

# PSS12021SAY

Constant current source in SOT353 package

Rev. 02 — 20 October 2004

Product data sheet

## 1. Product profile

### 1.1 General description

Resistor-equipped PNP transistor with two diodes on one chip in a SOT353 (SC-88A) plastic package. Stabilized output current of between 15  $\mu$ A and 50 mA by connection of an external resistor between pins 4 and 5.

### 1.2 Features

- One chip integrated constant current source
- Output current setting by use of an external resistor
- Very small package
- Reduces component count and board space.

### 1.3 Applications

- Automotive applications
- Generic constant current source
- Constant current LED driver
- Active bias control for audio amplifiers.

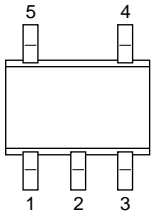
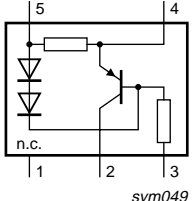
### 1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{out}$	output current		0.015	-	50	mA
$V_S$	supply voltage		-	-	75	V

## 2. Pinning information

**Table 2: Pinning**

Pin	Symbol	Description	Simplified outline	Symbol
1	n.c.	not connected		 sym049
2	IOUT	output current		
3	GND	ground		
4	REXT	external resistor		
5	VS	supply voltage		

## 3. Ordering information

**Table 3: Ordering information**

Type number	Package		
	Name	Description	Version
PSSI2021SAY	SC-88A	plastic surface mounted package; 5 leads	SOT353

## 4. Marking

**Table 4: Marking codes**

Type number	Marking code <sup>[1]</sup>
PSSI2021SAY	S1*

- [1] \* = -: made in Hong Kong.  
 \* = t: made in Malaysia.  
 \* = W: made in China.

## 5. Limiting values

**Table 5: Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
$I_{out}$	stabilized output current	see <a href="#">Figure 2</a>	0.015	50	mA
$V_S$	supply voltage		-	75	V
$V_{out}$	output voltage	$V_S = 75$ V	-	73	V
$V_R$	reverse voltage		[1] -	0.5	V
$P_{tot}$	total power dissipation	$T_{amb} \leq 25$ °C	[2] -	335	mW
$T_{stg}$	storage temperature		-65	+150	°C
$T_j$	junction temperature		-	150	°C
$T_{amb}$	ambient temperature		-65	+150	°C

[1] Between all terminals.

[2] Device mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint.

## 6. Thermal characteristics

**Table 6: Thermal characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1] -	-	370	K/W

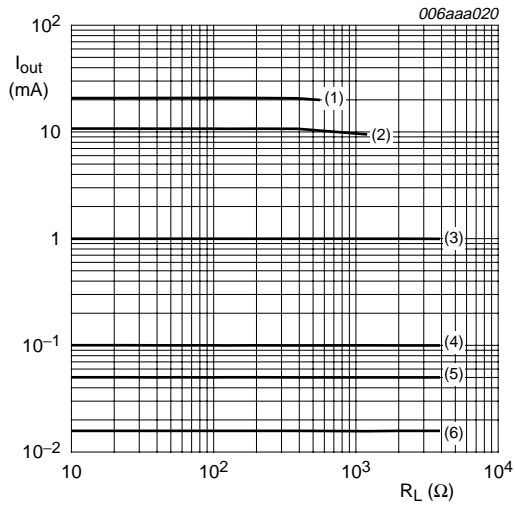
[1] Device mounted on a FR4 printed-circuit board, single-sided copper, tin-plated, standard footprint.

## 7. Characteristics

**Table 7: Characteristics**

$T_{amb} = 25$  °C unless otherwise specified.

