# 2N3055A (NPN), MJ15015 (NPN), MJ15016 (PNP)

**MJ15015 and MJ15016 are Preferred Devices**

# Complementary Silicon High-Power Transistors

These PowerBase™ complementary transistors are designed for high power audio, stepping motor and other linear applications. These devices can also be used in power switching circuits such as relay or solenoid drivers, dc−to−dc converters, inverters, or for inductive loads requiring higher safe operating area than the 2N3055.

### Features

- Current−Gain − Bandwidth−Product @ $I_C$ = 1.0 Adc
  $f_T$ = 0.8 MHz (Min) − NPN
  = 2.2 MHz (Min) − PNP
- Safe Operating Area − Rated to 60 V and 120 V, Respectively
- Pb−Free Packages are Available*

**MAXIMUM RATINGS** (Note 1)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage<br>2N3055A<br>MJ15015, MJ15016 | $V_{CEO}$ | <br>60<br>120 | Vdc |
| Collector−Base Voltage<br>2N3055A<br>MJ15015, MJ15016 | $V_{CBO}$ | <br>100<br>200 | Vdc |
| Collector−Emitter Voltage Base Reversed Biased<br>2N3055A<br>MJ15015, MJ15016 | $V_{CEV}$ | <br>100<br>200 | Vdc |
| Emitter−Base Voltage | $V_{EBO}$ | 7.0 | Vdc |
| Collector Current − Continuous | $I_C$ | 15 | Adc |
| Base Current | $I_B$ | 7.0 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C 2N3055A<br><br>Total Device Dissipation @ $T_C$ = 25°C<br>Derate above 25°C<br>MJ15015, MJ15016 | $P_D$ | 115<br>0.65<br><br>180<br>1.03 | W<br>W/°C |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | −65 to +200 | °C |

**THERMAL CHARACTERISTICS**

| Characteristics | Symbol | Max | Max | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 1.52 | 0.98 | °C/W |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Indicates JEDEC Registered Data. (2N3055A)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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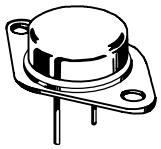
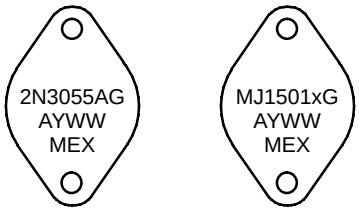
**http://onsemi.com**

## 15 AMPERE COMPLEMENTARY SILICON POWER TRANSISTORS 60, 120 VOLTS − 115, 180 WATTS



**TO−204AA (TO−3)**
**CASE 1−07**
**STYLE 1**

**MARKING DIAGRAMS**




2N3055A = Device Code
MJ1501x = Device Code
x = 5 or 6
G = Pb−Free Package
A = Assembly Location
Y = Year
WW = Work Week
MEX = Country of Origin

