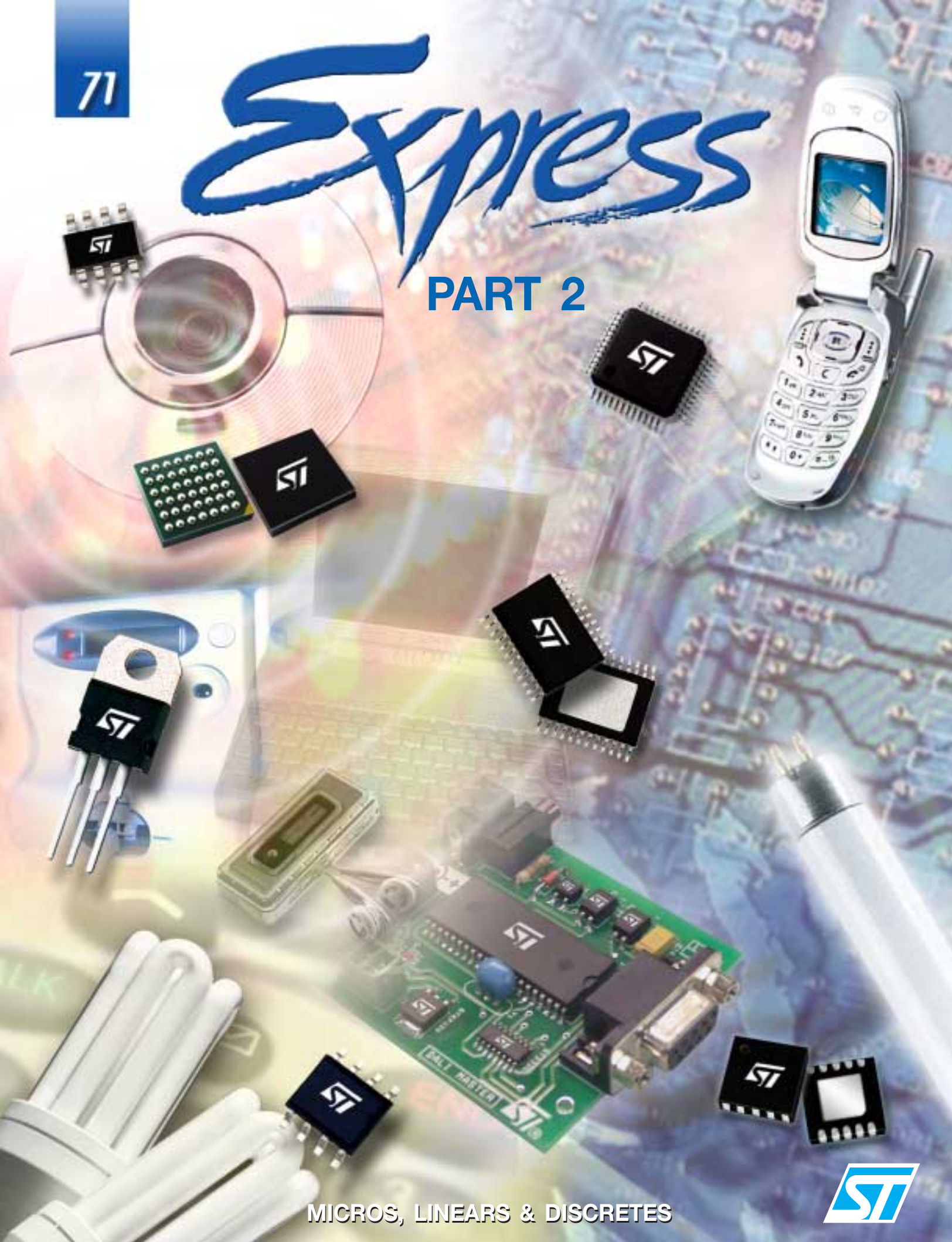


Express

PART 2



Contents

Express 71

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1.1GHz High Speed Op-Amp
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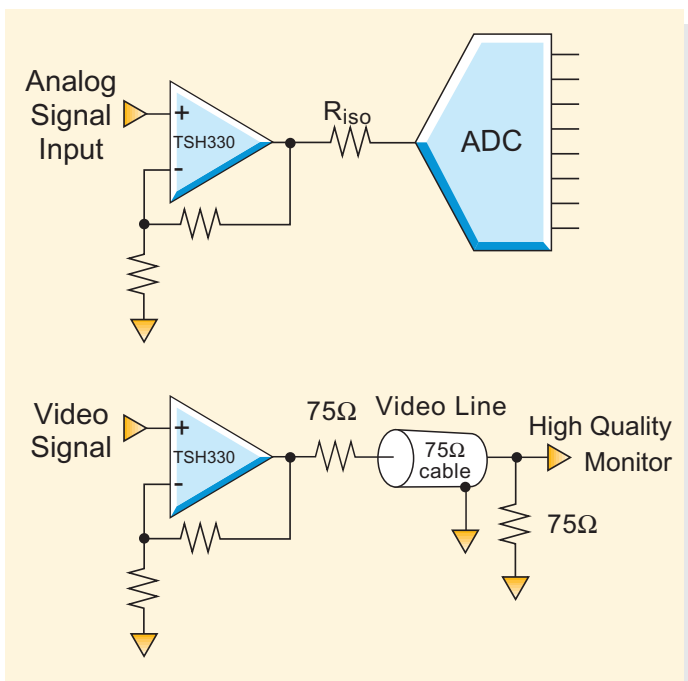
1.1GHz HIGH SPEED OP-AMP

Very wide bandwidth and excellent linearity are increasingly necessary for high-end equipment. The TSH330, with a 1.1 GHz bandwidth, is part of ST's new TSH3x series of high-speed operational amplifiers.

The TSH330, designed with an advanced BiCMOS process, marries the benefits of high performance with the price advantages of high volume production.

Main Features of the TSH330

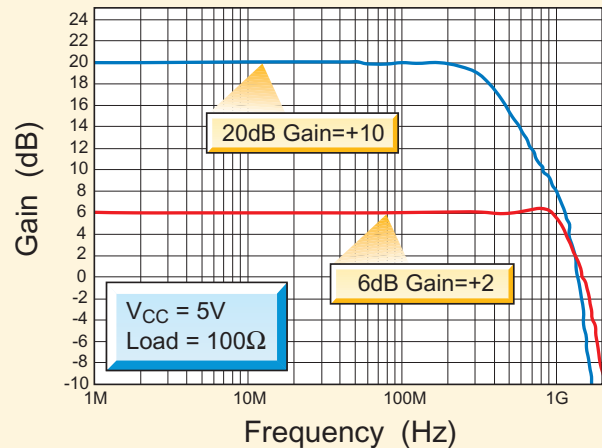
By combining a current feedback architecture with a very high-speed complementary technology, the TSH330 can provide a large bandwidth of 1.1GHz on only 16mA of quiescent current. This amplifier demonstrates a 0.1dB gain flatness up to 160-MHz at gain=2, and a high slew rate of 1800V/ μ s is provided, with only 1.3nV/ $\sqrt{\text{Hz}}$ of input-voltage noise. With an output stage optimized for driving video or instrumentation lines, the TSH330 demonstrates very good linearity: -78dBc versus 10MHz/2Vp-p on 100 Ω load and -73dBc versus 20MHz/2Vp-p on 100 Ω load.



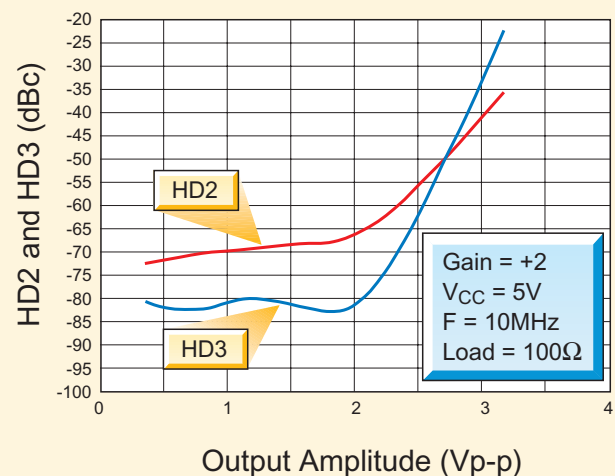
Typical application schematics

Packages

The TSH330 is available in an 8-pin SO-8 plastic package with a standard pin-out in tube and tape and reel (TSH330ID and TSH330IDT).



Small signal frequency response



Distortion versus amplitude

Main Applications

The TSH330 is aimed at applications such as instrumentation (oscilloscopes and analyzers), video drivers, high quality imaging and medical imaging.

1.2W FULL DIFFERENTIAL ZERO-POP HIGH-QUALITY AUDIO AMPLIFIER

Tailor-made for mobile communications, the TS4994 audio amplifier has fully differential inputs, zero pop and outstanding noise immunity.

Main Features

- Differential inputs;
- Zero pop and click;
- 100dB PSRR @ 217Hz with grounded inputs;
- Operating from $V_{CC} = 2.5V$ to $5.5V$;
- 1.2W Rail to Rail output power @ $V_{CC} = 5V$
THD = 1%, $F = 1kHz$, with 8Ω load;
- 70dB CMRR @ 217Hz;
- Ultra low consumption in standby mode (10nA);
- Selectable standby mode (active low or active high);
- Ultra fast startup time: 15ms typ;
- Available in Flip-Chip, DFN10 and MiniSO8.

