

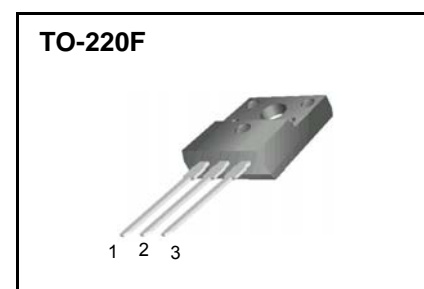
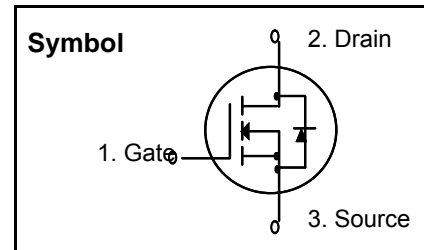
## N-Channel MOSFET

### Features

- $R_{DS(on)}$  (Max 0.85  $\Omega$ )@ $V_{GS}=10V$
- Gate Charge (Typical 38nC)
- Improved dv/dt Capability, High Ruggedness
- 100% Avalanche Tested
- Maximum Junction Temperature Range (150°C)

### General Description

This Power MOSFET is produced using Semiwell's advanced planar stripe, DMOS technology. This latest technology has been especially designed to minimize on-state resistance, have a high rugged avalanche characteristics. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supply, DC-AC converters for uninterrupted power supply, motor control.



### Absolute Maximum Ratings (\* Drain current limited by junction temperature)

| Symbol         | Parameter                                                                       | Value      | Units |
|----------------|---------------------------------------------------------------------------------|------------|-------|
| $V_{DSS}$      | Drain to Source Voltage                                                         | 500        | V     |
| $I_D$          | Continuous Drain Current(@ $T_C = 25^\circ C$ )                                 | 8.0*       | A     |
|                | Continuous Drain Current(@ $T_C = 100^\circ C$ )                                | 5.1*       | A     |
| $I_{DM}$       | Drain Current Pulsed (Note 1)                                                   | 32*        | A     |
| $V_{GS}$       | Gate to Source Voltage                                                          | $\pm 25$   | V     |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)                                         | 320        | mJ    |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)                                            | 13.4       | mJ    |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)                                              | 5.5        | V/ns  |
| $P_D$          | Total Power Dissipation(@ $T_C = 25^\circ C$ )                                  | 44         | W     |
|                | Derating Factor above 25 °C                                                     | 0.35       | W/°C  |
| $T_{STG}, T_J$ | Operating Junction Temperature & Storage Temperature                            | - 55 ~ 150 | °C    |
| $T_L$          | Maximum Lead Temperature for soldering purpose,<br>1/8 from Case for 5 seconds. | 300        | °C    |

### Thermal Characteristics

| Symbol          | Parameter                               | Value |      |      | Units |
|-----------------|-----------------------------------------|-------|------|------|-------|
|                 |                                         | Min.  | Typ. | Max. |       |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | -     | -    | 2.86 | °C/W  |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | -     | -    | 62.5 | °C/W  |

## Electrical Characteristics

$T_C = 25^\circ\text{C}$  unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

### Off Characteristics

|                                |                                           |                                                             |     |      |      |                           |
|--------------------------------|-------------------------------------------|-------------------------------------------------------------|-----|------|------|---------------------------|
| $BV_{DSS}$                     | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$               | 500 | --   | --   | V                         |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | 0.50 | --   | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$                | --  | --   | 1    | $\mu\text{A}$             |
|                                |                                           | $V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$            | --  | --   | 10   | $\mu\text{A}$             |
| $I_{GSSF}$                     | Gate-Body Leakage Current, Forward        | $V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$                 | --  | --   | 100  | nA                        |
| $I_{GSSR}$                     | Gate-Body Leakage Current, Reverse        | $V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$                | --  | --   | -100 | nA                        |

### On Characteristics

|              |                                   |                                                     |     |      |      |          |
|--------------|-----------------------------------|-----------------------------------------------------|-----|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$           | 2.0 | --   | 4.0  | V        |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = 10\text{ V}, I_D = 4.0\text{ A}$          | --  | 0.70 | 0.85 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = 40\text{ V}, I_D = 4.0\text{ A}$ (Note 4) | --  | 7.0  | --   | S        |

