

NTD40N03R

Power MOSFET

45 A, 25 V, N-Channel DPAK

Features

- Planar HD3e Process for Fast Switching Performance
- Low $R_{DS(on)}$ to Minimize Conduction Loss
- Low C_{iss} to Minimize Driver Loss
- Low Gate Charge
- Optimized for High Side Switching Requirements in High-Efficiency DC-DC Converters
- These are Pb-Free Devices

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	25	Vdc
Gate-to-Source Voltage – Continuous	V_{GS}	± 20	Vdc
Thermal Resistance – Junction-to-Case	$R_{\theta JC}$	3.0	$^\circ\text{C/W}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_D	50	W
Drain Current	I_D	45	A
– Continuous @ $T_C = 25^\circ\text{C}$, Chip	I_D	32	A
– Continuous @ $T_A = 25^\circ\text{C}$, Limited by Wires	I_D	100	A
– Single Pulse ($t_p \leq 10 \mu\text{s}$)	I_D		
Thermal Resistance – Junction-to-Ambient (Note 1)	$R_{\theta JA}$	71.4	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	2.1	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	9.2	A
Thermal Resistance – Junction-to-Ambient (Note 2)	$R_{\theta JA}$	100	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	1.5	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	I_D	7.8	A
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 175	$^\circ\text{C}$
Maximum Lead Temperature for Soldering Purposes, 1/8 in from case for 10 seconds	T_L	260	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. When surface mounted to an FR4 board using 0.5 sq. in pad size.
2. When surface mounted to an FR4 board using minimum recommended pad size.



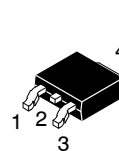
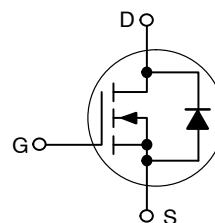
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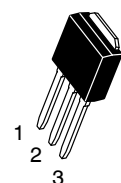
45 AMPERES, 25 VOLTS

$R_{DS(on)} = 12.6 \text{ m}\Omega$ (Typ)

N-CHANNEL

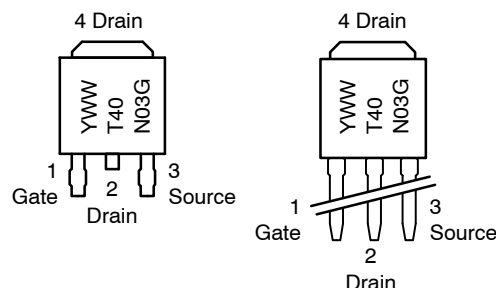


CASE 369AA
DPAK
(Surface Mount)
STYLE 2



CASE 369D
DPAK
(Straight Lead)
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENTS



Y = Year
WW = Work Week
T40N03 = Device Code
G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

NTD40N03R

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

Characteristics	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 3) ($V_{GS} = 0\text{ Vdc}$, $I_D = 250\text{ }\mu\text{Adc}$) Temperature Coefficient (Positive)	$V_{(br)DSS}$	25 –	28 –	– –	Vdc mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current ($V_{DS} = 20\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) ($V_{DS} = 20\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$, $T_J = 150^\circ\text{C}$)	I_{DSS}	– –	– –	1.0 10	μAdc
Gate-Body Leakage Current ($V_{GS} = \pm 20\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	–	–	± 100	nAdc

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage (Note 3) ($V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{Adc}$) Threshold Temperature Coefficient (Negative)	$V_{GS(th)}$	1.0 –	1.7 –	2.0 –	Vdc mV/ $^\circ\text{C}$
Static Drain-to-Source On-Resistance (Note 3) ($V_{GS} = 4.5\text{ Vdc}$, $I_D = 10\text{ Adc}$) ($V_{GS} = 10\text{ Vdc}$, $I_D = 10\text{ Adc}$)	$R_{DS(on)}$	– –	18.6 12.6	23 16.5	m Ω
Forward Transconductance (Note 3) ($V_{DS} = 10\text{ Vdc}$, $I_D = 10\text{ Adc}$)	g_{FS}	–	20	–	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{DS} = 20\text{ Vdc}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$)	C_{iss}	–	584	–	pF
Output Capacitance		C_{oss}	–	254	–	
Transfer Capacitance		C_{rss}	–	99	–	

