

## ICs for Communications

High Voltage Subscriber Line IC  
HV-SLIC

PEB/F 4065 Version 3.0

Data Sheet 03.98  
DS 1

<b>PEB/F 4065</b>		
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## High Voltage Subscriber Line IC HV-SLIC

PEB/F 4065

Version 1.1

SPT

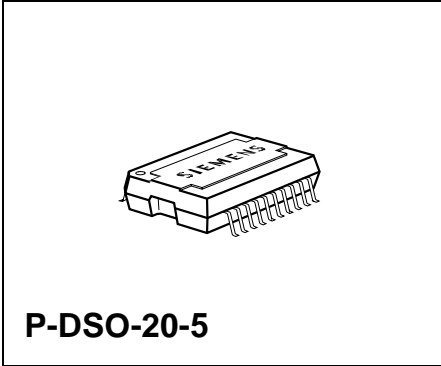
### 1 Overview

The High Voltage Subscriber Line IC PEB 4065 is a rugged and reliable interface between the telephone line and the SLICOFI, a low voltage Subscriber Line Interface and Codec Filter IC. It is fabricated in a Smart Power Technology offering a breakthrough voltage of at least 170 V.

The PEB 4065 provides battery feeding between – 24 V and – 80 V and internal ringing injection with a differential ring voltage up to 85 Vrms. In order to achieve these high amplitudes an auxiliary positive battery voltage is used during ringing. This voltage can also be applied in order to drive very long telephone lines.

The SLIC is designed for a voltage feeding – current sensing line interface concept and provides sensing of transversal and longitudinal current on both wires.

A power-down mode offers reduced power consumption at full functionality; in the power denial mode the device is switched off turning the line outputs to a high impedance state.



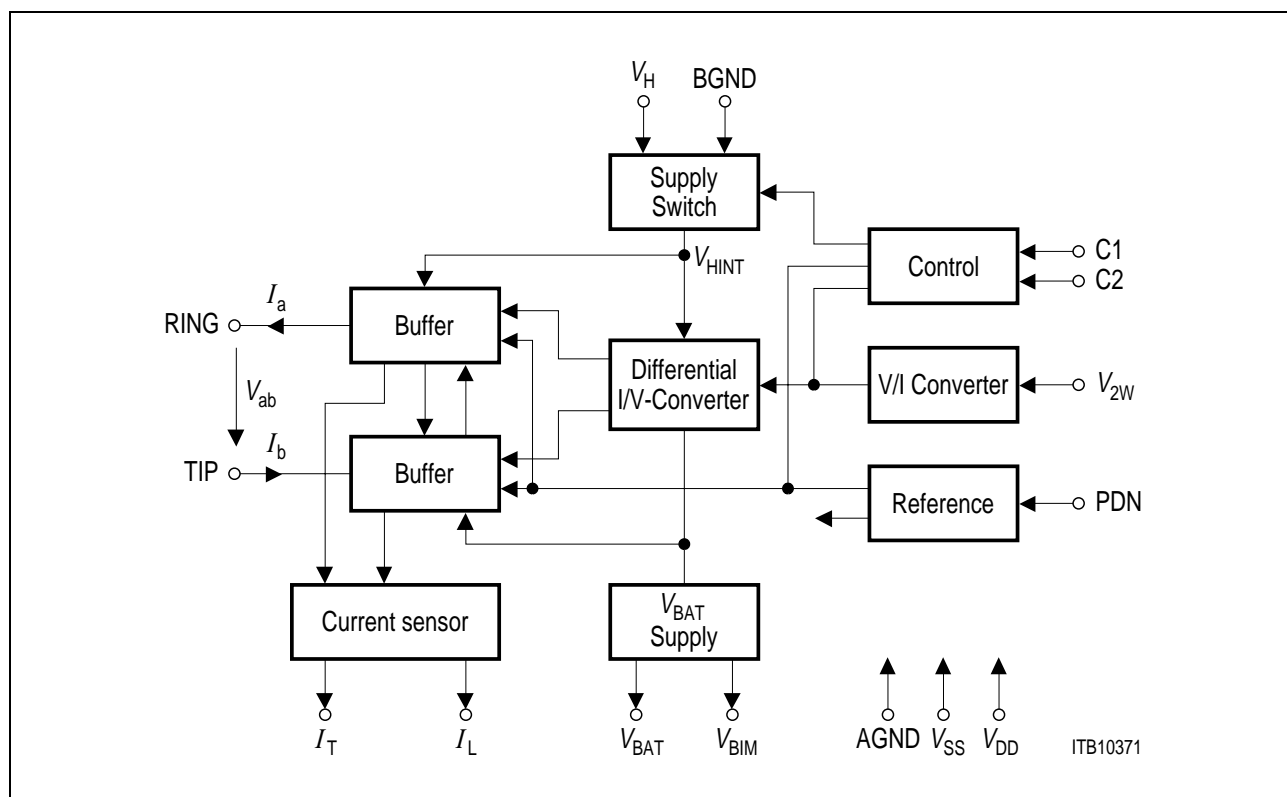
**P-DSO-20-5**

### 1.1 Features

- High voltage line feeding
- Internal ring and metering signal injection
- Sensing of transversal and longitudinal line current
- Reliable 170 V Smart Power Technology
- Battery voltage – 24 V ... – 80 V
- Boosted battery mode for long telephone lines and up to 85 Vrms balanced ringing
- Polarity reversal
- Small P-DSO-20-5 power package

Type	Ordering Code	Package
PEB/F 4065	on request	P-DSO-20-5

## 1.2 Functional Description



**Figure 1 Block Diagram**

The PEB 4065 supports AC and DC control loops based on feeding a voltage  $V_{ab}$  to the line and sensing the transversal line current  $I_{ab}$  (**Figure 2**).

It converts a unipolar input voltage  $V_{2W}$  into a differential output voltage  $V_{ab}$  with an AC receiving gain of

$$|Gr| = V_{abAC}/V_{2WAC} = 40.$$

This is accomplished by converting the input voltage to a current which is used to transpose the low voltage signals of the interface to the high voltage line feeding section. This current is reconverted to two voltages of opposite phase which are referenced to the positive and negative supply voltage, respectively. Thus the differential DC line-voltage in all normal polarity modes except ringing is related to the input voltage by

$$V_{abDC} = V_{BAT} - V_{HINT} + V_{fix} - 40 \times V_{2WDC}$$

$V_{BAT}$  negative battery voltage

$V_{HINT}$  internal positive supply voltage

$V_{fix}$  internal voltage drop of supply filter (appr. 2 V).

Depending on the operation mode,  $V_{HINT}$  is switched either to  $V_H$  ( $V_{HINT} = V_H - 1$  V) or to **BGND** ( $V_{HINT} = -0.5$  V) via the supply switch.

## Overview

Controlled by C2, the polarity of  $V_{ab}$  can be reversed and the DC-line-voltage then is

$$V_{abDC} = - (V_{BAT} - V_{HINT} + V_{fix} - 40 \times V_{2WDC}).$$

The transversal and longitudinal currents are measured in the buffers and scaled images are provided at the  $I_T$  and  $I_L$  pin, respectively:

$$I_T = (I_a + I_b)/100 = I_{ab}/50 \quad I_L = - (I_a - I_b)/100 = - I_{Long}/50.$$

The PEB 4065 operates in four modes controlled by ternary logic signals at the C1 and C2 input. Additionally, in the active modes a polarity reversal of the output voltage can be programmed (see **Table 1**).

Power down (PD): Power consumption is reduced by decreasing bias current levels. All functions operate at some small performance reductions. In this mode each of the line outputs can be programmed to show high impedance. HI b switches off the TIP buffer, while the current through the RING output still can be measured by  $I_T$  or  $I_L$ . Programming HI a reverses the polarity and switches off the RING buffer.

Conversation (CONV): This is the regular transmit and receive mode for voiceband and teletax. The line driving section is operated between  $V_{BAT}$  and BGND.

Boosted battery (BB): In order to drive longer telephone lines an auxiliary positive battery voltage  $V_H$  is used, enabling a higher DC-voltage across the line.

Ringin (RING): This mode also uses the auxiliary voltage  $V_H$  in order to provide a balanced ring signal of up to 85 Vrms. The ring tone without any DC-component has to be switched to the  $V_{2W}$  input. Internally a DC-voltage is superimposed. This voltage is proportional to the total supply voltage  $V_H - V_{BAT}$  and amounts to typically 23 V at  $V_H - V_{BAT} = 120$  V. The current sensing functions are available for ring trip detection.

The Power Denial (PDN) state is intended to reduce power consumption of the linecard to a minimum: the PEB 4065 is switched off completely by connecting the PDN pin to  $V_{DD}$ , no operation is available.

With respect to the output impedance of TIP and RING two PDN-modes have to be distinguished. A resistive one (PDNR) provides a connection of 15 kΩ each from TIP to BGND and RING to  $V_{BAT}$ , respectively, while the outputs of the buffers show high impedance (**Figure 3**).

The other mode (PDNH) offers high impedance at TIP and RING. It is entered when, in addition to connecting PDN to  $V_{DD}$ , the programming inputs C1, C2 are tied to  $V_{IL}$ .

All other combinations of C1, C2 yield the resistive power denial state PDNR.

