# N-channel Power MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) at $T_J$ max. | 700 | |
| $R_{DS(on)}$ max. at 25°C (mΩ) | $V_{GS}$=10V | 360 |
| $Q_g$ max. (nC) | 30 | |
| $Q_{gs}$ (nC) | 8.5 | |
| $Q_{gd}$ (nC) | 7.5 | |
| Configuration | single | |

## Features

- New Technology For High Voltage Device
- ID=11.5A(Vgs=10V)
- Ultra Low Gate Charge
- Improved dv/dt Capability
- RoHS Compliant


## Applications

- Switching Mode Power Supplies (SMPS)
- Power factor correction ( PFC )
- Uninterruptible Power Supply ( UPS )

| ORDERING INFORMATION | | | |
|---|---|---|---|
| Device | SPC65R360G | SPE65R360G | SPD65R360G |
| Device Package | TO-220F | TO-251 | TO-252 |
| Marking | 65R360G | | |

**ABSOLUTE MAXIMUM RATINGS** ($T_C$ = 25°C, unless otherwise noted)

| Parameter | Symbol | Limit | | Unit |
|---|---|---|---|---|
| | | SPC65R360G | SPE65R360G SPD65R360G | |
| Drain to Source Voltage | $V_{DSS}$ | 650 | 650 | V |
| Continuous Drain Current (@$T_C$=25°C) | $I_D$ | 11.5 (1) | 11.5 (1) | A |
| Continuous Drain Current (@$T_C$=100°C) | | 7 (1) | 7 (1) | A |
| Drain current pulsed (2) | $I_{DM}$ | 42 (1) | 42 (1) | A |
| Gate to Source Voltage | $V_{GS}$ | ±30 | ±30 | V |
| Single pulsed Avalanche Energy (3) | $E_{AS}$ | 144 | 144 | mJ |
| MOSFET dv/dt ruggedness (@$V_{DS}$=0~400V) | dv/dt | 25 | 25 | V/ns |
| Peak diode Recovery dv/dt (4) | dv/dt | 15 | 15 | V/ns |
| Total power dissipation (@$T_C$=25°C) | $P_D$ | 32.6 | 101 | W |
| Derating Factor above 25°C | | 0.26 | 0.97 | 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 = 72mH, $I_{AS}$ = 2A, $V_{DD}$ = 50V, $R_G$=25Ω, Starting at $T_J$ = 25°C
4. $I_{SD}$ ≤ $I_D$, di/dt = 100A/us, $V_{DD}$ ≤ BVdss, Starting at $T_J$ =25°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 |
|---|---|---|---|---|
| | | SPC65R360G | SPE65R360G SPD65R360G | |
| Thermal resistance, Junction to case | $R_{thjc}$ | 3.83 | 1.24 | °C/W |
| Thermal resistance, Junction to ambient | $R_{thja}$ | 80 | 62 | °C/W |

## ELECTRICAL CHARACTERISTICS ( $T_C$ = 25°C unless otherwise specified )

| Parameter | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain to source breakdown voltage | $BV_{DSS}$ | $V_{GS}$=0V, $I_D$=250uA | 650 | | | V |
| Breakdown voltage temperature coefficient | $\Delta BV_{DSS}$ / $\Delta TJ$ | $I_D$=250uA, referenced to 25°C | | 0.7 | | V/°C |
| Drain to source leakage current | $I_{DSS}$ | $V_{DS}$=650V, $V_{GS}$=0V | | | 1 | uA |
| | | $V_{DS}$=650V, $T_C$=125°C | | | 10 | uA |
| 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 | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250uA | 2 | 3 | 4 | V |
| Drain to source on state resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$ =6A | | 300 | 360 | mΩ |
| Forward Transconductance | Gfs | $V_{DS}$ = 20 V, $I_D$ = 6A | | 8 | | S |
| **Dynamic Characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=50V, f=1MHz | | 1200 | | pF |
| Output capacitance | $C_{oss}$ | | | 45 | | |
| Reverse transfer capacitance | $C_{rss}$ | | | 3.5 | | |
| Turn on delay time | $t_{d(on)}$ | $V_{DS}$=380V, $I_D$=11.5A , $R_G$=18Ω, $V_{GS}$=10V | | 11 | | ns |
| Rising time | tr | | | 5 | | |
| Turn off delay time | $t_{d(off)}$ | | | 50 | | |
| Fall time | $t_f$ | | | 5 | | |
| Total gate charge | $Q_g$ | $V_{DS}$=480V, $V_{GS}$=10V, $I_D$=11.5A | | 24 | 30 | nC |
| Gate-source charge | $Q_{gs}$ | | | 8.5 | | |
| Gate-drain charge | $Q_{gd}$ | | | 7.5 | | |