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$(V_{GS} = 10\text{ Vdc}$, $V_{DD} = 10\text{ Vdc}$, $I_D = 10\text{ Adc}$, $R_G = 3\text{ }\Omega$)	$t_{d(on)}$	–	4.5	–	ns
Rise Time		t_r	–	19.5	–	
Turn-Off Delay Time		$t_{d(off)}$	–	16.7	–	
Fall Time		t_f	–	3.5	–	
Gate Charge	$(V_{GS} = 4.5\text{ Vdc}$, $I_D = 10\text{ Adc}$, $V_{DS} = 10\text{ Vdc}$) (Note 3)	Q_T	–	5.78	–	nC
		Q_1	–	2.1	–	
		Q_2	–	2.5	–	

SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	$(I_S = 10\text{ Adc}$, $V_{GS} = 0\text{ Vdc}$) (Note 3) $(I_S = 10\text{ Adc}$, $V_{GS} = 0\text{ Vdc}$, $T_J = 125^\circ\text{C}$)	V_{SD}	– –	0.85 0.71	1.2 –	Vdc
Reverse Recovery Time	$(I_S = 10\text{ Adc}$, $V_{GS} = 0\text{ Vdc}$, $di_S/dt = 100\text{ A}/\mu\text{s}$) (Note 3)	t_{rr}	–	20.4	–	ns
		t_a	–	8.25	–	
		t_b	–	12.1	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.007	–	μC

