

SLLIMM™-nano, 2nd series IPM, 3 A, 600 V, 3-phase IGBT inverter bridge



N2DIP-26L type L
no stand-off



N2DIP-26L type Z
no stand-off



Features

- IPM 3 A, 600 V, 3-phase IGBT inverter bridge including 3 control ICs for gate driving and freewheeling diodes
- 3.3 V, 5 V, 15 V TTL/CMOS input comparators with hysteresis and pull-down/pull-up resistors
- Internal bootstrap diode
- Optimized for low electromagnetic interference
- Undervoltage lockout
- $V_{CE(SAT)}$ negative temperature coefficient
- Shutdown function
- Interlocking function
- Op-amp for advanced current sensing
- Comparator for fault protection against overcurrent
- NTC (UL 1434 CA 2 and 4)
- Isolation ratings of 1500 V_{rms}/min.
- Up to ±2 kV ESD protection (HBM C = 100 pF, R = 1.5 kΩ)
- UL recognition: UL 1557, file E81734

Applications

- 3-phase inverters for motor drives
- Dish washers, refrigerator compressors, heating systems, air-conditioning fans, draining and recirculation pumps

Description

This second series of SLLIMM (small low-loss intelligent molded module)-nano provides a compact, high-performance AC motor drive in a simple, rugged design. It is composed of six improved IGBTs with freewheeling diodes and three half-bridge HVICs for gate driving, providing low electromagnetic interference (EMI) characteristics with optimized switching speed. The package is designed to allow a better and more easily screwed-on heatsink, and is optimized for thermal performance and compactness in built-in motor applications or other low power applications where assembly space is limited. This IPM includes a completely uncommitted operational amplifier and a comparator that can be used to design a fast and efficient protection circuit. SLLIMM™ is a trademark of STMicroelectronics.

Product status links

[STGIPQ3H60T-HLS](#)

[STGIPQ3H60T-HZS](#)

Product summary

Order code: STGIPQ3H60T-HLS

Marking GIPQ3H60T-HLS

Package N2DIP-26L type L
no stand-off

Packing Tube

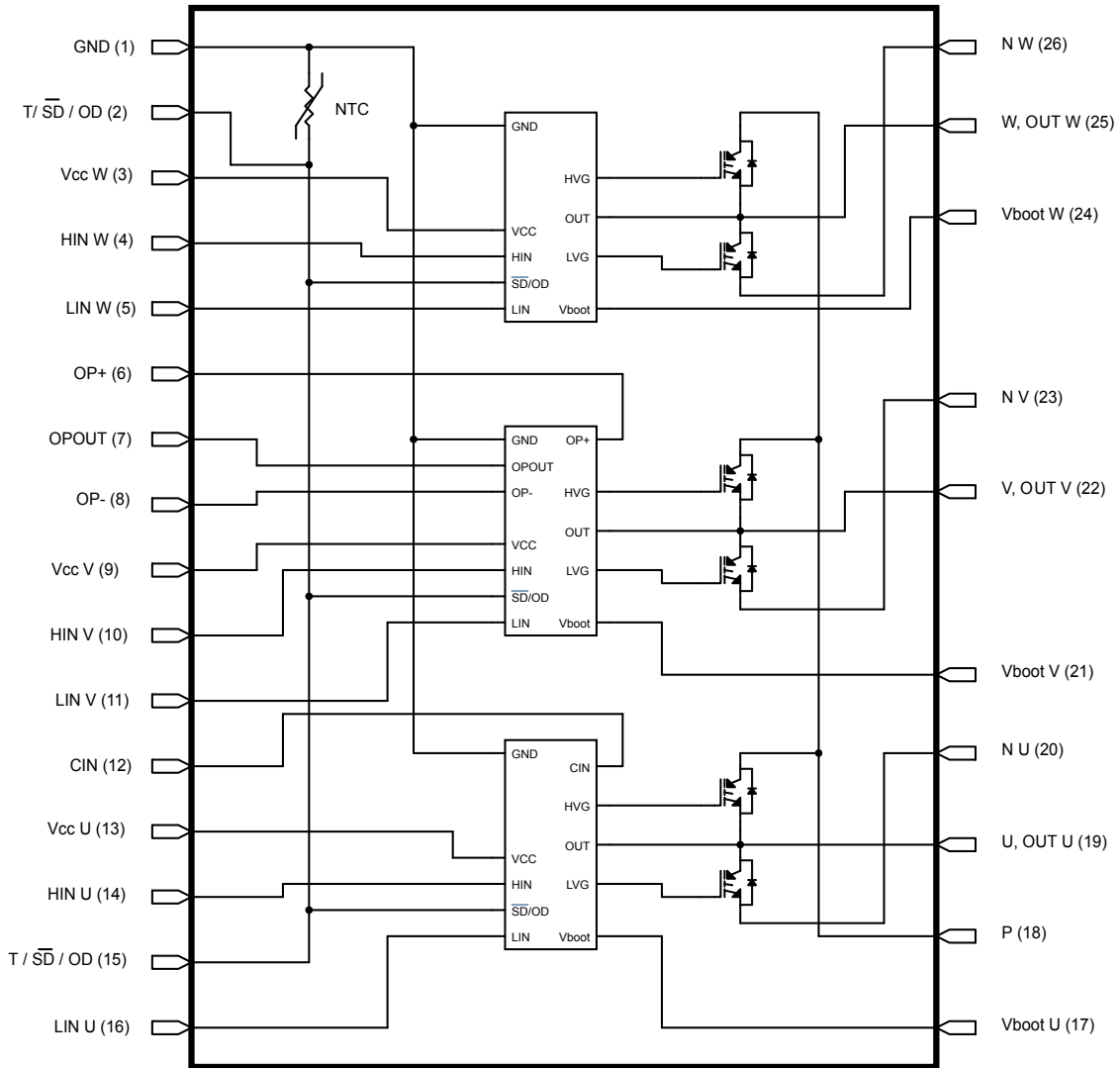
Order code: STGIPQ3H60T-HZS

Marking GIPQ3H60T-HZS

Package N2DIP-26L type Z
no stand-off

Packing Tube

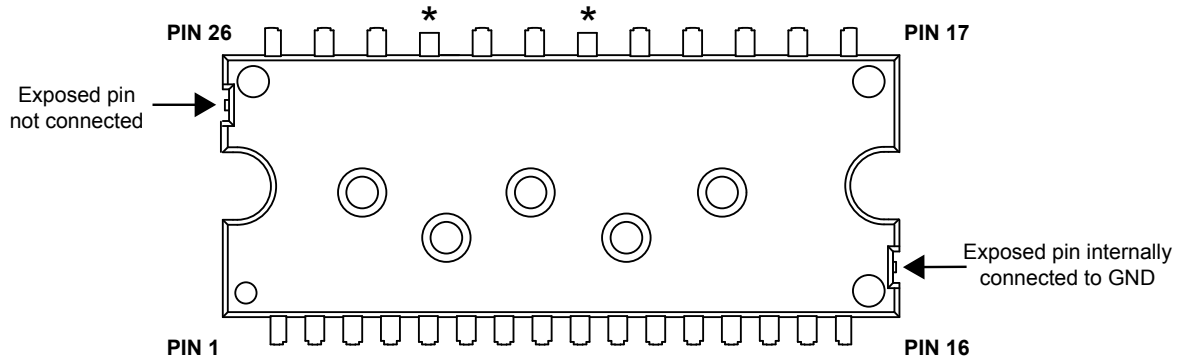
1 Internal schematic diagram and pin configuration

