

# N-Channel CICLON NexFET™ Power MOSFETs CSD16413Q5A

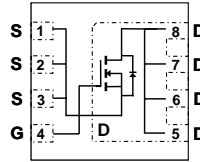


## Features

- Ultra Low Qg & Qgd
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant
- Halogen Free



QFN 5mm x 6mm Plastic Package



Top View

## Product Summary

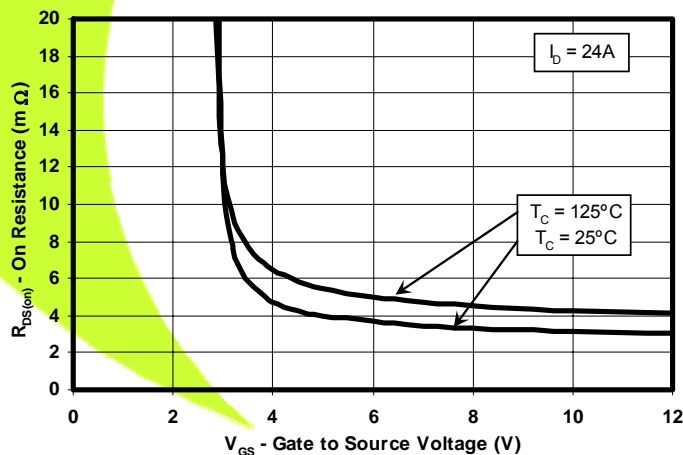
$V_{DS}$	25	V
$Q_g$	9.0	nC
$Q_{gd}$	2.5	nC
$R_{DS(on)}$	$V_{GS}=4.5V$	4.1 m $\Omega$
	$V_{GS}=10V$	3.1 m $\Omega$
$V_{th}$	1.6	V

## Maximum Values ( $T_A = 25^\circ C$ unless otherwise stated)

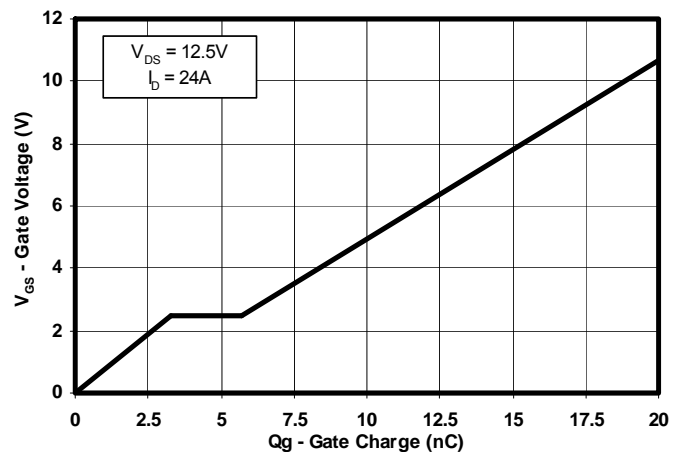
Symbol	Parameter	Value	Units
$V_{DS}$	Drain to Source Voltage	25	V
$V_{GS}$	Gate to Source Voltage	+16 / -12	V
$I_D$	Continuous Drain Current, $T_C = 25^\circ C$	100	A
	Continuous Drain Current <sup>1</sup>	24	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ C^2$	156	A
$P_D$	Power Dissipation <sup>1</sup>	3.1	W
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ C$
$E_{AS}$	Avalanche Energy, single pulse $I_D=46A, L = 0.1mH, R_G = 25\Omega$	106	mJ

1.  $R_{\theta ja} = 41^\circ C/W$  on  $1in^2$  Cu FR4 PCB.
2. Pulse width  $\leq 300 \mu s$ , duty cycle  $\leq 2\%$

## $R_{DS(on)}$ vs. $V_{GS}$



## Gate Charge



## Ordering Information

Type	Package	Package Media	Qty	Ship
CSD16413Q5A	QFN 5X6 Plastic Package	13 inch reel	2500	Tape and Reel

