

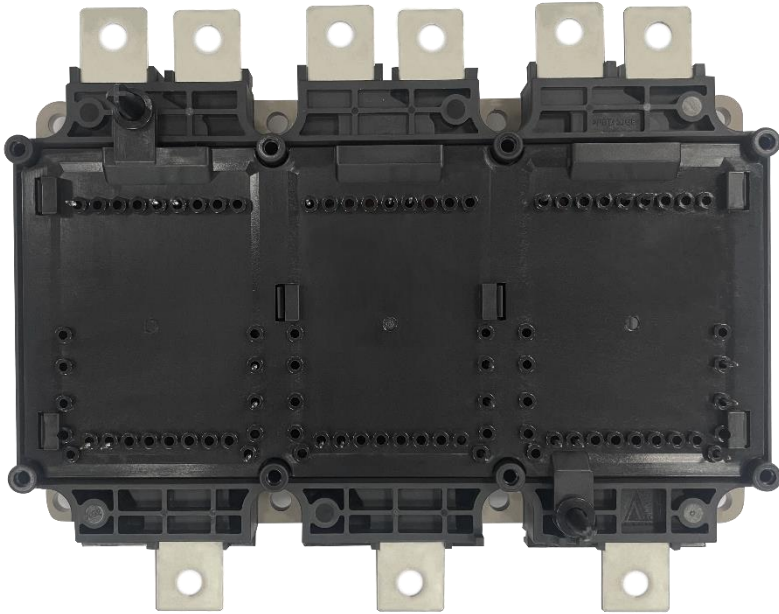


Power Module

AEP550B08TFST

DATASHEET

V1.0, 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

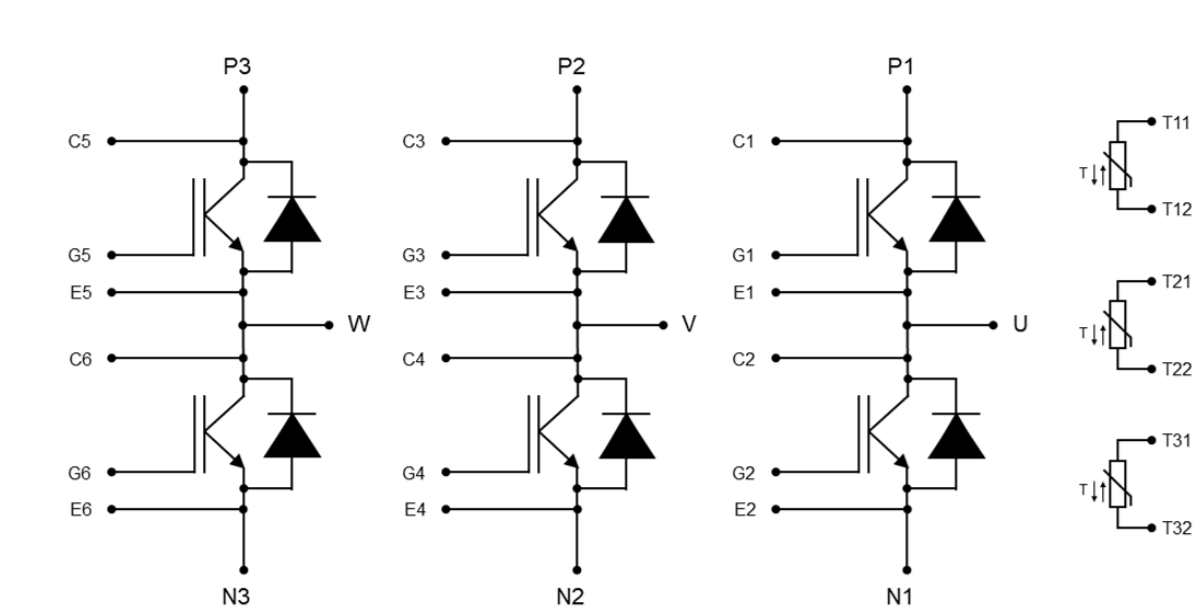
Mechanical Features

- 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}	550	A
Continuous DC collector current	$T_F = 70^\circ\text{C}, T_j = 175^\circ\text{C}$	$I_{C\text{ nom}}$	300	A
Repetitive peak collector current	$t_p = 1\text{ ms}$	I_{CRM}	1100	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	$I_C = 300\text{A}, V_{GE} = 15\text{V}$	$V_{CE,\text{sat}}$			1.20	V		
	$I_C = 300\text{A}, V_{GE} = 15\text{V}$				$T_j = 25^\circ\text{C}$		1.30	
	$I_C = 300\text{A}, V_{GE} = 15\text{V}$				$T_j = 150^\circ\text{C}$		1.35	
	$I_C = 300\text{A}, V_{GE} = 15\text{V}$				$T_j = 175^\circ\text{C}$		1.40	
	$I_C = 550\text{A}, V_{GE} = 15\text{V}$				$T_j = 25^\circ\text{C}$		1.55	
	$I_C = 550\text{A}, V_{GE} = 15\text{V}$				$T_j = 150^\circ\text{C}$		1.65	
Gate threshold voltage	$I_C = 9.6\text{ mA}, V_{CE} = V_{GE}$	$V_{G\text{Eth}}$	5.10	5.70	6.50	V		
	$I_C = 9.6\text{ mA}, V_{CE} = V_{GE}$						$T_j = 25^\circ\text{C}$	4.00
	$I_C = 9.6\text{ mA}, V_{CE} = V_{GE}$						$T_j = 150^\circ\text{C}$	3.30
Collector-emitter cut-off current	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$	I_{CES}			1.0	mA		
	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$						$T_j = 25^\circ\text{C}$	5.0
	$V_{CE} = 750\text{V}, V_{GE} = 0\text{V}$						$T_j = 150^\circ\text{C}$	10.0
Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	I_{GES}			400	nA		
Gate Charge	$V_{GE} = -8\text{ V} / + 15\text{ V},$ $V_{CE} = 400\text{V}$	Q_g		1.5		μC		
Internal gate resistor		$R_{G\text{int}}$		1.7		Ω		
Input capacitance	$f = 1\text{MHz}, V_{CE} = 50\text{ V},$ $V_{GE} = 0\text{V}$	C_{ies}		29.0		nF		
Output capacitance	$f = 1\text{MHz}, V_{CE} = 50\text{ V},$ $V_{GE} = 0\text{V}$	C_{oes}		1.0		nF		



AEP550B08TFST Power Module

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Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Reverse transfer capacitance	$f = 1\text{MHz}$, $V_{CE} = 50\text{V}$, $V_{GE} = 0\text{V}$	$T_j = 25^\circ\text{C}$ C_{res}		0.5		nF