Figure 1. Internal schematic diagram


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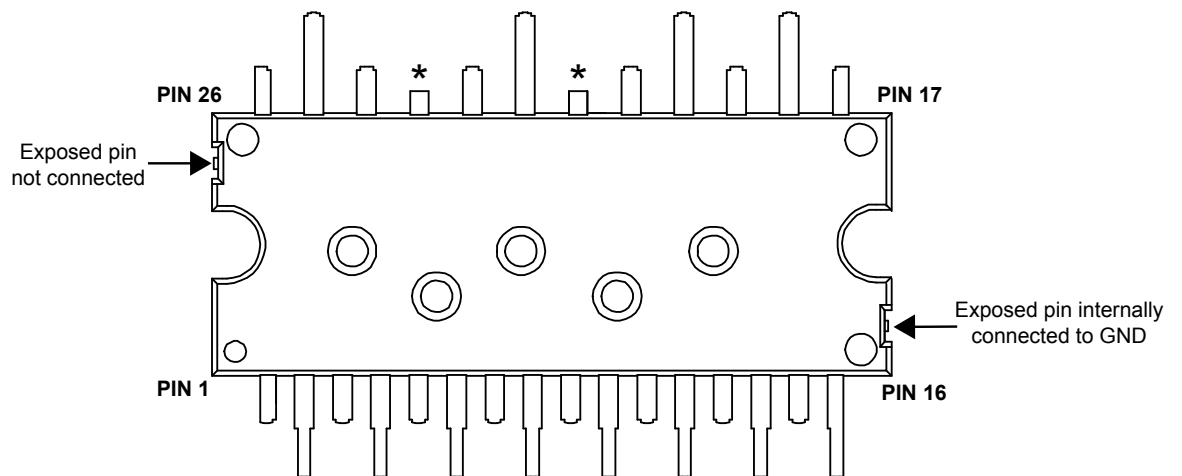
Table 1. Pin description

| Pin | Symbol | Description |
|-----|------------------------------|--|
| 1 | GND | Ground |
| 2 | T $\overline{\text{SD}}$ /OD | NTC thermistor terminal/shutdown logic input (active low)/open-drain (comparator output) |
| 3 | V _{CC} W | Low-voltage power supply W phase |
| 4 | HIN W | High-side logic input for W phase |
| 5 | LIN W | Low-side logic input for W phase |
| 6 | OP+ | Op-amp non-inverting input |
| 7 | OP _{OUT} | Op-amp output |
| 8 | OP- | Op-amp inverting input |
| 9 | V _{CC} V | Low-voltage power supply V phase |
| 10 | HIN V | High-side logic input for V phase |
| 11 | LIN V | Low-side logic input for V phase |
| 12 | CIN | Comparator input |
| 13 | V _{CC} U | Low-voltage power supply for V phase |
| 14 | HIN U | High-side logic input for V phase |
| 15 | T $\overline{\text{SD}}$ /OD | NTC thermistor terminal/shutdown logic input (active low)/open-drain (comparator output) |
| 16 | LIN U | Low-side logic input for U phase |
| 17 | V _{boot} U | Bootstrap voltage for U phase |
| 18 | P | Positive DC input |
| 19 | U, OUT _U | U phase output |
| 20 | N _U | Negative DC input for U phase |
| 21 | V _{boot} V | Bootstrap voltage for V phase |
| 22 | V, OUT _V | V phase output |
| 23 | N _V | Negative DC input for V phase |
| 24 | V _{boot} W | Bootstrap voltage for W phase |
| 25 | W, OUT _W | W phase output |
| 26 | N _W | Negative DC input for W phase |

Figure 2. Pin layout (top view) - N2DIP-26L type L


* Dummy pins internally connected to P (positive DC input)

GADG181220181209IG

Figure 3. Pin layout (top view) - N2DIP-26L type Z


* Dummy pins internally connected to P (positive DC input)

GADG181220181216IG

2 Electrical ratings

$T_J = 25\text{ °C}$ unless otherwise specified

2.1 Absolute maximum ratings

Table 2. Inverter part

| Symbol | Parameter | Value | Unit |
|----------------|---|-------|------|
| V_{CES} | Collector-emitter voltage for each IGBT ($V_{IN}^{(1)} = 0$) | 600 | V |
| I_C | Continuous collector current for each IGBT ($T_C = 25\text{ °C}$) | 3 | A |
| $I_{CP}^{(2)}$ | Peak collector current for each IGBT (less than 1 ms) | 6 | A |
| P_{TOT} | Total power dissipation for each IGBT ($T_C = 25\text{ °C}$) | 12 | W |

1. Applied among HIN_x , LIN_x and GND for $x = U, V, W$
2. Pulse width limited by maximum junction temperature.

Table 3. Control part

| Symbol | Parameter | Min. | Max. | Unit |
|---------------|--|-----------------|------------------|------|
| V_{CC} | Low voltage power supply | -0.3 | 21 | V |
| V_{boot} | Bootstrap voltage | -0.3 | 620 | V |
| V_{OUT} | Output voltage applied among OUT_U , OUT_V , OUT_W - GND | $V_{boot} - 21$ | $V_{boot} + 0.3$ | V |
| V_{CIN} | Comparator input voltage | -0.3 | $V_{CC} + 0.3$ | V |
| V_{op+} | Op-amp non-inverting input | -0.3 | $V_{CC} + 0.3$ | V |
| V_{op-} | Op-amp inverting input | -0.3 | $V_{CC} + 0.3$ | V |
| V_{IN} | Logic input voltage applied among HIN_x , LIN_x and GND | -0.3 | 15 | V |
| $V_{T/SD/OD}$ | Open-drain voltage | -0.3 | 15 | V |
| dV_{out}/dt | Allowed output slew rate | | 50 | V/ns |

Table 4. Total system

| Symbol | Parameter | Value | Unit |
|-----------|---|------------|------|
| V_{ISO} | Isolation withstand voltage applied to each pin and heatsink plate (AC voltage, $t = 60\text{ s}$) | 1500 | Vrms |
| T_J | Power chip operating junction temperature | -40 to 150 | °C |
| T_C | Module case operation temperature | -40 to 125 | °C |

2.2 Thermal data

Table 5. Thermal data

| Symbol | Parameter | Value | Unit |
|---------------|---|-------|------|
| $R_{th(j-c)}$ | Thermal resistance junction-case single IGBT | 10 | °C/W |
| | Thermal resistance junction-case single diode | 15 | |
| $R_{th(j-a)}$ | Thermal resistance junction-ambient | 44 | |

3 Electrical characteristics

$T_J = 25\text{ °C}$ unless otherwise noted.

3.1 Inverter part

Table 6. Static

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|---|--|------|------|------|---------------|
| I_{CES} | Collector cut-off current ($V_{IN}^{(1)} = 0$ "logic state") | $V_{CE} = 550\text{ V}$, $V_{CC} = V_{Boot} = 15\text{ V}$ | - | | 250 | μA |
| $V_{CE(sat)}$ | Collector-emitter saturation voltage | $V_{CC} = V_{boot} = 15\text{ V}$, $V_{IN}^{(1)} = 0$ to 5 V , $I_C = 1\text{ A}$ | - | 2.15 | 2.6 | V |
| V_F | Diode forward voltage | $V_{IN}^{(1)} = 0$ "logic state", $I_C = 1\text{ A}$ | - | 1.35 | 1.8 | V |

