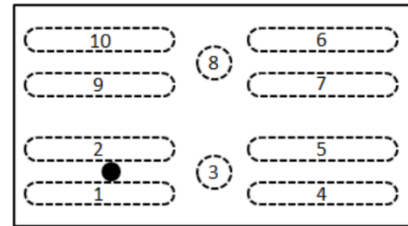


WNMD2188

Dual N-Channel, 12V, 13.7A, Power MOSFET

<https://www.omnivision-group.com>

V _{SSS} (V)	Max R _{SS(on)} (mΩ)
12	2.95@ V _{GS} =4.5V
	3.20@ V _{GS} =3.8V
	3.95@ V _{GS} =3.1V
	6.10@ V _{GS} =2.5V
ESD Rating:2000V HBM	

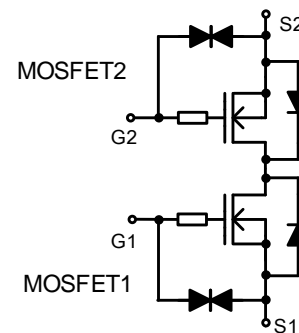


1,2,4,5=Source1(FET1) 3=Gate1 (FET1)
6,7,9,10=Source2(FET2) 8=Gate2 (FET2)

CSP-10L (Top view)

Descriptions

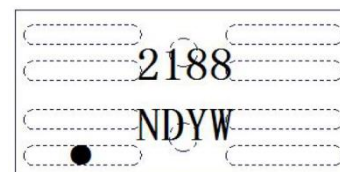
The WNMD2188 is Dual N-Channel enhancement MOS Field Effect Transistor and connecting the Drains on the circuit board is not required because the Drains of the MOSFET1 and the MOSFET2 are internally connected. Uses advanced trench technology and design to provide excellent R_{SS(ON)} with low gate charge. This device is designed for Lithium-Ion battery protection circuit. The WNMD2188 is available in CSP-10L package. Standard Product WNMD2188 is Pb-free and Halogen-free.



Pin Configuration

Features

- Trench Technology
- Supper high density cell design
- Excellent ON resistance for higher DC current
- Extremely Low Threshold Voltage
- Common-drain type
- Small package CSP-10L



2188 = Device Code
ND = Special Code
Y = Year
W = Week

Marking

Applications

- Lithium-Ion battery protection circuit

Order information

Device	Package	Shipping
WNMD2188-10/TR	CSP-10L	3000/Reel&Tape

Absolute Maximum ratings

Parameter	Symbol	Maximum	Unit	
Source-Source Voltage	V_{SS}	12	V	
Gate-Source Voltage	V_{GS}	± 8		
Continuous Source Current	$T_A=25^{\circ}\text{C}$	I_S^a	13.7	A
		I_S^b	33	
Pulsed Source Current ^c	I_{SM}	130		
Maximum Power Dissipation	$T_A=25^{\circ}\text{C}$	P_D^a	0.6	W
		P_D^b	3.5	
Operating Junction Temperature	T_J	-55 to 150	$^{\circ}\text{C}$	
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	$R_{\theta JA}^a$	140	210	$^{\circ}\text{C/W}$
	$R_{\theta JA}^b$	31	36	

Note:

