

## Advanced Power MOSFET

## SSP1N50A

### FEATURES

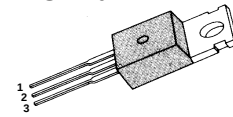
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS} = 500V$
- Lower  $R_{DS(ON)}$  : 4.046  $\Omega$  (Typ.)

$$BV_{DSS} = 500 V$$

$$R_{DS(on)} = 5.5 \Omega$$

$$I_D = 1.5 A$$

### TO-220



1.Gate 2. Drain 3. Source

### Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units         |
|----------------|-------------------------------------------------------------------------|--------------|---------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 500          | V             |
| $I_D$          | Continuous Drain Current ( $T_C=25^\circ C$ )                           | 1.5          | A             |
|                | Continuous Drain Current ( $T_C=100^\circ C$ )                          | 0.97         |               |
| $I_{DM}$       | Drain Current-Pulsed ①                                                  | 5            | A             |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 30$     | V             |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                        | 113          | mJ            |
| $I_{AR}$       | Avalanche Current ①                                                     | 1.5          | A             |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                           | 3.6          | mJ            |
| dv/dt          | Peak Diode Recovery dv/dt ③                                             | 3.5          | V/ns          |
| $P_D$          | Total Power Dissipation ( $T_C=25^\circ C$ )                            | 36           | W             |
|                | Linear Derating Factor                                                  | 0.29         | W/ $^\circ C$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^\circ C$    |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300          |               |

### Thermal Resistance

| Symbol          | Characteristic      | Typ. | Max. | Units        |
|-----------------|---------------------|------|------|--------------|
| $R_{\theta JC}$ | Junction-to-Case    | --   | 3.44 | $^\circ C/W$ |
| $R_{\theta CS}$ | Case-to-Sink        | 0.5  | --   |              |
| $R_{\theta JA}$ | Junction-to-Ambient | --   | 62.5 |              |

# SSP1N50A

## N-CHANNEL POWER MOSFET

### Electrical Characteristics ( $T_C=25^\circ\text{C}$ unless otherwise specified)

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units    | Test Condition                                                               |
|------------------------|-----------------------------------------|------|------|------|----------|------------------------------------------------------------------------------|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 500  | --   | --   | V        | $V_{GS}=0V, I_D=250\mu A$                                                    |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.63 | --   | V/°C     | $I_D=250\mu A$ <b>See Fig 7</b>                                              |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 2.0  | --   | 4.0  | V        | $V_{DS}=5V, I_D=250\mu A$                                                    |
| $I_{GSS}$              | Gate-Source Leakage, Forward            | --   | --   | 100  | nA       | $V_{GS}=30V$                                                                 |
|                        | Gate-Source Leakage, Reverse            | --   | --   | -100 |          | $V_{GS}=-30V$                                                                |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | 10   | $\mu A$  | $V_{DS}=500V$                                                                |
|                        |                                         | --   | --   | 100  |          | $V_{DS}=400V, T_C=125^\circ\text{C}$                                         |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 5.5  | $\Omega$ | $V_{GS}=10V, I_D=0.75A$ ④                                                    |
| $g_{fs}$               | Forward Transconductance                | --   | 1.1  | --   | $\Omega$ | $V_{DS}=50V, I_D=0.75A$ ④                                                    |
| $C_{iss}$              | Input Capacitance                       | --   | 220  | 290  | pF       | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                   |
| $C_{oss}$              | Output Capacitance                      | --   | 30   | 35   |          |                                                                              |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 11   | 13   |          |                                                                              |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 12   | 35   | ns       | $V_{DD}=250V, I_D=1.5A,$<br>$R_G=24\Omega$<br><b>See Fig 13</b> ④⑤           |
| $t_r$                  | Rise Time                               | --   | 13   | 35   |          |                                                                              |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 42   | 90   |          |                                                                              |
| $t_f$                  | Fall Time                               | --   | 15   | 40   |          |                                                                              |
| $Q_g$                  | Total Gate Charge                       | --   | 11   | 16   | nC       | $V_{DS}=400V, V_{GS}=10V,$<br>$I_D=1.5A$<br><b>See Fig 6 &amp; Fig 12</b> ④⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 1.6  | --   |          |                                                                              |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | --   | 5.5  | --   |          |                                                                              |

