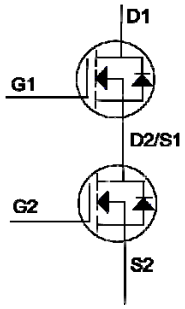
杰力科技股份有限公司
Excelliance MOS Corporation

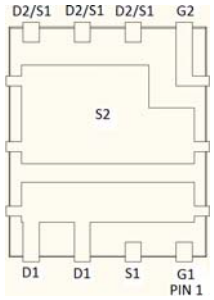
**EMB02Q03HP**

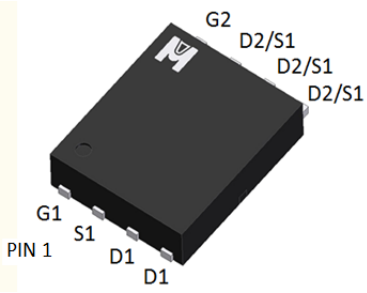
**N-Channel Logic Level Enhancement Mode Field Effect Transistor**

Product Summary:

| | N-CH-Q1 | N-CH-Q2 |
|---|---|---|
| $BV_{DSS}$ | 30V | 30V |
| $R_{DSON\ (MAX.)}$ | 5.0mΩ | 2.0mΩ |
| $I_D$ | 53A | 95A |




UIS, Rg 100% Tested

Pb-Free Lead Plating & Halogen Free

GREEN PRODUCT

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

| PARAMETERS/TEST CONDITIONS | | SYMBOL | LIMITS | | UNIT |
|---|---|---|---|---|---|
| | | | Q1 | Q2 | |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current[3] | $T_C$ = 25 °C | $I_D$ | 53 | 95 | A |
| | $T_C$ = 100 °C | | 33 | 60 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | 130 | 170 | |
| Continuous Drain Current[3] | $T_A$ = 25 °C | $I_D$ | 21 | 37 | |
| | $T_A$ = 70 °C | | 17 | 30 | |
| Avalanche Current | | $I_{AS}$ | 30 | 65 | |
| Avalanche Energy | L = 0.1mH, $R_G$=25Ω | $E_{AS}$ | 45 | 211 | mJ |
| Repetitive Avalanche Energy[2] | L = 0.05mH | $E_{AR}$ | 22 | 105 | |
| Power Dissipation | $T_C$ = 25 °C | $P_D$ | 25 | 31 | W |
| | $T_C$ = 100 °C | | 10 | 12.5 | |
| Power Dissipation | $T_A$ = 25 °C | $P_D$ | 1.8 | 1.9 | W |
| | $T_A$ = 70 °C | | 1.1 | 1.2 | |
| 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 | $R_{\theta JC}$ | Steady State | | 5 | 4 | °C / W |
| Junction-to-Ambient | $R_{\theta JA}$ | Steady State | | 70 | 65 | |
| | $R_{\theta JA}$ | t ≦ 10 s | | 30 | 25 | |

[1]Pulse width limited by maximum junction temperature.

[2]Duty cycle ≤ 1%

[3]Package limitation current, Q1=30A, Q2=36A

$R_{\theta JA}$ when mounted on a 1 $in^2$ pad of 2 oz copper.

