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

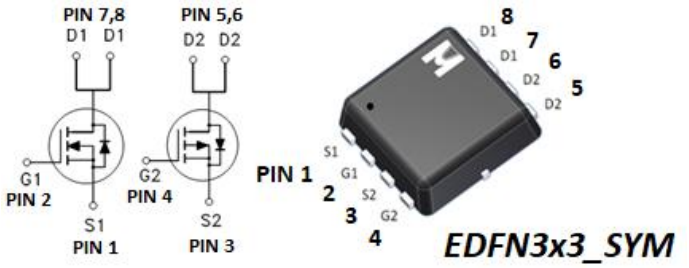
# EMB20C03V

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

**▪Product Summary:**

| | N-CH | P-CH |
|---|---|---|
| BVDSS | 30V | -30V |
| $R_{DSON\ (MAX.)}$@$V_{GS}$=10V | 20mΩ | 20mΩ |
| $R_{DSON\ (MAX.)}$@$V_{GS}$=4.5V | 38mΩ | 35mΩ |
| $I_D$ @$T_C$=25°C | 22A | -25A |
| $I_D$ @$T_A$=25°C | 10A | -10A |

**▪ Pin Description:**




N + P Channel MOSFET
UIS, Rg 100% Tested
Pb-Free Lead Plating & Halogen Free

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

| PARAMETERS/TEST CONDITIONS | | SYMBOL | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | N-CH | P-CH | |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current | $T_C$ = 25 °C | $I_D$ | 22 | -25 | A |
| | $T_C$ = 100 °C | | 13 | -16 | |
| Continuous Drain Current | $T_A$ = 25 °C | $I_D$ | 10 | -10 | |
| | $T_A$ = 70 °C | | 7 | -7 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | 42.5 | -51 | |
| Avalanche Current | | $I_{AS}$ | 19 | -40 | |
| Avalanche Energy | L = 0.1mH | EAS | 18 | 80 | mJ |
| Repetitive Avalanche Energy[2] | L = 0.05mH | EAR | 9 | 40 | |
| Power Dissipation | $T_C$ = 25 °C | $P_D$ | 15.6 | 20.8 | W |
| | $T_C$ = 100 °C | | 6.3 | 8.3 | |
| Power Dissipation | $T_A$ = 25 °C | $P_D$ | 3.1 | 3.1 | W |
| | $T_A$ = 70 °C | | 2 | 2 | |
| Operating Junction & Storage Temperature Range | | $T_j$, $T_{stg}$ | -55 to 150 | | °C |

▪ 100% UIS testing in condition of VD=25V, L=0.1mH, VG=10V, IL=12A, Rated VDS=30V N-CH
▪ 100% UIS testing in condition of VD=25V, L=0.1mH, VG=10V, IL=24A, Rated VDS=30V P-CH

**▪THERMAL RESISTANCE RATINGS**

| THERMAL RESISTANCE | SYMBOL | TYPICAL | MAXIMUM | | UNIT |
|---|---|---|---|---|---|
| | | | N-CH | P-CH | |
| Junction-to-Case | $R_{\theta JC}$ | | 8 | 6 | °C/W |
| Junction-to-Ambient[3] | $R_{\theta JA}$ | | 40 | 40 | |

[1]Pulse width limited by maximum junction temperature.
[2]Duty cycle < 1%
[3]40°C / W when mounted on a 1 in$^2$ pad of 2 oz copper.
[4]Guarantee by Engineering test

