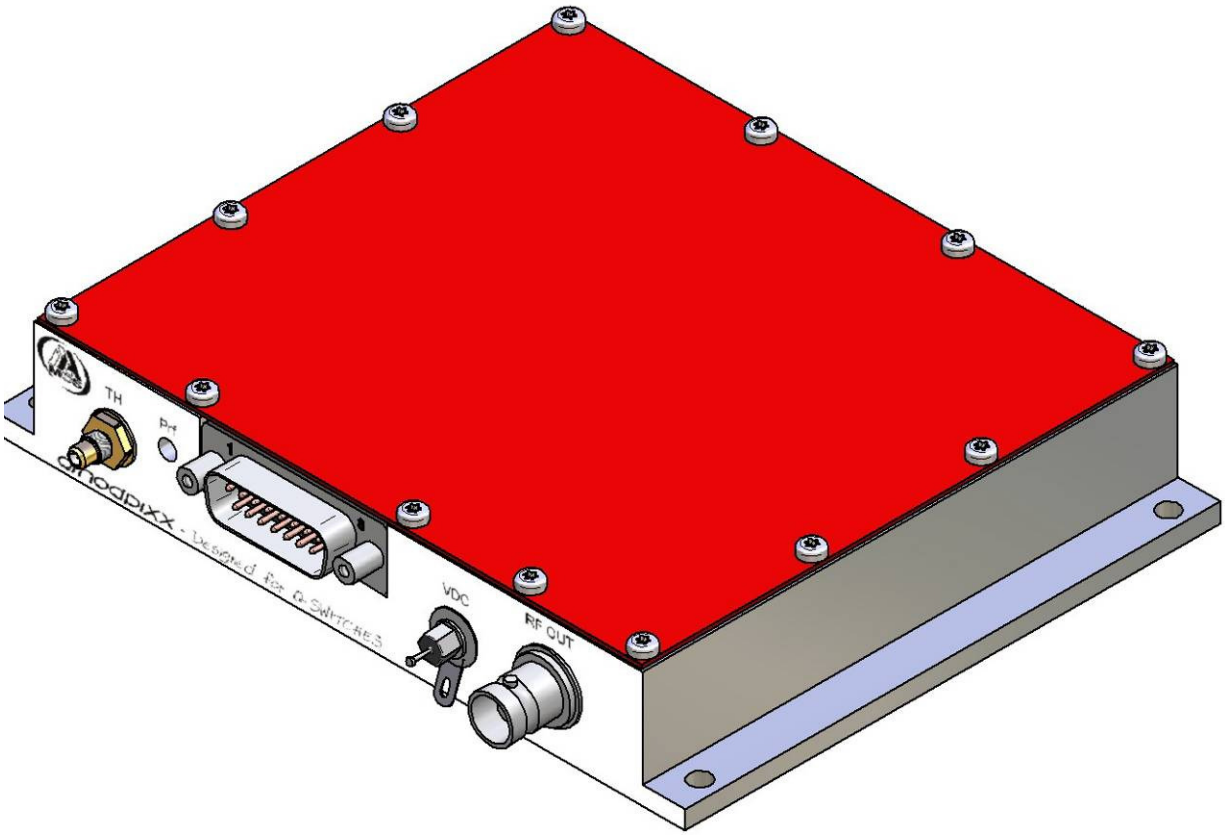
QMODP1-02

Operating Manual



For further information, contact
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Features and Description

• Class A • Fast Fall time • Compact OEM design • Up to 70 Watts

These drivers based on quartz oscillators. They produce a fixed stable and accurate RF frequency signal. The built-in amplifier delivers the necessary RF power to drive a high power water cooled Q-switch.

The RF output power can be externally modulated with various different signals.

Specifications

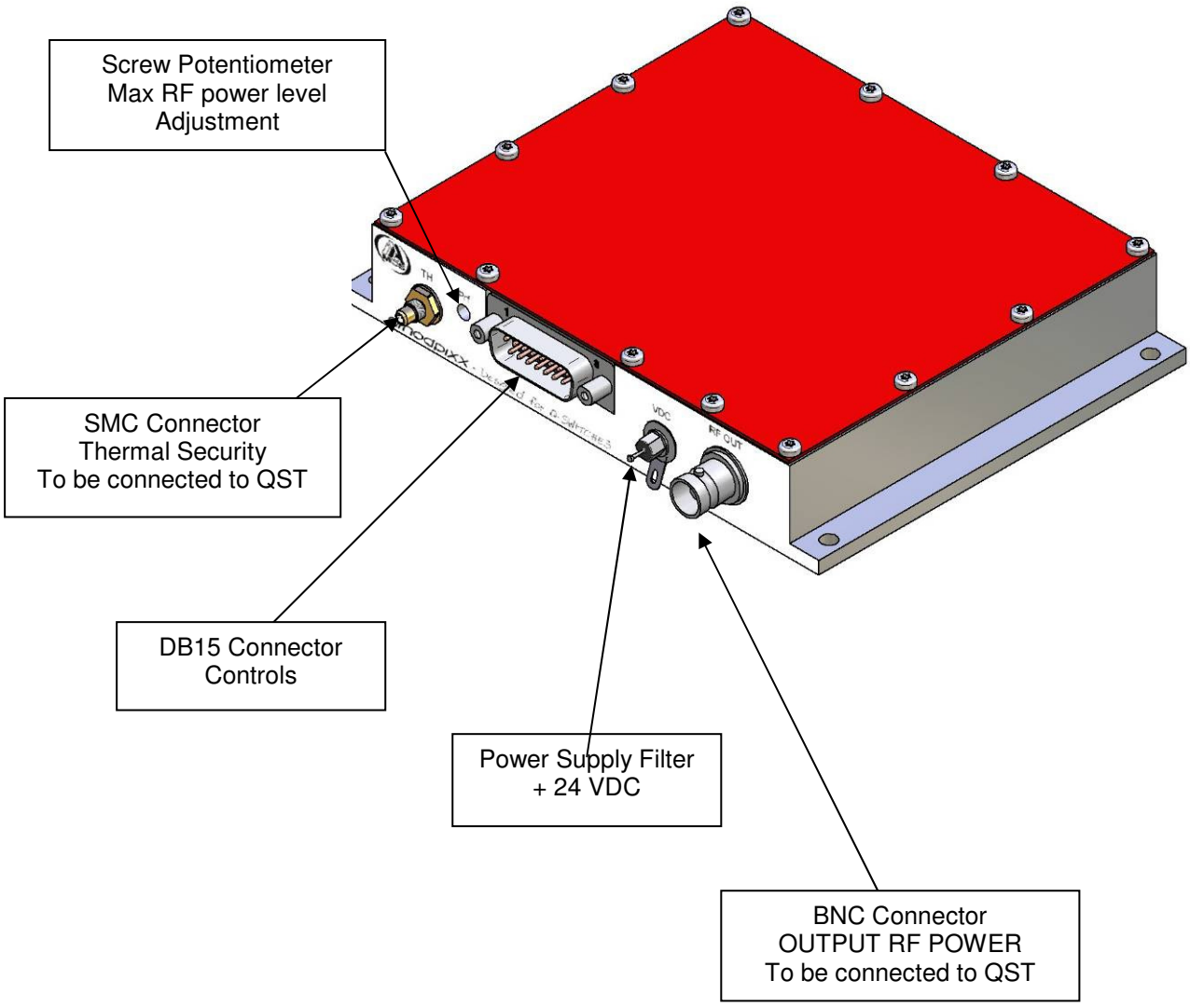
Carrier frequency	24, 27.12 or 40.68 MHz
Frequency stability	+/-100 ppm (-10, +70°C)
Power Supply	24(28) VDC - nom 6 A (< 6.5 A)
Rise Time / Fall time (10-90 %)	< 50 ns
DPC control (Digital Pulse Control)	TTL reversed / 1 kΩ, PULL DOWN
Analog power control	PAC Input : analog 0-5 V / 1 kΩ
Power adjust.	FAC Input : analog 0-5 V / 1 kΩ
Extinction ratio	> 45 dB, nom 50 dB
Output RF power	Up to 70 Watts
Output Impedance	50 Ω
V.S.W.R.	Nom < 1.5/1
RF connector	BNC
Controls connector	DB15
Thermal security	SMC / for Q-switch
Size	148 x 127 x 27 mm^3
Weight	580 g
Heat exchange	CONDUCTION THROUGH BASEPLATE MUST BE ATTACHED ON A HEATSINK OR WATER COOLED PLATE
Operating temperature / Max case Temp	10 to 70 °C

