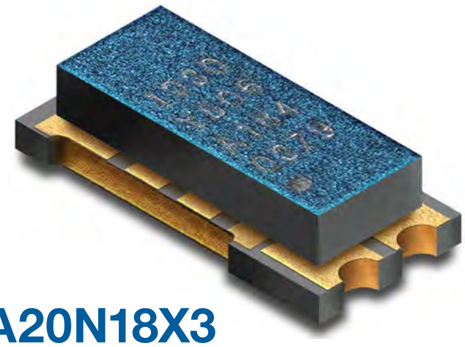
Features

- Low $R_{DS(on)}$
- Ultra-low Q_G For High Efficiency
- Logic Level
- Light Weight
- New Compact Die Adaptor Assembly
- Source Sense Pin
- Total Ionizing Dose LDR and HDR Immune
- Single Event
  - SEE immunity up to LET of 85 MeV/mg/cm^2 with V_{DS} up to 100% of rated Breakdown
- Neutron
  - Maintains Pre-Rad specification for up to 4 x 10^{15} Neutrons/cm^2

Application

- Commercial Satellite EPS & Avionics
- Deep Space Probes
- High Speed Rad-Hard DC-DC Conversion
- Rad-Hard Motor Controllers



CDA20N18X3

Rad-Hard e-GaN® 200 V, 18 A, 25 mΩ
Die Adaptor Product (CDA3)

Description

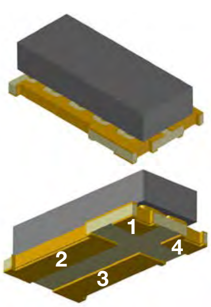
EPC Space CDA series of eGaN® power switching HEMTs have been specifically designed for critical applications in the high reliability or commercial satellite space environments. These devices have exceptionally high electron mobility and a low temperature coefficient resulting in very low $R_{DS(on)}$ values. The lateral structure of the die provides for very low gate charge (Q_G) and extremely fast switching times. These features enable faster power supply switching frequencies resulting in higher power densities, higher efficiencies and more compact circuitry.

Thermal Characteristics

Symbol	Parameter-Conditions	Value	Units
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (Note 3)	56	°C/W
$R_{\theta JC}$	Thermal Resistance Junction to Case	2.12	

I/O Pin Assignment *(Bottom View)*

Pin	Symbol	Description
1	G	Gate
2	D	Drain
3	S	Source
4	SS	Source Sense



Absolute Maximum Rating *(T_C = 25°C unless otherwise noted)*

Symbol	Parameter-Conditions	Value	Units
V_{DS}	Drain to Source Voltage (Note 1)	200	V
I_D	Continuous Drain Current I_D @ V_{GS} = 5 V, T_C = 25°C, $R_{\theta JA}$ < 56°C/W	18	A
I_{DM}	Single-Pulse Drain Current $t_{pulse} \leq$ 80 µs	72	
V_{GS}	Gate to Source Voltage (Note 2)	+6 / -4	V
T_J , T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C
T_{sol}	Package Mounting Surface Temperature	260	
ESD	ESD Class	1A (ΔA)	

Electrical Characteristics *(T_C = 25°C unless otherwise noted. Typical (TYP) values are for reference only.)*

Parameter	Symbol	Test Conditions		MIN	TYP	MAX	Units
Maximum Drain to Source Voltage	V_{DSMAX}	V_G = 0 V		-	-	200	V
Drain to Source Leakage	I_{DSS}	V_{DS} = 200 V, V_{GS} = 0 V	T_C = 25°C	-	26	150	µA
			T_C = 125°C	-		538	
Gate to Source Forward Leakage	I_{GSS}	V_{GS} = 5 V	T_C = 25°C	-	0.1	3.0	mA
Gate to Source Reverse Leakage	I_{GSS}	V_{GS} = -4 V	T_C = 25°C		-50	-150	
Gate to Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 3 mA	T_C = 25°C	0.8	1.2	2.5	V
Gate to Source Threshold Voltage Temperature Coefficient	$\Delta V_{GS(th)}/\Delta T$	$V_{DS} = V_{GS}$, I_D = 3 mA	-55°C < T_A < 150°C	-	|3.2|	-	mV/°C
Drain to Source Resistance (Note 4)	$R_{DS(on)}$	I_D = 18 A, V_{GS} = 5 V	T_C = 25°C	-	18	25	mΩ
Source to Drain Forward Voltage (Note 5)	V_{SD}	I_S = 0.5 A, V_G = 0 V	T_C = 25°C		1.75		V

