

Plastic Darlington Complementary Silicon Power Transistors

... designed for general-purpose amplifier and low-speed switching applications.

- High DC Current Gain —
 $h_{FE} = 2000$ (Typ) @ $I_C = 2.0$ Adc
- Collector-Emitter Sustaining Voltage — @ 100 mAdc
 $V_{CE(sus)} = 60$ Vdc (Min) — 2N6035, 2N6038
 $= 80$ Vdc (Min) — 2N6036, 2N6039
- Forward Biased Second Breakdown Current Capability
 $I_{S/b} = 1.5$ Adc @ 25 Vdc
- Monolithic Construction with Built-In Base-Emitter Resistors to Limit Leakage Multiplication
- Space-Saving High Performance-to-Cost Ratio TO-225AA Plastic Package

MAXIMUM RATINGS (1)

Rating	Symbol	2N6035 2N6038	2N6036 2N6039	Unit
Collector–Emitter Voltage	V _{CEO}	60	80	V _{dc}
Collector–Base Voltage	V _{CB}	60	80	V _{dc}
Emitter–Base Voltage	V _{EB}	5.0		V _{dc}
Collector Current — Continuous Peak	I _C	4.0 8.0		Adc
Base Current	I _B	100		mAdc
Total Power Dissipation @ T _C = 25°C Derate above 25°C	P _D	40 0.32		Watts W/°C
Total Power Dissipation @ T _A = 25°C Derate above 25°C	P _D	1.5 0.012		Watts
Operating and Storage Junction Temperature Range	T _J , T _{stg}	–65 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	θ_{JC}	3.12	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	θ_{JA}	83.3	$^\circ\text{C/W}$

(1) Indicates JEDEC Registered Data.

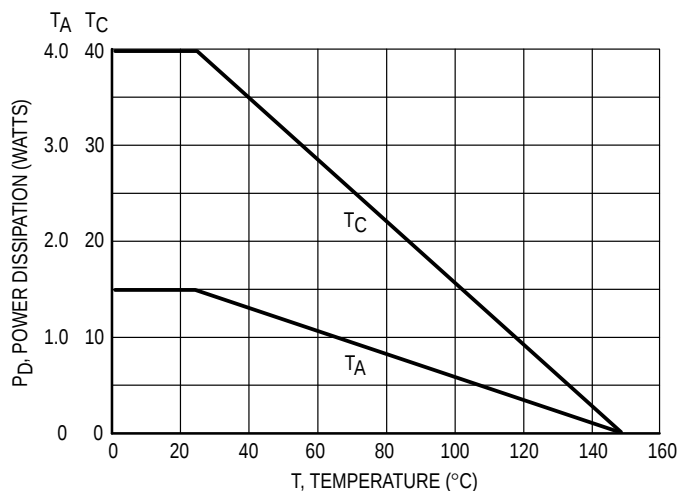


Figure 1. Power Derating

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

REV 7

2N6030 thru 2N6031
(See 2N5630)

PNP
2N6035

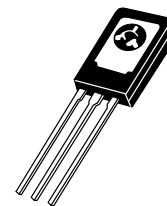
2N6036*

NPN
2N6038

2N6039*

*Motorola Preferred Device

DARLINGTON
4-AMPERE
COMPLEMENTARY
SILICON
POWER TRANSISTORS
60, 80 VOLTS
40 WATTS



CASE 77-08
TO-225AA TYPE

2N6035 2N6036 2N6038 2N6039

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CE(sus)}$	60 80	— —	Vdc
Collector–Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $I_B = 0$) ($V_{CE} = 80\text{ Vdc}$, $I_B = 0$)	I_{CEO}	— —	100 100	μA
Collector–Cutoff Current ($V_{CE} = 60\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 80\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CE} = 60\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 125^\circ\text{C}$) ($V_{CE} = 80\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 125^\circ\text{C}$)	I_{CEX}	— — — —	100 100 500 500	μA
Collector–Cutoff Current ($V_{CB} = 60\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 80\text{ Vdc}$, $I_E = 0$)	I_{CBO}	— —	0.5 0.5	mAdc
Emitter–Cutoff Current ($V_{BE} = 5.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	2.0	mAdc