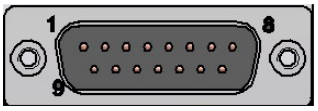
IMPORTANT

Your QMODXX driver is a fixed frequency driver dedicated to AO Q-Switches. The carrier frequency is stable and accurate to less than 1ppm/°C, in order to meet the sharpest AO applications. ..

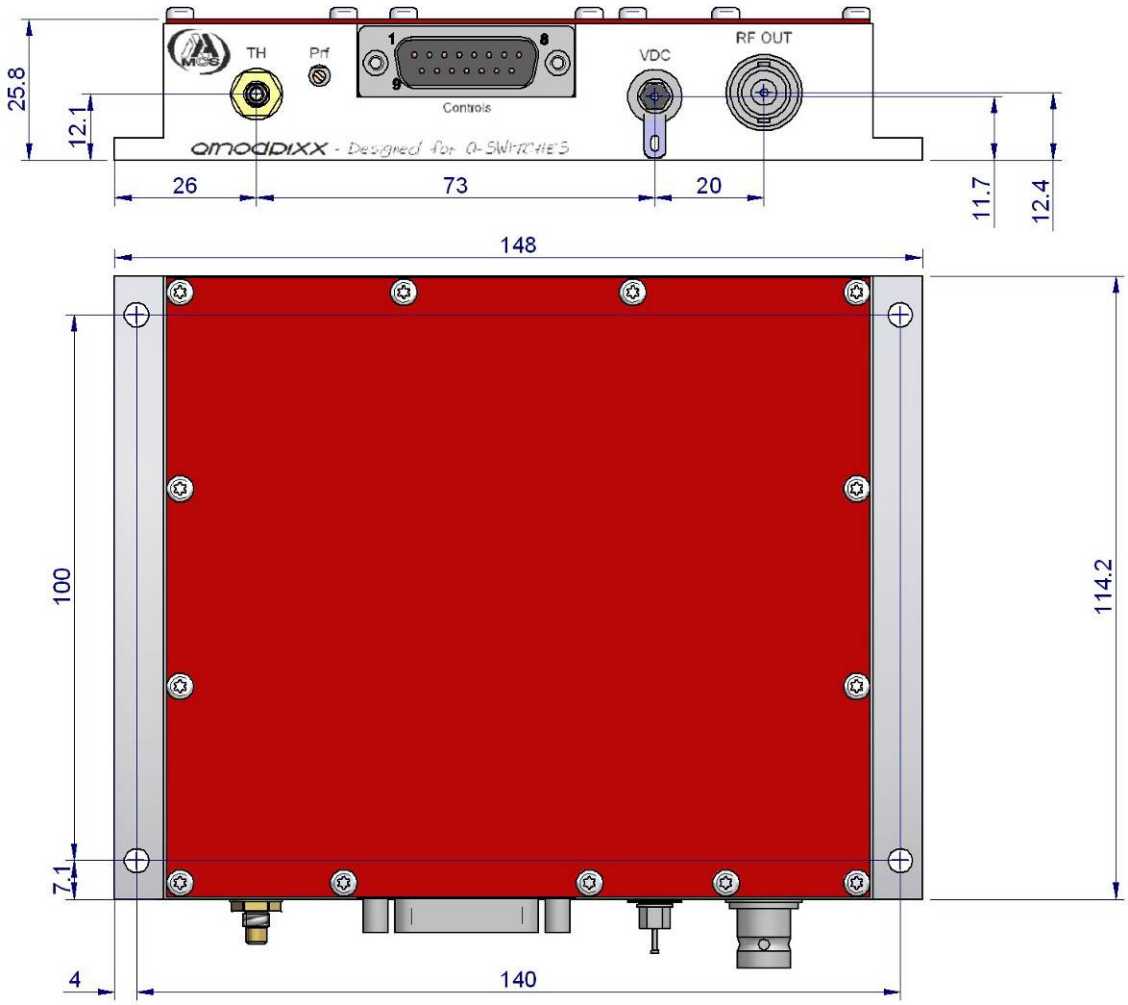
To have the exact specifications of your driver, please refer to the test sheet provided with each unit.

Pin Connections



	1- PAC : ANALOG POWER CONTROL (0-5V/1k) 2- Ground 3- DPC : TTL R Input (1k) 4- Ground 5- Alarm / QST thermal security (5V OK, 0V AO too hot) 6- Output power measurement 7- Ground 8- Return output power measurement 9- FAC : Power adj. (0-5V/1k) 10- Ground 11- +5V out (100mA max, must be link to FAC if not used) 12- Ground 13- NC 14- Ground 15- Alarm / Driver thermal security (5V OK, 0V T° Driver >70°C)

Mechanical drawing (mm)



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How to start driver ?

1. Connect the "RF OUTPUT" to the AO device (or 50 Ω power load).
Never use the driver output in open circuit, otherwise serious damages could happen.

