# Yinyuet® Series

| Series | Device | Description |
|---|---|---|
| YY® Series(Hybird SiC)note[1] | SYIM756C-SST | 3Φ 15A 600V, PFC 30A 600V (Up to 100 kHz), With NTC |

## Features

- Fully insulated single in-line power module, integrated with three-phase full bridge and PFC
- Using IMS insulated and heat-dissipating substrate
- SIP (single in line) insulated half-package structure is adopted
- Three-phase full bridge 15A 600V, PFC 30A 600V
- Active high, compatible with TTL / CMOS level
- Integrated bootstrap functionality
- PFC uses SiC SBD.
- Independent inverter and PFC over-current shutdown
- Under-voltage lockout at all channels
- Cross-conduction prevention
- Fault signal output
- Independent low side IGBT emitter
- Built-in NTC thermistor for temperature monitornote[2]

## Description

YY® series MIPS™ is a modular intelligent power system with three-phase full bridge inverter and PFC, optimize PCB size and system costs, simplify PCB assembly, improve reliability of electronic system, which reduce the comprehensive cost of electronic system. It is suitable for electronic system such as consumer electronics and Low power industrial equipment with motor drive and single-phase PFC. The package structure is good thermal conduction and electrical isolation. The product has over current, over temperature, under voltage and other protection functions and good EMI performance. Three-phase inverter adopts low power consumption IGBT and FRD, which is suitable for 5~20kHz carrier frequency. PFC adopts SiC SBD to improve conversion efficiency and system reliability, and is suitable for switching frequencies below 100kHz.

## Device Features

- IGBT: 600V 15A
- PFC IGBT: 600V 30A

## Target Applications

- Inverter
- Converter

Note1：PFC utilizes SiC-SBD.

Note2：The model with T integrates NTC temperature detection function internally.

## Product Information

| Model | Package | Marking | Packing Type | Quantity |
|---|---|---|---|---|
| SYIM756C-SST | SIP35-C | SYIM756C-SST | 8 PCS/TUBE | 448PCS/CARTON BOX |

## Internal Electrical Schematic

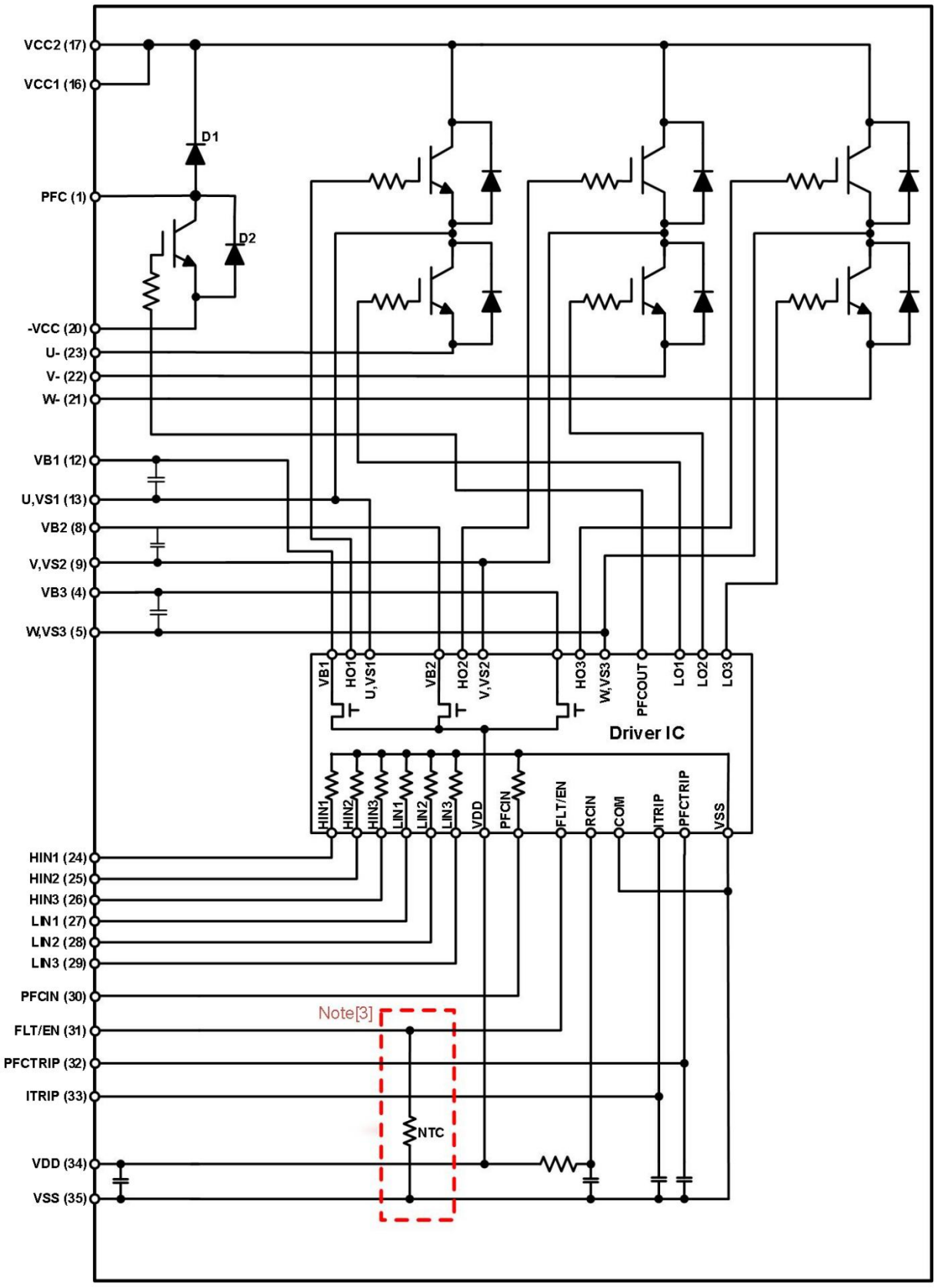
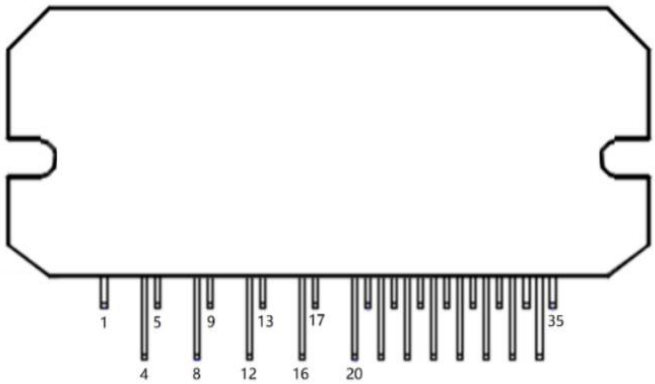



Figure 1　Module Circuit Diagram

Note3：SYIM756C-SST built in NTC thermistor.

## Pin Assignment




| Pin Number | Pin Name | Pin Description |
|---|---|---|
| 1 | PFC | PFC IGBT collector |
| 2 | / | / |
| 3 | | |
| 4 | VB3 | W-phase high side floating IC supply voltage |
| 5 | W,VS3 | W-phase high side floating IC supply offset voltage |
| 6 | / | / |
| 7 | | |
| 8 | VB2 | V-phase high side floating IC supply voltage |
| 9 | V,VS2 | V-phase high side floating IC supply offset voltage |
| 10 | / | / |
| 11 | | |
| 12 | VB1 | U-phase high side floating IC supply voltage |
| 13 | U,VS1 | U-phase high side floating IC supply offset voltage |
| 14 | / | / |
| 15 | | |
| 16 | VCC1 | Bus voltage input terminal |
| 17 | VCC2 | Bus voltage input terminal |
| 18 | / | / |
| 19 | | |
| 20 | -VCC | PFC IGBT emitter |
| 21 | W- | W-phase low side emitter |
| 22 | V- | V-phase low side emitter |
| 23 | U- | U-phase low side emitter |
| 24 | HIN1 | U-phase high side gate driver input |
| 25 | HIN2 | V-phase high side gate driver input |
| 26 | HIN3 | W-phase high side gate driver input |
| 27 | LIN1 | U-phase lower axle drive signal input |
| 28 | LIN2 | V-phase lower axle drive signal input |
| 29 | LIN3 | W-phase lower axle drive signal input |
| 30 | PFCIN | PFC drive signal input |
| 31 | FLT/EN | FAULT output and enabling input exing, NTC output(IM756C-SST) |
| 32 | PFCTRIP | PFC overcurrent protection voltage sampling end |
| 33 | ITRIP | Inverter overcurrent protection voltage sampling end |
| 34 | VDD | Low side control supply |
| 35 | VSS | Low side control negative supply |

