FAIRCHILD SEMICONDUCTOR®

August 2002

# FDS8333C

## 30V N & P-Channel PowerTrench® MOSFETs

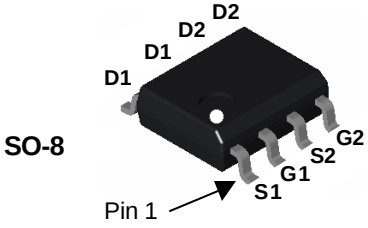
### General Description

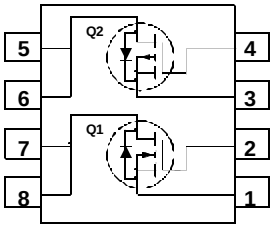
These N & P-Channel MOSFETs are produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize on-state resistance and yet maintain superior switching performance.

These devices are well suited for low voltage and battery powered applications where low in-line power loss and fast switching are required.

### Features

- **Q1** 4.1 A, 30V. $R_{DS(ON)}$ = 80 mΩ @ $V_{GS}$ = 10 V
  $R_{DS(ON)}$ = 130 mΩ @ $V_{GS}$ = 4.5 V
- **Q2** –3.4 A, 30V. $R_{DS(ON)}$ = 130 mΩ @ $V_{GS}$ = –10 V
  $R_{DS(ON)}$ = 200 mΩ @ $V_{GS}$ = –4.5 V
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$.
- High power and handling capability in a widely used surface mount package.




## 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 | ±20 | |
| $I_D$ | Drain Current – Continuous | (Note 1a) | 4.1 | –3.4 | A |
| | – Pulsed | | 20 | –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 | |

## Package Marking and Ordering Information

| Device Marking | Device | Reel Size | Tape width | Quantity |
|---|---|---|---|---|
| FDS8333C | FDS8333C | 7" | 12mm | 2500 units |