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

4. Switching characteristics are independent of operating junction temperatures.

NTD40N03R

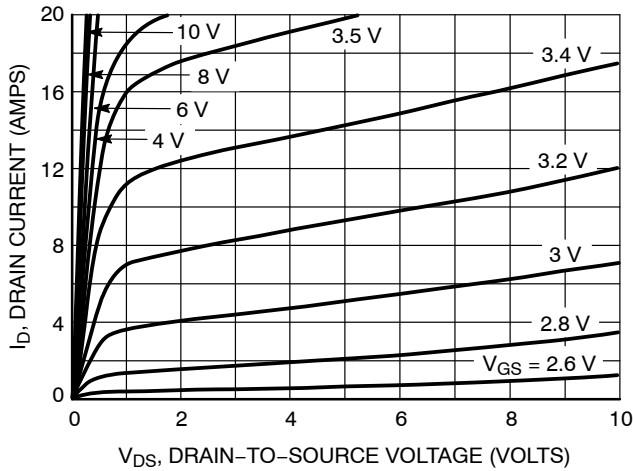


Figure 1. On-Region Characteristics

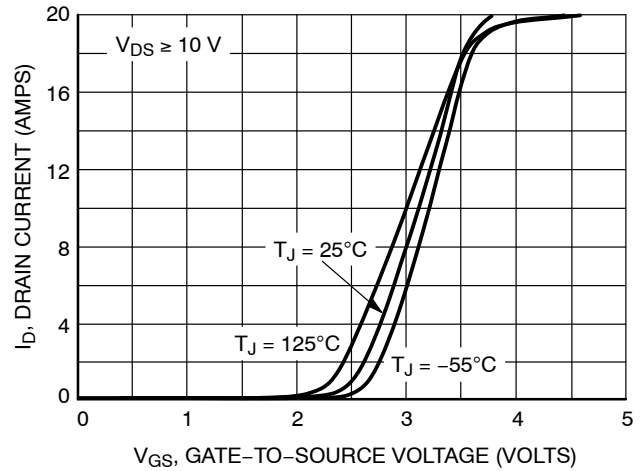


Figure 2. Transfer Characteristics

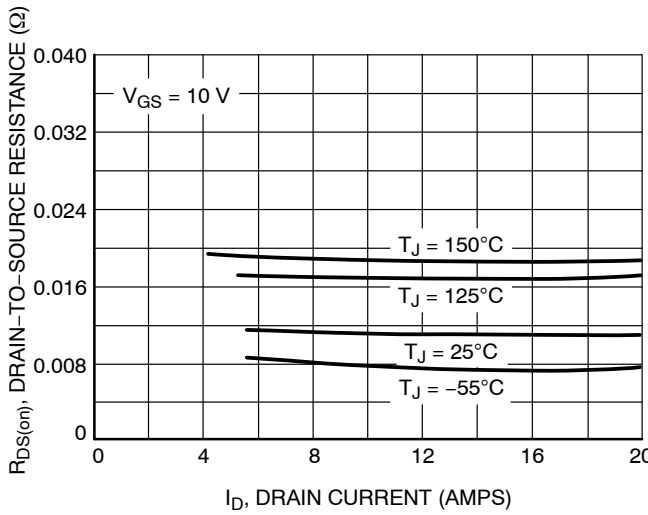


Figure 3. On-Resistance versus Drain Current and Temperature

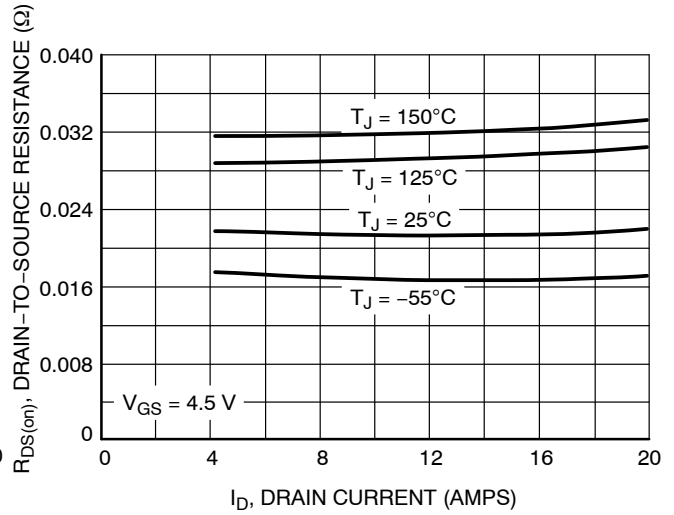


Figure 4. On-Resistance versus Drain Current and Temperature

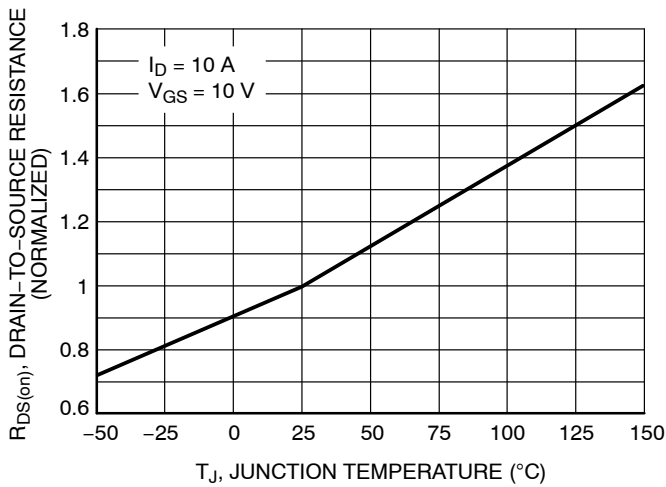


Figure 5. On-Resistance Variation with Temperature

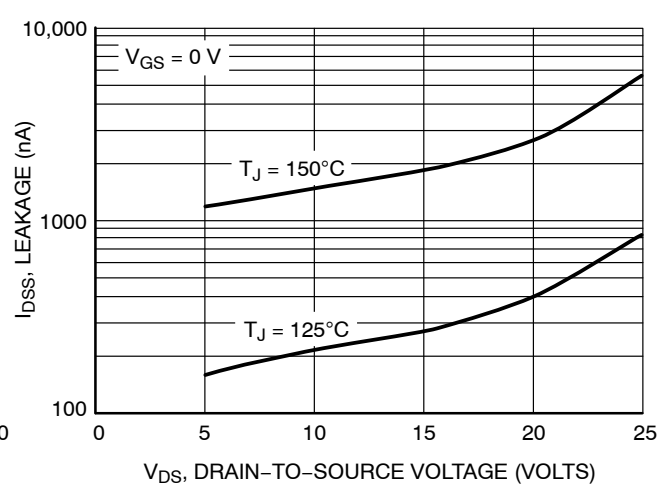


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTD40N03R

