

# FX50SMJ-03

High-Speed Switching Use  
Pch Power MOS FET

REJ03G0279-0100

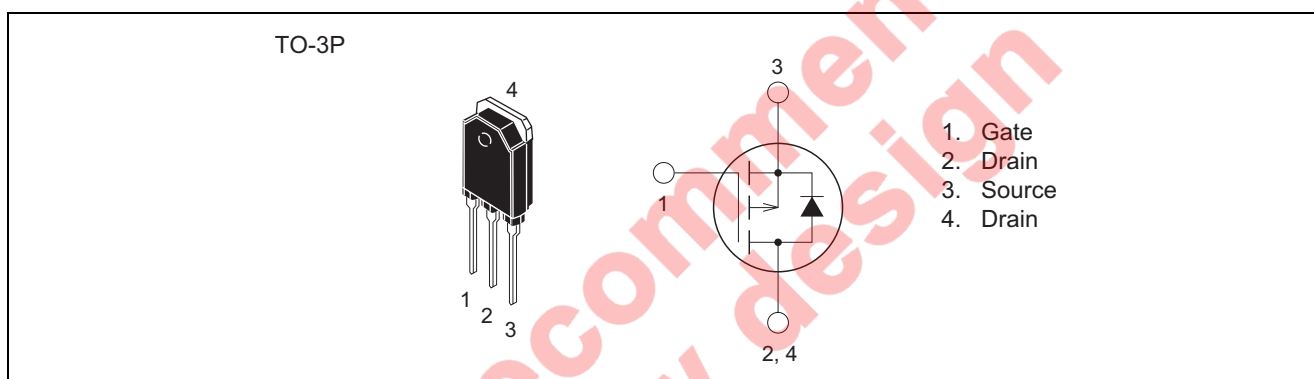
Rev.1.00

Aug.20.2004

## Features

- Drive voltage : 4 V
- $V_{DSS}$  : - 30 V
- $r_{DS(ON)(max)}$  : 35 m $\Omega$
- $I_D$  : - 50 A
- Recovery Time of the Integrated Fast Recovery Diode (TYP.) : 55 ns

## Outline



## Applications

Motor control, lamp control, solenoid control, DC-DC converters, etc.

## Maximum Ratings

(T<sub>c</sub> = 25°C)

| Parameter                  | Symbol           | Ratings      | Unit | Conditions     |
|----------------------------|------------------|--------------|------|----------------|
| Drain-source voltage       | $V_{DSS}$        | -30          | V    | $V_{GS} = 0$ V |
| Gate-source voltage        | $V_{GSS}$        | $\pm 20$     | V    | $V_{DS} = 0$ V |
| Drain current              | $I_D$            | -50          | A    |                |
| Drain current (Pulsed)     | $I_{DM}$         | -200         | A    |                |
| Avalanche current (Pulsed) | $I_{DA}$         | -50          | A    | L = 10 $\mu$ H |
| Source current             | $I_S$            | -50          | A    |                |
| Source current (Pulsed)    | $I_{SM}$         | -200         | A    |                |
| Maximum power dissipation  | $P_D$            | 70           | W    |                |
| Channel temperature        | T <sub>ch</sub>  | - 55 to +150 | °C   |                |
| Storage temperature        | T <sub>stg</sub> | - 55 to +150 | °C   |                |
| Mass                       | —                | 4.8          | g    | Typical value  |