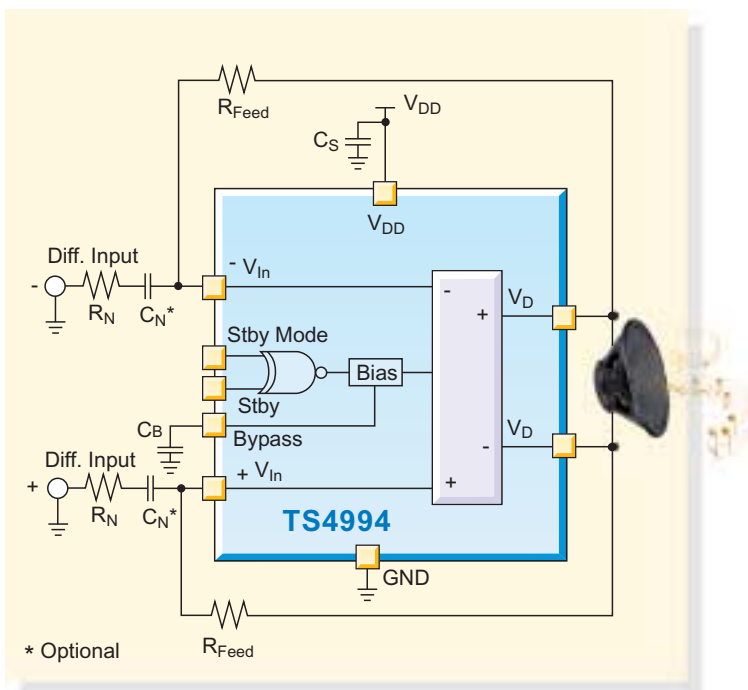
Applications

- Mobile phones;
- Laptop/Notebook PCs;
- PDAs;
- Portable audio devices.

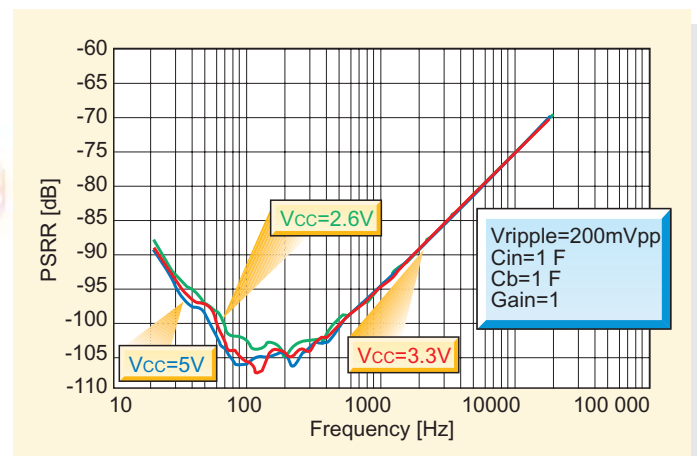


High Performance Portable Audio

Designed for high quality audio applications such as PDAs, laptops and mobile phones, the TS4994 is a Differential Audio Power Amplifier able to deliver 1.2W of continuous RMS output to an 8Ω load. The TS4994 also features ST's patented Pop and Click suppression circuits and, thanks to its differential inputs, it exhibits outstanding noise immunity. The device's negligible current consumption in standby mode makes it the perfect addition to power conscious portable applications. And, while it may be light on power consumption, the TS4994 is built tough enough to withstand short circuits and comes complete with its own internal thermal shutdown protection.



Typical application schematic



PSRR vs. frequency

1.5A, 1.5MHz, ADJUSTABLE, STEP-DOWN, SWITCHING REGULATOR

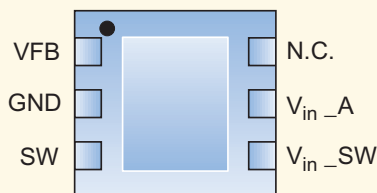
Firstborn of a new family of DC-DC converters, the ST1S03 possesses all the requirements coming from several market segments. It is expected to become a standard product able to replace the linear solution, when the power dissipation increases to a point considered unacceptable, for example in portable devices or in applications requiring very low supply voltages. It has been designed to be used primarily in hard disk drives and, for this reason, the new, BCD6 technology has been used in order to reach very high performance in terms of transient response and efficiency. Besides, the new trimming block allows easy adjustment of the reference voltage and the switching frequency using a pre-programmed sequence of digital bits. The high value of the applicable input voltage (16V), allows its use in consumer applications such as set-top box, TV sets and DVD reader/recorder. The ST1S03 is available in the increasingly popular tiny DFN6 3x3mm package.

Main Features

- Step-down, current mode, PWM DC-DC converter;
- Input voltage from 3 to 16V;
- High switching frequency: 1.5MHz;
- Output current capability up to 1.5A;
- Internal soft start to avoid the in-rush current during the power-on;
- Typical efficiency >70%;
- Non switching quiescent current: max 2.5mA ;
- Switch V_{DS} : max 350mV @ $I_{SW} = 750mA$;
- Package: DFN6 3x3mm EcoPack compliant.

ST1S03 Main Characteristics

MAX I_{out}	PWM f_s	FB	MAX V_{in}
1.5V	1.5MHz	0.8V	16V

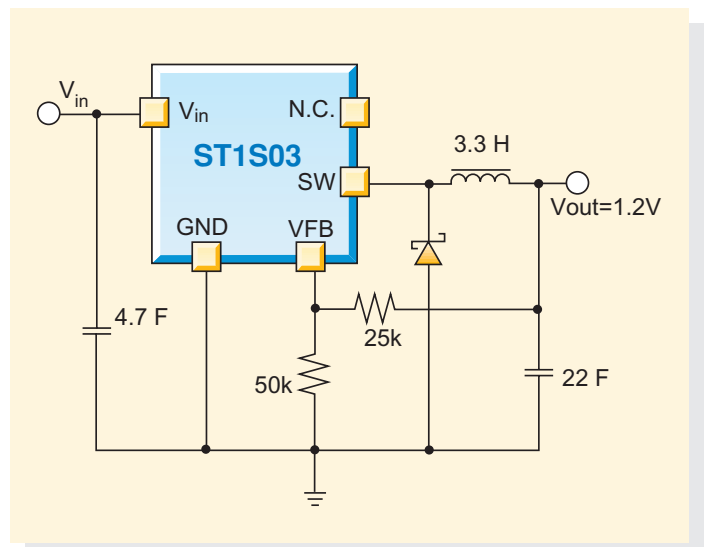


Pin configuration (top view)



Future Developments

This new switching regulator will soon be followed by others versions with increased flexibility, for example the ST1S06PM will have electronic shutdown and/or internal synchronous rectification.



Typical application circuit

For more information see application note AN2093: *ST1S03 - Buck converters for hard disk drives power supplies.*

ANALOG INTERFACE FOR ASYNCHRONOUS 3V AND 5V SMART CARDS

The ST8024 is a complete, cost effective analog interface for asynchronous 3V and 5V smart cards. It is used as a level adapter between the card and the microcontroller. Since very few external components are required to perform all supply, protection and control functions, the system cost is greatly reduced while the reliability is improved.

Applications

- Smart card readers for set-top boxes;
- IC card readers for banking;
- Identification;
- Electronic payment.

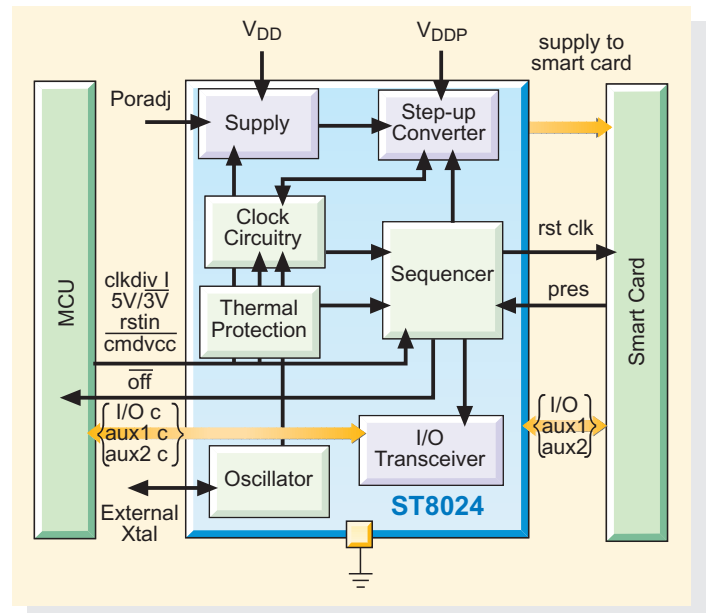
Features

- Designed to be compatible with the NDS conditional access systems;
- 3 or 5V supply for the IC;
- Step-up converter for V_{CC} generation;
- 3 specifically protected half duplex bi-directional buffered I/O lines;
- Automatic activation and deactivation sequences;
- Thermal and short-circuit protection on all card contacts;
- 26MHz integrated crystal oscillator;
- Clock generation for the card up to 20MHz with synchronous frequency changes;
- Supply supervisor for spike-killing during power-on and off and power-on reset;
- Threshold fixed internally or externally by a resistor bridge;
- Enhanced ESD protection on card side;
- Built-in debounce on card presence contact;
- ISO7816-3 compatible;
- SO-28 and TSSOP28 packages.