▪ **N-CH_ELECTRICAL CHARACTERISTICS ($T_J$ = 25 °C, Unless Otherwise Noted)**

| PARAMETER | SYMBOL | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| **STATIC** | | | | | | |
| Drain-Source Breakdown Voltage[4] | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250uA | 30 | | | V |
| Gate Threshold Voltage[4] | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250uA | 1.2 | 1.7 | 2.5 | |
| Gate-Body Leakage[4] | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | | | ±100 | nA |
| Zero Gate Voltage Drain Current[4] | $I_{DSS}$ | $V_{DS}$ = 24V, $V_{GS}$ = 0V | | | 1 | uA |
| | | $V_{DS}$ =20V, $V_{GS}$ =0V, $T_J$ = 125 °C | | | 25 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = 10V, $V_{GS}$ = 10V | 22 | | | A |
| Drain-Source On-State Resistance[1,4] | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 8A | | 17.8 | 20 | mΩ |
| | | $V_{GS}$ = 4.5V, $I_D$ = 6A | | 26.7 | 38 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = 5V, $I_D$ = 8A | | 13 | | S |
| DYNAMIC | | | | | | |
| Input Capacitance[5] | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 15V, f = 1MHz | | 520 | | pF |
| Output Capacitance[5] | $C_{oss}$ | | | 96 | | |
| Reverse Transfer Capacitance[5] | $C_{rss}$ | | | 73 | | |
| Gate Resistance[4,5] | $R_g$ | f = 1MHz | | 1.4 | | Ω |
| Total Gate Charge[1,2,5] | $Q_g$($V_{GS}$=10V) | $V_{DS}$ = 15V, $V_{GS}$ = 10V, $I_D$ = 20A | | 12 | | nC |
| | $Q_g$($V_{GS}$=4.5V) | | | 5 | | |
| Gate-Source Charge[1,2,5] | $Q_{gs}$ | | | 2.3 | | |
| Gate-Drain Charge[1,2,5] | $Q_{gd}$ | | | 5.1 | | |
| Turn-On Delay Time[1,2,5] | $t_{d(on)}$ | $V_{DS}$ = 15V, $V_{GS}$ = 10V, $I_D$ = 5A , Rg = 3Ω | | 5.3 | | nS |
| Rise Time[1,2,5] | $t_r$ | | | 9.1 | | |
| Turn-Off Delay Time[1,2,5] | $t_{d(off)}$ | | | 13.2 | | |
| Fall Time[1,2,5] | $t_f$ | | | 1.8 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Continuous Current | $I_S$ | | | | 22 | A |
| Pulsed Current[3] | $I_{SM}$ | | | | 42.5 | |
| Forward Voltage[1,4] | $V_{SD}$ | $I_F$ = $I_S$, $V_{GS}$ = 0V | | | 1.3 | V |
| Reverse Recovery Time[5] | $t_{rr}$ | $I_F$ = $I_S$, $dI_F/dt$ = 100A / uS | | 17.1 | | nS |
| Peak Reverse Recovery Current[5] | $I_{RM(REC)}$ | | | 0.46 | | A |
| Reverse Recovery Charge[5] | $Q_{rr}$ | | | 11.9 | | nC |

[1]Pulse test : Pulse Width ≦ 300 usec, Duty Cycle ≦ 2%.

[2]Independent of operating temperature.

[3]Pulse width limited by maximum junction temperature.

