

High Speed Low Power CAN, CAN FD Transceiver

NCV7344

Description

The NCV7344 CAN transceiver is the interface between a controller area network (CAN) protocol controller and the physical bus. The transceiver provides differential transmit capability to the bus and differential receive capability to the CAN controller.

The NCV7344 is an addition to the CAN high-speed transceiver family complementing NCV734x CAN stand-alone transceivers and previous generations such as AMIS42665, AMIS3066x, etc.

The NCV7344 guarantees additional timing parameters to ensure robust communication at data rates beyond 1 Mbps to cope with CAN flexible data rate requirements (CAN FD). These features make the NCV7344 an excellent choice for all types of HS-CAN networks, in nodes that require a low-power mode with wake-up capability via the CAN bus.

Features

- Compatible with ISO 11898–2:2016
- Specification for Loop Delay Symmetry up to 5 Mbps
- V_{IO} pin on NCV7344–3 Version Allowing Direct Interfacing with 3 V to 5 V Microcontrollers
- Very Low Current Standby Mode with Wake-up via the Bus
- Low Electromagnetic Emission (EME) and High Electromagnetic Immunity
- Very Low EME without Common-mode (CM) Choke
- No Disturbance of the Bus Lines with an Un-powered Node
- Transmit Data (TxD) Dominant Timeout Function
- Under All Supply Conditions the Chip Behaves Predictably
- Very High ESD Robustness of Bus Pins, >8 kV System ESD Pulses
- Thermal Protection
- Bus Pins Short Circuit Proof to Supply Voltage and Ground
- Bus Pins Protected Against Transients in an Automotive Environment
- These are Pb-free Devices

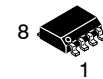
Quality

- Wettable Flank Package for Enhanced Optical Inspection
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

Typical Applications

- Automotive
- Industrial Networks

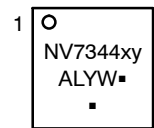
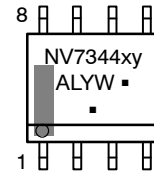
MARKING DIAGRAM



SOIC-8 NB
CASE 751-07



DFN8
MW SUFFIX
CASE 507AB



NV7344xy= Specific Device Code

x = - or A

y = 0 or 3

- = long filter time

A = short filter time

A = Assembly Location

L = Wafer Lot

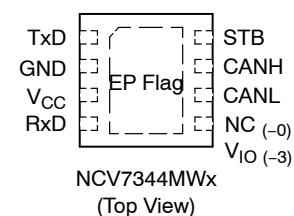
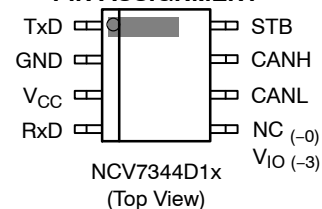
Y = Year

W = Work Week

▪ = Pb-Free Package

(Note: Microdot may be in either location)

PIN ASSIGNMENT



ORDERING INFORMATION

See detailed ordering and shipping information on page 11 of this data sheet.