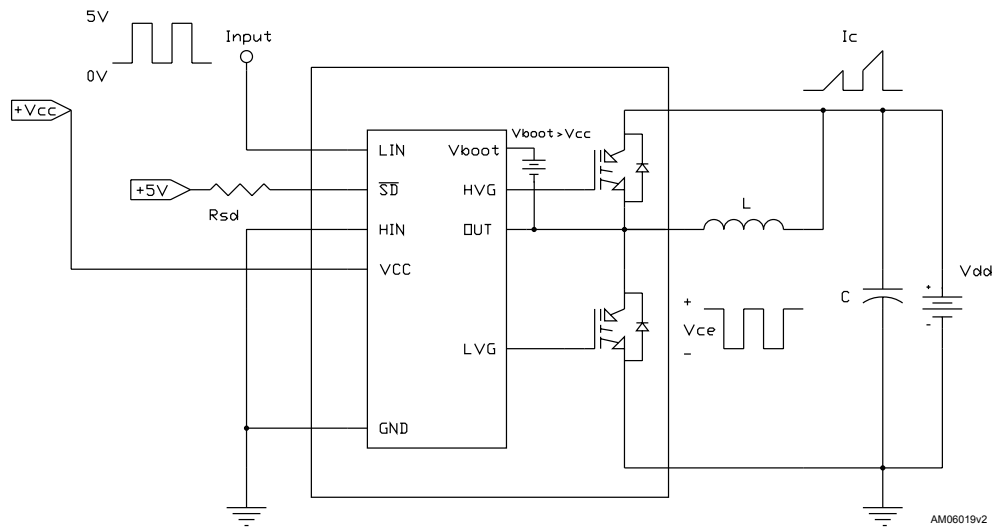
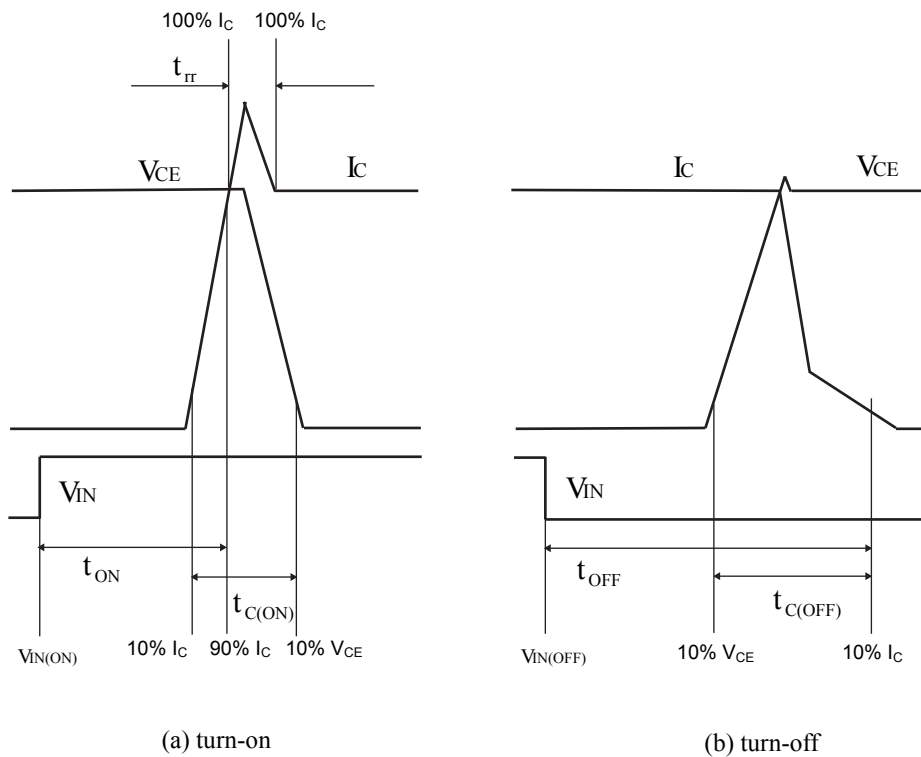
1. Applied among HIN_x , LIN_x and G_{ND} for $x = U, V, W$.

Table 7. Inductive load switching time and energy

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------------|---------------------------|---|------|------|------|---------------|
| $t_{on}^{(1)}$ | Turn-on time | $V_{DD} = 300\text{ V}$, $V_{CC} = V_{boot} = 15\text{ V}$, $V_{IN}^{(2)} = 0$ to 5 V , $I_C = 1\text{ A}$ (see Figure 5. Switching time definition) | - | 275 | - | ns |
| $t_{c(on)}^{(1)}$ | Crossover time (on) | | - | 90 | - | |
| $t_{off}^{(1)}$ | Turn-off time | | - | 890 | - | |
| $t_{c(off)}^{(1)}$ | Crossover time (off) | | - | 125 | - | |
| t_{rr} | Reverse recovery time | | - | 50 | - | μJ |
| E_{on} | Turn-on switching energy | | - | 18 | - | |
| E_{off} | Turn-off switching energy | | - | 13 | - | |

1. t_{ON} and t_{OFF} include the propagation delay time of the internal drive. $t_{C(ON)}$ and $t_{C(OFF)}$ are the switching times of the IGBT itself under the internally given gate driving conditions.

2. Applied among HIN_x , LIN_x and G_{ND} for $x = U, V, W$.

Figure 4. Switching time test circuit

Figure 5. Switching time definition


AM09223V1

Figure 5. Switching time definition refers to HIN, LIN inputs (active high).

3.2 Control part

Table 8. Low-voltage power supply

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---|--|------|------|------|---------------|
| V_{CC_hys} | V_{CC} UV hysteresis | | 1.2 | 1.5 | 1.8 | V |
| V_{CC_thON} | V_{CC} UV turn-ON threshold | | 11.5 | 12 | 12.5 | V |
| V_{CC_thOFF} | V_{CC} UV turn-OFF threshold | | 10 | 10.5 | 11 | V |
| I_{qccu} | Undervoltage quiescent supply current | $V_{CC} = 10\text{ V}$, $T/\overline{SD}/OD = 5\text{ V}$, $LIN = HIN = CIN = 0\text{ V}$ | | | 150 | μA |
| I_{qcc} | Quiescent current | $V_{CC} = 10\text{ V}$, $T/\overline{SD}/OD = 5\text{ V}$, $LIN = HIN = CIN = 0\text{ V}$ | | | 1 | mA |
| V_{ref} | Internal comparator (CIN) reference voltage | | 0.51 | 0.54 | 0.56 | V |

Table 9. Bootstrapped voltage

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---|--|------|------|------|---------------|
| V_{BS_hys} | V_{BS} UV hysteresis | | 1.2 | 1.5 | 1.8 | V |
| V_{BS_thON} | V_{BS} UV turn-ON threshold | | 11.1 | 11.5 | 12.1 | V |
| V_{BS_thOFF} | V_{BS} UV turn-OFF threshold | | 9.8 | 10 | 10.6 | V |
| I_{QBSU} | Undervoltage V_{BS} quiescent current | $V_{BS} < 9\text{ V}$, $T/\overline{SD}/OD = 5\text{ V}$, $LIN = 0\text{ V}$ and $HIN = 5\text{ V}$, $CIN = 0\text{ V}$ | | 70 | 110 | μA |
| I_{QBS} | V_{BS} quiescent current | $V_{BS} = 15\text{ V}$, $T/\overline{SD}/OD = 5\text{ V}$, $LIN = 0\text{ V}$ and $HIN = 5\text{ V}$, $CIN = 0$ | | 150 | 210 | μA |
| $R_{DS(on)}$ | Bootstrap driver on-resistance | LVG ON | | 120 | | Ω |

Table 10. Logic inputs

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------|--|--|------|------|------|---------------|
| V_{il} | Low logic level voltage | | | | 0.8 | V |
| V_{ih} | High logic level voltage | | 2.25 | | | V |
| I_{HINh} | HIN logic "1" input bias current | $HIN = 15\text{ V}$ | 20 | 40 | 100 | μA |
| I_{HINl} | HIN logic "0" input bias current | $HIN = 0\text{ V}$ | | | 1 | μA |
| I_{LINl} | LIN logic "0" input bias current | $LIN = 0\text{ V}$ | | | 1 | μA |
| I_{LINh} | LIN logic "1" input bias current | $LIN = 15\text{ V}$ | 20 | 40 | 100 | μA |
| I_{SDh} | \overline{SD} logic "0" input bias current | $\overline{SD} = 15\text{ V}$ | 210 | 350 | 477 | μA |
| I_{SDl} | \overline{SD} logic "1" input bias current | $\overline{SD} = 0\text{ V}$ | | | 3 | μA |
| Dt | Dead time | See Figure 10. Dead time and interlocking waveform definitions | | 180 | | ns |

