NCV4949C

100 mA, 5.0 V, Low Dropout Voltage Regulator with Reset and Sense

The NCV4949C is a monolithic integrated 5.0 V voltage regulator with a very low dropout and additional functions such as reset and an uncommitted voltage sense comparator.

It is designed for supplying microcontroller/microprocessor controlled systems particularly in automotive applications. The NCV4949C has improved reset behavior for lower input and output voltage levels.

Features

- Operating DC Supply Voltage Range 5.5 V to 40 V
- High Precision Output Voltage 5.0 V ±1%
- Output Current Capability Up to 100 mA
- Very Low Dropout Voltage Less Than 0.4 V
- Reset Circuit Sensing The Output Voltage
- Programmable Reset Pulse Delay
- Voltage Sense Comparator
- Fault Protection, +60 V Peak Transient Voltage, −40 V Reverse Voltage, Short Circuit, Thermal Overload
- NCV Prefix for Automotive and Other Applications Requiring Site and Change Control
- These are Pb−Free Devices

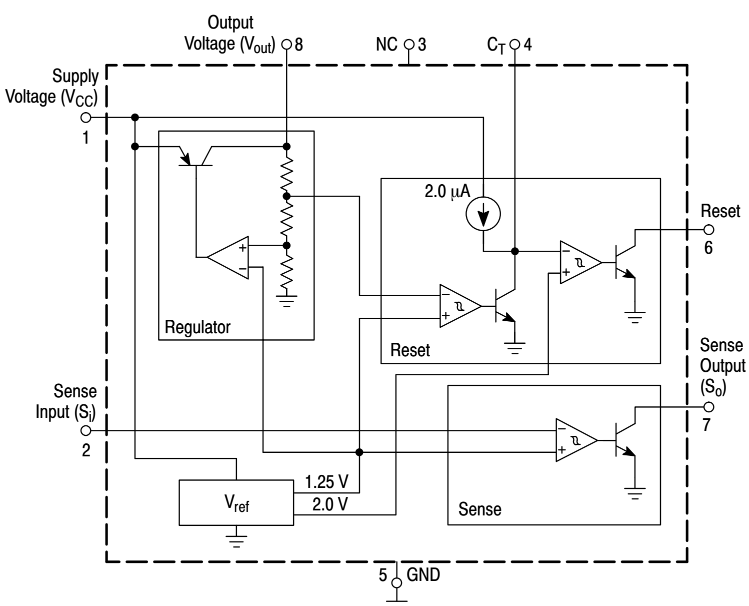

Figure 1. Representative Block Diagram

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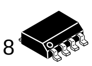
MARKING DIAGRAMS



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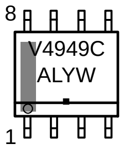
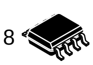
SOIC−8
D SUFFIX
CASE 751−07

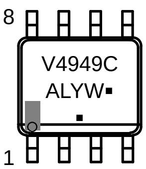




8

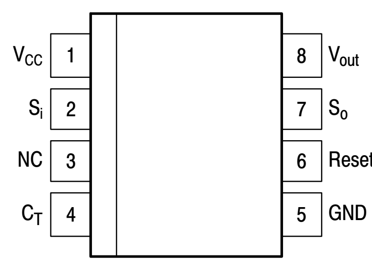
1

SOIC−8 EP
PD SUFFIX
CASE 751AC



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb−Free Device
(Note: Microdot may be in either location)

PIN CONNECTIONS



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

February, 2017 − Rev. 1

Publication Order Number:
NCV4949C/D

PIN FUNCTION DESCRIPTION

SO−8 Pin#	SO−8 EP	Symbol	Description
1	1	V_{CC}	Supply Voltage
2	2	S_i	Input of Sense Comparator
4	4	C_T	Reset Delay Capacitor
5	5	GND	Ground
6	6	Reset	Output of Reset Comparator
7	7	S_O	Output of Sense Comparator
8	8	V_{out}	Main Regulator Output
3	3	NC	No Connect
−	EPAD	EPAD	Connect to Ground potential or leave unconnected

MAXIMUM RATINGS

Rating	Symbol	Min	Max	Unit
DC Operating Supply Voltage	V_{CC}	5.5	40	V
Input to Regulator	V_{CC}	−40	45	V
Transient Supply Voltage (Note 1)	$V_{CC\ TR}$	−	60	V
Output	V_{out} I_{out}	−0.5 −10	20 Internally Limited	V mA
Sense Input	V_{SI} I_{SI}	−40 −1.0	45 1.0	V mA
Sense Output	V_{SO} I_{SO}	−0.3 −5.0	7.0 5.0	V mA
Reset Output	V_{Reset} I_{Reset}	−0.3 −5.0	7.0 5.0	V mA
Reset Delay	V_{CT} I_{CT}	−0.3 Internally Limited	7.0 Internally Limited	V mA
ESD Protection at any pin — Human Body Model Machine Model	−	− −	4000 400	V
Operating Junction Temperature Range	T_J	−40	+150	°C
Storage Temperature Range	T_{STG}	−50	+150	°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. Load Dump Test B (with centralized load dump suppression) according to ISO16750-2 standard. Guaranteed by design. Not tested in production. Passed Class C according to ISO16750-1.

