$V_{DSS}$ = 275 V, $R_{DS(ON)}$ = 0.26 Ω
Dual N-channel Power MOSFET

# SPF0004

Data Sheet

## Description

SPF0004 includes two N-channel power MOSFETs with zener diode for ESD protection. The package of SPF0004 isolates each MOSFET, and has heatsink connected to each drain.

## Features

- Automotive Qualified
- Low On Resistance
- ESD Protection Zener on Gate
- 100% Avalanche Tested
- Compliant with RoHS directive

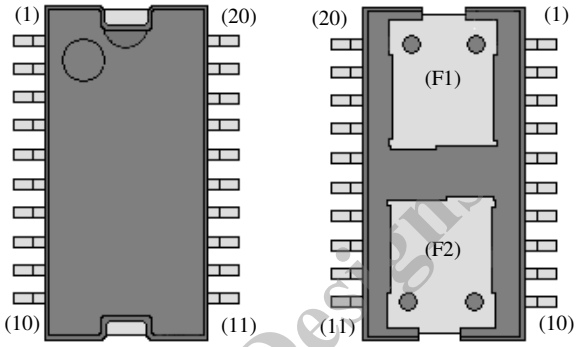
- $V_{DSS}$ ---------- 275 V ($I_D$ = 100 µA)
- $I_D$ ---------- ± 6 A
- $R_{DS(ON)}$ ----------0.26 Ω max. ($I_D$ = 6 A, $V_{GS}$ = 10 V)
- trr ---------- 117 ns (typ.)

## Applications

- DC/DC Converter
- Other Switched-mode Power Supply

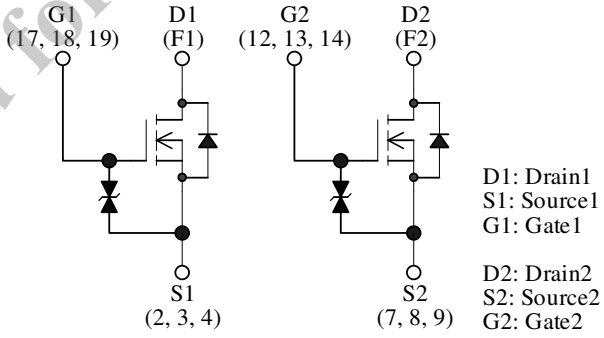
## Package

HSOP20




Not to scale

## Internal Schematic Diagram



## Absolute Maximum Ratings

Unless otherwise specified, $T_A$ = 25 °C

| Parameter | Symbol | Test conditions | Rating | Unit |
|---|---|---|---|---|
| Drain to Source Voltage | $V_{DSS}$ | | 275 | V |
| Gate to Source Voltage | $V_{GSS}$ | | ± 20 | V |
| Continuous Drain Current | $I_D$ | | ± 6 | A |
| Pulsed Drain Current | $I_{D(PULSE)}$ | Pulse width ≤ 100µs<br>Duty cycle ≤ 1 % | ± 30 | A |
| Single Pulse Avalanche Energy | $E_{AS}$ | $V_{DD}$ = 49 V,<br>L = 0.05 mH,<br>$I_{AS}$ = 40A,<br>$V_{GS}$ = +16 V, −13 V,<br>$R_G$ = 1.5 kΩ,<br>unclamped,<br>see Figure 1 | 47.5 | mJ |
| Avalanche Current | $I_{AS}$ | | 30 | A |
| Power Dissipation | $P_D$ | $T_C$ = 25 °C | 2.5 | W |
| Drain to Source dv/dt 1 | dv/dt 1 | $V_{DD}$ = 200 V,<br>L = 0.035 mH,<br>$R_G$ = 150Ω,<br>$I_{DP}$ = 30 A,<br>$V_{GS}$ = +16 V, −16 V,<br>di/dt ≥ −125 A/µs,<br>see Figure 2 | 5.6 | V/ns |
| Peak Diode Recovery dv/dt 2 | dv/dt 2 | $V_{DD}$ = 200 V,<br>L = 0.2 mH,<br>$I_{SDP}$ = 30 A,<br>See Figure 3 | 8.5 | V/ns |
| Peak Diode Recovery di/dt | di/dt | $V_{DD}$ = 200 V,<br>L = 0.2 mH,<br>$I_{SDP}$ = 30 A,<br>See Figure 3 | 220 | A/µs |
| Operating Junction Temperature | $T_J$ | | 150 | °C |
| Storage Temperature Range | $T_{STG}$ | | − 55 to 150 | °C |



