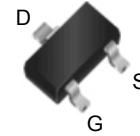
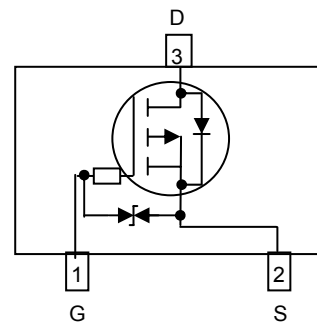


**WPM2093**
**Single P-Channel, -20V, -0.8A, Power MOSFET**
[Http://www.sh-willsemi.com](http://www.sh-willsemi.com)

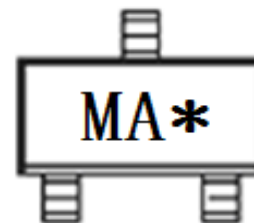
$V_{DS}$ (V)	Typical $R_{DS(on)}$ (m $\Omega$ )
-20	220 @ $V_{GS}=-4.5V$
	280 @ $V_{GS}=-2.8V$
	335 @ $V_{GS}=-2.5V$
	500 @ $V_{GS}=-1.8V$


**SOT-723**
**Descriptions**

The WPM2093 is P-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product WPM2093 is Pb-free.


**Pin configuration (Top view)**
**Features**

- Trench Technology
- Supper high density cell design
- Excellent ON resistance
- Extremely Low Threshold Voltage
- Small package SOT-723



MA= Device Code

\*= Month(A-Z)

**Marking**
**Applications**

- DC/DC converters
- Power supply converters circuit
- Load/Power Switching for portable device

**Order information**

Device	Package	Shipping
WPM2093-3/TR	SOT-723	8000/Tape&Reel

**Absolute Maximum ratings**

Parameter	Symbol	10 s	Steady State	Unit	
Drain-Source Voltage	$V_{DS}$	-20		V	
Gate-Source Voltage	$V_{GS}$	$\pm 10$			
Continuous Drain Current <sup>a d</sup>	$I_D$	$T_A=25^\circ\text{C}$	-0.82	-0.75	A
		$T_A=70^\circ\text{C}$	-0.66	-0.60	
Maximum Power Dissipation <sup>a d</sup>	$P_D$	$T_A=25^\circ\text{C}$	0.37	0.30	W
		$T_A=70^\circ\text{C}$	0.23	0.19	
Continuous Drain Current <sup>b d</sup>	$I_D$	$T_A=25^\circ\text{C}$	-0.70	-0.91	A
		$T_A=70^\circ\text{C}$	-0.56	-0.73	
Maximum Power Dissipation <sup>b d</sup>	$P_D$	$T_A=25^\circ\text{C}$	0.26	0.45	W
		$T_A=70^\circ\text{C}$	0.17	0.28	
Pulsed Drain Current <sup>c</sup>	$I_{DM}$	-1.5		A	
Operating Junction Temperature	$T_J$	-55 to 150		$^\circ\text{C}$	
Lead Temperature	$T_L$	260		$^\circ\text{C}$	
Storage Temperature Range	$T_{stg}$	-55 to 150		$^\circ\text{C}$	

**Thermal resistance ratings**

Single Operation					
Parameter		Symbol	Typical	Maximum	Unit
Junction-to-Ambient Thermal Resistance <sup>a</sup>	$t \leq 10 \text{ s}$	$R_{\theta JA}$	280	340	$^\circ\text{C/W}$
	Steady State		345	410	
Junction-to-Ambient Thermal Resistance <sup>b</sup>	$t \leq 10 \text{ s}$	$R_{\theta JA}$	400	470	
	Steady State		245	280	
Junction-to-Case Thermal Resistance	Steady State	$R_{\theta JC}$	280	340	

