

FDS6982

Dual N-Channel, Notebook Power Supply MOSFET

General Description

This part is designed to replace two single SO-8 MOSFETs in synchronous DC:DC power supplies that provide the various peripheral voltage rails required in notebook computers and other battery powered electronic devices. FDS6982 contains two unique 30V, N-channel, logic level, PowerTrench® MOSFETs designed to maximize power conversion efficiency.

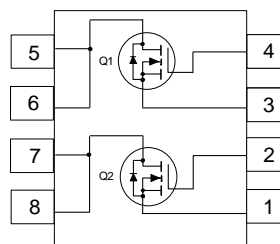
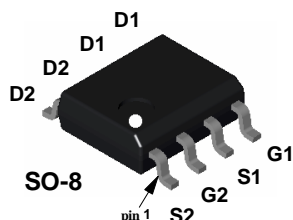
The high-side switch (Q1) is designed with specific emphasis on reducing switching losses while the low-side switch (Q2) is optimized for low conduction losses (less than 20mΩ at $V_{GS} = 4.5V$).

Applications

- Battery powered synchronous DC:DC converters.
- Embedded DC:DC conversion.

Features

- Q2: 8.6A, 30V. $R_{DS(on)} = 0.015 \Omega @ V_{GS} = 10V$
 $R_{DS(on)} = 0.020 \Omega @ V_{GS} = 4.5V$
- Q1: 6.3A, 30V. $R_{DS(on)} = 0.028 \Omega @ V_{GS} = 10V$
 $R_{DS(on)} = 0.035 \Omega @ V_{GS} = 4.5V$
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(on)}$.



Absolute Maximum Ratings T_A = 25°C unless otherwise noted

| Symbol | Parameter | Q2 | Q1 | Units |
|----------------|--|-------------|-----|-------|
| V_{DSS} | Drain-Source Voltage | 30 | 30 | V |
| V_{GSS} | Gate-Source Voltage | ±20 | ±20 | V |
| I_D | Drain Current - Continuous (Note 1a) | 8.6 | 6.3 | A |
| | - Pulsed | 30 | 20 | |
| P_D | Power Dissipation for Dual Operation | 2 | | W |
| | Power Dissipation for Single Operation (Note 1a) | 1.6 | | |
| | (Note 1b) | 1 | | |
| | (Note 1c) | 0.9 | | |
| T_J, T_{stg} | Operating and Storage Junction Temperature Range | -55 to +150 | | °C |

Thermal Characteristics

| | | | |
|-----------------|---|----|------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 78 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1) | 40 | °C/W |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape Width | Quantity |
|----------------|---------|-----------|------------|------------|
| FDS6982 | FDS6982 | 13" | 12mm | 2500 units |

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|--------|-----------|-----------------|------|-----|-----|-----|-------|
|--------|-----------|-----------------|------|-----|-----|-----|-------|

Off Characteristics

| | | | | | | | |
|--------------------------------------|---|---|----------|----------|----------|------|----------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$ | Q2 Q1 | 30 30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | Q2 Q1 | | 27 26 | | mV/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 24\text{ V}, V_{GS} = 0\text{ V}$ | All | | | 1 | μA |
| I_{GSSF} | Gate-Body Leakage, Forward | $V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$ | All | | | 100 | nA |
| I_{GSSR} | Gate-Body Leakage, Reverse | $V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$ | All | | | -100 | nA |

