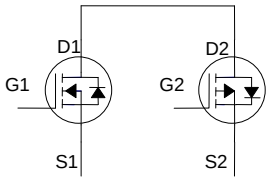
杰力科技股份有限公司
Excelliance MOS Corporation

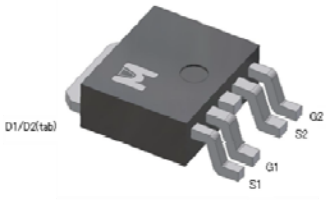
**EMB22C04A**

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

Product Summary:

| | N-CH | P-CH |
|---|---|---|
| $BV_{DSS}$ | 40V | -40V |
| $R_{DSON\ (MAX.)}$ | 22mΩ | 42mΩ |
| $I_D$ | 7.5A | -6A |




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 | $I_D$ | 7.5 | -6 | A |
| | $T_C$ = 70 °C | | 6 | -5 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | 30 | -24 | |
| Power Dissipation | $T_C$ = 25 °C | $P_D$ | 21 | | W |
| | $T_C$ = 70 °C | | 13 | | |
| Operating Junction & Storage Temperature Range | | $T_j$, $T_{stg}$ | -55 to 150 | | °C |

**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%

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

| PARAMETER | SYMBOL | TEST CONDITIONS | | LIMITS MIN | LIMITS TYP | LIMITS MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **STATIC** | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | N-CH | 40 | | | V |
| | | $V_{GS}$ = 0V, $I_D$ = -250μA | P-CH | -40 | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | N-CH | 1.5 | 2.0 | 3.0 | |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA | P-CH | -1.5 | -2.0 | -3.0 | |
| 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 | $I_{DSS}$ | $V_{DS}$ = 32V, $V_{GS}$ = 0V | N-CH | | | 1 | μA |
| | | $V_{DS}$ = -32V, $V_{GS}$ = 0V | P-CH | | | -1 | |
| | | $V_{DS}$ = 30V, $V_{GS}$ = 0V, $T_J$ = 125 °C | N-CH | | | 25 | |
| | | $V_{DS}$ = -30V, $V_{GS}$ = 0V, $T_J$ = 125 °C | P-CH | | | -25 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = 5V, $V_{GS}$ = 10V | N-CH | 7.5 | | | A |
| | | $V_{DS}$ = -5V, $V_{GS}$ = -10V | P-CH | -6 | | | |
| Drain-Source On-State Resistance[1] | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 7.5A | N-CH | | 20 | 22 | mΩ |
| | | $V_{GS}$ = -10V, $I_D$ = -6A | P-CH | | 37 | 42 | |
| | | $V_{GS}$ = 4.5V, $I_D$ = 5A | N-CH | | 33 | 40 | |
| | | $V_{GS}$ = -4.5V, $I_D$ = -4A | P-CH | | 70 | 85 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = 5V, $I_D$ = 7.5A | N-CH | | 20 | | S |
| | | $V_{DS}$ = -5V, $I_D$ = -6A | P-CH | | 10 | | |
| **DYNAMIC** | | | | | | | |
| Input Capacitance | $C_{iss}$ | N-CH | N-CH | | 536 | | pF |
| | | $V_{GS}$ = 0V, $V_{DS}$ = 20V, f = 1MHz | P-CH | | 810 | | |
| Output Capacitance | $C_{oss}$ | P-CH | N-CH | | 83 | | |
| | | $V_{GS}$ = 0V, $V_{DS}$ = -20V, f = 1MHz | P-CH | | 94 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | N-CH | | 66 | | |
| | | | P-CH | | 72 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Total Gate Charge[1,2] | $Q_g$ | N-CH<br>$V_{DS}$ = 20V, $V_{GS}$ = 10V,<br>$I_D$ = 7.5A<br>P-CH<br>$V_{DS}$ = -20V, $V_{GS}$ = -10V,<br>$I_D$ = -6A | N-CH | | 14.5 | | nC |
| | | | P-CH | | 15 | | |
| Gate-Source Charge[1,2] | $Q_{gs}$ | | N-CH | | 2.1 | | |
| | | | P-CH | | 2.6 | | |
| Gate-Drain Charge[1,2] | $Q_{gd}$ | | N-CH | | 4.3 | | |
| | | | P-CH | | 3.1 | | |
| Turn-On Delay Time[1,2] | $t_{d(on)}$ | N-CH<br>$V_{DS}$ = 10V,<br>$I_D$ = 1A, $V_{GS}$ = 10V, $R_{GS}$ = 6Ω<br>P-CH<br>$V_{DS}$ = -10V,<br>$I_D$ = -1A, $V_{GS}$ = -10V, $R_{GS}$ = 6Ω | N-CH | | 5 | | nS |
| | | | P-CH | | 12 | | |
| Rise Time[1,2] | $t_r$ | | N-CH | | 10 | | |
| | | | P-CH | | 15 | | |
| Turn-Off Delay Time[1,2] | $t_{d(off)}$ | | N-CH | | 15 | | |
| | | | P-CH | | 25 | | |
| Fall Time[1,2] | $t_f$ | | N-CH | | 12 | | |
| | | | P-CH | | 15 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C$ = 25 °C)** | | | | | | | |
| Continuous Current | $I_S$ | | N-CH | | | 7.5 | A |
| | | | P-CH | | | -6 | |
| Pulsed Current[3] | $I_{SM}$ | | N-CH | | | 20 | |
| | | | P-CH | | | -20 | |
| Forward Voltage[1] | $V_{SD}$ | $I_F$ = $I_S$, $V_{GS}$ = 0V | N-CH | | | 1.3 | V |
| | | | P-CH | | | -1.3 | |

