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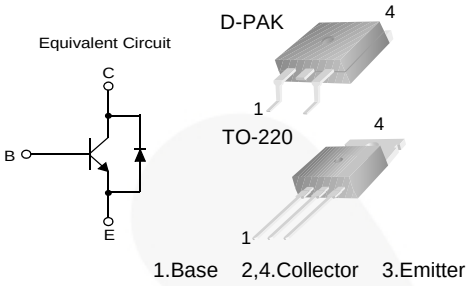
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July 2014

# KSC5502D / KSC5502DT
# NPN Triple Diffused Planar Silicon Transistor

## Features

- High Voltage Power Switch Switching Application
- Wide Safe Operating Area
- Built-in Free-Wheeling Diode
- Suitable for Electronic Ballast Application
- Small Variance in Storage Time
- Two Package Choices : D-PAK or TO-220




1.Base 2,4.Collector 3.Emitter

## Ordering Information

| Part Number | Top Mark | Package | Packing Method |
|---|---|---|---|
| KSC5502DTM | C5502D | TO-252 3L (DPAK) | Tape and Reel |
| KSC5502DTTU | C5502D | TO-220 3L | 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 $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CBO}$ | Collector-Base Voltage | 1200 | V |
| $V_{CEO}$ | Collector-Emitter Voltage | 600 | V |
| $V_{EBO}$ | Emitter-Base Voltage | 12 | V |
| $I_C$ | Collector Current (DC) | 2 | A |
| $I_{CP}$ | Collector Current (Pulse)(1) | 4 | A |
| $I_B$ | Base Current (DC) | 1 | A |
| $I_{BP}$ | Base Current (Pulse)(1) | 2 | A |
| $T_J$ | Junction Temperature | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | -65 to 150 | °C |
| EAS | Avalanche Energy ($T_J$ = 25°C) | 2.5 | mJ |

**Note:**

1. Pulse test: Pulse width = 5 ms, duty cycle ≤ 10%.

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## Thermal Characteristics

Values are at $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | KSC5502D (D-PAK) | KSC5502DT (TO-220) | Unit |
|---|---|---|---|---|
| $P_C$ | Collector Dissipation ($T_C$ = 25°C) | 87.83 | 118.16 | W |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 1.42 | 1.06 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 111.0 | 62.5 | °C/W |
| $T_L$ | Maximum Lead Temperature for Soldering Purpose: 1/8 inch from Case for 5 seconds | 270 | | °C |

## Electrical Characteristics

Values are at $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $BV_{CBO}$ | Collector-Base Breakdown Voltage | $I_C$ = 1 mA, $I_E$ = 0 | | 1200 | 1350 | | V |
| $BV_{CEO}$ | Collector-Emitter Breakdown Voltage | $I_C$ = 5 mA, $I_B$ = 0 | | 600 | 750 | | V |
| $BV_{EBO}$ | Emitter-Base Breakdown Voltage | $I_E$ = 500 µA, $I_C$ = 0 | | 12.0 | 13.7 | | V |
| $I_{CES}$ | Collector Cut-off Current | $V_{CES}$ = 1200 V, $V_{BE}$ = 0 | $T_C$ = 25°C | | | 100 | µA |
| | | | $T_C$ = 125°C | | | 500 | |
| $I_{CEO}$ | Collector Cut-off Current | $V_{CE}$ = 600 V, $I_B$ = 0 | $T_C$ = 25°C | | | 100 | µA |
| | | | $T_C$ = 125°C | | | 500 | |
| $I_{EBO}$ | Emitter Cut-off Current | $V_{EB}$ = 12 V, $I_C$ = 0 | $T_C$ = 25°C | | | 10 | µA |
| $h_{FE}$ | DC Current Gain | $V_{CE}$ = 1 V, $I_C$ = 0.2 A | $T_C$ = 25°C | 15 | 28 | 40 | |
| | | | $T_C$ = 125°C | 8 | 18 | | |
| | | $V_{CE}$ = 1 V, $I_C$ = 1 A | $T_C$ = 25°C | 4.0 | 6.4 | | |
| | | | $T_C$ = 125°C | 3.0 | 4.7 | | |
| | | $V_{CE}$ = 2.5 V, $I_C$ = 0.5 A | $T_C$ = 25°C | 12 | 20 | 30 | |
| | | | $T_C$ = 125°C | 6 | 12 | | |
| $V_{CE}$(sat) | Collector-Emitter Saturation Voltage | $I_C$ = 0.2 A, $I_B$ = 0.02 A | $T_C$ = 25°C | | 0.31 | 0.80 | V |
| | | | $T_C$ = 125°C | | 0.54 | 1.10 | |
| | | $I_C$ = 0.4 A, $I_B$ = 0.08 A | $T_C$ = 25°C | | 0.15 | 0.60 | |
| | | | $T_C$ = 125°C | | 0.23 | 1.00 | |
| | | $I_C$ = 1 A, $I_B$ = 0.2 A | $T_C$ = 25°C | | 0.40 | 1.50 | |
| | | | $T_C$ = 125°C | | 1.30 | 3.00 | |
| $V_{BE}$(sat) | Base-Emitter Saturation Voltage | $I_C$ = 0.4 A, $I_B$ = 0.08 A | $T_C$ = 25°C | | 0.77 | 1.00 | V |
| | | | $T_C$ = 125°C | | 0.60 | 0.90 | |
| | | $I_C$ = 1 A, $I_B$ = 0.2 A | $T_C$ = 25°C | | 0.83 | 1.20 | |
| | | | $T_C$ = 125°C | | 0.70 | 1.00 | |
| $C_{ib}$ | Input Capacitance | $V_{EB}$ = 8 V, $I_C$ = 0, f = 1 MHz | | | 385 | 500 | pF |
| $C_{ob}$ | Output Capacitance | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1 MHz | | | 60 | 100 | pF |
| $f_T$ | Current Gain Bandwidth Product | $I_C$ = 0.5 A, $V_{CE}$ = 10 V | | | 11 | | MHz |
| $V_F$ | Diode Forward Voltage | $I_F$ = 0.2 A | $T_C$ = 25°C | | 0.75 | 1.20 | V |
| | | | $T_C$ = 125°C | | 0.59 | | |
| | | $I_F$ = 0.4 A | $T_C$ = 25°C | | 0.80 | 1.30 | |
| | | | $T_C$ = 125°C | | 0.64 | | |
| | | $I_F$ = 1 A | $T_C$ = 25°C | | 0.90 | 1.50 | |

