T-39-11

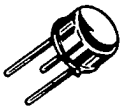
# N-channel enhancement-mode vertical DMOS FET

# ZVN0120

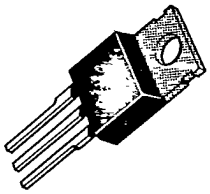
## FEATURES

- Compact geometry
- Fast switching speeds
- No secondary breakdown
- Excellent temperature stability
- High input impedance
- Low current drive
- Ease of paralleling

E-LINE (TO-92)
SUFFIX A



TO-39
SUFFIX B



TO-220
SUFFIX L

## DESCRIPTION

A compact interdigitated geometry forms the basis of this Ferranti MOSFET. Optimised for low on-resistance, low capacitance and fast switching this device is manufactured using the latest computer controlled processing techniques in order to achieve greater stability, reliability and ruggedness.

## PRODUCT SUMMARY

| Part No. | $BV_{DSS}$ | $I_D$ | $R_{DS(on)}$ |
|---|---|---|---|
| ZVN0120A | 200V | 0.16A | 16Ω |
| ZVN0120B | 200V | 0.42A | 16Ω |
| ZVN0120L* | 200V | 0.5A | 16Ω |

*BS-CECC approved.

# ZVN0120

**ABSOLUTE MAXIMUM RATINGS**

| Parameters | | E-line | TO-39 | TO-220 | Units |
|---|---|---|---|---|---|
| $V_{DS}$ | Drain-source voltage | 200 | 200 | 200 | V |
| $I_D$ | Continuous drain current (@ $T_A=25°C$) | 0.16 | 0.16 | 0.23 | A |
| $I_D$ | Continuous drain current (@ $T_C=25°C$) | – | 0.42 | 0.5 | A |
| $I_{DM}$ | Pulse drain current | 2 | 2 | 2 | A |
| $V_{GS}$ | Gate-source voltage | ±20 | ±20 | ±20 | V |
| $P_D$ | Max. power dissipation (@ $T_A=25°C$) | 0.7 | 0.7 | 1.5 | W |
| $P_D$ | Max. power dissipation (@ $T_C=25°C$) | – | 5 | 20 | W |
| $T_j$, $T_{stg}$ | Operating/storage temperature range | −55 to +150 | | | °C |

**ELECTRICAL CHARACTERISTICS** (at $T=25°C$ unless otherwise stated)

| Parameter | | Min. | Typ. | Max. | Unit | Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-source breakdown voltage | 200 | – | – | V | $I_D=1mA$, $V_{GS}=0V$ |
| $V_{GS(th)}$ | Gate-source threshold voltage | 1 | – | 3 | V | $I_D=1mA$, $V_{DS}=V_{GS}$ |
| $I_{GSS}$ | Gate body leakage | – | 0.1 | 20 | nA | $V_{GS}=±20V$, $V_{DS}=0V$ |
| $I_{DSS}$ | Zero gate voltage drain current | – | – | 10 | μA | $V_{DS}=$Max. rating, $V_{GS}=0V$ |
| | | – | – | 100 | μA | $V_{DS}=0.8\times$Max. rating, $V_{GS}=0V$ ($T=125°C$) (2) |
| $I_{D(on)}$ | On-state drain current (1) | 0.5 | 1 | – | A | $V_{DS}=25V$, $V_{GS}=10V$ |
| $R_{DS(on)}$ | Static drain-source on-state resistance (1) | – | – | 16 | Ω | $I_D=0.25A$, $V_{GS}=10V$ |
| $g_{fs}$ | Forward transconductance (1) (2) | 0.1 | 0.25 | – | S | $V_{DS}=25V$, $I_D=0.25A$ |
| $C_{iss}$ | Input capacitance (2) | – | 62 | 85 | pF | $V_{DS}=25V$, $V_{GS}=0V$, $f=1MHz$ |
| $C_{oss}$ | Common source output capacitance (2) | – | 9 | 20 | pF | |
| $C_{rss}$ | Reverse transfer capacitance (2) | – | 2 | 7 | pF | |
| $t_{d(on)}$ | Turn-on delay time (2) (3) | – | 3 | 7 | ns | $V_{DD}\approx 25V$, $I_D=0.25A$ |
| $t_r$ | Rise time (2) (3) | – | 2 | 8 | ns | |
| $t_{d(off)}$ | Turn-off delay time (2) (3) | – | 11 | 16 | ns | |
| $t_f$ | Fall time (2) (3) | – | 5 | 8 | ns | |

