



N-CHANNEL MOSFET

Qualified per MIL-PRF-19500/592

Qualified Levels:
JAN, JANTX, and
JANTXV

DESCRIPTION

This family of switching transistors is military qualified up to the JANTXV level for high-reliability applications. These devices are also available in a thru hole TO-254AA package. Microsemi also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

Important: For the latest information, visit our website <http://www.microsemi.com>.

FEATURES

- Surface mount equivalent of JEDEC registered 2N7224, 2N7225, 2N7227 and 2N7228 number series.
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/592. (See [part nomenclature](#) for all available options.)
- RoHS compliant by design.

APPLICATIONS / BENEFITS

- Low-profile design.
- Military and other high-reliability applications.

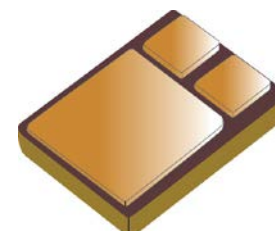
MAXIMUM RATINGS @ T_A = +25 °C unless otherwise stated

Parameters / Test Conditions	Symbol	Value	Unit
Operating & Storage Junction Temperature Range	T _J & T _{stg}	-55 to +150	°C
Thermal Resistance Junction-to-Case	R _{θJC}	0.83	°C/W
Total Power Dissipation @ T _A = +25 °C @ T _C = +25 °C ⁽¹⁾	P _T	4 150	W
Gate-Source Voltage, dc	V _{GS}	± 20	V
Drain Current, dc @ T _C = +25 °C ⁽²⁾	I _{D1}	2N7224U 34.0 2N7225U 27.4 2N7227U 14.0 2N7228U 12.0	A
Drain Current, dc @ T _C = +100 °C ⁽²⁾		2N7224U 21 2N7225U 17 2N7227U 9 2N7228U 8	
Off-State Current (Peak Total Value) ⁽³⁾	I _{DM}	2N7224U 136 2N7225U 110 2N7227U 56 2N7228U 48	A (pk)
Source Current		2N7224U 34.0 2N7225U 27.4 2N7227U 14.0 2N7228U 12.0	

- NOTES:**
1. Derated linearly by 1.2 W/°C for T_C > +25 °C.
 2. The following formula derives the maximum theoretical ID limit. ID is limited by package and internal wires and may also be limited by pin diameter:

$$I_D = \sqrt{\frac{T_J(\text{max}) - T_C}{R_{\theta JC} \times R_{DS(on)} @ T_J(\text{max})}}$$

3. I_{DM} = 4 × I_{D1} as calculated in note 2.



**U (SMD-1 or
TO-267AB)
Package**

Also available in:

TO-254AA package
(leadless)
 [2N7224 & 2N7228](#)

MSC – Lawrence

6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
(978) 620-2600
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MSC – Ireland

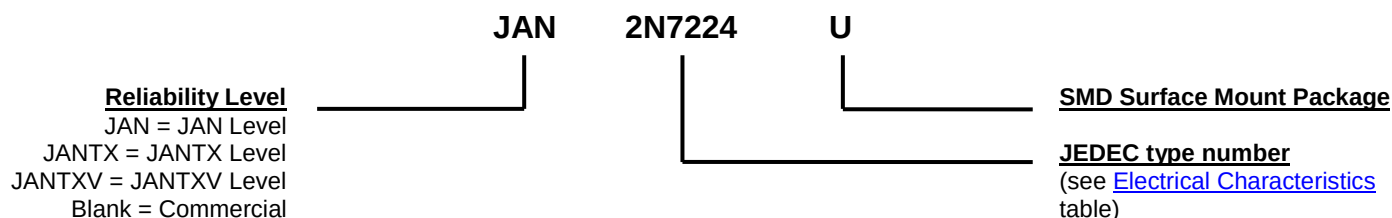
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Ennis, Co. Clare, Ireland
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www.microsemi.com

MECHANICAL and PACKAGING

- CASE: Ceramic and gold over nickel plated steel.
- TERMINALS: Gold over nickel plated tungsten/copper.
- MARKING: Part number, date code, A = anode.
- WEIGHT: 0.9 grams.
- See [Package Dimensions](#) on last page.

