15\text{V}$			1.30		
	$I_{\text{C}} = 820\text{A}$, $V_{\text{GE}} = 15\text{V}$			1.40		
	$I_{\text{C}} = 820\text{A}$, $V_{\text{GE}} = 15\text{V}$			1.60		
	$I_{\text{C}} = 820\text{A}$, $V_{\text{GE}} = 15\text{V}$			1.70		
Gate threshold voltage	$I_{\text{C}} = 9.6 \text{ mA}$, $V_{\text{CE}} = V_{\text{GE}}$	V_{GEth}	5.10	5.70	6.50	V
	$I_{\text{C}} = 9.6 \text{ mA}$, $V_{\text{CE}} = V_{\text{GE}}$			4.20		
	$I_{\text{C}} = 9.6 \text{ mA}$, $V_{\text{CE}} = V_{\text{GE}}$			3.95		
Collector-emitter cut-off current	$V_{\text{CE}} = 750\text{V}$, $V_{\text{GE}} = 0\text{V}$	I_{CES}			1.0	mA
	$V_{\text{CE}} = 750\text{V}$, $V_{\text{GE}} = 0\text{V}$			5.0		
	$V_{\text{CE}} = 750\text{V}$, $V_{\text{GE}} = 0\text{V}$			10.0		
Gate-emitter leakage current	$V_{\text{CE}} = 0\text{V}$, $V_{\text{GE}} = 20\text{V}$	I_{GES}			400	nA
Gate Charge	$V_{\text{GE}} = -8 \text{ V} / + 15 \text{ V}$, $V_{\text{CE}} = 400\text{V}$	Q_g		2.2		μC
Internal gate resistor		R_{Gint}		1.7		Ω
Input capacitance	$f = 1\text{MHz}$, $V_{\text{CE}} = 50 \text{ V}$, $V_{\text{GE}} = 0\text{V}$	C_{ies}		45		nF
Output capacitance	$f = 1\text{MHz}$, $V_{\text{CE}} = 50 \text{ V}$, $V_{\text{GE}} = 0\text{V}$	C_{oes}		2.8		nF
Reverse transfer capacitance	$f = 1\text{MHz}$, $V_{\text{CE}} = 50 \text{ V}$, $V_{\text{GE}} = 0\text{V}$	C_{res}		1.5		nF



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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Turn-on delay time, inductive load	$I_C = 450A$, $V_{CE} = 400V$, $V_{GE} = -8V / +15V$ $R_{GON} = 2.5\ \Omega$	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ $t_{d(on)}$		0.14 0.11 0.11		μs
Rise time, inductive load	$I_C = 450A$, $V_{CE} = 400V$, $V_{GE} = -8V / +15V$ $R_{GON} = 2.5\ \Omega$	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ t_r		0.069 0.070 0.072		μs
Turn-on energy loss per pulse	$I_C = 450A$, $V_{CE} = 400V$, $L_S = 30nH$ $V_{GE} = -8V / +15V$, $R_{GON} = 2.5\ \Omega$ $di/dt = 5500\ A/\mu s$ (25°C) $di/dt = 5100\ A/\mu s$ (150°C)	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ E_{on}		13.5 15.5 17.5		mJ
Turn-off delay time, inductive load	$I_C = 450A$, $V_{CE} = 400V$, $V_{GE} = -8V / +15V$ $R_{Goff} = 5.0\ \Omega$	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ $t_{d(off)}$		0.55 0.56 0.57		μs
Fall time, inductive load	$I_C = 450A$, $V_{CE} = 400V$, $V_{GE} = -8V / +15V$ $R_{Goff} = 5.0\ \Omega$	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ t_f		0.27 0.42 0.45		μs
Turn-off energy loss per pulse	$I_C = 450A$, $V_{CE} = 400V$, $L_S = 30nH$ $V_{GE} = -8V / +15V$, $R_{Goff} = 5.0\ \Omega$ $dv/dt = 2500\ V/\mu s$ (25°C) $dv/dt = 2200\ V/\mu s$ (150°C)	$T_J = 25^\circ C$ $T_J = 150^\circ C$ $T_J = 175^\circ C$ E_{off}		35.5 45.5 50.5		mJ
SC data	$V_{GE} \leq 15V$, $V_{CC} = 400V$ $t_p \leq 6\ \mu s$ $t_p \leq 3\ \mu s$	$T_J = 25^\circ C$ $T_J = 175^\circ C$ I_{sc}		4800 3800		A
Thermal resistance, junction to cooling fluid	Per IGBT; $dV/dT = 10\ dm^3/min$, $T_F = 70^\circ C$	R_{thJF}		0.120	0.140	K/W