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## Electrical Characteristics

Values are at $T_C$ = 25°C unless otherwise noted.

| Symbol | Parameter | Conditions | | Min | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $t_{fr}$ | Diode Froward Recovery Time (di/dt=10 A/µs) | $I_F$ = 0.2 A | | | 650 | | ns |
| | | $I_F$ = 0.4 A | | | 740 | | |
| | | $I_F$ = 1 A | | | 785 | | |
| $V_{CE}$(DSAT) | Dynamic Saturation Voltage | $I_C$ = 0.4 A, $I_{B1}$ = 80 mA, $V_{CC}$ = 300 V | at 1 µs | | 7.2 | | V |
| | | | at 3 µs | | 1.8 | | |
| | | $I_C$ = 1 A, $I_{B1}$ = 200 mA, $V_{CC}$ = 300 V | at 1 µs | | 18.0 | | |
| | | | at 3 µs | | 6.0 | | |
| **Resistive Load Switching (D.C < 10%, Pulse Width = 20 s)** | | | | | | | |
| $t_{ON}$ | Turn-On Time | $I_C$ = 0.4 A, $I_{B1}$ = 80 mA, $I_{B2}$ = 0.2 A, $V_{CC}$ = 300 V, $R_L$ = 750 Ω | $T_C$ = 25°C | | 175 | 350 | ns |
| | | | $T_C$ = 125°C | | 185 | | |
| $t_{OFF}$ | Turn-Off Time | | $T_C$ = 25°C | | 2.1 | 3.0 | µs |
| | | | $T_C$ = 125°C | | 2.6 | | |
| $t_{ON}$ | Turn-On Time | $I_C$ = 1 A, $I_{B1}$ = 160 mA, $I_{B2}$ = 160 mA, $V_{CC}$ = 300 V, $R_L$ = 300 Ω | $T_C$ = 25°C | | 240 | 450 | ns |
| | | | $T_C$ = 125°C | | 310 | | |
| $t_{OFF}$ | Turn-Off Time | | $T_C$ = 25°C | | 3.7 | 5.0 | µs |
| | | | $T_C$ = 125°C | | 4.5 | | |
| **Inductive Load Switching ($V_{CC}$ = 15 V)** | | | | | | | |
| $t_{STG}$ | Storage Time | $I_C$ = 0.4 A, $I_{B1}$ = 80 mA, $I_{B2}$ = 0.2 A, $V_Z$ = 300 V, $L_C$ = 200 H | $T_C$ = 25°C | | 1.2 | 2.0 | µs |
| | | | $T_C$ = 125°C | | 1.5 | | |
| $t_F$ | Fall Time | | $T_C$ = 25°C | | 90 | 200 | ns |
| | | | $T_C$ = 125°C | | 65 | | |
| $t_C$ | Cross-Over Time | | $T_C$ = 25°C | | 185 | 350 | ns |
| | | | $T_C$ = 125°C | | 145 | | |
| $t_{STG}$ | Storage Time | $I_C$ = 0.8 A, $I_{B1}$ = 160 mA, $I_{B2}$ = 160 mA, $V_{CC}$ = 300 V, $L_C$ = 200 H | $T_C$ = 25°C | | 3.30 | 4.50 | µs |
| | | | $T_C$ = 125°C | | 3.75 | | |
| $t_F$ | Fall Time | | $T_C$ = 25°C | | 90 | 250 | ns |
| | | | $T_C$ = 125°C | | 160 | | |
| $t_C$ | Cross-over Time | | $T_C$ = 25°C | | 300 | 600 | ns |
| | | | $T_C$ = 125°C | | 570 | | |