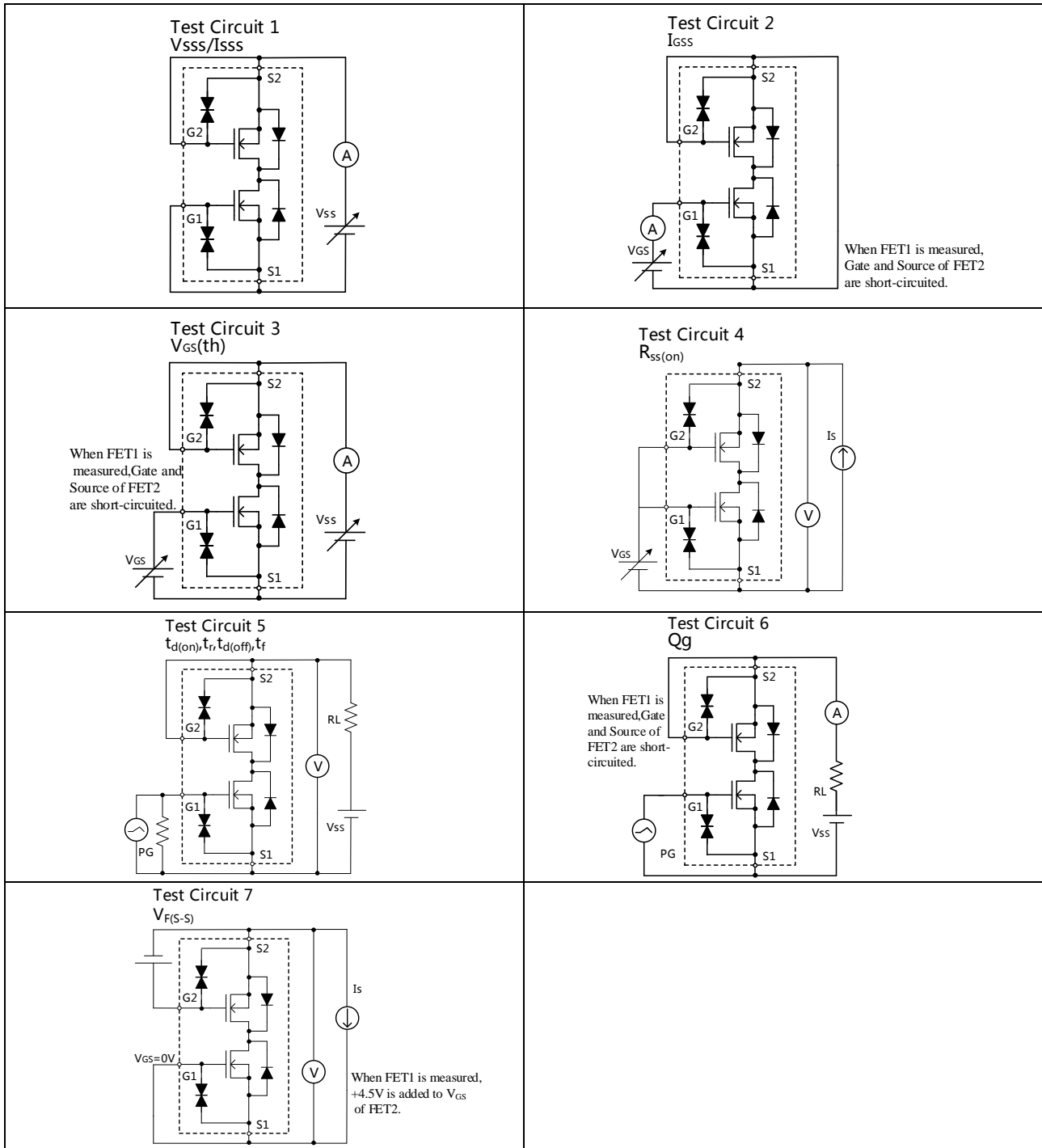
- FR-4 board (38mm X 38mm X t1.6mm, 70um Copper) minimum pad covered with copper.
- Ceramic substrate (70 mm X 70 mm X t1.0 mm, 70um Copper) fully covered with copper.
- Repetitive rating, ~10us pulse width, duty cycle ~1%, keep initial $T_J=25^{\circ}\text{C}$, the maximum allowed junction temperature of 150°C .
- The static characteristics are obtained using ~380us pulses, duty cycle ~1%.

