Professional semiconductor device manufacturer

5N50

N -channel Enhancement Mode Power MOSFET

V_{DSS}	500	V
I_D	5	A
$R_{DS(ON)}$	1.4	Ω

Features

500V, 5A

$R_{DS(ON)} < 1.75\Omega$ @ $V_{GS} = 10V$

Fast Switching

Improved dv/dt Capability

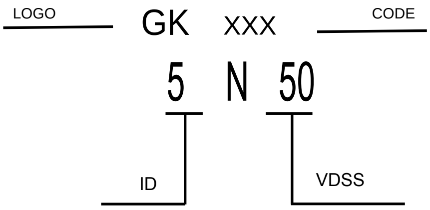
Applications

Load Switch

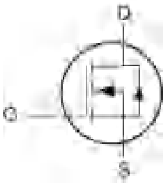
PWM Application

Power Management

TO-252



Equivalent Circuit



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (@ T_C = 25°C unless otherwise specified)

Symbol	Parameter		Value	Units
V_{DS}	Drain-to-Source Voltage		500	V
V_{GS}	Gate-to-Source Voltage		±30	V
I_D	Continuous Drain Current	$T_C = 25°C$	5	A
		$T_C = 100°C$	3	
I_{DM}	Pulsed Drain Current (1)		20	A
E_{AS}	Single Pulsed Avalanche Energy (2)		132	mJ
P_D	Power Dissipation	$T_C = 25°C$	83	W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient(3)		33	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case		1.5	
T_J, T_{STG}	Junction & Storage Temperature Range		-55 to 150	°C

Electrical Characteristics (T_J=25℃unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	I_D = 250µA, V_{GS} = 0V	500	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 500V, V_{GS} = 0V	-	-	1.0	µA
I_{GSS}	Gate-Body Leakage Current	V_{DS} = 0V, V_{GS} = ±30V	-	-	±100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250µA	2	3	4	V
$R_{DS(ON)}$	Static Drain-Source ON-Resistance$^{(4)}$	V_{GS} = 10V, I_D = 2.5A	-	1.40	1.75	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 25V, f = 1MHz	-	615	-	pF
C_{oss}	Output Capacitance		-	67	-	pF
C_{rss}	Reverse Transfer Capacitance		-	10	-	pF
Q_g	Total Gate Charge	V_{GS} = 0 to 10V V_{DS} = 250V, I_D = 2A	-	14	-	nC
Q_{gs}	Gate Source Charge		-	3.3	-	nC
Q_{gd}	Gate Drain("Miller") Charge		-	4	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On DelayTime	V_{GS} = 10V, V_{DD} = 240V I_D= 2A, R_{GEN} = 24Ω	-	12	-	ns
t_r	Turn-On Rise Time		-	17	-	ns
$t_{d(off)}$	Turn-Off DelayTime		-	45	-	ns
t_f	Turn-Off Fall Time		-	25	-	ns
Drain-Source Diode Characteristics and Max Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	5	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	20	A
V_{SD}	Drain to Source Diode Forward Voltage	V_{GS} = 0V, I_S = 5A	-	-	1.2	V
trr	Body Diode Reverse Recovery Time	I_F = 5A, di/dt = 100A/us	-	340	-	ns
Qrr	Body Diode Reverse Recovery Charge		-	2.9	-	µC

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
2. E_{AS} condition: Starting T_J=25C, V_{DD}=50V, V_G=10V, R_G=25ohm, L=21.5mH, I_{AS}=3.5A
3. RθJA is measured with the device mounted on a minimum recommended pad of 2oz copper FR4 PCB
4. Pulse Test: Pulse Width⩽300µs, Duty Cycle⩽0.5%.