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## Typical Performance Characteristics

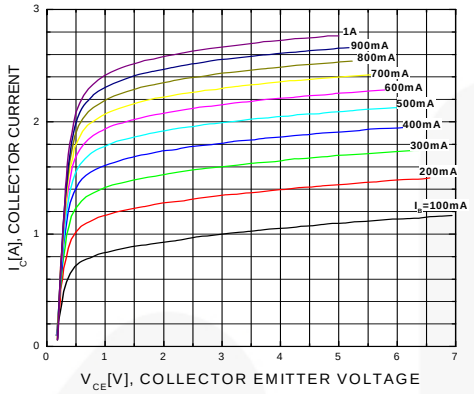



**Figure 1. Static Characteristic**

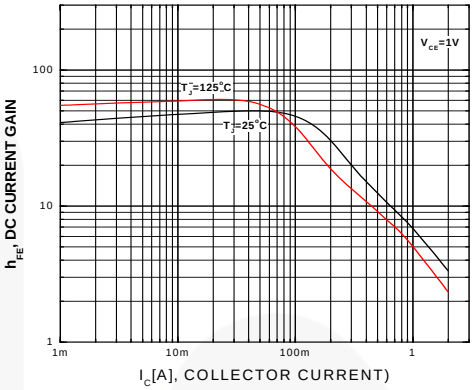



**Figure 2. DC Current Gain**

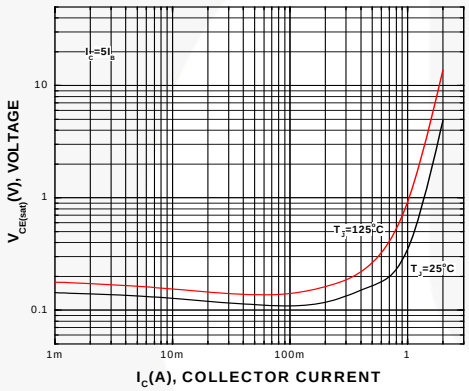



**Figure 3. Collector-Emitter Saturation Voltage**

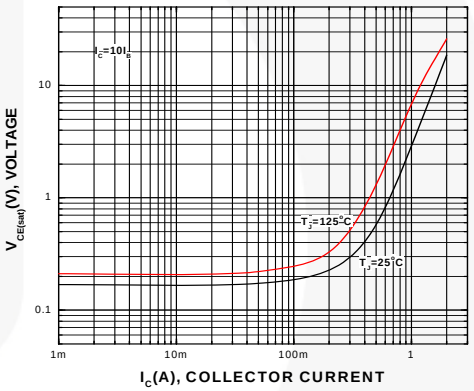



**Figure 4. Collector-Emitter Saturation Voltage**

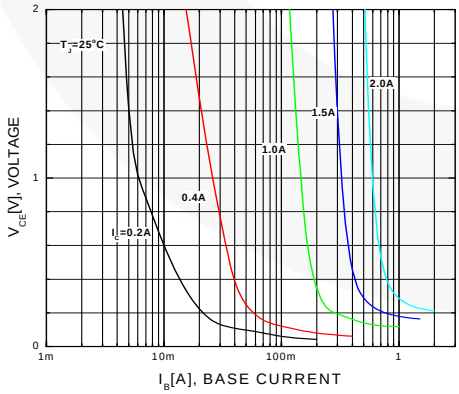



**Figure 5. Typical Collector Saturation Voltage**

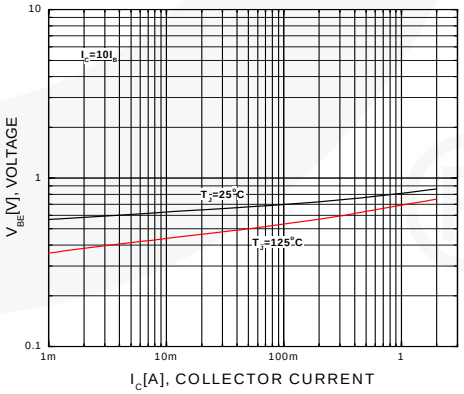



**Figure 6. Base-Emitter Saturation Voltage**



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## Typical Performance Characteristics (Continued)

