

Drive Features

- Form factor
- Internal/External
- Disk loading mechanism
- Data buffer capacity
- ROM type
- High-speed recording
- Buffer underrun protection
- Emergency eject
- Region protection code level (RPC)

Slim-Line
Internal drive
Tray load (bare disk)
2,048kByte
Flash-ROM
Supports 'High-Speed CD-RW' recording on High-Speed CD-RW media
Built-in functionality to prevent buffer underrun
Use the emergency eject only in emergency cases
Turn computer power off by properly shutting down the system
Insert a solid bar like a unbent paper clip (Diameter: 1 - 1.5 mm, min. length: 50 mm) into the emergency eject hole at the front of the drive and push gently. The tray will be ejected.
After removing the disc, gently push the tray to close
RPC-2

Speed factors

- Maximum speed factor CD read (CAV) From 10.3 to 24 x
- Maximum speed factor Audio-CD play (PCAV) From 4 to 6 x
- Maximum speed factor CD-DA transfer 8x
- Maximum speed factor CD-DA transfer 12x
- Maximum speed factor CD-R write (ZCLV) 16x
- Maximum speed factor CD-RW read (PCAV, High-Speed mode) From 8 to 12 x
- Maximum speed factor CD-RW write (CLV, standard mode) 4x
- Maximum speed factor CD-RW write (CLV, High-Speed mode) 10x
- Maximum speed factor DVD read (CAV, single layer) From 3.3 to 8 x
- Maximum speed factor DVD read (CAV, dual layer) From 2.5 to 6 x
- Maximum speed factor DVD-RAM read (4.7 GB/side) 1x
- Maximum speed factor DVD-R read (CAV) From 1.7 to 4 x
- Maximum speed factor DVD-R Ver. 2.0 write (CLV) 1x
- Maximum speed factor DVD-RW write (CLV) 1x
- Maximum speed factor DVD-RW read (CAV) From 1.7 to 4 x

Sustained block transfer rate

- CD (CAV) From 776 to 1,800 Blocks/s
- CD (PCAV) From 300 to 428 Blocks/s
- DVD (CAV, single layer) From 2,230 to 5,480 Blocks/s
- DVD (CAV, dual layer) From 1,690 to 4,056 Blocks/s
- DVD-RAM Ver. 2.1 (ZCLV) 1,352Blocks/s
- DVD-R (CAV) From 1,082 to 2,704 Blocks/s
- DVD-RW (CAV) From 1,082 to 2,704 Blocks/s

Sustained data transfer rate

- CD (CAV, Mode 1) From 1,545 to 3,600 kByte/s
- CD (CAV, Mode 2) From 1,761 to 4,104 kByte/s
- CD (PCAV, Mode 1) From 600 to 900 kByte/s

■ CD (PCAV, Mode 2)	From 684 to 1,026 kByte/s
■ CD-RW (PCAV, Mode 1)	From 600 to 900 kByte/s
■ CD-RW (PCAV, Mode 2)	From 684 to 1,026 kByte/s
■ DVD (CAV, single layer)	From 4,410 to 10,800 kByte/s
■ DVD (CAV, dual layer)	From 3,375 to 8,100 kByte/s
■ DVD-RAM Ver. 2.1 (ZCLV)	2,704kByte/s
■ DVD-R (CAV)	From 2,160 to 5,400 kByte/s
■ DVD-RW (CAV)	From 2,160 to 5,400 kByte/s
Burst data transfer rate	
■ PIO mode 4	16.7MByte/s
■ Multiple-word DMA transfer (Mode 2)	16.7MByte/s
■ Ultra DMA	33.3MByte/s
Average random access time	
■ CD	95ms
■ DVD	105ms
■ DVD-RAM	170ms
Average random seek time	
■ CD	90ms
■ DVD	95ms
■ DVD-RAM	120ms
Average full stroke access time	
■ CD	170ms
■ DVD	180ms
■ DVD-RAM	350ms
Applicable read/write formats	
■ Applicable write format CD-R/-RW	Disc-at-once Session-at-once Track-at-once Packet writing
■ Applicable write format DVD-R	Disc-at-once Incremental write
■ Applicable write format DVD-RW	Disc-at-once Incremental write Restricted overwrite
■ Applicable write disc	CD-ROM CD-ROM XA CD+(E)G CD-DA CD-i CD-i Bridge (Photo-CD) CD-i Bridge (Video-CD) CD-MIDI Mixed Mode CD Multisession CD-Extra Multisession Photo-CD Multisession Portfolio-CD DVD-R Ver. 2.0 for General DVD-RW Ver. 1.1
■ Applicable disc formats	CD-ROM CD-ROM XA CD+(E)G CD-DA CD-i CD-i Bridge (Photo-CD) CD-i Bridge (Video-CD)

