MIL-PRF-38534 CERTIFIED

M.S.KENNEDY CORP.

600V/200A THREE PHASE BRIDGE PEM WITH BRAKE

4854

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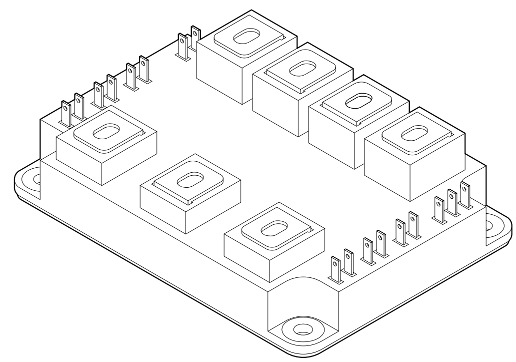
FEATURES:

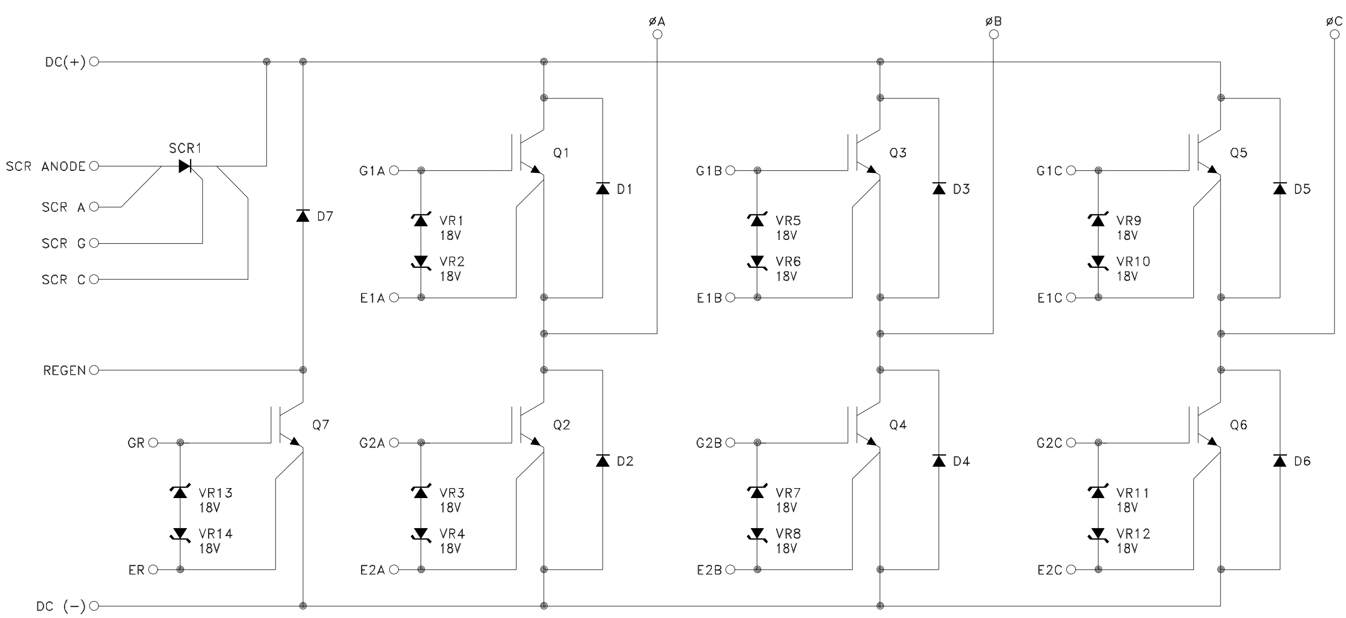
- Replaces MSK 4851
- Full Three Phase Bridge Configuration with SCR/IGBT Brake
- 600V Rated Voltage
- 200A Continuous Output Current
- Internal Zener Clamps on Gates
- Proprietary Encapsulation Provides Near Hermetic Performance
- MIL-PRF-38534 Screening Available (Modified)
- Light Weight Domed ALSIC Baseplate
- Robust Mechanical Design for Hi-Rel Applications
- Ultra-Low Inductance Internal Layout
- Withstands 96 Hours HAST and Thermal Cycling (-55°C to +125°C)
- Contact MSK for MIL-PRF-38534 (Modified) Qualification Status