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Static Characteristics</b>						
$BV_{DSS}$	Drain to Source Voltage	$V_{GS} = 0V, I_D = 250\mu A$	25	—	—	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{GS} = 0V, V_{DS} = 20V$	—	—	1	$\mu A$
$I_{GSS}$	Gate to Source Leakage Current	$V_{DS} = 0V, V_{GS} = +16/-12V$	—	—	100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.2	1.6	1.9	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 4.5V, I_D = 24A$	—	4.1	5.6	$m\Omega$
		$V_{GS} = 10V, I_D = 24A$	—	3.1	3.9	$m\Omega$
$g_{fs}$	Transconductance	$V_{DS} = 15V, I_D = 24A$	—	95	—	S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 12.5V$ $f = 1MHz$	—	1370	1780	pF
$C_{OSS}$	Output Capacitance		—	1060	1380	pF
$C_{RSS}$	Reverse Transfer Capacitance		—	84	109	pF
$R_g$	Series Gate Resistance		—	0.9	—	$\Omega$
$Q_g$	Gate Charge Total (4.5V)	$V_{DS} = 12.5V, I_D = 24A$	—	9.0	11.7	nC
$Q_{gd}$	Gate Charge Gate to Drain		—	2.5	—	nC
$Q_{gs}$	Gate Charge Gate to Source		—	3.5	—	nC
$Q_{g(th)}$	Gate Charge at $V_{th}$		—	2.2	—	nC
$Q_{OSS}$	Output Charge	$V_{DS} = 13.1V, V_{GS} = 0V$	—	21	—	nC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 12.5V$ $V_{GS} = 4.5V, I_D = 24A$ $R_G = 5.0\Omega$	—	12.9	—	ns
$t_r$	Rise Time		—	27	—	ns
$t_{d(off)}$	Turn Off Delay Time		—	15.7	—	ns
$t_f$	Fall Time		—	16.4	—	ns
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S = 24A, V_{GS} = 0V$	—	0.85	1.0	V
$Q_{rr}$	Reverse Recovery Charge	$V_{dd} = 13.1V, I_F = 24A,$ $di/dt = 300A/\mu s$	—	32	—	nC
$t_{rr}$	Reverse Recovery Time	$V_{dd} = 13.1V, I_F = 24A,$ $di/dt = 300A/\mu s$	—	28	—	ns

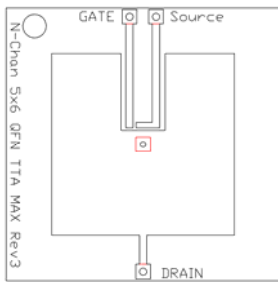
# N-Channel CICLON NexFET™ Power MOSFETs CSD16413Q5A



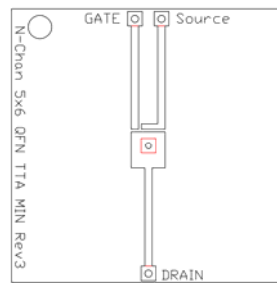
**Thermal Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise stated)

Symbol	Parameter	Min	Typ	Max	Units
<b>Thermal Characteristics</b>					
$R_{\theta JC}$	Thermal Resistance Junction to Case <sup>3</sup>	—	—	2.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (1 in <sup>2</sup> Cu area) <sup>3,4</sup>	—	—	51	$^\circ\text{C/W}$

- $R_{\theta JC}$  is determined with the device mounted on a 1in square 2 oz. Cu pad on a 1.5x1.5 in .060in thick FR4 board.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta ca}$  is determined by the user's board design.
- Device mounted on FR4 Material with 1in<sup>2</sup> of 2 oz. Cu.



Max  $R_{\theta JA} = 51^\circ\text{C/W}$  when mounted on 1in<sup>2</sup> of 2 oz. Cu.



Max  $R_{\theta JA} = 118^\circ\text{C/W}$  when mounted on min pad area of 2 oz. Cu.

