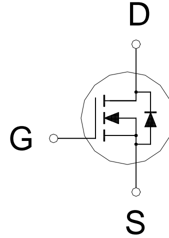
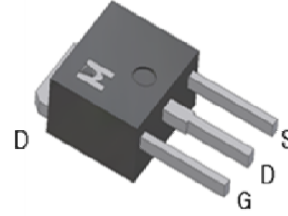
**N-Channel Logic Level Enhancement Mode Field Effect Transistor**

Product Summary:

| | |
|---|---|
| $BV_{DSS}$ | 600V |
| $R_{DSON}$ (MAX.) | 2.4Ω |
| $I_D$ | 4A |




UIS, 100% Tested

Pb-Free Lead Plating & Halogen Free

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

| PARAMETERS/TEST CONDITIONS | | SYMBOL | LIMITS | UNIT |
|---|---|---|---|---|
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Continuous Drain Current | $T_C$ = 25 °C | $I_D$ | 4 | A |
| | $T_C$ = 100 °C | | 3.2 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | 16 | |
| Avalanche Current | | $I_{AS}$ | 4 | |
| Avalanche Energy | L = 3mH, $I_D$=4A, $R_G$=25Ω | $E_{AS}$ | 24 | mJ |
| Repetitive Avalanche Energy[2] | L = 0.5mH | $E_{AR}$ | 4 | |
| Power Dissipation | $T_C$ = 25 °C | $P_D$ | 30 | W |
| | $T_C$ = 100 °C | | 12 | |
| 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 | $R_{\theta JC}$ | | 4.2 | °C / W |
| Junction-to-Ambient | $R_{\theta JA}$ | | 110 | |

[1]Pulse width limited by maximum junction temperature.

[2]Duty cycle ≤ 1%

**ELECTRICAL CHARACTERISTICS ($T_J$ = 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 | 600 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 2.5 | 3.5 | 4.5 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±30V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 600V, $V_{GS}$ = 0V | | | 10 | μA |
| | | $V_{DS}$ = 480V, $V_{GS}$ = 0V, $T_J$ = 125 °C | | | 25 | |
| Drain-Source On-State Resistance[1] | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 2A | | 2.1 | 2.4 | Ω |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = 25V, $I_D$ = 2A | | 2 | | S |
| **DYNAMIC** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1MHz | | 548 | | pF |
| Output Capacitance | $C_{oss}$ | | | 57 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 9 | | |
| Gate Resistance | $R_g$ | $V_{GS}$ = 15mV, $V_{DS}$ = 0V, f = 1MHz | | 3.5 | 6.5 | Ω |
| Total Gate Charge[1,2] | $Q_g$ | $V_{DS}$ = 300V, $V_{GS}$ = 10V, $I_D$ = 2A | | 11.9 | | nC |
| Gate-Source Charge[1,2] | $Q_{gs}$ | | | 3.5 | | |
| Gate-Drain Charge[1,2] | $Q_{gd}$ | | | 5.4 | | |
| Turn-On Delay Time[1,2] | $t_{d(on)}$ | $V_{DS}$ = 300V, $I_D$ = 1A, $V_{GS}$ = 10V, $R_G$ = 20Ω | | 15 | | nS |
| Rise Time[1,2] | $t_r$ | | | 25 | | |
| Turn-Off Delay Time[1,2] | $t_{d(off)}$ | | | 20 | | |
| Fall Time[1,2] | $t_f$ | | | 30 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C$ = 25 °C)** | | | | | | |
| Continuous Current | $I_S$ | | | | 4 | A |
| Pulsed Current[3] | $I_{SM}$ | | | | 16 | |
| Forward Voltage[1] | $V_{SD}$ | $I_F$ = 2A, $V_{GS}$ = 0V | | | 1.4 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = $I_S$, $dI_F/dt$ = 100A / μS | | 0.3 | | μS |
| Reverse Recovery Charge | $Q_{rr}$ | | | 1.0 | | μC |

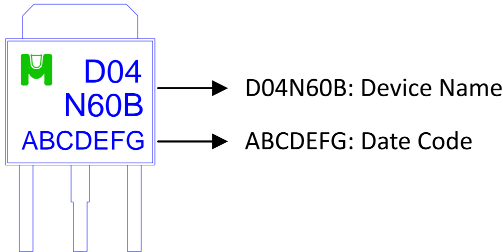
[1]Pulse test : Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%.