[4]Guarantee by FT test Item

[5]Guarantee by Engineering test

**EMC will review datasheet by quarter, and update new version.**

▪ N-CH_TYPICAL CHARACTERISTICS

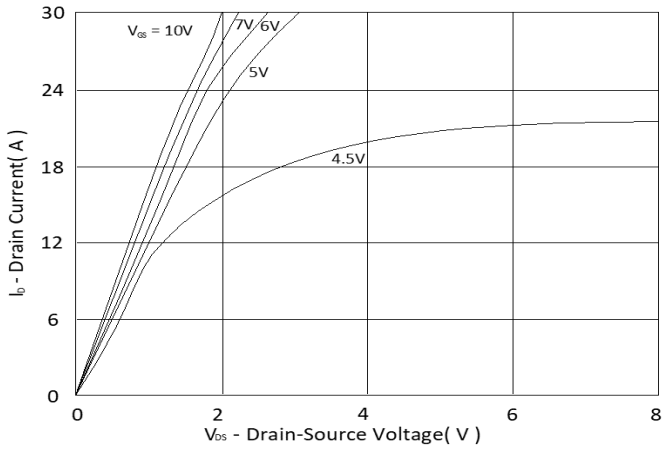



**Fig.1 Typical Output Characteristics**

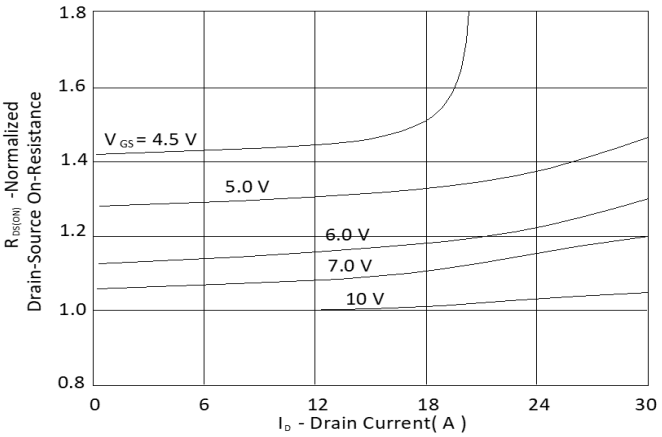



**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**

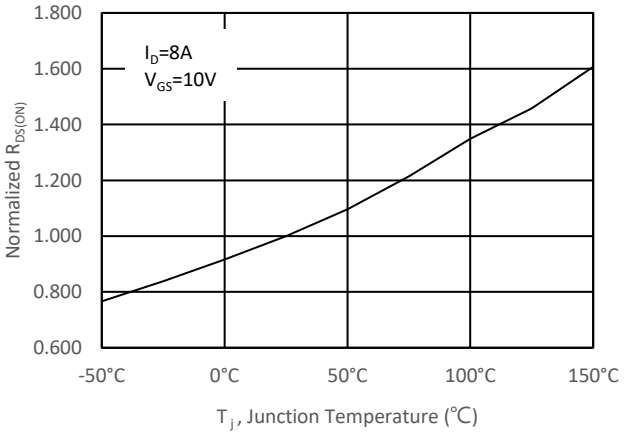



**Fig.3 Normalized On-Resistance v.s. Junction Temperature**

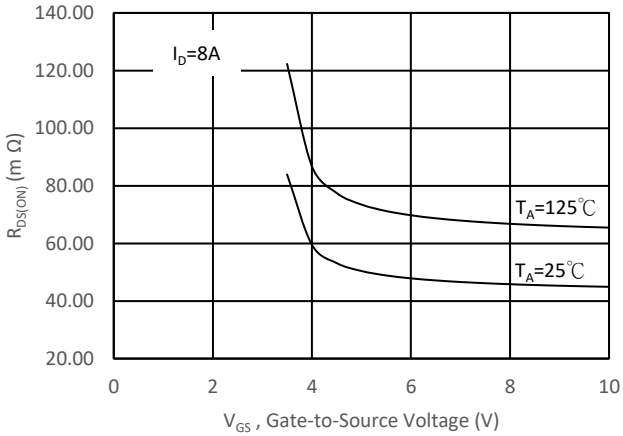



**Fig.4 On-Resistance v.s. Gate Voltage**

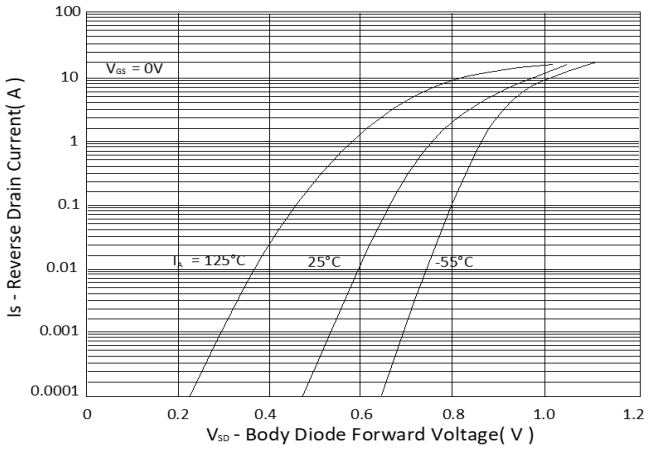



**Fig.5 Forward Characteristic of Reverse Diode**

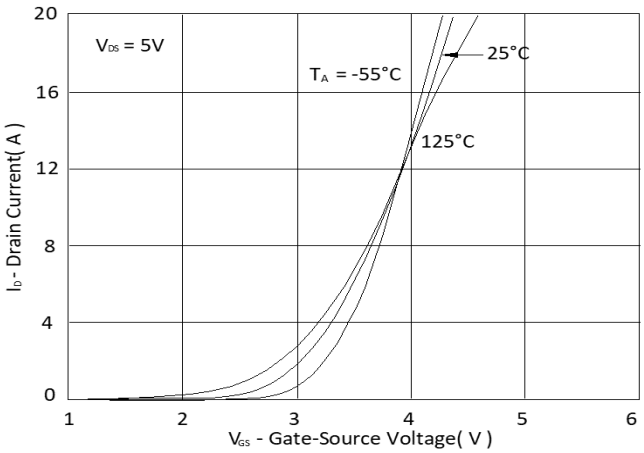



**Fig.6 Transfer Characteristics**

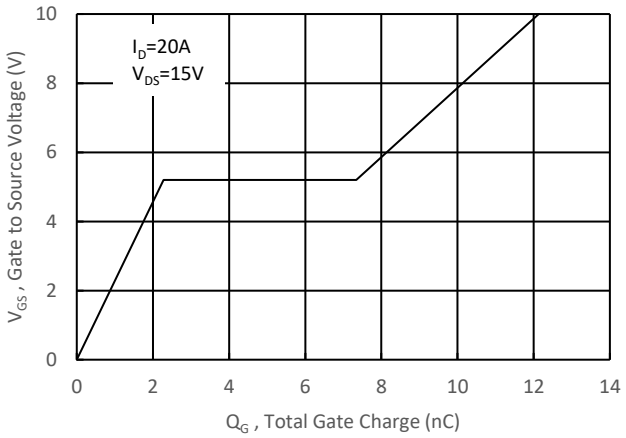



**Fig.7 Gate Charge Characteristics**

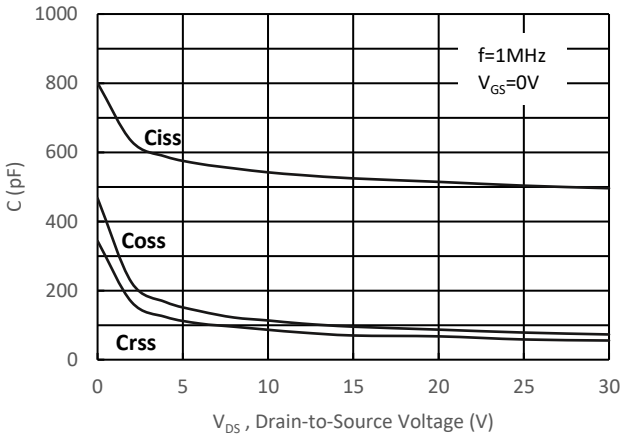



**Fig.8 Typical Capacitance Characteristics**

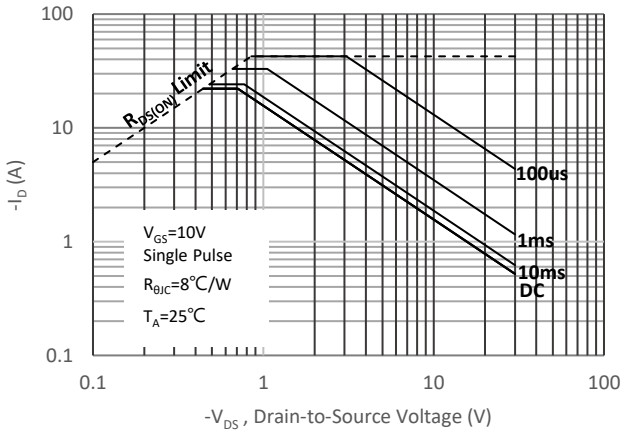



**Fig 9. Maximum Safe Operating Area**

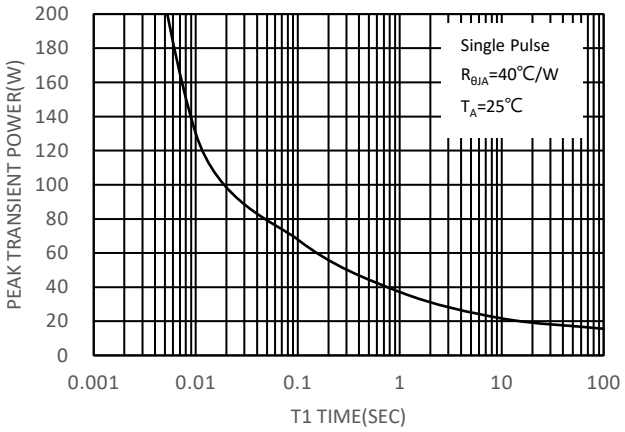



**Fig 10. Single Pulse Maximum Power Dissipation**

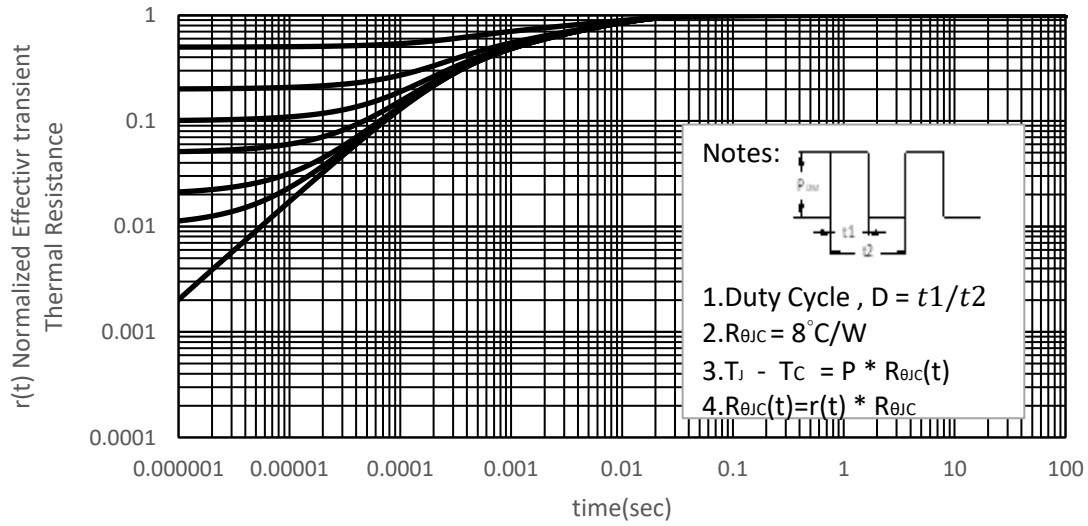



**Fig 11. Effective Transient Thermal Impedance**

▪ **P-CH_ELECTRICAL CHARACTERISTICS ($T_J$ = 25 °C, Unless Otherwise Noted)**

