

MOSFET - Power, P-Channel, SOT-223

-10 A, -20 V

NTF6P02, NVF6P02

Features

- Low $R_{DS(on)}$
- Logic Level Gate Drive
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- NVF 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

Typical Applications

- Power Management in Portables and Battery-Powered Products, i.e.: Cellular and Cordless Telephones and PCMCIA Cards

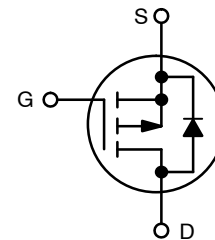
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	-20	Vdc
Gate-to-Source Voltage	V_{GS}	± 8.0	Vdc
Drain Current (Note 1)	I_D	-10	Adc
– Continuous @ $T_A = 25^\circ\text{C}$	I_D	-8.4	
– Continuous @ $T_A = 70^\circ\text{C}$	I_{DM}	-35	Apk
– Single Pulse ($t_p = 10 \mu\text{s}$)			
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	P_D	8.3	W
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to +150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = -20 \text{ Vdc}$, $V_{GS} = -5.0 \text{ Vdc}$, $I_{L(pk)} = -10 \text{ A}$, $L = 3.0 \text{ mH}$, $R_G = 25\Omega$)	E_{AS}	150	mJ
Thermal Resistance	$R_{\theta JL}$ $R_{\theta JA}$ $R_{\theta JA}$	15 71.4 160	$^\circ\text{C/W}$
– Junction to Lead (Note 1)			
– Junction to Ambient (Note 2)			
– Junction to Ambient (Note 3)			
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T_L	260	$^\circ\text{C}$

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.

1. Steady State.
2. When surface mounted to an FR4 board using 1" pad size, (Cu. Area 1.127 sq in), Steady State.
3. When surface mounted to an FR4 board using minimum recommended pad size, (Cu. Area 0.412 sq in), Steady State.

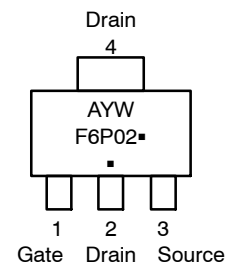
**-10 AMPERES
-20 VOLTS
 $R_{DS(on)} = 44 \text{ m}\Omega$ (Typ.)**



P-Channel MOSFET

MARKING DIAGRAM & PIN ASSIGNMENT

SOT-223
CASE 318E
STYLE 3



A = Assembly Location
Y = Year
W = Work Week
F6P02 = Specific Device Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping [†]
NTF6P02T3G	SOT-223 (Pb-Free)	4000 / Tape & Reel
NVF6P02T3G*	SOT-223 (Pb-Free)	4000 / Tape & Reel

