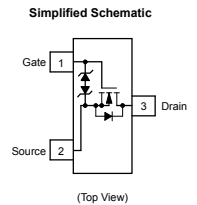
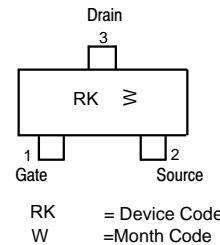


**380mA N-Channel Small Signal MOSFET - 60V**
**PRIMARY CHARACTERISTICS**

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	$I_D$ MAX (Note 1)
60 V	2.3 $\Omega$ @ 10 V	380 mA
	2.7 $\Omega$ @ 5.0 V	

**SOT-23 PACKAGE**
**MARKING DIAGRAM & PIN ASSIGNMENT**

**FEATURES**

- 380mA Drain Current
- 60V Drain-Source Voltage
- 2.3  $\Omega$  Drain-Source Resistance @ 10V
- 2.7  $\Omega$  Drain-Source Resistance @ 5.0V
- We declare that the material of product are Halogen Free and compliance with RoHS requirements.

**APPLICATIONS**

- Switching
- Amplifier
- Driver
- Motor Drive
- Power MOSFET

**MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise stated)**

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	60	V
Gate-to-Source Voltage	$V_{GS}$	±20	V
Drain Current (Note 1) Steady State $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$	$I_D$	320 230	mA
$t < 5$ s $T_A = 25^\circ\text{C}$ $T_A = 85^\circ\text{C}$		380 270	
Power Dissipation (Note 1) Steady State $t < 5$ s	$P_D$	300 420	mW
Pulsed Drain Current ( $t_p = 10 \mu\text{s}$ )	$I_{DM}$	1.5	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C
Source Current (Body Diode)	$I_S$	300	mA
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	°C
Gate-Source ESD Rating (HBM, Method 3015)	ESD	2000	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	417	°C/W
Junction-to-Ambient - $t \leq 5$ s (Note 1)	$R_{\theta JA}$	300	

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces)

**380mA N-Channel Small Signal MOSFET - 60V**
**ELECTRICAL CHARACTERISTICS** ( $T_J = 25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			71		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		1	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		500	
		$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}$	$T_J = 25^\circ\text{C}$			100
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$

**ON CHARACTERISTICS** (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.0		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			4.0		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$			2.3	$\Omega$
		$V_{GS} = 5.0\text{ V}, I_D = 50\text{ mA}$			2.7	
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 200\text{ mA}$	80			mS

**CHARGES AND CAPACITANCES**

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 25\text{ V}$		34		$\mu\text{F}$
Output Capacitance	$C_{OSS}$			3		
Reverse Transfer Capacitance	$C_{RSS}$			2.2		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}; I_D = 500\text{ mA}$		0.71		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.1		
Gate-to-Source Charge	$Q_{GS}$			0.32		
Gate-to-Drain Charge	$Q_{GD}$			0.16		

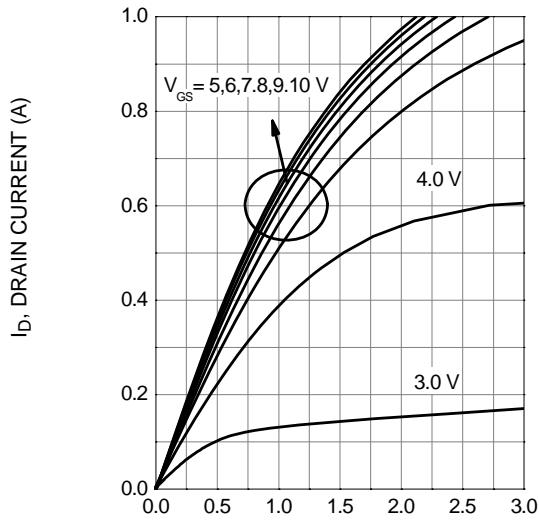
**SWITCHING CHARACTERISTICS,  $V_{GS} = V$**  (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{DS} = 10\text{ V}, V_{GEN} = 10\text{ V}, I_D = 500\text{ mA}$		3.8		ns
Rise Time	$t_r$			3.4		
Turn-Off Delay Time	$t_{d(OFF)}$			19		
Fall Time	$t_f$			12		

