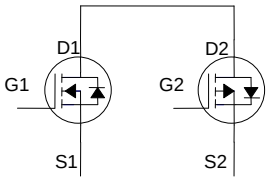
杰力科技股份有限公司
Excelliance MOS Corporation

**EMB21C03A**

**N & P-Channel Logic Level Enhancement Mode Field Effect Transistor**

Product Summary:

| | N-CH | P-CH |
|---|---|---|
| $BV_{DSS}$ | 30V | -30V |
| $R_{DSON\ (MAX.)}$ | 21mΩ | 40mΩ |
| $I_D$ | 8A | -6A |





UIS, 100% Tested

Pb-Free Lead Plating & Halogen Free

GP
GREEN PRODUCT

**ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25 °C Unless Otherwise Noted)**

| PARAMETERS/TEST CONDITIONS | | SYMBOL | LIMITS | | UNIT |
|---|---|---|---|---|---|
| Gate-Source Voltage | | $V_{GS}$ | N-CH | P-CH | V |
| | | | ±20 | ±20 | |
| Continuous Drain Current | $T_C$ = 25 °C | $I_D$ | 8 | -6 | A |
| | $T_C$ = 100 °C | | 6 | -5 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | 32 | -24 | |
| Avalanche Current | | $I_{AS}$ | 15 | -15 | |
| Avalanche Energy | L = 0.1mH, ID=10A, RG=25Ω(N)<br>L = 0.1mH, ID=-10A, RG=25Ω(P) | $E_{AS}$ | 5 | 5 | mJ |
| Repetitive Avalanche Energy[2] | L = 0.05mH | $E_{AR}$ | 2.5 | 2.5 | |
| Power Dissipation | $T_C$ = 25 °C | $P_D$ | 21 | | W |
| | $T_C$ = 100 °C | | 8.3 | | |
| Operating Junction & Storage Temperature Range | | $T_j$, $T_{stg}$ | -55 to 150 | | °C |

100% UIS testing in condition of $V_D$=15V, L=0.1mH, $V_G$=10V, $I_L$=8A, Rated $V_{DS}$=30V N-CH

100% UIS testing in condition of $V_D$=15V, L=0.1mH, $V_G$=-10V, $I_L$=-6A, Rated $V_{DS}$=-30V P-CH

**THERMAL RESISTANCE RATINGS**

| THERMAL RESISTANCE | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|---|---|---|---|---|
| Junction-to-Case | $R_{\theta JC}$ | | 6 | °C / W |
| Junction-to-Ambient[3] | $R_{\theta JA}$ | | 42 | |

[1]Pulse width limited by maximum junction temperature.

[2]Duty cycle ≤ 1%

[3]90°C / W when mounted on a 1 in$^2$ pad of 2 oz copper.

