RoHS Compliant

N-CHANNEL MOSFET

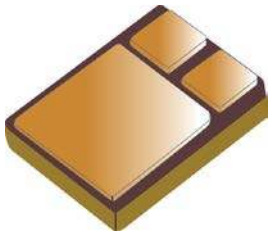
Qualified per MIL-PRF-19500/592

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.



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

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.

Also available in:

TO-254AA package (leaded)
2N7224 & 2N7228

MAXIMUM RATINGS @ T_A = +25 ºC 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		$R_{\theta JC}$	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 ºC (2)	2N7224U 2N7225U 2N7227U 2N7228U	I_{D1}	34.0 27.4 14.0 12.0	A
Drain Current, dc @ T_C = +100 ºC (2)	2N7224U 2N7225U 2N7227U 2N7228U	I_{D2}	21 17 9 8	A
Off-State Current (Peak Total Value) (3)	2N7224U 2N7225U 2N7227U 2N7228U	I_{DM}	136 110 56 48	A (pk)
Source Current	2N7224U 2N7225U 2N7227U 2N7228U	I_S	34.0 27.4 14.0 12.0	A

NOTES:
1. Derated linearly by 1.2 W/ºC for T_C > +25 ºC.
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:

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

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

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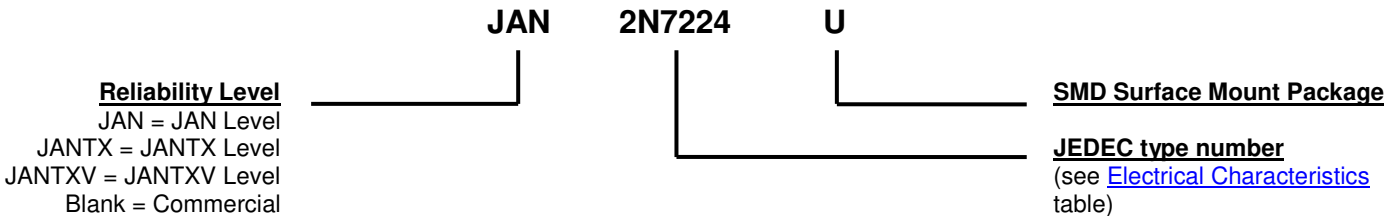
MECHANICAL and PACKAGING

- 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 °C, unless otherwise noted

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

ELECTRICAL CHARACTERISTICS @ T_A = +25 °C, unless otherwise noted (continued)

DYNAMIC CHARACTERISTICS

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

SWITCHING CHARACTERISTICS

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

GRAPHS

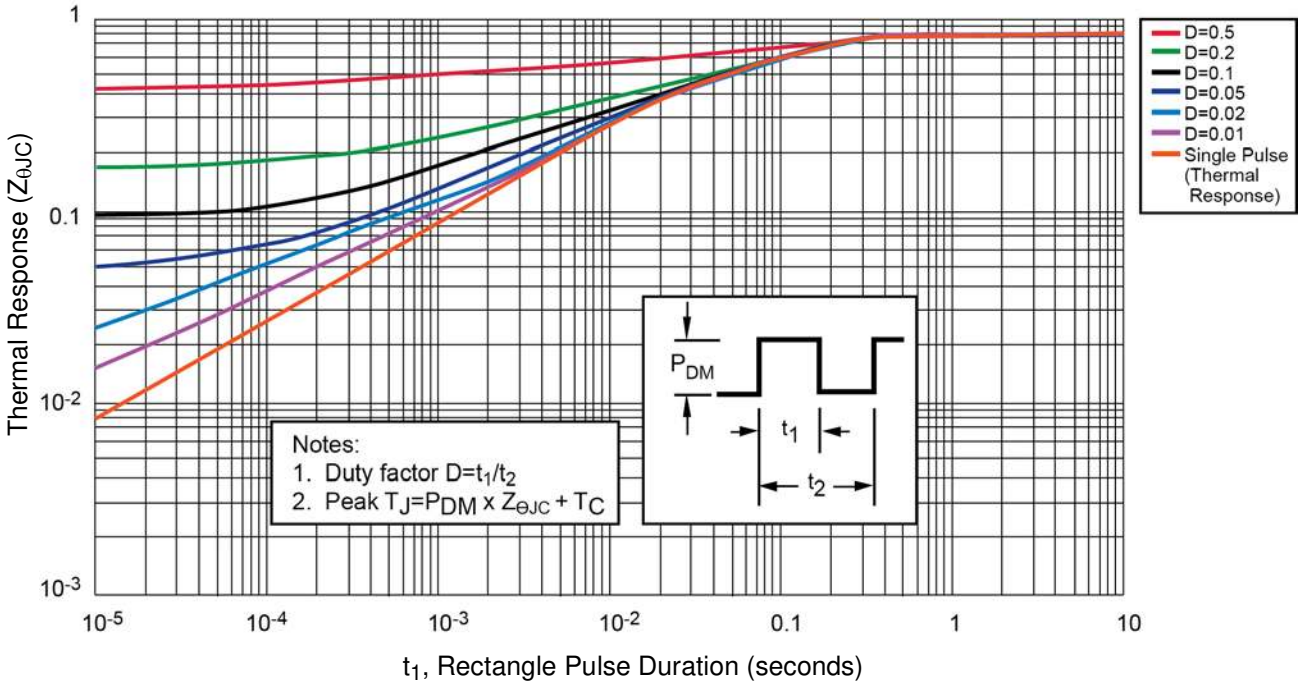
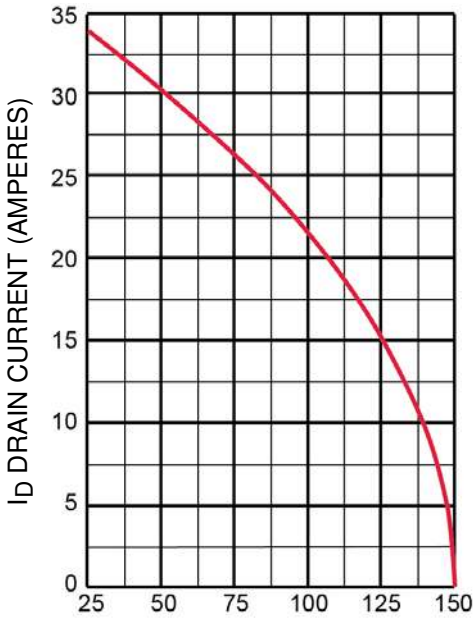


