



Phase Control Thyristor RMS SCRs, 25 A, 35 A



TO-48 (TO-208AA)

FEATURES

- General purpose stud mounted
- Broad forward and reverse voltage range - through 1200 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT

| PRIMARY CHARACTERISTICS | |
|-------------------------|---|
| $I_{T(AV)}$ | 16 A, 22 A |
| $I_{T(RMS)}$ | 25 A, 35 A |
| V_{DRM}/V_{RRM} | 25 V, 50 V, 100 V, 150 V, 200 V, 250 V, 300 V, 400 V, 500 V, 600 V, 700 V, 800 V, 1000 V 1200 V |
| V_{TM} | 2.3 V |
| I_{GT} | 60 mA |
| T_J | -40 °C to +125 °C |
| Package | TO-48 (TO-208AA) |
| Circuit configuration | Single SCR |

| MAJOR RATINGS AND CHARACTERISTICS | | | | |
|-----------------------------------|-----------------|----------------------------|----------------------------|------------------|
| PARAMETER | TEST CONDITIONS | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS |
| $I_{T(AV)}$ | | 16 ⁽¹⁾ | 22 ⁽¹⁾ | A |
| | T_C | -65 to +65 ⁽¹⁾ | -40 to +40 | °C |
| $I_{T(RMS)}$ | | 25 | 35 | A |
| I_{TSM} | 50 Hz | 145 | 285 | A |
| | 60 Hz | 150 ⁽¹⁾ | 300 ⁽¹⁾ | |
| I^2t | 50 Hz | 103 | 410 | A ² s |
| | 60 Hz | 94 | 375 | |
| I_{GT} | | 40 | 40 | mA |
| dV/dt | | - | 100 ⁽¹⁾ | V/ μ s |
| dl/dt | | 75 to 100 | 100 | A/ μ s |
| V_{DRM} | Range | 25 to 800 | 600 to 1200 | V |
| V_{RRM} | Range | 25 to 800 | 600 to 1200 | V |
| T_J | | -65 to +125 ⁽¹⁾ | -40 to +125 ⁽¹⁾ | °C |

Note

⁽¹⁾ JEDEC® registered value



ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS (APPLIED GATE VOLTAGE ZERO OR NEGATIVE) | | | |
|---|--|--|-------------------|
| TYPE NUMBER | V_{RRM}/V_{DRM} , MAXIMUM REPETITIVE PEAK REVERSE AND OFF-STATE VOLTAGE V | V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE ($t_p < 5$ ms) V | T_J |
| VS-2N681 | 25 | 35 | -65 °C to +125 °C |
| VS-2N682 | 50 | 75 | |
| VS-2N683 | 100 | 150 | |
| VS-2N684 | 150 | 200 | |
| VS-2N685 | 200 | 300 | |
| VS-2N686 | 250 | 350 | |
| VS-2N687 | 300 | 400 | |
| VS-2N688 | 400 | 500 | |
| VS-2N689 | 500 | 600 | |
| VS-2N690 | 600 | 720 | |
| VS-2N691 | 700 | 840 | |
| VS-2N692 | 800 | 960 | |
| VS-2N5205 | 800 | 960 | -40 °C to +125 °C |
| VS-2N5206 | 1000 | 1200 | |
| VS-2N5207 | 1200 | 1440 | |