## Thermal Characteristics

Unless otherwise specified, $T_A$ = 25 °C

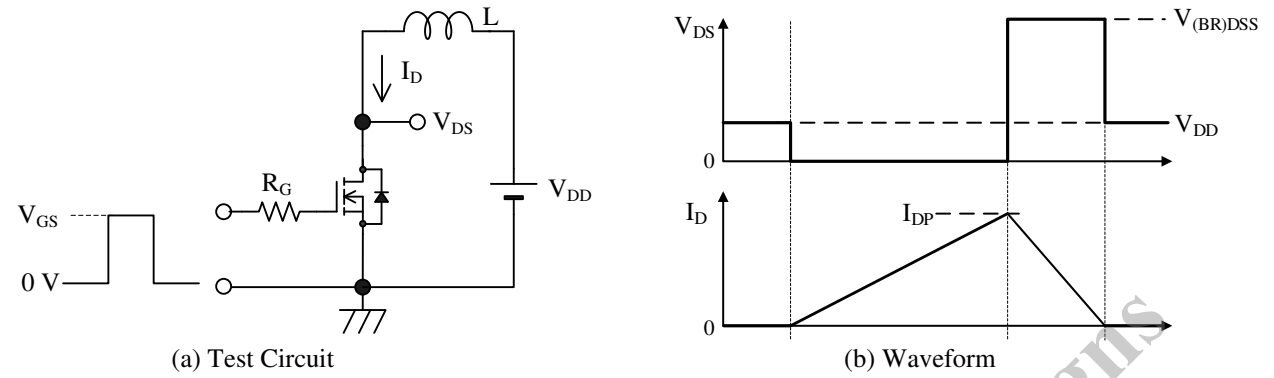
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Thermal Resistance (Junction to Case) | $R_{\theta JC}$ | | − | − | 4.7 | °C/W |

## Electrical Characteristics

Unless otherwise specified, $T_A$ = 25 °C

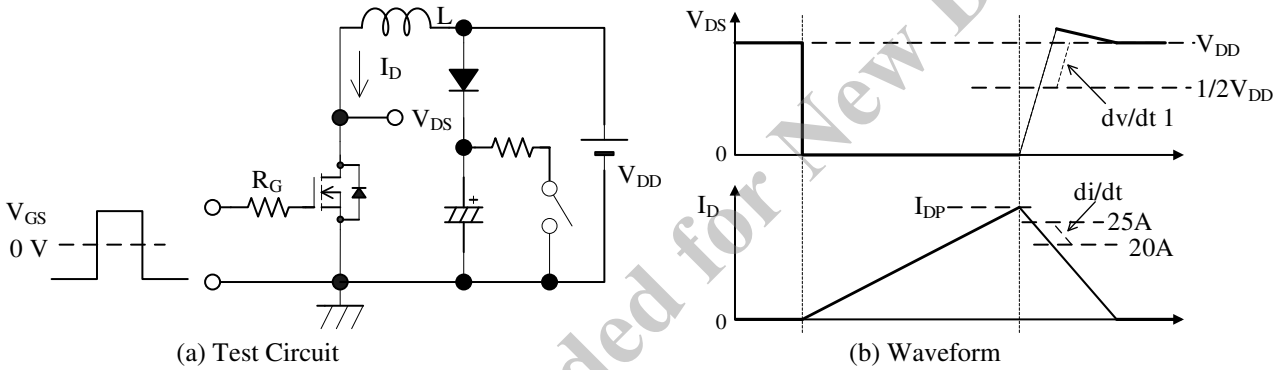
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Drain to Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D$ = 100 µA, $V_{GS}$ = 0 V | 275 | – | – | V |
| Drain to Source Leakage Current | $I_{DSS}$ | $V_{DS}$ = 275 V, $V_{GS}$ = 0 V | – | – | 100 | µA |
| Gate to Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ± 20 V | – | – | 10 | µA |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 1.90 | 2.25 | 2.60 | V |
| Forward Transconductance | $R_{e(yfs)}$ | $V_{DS}$ = 10 V, $I_D$ = 6 A | – | 20 | — | S |
| Static Drain to Source On-Resistance | $R_{DS(ON)}$ | $I_D$ = 6 A, $V_{GS}$ = 10 V | – | 0.20 | 0.26 | Ω |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 10 V<br>$V_{GS}$ = 0 V<br>f = 1 MHz | – | 960 | – | pF |
| Output Capacitance | $C_{oss}$ | | – | 250 | – | |
| Reverse Transfer Capacitance | $C_{rss}$ | | – | 36 | – | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 200 V<br>$I_D$ = 6 A<br>$V_{GS}$ = 10 V, $R_G$ = 10 Ω<br>Refer to Figure 4 | – | 15 | – | ns |
| Rise Time | $t_r$ | | – | 34 | – | |
| Turn-Off Delay Time | $t_{d(off)}$ | | – | 112 | – | |
| Fall Time | $t_f$ | | – | 144 | – | |
| Source to Drain Diode Forward Voltage | $V_{SD}$ | $I_{SD}$ = 6 A, $V_{GS}$ = 0 V | – | – | 1.2 | V |
| Source to Drain Diode Reverse Recovery Time | $t_{rr}$ | $I_{SDP}$ = 6 A<br>di/dt = 100 A/µs<br>Refer to Figure 3 | – | 117 | – | ns |

