# General Description

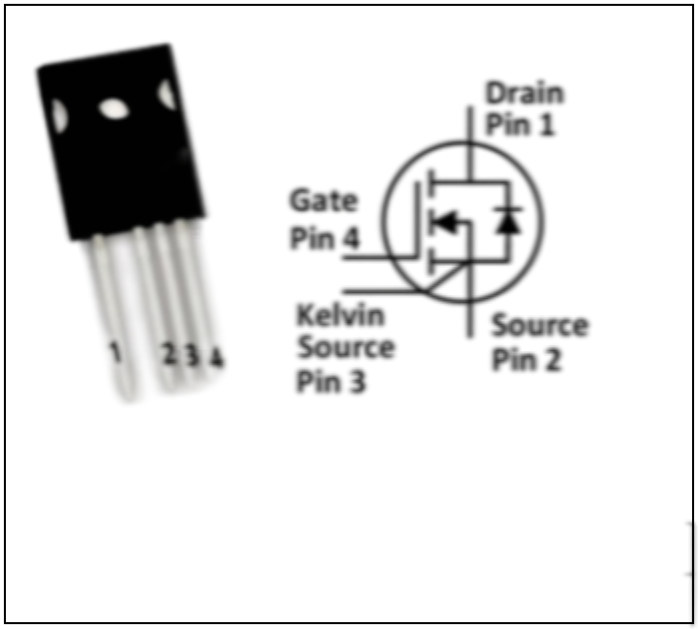
## Features

- High voltage, low on resistance
- High speed, low parasitic capacitance
- High junction temperature
- Fast recovery diode
- Kelvin connection driver

## Applications

- motor drive
- Photovoltaic inverter
- UPS power supply
- High voltage DC / DC converter
- Switching Mode Power Supply

## Package:TO-247-4




# Key performance parameters

| Type | $V_{DS}$ | $I_D$ $T_C$=25℃ | $R_{DS(ON)}$ |
|---|---|---|---|
| TK3M160120K | 1200V | 20A | 160mΩ |

## Maximum Ratings

$T_C$=25℃, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-source voltage $V_{GS}$ = 0V, $I_D$ =100 μ A | $V_{DS}$ | 1200 | V |
| Gate-source voltage Recommended maximum | $V_{GS}$ | -5 to 20 | V |

## Maximum Ratings

$T_C$=25℃, unless otherwise specified

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Continuous drain current : $V_{GS}$ = 20V<br>$T_C$ = 25° C<br>$T_C$ = 100° C | $I_D$ | <br>20<br>16 | A |
| Pulsed drain current: Pulse width limited by SOA | $I_{DM}$ | 50 | A |
| Power dissipation : $T_C$ = 25° C | $P_{TOT}$ | 138 | W |
| Storage temperature range : | $T_{stg}$ | -55 to +175 | °C |
| Operating and junction temperature: | $T_j$ | -55 to +175 | °C |
| Soldre temperature: Wave soldering only allowed at leads, 1.6 mm from case for 10 s | $T_L$ | 260 | °C |

## Thermal Resistance

| Parameter | Symbol | Typ. | Unit |
|---|---|---|---|
| Thermal resistance to shell | $R_{thJC}$ | 1.088 | °C/W |

## Electrical Characteristic

$T_C$ =25℃, unless otherwise specified

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Zero gate voltage drain current | $I_{DSS}$ | | 5 | 100 | μA | $V_{DS}$ = 1200V<br>$V_{GS}$ = 0V |
| Gate leakage current | $I_{GSS}$ | | 1 | ±100 | nA | $V_{DS}$ = 0V<br>$V_{GS}$ = -5~20V |
| Gate threshold voltage | $V_{TH}$ | | 2.9<br>1.9 | | V | $V_{GS}$ = $V_{DS}$<br>$I_D$ = 1.9mA<br>$T_C$ =175° C |
| Drain-source on-state resistance | $R_{ON}$ | | 160<br>250 | 195 | mΩ | $V_{GS}$ = 20V<br>$I_D$ = 10A<br>$T_J$ = 25℃<br>$T_J$ = 175℃ |
| Input capacitance | $C_{iss}$ | | 885 | | pF | $V_{DS}$ = 800V<br>$V_{GS}$ = 0V<br>f = 1MHz<br>$V_{AC}$ = 25mV |
| Output capacitance | $C_{oss}$ | | 38 | | | |
| Reverse transfer capacitance | $C_{rss}$ | | 2 | | | |
| The output capacitor stores energy | $E_{oss}$ | | 16 | | μJ | |
| Total gate charge | $Q_g$ | | 43 | | nC | $V_{DS}$ = 800V<br>$I_D$ = 10A<br>$V_{GS}$ = -5 to 20V |
| Gate to source charge | $Q_{gs}$ | | 9 | | | |
| Gate to drain charge | $Q_{gd}$ | | 19 | | | |
| Gate input resistance | $R_g$ | | 9.5 | | Ω | f =1MHz |
| Tuen-on switching energy | $E_{ON}$ | | 139.3 | | μJ | $V_{DS}$ = 800V,<br>$I_D$ = 10A,<br>$V_{GS}$ = -2 to 20V,<br>$R_{G(ext)}$ =5.1Ω,<br>L = 450μH |
| Turn-off switching energy | $E_{OFF}$ | | 39.2 | | μJ | |
| Turn-on delay time | $t_{d(on)}$ | | 6.4 | | ns | |
| Rise time | $t_r$ | | 19.4 | | | |
| Turn-off delay time | $t_{d(off)}$ | | 11.8 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Fall time | $t_f$ | | 14 | | | |

