

NTD5867NL

MOSFET – Power, N-Channel 60 V, 20 A, 39 mΩ

Features

- Low $R_{DS(on)}$
- High Current Capability
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V _{DSS}	60	V
Gate-to-Source Voltage – Continuous			V _{GS}	±20	V
Gate-to-Source Voltage – Non-Repetitive (t _p < 10 μs)			V _{GS}	±30	V
Continuous Drain Current (R _{θJC})	Steady State	T _C = 25°C	I _D	20	A
		T _C = 100°C		13	
Power Dissipation (R _{θJC})		T _C = 25°C	P _D	36	W
Pulsed Drain Current	t _p = 10 μs		I _{DM}	76	A
Operating Junction and Storage Temperature			T _J , T _{stg}	-55 to 150	°C
Source Current (Body Diode)			I _S	20	A
Single Pulse Drain-to-Source Avalanche Energy (V _{DD} = 50 V, V _{GS} = 10 V, R _G = 25 Ω, I _{L(pk)} = 19 A, L = 0.1 mH, T _J = 25°C)			E _{AS}	18	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T _L	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	3.5	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	45	

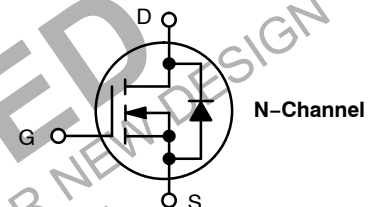
1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces).



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$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
60 V	39 mΩ @ 10 V	20 A
	50 mΩ @ 4.5 V	18 A

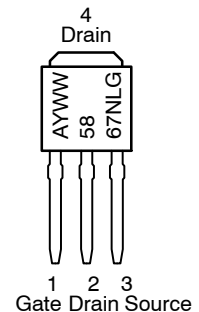
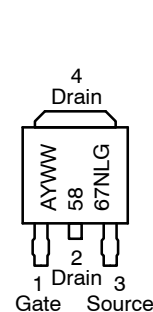


DPAK
CASE 369AA
(Surface Mount)
STYLE 2



IPAK
CASE 369D
(Straight Lead)
STYLE 2

MARKING DIAGRAMS & PIN ASSIGNMENT



A = Assembly Location*
Y = Year
WW = Work Week
5867NL = Device Code
G = Pb-Free Package

* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

NTD5867NL

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			60		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 60\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 2)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.5	1.8	2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.2		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		26	39	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		33	50	
Forward Transconductance	g_{FS}	$V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		8.0		S

CHARGES, CAPACITANCES AND GATE RESISTANCES

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$		675		pF
Output Capacitance	C_{oss}			68		
Reverse Transfer Capacitance	C_{rss}			47		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 48\text{ V}, I_D = 20\text{ A}$		15		nC
Threshold Gate Charge	$Q_{G(TH)}$			1.0		
Gate-to-Source Charge	Q_{GS}			2.2		
Gate-to-Drain Charge	Q_{GD}			4.3		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 48\text{ V}, I_D = 20\text{ A}$		7.6		nC
Gate Resistance	R_G			1.3		Ω

SWITCHING CHARACTERISTICS (Note 3)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DD} = 48\text{ V}, I_D = 20\text{ A}, R_G = 2.5\text{ }\Omega$		6.5		ns
Rise Time	t_r			12.6		
Turn-Off Delay Time	$t_{d(off)}$			18.2		
Fall Time	t_f			2.4		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 10\text{ A}$	$T_J = 25^\circ\text{C}$		0.87	1.2	V
			$T_J = 100^\circ\text{C}$		0.78		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = 20\text{ A}$		17			ns
Charge Time	t_a			13			
Discharge Time	t_b			4.0			
Reverse Recovery Charge	Q_{RR}			12			nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2\%$.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

