



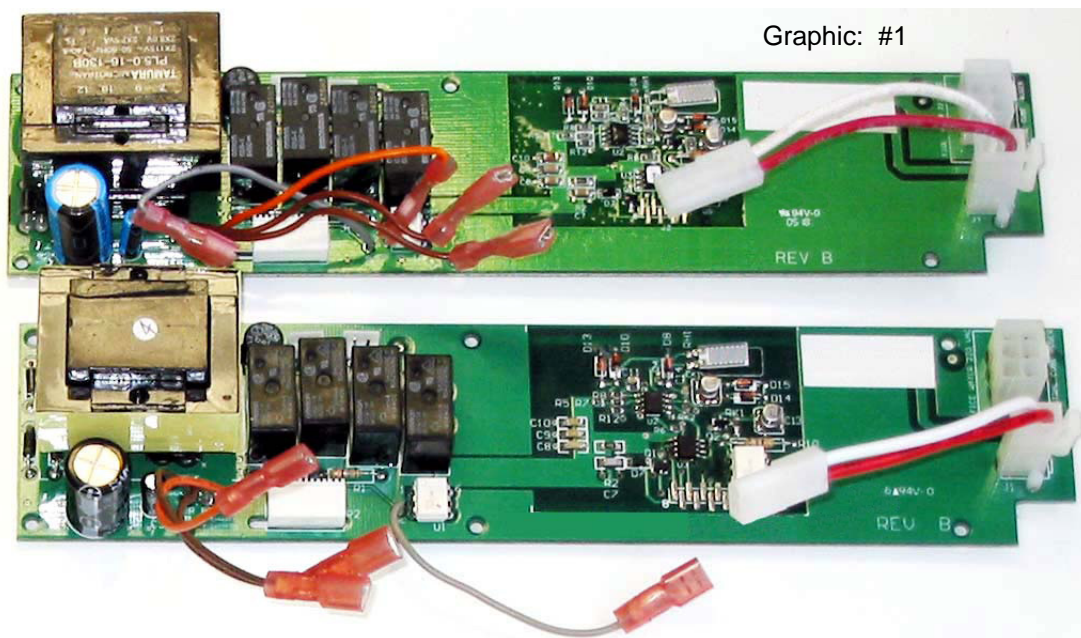
### 3.06

#### Introduction:

360° Test Labs has been retained to perform a formal competitive analysis of competing PCBAs/ Part Number: **Model 'X'**. For the client assembly, 360° Test Labs was supplied extensive documentation including BOMs, drawings, manufacturer specifications, and RoHS data. For the competitor assembly 360° Test Labs was supplied the BOM and then independently sourced missing requisite data from manufacturer documentation or distributor supplied documentation.

To make comparisons and draw supported conclusions, 360° Test Labs identified each component and the specifications associated with that component including, specified operating environments, ratings, and failure rates, etc. When the origin of manufacture was not determinable, analysis of materials physical and electrical characteristics was closely scrutinized.