Turn-on delay time, inductive load	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $V_{GE} = -8\text{V} / +15\text{V}$ $R_{GON} = 2.5\ \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ $t_{d(on)}$		0.085 0.090 0.095		μs
Rise time, inductive load	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $V_{GE} = -8\text{V} / +15\text{V}$ $R_{GON} = 2.5\ \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ t_r		0.057 0.060 0.061		μs
Turn-on energy loss per pulse	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $L_S = 30\text{nH}$ $V_{GE} = -8\text{V} / +15\text{V}$, $R_{GON} = 2.5\ \Omega$ $di/dt = 4200\text{A}/\mu\text{s}$ (25°C) $di/dt = 3900\text{A}/\mu\text{s}$ (175°C)	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ E_{on}		9.0 11.3 12.1		mJ
Turn-off delay time, inductive load	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $V_{GE} = -8\text{V} / +15\text{V}$ $R_{Goff} = 5.0\ \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ $t_{d(off)}$		0.37 0.42 0.43		μs
Fall time, inductive load	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $V_{GE} = -8\text{V} / +15\text{V}$ $R_{Goff} = 5.0\ \Omega$	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ t_f		0.27 0.42 0.43		μs
Turn-off energy loss per pulse	$I_C = 300\text{A}$, $V_{CE} = 400\text{V}$, $L_S = 30\text{nH}$ $V_{GE} = -8\text{V} / +15\text{V}$, $R_{Goff} = 5.0\ \Omega$ $dv/dt = 3300\text{V}/\mu\text{s}$ (25°C) $dv/dt = 2650\text{V}/\mu\text{s}$ (175°C)	$T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$ $T_j = 175^\circ\text{C}$ E_{off}		19.0 24.5 25.4		mJ
SC data	$V_{GE} \leq 15\text{V}$, $V_{CC} = 400\text{V}$ $t_p \leq 6\ \mu\text{s}$ $t_p \leq 3\ \mu\text{s}$	$T_j = 25^\circ\text{C}$ $T_j = 175^\circ\text{C}$ I_{sc}		4200 3500		A
Thermal resistance, junction to cooling fluid	Per IGBT; $dv/dT = 10\text{ dm}^3/\text{min}$, $T_F = 70^\circ\text{C}$	R_{thJF}		0.145	0.170	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}	550	A
Continuous DC forward current	$T_F = 70^\circ\text{C}, T_j = 175^\circ\text{C}$	I_{Cnom}	300	A
Repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	1100	A

