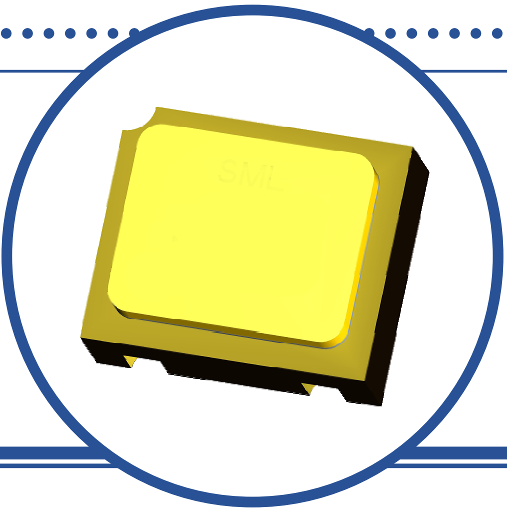
N-CHANNEL ENHANCEMENT MODE MOSFET

2N7002C1A / 2N7002C1B, 2N7002C1C / 2N7002C1D



- V_{DSS} = 60V , I_D = 115mA, $R_{DS(ON)}$ = 7.5Ω
- Fast Switching
- Low Threshold Voltage
- Integral Source-Drain Body Diode
- Hermetic Ceramic Surface Mount Package (SOT-23 compatible)
- High Reliability Screening Options Available
- Variants C1C & C1D with solder dip finished pads (63Sn/37Pb)

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise stated)

V_{DS}	Drain – Source Voltage		60V
V_{GS}	Gate – Source Voltage		±40V
I_D	Continuous Drain Current	$T_C = 25°C$	115mA
I_D	Continuous Drain Current	$T_C = 100°C$	75mA
I_{DM}	Pulsed Drain Current (1)		800mA
P_T	Total Power Dissipation at	$T_A \leq 25°C$	350mW
		De-rate $T_C > 25°C$	2.8mW/°C
T_J	Operating Temperature Range		-55 to +150°C
T_{stg}	Storage Temperature Range		-55 to +150°C

THERMAL PROPERTIES

Symbols	Parameters	Max	Units
$R_{\theta JA}$	Thermal Resistance, Junction To Ambient	357	°C/W

Notes

(1) Repetitive Rating: Pulse width limited by maximum junction temperature

(2) Pulse Width ≤ 380us, δ ≤ 2%

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise stated)