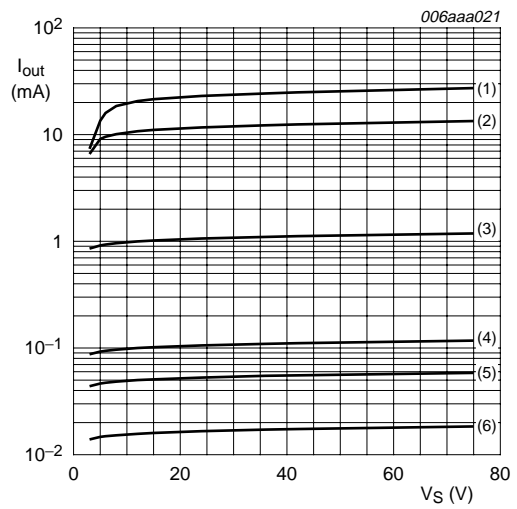
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_{out}$	stabilized output current	$V_S = 12$ V; $R_{ext} = open$ ; $V_{out} = 0$ V to 10 V; see <a href="#">Figure 2</a>	10	15	20	$\mu A$
$I_S$	supply current	$V_S = 12$ V; $I_{out} = 15$ $\mu A$ ; $V_{out} = 0$ V to 10 V; see <a href="#">Figure 4</a>	-	240	370	$\mu A$
		$V_S = 75$ V; $I_{out} = 15$ $\mu A$ ; $V_{out} = 0$ V; see <a href="#">Figure 4</a>	-	1.5	2.2	mA
$\Delta I_{out} / (I_{out} \times \Delta T_{amb})$	output current change over ambient temperature	$V_S = 12$ V; $V_{out} = 1$ V; $T_{amb} = -55$ °C to 150 °C	-	0.15	-	%/K
$\Delta I_{out} / I_{out}$	load stability of stabilized output current	$V_S = 12$ V; $V_{out} = 1$ V to 10 V	-	0.5	-	%
$R_{int}$	internal resistor value		-	48	-	k $\Omega$



$V_S = 12\text{ V}$ .

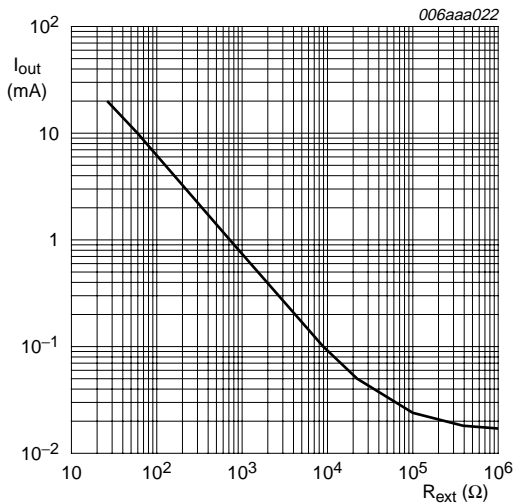
- (1)  $I_{out} = 20\text{ mA}$ .
- (2)  $I_{out} = 10\text{ mA}$ .
- (3)  $I_{out} = 1\text{ mA}$ .
- (4)  $I_{out} = 100\text{ }\mu\text{A}$ .
- (5)  $I_{out} = 50\text{ }\mu\text{A}$ .
- (6)  $I_{out} = 15\text{ }\mu\text{A}$ .

**Fig 1. Output current as a function of load resistance; typical values.**



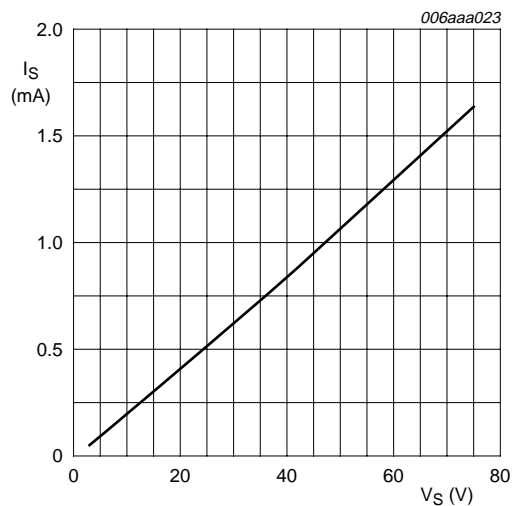
- (1)  $I_{out} = 20\text{ mA}$ .
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- (3)  $I_{out} = 1\text{ mA}$ .
- (4)  $I_{out} = 100\text{ }\mu\text{A}$ .
- (5)  $I_{out} = 50\text{ }\mu\text{A}$ .
- (6)  $I_{out} = 15\text{ }\mu\text{A}$ .

**Fig 2. Output current as a function of supply voltage; typical values.**



$V_S = 12\text{ V}$ ;  $R_L = 100\text{ }\Omega$ .

**Fig 3. Output current as a function of external resistance; typical values.**



$R_{ext} = \infty$ ;  $R_L = 100\text{ }\Omega$ .

**Fig 4. Supply current as a function of supply voltage; typical values.**

## 8. Application information

### External resistor calculation

The output current can be set by connecting an external resistor between VS (pin 5) and REXT (pin 4).