Dynamic Characteristics *(T_C = 25°C unless otherwise noted. Typical (TYP) values are for reference only.)*

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units
Input Capacitance	C_{ISS}	f = 1 MHz, V_{DS} = 100 V, V_{GS} =0 V (Note 6)		637	900	pF
Output Capacitance	C_{OSS}			300	359	
Reverse Transfer Capacitance	C_{RSS}			5	13	
Gate Resistance	R_G	f = 1 MHz, $V_{DS} = V_{GS}$ = 0 V		0.4		Ω
Total Gate Charge	Q_G	I_D = 18 A, V_{GS} = 5 V, V_{DS} = 100 V		2.7	6	nC
Gate to Drain Charge	Q_{GD}			0.9	1.95	
Gate to Source Charge	Q_{GS}			1.0	2	
Output Charge (Note 6)	Q_{OSS}	V_{GS} = 0 V_{GS}, V_{DS} = 100 V		35		
Source to Drain Recovery Charge	Q_{RR}	I_D = 18 A, V_{DS} = 100 V		<1		

Radiation Characteristics

EPC Space eGaN® HEMTs are tested according to MIL-STD-750 Method 1019 for total ionizing dose validation. Every manufacturing lot is tested for total ionizing dose of Gamma radiation with an in-situ bias for (i) V_{GS} = 5 V, (ii) V_{DS} = V_{GS} = 0 V and (iii) V_{DS} = 80% B_{VDSS}.

Electrical Characteristics up to 300 krads *(T_C = 25°C unless otherwise noted. Typical (TYP) values are for reference only.)*

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units
Maximum Drain to Source Voltage	V_{DSMAX}	V_{GS} = 0 V	-	-	200	V
Gate to Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS} , I_D = 3 mA	0.8	1.0	2.5	V
Drain to Source Leakage	I_{DSS}	V_{DS} = 200 V, V_{GS} = 0 V	-	2.6	250	µA
Gate to Source Forward Leakage	I_{GSS}	V_{GS} = 5 V	-	0.1	3	mA
Gate to Source Reverse Leakage	I_{GSS}	V_{GS} = -4 V	-	-50	-150	µA
Drain to Source Resistance (Note 4)	$R_{DS(on)}$	I_D = 18 A, V_{GS} = 5 V	-	18	25	mΩ

Typical Single Event Effect Safe Operating Area

Note : All Single Event Effect testing is performed on the K-500 Cyclotron at Texas A&M University

Test	Environment				V_{DS} Voltage (V)	
See SOA	Ion	LET MeV/mg/cm^2	Range µm	Energy MeV	V_{GS} = 0 V	V_{GS} = -4V
	Xe	50	131	1653	200	200
	Au	83.7	130	2482	175	175