**ELECTRICAL CHARACTERISTICS ($T_C$ = 25 °C, Unless Otherwise Noted)**

| PARAMETER | SYMBOL | TEST CONDITIONS | | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | |
| **STATIC** | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | N-CH | 30 | | | V |
| | | $V_{GS}$ = 0V, $I_D$ = -250μA | P-CH | -30 | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | N-CH | 1 | 1.5 | 3 | |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA | P-CH | -1 | -1.5 | -3 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | N-CH | | | ±100 | nA |
| | | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | P-CH | | | ±100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 24V, $V_{GS}$ = 0V | N-CH | | | 1 | μA |
| | | $V_{DS}$ = -24V, $V_{GS}$ = 0V | P-CH | | | -1 | |
| | | $V_{DS}$ = 20V, $V_{GS}$ = 0V, $T_J$ = 125 °C | N-CH | | | 25 | |
| | | $V_{DS}$ = -20V, $V_{GS}$ = 0V, $T_J$ = 125 °C | P-CH | | | -25 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = 10V, $V_{GS}$ = 10V | N-CH | 8 | | | A |
| | | $V_{DS}$ = -5V, $V_{GS}$ = -10V | P-CH | -6 | | | |
| Drain-Source On-State Resistance[1] | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 8A | N-CH | | 17 | 21 | mΩ |
| | | $V_{GS}$ = -10V, $I_D$ = -6A | P-CH | | 35 | 40 | |
| | | $V_{GS}$ = 4.5V, $I_D$ = 6A | N-CH | | 25 | 30 | |
| | | $V_{GS}$ = -4.5V, $I_D$ = -5A | P-CH | | 55 | 65 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = 5V, $I_D$ = 8A | N-CH | | 16 | | S |
| | | $V_{DS}$ = -5V, $I_D$ = -6A | P-CH | | 16 | | |
| **DYNAMIC** | | | | | | | |
| Input Capacitance | $C_{iss}$ | N-CH<br>$V_{GS}$ = 0V, $V_{DS}$ = 15V, f = 1MHz<br>P=CH<br>$V_{GS}$ = 0V, $V_{DS}$ = -15V, f = 1MHz | N-CH | | 520 | | pF |
| | | | P-CH | | 820 | | |
| Output Capacitance | $C_{oss}$ | | N-CH | | 88 | | |
| | | | P-CH | | 122 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | N-CH | | 62 | | |
| | | | P-CH | | 97 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Gate Charge[1,2] | $Q_g$($V_{GS}$=10V)<br>$Q_g$($V_{GS}$=-10V) | N-CH<br>$V_{DS}$ = 15V, $V_{GS}$ = 10V,<br>$I_D$ = 8A<br>P-CH<br>$V_{DS}$ = -15V, $V_{GS}$ = -10V,<br>$I_D$ = -6A | N-CH | | 11.5 | | nC |
| | | | P-CH | | 9 | | |
| | $Q_g$($V_{GS}$=4.5V)<br>$Q_g$($V_{GS}$=-4.5V) | | N-CH | | 5 | | |
| | | | P-CH | | 5.8 | | |
| Gate-Source Charge[1,2] | $Q_{gs}$ | | N-CH | | 1.6 | | |
| | | | P-CH | | 2.2 | | |
| Gate-Drain Charge[1,2] | $Q_{gd}$ | | N-CH | | 2.8 | | |
| | | | P-CH | | 2.5 | | |
| Turn-On Delay Time[1,2] | $t_{d(on)}$ | N-CH<br>$V_{DS}$ = 15V,<br>$I_D$ = 1A, $V_{GS}$ = 10V, $R_{GS}$ = 6Ω<br>P-CH<br>$V_{DS}$ = -15V,<br>$I_D$ = -1A, $V_{GS}$ = -10V, $R_{GS}$ = 6Ω | N-CH | | 11 | | nS |
| | | | P-CH | | 10 | | |
| Rise Time[1,2] | $t_r$ | | N-CH | | 16 | | |
| | | | P-CH | | 15 | | |
| Turn-Off Delay Time[1,2] | $t_{d(off)}$ | | N-CH | | 36 | | |
| | | | P-CH | | 28 | | |
| Fall Time[1,2] | $t_f$ | | N-CH | | 20 | | |
| | | | P-CH | | 15 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C$ = 25 °C)** | | | | | | | |
| Continuous Current | $I_S$ | | N-CH | | | 2.3 | A |
| | | | P-CH | | | -2.3 | |
| Pulsed Current[3] | $I_{SM}$ | | N-CH | | | 9.2 | |
| | | | P-CH | | | -9.2 | |
| Forward Voltage[1] | $V_{SD}$ | $I_F$ = $I_S$, $V_{GS}$ = 0V | N-CH | | | 1.2 | V |
| | | | P-CH | | | -1.2 | |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = $I_S$, $dI_F/dt$ = 100A / μS | N-CH | | 50 | | nS |
| | | | P-CH | | 55 | | |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | N-CH | | 30 | | A |
| | | | P-CH | | -22 | | |
| Reverse Recovery Charge | $Q_{rr}$ | | N-CH | | 2 | | nC |
| | | | P-CH | | 2.1 | | |

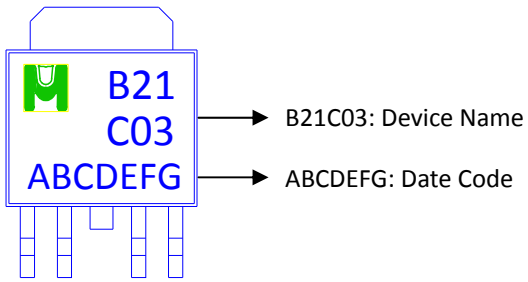
[1]Pulse test : Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%.

[2]Independent of operating temperature.