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** (Note 2) | | | | | |
| Collector−Emitter Sustaining Voltage (Note 3)<br>($I_C$ = 200 mAdc, $I_B$ = 0) | 2N3055A<br>MJ15015, MJ15016 | $V_{CEO(sus)}$ | 60<br>120 | −<br>− | Vdc |
| Collector Cutoff Current<br>($V_{CE}$ = 30 Vdc, $V_{BE(off)}$ = 0 Vdc)<br>($V_{CE}$ = 60 Vdc, $V_{BE(off)}$ = 0 Vdc) | <br>2N3055A<br>MJ15015, MJ15016 | $I_{CEO}$ | <br>−<br>− | <br>0.7<br>0.1 | mAdc |
| Collector Cutoff Current (Note 3)<br>($V_{CEV}$ = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) | 2N3055A<br>MJ15015, MJ15016 | $I_{CEV}$ | −<br>− | 5.0<br>1.0 | mAdc |
| Collector Cutoff Current<br>($V_{CEV}$ = Rated Value, $V_{BE(off)}$ = 1.5 Vdc,<br>$T_C$ = 150°C) | <br>2N3055A<br>MJ15015, MJ15016 | $I_{CEV}$ | <br>−<br>− | <br>30<br>6.0 | mAdc |
| Emitter Cutoff Current<br>($V_{EB}$ = 7.0 Vdc, $I_C$ = 0) | 2N3055A<br>MJ15015, MJ15016 | $I_{EBO}$ | −<br>− | 5.0<br>0.2 | mAdc |
| **SECOND BREAKDOWN** (Note 3) | | | | | |
| Second Breakdown Collector Current with Base Forward Biased<br>(t = 0.5 s non−repetitive)<br>($V_{CE}$ = 60 Vdc) | <br>2N3055A<br>MJ15015, MJ15016 | $I_{S/b}$ | <br>1.95<br>3.0 | <br>−<br>− | Adc |
| **ON CHARACTERISTICS** (Note 2 and 3) | | | | | |
| DC Current Gain<br>($I_C$ = 4.0 Adc, $V_{CE}$ = 2.0 Vdc)<br>($I_C$ = 4.0 Adc, $V_{CE}$ = 4.0 Vdc)<br>($I_C$ = 10 Adc, $V_{CE}$ = 4.0 Vdc) | | $h_{FE}$ | <br>10<br>20<br>5.0 | <br>70<br>70<br>− | − |
| Collector−Emitter Saturation Voltage<br>($I_C$ = 4.0 Adc, $I_B$ = 400 mAdc)<br>($I_C$ = 10 Adc, $I_B$ = 3.3 Adc)<br>($I_C$ = 15 Adc, $I_B$ = 7.0 Adc) | | $V_{CE(sat)}$ | <br>−<br>−<br>− | <br>1.1<br>3.0<br>5.0 | Vdc |
| Base−Emitter On Voltage<br>($I_C$ = 4.0 Adc, $V_{CE}$ = 4.0 Vdc) | | $V_{BE(on)}$ | 0.7 | 1.8 | Vdc |
| **DYNAMIC CHARACTERISTICS** (Note 3) | | | | | |
| Current−Gain − Bandwidth Product<br>($I_C$ = 1.0 Adc, $V_{CE}$ = 4.0 Vdc, f = 1.0 MHz) | 2N3055A, MJ15015<br>MJ15016 | $f_T$ | 0.8<br>2.2 | 6.0<br>18 | MHz |
| Output Capacitance<br>($V_{CB}$ = 10 Vdc, $I_E$ = 0, f = 1.0 MHz) | | $C_{ob}$ | 60 | 600 | pF |
| **SWITCHING CHARACTERISTICS** (2N3055A only) (Note 3) | | | | | |
| **RESISTIVE LOAD** | | | | | |
| Delay Time | ($V_{CC}$ = 30 Vdc, $I_C$ = 4.0 Adc, $I_{B1}$ = $I_{B2}$ = 0.4 Adc, $t_p$ = 25 μs Duty Cycle ≤ 2%) | $t_d$ | − | 0.5 | μs |
| Rise Time | | $t_r$ | − | 4.0 | μs |
| Storage Time | | $t_s$ | − | 3.0 | μs |
| Fall Time | | $t_f$ | − | 6.0 | μs |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.
3. Indicates JEDEC Registered Data. (2N3055A)

