

Features

- Input Voltage Range: 18V to 60V
- 1500 VDC Isolation
- On/Off Control
- V_o Adjust
- Differential Remote Sense
- Current Limit
- Short-Circuit Protection
- Over-Temperature Shutdown
- Undervoltage Lockout
- Space-Saving Package
- Solderable Copper Case
- UL1950 Recognized
- CSA 22.2 950 Certified
- EN60950 Approved
- VDE Licensed
- 5×10^6 Hrs MTBF
- Meets FCC Class A Radiated Limits

Description

The PT4580 series is a single-output isolated DC/DC converter, housed in a 19-pin space-saving package. These modules are UL, CSA, and VDE approved for telecom applications, and rated at 30W or 8A. The 18V to 60V input range allows easy integration into many distributed power applications which utilize 24V bus architectures.

Standard output voltages range from 1.8V to 15V, and are each adjustable by up to $\pm 10\%$. Operating features include a *Remote On/Off* control, an under-voltage lockout (UVLO), and a differential remote sense. Protection features include an output current limit, short-circuit protection, and over-temperature shutdown.

A $330\mu\text{F}$ output capacitor is required for proper operation.

Ordering Information

PT4581□ = 3.3V/8A (26.4W)
PT4582□ = 5.0V/6A
PT4583□ = 12.0V/2.5A
PT4584□ = 15.0V/2A
PT4585□ = 1.8V/8A (14.4W)

Pin-Out Information

Pin Function
1 Do Not Use
2 Remote On/Off †
3 Do Not Use
4 $-V_{in}$
5 $-V_{in}$
6 $-V_{in}$
7 $+V_{in}$
8 $+V_{in}$
9 $+V_{in}$
10 $-V_o$
11 $-V_o$
12 $-V_o$
13 -Remote Sense
14 $+V_o$
15 $+V_o$
16 $+V_o$
17 $+V_o$
18 V_o Adjust †
19 +Remote Sense

†For more information, see application notes.

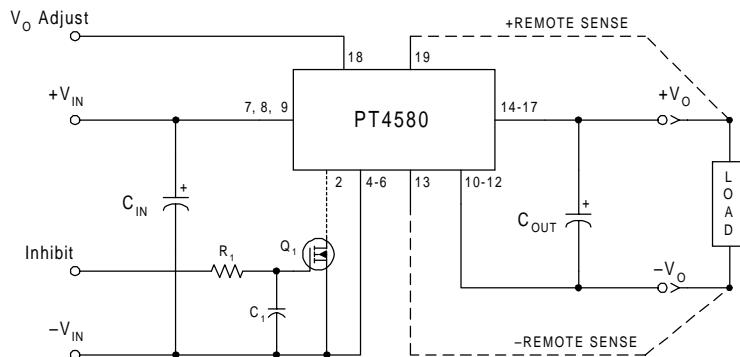
PT Series Suffix (PT1234x)

Case/Pin Configuration	Order Suffix	Package Code *
Vertical	N	(END)
Horizontal	A	(ENA)
SMD	C	(ENC)

* Previously known as package styles 1400 & 1410.

(Reference the applicable package code drawing for the dimensions and PC board layout)

Standard Application



C_{in} = Optional $100\mu\text{F}/100\text{V}$ electrolytic
 C_{out} = Required $330\mu\text{F}$ electrolytic (See Notes)
 Q_1 = N-Channel MOSFET
 R_1/C_1 = Optional (see application notes)

PT4580 Series

30-W 24/48-V Input
Isolated DC/DC Converter

Specifications (Unless otherwise stated, $T_a = 25^\circ\text{C}$, $V_{in} = 24\text{V}$, $C_{out} = 330\mu\text{F}$, and $I_o = I_{o\ max}$)

