Appendix B: Cortex-M3/M4 Instructions

Instruction	Operands	Description and Action
ADC, ADCS	{Rd,} Rn, Op2	Add with Carry, Rd ← Rn + Op2 + Carry, ADCS updates N,Z,C,V
ADD, ADDS	{Rd,} Rn, Op2	Add, Rd ← Rn + Op2, ADDS updates N,Z,C,V
ADD, ADDS	{Rd,} Rn, #imm12	Add Immediate, Rd ← Rn + imm12, ADDS updates N,Z,C,V
ADR	Rd, label	Load PC-relative Address, Rd ← <label>
AND, ANDS	{Rd,} Rn, Op2	Logical AND, Rd ← Rn AND Op2, ANDS updates N,Z,C
ASR, ASRS	Rd, Rm, <Rs|#n>	Arithmetic Shift Right, Rd ← Rm>>(Rs|n), ASRS updates N,Z,C
B	label	Branch, PC ← label
BFC	Rd, #lsb, #width	Bit Field Clear, Rd[(width+lsb–1):lsb] ← 0
BFI	Rd, Rn, #lsb, #width	Bit Field Insert, Rd[(width+lsb–1):lsb] ← Rn[(width-1):0]
BIC, BICS	{Rd,} Rn, Op2	Bit Clear, Rd ← Rn AND NOT Op2, BICS updates N,Z,C
BKPT	#imm	Breakpoint, prefetch abort or enter debug state
BL	label	Branch with Link, LR ← next instruction, PC ← label
BLX	Rm	Branch register with link, LR←next instr addr, PC←Rm[31:1]
BX	Rm	Branch register, PC ← Rm
CBNZ	Rn, label	Compare and Branch if Non-zero; PC ← label if Rn != 0
CBZ	Rn, label	Compare and Branch if Zero; PC ← label if Rn == 0
CLREX	-	Clear local processor exclusive tag
CLZ	Rd, Rm	Count Leading Zeros, Rd ← number of leading zeros in Rm
CMN	Rn, Op2	Compare Negative, Update N,Z,C,V flags on Rn + Op2
CMP	Rn, Op2	Compare, Update N,Z,C,V flags on Rn – Op2
CPSID	i	Disable specified (i) interrupts, optional change mode
CPSIE	i	Enable specified (i) interrupts, optional change mode
DMB	-	Data Memory Barrier, ensure memory access order
DSB	-	Data Synchronization Barrier, ensure completion of access
EOR, EORS	{Rd,} Rn, Op2	Exclusive OR, Rd ← Rn XOR Op2, EORS updates N,Z,C
ISB	-	Instruction Synchronization Barrier
IT	-	If-Then Condition Block
LDM	Rn{!}, reglist	Load Multiple Registers increment after, <reglist> = mem[Rn], Rn increments after each memory access
LDMDB, LDMEA	Rn{!}, reglist	Load Multiple Registers Decrement Before, <reglist> = mem[Rn], Rn decrements before each memory access
LDMFD, LDMIA	Rn{!}, reglist	<reglist> = mem[Rn], Rn increments after each memory access
LDR	Rt, [Rn, #offset]	Load Register with Word, Rt ← mem[Rn + offset]
LDRB, LDRBT	Rt, [Rn, #offset]	Load Register with Byte, Rt ← mem[Rn + offset]
LDRD	Rt, Rt2, [Rn,#offset]	Load Register with two words, Rt ← mem[Rn + offset], Rt2 ← mem[Rn + offset + 4]
LDREX	Rt, [Rn, #offset]	Load Register Exclusive, Rt ← mem[Rn + offset]
LDREXB	Rt, [Rn]	Load Register Exclusive with Byte, Rt ← mem[Rn]
LDREXH	Rt, [Rn]	Load Register Exclusive with Half-word, Rt ← mem[Rn]
LDRH, LDRHT	Rt, [Rn, #offset]	Load Register with Half-word, Rt ← mem[Rn + offset]
LDRSB, LDRSBT	Rt, [Rn, #offset]	Load Register with Signed Byte, Rt ← mem[Rn + offset]
LDRSH, LDRSHT	Rt, [Rn, #offset]	Load Register with Signed Half-word, Rt ← mem[Rn + offset]
LDRT	Rt, [Rn, #offset]	Load Register with Word, Rt ← mem[Rn + offset]
