



N-channel Power MOSFET

PRODUCT SUMMARY

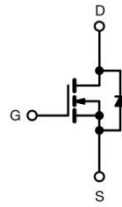
| | | |
|--|--------------|-----|
| V_{DS} (V) at T_J max. | 700 | |
| $R_{DS(on)}$ max. at 25°C (Ω) | $V_{GS}=10V$ | 0.9 |
| Q_g max. (nC) | 58 | |
| Q_{gs} (nC) | 9 | |
| Q_{gd} (nC) | 22 | |
| Configuration | single | |

Features

- $I_D=13A(V_{GS}=10V)$
- Ultra Low Gate Charge
- Improved dv/dt Capability
- 100% Avalanche Tested
- RoHS compliant



TO-220F



Schematic diagram

Applications

- Switching Mode Power Supplies (SMPS)
- PWM Motor Controls
- DC to DC Converters
- LED Lighting
- Bridge Circuits

ORDERING INFORMATION

| | |
|----------------|------------|
| Device | SPC13N65GE |
| Device Package | TO-220F |
| Marking | 13N65GE |

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|----------------|--------------------|------|
| Drain to Source Voltage | V_{DSS} | 650 | V |
| Continuous Drain Current (@ $T_C=25^\circ\text{C}$) | I_D | 13 ⁽¹⁾ | A |
| Continuous Drain Current (@ $T_C=100^\circ\text{C}$) | | 8.2 ⁽¹⁾ | A |
| Drain current pulsed ⁽²⁾ | I_{DM} | 52 ⁽¹⁾ | A |
| Gate to Source Voltage | V_{GS} | ± 30 | V |
| Single pulsed Avalanche Energy ⁽³⁾ | E_{AS} | 422 | mJ |
| Peak diode Recovery dv/dt ⁽⁴⁾ | dv/dt | 6 | V/ns |
| Total power dissipation (@ $T_C=25^\circ\text{C}$) | P_D | 42 | W |
| Derating Factor above 25°C | | 0.34 | W/°C |
| Operating Junction Temperature & Storage Temperature | T_{STG}, T_J | -55 to + 150 | °C |
| Maximum lead temperature for soldering purpose | T_L | 260 | °C |
| Mounting torque ⁽⁵⁾ | | 0.4~0.6 | N.m |

Notes

1. Drain current is limited by maximum junction temperature.
2. Repetitive rating : pulse width limited by junction temperature.
3. $L = 5\text{mH}$, $I_{AS} = 13\text{A}$, $V_{DD} = 50\text{V}$, $R_G=25\Omega$, Starting at $T_J = 25^\circ\text{C}$
4. $I_{SD} \leq 13\text{A}$, $di/dt = 100\text{A/us}$, $V_{DD} \leq BV_{DSS}$, Starting at $T_J = 25^\circ\text{C}$
5. Mounting consideration for TO220 Fullpack:

M3 screw plus flat washer is suggested, free of burr between devices and contact area, the devices are to be mounted to a hole not larger than 3.6mm in contact diameter (chamfer included).



| THERMAL CHARACTERISTICS | | | |
|---|------------|-------|------|
| Parameter | Symbol | Value | Unit |
| Thermal resistance, Junction to case | R_{thjc} | 3.0 | °C/W |
| Thermal resistance, Junction to ambient | R_{thja} | 45 | °C/W |

| ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified) | | | | | | |
|--|--------------------------------|---|------|------|------|----------|
| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
| Off Characteristics | | | | | | |
| Drain to source breakdown voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 650 | -- | -- | V |
| Breakdown voltage temperature coefficient | $\Delta BV_{DSS} / \Delta T_J$ | $I_D=250\mu A$, referenced to 25°C | -- | 0.51 | -- | V/°C |
| Drain to source leakage current | I_{DSS} | $V_{DS}=650V, V_{GS}=0V$ | -- | -- | 1 | μA |
| | | $V_{DS}=520V, T_C=125^\circ\text{C}$ | -- | -- | 50 | μA |
| Gate to source leakage current, forward | I_{GSS} | $V_{GS}=30V, V_{DS}=0V$ | -- | -- | 100 | nA |
| Gate to source leakage current, reverse | | $V_{GS}=-30V, V_{DS}=0V$ | -- | -- | -100 | nA |
| On Characteristics | | | | | | |
| Gate threshold voltage | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2 | -- | 4 | V |
| Drain to source on state resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=6.5A$ | -- | 0.75 | 0.9 | Ω |
| Forward Transconductance | G_{fs} | $V_{DS}=30V, I_D=6.5A$ | -- | 7 | -- | S |
| Dynamic Characteristics | | | | | | |
| Input capacitance | C_{iss} | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$ | -- | 1560 | -- | pF |
| Output capacitance | C_{oss} | | -- | 130 | -- | |
| Reverse transfer capacitance | C_{rss} | | -- | 22 | -- | |
| Turn on delay time | $t_{d(on)}$ | $V_{DS}=380V, I_D=13A, R_G=25\Omega$ | -- | 15 | -- | ns |
| Rising time | t_r | | -- | 45 | -- | |
| Turn off delay time | $t_{d(off)}$ | | -- | 90 | -- | |
| Fall time | t_f | | -- | 30 | -- | |
| Total gate charge | Q_g | $V_{DS}=520V, V_{GS}=10V, I_D=13A$ | -- | 50 | -- | nC |
| Gate-source charge | Q_{gs} | | -- | 9 | -- | |
| Gate-drain charge | Q_{gd} | | -- | 22 | -- | |

| SOURCE TO DRAIN DIODE RATINGS CHARACTERISTICS | | | | | | |
|---|----------|---|------|------|------|---------|
| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
| Continuous source current | I_S | Integral reverse p-n Junction diode in the MOSFET | -- | -- | 13 | A |
| Pulsed source current | I_{SM} | | -- | -- | 52 | A |
| Diode forward voltage drop. | V_{SD} | $I_S=13A, V_{GS}=0V$ | -- | -- | 1.2 | V |
| Reverse recovery time | T_{rr} | $I_S=13A, V_{GS}=0V, dI_F/dt=100A/\mu s$ | -- | 1321 | -- | ns |
| Reverse recovery Charge | Q_{rr} | | -- | 28 | -- | μC |



