

# SEMICONDUCTOR GENERAL CATALOG

## ASSPs

Audio & Video Equipment ICs  
Communications Equipment ICs  
Automotive ICs  
Peripheral Equipment LSIs  
Other Consumer Product ICs

Datasheet.Live

## Audio & Video Equipment ICs

### TV Set ICs (Audio Output ICs)

| Part Number | Package           | Use              | Functions and Features   | Operating Supply Voltage (V) |
|-------------|-------------------|------------------|--|------------------------------|
| TB2922HQ    | P-HZIP12-1.78B    | Audio output ICs | Sound output power: 20 W x 2, MOS output stage: Class AB, mute, standby, various protection circuits | 9 to 26                      |
| TB2924AFG   | P-HSOP36-450-0.65 |                  | Sound output power: 20 W x 2, PWM analog-input Class-D amp   | 11 to 20 (18)                |
| TB2964FTG   | P-QFN48-0707-0.50 |                  | Sound output power: 15 W x 2, I <sup>2</sup> S signal-input Class-D amp                              | 9 to 18                      |

- Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

### TV Tuning & Channel Decoder ICs (PIF, SIF ICs)

| Part Number | Package             | Use                         | Functions and Features  | Operating Supply Voltage (V) |
|-------------|---------------------|-----------------------------|---|------------------------------|
| TB1351FTG   | ☆ QFN36-P-0606-0.50 | Multi-standard PLL PIF/SIF  | D/K, I, B/G, M, L, L', multi-standard PIF/SIF, FM radio receiver support, PIF VCO, audio trap, SIF filter, general-purpose SW port, split-carrier and intercarrier sound, I <sup>2</sup> C bus  | 4.75 to 5.25                 |
| TB1354FTG   | ☆ QFN36-P-0606-0.50 | Multi-standard PLL PIF/SIF  | D/K, I, B/G, M, L, L', multi-standard PIF/SIF, FM radio receiver support, PIF VCO, audio trap, SIF filter, general-purpose SW port, split-carrier and intercarrier sound, I <sup>2</sup> C bus  | 4.75 to 5.25                 |
| TB1355FTG   | ☆ QFN36-P-0606-0.50 | Systems M and N PLL PIF/SIF | Systems M and N, FM radio receiver support, PIF VCO, audio trap, SIF filter, general-purpose SW port, split-carrier and intercarrier sound, I <sup>2</sup> C bus  | 4.75 to 5.25                 |
| TB1356FTG   | ☆ QFN36-P-0606-0.50 | Multi-standard PLL PIF/SIF  | D/K, I, B/G, M, L, L', multi-standard PIF/SIF, FM radio receiver support, PIF VCO, audio trap, SIF filter, general-purpose SW port, split-carrier and intercarrier sound, I <sup>2</sup> C bus, TOP adjustment pin, analog AFT output | 4.75 to 5.25                 |

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### (Channel Decoder ICs)

| Part Number   | Package                 | Use   | Functions and Features  | Operating Supply Voltage (V) |
|---------------|-------------------------|---|---|------------------------------|
| TC90532XBG    | ☆ P-FBGA177-1313-0.80C4 | 8PSK demodulator<br>OFDM demodulator                        | Digital BS broadcasting, digital CS broadcasting (ISDB-S), 8PSK, QPSK demodulation, error correction, digital terrestrial broadcasting (ISDB-T), OFDM demodulation, error correction, A/D converter, memory | 3.0 to 3.6<br>1.1 to 1.3     |
| TC90522XBG    | ☆ P-FBGA177-1313-0.80C4 | 8PSK demodulator<br>OFDM demodulator<br>(Two channels each) | Digital BS broadcasting, digital CS broadcasting (ISDB-S), 8PSK, QPSK demodulation, error correction, digital terrestrial broadcasting (ISDB-T), OFDM demodulation, error correction, A/D converter, memory | 3.0 to 3.6<br>1.1 to 1.3     |
| TC90527FG     | ☆ LQFP48-P-0707-0.50C   | OFDM demodulator  | Digital terrestrial broadcasting (ISDB-T), OFDM demodulation, error correction,   | 3.0 to 3.6<br>or 1.7 to 1.9  |
| TC90527WBG ** | —                       |   | A/D converter, memory   | 1.1 to 1.3                   |

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\*\* : Under development

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## Audio ICs (AM/FM Receiver ICs)

| Part Number | Package                | Description   | Intended Use |               |       | Functions |    |                     |                 | Functions and Features  | Operating Voltage (V) |
|-------------|------------------------|---|--------------|---------------|-------|-----------|----|---------------------|-----------------|---|-----------------------|
|             |                        |   | Car Audio    | General Audio | Other | F/E       | IF | Stereo Demodulation | Audio processor |   |                       |
| TB2132FNG   | ☆ P-SSOP30-300-0.65    | Single-chip AM/FM stereo tuner with PLL                                       |              | ○             |       | ■         | ■  | ■                   |                 | TV bands, VCO for MPX, compliant with new FCC standards   | 1.8 to 5.5            |
| TB2178FG    | ☆ P-LQFP48-0707-0.50   | Front End IC for Digital IF sampling tuner system                             | ○            |               |       | ■         |    |                     |                 | AM/FM front-end, IF amplifier, DAC outputs for RF synchronization   | 8.3                   |
| TC94A90FG   | ☆ P-LQFP216-2424-0.40A | IF sampling AM/FM digital processing tuner and Audio Digital Signal Processor | ○            |               |       |           | ■  | ■                   | ■               | IF-sampling ADC x 2 ch<br>Multipath noise cancellation with dual tuners<br>Multi-bit DA converter x 6 ch<br>Output ports for IBOC decoders<br>On-chip audio processor | 3.3/1.5               |