**ELECTRICAL CHARACTERISTICS ($T_J$ = 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 | Q1 | 30 | | | V |
| | | | Q2 | 30 | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | Q1 | 1 | 1.5 | 3 | |
| | | | Q2 | 1 | 1.5 | 3 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±20V | Q1 | | | ±100 | nA |
| | | | Q2 | | | ±100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 24V, $V_{GS}$ = 0V | Q1 | | | 1 | μA |
| | | | Q2 | | | 1 | |
| | | $V_{DS}$ = 20V, $V_{GS}$ = 0V, $T_J$ = 125 °C | Q1 | | | 25 | |
| | | | Q2 | | | 25 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = 10V, $V_{GS}$ = 10V | Q1 | 53 | | | A |
| | | | Q2 | 95 | | | |
| Drain-Source On-State Resistance[1] | $R_{DS(ON)}$ | $V_{GS}$ = 10V, $I_D$ = 16A | Q1 | | 4.0 | 5.0 | mΩ |
| | | $V_{GS}$ = 10V, $I_D$ = 25A | Q2 | | 1.6 | 2.0 | |
| | | $V_{GS}$ = 4.5V, $I_D$ = 10A | Q1 | | 6.0 | 7.8 | |
| | | $V_{GS}$ = 4.5V, $I_D$ = 15A | Q2 | | 2.3 | 3.0 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = 5V, $I_D$ = 16A | Q1 | | 50 | | S |
| | | $V_{DS}$ = 5V, $I_D$ = 25A | Q2 | | 70 | | |
| **DYNAMIC** | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 15V, f = 1MHz | Q1 | | 1508 | | pF |
| | | | Q2 | | 3813 | | |
| Output Capacitance | $C_{oss}$ | | Q1 | | 219 | | |
| | | | Q2 | | 540 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | Q1 | | 167 | | |
| | | | Q2 | | 440 | | |
| Gate Resistance | $R_g$ | $V_{GS}$ = 15mV, $V_{DS}$ = 0V, f = 1MHz | Q1 | | 0.9 | | Ω |
| | | | Q2 | | 1.5 | | |
| Total Gate Charge[1,2] | $Q_g$($V_{GS}$=10V) | Q1 $V_{DD}$ = 15V, $V_{GS}$ = 10V, $I_D$ = 16A | Q1 | | 25 | | nC |
| | | | Q2 | | 59 | | |
| | $Q_g$($V_{GS}$=4.5V) | | Q1 | | 13 | | |
| | | | Q2 | | 28 | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Gate-Source Charge[1,2] | $Q_{gs}$ | Q2<br>$V_{DD}$ = 15V, $V_{GS}$ = 10V,<br>$I_D$ = 25A | Q1 | | 5 | | |
| | | | Q2 | | 13 | | |
| Gate-Drain Charge[1,2] | $Q_{gd}$ | | Q1 | | 5.3 | | |
| | | | Q2 | | 11 | | |
| Turn-On Delay Time[1,2] | $t_{d(on)}$ | $V_{DD}$ = 15V,<br>$I_D$ = 1A, $V_{GS}$ = 10V, $R_{GS}$ = 2.7Ω | Q1 | | 20 | | nS |
| | | | Q2 | | 25 | | |
| Rise Time[1,2] | $t_r$ | | Q1 | | 15 | | |
| | | | Q2 | | 16 | | |
| Turn-Off Delay Time[1,2] | $t_{d(off)}$ | | Q1 | | 55 | | |
| | | | Q2 | | 60 | | |
| Fall Time[1,2] | $t_f$ | | Q1 | | 20 | | |
| | | | Q2 | | 25 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_J$ = 25 °C)** | | | | | | | |
| Continuous Current | $I_S$ | | Q1 | | | 20 | A |
| | | | Q2 | | | 33 | |
| Forward Voltage[1] | $V_{SD}$ | $I_F$ = 10A, $V_{GS}$ = 0V | Q1 | | | 1.2 | V |
| | | | Q2 | | | 1.2 | |
| Reverse Recovery Time | $t_{rr}$ | Q1<br>$I_F$ = 16A, $dI_F/dt$ = 100A / μS | Q1 | | 30 | | nS |
| | | | Q2 | | 35 | | |
| Reverse Recovery Charge | $Q_{rr}$ | Q2<br>$I_F$ = 25A, $dI_F/dt$ = 100A / μS | Q1 | | 18 | | nC |
| | | | Q2 | | 25 | | |

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

[2]Independent of operating temperature.

[3]Pulse width limited by maximum junction temperature.

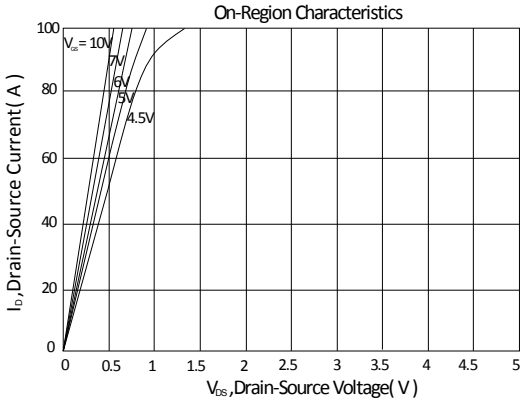
## Ordering & Marking Information:

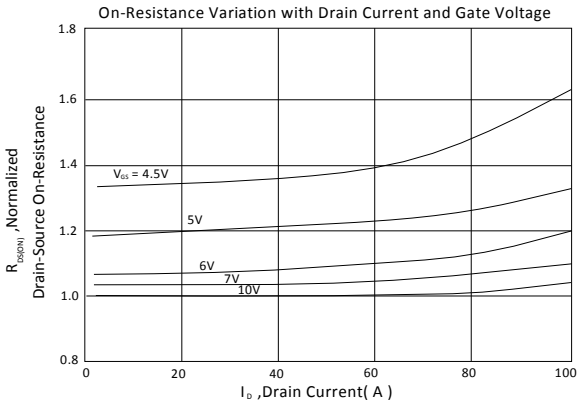
Device Name: EMB02Q03HP for Asymmetric Dual EDFN 5 x 6

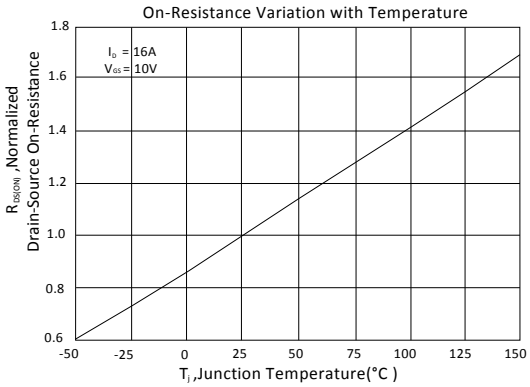

→ B02Q03: Device Name

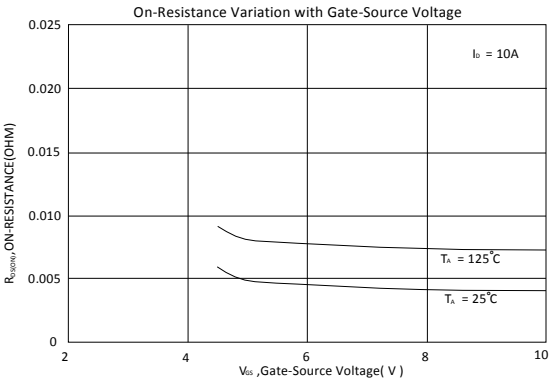
→ ABCDEFG: Date Code

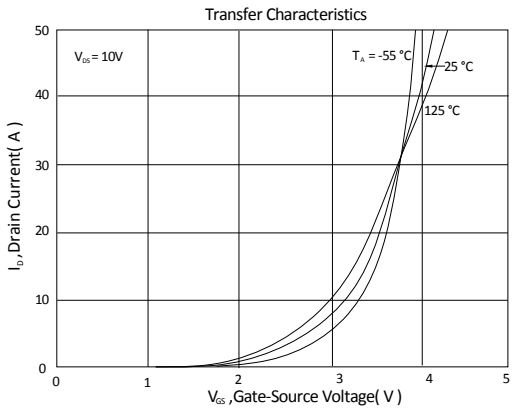
## Q1 TYPICAL CHARACTERISTICS

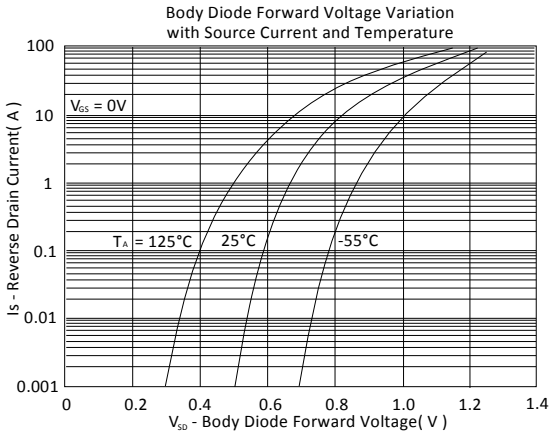


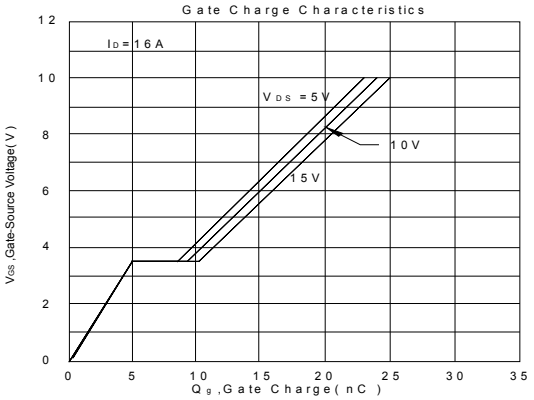



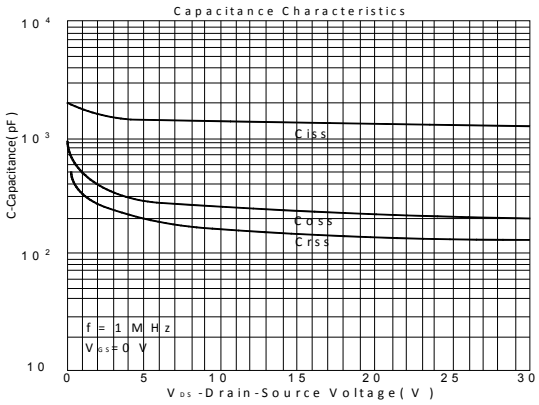



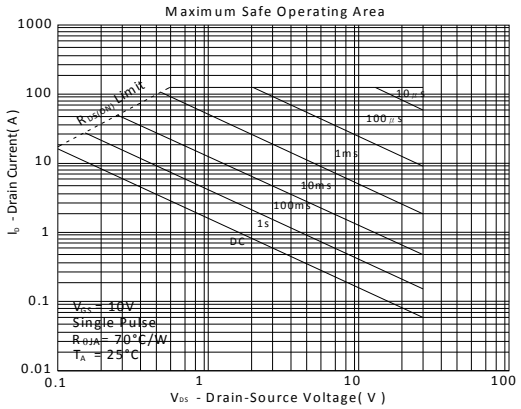