**SOURCE-DRAIN DIODE CHARACTERISTICS**

| | Parameter | Typ. | Unit | Conditions |
|---|---|---|---|---|
| $V_{SD}$ | Forward ON voltage (1) | 0.76 | V | $V_{GS}=0V$, $I_S=0.16A$ |
| $t_{rr}$ | Reverse recovery time | 105 | ns | $V_{GS}=0V$, $I_F=0.16A$ $I_R=0.1A$ |

(1) Measured under pulsed conditions. Width = 300μs. Duty cycle ≤ 2%.
(2) Sample test.
(3) Switching times measured with 50Ω source impedance and < 5ns rise time on a pulse generator.

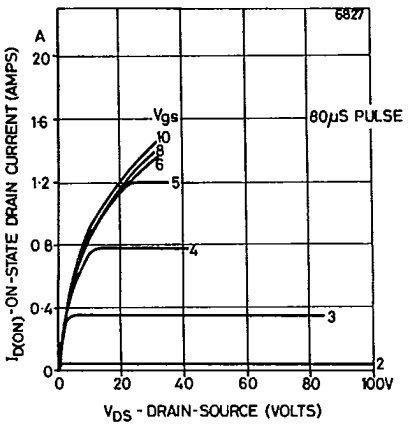



**Fig. 1 Typical output characteristics**

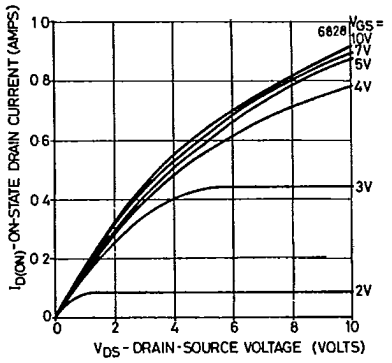



**Fig. 2 Typical saturation characteristics**

# ZVN0120

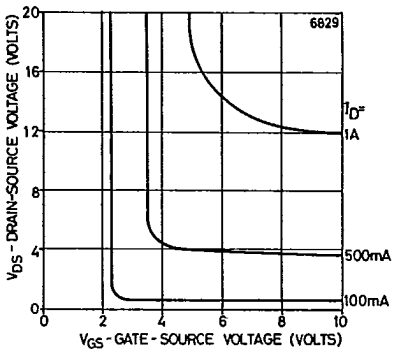



**Fig. 3 Typical voltage saturation characteristics**

**Fig. 4 Transfer Characteristics**

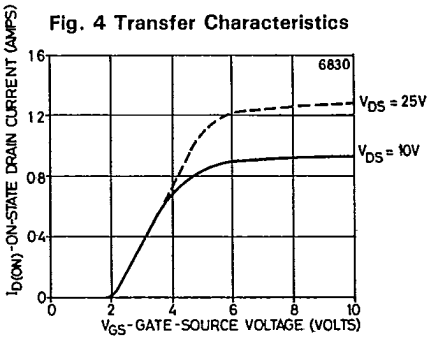



