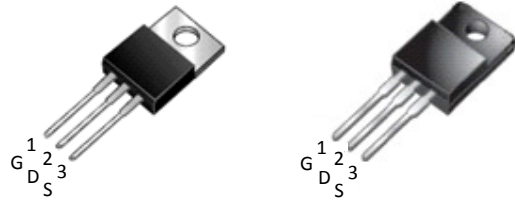


**650V / 12A**  
**N-Channel Enhancement Mode MOSFET**

650V,  $R_{DS(ON)}=0.8\Omega@V_{GS}=10V, I_D=6.0A$

### Features

- Low ON Resistance
- Fast Switching
- Low Gate Charge & Low  $C_{RSS}$
- Fully Characterized Avalanche Voltage and Current
- Specially Designed for AC Adapter, Battery Charger and SMPS
- In compliance with EU RoHs 2002/95/EC Directives



TO-220AB

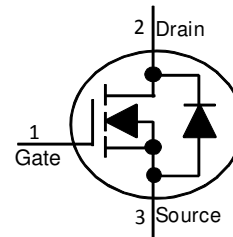
ITO-220AB

### Mechanical Information

- Case: TO-220AB / ITO-220AB Molded Plastic
- Terminals : Solderable per MIL-STD-750, Method 2026

### Marking & Ordering Information

| TYPE      | MARKING | PACKAGE   | PACKING    |
|-----------|---------|-----------|------------|
| HY12N65T  | 12N65T  | TO-220AB  | 50PCS/TUBE |
| HY12N65FT | 12N65FT | ITO-220AB | 50PCS/TUBE |



### Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ unless otherwise noted )

| Parameter  |                        | Symbol         | HY12N65T    | HY12N65FT | Units            |
|--|------------------------|----------------|-------------|-----------|------------------|
| Drain-Source Voltage   |                        | $V_{DS}$       | 650         |           | V                |
| Gate-Source Voltage  |                        | $V_{GS}$       | $\pm 30$    |           | V                |
| Continuous Drain Current   | $T_c=25^\circ\text{C}$ | $I_D$          | 12          | 12        | A                |
| Pulsed Drain Current <sup>1)</sup>                                       |                        | $I_{DM}$       | 48          | 48        | A                |
| Maximum Power Dissipation  | $T_c=25^\circ\text{C}$ | $P_D$          | 175         | 52        | W                |
| Derating Factor  |                        |                | 1.4         | 0.42      |                  |
| Avalanche Energy with Single Pulse<br>$I_{AS}=12A, V_{DD}=90V, L=10.5mH$ |                        | $E_{AS}$       | 760         |           | mJ               |
| Operating Junction and Storage Temperature Range                         |                        | $T_J, T_{STG}$ | -55 to +150 |           | $^\circ\text{C}$ |

**Note :** 1. Maximum DC current limited by the package

### Thermal Characteristics

| PARAMETER                              | Symbol          | HY12N65T | HY12N65FT | Units              |
|--|-----------------|----------|-----------|--------------------|
| Junction-to-Case Thermal Resistance    | $R_{\theta JC}$ | 0.7      | 2.4       | $^\circ\text{C/W}$ |
| Junction-to Ambient Thermal Resistance | $R_{\theta JA}$ | 62.5     | 100       | $^\circ\text{C/W}$ |

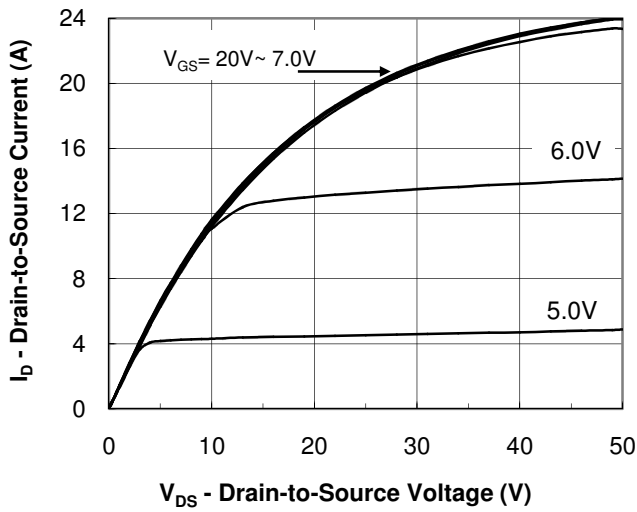
**COMPANY RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN,FUNCTIONS AND RELIABILITY WITHOUT NOTICE**

