NX5P2553

Precision adjustable current-limited power switch

Rev. 1 — 6 July 2015 **Product data sheet**

1. General description

The NX5P2553 is a precision adjustable current-limited power switch. The device includes undervoltage lockout, overtemperature, and reverse bias protection circuits designed to isolate the switch terminals when a fault condition occurs. It also has an overcurrent protection circuit to limit the output current. The device features two power switch terminals, one input (VIN), and one output (VOUT). It also consists of a current limit input (ILIM) for defining the overcurrent limit, an open-drain fault output ($\overline{\text{FAULT}}$) to indicate when a fault condition has occurred, and an enable input (EN) to control the state of the switch.

The overcurrent limit threshold can be programmed between 85 mA and 1.8 A using an external resistor between the ILIM and GND pins. The device has built-in soft-start. This feature controls the output rise time by minimizing current surges when the switch is enabled.

Designed for operation from 2.5 V to 5.5 V, it is used in power domain isolation applications to protect from out of range operation. The enable input includes integrated logic level translation making the device compatible with lower voltage processors and controllers.

2. Features and benefits

- Wide supply voltage range from 2.5 V to 5.5 V
- I_{SW} maximum 1.5 A continuous current
- ±6 % current-limit accuracy at 1.8 A (typical)
- Meets USB current-limiting requirements
- Adjustable current limit from 85 mA to 1800 mA (typical)
- Constant current mode in overcurrent situation
- Overtemperature protection
- Very low ON resistance: 95 mΩ (typical) for TSOP6 package
- Fast short-circuit switch-off response (2.0 μs typical)
- ILIM short detection
- Reverse input-output voltage protection
- Built-in soft-start
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001-2012 Class 2 exceeds 2000 V
  - CDM JESD22-C101D exceeds 500 V
  - IEC61000-4-2 contact discharge exceeds 8 kV for VOUT (with external capacitance)
- Specified from –40 °C to +85 °C ambient temperature

3. Applications

- USB port/hubs
- Digital TV and set-top boxes
- VoIP phones

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
NX5P2553GV	–40 °C to +85 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457
NX5P2553GU	–40 °C to +85 °C	HXSON6	plastic, thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 1.6 × 1.6 × 0.5 mm	SOT1189-1
NX5P2553GU6	–40 °C to +85 °C	HXSON6	plastic, thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 2.0 × 2.0 × 0.5 mm	SOT1348-1

5. Marking

Table 2. Marking codes

Type number	Marking code[1]
NX5P2553GV	x53
NX5P2553GU	x53
NX5P2553GU6	x53

[1] The pin 1 indicator is on the lower left corner of the device, below the marking code.

6. Functional diagram

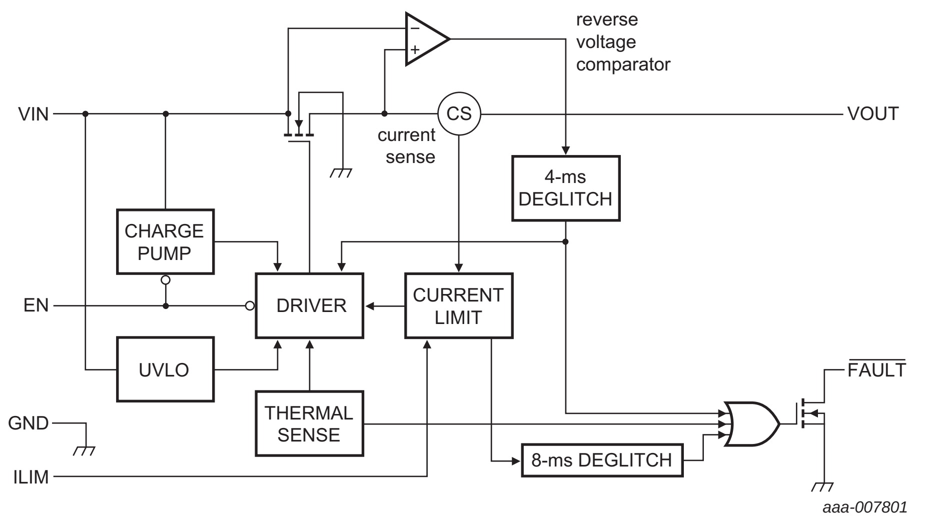


Fig 1. Logic diagram

7. Pinning information

7.1 Pinning

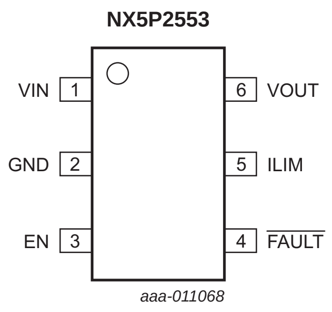
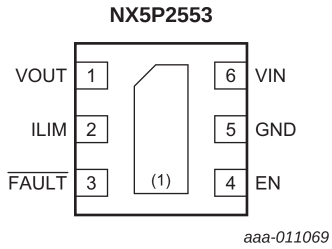


Fig 2. Pin configuration SOT457 (TSOP6)



Transparent top view

(1) This pad is not a supply pin. The substrate is attached to the pad using conductive die attach material. It is used for heat sink purpose. The solder land should be connected to GND.

Fig 3. Pin configuration SOT1189-1 and SOT1348-1 (HXSON6)

7.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	TSOP6	HXSON6	
VOUT	6	1	output voltage
ILIM	5	2	current limiter I/O
FAULT	4	3	fault condition indicator (open-drain; active LOW)
EN	3	4	enable input (active HIGH)
GND	2	5	ground (0 V)
VIN	1	6	input voltage[1]

[1] Connect a decoupling capacitance with a minimum value of 0.1 μF as close as possible to the input VIN.

8. Functional description

Table 4. Function table[1]

Input EN	Switch
L	switch OFF
H	switch ON

[1] H = HIGH voltage level; L = LOW voltage level.

8.1 EN input

When EN is set to LOW, the N-channel MOSFET is disabled and the device enters a low-power mode. In low-power mode, all protection circuits are disabled and the $\overline{\text{FAULT}}$ output is set to high-impedance state. When EN is set to HIGH, all protection circuits are enabled. If no fault conditions exist, the N-channel MOSFET is enabled.

8.2 UnderVoltage LockOut (UVLO)

The UVLO circuit is active until VIN > 2.35 V. It disables the N-channel MOSFET and switches the device back to low-power mode. It occurs irrespective of the logic level on the EN pin. Once VIN > 2.35 V, the EN pin controls the N-channel MOSFET state. The UVLO circuit remains active in low-power mode.

8.3 ILIM

The OverCurrent Protection (OCP) circuit trigger value I_{ocp} is set using an external resistor connected to the ILIM pin as shown in Figure 8. If EN is set to HIGH and the ILIM pin is grounded, the N-channel MOSFET is disabled and the $\overline{\text{FAULT}}$ output is set to LOW.

8.4 OverCurrent Protection (OCP)

Three possible overcurrent conditions can occur. They are:

- Overcurrent at start-up, $I_{SW} > I_{ocp}$ when enabling the N-channel MOSFET
- Overcurrent when enabled, $I_{SW} > I_{ocp}$ when the N-channel MOSFET is enabled
- Short-circuit when enabled, $I_{SW} > 4 \times I_{ocp}$ (typical)

8.4.1 Overcurrent at start-up

If the device senses a short or overcurrent while enabling the N-channel MOSFET, OCP is triggered. It limits the output current to I_{ocp} and after the deglitch time sets the $\overline{\text{FAULT}}$ output to LOW, as shown in Figure 22. Increased power dissipation combined with the OTP may lead to temperature cycling.