## Absolute Maximum Ratings ($V_{DD}$=15V, $V_{GE}$=15V, $T_C$=25°C if not stated otherwise)

### Module Section

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{ISO}$ | Isolation test voltage | RMS, f=60Hz, t=1min | - | 2000 | $V_{RMS}$ |
| $T_{J(HVIC/IGBT/FRD)}$ | Operating junction temperature range | - | -40 | 150 | °C |
| $T_C$ | Operating case temperature range | - | -40 | 125 | |
| $T_{STG}$ | Storage temperature range | - | -50 | 150 | |

### PFC Section

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $I_{O\_PFC}$ | PFC Output current | $T_J$≤150°C | - | 30 | A |
| $I_{PK\_PFC}$ | PFC Maximum peak output current | $T_J$≤150°C, $t_{Pulse}$≤ 1ms | - | 60 | |
| $P_{D\_PFC}$ | Power dissipation per IGBT | $T_C$=25°C | - | 41 | W |

### Inverter Section

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CES}$ / $V_{RRM}$ | Max. blocking voltage | $I_C$=250μA | - | 600 | V |
| $V_{CC(Surge)}$ | DC link supply voltage (surge) of P-N | - | - | 500 | |
| $V_{CC}$ | DC link supply voltage of P-N | - | - | 450 | |
| $I_O$ | Output current | $T_J$≤150°C | - | 15 | A |
| $I_{PK}$ | Maximum peak output current | $T_J$≤150°C, $t_{Pulse}$≤ 1ms | - | 30 | |
| $P_D$ | Power dissipation per IGBT | $T_C$=25°C | - | 25.5 | W |

### Control Section

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ | Module supply voltage | - | -0.3 | 20 | V |
| $V_{BS}$ | High side floating supply voltage ($V_B$ vs. $V_S$) | - | -1 | 20 | |
| $V_{IN}$ | LIN, HIN, PFCIN, FLT/EN Input voltage | - | -0.3 | $V_{DD}$+0.3 | |
| $V_{FLT/EN}$ | FLT/EN Output Voltage | - | -0.3 | $V_{DD}$+0.3 | |
| $V_{ITRIP}$ | ITRIP Input voltage | - | -0.3 | 5 | |
| $V_{PFCTRIP}$ | PFCTRIP Input voltage | - | -2 | 5 | |

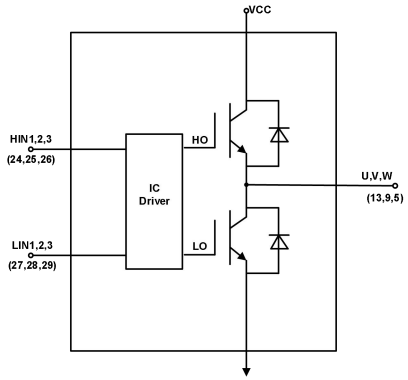
### Thermal Characteristics

| Symbol | Parameter | Condition | Min | Max | Unit |
|---|---|---|---|---|---|
| $R_{TH(J-C)INVG}$ | Inverter IGBT J-C thermal resistance | - | - | 3.7 | °C/W |
| $R_{TH(J-C)INVD}$ | Inverter FRD J-C thermal resistance | - | - | 6.1 | |
| $R_{TH(J-C)PFCG}$ | PFC IGBT J-C thermal resistance | - | - | 2.3 | |
| $R_{TH(J-C)PFCD}$ | PFC SBD J-C thermal resistance | - | - | 2.5 | |

## Recommended Operating Condition

Input / output logic sequence diagram Figure2。The power module should work within the recommended conditions，The listed voltages are all based on the COM terminal。

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | DC link supply voltage of P-N | - | 300 | 400 | V |
| $V_{BS}$ | High side floating supply voltage ($V_B$ vs. $V_S$) | 12.5 | 15 | 17.5 | |
| $V_{DD}$ | Low side supply voltage | 13.5 | 15 | 18 | |
| $V_{IN}$ | LIN, HIN, PFCIN, ITRIP, FLT/EN input voltage | 0 | - | 5 | |
| $f_{P\_INV}$ | PWM frequency (Inverter) | - | - | 20 | kHz |
| $f_{P\_PFC}$ | PWM frequency (PFC) | - | - | 100 | |
| DT | Dead time | 2 | - | - | μs |
| $PW_{IN(ON)}$ | Minimum input pulse width | 0.5 | - | - | |
| $PW_{IN(OFF)}$ | | 0.5 | - | - | |
| T | Torque of mounting screw(M3 Screw) | 0.4 | - | 0.5 | N·m |




| FLT/EN | ITRIP | HIN1,2,3 | LIN1,2,3 | U,V,W |
|---|---|---|---|---|
| 1 | 0 | 1 | 0 | VCC |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | OFF |
| 1 | 0 | 1 | 1 | OFF |
| 1 | 1 | X | X | OFF |
| 0 | X | X | X | OFF |

Figure 2　Input-Output logic table

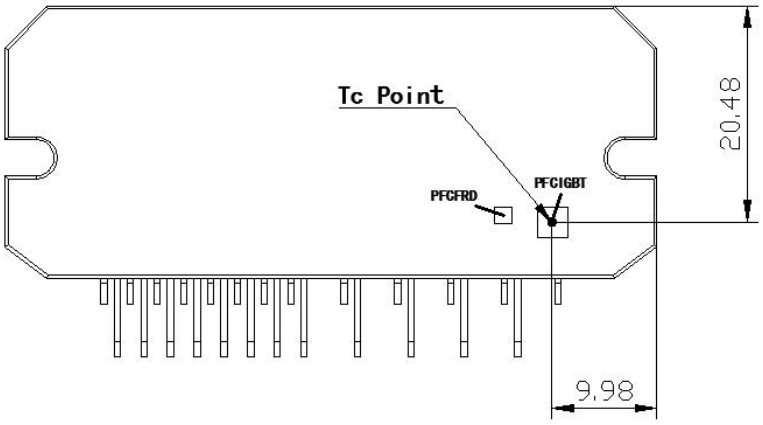



Figure 3　$T_C$ measurement point

## Electrical Characteristics

**Static Parameters** ($V_{DD}$=15V, $V_{GE}$=15V, $T_C$=25°C if not stated otherwise)

### PFC Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector-Emitter saturation voltage | $I_C$=30A | - | 1.65 | 2.0 | V |
| $I_{CES}$ | Collector-Emitter leakage current | $T_J$=25°C, $V_{IN}$=0V, PFC=600V | - | - | 0.1 | mA |
| | | $T_J$=125°C, $V_{IN}$=0V, PFC=600V, | - | - | 1.0 | |
| $V_{FM1}$ | Diode forward voltage(D1) | $I_F$=20A | - | 1.60 | 2.00 | V |
| | | $I_F$=30A | - | 1.68 | 2.80 | |
| $I_{FSM}$ | SBD Surge non-repetitive forward current(D1) | tp=2ms, half sine pulse | - | 150 | - | A |
| $Q_C$ | SBD Total capacitive charge(D1) | $V_R$=400V | - | 50 | - | nC |
| C | SBD Total capacitance(D1) | f=1MHz,$V_R$=0V | - | 1100 | - | pF |
| $V_{FM2}$ | Diode forward voltage(D2) | $I_F$=2A | - | 1.3 | 1.6 | V |

### Inverter Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector-Emitter saturation voltage | $I_C$=15A | - | 1.7 | 2.1 | V |
| $I_{CES}$ | Collector-Emitter leakage current | $T_J$=25°C, $V_{IN}$=0V, VCC=600V | - | - | 0.1 | mA |
| | | $T_J$=125°C, $V_{IN}$=0V, VCC=600V | - | - | 1.0 | |
| $V_{FM}$ | Diode forward voltage | $I_C$=15A | - | 1.6 | 2.2 | V |

