FORCE TECHNOLOGIES LTD

Features

- **Fast Read Access Time - 70ns**
- **Low-Power CMOS Operation**
  - **100 µA max. Standby**
  - **20 mA max. Active at 5 MHz**
- **JEDEC Standard Packages**
  - **28-Lead 600-mil Windowed CDIL**
  - **32-Lead Windowed LCC/JLCC**
  - **28-Lead Custom**
- **5V ± 10% Supply**
- **High-Reliability Atmel CMOS die Technology**
  - **2,000V ESD Protection**
  - **200 mA Latchup Immunity**
- **Rapid™ Atmel Programming Algorithm - 100 mms/byte (typical)**
- **CMOS and TTL Compatible Inputs and Outputs**
- **Integrated Product Identification Code**
- **Commercial, Industrial, Mil Temperature Ranges inc Hi-Rel /DMB/8 883 5004/5005**

512K (64K x 8) UVEPROM

FT27C512R

Description

The FT27C512R is a low-power, high-performance 524,288-bit UV erasable programmable read only memory (UVEPROM) organized 64K by 8 bits. It requires only one 5V power supply in normal read mode operation. Any byte can be accessed in less than 45 ns, eliminating the need for speed reducing WAIT states on high-performance microprocessor systems.

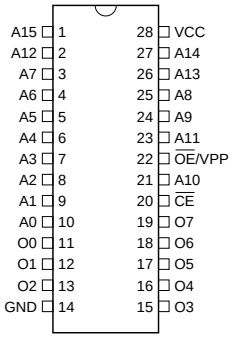
Atmel's die in CMOS technology provides high-speed, lower active power consumption, and significantly faster programming. Power consumption is typically only 8 mA in Active Mode and less than 10 µA in Standby.

(continued)

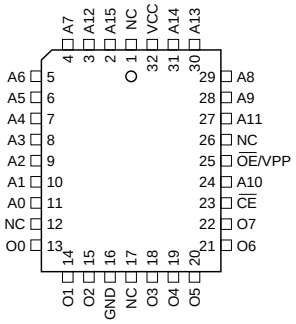
Pin Configurations

Pin Name	Function
A0 to A15	Addresses
O0 - O7	Outputs
$\overline{CE}$	Chip Enable
$\overline{OE}$/VPP	Output Enable/VPP
NC	No Connect

CDIL Top View



LCC/JLCC Top View



Note: LCC/JLCC Package Pins 1 and 17 are DON'T CONNECT.

The FT27C512R is available in a choice of industry standard JEDEC-approved UV erasable re-programmable Ceramic CDIL, LCC, JLCC, Custom packages. All devices feature two-line control ($\overline{CE}$, $\overline{OE}$) to give designers the flexibility to prevent bus contention.

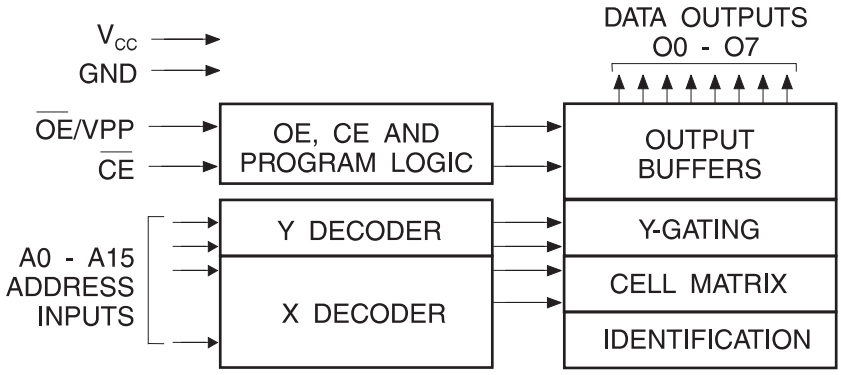
With 64K byte storage capability, the FT27C512R allows firmware to be stored reliably and to be accessed by the system without the delays of mass storage media.