Table 11. Op-amp characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------|-----------------------------------|---|------|------|------|------------|
| V_{io} | Input offset voltage | $V_{ic} = 0\text{ V}$, $V_o = 7.5\text{ V}$ | | | 6 | mV |
| I_{io} | Input offset current | $V_{ic} = 0\text{ V}$, $V_o = 7.5\text{ V}$ | | 4 | 40 | nA |
| I_{ib} | Input bias current ⁽¹⁾ | | | 100 | 200 | nA |
| V_{OL} | Low level output voltage | $R_L = 10\text{ k}\Omega$ to V_{CC} | | 75 | 150 | mV |
| V_{OH} | High level output voltage | $R_L = 10\text{ k}\Omega$ to GND | 14 | 14.7 | | V |
| I_o | Output short-circuit current | Source, $V_{id} = +1\text{ V}$; $V_o = 0\text{ V}$ | 16 | 30 | | mA |
| | | Sink, $V_{id} = -1\text{ V}$; $V_o = V_{CC}$ | 50 | 80 | | mA |
| SR | Slew rate | $V_i = 1 - 4\text{ V}$; $C_L = 100\text{ pF}$; unity gain | 2.5 | 3.8 | | V/ μ s |
| GBWP | Gain bandwidth product | $V_o = 7.5\text{ V}$ | 8 | 12 | | MHz |
| A_{vd} | Large signal voltage gain | $R_L = 2\text{ k}\Omega$ | 70 | 85 | | dB |
| SVR | Supply voltage rejection ratio | vs V_{CC} | 60 | 75 | | dB |
| CMRR | Common mode rejection ratio | | 55 | 70 | | dB |

1. The direction of input current is out of the IC.

Table 12. Sense comparator characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|---|--|------|------|------|------------|
| I_{ib} | Input bias current | $V_{CIN} = 1\text{ V}$ | - | | 1 | μ A |
| V_{od} | Open-drain low level output voltage | $I_{od} = 3\text{ mA}$ | - | | 0.5 | V |
| R_{ON_OD} | Open-drain low level output | $I_{od} = 3\text{ mA}$ | - | 166 | | Ω |
| R_{PD_SD} | \overline{SD} pull-down resistor ⁽¹⁾ | | - | 125 | | k Ω |
| t_{d_comp} | Comparator delay | T/ \overline{SD} /OD pulled to 5 V through 100 k Ω resistor | - | 90 | 130 | ns |
| SR | Slew rate | $C_L = 180\text{ pF}$, $R_{pu} = 5\text{ k}\Omega$ | - | 60 | | V/ μ s |
| t_{sd} | Shutdown to high-/low-side driver propagation delay | $V_{OUT} = 0$, $V_{boot} = V_{CC}$, $V_{IN} = 0$ to 3.3 V | - | 125 | | ns |
| t_{isd} | Comparator triggering to high-/low-side driver turn-off propagation delay | Measured applying a voltage step from 0 V to 3.3 V to pin CIN | - | 200 | | |

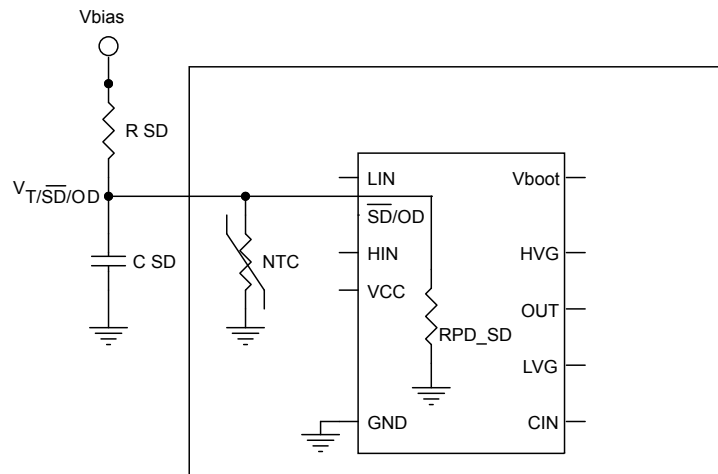
1. Equivalent values as a result of the resistances of three drivers in parallel.

Table 13. Truth table

| Conditions | Logic input (V_I) | | | Output | |
|--|-----------------------|------------------|------------------|--------|-----|
| | $\overline{T/SD/OD}$ | LIN | HIN | LVG | HVG |
| Shutdown enable half-bridge tri-state | L | X ⁽¹⁾ | X ⁽¹⁾ | L | L |
| Interlocking half-bridge tri-state | H | H | H | L | L |
| 0 "logic state" half-bridge tri-state | H | L | L | L | L |
| 1 "logic state" low-side direct driving | H | H | L | H | L |
| 1 "logic state" high-side direct driving | H | L | H | L | H |

1. X: don't care.

3.2.1 NTC thermistor

Figure 6. Internal structure of \overline{SD} and NTC


RPD_SD: equivalent value as result of resistances of three drivers in parallel.

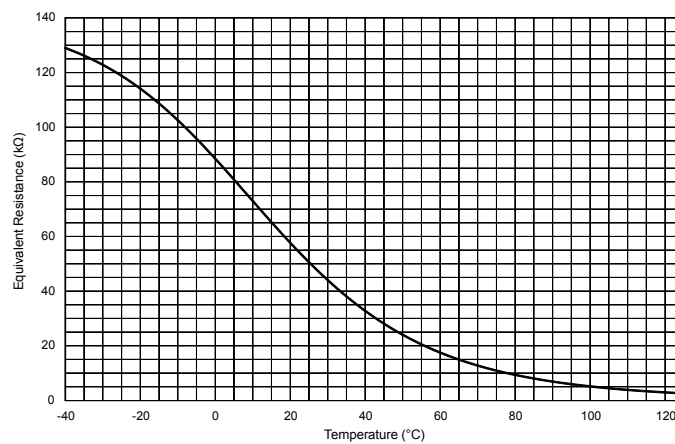
Figure 7. Equivalent resistance ($NTC//R_{PD_SD}$)