NCV7344

BLOCK DIAGRAM

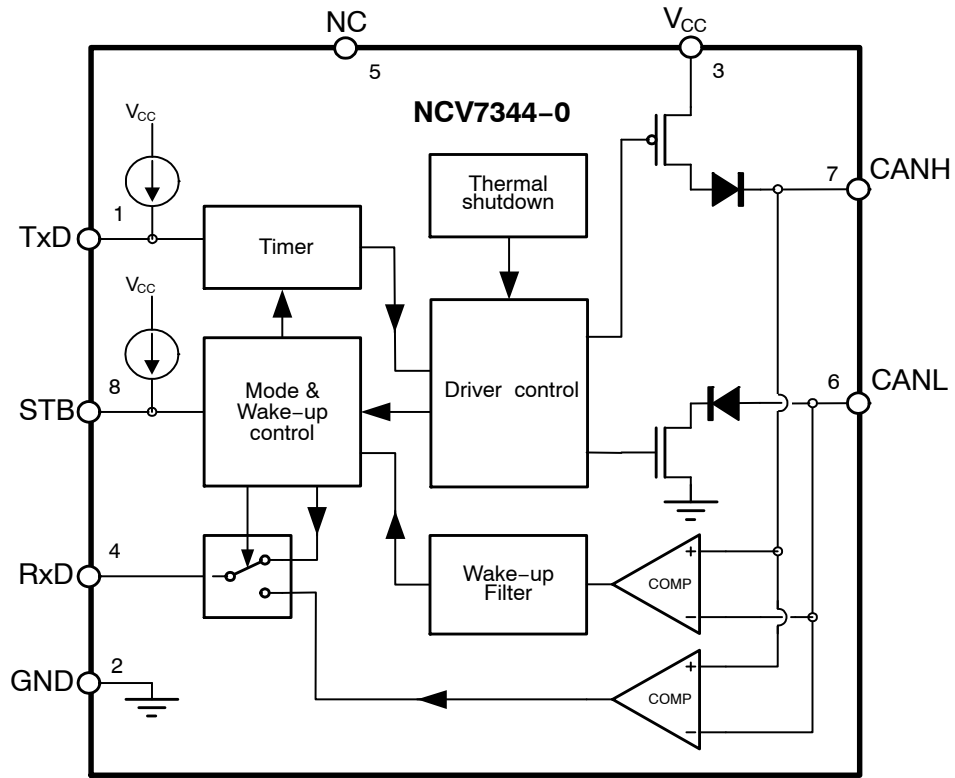


Figure 1. NCV7344-0 Block Diagram

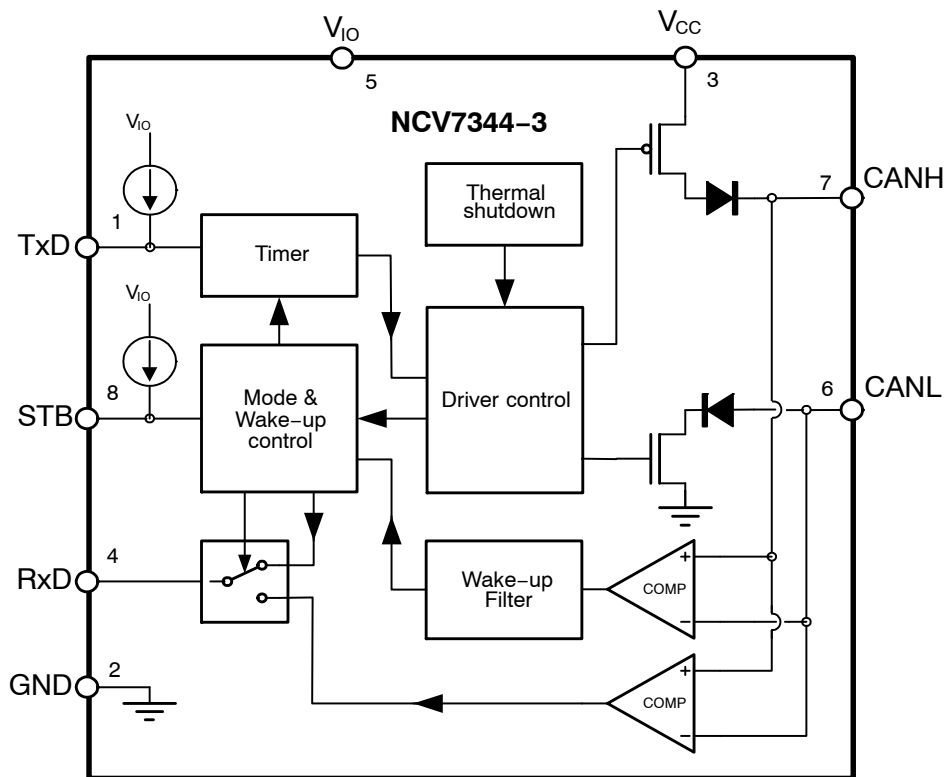


Figure 2. NCV7344-3 Block Diagram

NCV7344

TYPICAL APPLICATION

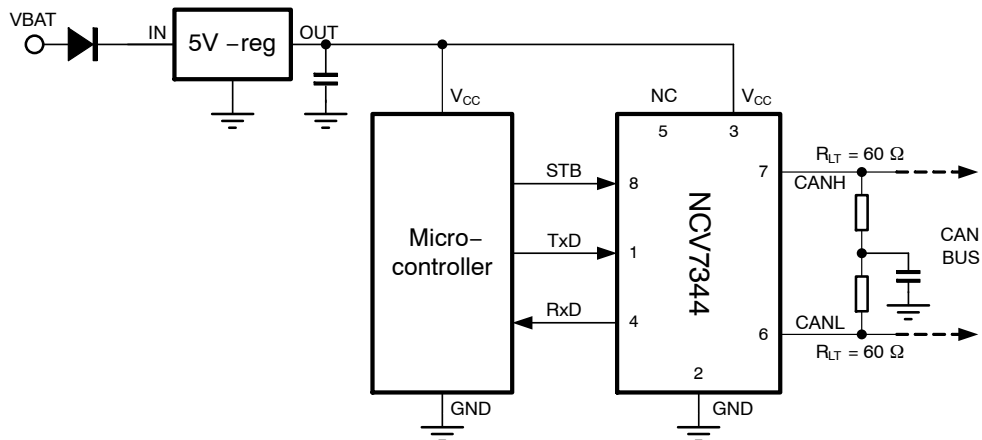


Figure 3. Application Diagram NCV7344-0

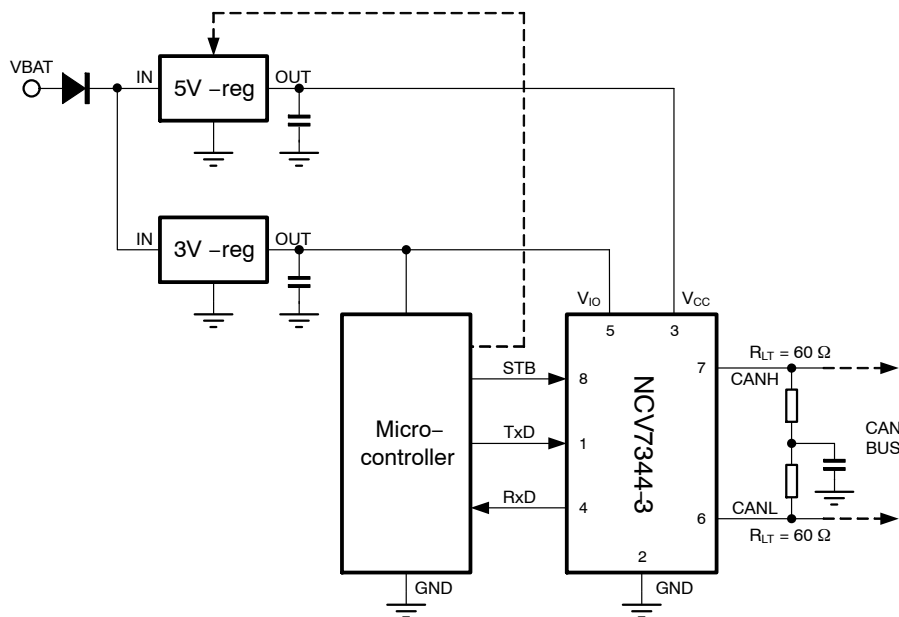


Figure 4. Application Diagram NCV7344-3

Table 1. PIN FUNCTION DESCRIPTION

| Pin | Name | Description |
|-----|-----------------|---|
| 1 | TxD | Transmit data input; low input → dominant driver; internal pull-up current |
| 2 | GND | Ground |
| 3 | V _{CC} | Supply voltage |
| 4 | RxD | Receive data output; dominant transmitter → low output |
| 5 | NC | Not connected. On NCV7344-0 only |
| 5 | V _{IO} | Digital Input / Output pins and other functions supply voltage. On NCV7344-3 only |
| 6 | CANL | Low-level CAN bus line (low in dominant mode) |
| 7 | CANH | High-level CAN bus line (high in dominant mode) |
| 8 | STB | Standby mode control input; internal pull-up current |
| | EP | Exposed Pad. Recommended to connect to GND or left floating in application (DFN8 package only). |

FUNCTIONAL DESCRIPTION

Operating Modes

NCV7344 provides two modes of operation as illustrated in Table 2. These modes are selectable through pin STB.

Table 2. OPERATING MODES

| Pin STB | Mode | Pin RxD | |
|---------|---------|---------------------------------------|---------------------------------------|
| Low | Normal | Low when bus dominant | High when bus recessive |
| High | Standby | Follows the bus when wake-up detected | High when no wake-up request detected |

Normal Mode

In the normal mode, the transceiver is able to communicate via the bus lines. The signals are transmitted and received to the CAN controller via the pins TxD and RxD. The slopes on the bus lines outputs are optimized to give low EME.

Standby Mode

In standby mode both the transmitter and receiver are disabled and a very low-power differential receiver monitors the bus lines for CAN bus activity. The bus lines are biased to ground and supply current is reduced to a minimum, typically 10 μ A. When a wake-up request is detected by the low-power differential receiver, the signal is first filtered and then verified as a valid wake signal after a time period of t_{wake_filt} , the RxD pin is driven low by the transceiver (following the bus) to inform the controller of the wake-up request.