Force's 27C512R has additional features to ensure high quality and efficient production use. The Rapid™ Programming Algorithm reduces the time required to program the part and guarantees reliable programming. Programming time is typically only 100 µs/byte. The Integrated Product Identification Code electronically identifies the device and manufacturer. This feature is used by industry standard programming equipment to select the proper programming algorithms and voltages. Atmel die gives Atmel signature.

System Considerations

Switching between active and standby conditions via the Chip Enable pin may produce transient voltage excursions. Unless accommodated by the system design, these transients may exceed data sheet limits, resulting in device non-conformance. At a minimum, a 0.1 µF high frequency, low inherent inductance, ceramic capacitor should be utilized for each device. This capacitor should be connected between the V_{CC} and Ground terminals of the device, as close to the device as possible. Additionally, to stabilize the supply voltage level on printed circuit boards with large EPROM arrays, a 4.7 µF bulk electrolytic capacitor should be utilized, again connected between the V_{CC} and Ground terminals. This capacitor should be positioned as close as possible to the point where the power supply is connected to the array.

Block Diagram



Absolute Maximum Ratings*

Temperature Under Bias	-55°C to + 125°C
Storage Temperature	-65°C to + 150°C
Voltage on Any Pin with Respect to Ground	-2.0V to + 7.0V(1)
Voltage on A9 with Respect to Ground	-2.0V to + 14.0V(1)
V_{PP} Supply Voltage with Respect to Ground	-2.0V to + 14.0V(1)

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note: 1. Minimum voltage is -0.6V dc which may undershoot to -2.0V for pulses of less than 20 ns. Maximum output pin voltage is V_{CC} + 0.75V dc which may overshoot to +7.0 volts for pulses of less than 20 ns.

Operating Modes

Mode\Pin	$\overline{CE}$	$\overline{OE}/V_{PP}$	Ai	Outputs
Read	V_{IL}	V_{IL}	Ai	D_{OUT}
Output Disable	V_{IL}	V_{IH}	X(1)	High Z
Standby	V_{IH}	X(1)	X	High Z
Rapid Program(2)	V_{IL}	V_{PP}	Ai	D_{IN}
PGM Inhibit	V_{IH}	V_{PP}	X(1)	High Z
Product Identification(4)	V_{IL}	V_{IL}	A9 = V_H(3) A0 = V_{IH} or V_{IL} A1 - A15 = V_{IL}	Identification Code

Notes:
1. X can be V_{IL} or V_{IH}.
2. Refer to Programming Characteristics.
3. V_H = 12.0 ± 0.5V.
4. Two identifier bytes may be selected. All Ai inputs are held low (V_{IL}), except A9 which is set to V_H and A0 which is toggled low (V_{IL}) to select the Manufacturer's Identification byte and high (V_{IH}) to select the Device Code byte.

DC and AC Operating Conditions for Read Operation

		FT27C512R					
		-45	**-55**	**-70**	**-90**	**-12**	**-15**
Operating Temp.(Case)	Com.			0°C - 70°C	0°C - 70°C	0°C - 70°C	0°C - 70°C
	Ind.			-40°C - 85°C	-40°C - 85°C	-40°C - 85°C	-40°C - 85°C
	Mil			-55oC-125oC	-55oC-125oC	-55oC-125oC	-55oC-125oC
V_{CC} Supply		5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%	5V ± 10%

DC and Operating Characteristics for Read Operation

Symbol	**Parameter**	**Condition**		**Min**	**Max**	**Units**
I_{LI}	Input Load Current	V_{IN} = 0V to V_{CC}	Com., Ind,		±1	µA
			Mil .		±5	mA
I_{LO}	Output Leakage Current	V_{OUT} = 0V to V_{CC}	Com., Ind,		±5	µA
			Mil.		±10	mA
I_{SB}	V_{CC}(1) Standby Current	I_{SB1} (CMOS), $\overline{CE}$ = V_{CC} ± 0.3V			100	µA
		I_{SB2} (TTL), $\overline{CE}$ = 2.0 to V_{CC} + 0.5V			1	mA
I_{CC}	V_{CC} Active Current	f = 5 MHz, I_{OUT} = 0 mA, $\overline{CE}$ = V_{IL} /Ind,mil			20/25	mA
V_{IL}	Input Low Voltage			-0.6	0.8	V
V_{IH}	Input High Voltage			2.0	V_{CC} + 0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA			0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA		2.4		V