Table 1    Programming of Operation Modes

		C2 (Pin 13)		
		$V_{IL}$	$V_{IZ}$	$V_{IH}$
C1 (Pin 12)	$V_{IL}$	RING RP	RING NP	HI a RP
	$V_{IZ}$	BB RP	BB NP	HI b NP
	$V_{IH}$	CONV RP	CONV NP	PD NP

NP            Normal Polarity            RP...Reverse Polarity  
HI a RP    Ring wire set to high impedance  
HI b NP    Tip wire set to high impedance

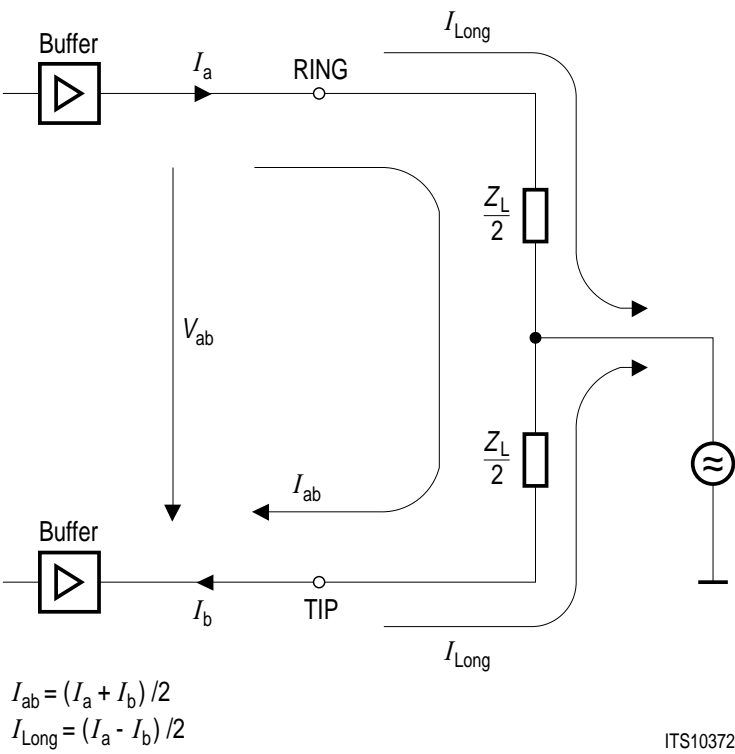
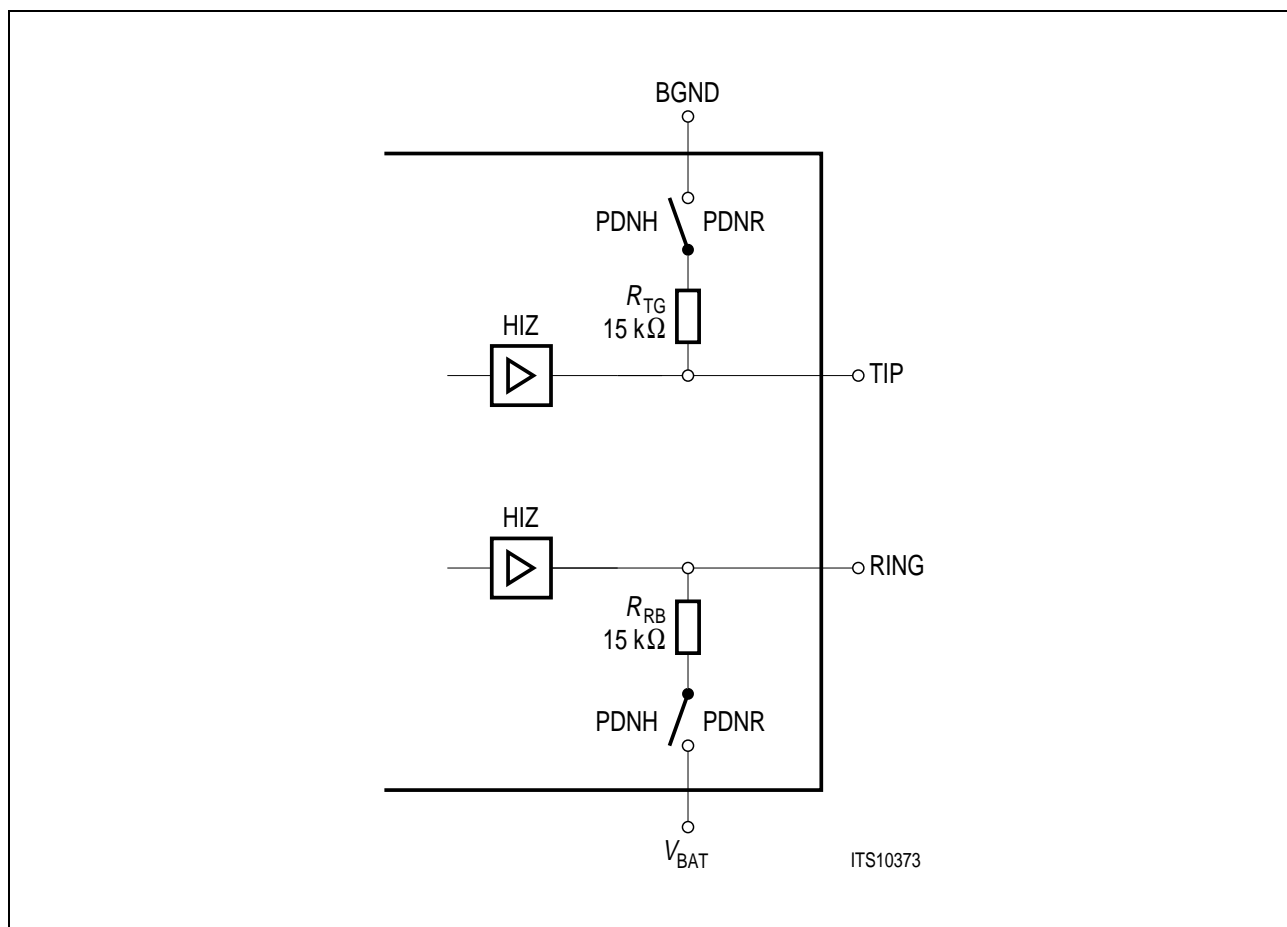


Figure 2    Definition of Output Current Directions



**Figure 3 TIP and RING Impedance in Power Denial**



1.3 Pin Description

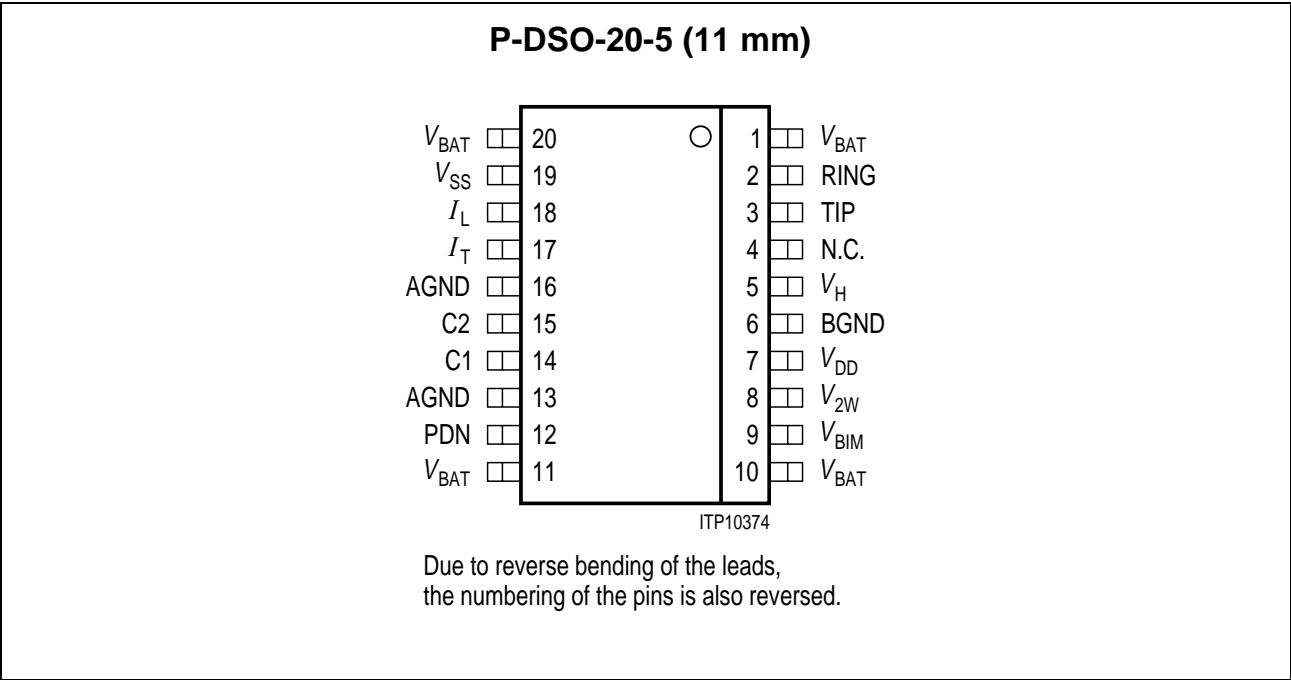


Figure 4 Pin Configuration (top view)

Table 2 Pin Definition and Functions

Pin No.	Symbol	Type Input (I) Output (O)	Function
1, 10, 11, 20	$V_{BAT}$	Supply	Negative battery supply voltage (– 24 ... – 80 V), referred to BGND
2	RING	O	Subscriber loop connection, negative wire in normal polarity; direction of positive $I_a$ current out of this pin
3	TIP	O	Subscriber loop connection, more positive wire in normal polarity; direction of positive $I_b$ current into this pin
4	–	N.C.	Not connected
5	$V_H$	Supply	Auxiliary positive battery supply voltage (0 ... + 90 V) used in ringing and boosted battery mode
6	BGND	Supply	Battery ground: TIP, RING, $V_{BAT}$ and $V_H$ refer to this pin
7	$V_{DD}$	Supply	Positive supply voltage (+ 5 V), referred to AGND

## Overview

Table 2 Pin Definition and Functions (cont'd)

Pin No.	Symbol	Type Input (I) Output (O)	Function
8	$V_{2W}$	I	Two wire input voltage; multiplied by + 20 and – 20, respectively, it appears at the TIP and RING outputs
9	$V_{BIM}$	O	Down scaled image of the total supply voltage ( $V_{HINT} - V_{BAT}$ ); scaling factor 40
12	PDN	I/O	Power denial, reference output when connected to ground via a resistor, switches the device off when connected to $V_{DD}$
13, 16	AGND	Supply	Analog ground: $V_{DD}$ , $V_{SS}$ and all signal and control pins with exception of TIP and RING refer to AGND
14	C1	I/O	Ternary logic input, controlling the operation mode; in case of thermal overload this pin sinks a current of typ. 550 $\mu$ A
15	C2	I	Ternary logic input, controlling the operation mode
17	$I_T$	O	Current output representing the transversal current scaled down by 50; In normal polarity this pin sinks the $I_T$ current.
18	$I_L$	O	Current output representing the longitudinal current scaled down by 50; For $I_{long}$ flowing out of TIP and RING this pin sinks the $I_L$ current.
19	$V_{SS}$	Supply	Negative supply voltage (– 5 V), referred to AGND