## Test Circuits and Waveforms



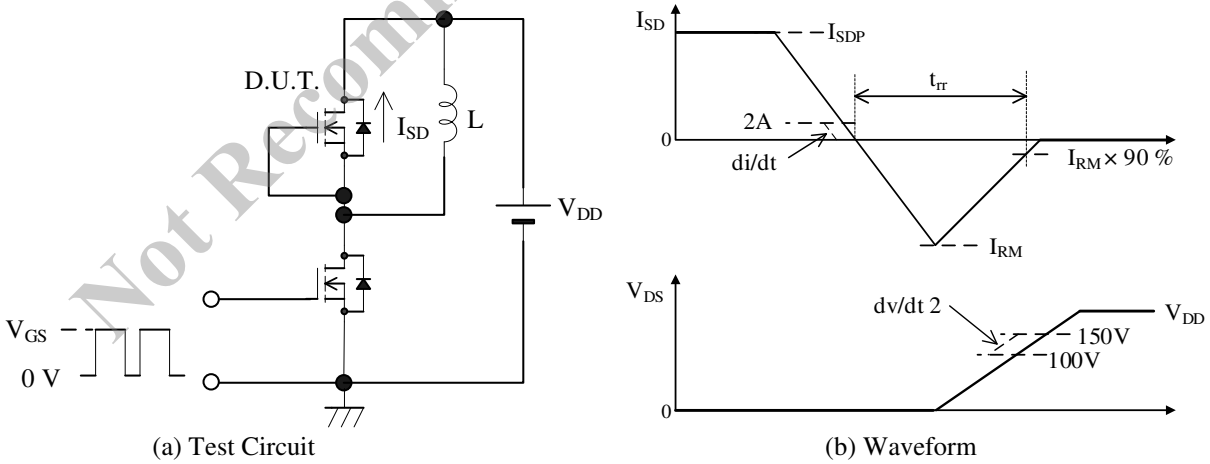

(a) Test Circuit (b) Waveform

Figure 1 Unclamped Inductive Switching




(a) Test Circuit (b) Waveform

Figure 2 dv/dt Strength




(a) Test Circuit (b) Waveform

Figure 3 Diode Reverse Recovery Time

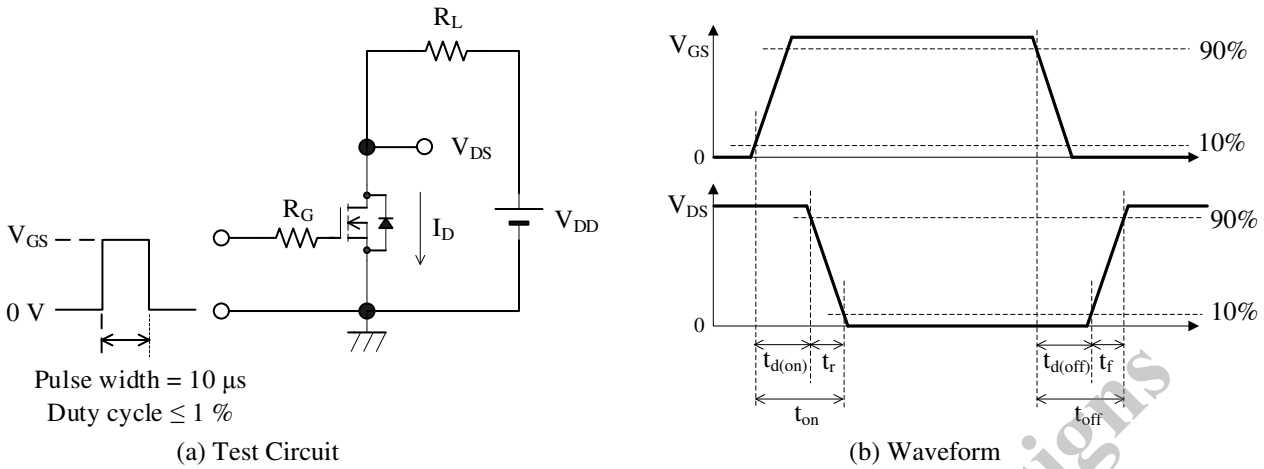



Figure 4 Switching Time

## Ratings and Characteristics Curves

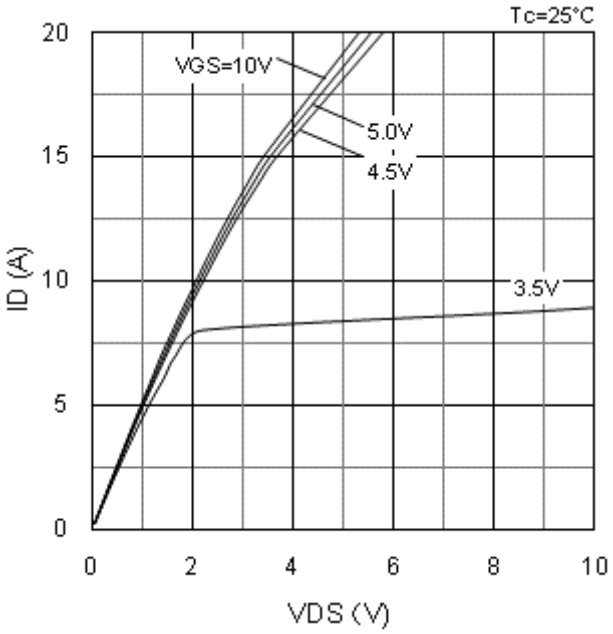