## Reverse Diode Characteristics

$T_C$ =25℃, unless otherwise specified

| Parameter | Symbol | Value | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | | |
| Diode forward voltage | $V_{SD}$ | | 4.1<br>3.7 | | V | $I_{SD}$ = 5A<br>$V_{GS}$ = 0V<br>$T_J$ = 175° C |
| Reverse recovery time | $t_{rr}$ | | 33.2 | | ns | $V_{GS}$= -2V/+20V,<br>$I_{SD}$ = 10A, $V_R$ = 800V,<br>di/dt = 1000A/us,<br>$R_{G(ext)}$=13Ω |
| Reverse recovery charge | $Q_{rr}$ | | 101.5 | | nC | |
| Reverse recovery peak current | $I_{RRM}$ | | 5.6 | | A | |

## Characteristics Curves

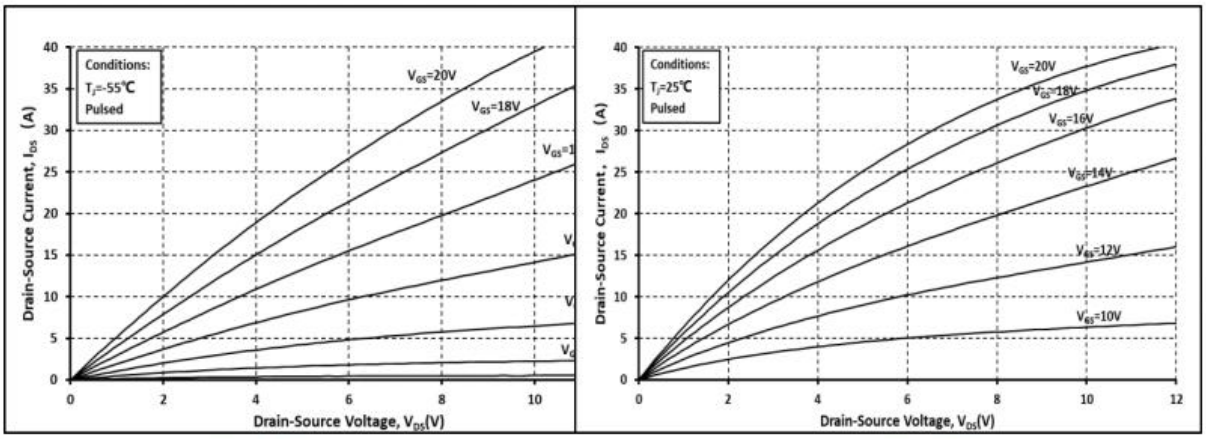



图. 1 输出曲线 @ $T_j$=-55°C

图. 2 输出曲线 @ $T_j$=25°C

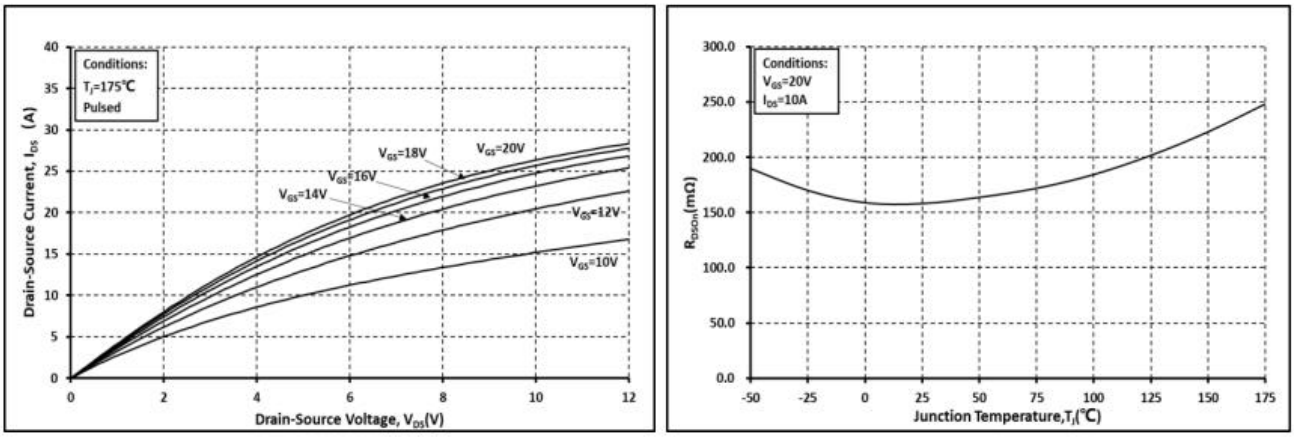



图. 3 输出曲线 @ $T_j$=175°C

图. 4 Ron 和温度关系曲线

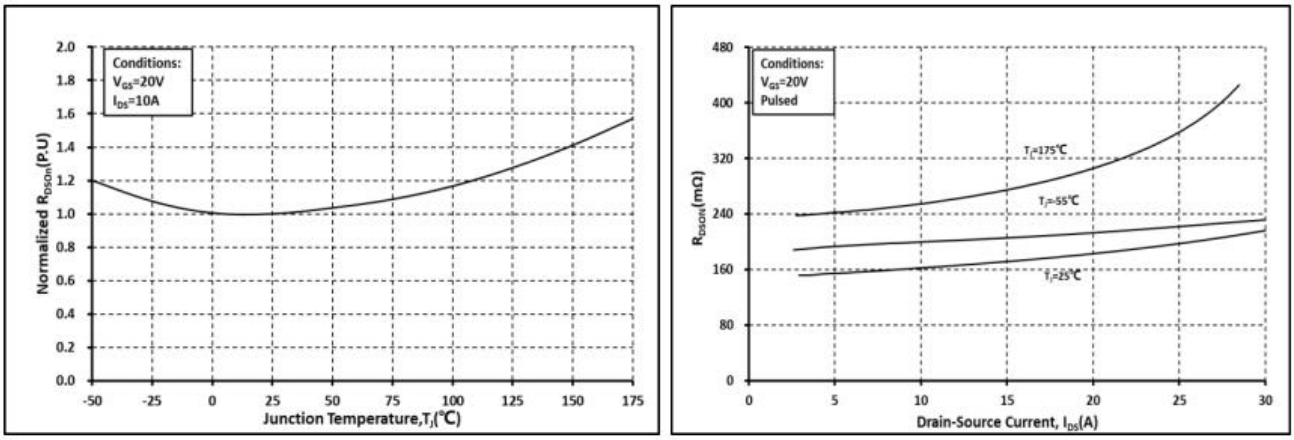



图. 5 归一化的 Ron 和温度关系曲线

图 6 各温度下的 Ron 和 $I_{DS}$ 关系曲线

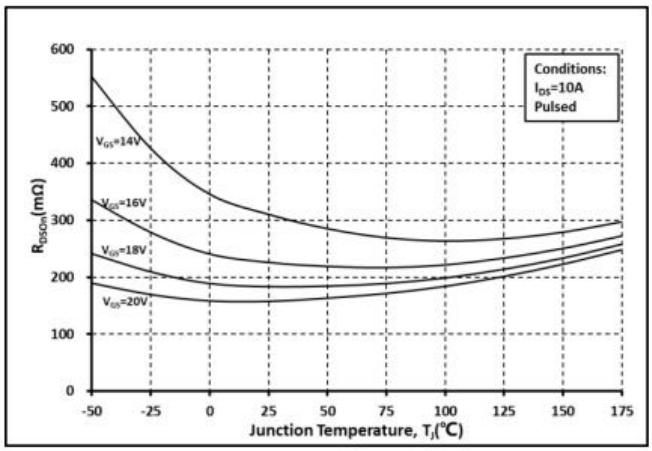



图. 7 各 $V_{GS}$ 下的 Ron 和温度关系曲线

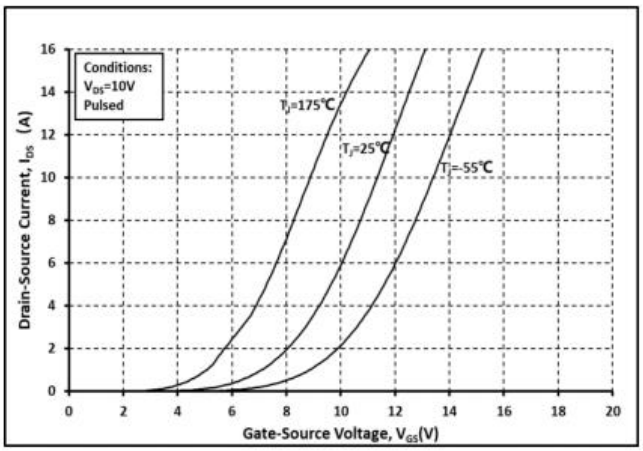