Wake-up

When a valid wake-up pattern (phase in order dominant – recessive – dominant) is detected during the standby mode the RxD pin follows the bus. Minimum length of each phase is t_{wake_filt} – see Figure 5.

Pattern must be received within t_{wake_to} to be recognized as valid wake-up otherwise internal logic is reset.

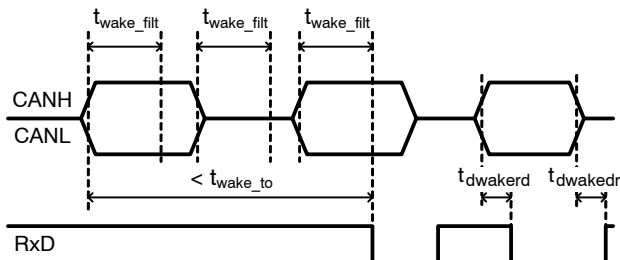


Figure 5. NCV7344 Wake-up Behavior

Overtemperature Detection

A thermal protection circuit protects the IC from damage by switching off the transmitter if the junction temperature exceeds a value of approximately 180°C. Because the transmitter dissipates most of the power, the power dissipation and temperature of the IC is reduced. All other IC functions continue to operate. The transmitter off-state resets when the temperature decreases below the shutdown threshold and pin TxD goes high. The thermal protection circuit is particularly needed when a bus line short circuits.

TxD Dominant Timeout Function

A TxD dominant timeout timer circuit prevents the bus lines being driven to a permanent dominant state (blocking all network communication) if pin TxD is forced permanently low by a hardware and/or software application failure. The timer is triggered by a negative edge on pin TxD. If the duration of the low-level on pin TxD exceeds the internal timer value $t_{dom(TxD)}$, the transmitter is disabled, driving the bus into a recessive state. The timer is reset by a positive edge on pin TxD.

This TxD dominant timeout time $t_{dom(TxD)}$ defines the minimum possible bit rate to 17 kbps.

Fail Safe Features

A current-limiting circuit protects the transmitter output stage from damage caused by accidental short circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.

Standby undervoltage on VCC pin prevents the chip sending data on the bus when there is not enough VCC supply voltage by entering standby mode. Undervoltage detection on VIO pin (NCV7344-3 version only) also causes transition to standby mode. Switch-off undervoltage detection level on supply pin(s) forces transceiver to disengage from the bus until the supply is recovered. After supply is recovered TxD pin must be first released to high to allow sending dominant bits again. Recovery time from undervoltage detection is equal to $t_{d(stb-nm)}$ time.

The pins CANH and CANL are protected from automotive electrical transients (according to ISO 7637; see Figure 7). Pins TxD and STB are pulled high internally should the input become disconnected. Pins TxD, STB and RxD will be floating, preventing reverse supply should the VCC supply be removed.

VIO Supply Pin

The VIO pin (available only on NCV7344-3 version) should be connected to microcontroller supply pin. By using VIO supply pin shared with microcontroller the I/O levels between microcontroller and transceiver are properly adjusted. See Figure 4. Pin VIO also provides the internal supply voltage for low-power differential receiver of the transceiver. This allows detection of wake-up request even when there is no supply voltage on pin VCC.

ELECTRICAL CHARACTERISTICS

Definitions

All voltages are referenced to GND (pin 2). Positive currents flow into the IC. Sinking current means the current is flowing into the pin; sourcing current means the current is flowing out of the pin.

ABSOLUTE MAXIMUM RATINGS

Table 3. ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Conditions | Min | Max | Unit |
|------------------------|---|---|------|------|------|
| V _{SUP} | Supply voltage V _{CC} , V _{IO} | | -0.3 | +6 | V |
| V _{CANH} | DC voltage at pin CANH | 0 < V _{CC} < 5.25 V; no time limit | -42 | +42 | V |
| V _{CANL} | DC voltage at pin CANL | 0 < V _{CC} < 5.25 V; no time limit | -42 | +42 | V |
| V _{CANH-CANL} | DC voltage between CANH and CANL | | -42 | +42 | V |
| V _{IO} | DC voltage at pin TxD, RxD, STB | | -0.3 | +6 | V |
| V _{esdHBM} | Electrostatic discharge voltage at all pins, Component HBM | (Note 1) | -8 | +8 | kV |
| V _{esdCDM} | Electrostatic discharge voltage at all pins, Component CDM | (Note 2) | -750 | +750 | V |
| V _{esdIEC} | Electrostatic discharge voltage at pins CANH and CANL, System HBM (Note 4) | (Note 3) | -8 | +8 | kV |
| V _{schaff} | Voltage transients, pins CANH, CANL. According to ISO7637-3, Class C (Note 4) | test pulses 1 | -100 | | V |
| | | test pulses 2a | | +75 | V |
| | | test pulses 3a | -150 | | V |
| | | test pulses 3b | | +100 | V |
| Latch-up | Static latch-up at all pins | (Note 5) | | 150 | mA |
| T _{stg} | Storage temperature | | -55 | +150 | °C |
| T _J | Maximum junction temperature | | -40 | +170 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Standardized human body model electrostatic discharge (ESD) pulses in accordance to EIA-JESD22. Equivalent to discharging a 100 pF capacitor through a 1.5 kΩ resistor.
2. Standardized charged device model ESD pulses when tested according to AEC-Q100-011
3. System human body model electrostatic discharge (ESD) pulses in accordance to IEC 61000-4-2. Equivalent to discharging a 150 pF capacitor through a 330 Ω resistor referenced to GND.
4. Results were verified by external test house.
5. Static latch-up immunity: Static latch-up protection level when tested according to EIA/JESD78.

Table 4. THERMAL CHARACTERISTICS

| Parameter | Symbol | Value | Unit |
|---|------------------|-------|------|
| Thermal characteristics, SOIC-8 (Note 6) | | | |
| Thermal Resistance Junction-to-Air, Free air, 1S0P PCB (Note 7) | R _{θJA} | 131 | °C/W |
| Thermal Resistance Junction-to-Air, Free air, 2S2P PCB (Note 8) | R _{θJA} | 81 | °C/W |
| Thermal characteristics, DFN8 (Note 6) | | | |
| Thermal Resistance Junction-to-Air, Free air, 1S0P PCB (Note 7) | R _{θJA} | 125 | °C/W |
| Thermal Resistance Junction-to-Air, Free air, 2S2P PCB (Note 8) | R _{θJA} | 58 | °C/W |

6. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.
7. Values based on test board according to EIA/JEDEC Standard JESD51-3, signal layer with 10% trace coverage.
8. Values based on test board according to EIA/JEDEC Standard JESD51-7, signal layers with 10% trace coverage.