Figure 5 $I_D$ vs. $V_{DS}$ characteristics (typ.)

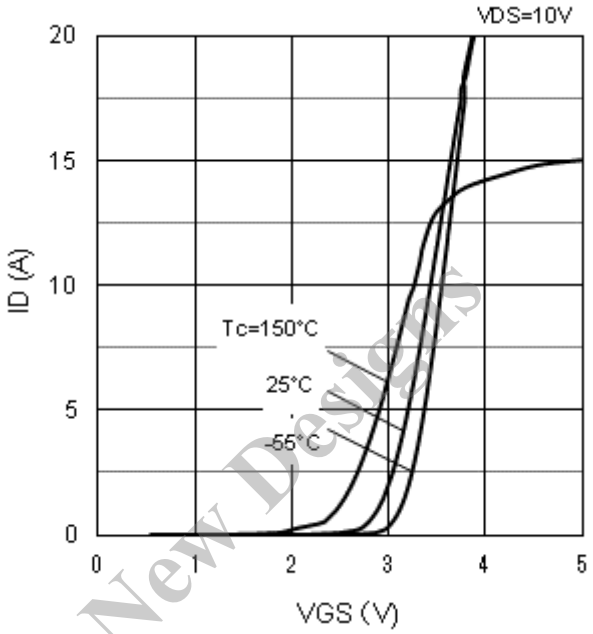



Figure 6 $I_D$ vs. $V_{GS}$ characteristics (typ.)

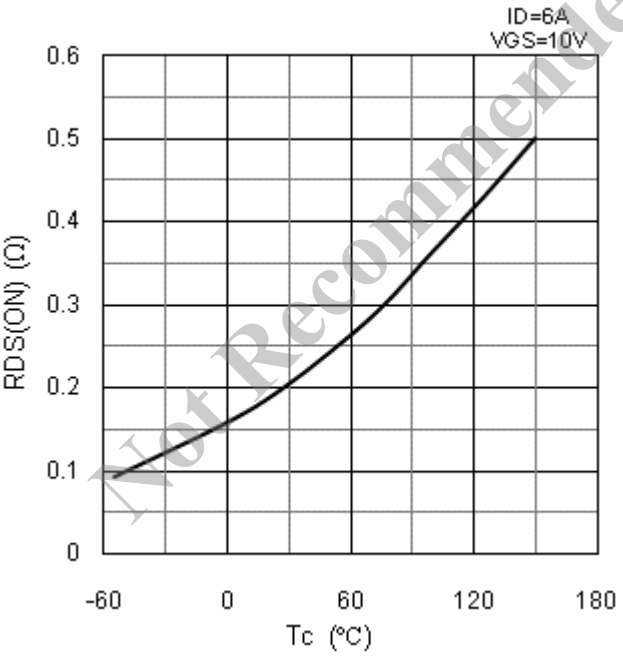



Figure 7 $R_{DS(ON)}$ vs. $T_C$ characteristics (typ.)

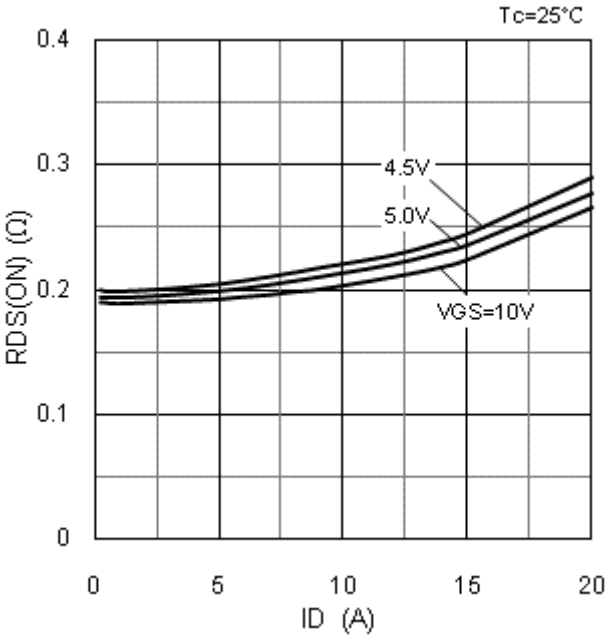



Figure 8 $R_{DS(ON)}$ vs. $I_D$ characteristics (typ.)