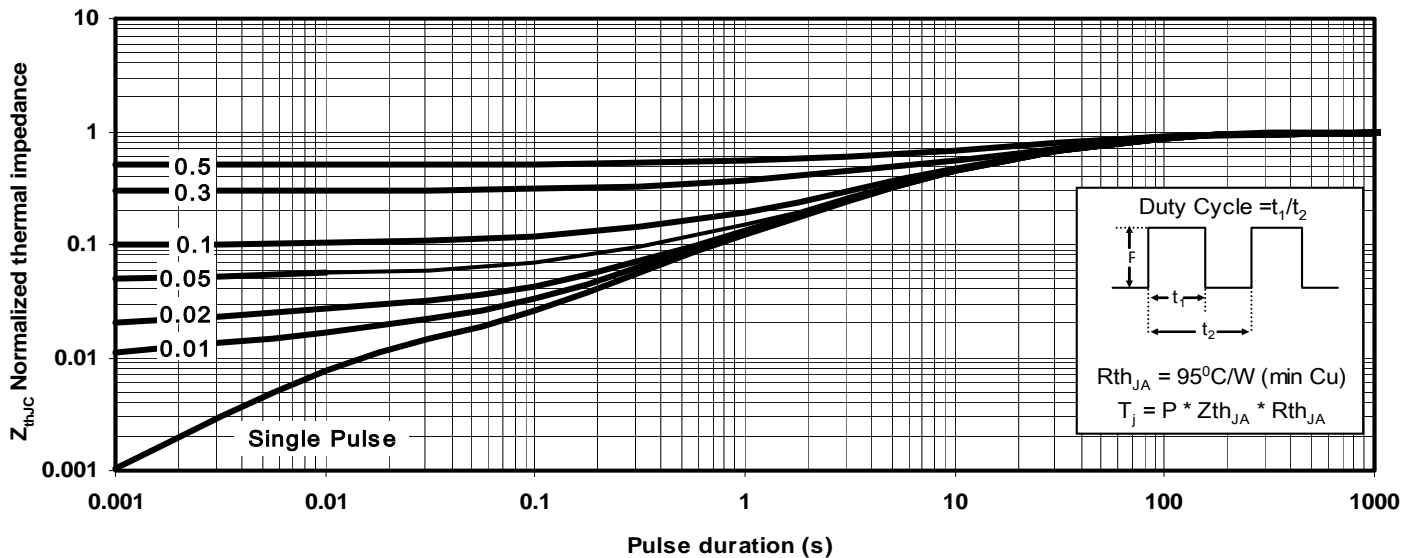


Figure 1: Transient Thermal Impedance

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

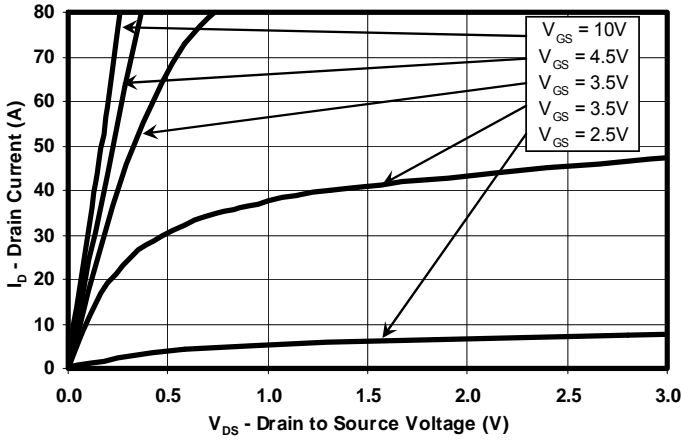


Figure 2: Saturation Characteristics

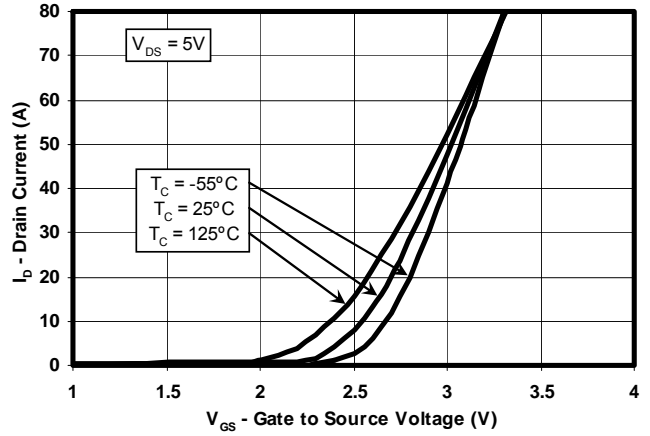


Figure 3: Transfer Characteristics

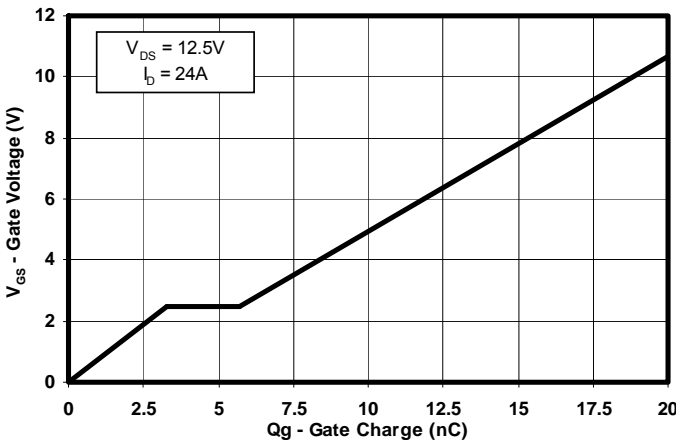


Figure 4: Gate Charge