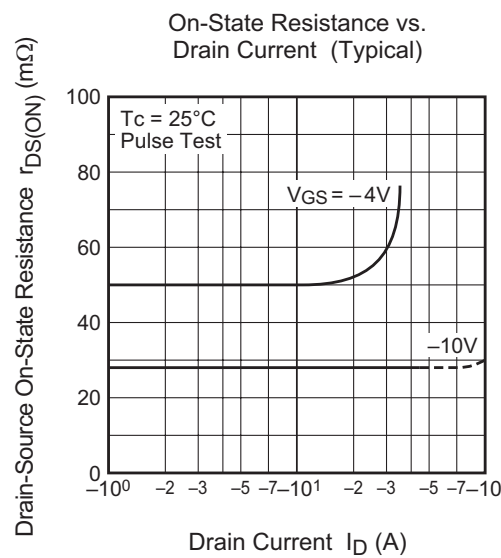
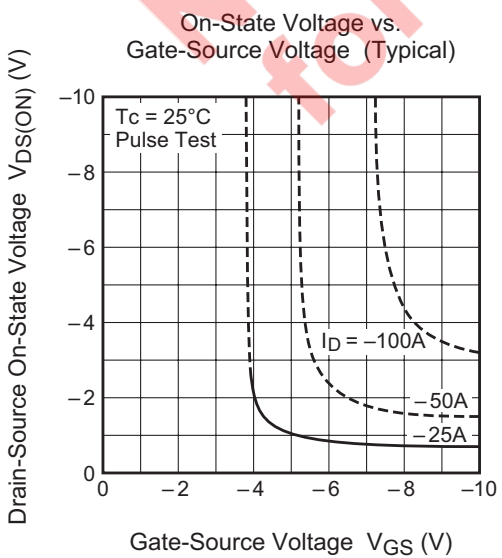
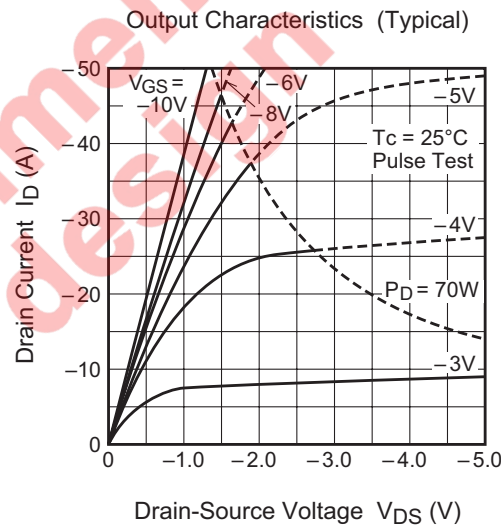
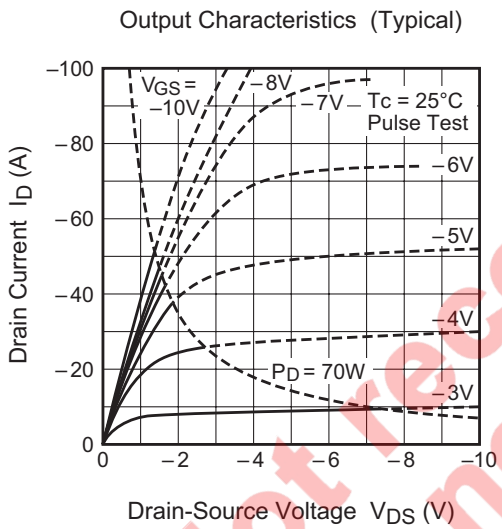
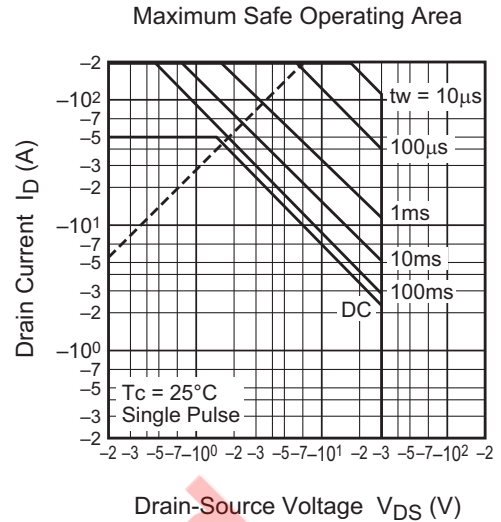
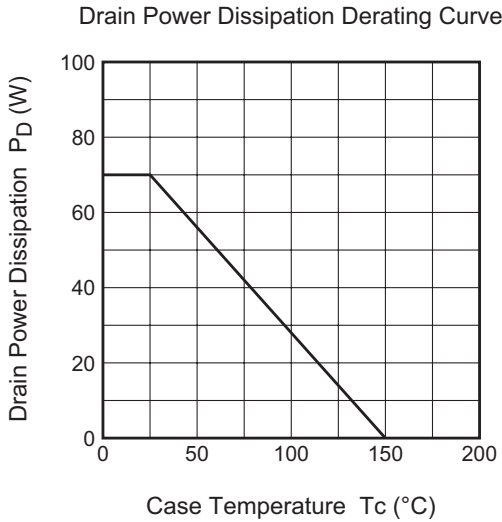
## Electrical Characteristics