DESCRIPTION:

The MSK 4854 is one of a family of plastic encapsulated modules (PEM) developed specifically for use in military, aerospace and other severe environment applications. The Three Phase Bridge configuration along with the SCR/IGBT brake circuit and 600 volt/200 amp rating make it ideal for use in high current motor drive and inverter applications. The Aluminum Silicon Carbide (AlSiC) baseplate offers superior flatness and light weight; far better than the copper or copper alloys found in most high power plastic modules. The high thermal conductivity materials used to construct the MSK 4854 allow high power outputs at elevated baseplate temperatures. Our proprietary coating, SEES™ - Severe Environment Encapsulation System - protects the internal circuitry of MSK PEM's from moisture and contamination, allowing them to pass the rugged environmental screening requirements of military and aerospace applications. MSK PEM's are also available with industry standard silicone gel coatings for a lower cost option.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- Motor Drives
- Inverters

ABSOLUTE MAXIMUM RATING ⑧

V_{CE}	Collector to Emitter Voltage	600V
V_{GE}	Gate to Emitter Voltage	±20V
I_{OUT}	Current (Continuous)	200A
I_{OUTP}	Current Pulsed (1mS)	400A
V_{CASE}	Case Isolation Voltage	2500 V
T_{ST}	Storage Temperature Range	-55°C to +125°C
T_J	Junction Temperature	150°C
T_C	Case Operating Temperature Range	
	MSK 4854H	-55°C to +125°C
	MSK 4854	-40°C to +85°C

ELECTRICAL SPECIFICATIONS

Parameter ⑥	Test Conditions	Group A Subgroup	MSK 4854 H Min.	MSK 4854 H Typ.	MSK 4854 H Max.	MSK 4854 Min.	MSK 4854 Typ.	MSK 4854 Max.	Units
Collector-Emitter Saturation Voltage	I_C=200A, V_{GE}=15V	1	-	2.55	2.9	-	2.55	3.0	V
		2	-	2.90	3.2	-	-	-	V
		3	-	3.60	4.0	-	-	-	V
Collector-Emitter Leakage Current	V_{CE}=600V, V_{GE}=0V	1	-	0.5	350	-	0.5	400	uA
		2	-	170	1700	-	-	-	uA
Gate Threshold Voltage	I_C=60mA, V_{CE}=V_{GE}	1	3.5	4.1	7.5	3.3	4.1	7.8	V
		2	3.0	3.5	7.5	-	-	-	V
		3	4.0	4.5	8.5	-	-	-	V
Gate Leakage Current	V_{CE}=0V, V_{GE}=±15V	1	-	0.1	10	-	0.1	10	uA
		2	-	0.6	10	-	-	-	uA
		3	-	0.1	10	-	-	-	uA
Diode Forward Voltage	I_C=200A	1	-	1.8	2.5	-	1.8	2.6	V
		2	-	1.8	2.5	-	-	-	V
		3	-	2.0	2.8	-	-	-	V
SCR Reverse Leakage	V_{RRM}=600V	1	-	0.01	15	-	0.01	18	mA
		2	-	0.01	15	-	-	-	mA
		3	-	0.01	15	-	-	-	mA
SCR On Voltage	I_F=100A	1	-	1.0	1.35	-	1.0	1.4	V
		2	-	1.0	1.35	-	-	-	V
		3	-	1.0	1.35	-	-	-	V
SCR Holding Current		1	-	100	300	-	100	325	mA
		2	-	90	300	-	-	-	mA
		3	-	110	300	-	-	-	mA
Regen Diode Forward Voltage	I_F=50A	1	-	1.3	2.4	-	1.3	2.5	V
Total Gate Charge ①	V=300V, I_C=200A	4	-	1.0	1.5	-	1.0	1.6	uC
E(on) ①	V=300V, I_C=200A, RG=5Ω, V_{GE}=-7/+15V	4	-	6	-	-	6	-	mJ
	V=300V, I_C=100A, RG=5Ω, V_{GE}=-7/+15V	4	-	3	6	-	3	7	mJ
	V=300V, I_C=200A, RG=5Ω, V_{GE}=-7/+15V	5	-	7	-	-	-	-	mJ
	V=300V, I_C=100A, RG=5Ω, V_{GE}=-7/+15V	5	-	4	-	-	-	-	mJ
E(off) ①	V=300V, I_C=200A, RG=10Ω, V_{GE}=-7/+15V	4	-	20	-	-	20	-	mJ
	V=300V, I_C=100A, RG=10Ω, V_{GE}=-7/+15V	4	-	9	12	-	9	13	mJ
	V=300V, I_C=200A, RG=10Ω, V_{GE}=-7/+15V	5	-	22	-	-	-	-	mJ
	V=300V, I_C=100A, RG=10Ω, V_{GE}=-7/+15V	5	-	10	-	-	-	-	mJ
Diode Reverse Recovery Time ①	I_E=200, di/dt=3500A/uS	4	-	190	-	-	190	-	nS
	I_E=100, di/dt=3500A/uS	4	-	185	-	-	185	-	nS
	I_E=200, di/dt=3500A/uS	5	-	270	-	-	-	-	nS
	I_E=100, di/dt=3500A/uS	5	-	250	-	-	-	-	nS
Diode Reverse Energery ①	I_E=200, di/dt=3500A/uS	4	-	2.5	-	-	2.5	-	mJ
	I_E=100, di/dt=3500A/uS	4	-	2	4	-	2	-	mJ
	I_E=200, di/dt=3500A/uS	5	-	5	-	-	-	-	mJ
	I_E=100, di/dt=3500A/uS	5	-	8	-	-	-	-	mJ
Thermal Resistance ①	IGBT @ T_J=125°C	-	-	0.16	0.19	-	0.16	0.19	°C/W
	DIODE @ T_J=125°C	-	-	0.18	0.21	-	0.18	0.21	°C/W

