NTD65N03R

Power MOSFET
25 V, 65 A, Single N−Channel, DPAK

Features
- Low $R_{DS(on)}$
- Ultra Low Gate Charge
- Low Reverse Recovery Charge
- Pb−Free Packages are Available

Applications
- Desktop CPU Power
- DC−DC Converters
- High and Low Side Switch

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	25	V
Gate−to−Source Voltage			V_{GS}	± 20	V
Continuous Drain Current ($R_{\theta JC}$) Limited by Die	Steady State	T_C = 25°C	I_D	65	A
		T_C = 85°C		45	
Continuous Drain Current ($R_{\theta JC}$) Limited by Wire		T_C = 25°C	I_D	32	A
Power Dissipation ($R_{\theta JC}$)		T_C = 25°C	P_D	50	W
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	11.4	A
		T_A = 85°C		8.9	
Power Dissipation (Note 1)		T_A = 25°C	P_D	1.88	W
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	9.5	A
		T_A = 85°C		7.4	
Power Dissipation (Note 2)		T_A = 25°C	P_D	1.3	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	130	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 175	°C
Drain−to−Source (dv/dt)			dv/dt	2.0	V/ns
Source Current (Body Diode)			I_S	2.1	A
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 24 V, V_{GS} = 10 V, I_L = 12 A, L = 1.0 mH, R_G = 25 Ω)			E_{AS}	71.7	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°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. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface−mounted on FR4 board using the minimum recommended pad size (Cu area = 0.15 in sq) [1 oz] including traces.
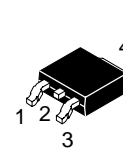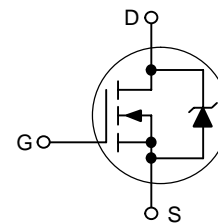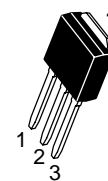
ON Semiconductor®

http://onsemi.com

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
25 V	6.5 mΩ @ 10 V	65 A
	9.7 mΩ @ 4.5 V	

N−Channel

CASE 369AA
DPAK
(Bend Lead)
STYLE 2

CASE 369D
DPAK
(Straight Lead)
STYLE 2
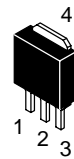
CASE 369AC
3 IPAK
(Straight Lead)

MARKING DIAGRAMS
& PIN ASSIGNMENTS
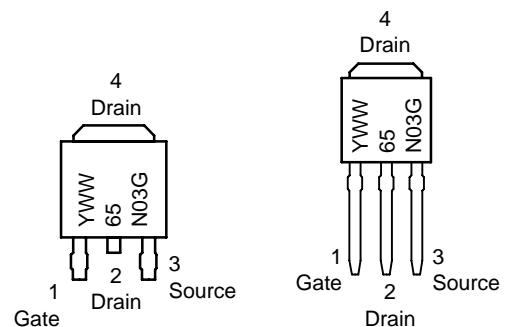
Y = Year
WW = Work Week
65N03 = Device Code
G = Pb−Free Package

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

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	2.5	°C/W
Junction−to−Ambient − Steady State (Note 3)	$R_{\theta JA}$	80	
Junction−to−Ambient − Steady State (Note 4)	$R_{\theta JA}$	115	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		25	29.5		V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				19.2		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 20 V	T_J = 25°C			1.5	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V				± 100	nA
ON CHARACTERISTICS (Note 5)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0	1.74	2.0	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				4.8		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 30 A			6.5	8.4	mΩ
		V_{GS} = 4.5 V, I_D = 30 A			9.7	14.6	
Forward Transconductance	g_{FS}	V_{DS} = 15 V, I_D = 15 A			27		mHos
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{iss}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 20 V			1177	1400	pF
Output Capacitance	C_{oss}				555		
Reverse Transfer Capacitance	C_{rss}				218		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 5.0 V, V_{DS} = 10 V, I_D = 30 A			12.2	16	nC
Threshold Gate Charge	$Q_{G(TH)}$				1.5		
Gate−to−Source Charge	Q_{GS}				2.95		
Gate−to−Drain Charge	Q_{GD}				6.08		
SWITCHING CHARACTERISTICS (Note 6)							
Turn−On Delay Time	$t_{d(on)}$	V_{GS} = 10 V, V_{DS} = 25 V, I_D = 30 A, R_G = 3.0 Ω			6.3		ns
Rise Time	t_r				18.6		
Turn−Off Delay Time	$t_{d(off)}$				20.3		
Fall Time	t_f				8.8		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 20 A	T_J = 25°C		0.85	1.1	V
			T_J = 125°C		0.72		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = 20 A			28.8		ns
Charge Time	t_a				12.8		
Discharge Time	t_b				16		
Reverse Recovery Time	Q_{RR}				20		nC
PACKAGE PARASITIC VALUES							
Source Inductance	L_S	T_A= 25°C			2.49		nH
Drain Inductance	L_D				0.02		
Gate Inductance	L_G				3.46		
Gate Resistance	R_G				1.75		Ω

3. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
4. Surface−mounted on FR4 board using the minimum recommended pad size (Cu area = 0.15 in sq [1 oz] including traces).
5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
6. Switching characteristics are independent of operating junction temperatures.
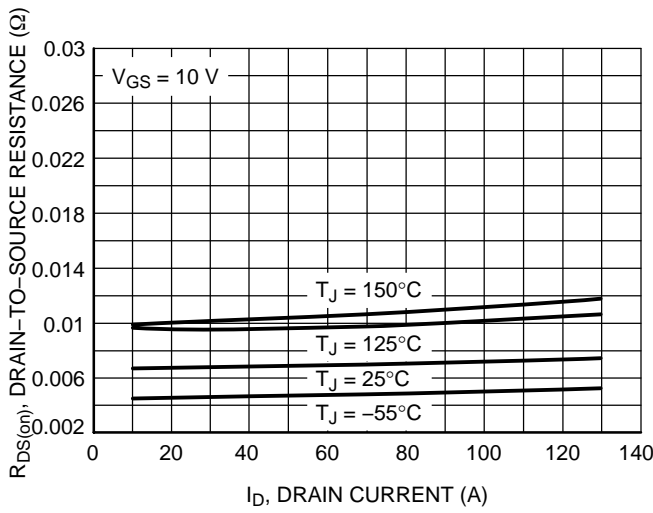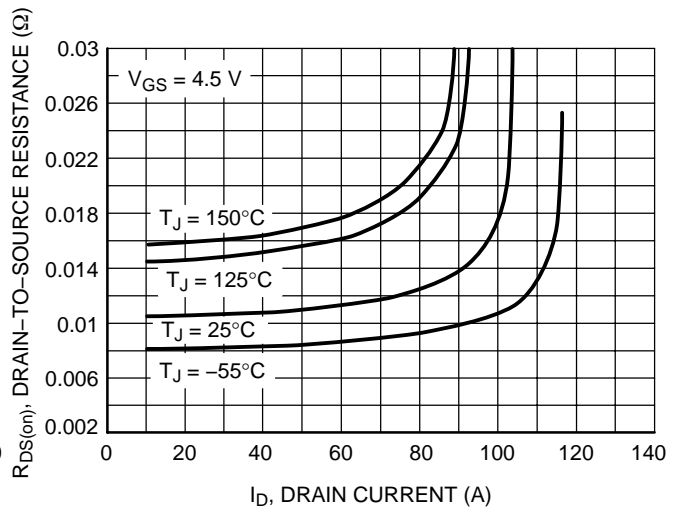
NTD65N03R
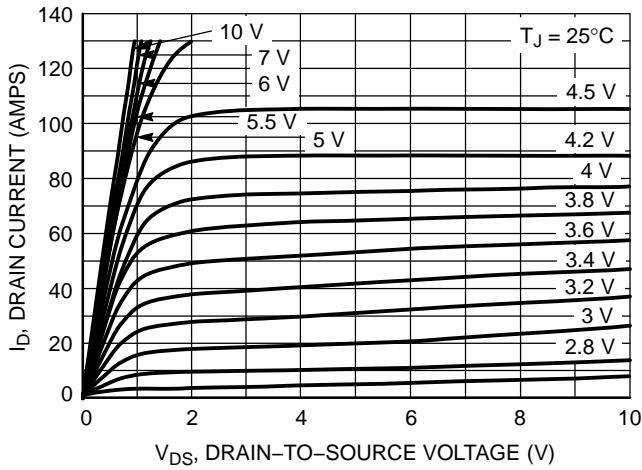
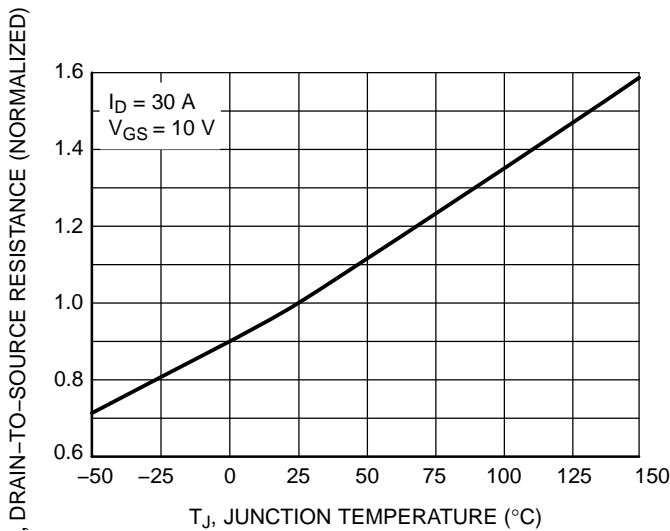**Figure 1. On−Region Characteristics**
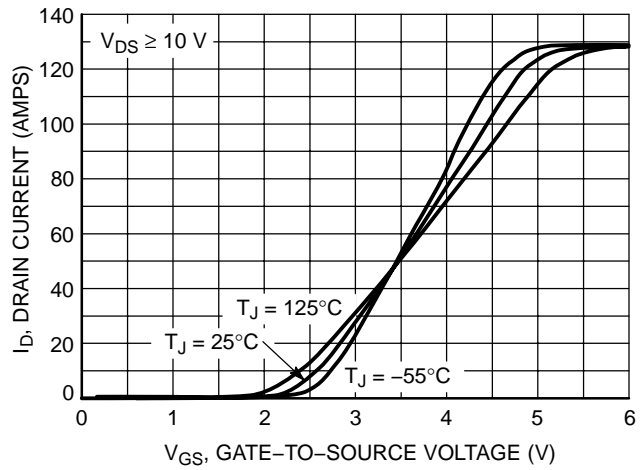
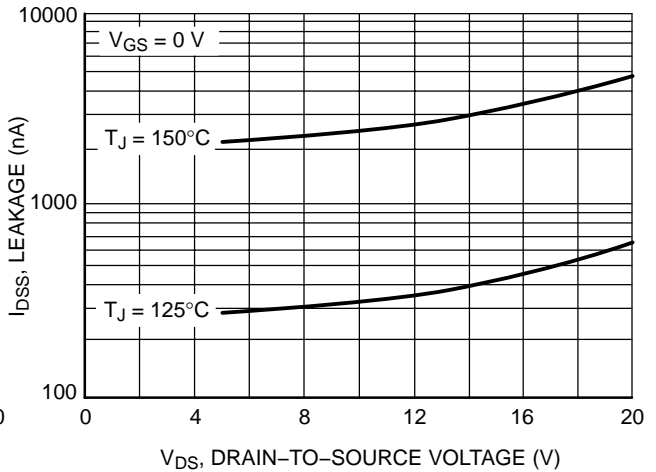**Figure 2. Transfer Characteristics**