[2]Independent of operating temperature.

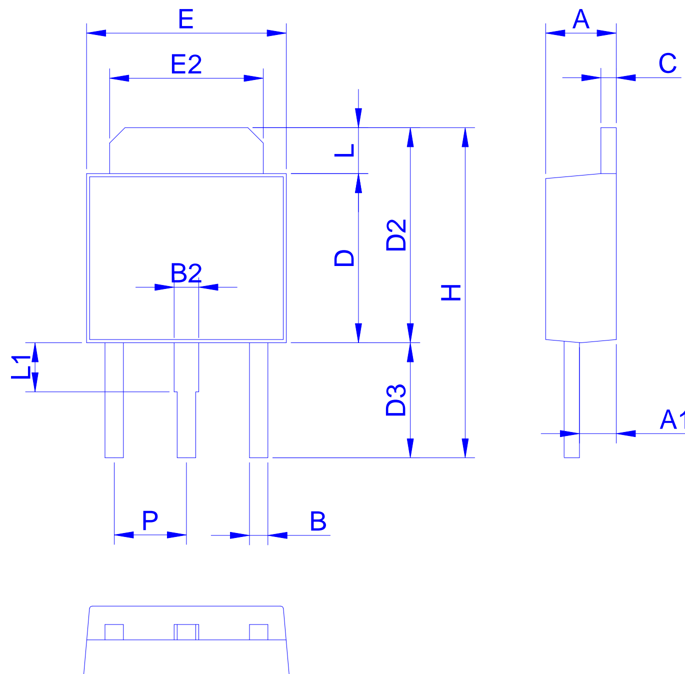
[3]Pulse width limited by maximum junction temperature.

Ordering & Marking Information:

Device Name: EMD04N60CSB for IPAK (TO-251)