	CD-MIDI CD-TEXT CD-R CD-RW Multisession CD-Extra Multisession CD-R Multisession CD-RW Multisession Photo-CD Multisession Portfolio-CD DVD-ROM (DVD-5) DVD-ROM (DVD-9) DVD-ROM (DVD-10) DVD-ROM (DVD-18) DVD-R Ver. 1.0 (3.9 GByte) DVD-R Ver. 2.0 DVD-RW Ver. 1.0 DVD-RW Ver. 1.1 DVD-RAM Ver. 2.1
Rotational speed	
■ CD-ROM (CAV)	5,100rpm
■ CD-DA transfer (PCAV)	From 2,560 to 4,300 rpm
■ Audio CD (PCAV)	From 1,200 to 2,000 rpm
■ Video CD (PCAV)	From 1,200 to 2,000 rpm
■ CD-R (CAV)	5,100rpm
■ CD-R write (CLV)	From 1,700 to 3,960 rpm
■ CD-R write (ZCLV)	From 2,648 to 3,973 rpm
■ CD-RW write (CLV, standard mode)	From 850 to 1,980 rpm
■ CD-RW write (CLV, High-Speed mode)	From 2,125 to 4,950 rpm
■ DVD (CAV, single layer)	4,670rpm
■ DVD (CAV, dual layer)	3,792rpm
■ DVD-Video (CAV, CSS disk)	2,780rpm
■ DVD-RAM Ver. 2.1 (ZCLV)	From 1,380 to 3,300 rpm
■ DVD-R Ver. 2 write (CLV)	From 570 to 1,390 rpm
■ DVD-R Ver. 1 (CAV)	2,560rpm
■ DVD-R Ver. 2 (CAV)	2,224rpm
■ DVD-RW (CAV)	2,224rpm
■ DVD-RW Ver. 1 write (CLV)	From 570 to 1,390 rpm
Load/eject	
■ Load/eject methods	Manual load Emergency eject Eject by ATAPI command
Acoustic noise	
■ Acoustic noise	40dB
Spin-up time	
■ CD	2.2s
■ DVD	2.2s
■ DVD-RAM	2.6s
Air flow	
■ Air flow	Not required
Media information	
■ Optical disk diameter	120 mm mm 80 mm (usable only in horizontal position of the drive) mm

Data block capacity

■ CD (Mode 1)	2,048Byte/block
■ CD (Mode 2)	2,336Byte/block
■ DVD-ROM	2,048Byte/block
■ DVD-RAM	2,048Byte/block

Disc capacity

■ CD (Mode 1)	656.5MByte
■ CD (Mode 2)	748.8MByte
■ DVD-5	4,377MByte
■ DVD-9	7,959MByte
■ DVD-10	8,754MByte
■ DVD-18	15,917MByte
■ DVD-RAM Ver. 1.0	2,324MByte
■ DVD-RAM Ver. 2.1	4,377MByte
■ DVD-R Ver. 1 (3.9 GByte)	3,679MByte
■ DVD-R Ver. 2 (4.7 GByte)	4,377MByte
■ DVD-RW	4,377MByte

Installation conditions

■ Installation conditions	Horizontal: +/- 15° in both left/right and front/rear directions. Vertical (Eject button to the left): 15° to the left direction. Vertical (Eject button to the right): 30° to the right direction.
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Hard read error rate

■ CD (Mode 1)	10 ⁻¹⁵ max.
■ CD (Mode 2)	10 ⁻¹² max.
■ DVD	10 ⁻¹⁵ max.

Seek error rate

■ General	10 ⁻⁶ max.
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MTBF (Mean Time Between Failures)

■ MTBF	60,000Hours
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MTBF assumptions

■ Power-on hours	5,436Hours/year
■ On/off cycles	313Cycles/year
■ Number of accesses	600,000Accesses/year
■ Operating duty cycle (Read)	20% of Power-on time
■ Operating duty cycle (Write)	2% of Power-on time

MTTR (Mean Time To Repair)

■ MTTR	0.5Hours
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Drive life

■ Drive life	15,000Hours
■ Load/eject	10,000Times
■ Interface connector: Attach/detach	500Times (min.)