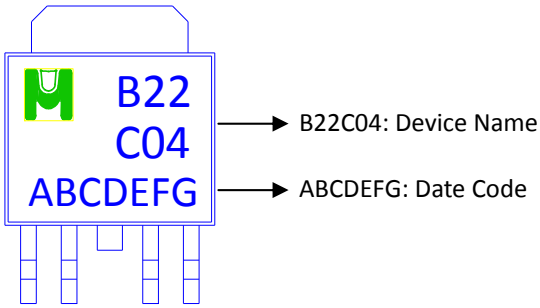
[1]Pulse test : Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%.

[2]Independent of operating temperature.

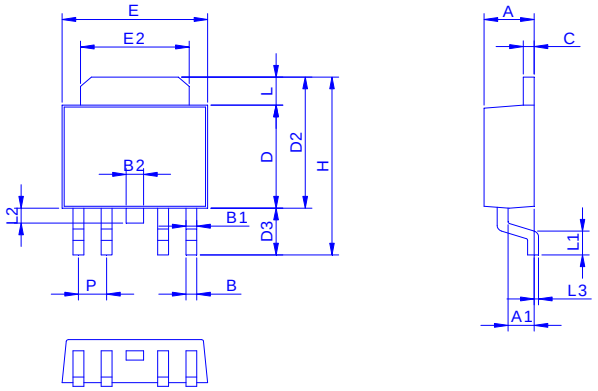
[3]Pulse width limited by maximum junction temperature.

## Ordering & Marking Information:

Device Name: EMB22C04A for DPAK (TO-252)

