

MGP15N40CL, MGB15N40CL, MGC15N40CL

Internally Clamped N-Channel IGBT

This Logic Level Insulated Gate Bipolar Transistor (IGBT) features monolithic circuitry integrating ESD and Over-Voltage clamped protection for use in inductive coil drivers applications. Primary uses include Ignition, Direct Fuel Injection, or wherever high voltage and high current switching is required.

- Gate-Emitter ESD Protection
- Temperature Compensated Gate-Collector Voltage Clamp Limits Stress Applied to Load
- Integrated ESD Diode Protection
- Low Threshold Voltage to Interface Power Loads to Logic or Microprocessor Devices
- Low Saturation Voltage
- High Pulsed Current Capability
- Optional Gate Resistor (R_G)

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

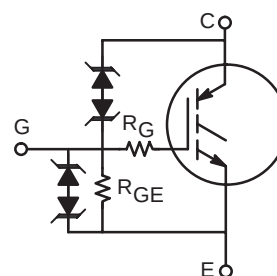
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CES}	440	V_{DC}
Collector-Gate Voltage	V_{CER}	440	V_{DC}
Gate-Emitter Voltage	V_{GE}	22	V_{DC}
Collector Current-Continuous @ $T_C = 25^\circ\text{C}$	I_C	15	A_{DC}
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	136 1.0	Watts $W/^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 175	$^\circ\text{C}$



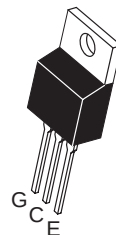
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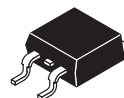
N-CHANNEL IGBT
15 A, 410 V
 $V_{CE(on)} = 1.8 \text{ V MAX}$



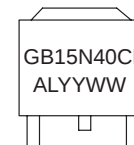
MARKING DIAGRAMS



TO-220
CASE 221A
STYLE 9



D2PAK
CASE 418B
STYLE 3



A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MGP15N40CL	TO-220	50 Units/Rail
MGB15N40CLT4	D2PAK	800 Tape & Reel
MGC15N40CL	Die Options	Not Applicable

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UNCLAMPED DRAIN-TO-SOURCE AVALANCHE CHARACTERISTICS ($T_J < 150^\circ\text{C}$)

Characteristic	Symbol	Value	Unit
Single Pulse Collector-to-Emitter Avalanche Energy $V_{CC} = 50\text{ V}$, $V_{GE} = 5\text{ V}$, Pk $I_L = 14.2\text{ A}$, $L = 3\text{ mH}$, Starting $T_J = 25^\circ\text{C}$ $V_{CC} = 50\text{ V}$, $V_{GE} = 5\text{ V}$, Pk $I_L = 10\text{ A}$, $L = 3\text{ mH}$, Starting $T_J = 150^\circ\text{C}$	E_{AS}	300 150	mJ

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	62.5	
TO-220 D ² PAK	$R_{\theta JA}$	50	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 5 seconds	T_L	275	$^\circ\text{C}$

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

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Clamp Voltage	BV_{CES}	$I_C = 2\text{ mA}$ $T_J = -40^\circ\text{C}$ to 175°C	380	410	440	V_{DC}
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE} = 350\text{ V}$, $V_{GE} = 0$, $T_J = 25^\circ\text{C}$	–	1.0	40	μADC
		$V_{CE} = 350\text{ V}$, $V_{GE} = 0$, $T_J = 150^\circ\text{C}$	–	10	200	
Reverse Collector-Emitter Leakage Current	I_{ECS}	$V_{CE} = -24\text{ V}$	–	0.35	1.0	mA
Gate-Emitter Clamp Voltage	BV_{GES}	$I_G = 5\text{ mA}$	17	20	22	V_{DC}
Gate-Emitter Leakage Current	I_{GES}	$V_{GE} = 10\text{ V}$	384	550	1000	μADC
Gate Resistor (Optional)	R_G	–	–	70	–	Ω
Gate Emitter Resistor	R_{GE}	–	10	18	26	k Ω

ON CHARACTERISTICS*

Gate Threshold Voltage	$V_{GE(th)}$	$I_C = 1\text{ mA}$ $V_{GE} = V_{CE}$	1.0	1.6	2.1	V_{DC}
Threshold Temperature Coefficient (Negative)	–	–	–	4.4	–	mV/ $^\circ\text{C}$
Collector-to-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 6\text{ A}$, $V_{GE} = 4\text{ V}$	–	1.25	1.8	V_{DC}
Collector-to-Emitter On-Voltage	$V_{CE(on)}$	$I_C = 10\text{ A}$, $V_{GE} = 4.5\text{ V}$, $T_J = 150^\circ\text{C}$	–	1.45	1.8	V_{DC}
Forward Transconductance	gfs	$V_{CE} = 5\text{ V}$, $I_C = 6\text{ A}$	8.0	15	–	Mhos

DYNAMIC CHARACTERISTICS

Input Capacitance	C_{ISS}	$V_{CC} = 15\text{ V}$	–	700	–	pF
Output Capacitance	C_{OSS}	$V_{GE} = 0\text{ V}$	–	130	–	
Transfer Capacitance	C_{RSS}	$f = 1\text{ MHz}$	–	3.5	–	

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

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

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS*

Turn-Off Delay Time	$t_{d(off)}$	$V_{CC} = 300\text{ V},$ $I_C = 10\text{ A}$	–	13	–	μSec
Fall Time	t_f	$R_G = 1\text{ k}\Omega,$ $L = 300\text{ }\mu\text{H}$	–	6.0	–	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 10\text{ V},$ $I_C = 6.5\text{ A}$	–	1.0	–	μSec
Rise Time	t_r	$R_G = 1\text{ k}\Omega,$ $R_L = 1\text{ }\Omega$	–	5.0	–	
Gate Charge	Q_T	$V_{CC} = 350\text{ V}$	–	TBD	–	nC
	Q_1	$I_C = 15\text{ A}$	–	TBD	–	
	Q_2	$V_{GE} = 5\text{ V}$	–	TBD	–	

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

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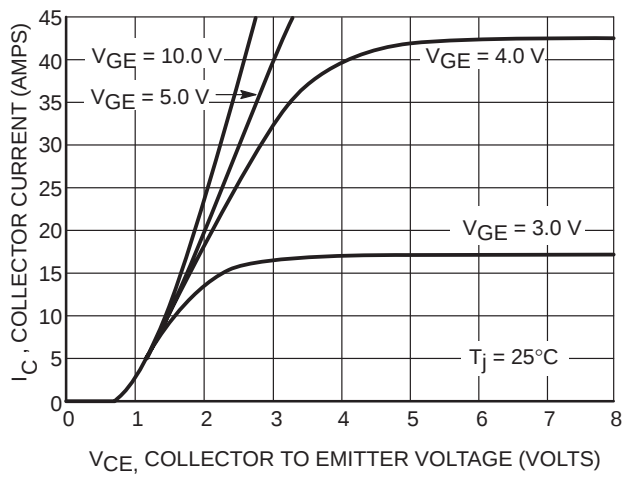


Figure 1. Output Characteristics

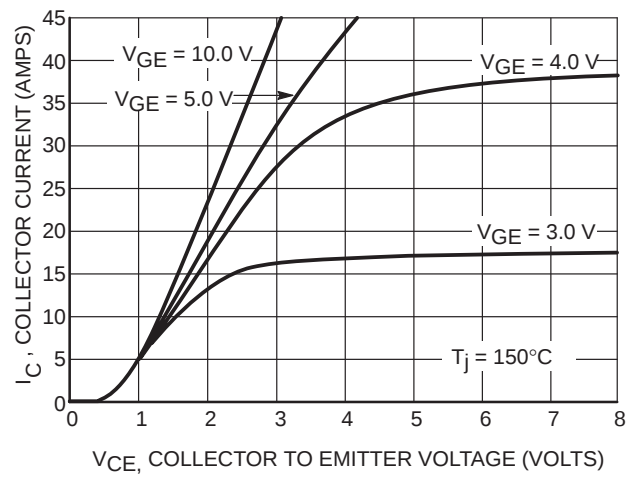


Figure 2. Output Characteristics

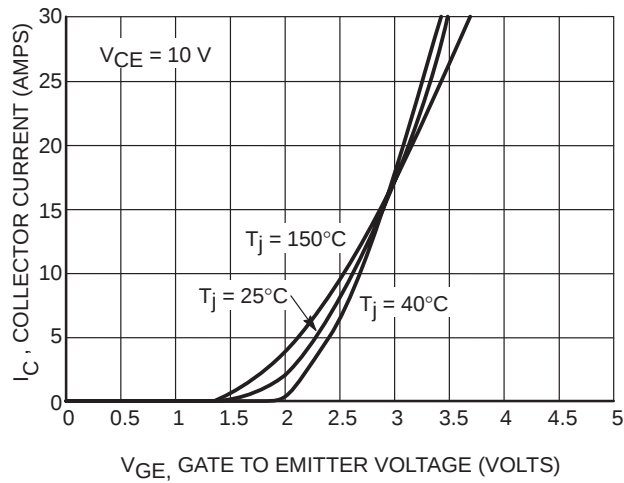


Figure 3. Transfer Characteristics

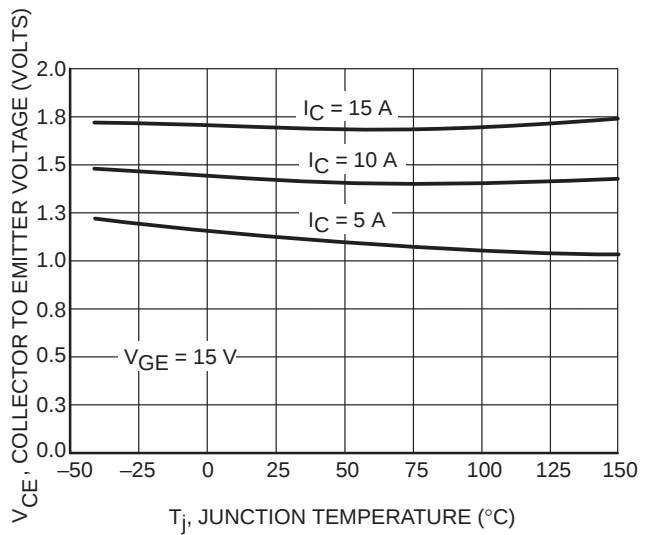


Figure 4. Collector-to-Emitter Saturation Voltage versus Junction Temperature

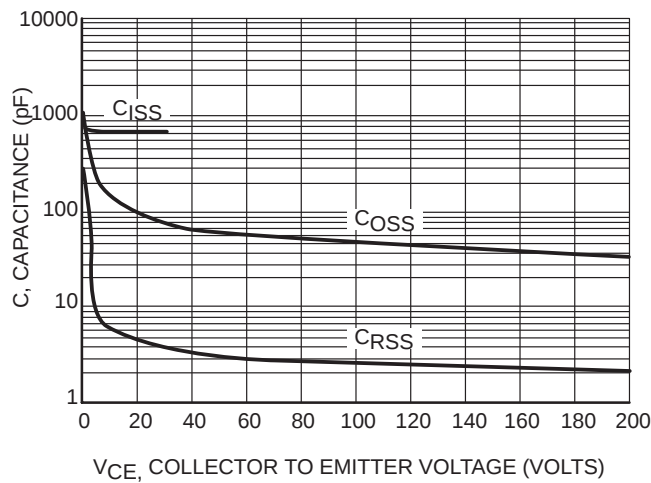


Figure 5. Capacitance Variation

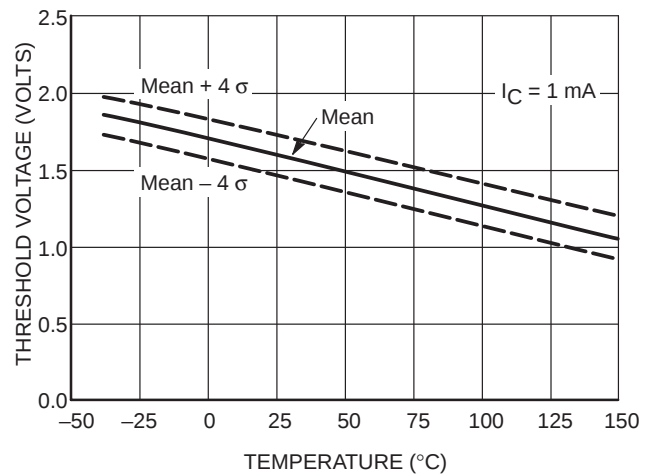


Figure 6. Threshold Voltage versus Temperature

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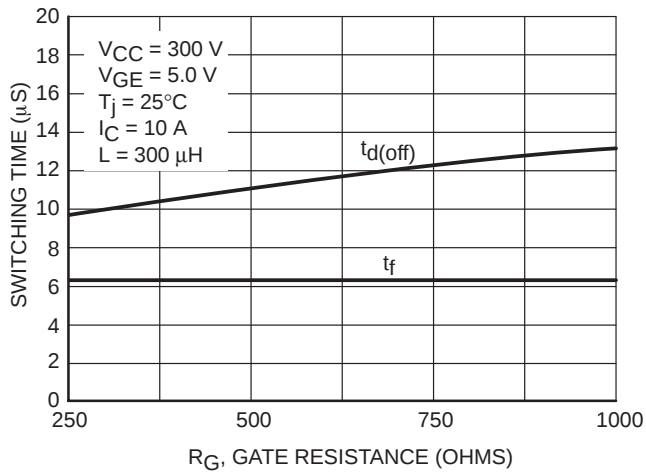


Figure 7. Switching Speed versus Gate Resistance

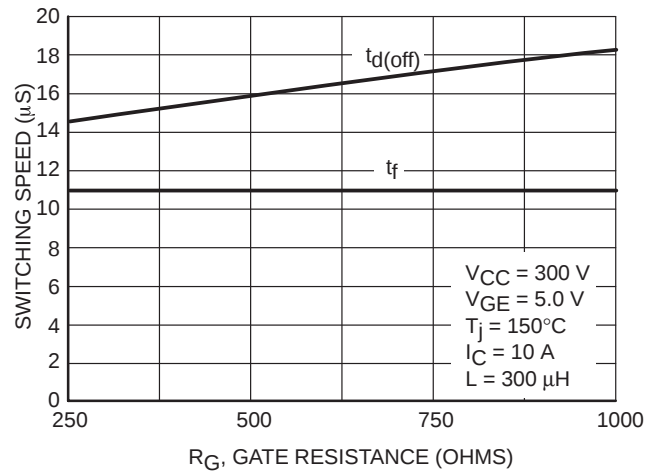


Figure 8. Switching Speed versus Gate Resistance

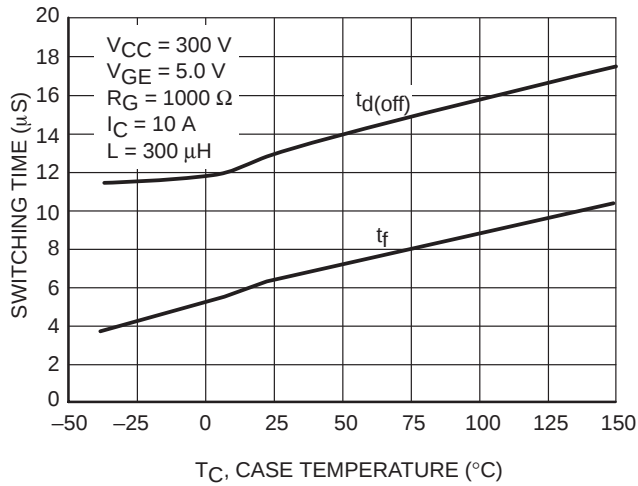


Figure 9. Switching Speed versus Case Temperature

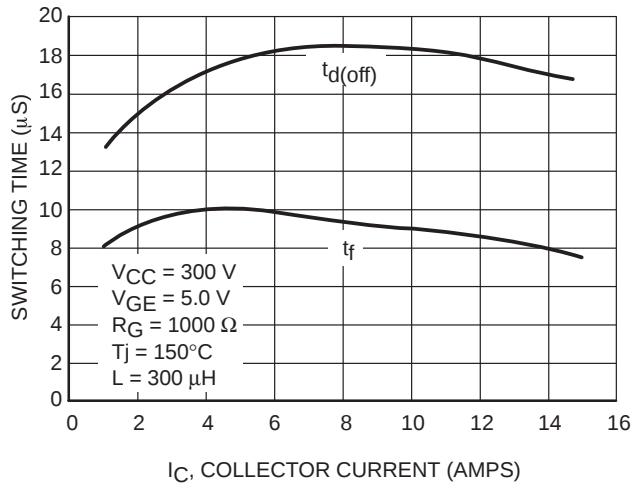


Figure 10. Total Switching Losses versus Collector Current

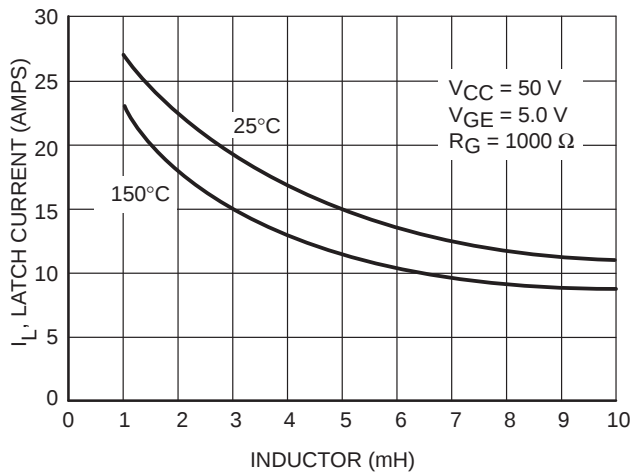


Figure 11. Latch Current versus Inductor (Typical)

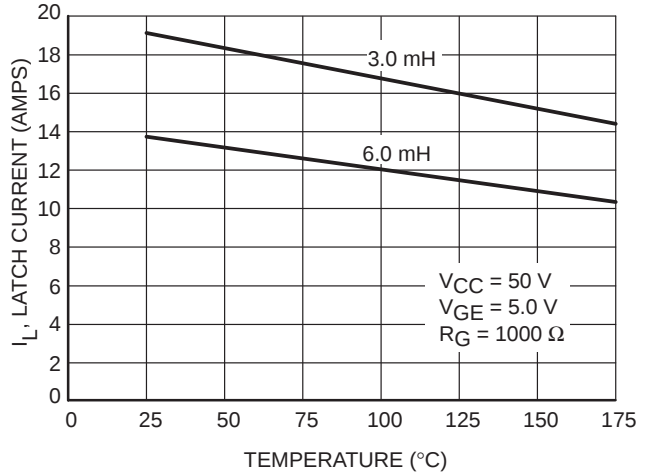
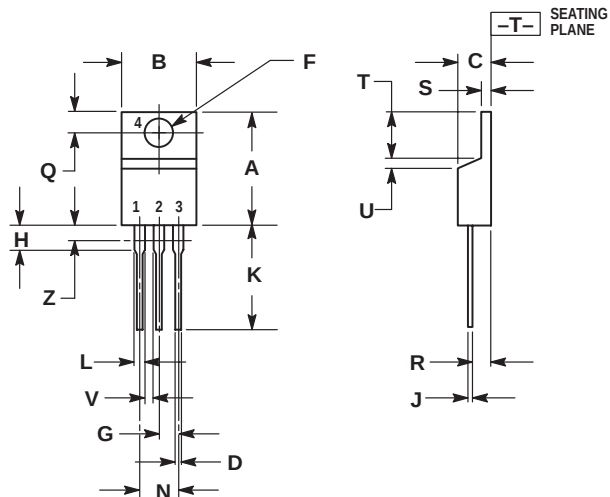


Figure 12. Latch Current versus Temperature (Typical)

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PACKAGE DIMENSIONS

TO-220 CASE 221A-09 ISSUE AA



NOTES:

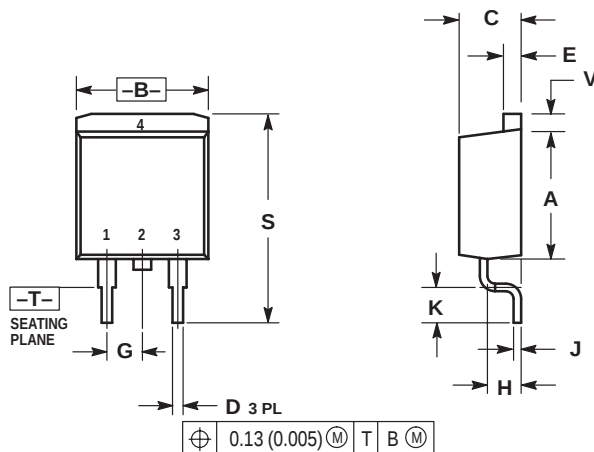
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

STYLE 9:

- PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

D2PAK CASE 418B-03 ISSUE D



NOTES:

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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100	BSC	2.54	BSC
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 3:

- PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

Notes

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