RATING AND CHARACTERISTIC CURVES

Figure 1: Output Characteristics

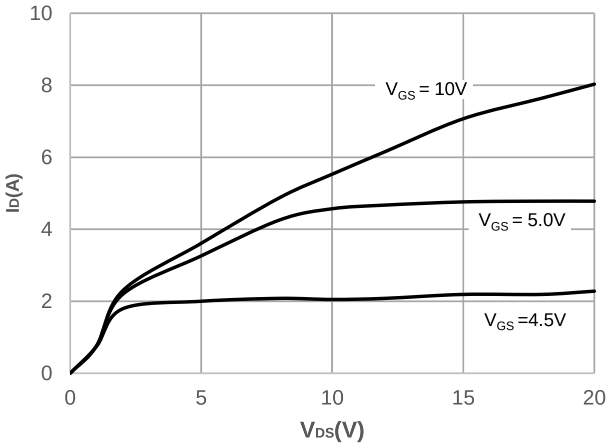


Figure 2: Typical Transfer Characteristics

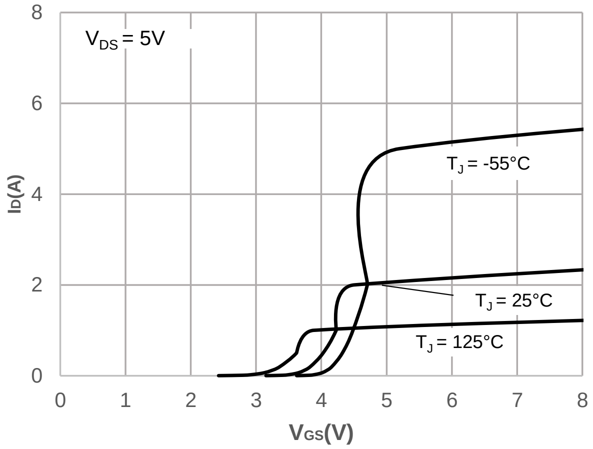


Figure 3: On-resistance vs. Drain Current

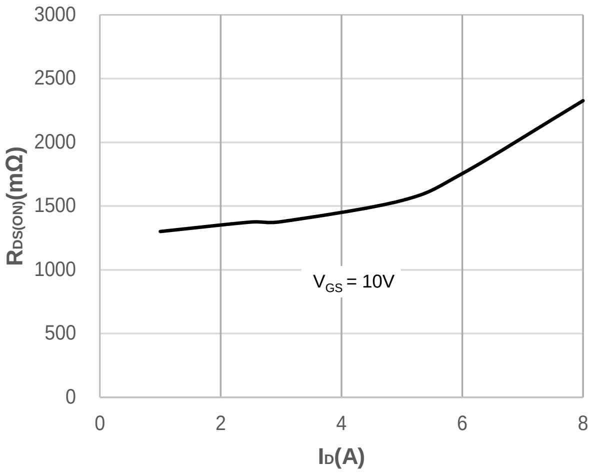


Figure 4: Body Diode Characteristics

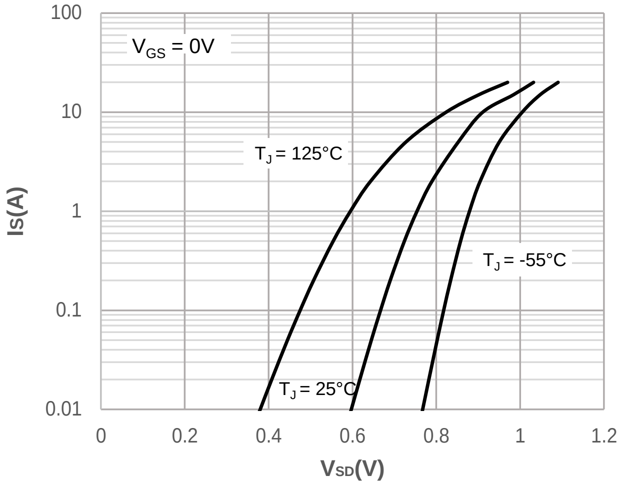


Figure 5: Gate Charge Characteristics

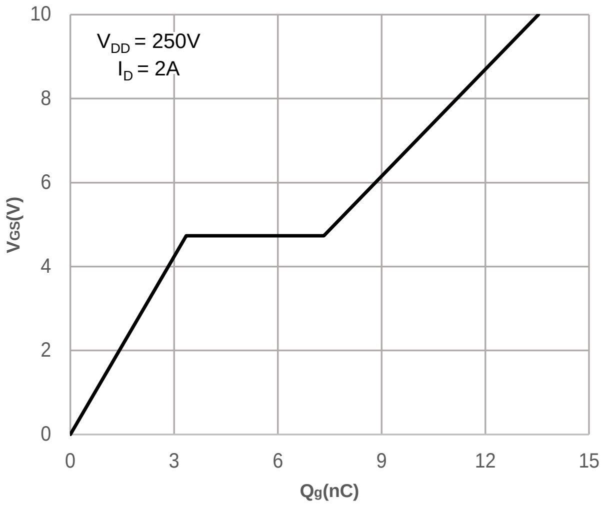
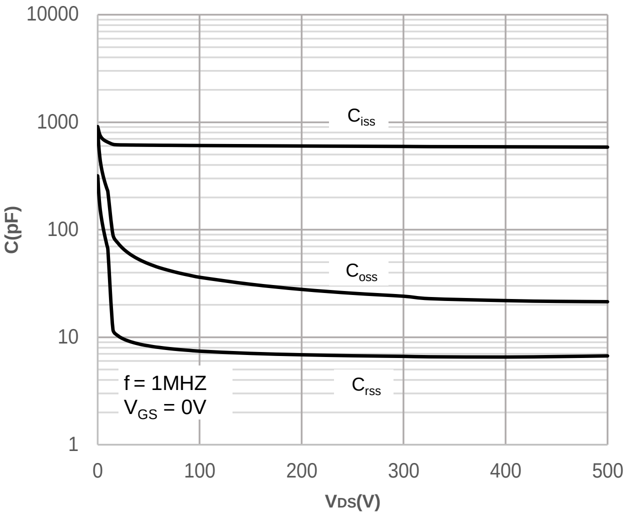


