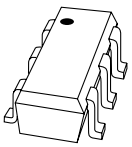


PUML1/DG

50 V, 200 mA NPN general-purpose transistor/ 100 mA NPN resistor-equipped transistor

Rev. 01 — 14 July 2008 Product data sheet

1. Product profile

1.1 General description

NPN general-purpose transistor and NPN Resistor-Equipped Transistor (RET) in one SOT363 (SC-88) very small Surface-Mounted Device (SMD) plastic package.

1.2 Features

- General-purpose transistor:
  - 200 mA collector current I_C
- Resistor-equipped transistor:
  - Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs
- Very small SMD plastic package
- AEC-Q101 qualified

1.3 Applications

- Inverter and switches
- Low-frequency amplifier
- Driver stages

1.4 Quick reference data

Table 1. Quick reference data

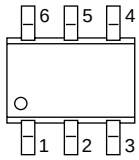
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (general-purpose transistor)						
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_C	collector current		-	-	200	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 2 mA	210	-	340	
TR2 (resistor-equipped transistor)						
V_{CEO}	collector-emitter voltage	open base	-	-	50	V
I_O	output current		-	-	100	mA
R1	bias resistor 1 (input)		7	10	13	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	

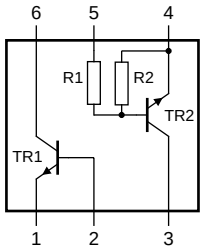
NXP founded by Philips

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	emitter TR1		
2	base TR1		
3	output (collector) TR2		
4	GND (emitter) TR2		
5	input (base) TR2		
6	collector TR1		





006aab253

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PUML1/DG	SC-88	plastic surface-mounted package; 6 leads	SOT363

4. Marking

Table 4. Marking codes

Type number	Marking code[1]
PUML1/DG	PA*

[1] * = -: made in Hong Kong
* = p: 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
TR1 (general-purpose transistor)					
V_{CBO}	collector-base voltage	open emitter	-	60	V
V_{CEO}	collector-emitter voltage	open base	-	50	V
V_{EBO}	emitter-base voltage	open collector	-	6	V
I_C	collector current		-	200	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms	-	200	mA
I_{BM}	peak base current	single pulse; $t_p \leq 1$ ms	-	100	mA

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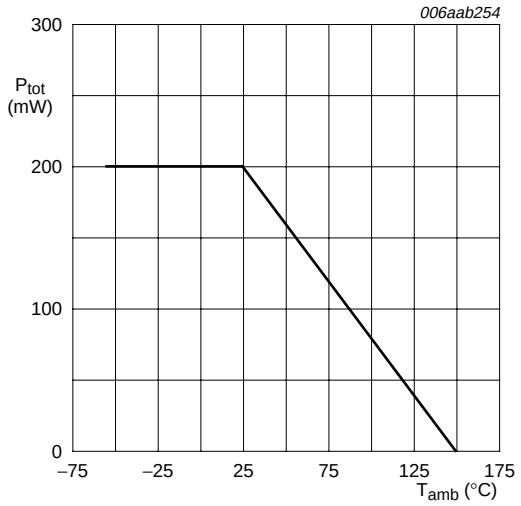
Table 5. Limiting values *…continued*

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

Symbol	Parameter	Conditions		Min	Max	Unit
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	200	mW
TR2 (resistor-equipped transistor)						
V_{CBO}	collector-base voltage	open emitter		-	50	V
V_{CEO}	collector-emitter voltage	open base		-	50	V
V_{EBO}	emitter-base voltage	open collector		-	10	V
V_I	input voltage					
	positive			-	+40	V
	negative			-	–10	V
I_O	output current			-	100	mA
I_{CM}	peak collector current	single pulse; $t_p \leq 1$ ms		-	100	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	200	mW
Per device						
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	[1]	-	300	mW
T_j	junction temperature			-	150	°C
T_{amb}	ambient temperature			–55	+150	°C
T_{stg}	storage temperature			–65	+150	°C

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.