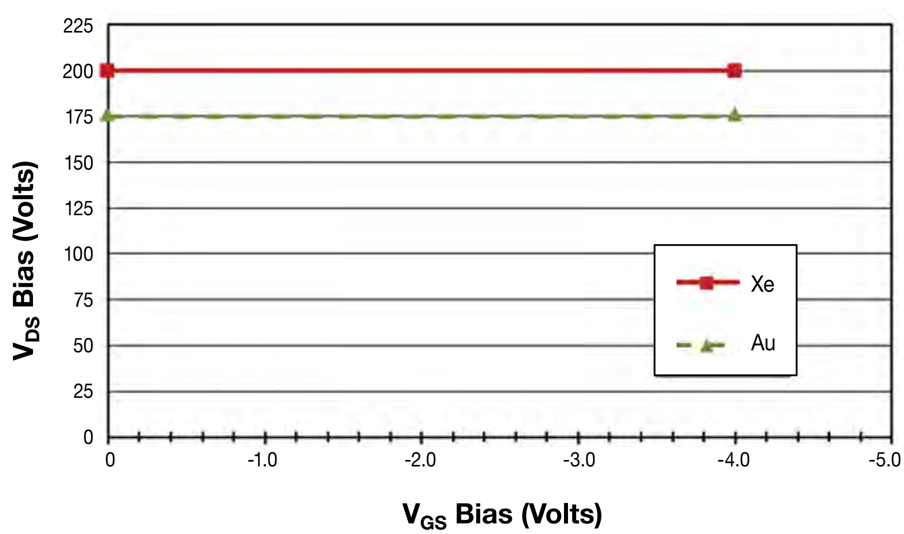


Figure 1. Typical Single Event Effect Safe Operating Area

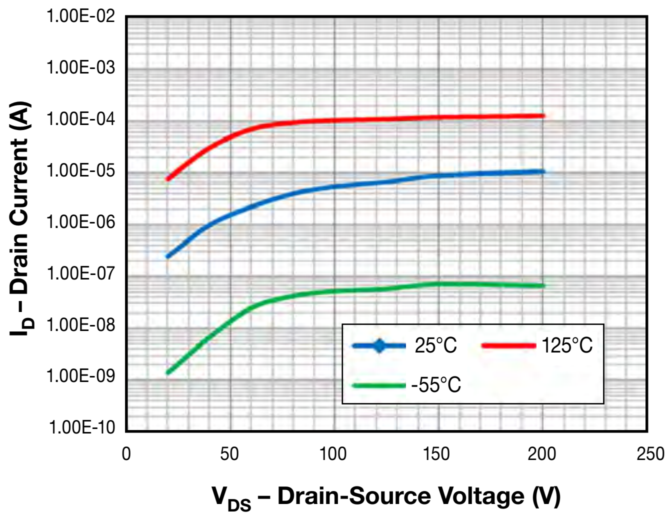


Figure 2. Typical Drain-Source Leakage Current vs. Ambient Temperature

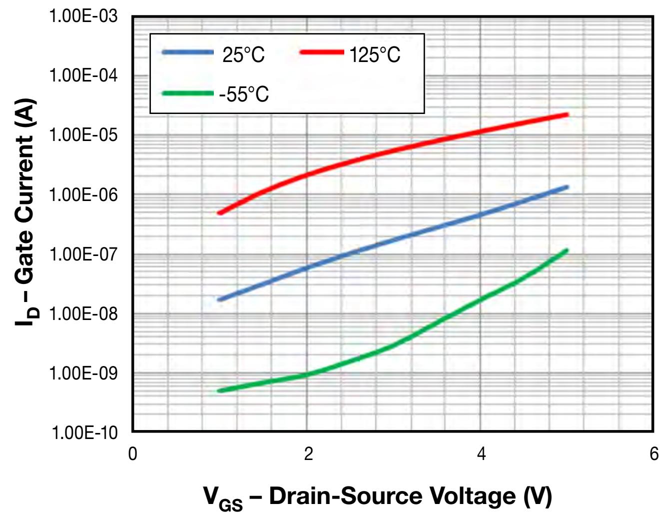


Figure 3. Gate-Source Leakage Current vs. Ambient Temperature

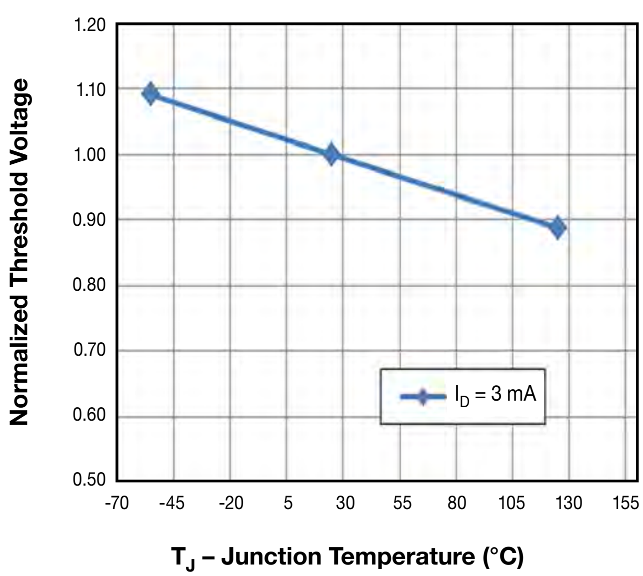