Figure 8. Equivalent resistance (NTC//R_{PD_SD}) zoom

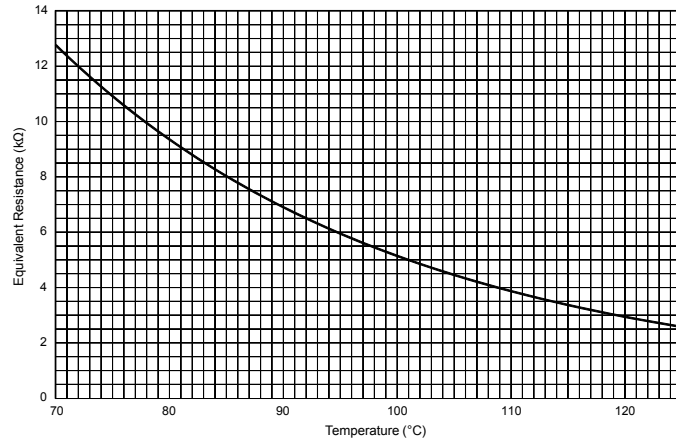
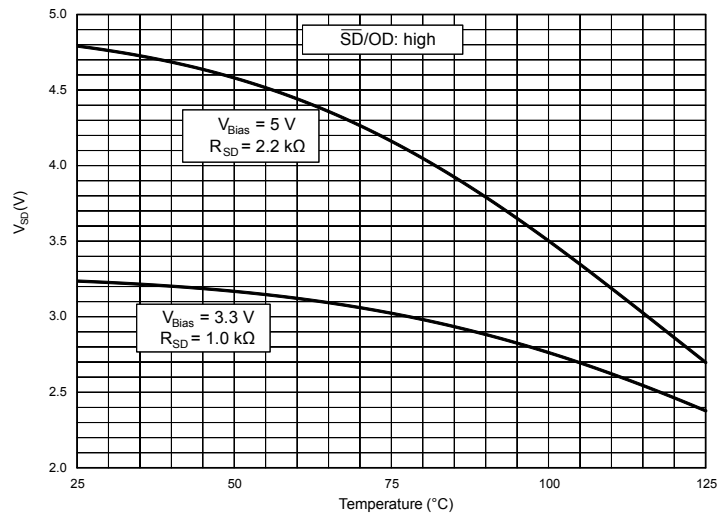
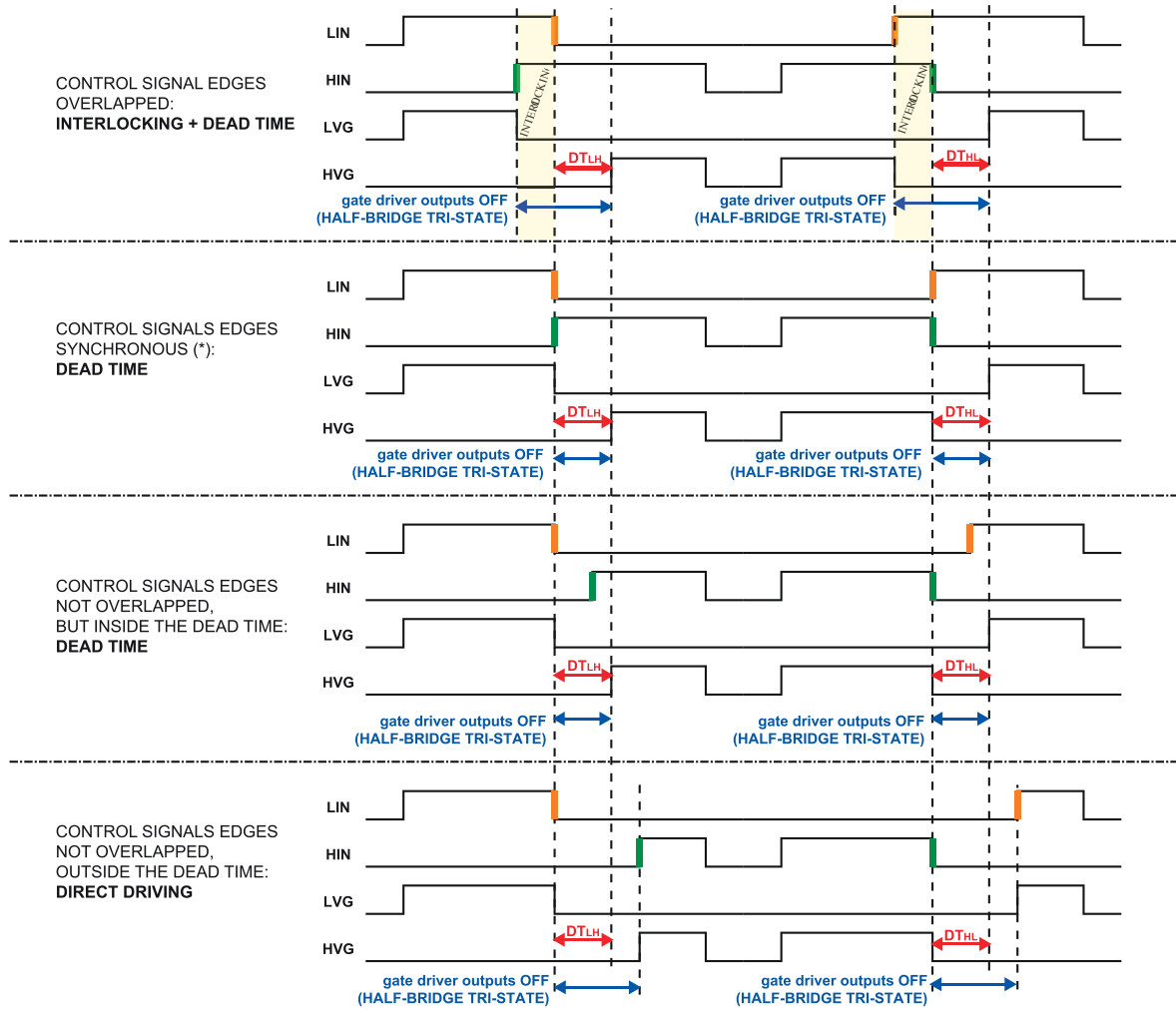


Figure 9. Voltage of T/SD/OD pin according to NTC temperature



3.3 Waveform definitions

Figure 10. Dead time and interlocking waveform definitions


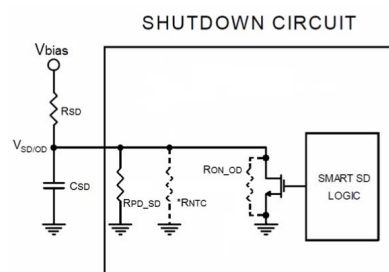
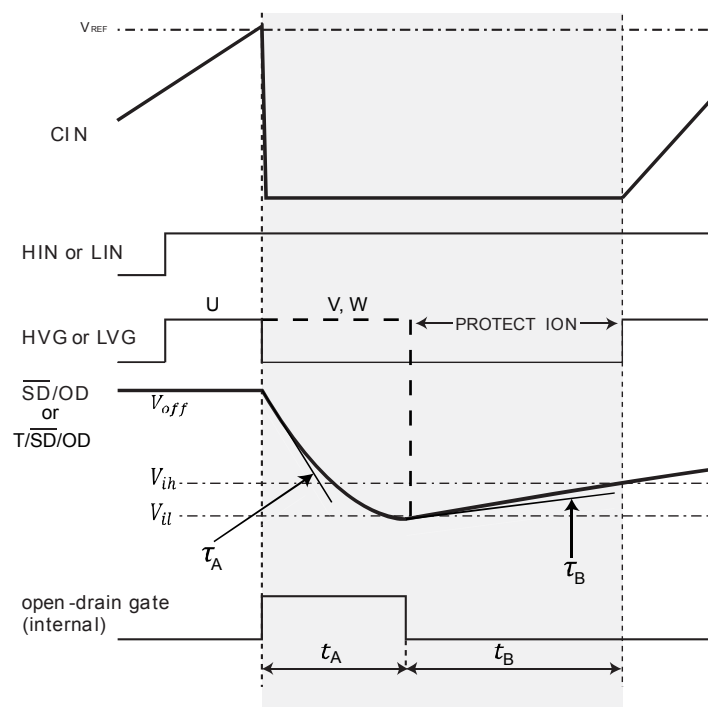
4 Shutdown function

The device is equipped with three half-bridge IC gate drivers and integrates a comparator for fault detection. The comparator has an internal voltage reference V_{REF} connected to the inverting input, while the non-inverting input pin (CIN) can be connected to an external shunt resistor for current monitoring.

Since the comparator is embedded in the U IC gate driver, in case of fault it disables directly the U outputs, whereas the shutdown of V and W IC gate drivers depends on the RC value of the external SD circuitry, which fixes the disabling time.

For an effective design of the shutdown circuit, please refer to Application note AN4966.

Figure 11. Shutdown timing waveforms



$$t_A \cong \tau_A \cdot \ln \left(\frac{V_{off} - V_{on}}{V_{il} - V_{on}} \right), \quad t_B \cong \tau_B \cdot \ln \left(\frac{V_{il} - V_{off}}{V_{ih} - V_{off}} \right)$$

$$\tau_A = (R_{ON_OD} // R_{SD} // R_{PD_SD} // R_{NTC}) \cdot C_{SD} \cong R_{ON_OD} \cdot C_{SD}$$

$$\tau_B = (R_{SD} // R_{PD_SD} // R_{NTC}) \cdot C_{SD}$$

$$V_{on} = \frac{R_{ON_OD} // R_{PD_OD} // R_{NTC}}{(R_{ON_OD} // R_{PD_OD} // R_{NTC}) + R_{SD}} \cdot V_{bias}$$

$$\cong \frac{R_{ON_OD}}{R_{ON_OD} + R_{SD}} \cdot V_{bias}$$

$$V_{off} = \frac{R_{PD_OD} // R_{NTC}}{(R_{PD_OD} // R_{NTC}) + R_{SD}} \cdot V_{bias}$$

R_{SD} and C_{SD} external circuitry must be designed to ensure $V_{on} < V_{il}$ & $V_{off} > V_{ih}$

Please refer to AN4966 for further details.

* R_{NTC} to be considered only when the NTC is internally connected to the T/SD/OD pin.