On Characteristics (Note 2)

| | | | | | | | |
|--|--|---|----------|----------|------------|--------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$ | Q2 Q1 | 1 1 | 2.2 1.6 | 3 3 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$, Referenced to 25°C | Q2 Q1 | | -5 -4 | | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 8.6\text{ A}$ | Q2 | | 0.012 | 0.015 | Ω |
| | | $V_{GS} = 10\text{ V}, I_D = 8.6\text{ A}, T_J = 125^\circ\text{C}$ | | | 0.018 | 0.024 | |
| | | $V_{GS} = 4.5\text{ V}, I_D = 7.5\text{ A}$ | | | 0.016 | 0.020 | |
| | | $V_{GS} = 10\text{ V}, I_D = 6.3\text{ A}$ | Q1 | | 0.021 | 0.028 | Ω |
| | | $V_{GS} = 10\text{ V}, I_D = 6.3\text{ A}, T_J = 125^\circ\text{C}$ | | | 0.038 | 0.047 | |
| | | $V_{GS} = 4.5\text{ V}, I_D = 5.6\text{ A}$ | | | 0.028 | 0.035 | |
| $I_{D(on)}$ | On-State Drain Current | $V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$ | Q2 Q1 | 30 20 | | | A |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{ V}, I_D = 8.6\text{ A}$ | Q2 | | 50 | | S |
| | | $V_{DS} = 5\text{ V}, I_D = 6.3\text{ A}$ | Q1 | | 40 | | |

Dynamic Characteristics

| | | | | | | | |
|-----------|------------------------------|--|----------|--|-------------|--|----|
| C_{iss} | Input Capacitance | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$ | Q2 Q1 | | 2085 760 | | pF |
| C_{oss} | Output Capacitance | | Q2 Q1 | | 420 160 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | Q2 Q1 | | 160 70 | | pF |

Electrical Characteristics (continued) $T_A = 25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Type | Min | Typ | Max | Units |
|--------|-----------|-----------------|------|-----|-----|-----|-------|
|--------|-----------|-----------------|------|-----|-----|-----|-------|

Switching Characteristics (Note 2)

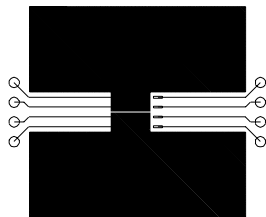
| | | | | | | | |
|--------------|---------------------|--|----|----|------|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 15\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 10\text{ V}, R_{GEN} = 6\ \Omega$ | Q2 | | 15 | 27 | ns |
| t_r | Turn-On Rise Time | | Q1 | | 10 | 18 | ns |
| | | | Q2 | | 11 | 20 | |
| $t_{d(off)}$ | Turn-Off Delay Time | | Q1 | | 14 | 25 | ns |
| | | Q2 | | 36 | 58 | | |
| t_f | Turn-Off Fall Time | Q1 | | 21 | 34 | ns | |
| | | Q2 | | 18 | 29 | | |
| Q_g | Total Gate Charge | Q2 $V_{DS} = 15\text{ V}, I_D = 8.6\text{ A}, V_{GS} = 5\text{ V}$ | Q2 | | 18.5 | 26 | nC |
| | | | Q1 | | 8.5 | 12 | |
| Q_{gs} | Gate-Source Charge | Q1 $V_{DS} = 15\text{ V}, I_D = 6.3\text{ A}, V_{GS} = 5\text{ V}$ | Q2 | | 7.3 | | nC |
| | | | Q1 | | 2.4 | | |
| Q_{gd} | Gate-Drain Charge | | Q2 | | 6.2 | | nC |
| | | | Q1 | | 3.1 | | |

Drain-Source Diode Characteristics and Maximum Ratings

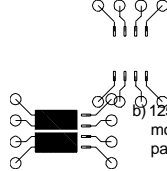
| | | | | | | | |
|----------|---|--|----|--|------|-----|---|
| I_S | Maximum Continuous Drain-Source Diode Forward Current | | Q2 | | | 1.3 | A |
| V_{SD} | Drain-Source Diode Forward Voltage | $V_{GS} = 0\text{ V}, I_S = 1.3\text{ A}$ (Note 2) | Q2 | | 0.72 | 1.2 | V |
| | | | Q1 | | 0.74 | 1.2 | |

Notes:

- $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. Thermal rating based on independent single device operation.



a) 78° C/W when mounted on a 0.5 in^2 pad of 2 oz. copper.



b) 125° C/W when mounted on a 0.02 in^2 pad of 2 oz. copper.