## 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 | | | 11.5 | A |
| Pulsed source current | $I_{SM}$ | | | | 42 | A |
| Diode forward voltage drop. | $V_{SD}$ | $I_S$=11.5A, $V_{GS}$=0V | | 0.9 | 1.3 | V |
| Reverse recovery time | $T_{rr}$ | $I_S$=11.5A, $V_{GS}$=0V, $dI_F/dt$=100A/us | | 220 | | ns |
| Reverse recovery Charge | Qrr | | | 2.2 | | uC |

**Fig1. Output characteristics**

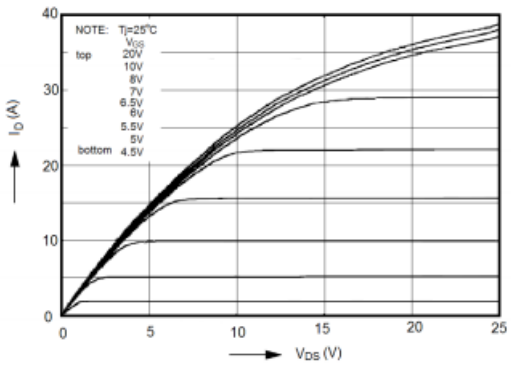



**Fig2. Maximum Drain Current vs. Case Temperature**

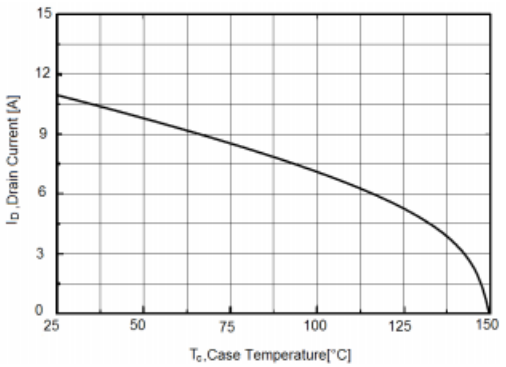



