

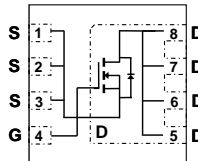
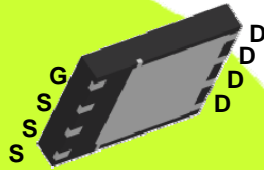
# N-Channel CICLON NexFET™ Power MOSFETs CSD16321Q5



## Features

- Optimized for 5V gate drive
- Ultra Low Qg & Qgd
- Low Thermal Resistance
- Avalanche Rated
- Pb Free Terminal Plating
- RoHS Compliant

QFN 5mm x 6mm Plastic Package



Top View

## Product Summary

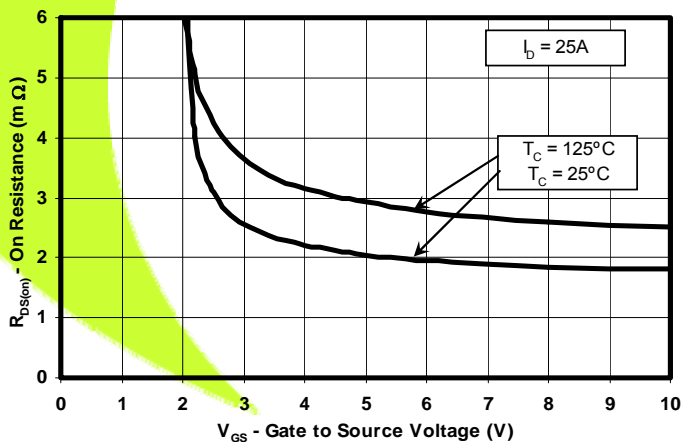
$V_{DS}$	25	V
$Q_g$	14	nC
$Q_{gd}$	2.5	nC
$R_{DS(on)}$	$V_{GS} = 3.0V$	2.8 m $\Omega$
	$V_{GS} = 4.5V$	2.1 m $\Omega$
	$V_{GS} = 8.0V$	1.9 m $\Omega$
$V_{th}$	1.1	V

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

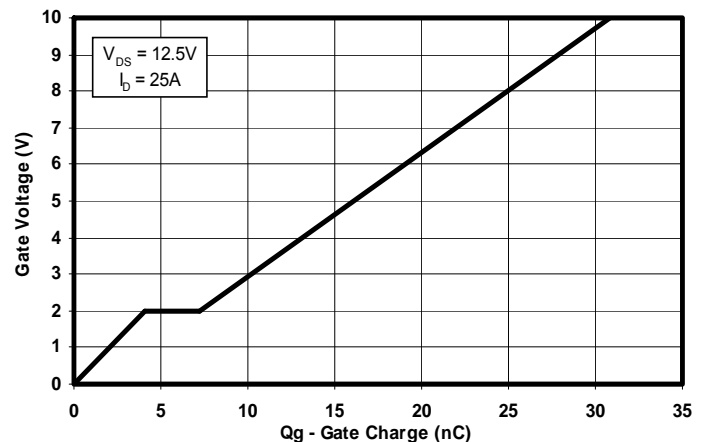
Symbol	Parameter	Value	Units
$V_{DS}$	Drain to Source Voltage	25	V
$V_{GS}$	Gate to Source Voltage	+10 / -6	V
$I_D$	Continuous Drain Current, $T_C = 25^\circ C$	100	A
	Continuous Drain Current <sup>1</sup>	31	A
$I_{DM}$	Pulsed Drain Current, $T_A = 25^\circ C$ <sup>2</sup>	200	A
$P_D$	Power Dissipation <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 $I_D = 66A, L = 0.1mH, R_G = 25\Omega$	218	mJ

1.  $R_{\theta JA} = 39^\circ C/W$  on 1in<sup>2</sup> Cu (2 oz.) on 0.060" thick FR4 PCB.
2. See Figure 10