c) 135° C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$

Typical Characteristics: Q2

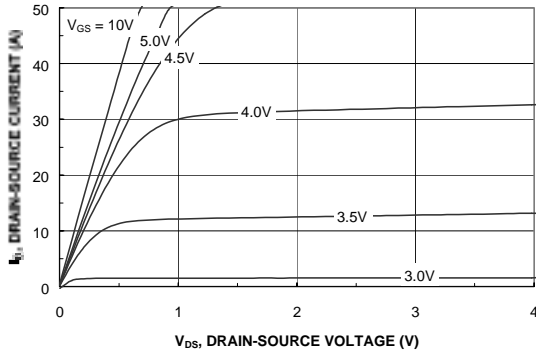


Figure 1. On-Region Characteristics.

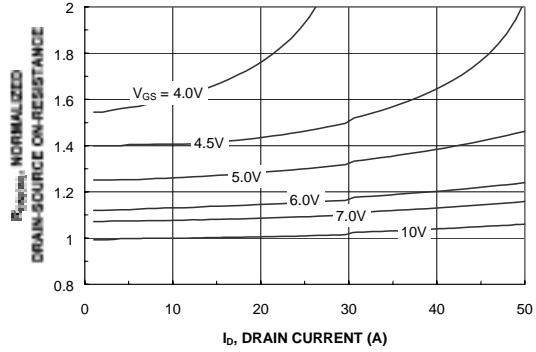


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

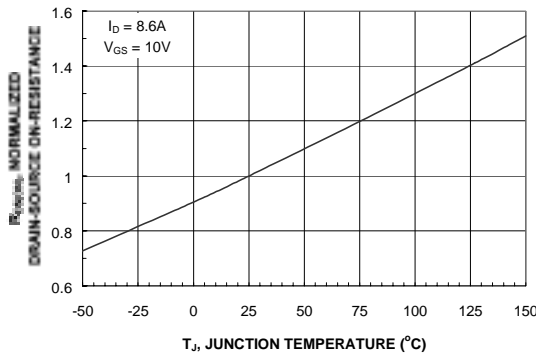


Figure 3. On-Resistance Variation with Temperature.

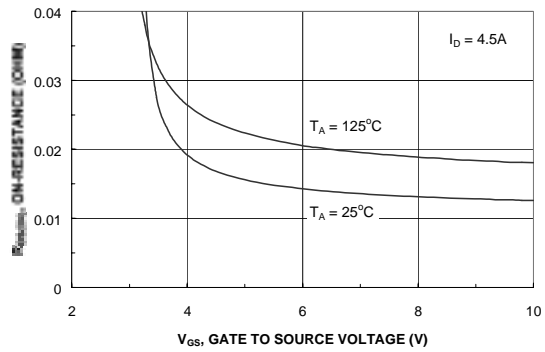


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

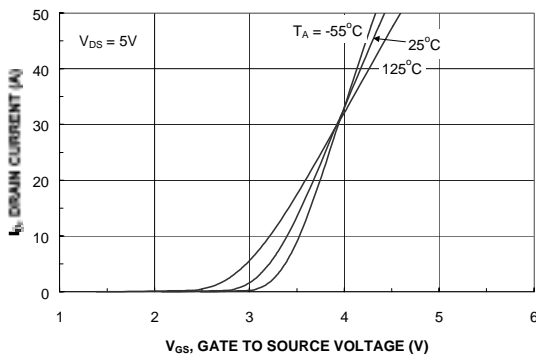


Figure 5. Transfer Characteristics.

