GM8136

H264 ENCODER

User Guide
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GM8136 H264 Encoder User Guide

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Chapter 1

Introduction

This chapter contains the following sections:

- 1.1   Overview
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1.1   Overview

The H264 high-profile encoder is a high-performance hardware video encoder based on the MPEG4 AVC/JVT/H.264 video coding standard. The encoder is designed to compress a sequence of YcbCr 4:2:2 pictures into a compressed video bitstream. The supported resolutions are up to 4096x4096. The features of H264 encoder include the following MPEG4 AVC/JVT/H.264 (ISO/IEC 14496-10) video coding standard:

- High profile level 4.1
- Supports I, B, and P frame encodings
- Supports CAVLC and CABAC entropy coding
- Includes de-interlace and de-noise preprocessor
- Configures horizontal and vertical search ranges as 16pixels ~ 256pixels with configuration steps of 8pixels
- CBR and VBR (Rate control by firmware)
- Supports user-defined quantization matrix
- Supports mono (4:0:0) encoding
- Supports 4x4 and 8x8 transform coding
- Supports 4x4 and 8x8 intra predictions

1.2   Related Document

The reference document includes:

- H264_Rate_Control_User_Guide_xxx.pdf

Chapter 2

Driver Module of H264 Encoder

This chapter contains the following sections:

- 2.1   Driver Module
- 2.2   Module Parameter

2.1   Driver Module

The H264 encoder module contains the following part:

- favc_enc.ko

  This is the H264 encoder core. It includes the H264 encoder hardware control layer and middle ware (GM_graph) communication layer.

The following example shows the operation procedure:

```
/ # insmod favc_enc.ko h264e_max_b_frame=0 h264e_max_width=1920 h264e_max_height=1088
FAVC Encoder v0.1.105, built @ Sep 30 2014 17:39:25 (GM8136)
```

2.2   Module Parameter

Table 2-1 lists and describes the module parameters when inserting the H264 encoder driver.

Table 2-1.   Module Parameters

Name	Default Value	Description
h264e_max_width	0	Maximal width of the encoded frame
h264e_max_height	0	Maximal height of the encoded frame
h264e_max_chn	128	Maximal number of the channel ID
h264e_snapshot_chn	0	Number of the snapshot channels
h264e_max_b_frame	0	Maximal number of b frame in gop
		0: Not support b frame
h264e_yuv_swap	0	Input YUV422 format
		0: CbYCrY
		1: YCbYCr
use_ioremap_wc	0	Register of mcp280 remap type
		0: ncnb
		1: ncb
config_path	"/mnt/mtd"	Specify the configure path
h264e_slice_offset	0	Output slice offset
		0: Not output the position of echo slice on the bitstream
		1: Output the position of echo slice on the bitstream (At most, first four slices)
h264e_tight_buf	0	Allocate exact number of the reference buffers

Name	Default Value	Description
h264e_one_ref_buf	0	Reduce number of the reference buffers
		0: Reference buffer and reconstructed buffer are different buffers.
		1: Reference buffer and reconstructed buffer are the same buffers.
h264e_user_config	0	Using "favce_param.cfg" to be the encode setting for each channel
pwm	0	Control clock ratio

Chapter 3

H264 Encoder Proc Node

This chapter contains the following sections:

The H264 encoder module provides several proc nodes. Users can read the information of the H264 encoder or setup the configuration through the nodes.

3.1   /proc/videograph/h264e/info

Users can use /proc/videograph/h264e/info to get the driver information, including the versions of the drivers and the values of the module parameters.

Usage:

- Get the version of the driver and value of the module parameters

    cat /proc/videograph/h264e/info

```
FAVC Encoder v0.1.105, built @ Oct 13 2014 15:04:11 (GM8136)
module parameter
====================            ======
h264e_max_width                 1920
h264e_max_height                1088
h264e_max_b_frame               0
h264e_max_chn                   128
h264e_snapshot_chn              0
h264e_yuv_swap                  0
pwm                             0
config_path                     "/mnt/mtd"
use_ioremap_wc                  0
h264e_slice_offset              1
h264e_one_ref_buf               1
h264e_tight_buf                 1
h264e_user_config               0
```

3.2   /proc/videograph/h264e/chn_info

Users can use /proc/videograph/h264e/chn_info to get the settings of each encoded channel, including the resolution, frame rate, gop, bitrate, mode of the rate control, and current quant value.

Usage:

- Get the settings of each channel

    cat /proc/videograph/h264e/chn_info

chn	resolution	buf.type	gop	mode	fps	bitrate	max.br	init.q	min.q	max.q	qp
0	704x480	D1	60	CB R	900/3 0	1024	0	30	15	51	29

| 1 | 352x244 | cif | 60 | CB | 900/3 | 512 | 0 | 30 | 15 | 51 | 32 |
| | | | | R | 0 | | | | | | |

3.3 /proc/videograph/h264e/utilization

Users can use /proc/videograph/h264e/utilization to get the percentage of the hardware utilization and set the time period of the measured utilization.