2. Connect the convenient power supply (24 VDC) through the power supply filter (+V and ground). Check that your power supply can deliver enough current (as per specified). The power supply must be off.

3. Recommended Ambiant temperature is 10°C to 40°C for correct operation. This driver must be attached to a convenient heatsink. Recommended case temperature is 50°C maximum. However, acceptable case temperature can be up to 65°C.

4. Connect the thermal security (Front panel SMC connector) to the AO device if it is equipped with thermal security switch. Note : The driver cannot operate without this connection. This security can be disabled by short circuit. An Alarm (pin 5) is provided. A low level (0) indicates a correct operation of the driver, while a high level (1) indicates a faulty condition (security not connected, too high temperature of the QST…). In case a faulty condition occurs, then the driver stops operation. To restart operation, driver must be switched OFF and ON.

5. Connect the external Control Signals (DPC+PAC) to the amplitude control sources (Laboratory power supply, signal generator, PC interface board...).
DPC = TTL reversed / 1 Kohms signal for pulse control.
PAC = Analog 0-5V / 1 Kohms for RF OFF power level control.
FAC = Analog 0-5V / 1 Kohms for RF ON power level control.
Take care to match the output impedance of the controller with the input impedance of the modulation inputs (1KΩ). (You can also use compatible output impedance. In case of doubt, contact AA. Sa.)
In case of impedance mismatch, your driver will not operate in a proper way.

6. Switch on the power supply (+ 24 VDC...). Maximum ripples +/- 1%.

7. THEN switch on the control signals commands. Maximum ripples +/- 1%.
When the driver is associated to an AO device, the maximum RF power level is adjusted at factory in order to get the maximum acousto-optic performances (see test sheet).
When bought alone, the maximum RF output power is set to an arbitrary value (refer to test sheet).

8. A warm up time of 15 minutes is necessary to get the best output power stability of this driver. However, for Q-switch operation, immediate operation after switch on is possible.

Maximum RF power adjustment

A screw potentiometer ("POWER ADJ") is available to fully adjust the maximum RF power level from 0 to a maximum value (see test sheet).
To adjust the maximum RF power level, your modulation input must be active, with the maximum level. At the contrary, the output RF power of your driver will be only a fraction of the maximum signal. For more information, refer to "Amplitude modulation" part.

With a screwdriver (2,2 mm large) :
- rotate the single-turn potentiometer to increase RF power.
- rotate reverse side to decrease RF power.

When monitoring the output signal from your driver, you will observe a sine wave, which frequency is equal to the carrier frequency of your driver, and which amplitude is set via the POWER ADJ.

The output RF power PRF through a 50 Ω load (R) is related to the peak to peak signal amplitude Vpp by the relation:

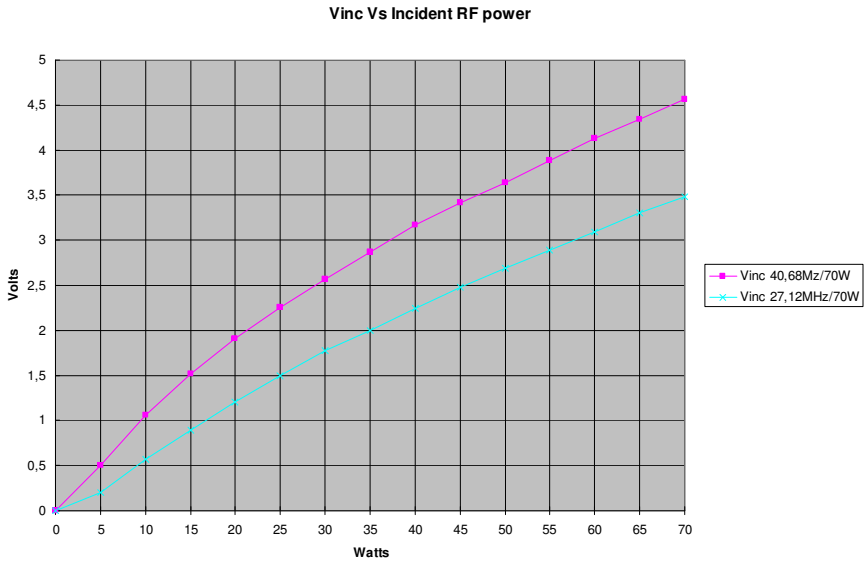
$$P_{RF} = \frac{V_{pp}^2}{8R} = \frac{V_{pp}^2}{400}$$

POWER MEASUREMENT (Pin 6)

This output signal from DB15 connector is provided to user in order to monitor Incident RF power (or output RF power going to Q-switch).
This signal can be used in order to create an appropriate alarm if necessary.

Signal from Pin 6 is an analog signal (0 to few V) giving an indication of the output RF power. This analog signal varies proportionally with the level of power. Voltage signal must be calibrated by user.

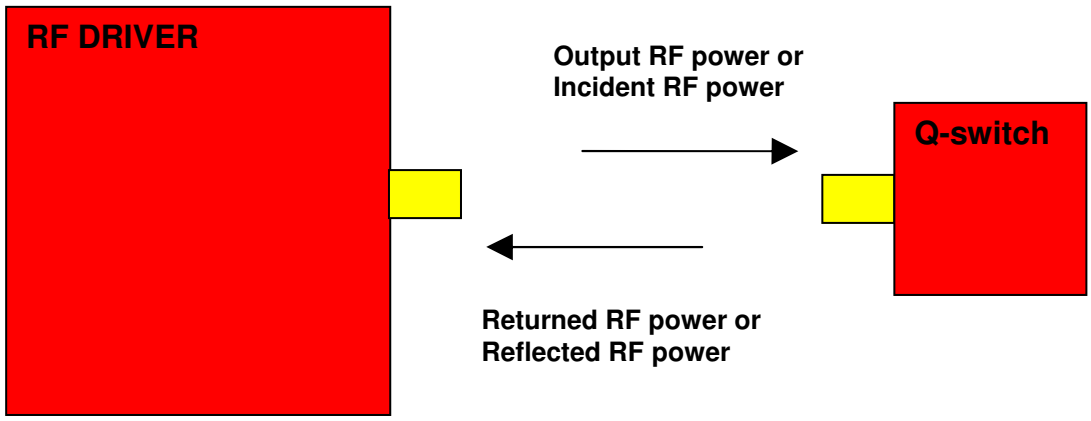
Exemple



REFLECTED RF POWER MEASUREMENT (Pin 8)

This output signal from DB15 connector is provided to user in order to monitor Returned output RF power (Returned Output power measurement Pin 8).
This signal can be used in order to create an appropriate alarm.