ON CHARACTERISTICS

DC Current Gain ($I_C = 0.5\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$) ($I_C = 2.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$) ($I_C = 4.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$)	h_{FE}	500 750 100	— 15,000 —	—
Collector–Emitter Saturation Voltage ($I_C = 2.0\text{ Adc}$, $I_B = 8.0\text{ mAdc}$) ($I_C = 4.0\text{ Adc}$, $I_B = 40\text{ mAdc}$)	$V_{CE(sat)}$	— —	2.0 3.0	Vdc
Base–Emitter Saturation Voltage ($I_C = 4.0\text{ Adc}$, $I_B = 40\text{ mAdc}$)	$V_{BE(sat)}$	—	4.0	Vdc
Base–Emitter On Voltage ($I_C = 2.0\text{ Adc}$, $V_{CE} = 3.0\text{ Vdc}$)	$V_{BE(on)}$	—	2.8	Vdc

DYNAMIC CHARACTERISTICS

Small–Signal Current–Gain ($I_C = 0.75\text{ Adc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ MHz}$)	$ h_{fe} $	25	—	—
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1\text{ MHz}$)	C_{ob}	— —	200 100	pF

* Indicates JEDEC Registered Data.

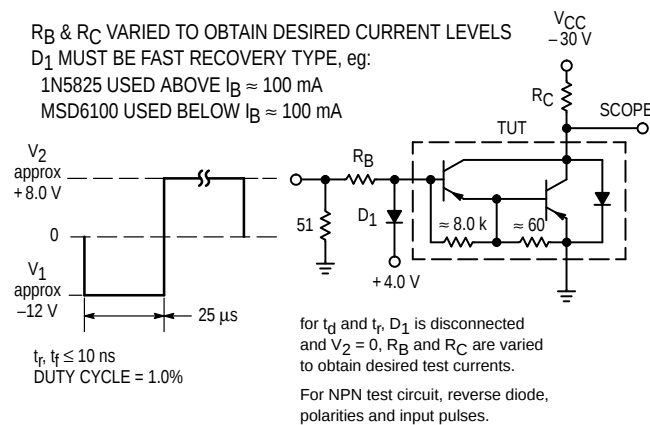


Figure 2. Switching Times Test Circuit

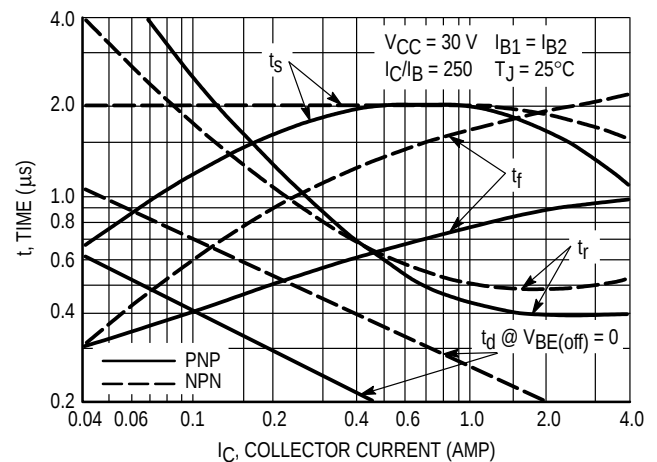


Figure 3. Switching Times

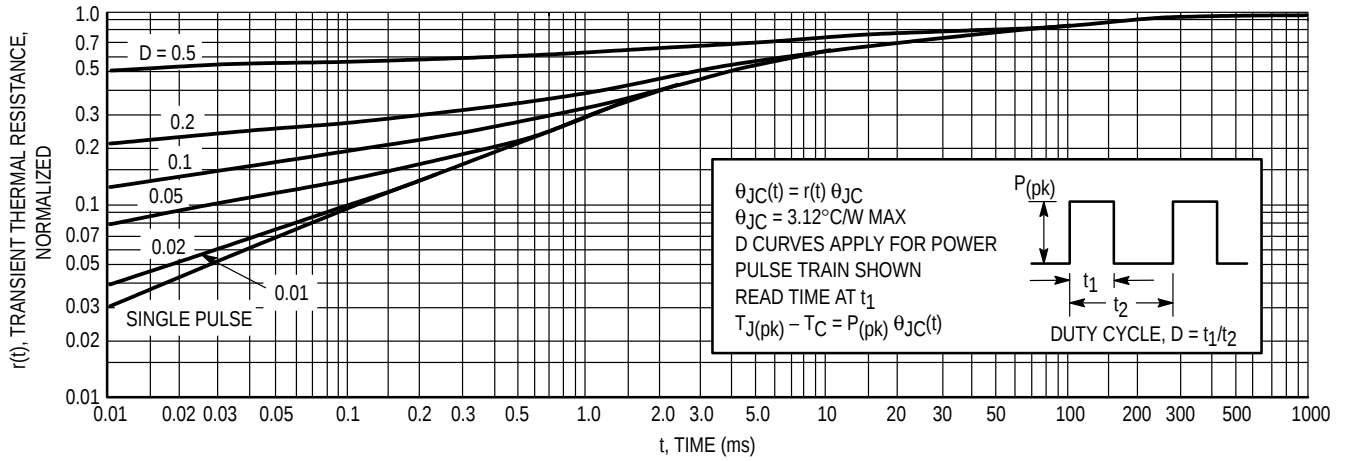


Figure 4. Thermal Response

ACTIVE-REGION SAFE-OPERATING AREA

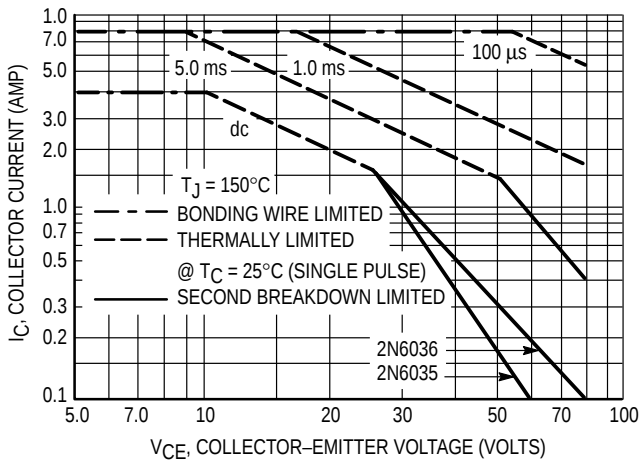


Figure 5. 2N6035, 2N6036

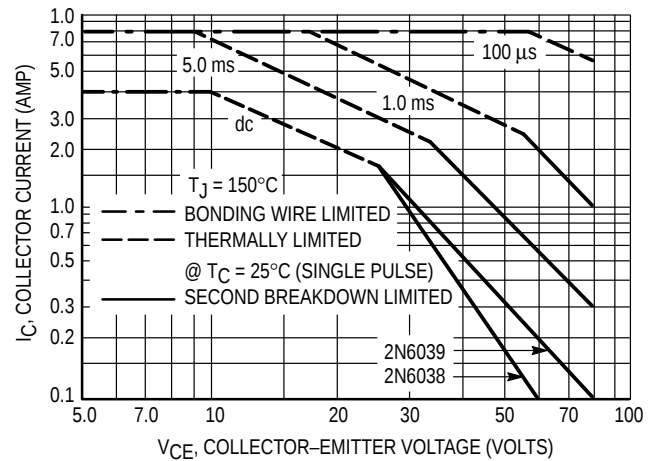


Figure 6. 2N6038, 2N6039

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 5 and 6 is based on $T_{J(pk)} = 150^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} < 150^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

