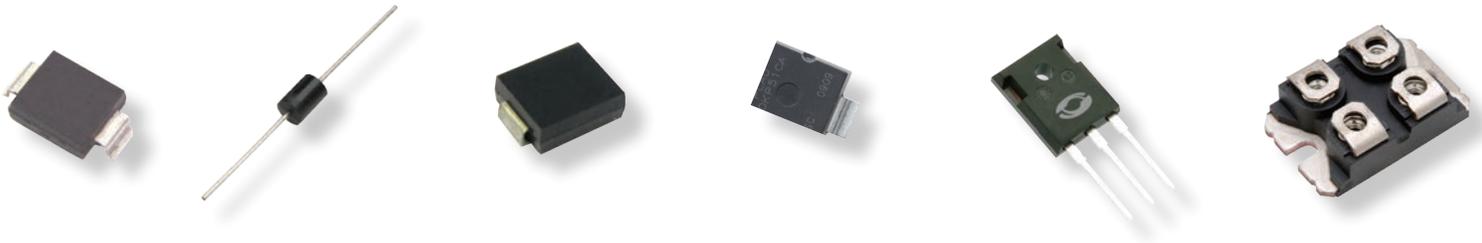


# Hi-Rel Non-Hermetic Products Portfolio



Transient Voltage Suppressors

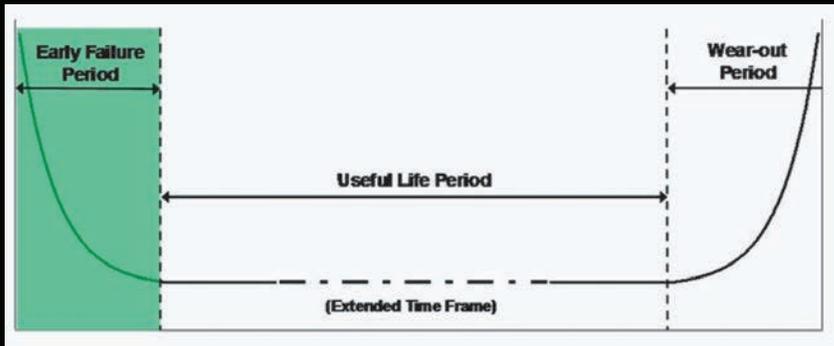
MOSFETs

IGBTs

Rectifiers

# About Microsemi's High-Reliability Non-Hermetic Products

Standard commercial grade semiconductor testing may not detect some types of problems such as cracked die or ionic contamination. These and other defects lead to early life failures, and screening for them is particularly important in large die devices. Microsemi's high-reliability Non-hermetic / Plastic products under go through an "Up-screening Program" Modeled on JANxxx Military Qualification Procedures uncover these defects and reduce or eliminate the region of early life failures. The tests are defined in MIL-PRF-19500, Appendix E, Table III.



Microsemi's high-reliability program also provides for date coding and lot traceability of all devices, continuous reliability monitoring, and controlled foundry, assembly, and test locations. Customers are also provided a full Certificate of Conformance with every lot. Any product changes are made only under a process/product change notification process with the customer.

We offer 3 levels of cost effective "up-screening" for more robust applications, such as avionics flight hardware, where even a very low level of device mortality is unacceptable. The available screening processes are described in the accompanying tables and are defined as MA, MXL and MX screening processes. These screening processes are recommended for all robust or harsh environmental applications, and for all power levels. Microsemi customers do not need to create Source Control Drawings nor define screening flows to specify these up-screening options.

**Examples: MA1.5KE48CA or MXSMLJ43CA**

Custom flows are always available from Microsemi to support application specific requirements.

## TRANSIENT VOLTAGE SUPPRESSORS

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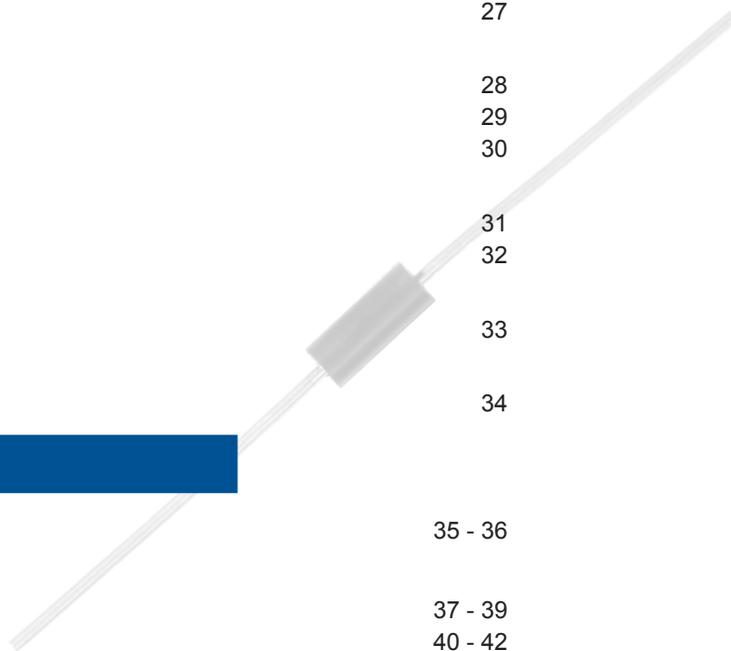
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Within the metal and composite shell of every jetliner, tens of thousands of sensitive semiconductor components perform critical functions from navigation to engine control. Since aircraft are struck by lightning on average twice a year, protection of sensitive electronic devices is essential.



## HiRel TVS Up-Screening Matrix

Process, Screen or Test Description	Product Assurance Level Requirement			
Part Prefix:	M	MA	MXL	MX
100% DC Electrical Test, Go/No-Go	R	R	R	R
3 Sigma lot norm of key parameters	R	R	R	R
Initial Surge Test	1x	1x	1x	1x
Post-surge Electrical Testing	R	R	R	R
Temperature Cycling Testing	10 Cycles <sup>1</sup>	10 Cycles	20 Cycles	20 Cycles
Post Temperature Cycling Surge	1x <sup>1</sup>	3x	10x	10x
Pre-HTRB Electrical Test, Read & Record			R	R
HTRB		24 hours <sup>2</sup>	96 hours <sup>3</sup>	96 hours <sup>3</sup>
Interim Electrical Test, Read & Record			R	R
Final Electrical Test, Read & Record	go/no-go <sup>1</sup>	go/no-go	R	R
Delta Calculations			R	R
PDA Evaluation			R	R
Group A Conformance Inspection			R	R
Group B Conformance Inspection				R
Group C Conformance Inspection				R
Certificate of Conformance	R	R	R	R

R - Required and performed based on MIL-PRF-19500 conditions and limits

1 - Tests performed on PLAD15KP, PLAD30KP, PLAD6.5KP and PLAD7.5KP only

2 - 24 hours for unidirectional. 24 hours each side for bidirectional.

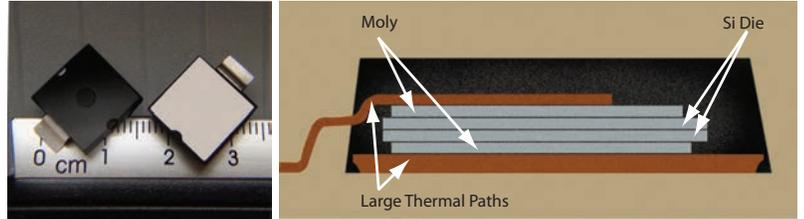
3 - 96 hours for unidirectional. 48 hours each side for bidirectional.

# High Reliability Non-Hermetic TVS

## TVS Diodes for Transient Voltage Protection for Avionics and Robust Environments or Applications

Microsemi Corporation (MSCC) is a world leader in the design, fabrication, qualification, and supply of Transient Voltage Suppressors (TVS). Applications include military and medical equipment, telecommunications, computers and their peripherals. Microsemi also provides protection to the electronics of engine control systems in the sophisticated avionics and aerospace industries. The company offers a broad portfolio of both uni- and bi-directional discrete plastic TVS devices with power levels from 600W to 130kW. The qualification test plans and reliability monitoring provided for all these products are in line with the best industry standard practices.

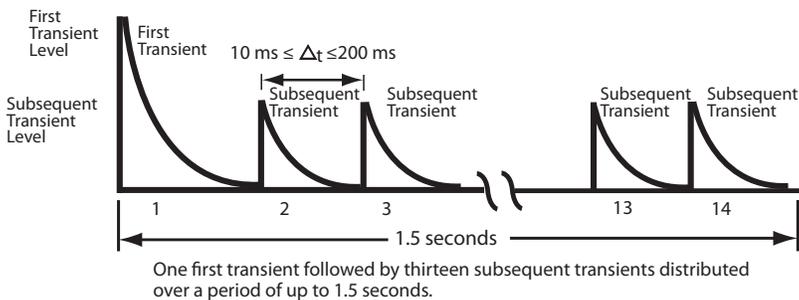
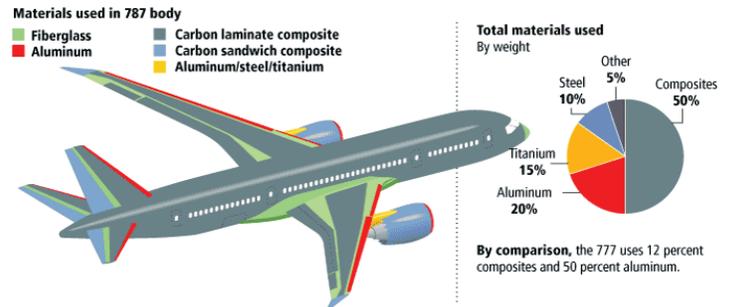
This catalog includes an exciting expansion in Microsemi's industry leading Plastic Large Area Device (PLAD) surface mount package offerings for TVS devices. PLADs provide large exposed metal pads on the bottom of the package with excellent direct internal connection to the die – there are no wire bonds. This provides a very low resistance thermal path, which is much superior to axial leaded devices and is critical in meeting the expanding requirements for multi-stroke and multi-burst event protection in composite body aircraft.



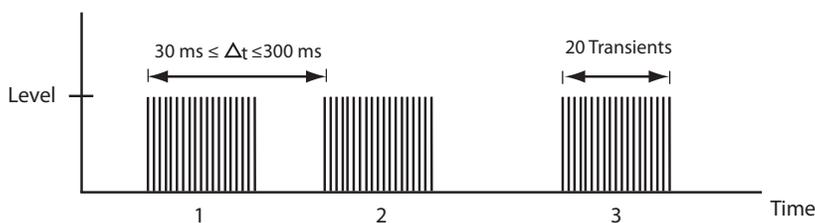
PLAD provides large exposed metal pads on the bottom of the package with excellent direct internal connection to the die (15KP and 30KP family packages shown).

### Multi-Stroke and Multi-Burst TVS Protection

Increasing emphasis is being placed on multi-stroke and multi-burst lightning protection, particularly (but not exclusively) in the protection of the growing proportion of new aircraft being built with largely composite bodies. Test standards for these hazards are defined by RTCA standard DO-160. Microsemi's high-reliability plastic PLAD packaged TVS devices are uniquely suited to address these requirements. Micronote 133 addresses these requirements in detail, and is available at [www.microsemi.com](http://www.microsemi.com).



### Multi-burst Test Specification



## Tutorial on TVS Component Selection

# Q&A

To use the TVS selection tables in this brochure, you must be able to answer the following questions:

**1. What is the continuous or repetitive peak operating voltage at the circuit location where the TVS will be placed to protect a sensitive load?**

This will determine the “Working Standoff Voltage” ( $V_{wm}$ ) and minimum “Breakdown Voltage” ( $V_{br}$ ) required of the TVS.  $V_{wm}$  is the voltage across the TVS in its “off”, non-conducting state. You typically match this to the nominal working voltage of the circuit you are protecting.  $V_{br}$  is the voltage at which avalanche breakdown begins and the TVS starts conducting.  $V_{br}$  must be greater than the high end of the tolerance range of the operating voltage of the circuit you are protecting.

**2. What is the worst case transient waveform in peak impulse current and pulse shape the TVS needs to divert around the sensitive load?**

This will determine the Peak Surge Current ( $I_{pp}$ ) the TVS must handle, and the correct de-rating factor (if any) required due to the pulse shape. See MicroNote 120.

**3. What is the worst case peak voltage the sensitive load can withstand for the pulse duration in item #2 above?**

This will determine the minimum Clamping Voltage ( $V_c$ ) required of the TVS. This is the voltage across the TVS at the Peak Surge Current ( $I_{pp}$ ).

**4. What is the repetitive peak pulse power dissipation required?**

This will determine the “Peak Pulse Power” ( $P_{pp}$ ) required of the TVS. It is equal to  $I_{pp} \times V_c$ .

**5. Is the required  $V_C$  lower in value than available on the data sheet for the  $V_{WM}$  described in item #1?**

If the answer is yes, oversizing the  $P_{pp}$  selection for a given pulse condition will reduce  $V_C$  and bring it closer to  $V_{BR}$  and  $V_{WM}$ . Also see MicroNote 108.

**6. What package style is needed – Axial or Surface Mount?**

**7. Is the pulse shape and duration different than that for which  $P_{pp}$  is specified, or is the waveform of the threat difficult to define?**

$P_{pp}$  is typically rated for one of two standard exponential waveforms – 8/20  $\mu s$  (8  $\mu s$  rise time, 20  $\mu s$  fall time to 50% of peak current) or 10/1000  $\mu s$ . Shorter or longer pulses or different pulse shapes will increase or decrease the peak power the TVS can safely dissipate. See MicroNote 125 for general recommendations regarding industry standards on protection, and MicroNote 120 for advice on adjusting for various waveforms.

# High Reliability Non-Hermetic TVS

## SYMBOLS AND DEFINITIONS

Symbol	Definition
$V_{WM}$	Working Standoff Voltage: The voltage across the TVS in its off, non-conducting state.
$V_{BR}$	Breakdown Voltage: The minimum voltage at which avalanche breakdown begins and the TVS starts conducting.
$P_{PP}$	Peak Pulse Power: The peak power that can be applied for a specific pulse width and waveform.
$I_D$	Standby Current: The maximum current that will flow at $V_{WM}$ .
$I_{PP}$	Peak Pulse Current: The peak current that can be applied for a specified pulse width and waveform.
C	Capacitance: The capacitance in picofarads of the TVS as defined and at 0V at a frequency of 1MHz.

## HIGH RELIABILITY TVS COMPONENT SUMMARY

The table below summarizes the Microsemi range of high-reliability TVS devices, while the images illustrate the package sizes. New families and packages will shortly be added to the product range.

Product Family	Rated Standoff Voltage V <sub>WM</sub>	Minimum Breakdown Voltage V <sub>BR</sub>	Peak Pulse Power Rating	SMD/Axial	Package
SMB	5.0V - 170V	6.4V - 189V	600W	SMD	DO-214AA, DO-215AA
SMC	5.0V - 170V	6.4V - 189V	1.5kW	SMD	DO-214AB, DO-215AB
SMCxLCE	6.5V - 170V	7.22V - 189V	1.5kW	SMD	DO-214AB, DO-215AB
SML	5.0V - 170V	6.4V - 189V	3kW	SMD	DO-214AB, DO-215AB
PLAD6.5KP	10V - 48V	11.1V - 189V	6.5kW	SMD	mini-PLAD
PLAD7.5KP	10V - 48V	11.1V - 189V	7.5kW	SMD	mini-PLAD
PLAD15KP	7.0V - 200V	7.78V - 222V	15kW	SMD	PLAD
PLAD30KP	14V - 400V	15.6V - 444V	30kW	SMD	PLAD
P4KE	5.8V - 342V	6.45V - 380V	400W	Axial	DO-41 [DO-204AL]
P6KE	5.8V - 171V	6.45V - 190V	600W	Axial	T-18
1.5KE	5.8V - 324V	6.45V - 380V	1.5kW	Axial	Case 1
LCE	6.5V - 170V	7.22V - 189V	1.5kW	Axial	Case 1
5KP	5V - 110V	6.4V - 122V	5kW	Axial	Case 5A [DO-204AR]
15KP	22V - 280V	24.4V - 311V	15kW	Axial	Case 5A [DO-204AR]
RT100KP	40V - 400V	44.4V - 444V	100kW	Axial	Case 5A [DO-204AR]
PK5E	5.0V - 170V	6.4V - 189V	500W	Axial	DO41 [DO-204AL]
SMBJSAC	5.0V - 75V	7.60V - 83.3V	500W	SMD	DO-214AA
RT130KP	275V - 295V	300V	130kW	Axial	Case 5A [DO-204AR]
RT65KP	48V - 75V	53.3V - 83.3V	65kW	Axial	Case 5A [DO-204AR]
SMBG2K	3.0V - 5.0V	4.3V - 5.9V	300 - 2000W	SMD	DO-214AA, DO-215AA



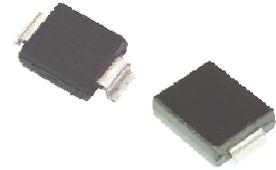
The following pages detail the range of High-Reliability Plastic TVS devices available. Refer to the applicable datasheets for more comprehensive information. All Microsemi technical documents are located on Microsemi's website: [www.microsemi.com](http://www.microsemi.com).

# SMB/SMC/SML Surface Mount Devices

## SMx Surface Mount Devices from the Discrete Products Group (DPG)

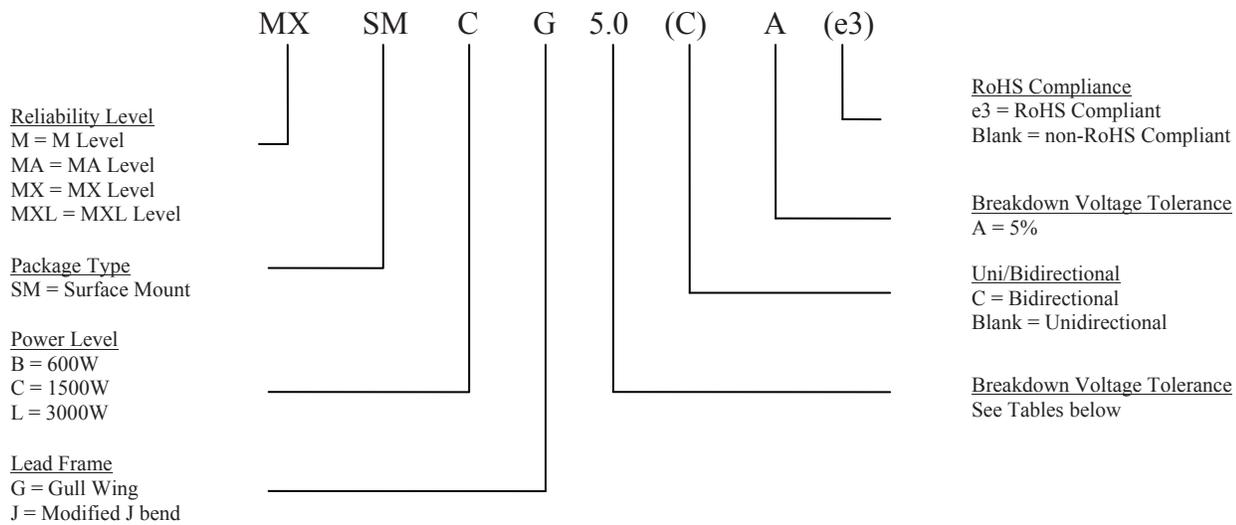
### FEATURES

- Peak Pulse Power at 10/1000 $\mu$ S
  - SMB series – 600W
  - SMC series – 1500W
  - SML series – 3000W
- Standoff voltages of 5V to 170V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional and Bidirectional versions available
- Available in Gull-Wing and modified J-lead lead forming designs



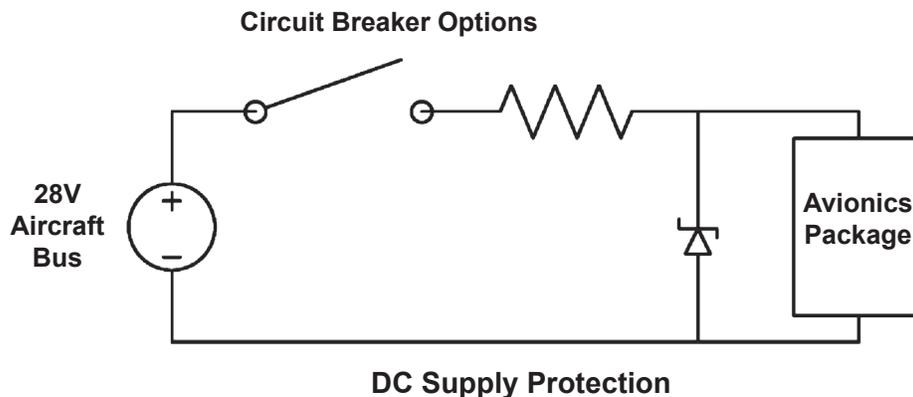
### APPEARANCE

### PART NOMENCLATURE



#### Sample Part Number

**MXLSMLG36CA** – MXL screened surface mount 3kW device, Gull Wing, 36V stand-off, bi-directional, 5% tolerance and non-RoHS compliant.



