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FDC6333C

30V N & P-Channel PowerTrench[®] MOSFETs

General Description

These N & P-Channel MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

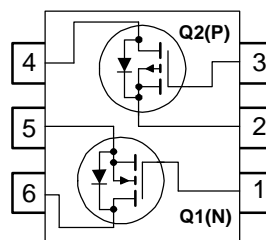
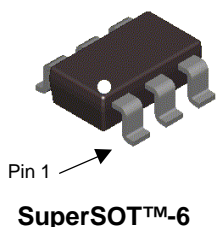
These devices have been designed to offer exceptional power dissipation in a very small footprint for applications where the bigger more expensive SO-8 and TSSOP-8 packages are impractical.

Applications

- DC/DC converter
- Load switch
- LCD display inverter

Features

- **Q1** 2.5 A, 30V. $R_{DS(ON)} = 95 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 150 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- **Q2** -2.0 A, 30V. $R_{DS(ON)} = 150 \text{ m}\Omega @ V_{GS} = -10 \text{ V}$
 $R_{DS(ON)} = 220 \text{ m}\Omega @ V_{GS} = -4.5 \text{ V}$
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$.
- SuperSOT -6 package: small footprint (72% smaller than SO-8); low profile (1mm thick).



Absolute Maximum Ratings T_A=25°C unless otherwise noted

| Symbol | Parameter | Q1 | Q2 | Units |
|-----------------------------------|--|-------------|------|-------|
| V _{DSS} | Drain-Source Voltage | 30 | -30 | V |
| V _{GSS} | Gate-Source Voltage | ±16 | ±25 | V |
| I _D | Drain Current – Continuous (Note 1a) | 2.5 | -2.0 | A |
| | – Pulsed | 8 | -8 | |
| P _D | Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c) | 0.96 | | W |
| | | 0.9 | | |
| | | 0.7 | | |
| T _J , T _{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | | °C |

Thermal Characteristics

| | | | |
|------------------|---|-----|------|
| R _{θJA} | Thermal Resistance, Junction-to-Ambient (Note 1a) | 130 | °C/W |
| R _{θJC} | Thermal Resistance, Junction-to-Case (Note 1) | 60 | °C/W |

Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|----------------|----------|-----------|------------|------------|
| .333 | FDC6333C | 7" | 8mm | 3000 units |

Electrical Characteristics

T_A = 25°C unless otherwise noted

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

Off Characteristics

| | | | | | | |
|--------------------------------------|---|---|----------|-----------|--------------|-------|
| BV _{DSS} | Drain–Source Breakdown Voltage | V _{GS} = 0 V, I _D = 250 μA V _{GS} = 0 V, I _D = –250 μA | Q1 Q2 | 30 –30 | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I _D = 250 μA, Ref. to 25°C I _D = –250 μA, Ref. to 25°C | Q1 Q2 | | 27 –22 | mV/°C |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} = 24 V, V _{GS} = 0 V V _{DS} = –24 V, V _{GS} = 0 V | Q1 Q2 | | 1 –1 | μA |
| I _{GSSF} | Gate–Body Leakage, Forward | V _{GS} = 16 V, V _{DS} = 0 V V _{GS} = 25 V, V _{DS} = 0 V | Q1 Q2 | | 100 100 | nA |
| I _{GSSR} | Gate–Body Leakage, Reverse | V _{GS} = –16 V, V _{DS} = 0 V V _{GS} = –25 V, V _{DS} = 0 V | Q1 Q2 | | –100 –100 | nA |

