

Features

- Low Input/Output Leakage
- Exceptional ON Resistance and Maximum DC Current Capability
- Epoxy Meets UL 94 V-0 Flammability Rating
- Moisture Sensitivity Level 1
- Halogen Free Available Upon Request By Adding Suffix "-HF"
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

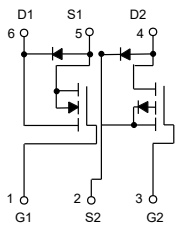
Maximum Ratings

- Operating Junction Temperature Range : -55°C to +150°C
- Storage Temperature Range: -55°C to +150°C
- Maximum Thermal Resistance: 119°C/W Junction to Ambient^(Note)

| Parameter | Symbol | Rating | Unit |
|--------------------------|----------|--------|------|
| N-Channel | | | |
| Drain-Source Voltage | V_{DS} | 20 | V |
| Gate-Source Voltage | V_{GS} | ±8 | V |
| Continuous Drain Current | I_D | 5 | A |
| P-Channel | | | |
| Drain-Source Voltage | V_{DS} | -20 | V |
| Gate-Source Voltage | V_{GS} | ±12 | V |
| Continuous Drain Current | I_D | -4 | A |

Note: Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch.

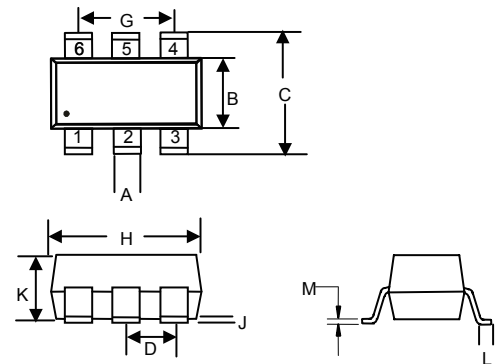
Internal Structure



Marking: 2038

**Dual
N&P-Channel
MOSFET**

SOT23-6L



| DIM | DIMENSIONS | | | | NOTE |
|-----|------------|-------|------|------|------|
| | INCHES | | MM | | |
| | MIN | MAX | MIN | MAX | |
| A | 0.012 | 0.020 | 0.30 | 0.50 | |
| B | 0.051 | 0.070 | 1.30 | 1.80 | |
| C | 0.087 | 0.126 | 2.20 | 3.20 | |
| D | 0.037 | | 0.95 | | TYP. |
| G | 0.074 | | 1.90 | | TYP. |
| H | 0.106 | 0.122 | 2.70 | 3.10 | |
| J | 0.002 | 0.006 | 0.05 | 0.15 | |
| K | 0.030 | 0.051 | 0.75 | 1.30 | |
| L | 0.012 | 0.024 | 0.30 | 0.60 | |
| M | 0.003 | 0.008 | 0.08 | 0.22 | |

Electrical Characteristics @ 25°C (Unless Otherwise Specified)
N-Channel

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---------------|---|-----|-----|-----------|------------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$ | 20 | | | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = 20V, V_{GS} = 0V$ | | | 1 | μA |
| Gate-body leakage current | I_{GSS} | $V_{GS} = \pm 12V, V_{DS} = 0V$ | | | ± 0.1 | μA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 0.5 | 0.7 | 1 | V |
| Drain-source on-resistance ^(Note 1) | $R_{DS(on)}$ | $V_{GS} = 4.5V, I_D = 4.5A$ | | | 38 | m Ω |
| | | $V_{GS} = 2.5V, I_D = 3.5A$ | | | 45 | |
| Forward transconductance | g_{FS} | $V_{DS} = 5V, I_D = 7A$ | 9 | | | S |
| Diode forward voltage | V_{SD} | $I_S = 1.7A, V_{GS} = 0V$ | | 0.7 | 1.3 | V |
| Dynamic characteristics^(Note 2) | | | | | | |
| Total gate charge | Q_g | $V_{DS} = 10V, V_{GS} = 4.5V, I_D = 4A$ | | 11 | | nC |
| Gate-source charge | Q_{gs} | | | 2.3 | | |
| Gate-drain charge | Q_{gd} | | | 2.5 | | |
| Input Capacitance | C_{iss} | $V_{DS} = 8V, V_{GS} = 0V, f = 1MHz$ | | 800 | | pF |
| Output Capacitance | C_{oss} | | | 155 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 125 | | |
| Switching Characteristics^(Note 2) | | | | | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = 10V, V_{GS} = 4V, I_D = 1A$ $R_G = 10\Omega$ | | 18 | | ns |
| Turn-on rise time | t_r | | | 5 | | |
| Turn-off delay time | $t_{d(off)}$ | | | 43 | | |
| Turn-off fall time | t_f | | | 20 | | |

Notes : 1. Pulse Test : Pulse width $\leq 300\mu s$, duty cycle $\leq 0.5\%$.