图. 8 各温度下的传输特性曲线

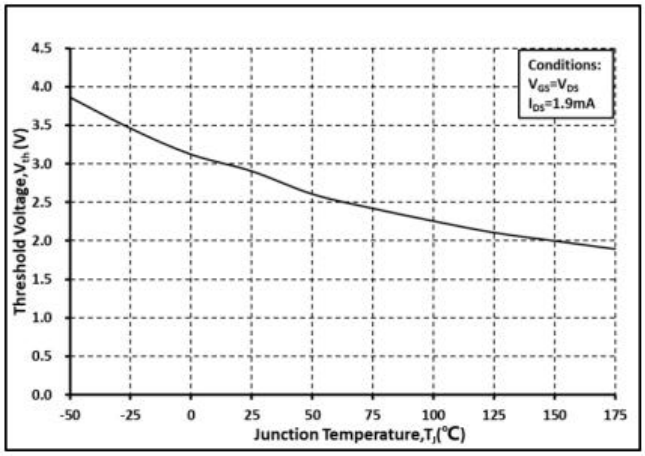



图. 9 阈值电压随温度变化曲线

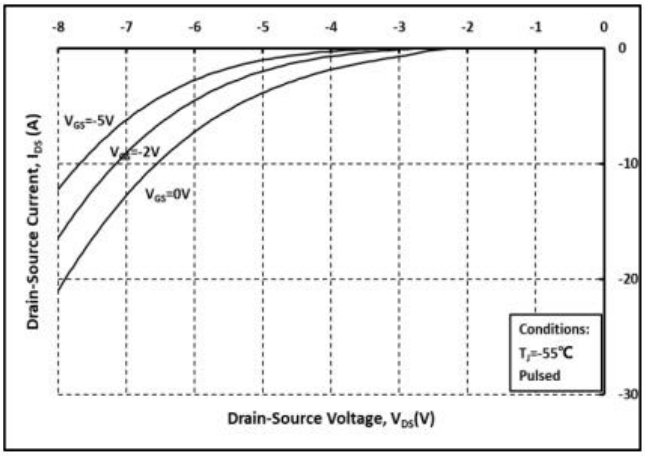



图. 10 体二极管导通曲线 @ $T_J$=-55℃

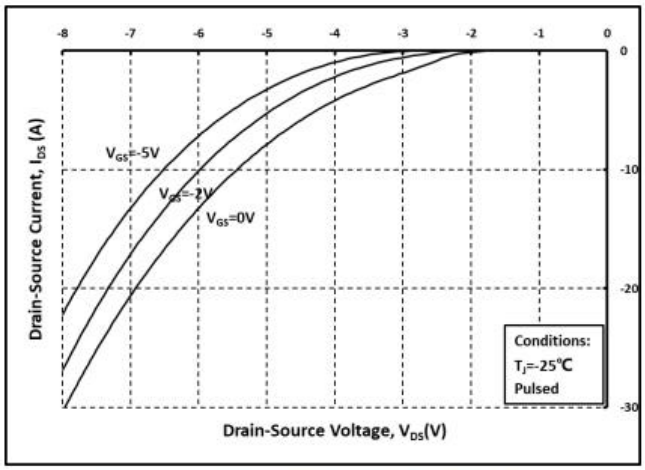



图. 11 体二极管导通曲线 @ $T_J$=25℃

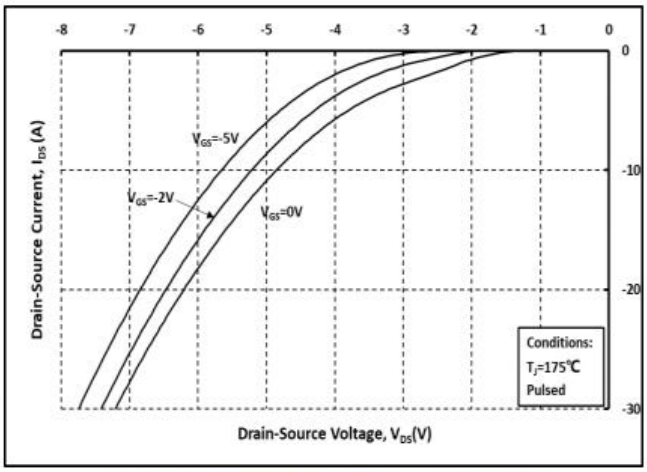



图. 12 体二极管导通曲线 @ $T_J$=175°C

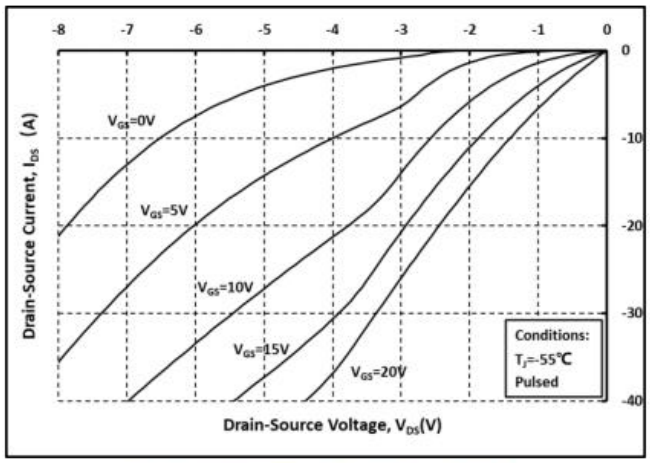



图. 13 第三象限曲线 @ $T_J$=-55℃

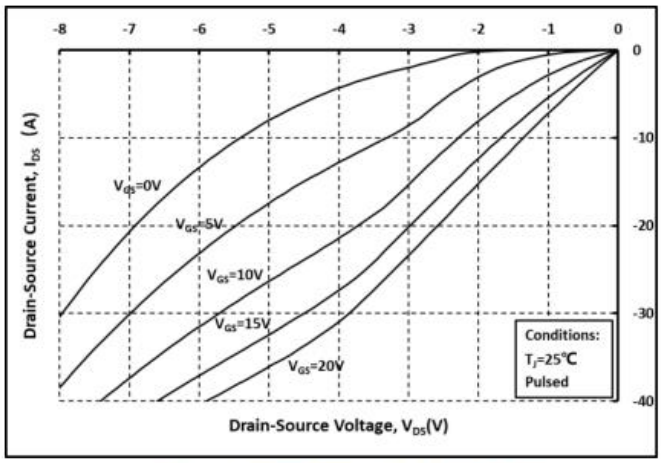



图. 14 第三象限曲线 @ $T_J$=25℃

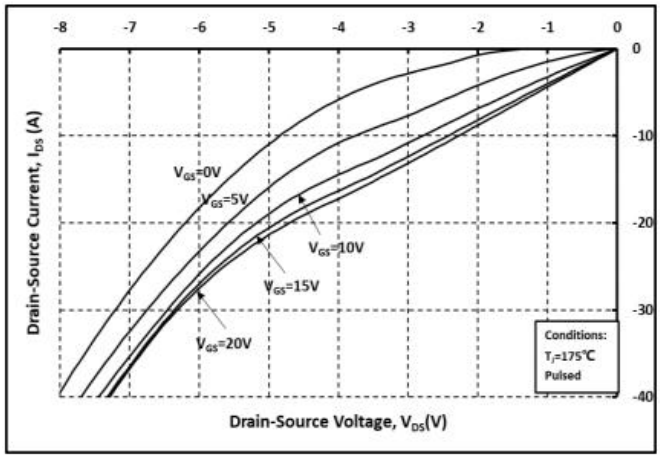