Figure 4. Normalized Threshold Voltage vs.Temperature

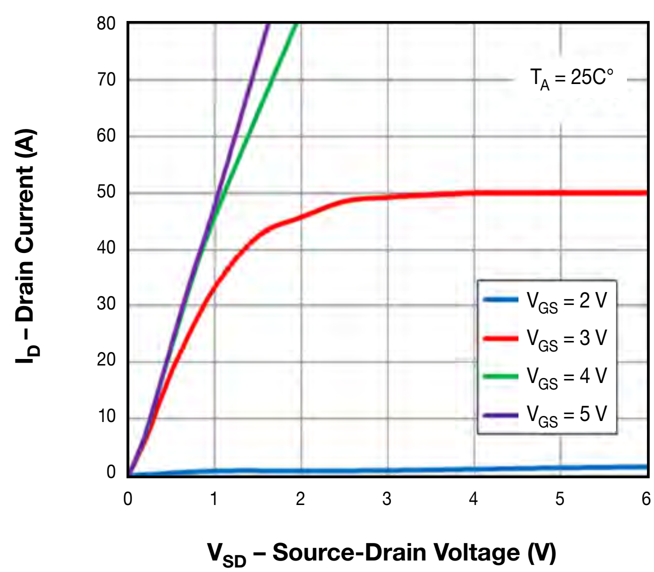


Figure 5. Typical Output Characteristics

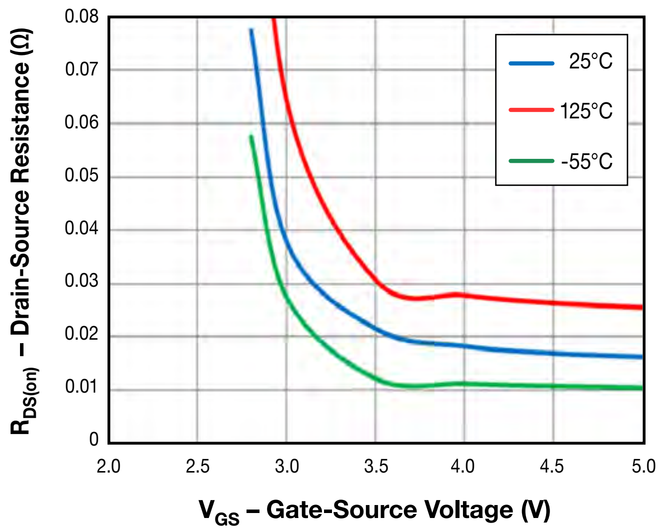


Figure 6. Typical Drain-Source ON Resistance vs. Gate-Source Voltage vs. Ambient Temperature

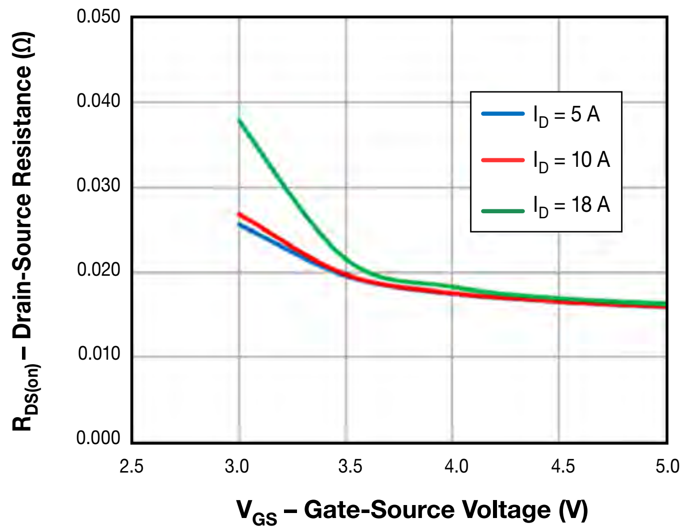


Figure 7. Typical Drain-Source ON Resistance vs. Gate-Source Voltage vs. Drain Current