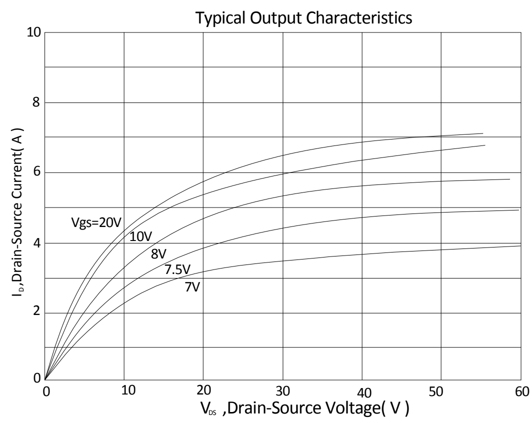

Outline Drawing

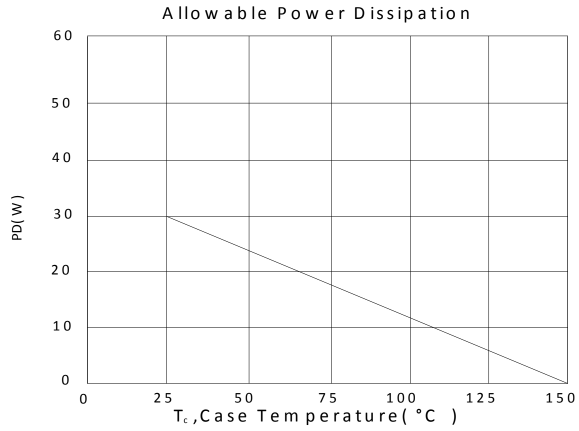


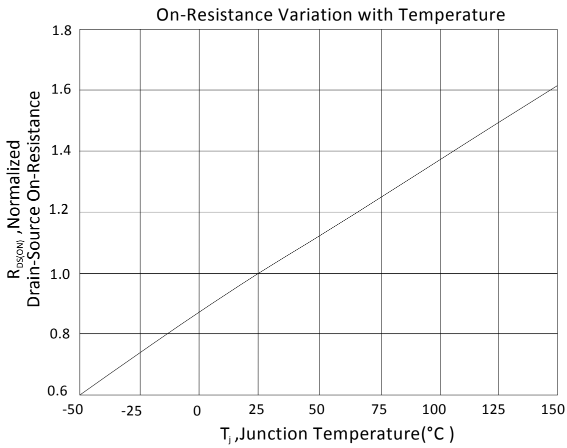

Dimension in mm

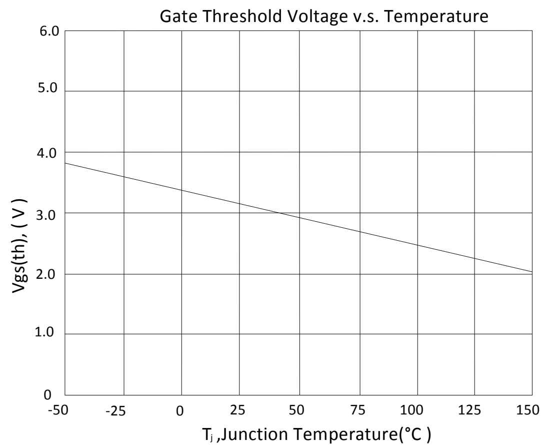
| Dimension | A | A1 | B | B2 | C | D | D2 | D3 | E | E2 | H | L | L1 | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 2.10 | 0.90 | 0.40 | 0.60 | 0.40 | 5.30 | 6.70 | 3.40 | 6.30 | 4.80 | 10.2 | 0.89 | 0.90 | 2.10 |
| Max. | 2.50 | 1.50 | 0.90 | 1.15 | 0.60 | 6.25 | 7.30 | 4.30 | 6.80 | 5.50 | 11.5 | 1.40 | 1.80 | 2.50 |