NOTES:

① Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
② Industrial grade devices shall be tested to subgroup 1 unless otherwise specified.
③ Military grade devices ("H" suffix) shall be 100% tested to subgroups 1, 2 and sample tested to subgroup 3.
④ Subgroups 4 testing available upon request.
⑤ Subgroup 1, 4 T_A = +25°C
2, 5 T_A = +125°C
3 T_A = -55°C
⑥ All specifications apply to both the upper and lower sections of the half bridge.
⑦ V_{GE}=15V unless otherwise specified.
⑧ Continuous operation at or above absolute maximum ratings may adversly effect the device performance and/or life cycle

THERMAL CALCULATIONS

Power dissipation and maximum allowable temperature rise involve many variables working together. Collector current, PWM duty cycle and switching frequency all factor into power dissipation. DC losses or "ON-TIME" losses are simply V_{CE}(SAT) x Collector Current x PWM duty cycle. For the MSK 4854, V_{CE}(SAT) = TBD max., and at 200 amps and a PWM duty cycle of 30%, DC losses equal TBD watts. Switching losses, in milli-joules, vary proportionally with switching frequency. The MSK 4854 typical switching losses at V_{CE} = 300V and I_{CE} = 200A are about TBDmJ, which is simply the sum of the turn-on switching loss and the turn-off switching loss. Multiplying the switching frequency times the switching losses will result in a power dissipation number for switching. The MSK 4854, at 15KHz, will exhibit switching power dissipation of TBD watts. The total losses are the sum of DC losses plus switching losses, or in this case, TBD watts total. TBD watts x 0.19°C/W thermal resistance equals TBD degrees of temperature rise between the case and the junction. Subtracting TBD°C from the maximum junction temperature of 150°C equals TBD°C maximum case temperature for this example.

V_{CE}(SAT) x IC x PWM duty cycle = TBDV x 200 amps x 30% = TBD watts DC losses

Turn-on switching loss + Turn-off switching loss = Total switching losses = TBD + TBD = TBDmJ

Total switching loss x PWM frequency = Total switching power dissipation = TBDmJ x 15KHz = TBD watts

Total power dissipation = DC losses + switching losses = TBD + TBD = TBD watts

Junction temperature rise above case = Total power dissipation x thermal resistance