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## 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<br>$V_{GS}$ = 0 V, $I_D$ = –250 µA | **Q1**<br>**Q2** | 30<br>–30 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | | $I_D$ = 250 µA,Ref. to 25°C<br>$I_D$ = –250 µA,Ref. to 25°C | **Q1**<br>**Q2** | | 25<br>–22 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V<br>$V_{DS}$ = –24 V, $V_{GS}$ = 0 V | **Q1**<br>**Q2** | | | 1<br>–1 | µA |
| $I_{GSSF}$ /$I_{GSSR}$ | Gate–Body Leakage, Forward | | $V_{GS}$ = ± 16 V, $V_{DS}$ = 0 V | | | | ±100 | nA |
| $I_{GSSF}$ /$I_{GSSR}$ | Gate–Body Leakage, Reverse | | $V_{GS}$ = ± 20V , $V_{DS}$ = 0 V | | | | ±100 | nA |
| **On Characteristics** (Note 2) | | | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | **Q1** | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | | 1 | 1.7 | 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 | | $I_D$ = 250 µA,Ref. To 25°C<br>$I_D$ = –250 µA,Ref. to 25°C | **Q1**<br>**Q2** | | –4.2<br>3.7 | | mV/°C |
| $R_{DS(on)}$ | Static Drain–Source On–Resistance | **Q1** | $V_{GS}$ = 10 V, $I_D$ = 4.1 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 3.2 A<br>$V_{GS}$ = 10 V, $I_D$ = 4.1 A $T_J$=125°C | | | 67<br>81<br>103 | 80<br>130<br>145 | mΩ |
| | | **Q2** | $V_{GS}$ = –10 V, $I_D$ = –3.4 A<br>$V_{GS}$ = – 4.5 V, $I_D$ = –2.5 A<br>$V_{GS}$ = –10V,$I_D$ = –3.4A, $T_J$=125°C | | | 105<br>167<br>147 | 130<br>200<br>220 | |
| $I_{D(on)}$ | On–State Drain Current | **Q1** | $V_{GS}$ = 10 V, $V_{DS}$ = 5 V | | 10 | | | A |
| | | **Q2** | $V_{GS}$ = –10 V, $V_{DS}$ = –5 V | | –5 | | | |
| $g_{FS}$ | Forward Transconductance | **Q1** | $V_{DS}$ = 5 V $I_D$ = 4.1 A | | | 9 | | S |
| | | **Q2** | $V_{DS}$ = –5 V $I_D$ = –3.4A | | | 5 | | |
| **Dynamic Characteristics** | | | | | | | | |
| $C_{iss}$ | Input Capacitance | **Q1** | $V_{DS}$=10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 282 | | pF |
| | | **Q2** | $V_{DS}$=–10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 185 | | |
| $C_{oss}$ | Output Capacitance | **Q1** | $V_{DS}$=10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 49 | | pF |
| | | **Q2** | $V_{DS}$=–10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 56 | | |
| $C_{rss}$ | Reverse Transfer Capacitance | **Q1** | $V_{DS}$=10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 20 | | pF |
| | | **Q2** | $V_{DS}$=–10 V, $V_{GS}$= 0 V, f=1.0MHz | | | 26 | | |
| $R_G$ | Gate Resistance | **Q1** | $V_{GS}$= 15 mV, f=1.0MHz | | | 2.3 | | Ω |
| | | **Q2** | $V_{GS}$=–15 mV, f=1.0MHz | | | –9.6 | | |
| **Switching Characteristics** (Note 2) | | | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | **Q1** | For **Q1**:<br>$V_{DS}$ =10 V, $I_{DS}$= 1 A<br>$V_{GS}$= 4.5 V, $R_{GEN}$ = 6 Ω<br>For **Q2**:<br>$V_{DS}$ =–10 V, $I_{DS}$= –1 A<br>$V_{GS}$= –4.5 V, $R_{GEN}$ = 6 Ω | | | 4.5 | 9 | ns |
| | | **Q2** | | | | 4.5 | 9 | |
| $t_r$ | Turn–On Rise Time | **Q1** | | | | 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**:<br>$V_{DS}$ =10 V, $I_{DS}$= 4.1 A<br>$V_{GS}$= 4.5 V, $R_{GEN}$ = 6 Ω<br>For **Q2**:<br>$V_{DS}$ =–10 V, $I_{DS}$= –3.4 A<br>$V_{GS}$= –4.5 V, | | | 4.7 | 6.6 | nC |
| | | **Q2** | | | | 4.1 | 5.7 | |
| $Q_{gs}$ | Gate–Source Charge | **Q1** | | | | 0.9 | | nC |
| | | **Q2** | | | | 0.8 | | |
| $Q_{gd}$ | Gate–Drain Charge | **Q1** | | | | 0.6 | | nC |
| | | **Q2** | | | | 0.4 | | |

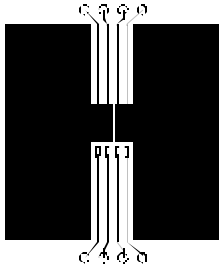
## Electrical Characteristics

$T_A$ = 25°C unless otherwise noted

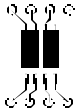
| Symbol | Parameter | | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|---|
| **Drain–Source Diode Characteristics and Maximum Ratings** | | | | | | | |
| $V_{SD}$ | Drain–Source Diode Forward Voltage | **Q1** | $V_{GS}$ = 0 V, $I_S$ = 1.3 A (Note 2) | | 0.8 | 1.2 | V |
| | | **Q2** | $V_{GS}$ = 0 V, $I_S$ = –1.3 A (Note 2) | | 0.8 | –1.2 | |
| $t_{rr}$ | Diode Reverse Recovery Time | **Q1** | $I_F$ = 4.1 A, $d_{iF}/d_t$ = 100 A/µs | | 16.3 | | nS |
| | | **Q2** | $I_F$ = –3.4 A, $d_{iF}/d_t$ = 100 A/µs | | 14.5 | | |
| $Q_{rr}$ | Diode Reverse Recovery Charge | **Q1** | $I_F$ = 4.1 A, $d_{iF}/d_t$ = 100 A/µs | | 26.7 | | nC |
| | | **Q2** | $I_F$ = –3.4 A, $d_{iF}/d_t$ = 100 A/µs | | 21.1 | | |