Note

- JEDEC registered values

| ABSOLUTE MAXIMUM RATINGS | | | | | | |
|---|------------------------------|---|--|---------------------------|------------------------------|-------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS |
| Maximum average on-state current at case temperature | $I_{T(AV)}$ | 180° half sine wave conduction | | 16 ⁽¹⁾ | 22 ⁽¹⁾ | A |
| | | | | -65 to +65 ⁽¹⁾ | -40 to +40 ⁽¹⁾ | °C |
| Maximum RMS on-state current | $I_{T(RMS)}$ | | | 25 | 35 | A |
| Maximum peak, one-cycle non-repetitive surge current | I_{TSM} | 50 Hz half cycle sine wave or 6 ms rectangular pulse | Following any rated load condition, and with rated V_{RRM} applied following surge | 145 | 285 | A |
| | | 60 Hz half cycle sine wave or 5 ms rectangular pulse | | 150 ⁽¹⁾ | 300 ⁽¹⁾ | |
| | | 50 Hz half cycle sine wave or 6 ms rectangular pulse | Same conditions as above except with V_{RRM} applied following surge = 0 | 170 | 340 | |
| | | 60 Hz half cycle sine wave or 5 ms rectangular pulse | | 180 | 355 | |
| Maximum I^2t capability for fusing | I^2t | t = 10 ms | Rated V_{RRM} applied following surge, initial $T_J = 125$ °C | 103 | 410 | A ² s |
| | | t = 8.3 ms | | 94 | 375 | |
| Maximum I^2t capability for individual device fusing | I^2t | t = 10 ms | $V_{RRM} = 0$ following surge, initial $T_J = 125$ °C | 145 | 580 | |
| | | t = 8.3 ms | | 135 | 530 | |
| Maximum $I^2\sqrt{t}$ capability for individual device fusing | $I^2\sqrt{t}$ ⁽²⁾ | t = 0.1 ms to 10 ms, initial $T_J < 125$ °C V_{RRM} applied following surge = 0 | | 1450 | 5800 | A ² √s |
| Maximum peak on-state voltage | V_{TM} | $T_J = 25$ °C, $I_{T(AV)} = 16$ A (50 A peak) 2N681, $I_{T(AV)} = 22$ A (70 A peak) 2N5204 | | 2 ⁽¹⁾ | 2.3 ⁽¹⁾ | V |
| Maximum holding current | I_H | Anode supply 24 V, initial $I_T = 1.0$ A | | 20 at 25 °C (typical) | 200 ⁽¹⁾ at -40 °C | mA |

Notes

- ⁽¹⁾ JEDEC registered value
⁽²⁾ I^2t for time $t_x = I^2\sqrt{t} \cdot \sqrt{t_x}$



| SWITCHING | | | | | |
|--|--------|--|--------------------|---------------------|------------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS |
| Maximum non-repetitive rate of rise of turned-on current | di/dt | $T_C = 125\text{ }^\circ\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 2 \times di/dt$, gate pulse = 20 V, $15\ \Omega$, $t_p = 6\ \mu\text{s}$, $t_r = 0.1\ \mu\text{s}$ maximum Per JEDEC standard RS-397, 5.2.2.6 | 100 | - | A/ μs |
| | | | 75 | - | |
| | | | - | 100 | |
| Typical delay time | t_d | $T_C = 25\text{ }^\circ\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 10\ \text{A}$ DC resistive circuit, gate pulse = 10 V, $40\ \Omega$ source, $t_p = 6\ \mu\text{s}$, $t_r = 0.1\ \mu\text{s}$ | 1 | 1 | μs |

| BLOCKING | | | | | | | |
|--|--------------------------|---|------------------------|--|--------------------|------------------|----|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS | | |
| Minimum critical rate of rise of off-state voltage | dV/dt | $T_J = 125\text{ }^\circ\text{C}$, exponential to 100 % rated V_{DRM} | Gate open circuited | 100 (typical) | 100 ⁽¹⁾ | V/ μs | |
| | | $T_J = 125\text{ }^\circ\text{C}$, exponential to 67 % rated V_{DRM} | | 250 (typical) | 250 | | |
| Maximum reverse leakage current | I_{DRM} , I_{RRM} | $T_J = 125\text{ }^\circ\text{C}$ | | V_{RRM} , $V_{DRM} = 400\ \text{V}$ | 3.5 | - | mA |
| | | | | V_{RRM} , $V_{DRM} = 500\ \text{V}$ | 3.5 | - | |
| | | | | V_{RRM} , $V_{DRM} = 600\ \text{V}$ | 2.5 | 3.3 | |
| | | | | V_{RRM} , $V_{DRM} = 700\ \text{V}$ | 2.2 | - | |
| | | | | V_{RRM} , $V_{DRM} = 800\ \text{V}$ | 2 | 2.5 | |
| | | | | V_{RRM} , $V_{DRM} = 1000\ \text{V}$ | - | 2 | |
| | | | | V_{RRM} , $V_{DRM} = 1200\ \text{V}$ | - | 1.7 | |