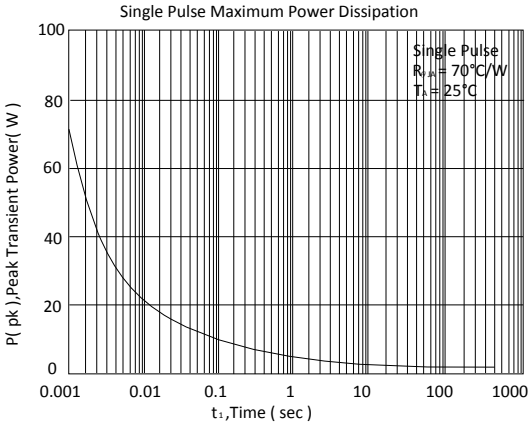



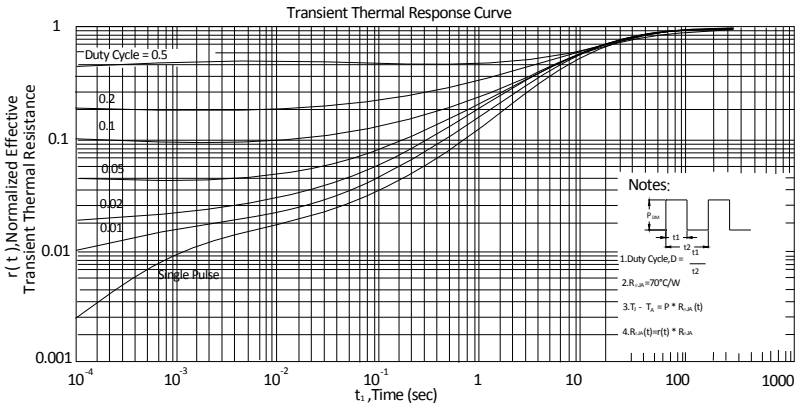




Gate Charge Characteristics
I D = 16 A
V D S = 5 V
10 V
15 V
VGS ,Gate-Source Voltage( V )
Q g ,Gate Charge( nC )


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

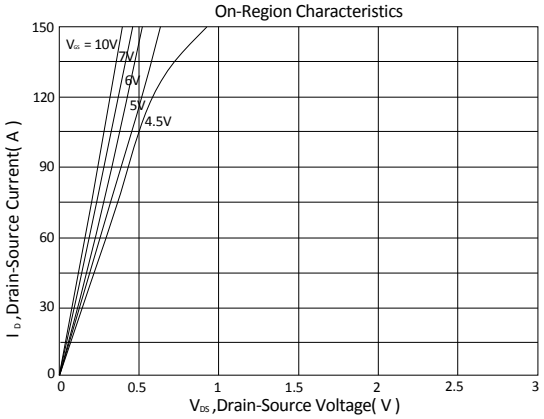

Maximum Safe Operating Area
RDS(on) Limit
100 μs
1ms
10ms
100ms
1s
DC
VGS = 10V
Single Pulse
RθJA= 70°C/W
TA = 25°C
ID - Drain Current( A )
VDS - Drain-Source Voltage( V )