(T<sub>ch</sub> = 25°C)

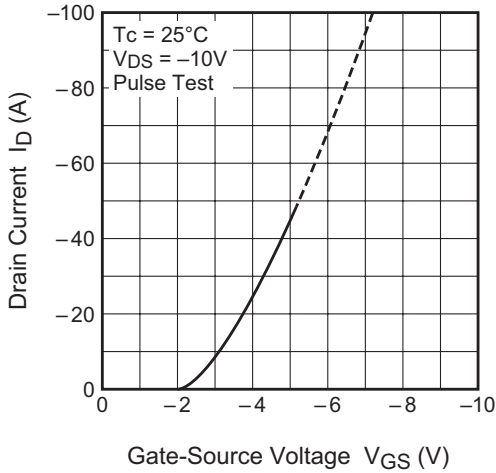
| Parameter                        | Symbol         | Min. | Typ.  | Max.  | Unit | Test conditions  |
|----------------------------------|----------------|------|-------|-------|------|--|
| Drain-source breakdown voltage   | $V_{(BR)DSS}$  | -30  | —     | —     | V    | $I_D = 1 \text{ mA}$ , $V_{GS} = 0 \text{ V}$  |
| Gate-source leakage current      | $I_{GSS}$      | —    | —     | ±0.1  | μA   | $V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0 \text{ V}$   |
| Drain-source leakage current     | $I_{DSS}$      | —    | —     | -0.1  | mA   | $V_{DS} = -30 \text{ V}$ , $V_{GS} = 0 \text{ V}$  |
| Gate-source threshold voltage    | $V_{GS(th)}$   | -1.3 | -1.8  | -2.3  | V    | $I_D = -1 \text{ mA}$ , $V_{DS} = -10 \text{ V}$   |
| Drain-source on-state resistance | $r_{DS(ON)}$   | —    | 28    | 35    | mΩ   | $I_D = -25 \text{ A}$ , $V_{GS} = -10 \text{ V}$   |
| Drain-source on-state resistance | $r_{DS(ON)}$   | —    | 54    | 72    | mΩ   | $I_D = -9 \text{ A}$ , $V_{GS} = -4 \text{ V}$   |
| Drain-source on-state voltage    | $V_{DS(ON)}$   | —    | -0.70 | -0.88 | V    | $I_D = -25 \text{ A}$ , $V_{GS} = -10 \text{ V}$   |
| Forward transfer admittance      | $ y_{fs} $     | —    | 23    | —     | S    | $I_D = -25 \text{ A}$ , $V_{DS} = -10 \text{ V}$   |
| Input capacitance                | $C_{iss}$      | —    | 4270  | —     | pF   | $V_{DS} = -10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ ,<br>$f = 1 \text{ MHz}$   |
| Output capacitance               | $C_{oss}$      | —    | 695   | —     | pF   |  |
| Reverse transfer capacitance     | $C_{rss}$      | —    | 342   | —     | pF   |  |
| Turn-on delay time               | $t_{d(on)}$    | —    | 21    | —     | ns   | $V_{DD} = -15 \text{ V}$ , $I_D = -25 \text{ A}$ ,<br>$V_{GS} = -10 \text{ V}$ ,<br>$R_{GEN} = R_{GS} = 50 \Omega$ |
| Rise time                        | $t_r$          | —    | 103   | —     | ns   |  |
| Turn-off delay time              | $t_{d(off)}$   | —    | 223   | —     | ns   |  |
| Fall time                        | $t_f$          | —    | 122   | —     | ns   |  |
| Source-drain voltage             | $V_{SD}$       | —    | -1.0  | -1.5  | V    | $I_S = -25 \text{ A}$ , $V_{GS} = 0 \text{ V}$   |
| Thermal resistance               | $R_{th(ch-c)}$ | —    | —     | 1.79  | °C/W | Channel to case  |
| Reverse recovery time            | $t_{rr}$       | —    | 55    | —     | ns   | $I_S = -25 \text{ A}$ , $dis/dt = 50 \text{ A}/\mu\text{s}$  |

