MOTOROLA

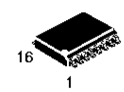
TCA0372

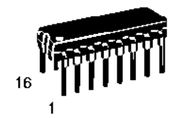
Dual Power Operational Amplifier

The TCA0372 is a monolithic circuit intended for use as a power operational amplifier in a wide range of applications, including servo amplifiers and power supplies. No deadband crossover distortion provides better performance for driving coils.

- Output Current to 1.0 A
- Slew Rate of 1.3 V/µs
- Wide Bandwidth of 1.1 MHz
- Internal Thermal Shutdown
- Single or Split Supply Operation
- Excellent Gain and Phase Margins
- Common Mode Input Includes Ground
- Zero Deadband Crossover Distortion

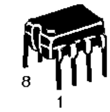
DW SUFFIX
PLASTIC PACKAGE
CASE 751G
SOP (12+2+2)L



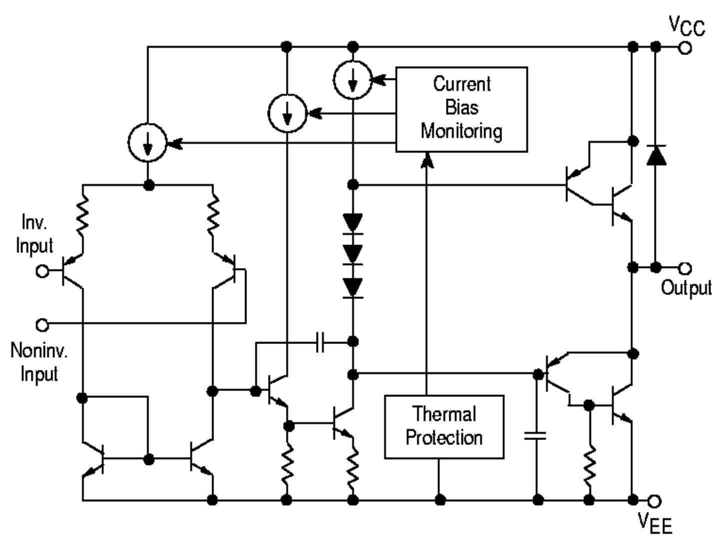


DP2 SUFFIX
PLASTIC PACKAGE
CASE 648

DP1 SUFFIX
PLASTIC PACKAGE
CASE 626

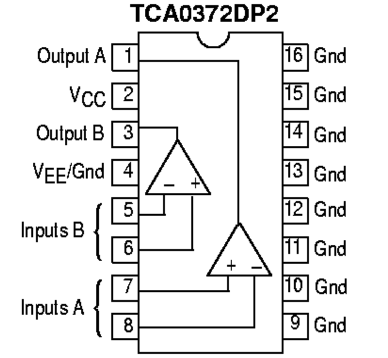


Representative Block Diagram



PIN CONNECTIONS

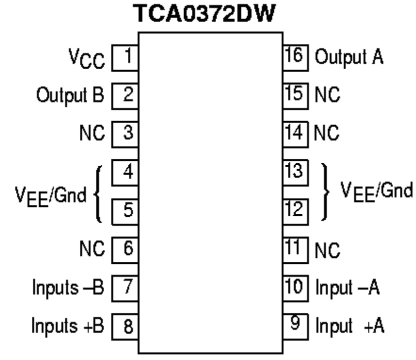
TCA0372DP2



(Top View)

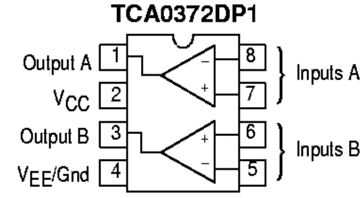
*Pins 4 and 9 to 16 are internally connected.

TCA0372DW



(Top View)

TCA0372DP1



(Top View)

ORDERING INFORMATION

Device	Operating Temperature Range	Package
TCA0372DW	T_J = –40° to +150°C	SOP (12+2+2) L
TCA0372DP1		Plastic DIP
TCA0372DP2		Plastic DIP

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Supply Voltage (from V_{CC} to V_{EE})	V_S	40	V
Input Differential Voltage Range	V_{IDR}	(Note 1)	V
Input Voltage Range	V_{IR}	(Note 1)	V
Junction Temperature (Note 2)	T_J	+150	°C
Storage Temperature Range	T_{stg}	–55 to +150	°C
DC Output Current	I_O	1.0	A
Peak Output Current (Nonrepetitive)	$I_{(max)}$	1.5	A

DC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = –15 V, R_L connected to ground, T_J = –40° to +125°C.)