NCV7344

ELECTRICAL CHARACTERISTICS

Table 5. ELECTRICAL CHARACTERISTICS $V_{CC} = 4.75\text{ V to }5.25\text{ V}$; $V_{IO} = 2.8\text{ to }5.25\text{ V}$; $T_J = -40\text{ to }+150^\circ\text{C}$; $R_{LT} = 60\ \Omega$, $C_{LT} = 100\text{ pF}$, C_1 not used, $C_{RXD} = 15\text{ pF}$ unless specified otherwise.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---|--|------|------|------|---------------|
| SUPPLY (Pin V_{CC}) | | | | | | |
| V_{CC} | Power supply voltage | (Note 9) | 4.75 | 5 | 5.25 | V |
| I_{CC} | Supply current | Dominant; $V_{TXD} = \text{Low}$ | 20 | 45 | 70 | mA |
| | | Recessive; $V_{TXD} = \text{High}$ | 1.9 | 5 | 10 | mA |
| I_{CCS} | Supply current in standby mode | $T_J \leq 100^\circ\text{C}$, (Note 10) | – | 10 | 15 | μA |
| $V_{UVD(VCC)(stby)}$ | Standby undervoltage detection V_{CC} pin | | 3.5 | 4 | 4.3 | V |
| $V_{UVD(VCC)(swoff)}$ | Switch-off undervoltage detection V_{CC} pin | | 2.0 | 2.3 | 2.6 | V |
| V_{IO} SUPPLY VOLTAGE (Pin V_{IO}) Only for NCV7344–3 version | | | | | | |
| V_{IO} | Supply voltage on pin V_{IO} | | 2.8 | – | 5.5 | V |
| I_{IOS} | Supply current on pin V_{IO} in standby mode | $T_J \leq 100^\circ\text{C}$, (Note 10) | – | – | 11 | μA |
| I_{CCS} | Supply current on pin V_{CC} in standby mode | $T_J \leq 100^\circ\text{C}$, (Note 10) | – | 0 | 4.0 | μA |
| I_{IONM} | Supply current on pin V_{IO} during normal mode | Dominant; $V_{TXD} = \text{Low}$ | 0.45 | 0.65 | 0.9 | mA |
| | | Recessive; $V_{TXD} = \text{High}$ | 0.32 | 0.43 | 0.58 | |
| V_{UVDVIO} | Undervoltage detection voltage on V_{IO} pin | | 2.0 | 2.3 | 2.6 | V |
| TRANSMITTER DATA INPUT (Pin TxD) | | | | | | |
| V_{IH} | High-level input voltage | Output recessive | 2.0 | – | – | V |
| V_{IL} | Low-level input voltage | Output dominant | – | – | 0.8 | V |
| I_{IH} | High-level input current | $V_{TXD} = V_{CC}/V_{IO}$ | –5 | 0 | +5 | μA |
| I_{IL} | Low-level input current | $V_{TXD} = 0\text{ V}$ | –300 | –150 | –75 | μA |
| C_i | Input capacitance | (Note 10) | – | 5 | 10 | pF |
| TRANSMITTER MODE SELECT (Pin STB) | | | | | | |
| V_{IH} | High-level input voltage | Standby mode | 2.0 | – | – | V |
| V_{IL} | Low-level input voltage | Normal mode | – | – | 0.8 | V |
| I_{IH} | High-level input current | $V_{STB} = V_{CC}/V_{IO}$ | –1 | 0 | +1 | μA |
| I_{IL} | Low-level input current | $V_{STB} = 0\text{ V}$ | –15 | – | –1 | μA |
| C_i | Input capacitance | (Note 10) | – | 5 | 10 | pF |
| RECEIVER DATA OUTPUT (Pin RxD) | | | | | | |
| I_{OH} | High-level output current | Normal mode $V_{RXD} = V_{CC}/M_{IO} - 0.4\text{ V}$ | –8 | –3 | –1 | mA |
| I_{OL} | Low-level output current | $V_{RXD} = 0.4\text{ V}$ | 1 | 6 | 12 | mA |
| BUS LINES (Pins CANH and CANL) | | | | | | |
| $I_{o(rec)}$ | Recessive output current at pins CANH and CANL | $-27\text{ V} < V_{CANH}$, $V_{CANL} < +32\text{ V}$; Normal mode | –5 | – | +5 | mA |
| I_{LI} | Input leakage current | $0\ \Omega < R(V_{CC}\text{ to GND}) < 1\text{ M}\Omega$ $V_{CANL} = V_{CANH} = 5\text{ V}$ | –5 | 0 | +5 | μA |
| $V_{o(rec)(CANH)}$ | Recessive output voltage at pin CANH | Normal mode, $V_{TXD} = \text{High}$; R_{LT} and C_{LT} not used | 2.0 | 2.5 | 3.0 | V |
| $V_{o(rec)(CANL)}$ | Recessive output voltage at pin CANL | Normal mode, $V_{TXD} = \text{High}$; R_{LT} and C_{LT} not used | 2.0 | 2.5 | 3.0 | V |
| $V_{o(off)(CANH)}$ | Recessive output voltage at pin CANH | Standby mode; R_{LT} and C_{LT} not used | –0.1 | 0 | 0.1 | V |