#### Findings:



Note: Additional Information Found in Appendix for Red Shaded Items

RefDes	Description	Value	Model 'X'			Model 'X'-2			Notes
			Manufacturer	Part Number	Specifications	Manufacturer	Part Number	Specifications	
PCB	PCB FR4, 1.5 OZ CU, .062" THICK		MONKUNGCINHO	.40575900				Equivalent parts--no notable specification variances.	
	SILICONE CONFORMAL COATING DOW CORNING 3-1753							Not used on cabinet board. See conformal coating notes that follow this table.	
P2	CONNECTOR 10 PIN 1.25MM SPACING CABLE THRU BRD		MOLEX	52492-1020		MOLEX	52492-1020	Same part.	
D1 - 4, D6	DIODE RECTIFIER 1 AMP 400PIV DO-41		PANJIT	1N4004(TB)	1 amp 400 PIV		1N4004	While this part is rated 400V, a bench test showed the Panjit breakdown was > 800 VDC. Part sample exceeds specs.	
F1	FUSE MSF 1 AMP 250V QUICK ACT		Conquer	MSF 1A/250V	FUSE MEF 1A/250V	SCHURTER	0034 6014	Equivalent parts. Identical overload ratings. The client Part has a wider temp rating, -55C to + 125C vs -40C to +85 C for the competing Part. See appendix for specification highlight.	
K1 - 4	Single Pole Relay, 5A N.O. 5VDC		OMRON	G5Q-14		OMRON	G5S-1	The G5S-1 is rated 5 amps through the Normally Open Contacts, and 3 amps through the Normally Closed Contacts. The G5Q-14 is rated 10 amps through the Normally Open and 5 through the Normally Closed Contacts. All other specifications are identical. The client G5Q-14 is clearly a superior part. See appendix for specification highlight.	
U1, U5	TRIAC THRU-6 PIN DIP T-H		Fairchild	MOC-3083M		Song Chuan	892-1CC-S 5VDC	Same part. QT Optoelectronics is a Vendor not a manufacturer.	
P3, P4	SHROUDED HEADER CONN 2 PIN 2.5MM PITCH WHITE		Chyaoshiunn	JS-1151-02		QT OPTOELECTRONICS	MOC3083-M	Equivalent parts--no notable specification variances.	
P1	CONNECTOR 6 PIN MINI-FIT		TKP	JS-1151-06		JST	B2B-EH-A	Equivalent parts--no notable specification variances.	
						MOLEX	39-29-9066	Equivalent parts--no notable specification variances.	
						AMP	794662-6	Equivalent parts--no notable specification variances.	
C2	CAPACITOR ELECTROLYTIC 2200UF 25V 5MM	2200UF	YELLOWSTONE	GR2200M25W1321		PANASONIC	ECA-1EM222	Equivalent parts. Leakage Currents are rated differently. Panasonic 1 and 2 min values at 20C, Stone 3 min at 25C, but both are < 3uAmps after 3 min. See appendix for specification highlight.	
			YELLOWSTONE	GR10M25W0511		ILLINOIS CAP	228CK5025M	Equivalent parts. Leakage Currents are rated differently. Panasonic 1 and 2 min values at 20C, Stone 3 min at 25 C, but both are < 3uAmps after 3 min. The Stone part is rated to 105 C, while the Panasonic part is only rated 85C. See appendix for specification highlight.	
C3	CAPACITOR ELECTROLYTIC 10UF 25V 2.5MM	10uF				PANASONIC	ECA-1EM100	Equivalent parts. Leakage Currents are rated differently. Panasonic 1 and 2 min values at 20C, Stone 3 min at 25 C, but both are < 3uAmps after 3 min. The Stone part is rated to 105 C, while the Panasonic part is only rated 85C. See appendix for specification highlight.	
SL	GRAY WIRE ASM (ICE CRADLE) T-H		Yung Hua	1007#22 70m/m+FDNFYD1-187(5)+5192T-GREY				No Information on the competing wire, client wire meets UL voltage and flame tests.	
OR	ORANGE WIRE ASM (WATER CRADLE) T-H		Yung Hua	1007#22 70m/m+FDNFYD1-187(5)+5191T-OR				No Information on the competing wire, client wire meets UL voltage and flame tests.	
BR	BROWN WIRE ASM (COMMON CRADLE) T-H		Yung Hua	1007#22 70m/m+FDNFYD1-187(5)+5190T-BR				No Information on the competing wire, client wire meets UL voltage and flame tests.	
R1, R10	RESISTOR CARBON FILM 560 OHM 5% 0.25W THRU-HOLE	560 Ohm	Tzaiyuan	560Q		SEI	CF145605%	Equivalent parts--no notable specification variances.	
	TRANSISTOR SINGLE NPN DIGITAL 15VDC 600MA SMT3		ROHM	DTC323TK146		ROHM	DTC323TK 146	Same part.	
	XSTR N CHAN MOSFET 60VDC 115MA SMT SOT-23		PANJIT	2N7002		FAIRCHILD	2N7002	The Panjit is a somewhat superior part. Panjit's part is rated for 350 milliwatts to Fairchild's 200 milliwatts. Both parts are rated 60 VDC, but the Panjit is rated typical 105 VDC. See appendix for specification highlight.	
						CENTRAL SEMICONDUCTOR	2N7002	Equivalent parts--no notable specification variances.	
