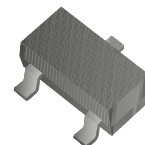


## P-Channel MOSFET

RoHS Device  
Halogen Free



## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)MAX}$      | $I_D$ |
|---------------|----------------------|-------|
| -20V          | 46m $\Omega$ @ -4.5V | -4.1A |
|               | 70m $\Omega$ @ -2.5V |       |

## Features

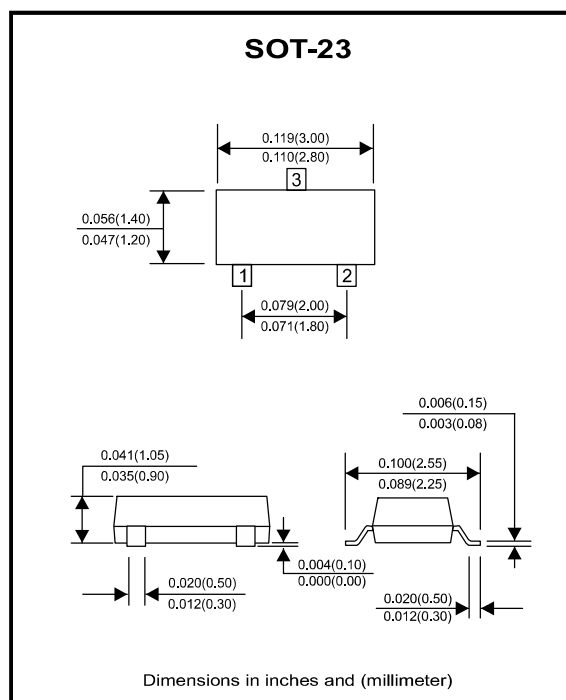
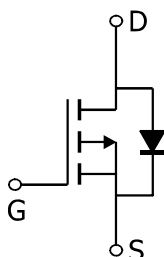
- High Power and Current Handling Capability
- Lead Free Product is Acquired
- Surface Mount Package

## Application

- PWM Applications
- Load Switch
- Power Management

## Circuit Diagram

- G : Gate
- S : Source
- D : Drain

Absolute Maximum Ratings ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol          | Parameter                               |                             | Max.        | Units                |
|-----------------|-----------------------------------------|-----------------------------|-------------|----------------------|
| $V_{DSS}$       | Drain-Source Voltage                    |                             | -20         | V                    |
| $V_{GSS}$       | Gate-Source Voltage                     |                             | $\pm 12$    | V                    |
| $I_D$           | Continuous Drain Current                | $T_C = 25^{\circ}\text{C}$  | -4.1        | A                    |
|                 |                                         | $T_C = 100^{\circ}\text{C}$ | -3.2        |                      |
| $I_{DM}$        | Pulsed Drain Current <sup>note1</sup>   |                             | -15         | A                    |
| $P_D$           | Power Dissipation                       | $T_C = 25^{\circ}\text{C}$  | 1.7         | W                    |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient |                             | 74          | $^{\circ}\text{C/W}$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range |                             | -55 to +150 | $^{\circ}\text{C}$   |