Characteristics Values

Parameter	Conditions	Symbol	Typ.	Max.	Unit	
Forward voltage	$I_F = 300\text{A}, V_{GE} = 0\text{V}$	V_F	$T_j = 25^\circ\text{C}$	1.50	1.70	V
	$I_F = 300\text{A}, V_{GE} = 0\text{V}$		$T_j = 150^\circ\text{C}$	1.55		
	$I_F = 300\text{A}, V_{GE} = 0\text{V}$		$T_j = 175^\circ\text{C}$	1.60		
	$I_F = 550\text{A}, V_{GE} = 0\text{V}$		$T_j = 25^\circ\text{C}$	1.80		
	$I_F = 550\text{A}, V_{GE} = 0\text{V}$		$T_j = 150^\circ\text{C}$	2.00		
	$I_F = 550\text{A}, V_{GE} = 0\text{V}$		$T_j = 175^\circ\text{C}$	2.10		
Peak reverse recovery current	$I_F = 300\text{A}, V_R = 400\text{V},$ $V_{GE} = -8\text{V},$ $-di_F/dt = 4200 \text{ A}/\mu\text{s} (25^\circ\text{C})$ $-di_F/dt = 3300 \text{ A}/\mu\text{s} (175^\circ\text{C})$	I_{RM}	$T_j = 25^\circ\text{C}$	195	A	
			$T_j = 150^\circ\text{C}$	235		
			$T_j = 175^\circ\text{C}$	250		
Recovered charge	$I_F = 300\text{A}, V_R = 400\text{V},$ $V_{GE} = -8\text{V},$ $-di_F/dt = 4200 \text{ A}/\mu\text{s} (25^\circ\text{C})$ $-di_F/dt = 3300 \text{ A}/\mu\text{s} (175^\circ\text{C})$	Q_{rr}	$T_j = 25^\circ\text{C}$	10.8	μC	
			$T_j = 150^\circ\text{C}$	17.8		
			$T_j = 175^\circ\text{C}$	20.1		
Reverse recovery energy	$I_F = 300\text{A}, V_R = 400\text{V},$ $V_{GE} = -8\text{V}$ $-di_F/dt = 4200 \text{ A}/\mu\text{s} (25^\circ\text{C})$ $-di_F/dt = 3300 \text{ A}/\mu\text{s} (175^\circ\text{C})$	E_{rec}	$T_j = 25^\circ\text{C}$	2.9	mJ	
			$T_j = 150^\circ\text{C}$	5.0		
			$T_j = 175^\circ\text{C}$	5.7		
Thermal resistance, junction to cooling fluid	Per diode; $dV/dT = 10 \text{ dm}^3/\text{min},$ $T_F = 70^\circ\text{C}$	R_{thJF}	0.255	0.290	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	$T_c = 100^\circ\text{C}$, $R_{100}=493\Omega$	$\Delta R/R$	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

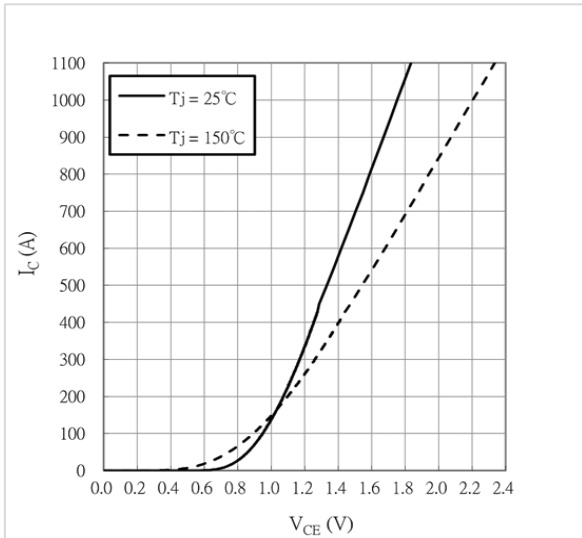
Parameter	Conditions	Symbol	Value	Unit
Isolation test voltage	RMS, $f = 0 \text{ Hz}$, $t = 1 \text{ sec}$	V_{ISOL}	4.2	kV
Module baseplate material			Cu + Ni	
Module internal isolation material			Al_2O_3	
Creepage distance	Terminal to Heat sink	d_{cree}	9.0	mm
	Terminal to Terminal		9.0	
Clearance	Terminal 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}		8		nH
Storage temperature		T_{stg}	-40		125	$^\circ\text{C}$
Weight		G		750		g

