Bulletin I27191 02/05

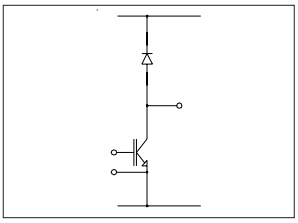
International
IOR Rectifier

50MT060ULSA
50MT060ULSTA

"LOW SIDE CHOPPER" IGBT MTP — Ultrafast Speed IGBT

Features

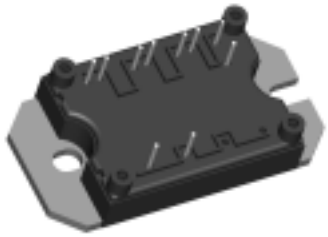
- Gen. 4 Ultrafast Speed IGBT Technology
- HEXFRED ™ Diode with UltraSoft Reverse Recovery
- Very Low Conduction and Switching Losses
- Optional SMD Thermistor (NTC)
- Al_2O_3 DBC
- Very Low Stray Inductance Design for High Speed Operation
- UL approved (file E78996)



V_{CES} = 600V
I_C = 100A,
T_C = 25°C

Benefits

- Optimized for Welding, UPS and SMPS Applications
- Operating Frequencies > 20 kHz Hard Switching, >200 kHz Resonant Mode
- Low EMI, requires Less Snubbing
- Direct Mounting to Heatsink
- PCB Solderable Terminals
- Very Low Junction-to-Case Thermal Resistance



MTP

Absolute Maximum Ratings

	Parameters			Max	Units
V_{CES}	Collector-to-Emitter Voltage			600	V
I_C	Continuos Collector Current		@ T_C = 25°C	100	A
			@ T_C = 122°C	50	
I_{CM}	Pulsed Collector Current			200	
I_{LM}	Peak Switching Current			200	
I_F	Diode Continuous Forward Current		@ T_C = 100°C	48	
I_{FM}	Peak Diode Forward Current			200	
V_{GE}	Gate-to-Emitter Voltage			± 20	V
V_{ISOL}	RMS Isolation Voltage, Any Terminal to Case, t = 1 min			2500	
P_D	Maximum Power Dissipation	IGBT	@ T_C = 25°C	445	W
			@ T_C = 100°C	175	
		Diode	@ T_C = 25°C	205	
			@ T_C = 100°C	83	

Electrical Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600			V	V_{GE} = 0V, I_C = 250µA
$V_{CE(on)}$	Collector-to-Emitter Voltage		1.69	2.31		V_{GE} = 15V, I_C = 50A
			1.96	2.55		V_{GE} = 15V, I_C = 100A
			1.88	2.24		V_{GE} = 15V, I_C = 100A, T_J = 150°C
$V_{GE(th)}$	Gate Threshold Voltage	3		6		I_C = 0.5mA
B_{VR}	Diode Reverse Breakdown Voltage	600				I_R = 200µA
$\Delta V_{GE(th)}/$	Temperature Coeff. of		- 13		mV/°C	V_{CE} = V_{GE}, I_C = 500µA
ΔT_J	Threshold Voltage					
g_{fe}	Forward Transconductance	22	29		S	V_{CE} = 50V, I_C = 100A
I_{CES}	Collector-to-Emiter Leaking Current			0.25	mA	V_{GE} = 0V, V_{CE} = 600V
				6		V_{GE} = 0V, V_{CE} = 600V, T_J = 150°C
V_{FM}	Diode Forward Voltage Drop		1.64	1.82	V	I_F = 100A, V_{GE} = 0V
			1.56	1.74		I_F = 100A, V_{GE} = 0V, T_J = 150°C
I_{GES}	Gate-to-Emitter Leakage Current			± 250	nA	V_{GE} = ± 20V

Switching Characteristics @ T_J = 25°C (unless otherwise specified)