Usage:

- Get the hardware utilization

  cat /proc/videograph/h264e/utilization

  ```
  HW Utilization Period=5(sec) Utilization=78
  ```

- Set the period of the hardware utilization measurement

  echo [sec] > /proc/videograph/h264e/utilization

3.4 /proc/videograph/h264e/callback_period

Users can use /proc/videograph/h264e/callback_period to get and set the callback period.

Usage:

- Get the callback period

  cat /proc/videograph/h264e/callback_period

  ```
  Callback Period = 3 (msecs)
  ```

- Set the callback period

  echo [msec] > /proc/videograph/h264e/callback_period

3.5   /proc/videograph/h264e/level

Users can use /proc/videograph/h264e/level to set the debug level. Higher debug level will dump more information to the background log.

Usage:

- Get the debug level

  cat /proc/videograph/h264e/level

  ```
  Log level = 2 (0: emergy, 1: error, 2: warning, 3: debug, 4: info)
  ```

- Set the debug level

  Echo [level] /proc/videograph/h264e/level

  [level]:

  0: Emergency message

  1: Error message

  2: Warning message

  3: Debug message

  4: Information

  For example, if the current debug level is 2, the driver will dump the emergency message, error message, and warning message.

3.6   /proc/videograph/h264e/property

Users can use /proc/videograph/h264e/property to get the input property of the specified channel.

Usage:

- Get the input property of the specified channel

  cat /proc/videograph/h264e/property

  ```
  usage: echo [chn] > /proc/videograph/h264e/property
  FAVCE favce ch0 job 14257793
  ============================================================
  ID     Name(string)     Value(hex)          Readme
  ```

```
2       src_xy          00240050                roi xy
4       src_dim         00900060                encode resolution
47      init_quant      0000001e                initial quant
41      bitrate         000000e6                target bitrate (Kb)
43      idr_interval    00000036                I frame interval
38      didn_mode       00000000                didn mode
…
```

- Set the specified channel ID to get property

  echo [chn] > /proc/videograph/h264e/property

3.7   /proc/videograph/h264e/job

Users can use /proc/videograph/h264e/job to get the information of job in the encoder job list.

Usage:

- Get the information of the job list

  cat /proc/videograph/h264e/job

```
usage: echo [chn] > /proc/videograph/h264e/job ([chn] = 999: means dump all job)
current [chn] = 999
Engine    Minor    Job_ID          Status          Puttime
====================================
0         41       15838469        STANDBY         0xb3f1
0         35       15841020        ONGOING         0x8e75
```

- Set the specified channel to get the job information

  echo [chn] > /proc/videograph/h264e/job

  [chn]: 999 means to get job information in job list

3.8 /proc/videograph/h264e/param

Users can use /proc/videograph/h264e/param to get and set the encode parameters.

Usage:

- Get the encode parameters

  cat /proc/videograph/h264e/param

Parameter name	Value	Note
DefaultCfg	1	0: Light quality (Between performance and quality)
		1: Performance
		2: Quality
		3: User definition
SymbolMode	0	0: CAVLC
		1: CABAC
ROIQPType	1	0: Disable ROI QP
		1: Delta QP
		2: Fixed QP
ROIDeltaQP	-4	ROI QP = Frame QP - Delta QP
ROIFixedQP	20	ROI QP = Fixed QP
ResendSPSPPS	1	0: Packing sps and pps (Only the first IDR frame)
		1: Packing sps and pps (Each I frame_
		2: Packing sps and pps (Each frame)
CbQPOffset	6	Cb QP offset
CrQPOffset	6	Cr QP offset
DFDisableIdc	0	Deblock idc
		0: Strong
		1: Disable
		2: Weak
DFAlpha	6	H264 deblock coefficient
DFBeta	6	H264 deblock coefficient

Parameter name	Value	Note
DiDnMode	0	DiDn enable
		-1: Using property input
		Bit0: Spatial de-interlace
		Bit1: Temporal de-interlace
		Bit2: Spatial denoise
		Bit3: Temporal denoise
PRef0SearchRangeX	32	Search range of X
PRef0SearchRangeY	16	Search range of Y
DisableCoeff	0	Threshold residual coefficient
		0: Enable coefficient threshold
		1: Disable coefficient threshold
LumaCoeffThd	4	Threshold coefficient of luma
ChromaCoeffThd	4	Threshold coefficient of chroma
DeltaQPWeight	5	Delta QP of each MB
		5: Disable Delta QP
		4: Enable Delta QP by image variance
DeltaQPStrength	19	Coefficient of Delta QP
DeltaQPThd	231	Coefficient of Delta QP
MaxDeltaQP	5	Max. Delta QP of MB
Transform8x8	0	0: Disable 8x8 transform
		1: Enable 8x8 transform
InterDefaultTransformSize	0	Inter hardware transform size
		0: 4x4
		1: 8x8
DisablePInterPartition	6	Disable inter prediction mode of P frame
		Bit 0: 8x8
		Bit 1: 8x16
		Bit 2: 16x8
		Bit 3: 16x16
DisableBInterPartition	14	Disable inter prediction mode of B frame
		Bit 0: 8x8
		Bit 1: 8x16
		Bit 2: 16x8
		Bit 3: 16x16