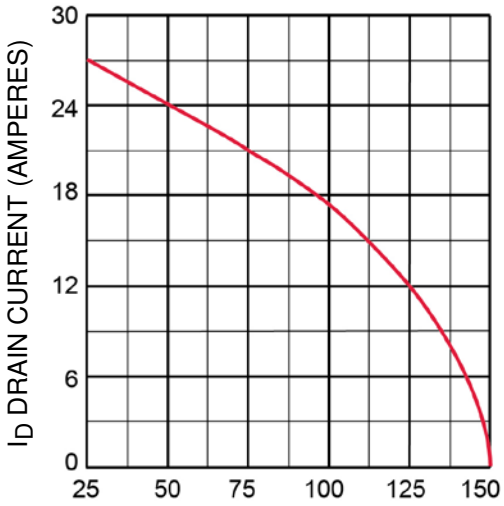
FIGURE 1
Thermal Impedance Curves

GRAPHS (continued)

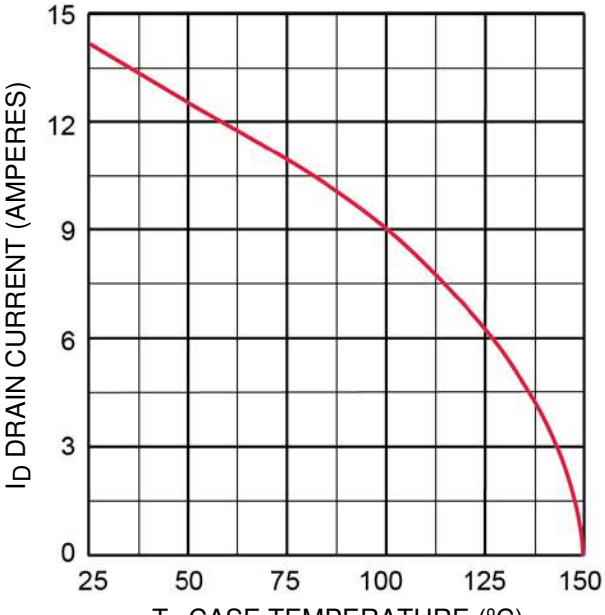
FIGURE 2 – Maximum Drain Current vs Case Temperature Graphs