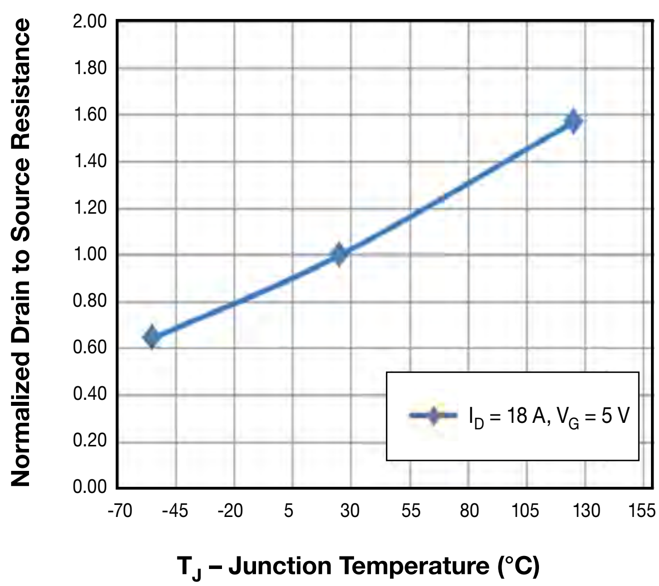


Figure 8. Typical Source-Drain Voltage vs. Temperature

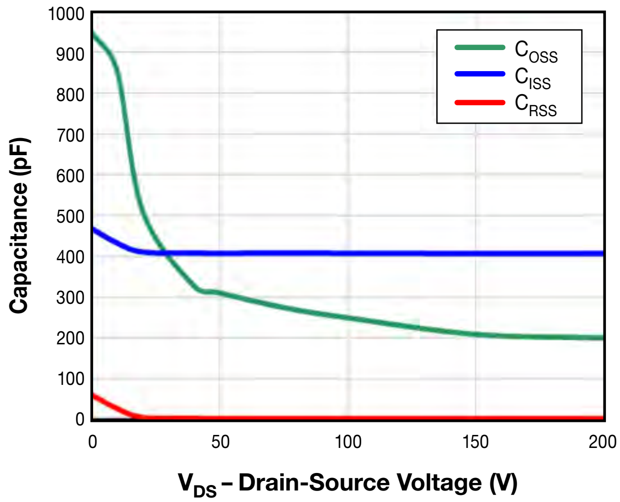


Figure 9. Typical Inter-Electrode Capacitance vs. Drain-Source Voltage

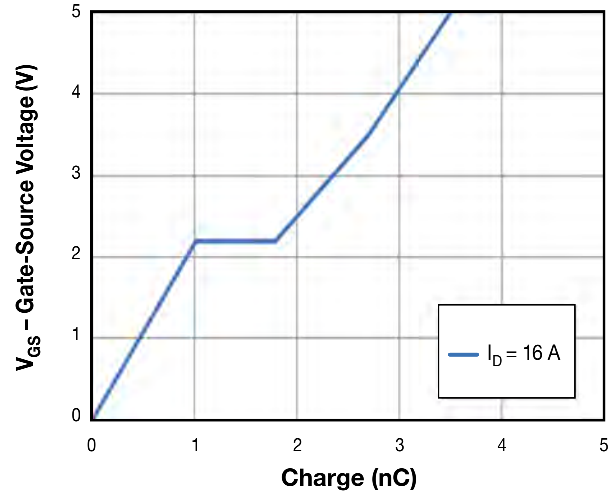


Figure 10. Typical Gate Charge vs. Drain Current

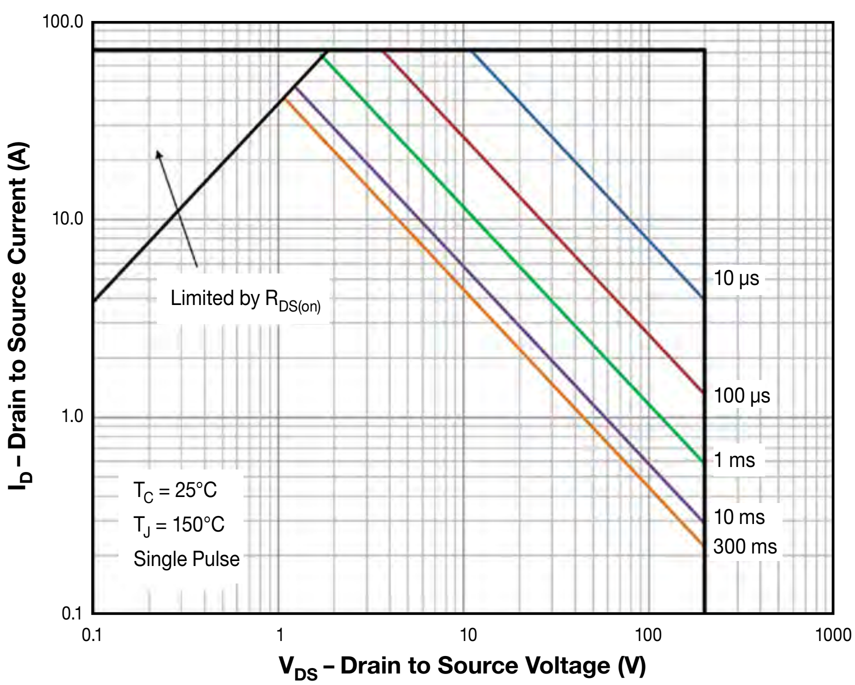