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



## Gate Charge



## Ordering Information

Type	Package	Package Media	Qty	Ship
CSD16321Q5	QFN 5X6 Plastic Package	13 inch reel	2500	Tape and Reel

N-Channel  
**CICLON NexFET™ Power MOSFETs**  
**CSD16321Q5**



**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	$V_{DS} = 0V, V_{GS} = 10V$	—	—	100	nA
$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	0.9	1.1	1.4	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 3.0V, I_D = 25A$	—	2.8	3.5	$m\Omega$
		$V_{GS} = 4.5V, I_D = 25A$	—	2.1	2.6	$m\Omega$
		$V_{GS} = 8.0V, I_D = 25A$	—	1.9	2.4	$m\Omega$
$g_{fs}$	Transconductance	$V_{DS} = 12.5V, I_D = 25A$	—	150	—	S
<b>Dynamic Characteristics</b>						
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V, V_{DS} = 12.5V$ $f = 1MHz$	—	2360	3100	pF
$C_{OSS}$	Output Capacitance		—	1700	2200	pF
$C_{RSS}$	Reverse Transfer Capacitance		—	115	150	pF
$R_g$	Series Gate Resistance		—	1.2	—	$\Omega$
$Q_g$	Gate Charge Total (4.5V)	$V_{DS} = 12.5V, I_D = 25A$	—	14	19	nC
$Q_{gd}$	Gate Charge Gate to Drain		—	2.5	—	nC
$Q_{gs}$	Gate Charge Gate to Source		—	4.0	—	nC
$Q_{g(th)}$	Gate Charge at $V_{th}$		—	2.1	—	nC
$Q_{OSS}$	Output Charge	$V_{DS} = 15V, V_{GS} = 0V$	—	36	—	nC
$t_{d(on)}$	Turn On Delay Time	$V_{DS} = 12.5V$ $V_{GS} = 4.5V, I_D = 25A$ $R_G = 2.7\Omega$	—	11	—	ns
$t_r$	Rise Time		—	19	—	ns
$t_{d(off)}$	Turn Off Delay Time		—	40	—	ns
$t_f$	Fall Time		—	30	—	ns
<b>Diode Characteristics</b>						
$V_{SD}$	Diode Forward Voltage	$I_S = 25A, V_{GS} = 0V$	—	0.8	1.0	V
$Q_{rr}$	Reverse Recovery Charge	$V_{dd} = 13V, I_F = 25A,$ $di/dt = 300A/\mu s$	—	33	—	nC
$t_{rr}$	Reverse Recovery Time	$V_{dd} = 13V, I_F = 25A,$ $di/dt = 300A/\mu s$	—	32	—	ns

www.DataSheet4U.com

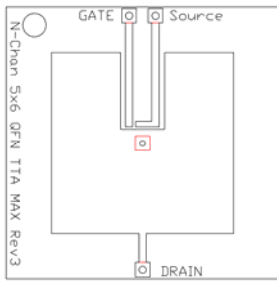
# N-Channel CICLON NexFET™ Power MOSFETs CSD16321Q5



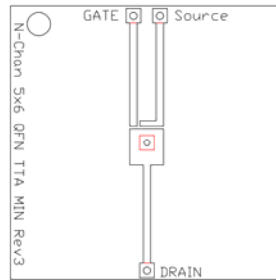
## Thermal Characteristics (T<sub>A</sub> = 25°C unless otherwise stated)

Symbol	Parameter	Min	Typ	Max	Units
<b>Thermal Characteristics</b>					
R <sub>θJC</sub>	Thermal Resistance Junction to Case <sup>3</sup>	—	—	1.1	°C/W
R <sub>θJA</sub>	Thermal Resistance Junction to Ambient <sup>3,4</sup>	—	—	50	°C/W

- R<sub>θJC</sub> 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<sub>θJC</sub> is guaranteed by design while R<sub>θca</sub> is determined by the user's board design.
- Device mounted on FR4 Material with 1in<sup>2</sup> of 2 oz. Cu.