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
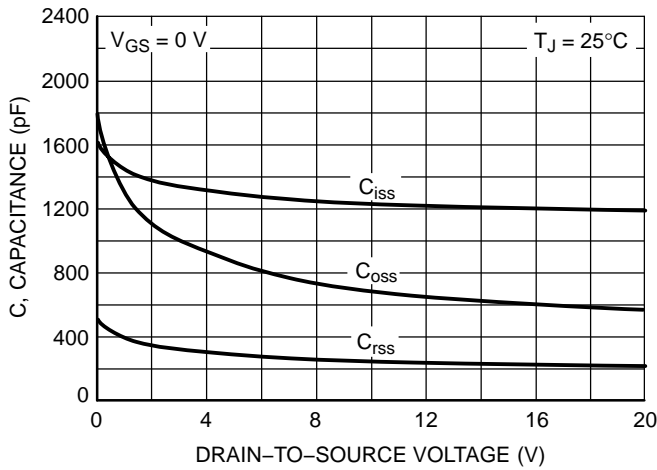
NTD65N03R
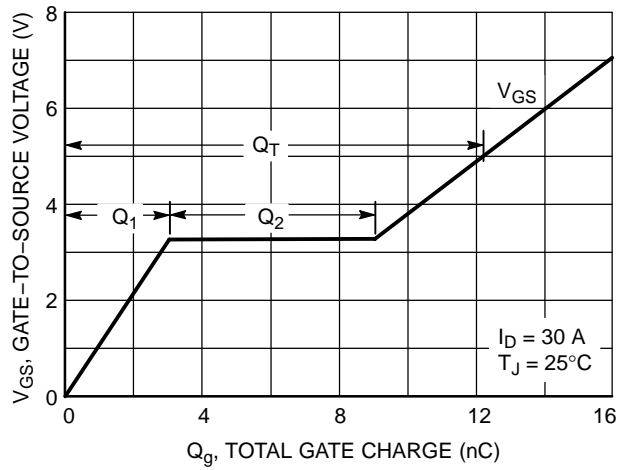