8.4.2 Overcurrent when enabled

When enabled, if the device senses $I_{SW} > I_{ocp}$, the OCP is triggered. It limits the output current to I_{ocp} and after the deglitch time sets the $\overline{\text{FAULT}}$ output to LOW. Limiting the output current reduces $V_{O(VOUT)}$, as shown in Figure 20 and Figure 21. Increased power dissipation combined with the OTP may lead to temperature cycling.

8.4.3 Short-circuit when enabled

When enabled, if the device senses $I_{SW} > 4 \times I_{ocp}$, a short-circuit is detected. The device disables the N-channel MOSFET immediately. It then enables the N-channel MOSFET, output current is limited to I_{ocp} and after the deglitch time, the $\overline{\text{FAULT}}$ output is set to LOW as shown in Figure 16 to Figure 19. Increased power dissipation combined with the OTP may lead to temperature cycling.

8.5 Reverse-Voltage Protection (RVP)

If VOUT exceeds VIN by 140 mV for the deglitch time, RVP protects the device by disabling the N-channel MOSFET. When the reverse voltage condition is removed for the deglitch time, the N-channel MOSFET is enabled as shown in Figure 14 and Figure 15.

8.6 FAULT output

The FAULT pin is an open-drain output that requires an external pull-up resistor. If any of the protection circuits are activated, FAULT is set to LOW to indicate that a fault has occurred. It returns to the high-impedance state automatically once the fault condition is removed.

8.7 OverTemperature Protection (OTP)

If the device temperature exceeds 155 °C when EN is set HIGH and the device is not in current limit, OTP triggers. It disables the N-channel MOSFET and sets the FAULT pin to LOW. Any transition on the EN pin has no effect. Once the device temperature decreases below 125 °C, the device returns to the defined state.

If the device temperature exceeds 130 °C when EN is set HIGH and the device is in current limit, OTP triggers. It disables the N-channel MOSFET and sets the FAULT pin to LOW. Any transition on the EN pin has no effect. Once the device temperature decreases below 118 °C, the device returns to the defined state.

9. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	Unit
V_I	input voltage	inputs EN and ILIM	[1]	–0.35	+6.5	V
		input VIN	[2]	–0.35	+6.5	V
V_O	output voltage	output FAULT	[1]	–0.35	$V_{I(VIN)}$	V
		output VOUT	[2]	–0.35	+6.5	V
V_{SW}	switch voltage		[2]	–6.5	+6.5	V
I_{IK}	input clamping current	input EN; $V_{I(EN)} < -0.35$ V		–50	-	mA
		input ILIM; $V_{I(ILIM)} < -0.35$ V		–50	-	mA
I_{source}	source current	input ILIM		-	1	mA
I_{OK}	output clamping current	$V_O < 0$ V		–50	-	mA
I_{SK}	switch clamping current	input VIN; $V_{I(VIN)} < -0.35$ V		–50	-	mA
		output VOUT; $V_{O(VOUT)} < -0.35$ V		–50	-	mA
I_{SW}	switch current	$V_{SW} > -0.35$ V	[3]	-	1900	mA
$T_{j(max)}$	maximum junction temperature			–40	+150	°C
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	NX5P2553GV	[4]	-	300	mW
		NX5P2553GU	[4]	-	315	mW
		NX5P2553GU6	[4]	-	340	mW

[1] If the input current rating is observed, the minimum input voltage rating may be exceeded.

[2] If the switch clamping current rating is observed, the minimum and maximum switch voltage ratings may be exceeded.

[3] Internally limited.

[4] The (absolute) maximum power dissipation depends on the junction temperature T_j. Higher power dissipation is allowed with lower ambient temperatures. The conditions to determine the specified values are T_{amb} = 85 °C and the use of a two layer PCB.

10. Recommended operating conditions

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_I	input voltage	input VIN	2.5	5.5	V
		input EN	0	5.5	V
I_{SW}	switch current	T_j = –40 °C to +125 °C	0	1.2	A
		T_j = –40 °C to +105 °C	0	1.5	A
$I_{O(sink)}$	output sink current	output $\overline{FAULT}$	–10	-	mA
R_{ILIM}	current limit resistance	input ILIM [1]	15	232	kΩ
C_{dec}	decoupling capacitance	VIN and VOUT to GND	0.1	-	μF
T_{amb}	ambient temperature		–40	+85	°C
T_j	junction temperature	I_{SW} < 1.2 A	–40	+125	°C
		I_{SW} < 1.5 A	–40	+105	°C

[1] Current-limit threshold resistor range from ILIM to GND.

11. Thermal characteristics

Table 7. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	NX5P2553GV [1]	133	K/W
		NX5P2553GU [1]	105	K/W
		NX5P2553GU6 [1]	93	K/W

[1] $R_{th(j-a)}$ is dependent upon board layout. To minimize $R_{th(j-a)}$, ensure that all pins have a solid connection to larger copper layer areas. In multi-layer PCBs, the second layer should be used to create a large heat spreader area below the device. Avoid using solder-stop varnish under the device.

12. Static characteristics

Table 8. Static characteristics

At recommended operating conditions; $V_{I(VIN)}$ = $V_{I(EN)}$ and $R_{\overline{FAULT}}$ = 10 kΩ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 4, Figure 5, Figure 6, and Figure 11.

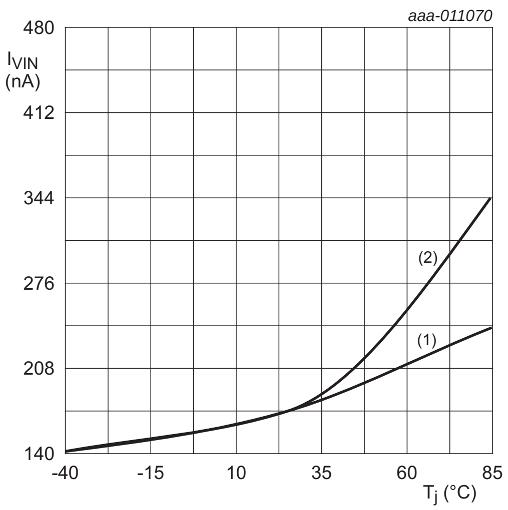
Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
V_{IH}	HIGH-level input voltage	EN input; $V_{I(VIN)}$ = 2.5 V to 5.5 V	1.3	-	-	V
V_{IL}	LOW-level input voltage	EN input; $V_{I(VIN)}$ = 2.5 V to 5.5 V	-	-	0.56	V
I_{LI}	input leakage current	EN input; $V_{I(VIN)}$ = 2.5 V to 5.5 V; $V_{I(EN)}$ = 0 V or 5.5 V	-	-	±0.5	μA
I_{VIN}	supply current	VOUT open; $V_{I(VIN)}$ = 5.5 V				
		EN = GND (low-power mode)	-	0.3	1	μA
		EN = $V_{I(VIN)}$; R_{ext} = 20 kΩ	-	160	225	μA
		EN = $V_{I(VIN)}$; R_{ext} = 210 kΩ	-	135	200	μA
I_{OFF}	power-off leakage current	VOUT; T_j = 25 °C; $V_{I(VIN)}$ = 0 V; $V_{O(VOUT)}$ = 5.5 V	-	0.1	1	μA