**DRAIN-SOURCE DIODE CHARACTERISTICS**

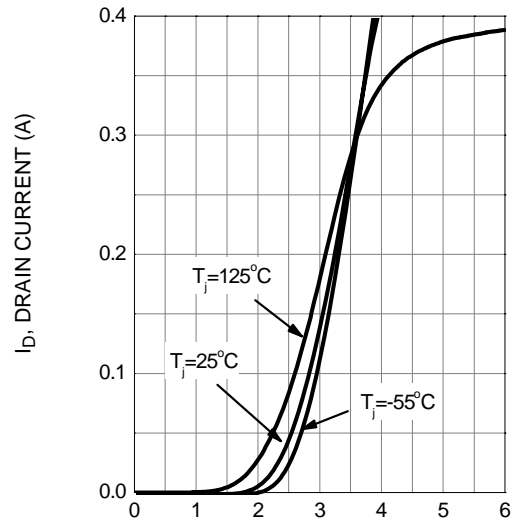
Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 115\text{ mA}$	$T_J = 25^\circ\text{C}$		1.4	V
			$T_J = 85^\circ\text{C}$		0.7	

- Pulse Test: pulse width  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$
- Switching characteristics are independent of operating junction temperatures

**TYPICAL ELECTRICAL CHARACTERISTICS**


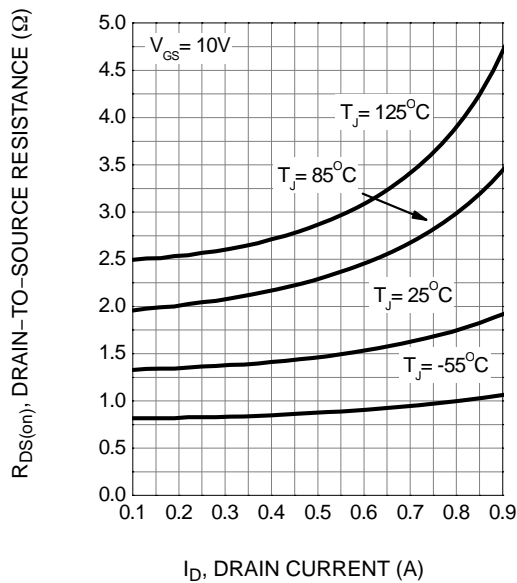
$V_{DS}$ , DRAIN-TO-SOURCE VOLTAGE (V)

**Figure 1. On-Region Characteristics**



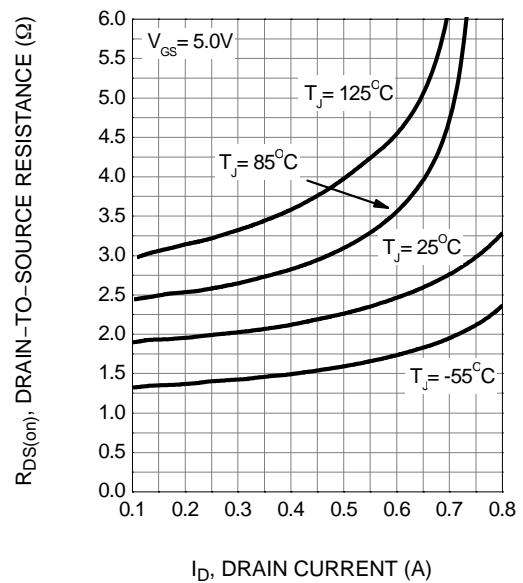
$V_{GS}$ , GATE-TO-SOURCE VOLTAGE (V)