Max R<sub>θJA</sub> = 48°C/W when mounted on 1in<sup>2</sup> of 2 oz. Cu.



Max R<sub>θJA</sub> = 115°C/W when mounted on min pad area of 2 oz. Cu.

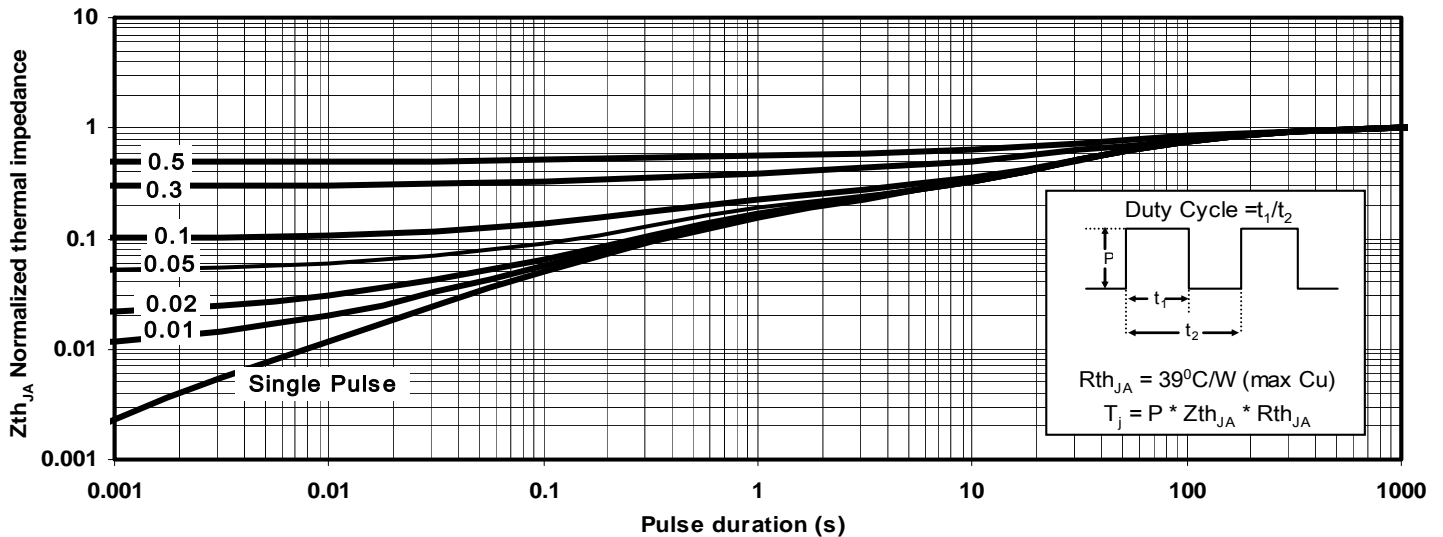


Figure 1: Transient Thermal Impedance

N-Channel  