Characteristics	Symbol	Min	Typ	Max	Unit
Input Offset Voltage (V_{CM} = 0) T_J = +25°C T_J, T_{low} to T_{high}	V_{IO}	 — —	 1.0 —	 15 20	mV
Average Temperature Coefficient of Offset Voltage	$\Delta V_{IO}/\Delta T$	—	20	—	µV/°C
Input Bias Current (V_{CM} = 0)	I_{IB}	—	100	500	nA
Input Offset Current (V_{CM} = 0)	I_{IO}	—	10	50	nA
Large Signal Voltage Gain V_O = ±10 V, R_L = 2.0 k	A_{VOL}	30	100	—	V/mV
Output Voltage Swing (I_L = 100 mA) T_J = +25°C T_J = T_{low} to T_{high} T_J = +25°C T_J = T_{low} to T_{high}	V_{OH} V_{OL}	 14.0 13.9 — —	 14.2 — –14.2 —	 — — –14.0 –13.9	V
Output Voltage Swing (I_L = 1.0 A) V_{CC} = +24 V, V_{EE} = 0 V, T_J = +25°C V_{CC} = +24 V, V_{EE} = 0 V, T_J = T_{low} to T_{high} V_{CC} = +24 V, V_{EE} = 0 V, T_J = +25°C V_{CC} = +24 V, V_{EE} = 0 V, T_J = T_{low} to T_{high}	V_{OH} V_{OL}	 22.5 22.5 — —	 22.7 — 1.3 —	 — — 1.5 1.5	V
Input Common Mode Voltage Range T_J = +25°C T_J = T_{low} to T_{high}	V_{ICR}		 V_{EE} to (V_{CC} –1.0) V_{EE} to (V_{CC} –1.3)		V
Common Mode Rejection Ratio (R_S = 10 k)	CMRR	70	90	—	dB
Power Supply Rejection Ratio (R_S = 100 Ω)	PSRR	70	90	—	dB
Power Supply Current T_J = +25°C T_J = T_{low} to T_{high}	I_D	 — —	 5.0 —	 10 14	mA

NOTES: 1. Either or both input voltages should not exceed the magnitude of V_{CC} or V_{EE}.
2. Power dissipation must be considered to ensure maximum junction temperature (T_J) is not exceeded.

AC ELECTRICAL CHARACTERISTICS (V_{CC} = +15 V, V_{EE} = –15 V, R_L connected to ground, T_J = +25°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
Slew Rate (V_{in} = –10 V to +10 V, R_L = 2.0 k, C_L = 100 pF) A_V = –1.0, T_J = T_{low} to T_{high}	SR	1.0	1.4	—	V/µs
Gain Bandwidth Product (f = 100 kHz, C_L = 100 pF, R_L = 2.0 k) T_J = 25°C T_J = T_{low} to T_{high}	GBW	 0.9 0.7	 1.4 —	 — —	MHz
Phase Margin T_J = T_{low} to T_{high} R_L = 2.0 k, C_L = 100 pF	ϕ_m	—	65	—	Degrees
Gain Margin R_L = 2.0 k, C_L = 100 pF	A_m	—	15	—	dB
Equivalent Input Noise Voltage R_S = 100 Ω, f = 1.0 to 100 kHz	e_n	—	22	—	$nV/\sqrt{Hz}$
Total Harmonic Distortion A_V = –1.0, R_L = 50 Ω, V_O = 0.5 VRMS, f = 1.0 kHz	THD	—	0.02	—	%

NOTE: In case V_{EE} is disconnected before V_{CC}, a diode between V_{EE} and Ground is recommended to avoid damaging the device.