Characteristic	Symbol	Conditions	PT4580 SERIES			
			Min	Typ	Max	Units
Output Current	I_o	Over V_{in} range	$V_o = 15\text{V}$	0.1 (1)	—	2.0
			$V_o = 12\text{V}$	0.1 (1)	—	2.5
			$V_o = 5.0\text{V}$	0.25 (1)	—	6.0
			$V_o \leq 3.3\text{V}$	0.25 (1)	—	8.0
Input Voltage Range	V_{in}	Over I_o Range	—	18.0	24.0	60.0
Set Point Voltage Tolerance	$V_o\ tol$	$V_o \geq 5.0\text{V}$	—	±1	±1.5	% V_o
		$V_o \leq 3.3\text{V}$	—	±33	±50	mV
Temperature Variation	Reg_{temp}	$-40^\circ \leq T_a \leq +85^\circ\text{C}$	—	±0.5	—	% V_o
Line Regulation	Reg_{line}	Over V_{in} range	$V_o \geq 5.0\text{V}$	—	±0.2	±1.0
			$V_o \leq 3.3\text{V}$	—	±7	±33
Load Regulation	Reg_{load}	Over I_o range	$V_o \geq 5.0\text{V}$	—	±0.4	±1.0
			$V_o \leq 3.3\text{V}$	—	±13	±33
Total Output Voltage Variation	ΔV_{otot}	Includes set-point, line, load, $-40^\circ \leq T_a \leq +85^\circ\text{C}$	$V_o \geq 5.0\text{V}$	—	±2	—
			$V_o \leq 3.3\text{V}$	—	±67	—
Efficiency	η		$V_o = 15\text{V}$	—	85	—
			$V_o = 12\text{V}$	—	86	—
			$V_o = 5.0\text{V}$	—	83	—
			$V_o = 3.3\text{V}$	—	80	—
			$V_o = 1.8\text{V}$	—	70	—
V_o Ripple (pk-pk)	V_r	20MHz bandwidth	$V_o \geq 5.0\text{V}$	—	1.0	2.0
			$V_o \leq 3.3\text{V}$	—	50	75
Transient Response	t_{tr}	0.1A/μs load step, 50% to 100% $I_{o\ max}$	—	100	200	μs
			V_o over/undershoot	$V_o \geq 5.0\text{V}$	±3.0	±5.0
			$V_o \leq 3.3\text{V}$	—	±100	±150
Short Circuit Current	I_{sc}	—	—	2x $I_{o\ max}$	—	A
Switching Frequency	f_s	Over V_{in} range	$V_o \geq 10\text{V}$	450	500	550
			$V_o < 10\text{V}$	700	750	800
Under-Voltage Lockout	UVLO	V_{in} increasing V_{in} decreasing	—	17	—	V
Remote On/Off Input (pin 2)	V_{IH}	Referenced to $-V_{in}$ (pins 4–6)	—	2.5	—	15 (2)
			V_{IL}	-0.2	—	+0.8
			I_{IL}	-3	-6	-10
Standby Input Current	$I_{in\ standby}$	pins 2 & 4 connected	—	8	16	mA
Internal Input Capacitance	C_{in}	—	—	0.66	—	μF
External Output Capacitance	C_{out}	Between $+V_o$ and $-V_o$	$V_o \geq 9.0\text{V}$	260	330	600 (3)
			$V_o \leq 5.0\text{V}$	260	330	1,000 (3)
Isolation Voltage Capacitance Resistance		Input-output/input-case Input-output Input-output	1500	—	—	Vdc
			—	1200	—	pF
			10	—	—	MΩ
Operating Temperature Range	T_a	Over V_{in} range	-40 (4)	—	+85 (5)	°C
Maximum Case Temperature	T_c	—	—	—	100	°C
Storage Temperature Range	T_s	—	-40	—	+125	°C
Reliability	MTBF	Per Bellcore TR-332 50% stress, $T_a = 40^\circ\text{C}$, ground benign	5.0	—	—	10 ⁶ Hrs
Mechanical Shock	—	Per Mil-Std-883D, method 2002.3, 1mS, half-sine, mounted to a fixture	—	500	—	G's
Mechanical Vibration	—	Per Mil-Std-883D, method 2007.2, 20-2000Hz, soldered to board	—	20	—	G's
Weight	—	—	—	40	—	grams
Flammability	—	Materials meet UL 94V-0	—	—	—	

Notes: (1) The DC/DC converter will operate at no load with reduced specifications.

(2) The Remote On/Off input has an internal pull-up. If it is left open circuit the converter will operate when input power is applied. A low-leakage (<100nA) MOSFET is recommended to control this input. The open-circuit voltage is less than 10V. See application notes for interface considerations.

(3) Output capacitor values are absolute. Allowances must be made for any additional de-coupling capacitors and the total external capacitor tolerance. The value of external capacitance is limited due to regulator startup current requirements. Consult the factory for further details.