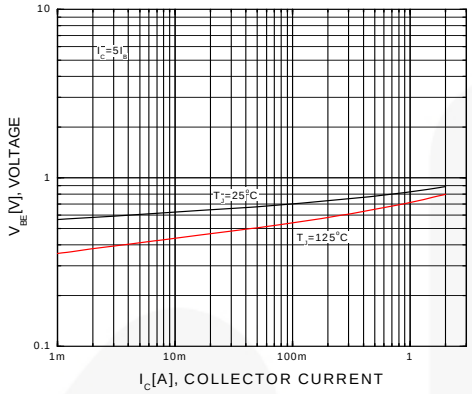



**Figure 7. Base-Emitter Saturation Voltage**

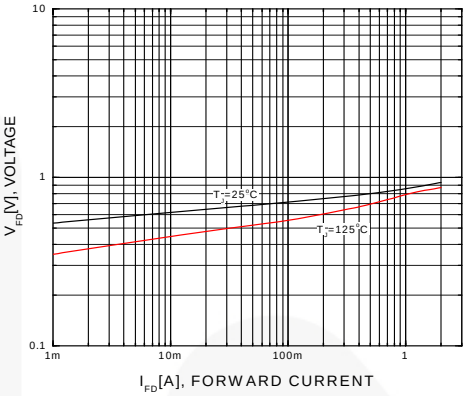



**Figure 8. Diode Forward Voltage**

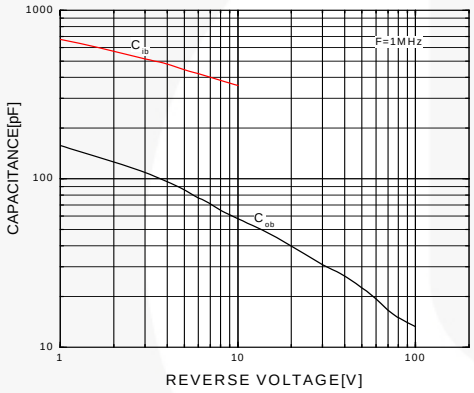



**Figure 9. Collector Output Capacitance**

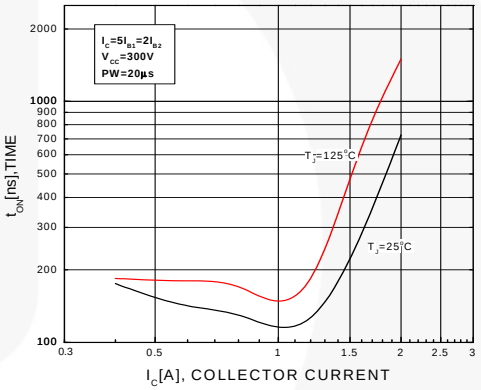



**Figure 10. Resistive Switching Time, $t_{on}$**

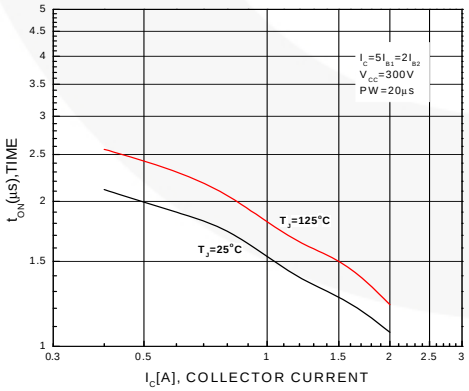



**Figure 11. Resistive Switching Time, $t_{off}$**

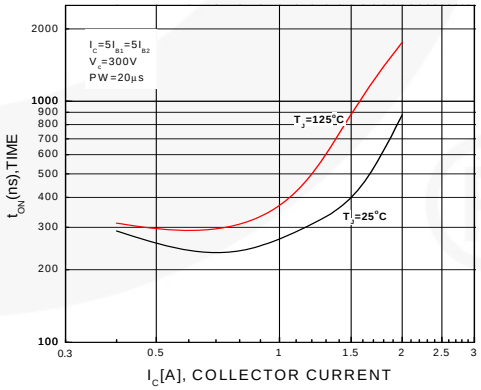



**Figure 12. Resistive Switching Time, $t_{on}$**



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## Typical Performance Characteristics (Continued)