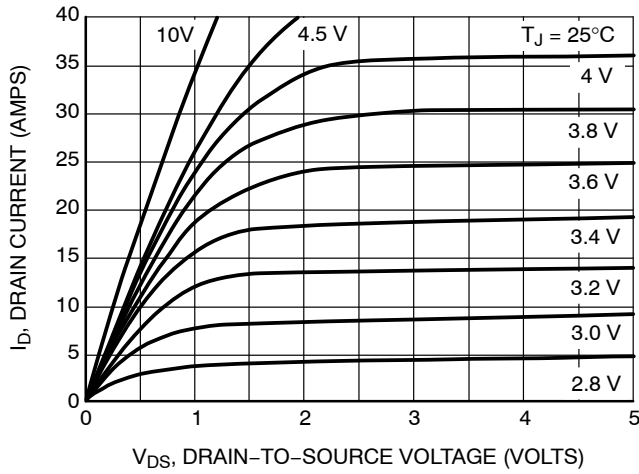


Figure 1. On-Region Characteristics

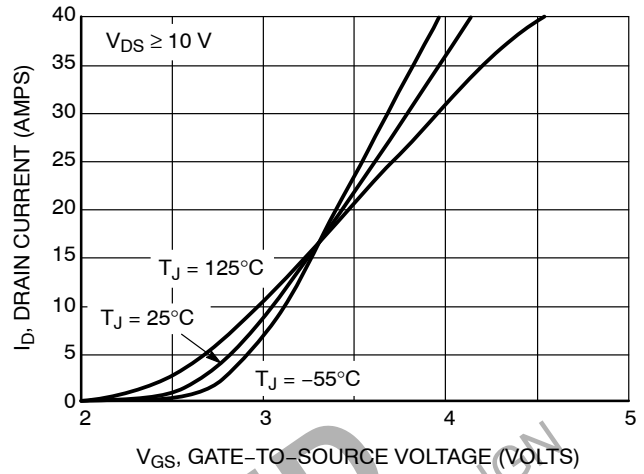


Figure 2. Transfer Characteristics

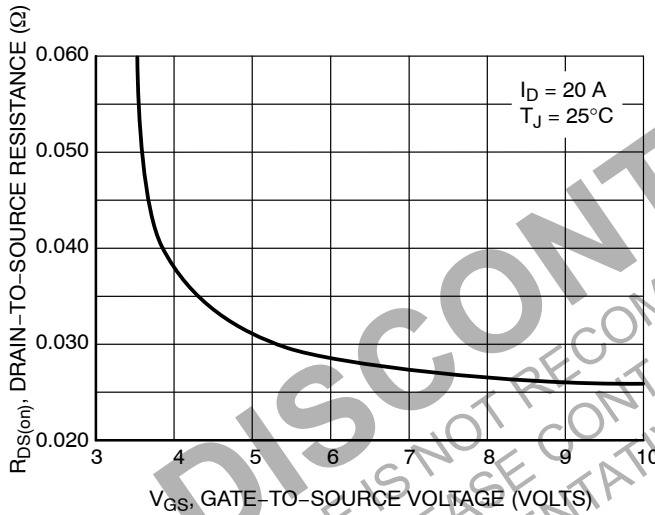


Figure 3. On-Resistance vs. Gate-to-Source Voltage

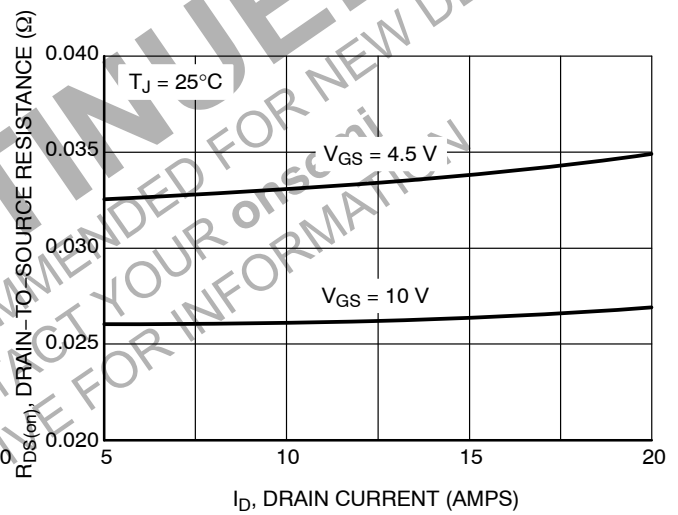


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