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## (Power Amp ICs)

| Part Number | Package           | Intended Use |                         |                 | Output Power (POUT) |            |          | Functions and Features   | Operating Voltage (V)                    |
|-------------|-------------------|--------------|-------------------------|-----------------|---------------------|------------|----------|--|--|
|             |                   | Car Stereos  | Cassette Tape Recorders | TV/Home Stereos | Recommended Vcc     | RL = 4 Ω   | RL = 8 Ω |  |  |
| TB2901HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, high-side switch, Maximum power: 50 W x 4 ch, RL = 2 Ω operation guaranteed  | 9 to 18                                  |
| TB2902HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, mute, Command-controlled standby mode, Maximum power: 47 W x 4 ch, I2C-bus-controlled self-diagnosis, RL = 2 Ω operation guaranteed, Selectable voltage gain (26/12 dB)                        | 9 to 18                                  |
| TB2903HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 50 W x 4 ch   | 9 to 18                                  |
| TB2904HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 47 W x 4 ch, speaker burnout prevention   | 9 to 18                                  |
| TB2905HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, Class-KB efficiency, Maximum power: 47 W x 4 ch, self-diagnosis, RL = 2 Ω operation guaranteed, DC offset and clipping detector  | 9 to 18                                  |
| TB2906HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 47 W x 4 ch, 34dB voltage gain, Speaker burnout prevention  | 9 to 18                                  |
| TB2912HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, mute, Command-controlled standby mode, Maximum power: 47 W x 4 ch, I2C-bus-controlled self-diagnosis, RL = 2 Ω operation guaranteed, Selectable voltage gain (26/12 dB)                        | 9 to 18 (RL = 4 Ω)<br>9 to 16 (RL = 2 Ω) |
| TB2913HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, clipping detector, Maximum power: 50 W x 4 ch  | 9 to 18                                  |
| TB2915HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 24 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, Maximum power: 49 W x 4 ch, Class-KB efficiency, DC offset and short-circuit detection, Cross-wiring detection, RL = 2 Ω operation guaranteed, offset detection,         | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω) |
| TB2921AHQ   | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   | —        | MOS amplifier for 4 BTL channels, standby switch, mute, high-side switch, Maximum power: 51 W x 4 ch, RL = 2 Ω operation guaranteed  | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω) |
| TB2922HQ    | HZIP12-P-1.78B    |              |                         | ■               | 18 V                | 37 W x 2   | 22 W x 2 | MOS amplifier for 2 BTL channels, standby switch, mute   | 9 to 26                                  |
| TB2923AHQ   | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 25 W x 4   | —        | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 51 W x 4 ch, RL = 2 Ω operation guaranteed, short-circuit detection   | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω) |
| TB2924AFG   | HSOP36-P-450-0.65 |              |                         | ■               | 15 V                | 19.5 W x 2 | 12 W x 2 | Class D amplifier for 2 BTL channels, standby switch, mute   | 11 to 18 (20)                            |
| TB2926HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   | —        | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 49 W x 4 ch, short-circuit detection, Speaker burnout prevention  | 8 to 18                                  |
| TB2929HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 21 W x 4   |          | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 49 W x 4 ch, AUX amp  | 8 to 18                                  |
| TB2932AHQ   | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, mute, Command-controlled standby mode, Hardware-standby mode, Maximum power: 49 W x 4 ch, I2C-bus-controlled self-diagnosis, RL = 2 Ω operation guaranteed, Selectable voltage gain (26/12 dB) | 8 to 18                                  |
| TB2932HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4   |          | MOS amplifier for 4 BTL channels, mute, Maximum power: 49 W x 4 ch, Command-controlled standby mode, RL = 2 Ω operation guaranteed I2C-bus-controlled self-diagnosis, Selectable voltage gain (26/12 dB)                         | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω) |