图. 15 第三象限曲线 @ $T_J$=175℃

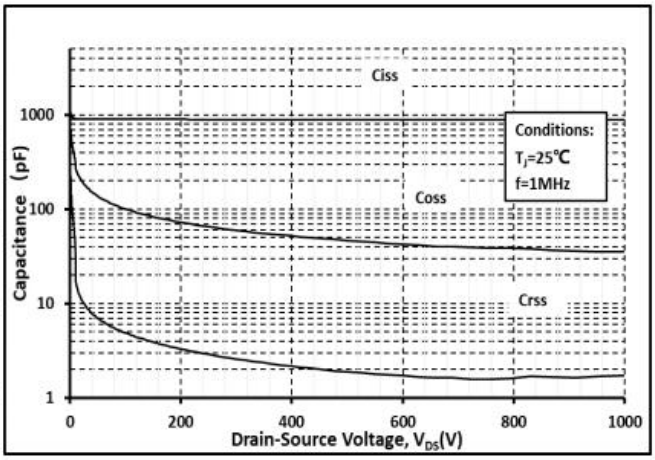



图. 16 各电容和 $V_{DS}$ 关系曲线

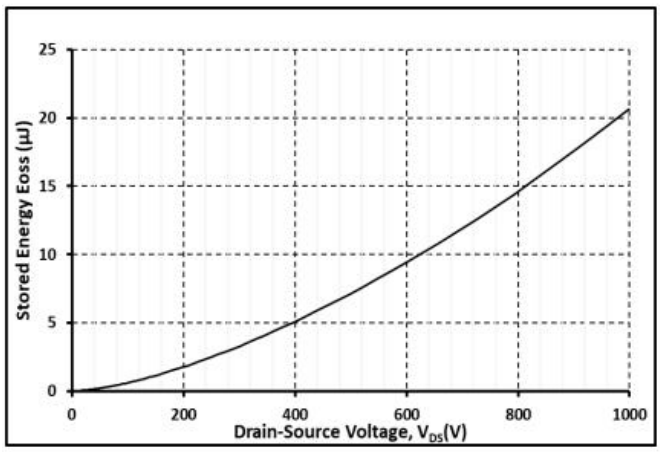



图. 17 输出电容存储能量曲线

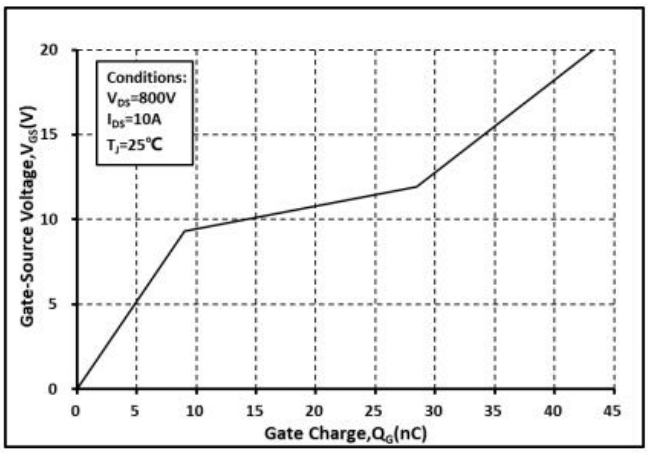



图. 18 栅电荷特征曲线

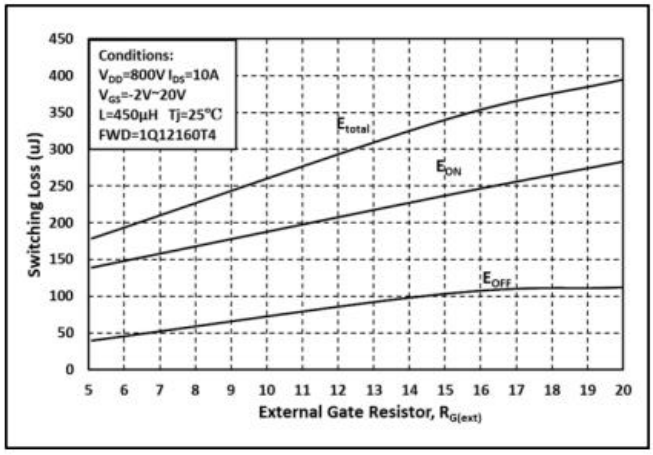



图. 19 开关能量和栅极电阻 $R_{G(ext)}$ 关系曲线

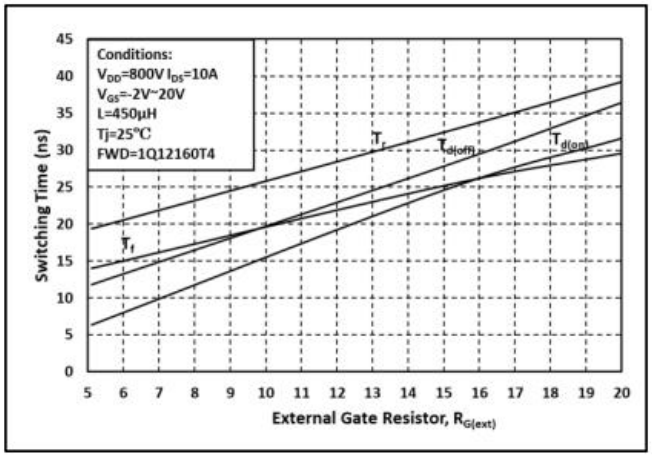



图. 20 开关时间和栅极电阻 $R_{G(ext)}$ 关系曲线

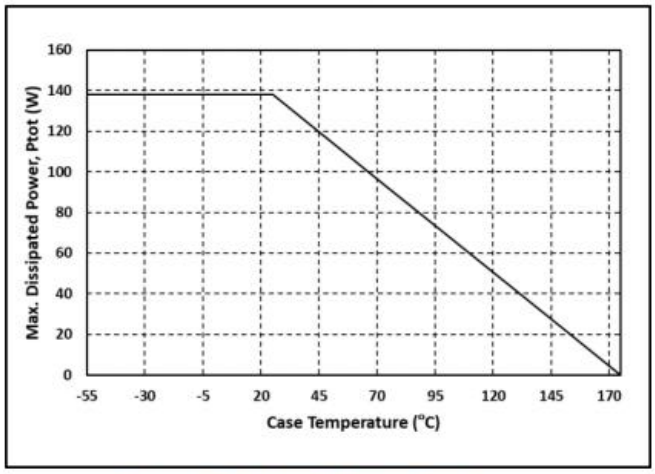



图. 21 漏端电流和温度关系曲线