2. Guaranteed by design, not subject to production testing.

Electrical Characteristics @ 25°C (Unless Otherwise Specified)

P-Channel

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---------------|--|------|------|-----------|------------|
| Static Characteristics | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$ | -20 | | | V |
| Zero gate voltage drain current | I_{DSS} | $V_{DS} = -16V, V_{GS} = 0V$ | | | -1 | μA |
| Gate-body leakage current | I_{GSS} | $V_{GS} = \pm 12V, V_{DS} = 0V$ | | | ± 100 | nA |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = -250\mu A$ | -0.5 | -0.7 | -1 | V |
| Drain-source on-resistance ^(Note 1) | $R_{DS(on)}$ | $V_{GS} = -4.5V, I_D = -0.5A$ | | 70 | 90 | m Ω |
| | | $V_{GS} = -2.5V, I_D = -0.5A$ | | 90 | 110 | |
| Forward transconductance | g_{FS} | $V_{DS} = -5V, I_D = -2A$ | 5 | | | S |
| Dynamic characteristics^(Note 2) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = -10V, V_{GS} = 0V, f = 1MHz$ | | 405 | | pF |
| Output Capacitance | C_{oss} | | | 75 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 55 | | |
| Gate resistance | R_g | $f = 1MHz$ | | 6 | | Ω |
| Total Gate Charge | Q_g | $V_{DS} = -10V, V_{GS} = -2.5V, I_D = -3A$ | | 3.3 | 12 | nC |
| Gate-Source Charge | Q_{gs} | | | 0.7 | | |
| Gate-Drain Charge | Q_{gd} | | | 1.3 | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD} = -10V, V_{GEN} = -4.5V, I_D = -1A$ $R_L = 10\Omega, R_{GEN} = 1\Omega$ | | 11 | | ns |
| Turn-on rise time | t_r | | | 35 | | |
| Turn-off delay time | $t_{d(off)}$ | | | 30 | | |
| Turn-off fall time | t_f | | | 10 | | |
| Source-Drain Diode characteristics | | | | | | |
| Diode Forward voltage | V_{SD} | $V_{GS} = 0V, I_S = -1.25A$ | | -0.7 | -1.3 | V |

Notes : 1. Pulse Test : Pulse width $\leq 300\mu s$, duty cycle $\leq 0.5\%$.

2. Guaranteed by design, not subject to production testing.

Curve Characteristics(N-Channel)