THERMAL CHARACTERISTICS

Characteristic		Test Conditions (Typical Values)			Unit
		Note 2	Note 3	Note 4	
SOIC−8	Junction−to−Lead (Ψ_{JLx6} θ_{JL6}) Junction−to−Ambient ($R_{\theta JA}$, θ_{JA})	65.6 169.4	62 147.6	61 127.2	°C/W
SOIC−8 EP	Junction−to−Lead (Ψ_{JL6}, θ_{JL6}) Junction−to−Ambient ($R_{\theta JA}$, θ_{JA})	36.1 109.2	32.1 91.1	27.4 71.9	°C/W

2. 1 oz. Copper, 100 mm sq. Copper area, 1.5 mm thick FR−4.
3. 1 oz. Copper, 200 mm sq. Copper area, 1.5 mm thick FR−4.
4. 1 oz. Copper, 500 mm sq. Copper area, 1.5 mm thick FR−4.

LEAD TEMPERATURE SOLDERING REFLOW (Note 5)

Rating	Symbol	Min	Max	Unit
Reflow (SMD styles only) lead free 60 − 150 sec above 217, 40 sec max at peak	Tsld	−	260	°C
Moisture Sensitivity Level (SOIC−8)	MSL	Level 1		
Moisture Sensitivity Level (SOIC−8EP)	MSL	Level 2		

5. Per IPC / JEDEC J−STD−020C.

ELECTRICAL CHARACTERISTICS (V_{CC} = 14 V, −40°C < T_J < 150°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = 25°C, I_{out} = 1.0 mA)	V_{out}	4.95	5.0	5.05	V
Output Voltage (6.0 V < V_{CC} < 28 V, 1.0 mA < I_{out} < 50 mA)	V_{out}	4.9	5.0	5.1	V
Output Voltage (V_{CC} = 35 V, t < 1.0 s, 1.0 mA < I_{out} < 50 mA)	V_{out}	4.9	5.0	5.1	V
Dropout Voltage	V_{drop}				V
I_{out} = 10 mA		–	0.08	0.25	
I_{out} = 50 mA		–	0.18	0.40	
I_{out} = 100 mA		–	0.22	0.50	
Input to Output Voltage Difference in Undervoltage Condition (V_{CC} = 4.0 V, I_{out} = 35 mA)	V_{IO}	–	0.12	0.4	V
Line Regulation (6.0 V < V_{CC} < 28 V, I_{out} = 1.0 mA)	Reg_{line}	–	1.0	20	mV
Load Regulation (1.0 mA < I_{out} < 100 mA)	Reg_{load}	–	1.0	30	mV
Current Limit	I_{Lim}				mA
V_{out} = 4.5 V		105	320	400	
V_{out} = 0 V		–	220	–	
Quiescent Current (I_{out} = 0.3 mA, T_J < 100°C)	I_{QSE}	–	120	260	μA
Quiescent Current (I_{out} = 100 mA)	I_Q	–	–	5.0	mA

RESET

Characteristic	Symbol	Min	Typ	Max	Unit
Reset Threshold Voltage	V_{Resth}	–	4.5	–	V
Reset Threshold Hysteresis	$V_{Resth,hys}$				mV
@ T_J = 25°C		50	100	200	
@ T_J = −40 to +125°C		50	–	300	
Reset Pulse Delay (C_T = 100 nF, t_R ≥ 100 μs)	t_{ResD}	55	100	180	ms
Reset Reaction Time (C_T = 100 nF)	t_{ResR}	–	5.0	30	μs
Reset Output Low Voltage (R_{Reset} = 10 kΩ to V_{out}, V_{CC} ≥ 3.0 V)	V_{ResL}	–	–	0.3	V
Reset Output High Leakage Current (V_{Reset} = 5.0 V)	I_{ResH}	–	–	1.0	μA
Delay Comparator Threshold	V_{CTth}	–	2.0	–	V
Delay Comparator Threshold Hysteresis	$V_{CTth, hys}$	–	100	–	mV

SENSE

Characteristic	Symbol	Min	Typ	Max	Unit
Sense Low Threshold (V_{SI} Decreasing = 1.5 V to 1.0 V)	V_{SOth}	1.16	1.25	1.35	V
Sense Threshold Hysteresis	$V_{SOth,hys}$	20	100	200	mV
Sense Output Low Voltage (V_{SI} ≤ 1.16 V, V_{CC} ≥ 3.0 V, R_{SO} = 10 kΩ to V_{out})	V_{SOL}	–	–	0.4	V
Sense Output Leakage (V_{SO} = 5.0 V, V_{SI} ≥ 1.5 V)	I_{SOH}	–	–	1.0	μA
Sense Input Current	I_{SI}	−1.0	0.1	1.0	μA

THERMAL SHUTDOWN

Characteristic	Symbol	Min	Typ	Max	Unit
Thermal Shutdown Temperature (I_{out} = 1 mA) (Note 6)	T_{SD}	150	–	200	°C