On Characteristics (Note 2)

| | | | | | | | |
|--|--|----|--|----|------------------|-------------------|-------|
| V _{GS(th)} | Gate Threshold Voltage | Q1 | V _{DS} = V _{GS} , I _D = 250 μA | 1 | 1.8 | 3 | V |
| | | Q2 | V _{DS} = V _{GS} , I _D = –250 μA | –1 | –1.8 | –3 | |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | Q1 | I _D = 250 μA, Ref. To 25°C | | 4 | | mV/°C |
| | | Q2 | I _D = –250 μA, Ref. to 25°C | | –4 | | |
| R _{DS(on)} | Static Drain–Source On–Resistance | Q1 | V _{GS} = 10 V, I _D = 2.5 A V _{GS} = 4.5 V, I _D = 2.0 A V _{GS} = 10 V, I _D = 2.5 A, T _J = 125°C | | 73 90 106 | 95 150 148 | mΩ |
| | | Q2 | V _{GS} = –10 V, I _D = –2.0 A V _{GS} = –4.5 V, I _D = –1.7 A V _{GS} = 10 V, I _D = –2.0 A, T _J = 125°C | | 95 142 149 | 130 220 216 | |
| I _{D(on)} | On–State Drain Current | Q1 | V _{GS} = 10 V, V _{DS} = 5 V | 8 | | | A |
| | | Q2 | V _{GS} = –10 V, V _{DS} = –5 V | –8 | | | |
| g _{FS} | Forward Transconductance | Q1 | V _{DS} = 5 V, I _D = 2.5 A | | 7 | | S |
| | | Q2 | V _{DS} = –5 V, I _D = –2.0 A | | 3 | | |

Dynamic Characteristics

| | | | | | | | |
|------------------|------------------------------|----|---|--|-----|--|----|
| C _{iss} | Input Capacitance | Q1 | V _{DS} = 15 V, V _{GS} = 0 V, f = 1.0 MHz | | 282 | | pF |
| | | Q2 | V _{DS} = –15 V, V _{GS} = 0 V, f = 1.0 MHz | | 185 | | |
| C _{oss} | Output Capacitance | Q1 | V _{DS} = 15 V, V _{GS} = 0 V, f = 1.0 MHz | | 49 | | pF |
| | | Q2 | V _{DS} = –15 V, V _{GS} = 0 V, f = 1.0 MHz | | 56 | | |
| C _{rss} | Reverse Transfer Capacitance | Q1 | V _{DS} = 15 V, V _{GS} = 0 V, f = 1.0 MHz | | 20 | | pF |
| | | Q2 | V _{DS} = –15 V, V _{GS} = 0 V, f = 1.0 MHz | | 26 | | |

Switching Characteristics (Note 2)

| | | | | | | | |
|---------------------|---------------------|----|---|--|-----|-----|----|
| t _{d(on)} | Turn–On Delay Time | Q1 | For Q1: V _{DS} = 15 V, I _{DS} = 1 A V _{GS} = 10 V, R _{GEN} = 6 Ω | | 4.5 | 9 | ns |
| | | Q2 | | | 4.5 | 9 | |
| t _r | Turn–On Rise Time | Q1 | For Q2: V _{DS} = –15 V, I _{DS} = –1 A V _{GS} = –10 V, R _{GEN} = 6 Ω | | 6 | 12 | ns |
| | | Q2 | | | 13 | 23 | |
| t _{d(off)} | Turn–Off Delay Time | Q1 | | | 19 | 34 | ns |
| | | Q2 | | | 11 | 20 | |
| t _f | Turn–Off Fall Time | Q1 | | | 1.5 | 3 | ns |
| | | Q2 | | | 2 | 4 | |
| Q _g | Total Gate Charge | Q1 | For Q1: V _{DS} = 15 V, I _{DS} = 2.5 A V _{GS} = 10 V, R _{GEN} = 6 Ω | | 4.7 | 6.6 | nC |
| | | Q2 | | | 4.1 | 5.7 | |
| Q _{gs} | Gate–Source Charge | Q1 | For Q2: V _{DS} = –15 V, I _{DS} = –2.0 A V _{GS} = –10 V, | | 0.9 | | nC |
| | | Q2 | | | 0.8 | | |
| Q _{gd} | Gate–Drain Charge | Q1 | | | 0.6 | | nC |
| | | Q2 | | | 0.4 | | |

Electrical Characteristics

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

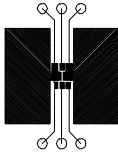
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Drain–Source Diode Characteristics and Maximum Ratings