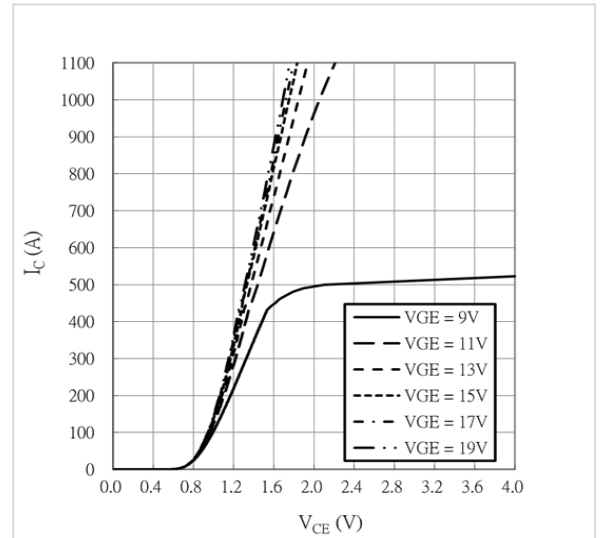
¹⁾ Extracted by following UL 746A

Characteristics Diagrams

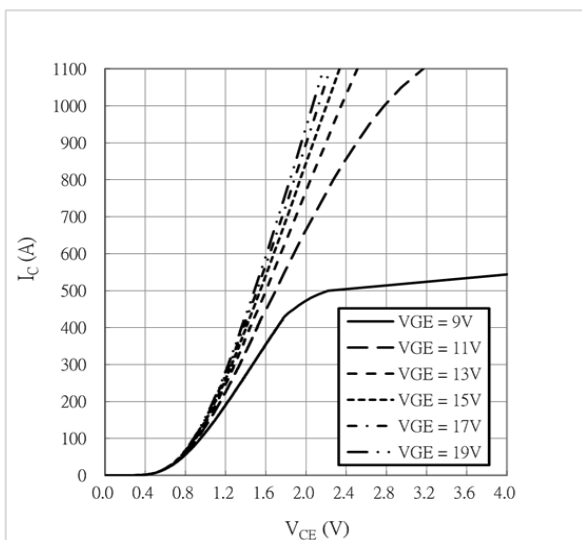
Output characteristics IGBT, Inverter
 $V_{GE} = 15\text{ V}$, $I_C = f(V_{CE})$



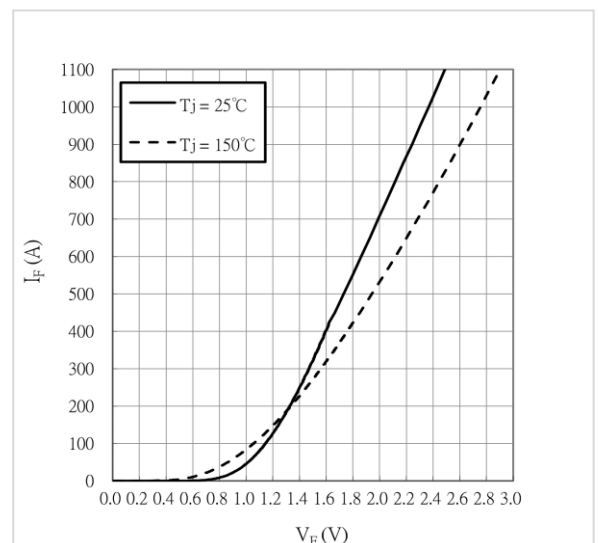
Output characteristics IGBT, Inverter
 $T_j = 25^\circ\text{C}$, $I_C = f(V_{CE})$