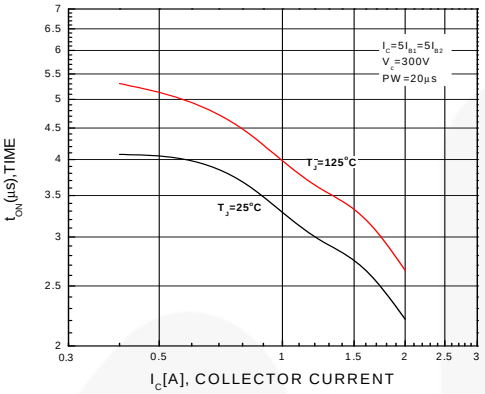



**Figure 13. Resistive Switching Time, $t_{off}$**

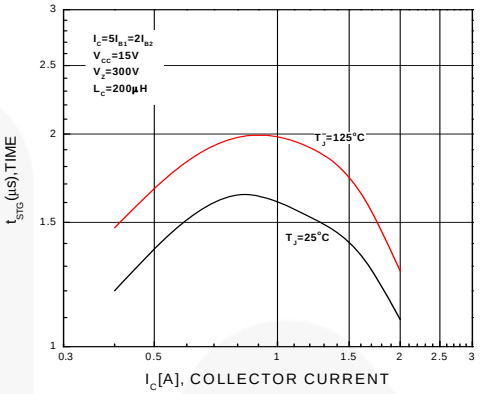



**Figure 14. Inductive Switching Time, $t_{STG}$**

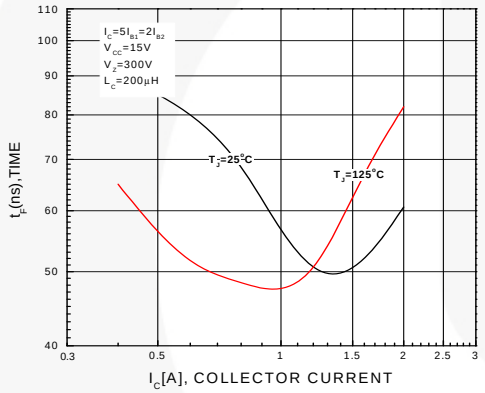



**Figure 15. Inductive Switching Time, $t_F$**

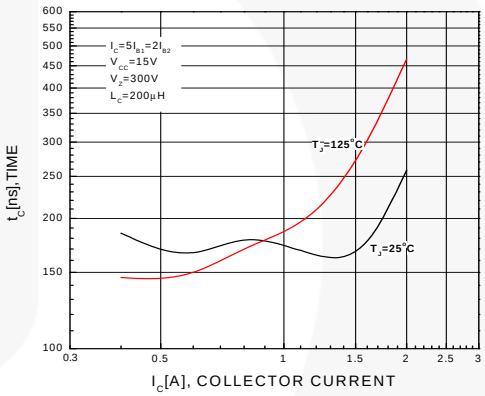



**Figure 16. Inductive Switching Time, $t_C$**

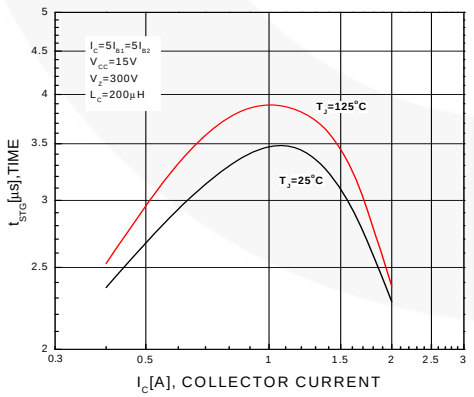



**Figure 17. Inductive Switching Time, $t_{STG}$**

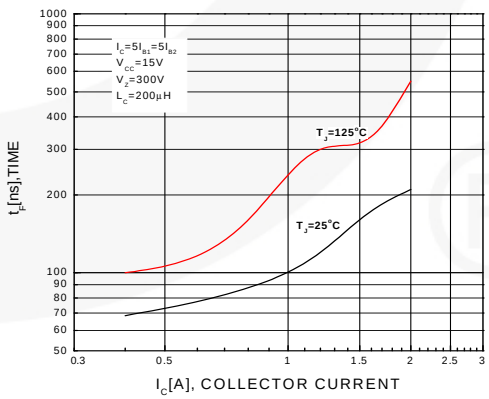



**Figure 18. Inductive Switching Time, $t_F$**

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## Typical Performance Characteristics (Continued)

