

# ALPHANUMERIC INDEX — CROSS-REFERENCE (Continued)

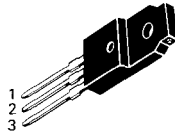
| Industry<br>Part Number | Motorola<br>Direct<br>Replacement | Motorola<br>Similar<br>Replacement | Page<br>Number | Industry<br>Part Number | Motorola<br>Direct<br>Replacement | Motorola<br>Similar<br>Replacement | Page<br>Number |
|-------------------------|-----------------------------------|------------------------------------|----------------|-------------------------|-----------------------------------|------------------------------------|----------------|
| MJF127                  | MJF127                            |                                    | 3-1016         | MPS-U60                 | MPS-U60                           |                                    | 3-1066         |
| MJF15030                | MJF15030                          |                                    | 3-1026         | MPS-U95                 | MPS-U95                           |                                    | 3-1068         |
| MJF15031                | MJF15031                          |                                    | 3-1026         | MPSU01                  | MPS-U01                           |                                    | 3-1040         |
| MJF2955                 | MJF2955                           |                                    | —              | MPSU01A                 | MPS-U01A                          |                                    | 3-1040         |
| MJF3055                 | MJF3055                           |                                    | —              | MPSU02                  | MPS-U02                           |                                    | 3-1042         |
| MJF47                   | MJF47                             |                                    | 3-1007         | MPSU03                  | MPS-U03                           |                                    | 3-1044         |
| MJF6107                 | MJF6107                           |                                    | 3-1022         | MPSU04                  | MPS-U04                           |                                    | 3-1044         |
| MJH10012                | MJH10012                          |                                    | 3-596          | MPSU05                  | MPS-U05                           |                                    | 3-1048         |
| MJH11017                | MJH11017                          |                                    | 3-1034         | MPSU06                  | MPS-U06                           |                                    | 3-1048         |
| MJH11018                | MJH11018                          |                                    | 3-1034         | MPSU07                  | MPS-U07                           |                                    | 3-1050         |
| MJH11019                | MJH11019                          |                                    | 3-1034         | MPSU10                  | MPS-U10                           |                                    | 3-1052         |
| MJH11020                | MJH11020                          |                                    | 3-1034         | MPSU11                  |                                   | MPS-U10                            | 3-1052         |
| MJH11021                | MJH11021                          |                                    | 3-1034         | MPSU12                  |                                   | MPS-U45                            | 3-1055         |
| MJH11022                | MJH11022                          |                                    | 3-1034         | MPSU45                  | MPS-U45                           |                                    | 3-1055         |
| MJH12004                | MJH12004                          |                                    | 3-644          | MPSU51                  | MPS-U51                           |                                    | 3-1058         |
| MJH12005                | MJH12005                          |                                    | —              | MPSU51A                 | MPS-U51A                          |                                    | 3-1058         |
| MJH13090                | MJH13090                          |                                    | 3-688          | MPSU52                  | MPS-U52                           |                                    | 3-1060         |
| MJH13091                | MJH13091                          |                                    | 3-758          | MPSU55                  | MPS-U55                           |                                    | 3-1062         |
| MJH16002                | MJH16002                          |                                    | 3-976          | MPSU56                  | MPS-U56                           |                                    | 3-1062         |
| MJH16002A               | MJH16002A                         |                                    | 3-734          | MPSU57                  | MPS-U57                           |                                    | 3-1064         |
| MJH16004                | MJH16004                          |                                    | 3-976          | MPSU60                  | MPS-U60                           |                                    | 3-1066         |
| MJH16006                | MJH16006                          |                                    | 3-742          | MPSU95                  | MPS-U95                           |                                    | 3-1068         |
| MJH16006A               | MJH16006A                         |                                    | 3-750          | NSD102                  |                                   | 2N4923                             | 3-79           |
| MJH16008                | MJH16008                          |                                    | 3-742          | NSD103                  |                                   | 2N4923                             | 3-79           |
| MJH16010                | MJH16010                          |                                    | 3-758          | NSD104                  |                                   | 2N4923                             | 3-79           |
| MJH16010A               | MJH16010A                         |                                    | 3-766          | NSD105                  |                                   | 2N4923                             | 3-79           |
| MJH16012                | MJH16012                          |                                    | 3-758          | NSD106                  |                                   | 2N4923                             | 3-79           |
| MJH16018                | MJH16018                          |                                    | 3-782          | NSD131                  |                                   | MJE340                             | 3-876          |
| MJH16032                | MJH16032                          |                                    | 3-984          | NSD132                  |                                   | MJE340                             | 3-876          |