# SMB Surface Mount Devices (SMDs)

## SMB 600 WATT, ALL ELECTRICAL CHARACTERISTICS @ 25 °C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$	BREAKDOWN CURRENT $I_{BR}$	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_c$	PEAK PULSE CURRENT $I_{PP}$	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$
	Volts	Volts	mA	Volts	Amps	$\mu A$
SMBx5.0A	5.0	6.40	10	9.2	65.2	800
SMBx6.0A	6.0	6.67	10	10.3	58.3	800
SMBx6.5A	6.5	7.22	10	11.2	53.6	500
SMBx7.0A	7.0	7.78	10	12.0	50.0	200
SMBx7.5A	7.5	8.33	1	12.9	46.5	100
SMBx8.0A	8.0	8.89	1	13.6	44.1	50
SMBx8.5A	8.5	9.44	1	14.4	41.7	10
SMBx9.0A	9.0	10.0	1	15.4	39.0	5
SMBx10A	10	11.1	1	17.0	35.3	5
SMBx11A	11	12.2	1	18.2	33.0	5
SMBx12A	12	13.3	1	19.9	30.2	5
SMBx13A	13	14.4	1	21.5	27.9	1
SMBx14A	14	15.6	1	23.2	25.8	1
SMBx15A	15	16.7	1	24.4	24.0	1
SMBx16A	16	17.8	1	26.0	23.1	1
SMBx17A	17	18.9	1	27.6	21.7	1
SMBx18A	18	20.0	1	29.2	20.5	1
SMBx20A	20	22.2	1	32.4	18.5	1
SMBx22A	22	24.4	1	35.5	16.9	1
SMBx24A	24	26.7	1	38.9	15.4	1
SMBx26A	26	28.9	1	42.1	14.2	1
SMBx28A	28	31.1	1	45.4	13.2	1
SMBx30A	30	33.3	1	48.4	12.4	1
SMBx33A	33	36.7	1	53.3	11.3	1
SMBx36A	36	40.0	1	58.1	10.3	1
SMBx40A	40	44.4	1	64.5	9.3	1
SMBx43A	43	47.8	1	69.4	8.6	1
SMBx45A	45	50.0	1	72.7	8.3	1
SMBx48A	48	53.3	1	77.4	7.7	1
SMBx51A	51	56.7	1	82.4	7.3	1
SMBx54A	54	60.0	1	87.1	6.9	1
SMBx58A	58	64.4	1	93.6	6.4	1
SMBx60A	60	66.7	1	96.8	6.2	1
SMBx64A	64	71.1	1	103	5.8	1
SMBx70A	70	77.8	1	113	5.3	1
SMBx75A	75	83.3	1	121	4.9	1
SMBx78A	78	86.7	1	126	4.7	1
SMBx85A	85	94.4	1	137	4.4	1
SMBx90A	90	100	1	146	4.1	1
SMBx100A	100	111	1	162	3.7	1
SMBx110A	110	122	1	177	3.4	1
SMBx120A	120	133	1	193	3.1	1
SMBx130A	130	144	1	209	2.9	1
SMBx150A	150	167	1	243	2.5	1
SMBx160A	160	178	1	259	2.3	1
SMBx170A	170	189	1	275	2.2	1

### PAD LAYOUT

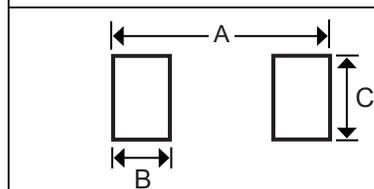
	SMBJ (DO-214AA)		SMBG (DO-215AA)		
	INCHES	mm	INCHES	mm	
A	.260	6.60	A	.320	8.13
B	.085	2.16	B	.085	2.16
C	.110	2.79	C	.110	2.79

# SMC Surface Mount Devices (SMDs)

## SMC 1.5kW, ALL ELECTRICAL CHARACTERISTICS @ 25 °C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
SMCx5.0A	5.0	6.40	10	9.2	163.0	1000
SMCx6.0A	6.0	6.67	10	10.3	145.6	1000
SMCx6.5A	6.5	7.22	10	11.2	133.9	500
SMCx7.0A	7.0	7.78	10	12.0	125.0	200
SMCx7.5A	7.5	8.33	1	12.9	116.3	100
SMCx8.0A	8.0	8.89	1	13.6	110.3	50
SMCx8.5A	8.5	9.44	1	14.4	104.2	20
SMCx9.0A	9.0	10.0	1	15.4	97.4	10
SMCx10A	10	11.1	1	17.0	88.2	5
SMCx11A	11	12.2	1	18.2	82.4	5
SMCx12A	12	13.3	1	19.9	75.3	5
SMCx13A	13	14.4	1	21.5	69.7	1
SMCx14A	14	15.6	1	23.2	64.7	1
SMCx15A	15	16.7	1	24.4	61.5	1
SMCx16A	16	17.8	1	26.0	57.7	1
SMCx17A	17	18.9	1	27.6	53.3	1
SMCx18A	18	20.0	1	29.2	51.4	1
SMCx20A	20	22.2	1	32.4	46.3	1
SMCx22A	22	24.4	1	35.5	42.2	1
SMCx24A	24	26.7	1	38.9	38.6	1
SMCx26A	26	28.9	1	42.1	35.6	1
SMCx28A	28	31.1	1	45.4	33.0	1
SMCx30A	30	33.3	1	48.4	31.0	1
SMCx33A	33	36.7	1	53.3	28.1	1
SMCx36A	36	40.0	1	58.1	25.8	1
SMCx40A	40	44.4	1	64.5	23.2	1
SMCx43A	43	47.8	1	69.4	21.6	1
SMCx45A	45	50.0	1	72.7	20.6	1
SMCx48A	48	53.3	1	77.4	19.4	1
SMCx51A	51	56.7	1	82.4	18.2	1
SMCx54A	54	60.0	1	87.1	17.2	1
SMCx58A	58	64.4	1	93.6	16.0	1
SMCx60A	60	66.7	1	96.8	15.5	1
SMCx64A	64	71.1	1	103.0	14.6	1
SMCx70A	70	77.8	1	113	13.3	1
SMCx75A	75	83.3	1	121	12.4	1
SMCx78A	78	86.7	1	126	11.4	1
SMCx85A	85	94.4	1	137	10.4	1
SMCx90A	90	100	1	146	10.3	1
SMCx100A	100	111	1	162	9.3	1
SMCx110A	110	122	1	177	8.4	1
SMCx120A	120	133	1	193	7.8	1
SMCx130A	130	144	1	209	7.2	1
SMCx150A	150	167	1	243	6.2	1
SMCx160A	160	178	1	259	5.8	1
SMCx170A	170	189	1	275	5.5	1

### PAD LAYOUT



#### SMCJ (DO-214AB)

	INCHES	mm
A	.390	9.90
B	.110	2.79
C	.150	3.81

#### SMCG (DO-215AB)

	INCHES	mm
A	.510	12.95
B	.110	2.79
C	.150	3.81

# SML Surface Mount Devices (SMDs)

## SML 3kW, ALL ELECTRICAL CHARACTERISTICS @ 25 °C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
SMLx5.0A	5.0	6.40	10	9.2	326.0	1000
SMLx6.0A	6.0	6.67	10	10.3	291.3	1000
SMLx6.5A	6.5	7.22	10	11.2	267.9	500
SMLx7.0A	7.0	7.78	10	12.0	250.0	200
SMLx7.5A	7.5	8.33	1	12.9	232.6	100
SMLx8.0A	8.0	8.89	1	13.6	220.6	50
SMLx8.5A	8.5	9.44	1	14.4	208.4	25
SMLx9.0A	9.0	10.0	1	15.4	194.8	10
SMLx10A	10	11.1	1	17.0	176.4	5
SMLx11A	11	12.2	1	18.2	164.8	5
SMLx12A	12	13.3	1	19.9	150.6	5
SMLx13A	13	14.4	1	21.5	139.4	5
SMLx14A	14	15.6	1	23.2	129.4	2
SMLx15A	15	16.7	1	24.4	123.0	2
SMLx16A	16	17.8	1	26.0	115.4	2
SMLx17A	17	18.9	1	27.6	106.6	2
SMLx18A	18	20.0	1	29.2	102.8	2
SMLx20A	20	22.2	1	32.4	92.6	2
SMLx22A	22	24.4	1	35.5	84.4	2
SMLx24A	24	26.7	1	38.9	77.2	2
SMLx26A	26	28.9	1	42.1	71.2	2
SMLx28A	28	31.1	1	45.4	66.0	2
SMLx30A	30	33.3	1	48.4	62.0	2
SMLx33A	33	36.7	1	53.3	56.2	2
SMLx36A	36	40.0	1	58.1	51.6	2
SMLx40A	40	44.4	1	64.5	46.4	2
SMLx43A	43	47.8	1	69.4	43.2	2
SMLx45A	45	50.0	1	72.7	41.2	2
SMLx48A	48	53.3	1	77.4	38.8	2
SMLx51A	51	56.7	1	82.4	36.4	2
SMLx54A	54	60.0	1	87.1	34.4	2
SMLx58A	58	64.4	1	93.6	32.0	2
SMLx60A	60	66.7	1	96.8	31.0	2
SMLx64A	64	71.1	1	103	29.2	2
SMLx70A	70	77.8	1	113	26.6	2
SMLx75A	75	83.3	1	121	24.8	2
SMLx78A	78	86.7	1	126	22.8	2
SMLx85A	85	94.4	1	137	20.8	2
SMLx90A	90	100	1	146	20.6	2
SMLx100A	100	111	1	162	18.6	2
SMLx110A	110	122	1	177	16.8	2
SMLx120A	120	133	1	193	15.6	2
SMLx130A	130	144	1	209	14.4	2
SMLx150A	150	167	1	243	12.4	2
SMLx160A	160	178	1	259	11.6	2
SMLx170A	170	189	1	275	11.0	2

### PAD LAYOUT

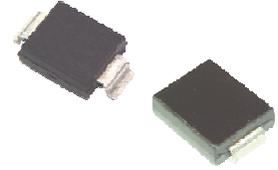
	SMLJ (DO-214AB)		SMLG (DO-215AB)		
		INCHES	mm		INCHES
A	.390	9.90	A	.510	12.95
B	.110	2.79	B	.110	2.79
C	.150	3.81	C	.150	3.81

# SMCxLCE Surface Mount Devices (SMDs)

## Low Capacitance 1.5kW SMDs from the Discrete Products Group (DPG)

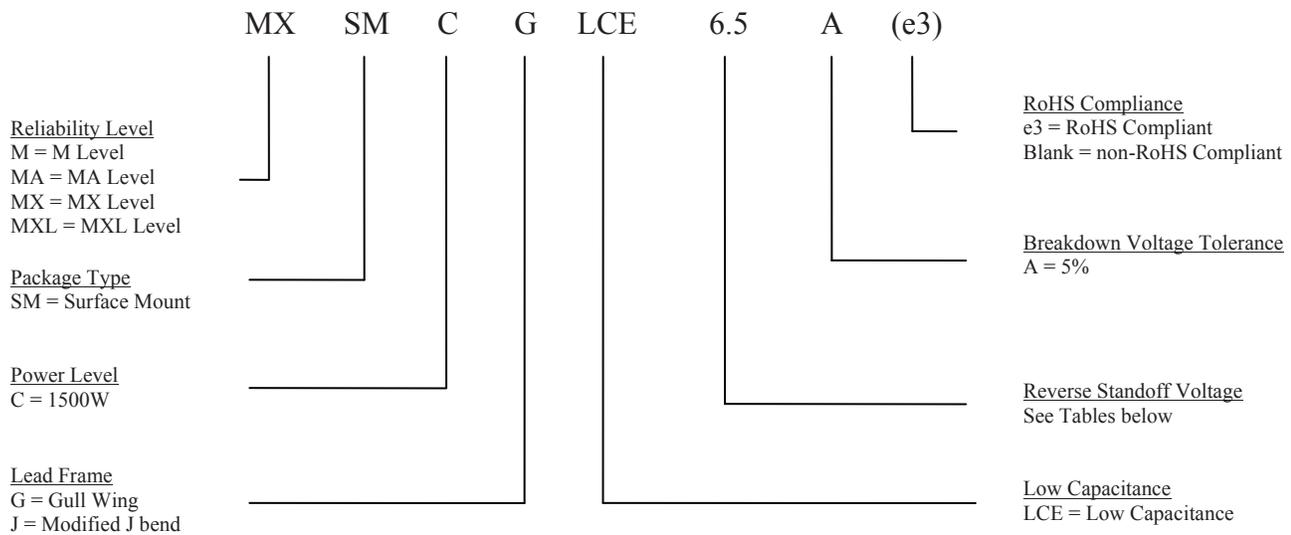
### FEATURES

- 1500W Peak Pulse Power at 10/1000 $\mu$ S
- Standoff voltages of 6.5V to 170V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional versions only
- Available in Gull-Wing and modified J-lead lead forming designs
- Uses a rectifier diode in series and in the opposite direction of the protection diode to lower device capacitance
- Replaces axial LCE devices for surface mount applications



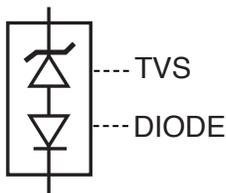
### APPEARANCE

### PART NOMENCLATURE

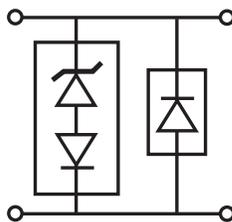


#### Sample Part Number

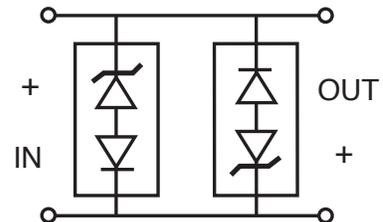
**MXSMCJLCE6.5Ae3** – MX screened surface mount 1.5kW device, J bend, 6.5V stand-off, uni-directional low capacitance, 5% tolerance and RoHS compliant.



TVS with internal low capacitance rectifier diode



Optional Unidirectional configuration (TVS and separate rectifier diode in parallel)



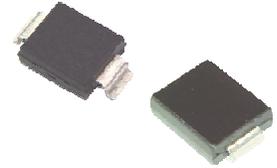
Optional Bidirectional configuration ( two TVS devices in parallel)

# MSMBG Surface Mount Devices (SMDs)

## Low Capacitance 2.5kW SMDs from the Discrete Products Group (DPG)

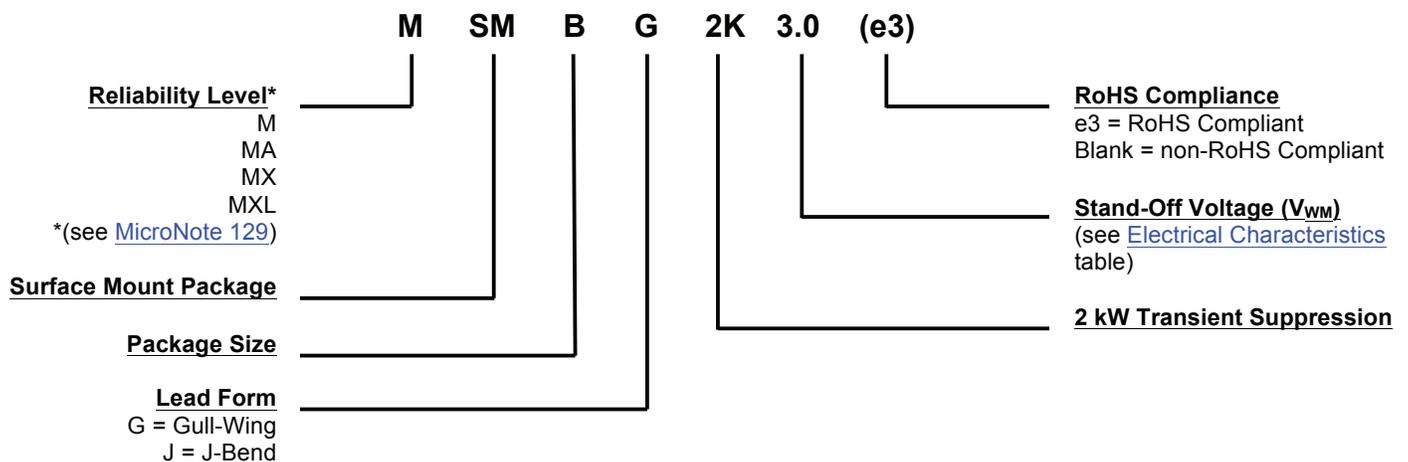
### FEATURES

- High reliability upscreened devices with wafer fabrication and assembly lot traceability.
- All devices 100% surge tested.
- Suppresses transients up to 2 kW @ 8/20  $\mu$ s.
- Other screening in reference to MIL-PRF-19500 is also available. Refer to MicroNote 129 for more details on the screening options. (See part nomenclature for all options.)
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B.
- 3 $\sigma$  lot norm screening performed on standby current ID.
- RoHS compliant versions available.