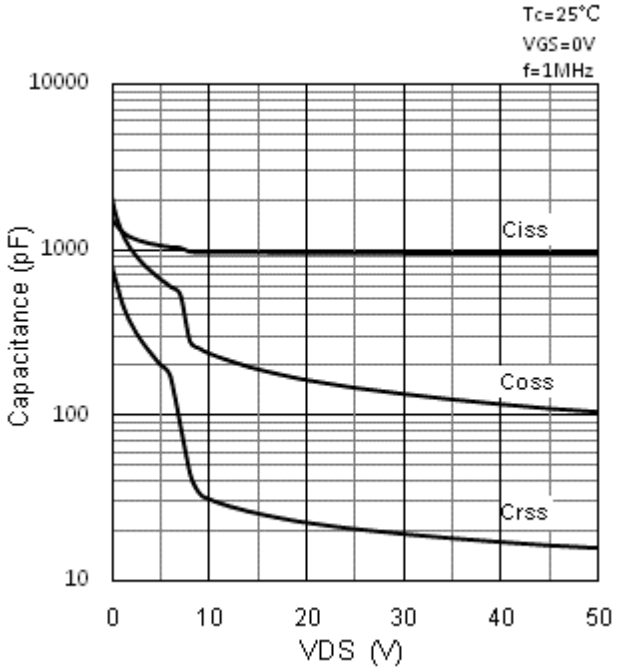



Figure 9 Capacitance vs. $V_{DS}$ characteristics (typ.)

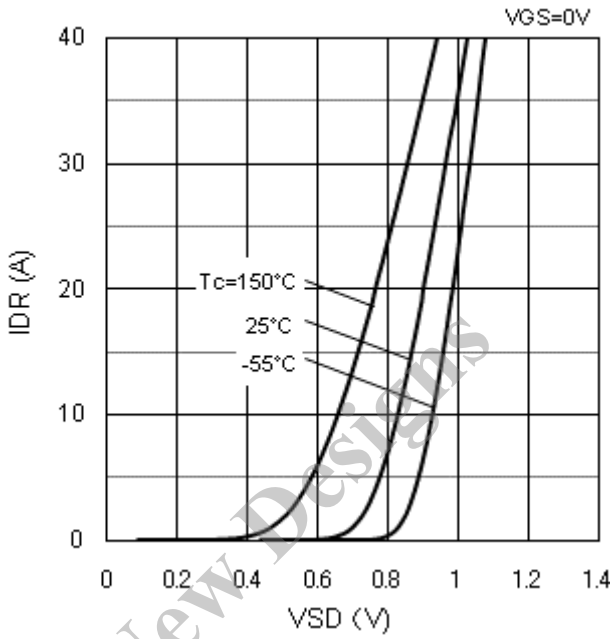



Figure 10 $I_{DR}$ vs. $V_{SD}$ characteristics (typ.)

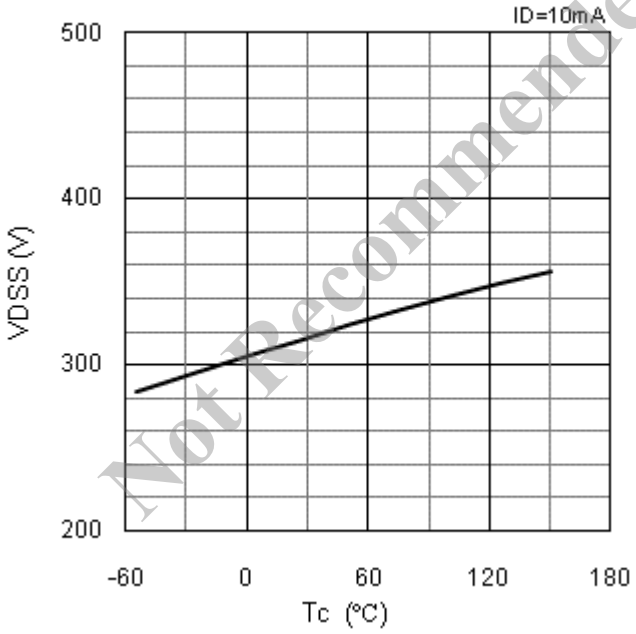



Figure 11 $V_{DSS}$ vs. $T_C$ characteristics (typ.)

