



## 100V 3.7mΩ N-Ch Power MOSFET

### Features

- Ultra-low  $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested, 100%  $R_g$  Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant

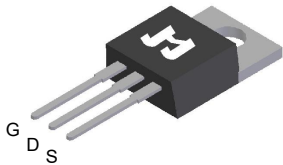
### Product Summary

| Parameter                                | Value | Unit |
|--|-------|------|
| $V_{DS}$                                 | 100   | V    |
| $V_{GS(th)}$ Typ                         | 2.7   | V    |
| $I_D$ (@ $V_{GS} = 10V$ ) <sup>(1)</sup> | 134   | A    |
| $R_{DS(ON)}$ Typ (@ $V_{GS} = 10V$ )     | 3.7   | mΩ   |

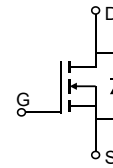
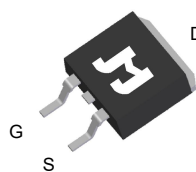
### Applications

- Power Management in Computing, CE, IE 4.0, Communications
- Motor Driving in Power Tool, E-vehicle, Robotics
- Current Switching in DC/DC & AC/DC (SR) Sub-systems

TO-220-3L Top View



TO-263-3L Top View

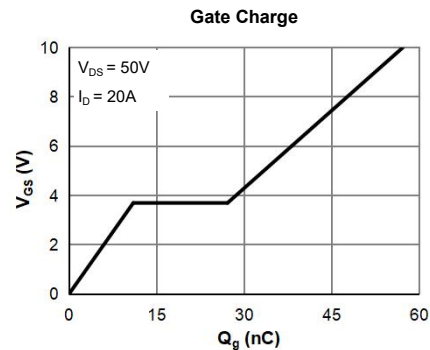
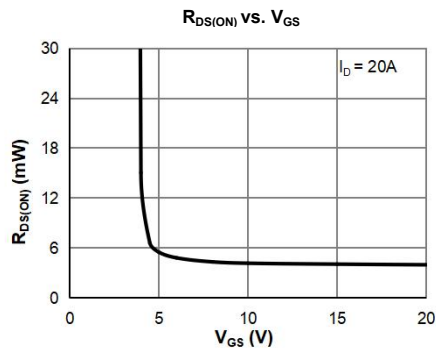


### Ordering Information

| Device        | Package   | # of Pins | Marking | MSL | $T_J$ (°C) | Media        | Quantity (pcs) |
|---------------|-----------|-----------|---------|-----|------------|--------------|----------------|
| JMSH1004BC-U  | TO-220-3L | 3         | SH1004B | N/A | -55 to 150 | Tube         | 50             |
| JMSH1004BE-13 | TO-263-3L | 3         | SH1004B | 3   | -55 to 150 | 13-inch Reel | 800            |

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

| Parameter                               | Symbol         | Value                     | Unit |
|---|----------------|---------------------------|------|
| Drain-to-Source Voltage                 | $V_{DS}$       | 100                       | V    |
| Gate-to-Source Voltage                  | $V_{GS}$       | ±20                       | V    |
| Continuous Drain Current <sup>(1)</sup> | $I_D$          | $T_C = 25^\circ\text{C}$  | 134  |
|   |                | $T_C = 100^\circ\text{C}$ | 85   |
| Pulsed Drain Current <sup>(2)</sup>     | $I_{DM}$       | 411                       | A    |
| Avalanche Current <sup>(3)</sup>        | $I_{AS}$       | 45                        | A    |
| Avalanche Energy <sup>(3)</sup>         | $E_{AS}$       | 304                       | mJ   |
| Power Dissipation <sup>(4)</sup>        | $P_D$          | $T_C = 25^\circ\text{C}$  | 156  |
|   |                | $T_C = 100^\circ\text{C}$ | 63   |
| Junction & Storage Temperature Range    | $T_J, T_{STG}$ | -55 to 150                | °C   |