### APPEARANCE

### PART NOMENCLATURE



### ELECTRICAL CHARACTERISTICS @ 25°C

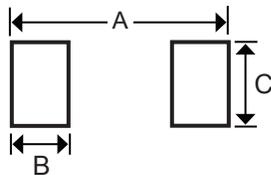
PART NUMBER		BREAKDOWN VOLTAGE Minimum	BREAKDOWN CURRENT	RATED STANDOFF VOLTAGE	MAX STANDBY CURRENT	MAX CLAMPING VOLTAGE	PEAK PULSE CURRENT	TEMPERATURE COEFFICIENT of $V_{(BR)}$
		$V_{(BR)}$	$I_{(BR)}$	$V_{WM}$	$I_D @ V_{WM}$	$V_C @ I_{PP}$	$I_{PP}$	$\alpha_{V(BR)}$
Gull-Wing	J-Bend	V	mA	V	$\mu$ A	V	A	% / °C
MSMBG2K3.0	MSMBJ2K3.0	4.3	50	3.0	1500	5.4	10	+0/ -0.05
MSMBG2K3.3	MSMBJ2K3.3	4.6	50	3.3	700	5.8	10	$\pm$ 0.025
MSMBG2K4.0	MSMBJ2K4.0	5.0	50	4.0	400	6.3	10	$\pm$ 0.030
MSMBG2K4.5	MSMBJ2K4.5	5.4	50	4.5	50	6.6	10	$\pm$ 0.040
MSMBG2K5.0	MSMBJ2K5.0	5.9	50	5.0	5	7.6	10	+0.050

# SMCxLCE Surface Mount Devices (SMDs)

## SMCxLCE 1.5kW, ALL ELECTRICAL CHARACTERISTICS @ 25 °C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$ Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$ Volts	BREAKDOWN CURRENT $I_{BR}$ mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_c$ Volts	PEAK PULSE CURRENT $I_{PP}$ Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$ $\mu A$	MAX CAP @ 0 Volts $f=1$ MHZ pF	WORKING INVERSE BLOCKING VOLTAGE $V_{WIB}$ Volts	INVERSE BLOCKING LEAKAGE CURRENT $I_{IB}$ $\mu A$	PEAK INVERSE BLOCKING VOLTAGE $V_{PIB}$ Volts
SMCxLCE6.5A	6.5	7.22	10	11.2	100	1000	100	75	10	100
SMCxLCE7.0A	7.0	7.78	10	12.0	100	500	100	75	10	100
SMCxLCE7.5A	7.5	8.33	10	12.9	100	250	100	75	10	100
SMCxLCE8.0A	8.0	8.89	1	13.6	100	100	100	75	10	100
SMCxLCE8.5A	8.5	9.44	1	14.4	100	50	100	75	10	100
SMCxLCE9.0A	9.0	10.0	1	15.4	97	10	100	75	10	100
SMCxLCE10A	10	11.1	1	17.0	88	5	100	75	10	100
SMCxLCE11A	11	12.2	1	18.2	82	5	100	75	10	100
SMCxLCE12A	12	13.3	1	19.9	75	5	100	75	10	100
SMCxLCE13A	13	14.4	1	21.5	70	5	100	75	10	100
SMCxLCE14A	14	15.6	1	23.2	65	5	100	75	10	100
SMCxLCE15A	15	16.7	1	24.4	61	5	100	75	10	100
SMCxLCE16A	16	17.8	1	26.0	57	5	100	75	10	100
SMCxLCE17A	17	18.9	1	27.6	49	5	100	75	10	100
SMCxLCE18A	18	20.0	1	29.2	51	5	100	75	10	100
SMCxLCE20A	20	22.2	1	32.4	46	5	100	75	10	100
SMCxLCE22A	22	24.4	1	35.5	42	5	100	75	10	100
SMCxLCE24A	24	26.7	1	38.9	39	5	100	75	10	100
SMCxLCE26A	26	28.9	1	42.1	36	5	100	75	10	100
SMCxLCE28A	28	31.1	1	45.5	33	5	100	75	10	100
SMCxLCE30A	30	33.3	1	48.4	31	5	100	75	10	100
SMCxLCE33A	33	36.7	1	53.3	28.1	5	100	75	10	100
SMCxLCE36A	36	40.0	1	58.1	25.8	5	100	75	10	100
SMCxLCE40A	40	44.4	1	64.5	23.3	5	100	75	10	100
SMCxLCE43A	43	47.8	1	69.4	21.6	5	100	150	10	200
SMCxLCE45A	45	50.0	1	72.7	20.6	5	100	150	10	200
SMCxLCE48A	48	53.3	1	77.4	19.4	5	100	150	10	200
SMCxLCE51A	51	56.7	1	82.4	18.2	5	100	150	10	200
SMCxLCE54A	54	60.0	1	87.1	17.2	5	100	150	10	200
SMCxLCE58A	58	64.4	1	93.6	16.0	5	100	150	10	200
SMCxLCE60A	60	66.7	1	96.8	15.5	5	90	150	10	200
SMCxLCE64A	64	71.1	1	103	14.6	5	90	150	10	200
SMCxLCE70A	70	77.8	1	113	13.3	5	90	150	10	200
SMCxLCE75A	75	83.3	1	121	12.4	5	90	150	10	200
SMCxLCE80A	80	88.7	1	129	11.6	5	90	150	10	200
SMCxLCE90A	90	100	1	146	10.3	5	90	300	10	200
SMCxLCE100A	100	111	1	162	9.3	5	90	300	10	200
SMCxLCE110A	110	122	1	178	8.4	5	90	300	10	400
SMCxLCE120A	120	133	1	193	7.8	5	90	300	10	400
SMCxLCE130A	130	144	1	209	7.2	5	90	300	10	400
SMCxLCE150A	150	167	1	243	6.2	5	90	300	10	400
SMCxLCE160A	160	178	1	259	5.8	5	90	300	10	400
SMCxLCE170A	170	189	1	275	5.4	5	90	300	10	400

### PAD LAYOUT



#### SMCJ (DO-214AB)

	INCHES	mm
A	.390	9.90
B	.110	2.79
C	.150	3.81

#### SMCG (DO-215AB)

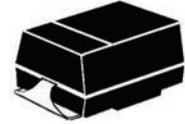
	INCHES	mm
A	.510	12.95
B	.110	2.79
C	.150	3.81

# SMBJSAC Surface Mount Devices (SMDs)

## Low Capacitance 1.5kW SMDs from the Discrete Products Group (DPG)

### FEATURES

- High reliability controlled devices with wafer fabrication and assembly lot traceability
- 100% surge tested devices
- Optional up screening available by replacing the M prefix with MA, MX or MXL. These prefixes specify various screening and conformance inspection options based on MIL-PRF-19500. Refer to MicroNote 129 for more details on the screening options
- Low capacitance performance of 30pF
- Suppresses transients up to 500 W Peak Pulse Power @ 10/1000
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant devices available by adding an “e3” suffix
- 3σ lot norm screening performed on Standby Current ID



### APPEARANCE

## MSMBJSAC5.0 thru MSMBJSAC75, e3, ALL ELECTRICAL CHARACTERISTICS @ 25 °C

MICROSEMI PART NUMBER	REVERSE STAND-OFF VOLTAGE (Note 1) $V_{WM}$ Volts	BREAKDOWN VOLTAGE @ $I_{BR}$ 1.0mA $V_{(BR)}$ Volts Min.	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$ μA	MAXIMUM CLAMPING VOLTAGE $I_P = 5.0A^*$ $V_C$ Volts	MAXIMUM PEAK PULSE CURRENT* RATING $I_{PP}$ Amps	MAXIMUM CAPACITANCE @ 0 Volts, f=1 MHz pF	WORKING INVERSE BLOCKING VOLTAGE $V_{WIB}$ Volts	INVERSE BLOCKING LEAKAGE CURRENT $I_{IB}$ @ $V_{WIB}$ μA	PEAK INVERSE BLOCKING VOLTAGE $V_{PIB}$ Volts
MSMBJSAC5.0	5.0	7.60	300	10.0	44	30	75	10	100
MSMBJSAC6.0	6.0	7.90	300	11.2	41	30	75	10	100
MSMBJSAC7.0	7.0	8.33	300	12.6	38	30	75	10	100
MSMBJSAC8.0	8.0	8.89	100	13.4	36	30	75	10	100
MSMBJSAC8.5	8.5	9.44	50	14.0	34	30	75	10	100
MSMBJSAC10	10	11.10	5.0	16.3	29	30	75	10	100
MSMBJSAC12	12	13.30	5.0	19.0	25	30	75	10	100
MSMBJSAC15	15	16.70	5.0	23.6	20	30	75	10	100
MSMBJSAC18	18	20.00	5.0	28.8	15	30	75	10	100
MSMBJSAC22	22	24.40	5.0	35.4	14	30	75	10	100
MSMBJSAC26	26	28.90	5.0	42.3	11.1	30	75	10	100
MSMBJSAC36	36	40.0	5.0	60.0	8.6	30	75	10	100
MSMBJSAC45	45	50.00	5.0	77.0	6.8	30	150	10	200
MSMBJSAC50	50	55.50	5.0	88.0	5.8	30	150	10	200
MSMBJSAC75	75	83.3	5.0	121	4.1	30	150	10	200

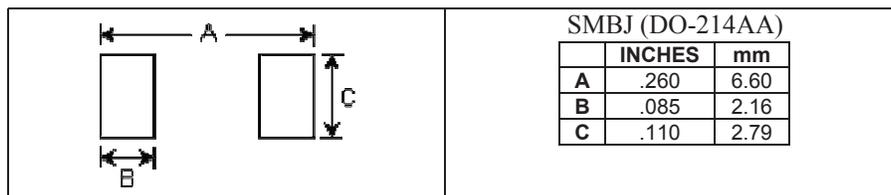
\*See Figure 3. For the MSMBJSAC75, the maximum clamping voltage  $V_C$  is at the maximum rated Peak Pulse Current ( $I_{PP}$ ) of 4.1 Amps.

**Clamping Factor:** The ratio of the numerical value of  $V_C$  to  $V_{(BR)}$  is typically 1.4 @ full rated power, 1.20 @ 50% rated power. Also see MicroNote 108.

**Note 1:** A transient voltage suppressor is normally selected according to voltage ( $V_{WM}$ ), that should be equal to or greater than the dc or continuous peak operating voltage level.

**Note 2:** When pulse testing, test in TVS avalanche direction. Do not pulse in “forward” direction. See section for “Schematic Applications” herein.

### PAD LAYOUT



# PLAD Surface Mount Devices

## PLAD Surface Mount Devices from the Discrete Products Group (DPG)

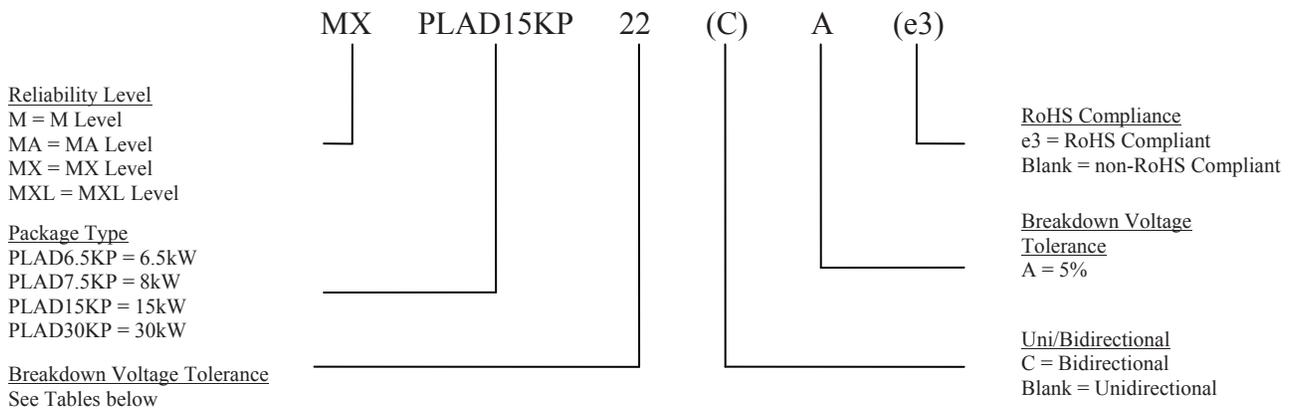
### FEATURES

- Peak Pulse Power at 10/1000 $\mu$ s
  - PLAD6.5KP series – 6.5kW
  - PLAD7.5KP series – 7.5kW
  - PLAD15KP series – 15kW
  - PLAD30KP series – 30kW
- Standoff voltage
  - PLAD6.5KP – 10V to 48V
  - PLAD7.5KP – 10V to 48V
  - PLAD15KP – 7V to 200V
  - PLAD30KP – 14V to 400V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional and Bidirectional versions available
- Replaces high power through-hole devices for surface mount applications

### APPEARANCE

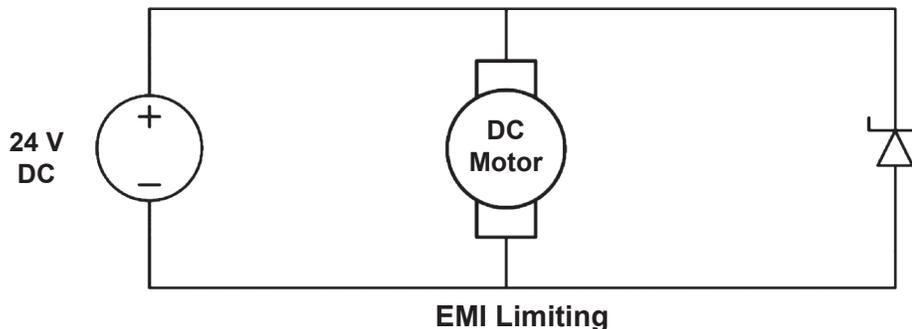


### PART NOMENCLATURE



#### Sample Part Number

**MXPLAD15KP9.0Ae3** – MX screened PLAD 15kW device, 9V reverse stand-off, uni-directional, 5% tolerance and RoHS compliant



## PLAD6.5KP 6.5kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_b$  $\mu A$
PLAD6.5KP10A PLAD6.5KP11A	10 11	11.1 - 12.3 12.2 - 13.5	5 5	17.0 18.2	383 358	15 10
PLAD6.5KP12A PLAD6.5KP13A	12 13	13.3 - 14.7 14.4 - 15.9	5 5	19.9 21.5	327 302	10 10
PLAD6.5KP14A PLAD6.5KP15A	14 15	15.6 - 17.2 16.7 - 18.5	5 5	23.2 24.4	280 267	10 10
PLAD6.5KP16A PLAD6.5KP17A	16 17	17.8 - 19.7 18.9 - 20.9	5 5	26.0 27.6	250 236	10 10
PLAD6.5KP18A PLAD6.5KP20A	18 20	20.0 - 22.1 22.2 - 24.5	5 5	29.2 32.4	223 202	10 10
PLAD6.5KP22A PLAD6.5KP24A	22 24	24.4 - 26.9 26.7 - 29.5	5 5	35.5 38.9	183 167	10 10
PLAD6.5KP26A PLAD6.5KP28A	26 28	28.9 - 31.9 31.1 - 34.4	5 5	42.1 45.5	154 143	10 10
PLAD6.5KP30A PLAD6.5KP33A	30 33	33.3 - 36.8 36.7 - 40.6	5 5	48.4 53.3	135 123	10 10
PLAD6.5KP36A PLAD6.5KP40A	36 40	40.0 - 44.2 44.4 - 49.1	5 5	58.1 64.5	111 101	10 10
PLAD6.5KP43A PLAD6.5KP45A	43 45	47.8 - 52.8 50.0 - 55.3	5 5	69.4 72.7	93 89	10 10
PLAD6.5KP48A	48	53.3 - 58.9	5	77.4	85	10

## PLAD7.5KP 7.5kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
PLAD7.5KP10A PLAD7.5KP11A	10 11	11.1 - 12.3 12.2 - 13.5	5 5	17.0 18.2	471 440	15 10
PPLAD7.5KP12A PPLAD7.5KP13A	12 13	13.3 - 14.7 14.4 - 15.9	5 5	19.9 21.5	402 372	10 10
PLAD7.5KP14A PPLAD7.5KP15A	14 15	15.6 - 17.2 16.7 - 18.5	5 5	23.2 24.4	345 328	10 10
PLAD7.5KP16A PLAD7.5KP17A	16 17	17.8 - 19.7 18.9 - 20.9	5 5	26.0 27.6	308 290	10 10
PLAD7.5KP18A PLAD7.5KP20A	18 20	20.0 - 22.1 22.2 - 24.5	5 5	29.2 32.4	274 248	10 10
PLAD7.5KP22A PLAD7.5KP24A	22 24	24.4 - 26.9 26.7 - 29.5	5 5	35.5 38.9	225 206	10 10
PLAD7.5KP26A PPLAD7.5KP28A	26 28	28.9 - 31.9 31.1 - 34.4	5 5	42.1 45.5	190 176	10 10
PLAD7.5KP30A PLAD7.5KP33A	30 33	33.3 - 36.8 36.7 - 40.6	5 5	48.4 53.3	166 151	10 10
PLAD7.5KP36A PLAD7.5KP40A	36 40	40.0 - 44.2 44.4 - 49.1	5 5	58.1 64.5	137 124	10 10
PLAD7.5KP43A PLAD7.5KP45A	43 45	47.8 - 52.8 50.0 - 55.3	5 5	69.4 72.7	115 110	10 10
PPLAD7.5KP48A	48	53.3 - 58.9	5	77.4	104	10

## PLAD15KP 15kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
PLAD15KP7.0A	7.0	7.78	150	12.0	1251	3000
PLAD15KP7.5A	7.5	8.33	5	12.9	1164	750
PLAD15KP8.0A	8.0	8.89	5	13.6	1101	450
PLAD15KP8.5A	8.5	9.44	5	14.4	1041	150
PLAD15KP9.0A	9.0	10.0	5	15.4	975	60
PLAD15KP10A	10	11.1	5	17.0	882	45
PLAD15KP11A	11	12.2	5	18.2	822	10
PLAD15KP12A	12	13.3	5	19.9	753	10
PLAD15KP13A	13	14.4	5	21.5	696	10
PLAD15KP14A	14	15.6	5	23.2	645	10
PLAD15KP15A	15	16.7	5	24.4	618	10
PLAD15KP16A	16	17.8	5	26.0	576	10
PLAD15KP17A	17	18.9	5	27.6	543	10
PLAD15KP18A	18	20.0	5	29.2	516	10
PLAD15KP20A	20	22.2	5	32.4	462	10
PLAD15KP22A	22	24.4	5	35.5	423	10
PLAD15KP24A	24	26.7	5	38.9	384	10
PLAD15KP26A	26	28.9	5	42.1	357	10
PLAD15KP28A	28	31.1	5	45.5	330	10
PLAD15KP30A	30	33.3	5	48.4	309	10
PLAD15KP33A	33	36.7	5	53.3	282	10
PLAD15KP36A	36	40.0	5	58.1	258	10
PLAD15KP40A	40	44.4	5	64.5	234	10
PLAD15KP43A	43	47.8	5	69.4	216	10
PLAD15KP45A	45	50.0	5	72.7	207	10
PLAD15KP48A	48	53.3	5	77.4	195	10
PLAD15KP51A	51	56.7	5	82.4	183	10
PLAD15KP54A	54	60.0	5	87.1	171	10
PLAD15KP58A	58	64.4	5	93.6	159	10
PLAD15KP60A	60	66.7	5	96.8	156	10
PLAD15KP64A	64	71.1	5	103	147	10
PLAD15KP70A	70	77.8	5	113	132	10
PLAD15KP75A	75	83.3	5	121	123	10
PLAD15KP78A	78	86.7	5	126	120	10
PLAD15KP85A	85	94.4	5	137	108	10
PLAD15KP90A	90	100	5	146	102	10
PLAD15KP100A	100	111	5	162	93	10
PLAD15KP110A	110	122	5	177	84	10
PLAD15KP120A	120	133	5	193	78	10
PLAD15KP130A	130	144	5	209	71	10
PLAD15KP150A	150	167	5	243	62	10
PLAD15KP160A	160	178	5	259	58	10
PLAD15KP170A	170	189	5	275	55	10
PLAD15KP180A	180	200	5	291	52	10
PLAD15KP200A	200	222	5	322	47	10

## PLAD30KP 30kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_b$  $\mu A$
PLAD30KP14A	14	15.6	150	24.0	1251	3000
PLAD30KP15A	15	16.7	5	25.8	1164	750
PLAD30KP16A	16	17.8	5	27.2	1101	450
PLAD30KP17A	17	18.9	5	28.8	1041	150
PLAD30KP18A	18	20.0	5	30.8	975	60
PLAD30KP20A	20	22.2	5	34.0	882	45
PLAD30KP22A	22	24.4	5	36.4	822	10
PLAD30KP24A	24	26.7	5	39.8	753	10
PLAD30KP26A	26	28.9	5	43.0	696	10
PLAD30KP28A	28	31.1	5	46.4	645	10
PLAD30KP30A	30	33.3	5	48.8	618	10
PLAD30KP33A	33	36.7	5	53.3	564	10
PLAD30KP36A	36	40.0	5	58.1	516	10
PLAD30KP40A	40	44.4	5	64.5	468	10
PLAD30KP43A	43	47.8	5	69.4	432	10
PLAD30KP45A	45	50.0	5	72.7	414	10
PLAD30KP48A	48	53.3	5	77.4	390	10
PLAD30KP51A	51	56.7	5	82.4	366	10
PLAD30KP54A	54	60.0	5	87.1	342	10
PLAD30KP58A	58	64.4	5	93.6	318	10
PLAD30KP60A	60	66.7	5	96.8	312	10
PLAD30KP64A	64	71.1	5	103.0	294	10
PLAD30KP70A	70	77.8	5	113	264	10
PLAD30KP75A	75	83.3	5	121	246	10
PLAD30KP78A	78	86.7	5	126	240	10
PLAD30KP85A	85	94.4	5	137	216	10
PLAD30KP90A	90	100	5	146	204	10
PLAD30KP100A	100	111	5	162	186	10
PLAD30KP110A	110	122	5	177	168	10
PLAD30KP120A	120	133	5	193	156	10
PLAD30KP130A	130	144	5	209	142	10
PLAD30KP150A	150	167	5	243	124	10
PLAD30KP160A	160	178	5	259	116	10
PLAD30KP170A	170	189	5	275	110	10
PLAD30KP180A	180	200	5	291	104	10
PLAD30KP200A	200	222	5	322	94	10
PLAD30KP220A	220	245	5	356	84	10
PLAD30KP260A	260	289	5	419	71	10
PLAD30KP280A	280	311	5	451	66	10
PLAD30KP300A	300	333	5	483	62	10
PLAD30KP350A	350	389	5	564	53	10
PLAD30KP400A	400	444	5	644	46	10