Fig. 1 - Output Characteristics

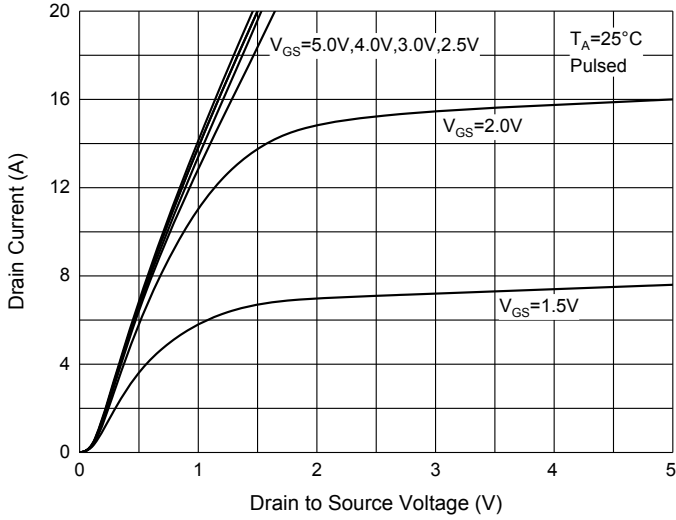


Fig. 2 - Transfer Characteristics

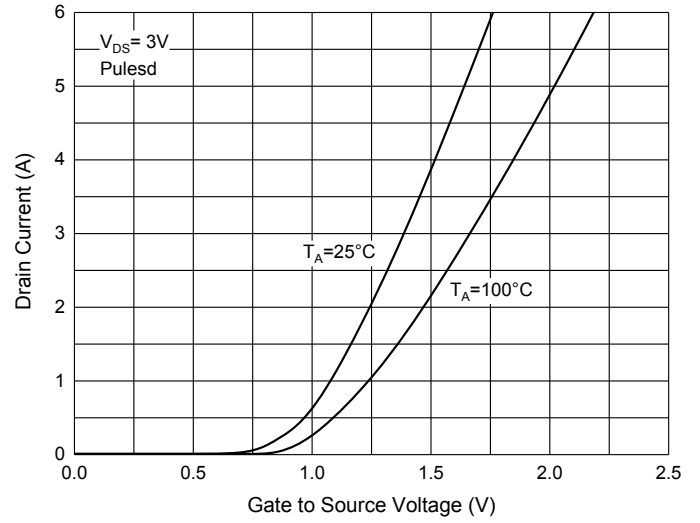


Fig. 3 - $R_{DS(ON)} - I_D$

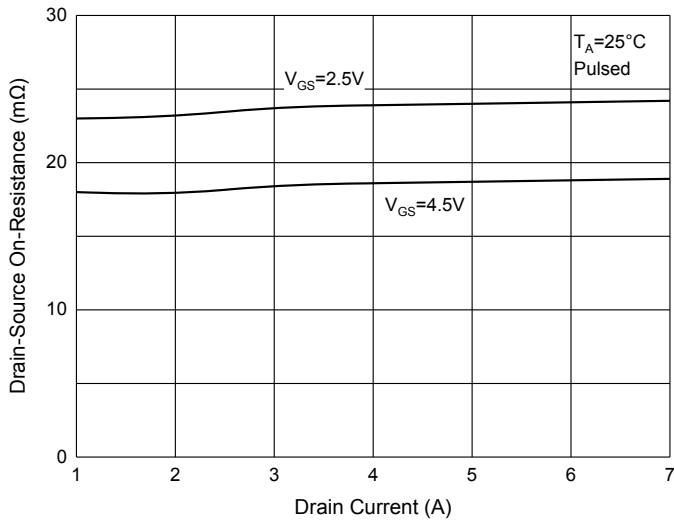


Fig. 4 - $R_{DS(ON)} - V_{GS}$

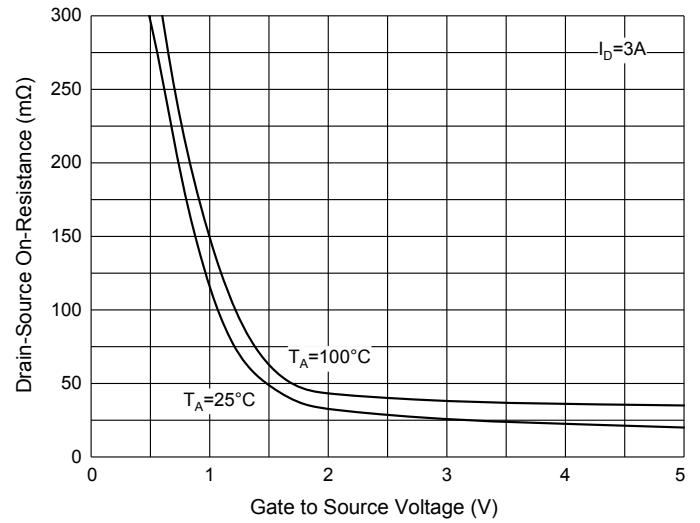


Fig. 5 - $I_S - V_{SD}$

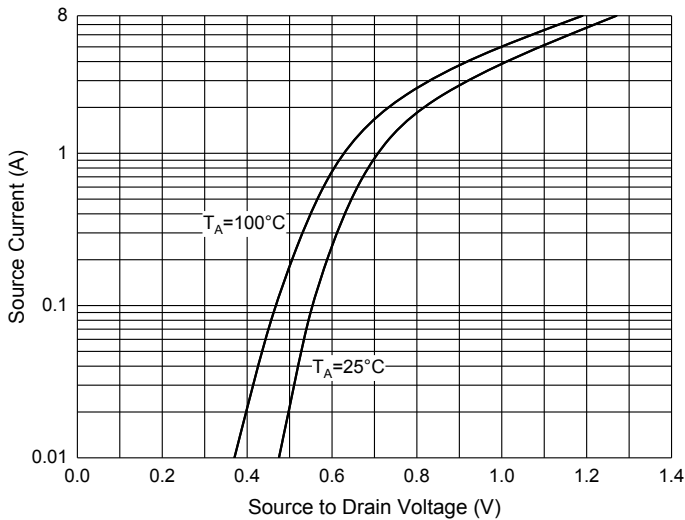
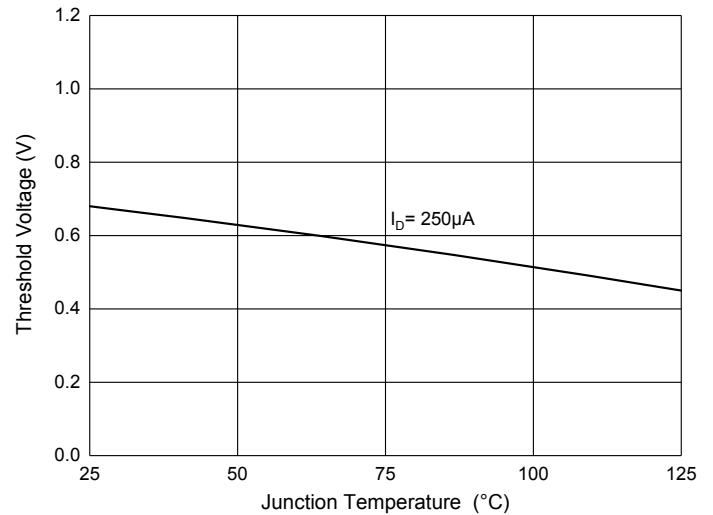