a Surface mounted on FR4 Board using 1 square inch pad size, 1oz copper

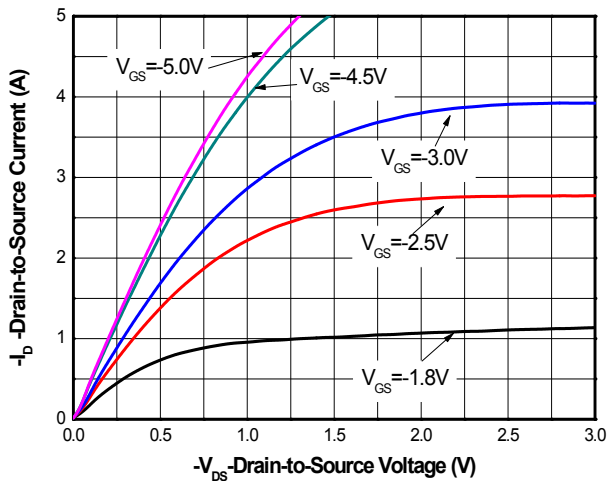
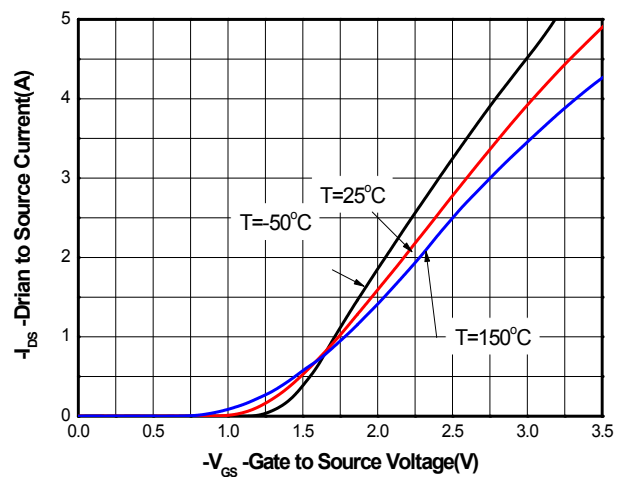
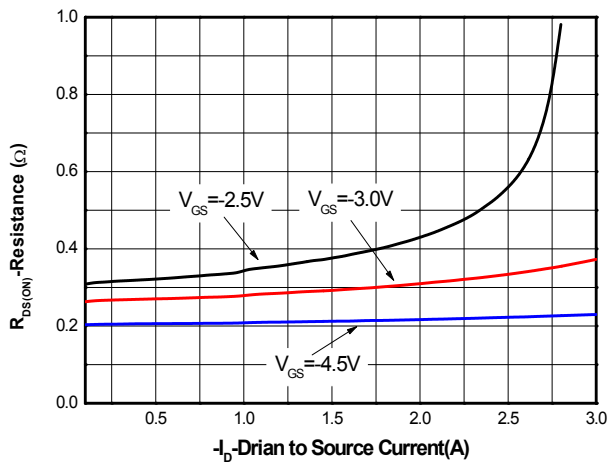
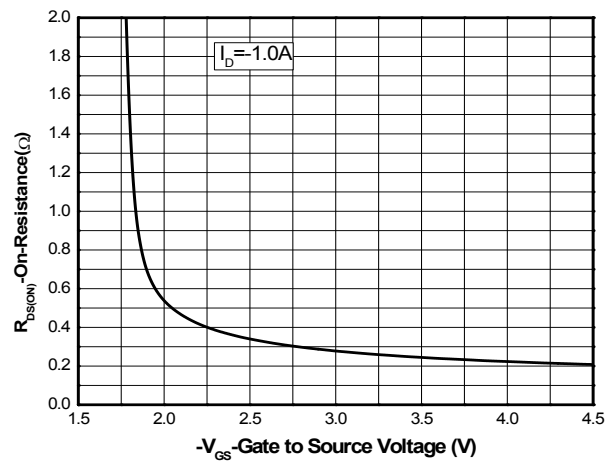
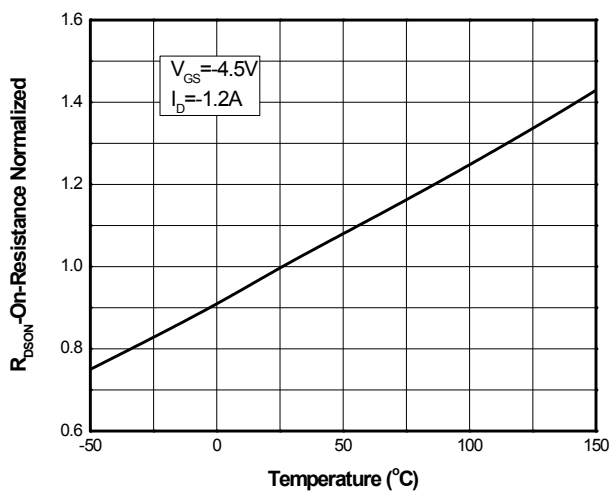
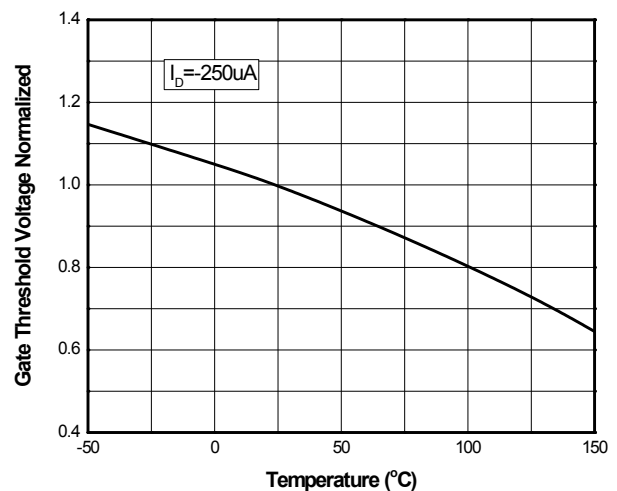
b Surface mounted on FR4 board using minimum pad size, 1oz copper