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

6. Values based on design and/or characterization.

TYPICAL CHARACTERISTICS

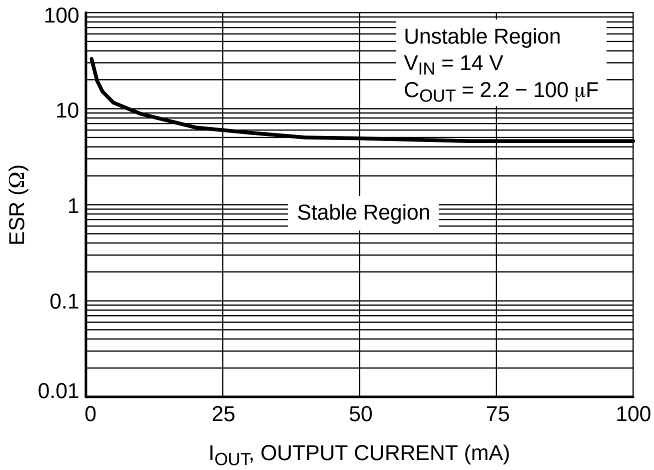


Figure 2. ESR Stability Border vs. Output Current

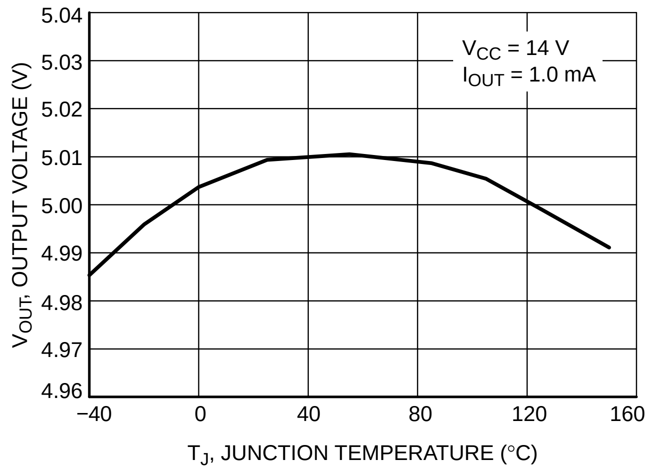


Figure 3. Output Voltage vs. Junction Temperature

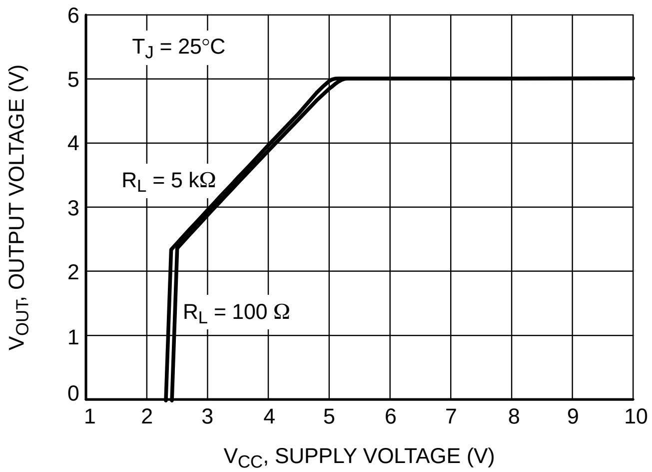


Figure 4. Output Voltage vs. Supply Voltage