## Electrical Characteristics

## 2 Electrical Characteristics

## 2.1 Absolute Maximum Ratings

Table 3

Parameter	Symbol	Limit Values		Unit	Condition
		min.	max.		
Battery voltage	$V_{BAT}$	– 90	0.5	V	referred to BGND
Auxiliary supply voltage	$V_H$	– 0.5	90	V	referred to BGND
Total battery supply voltage, continuously	$V_H - V_{BAT}$	–	160	V	–
Total battery supply voltage, pulse < 1 ms	$V_H - V_{BAT}$	–	170	V	–
$V_{DD}$ supply voltage	$V_{DD}$	– 0.4	5.5	V	referred to AGND
$V_{SS}$ supply voltage	$V_{SS}$	– 5.5	0.4	V	referred to AGND
Ground voltage difference	$V_{BGND} - V_{AGND}$	– 0.5	0.5	V	–
Junction temperature	$T_j$	–	150	°C	–
Input voltages	$V_{2W}, V_{C1}, V_{C2}$	$V_{SS} - 0.3$	$V_{DD} + 0.3$	V	–
Voltages on current outputs	$V_{IT}, V_{IL}$	– 3.5	$V_{DD} + 0.3$	V	–
Voltages on PDN	$V_{PDN}$	– 0.3	$V_{DD} + 0.3$	V	–
RING, TIP voltages, continuously	$V_a, V_b$	$V_{BAT} - 0.3$	$V_H + 0.3$	V	–
RING, TIP voltages, pulse < 1 ms <sup>1)</sup>	$V_a, V_b$	$V_{BAT} - 10$	$V_H + 10$	V	–
RING, TIP voltages, pulse < 1 μs <sup>1)</sup>	$V_a, V_b$	$V_{BAT} - 30$	$V_H + 30$	V	–
ESD-voltage, all pins	–	–	1	kV	Human body model

<sup>1)</sup> See Test Figure 10.

*Note: Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.*

Electrical Characteristics

2.2 Operating Range

Table 4

Parameter	Symbol	Limit Values		Unit	Condition
		min.	max.		
Battery voltage	$V_{BAT}$	– 80	– 24	V	referred to BGND
Auxiliary supply voltage	$V_H$	5	85	V	referred to BGND
Total battery supply voltage	$V_H - V_{BAT}$	–	150	V	–
$V_{DD}$ supply voltage	$V_{DD}$	4.75	5.25	V	referred to AGND
$V_{SS}$ supply voltage	$V_{SS}$	– 5.25	– 4.75	V	referred to AGND
Ground voltage difference	–	– 0.3	0.3	V	–
Ambient temperature	$T_{amb}$	0 – 40	70 85	°C °C	PEB 4065 PEF 4065
Voltage compliance $I_T, I_L$	$V_{IT}, V_{IL}$	– 3	3	V	–
Input range $V_{2W}$	$V_{2W}$	– 3.2	+ 3.2	V	RING
		– 3.2	0	V	CONV, PD, BB

Note: In the operating range the functions given in the circuit description are fulfilled.

2.3 Thermal Resistances

Table 5

Parameter	Symbol	Limit Values	Unit	Condition
Junction to case	$R_{th, jC}$	5	K/W	–
Junction to ambient	$R_{th, jA}$	20	K/W	with heatsink, typ.

## Electrical Characteristics

## 2.4 Electrical Parameters

Min/max values are valid within the full operating range. If PEB- and PEF-specifications are different, both values can be found in the respective column.

Testing is performed according to the test figures with external circuitry as depicted in **Figure 4**. Unless otherwise stated, load impedance  $R_L = 600 \Omega$ . Test temperatures are 25 and 70 °C for PEB, – 40, 25 and 85 °C for PEF-type (without heatsink). DC line voltages refer to  $V_{BAT} = -70 \text{ V}$  and  $V_H = +60 \text{ V}$ .

Table 6 Supply Currents and Power Dissipation

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.
				min.	typ.	max. PEB/PEF		
Power Denial								
1.	V <sub>DD</sub> current	I <sub>DD</sub>	PDNH, PDNR	—	50	120/150	μA	1
2.	V <sub>SS</sub> current	I <sub>SS</sub>	PDNH PDNR	—	50 150	120/150 250/300	μA	1
3.	V <sub>BAT</sub> current	I <sub>BAT</sub>	PDNH PDNR	—	10 50	30 120	μA	1
4.	V <sub>H</sub> current	I <sub>H</sub>	PDNH, PDNR	—	1	10	μA	1
Power Down <span style="float:right">V<sub>2W</sub> = – 0.5 V<sup>1)</sup></span>								
5.	V <sub>DD</sub> current	I <sub>DD</sub>	PD	—	0.5	1.0	mA	1
6.	V <sub>SS</sub> current	I <sub>SS</sub>	PD	—	0.3	0.4	mA	1
7.	V <sub>BAT</sub> current	I <sub>BAT</sub>	PD	—	3.3	4.3/4.4	mA	1
8.	V <sub>H</sub> current	I <sub>H</sub>	PD	—	1	10	μA	1
9.	Quiescent power dissipation	P <sub>Q</sub>	PD	—	—	315	mW	1
Conversation, Normal and Reverse Polarity <span style="float:right">V<sub>2W</sub> = – 0.5 V<sup>1)</sup></span>								
10.	V <sub>DD</sub> current	I <sub>DD</sub>	CONV	—	0.8	1.0/1.1	mA	1
11.	V <sub>SS</sub> current	I <sub>SS</sub>	CONV	—	0.4	0.5/0.6	mA	1
12.	V <sub>BAT</sub> current	I <sub>BAT</sub>	CONV	—	4.0	5.8/5.9	mA	1
13.	V <sub>H</sub> current	I <sub>H</sub>	CONV	—	1	10	μA	1
14.	Quiescent power dissipation	P <sub>Q</sub>	CONV	—	—	420	mW	1

Electrical Characteristics

Table 6    Supply Currents and Power Dissipation (cont'd)

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.
				min.	typ.	max. PEB/PEF		
Boosted Battery Mode Normal and Reverse Polarity							$V_{2W} = -0.5\text{ V}^{(1)}$	
15.	$V_{DD}$ current	$I_{DD}$	BB	—	0.8	1.0	mA	1
16.	$V_{SS}$ current	$I_{SS}$	BB	—	1.7	2.0	mA	1
17.	$V_{BAT}$ current	$I_{BAT}$	BB	—	4.0	6.1/6.2	mA	1
18.	$V_H$ current	$I_H$	BB	—	3.0	4.8	mA	1
19.	Quiescent power dissipation	$P_Q$	BB	—	—	740	mW	1
Ringing Mode Normal and Reverse Polarity							$V_{2W} = 0\text{ V}$	
20.	$V_{DD}$ current	$I_{DD}$	RING	—	2.3	2.6	mA	1
21.	$V_{SS}$ current	$I_{SS}$	RING	—	2.8	3.2	mA	1
22.	$V_{BAT}$ current	$I_{BAT}$	RING	—	8.8	12/12.5	mA	1
23.	$V_H$ current	$I_H$	RING	—	7.1	10	mA	1
24.	Quiescent power dissipation	$P_Q$	RING	—	1300	1500	mW	1

<sup>1)</sup>  $I_{BAT}$  and  $I_H$  depend on the value of  $V_{2W}$ :  
 $I_{BAT}(V_{2W}) = I_{BAT(0)} + |V_{2W}|/440\ \Omega$       typ. (PD, CONV, BB)  
 $I_H(V_{2W}) = I_{H(0)} + |V_{2W}|/440\ \Omega$       typ. (BB)

## Electrical Characteristics

Table 7 DC-Characteristics

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min. PEB/ PEF	typ.	max. PEB/ PEF			
Line Termination TIP, RING									
25.	Power down DC line voltage	$ V_{ab,DC} $	PD	46	49	52	V	2	$V_{2W} = -0.5\text{ V}$
26.			PD	- 14	- 11	- 8	V		$V_{2W} = -2\text{ V}$
27.	Conversation DC line voltage	$ V_{ab,DC} $	CONV	65	66.5	68.5	V	2	$V_{2W} = 0\text{ V}$
28.			CONV	46.6	47.8	48.8	V		$V_{2W} = -0.5\text{ V}$
29.			CONV	- 14	- 12.2	- 10.4	V		$V_{2W} = -2\text{ V}$
30.	Ring DC line voltage	$ V_{ab,DC} $	RING	22.1	25	27.7	V	2	$V_{2W} = 0\text{ V}$
31.	Output current limit	$ I_{a,max} $ , $ I_{b,max} $	PD others	85/80 90/85	- -	130 130/ 135	mA mA	3	$V_{2W} = -0.5\text{ V}$ $V_a, V_b$ acc. to <b>Test Figure 3</b>
32.	Loop open resistance TIP to BGND	$R_{TG}$	PDNR	12/11	15	18/19	kΩ	9	$I_b = 2\text{ mA}$
33.	Loop open resistance RING to $V_{BAT}$	$R_{RB}$	PDNR	12/11	15	18/19	kΩ		$I_a = 2\text{ mA}$
34.	Power denial output leakage current	$I_{Leak,a}$	PDNH	- 30	-	30	μA	-	$V_{BAT} < V_a < V_H$
35.		$I_{Leak,b}$		- 30	-	30	μA		$V_{BAT} < V_a < V_H$
36.	High impedance output leakage current	$I_{Leak,a}$	HI a	- 30	-	30	μA	-	$V_{BAT} < V_a < V_{H-3}$
37.		$I_{Leak,b}$	HI b	- 30	-	30	μA		$V_{BAT} < V_b < V_{H-3}$

## Electrical Characteristics

Table 7 DC-Characteristics (cont'd)