**CICLON NexFET™ Power MOSFETs**  
**CSD16321Q5**



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

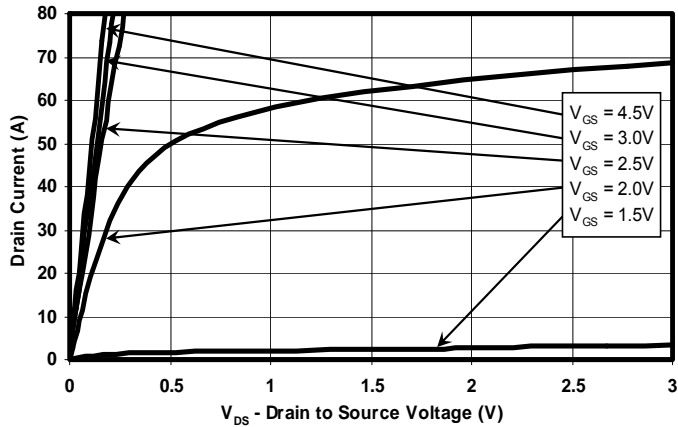


Figure 2: Saturation Characteristics

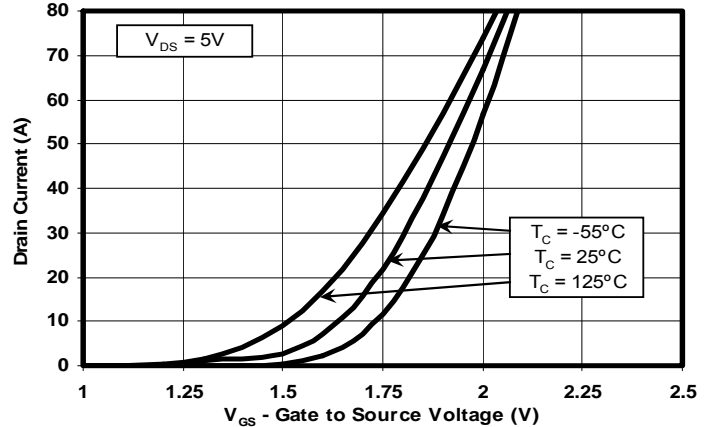


Figure 3: Transfer Characteristics

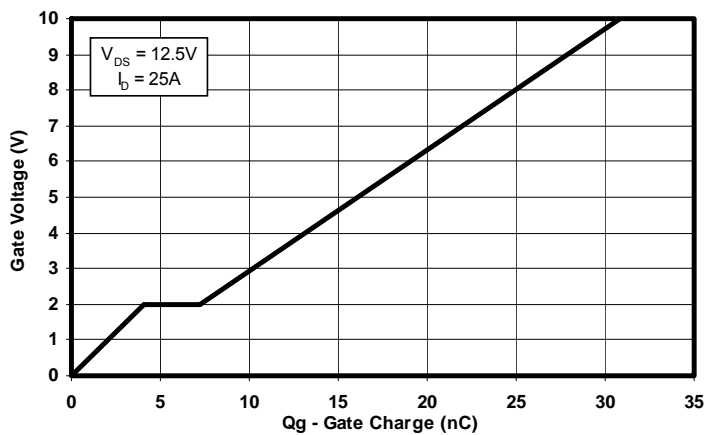


Figure 4: Gate Charge