Power Supply

The supply voltage (V_{DD}) should be in the range of 2.7 to 6.5V. Integrated in the ST8024 is a DC/DC converter powered by V_{DDP} . This supply voltage provides the V_{CC} for 5 or 3V cards.

The DC/DC converter works as a voltage doubler or



ST8024 block diagram

follower according to the respective values of V_{CC} and V_{DDP} . A voltage supervisor block maintains the IC in the inactive mode during powering-up or powering-down of V_{DD} .

Functional Description

After power-on reset, the microcontroller checks the presence of the card. If present, the microcontroller may start a card session. When the activation sequence is complete, the ST8024 will be in the active state. Data is exchanged between the card and the microcontroller via the I/O lines. As a session is finished the circuit carries out an automatic deactivation sequence and ends in the inactive state. The ST8024 is designed to monitor potentially dangerous fault conditions: over temperature, short circuit or a card extraction, then as soon as the fault is detected, an emergency deactivation is automatically performed.

Ordering Codes

P / N	Temp. range	Package
ST8024CD	0 to 70°C	SO-28
ST8024CDR	0 to 70°C	SO-28
ST8024CTR	0 to 70°C	TSSOP28

ESD PROTECTION: LOW CAPACITANCE ESD ARRAY IN SOT-666

As a major reference in the field of over-voltage protection components, ST has a long history of producing outstanding monolithic TRANSIL arrays designed to provide low cost and reliable protection against Electro-Static Discharges.

With the evolution of electronic devices towards ever increasing data exchange rates and faster signal speeds, low capacitance ESD protection without distortion effects are prerequisite in developing state-of-the-art computer, telecom or consumer devices. The new ESDALC6V1P6 introduced by ST has been designed to meet such protection requirements for devices with high speed communication rates.

Targeted Applications

- Video ports for monitors and flat-panels;
- SIM and UIM port (GSM standard 11-18);
- Cellular phone RS232 port and digital lines;
- 10/100 Ethernet ports;
- USB 2.0 data lines;
- Notebooks, PDAs I/O ports;
- Other high speed data lines (DVI).

Main Product Features

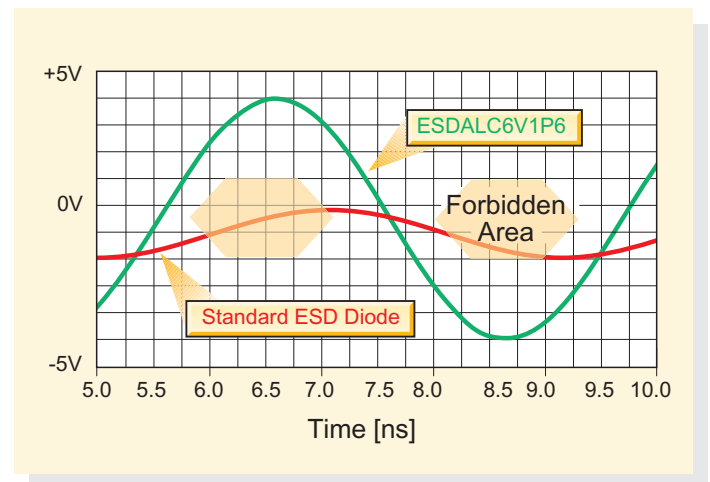
The ESDALC6V1P6 is a 4-line voltage suppressor that provides ESD protection according to IEC 61000-4-2, level 4 (8kV contact discharge / 15kV air discharge). Internal design has been optimized to minimize capacitance values down to 7 pF at 5 Volts and to guarantee $V_{br\ min}$ at 6.1 Volts. In addition the SOT-666 saves up to 40% PCB space in comparison with the standard SOT323-6L.

ESD Protection and Data Integrity

With high speed data rate protocols, the capacitance of the protection device can start filtering the signal data, resulting in distorted waveforms that can render a system defective. This reveals how important the capacitance value of the ESD suppressor is for high speed data lines. The figure on the right shows the difference for the low/high state transition between



the ESDALC6V1P6 (9pF @ 1V) and a standard ESD protection diode with capacitance specified at 70pF at 1V.



Effect on protection capacitance value on USB 2.0 full speed pattern signal recommendation.

For data rate protocols in the 100Mbit/s range, the ESDALC6V1P6 helps maintain signal integrity while ensuring high level ESD protection functionality in an extremely small package.

Main Advantages of the ESDALC6V1P6

- Low distortion effect at high speed rates;
- IEC61000-4-2 level 4 ESD compliance;
- SOT-666 package (5 pin version available);
- Lead-free component.

BAT20J Schottky for LED Drivers

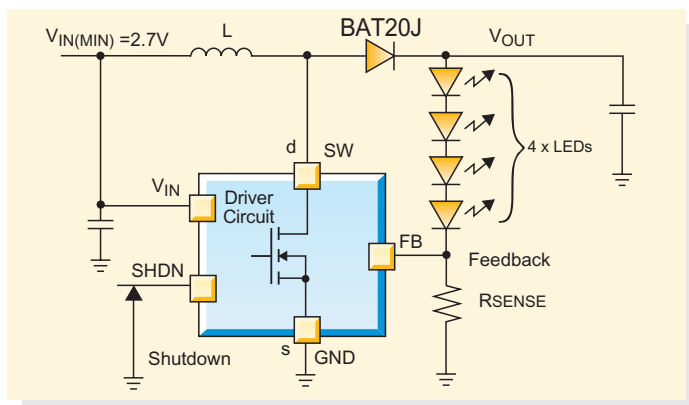
By B. Peron & S. Mosquera Duran
ASD & Discretes Applications & Marketing

NEW BAT20J SCHOTTKY DIODE FOR LED DRIVERS IN MOBILE PHONES

Portable devices continue to become increasingly sophisticated with new features and capabilities such as color LCD displays, MP3 players and games being incorporated. However, all these new features are accepted by mobile phone consumers only if there is no compromise in the weight and the battery life of the phone. To meet these conflicting needs, ST is introducing a new power schottky, the BAT20J. This new diode has been especially developed to get the best DC/DC converter performance for LED drivers in portable equipment.

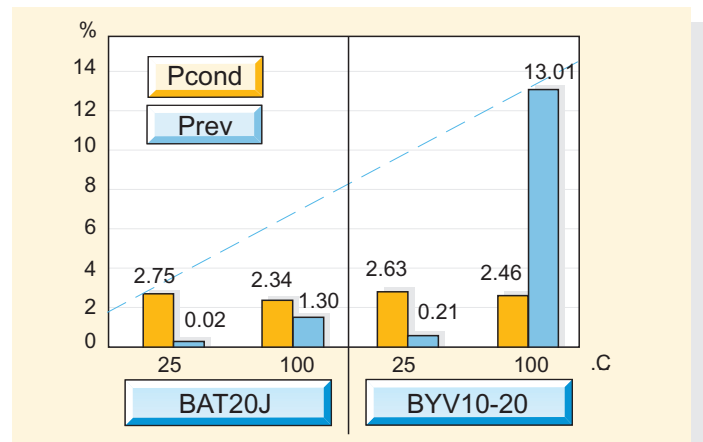
Improved DC/DC Efficiency

This new schottky diode is based on existing 20Volt barrier technology, but the V_{rrm} characteristic has been upgraded to 23Volts to take into consideration overvoltage spikes induced during the Power MOSFET's switching phases.



Boost regulator topology for LED drivers

The new BAT20J brings both optimized forward voltage and leakage current characteristics which allow the minimization of the reverse losses at high temperatures, while conduction losses are obviously restricted at the lowest possible value. The following graphs show how the boost diode reverse losses can damage the DC/DC global efficiency by up to 13% at high temperatures. In addition, the low leakage current characteristic brings the added advantage of limiting thermal instability of the system by reducing the risk of thermal runaway.



Efficiency drop due to the conduction losses (Pcond) and reverse losses (Prev) versus the junction temperature

BAT20J Features

The BAT20J has been especially designed for the backlighting of LCDs in mobile phones.

The main features of the product are:

- 23Volts V_{rrm} Schottky diode;
- Low leakage current for thermal stability;
- Low conduction losses for yield optimization;
- Low junction capacitance diode;
- Small lead-free plastic packages.

Micro-Package Reduces PCB Area

By using the latest plastic micro-package available on the market, the BAT20J, available in SOD323 and SOT-666 packages, takes the next step towards the integration of discrete components.

THE COOLEST 100HZ & HDTV DAMPERS

One of the main targets for high end CRT TVs designers is to minimize the total power losses. At this frequency, main power losses being conduction and switch-on power losses, ST has introduced a new family of DAMPER diodes for horizontal deflection circuits in high end CRT TV applications such as 100Hz TVs and HDTVs. Thanks to an optimized trade-off these devices allow high performance deflection circuits at a low cost.

