

NTD5406N, STD5406N

Power MOSFET

40 V, 70 A, Single N-Channel, DPAK

Features

- Low $R_{DS(on)}$
- High Current Capability
- Low Gate Charge
- STD Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

Applications

- Electronic Brake Systems
- Electronic Power Steering
- Bridge Circuits

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

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V _{DSS}	40	V
Gate-to-Source Voltage			V _{GS}	±20	V
Continuous Drain Current – R _{θJC}	Steady State	T _C = 25°C	I _D	70	A
		T _C = 125°C		40	
Power Dissipation – R _{θJC}	Steady State	T _C = 25°C	P _D	100	W
Continuous Drain Current – R _{θJA} (Note 1)	Steady State	T _A = 25°C	I _D	12.2	A
		T _A = 125°C		7.0	
Power Dissipation – R _{θJA} (Note 1)	Steady State	T _A = 25°C	P _D	3.0	W
Pulsed Drain Current	t _p = 10 μs		I _{DM}	150	A
Operating Junction and Storage Temperature			T _J , T _{STG}	–55 to 175	°C
Source Current (Body Diode) Pulsed			I _S	63.5	A
Single Pulse Drain-to-Source Avalanche Energy – (V _{DD} = 50 V, V _{GS} = 10 V, I _{PK} = 30 A, L = 1 mH, R _G = 25 Ω)			EAS	450	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 RATINGS (Note 1)

Parameter	Symbol	Max	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.5	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	49	

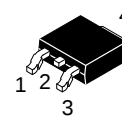
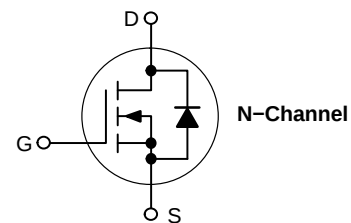
1. Surface mounted on FR4 board using 1 sq in pad size, (Cu Area 1.127 sq in [2 oz] including traces).



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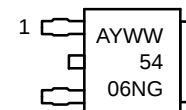
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$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	I_D MAX (Note 1)
40 V	8.7 m Ω @ 10 V	70 A



DPAK
CASE 369C
STYLE 2

MARKING DIAGRAM



A = Assembly Location*
Y = Year
WW = Work Week
5406N = Specific Device Code
G = Pb-Free Device

* 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

Device	Package	Shipping†
NTD5406NT4G	DPAK (Pb-Free)	2500 / Tape & Reel
STD5406NT4G*	DPAK (Pb-Free)	2500 / Tape & Reel
STD5406NT4G-VF01	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.

NTD5406N, STD5406N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			42		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 100^\circ\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 30\text{ V}$			± 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		3.5	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			-7.0		mV/ $^\circ\text{C}$
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		8.7	10	$\text{m}\Omega$
		$V_{GS} = 5.0\text{ V}, I_D = 10\text{ A}$		13.2	17	
Forward Transconductance	g_{FS}	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		19		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 32\text{ V}$		1375	2500	pF
Output Capacitance	C_{OSS}			370	700	
Reverse Transfer Capacitance	C_{RSS}			160	300	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 32\text{ V}, I_D = 30\text{ A}$		45		nC
Threshold Gate Charge	$Q_{G(TH)}$			2.0		
Gate-to-Source Charge	Q_{GS}			5.4		
Gate-to-Drain Charge	Q_{GD}			20		

SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 32\text{ V}, I_D = 30\text{ A}, R_G = 2.5\text{ }\Omega$		7.2		ns
Rise Time	t_r			57		
Turn-Off Delay Time	$t_{d(OFF)}$			30		
Fall Time	t_f			67		

SWITCHING CHARACTERISTICS, $V_{GS} = 5\text{ V}$ (Note 3)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 5.0\text{ V}, V_{DD} = 20\text{ V}, I_D = 30\text{ A}, R_G = 2.5\text{ }\Omega$		15		ns
Rise Time	t_r			147		
Turn-Off Delay Time	$t_{d(OFF)}$			20		
Fall Time	t_f			29		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 10 A	T _J = 25°C		0.82	1.1	V
			T _J = 125°C		0.67		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _{SD} /dt = 100 A/μs, I _S = 10 A			46		ns
Charge Time	t _a				24		
Discharge Time	t _b				22		
Reverse Recovery Charge	Q _{RR}				65		

