

N-Channel Enhancement Mode Power MOSFET

MTN5N50BFP

| | |
|---|--------------|
| BV_{DSS} | 500V |
| $I_D @ V_{GS}=10V, T_C=25^\circ C$ | 4.5A |
| $R_{DS(on)(TYP)} @ V_{GS}=10V, I_D=2.25A$ | 1.1 Ω |

Description

The MTN5N50BFP is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-220FP package is universally preferred for all commercial-industrial applications

Features

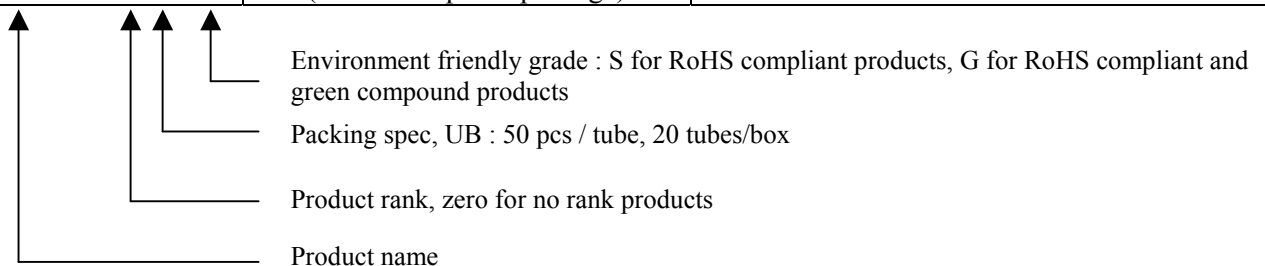
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- Insulating package, front/back side insulating voltage=2500V(AC)
- RoHS compliant package

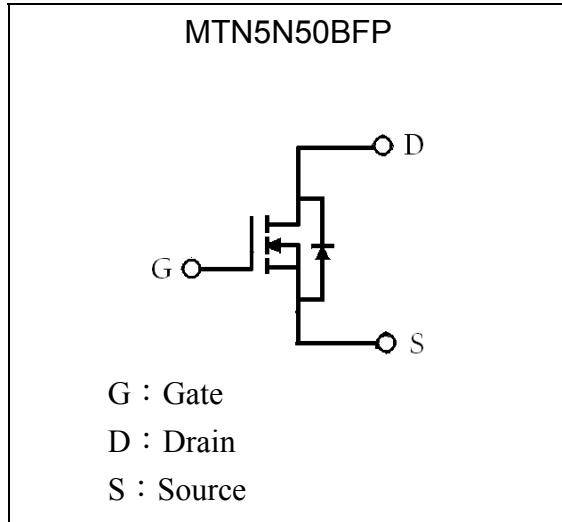
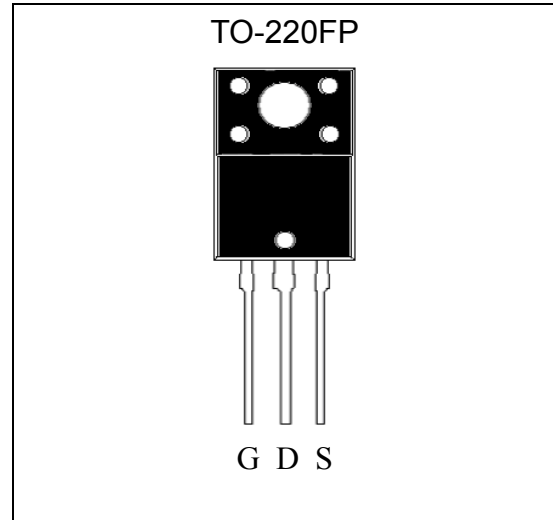
Applications

- Open Framed Power Supply
- Adapter
- STB

Ordering Information

| Device | Package | Shipping |
|-------------------|--------------------------------------|---|
| MTN5N50BFP-0-UB-S | TO-220FP (RoHS compliant package) | 50 pcs/tube, 20 tubes/box, 4 boxes / carton |



Symbol

Outline

Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

| Parameter | Symbol | Limits | Unit |
|--|----------------|----------|---------------------|
| Drain-Source Voltage | V_{DS} | 500 | V |
| Gate-Source Voltage | V_{GS} | ± 30 | V |
| Continuous Drain Current | I_D | 4.5* | A |
| Continuous Drain Current @ $T_C=100^\circ\text{C}$ | I_D | 2.8* | A |
| Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 1) | I_{DM} | 18 * | A |
| Single Pulse Avalanche Energy (Note 2) | E_{AS} | 90 | mJ |
| Avalanche Current (Note 1) | I_{AS} | 4.5 | A |
| Repetitive Avalanche Energy (Note 1) | E_{AR} | 8.5 | mJ |
| Peak Diode Recovery dv/dt (Note 3) | dv/dt | 4.5 | V/ns |
| Maximum Temperature for Soldering @ Lead at 0.125 in(0.318mm) from case for 10 seconds | T_L | 300 | $^\circ\text{C}$ |
| Total Power Dissipation ($T_A=25^\circ\text{C}$) | P_D | 2 | W |
| Total Power Dissipation ($T_C=25^\circ\text{C}$) | | 33 | W |
| Linear Derating Factor | | 0.26 | W/ $^\circ\text{C}$ |
| Operating Junction and Storage Temperature | T_j, T_{stg} | -55~+150 | $^\circ\text{C}$ |

* Drain current limited by maximum junction temperature.

Note : 1.Repetitive rating; pulse width limited by maximum junction temperature.

2. $I_{AS}=4.5\text{A}$, $V_{DD}=50\text{V}$, $L=8\text{mH}$, $R_G=25\ \Omega$, starting $T_J=+25^\circ\text{C}$.