NCV7344

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------------------------|---|--|------|------|------|------------|
| BUS LINES (Pins CANH and CANL) | | | | | | |
| $V_{o(off)}(CANL)$ | Recessive output voltage at pin CANL | Standby mode; R_{LT} and C_{LT} not used | -0.1 | 0 | 0.1 | V |
| $V_{o(off)}(diff)$ | Differential bus output voltage ($V_{CANH} - V_{CANL}$) | Standby mode; R_{LT} and C_{LT} not used | -0.2 | 0 | 0.2 | V |
| $V_{o(dom)}(CANH)$ | Dominant output voltage at pin CANH | $V_{TxD} = 0\text{ V}$; $t < t_{dom}(TxD)$; $50\ \Omega < R_{LT} < 65\ \Omega$ | 2.75 | 3.5 | 4.5 | V |
| $V_{o(dom)}(CANL)$ | Dominant output voltage at pin CANL | $V_{TxD} = 0\text{ V}$; $t < t_{dom}(TxD)$; $50\ \Omega < R_{LT} < 65\ \Omega$ | 0.5 | 1.5 | 2.25 | V |
| $V_{o(dom)}(diff)$ | Differential bus output voltage ($V_{CANH} - V_{CANL}$) | $V_{TxD} = 0\text{ V}$; dominant; $45\ \Omega < R_{LT} < 65\ \Omega$ | 1.5 | 2.25 | 3.0 | V |
| $V_{o(dom)}(diff)_{arb}$ | Differential bus output voltage during arbitration ($V_{CANH} - V_{CANL}$) | $R_{LT} = 2.24\text{ k}\Omega$ (Note 10) | 1.5 | - | 5.0 | V |
| $V_{o(rec)}(diff)$ | Differential bus output voltage ($V_{CANH} - V_{CANL}$) | $V_{TxD} = \text{High}$; recessive; no load | -50 | 0 | +50 | mV |
| $V_{o(dom)}(sym)$ | Dominant output voltage driver symmetry ($V_{CANH} + V_{CANL}$) | $R_{LT} = 60\ \Omega$; $C_1 = 4.7\text{ nF}$; $TxD = \text{square wave up to }1\text{ MHz}$ | 0.9 | 1.0 | 1.1 | V_{CC} |
| $I_{o(sc)}(CANH)$ | Short circuit output current at pin CANH | $-3\text{ V} < V_{CANH} < +18\text{ V}$ | -100 | -70 | 1.5 | mA |
| $I_{o(sc)}(CANL)$ | Short circuit output current at pin CANL | $-3\text{ V} < V_{CANL} < +36\text{ V}$ | -1.5 | 70 | 100 | mA |
| $V_{i(rec)}(diff)_{NM}$ | Differential input voltage range recessive state | Normal or Silent mode; $-12\text{ V} \leq V_{CANH}$, $V_{CANL} \leq +12\text{ V}$; no load | -3.0 | - | 0.5 | V |
| $V_{i(rec)}(diff)_{LP}$ | | Standby or Sleep mode; $-12\text{ V} \leq V_{CANH}$, $V_{CANL} \leq +12\text{ V}$; no load | -3.0 | - | 0.4 | V |
| $V_{i(dom)}(diff)_{NM}$ | Differential input voltage range dominant state | Normal or Silent mode; $-12\text{ V} \leq V_{CANH}$, $V_{CANL} \leq +12\text{ V}$; no load | 0.9 | - | 8.0 | V |
| $V_{i(dom)}(diff)_{LP}$ | | Standby or Sleep mode; $-12\text{ V} \leq V_{CANH}$, $V_{CANL} \leq +12\text{ V}$; no load | 1.05 | - | 8.0 | V |
| $V_{i(diff)}(th)_{NORM}$ | Differential receiver threshold voltage in normal mode | $-12\text{ V} \leq V_{CANL} \leq +12\text{ V}$; $-12\text{ V} \leq V_{CANH} \leq +12\text{ V}$ | 0.5 | - | 0.9 | V |
| $V_{i(diff)}(th)_{NORM_H}$ | Differential receiver threshold voltage in normal mode, extended range | $-30\text{ V} < V_{CANL} < +35\text{ V}$; $-30\text{ V} < V_{CANH} < +35\text{ V}$ | 0.4 | - | 1.0 | V |
| $V_{i(diff)}(th)_{STDBY}$ | Differential receiver threshold voltage in standby mode | $-12\text{ V} \leq V_{CANL} \leq +12\text{ V}$; $-12\text{ V} \leq V_{CANH} \leq +12\text{ V}$ | 0.4 | - | 1.05 | V |
| $R_{i(cm)}(CANH)$ | Common-mode input resistance at pin CANH | $-2\text{ V} \leq V_{CANH} \leq +7\text{ V}$; $-2\text{ V} \leq V_{CANL} \leq +7\text{ V}$ | 15 | 26 | 37 | k Ω |
| $R_{i(cm)}(CANL)$ | Common-mode input resistance at pin CANL | $-2\text{ V} \leq V_{CANH} \leq +7\text{ V}$; $-2\text{ V} \leq V_{CANL} \leq +7\text{ V}$ | 15 | 26 | 37 | k Ω |
| $R_{i(cm)}(m)$ | Matching between pin CANH and pin CANL common mode input resistance | $V_{CANH} = V_{CANL} = +5\text{ V}$ | -1 | 0 | +1 | % |
| $R_{i(diff)}$ | Differential input resistance | $-2\text{ V} \leq V_{CANH} \leq +7\text{ V}$; $-2\text{ V} \leq V_{CANL} \leq +7\text{ V}$ | 25 | 50 | 75 | k Ω |
| $C_i(CANH)$ | Input capacitance at pin CANH | $V_{TxD} = \text{High}$; (Note 10) | - | 7.5 | 20 | pF |
| $C_i(CANL)$ | Input capacitance at pin CANL | $V_{TxD} = \text{High}$; (Note 10) | - | 7.5 | 20 | pF |
| $C_i(diff)$ | Differential input capacitance | $V_{TxD} = \text{High}$; (Note 10) | - | 3.75 | 10 | pF |

NCV7344

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|--|------|-----|-----|------------------|
| TIMING CHARACTERISTICS (see Figures 6 and 8) | | | | | | |
| $t_{d(TxD-BUSon)}$ | Delay TxD to bus active | | – | 75 | – | ns |
| $t_{d(TxD-BUSoff)}$ | Delay TxD to bus inactive | | – | 85 | – | ns |
| $t_{d(BUSon-RxD)}$ | Delay bus active to RxD | | – | 24 | – | ns |
| $t_{d(BUSoff-RxD)}$ | Delay bus inactive to RxD | | – | 32 | – | ns |
| t_{pd_dr} | Propagation delay TxD to RxD dominant to recessive transition | | 50 | 100 | 210 | ns |
| t_{pd_rd} | Propagation delay TxD to RxD recessive to dominant transition | | 50 | 120 | 210 | ns |
| $t_{d(stb-nm)}$ | Delay standby mode to normal mode | | 5 | 11 | 20 | μs |
| t_{wake_filt} | Filter time for wake-up via bus | NCV7344 version | 0.5 | – | 5 | μs |
| | | NCV7344A version | 0.15 | – | 1.8 | μs |
| $t_{dwakerd}$ | Delay to flag wake event (recessive to dominant transitions) | Valid bus wake-up event | 0.5 | 2.6 | 6 | μs |
| $t_{dwakedr}$ | Delay to flag wake event (dominant to recessive transitions) | Valid bus wake-up event | 0.5 | 2.6 | 6 | μs |
| t_{wake_to} | Bus time for wake-up timeout | Standby mode | 1 | – | 10 | ms |
| $t_{dom(TxD)}$ | TxD dominant time for timeout | $V_{TxD} = \text{Low}; \text{Normal mode}$ | 1 | – | 10 | ms |
| $t_{Bit(RxD)}$ | Bit time on RxD pin | $t_{Bit(TxD)} = 500\text{ ns}$ | 400 | – | 550 | ns |
| | | $t_{Bit(TxD)} = 200\text{ ns}$ | 120 | – | 220 | ns |
| $t_{Bit(Vi(diff))}$ | Bit time on bus (CANH – CANL pin) | $t_{Bit(TxD)} = 500\text{ ns}$ | 435 | – | 530 | ns |
| | | $t_{Bit(TxD)} = 200\text{ ns}$ | 155 | – | 210 | ns |
| Δt_{Rec} | Receiver timing symmetry $\Delta t_{Rec} = t_{Bit(RxD)} - t_{Bit(Vi(diff))}$ | $t_{Bit(TxD)} = 500\text{ ns}$ | –65 | – | +40 | ns |
| | | $t_{Bit(TxD)} = 200\text{ ns}$ | –45 | – | +15 | ns |
| THERMAL SHUTDOWN | | | | | | |
| $T_{J(sd)}$ | Shutdown junction temperature | Junction temperature rising | 160 | 180 | 200 | $^\circ\text{C}$ |