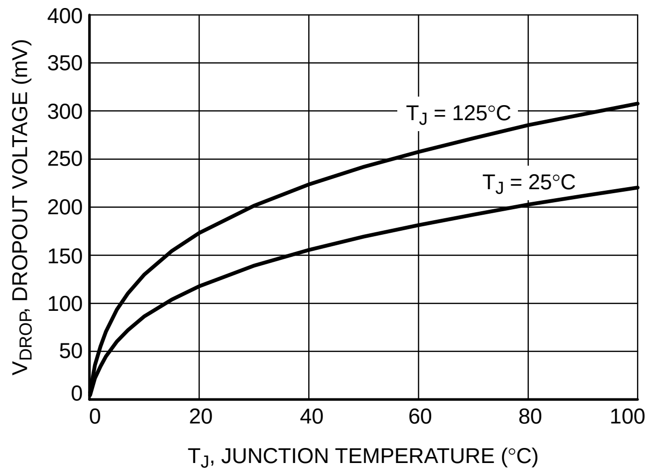


Figure 5. Dropout Voltage vs. Output Current

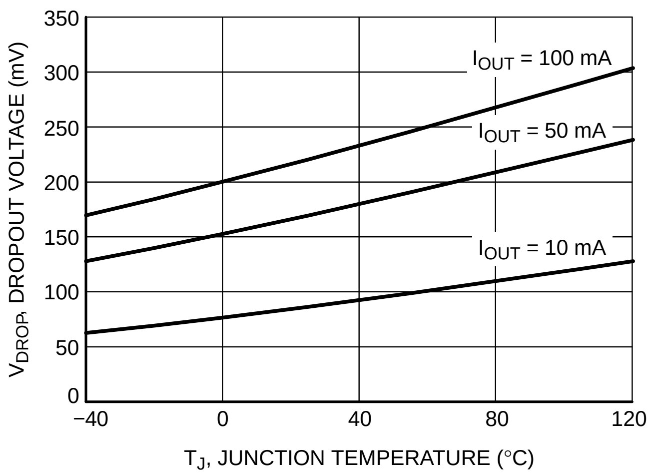


Figure 6. Dropout Voltage vs. Junction Temperature

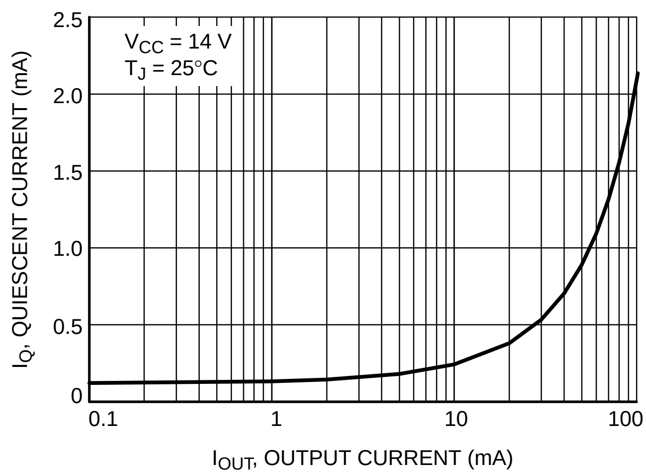


Figure 7. Quiescent Current vs. Output Current

TYPICAL CHARACTERISTICS

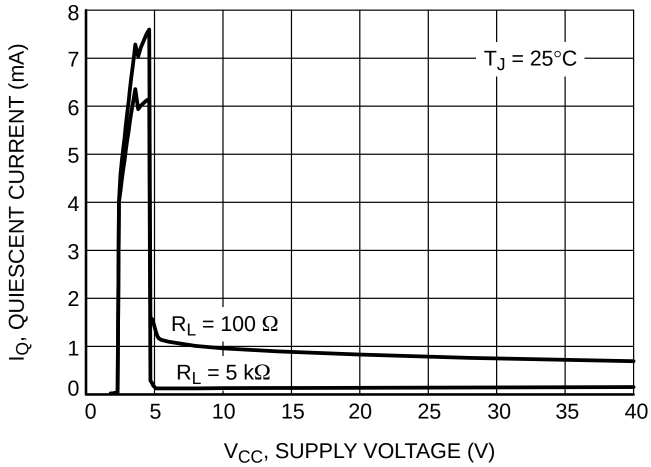


Figure 8. Quiescent Current vs. Supply Voltage

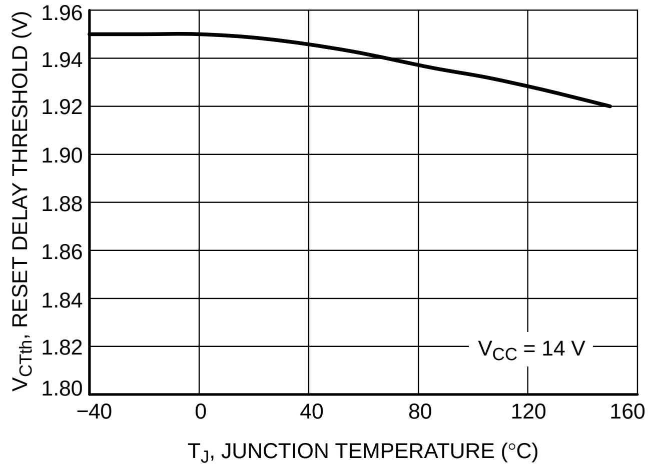