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

NTF6P02, NVF6P02

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

Characteristic	Symbol	Min	Typ	Max	Unit	
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage (Note 4) (V _{GS} = 0 Vdc, I _D = -250 μAdc) Temperature Coefficient (Positive)	V _{(BR)DSS}	-20 -	-25 -11	- -	Vdc mV/°C	
Zero Gate Voltage Drain Current (V _{DS} = -20 Vdc, V _{GS} = 0 Vdc) (V _{DS} = -20 Vdc, V _{GS} = 0 Vdc, T _J = 125 °C)	I _{DSS}	- -	- -	-1.0 -10	μAdc	
Gate-Body Leakage Current (V _{GS} = ±8.0 Vdc, V _{DS} = 0 Vdc)	I _{GSS}	-	-	±100	nAdc	
ON CHARACTERISTICS (Note 4)						
Gate Threshold Voltage (Note 4) (V _{DS} = V _{GS} , I _D = -250 μAdc) Threshold Temperature Coefficient (Negative)	V _{GS(th)}	-0.4 -	-0.7 2.6	-1.0 -	Vdc mV/°C	
Static Drain-to-Source On-Resistance (Note 4) (V _{GS} = -4.5 Vdc, I _D = -6.0 Adc) (V _{GS} = -2.5 Vdc, I _D = -4.0 Adc) (V _{GS} = -2.5 Vdc, I _D = -3.0 Adc)	R _{DS(on)}	- - -	44 57 57	50 70 -	mΩ	
Forward Transconductance (Note 4) (V _{DS} = -10 Vdc, I _D = -6.0 Adc)	g _{fs}	-	12	-	Mhos	
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V _{DS} = -16 Vdc, V _{GS} = 0 V, f = 1.0 MHz)	C _{iss}	-	900	1200	pF
Output Capacitance		C _{oss}	-	350	500	
Transfer Capacitance		C _{rss}	-	90	150	
Input Capacitance	(V _{DS} = -10 Vdc, V _{GS} = 0 V, f = 1.0 MHz)	C _{iss}	-	940	-	pF
Output Capacitance		C _{oss}	-	410	-	
Transfer Capacitance		C _{rss}	-	110	-	
SWITCHING CHARACTERISTICS (Note 5)						
Turn-On Delay Time	(V _{DD} = -5.0 Vdc, I _D = -1.0 Adc, V _{GS} = -4.5 Vdc, R _G = 6.0 Ω)	t _{d(on)}	-	7.0	12	ns
Rise Time		t _r	-	25	45	
Turn-Off Delay Time		t _{d(off)}	-	75	125	
Fall Time		t _f	-	50	85	
Turn-On Delay Time	(V _{DD} = -16 Vdc, I _D = -6.0 Adc, V _{GS} = -4.5 Vdc, R _G = 2.5 Ω)	t _{d(on)}	-	8.0	-	ns
Rise Time		t _r	-	30	-	
Turn-Off Delay Time		t _{d(off)}	-	60	-	
Fall Time		t _f	-	60	-	
Gate Charge	(V _{DS} = -16 Vdc, I _D = -6.0 Adc, V _{GS} = -4.5 Vdc) (Note 4)	Q _T	-	15	20	nC
		Q _{gs}	-	1.7	-	
		Q _{gd}	-	6.0	-	
SOURCE-DRAIN DIODE CHARACTERISTICS						
Forward On-Voltage	(I _S = -3.0 Adc, V _{GS} = 0 Vdc) (Note 4) (I _S = -2.1 Adc, V _{GS} = 0 Vdc) (I _S = -3.0 Adc, V _{GS} = 0 Vdc, T _J = 125 °C)	V _{SD}	- - -	-0.82 -0.74 -0.68	-1.2 - -	Vdc

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

Characteristic	Symbol	Min	Typ	Max	Unit
SOURCE-DRAIN DIODE CHARACTERISTICS					
Reverse Recovery Time	t_{rr}	–	42	–	ns
	t_a	–	17	–	
	t_b	–	25	–	
Reverse Recovery Stored Charge	Q_{RR}	–	0.036	–	μC

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.

- Pulse Test: Pulse Width $\leq 300\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$.
- Switching characteristics are independent of operating junction temperatures.