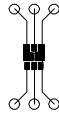
| | | | | | | | |
|----------|---|----|---|----------|------|------|---|
| I_S | Maximum Continuous Drain–Source Diode Forward Current | Q1 | | | 0.8 | A | |
| | | Q2 | | | -0.8 | | |
| V_{SD} | Drain–Source Diode Forward Voltage | Q1 | $V_{GS} = 0\text{ V}, I_S = 0.8\text{ A}$ | (Note 2) | 0.8 | 1.2 | V |
| | | Q2 | $V_{GS} = 0\text{ V}, I_S = 0.8\text{ A}$ | (Note 2) | 0.8 | -1.2 | |

Notes:

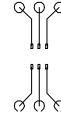
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 130°C/W when mounted on a 0.125 in^2 pad of 2 oz. copper.



b) 140°C/W when mounted on a $.004\text{ in}^2$ pad of 2 oz copper



c) 180°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < $300\mu\text{s}$, Duty Cycle < 2.0%

Typical Characteristics: N-Channel

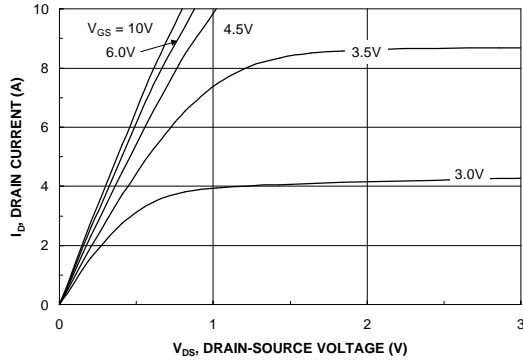


Figure 1. On-Region Characteristics.

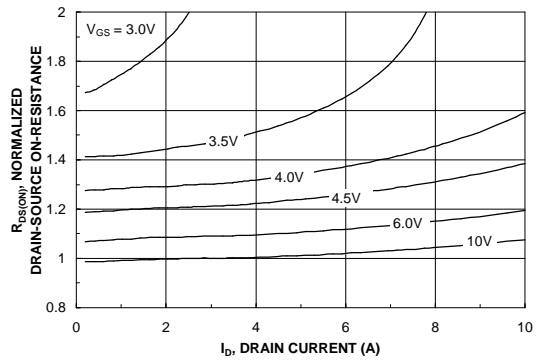


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

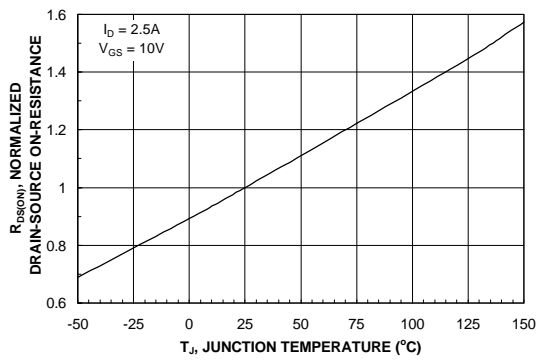


Figure 3. On-Resistance Variation with Temperature.

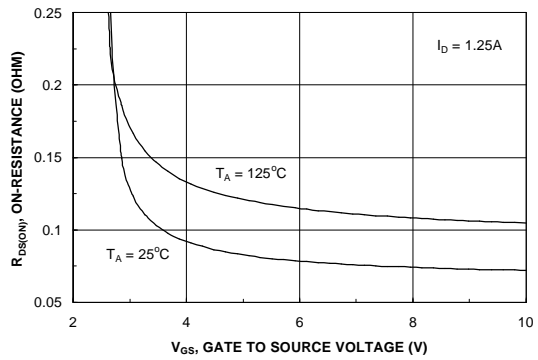


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

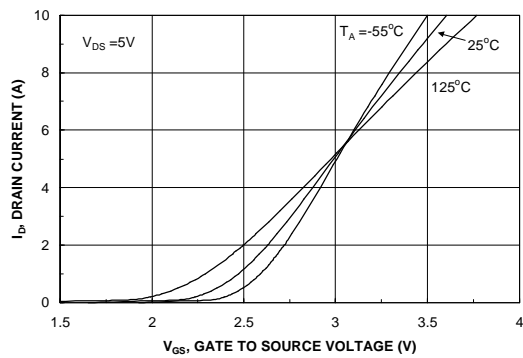


Figure 5. Transfer Characteristics.