PART NOMENCLATURE

SYMBOLS & DEFINITIONS

Symbol	Definition
di/dt	Rate of change of diode current while in reverse-recovery mode, recorded as maximum value.
I_F	Forward current
R_G	Gate drive impedance
V_{DD}	Drain supply voltage
V_{DS}	Drain source voltage, dc
V_{GS}	Gate source voltage, dc

ELECTRICAL CHARACTERISTICS @ $T_A = +25^\circ\text{C}$, unless otherwise noted

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
OFF CHARACTERISTICS					
Drain-Source Breakdown Voltage $V_{GS} = 0\text{ V}, I_D = 1.0\text{ mA}$	2N7224U 2N7225U 2N7227U 2N7228U	$V_{(BR)DSS}$	100 200 400 500		V
Gate-Source Voltage (Threshold) $V_{DS} \geq V_{GS}, I_D = 0.25\text{ mA}$ $V_{DS} \geq V_{GS}, I_D = 0.25\text{ mA}, T_J = +125^\circ\text{C}$ $V_{DS} \geq V_{GS}, I_D = 0.25\text{ mA}, T_J = -55^\circ\text{C}$		$V_{GS(th)1}$ $V_{GS(th)2}$ $V_{GS(th)3}$	2.0 1.0	4.0 5.0	V
Gate Current $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$ $V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}, T_J = +125^\circ\text{C}$		I_{GSS1} I_{GSS2}		± 100 ± 200	nA
Drain Current $V_{GS} = 0\text{ V}, V_{DS} = 80\text{ V}$ $V_{GS} = 0\text{ V}, V_{DS} = 160\text{ V}$ $V_{GS} = 0\text{ V}, V_{DS} = 320\text{ V}$ $V_{GS} = 0\text{ V}, V_{DS} = 400\text{ V}$	2N7224U 2N7225U 2N7227U 2N7228U	I_{DSS1}		25	μA
Drain Current $V_{GS} = 0\text{ V}, V_{DS} = 80\text{ V}, T_J = +125^\circ\text{C}$ $V_{GS} = 0\text{ V}, V_{DS} = 160\text{ V}, T_J = +125^\circ\text{C}$ $V_{GS} = 0\text{ V}, V_{DS} = 320\text{ V}, T_J = +125^\circ\text{C}$ $V_{GS} = 0\text{ V}, V_{DS} = 400\text{ V}, T_J = +125^\circ\text{C}$	2N7224U 2N7225U 2N7227U 2N7228U	I_{DSS2}		0.25	mA
Static Drain-Source On-State Resistance $V_{GS} = 10\text{ V}, I_D = 21.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 17.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 9.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 8.0\text{ A pulsed}$	2N7224U 2N7225U 2N7227U 2N7228U	$r_{DS(on)1}$		0.070 0.100 0.315 0.415	Ω
Static Drain-Source On-State Resistance $V_{GS} = 10\text{ V}, I_D = 34.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 27.4\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 14.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 12.0\text{ A pulsed}$	2N7224U 2N7225U 2N7227U 2N7228U	$r_{DS(on)2}$		0.081 0.105 0.415 0.515	Ω
Static Drain-Source On-State Resistance $T_J = +125^\circ\text{C}$ $V_{GS} = 10\text{ V}, I_D = 21.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 17.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 9.0\text{ A pulsed}$ $V_{GS} = 10\text{ V}, I_D = 8.0\text{ A pulsed}$	2N7224U 2N7225U 2N7227U 2N7228U	$r_{DS(on)3}$		0.11 0.17 0.68 0.90	Ω
Diode Forward Voltage $V_{GS} = 0\text{ V}, I_D = 34.0\text{ A pulsed}$ $V_{GS} = 0\text{ V}, I_D = 27.4\text{ A pulsed}$ $V_{GS} = 0\text{ V}, I_D = 14.0\text{ A pulsed}$ $V_{GS} = 0\text{ V}, I_D = 12.0\text{ A pulsed}$	2N7224U 2N7225U 2N7227U 2N7228U	V_{SD}		1.8 1.9 1.7 1.7	V