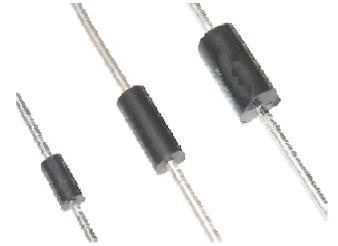
# P4KE/P5KE/P6KE/1.5KE Axial Devices

## KE Axial Devices from the Discrete Products Group (DPG)

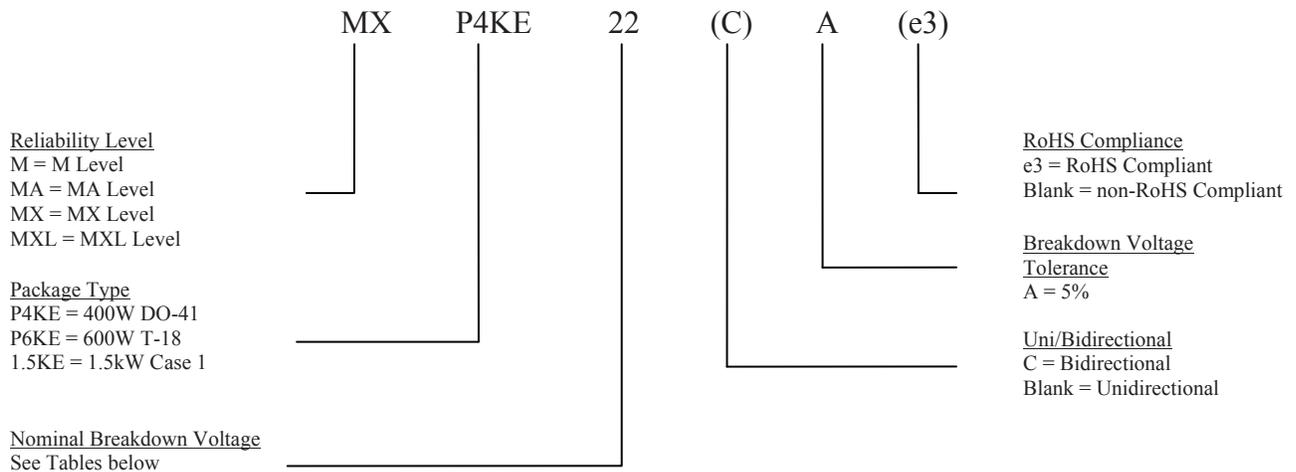
### FEATURES

- Peak Pulse Power at 10/1000 $\mu$ S
  - P4KE series – 400W
  - P5KE series – 500W
  - P6KE series – 600W
  - 1.5KE series – 1.5kW
- Standoff voltage
  - P4KE series – 5.8V to 342V
  - P5KE series – 5.0V to 170V
  - P6KE series – 5.8V to 171V
  - 1.5KE series – 5.8V to 324V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional and Bidirectional versions available

### APPEARANCE

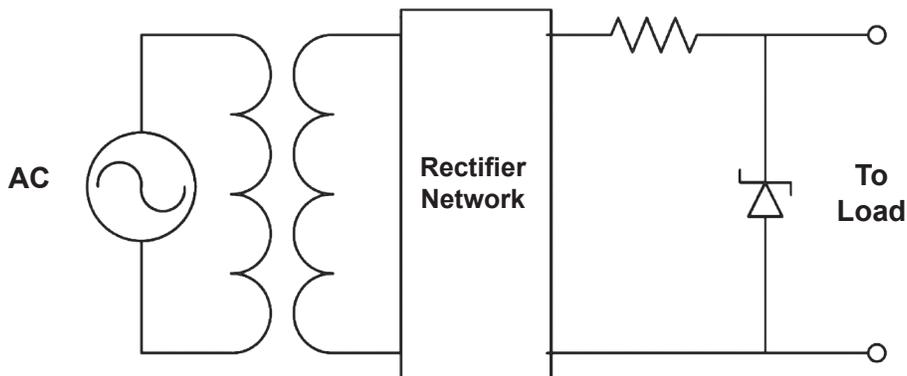


### PART NOMENCLATURE



#### Sample Part Number

**MA1.5KE27Ae3** – MA screened 1.5KE 15kW device, 27V breakdown, uni-directional, 5% tolerance and RoHS compliant



**DC Line Protection**

# P4KE/P5KE/P6KE/1.5KE Axial Devices

## P4KE 400 WATT, ALL ELECTRICAL CHARACTERISTICS @25°C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
P4KE6.8A	5.80	6.45	10	10.5	38	500
P4KE7.5A	6.40	7.13	10	11.3	35	200
P4KE8.2A	7.02	7.79	10	12.1	33	100
P4KE9.1A	7.78	8.65	1	13.4	30	20
P4KE10A	8.55	9.50	1	14.5	28	5
P4KE11A	9.40	10.5	1	15.6	26	2
P4KE12A	10.2	11.4	1	16.7	24	1
P4KE13A	11.1	12.4	1	18.2	22	1
P4KE15A	12.8	14.3	1	21.2	19	1
P4KE16A	13.6	15.2	1	22.5	18	1
P4KE18A	15.3	17.1	1	25.2	16	1
P4KE20A	17.1	19.0	1	27.7	14.5	1
P4KE22A	18.8	20.9	1	30.6	13	1
P4KE24A	20.5	22.8	1	33.2	12	1
P4KE27A	23.1	25.7	1	37.5	11	1
P4KE30A	25.6	28.5	1	41.4	9.5	1
P4KE33A	28.2	31.4	1	45.7	9.0	1
P4KE36A	30.8	34.2	1	49.9	8.0	1
P4KE39A	33.3	37.1	1	53.9	7.5	1
P4KE43A	36.8	40.9	1	59.3	7.0	1
P4KE47A	40.2	44.7	1	64.8	6.2	1
P4KE51A	43.6	48.5	1	70.1	5.7	1
P4KE56A	47.8	53.2	1	77.0	5.2	1
P4KE62A	53.0	58.9	1	85.0	4.7	1
P4KE68A	58.1	64.6	1	92.0	4.4	1
P4KE75A	64.1	71.3	1	103.0	3.9	1
P4KE82A	70.1	77.9	1	113.0	3.5	1
P4KE91A	77.8	86.5	1	125.0	3.2	1
P4KE100A	85.5	95.0	1	137.0	2.9	1
P4KE110A	94.0	105.0	1	152.0	2.6	1
P4KE120A	102.0	114.0	1	165.0	2.4	1
P4KE130A	111.0	124.0	1	179.0	2.2	1
P4KE150A	128.0	143.0	1	207.0	1.95	1
P4KE160A	136.0	152.0	1	219.0	1.8	1
P4KE170A	145.0	162.0	1	234.0	1.7	1
P4KE180A	154.0	171.0	1	246.0	1.6	1
P4KE200A	171.0	190.0	1	274.0	1.5	1
P4KE220A	185.0	209.0	1	328.0	1.0	1
P4KE250A	214.0	237.0	1	344.0	1.0	1
P4KE300A	256.0	285.0	1	414.0	1.0	1
P4KE350A	300.0	333.0	1	482.0	1.0	1
P4KE400A	342.0	380.0	1	548.0	1.0	1

# P4KE/P5KE/P6KE/1.5KE Axial Devices

## P5KE 500 WATT, ALL ELECTRICAL CHARACTERISTICS @25°C

PART NUMBER	BREAKDOWN VOLTAGE $V_{BR}$		TEST CURRENT $I_{BR}$	RATED STANDOFF VOLTAGE $V_{WM}$	MAX STANDBY CURRENT $I_D @ V_{WM}$	MAX CLAMPING VOLTAGE $V_C @ I_{PP}$	MAX PEAK PULSE CURRENT $I_{PP}$	MAX TEMP COEFFICIENT OF $V_{BR}$ $\alpha V_{BR}$
	Min.	Max.						
	V	V	mA	V	$\mu A$	V	A	%/°C
P5KE5.0A	6.4	7.0	10	5.0	600	9.2	54.3	.057
P5KE6.0A	6.67	7.37	10	6.0	600	10.3	48.5	.059
P5KE6.5A	7.22	7.98	10	6.5	400	11.2	44.7	.061
P5KE7.0A	7.78	8.60	10	7.0	150	12.0	41.7	.065
P5KE7.5A	8.33	9.21	1	7.5	50	12.9	38.8	.067
P5KE8.0A	8.89	9.83	1	8.0	25	13.6	36.7	.070
P5KE8.5A	9.44	10.4	1	8.5	5	14.4	34.7	.073
P5KE9.0A	10.0	11.1	1	9.0	1	15.4	32.5	.076
P5KE10A	11.1	12.3	1	10	1	17.0	29.4	.078
P5KE11A	12.2	13.5	1	11	1	18.2	27.4	.081
P5KE12A	13.3	14.7	1	12	1	19.9	25.1	.082
P5KE13A	14.4	15.9	1	13	1	21.5	23.2	.084
P5KE14A	15.6	17.2	1	14	1	23.2	21.5	.086
P5KE15A	16.7	18.5	1	15	1	24.4	20.6	.087
P5KE16A	17.8	19.7	1	16	1	26.0	19.2	.088
P5KE17A	18.9	20.9	1	17	1	27.6	18.1	.090
P5KE18A	20.0	22.1	1	18	1	29.2	17.2	.092
P5KE20A	22.2	24.5	1	20	1	32.4	15.4	.093
P5KE22A	24.4	26.9	1	22	1	35.5	14.1	.094
P5KE24A	26.7	29.5	1	24	1	38.9	12.8	.096
P5KE26A	28.9	31.9	1	26	1	42.1	11.9	.097
P5KE28A	31.1	34.4	1	28	1	45.4	11.0	.098
P5KE30A	33.3	36.8	1	30	1	48.4	10.3	.099
P5KE33A	36.7	40.6	1	33	1	53.3	9.4	.100
P5KE36A	40.0	44.2	1	36	1	58.1	8.6	.101
P5KE40A	44.4	49.1	1	40	1	64.5	7.8	.101
P5KE43A	47.8	52.8	1	43	1	69.4	7.2	.102
P5KE45A	50.0	55.3	1	45	1	72.7	6.9	.102
P5KE48A	53.3	58.9	1	48	1	77.4	6.5	.103
P5KE51A	56.7	62.7	1	51	1	82.4	6.1	.103
P5KE54A	60.0	66.3	1	54	1	87.1	5.7	.104
P5KE58A	64.4	71.2	1	58	1	93.6	5.3	.104
P5KE60A	66.7	73.7	1	60	1	96.8	5.2	.104
P5KE64A	71.1	78.6	1	64	1	103.0	4.9	.105
P5KE70A	77.8	86.0	1	70	1	113.0	4.4	.105
P5KE75A	83.3	92.1	1	75	1	121.0	4.1	.105
P5KE78A	86.7	95.8	1	78	1	126.0	4.0	.106
P5KE85A	94.4	104.0	1	85	1	137.0	3.6	.106
P5KE90A	100.0	111.0	1	90	1	146.0	3.4	.107
P5KE100A	111.0	123.0	1	100	1	162.0	3.1	.107
P5KE110A	122.0	135.0	1	110	1	177.0	2.8	.107
P5KE120A	133.0	147.0	1	120	1	193.0	2.0	.107
P5KE130A	144.0	159.0	1	130	1	209.0	2.4	.108
P5KE150A	167.0	185.0	1	150	1	243.0	2.1	.108
P5KE160A	178.0	197.0	1	160	1	259.0	1.9	.108
P5KE170A	189.0	209.0	1	170	1	275.0	1.8	.108

**NOTE 1:** Forward Voltage ( $V_F$ ) @ 35 A peak, 8.3 ms sine wave equal to 3.5 volts (excluding bidirectional).

**NOTE 2:** For bidirectional construction, indicate a CA suffix after part number, e.g. MP5KE170CA. Bidirectional capacitance is half that shown in Figure 4 at zero volts.

# P4KE/P5KE/P6KE/1.5KE Axial Devices

## P6KE 600 WATT, ALL ELECTRICAL CHARACTERISTICS @25°C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_c$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_b$  $\mu A$
P6KE6.8A	5.8	6.45	10	10.5	57	1000
P6KE7.5A	6.4	7.13	10	11.3	53	500
P6KE8.2A	7.02	7.79	10	12.1	50	200
P6KE9.1A	7.78	8.65	1	13.4	45	50
P6KE10A	8.55	9.5	1	14.5	41	10
P6KE11A	9.4	10.5	1	15.6	38	5
P6KE12A	10.2	11.4	1	16.7	36	5
P6KE13A	11.1	12.4	1	18.2	33	5
P6KE15A	12.8	14.3	1	21.2	28	1
P6KE16A	13.6	15.2	1	22.5	27	1
P6KE18A	15.3	17.1	1	25.2	24	1
P6KE20A	17.1	19	1	27.7	22	1
P6KE22A	18.8	20.9	1	30.6	20	1
P6KE24A	20.5	22.8	1	33.2	18	1
P6KE27A	23.1	25.7	1	37.5	16	1
P6KE30A	25.6	28.5	1	41.4	14.4	1
P6KE33A	28.2	31.4	1	45.7	13.2	1
P6KE36A	30.8	34.2	1	49.9	12	1
P6KE39A	33.3	37.1	1	53.9	11.2	1
P6KE43A	36.8	40.9	1	59.3	10.1	1
P6KE47A	40.2	44.7	1	64.8	9.3	1
P6KE51A	43.6	48.5	1	70.1	8.6	1
P6KE56A	47.8	53.2	1	77	7.8	1
P6KE62A	53	58.9	1	85	7.1	1
P6KE68A	58.1	64.6	1	92	6.5	1
P6KE75A	64.1	71.3	1	103	5.8	1
P6KE82A	70.1	77.9	1	113	5.3	1
P6KE91A	77.8	86.5	1	125	4.8	1
P6KE100A	85.5	95	1	137	4.4	1
P6KE110A	94	105	1	152	3.4	1
P6KE120A	102	114	1	165	3.6	1
P6KE130A	111	124	1	179	3.3	1
P6KE150A	128	143	1	207	2.9	1
P6KE160A	136	152	1	219	2.7	1
P6KE170A	145	161	1	234	2.6	1
P6KE180A	154	171	1	246	2.4	1
P6KE200A	171	190	1	274	2.2	1

## 1.5KE 1.5kW, ALL ELECTRICAL CHARACTERISTICS @25°C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
1.5KE6.8A	5.80	6.45	10	10.5	143.0	1000
1.5KE7.5A	6.40	7.13	10	11.3	132.0	500
1.5KE8.2A	7.02	7.79	10	12.1	124.0	200
1.5KE9.1A	7.78	8.65	1	13.4	112.0	50
1.5KE10A	8.55	9.50	1	14.5	103.0	10
1.5KE11A	9.40	10.50	1	15.6	96.0	5
1.5KE12A	10.220	11.40	1	16.7	90.0	5
1.5KE13A	11.10	12.40	1	18.2	82.0	5
1.5KE15A	12.80	14.30	1	21.2	71.0	1
1.5KE16A	13.60	15.20	1	22.5	67.0	1
1.5KE18A	15.30	17.10	1	25.2	59.5	1
1.5KE20A	17.10	19.00	1	27.7	54.0	1
1.5KE22A	18.80	20.90	1	30.6	49.0	1
1.5KE24A	20.50	22.80	1	33.2	45.0	1
1.5KE27A	23.10	25.70	1	37.5	40.0	1
1.5KE30A	25.60	28.50	1	41.4	36.0	1
1.5KE33A	28.20	31.40	1	45.7	33.0	1
1.5KE36A	30.80	34.20	1	49.9	30.0	1
1.5KE39A	33.30	37.10	1	53.9	28.0	1
1.5KE43A	36.80	40.90	1	59.3	25.3	1
1.5KE47A	40.20	44.70	1	64.8	23.2	1
1.5KE51A	43.60	48.50	1	70.1	21.4	1
1.5KE56A	47.80	53.20	1	77.0	19.5	1
1.5KE62A	53.00	58.90	1	85.0	17.7	1
1.5KE68A	58.10	64.60	1	92.0	16.3	1
1.5KE75A	64.10	71.30	1	103.0	14.6	1
1.5KE82A	70.10	77.90	1	113.0	13.3	1
1.5KE91A	77.80	86.50	1	125.0	12.0	1
1.5KE100A	85.50	95.00	1	137.0	11.0	1
1.5KE110A	94.00	105.00	1	152.0	9.9	1
1.5KE120A	102.00	114.00	1	165.0	9.1	1
1.5KE130A	111.00	124.00	1	179.0	8.4	1
1.5KE150A	128.00	143.00	1	207.0	7.2	1
1.5KE160A	136.00	152.00	1	219.0	6.8	1
1.5KE170A	145.00	162.00	1	234.0	6.4	1
1.5KE180A	154.00	171.00	1	246.0	6.1	1
1.5KE200A	171.00	190.00	1	274.0	5.5	1
1.5KE220A	185.00	209.00	1	328.0	4.6	1
1.5KE250A	214.00	237.00	1	344.0	5.0	1
1.5KE300A	256.00	285.00	1	414.0	5.0	1
1.5KE350A	300.00	332.00	1	482.0	4.0	1
1.5KE400A	324.00	380.00	1	548.0	4.0	1

# LCE Low Capacitance Axial Devices

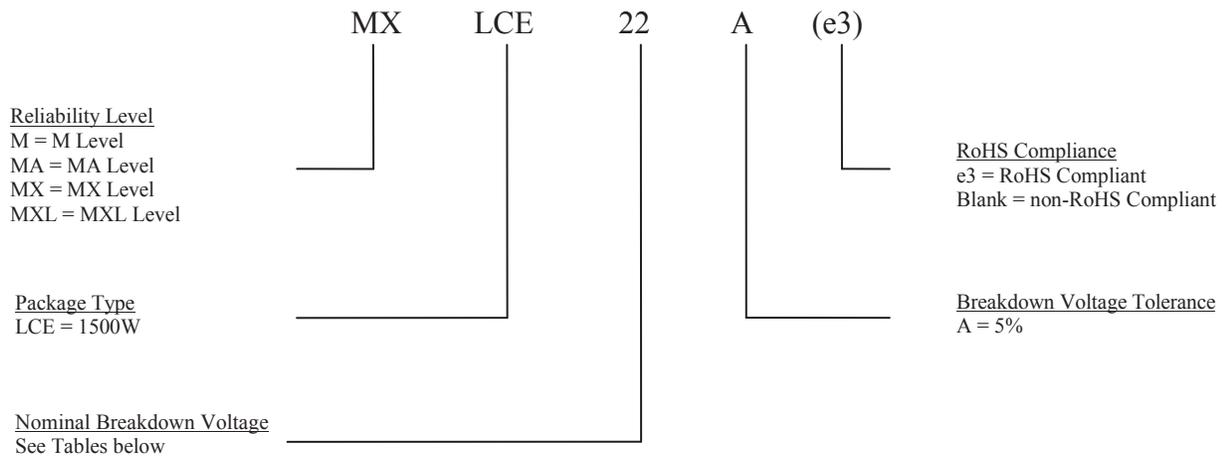
## LCE Axial Devices from the Discrete Products Group (DPG)

### FEATURES

- 1.5kW Peak Pulse Power at 10/1000 $\mu$ S
- Standoff voltage of 6.5V to 170V
- Operational and Storage Temperature of -65°C to +150°C
- Includes a rectifier diode element in series and the opposite direction to achieve low capacitance performance  $\leq 100$ pF
- Two devices may be used in anti-parallel for complete AC protection if bidirectional transient protection capability is required