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

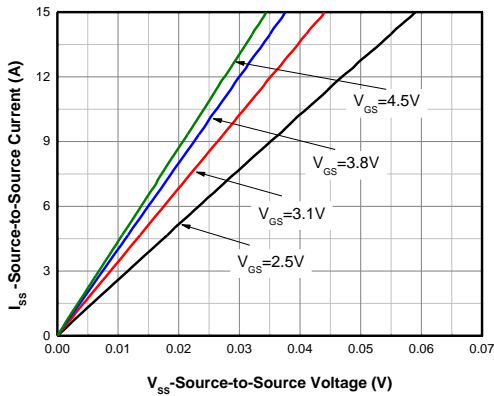
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Source to Source Voltage	V _{SSS}	V _{GS} = 0 V, I _S = 1mA	12			V
Zero Gate Voltage Drain Current	I _{SSS}	V _{SS} = 10 V, V _{GS} = 0V TEST CIRCUIT 1			1	uA
Gate Leakage Current	I _{GSS}	V _{SS} = 0 V, V _{GS} = ±8V TEST CIRCUIT 2			±10	uA
		V _{SS} = 0 V, V _{GS} = ±5V TEST CIRCUIT 2			±1	uA
ON CHARACTERISTICS						
Gate to Source Cut-off Voltage	V _{GS(th)}	V _{SS} = 10 V, I _S = 1mA TEST CIRCUIT 3	0.5	0.9	1.4	V
Source to Source On-state Resistance	R _{SS(on)}	V _{GS} = 4.5V, I _S = 6.0A TEST CIRCUIT 4	1.55	2.20	2.95	mΩ
		V _{GS} = 3.8V, I _S = 6.0A TEST CIRCUIT 4	1.60	2.40	3.20	
		V _{GS} = 3.1V, I _S = 6.0A TEST CIRCUIT 4	1.65	2.80	3.95	
		V _{GS} = 2.5V, I _S = 6.0A TEST CIRCUIT 4	1.90	3.80	6.10	
BODY DIODE CHARACTERISTICS						
Body Diode Forward Voltage	V _{F(S-S)}	V _{GS} = 0 V, I _F = 6.0A TEST CIRCUIT 7		0.7	1.2	V
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.0V, V _{SS} = 6.0V, I _S = 6.0A, TEST CIRCUIT 5		1.5		us
Rise Time	t _r			3.8		
Turn-Off Delay Time	t _{d(OFF)}			5.7		
Fall Time	t _f			5.8		
CHARGES, CAPACITANCES AND GATE RESISTANCE						
Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1kHz, V _{SS} = 10 V		3133		pF
Output Capacitance	C _{OSS}			657		
Reverse Transfer Capacitance	C _{RSS}			540		
Total Gate Charge	Q _{G(TOT)}	V _{G1S1} = 4.0 V, V _{SS} = 6.0V, I _S = 6.0A TEST CIRCUIT 6		31.5		nC
Gate-to-Source Charge	Q _{GS}			5.4		
Gate-to-Drain Charge	Q _{GD}			10.8		

Test Circuit

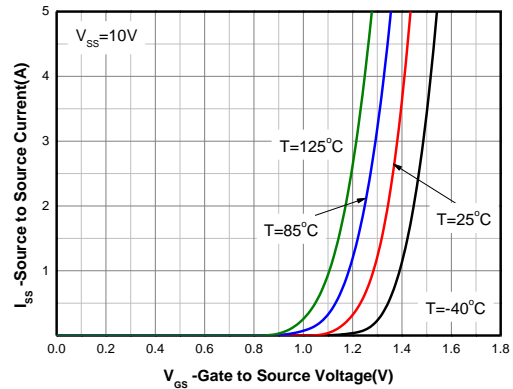
FET1 and the FET2 are both measured. Test circuits are example of measuring the FET1 side



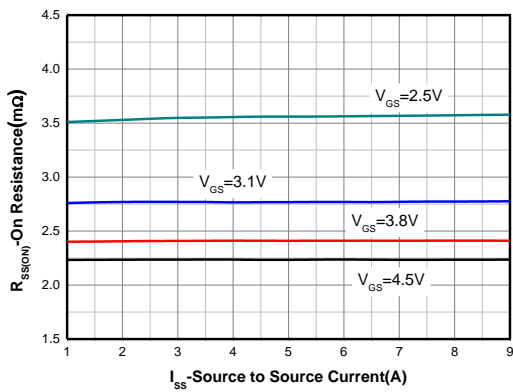
Typical Characteristics ($T_A=25^\circ\text{C}$, unless otherwise noted)