Signal from Pin 8 is an analog signal (0 to few Volts) giving an indication of the reflected RF power. This analog signal varies proportionally with the level of reflected power. An abnormal level of returned RF power means that the associated Q-switch may have some trouble. This voltage signal must be calibrated by user. The response curve is near similar to the Incident power one.



Methods of controls

Basic Pulse control (DPC Input / Digital Pulse Control)

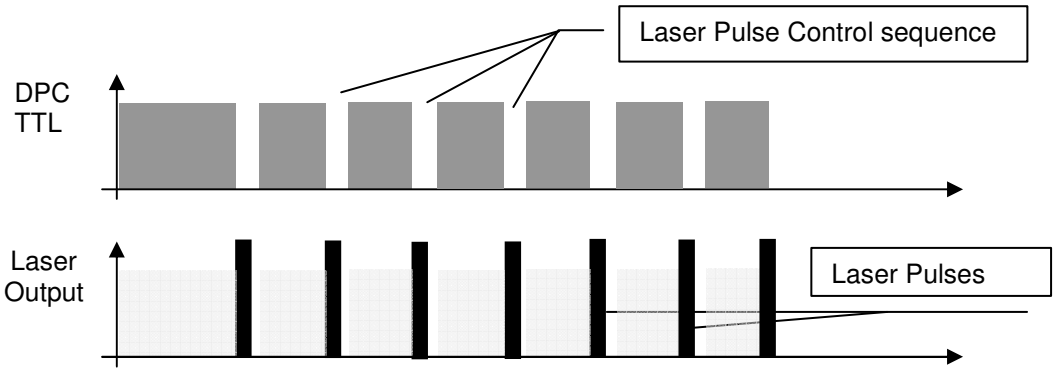
For all AA drivers, the Laser pulses are triggered by a TTL signal (Digital Pulse Control).
This input allow to control the Q-swicth with two states :

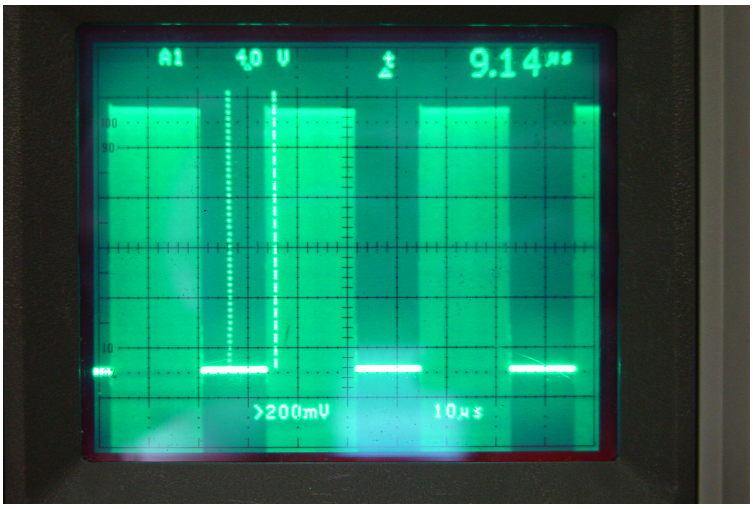
- No losses (TTL=0)= No RF power applied on Q-switch = Laser pulse can evolved
- Full Losses (TTL=1)= Full RF Power applied on Q-switch = Laser Cavity Blocked

Attention: standard DPC input for QMODP1 is TTL reversed::
TTL=0 → RF power = OFF, TTL=1 → RF power = ON.

On request DPC input can be TTL direct :
TTL=0 → RF power = OFF, TTL=1 → RF power = ON.

For Lasers which do need to have first pulse suppression, Q-switch can be controlled only with DPC input.





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Analog Power control (FAC input / Full Analog Control)

AA provides a supplementary analog input in order to control the RF power level. This input is pulled down (Typ 0-5Volts) –it means, that if it is not connected, then signal is ramped to 0, then output power is disabled. The analog FAC signal controls linearly the RF amplitude of the output signal.

Note that the analog power control is combined with TTL pulse control (DPC) as follows:

Output RF power ~ TTL (DPC) X Analog (FAC)

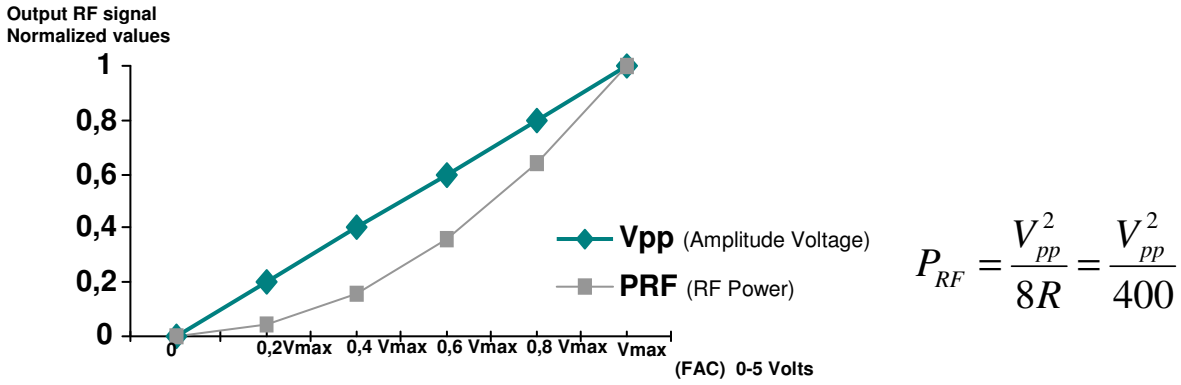
If TTL (DPC) = 0 → Output RF Power = 0 whatever is FAC input (0 or 5 V)
If TTL (DPC) = 1 → Output RF Power = 0 if FAC=0V
Maximum if FAC = 5V
Xx versus FAC input

If user do not want to use FAC analog input, then it must be connected to +5V to be disabled. In case it is not connected, then RF power cannot be controlled.