3. $I_{SD}\leq 4.5\text{A}$, $di/dt\leq 100\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, starting $T_J=+25^\circ\text{C}$.

Thermal Data

| Parameter | Symbol | Value | Unit |
|--|--------------|-------|---------------------------|
| Thermal Resistance, Junction-to-case, max | $R_{th,j-c}$ | 3.8 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction-to-ambient, max | $R_{th,j-a}$ | 62.5 | $^\circ\text{C}/\text{W}$ |



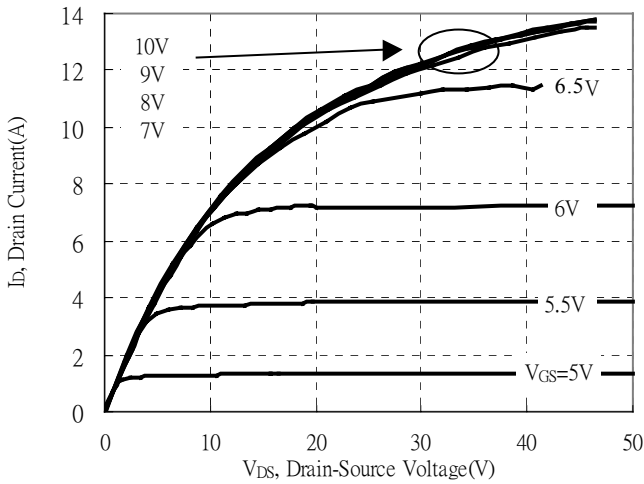
Characteristics (Tc=25°C, unless otherwise specified)

| Symbol | Min. | Typ. | Max. | Unit | Test Conditions |
|-------------------------------------|------|------|------|------|---|
| Static | | | | | |
| BV _{DSS} | 500 | - | - | V | V _{GS} =0V, I _D =250μA, T _j =25°C |
| ΔBV _{DSS} /ΔT _j | - | 0.6 | - | V/°C | Reference to 25°C, I _D =250μA |
| V _{GS(th)} | 2.0 | - | 4.0 | V | V _{DS} = V _{GS} , I _D =250μA |
| *G _{FS} | - | 5 | - | S | V _{DS} =15V, I _D =2.25A |
| I _{GSS} | - | - | ±100 | nA | V _{GS} =±30V |
| I _{DSS} | - | - | 1 | μA | V _{DS} =500V, V _{GS} =0V |
| | - | - | 10 | | V _{DS} =400V, V _{GS} =0V, T _C =125°C |
| *R _{DS(ON)} | - | 1.1 | 1.5 | Ω | V _{GS} =10V, I _D =2.25A |
| Dynamic | | | | | |
| *Q _g | - | 17.4 | - | nC | I _D =4.5A, V _{DD} =400V, V _{GS} =10V |
| *Q _{gs} | - | 3.4 | - | | |
| *Q _{gd} | - | 7.6 | - | | |
| *t _{d(ON)} | - | 10.6 | - | ns | V _{DD} =250V, I _D =4.5A, V _{GS} =10V, R _G =25Ω |
| *t _r | - | 10 | - | | |
| *t _{d(OFF)} | - | 35 | - | | |
| *t _f | - | 31.2 | - | | |
| C _{iss} | - | 572 | - | pF | V _{GS} =0V, V _{DS} =25V, f=1MHz |
| C _{oss} | - | 65 | - | | |
| C _{rss} | - | 32 | - | | |
| Source-Drain Diode | | | | | |
| *V _{SD} | - | - | 1.5 | V | I _S =4.5A, V _{GS} =0V |
| *I _S | - | - | 4.5 | A | |
| *I _{SM} | - | - | 18 | | |
| *t _{rr} | - | 260 | - | ns | V _{GS} =0, I _F =4.5A, dI/dt=100A/μs |
| *Q _{rr} | - | 1.1 | - | μC | |

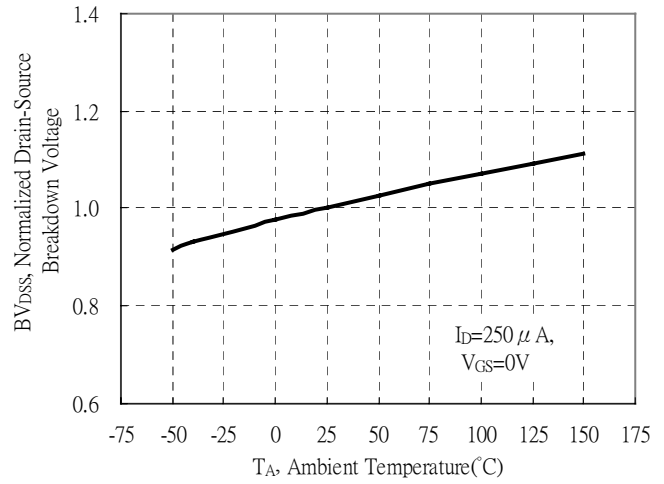
*Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