**Electrical Characteristics** (@  $T_J = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                         | Symbol        | Conditions  | Min.      | Typ. | Max.       | Unit          |                  |
|-----------------------------------|---------------|---|-----------|------|------------|---------------|------------------|
| <b>STATIC PARAMETERS</b>          |               |   |           |      |            |               |                  |
| Drain-Source Breakdown Voltage    | $V_{(BR)DSS}$ | $I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$                            | 100       |      |            | V             |                  |
| Zero Gate Voltage Drain Current   | $I_{DSS}$     | $V_{DS} = 80\text{V}, V_{GS} = 0\text{V}$<br>$T_J = 55^\circ\text{C}$ |           |      | 1.0<br>5.0 | $\mu\text{A}$ |                  |
| Gate-Body Leakage Current         | $I_{GSS}$     | $V_{DS} = 0\text{V}, V_{GS} = \pm 20\text{V}$                         |           |      | $\pm 100$  | nA            |                  |
| Gate Threshold Voltage            | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                               | 2.0       | 2.7  | 4.0        | V             |                  |
| Static Drain-Source ON-Resistance | $R_{DS(ON)}$  | $V_{GS} = 10\text{V}, I_D = 20\text{A}$                               | TO-263-3L |      | 3.7        | 4.5           | $\text{m}\Omega$ |
|                                   |               |   | TO-220-3L |      | 3.9        | 4.7           | $\text{m}\Omega$ |
| Forward Transconductance          | $g_{FS}$      | $V_{DS} = 5\text{V}, I_D = 20\text{A}$                                |           | 106  |            | S             |                  |
| Diode Forward Voltage             | $V_{SD}$      | $I_S = 1\text{A}, V_{GS} = 0\text{V}$                                 |           | 0.71 | 1.0        | V             |                  |
| Diode Continuous Current          | $I_S$         | $T_C = 25^\circ\text{C}$  |           |      | 156        | A             |                  |

**DYNAMIC PARAMETERS** <sup>(5)</sup>

|                              |           |  |  |      |  |          |
|------------------------------|-----------|--|--|------|--|----------|
| Input Capacitance            | $C_{iss}$ | $V_{GS} = 0\text{V}, V_{DS} = 50\text{V}, f = 1\text{MHz}$ |  | 3433 |  | pF       |
| Output Capacitance           | $C_{oss}$ |  |  | 905  |  | pF       |
| Reverse Transfer Capacitance | $C_{rss}$ |  |  | 13.0 |  | pF       |
| Gate Resistance              | $R_g$     | $V_{GS} = 0\text{V}, V_{DS} = 0\text{V}, f = 1\text{MHz}$  |  | 2.1  |  | $\Omega$ |

**SWITCHING PARAMETERS** <sup>(5)</sup>

|   |              |  |  |      |  |    |
|---|--------------|--|--|------|--|----|
| Total Gate Charge (@ $V_{GS} = 10\text{V}$ )  | $Q_g$        | $V_{GS} = 0 \text{ to } 10\text{V}$<br>$V_{DS} = 50\text{V}, I_D = 20\text{A}$ |  | 57   |  | nC |
| Total Gate Charge (@ $V_{GS} = 6.0\text{V}$ ) | $Q_g$        |  |  | 38   |  | nC |
| Gate Source Charge                            | $Q_{gs}$     |  |  | 11.0 |  | nC |
| Gate Drain Charge                             | $Q_{gd}$     |  |  | 16.1 |  | nC |
| Turn-On Delay Time                            | $t_{D(on)}$  |  |  | 14.1 |  | ns |
| Turn-On Rise Time                             | $t_r$        | $V_{GS} = 10\text{V}, V_{DS} = 50\text{V}$                                     |  | 34   |  | ns |
| Turn-Off Fall Time                            | $t_{D(off)}$ | $R_L = 2.5\Omega, R_{GEN} = 6\Omega$   |  | 60   |  | ns |
| Turn-Off Fall Time                            | $t_f$        |  |  | 50   |  | ns |
| Body Diode Reverse Recovery Time              | $t_{rr}$     | $I_F = 15\text{A}, di_F/dt = 100\text{A}/\mu\text{s}$                          |  | 60   |  | ns |
| Body Diode Reverse Recovery Charge            | $Q_{rr}$     | $I_F = 15\text{A}, di_F/dt = 100\text{A}/\mu\text{s}$                          |  | 63   |  | nC |

**Thermal Performance**

| Parameter                               | Symbol          | Typ. | Max. | Unit                      |
|---|-----------------|------|------|---------------------------|
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 45   | 55   | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 0.65 | 0.80 | $^\circ\text{C}/\text{W}$ |

**Notes:**

1. Computed continuous current assumes the condition of  $T_{J\_Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under  $T_{J\_Max} = 150^\circ\text{C}$ .
3. This single-pulse measurement was taken under the following condition [ $L = 300\mu\text{H}, V_{GS} = 10\text{V}, V_{DS} = 50\text{V}$ ] while its value is limited by  $T_{J\_Max} = 150^\circ\text{C}$ .
4. The power dissipation  $P_D$  is based on  $T_{J\_Max} = 150^\circ\text{C}$ .
5. This value is guaranteed by design hence it is not included in the production test.