Figure 6: Capacitance Characteristics



RATING AND CHARACTERISTIC CURVES

Figure 7: Normalized Breakdown voltage vs. Junction Temperature

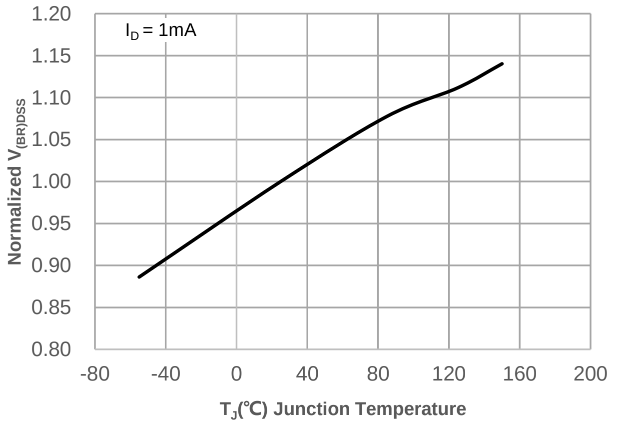


Figure 8: Normalized on Resistance vs. Junction Temperature

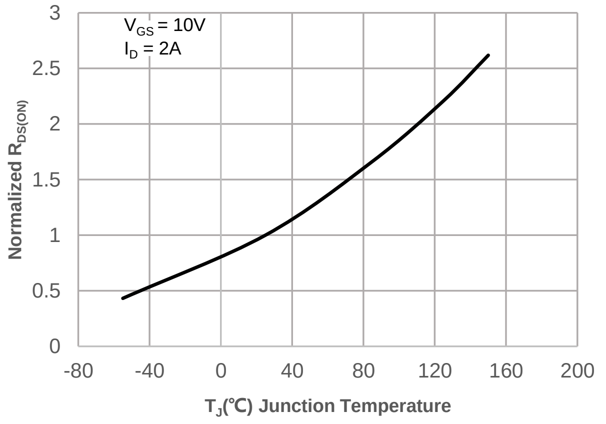


Figure 9: Maximum Safe Operating Area