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5.1 Guidelines

- Input signals HIN, LIN are active high logic. A 375 k Ω (typ.) pull-down resistor is built-in for each input. To avoid input signal oscillation, the wiring of each input should be as short as possible, and the use of RC filters (R_1 , C_1) on each input signal is suggested. The filters should be with a time constant of about 100 ns and placed as close as possible to the IPM input pins.
- The use of a bypass capacitor C_{VCC} (aluminum or tantalum) can reduce the transient circuit demand on the power supply. Also, to reduce any high-frequency switching noise distributed on the power lines, a decoupling capacitor C_2 (100 to 220 nF, with low ESR and low ESL) should be placed as close as possible to the Vcc pin and in parallel with the bypass capacitor.
- The use of an RC filter (R_{SF} , C_{SF}) is recommended to prevent protection circuit malfunction. The time constant ($R_{SF} \times C_{SF}$) should be set to 1 μ s and the filter must be placed as close as possible to the C_{IN} pin.
- The \overline{SD} is an input/output pin (open-drain type if it is used as output). A built-in thermistor NTC is internally connected between the \overline{SD} pin and GND. The voltage V_{SD-GND} decreases as the temperature increases, due to the pull-up resistor R_{SD} . In order to keep the voltage always higher than the high-level logic threshold, the pull-up resistor should be set to 1 k Ω or 2.2 k Ω for 3.3 V or 5 V MCU power supply, respectively. The C_{SD} capacitor of the filter on \overline{SD} should be fixed no higher than 3.3 nF in order to assure the SD activation time $\tau_A \leq 500$ ns. Besides, the filter should be placed as close as possible to the SD pin.
- The decoupling capacitor C_3 (from 100 to 220 nF, ceramic with low ESR and low ESL), in parallel with each C_{boot} , filters high-frequency disturbance. Both C_{boot} and C_3 (if present) should be placed as close as possible to the U, V, W and V_{boot} pins. Bootstrap negative electrodes should be connected to U, V, W terminals directly and separated from the main output wires.
- To avoid overvoltage on the Vcc pin, a Zener diode (Dz1) can be used. Similarly on the V_{boot} pin, a Zener diode (Dz2) can be placed in parallel with each C_{boot} .
- The use of the decoupling capacitor C_4 (100 to 220 nF, with low ESR and low ESL) in parallel with the electrolytic capacitor C_{vdc} is useful to prevent surge destruction. Both capacitors C_4 and C_{vdc} should be placed as close as possible to the IPM (C_4 has priority over C_{vdc}).
- By integrating an application-specific type HVIC inside the module, direct coupling to the MCU terminals without an optocoupler is possible.
- Low-inductance shunt resistors have to be used for phase leg current sensing.
- In order to avoid malfunctions, the wiring on N pins, the shunt resistor and PWR_GND should be as short as possible.
- The connection of SGN_GND to PWR_GND on one point only (close to the shunt resistor terminal) can reduce the impact of power ground fluctuation.

These guidelines ensure the specifications of the device for application designs. For further details, please refer to the relevant application note.

Table 14. Recommended operating conditions

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------|------------------------------------|--|------|------|------|--------------|
| V_{PN} | Supply voltage | Applied among P-Nu, Nv, Nw | | 300 | 500 | V |
| V_{CC} | Control supply voltage | Applied to V_{CC-GND} | 13.5 | 15 | 18 | V |
| V_{BS} | High-side bias voltage | Applied to $V_{BOOTx-OUT}$ for x = U, V, W | 13 | | 18 | V |
| t_{dead} | Blanking time to prevent arm-short | For each input signal | 1.5 | | | μ s |
| f_{PWM} | PWM input signal | -40 $^{\circ}$ C < T_C < 100 $^{\circ}$ C -40 $^{\circ}$ C < T_J < 125 $^{\circ}$ C | | | 25 | kHz |
| T_C | Case operation temperature | | | | 100 | $^{\circ}$ C |

6 Electrical characteristics (curves)

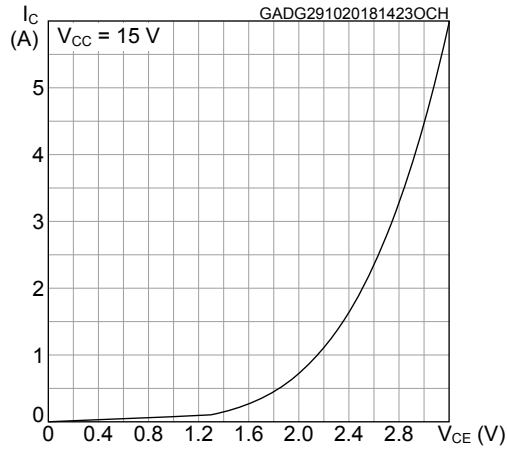
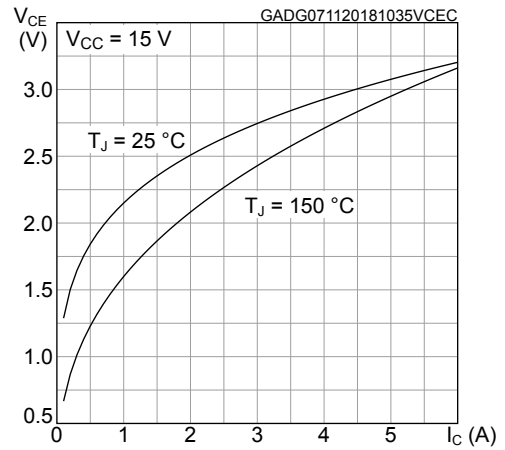
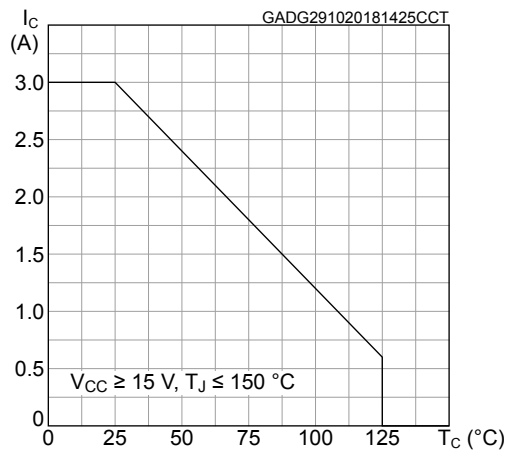
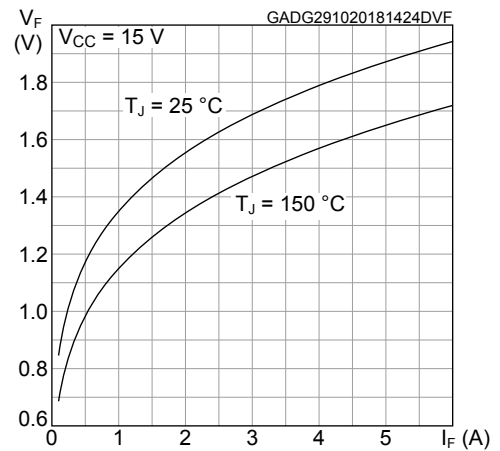
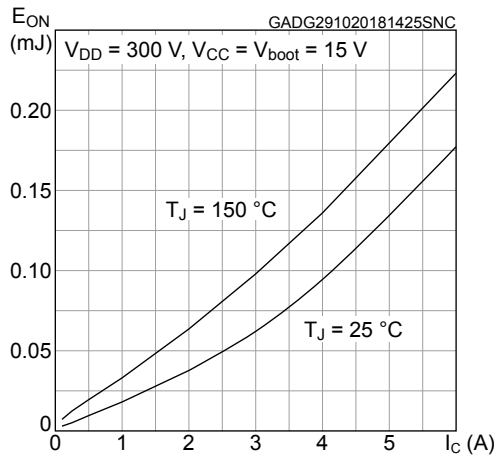
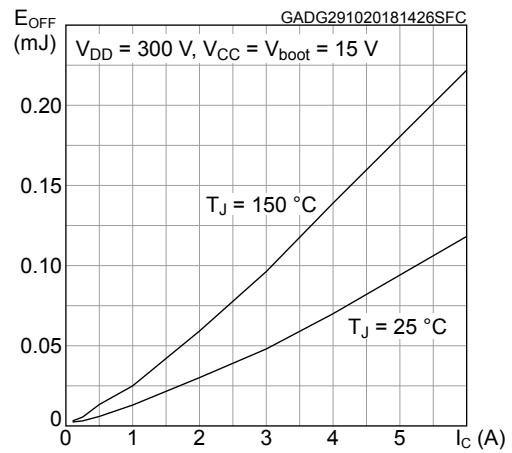
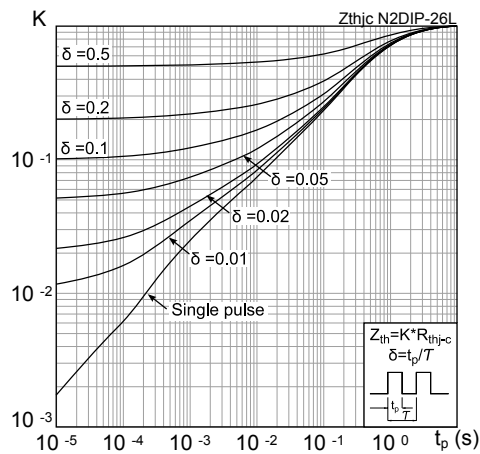
Figure 13. Output characteristics