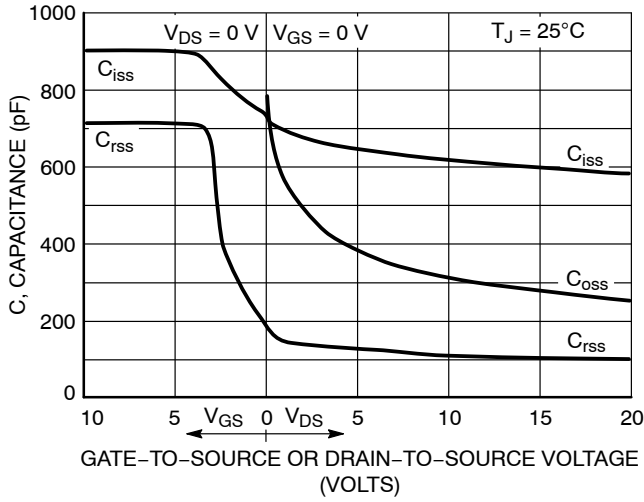


Figure 7. Capacitance Variation

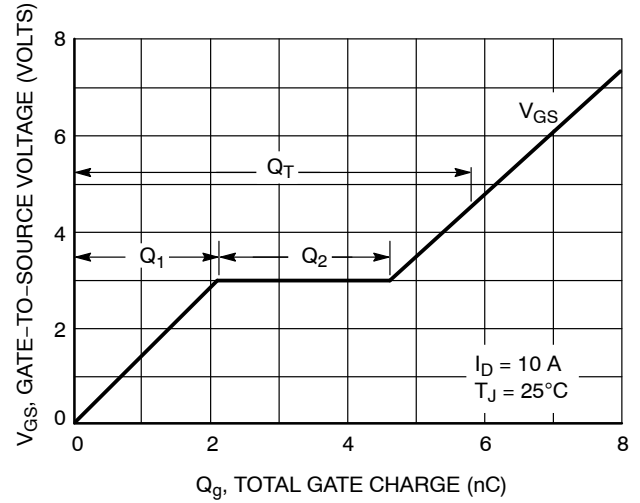


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

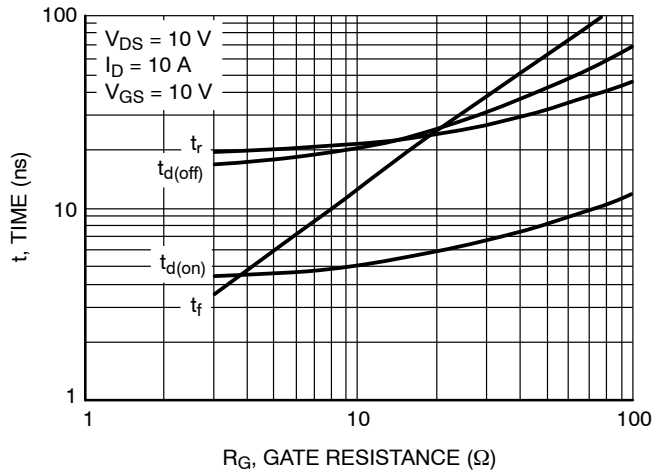


Figure 9. Resistive Switching Time Variation versus Gate Resistance

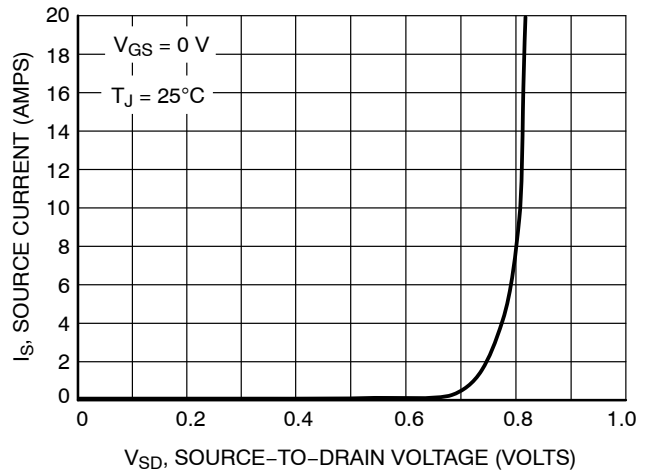


Figure 10. Diode Forward Voltage versus Current

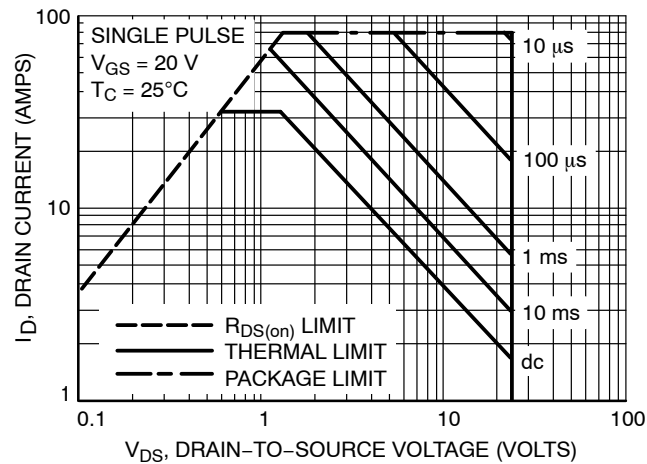


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTD40N03R

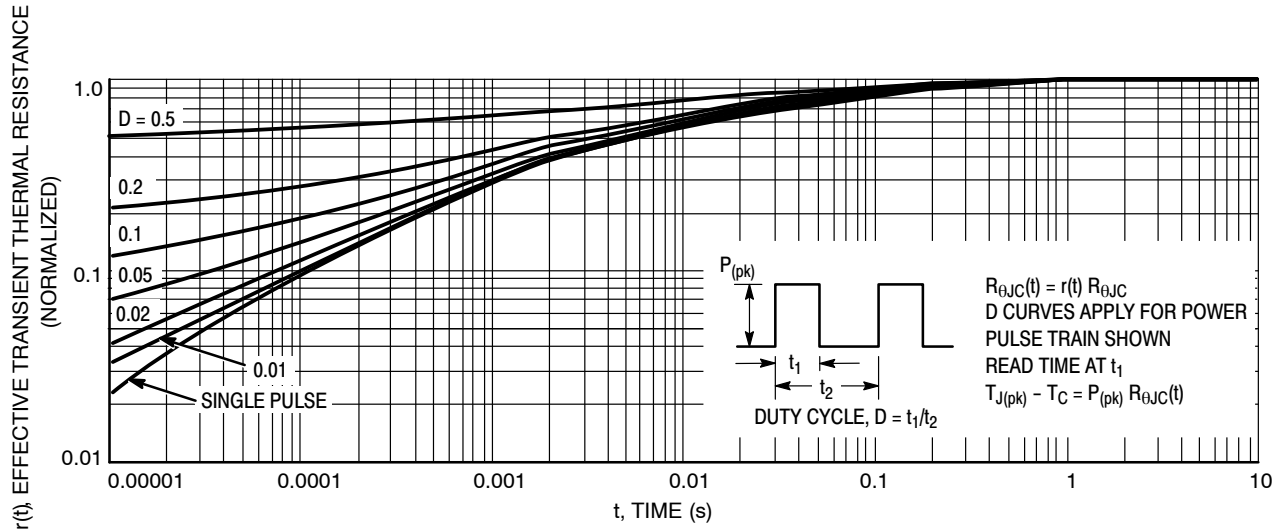


Figure 12. Thermal Response

ORDERING INFORMATION

Device	Package	Shipping [†]
NTD40N03R-1G	DPAK (Straight Lead) (Pb-Free)	75 Units/Rail
NTD40N03RT4G	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