Figure 1. Supply Current versus Suppy Voltage with No Load

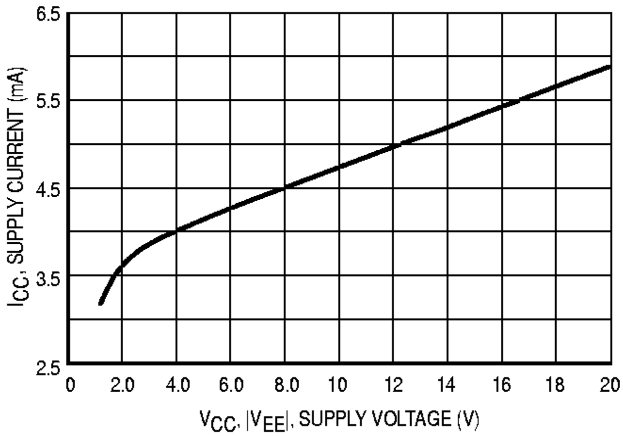


Figure 2. Output Saturation Voltage versus Load Current

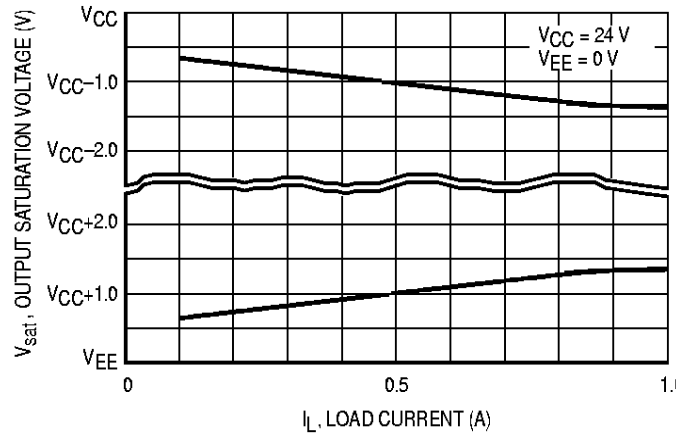


Figure 3. Voltage Gain and Phase versus Frequency

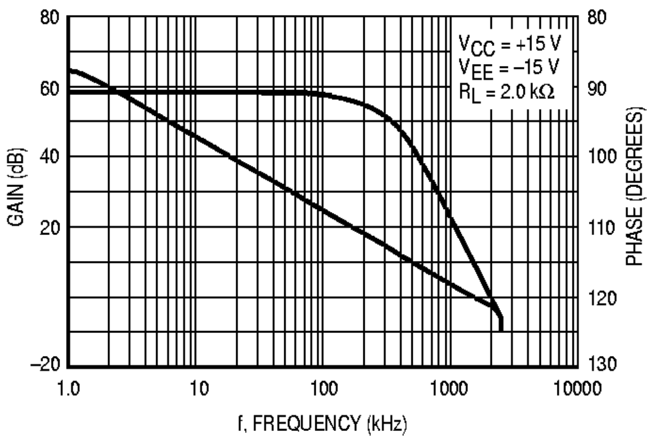


Figure 4. Phase Margin versus Output Load Capacitance

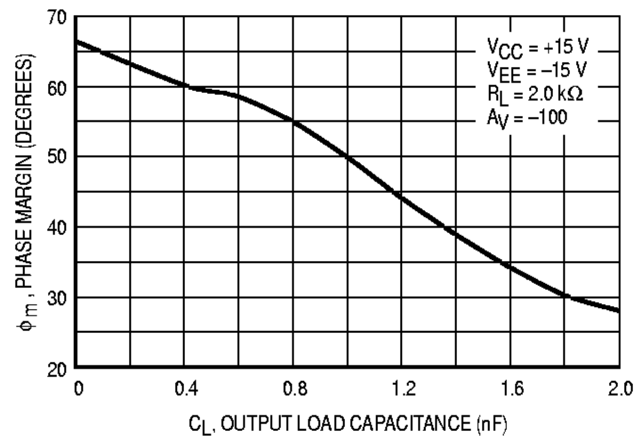


Figure 5. Small Signal Transient Response

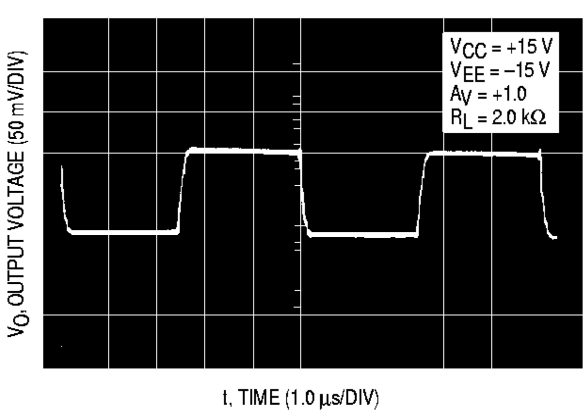


Figure 6. Large Signal Transient Response

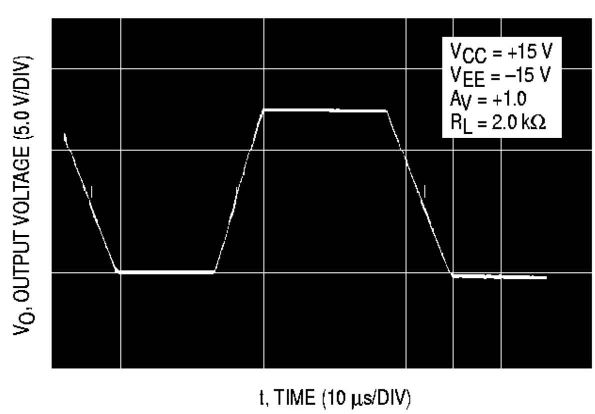


Figure 7. Sine Wave Reponse

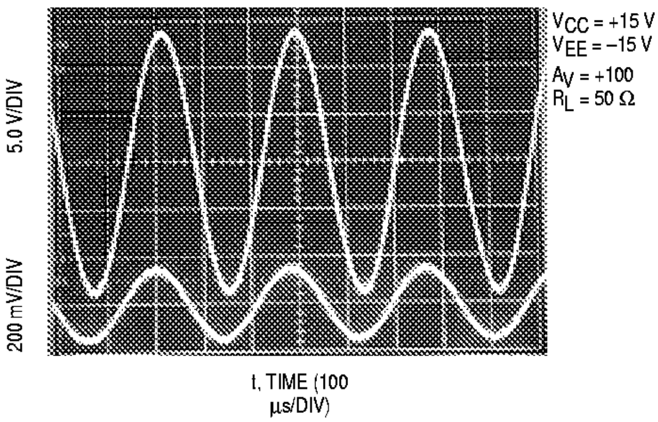


Figure 8. Bidirectional DC Motor Control with Microprocessor–Compatible Inputs

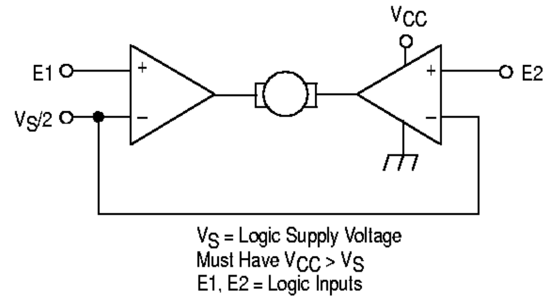
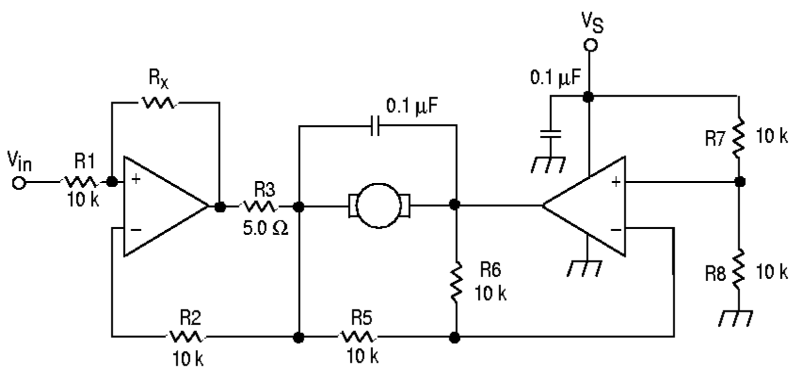


Figure 9. Bidirectional Speed Control of DC Motors



For circuit stability, ensure that $R_x > \frac{2R3 \cdot R1}{R_M}$ where, R_M = internal resistance of motor.

The voltage available at the terminals of the motor is: $V_M = 2\,(V_1 - \frac{V_S}{2}) + |R_o| \cdot I_M$

where, $|R_o| = \frac{2R3 \cdot R1}{R_x}$ and I_M is the motor current.

THERMAL INFORMATION

The maximum power consumption an integrated circuit can tolerate at a given operating ambient temperature can be found from the equation:

$$P_{D(TA)} = \frac{T_{J(max)} - T_A}{R_{\theta JA}\ (typ)}$$

where, $P_{D(TA)}$ = power dissipation allowable at a given operating ambient temperature.

This must be greater than the sum of the products of the supply voltages and supply currents at the worst case operating condition.