Parameter name	Value	Note
DisableIntra8x8	1	Disable intra 8x8 prediction mode
IntraMode	0	Intra 4x4 prediction mode
		0: 5 modes
		1: 9 modes
FastIntra4x4	1	Fast algorithm of intra prediction
DisableIntra16x16Plane	1	Disable intra 16x16 plane prediction
DisableIntraInInter	0	Disable intra prediction of P/B frame
DisableIntra4x4	0	Disable intra 4x4 prediction mode of I frame
DisableIntra16x16	0	Disable intra 16x16 prediction mode of I frame
IPOffset	2	QP offset of I/P frame
PBOffset	2	QP offset of P/B frame
QPStep	1	QP step
MinQuant	1	Minimal QP
MaxQuant	51	Maximal QP
IntraCostRatio	0	Intra cost weight
ForceMV0Thd	0	Force MV to be zero by image variance
CABACInitMode	0	CABAC init idc
CostEarlyTerminate	0	Early termination by cost
		0: Disable
PCycleEarlyTerminate	4095	Early termination by cycle of P frame: 4095 disable
BCycleEarlyTerminate	4095	Early termination by cycle of B frame: 4095 disable
ScalingListEnable	0	Scaling matrix
		0: Disable
		1: Enable
MCNREnable	0	MCNR
		0: Disable
		1: Enable
MCNRShift	2	MCNR parameter
MCNRMVThd	4	MCNR parameter
Profile	100	Default profile
		66: Baseline profile
		77: Main profile
		100: High profile

Parameter name	Value	Note
LevelIdc	0	Level idc
		0: Using the default setting
		Others: level_idc = LevelIdc/10

- Set the encode parameters

  echo [parameter name] [value(dec)] > /proc/videograph/h264e/param

3.9 /proc/videograph/h264e/didn

Users can use /proc/videograph/h264e/didn to get and set the didn parameters.

Usage:

- Get the didn parameters

  cat /proc/videograph/h264e/didn
- Set the didn parameters

  echo [parameters name] [value(dec)] > /proc/videograph/h264e/didn

3.10 /proc/videograph/h264e/ref_info

Users can use /proc/videograph/h264e/ref_info to get the number of the allocated buffers and usage of buffer.

Usage:

- Get the number of the allocated buffers

  echo 0 > /proc/videograph/h264e/ref_info

  cat /proc/videograph/h264e/ref_info

```
dump ref buffer flag = 0 (0: dump pool number, 1: dump ref pool, 2: dump chn pool)
allocate reference buffer va0xbb000000/pa0x20000000, size 27800064
        D1: unit 622080, num 36, size 22394880
        CIF: unit 158976, num 34, size 5405184
        sys info size 11520, mvinfo size 130560, l1col size 261120
              total size 28203264 byte (26.896M)
```

- Get the number of the allocated buffer

  echo 1 > /proc/videograph/h264e/ref_info

  cat /proc/videograph/h264e/ref_info

```
Reference Pool
Avail:
id   addr_virt      addr_phy      size
0    0xbb686a00     0x20686a00    622080
1    0xbc8b1600     0x218b1600    158976
Allocated:
id   addr_virt      addr_phy      size
2    0xbb556e00     0x20556e00    622080
3    0xbbaadc00     0x20aadc00    622080
4    0xbc94ca00     0x2194ca00    158976
5    0xbc99a400     0x2199a400    158976
```

- Get the used buffer of each channel

  echo 2 > /proc/videograph/h264e/ref_info

  cat /proc/videograph/h264e/ref_info

```
Channel used pool
chn    res     s.res    addr_virt      addr_phy      size
===    ====    ====     =========      =========     ======
 0     CIF     CIF      0xbc5f6c00     0x215f6c00    158976
 1     D1      D1       0xbc09c800     0x2109c800    622080
 2     CIF     CIF      0xbc692000     0x21692000    158976
 3     D1      D1       0xbb12fc00     0x2012fc00    622080
```

3.11 /proc/videograph/h264e/q_matrix

Users can use /proc/videograph/h264e/q_matrix to get and set the scaling matrix.

- Get the scaling matrix

  cat /proc/videograph/h264e/q_matrix

- Set the scaling matrix

  echo [matrix idx] [idx] [value] > /proc/videograph/h264e/q_matrix

3.12 /proc/videograph/h264e/mcnr

Users can use /proc/videograph/h264e/mcnr to get and set the mcnr matrix

- Get the mcnr matrix

    cat /proc/videograph/h264e/mcnr

- Set the mcnr matrix

    echo [H/L] [idx] [value] > /proc/videograph/h264e/mcnr