Typical Characteristics

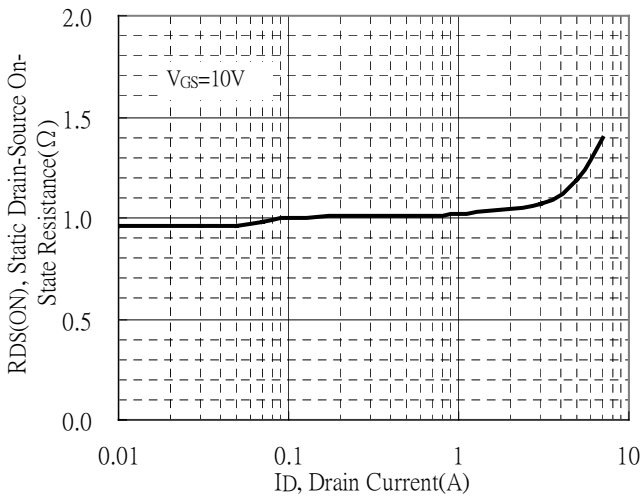
Typical Output Characteristics



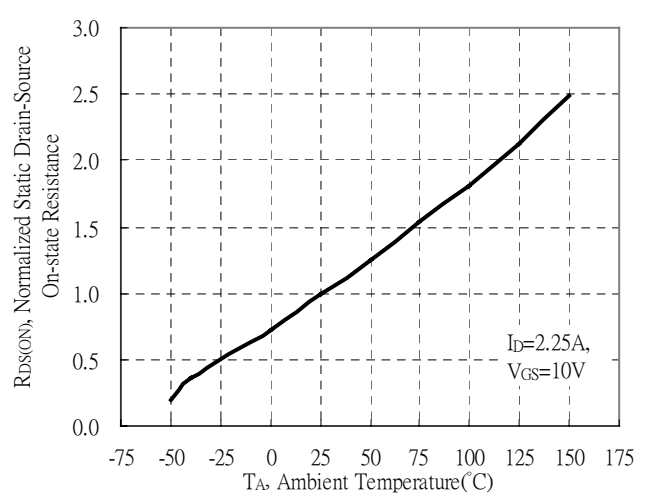
Brekdown Voltage vs Ambient Temperature



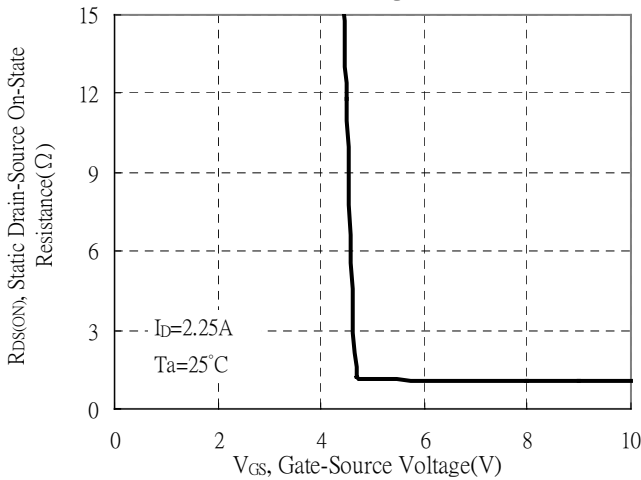
Static Drain-Source On-State resistance vs Drain Current



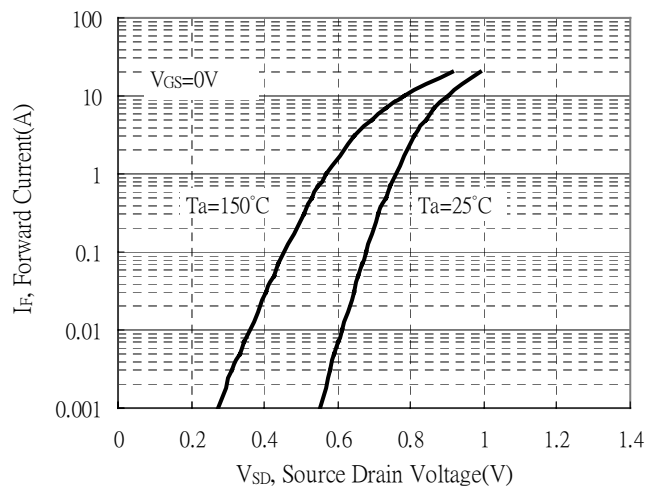
Static Drain-Source On-resistance vs Ambient Temperature



Static Drain-Source On-State Resistance vs Gate-Source Voltage

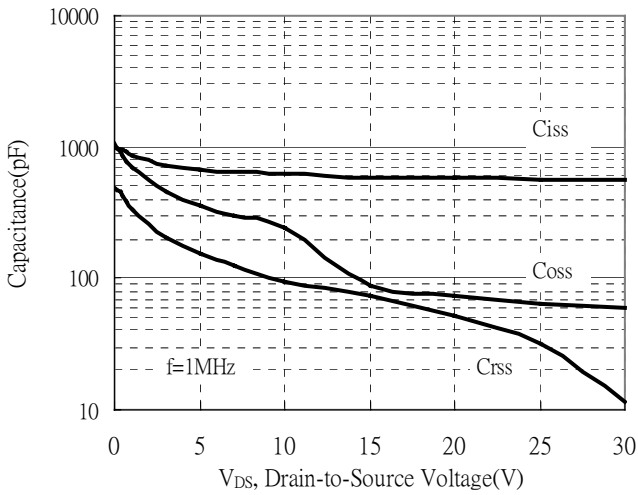


Forward Drain Current vs Source-Drain Voltage

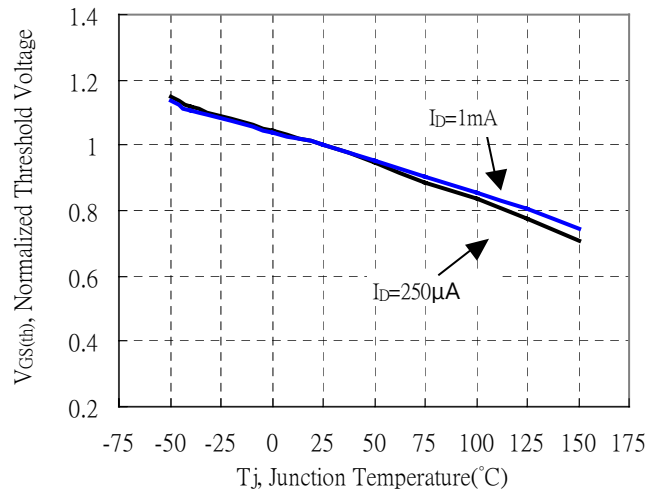


Typical Characteristics(Cont.)