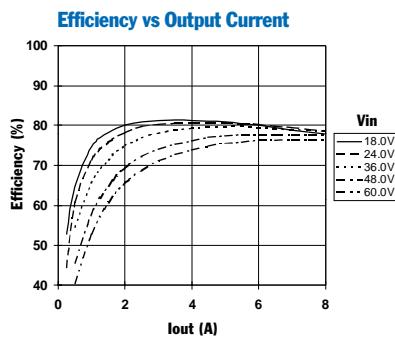
(4) For operation below 0°C, the required external output capacitor must have temperature stable characteristics. E.g. Tantalum or Oscon® types.

(5) See Safe Operating Area curves or contact the factory for the appropriate thermal derating.

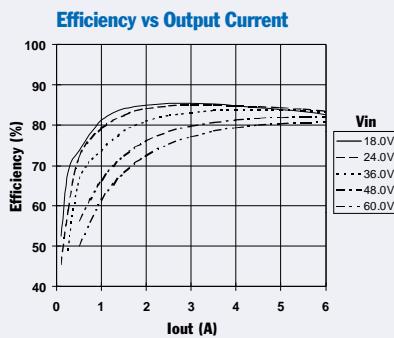
PT4580 Series

30-W 24/48-V Input
Isolated DC/DC Converter

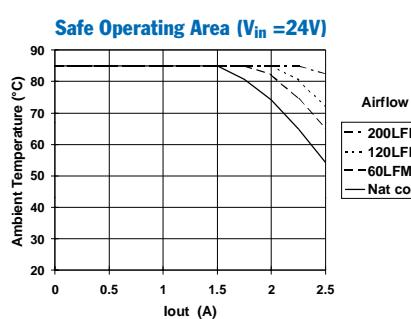
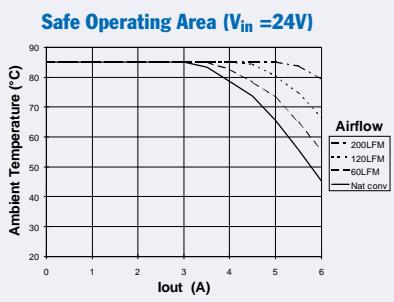
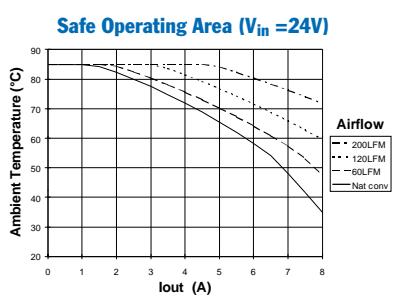
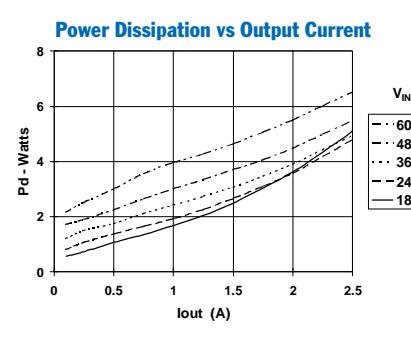
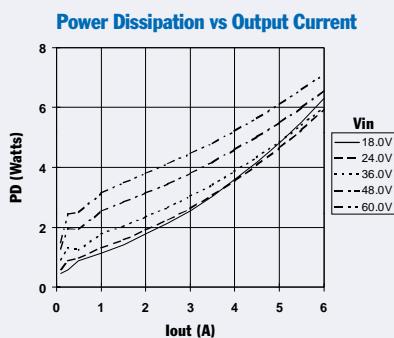
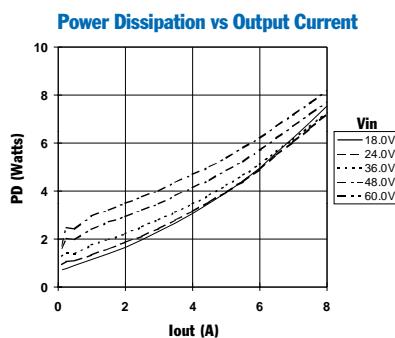
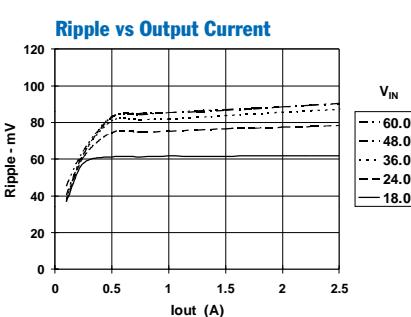
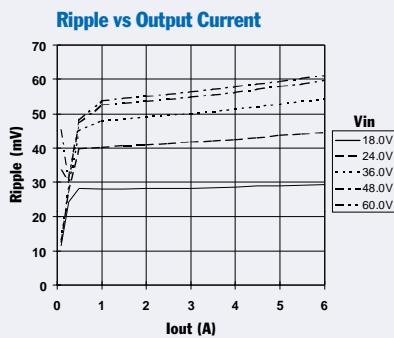
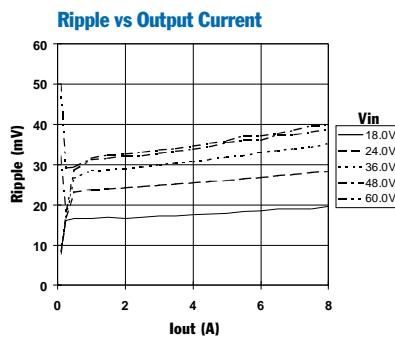
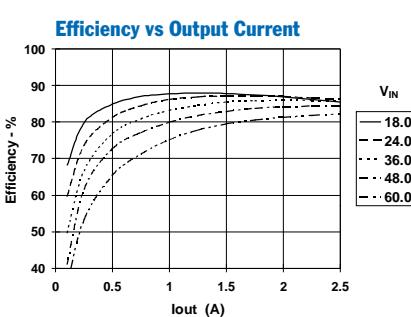
PT4581, 3.3 VDC (See Note A)



