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January 2016

## FJ15603D

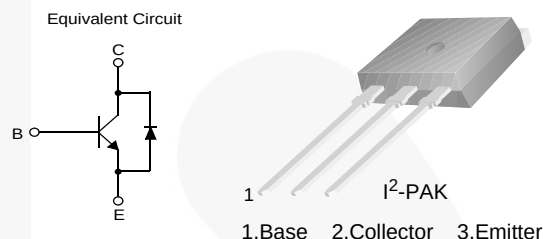
### NPN Silicon Transistor

#### Applications

- High Voltage and High Speed Power Switch Application
- Electronic Ballast Application

#### Features

- Wide Safe Operating Area
- Small Variance in Storage Time
- Built-in Free Wheeling Diode



#### Ordering Information

| Part Number | Marking | Package           | Packing Method |
|-------------|---------|-------------------|----------------|
| FJ15603DTU  | J5603D  | TO-262 3L (I2PAK) | Rail           |

#### Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol    | Parameter                                           | Value       | Unit             |
|-----------|-----------------------------------------------------|-------------|------------------|
| $V_{CBO}$ | Collector-Base Voltage                              | 1600        | V                |
| $V_{CEO}$ | Collector-Emitter Voltage                           | 800         | V                |
| $V_{EBO}$ | Emitter-Base Voltage                                | 12          | V                |
| $I_C$     | Collector Current (DC)                              | 3           | A                |
| $I_{CP}$  | Collector Current (Pulse) <sup>(1)</sup>            | 6           | A                |
| $I_B$     | Base Current (DC)                                   | 2           | A                |
| $I_{BP}$  | Base Current (Pulse) <sup>(1)</sup>                 | 4           | A                |
| $P_C$     | Power Dissipation ( $T_C = 25^\circ\text{C}$ )      | 100         | W                |
| $T_J$     | Junction Temperature                                | 150         | $^\circ\text{C}$ |
| $T_{STG}$ | Storage Junction Temperature Range                  | -65 to +150 | $^\circ\text{C}$ |
| EAS       | Avalanche Energy ( $T_J = 25^\circ\text{C}$ , 8 mH) | 3.5         | mJ               |

#### Notes:

1. Pulse test: pulse width = 5 ms, duty cycle  $\leq 10\%$

**Thermal Characteristics<sup>(2)</sup>**

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol          | Parameter                               | Rating | Unit               |
|-----------------|-----------------------------------------|--------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | 1.25   | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 80     | $^\circ\text{C/W}$ |

**Note:**

2. Device mounted on minimum pad size.

**Electrical Characteristics<sup>(3)</sup>**

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol        | Parameter                            | Conditions                                        | Min.                      | Typ. | Max. | Unit          |
|---------------|--------------------------------------|---------------------------------------------------|---------------------------|------|------|---------------|
| $BV_{CBO}$    | Collector-Base Breakdown Voltage     | $I_C = 0.5\text{ mA}, I_E = 0$                    | 1600                      | 1689 |      | V             |
| $BV_{CEO}$    | Collector-Emitter Breakdown Voltage  | $I_C = 5\text{ mA}, I_B = 0$                      | 800                       | 870  |      | V             |
| $BV_{EBO}$    | Emitter-Base Breakdown Voltage       | $I_E = 0.5\text{ mA}, I_C = 0$                    | 12.0                      | 14.8 |      | V             |
| $I_{CES}$     | Collector Cut-Off Current            | $V_{CE} = 1600\text{ V}, V_{BE} = 0$              | $T_C = 25^\circ\text{C}$  | 0.01 | 100  | $\mu\text{A}$ |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ |      | 1000 |               |
| $I_{CEO}$     | Collector Cut-Off Current            | $V_{CE} = 800\text{ V}, I_B = 0$                  | $T_C = 25^\circ\text{C}$  | 0.01 | 100  | $\mu\text{A}$ |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ |      | 1000 |               |
| $I_{EBO}$     | Emitter Cut-Off Current              | $V_{EB} = 12\text{ V}, I_C = 0$                   |                           | 0.05 | 500  | $\mu\text{A}$ |
| $h_{FE}$      | DC Current Gain                      | $V_{CE} = 3\text{ V}, I_C = 0.4\text{ A}$         | $T_C = 25^\circ\text{C}$  | 20   | 29   |               |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ | 6    | 15   |               |
|               |                                      | $V_{CE} = 10\text{ V}, I_C = 5\text{ mA}$         | $T_C = 25^\circ\text{C}$  | 20   | 43   |               |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ | 20   | 46   |               |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C = 250\text{ mA}, I_B = 25\text{ mA}$         |                           | 0.50 | 1.25 | V             |
|               |                                      | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$         |                           | 1.50 | 2.50 |               |
|               |                                      | $I_C = 1\text{ A}, I_B = 0.2\text{ A}$            |                           | 1.20 | 2.50 |               |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage      | $I_C = 500\text{ mA}, I_B = 50\text{ mA}$         | $T_C = 25^\circ\text{C}$  | 0.74 | 1.20 | V             |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ | 0.61 | 1.10 |               |
|               |                                      | $I_C = 2\text{ A}, I_B = 0.4\text{ A}$            | $T_C = 25^\circ\text{C}$  | 0.85 | 1.20 |               |
|               |                                      |                                                   | $T_C = 125^\circ\text{C}$ | 0.74 | 1.10 |               |
| $C_{ib}$      | Input Capacitance                    | $V_{EB} = 10\text{ V}, I_C = 0, f = 1\text{ MHz}$ |                           | 745  | 1000 | pF            |
| $C_{ob}$      | Output Capacitance                   | $V_{CB} = 10\text{ V}, I_E = 0, f = 1\text{ MHz}$ |                           | 56   | 500  | pF            |
| $f_T$         | Current Gain Bandwidth Product       | $I_C = 0.1\text{ A}, V_{CE} = 10\text{ V}$        |                           | 5    |      | MHz           |
| $V_F$         | Diode Forward Voltage                | $I_F = 0.4\text{ A}$                              |                           | 0.76 | 1.20 | V             |
|               |                                      | $I_F = 1\text{ A}$                                |                           | 0.83 | 1.50 |               |