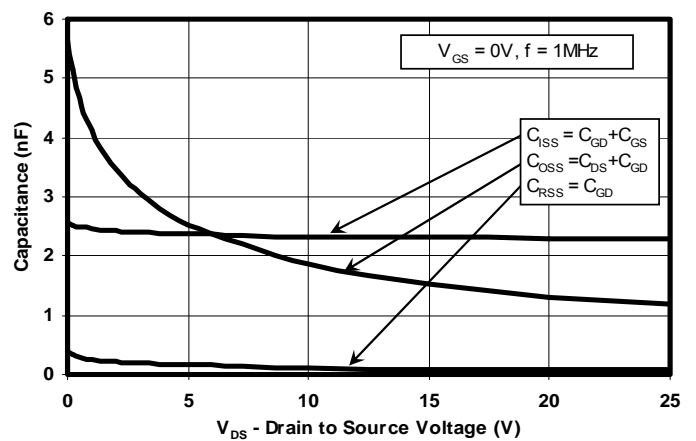


Figure 5: Capacitance

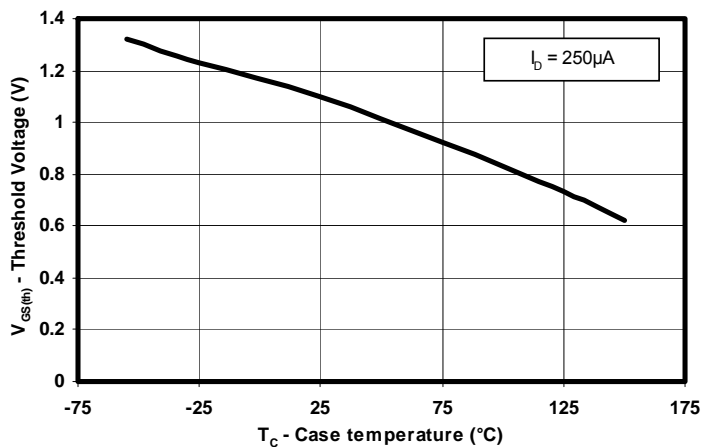


Figure 6: Threshold Voltage vs. Temperature

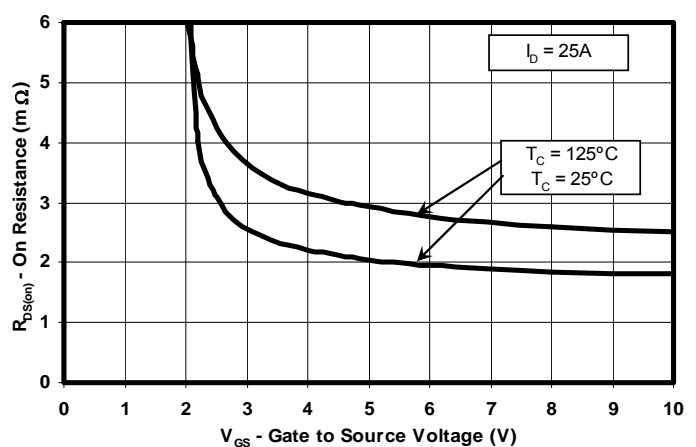
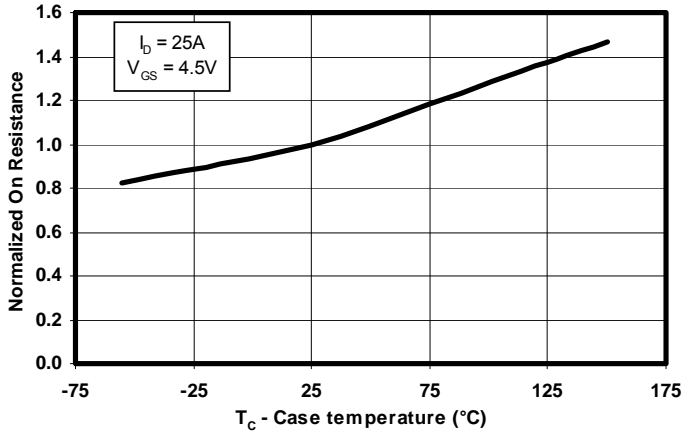
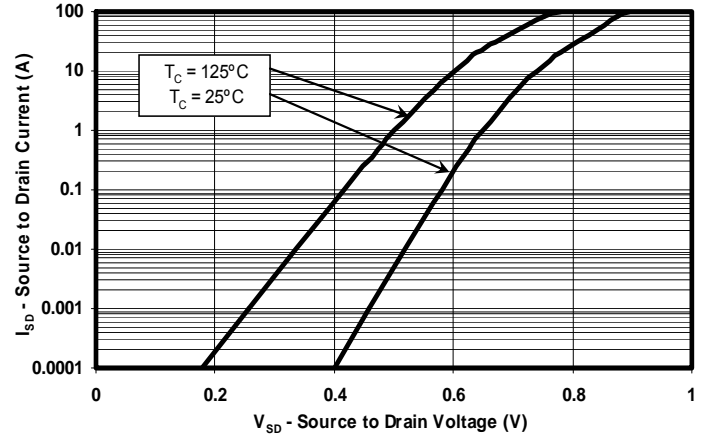