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

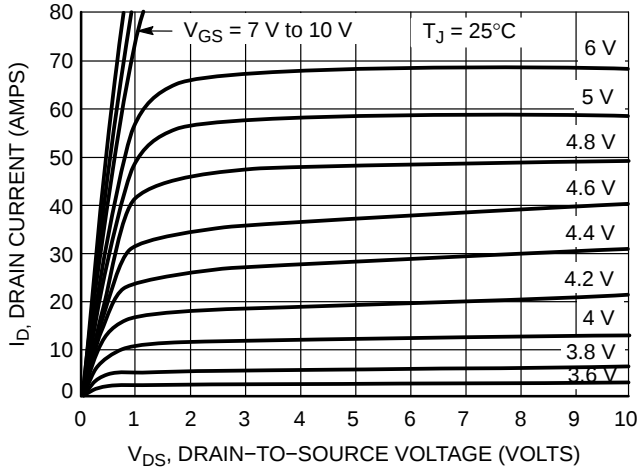


Figure 1. On-Region Characteristics

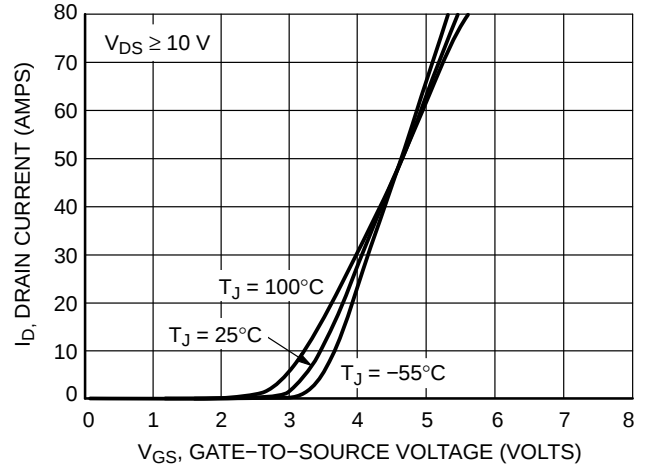


Figure 2. Transfer Characteristics

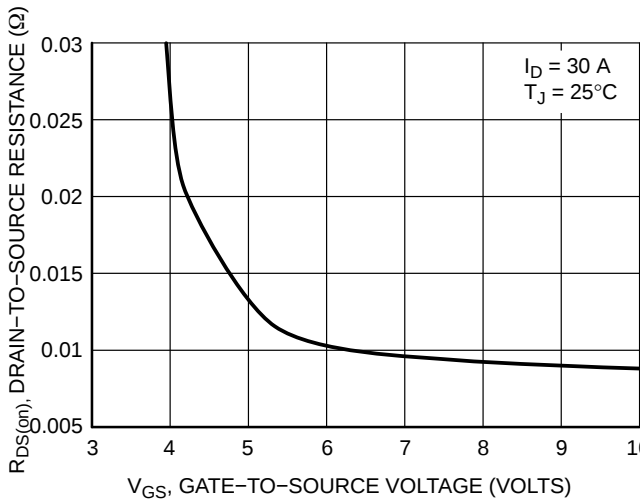


Figure 3. On-Resistance vs. Gate-to-Source Voltage

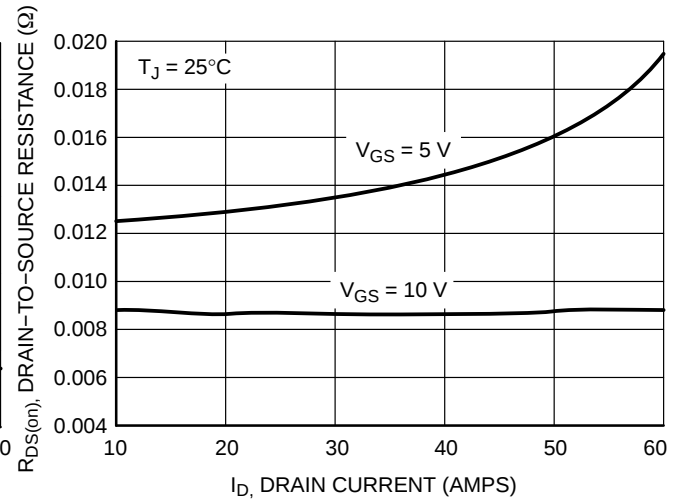


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

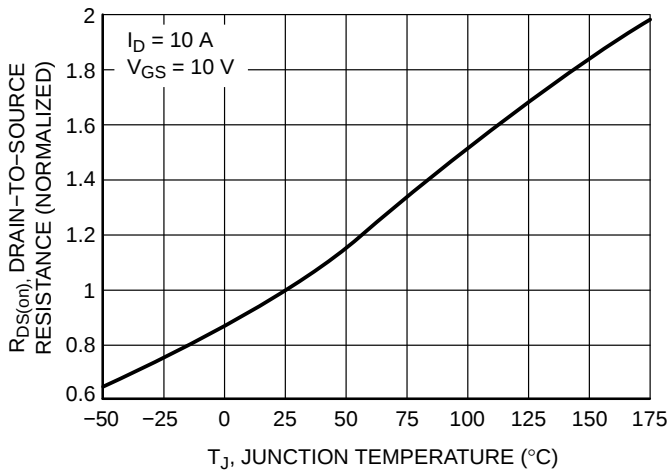


Figure 5. On-Resistance Variation with Temperature

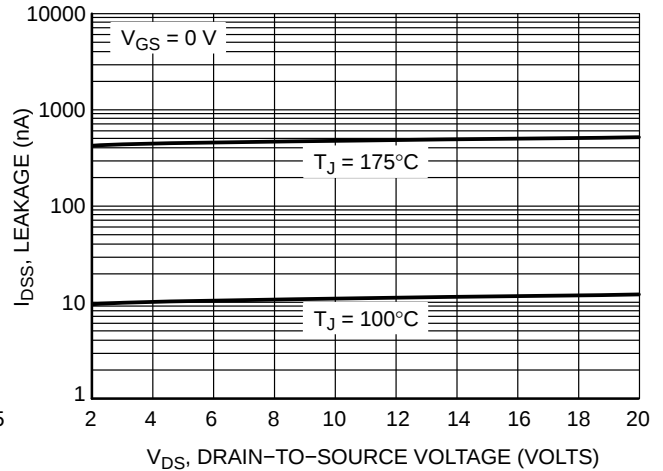


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