### Dynamic Characteristics

|           |                              |                                                                      |    |      |      |    |
|-----------|------------------------------|----------------------------------------------------------------------|----|------|------|----|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 1570 | 2040 | pF |
| $C_{oss}$ | Output Capacitance           |                                                                      | -- | 150  | 195  | pF |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                      | -- | 15   | 20   | pF |

### Switching Characteristics

|              |                     |                                                                                           |    |     |     |    |
|--------------|---------------------|-------------------------------------------------------------------------------------------|----|-----|-----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 250\text{ V}, I_D = 8.0\text{ A},$<br>$R_G = 25\ \Omega$<br><br>(Note 4, 5)     | -- | 25  | 60  | ns |
| $t_r$        | Turn-On Rise Time   |                                                                                           | -- | 75  | 160 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                           | -- | 125 | 260 | ns |
| $t_f$        | Turn-Off Fall Time  |                                                                                           | -- | 75  | 160 | ns |
| $Q_g$        | Total Gate Charge   | $V_{DS} = 400\text{ V}, I_D = 8.0\text{ A},$<br>$V_{GS} = 10\text{ V}$<br><br>(Note 4, 5) | -- | 38  | 50  | nC |
| $Q_{gs}$     | Gate-Source Charge  |                                                                                           | -- | 8   | --  | nC |
| $Q_{gd}$     | Gate-Drain Charge   |                                                                                           | -- | 13  | --  | nC |

### Drain-Source Diode Characteristics and Maximum Ratings

|          |                                                       |                                                                                               |    |      |     |               |
|----------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------|----|------|-----|---------------|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current | --                                                                                            | -- | 8.0  | A   |               |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current     | --                                                                                            | -- | 32   | A   |               |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 8.0\text{ A}$                                                     | -- | --   | 1.5 | V             |
| $t_{rr}$ | Reverse Recovery Time                                 | $V_{GS} = 0\text{ V}, I_S = 8.0\text{ A},$<br>$di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4) | -- | 270  | --  | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                               |                                                                                               | -- | 1.89 | --  | $\mu\text{C}$ |

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 9.0\text{ mH}, I_{AS} = 8.0\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 8.0\text{ A}, di/dt \leq 300\ \mu\text{A}/\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