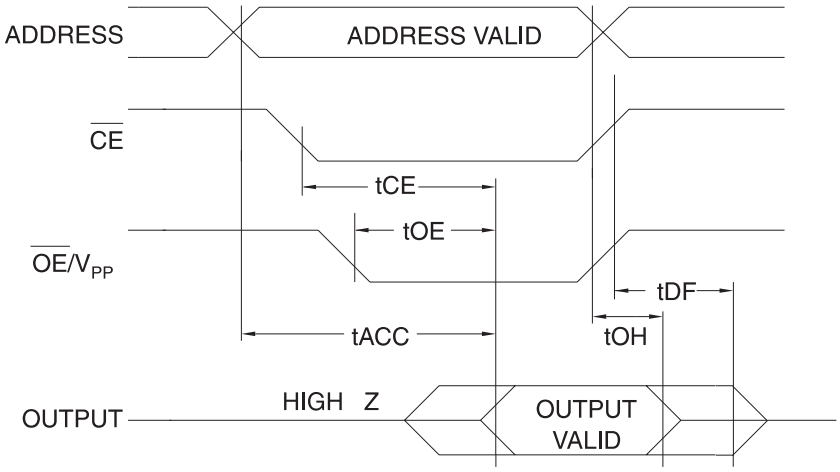
Notes: 1. V_{CC} must be applied simultaneously with or before $\overline{OE}/V_{PP}$ and removed simultaneously with or after $\overline{OE}/V_{PP}$.

AC Characteristics for Read Operation

			FT27C512R												
			-45		**-55**		**-70**		**-90**		**-12**		**-15**		
Symbol	**Parameter**	**Condition**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Units**
t_{ACC}(3)	Address to Output Delay	$\overline{CE}$= $\overline{OE}/V_{PP}$ = V_{IL}						70		90		120		150	ns
t_{CE}(2)	$\overline{CE}$ to Output Delay	$\overline{OE}/V_{PP}$ = V_{IL}						70		90		120		150	ns
t_{OE}(2)(3)	$\overline{OE}/V_{PP}$ to Output Delay	$\overline{CE}$ = V_{IL}						30		35		35		40	ns
t_{DF}(4)(5)	$\overline{OE}/V_{PP}$ or $\overline{CE}$ High to Output Float, whichever occurred first							25		25		30		35	ns
t_{OH}	Output Hold from Address, $\overline{CE}$ or $\overline{OE}/V_{PP}$, whichever occurred first							0		0		0		0	

Notes: 2, 3, 4, 5. - see AC Waveforms for Read Operation.

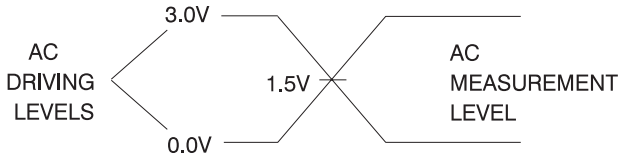
AC Waveforms for Read Operation[1]



Notes:
1. Timing measurement reference level is 1.5V for -45 and -55 devices. Input AC drive levels are V_{IL} = 0.0V and V_{IH} = 3.0V. Timing measurement reference levels for all other speed grades are V_{OL} = 0.8V and V_{OH} = 2.0V. Input AC drive levels are V_{IL} = 0.45V and V_{IH} = 2.4V.
2. $\overline{OE}/V_{PP}$ may be delayed up to t_{CE} - t_{OE} after the falling edge of $\overline{CE}$ without impact on t_{CE}.
3. $\overline{OE}/V_{PP}$ may be delayed up to t_{ACC} - t_{OE} after the address is valid without impact on t_{ACC}.
4. This parameter is only sampled and is not 100% tested.
5. Output float is defined as the point when data is no longer driven.