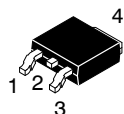
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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

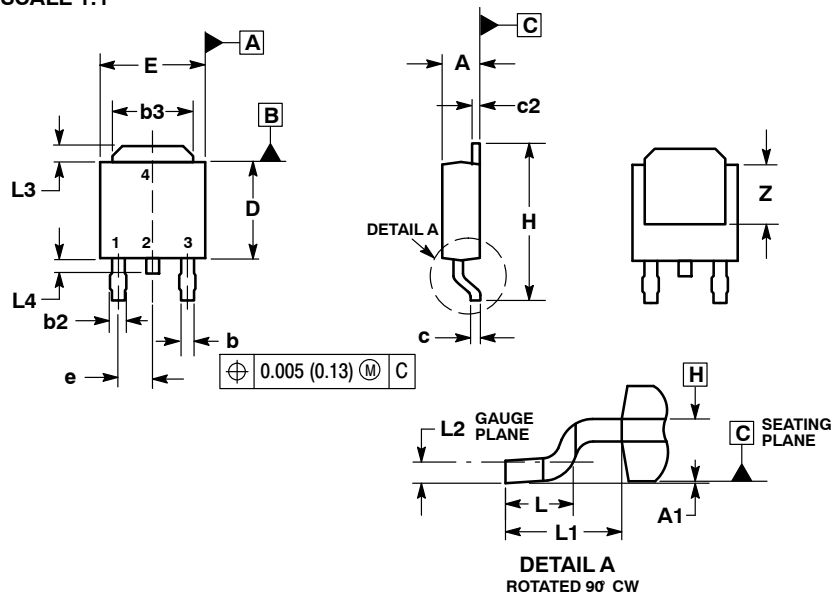
STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

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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

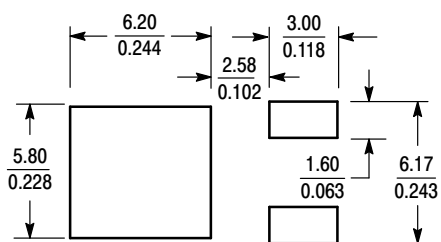
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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)

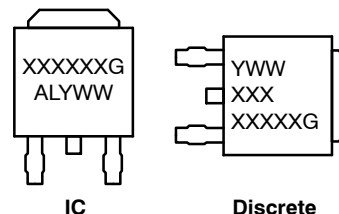
*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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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