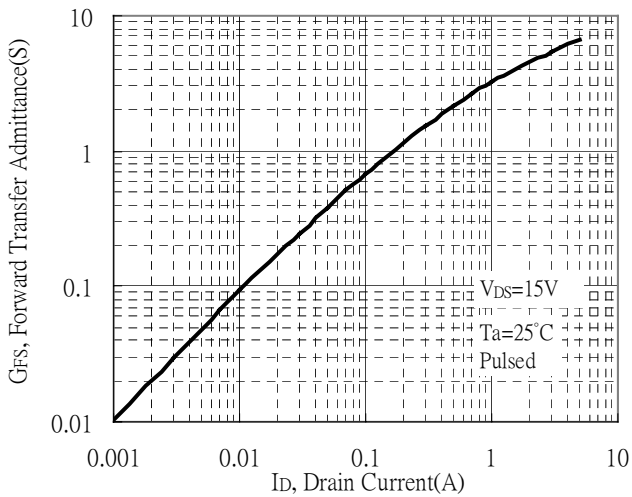
Capacitance vs Reverse Voltage



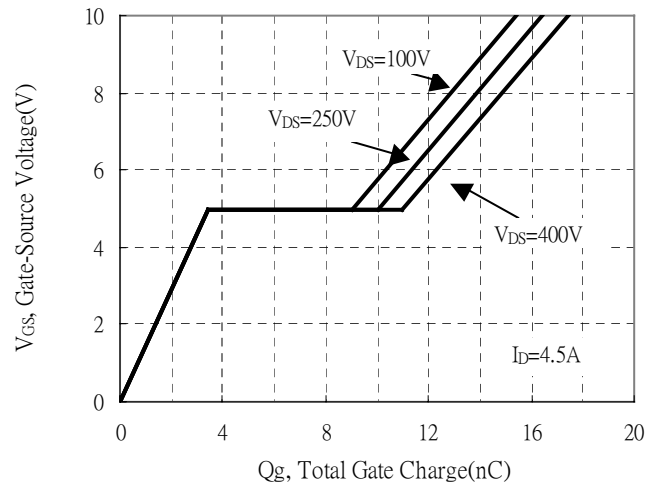
Threshold Voltage vs Junction Temperature



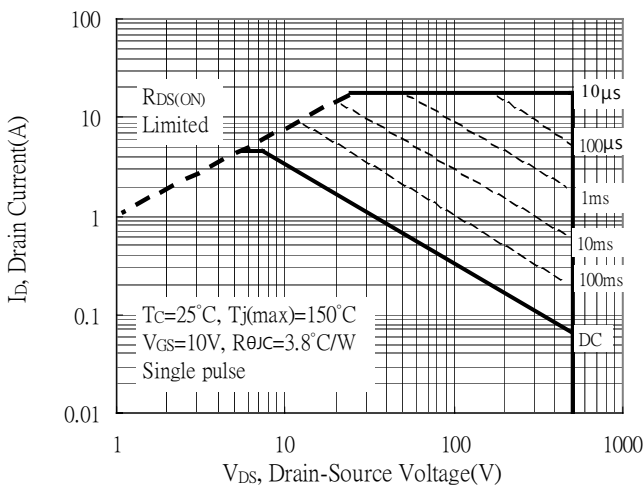
Forward Transfer Admittance vs Drain Current