TYPICAL ELECTRICAL CHARACTERISTICS

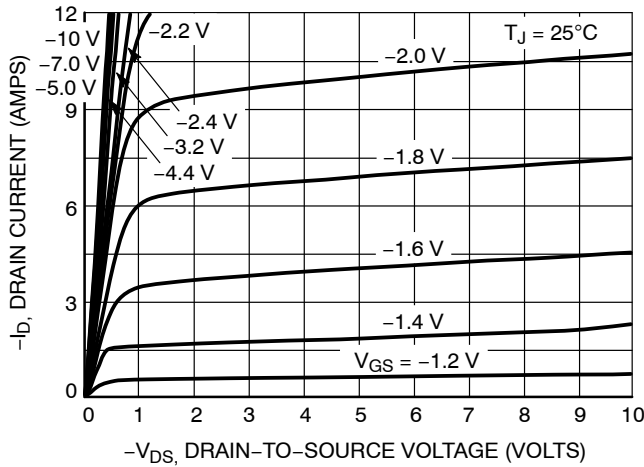


Figure 1. On-Region Characteristics

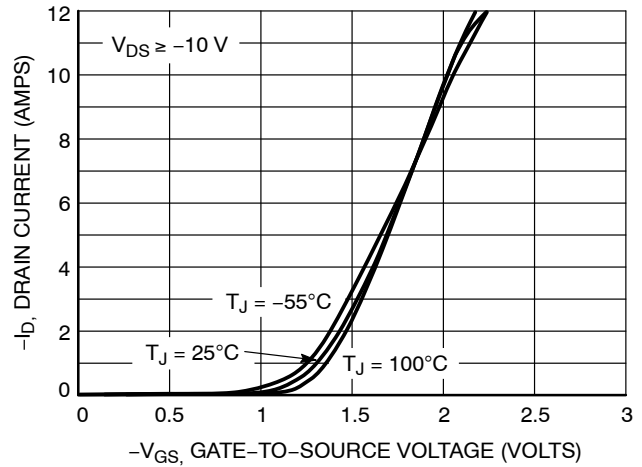


Figure 2. Transfer Characteristics

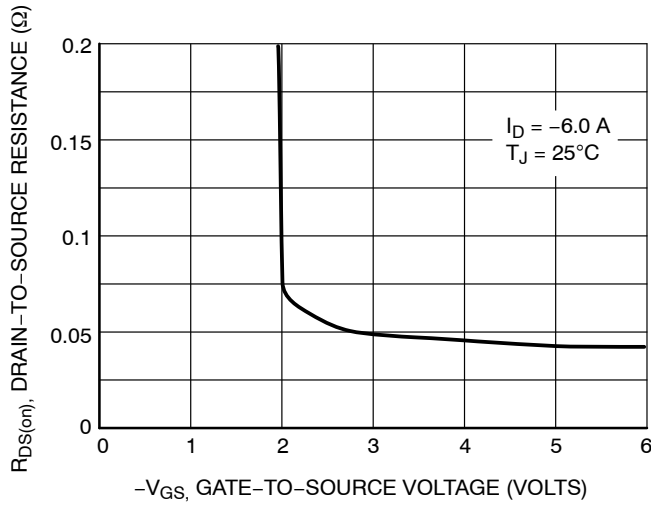


Figure 3. On-Resistance versus Gate-to-Source Voltage

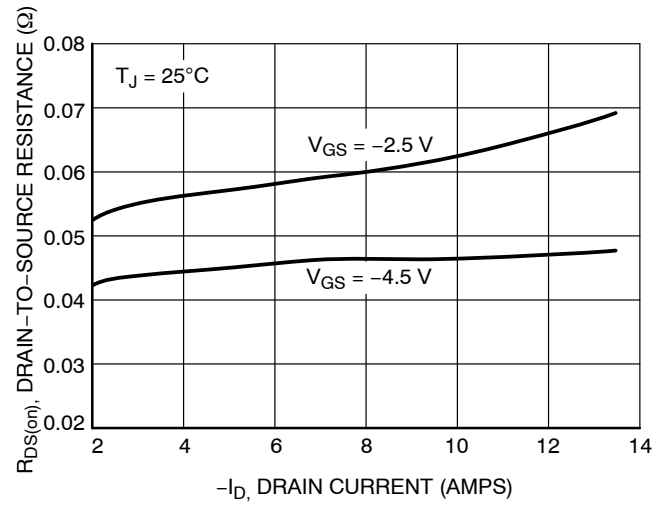


Figure 4. On-Resistance versus Drain Current and Gate Voltage

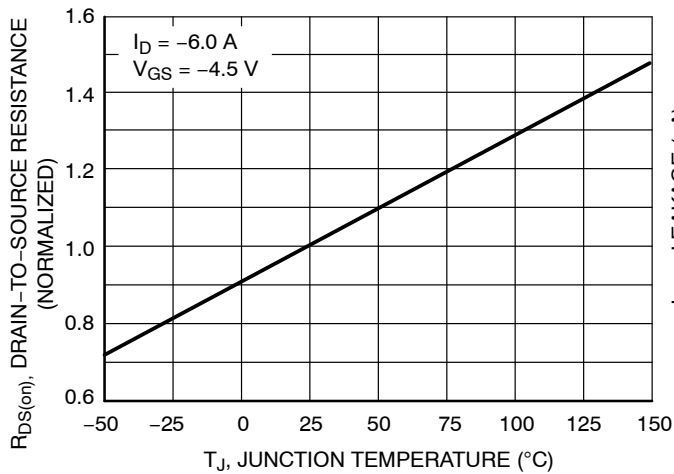


Figure 5. On-Resistance Variation with Temperature

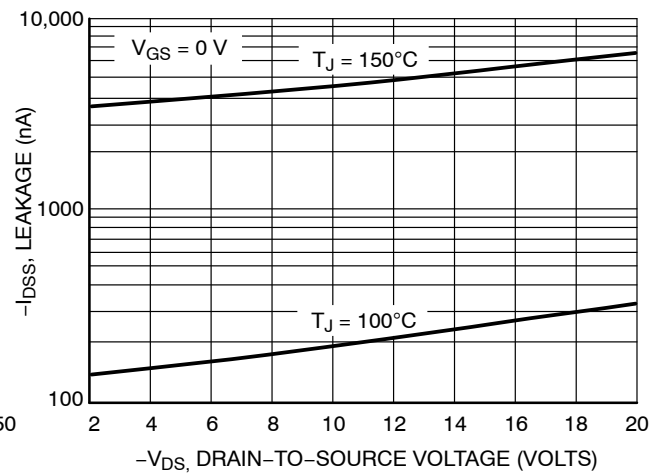


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

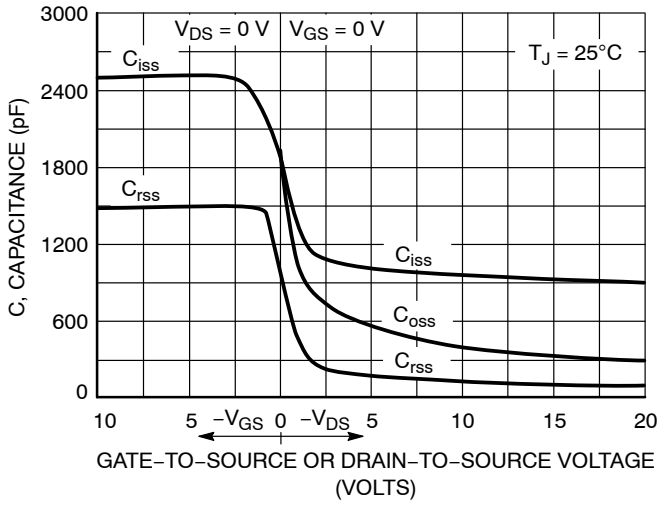


Figure 7. Capacitance Variation

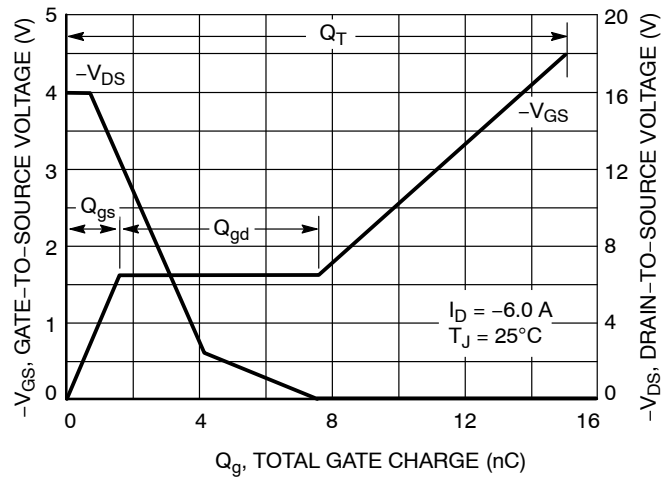


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