Figure 7: On Resistance vs. Gate Voltage

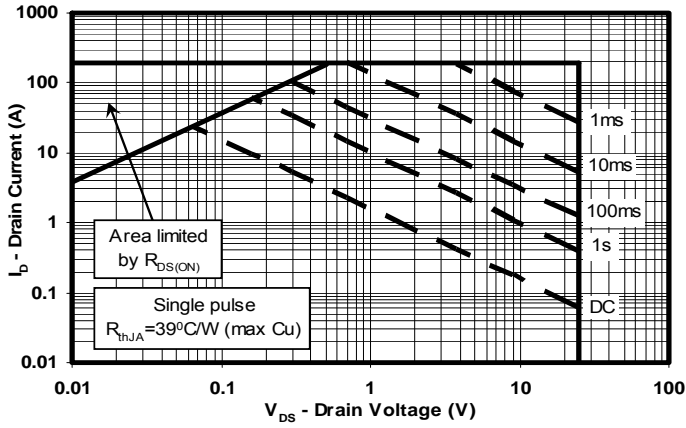
**Typical MOSFET Characteristics** ( $T_A = 25^\circ\text{C}$  unless otherwise stated)



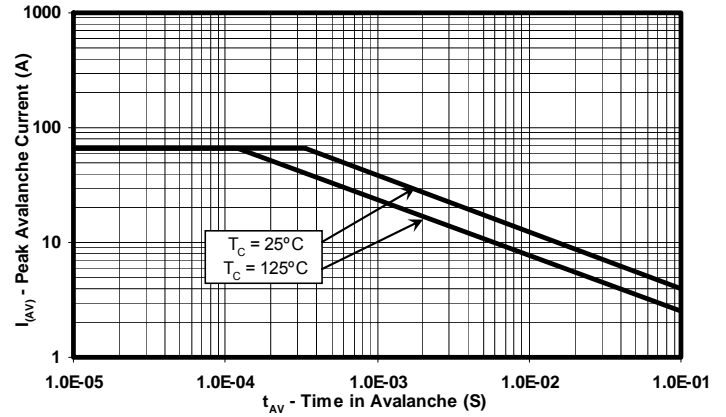
**Figure 8: On Resistance vs. Temperature**



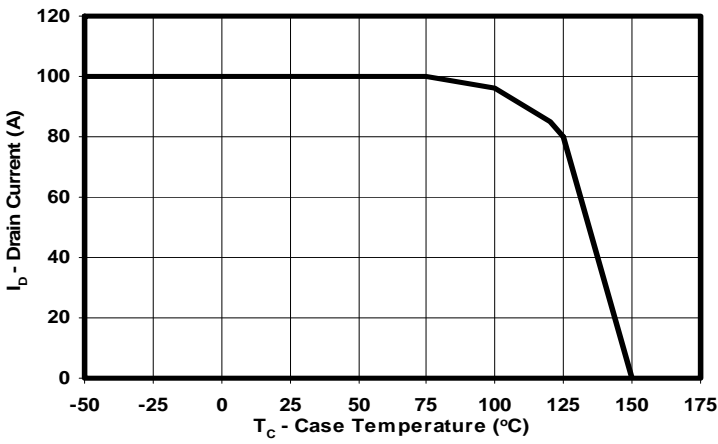
**Figure 9: Typical Diode Forward Voltage**