### Source-Drain Diode Ratings and Characteristics

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                              |
|----------|---------------------------|------|------|------|---------|---------------------------------------------|
| $I_S$    | Continuous Source Current | --   | --   | 1.5  | A       | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | 5    |         |                                             |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | 1.15 | V       | $T_J=25^\circ\text{C}, I_S=1.5A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 162  | --   | ns      | $T_J=25^\circ\text{C}, I_F=1.5A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 0.54 | --   | $\mu C$ | $di_F/dt=100A/\mu s$ ④                      |

#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=90\text{mH}, I_{AS}=1.5A, V_{DD}=50V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD} \leq 1.5A, di/dt \leq 70A/\mu s, V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width = 250  $\mu s$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature

# N-CHANNEL POWER MOSFET

# SSP1N50A

Fig 1. Output Characteristics

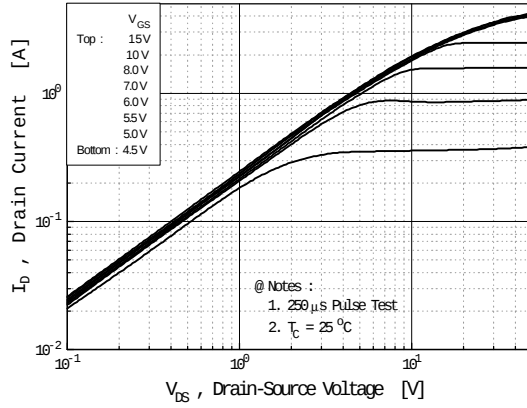


Fig 2. Transfer Characteristics

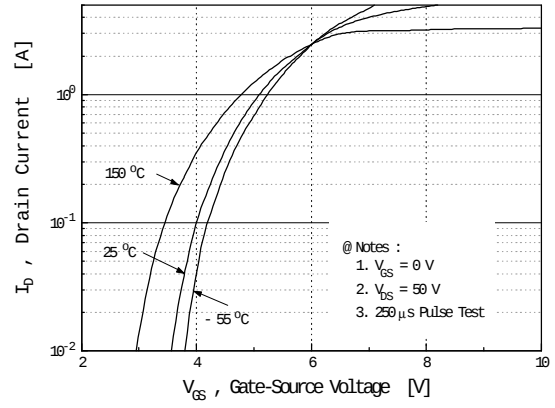


Fig 3. On-Resistance vs. Drain Current

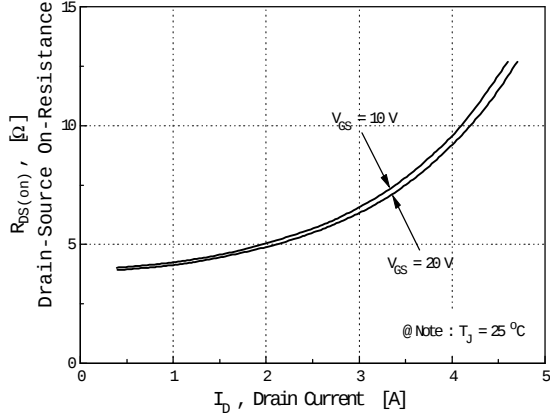


Fig 4. Source-Drain Diode Forward Voltage

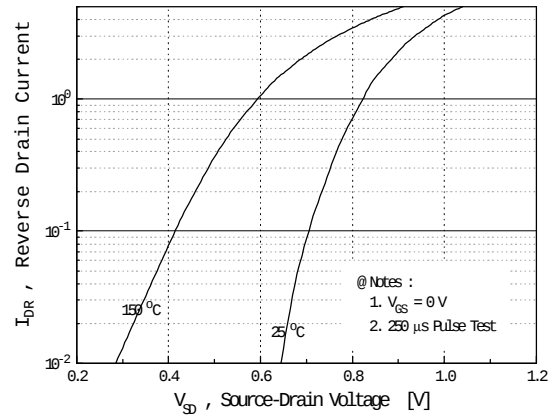


Fig 5. Capacitance vs. Drain-Source Voltage

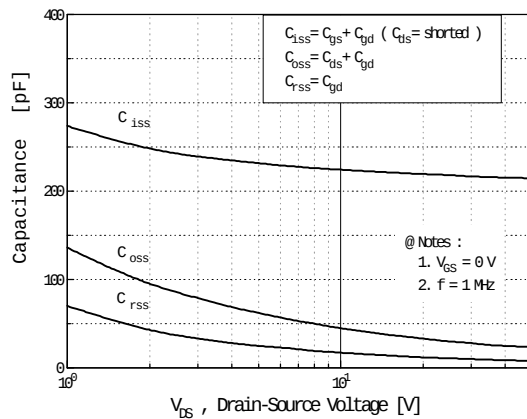
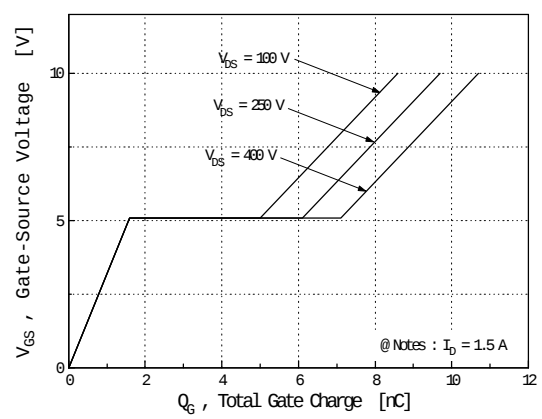
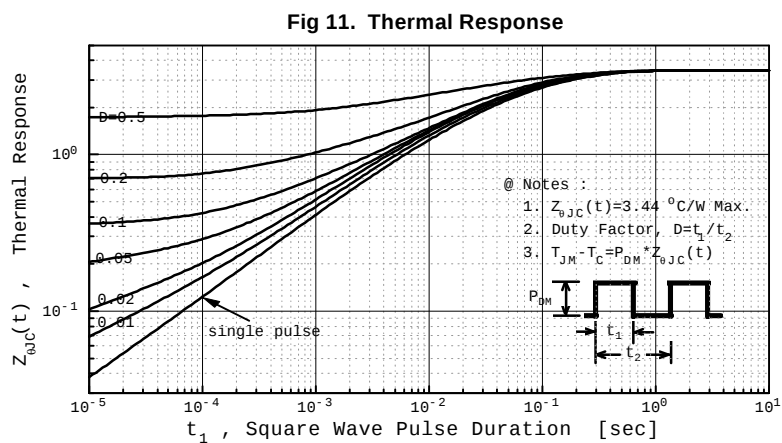
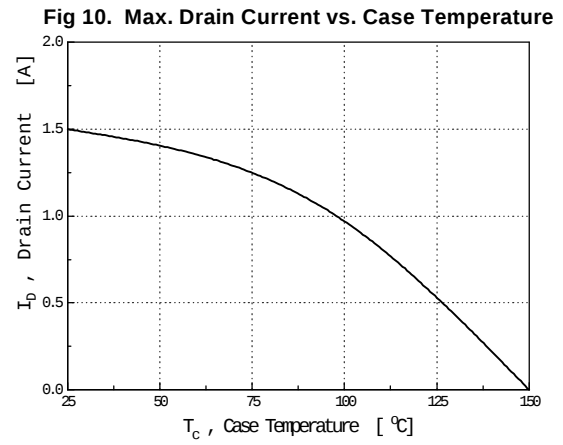
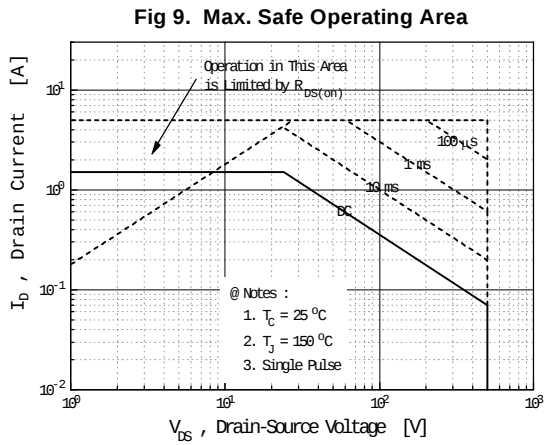
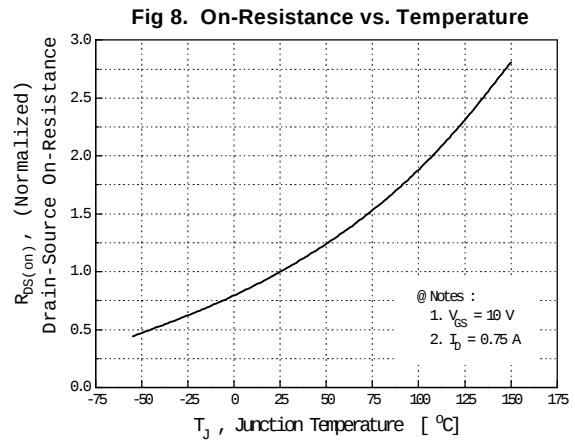
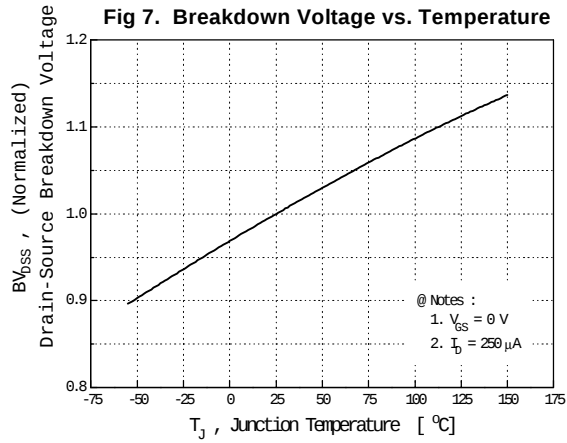