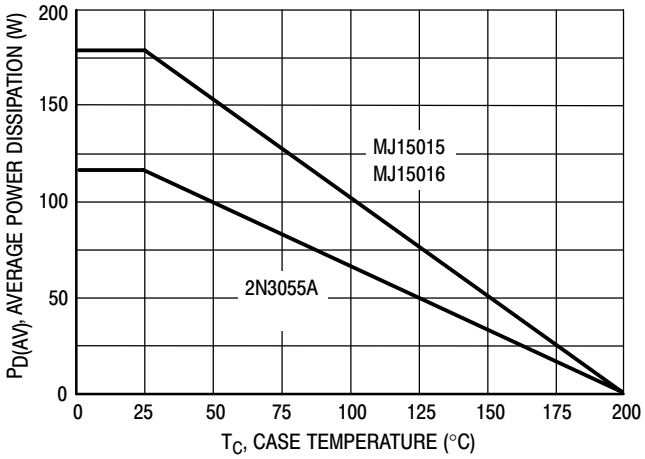



**Figure 1. Power Derating**

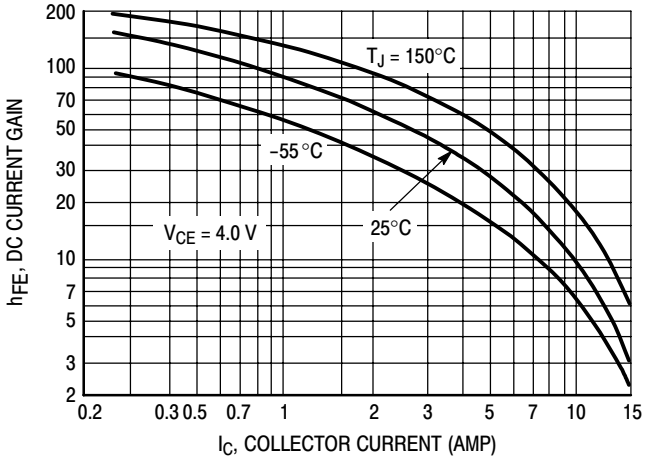



**Figure 2. DC Current Gain**

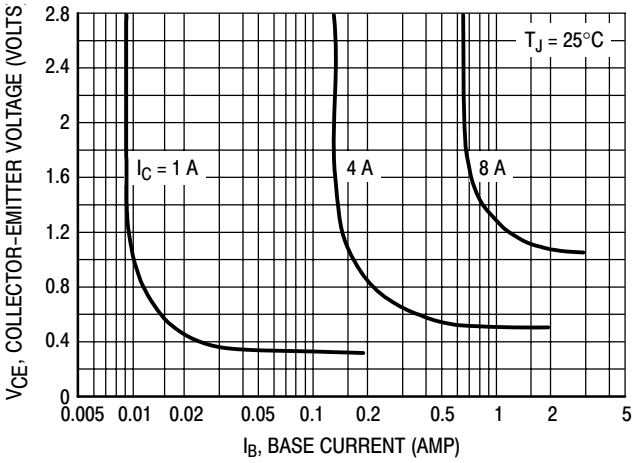



**Figure 3. Collector Saturation Region**

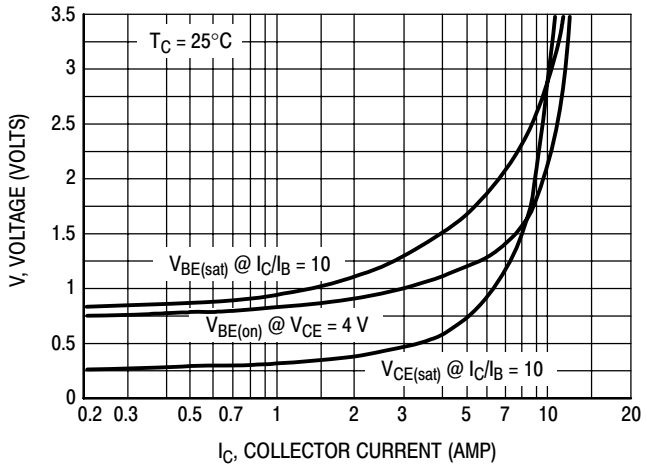



**Figure 4. “On” Voltages**

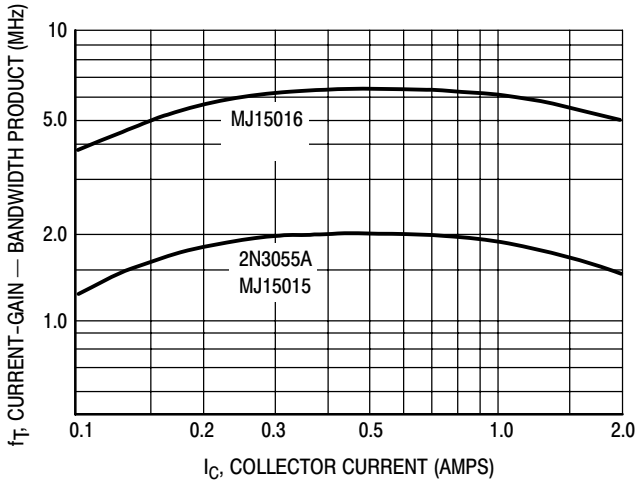



**Figure 5. Current−Gain — Bandwidth Product**

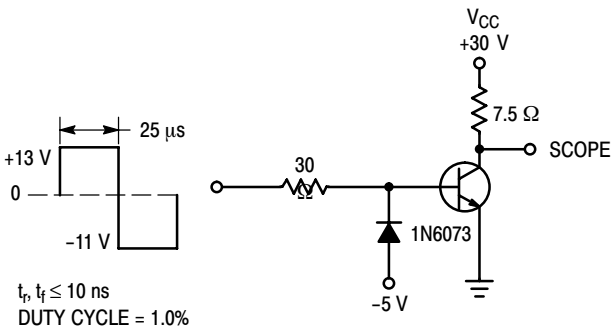



**Figure 6. Switching Times Test Circuit (Circuit shown is for NPN)**

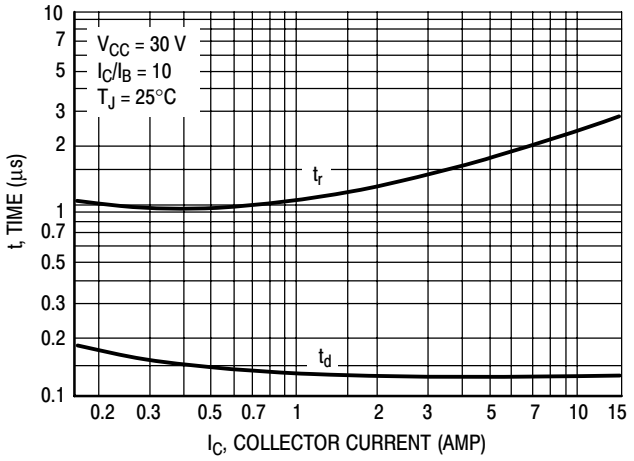



**Figure 7. Turn−On Time**

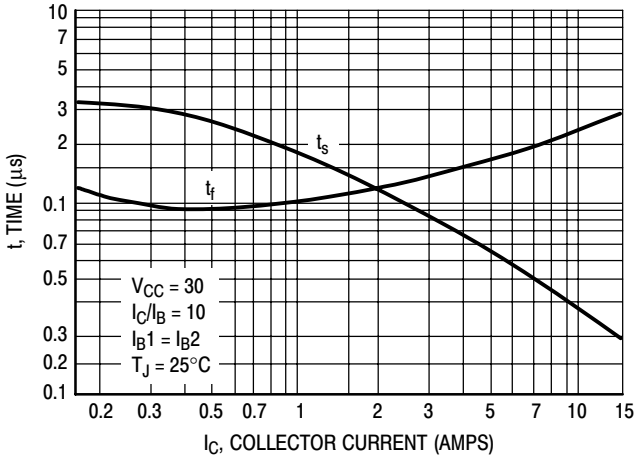



**Figure 8. Turn−Off Times**

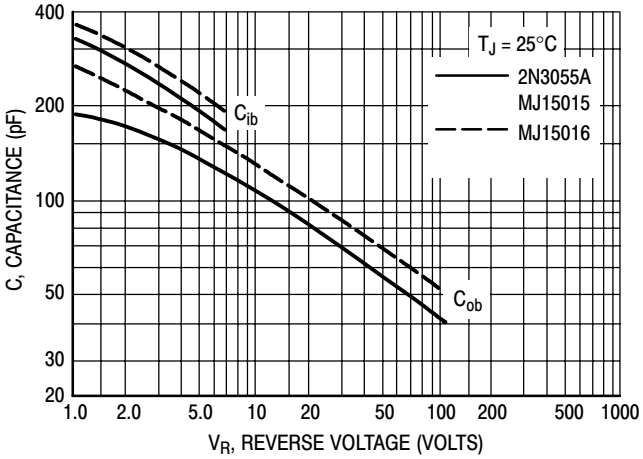