| PARAMETER | SYMBOL | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| **STATIC** | | | | | | |
| Drain-Source Breakdown Voltage[4] | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = -250uA | -30 | | | V |
| Gate Threshold Voltage[4] | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = -250uA | -1 | -1.7 | -3 | |
| Gate-Body Leakage[4] | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | | | ±100 | nA |
| Zero Gate Voltage Drain Current[4] | $I_{DSS}$ | $V_{DS}$ = -24V, $V_{GS}$ = 0V | | | -1 | uA |
| | | $V_{DS}$ =-20V, $V_{GS}$ =0V, $T_J$ = 125 °C | | | -25 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = -10V, $V_{GS}$ = -10V | -25 | | | A |
| Drain-Source On-State Resistance[1,4] | $R_{DS(ON)}$ | $V_{GS}$ = -10V, $I_D$ = -10A | | 14.7 | 20 | mΩ |
| | | $V_{GS}$ = -4.5V, $I_D$ = -7A | | 20.6 | 35 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = -5V, $I_D$ = -8A | | 9 | | S |
| DYNAMIC | | | | | | |
| Input Capacitance[5] | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = -15V, f = 1MHz | | 1280 | | pF |
| Output Capacitance[5] | $C_{oss}$ | | | 211 | | |
| Reverse Transfer Capacitance[5] | $C_{rss}$ | | | 164 | | |