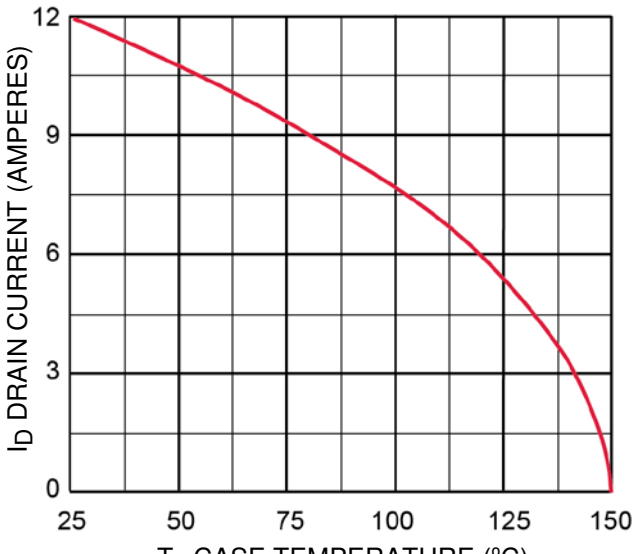
For 2N7224U



For 2N7225U



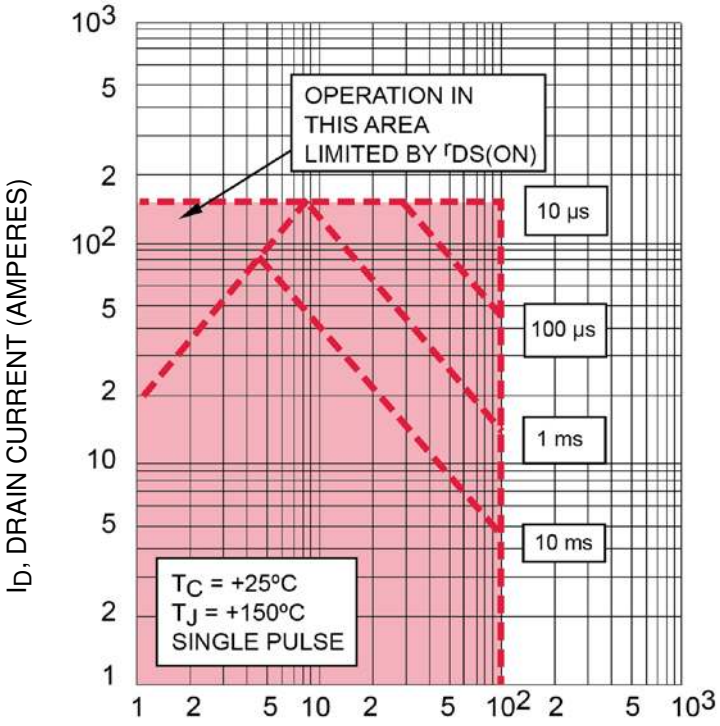
For 2N7227U



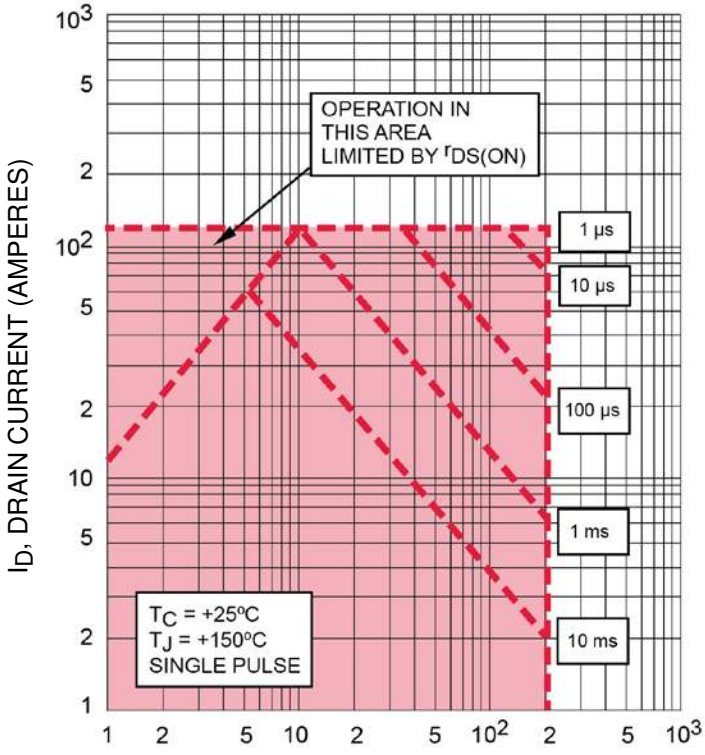
For 2N7228U

GRAPHS (continued)