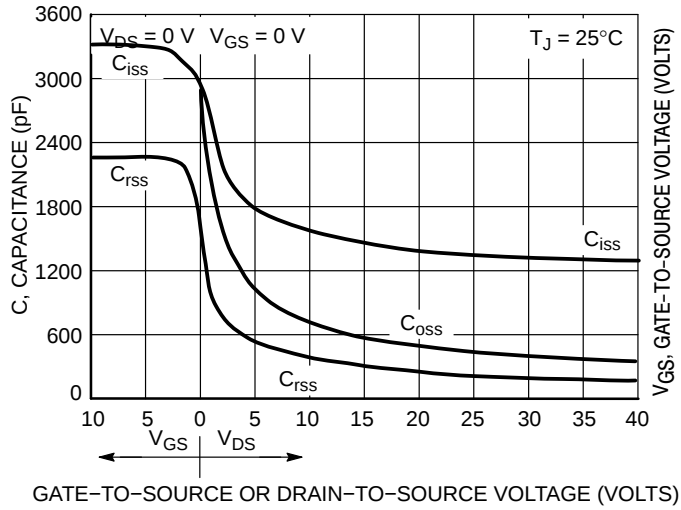


Figure 7. Capacitance Variation

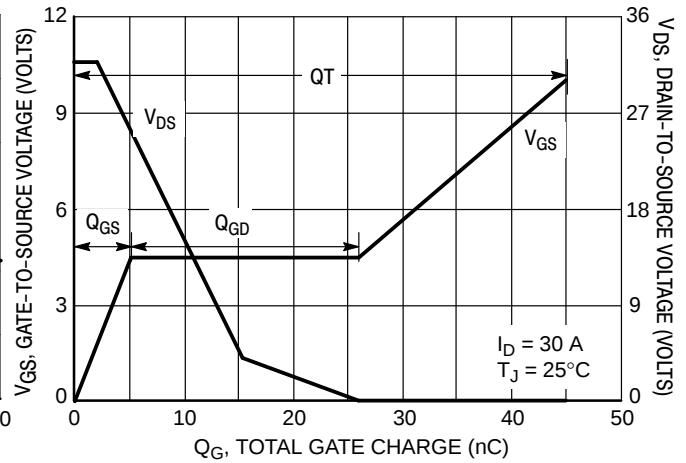


Figure 8. Gate-To-Source and Drain-To-Source Voltage vs. Total Charge

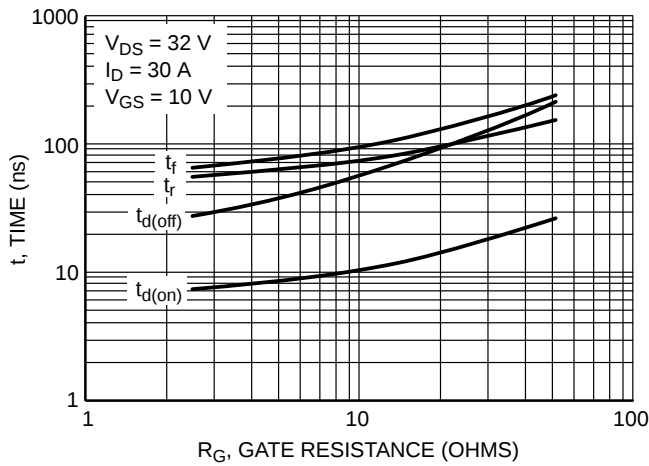


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

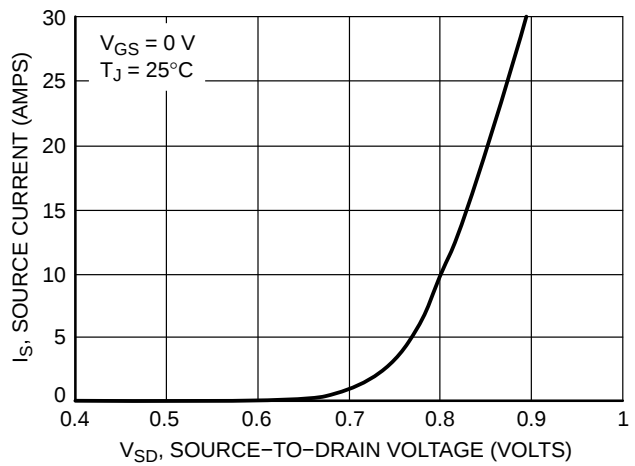


Figure 10. Diode Forward Voltage vs. Current

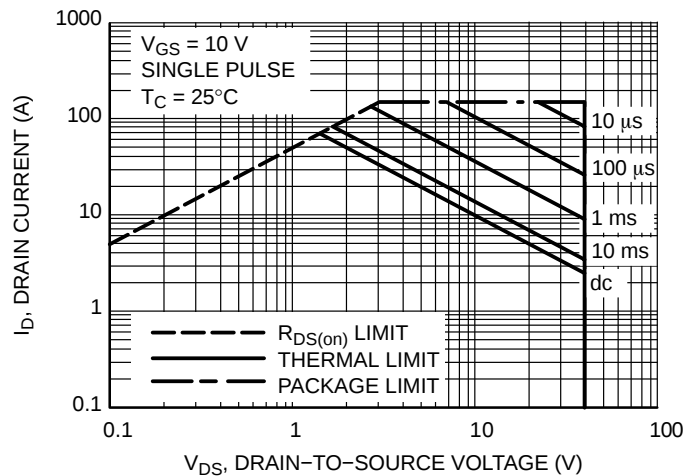


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTD5406N, STD5406N

TYPICAL PERFORMANCE CURVES

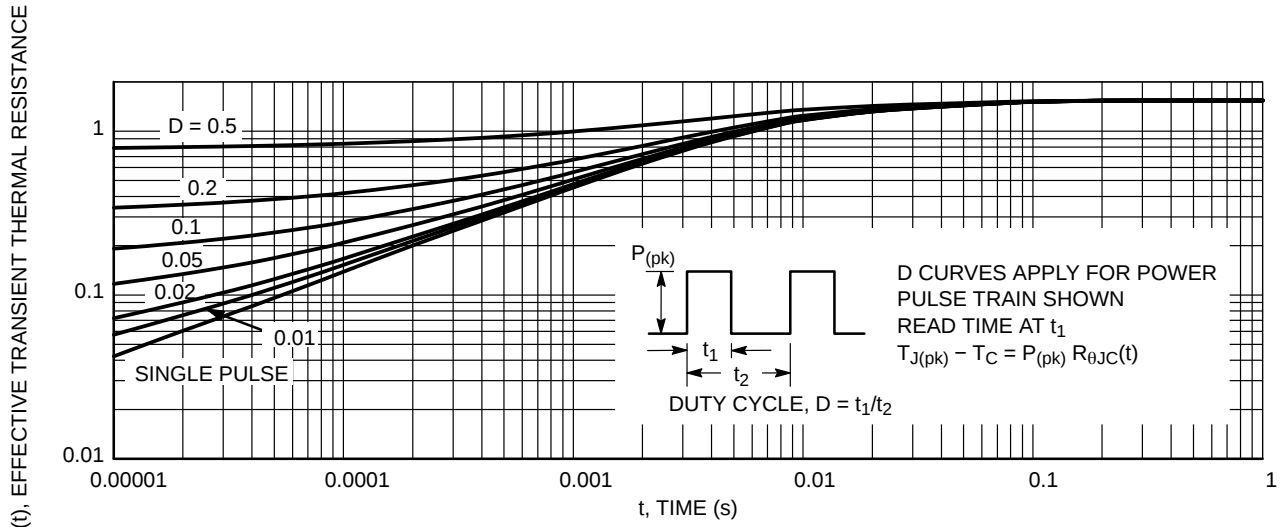
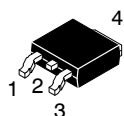