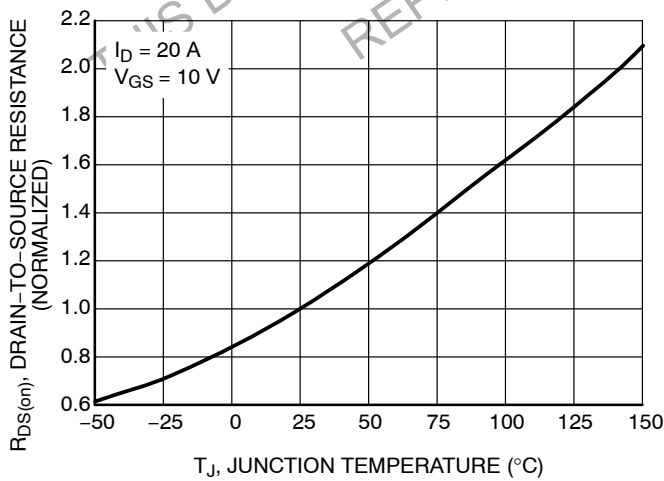


Figure 5. On-Resistance Variation with Temperature

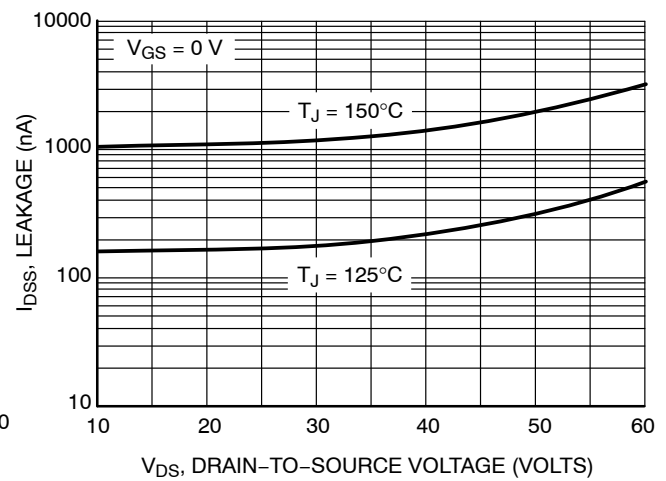


Figure 6. Drain-to-Source Leakage Current vs. Drain Voltage

TYPICAL PERFORMANCE CURVES

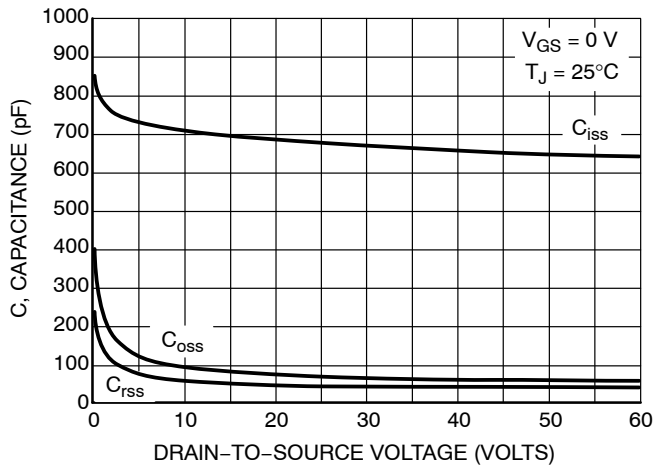


Figure 7. Capacitance Variation

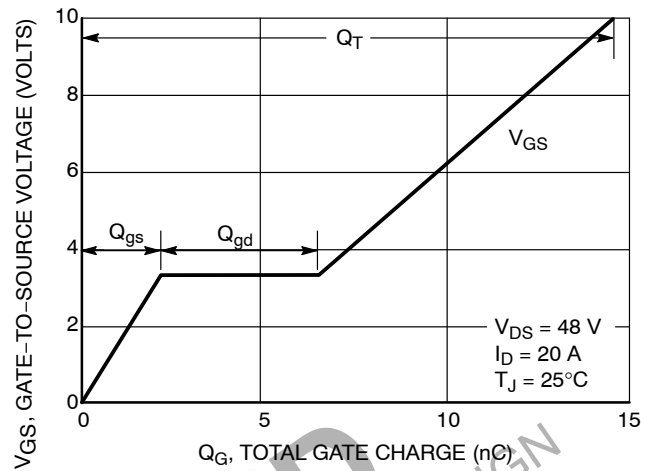