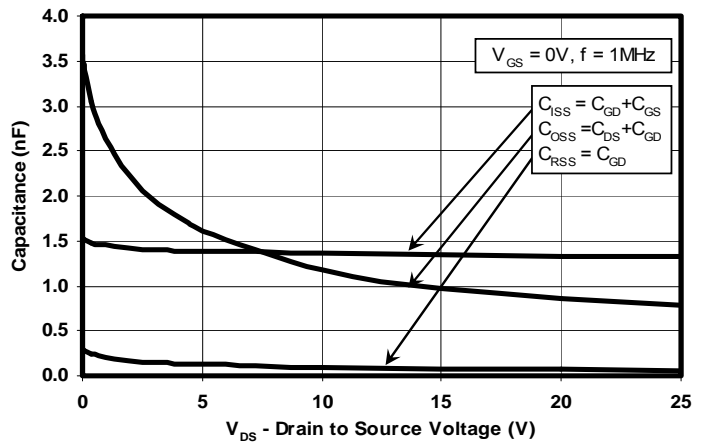


Figure 5: Capacitance

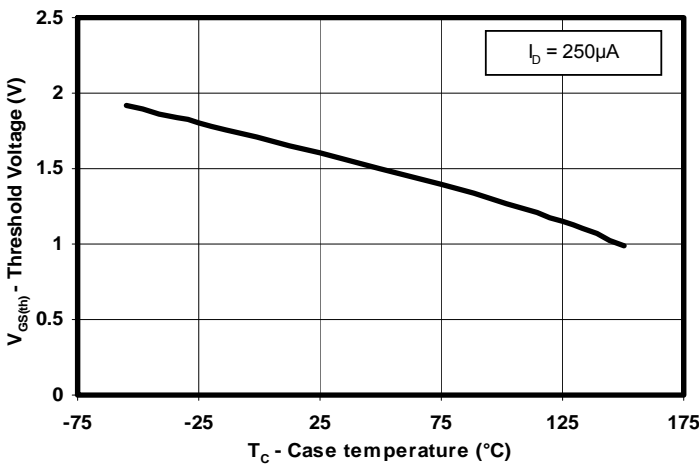


Figure 6: Threshold Voltage vs. Temperature

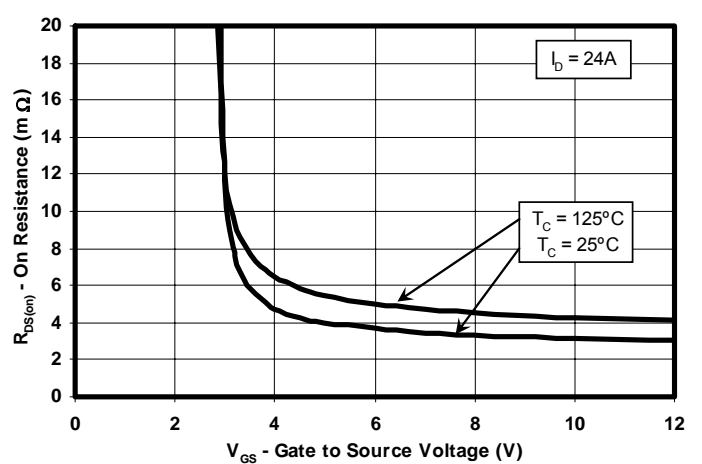


Figure 7: On Resistance vs. Gate Voltage

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## Typical MOSFET Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise stated)