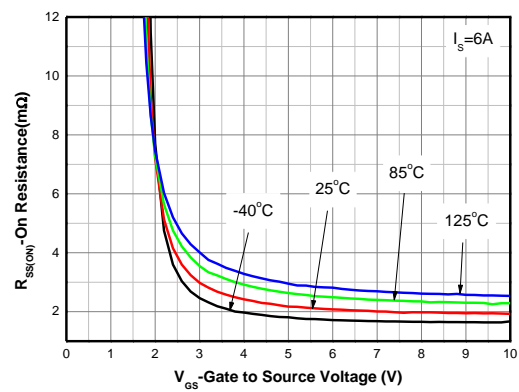
Output Characteristics ^d



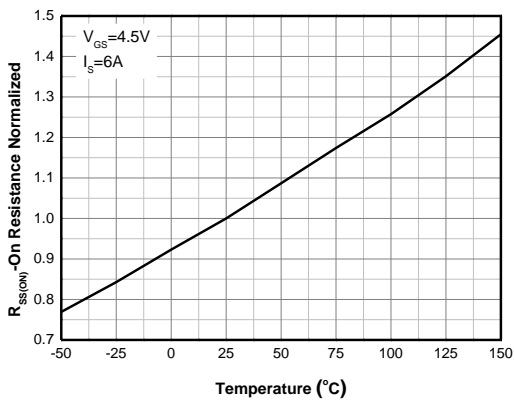
Transfer Characteristics ^d



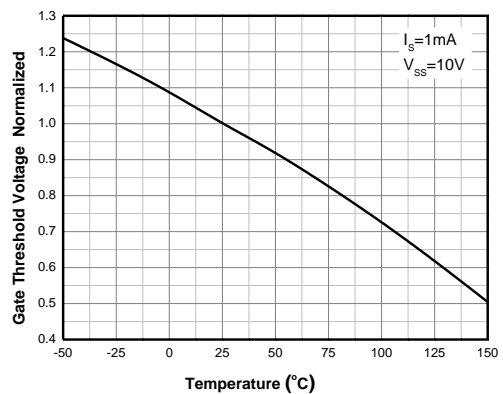
On-Resistance vs. Source Current ^d



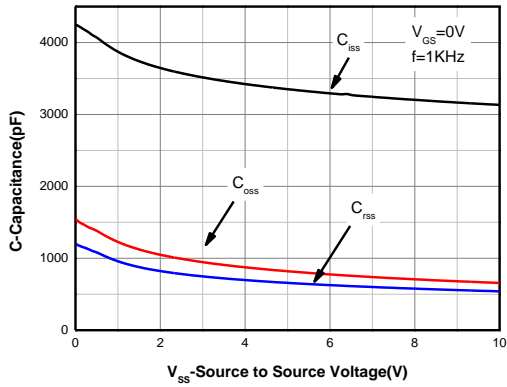
On-Resistance vs. Gate-to-Source Voltage ^d



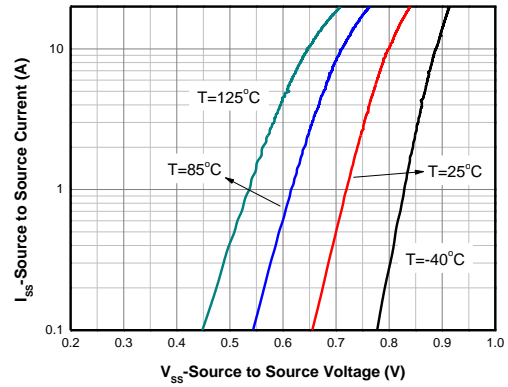
On-Resistance vs. Junction Temperature ^d