**Figure 2. Transfer Characteristics**



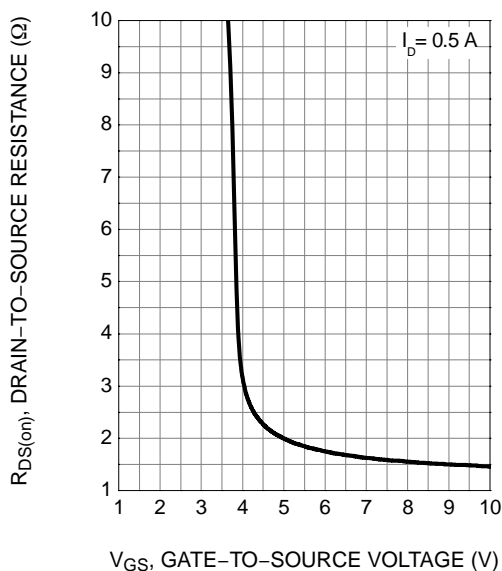
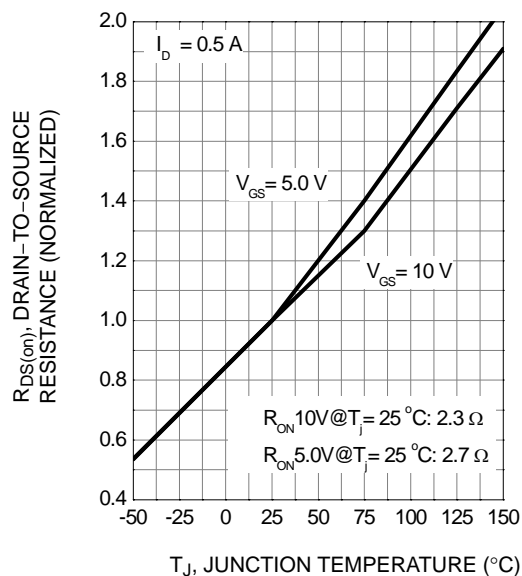
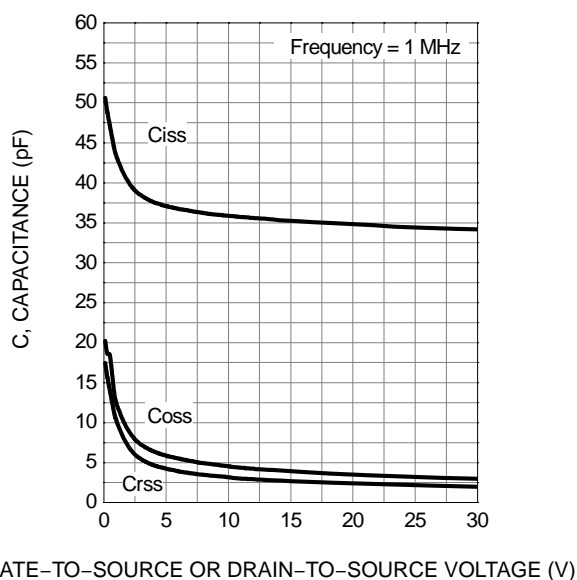
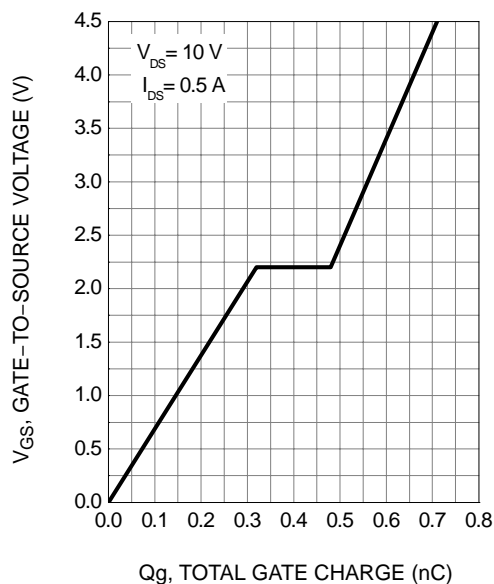
$I_D$ , DRAIN CURRENT (A)

**Figure 3. On-Resistance vs. Drain Current and Temperature**



$I_D$ , DRAIN CURRENT (A)