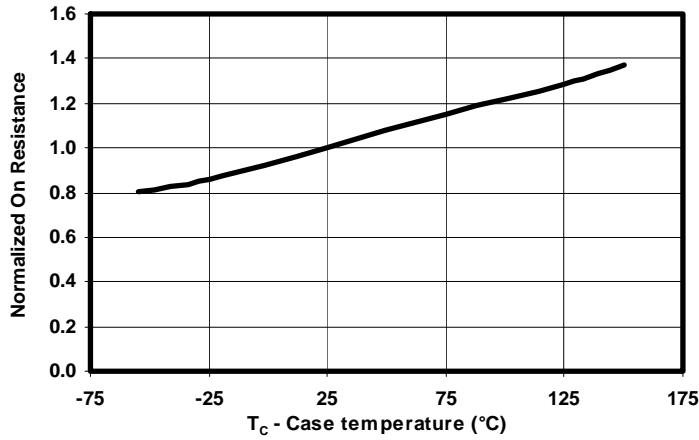


Figure 8: On Resistance vs. Temperature

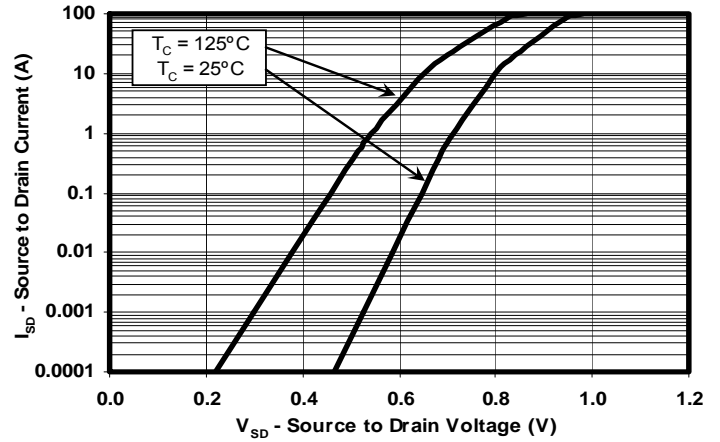


Figure 9: Typical Diode Forward Voltage

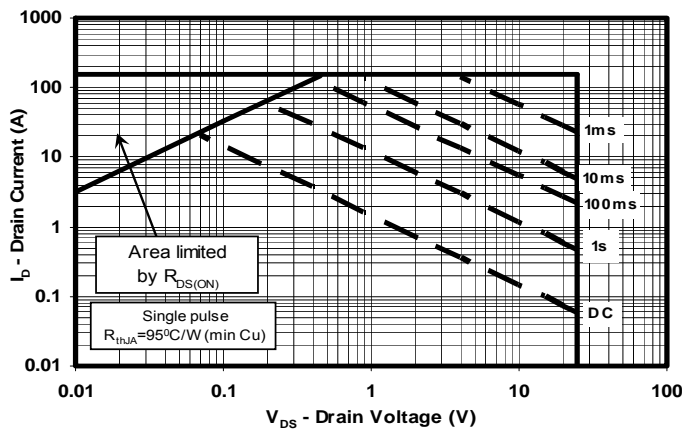


Figure 10: Maximum Safe Operating Area

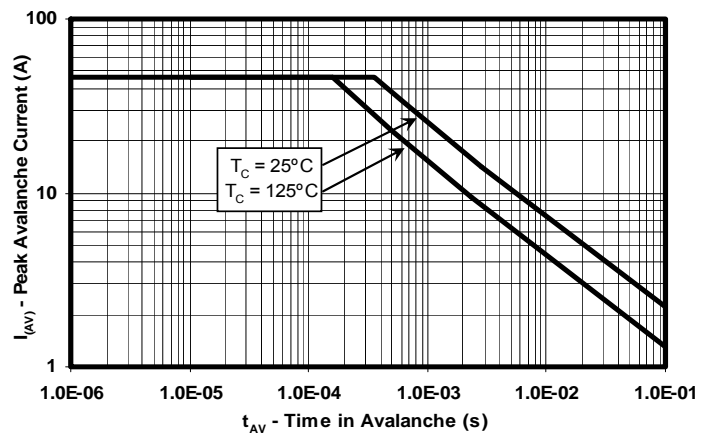


Figure 11: Single Pulse Unclamped Inductive Switching