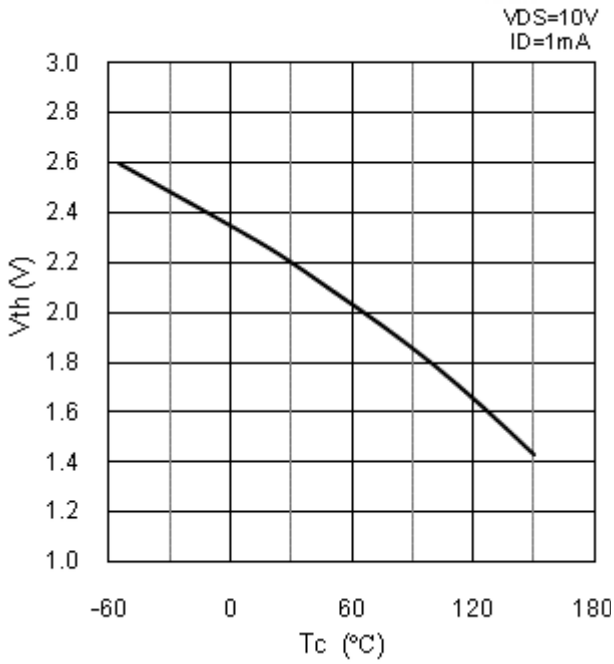



Figure 12 $V_{th}$ vs. $T_C$ characteristics (typ.)

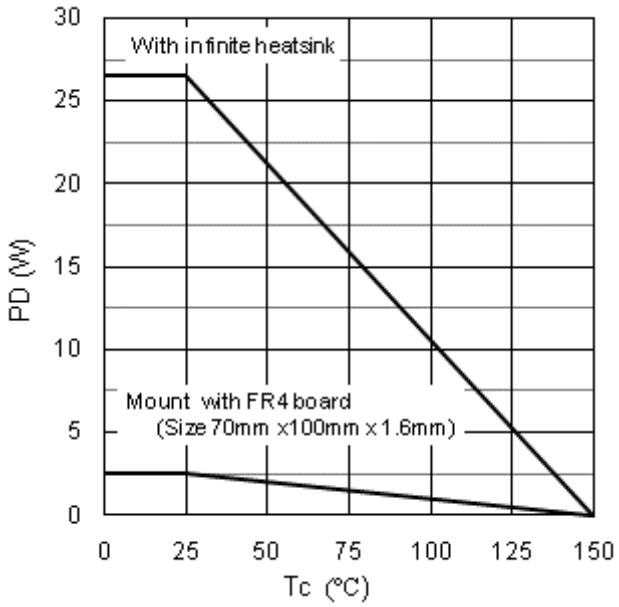



Figure 13 $P_D$ vs. $T_C$ characteristics (typ.)

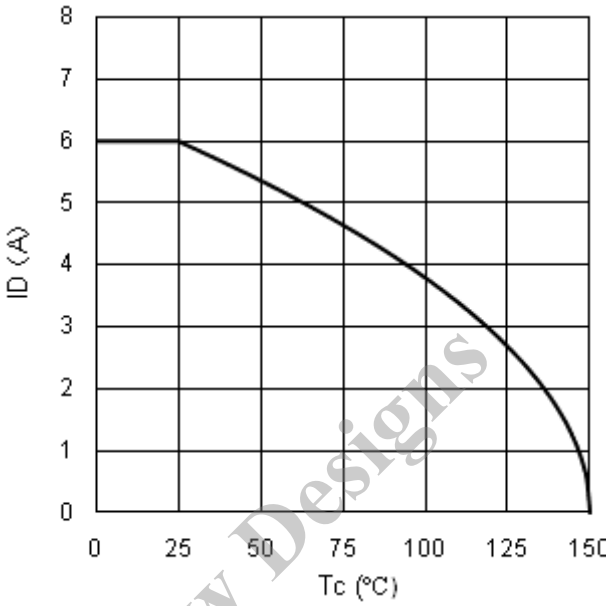



Figure 14 $I_D$ vs. $T_C$ characteristics (typ.)

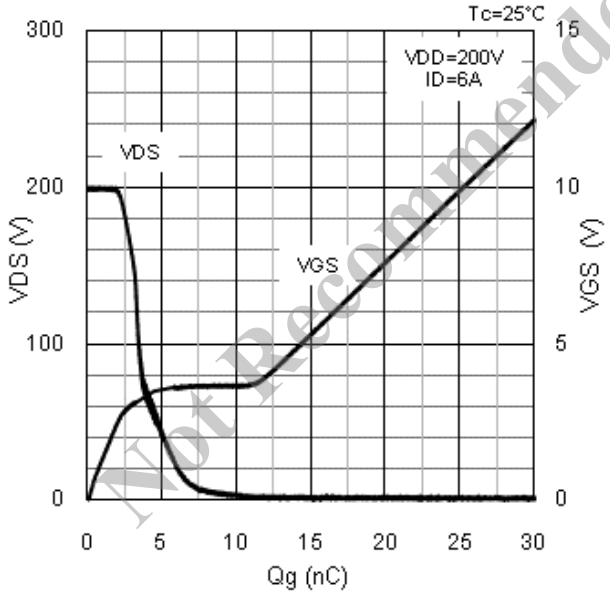



Figure 15 Dynamic input / output characteristics (typ.)