$I_{out}$  then calculates to: 
$$I_{out} = \frac{0.617}{R_{ext}} + 15 \mu A$$

Without an external resistor the output current will be typically 15  $\mu A$ .

### Typical output currents versus supply voltage $V_S$

The applied supply voltage determines the output current. [Table 8](#) gives typical  $I_{out}$  values at specified supply voltages, assuming that the working output current is 70 % of the maximum possible output current.

**Table 8:** Typical output currents at specified supply voltages

$V_S$ (V)	$I_{out}$ (mA)
5	6
12	18
24	38
36	60

### 8.1 Typical application circuits

#### LED driver

Figure 5 shows a typical application circuit for an LED driver. The constant current ensures a constant LED brightness.

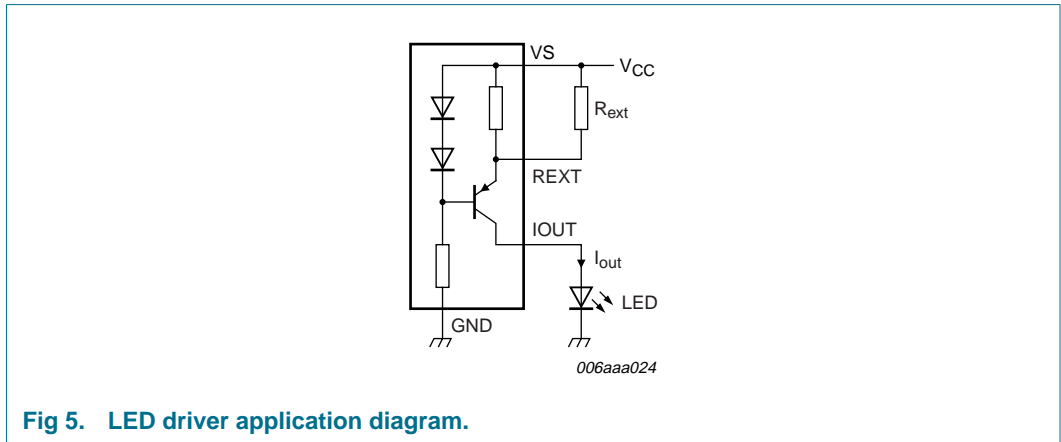


Fig 5. LED driver application diagram.

#### Switching the current ON/OFF

The output can be switched ON and OFF by connecting a resistor-equipped transistor (RET, e.g. PDTC124XU) as shown in Figure 6.

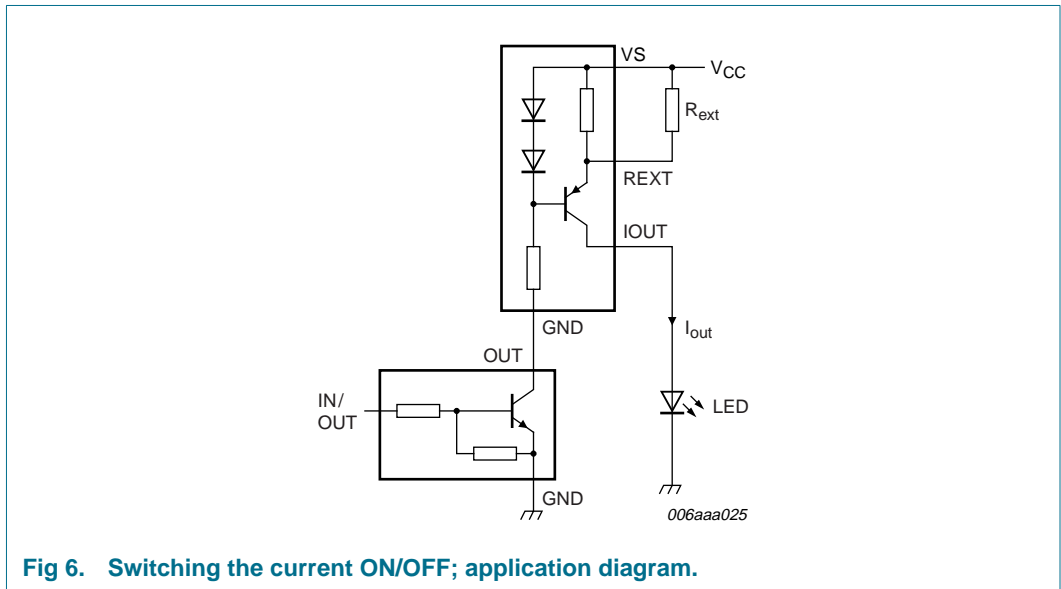
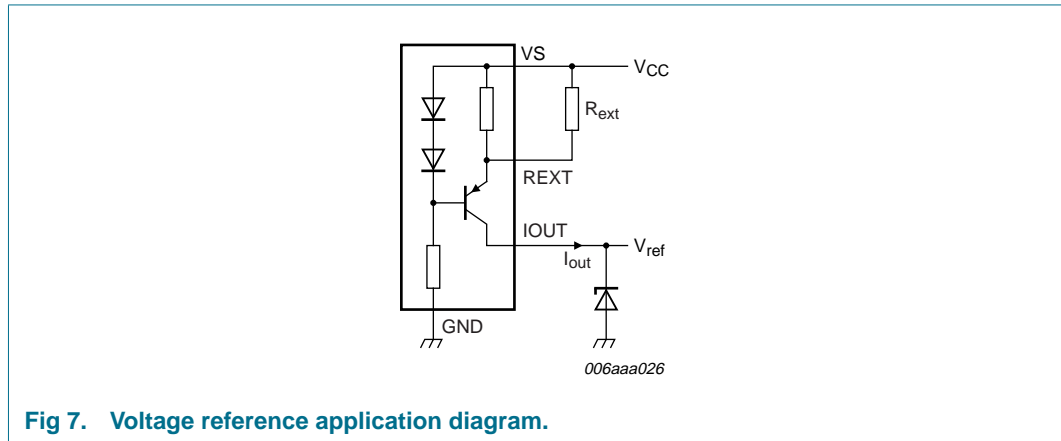