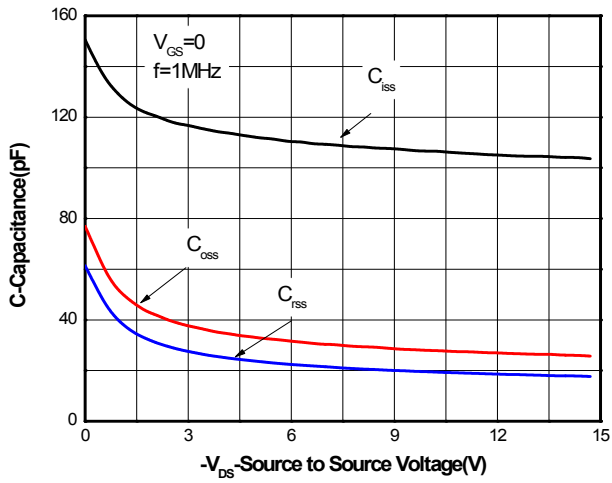
c Repetitive rating, pulse width limited by junction temperature,  $t_p=10\mu\text{s}$ , Duty Cycle=1%

d Repetitive rating, pulse width limited by junction temperature  $T_J=150^\circ\text{C}$ .

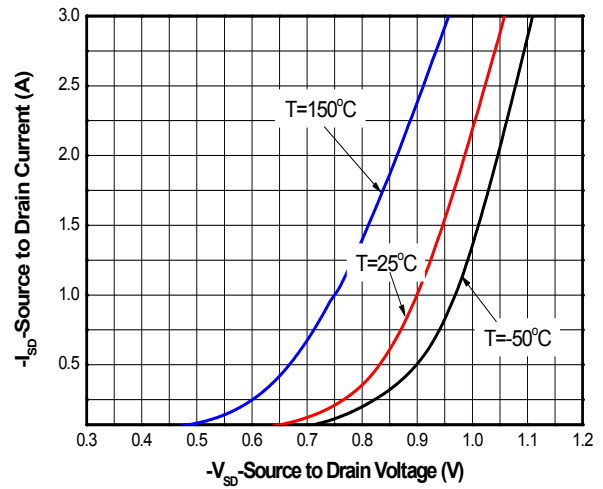
**Electronics Characteristics (Ta=25°C, unless otherwise noted)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\mu\text{A}$	-20			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
Gate-to-source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 10\text{ V}$			$\pm 5.0$	$\mu\text{A}$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-0.45	0.7	-1.0	V
Drain-to-source On-resistance	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -0.8\text{ A}$		220	360	m $\Omega$
		$V_{GS} = -2.8\text{ V}, I_D = -0.5\text{ A}$		280	400	
		$V_{GS} = -2.5\text{ V}, I_D = -0.5\text{ A}$		335	450	
		$V_{GS} = -1.8\text{ V}, I_D = -0.3\text{ A}$		500	760	
<b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b>						
Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -15\text{ V}$		104		pF
Output Capacitance	$C_{OSS}$			25		
Reverse Transfer Capacitance	$C_{RSS}$			19		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, I_D = -1\text{ A}$		1.10		nC
Threshold Gate Charge	$Q_{G(TH)}$			0.25		
Gate-to-Source Charge	$Q_{GS}$			0.38		
Gate-to-Drain Charge	$Q_{GD}$			0.47		
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_d(ON)$	$V_{GS} = -4.5\text{ V}, V_{DS} = -10\text{ V}, R_G = 6\ \Omega, I_D = -1\text{ A}$		7.2		ns
Rise Time	$t_r$			7.5		
Turn-Off Delay Time	$t_d(OFF)$			18.5		
Fall Time	$t_f$			10.7		
<b>BODY DIODE CHARACTERISTICS</b>						
Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = -0.5\text{ A}$	-0.5	-0.8	-1.2	V

