

High voltage fast-switching NPN power transistor

Features

- High voltage capability
- High DC current gain
- Minimum lot to lot spread for reliable operation

Application

- Switching mode power supplies

Description

The STW2040 is manufactured using diffused collector in planar technology adopting base island layout.

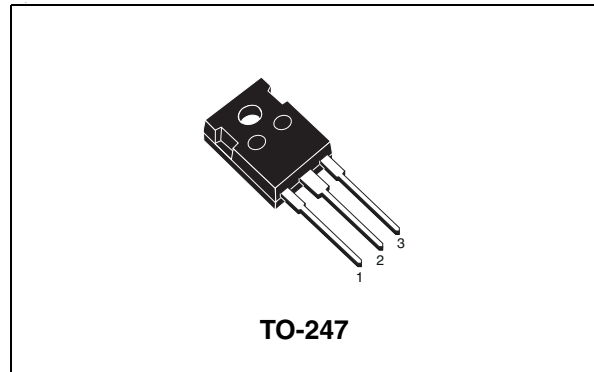


Figure 1. Internal schematic diagram

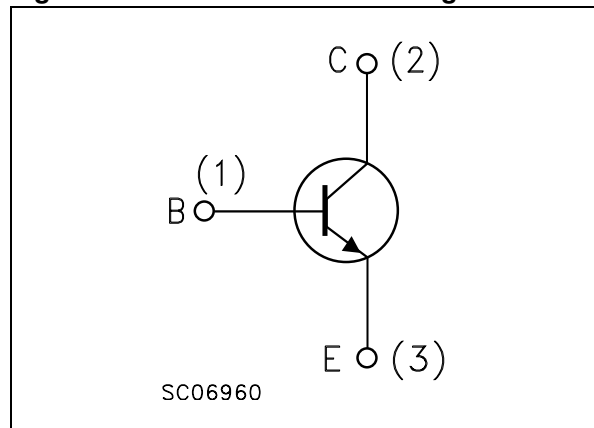


Table 1. Device summary

| Order code | Marking | Package | Packaging |
|------------|---------|---------|-----------|
| STW2040 | W2040 | TO-247 | Tube |

1 Absolute maximum ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------|
| V_{CES} | Collector-emitter voltage ($V_{CE} = 0$) | 700 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 500 | V |
| V_{EBO} | Emitter-base voltage ($I_C = 0$) | 9 | V |
| I_C | Collector current | 20 | A |
| I_{CM} | Collector peak current | 30 | A |
| I_B | Base current | 7 | A |
| I_{BM} | Base peak current | 10 | A |
| P_{TOT} | Total dissipation at $T_c = 25\text{ °C}$ | 125 | W |
| T_{stg} | Storage temperature | -65 to 150 | °C |
| T_J | Max. operating junction temperature | 150 | °C |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|--------------------------------------|-------|------|
| R_{thJC} | Thermal resistance junction-case max | 1 | °C/W |

2 Electrical characteristics

($T_{\text{case}} = 25\text{ °C}$; unless otherwise specified)