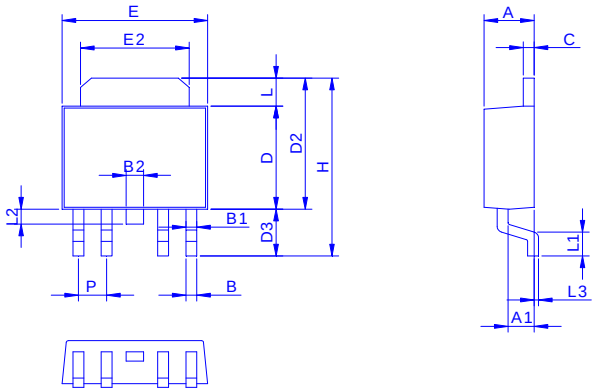
[3]Pulse width limited by maximum junction temperature.

## Ordering & Marking Information:

Device Name: EMB21C03A for DPAK (TO-252)

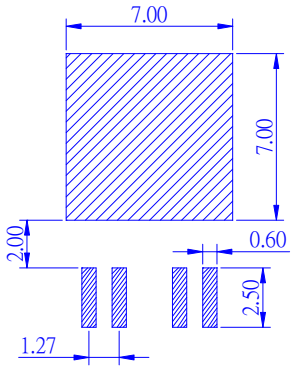



## Outline Drawing

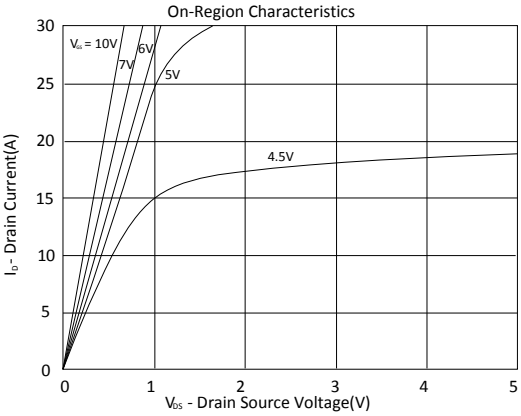


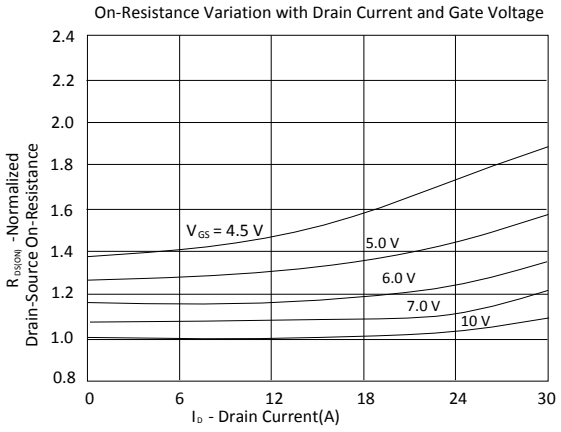

Dimension in mm

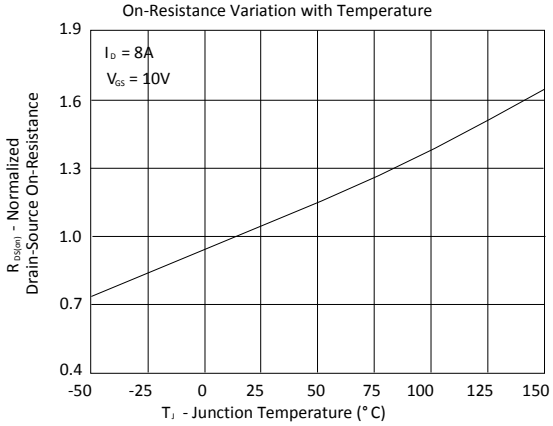
| Dimension | A | A1 | B | B1 | B2 | C | D | D2 | D3 | E | E2 | H | L | L1 | L2 | L3 | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 2.10 | 1.10 | 0.30 | 0.55 | 0.40 | 0.40 | 5.30 | 6.70 | 2.20 | 6.30 | 4.80 | 9.20 | 1.30 | 0.90 | 0.50 | 0.00 | 1.17 |
| Max. | 2.50 | 1.30 | 0.70 | 0.75 | 0.80 | 0.60 | 5.70 | 7.30 | 3.00 | 6.70 | 5.45 | 10.15 | 1.70 | 1.50 | 1.10 | 0.30 | 1.37 |