PT4582, 5.0 VDC (See Note A)



PT4583, 12.0 VDC (See Note A)



Note A: All data listed in the above graphs has been developed from actual products tested at 25°C. This data is considered typical data for the DC-DC Converter.

Note B: SOA Curves represent operating conditions at which internal components are at or below manufacturer's maximum rated operating temperatures.

Adjusting the Output Voltage of Power Trends' 30W Isolated DC/DC Converter Series

The factory pre-set output voltage of Power Trends' 30W series of isolated DC/DC converters may be adjusted within a nominal $\pm 10\%$ range. This is accomplished with the addition of a single external resistor. For the input voltage range specified in the data sheet, Table 1 gives the allowable adjustment range for each model as V_o (min) and V_o (max).

Adjust Up: An increase in the output voltage is obtained by adding a resistor, R_2 between V_o adjust (pin 18), and -Remote Sense (pin 13). *See note 4.*

Adjust Down: Add a resistor (R_1), between V_o adjust (pin 18), and +Remote Sense (pin 19).

Refer to Figure 1 and Tables 2 & 3 for both the placement and value of the required resistor, (R_1) or R_2 .

Notes:

1. Use only a single 1% resistor in either the (R_1) or R_2 location. Place the resistor as close to the ISR as possible.
2. Never connect capacitors to V_o adjust. Any capacitance added to the V_o adjust control pin will affect the stability of the ISR.

Table 1

DC/DC CONVERTER ADJUSTMENT RANGE AND FORMULA PARAMETERS

Series Pt

AL Case:

24V Bus				PT3341	PT3342	PT3343	PT3344
48V Bus				PT3321	PT3322	PT3323	PT3324
CU Case:							
24V Bus	PT4585			PT4581	PT4582	PT4583	PT4584
48V Bus	PT4567	PT4565	PT4566	PT4561	PT4562	PT4571	PT4563
V_o(nom)	1.8V	1.8V	2.0V	2.5V	3.3V	5.0V	9.0V
V_o(min)	1.62V	1.62V	1.8V	2.25V	2.95V	4.5V	7.0V
V_o(max)	2.5V	1.98V	2.2V	2.75V	3.65V	5.5V	10.0V
V_r	1.225V						
K_o (V-kΩ)	69.58	69.58	62.47	42.33	68.89	68.71	133.25
R_s (kΩ)	80.6	80.6	150.0	121.0	150.0	121.0	110