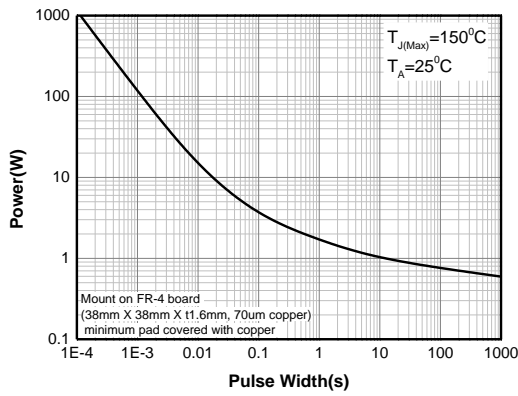
Threshold Voltage vs. Temperature



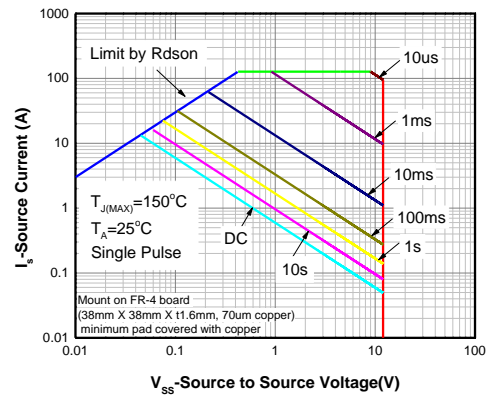
Capacitance



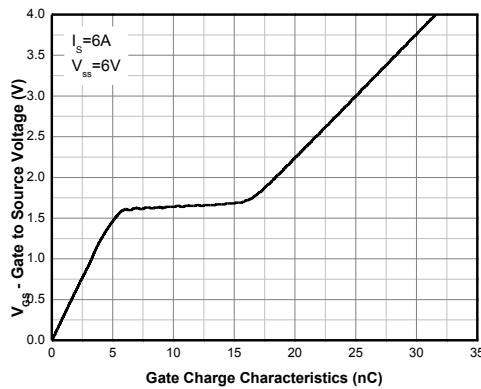
Body Diode Forward Voltage^d



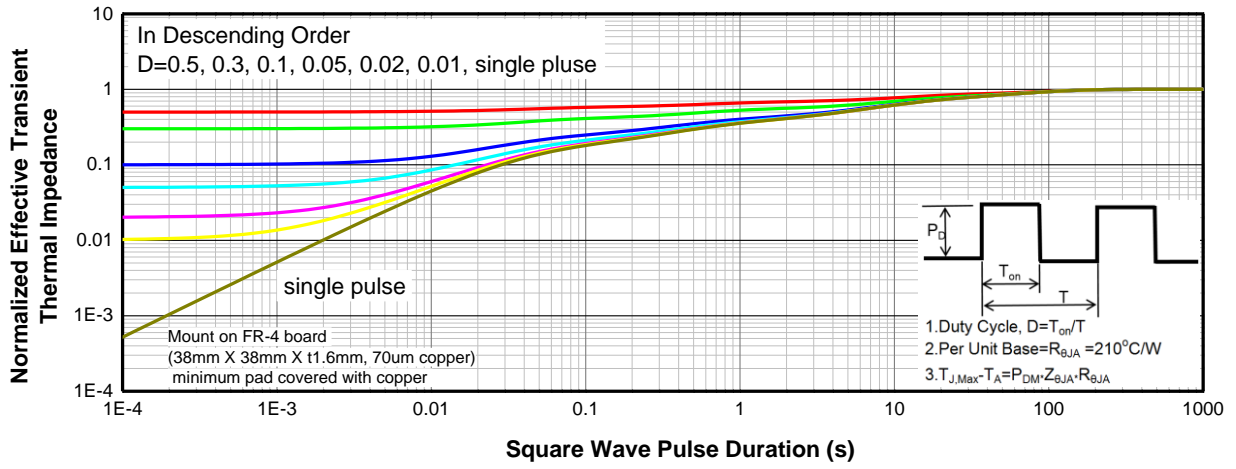
Single Pulse power



Safe Operating Power



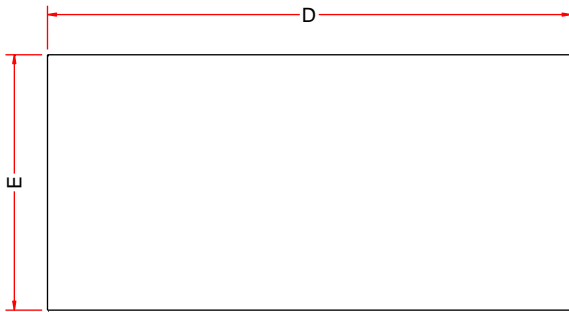
Gate Charge Characteristics



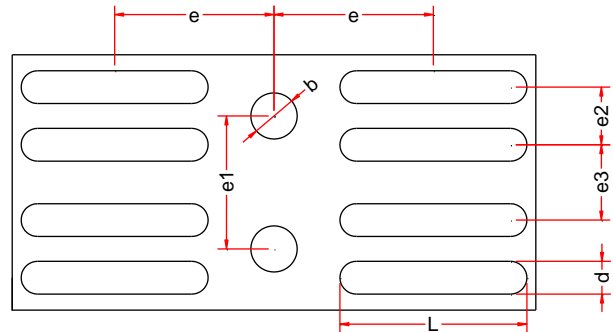
Transient thermal response (Junction-to-Ambient)