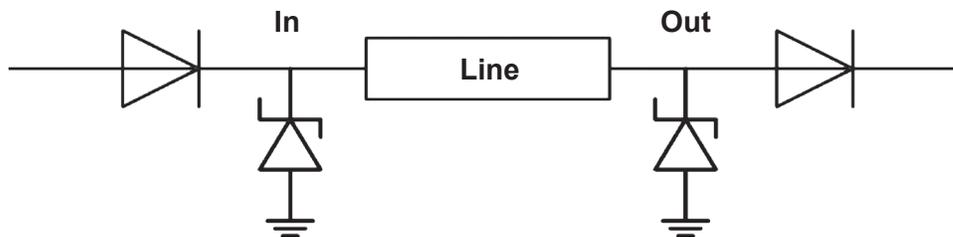


### PART NOMENCLATURE



#### Sample Part Number

**MALCE48A** – MA screened axial Low Capacitance 1.5kW device, 48V stand-off, unidirectional with 5% tolerance



Single Line

# LCE Low Capacitance Axial Devices

## LCE 1.5kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$ Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$ Volts	BREAKDOWN CURRENT $I_{BR}$ mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$ Volts	PEAK PULSE CURRENT $I_{PP}$ Amps	MAXIMUM STANDBY CURRENT $I_D$ @ $V_{WM}$ $\mu$ A	MAX CAP @ 0 Volts $f=1$ MHZ pF	WORKING INVERSE BLOCKING VOLTAGE $V_{WIB}$ @ $V_{WIB}$ Volts	INVERSE BLOCKING LEAKAGE CURRENT $I_{IB}$ @ $V_{WIB}$ $\mu$ A	PEAK INVERSE BLOCKING VOLTAGE $V_{PIB}$ Volts
LCE6.5A	6.5	7.22	10	11.2	100	1000	100	75	10	100
LCE7.0A	7.0	7.78	10	12.0	100	500	100	75	10	100
LCE7.5A	7.5	8.33	10	12.9	100	250	100	75	10	100
LCE8.0A	8.0	8.89	1	13.6	100	100	100	75	10	100
LCE8.5A	8.5	9.44	1	14.4	100	50	100	75	10	100
LCE9.0A	9.0	10.0	1	15.4	97	10	100	75	10	100
LCE10A	10	11.1	1	17.0	88	5	100	75	10	100
LCE11A	11	12.2	1	18.2	82	5	100	75	10	100
LCE12A	12	13.3	1	19.9	75	5	100	75	10	100
LCE13A	13	14.4	1	21.5	70	5	100	75	10	100
LCE14A	14	15.6	1	23.2	65	5	100	75	10	100
LCE15A	15	16.7	1	24.4	61	5	100	75	10	100
LCE16A	16	17.8	1	26.0	57	5	100	75	10	100
LCE17A	17	18.9	1	27.6	54	5	100	75	10	100
LCE18A	18	20.0	1	29.2	51	5	100	75	10	100
LCE20A	20	22.2	1	32.4	46	5	100	75	10	100
LCE22A	22	24.4	1	35.5	42	5	100	75	10	100
LCE24A	24	26.7	1	38.9	39	5	100	75	10	100
LCE26A	26	28.9	1	42.1	36	5	100	75	10	100
LCE28A	28	31.1	1	45.4	33	5	100	75	10	100
LCE30A	30	33.3	1	48.4	31	5	100	75	10	100
LCE33A	33	36.7	1	53.3	28.1	5	100	75	10	100
LCE36A	36	40.0	1	58.1	25.8	5	100	75	10	100
LCE40A	40	44.4	1	64.5	23.3	5	100	75	10	100
LCE43A	43	47.8	1	69.4	21.6	5	100	150	10	200
LCE45A	45	50.0	1	72.7	20.6	5	100	150	10	200
LCE48A	48	53.3	1	77.4	19.4	5	100	150	10	200
LCE51A	51	56.7	1	82.4	18.2	5	100	150	10	200
LCE54A	54	60.0	1	87.1	17.2	5	100	150	10	200
LCE58A	58	64.4	1	93.6	16.0	5	100	150	10	200
LCE60A	60	66.7	1	96.8	15.5	5	90	150	10	200
LCE64A	64	71.1	1	103	14.6	5	90	150	10	200
LCE70A	70	77.8	1	113	13.3	5	90	150	10	200
LCE75A	75	83.3	1	121	12.4	5	90	150	10	200
LCE80A	80	88.7	1	129	11.6	5	90	150	10	200
LCE90A	90	100	1	146	10.3	5	90	300	10	200
LCE100A	100	111	1	162	9.3	5	90	300	10	200
LCE110A	110	122	1	178	8.4	5	90	300	10	400
LCE120A	120	133	1	193	7.8	5	90	300	10	400
LCE130A	130	144	1	209	7.2	5	90	300	10	400
LCE150A	150	167	1	243	6.2	5	90	300	10	400
LCE160A	160	178	1	259	5.8	5	90	300	10	400
LCE170A	170	189	1	275	5.4	5	90	300	10	400

## 5KP/15KP Axial Devices from the Discrete Products Group (DPG)

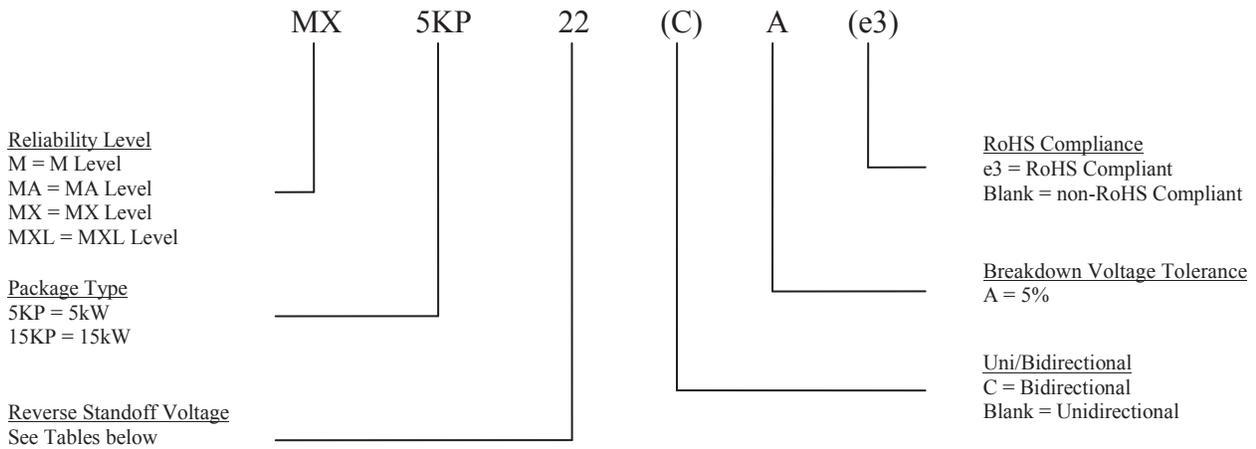
### FEATURES

- Peak Pulse Power at 10/1000 $\mu$ S
  - 5KP series – 5kW
  - 15KP series – 15kW
- Standoff voltage
  - 5KP series – 5V to 110V
  - 15KP series – 22V to 280V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional and Bidirectional versions available



### APPEARANCE

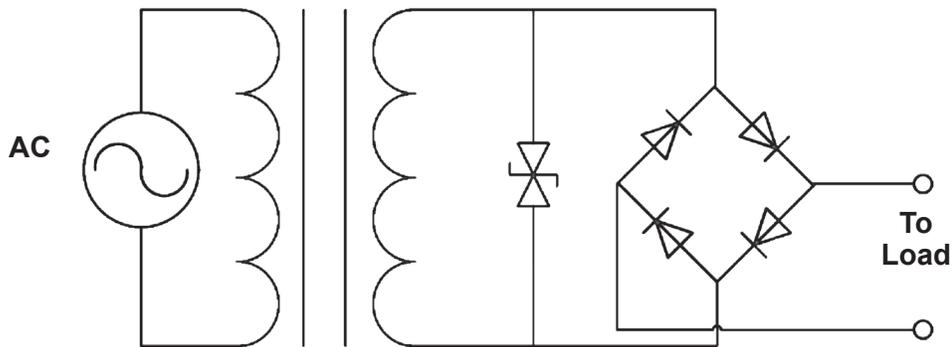
### PART NOMENCLATURE



#### Sample Part Numbers

**MA5KP36Ae3** – MA screened axial 5kW device, 36V reverse stand-off, uni-directional, 5% tolerance and RoHS compliant

**MXL15KPA40CA** – MXL screened axial 15kW device, 40V breakdown, bi-directional, 5% tolerance and non-RoHS compliant



**AC Supply Protection**

## 5KP 5kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
5KP5.0A	5.0	6.40	50	9.2	543	2000*
5KP6.0A	6.0	6.67	50	10.3	485	5000
5KP6.5A	6.5	7.22	50	11.2	447	2000
5KP7.0A	7.0	7.78	50	12.0	417	1000
5KP7.5A	7.5	8.33	5	12.9	388	250
5KP8.0A	8.0	8.89	5	13.6	367	150
5KP8.5A	8.5	9.44	5	14.4	347	50
5KP9.0A	9.0	10.0	5	15.4	325	20
5KP10A	10	11.1	5	17.0	294	15
5KP11A	11	12.2	5	18.2	274	10
5KP12A	12	13.3	5	19.9	251	10
5KP13A	13	14.4	5	21.5	232	10
5KP14A	14	15.6	5	23.2	215	10
5KP15A	15	16.7	5	24.4	206	10
5KP16A	16	17.8	5	26.0	192	10
5KP17A	17	18.9	5	27.6	181	10
5KP18A	18	20.0	5	29.2	172	10
5KP20A	20	22.2	5	32.4	154	10
5KP22A	22	24.4	5	35.5	141	10
5KP24A	24	26.7	5	38.9	128	10
5KP26A	26	28.9	5	42.1	119	10
5KP28A	28	31.1	5	45.5	110	10
5KP30A	30	33.3	5	48.4	103	10
5KP33A	33	36.7	5	53.3	94	10
5KP36A	36	40.0	5	58.1	86	10
5KP40A	40	44.4	5	64.5	78	10
5KP43A	43	47.8	5	69.4	72	10
5KP45A	45	50.0	5	72.7	69	10
5KP48A	48	53.3	5	77.4	65	10
5KP51A	51	56.7	5	82.4	61	10
5KP54A	54	60.0	5	87.1	57	10
5KP58A	58	64.4	5	93.6	53	10
5KP60A	60	66.7	5	96.8	52	10
5KP64A	64	71.1	5	103.0	49	10
5KP70A	70	77.8	5	113	44	10
5KP75A	75	83.3	5	121	41	10
5KP78A	78	86.7	5	126	40	10
5KP85A	85	94.4	5	137	36	10
5KP90A	90	100	5	146	34	10
5KP100A	100	111	5	162	31	10
5KP110A	110	122	5	177	28	10

## 15KP 15kW, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu A$
15KP22A	22	24.4	10	37.1	404	500
15KP24A	24	26.7	5	40.7	369	150
15KP26A	26	28.9	5	44.0	341	50
15KP28A	28	31.1	5	47.5	316	25
15KP30A	30	33.3	5	50.7	296	15
15KP33A	33	36.7	5	54.8	274	10
15KP36A	36	40.0	5	59.7	251	10
15KP40A	40	44.4	5	65.8	228	10
15KP43A	43	47.8	5	69.7	215	10
15KP45A	45	50.0	5	73.0	205	10
15KP48A	48	53.3	5	77.7	193	10
15KP51A	51	56.7	5	82.8	181	10
15KP54A	54	60.0	5	87.5	171	10
15KP58A	58	64.4	5	94.0	160	10
15KP60A	60	66.7	5	97.3	154	10
15KP64A	64	71.7	5	104	144	10
15KP70A	70	77.8	5	114	132	10
15KP75A	75	83.3	5	122	123	10
15KP78A	78	86.7	5	126	119	10
15KP85A	85	94.4	5	137	109	10
15KP90A	90	100	5	146	103	10
15KP100A	100	111	5	162	93	10
15KP110A	110	122	5	178	84	10
15KP120A	120	133	5	193	78	10
15KP130A	130	144	5	209	72	10
15KP150A	150	167	5	243	62	10
15KP160A	160	178	5	259	58	10
15KP170A	170	189	5	275	55	10
15KP180A	180	200	5	291	52	10
15KP200A	200	222	5	322	47	10
15KP220A	220	245	5	356	42	10
15KP240A	240	267	5	388	39	10
15KP260A	260	289	5	419	36	10
15KP280A	280	311	5	452	33	10

## RT100KP Axial Devices from the Discrete Products Group (DPG)

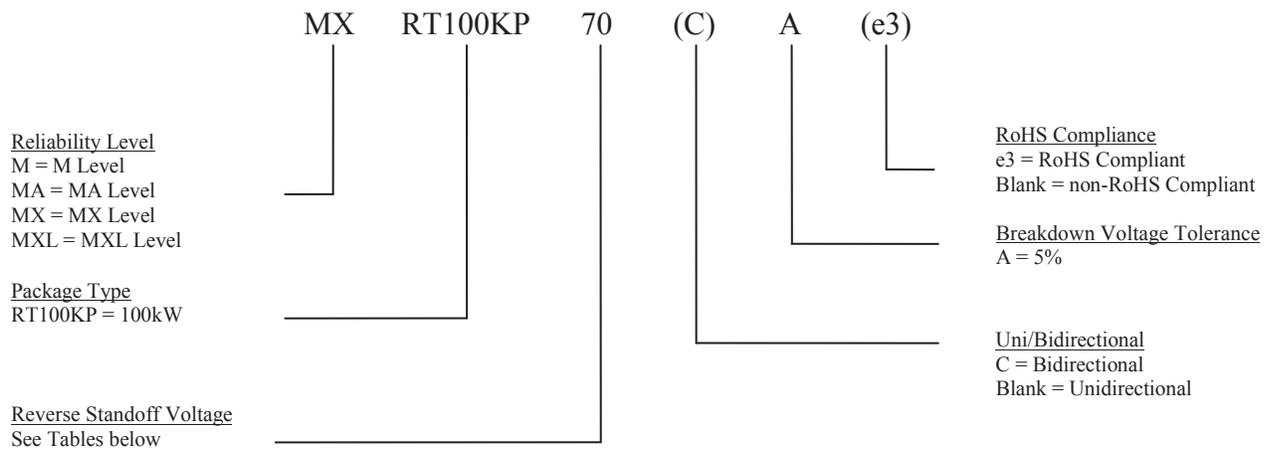
### FEATURES

- 100kW Peak Pulse Power at 6.4/69μS
- Standoff voltage of 40V to 400V
- Operational and Storage Temperature of -65°C to +150°C
- Unidirectional and Bidirectional versions available
- Designed for aircraft applications requiring high power transient protection with a comparatively small axial-package size

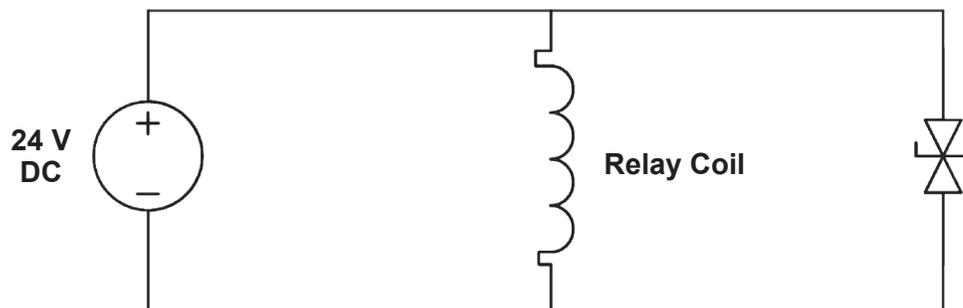


### APPEARANCE

### PART NOMENCLATURE



**Sample Part Number**  
**MXRT100KP70CAe3** – MX screened axial 100kW device, 70V stand-off, bi-directional, 5% tolerance and RoHS compliant.



**Relay Transient Protection**

## RT100KP 100kW @ 6.4/69 $\mu$ S, ALL ELECTRICAL CHARACTERISTICS @ 25° C

TYPE NUMBER	REVERSE STAND-OFF VOLTAGE $V_{WM}$  Volts	MINIMUM BREAKDOWN VOLTAGE $V_{BR}$ MIN @ $I_{BR}$  Volts	BREAKDOWN CURRENT $I_{BR}$  mA	MAXIMUM CLAMPING VOLTAGE @ $I_{PP}$ $V_C$  Volts	PEAK PULSE CURRENT $I_{PP}$  Amps	MAXIMUM STANDBY CURRENT @ $V_{WM}$ $I_D$  $\mu$ A
RT100KP40A	40	44.4	20	78.6	1273 *	1500
RT100KP43A	43	47.8	10	84.5	1184 *	500
RT100KP45A	45	50.0	5	88.5	1130 *	150
RT100KP48A	48	53.3	5	94.3	1061 *	150
RT100KP51A	51	56.7	5	101	990 *	50
RT100KP54A	54	60.0	5	106	943 *	25
RT100KP58A	58	64.4	5	114	878	15
RT100KP60A	60	66.7	5	118	848	15
RT100KP64A	64	71.1	5	126	795	10
RT100KP70A	70	77.8	5	138	725	10
RT100KP75A	75	83.3	5	147	680	10
RT100KP78A	78	86.7	5	153	655	10
RT100KP85A	85	94.4	5	166	602	10
RT100KP90A	90	100	5	178	563	10
RT100KP100A	100	111	5	197	508	10
RT100KP110A	110	122	5	216	463	10
RT100KP120A	120	133	5	235	426	10
RT100KP130A	130	144	5	254	394	10
RT100KP150A	150	167	5	296	338	10
RT100KP160A	160	178	5	315	318	10
RT100KP170A	170	189	5	334	300	10
RT100KP180A	180	200	5	354	283	10
RT100KP200A	200	222	5	392	256	10
RT100KP220A	220	245	5	434	231	10
RT100KP250A	250	278	5	493	203	10
RT100KP260A	260	289	5	512	196	10
RT100KP280A	280	311	5	552	181	10
RT100KP300A	300	333	5	590	170	10
RT100KP350A	350	389	5	690	145	10
RT100KP400A	400	444	5	787	127	10

\* The Maximum Peak Pulse Current ( $I_{PP}$ ) shown represents the performance capabilities by design. Surge test screening is only performed up to 900 Amps (test equipment limitations).