**Electrical Characteristics (  $T_c=25^{\circ}\text{C}$  unless otherwise noted )**

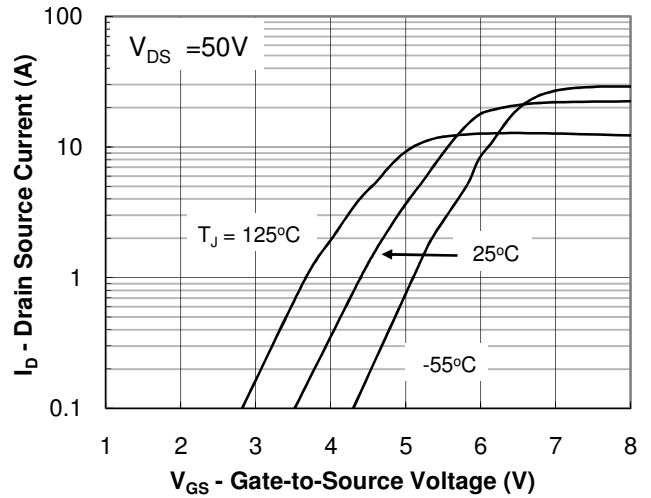
| Parameter                        | Symbol       | Test Condition                                       | Min. | Typ. | Max.      | Units    |
|----------------------------------|--------------|--|------|------|-----------|----------|
| <b>Static</b>                    |              |  |      |      |           |          |
| Drain-Source Breakdown Voltage   | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                            | 650  | -    | -         | V        |
| Gate Threshold Voltage           | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                        | 2.0  | -    | 4.0       | V        |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=6.0A$                               | -    | 0.69 | 0.8       | $\Omega$ |
| Zero Gate Voltage Drain Current  | $I_{DSS}$    | $V_{DS}=650V, V_{GS}=0V$                             | -    | -    | 10        | $\mu A$  |
| Gate Body Leakage                | $I_{GSS}$    | $V_{GS}=\pm 30V, V_{DS}=0V$                          | -    | -    | $\pm 100$ | nA       |
| <b>Dynamic</b>                   |              |  |      |      |           |          |
| Total Gate Charge                | $Q_g$        | $V_{DS}=520V, I_D=12A,$<br>$V_{GS}=10V$              | -    | 42.6 | 52        | nC       |
| Gate-Source Charge               | $Q_{gs}$     |  | -    | 8.2  | -         |          |
| Gate-Drain Charge                | $Q_{gd}$     |  | -    | 12.8 | -         |          |
| Turn-On Delay Time               | $t_{d(on)}$  | $V_{DD}=325V, I_D=12A$<br>$V_{GS}=10V, R_G=25\Omega$ | -    | 14.6 | 20        | ns       |
| Turn-On Rise Time                | $t_r$        |  | -    | 22.6 | 32        |          |
| Turn-Off Delay Time              | $t_{d(off)}$ |  | -    | 65.2 | 85        |          |
| Turn-Off Fall Time               | $t_f$        |  | -    | 22.8 | 36        |          |
| Input Capacitance                | $C_{iss}$    | $V_{DS}=25V, V_{GS}=0V$<br>$f=1.0\text{MHz}$         | -    | 1400 | 2050      | pF       |
| Output Capacitance               | $C_{oss}$    |  | -    | 175  | 210       |          |
| Reverse Transfer Capacitance     | $C_{rss}$    |  | -    | 5.5  | 12        |          |
| <b>Source-Drain Diode</b>        |              |  |      |      |           |          |
| Max. Diode Forward Current       | $I_S$        | -  | -    | -    | 12        | A        |
| Max.Pulsed Source Current        | $I_{SM}$     | -  | -    | -    | 48        | A        |
| Diode Forward Voltage            | $V_{SD}$     | $I_S=12A, V_{GS}=0V$                                 | -    | -    | 1.4       | V        |
| Reverse Recovery Time            | $t_{rr}$     | $V_{GS}=0V, I_F=12A$<br>$di/dt=100A/\mu s$           | -    | 460  | -         | ns       |
| Reverse Recovery Charge          | $Q_{rr}$     |  | -    | 4.6  | -         | $\mu C$  |