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(Power Amp ICs) (Continued)

| Part Number | Package           | Intended Use |                         |                 | Output Power (Pout) |                 |                            | Functions and Features  | Operating Voltage (V)                     |
|-------------|-------------------|--------------|-------------------------|-----------------|---------------------|-----------------|----------------------------|---|---|
|             |                   | Car Stereos  | Cassette Tape Recorders | TV/Home Stereos | Recommended Vcc     | RL = 4 Ω        | RL = 8 Ω                   |   |   |
| TB2933HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, mute, Maximum power: 49 W x 4 ch, Command-controlled standby mode, RL = 2 Ω operation guaranteed<br>I <sup>2</sup> C-bus-controlled self-diagnosis, Selectable voltage gain (34/20 dB)                    | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω)  |
| TB2934HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, mute, Command-controlled standby mode, Maximum power: 47 W x 4 ch, RL = 2 Ω operation guaranteed<br>I <sup>2</sup> C-bus-controlled self-diagnosis, 34dB voltage gain, Selectable voltage gain (34/20 dB) | 9 to 18 (RL = 4 Ω)<br>9 to 16 (RL = 2 Ω)  |
| TB2936HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 49 W x 4 ch, 34dB voltage gain, clipping detector  | 8 to 18                                   |
| TB2939HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 24 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 45 W x 4 ch, self-diagnosis, short-circuit detection   | 8 to 18                                   |
| TB2946HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, offset detection, Maximum power: 49 W x 4 ch, RL = 2 Ω operation guaranteed, Short-circuit detection  | 8 to 18                                   |
| TB2956HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, clipping detector<br>Maximum power: 49 W x 4 ch, RL = 2 Ω operation guaranteed, Short-circuit detection   | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω)  |
| TB2964FTG ☆ | QFN48-P-0707-0.50 |              |                         | ■               | 15 V                | 15 W x 2        | 10 W x 2                   | MOS amplifier for 2 BTL channels, Muting control (soft mute, forced mute), Oversampling digital filter with an asynchronous sampling rate converter, De-emphasis, Digital attenuator, Protection circuits                                   | 9 to 18                                   |
| TB2976HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, Maximum power: 49 W x 4 ch, RL = 2 Ω operation guaranteed, Offset detection, Short-circuit detection  | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω)  |
| TB2986HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | SEPP<br>6 W x 4 | BTL(2ch-3ch)<br>12.3 W x 1 | MOS amplifier for 4 BTL channels, standby switch, mute, Maximum power: 49 W x 4 ch, RL = 2 Ω operation guaranteed, Offset detection, Short-circuit detection  | 8 to 18 (RL = 4 Ω)<br>8 to 16 (RL = 2 Ω)  |
| TB2999KG    | HZIP25-P-1.00L    | ■            |                         | ■               | 13.2 V              | 23 W x 4        |                            | MOS amplifier for SEPP4 channels, SEPP2 and BLT1 channels (2 ch + 3 ch) MOS amp, standby switch, mute, Maximum power: 12 W x 4 ch, offset detection, short-circuit detection<br>2.1 ch Maximum power: 12 W x 2 ch + 22.5 W x 1              | 8 to 18<br>(SEPP:RL = 4 Ω,<br>BTL:RL=8 Ω) |
| TB2931HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, Maximum power: 49 W x 4 ch, Offset detection, short-circuit detection, speaker burnout prevention   | 6 to 18 (RL = 4 Ω)<br>6 to 16 (RL = 2 Ω)  |
| TB2938HQ    | HZIP25-P-1.00F    | ■            |                         |                 | 13.2 V              | 23 W x 4        |                            | MOS amplifier for 4 BTL channels, standby switch, mute, Maximum power: 49 W x 4 ch, Offset detection, short-circuit detection, speaker burnout prevention   | 6 to 18                                   |

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- Contact the Toshiba sales representative for information about RoHS compliance before you purchase any components.

(Headphone Amp ICs)

| Part Number  | Package                | Intended Use  |                          | Output Power  | Functions and Features   | Operating Voltage (V)   |
|--------------|------------------------|---------------|--------------------------|---|--|---|
|              |                        | Mobile Phones | Digital Portable Stereos |   |  |   |
| TB2173FTG ☆  | P-VQON44-P-0606-0.4    | ■             | ■                        | 9.5 mW (+B = 1.2 V, 16 Ω)   | Support for 2 sources, electric volume, bass boost with AGC, OCL/output capacitor coupling, Gv = 8dB/24dB, beep, standby switch, mute, port expansion circuit                                    | +B = 0.9 to 4.5<br>V <sub>DD</sub> = 1.8 to 4.5<br>V <sub>CC</sub> = 1.8 to 4.5 |
| TC94B06WBG ☆ | S-UFBGA16-0202-0.40A02 | ■             | ■                        | 9.6 mW (AV <sub>DD</sub> = 3.6 V, 16 Ω)<br>12.4 mW (AV <sub>DD</sub> = 3.6 V, 32 Ω) | High-efficiency class-G amp, electric volume, differential inputs, I <sup>2</sup> C control (individually controllable left and right channels), FM tuner support (SGND), overcurrent protection | AV <sub>DD</sub> = 2.3 to 4.8   |