9. In the range between $V_{UVD}(V_{CC})(stby)$ and 4.75 V and from 5.25 V to 6 V the chip is fully functional; some parameters may be outside of the specification.

10. Values based on design and characterization, not tested in production

NCV7344

MEASUREMENT SETUPS AND DEFINITIONS

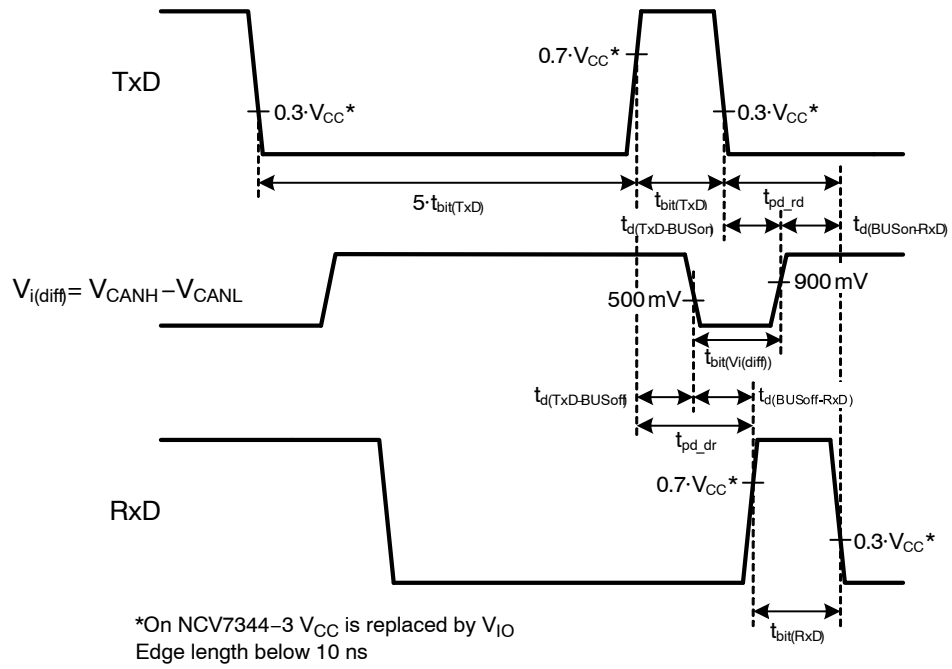


Figure 6. Transceiver Timing Diagram

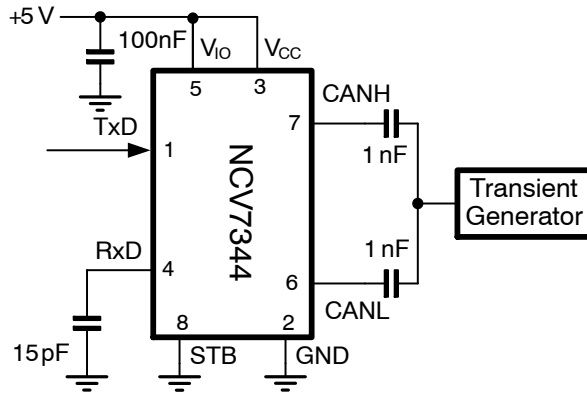


Figure 7. Test Circuit for Automotive Transients

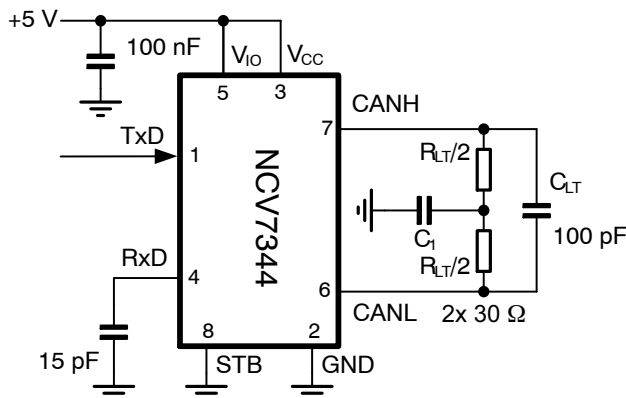


Figure 8. Test Circuit for Timing Characteristics

Table 6. ISO 11898–2:2016 Parameter Cross–Reference Table

| ISO 11898–2:2016 Specification | | NCV7344 Datasheet |
|---|------------------------------|--|
| Parameter | Notation | Symbol |
| Dominant output characteristics | | |
| Single ended voltage on CAN_H | V_{CAN_H} | $V_{o(dom)}(CANH)$ |
| Single ended voltage on CAN_L | V_{CAN_L} | $V_{o(dom)}(CANL)$ |
| Differential voltage on normal bus load | V_{Diff} | $V_{o(dom)}(diff)$ |
| Differential voltage on effective resistance during arbitration | V_{Diff} | $V_{o(dom)}(diff_arb)$ |
| Differential voltage on extended bus load range (optional) | V_{Diff} | $V_{o(dom)}(diff)$ |
| Driver symmetry | | |
| Driver symmetry | V_{SYM} | $V_{o(dom)}(sym)$ |
| Driver output current | | |
| Absolute current on CAN_H | I_{CAN_H} | $I_o(SC)(CANH)$ |
| Absolute current on CAN_L | I_{CAN_L} | $I_o(SC)(CANL)$ |
| Receiver output characteristics, bus biasing active | | |
| Single ended output voltage on CAN_H | V_{CAN_H} | $V_{o(rec)}(CANH)$ |
| Single ended output voltage on CAN_L | V_{CAN_L} | $V_{o(rec)}(CANL)$ |
| Differential output voltage | V_{Diff} | $V_{o(rec)}(diff)$ |
| Receiver output characteristics, bus biasing inactive | | |
| Single ended output voltage on CAN_H | V_{CAN_H} | $V_{o(off)}(CANH)$ |
| Single ended output voltage on CAN_L | V_{CAN_L} | $V_{o(off)}(CANL)$ |
| Differential output voltage | V_{Diff} | $V_{o(off)}(diff)$ |
| Optional transmit dominant timeout | | |
| Transmit dominant timeout, long | t_{dom} | $t_{dom}(TxD)$ |
| Transmit dominant timeout, short | t_{dom} | NA |
| Static receiver input characteristics, bus biasing active | | |
| Recessive state differential input voltage range | V_{Diff} | $V_{i(rec)}(diff_NM)$ |
| Dominant state differential input voltage range | V_{Diff} | $V_{i(dom)}(diff_NM)$ |
| Static receiver input characteristics, bus biasing inactive | | |
| Recessive state differential input voltage range | V_{Diff} | $V_{i(rec)}(diff_LP)$ |
| Dominant state differential input voltage range | V_{Diff} | $V_{i(dom)}(diff_LP)$ |
| Receiver input resistance | | |
| Differential internal resistance | R_{Diff} | $R_{i(diff)}$ |
| Single ended internal resistance | R_{CAN_H} R_{CAN_L} | $R_{i(cm)}(CANH)$ $R_{i(cm)}(CANL)$ |