Diode Inverter

Maximum Rated Values

Parameter	Conditions	Symbol	Values	Unit
Repetitive peak reverse voltage	$T_J = 25^{\circ}\text{C}$	V_{RRM}	750	V
Implemented forward current		I_{FN}	820	A
Continuous DC forward current		I_F	450	A
Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	1640	A
I^2t (value)	$V_R = 0 \text{ V}$, $t_p = 10 \text{ ms}$, $T_J = 150^{\circ}\text{C}$	I^2t	19000	A^2s

Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit
Forward voltage	$I_F = 450\text{A}$, $V_{GE} = 0\text{V}$	V_F	1.45	1.65	V
	$I_F = 450\text{A}$, $V_{GE} = 0\text{V}$		1.50		
	$I_F = 450\text{A}$, $V_{GE} = 0\text{V}$		1.55		
	$I_F = 820\text{A}$, $V_{GE} = 0\text{V}$		1.80		
	$I_F = 820\text{A}$, $V_{GE} = 0\text{V}$		1.85		
	$I_F = 820\text{A}$, $V_{GE} = 0\text{V}$		1.90		
Peak reverse recovery current	$I_F = 450\text{A}$, $V_R = 400\text{V}$, $V_{GE} = -8\text{V}$, $-di_F/dt = 5000 \text{ A}/\mu\text{s}$ (25°C) $-di_F/dt = 4100 \text{ A}/\mu\text{s}$ (150°C)	I_{RM}	225		A
			275		
			290		
Recovered charge	$I_F = 450\text{A}$, $V_R = 400\text{V}$, $V_{GE} = -8\text{V}$, $-di_F/dt = 5000 \text{ A}/\mu\text{s}$ (25°C) $-di_F/dt = 4100 \text{ A}/\mu\text{s}$ (150°C)	Q_{rr}	14.0		μC
			26.5		
			31.0		
Reverse recovery energy	$I_F = 450\text{A}$, $V_R = 400\text{V}$, $V_{GE} = -8\text{V}$, $-di_F/dt = 5000 \text{ A}/\mu\text{s}$ (25°C) $-di_F/dt = 4100 \text{ A}/\mu\text{s}$ (150°C)	E_{rec}	3.5		mJ
			8.3		
			9.6		
Thermal resistance, junction to cooling fluid	Per diode; $dV/dT = 10 \text{ dm}^3/\text{min}$, $T_F = 70^{\circ}\text{C}$	R_{thJF}	0.175	0.200	K/W



NTC-Thermistor

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Rated resistance	$T_c = 25^\circ\text{C}$	R_{25}		5.0		k Ω
Resistance tolerance	$T_c = 100^\circ\text{C}$, $R_{100}=493\Omega$	$\Delta R/R$	5		5	%
B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/50}$		3375		K
B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/80}$		3411		K
B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298 \text{ K}))]$	$B_{25/100}$		3433		K