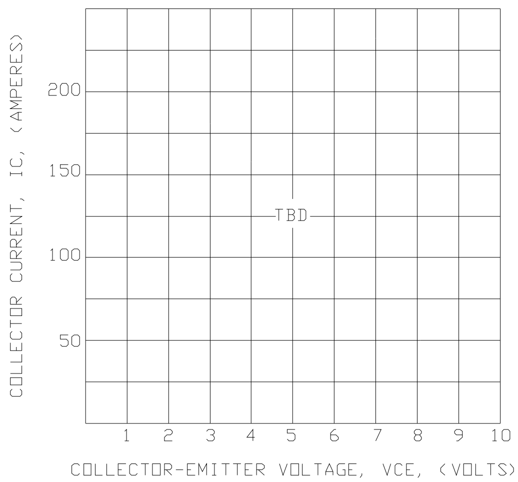
TBD watts x TBD°C/W = TBD°C temperature rise above case

Maximum junction temperature - junction temperature rise = maximum baseplate temperature

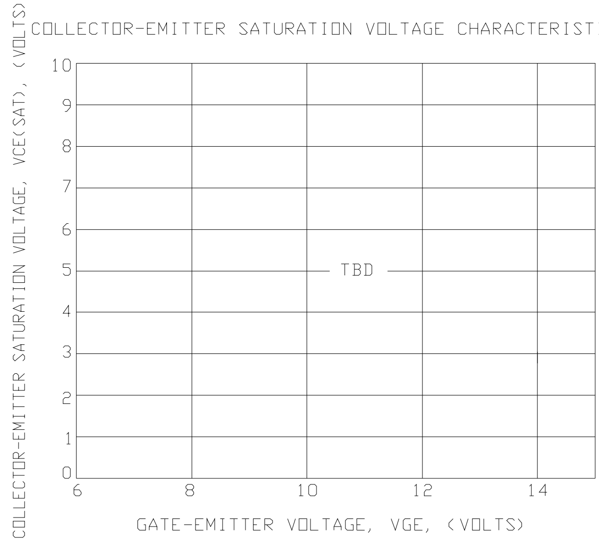
150°C - TBD°C = TBD°C

TYPICAL PERFORMANCE CURVES

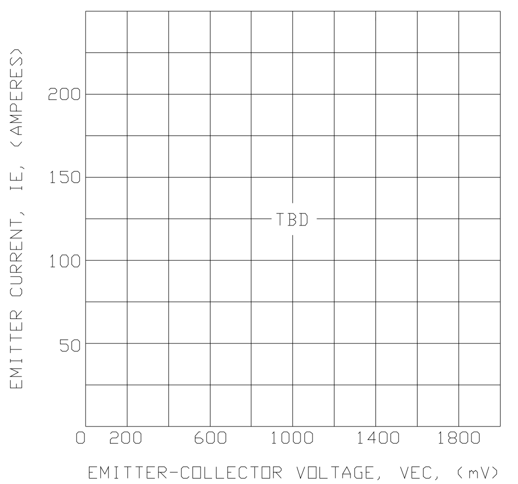
TYPICAL OUTPUT CHARACTERISTICS



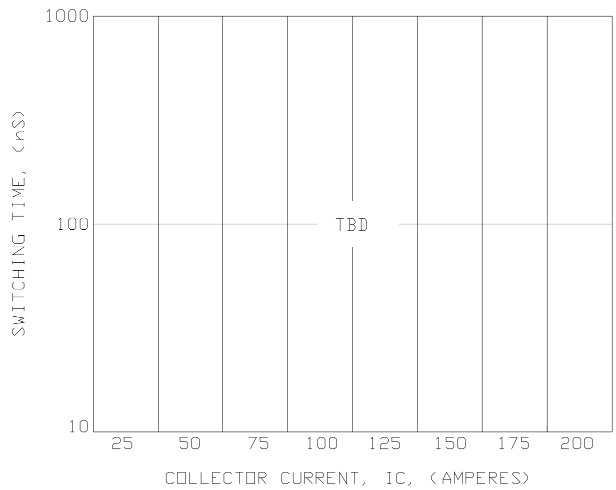
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS



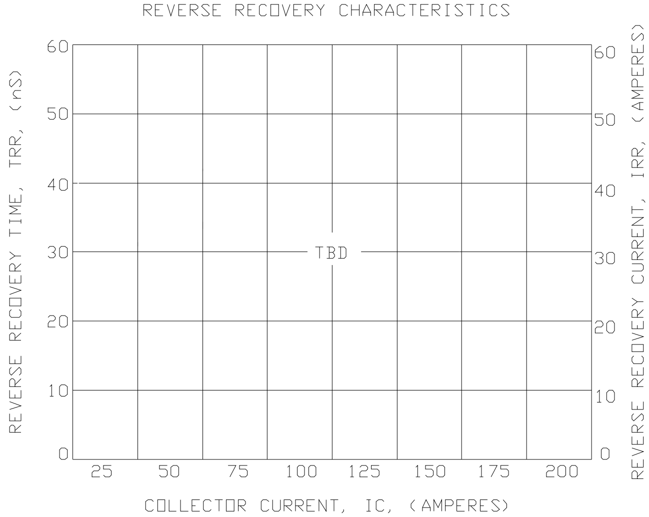
FREE-WHEEL DIODE FORWARD CHARACTERISTICS



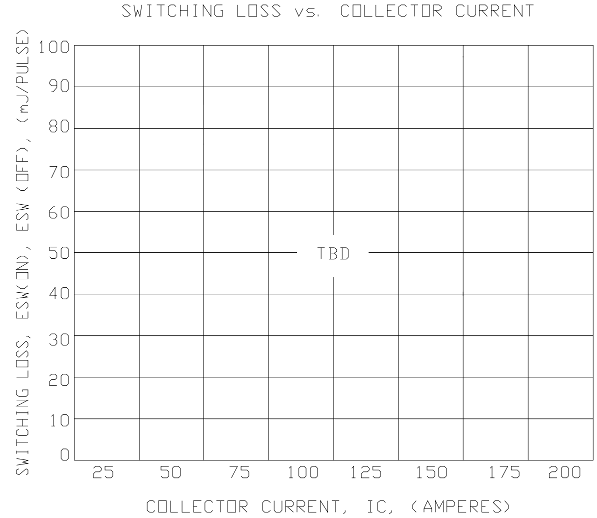
SWITCHING CHARACTERISTICS



REVERSE RECOVERY CHARACTERISTICS



SWITCHING LOSS vs. COLLECTOR CURRENT

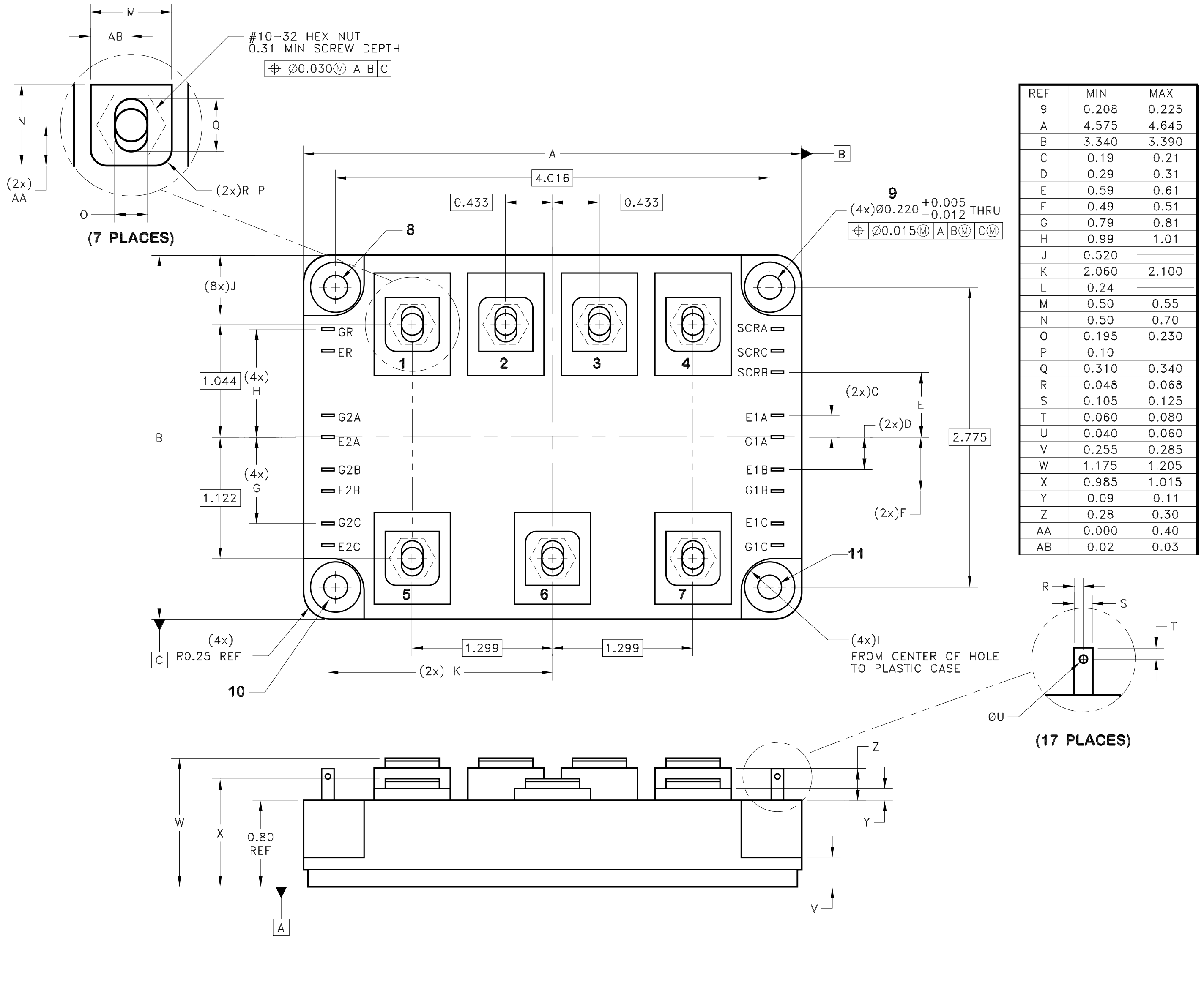


SCREENING CHART

OPERATION IN ACCORDANCE WITH MIL-PRF-38534	INDUSTRIAL	CLASS H
QUALIFICATION (MODIFIED)	NO	YES
ELEMENT EVALUATION	NO	YES
CLEAN ROOM PROCESSING	YES	YES
NON DESTRUCT BOND PULL SAMPLE	YES	YES
CERTIFIED OPERATORS	NO	YES
MIL LINE PROCESSING	YES	YES
MAX REWORK SPECIFIED	NO	YES
ENCAPSULANT	GEL COAT	SEES ™
PRE-CAP VISUAL	YES - INDUSTRIAL	YES - CLASS H
TEMP CYCLE (-55°C TO +125°C)	NO	YES
BURN-IN	NO	YES - 160 HOURS
ELECTRICAL TESTING	YES - 25°C	YES - FULL TEMP
EXTERNAL VISUAL	YES - SAMPLE	YES
XRAY	NO	NO