FR4 PCB, standard footprint

Fig 1. Per transistor: Power derating curve

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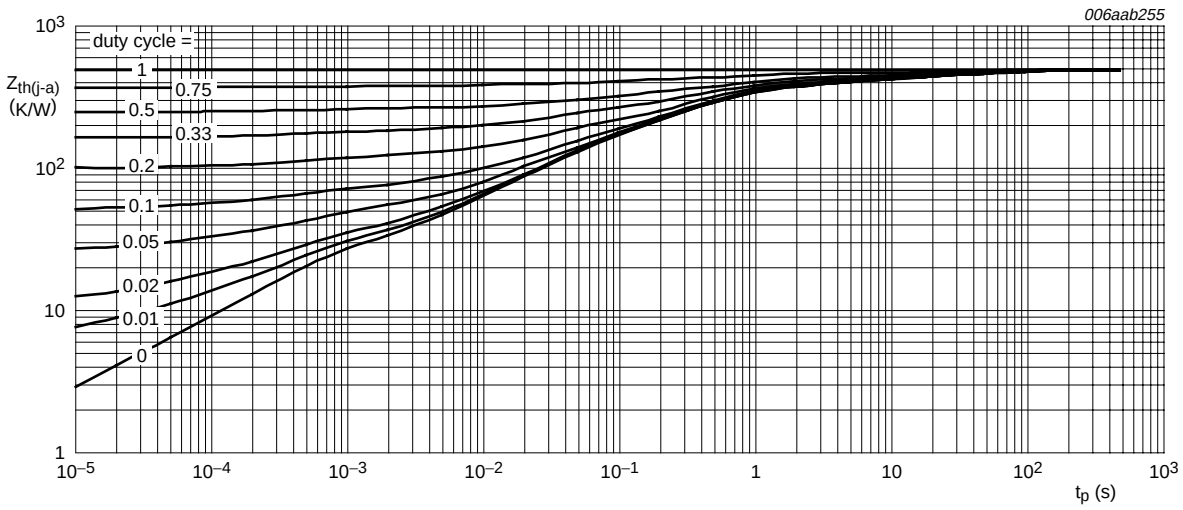
6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Per transistor							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	625	K/W
Per device							
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	-	-	417	K/W

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated and standard footprint.



FR4 PCB, standard footprint

Fig 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration

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7. Characteristics

Table 7. Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
TR1 (general-purpose transistor)						
I_{CBO}	collector-base cut-off current	V_{CB} = 60 V; I_E = 0 A	-	-	10	nA
		V_{CB} = 60 V; I_E = 0 A; T_j = 150 °C	-	-	5	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	10	nA
h_{FE}	DC current gain	V_{CE} = 2 V; I_C = 100 mA	90	-	-	
		V_{CE} = 10 V; I_C = 2 mA	210	-	340	
V_{CEsat}	collector-emitter saturation voltage	I_C = 100 mA; I_B = 10 mA	-	-	250	mV
f_T	transition frequency	V_{CE} = 10 V; I_C = 2 mA; f = 100 MHz	100	-	-	MHz
		V_{CE} = 6 V; I_C = 10 mA; f = 100 MHz	-	230	-	MHz
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz	-	-	3	pF
TR2 (resistor-equipped transistor)						
I_{CBO}	collector-base cut-off current	V_{CB} = 50 V; I_E = 0 A	-	-	100	nA
I_{CEO}	collector-emitter cut-off current	V_{CE} = 30 V; I_B = 0 A	-	-	1	µA
		V_{CE} = 30 V; I_B = 0 A; T_j = 150 °C	-	-	50	µA
I_{EBO}	emitter-base cut-off current	V_{EB} = 5 V; I_C = 0 A	-	-	400	µA
h_{FE}	DC current gain	V_{CE} = 5 V; I_C = 5 mA	30	-	-	
V_{CEsat}	collector-emitter saturation voltage	I_C = 10 mA; I_B = 0.5 mA	-	-	150	mV
$V_{I(off)}$	off-state input voltage	V_{CE} = 5 V; I_C = 100 µA	-	1.1	0.8	V
$V_{I(on)}$	on-state input voltage	V_{CE} = 0.3 V; I_C = 10 mA	2.5	1.8	-	V
R1	bias resistor 1 (input)		7	10	13	kΩ
R2/R1	bias resistor ratio		0.8	1	1.2	
C_c	collector capacitance	V_{CB} = 10 V; I_E = i_e = 0 A; f = 1 MHz	-	-	2.5	pF