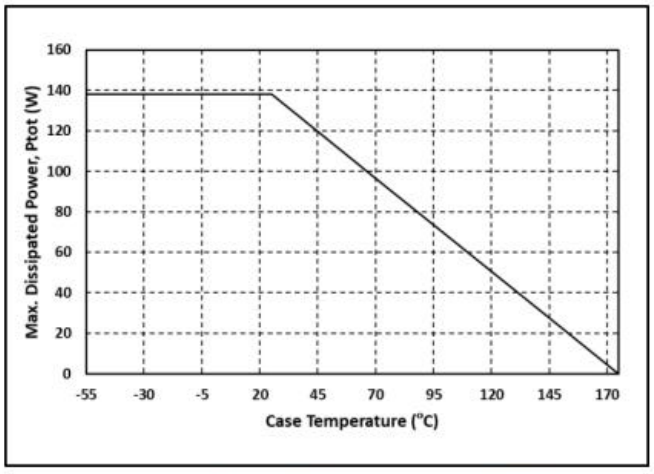



图. 22 最大功耗降额和温度关系曲线

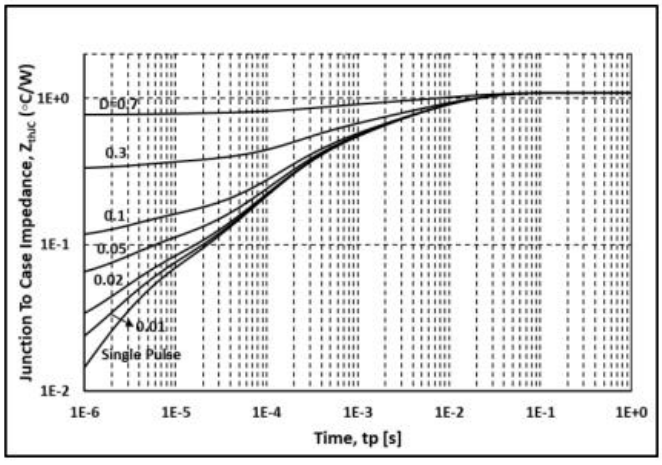



图. 23 热阻曲线

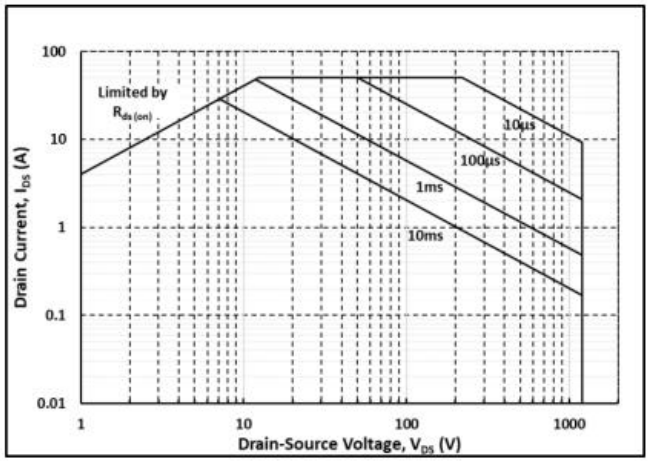
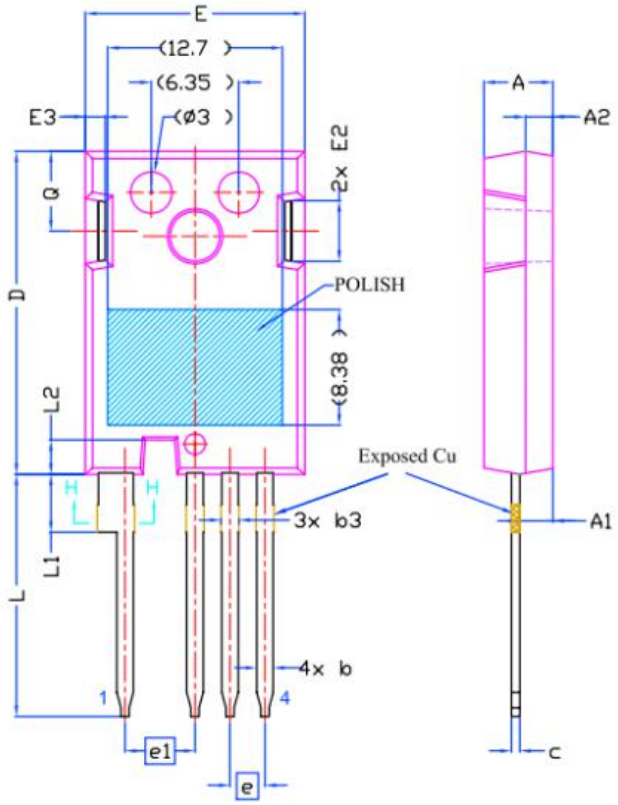
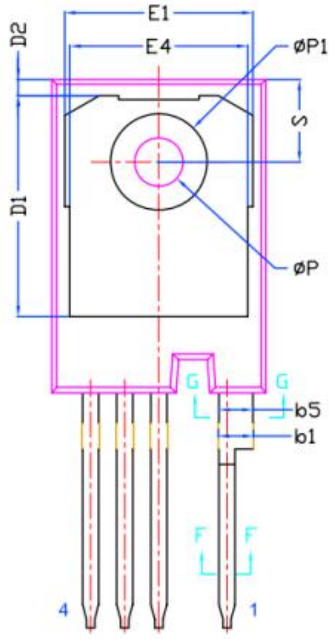


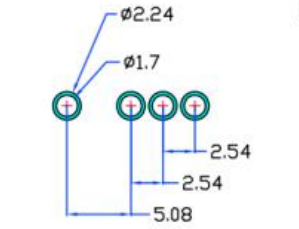

图. 24 安全工作区示意图

## Package Outline:TO-247-4

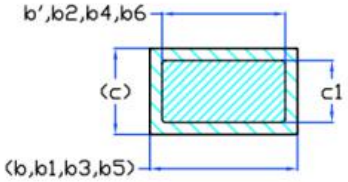



| SYMBOL | DIMENSIONS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.41 | 2.54 |
| A2 | 1.91 | 2.00 | 2.16 |