**Figure 9. Capacitances**

## COLLECTOR CUT−OFF REGION

**NPN**

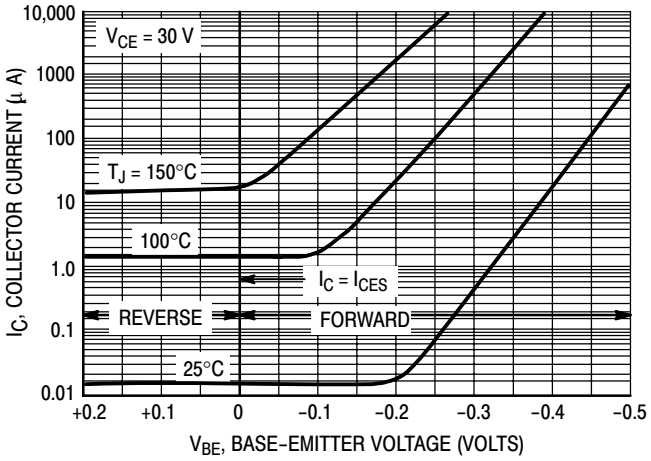



**Figure 10. 2N3055A, MJ15015**

**PNP**

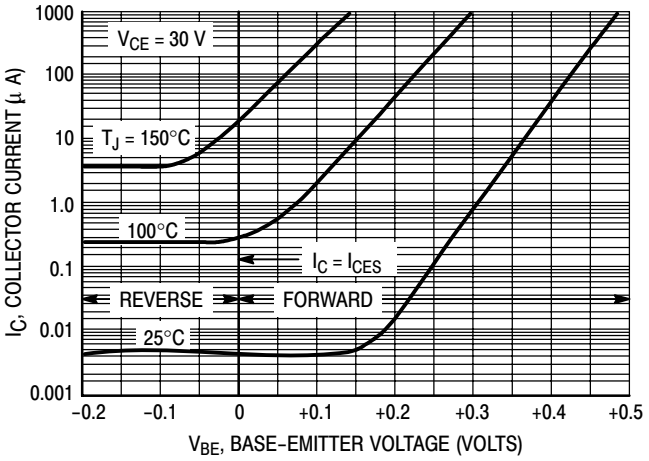



**Figure 11. MJ15016**

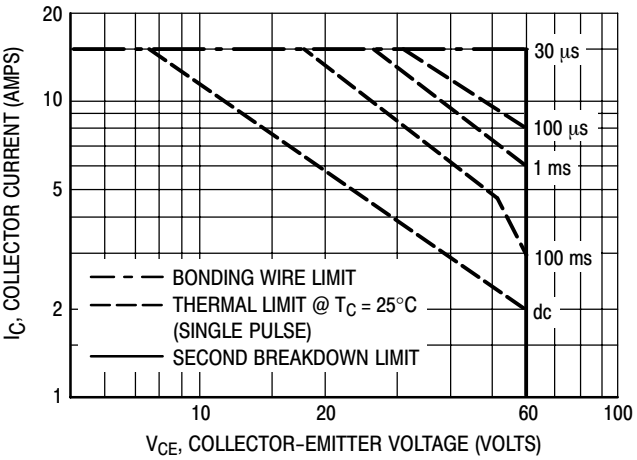



**Figure 12. Forward Bias Safe Operating Area 2N3055A**

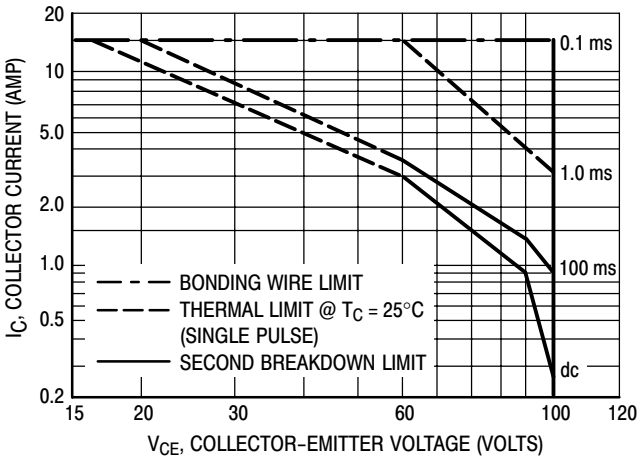



**Figure 13. Forward Bias Safe Operating Area MJ15015, MJ15016**

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe Operating area curves indicate $I_C - V_{CE}$ limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

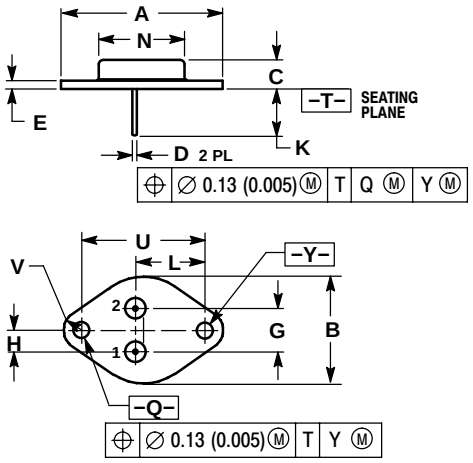
The data of Figures 12 and 13 is based on $T_C$ = 25°C; $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated for temperature according to Figure 1.