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### (Analog Switches)

| Part Number    | Package                                   | Features  | Operating Voltage (V) |                 |
|----------------|---|---|-----------------------|-----------------|
|                |   |   | V <sub>DD</sub>       | V <sub>SS</sub> |
| TC9162CNG/CFG  | P-SDIP28-400-1.78<br>P-SOP28-450-1.27B ☆  | High breakdown voltage, analog function switch array  | 6.0 to 17.0           | -17.0 to -6.0   |
| TC9163CNG/CFG  |   |   | 6.0 to 17.0           | -17.0 to -6.0   |
| TC9164CNG/CFG  |   |   | 6.0 to 17.0           | -17.0 to -6.0   |
| TC9273CNG/CFG  | P-SDIP28-400-1.78<br>P-SOP28-450-1.27B ☆  | High breakdown voltage, analog function switch array<br>semi-customization available            | 6.0 to 17.0           | -17.0 to -6.0   |
| TC9274CNG/CFG  | P-SDIP42-600-1.78<br>P-QFP44-1414-0.80K ☆ |   | 6.0 to 17.0           | -17.0 to -6.0   |
| TC94A46CNG/CFG | P-SDIP42-600-1.78<br>P-QFP80-1420-0.80M ☆ | High breakdown voltage, analog function switch array<br>14-circuit, 3-contact analog switch x 2 | 6.0 to 17.0           | -17.0 to -6.0   |
| TC94A88FG *    | P-QFP80-1420-0.80M ☆                      | High breakdown voltage, analog function switch array<br>13-circuit, 4-contact analog switch x 2 | 6.0 to 17.0           | -17.0 to -6.0   |

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\*: New product

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### (Electronic Volume Control ICs)

| Part Number            | Package                                  | Classification  | Features  | Operating Voltage (V)                         |                 |
|------------------------|--|---|---|---|-----------------|
|                        |  |   |   | V <sub>DD</sub>                               | V <sub>SS</sub> |
| TC9235APG/AFG          | P-DIP16-300-2.54A<br>P-SOP16-300-1.27 ☆  | Volume control  | Up/down-type electronic volume control  | 4.5 to 12.0                                   | —               |
| TC9459BNG/BFG          | P-SDIP28-400-1.78<br>P-SOP28-450-1.27B ☆ | High-breakdown-voltage<br>volume control  | High breakdown voltage, serial-data-controlled electronic volume control + loudness control   | 6.0 to 17.0                                   | -17.0 to -6.0   |
| TC9482BNG/BFG          | P-SDIP28-400-1.78<br>P-SOP28-450-1.27B ☆ |   | High breakdown voltage, 6-channel serial-data-controlled electronic volume control  | 6.0 to 17.0                                   | -17.0 to -6.0   |
| TC94A32BFG             | P-SOP28-450-1.27B ☆                      |   | High breakdown voltage, serial-data-controlled electronic volume control with trim volume   | 6.0 to 17.0                                   | -17.0 to -6.0   |
| TC94A27BUG             | P-LQFP44-1010-0.80A ☆                    |   | 4-channel serial-data-controlled electronic volume control with trim volume   | 6.0 to 17.0                                   | -17.0 to -6.0   |
| TC94A81UG              | P-LQFP44-1010-0.80A ☆                    |   | High breakdown voltage, 2-channel serial-data-controlled electronic volume control with trim volume, 4-input selector and zero crossing detection circuit | 6.0 to 17.0                                   | -17.0 to -6.0   |
| TC9422ANG<br>TC9422AFG | P-SDIP28-400-1.78<br>P-SOP28-450-1.27B ☆ |   | Single-chip<br>volume control   | Volume, 2-band tone control, 4-input selector | 6.0 to 12.0     |
| TC9499ANG/AFG          |  | 6-channel serial-data-controlled electronic volume control with trim volume settings<br>(dual power supplies) |   | 4.5 to 7.0                                    | -7.0 to -4.5    |

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### (Compact Disc Player ICs)

| Part Number     | Package              | Classification        | Features   | Operating Voltage (V) |
|-----------------|----------------------|-----------------------|--|-----------------------|
| TC94A15FG ☆     | P-LQFP100-1414-0.50C | Single-chip processor | Sync separation, EFM demodulation, error detection/correction, error-corrected output, microcontroller interface, search control, digital equalizer, text data decoding, variable-speed playback, x8 oversampling digital filter, 1-bit DA converter, Integrated head amp, x4 play back mode for CD-DA/R   | 3.3/1.5               |
| TC94B16FG ** ☆  | P-LQFP80-1212-0.50F  | Single-chip processor | Sync separation, EFM demodulation, error detection/correction, error-corrected output, microcontroller interface, search control, digital equalizer, text data decoding, variable-speed playback, x8 oversampling digital filter, Multi-bit DA converter, head amp<br>On-chip 3.3-to-1.5-V regulator, x4 play back mode for CD-DA/R                      | 3.3/1.5               |
| TC94B17MFG ** ☆ | P-LQFP80-1212-0.50F  | Single-chip processor | Sync separation, EFM demodulation, error detection/correction, error-corrected output, microcontroller interface, search control, digital equalizer, text data decoding, variable-speed playback, x8 oversampling digital filter, Multi-bit DA converter, head amp<br>On-chip 3.3-to-1.5-V regulator, x4 play back mode for CD-DA/R, shock-proof feature | 3.3/1.5               |