Figure 1

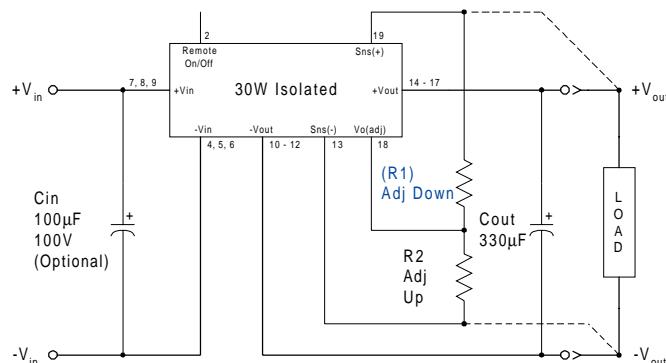


Table 2**DC/DC CONVERTER ADJUSTMENT RESISTOR VALUES**

Series Pt #	AL Case	24V Bus	PT3327	PT3325	PT3326	PT3321
48V Bus	PT4585	PT4567	PT4565	PT4566	PT4561	
Current	8Adc	8Adc	8Adc	8Adc	8Adc	
V _o (nom)	1.8V	1.8V	2.0V	2.5V	3.3V	
V _a (req'd)						
1.65	(80.3)kΩ	(80.3)kΩ				
1.7	(189.0)kΩ	(189.0)kΩ				
1.75	(516.0)kΩ	(516.0)kΩ				
1.8						
1.85	1.31MΩ	1.31MΩ	(62.5)kΩ			
1.9	615.0kΩ	615.0kΩ	(194.0)kΩ			
1.95	383.0kΩ	383.0kΩ	(589.0)kΩ			
2.0	267.0kΩ					
2.05	198.0kΩ		1.1MΩ			
2.1	151.0kΩ		475.0kΩ			
2.15	118.0kΩ		266.0kΩ			
2.2	93.3kΩ		162.0kΩ			
2.25	74.0kΩ		(20.7)kΩ			
2.3	58.6kΩ		(64.7)kΩ			
2.35	45.9kΩ		(138.0)kΩ			
2.4	35.4kΩ		(285.0)kΩ			
2.45	26.4kΩ		(726.0)kΩ			
2.5	18.8kΩ					
2.55			726.0kΩ			
2.6			302.0kΩ			
2.65			161.0kΩ			
2.7			90.6kΩ			
2.75			48.3kΩ			
2.95			(127.0)kΩ			
3.0			(183.0)kΩ			
3.05			(261.0)kΩ			
3.1			(377.0)kΩ			
3.15			(572.0)kΩ			
3.2			(961.0)kΩ			
3.25			(2.13)MΩ			
3.3						
3.35			1.23MΩ			
3.4			539.0kΩ			
3.45			309.0kΩ			
3.5			194.0kΩ			
3.55			126.0kΩ			
3.6			79.6kΩ			
3.65			46.8kΩ			

R1 = (Blue) R2 = Black

Application Notes

PT3320/3340/4560/4580 Series

Table 3

DC/DC CONVERTER ADJUSTMENT RESISTOR VALUES

Series Pt #

AL Case

24V Bus **PT3342**

48V Bus **PT3322**

CU Case

24V Bus **PT4582**

48V Bus **PT4562**

Current **6Adc**

V_o(nom) **5.0V**

V_a(req'd)

4.5 **(246.0)kΩ**

4.55 **(293.0)kΩ**

4.6 **(352.0)kΩ**

4.65 **(428.0)kΩ**

4.7 **(529.0)kΩ**

4.75 **(670.0)kΩ**

4.8 **(882.0)kΩ**

4.85 **(1.23)MΩ**

4.9 **(1.94)MΩ**

4.95

5.0

5.05

5.1 **566.0kΩ**

5.15 **337.0kΩ**

5.2 **223.0kΩ**

5.25 **154.0kΩ**

5.3 **108.0kΩ**

5.35 **75.3kΩ**

5.4 **50.8kΩ**

5.45 **31.7kΩ**

5.5 **16.4kΩ**

PT3343 **PT3344**

PT3323 **PT3324**

PT4583 **PT4584**

PT4571 **PT4563** **PT4564**

3.3Adc **2.5Adc** **2.0Adc**

9.0V **12.0V** **15.0V**

V_a(req'd)