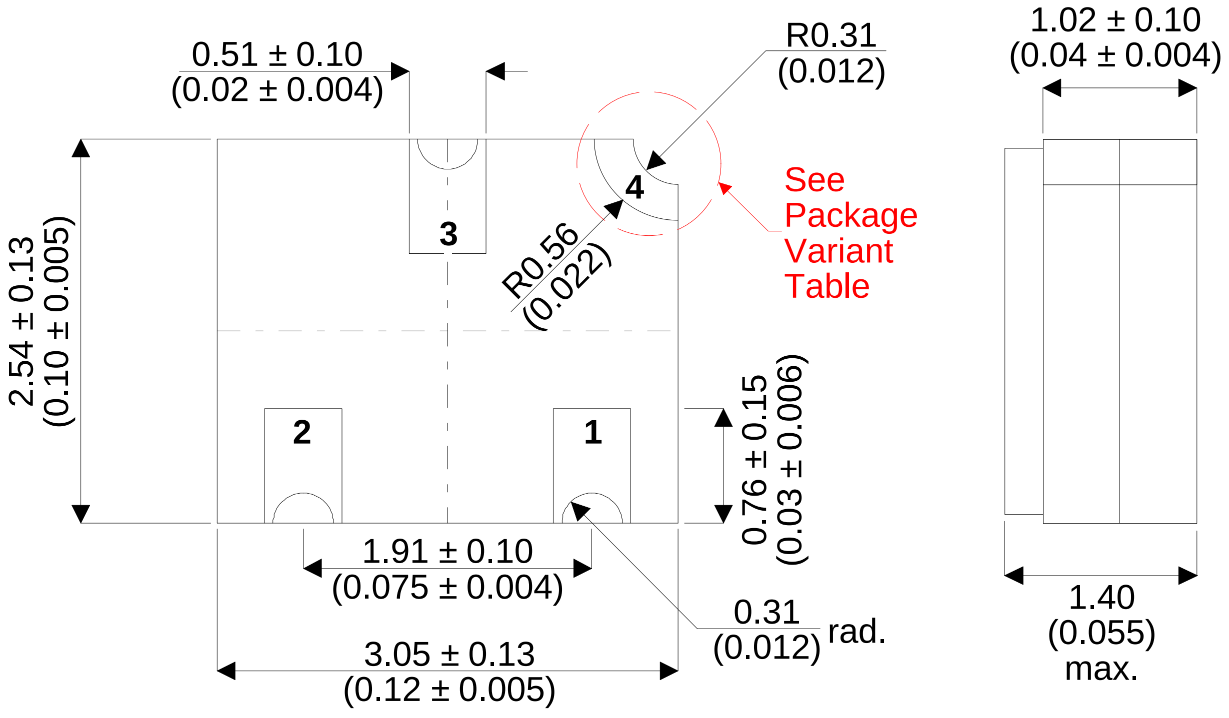
Symbols	Parameters	Test Conditions		Min.	Typ.	Max.	Units
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$	$I_D = 10µA$	60			V
$V_{GS(th)}$	Gate Threshold Voltage	$I_D = 250µA$	$V_{DS} \geq V_{GS}$	1.0		2.5	V
		$I_D = 1.0mA$	$T_A = -55°C$			2.5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 20V$	$V_{DS} = 0V$			±100	nA
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0$	$V_{DS} = 60V$			1.0	µA
			$T_A = 125°C$			500	
$V_{DS(on)}$(2)	Static Drain-Source On-State Voltage	$V_{GS} = 5V$	$I_D = 50mA$			1.5	V
		$V_{GS} = 10V$	$I_D = 0.5A$			3.75	
$R_{DS(on)}$(2)	Static Drain-Source On-State Resistance	$V_{GS} = 5V$	$I_D = 50mA$			7.5	Ω
			$T_A = 125°C$			13.5	
		$V_{GS} = 10V$	$I_D = 0.5A$			7.5	
			$T_A = 125°C$			13.5	
g_{fs}(2)	Forward Transconductance	$V_{DS} = 10V$	$I_D = 0.2A$	80			m℧
V_{SD}(2)	Body Diode Forward Voltage	$V_{GS} = 0$	$I_S = 0.2A$	0.7		1.2	V

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{GS} = 0$			50	pF
C_{oss}	Output Capacitance	$V_{DS} = 25V$			25	
C_{rss}	Reverse Transfer Capacitance	f = 1.0MHz			5	
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30V$			20	ns
$t_{d(off)}$	Turn-Off Delay Time	$I_D = 0.2A$ $R_G = 50Ω$			20	

MECHANICAL DATA

Dimensions in mm (inches)



LCC1
Underside View

PACKAGE VARIANT TABLE

Variant	Pad 1	Pad 2	Pad 3	Pad 4	Pad Finish	Order Part No.
A	Gate	Source	Drain	No Pad (3-Pins Only)	Au Finished	2N7002C1A
B	Gate	Source	Drain	Lid Shield Contact *	Au Finished	2N7002C1B
C	Gate	Source	Drain	No Pad (3-Pins Only)	Hot Solder Dip - 63Sn/37Pb	2N7002C1C
D	Gate	Source	Drain	Lid Shield Contact *	Hot Solder Dip - 63Sn/37Pb	2N7002C1D

* The additional contact provides a connection to the lid in the application. Connecting the metal lid to a known electrical potential stops deep dielectric discharge in space applications; see the Space Weather link www.semelab.co.uk/mil/lcc1_4 on the Semelab web site. Package variant to be specified at order.