### Control Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IN,TH+}$ | LIN, HIN, PFCIN, FLT/EN Logic "1" input voltage | - | 2.9 | - | - | V |
| $V_{IN,TH-}$ | LIN, HIN, PFCIN, FLT/EN Logic "0" input voltage | - | - | - | 1.0 | |
| $V_{BSUV+}$ | VBS supply under voltage positive going threshold | - | 10.2 | 11.1 | 12.5 | |
| $V_{BSUV-}$ | VBS supply under voltage negative going threshold | - | 10 | 10.9 | 12.3 | |
| $V_{DDUV+}$ | VDD supply under voltage positive going threshold | - | 10.2 | 11.1 | 12.5 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{DDUV-}$ | VDD supply under voltage negative going threshold | - | 10 | 10.9 | 12.3 | V |
| $V_{ITRIP}$ | $I_{TRIP}$ threshold voltage | - | 0.45 | 0.50 | 0.55 | |
| $V_{PFCTRIP}$ | $PFC_{TRIP}$ threshold voltage | - | -0.25 | -0.31 | -0.37 | |
| $I_{QBS}$ | VBS Quiescent supply current | - | - | - | 30 | μA |
| $I_{QDD}$ | VDD Quiescent supply current | - | - | - | 10 | mA |
| $I_{IN+}$ | LIN, HIN, PFCIN current | $V_{IN}$ =3.3V | - | 700 | - | μA |
| $I_{IN-}$ | LIN, HIN, PFCIN current | $V_{IN}$ =0V | - | 0 | 1 | |
| $I_{ITRIP+}$ | ITRIP current | $V_{ITRIP}$ =0.45V | - | 2 | - | |
| $I_{ITRIP-}$ | ITRIP Zero voltage current | $V_{ITRIP}$ =0V | - | 0 | 1 | |
| $I_{PFCTRIP+}$ | PFCTRIP current | $V_{PFCTRIP}$ =250mV | - | -17 | - | |
| $I_{PFCTRIP-}$ | PFCTRIP Zero voltage current | $V_{PFCTRIP}$ =0V | - | -13 | - | |
| $R_{FLT}$ | Fault Low level on state resistance | - | - | 50 | 100 | Ω |
| $V_{F(BSD)}$ | Bootstrap diode forward voltage | I=1mA | - | 1 | 1.5 | V |

## Dynamic Parameters ($V_{DD}$=15V, $V_{GE}$=15V, $T_C$=25°C if not stated otherwise)

### PFC Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{ON}$ | Turn-on propagation delay time | $I_C$=30A, VCC=350V, H=400μH, $V_{IN}$=0V or $V_{IN}$=5.0V | - | 0.60 | - | μs |
| $t_{OFF}$ | Turn-off propagation delay time | | - | 0.75 | - | |

### Inverter Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{ON}$ | Turn-on propagation delay time | $I_C$=15A, $V_{CC}$=350V, H=400μH, $V_{IN}$=0V or 5V | - | 0.84 | - | μs |
| $t_{OFF}$ | Turn-off propagation delay time | | - | 1.42 | - | |

### Control Section

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{FLT}$ | FLT trigger delay time (Figure 13) | - | - | 0.7 | - | μs |
| $t_{FLT\_CLR}$ | FLT clearance delay time (Figure 13) | - | 1.1 | 1.7 | 2.5 | ms |
| $t_{ITRIP}$ | ITRIP to shutdown propagation delay (Figure 13) | - | - | 1.2 | - | μs |
| $t_{PFCTRIP}$ | PFCTRIP to shutdown propagation delay | - | - | 1.1 | - | |

## NTC Characteristic (IM756C-SST)

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | 25°C resistance | $T_C$=25°C | 99 | 100 | 101 | kΩ |
| $R_{100}$ | 100°C resistance | $T_C$=100°C | 5.18 | 5.38 | 5.60 | |
| B | B constant (25°C~50°C) | $R_2=R_1e^{[B(1/T2-1/T1)]}$ | 4208 | 4250 | 4293 | K |
| TEMP | Temperature range | - | -40 | - | 125 | °C |

NCP15WF104F03RC
R25 100 k ohm +/- 1%
B(25/50) 4250K +/-1 %

| TEMP. (deg.C) | R-low (k ohm) | R-center (k ohm) | R-high (k ohm) | TEMP. (deg.C) | R-low (k ohm) | R-center (k ohm) | R-high (k ohm) |
|---|---|---|---|---|---|---|---|
| -40 | 4191.5221 | 4397.1193 | 4612.3399 | 2 | 313.2543 | 320.1216 | 327.1067 |
| -39 | 3904.3007 | 4092.8737 | 4290.1256 | 3 | 296.9408 | 303.2866 | 309.737 |
| -38 | 3638.6865 | 3811.717 | 3992.5763 | 4 | 281.5705 | 287.4335 | 293.3892 |
| -37 | 3392.915 | 3551.7485 | 3717.6457 | 5 | 267.0836 | 272.4995 | 277.9974 |
| -36 | 3165.3767 | 3311.2358 | 3463.4696 | 6 | 253.4246 | 258.4264 | 263.5006 |
| -35 | 2954.6027 | 3088.5989 | 3228.3492 | 7 | 240.5415 | 245.1598 | 249.8418 |
| -34 | 2759.2514 | 2882.3958 | 3010.735 | 8 | 228.386 | 232.6491 | 236.968 |
| -33 | 2578.0968 | 2691.3096 | 2809.213 | 9 | 216.9132 | 220.8471 | 224.8299 |
| -32 | 2410.0177 | 2514.137 | 2622.4921 | 10 | 206.0809 | 209.7098 | 213.3813 |
| -31 | 2253.9885 | 2349.7776 | 2449.3926 | 11 | 195.85 | 199.1962 | 202.5794 |
| -30 | 2109.07 | 2197.225 | 2288.8359 | 12 | 186.1838 | 189.2681 | 192.3843 |
| -29 | 1974.402 | 2055.5577 | 2139.8353 | 13 | 177.0481 | 179.8896 | 182.7585 |
| -28 | 1849.1959 | 1923.9316 | 2001.4876 | 14 | 168.411 | 171.0275 | 173.6673 |
| -27 | 1732.7288 | 1801.5732 | 1872.9656 | 15 | 160.2427 | 162.6506 | 165.0781 |
| -26 | 1624.337 | 1687.7731 | 1753.5114 | 16 | 152.512 | 154.7264 | 156.9573 |
| -25 | 1523.4112 | 1581.8805 | 1642.4297 | 17 | 145.197 | 147.2321 | 149.2807 |
| -24 | 1429.2026 | 1483.0995 | 1538.8751 | 18 | 138.2731 | 140.142 | 142.0219 |
| -23 | 1341.4177 | 1391.1132 | 1442.5055 | 19 | 131.7174 | 133.4322 | 135.1557 |
| -22 | 1259.5795 | 1305.4128 | 1352.7786 | 20 | 125.5083 | 127.0802 | 128.659 |
| -21 | 1183.249 | 1225.5307 | 1269.1963 | 21 | 119.6263 | 121.0658 | 122.5104 |
| -20 | 1112.0223 | 1151.0367 | 1191.3009 | 22 | 114.0515 | 115.3684 | 116.6887 |
| -19 | 1045.5274 | 1081.5351 | 1118.671 | 23 | 108.7664 | 109.9695 | 111.1748 |
| -18 | 983.4216 | 1016.6613 | 1050.9194 | 24 | 103.7544 | 104.8521 | 105.9508 |
| -17 | 925.3889 | 956.0796 | 987.6893 | 25 | 99 | 100 | 101 |
| -16 | 871.1382 | 899.4806 | 928.6522 | 26 | 94.3996 | 95.3981 | 96.3975 |
| -15 | 820.4005 | 846.5788 | 873.5051 | 27 | 90.0373 | 91.0322 | 92.029 |
| -14 | 772.9276 | 797.111 | 821.9688 | 28 | 85.8993 | 86.889 | 87.8813 |
| -13 | 728.4903 | 750.8341 | 773.7859 | 29 | 81.9732 | 82.9561 | 83.9424 |
| -12 | 686.8767 | 707.5237 | 728.7184 | 30 | 78.247 | 79.2216 | 80.2004 |
| -11 | 647.8909 | 666.9723 | 686.5469 | 31 | 74.7099 | 75.6752 | 76.6453 |
| -10 | 611.3519 | 628.9882 | 647.0685 | 32 | 71.3511 | 72.306 | 73.2662 |
| -9 | 577.0418 | 593.3421 | 610.0418 | 33 | 68.1608 | 69.1042 | 70.0537 |
| -8 | 544.8642 | 559.9309 | 575.3567 | 34 | 65.1296 | 66.0608 | 66.9986 |
| -7 | 514.6742 | 528.6016 | 542.8516 | 35 | 62.2488 | 63.1671 | 64.0926 |
| -6 | 486.3375 | 499.2124 | 512.377 | 36 | 59.5102 | 60.415 | 61.3275 |
| -5 | 459.7296 | 471.6321 | 483.7943 | 37 | 56.9061 | 57.7969 | 58.6958 |
| -4 | 434.7669 | 445.7716 | 457.0092 | 38 | 54.4292 | 55.3056 | 56.1905 |
| -3 | 411.305 | 421.4796 | 431.8627 | 39 | 52.0726 | 52.9343 | 53.8048 |
| -2 | 389.2453 | 398.6521 | 408.2455 | 40 | 49.83 | 50.6766 | 51.5325 |
| -1 | 368.496 | 377.1927 | 386.056 | 41 | 47.6969 | 48.5283 | 49.3693 |
| 0 | 348.9722 | 357.0117 | 365.1999 | 42 | 45.666 | 46.482 | 47.3079 |
| 1 | 330.5751 | 338.0058 | 345.569 | 43 | 43.7319 | 44.5325 | 45.3431 |