**Electrical Characteristics** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| Symbol                                                 | Parameter                                                 | Test Condition                                                                                                           | Min.  | Typ. | Max. | Units |
|--------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------|------|------|-------|
| Off Characteristic                                     |                                                           |                                                                                                                          |       |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                            | V <sub>GS</sub> =0V,I <sub>D</sub> = -250μA                                                                              | -20   | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                           | V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V,                                                                            | -     | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                              | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V                                                                              | -     | -    | ±100 | nA    |
| On Characteristics                                     |                                                           |                                                                                                                          |       |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA                                                              | -0.45 | -0.7 | -1.0 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br><small>note2</small> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4.1A                                                                            | -     | 35   | 46   | mΩ    |
|                                                        |                                                           | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-3A                                                                              | -     | 46   | 70   |       |
| g <sub>FS</sub>                                        | Forward Transconductance                                  | V <sub>DS</sub> =-5V, I <sub>D</sub> = -2A                                                                               | -     | 6    | -    | S     |
| Dynamic Characteristics                                |                                                           |                                                                                                                          |       |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                         | V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                                              | -     | 954  | -    | pF    |
| C <sub>oss</sub>                                       | Output Capacitance                                        |                                                                                                                          | -     | 131  | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                              |                                                                                                                          | -     | 117  | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                         | V <sub>DS</sub> = -10V, I <sub>D</sub> = -4.1A,<br>V <sub>GS</sub> = -4.5V                                               | -     | 7.8  | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                        |                                                                                                                          | -     | 1.2  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                               |                                                                                                                          | -     | 1.6  | -    | nC    |
| Switching Characteristics                              |                                                           |                                                                                                                          |       |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                        | V <sub>DD</sub> = -10V, I <sub>D</sub> = -3.3A,<br>R <sub>G</sub> = 1Ω, V <sub>GEN</sub> =-4.5V,<br>R <sub>L</sub> =1.2Ω | -     | 12   | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                         |                                                                                                                          | -     | 35   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                       |                                                                                                                          | -     | 30   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                        |                                                                                                                          | -     | 10   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                           |                                                                                                                          |       |      |      |       |
| I <sub>s</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current  |                                                                                                                          | -     | -    | -4.1 | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current      |                                                                                                                          | -     | -    | -15  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                     | V <sub>GS</sub> = 0V, I <sub>s</sub> = -4.1A                                                                             | -     | -    | -1.2 | V     |
| t <sub>rr</sub>                                        | Reverse Recovery Time                                     | V <sub>GS</sub> =0V, I <sub>s</sub> =-4.1A,                                                                              | -     | 20   | -    | ns    |
| Q <sub>rr</sub>                                        | Reverse Recovery Charge                                   | di/dt=100A/μs                                                                                                            | -     | 9    | -    | nC    |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$

## Typical Performance Characteristics

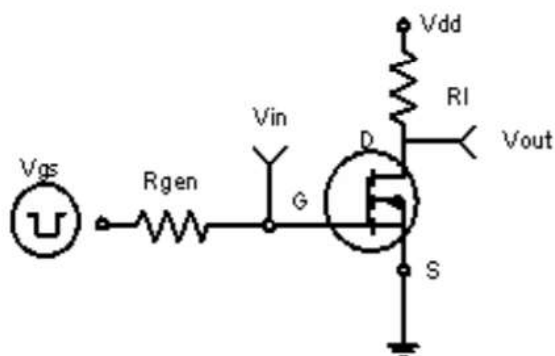


Figure 1: Switching Test Circuit

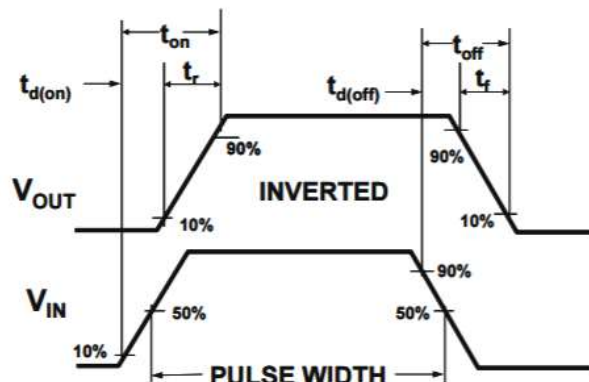
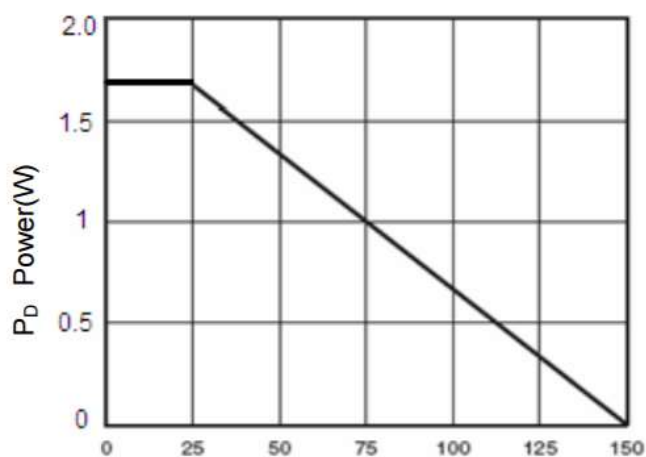
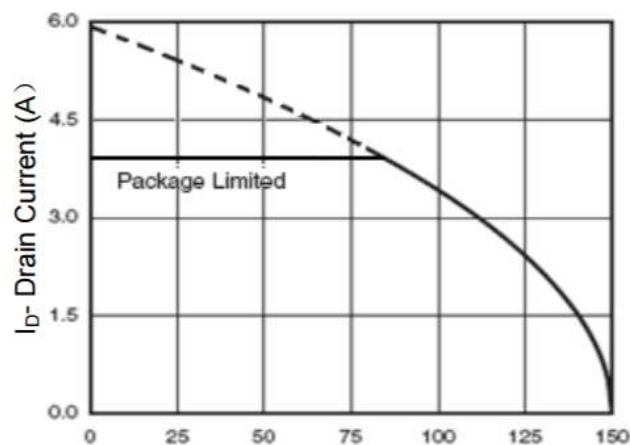


