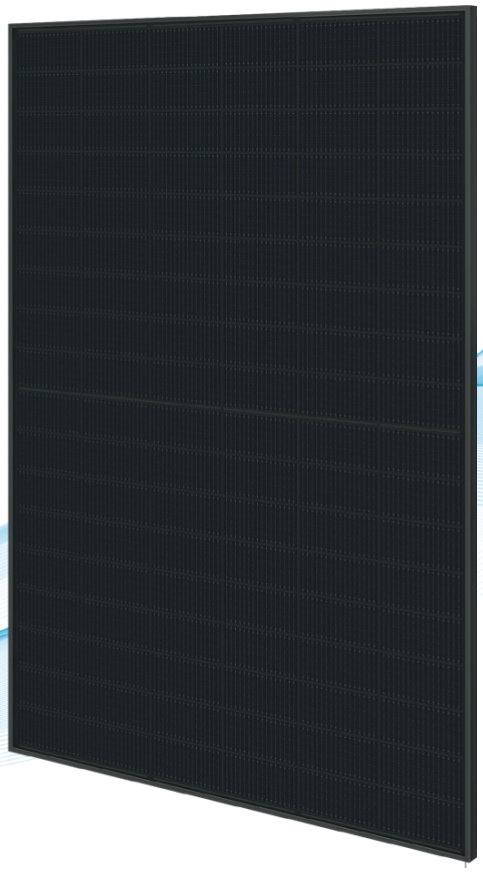
# HD HYUNDAI SOLAR MODULE

## NF(BK) Series

### Premium N-Type TOPCon Module

HiN-T435NF(BK) | HiN-T440NF(BK) | HiN-T445NF(BK)



22.79%
High Efficiency

High-End
TOPCon
Technology

Higher
Bifaciality

Long-Term
Reliability

Compatible
with Carport
Applications

For Residential
(Full Black Design)

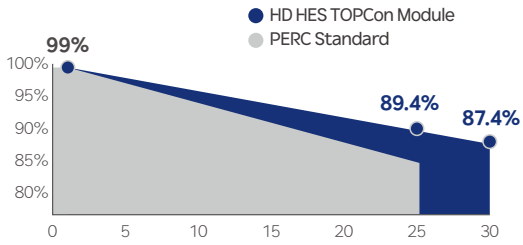
## HD Hyundai's Warranty Provisions

25 YEARS

- 25-Year Product Warranty
  - Materials and workmanship

30 YEARS

- 30-Year Performance Warranty
  - First year degradation: 1%
  - Linear warranty after initial year: with 0.4%p annual degradation, 87.4% is guaranteed up to 30years




*Refer to HD HES standard warranty for details.

## Certification

- ISO 9001 : Quality management systems
- ISO 14001 : Environmental management systems
- ISO 45001 : Occupational health and safety management systems
- UL 61730: Photovoltaic (PV) module safety qualification (CSA)
- IEC 61701: Salt mist corrosion testing
- IEC 62716: Ammonia corrosion testing
- IEC 62804: Potential Induced Degradation (PID) testing
- IEC 60068-2-68: Sand and dust testing for environmental durability

## Electrical Characteristics

| HiN-TxxxNF(BK) | | HiN-T435NF | | HiN-T440NF | | HiN-T445NF | |
|---|---|---|---|---|---|---|---|
| Item | Unit | | BNPI | | BNPI | | BNPI |
| Nominal output (Pmax) | W | 435 | 482 | 440 | 488 | 445 | 493 |
| Open circuit voltage (Voc) | V | 38.6 | 38.6 | 38.8 | 38.8 | 39.0 | 39.0 |
| Short circuit current (Isc) | A | 14.32 | 15.87 | 14.39 | 15.94 | 14.46 | 16.02 |
| Voltage at Pmax (Vmpp) | V | 32.1 | 32.1 | 32.3 | 32.3 | 32.5 | 32.5 |
| Current at Pmax (Impp) | A | 13.56 | 15.01 | 13.63 | 15.10 | 13.70 | 15.18 |
| Module efficiency | % | 22.28 | 24.68 | 22.53 | 25.00 | 22.79 | 25.25 |
| Power Class Sorting | W | 0 ~ +5 | | | | | |
| Temperature coefficient of Pmax | %/K | -0.30 | | | | | |
| Temperature coefficient of Voc | %/K | -0.25 | | | | | |
| Temperature coefficient of Isc | %/K | 0.046 | | | | | |
| Bifaciality | % | 80%±10% | | | | | |

*STC : Irradiance 1,000 W/m², cell temperature 25℃, AM=1.5 / Test uncertainty for Pmax ±3%; Voc ±3%; Isc ±3%
**The electrical properties of BNPI are measured under the irradiance corresponding to 1000 W/m² on the module front and 135 W/m² on the module rear.