Fig1. Output characteristics

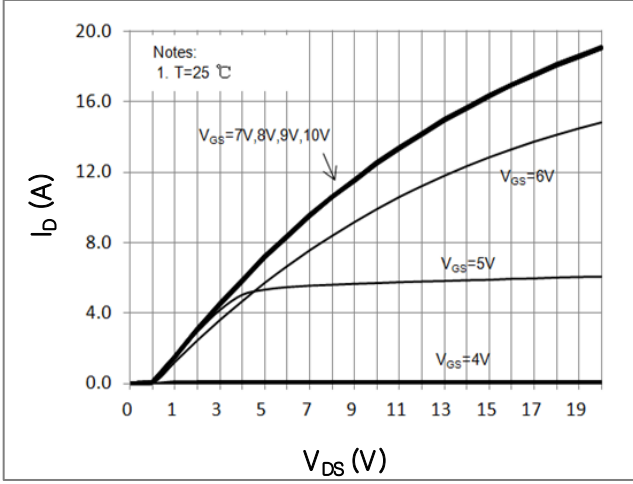


Fig2. Drain-source on-state resistance

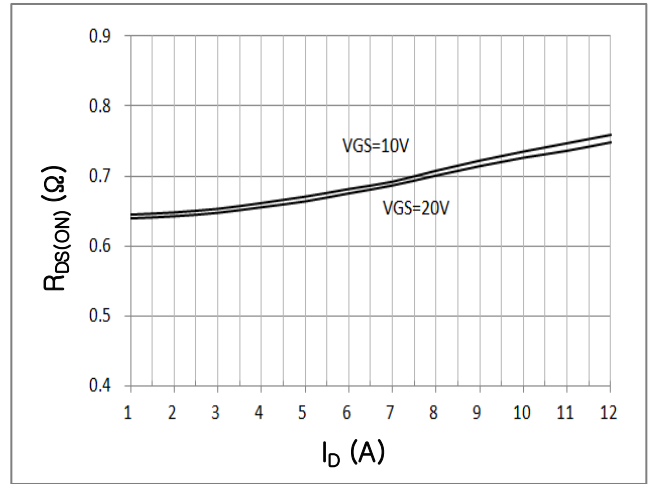


Fig3. Gate charge characteristics

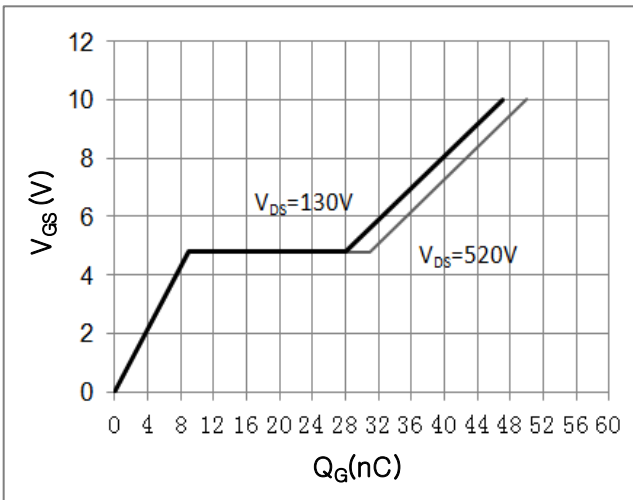


Fig 4. Capacitance Characteristics

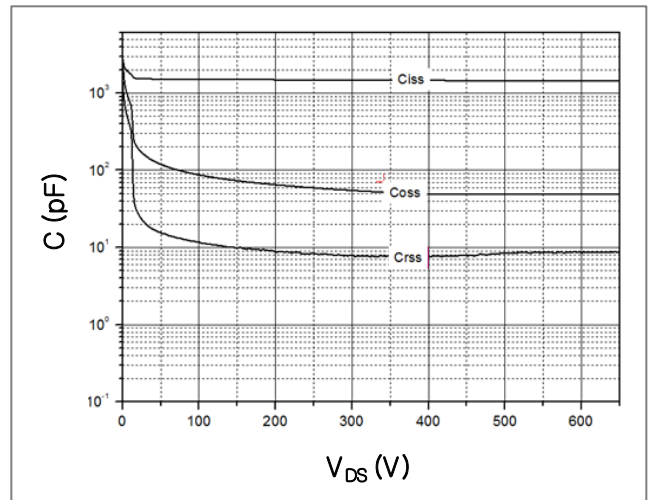


Fig 5. RDS(ON) vs junction temperature

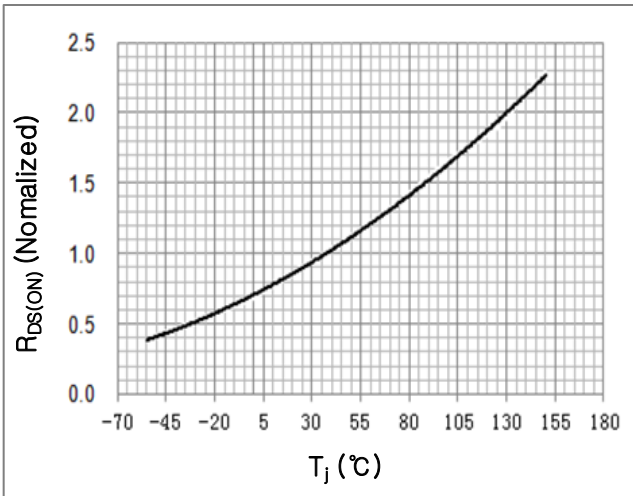


Fig 6. BVDS vs junction temperature