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---------------|-------------------|------------|---|
| I_{CES} | Collector cut-off current ($V_{\text{BE}} = 0$) | $V_{\text{CE}} = 700\text{ V}$ | | | 250 | μA |
| I_{EBO} | Emitter cut-off current ($I_{\text{C}} = 0$) | $V_{\text{EB}} = 9\text{ V}$ | | | 1 | mA |
| $V_{(\text{BR})\text{CEO}}$ | Collector-emitter breakdown voltage ($I_{\text{B}} = 0$) | $I_{\text{C}} = 10\text{ mA}$ | 500 | | | V |
| $V_{\text{CE}(\text{sat})}^{(1)}$ | Collector-emitter saturation voltage | $I_{\text{C}} = 6\text{ A}$ $I_{\text{B}} = 1.2\text{ A}$ $I_{\text{C}} = 12\text{ A}$ $I_{\text{B}} = 2.4\text{ A}$ $I_{\text{C}} = 20\text{ A}$ $I_{\text{B}} = 4\text{ A}$ | | 0.2 0.3 0.6 | 0.5 | V V V |
| $V_{\text{BE}(\text{sat})}^{(1)}$ | Base-emitter saturation voltage | $I_{\text{C}} = 6\text{ A}$ $I_{\text{B}} = 1.2\text{ A}$ $I_{\text{C}} = 12\text{ A}$ $I_{\text{B}} = 2.4\text{ A}$ | | | 1.2 1.5 | V V |
| $h_{\text{FE}}^{(1)}$ | DC current gain | $I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 6\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ $I_{\text{C}} = 12\text{ A}$ $V_{\text{CE}} = 5\text{ V}$ | 8 15 10 | 21 | 27 | |
| t_{on} t_{f} t_{s} | Resistive load Turn-on time Fall time Storage time | $V_{\text{CC}} = 200\text{ V}$ $V_{\text{BE}(\text{off})} = -5\text{ V}$ $I_{\text{C}} = 7.5\text{ A}$ $I_{\text{B}(\text{on})} = 1.5\text{ A}$ $I_{\text{B}(\text{off})} = -3\text{ A}$ | | 140 100 1.6 | | ns ns μs |
| t_{s} t_{f} | Inductive load Storage time Fall time | $V_{\text{CL}} = 250\text{ V}$ $V_{\text{BE}(\text{off})} = -5\text{ V}$ $I_{\text{C}} = 7.5\text{ A}$ $I_{\text{B}(\text{on})} = 1.5\text{ A}$ $I_{\text{B}(\text{off})} = -3\text{ A}$ | | 1.8 30 | | μs ns |

1. Pulsed duration = 300 μs , duty cycle $\leq 1.5\%$

2.1 Electrical characteristic (curves)

Figure 2. Safe operating area

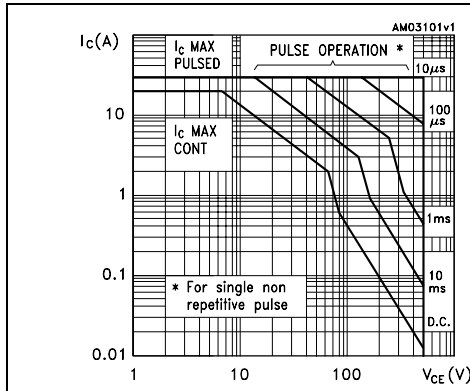


Figure 3. Derating curve

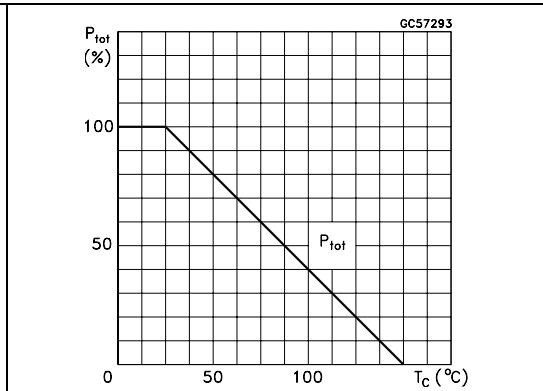


Figure 4. Reverse biased safe operating area

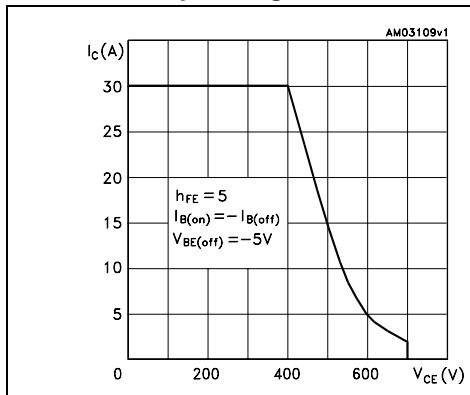


Figure 5. Output characteristics

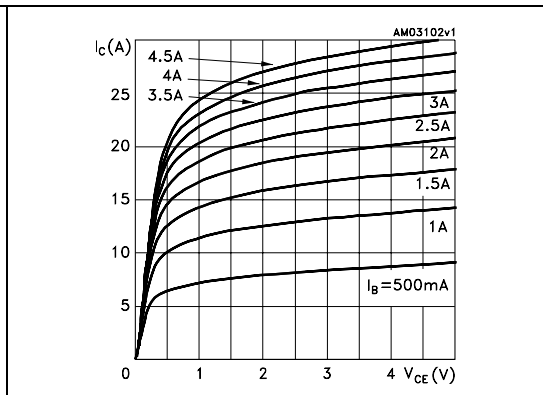


Figure 6. DC current gain ($V_{CE} = 1 V$)