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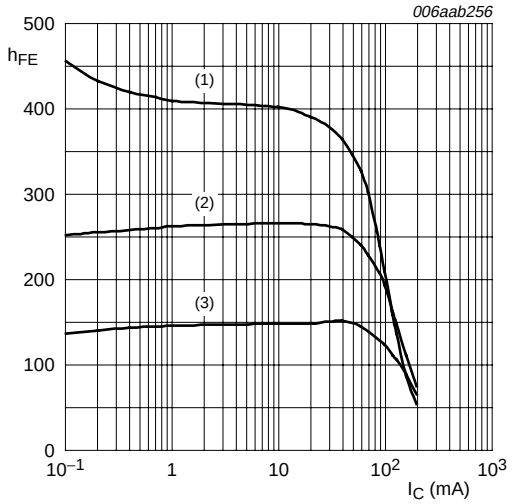


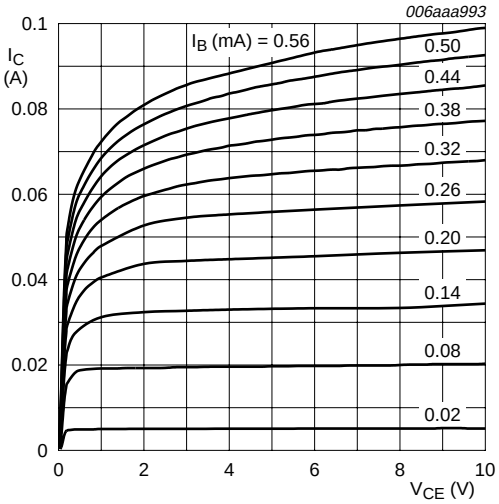
V_{CE} = 10 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

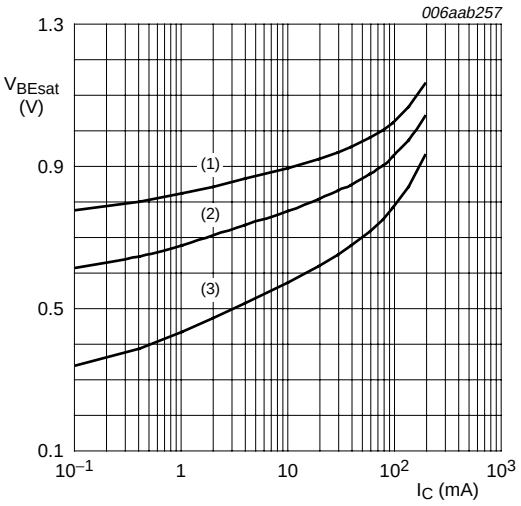
(3) T_{amb} = −55 °C

Fig 3. TR1: DC current gain as a function of collector current; typical values



T_{amb} = 25 °C

Fig 4. TR1: Collector current as a function of collector-emitter voltage; typical values



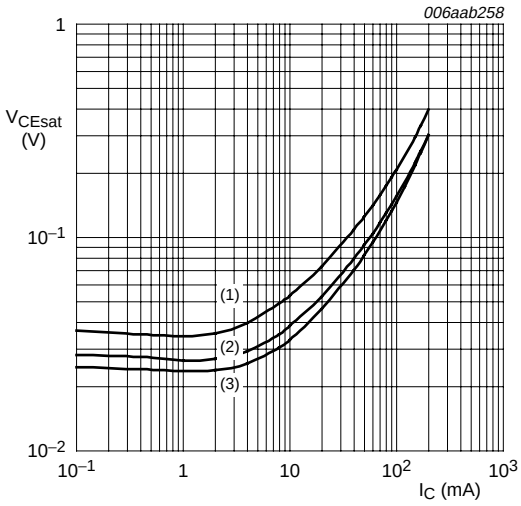
I_C/I_B = 10

(1) T_{amb} = −55 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 150 °C

Fig 5. TR1: Base-emitter saturation voltage as a function of collector current; typical values



I_C/I_B = 10

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = −55 °C

Fig 6. TR1: Collector-emitter saturation voltage as a function of collector current; typical values