7.0 **(9.9)kΩ**

7.2 **(29.2)kΩ**

7.4 **(53.2)kΩ**

7.6 **(84.2)kΩ**

7.8 **(125.0)kΩ**

8.0 **(183.0)kΩ**

8.2 **(270.0)kΩ**

8.4 **(414.0)kΩ**

8.6 **(703.0)kΩ**

8.8 **(1.57)MΩ**

9.0

9.2 **556.0kΩ**

9.4 **223.0kΩ**

9.6 **112.0kΩ**

9.8 **56.6kΩ**

10.0 **23.3kΩ**

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10.8 **(285.0)kΩ**

11.0 **(371.0)kΩ**

11.2 **(500.0)kΩ**

11.4 **(715.0)kΩ**

11.6 **(1.15)MΩ**

11.8

12.0

12.2 **588.0kΩ**

12.4 **249.0kΩ**

12.6 **136.0kΩ**

12.8 **78.9kΩ**

13.0 **45.0kΩ**

13.2 **22.3kΩ**

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13.5 **(323.0)kΩ**

13.6 **(355.0)kΩ**

13.8 **(437.0)kΩ**

14.0 **(522.0)kΩ**

14.2 **(724.0)kΩ**

14.4 **(1010.0)kΩ**

14.6 **(1.58)MΩ**

14.8

15.0

15.2 **607.0kΩ**

15.4 **263.0kΩ**

15.6 **149.0kΩ**

15.8 **91.3kΩ**

16.0 **56.9kΩ**

16.5 **11.1kΩ**

R1 = **(Blue)** R2 = Black

Using Remote On/Off on Power Trends' 30W Isolated DC-DC Converter Series

Power Trends' 30W isolated series of DC/DC converters incorporate a *Remote On/Off* function. This function may be used in applications for battery conservation, power-up/shutdown sequencing, or to co-ordinate the power-up of the regulator for active in-rush current control. (See TI application reports, SLTA021, and SLUA250).

The Remote On/Off function is provided by pin 2. If pin 2 is left open-circuit, the converter provides a regulated output whenever a valid source voltage 1 is applied between $+V_{in}$ (pins 7-9), and $-V_{in}$ (pins 4-6). Applying a low voltage 2, with respect to $-V_{in}$ (pin 2), disables the regulator output 3. Table 1 details the control requirements for this input. Figure 1 shows how a discrete MOSFET (Q_1) may be referenced to the negative input voltage rail to control the Remote On/Off pin.

Table 1 Remote On/Off Control Requirements²

Parameter	min	max
Enable (V_{IH})	2.5V ⁵	15V (or open circuit) ⁴
Disable (V_{IL})	-0.3V	0.8V

Notes:

1. These converters incorporate an "Under Voltage Lockout" (UVLO) function. This function automatically holds the converter output in the "Off" state until there is sufficient input voltage for the converter to produce a regulated output. Table 2 gives the applicable UVLO thresholds.

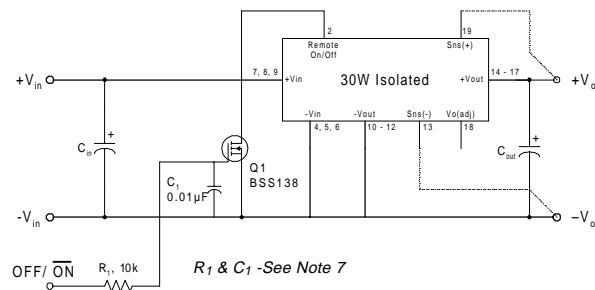
Table 2 UVLO Thresholds

Series	UVLO Threshold	V_{in} Range
PT3320/4560	$34 \pm 2.0V$	36 - 75V
PT3340/4580	$16.5 \pm 1.5V$	18 - 60V

2. The Remote On/Off control pin uses $-V_{in}$ (pins 4-6) as its ground reference. All voltages specified are with respect to $-V_{in}$.
3. When the converter output is disabled the current drawn from the input supply is typically reduced to 8mA (16mA maximum).
4. The internal circuitry comprises of a high impedance ($3\mu A$ - $10\mu A$) current source. The open-circuit voltage is less than 10V.
5. The Remote On/Off pin is ideally controlled using devices with an open-collector (or open-drain) output. A small low-leakage MOSFET ($<100nA$) is recommended. A pull-up resistor is not required, but may be necessary to ensure that the Remote On/Off pin exceeds V_{IH} (min) (see Table 1). *Do not* use a pull-up resistor to the $+V_{in}$ input, or drive the pin above V_{IH} (max).