| Receiver input resistance matching | | |
| Matching a of internal resistance | m_R | $R_{i(cm)}(m)$ |
| Implementation loop delay requirement | | |
| Loop delay | t_{Loop} | t_{pd_rd} t_{pd_dr} |
| Optional implementation data signal timing requirements for use with bit rates above 1 Mbit/s and up to 2 Mbit/s | | |
| Transmitted recessive bit width @ 2 Mbit/s | $t_{Bit}(Bus)$ | $t_{Bit}(Vi(diff))$ |
| Received recessive bit width @ 2 Mbit/s | $t_{Bit}(RXD)$ | $t_{Bit}(RxD)$ |

Table 6. ISO 11898–2:2016 Parameter Cross–Reference Table

| Parameter | Notation | Symbol |
|---|------------------------------|--------------------------|
| Receiver timing symmetry @ 2 Mbit/s | Δt_{Rec} | Δt_{Rec} |
| Optional implementation data signal timing requirements for use with bit rates above 2 Mbit/s and up to 5 Mbit/s | | |
| Transmitted recessive bit width @ 5 Mbit/s | $t_{Bit(Bus)}$ | $t_{Bit(Vi(diff))}$ |
| Transmitted recessive bit width @ 5 Mbit/s | $t_{Bit(RxD)}$ | $t_{Bit(RxD)}$ |
| Received recessive bit width @ 5 Mbit/s | Δt_{Rec} | Δt_{Rec} |
| Maximum ratings of V_{CAN_H}, V_{CAN_L} and V_{Diff} | | |
| Maximum rating V_{Diff} | V_{Diff} | $V_{CANH-CANL}$ |
| General maximum rating V_{CAN_H} and V_{CAN_L} | V_{CAN_H} V_{CAN_L} | V_{CANH} V_{CANL} |
| Optional: Extended maximum rating V_{CAN_H} and V_{CAN_L} | V_{CAN_H} V_{CAN_L} | NA |
| Maximum leakage currents on CAN_H and CAN_L, unpowered | | |
| Leakage current on CAN_H, CAN_L | I_{CAN_H} I_{CAN_L} | I_{LI} |
| Bus biasing control timings | | |
| CAN activity filter time, long | t_{Filter} | t_{wake_filt} |
| CAN activity filter time, short | t_{Filter} | t_{wake_filt} |
| Wake-up timeout, short | t_{Wake} | NA |
| Wake-up timeout, long | t_{Wake} | t_{wake_to} |
| Timeout for bus inactivity (Required for selective wake-up implementation only) | $t_{Silence}$ | NA |
| Bus Bias reaction time (Required for selective wake-up implementation only) | t_{Bias} | NA |

DEVICE ORDERING INFORMATION (High Speed Low Power CAN, CANFD Transceiver)

| Part Number | Long FT | Short FT | Vio | NC | Temperature Range | Package | Shipping† |
|----------------|---------|----------|-----|----|-------------------|---|--------------------|
| NCV7344D10R2G | X | | | X | -40°C to +150°C | SOIC 150 8 GREEN (Matte Sn, JEDEC MS-012) (Pb-Free) | 3000 / Tape & Reel |
| NCV7344D13R2G | X | | X | | | | |
| NCV7344AD10R2G | | X | | X | | | |
| NCV7344AD13R2G | | X | X | | | | |
| NCV7344MW0R2G | X | | | X | | DFN 8 Wettable Flank (Pb-Free) | |
| NCV7344MW3R2G | X | | X | | | | |
| NCV7344AMW0R2G | | X | | X | | | |
| NCV7344AMW3R2G | | X | X | | | | |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

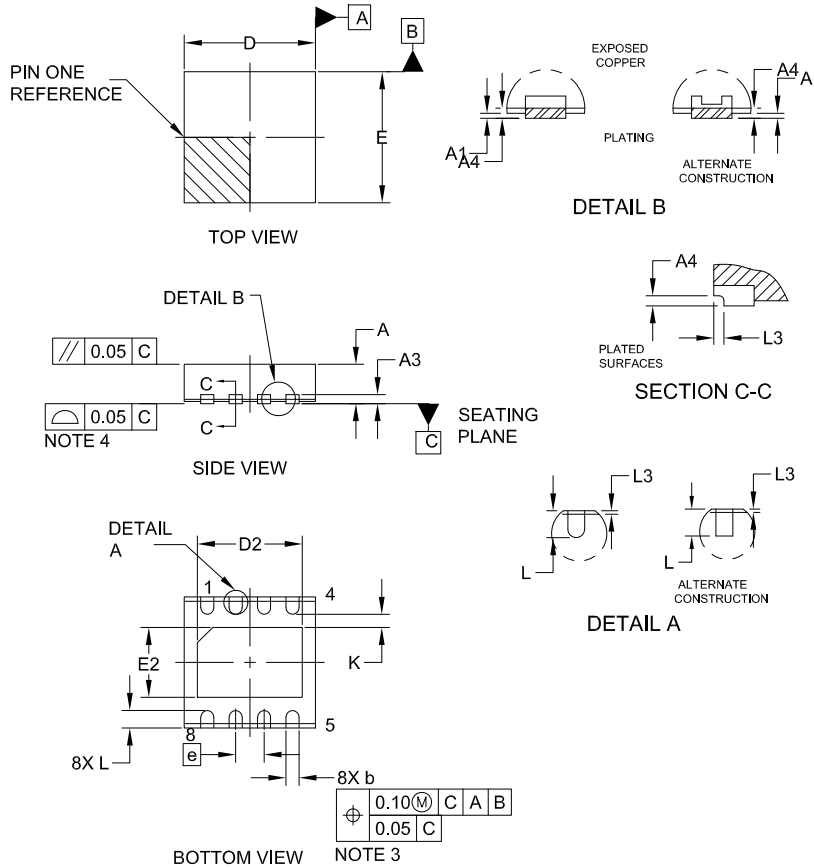
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DFNW8 3x3, 0.65P CASE 507AB ISSUE E