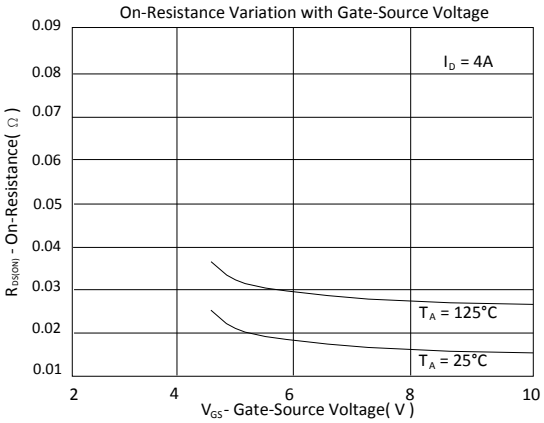


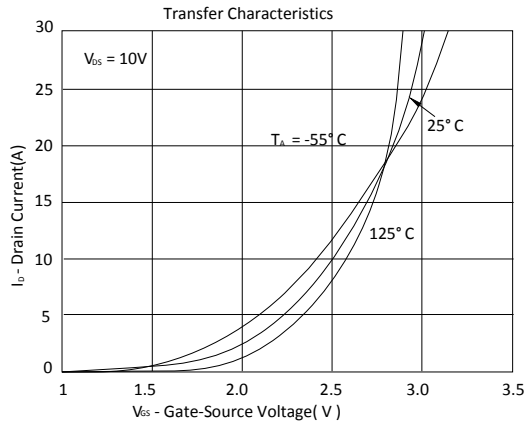
N-Channel

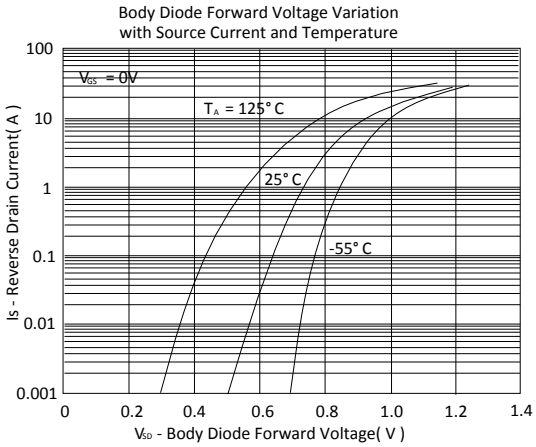

On-Region Characteristics
$V_{GS}$ = 10V
7V
6V
5V
4.5V
$I_D$ - Drain Current(A)
$V_{DS}$ - Drain Source Voltage(V)


On-Resistance Variation with Drain Current and Gate Voltage
$V_{GS}$ = 4.5 V
5.0 V
6.0 V
7.0 V
10 V
$R_{DS(ON)}$ -Normalized
Drain-Source On-Resistance
$I_D$ - Drain Current(A)

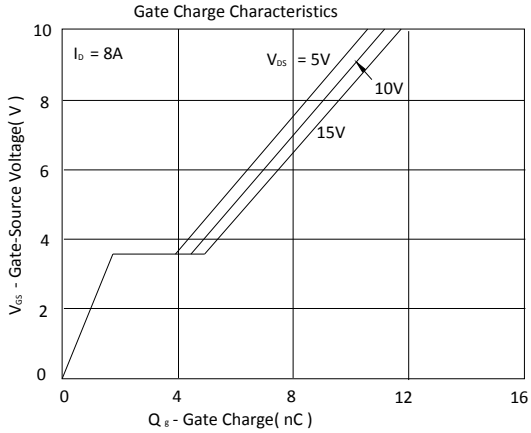

On-Resistance Variation with Temperature
$I_D$ = 8A
$V_{GS}$ = 10V
$R_{DS(on)}$ - Normalized
Drain-Source On-Resistance
$T_J$ - Junction Temperature (°C)


On-Resistance Variation with Gate-Source Voltage
$I_D$ = 4A
$T_A$ = 125°C
$T_A$ = 25°C
$R_{DS(ON)}$ - On-Resistance( Ω )
$V_{GS}$- Gate-Source Voltage( V )