| MJH16034                | MJH16034                          |                                    | 3-984          | NSD133                  |                                   | MJE340                             | 3-876          |
| MJH6282                 | MJH6282                           |                                    | 3-1030         | NSD134                  |                                   | MJE340                             | 3-876          |
| MJH6283                 | MJH6283                           |                                    | 3-1030         | NSD135                  |                                   | MJE340                             | 3-876          |
| MJH6284                 | MJH6284                           |                                    | 3-1030         | NSD151                  |                                   | MJE800                             | 3-888          |
| MJH6285                 | MJH6285                           |                                    | 3-1030         | NSD152                  |                                   | MJE800                             | 3-888          |
| MJH6286                 | MJH6286                           |                                    | 3-1030         | NSD202                  |                                   | 2N4919                             | 3-75           |
| MJH6287                 | MJH6287                           |                                    | 3-1030         | NSD203                  |                                   | 2N4919                             | 3-75           |
| MJH6676                 | MJH6676                           |                                    | 3-758          | NSD204                  |                                   | 2N4919                             | 3-75           |
| MJH6677                 | MJH6677                           |                                    | 3-758          | NSD205                  |                                   | 2N4919                             | 3-75           |
| MJH6678                 | MJH6678                           |                                    | 3-758          | NSD206                  |                                   | 2N4919                             | 3-75           |
| MPC900                  |                                   |                                    | 3-143          | NSD3439                 |                                   | MJE3439                            | 3-908          |
| MPS-U01                 | MPS-U01                           |                                    | 3-1040         | NSD3440                 |                                   | MJE3440                            | 3-908          |
| MPS-U01A                | MPS-U01A                          |                                    | 3-1040         | NSDU01                  |                                   | MPS-UC1                            | 3-1040         |
| MPS-U02                 | MPS-U02                           |                                    | 3-1042         | NSDU01A                 |                                   | MPS-UC1A                           | 3-1040         |
| MPS-U03                 | MPS-U03                           |                                    | 3-1044         | NSDU05                  |                                   | MPS-U05                            | 3-1048         |
| MPS-U04                 | MPS-U04                           |                                    | 3-1044         | NSDU06                  |                                   | MPS-U06                            | 3-1048         |
| MPS-U05                 | MPS-U05                           |                                    | 3-1048         | NSDU07                  |                                   | MPS-U07                            | 3-1050         |
| MPS-U06                 | MPS-U06                           |                                    | 3-1048         | NSDU45                  |                                   | MPS-U45                            | 3-1055         |
| MPS-U07                 | MPS-U07                           |                                    | 3-1050         | NSDU51                  |                                   | MPS-U51                            | 3-1058         |
| MPS-U10                 | MPS-U10                           |                                    | 3-1052         | NSDU51A                 |                                   | MPS-U51A                           | 3-1058         |
| MPS-U11                 |                                   |                                    | 3-1052         | NSDU55                  |                                   | MPS-U55                            | 3-1062         |
| MPS-U12                 |                                   |                                    | 3-1055         | NSDU56                  |                                   | MPS-U56                            | 3-1062         |
| MPS-U31                 |                                   |                                    | 3-1048         | NSDU57                  |                                   | MPS-U57                            | 3-1064         |
| MPS-U45                 | MPS-U45                           |                                    | 3-1055         | NSE170                  |                                   | MJE170                             | 3-862          |
| MPS-U47                 |                                   |                                    | 3-1048         | NSE171                  |                                   | MJE171                             | 3-862          |
| MPS-U51                 | MPS-U51                           |                                    | 3-1058         | NSE180                  |                                   | MJE180                             | 3-862          |
| MPS-U51A                | MPS-U51A                          |                                    | 3-1058         | NSE181                  |                                   | MJE181                             | 3-862          |
| MPS-U52                 | MPS-U52                           |                                    | 3-1060         | NSP105                  |                                   | TIP42A                             | 3-1083         |
| MPS-U55                 | MPS-U55                           |                                    | 3-1062         | NSP2010                 |                                   | TIP42                              | 3-1083         |
| MPS-U56                 | MPS-U56                           |                                    | 3-1062         | NSP2011                 |                                   | TIP42A                             | 3-1083         |
| MPS-U57                 | MPS-U57                           |                                    | 3-1064         | NSP2021                 |                                   | TIP41A                             | 3-1083         |

\*Consult Motorola if a direct replacement is necessary.