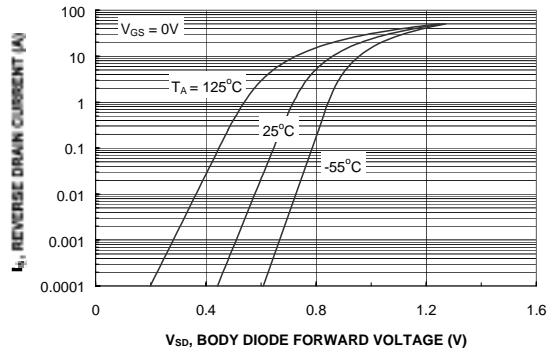


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: Q2 (continued)

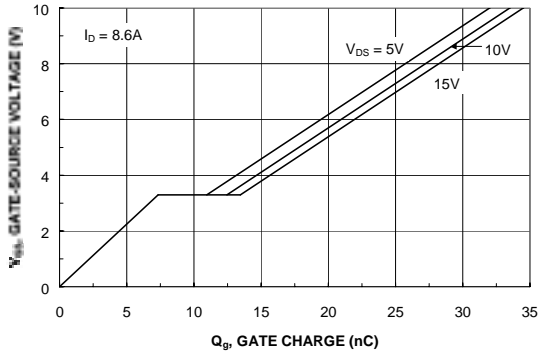


Figure 7. Gate-Charge Characteristics.

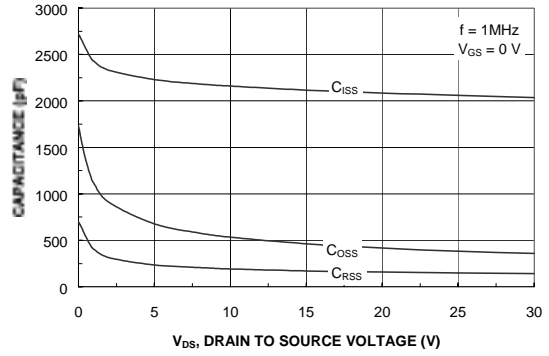


Figure 8. Capacitance Characteristics.

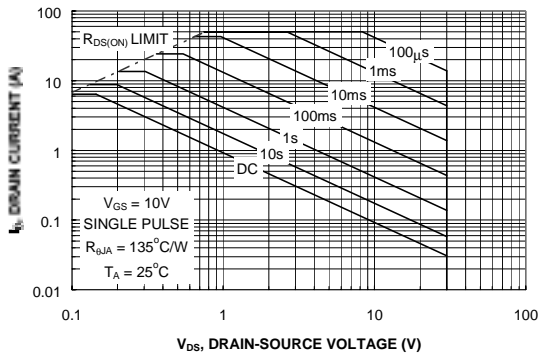


Figure 9. Maximum Safe Operating Area.

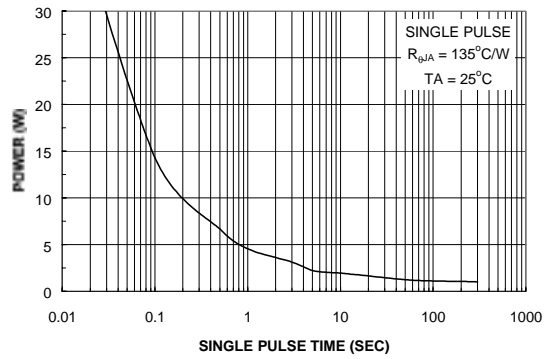


Figure 10. Single Pulse Maximum Power Dissipation.

Typical Characteristics: Q1

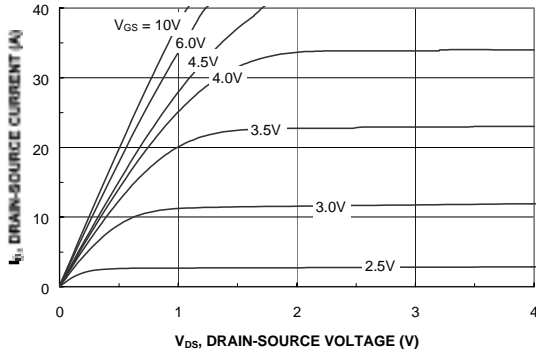


Figure 11. On-Region Characteristics.