ELECTRICAL CHARACTERISTICS @ $T_A = +25\text{ }^{\circ}\text{C}$, unless otherwise noted (continued)
DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Gate Charge:				
On-State Gate Charge	$Q_{g(on)}$			nC
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7224U			125	
$V_{GS} = 10\text{ V}$, $I_D = 27.4\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7225U			115	
$V_{GS} = 10\text{ V}$, $I_D = 14.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7227U			110	
$V_{GS} = 10\text{ V}$, $I_D = 12.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7228U			120	
Gate to Source Charge	Q_{gs}			nC
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7224U			22	
$V_{GS} = 10\text{ V}$, $I_D = 27.4\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7225U			22	
$V_{GS} = 10\text{ V}$, $I_D = 14.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7227U			18	
$V_{GS} = 10\text{ V}$, $I_D = 12.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7228U			19	
Gate to Drain Charge	Q_{gd}			nC
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7224U			65	
$V_{GS} = 10\text{ V}$, $I_D = 27.4\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7225U			60	
$V_{GS} = 10\text{ V}$, $I_D = 14.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7227U			65	
$V_{GS} = 10\text{ V}$, $I_D = 12.0\text{ A}$, $V_{DS} = 50\text{ V}$ 2N7228U			70	

SWITCHING CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Turn-on delay time	$t_{d(on)}$			ns
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224U				
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225U			35	
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227U				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228U				
Rinse time	t_r			ns
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224U				
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225U			190	
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227U				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228U				
Turn-off delay time	$t_{d(off)}$			ns
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224U				
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225U			170	
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227U				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228U				
Fall time	t_f			ns
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224U				
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225U			130	
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227U				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228U				
Diode Reverse Recovery Time	t_{rr}			ns
$di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq 30\text{ V}$, $I_F = 34.0\text{ A}$ 2N7224U			500	
$di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq 30\text{ V}$, $I_F = 27.4\text{ A}$ 2N7225U			950	
$di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq 30\text{ V}$, $I_F = 14.0\text{ A}$ 2N7227U			1200	
$di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq 30\text{ V}$, $I_F = 12.0\text{ A}$ 2N7228U			1600	