### Typical Electrical & Thermal Characteristics

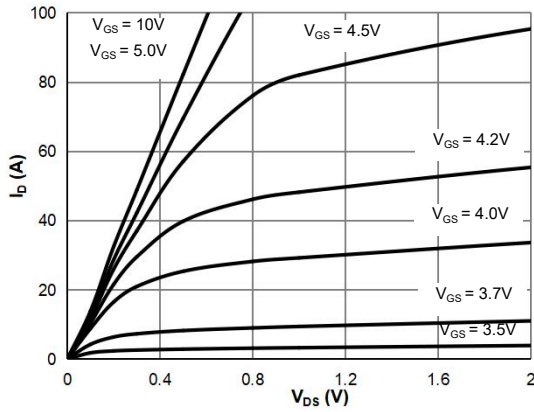


Figure 1: Saturation Characteristics

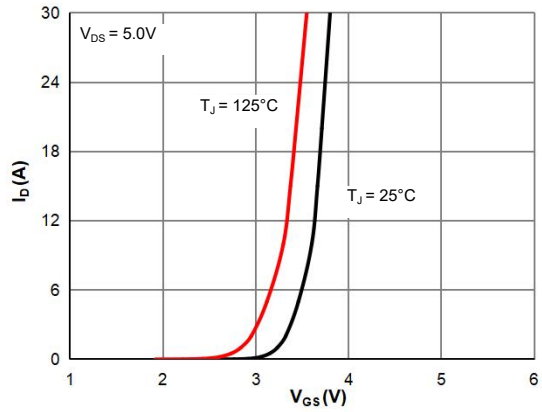


Figure 2: Transfer Characteristics

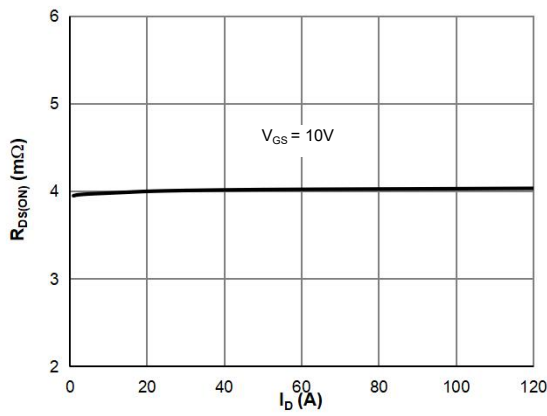


Figure 3:  $R_{DS(ON)}$  vs. Drain Current

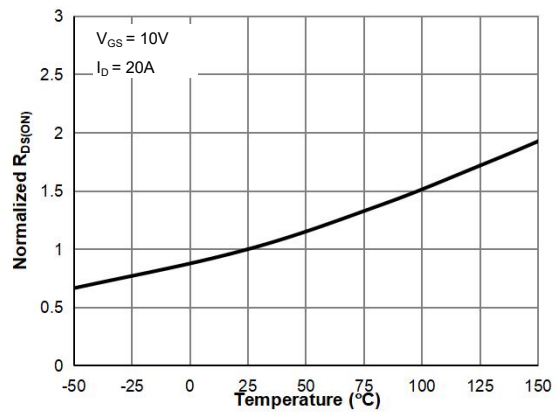


Figure 4:  $R_{DS(ON)}$  vs. Junction Temperature

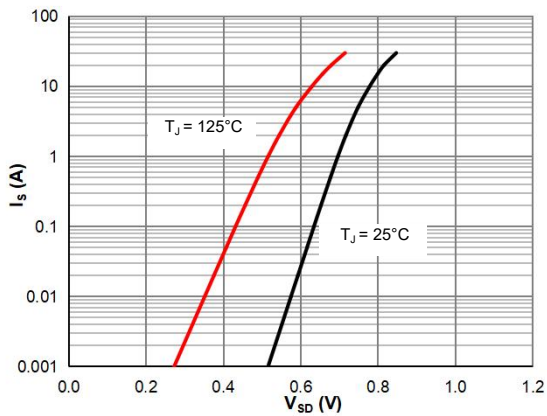


Figure 5: Body-Diode Characteristics

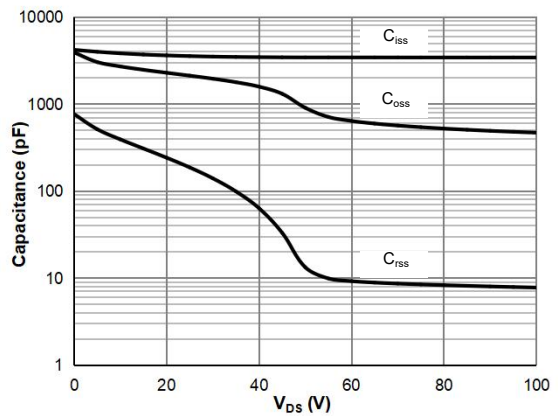


Figure 6: Capacitance Characteristics



Typical Electrical & Thermal Characteristics

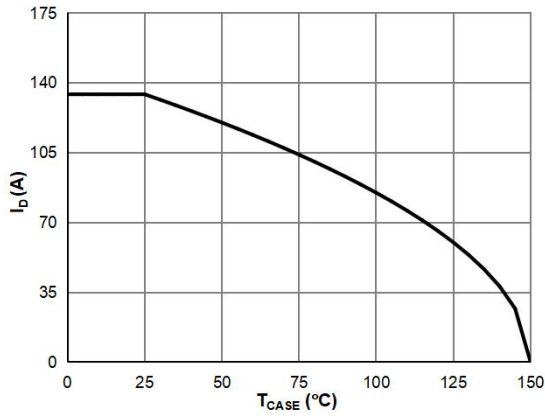


Figure 7: Current De-rating

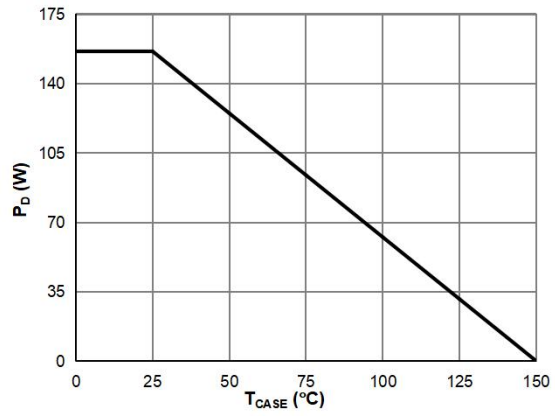


Figure 8: Power De-rating

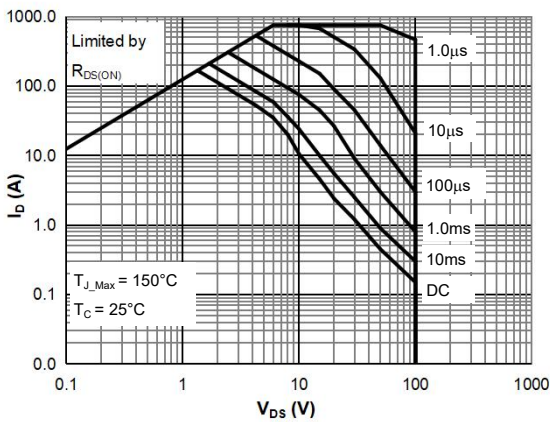


Figure 9: Maximum Safe Operating Area