	Parameters	Min	Typ	Max	Units	Test Conditions
Q_g	Total Gate Charge (turn-on)		370	555	nC	I_C = 100A
Q_{ge}	Gate-Emitter Charge (turn-on)		64	96		V_{CC} = 480V
Q_{gc}	Gate-Collector Charge (turn-on)		163	245		V_{GE} = 15V
E_{on}	Turn-On Switching Loss		0.7	1.2	mJ	I_C = 50A, V_{CC} = 480V, V_{GE} = 15V,
E_{off}	Turn-Off Switching Loss		1.7	2.6		R_g = 5Ω
E_{ts}	Total Switching Loss		2.4	3.8		Energy losses include tail and diode reverse recovery
E_{on}	Turn-On Switching Loss		1.1	1.7	mJ	I_C = 50A, V_{CC} = 480V, V_{GE} = 15V
E_{off}	Turn-Off Switching Loss		2.5	3.8		R_g = 5Ω, T_J = 125°C
E_{ts}	Total Switching Loss		3.6	5.5		Energy losses include tail and diode reverse recovery
C_{ies}	Input Capacitance		9800	14700		V_{GE} = 0V
C_{oes}	Output Capacitance		602	903	pF	V_{CC} = 30V
C_{res}	Reverse Transfer Capacitance		121	182		f = 1.0 MHz
C_t	Diode Junction Capacitance		118	177		V_r = 600V, f = 1.0 MHz
trr	Diode Reverse Recovery Time		99	150	ns	V_{CC} = 480V, I_C = 50A
Irr	Diode Peak Reverse Current		6.5	9.8	A	di/dt = 200A/µs
Qrr	Diode Recovery Charge		320	735	nC	R_g = 5Ω
$di_{(rec)}M/dt$	Diode PeakRate of Fall of Recovery During t_b		236		A/µs	

Thermistor Specifications (50MT060ULSTA only)

Parameters		Min	Typ	Max	Units	Test Conditions
R_0 (1)	Resistance		30		kΩ	T_0 = 25°C
β (1) (2)	Sensitivity index of the thermistor material		4000		K	T_0 = 25°C T_1 = 85°C

(1) T_0,T_1 are thermistor's temperatures (2) $\frac{R_0}{R_1} = \exp\left[\beta\left(\frac{1}{T_0}-\frac{1}{T_1}\right)\right]$, Temperatures in kelvin

Thermal- Mechanical Specifications

Parameters			Min	Typ	Max	Units
T_J	Operating Junction Temperature Range		- 40		150	°C
T_{STG}	Storage Temperature Range		- 40		125	
R_{thJC}	Junction-to-Case	IGBT			0.28	°C/ W
		Diode			0.6	
R_{thCS}	Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module		0.06		
T	Mounting torque to heatsink	(3)	3 ± 10%			Nm
Wt	Weight		66			g