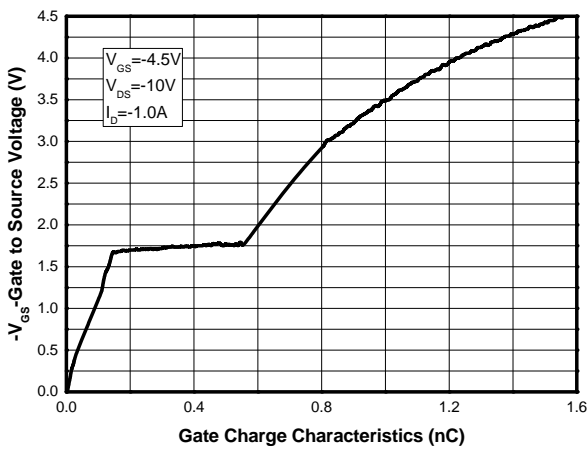
**Typical Characteristics (Ta=25°C, unless otherwise noted)**

**Output characteristics**

**Transfer characteristics**

**On-Resistance vs. Drain current**

**On-Resistance vs. Gate-to-source voltage**

**On-Resistance vs. Junction temperature**

**Threshold voltage vs. Temperature**



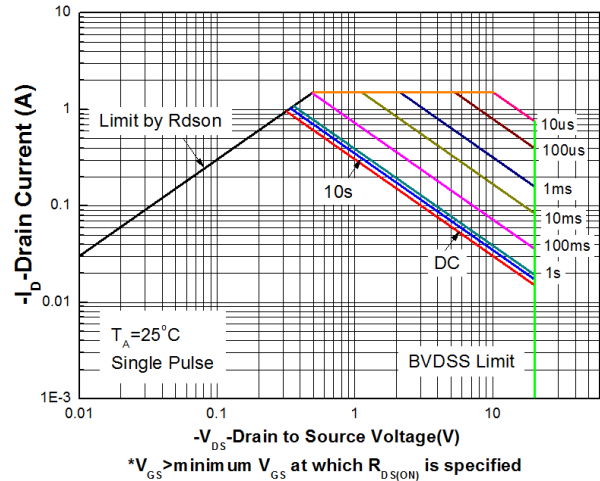