PIN FINISH	NI	NI

NOTE: ADDITIONAL SCREENING IS AVAILABLE SUCH AS XRAY, CSAM, MECHANICAL SHOCK, ETC. CONTACT FACTORY FOR QUAL STATUS.

MECHANICAL SPECIFICATIONS



REF	MIN	MAX
9	0.208	0.225
A	4.575	4.645
B	3.340	3.390
C	0.19	0.21
D	0.29	0.31
E	0.59	0.61
F	0.49	0.51
G	0.79	0.81
H	0.99	1.01
J	0.520	——
K	2.060	2.100
L	0.24	——
M	0.50	0.55
N	0.50	0.70
O	0.195	0.230
P	0.10	——
Q	0.310	0.340
R	0.048	0.068
S	0.105	0.125
T	0.060	0.080
U	0.040	0.060
V	0.255	0.285
W	1.175	1.205
X	0.985	1.015
Y	0.09	0.11
Z	0.28	0.30
AA	0.000	0.40
AB	0.02	0.03

WEIGHT = 442 GRAMS MAX.

ORDERING INFORMATION

MSK4854 H

SCREENING

BLANK = INDUSTRIAL

H = MIL-PRF-38534 CLASS H (MODIFIED)

GENERAL PART NUMBER

THE ABOVE EXAMPLE IS A MILITARY SCREENED MODULE.

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