**Notes:**

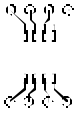
**1.** $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 78°C/W when mounted on a 0.5in$^2$ 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

**2.** Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

## Typical Characteristics: N-Channel

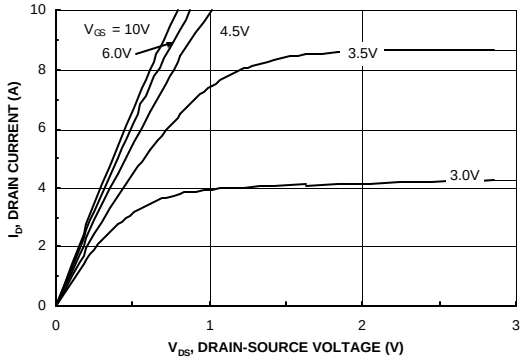



**Figure 1. On-Region Characteristics.**

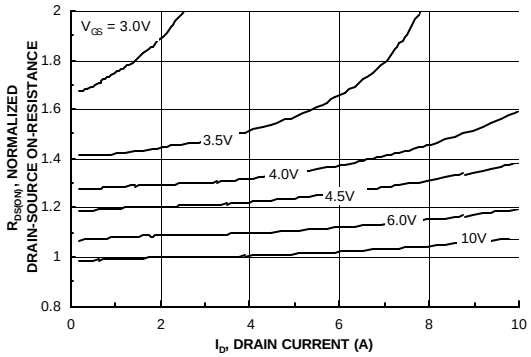



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.**

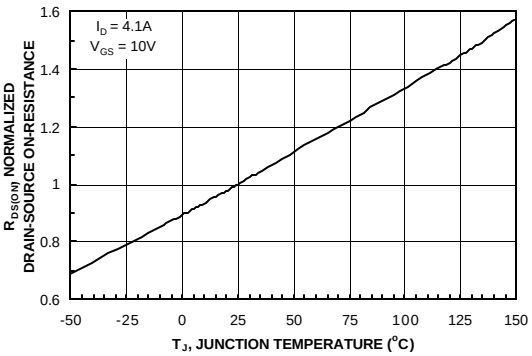



**Figure 3. On-Resistance Variation withTemperature.**

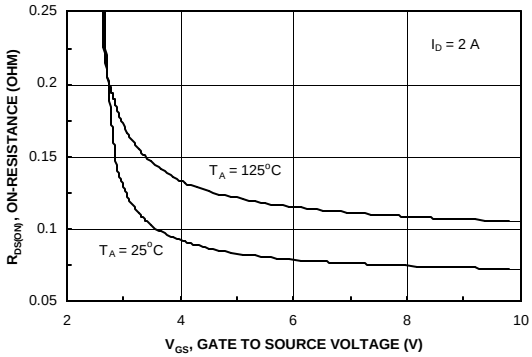



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage.**

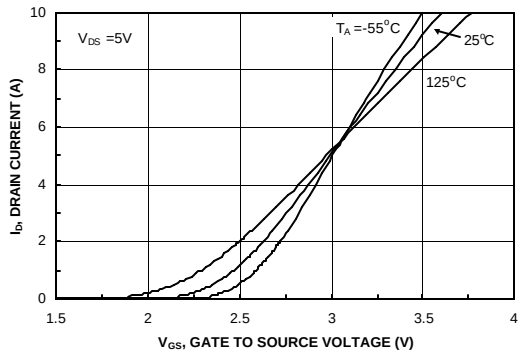



**Figure 5. Transfer Characteristics.**

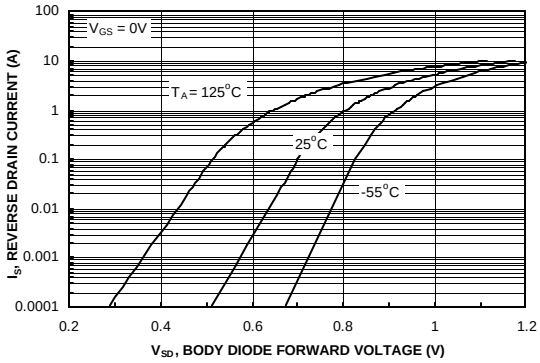



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics: N-Channel (continued)