# Typical Characteristics

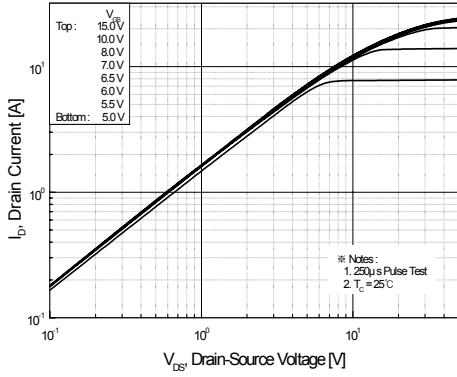


Figure 1. On-Region Characteristics

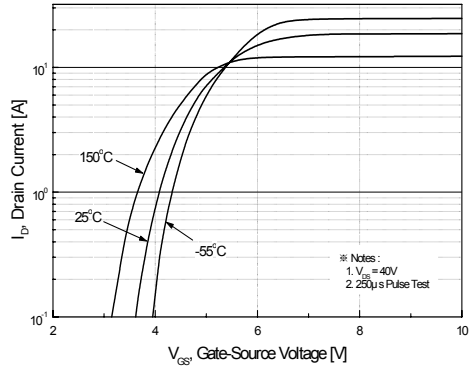


Figure 2. Transfer Characteristics

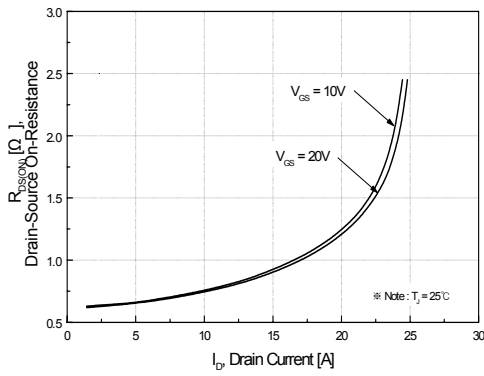


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

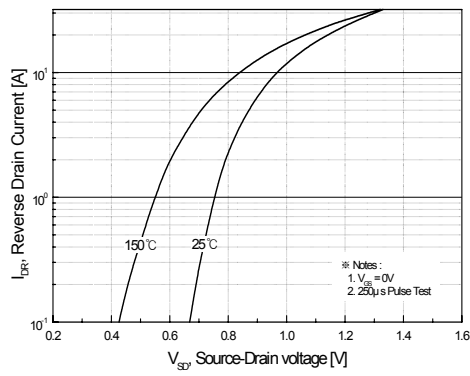


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

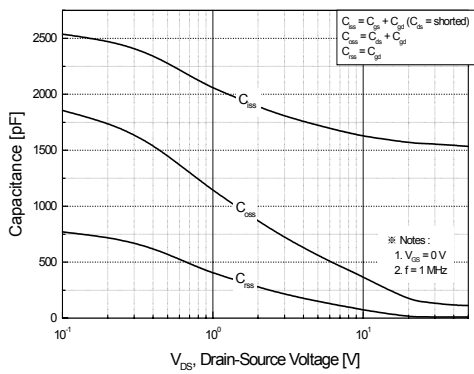


Figure 5. Capacitance Characteristics

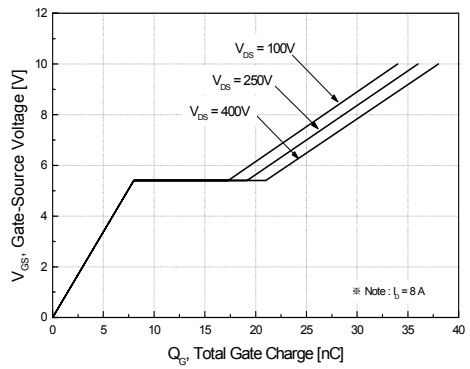
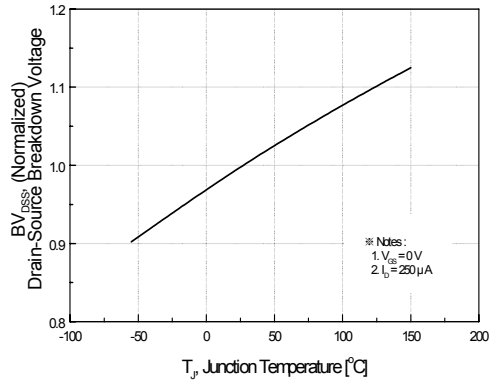
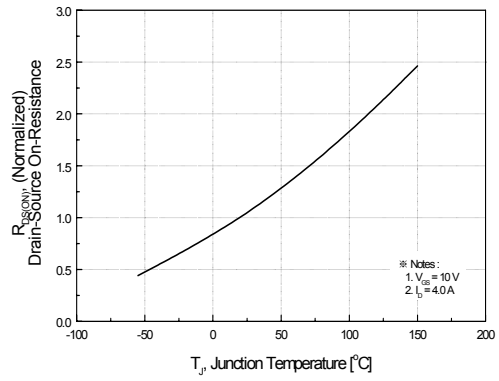


Figure 6. Gate Charge Characteristics

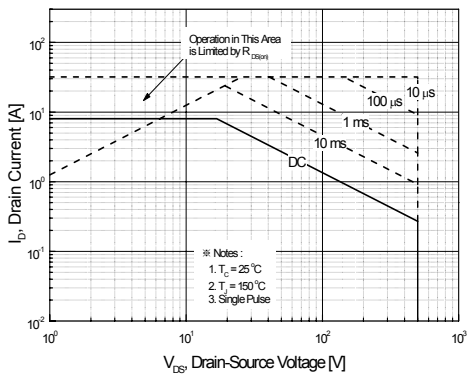
## Typical Characteristics (Continued)



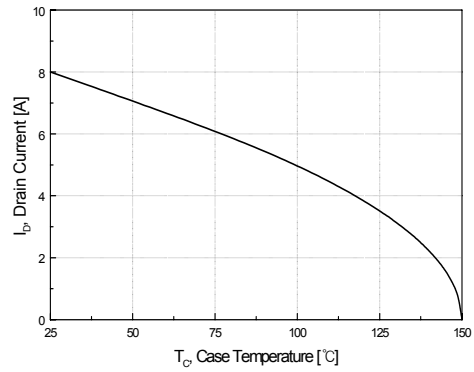
**Figure 7. Breakdown Voltage Variation vs Temperature**