Figure 9. Reset Delay Threshold vs. Junction Temperature

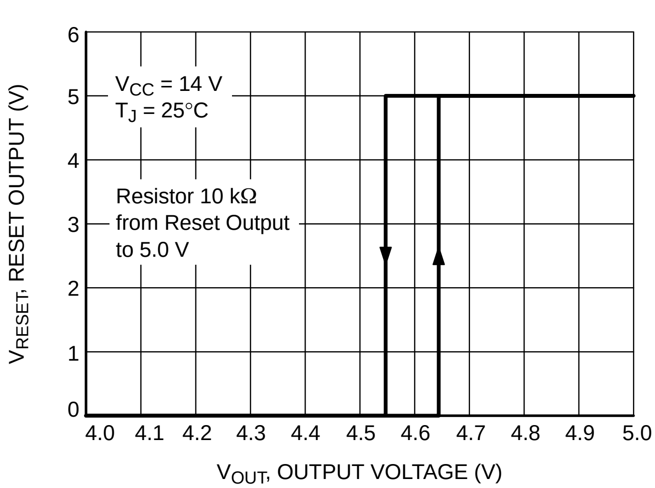


Figure 10. Reset Output vs. Regulator Output Voltage

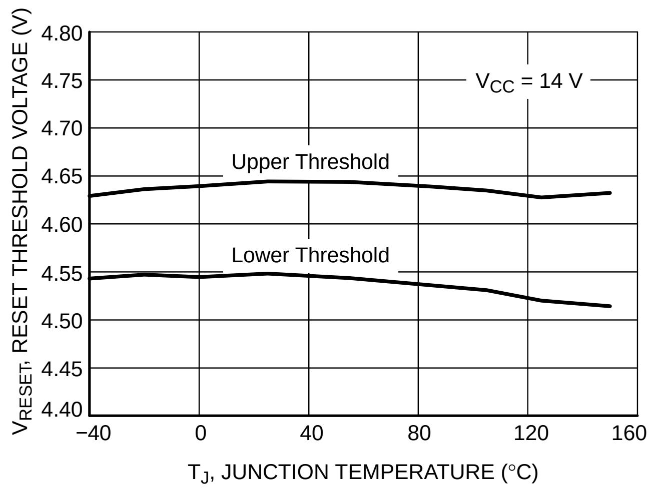


Figure 11. Reset Thresholds vs. Junction Temperature

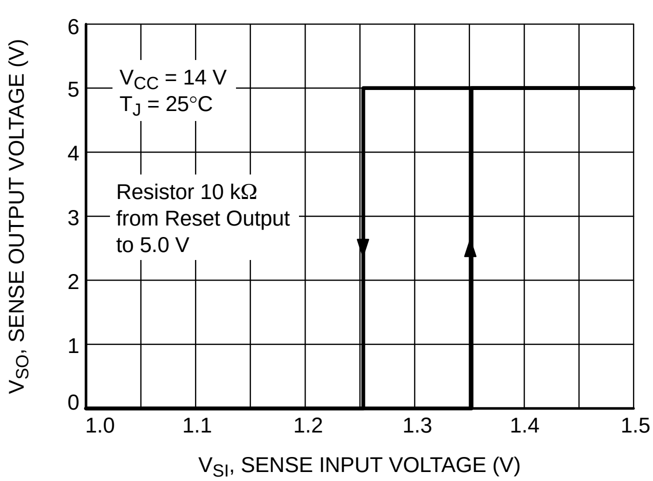


Figure 12. Sense Output vs. Sense Input Voltage

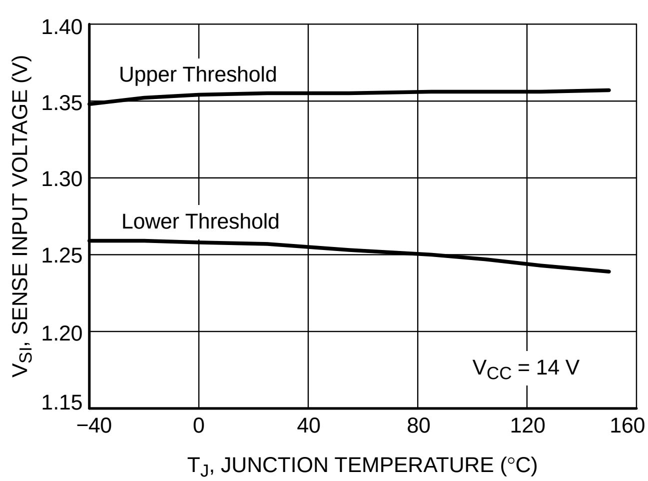
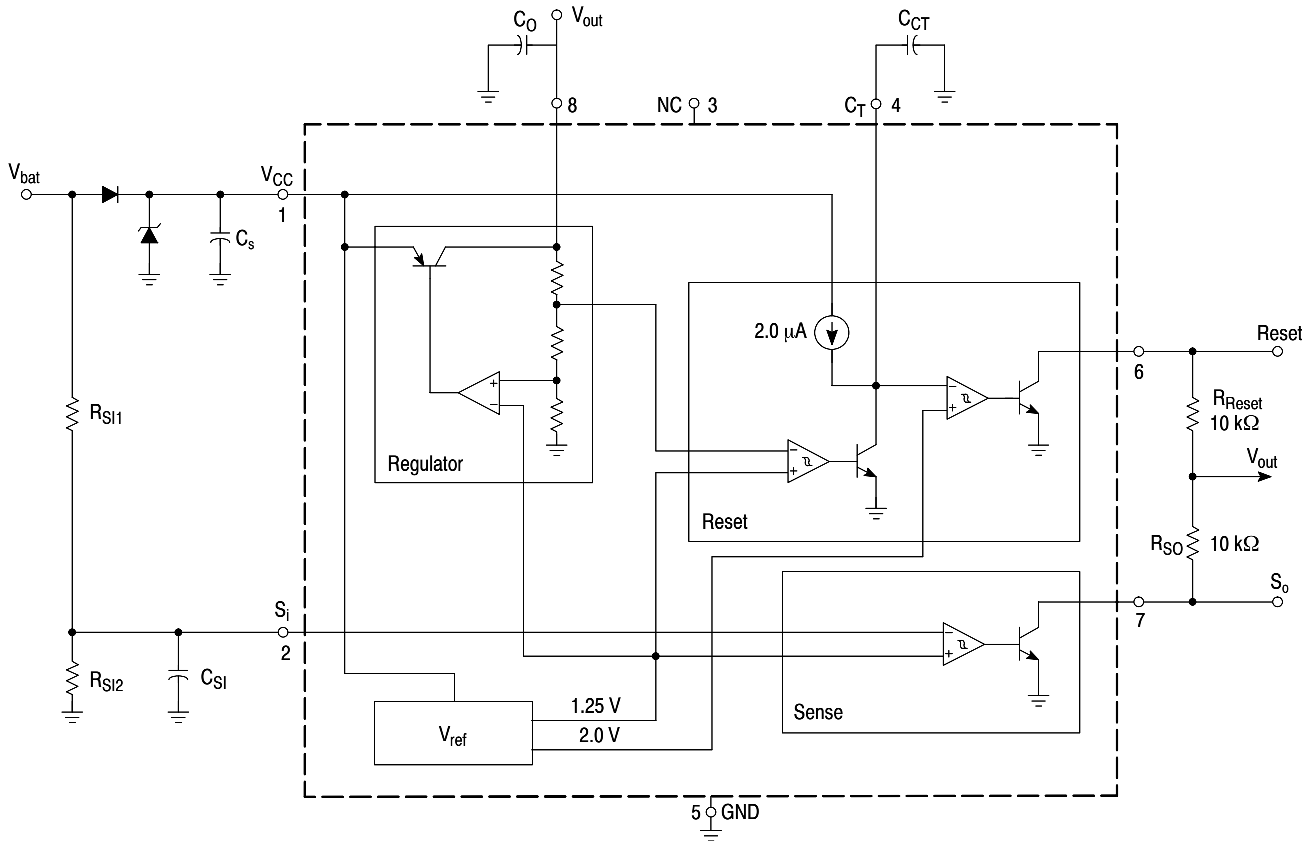