| Gate Resistance[4,5] | $R_g$ | f = 1MHz | | 6.15 | | Ω |
| Total Gate Charge[1,2,5] | $Q_g$($V_{GS}$=10V) | $V_{DS}$ = -15V, $V_{GS}$ = -10V, $I_D$ = -20A | | 25 | | nC |
| | $Q_g$($V_{GS}$=4.5V) | | | 12 | | |
| Gate-Source Charge[1,2,5] | $Q_{gs}$ | | | 5.2 | | |
| Gate-Drain Charge[1,2,5] | $Q_{gd}$ | | | 5.3 | | |
| Turn-On Delay Time[1,2,5] | $t_{d(on)}$ | $V_{DS}$ = -15V, $V_{GS}$ = -10V, $I_D$ = -5A , Rg = 3Ω | | 6 | | nS |
| Rise Time[1,2,5] | $t_r$ | | | 11.4 | | |
| Turn-Off Delay Time[1,2,5] | $t_{d(off)}$ | | | 41.7 | | |
| Fall Time[1,2,5] | $t_f$ | | | 35 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Continuous Current | $I_S$ | | | | -25 | A |
| Pulsed Current[3] | $I_{SM}$ | | | | -51 | |
| Forward Voltage[1,4] | $V_{SD}$ | $I_F$ = $I_S$, $V_{GS}$ = 0V | | | -1.3 | V |
| Reverse Recovery Time[5] | $t_{rr}$ | $I_F$ = $I_S$, $dI_F/dt$ = 100A / uS | | 18.8 | | nS |
| Peak Reverse Recovery Current[5] | $I_{RM(REC)}$ | | | 0.49 | | A |
| Reverse Recovery Charge[5] | $Q_{rr}$ | | | 12.4 | | nC |

[1]Pulse test : Pulse Width ≦ 300 usec, Duty Cycle ≦ 2%.

[2]Independent of operating temperature.

[3]Pulse width limited by maximum junction temperature.