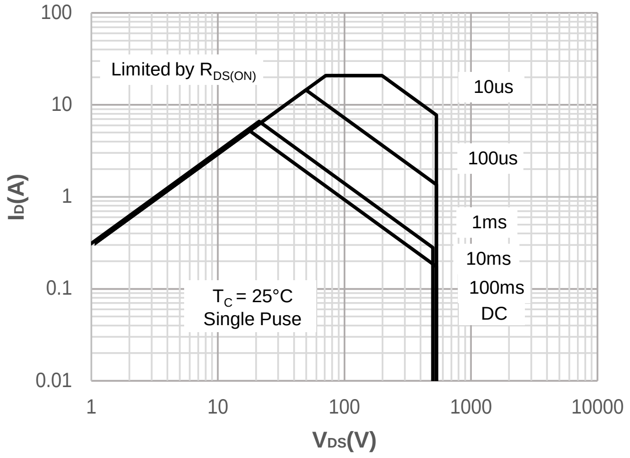


Figure 10: Maximum Continuous Drian Current vs. Case Temperature

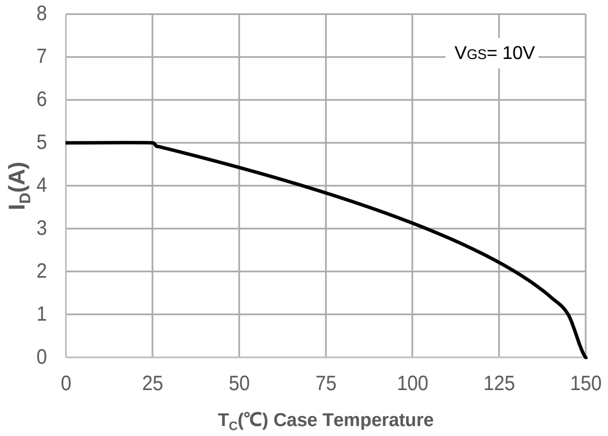


Figure 11: Normalized Maximum Transient Thermal Impedance

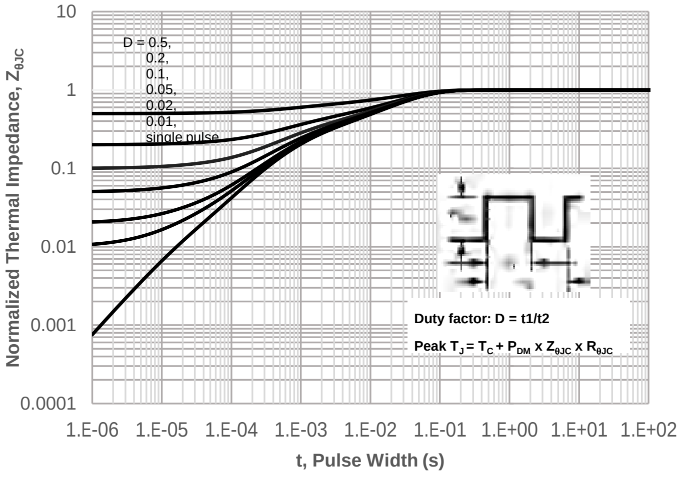
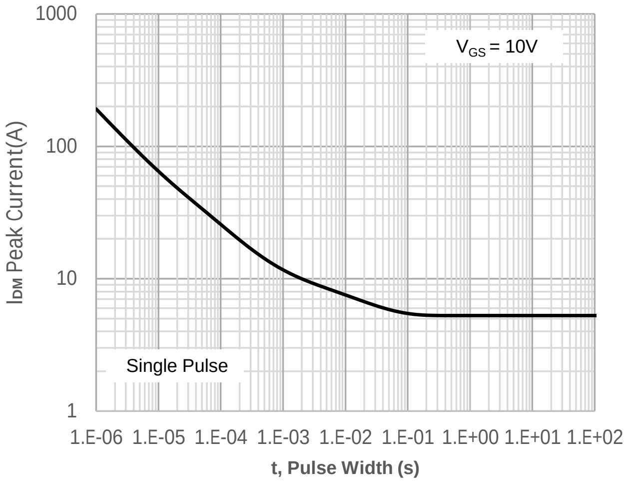
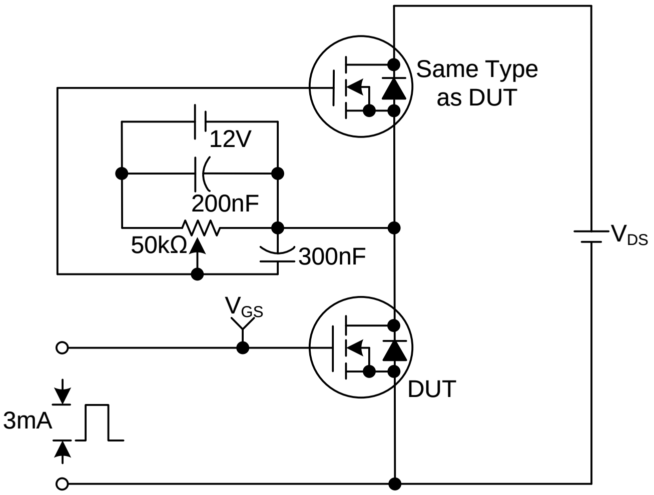