**TABLE 5 — PLASTIC TO-220 (continued)**

| I <sub>C</sub> Cont<br>Amps<br>Max | V <sub>CEO</sub> (sus)<br>Volts<br>Min | Device Type |          | h <sub>FE</sub><br>Min/Max | @ I <sub>C</sub><br>Amp | Resistive Switching         |                             |                         | f <sub>T</sub><br>MHz<br>Min | P <sub>D</sub> (Case)<br>Watts<br>@ 25°C |
|------------------------------------|----------------------------------------|-------------|----------|----------------------------|-------------------------|-----------------------------|-----------------------------|-------------------------|------------------------------|------------------------------------------|
|                                    |                                        | NPN         | PNP      |                            |                         | t <sub>s</sub><br>μs<br>Max | t <sub>f</sub><br>μs<br>Max | @ I <sub>C</sub><br>Amp |                              |                                          |
| 10                                 | 60                                     | D44H7       | D45H7    | 20 min                     | 4                       |                             |                             |                         |                              | 50                                       |
|                                    |                                        | D44H8       | D45H8    | 40 min                     | 4                       |                             |                             |                         |                              | 50                                       |
|                                    |                                        |             | D45H9    | 40 min                     | 4                       |                             |                             |                         |                              | 50                                       |
|                                    |                                        | MJE2801T    |          | 25/100                     | 3                       |                             |                             |                         |                              | 75                                       |
|                                    |                                        | MJE3055T    | MJE2955T | 20/70                      | 4                       |                             |                             |                         |                              | 75                                       |
|                                    |                                        | 2N6387##    | 2N6667## | 1k/20k                     | 5                       |                             |                             |                         | 20#                          | 65                                       |
|                                    |                                        | SE9300##    | SE9400## | 1k min                     | 4                       |                             |                             |                         | 1#                           | 70                                       |
|                                    | 80                                     | BDX33B##    | BDX34B## | 750 min                    | 3                       |                             |                             |                         | 3                            | 70                                       |
|                                    |                                        | BD809       | BD810    | 15 min                     | 4                       |                             |                             |                         | 1.5                          | 90                                       |
|                                    |                                        | D44E3##     |          | 1000 min                   | 5                       | 2 typ                       | 0.5 typ                     | 10                      |                              | 50                                       |
|                                    |                                        |             | D45H12   | 40 min                     | 4                       |                             |                             |                         |                              | 50                                       |
|                                    |                                        | 2N6388##    | 2N6668## | 1k/20k                     | 5                       |                             |                             |                         | 20#                          | 65                                       |
|                                    |                                        | D44H10      | D45H10   | 20 min                     | 4                       | 0.5 typ                     | 0.14 typ                    | 5                       | 50 typ                       | 50                                       |
| 12                                 | 300                                    | D44H11      | D45H11   | 40 min                     | 4                       | 0.5 typ                     | 0.14 typ                    | 5                       | 50 typ                       | 50                                       |
|                                    |                                        | SE9301##    | SE9401## | 1k min                     | 4                       |                             |                             |                         | 1#                           | 70                                       |
|                                    |                                        | BDX33C##    | BDX34C## | 750 min                    | 3                       |                             |                             |                         | 3                            | 70                                       |
|                                    |                                        | SE9302##    | SE9402## | 1k min                     | 4                       |                             |                             |                         | 1#                           | 70                                       |
|                                    |                                        | MJE13008    |          | 6/30                       | 8                       | 3                           | 0.7                         | 8                       | 4                            | 100                                      |
|                                    |                                        | MJE13009    |          | 6/30                       | 8                       | 3                           | 0.7                         | 8                       | 4                            | 100                                      |
|                                    | 400                                    | D44VH1      | D45VH1   | 20 min                     | 4                       | 0.7                         | 0.09                        | 8                       | 50 typ                       | 83                                       |
|                                    |                                        | 2N6486      | 2N6489   | 20/150                     | 5                       | 0.6 typ                     | 0.3 typ                     | 5                       | 5                            | 75                                       |
|                                    |                                        | BDW39       | BDW44    | 1 k min                    | 5                       | 1 typ                       | 1.5 typ                     | 5                       | 4                            | 85                                       |
|                                    |                                        | D44VH4      | D45VH4   | 20 min                     | 4                       | 0.5                         | 0.09                        | 8                       | 50 typ                       | 83                                       |
|                                    |                                        | 2N6487      | 2N6490   | 20/150                     | 5                       | 0.6 typ                     | 0.3 typ                     | 5                       | 5                            | 75                                       |
|                                    |                                        | BDW40       | BDW45    | 1 k min                    | 5                       | 1 typ                       | 1.5 typ                     | 5                       | 4                            | 85                                       |
| 15                                 | 60                                     | D44VH7      |          | 20 min                     | 4                       | 0.5                         | 0.09                        | 8                       | 50 typ                       | 85                                       |
|                                    |                                        | 2N6488      | 2N6491   | 20/150                     | 5                       | 0.6 typ                     | 0.3 typ                     | 5                       | 5                            | 75                                       |
|                                    |                                        | BDW41       | BDW46    | 1 k min                    | 5                       | 1 typ                       | 1.5 typ                     | 5                       | 4                            | 85                                       |
|                                    |                                        | D44VH10     | D45VH10  | 20 min                     | 4                       | 0.5                         | 0.09                        | 8                       | 50 typ                       | 83                                       |
|                                    |                                        | BDW42       | BDW47    | 1 k min                    | 5                       | 1 typ                       | 1.5 typ                     | 5                       | 4                            | 85                                       |
|                                    |                                        | BDW43       | BDW48    | 1 k min                    | 5                       | 1 typ                       | 1.5 typ                     | 5                       | 4                            | 85                                       |