GRAPHS

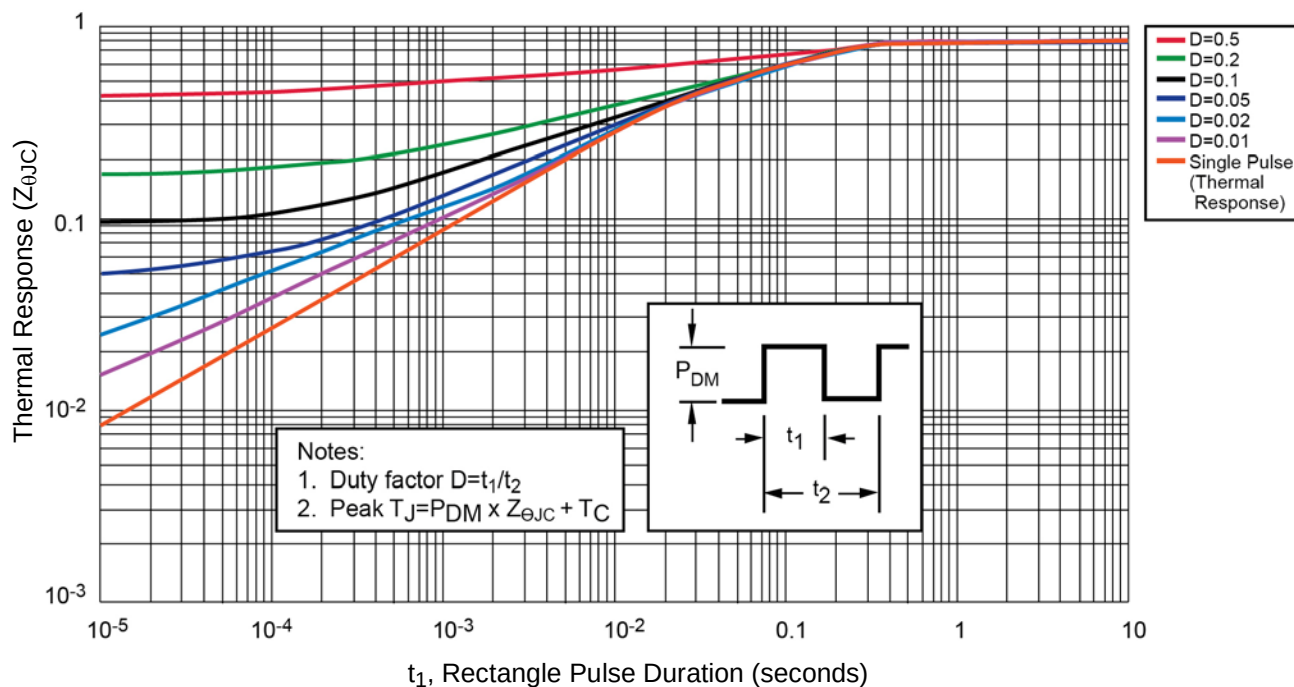
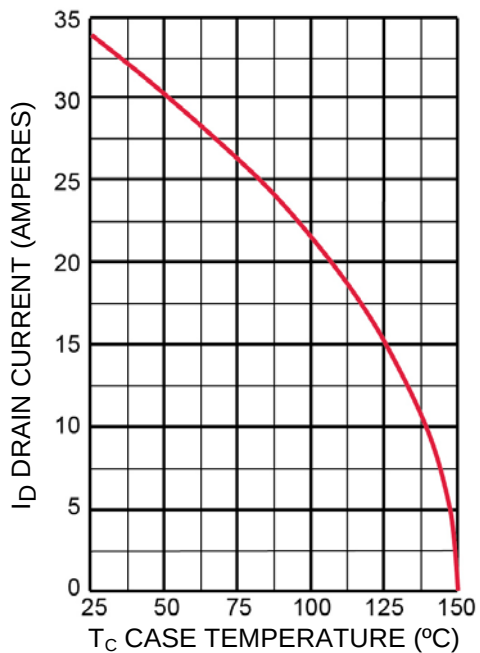
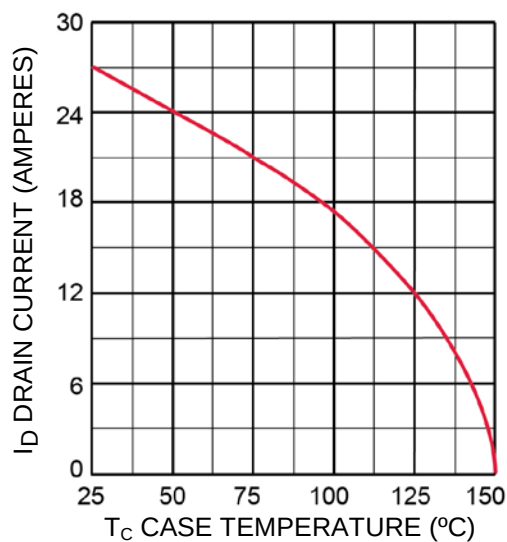


