NEX52041

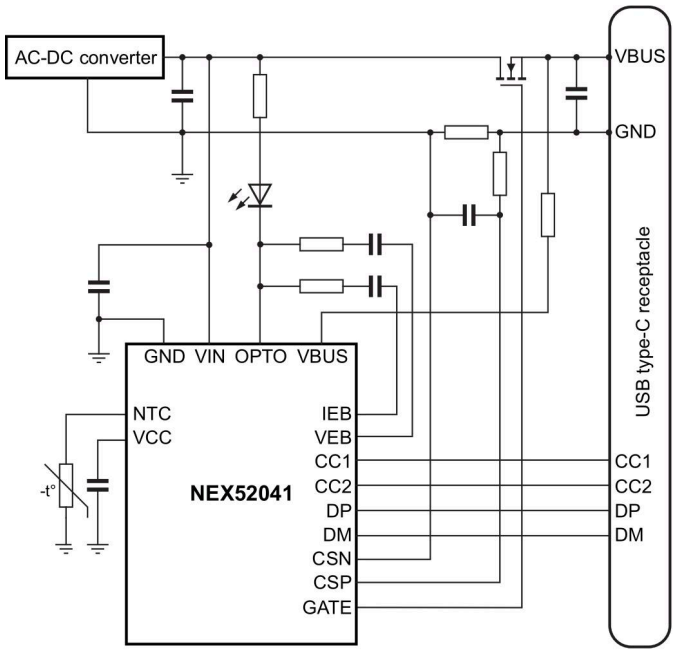
USB Type-C and Power Delivery controller

Rev. 1.1 — 19 March 2025 **Product data sheet**

1. General description

The NEX52041 is a USB Type-C and Power Delivery (PD) controller with support to multiple DP/DM based fast charging protocols. It is designed for the power source application supporting Type-C CC detection, PD communication with cables and PD devices, as well as DP/DM power contract negotiation with flash charging supported mobile devices.

It is designed with Constant-Voltage (CV), Constant-Current (CC) control loop to support applications with optocoupler and to work with different DC/DC or AC/DC converters.



aaa-042350

Table 1. Device information

Part number	Package	Body size (nominal)
NEX5204100BV	HWQFN16	4.0 mm x 4.0 mm
NEX5204100BY	HWQFN24	4.0 mm x 4.0 mm

2. Features and benefits

- USB Type-C Power Delivery (PD) controller
  - Programmable Type-C default, 1.5 A, 3 A source capability advertisement
  - USB PD3.1 SPR with PPS
  - Integrated VCONN power supply and switch
  - SOP' communication support for E-Marker
  - USB-IF certified for PD 3.1. (TID 12567)
- Mobile charging protocols support
  - BC1.2 DCP and legacy charging protocols
  - Proprietary charging protocols
- Wide operation ranges from 3.3 V to 23 V
- CC1 and CC2 pins with 25 V tolerance to stand against short-to-VBUS
- Programmable GPIOs
- I²C interface
- Integrate N-MOSFET gate drive
- Programmable cable compensation for VBUS
- Built-in VIN and VBUS discharge (GPIO configurable to drive external discharge low-side MOSFET)
- Low power mode support
- Programmable fault protection and threshold
  - OVP and UVP
  - OVP for CC pins and DP/DM pins
  - Programmable VBUS output OCP
  - OTP
- Multi-IC communication for smart power distribution in multi-port applications
- Embedded MCU with 16 kB MTP-ROM

3. Applications

- Power adapters
- Wall adapters
- Power storage

4. Ordering information

Table 2. Ordering information

Type number	Package			
	Temperature range (T_J)	Name	Description	Version
NEX5204100BV	-40 °C to +150 °C	HWQFN16	plastic thermal enhanced very very thin quad flat package; no leads; 16 terminals; 0.65 mm pitch; 4 x 4 x 0.75 mm body	SOT8109-1
NEX5204100BY	-40 °C to +150 °C	HWQFN24	plastic thermal enhanced package; no leads; 24 terminals; 0.5 mm pitch, 4.00 × 4.00 × 0.75 mm body	SOT8041-2