Note

(1) JEDEC registered value

| TRIGGERING | | | | | |
|---|-------------|--|---|---------------------|-------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS |
| Maximum peak gate power | P_{GM} | $t_p < 5\ \text{ms}$ for 2N681 series; $t_p < 500\ \mu\text{s}$ for 2N5204 series | 5 ⁽¹⁾ | 60 ⁽¹⁾ | W |
| Maximum average gate power | $P_{G(AV)}$ | | 0.5 ⁽¹⁾ | 0.5 ⁽¹⁾ | |
| Maximum peak positive gate current | $+I_{GM}$ | | 2 ⁽¹⁾ | 2 | A |
| Maximum peak positive gate voltage | $+V_{GM}$ | | 10 ⁽¹⁾ | - | V |
| Maximum peak negative gate voltage | $-V_{GM}$ | | 5 ⁽¹⁾ | 5 ⁽¹⁾ | |
| Maximum required DC gate current to trigger | I_{GT} | $T_C = \text{min. rated value}$ | Maximum required gate trigger current is the lowest value which will trigger all units with +6 V anode to cathode | | mA |
| | | $T_C = 25\text{ }^\circ\text{C}$ | 40 | 40 | |
| | | $T_C = 125\text{ }^\circ\text{C}$ | 18.5 | 20 | |
| Typical DC gate current to trigger | | $T_C = 25\text{ }^\circ\text{C}$, +6 V anode to cathode | 30 | 30 | |
| Maximum required DC gate voltage to trigger | V_{GT} | $T_C = -65\text{ }^\circ\text{C}$ | Maximum required gate trigger voltage is the lowest value which will trigger all units with +6 V anode to cathode | | V |
| | | $T_C = 25\text{ }^\circ\text{C}$ | 2 | 2 | |
| Typical DC gate voltage to trigger | | $T_C = 25\text{ }^\circ\text{C}$, +6 V anode to cathode | 1.5 | 1.5 | |
| Maximum DC gate voltage not to trigger | V_{GD} | $T_C = 125\text{ }^\circ\text{C}$ | 0.25 ⁽¹⁾ | 0.25 ⁽¹⁾ | V |

Note

(1) JEDEC registered value



| THERMAL AND MECHANICAL SPECIFICATIONS | | | | | |
|---|----------------|--|---------------------------|---------------------------|----------|
| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES 2N681-92 | VALUES 2N5205-07 | UNITS |
| Operating junction and storage temperature range | T_J, T_{Stg} | | -65 to 125 ⁽¹⁾ | -40 to 125 ⁽¹⁾ | °C |
| Maximum internal thermal resistance, junction to case | R_{thJC} | DC operation | 1.5 | 1.5 ⁽¹⁾ | °C/W |
| Typical thermal resistance, case to sink | R_{thCS} | Mounting surface, smooth, flat and greased | 0.35 | 0.35 | |
| Mounting torque ± 10 % | to nut | Lubricated threads (Non-lubricated threads) | 20 (27.5) | | lbf · in |
| | | | 0.23 (0.32) | | kgf · cm |
| | | | 2.3 (3.1) | | N · m |
| | to device | Lubricated threads | 25 | | lbf · in |
| | | | 0.29 | | kgf · cm |
| | | | 2.8 | | N · m |
| Approximate weight | | | 14 | 14 | g |
| | | | 0.49 | 0.5 | oz. |
| Case style | | | TO-48 (TO-208AA) | | |