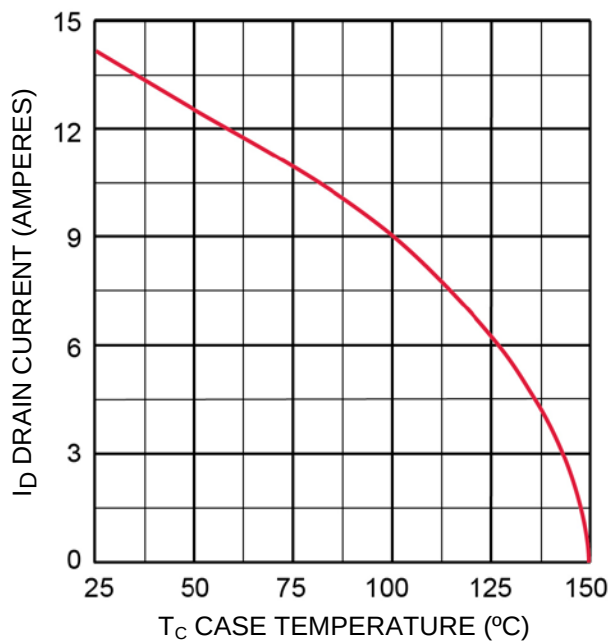
FIGURE 1
Thermal Impedance Curves

GRAPHS (continued)
FIGURE 2 – Maximum Drain Current vs Case Temperature Graphs


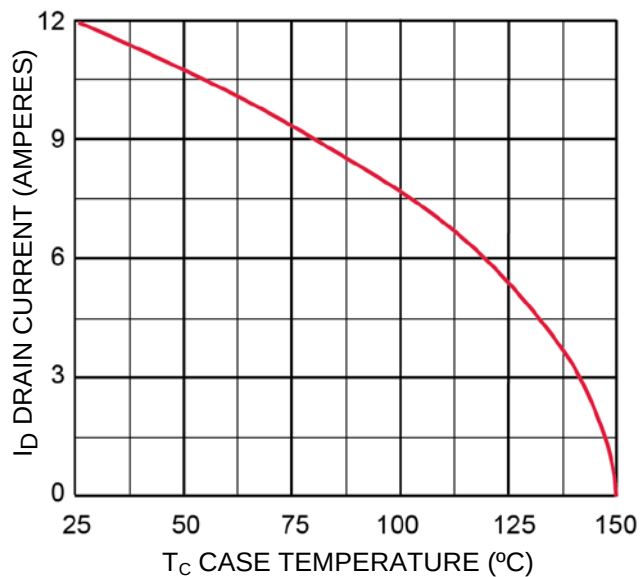
For 2N7224U



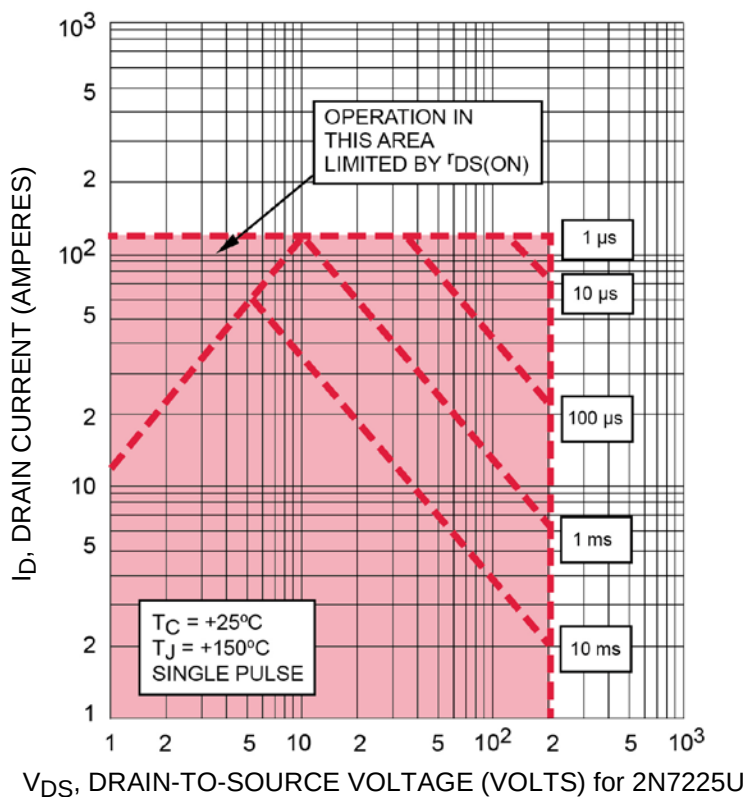
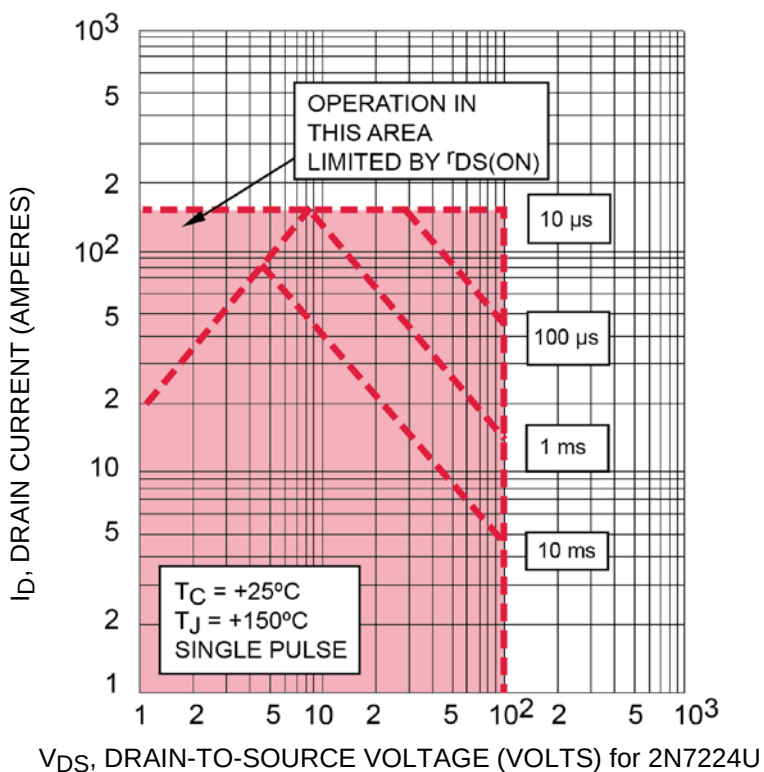
For 2N7225U