[4]Guarantee by FT test Item

[5]Guarantee by Engineering test

**EMC will review datasheet by quarter, and update new version.**

▪ P-CH_TYPICAL CHARACTERISTICS

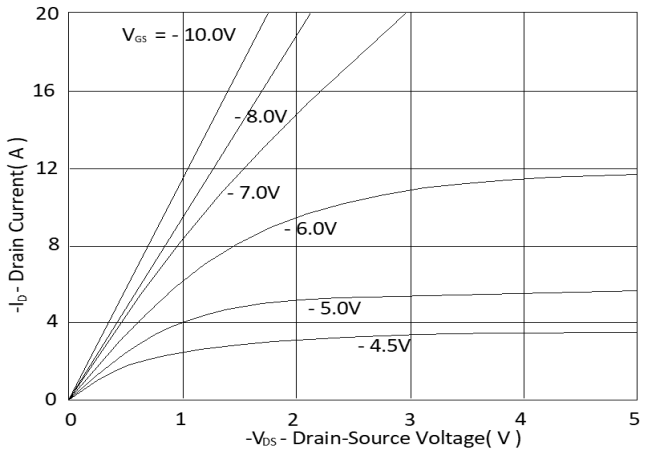



**Fig.1 Typical Output Characteristics**

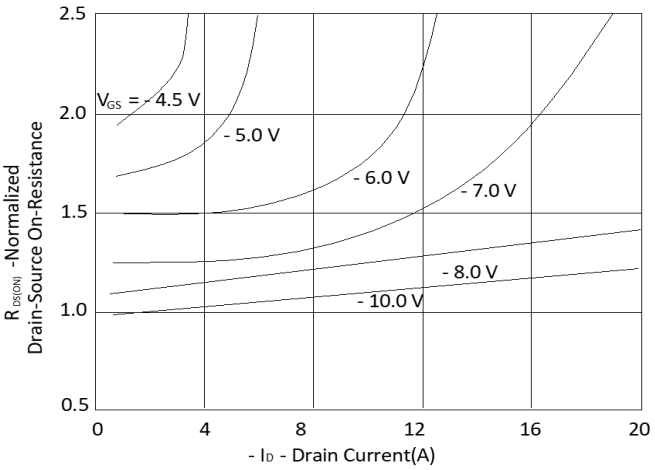



**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**

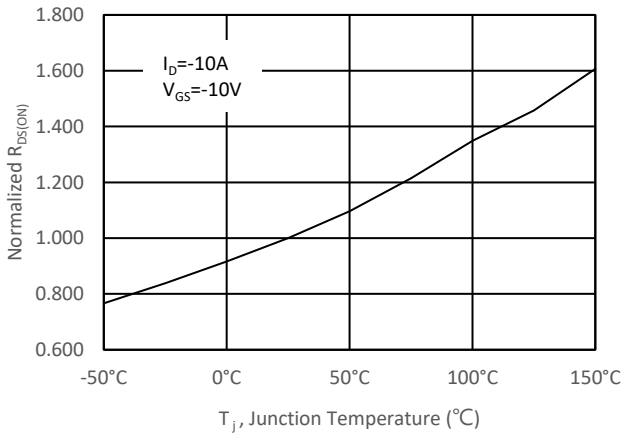



**Fig.3 Normalized On-Resistance v.s. Junction Temperature**

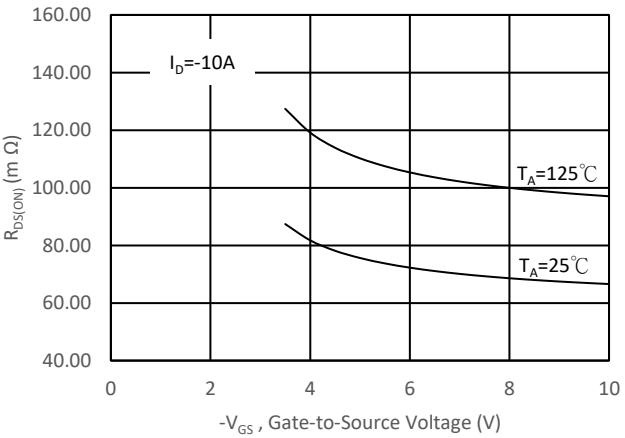



**Fig.4 On-Resistance v.s. Gate Voltage**

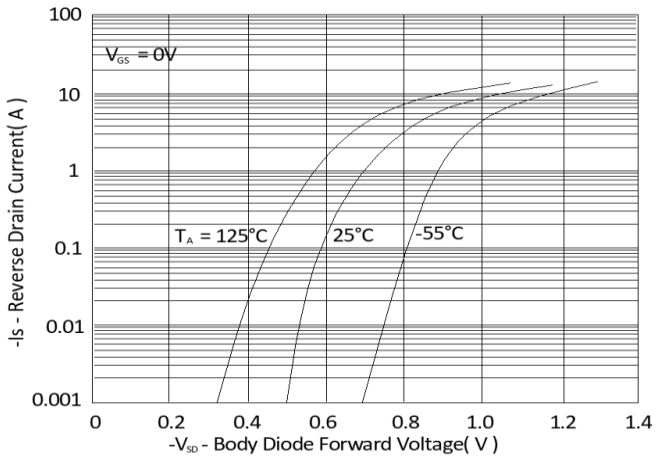



**Fig.5 Forward Characteristic of Reverse Diode**

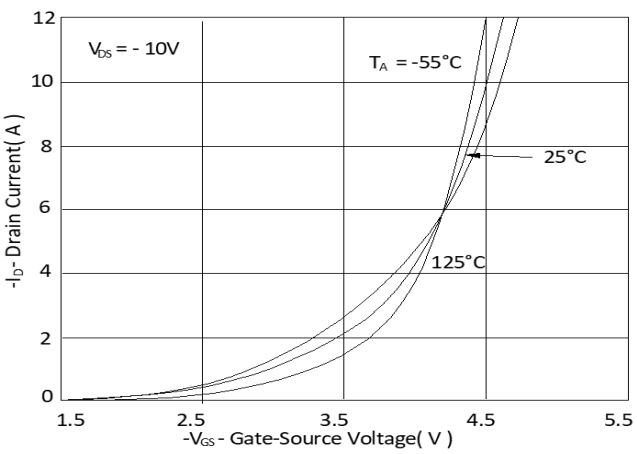



**Fig.6 Transfer Characteristics**

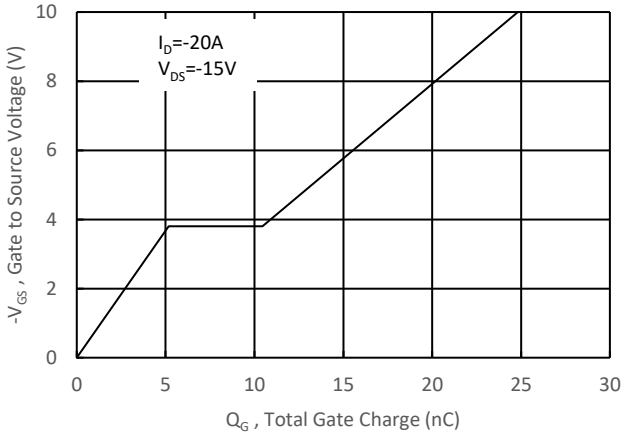