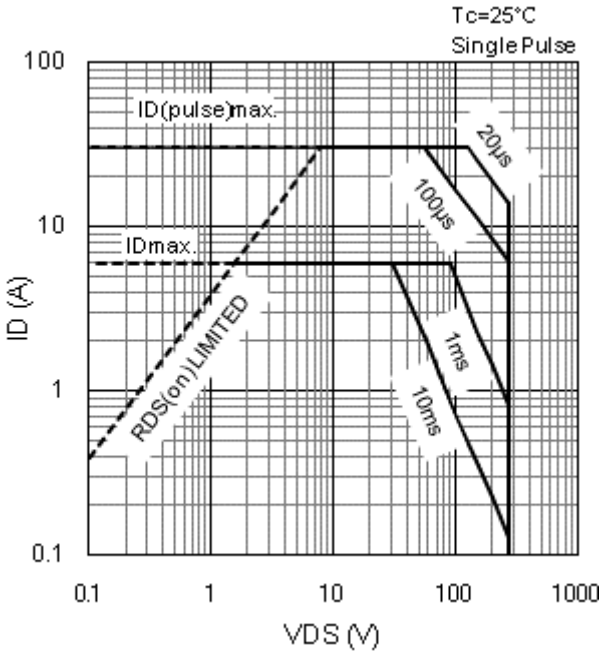



Figure 16 Safe operating area

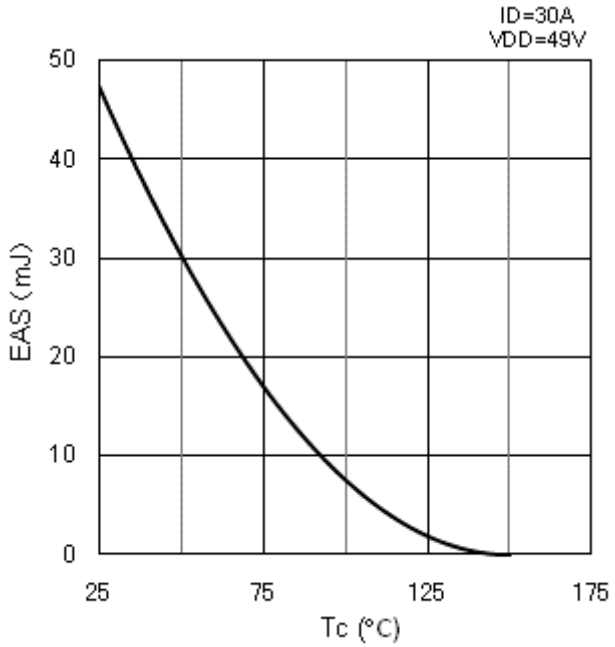



Figure 17. $E_{AS}$ vs. $T_C$ characteristics (typ.)



