2N7380; 2N7380U3
2N7381

N-Chanel Radiation Hardened MOSFET (TO-257AA & TO-276AA)

Rev. V6

Introduction

VPT Components' new radiation-tolerant power MOSFETs are now available in die and standard TO257AA and U3 package options, as well as custom packaging for HiRel environments. Applications within the military, aerospace, medical, nuclear power generation, and high-energy physics research laboratories can benefit from the use of this new series of MOSFETs. VPT Components' power MOSFETs are radiation tolerant to 100 krad (Si) and are SEGR/SEB immune to their full rated breakdown potential.

Operational power losses are minimized by VPT Components' ideal combination of low $r_{DS(on)}$ and gate charge. Die size is optimized for maximum current rating while meeting industry norms. These units are suitable for stand alone and hybrid applications.

These MOSFETs are well suited for low loss switching applications, such as DC to DC converters and solid-state relays. Die performance is drop-in compatible with industry standards.

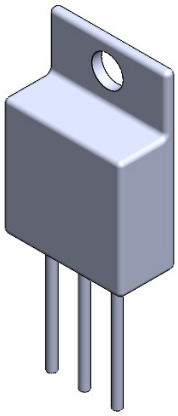


FIGURE 1:
TO-257AA
Package

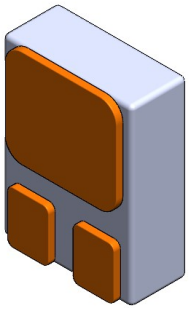
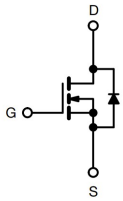


FIGURE 2:
SMD-0.5 TO-267AA
Package



N-Channel MOSFET

Features

- Available in JANSR, JANVR
  Per MIL-PRF-19500/614
- TO-257AA & surface mount
  SMD-0.5 TO-276AA (U3) packages
- Hermetically Sealed

Maximum Ratings (T_A = +25°C unless otherwise specified)

Type	P_T T_C = +25°C (1)	P_T T_A= +25°C (free air)	$R_{\theta JC}$	I_{AS}	E_{AS}	V_{GS}	I_{D1} T_C = +25°C	I_{D2} T_C = +100°C	I_S	I_{DM}	T_J & T_{STG}	Max $r_{DS(on)1}$ V_{GS} = 10 V dc, I_D = I_{D2} T_J = +25°C (1)
	W	W	°C/W	A dc	mJ	V dc	A dc	A dc	A dc	A (pk)	°C	Ω
2N7380 2N7380U3 2N7381	75	2	1.67	14.4 14.4 9.4	150	±20	14.4 14.4 9.4	9.1 9.1 6.0	14.4 14.4 9.4	57.6 57.6 37.6	-55 to +150	0.18 0.18 0.40

NOTES:
1. Derate linearly 0.6 W/°C for T_C > +25°C.

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Primary Electrical Characteristics (2N7380, U; 2N7381)