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



Forward characteristics of Diode, Inverter
 $I_F = f(V_F)$



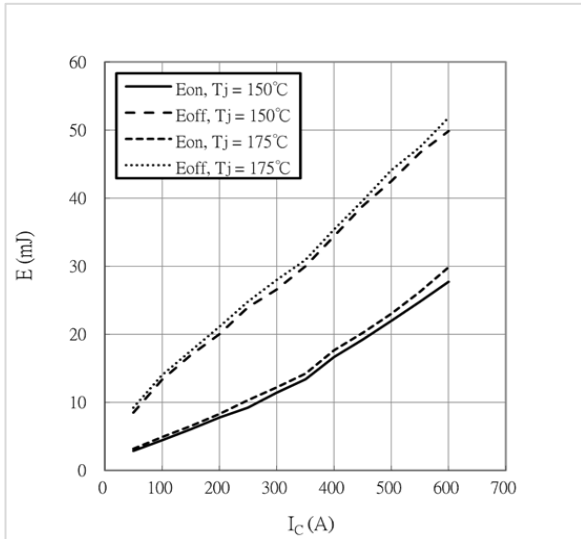


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Switching losses IGBT, Inverter

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

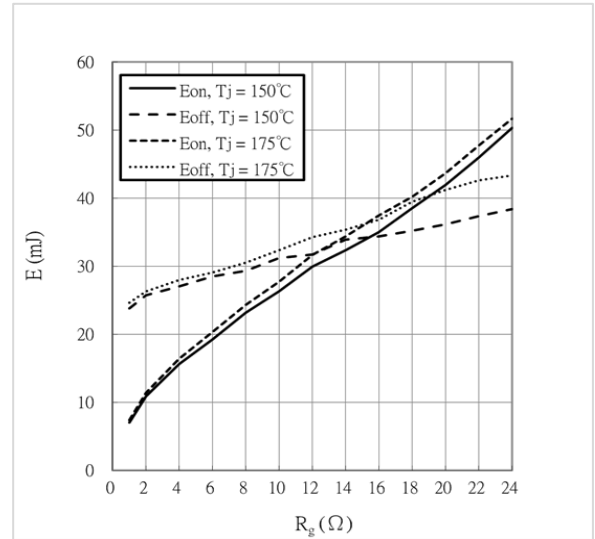
$R_{Goff} = 5.0\ \Omega$, $V_{CE} = 400\text{ V}$, E_{ON} & $E_{off} = f(I_c)$



Switching losses IGBT, Inverter

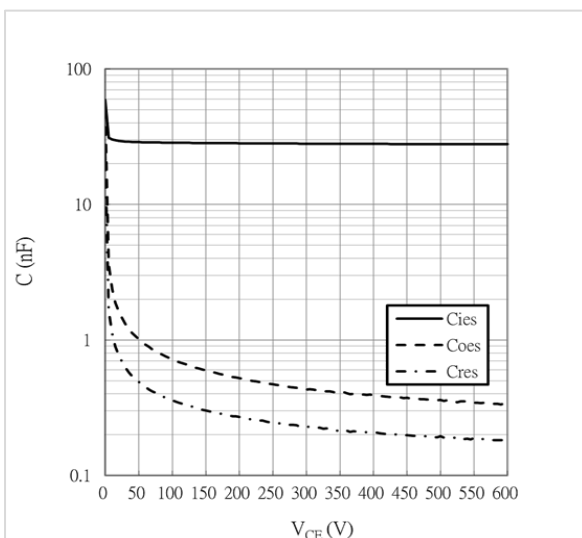
$V_{GE} = +15\text{ V} / -8\text{ V}$, $V_{CE} = 400\text{ V}$, $I_c = 300\text{ A}$