# MRT130KP Transient Voltage Suppressor

## 130 kW Transient Voltage Suppressor from the Discrete Products Group (DPG)

### FEATURES

- High reliability controlled devices with wafer fabrication and assembly lot traceability
- 100 % surge tested devices
- Suppresses transients up to 130 kW @ 6.4/69  $\mu$ s
- Fast response with less than 5ns turn-on time
- Available as either low clamp with “CV” suffix or normal clamping features with “CA” suffix
- Optional upscreening available by replacing the M prefix with MA, MX or MXL. These prefixes specify various screening and conformance inspection options based on MIL-PRF-19500. Refer to MicroNote 129 for more details on the screening options.
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS Compliant devices available by adding “e3” suffix
- 3 $\sigma$  lot norm screening performed on Standby Current  $I_D$

### ELECTRICAL CHARACTERISTICS @ 25°C

MICROSEMI PART NUMBER	Working Standoff Voltage $V_{WM}$	Maximum Standby Current $I_D @ V_{WM}$	Minimum Breakdown Voltage $V_{BR} @ I_{BR}$	Breakdown Current $I_{BR}$	Maximum Clamping Voltage $V_C @ I_{PP}$ (Note 1)	Peak Pulse Current $I_{PP} @ 6.4/69 \mu s$ (Note 2)
	V max	$\mu A$	Volts	mA	Volts	Amps
MRT130KP275CV	275	5	300	5	400	292
MRT130KP275CA	275	5	300	5	445	292
MRT130KP295CV	295	5	300	5	410	282
MRT130KP295CA	295	5	300	5	460	282

# MRT65KP Transient Voltage Suppressor

## 65 kW Transient Voltage Suppressor from the Discrete Products Group (DPG)

### FEATURES

- High reliability controlled devices with wafer fabrication and assembly lot traceability
- 100 % surge tested devices
- Suppresses transients up to 65 kW @ 6.4/69  $\mu$ s
- Fast response with less than 5ns turn-on time
- Preferred 65kW TVS for aircraft power bus protection
- Optional upscreening available by replacing the M prefix with MA, MX or MXL  
These prefixes specify various screening and conformance inspection options based on MIL-PRF-19500. Refer to MicroNote 129 for more details on the screening options.
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS Compliant devices available by adding "e3" suffix 3 $\sigma$  lot norm screening performed on Standby Current  $I_D$

### ELECTRICAL CHARACTERISTICS @ 25°C

MICROSEMI PART NUMBER (replace A suffix with CA for bidirectional)	Working Standoff Voltage $V_{WM}$	Maximum Standby Current $I_D @ V_{WM}$	Minimum Breakdown Voltage $V_{BR} @ I_{BR}$	Breakdown Current $I_{BR}$	Maximum Clamping Voltage $V_C @ I_{PP}$ (Note 1)	Peak Pulse Current $I_{PP} @ 6.4/69 \mu s$ (Note 2)
	V max	$\mu A$	V	mA	V	A
MRT65KP48A	48	5	53.3	5	77.7	836
MRT65KP54A	54	5	60.0	5	87.5	742
MRT65KP60A	60	5	66.7	5	97.3	668
MRT65KP75A	75	5	83.3	5	122	533



# Power Products Up-screening Program

## MOSFETs, IGBTs and RECTIFIERS

Some High Reliability programs use plastic devices but require up-screening for additional reliability. DPG has made it easier to order plastic up-screened devices by creating a standard up-screen plastic flow—all devices for the two flows shown below will be marked “MXL”. All plastic discrete switching parts (MOSFETs, IGBTs, and Diodes) on the following pages can be up-screened to their standard flows by simply adding “MXL” to the front of the part number, for example APT28M120B2 would become MXLAPT28M120B2. Due to the limited number of characters that we can use on the actual pack, “MXL” will be used as a designator on the package (see sample package at right) to show that it is indeed an up-screened part. If a variation of the standard flow is required, we will use our standard SCD (Standard Custom Device) process to comply with the customer’s need.



### Screening for MOSFETs, IGBTs & Rectifiers

Process, Screen or Test Description	Product Assurance Level Requirement
<b>Part Prefix:</b>	MXL
Stabilization Bake	24 hours
100% DC Electrical Test, Go/No-Go	R
Temperature Cycling	20 Cycles <sup>1</sup>
Initial Electrical Test	R
HTGB	48 hours <sup>2</sup>
Interim Electrical Test	R
HTRB	168 hours
Final Electrical Test, Go/no-go	R

R - Required and performed based on military test conditions and limits

1 - Not for ISOTOPs

2 - Not for Diodes

# MOSFETs, IGBTs and Diodes

## Family of Products Available for Up-Screen

<p><b>MOSFETs and FREDFETS</b> (fast body diode) <b>MOS5, MOS7, MOS8</b> <b>500V, 600V, 800V, 1000V, 1200V</b> Some 100V, 200V, &amp; 300V offerings</p>	<p><b>DIODES</b></p> <p><b>DQ Series</b> <b>600V, 1000V, 1200V</b> High Speed Diode Series</p> <p><b>D Series</b> <b>200V, 300V, 400V, 600V, 1000V, 1200V</b> Medium Speed Diode Series</p> <p><b>DS Series</b> <b>600V</b> High Speed Diode Series</p> <p><b>DL Series</b> <b>600V</b> Ultra Soft Recovery Diode Series</p> <p><b>S Series (Schottky)</b> <b>200V</b> Low Vf Diode Series</p>	<p><b>IGBTs</b></p> <p><b>Single and Combination (w/diode) devices</b></p> <p><b>600V</b></p> <p><b>Field Stop Series (GN):</b> Frequency: 10kHz to 30kHz  <b>Thunderbolt Series (GT):</b> Frequency: 20kHz to 100kHz  <b>Thunderbolt HS Series (GS):</b> Frequency: 40kHz to 120kHz  <b>Power MOS8 Series (GA):</b> Frequency: 40kHz to 110kHz</p> <p><b>900V</b></p> <p><b>Power MOS8 Series (GA):</b> Frequency: 10kHz to 60kHz</p> <p><b>1200V</b></p> <p><b>Field Stop Series (GN):</b> Frequency: 10kHz to 20kHz  <b>Fast Series (GF):</b> Frequency: 20kHz to 30kHz  <b>Thunderbolt Series (GT):</b> Frequency: 25kHz to 50kHz</p>
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## Standard Packages



SOT-227  
ISOTOP



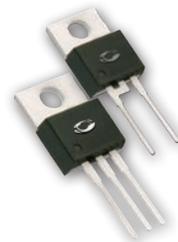
TO-247  
TO-247 Max



TO-268  
D3



TO-264  
TO-264 Max

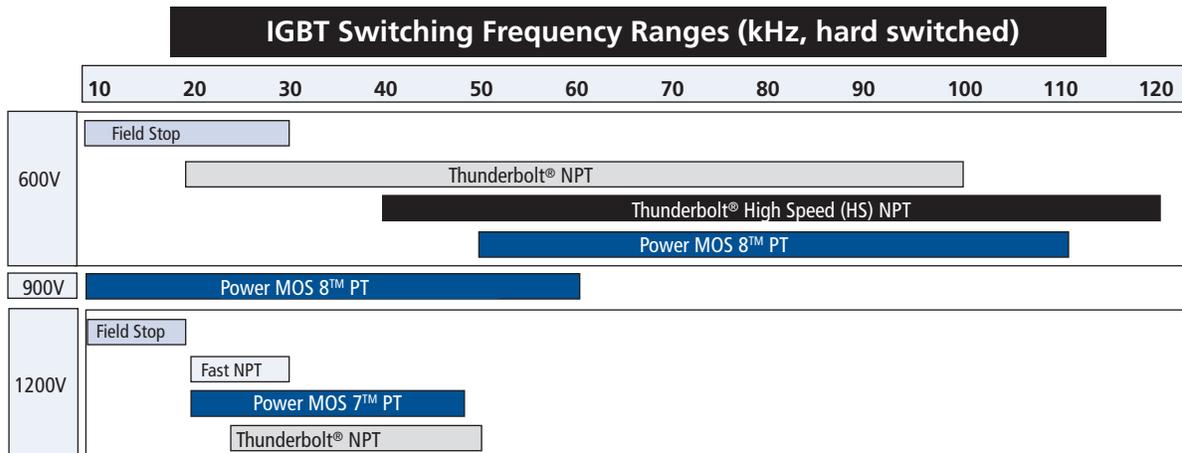


TO-220

# Insulated Gate Bipolar Transistors (IGBTs)

## IGBTs from Microsemi Discrete Products Group (DPG)

IGBT products from Microsemi DPG provide high quality solutions for a wide range of high voltage, high power applications. The switching frequency range spans from DC for minimal conduction loss to over 100kHz for very high power density SMPS applications. The frequency range for each product type is shown in the graph below. Each IGBT product represents the latest in IGBT technology, providing the best possible performance/cost combination for the targeted application. There are six product series that utilize three different IGBT technologies: Non-Punch-Through (NPT), Punch-Through (PT) and Field Stop.



Standard Series	Voltage Ratings (V)	Technology	Easy to Parallel	Short Circuit SOA	Comment
Thunderbolt® (GT)	600, 1200	NPT	X	X	General purpose, high speed
Thunderbolt® (GS) High Speed	600	NPT	X	X	Highest speed
FAST (GF)	1200	NPT	X	X	General purpose, medium speed
MOS 7™ (GP)	1200	PT			Ultra-low gate charge
MOS 8™ (GA)	600, 900	PT			Highest efficiency
Field Stop (GN) Trench Gate	600, 1200	Field Stop	X	X	Lowest conduction loss

## Product Options

All standard IGBT products are available as a single IGBT or as a Combi product packaged with an anti-parallel DQ series diode. Package options include TO-220, TO-247, T-Max®, TO-264, and SOT-227. Customized products are available; contact factory for details.

## Resonant Mode Combi

Resonant Mode Combi products, which are high speed IGBTs packaged with a low VF anti-parallel DL series diode. These Combis are intended for use in resonant mode circuits, such as the phase shifted bridge, where fast turn-off of the IGBT is needed but the recovery speed of the anti-parallel diode is less important than its forward voltage. Resonant Mode IGBTs maximize efficiency by reducing turn-off switching loss in the IGBT and minimizing conduction loss of the anti-parallel diode. The table below summarizes the key features and technology for the Resonant Mode IGBT products.

Resonant Mode Series	Voltage Ratings (V)	Technology	Easy to Parallel	Short Circuit SOA	Comment
Thunderbolt®	600, 1200	NPT	X	X	General purpose, high speed
Thunderbolt® High Speed	600	NPT	X	X	Highest speed
MOS 7	600	PT			Highest efficiency

# Insulated Gate Bipolar Transistors (IGBTs)

## POWER MOS 8™

- PT Technology
- Fast Switching
- Highest Efficiency
- Combi with High Speed DQ Diode

	BV <sub>CES</sub> Volts	V <sub>CE(ON)</sub> Typ 25°C	I <sub>C2</sub> 100°C	Recommended Maximum I <sub>C</sub>		Part Number	Package Style	
				50 kHz	80 kHz			
<b>POWER MOS 8™</b>	<b>SINGLE</b>	600	2.0	28	19	14	APT28GA60K	TO-220
			2.0	36	21	17	APT36GA60B	TO-247 or D <sup>3</sup>
	2.0		44	26	20	APT44GA60B	TO-247 or D <sup>3</sup>	
	2.0		54	30	23	APT54GA60B	TO-247 or D <sup>3</sup>	
	2.0		68	35	27	APT68GA60B	TO-247 or D <sup>3</sup>	
	2.0		80	40	31	APT80GA60B	TO-247 or D <sup>3</sup>	
			2.0	102	51	39	APT102GA60B2	T-MAX® or TO-264
		900	2.5	27	14	8	APT27GA90K	TO-220
			2.5	35	17	10	APT35GA90B	TO-247 or D <sup>3</sup>
			2.5	43	21	13	APT43GA90B	TO-247 or D <sup>3</sup>
			2.5	64	29	19	APT64GA90B	TO-247 or D <sup>3</sup>
			2.5	80	34	23	APT80GA90B	TO-247 or D <sup>3</sup>
		<b>Combi (IGBT &amp; "DQ" FRED)</b>						
		600	2.0	28	19	14	APT28GA60BD15	TO-247 or D <sup>3</sup>
			2.0	36	21	17	APT36GA60BD15	TO-247 or D <sup>3</sup>
			2.0	44	26	20	APT44GA60BD30	TO-247 or D <sup>3</sup>
			2.0	47	39	30	APT47GA60JD40	ISOTOP®
			2.0	54	30	23	APT54GA60BD30	TO-247 or D <sup>3</sup>
			2.0	60	48	36	APT60GA60JD60	ISOTOP®
			2.0	68	35	27	APT68GA60BD40	T-MAX® or TO-264
			2.0	80	40	31	APT80GA60LD40	TO-264
		900	2.5	27	14	8	APT27GA90BD15	TO-247 or D <sup>3</sup>
			2.5	35	17	10	APT35GA90BD15	TO-247 or D <sup>3</sup>
			2.5	43	21	13	APT43GA90BD30	TO-247 or D <sup>3</sup>
	2.5		46	33	21	APT46GA90JD40	ISOTOP®	
	2.5		64	29	19	APT64GA90BD2D30	T-MAX® or TO-264	
	2.5		80	34	23	APT80GA90LD40	TO-264	
	<b>SINGLE</b>	600	1.5	24	15	10	APT20GN60BG	TO-247 or D <sup>3</sup>
			1.5	37	20	14	APT30GN60BG	TO-247 or D <sup>3</sup>
	1.5		64	30	21	APT50GN60BG	TO-247 or D <sup>3</sup>	
	1.5		93	42	30	APT75GN60BG	TO-247 or D <sup>3</sup>	
	1.5		123	75	47	APT150GN60J	ISOTOP®	
	1.5		135	54	39	APT100GN60B2G	T-MAX®	
	1.5		190	79	57	APT150GN60B2G	T-MAX®	
	1.5		230	103	75	APT200GN60B2G	T-MAX®	
	1.5		158	100	66	APT200GN60J	ISOTOP®	
	1200		1.7	33	19	13	APT25GN120BG	TO-247 or D <sup>3</sup>
		1.7	46	24	17	APT35GN120BG	TO-247 or D <sup>3</sup>	
		1.7	66	32	22	APT50GN120B2G	T-MAX®	
		1.7	70	44	27	APT100GN120J	ISOTOP®	
		1.7	99	45	30	APT75GN120B2G	T-MAX® or TO-264	
		1.7	120	58	38	APT100GN120B2G	T-MAX®	
		1.7	99	60	36	APT150GN120J	ISOTOP®	
		<b>Combi (IGBT &amp; "DQ" FRED)</b>						
	600	1.5	24	15	10	APT20GN60BDQ1G	TO-247 or D <sup>3</sup>	
		1.5	37	20	14	APT30GN60BDQ2G	TO-247 or D <sup>3</sup>	
		1.5	64	30	21	APT50GN60BDQ2G	TO-247 or D <sup>3</sup>	
		1.5	93	42	30	APT75GN60LDQ3G	TO-264	
		1.5	123	75	47	APT150GN60JDQ4	ISOTOP®	
		1.5	135	54	39	APT100GN60LDQ4G	TO-264	
		1.5	190	79	57	APT150GN60LDQ4G	TO-264	
		1.5	158	100	66	APT200GN60JDQ4	ISOTOP®	
	1200	1.7	22	14	10	APT15GN120BDQ1G	TO-247 or D <sup>3</sup>	
		1.7	33	19	13	APT25GN120BDQ2G	T-MAX®	
		1.7	46	24	17	APT35GN120L2DQ2G	264-MAX™	
		1.7	57	36	22	APT75GN120JDQ3	ISOTOP®	
		1.7	66	32	22	APT50GN120L2DQ2G	264-MAX™	
		1.7	70	44	27	APT100GN120JDQ4	ISOTOP®	
		1.7	99	60	36	APT150GN120JDQ4	ISOTOP®	



TO-220



TO-247[B]



D<sup>3</sup> PAK[S]

Part Numbers for D<sup>3</sup> packages - replace "B" with "S" in part number



T-MAX®[B2]



TO-264[L]

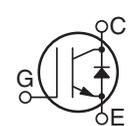


264-MAX™[L2]

Part Numbers for TO-264 packages - replace "B2" with "L" in part number



ISOTOP®[J]  
SOT-227



Current @ Frequency Test Conditions: T<sub>j</sub> = 125°C, T<sub>c</sub> = 100°C except Isotop® where T<sub>c</sub> = 80°C, V<sub>cc</sub> = 67% rated voltage Hard Switch

# Insulated Gate Bipolar Transistors (IGBTs)

## Power MOS 7® and IGBT

- PT Technology
- Ultra-low Gate Charge
- Combi with High Speed DQ Diode

## THUNDERBOLT®

- NPT Technology
- Short Circuit Rated
- Moderate to High Frequency
- Easy Paralleling

## THUNDERBOLT® HIGH SPEED

- High Speed Switching - Reduced Eoff
- Fastest Switching
- NPT Technology

## FAST

- NPT Technology
- Short Circuit Rated
- Low to Moderate Freq.
- Low Conduction Loss
- Easy Paralleling

## RESONANT MODE COMBI IGBTs

- NPT or PT Technology
- Low  $V_f$  Diode
- Ultrasoft Recovery Diode
- Avalanche Rated
- High Speed Switching-Reduced  $E_{off}$

	BV <sub>CES</sub> Volts	V <sub>CE(ON)</sub> Typ 25°C	I <sub>C2</sub> 100°C	Recommended Maximum I <sub>C</sub>		Part Number	Package Style
				20 kHz	40 kHz		
Power MOS 7® and IGBT	<b>SINGLE</b>			20 kHz	40 kHz		
	1200	3.3	33	19	12	APT25GP120BG	TO-247
		3.3	46	24	15	APT35GP120BG	TO-247
		3.3	54	29	18	APT45GP120BG	TO-247
		3.3	34	28	18	APT45GP120J	ISOTOP
		3.3	91	42	24	APT75GP120B2G	T-MAX™
		3.3	57	40	23	APT75GP120J	ISOTOP
	<b>Combi (IGBT &amp; "DQ" FRED)</b>			20 kHz	40 kHz		
	1200	3.3	20	11	7	APT13GP120BDQ1G	TO-247
		3.3	33	19	12	APT25GP120BDQ1G	TO-247
3.3		46	24	15	APT35GP120B2DQ2G	T-MAX™	
3.3		54	29	18	APT45GP120B2DQ2G	T-MAX™	
3.3		34	28	18	APT45GP120JDQ2	ISOTOP	
	3.3	57	40	23	APT75GP120JDQ3	ISOTOP	
THUNDERBOLT®	<b>SINGLE</b>			30 kHz	60 kHz		
	600	2.0	20	14	10	APT20GT60KRG	TO-220
		2.0	20	14	10	APT20GT60BRG	TO-247 or D <sup>3</sup>
		2.0	30	19	13	APT30GT60BRG	TO-247 or D <sup>3</sup>
		2.0	40	25	16	APT40GT60BRG	TO-247 or D <sup>3</sup>
		2.0	50	30	20	APT50GT60BRG	TO-247 or D <sup>3</sup>
		2.0	60	35	22	APT60GT60BRG	TO-247 or D <sup>3</sup>
		2.0	100	56	35	APT100GT60B2RG	T-MAX® or TO-264
	1200	3.2	18	11	8	APT15GT120BRG	TO-247 or D <sup>3</sup>
		3.2	25	16	11	APT25GT120BRG	TO-247 or D <sup>3</sup>
		3.2	50	27	17	APT50GT120B2RG	T-MAX® or TO-264
		3.2	60	40	21	APT100GT120JR	ISOTOP®
		3.2	90	52	25	APT150GT120JR	ISOTOP®
	<b>Combi (IGBT &amp; "DQ" FRED)</b>			30 kHz	60 kHz		
	600	2.0	15	11	8	APT15GT60BRDQ1G	TO-247 or D <sup>3</sup>
		2.0	20	14	10	APT20GT60BRDQ1G	TO-247 or D <sup>3</sup>
		2.0	30	19	13	APT30GT60BRDQ2G	TO-247 or D <sup>3</sup>
		2.0	48	29	18	APT60GT60JRDQ3	ISOTOP®
2.0		50	30	20	APT50GT60BRDQ2G	TO-247 or D <sup>3</sup>	
2.0		100	37	22	APT100GT60JRDQ4	ISOTOP®	
1200	3.2	18	11	8	APT15GT120BRDQ1G	TO-247 or D <sup>3</sup>	
	3.2	25	16	11	APT25GT120BRDQ2G	TO-247 or D <sup>3</sup>	
	3.2	50	27	17	APT50GT120B2RDQ2G	T-MAX® or TO-264	
	3.2	42	34	19	APT75GT120JRDQ3	ISOTOP®	
	3.2	60	40	21	APT100GT120JRDQ4	ISOTOP®	
THUNDERBOLT® HIGH SPEED	<b>SINGLE</b>			50 kHz	80 kHz		
	600	2.8	30	14	9	APT30GS60KRG	TO-220
		2.8	50	23	16	APT50GS60BRG	TO-247 or D <sup>3</sup>
<b>Combi (IGBT &amp; "DQ" FRED)</b>			50 kHz	80 kHz			
600	2.8	30	14	9	APT30GS60BRDQ2G	TO-247 or D <sup>3</sup>	
	2.8	50	23	16	APT50GS60BRDQ2G	TO-247 or D <sup>3</sup>	
FAST	<b>SINGLE</b>			15 kHz	30 kHz		
	1200	2.5	14	8	5	APT11GF120KRG	TO-220
		2.5	20	11	7	APT20GF120KRG	TO-220
		2.5	35	16	10	APT33GF120BRG	TO-247 or D <sup>3</sup>
		2.5	75	27	17	APT50GF120B2RG	T-MAX®
		2.5	75	27	17	APT50GF120LRG	TO-264
<b>Combi (IGBT &amp; "DQ" FRED)</b>			15 kHz	30 kHz			
1200	2.5	35	16	10	APT33GF120B2RDQ2G	T-MAX®	
	2.5	64	33	17	APT50GF120JRDQ3	ISOTOP®	
	2.5	80	42	20	APT60GF120JRDQ3	ISOTOP®	
RESONANT MODE COMBI IGBTs	<b>Combi (IGBT &amp; "DL" FRED)</b>			50 kHz	80 kHz		
	600	2.8	50	23	16	APT50GS60BRDLG	TO-247
		2.8	30	14	9	APT30GS60BRDLG	TO-247
		2.2	50	41	31	APT50GP60LDL	TO-264
		2.2	45	28	22	APT30GP60B2DL	T-MAX® or TO-264
2.2		25	17	14	APT15GP60BDL	TO-247	
1200	3.2	25	16	11	APT25GT120BRDL	TO-247	
	3.2	50	28	17	APT50GT120B2RDL	T-MAX®	
	3.2	100	40	21	APT100GT120JRDLD	ISOTOP®	



TO-220[K]



D<sup>3</sup> PAK[S]



TO-247[B]

Part Numbers for D<sup>3</sup> packages - replace "B" with "S" in part number



T-MAX®[B2]

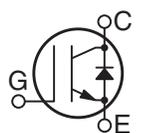


TO-264[L]

Part Numbers for L packages - replace "B2" with "L" in part number



ISOTOP®[J]  
SOT-227



Current @ Frequency Test Conditions: T<sub>j</sub> = 125°C, T<sub>c</sub> = 100°C except Isotop® where T<sub>c</sub> = 80°C, V<sub>cc</sub> = 67% rated voltage Hard Switch

## NEW Power MOS 8™ MOSFETs / FREDFETs (fast body diode)



Power MOS 8™ is Microsemi's latest family of high speed, high voltage (500-1200V) N-channel switch-mode power transistors with lower EMI characteristics and lower cost compared to previous generation devices. These new MOSFETs /FREDFETs have been optimized for both hard and soft switching in high frequency, high voltage applications rated above 500W. There are 2 product types in the Power MOS 8™ MOSFET family:



- 1) **MOSFET**
- 2) **FREDFETs** have a fast recovery body diode characteristic, providing high commutation  $dv/dt$  ruggedness and high reliability in ZVS circuits.