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\*\* : Under development

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## (CD/MP3 Player IC)

| Part Number   | Package              | Classification        | Features  | Operating Voltage (V) |
|---------------|----------------------|-----------------------|---|-----------------------|
| TC94A92FG ☆   | P-LQFP80-1212-0.50F  | Single-chip processor | CD-DA/R/RW: x2 playback, low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits), standby mode, Supports various compressed audio formats: MP3, WMA, AAC<br>RF amp, CD digital servo, 8fs digital filter, Multi-bit DA converter                                       | 3.3/1.5               |
| TC94A93MFG ☆  | P-LQFP80-1212-0.50F  | Single-chip processor | CD-DA/R/RW: x2 playback, low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits), standby mode, Supports various compressed audio formats: MP3, WMA, AAC<br>RF amp, CD digital servo, 8fs digital filter<br>Multi-bit DA converter, shock-proof feature                | 3.3/1.5               |
| TC94A99FG * ☆ | P-LQFP100-1414-0.50H | Single-chip processor | CD-DA/R/RW: x4 playback, low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits), standby mode, Supports various compressed audio formats: MP3, WMA, AAC<br>Audio DSP for sound-field control, RF amp, CD digital servo, 4fs digital filter,<br>Multi-bit DA converter | 3.3/1.5               |

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\*: New product

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## (Digital Signal Processor for Digital Amp System Applications)

| Part Number | Package             | Classification                 | Features  | Operating Voltage (V) |
|-------------|---------------------|--------------------------------|---|-----------------------|
| TC94A34FG ☆ | P-LQFP64-1010-0.50E | Audio digital signal processor | Low power consumption, 1-Mbit SRAM (128 Kwords x 8 bits)<br>Supports various compressed audio formats: MP3, WMA, AAC<br>Program ROM (20 K), program RAM (4 K), standby mode | 3.3/1.5               |

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# Communications Equipment ICs

## RF IC Series (Bipolar/Bi-CMOS/CMOS ICs)

| Part Number         | Package (Pin Pitch) | Functions | Applications                      | Features  | Power Supply Voltage (V)   |            |
|---------------------|---------------------|-----------|-----------------------------------|---|--|------------|
| <b>TB31224CFG</b>   | QFP48 (0.8 mm)      | RF IC     | Cordless phones                   | CTO-compatible PLL, IF detection and compander integrated into a single chip<br>on-chip peripherals   | Power-on reset   | 2.0 to 6.0 |
| <b>TB31261AFG</b> ☆ | QFP52 (0.65 mm)     |           |                                   | 900-MHz PLL, IF detection and compander integrated into a single chip,<br>on-chip peripherals   |  | 2.7 to 5.5 |
| <b>TB31262FG</b> ☆  | QFP52 (0.65 mm)     |           |                                   |   | VCO, varicap, LNA, MIX and PA integrated into a single chip                | 2.0 to 5.0 |
| TB32302FG ☆         | QFP52 (0.65 mm)     |           | Low-power radio                   | 400-MHz low-power radio, telemeter support, PLL, VCO, LNA, MIX, IF detection and PA integrated into a single chip   |  | 2.2 to 4.0 |
| JTB32303-AS         | Chip                |           | Transceiver (FRS/GMRS/PMR)        | Chip supply<br>PLL, XOUT, LNA, MIX, IF amp, RSSI, Noise detector, Audio amp and TX-buffer into a single chip  |  | 2.5 to 4.5 |
| JTB32304-AS         | Chip                |           |                                   | Chip supply<br>PLL, XOUT, LNA, 2nd MIX, IF amp, RSSI, Noise detector, Audio amp and TX-buffer into a single chip  |  | 2.5 to 4.5 |
| ETB32304-AS         | Wafer               |           |                                   | Wafer supply<br>PLL, XOUT, LNA, 2nd MIX, IF amp, RSSI, Noise detector, Audio amp and TX-buffer into a single chip   |  | 2.5 to 4.5 |
| TA32305FNG ☆        | SSOP30 (0.65 mm)    |           | Remote control (AM/FM)            | 240 kHz to 450 MHz RF amp, MIX, AM/FM demodulator, 2-level comparator,<br>V <sub>cc</sub> = 2.2 V to 5.5 V, on-chip local x8 multiplier, receiver/transmitter |  | 2.2 to 5.5 |
| TC31298IXBG ☆       | FBGA52 (0.5 mm)     |           | Bluetooth (RF IC for chipset)     | PLL, VCO, LNA, MIX, BPF, IF-amp, Digital detector, ADC, DAC, PA, antenna SW, PLL loopfilter integrated into a single chip                                     | Current consumption<br>Transmitter: 65 mA (typ.)<br>Receiver: 65 mA (typ.) | 3.0 to 3.6 |
| TC31299IXBG ☆       | FBGA52 (0.5 mm)     |           | Bluetooth EDR (RF IC for chipset) | Bluetooth EDR-compliant single-chip RF IC with PLL, VCO, LNA, MIX, BPF, IF amp, digital detector, DAC, ADC, PA, antenna switch and PLL loop filter            |  |            |
| TA31273FNG          | SSOP20 (0.65 mm)    |           | Remote control (AM)               | 240 kHz to 450 MHz RF amp, MIX, AM demodulator, 2-level comparator,<br>on-chip local x8 multiplier  |  | 3.0 to 5.5 |
| TA31275FNG ☆        | SSOP24 (0.65 mm)    |           | Remote control (AM/FM)            | 240 kHz to 450 MHz RF amp, narrow band system, MIX, AM/FM demodulator, 2-level comparator,<br>on-chip local x8 multiplier                                     |  | 2.4 to 5.5 |
| TB31370FNG ☆        | SSOP24 (0.65 mm)    |           |                                   | RF operating frequency: 315 MHz<br>on-chip VCO, IF filter, detector   |  | 4.0 to 5.5 |
| TB31371FNG ☆        | SSOP24 (0.65 mm)    |           |                                   | RF operating frequency: 433.92 MHz<br>on-chip VCO, IF filter, detector  |  | 3.6 to 5.5 |
| TB31372FNG ☆        | SSOP24 (0.65 mm)    |           | Remote control (AM/FM)            | RF operating frequency: 315 MHz<br>on-chip VCO, IF filter, detector, on-chip high-speed comparator  |  | 3.6 to 5.5 |
| TB31373FNG ☆        | SSOP24 (0.65 mm)    |           |                                   | RF operating frequency: 433.92 MHz<br>on-chip VCO, IF filter, detector, on-chip high-speed comparator   |  |            |