Single Pulse Maximum Power Dissipation
Single Pulse
RθJA = 70°C/W
TA = 25°C
P( pk ),Peak Transient Power( W )
t1 ,Time ( sec )

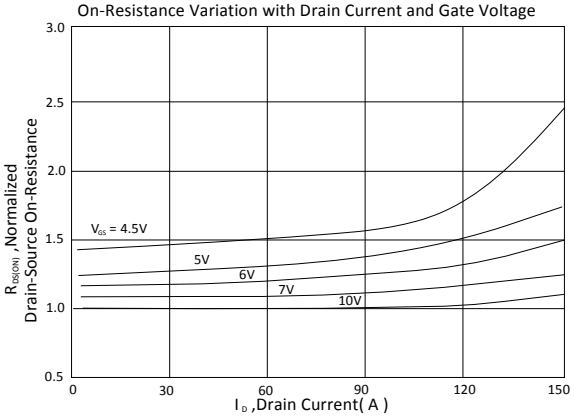

Transient Thermal Response Curve
Duty Cycle = 0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Notes:
1.Duty Cycle,D =
2.RθJA=70°C/W
3.TJ - TA = P * RθJA(t)
4.RθJA(t)=r(t) * RθJA
r( t ),Normalized Effective Transient Thermal Resistance
t1 ,Time (sec)