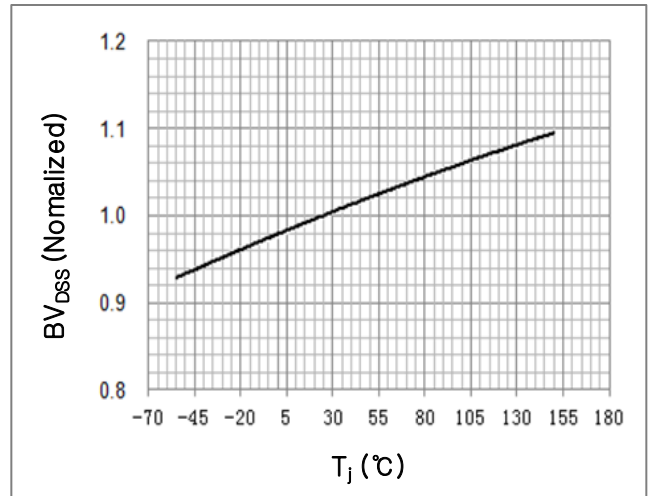


Fig 7 . Safe operating area

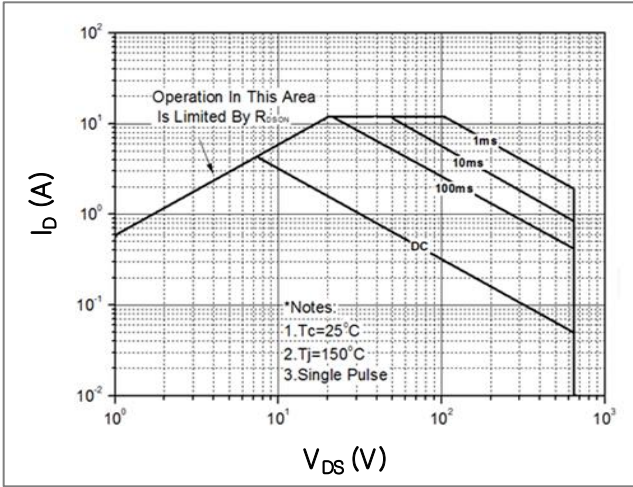


Fig 8 . Transient thermal impedance

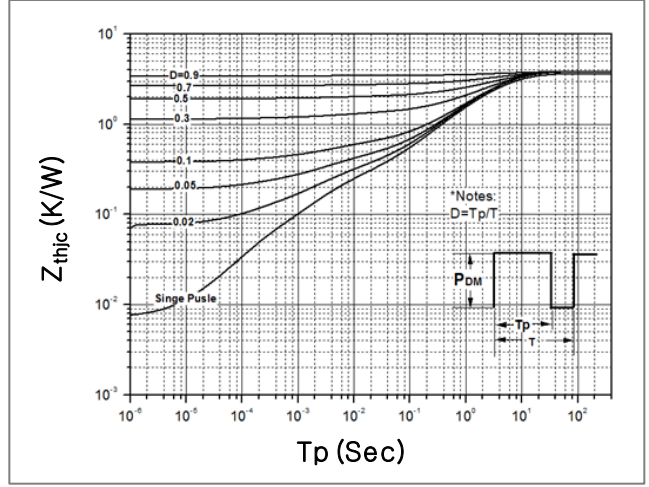


Fig 9. Forward characteristics of reverse diode

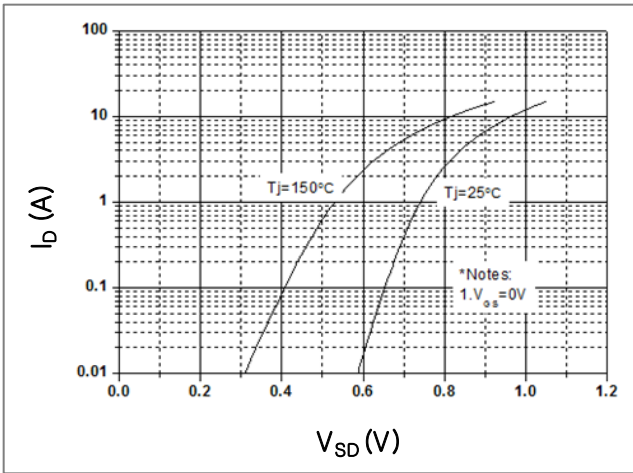


Fig 10. Gate charge test circuit & waveform

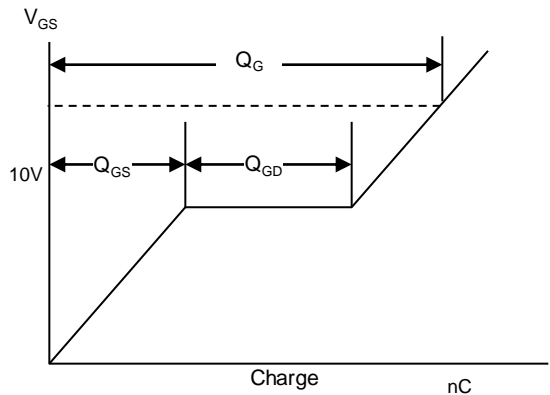
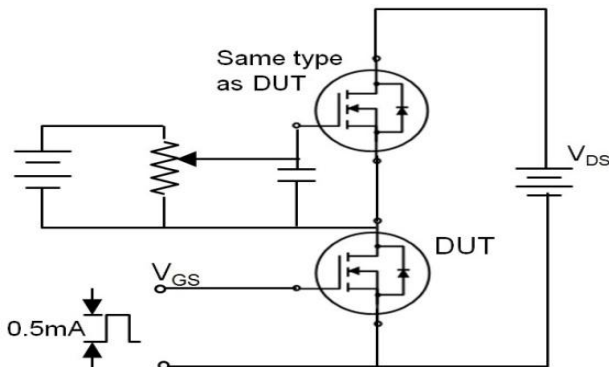