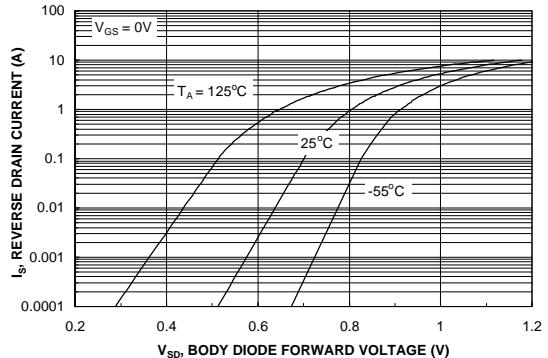


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: N-Channel (continued)

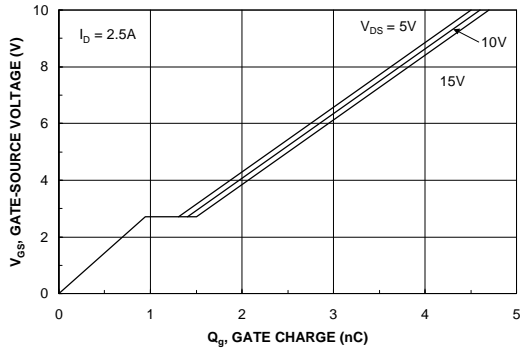


Figure 7. Gate Charge Characteristics.

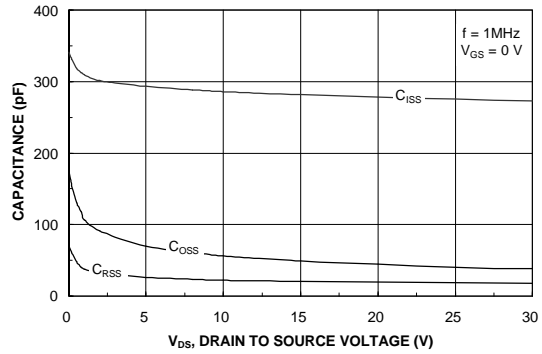


Figure 8. Capacitance Characteristics.

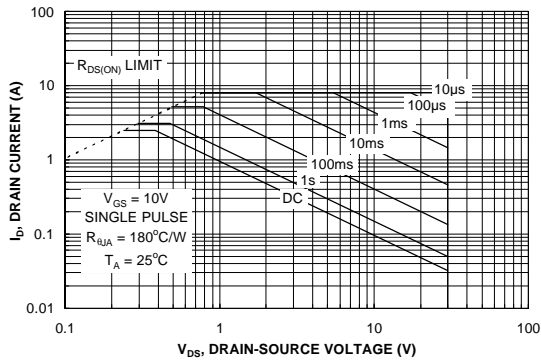


Figure 9. Maximum Safe Operating Area.

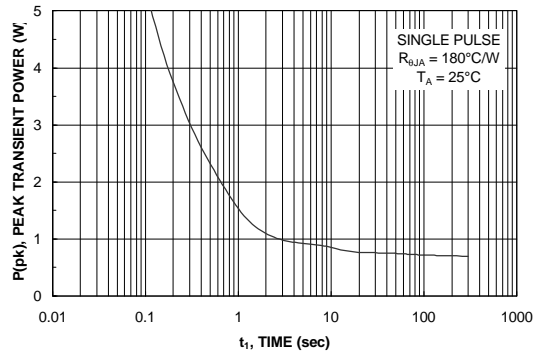


Figure 10. Single Pulse Maximum Power Dissipation.