Key Parameters of Damper Diodes

The power losses are broken down as follows:

- P_{on} : Switch-on power losses depending on peak forward voltage (V_{FP});
- P_{cond} : Conduction power losses depending on forward voltage (V_F);
- P_{rev} : Reverse power losses depending on leakage current (I_R);
- P_{off} : Switch-off power losses depending on reverse recovery time (t_{rr}).

The Best Trade-off

For high switching frequencies, P_{on} is high and V_{FP} becomes a critical parameter. V_{FP} increases with $(di/dt)_{ON}$. In this application, this parameter $((di/dt)_{ON})$ is mainly fixed by the layout and is generally lower than $100A/\mu s$.

- In the mainstream CRT TV market where frequencies are moving from 50/60Hz to 100/120Hz, the conventional 100Hz TV has a maximum deflection frequency of 32kHz (for 50Hz mains). The recommended device for this frequency is the DTV1500SDFP.
- At HDTV frequencies such as 56kHz, V_{FP} becomes even more critical and therefore the recommended device is the DTV1500HDFP.

	DTV1500SDFP For Standard Definition TV	DTV1500HDFP For High Definition TV
V_{RRM}	1500V	1500V
$I_F(av)$	6A	6A
$V_F(Typ)$ ($I_F(av)$, 125°C)	1.1V	1.0V
$t_{rr}(Typ)$ (1A, -50A / μs 30V, 25°C)	150ns	150ns
$V_{FP}(Typ)$ (6A, 80A / μs 100°C)	26	21
PACKAGE	TO-220FPAC (Fullpack)	TO-220FPAC (Fullpack)

Key parameters of two different DAMPER diodes



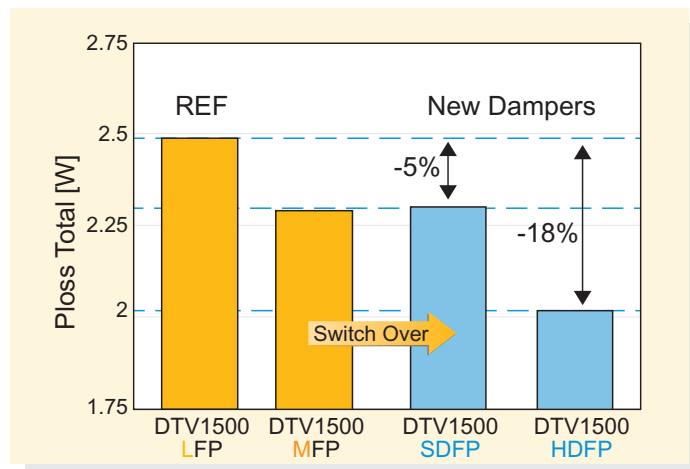
The new family of DAMPER diodes has very good dynamical (low V_{FP}) and static parameters (low V_F) to meet CRT TV technical requirements: a low V_{FP} reduces the turn-on switching losses and a low V_F minimizes the forward power losses.

As typical deflection frequencies in a 100Hz or HDTV CRT TV are far below the critical deflection frequency (F_c), a t_{rr} of 150ns is fully compatible with high end CRT TV designs.

Device Comparison

The graph below clearly shows the cost and performance benefits brought by ST's new Damper diodes with respect to existing parts.

- Less total power losses for the same cost when using DTV1500SDFP instead of DTV1500LFP;
- Equivalent performance at a lower cost when using DTV1500SDFP instead of DTV1500MFP.



Total power losses comparison ($F=32kHz$, $I_{peak}=6A$, $\rho=0.45$)

200V Ultrafast Dual Diodes

By JR Hecquefeuille
ASD & Discretes Product Marketing

COMPLETE RANGE OF 200V BIPOLAR RECTIFIERS - FROM 2X8A TO 2X100A

200V diodes are used in many kinds of applications, ranging from adaptors to server SMPS, and from industrial welding to automotive. Increasing the power density is the common objective in all these applications. To sustain this trend, 200V diodes have to withstand two major factors:

- The ambient temperature within the equipment increases involving an increase of the leakage current of the diode;
- A significant growth of the forward current flowing through the diode.

While designers constantly work at optimizing the cost/performance ratio and the reliability of their applications, ST is introducing a new 200V ultrafast series that brings temperature behaviour improvements at a competitive price.



Leakage Current & Reliability Gain

The 200V family has been designed to optimize the cost performance ratio, by dividing the leakage current by 10 compared to the existing range, while providing customers with affordable devices. The reduction of the leakage current with the 200V series induces lower reverse losses, especially at higher junction temperatures, and thus more margin with respect to the thermal runaway risk. This is also reinforced, for all new products except ISOTOP, which has a maximum junction temperature of 175°C. This allows a new generation to overdrive higher currents, as described in the following table. Furthermore, the softness characteristic used for this new range is equivalent to the one in the previous 200V series. This means that in working conditions the new "STTH" series will have the same EMC performance as the existing range.

	STTH1602CT New Ultrafast	STPR1620CT Existing Range
V _{RRM} (V)	200	200
I _{Fav} @ T _c =120°C	2 x 10A	2 x 8A
V _F max @ 8A & 125°C (V)	0.94	0.99
I _R max @ 125°C (μA)	60	600
t _{rr} max @ 25°C (ns)	26	30
T _j max (°C)	175	150
Price reference	Same Price	

Comparative performance of existing range versus new STTH ultrafast 200V devices for 2x8A devices

STTH Product Range

Product	I _F [A]	V _F max 150°C [V]	I _R max 125°C [μA]	t _{rr} max 25°C	Package
STTH802Cxxx	2x4	0.90	40	20	Wide range from DPAK, D ² PAK, TO-220 to TO-247
STTH1002Cxxx	2x5	0.89	40	25	
STTH1302Cxxx	2x6.5	0.95	60	25	
STTH1602Cxxx	2x8	0.89	60	26	
STTH2002Cxxx	2x10	0.89	100	27	
STTH3002Cxxx	2x15	0.84	125	22	
STTH6002CW	2x30	0.84	300	27	TO-247
STTH6102TV1	2x30	0.81	300	30	ISOTOP
STTH12002TV1	2x60	0.82	500	43	
STTH20002TV1	2x100	0.81	800	63	

Advantages Of The New STTH Diodes

- Better or same V_F / t_{rr} performance than the previous range;
- Lower I_R resulting in reducing thermal runaway risk;
- Optimized cost / performance ratio;
- T_j set at 175°C (excluding ISOTOP).

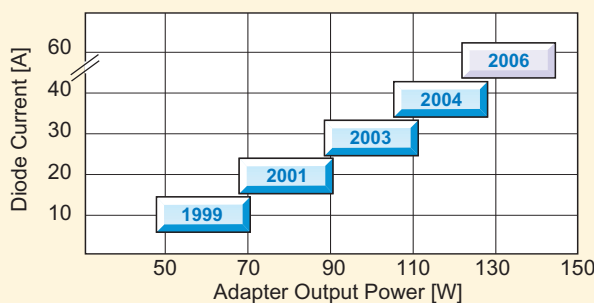
The 200V "STTH" family completes ST's wide range of ultrafast diodes, and thanks to the availability of multiple current ratings they perfectly match all kinds of application requirements.

High Current Diodes

By Jr Hecquefeuille
ASD & Discretes Product Marketing

UP TO 50% MORE CURRENT ALLOWED IN TO-220 AND TO-247 PACKAGES

During the last 3 years, the output power of notebook adaptors has doubled to typically 100W. This trend is bound to continue, and the new generations will be up to around 180W by 2006. The impact on design is to increase the current rating of the secondary rectification diode, as shown below. Many other applications such as servers and base station SMPS are following the same trend of more power and current in the rectification diodes.

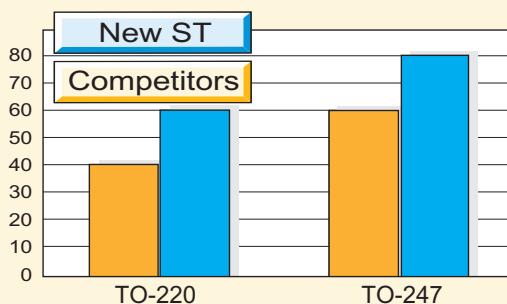


Diode current specification versus adaptor output power

ST has introduced new TO-220 and TO-247 high current rated Schottky diodes to help designers challenge the power density growth of the future generations of SMPS.

More Current Allowed In The Packages

ST's new 100V and 150V Schottky diodes offer up to 50% more current in the same package. They can replace devices in larger packages or reduce the number of paralleled devices to achieve the desired current rating. For these reasons, they contribute to increasing the power density of the applications.



Current ratings comparison by package for new 100V and 150V Schottky diodes



Less Losses In The Diodes

The main advantages of the new TO-220 and TO-247 devices using ST's existing 100V and 150V Schottky barriers are:

- Power density integration with higher current ratings;
- Lower V_F without degrading the leakage current;
- 175°C max junction temperature.

These new devices are especially designed to follow the trend of higher power density in notebook adaptors, servers and telecom base stations SMPS.