Capacitance



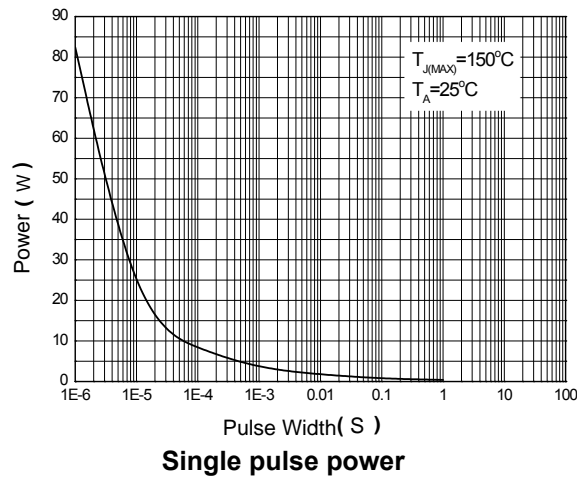
Body diode forward voltage



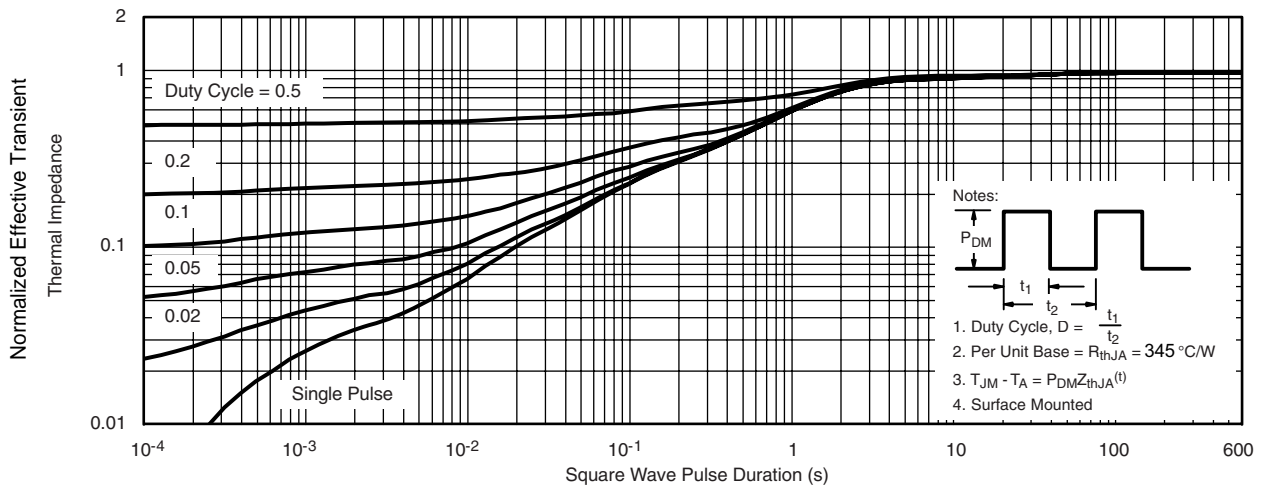
Gate Charge Characteristics



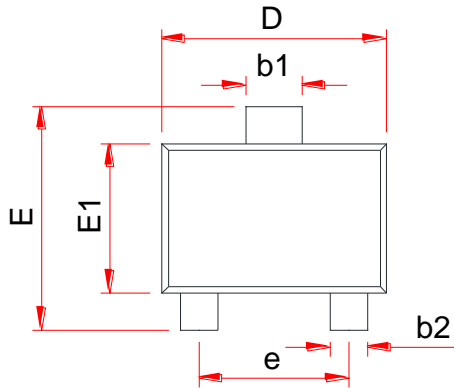
Safe operating power



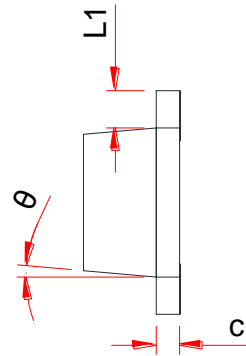
Single pulse power



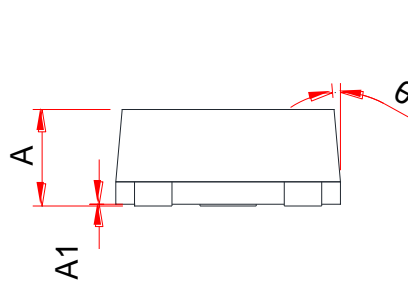
**Transient thermal response (Junction-to-Ambient)**