Typical Characteristics: P-Channel

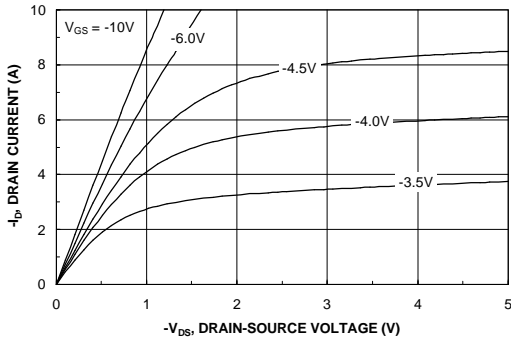


Figure 11. On-Region Characteristics.

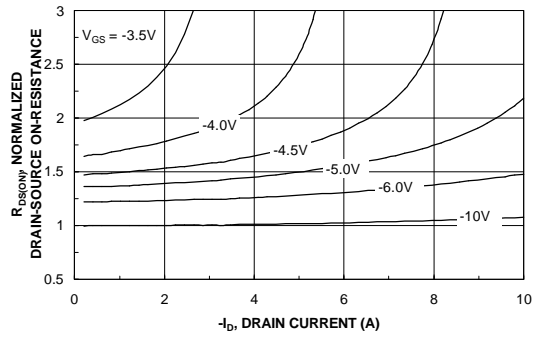


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

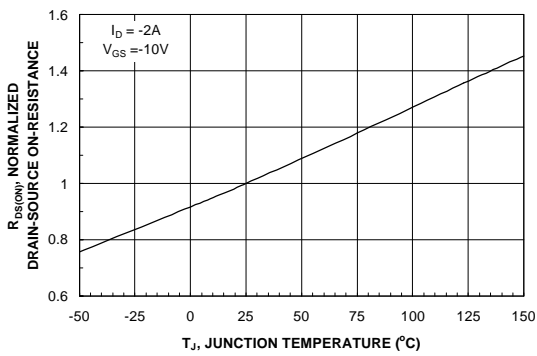


Figure 13. On-Resistance Variation with Temperature.

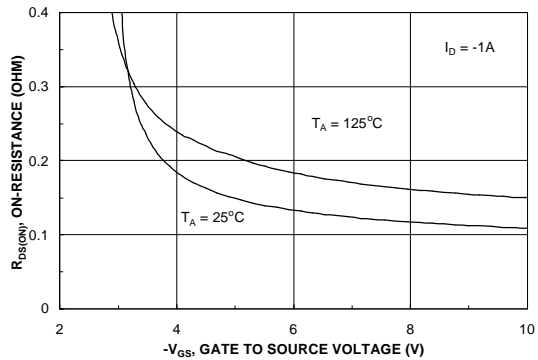


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

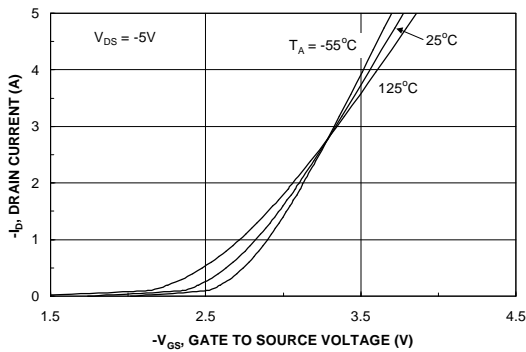


Figure 15. Transfer Characteristics.

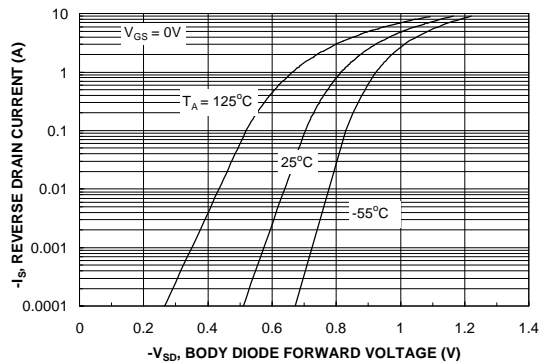


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics: P-Channel (continued)

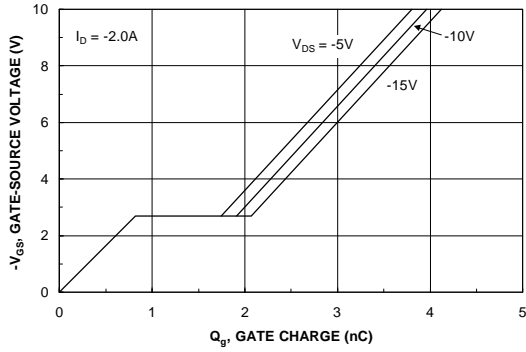


Figure 17. Gate Charge Characteristics.