	CAP CER 0.001UF 50VDC +/-10% X7R SMT 0805	.001 uF	Compostar	0805-0001-50-7r	50V X7R +/-10%	KEMET	C0805C102K5RACTU	The Kemet part meets RoHS requirements, but does not mention compatibility with SAC solders.	
	CAP CER 0.01UF 50VDC +/-10% X7R SMT 0805	.01 uF	Compostar	0805-001-50-7r	50V X7R +/-10%	PANASONIC	ECJ2YB1H105K	See appendix for specification highlight.	
	CAPACITOR CERAMIC 0.01UF (10000PF) 50VDC +/-10% X7R SMT 1206	.01 uF	Compostar	1206-001-50-7r	50V X7R +/-10%	PANASONIC	ECJ2YB1H105K	Equivalent parts--no notable specification variances.	
	CAP CER 0.1UF 50VDC +/-10% X7R SMT 1206	.1 uF	Compostar	1206-01-50-7r	50V X7R +/-10%	PANASONIC	ECJ2YB1H105K	See appendix for specification highlight.	
						AVX	12065C104KAT2A	Equivalent parts--no notable specification variances.	
D7	DIODE SCHOTTKY RECTIFIER 20V 500MA SMT SOD123		ON	MBR0520L1G		FAIRCHILD	MBR0520L	Same part.	
						ON-SEMI	MBR0520L1T1	Equivalent parts. While the Rohm part supported Lead-Free soldering, the part itself did not claim RoHS compliance.	
R7, R8	RES THICK FILM MARKED 1K 1% 1/8W OR 1/10W SMT 0805	1K	Tzaiyuan	0805-1k-5		ROHM	MCR10E2HF1001	Equivalent parts. While the Rohm part supported Lead-Free soldering, the part itself did not claim RoHS compliance.	
	CAPACITOR CERAMIC 10PF 50VDC +/-5% NPO SMT MULTILAYER CHIP 1206 COG, ALTERNATE AVX12061A100JATMA 100V KEMET	10 pF	Compostar	1206-0001-50-7r	50V X7R +/-10%	AVX	12065A100DATIA	See appendix for specification highlight.	
						RFE	MA1206CG100K900R	Equivalent parts--no notable specification variances.	
C13, C14	CAP ELECTROLYTIC 10UF 16VDC SMT 4 X 4.5MM	10 uF	Nichicon	UZS1C100MCL1GB	16v -40-85 UZS1C100MCL1GB	NICHICON	UZS1C100MCR1GB	Same part.	
						TECATE	MXLP-016/MAX51R13	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
						ILLINOIS CAP	106SLP016M	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
R2	RES THICK FILM MARKED 4.7K 5% 1/4W SMT 1206	4.7K	Tzaiyuan	1206-47-5	1%	PANASONIC	ERJ-8GEYJ472V	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
						ROHM	MCR18E2HJ472	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
R12	RES THICK FILM MARKED 7.32K 1% 1/8W SMT 0805	7.32K	Tzaiyuan	0805-732-1	1%	PANASONIC	ERJ-6ENF7321V	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
						ROHM	MCR10E2HF7321	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
	RES THICK FILM MARKED 24.9K 1% 1/8W SMT 0805	24.9K	Tzaiyuan	0805-129-1	1%	PANASONIC	ERJ-6ENF2492V	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
						ROHM	MCR10E2HF2492	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
R3 - R6	RES THICK FILM MARKED 10K 1% 1/8W SMT 0805	10K	Tzaiyuan	0805-10k-5	1%	PANASONIC	ERJ-6ENF1002V	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
						ROHM	MCR10E2HF1002	Equivalent parts. While the Rohm part supported Lead Free soldering, the part itself did not claim RoHS compliance.	
RH1	SENSOR HUMIDITY RESITIVE +/-5% 0.1" PITCH T-H		GE	EMD-4000	+5%	GENERAL EASTERN INSTRUMENTS	EMD-4000	Same part.	
D8, D10, D13 - 15	DIODE HIGH SPEED SWITCHING 100VDC 200MA T-H DO-35		Fairchild	1N914		FAIRCHILD	1N914	Same part.	
						VISHAY	1N914	Equivalent parts--no notable specification variances.	
U2	IC DUAL WIDE LOW POWER OP AMP SMT SOIC-8		ON	LM358		NATIONAL	LM358AM	The ON Semiconductor component has ESD clamps on the Op Amp inputs. These can be very important in consumer appliances. The National Semi part does not mention ESD protection; thus, the ON Semi is a superior part. The ON LM358 is RoHS.	
						TEXAS INSTRUMENTS	LM358D	Equivalent parts--no notable specification variances.	
U3	IC 8-BIT MICROCONTROLLER 1024 WORDS SOIC-8 (HSFRA/Hex)		Microchip	PIC12F675		MICROCHIP	PIC12F675-/SN	Same Part	
J1	CONN 2 PIN MINI-FIT		Chyaoshiunn	P1201-02(TKP)		MOLEX	39-29-9022	Equivalent parts--no notable specification variances.	
T1	TRANSFORMER 115/230VAC 60/50HZ 5VA 16V SERIES 8V PARALLEL CLASS B T-H		Eng Electric Co.	1P41-160031A-063	115/230VAC	TAMURA	PL5-0-16-130B MEC	Equivalent parts. competing HiPot tested to 2500 V, client HiPot tested to 1800 V.	
	Label #1		E-SHIN	3918	Warning Label			Same part.	
	Label #2		E-SHIN	38904	White Label			Equivalent label.	