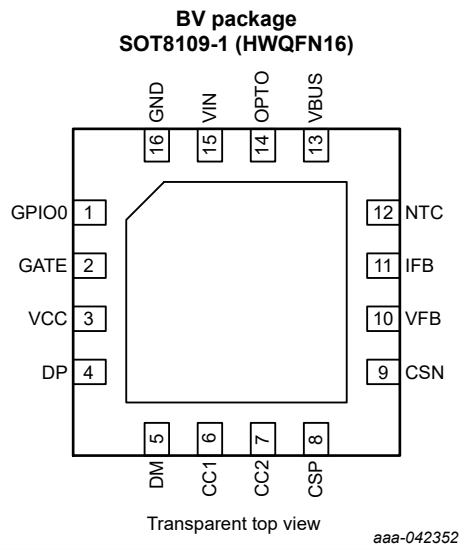
5. Marking

Table 3. Marking code

Type number	Marking code
NEX5204100BV	NEX52041
NEX5204100BY	NEX52041

6. Pin configuration and description

6.1. Pin configuration

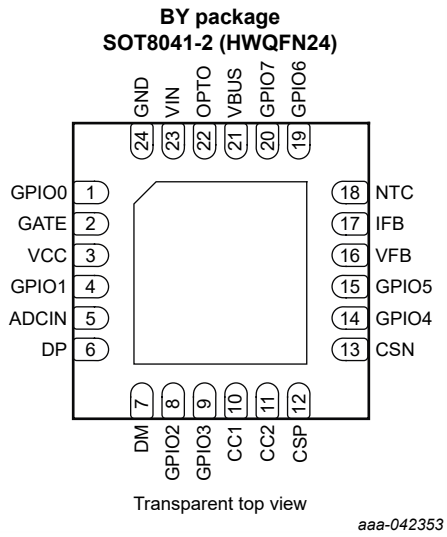


The thermal pad must be connected to the ground (GND) of the device

Fig. 1. NEX5204100BV (SOT8109-1/HWQFN16) pin diagram

Table 4. NEX5204100BV (SOT8109-1/HWQFN16) pin description

Symbol	Pin	I/O	Description
GPIO0	1	digital input/output analog input	GPIO0 pin, could work as configurable GPIO, open-drain output only, can also be configured as ADC
GATE	2	analog output	N-channel MOSFET gate drive
VCC	3	PWR	internal 3.5 V LDO regulator output pin, connect to 1 µF capacitor to GND
DP	4	-	USB DP channel
DM	5	-	USB DM channel
CC1	6	-	type-C configuration channel 1 (CC1)
CC2	7	-	type-C configuration channel 2 (CC2)
CSP	8	analog input	current sense amplifier positive input
CSN	9	analog input	current sense amplifier negative input
VFB	10	analog input	voltage feedback pin for the compensation
IFB	11	analog input	current feedback pin for the compensation
NTC	12	analog input	connect NTC thermistor to this pin. The pin has internal pull-up current source
VBUS	13	-	VBUS sensing and discharging pin
OPTO	14	-	current sink of voltage/current regulation for optocoupler
VIN	15	PWR	power source of the IC
GND	16	PWR	ground, connect this pin close to the GND terminal of the input and output capacitors
PowerPad	-	PWR	thermal pad and ground of the device



The thermal pad must be connected to the ground (GND) of the device

Fig. 2. NEX5204100BY (SOT8041-2/HWQFN24) pin diagram

Table 5. NEX5204100BY (SOT8041-2/HWQFN24) pin description

Symbol	Pin	I/O	Description
GPIO0	1	digital input/output analog input	GPIO0 pin, open-drain output only, can also be configured as ADC
GATE	2	analog output	N-channel MOSFET gate drive
VCC	3	PWR	internal LDO regulator output pin, connect to 1 µF capacitor to GND
GPIO1	4	digital input/output	GPIO1, open-drain output only
ADCIN	5	analog input	ADC input pin reserved for external voltage sensing
DP	6	-	USB DP channel
DM	7	-	USB DM channel
GPIO2	8	digital input/output	GPIO2 pin, open-drain output only
GPIO3	9	digital input/output	GPIO3 pin, open-drain output only
CC1	10	-	type-C configuration channel 1 (CC1)
CC2	11	-	type-C configuration channel 2 (CC2)
CSP	12	analog input	current sense amplifier positive input
CSN	13	analog input	current sense amplifier negative input
GPIO4	14	digital input/output	GPIO4, open-drain output only
GPIO5	15	digital input/output	GPIO5, open-drain output only
VFB	16	analog input	voltage feedback pin for the compensation
IFB	17	analog input	current feedback pin for the compensation
NTC	18	analog input	connect NTC thermistor to this pin. The pin has internal pull-up current source
GPIO6	19	digital input/output analog input	GPIO6 pin, open-drain output only, can also be configured as ADC
GPIO7	20	digital input/output	GPIO7, open-drain output only
VBUS	21	-	VBUS sensing and discharging pin
OPTO	22	-	current sink of voltage/current regulation for optocoupler
VIN	23	PWR	power source of the IC
GND	24	PWR	ground, connect this pin close to the GND terminal of the input and output capacitors
PowerPad	-	PWR	thermal pad and ground of the device

7. Limiting values

Table 6. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).[1]

Symbol	Parameter	Conditions	Min	Max	Unit
V_{PIN}	pin voltage	pins VIN, VBUS, OPTO	-0.3	30	V
		pins CC1, CC2, GPIO0, IFB, NTC	-0.3	25	V
		GATE to VIN	-	10	V
		pins VCC, GPIO1-7, CSP, CSN, VFB, DP, DM, ADCIN	-0.3	7	V
T_J	junction temperature		-40	125	°C