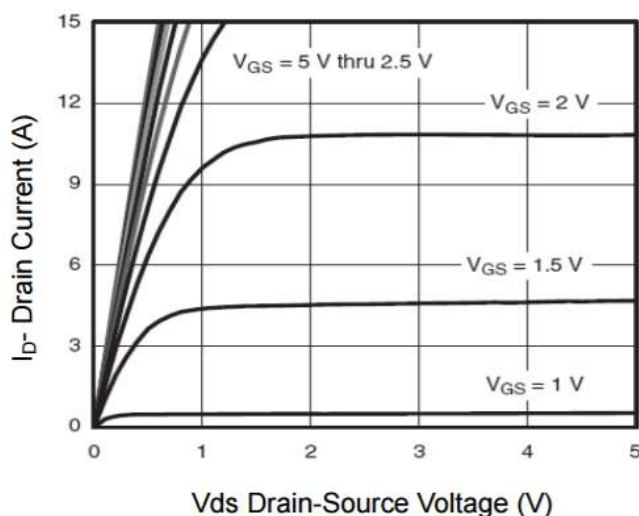
Figure 2: Switching Waveforms



T<sub>J</sub>-Junction Temperature (°C)  
Figure 3 Power Dissipation



T<sub>J</sub>-Junction Temperature (°C)  
Figure 4 Drain Current



V<sub>GS</sub> = 5 V thru 2.5 V  
Figure 5 Output Characteristics

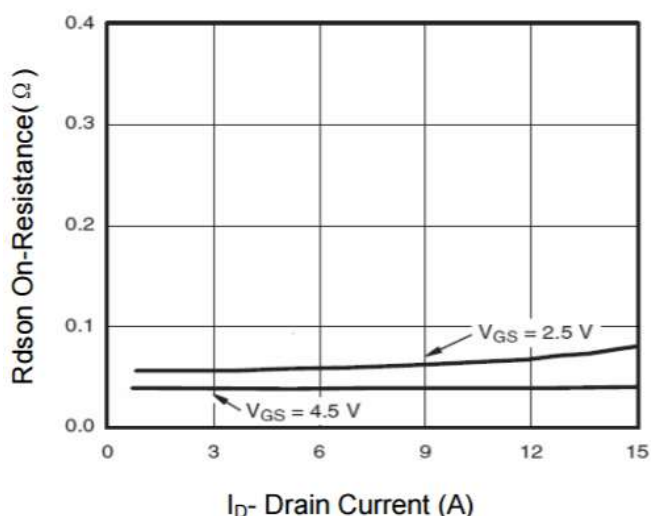
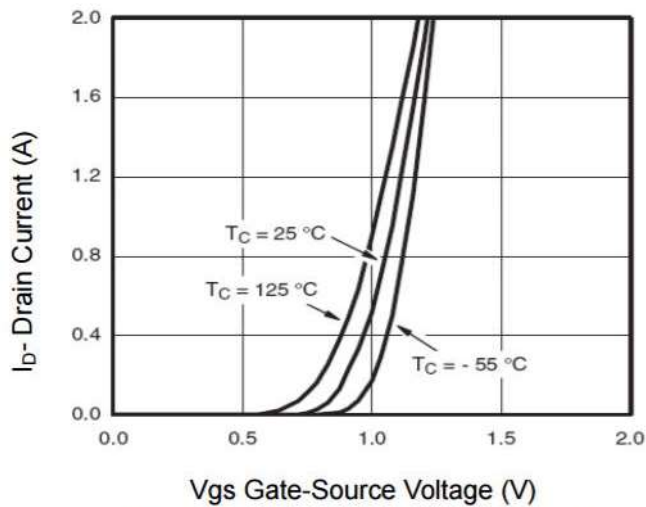
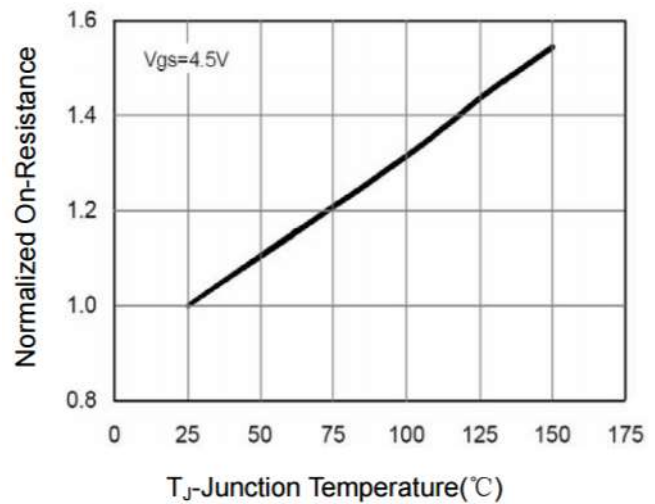