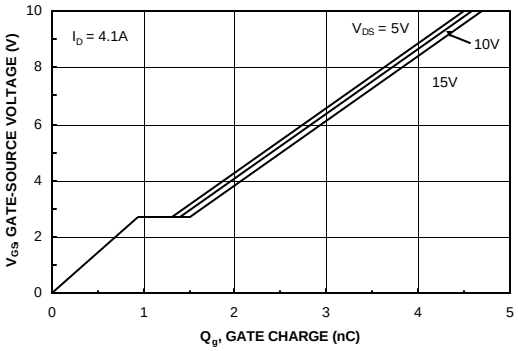



**Figure 7. Gate Charge Characteristics.**

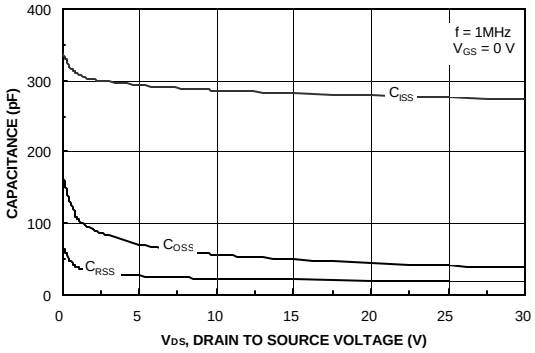



**Figure 8. Capacitance Characteristics.**

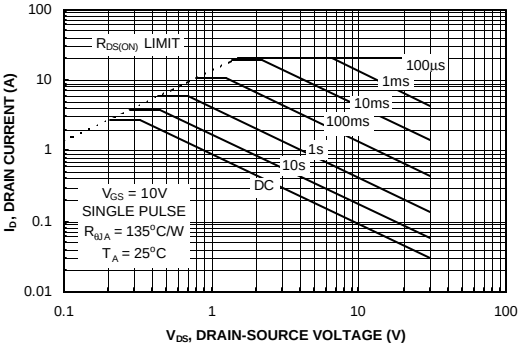



**Figure 9. Maximum Safe Operating Area.**

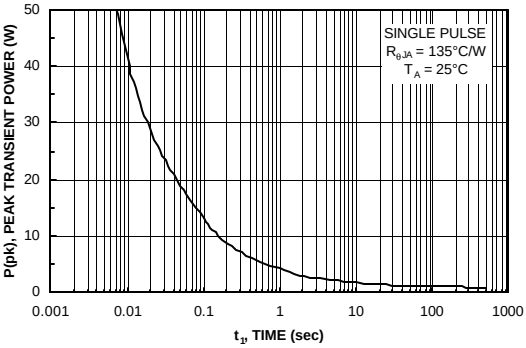



**Figure 10. Single Pulse Maximum Power Dissipation.**

## Typical Characteristics: P-Channel

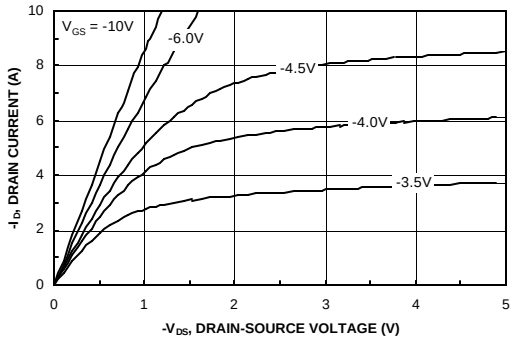



**Figure 11. On-Region Characteristics.**

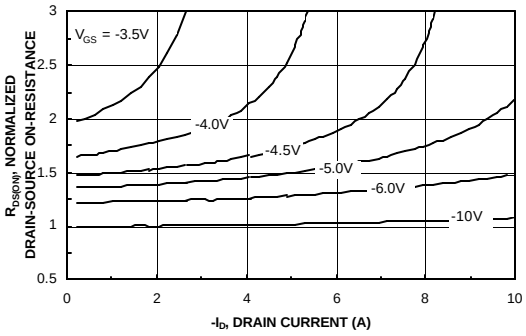



**Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.**

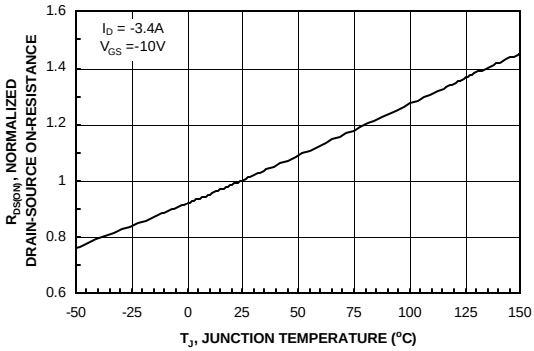