[1] Stresses beyond those conditions under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

8. ESD ratings

Table 7. ESD ratings

Symbol	Parameter	Conditions	Value	Unit
V_{ESD}	electrostatic discharge voltage	Human-Body Model (HBM), per ANSI/ESDA/JEDEC JS-001	±2000	V
		Charged-Device Model (CDM), per JEDEC specification JESD22-C101	±500	V

9. Recommended operating conditions

Table 8. Recommended operating conditions

Typical values correspond to T_J = 25 °C. Minimum and maximum limits apply over -40 °C to 125 °C junction temperature range unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{VIN}	supply voltage V_{IN}		3.3	-	23	V
T_{amb}	ambient temperature		-40	-	85	°C
T_J	junction temperature		-40	-	125	°C

10. Thermal information

Table 9. Thermal information

Thermal resistance according to JEDEC51-5 and -7.

Symbol	Parameter	HWQFN16 SOT8109-1	HWQFN24 SOT8041-2	Unit
$R_{\theta JA}$	junction to ambient thermal resistance	47	46	°C/W
$R_{\theta JC(top)}$	junction to case(top) thermal resistance	22	23	°C/W

11. Electrical characteristics

Power supply and regulation characteristics

Table 10. Power supply and regulation characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
VIN supply parameters						
VIN	VIN power supply range		3.3	-	23	V
VIN_{UVLO_R}	IC power on reset threshold	VIN rising	-	3.1	-	V
VIN_{UVLO_F}	IC under voltage lock-out threshold	VIN falling	-	2.85	-	V
VCC_{LDO_OUT}	internal LDO output on VCC pin	For VIN = 3.6 V to 23 V	-	3.5	-	V
I_{active}	device connected, block active	CCx is attached with an R_d	-	4	-	mA
I_{sleep}	device connected, enter sleep mode	CCx is attached with an R_d, VIN = 20 V	-	800	-	µA
		CCx is unattached, VIN = 20 V	-	200	-	µA
VIN_{OVP}	programmable rising threshold to trigger VIN OVP		-	+10	-	%
			-	+15	-	%
			-	+20	-	%
			-	+25	-	%
I_{load_DCHG}	programmable load discharge current		-	50	-	mA
			-	100	-	mA
			-	140	-	mA
			-	170	-	mA
I_{VBUS_DCHG}	VBUS discharge current		-	20	-	mA
CC and CV regulation parameters						
V_{acc_5V}	5 V output by default		4.75	5.0	5.5	V
N_{acc_V}	output voltage control accuracy	T_{amb} = 25 °C	-1	-	+1	%
N_{acc_V}	output voltage control accuracy	T_J = -40 °C to 125 °C	-3	-	+3	%
$R_{\_CS}$	current sensing resistor		-	5		mΩ
N_{acc_C}	output current control accuracy	I_{output} < 3 A	-0.15	-	+0.15	A
N_{acc_C}	output current control accuracy	I_{output} ≥ 3 A	-3	-	+3	%
$I_{\_OCP}$	over current protection tripping point	configured to 3 A	-	3.2	-	A
$I_{\_SCP}$	short-circuit protection tripping point	configured to 12 A	-	12	-	A

[1] All typical values are measured at T_J = 25 °C.

Gate driver characteristics

Table 11. Gate driver characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
N-MOSFET gate driver parameters						
V_{GATE}	output high voltage	VIN ≤ 21 V	VBUS + 4	-	VBUS + 7	V
$I_{\_GATE\_DCHG}$	gate discharge current		-	20	-	mA

[1] All typical values are measured at T_J = 25 °C.

CC detection and PD PHY characteristics

Table 12. CC detection and PD PHY characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
CC1/2 detection parameters (Type C-function)						
$I_{Rp\_default}$	type-C source current at default current		64	80	96	µA
$I_{Rp\_1.5A}$	type-C source current at 1.5 A		166	180	194	µA
I_{Rp_3A}	type-C source current at 3 A		304	330	356	µA
V_{th_Rd}	threshold for internal circuit to start CC recognition for R_d when configured to default or 1.5 A type-C source current		1.45	1.6	1.75	V
	threshold for internal circuit to start CC recognition for R_d when configured to 3 A type-C source current		2.45	2.6	2.75	V
V_{th_Ra}	threshold for internal circuit to start CC recognition for R_d when configured to default type-C source current		0.15	0.2	0.25	V
	threshold for internal circuit to start CC recognition for R_d when configured to 1.5 A Type-C source current		0.35	0.4	0.45	V
	threshold for internal circuit to start CC recognition for R_d when configured to 3 A type-C source current		0.75	0.8	0.85	V
CC-V_{CONN} parameters						
V_{CONN_Valid}	VCONN output voltage range		3	5	5.5	V
I_{VCONN}	source current capability on V_{CONN}		20	-	-	mA
BMC Common Parameters						
$f_{BitRate}$	bit rate		270	300	330	Kbps
$t_{UnitInterval}$	bit unit interval	$1/f_{BitRate}$	3.03	3.3	3.7	µs
BMC Transmitter Parameters						
$p_{BitRate}$	maximum difference between the bitrate during the part of the packet following the preamble and the reference bitrate.	the reference bit rate is the average bit rate of the last 32 bits of the Preamble.	-	-	0.25	%