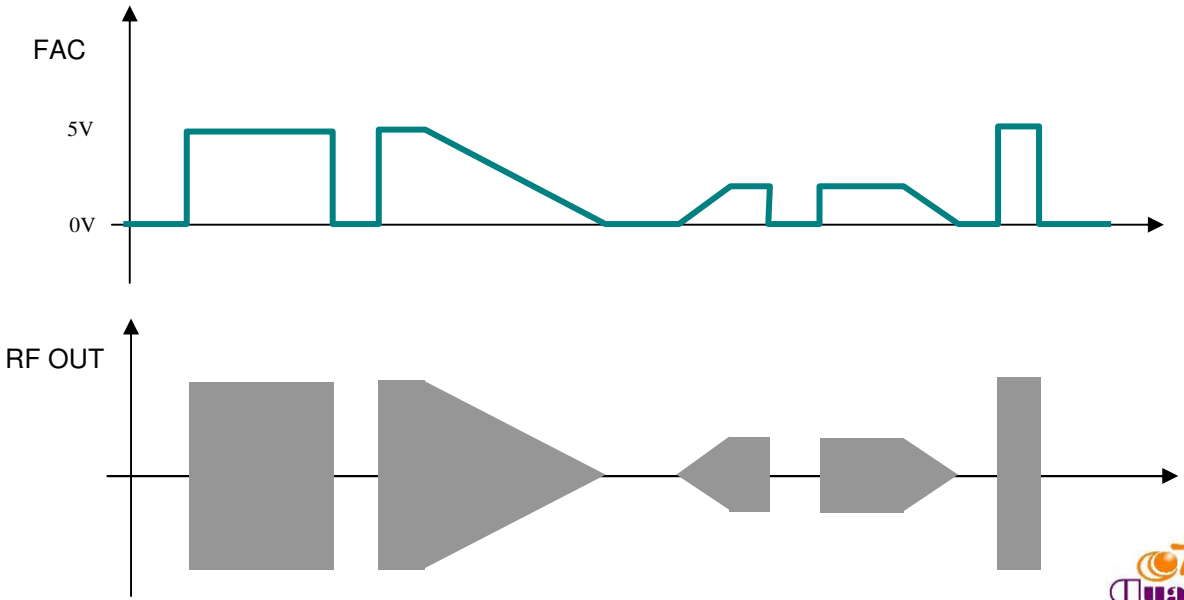
Analog Modulation:

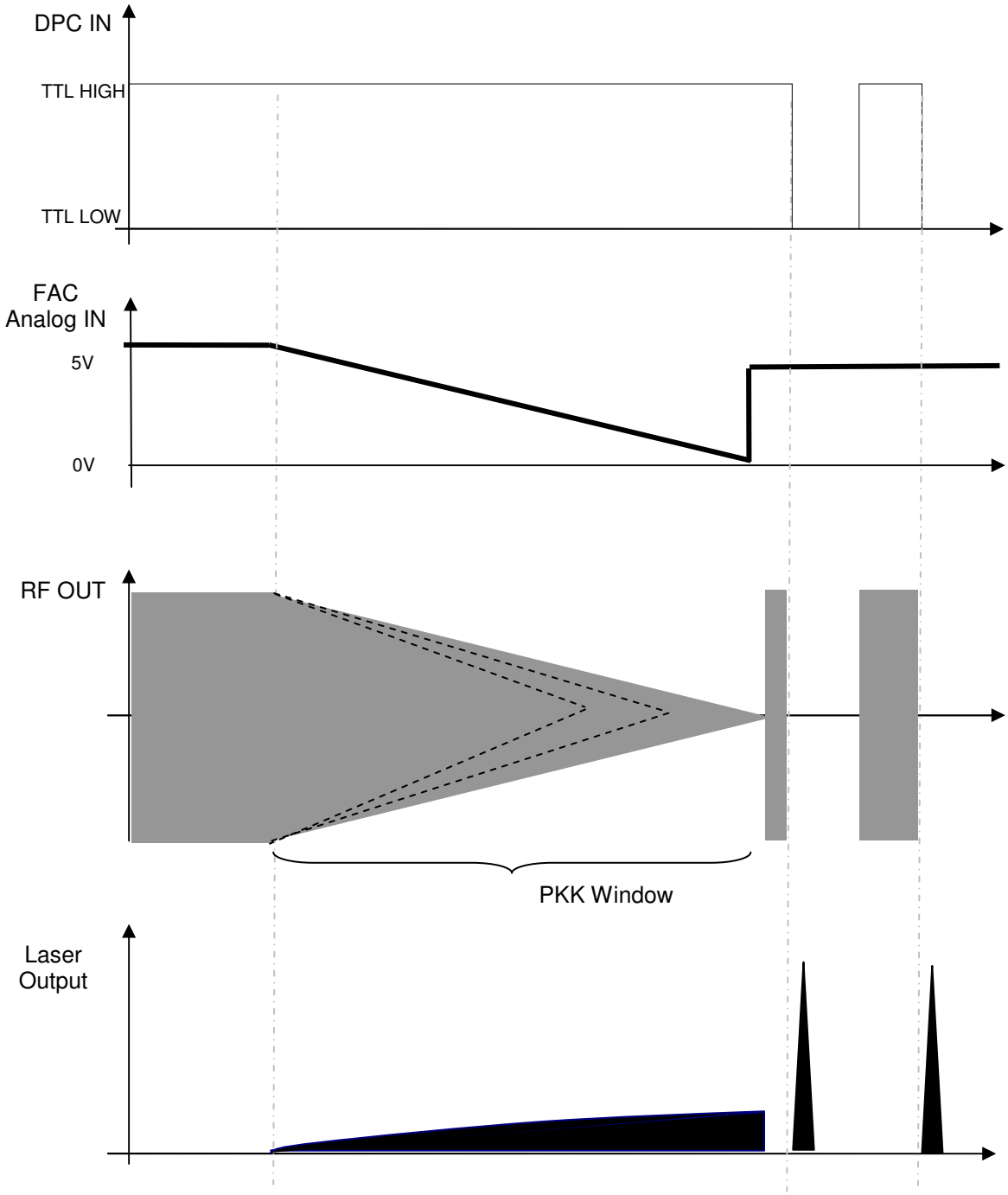
If TTL signal (DPC) is set to 1, then user can fully control the Q-switch with the FAC analog input. This input behaves like a full analog modulation, for which output RF amplitude is linearly increased versus input FAC Voltage.

TTL (DPC) is set to 1:



$$P_{RF} = \frac{V_{pp}^2}{8R} = \frac{V_{pp}^2}{400}$$





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Pulse Analog Control (PAC / RF OFF Analog Control)

The PAC input is an alternative analog input, which controls the **RF OFF** level of the driver.
This input (analog 0-5V typ) is pulled up. It means that when it is not connected, the signal ramped up to 5 Volts, and the driver can operate normally.

