

MS 13P21

P-Channel 20-V (D-S) MOSFET

Description

These miniature surface mount MOSFETs utilize a high cell density trench process to provide low $r_{DS(on)}$ and to ensure minimal power loss and heat dissipation. Typical applications are DC-DC converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

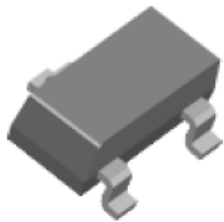
Features

- Low $r_{DS(on)}$ provides higher efficiency and extends battery life
- Low thermal impedance copper leadframe SC70-3 saves board space
- Fast switching speed
- High performance trench technology
- RoHS compliant package

Package type : SC70-3

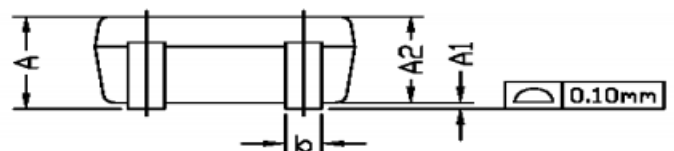
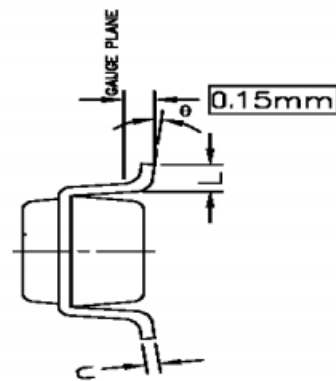
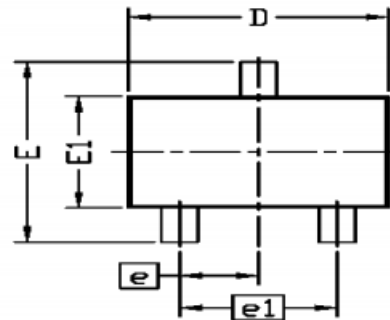
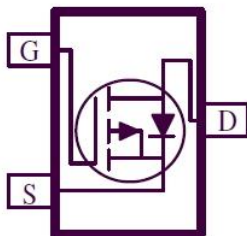
Packing & Order Information

3,000/Reel



**RoHS
COMPLIANT**

Graphic symbol



| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---------|---------------------------|------|------|----------------------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | | | 1.10 | | | 0.043 |
| A1 | 0.00 | | 0.10 | 0.00 | | 0.004 |
| A2 | 0.7 | 0.9 | 1.00 | 0.028 | 0.035 | 0.039 |
| b | 0.15 | | 0.30 | 0.006 | | 0.012 |
| c | 0.08 | | 0.22 | 0.003 | | 0.009 |
| D | 1.85 | 2.10 | 2.15 | 0.073 | 0.083 | 0.085 |
| E | 1.80 | 2.30 | 2.40 | 0.071 | 0.091 | 0.094 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| e1 | 1.30 BSC | | | 0.051 BSC | | |
| E1 | 1.1 | 1.30 | 1.4 | 0.043 | 0.051 | 0.055 |
| L | 0.26 | 0.36 | 0.46 | 0.010 | 0.014 | 0.018 |
| theta | 0° | 4° | 8° | 0° | 4° | 8° |

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MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | Unit |
|---------------|--|-------------|------------------|
| V_{DS} | Drain-Source Voltage | -20 | V |
| V_{GS} | Gate-Source Voltage | ± 8 | V |
| I_D | Continuous Drain Current ^a ($T_A=25^\circ\text{C}$) | -1.7 | A |
| | Continuous Drain Current ^a ($T_A=70^\circ\text{C}$) | -1.4 | A |
| I_{DM} | Pulsed Drain Current ^b | -2.5 | A |
| I_S | Continuous Source Current (Diode Conduction) ^a | ± 0.28 | A |
| P_D | Power Dissipation ^a ($T_A=25^\circ\text{C}$) | 0.34 | W |
| | Power Dissipation ^a ($T_A=70^\circ\text{C}$) | 0.22 | W |
| T_J/T_{STG} | Operating Junction and Storage Temperature | -55 to +150 | $^\circ\text{C}$ |

THERMAL RESISTANCE RATINGS

| Symbol | Parameter | Maximum | Units |
|------------|--|---------|--------------------|
| R_{THJA} | Maximum Junction-to-Ambient C/W ^a ($t \leq 5$ sec) | 375 | $^\circ\text{C/W}$ |
| | Maximum Junction-to-Ambient C/W ^a (Steady-State) | 430 | |