FIGURE 3 – Maximum Safe Operating Area

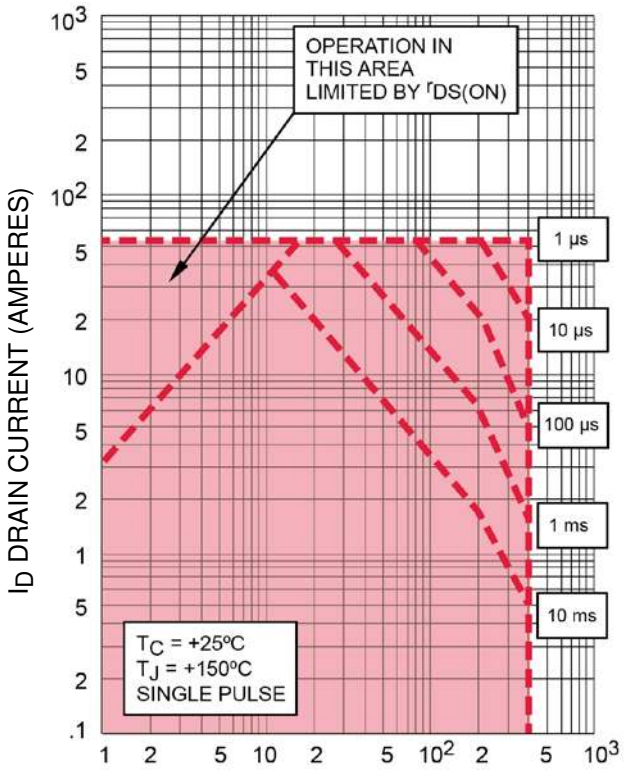


for 2N7224U

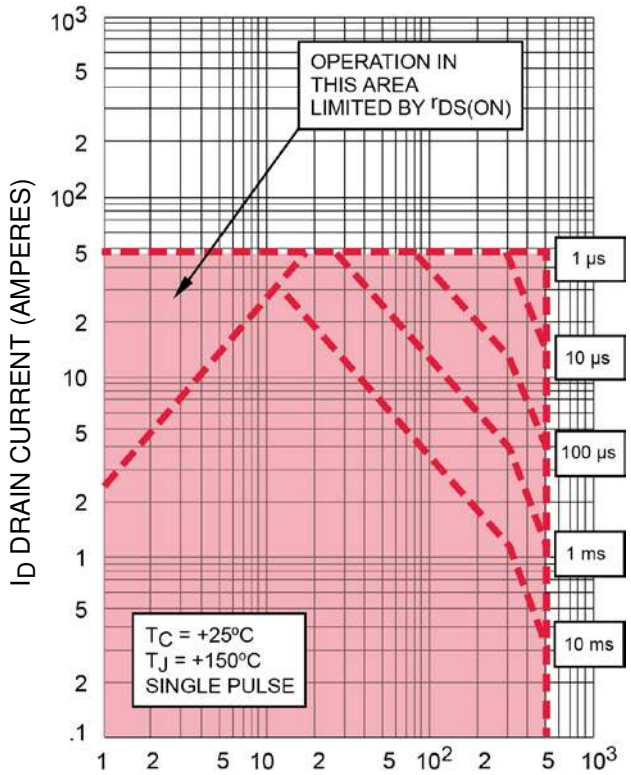


for 2N7225U

GRAPHS (continued)

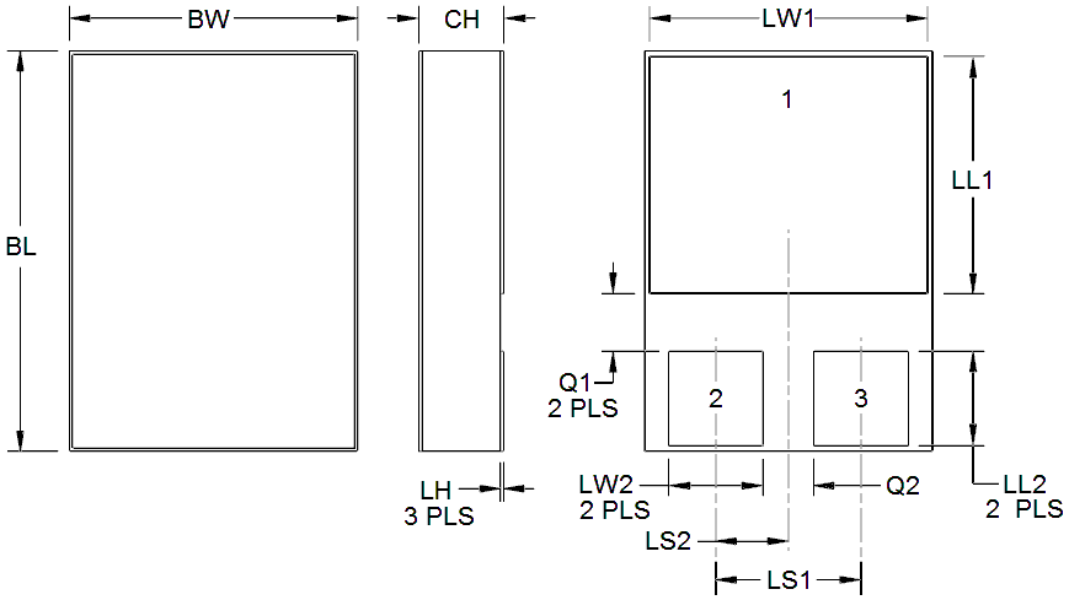


V_{DS}, DRAIN-TO-SOURCE VOLTAGE (VOLTS) for 2N7227U



V_{DS}, DRAIN-TO-SOURCE VOLTAGE (VOLTS) for 2N7228U

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 Φx 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			