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
$V_{TX\_CC\_H}$	BMC transmitter high voltage	applies to both no load condition and under the load condition specified in CC1/2 Transmitter load mode	1.05	1.125	1.2	V
$V_{TX\_CC\_L}$	BMC transmitter low voltage	applies to both no load condition and under the load condition specified in CC1/2 Transmitter load mode	-75	-	75	mV
t_{BMC_RISE}	BMC (Biphase Mark Coding) rising time	R_{load} = 5.1 kΩ, C_{load} = 1 nF, C_{cc} = 520 pF, 10 % and 90 % amplitude points, minimum is under an unloaded condition. (10 % and 90 % amplitude points, minimum is under an unloaded condition of CC1/2)	300	-	-	ns
t_{BMC_FALL}	BMC (Biphase Mark Coding) fallingtime		300	-	-	ns
$Z_{BMCDriver}$	transmitter output impedance	during transmission	33	50	75	Ω
BMC Receiver Parameters						
$t_{RxFilter}$	Rx bandwidth limiting filter (digital or analog)		100	-	-	ns
Z_{BMCRx}	receiver input impedance	does not include pull-up or pull-down resistance from cable detect. Transmitter is Hi-Z.	2	-	-	MΩ

[1] All typical values are measured at T_J = 25 °C.

DP/DMdetection PHY characteristics

Table 13. DP/DMdetection PHY characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
Apple divider3 interface parameters						
V_{DAT_2P7V}	DP/DM voltage		-	2.7	-	V
R_{DAT_2P7V}	DP/DM output impedance		-	30	-	kΩ
BC1.2 DP/DM interface parameters						
V_{SEL_REF}	output voltage selection reference		1.8	2	2.2	V
V_{DAT_REF}	data detection reference		0.25	0.325	0.4	V
t_{DBC_H}	DP, DM high debounce time		1.0	-	1.5	s
R_{DCP_DAT}	DP to DM short resistance during DCP mode		-	-	200	Ω
R_{DM_DWN}	DM pull-down resistance		-	15		kΩ
R_{DP_LKG}	DP leakage resistance		500	750	1000	kΩ
R_{DM_LKG}	DM leakage resistance		500	750	1000	kΩ

[1] All typical values are measured at T_J = 25 °C.

ADC characteristics

Table 14. ADC characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
ADC Parameters						
V_{ADC_REF}	ADC reference voltage range		-	2500	-	mV
N_{ADC}	ADC resolution	Min effective bits	-	11	-	bit
R_{sample}	ADC sample rate	Min required sample rate	-	125	-	ksps

[1] All typical values are measured at T_J = 25 °C.

Thermal sensing characteristics

Table 15. Thermal sensing characteristics

Symbol	Parameter	Conditions	T_J = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
Thermal protection						
T_{SD}	thermal shutdown temperature	rising junction temperature	-	150	-	°C
	thermal shutdown hysteresis		-	20	-	°C
I_{NTC_EXT}	external NTC pull-high current		-	20	-	µA

[1] All typical values are measured at T_J = 25 °C.

12. Detailed description

The NEX52041 is a USB Type-C and Power Delivery (PD) controller with support to multiple DP/DM based fast charge protocols. It is designed for the power source application supporting Type-C CC detection, PD communication with cables and PD devices, as well as D+/D- power contract negotiation with flash charging supported mobile devices.

It is designed with Constant-Voltage (CV), Constant-Current (CC) control loop programmable and integrated to minimize external components with support of optocoupler.