### **Additional Comparative Details:**

The competitor board has a silicon based conformal coating over the Op-Amp area, the client board does not—an engineering review of the necessity of this coating should be made. On the positive side, the Op-Amp gain could be very sensitive to debris on the circuits—conformal coating would prevent this.

On the negative side, the Humidity Sensor on the competitor board has been conformally coated. **It is unlikely that the Humidity Sensor has been properly functioning on the competitor board.** The problem could be corrected by masking the Humidity Sensor during coating, or installing the sensor during a later step.

### **360° Test Labs Independently Concludes and Certifies:**

The competing boards are functionally equivalent and of equivalent quality—excepting the issue noted above relating to conformal coating.

# Appendix - Highlighted Competitor Related Specification Sheets

**FUSES**  
Non resettable fuses

**MSF 125, MSF 250, MST 250,  
MSTU 250, MXT 250**

Technical data and packaging  
Types MSF 125  
MSF 250  
MST 250  
MSTU 250  
MXT 250

**Additional technical data**

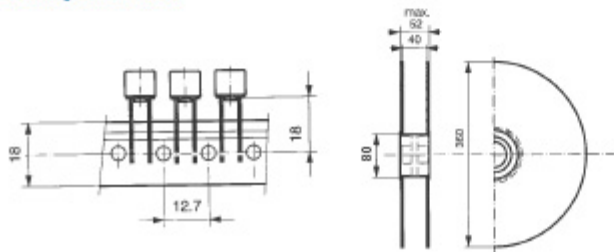
Ambient temperature max. $T_a$	MSF 125: -25 °C to +85 °C MSF / MST / MSTU / MXT 250: -40 °C to +85 °C
Permissible continuous operating current at 23 °C	MSF 125: $0,7 \cdot I_n$ Shift of the rated current at ambient air temperatures > 23 °C see diagramm on page 204 MSF / MST / MSTU / MXT 250: $1 \cdot I_n$
Resistance to vibration	Frequency 10 + 2000 Hz, cross-over frequency 60 Hz < 60 Hz constant amplitude of 1,5 mm (except MSF 125: 0,75 mm) > 60 Hz constant acceleration of 100 m/s <sup>2</sup> (10 g) according to IEC 60068-2-6, test Fc /
Resistance to shock	490 m/s <sup>2</sup> (50 g), 11 ms according to IEC 60068-2-27
Climate category	Types MSF 125 25/085/21 MXT 250 40/085/21 MSF 250 MST 250 MSTU 250 } according to IEC 60068-1
Fuse-link temp. rise $\leq 75$ K (UL/CSA)	Trackwidth for: I $\leq$ 4 A 2,5 mm I $\leq$ 5 A- 7 A 5,0 mm I $\leq$ 8 A-10 A 10 mm
Solderability	235 °C / 2 sec. according to IEC 60068-2-20, test Ta
Soldering heat resistance	260 °C / 10 sec. according to IEC 60068-2-20, test Tb
Materials Socket and cap	temperature resistant plastic, UL 94V-0
Terminals	Copper tin-plated