**Figure 10: Maximum Safe Operating Area**



**Figure 11: Single Pulse Unclamped Inductive Switching**

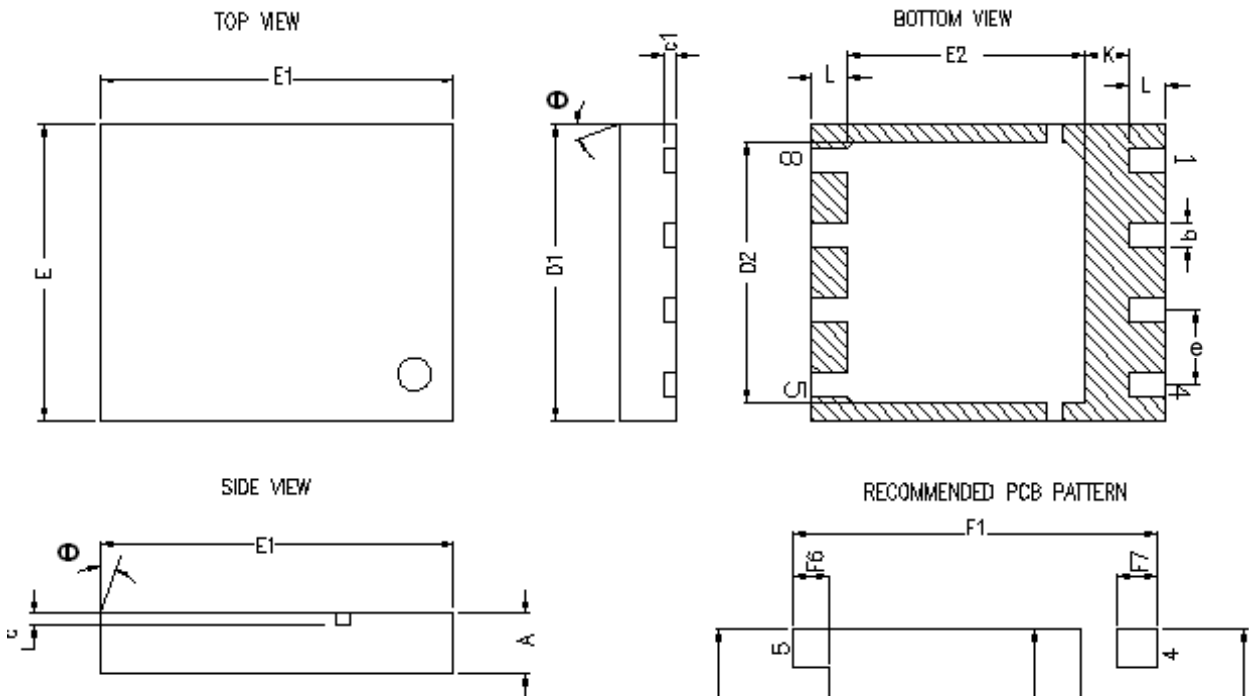


**Figure 12: Maximum Drain Current vs. Temperature**

N-Channel  
 www.DataSheet4U.com  
**CICLON NexFET™ Power MOSFETs**  
**CSD16321Q5**



**Q5 Package Dimensions**



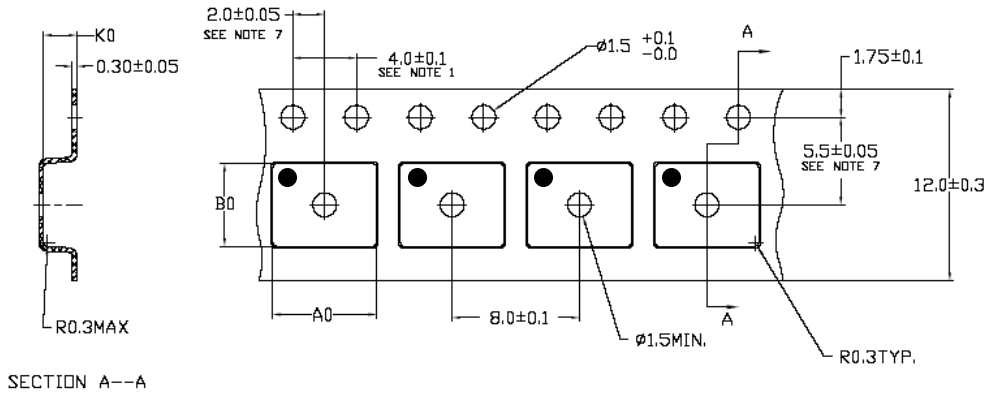
DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.950	1.050	0.037	0.039
b	0.360	0.460	0.014	0.018
c	0.150	0.250	0.006	0.010
c1	0.150	0.250	0.006	0.010
D1	4.900	5.100	0.193	0.201
D2	4.320	4.520	0.170	0.178
E	4.900	5.100	0.193	0.201
E1	5.900	6.100	0.232	0.240
E2	3.920	4.12	0.154	0.162
e	1.27 TYP		0.050	
L	0.510	0.710	0.020	0.028
θ	0.00	-	-	-
K	0.760	-	0.030	-
F1	6.205	6.305	0.244	0.248
F2	4.460	4.560	0.176	0.180
F3	4.460	4.560	0.176	0.180
F4	0.650	0.700	0.026	0.028
F5	0.620	0.670	0.024	0.026
F6	0.630	0.680	0.025	0.027
F7	0.700	0.800	0.028	0.031
F8	0.650	0.700	0.026	0.028
F9	0.620	0.670	0.024	0.026
F10	4.900	5.000	0.193	0.197
F11	4.460	4.560	0.176	0.180