NCP15WF104F03RC
R25 100 k ohm +/- 1 %
B(25/50) 4250K +/- 1 %

| TEMP. (deg.C) | R-low (k ohm) | R-center (k ohm) | R-high (k ohm) | TEMP. (deg.C) | R-low (k ohm) | R-center (k ohm) | R-high (k ohm) |
|---|---|---|---|---|---|---|---|
| 44 | 41.8896 | 42.6745 | 43.4699 | 86 | 8.2806 | 8.5722 | 8.8733 |
| 45 | 40.1341 | 40.9035 | 41.6835 | 87 | 7.9988 | 8.2834 | 8.5772 |
| 46 | 38.4593 | 39.2132 | 39.9778 | 88 | 7.7279 | 8.0055 | 8.2924 |
| 47 | 36.8626 | 37.601 | 38.3503 | 89 | 7.4673 | 7.7383 | 8.0182 |
| 48 | 35.34 | 36.0629 | 36.797 | 90 | 7.2167 | 7.4811 | 7.7543 |
| 49 | 33.8878 | 34.5953 | 35.3142 | 91 | 6.9764 | 7.2344 | 7.5012 |
| 50 | 32.5022 | 33.1946 | 33.8983 | 92 | 6.7453 | 6.9971 | 7.2575 |
| 51 | 31.1818 | 31.8591 | 32.5479 | 93 | 6.5228 | 6.7685 | 7.0228 |
| 52 | 29.9215 | 30.5839 | 31.2579 | 94 | 6.3086 | 6.5484 | 6.7967 |
| 53 | 28.7183 | 29.366 | 30.0253 | 95 | 6.1024 | 6.3365 | 6.5789 |
| 54 | 27.5694 | 28.2026 | 28.8474 | 96 | 5.9031 | 6.1316 | 6.3682 |
| 55 | 26.472 | 27.0909 | 27.7215 | 97 | 5.7112 | 5.9341 | 6.1652 |
| 56 | 25.4236 | 26.0284 | 26.6449 | 98 | 5.5263 | 5.7439 | 5.9695 |
| 57 | 24.4218 | 25.0127 | 25.6154 | 99 | 5.3482 | 5.5606 | 5.7808 |
| 58 | 23.4643 | 24.0416 | 24.6306 | 100 | 5.1766 | 5.3839 | 5.5989 |
| 59 | 22.5489 | 23.1128 | 23.6884 | 101 | 5.0119 | 5.2143 | 5.4243 |
| 60 | 21.6737 | 22.2243 | 22.7867 | 102 | 4.8531 | 5.0507 | 5.2558 |
| 61 | 20.8365 | 21.3743 | 21.9237 | 103 | 4.7001 | 4.893 | 5.0934 |
| 62 | 20.0357 | 20.5607 | 21.0974 | 104 | 4.5526 | 4.7409 | 4.9366 |
| 63 | 19.2694 | 19.782 | 20.3062 | 105 | 4.4103 | 4.5942 | 4.7853 |
| 64 | 18.536 | 19.0364 | 19.5484 | 106 | 4.2731 | 4.4527 | 4.6393 |
| 65 | 17.834 | 18.3225 | 18.8224 | 107 | 4.1407 | 4.3161 | 4.4984 |
| 66 | 17.1633 | 17.6401 | 18.1283 | 108 | 4.013 | 4.1843 | 4.3624 |
| 67 | 16.521 | 16.9864 | 17.4631 | 109 | 3.8898 | 4.057 | 4.231 |
| 68 | 15.9058 | 16.36 | 16.8254 | 110 | 3.7709 | 3.9342 | 4.1042 |
| 69 | 15.3164 | 15.7596 | 16.2141 | 111 | 3.6561 | 3.8156 | 3.9817 |
| 70 | 14.7516 | 15.1841 | 15.6278 | 112 | 3.5452 | 3.7011 | 3.8634 |
| 71 | 14.209 | 14.631 | 15.0641 | 113 | 3.4383 | 3.5905 | 3.749 |
| 72 | 13.6888 | 14.1006 | 14.5234 | 114 | 3.3349 | 3.4836 | 3.6386 |
| 73 | 13.19 | 13.5918 | 14.0045 | 115 | 3.2351 | 3.3804 | 3.5318 |
| 74 | 12.7117 | 13.1037 | 13.5065 | 116 | 3.1393 | 3.2812 | 3.4292 |
| 75 | 12.2529 | 12.6354 | 13.0285 | 117 | 3.0466 | 3.1853 | 3.33 |
| 76 | 11.8139 | 12.1871 | 12.5708 | 118 | 2.9571 | 3.0926 | 3.2341 |
| 77 | 11.3926 | 11.7567 | 12.1312 | 119 | 2.8706 | 3.0031 | 3.1413 |
| 78 | 10.9883 | 11.3436 | 11.7091 | 120 | 2.787 | 2.9164 | 3.0516 |
| 79 | 10.6002 | 10.9468 | 11.3036 | 121 | 2.7057 | 2.8322 | 2.9643 |
| 80 | 10.2276 | 10.5657 | 10.9139 | 122 | 2.6271 | 2.7508 | 2.8799 |
| 81 | 9.8697 | 10.1996 | 10.5395 | 123 | 2.5511 | 2.672 | 2.7982 |
| 82 | 9.526 | 9.8479 | 10.1796 | 124 | 2.4777 | 2.5958 | 2.7192 |
| 83 | 9.1958 | 9.5098 | 9.8336 | 125 | 2.4066 | 2.522 | 2.6427 |
| 84 | 8.8785 | 9.1849 | 9.5009 | | | | |
| 85 | 8.5736 | 8.8726 | 9.181 | | | | |