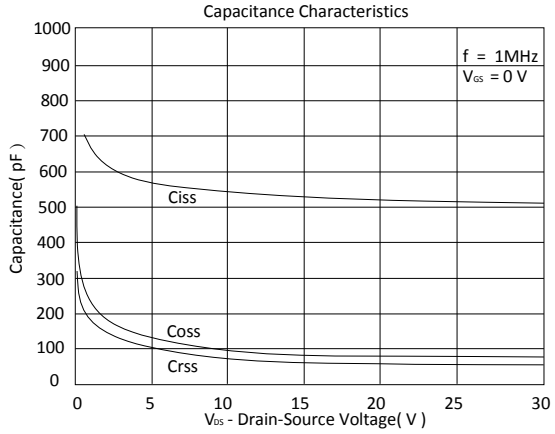

Transfer Characteristics
$V_{DS}$ = 10V
$T_A$ = -55° C
25° C
125° C
$I_D$ - Drain Current(A)
$V_{GS}$ - Gate-Source Voltage( V )


Body Diode Forward Voltage Variation
with Source Current and Temperature
$V_{GS}$ = 0V
$T_A$ = 125° C
25° C
-55° C
Is - Reverse Drain Current( A )
$V_{SD}$ - Body Diode Forward Voltage( V )

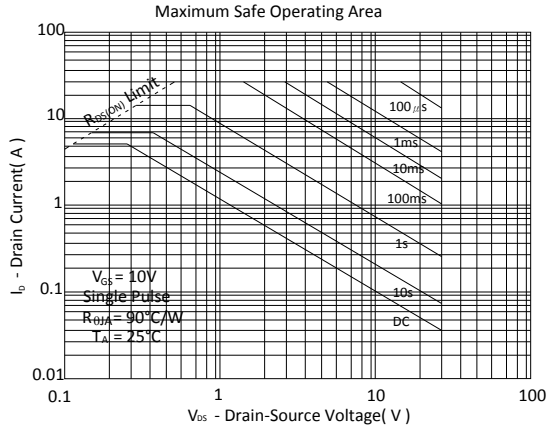
Gate Charge Characteristics



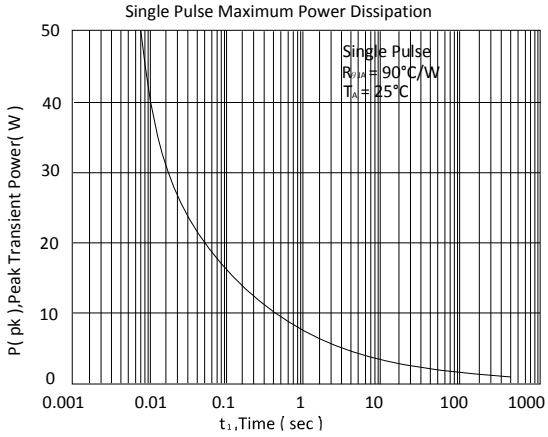

Capacitance Characteristics



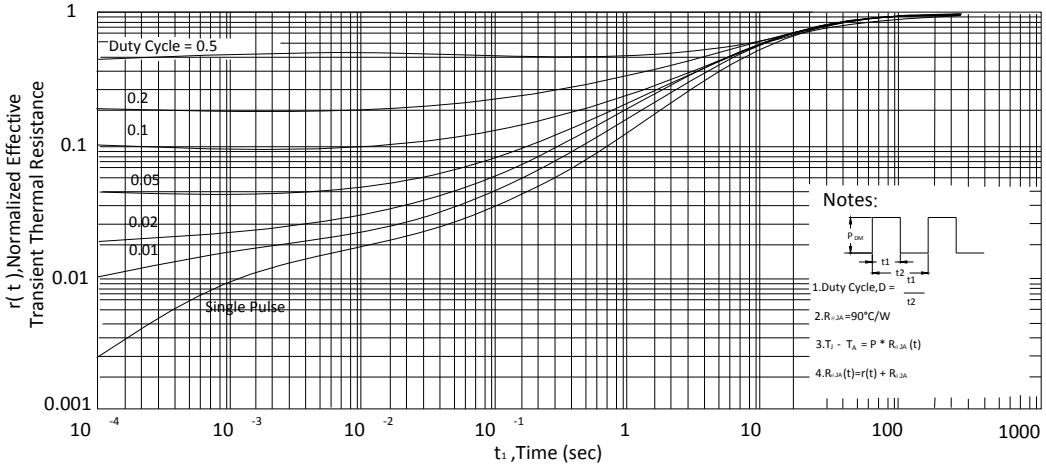