## Q2 TYPICAL CHARACTERISTICS

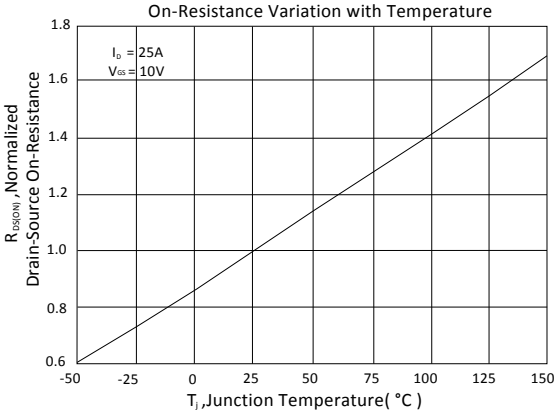
On-Region Characteristics



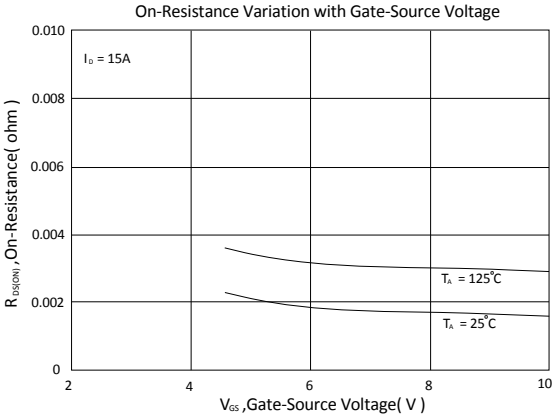

On-Resistance Variation with Drain Current and Gate Voltage



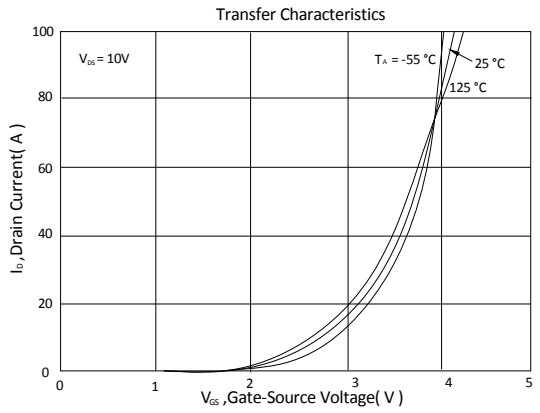

On-Resistance Variation with Temperature



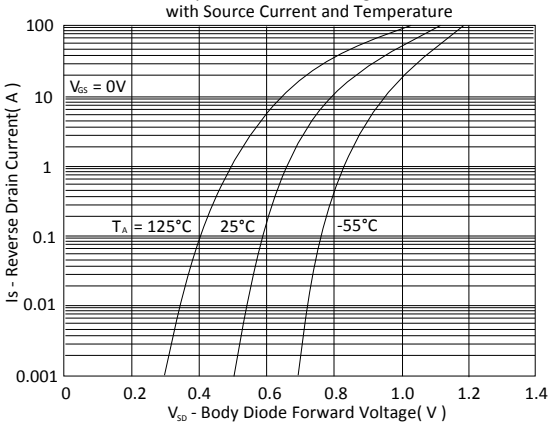

On-Resistance Variation with Gate-Source Voltage

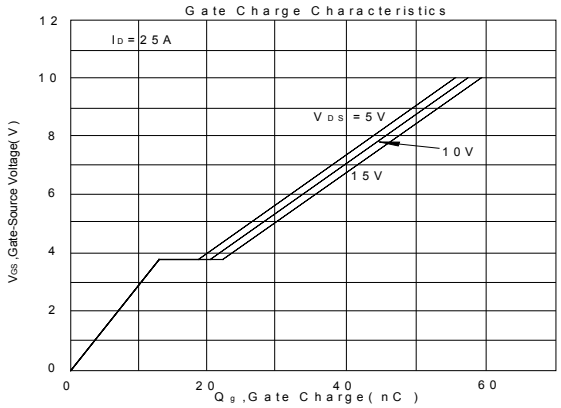


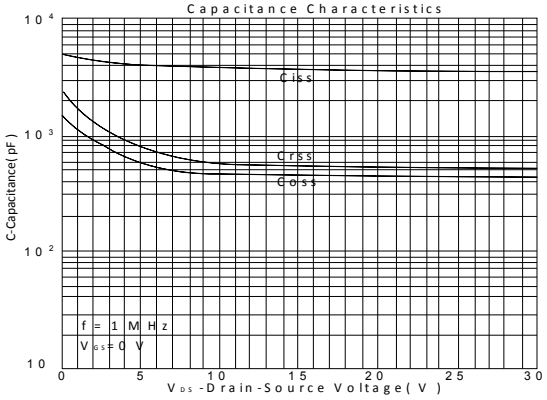

Transfer Characteristics

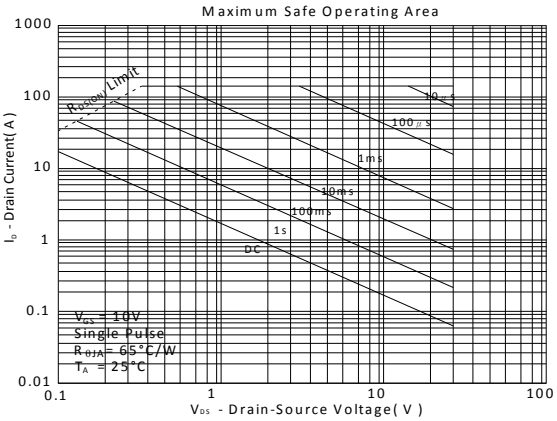


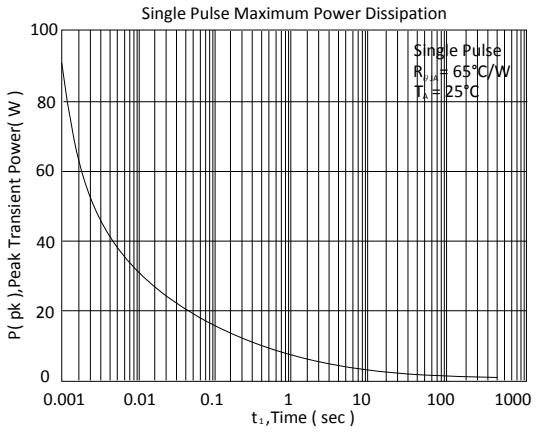

Body Diode Forward Voltage Variation with Source Current and Temperature

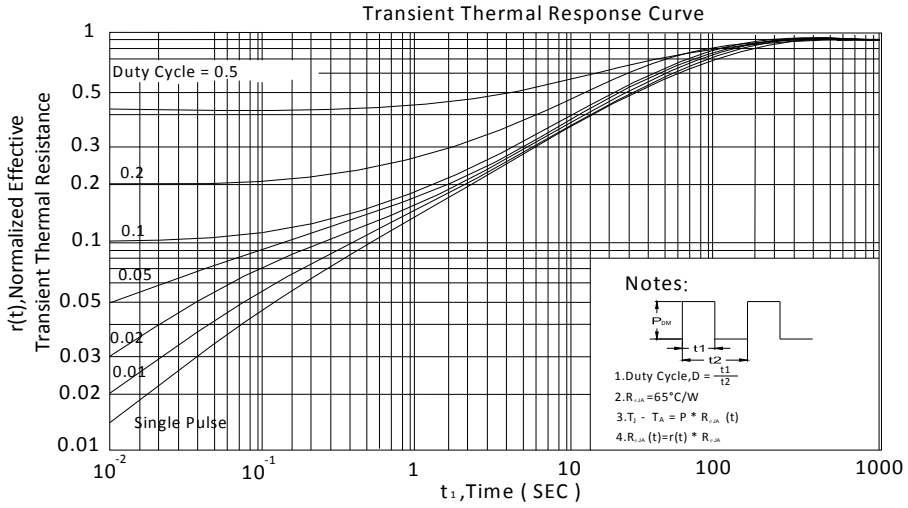



Gate Charge Characteristics
ID = 25A
VDS = 5V
10V
15V
VGS ,Gate-Source Voltage( V )
Qg ,Gate Charge( nC )

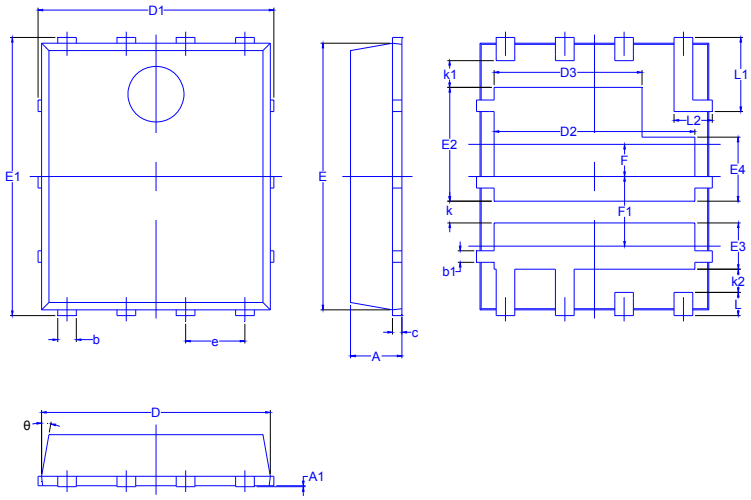

Capacitance Characteristics
Ciss
Crss
Coss
f = 1 MHz
VGS = 0 V
C-Capacitance( pF )
VDS -Drain-Source Voltage( V )


Maximum Safe Operating Area
RDS(ON) Limit
10 μs
100 μs
1ms
10ms
100ms
1s
DC
VGS = 10V
Single Pulse