Fig 6. Gate Charge vs. Gate-Source Voltage

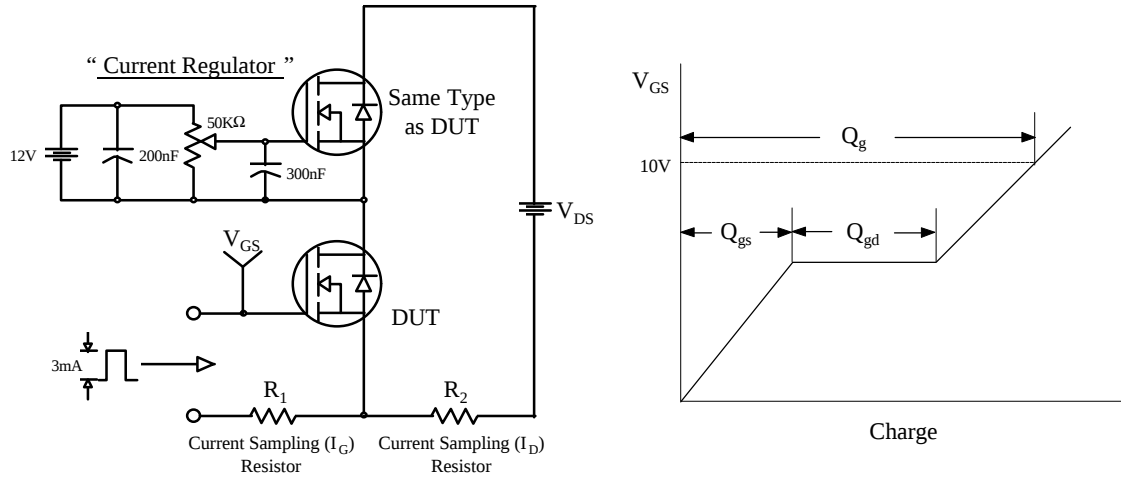


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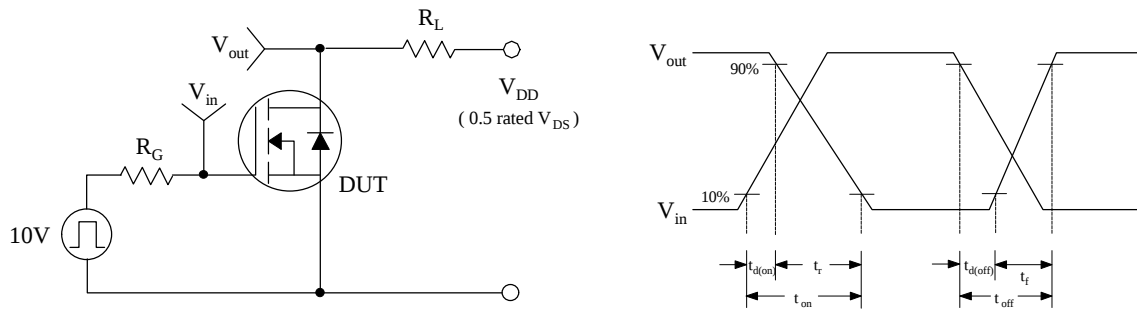
## N-CHANNEL POWER MOSFET