| b' | 1.07 | 1.20 | 1.28 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 2.39 | 2.67 | 2.94 |
| b2 | 2.39 | 2.67 | 2.84 |
| b3 | 1.07 | 1.30 | 1.60 |
| b4 | 1.07 | 1.30 | 1.50 |
| b5 | 2.39 | 2.53 | 2.69 |
| b6 | 2.39 | 2.53 | 2.64 |
| c | 0.55 | 0.60 | 0.68 |
| c1 | 0.55 | 0.60 | 0.65 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 16.55 | 17.65 |
| D2 | 0.95 | 1.19 | 1.25 |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 13.10 | 14.02 | 14.15 |
| E2 | 3.68 | 4.40 | 5.10 |
| E3 | 1.00 | 1.45 | 1.90 |
| E4 | 12.38 | 13.26 | 13.43 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| L | 17.31 | 17.57 | 17.82 |
| L1 | 3.97 | 4.19 | 4.37 |
| L2 | 2.35 | 2.50 | 2.65 |
| øP | 3.51 | 3.61 | 3.65 |
| øP1 | 7.19 REF. | | |
| Q | 5.49 | 5.79 | 6.00 |
| S | 6.04 | 6.17 | 6.30 |




Recommended Solder Pad Layout




Section F--F, G--G, H--H

**说明：**

1. 封装标准参考：：JEDEC TO247, Variation AD
2. 以上单位为：毫米
3. 需要开槽，槽口可为圆形
4. 尺寸 D 和 E 不包括模具溢料