**Fig3. Gate charge characteristics**

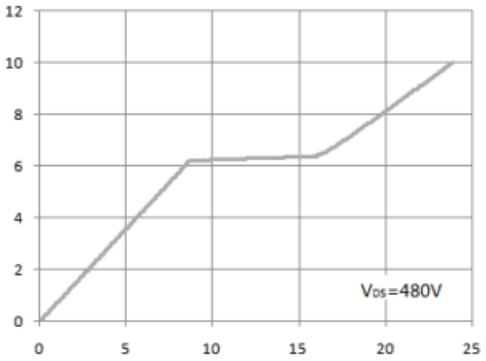



**Fig 4. Capacitance Characteristics**

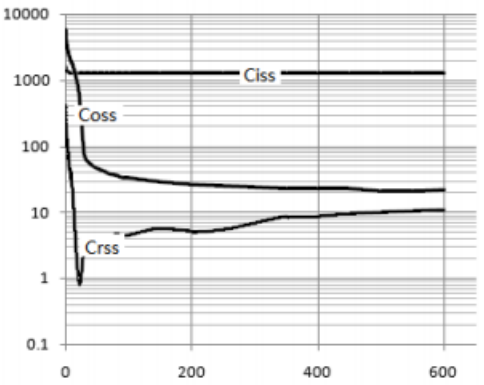



**Fig 5. $R_{DS(ON)}$ vs junction temperature**

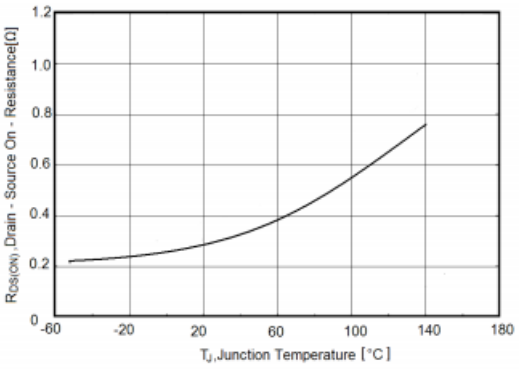



**Fig 6. Temperature vs. Drain-to-Source Voltage**

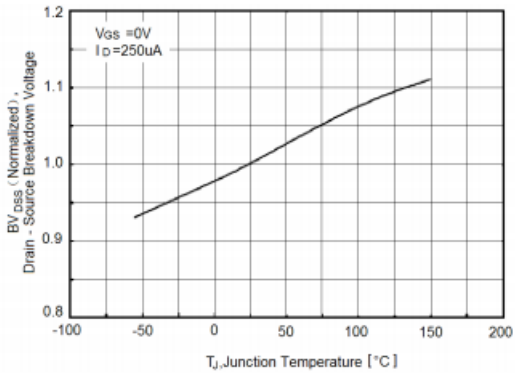


**Fig 7 . Safe operating area (TO-220F)**

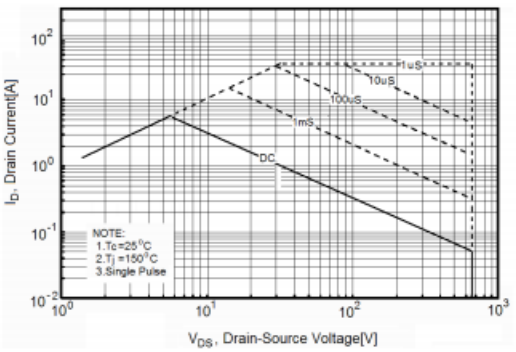