Main Advantages

ST uses one more wire to internally connect the die to the pins of the TO-220 or TO-247 packages. This reduces the V_F of the diodes by 20mV at 60Amps, and leads to fewer conduction losses in the application. Furthermore, the ST trade-off of the existing 100V and 150V Schottky barriers provides a tiny leakage current that allows the devices to operate up to a junction temperature of 175°C.

Product Range

P / N	Voltage [V]	Current [A]	V_F typ @ 125°C & I_o [μ A]	T_j max [°C]	Package
STPS60H100CT	100	2 x 30	0.67	175	TO-220
STPS61H100CW	100	2 x 30	0.63	175	TO-247
STPS40150Cx	150	2 x 20	0.69	175	TO-220 TO-247
STPS60150	150	2 x 30	0.72	175	TO-220
STPS61150	150	2 x 30	0.63	175	TO-247
STPS80150	150	2 x 40	0.68	175	TO-247

AC POWER MANAGEMENT IN HOME APPLIANCE SYSTEMS

Most new air-conditioners and refrigerators are electronically controlled using an 8-bit microcontroller. Their electronics is designed with a system platform approach in order to reduce their development time and maximize the number of models produced. For these appliances, ST is introducing the STCC05-BD4, a new power management device that includes the functions required for AC power control and safety.

Features

- 7 to 18V input supply voltage;
- 5V +/- 5% full tolerance 50mA Voltage Regulator;
- MCU reset circuit with noise filter;
- Internally filtered zero voltage synchronization;
- One 150mA compressor relay coil driver;
- Three 50mA power relay coil drivers;
- 30mA buzzer driver with smooth sound control;
- Speed sensor level shifter;
- ECOPACK lead-free DIP-20 package;
- -20 to 85°C ambient temperature.

Complete Analog Functions In One

The STCC05 has been designed specifically for the digital control of air-conditioners or refrigerators. It integrates:

- Nine analog and power functions, which are required around the MCU to sense and drive the AC power loads;
- Zero voltage filtered synchronization;
- Three 50 and one 150mA relay coil drivers with their free-wheeling diode;
- The MCU 5V supply with its reset circuit;
- The level shifter of the indoor fan speed sensor- or the door switch- and the enhanced buzzer driver.

Using a 20V power technology, this device is able to run with large input voltage variations from 7 to 18V. Housed in the lead-free DIP-20 package, it has a 90°C/W thermal resistance able to cool its 50mA regulator and its coil drivers of up to 250mA on an extended temperature range from -20 to 85°C.

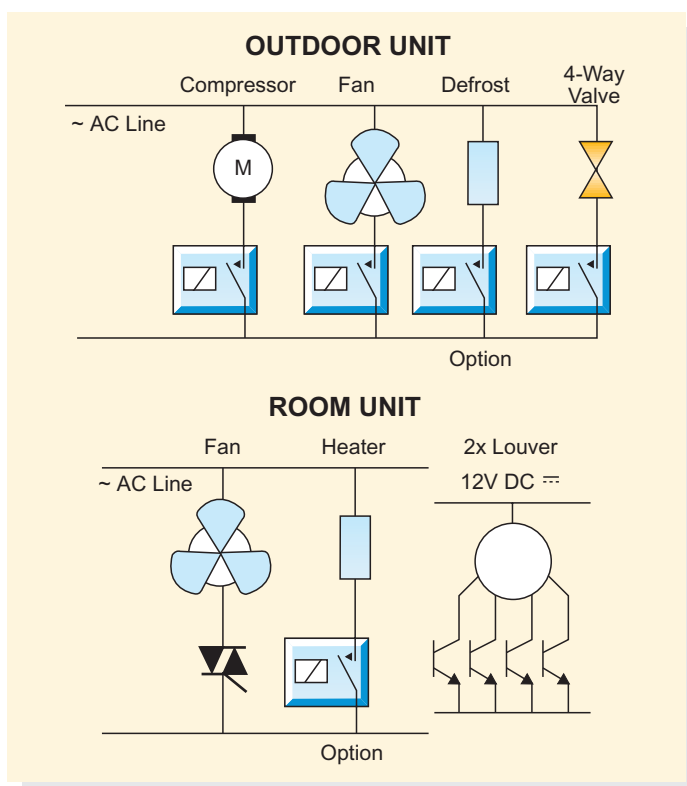
The Key Companion In The Electronic Platform

Designed to fulfil the electronic partitioning of air-conditioners, the STCC05 is a cost effective solution that allows the system performance to be improved, especially with respect to the MCU supply, the buzzer operation and the thermal operation of the power drivers. For instance, the buzzer driver embeds a discharge resistor and a serial resistor to eliminate annoying sound harmonics; an enabling pin allows the buzzer power-up and down to be smoothed improving the sound generated by the MCU synthesizer.

The STCC05 is an easy-to-design circuit reducing the debug phase once designed in the platform kit.

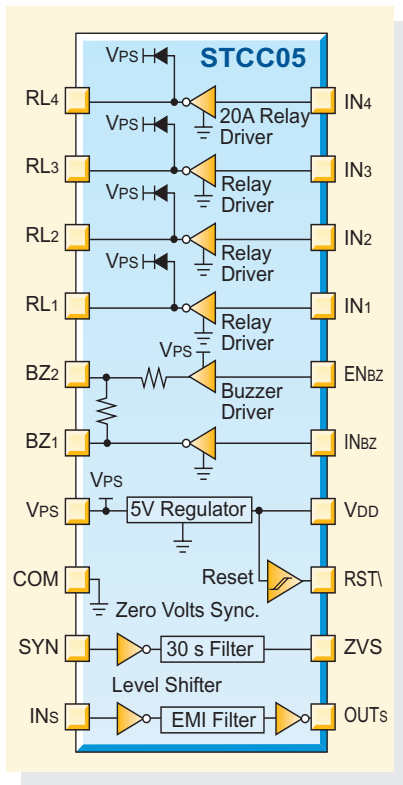
Higher Reliability With Lower Maintenance

The power technology and the internal circuitry of STCC05 have been chosen to achieve a robust and reliable device and to enable the system to successfully withstand the standardized ESD discharges, EOS surges and EFT fast transients: the reset and the zero



Split air-conditioner power diagram

voltage synchronization immunity are reinforced with some filters; the power supply is self-protected by an over-current limitation and thermal shutdown.



The major benefits of these features are to reduce the field maintenance and to drastically increase the life-time of the appliance.

Finally, the STCC05 allows a 6 Sigma quality standard to be reached thanks to a tight control critical of each applicative parameter.

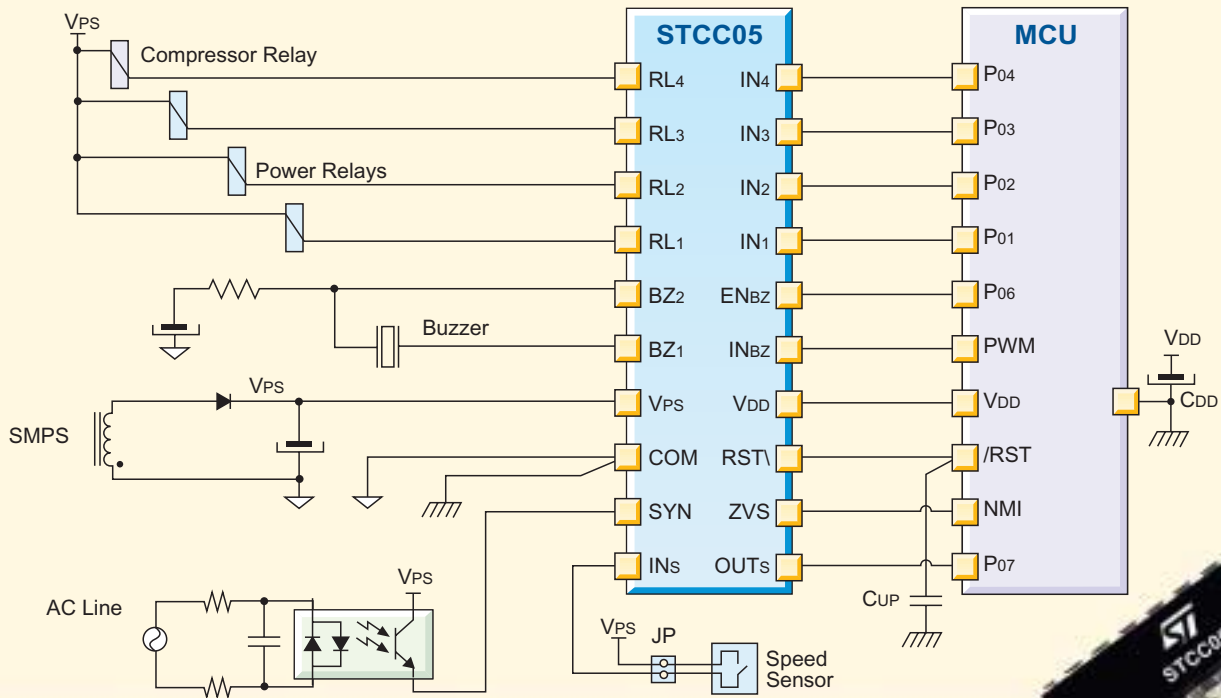
STCC05 block diagram

Benefits

- High functional reliability reduces the appliance field maintenance;
- High ESD robustness and EFT immunity compliant with IEC61000-4 standards;
- 6 Sigma parametric quality;
- Higher module compactness thanks to a full system/platform solution;
- Easy to design with an optimum partitioning;
- Faster module assembly time than with discrete boards.