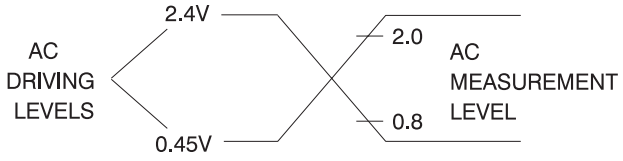
Input Test Waveforms and Measurement Levels

For -45 and -55 devices only:



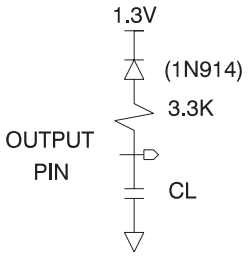
t_R, t_F < 5 ns (10% to 90%)

For -70, -90, -12, -15, and -20 devices:



t_R, t_F < 20 ns (10% to 90%)

Output Test Load



Note: C_L = 100 pF including jig capacitance, except for the -45 and -55 devices, where C_L = 30 pF.

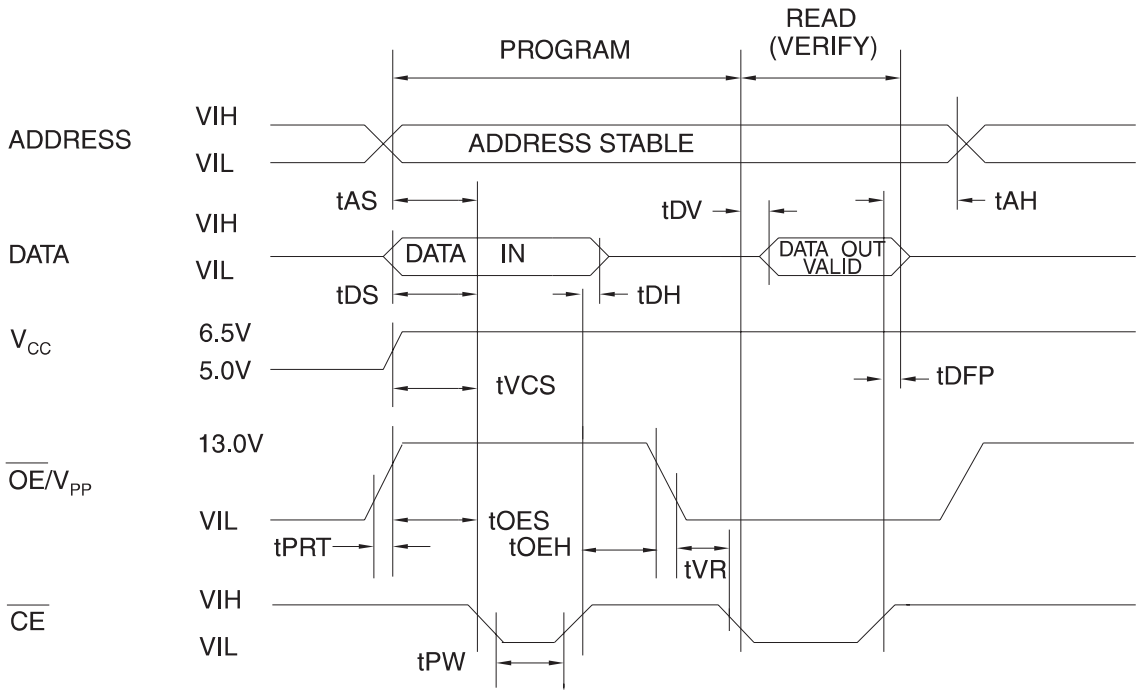
Pin Capacitance

(f = 1 MHz T = 25°C)[1]

	Typ	Max	Units	Conditions
C_{IN}	4	6	pF	V_{IN} = 0V
C_{OUT}	8	12	pF	V_{OUT} = 0V

Note: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

Programming Waveforms(1)



Notes: 1. The Input Timing Reference is 0.8V for V_{IL} and 2.0V for V_{IH}.