**Fig. 4 Typical transfer characteristics**

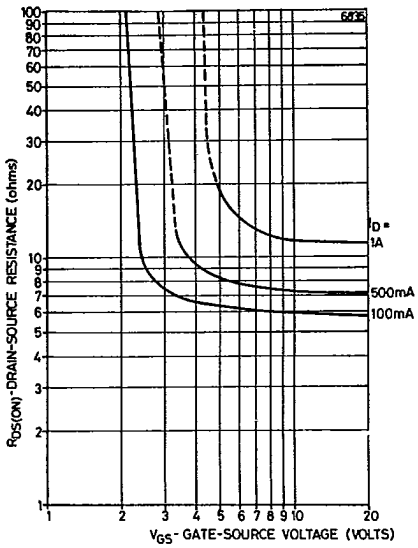



**Fig. 5 Typical on-resistance v gate-source voltage**

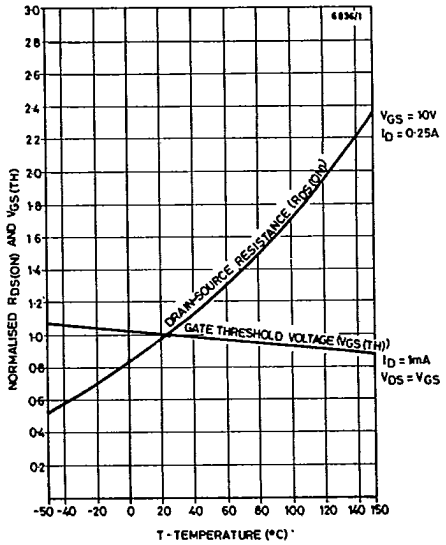



**Fig. 6 Normalised $R_{DS(on)}$ and $V_{GS(th)}$ v temperature**

# ZVN0120

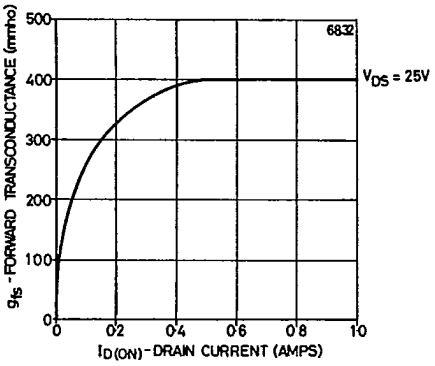



**Fig. 7 Typical transconductance v drain current**

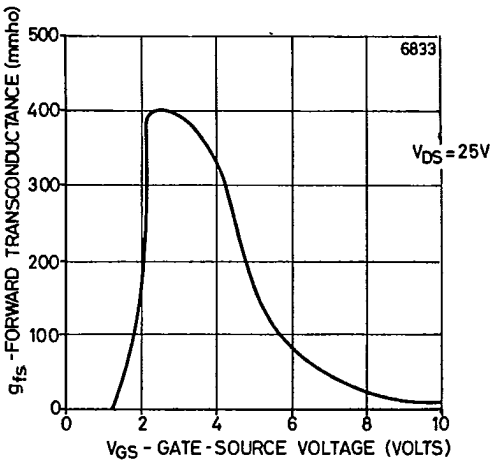



**Fig. 8 Typical transconductance v gate-source voltage**

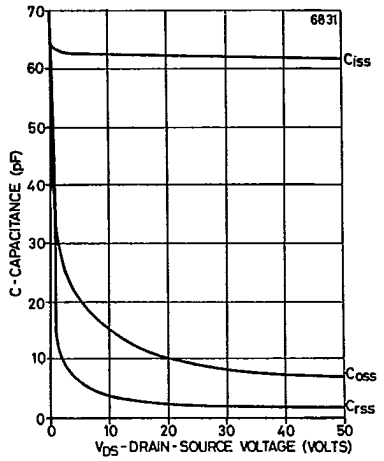



**Fig. 9 Typical capacitance v drain-source voltage**

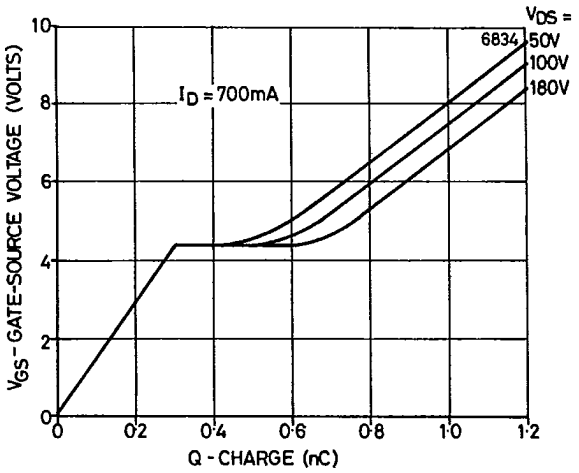



**Fig. 10 Typical gate charge v gate-source voltage**

# ZVN0120

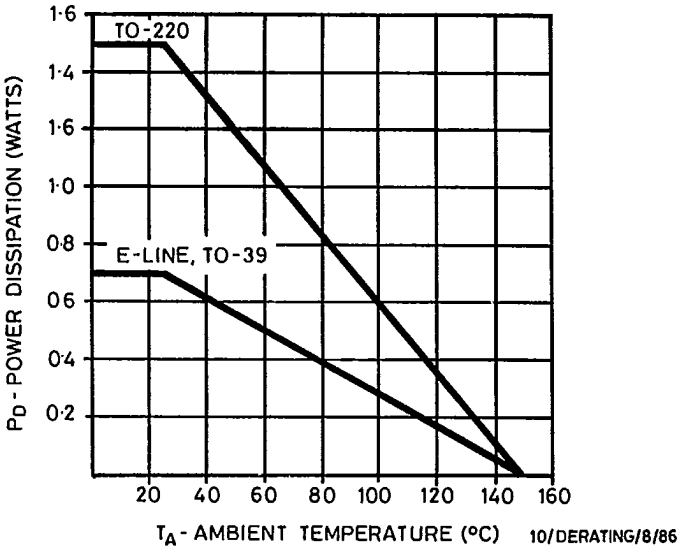