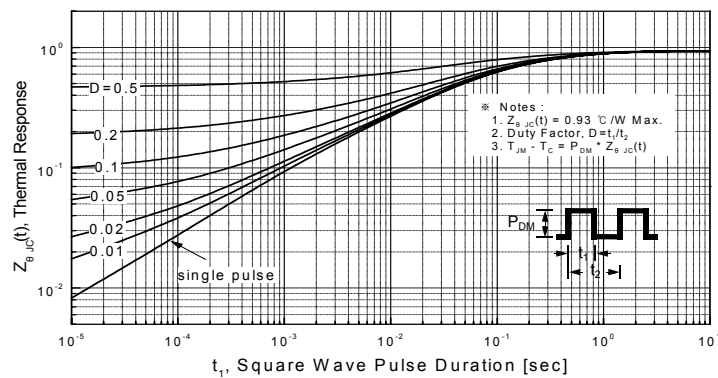
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9. Maximum Safe Operating Area**

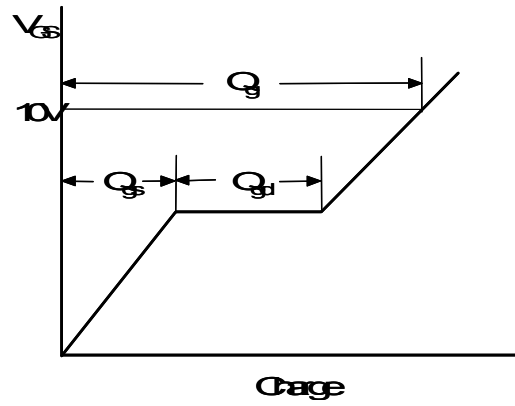
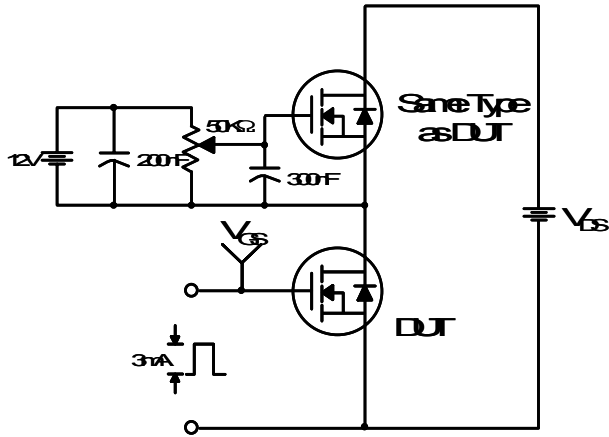


**Figure 10. Maximum Drain Current vs Case Temperature**

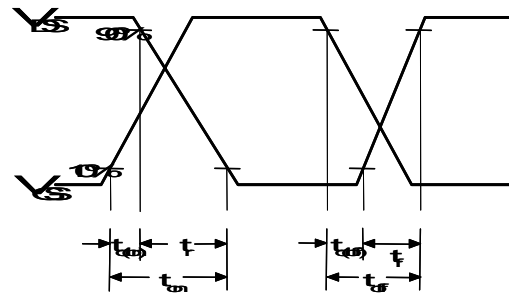
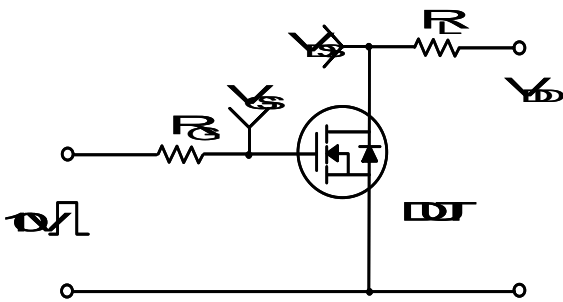