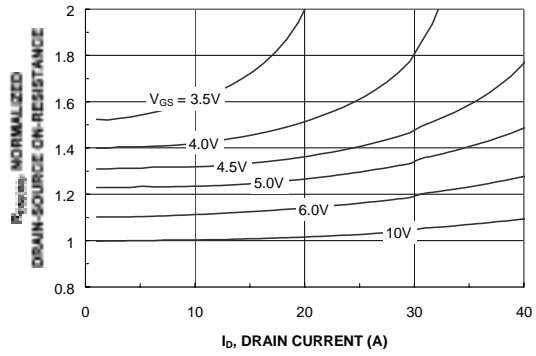


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

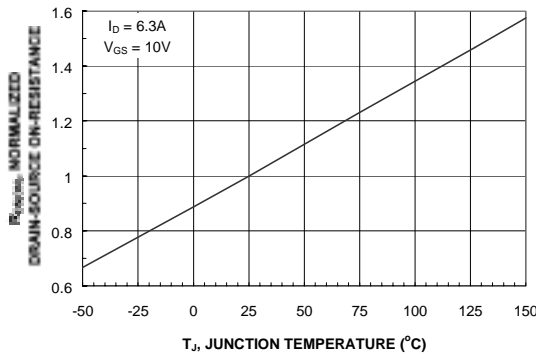


Figure 13. On-Resistance Variation with Temperature.

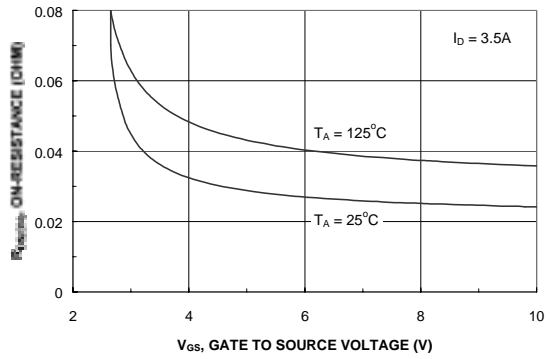


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

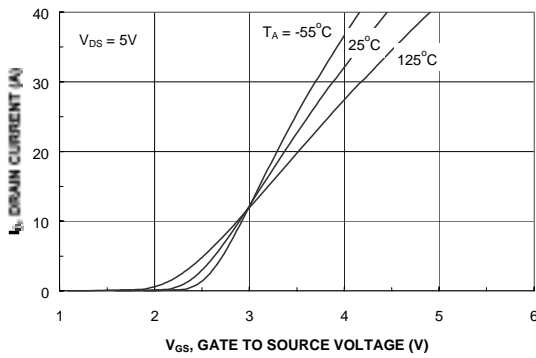


Figure 15. Transfer Characteristics.

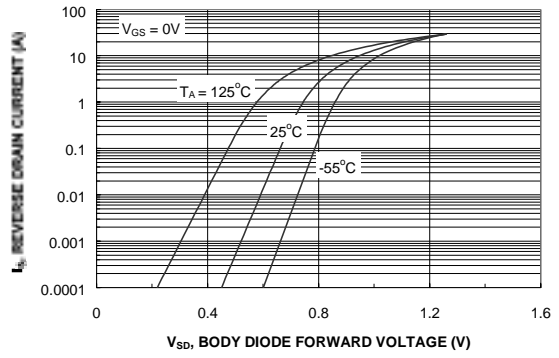


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: Q1 (continued)

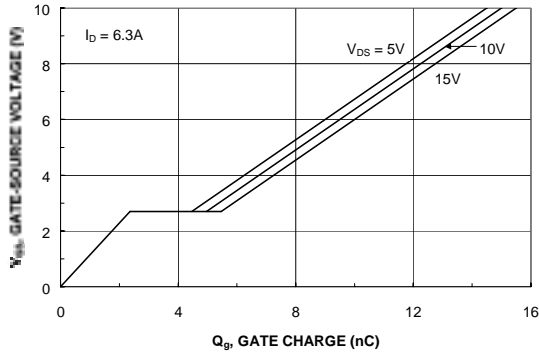


Figure 17. Gate-Charge Characteristics.