**NOTE :** Plus Test : Pluse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

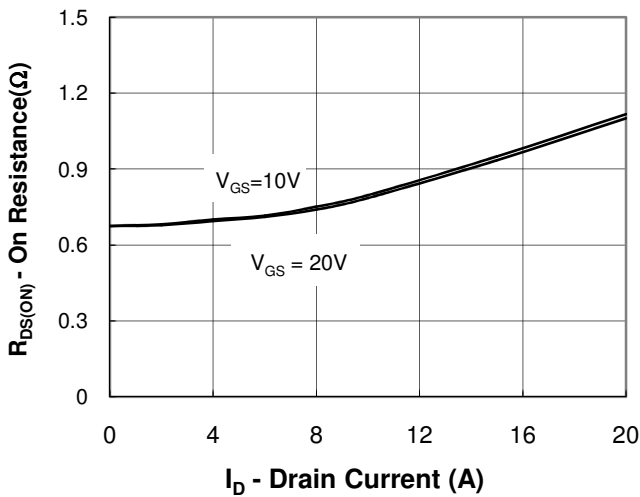
### Typical Characteristics Curves ( $T_C=25^\circ\text{C}$ , unless otherwise noted)



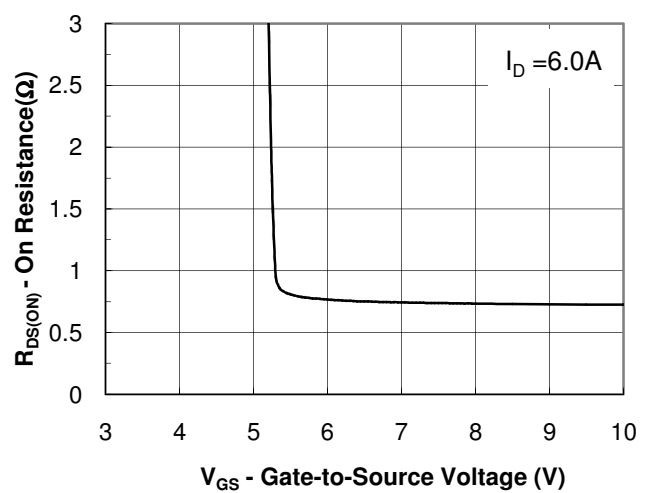
**Fig.1 Output Characteristic**



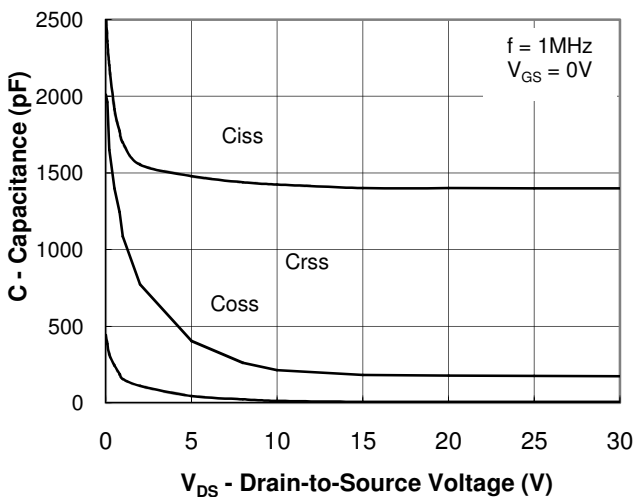
**Fig.2 Transfer Characteristic**



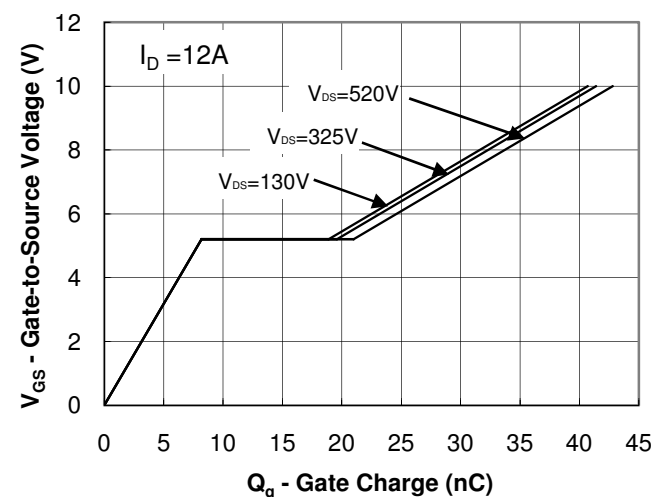
**Fig.3 On-Resistance vs Drain Current**