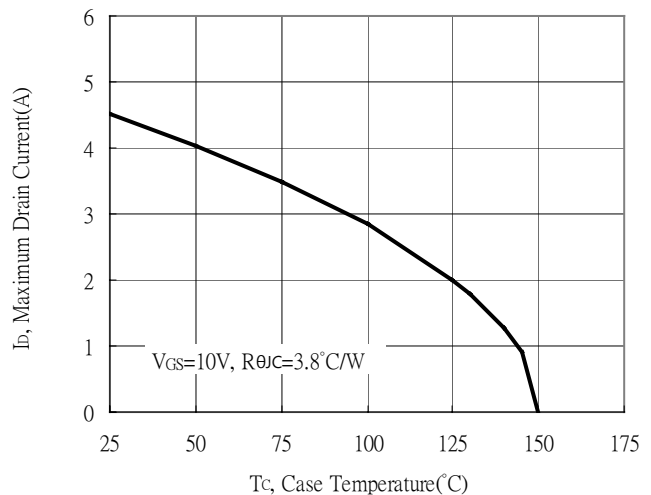
Gate Charge Characteristics



Maximum Safe Operating Area

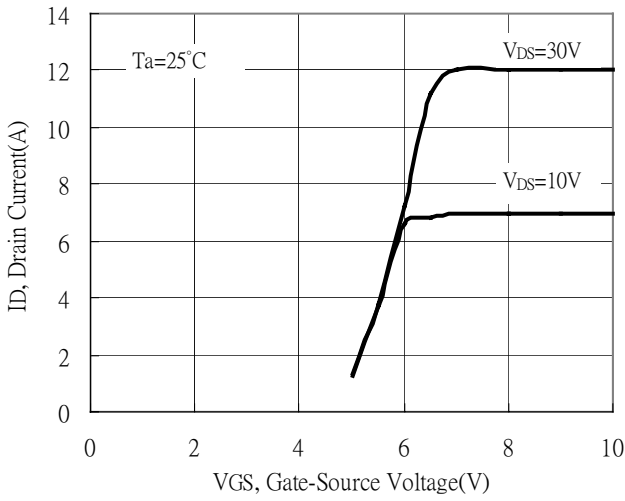


Maximum Drain Current vs Case Temperature

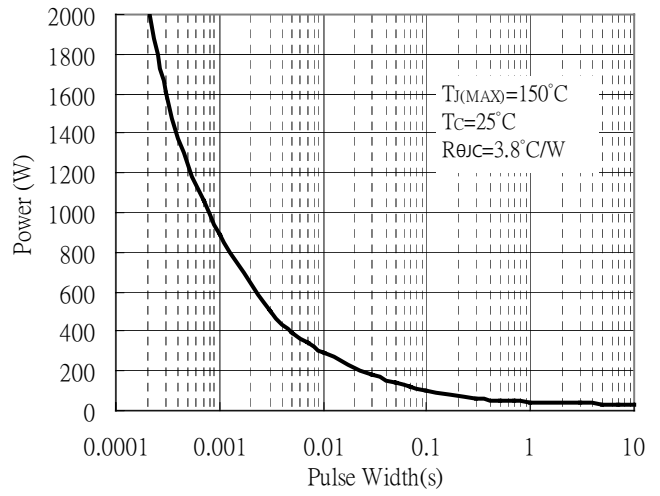


Typical Characteristics(Cont.)

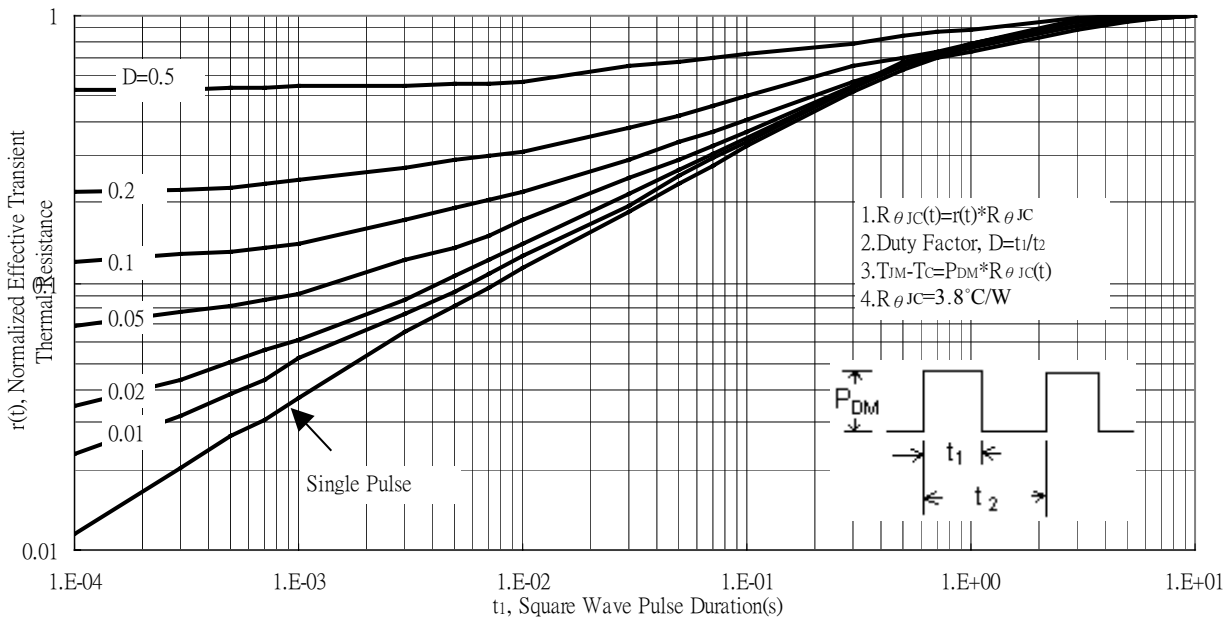
Drain Current vs Gate-Source Voltage



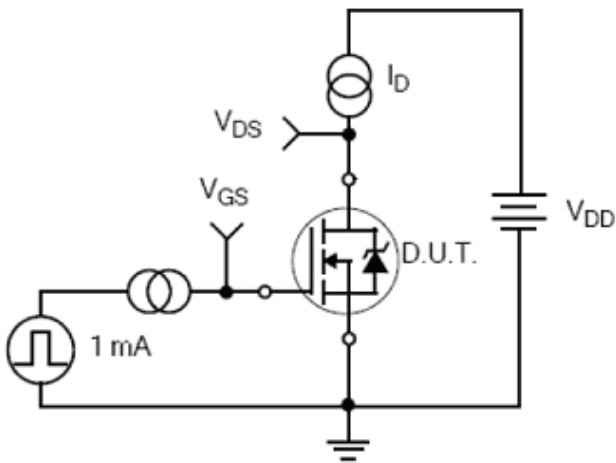
Single Pulse Power Rating, Junction to Case