Table 8. Static characteristics *...continued*
At recommended operating conditions; $V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}} = 10\ k\Omega$ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 4, Figure 5, Figure 6, and Figure 11.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$I_{S(OFF)}$	OFF-state leakage current	VOUT; T_j = 25 °C; $V_{I(VIN)}$ = 5.5 V; $V_{O(VOUT)}$ = 0 V to 5.5 V	-	±0.1	±1	μA
V_{trip}	trip level voltage	RVP; $V_{I(VIN)}$ = 2.5 V to 5.5 V	80	140	195	mV
V_{UVLO}	undervoltage lockout voltage	VIN input	-	2.35	2.45	V
$V_{hys(UVLO)}$	undervoltage lockout hysteresis voltage		-	25	-	mV
V_{OL}	LOW-level output voltage	$\overline{FAULT}$; $V_{I(VIN)}$ = 2.5 V to 5.5 V; I_O = 1 mA	-	-	180	mV
I_{OZ}	OFF-state output current	$\overline{FAULT}$; $V_{I(VIN)}$ = 5.5 V; $V_{O(\overline{FAULT})}$ = 5.5 V	-	-	1	μA

[1] Typical values are measured at T_j = 25 °C.

12.1 Graphs

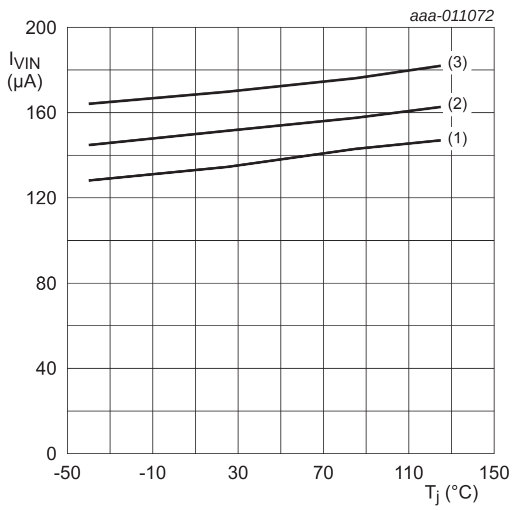


$V_{I(EN)}$ = GND; R_{ILIM} = 20 kΩ.

(1) $V_{I(VIN)}$ = 2.5 V

(2) $V_{I(VIN)}$ = 5.5 V

Fig 4. Typical supply current versus junction temperature when $V_{I(EN)}$ = GND



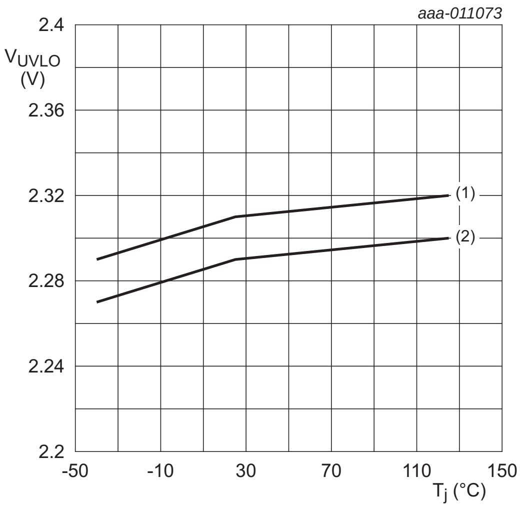
$V_{I(EN)} = V_{I(VIN)}$; R_{ILIM} = 20 kΩ.

(1) $V_{I(VIN)}$ = 2.5 V

(2) $V_{I(VIN)}$ = 5.0 V

(3) $V_{I(VIN)}$ = 5.5 V

Fig 5. Typical supply current versus junction temperature when $V_{I(EN)} = V_{I(VIN)}$



R_{ILIM} = 20 kΩ.

(1) Rising edge

(2) Falling edge

Fig 6. Typical undervoltage lockout voltage versus junction temperature

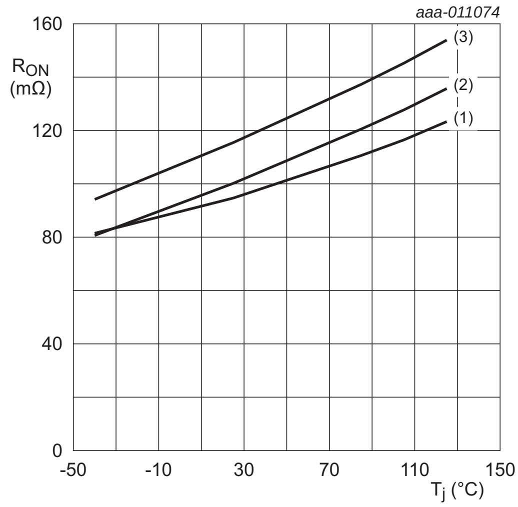
12.2 ON resistance

Table 9. ON resistance

$V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}}$ = 10 kΩ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 7 and Figure 11.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R_{ON}	ON resistance	$V_{I(VIN)}$ = 2.5 V to 5.5 V				
		NX5P2553GU; T_j = 25 °C	-	100	115	mΩ
		NX5P2553GU; T_j = –40 °C to +105 °C	-	-	140	mΩ
		NX5P2553GU; T_j = –40 °C to +125 °C	-	-	150	mΩ
		NX5P2553GU6; T_j = 25 °C	-	115	125	mΩ
		NX5P2553GU6; T_j = –40 °C to +105 °C	-	-	150	mΩ
		NX5P2553GU6; T_j = –40 °C to +125 °C	-	-	160	mΩ
		NX5P2553GV; T_j = 25 °C	-	95	100	mΩ
		NX5P2553GV; T_j = –40 °C to +125 °C	-	-	135	mΩ

12.3 ON resistance graph



R_{ILIM} = 20 kΩ.

(1) NX5P2553GV

(2) NX5P2553GU

(3) NX5P2553GU6

Fig 7. Typical ON resistance versus junction temperature

12.4 Current limit

Table 10. Characteristics

$V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}}$ = 10 kΩ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 8, Figure 11, Figure 23 and Figure 24.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
I_{ocp}	overcurrent protection current	$V_{I(VIN)}$ = 2.5 V to 5.5 V				
		R_{ILIM} = 15 kΩ; T_j = –40 °C to +105 °C	1650	1780	1900	mA
		R_{ILIM} = 20 kΩ; T_j = 25 °C	1230	1320	1430	mA
		R_{ILIM} = 20 kΩ; T_j = –40 °C to +125 °C	1215	1320	1450	mA
		R_{ILIM} = 49.9 kΩ; T_j = 25 °C	480	530	560	mA
		R_{ILIM} = 49.9 kΩ; T_j = –40 °C to +125 °C	465	530	575	mA
		R_{ILIM} = 210 kΩ; T_j = –40 °C to +125 °C	95	140	180	mA
		ILIM shorted to VIN; T_j = –40 °C to +125 °C	50	85	115	mA

[1] Typical values are measured at T_j = 25 °C.