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- The products shown in bold are also manufactured in offshore fabs.
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# Automotive ICs

## System Power Supplies

| Part Number | Package          | Functions  | Characteristics           |                       |                           | Remarks  | Supply Voltage (V) |
|-------------|------------------|--|---------------------------|-----------------------|---------------------------|--|--------------------|
|             |                  |  | Output Voltage Typ. (V)   | Input Voltage Max (V) | Power Dissipation Max (W) |  |                    |
| TB9000FG    | SSOP16           | CPU voltage regulator, watchdog timer  | 5                         | 45 (1 s)              | 0.6                       | Low current consumption: 120 $\mu$ A (typ.)<br>Reset on watchdog timeout<br>Reset detection: 4.7 V<br>External transistor required   | 6 to 16            |
| TB9000AFG   | SSOP16           | CPU voltage regulator, watchdog timer  | 5                         | 45 (1 s)              | 0.6                       | Low current consumption: 120 $\mu$ A (typ.)<br>Reset on watchdog timeout<br>Reset detection: 4.2 V<br>External transistor required   | 6 to 16            |
| TB9000CFNG  | SSOP20 (0.65)    | CPU voltage regulator, watchdog timer  | 5                         | 45 (1 s)              | 0.68                      | Low current consumption: 120 $\mu$ A (typ.)<br>Reset on watchdog timeout<br>Reset detection: 4.7 V<br>External transistor required   | 6 to 16            |
| TB9001FNG   | SSOP20 (0.65)    | CPU voltage regulator, watchdog timer  | 5                         | 45 (1 s)              | 0.68                      | Low current consumption: 95 $\mu$ A (typ.)<br>Internal 32 kHz clock<br>External transistor required  | 6 to 16            |
| TB9004FNG   | ☆ SSOP24 (0.65)  | CPU dual voltage regulator, watchdog timer                                   | 3.4/2.5/1.5<br>5.0        | 45 (1 s)              | 0.85                      | 3.4/2.5/1.5 V selectable<br>2 reset pins<br>Low current consumption:<br>0 $\mu$ A ( $V_{cc1/2}$ : off) (typ.)<br>External transistor required  | 6 to 16            |
| TB9005FG    | ** SSOP20 (0.65) | CPU voltage regulator, watchdog timer  | 5                         | 45 (1 s)              | 0.68                      | Low current consumption: 90 $\mu$ A (typ.)<br>Reset on watchdog timeout<br>Reset detection: 4.7 V or 4.2 V (selectable)<br>External transistor required  | 6 to 18            |
| TB9041FG    | ** ☆ QFN36 (0.5) | CPU voltage regulator, switching regulator, series regulator, watchdog timer | 3.3/1.5/1.2<br>5.0<br>5.0 | 40 (1 s)              | 0.85                      | Low current consumption: 0 $\mu$ A<br>(SWReg/LDO1/LDO2/LDO3 : OFF) (Typ.)<br>3.3 V/1.5 V/1.2 V selectable<br>2 reset pins<br>On-chip output driver (One channel allows use of an external transistor.) | 7 to 18            |