**Figure 11. Transient Thermal Response Curve**

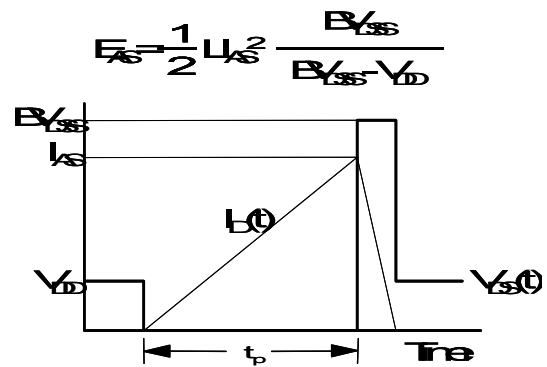
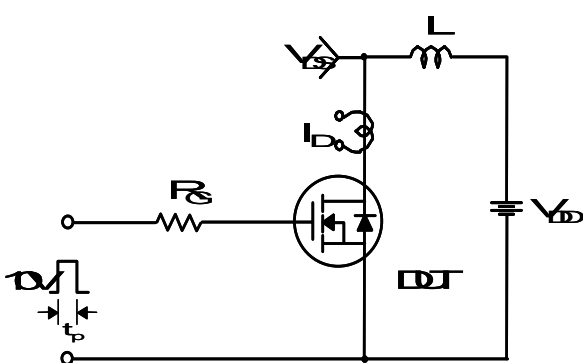
### Gate Charge Test Circuit & Waveform



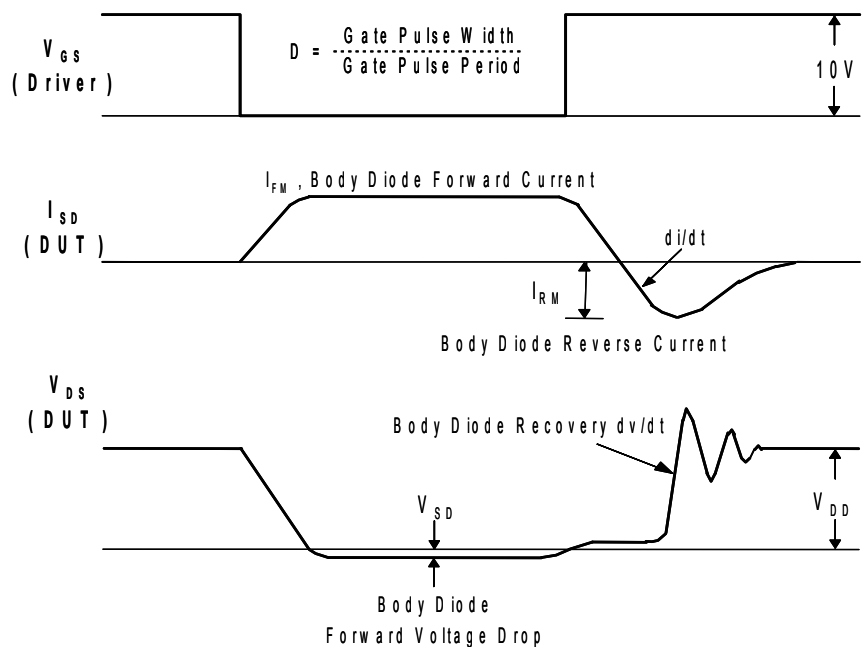
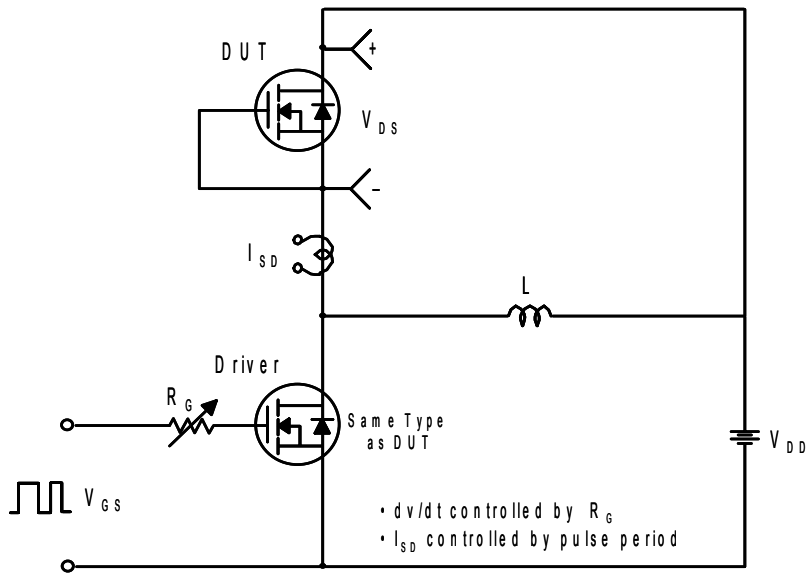
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



### Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-220F