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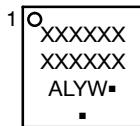


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINALS AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM THE TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. THIS DEVICE CONTAINS WETTABLE FLANK DESIGN FEATURES TO AID IN FILLET FORMATION ON THE LEADS DURING MOUNTING.

| DIM | MILLIMETERS | | |
|-----|-------------|------|------|
| | MIN. | NOM. | MAX. |
| A | 0.80 | 0.85 | 0.90 |
| A1 | — | — | 0.05 |
| A3 | 0.20 REF | | |
| A4 | 0.10 | — | — |
| b | 0.25 | 0.30 | 0.35 |
| D | 2.95 | 3.00 | 3.05 |
| D2 | 2.30 | 2.40 | 2.50 |
| E | 2.95 | 3.00 | 3.05 |
| E2 | 1.50 | 1.60 | 1.70 |
| e | 0.65 BSC | | |
| K | 0.30 REF | | |
| L | 0.35 | 0.40 | 0.45 |
| L3 | 0.00 | 0.05 | 0.10 |

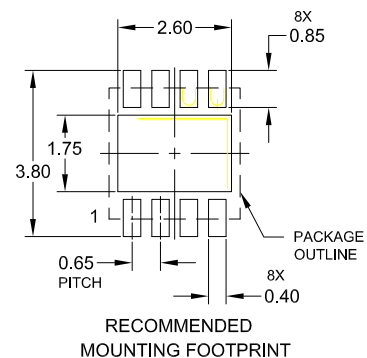
GENERIC MARKING DIAGRAM*



- XXXXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

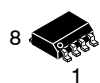


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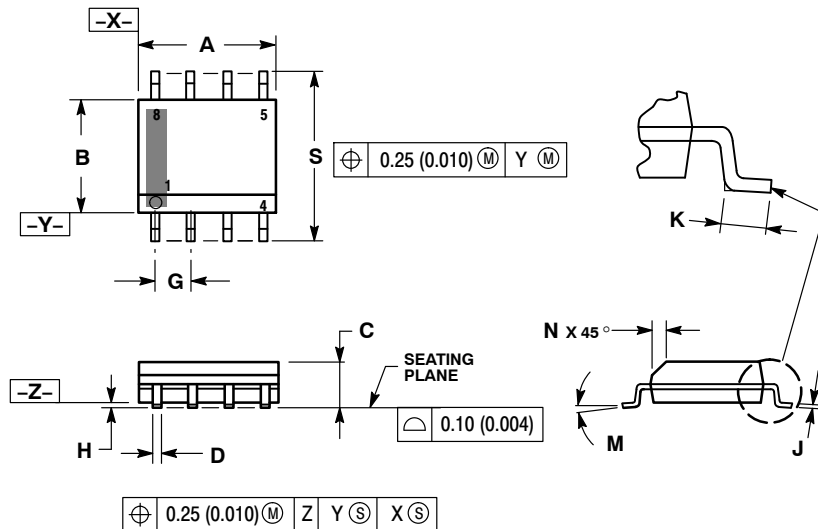
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SCALE 1:1

SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

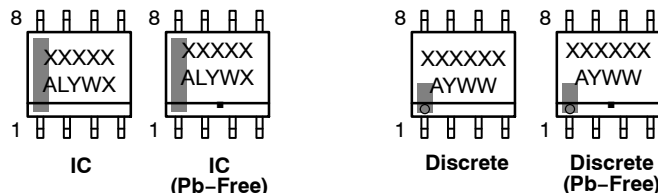
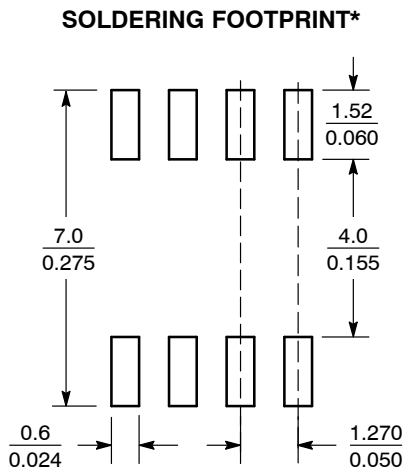


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.80 | 5.00 | 0.189 | 0.197 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.053 | 0.069 |
| D | 0.33 | 0.51 | 0.013 | 0.020 |
| G | 1.27 BSC | | 0.050 BSC | |
| H | 0.10 | 0.25 | 0.004 | 0.010 |
| J | 0.19 | 0.25 | 0.007 | 0.010 |
| K | 0.40 | 1.27 | 0.016 | 0.050 |
| M | 0° | 8° | 0° | 8° |
| N | 0.25 | 0.50 | 0.010 | 0.020 |
| S | 5.80 | 6.20 | 0.228 | 0.244 |

GENERIC MARKING DIAGRAM*



XXXXXX = Specific Device Code
 A = Assembly Location
 L = Wafer Lot
 Y = Year
 W = Work Week
 ■ = Pb-Free Package

XXXXXX = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ■ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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ISSUE AK

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| <p>STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE</p> | <p>STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE</p> | <p>STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd</p> | <p>STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1</p> |
| <p>STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON</p> | <p>STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND</p> | <p>STYLE 11: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1</p> | <p>STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> | <p>STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN</p> | <p>STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON</p> | <p>STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1</p> |
| <p>STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC</p> | <p>STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE</p> | <p>STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1</p> | <p>STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN</p> |
| <p>STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6</p> | <p>STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND</p> | <p>STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT</p> | <p>STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE</p> |
| <p>STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT</p> | <p>STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC</p> | <p>STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN</p> | <p>STYLE 28: PIN 1. SW_TO_GND 2. DASIC OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN</p> |
| <p>STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1</p> | <p>STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1</p> | | |

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