Fig. 6 - Threshold Voltage



Curve Characteristics(P-Channel)

Fig. 1 - Output Characteristics

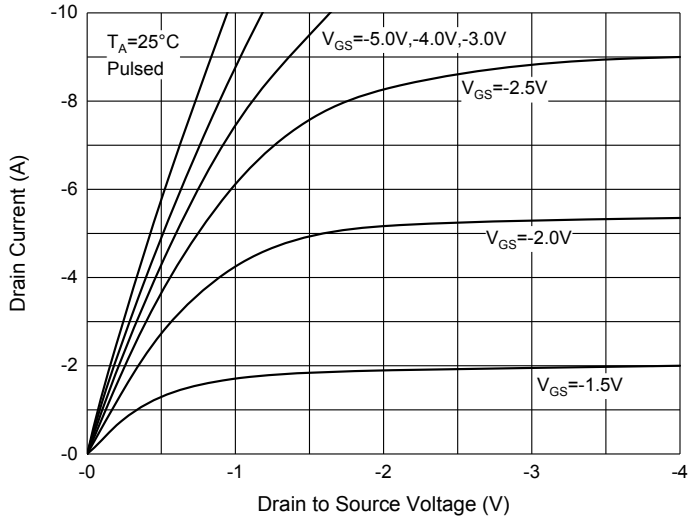


Fig. 2 - Transfer Characteristics

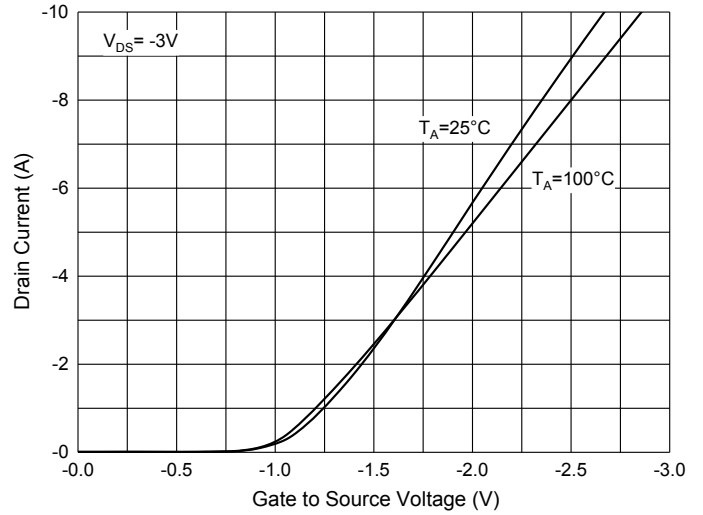


Fig. 3 - $R_{DS(ON)} - I_D$

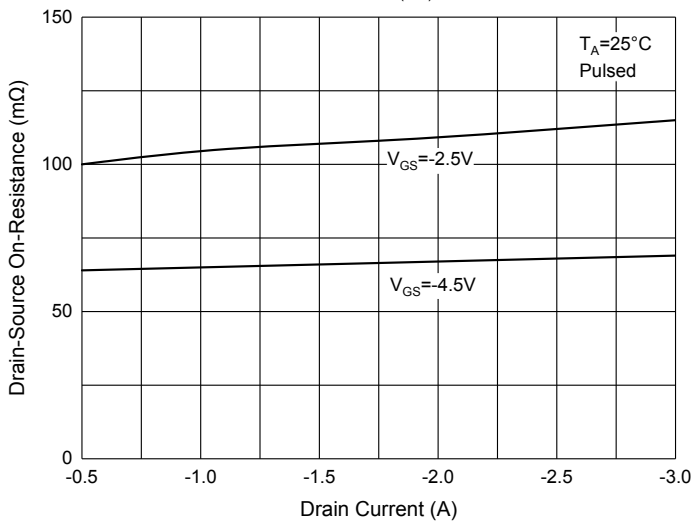


Fig. 4 - $R_{DS(ON)} - V_{GS}$

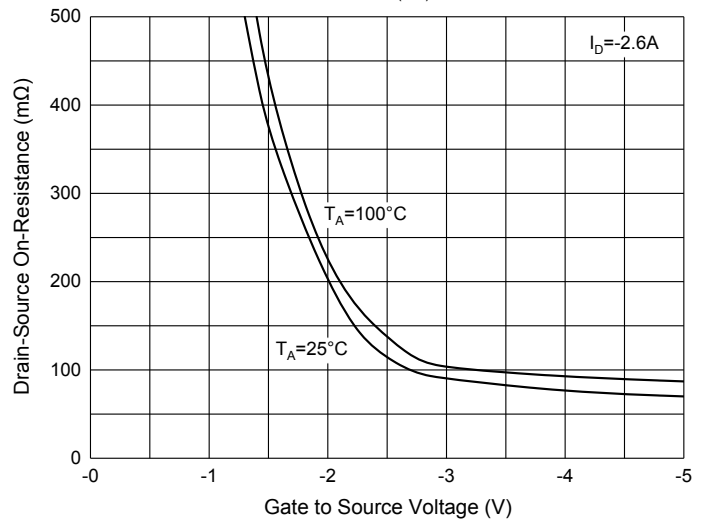