RθJA = 65°C/W
TA = 25°C
ID - Drain Current( A )
VDS - Drain-Source Voltage( V )


Single Pulse Maximum Power Dissipation
Single Pulse
RθJA = 65°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:
PDM
t1
t2
1.Duty Cycle,D = t1/t2
2.RθJA =65°C/W
3.TJ - TA = P * RθJA (t)
4.RθJA (t)=r(t) * RθJA
r(t),Normalized Effective Transient Thermal Resistance
t1,Time ( SEC )

Outline Drawing




Dimension in mm

| Dimension | A | A1 | b | b1 | c | D | D1 | D2 | D3 | E | E1 | E2 | E3 | E4 | e |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 1.00 | 0.00 | 0.30 | 0.15 | 0.15 | 4.80 | | 4.15 | 3.02 | 5.65 | | 2.3 | 0.85 | 1.23 | |
| Typ. | | | | | | | 5.05BSC | | | | 6.00BSC | | | | 1.27BSC |
| Max. | 1.20 | 0.05 | 0.50 | 0.35 | 0.25 | 5.00 | | 4.45 | 3.32 | 5.85 | | 2.60 | 1.15 | 1.53 | |

| Dimension | L | L1 | L2 | k | k1 | k2 | F | F1 | θ |
|---|---|---|---|---|---|---|---|---|---|
| Min. | 0.40 | 1.50 | 0.72 | | | | | | |
| Typ. | | | | 0.47BSC | 0.58BSC | 0.50BSC | 0.695REF | 1.50REF | 10° REF |
| Max. | 0.60 | 1.70 | 0.92 | | | | | | |

Recommended minimum pads