**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**

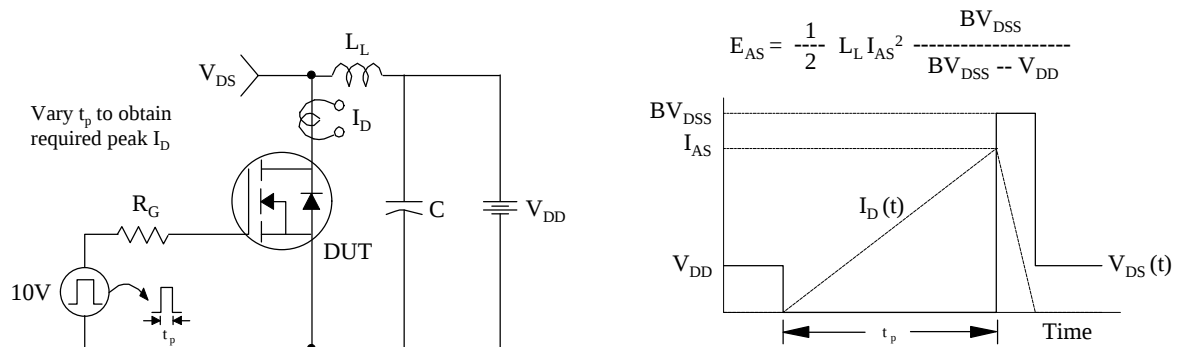
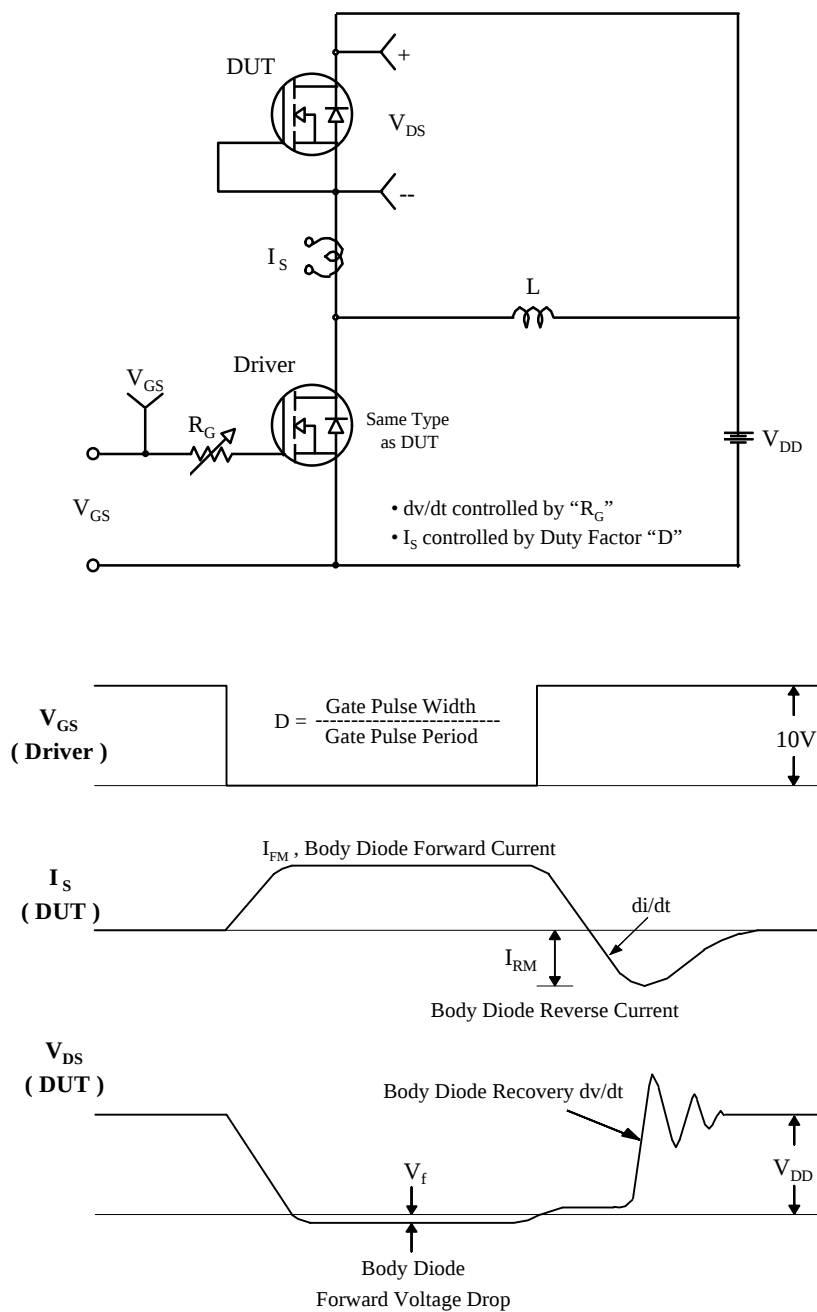


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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| FACT Quiet Series™   | Quiet Series™           |      |
| FAST®                | SuperSOT™-3             |      |
| FAST <sup>r</sup> ™  | SuperSOT™-6             |      |
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