Not recommended  
for new design

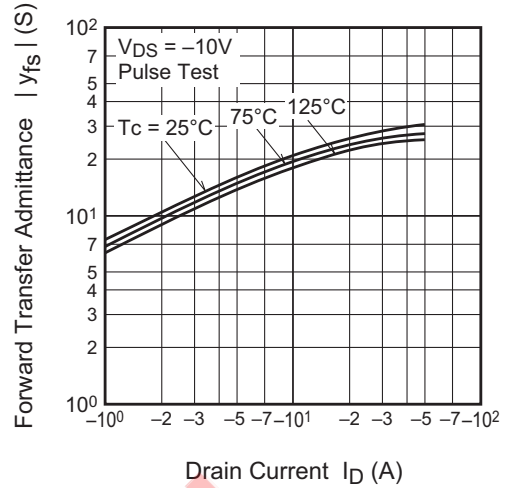
Performance Curves



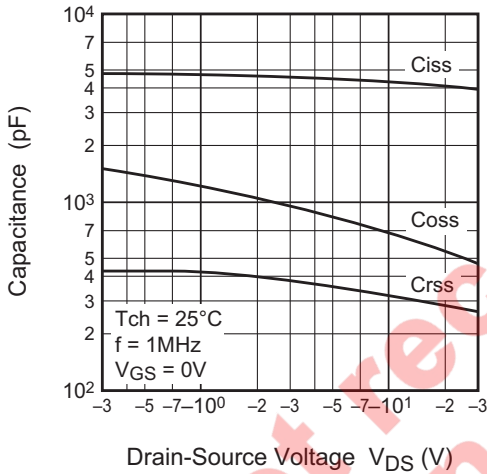
Transfer Characteristics (Typical)



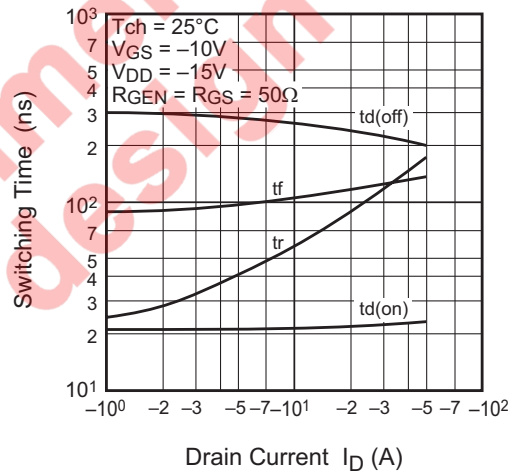
Forward Transfer Admittance vs. Drain Current (Typical)



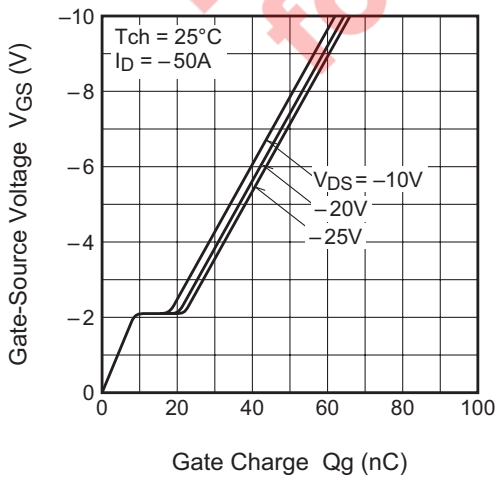
Capacitance vs. Drain-Source Voltage (Typical)