2. t_{OE} and t_{DFP} are characteristics of the device but must be accommodated by the programmer.

DC Programming Characteristics

$T_A = 25 \pm 5°C$, $V_{CC} = 6.5 \pm 0.25V$, $\overline{OE}/V_{PP} = 13.0 \pm 0.25V$

Symbol	Parameter	Test Conditions	Limits		Units
			Min	Max	
I_{LI}	Input Load Current	$V_{IN} = V_{IL}, V_{IH}$		±10	µA
V_{IL}	Input Low Level		-0.6	0.8	V
V_{IH}	Input High Level		2.0	V_{CC} + 1	V
V_{OL}	Output Low Voltage	I_{OL} = 2.1 mA		0.4	V
V_{OH}	Output High Voltage	I_{OH} = -400 µA	2.4		V
I_{CC2}	V_{CC} Supply Current (Program and Verify)			25	mA
I_{PP2}	$\overline{OE}/V_{PP}$ Current	$\overline{CE} = V_{IL}$		25	mA
V_{ID}	A9 Product Identification Voltage		11.5	12.5	V

AC Programming Characteristics

$T_A = 25 \pm 5°C$, $V_{CC} = 6.5 \pm 0.25V$, $\overline{OE}/V_{PP} = 13.0 \pm 0.25V$

Symbol	Parameter	Test Conditions[1]	Limits		Units
			Min	Max	
t_{AS}	Address Setup Time	Input Rise and Fall Times (10% to 90%) 20ns Input Pulse Levels 0.45V to 2.4V Input Timing Reference Level 0.8V to 2.0V Output Timing Reference Level 0.8V to 2.0V	2		µs
t_{OES}	$\overline{OE}/V_{PP}$ Setup Time		2		µs
t_{OEH}	$\overline{OE}/V_{PP}$ Hold Time		2		µs
t_{DS}	Data Setup Time		2		µs
t_{AH}	Address Hold Time		0		µs
t_{DH}	Data Hold Time		2		µs
t_{DFP}	$\overline{CE}$ High to Output Float Delay[2]		0	130	ns
t_{VCS}	V_{CC} Setup Time		2		µs
t_{PW}	$\overline{CE}$ Program Pulse Width[3]		95	105	µs
t_{DV}	Data Valid from $\overline{CE}$[2]			1	µs
t_{VR}	$\overline{OE}/V_{PP}$ Recovery Time		2		µs
t_{PRT}	$\overline{OE}/V_{PP}$ Pulse Rise Time During Programming		50		ns

Notes: 1. V_{CC} must be applied simultaneously or before $\overline{OE}/V_{PP}$ and removed simultaneously or after $\overline{OE}/V_{PP}$

2. This parameter is only sampled and is not 100% tested. Output Float is defined as the point where data is no longer driven—see timing diagram.