Figure 11. Safe Operating Area

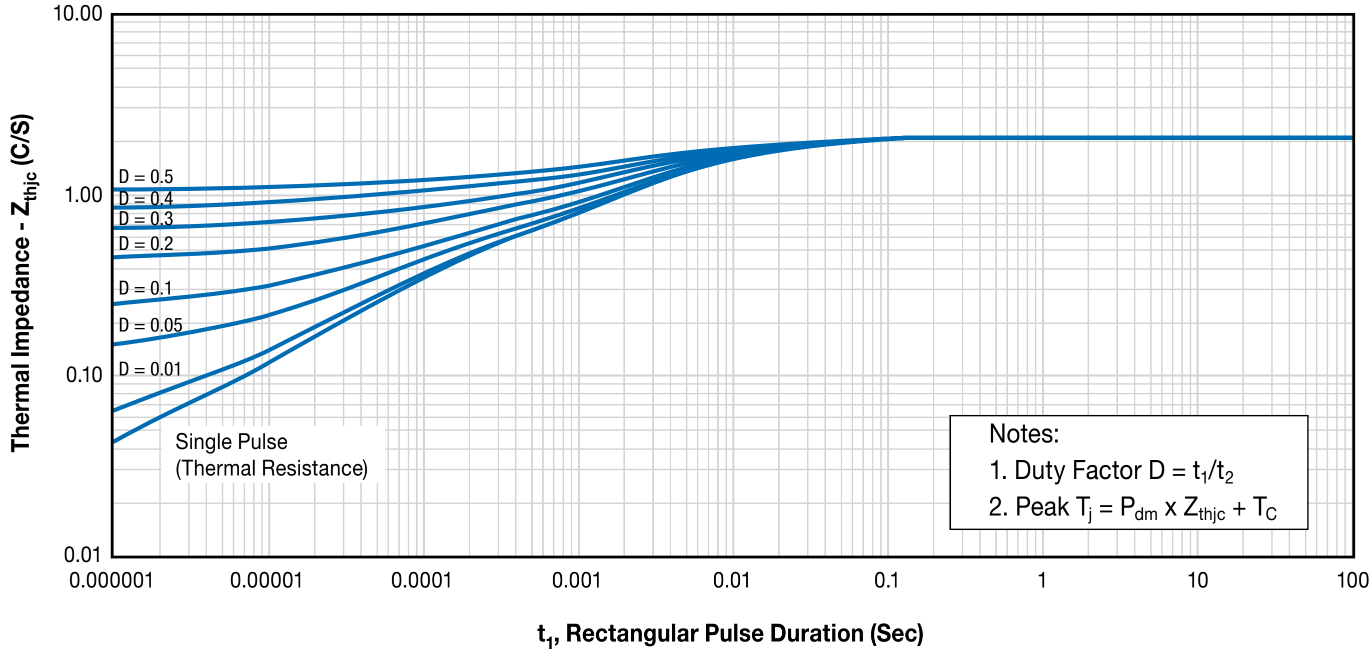


Figure 12. Transient Thermal Impedance, Junction to Case

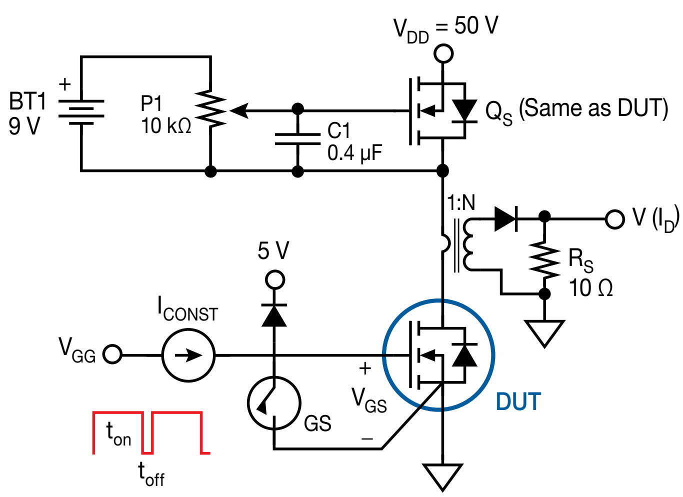


Figure 13. Charge Test Circuit

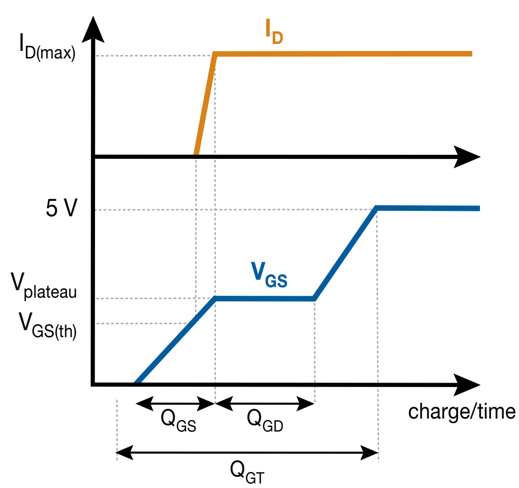
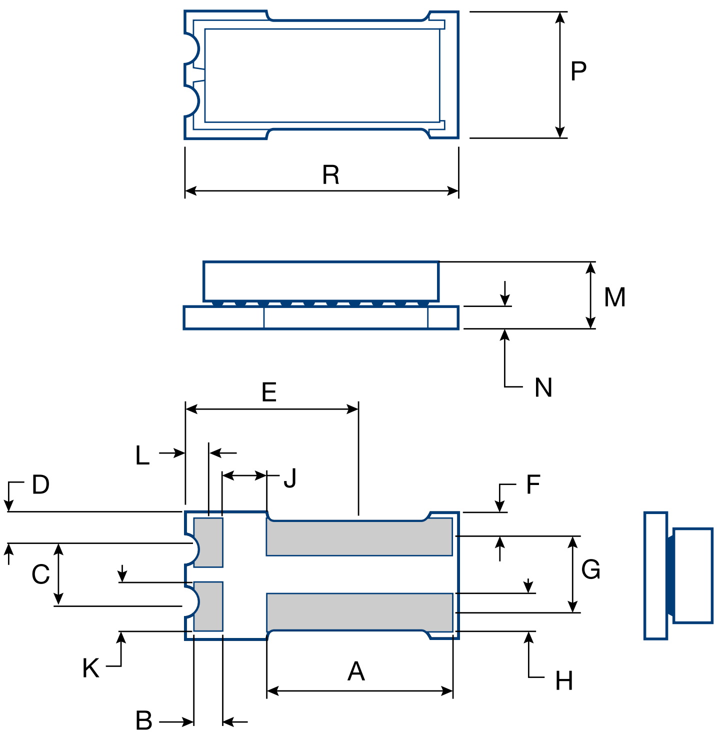


Figure 14. Typical Gate Charge Test Waveform