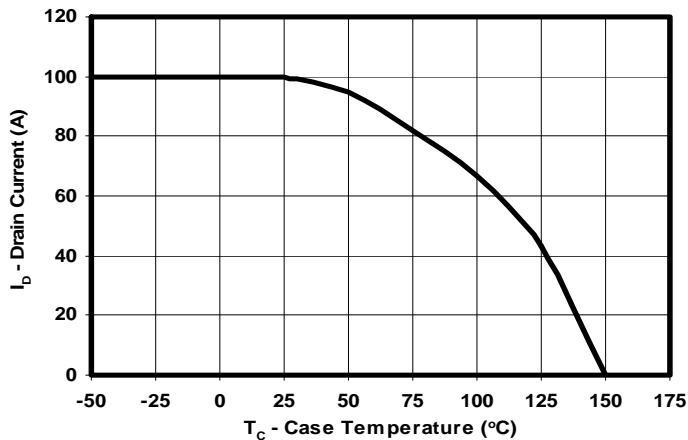
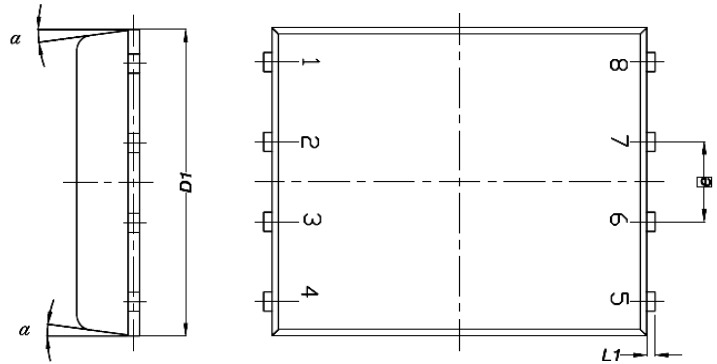
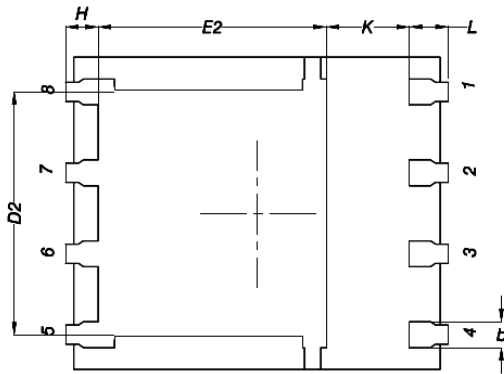


Figure 12: Maximum Drain Current vs. Temperature

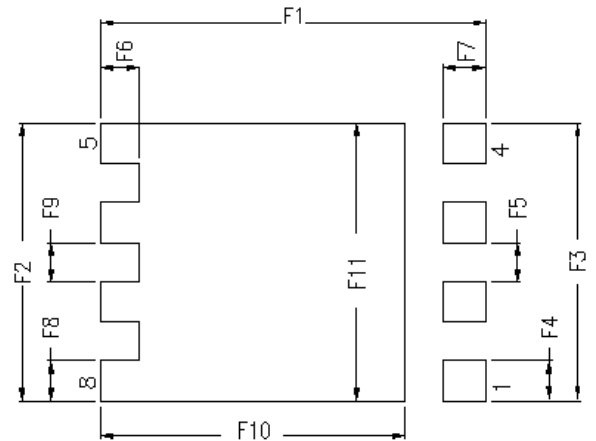
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**CSD16413Q5A Package Dimensions**