Figure 12. Thermal Response

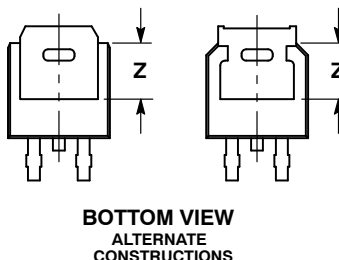
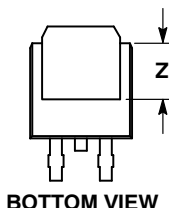
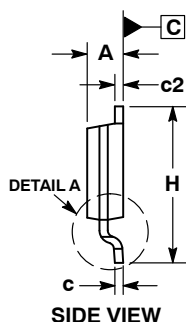
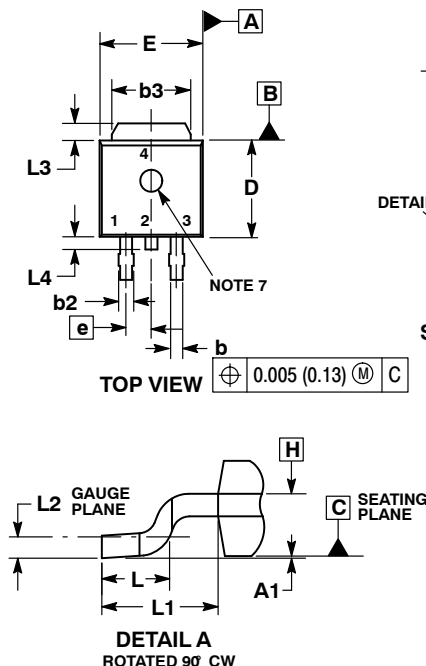
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

DPAK (SINGLE GAUGE) CASE 369C ISSUE F

DATE 21 JUL 2015

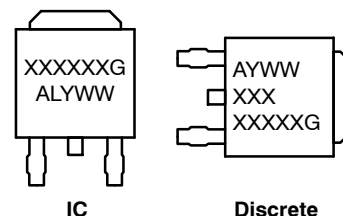


NOTES:

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.
7. OPTIONAL MOLD FEATURE.

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	0.028	0.045	0.72	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	0.114	REF	2.90	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*



IC

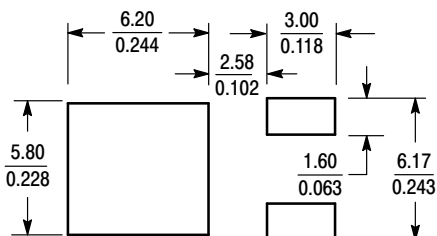
Discrete

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. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

- 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
- STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE
- STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE
- STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

SOLDERING FOOTPRINT*



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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