(3) A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads

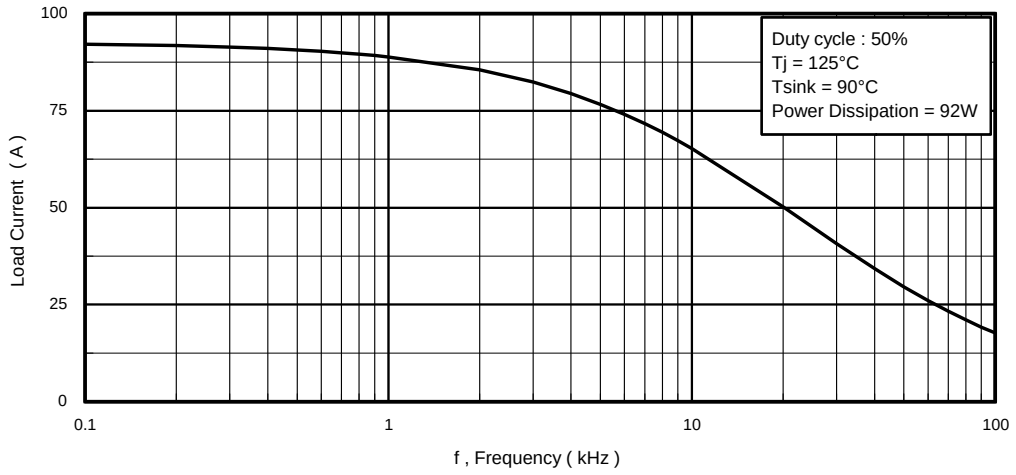


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

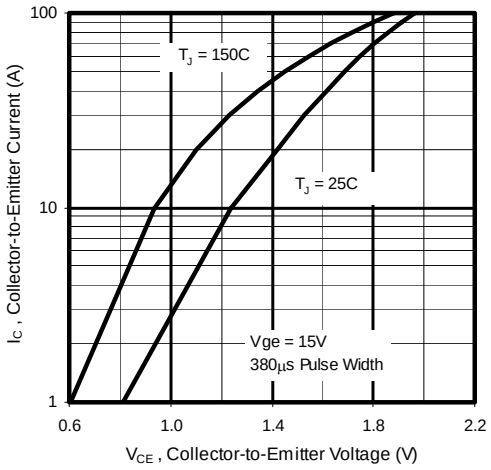


Fig. 2 - Typical Output Characteristics

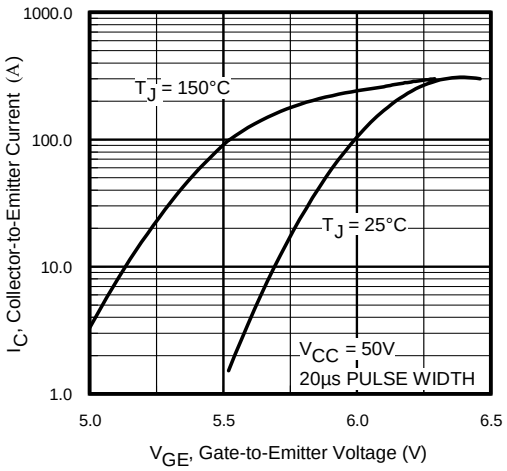


Fig. 3 - Typical Transfer Characteristics

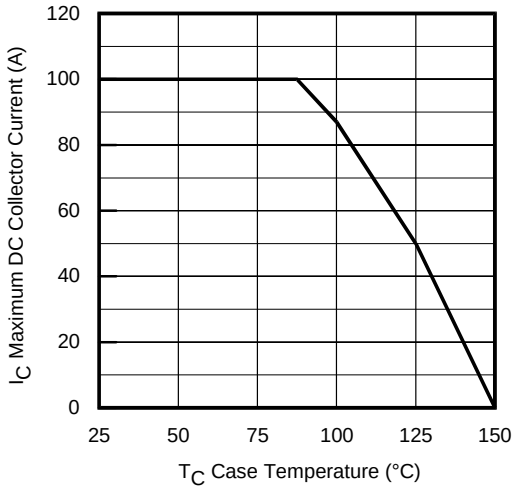


Fig. 4 - Maximum Collector Current vs. Case Temperature

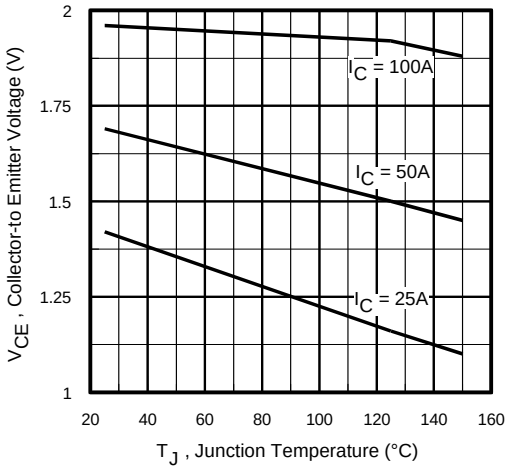