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min. PEB/ PEF	typ.	max. PEB/ PEF			
Reference Voltage Outputs P <sub>DN</sub> , V <sub>BIM</sub>									
38.	Output voltage on P <sub>DN</sub>	V <sub>ref</sub>	all	1.15	1.25	1.35	V	1	–
39.	Battery image voltage	V <sub>BIM</sub>	CONV, PD	– 1.75	– 1.7	– 1.65	V	1	–
40.			BB, RING	– 3.25	– 3.18	– 3.1	V		
Two-wire Input V <sub>2W</sub>									
41.	Input current	I <sub>2W</sub>	all	– 30	–	30	μA	–	– 3.2 V < V <sub>2W</sub> < 3.2 V
42.	Input capacitance	–	–	–	–	20	pF	–	–
Current Outputs I <sub>T</sub> , I <sub>L</sub> <span style="float:right">V<sub>2W</sub> = – 0.5 V</span>									
43.	I <sub>T</sub> output current	I <sub>T</sub>	PD, CONV	–	–	15	μA	2	I <sub>a</sub> = I <sub>b</sub> = 0
44.			PD, CONV	380		420	μA		I <sub>a</sub> = I <sub>b</sub> = 20 mA <sup>1)</sup>
45.			CONV	0.95		1.05	mA		I <sub>a</sub> = I <sub>b</sub> = 50mA <sup>1)</sup>
46.			RING			20	μA		I <sub>a</sub> = I <sub>b</sub> = 0
47.	I <sub>L</sub> output current	I <sub>L</sub>	PD, CONV	–	–	30	μA	2	I <sub>a</sub> = I <sub>b</sub> = 0
48.			PD, CONV			30	μA		I <sub>a</sub> = I <sub>b</sub> = 20 mA <sup>1)</sup>
49.			PD, CONV	65		135	μA		I <sub>a</sub> = 15 mA, I <sub>b</sub> = 25 mA
50.			CONV	180		320	μA		I <sub>a</sub> = 37.5 mA, I <sub>b</sub> = 62.5 mA



## Electrical Characteristics

Table 7 DC-Characteristics (cont'd)

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min. PEB/ PEF	typ.	max. PEB/ PEF			
Control Inputs C1, C2									
51.	H-input voltage	$V_{IH}$	all	2	–	–	V	–	–
52.	Z-input voltage	$V_{IZ}$	all	– 0.8	–	0.8	V	–	–
53.	L-input voltage	$V_{IL}$	all	–	–	– 2	V	–	–
54.	Input leakage current	$I_{Leak}$	all	– 5	–	5	μA	–	– 5 V < $V_{C1(2)}$ < + 5 V
55.	Thermal overload current C1	$I_{therm}$	all	500	550	–	μA	–	$V_{C1} = - 3.2$ V
56.	Switching Temperature (guaranteed by design)	$T_{joff}$	all	–	165	–	°C	–	–
		$T_{jon}$	all	–	145	–	°C	–	–

<sup>1)</sup> Polarity of  $I_a$  and  $I_b$  is reversed for measurement in reverse polarity mode

**Note:** The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at  $T_A = 25^{\circ}C$  and the given supply voltage.

## Electrical Characteristics

## 2.5 AC-Characteristics

(Normal and reverse polarity unless otherwise stated)

Table 8

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min.	typ.	max. PEB/ PEF			
Line Termination TIP, RING									
57.	Receive gain	Gr	CONV, BB	31.92	32.04	32.16	dB	4	$V_{2W,AC} = 50 \text{ mVrms}$ $f = 1015 \text{ Hz}$ $I_{ab} = 20 \text{ mA}$
58.			CONV	31.88	32.04	32.2	dB		$I_{ab} = 50 \text{ mA}$
59.	Gain flatness (guaranteed by design)	dGr	CONV, BB	− 0.05	−	0.05	dB	−	$300 \text{ Hz} < f < 3400 \text{ Hz}$ $V_{2W,AC} = 50 \text{ mVrms}$
60.	Gain tracking (guaranteed by design)	dGr	CONV	− 0.2	−	0.2	dB	−	$3 \text{ dBm0} > V_{ab} > -20 \text{ dBm0}$ $f = 1015 \text{ Hz}$
61.	Total harmonic distortion $V_{ab}$	THD	CONV	−	−	0.3	%	4	$V_{2W,AC} = 50 \text{ mVrms}$ $f = 1015 \text{ Hz}$ $I_{ab} = 20 \text{ mA}$
62.	Teletax distortion	THD TT X	CONV	−	−	3	%	5	$f = 16 \text{ kHz}$ $R_L = 200 \Omega$ $I_{ab} = 50 \text{ mA}$ $V_{ab,AC} = 2 \text{ Vrms}$
63.				−	−	3	%		$V_{ab,AC} = 5 \text{ Vrms}$ $I_{ab} = 0 \text{ mA},$ $V_{ab} = 55 \text{ V}$
64.				−	−	5	%		$V_{ab,AC} = 2 \text{ Vrms}$
65.	Psophometric noise	$N_P, V_{ab}$	CONV	−	−	− 75	dBmp	4	$I_{ab} = 30 \text{ mA}$
66.	Longitudinal to transversal rejection ratio $V_{long}/V_{ab}$	LTRR	CONV	61/58	−	−	dB	6	$V_{long} = 3 \text{ Vrms}$ $300 \text{ Hz} < f < 3.4 \text{ kHz}$ $I_{ab} = 30 \text{ mA}$
67.	Transversal to longitudinal rejection ratio $V_{ab}/V_{long}$	TLRR	CONV	50	−	−	dB	7	$V_{2W,AC} = 150 \text{ mVrms}$ $300 \text{ Hz} < f < 3.4 \text{ kHz}$ $I_{ab} = 30 \text{ mA}$

## Electrical Characteristics

Table 8 (cont'd)

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min.	typ.	max. PEB/ PEF			
68.	Power supply rejection ratio $V_{BAT}/V_{ab}$	PSRR	CONV, BB	33	40	—	dB	4	300 Hz < $f$ < 3.4 kHz $V_{Supply,AC} = 100$ mVp $I_{ab} = 30$ mA
			PD	30/28	—	—	dB		
69.	$V_H/V_{ab}$		BB	33/30	40	—	dB		
70.	$V_{DD}/V_{ab}$		CONV, BB	33	50	—	dB		
71.	$V_{SS}/V_{ab}$		CONV, BB	33	50 25	—	dB dB		
72.	Ringing voltage	$V_{RING}$	RING	67	—	—	Vrms, diff	8	$R_L = 1$ k $\Omega$ $C_L = 1$ $\mu$ F $f = 66$ Hz $V_{2W} = 1.7$ Vrms
73.	Ringing voltage with extended $V_H$			84	—	—	Vrms, diff	8	$V_H = 80$ V $f = 20$ Hz $V_{2W} = 2.2$ Vrms
74.	Ringing distortion	THD	RING	—	—	4	%	8	$f = 66$ Hz $V_{2W} = 1.7$ Vrms
<b>Transversal Current Output <math>I_T</math></b>									
75.	Transversal current ratio	Git	CONV, BB	33.89	33.98	34.07	dB	4	$V_{2W} = 50$ mVrms $f = 1015$ Hz $I_{ab} = 20$ mA
76.			CONV	33.89	33.98	34.07	dB		$I_{ab} = 50$ mA
77.	Gain flatness (guaranteed by design)	dGit	CONV, BB	— 0.05	—	0.05	dB	—	300 Hz < $f$ < 3400 Hz $V_{2W,AC} = 50$ mVrms $I_{ab} = 20$ mA
78.	Gain tracking (guaranteed by design)	dGit	CONV	— 0.2	—	0.2	dB	—	3 dBm0 > $V_{ab}$ > — 20 dBm0 $f = 1015$ Hz
79.	Total harmonic distortion $V_{IT}$	THD, $I_T$	CONV	—	0.01	0.3	%	4	$V_{2W,AC} = 50$ mVrms $f = 1015$ Hz $I_{ab} = 15$ mA

## Electrical Characteristics

Table 8 (cont'd)

No.	Parameter	Symbol	Mode	Limit Values			Unit	Test Fig.	Test Condition
				min.	typ.	max. PEB/ PEF			
80.	Psophometric noise	$N_P, V_{IT}$	CONV	–	–	– 100 –97	dBmp	4	$I_{ab} = 30 \text{ mA}$ , $T > 0^\circ\text{C}$ $-40^\circ\text{C} < T < 0^\circ\text{C}$
81.	Frequency response $V_{IT}/V_{2W}$ (guaranteed by design) Amplitude	–	CONV	– 0.5	1.7	1.95	dB	4	$f = 200 \text{ kHz}$ $V_{2W,AC} = 50 \text{ mVrms}$ $I_{Line} = 20 \text{ mA}$ $C_s = 0.2 \text{ nF}$
82.	Phase			100	–	–	deg		
83.	Longitudinal to transversal current output rejection ratio $V_{long}/V_{IT}$	LITRR	CONV	75	–	–	dB	6	$V_{long} = 3 \text{ Vrms}$ $I_{ab} = 30 \text{ mA}$
84.				81	–	–	dB		$300 \text{ Hz} < f < 3.4 \text{ kHz}$ $f = 1015 \text{ Hz}$
85.	Power supply rejection ratio $V_{BAT}/V_{IT}$	PSRR	CONV, PD	50	60	–	dB	4	$300 \text{ Hz} < f < 3.4 \text{ kHz}$ $V_{supply,AC} = 100 \text{ mVp}$ $I_{ab} = 30 \text{ mA}$
86.	$V_H/V_{IT}$		BB	50	60	–	dB		
87.	$V_{DD}/V_{IT}$		CONV	50	60	–	dB		
88.	$V_{SS}/V_{IT}$		CONV	50	60	–	dB		

## Electrical Characteristics

**Table 9 External Elements in the Application Circuit (Figure 5)**

Typical values are used in the test circuits, unless otherwise specified.