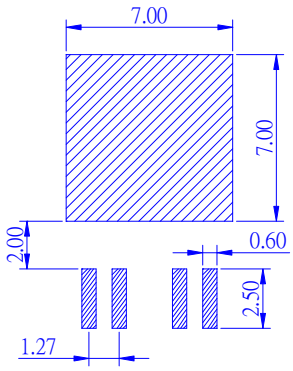



## Outline Drawing

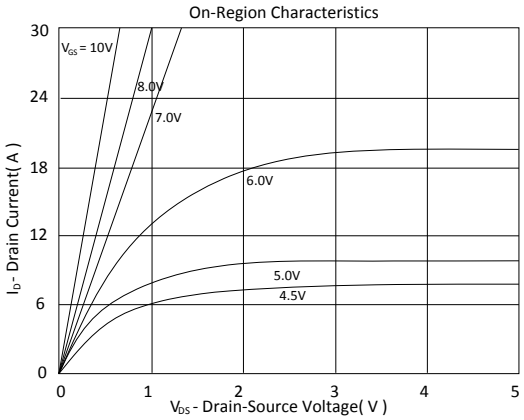


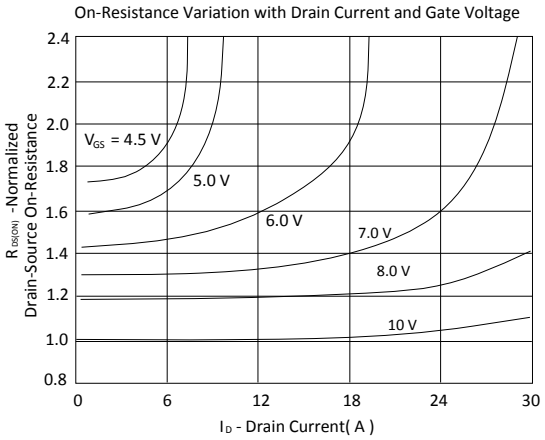

Dimension in mm

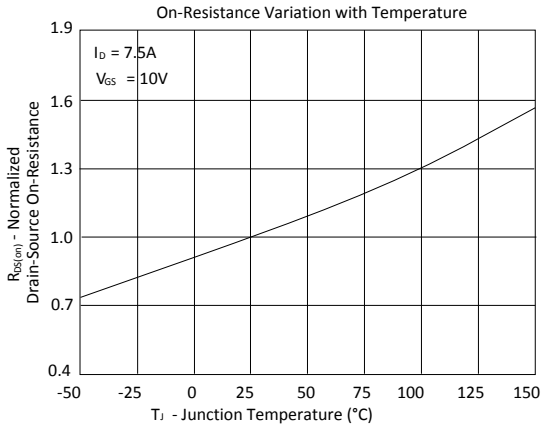
| Dimension | A | A1 | B | B1 | B2 | C | D | D2 | D3 | E | E2 | H | L | L1 | L2 | L3 | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 2.10 | 1.10 | 0.30 | 0.55 | 0.40 | 0.40 | 5.30 | 6.70 | 2.20 | 6.30 | 4.80 | 9.20 | 1.30 | 0.90 | 0.50 | 0.00 | 1.17 |
| Max. | 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 |