Module

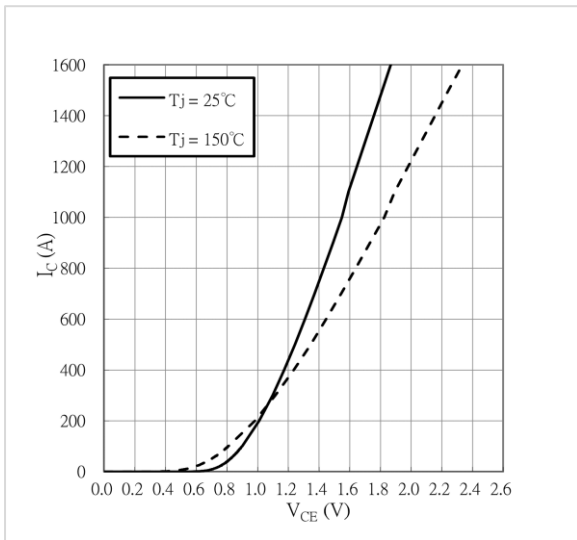
Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, $f = 0 \text{ Hz}$, $t = 1 \text{ sec}$	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material			Al_2O_3	
Creepage distance	Terminal to Heat sink	d_{cree}	9.0	mm
	Terminal to Terminal		9.0	
Clearance	Terminal 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		L_{SCE}		7		nH
Storage temperature		T_{stg}	-40		125	$^\circ\text{C}$
Weight		G		750		g

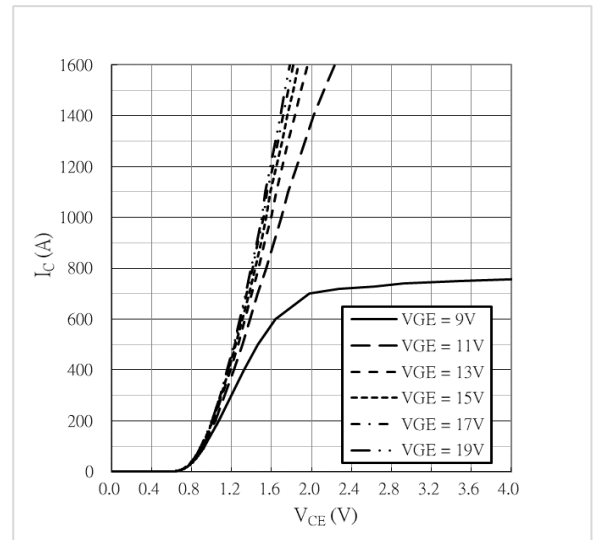
¹⁾ Extracted by following UL 746A

Characteristics Diagrams

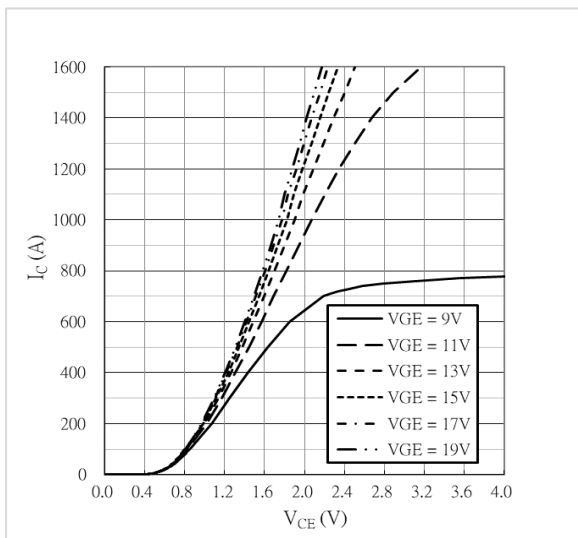
Output characteristics IGBT, Inverter
 $V_{GE} = 15 \text{ V}$, $I_C = f(V_{CE})$