Figure 13. Sense Thresholds vs. Junction Temperature

APPLICATION INFORMATION



NOTE: 1. For good dynamic performance: $C_S \geq 1.0\ \mu F$, $C_O \geq 4.7\ \mu F$, ESR < 4.5 Ω at 10 kHz

Figure 14. Application Schematic

OPERATING DESCRIPTION

The NCV4949C is a monolithic integrated low dropout voltage regulator. Several outstanding features and auxiliary functions are implemented to meet the requirements of supplying microprocessor systems in automotive applications. It is also suitable in other applications where the included functions are required. The modular approach of this device allows the use of other features and functions independently when required.

Voltage Regulator

The voltage regulator uses a lateral PNP transistor as a regulating element. With this structure, very low dropout voltage at currents up to 100 mA is obtained. The dropout operation of the standby regulator is maintained typically down to 2.5 V input supply voltage.

A typical curve showing the standby output voltage as a function of the input supply voltage is shown in Figure 16.

The current consumption of the device (quiescent current) is less than 200 μA.

To reduce the quiescent current peak in the undervoltage region and to improve the transient response in this region, the dropout voltage is controlled. The quiescent current as a function of the supply input voltage is shown in Figure 17.

Short Circuit Protection:

The maximum output current is internally limited. In case of short circuit, the output current is foldback current limited as described in Figure 15.