**Note:**

3. Pulse test: pulse width = 20  $\mu\text{s}$ , duty cycle  $\leq 10\%$ .

**Electrical Characteristics** (Continued)Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol                                                              | Parameter       | Conditions                                                                                                                              | Min. | Typ. | Max. | Unit    |
|---------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------|
| RESISTIVE LOAD SWITCHING (D.C $\leq$ 10%, Pulse Width = 20 $\mu$ s) |                 |                                                                                                                                         |      |      |      |         |
| t <sub>ON</sub>                                                     | Turn-On Time    | I <sub>C</sub> = 0.3 A, I <sub>B1</sub> = 50 mA,<br>I <sub>B2</sub> = 150 A, V <sub>CC</sub> = 125 V,<br>R <sub>L</sub> = 416 $\Omega$  |      | 400  | 600  | ns      |
| t <sub>STG</sub>                                                    | Storage Time    |                                                                                                                                         | 1.9  | 2.1  | 2.3  | $\mu$ s |
| t <sub>F</sub>                                                      | Fall Time       |                                                                                                                                         |      | 310  | 1000 | ns      |
| t <sub>ON</sub>                                                     | Turn-On Time    | I <sub>C</sub> = 0.5 A, I <sub>B1</sub> = 50 mA,<br>I <sub>B2</sub> = 250 mA, V <sub>CC</sub> = 125 V,<br>R <sub>L</sub> = 250 $\Omega$ |      | 600  | 1100 | ns      |
| t <sub>STG</sub>                                                    | Storage Time    |                                                                                                                                         |      | 1.3  | 1.5  | $\mu$ s |
| t <sub>F</sub>                                                      | Fall Time       |                                                                                                                                         |      | 180  | 350  | ns      |
| INDUCTIVE LOAD SWITCHING (V <sub>CC</sub> = 15 V)                   |                 |                                                                                                                                         |      |      |      |         |
| t <sub>STG</sub>                                                    | Storage Time    | I <sub>C</sub> = 0.3 A, I <sub>B1</sub> = 50 mA,<br>I <sub>B2</sub> = 150 mA, V <sub>Z</sub> = 300 V,<br>L <sub>C</sub> = 200 H         | 0.8  |      | 1.2  | $\mu$ s |
| t <sub>F</sub>                                                      | Fall Time       |                                                                                                                                         |      | 170  | 250  | ns      |
| t <sub>C</sub>                                                      | Cross-Over Time |                                                                                                                                         |      | 180  | 250  | ns      |
| t <sub>STG</sub>                                                    | Storage Time    | I <sub>C</sub> = 0.5 A, I <sub>B1</sub> = 50 mA,<br>I <sub>B2</sub> = 250 mA, V <sub>Z</sub> = 300 V,<br>L <sub>C</sub> = 200 H         | 0.8  |      | 1.2  | $\mu$ s |
| t <sub>F</sub>                                                      | Fall Time       |                                                                                                                                         |      | 140  | 175  | ns      |
| t <sub>C</sub>                                                      | Cross-Over Time |                                                                                                                                         |      | 170  | 200  | ns      |