# |h<sub>FE</sub>| @ 1 MHz, ## Darlington

**TABLE 6 — PLASTIC Full Pak (TO-220 Type)**

**CASE 221C-02**

| I <sub>C</sub> Cont<br>Amps<br>Max | V <sub>CEO</sub> (sus)<br>Volts<br>Min | Device Type |          | h <sub>FE</sub><br>Min/Max | @ I <sub>C</sub><br>Amp | Resistive Switching         |                             |                         | f <sub>T</sub><br>MHz<br>Min | P <sub>D</sub> (Case)<br>Watts<br>@ 25°C |
|------------------------------------|----------------------------------------|-------------|----------|----------------------------|-------------------------|-----------------------------|-----------------------------|-------------------------|------------------------------|------------------------------------------|
|                                    |                                        | NPN         | PNP      |                            |                         | t <sub>s</sub><br>μs<br>Max | t <sub>f</sub><br>μs<br>Max | @ I <sub>C</sub><br>Amp |                              |                                          |
| 1                                  | 250                                    | MJF47       |          | 30/150                     | 0.3                     | 2 typ                       | 0.17 typ                    | 0.3                     | 10                           | 28                                       |
| 5                                  | 100                                    | MJF122##    | MJF127## | 2000 min                   | 3                       | 1.5 typ                     | 1.5 typ                     | 3                       | 4#                           | 28                                       |
| 8                                  | 80                                     |             | MJF6107  | 30/90                      | 2                       | 0.5 typ                     | 0.13 typ                    | 2                       | 4                            | 35                                       |
|                                    | 100                                    | MJF102##    | MJF107## | 3000 min                   | 3                       | 1.5 typ                     | 1.5 typ                     | 3                       | 4#                           | 35                                       |
|                                    | 150                                    | MJF15030    | MJF15031 | 40 min                     | 3                       | 1 typ                       | 0.15 typ                    | 3                       | 30                           | 35                                       |
| 10                                 | 60                                     | MJF3055     | MJF2955  | 20/100                     | 4                       |                             |                             |                         | 2                            | 40                                       |

# |h<sub>FE</sub>| @ 1 MHz, ## Darlington

# Full Pak

## Complementary

## Power Transistors

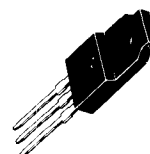
### For Isolated Package Applications

**NPN**  
**MJF15030**  
**PNP**  
**MJF15031**

**COMPLEMENTARY SILICON**  
**POWER TRANSISTORS**  
**8 AMPERES**  
**150 VOLTS**  
**36 WATTS**

Designed for general-purpose amplifier and switching applications, where the mounting surface of the device is required to be electrically isolated from the heatsink or chassis.