Figure 6 Drain-Source On-Resistance

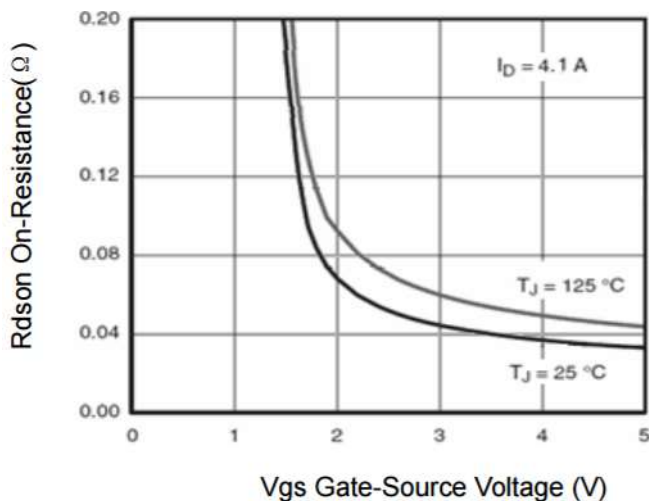
## Typical Performance Characteristics



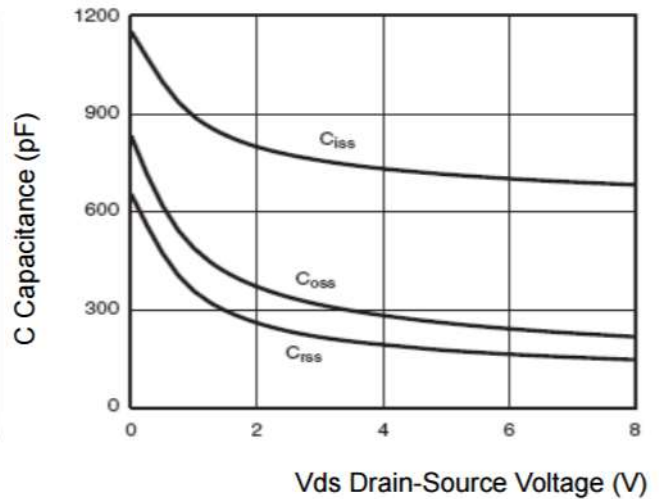
**Figure 7 Transfer Characteristics**



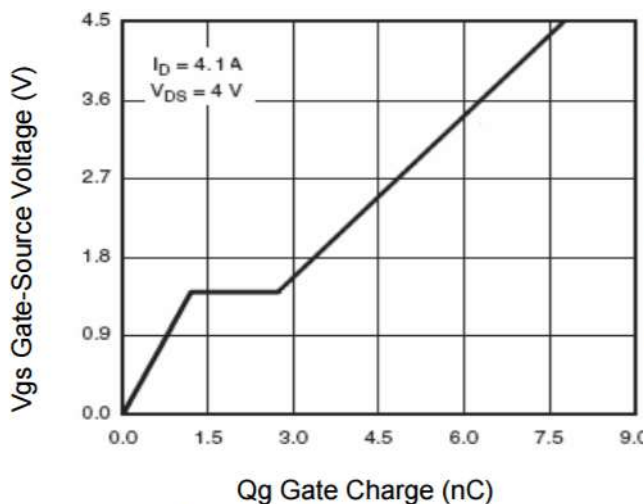
**Figure 8 Drain-Source On-Resistance**



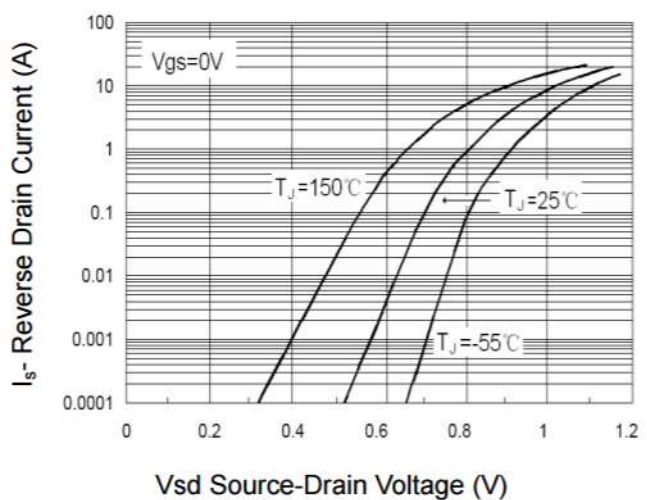
**Figure 9 Rdson vs Vgs**



**Figure 10 Capacitance vs Vds**

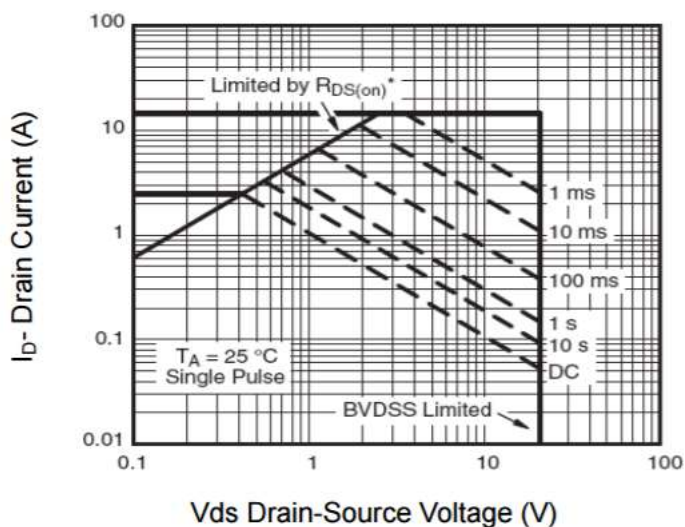