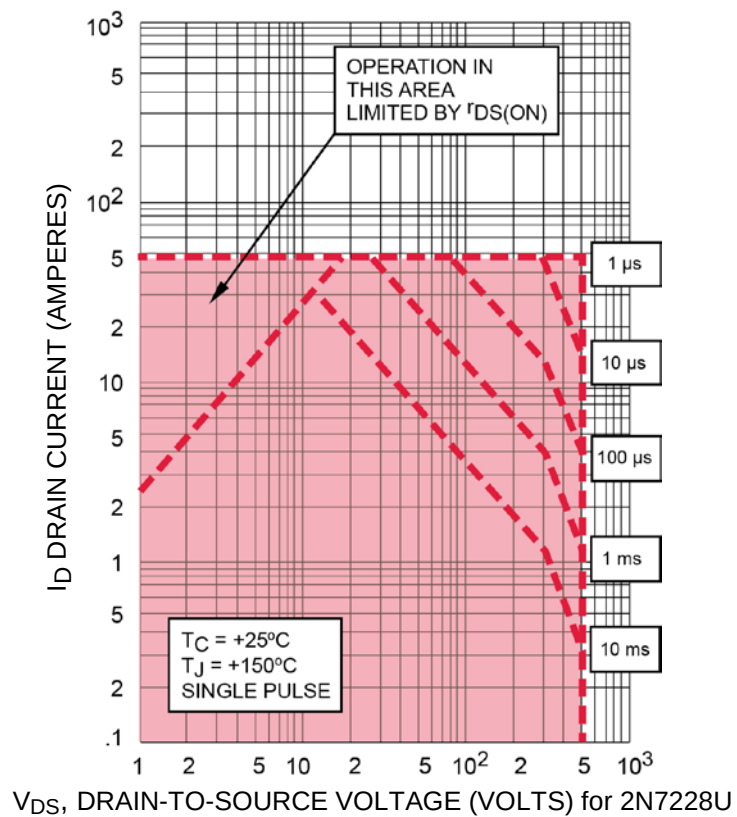
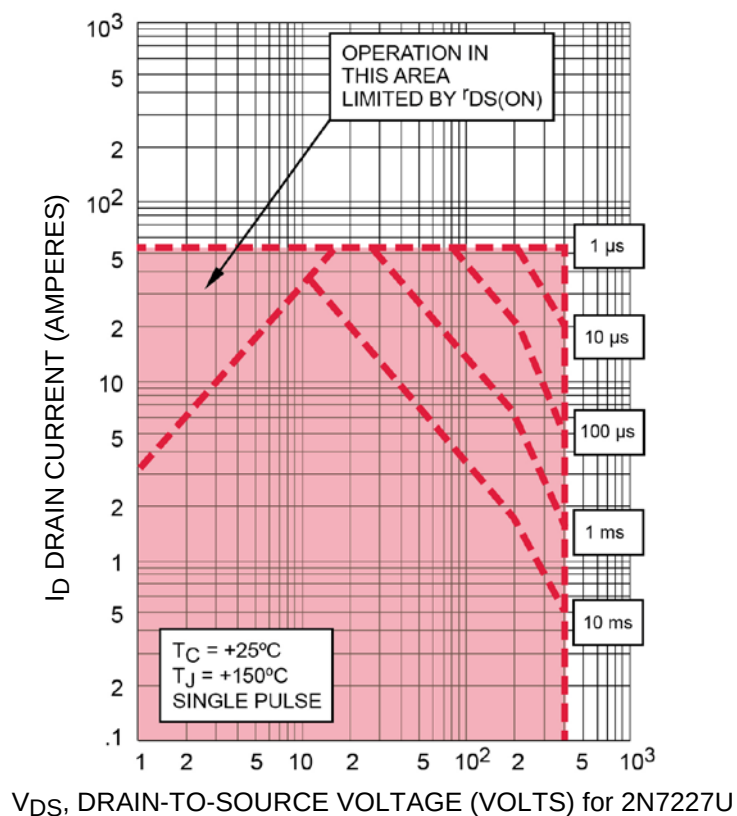