**Fig.4 On-Resistance vs Gate to Source Voltage**

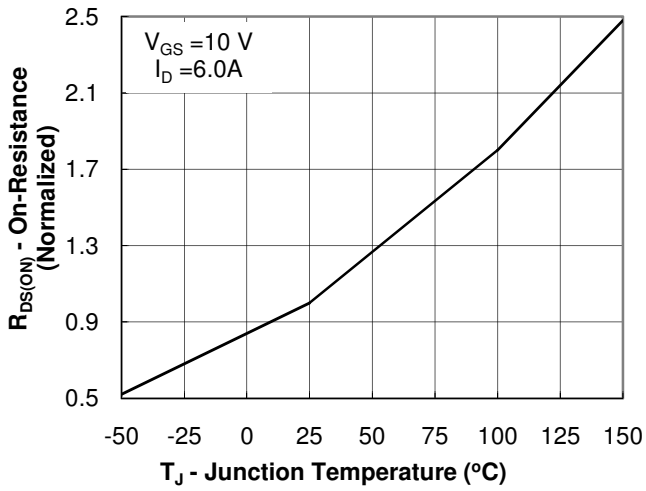


**Fig.5 Capacitance Characteristic**

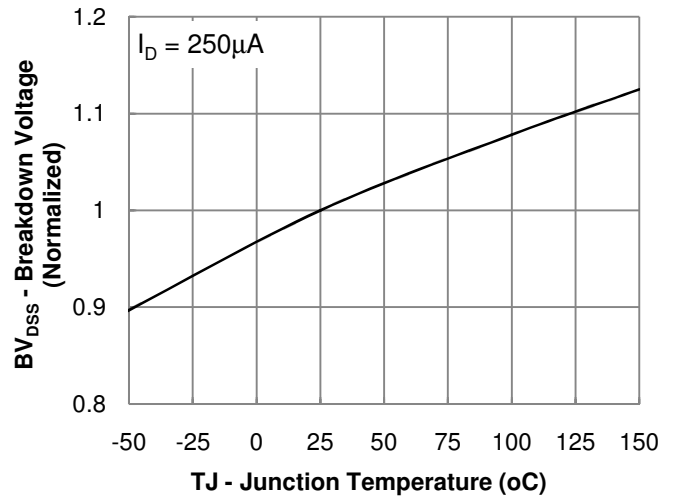


**Fig.6 Gate Charge Characteristic**

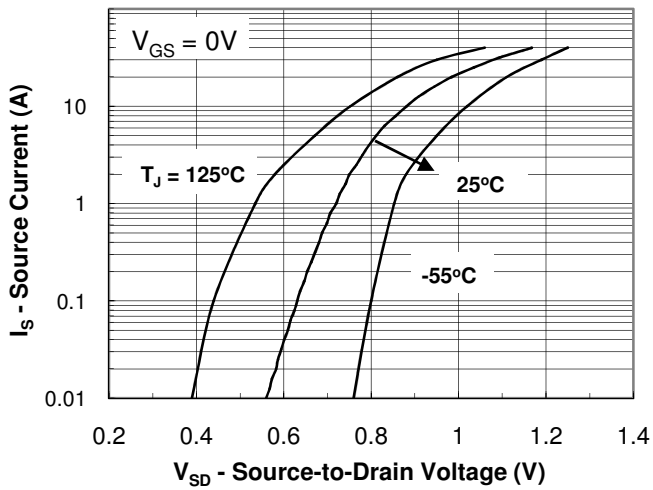
## Typical Characteristics Curves ( $T_C=25^\circ\text{C}$ , unless otherwise noted)



**Fig.7 On-Resistance vs Junction Temperature**



**Fig.8 Breakdown Voltage vs Junction Temperature**



**Fig.9 Body Diode Forward Voltage Characteristic**