Dedicated to AC Power Management

The STCC05 is the second circuit of the home appliance oriented STCC range; it embeds all the AC power management and safety functions required for a refrigerator and air-conditioner control platform. Thanks to an exhaustive functional definition including electromagnetic compatibility, it maximizes the integration of the discrete devices, improving the performance and the reliability of the system while reducing its overall cost and development time.



STCC05 A/C application diagram



M41T6X ULTRA LOW CURRENT FAMILY OF SERIAL RTCs

Many applications require the date and time, and Real-Time Clocks provide those functions. For example, in data storage applications, all files have date and time attributes that are updated every time a file is created or modified, and the RTC data must be accessed every time that occurs.

RTCs can be implemented in software and in ASIC logic. But maintaining the clock can present added power management challenges. While low-power microcontrollers and ASICs are available, they still draw much more current than a dedicated RTC, and often cannot operate over a wide voltage range. A better solution is ST's new M41T6x family of Serial RTCs. These devices lead the way with low current and low voltage operation and come in a tiny QFN package.

Ultra Low Standby Current

The M41T6x family boasts typical standby currents of only 350 nanoamps at 3.0V which makes ST a leader in the marketplace.

These RTCs do not include battery switchover circuits, but are targeted at applications where they are not needed. In many of today's applications, the entire system is often backed up, so individual components such as the RTC don't need backup circuitry on chip. Capacitor backup is another example where switchover is not required. The capacitor's charging diode inherently provides the switchover mechanism. Handheld applications are a case where the RTC may run off the system battery and also be backed up by a capacitor. And since there is no backup circuitry, the RTC can be made smaller and less costly, and draw even lower power. Since current draw is very important in handheld and battery operated systems, the standby current of the RTC is the critical parameter. It determines the rate of battery consumption - how long the battery will last - as well as the backup life when using capacitor backup. Drawing only 350nA, users can get from minutes to months of backup time with a capacitor. And they won't encounter the regulatory issues often associated with batteries.



Small QFN16 Package

Today's handheld devices put more functions into small packages than ever before, and when users are doing that, they want the smallest packages available. ST's QFN16 measures only 3mm by 3mm, and is as small as any RTC in the industry.

Low Voltage Operation

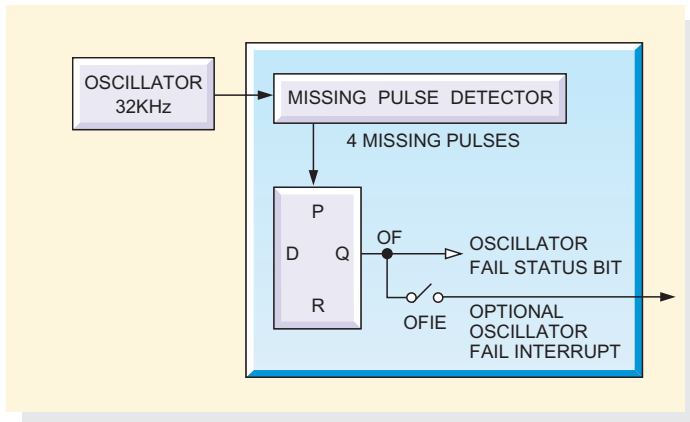
While 5V applications are still around, there is shrinking demand for it, but there is growing demand for 3 and 3.3V solutions. Furthermore, the next sweetspot is expected to be 1.8V. Operating from 1.3V to 3.6V, the M41T6x family meets today's demands, and will meet tomorrow's, too. Plus, they will keep time all the way down to 1.0V. These are outstanding numbers that should please any user. In capacitor backed applications, because they keep time all the way down to 1.0V, the M41T6x series RTCs are able to use more of the charge stored in the backup capacitor thereby extending the backup life even further. This means less capacitance is required for a given backup time. For the double layer capacitors ("supercaps") often used in these applications, reducing the capacitance lowers the cost. Lower timekeeping voltage also means that in applications where the system voltage often sags - such as in battery operated and handheld devices - the timekeeping function is made more robust because the voltage must drop to a lower level before the clock begins to lose time. At the end of the day when a handheld unit's rechargeable batteries have begun to sag, the clock will still be running, and the user won't need to reprogram it.

Oscillator Fail Detect

Brown-out occurs when V_{CC} drops too low for reliable operation of the circuit, but not low enough to ensure

a proper power down/power up sequence. Some registers may get corrupted thereby losing track of the real time.

To detect this brown-out condition, the M41T6x parts include an Oscillator Fail Detect circuit. If, due to low V_{CC}, the oscillator begins to run intermittently, or stops altogether, a special filter detects this and sets a bit indicating such. The system software now has a bit it can check to indicate whether the time is still good or has possibly been corrupted. This is a key feature for many users, and a major selling point for these devices.



Oscillator fail detect circuit

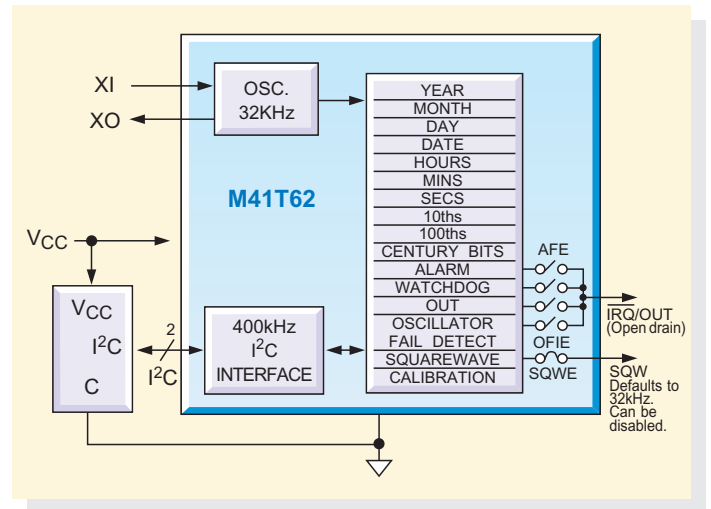
32KHz Output

Many applications, especially battery operated ones, use 32KHz as a low power operating frequency. These systems will dynamically switch frequencies to a higher speed on demand, then switch back to the slower speed to conserve power. In some cases, the higher speed is generated using phase-locked loop clock synthesis with a 32KHz reference. The M41T62, M41T63 and M41T64 all include 32KHz outputs for this purpose. At power up, these outputs default to 32KHz out and enabled, but when not required, they can be turned off via configuration bits in the clock registers. Having the 32KHz output saves users the cost of an extra crystal, and can help reduce system power consumption.

M41T62

The M41T62 includes a Watchdog and Alarm along with a Programmable Squarewave which defaults to 32KHz at power up. The Calibration feature allows

users to get accuracies down to +/-5 seconds per month, and the Oscillator Fail Detect circuit indicates when the time may be corrupted (due to brown out). 10ths and 100ths of seconds are available for extra fine resolution. Drawing only 350nanoamps at 3.0V, the M41T62 is hard to beat.



M41T62 block diagram

P / N	Alarm IRQ	Watch-dog Out	Square-wave Out	32 KHz Out	Oscillator Fail Detected	Availability
M41T65	■	■			■	Production
M41T64			■	■	■	Limited Sampling
M41T63		■	■	■	■	Limited Sampling
M41T62	■	■	■	■	■	Production
M41T60					■	Production
M41T50*	■					Sampling

* Runs off 50/60Hz - No crystal required

Family Features

- 350 nanoamps standby (typ) at 3.0V;
- 1.3V to 3.6V operation
 - timekeeping down to 1.0V;
- 400 KHz I²C Interface;
- BCD registers for year, month, day, date, hours, minutes, seconds and 10ths and 100ths of seconds;
- 2 century bits (Y2.1K compliant);
- Automatic leap year adjustment;
- Lead-free QFN16 package;
- -40° to +85°C operating range;
- Programmable alarm and interrupt;
- Programmable squarewave output;
- Dedicated 32KHz output.

NEW STM682X FAMILY OF RESET ICs WITH WATCHDOGS

A Reset circuit monitors the system power and provides the Power-On Reset signal that initializes the processor, holding the processor in reset a short time to allow the system power to become stable. It continues to monitor the system power, and if a Low Voltage is Detected, it resets the processor. These two functions are called POR-LVD, and they ensure the proper operation of the system.

ST brought to market last year a series of 3 and 4 pin Reset ICs that provide POR-LVD. The 4 pin versions also include Manual Reset inputs. Building on this, a new family of 5 pin Reset devices, which will be available early in 2005, will also include Watchdog timers which protect against runaway software. POR-LVD and Watchdogs make systems more robust, more tolerant of real world events that can disrupt system operation.