**Fig. 11 Power v temperature derating curve (ambient)**

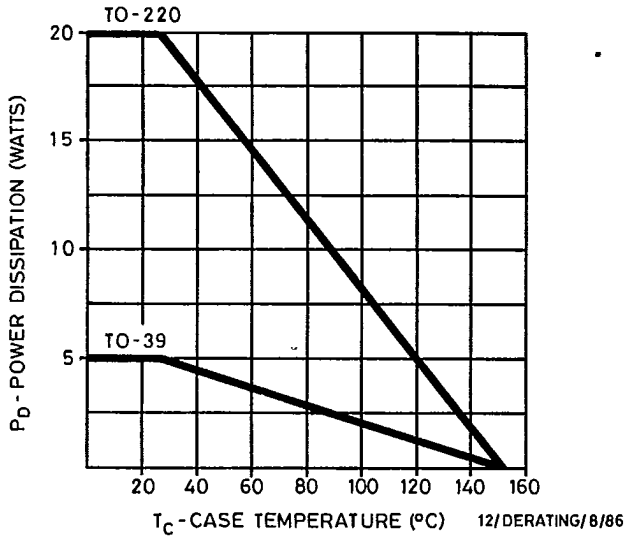
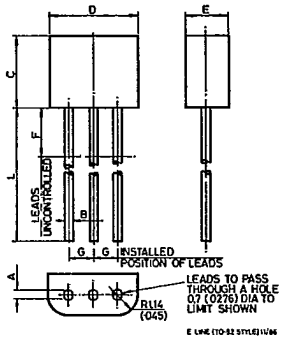



**Fig. 12 Power v temperature derating curve (case)**

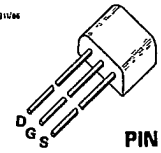
# PACKAGE DETAILS

T-91-20

**E-Line (TO-92 style)**



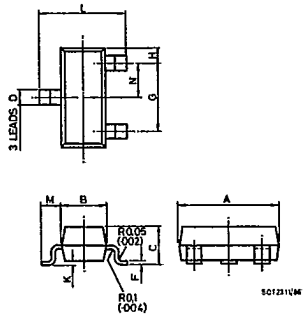

| DIMENSION | MILLIMETRES | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.41 | 0.495 | 0.016 | 0.0195 |
| B | 0.41 | 0.495 | 0.016 | 0.0195 |
| C | 3.61 | 4.01 | 0.142 | 0.158 |
| D | 4.37 | 4.77 | 0.172 | 0.188 |
| E | 2.16 | 2.41 | 0.085 | 0.095 |
| F | | 2.5 | | 0.098 |
| G | 1.27 NOM | | 0.050 NOM | |
| L | 12.06 | 13.97 | 0.475 | 0.550 |




**PIN CONFIGURATION**

Available on tape on reels. Please enquire for details.