SCREENING OPTIONS

Space Level (JQRS/ESA) and High Reliability options are available in accordance with the High Reliability and Screening Options Handbook available for download from the from the TT electronics Semelab web site.

ESA Quality Level Products are based on the testing procedures specified in the generic ESCC 5000 and in the corresponding part detail specifications.

Semelabs QR216 and QR217 processing specifications (JQRS), in conjunction with the companies ISO 9001:2000 approval present a viable alternative to the American MIL-PRF-19500 space level processing.

QR217 (Space Level Quality Conformance) is based on the quality conformance inspection requirements of MIL-PRF-19500 groups A (table V), B (table VIa), C (table VII) and also ESA / ESCC 5000 (chart F4) lot validation tests.

QR216 (Space Level Screening) is based on the screening requirements of MIL-PRF-19500 (table IV) and also ESA /ESCC 5000 (chart F3).

JQRS parts are processed to the device data sheet and screened to QR216 with conformance testing to Q217 groups A and B in accordance with MIL-STD-750 methods and procedures.

Additional conformance options are available, for example Pre-Cap Visual Inspection, Buy-Off Visit or Data Packs. These are chargeable and must be specified at the order stage (See Ordering Information). Minimum order quantities may apply.

Alternative or additional customer specific conformance or screening requirements would be considered. Contact Semelab sales with enquires.

MARKING DETAILS

Screened parts are typically marked with specification number, serial number (or week of seal) as shown in the example below. All non screened parts are printed with three characters only eg. 02A.

Customer specific marking requirements can be arranged at time of order but is approximately limited to two lines of 7 Characters. This is to ensure text remains readable..

Example Marking:

ORDERING INFORMATION

Part number is built from part, package variant and screening level. The part number can be extended to include the additional options as shown below.

Type – See Electrical Stability Characteristics Table
Package Variant – See Mechanical Data
Screening Level – See Screening Options (ESA / JQRS)

Additional Options:

Customer Pre-Cap Visual Inspection	.CVP
Customer Buy-Off visit	.CVB
Data Pack	.DA
Solderability Samples	.SS
Scanning Electron Microscopy	.SEM
Radiography (X-ray)	.XRAY
Total Dose Radiation Test	.RAD
MIL-PRF-19500 (QR217)	
Group B charge	.GRPB
Group B destructive mechanical samples	.GBDM (12 pieces)
Group C charge	.GRPC
Group C destructive electrical samples	.GCDE (12 pieces)
Group C destructive mechanical samples	.GCDM (6 pieces)
ESA/ESCC	
Lot Validation Testing (subgroup 1) charge	.LVT1
LVT1 destructive samples (environmental)	.L1DE (15 pieces)
LVT1 destructive samples (mechanical)	.L1DM (15 pieces)
Lot Validation Testing (subgroup 2) charge	.LVT2
LVT2 endurance samples (electrical)	.L2D (15 pieces)
Lot Validation Testing (subgroup 3) charge	.LVT3
LVT3 destructive samples (mechanical)	.L3D (5 pieces)

Additional Option Notes:
1) All 'Additional Options' are chargeable and must be specified at order stage.
2) When Group B,C or LVT is required, additional electrical and mechanical destructive samples must be ordered
3) All destructive samples are marked the same as other production parts unless otherwise requested.

Example ordering information:
The following example is for the 2N7002C1A/B/C/D part; package variant B, JQRS screening, additional Group C conformance testing and a Data pack.

Part Numbers:
2N7002C1A/B/C/DB-JQRS (Include quantity for flight parts)
2N7002C1A/B/C/DB -JQRS.GRPC (chargeable conformance option)
2N7002C1A/B/C/DB -JQRS.GCDE (charge for destructive parts)
2N7002C1A/B/C/DB -JQRS.GCDM (charge for destructive parts)
2N7002C1A/B/C/DB -JQRS.DA (charge for Data pack)

Customers with any specific requirements (e.g. marking, package or screening) may be supplied with a similar alternative part number (there is maximum 20 character limit to part numbers). Contact Semelab sales with all enquiries