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

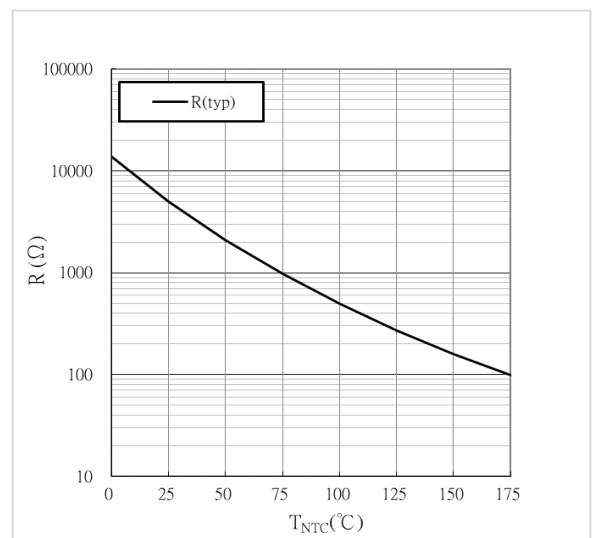


Capacitance characteristics IGBT, inverter

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



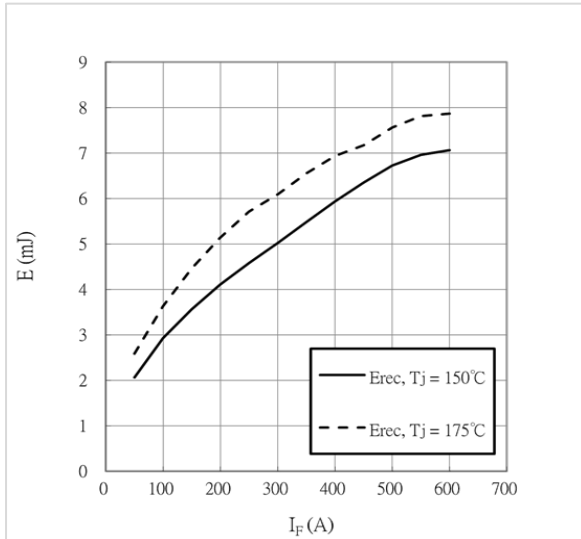
NTC-Thermistor-temperature characteristics