Fig. 5 - $I_S - V_{SD}$

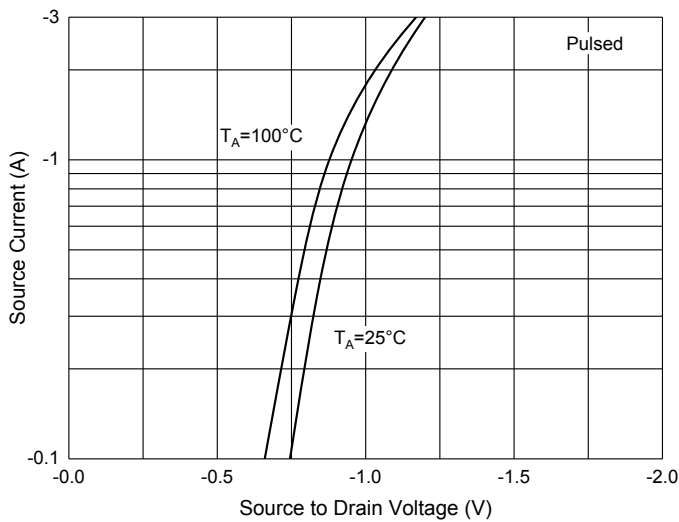
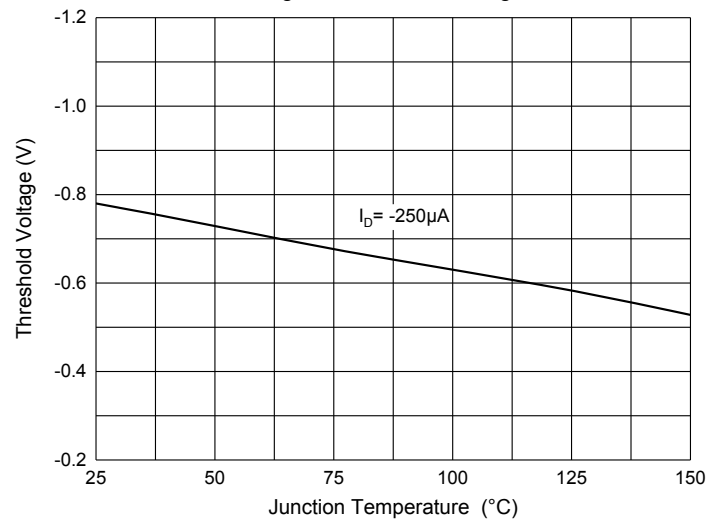


Fig. 6 - Threshold Voltage



Ordering Information

| Device | Packing |
|----------------|-----------------------|
| Part Number-TP | Tape&Reel: 3Kpcs/Reel |

Note : Adding "-HF" suffix for halogen free, eg. Part Number-TP-HF

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