Ext. Part	Function	Typ. Value	Tolerance	Limit Values		Comment
				min.	max.	
$R_1$	Biassing, current reference	25 k $\Omega$	—	—	50 k $\Omega$	power dissipation increases with smaller $R_1$
$R_2, R_3$	$I_T, I_L$ gain adjustment	1 k $\Omega$	0.1% (rel.)	—	—	clipping for $I_T \times R_2 > 3 \text{ V}$ or $I_L \times R_3 > 3 \text{ V}$
$R_S$	Protection, isolation of capacitive load	50 $\Omega$	0.1% (rel.)	30 $\Omega$	—	—
$R_5, R_6$	Protection	50 $\Omega$	0.1% (rel.)	—	—	—
$C_1$	C for the internal supply voltage filter	22 $\mu\text{F}$ ( $f_{3\text{dB}} \approx 3 \text{ Hz}$ )	20%	10 nF	—	$f_{3\text{dB}}$ increases with smaller $C_1$ , causing worse low frequency PSRR from $V_{\text{BAT}}$
$C_S$	Suppression of voltage spikes, frequency compensation	15 nF	5% (rel.)	200 pF	20 nF	—
$C_2, C_3$	$V_{\text{DD}}, V_{\text{SS}}$ supply voltage blocking	1 $\mu\text{F}$	20%	10 nF	—	$C_2, C_3 > 1 \mu\text{F}$ and $C_4 \approx C_5$ allows arbitrary switching sequence of all supply voltages incl.
$C_4$	$V_H$ blocking	100 nF	—	—	—	
$C_5$	$V_{\text{BAT}}$ blocking	100 nF	20%	100 nF	—	ground

**Note: Exceeding the min./max. limits can cause stability problems!**

Electrical Characteristics

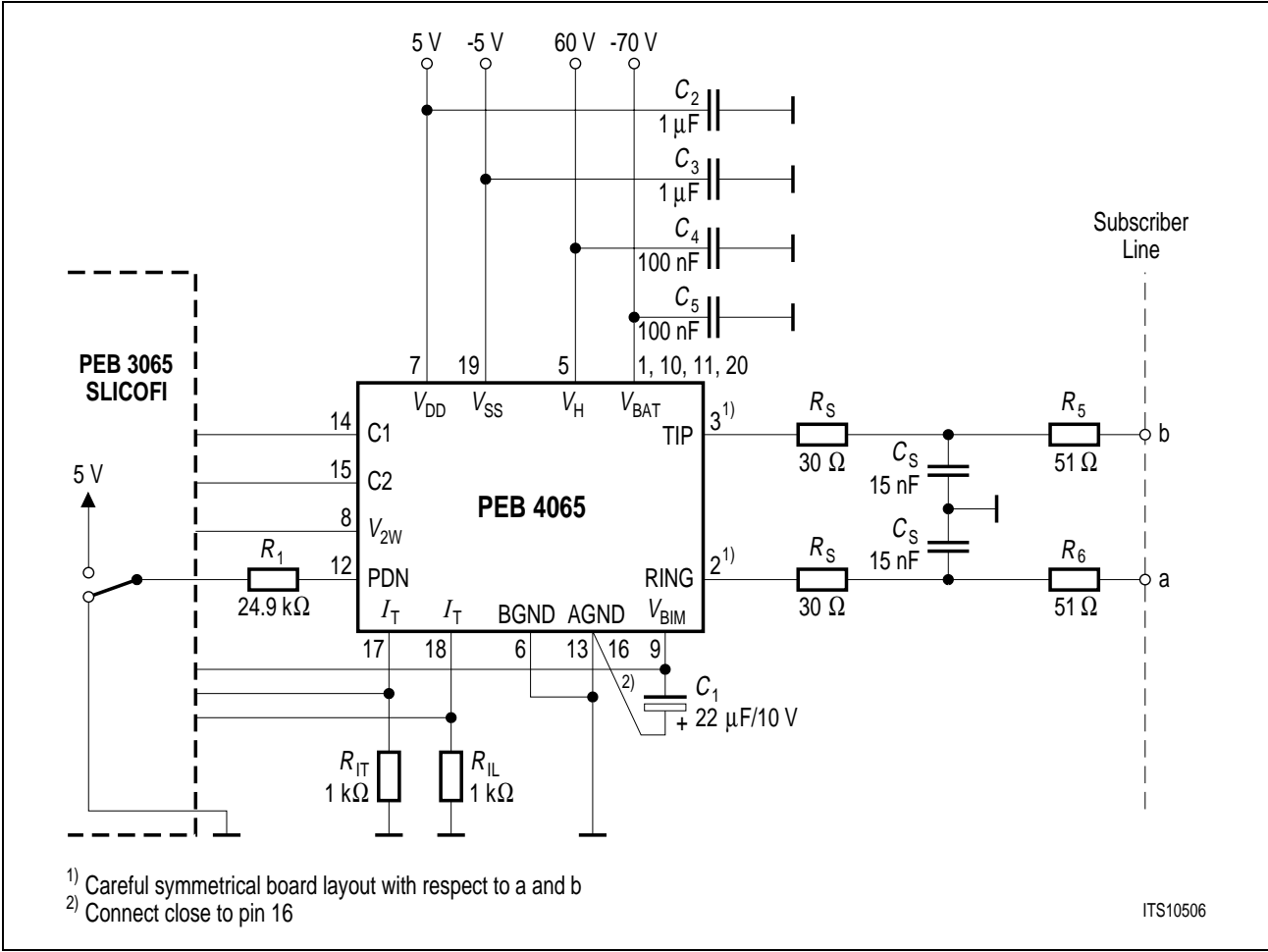
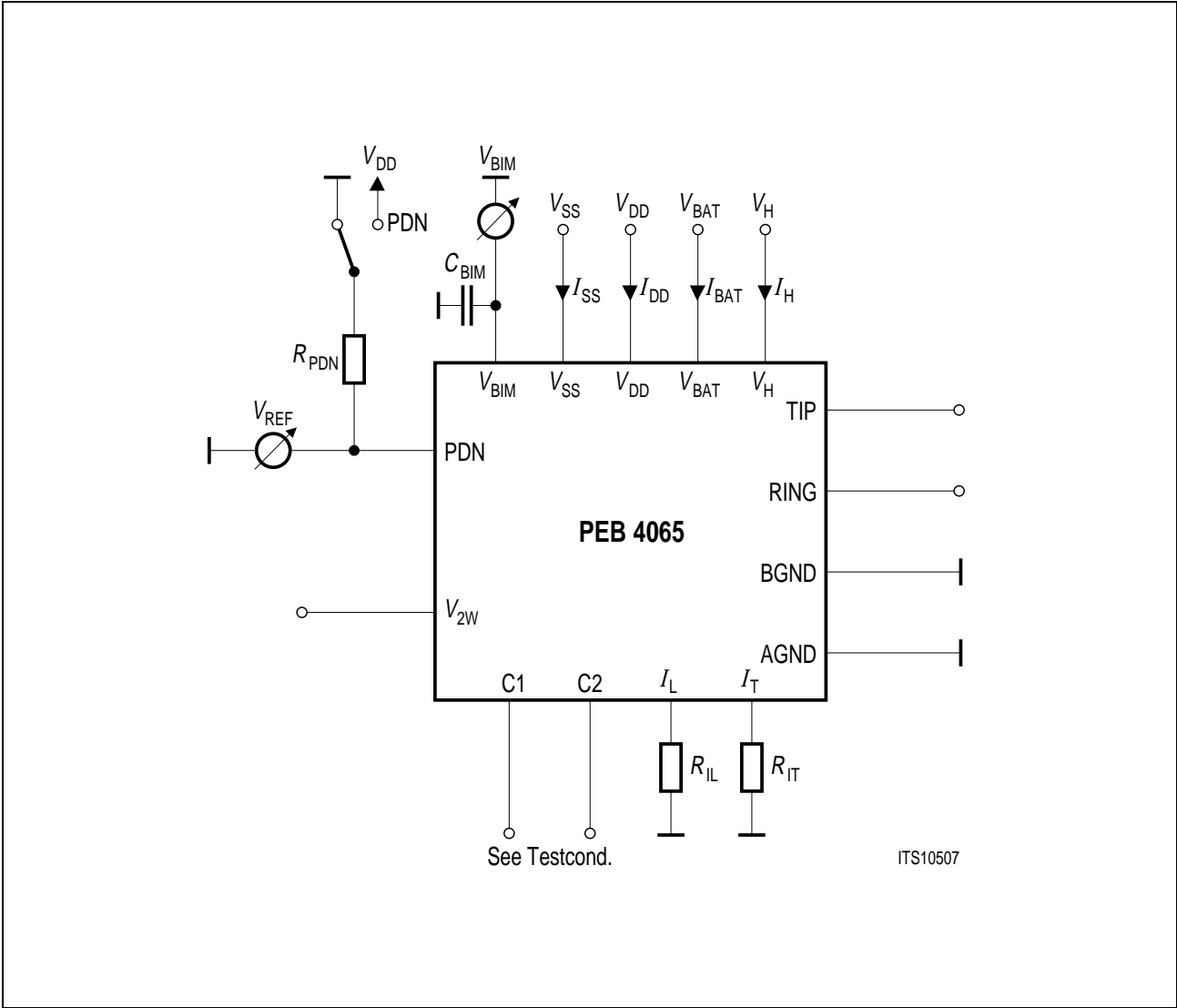