5-pin Reset Selector

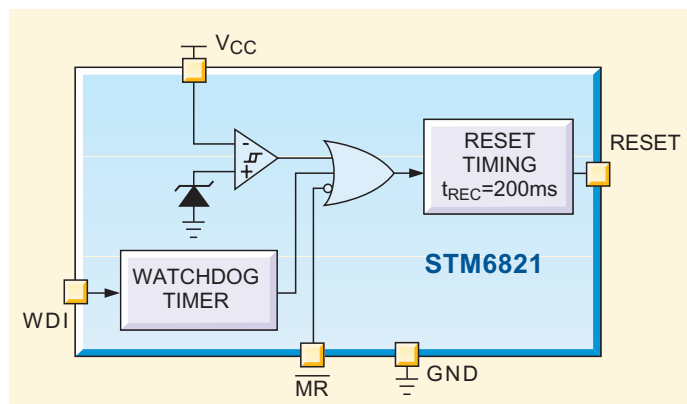
Root P/N	Reset Output(s)	Manual Reset Input	Watchdog
STM6821	Active-high, Push-pull	■	■
STM6823	Active-low, Push-pull	■	■
STM6824	Active-high and Active-low, Both Push-pull		■
STM6825	Active-high and Active-low, Both Push-pull	■	

Four basic devices are being released now. Three more, with open drain outputs, will come later. Present options include reset output polarity – active low, active high or both – and Manual Reset input, Watchdog or both.

Each basic device has five voltage options, with a sixth option coming later in the year.

5-pin Reset Selector

Basic P/N	V _{RST} (NOM)
STM682xL	4.65V
STM682xM	4.40V
STM682xT	3.08V
STM682xS	2.93V
STM682xR	2.63V



STM6821 5-pin reset block diagram

Market Issues

While many processors today include these supervisory features, users often still add external units. The microprocessor's on-chip references often lack the desired precision. And external watchdogs will still function when on-board ones fail. Other users prefer two watchdogs, with the external one backing up the on-board one.

So the market for reset and supervisor devices is still strong and ST is positioning itself to be a player with a broad portfolio ranging from basic resets to microprocessor supervisors with switchover to high-end supervisors with real-time clocks and security features such as tamper detect and RAM clear.

Small Packages

The 5-Pin Reset family comes in a tiny SOT23-5L package, measuring 1.5 x 2.8 mm (nominal).



SOT23-5L package

ST7Lite family

By F. Gaillard
Microcontrollers Product Marketing

OPTIMIZED FOR SMALL-SCALE, COST SENSITIVE MICROCONTROLLER APPLICATIONS

ST's ST7Lite series consists of entry level standard 8-bit Flash microcontroller devices ideal for cost-sensitive applications. It provides outstanding flexibility at every stage of the product cycle, from first prototype to production logistics, ensuring reduced cost of ownership and fast time to market.

ST7Lite series come with a variety of integrated peripherals that make them versatile enough for a wide range of applications.

All MCUs use the same single-voltage Flash technology and are programmed using the same techniques and tools. They also share a common emulator and software development platform.

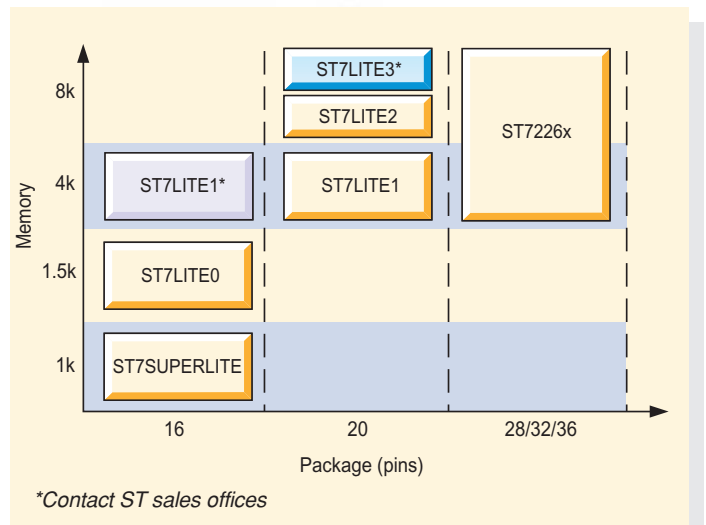
The ST7Lite family is designed for ease of use with silicon, software, development tools, reference designs and service, all in one package.

Key Features and Benefits

- Low-cost 8-bit microcontroller with more on-chip functionalities, making applications smaller and easier to design;
- Highly-accurate internal 1MHz RC oscillator;
- Data EEPROM;
- Trimmable internal low-voltage detector, eliminates need for external power-on and brown-out management circuits;
- Read-out protection against software piracy;
- Fast A/D converter (3.5µs conversion time at 8MHz fCPU) including op-amp;
- Single-voltage Flash for fast programming;
- Fast and flexible timers for PWM generation, output compare and input capture;
- Full set of development tools including C compilers and in-circuit debuggers.

Applications

- Lighting;
- Alarms;
- Home appliances;
- Sensors;
- Air-conditioning;
- Metering;
- Touch control;
- Motor control;
- DC/DC converters;
- Toys.



ST7Lite family product guide

Hardware and Software Development Tools

For fast and easy development, ST offers a wide range of state-of-the-art development tools including:

- Starter kits;
- Real-time, in-circuit debugging kits;
- Mid-range to high-end emulators (DVP and EMU series);
- Programmers;
- IDEs, C compilers (including free versions).

Web Support www.st.com/mcu

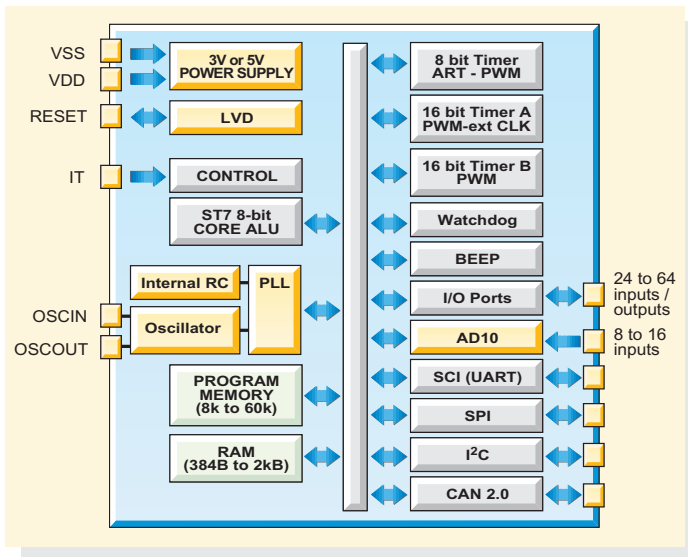
Discussion forums, knowledge base, FAQs, third-party directory and newsletter.

COST-EFFECTIVE 8-BIT MICROCONTROLLERS FOR ROBUST AND EASY DEVELOPMENT

ST7232x series general purpose microcontrollers are ideal for applications requiring the most stringent Automotive and Industrial standards, for medium to large memory capacities with various pin-count packages in Flash and ROM versions.

Features

- High-density Flash and ROM program memory;
- Various serial interfaces: SPI, SCI, CAN & I²C;
- Up to 5 timers with PWMs, beep, Watchdog;
- 10-bit ADC with 8 to 16 inputs, 7.5µs conversion time;
- Broad range of packages (32-pin up to 80-pin);
- Four power saving modes suitable for 5 and 3V power-critical applications;
- Integrated reset with scalable low-voltage detector.



ST7232x block diagram

Key Benefits

Cost effective

- Fast Program FLASH and cost effective ROM;
- Broad range of optimized Hardware peripherals.

Robust

- Qualified with automotive and industrial standards;
- Robust design suitable for EMC-critical environments.

Scalable and portable

- Full pin-to-pin and peripherals compatibility;
- Easy re-use across a wide range of 5V and 3V applications from 8k-32 pins up to 60k-80 pins.

Major Application Areas

INDUSTRIAL

- Home appliance;
- Air conditioning;
- Connectivity.

COMPUTER

- Keyboard;
- Mice;
- UPS;
- Printer, fax;
- Game pad.

AUTOMOTIVE

- Power train;
- Engine management.

P / N	Memory Size	Package
ST72F324K	8k / 16k / 32k	TQFP32
ST72F324J	8k / 16k / 32k	TQFP44
ST72F321J	48k / 60k	
ST72F321AR	32k / 48k / 60k	TQFP64
ST72F521M	60k	TQFP80

Temperature range (0;70°C) up to (-40 ; 125°C)

Easy Development

- A full ST7 software library of C routines to significantly reduce coding time and development costs
- More than 100 relevant application notes and reference designs covering:

Peripheral Usage and Optimization

LCD driver / analog keyboard driver / SMBus slave / SCI / LIN / SPI / I²C / timers drivers, etc.

Application Optimization

EMC design guidelines / minimizing ADC conversion errors / minimizing power consumption / etc.

Software Drivers

ST7 math utility routines / in-application programming / etc.

Hardware and Software Development Tools

For fast and easy development, ST offers a wide range of enhanced development tools:

- Starter kits & evaluation boards;
- Real-time, in-circuit debugging kits;
- Real-time mid-range to high-end emulators (DVP and EMU series);
- Development & mass production Programmers;
- Software toolchain: IDEs, C compilers, debuggers, linkers (including free versions).