Fig 6. Switching the current ON/OFF; application diagram.

**Voltage reference**

The PSSI2021SAY supplies a constant current to the Zener diode regardless of supply voltage variation, resulting in a constant reference voltage (see [Figure 7](#)).



**Fig 7. Voltage reference application diagram.**

9. Package outline

Plastic surface mounted package; 5 leads

SOT353

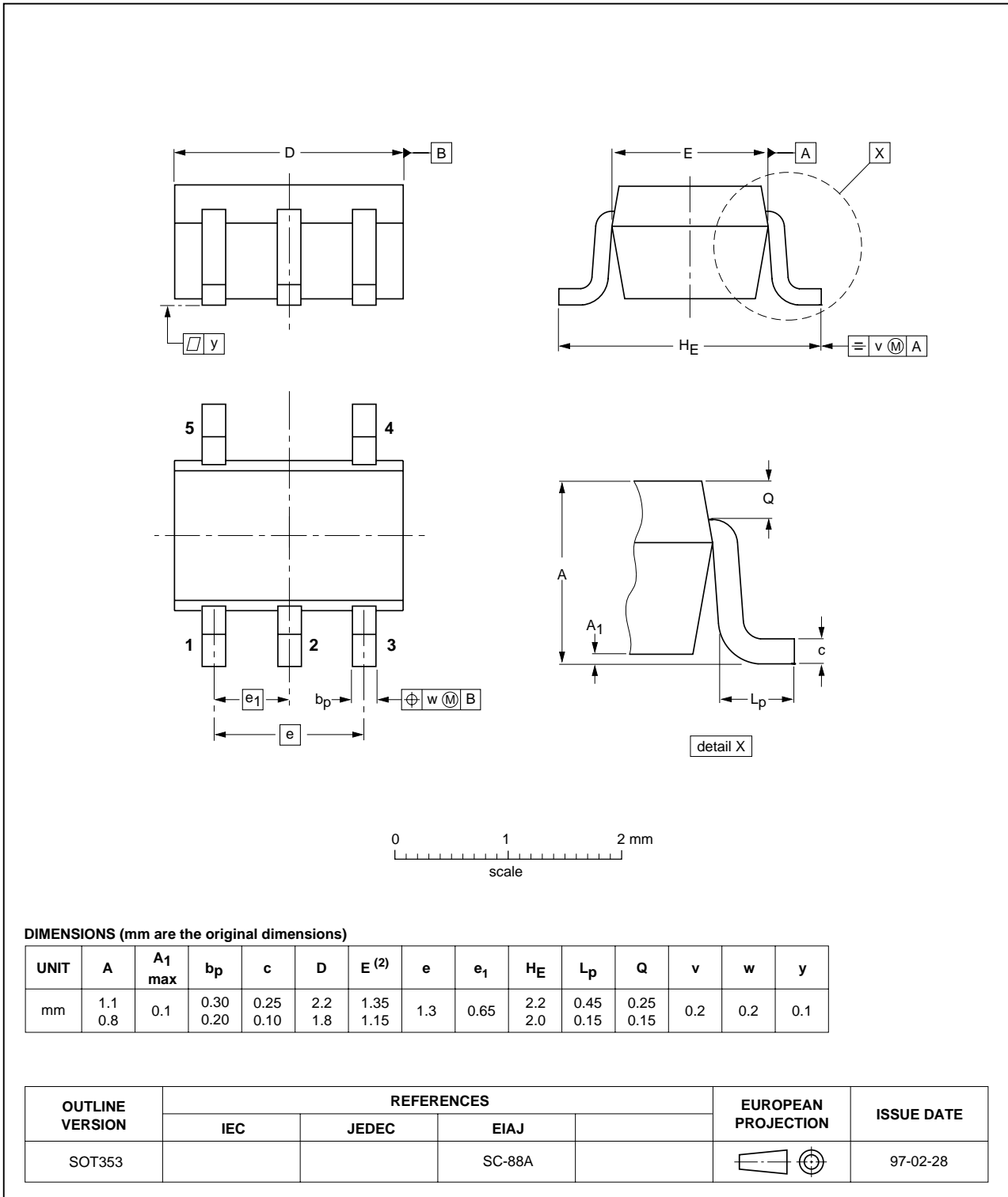


Fig 8. Package outline SOT353 (SC-88A).



## 10. Packing information

**Table 9: Packing methods**

The indicated -xxx are the last three digits of the 12NC ordering code. [\[1\]](#)

Type number	Package	Description	Packing quantity
			3000
PSSI2021SAY	SOT353	4 mm pitch, 8 mm tape and reel	-115

[1] For further information and the availability of packing methods, see [Section 15](#).

## 11. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
PSSI2021SAY_2	20041020	Product data sheet	-	9397 750 13673	PSSI2021SAY_1
Modifications:	<ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li> <li>• <a href="#">Section 1.1</a>: General description specified</li> <li>• <a href="#">Section 1.2</a>: two features added</li> <li>• <a href="#">Section 1.3</a>: Applications revised</li> <li>• <a href="#">Section 1.4</a>: Quick reference data added</li> <li>• <a href="#">Section 4</a>: marking code enhanced and <a href="#">Table note 1</a> amended</li> <li>• <a href="#">Section 5</a>: Limiting values: <math>I_{stab}</math> redefined to <math>I_{out}</math></li> <li>• <a href="#">Table 7</a>: Characteristics: <math>I_{stab}</math> redefined to <math>I_{out}</math></li> <li>• <a href="#">Table 7</a>: Characteristics: <math>I_{supply}</math> redefined to <math>I_S</math></li> <li>• <a href="#">Table 7</a>: Characteristics: <math>\Delta I_{stab} / I_{stab}</math> redefined to <math>\Delta I_{out} / I_{out}</math></li> <li>• <a href="#">Table 7</a>: Characteristics: <math>\Delta I_{stab} / \Delta T \times I_{stab}</math> redefined to <math>\Delta I_{out} / (I_{out} \times \Delta T_{amb})</math></li> <li>• <a href="#">Table 7</a>: Characteristics: <math>R_{int}</math> added</li> <li>• <a href="#">Figure 1</a>: output current as a function of load resistance added</li> <li>• <a href="#">Figure 2</a>: output current as a function of supply voltage added</li> <li>• <a href="#">Figure 3</a>: output current as a function of external resistance added</li> <li>• <a href="#">Figure 4</a>: supply current as a function of supply voltage added</li> <li>• <a href="#">Section 8</a>: Application information added</li> <li>• <a href="#">Section 8.1</a>: Typical application circuits section added</li> <li>• <a href="#">Figure 5</a>: application diagram: LED driver added</li> <li>• <a href="#">Figure 6</a>: application diagram: switching the current ON/OFF added</li> <li>• <a href="#">Figure 7</a>: application diagram: voltage reference added</li> <li>• <a href="#">Section 10</a>: Packing information added.</li> </ul>				
PSSI2021SAY_1	20010507	Product specification	-	9397 750 08089	-

## 12. Data sheet status

Level	Data sheet status <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	Definition
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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