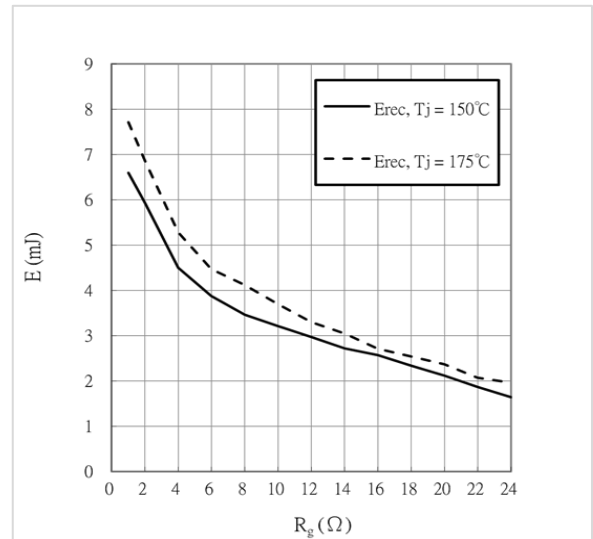
Switching losses Diode, Inverter

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



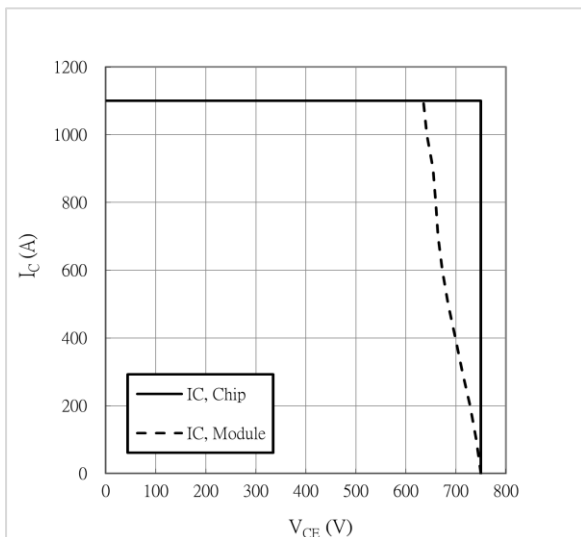
Switching losses Diode, Inverter

$I_F = 300 \text{ A}$, $V_R = 400 \text{ V}$, $E_{rec} = f(R_G)$



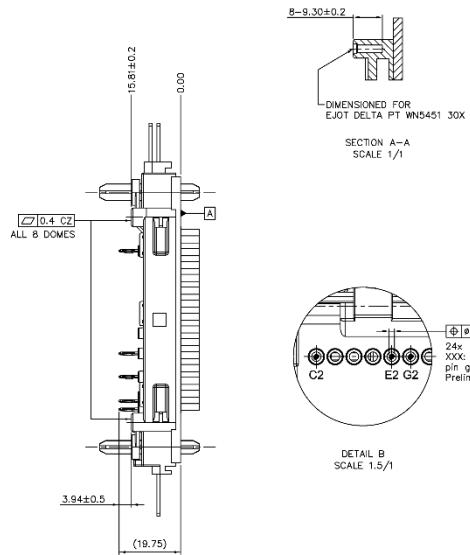
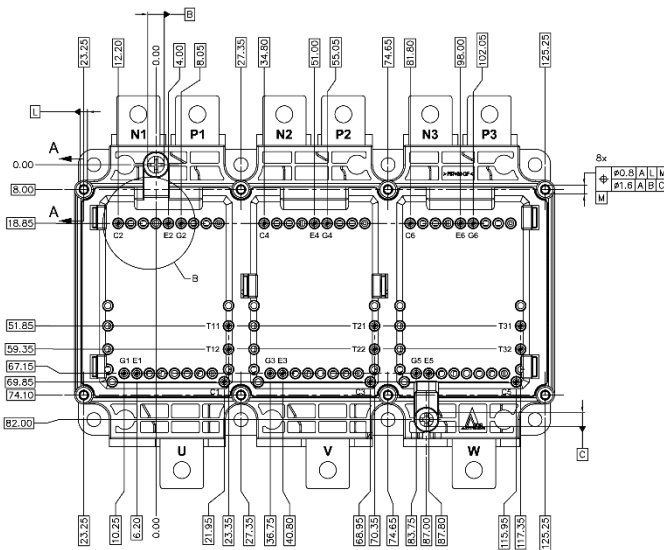
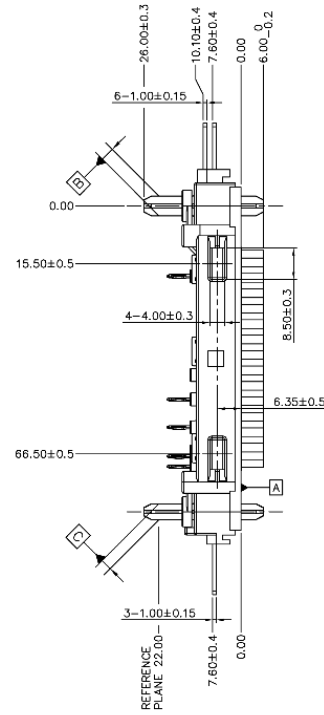
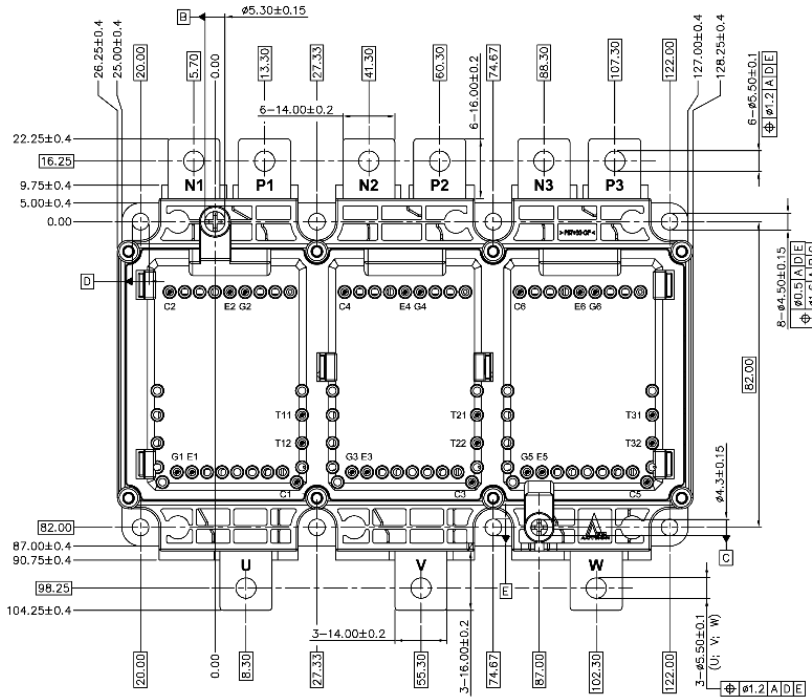
Reverse bias safe operating area (RBSOA)

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





Package Outlines



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