PACKAGE OUTLINE DIMENSIONS

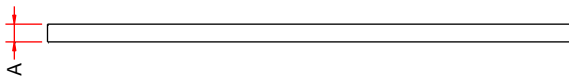
CSP-10L



TOP VIEW



BOTTOM VIEW



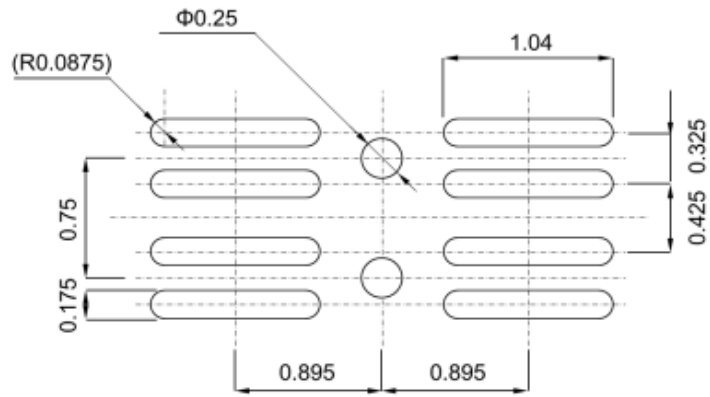
SIDE VIEW

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.09	0.11	0.13
D	2.94	2.98	3.02
E	1.45	1.49	1.53
b	0.25 typ.		
d	0.175 typ.		
e	0.895typ.		
e1	0.75 typ.		
e2	0.325 typ.		
e3	0.425 typ.		
L	1.04 typ.		

RECOMMENDED LAND PATTERN (Unit: mm)

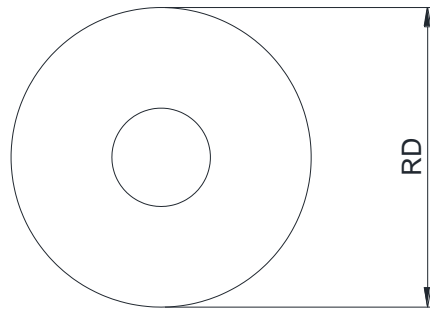
■ Land Pattern (Reference)

Unit: mm

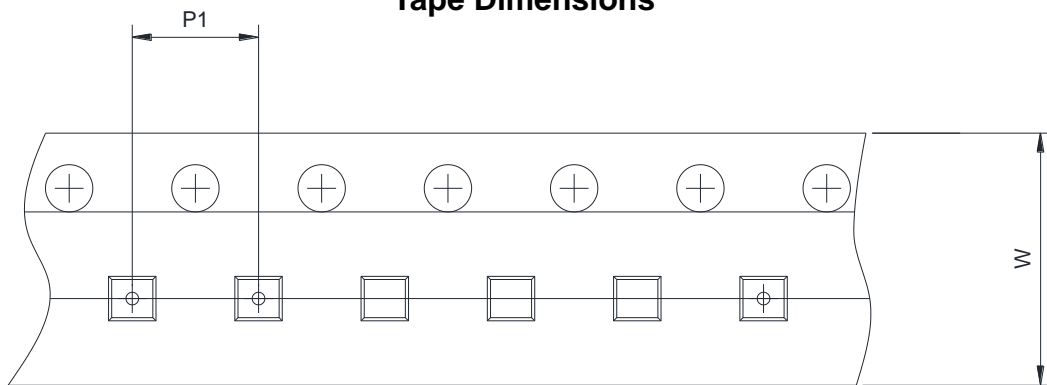


TAPE AND REEL INFORMATION

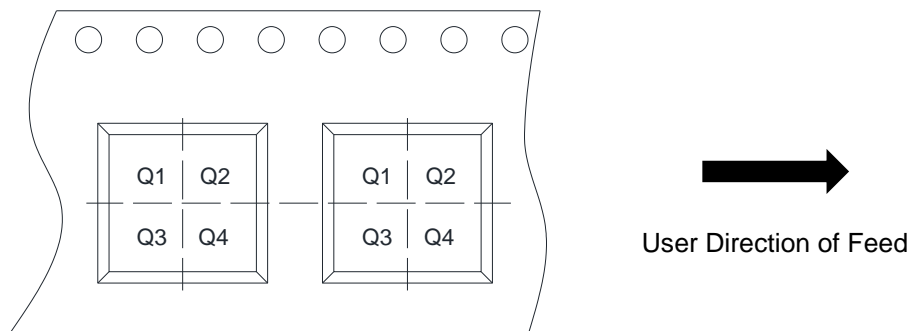
Reel Dimensions



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		
P1	Pitch between successive cavity centers	<input type="checkbox"/> 2mm	<input checked="" type="checkbox"/> 4mm	<input type="checkbox"/> 8mm	
Pin1	Pin1 Quadrant	<input type="checkbox"/> Q1	<input type="checkbox"/> Q2	<input type="checkbox"/> Q3	<input checked="" type="checkbox"/> Q4