**Figure 4. On-Resistance vs. Drain Current and Temperature**

**TYPICAL ELECTRICAL CHARACTERISTICS**

**Figure 5. On-Resistance vs. Gate-to-Source Voltage**

**Figure 6. On-Resistance Variation with Temperature**

**Figure 7. Capacitance Variation**

**Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**

TYPICAL ELECTRICAL CHARACTERISTICS

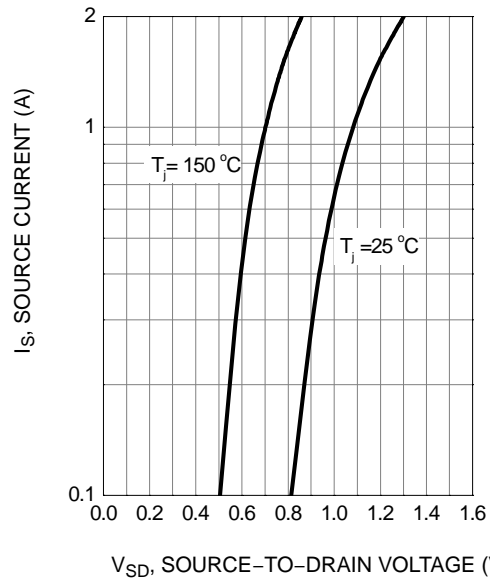
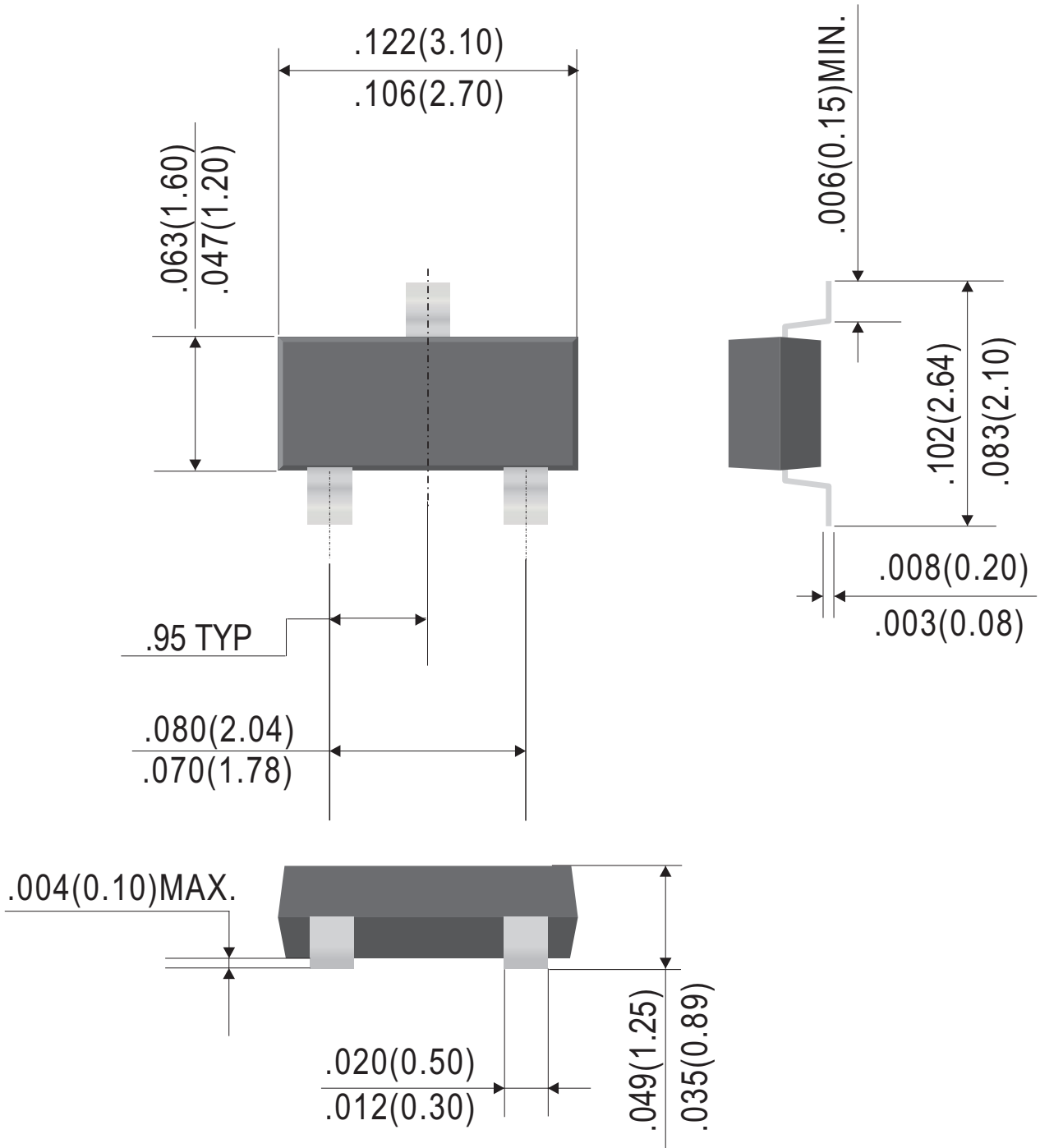