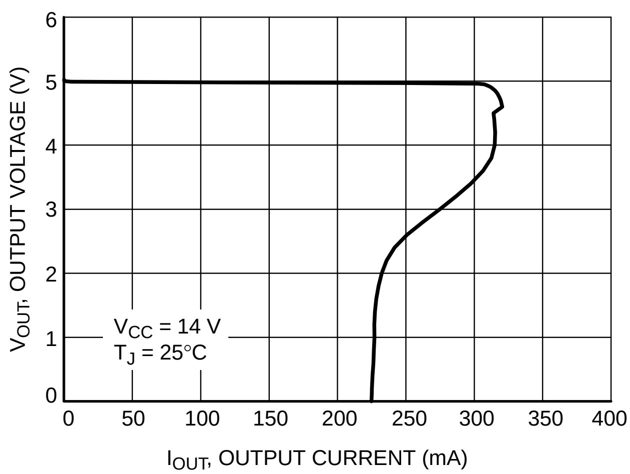


Figure 15. Foldback Characteristic of V_{out}

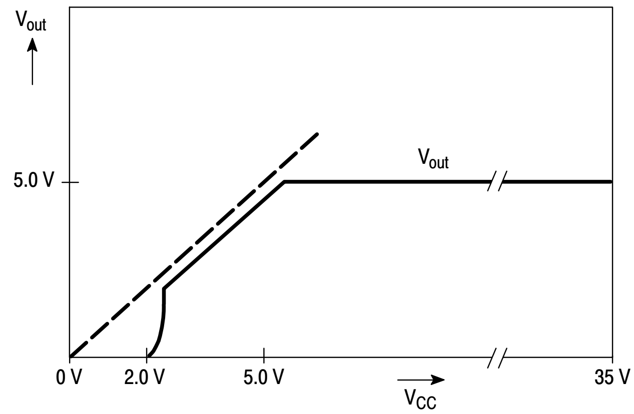


Figure 16. Output Voltage vs. Supply Voltage

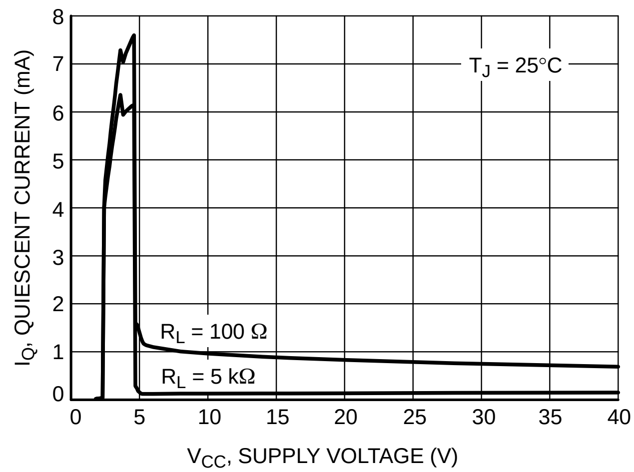


Figure 17. Quiescent Current vs. Supply Voltage

Reset Circuit

The block circuit diagram of the reset circuit is shown in Figure 18.

The reset circuit supervises the output voltage. The reset threshold of 4.5 V is defined by the internal reference voltage and standby output divider.

The reset pulse delay time t_{RD}, is defined by the charge time of an external capacitor C_T:

$$t_{RD} = \frac{C_T \times 2.0\ V}{2.0\ \mu A}$$

The reaction time of the reset circuit originates from the discharge time limitation of the reset capacitor C_T and is proportional to the value of C_T. The reaction time of the reset circuit increases the noise immunity.

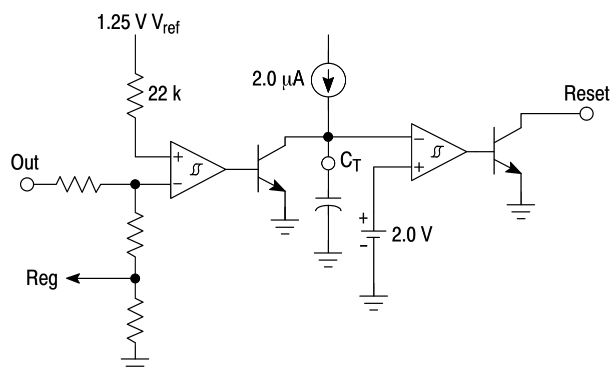


Figure 18. Reset Circuit

Output voltage drops below the reset threshold only marginally longer than the reaction time results in a shorter reset delay time.

The nominal reset delay time will be generated for output voltage drops longer than approximately 50 µs. The typical reset output waveforms are shown in Figure 19.

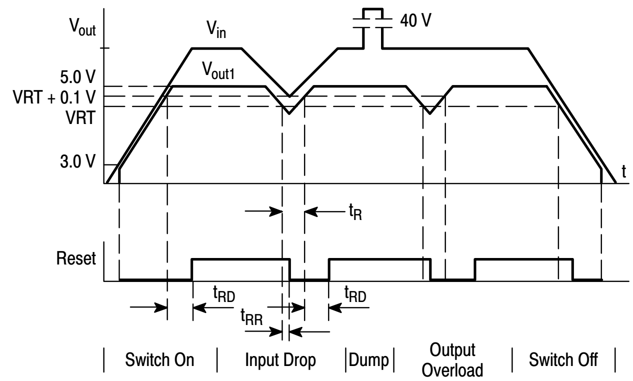


Figure 19. Typical Reset Output Waveforms

Sense Comparator

The sense comparator compares an input signal with an internal voltage reference of typical 1.25 V. The use of an external voltage divider makes this comparator very flexible in the application.

It can be used to supervise the input voltage either before or after a protection diode and to provide additional information to the microprocessor such as low voltage warnings.

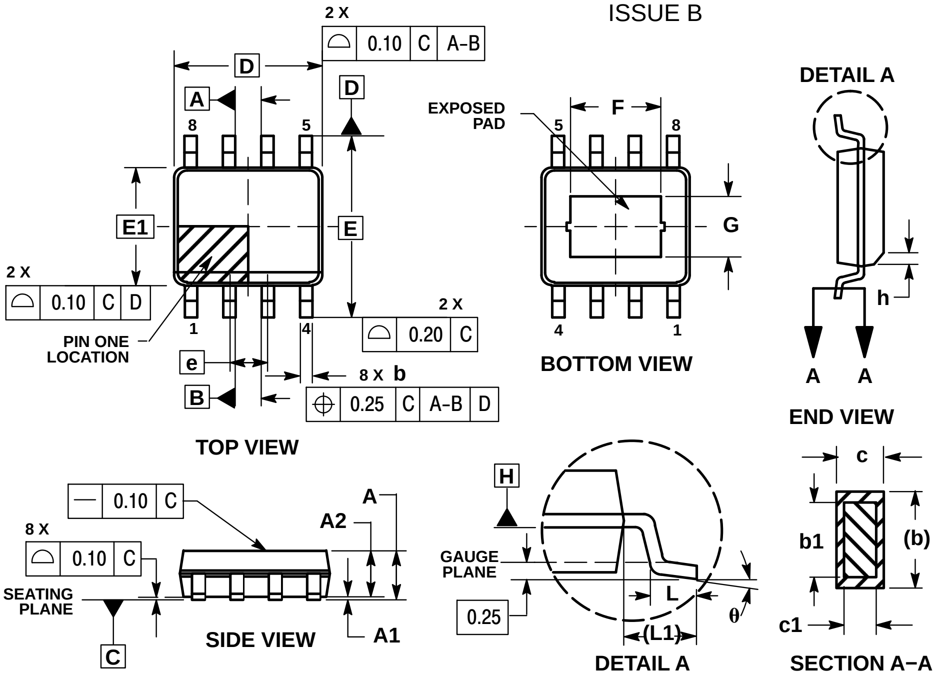
ORDERING INFORMATION

Device	Package	Shipping†
NCV4949CDR2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
NCV4949CPDR2G	SOIC−8 EP (Pb−Free)	2500 / Tape & Reel

†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.