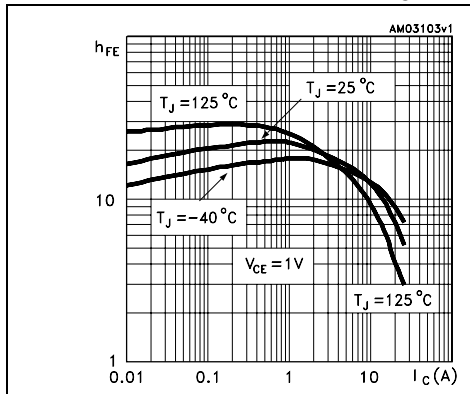


Figure 7. DC current gain ($V_{CE} = 5 V$)

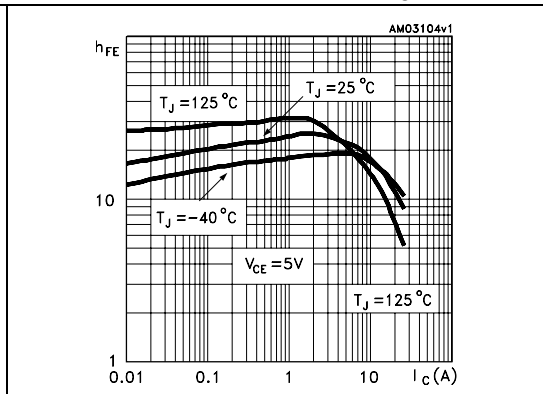


Figure 8. Collector-emitter saturation voltage

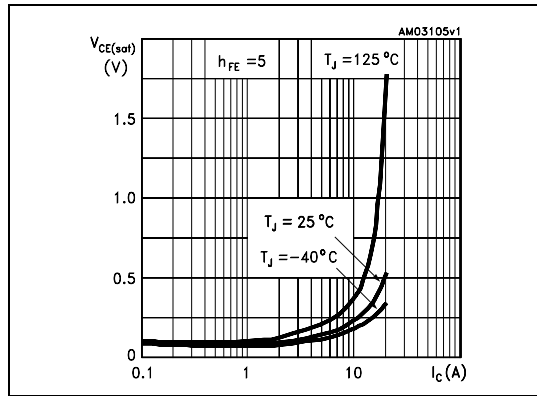


Figure 9. Base-emitter saturation voltage

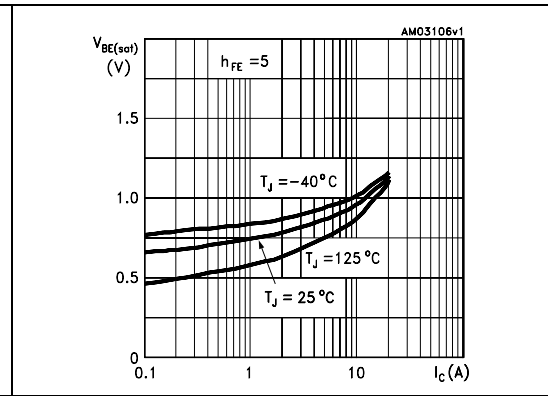


Figure 10. Inductive load switching time