## Typical Performance Characteristics

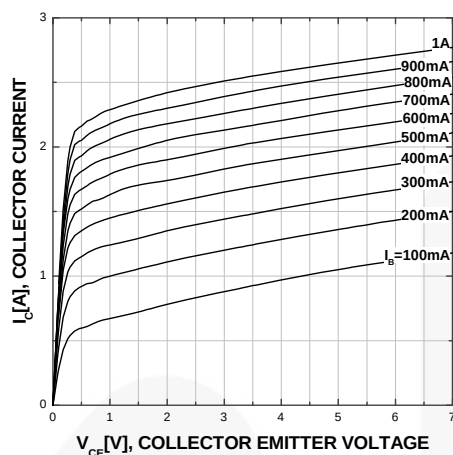


Figure 1. Static Characteristic

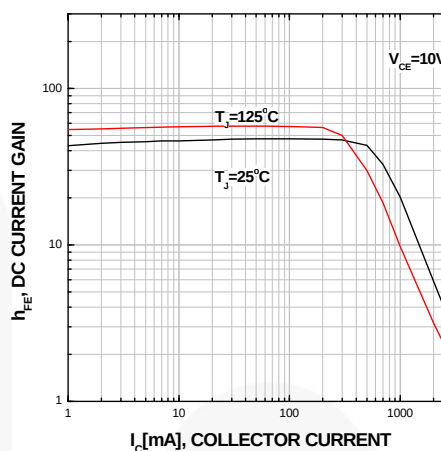


Figure 2. DC Current Gain

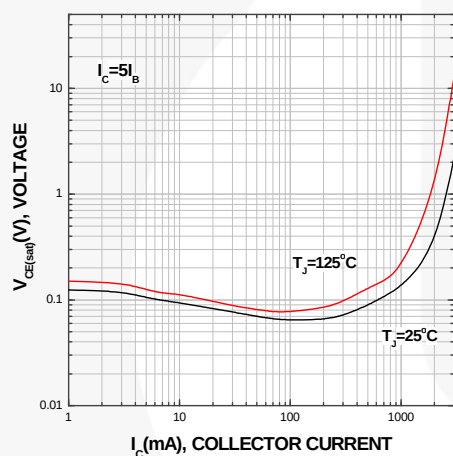


Figure 3. Collector-Emitter Saturation Voltage

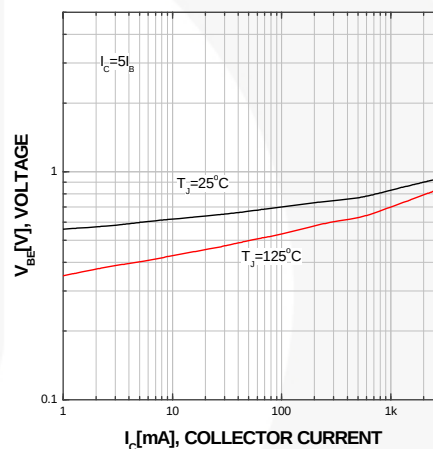


Figure 4. Base-Emitter Saturation Voltage