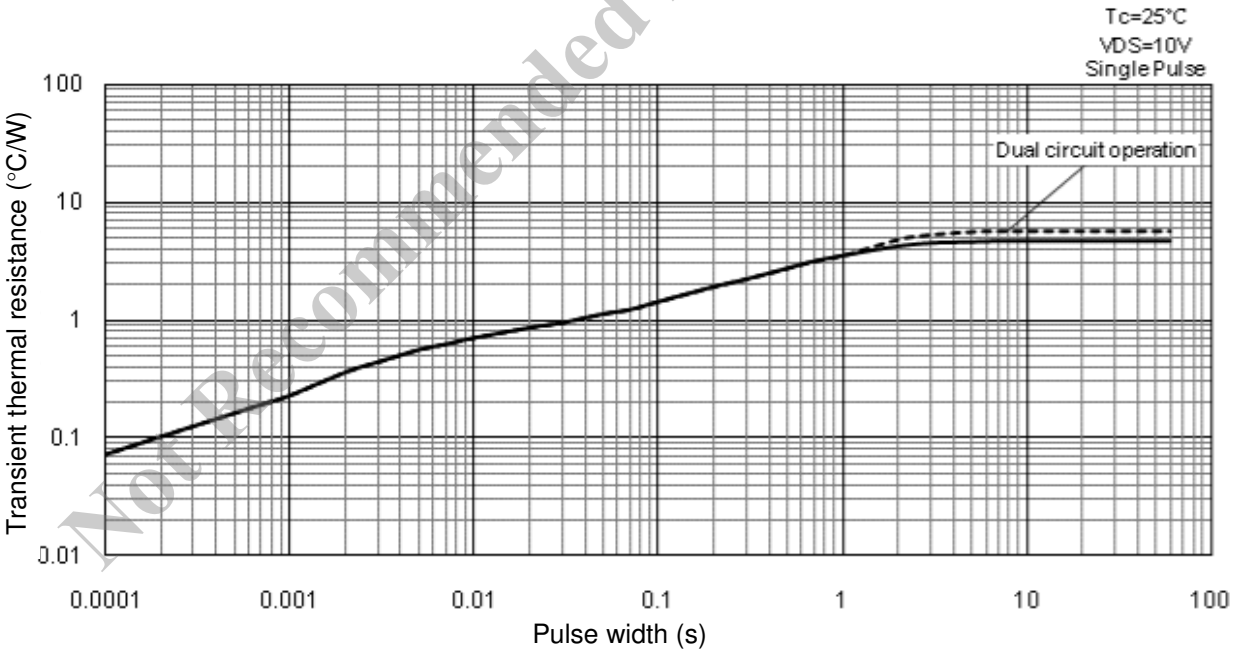
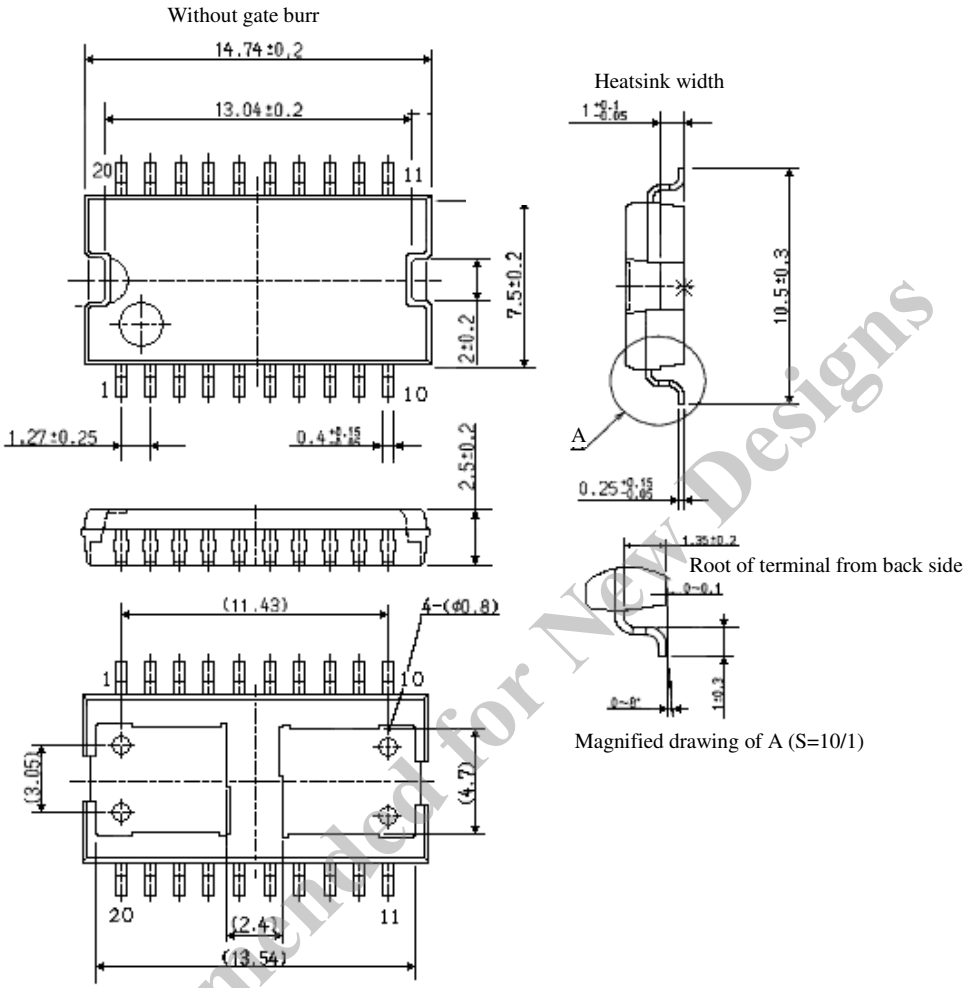



Figure 18. Transient Thermal Resistance

## Physical Dimensions

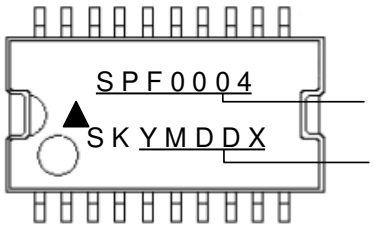
- **HSOP20 package**




**NOTES:**

- Dimensions in millimeters
- Lead treatment: Pb-free (RoHS compliant)
- When soldering the products, make sure to minimize the working time, within the following limits:
  Reflow (MSL 3)
  Preheat: 170 to 190 °C / 110 s
  Solder heating: 220 to 250 °C / 60s (3 times)
  Soldering iron: 380 ± 10 °C / 3.5 ± 0.5 s, 1 time

## Marking Diagram




Part Number

Lot Number

Y is the last digit of the year of manufacture (0 to 9)
M is the month of the year (1 to 9, O, N or D)
DD is the day of the month (01 to 31)
X is control number (A to Z)

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