**Packaging**

- Boxes of 100 pieces
- Taped and reeled 750 pieces  
MSF 125, 1000 pieces
- Ammpack 1000 pieces on request

**Tape and reel**

according to IEC 60286-2



## Specifications

### ■ COIL RATINGS

Rated voltage	5 VDC	9 VDC	12 VDC	18 VDC	24 VDC	48 VDC
Rated current	80 mA	44.4 mA	33.3 mA	22.2 mA	16.7 mA	8.3 mA
Coil resistance	62.5 Ω	202.5 Ω	380 Ω	810 Ω	1,440 Ω	5,760 Ω
Must operate voltage	75% max. of rated voltage					
Must release voltage	5% min. of rated voltage					
Max. voltage	150% of rated voltage at 23°C, 110% of rated voltage at 70°C					
Power consumption	Approx. 400 mW					

Note: Rated current and coil resistance are measured at 23°C with a tolerance of ±10%.

### ■ CONTACT RATINGS

Load	Resistive load	Inductive load
Rated load	2 A (NO)/2 A (NC) at 277 VAC 3 A (NO)/3 A (NC) at 125 VAC 3 A (NO)/3 A (NC) at 30 VDC	0.5 A at 250 VAC, cosφ=0.4 1 A at 250 VAC, cosφ=0.6 0.8 A at 250 VAC, cosφ=0.8
Contact material	Ag	
Rated carry current	5 A (NO)/3 A (NC)	
Max. switching voltage	277 VAC, 30 VDC	
Max. switching current	5 A (NO)/3 A (NC)	1 A
Max. switching capacity	625 VA, 150 W (NO) 375 VA, 90 W (NC)	250 VA
Min. permissible load	10 mA at 5 VDC	

Note: P level: λ80=0.1 × 10<sup>-6</sup> operation (with an operating frequency of 120 operations/min.)

### ■ CHARACTERISTICS

Contact resistance (See Note 2.)	100 mΩ max.
Operate time (See Note 3.)	10 ms max.
Release time (See Note 3.)	5 ms max.
Insulation resistance (See Note 4.)	1,000 MΩ min.
Dielectric strength	4,000 VAC, 50/60 Hz for 1 min between coil and contacts 750 VAC, 50/60 Hz for 1 min between contacts of same polarity
Impulse withstand voltage	6 kV (1.2 × 50 μs)
Vibration resistance	Destruction: 10 to 55 Hz, 1.5-mm double amplitude for 2 hours Malfunction: 10 to 55 Hz, 1.5-mm double amplitude for 3 minutes
Shock resistance	Destruction: 1,000 m/s <sup>2</sup> (approx. 100G) Malfunction: Energized: 100 m/s <sup>2</sup> (approximately 10G) Non-energized: 50 m/s <sup>2</sup> (approximately 5G)

(This table continues on the next page.)