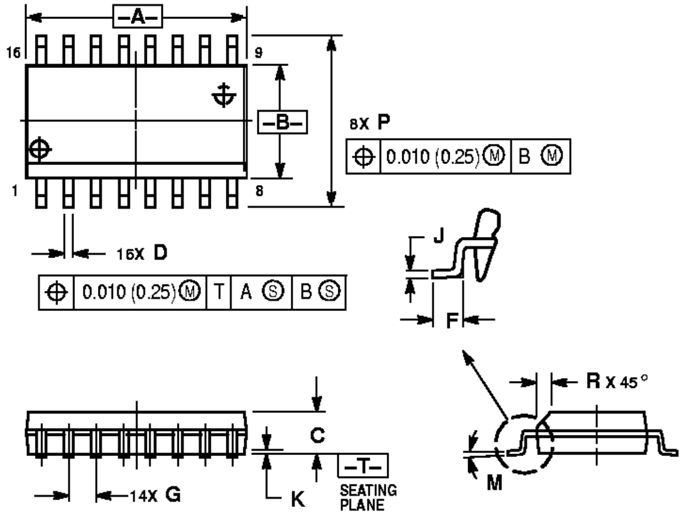
$T_{J(max)}$ = Maximum operating junction temperature as listed in the maximum ratings section.

T_A = Maximum desired operating ambient temperature.

$R_{\theta JA(typ)}$ = Typical thermal resistance junction–to–ambient.

OUTLINE DIMENSIONS

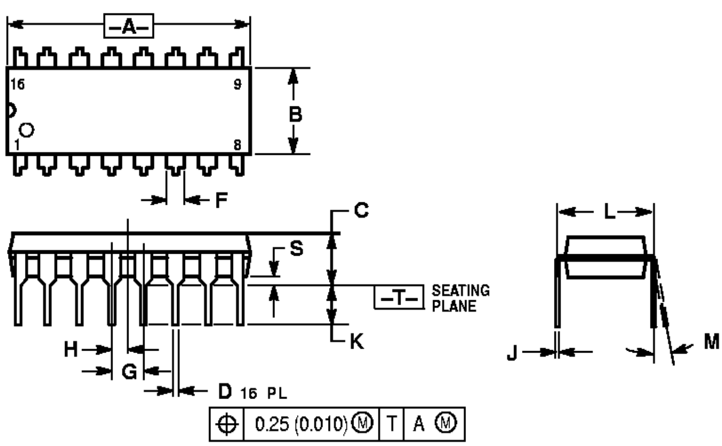
DW SUFFIX
PLASTIC PACKAGE
CASE 751G–02
(SOP (12+2+2)L)
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	10.15	10.45	0.400	0.411
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

DP2 SUFFIX
PLASTIC PACKAGE
CASE 648–08
ISSUE R

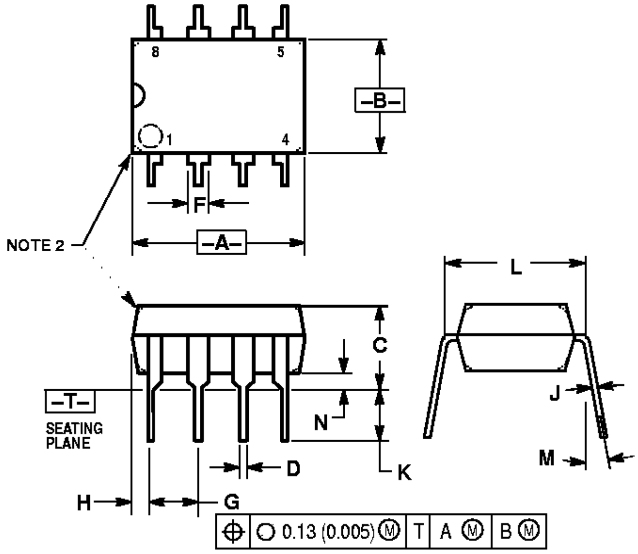


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

OUTLINE DIMENSIONS

DP1 SUFFIX
PLASTIC PACKAGE
CASE 626–05
ISSUE K



NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

Mfax is a trademark of Motorola, Inc.

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 1–303–675–2140 or 1–800–441–2447

JAPAN: Motorola Japan Ltd.; SPD, Strategic Planning Office, 141,
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan. 81–3–5487–8488

Customer Focus Center: 1–800–521–6274

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 1–602–244–6609
Motorola Fax Back System – US & Canada ONLY 1–800–774–1848
– http://sps.motorola.com/mfax/

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre,
2, Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong.
852–26629298

HOME PAGE: http://motorola.com/sps/

MOTOROLA