Figure 8. Gate-To-Source Voltage vs. Total Charge

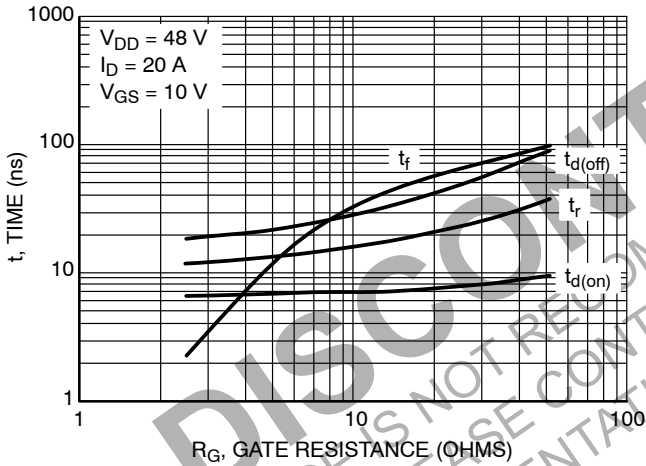


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

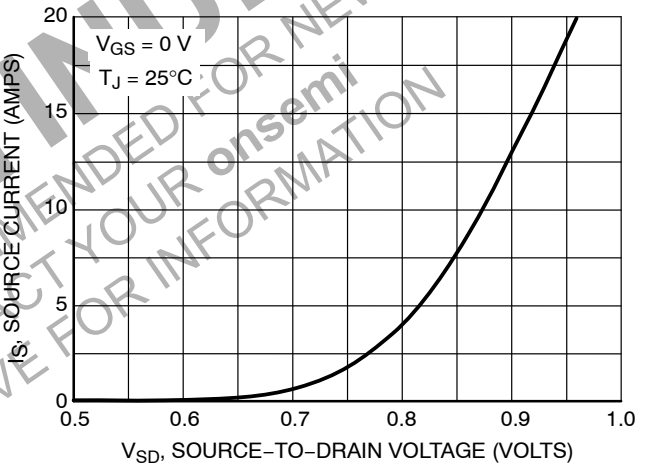


Figure 10. Diode Forward Voltage vs. Current

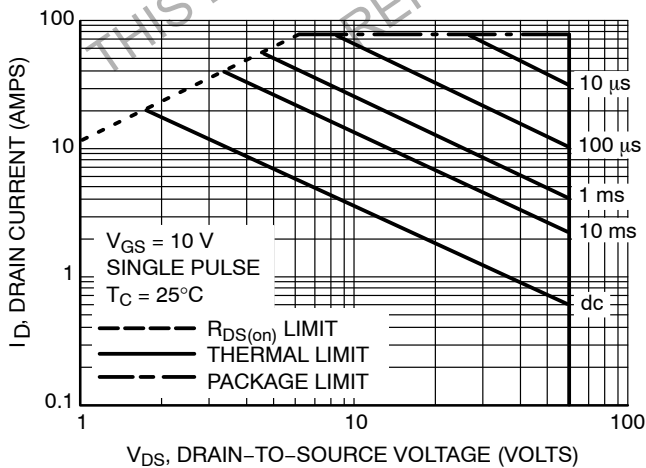


Figure 11. Maximum Rated Forward Biased Safe Operating Area