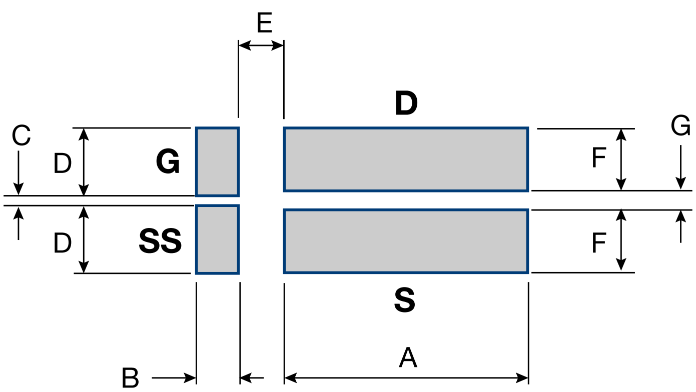
Package Outline and Dimensions



Symbol	Inches	Millimeters	Note
A	0.108	2.743	
B	0.025	0.635	
C	0.044	1.117	
D	0.022	0.558	
E	0.105	2.668	
F	0.018	0.457	
G	0.051	1.295	
H	0.025	0.635	
J	0.026	0.660	
K	0.034	.0864	
L	0.013	0.330	
M	0.047	1.194	Ref.only
N	0.020	0.508	
P	0.088	2.235	
R	0.164	4.166	