The analog PAC signal controls linearly the RF OFF amplitude of the output signal. It controls the threshold of leakage.
Note that the PAC Amplitude control is combined with TTL pulse control (DPC) as follows:

RF POWER OUTPUT ~ TTL (DPC) + Analog (PAC)

If TTL (DPC) = 0 → Output RF Power = 0 if PAC=0V
Maximum if PAC = 5V
Xx versus PAC input

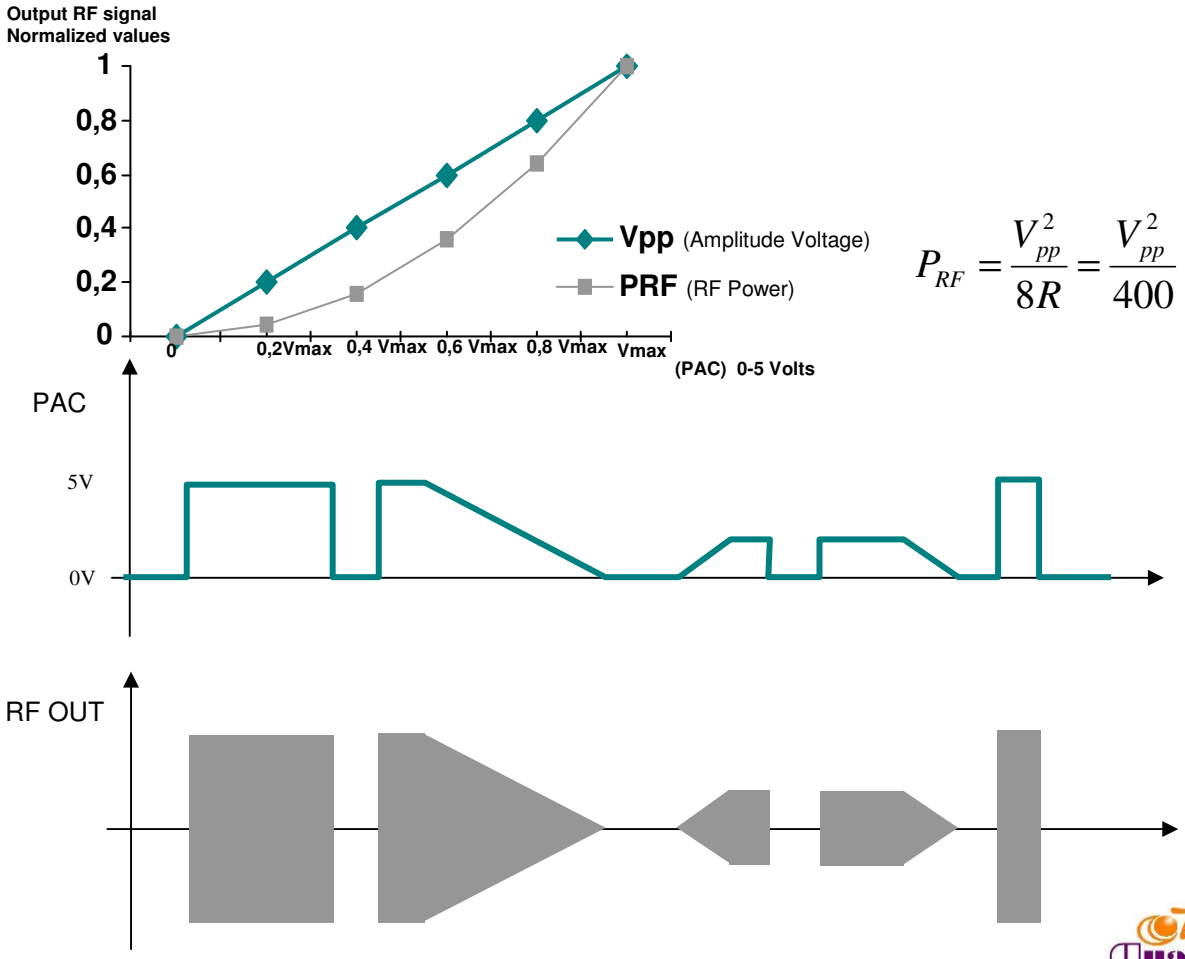
If TTL (DPC) = 1 → Output RF Power = Max whatever is PAC input (0 or 5 V)

If user do not want to use PAC analog input, then it can be not connected (pulled down to 0 / no effect).

Analog Modulation:

If TTL signal (DPC) is set to 0, then user can fully control the Q-switch with the PAC analog input. This input then behaves like a full analog modulation, for which output RF amplitude is linearly increased versus input PAC Voltage.

TTL (DPC) is set to 0:



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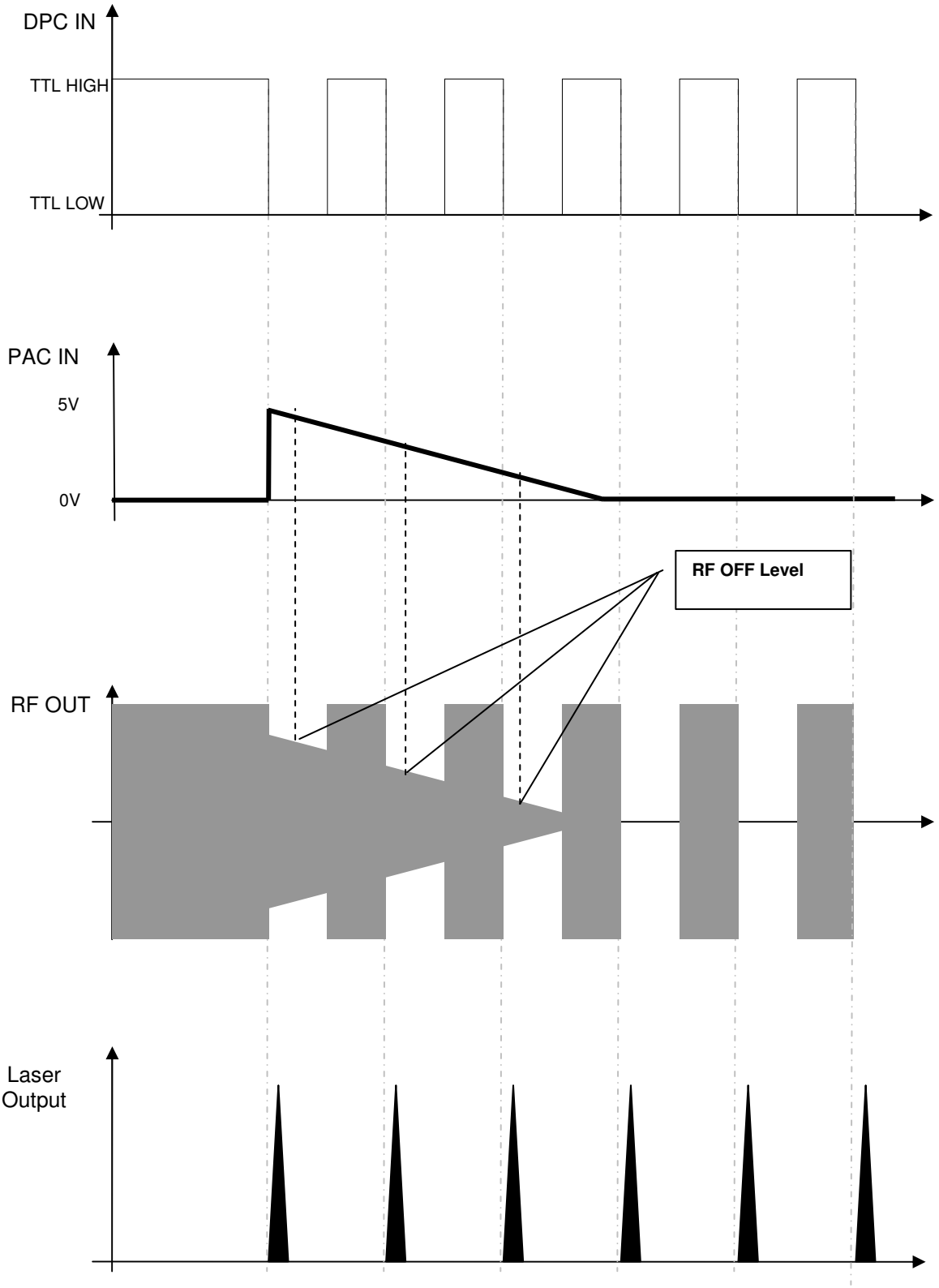