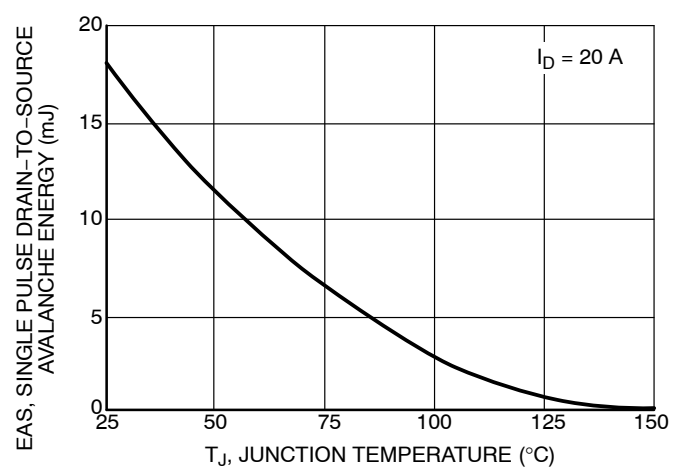
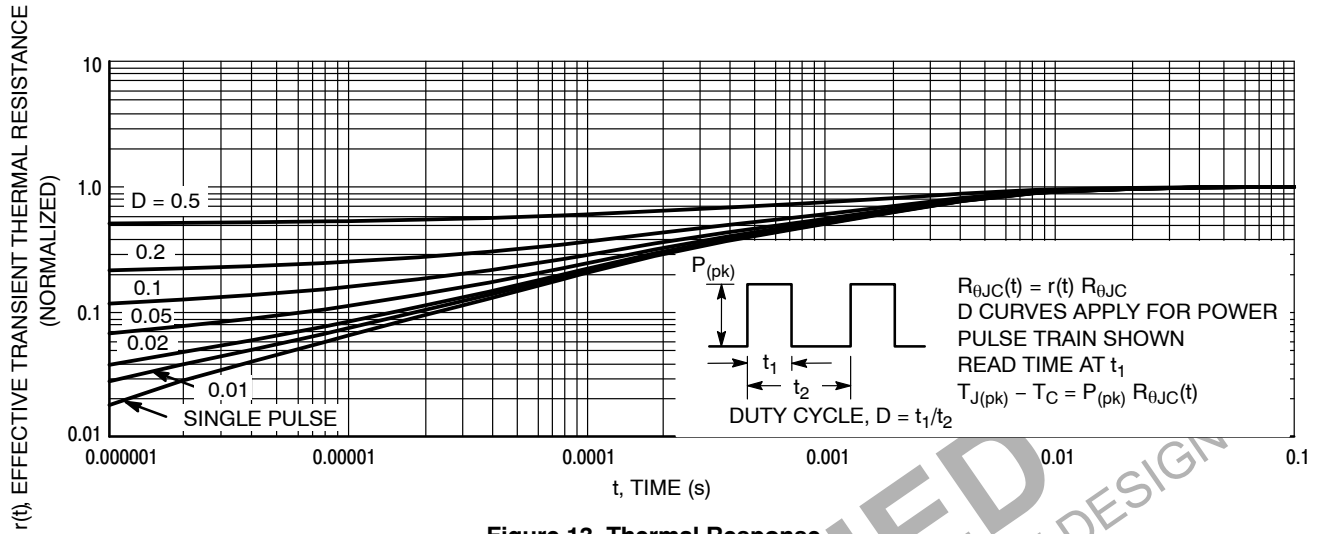


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

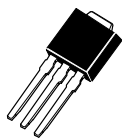
TYPICAL PERFORMANCE CURVES



ORDERING INFORMATION

Order Number	Package	Shipping [†]
NTD5867NL-1G	IPAK (Straight Lead) (Pb-Free)	75 Units / Rail
NTD5867NLT4G	DPAK (Pb-Free)	2500 / Tape & Reel