Figure 7. Capacitance Variation

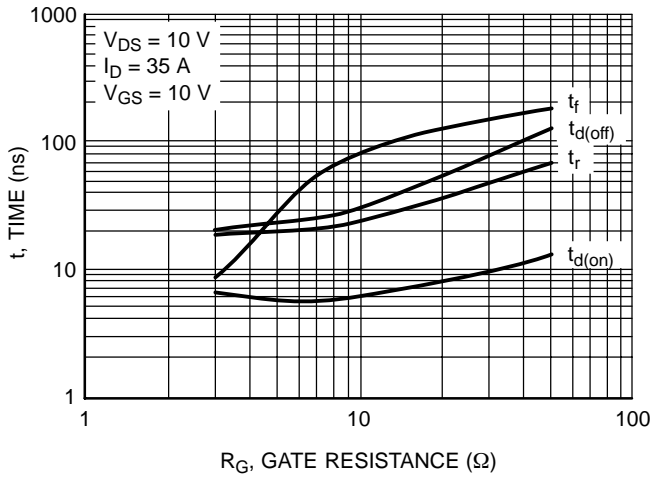**Figure 8. Gate–to–Source and
Drain–to–Source Voltage versus Total Charge**

**Figure 9. Resistive Switching Time Variation
versus Gate Resistance**
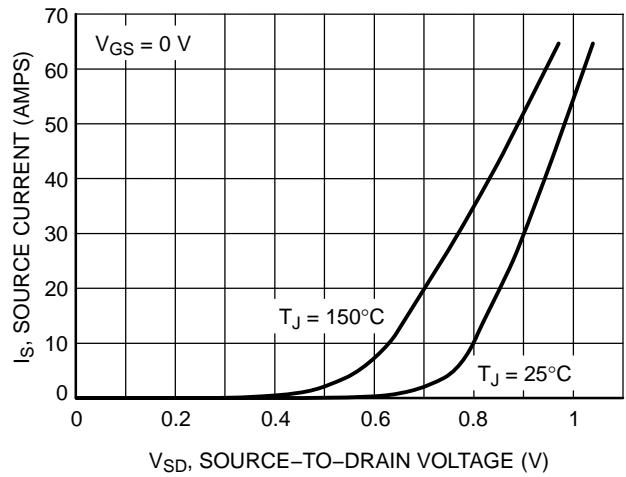
**Figure 10. Diode Forward Voltage versus
Current**
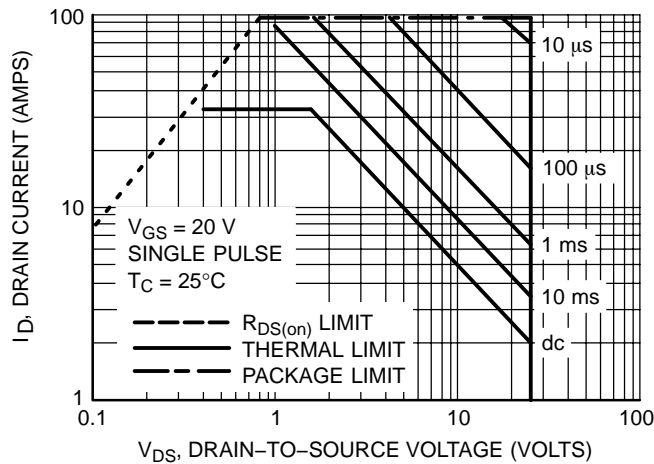
**Figure 11. Maximum Rated Forward Biased
Safe Operating Area**