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

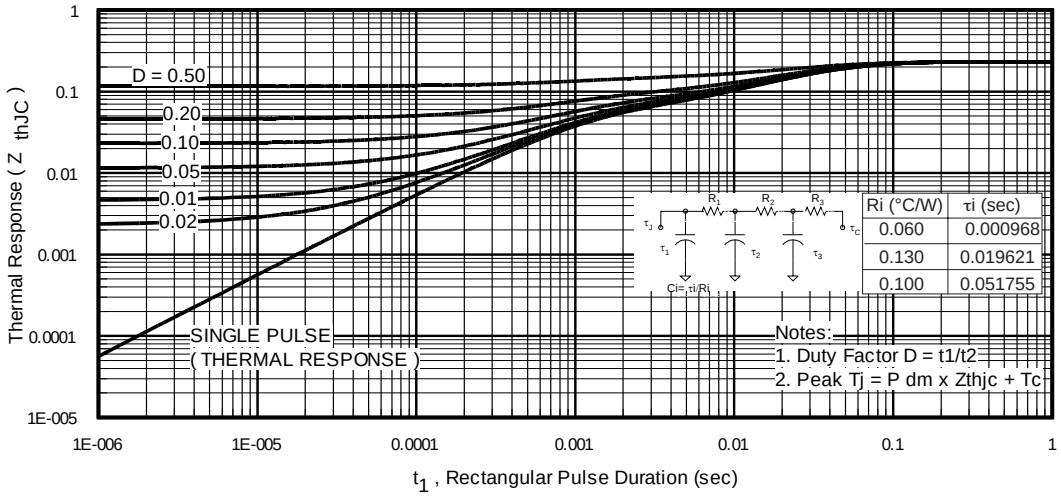


Fig. 6a Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

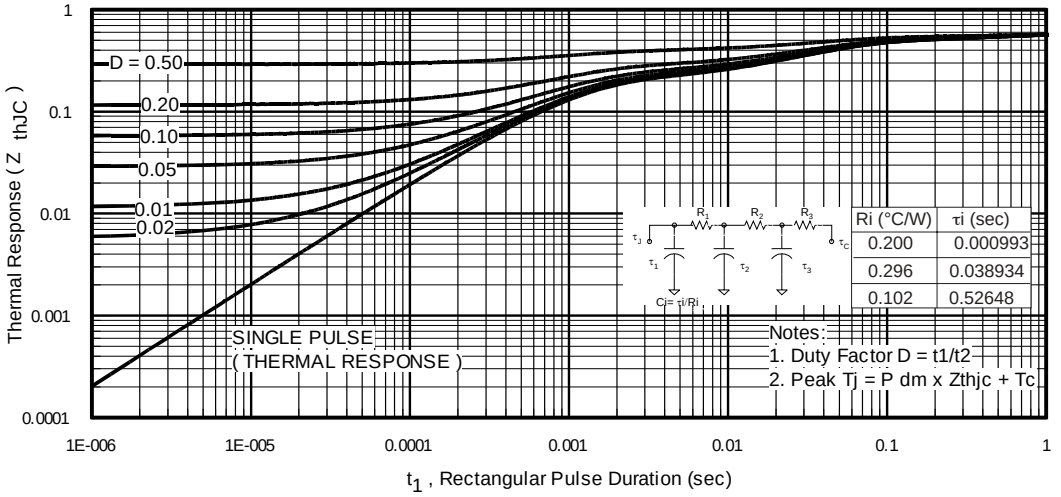


Fig. 6b Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

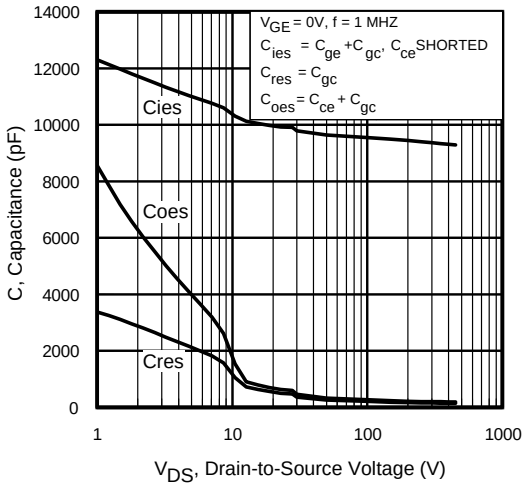


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

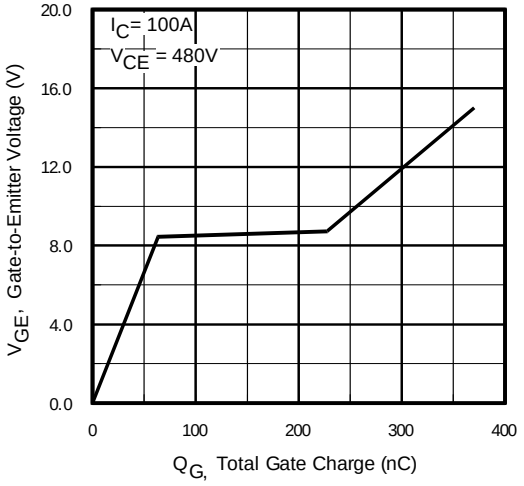


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

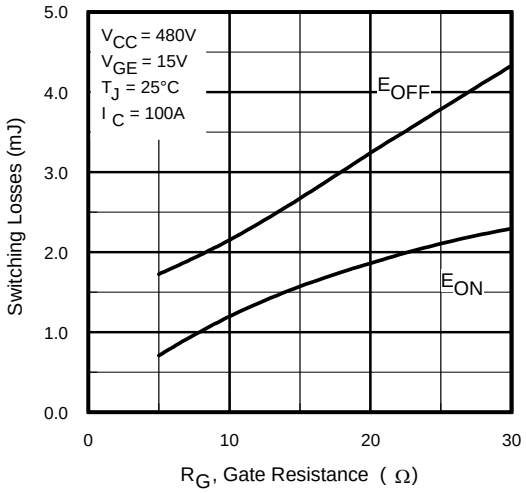