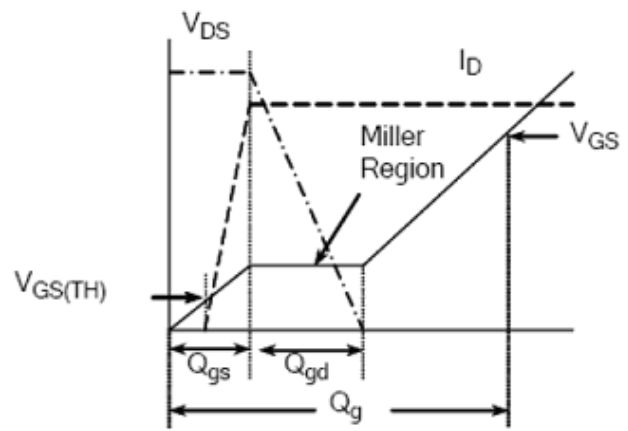
Transient Thermal Response Curves



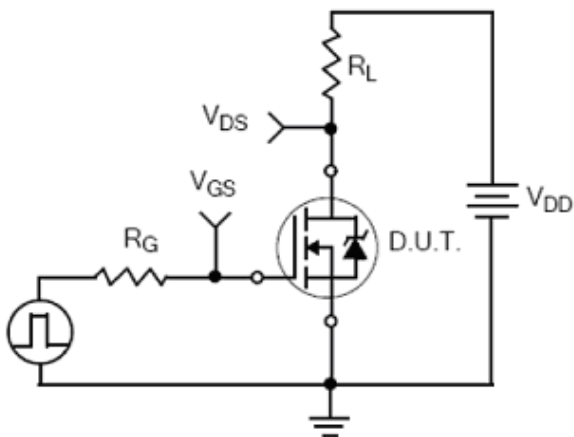
Test Circuit and Waveforms



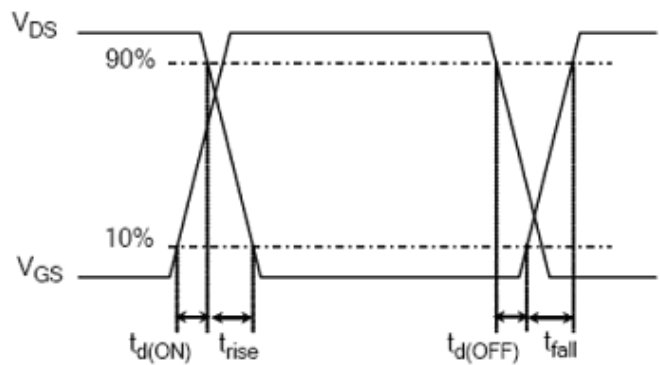
Gate Charge Test Circuit



Gate Charge Waveform

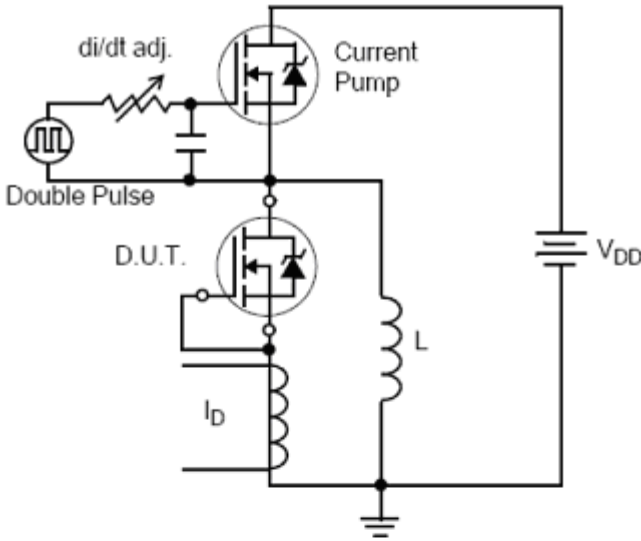


Resistive Switching Test Circuit

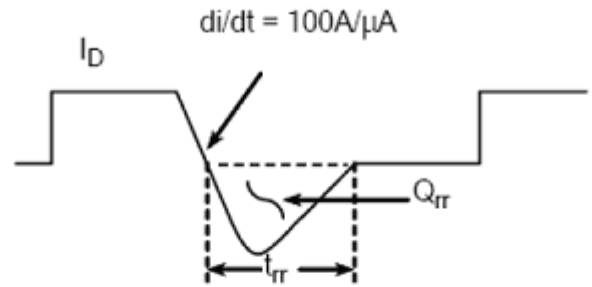


Resistive Switching Waveforms

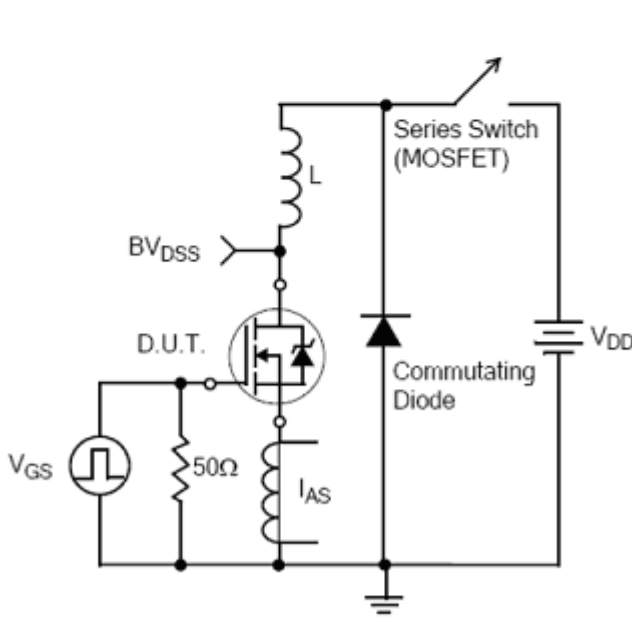
Test Circuit and Waveforms(Cont.)