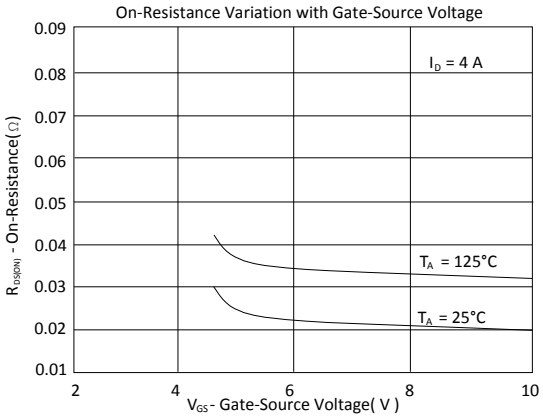


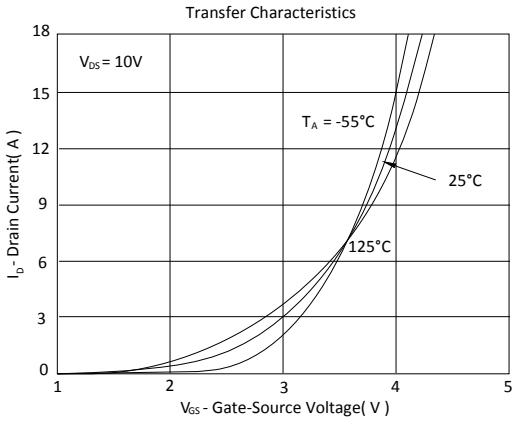
N-Channel

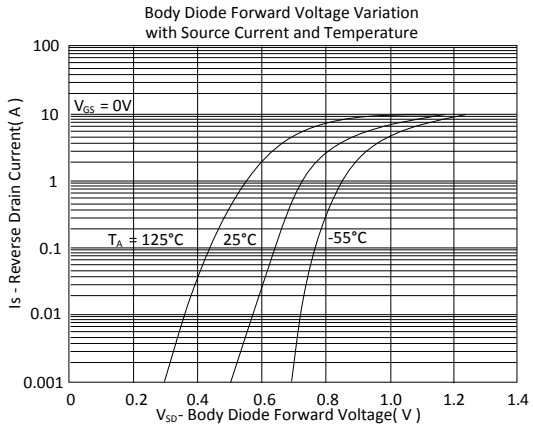

On-Region Characteristics
$V_{GS}$ = 10V
8.0V
7.0V
6.0V
5.0V
4.5V
$I_D$ - Drain Current( A )
$V_{DS}$ - Drain-Source Voltage( V )

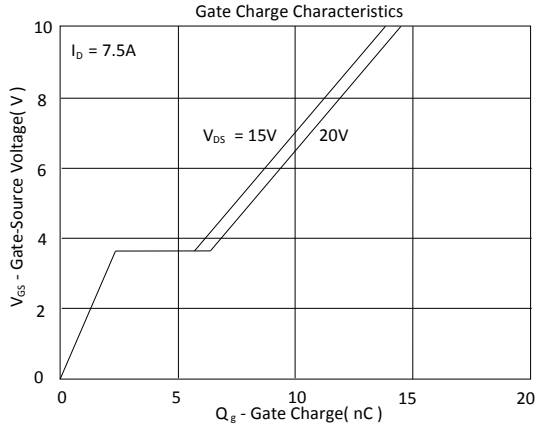

On-Resistance Variation with Drain Current and Gate Voltage
$V_{GS}$ = 4.5 V
5.0 V
6.0 V
7.0 V
8.0 V
10 V
$R_{DS(ON)}$ -Normalized
Drain-Source On-Resistance
$I_D$ - Drain Current( A )

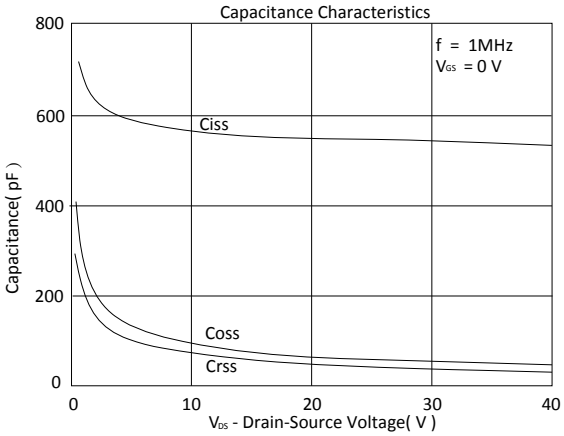

On-Resistance Variation with Temperature
$I_D$ = 7.5A
$V_{GS}$ = 10V
$R_{DS(on)}$ - Normalized
Drain-Source On-Resistance
$T_J$ - Junction Temperature (°C)

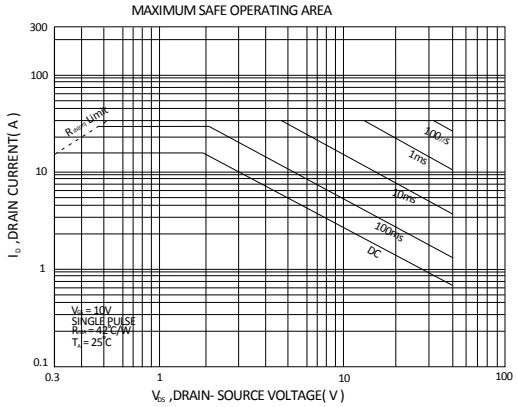

On-Resistance Variation with Gate-Source Voltage
$I_D$ = 4 A
$T_A$ = 125°C
$T_A$ = 25°C
$R_{DS(ON)}$ - On-Resistance(Ω)
$V_{GS}$ - Gate-Source Voltage( V )

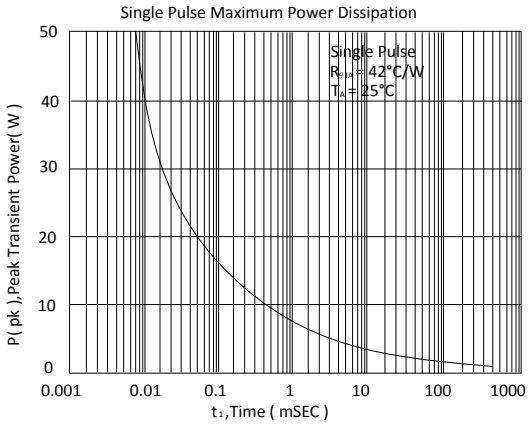

Transfer Characteristics
$V_{DS}$ = 10V
$T_A$ = -55°C
25°C
125°C
$I_D$ - Drain Current( A )
$V_{GS}$ - Gate-Source Voltage( V )

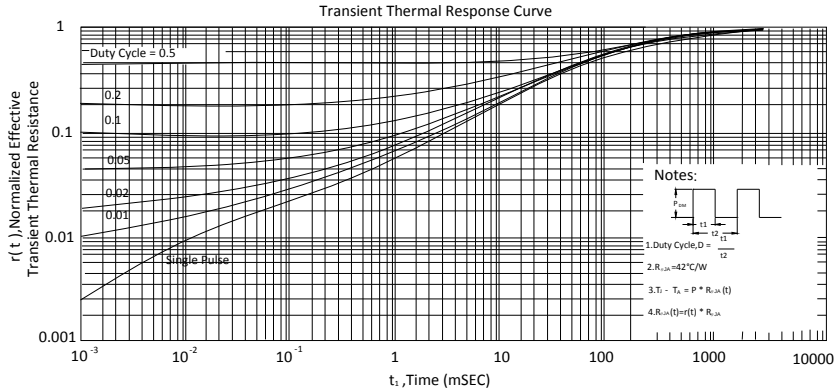

Body Diode Forward Voltage Variation
with Source Current and Temperature
$V_{GS}$ = 0V
$T_A$ = 125°C
25°C
-55°C
Is - Reverse Drain Current( A )
$V_{SD}$ - Body Diode Forward Voltage( V )


Gate Charge Characteristics
$I_D$ = 7.5A
$V_{DS}$ = 15V
20V
$V_{GS}$ - Gate-Source Voltage( V )
$Q_g$ - Gate Charge( nC )

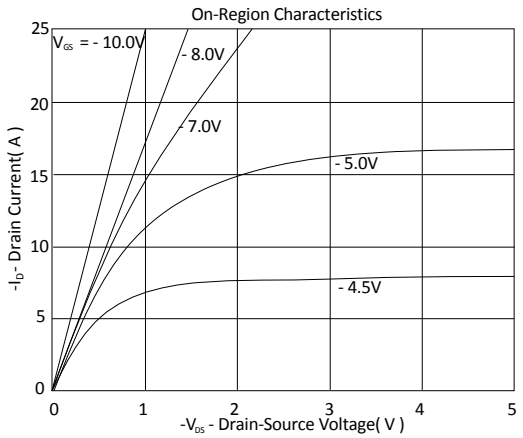

Capacitance Characteristics
f = 1MHz
$V_{GS}$ = 0 V
Ciss
Coss
Crss
Capacitance( pF )
$V_{DS}$ - Drain-Source Voltage( V )