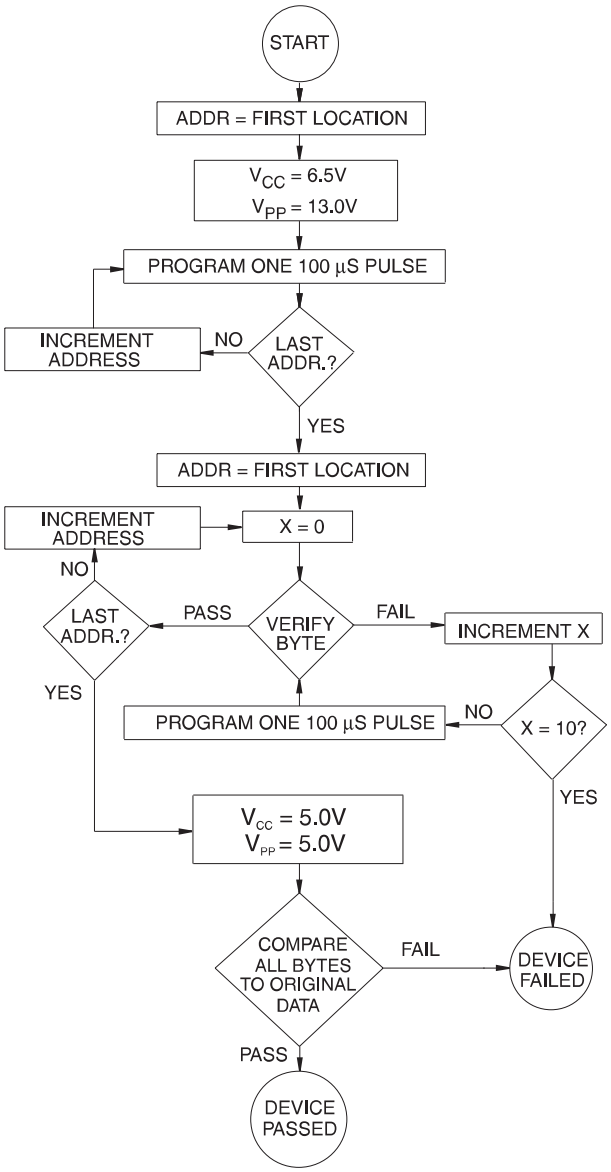
3. Program Pulse width tolerance is 100 µsec ± 5%.

FT27C512R Integrated Product Identification Code-Atmel Die

Codes	Pins									Hex Data
	A0	O7	O6	O5	O4	O3	O2	O1	O0	
Manufacturer	0	0	0	0	1	1	1	1	0	1E
Device Type	1	0	0	0	0	1	1	0	1	0D

Rapid Programming Algorithm

A 100 µs $\overline{CE}$ pulse width is used to program. The address is set to the first location. V_{CC} is raised to 6.5V and $\overline{OE}/V_{PP}$ is raised to 13.0V. Each address is first programmed with one 100 µs $\overline{CE}$ pulse without verification. Then a verification/reprogramming loop is executed for each address. In the event a byte fails to pass verification, up to 10 successive 100 µs pulses are applied with a verification after each pulse. If the byte fails to verify after 10 pulses have been applied, the part is considered failed. After the byte verifies properly, the next address is selected until all have been checked. $\overline{OE}/V_{PP}$ is then lowered to V_{IL} and V_{CC} to 5.0V. All bytes are read again and compared with the original data to determine if the device passes or fails.



Ordering Information

t_{ACC} (ns)	I_{CC} (mA)		Ordering Code	Package	Operation Range
	Active	Standby			
70	**20**	**0.1**	**FT27C512R-XXDC** **FT27C512R-XXLC** **FT27C512R-XXKC** **FT27C512R-XX-xxx**	**WinCDIL** **WinLCC** **WinJLCC** **xxx-Custom**	Commercial (0°C to 70°C)
	20	**0.1**	**FT27C512R-XXDI** **FT27C512R-XXLI** **FT27C512R-XXKI** **FT27C512R-XXTI-xxx**	**WinCDIL** **WinLCC** **WinJLCC** **xxx-Custom**	Industrial (-40°C to 85°C)
	20	**0.1**	**FT27C512R-XXDM** **FT27C512R-XXLM** **FT27C512R-XXKM**	**WinCDIL** **WinLCC** **WinJLCC**	Military (-55°C to 125°C)

Package Type	
JLCC	32-Lead, Ceramic J-Leaded Windowed Chip Carrier (JLCC)
CDIL	28-Lead, 0.600" Wide, Ceramic Windowed Dual Inline Package (PDIP)
LCC	32-Lead,Ceramic Windowed LCC (LCC)
DMB/DMB8	DMB=tested to Mil-Std-883 Method 5004 DMB8=tested to Mil-Std-883 method 5005

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