- Isolated Overmold Package (1500 Volts RMS Min.)
- Electrically Similar to the Popular MJE15030 and MJE15031
- 150 V<sub>CEO(sus)</sub>
- 8 A Rated Collector Current
- No Isolating Washers Required
- Reduced System Cost
- High Current Gain-Bandwidth Product  
 $f_T = 30 \text{ MHz (Min) @ } I_C = 500 \text{ mAdc}$



**CASE 221C-02**  
**TO-220 TYPE**

#### MAXIMUM RATINGS

| Rating                                           | Symbol                            | Value       | Unit  |
|--------------------------------------------------|-----------------------------------|-------------|-------|
| Collector-Emitter Voltage                        | V <sub>CEO</sub>                  | 150         | Vdc   |
| Collector-Base Voltage                           | V <sub>CB</sub>                   | 150         | Vdc   |
| Emitter-Base Voltage                             | V <sub>EB</sub>                   | 5           | Vdc   |
| Isolation Voltage (RMS for 1 Min)                | V <sub>ISOL</sub>                 | 1500        | Vrms  |
| Collector Current — Continuous                   | I <sub>C</sub>                    | 8           | Adc   |
| — Peak                                           |                                   | 16          |       |
| Base Current                                     | I <sub>B</sub>                    | 2           | Adc   |
| Total Power Dissipation* @ T <sub>C</sub> = 25°C | P <sub>D</sub>                    | 36          | Watts |
| Derate above 25°C                                |                                   | 0.29        | W/°C  |
| Total Power Dissipation @ T <sub>A</sub> = 25°C  | P <sub>D</sub>                    | 2           | Watts |
| Derate above 25°C                                |                                   | 0.016       | W/°C  |
| Operating and Storage Junction Temperature Range | T <sub>J</sub> , T <sub>stg</sub> | -65 to +150 | °C    |

#### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol           | Max  | Unit |
|-----------------------------------------|------------------|------|------|
| Thermal Resistance, Junction to Case*   | R <sub>θJC</sub> | 3.5  | °C/W |
| Thermal Resistance, Junction to Ambient | R <sub>θJA</sub> | 62.5 | °C/W |
| Lead Temperature for Soldering Purpose  | T <sub>L</sub>   | 260  | °C   |

\*Measurement made with thermocouple contacting the bottom insulated mounting surface (in a location beneath the die), the device mounted on a heatsink with thermal grease and a mounting torque of  $\geq 6 \text{ in. lbs.}$

Full Pak is a trademark of Motorola Inc.

# MJF15030, MJF15031

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

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

### OFF CHARACTERISTICS

|                                                                                 |               |     |    |                 |
|---------------------------------------------------------------------------------|---------------|-----|----|-----------------|
| Collector-Emitter Sustaining Voltage (1) ( $I_C = 10\text{ mAdc}$ , $I_B = 0$ ) | $V_{CE(sus)}$ | 150 | —  | Vdc             |
| Collector Cutoff Current ( $V_{CE} = 150\text{ Vdc}$ , $I_B = 0$ )              | $I_{CEO}$     | —   | 10 | $\mu\text{Adc}$ |
| Collector Cutoff Current ( $V_{CB} = 150\text{ Vdc}$ , $I_E = 0$ )              | $I_{CBO}$     | —   | 10 | $\mu\text{Adc}$ |
| Emitter Cutoff Current ( $V_{BE} = 5\text{ Vdc}$ , $I_C = 0$ )                  | $I_{EBO}$     | —   | —  | $\mu\text{Adc}$ |

### ON CHARACTERISTICS (1)

|                                                                                                                                                                                                                                        |               |                      |                  |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------|------------------|-----|
| DC Current Gain ( $I_C = 0.1\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ )<br>( $I_C = 2\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ )<br>( $I_C = 3\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ )<br>( $I_C = 4\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ ) | $h_{FE}$      | 40<br>40<br>40<br>20 | —<br>—<br>—<br>— | —   |
| DC Current Gain Linearity<br>( $V_{CE}$ from 2 V to 20 V, $I_C$ from 0.1 A to 3 A)<br>(NPN to PNP)                                                                                                                                     | $h_{FE}$      | Typ<br>2<br>3        |                  |     |
| Collector-Emitter Saturation Voltage ( $I_C = 1\text{ Adc}$ , $I_B = 0.1\text{ Adc}$ )                                                                                                                                                 | $V_{CE(sat)}$ | —                    | 0.5              | Vdc |
| Base-Emitter On Voltage ( $I_C = 1\text{ Adc}$ , $V_{CE} = 2\text{ Vdc}$ )                                                                                                                                                             | $V_{BE(on)}$  | —                    | 1                | Vdc |