Fig. 9 - Typical Switching Losses vs. Gate Resistance

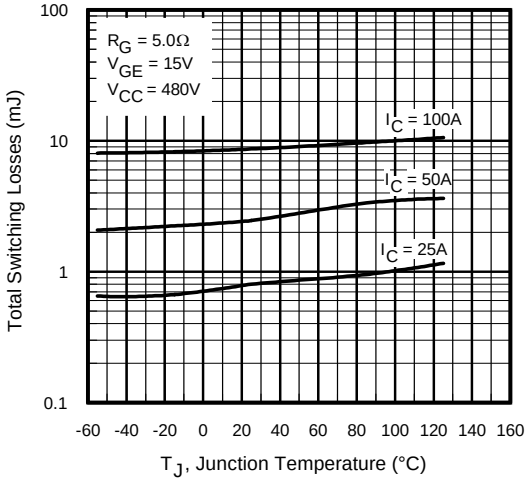


Fig. 10 - Typical Switching Losses vs. Junction Temperature

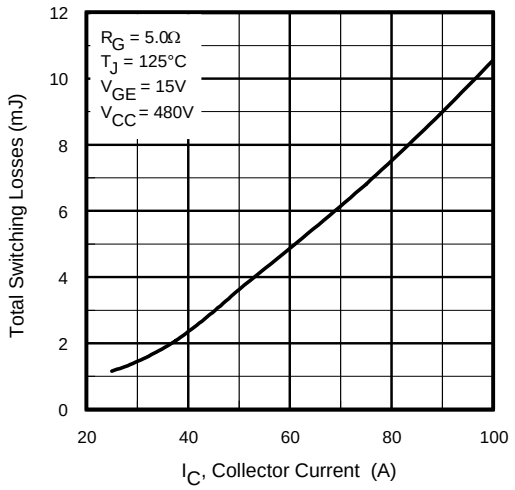


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

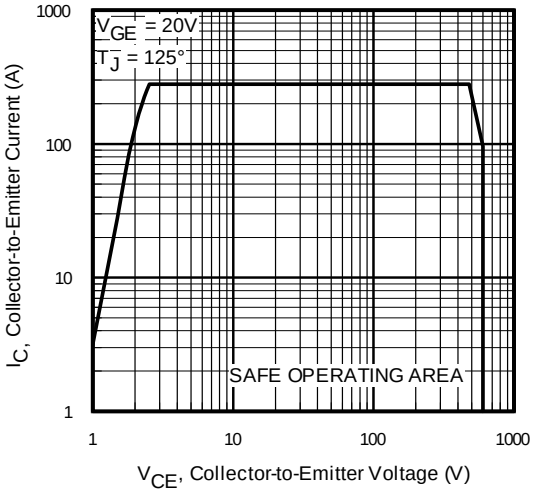


Fig. 12 - Turn-Off SOA

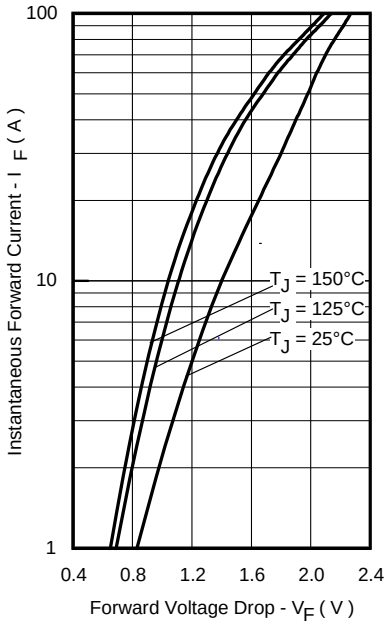


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

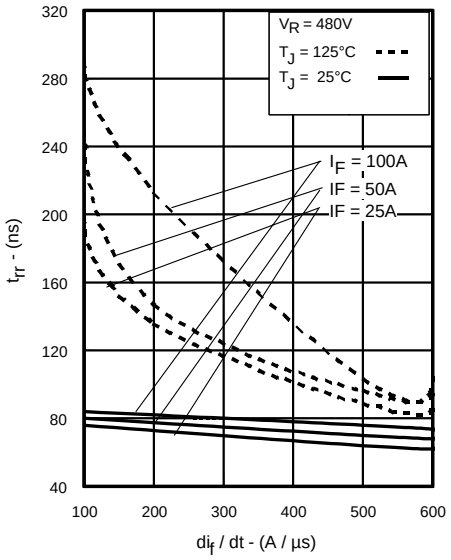