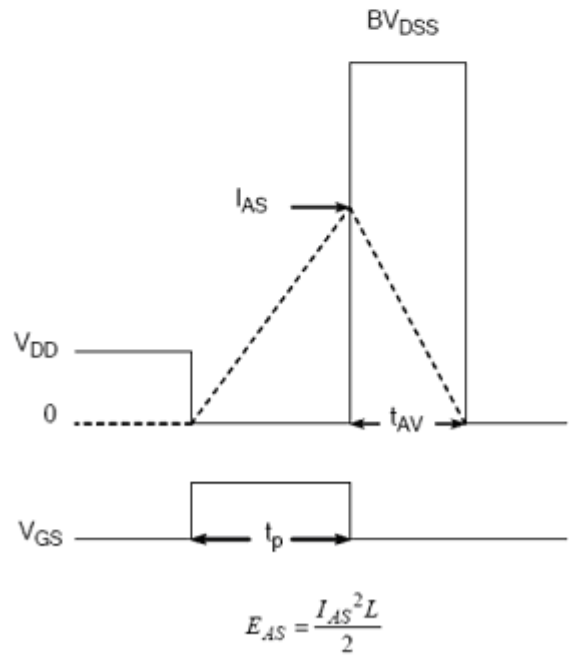
Diode Reverse Recovery Test Circuit



Diode Reverse Recovery Waveform



Unclamped Inductive Switching Test Circuit

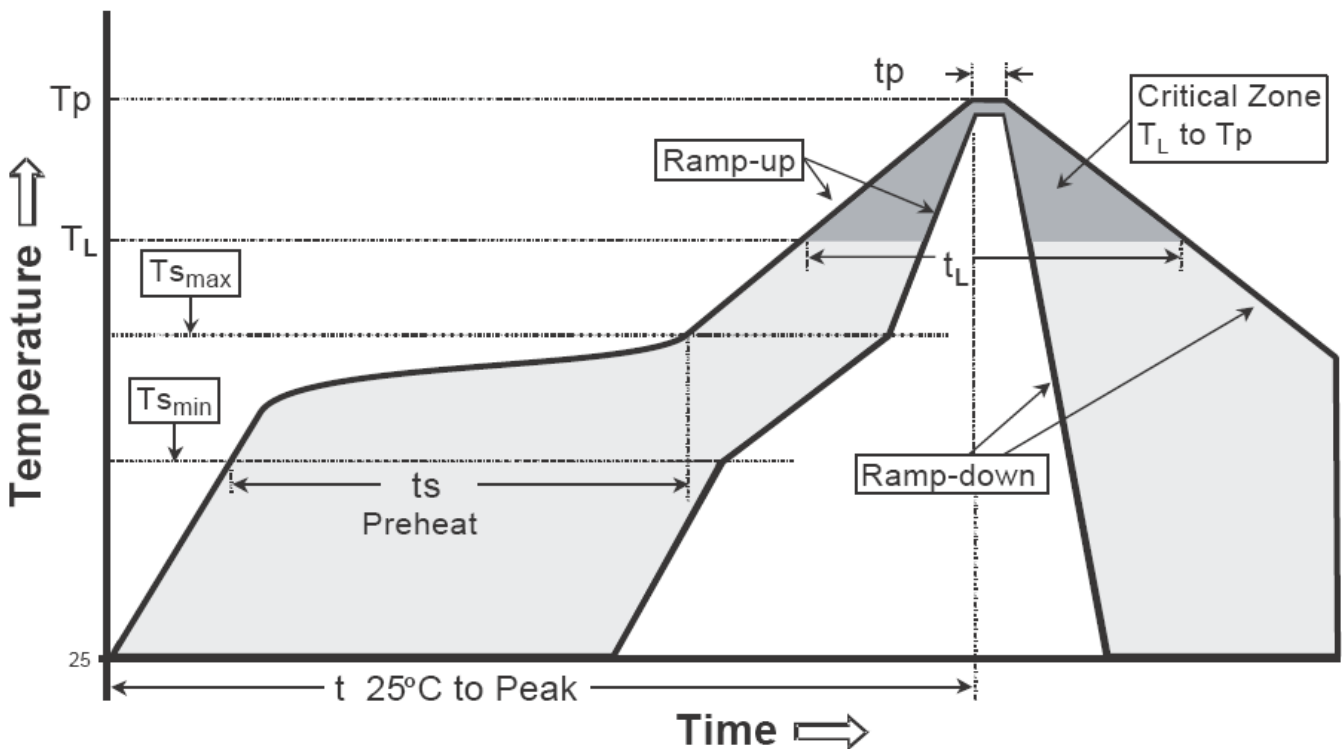


Unclamped Inductive Switching Waveforms

Recommended wave soldering condition

| | | |
|-----------------|------------------|-----------------|
| Product | Peak Temperature | Soldering Time |
| Pb-free devices | 260 +0/-5 °C | 5 +1/-1 seconds |