LSL, LSLS	Rd, Rm, <Rs|#n>	Logic Shift Left, Rd ← Rm << Rs|n, LSLS update N,Z,C
LSR, LSRS	Rd, Rm, <Rs|#n>	Logic Shift Right, Rd ← Rm >> Rs|n, LSRS update N,Z,C
MLA	Rd, Rn, Rm, Ra	Multiply with Accumulate, Rd ← (Ra + (Rn*Rm))[31:0]
MLS	Rd, Rn, Rm, Ra	Multiply with Subtract, Rd ← (Ra – (Rn*Rm))[31:0]
MOV, MOVS	Rd, Op2	Move, Rd ← Op2, MOVS updates N,Z,C
MOVT	Rd, #imm16	Move Top, Rd[31:16] ← imm16, Rd[15:0] unaffected
MOVW, MOVWS	Rd, #imm16	Move 16-bit Constant, Rd ← imm16, MOVWS updates N,Z,C
MRS	Rd, spec_reg	Move from Special Register, Rd ← spec_reg
MSR	spec_reg, Rm	Move to Special Register, spec_reg ← Rm, Updates N,Z,C,V
MUL, MULS	{Rd,} Rn, Rm	Multiply, Rd ← (Rn*Rm)[31:0], MULS updates N,Z
MVN, MVNS	Rd, Op2	Move NOT, Rd ← 0xFFFFFFFF EOR Op2, MVNS updates N,Z,C

NOP	-	No Operation
ORN, ORNS	{Rd,} Rn, Op2	Logical OR NOT, Rd ← Rn OR NOT Op2, ORNS updates N,Z,C
ORR, ORRS	{Rd,} Rn, Op2	Logical OR, Rd ← Rn OR Op2, ORRS updates N,Z,C
POP	reglist	Canonical form of LDM SP!, <reglist>
PUSH	reglist	Canonical form of STMDB SP!, <reglist>
RBIT	Rd, Rn	Reverse Bits, for (i = 0; i < 32; i++): Rd[i] = RN[31–i]
REV	Rd, Rn	Reverse Byte Order in a Word, Rd[31:24]←Rn[7:0], Rd[23:16]←Rn[15:8], Rd[15:8]←Rn[23:16], Rd[7:0]←Rn[31:24]
REV16	Rd, Rn	Reverse Byte Order in a Half-word, Rd[15:8]←Rn[7:0], Rd[7:0]←Rn[15:8], Rd[31:24]←Rn[23:16], Rd[23:16]←Rn[31:24]
REVSH	Rd, Rn	Reverse Byte order in Low Half-word and sign extend, Rd[15:8]←Rn[7:0], Rd[7:0]←Rn[15:8], Rd[31:16]←Rn[7]*&0xFFFF
ROR, RORS	Rd, Rm, <Rs|#n>	Rotate Right, Rd ← ROR(Rm, Rs|n), RORS updates N,Z,C
RRX, RRXS	Rd, Rm	Rotate Right with Extend, Rd ← RRX(Rm), RRXS updates N,Z,C
RSB, RSBS	{Rd,} Rn, Op2	Reverse Subtract, Rd ← Op2 – Rn, RSBS updates N,Z,C,V
SBC, SBCS	{Rd,} Rn, Op2	Subtract with Carry, Rd ← Rn–Op2–NOT(Carry), updates NZCV
SBFX	Rd, Rn, #lsb, #width	Signed Bit Field Extract, Rd[(width–1):0] = Rn[(width+lsb–1):lsb], Rd[31:width] = Replicate(Rn[width+lsb–1])
SDIV	{Rd,} Rn, Rm	Signed Divide, Rd ← Rn/Rm
SEV	-	Send Event
SMLAL	RdLo, RdHi, Rn, Rm	Signed Multiply with Accumulate, RdHi,RdLo ← signed(RdHi,RdLo + Rn*Rm)
SMULL	RdLo, RdHi, Rn, Rm	Signed Multiply, RdHi,RdLo ← signed(Rn*Rm)
SSAT	Rd, #n, Rm{,shift #s}	Signed Saturate, Rd ← SignedSat((Rm shift s), n). Update Q
STM	Rn{!}, reglist	Store Multiple Registers
STMDB, STMEA	Rn{!}, reglist	Store Multiple Registers Decrement Before
STMFD, STMIA	Rn{!}, reglist	Store Multiple Registers Increment After
STR	Rt, [Rn, #offset]	Store Register with Word, mem[Rn+offset] = Rt
STRB, STRBT	Rt, [Rn, #offset]	Store Register with Byte, mem[Rn+offset] = Rt
STRD	Rt,Rt2,[Rn,#offset]	Store Register with two Words, mem[Rn+offset] = Rt, mem[Rn+offset+4] = Rt2
STREX	Rd, Rt, [Rn,#offset]	Store Register Exclusive if allowed, mem[Rn + offset] ← Rt, clear exclusive tag, Rd ← 0. Else Rd ← 1.