N-Channel

**CICLON NexFET™ Power MOSFETs**  
**CSD16321Q5**



**Q5 Tape and Reel Information**



A0=6.5±0.1  
 B0=5.3±0.1  
 K0=1.4±0.1

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. THICKNESS: 0.30 +/-0.05mm

**Package Marking Information**

Location:

1st Line

CSD = Fixed Characters

NNNNN = Product Code

2nd Line (Date Code)

YY = Last 2 digits of the Year

WW = 2-digit Work Week

C = Country of Origin

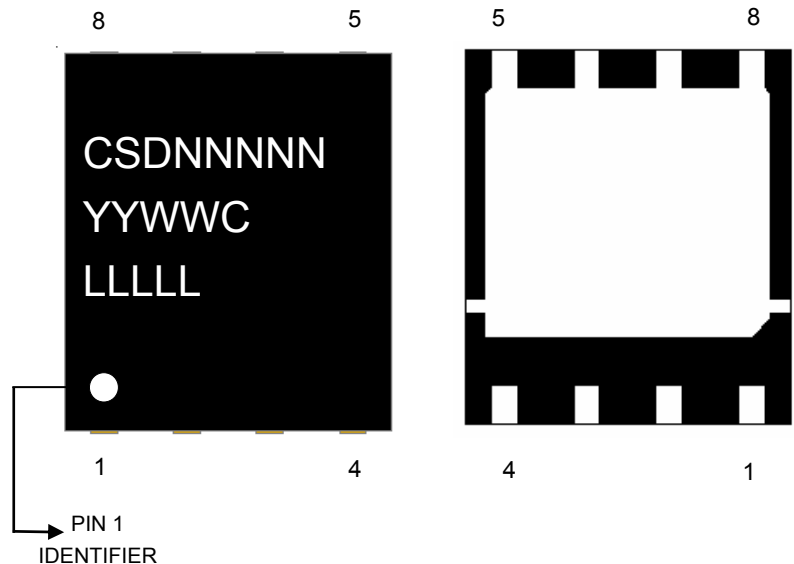
> Philippines = P

> Taiwan = T

> China = C

3rd Line

LLLLL= Last 5 digits of the Wafer Lot #



N-Channel

[www.DataSheet4U.com](http://www.DataSheet4U.com)

# **CICLON** NexFET™ Power MOSFETs CSD16321Q5



#### **Disclaimer**

**CICLON** Semiconductor Device Corp. ("**CICLON**") reserves the right to make corrections, modifications, enhancements, improvements and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to **CICLON**'s terms and conditions of sale supplied at the time of order acknowledgement.

#### **Additional Information**

For further information on technology, delivery terms and conditions, or pricing please contact your nearest **CICLON** Semiconductor representative.

**CICLON** Semiconductor Device Corp.  
116 Research Drive, Bethlehem, PA 18015  
**T** 610-849-5100 **F** 610-849-5101

© 2008 **CICLON** Semiconductor Device Corp., rev 2.0  
All rights reserved. Confidential and proprietary information. Do not distribute.

[www.ciclonsemi.com](http://www.ciclonsemi.com)

[www.DataSheet4U.com](http://www.DataSheet4U.com)



## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2009, Texas Instruments Incorporated