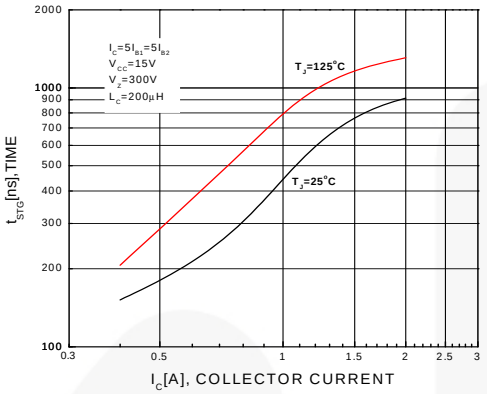



**Figure 19. Inductive Switching Time, $t_C$**

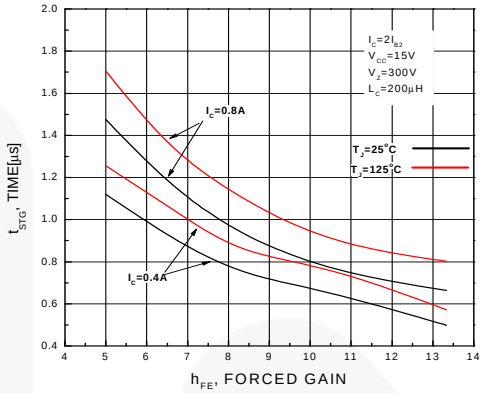



**Figure 20. Inductive Switching Time, $t_{STG}$**

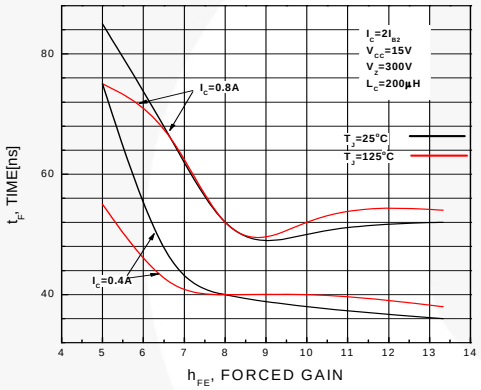



**Figure 21. Inductive Switching Time, $t_F$**

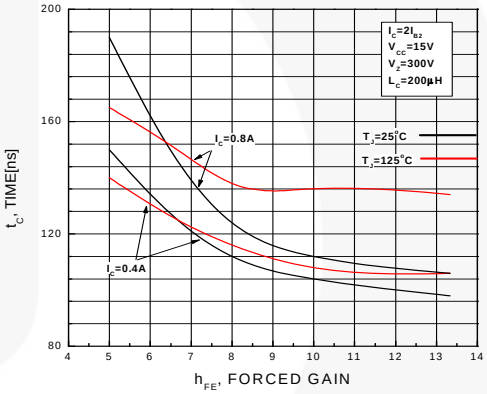



**Figure 22. Inductive Switching Time, $t_C$**

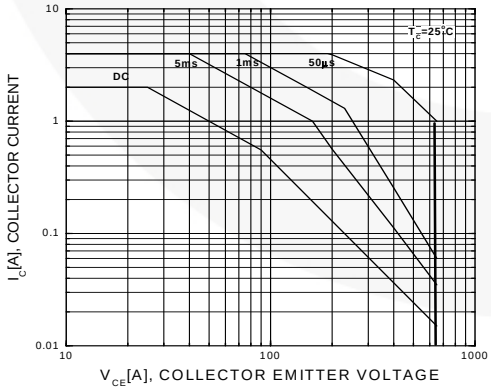



**Figure 23. Forward Bias Safe Operating Area**

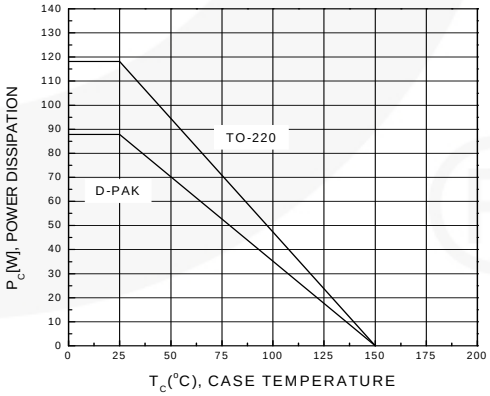



**Figure 24. Power Derating**



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## Typical Performance Characteristics (Continued)