Figure 14. $V_{ce(sat)}$ vs collector current

Figure 15. I_C vs case temperature

Figure 16. Diode V_F vs forward current


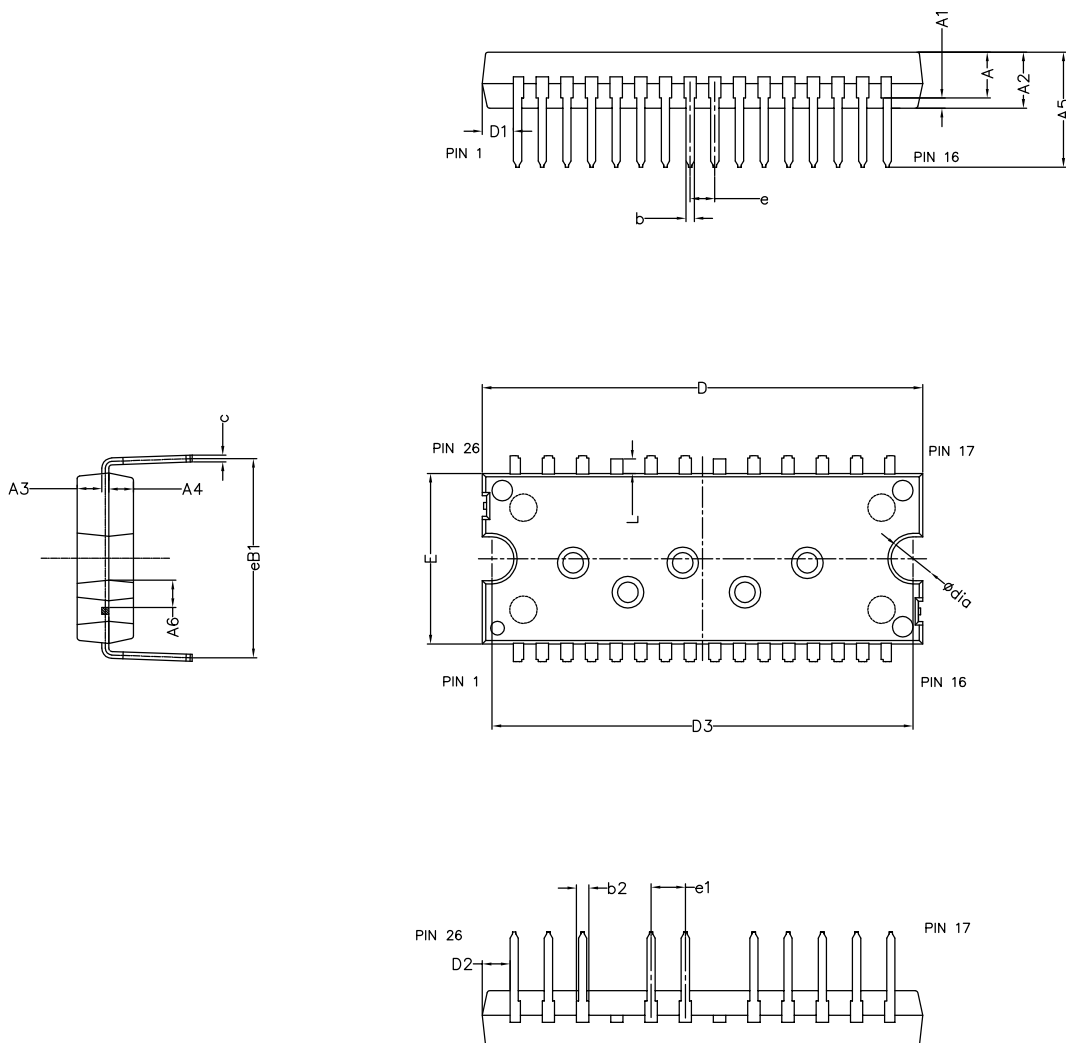
Figure 17. E_{on} switching energy vs collector current

Figure 18. E_{off} switching energy vs collector current

Figure 19. Thermal impedance for IGBT


7 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK®** packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

7.1 N2DIP-26L type L no stand-off package information

Figure 20. N2DIP-26L type L no stand-off package outline



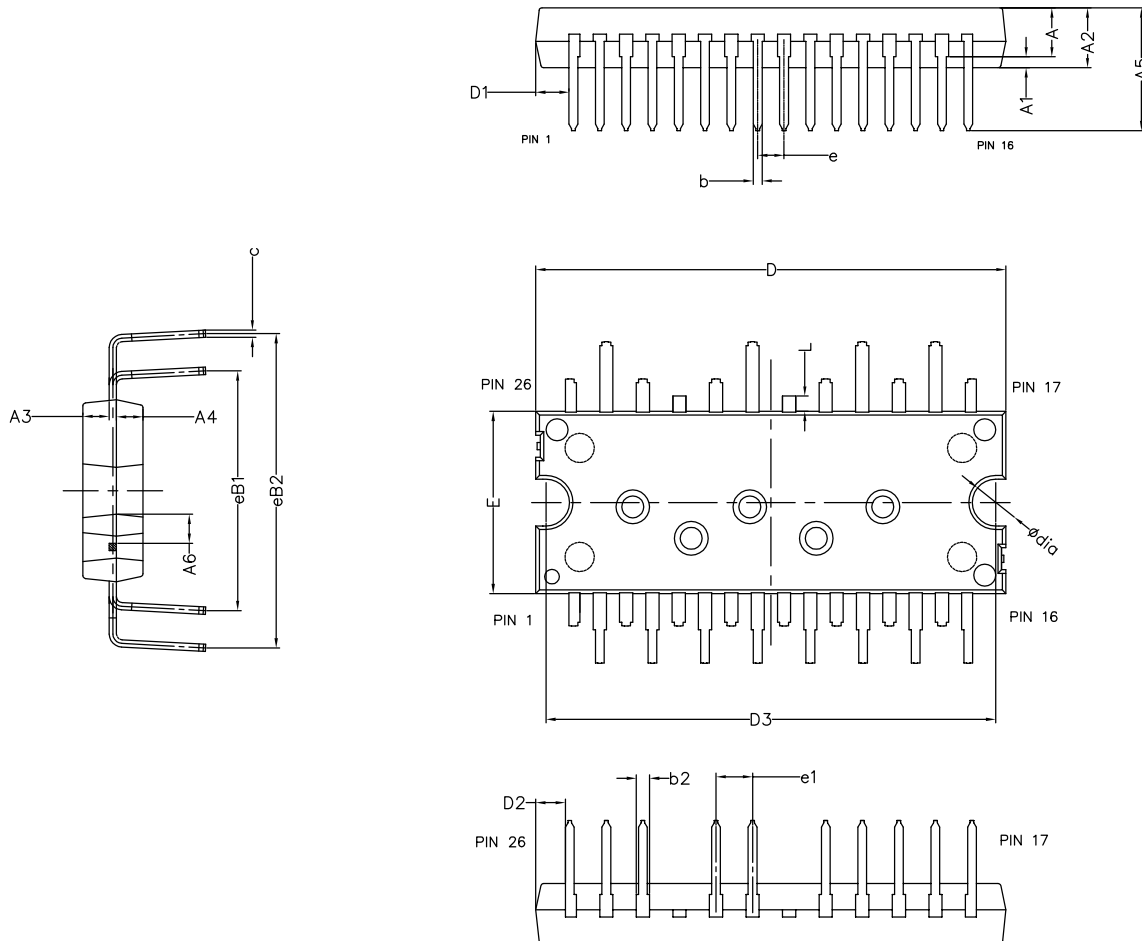
8558322_3_typeL_NO_stand_off

Table 15. N2DIP-26L type L no stand-off mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | | | 3.80 |
| A1 | 0.45 | 0.75 | 1.05 |
| A2 | 4.00 | 4.10 | 4.20 |
| A3 | 1.70 | 1.80 | 1.90 |
| A4 | 1.70 | 1.80 | 1.90 |
| A5 | 8.10 | 8.40 | 8.70 |
| A6 | 1.75 | | |
| b | 0.53 | | 0.72 |
| b2 | 0.83 | | 1.02 |
| c | 0.46 | | 0.59 |
| D | 32.05 | 32.15 | 32.25 |
| D1 | 2.10 | | |
| D2 | 1.85 | | |
| D3 | 30.65 | 30.75 | 30.85 |
| E | 12.35 | 12.45 | 12.55 |
| e | 1.70 | 1.80 | 1.90 |
| e1 | 2.40 | 2.50 | 2.60 |
| eB1 | 14.25 | 14.55 | 14.85 |
| L | 0.85 | 1.05 | 1.25 |
| Dia | 3.10 | 3.20 | 3.30 |

