

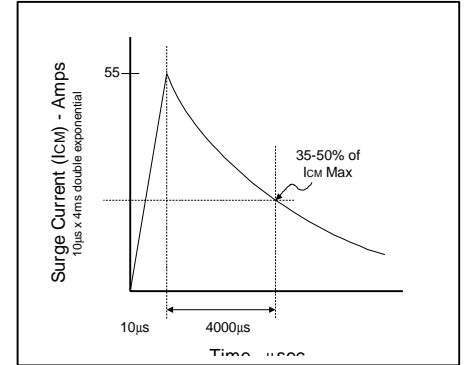
**MSAGA11F120D**  
 Fast IGBT Die for Implantable  
 Cardio Defibrillator  
 Applications

DESCRIPTION:

- N-Channel enhancement mode high density IGBT die
- Passivation: Polyimide, 20 um, over Silicon Nitride, .8um
- Emitter Metallization: Al/1%Si for aluminum wire bonding, 3.2 um typical.
- Collector/Gate Metallization: Ti – Ni (1 um) – Ag (0.2 um) for soft solder attach

FEATURES:

- Low Forward Voltage Drop, Low Tail Current
- Avalanche and Surge Rated
- High Freq. Switching to 20KHz
- Ultra Low Leakage Current
- RBSOA and SCSOA Rated
- Available with Lot Acceptance Testing Spec MSAGA11F120DL, "-L" Suffix



MAXIMUM RATINGS:

SYMBOL	PARAMETER	VALUE	UNIT
V <sub>CES</sub>	Collector-Emitter Voltage	1200	Volts
V <sub>CGR</sub>	Collector-Gate Voltage (R <sub>GE</sub> = 20KW)	1200	Volts
V <sub>EG</sub>	Emitter-Collector Voltage	15	Volts
V <sub>GE</sub>	Gate-Emitter Voltage	±20	Volts
I <sub>C1</sub>	Continuous Collector Current @ T <sub>C</sub> = 25°C	22	Amps
I <sub>C2</sub>	Continuous Collector Current @ T <sub>C</sub> = 110°C	11	Amps
I <sub>CM</sub>	Surge Current (10ms x 4ms double exponential, see figure 2)	55	Amps
I <sub>CM1</sub>	Pulsed Collector Current ① @ T <sub>C</sub> = 25°C	44	Amps
I <sub>CM2</sub>	Pulsed Collector Current ① @ T <sub>C</sub> = 110°C	22	Amps
I <sub>Csurge2</sub>	Surge Current: tp= 2 us (ton= 1.5 ms; toff= 0.5 ms to 50% decay), 10 pulses, duty cycle= 1:2,500,000 (12 pulses/minute)	400	Apk
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	10	mJ
P <sub>D</sub>	Total Power Dissipation	125	Watts
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage: Junction Temperature Range	-55 to 150	°C

STATIC ELECTRICAL CHARACTERISTICS:

SYMBOL	CHARACTERISTIC / TEST CONDITIONS	MIN	TYP	MAX	UNIT
BV <sub>CES</sub>	Collector-Emitter Breakdown Voltage (V <sub>GE</sub> = 0V, I <sub>C</sub> = 0.5mA)	1200			Volts
RBV <sub>CES</sub>	Collector-Emitter Reverse Breakdown Voltage③ (V <sub>GE</sub> = 20V, I <sub>C</sub> = 10mA)	-15			Volts
	Gate Threshold Voltage (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 350mA, T <sub>J</sub> = 37°C)		5.7		Volts
V <sub>GE(TH)</sub>	Gate Threshold Voltage (V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 350mA, T <sub>J</sub> = 25°C)	4.5	5.5	6.5	Volts
V <sub>CE(ON)</sub>	Collector-Emitter On Voltage (V <sub>GE</sub> = 15V, I <sub>C</sub> = I <sub>C2</sub> , T <sub>J</sub> = 25°C)		3.1	3.5	Volts
	Collector-Emitter On Voltage (V <sub>GE</sub> = 15V, I <sub>C</sub> = I <sub>C2</sub> , T <sub>J</sub> = 37°C)		3.5		Volts
	Collector-Emitter On Voltage (V <sub>GE</sub> = 15V, I <sub>C</sub> = I <sub>C2</sub> , T <sub>J</sub> = 125°C)		4	4.5	Volts
I <sub>CES</sub>	Collector Cut-off Current (V <sub>CE</sub> = 80%V <sub>CES</sub> , V <sub>GE</sub> = 0V, T <sub>J</sub> = 25°C)		0.02	10	uA
	Collector Cut-off Current (V <sub>CE</sub> = 80%V <sub>CES</sub> , V <sub>GE</sub> = 0V, T <sub>J</sub> = 37°C)		0.07		uA
	Collector Cut-off Current (V <sub>CE</sub> = 80%V <sub>CES</sub> , V <sub>GE</sub> = 0V, T <sub>J</sub> = 125°C)			1000	uA
	Gate-Emitter Leakage Current (V <sub>GE</sub> = ±25V, V <sub>CE</sub> = 0V)		2	±100	nA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>GE</sub> = ±25V, V <sub>CE</sub> = 0V), T <sub>J</sub> = 37°C		4		nA

DYNAMIC CHARACTERISTICS:

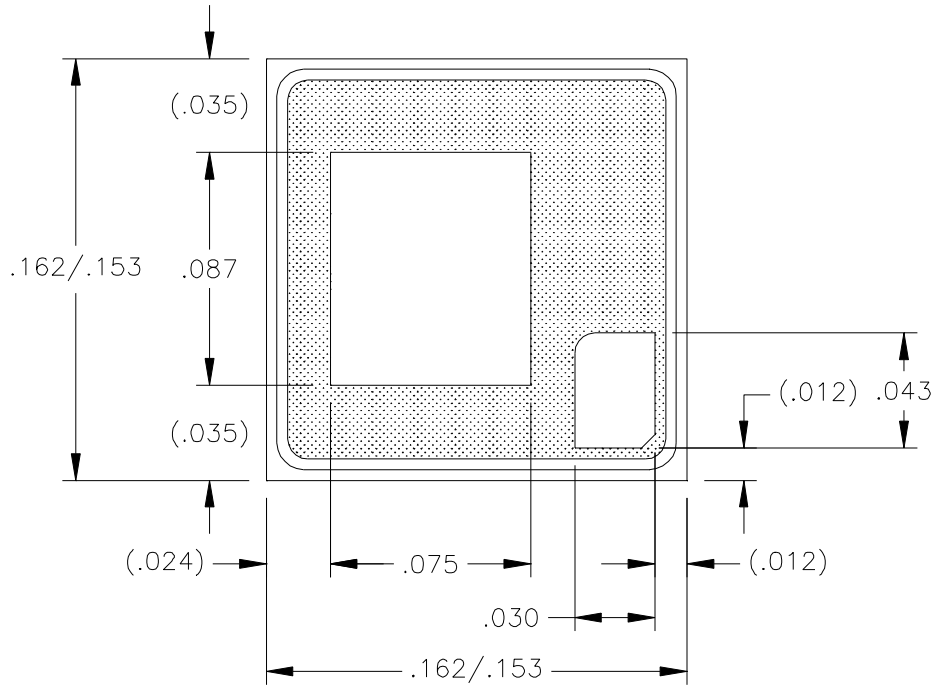
SYMBOL	CHARACTERISTIC	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{ies}$	Input Capacitance	$V_{GE} = 0V$		600	720	pF
$C_{oes}$	Output Capacitance	$V_{CE} = 25V$		60	120	pF
$C_{ros}$	Reverse Transfer Capacitance	$f = 1\text{ MHz}$		38	55	pF
$Q_g$	Total Gate Charge	$V_{GE} = 15V$		60		nC
$Q_{ge}$	Gate-Emitter Charge	$V_{CC} = 0.5V_{CES}$		4		nC
$Q_{gc}$	Gate-Collector ("Miller") Charge	$I_C = I_{C2}$		36		nC
$t_d(\text{on})$	Turn-on Delay Time	Resistive Switching (25°C)		35		ns
$t_r$	Rise Time	$V_{GE} = 15V, V_{CC} = 0.5V_{CES}$		120		ns
$t_d(\text{off})$	Turn-off Delay Time	$I_C = I_{C2}$		580		ns
$t_f$	Fall Time	$R_e = 150W$		260		ns
$t_d(\text{on})$	Turn-On Delay Time	Inductive Switching (25°C)		55	110	ns
$t_r$	Rise Time	$V_{CLAMP(PEAK)} = 0.5V_{CES}$		50	100	ns
$t_d(\text{off})$	Turn-off Delay Time	$V_{GE} = 15V, I_C = I_{C2}$		380	570	ns
$t_f$	Fall Time	$R_G = 150W, T_J = +25^\circ C$		80	120	ns
$t_d(\text{on})$	Turn-on Delay Time	Inductive Switching (125°C)		40		ns
$t_r$	Rise Time	$V_{CLAMP(PEAK)} = 0.5V_{CES}$		100		ns
$t_d(\text{off})$	Turn-off Delay Time (tsv)	$V_{GE} = 15V, I_C = I_{C2}$		550 700		ns
$t_f$	Fall Time (tfv)	$R_G = 150W, T_J = +125^\circ C$		160 40		ns
$t_f$	Fall Time (tfi)					ns
$E_{off}$	Turn-off Switching Energy			1		mJ
$g_{fe}$	Forward Transconductance	$V_{CE} = 20V, I_C = I_{C2}$	4.5	5		S

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ②  $I_C = I_{C2}, V_{CC} = 50V, R_{CE} = 25W, L = 300nH, T_J = 25^\circ C$
- ③  $T_J = 150^\circ C$
- ④ See MIL-STD-750 Method 3471

DIE PROBE PARAMETERS (100% TESTS):

SYMBOL	CHARACTERISTIC / TEST CONDITIONS	MIN	TYP	MAX	UNIT
$BV_{CES}$	Collector-Emitter Breakdown Voltage ( $V_{GE} = 0V, I_C = 0.5mA$ )	1200	1400		Volts
$RBV_{CES}$	Collector-Emitter Reverse Breakdown Voltage ③ ( $V_{GE} = 15V, I_C = 10mA$ )	-15	30		
$V_{GE(TH)}$	Gate Threshold Voltage ( $V_{CE} = 6.5V, I_C = 350mA, T_J = 25^\circ C$ )	4.6	5.5	6.5	
$V_{CE(ON)}$	Collector-Emitter On Voltage ( $V_{GE} = 12V, I_C = 1A, T_J = 25^\circ C$ )		1.45	2.0	
$I_{CES}$	Collector Cut-off Current ( $V_{CE} = 1200V, V_{GE} = 0V, T_J = 25^\circ C$ )		0.15	400	uA
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{GE} = \pm 20V, V_{CE} = 0V$ )		5	±120	nA

MECHANICAL CHARACTERISTICS



DIE THICKNESS:  $.00725/.00850$

TYPICAL SURGE PERFORMANCE