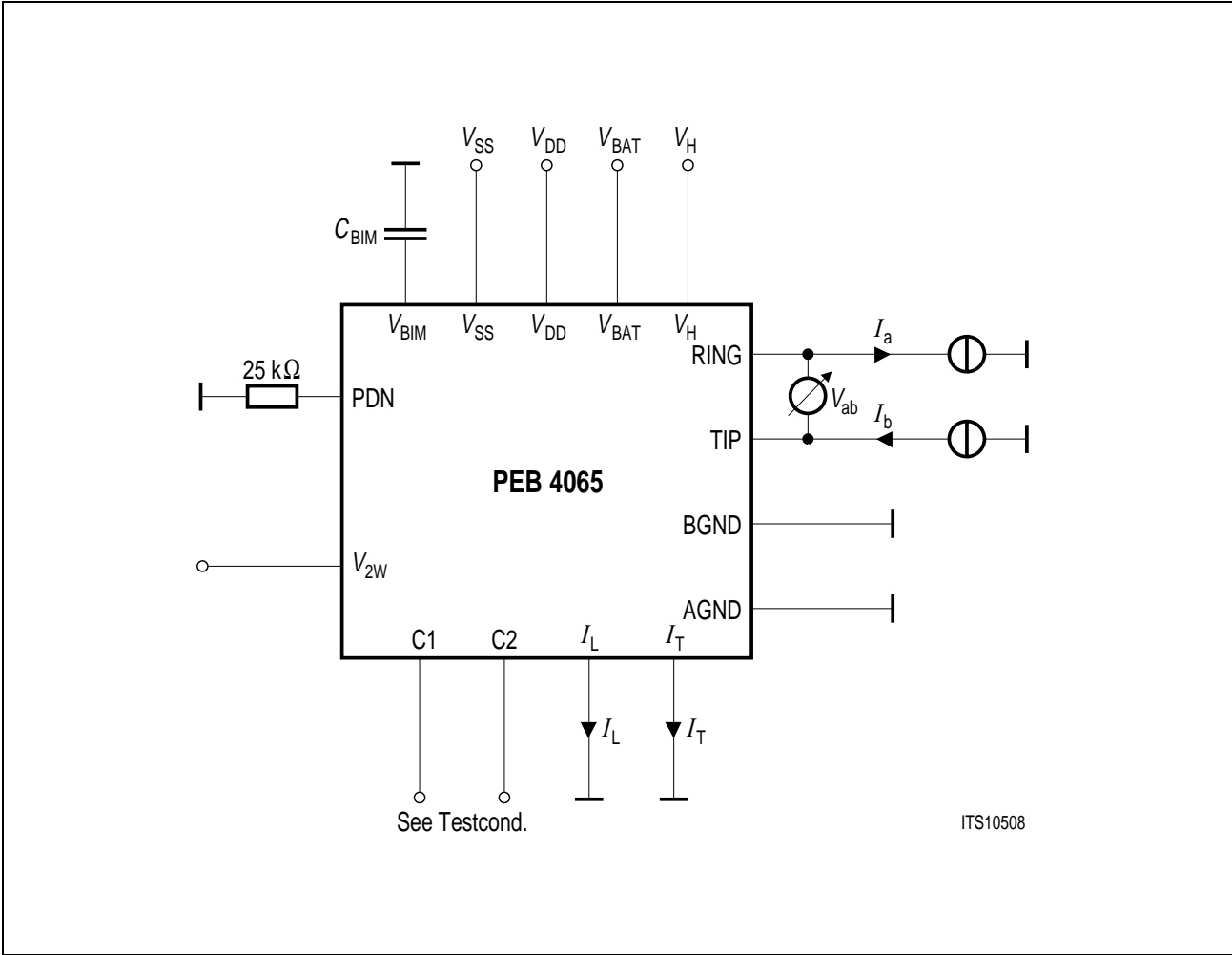
Figure 5 Application Circuit

Electrical Characteristics



Test Figure 1     DC Characteristics and Power Dissipation

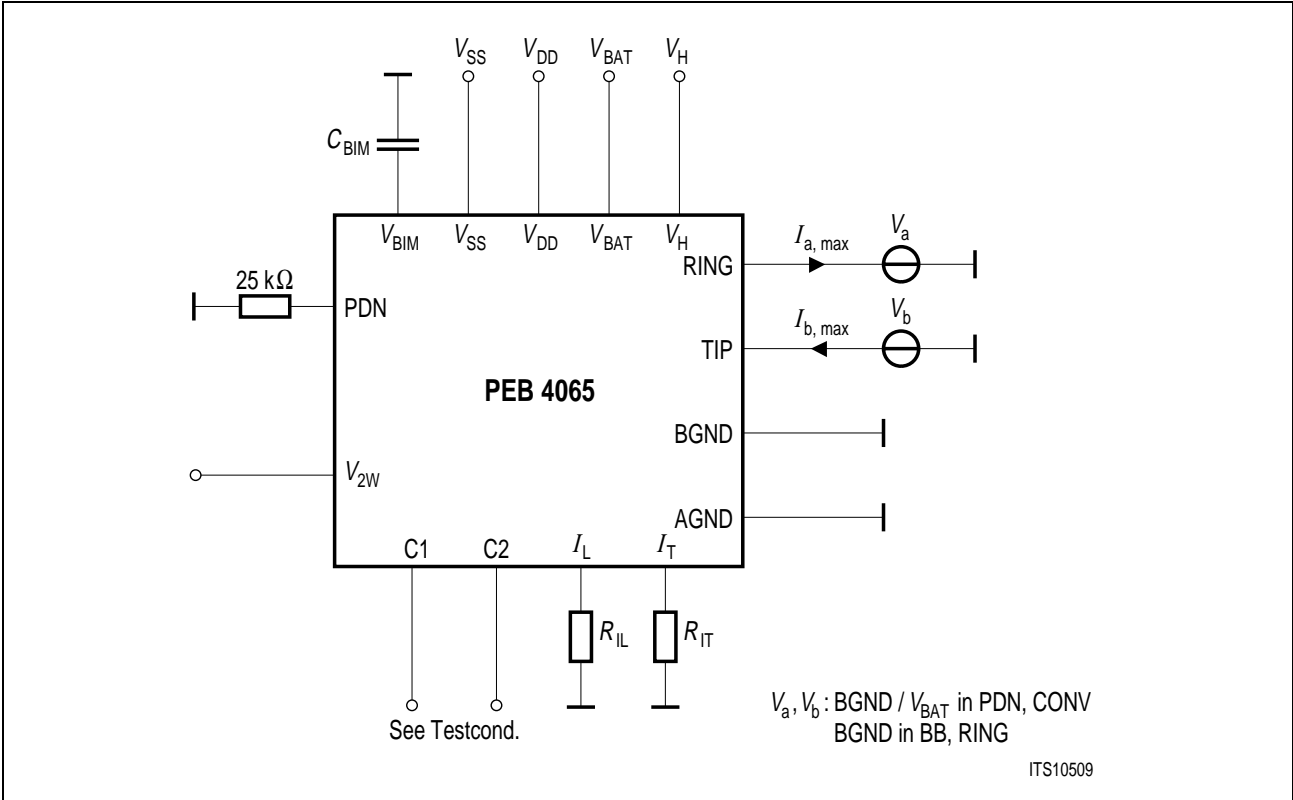
Electrical Characteristics



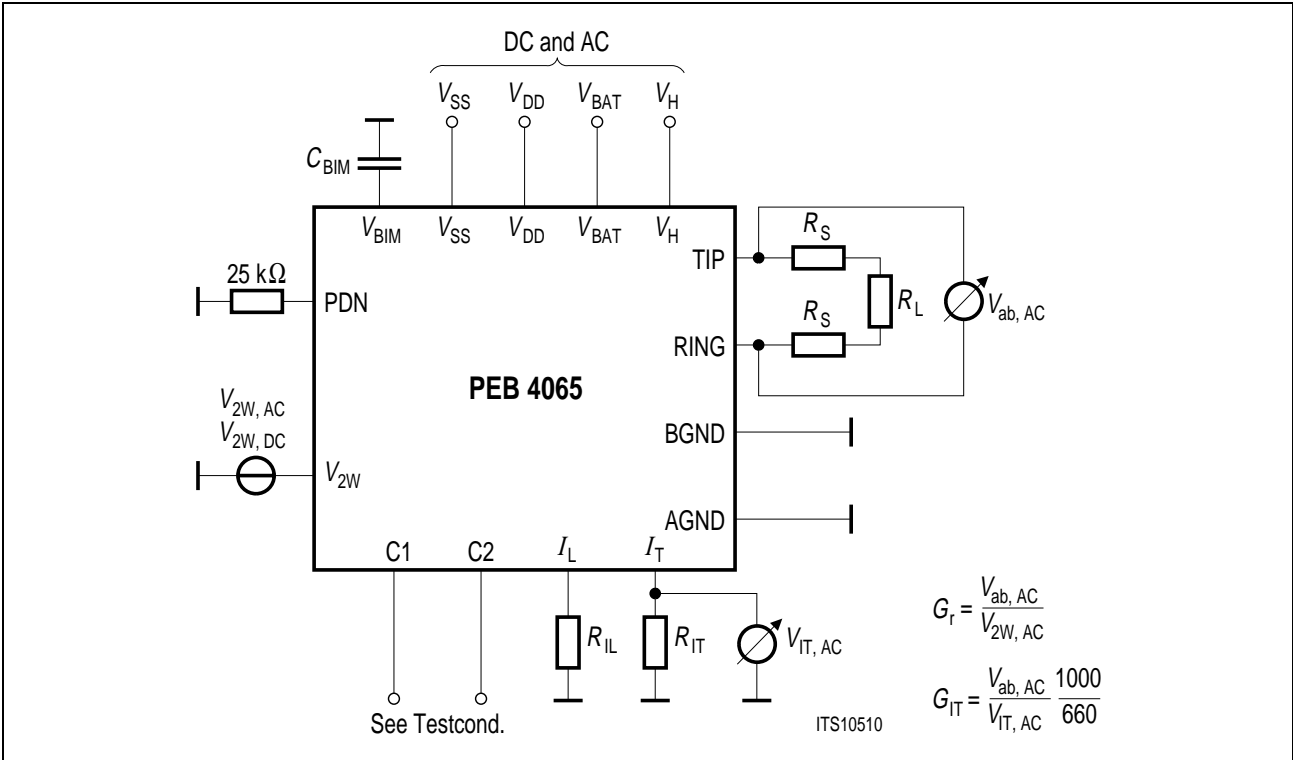
Test Figure 2    DC Line Voltage and Currents