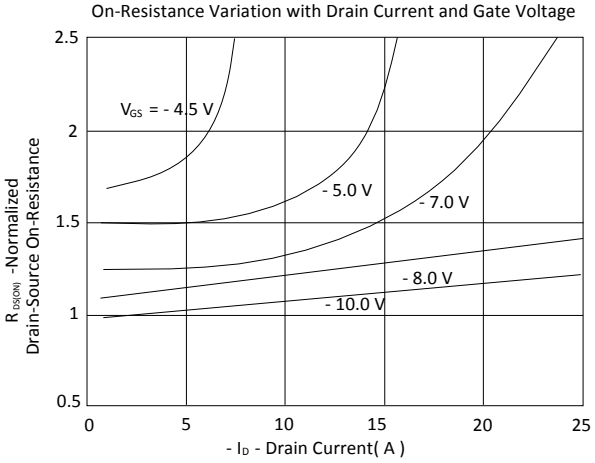

MAXIMUM SAFE OPERATING AREA
$R_{DS(on)}$ Limit
100μs
1ms
10ms
100ms
DC
$V_{GS}$ = 10V
SINGLE PULSE
$R_{\theta JA}$ = 42°C/W
$T_A$ = 25°C
$I_D$ ,DRAIN CURRENT( A )
$V_{DS}$ ,DRAIN- SOURCE VOLTAGE( V )

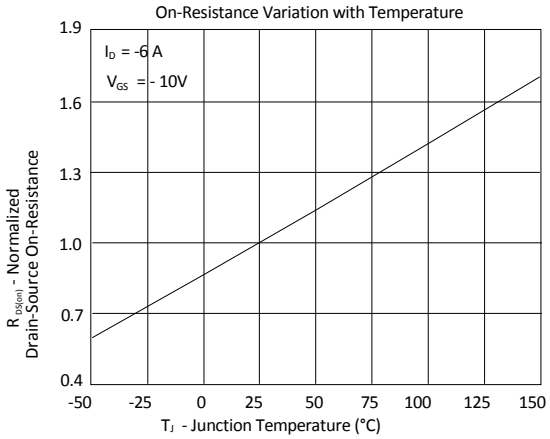

Single Pulse Maximum Power Dissipation
Single Pulse
$R_{\theta JA}$ = 42°C/W
$T_A$ = 25°C
P( pk ),Peak Transient Power( W )
$t_1$ ,Time ( mSEC )

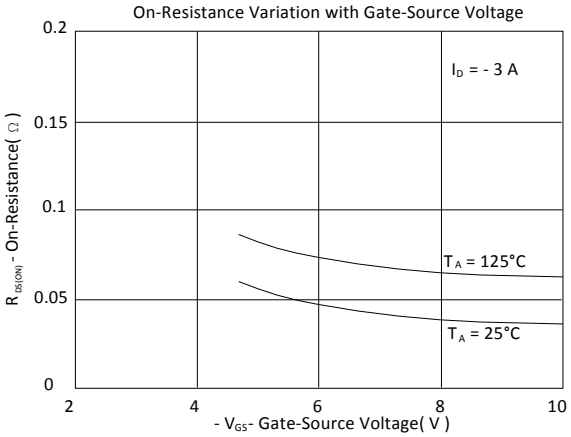

Transient Thermal Response Curve
Duty Cycle = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Notes:
1.Duty Cycle,D =
2.$R_{\theta JA}$=42°C/W
3.$T_J$ - $T_A$ = P * $R_{\theta JA}$ (t)
4.$R_{\theta JA}$(t)=r(t) * $R_{\theta JA}$
r( t ),Normalized Effective Transient Thermal Resistance
$t_1$ ,Time (mSEC)