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| 2N3055A | TO−204 | 100 Units / Tray |
| 2N3055AG | TO−204 (Pb−Free) | |
| MJ15015 | TO−204 | 100 Units / Tray |
| MJ15015G | TO−204 (Pb−Free) | |
| MJ15016 | TO−204 | |
| MJ15016G | TO−204 (Pb−Free) | |

## PACKAGE DIMENSIONS

**TO−204 (TO−3)**
CASE 1−07
ISSUE Z




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. ALL RULES AND NOTES ASSOCIATED WITH REFERENCED TO−204AA OUTLINE SHALL APPLY.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 1.550 REF | | 39.37 REF | |
| B | --- | 1.050 | --- | 26.67 |
| C | 0.250 | 0.335 | 6.35 | 8.51 |
| D | 0.038 | 0.043 | 0.97 | 1.09 |
| E | 0.055 | 0.070 | 1.40 | 1.77 |
| G | 0.430 BSC | | 10.92 BSC | |
| H | 0.215 BSC | | 5.46 BSC | |
| K | 0.440 | 0.480 | 11.18 | 12.19 |
| L | 0.665 BSC | | 16.89 BSC | |
| N | --- | 0.830 | --- | 21.08 |
| Q | 0.151 | 0.165 | 3.84 | 4.19 |
| U | 1.187 BSC | | 30.15 BSC | |
| V | 0.131 | 0.188 | 3.33 | 4.77 |

STYLE 1:
PIN 1. BASE
2. EMITTER
CASE: COLLECTOR



### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
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**Fax**: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
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2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
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