Electrical Characteristics

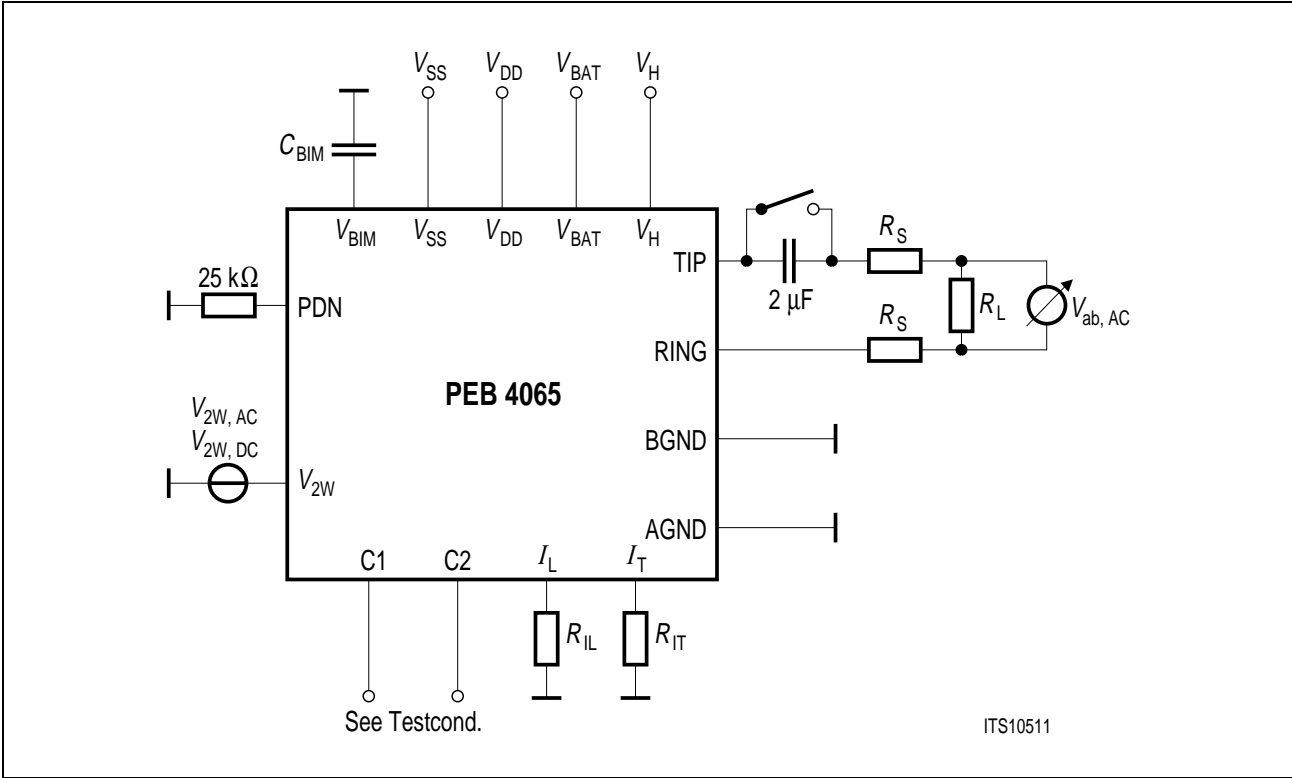


Test Figure 3    Output Current Limit

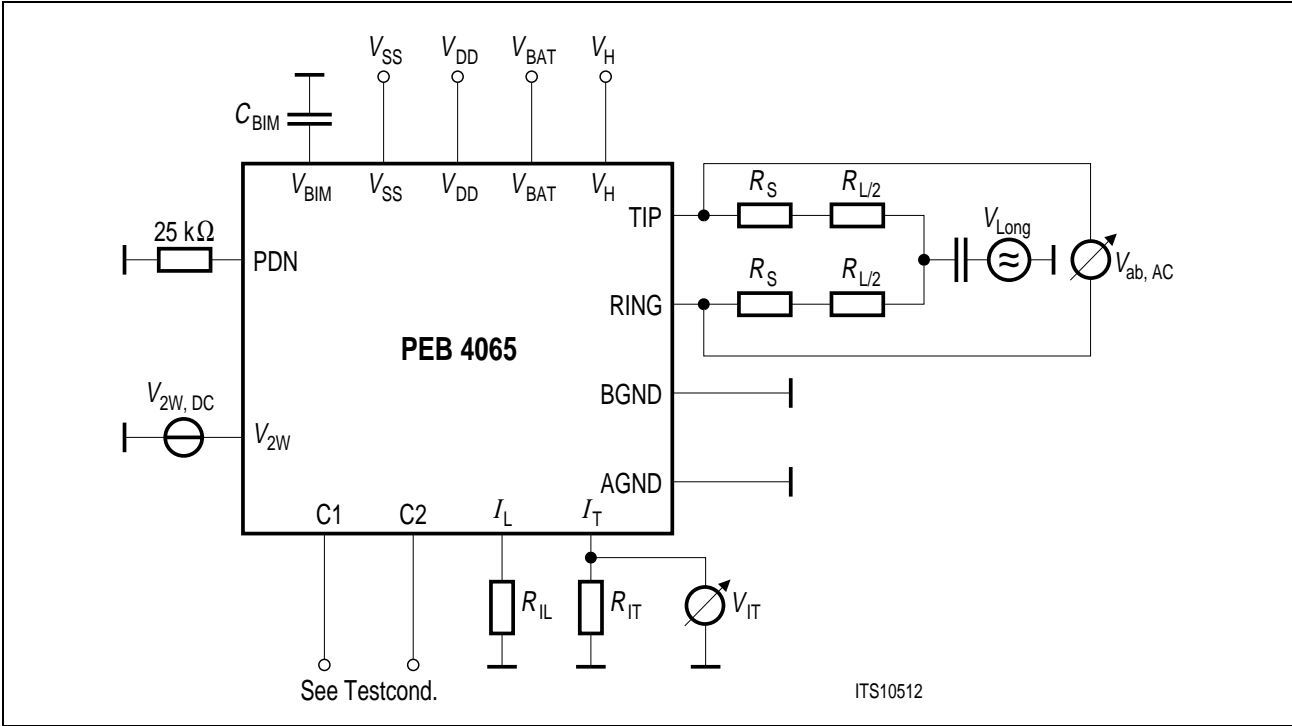


Test Figure 4    Receive Gain, Transversal Current Ratio, THD, Noise and Power Supply Rejection