STREXB	Rd, Rt, [Rn]	Store Register Exclusive Byte, mem[Rn] ← Rt[15:0] or mem[Rn] ← Rt[7:0], clear exclusive tag, Rd ← 0. Else Rd ← 1
STREXH	Rd, Rt, [Rn]	Store Register Exclusive Half-word, mem[Rn] ← Rt[15:0] or mem[Rn] ← Rt[7:0], clear exclusive tag, Rd ← 0. Else Rd ← 1
STRH, STRHT	Rt, [Rn, #offset]	Store Half-word, mem[Rn + offset] ← Rt[15:0]
STRT	Rt, [Rn, #offset]	Store Register with Translation, mem[Rn + offset] = Rt
SUB, SUBS	{Rd,} Rn, Op2	Subtraction, Rd ← Rn – Op2, SUBS updates N,Z,C,V
SUB, SUBS	{Rd,} Rn, #imm12	Subtraction, Rd ← Rn-imm12, SUBS updates N,Z,C,V
SVC	#imm	Supervisor Call
SXTB	{Rd,} Rm {,ROR #n}	Sign Extend Byte, Rd ← SignExtend((Rm ROR (8*n))[7:0])
SXTH	{Rd,} Rm {,ROR #n}	Sign Extend Half-word, Rd←SignExtend((Rm ROR (8*n))[15:0])
TBB	[Rn, Rm]	Table Branch Byte, PC ← PC+ZeroExtend(Memory(Rn+Rm,1)<<1)
TBH	[Rn, Rm, LSL #1]	Table Branch Halfword, PC←PC+ZeroExtend(Memory(Rn+Rm<<1,2)<<1)
TEQ	Rn, Op2	Test Equivalence, Update N,Z,C,V on Rn EOR Operand2
TST	Rn, Op2	Test, Update N,Z,C,V on Rn AND Op2
UBFX	Rd, Rn, #lsb, #width	Unsigned Bit Field Extract, Rd[(width–1):0] = Rn[(width+lsb–1):lsb], Rd[31:width] = Replicate(0)
UDIV	{Rd,} Rn, Rm	Unsigned Divide, Rd ← Rn/Rm
UMLAL	RdLo, RdHi, Rn, Rm	Unsigned Multiply with Accumulate, RdHi,RdLo ← unsigned(RdHi,RdLo + Rn*Rm)
UMULL	RdLo, RdHi, Rn, Rm	Unsigned Multiply, RdHi,RdLo ← unsigned(Rn*Rm)
USAT	Rd, #n, Rm{,shift #s}	Unsigned Saturate, Rd←UnsignedSat((Rm shift s),n), Update Q
UXTB	{Rd,} Rm {,ROR #n}	Unsigned Extend Byte, Rd ← ZeroExtend((Rm ROR (8*n))[7:0])
UXTH	{Rd,} Rm {,ROR #n}	Unsigned Extend Halfword, Rd ← ZeroExtend((Rm ROR (8*n))[15:0])
WFE	-	Wait For Event and Enter Sleep Mode
WFI	-	Wait for Interrupt and Enter Sleep Mode