**SOT-23**



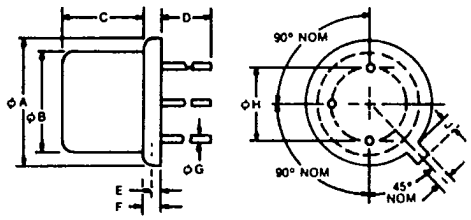

| DIMENSION | MILLIMETRES | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 2.75 | 3.04 | 0.108 | 0.120 |
| B | 1.2 | 1.4 | 0.047 | 0.055 |
| C | 0.89 | 1.12 | 0.035 | 0.044 |
| D | 0.37 | 0.43 | 0.0145 | 0.017 |
| F | 0.085 | 0.14 | 0.0034 | 0.0055 |
| G | 1.78 | 2.04 | 0.070 | 0.080 |
| H | 0.33 | 0.51 | 0.013 | 0.020 |
| K | 0.075 | 0.125 | 0.003 | 0.005 |
| L | 2.10 | 2.5 | 0.0825 | 0.0985 |
| M | 0.45 | 0.64 | 0.018 | 0.025 |
| N | 0.89 | 1.02 | 0.035 | 0.040 |


**PIN CONFIGURATION**

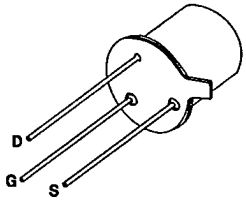
Available in tape on reels. Please enquire for details.

# PACKAGE DETAILS

**TO-39**

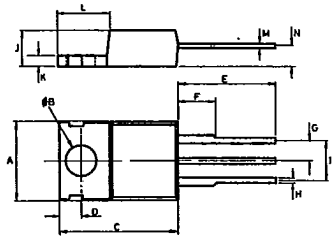



| DIMENSION | INCHES | | MILLIMETRES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| ØA | 0.350 | 0.370 | 8.99 | 9.40 |
| ØB | 0.306 | 0.335 | 7.77 | 8.51 |
| C | 0.240 | 0.260 | 6.10 | 6.60 |
| D | 0.500 | | 12.70 | |
| E | 0.009 | 0.023 | 0.229 | 0.548 |
| F | 0.018 | 0.045 | 0.458 | 1.143 |
| ØG | 0.016 | 0.021 | 0.406 | 0.533 |
| ØH | 0.190 | 0.210 | 4.83 | 5.33 |
| I | 0.028 | 0.037 | 0.711 | 0.939 |
| J | 0.026 | 0.040 | 0.660 | 1.016 |

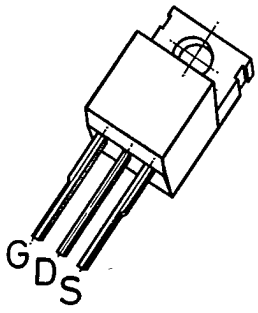



**PIN CONFIGURATION**

**TO-220**




| DIMENSION | INCHES | | MILLIMETRES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.387 | 0.403 | 9.8 | 10.2 |
| ØB | 0.139 | 0.147 | 3.53 | 3.73 |
| C | 0.612 | 0.648 | 15.56 | 16.46 |
| D | 0.10 | 0.12 | 2.55 | 3.05 |
| E | 0.50 | 0.56 | 12.71 | 14.21 |
| F | | 0.25 | | 6.35 |
| G | 0.09 | 0.11 | 2.29 | 2.79 |
| H | 0.022 | 0.032 | 0.57 | 0.83 |
| I | 0.19 | 0.21 | 4.85 | 5.35 |
| J | 0.17 | 0.19 | 4.32 | 4.82 |
| K | 0.045 | 0.055 | 1.14 | 1.4 |
| L | 0.245 | 0.265 | 6.23 | 6.73 |
| M | 0.015 | 0.025 | 0.37 | 0.63 |
| N | 0.085 | 0.105 | 2.15 | 2.65 |




**PIN CONFIGURATION**