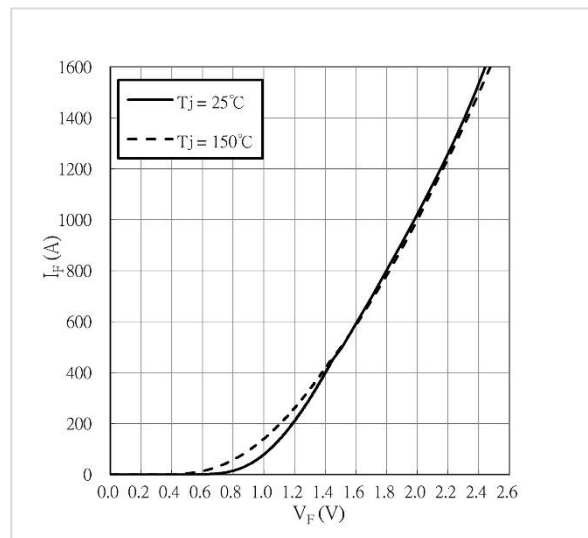
Output characteristics IGBT, Inverter
 $T_j = 25^\circ\text{C}$, $I_C = f(V_{CE})$



Output characteristics IGBT, Inverter
 $T_j = 150^\circ\text{C}$, $I_C = f(V_{CE})$



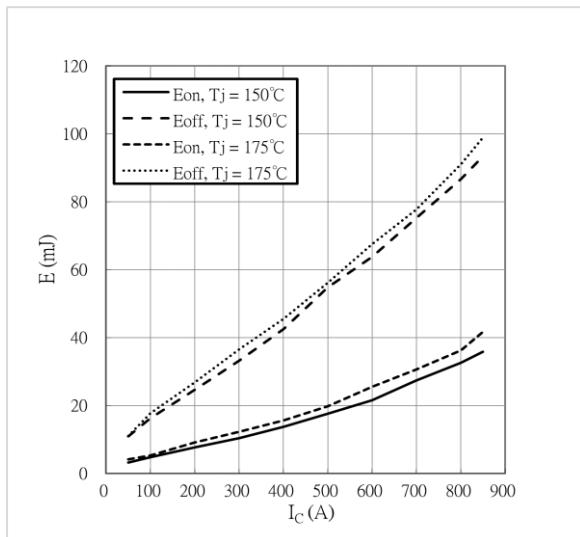
Forward characteristics of Diode, Inverter
 $I_f = f(V_f)$



Switching losses IGBT, Inverter

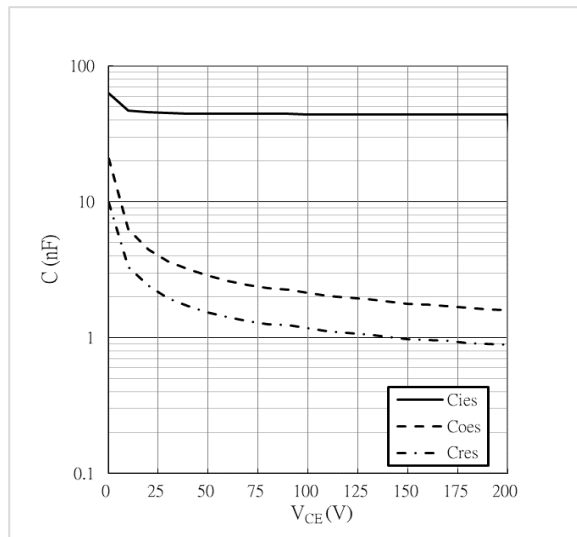
$V_{GE} = +15\text{ V} / -8\text{ V}$, $R_{GON} = 2.5\ \Omega$,