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## Brush Motor Drivers

| Part Number | Package            | Functions                                      | Characteristics         |                         |                       |                           | Remarks  | Supply Voltage (V) |
|-------------|--------------------|--|-------------------------|-------------------------|-----------------------|---------------------------|--|--------------------|
|             |                    |  | Output Voltage Typ. (V) | Output Current Max (mA) | Input Voltage Max (V) | Power Dissipation Max (W) |  |                    |
| TA8050AFG   | HSOP20             | H-bridge driver                                | —                       | 1500                    | 60 (1 s)              | 2.0                       | Standby function   | 8 to 16            |
| TA8050FG    | HSOP20             | H-bridge driver                                | —                       | 1500                    | 60 (1 s)              | 2.0                       |  | 6 to 16            |
| TA8083PG    | DIP16              | H-bridge driver                                | —                       | 500                     | 60 (1 s)              | 1.4                       | Diagnosis function and standby function  | 8 to 16            |
| TA8083FG    | HSOP20             | H-bridge driver                                | —                       | 500                     | 60 (1 s)              | 2.0                       | Diagnosis function and standby function  | 8 to 16            |
| TA8083AFG   | HSOP20             | H-bridge driver                                | —                       | 800                     | 60 (1 s)              | 2.0                       | Diagnosis function and standby function  | 8 to 16            |
| TB9056FNG   | ☆ SSOP24 (0.65)    | LIN-compatible H-bridge driver                 | —                       | 300                     | 40 (1 s)              | 0.85                      | LIN Rev. 1.3<br>Motor driver: $R_{\text{DS(on)}}$ (H bridge: P-ch + N-ch) = 2.2 $\Omega$ (typ.)<br>Potentiometer support | 7 to 18            |
| TB9100FNG   | ** ☆ SSOP24 (0.65) | 3 ch H-bridge driver / 6 ch Half-bridge driver | —                       | 1000                    | 40 (1 s)              | 1.32                      | SPI communications, Diagnosis function<br>P-ch + N-ch = 0.8 $\Omega$ (Typ.)  | 7 to 18            |
| TB9110FNG   | ** ☆ SSOP24 (0.65) | N-ch MOS pre-driver                            | —                       | 20 (Note)               | 40 (1 s)              | 1.0                       | Diagnosis function and standby function,<br>On-chip charge pump  | 7 to 18            |

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\*\* : Under development

Note: An external N-channel FET is required as a gate driver.

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## Brushless Motor Drivers

| Part Number   | Package       | Functions  | Features   | Supply Voltage (V) |
|---------------|---------------|--|--|--------------------|
| TB9061FNG ☆   | SSOP24 (0.65) | Sensorless control with 120° commutation, Pre-driver | 3-phase, full-wave sensorless drive<br>PWM pulse input control/DC level input control (selectable)<br>Comparator for induced voltage detection<br>Thermal shutdown, overcurrent detection, overvoltage detection   | 5.5 to 18          |
| TB9065FG ☆    | QFP64 (0.65)  | Pre-driver   | Charge-pump brushless pre-driver<br>LIN transceiver<br>5 V power supply for a microcontroller (Requires external PNP transistors.)<br>Watchdog timer, power-on-reset timer<br>3 ch analog comparator for Hall-effect devices<br>Op-amp/comparator for motor overcurrent detection  | 7 to 18            |
| TB9067FNG ☆   | SSOP24 (0.65) | Hall IC, Pre-driver for 120° commutation             | 120-degree commutation logic<br>Pre-drivers for a high-side P-ch FET and a low-side N-h FET<br>PWM pulse input control/DC level input control (selectable)<br>Two options for setting the output duty cycle (pulse input, analog input)<br>Overcurrent detection, thermal shutdown, supply voltage increase, supply voltage decrease<br>Soft start | 6 to 18            |
| TB9068FG ** ☆ | QFP48 (0.5)   | Motor driver with a LIN transceiver                  | Motor driver R <sub>DS(on)</sub> : P-ch = 1 Ω (typ.), N-ch = 1 Ω (typ.)<br>120-degree commutation logic<br>LIN 1.3-based transceiver<br>5-V supply for a microcontroller (external PNP transistor required)<br>Watchdog timer, power-on reset timer<br>Three analog comparators for Hall devices   | 7 to 18            |
| TB9080FG ** ☆ | QFP64 (0.5)   | Hall elements, Pre-driver for sine-wave control      | Supports both PWM and DC inputs for sine-wave driver logic.<br>Motor RPM feedback, auto lead angle correction<br>Abnormal condition detection such as overcurrent, overvoltage, overtemperature and motor lock<br>Sleep mode   | 7 to 18            |