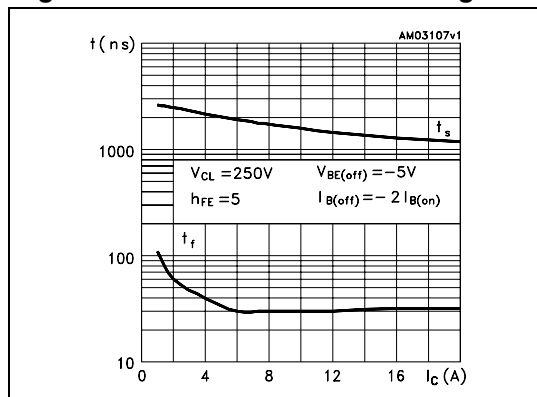
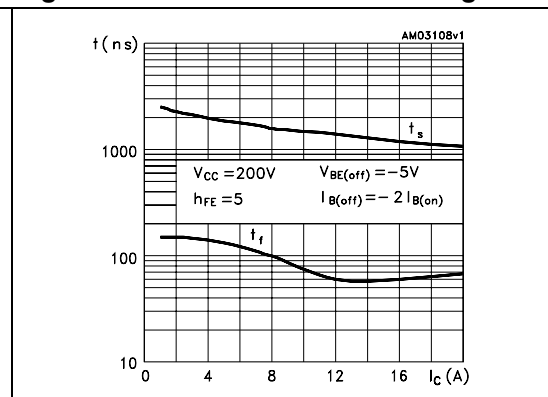
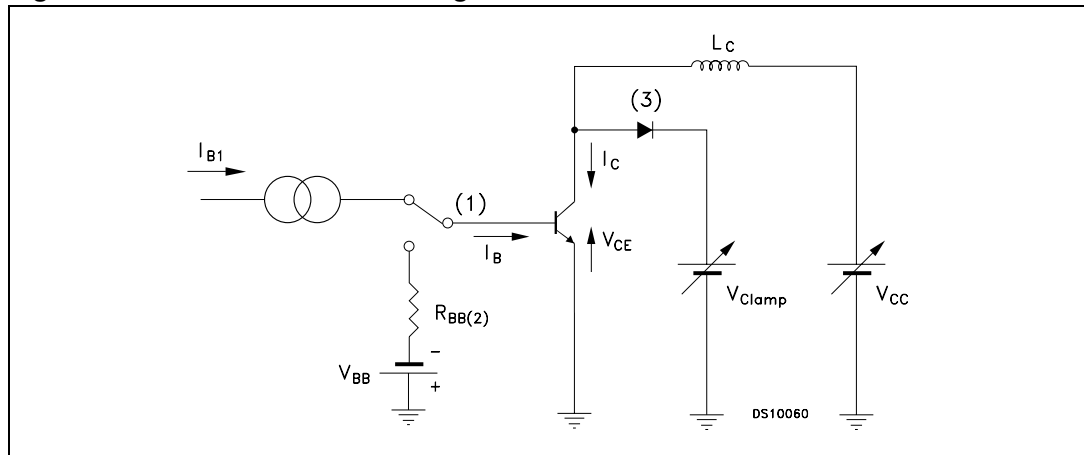


Figure 11. Resistive load switching time



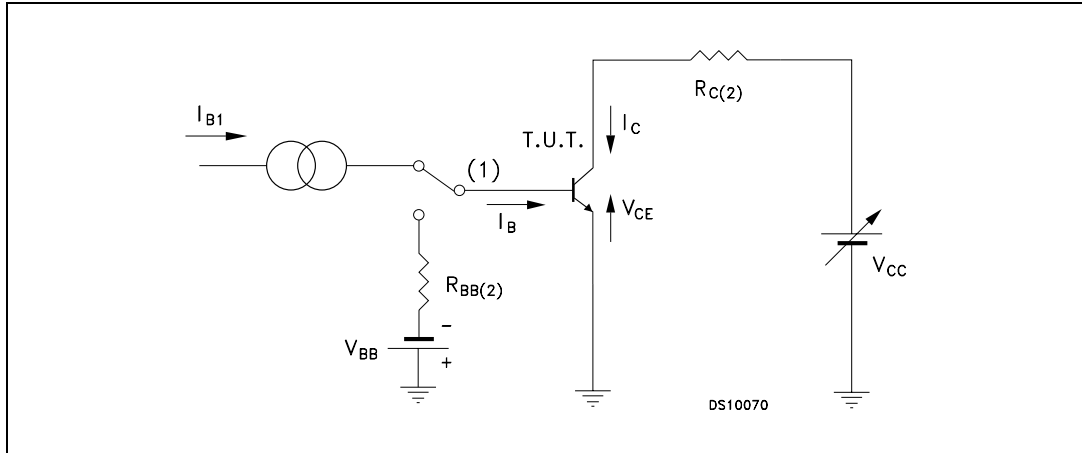
2.2 Test circuits

Figure 12. Inductive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor
3. Fast recovery rectifier