Note

⁽¹⁾ JEDEC registered value

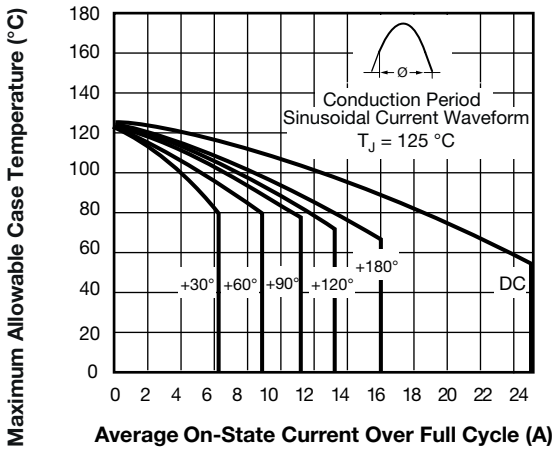


Fig. 1 - Maximum Allowable Case Temperature vs. Average On-State Current, 2N681 Series

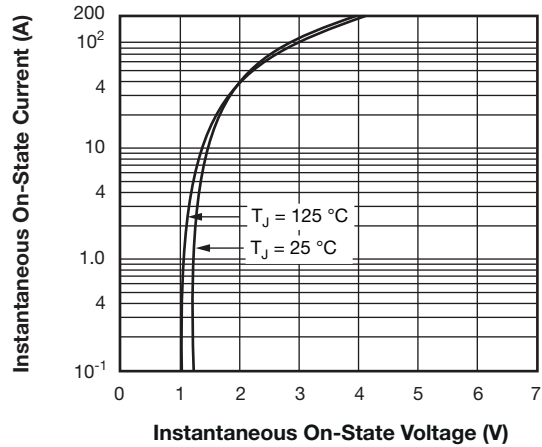
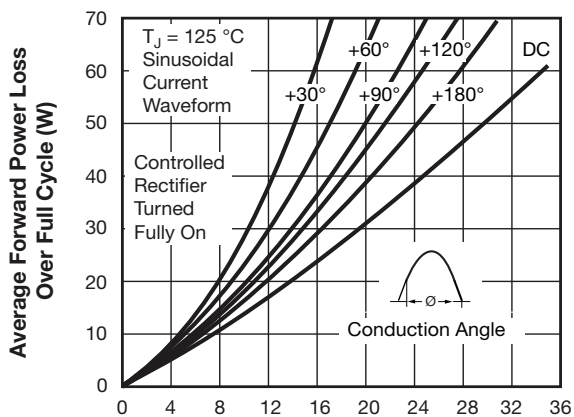
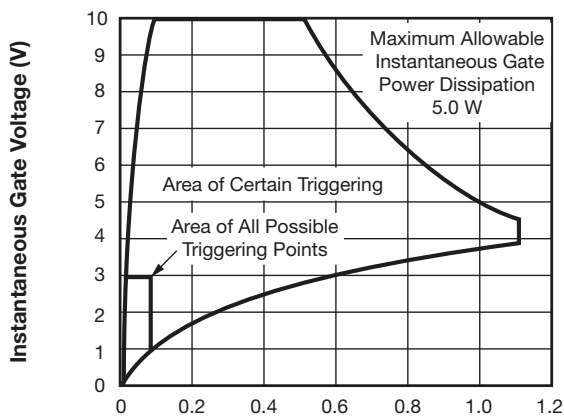


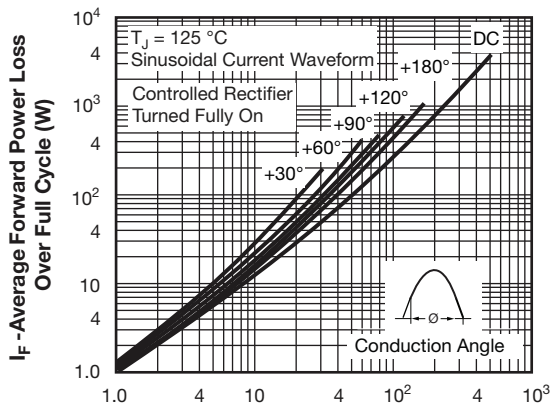
Fig. 2 - Maximum On-State Voltage vs. Current, 2N681 Series