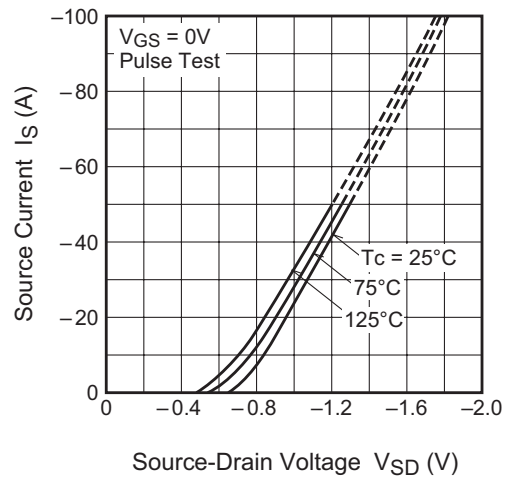
Switching Characteristics (Typical)

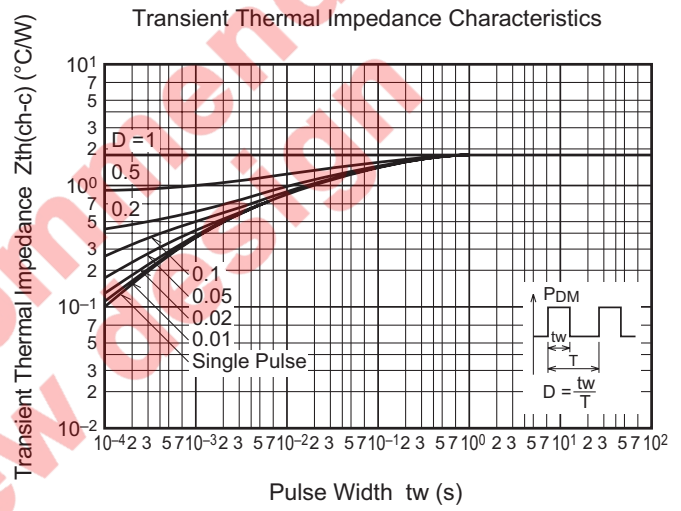
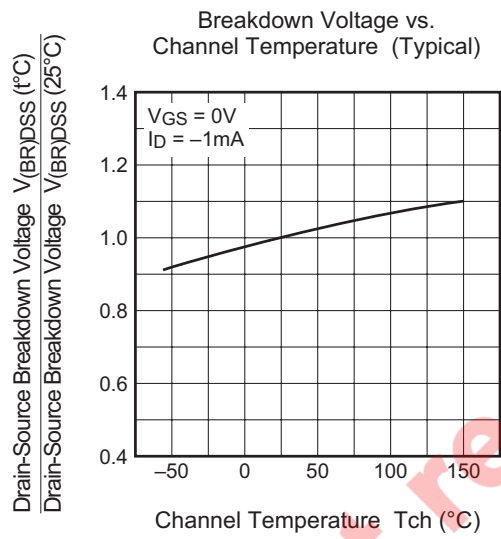
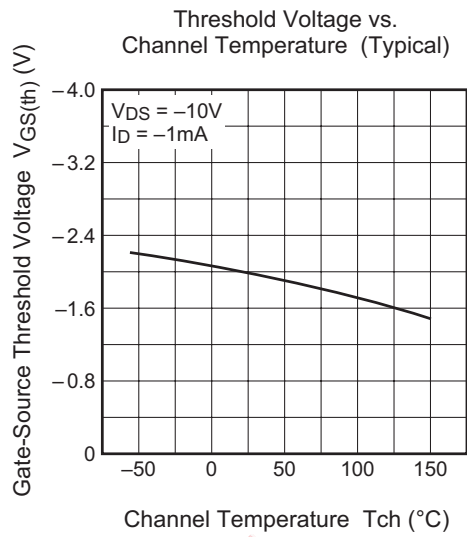
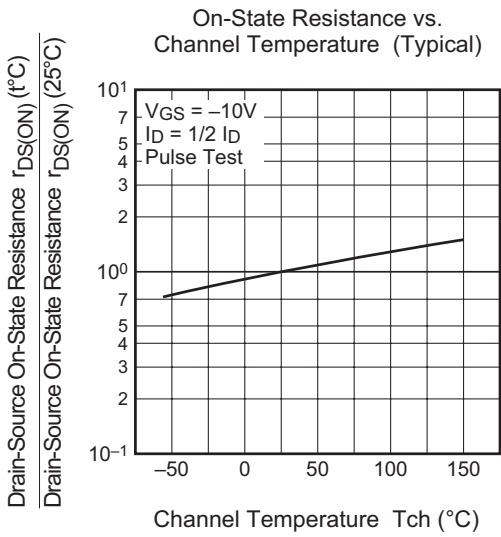