PACKAGE DIMENSIONS

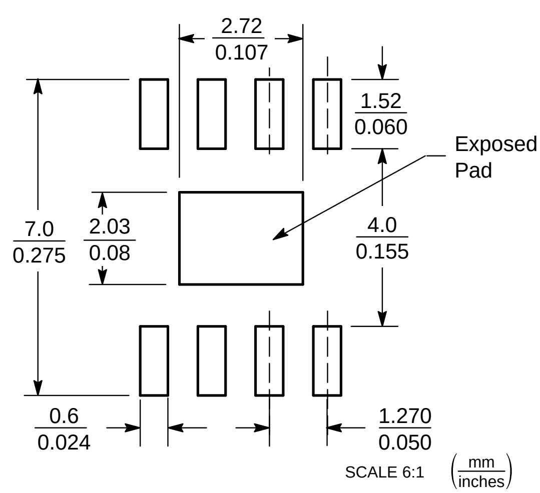
SOIC−8 EP
CASE 751AC
ISSUE B



NOTES:
1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS IN MILLIMETERS (ANGLES IN DEGREES).
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 MM TOTAL IN EXCESS OF THE “b” DIMENSION AT MAXIMUM MATERIAL CONDITION.
4. DATUMS A AND B TO BE DETERMINED AT DATUM PLANE H.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.00	0.10
A2	1.35	1.65
b	0.31	0.51
b1	0.28	0.48
c	0.17	0.25
c1	0.17	0.23
D	4.90 BSC	
E	6.00 BSC	
E1	3.90 BSC	
e	1.27 BSC	
L	0.40	1.27
L1	1.04 REF	
F	2.24	3.20
G	1.55	2.51
h	0.25	0.50
θ	0 °	8 °

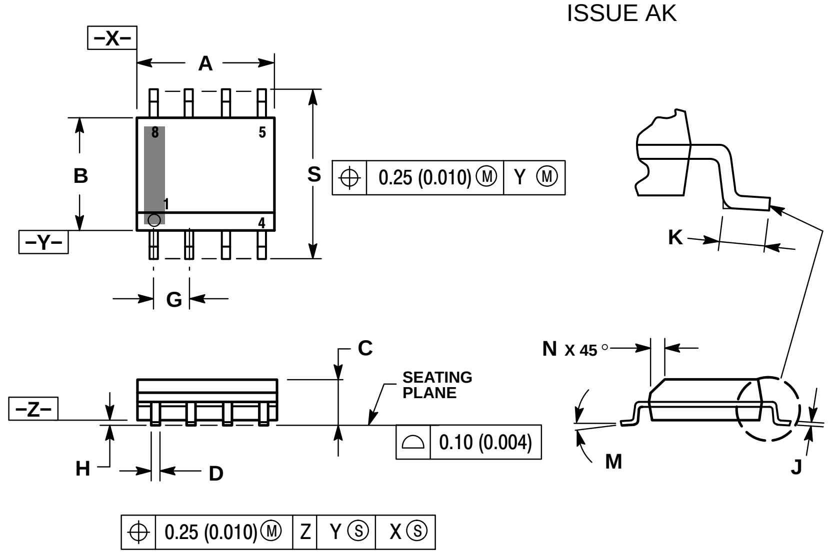
SOLDERING FOOTPRINT*



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

PACKAGE DIMENSIONS

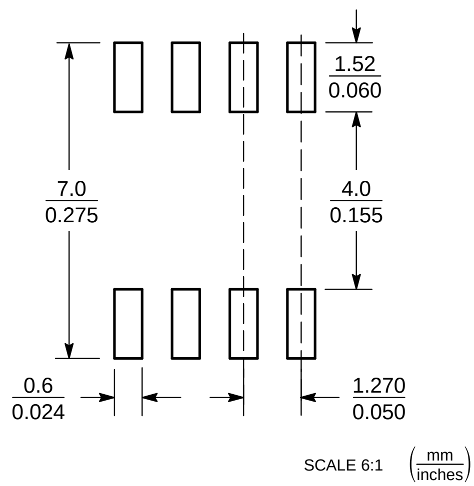
SOIC−8 NB
CASE 751−07
ISSUE AK



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.

	MILLIMETERS		INCHES	
DIM	**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

SOLDERING FOOTPRINT*



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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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Japan Customer Focus Center
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ON Semiconductor Website: **www.onsemi.com**

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For additional information, please contact your local Sales Representative