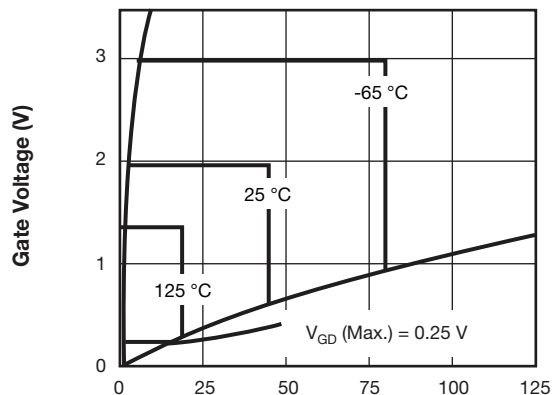
Average On-State Current Over Full Cycle (A)
 Fig. 3 - Maximum Low Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series



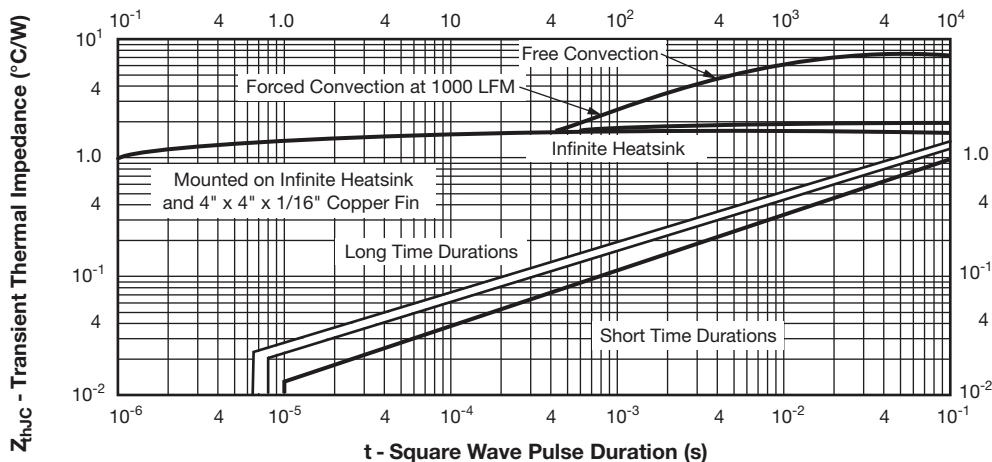
Instantaneous Gate Current (A)
 Fig. 5 - Gate Characteristics, 2N681 Series



Average On-State Current Over Full Cycle (A)
 Fig. 4 - Maximum High Level On-State Power Loss vs. Current (Sinusoidal Current Waveform), 2N681 Series



Gate Current (mA)
 Fig. 5a - Area of All Possible Triggering Points vs. Temperature, 2N681 Series



t - Square Wave Pulse Duration (s)
 Fig. 6 - Maximum Transient Thermal Impedance, Junction to Case, vs. Pulse Duration, 2N681 Series