12.5 Current limit graph

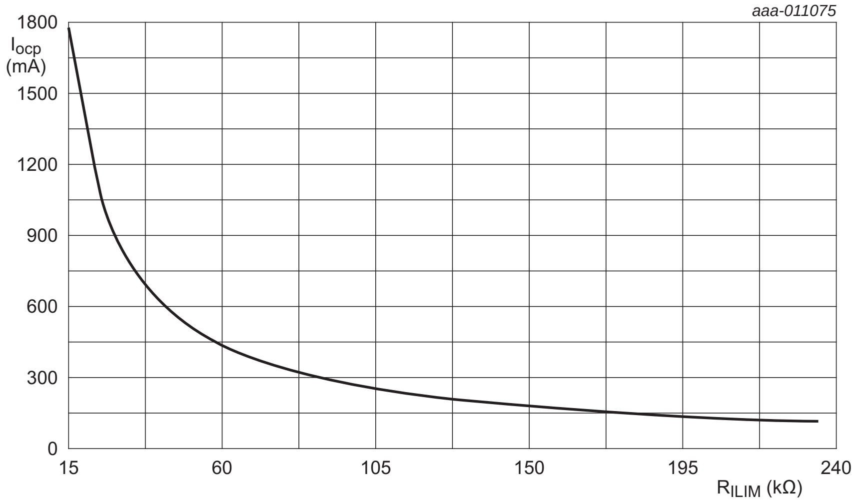


Fig 8. Typical overcurrent protection current versus external resistor value R_{ILIM}

12.6 Thermal shutdown

Table 11. Thermal shutdown

$V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}} = 10\ k\Omega$ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 11.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{th(ots)}$	overtemperature shutdown threshold temperature	in normal mode	155	-	-	°C
		in current limit mode	130	-	-	°C
$T_{th(ots)hys}$	overtemperature shutdown threshold temperature hysteresis	in normal mode	-	30	-	°C
		in current limit mode	-	12	-	°C

13. Dynamic characteristics

Table 12. Characteristics

At recommended operating conditions; $V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}} = 10\ k\Omega$ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, and Figure 22.

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
t_{TLH}	LOW to HIGH output transition time	VOUT; $V_{I(VIN)}$ = 5.5 V	-	1.2	1.5	ms
		VOUT; $V_{I(VIN)}$ = 2.5 V	-	0.5	1.0	ms
t_{THL}	HIGH to LOW output transition time	VOUT; $V_{I(VIN)}$ = 5.5 V	0.2	-	0.5	ms
		VOUT; $V_{I(VIN)}$ = 2.5 V	0.2	-	0.5	ms
t_{en}	enable time	EN to VOUT; $V_{I(VIN)}$ = 5.5 V [2]	-	-	3	ms
t_{dis}	disable time	EN to VOUT; $V_{I(VIN)}$ = 5.5 V [3]	-	-	3	ms

Table 12. Characteristics *...continued*

At recommended operating conditions; $V_{I(VIN)} = V_{I(EN)}$ and $R_{\overline{FAULT}} = 10\ k\Omega$ unless otherwise specified; voltages are referenced to GND (ground = 0 V); see Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14, Figure 15, Figure 16, and Figure 22.

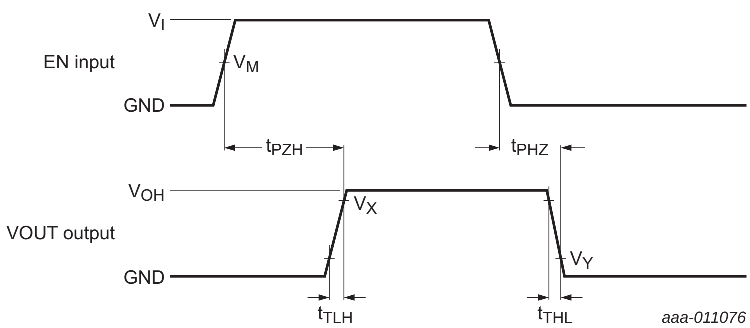
Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
t_{off}	turn-off time	short-circuit; $V_{I(VIN)} = 5$ V	-	2	-	µs
		RVP; $V_{I(VIN)} = 5$ V	3	5	7	ms
t_{degl}	deglitch time	$\overline{FAULT}$; OCP; $V_{I(VIN)} = 5$ V	5	8.7	12	ms
		$\overline{FAULT}$; RVP; $V_{I(VIN)} = 5$ V	2	4.4	6	ms

[1] Typical values are measured at $T_j = 25$ °C.

[2] t_{en} is the same as t_{PZH}.

[3] t_{dis} is the same as t_{PHZ}.

13.1 Waveform and test circuits



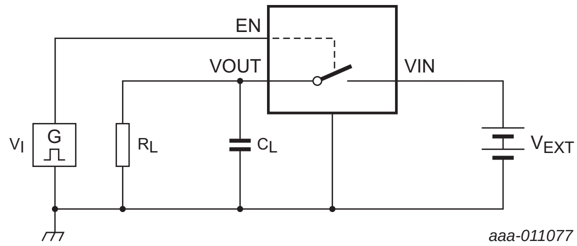
Measurement points are given in Table 13.

Logic level: V_{OH} is the typical output voltage that occurs with the output load.

Fig 9. Switching times and rise and fall times

Table 13. Measurement points

Supply voltage	EN input	Output	
$V_{I(VIN)}$	V_M	V_X	V_Y
2.5 V	$0.5 \times V_{I(EN)}$	$0.9 \times V_{OH}$	$0.1 \times V_{OH}$
5.5 V	$0.5 \times V_{I(EN)}$	$0.9 \times V_{OH}$	$0.1 \times V_{OH}$



Test data is given in Table 14.

Definitions test circuit:

R_L = Load resistance.

C_L = Load capacitance including jig and probe capacitance.

V_{EXT} = External voltage for measuring switching times.

Fig 10. Test circuit for measuring switching times

Table 14. Test data

Supply voltage	EN input	Load	
V_{EXT}	$V_{I(EN)}$	C_L	R_L
2.5 V	0 V to $V_{I(VIN)}$	1 μF	100 Ω
5.5 V	0 V to $V_{I(VIN)}$	1 μF	100 Ω

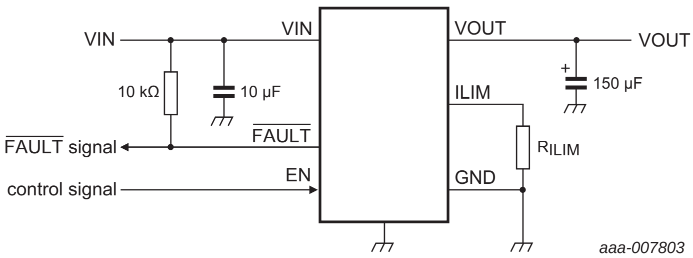
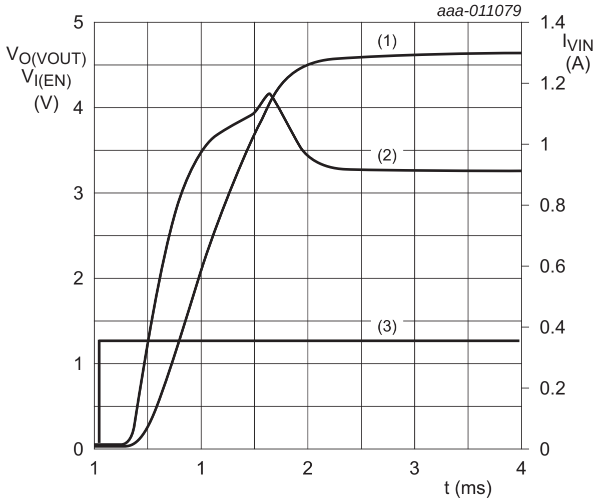