Electrical Characteristics

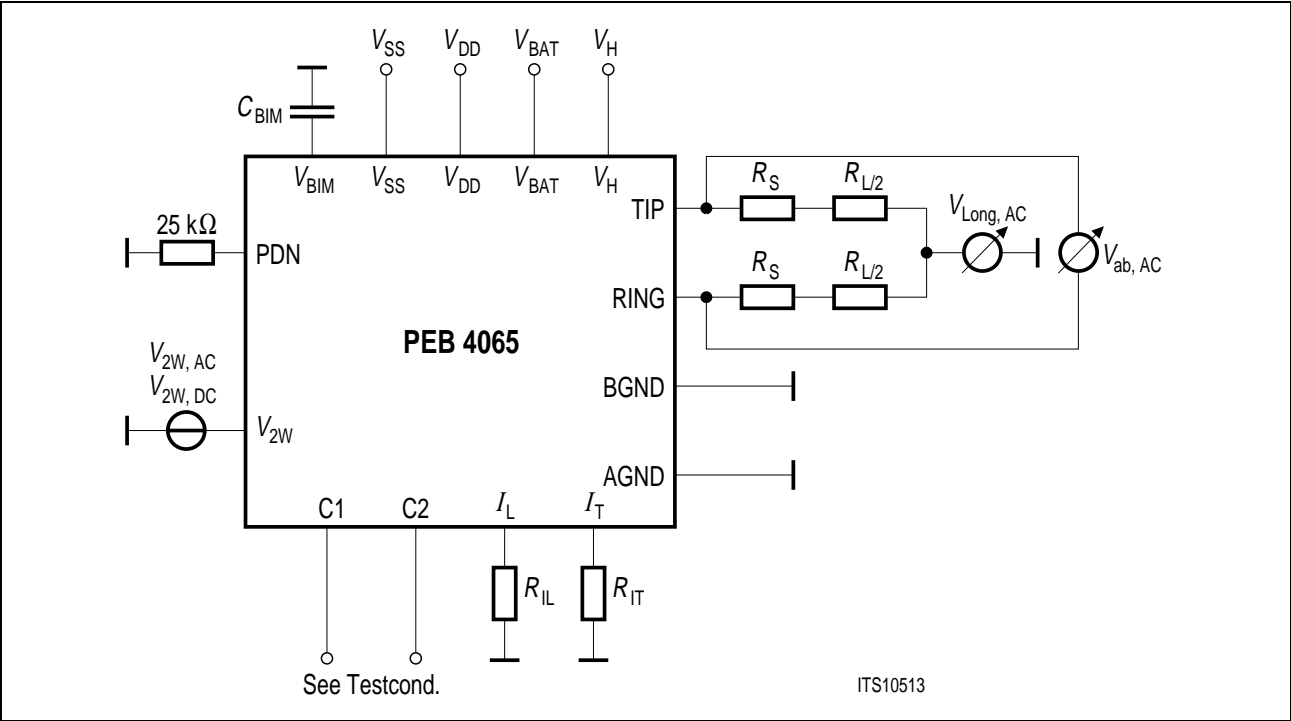


Test Figure 5    Teletax Distortion

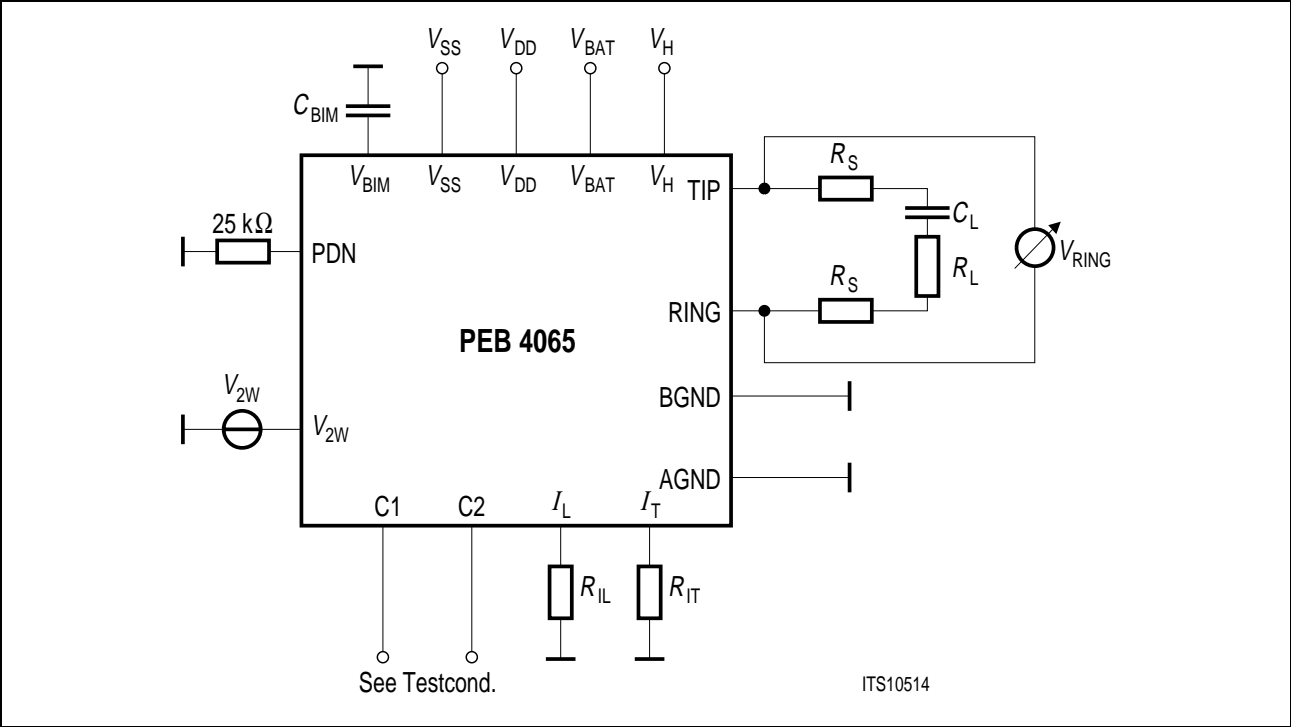


Test Figure 6    Longitudinal to Transversal Rejection Ratio

Electrical Characteristics

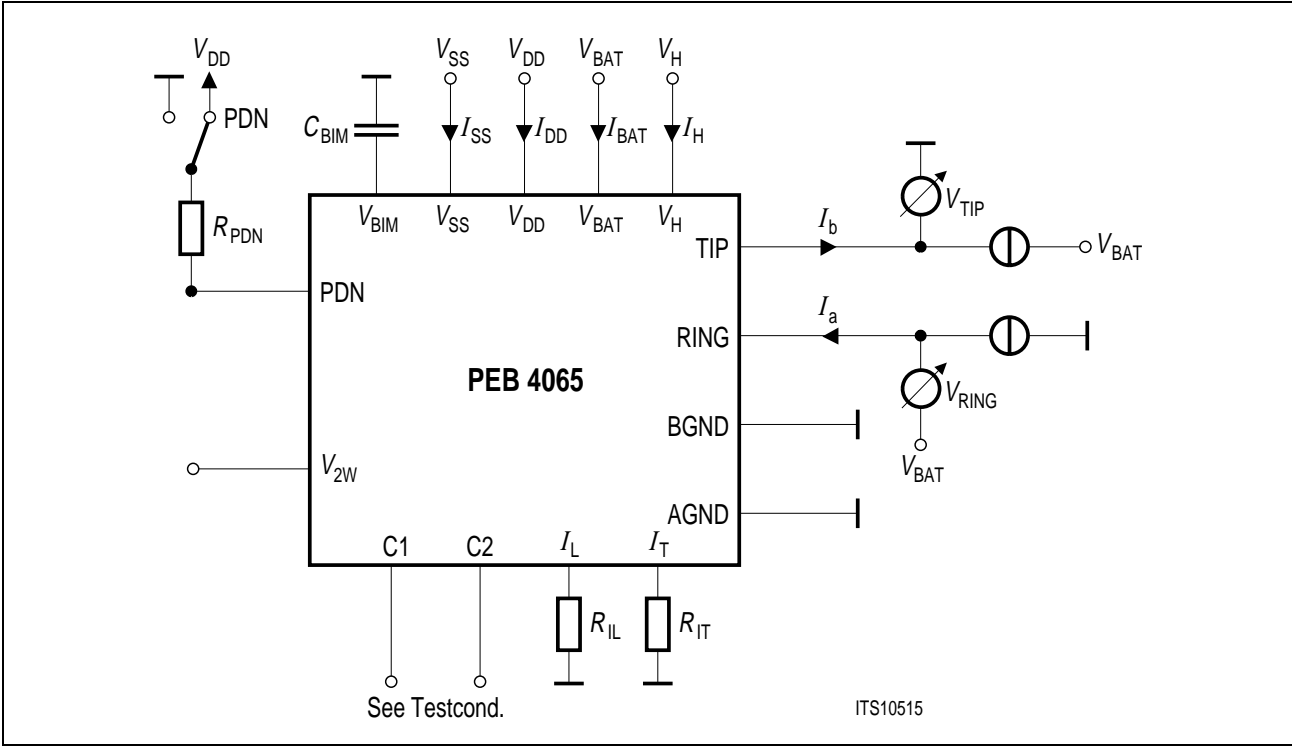


Test Figure 7    Transversal to Longitudinal Rejection Ratio

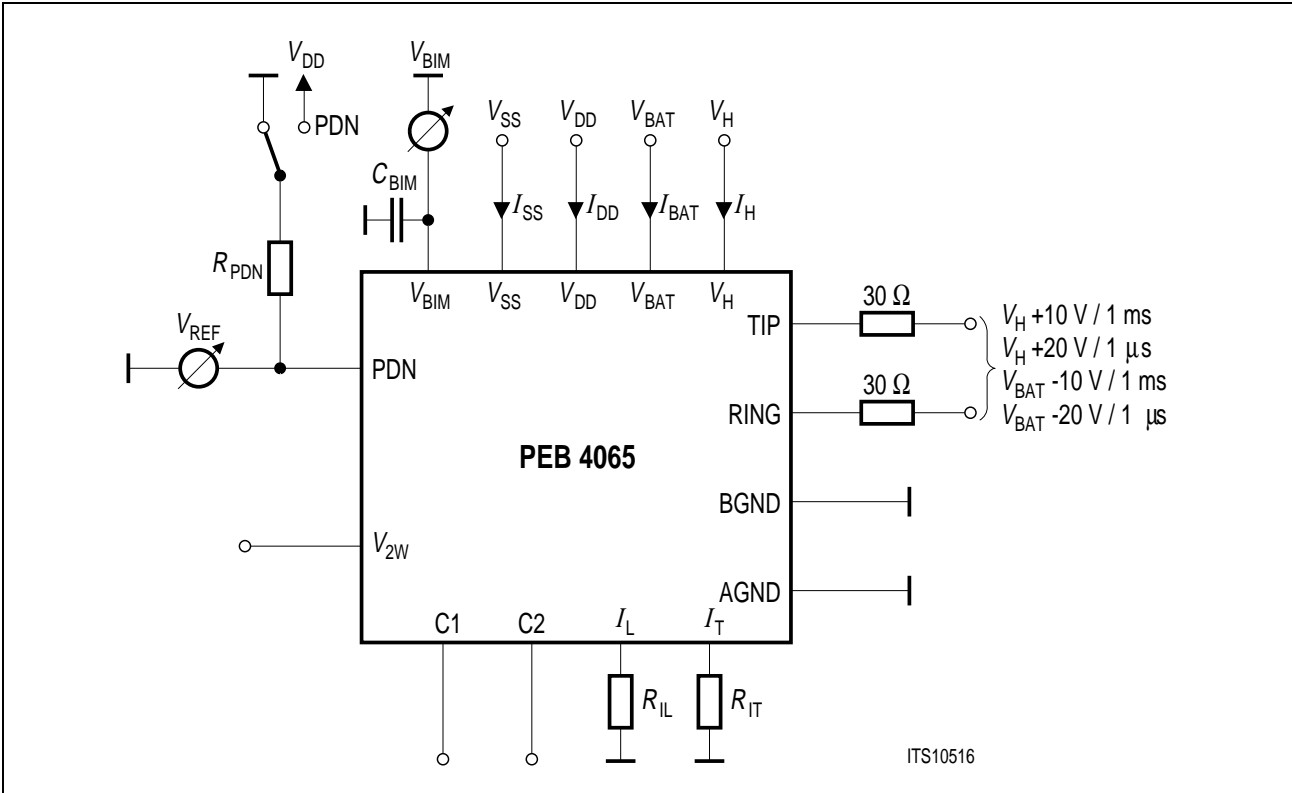


Test Figure 8    Ringing

Electrical Characteristics



Test Figure 9    Output Resistance in PDNR Mode

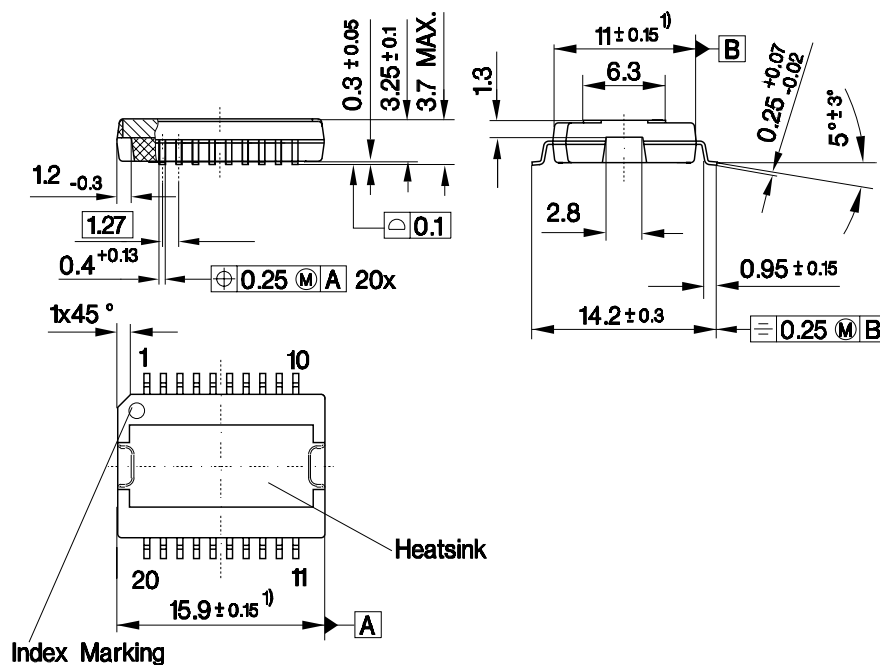


Test Figure 10    TIP, RING Overvoltage Pulses

### 3 Package Outlines

#### P-DSO-20-5

(Plastic Dual Small Outline Package)



1) Does not include plastic or metal protrusion of 0.15 max. per side

GPS05755

#### Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm