

# MJH6284 (NPN), MJH6287 (PNP)

## Darlington Complementary Silicon Power Transistors

These devices are designed for general-purpose amplifier and low-speed switching motor control applications.

### Features

- Similar to the Popular NPN 2N6284 and the PNP 2N6287
- Rugged RBSOA Characteristics
- Monolithic Construction with Built-in Collector-Emitter Diode
- These are Pb-Free Devices\*

### MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Collector-Emitter Voltage	$V_{CEO}$	100	Vdc
Collector-Base Voltage	$V_{CB}$	100	Vdc
Emitter-Base Voltage	$V_{EB}$	5.0	Vdc
Collector Current – Continuous – Peak	$I_C$	20 40	Adc
Base Current	$I_B$	0.5	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	160 1.28	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.78	$^\circ\text{C}/\text{W}$

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.

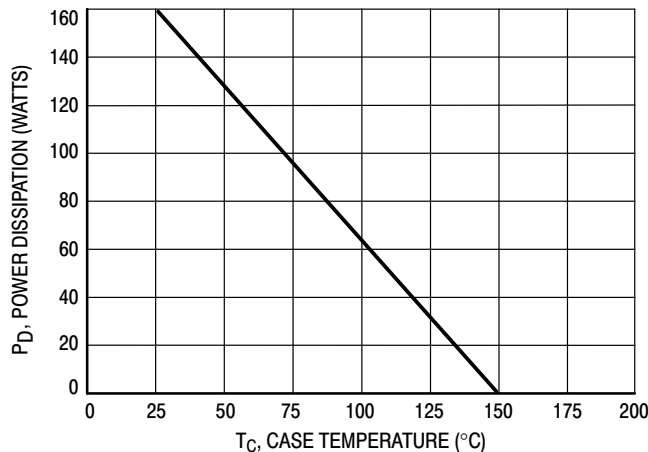


Figure 1. Power Derating

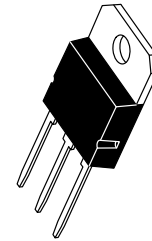
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



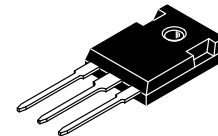
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**DARLINGTON 20 AMPERE  
COMPLEMENTARY SILICON  
POWER TRANSISTORS  
100 VOLTS, 160 WATTS**



SOT-93  
(TO-218)  
CASE 340D



TO-247  
CASE 340L  
STYLE 3

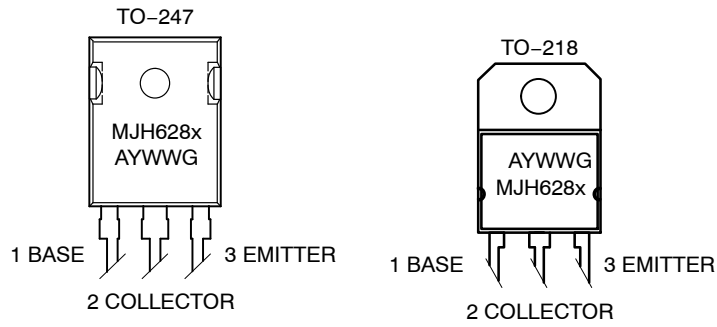
**NOTE: Effective June 2012 this device will be available only in the TO-247 package. Reference FPCN# 16827.**

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# MJH6284 (NPN), MJH6287 (PNP)

## MARKING DIAGRAMS



MJH628x = Device Code  
 x = 4 or 7  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 G = Pb-Free Package

## ORDERING INFORMATION

Device Order Number	Package Type	Shipping
MJH6284G	TO-218 (Pb-Free)	30 Units / Rail
MJH6287G	TO-218 (Pb-Free)	30 Units / Rail
MJH6284G	TO-247 (Pb-Free)	30 Units / Rail
MJH6287G	TO-247 (Pb-Free)	30 Units / Rail

# MJH6284 (NPN), MJH6287 (PNP)

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Sustaining Voltage (I <sub>C</sub> = 0.1 Adc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	100	-	Vdc
Collector Cutoff Current (V <sub>CE</sub> = 50 Vdc, I <sub>B</sub> = 0)	I <sub>CEO</sub>	-	1.0	mAdc
Collector Cutoff Current (V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc) (V <sub>CE</sub> = Rated V <sub>CB</sub> , V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 150°C)	I <sub>CEX</sub>	-	0.5 5.0	mAdc
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	-	2.0	mAdc

## ON CHARACTERISTICS (Note 1)

DC Current Gain (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc) (I <sub>C</sub> = 20 Adc, V <sub>CE</sub> = 3.0 Vdc)	h <sub>FE</sub>	750 100	18,000 -	-
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 Adc, I <sub>B</sub> = 40 mAdc) (I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)	V <sub>CE(sat)</sub>	- -	2.0 3.0	Vdc
Base-Emitter On Voltage (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc)	V <sub>BE(on)</sub>	-	2.8	Vdc
Base-Emitter Saturation Voltage (I <sub>C</sub> = 20 Adc, I <sub>B</sub> = 200 mAdc)	V <sub>BE(sat)</sub>	-	4.0	Vdc

## DYNAMIC CHARACTERISTICS

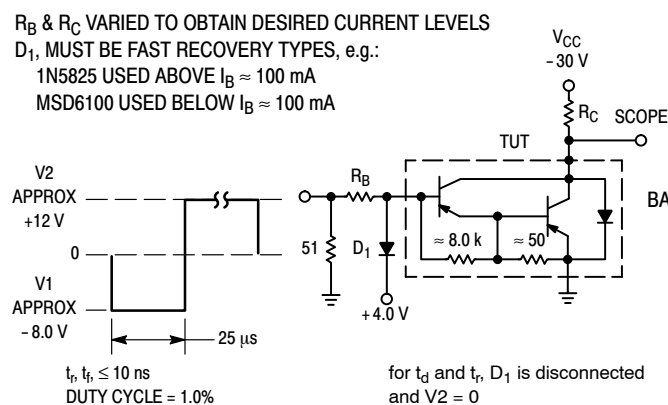
Current-Gain Bandwidth Product (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 MHz)	f <sub>T</sub>	4.0	-	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	- -	400 600	pF
				MJH6284 MJH6287
Small-Signal Current Gain (I <sub>C</sub> = 10 Adc, V <sub>CE</sub> = 3.0 Vdc, f = 1.0 kHz)	h <sub>fe</sub>	300	-	-

## SWITCHING CHARACTERISTICS

Resistive Load		Symbol	Typical		Unit
			NPN	PNP	
Delay Time	V <sub>CC</sub> = 30 Vdc, I <sub>C</sub> = 10 Adc I <sub>B1</sub> = I <sub>B2</sub> = 100 mA Duty Cycle = 1.0%	t <sub>d</sub>	0.1	0.1	μs
Rise Time		t <sub>r</sub>	0.3	0.3	
Storage Time		t <sub>s</sub>	1.0	1.0	
Fall Time		t <sub>f</sub>	3.5	2.0	

1. Pulse test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

R<sub>B</sub> & R<sub>C</sub> VARIED TO OBTAIN DESIRED CURRENT LEVELS  
D<sub>1</sub>, MUST BE FAST RECOVERY TYPES, e.g.:  
1N5825 USED ABOVE I<sub>B</sub> ≈ 100 mA  
MSD6100 USED BELOW I<sub>B</sub> ≈ 100 mA



For NPN test circuit reverse diode and voltage polarities.

Figure 2. Switching Times Test Circuit

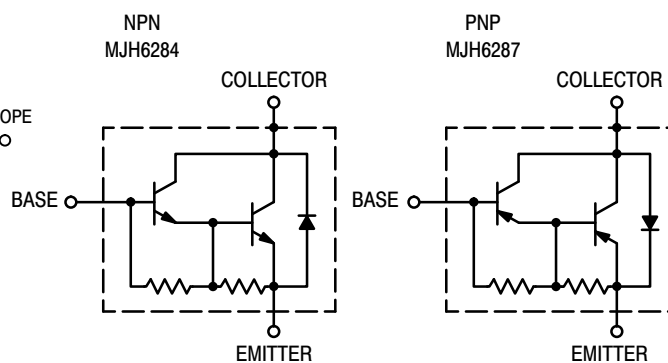


Figure 3. Darlington Schematic

## MJH6284 (NPN), MJH6287 (PNP)

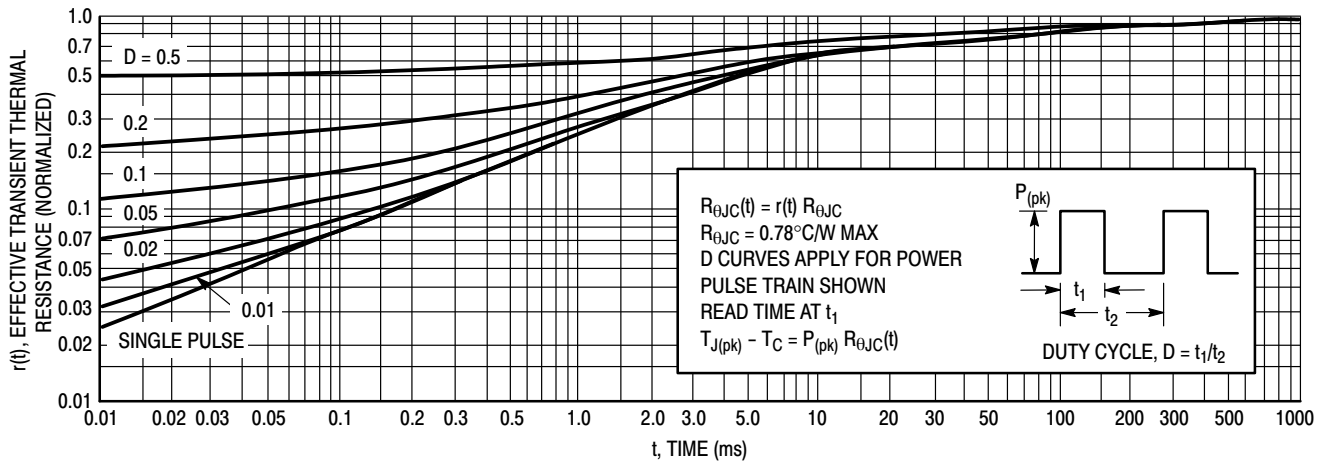


Figure 4. Thermal Response

### FBSOA, FORWARD BIAS SAFE OPERATING AREA

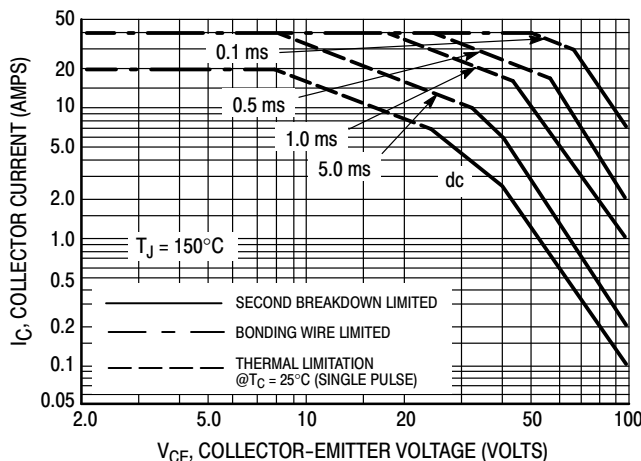


Figure 5. MJH6284, MJH6287

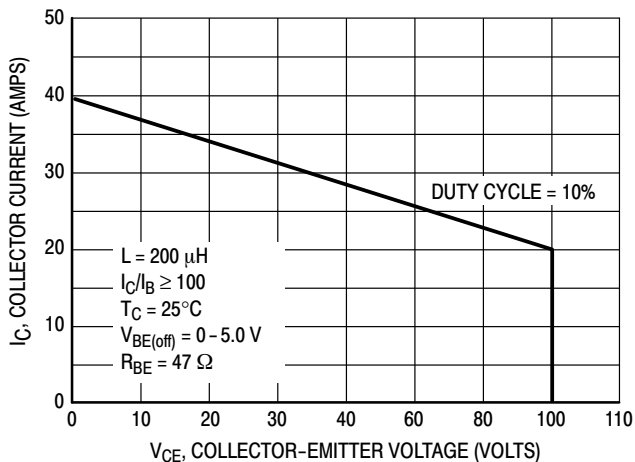


Figure 6. Maximum RBSOA, Reverse Bias Safe Operating Area

### FORWARD BIAS

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate  $I_C - V_{CE}$  limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on  $T_{J(pk)} = 150^{\circ}\text{C}$ ;  $T_C$  is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided  $T_{J(pk)} \leq 150^{\circ}\text{C}$ .  $T_{J(pk)}$  may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

# MJH6284 (NPN), MJH6287 (PNP)

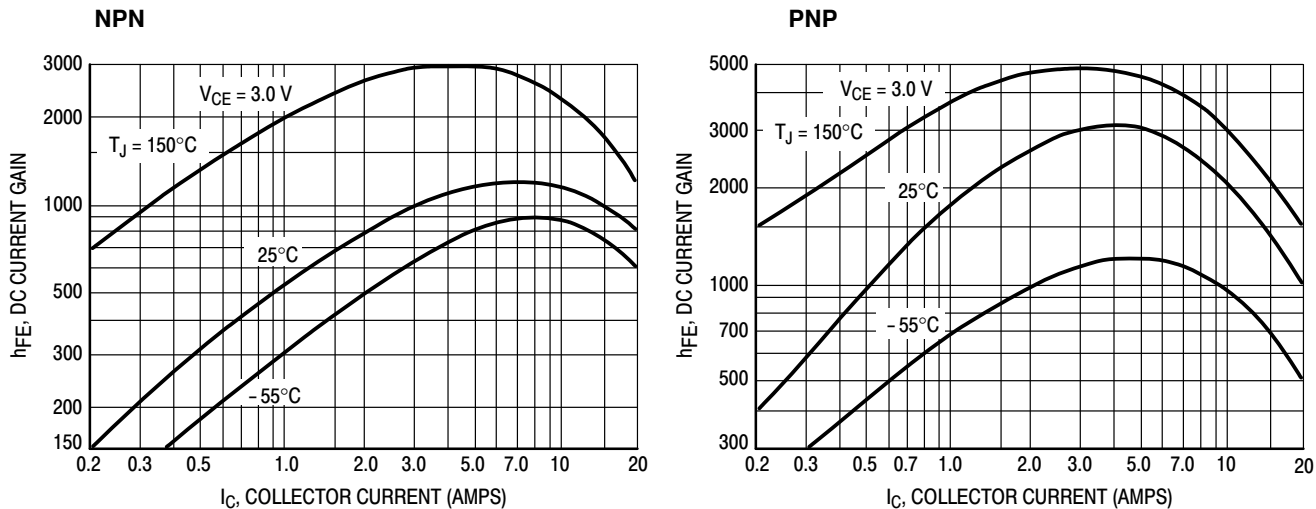


Figure 7. DC Current Gain

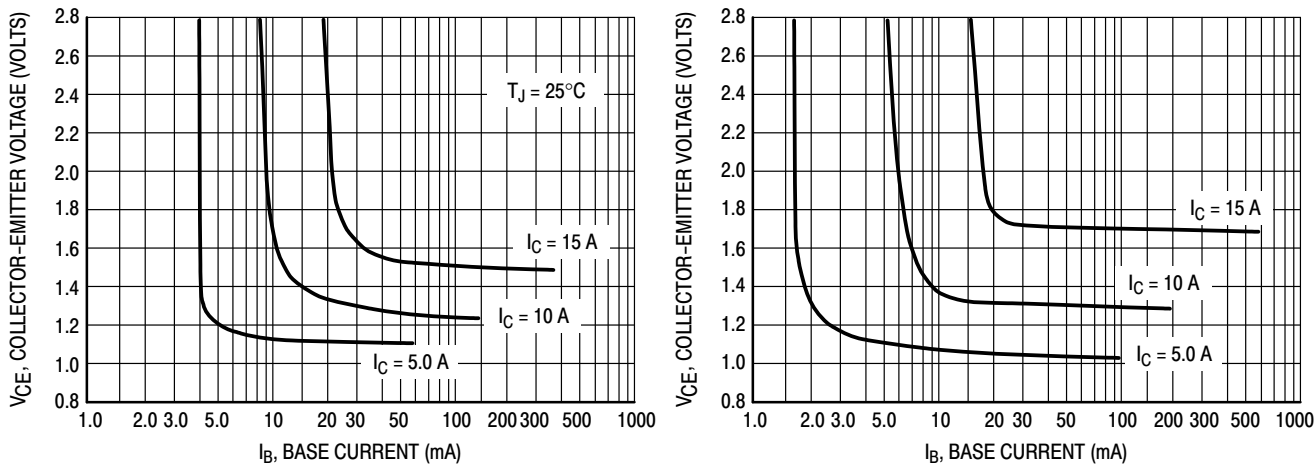


Figure 8. Collector Saturation Region

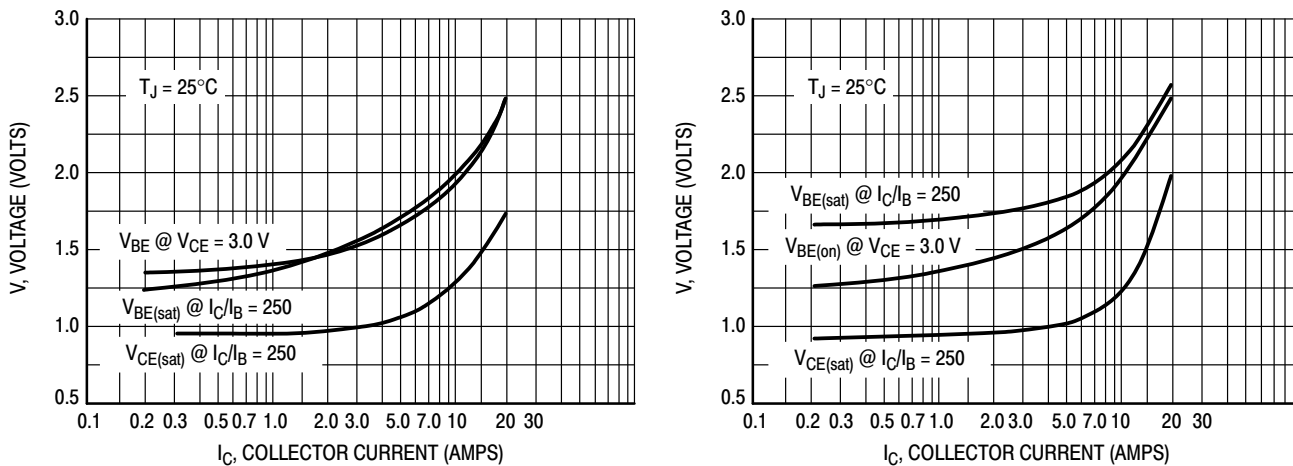


Figure 9. "On" Voltages

# MECHANICAL CASE OUTLINE

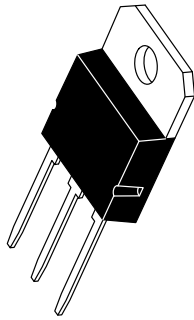
## PACKAGE DIMENSIONS

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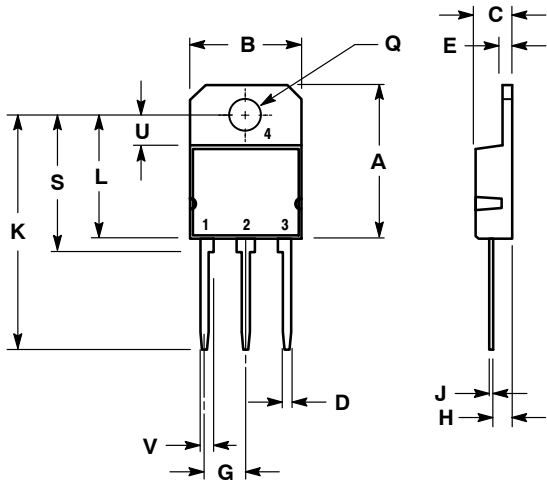