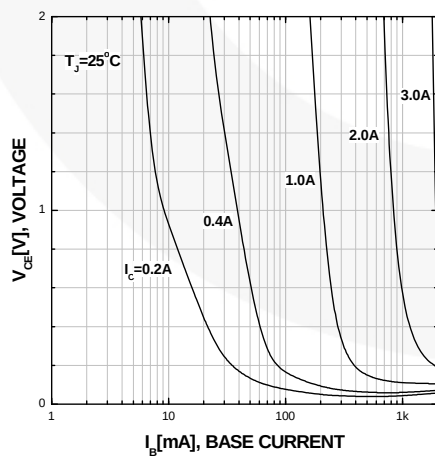


Figure 5. Typical Collector Saturation Voltage

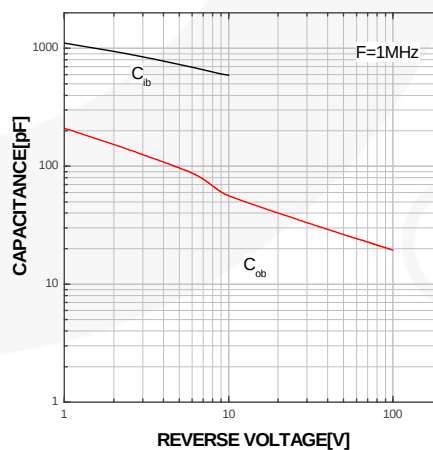
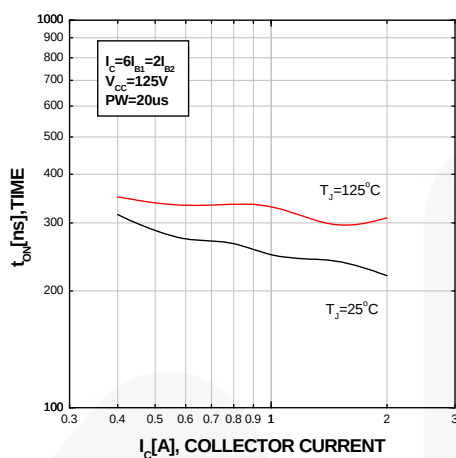
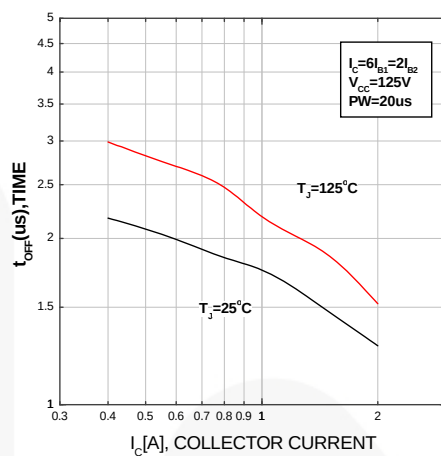
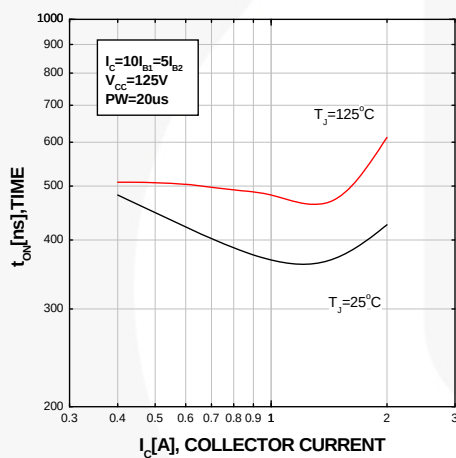
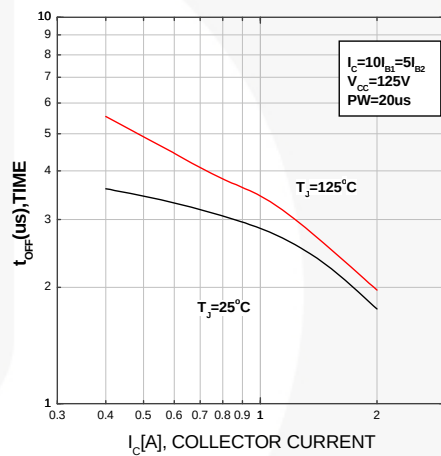
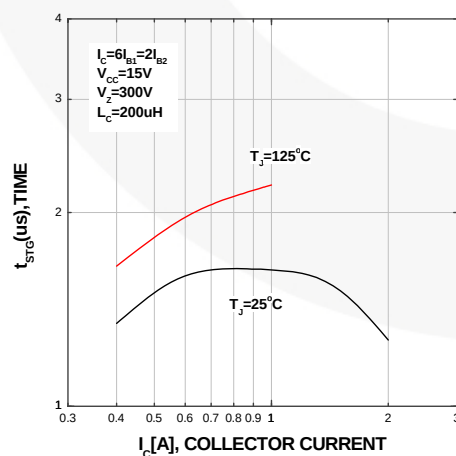
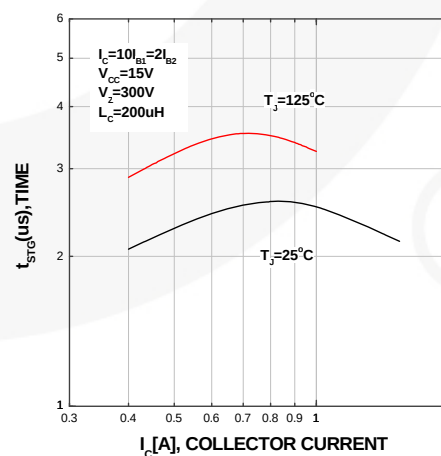