Characteristics	Test Conditions	Symbol	Min.	Max.	Unit
Drain-Source Breakdown Voltage 2N7380, 2N7380U3 2N7381	V_{GS} = 0 V, I_D = 1 mA	$V_{(BR)DSS}$	100 200	—	V
Gate-Threshold Voltage	$V_{DS} \geq V_{GS}$, I_D = 1.0 mA	$V_{GS(TH)1}$	2.0	4.0	V
Gate-Body Leakage Forward	V_{GS} = +20V, V_{DS} = 0V	I_{GSSF1}	—	+100	nA
Gate-Body Leakage Reverse	V_{GS} = -20V, V_{DS} = 0V	I_{GSSR1}	—	-100	nA
Zero-Gate Voltage Drain Current 2N7380, 2N7380U3 2N7381	V_{GS} = 0V, V_{DS} = 80V V_{DS} = 160V	I_{DSS1}	—	25	µA
Drain-Source On-Resistance Pulsed dc Voltage 2N7380, 2N7380U3 2N7381	V_{GS} = 12V, I_D = 9.1A I_D = 6.0A	$r_{DS(on)2}$	—	0.18 0.40	Ω
Forward Voltage Drain Diode Pulsed dc Voltage 2N7380 2N7380U3 2N7381	V_{GS} = 0V, I_D = 14.4A I_D = 14.4A I_D = 9.4A	V_{SD}	—	1.8 1.5 1.4	V
Forward Transconductance 2N7380, 2N7380U3 2N7381	V_{DD} = 12V, I_D = 9.1A I_D = 6.0A	g_{FS}	2.5	—	S
Turn-on Delay Time 2N7380 2N7380U3 2N7381	V_{GS} = 12V, R_G = 7.5Ω, I_D = 14.4A, V_{DD} = 50V I_D = 14.4A, V_{DD} = 50V I_D = 9.4A, V_{DD} = 100V	$t_{d(on)}$	—	25 35 25	ns
Rise Time 2N7380 2N7380U3 2N7381	V_{GS} = 12V, R_G = 7.5Ω, I_D = 14.4A, V_{DD} = 50V I_D = 14.4A, V_{DD} = 50V V_{DD} = 100V	t_r	—	60 75 50	ns
Turn-off Delay Time 2N7380, 2N7380U3 2N7381	V_{GS} = 12V, R_G = 7.5Ω, I_D = 14.4A, V_{DD} = 50V V_{DD} = 100V	$t_{d(off)}$	—	40 70	ns
Fall Time 2N7380, 2N7380U3 2N7381	V_{GS} = 12V, R_G = 7.5Ω, I_D = 14.4A, V_{DD} = 50V V_{DD} = 100V	t_f	—	30 60	ns

NOTE: All voltages and currents are in dc.

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Primary Electrical Characteristics (2N7380, U3; 2N7381)

Characteristics	Test Conditions	Symbol	Min.	Max.	Units
On-state Gate Charge 2N7380, 2N7380U3 2N7381	V_{GS} = ±20V, T_A = +175°C, t=24 hours	$Q_{G(on)}$	—	40 50	nC
Gate to Source Charge 2N7380, 2N7380U3 2N7381	V_{GS} = ±20V, T_A = +175°C, t=24 hours	Q_{GS}	—	10	nC
Gate to Drain Charge 2N7380, 2N7380U3 2N7381	V_{GS} = ±20V, T_A = +175°C, t=24 hours	Q_{GD}	—	20 25	nC
Reverse Recovery Time 2N7380 2N7380U3 2N7381	di/dt = 100A/µs, V_{DD} ≤ 50V, I_D = 14.4A I_D = 14.4A I_D = 9.4A	t_{rr}	—	 275 275 460	ns

Temperature Testing Electrical Characteristics (2N7380, U; 2N7381)

Characteristics	Test Conditions	Symbol	Min.	Max.	Unit
High Temperature Operation	$T_C = T_J$ = +125°C	—	—	—	—
Gate-Body Leakage Forward	V_{GS} = +20V, V_{DS} = 0V	I_{GSSF2}	—	+200	nA
Gate-Body Leakage Reverse	V_{GS} = -20V, V_{DS} = 0V	I_{GSSR2}	—	-200	nA
Zero-Gate Voltage Drain Current 2N7380, 2N7380U3 2N7381	V_{GS} = 0V V_{DS} = 80V V_{DS} = 160V	I_{DSS2}	—	0.25	µA
Drain-Source On-Resistance 2N7380 2N7380U3 2N7381	V_{GS} = 12V, I_D = 9.1A I_D = 9.1A I_D = 6.0A	$r_{DS(on)3}$	—	 0.36 0.36 0.75	Ω
Gate-Threshold Voltage	V_{DS} ≥ V_{GS}, I_D = 1 mA	$V_{GS(TH)2}$	1.0	—	V

Characteristics	Test Conditions	Symbol	Min.	Max.	Unit
Low Temperature Operation	$T_C = T_J$ = -55°C	—	—	—	—
Gate-Threshold Voltage	V_{DS} ≥ V_{GS}, I_D = 1.0 mA	$V_{GS(TH)3}$	—	5.0	V

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Outline Drawing (TO-257AA)