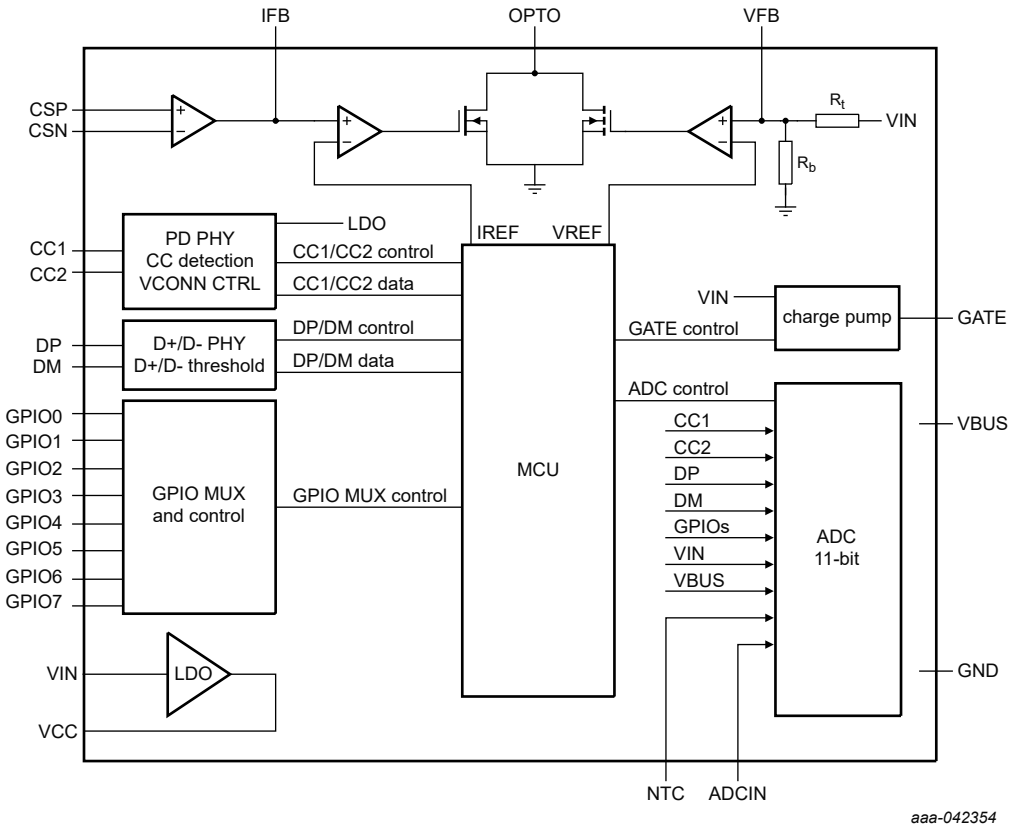


Fig. 3. NEX52041 functional block diagram

12.1. USB Type-C and PD

Features

- Programmable Type-C default, 1.5 A, 3 A source capability advertisement
- USB PD3.1 compliant, SPR with PPS, support up to 7 PDOs
  - Fixed PDO – Source: 5 V/9 V/15 V/20 V at 3 A max, and 20 V at 5 A max
  - APDO: PPS range of 5 V to 11 V, 5 V to 16 V, 5 V to 21 V at 3 A max, and 5 V to 21 V at 5 A max
- VCONN power supply and switch integrated
- SOP' communication support for e-marker

USB-PD physical layer

The pull-high current I_{Rp} on CC pins are configurable to advertise USB Type-C source current with default, 1.5 A, 3 A ratings, as well as to set the DC bias voltage on CC pin during USB-PD communication. It supports to detect R_d pull-low resistor and also R_a for cables that supports the SOP' communications. One of the CC lines with R_d is used to transmit and receive the USB-PD message.

CC1 and CC2 designed to tolerant 25 V voltage that is helpful to stand against a short-to-VBUS fault during connection or disconnection.

12.2. DP/DM interface

DP/DM interface is designed to support BC1.2 DCP mode and other legacy charging protocols.

The NEX52041 also support customized proprietary charging protocols and operations.

12.3. MCU

The NEX52041 is designed with MCU and MTP. It can support customized operation and interruptions.

For multi-port application, the NEX52041 can support “multi-IC” feature, in which two or more NEX52041 can communicate with others through GPIO or I²C to support multi-port power supply system.

12.4. Control loop compensation

The Constant Voltage (CV) loop compensation and Constant Current (CC) loop compensation are implemented. VIN voltage is scaled by a resistor divider to be as the feedback voltage. It is compared with the internal voltage reference to generate an error signal. The CV loop can compensate this error signal. And then the compensated signal is employed to drive the primary side of the optocoupler and control the AC-DC power loop.

12.5. GATE drive and VBUS discharge

NEX52041 implements charge pump to drive external N-MOSFET. Also, the GATE pin has internal discharge circuit in order to fast turn-off the power path when fault states are detected.

The VBUS pin also has internal discharge circuits, it helps to discharge VSAFE5V to VSAFE0 when reset happens. Also, in the case of a 20 V to 5 V or 0 V transition, the discharge circuit helps to decrease the time dissipating the energy on VBUS to settle the voltage efficiently.

12.6. GPIO

NEX52041 contains 8 GPIOs in total and can be configured into different functions. Typically, the GPIO can be configured to support the function of interrupt input, ADC input, or output pin controlled by the FW. The GPIO allowed configurations are summarized in Table 16.

Table 16. GPIO configuration

	INT	ADC	Pull-up	Pull-down	Open-drain output	Direct output	UART
GPIO0					√		
GPIO1					√		
GPIO2	√	√	√	√	√	√	√
GPIO3	√	√	√	√	√	√	√
GPIO4					√		
GPIO5					√		
GPIO6	√	√	√	√	√	√	
GPIO7	√	√	√	√	√	√	

12.7. Protections

NEX52041 implements adjustable OVP function with 4 options.