Figure 6. Capacitance

## Typical Performance Characteristics (Continued)

Figure 7. Resistive Switching Time,  $t_{on}$ Figure 8. Resistive Switching Time,  $t_{off}$ Figure 9. Resistive Switching Time,  $t_{on}$ Figure 10. Resistive Switching Time,  $t_{off}$ Figure 11. Inductive Switching Time,  $t_{STG}$ Figure 12. Inductive Switching Time,  $t_{STG}$

## Typical Performance Characteristics (Continued)

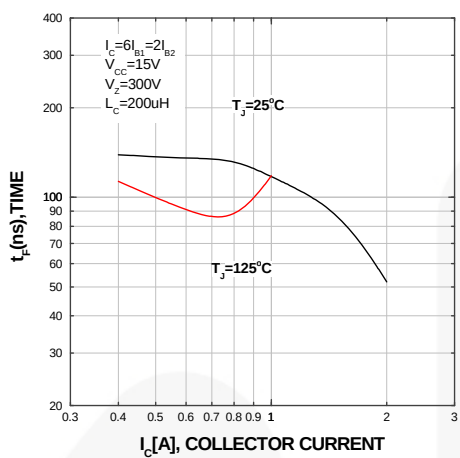
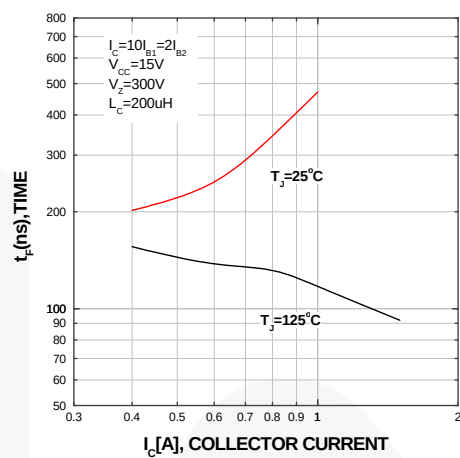
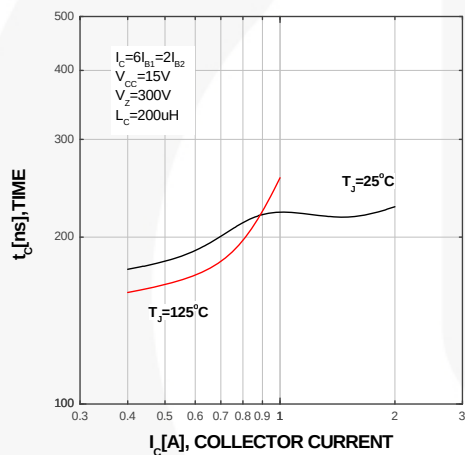
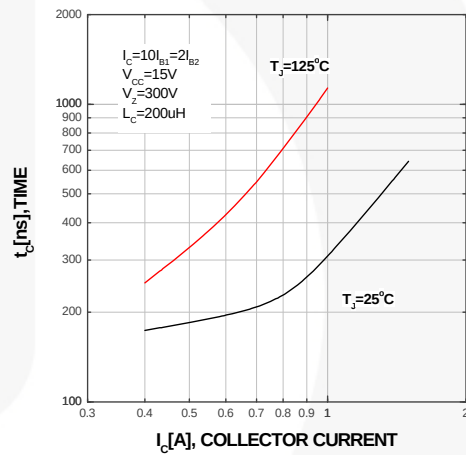
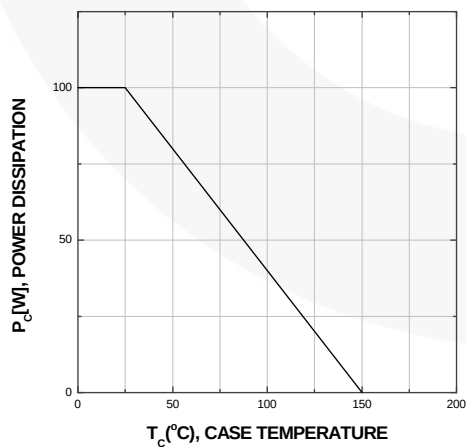
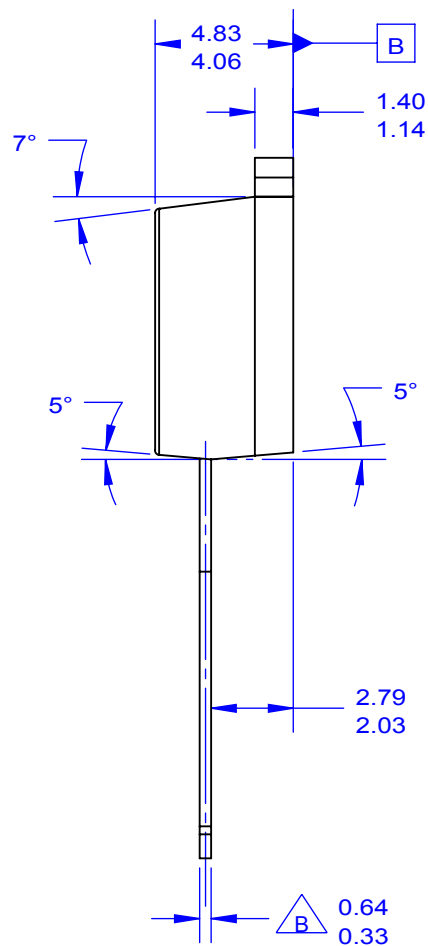
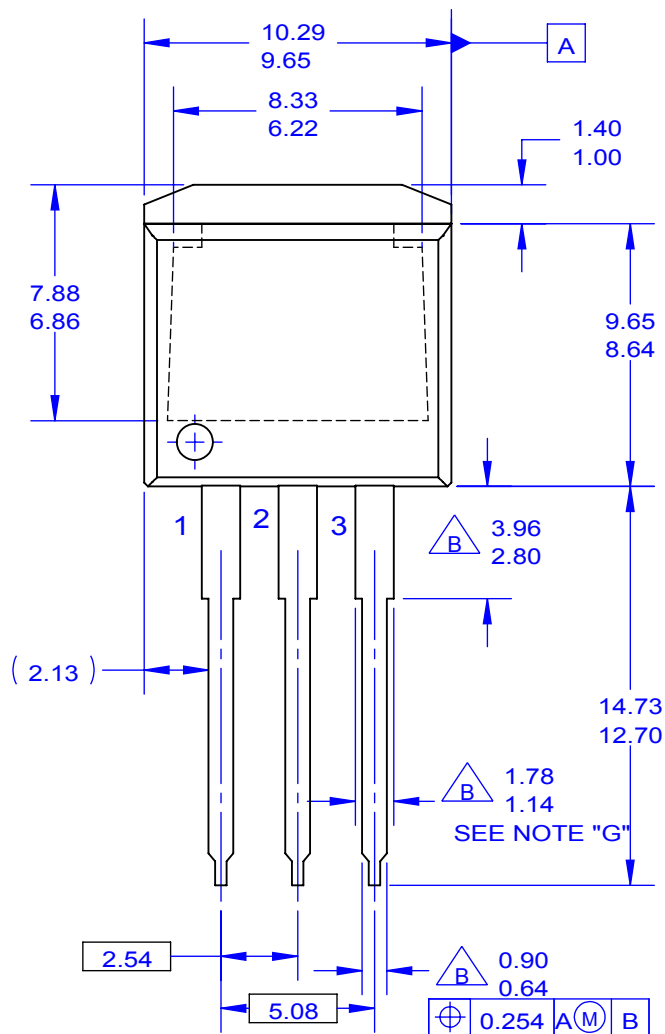
Figure 13. Inductive Switching Time,  $t_F$ Figure 14. Inductive Switching Time,  $t_F$ Figure 15. Inductive Switching Time,  $t_C$ Figure 16. Inductive Switching Time,  $t_C$ 

Figure 17. Power Derating



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO TO262 JEDEC VARIATION AA.
- B. DOES NOT COMPLY JEDEC STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ANSI Y14.5-1994.
- F. LOCATION OF PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF PACKAGE)
- G. MAXIMUM WIDTH FOR F102 DEVICE = 1.35 MAX.
- H. DRAWING FILE NAME: TO262A03REV6





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«FORSTAR» (основан в 1998 г.)

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