7.2 N2DIP-26L type Z no stand-off package information

Figure 21. N2DIP-26L type Z no stand-off package outline



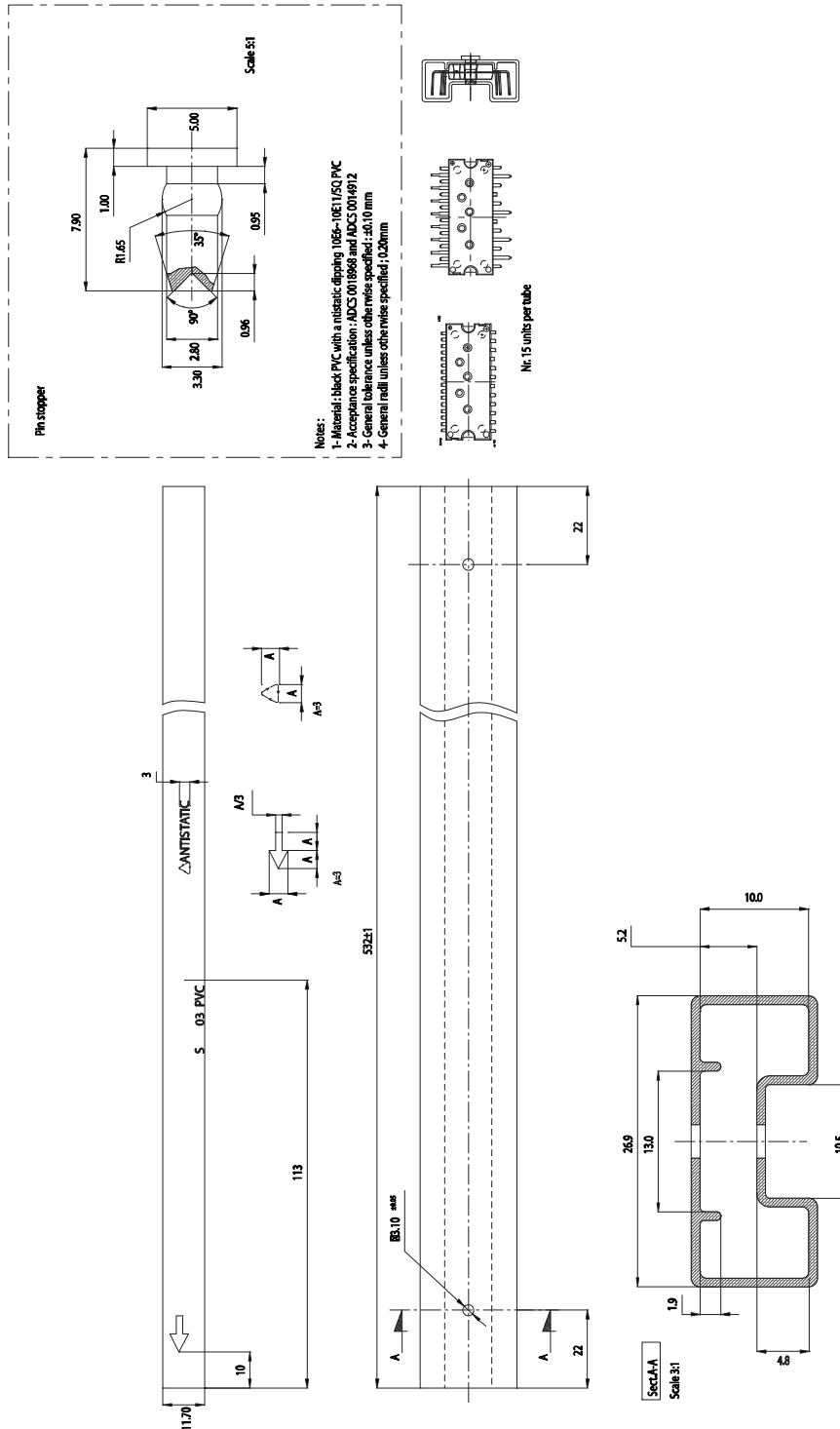
8558322_3_typeZ_NO_stand_off

Table 16. N2DIP-26L type Z no stand-off mechanical data

| Dim. | mm | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | | | 3.80 |
| A1 | 0.45 | 0.75 | 1.05 |
| A2 | 4.00 | 4.10 | 4.20 |
| A3 | 1.70 | 1.80 | 1.90 |
| A4 | 1.70 | 1.80 | 1.90 |
| A5 | 8.10 | 8.40 | 8.70 |
| A6 | 1.75 | | |
| b | 0.53 | | 0.72 |
| b2 | 0.83 | | 1.02 |
| c | 0.46 | | 0.59 |
| D | 32.05 | 32.15 | 32.25 |
| D1 | 2.10 | | |
| D2 | 1.85 | | |
| D3 | 30.65 | 30.75 | 30.85 |
| E | 12.35 | 12.45 | 12.55 |
| e | 1.70 | 1.80 | 1.90 |
| e1 | 2.40 | 2.50 | 2.60 |
| eB1 | 16.10 | 16.40 | 16.70 |
| eB2 | 21.18 | 21.48 | 21.78 |
| L | 0.85 | 1.05 | 1.25 |
| Dia | 3.10 | 3.20 | 3.30 |

7.3 N2DIP-26L packing information

Figure 22. N2DIP-26L tube (dimensions are in mm)



Revision history

Table 17. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 08-Jul-2015 | 1 | Initial release. |
| 07-Oct-2015 | 2 | Document status promoted from preliminary data to production data. |
| 24-Mar-2017 | 3 | Modified features on cover page Modified Figure 4: <i>"Internal structure of SD and NTC"</i> Minor text changes. |
| 18-Dec-2018 | 4 | Updated package silhouette on cover page. Updated Section 1 Internal schematic diagram and pin configuration , Section 2.1 Absolute maximum ratings , Section 3.2 Control part , Section 4 Shutdown function and Section 5.1 Guidelines . Added Section 6 Electrical characteristics (curves) . Updated Section 7 Package information . Minor text changes |

Contents

| | | |
|--------------|---|-----------|
| 1 | Internal schematic diagram and pin configuration | 2 |
| 2 | Electrical ratings | 5 |
| 2.1 | Absolute maximum ratings | 5 |
| 2.2 | Thermal data | 5 |
| 3 | Electrical characteristics | 7 |
| 3.1 | Inverter part | 7 |
| 3.2 | Control part | 8 |
| 3.2.1 | NTC thermistor | 11 |
| 3.3 | Waveform definitions | 12 |
| 4 | Smart shutdown function | 14 |
| 5 | Application circuit example | 15 |
| 5.1 | Guidelines | 16 |
| 6 | Electrical characteristics (curves) | 17 |
| 7 | Package information | 19 |
| 7.1 | N2DIP-26L type L no stand-off package information | 19 |
| 7.2 | N2DIP-26L type Z no stand-off package information | 20 |
| 7.3 | N2DIP-26L packing information | 22 |
| | Revision history | 24 |

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