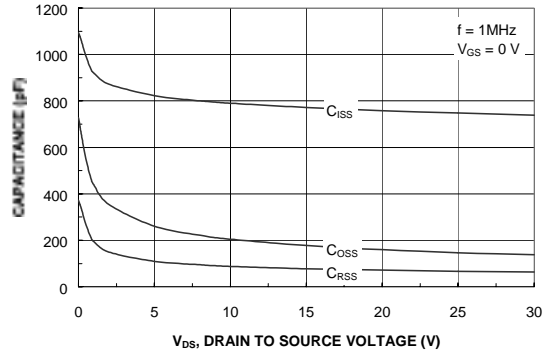


Figure 18. Capacitance Characteristics.

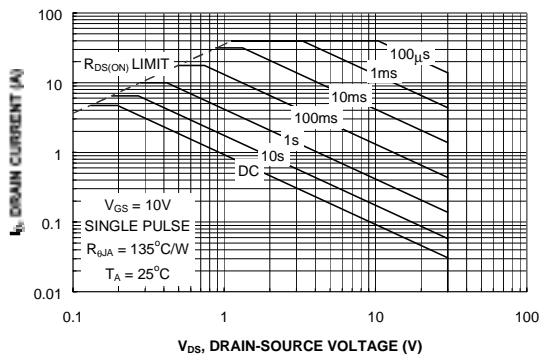


Figure 19. Maximum Safe Operating Area.

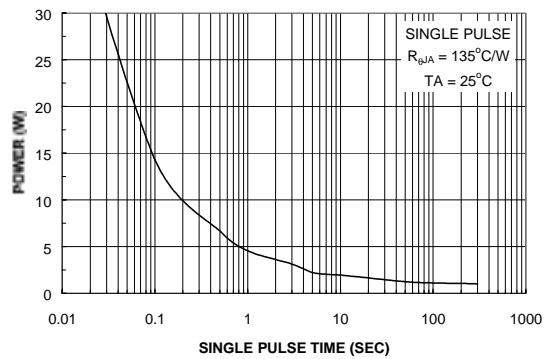


Figure 20. Single Pulse Maximum Power Dissipation.

Typical Characteristics: Q1 & Q2 (continued)

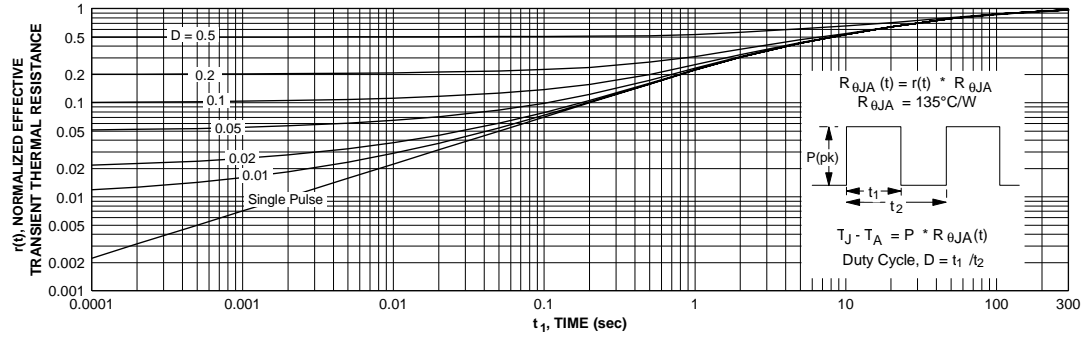


Figure 21. Transient Thermal Response Curve.

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| CROSSVOLT TM | GlobalOptoisolator TM | POP TM | SuperSOT TM -3 | |
| DenseTrench TM | GTO TM | Power247 TM | SuperSOT TM -6 | |
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