**Figure 11 Gate Charge**

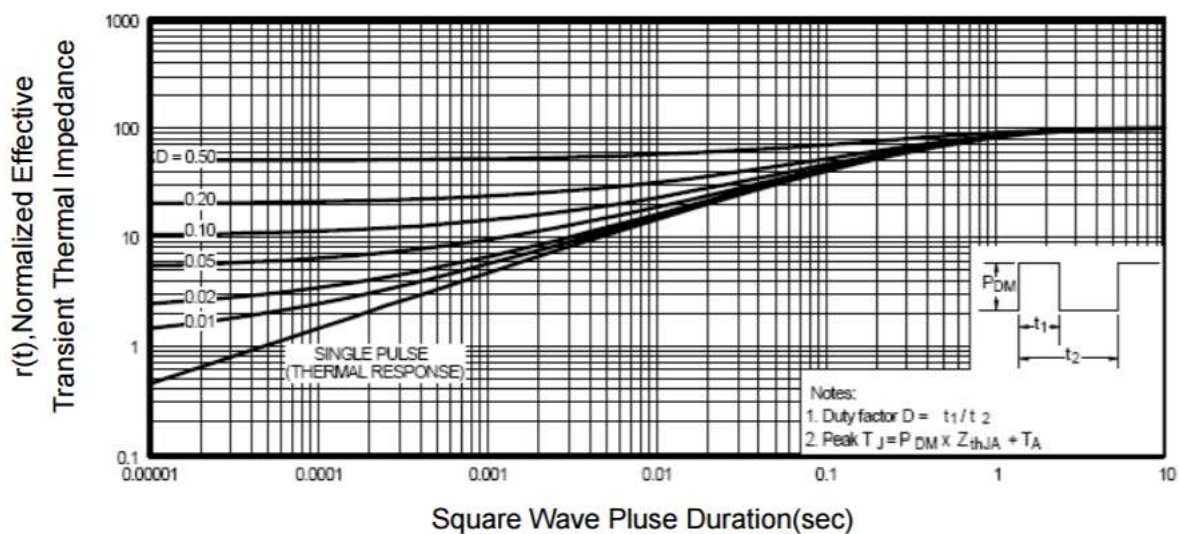


**Figure 12 Source- Drain Diode Forward**

## Typical Performance Characteristics



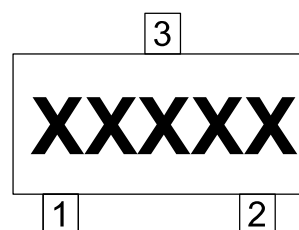
**Figure 13 Safe Operation Area**



**Figure 14 Normalized Maximum Transient Thermal Impedance**

## Marking Code

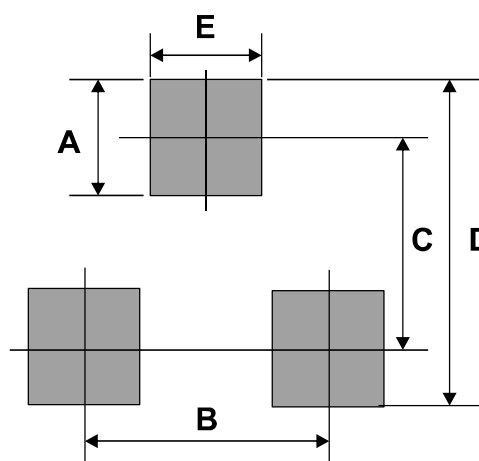
| Part Number | Marking Code |
|-------------|--------------|
| LM2305A     | 2305A        |