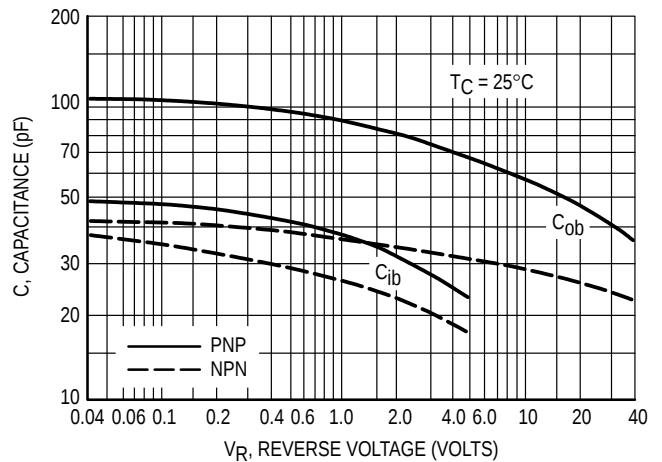


Figure 7. Capacitance

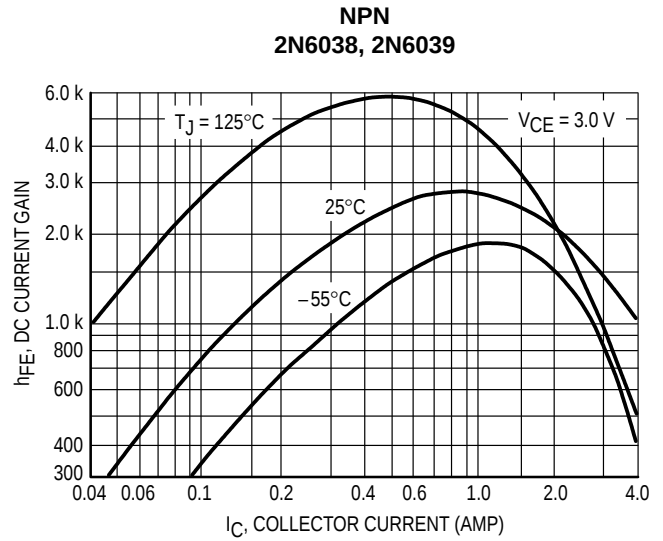
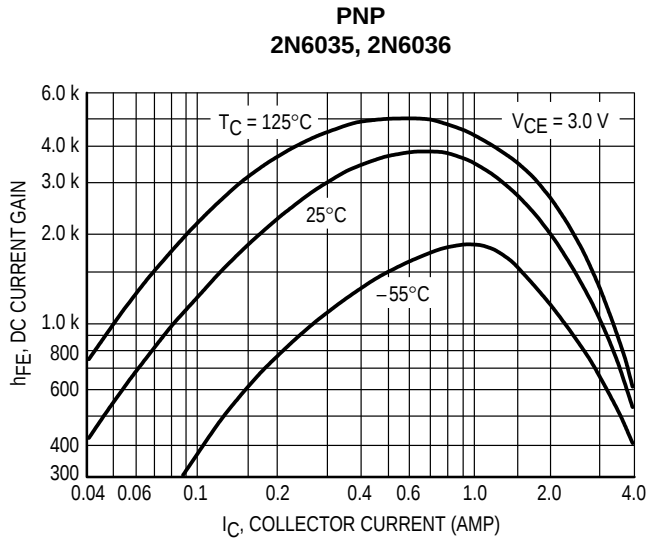


Figure 8. DC Current Gain

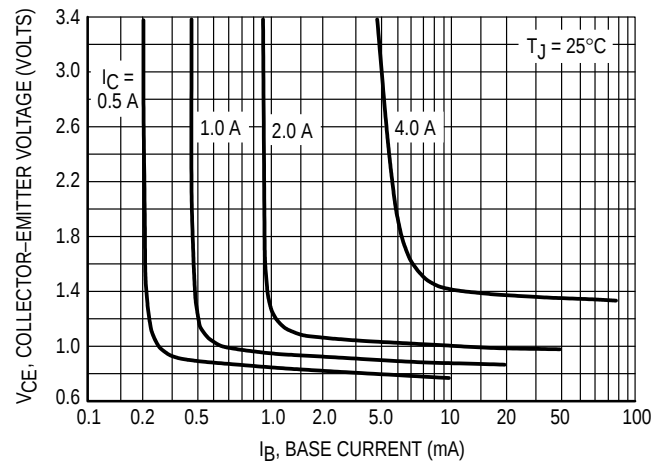
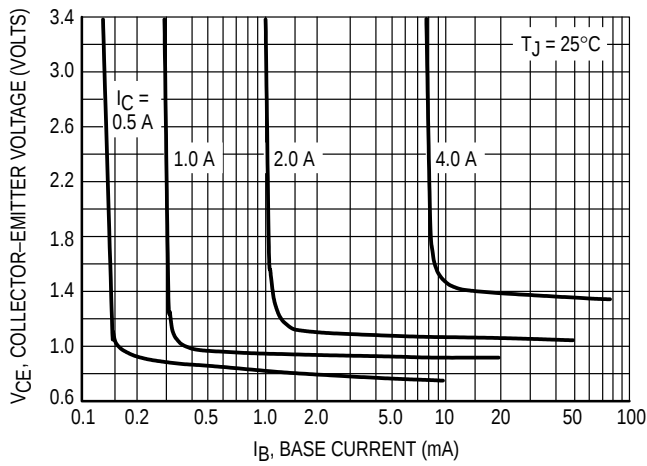