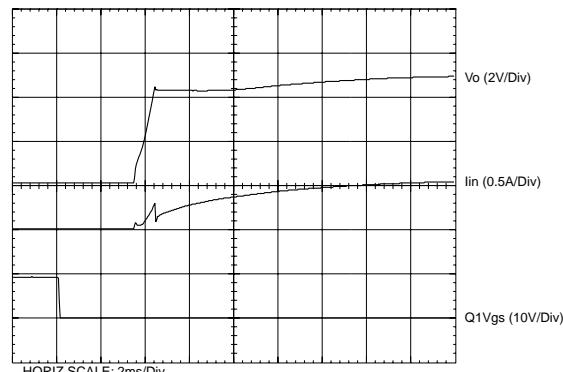
6. Keep the on/off transition to less than 1ms. This prevents erratic operation of the ISR, whereby the output voltage may drift un-regulated between 0V and the rated output voltage during power-up.
7. In Figure 1, Q_1 is a low-threshold MOSFET. The components R_1 and C_1 are added to improve noise susceptibility.

Figure 1



Turn-On Time: When the Remote On/Off input is left open-circuit, the output of the converter is automatically enabled when a valid input voltage 1 is applied to the input power pins. The converter typically rises to full regulation within 30ms of the application of power (or after the release of the Remote On/Off pin with input power applied). The actual turn-on time will vary with the input voltage, output load, and the total amount of capacitance connected to the output. Using the circuit of Figure 1, Figure 2 shows the typical output voltage and input current waveforms for a PT3322/PT4562 after Q_1 is turned off. The turn off of Q_1 correlates with the fall of the Q_1 V_{gs} waveform. The waveforms were measured with a 48Vdc input voltage, and 5-A resistive load.

Figure 2



VDE Approved Installation Instructions (Installationsanleitung)

Nennspannung (Rated Voltage):	PT4560 36 to 72 Vdc, Transient to 75Vdc PT4580 18 to 60 Vdc, PT4599 19 to 31 Vdc
Nennaufnahme (Rated Input):	PT4560 1.5 Adc PT4580, PT4599 3.0 Adc
Nennleistung (Rated Power):	30 Watts Maximum
Ausgangsspannung (Sec. Voltage):	PT4560 Series PT4561, 3.3 Vdc, 8.0 Adc PT4562, 5.0 Vdc, 6.0 Adc PT4563, 12.0 Vdc, 2.5 Adc PT4564, 15.0 Vdc, 2.0 Adc PT4565, 2.0 Vdc, 8.0 Adc PT4566, 2.5 Vdc, 8.0 Adc PT4567, 1.8 Vdc, 8.0 Adc PT4568, 5.2 Vdc, 6.0 Adc PT4569, 6.0 Vdc, 5.0 Adc PT4570, 8.0 Vdc, 3.75 Adc PT4571, 9.0 Vdc, 3.3 Adc
Ausgangsstrom (Sec. Current): oder (or) Ausgangsleistung (Sec. Power):	PT4580 Series PT4581, 3.3 Vdc, 8.0 Adc PT4582, 5.0 Vdc, 6.0 Adc PT4583, 12.0 Vdc, 2.5 Adc PT4584, 15.0 Vdc, 2.0 Adc PT4585, 1.8 Vdc, 8.0 Adc PT4599, 5.0 Vdc, 6.0 Adc

Angabe der Umgebungstemperatur

(Information on ambient temperature): +85°C Ambient or 100°C Case Maximum

Besondere Hinweise (Special Instructions):

Es ist vorzusehen, daß die Spannungsversorgung in einer Endanwendung über eine isolierte Sekundaerschaltung bereit gestellt wird. Die Eingangsspannung der Spannungsversorgungsmodule muss eine verstärkte Isolierung von der Wechselstromquelle aufweisen.

Die Spannungsversorgung muss gemäß den Gehäuse-, Montage-, Kriech- und Luftstrecken-, Markierungs- und Trennanforderungen der Endanwendung installiert werden. Bei Einsatz eines TNV-3-Einganges muss die SELV-Schaltung ordnungsgemäß geerdet werden.

(The power supply is intended to be supplied by isolated secondary circuitry in an end use application. The input power to these power supplies shall have reinforced insulation from the AC mains.

The power supply shall be installed in compliance with the enclosure, mounting, creepage, clearance, casualty, markings, and segregation requirements of the end-use application. When the input is TNV-3, the SELV circuitry must be reliably grounded.)

Offenbach,

VDE Prüf- und Zertifizierungsinstitut
Abteilung / Department TD

(Jürgen Bärwinkel)

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