**Fig.7 Gate Charge Characteristics**

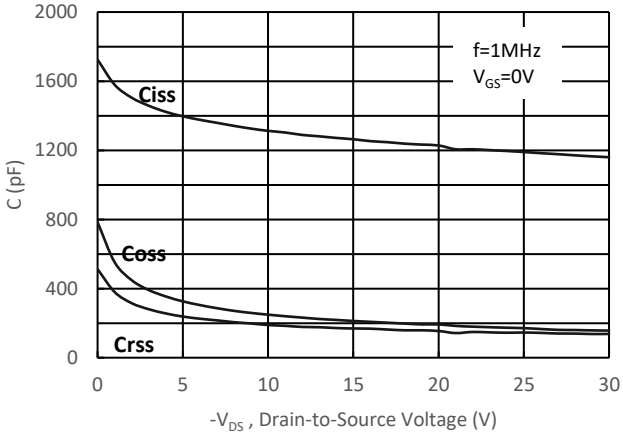



**Fig.8 Typical Capacitance Characteristics**

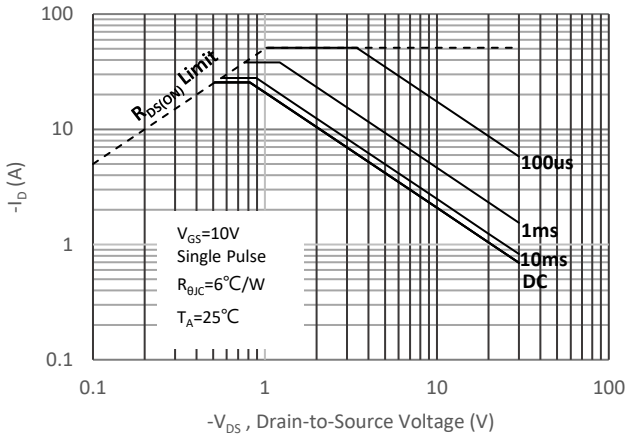



**Fig 9. Maximum Safe Operating Area**

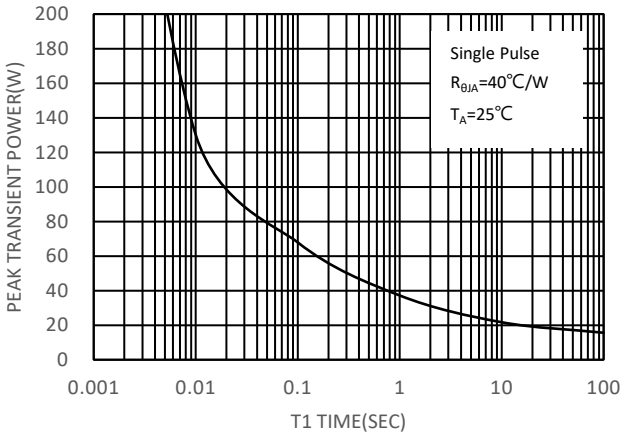



**Fig 10. Single Pulse Maximum Power Dissipation**

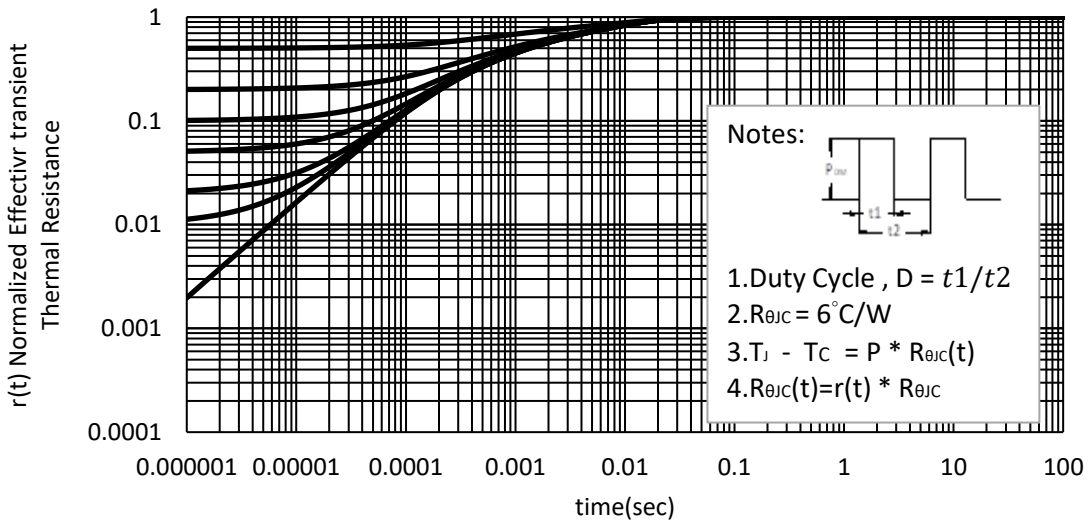



**Fig 11. Effective Transient Thermal Impedance**

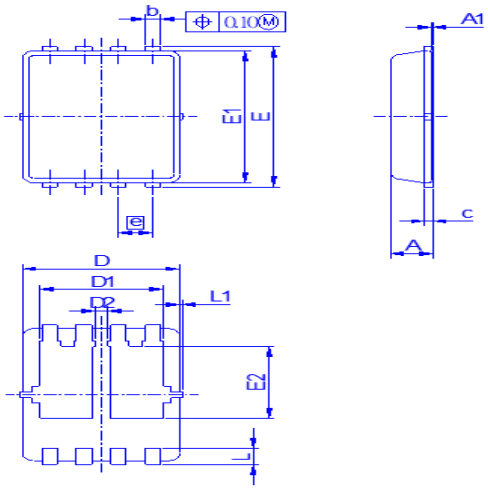
## Ordering & Marking Information:

Device Name: EMB20C03V for EDFN 3x3


B20C03: Device Name

ABCDEFG: Date Code
A: Assembly House
B: Year(A:2008 B:2009 C:2010….)
C: Month(A:01 B:02 C:03 D:04 E:05 F:06 G:07 H:08 I:09 J:10 K:11 L:12)
DEFG: Serial No.

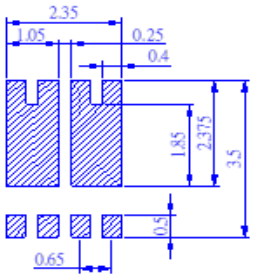
## Outline Drawing



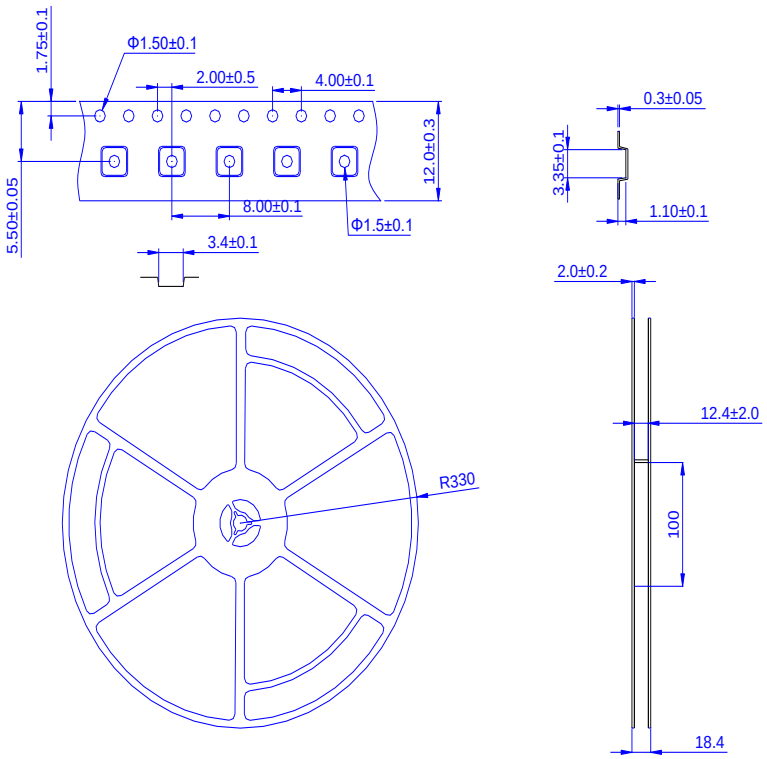