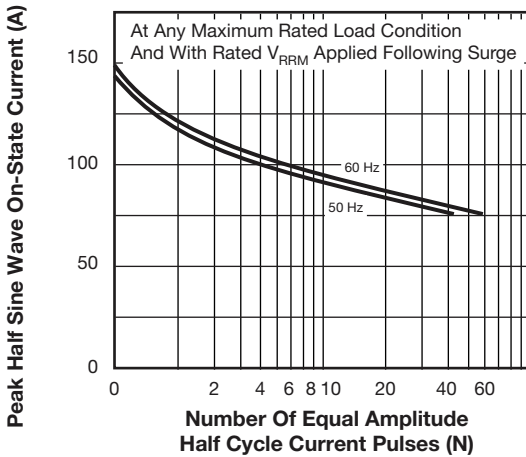


Fig. 7 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 2N681 Series

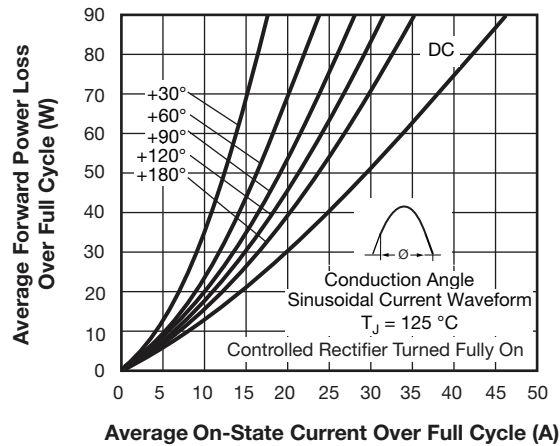


Fig. 10 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

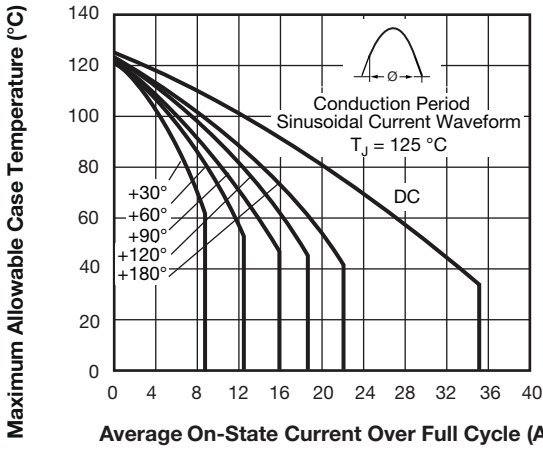


Fig. 8 - Maximum Allowable Case Temperature vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

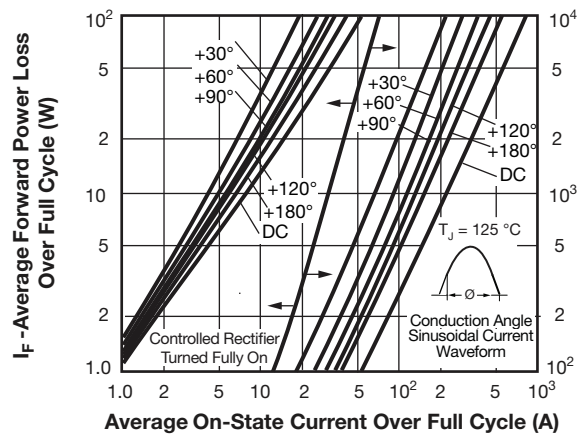


Fig. 11 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Sinusoidal Current Waveform), 2N5205 Series

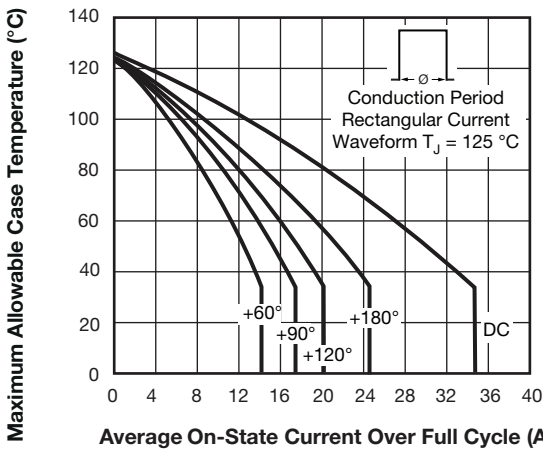


Fig. 9 - Maximum Allowable Case Temperature vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