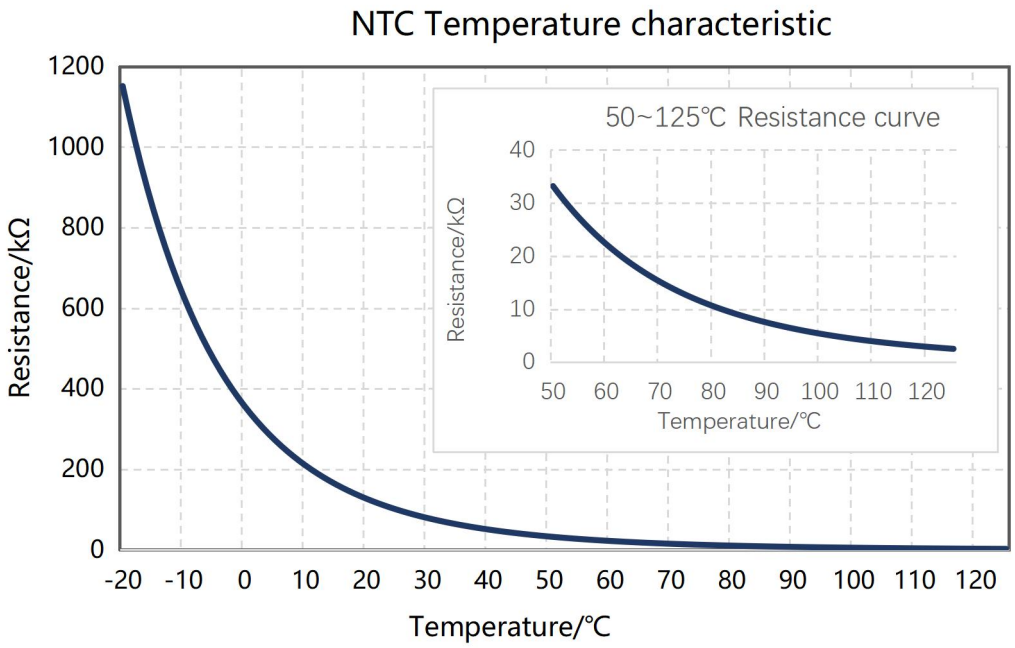



Figure 4 NTC Temperature - Resistance

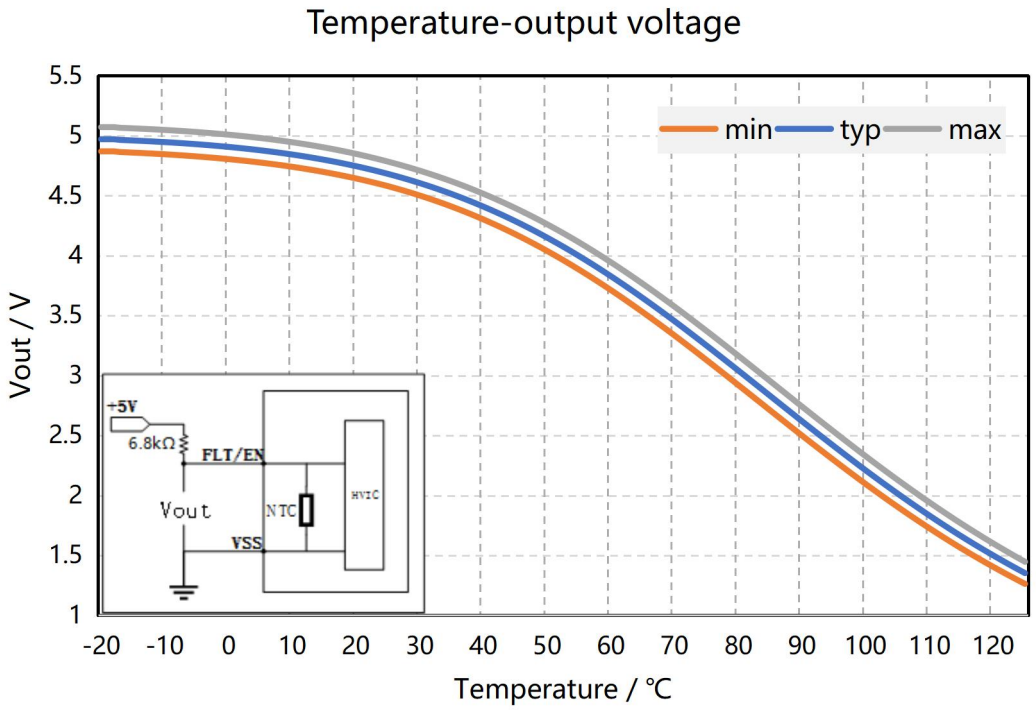



Figure 5 NTC Temperature - Voltage

## Mechanical Characteristics and Ratings

| Symbol | Parameter | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| T | Mounting torque | M3 screw | 0.4 | - | 0.5 | N·m |
| CTI | Comparative Tracking Index | - | 600 | - | - | V |
| BKCurve | Curvature of module backside | Only convex faces are allowed | 0 | - | 100 | μm |

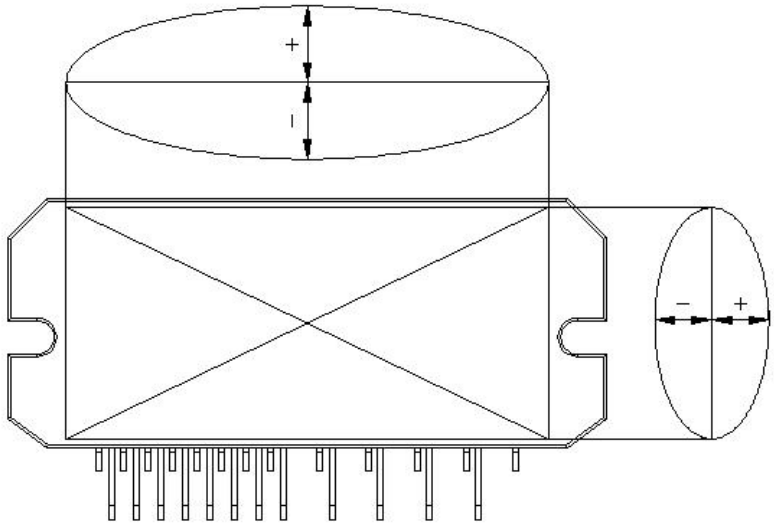
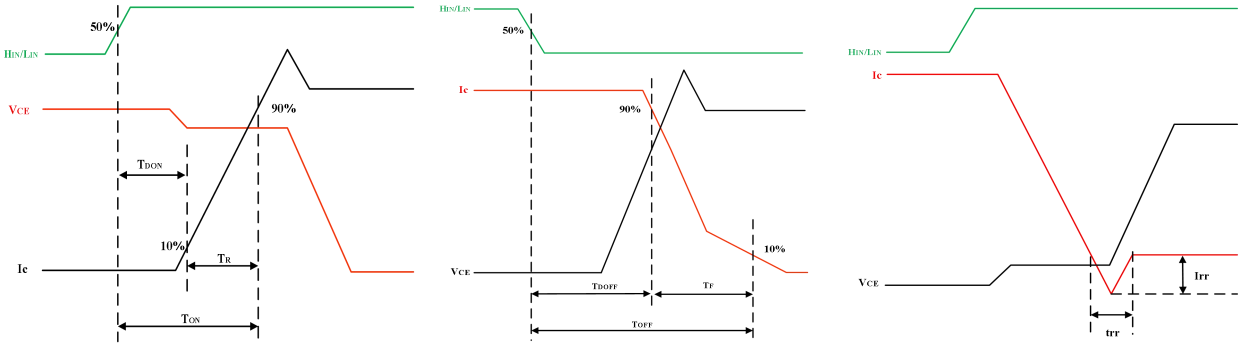



Figure 6 Backside curvature measurement position




a. Turn-on b. Turn-off c. FRD Reverse Recovery Time

Figure 7 Switching times definition

$f_P$=10kHz, RMS output current for inverter:

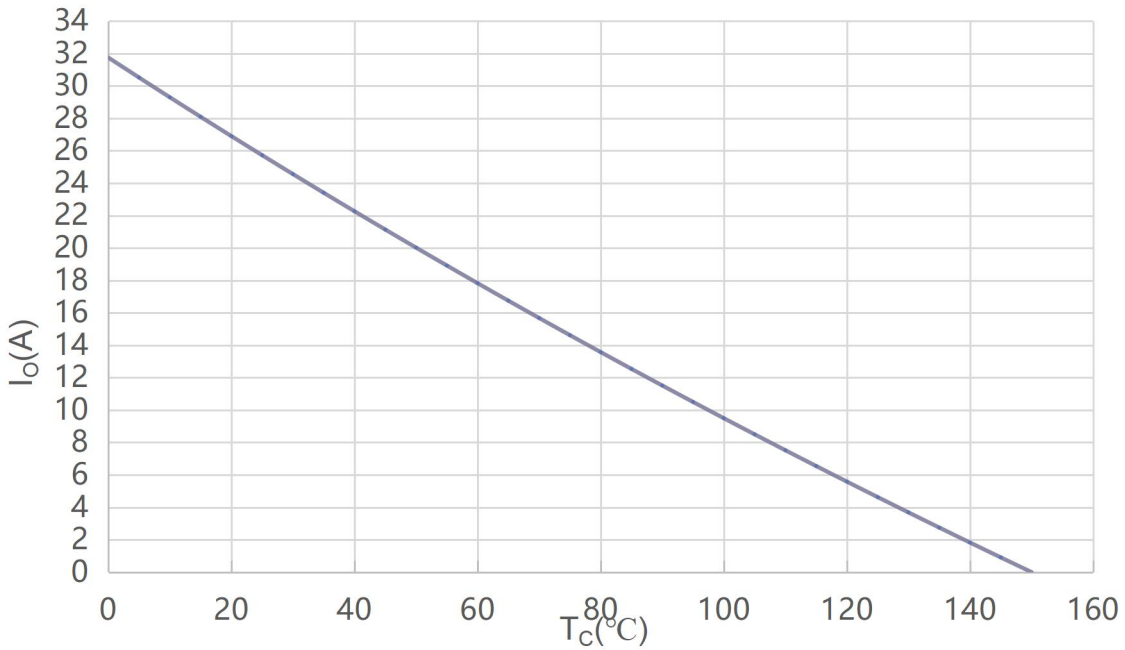



Figure 8 Maximum operating current SOA(Inverter Section)

$f_{P\_PFC}$=40kHz, $I_{O\_PFC}$ vs. $T_C$ for PFC-IGBT:

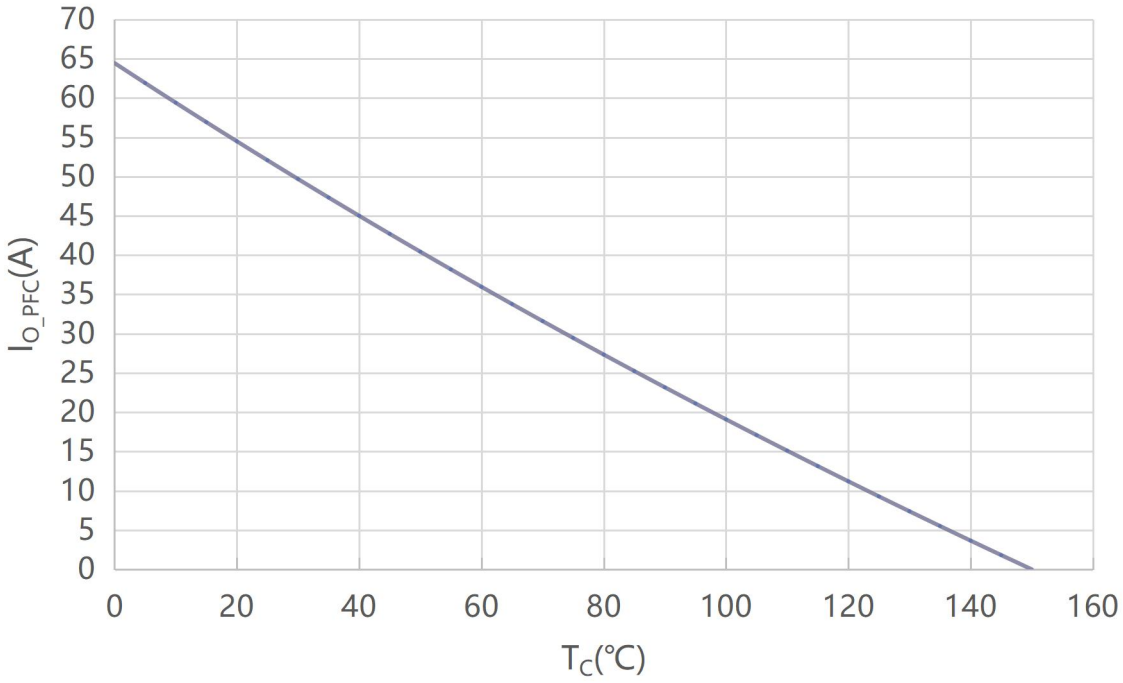



Figure 9 Maximum operating current SOA(PFC Section)

$f_{P\_PFC}$=60kHz, $I_{O\_PFC}$ vs. $T_C$ for PFC-IGBT:

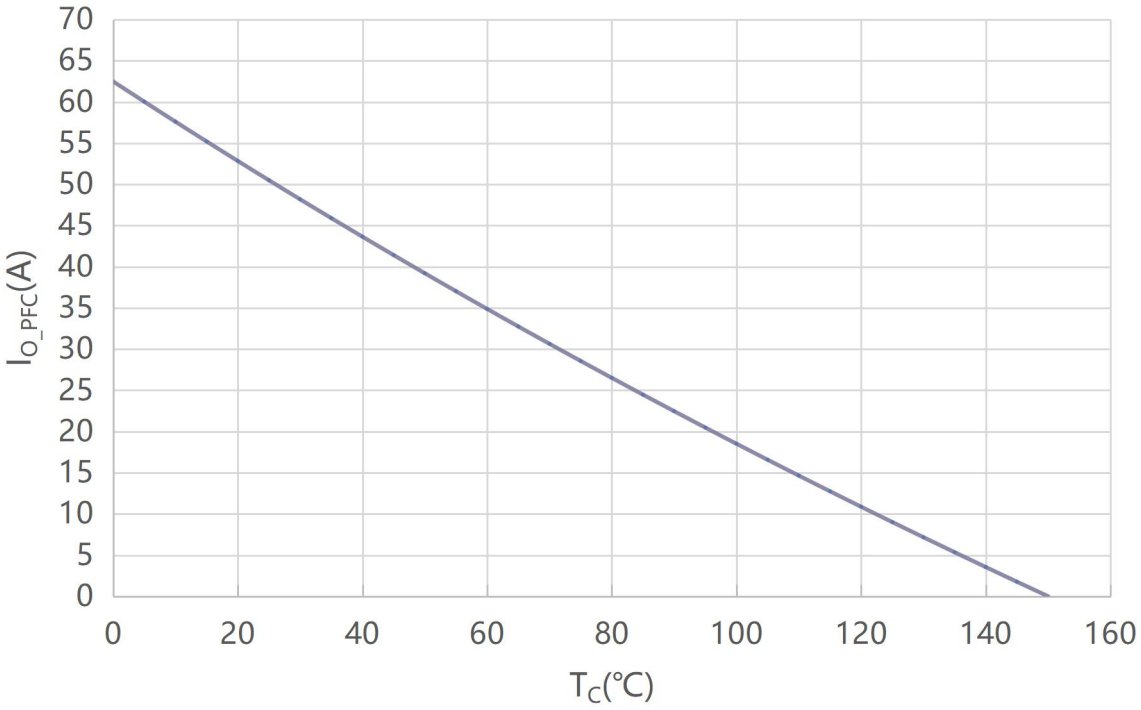



Figure 10 Maximum operating current SOA(PFC Section)

$f_{P\_PFC}$=80kHz, $I_{O\_PFC}$ vs. $T_C$ for PFC-IGBT:

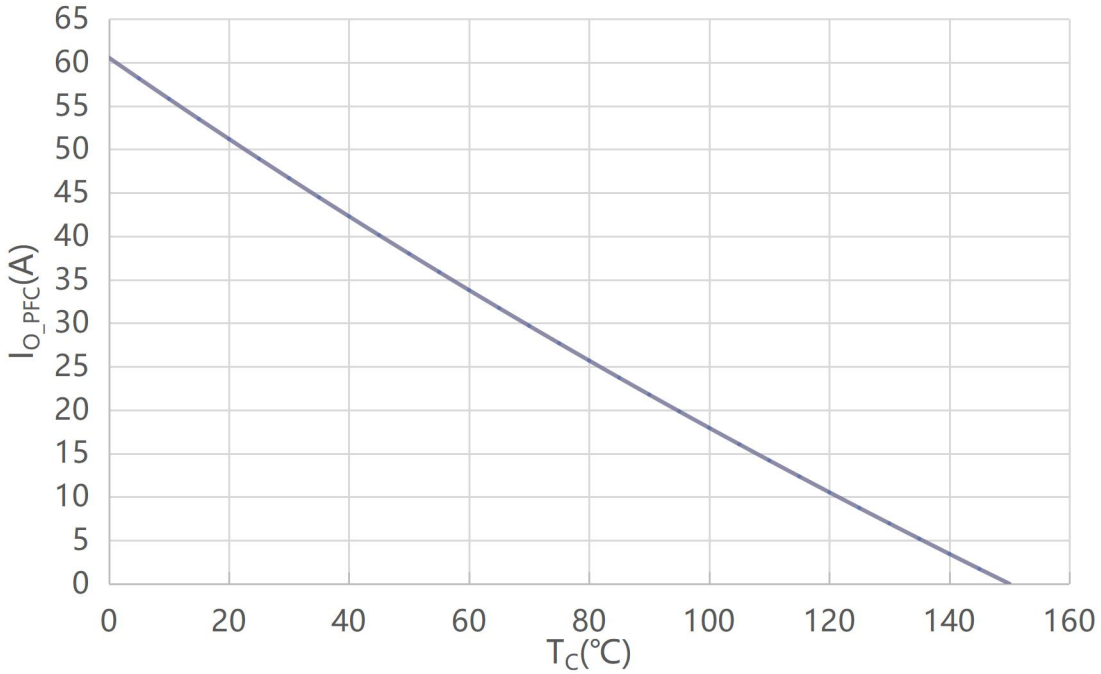



Figure 11　Maximum operating current SOA(PFC Section)