**Figure 13. On-Resistance Variation withTemperature.**

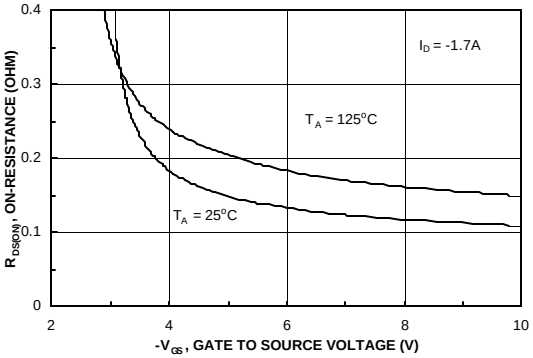



**Figure 14. On-Resistance Variation with Gate-to-Source Voltage.**

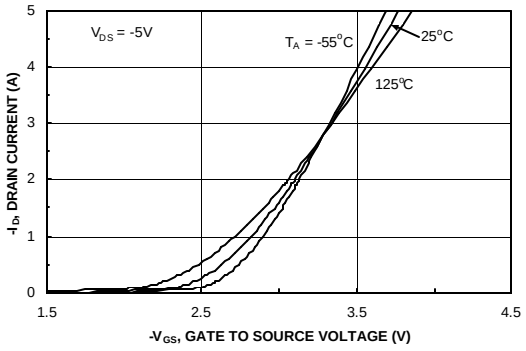



**Figure 15. Transfer Characteristics.**

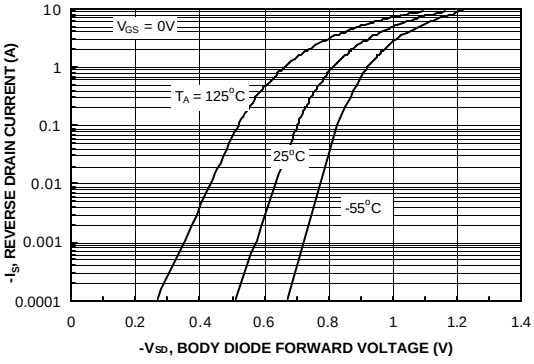



**Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.**

## Typical Characteristics: P-Channel (continued)

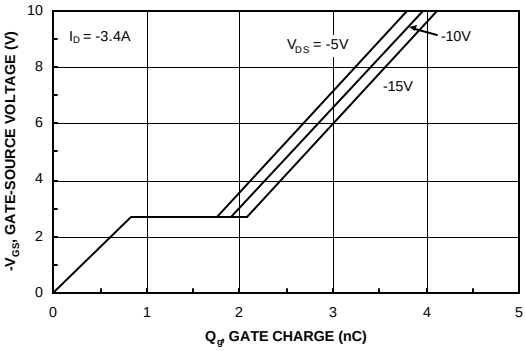



**Figure 17. Gate Charge Characteristics.**

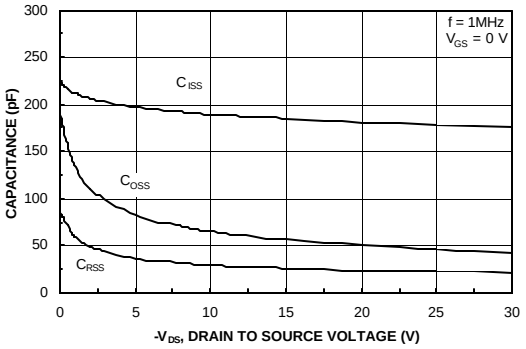