### DYNAMIC CHARACTERISTICS

|                                                                                                                           |       |    |   |     |
|---------------------------------------------------------------------------------------------------------------------------|-------|----|---|-----|
| Current Gain-Bandwidth Product (2)<br>( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f_{test} = 10\text{ MHz}$ ) | $f_T$ | 30 | — | MHz |
|---------------------------------------------------------------------------------------------------------------------------|-------|----|---|-----|

Notes: 1. Pulse Test: Pulse Width  $\leq 300\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .  
2.  $f_T = |h_{fe}| \cdot f_{test}$

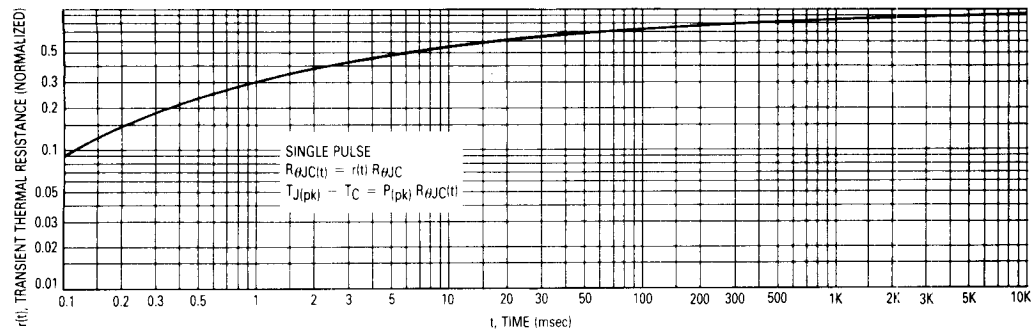


Figure 1. Thermal Response

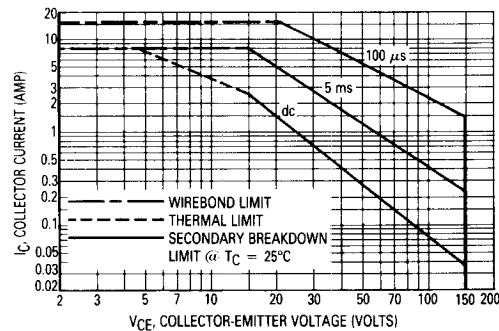


Figure 2. Forward Bias Safe Operating Area

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 2 and 3 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 1. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