NOMINAL (TOLERANCE ± .005 in/0.127 mm)

CDA3 Footprint for Printed Circuit Board Design



Symbol	Inches	Millimeters	Note
A	0.112	2.844	
B	0.023	0.584	
C	0.010	0.254	MIN
D	0.036	0.914	
E	0.022	0.558	
F	0.029	0.736	
G	0.022	0.558	

NOMINAL (TOLERANCE ± .005 in/0.127 mm)

Notes

Note 1. NEVER exceed the absolute maximum V_{DS} of the device otherwise permanent damage/destruction may result.

Note 2. NEVER exceed the absolute maximum V_{GS} of the device otherwise permanent damage/destruction may result. We recommend a VGS of 5V for optimum operation across life and radiation.

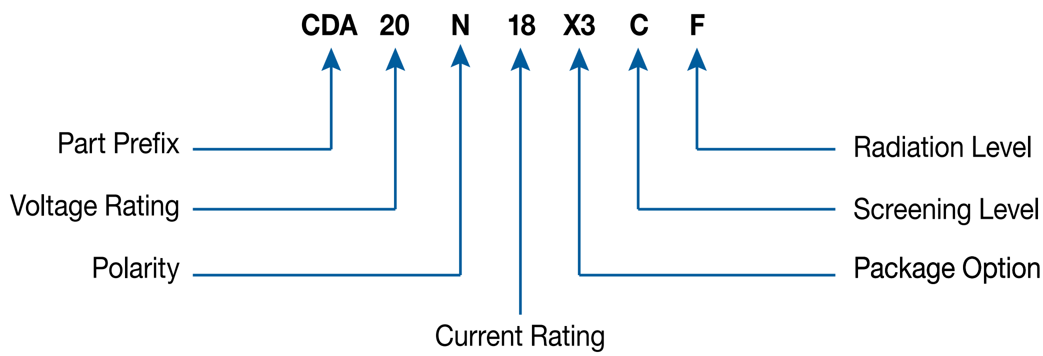
Note 3. $R_{\theta JA}$ measured with CDA1 package mounted to double-sided PCB, 0.063” thickness with 1.0 square inches of copper area on the top (mounting side) and a flood etch (3 square inches) on the bottom side.

Note 4. Measured using four wire (Kelvin) sensing and pulse measurement techniques. Measurement pulse width is 80 µs and duty cycle is 1%, maximum.

Note 5. With pulse measurement width 100–380 µs.

Note 6. Guaranteed by design/device construction. Not tested.

EPC Space Part Number Information



Ordering Information Availability

Screening Options	Rad Assurance Options
1 character	**1 character**
C = Developmental Unit V = Lite Screened	R = 100 krad, LET = 64 F = 300 krad, LET = 64 G = 500 krad, LET = 64 H = 1000 krad, LET = 64 Z = 1000 krad, LET = 84

Part Number	Screening Level	Shipping
CDA20N18X3*C	Engineering Samples	Waffle Trays
CDA20N18X3*S	Space Level	

[1] Screening and qualification consistent to an equivalent MIL-PRF-19500 specification (KC).

C version CDA units are intended for engineering development purposes only and NOT supplied with radiation performance guarantees nor supplemental data packages

Data Package Order Detail
Consistent to MIL-PRF-19500 general specification

SPACE Screen

1. CDA20N18X3*S – OPTIONAL DATA PACKAGE

A. Certificate of Compliance

B. Serialization Records

C. Preconditioning – Attributes Data Sheet (Lot Sample)

– HTGB - Hi Temp Gate Stress Post Reverse Bias Data

– HTRB - Hi Temp Drain Stress Post Reverse Bias Data

D. Group A – Attributes Data Sheet

E. Group B – Selected Mechanical Stress Test

F. Group D – Attributes Data Sheet

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Revisions

Datasheet Revision	Product Status
REV P#	Proposal/development
REV Q#	Characterization and Qualification
M-701-006-D	Production Released

Information subject to change without notice.
Revised October, 2023