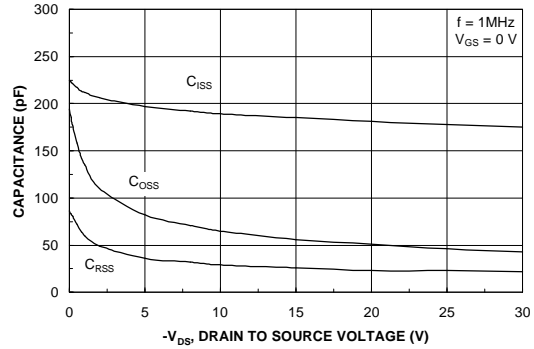


Figure 18. Capacitance Characteristics.

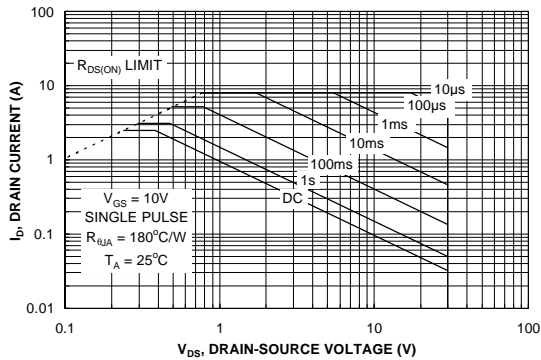


Figure 19. Maximum Safe Operating Area.

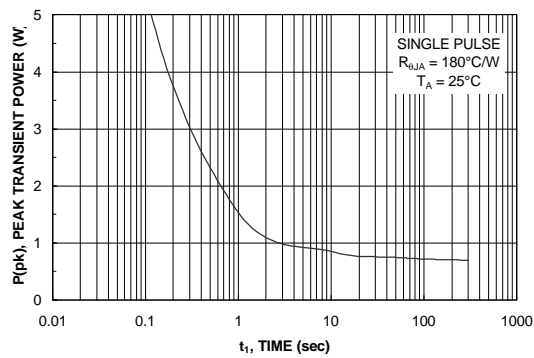


Figure 20. Single Pulse Maximum Power Dissipation.

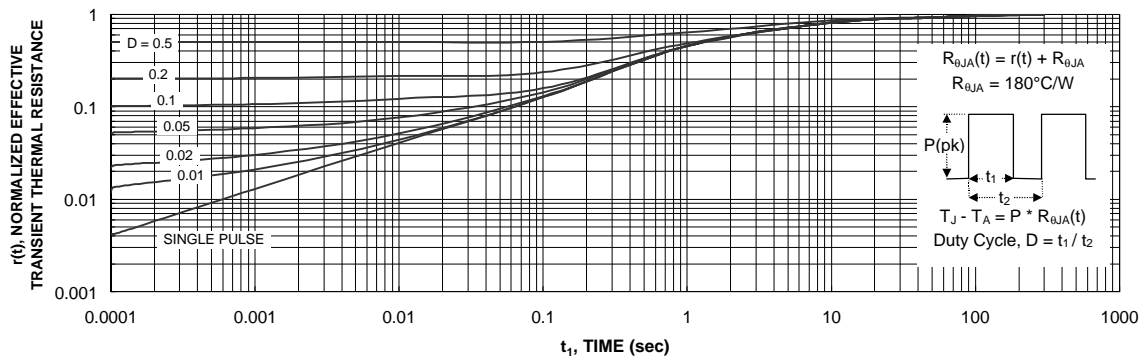


Figure 21. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c.
Transient thermal response will change depending on the circuit board design.

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