Fig 11. Typical characteristics reference schematic



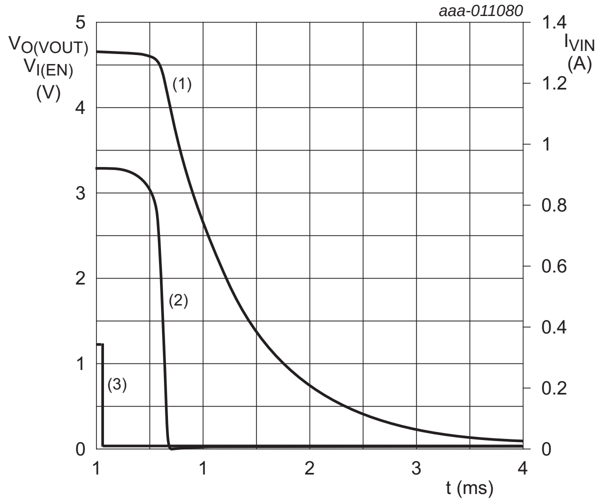
$V_{I(VIN)}$ = 5 V; R_L = 5 Ω; R_{ILIM} = 20 kΩ.

(1) $V_{O(VOUT)}$

(2) I_{VIN}

(3) $V_{I(EN)}$

Fig 12. Typical enable time



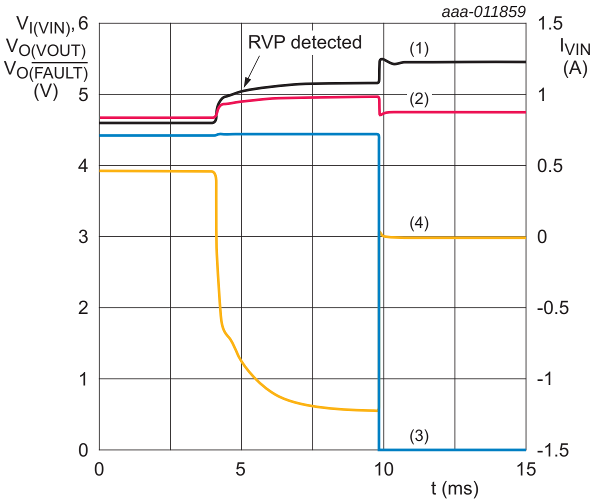
$V_{I(VIN)}$ = 5 V; R_L = 5 Ω; R_{ILIM} = 20 kΩ.

(1) $V_{O(VOUT)}$

(2) I_{VIN}

(3) $V_{I(EN)}$

Fig 13. Typical disable time



$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 5 Ω.

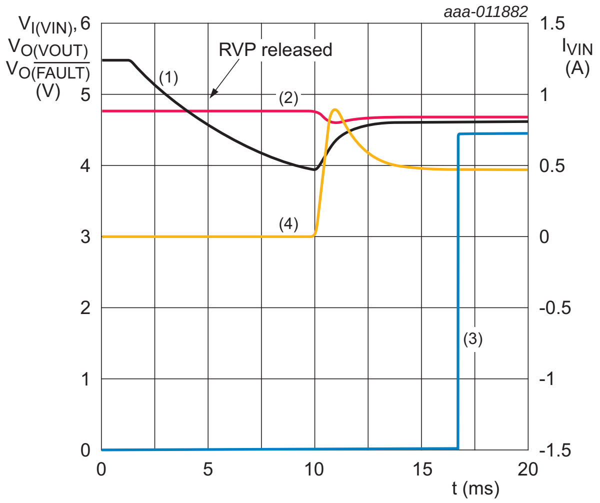
(1) $V_{O(VOUT)}$

(2) $V_{I(VIN)}$

(3) $V_{O(\overline{FAULT})}$

(4) I_{VIN}

Fig 14. Reverse-voltage protection response



$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 10 Ω.

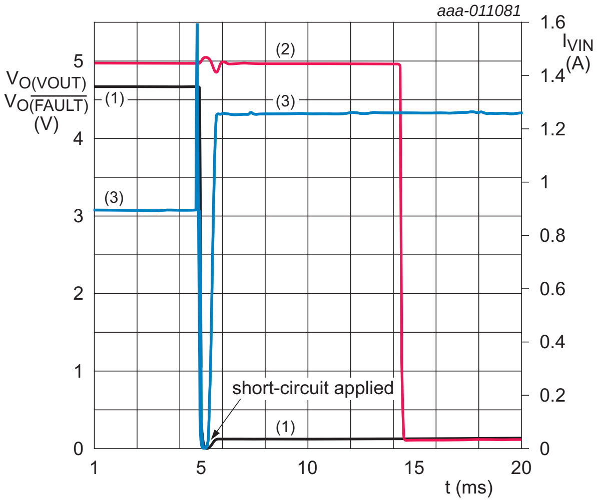
(1) $V_{O(VOUT)}$

(2) $V_{I(VIN)}$

(3) $V_{O(\overline{FAULT})}$

(4) I_{VIN}

Fig 15. Reverse-voltage protection recovery



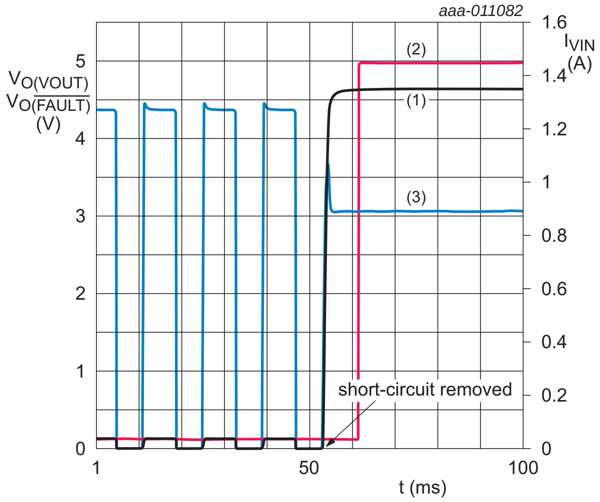
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 5 Ω.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 16. Full load to short-circuit response



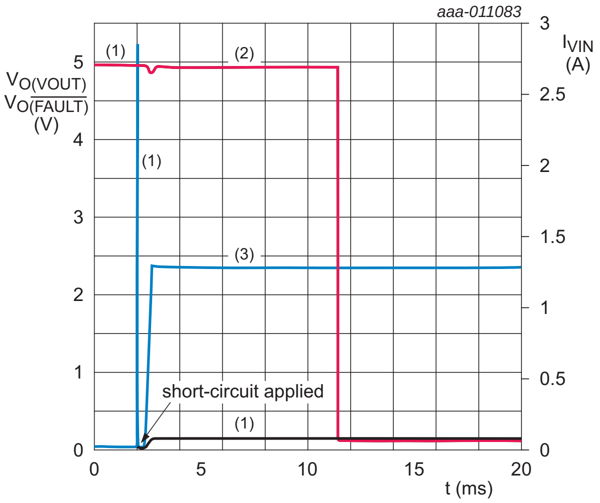
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 5 Ω.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 17. Short-circuit to full load response