xxxxxx = Product type marking code

## Suggested PAD Layout

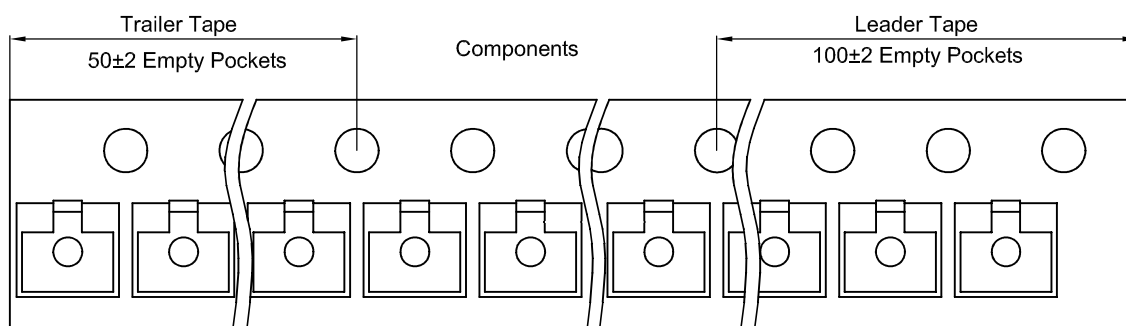
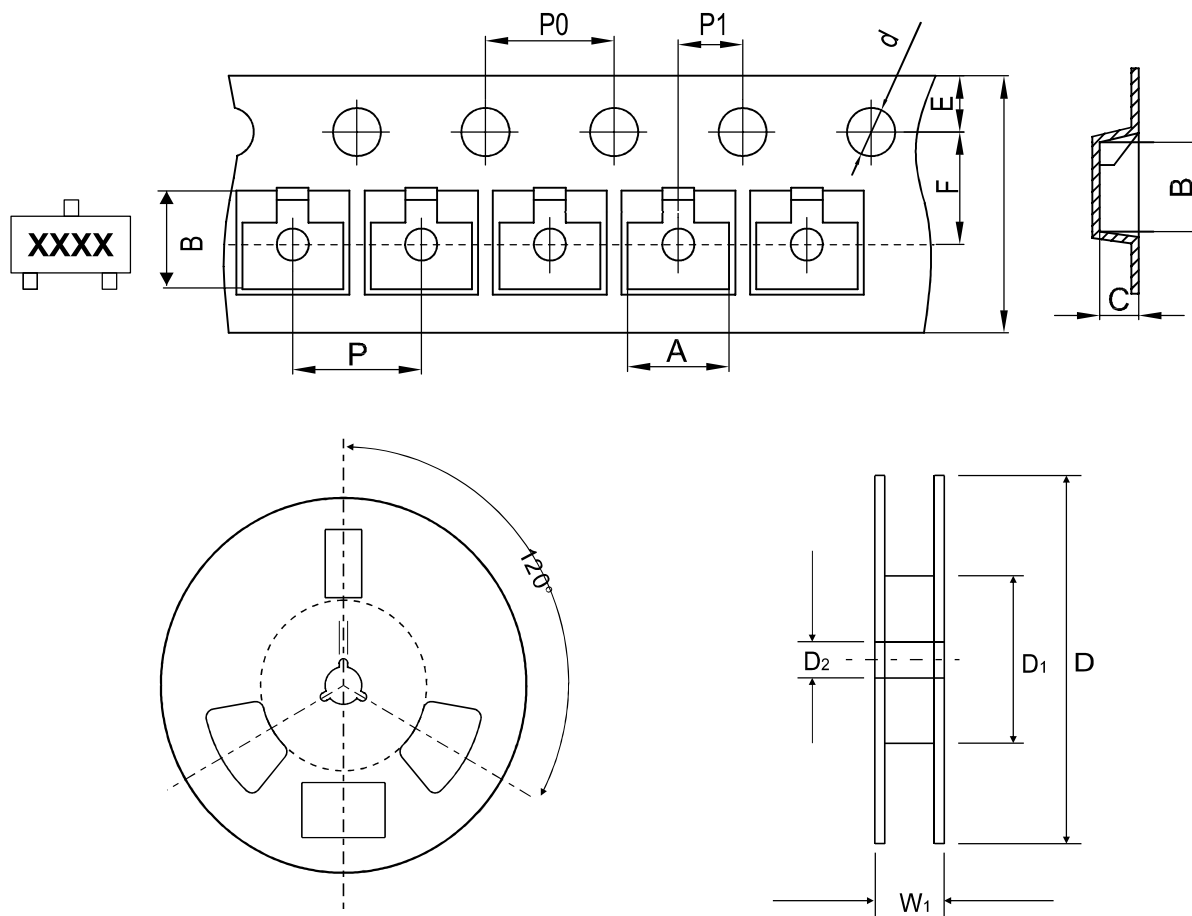
| SIZE | SOT-23 |        |
|------|--------|--------|
|      | (mm)   | (inch) |
| A    | 0.80   | 0.031  |
| B    | 1.90   | 0.075  |
| C    | 2.02   | 0.080  |
| D    | 2.82   | 0.111  |
| E    | 0.60   | 0.024  |



## Standard Packaging

| Case Type | Qty Per Reel | Reel Size |
|-----------|--------------|-----------|
|           | (Pcs)        | (inch)    |
| SOT-23    | 3,000        | 7         |

## Reel Taping Specification



| SOT-23 | SYMBOL | A                 | B                 | C                 | d                 | D                 | D1                | D2                |
|--------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|        | (mm)   | $3.15 \pm 0.10$   | $2.77 \pm 0.10$   | $1.22 \pm 0.10$   | $1.50 \pm 0.10$   | $178.00 \pm 2.00$ | $54.40 \pm 1.00$  | $13.00 \pm 1.00$  |
|        | (inch) | $0.124 \pm 0.004$ | $0.109 \pm 0.004$ | $0.048 \pm 0.004$ | $0.059 \pm 0.004$ | $7.008 \pm 0.079$ | $2.142 \pm 0.039$ | $0.512 \pm 0.039$ |

| SOT-23 | SYMBOL | E                 | F                 | P                 | P0                | P1                | W                         | W1                |
|--------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------------------|-------------------|
|        | (mm)   | $1.75 \pm 0.10$   | $3.50 \pm 0.10$   | $4.00 \pm 0.10$   | $4.00 \pm 0.10$   | $2.00 \pm 0.10$   | $8.00 + 0.30 / - 0.10$    | $12.30 \pm 1.00$  |
|        | (inch) | $0.069 \pm 0.004$ | $0.138 \pm 0.004$ | $0.157 \pm 0.004$ | $0.157 \pm 0.004$ | $0.079 \pm 0.004$ | $0.315 + 0.012 / - 0.004$ | $0.484 \pm 0.039$ |

Company reserves the right to improve product design , functions and reliability without notice.