Fig 11. Switching time test circuit & waveform

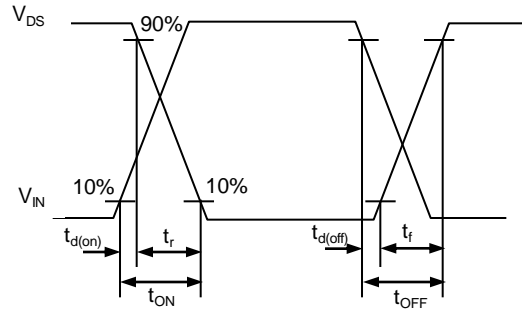
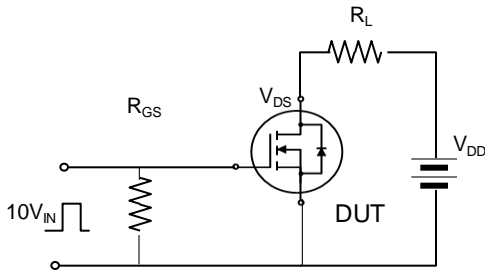


Fig 12. Unclamped Inductive switching test circuit & waveform

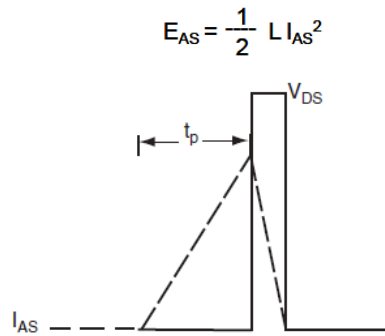
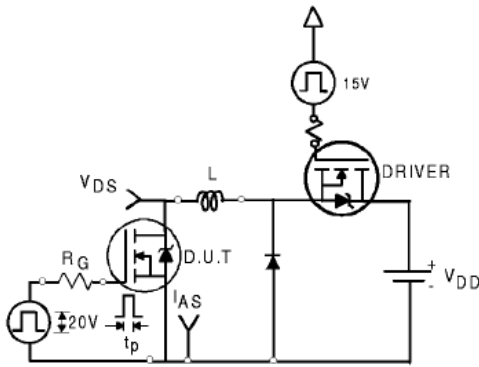
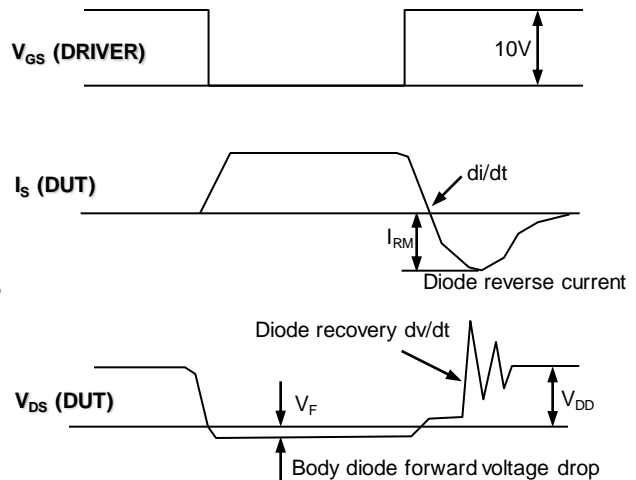
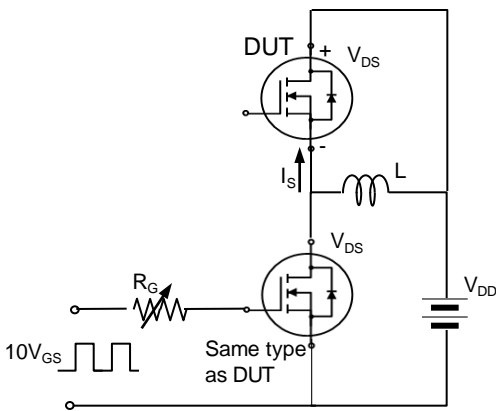


Fig 13. Peak diode recovery dv/dt test circuit & waveform



*. dv/dt controlled by R_G
 *. I_S controlled by pulse period



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