OCP is also implemented and can be configured through FW. When the OCP occurs, the FW handles the fault state.

The SCP is implemented to deal with short to GND condition.

The NTC pin allows external thermal sensing to trigger over temperature protection.

12.8. Thermal shutdown

The junction temperature (T_J) of the device is monitored by an internal temperature sensor. When T_J exceeds the thermal shutdown temperature T_{SD} of 150 °C, the device enters thermal shutdown. When T_J decreases below the hysteresis amount of typically 20 °C, the device resumes operation.

13. Application implementation

Application diagram

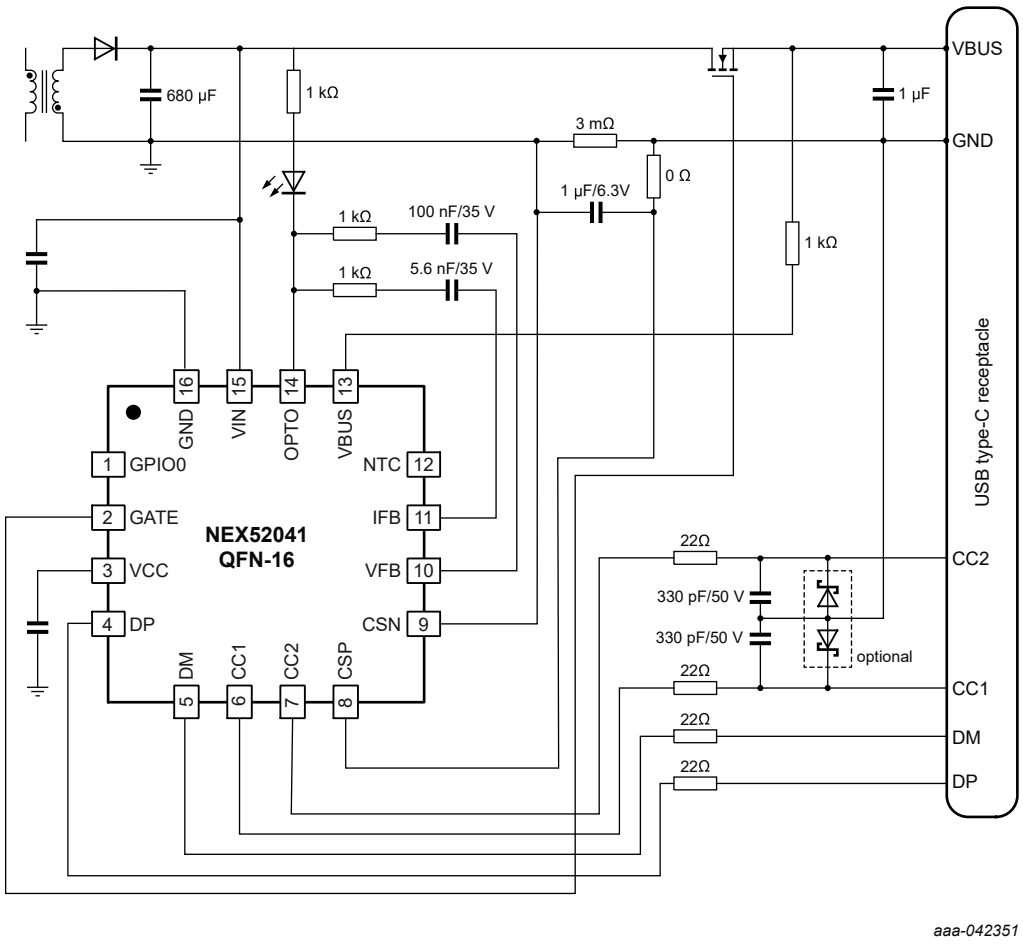
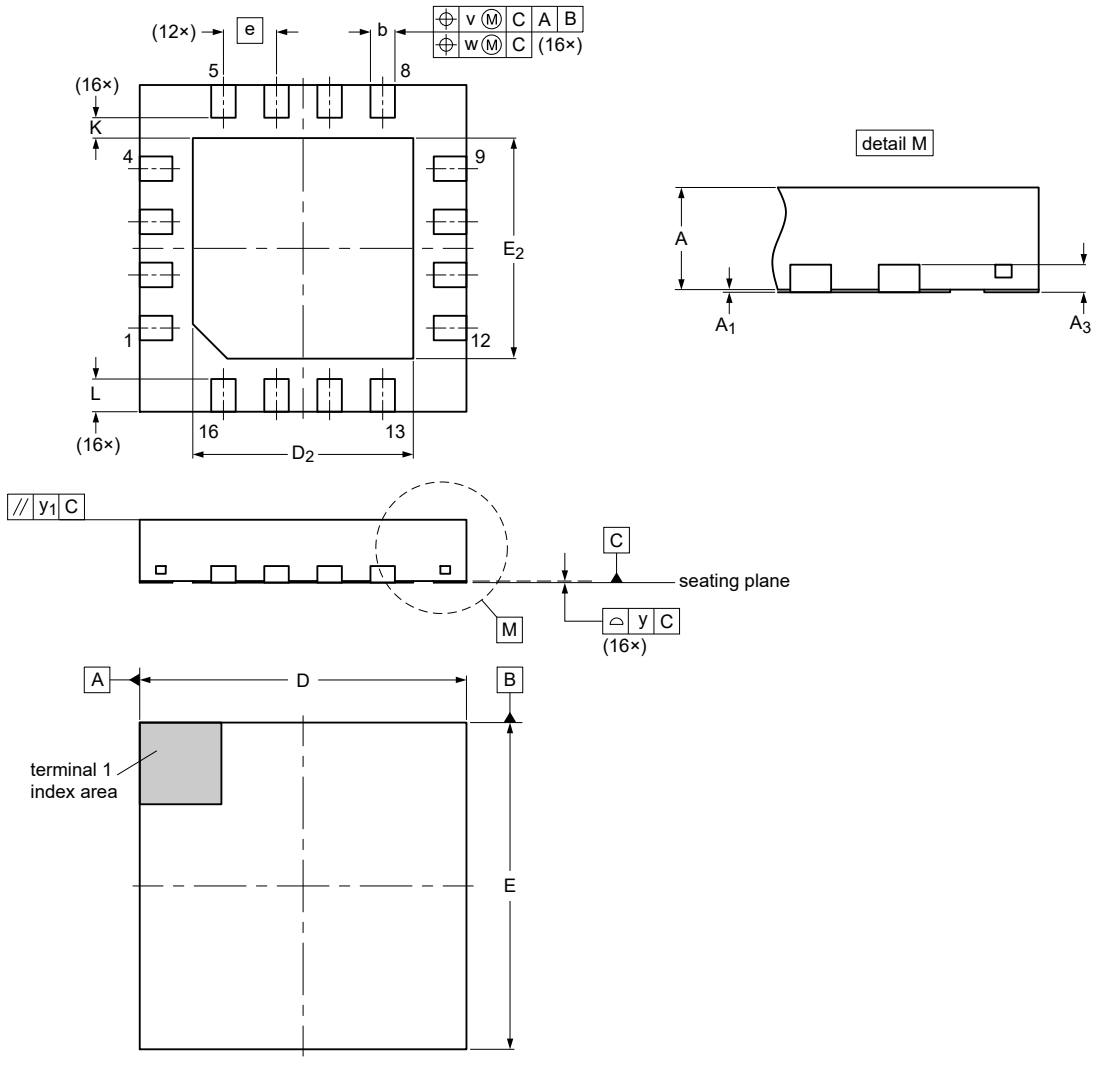