Maximum Safe Operating Area



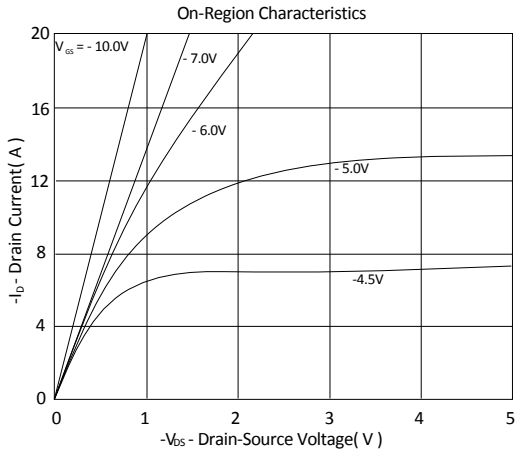

Single Pulse Maximum Power Dissipation

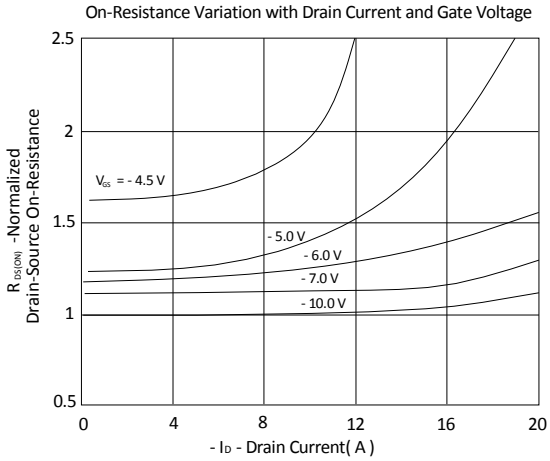


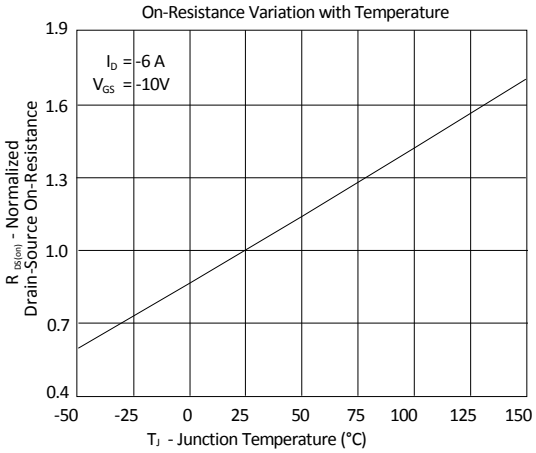

Transient Thermal Response Curve

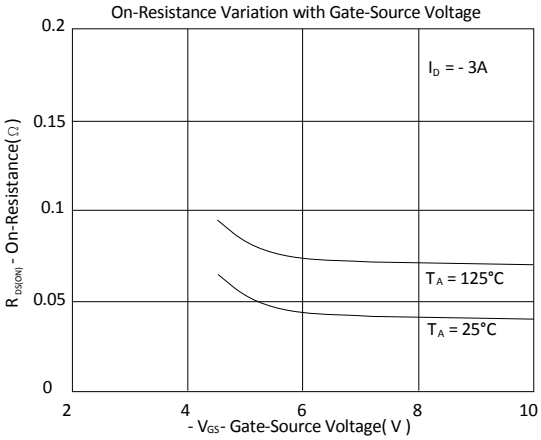


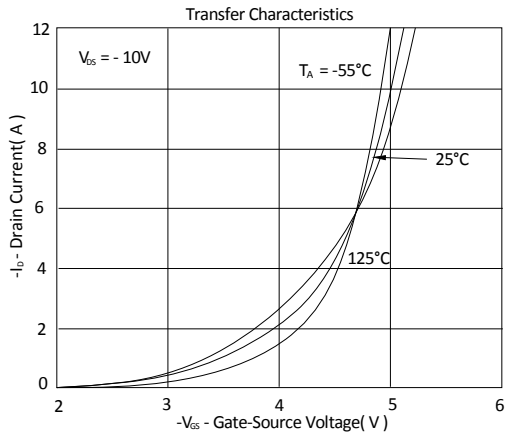
P-Channel

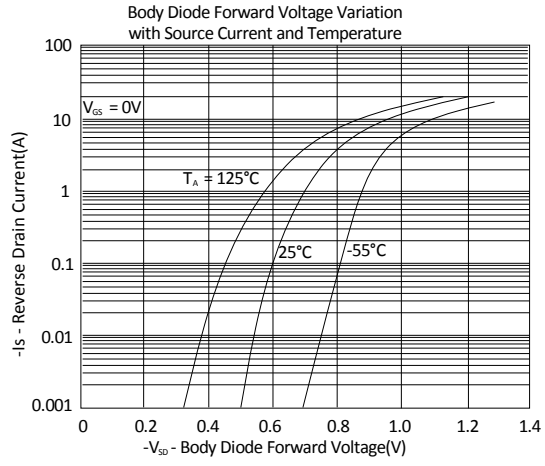

On-Region Characteristics
$V_{GS}$ = - 10.0V
- 7.0V
- 6.0V
- 5.0V
-4.5V
-$I_D$ - Drain Current( A )
-$V_{DS}$ - Drain-Source Voltage( V )

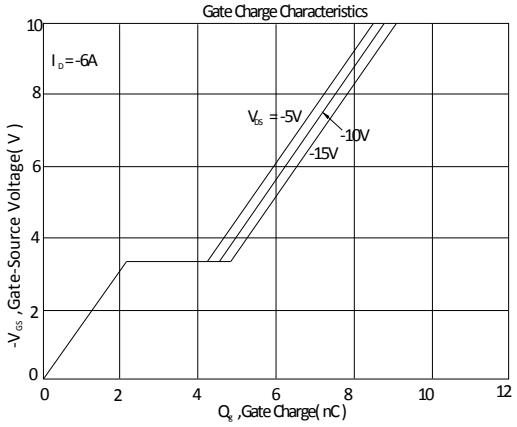

On-Resistance Variation with Drain Current and Gate Voltage