Figure 9. Diode Forward Voltage vs. Current

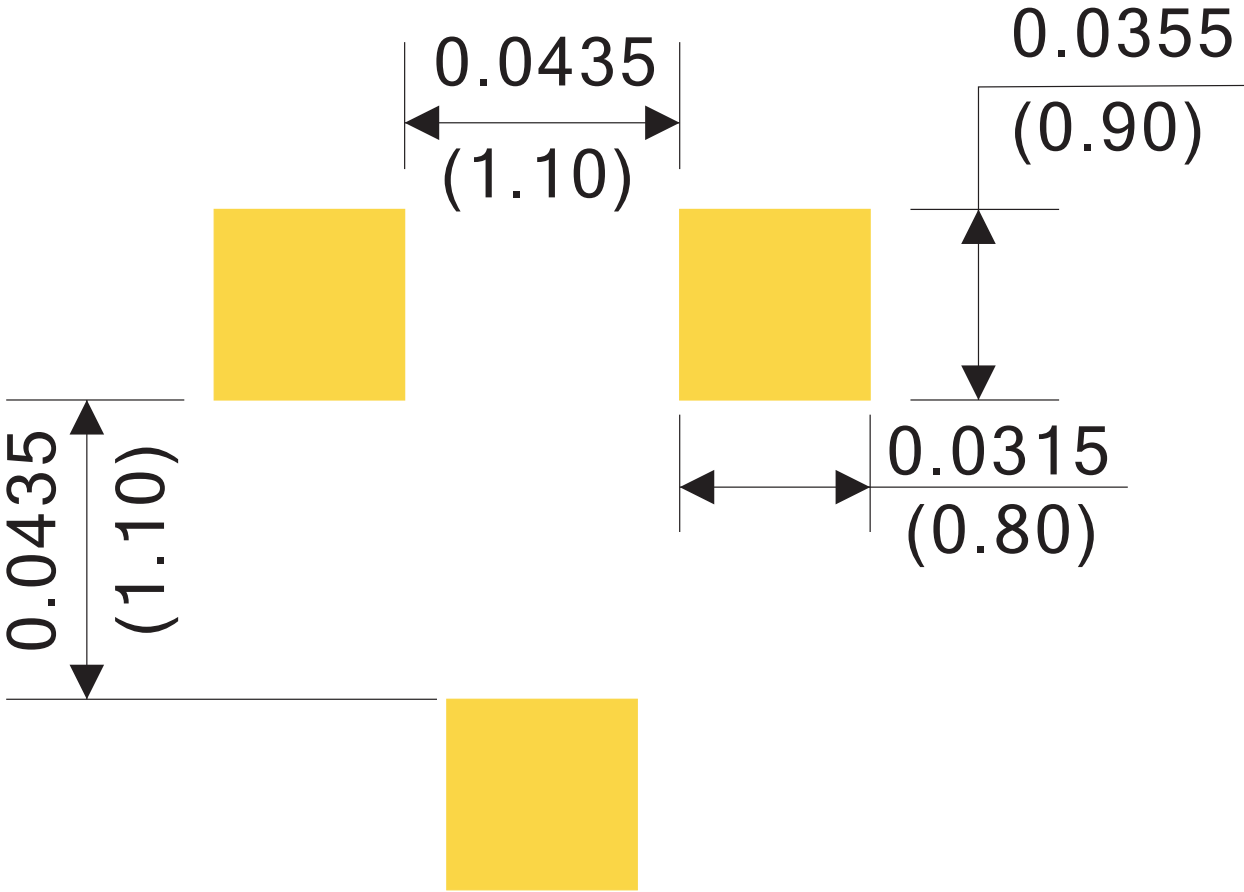
# Outline Drawing

# SOT-23



Dimensions in inches and (millimeters)

Rev.E

Suggested Soldering Pad Layout	SOT-23
 <p style="text-align: center;">Dimensions in inches and (millimeters)</p>	

RevA

**Ordering Information:**

Device PN	Packing
2N7002KLT1 -T <sup>(1)</sup> H <sup>(2)</sup> -WS	Tape&Reel: 3 Kpcs/Reel

Note: (1) Packing code, Tape &amp; Reel Packing

(2) Halogen free product for packing code suffix "H"

**\*\*\*Disclaimer\*\*\***

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