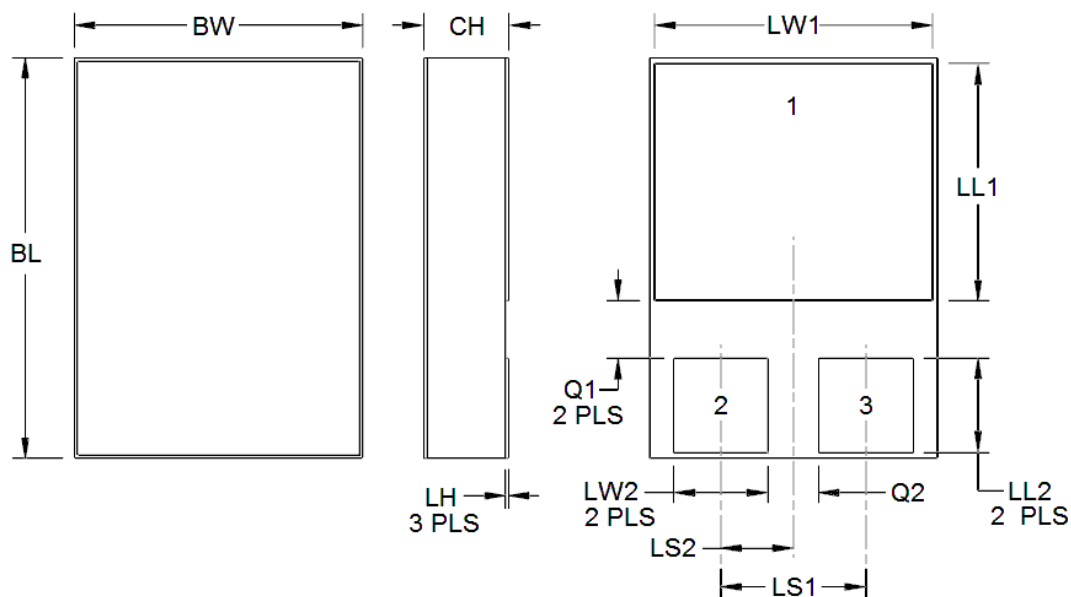
For 2N7227U



For 2N7228U

GRAPHS (continued)
FIGURE 3 – Maximum Safe Operating Area


GRAPHS (continued)


PACKAGE DIMENSIONS

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. The lid shall be electrically isolated from the drain, gate and source.
4. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.

Symbol	DIMENSIONS			
	INCH		MILLIMETERS	
	Min	Max	Min	Max
BL	.620	.630	15.75	16.00
BW	.445	.455	11.30	11.56
CH	-	.142	-	3.60
LH	.010	.020	.026	.050
LL1	.410	.420	10.41	10.67
LL2	.152	.162	3.86	4.11
LS1	.210 BSC		5.33 BSC	
LS2	.105 BSC		2.67 BSC	
LW1	.370	.380	9.40	9.65
LW2	.135	.145	3.43	3.68
Q1	.030	-	0.76	-
Q2	.035	-	0.89	-
Term 1	Drain			
Term 2	Gate			
Term 3	Source			