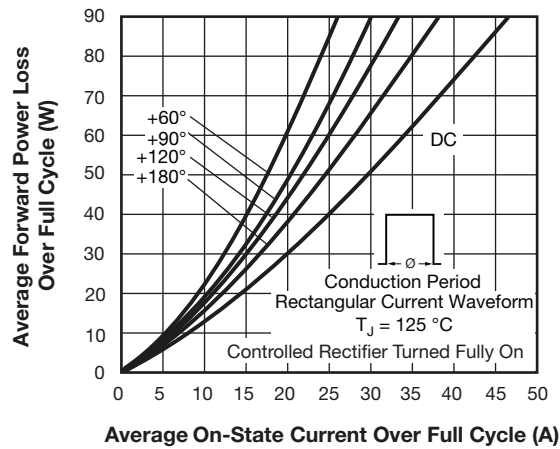


Fig. 12 - Maximum Low-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

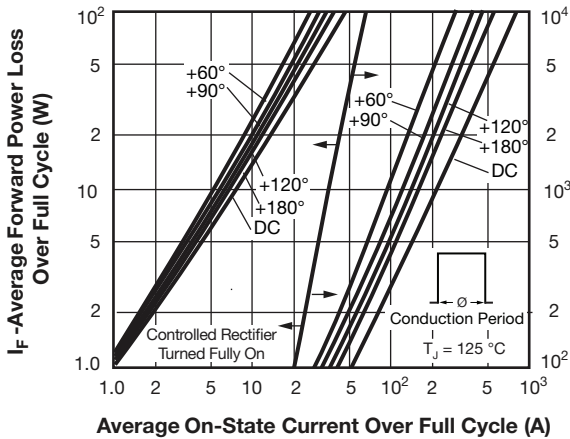


Fig. 13 - Maximum High-Level On-State Power Loss vs. Average On-State Current (Rectangular Current Waveform), 2N5205 Series

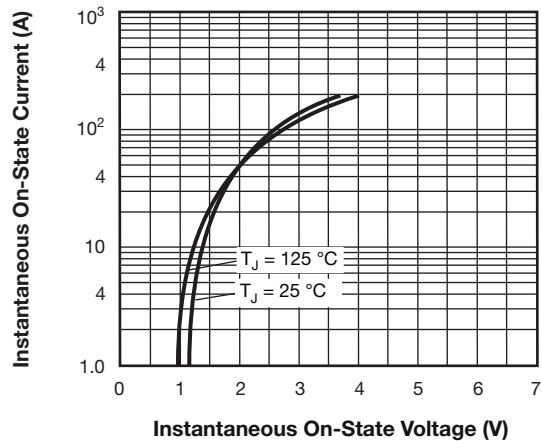


Fig. 14 - Maximum Instantaneous On-State Voltage vs. Instantaneous On-State Current, 2N5205 Series

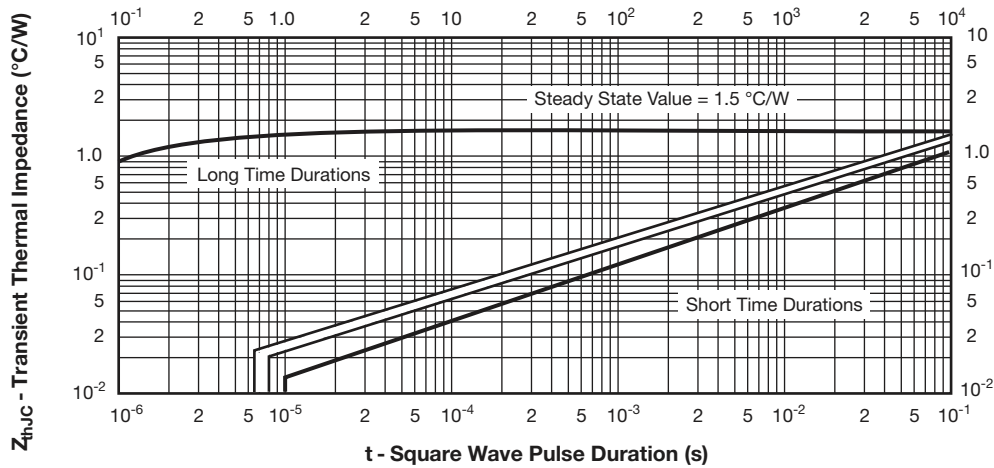


Fig. 15 - Maximum Transient Thermal Resistance, Junction to Case vs. Pulse Duration, 2N5205 Series

LINKS TO RELATED DOCUMENTS

Dimensions

www.vishay.com/doc?95333



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