Figure 9. Collector Saturation Region

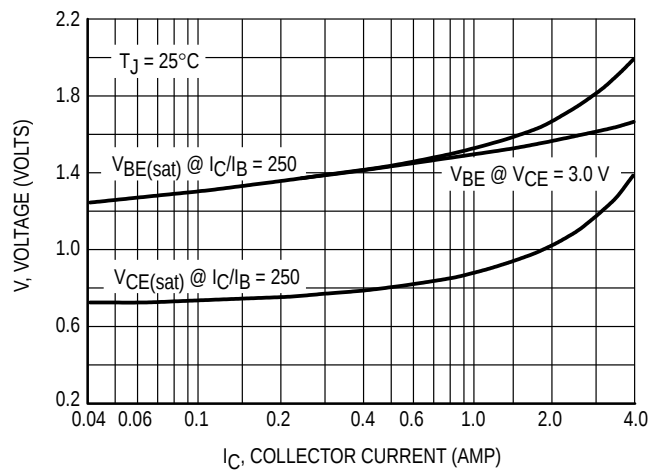
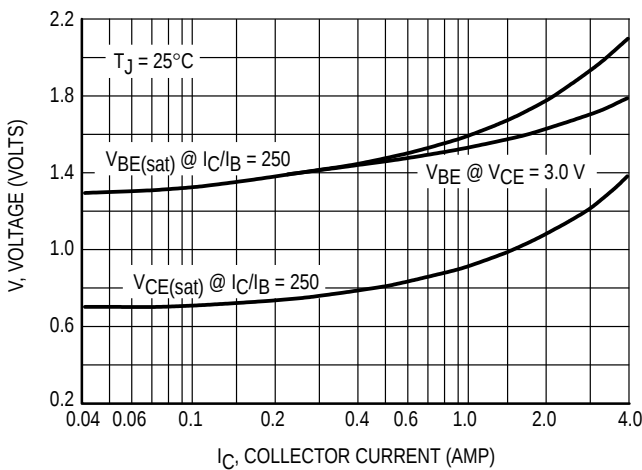
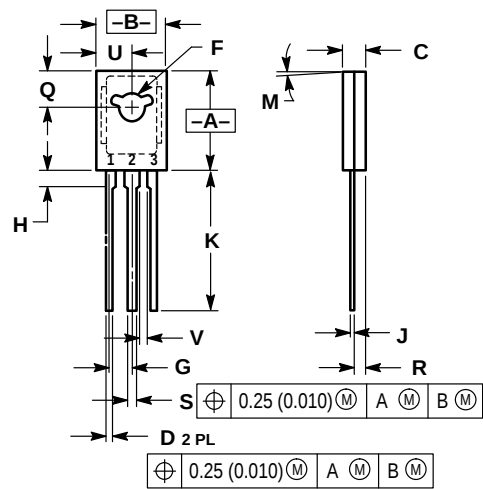


Figure 10. "On" Voltages

PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.055	1.15	1.39
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	—	1.02	—

- STYLE 1:
1. EMITTER
 2. COLLECTOR
 3. BASE

CASE 77-08
TO-225AA TYPE
ISSUE V

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

How to reach us:

USA / EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244-6609
INTERNET: <http://Design-NET.com>

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MOTOROLA



2N6035/D