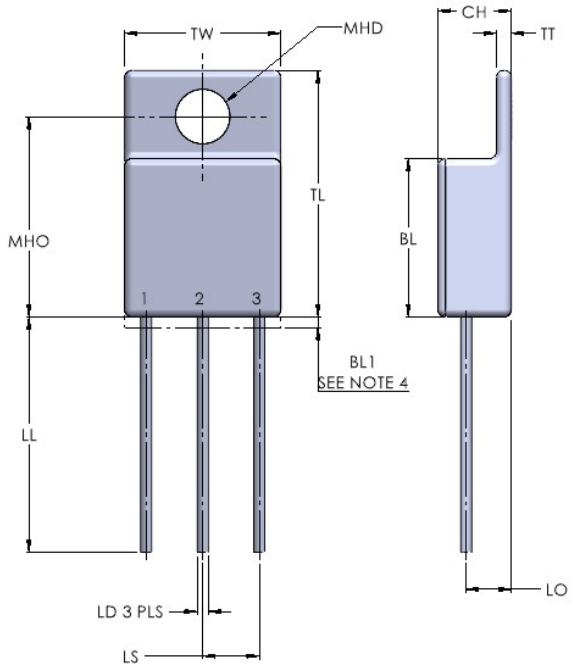

FIGURE 3. Dimensions and configurations for TO-257AA package.

Symbol	Inches		mm	
	Min	Max	Min	Max
BL	.410	.430	10.41	10.92
BL1		.028		0.71
CH	.190	.200	4.83	5.08
LD	0.025	.035	0.64	0.89
LL	0.500	0.650	12.70	16.51
LO	.120 BSC		3.05 BSC	
LS	.100 BSC		2.54 BSC	
MHD	.140	.150	3.56	3.86
MHO	.527	.537	13.39	13.64
TL	.645	.665	16.38	16.89
TT	.035	.045	0.89	1.14
TW	.410	.420	10.41	10.67
1	Drain			
2	Source			
3	Gate			

NOTES:
1. Dimensions are in inches. Millimeters are given for general information only.
2. All terminals are isolated from case.
3. This area is for the lead feed-through eyelets (configuration is optional, but will not extend beyond this zone).
4. In accordance with ASME Y14.5, diameters are equivalent to φx symbology.

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Outline Drawing (SMD 0.5 TO-276AA)

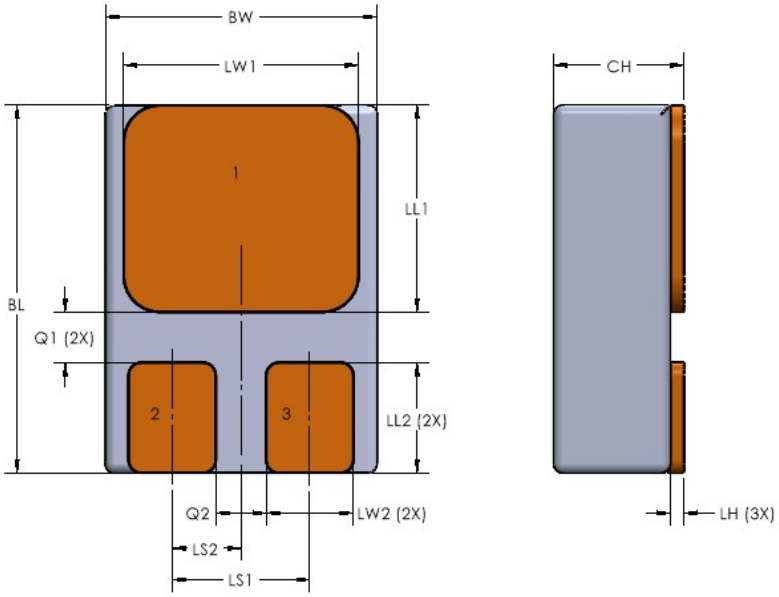

FIGURE 4: Dimensions and configuration of surface mount (TO-276AA, SMD-0.5) package.

Symbol	Inches		mm	
	Min	Max	Min	Max
BL	.395	.405	10.04	10.28
BW	.291	.301	7.40	7.64
CH		.124		3.15
LW1	.010	.020	0.25	0.51
LW2	.090	.100	2.29	2.54
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.93	3.17
LS1	.150 BSC		3.81BSC	
LS2	.075 BSC		1.91 BSC	
Q1	.030		.762	
Q2	.030		.762	
1	Drain			
2	Gate			
3	Source			

NOTES:
1. Dimension are in inches. Millimeters are given for information only.
2. The lid shall be electrically isolated from the drain, gate, and source.
3. In accordance with ASME Y14.5, diameters are equivalent to φx symbology.

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