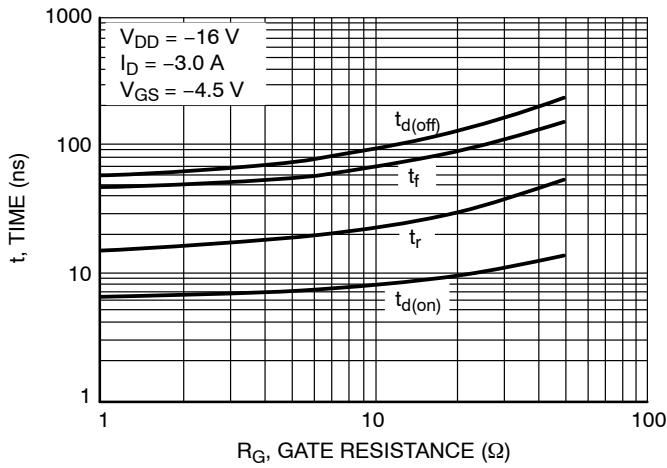


Figure 9. Resistive Switching Time Variation versus Gate Resistance

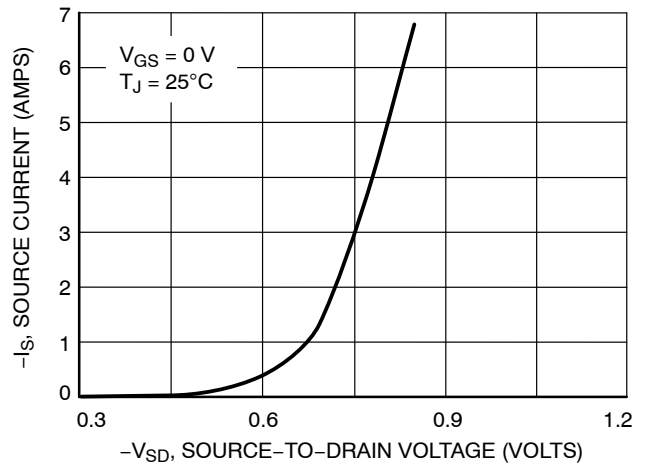


Figure 10. Diode Forward Voltage versus Current

NTF6P02, NVF6P02

TYPICAL ELECTRICAL CHARACTERISTICS

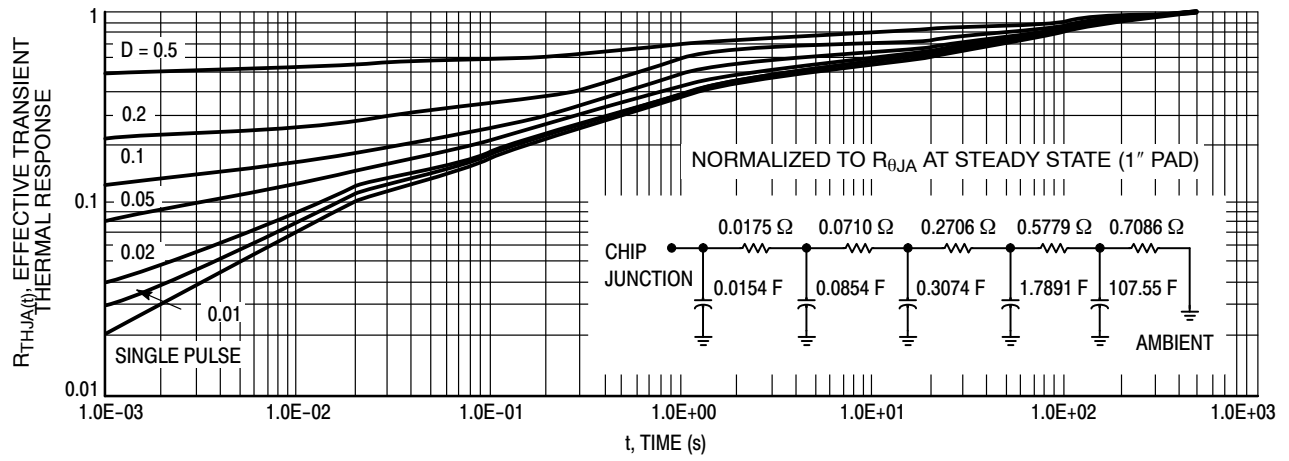


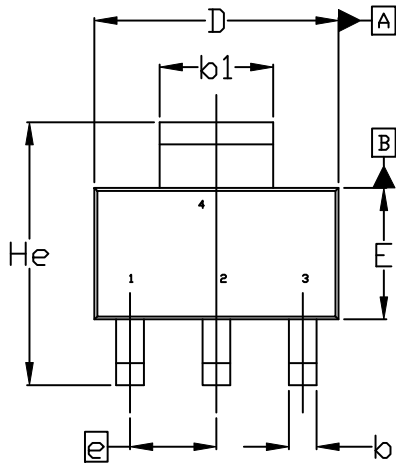
Figure 11. FET Thermal Response



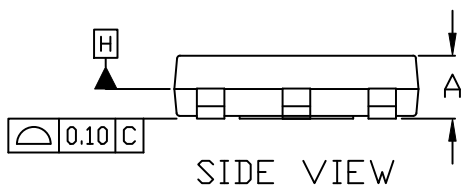
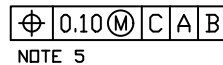
SCALE 1:1

SOT-223 (TO-261)
CASE 318E-04
ISSUE R

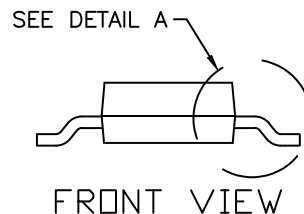
DATE 02 OCT 2018



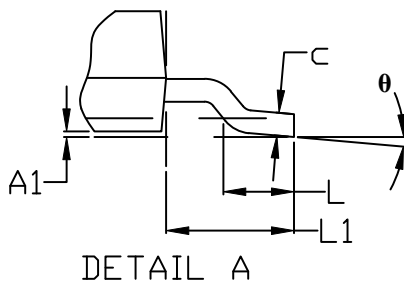
TOP VIEW



SIDE VIEW



FRONT VIEW

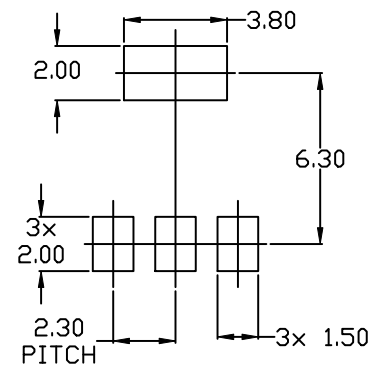


DETAIL A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.200MM PER SIDE.