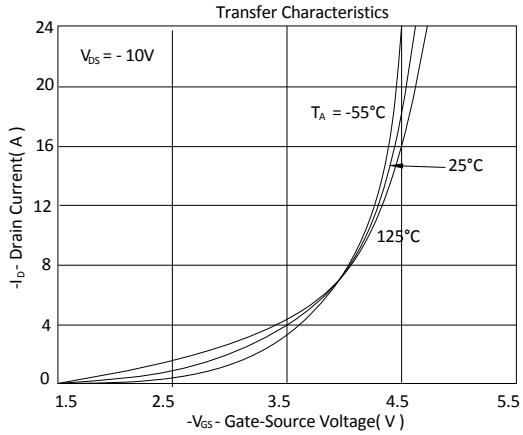
P-Channel

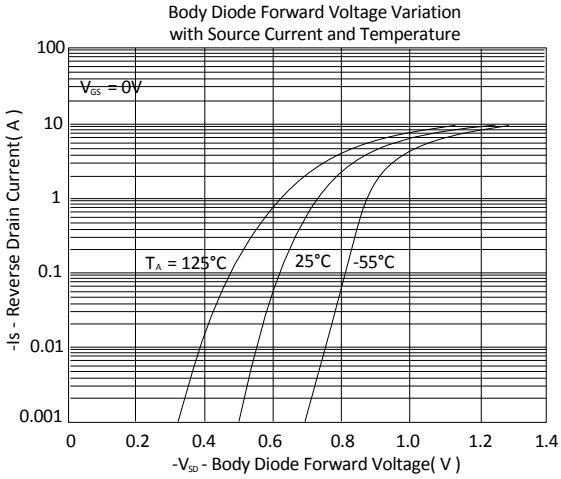

On-Region Characteristics
$V_{GS}$ = - 10.0V
- 8.0V
- 7.0V
- 5.0V
- 4.5V
$-I_D$- Drain Current( A )
$-V_{DS}$ - Drain-Source Voltage( V )

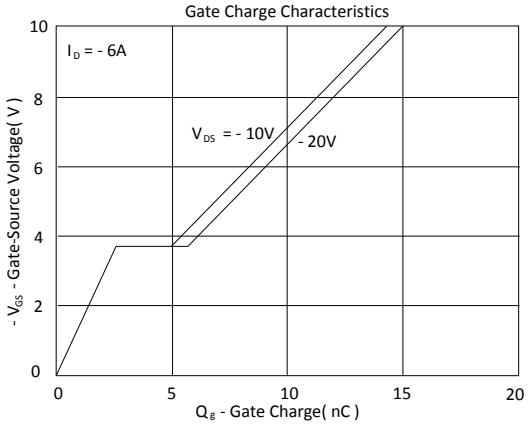

On-Resistance Variation with Drain Current and Gate Voltage
$V_{GS}$ = - 4.5 V
- 5.0 V
- 7.0 V
- 8.0 V
- 10.0 V
$R_{DS(ON)}$ -Normalized
Drain-Source On-Resistance
- $I_D$ - Drain Current( A )

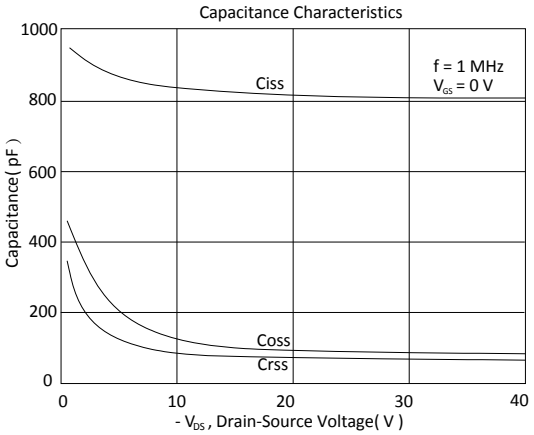

On-Resistance Variation with Temperature
$I_D$ = -6 A
$V_{GS}$ = - 10V
$R_{DS(ON)}$ - Normalized
Drain-Source On-Resistance
$T_J$ - Junction Temperature (°C)