$V_{GS}$ = - 4.5 V
- 5.0 V
- 6.0 V
- 7.0 V
- 10.0 V
$R_{DS(ON)}$ -Normalized
Drain-Source On-Resistance
- $I_D$ - Drain Current( A )

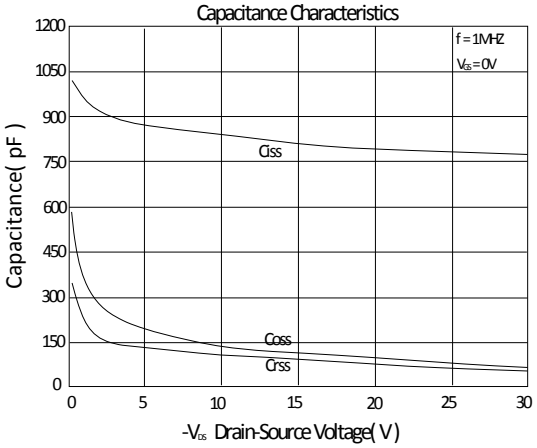

On-Resistance Variation with Temperature
$I_D$ = -6 A
$V_{GS}$ = -10V
$R_{DS(on)}$ - Normalized
Drain-Source On-Resistance
$T_J$ - Junction Temperature (°C)

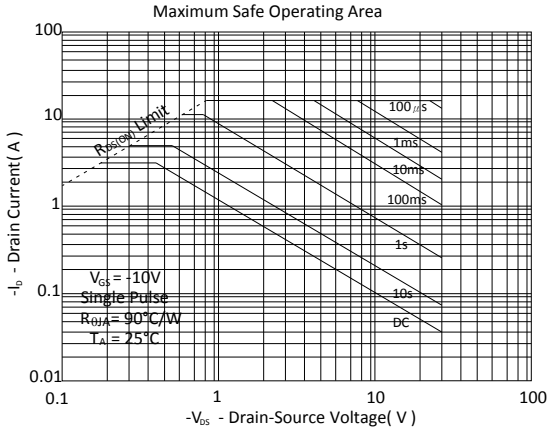

On-Resistance Variation with Gate-Source Voltage
$I_D$ = - 3A
$T_A$ = 125°C
$T_A$ = 25°C
$R_{DS(ON)}$ - On-Resistance(Ω)
- $V_{GS}$ - Gate-Source Voltage( V )