**Fig 8 . Transient thermal impedance (TO-220F)**

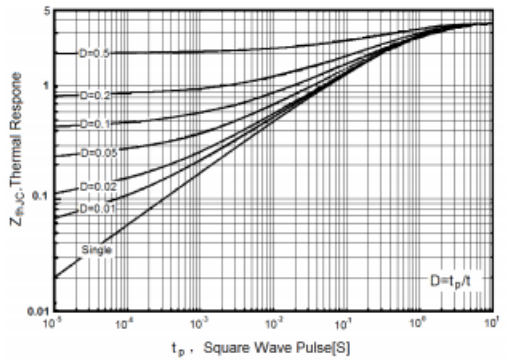



**Fig 9 . Safe operating area (TO-251/252)**

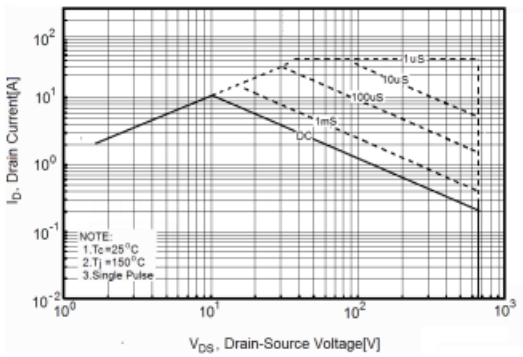



**Fig 10 . Transient thermal impedance (TO-251/252)**

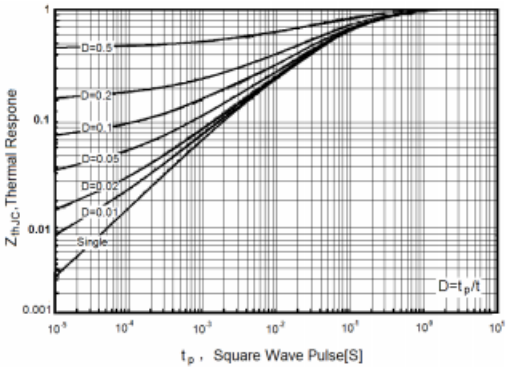



**Fig 11. Forward characteristics of reverse diode**

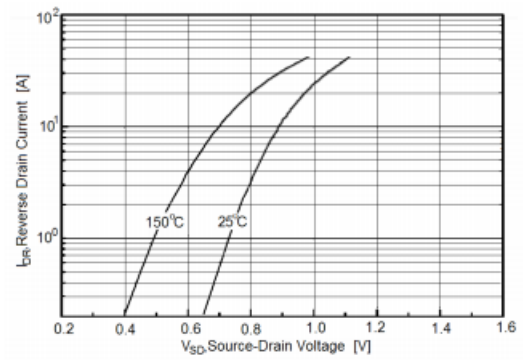



**Fig 12 . Transfer characteristics**

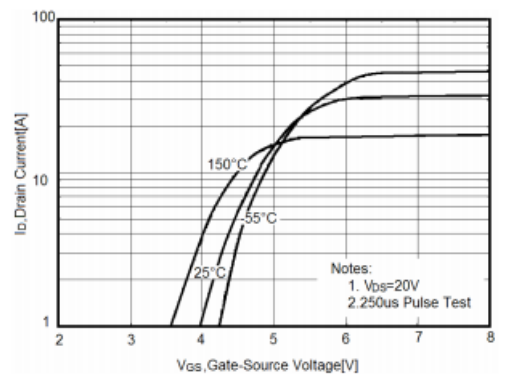
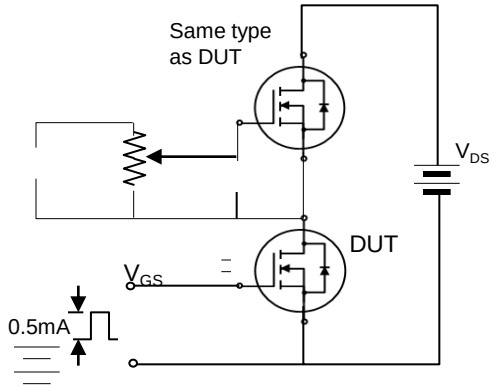