**Package outline dimensions**
**SOT-723**


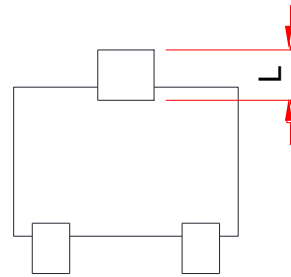
Top View



Side View

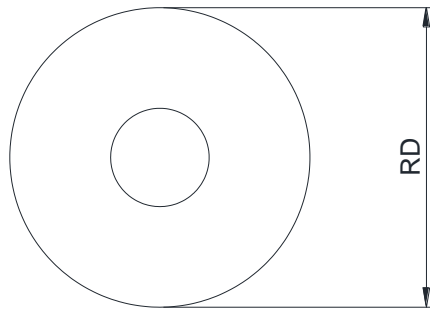
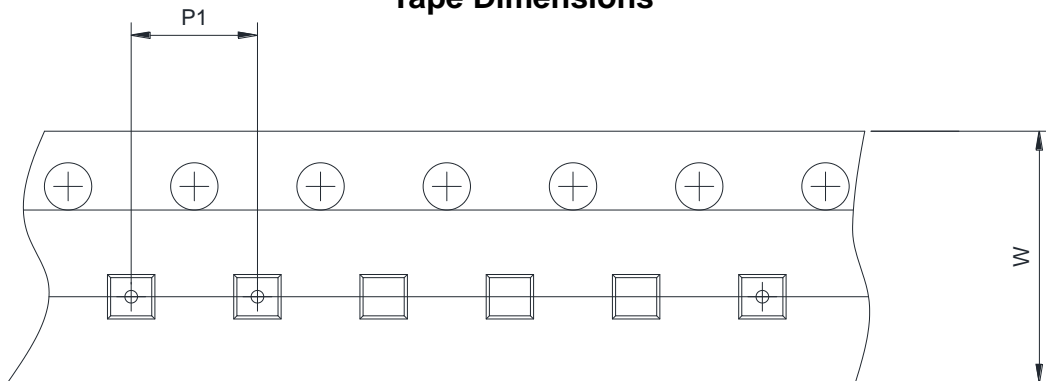
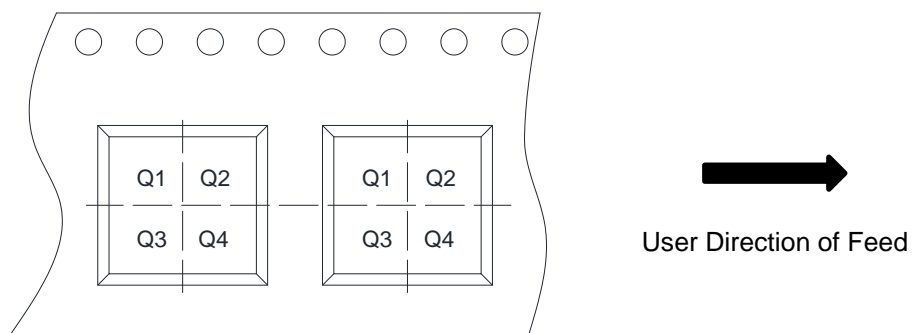


Side View



Bottom View

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.43	-	0.55
A1	0.00	-	0.05
c	0.08	0.13	0.18
b1	0.27	-	0.37
b2	0.17	-	0.27
L	0.27 Ref.		
L1	0.15	0.20	0.25
D	1.15	1.20	1.25
E	1.15	1.20	1.25
E1	0.75	0.80	0.85
e	0.80 Typ.		
$\theta$	7 ° Ref.		

**TAPE AND REEL INFORMATION**
**Reel Dimensions**

**Tape Dimensions**

**Quadrant Assignments For PIN1 Orientation In Tape**


RD	Reel Dimension	<input checked="" type="checkbox"/> 7inch	<input type="checkbox"/> 13inch
W	Overall width of the carrier tape	<input checked="" type="checkbox"/> 8mm	<input type="checkbox"/> 12mm <input type="checkbox"/> 16mm
P1	Pitch between successive cavity centers	<input checked="" type="checkbox"/> 2mm	<input type="checkbox"/> 4mm <input type="checkbox"/> 8mm
Pin1	Pin1 Quadrant	<input type="checkbox"/> Q1	<input type="checkbox"/> Q2 <input checked="" type="checkbox"/> Q3 <input type="checkbox"/> Q4