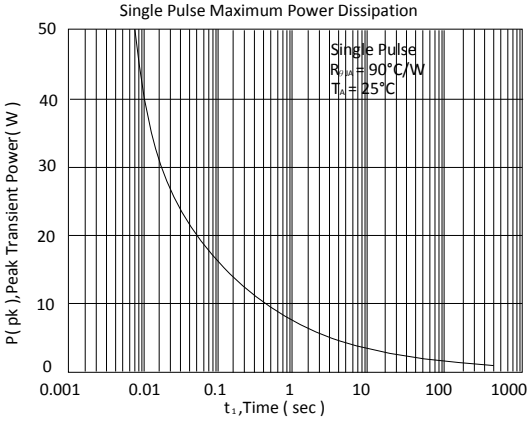

Transfer Characteristics
$V_{DS}$ = - 10V
$T_A$ = -55°C
25°C
125°C
-$I_D$ - Drain Current( A )
-$V_{GS}$ - Gate-Source Voltage( V )

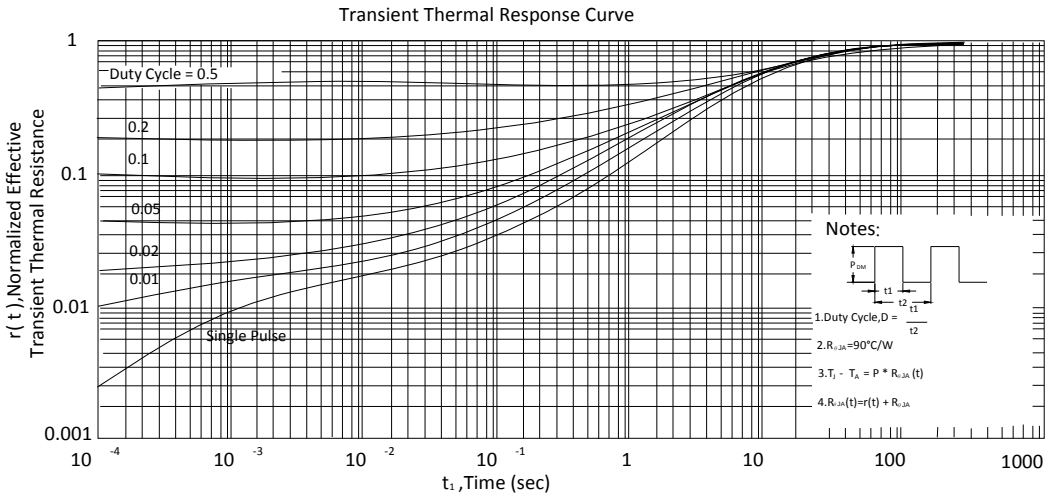

Body Diode Forward Voltage Variation
with Source Current and Temperature
$V_{GS}$ = 0V
$T_A$ = 125°C
25°C
-55°C
-Is - Reverse Drain Current(A)
-$V_{SD}$ - Body Diode Forward Voltage(V)


Gate Charge Characteristics
I D = -6A
VDS = -5V
-10V
-15V
-VGS ,Gate-Source Voltage( V )
Qg ,Gate Charge( nC )


Capacitance Characteristics
f = 1MHZ
VGS = 0V
Ciss
Coss
Crss
Capacitance( pF )
-VDS Drain-Source Voltage( V )


Maximum Safe Operating Area
RDS(ON) Limit
100 μs
1ms
10ms
100ms
1s
10s
DC
VGS = -10V
Single Pulse
RθJA = 90°C/W
TA = 25°C
-ID - Drain Current( A )
-VDS - Drain-Source Voltage( V )


Single Pulse Maximum Power Dissipation
Single Pulse
RθJA = 90°C/W
TA = 25°C
P( pk ),Peak Transient Power( W )
t1 ,Time ( sec )


Transient Thermal Response Curve
Duty Cycle = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Notes:
1.Duty Cycle,D =
2.RθJA=90°C/W
3.TJ - TA = P * RθJA (t)
4.RθJA(t)=r(t) + RθJA
r( t ),Normalized Effective Transient Thermal Resistance
t1 ,Time (sec)