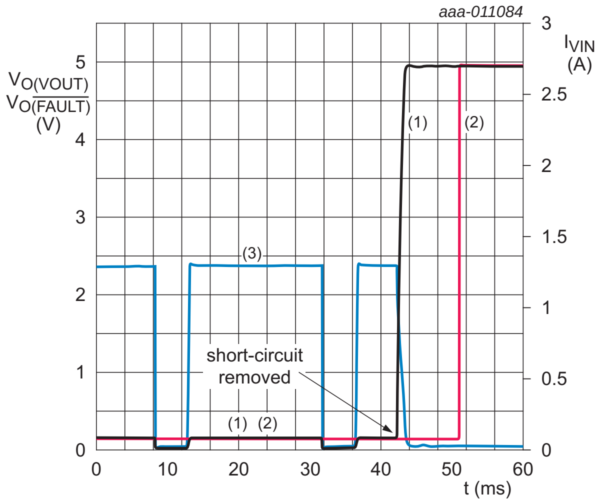
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 18. No-load to short-circuit response



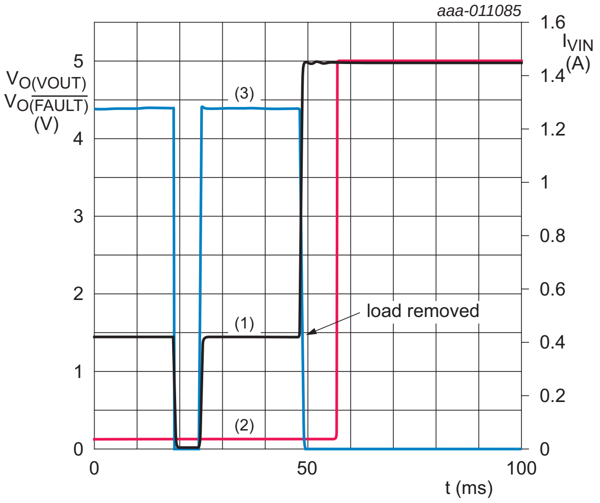
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 19. Short-circuit to no-load response



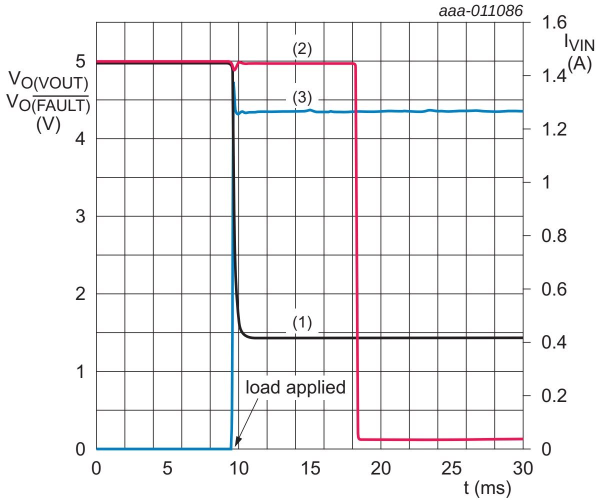
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 1 Ω.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 20. 1 Ω load to no-load response



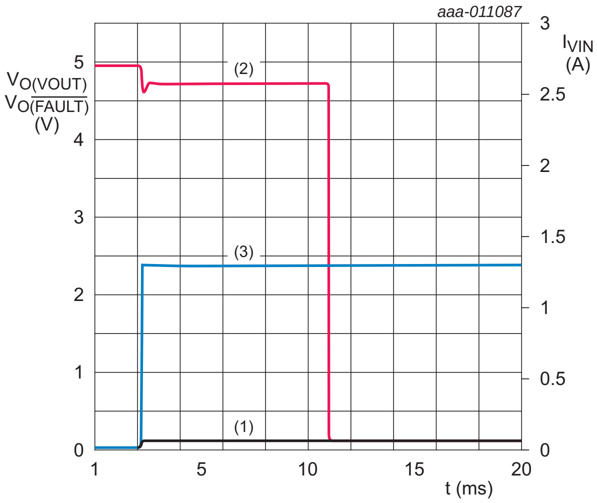
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ; R_L = 1 Ω.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 21. No-load to 1 Ω load response



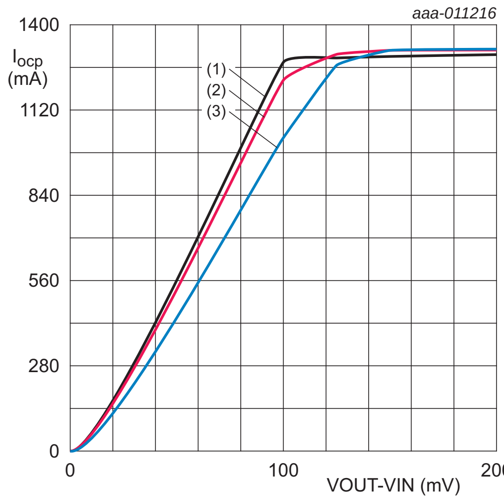
$V_{I(VIN)}$ = 5 V; R_{ILIM} = 20 kΩ.

(1) $V_{O(VOUT)}$

(2) $V_{O(\overline{FAULT})}$

(3) I_{VIN}

Fig 22. Device enabled into short-circuit



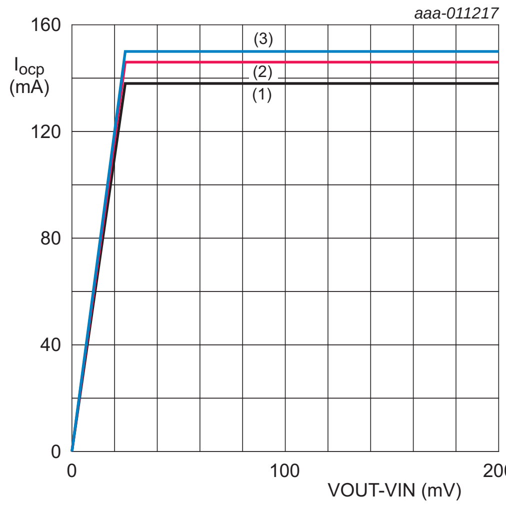
$V_{I(VIN)}$ = 5.5 V; R_{ILIM} = 20 kΩ.

(1) T_{amb} = –40 °C

(2) T_{amb} = +25 °C

(3) T_{amb} = +125 °C

Fig 23. Switch current versus switch voltage



$V_{I(VIN)}$ = 5.5 V; R_{ILIM} = 200 kΩ.

(1) T_{amb} = –40 °C

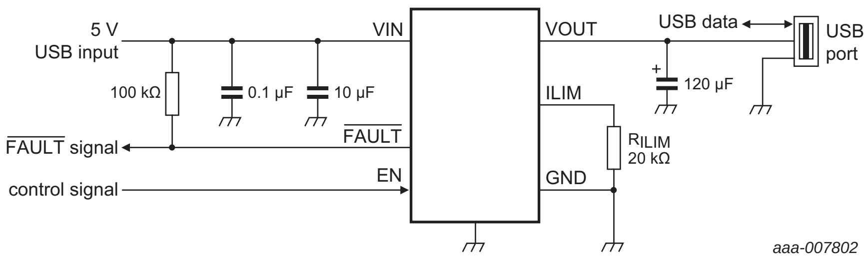
(2) T_{amb} = +25 °C

(3) T_{amb} = +125 °C

Fig 24. Switch current versus switch voltage

14. Application information

14.1 Application diagram



For the IEC61000-4-2 contact discharge test, the 10 μF input capacitance is not needed.