Fig. 4. Typical application block diagram

14. Package outline

**Plastic thermal enhanced very very thin Quad Flat package;
no leads; 16 terminals; 0.65 mm pitch; 4.0 mm x 4.0 mm x 0.75 mm body** **SOT8109-1**



Dimensions (mm are the original dimensions)

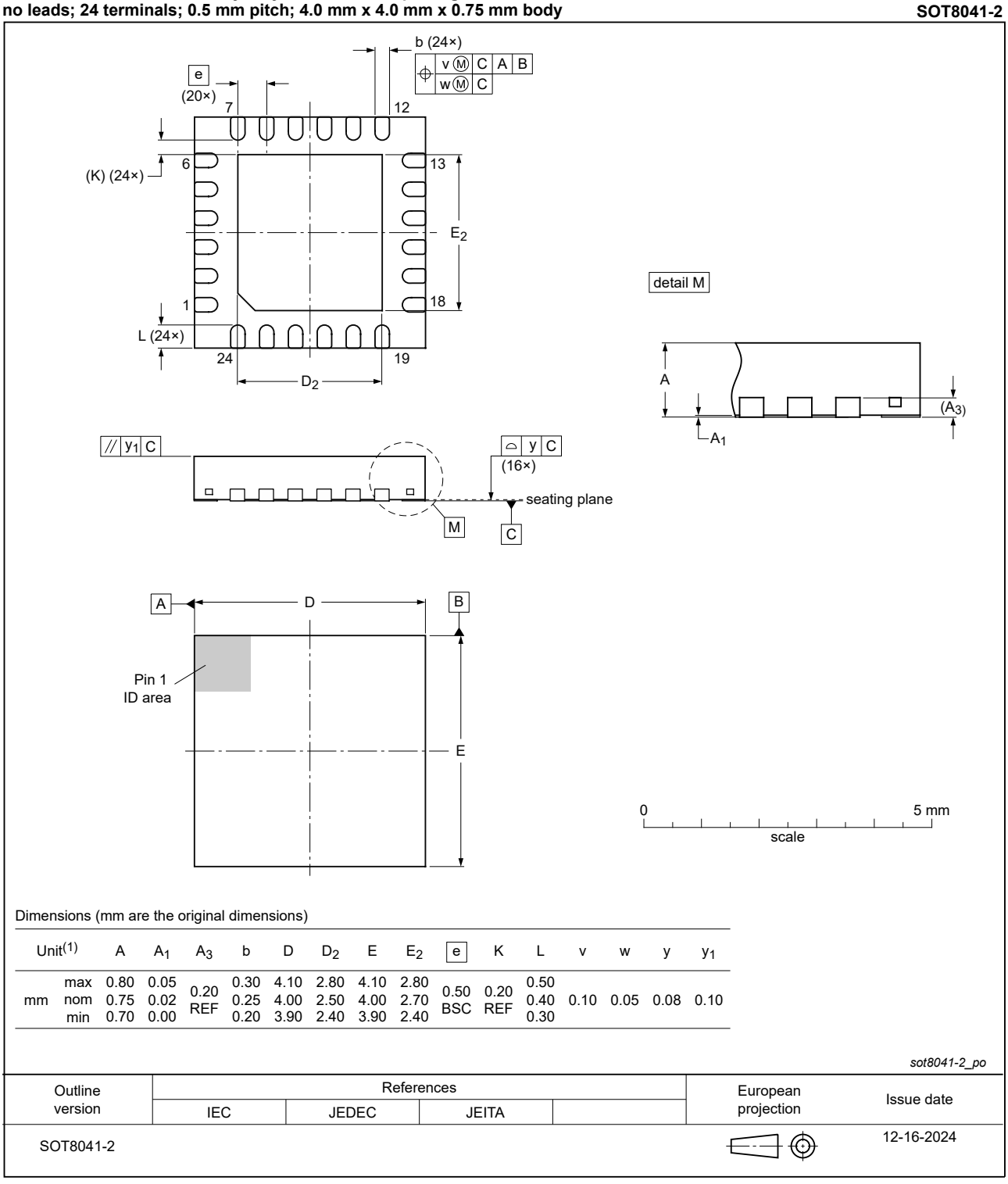
Unit[1]		A	A_1	A_3	b	D	D_2	E	E_2	e	K	L	v	w	y	y_1
mm	max	0.80	0.05	0.20	0.35	4.10	2.80	4.10	2.80	0.65	0.25	0.50	0.10	0.05	0.08	0.10
	nom	0.75	0.02	REF	0.30	4.00	2.70	4.00	2.70	BSC	REF	0.40				
	min	0.70	0.00		0.25	3.90	2.60	3.90	2.60			0.30				

sot8109-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8109-1		MO-220				24-12-18

Fig. 5. Package outline SOT8109-1 (HWQFN16)

Plastic thermal enhanced very very thin Quad Flat package, no leads; 24 terminals; 0.5 mm pitch; 4.0 mm x 4.0 mm x 0.75 mm body **SOT8041-2**



Dimensions (mm are the original dimensions)

Unit[1]		A	A_1	A_3	b	D	D_2	E	E_2	e	K	L	v	w	y	y_1
mm	max	0.80	0.05	0.20 REF	0.30	4.10	2.80	4.10	2.80	0.50 BSC	0.20 REF	0.50	0.10	0.05	0.08	0.10
	nom	0.75	0.02		0.25	4.00	2.50	4.00	2.70			0.40				
	min	0.70	0.00		0.20	3.90	2.40	3.90	2.40			0.30				

sot8041-2_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT8041-2						12-16-2024

Fig. 6. Package outline SOT8041-2 (HWQFN24)

15. Abbreviations

Table 17. Abbreviations

Acronym	Description
AC	Alternate Current
APDO	Augmented Power Data Object
CC	Configuration Channel
CDM	Charged Device Model
DC	Direct Current
HBM	Human Body Model
LDO	Low-DropOut
MCU	Microcontroller Unit
MTP-ROM	Multi-time Programmable Read-Only Memory
NTC	Negative Temperature Coefficient
OCP	Over-Current Protection
OTP	Over Temperature Protection
OVP	Over-Voltage Protection
PDO	Power Data Object
PPS	Programmable Power Supply
SPR	Standard Power Range
USB	Universal Serial Bus
UVLO	UnderVoltage LockOut
UVP	Under-Voltage Protection

16. Revision history

Table 18. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NEX52041 v. 1.1	20250319	Product data sheet	-	-
Modification	• Package outline descriptions for Fig. 5 and Fig. 6 updated.			
NEX52041 v. 1	20250212	Product data sheet	-	-

17. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use in automotive applications — This Nexperia product has been qualified for use in automotive applications. Unless otherwise agreed in writing, the product is not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

For more information, please visit: http://www.nexperia.com
For sales office addresses, please send an email to: salesaddresses@nexperia.com
Date of release: 19 March 2025