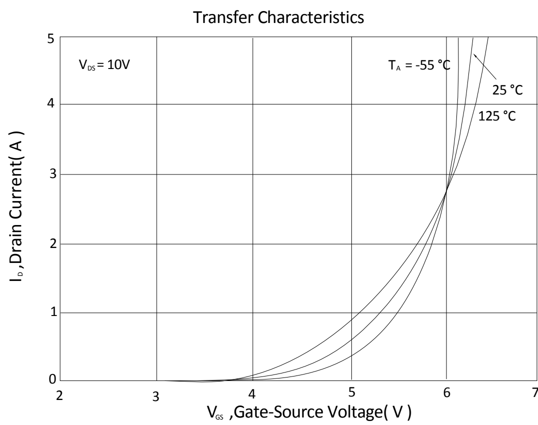
**TYPICAL CHARACTERISTICS**

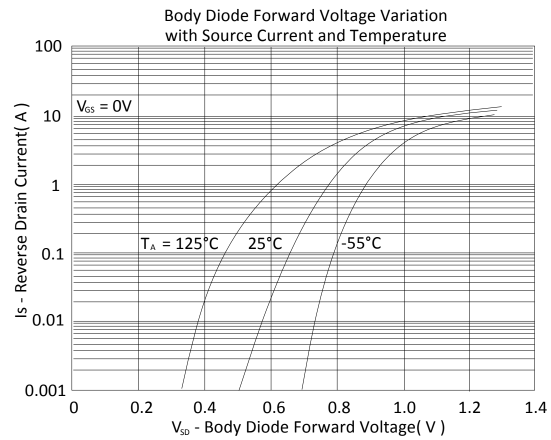


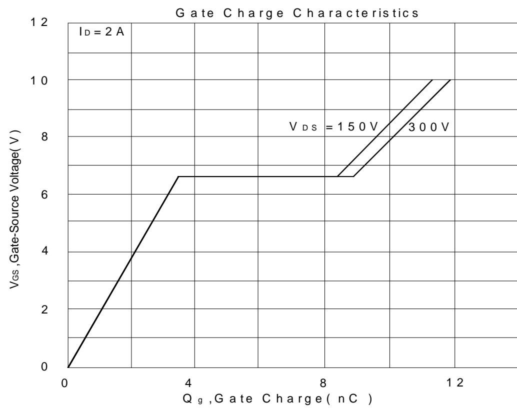



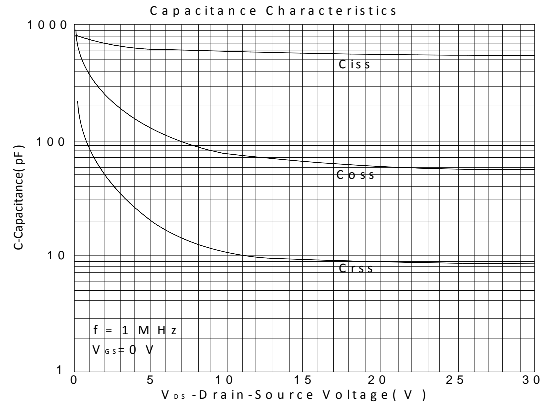



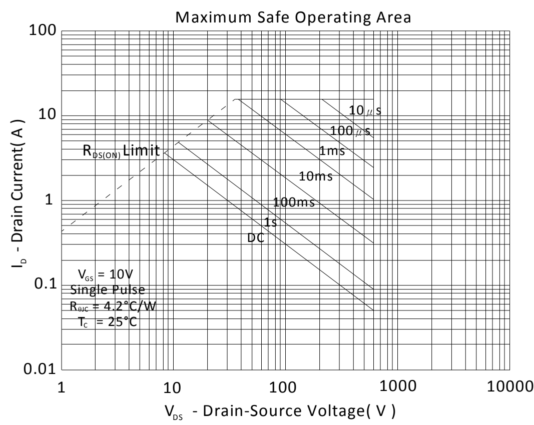



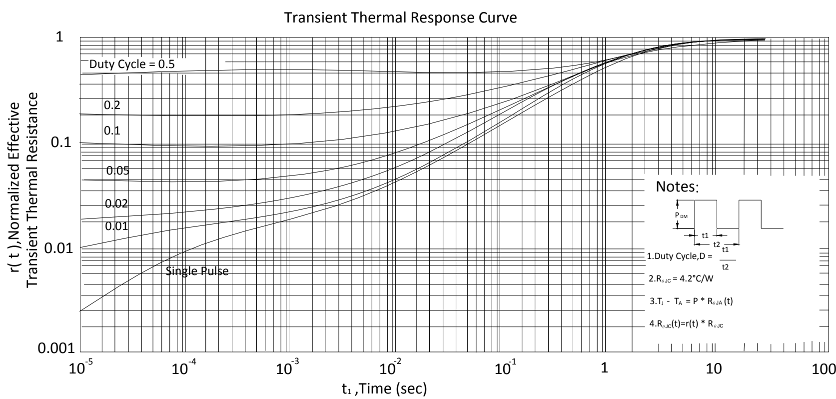




Gate Charge Characteristics
ID = 2A
VDS = 150V
300V
VGS ,Gate-Source Voltage( V )
Qg ,Gate Charge( nC )


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


Maximum Safe Operating Area
RDS(ON) Limit
10 μs
100 μs
1ms
10ms
100ms
1s
DC
VGS = 10V
Single Pulse
RθJC = 4.2°C/W
TC = 25°C
ID - Drain Current( A )
VDS - Drain-Source Voltage( V )


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 = t1/t2
2.RθJC = 4.2°C/W
r( t ),Normalized Effective Transient Thermal Resistance
t1 ,Time (sec)