STR7 ARM Family

By S. Haddad
Microcontrollers Marketing Team

32-BIT ARM-BASED MICRO-CONTROLLERS AND EMBEDDED PROCESSORS

The STR7 microcontrollers are a new range of high-performance 32-bit microcontrollers made by ST. Built on leading ARM architecture, the STR7 family comprises highly integrated micro-controllers with embedded Flash, and flexible embedded-processors with cache, MMU and memory interfaces.

STR710F 32bit Flash MCU

The STR710F series with embedded FLASH is ideal for embedded applications requiring a compact yet powerful MCU, or versatile scalable solutions such as user interfaces, factory automation systems and point-of sale applications.

STR710F Features

- Industry standard ARM7TDMI RISC 32-bit CPU;
- 128k/256k embedded Flash with 16k data Flash;
- 16/64k high-speed SRAM;
- Versatile package options, with a small low pin count TQFP64 package and a TQFP144 package with external memory interface;
- Up to 10 communication interfaces including CAN,USB, HDLC and smartcard interface;
- Four low-power modes.

STR720 32bit Embedded Processor

The STR720F series with cache, MMU and SDRAM interface is ideal for embedded applications requiring high computing power, flexible system memory and an advanced operating system.

Device Summary

P / N	Temperature	Flash	SRAM	Package	ADC	Peripheral
STR710FZ2T6	-40 to +85°C	256KB +16kB	64kB	TQFP144	12-bit, 4 ch	10 serial, USB, CAN, EMI
STR710FZ1T6	-40 to +85°C	128KB +16kB	16kB	TQFP144	12-bit, 4 ch	10 serial, USB, CAN, EMI
STR711FR2T6	-40 to +85°C	256KB +16kB	64kB	TQFP64	12-bit, 4 ch	10 serial, USB
STR711FR1T6	-40 to +85°C	128KB +16kB	16kB	TQFP64	12-bit, 4 ch	10 serial, USB
STR712FR2T6	-40 to +85°C	256KB +16kB	64kB	TQFP64	12-bit, 4 ch	10 serial, CAN
STR712FR1T6	-40 to +85°C	128KB +16kB	16kB	TQFP64	12-bit, 4 ch	10 serial, CAN
STR720RBQ6	-40 to +85°C	0KB	16kB	PQFP208	12-bit, 4 ch	Cache and MMU, USB, CAN, EMI and SDRAM interface



STR720 Features

- Industry standard ARM720T RISC 32-bit CPU;
- 8kB cache and memory management unit;
- External memory interface for Flash and SRAM;
- SDRAM interface with 128MB address space;
- Six communication peripherals including CAN and USB;
- Four low-power modes.

Development Tools From ST

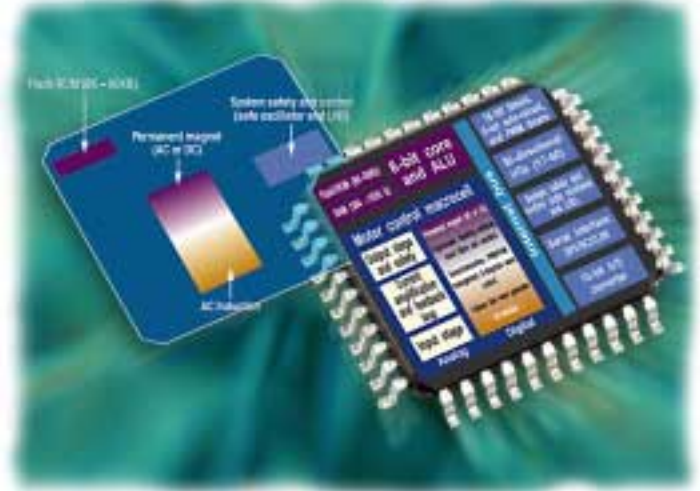
Through our partnership with ARM, ST is able to provide a low-cost ARM RealView Developer Kit specifically for ST devices, based on the popular ARM RealView Developer Suite software and hardware solution.

Support From Third-Party Suppliers

Numerous compilers, emulation systems and operating systems from third-party tool vendors support STR7 products.

MICROCONTROLLER FOR 3-PHASE BRUSHLESS MOTOR CONTROL

Already popular in industrial applications, three-phase BLDC and induction motors are increasingly used in the appliance and automotive markets. They offer numerous benefits for the consumer, including significantly higher efficiency, lower acoustic noise and improved reliability, compared to brush or single phase motors. The cost of the electronic controller – the so-called ‘inverter’ – has decreased steadily in recent years due to design integration and process optimization, and the introduction of the ST7MC family is another distinct step in the direction of cost reduction, higher integration and performance; available in small footprint packages it will allow motor manufacturers to fit the complete inverter PCB within the motor casing.



What You Get With ST7MC

- Flash and ROM products pin to pin compatible;
- Product family approach: 32-pin to 80-pin, 8k to 60k;
- Single micro approach for control of three-phase induction and BLDC motors;
- Suitable for Star and Delta motors/compressors from 12V to 300V;
- Voltage or Current Mode Control;
- Sensorless and Position/Speed control;
- PWM or PAM (Pulse Amplitude Modulation);
- 6 Step or Sine Wave Signa;
- Dedicated HW Motor Control cell leaves 70% of CPU resources free for non-motor control tasks.

Ordering Information

P / N	Memory Size [Prog/RAM]	Package
ST7FMC1K2T6	8K / 384B	TQFP32
ST7FMC2S4T6	16K / 768B	TQFP44
ST7FMC2S6T6	32K / 1024B	TQFP44
ST7FMC2R6T6	32K / 1024B	TQFP64
ST7FMC2R7T6	48K / 1536B	TQFP64
ST7FMC2M9T6	60K / 1536B	TQFP80

Temperature Range -40 to 85 °C

Optimized and Low-Cost

The ST7MC devices feature ST’s on-chip motor control peripheral, the MTC, which consists of a three-phase Pulse Width Modulator multiplexed on six high-sink outputs, with a high-sensitivity Back EMF (BEMF) zero-crossing detector for the sensorless control of permanent magnet Brushless Direct Current (BLDC) motors. ST’s patented ‘three resistors’ sensorless control method – in conjunction with on-chip comparators, op-amp and co-processor unit – provides the lowest possible system cost and the highest system integration for BLDC motor control.

The MTC’s input pins can also be configured for Hall, tachometer or encoder sensing. In addition, comprehensive filters and settings allow the control of any star or delta wound motor, from 12V to 240V, in various control topologies (six-step / Sine wave, Current/Voltage, PAM / PWM).

Based on an industry standard 8-bit core, the ST7MC family is available in dual voltage Flash memory and ROM versions, from 8-Kbyte to 60-Kbyte, and in various packages from the 32-pin TQFP32 (7 x 7mm) to the 80-pin TQFP80 (14 x 14mm). As well as the motor control peripheral, the devices feature a 10-bit ADC, Serial Peripheral Interface (SPI), Local Interconnect Network Serial Communications Interface (LINSCI) to make the family suitable for automotive applications, five sophisticated timers (8 and 16-bit)

for control and protection, and up to 60 I/O lines. Particular attention has been paid to reliability and safety features. At system level the ST7MC includes an embedded secure Reset circuit with Low Voltage Detector, and multiple clock sources with Clock Security System (CSS), all under

System Integrity management. Within the MTC itself a set of programmable filters and windowing mechanisms guarantee reliable operation under high ambient noise conditions, and in the event of sudden torque variations. A hardware asynchronous “emergency stop” provides efficient protection for power stages.

ST7MC Starter Kit

The ST7MC starter-kit is a comprehensive and innovative development platform designed around the new ST7MC microcontroller, targeted specifically at motor control applications, which will reduce the time-to-market and development cost of applications that use three-phase brushless motors such as Brushless Direct Current (BLDC) and induction motors (including compressors). In addition to offering both quick demonstration and in-depth evaluation capabilities, the starter-kit’s comprehensive hardware, coupled with a no-concessions software package, allows a project to be debugged to an advanced stage in real time. It can provide a demonstration in a few minutes, a full evaluation over perhaps several days, and actual project development and refinement over a number of weeks. The hardware platform consists of a sensorless BLDC blower implementation; an inverter and control board; a high voltage



isolation board; and a SofTec inDART-STX debugger/programmer, with USB interface, for communication, programming and debugging. The complete system is intended to be connected to a PC, but can also be operated in standalone mode.

Application Notes

In order to speed-up application development, the ST7MC comes with a set of application notes which describe the basic software libraries available for different motor types, as well as some hints on how to benefit from the powerful ST7MC family features.

- AN1904: ST7MC AC three-phase induction motor control library;
- AN1905: ST7MC brushless permanent magnet DC motor control library;
- AN1946: Brushless PMDC motor control with ST7MC
- AN1947: ST7MC brushless permanent magnet AC Sinus motor control library;
- AN1953: Active PFC library for ST7MC in inverter applications;
- AN2009: PWM management for 3 phase BLDC motor control with ST7MC;
- AN2030: BACK EMF detection during PWM on time with ST7MC;
- AN2038: I²C emulation with ST7MC in slave mode;
- AN2039: ST7MC single-phase and bi-phase induction motor control library.