Fig 25. Application diagram

14.2 Best practices

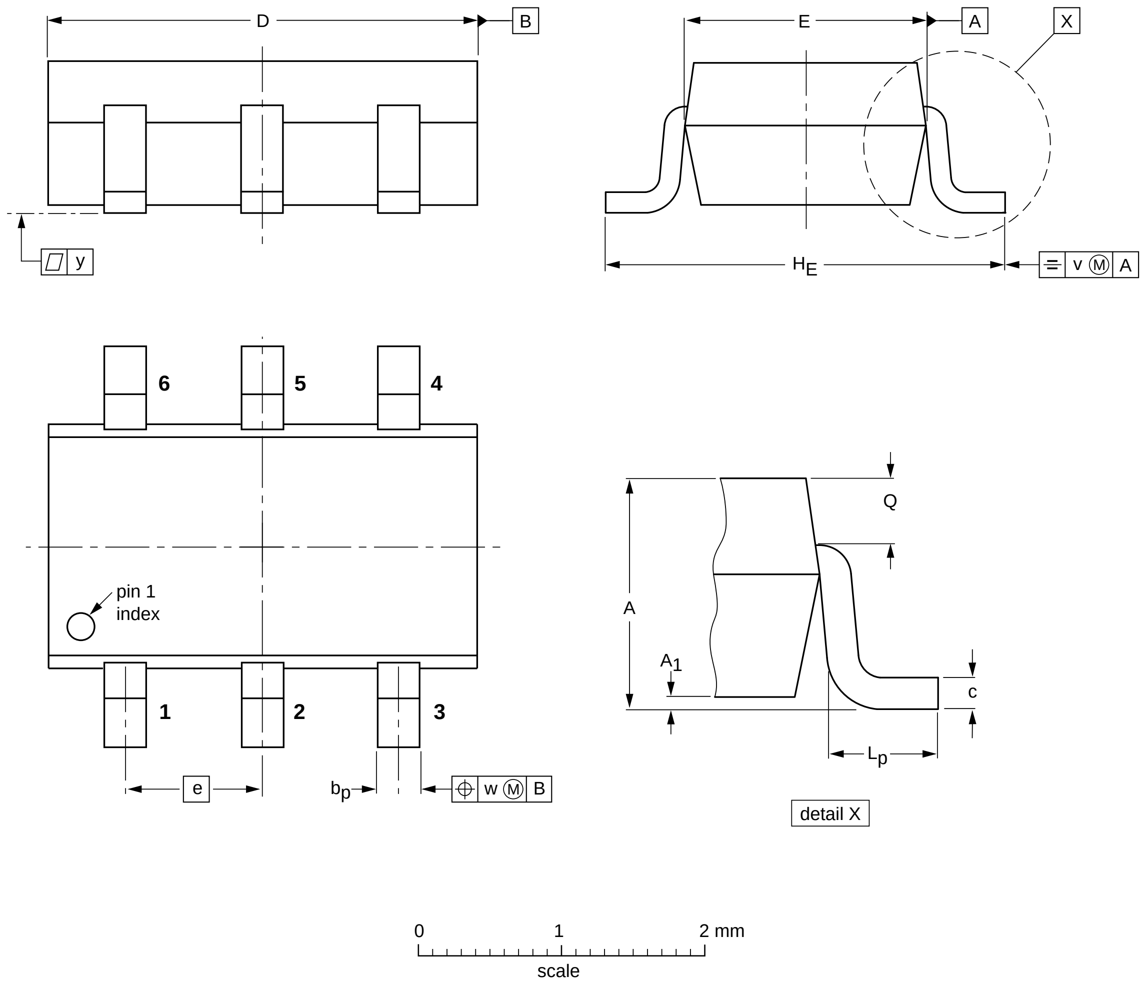
In order to avoid product damage, the device should always operate within the boundaries given in Section 9. However, in applications with high switching currents, these limits might be violated during transients even when the static values are well within the limiting values. The device includes soft-start which limits in-rush current when enabling the N-channel MOSFET. This feature does not limit current transients due to load change when the N-channel MOSFET is already enabled.

The following aspects can be taken as guideline:

- Widen the circuit board traces between:
  - Power supply and VIN input
  - VOUT output and load connection (USB plug)
  - Load GND (USB plug) and power supply GND as much as possible. Define a Kelvin point in the GND line, close to the product and have the device GND connected to it.
- Use combination of larger and smaller value capacitors with low ESR at the VIN input and the VOUT output. Ensure that wires to the VIN input, VOUT output and the Kelvin point are short. Wires behave like coils. Transient currents (e.g. as a result of a short) may lead to high positive or negative inductance voltages. The carefully routed high-current path and the short wired capacitors at the VIN input and the VOUT output keeps these voltages away from the product.
- Load transients affect the supply of the application. Load transients result from the switch enable and disable process as well as load jumps (application of or removal of load). The supply might react to load transients with voltage jumps that exceed the Limiting values. If such voltage jumps are larger, the capacitors at the VIN input and the VOUT output might not be able to filter them. A strong 6 V Zener diode between VIN and GND might be considered. Improving the design of the supply is a better solution.

15. Package outline

Plastic surface-mounted package (TSOP6); 6 leads **SOT457**



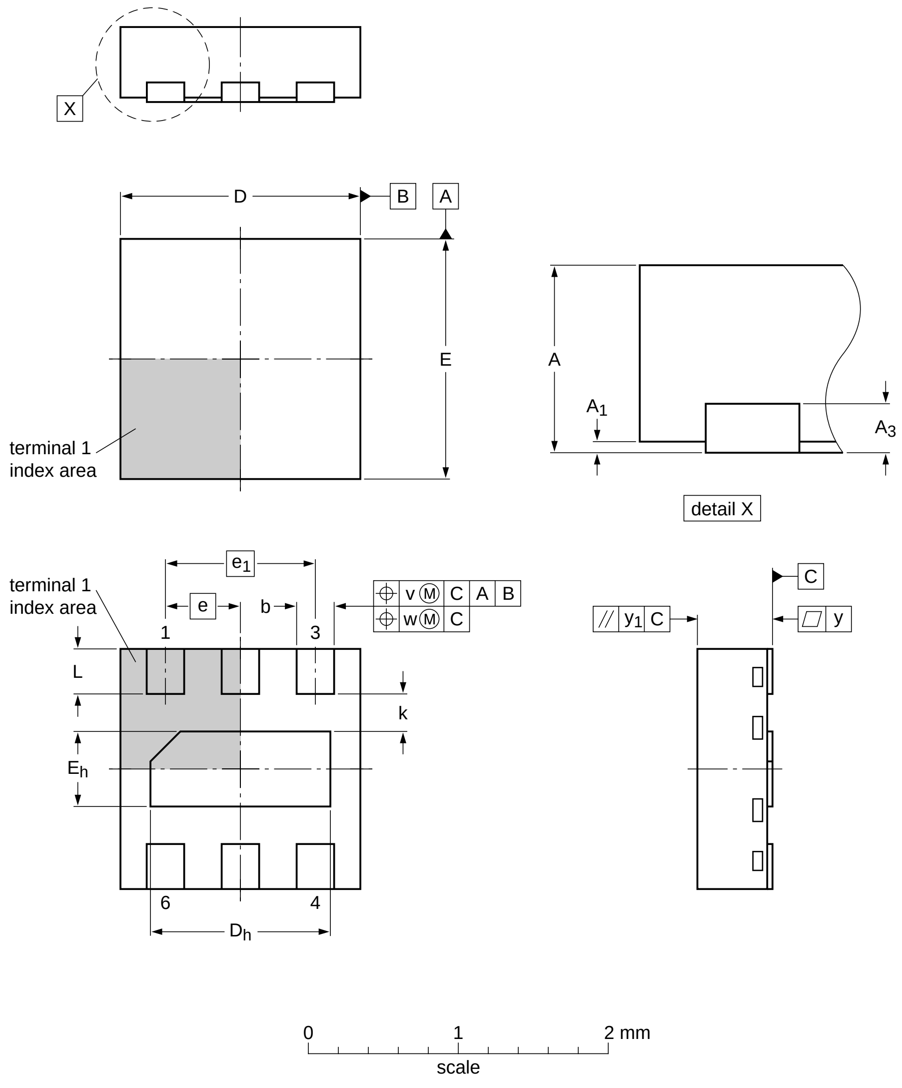
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~05-11-07~~ 06-03-16