Notes

- Surface Mounted on 1" x 1" FR4 Board.
- Pulse width limited by maximum junction temperature

Static

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|--------------|---|--|------|-------|-----------|---------------|
| V_{GS} | Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = -250\mu\text{A}$ | -0.4 | | | V |
| I_{GSS} | Gate-Body Leakage | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$ | | | ± 100 | nA |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$ $V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^\circ\text{C}$ | | | -1 -10 | μA |
| $I_{D(on)}$ | On-State Drain Current ^A | $V_{DS} = -5\text{ V}, V_{GS} = -4.5\text{ V}$ | -5 | | | A |
| $R_{DS(on)}$ | Drain-Source On-Resistance ^A | $V_{GS} = -4.5\text{ V}, I_D = -1.7\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -1.5\text{ A}$ | | | 79 110 | m Ω |
| g_{fs} | Forward Transconductance ^A | $V_{DS} = -5\text{ V}, I_D = -1.25\text{ A}$ | | 9 | | S |
| V_{SD} | Diode Forward Voltage | $I_S = -0.46\text{ V}, V_{GS} = 0\text{ V}$ | | -0.65 | | V |

Dynamic^b

| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
|--------------|---------------------|---|-----|------|------|-------|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = -10\text{ V}, I_L = -1\text{ A},$ $V_{GEN} = -4.5\text{ V}, R_G = 6\ \Omega$ | -- | 10 | -- | ns |
| t_r | Rise Time | | -- | 9 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 27 | -- | ns |
| t_f | Fall Time | | -- | 11 | -- | ns |

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| Dynamic ^b | | | | | | |
|----------------------|--------------------|---|-----|------|------|-------|
| Symbol | Parameter | Test Conditions | Min | Typ. | Max. | Units |
| Q_g | Total Gate Charge | $V_{DS} = -10\text{ V}$, $I_D = -1.7\text{ A}$, $V_{GS} = -4.5\text{ V}$ | -- | 7.2 | -- | nC |
| Q_{gs} | Gate-Source Charge | | -- | 1.7 | -- | nC |
| Q_{gd} | Gate-Drain Charge | | -- | 1.5 | -- | nC |

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Typical Electrical Characteristics