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

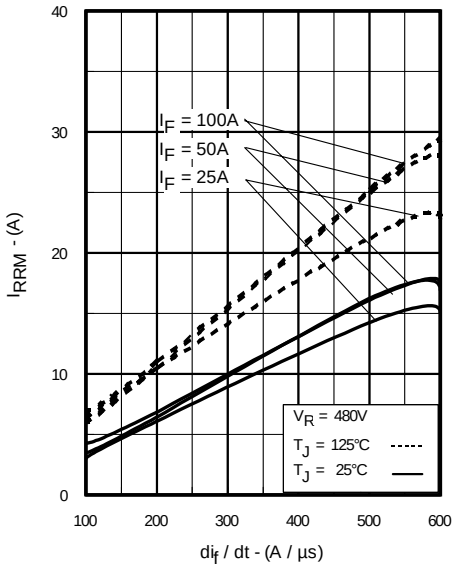


Fig. 15 - Typical Recovery Current vs. di_f/dt

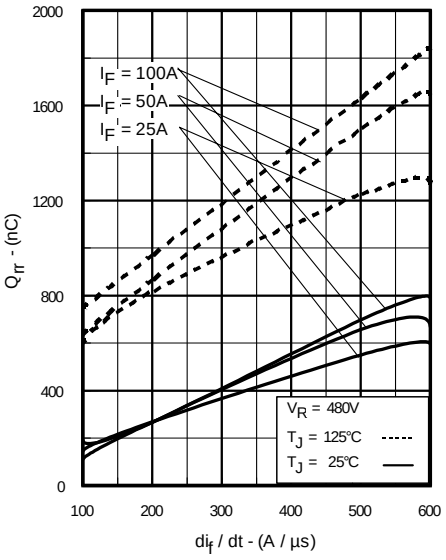


Fig. 16 - Typical Stored Charge vs. di_f/dt

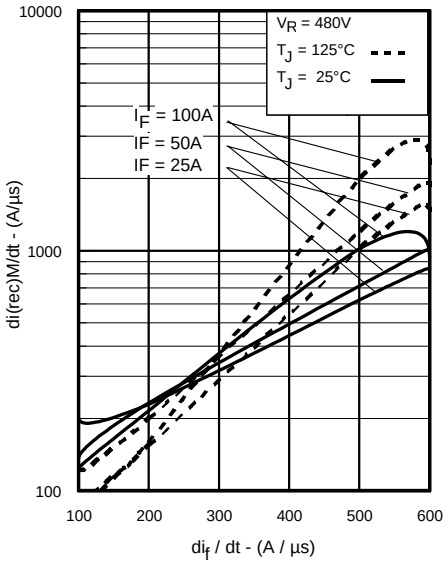
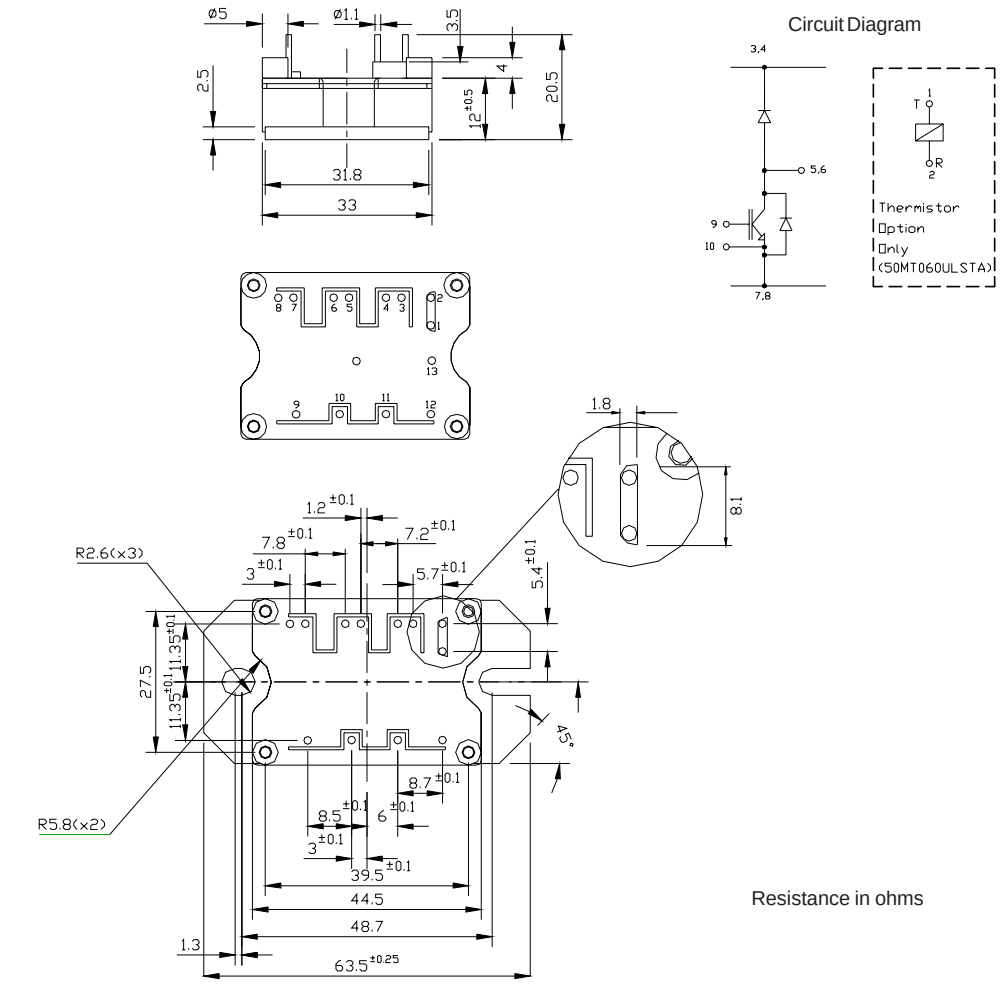


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

Outline Table

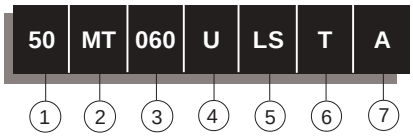


Dimensions in millimetres

Note: unused terminals are not assembled in the package

Ordering Information Table

Device Code



1	-	Current Rating (50 = 50A)
2	-	Essential Part Number
3	-	Voltage rating (060 = 600V)
4	-	Speed/ Type (U = Ultra Fast IGBT)
5	-	Circuit Configuration (LS = Low Side Chopper)
6	-	Special Option • none = no special option • T = Thermistor
7	-	A = Al_2O_3 DBC Substrate

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

International
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