Example of FIRST PULSE SUPPRESSION control

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RISE TIME / FALL TIME

The rise time Tr and fall time Tf of your driver specified in your test sheet corresponds to the necessary time for the output RF signal to rise from 10 % to 90 % of the maximum amplitude value, after a leading edge front. This time is linked to carrier frequency and RF technology. (Fig 13, 14, 15)

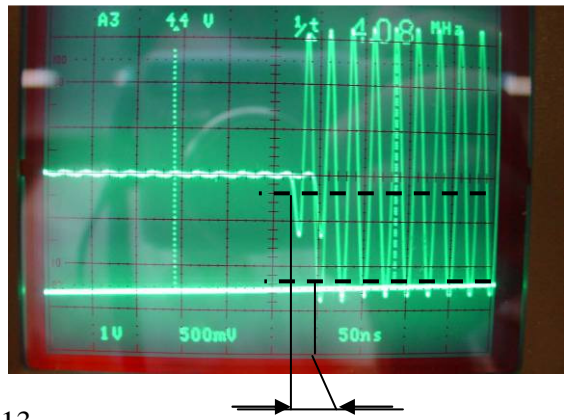


Fig 13 Rise time

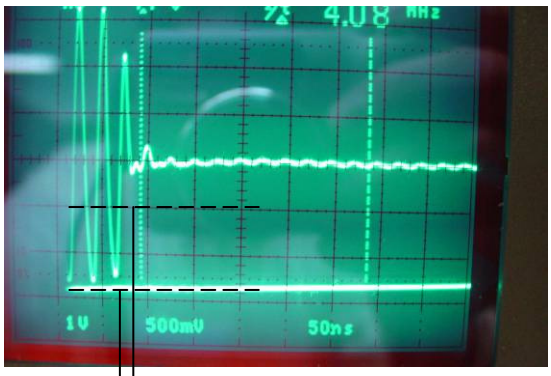
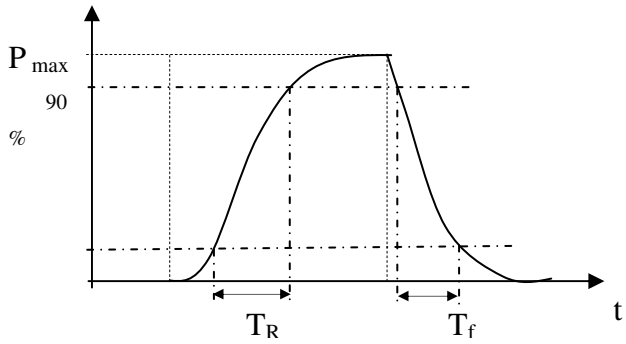


Fig 14 Fall time



Fig

EXTINCTION RATIO

The extinction ratio of your driver specified in the test sheet is the ratio between the maximum output RF level (MOD IN = max value) with the minimum output level (MOD IN = MIN value).
A bad modulation input signal can be responsible for the extinction ratio deterioration.

$$Extinction\ \ ratio = 10\log(\frac{P_{\max}}{P_{\min}}) = 20\log(\frac{V_{pp\ \max}}{V_{pp\ \min}}) \quad (dB)$$

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THERMAL Security (SMC Connector on front panel)

Connect the thermal security (Front panel SMC connector) to the AO device convenient output : **The driver cannot operate without this connection.**
This security can be disabled by a short circuit. An open circuit will ramp down to 0 the output RF power of the driver, and will send a faulty status on PIN 5 (thermal ALARM).

AO THERMAL ALARM (Pin 5)

This pin indicates the status of the thermal security of the QST.
An Alarm (pin 5) is provided. A high level (1) indicates a correct operation of the driver, while a low level (0) indicates a faulty condition (security not connected, too high temperature of the QST…). In case a faulty condition occurs, then the driver stops operation.

Driver THERMAL ALARM (Pin 15)