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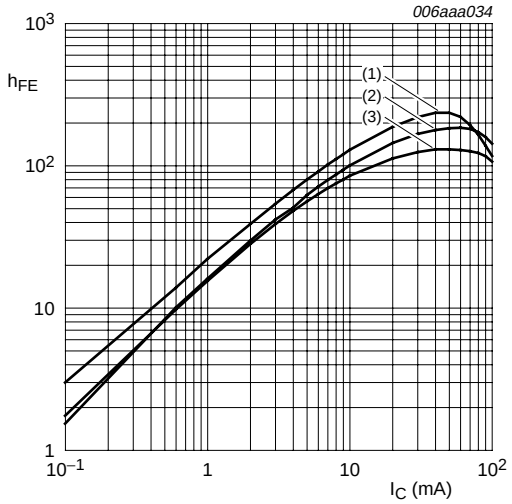


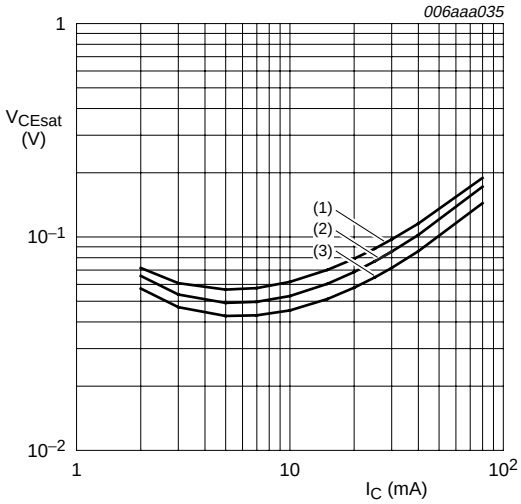
V_{CE} = 5 V

(1) T_{amb} = 150 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –40 °C

Fig 7. TR2: DC current gain as a function of collector current; typical values



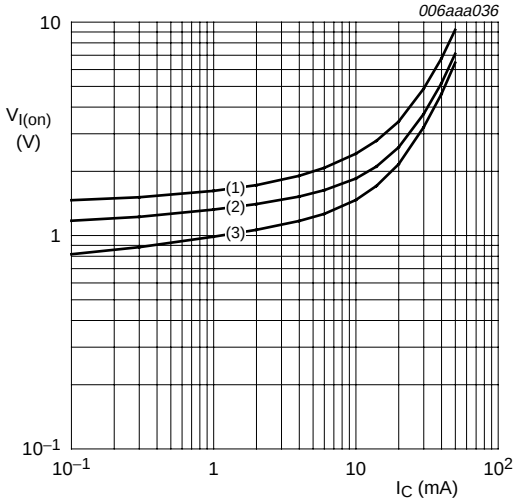
I_C/I_B = 20

(1) T_{amb} = 100 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = –40 °C

Fig 8. TR2: Collector-emitter saturation voltage as a function of collector current; typical values



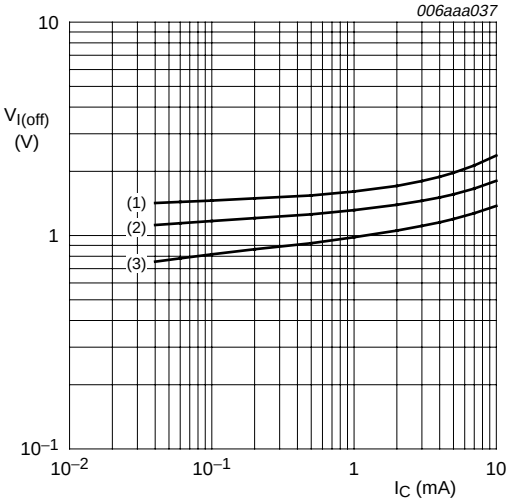
V_{CE} = 0.3 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 9. TR2: On-state input voltage as a function of collector current; typical values



V_{CE} = 5 V

(1) T_{amb} = –40 °C

(2) T_{amb} = 25 °C

(3) T_{amb} = 100 °C

Fig 10. TR2: Off-state input voltage as a function of collector current; typical values

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8. Test information

8.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard *Q101 - Stress test qualification for discrete semiconductors*, and is suitable for use in automotive applications.