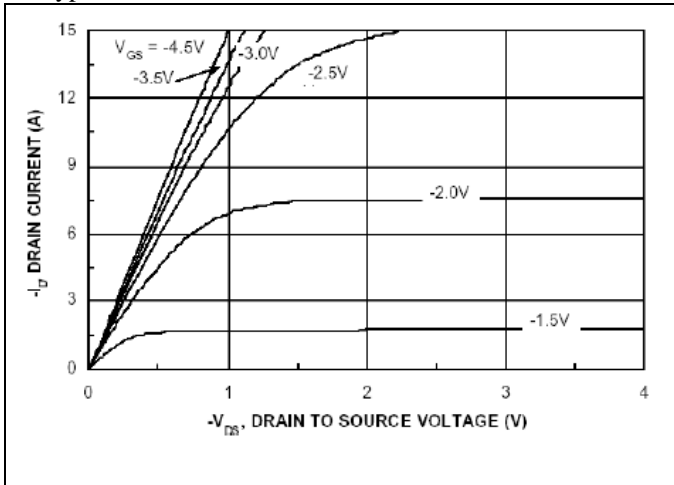


FIG.1-ON REGION CHARACTERISTICS

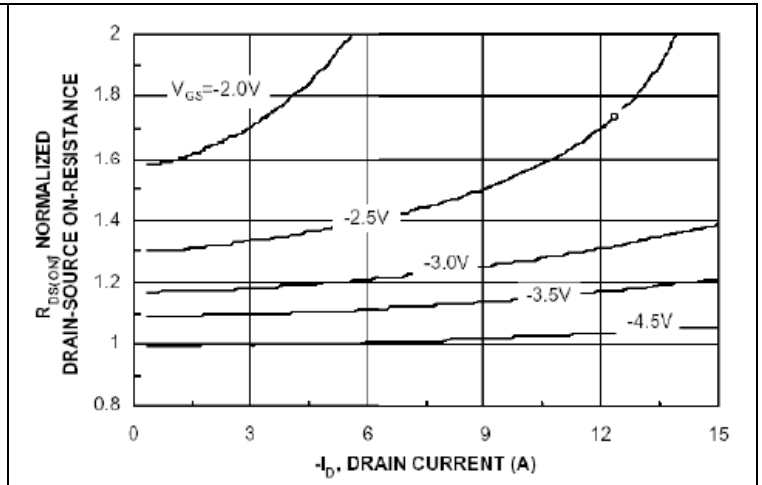


FIG.2-ON-RESISTANCE VARIATION WITH DRAIN CURRENT AND GATE VOLTAGE

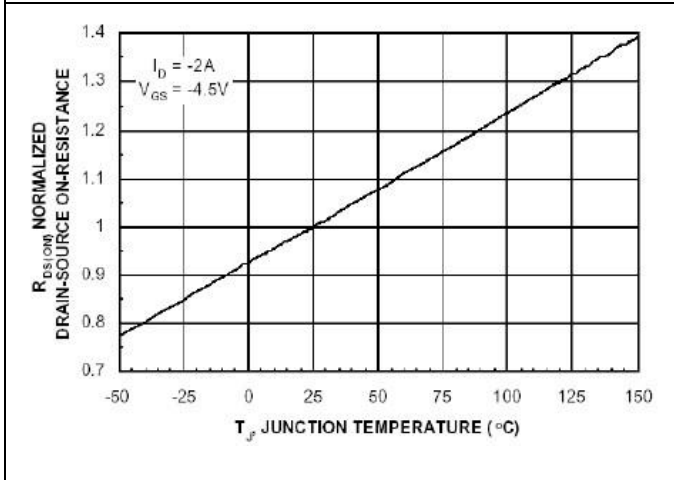


FIG.3-ON RESISTANCE VARIATION WITH TEMPERATURE

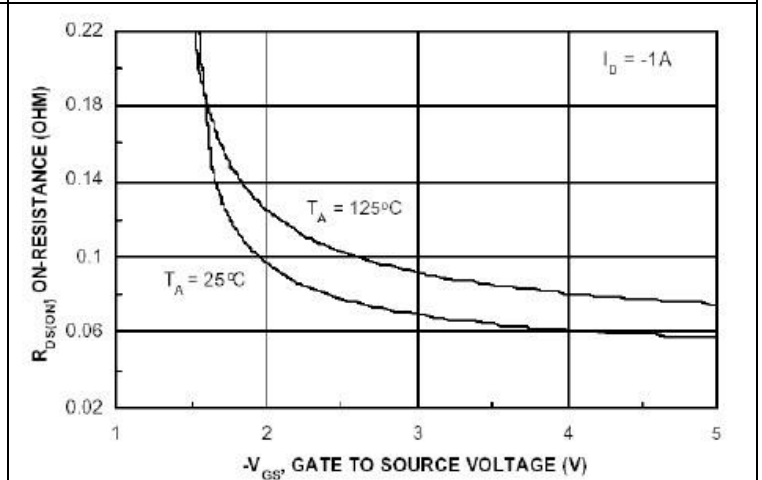