**Figure 18. Capacitance Characteristics.**

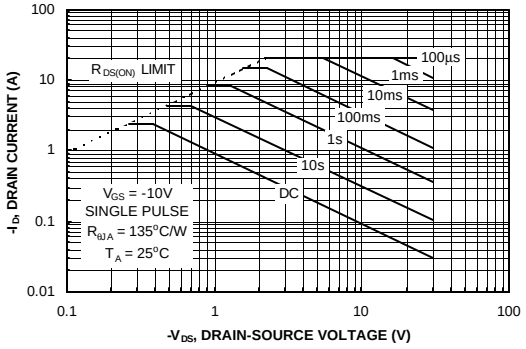



**Figure 19. Maximum Safe Operating Area.**

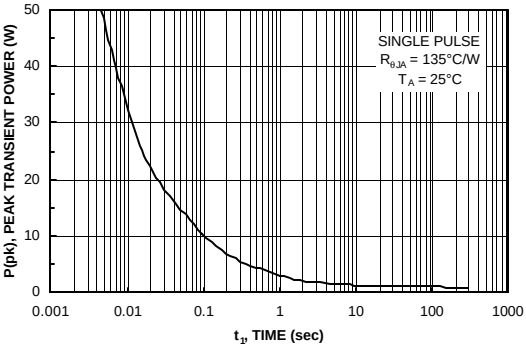



**Figure 20. Single Pulse Maximum Power Dissipation.**

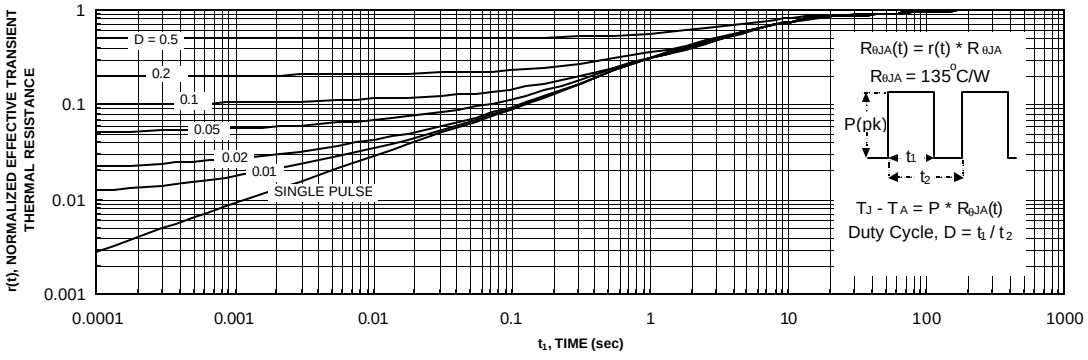



**Figure 21. Transient Thermal Response Curve.**

**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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**Данный компонент на территории Российской Федерации**

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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