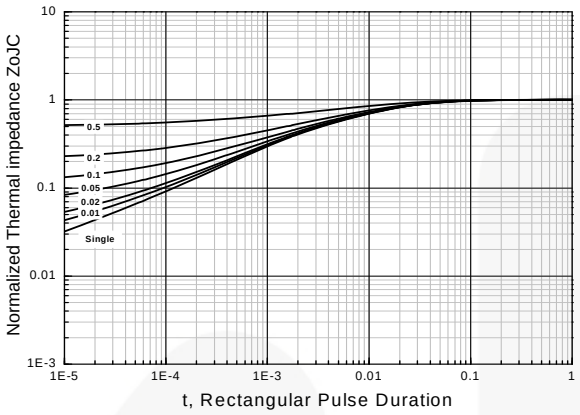



**Figure 25. ZoJC, Transient Thermal Impedance (D-PAK)**

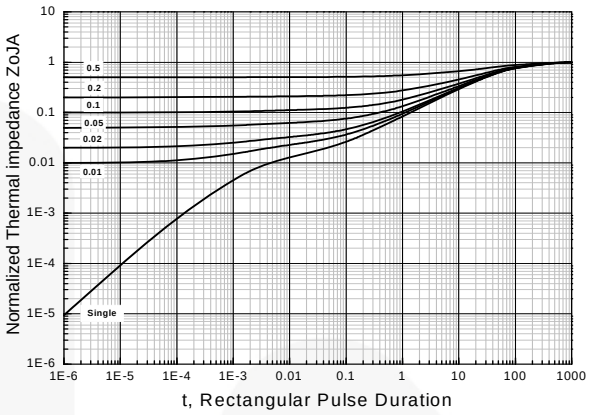



**Figure 26. ZoJA, Transient Thermal Impedance (D-PAK)**

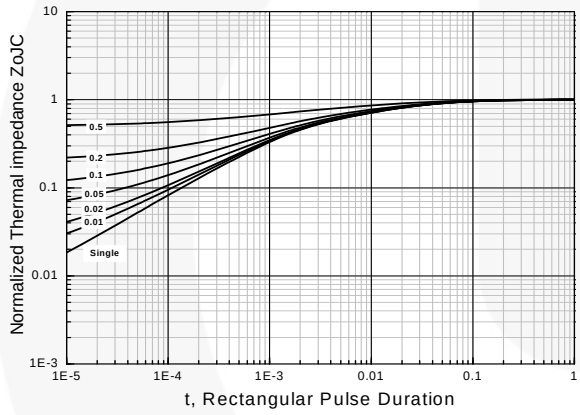



**Figure 27. ZoJC, Transient Thermal Impedance (TO-220)**

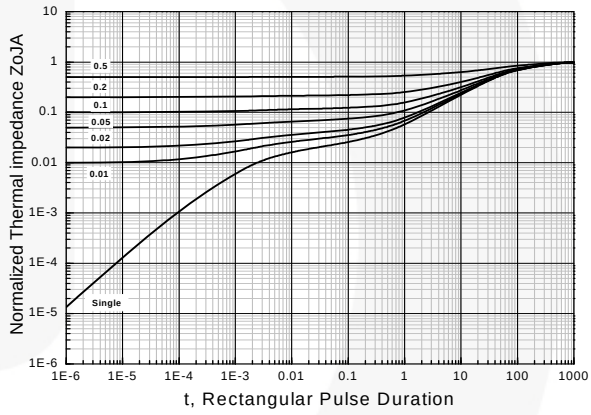