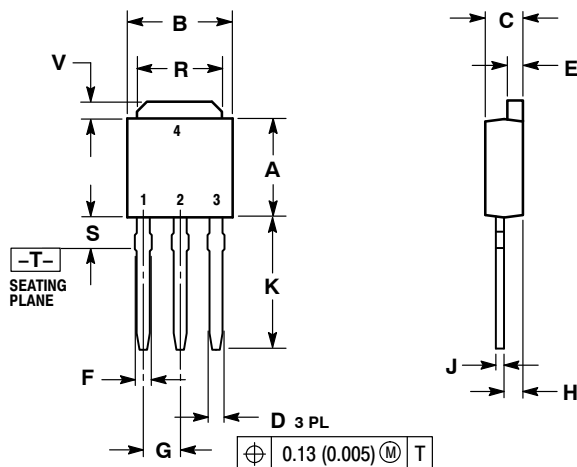
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



DPAK INSERTION MOUNT
CASE 369
ISSUE O

DATE 02 JAN 2000

SCALE 1:1



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.250	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.033	0.040	0.84	1.01
F	0.037	0.047	0.94	1.19
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.175	0.215	4.45	5.46
S	0.050	0.090	1.27	2.28
V	0.030	0.050	0.77	1.27

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

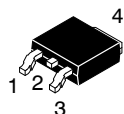
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

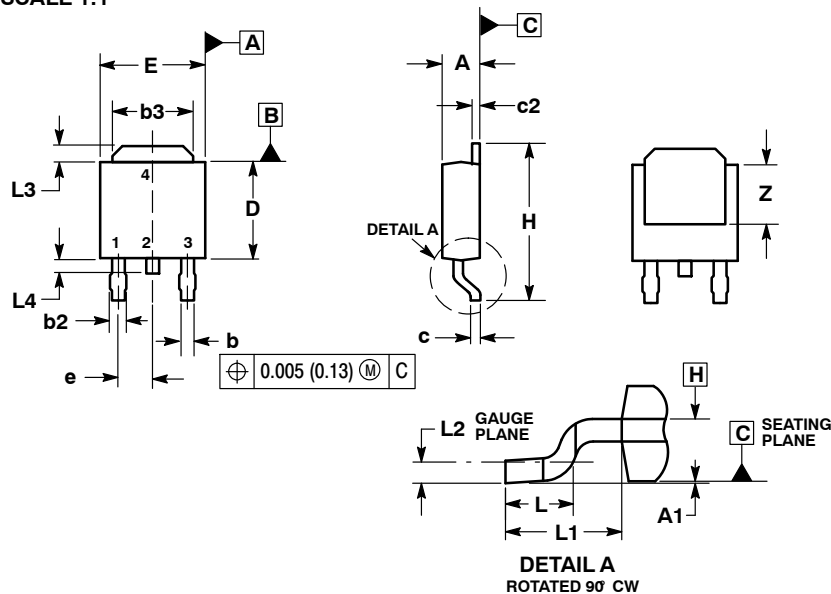
STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

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SCALE 1:1



STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

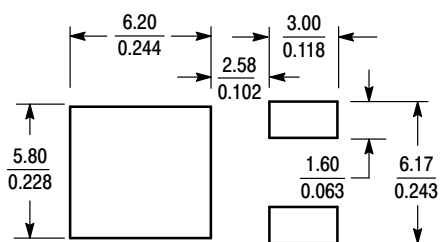
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

SOLDERING FOOTPRINT*



SCALE 3:1 (mm/inches)

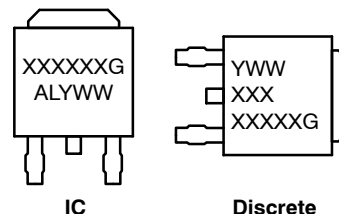
*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.030	0.045	0.76	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.108 REF		2.74 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4		0.040		1.01
Z	0.155		3.93	

GENERIC
MARKING DIAGRAM*



XXXXXX = Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

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