$R_{Goff} = 5.0\ \Omega$, $V_{CE} = 400\text{ V}$, E_{ON} & $E_{off} = f(I_C)$



Capacitance characteristics IGBT, inverter

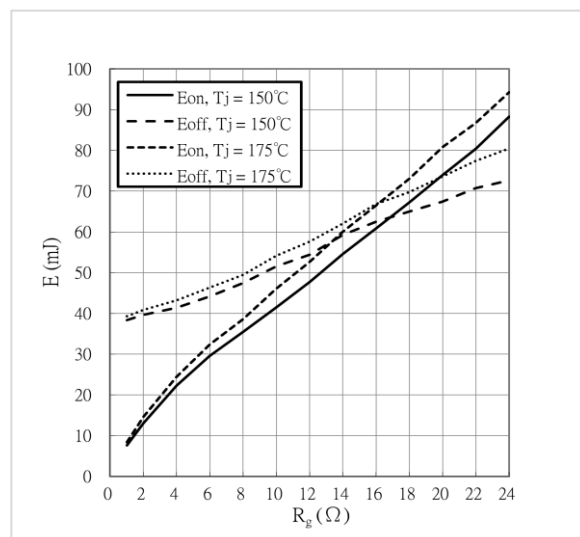
$V_{GE} = 0\text{ V}$, $T_j = 25^\circ\text{C}$, $f = 1\text{ MHz}$, $C = f(V_{CE})$



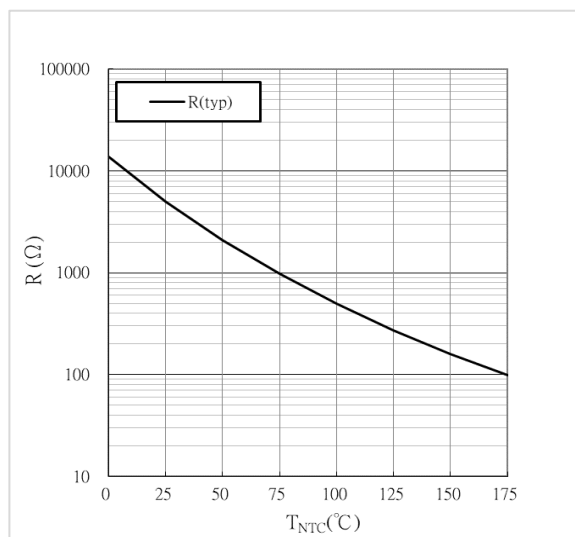
Switching losses IGBT, Inverter

$V_{GE} = +15\text{ V} / -8\text{ V}$, $V_{CE} = 400\text{ V}$, $I_C = 450\text{ A}$