FIG.4-ON-RESISTANCE VARIATION WITH GATE TO SOURCE VOLTAGE

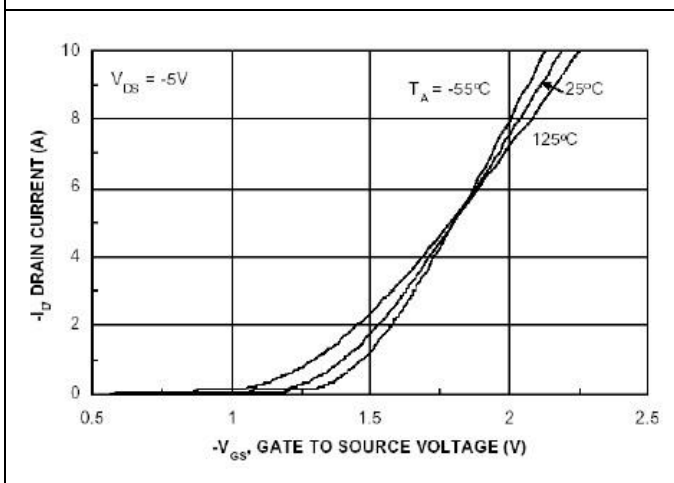


FIG.5-TRANSFER CHARACTERISTICS

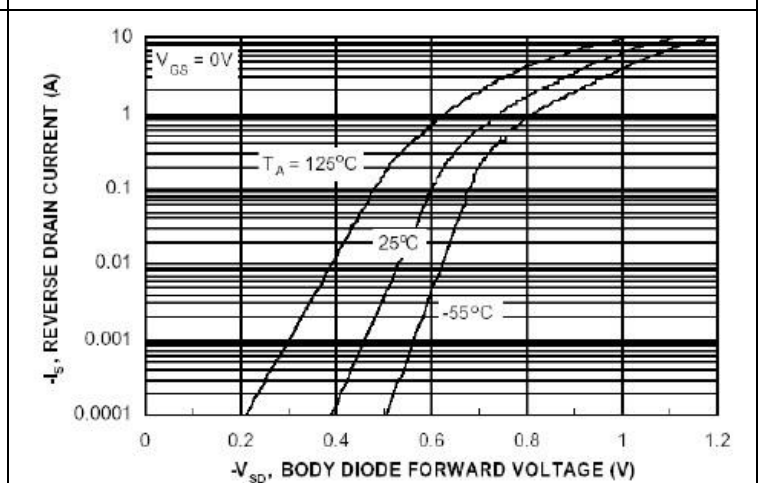


FIG.6-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

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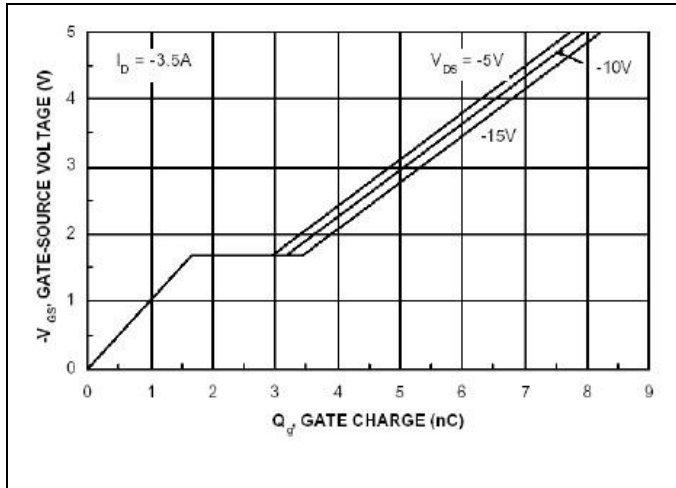