Temperature and humidity

■ Operating temperature	From 5 to 50 °C
■ Storage temperature	From -10 to 60 °C
■ Shipping temperature	From -40 to 65 °C
■ Operating temperature gradient	11°C/hour
■ Storage temperature gradient	20°C/hour
■ Shipping temperature gradient	20°C/hour
■ Operating humidity	From 8 to 80 %
■ Storage humidity	From 5 to 95 %
■ Shipping humidity	From 5 to 95 %
■ Condensation	In all the above conditions there must be no condensation.

Vibration

■ Operating (Read, no hard error)	0.25G
■ Operating write	0.25G
■ Non-operating (No damage)	1G
■ Shipping (No damage)	1G

Shock

■ Operating (Horizontal, read, no hard error)	1.5G
■ Operating (Read, no data loss)	10G
■ Operating (Horizontal, write, no error)	1.5G
■ Operating (Vertical, write, no error)	0.8G
■ Non-operating (no disk mounted, no damage)	100G
■ Drop (bulk package, 20 pcs.)	0.6 m drop once for each 6 surfaces, 1 edge and 1 corner
■ Drop (bulk package, 50 pcs.)	0.4 m drop once (Bottom side only)

Operating pressure and altitude

■ Operating	From 0 to 3,000 m
■ Shipping	From 0 to 12,000 m

External dimensions

■ WxHxD	128 x 12.7 x 126.1mm
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Mass (Weight)

■ Net.	0.2kg
■ Bulk package (20 pcs.)	4.9kg
■ Bulk package (50 pcs.)	11.9kg

Configuration

■ Optical pick-up	1-lens/2-laser system.
■ Laser wave lengths	DVD: 650 nm CD: 780 nm
■ Spindle motor	Brushless DC-motor
■ Feed motor	DC-motor

Source voltage

■ Operating	+ 5 V (+/- 5 %)
■ Start-up	+ 5 V (+/- 8 %)
■ Spike	100mV
■ Ripple	100mV

Current drain

■ Sleep CD (+ 5V)	55mA
■ Sleep DVD (+ 5V)	55mA
■ Stand-by CD (Laser off, motor off, + 5V)	65mA
■ Stand-by DVD (Laser off, motor off, + 5V)	65mA
■ Continuous data read CD (+ 5V)	735mA
■ Continuous data read DVD (+ 5V)	580mA
■ Average CD (20% random access, + 5V)	715mA
■ Average DVD (20% random access, + 5V)	705mA
■ Maximum CD (100% random access, + 5V)	760mA
■ Maximum DVD (100% random access, + 5V)	740mA
■ Peak in executing access CD (+ 5V)	1,700mA
■ Peak in executing access DVD (+ 5V)	1,700mA
■ Write CD-R (+ 5V)	1,000mA
■ Write CD-RW (Standard mode, + 5V)	660mA
■ Write DVD-R (+ 5V)	580mA

Power consumption

■ Average CD	3.6W
■ Average DVD	3.5W

Analogue out

■ Output level	0.8V
■ Type	Unbalanced
■ Load impedance	47kOhm
■ Frequency response	From 20 to 20,000 Hz
■ Distortion (Percentual)	Max. 0.04%
■ Signal-to-noise ratio	80dB

Audio modes

■ Audio modes	16 modes including 'Stereo', 'LCh Mono', 'RCh Mono' and 'Mute' are selectable by command. Default mode is 'Stereo'. 16 steps of attenuation level for the audio output are selectable by command. Default level is 0 dB.
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Interface

■ Applicable to	T13/1321D Rev. 3 ATAPI SFF8020i Rev. 2.6 ATAPI SFF8090 Ver. 5, Rev. 1.4
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Connections and cables

■ ATAPI-cable length	0.46m
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Electrostatic discharge

■ Conforms to standard	EN61000-4-2
■ Damage including	Min. 15kV
■ Operating	Max. 8kV

Safety standards/Agency approvals

■ Safety	CAN/CSA-22.2 No. 950 EN60950 UL 1950
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■ **Laser**

■ **EMI**

■ **CE**

EN60825-1
FDA CFR21
Taiwan EMI CNS 13438

EN 50081-1
EN55022
EN55024+A1
EN61000-4-2+A1
EN61000-4-3+A1
EN61000-4-4
EN61000-4-5
EN61000-4-6
EN61000-4-8
EN61000-4-11

Maintenance and handling

■ **Optical pick-up head**

Optical pick-up: A dirty optical pick-up will degrade the access time. Please do not try to clean it yourself!

■ **Optical media**

Optical disk: Try to avoid touching the data area of the disk as dirt and smears will degrade the disk accessing speed. If the disk is dirty, wipe with a soft cloth from the center of the media straight to the outside.