E_{ON} & $E_{off} = f(R_g)$

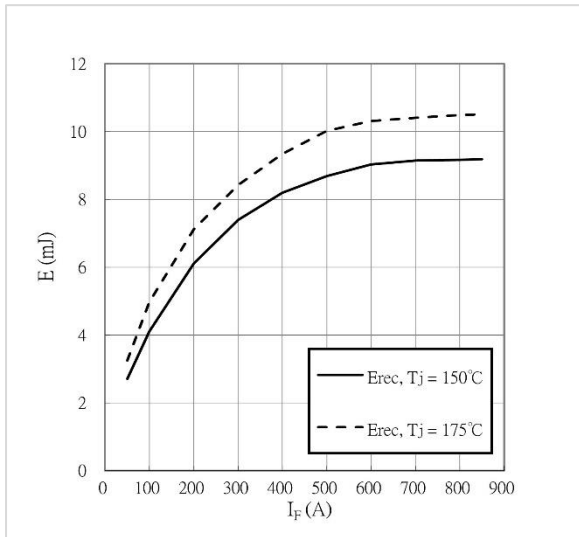


NTC-Thermistor-temperature characteristic



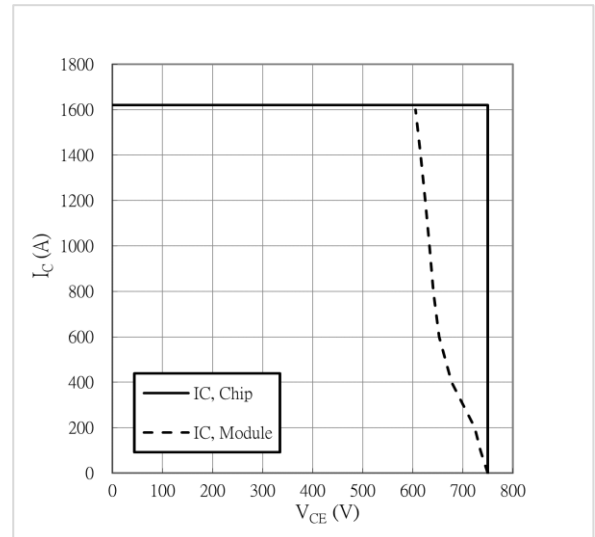
Switching losses Diode, Inverter

$R_G = 2.5 \Omega$, $V_R = 400 \text{ V}$, $E_{\text{rec}} = f(I_F)$



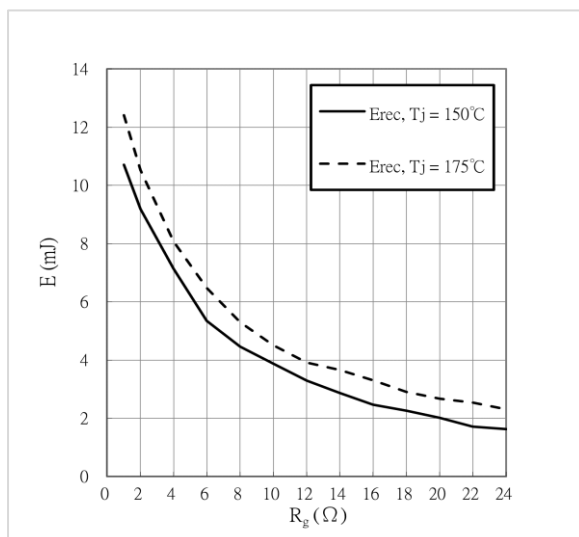
Reverse bias safe operating area (RBSOA)

$V_{GE} = +15 \text{ V} / -8 \text{ V}$, $R_{\text{Goff}} = 5.0 \Omega$, $T_j = 175^\circ\text{C}$