---

### Features

- Fast switching
- Low EMI
- Quiet switching
- Avalanche energy rated
- Low gate charge
- Lower cost

### Applications

- Power factor correction
  - Server and telecom power systems
  - Solar inverters
  - Arc welding
  - Plasma cutting
  - Battery chargers
  - Medical
  - Semiconductor capital equipment
  - Induction heating
- 

### Quiet Switching

The new Power MOS 8™ series is a result of extensive research into quiet switching. Input and reverse transfer capacitance values as well as their ratio were set at specific values to achieve quiet switching with minimal switching loss. The Power MOS 8™ series of devices are inherently quiet switching, stable when connected in parallel, very efficient, and lower cost than previous generations.

### Body Diode Options

As with previous generation products, Power MOS 8™ MOSFETs and FREDFETs are available in all voltage ratings. A FREDFET is a MOSFET with a faster recovery intrinsic body diode. This results in improved reliability in ZVS circuits due to shorter minority carrier lifetime and increased commutation  $dv/dt$  ruggedness. If a fast recovery body diode is not needed, MOSFET versions are available.

# Power MOS 8™ MOSFETs / FREDFETs

BV <sub>(DSS)</sub> Volts	R <sub>DS(ON)</sub> Max	I <sub>D</sub>	MOSFET Part #	I <sub>D</sub>	FREDFET Part #	Package Style
1200	3.80	5	APT4M120K			TO-220
	4.20			4	APT4F120K	TO-220
	2.40			7	APT7F120B	TO-247 or D <sup>3</sup>
	2.10	8	APT7M120B			TO-247 or D <sup>3</sup>
	1.20			14	APT13F120B	TO-247 or D <sup>3</sup>
	1.10	14	APT14M120B			TO-247 or D <sup>3</sup>
	0.70			23	APT22F120B2	T-MAX® or TO-264
	0.63	24	APT24M120B2			T-MAX® or TO-264
	0.58			27	APT26F120B2	T-MAX® or TO-264
	0.58			18	APT17F120J	ISOTOP®
	0.53	29	APT28M120B2			T-MAX® or TO-264
	0.53	19	APT19M120J			ISOTOP®
	0.32			33	APT32F120J	ISOTOP®
0.29	35	APT34M120J			ISOTOP®	
1000	2.80			5	APT5F100K	TO-220
	2.50	6	APT6M100K			TO-220
	2.00			7	APT7F100B	TO-247
	1.80	8	APT8M100B			TO-247 or D <sup>3</sup>
	1.60			9	APT9F100B	TO-247 or D <sup>3</sup>
	1.40	9	APT9M100B			TO-247 or D <sup>3</sup>
	0.98			14	APT14F100B	TO-247 or D <sup>3</sup>
	0.88	14	APT14M100B			TO-247 or D <sup>3</sup>
	0.78			17	APT17F100B	TO-247 or D <sup>3</sup>
	0.70	18	APT18M100B			TO-247 or D <sup>3</sup>
	0.44			30	APT29F100B2	T-MAX® or TO-264
	0.44			20	APT19F100J	ISOTOP®
	0.38	32	APT31M100B2	35	APT34F100B2	T-MAX® or TO-264
	0.38	21	APT21M100J	23	APT22F100J	ISOTOP®
	0.33	37	APT37M100B2			T-MAX® or TO-264
	0.33	25	APT25M100J			ISOTOP®
0.20			42	APT41F100J	ISOTOP®	
0.18	45	APT45M100J			ISOTOP®	
800	1.50			7	APT7F80K	TO-220
	1.35	8	APT8M80K			TO-220
	0.90			12	APT11F80B	TO-247 or D <sup>3</sup>
	0.80	13	APT12M80B			TO-247 or D <sup>3</sup>
	0.58			18	APT17F80B	TO-247 or D <sup>3</sup>
	0.53	19	APT18M80B			TO-247 or D <sup>3</sup>
	0.43			23	APT22F80B	TO-247 or D <sup>3</sup>
	0.39	25	APT24M80B			TO-247 or D <sup>3</sup>
	0.24			41	APT38F80B2	T-MAX® or TO-264
	0.21	43	APT41M80B2	47	APT44F80B2	T-MAX® or TO-264
	0.21			31	APT29F80J	ISOTOP®
	0.19	49	APT48M80B2			T-MAX® or TO-264
	0.19	33	APT32M80J			ISOTOP®
	0.11			57	APT53F80J	ISOTOP®
0.10	60	APT58M80J			ISOTOP®	



TO-220[K]



TO-247[B]



D<sup>3</sup> PAK[S]

Part Numbers for D<sup>3</sup> packages - replace "B" with "S" in part number



T-MAX®[B2]



TO-264[L]

Part Numbers for TO-264 packages - replace "B2" with "L" in part number



ISOTOP®[J]  
SOT-227  
(ISOLATED BASE)

# Power MOS 8™ MOSFETs / FREDFETs

BV <sub>(DSS)</sub> Volts	R <sub>DS(ON)</sub> Max	I <sub>D</sub>	MOSFET Part #	I <sub>D</sub>	FREDFET Part #	Package
600	0.62			12	APT12F60K	TO-220
	0.43			16	APT15F60B	TO-247 or D <sup>3</sup>
	0.37			19	APT18F60B	TO-247 or D <sup>3</sup>
	0.29			24	APT23F60B	TO-247 or D <sup>3</sup>
	0.22			30	APT28F60B	TO-247 or D <sup>3</sup>
	0.19	36	APT34M60B	36	APT34F60B	TO-247 or D <sup>3</sup>
	0.15	45	APT43M60B2	45	APT43F60B2	T-MAX® or TO-264
	0.15	31	APT30M60J	31	APT30F60J	ISOTOP®
	0.11	60	APT56M60B2	60	APT56F60B2	T-MAX® or TO-264
	0.11	42	APT39M60J	42	APT39F60J	ISOTOP®
	0.09	70	APT66M60B2	70	APT66F60B2	T-MAX® or TO-264
	0.09	49	APT47M60J	49	APT47F60J	ISOTOP®
0.055	84	APT80M60J	84	APT80F60J	ISOTOP®	
500	0.39			15	APT15F50K	TO-220[K] or TO-220[KF]*
	0.30			20	APT20F50B	TO-247 or D <sup>3</sup>
	0.24			24	APT24F50B	TO-247 or D <sup>3</sup>
	0.19			30	APT30F50B	TO-247 or D <sup>3</sup>
	0.15			37	APT37F50B	TO-247 or D <sup>3</sup>
	0.13			43	APT42F50B	TO-247 or D <sup>3</sup>
	0.10	56	APT56M50B2	56	APT56F50B2	T-MAX® or TO-264
	0.10	38	APT38M50J	38	APT38F50J	ISOTOP®
	0.075	75	APT75M50B2	75	APT75F50B2	T-MAX® or TO-264
	0.075	51	APT51M50J	51	APT51F50J	ISOTOP®
	0.062	84	APT84M50B2	84	APT84F50B2	T-MAX® or TO-264
	0.062	58	APT58M50J	58	APT58F50J	ISOTOP®
	0.036	103	APT100M50J	103	APT100F50J	ISOTOP®

\* Available on APT15F50K

## Low Voltage Power MOS V® MOSFETs / FREDFETs

300	0.085	40	APT30M85BVFRG	40	APT30M85BVFRG	TO-247 or D <sup>3</sup>
	0.070	48	APT30M70BVFRG	48	APT30M70BVFRG	TO-247 or D <sup>3</sup>
	0.040	70	APT30M40JVFRG	70	APT30M40JVFRG	ISOTOP®
	0.019	130	APT30M19JVFR	130	APT30M19JVFR	ISOTOP®
200	0.045	56	APT20M45BVFRG	56	APT20M45BVFRG	TO-247 or D <sup>3</sup>
	0.038	67	APT20M38BVFRG	37	APT20M38BVFRG	TO-247 or D <sup>3</sup>
	0.022	100	APT20M22B2VFRG	100	APT20M22B2VFRG	T-MAX® or TO-264
	0.011	175	APT20M11JVFR	175	APT20M11JVFR	ISOTOP®



TO-220[K] or TO-220[KF]\*



TO-247[B]



D<sup>3</sup> PAK[S]

Part Numbers for D<sup>3</sup> packages  
- replace "B" with "S" in part  
number



T-MAX®[B2]



TO-264[L]

Part Numbers for TO-264  
packages - replace "B2" with  
"L" in part number



ISOTOP®[J]  
SOT-227  
(ISOLATED BASE)

# Ultrafast, Low Gate Charge MOSFETs

## FOR 250 kHz - 2 MHz SWITCHING APPLICATIONS

The Ultrafast, Low Gate Charge MOSFET family combines the lowest gate charge available in the industry with Microsemi's proprietary self-aligned aluminum metal gate structure. The result is a MOSFET capable of extremely fast switching speeds and very low switching losses. The metal gate structure and the layout of these chips provide an internal series gate resistance (EGR) an order of magnitude lower than competitive devices built with a polysilicon gate.

These devices are ideally suited for high frequency and pulsed high voltage applications.

### Typical Applications:

- Class D amplifiers up to 2 MHz
- High voltage pulsed DC
- AM transmitters
- Plasma deposition/etch

FEATURES:	BENEFITS:
• Series Gate Resistance (Rg) <0.1 ohm	• Fast switching, uniform signal propagation
• Tr and Tf times of <10ns	• Pulse power applications
• Industry's Lowest Gate Charge	• Fast switching, reduced gate drive power

BV <sub>(DSS)</sub> Volts	R <sub>DS(ON)</sub> Max	I <sub>D</sub>	MOSFET Part #	FREDFET Part #	Package Style
1200	4.700	3.5		APT1204R7KFLG	TO-220
	4.700	3.5		APT1204R7BFLG	TO-247
	1.400	9		APT1201R4BFLG	TO-247
	0.670	18	APT12067B2LLG		T-MAX®
	0.670	17	APT12067JLL		ISOTOP®
	0.570	22	APT12057B2LLG		T-MAX®
	0.570	19	APT12057JLL		ISOTOP®
	0.310	30	APT12031JLL		ISOTOP®
1000	0.900	12	APT10090BLLG		TO-247
	0.780	14	APT10078BLLG		TO-247
	0.450	23	APT10045B2LLG		T-MAX® or TO-264
	0.450	21	APT10045JLL		ISOTOP®
	0.350	28	APT10035B2LL		T-MAX®
	0.350	25	APT10035JLL		ISOTOP®
	0.260	38		APT10026L2FLLG	TO-264 MAX
	0.260	30	APT10026JLL	APT10026JFLL	ISOTOP®
	0.210	37	APT10021JLL	APT10021JFLL	ISOTOP®
800	0.140	52	APT8014L2LLLG	APT8014L2FLLG	TO-264 MAX
	0.110	51	APT8011JLL	APT8011JFLL	T-MAX™ or TO-264
	0.200	38	APT8020B2LL		T-MAX®
	0.200	33	APT8020JLL		ISOTOP®
500	0.140	35	APT5014BLLG		TO-247
	0.100	46	APT5010B2LLG	APT5010B2FLLG	T-MAX® or TO-264
	0.065	67	APT50M65B2LLG	APT50M65B2FLLG	T-MAX® or TO-264
	0.065	58	APT50M65JLLG	APT50M65JFLLG	ISOTOP®
	0.075	51	APT50M75JLL	APT50M75JFLL	ISOTOP®
	0.075	57	APT50M75B2LLG		T-MAX® or TO-264
	0.050	71	APT50M50JLL		ISOTOP®
	0.038	88	APT50M38JLL		ISOTOP®



T-MAX®[B2]

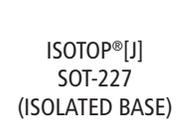


TO-247[B]



ISOTOP®[J]  
SOT-227  
(ISOLATED BASE)

$V_{DS}$ Volts	$R_{DS(ON)}$ Ohms	$I_{D(Cont)}$ Amps	Part Number	Package Style
<b>C3 TECHNOLOGY</b>				
900	0.120	36	APT36N90BC3G	TO-247
800	0.450	11	APT11N80KC3G	TO-220
	0.450	11	APT11N80BC3G	TO-247
	0.145	34	APT34N80B2C3G	T-MAX® or TO-264
	0.145	34	APT34N80LC3G	TO-264
650	0.035	94	APT94N65B2C3G	T-MAX® or TO-264
	0.070	47	APT47N65BC3G	TO-247 or D <sup>3</sup>
600	0.070	47	APT47N60BC3G	TO-247 or D <sup>3</sup>
	0.035	77	APT77N60JC3	ISOTOP®
	0.042	94	APT94N60L2C3G	264-MAX™
	<b>COOLMOS FREDFETS</b>			
600	0.083	40	APT47N60BCFG	TO-247
	<b>SERVER SERIES</b>			
	0.045	60	APT60N60BCSG	TO-247
<b>NEW! C6 TECHNOLOGY</b>				
600	0.041	77	APT77N60BC6	TO-247 or D3
	0.070	53	APT53N60BC6	TO-247 or D3
	0.099	38	APT38N60BC6	TO-247 or D3
	0.125	30	APT30N60KC6	TO-220
	0.125	30	APT30N60BC6	TO-247 or D3
	0.035	106	APT106N60B2C6	T-MAX™ or TO-264
650	0.041	85	APT97N65B2C6	T-MAX™ or TO-264
	0.021	140	APT140N65JC6	ISOTOP



\*COOLMOS™ comprise a new family of transistors developed by Infineon Technologies AG.  
\*COOLMOS™ is a trademark of Infineon Technologies AG

## Linear MOSFETs

### What is a Linear MOSFET?

A MOSFET specifically designed to be more robust than a standard MOSFET when operated with both high voltage and high current near DC conditions (>100msecs).

### The Problem with SMPS MOSFETs

MOSFETs optimized for high frequency SMPS applications have poor high voltage DC SOA. Most SMPS type MOSFETs over-state SOA capability at high voltage on the data sheets. Above ~30V and DC conditions, SOA drops faster than is indicated by P<sub>D</sub> limited operation.

For pulsed loads (t<10ms) there is generally no problem using a standard MOSFET.

### Technology Innovation

Introduced in 1999, Microsemi modified its proprietary patented self-aligned metal gate MOSFET technology for enhanced performance in high voltage, linear applications. These Linear MOSFETs typically provide 1.5-2.0 times the DC SOA capability at high voltage compared to other MOSFET technologies optimized for switching applications.

### Designers will need Linear MOSFETs when...

- High Current & > 200V >100msec
- Used as a variable power resistor
- Soft start application (limit surge currents)
- Linear amplifier circuit

### Typical Applications...

- Active loads above 200 volts such as DC dynamic loads for testing power supplies, batteries, fuel cells, etc.
- High voltage, high current constant current sources.

$V_{DS}$ Volts	$R_{DS(ON)}$ Ohms	$I_{D(Cont)}$ Amps	SOA Watts	Part Number	Package Style
1000	0.600	18	325	APL1001J	<p>T-MAX@[B2]</p> <p>TO-264[L]</p> <p>ISOTOP@[J] SOT-227 (ISOLATED BASE)</p>
600	0.125	49	325	APL602B2G	
	0.125	43	325	APL602J	
500	0.090	58	325	APL502B2G	
	0.090	52	325	APL502J	

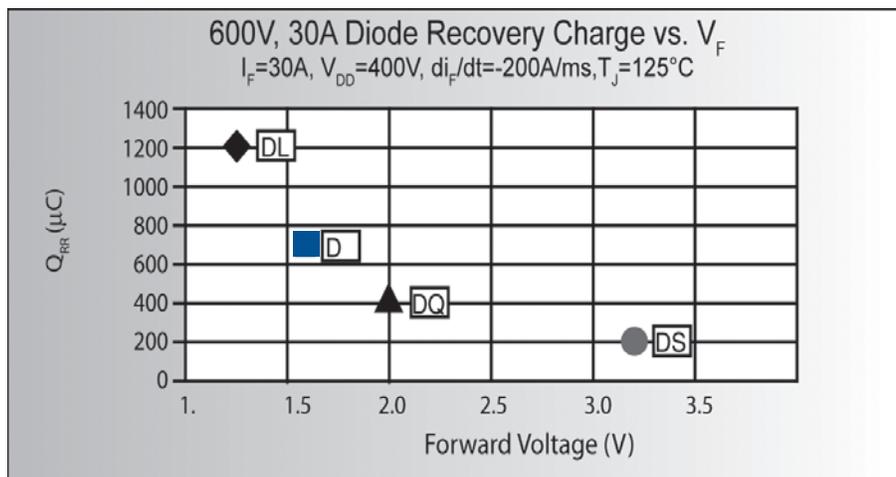
Part Numbers for TO-264 packages - replace "B2" with "L" in part number

# Ultra Fast Recovery Diodes

Microsemi DPG offers five series of discrete diode products: a new DL series low  $V_F$  ultra-soft recovery, the medium speed medium  $V_F$  D series, the high speed DQ series, the very high speed DS series, and the silicon Schottky S series. These series of diodes are designed to provide high quality solutions to a wide range of high voltage, high power application requirements, ranging from fast recovery for continuous conduction mode power factor correction to low conduction loss for output rectification. Distinguishing features, technology used, and applications for each product family are summarized in the table below.

Series	Voltage Ratings	Features	Applications	Comment
DL	600	Low $V_F$ Ultra-soft recovery Avalanche Rated	Output rectifier Resonant circuits	Ultra-soft recovery minimizes or eliminates snubber
D	200, 300, 400, 600, 1000, 1200	Medium $V_F$ Medium Speed	Freewheeling Diode Output rectifier DC-DC converter	Proprietary platinum process
DQ	600, 1000, 1200	High speed Avalanche Rated	PFC Freewheeling Diode DC-DC converter	Stepped epi improves softness Proprietary platinum process
DS	600	Very high speed	High frequency PFC	Proprietary platinum process
Schottky	200	Low $V_F$ Avalanche rated	Output rectifier Freewheeling Diode DC-DC converter	

The graph below shows the relative recovery speed and forward voltage positions of 600V DL, D, DQ and DS series diodes.