Gate-Source Voltage vs. Gate Charge (Typical)

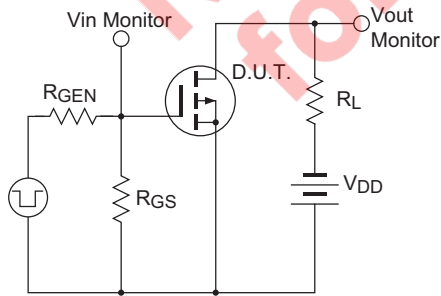


Source-Drain Diode Forward Characteristics (Typical)

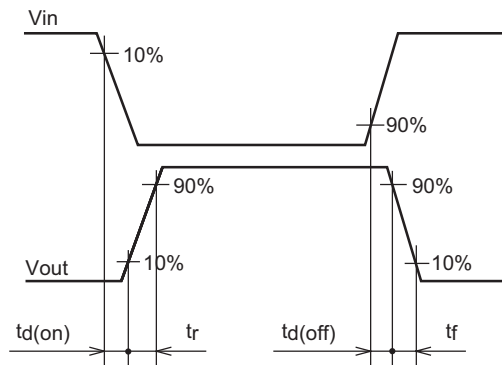




Switching Time Measurement Circuit



Switching Waveform



### Package Dimensions

**TO-3P**

|                   |            |                            |               |
|-------------------|------------|----------------------------|---------------|
| EIAJ Package Code | JEDEC Code | Mass (g) (reference value) | Lead Material |
| Conforms          | —          | 4.8                        | Cu alloy      |

Note 1) The dimensional figures indicate representative values unless otherwise the tolerance is specified.

| Symbol         | Dimension in Millimeters |     |     |
|----------------|--------------------------|-----|-----|
|                | Min                      | Typ | Max |
| A              | —                        | —   | —   |
| A <sub>1</sub> | —                        | —   | —   |
| A <sub>2</sub> | —                        | —   | —   |
| b              | —                        | —   | —   |
| D              | —                        | —   | —   |
| E              | —                        | —   | —   |
| e              | —                        | —   | —   |
| x              | —                        | —   | —   |
| y              | —                        | —   | —   |
| y <sub>1</sub> | —                        | —   | —   |
| ZD             | —                        | —   | —   |
| ZE             | —                        | —   | —   |

### Order Code

| Lead form     | Standard packing                  | Quantity | Standard order code           | Standard order code example |
|---------------|-----------------------------------|----------|-------------------------------|-----------------------------|
| Straight type | Static electricity prevention bag | 20       | Type name                     | FX50SMJ-03                  |
| Lead form     | Plastic Magazine (Tube)           | 30       | Type name – Lead forming code | FX50SMJ-03-A8               |

Note : Please confirm the specification about the shipping in detail.

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