4. DATUMS A AND B ARE DETERMINED AT DATUM H.
5. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
6. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

MILLIMETERS			
DIM	MIN.	NOM.	MAX.
A	1.50	1.63	1.75
A1	0.02	0.06	0.10
b	0.60	0.75	0.89
b1	2.90	3.06	3.20
c	0.24	0.29	0.35
D	6.30	6.50	6.70
E	3.30	3.50	3.70
e	2.30 BSC		
L	0.20	---	---
L1	1.50	1.75	2.00
He	6.70	7.00	7.30
θ	0°	---	10°


RECOMMENDED MOUNTING
FOOTPRINT

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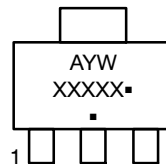
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DATE 02 OCT 2018

STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR	STYLE 2: PIN 1. ANODE 2. CATHODE 3. NC 4. CATHODE	STYLE 3: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN	STYLE 4: PIN 1. SOURCE 2. DRAIN 3. GATE 4. DRAIN	STYLE 5: PIN 1. DRAIN 2. GATE 3. SOURCE 4. GATE
STYLE 6: PIN 1. RETURN 2. INPUT 3. OUTPUT 4. INPUT	STYLE 7: PIN 1. ANODE 1 2. CATHODE 3. ANODE 2 4. CATHODE	STYLE 8: CANCELLED	STYLE 9: PIN 1. INPUT 2. GROUND 3. LOGIC 4. GROUND	STYLE 10: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE
STYLE 11: PIN 1. MT 1 2. MT 2 3. GATE 4. MT 2	STYLE 12: PIN 1. INPUT 2. OUTPUT 3. NC 4. OUTPUT	STYLE 13: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR		

**GENERIC
MARKING DIAGRAM***



A = Assembly Location
 Y = Year
 W = Work Week
 XXXXX = Specific Device Code
 ▪ = Pb-Free Package

(Note: Microdot may be in either location)
 *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.

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