NTD65N03R

ORDERING INFORMATION

Order Number	Package	Shipping†
NTD65N03R	DPAK−3	75 Units / Rail
NTD65N03RG	DPAK−3 (Pb−Free)	75 Units / Rail
NTD65N03RT4	DPAK−3	2500 / Tape & Reel
NTD65N03RT4G	DPAK−3 (Pb−Free)	2500 / Tape & Reel
NTD65N03R−1	DPAK−3 Straight Lead	75 Units / Rail
NTD65N03R−1G	DPAK−3 Straight Lead (Pb−Free)	75 Units / Rail
NTD65N03R−35	DPAK Straight Lead Trimmed (3.5 ± 0.15 mm)	75 Units / Rail
NTD65N03R−35G	DPAK Straight Lead Trimmed (3.5 ± 0.15 mm) (Pb−Free)	75 Units / Rail

†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.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®
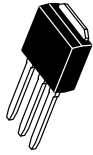
IPAK
CASE 369D–01
ISSUE C

DATE 15 DEC 2010

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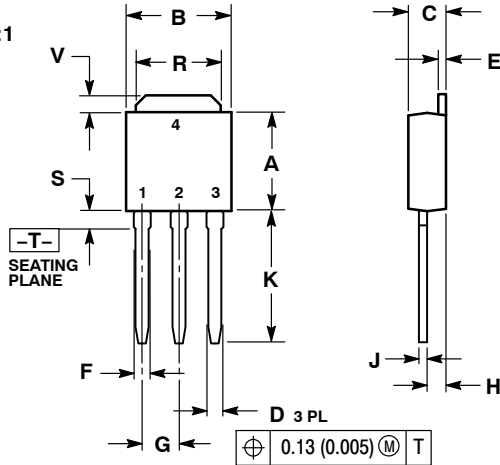
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	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	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
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	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

⊕ | 0.13 (0.005) Ⓜ | T

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

MARKING DIAGRAMS

Discrete

YWW
xxxxxxxx

Integrated Circuits
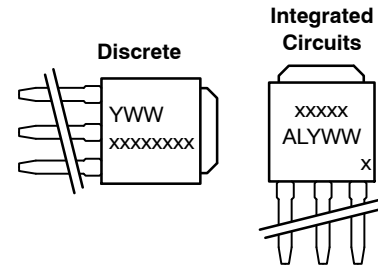
xxxxx
ALYWW
x

xxxxxxxxx = Device Code
A = Assembly Location
IL = Wafer Lot
Y = Year
WW = Work Week

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DESCRIPTION:	IPAK (DPAK INSERTION MOUNT)		PAGE 1 OF 1

DPAK (SINGLE GUAGE)
CASE 369AA–01
ISSUE B

DATE 03 JUN 2010

SCALE 1:1

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. 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.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

DETAIL A

DETAIL A
ROTATED 90° CW

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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	---

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

GENERIC MARKING DIAGRAM*

XXXXXXG
ALYWW

IC

YWW
XXX
XXXXXG
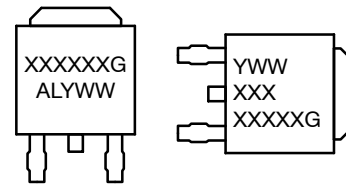
Discrete

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.

SOLDERING FOOTPRINT*

6.20 / 0.244
3.00 / 0.118
2.58 / 0.102
5.80 / 0.228
1.60 / 0.063
6.17 / 0.243
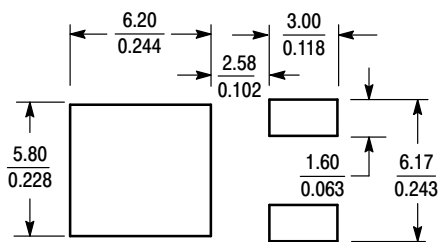
SCALE 3:1   (mm / inches)

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

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DESCRIPTION:	DPAK (SINGLE GAUGE)		PAGE 1 OF 1

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