FIG.7-GATE CHARGE CHARACTERISTIC

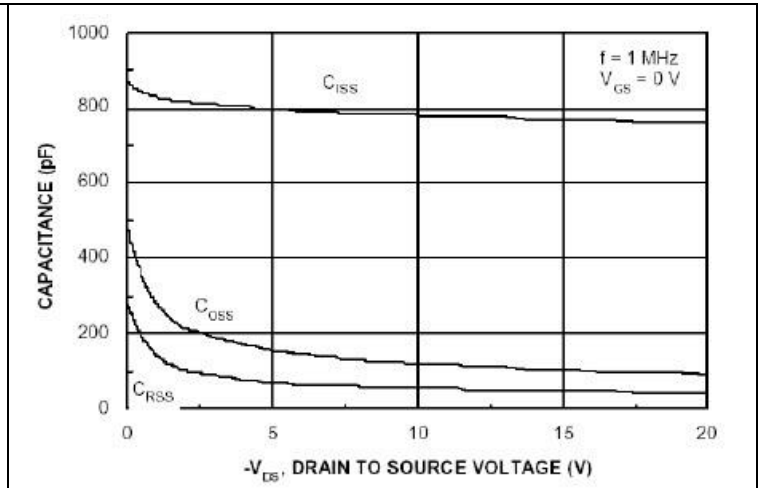


FIG.8-CAPACITANCE CHARACTERISTIC

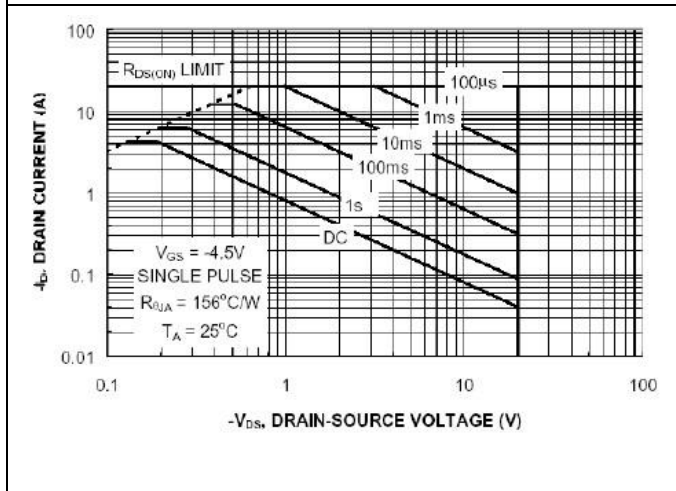


FIG.9-MAXIMUM SAFE OPERATING AREA

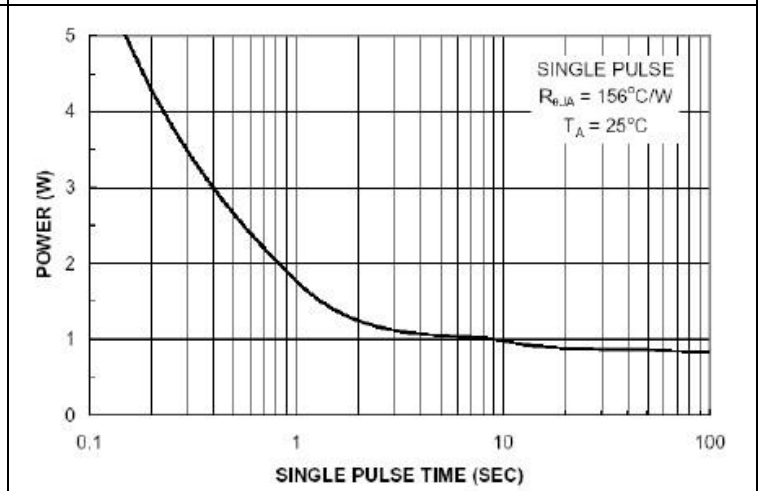


FIG.10-SINGLE PULSE MAXIMUM POWER DISSIPATION

Normalized Thermal Transient Junction to Ambient

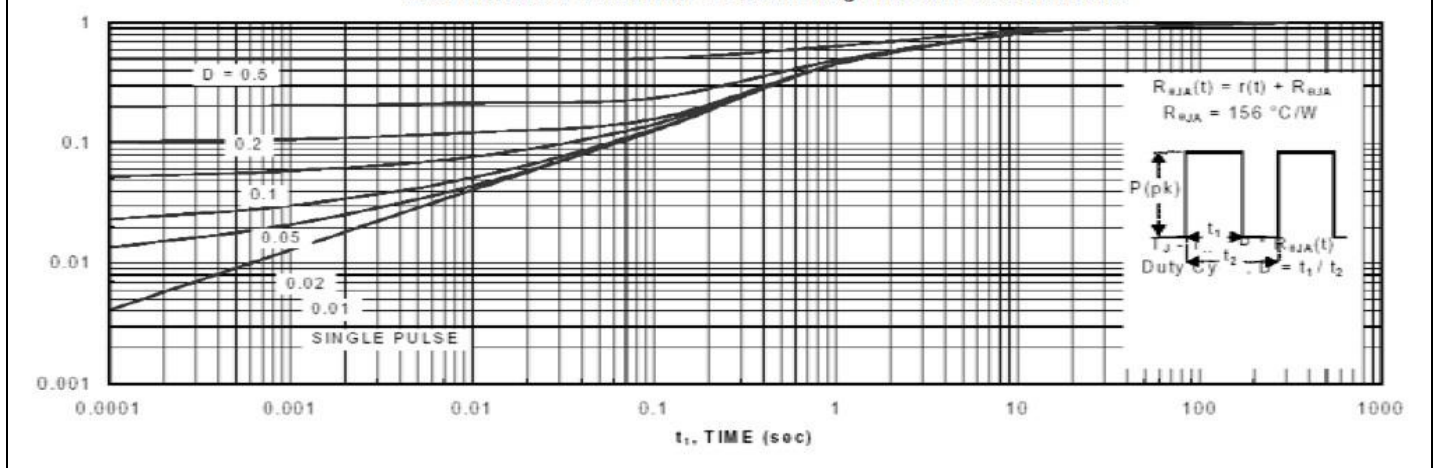


FIG.11-TRANSIENT THERMAL RESPONSE CURVE

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