RECOMMENDED PCB PATTERN



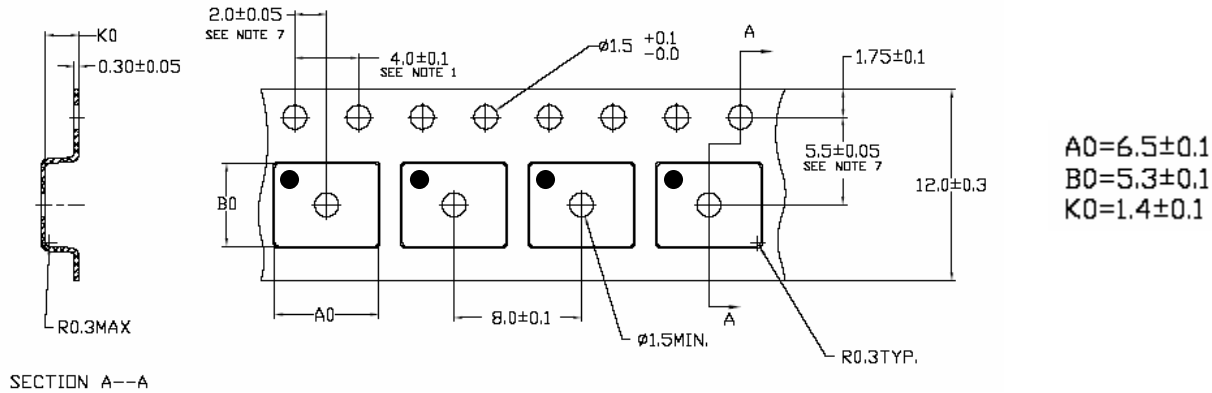
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.33	0.41	0.51
c	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
a	0°		12°

DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
F1	6.205	6.305	0.244	0.248
F2	4.46	4.56	0.176	0.18
F3	4.46	4.56	0.176	0.18
F4	0.65	0.7	0.026	0.028
F5	0.62	0.67	0.024	0.026
F6	0.63	0.68	0.025	0.027
F7	0.7	0.8	0.028	0.031
F8	0.65	0.7	0.026	0.028
F9	0.62	0.67	0.024	0.026
F10	4.9	5	0.193	0.197
F11	4.46	4.56	0.176	0.18

# N-Channel CICLON NexFET™ Power MOSFETs CSD16413Q5A



## Q5A Tape and Reel Information



### Note:

1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE +/-0.2
2. CAMBER NOT TO EXCEED 1mm IN 100mm, NONCUMULATIVE OVER 250mm
3. MATERIAL:BLACK STATIC DISSIPATIVE POLYSTYRENE
4. ALL DIMENSIONS ARE IN mm (UNLESS OTHERWISE SPECIFIED)
5. A0 AND B0 MEASURED ON A PLANE 0.3mm ABOVE THE BOTTOM OF THE POCKET

## Package Marking Information

Location:

### 1st Line

CSD = Fixed Characters

NNNN = Product Code

### 2nd Line (Date Code)

YY = Last 2 digits of the Year

WW = 2-digit Work Week

C = Country of Origin

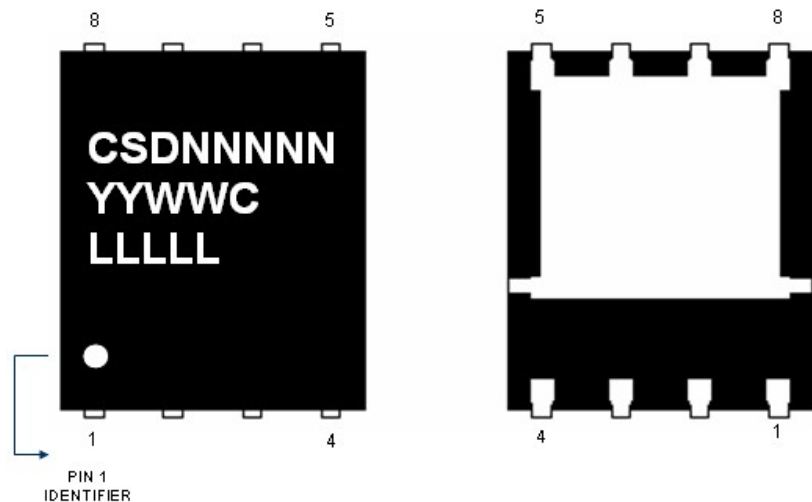
> Philippines = P

> Taiwan = T

> China = C

### 3rd Line

LLLLL = Last 5 digits of the Wafer Lot #



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