**Fig 13. Gate charge test circuit & waveform**



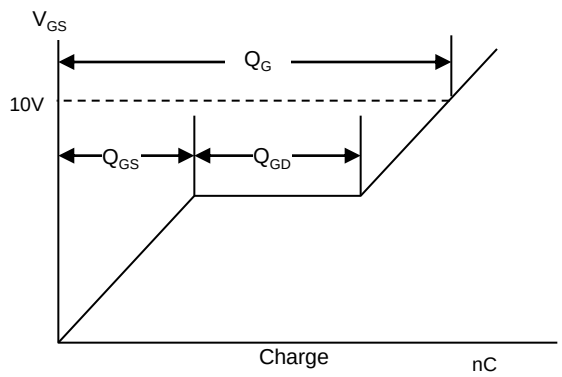



**Fig 14. Switching time test circuit & waveform**

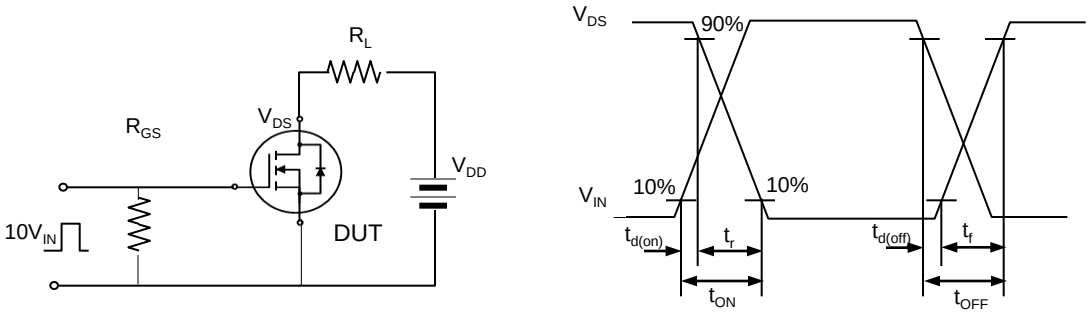



**Fig 15. Unclamped Inductive switching test circuit & waveform**

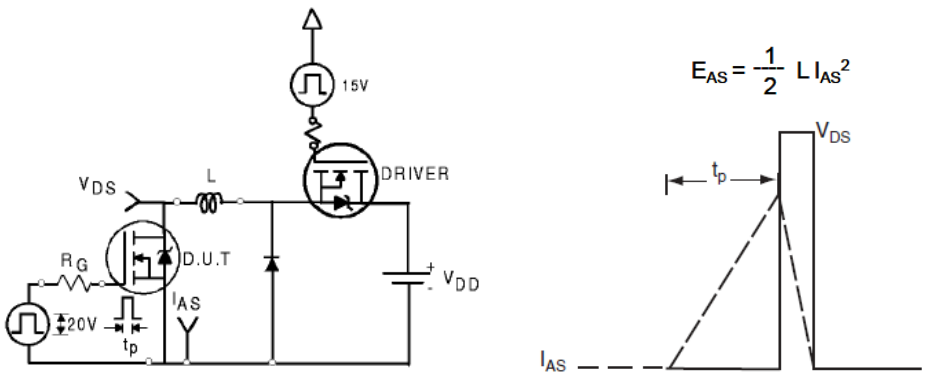
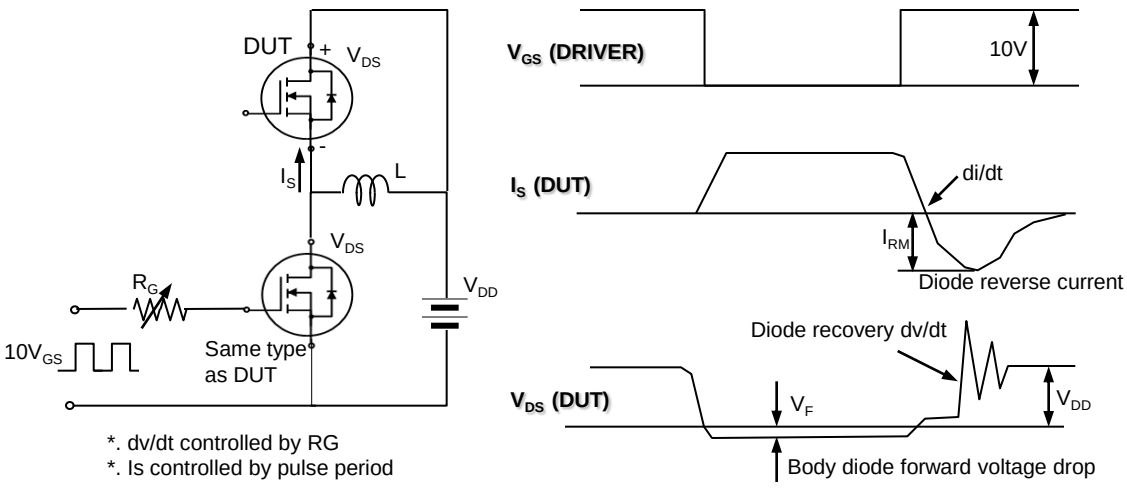



**Fig 16. Peak diode recovery dv/dt test circuit & waveform**



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