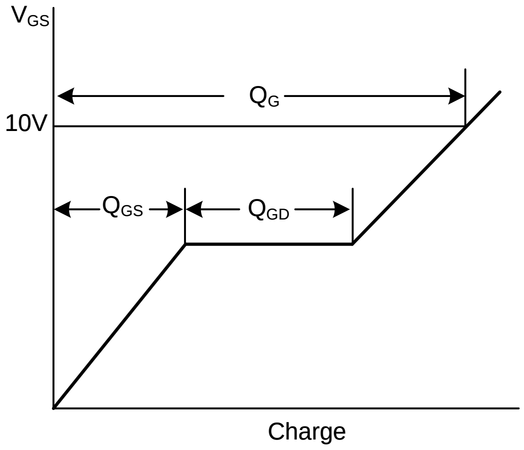
Figure 12: Peak Current Capacity



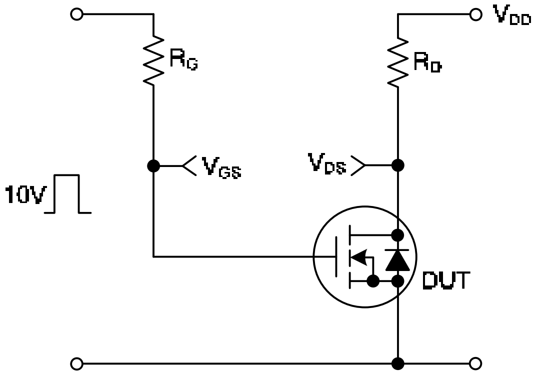
Test Circuit



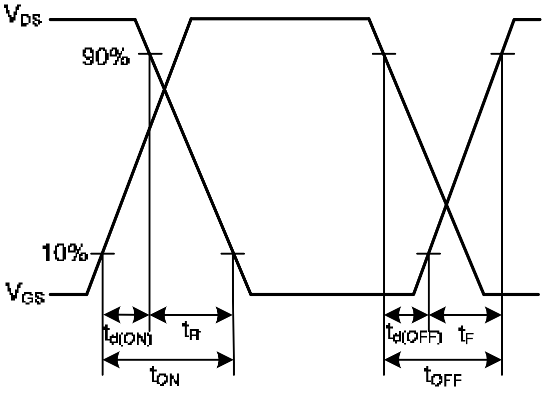
Gate Charge Test Circuit



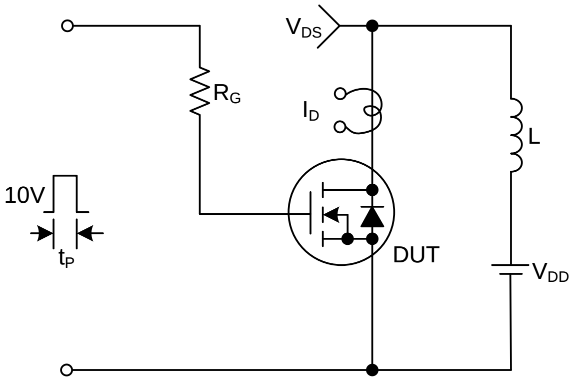
Gate Charge Waveforms



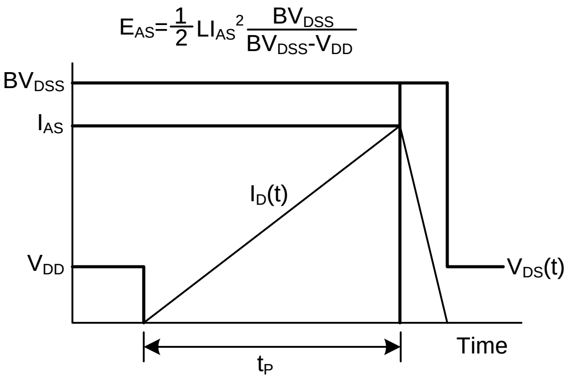
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit

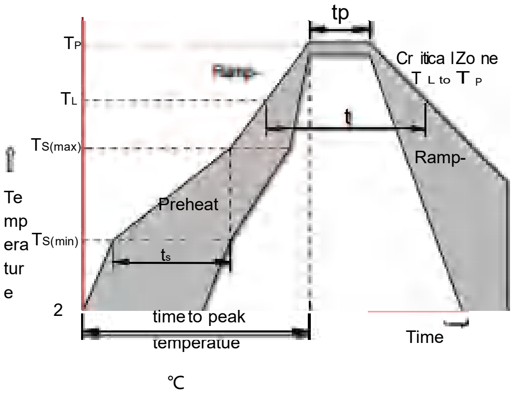


Unclamped Inductive Switching Waveforms

Soldering parameters

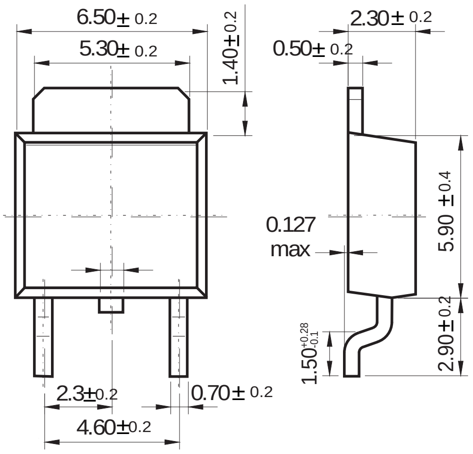
Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150℃
	-Temperature Max($T_{s(max)}$)	+200℃
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3℃/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3℃/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217℃
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_p)		+260(+0/-5)℃
Time within 5℃ of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6℃/sec. Max
Time 25℃ to Peak Temp (T_P)		8 min. Max
Do not exceed		+260℃

FIG5: Reflow condition

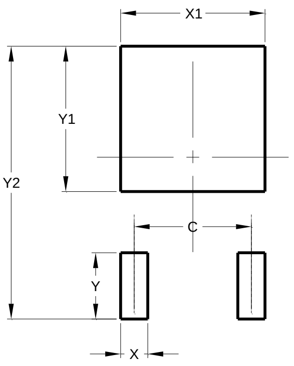


Package Dimensions & Suggested Pad Layout

TO-252



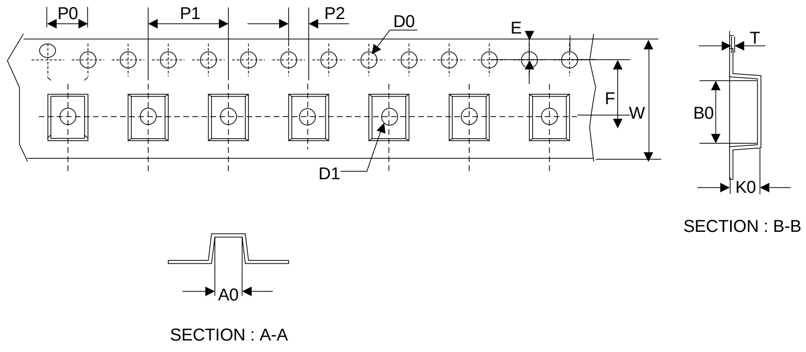
Dimensions in inches and (millimeters)



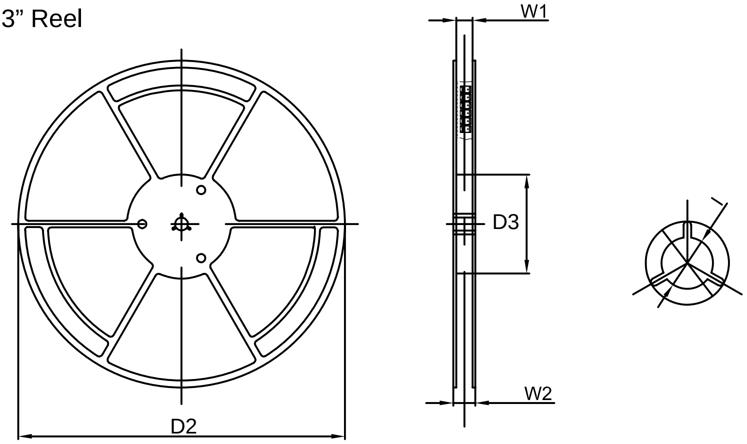
Dimensions	Value (in mm)
C	4.55
X	1.50
X1	5.80
Y	2.70
Y1	6.00
Y2	10.90

Tape & rell specification

Tape



13” Reel



Symbol	Dimension (mm)
P0	4.00±0.20
P1	8.00±0.20
P2	2.00±0.20
D0	1.55±0.15
D1	1.55±0.20
E	1.75±0.20
F	7.50±0.20
W	16.00±0.20
A0	7.10±0.20
B0	10.50±0.20
K0	2.70±0.20
T	0.30±0.10
D2	330.0±5.0
D3	100.0±4.0
W1	20.0±5.0
W2	25.0±5.0
I	13.0±2.0

Quantity: 2500PCS