**Figure 28. ZoJA, Transient Thermal Impedance (TO-220)**



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## Physical Dimensions

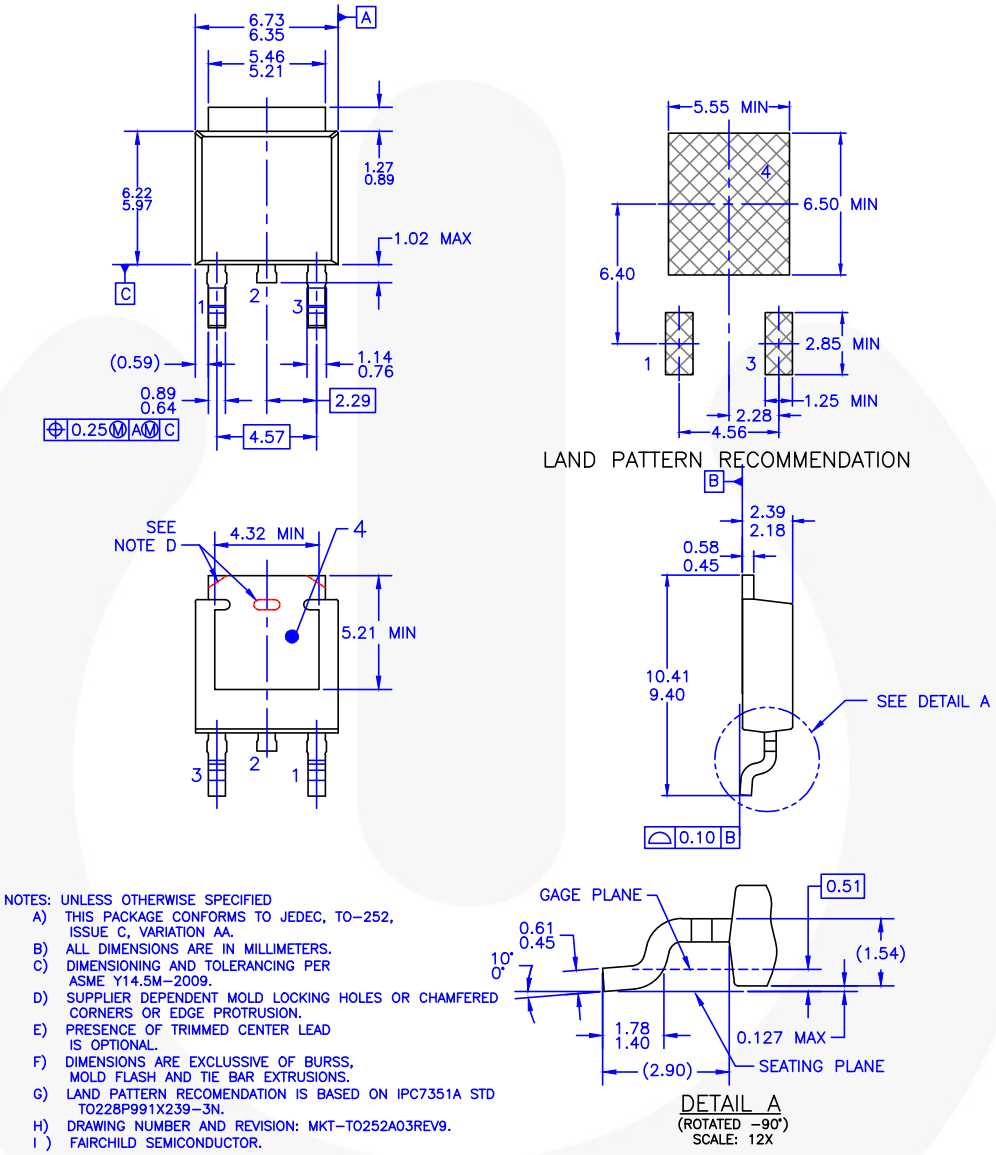



**Figure 29. TO-252 (D-PAK), MOLDED, 3-LEAD, OPTION AA & AB**

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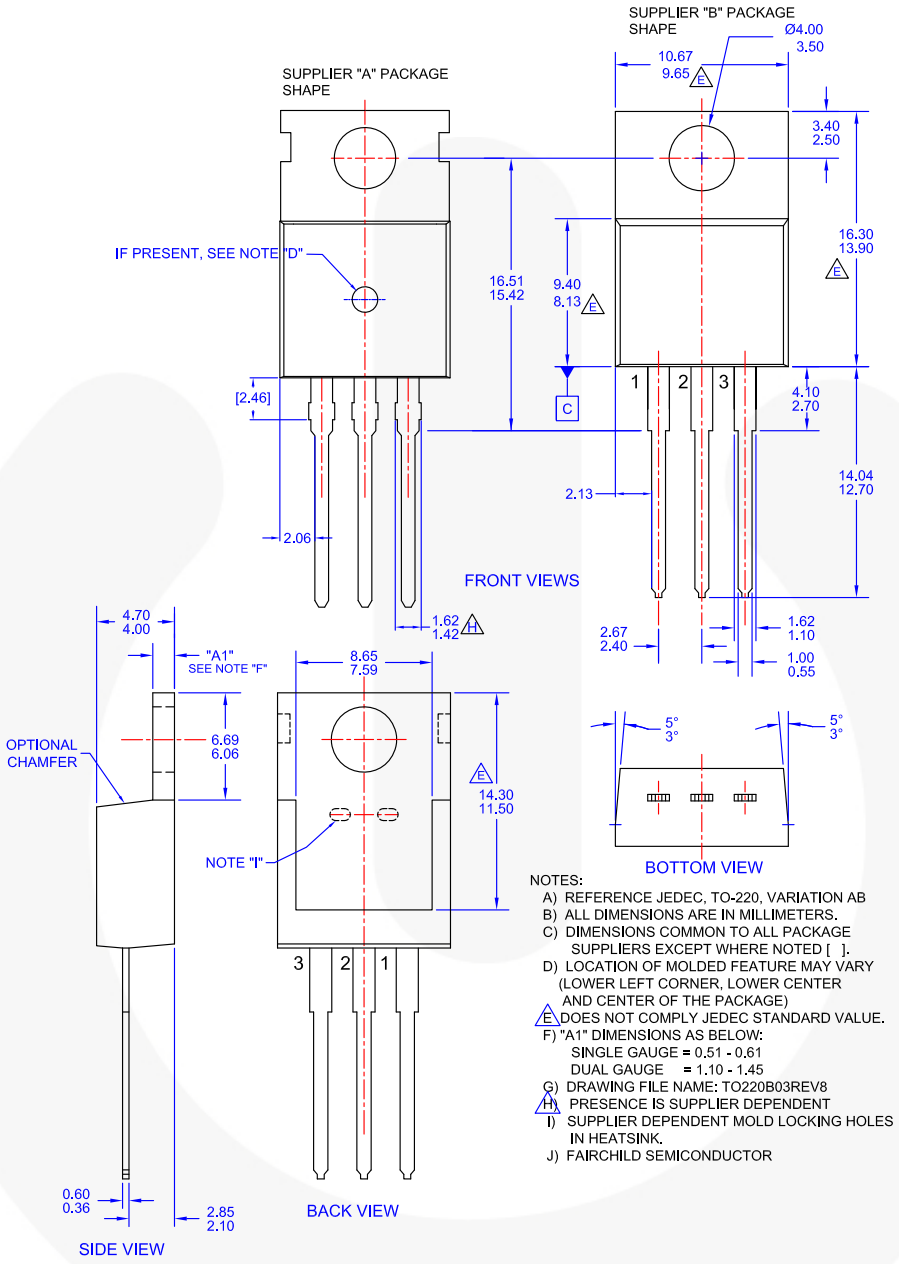



**Figure 30. TO-220, MOLDED, 3LEAD, JEDEC VARIATION AB**

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