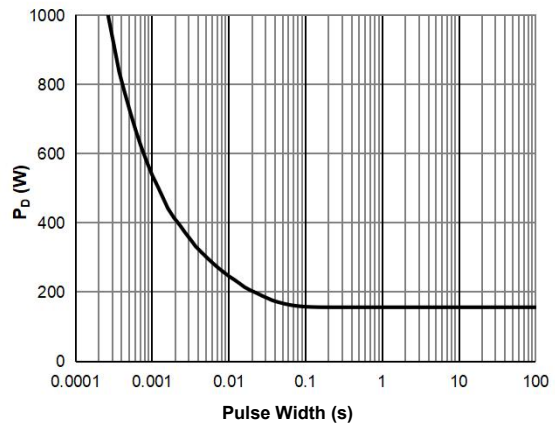


Figure 10: Single Pulse Power Rating, Junction-to-Case

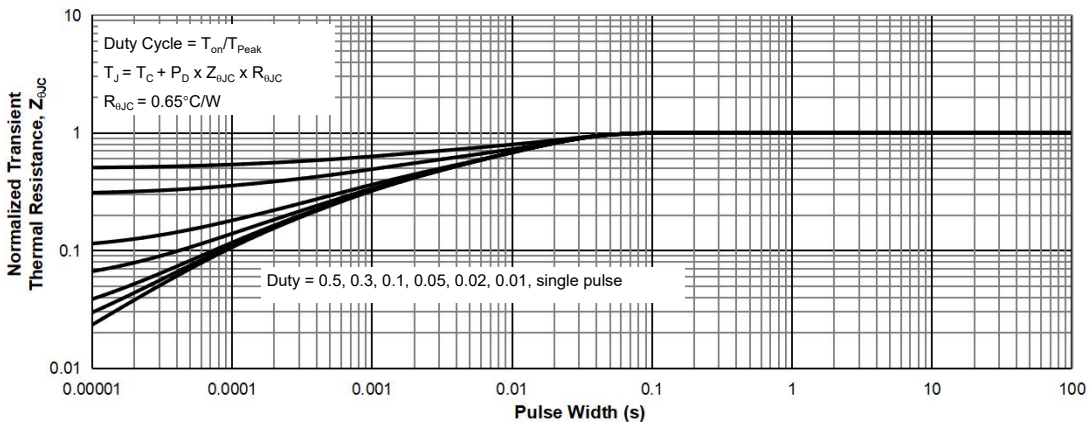
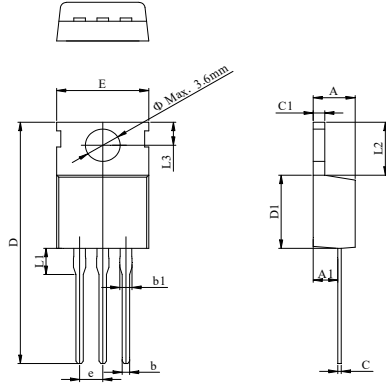


Figure 11: Normalized Maximum Transient Thermal Impedance



### TO-220-3L Package Information

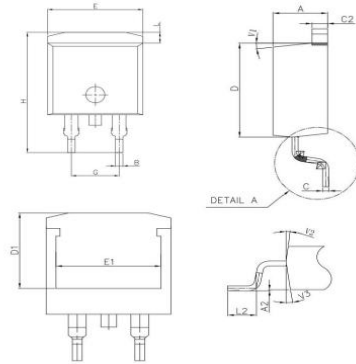
#### Package Outline



| DIM. | MILLIMETER |          |       |
|------|------------|----------|-------|
|      | MIN.       | NOM.     | MAX.  |
| A    | 4.24       |          | 4.70  |
| A1   | 2.20       |          | 3.00  |
| b    | 0.70       |          | 0.95  |
| b1   | 1.14       |          | 1.70  |
| C    | 0.40       |          | 0.60  |
| C1   | 1.15       |          | 1.40  |
| D    | 28.00      |          | 29.80 |
| D1   | 8.80       |          | 9.90  |
| E    | 9.70       |          | 10.50 |
| L1   |            |          | 3.80  |
| L2   | 6.25       |          | 6.90  |
| L3   | 2.40       |          | 3.00  |
| e    |            | 2.54 BSC |       |

### TO-263-3L Package Information

#### Package Outline



| SYMBOL | DIMENSIONS |       |       |
|--------|------------|-------|-------|
|        | MIN        | NOM   | MAX   |
| A      | 4.3        | 4.55  | 4.7   |
| A2     | 0          |       | 0.25  |
| B      | 0.75       | 0.8   | 0.85  |
| C      | 0.38       | 0.46  | 0.55  |
| C2     | 1.25       | 1.3   | 1.35  |
| D      | 8.9        | 9.3   | 9.6   |
| D1     | 7.4        | 7.65  | 7.9   |
| E      | 9.9        | 10.05 | 10.21 |
| E1     | 8.3        | 8.6   | 8.9   |
| G      | 5.03       | 5.08  | 5.13  |
| H      | 14.7       | 15    | 15.8  |
| L2     | 2.2        | 2.35  | 2.5   |

#### Recommended Footprint