Fig 26. Package outline SOT457 (TSOP6)

HXSON6: plastic, thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 1.6 x 1.6 x 0.5 mm SOT1189-1



Dimensions

Unit[(1)]		A	A_1	A_3	b	D	D_h	E	E_h	e	e_1	k	L	v	w	y	y_1
	max	0.5	0.05		0.30	1.7	1.3	1.7	0.6				0.35				
mm	nom			0.127	0.25	1.6	1.2	1.6	0.5	0.5	1		0.30	0.1	0.05	0.05	0.05
	min		0.00		0.20	1.5	1.1	1.5	0.4			0.2	0.25				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1189-1_po

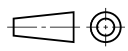
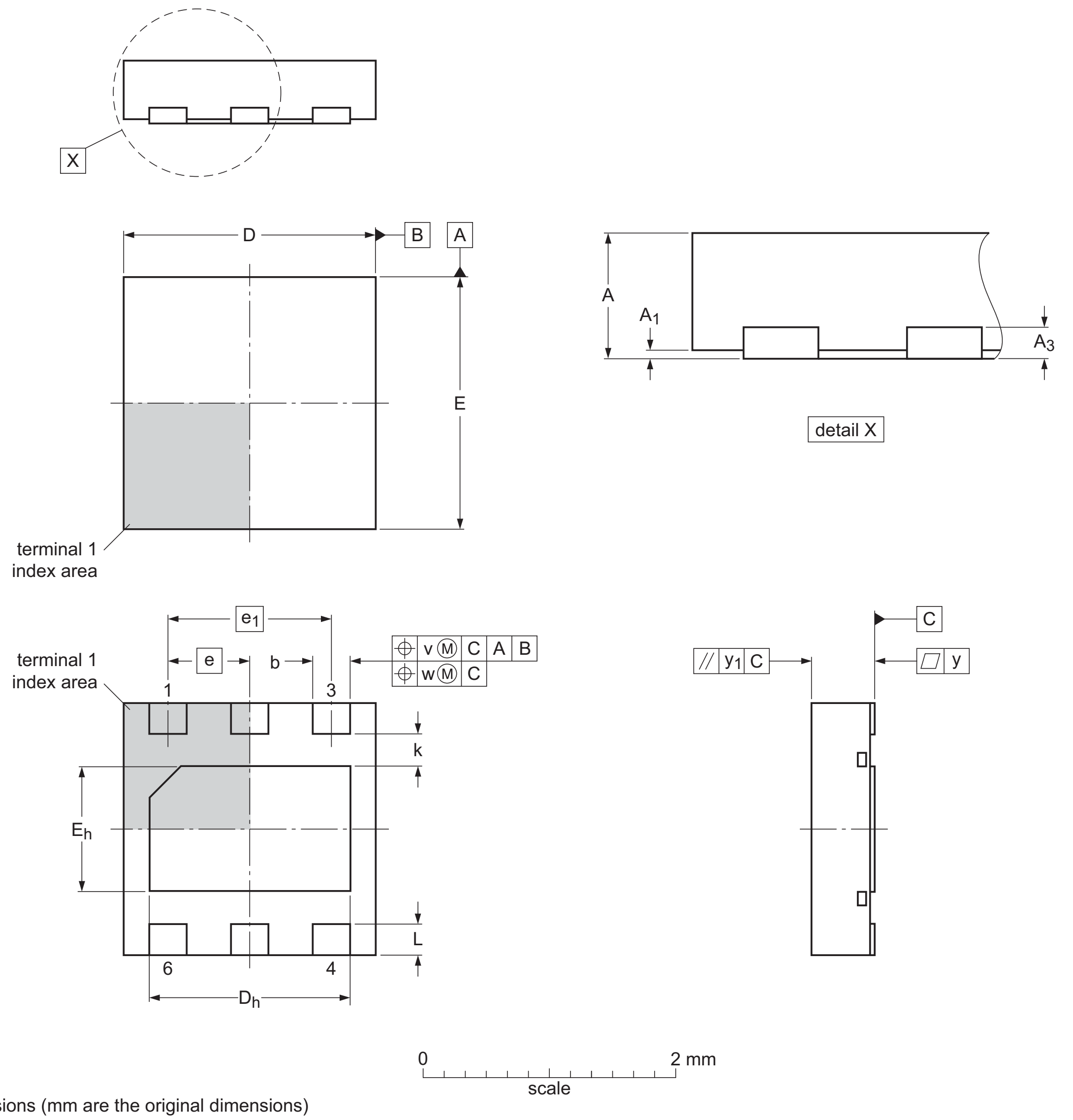
Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1189-1	- - -	- - -	- - -			~~10-08-02~~ 10-10-11

Fig 27. Package outline SOT1189-1 (HXSON6)

HXSON6: plastic, thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 2.0 x 2.0 x 0.5 mm — **SOT1348-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_3	b	$D^{(1)}$	D_h	$E^{(1)}$	E_h	e	e_1	k	L	v	w	y	y_1
	max	0.5	0.05		0.35	2.1	1.7	2.1	1.1				0.30				
mm	nom			0.127	0.30	2.0	1.6	2.0	1.0	0.65	1.3		0.25	0.1	0.05	0.05	0.05
	min		0.00		0.25	1.9	1.5	1.9	0.9			0.2	0.20				

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1348-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1348-1	- - -	- - -	- - -			~~13-09-04~~ 15-05-08

Fig 28. Package outline SOT1348-1 (HXSON6)

16. Abbreviations

Table 15. Abbreviations

Acronym	Description
CDM	Charged Device Model
ESD	ElectroStatic Discharge
ESR	Equivalent Series Resistance
HBM	Human Body Model
MOSFET	Metal-Oxide Semiconductor Field-Effect Transistor
OCP	OverCurrent Protection
OTP	OverTemperature Protection
PCB	Printed-Circuit Board
RVP	Reverse-Voltage Protection
USB	Universal Serial Bus
UVLO	UnderVoltage LockOut
VoIP	Voice over Internet Protocol

17. Revision history

Table 16. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
NX5P2553 v.1	20150706	Product data sheet	-	-

18. Legal information

18.1 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 URL http://www.nxp.com.

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20. Contents

Date of release: 6 July 2015
Document identifier: NX5P2553