Switching losses Diode, Inverter

$I_F = 450 \text{ A}$, $V_R = 400 \text{ V}$, $E_{\text{rec}} = f(R_g)$

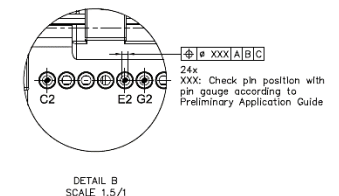
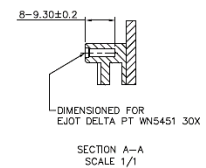
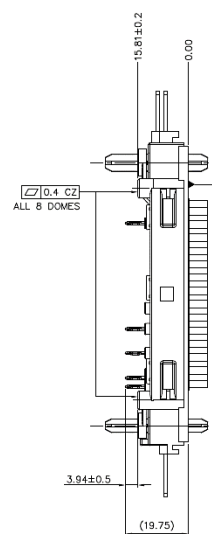
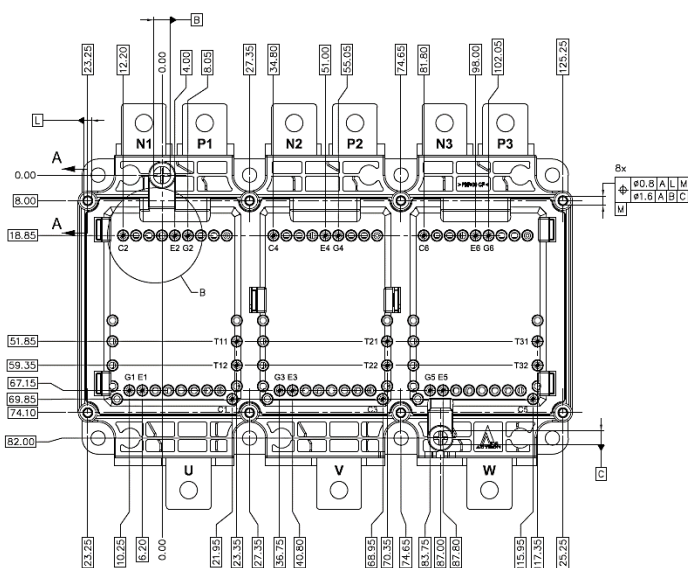
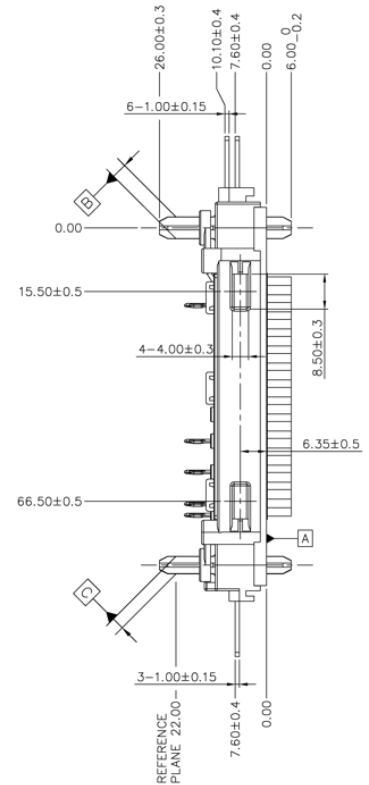
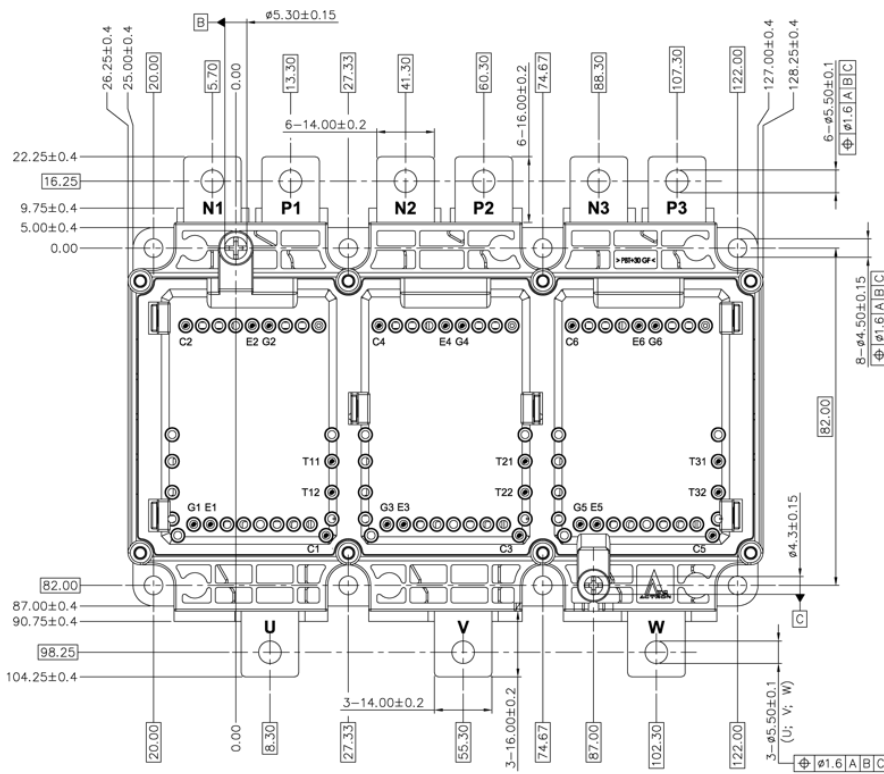




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Package Outlines



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