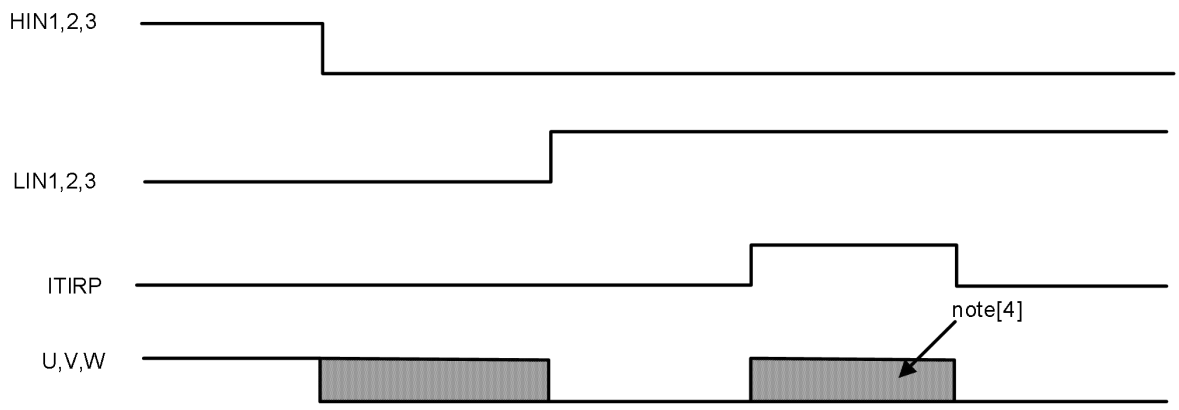



Figure 12　ITRIP timing chart

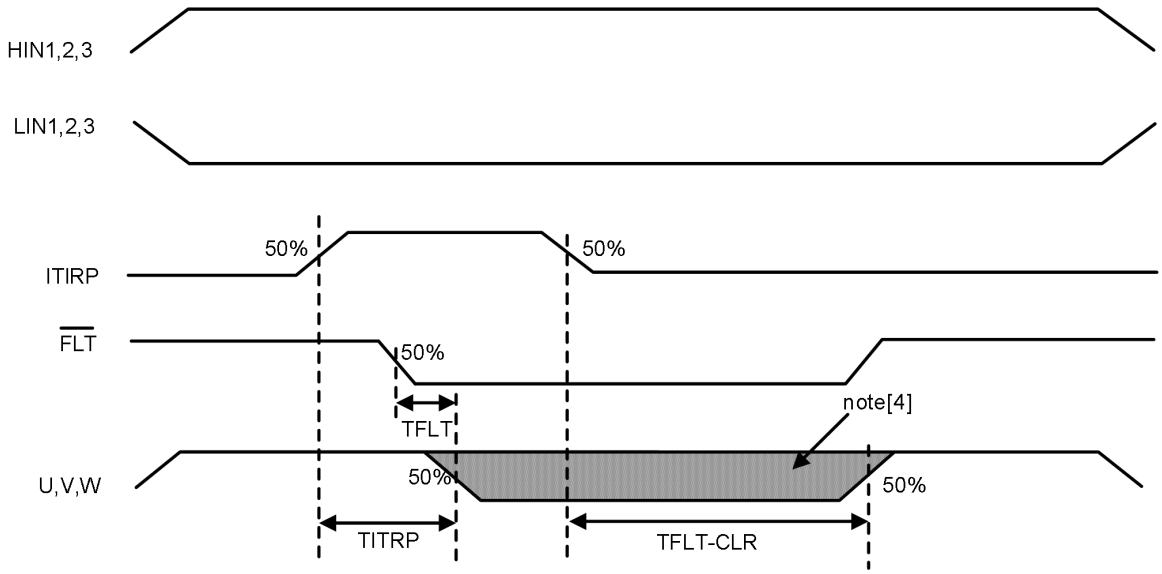



Figure 13　ITRIP、FLT time waveform

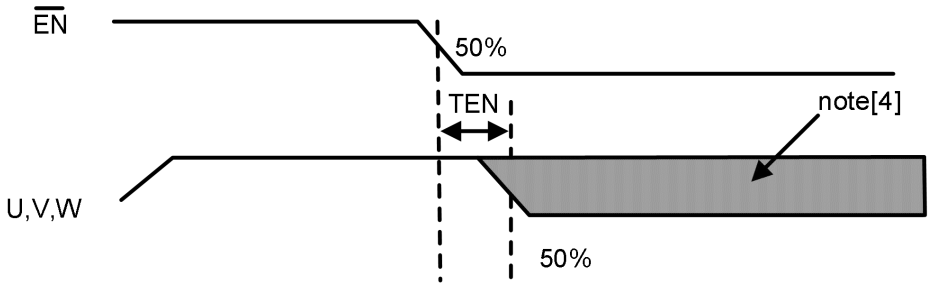



Figure 14　EN time waveform

Note4：The shaded area indicates that both the upper and lower bridges are off，At this time, the output voltage of half bridge is determined by the direction of load current.

## Circuit of a Typical Application

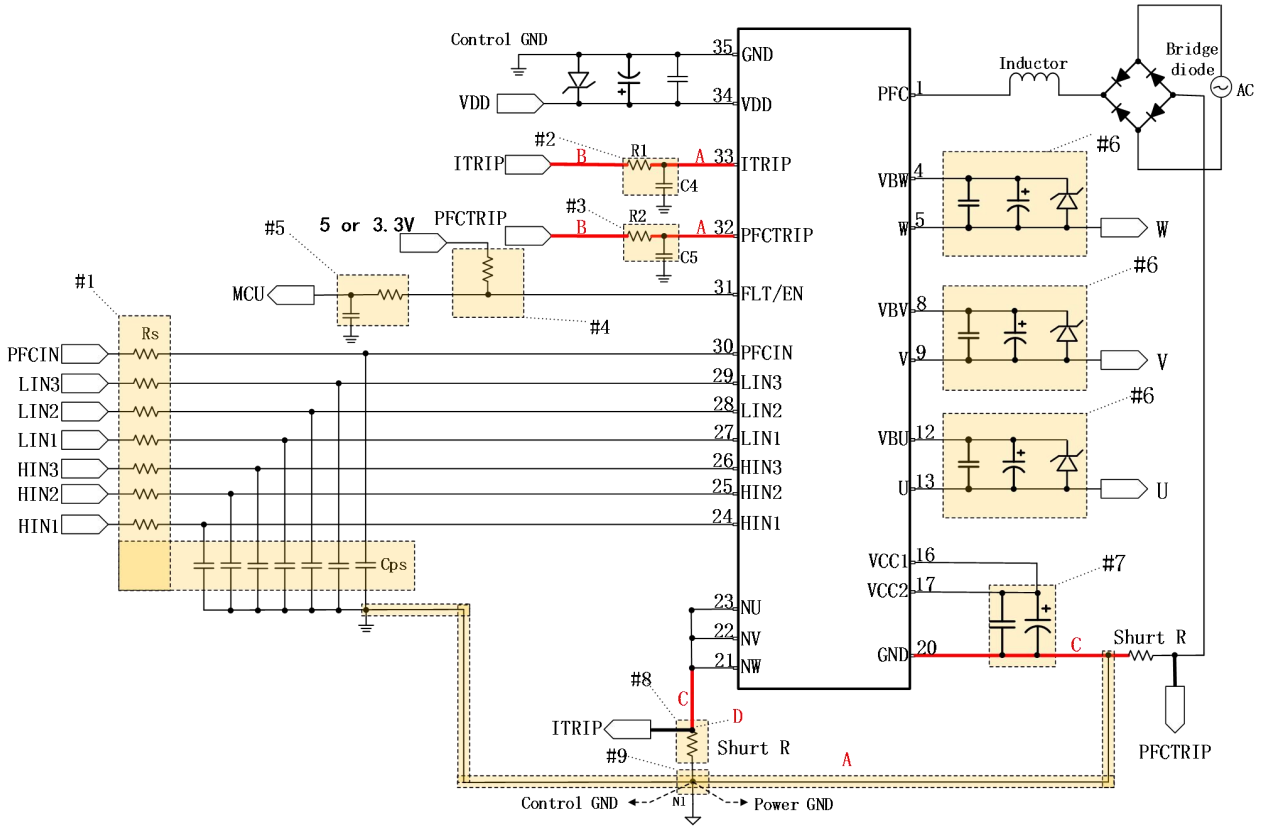



Figure 15 Application circuit

1. Input circuit

- Input signal is active-HIGH type. There is a 4.7kΩ resistor inside the HVIC to pull down each input signal line to GND.
- RC coupling circuits is recommanded for the prevention of input signal oscillation. $R_S \cdot C_{PS}$ time constant should be selected in the range 50~150ns ( recommended $R_S$=100Ω, $C_{PS}$=1nF).
- The capacitors should be located close to MIPS terminals (to COM terminal especially).