MJF15030, MJF15031

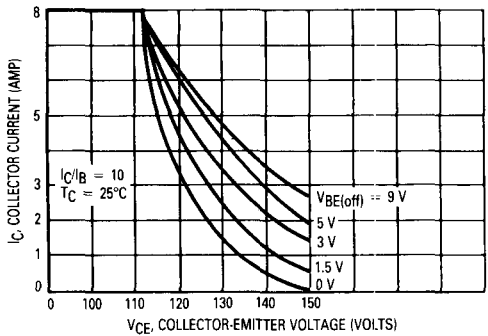


Figure 3. Reverse-Bias Switching Safe Operating Area

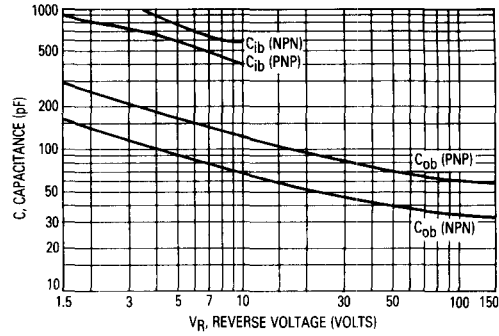


Figure 4. Capacitances

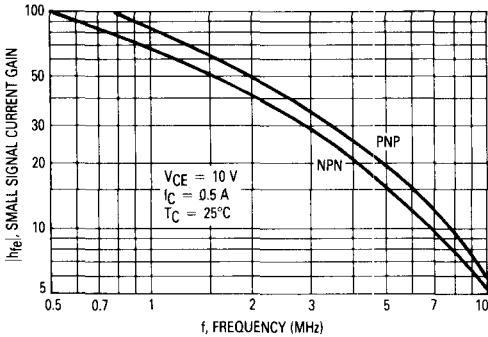


Figure 5. Small-Signal Current Gain

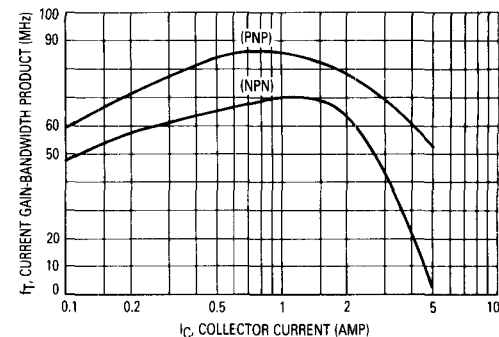


Figure 6. Current Gain-Bandwidth Product

DC CURRENT GAIN

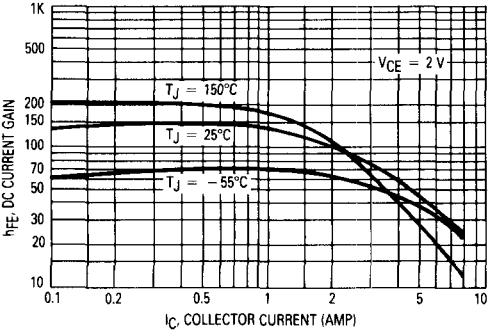


Figure 7a. MJF15030 NPN

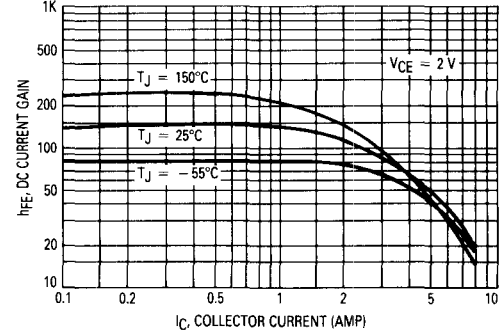


Figure 7b. MJF15031 PNP

# MJF15030, MJF15031

## "ON" VOLTAGE

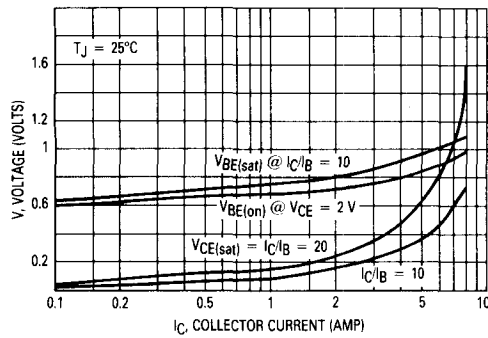


Figure 8a. MJF15030 NPN

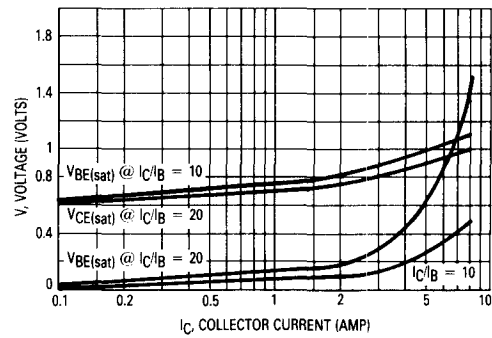


Figure 8b. MJF15031 PNP

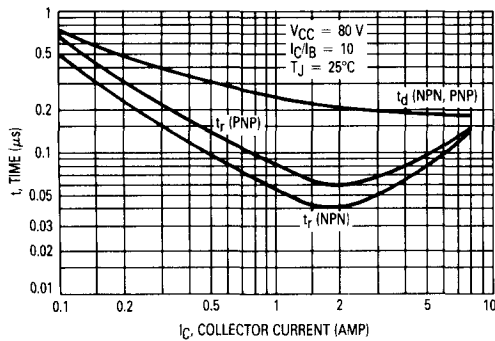


Figure 9. Turn-On Times

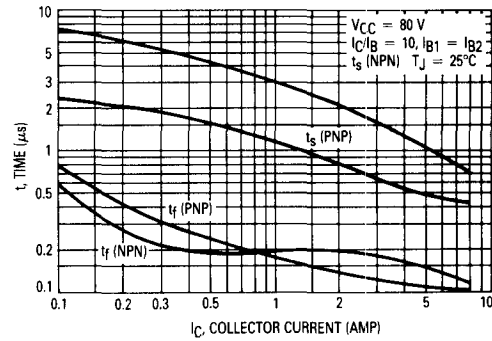


Figure 10. Turn-Off Times