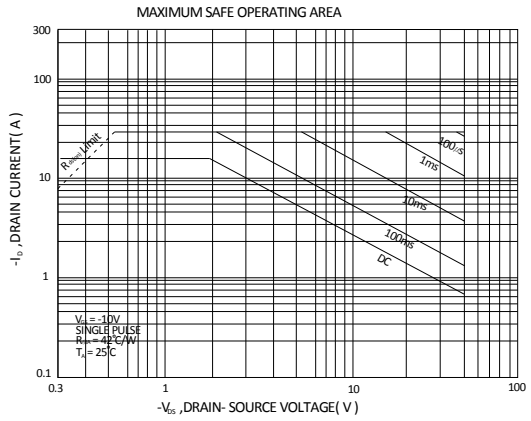

On-Resistance Variation with Gate-Source Voltage
$I_D$ = - 3 A
$T_A$ = 125°C
$T_A$ = 25°C
$R_{DS(ON)}$ - On-Resistance( Ω )
- $V_{GS}$- Gate-Source Voltage( V )

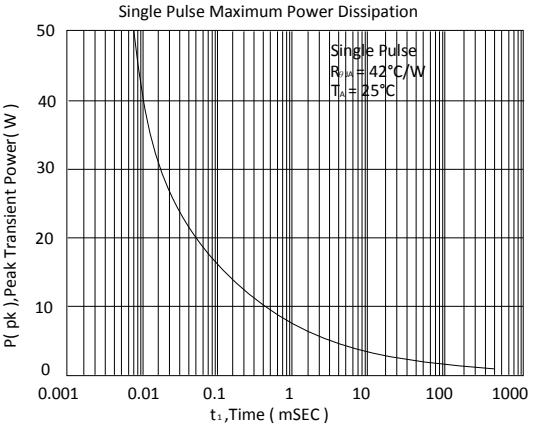

Transfer Characteristics
$V_{DS}$ = - 10V
$T_A$ = -55°C
25°C
125°C
$-I_D$- Drain Current( A )
$-V_{GS}$ - Gate-Source Voltage( V )

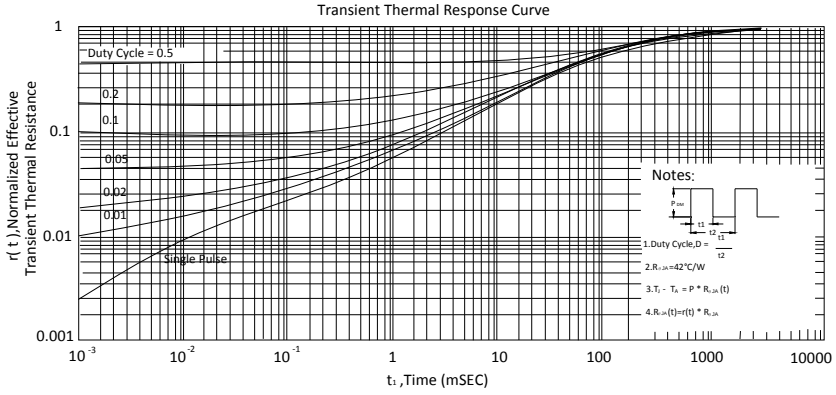

Body Diode Forward Voltage Variation
with Source Current and Temperature
$V_{GS}$ = 0V
$T_A$ = 125°C
25°C
-55°C
-Is - Reverse Drain Current( A )
$-V_{SD}$ - Body Diode Forward Voltage( V )


Gate Charge Characteristics
I D = - 6A
V DS = - 10V
- 20V
- V GS - Gate-Source Voltage( V )
Q g - Gate Charge( nC )


Capacitance Characteristics
f = 1 MHz
V GS = 0 V
Ciss
Coss
Crss
Capacitance( pF )
- V DS , Drain-Source Voltage( V )


MAXIMUM SAFE OPERATING AREA
-I D , DRAIN CURRENT( A )
-V DS ,DRAIN- SOURCE VOLTAGE( V )
100μs
1ms
10ms
100ms
DC
V GS = -10V
SINGLE PULSE
R θJA = 42℃/W
T A = 25℃


Single Pulse Maximum Power Dissipation
Single Pulse
R θJA = 42℃/W
T A = 25℃
P( pk ),Peak Transient Power( W )
t 1 ,Time ( mSEC )


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.R θJA=42℃/W
r( t ),Normalized Effective Transient Thermal Resistance
t 1 ,Time (mSEC)