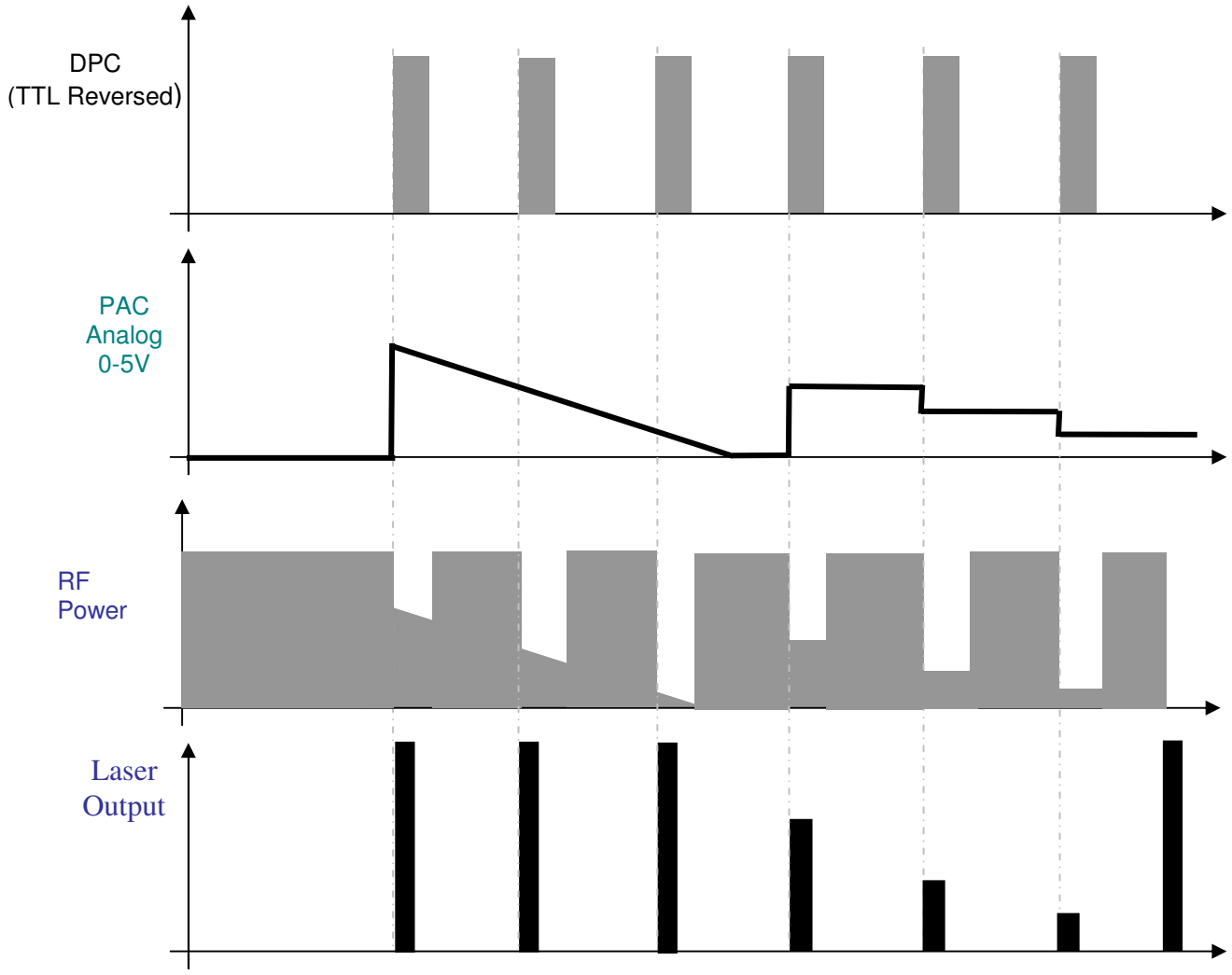
This pin indicates the status of the thermal security of the driver.
An Alarm (pin 5) is provided. A high level (1) indicates a correct operation of the driver, while a low level (0) indicates a faulty condition (security not connected, too high temperature of the driver, >70°C…). In case a faulty condition occurs, then the driver stops operation.

CHRONOGRAMS

Mixed Mode DPC+PAC : Pulse Analog Control

This operating mode allow user to control manually with an analog signal the RF off level, as well as to control the laser pulse power.

The PAC analog signal (0-5 V) is controlled by user. It corresponds to the RF off level of the output radio-frequency driver, which is synchronized with the DPC signal (repetition rate).



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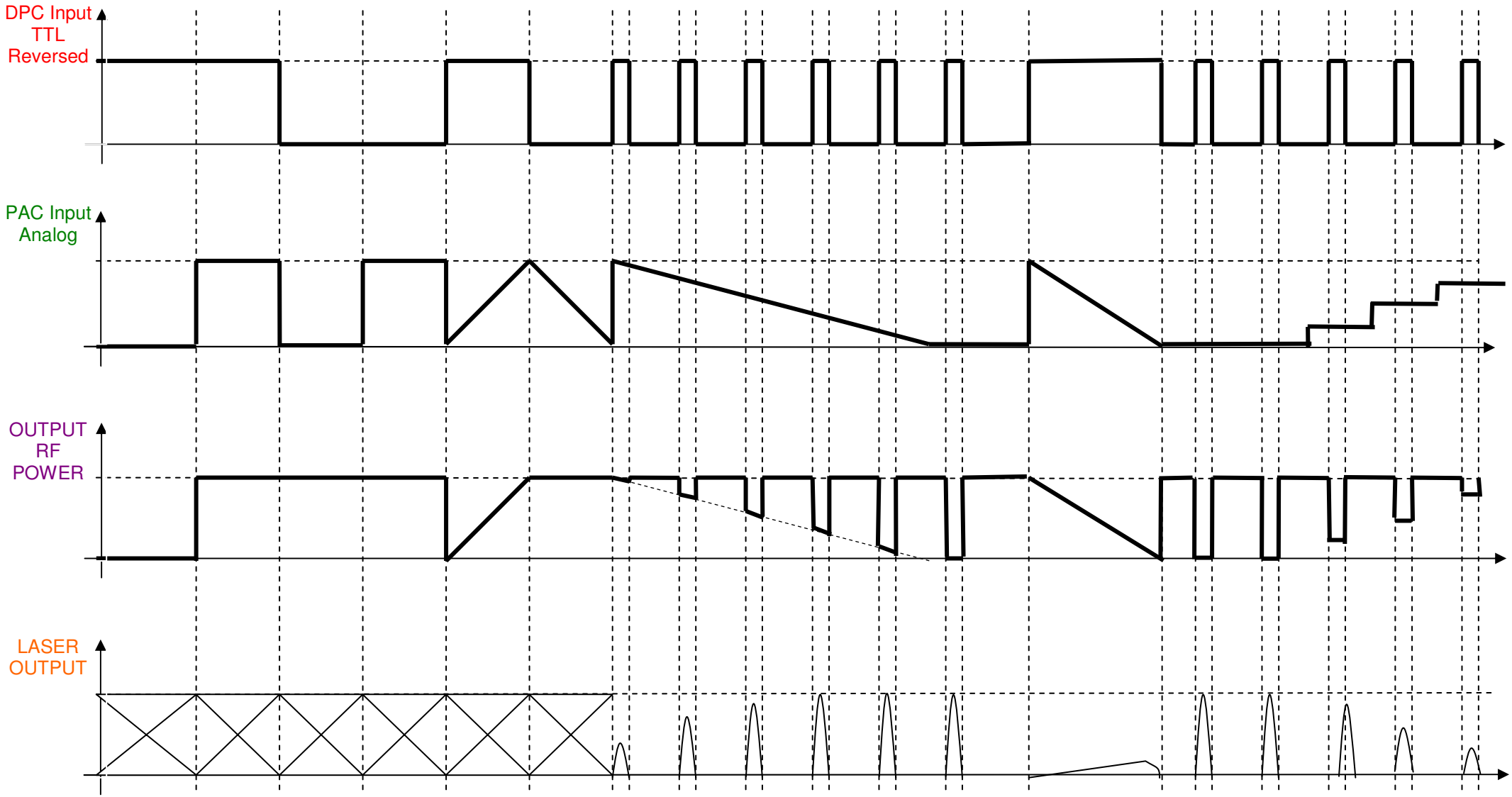

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