Figure 13. Resistive load switching test circuit



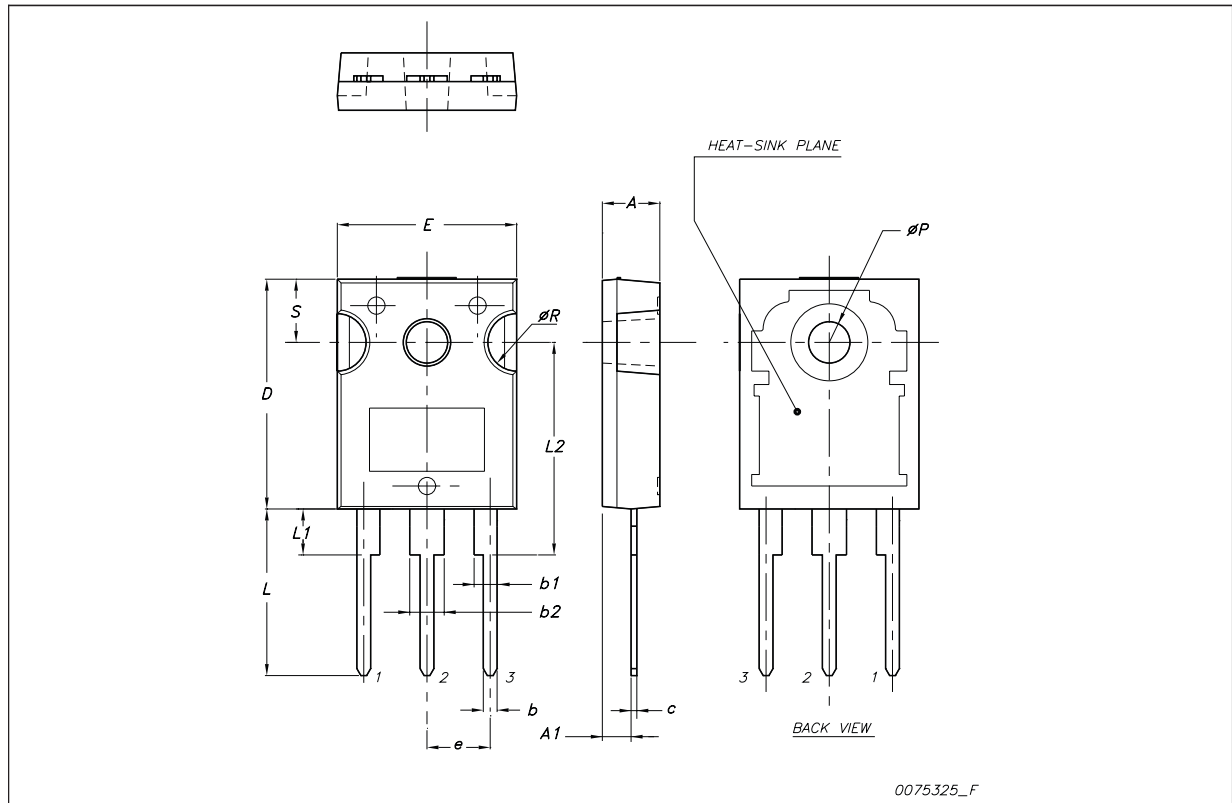
1. Fast electronic switch
2. Non-inductive resistor

3 Package mechanical data

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TO-247 mechanical data

| Dim. | mm. | | |
|------|-------|-------|-------|
| | Min. | Typ. | Max. |
| A | 4.85 | | 5.15 |
| A1 | 2.20 | | 2.60 |
| b | 1.0 | | 1.40 |
| b1 | 2.0 | | 2.40 |
| b2 | 3.0 | | 3.40 |
| c | 0.40 | | 0.80 |
| D | 19.85 | | 20.15 |
| E | 15.45 | | 15.75 |
| e | | 5.45 | |
| L | 14.20 | | 14.80 |
| L1 | 3.70 | | 4.30 |
| L2 | | 18.50 | |
| øP | 3.55 | | 3.65 |
| øR | 4.50 | | 5.50 |
| S | | 5.50 | |



4 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 07-Nov-2008 | 1 | Initial release. |
| 10-Jun-2009 | 2 | Document status promoted from preliminary data to datasheet. |

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