Radial Lead Type

Series: M Type : A

■ Features

Endurance:85°C 2000 h  
Smaller than series SU

Standard

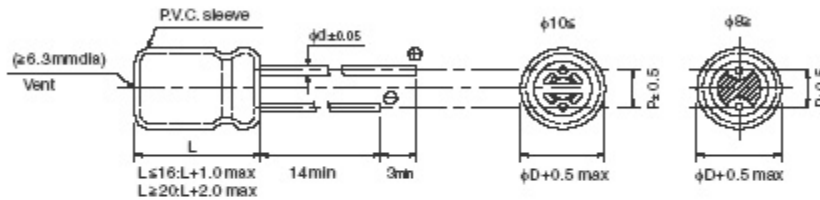
Japan  
Malaysia  
China  
Taiwan



■ Specifications

Category Temp. Range	-40 to + 85°C		-25 to + 85°C												
Rated W.V. Range	6.3 to 100 V .DC		160 to 450 V .DC												
Nominal Cap. Range	0.1 to 22000 μF		1.0 to 470 μF												
Capacitance Tolerance	±20 % (120Hz/+20°C)														
DC Leakage Current	I ≤ 0.03 CV or 4(μA) after 1 minutes I ≤ 0.01 CV or 3(μA) after 2 minutes ( Whichever, is greater)		I ≤ 0.06 CV + 10(μA) after 2 minutes												
Dissipation Factor	Please see the attached standard products list														
Characteristics at Low Temperature	W.V.(V)	6.3	10	16	25	35	50	63	100	160	200	250	350	400	450
	Z(-25°C)/Z(+20°C)	5	4	3	2	2	2	2	2	2	2	3	5	6	6
	Z(-40°C)/Z(+20°C)	12	10	8	5	4	3	3	3	-	-	-	-	-	-
Endurance	After applying rated working voltage for 2000 hours at +85°C and then being stabilized at +20°C, capacitor shall meet the following limits.														
	Capacitance change	± 20% of initial measured value													
	D.F.	≤ 150 % of initial specified value													
	DC leakage current	≤ initial specified value													
Shelf Life	After storage for 1000 hours at +85±2 °C with no voltage applied and then being stabilized at +20 °C, capacitors shall meet the limits specified in "Endurance".(With voltage treatment)														

■ Dimensions in mm (not to scale)



Body Dia. φD	5	6.3	8	10	12.5	16	18
Lead Dia. φd	0.5	0.5	0.6	0.6	0.6	0.8	0.8
Lead space P	2	2.5	3.5	5	5	7.5	7.5

Design and specifications are subject to change without notice. Ask factory for technical specifications before purchase and/or use.

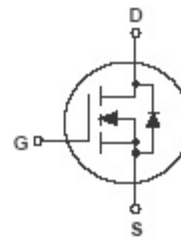
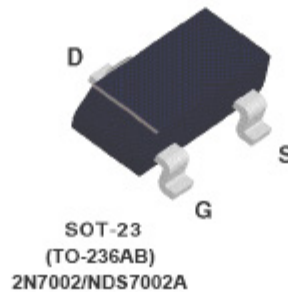
**2N7000 / 2N7002 / NDS7002A**  
**N-Channel Enhancement Mode Field Effect Transistor**

**General Description**

These N-Channel enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. These products have been designed to minimize on-state resistance while provide rugged, reliable, and fast switching performance. They can be used in most applications requiring up to 400mA DC and can deliver pulsed currents up to 2A. These products are particularly suited for low voltage, low current applications such as small servo motor control, power MOSFET gate drivers, and other switching applications.

**Features**

- High density cell design for low  $R_{DS(ON)}$
- Voltage controlled small signal switch.
- Rugged and reliable.
- High saturation current capability.



**Absolute Maximum Ratings**  $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	2N7000	2N7002	NDS7002A	Units
$V_{DSS}$	Drain-Source Voltage		60		V
$V_{DGR}$	Drain-Gate Voltage ( $R_{GS} \leq 1 \text{ M}\Omega$ )		60		V
$V_{GSS}$	Gate-Source Voltage - Continuous		$\pm 20$		V
	- Non Repetitive ( $t_p < 50\mu\text{s}$ )		$\pm 40$		
$I_D$	Maximum Drain Current - Continuous	200	115	280	mA
	- Pulsed	500	800	1500	
$P_D$	Maximum Power Dissipation	400	200	300	mW
	Derated above $25^\circ\text{C}$	3.2	1.6	2.4	
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150		-65 to 150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300			$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	312.5	625	417	$^\circ\text{C}/\text{W}$
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Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted							
Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>							
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 10\ \mu\text{A}$	All	60			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 125^\circ\text{C}$	2N7000			1	$\mu\text{A}$
		$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ $T_J = 125^\circ\text{C}$	2N7002 NDS7002A			1	$\mu\text{A}$
$I_{GSSF}$	Gate - Body Leakage, Forward	$V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$	2N7000			10	nA
		$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	2N7002 NDS7002A			100	nA
$I_{GSSR}$	Gate - Body Leakage, Reverse	$V_{GS} = -15\text{ V}, V_{DS} = 0\text{ V}$	2N7000			-10	nA
		$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	2N7002 NDS7002A			-100	nA
<b>ON CHARACTERISTICS (Note 1)</b>							
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	2N7000	0.8	2.1	3	V
		$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	2N7002 NDS7002A	1	2.1	2.5	
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $T_J = 125^\circ\text{C}$	2N7000		1.2	5	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		1.8	5.3		
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $T_J = 100^\circ\text{C}$	2N7002		1.2	7.5	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$ $T_J = 100^\circ\text{C}$		1.7	13.5		
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$ $T_J = 100^\circ\text{C}$		1.7	7.5		
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$ $T_J = 125^\circ\text{C}$	NDS7002A		1.2	2	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$ $T_J = 125^\circ\text{C}$		2	3.5		
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$ $T_J = 125^\circ\text{C}$		1.7	3		
$V_{DS(ON)}$	Drain-Source On-Voltage	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7000		0.6	2.5	V
		$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		0.14	0.4		
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	2N7002		0.6	3.75	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$		0.09	1.5		
		$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$	NDS7002A		0.6	1	
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$		0.09	0.15		