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# Peripheral Equipment LSIs

| Part Number     | Package         | Device Type   | Characteristics         |                         |                       |                           | Remarks   | Power Supply Voltage (V) |
|-----------------|-----------------|---|-------------------------|-------------------------|-----------------------|---------------------------|---|--------------------------|
|                 |                 |   | Output Voltage Typ. (V) | Output Current Max (mA) | Input Voltage Max (V) | Power Dissipation Max (W) |   |                          |
| TB6066FNG       | VSOP16          | Shock sensor amp (low-noise charge amp)                 | —                       | —                       | —                     | 0.025                     | 1 channel, Window Comparator  | 2.7 to 5.5               |
| TB6073AFNG      | VSOP16          | Shock sensor amp (low-noise charge amp)                 | —                       | —                       | —                     | 0.0225                    | 2 channel   | 2.7 to 5.5               |
| TB6078AFUG      | SM8             | Shock sensor amp (low-noise charge amp)                 | —                       | —                       | —                     | 0.0195                    | 1 channel, small package, low-noise   | 2.7 to 5.5               |
| TB6079AFKG *    | US16            | Shock sensor amp (Sensor signal Amplifier)              | —                       | —                       | —                     | 0.022                     | Two I/O rail-to-rail op amps, reference amp, Window Comparator, small package       | 2.3 to 5.5               |
| TB6082FNG *     | VSOP10          | Shock sensor amp (low-noise charge amp)                 | —                       | —                       | —                     | 0.03                      | 1 channel, Built-in an Amplifier for notch filter, low-noise                        | 2.3 to 5.5               |
| TB6086FKG *     | US16            | Shock sensor amp (Sensor signal Amplifier)              | —                       | —                       | —                     | 0.022                     | 1 channel, Built-in an Amplifier for notch filter, Window Comparator, small package | 3.0 to 5.5               |
| TC9350BFNG      | VSOP16          | USB optical mouse controller                            | —                       | —                       | —                     | 0.026                     | USB optical mouse controller  | 4.35 to 5.25             |
| TC93A02FUG/AFUG | SSOP6           | High-frequency modulator for optical disk drives (2-ch) | —                       | —                       | —                     | —                         | Designed for dual-wavelength laser diodes   | 4.5 to 5.5               |
| TC9399FNG       | VSOP16          | Laser diode driver for CD-RW drives                     | —                       | 400                     | —                     | —                         | Designed for optical disk drives  | 4.5 to 5.5               |
| TC93A04FNG/FTG  | VSOP16 /TSSOP16 | Laser diode driver for combo drives                     | —                       | 400                     | —                     | —                         | Designed for dual-wavelength laser diodes   | 4.5 to 5.5               |
| TC93A05FNG      | VSOP16          | Laser diode driver for combo drives                     | —                       | 400                     | —                     | —                         | Designed for dual-wavelength laser diodes   | 4.5 to 5.5               |
| TC93A14AFUG     | SSOP6           | High-frequency modulator for optical disk drives (2-ch) | —                       | —                       | —                     | —                         | Spectrum diffusion type   | 4.5 to 5.5               |
| TC93A16FTG      | VOON24 ☆        | Laser diode driver for Blu-ray Disc playback            | —                       | 100                     | —                     | —                         | 3-terminal  | 4.5 to 12                |
| TC93A24FUG *    | SSOP6           | High-frequency superimposition for Blu-ray Disc         | —                       | —                       | —                     | —                         | Designed for blue-violet lasers   | 4.5 to 5.0               |

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## Other Consumer Product ICs

### Mixed-Signal Controllers

| Part Number  | ROM (Kbytes) | RAM (Bytes) | Minimum Instruction Execution Times (μs) | SIO (Ch) | I <sup>2</sup> C (Ch) | 10-Bit AD Converter (Ch) | 18-Bit Timer/Counter (Ch) | 16-Bit Timer/Counter (Ch) | 10-Bit Timer/Counter (Ch) | 8-Bit Timer/Counter (Ch) | Watchdog Timer | Clock Gear | Power-On Reset | Sensor Sampling Circuit | Offset Voltage Adjustment Circuit | On-chip Debug Function | Internal Oscillator (High-Speed) | Internal Oscillator (Low-Speed) | I/O Port (Pins) | Power Supply Voltage (V) | Operating Temperature (°C) | Package                |
|--------------|--------------|-------------|--|----------|-----------------------|--------------------------|---------------------------|---------------------------|---------------------------|--------------------------|----------------|------------|----------------|-------------------------|-----------------------------------|------------------------|----------------------------------|---------------------------------|-----------------|--------------------------|----------------------------|------------------------|
| TMP89FH00DUG | 16           | 1024        | 0.2                                      | 1        | 1                     | 4                        |                           | 1                         |                           |                          | Yes            | Yes        | Yes            | (Note1)<br>Yes          | Yes                               | Yes                    | Yes                              | Yes                             | 15              | 2.2 to 3.6               | -40 to 85                  | LQFP48<br>(7×7 mm)     |
| TMP89FH00WBG | 16           | 1024        | 0.2                                      | 1        | 1                     | 4                        |                           | 1                         |                           |                          | Yes            | Yes        | Yes            | (Note1)<br>Yes          | Yes                               | Yes                    | Yes                              | Yes                             | 15              | 2.2 to 3.6               | -40 to 85                  | WCSP39<br>(3.8×3.8 mm) |

Note1) Supports 1- to 4-axes resistive-bridge-type acceleration sensors.

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### CLC (Common Line Communication) ICs

| Part Number | Package            | Applications             | Features  | Supply Voltage (V) |
|-------------|--------------------|--------------------------|---|--------------------|
| T6B70BFG ☆  | SOP16-P-300-1.27   | Interface IC for boilers | Carrier receiver, carrier identification, carrier pseudo-sine wave generator  | 4.5 to 5.5         |
| T6B70BFNG   | SSOP16-P-225-0.65B | Interface IC for boilers | Carrier receiver, carrier identification, carrier pseudo-sine wave generator<br>Smaller package version of T6B70BFG | 4.5 to 5.5         |

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