9. Package outline

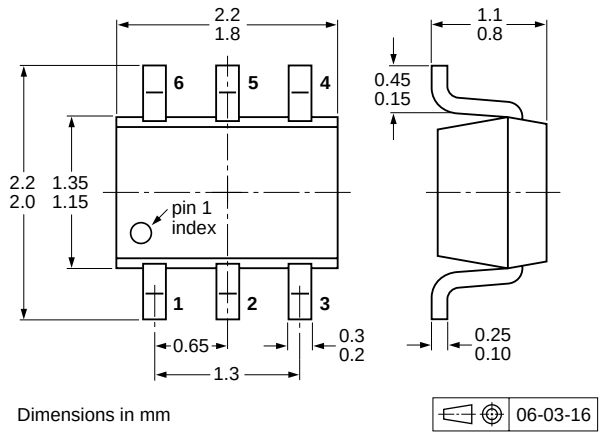

Fig 11. Package outline SOT363 (SC-88)

10. Packing information

Table 8. Packing methods

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

Type number	Package	Description		Packing quantity	
				3000	10000
PUML1/DG	SOT363	4 mm pitch, 8 mm tape and reel; T1	[2]	-115	-135
		4 mm pitch, 8 mm tape and reel; T2	[3]	-125	-165

[1] For further information and the availability of packing methods, see Section 14.

[2] T1: normal taping

[3] T2: reverse taping

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11. Soldering

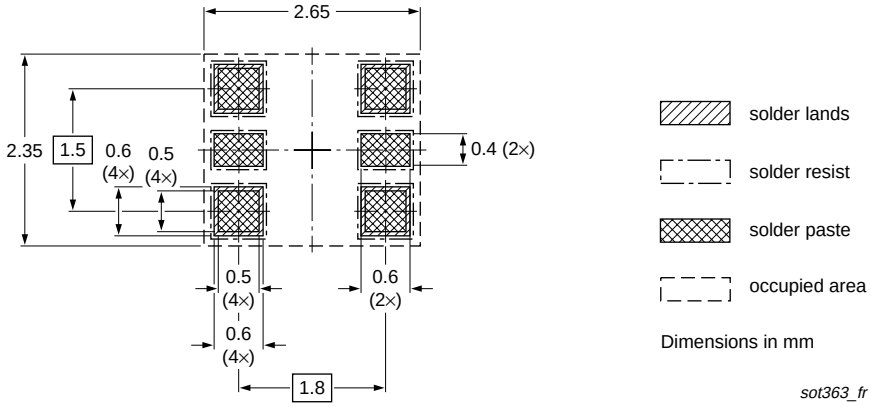

Fig 12. Reflow soldering footprint SOT363 (SC-88)

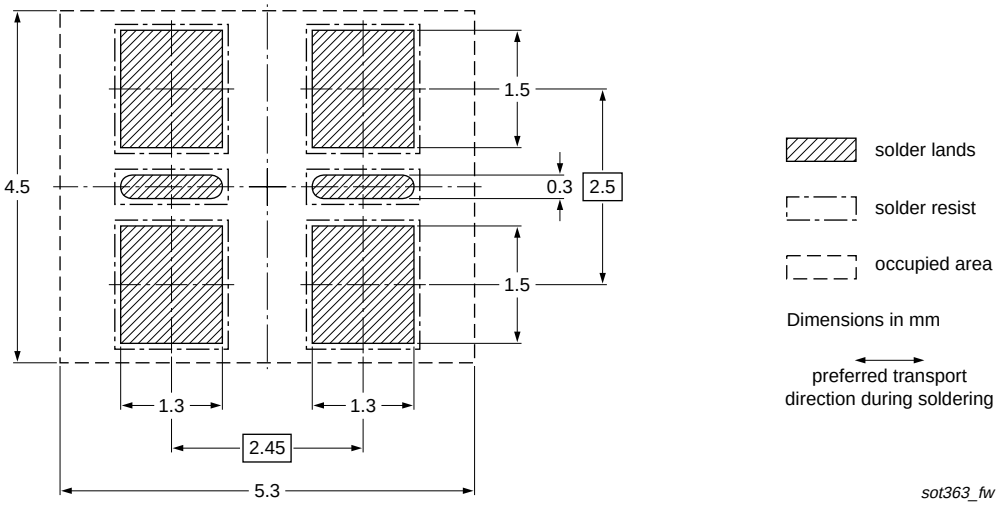

Fig 13. Wave soldering footprint SOT363 (SC-88)

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12. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PUML1_DG_1	20080714	Product data sheet	-	-

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13. Legal information

13.1 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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