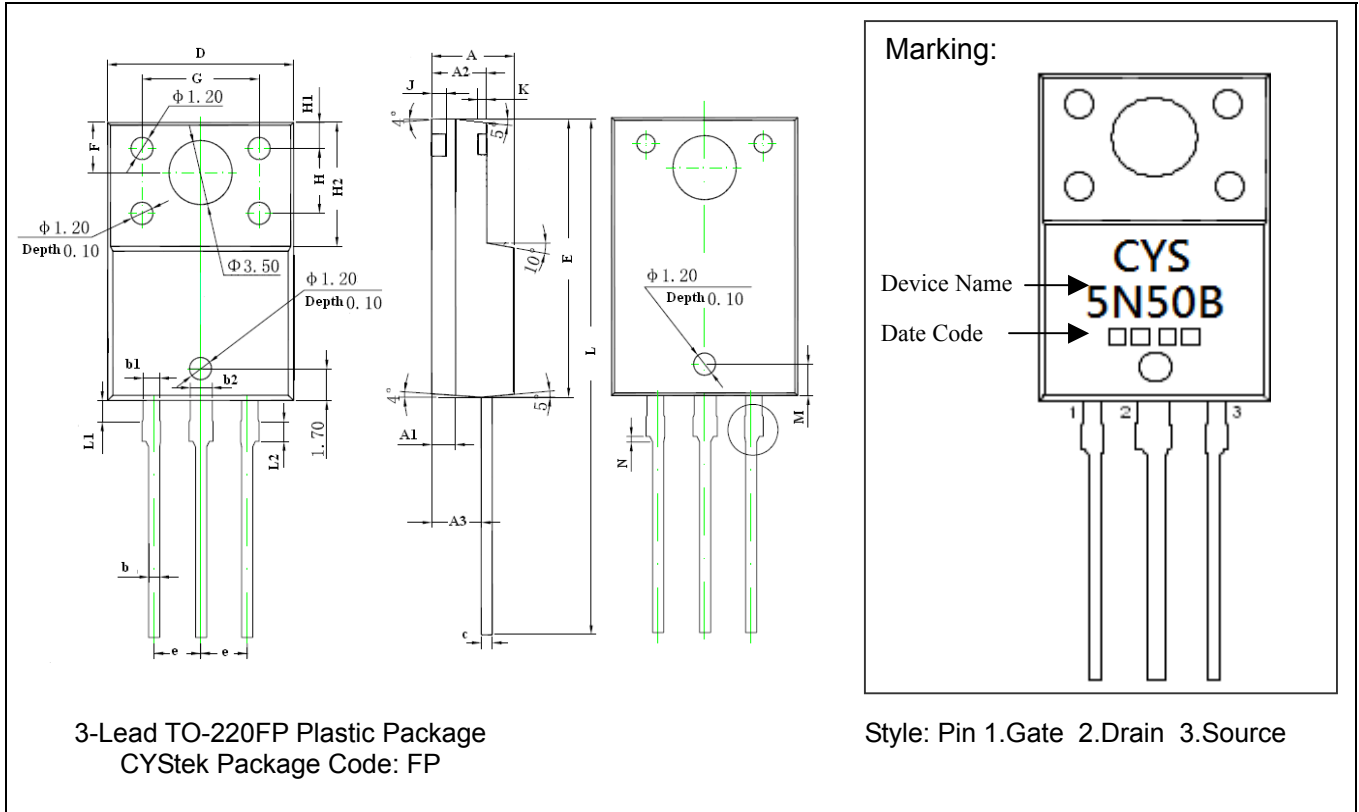
Recommended temperature profile for IR reflow



| Profile feature | Sn-Pb eutectic Assembly | Pb-free Assembly |
|---|-------------------------|------------------|
| Average ramp-up rate (T _{smax} to T _p) | 3°C/second max. | 3°C/second max. |
| Preheat | | |
| -Temperature Min(T _{s min}) | 100°C | 150°C |
| -Temperature Max(T _{s max}) | 150°C | 200°C |
| -Time(t _{s min} to t _{s max}) | 60-120 seconds | 60-180 seconds |
| Time maintained above: | | |
| -Temperature (T _L) | 183°C | 217°C |
| - Time (t _L) | 60-150 seconds | 60-150 seconds |
| Peak Temperature(T _P) | 240 +0/-5 °C | 260 +0/-5 °C |
| Time within 5°C of actual peak temperature(tp) | 10-30 seconds | 20-40 seconds |
| Ramp down rate | 6°C/second max. | 6°C/second max. |
| Time 25 °C to peak temperature | 6 minutes max. | 8 minutes max. |

Note : All temperatures refer to topside of the package, measured on the package body surface.

TO-220FP Dimension



*Typical

| DIM | Inches | | Millimeters | | DIM | Inches | | Millimeters | |
|-----|-----------|-------|-------------|-------|-----|-----------|-------|-------------|-------|
| | Min. | Max. | Min. | Max. | | Min. | Max. | Min. | Max. |
| A | 0.171 | 0.183 | 4.35 | 4.65 | G | 0.246 | 0.258 | 6.25 | 6.55 |
| A1 | 0.051 REF | | 1.300 REF | | H | 0.138 REF | | 3.50 REF | |
| A2 | 0.112 | 0.124 | 2.85 | 3.15 | H1 | 0.055 REF | | 1.40 REF | |
| A3 | 0.102 | 0.110 | 2.60 | 2.80 | H2 | 0.256 | 0.272 | 6.50 | 6.90 |
| b | 0.020 | 0.030 | 0.50 | 0.75 | J | 0.031 REF | | 0.80 REF | |
| b1 | 0.031 | 0.041 | 0.80 | 1.05 | K | 0.020 | | 0.50 REF | |
| b2 | 0.047 REF | | 1.20 REF | | L | 1.102 | 1.118 | 28.00 | 28.40 |
| c | 0.020 | 0.030 | 0.500 | 0.750 | L1 | 0.043 | 0.051 | 1.10 | 1.30 |
| D | 0.396 | 0.404 | 10.06 | 10.26 | L2 | 0.036 | 0.043 | 0.92 | 1.08 |
| E | 0.583 | 0.598 | 14.80 | 15.20 | M | 0.067 REF | | 1.70 REF | |
| e | 0.100 * | | 2.54* | | N | 0.012 REF | | 0.30 REF | |
| F | 0.106 REF | | 2.70 REF | | | | | | |

Notes: 1.Controlling dimension: millimeters.
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

Material:

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

Important Notice:

- All rights are reserved. Reproduction in whole or in part is prohibited without the prior written approval of CYStek.
- CYStek reserves the right to make changes to its products without notice.
- CYStek **semiconductor products are not warranted to be suitable for use in Life-Support Applications, or systems.**
- CYStek assumes no liability for any consequence of customer product design, infringement of patents, or application assistance.