| Additional Power Gain from rear side | | | | | |
|---|---|---|---|---|---|
| Pmpp gain | Pmpp[W] | Vmpp[V] | Impp[A] | Voc[V] | Isc[A] |
| 5% | 458 | 32.30 | 14.18 | 38.80 | 14.97 |
| 15% | 493 | 32.30 | 15.27 | 38.80 | 16.12 |
| 25% | 528 | 32.40 | 16.36 | 38.90 | 17.27 |

*Electrical characteristics with different rear power gain (reference to 440W)

## Mechanical Characteristics

| | |
|---|---|
| Dimensions | 1,722mm (L) x 1,134mm (W) x 30mm (H)<br>(67.8in x 44.6in x 1.2in) |
| Weight | 24.5 kg (54.01lbs) |
| Solar Cells | N-Type TOPCon, 108 (6x18) monocrystalline 16BB half-cut bifacial cells |
| Output Cables | Cable : (+)1,200mm(47.2in), (-)1,200mm(47.2in) / Customized length available<br>Connector : Stäubli MC4 genuine Connector / IP68 |
| Junction Box | 3-part, 3 bypass diodes, IP68 rated |
| Construction | Front : 2.0mm(0.08in) semi-tempered solar glass with high transmittance and anti-reflective coating<br>Rear : 2.0mm(0.08in) semi-tempered solar glass |
| Frame | Anodized aluminum alloy |

## Installation Safety Guide

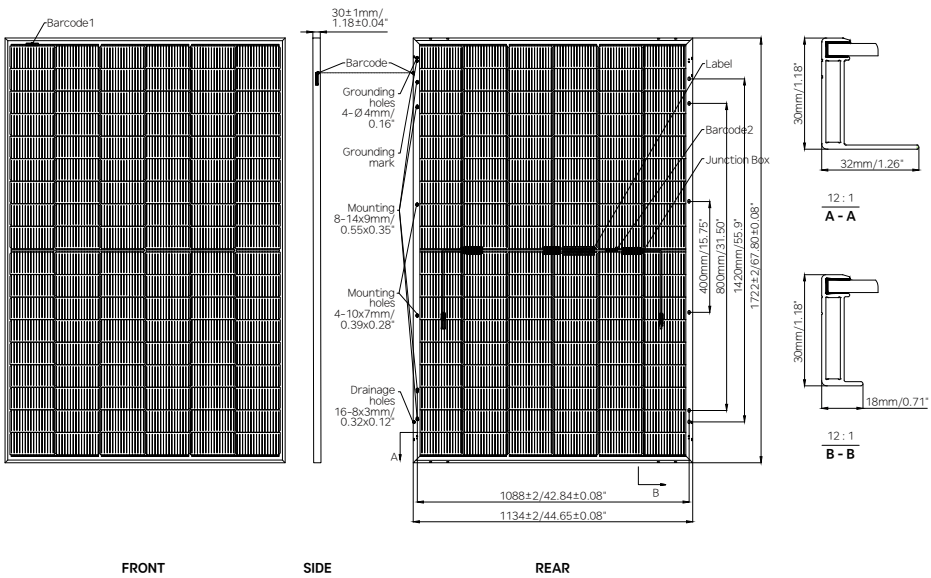
- Only qualified personnel should install or perform maintenance.
- Be aware of dangerous high DC voltage.
- Do not handle or install modules when they are wet.

| | |
|---|---|
| Nominal Module Operation Temperature | 44℃ ± 2℃ |
| Operating Temperature | -40℃~+85℃ |
| Maximum System Voltage | DC 1,500 V |
| Maximum Reverse Current | 30A |
| Maximum Test Load<br>*See Installation Manual | Front 5,400Pa<br>*Rear 5,400Pa |
| Fire Performance | Type 29 |

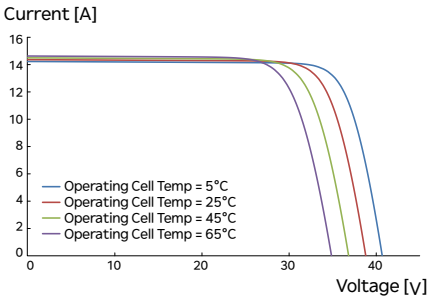
## Shipping Configurations

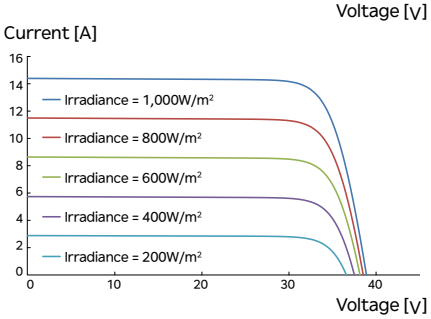
| | | | |
|---|---|---|---|
| Packing Direction | Vertical | Packing pallet weight (kg) | 912 |
| Container Size (HC) | 40' | Modules Per Pallet (pcs) | 36 |
| Pallets Per Container | 22 | Modules Per Container (pcs) | 792 |

## Module Diagram (unit : mm)




## I-V Curves (HiN-T440NF(BK))

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HD HYUNDAI ENERGY SOLUTIONS