2N7000.SAM Rev. A1

**SUBJECT:** ECJ-xxxxxxx Series Multi-Layer Ceramic Chip Capacitor Standard Capacitance Values in 0402, 0603, 0805, 1206 Case Sizes

**BULLETIN #:** ECN.PG33.05.26.04-1

**Date:** May 26, 2004 supercedes

**BULLETIN #:** ECN.PG33.03.17.04-2

**Dated:** March 17, 2004

**Page 1 of 4**

**WHICH WAS PREVIOUSLY INCORRECTLY LISTED AS A DISCONTINUATION NOTICE IS NOW CORRECTLY LISTED AS “ NOT RECOMMENDED FOR NEW DESIGNS ” NOTICE**

**EFFECTIVE DATE:** April 1, 2004

**REASON FOR CHANGE:** Moving the particular capacitance values into a smaller size package in line with industry trends and technology capability. In some instances, because of low usage, some capacitance values will not be available in the future. These P/Ns are those being considered.

**ENGINEERING CHANGE DETAILS:** See below for the particular part numbers.

**OTHER DETAILS:**

**Affected Part Numbers:** [ P/Ns with or without 'dash' '-' are valid ]

<u>Case Size</u>	<u>Nominal Capacitance</u>	<u>Old Part Number</u>	<u>New Part Number</u>
0402	1,500 pF	ECJ-0EF1H152x	No Replacement
0402	3,300 pF	ECJ-0EF1H332x	No Replacement
0402	6,800 pF	ECJ-0EF1H682x	No Replacement
0402	1,500 pF	ECJ-0EF1E152x	No Replacement
0402	3,300 pF	ECJ-0EF1E332x	No Replacement
0402	6,800 pF	ECJ-0EF1E682x	No Replacement
0402	15,000 pF	ECJ-0EF1E153x	No Replacement
0402	15,000 pF	ECJ-0EF1C153x	No Replacement
0402	33,000 pF	ECJ-0EF1C333x	No Replacement
0402	68,000 pF	ECJ-0EF1C683x	No Replacement
0603	0.12 $\mu$ F	ECJ-1VB1A124x	No Replacement
0603	0.18 $\mu$ F	ECJ-1VB1A184x	No Replacement
0603	0.27 $\mu$ F	ECJ-1VB0J274x	No Replacement
0603	0.33 $\mu$ F	ECJ-1VB0J334x	No Replacement
0603	0.39 $\mu$ F	ECJ-1VB0J394x	No Replacement
0603	0.56 $\mu$ F	ECJ-1VB0J564x	No Replacement
0603	0.82 $\mu$ F	ECJ-1VB0J824x	No Replacement
0603	1,000 pF	ECJ-1VF1H102x	No Replacement
0603	1,500 pF	ECJ-1VF1H152x	No Replacement
0603	2,200 pF	ECJ-1VF1H222x	No Replacement
0603	3,300 pF	ECJ-1VF1H332x	No Replacement
0603	4,700 pF	ECJ-1VF1H472x	No Replacement
0603	6,800 pF	ECJ-1VF1H682x	No Replacement
0603	15,000 pF	ECJ-1VF1H153x	No Replacement
0603	33,000 pF	ECJ-1VF1H333x	No Replacement
0603	68,000 pF	ECJ-1VF1H683x	No Replacement
0603	68,000 pF	ECJ-1VF1E683x	No Replacement
0603	0.15 $\mu$ F	ECJ-1VF1C154x	No Replacement
0603	0.33 $\mu$ F	ECJ-1VF1C334x	No Replacement
0603	0.68 $\mu$ F	ECJ-1VF1A684x	No Replacement