2. ITRIP circuit

- $R_1$, C4 of RC filter for preventing protection circuit malfunction is recommended to select tight tolerance, temp-compensated type.
- The capacitor must be located close to ITRIP and COM terminals.
- The time constant $R_1 \cdot C_4$ should be set so that SC current is shut down within 2μs (1.5μs~2μs is general value). SC interrupting time might vary with the wiring pattern, so the enough evaluation on the real system is necessary.
- To prevent malfunction, the wiring of A, B, C should be as short as possible.
- The point D at which the wiring to ITRIP filter is divided should be near the terminal of shunt resistor. NU, NV, NW terminals should be connected at near NU, NV, NW terminals.

3. PFCTRIP circuit

- $R_2$, $C_5$ of RC filter for preventing protection circuit malfunction is recommended to select tight tolerance, temp-compensated type.
- The capacitor must be located close to PFCTRIP and COM terminals.

- The time constant $R_2$·$C_5$ should be set so that SC current is shut down within 2μs (1.5μs~3μs is general value). SC interrupting time might vary with the wiring pattern, so the enough evaluation on the real system is necessary.
- In order to avoid malfunction, PFCTRIP can even be pulled up to MCU power supply from 3.3V to 5V by a 10K ω resistor, or grounded by a 0 ω resistor.

4. FAULT circuit

- FLT/EN output is open-drain type. This signal line should be pulled up to the positive side of the MCU or control power supply with a resistor that makes $I_{FO}$ below 2 mA.

5. FLT/EN/VTH circuit (IM756C-SST)

- FLT/EN output is open-drain type. This signal line should be pulled up to the positive side of the MCU or control power supply with a resistor that makes $I_{FO}$ below 2 mA.
- This terminal should be pulled up to the bias voltage of 5V/3.3V through a proper resistor to define suitable voltage for temperature monitoring.
- It is recommended that RC filter is placed close to the controller.

6. VB-VS circuit

- Capacitors for high side floating supply voltage should be placed close to VB and VS terminals.
- Additional high frequency capacitors, typically 0.1μF, are strongly recommended.
- The zener diode or transient voltage suppressor should be adopted for the protection of HVIC from the surge destruction between each pair of control supply terminals (recommended zener diode is 20V/1W, which has the lower zener impedance characteristic than about 15Ω).

7. Snubber capacitor

- To prevent surge destruction, the wiring between the smoothing capacitor and the P&GND pins should be as short as possible. The use of a high-frequency non-inductive capacitor of around 0.1~1μF between the P and GND pins is recommended.

8. Shunt resistor

- SMD type shunt resistors are strongly recommended to minimize its internal stray inductance.
- The point D at which the wiring to ITRIP filter is divided should be near the terminal of shunt resistor. NU, NV, NW terminals should be connected at near NU, NV, NW terminals.

9. Ground pattern

- If control GND is connected with power GND by common broad pattern, it may cause malfunction by power GND fluctuation.
- It is recommended to connect control GND and power GND at only a point N1 (near the terminal of shunt resistor).

10. Noise

- If high frequency noise superimposed to the control supply line, HVIC malfunction might happen and cause MIPS erroneous operation.

  To avoid such problem, line ripple voltage should meet dV/dt ≤+/-1V/μs, $V_{ripple}$≤2Vp-p.

## Package Outline

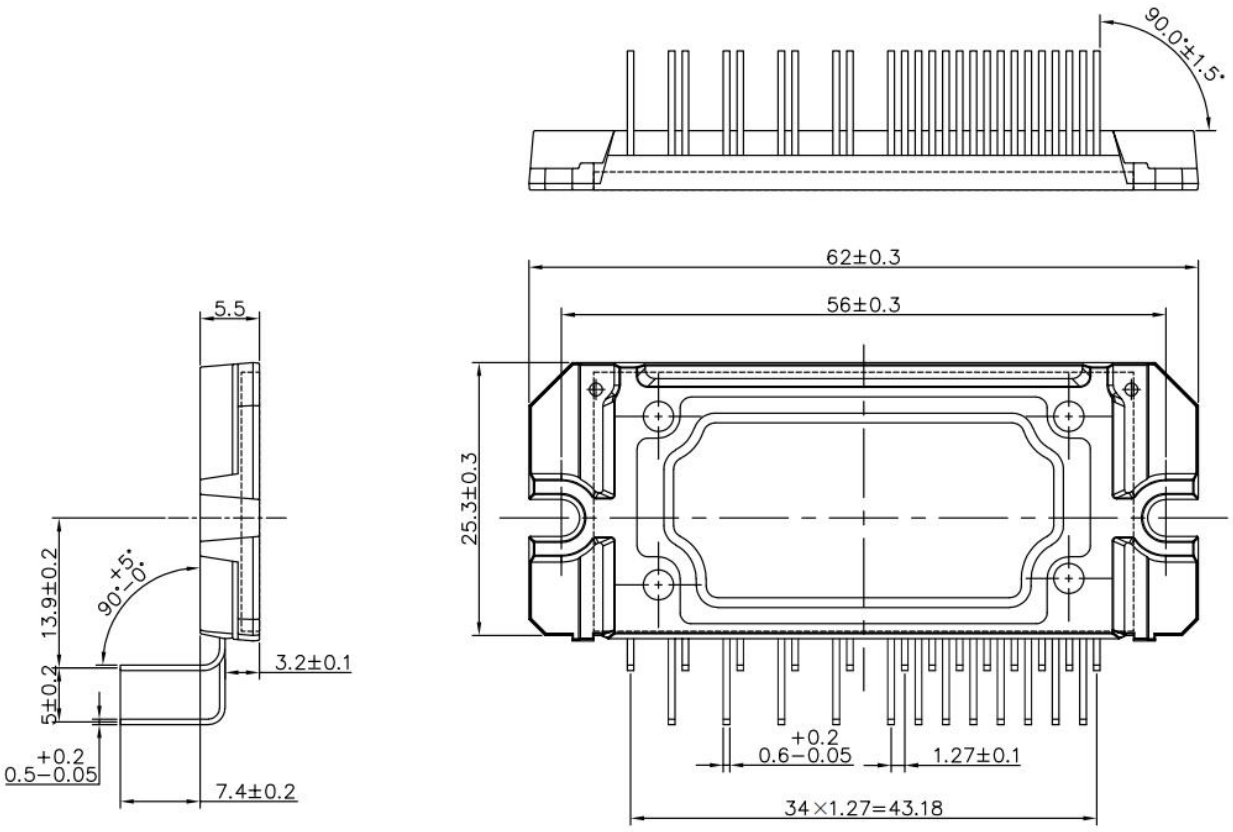



Figure 16 Package size drawing

Note5：Dimension in mm

## Revision history

| Document version | Chapter | Date of release | Reviser | Reviewer | Description of changes |
|---|---|---|---|---|---|
| V1.0 EN | all | 2024.12.15 | Tuming Zhang | | New |
| V1.1 EN | PFC Section | 2025.4.18 | Tuming Zhang | | Modify the silicon carbide (SiC) parameters of D1 in the PFC section |
| V1.2 EN | PFC Section | 2025.5.21 | Tuming Zhang | | Modify the silicon carbide (SiC) parameters of D1 in the PFC section |
| V1.3 EN | PFC Section | 2025.6.12 | Jinlin Lu | | Modify PFC-SBD (D1) parameters to MPS process parameters based on version 1.2 |
| V1.3 EN | Internal Electrical Schematic | 2025.6.21 | Jinlin Lu | | Modify Visio file |
| V1.4 EN | (Page 1) Device Features、Product Information; (Page 4) Control Section; (Page 6) PFC Section; | 2025.7.25 | Jinlin Lu | | (Page 1) Device Features delete "$T_C$=25°C" ;Product Information delete "64PCS/INNER BOX" ; (Page 4) "Min=0.3V, Max=$V_{DD}$+0.3V" ; (Page 6) Add: $V_{FM1}$(IF=30A)_Typ=1.68V,$V_{FM1}$(IF=30A)_Max=2.80V; Modify: $V_{FM2}$" Typ=1.3V,Max=1.6V";$I_{FSM}$ "Condition: tp=2ms, half sine pulse" (Page 4) 2.Min: "-0.5" , Max:" VDD+0.5" . (Page 6) $V_{FM2}$" Typ=0.8V, Max=1.1V";;$I_{FSM}$ "Condition: tp=10ms, half sine pulse" . |
| V1.5 EN | Page 5 Terms and Conditions Page 9 Structure and Material Properties | 2025.11.13 | Yue Wang | Jiawen He | The screw torque shall be 0.4-0.5 N·m. The original allowable screw torque was 0.8 N·m. |
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