# Ultra Fast Recovery Diodes

Volts	$I_F$ (avg) Amps	$V_F$ (volts) Typ 25°C	$t_{RR}$ (ns) Typ 25°C	$Q_{RR}$ (nC) Typ 125°C at $I_F = I_F$ (avg)	Diode Series	Part Number	Package Style
<b>SINGLE</b>	15	2.8	21	960	DQ	APT15DQ120BG	TO-247
1200	15	2.8	21	960	DQ	APT15DQ120KG	TO-220
	15	2.0	32	1300	D	APT15D120BG	TO-247
	15	2.0	32	1300	D	APT15D120KG	TO-220
	30	2.8	24	1800	DQ	APT30DQ120BG	TO-247
	30	2.8	24	1800	DQ	APT30DQ120KG	TO-220
	30	2.0	31	3450	D	APT30D120BG	TO-247
	40	2.8	26	2200	DQ	APT40DQ120BG	TO-247
	60	2.8	30	2800	DQ	APT60DQ120BG	TO-247
	60	2.0	38	4000	D	APT60D120BG	TO-247
	75	2.8	32	3340	DQ	APT75DQ120BG	TO-247
1000	15	2.5	20	810	DQ	APT15DQ100BG	TO-247
	15	2.5	20	810	DQ	APT15DQ100KG	TO-220
	15	1.9	28	1550	D	APT15D100KG	TO-220
	30	2.5	22	1250	DQ	APT30DQ100BG	TO-247
	30	2.5	22	1250	DQ	APT30DQ100KG	TO-247
	30	1.9	29	2350	D	APT30D100BG	TO-247
	40	2.5	24	1430	DQ	APT40DQ100BG	TO-247
	60	2.5	29	2325	DQ	APT60DQ100BG	TO-247
	60	1.9	34	3600	D	APT60D100BG	TO-247
	75	2.5	33	2660	DQ	APT75DQ100BG	TO-247
600	8	2.0	14	160	DQ	APT8DQ60KG	TO-220
	15	2.0	16	250	DQ	APT15DQ60BG	TO-247
	15	2.0	16	250	DQ	APT15DQ60KG	TO-220
	15	1.6	21	520	D	APT15D60BG	TO-247
	15	1.6	21	520	D	APT15D60KG	TO-220
	30	2.0	19	400	DQ	APT30DQ60BG	TO-247
	30	2.0	19	400	DQ	APT30DQ60KG	TO-220
	30	1.6	23	700	D	APT30D60BG	TO-247
	30	1.25	35	3800	DL	APT30DL60BG	TO-247
	40	2.0	22	480	DQ	APT40DQ60BG	TO-247
	60	2.0	26	640	DQ	APT60DQ60BG	TO-247
	60	1.6	40	920	D	APT60D60BG	TO-247
	75	2.0	29	650	DQ	APT75DQ60BG	TO-247
	75	1.25	42	3800	DL	APT75DL60BG	TO-247
	400	100	1.25	45	3800	DL	APT100DL60BG
150		1.25	53	3800	DL	APT150DL60B2G	T-MAX®
30		1.3	22	360	D	APT30D40BG	TO-247
60		1.3	30	540	D	APT60D40BG	TO-247
200		30	1.1	21	150	D	APT30D20BG
	30	0.83	25	448	Schottky	APT30S20BG	TO-247
	60	1.1	30	250	D	APT60D20BG	TO-247
	60	0.83	35	490	Schottky	APT60S20BG	TO-247
	100	0.89	40	690	Schottky	APT100S20BG	TO-247



TO-220[K]



D<sup>3</sup> PAK[S]  
TO-268



TO-247[B]



T-MAX®[B2]

## TANDEM, DS DIODES FOR PFC BOOST APPLICATIONS

600	15	3.2	13	85	DS	APT15DS60BG	TO-247
	30	3.2	17	180	DS	APT30DS60BG	TO-247

(2, 300V Diodes Connected In Series)

Part Numbers for D<sup>3</sup> packages - replace "B" with "S" in part number



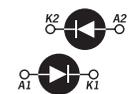
TO-247[B]

# Ultra Fast Recovery Diodes

Volts	I <sub>F (avg)</sub> Amps	V <sub>F</sub> (volts) Typ 25°C	t <sub>RR</sub> (ns) Typ 25°C	Q <sub>RR</sub> (nC) Typ 125°C at I <sub>F</sub> = I <sub>F (avg)</sub>	Diode Series	Part Number	Package Style	
<b>DUAL</b>	2x27	2.0	31	3450	D	APT2X30D120J	ISOTOP®	
1200	2x30	2.6	25	1800	DQ	APT2X30DQ120J		
	2x53	2.0	38	4000	D	APT2X60D120J		
	2x60	2.5	30	2890	DQ	APT2X60DQ120J		
	2x93	2.0	47	5350	D	APT2X100D120J		
	2x100	2.4	45	5240	DQ	APT2X100DQ120J		
	1000	2x28	1.9	29	2350	D		APT2X30D100J
2x55		1.9	34	3600	D	APT2X60D100J		
2x60		2.2	30	2350	DQ	APT2X60DQ100J		
2x95		1.9	43	4050	D	APT2X100D100J		
2x100		2.1	45	3645	DQ	APT2X100DQ100J		
600	2x30	1.8	20	400	DQ	APT2X30DQ60J		
	2x30	1.6	23	700	D	APT2X30D60J		
	2x60	1.7	27	650	DQ	APT2X60DQ60J		
	2x60	1.6	40	920	D	APT2X60D60J		
	2x100	1.6	30	980	DQ	APT2X100DQ60J		
	2x100	1.6	34	1450	D	APT2X100D60J		
	2x150	1.25	53	3800	DL	APT2X150DL60J		
400	2x30	1.3	22	360	D	APT2X30D40J		
	2x60	1.3	30	540	D	APT2X60D40J		
	2x100	1.3	37	1050	D	APT2X100D40J		
	2x100	1.0	40	3550	DL	APT2X101DL40J <sup>++</sup>		
300	2x100	1.2	36	650	D	APT2X101D30J		
200	2x30	0.80	25	448	Schottky	APT2X31S20J		
	2x60	0.83	35	490	Schottky	APT2X61S20J		
	2x100	1.1	39	840	D	APT2X100D20J		
	2x100	0.89	40	690	Schottky	APT2X101S20J		
1200	2x30	2.8	26	2100	DQ	APT30DQ120BCTG		TO-247 [BCT]
1000	2x15	2.5	20	810	DQ	APT15DQ100BCTG		TO-247 [BCT]
	2x15	1.9	28	1550	D	APT15D100BCTG		TO-247 [BHB]
	2x30	1.9	29	2360	D	APT30D100BCTG		TO-247 [BHB]
	2x30	1.9	30	2350	D	APT30D100BHBG		TO-247 [BCA]
	2x60	2.5	29	2325	DQ	APT60DQ100LCTG		TO-264 [LCT]
	2x60	1.9	35	3600	D	APT60D100LCTG		TO-264 [LCT]
600	2x15	1.6	21	520	D	APT15D60BCTG		TO-247
	2x15	2.0	15	250	DQ	APT15DQ60BCTG		TO-247 [BCT]
	2x15	1.6	20	520	D	APT15D60BCAG		TO-247 [BCA]
	2x30	2.0	22	480	DQ	APT30DQ60BHBG		TO-247 [BHB]
	2x30	2.0	19	400	DQ	APT30DQ60BCTG		TO-247 [BCT]
	2x30	1.6	23	700	D	APT30D60BCTG		TO-247 [BCT]
	2x30	1.6	25	700	D	APT30D60BHBG	TO-247 [BHB]	
	2x30	1.6	25	700	D	APT30D60BCAG	TO-247 [BCA]	
	2x30	1.25	35	3800	DL	APT30DL60BCTG	TO-247 [BCT]	
	2x40	2.0	22	480	DQ	APT40DQ60BCTG	TO-247 [BCT]	
	2x60	2.0	26	640	DQ	APT60DQ60BCTG	TO-247 [BCT]	
2x60	1.6	30	920	D	APT60D60LCTG	TO-264 [LCT]		
400	2x30	1.3	22	360	D	APT30D40BCTG	TO-247 [BCT]	
	2x60	1.3	30	540	D	APT60D40LCTG	TO-264 [LCT]	
300	2x30	1.2	25	1300	D	APT30D30BCTG	TO-247 [BCT]	
200	2x30	1.1	21	150	D	APT30D20BCTG	TO-247 [KCT]	
	2x30	1.1	21	150	D	APT30D20BCAG	TO-247 [BCA]	
	2x30	0.80	25	448	Schottky	APT30S20BCTG	TO-247 [BCT]	
	2x60	0.83	35	490	Schottky	APT60S20B2CTG	T-MAX® [B2CT]	
	2x100	0.89	40	690	Schottky	APT100S20LCTG	TO-264[LCT]	



ISOTOP®[J] SOT-227  
Antiparallel  
Configuration  
(ISOLATED BASE)



Part Numbers for Parallel Configuration replace 30, 60, or 100 with 31, 61, or 101. Except Schottky

Example: 2X30D120J becomes 2X31D120J



TO-220[KCT]  
\*Common Cathode



TO-247[BCA]  
\*Common Anode



TO-247[BCT]  
\*Common Cathode



TO-247[BHB]  
\*Half Bridge

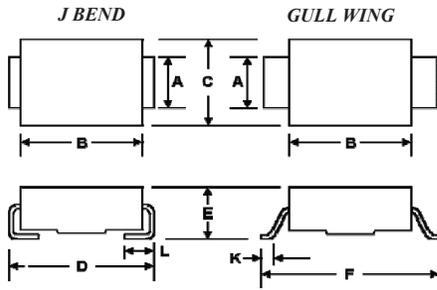


T-MAX® [B2CT]  
\*Common Cathode



TO-264[LCT]  
\*Common Cathode

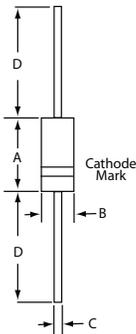
## SMB/SMC/SML



SMB PACKAGE DIMENSIONS IN INCHES (DO-214AA/DO-215AA)								
	A	B	C	D	E	F	K	L
MIN	.077	.160	.130	.205	.077	.235	.015	.030
MAX	.083	.180	.155	.220	.104	.255	.030	.060
DIMENSIONS IN MILLIMETERS								
MIN	1.95	4.06	3.30	5.21	1.95	5.97	.381	.760
MAX	2.10	4.57	3.94	5.59	2.65	6.48	.762	1.520

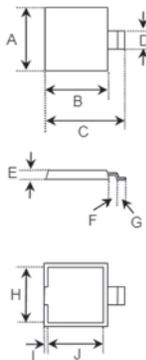
SMC/SML PACKAGE DIMENSIONS IN INCHES (DO-214AB/DO-215AB)								
	A	B	C	D	E	F	K	L
MIN	.115	.260	.220	.305	.077	.380	.025	.030
MAX	.121	.280	.245	.320	.110	.400	.040	.060
DIMENSIONS IN MILLIMETERS								
MIN	2.92	6.60	5.59	7.75	1.95	9.65	0.635	.760
MAX	3.07	7.11	6.22	8.13	2.80	10.16	1.016	1.520

## P4KE, P6KE, 1.5KE & LCE



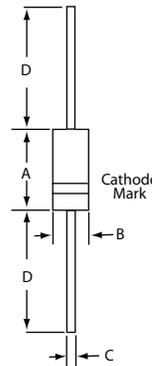
DIM	P4KE (DO-41)				P6KE (T-18)				1.5KE & LCE (Case 1)			
	INCHES		MM		INCHES		MM		INCHES		MM	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	-	.205	-	5.207	.330	.350	8.39	8.89	.360	.375	9.144	9.525
B	-	.107	-	2.72	.130	.145	3.31	3.68	.190	.205	4.826	5.207
C	.03	.034	.76	.86	.038	.042	0.97	1.06	.038	.042	.965	1.067
D	1.00	-	25.4	-	1.00	-	25.4	-	1.10	-	27.9	-

## mini-PLAD



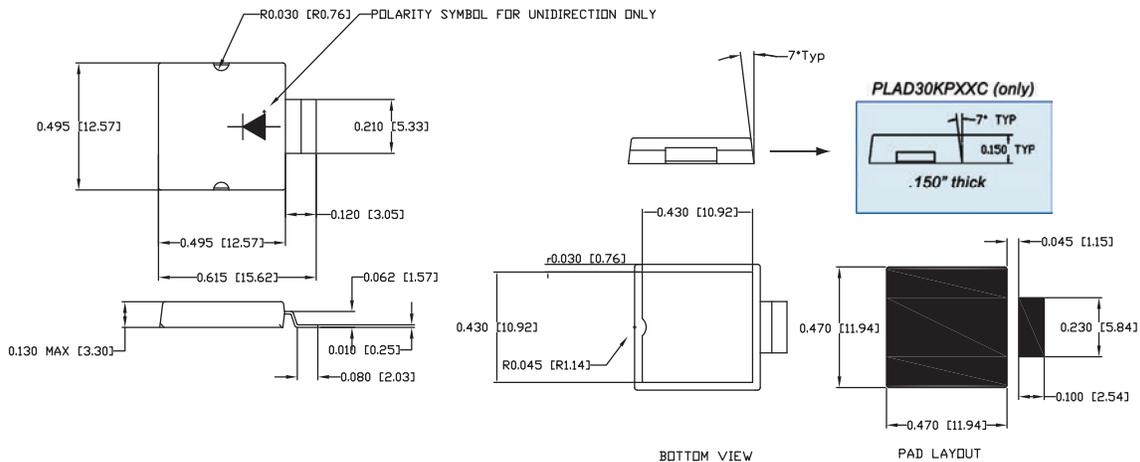
Ref.	Dimensions	
	mm	inches
	Typ.	Typ.
A	8.76	0.345
B	8.76	0.345
C	11.27	0.444
D	2.54	0.100
E	3.18	0.125
F	0.76	0.030
G	1.78	0.070
H	7.24	0.285
I	0.76	0.030
J	7.24	0.285

## 5KP, 15KP and RT100KP Case 5A

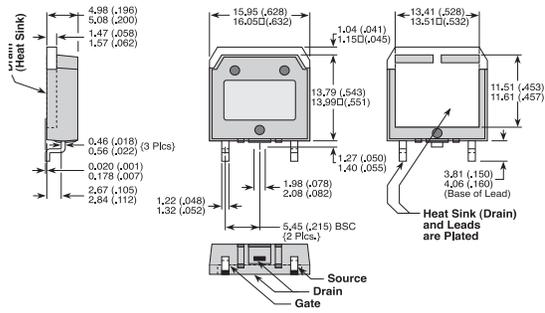


DIM	RT100KP (Case 5A)			
	INCHES		MM	
	MIN	MAX	MIN	MAX
A	.365	.385	9.271	9.779
B	.235	.255	5.969	6.477
C	.047	.053	1.194	1.346
D	.75	-	19.05	-

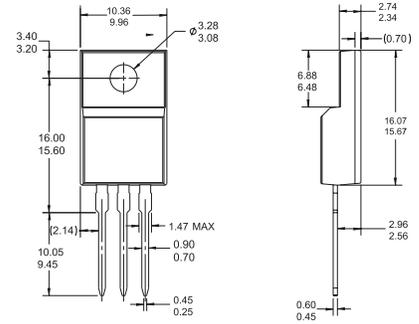
## PLAD



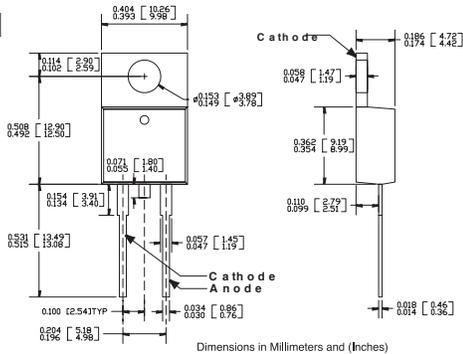
## D<sup>3</sup> Pak or TO-268



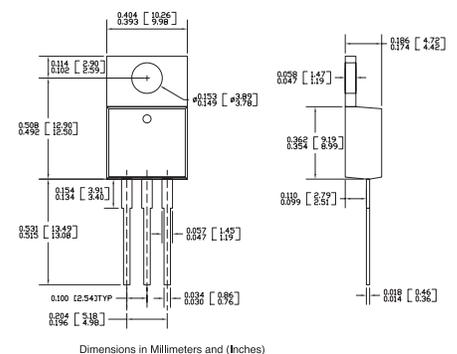
## TO-220 [KF]



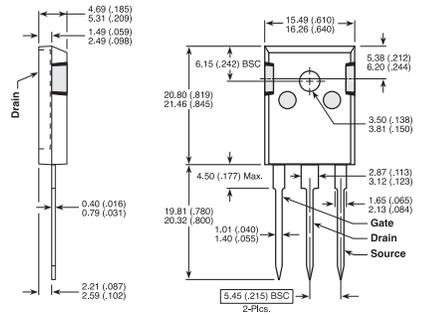
## TO-220 2-Lead



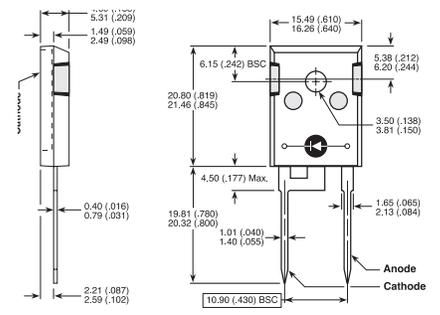
## TO-220 3-Lead



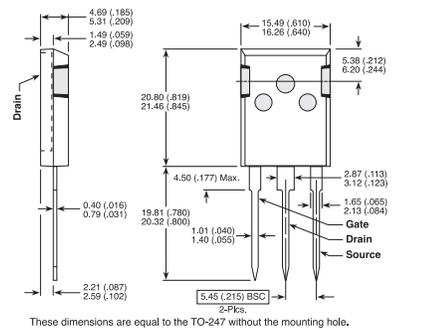
## TO-247 3-Lead



## TO-247 2-Lead

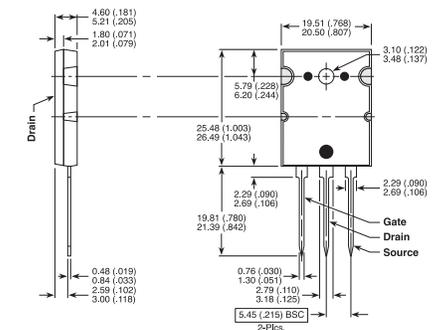


## T-MAX<sup>®</sup>

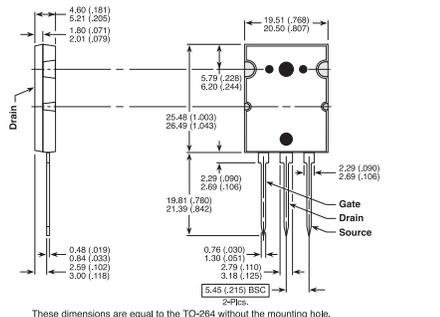


These dimensions are equal to the TO-247 without the mounting hole.

## TO-264

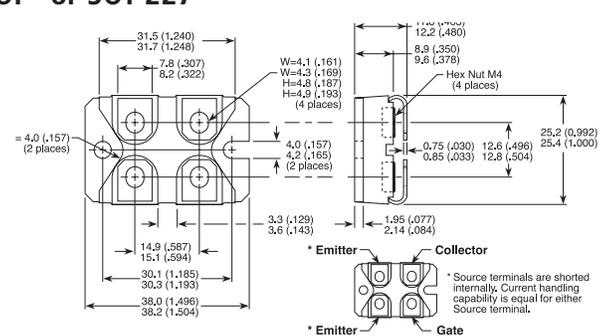


## 264 MAX<sup>™</sup>



These dimensions are equal to the TO-264 without the mounting hole.

## ISOTOP<sup>®</sup> or SOT-227



\* Source terminals are shorted internally. Current handling capability is equal for either Source terminal.







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