# CERAMIC CAPACITORS

## MA Series: Multilayer Surface Mount

### STANDARD VOLTAGES AND CAPACITANCE RANGES (pF)

Temperature Coefficient			COG/NPO	X7R	X5R	Y5V
Size Code	Voltage	Code	(CG)	(XR)	(XR)	(YV)
0402	6.3V	060			100,000 - 1,000,000	
	10V	100		27,000 - 47,000	47,000 - 1,000,000	
	16V	160		5,600 - 22,000		47,000 - 100,000
	25V	250	0.5 - 470	3,900 - 4,700		10,000 - 47,000
	50V	500	0.5 - 220	120 - 3,300		10,000 - 47,000
0603	6.3V	060			1,000,000 - 2,200,000	2,200,000
	10V	100		120,000 - 220,000	330,000 - 680,000	470,000 - 1,000,000
	16V	160		33,000 - 100,000		220,000 - 1,000,000
	25V	250	1,000 - 2,200	27,000 - 100,000		10,000 - 220,000
	50V	500	0.5 - 2,200	120 - 100,000		10,000 - 100,000
	100V	101	0.5 - 680	120 - 10,000		
0805	6.3V	060			2,200,000 - 10,000,000	10,000,000
	10V	100		330,000 - 1,000,000	1,000,000 - 4,700,000	2,200,000 - 10,000,000
	16V	160		120,000 - 470,000	330,000 - 1,000,000	330,000 - 2,200,000
	25V	250	5,600 - 15,000	100,000 - 330,000		100,000 - 1,000,000
	50V	500	0.5 - 4,700	120 - 100,000		10,000 - 1,000,000
	100V	101	0.5 - 2,700	120 - 22,000		
	250V	251	0.5 - 1,500	150 - 22,000		
	500V	501	0.5 - 470	150 - 5,600		
	1000V	102	0.5 - 270	150 - 2,700		
1206	10V	100		1,000,000	3,300,000 - 10,000,000	2,200,000 - 22,000,000
	16V	160		330,333 - 1,000,000	2,200,000 - 4,700,000	2,200,000 - 4,700,000
	25V	250	8,2000 - 47,000	120,000 - 1,000,000		100,000 - 1,000,000
	50V	500	0.5 - 4,700	220 - 470,000		10,000 - 1,000,000
	100V	101	0.5 - 2,700	220 - 100,000		
	250V	251	0.5 - 3,900	150 - 47,000		
	500V	501	0.5 - 2,200	150 - 22,000		
	1000V	102	0.5 - 1,500	150 - 3,300		
	2000V	202	0.5 - 270	150 - 1,000		
1210	6.3V	060			22,000,000 - 47,000,000	
	10V	100			22,000,000	22,000,000 - 47,000,000
	16V	160			6,800,000 - 10,000,000	10,000,000 - 22,000,000
	25V	250	12,000 - 22,000	220,000 - 4,700,000		10,000,000
	50V	500	5,600 - 15,000	120,000 - 1,000,000	2,200,000 - 3,300,000	
	100V	101	1,000 - 10,000	47,000 - 220,000		
	250V	251	1,000 - 6,800	56,000 - 100,000		
	500V	501	1,000 - 3,300	150 - 22,000		
	1000V	102	0.5 - 2,200	150 - 3,900		
	2000V	202	0.5 - 560	150 - 1,800		
1812 (also 1808 size for 250V - 3KV)	6.3V	060			47,000 - 100,000,000	100,000,000
	16V	160			22,000	47,000,000
	25V	250	47,000 - 100,000			
	50V	500	4,700 - 33,000	220,000 - 3,300,000		
	100V	101	1,200 - 27,000	100,000 - 680,000		
	250V	251	1,000 - 12,000	150 - 470,000		
	500V	501	1,000 - 5,600	150 - 100,000		
	1000V	102	0.5 - 4,700	150 - 22,000		
	2000V	202	0.5 - 1,200	150 - 4,700		
3000V	302	0.5 - 390	150 - 2,200			

\*Surface mount offerings continue to change, please contact RFE International, for values, sizes, and voltages not listed.

### PART NUMBER EXAMPLE

MA 1206 XR 104 K 500 R

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