| Dimension | A | A1 | b | c | D | D1 | D2 | E | E1 | E2 | e | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 0.65 | 0 | 0.2 | 0.1 | 2.9 | 2.15 | 0.28 | 3.1 | 2.9 | 1.53 | 0.55 | 0.3 |
| Typ. | 0.75 | - | 0.3 | 0.15 | 3 | 2.47 | 0.38 | 3.2 | 3 | 1.81 | 0.65 | 0.4 |
| Max. | 0.9 | 0.05 | 0.4 | 0.25 | 3.3 | 2.75 | - | 3.5 | 3.3 | 1.98 | 0.75 | 0.5 |

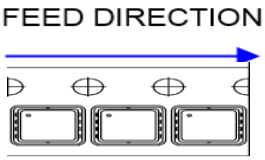
| Dimension | L1 | θ1 |
|---|---|---|
| Min. | - | 0◦ |
| Typ. | 0.075 | 10◦ |
| Max. | 0.15 | 14◦ |

## Footprint



◆ **Tape&Reel Information:5000pcs/Reel(Dimension in millimeter)**




| 產品別 | EDFN 3x3 |
|---|---|
| Reel尺寸 | 13" |
| 編帶方式 |   |
| 前空格 | 50 |
| 後空格 | 50 |
| 裝箱數 | |
| 滿捲數量 | 5K |
| 捲/內盒比 | 1:1 |
| 內盒滿箱數 | 5K |
| 內/外箱比 | 10:1 |
| 外箱滿箱數 | 50K |