### SOT-93 (TO-218) CASE 340D-02 ISSUE E

DATE 01/03/2002



SCALE 1:1



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

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

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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	---	20.35	---	0.801
B	14.70	15.20	0.579	0.598
C	4.70	4.90	0.185	0.193
D	1.10	1.30	0.043	0.051
E	1.17	1.37	0.046	0.054
G	5.40	5.55	0.213	0.219
H	2.00	3.00	0.079	0.118
J	0.50	0.78	0.020	0.031
K	31.00 REF		1.220 REF	
L	---	16.20	---	0.638
Q	4.00	4.10	0.158	0.161
S	17.80	18.20	0.701	0.717
U	4.00 REF		0.157 REF	
V	1.75 REF		0.069	

### MARKING DIAGRAM



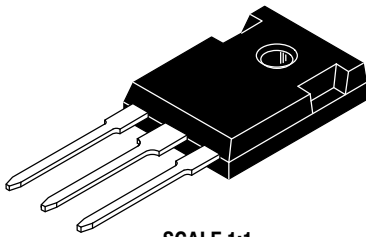
A = Assembly Location  
Y = Year  
WW = Work Week  
xxxxx = Device Code

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

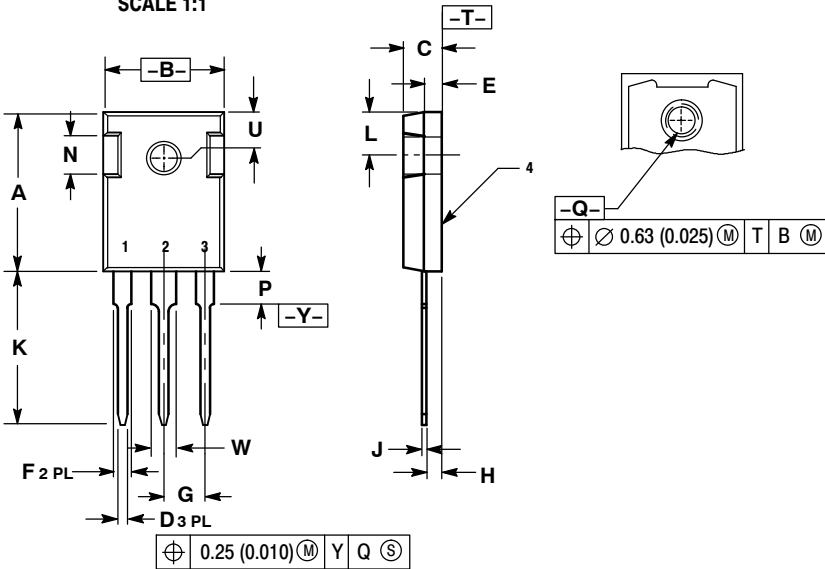
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TO-247  
CASE 340L-02  
ISSUE F

DATE 26 OCT 2011

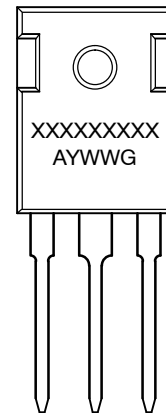
SCALE 1:1



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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	1.90	2.60	0.075	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	19.81	20.83	0.780	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

### GENERIC MARKING DIAGRAM\*



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

- STYLE 1:  
 PIN 1. GATE  
 2. DRAIN  
 3. SOURCE  
 4. DRAIN
- STYLE 2:  
 PIN 1. ANODE  
 2. CATHODE (S)  
 3. ANODE 2  
 4. CATHODES (S)
- STYLE 3:  
 PIN 1. BASE  
 2. COLLECTOR  
 3. EMITTER  
 4. COLLECTOR
- STYLE 4:  
 PIN 1. GATE  
 2. COLLECTOR  
 3. EMITTER  
 4. COLLECTOR
- STYLE 5:  
 PIN 1. CATHODE  
 2. ANODE  
 3. GATE  
 4. ANODE
- STYLE 6:  
 PIN 1. MAIN TERMINAL 1  
 2. MAIN TERMINAL 2  
 3. GATE  
 4. MAIN TERMINAL 2

\*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.

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